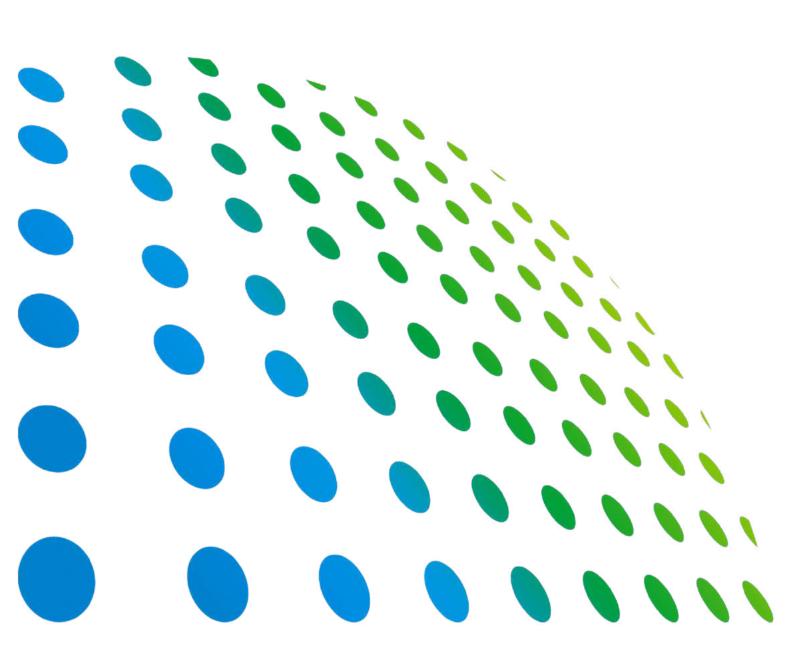


# Regenerative Grid Simulator 61800-100 User's Manual





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## Regenerative Grid Simulator 61800-100 User's Manual

Chroma			
		3 	

Version 1.1 April 2020

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### CHROMA ATE INC.

66 Huaya 1st Road, Guishan, Taoyuan 33383, Taiwan

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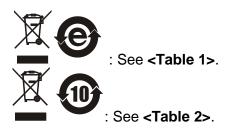
### CHROMA ATE INC.

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http://www.chromaate.com

# **Material Contents Declaration**

The recycling label shown on the product indicates the Hazardous Substances contained in the product as the table listed below.



### <Table 1>

	Hazardous Substances						
Part Name	Lead	Mercury	Cadmium	Hexavalent Chromium	-	Selected Phthalates Group	
	Pb	Hg	Cd	Cr <sup>6+</sup>	PBB/PBDE	DEHP/BBP/DBP/DIBP	
PCBA	0	0	0	0	0	0	
CHASSIS	0	0	0	0	0	0	
ACCESSORY	0	0	0	0	0	0	
PACKAGE	0	0	0	0	0	0	

"O" indicates that the level of the specified chemical substance is less than the threshold level specified in the standards of SJ/T-11363-2006, EU Directive 2011/65/EU, and 2015/863/EU.

" $\times$ " indicates that the level of the specified chemical substance exceeds the threshold level specified in the standards of SJ/T-11363-2006, EU Directive 2011/65/EU, and 2015/863/EU.

### Remarks:

- 1. The CE marking on product is a declaration of product compliance with EU Directive 2011/65/EU and 2015/863/EU.
- 2. This product is complied with EU REACH regulation and no SVHC in use.

### Disposal

Do not dispose of electrical appliances as unsorted municipal waste, use separate collection facilities. Contact your local government for information regarding the collection systems available. If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging your health and well-being. When replacing old appliances with new one, the retailer is legally obligated to take back your old appliances for disposal at least for free of charge.



### <Table 2>

				Hazardou	s Substances	
Part Name	Lead	Mercury	Cadmium	Hexavalent Chromium	Biphenyls/ Polybromodiphenyl	Selected Phthalates Group
				- 6+	Ethers	
	Pb	Hg	Cd	Cr <sup>6+</sup>	PBB/PBDE	DEHP/BBP/DBP/DIBP
PCBA	×	0	0	0	0	0
CHASSIS	×	0	0	0	0	0
ACCESSORY	×	0	0	0	0	0
PACKAGE	0	0	0	0	0	0

"O" indicates that the level of the specified chemical substance is less than the threshold level specified in the standards of SJ/T-11363-2006, EU Directive 2011/65/EU, and 2015/863/EU.

" $\times$ " indicates that the level of the specified chemical substance exceeds the threshold level specified in the standards of SJ/T-11363-2006, EU Directive 2011/65/EU, and 2015/863/EU.

- 1. Chroma is not fully transitioned to lead-free solder assembly at this moment; however, most of the components used are RoHS compliant.
- 2. The environment-friendly usage period of the product is assumed under the operating environment specified in each product's specification.
- 3. This product is complied with EU REACH regulation and no SVHC in use.

### Disposal

Do not dispose of electrical appliances as unsorted municipal waste, use separate collection facilities. Contact your local government for information regarding the collection systems available. If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging your health and well-being. When replacing old appliances with new one, the retailer is legally obligated to take back your old appliances for disposal at least for free of charge.



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## **Declaration of Conformity**

For the following equipment :

#### Regenerative Grid Simulator

(Product Name/ Trade Name)

61800-100, 61500-100

(Model Designation)

CHROMA ATE INC.

CE

(Manufacturer Name)

66 Huaya 1st Road, Guishan, Taoyuan 33383, Taiwan

(Manufacturer Address)

Is herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Laws of the Member States relating to Electromagnetic Compatibility (2014/30/EU) and Low Voltage Directive (2014/35/EU). For the evaluation regarding the Directives, the following standards were applied:

EN 61326-1:2013

EN 55011:2016, EN 61000-4-2:2009, EN 61000-4-3:2006/A1:2008/A2:2010

EN 61000-4-4:2012, EN 61000-4-5:2014, EN 61000-4-6:2014

EN 61000-4-8:2010

IEC/EN 61010-1:2010

The equipment describe above is in conformity with Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

The following importer/manufacturer or authorized representative established within the EUT is responsible for this declaration :

CHROMA ATE INC.

(Company Name)		
66 Huaya 1 <sup>st</sup> Road	, Guishan, Taoyuan 33383, Tai	wan
(Company Address)		
Person responsible	for this declaration:	
Mr. Vincent Wu		
(Name, Surname)		
T&M BU Vice Pres	ident	
(Position/Title)		
Taiwan	2019.02.12	Vmut Wh
(Place)	(Date)	(Legal Signature)

# **Safety Summary**

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or specific WARNINGS given elsewhere in this manual will violate safety standards of design, manufacture, and intended use of the instrument. Chroma assumes no liability for the customer's failure to comply with these requirements.

<b>~</b> ]=	<b>BEFORE APPLYING POWER</b> Verify that the power is set to match the rated input of this power supply.
	<b>PROTECTIVE GROUNDING</b> Make sure to connect the protective grounding to prevent an electric shock before turning on the power.
	<b>NECESSITY OF PROTECTIVE GROUNDING</b> Never cut off the internal or external protective grounding wire, or disconnect the wiring of protective grounding terminal. Doing so will cause a potential shock hazard that may bring injury to a person.
	<b>FUSES</b> Only fuses with the required rated current, voltage, and specified type (normal blow, time delay, etc.) should be used. Do not use repaired fuses or short-circuited fuse holders. To do so could cause a shock or fire hazard.
	<b>DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE</b> Do not operate the instrument in the presence of flammable gases or fumes. The instrument should be used in an environment of good ventilation.
	<b>DO NOT REMOVE THE COVER OF THE INSTRUMENT</b> Operating personnel must not remove the cover of the instrument. Component replacement and internal adjustment can be done only by qualified service personnel.
0.1	<b>DO NOT MOVE THE EQUIPMENT ON SLOPE PAVEMENT</b> Do not move the equipment on slope pavement when changing the location. Be sure to use foot pads to stabilize the equipment when positioning it.
	<b>DO NOT MOVE THE EQUIPMENT ON BUMPY PAVEMENT</b> Do not move the equipment on bumpy pavement when changing the location. Be sure to use foot pads to stabilize the equipment when positioning it.
<b>AWARNING</b>	<ol> <li>Lethal voltage, the output is up to 426V peak voltage.</li> <li>If the output terminal and circuit are connected to output when the power is on, it could cause death if touches it.</li> <li>Please make sure the floor is flat and endurable for maximum weight before placing the device. Please install it close to the primary structure (beams).</li> <li>The load bearing of each foot pad is about 300kg. Considering the floor structure, it is suggested to use an iron plate of 350mm/350mm/10t to disperse the pressure.</li> </ol>

# **Safety Symbols**

4	DANGER – High voltage.
$\triangle$	<b>Explanation:</b> To avoid injury, death of personnel, or damage to the instrument, the operator must refer to an explanation in the instruction manual.
	<b>High temperature:</b> This symbol indicates the temperature is now higher than the acceptable range of human. Do not touch it to avoid any personal injury.
	<b>Protective grounding terminal:</b> To protect against electrical shock in case of a fault. This symbol indicates that the terminal must be connected to ground before operation of equipment.
Ţ	<b>Functional grounding:</b> To identify an earth (ground) terminal in cases where the protective ground is not explicitly stated. This symbol indicates the power connector does not provide grounding.
$\mathcal{A}$	Frame or chassis: To identify a frame or chassis terminal.
$\sim$	Alternating Current (AC)
$\sim$	Direct Current (DC) / Alternating Current (AC)
	Direct Current (DC)
	Push-on/Push-off power switch
	The <b>WARNING</b> sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a <b>WARNING</b> sign until the indicated conditions are fully understood and met.
<b>CAUTION</b>	The <b>CAUTION</b> sign denotes a hazard. It may result in personal injury or death if not noticed timely. It calls attention to procedures, practices and conditions.
✓ Notice	The <b>Notice</b> sign denotes important information in procedures, applications or the areas that require special attention. Be sure to read it carefully.

# **Moving the Device**

Since the device weighs heavy, for your safety be sure to use tool to move it in accordance with the following figure.



The instrument must place horizontally during transportation and use. It is strictly forbidden to slant the device, or it may cause the device to be damaged.

# Cleaning

It is suggested to regularly perform internal cleaning and maintenance. The standard period is 1 year. Due to different environment use conditions, the maintenance period can be adjusted according to your use environment. Please contact your local technical service personnel for related service requirements.

# **Revision History**

The following lists the additions, deletions and modifications in this manual at each revision.

Date	Version	Revised Sections
Sep. 2019	1.0	Complete this manual.
Apr. 2020	1.1	Modify the following:
		<ul> <li>"Specifications" in "Overview" chapter</li> </ul>
		<ul> <li>"1_Phase Mode" in "Local Operation" chapter</li> </ul>
		<ul> <li>"Parallel/Series (Optional) Operation" chaper</li> </ul>
		<ul> <li>"Instrument Command Dictionary" in "Remote Operation" chapter</li> </ul>
		Add the following:
		<ul> <li>Moving and cleaning description</li> </ul>
		<ul> <li>"AC Load Mode (Optional)" chapter</li> </ul>

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# 1. Overview

## 1.1 Introduction

The distributed power grids of today such as solar power and wind power generation are growing gradually. To cope with this trend, the equipment manufacturers have to follow the standards (IEEE 1547 / IEC 61000-3-15 / IEC 62116 for instance) to perform the tests and certify their equipment meets the standard. The Chroma 61800 Series Regenerative Grid Simulator released lately can provide the test solutions required for parallel grids. Its full four quadrant operation, energy recycling and voltage waveform editing functions (such as the simulation of voltage fall and harmonic distortion) are in compliance with the standard. Most importantly, the 61800 Series provides an effective energy saving solution that can feed the energy generated during testing back to the grid instead of consuming it as heat energy. Besides the distributed power test application, the 61800 Series Regenerative Grid Simulation can also apply to other green products associate tests like Vehicle to Grid (V2G) and Energy Saving System (ESS).

## 1.2 Feature

- Voltage: 0~300V
- Frequency: DC, 30Hz~100Hz
- Energy regenerative function with 100% rated current recycling capability
- Conform with the test applications of PV inverter, Smart Grid and EV associate products
- Selectable 1-phase/3-phase AC output
- Controllable voltage and frequency for change rate
- Output limit setting for voltage and current
- Voltage waveform setting for 0~360 switching degree
- Sync TTL signal Output for changed voltage
- LIST, STEP, PULSE mode for Power Line Disturbance (PLD) simulation
- Voltage interruption/transient simulation (conform with LVRT test)
- Distortion waveform synthesis of harmonics and interharmonics
- Parameter measurement functions including step of harmonic current
- Programmable analog interface
- Digital interface: GPIB, RS-232, USB and Ethernet
- Support parallel mode to meet high power output requirements (parallel mode only supports three-phase output)

## 1.3 Specifications

The following table lists the specification of Chroma 61800-100 Regenerative Grid Simulator. All specifications are verified in accordance with Chroma's standard test procedure. Unless otherwise specified, all specifications are tested under the condition of remote connected voltage sense within the temperature of  $25 \pm 1^{\circ}$ C and load resistance.

Model	61800-100		
	AC Output Rating		
1-Phase Power	105kVA		
3-Phase Total Power	105kVA		
Power per Phase	35kVA		
· · · ·	Voltage		
Output Voltage	0~300V <sub>LN</sub>		
	Optional HV: 0-500VLN		
Accuracy <sup>*1</sup>	0.1%+0.2%F.S.		
Resolution	0.1 V		
Distortion *1*2	< 0.5% @30-65Hz < 0.8% @65-100Hz		
Line Regulation	0.10%		
Load Regulation <sup>*3</sup>	0.20%		
	Maximum Current (1-Phase) <sup>*4</sup>		
Output Current (RMS)	420A		
Output Current (Peak)	1080A		
	Maximum Current (3-Phase/per phase) *5		
Output Current (RMS)	140A@250V (maximum CP)		
Output Current (Peak)	360A		
	Frequency		
Range	DC, 30Hz ~ 100Hz		
Accuracy <sup>*1</sup>	0.01%F.S		
Resolution	0.01Hz		
DC Output Rating (1-Phase) *4			
Power	52.5kW		
Voltage <sup>*4</sup>	424V (Optional HV: 707V)		
Current	210A		
	DC Output Rating (3-Phase/per phase) *7		
Power	17.5kW		
Voltage <sup>*6</sup>	424V (Optional HV: 707V)		
Current	70A		
	Source Mode		
_	< 5% (Typical)		
Current Harmonic	Regen Mode		
Distortion *8	< 5%@3Ø 200-220V±10%V <sub>LL</sub>		
	< 6%@3Ø 380-400V±10%V <sub>LL</sub>		
	< 10%@3Ø 440-480V±10%V <sub>LL</sub>		
Power Factor	0.95 (Typical)		
 	Input 3-Phase Rating (Each Phase)		
Voltage Range <sup>*9</sup>	3Ø 200-220V±10%V <sub>LL</sub> 3Ø 380-400V±10%V <sub>LL</sub>		
vollage Rallye	3Ø 380-400V±10%V <sub>LL</sub> 3Ø 440-480V±10%V <sub>LL</sub>		
Frequency Range	47-63 Hz		
Maximum Current	47-03 112 438A Max./Phase		
	TOUR WAA/T HASE		

Model	61800-100			
	(3Ø200-220V±10%V <sub>LL</sub> )			
	228A Max./Phase			
	(3Ø 380-400V±10%V <sub>11</sub> )			
	200A Max./Phase			
	(3Ø 440-480V±10%V <sub>LL</sub> )			
Hold-up Time	>10ms			
	Measurement			
	Voltage			
Dongo	0~300V <sub>LN</sub>			
Range	Optional HV: 0-500V <sub>LN</sub>			
Accuracy	0.1%+0.2%F.S.			
Resolution	0.01 V			
	Current (Each Phase)			
Range	360A			
Accuracy (RMS) <sup>*14</sup>	0.4%+0.3%F.S.			
Accuracy (Peak) *14	0.4%+0.6%F.S.			
Resolution <sup>*10</sup>	0.01 A			
	Power			
Accuracy	0.4%+0.4% F.S.			
Resolution	0.1 W			
	Others			
Efficiency <sup>*11</sup>	80%(Typical)			
Dimension (W×D×H)	780 x 1000 x 1740 mm 30.70×39.37×68.50 in.			
Weight	1120kg			
Protection	OVP, OCP, OPP, OTP, FAN			
Remote Interface	GPIB, RS-232, USBTMC, Ethernet			
Temperature Range				
Operating	0°C to 40°C			
Storage	-40°C to 85°C			
Humidity <sup>*12</sup>	0% to 95%			
Safety & EMC	CE			

### Regenerative AC Load (ACL optional accessory)

Model	61800-100		
	Loading Current (per phase)		
Current	140A		
Max. Current	360A <sub>peak</sub>		
	Operating Voltage		
Range	50~300V <sub>LN</sub>		
Max. Voltage	424V <sub>peak</sub>		
	Operating Frequency		
Range	30Hz ~ 100Hz		
Accuracy	0.01% F.S.		
Resolution	0.1Hz		
Cons	Constant Current Rectification Mode (per phase)		
Current Range	0~140A		
Accuracy	0.3% + 0.5%F.S.		
Accuracy	(above 2A)		
Resolution	0.1A		
Crest Factor Range	1.414~2.57		

Model	61800-100	
Crest Factor Resolution	0.001	
Constant Power Rectification Mode (per phase)		
Power Range	0~35kW	
A 2014/2014	0.3% + 0.6%F.S.	
Accuracy	(above 200W)	
Resolution	10W	
Crest Factor Range	1.414~2.57	
Crest Factor Resolution	0.001	
Consta	ant Current Phase Variation Mode (per phase)	
Current Range	0~140A	
Accuracy	0.3% + 0.5%F.S.	
	(above 5A)	
Resolution	0.1A	
	-90deg ~ +90deg	
Phase Range	(current source mode	
Thase Range	+90.1deg ~ +180deg	
***	& -90.1deg ~ -180deg)	
Accuracy <sup>*16</sup>	0.6%F.S.(30~100Hz)	
Phase Resolution 0.1deg		
	ant Power Phase Variation Mode (per phase)	
Power Range	0~35kW	
Accuracy	0.3% + 0.6%F.S.	
	(above 1.5W)	
Resolution	10W	
	-45deg ~ 0deg & +45deg ~ 0deg	
Phase Range	(current source mode	
	+135deg ~ +180deg	
*16	& -135deg ~ -180deg)	
Accuracy <sup>*16</sup>	0.6%F.S.(30~100Hz)	
Phase Resolution	0.1deg	
Constant Resistance Mode (per phase)		
Range	1~300ohm	
A	Convert to current value	
Accuracy	0.3% + 0.7%F.S.	
Depolytics	(above 5A)	
Resolution	0.10hm	
Current Harmonics	<3% (Full load at 250V/50Hz/sinewave)	

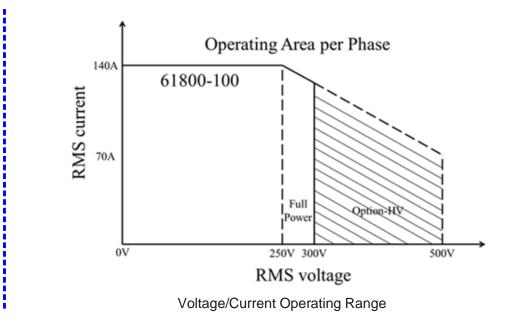
### 210kVA 900VLN series high voltage function (optional accessory)

AC Output Rating		
3-phase Mode Total Power	210kVA	
Power Per Phase	70KVA	
Voltage		
Output Voltage	0~900V <sub>LN</sub>	
Accuracy <sup>*1</sup>	0.1%+0.2%F.S.	
Resolution	0.1 V	
Distortion*1*2	< 0.8% @50/60Hz < 1.0% @30Hz~100Hz	
Voltage Regulation	0.10%	

Load Regulation *3	0.20%	
N N	ax. Current (3-phase mode/ per phase) *5	
Output Current (RMS)	140A	
Output Current (Peak)	360A	
	Frequency	
Range	DC, 30Hz ~ 100Hz	
Accuracy <sup>*1</sup>	0.02% F.S.	
Resolution	0.01Hz	
DC	Output Rating (3-phase mode/ per phase) <sup>*7</sup>	
Power	35kW	
Voltage <sup>*6</sup>	1272V	
Current	70A	
	Energy Regenerative Function	
	Source Mode	
	< 5% (Typical)	
Current Harmonic	Regen Mode	
Distortion <sup>*8</sup>	< 5%@3Ø 200-220V±10%V <sub>LL</sub>	
	< 6%@3Ø 380-400V±10%V <sub>LL</sub>	
	< 10%@3Ø 440-480V±10%V <sub>LL</sub>	
Power Factor	0.95 (Typical)	
	Input 3-phase Rating (per phase)	
	3Ø 200-220V±10%V <sub>LL</sub>	
Voltage Range <sup>*9</sup>	3Ø 380-400V±10%V <sub>LL</sub>	
	3Ø 440-480V±10%V <sub>LL</sub>	
Frequency Range	47-63 Hz	
	438A Max./Phase (3Ø 200-220V±10%V <sub>LL</sub> )	
Max. Current	228A Max./Phase (3Ø 380-400V±10%V <sub>LL</sub> )	
	200A Max./Phase (3Ø 440-480V±10%V <sub>LL</sub> )	
Power Factor	0.95 (Typical)	
	Measurement Voltage	
Panga		
Range	0~900V <sub>LN</sub> 0.1%+0.2%F.S.	
Accuracy	0.1%+0.2%F.S. 0.01 V	
Resolution	Current <sup>*10</sup> (per phase)	
Dongo	360A	
Range	0.4%+0.3%F.S.	
Accuracy (RMS) *14	0.4%+0.6%F.S.	
Accuracy (Peak) <sup>*14</sup> Resolution <sup>*10</sup>		
	0.01 A Power	
Δοομεοογ		
Accuracy	0.4%+0.4% F.S. 0.1 W	
Resolution	Others	
Efficiency <sup>*11</sup> Dimension (W×D×H)	80%(Typical) 1700 x 1000 x 1740 mm / 62.92×39.37×68.50 in.	
	2240kg/4938lbs	
Weight Protection	OVP, OCP, OPP, OTP, FAN	
Remote Interface GPIB, RS-232, USB, Ethernet		
Onorotiina	Temperature Range	
Operatiing	<u>0°C to 40°C</u> -40°C to 85°C	
Storage	-4010 10 8510	

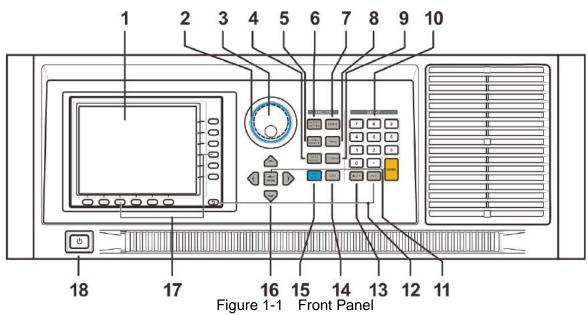
Humidity <sup>*12</sup>	0% to 95%
Safety & EMC	CE

Note	*1: The accuracy of voltage, frequency and maximum distortion tests use Power
	Analyzer Line Filter=50kHz and Update rate=250ms to measure the linear load. The referenced instrument is Model: YOKOGAWA WT3000.
	*2: The maximum distortion test is the maximum output power to linear load when the
	output voltage is set to 500VAC.
	*3: The load regulation condition is to set the sine wave output.
	*4: The multi-simulator parallel mode does not support single-phase mode.
	*5: The maximum current in parallel mode is N times the maximum current of a single
	unit. Ex. When 5 units are paralleled, the 61800-100 output current (RMS) is
	140x5=900A and the output peak current is 2313A.
	*6: The purpose of DC voltage output is to set the DC-bias for AC+DC.
	*7: The DC output rating in parallel mode (per phase in 3-phase mode) is N times that of
	a single unit. Ex. When 5 units are paralleled, the 61800-100 DC output current is
	70x5=350A.
	*8: The current harmonic distortion in Energy Recycling Mode is 3Ø 220VLL@60Hz, 3Ø
	380V <sub>LL</sub> @60Hz, 3Ø 480V <sub>LL</sub> @60Hz.
	*9: If an extra breaker is required for wiring, the input specification 3Ø
	$200-220V\pm10\%V_{LL}$ must use the breaker larger than 450A. For the input
	specification 3Ø 380-400V $\pm$ 10% V <sub>LL</sub> and 3Ø 440-480V $\pm$ 10%V <sub>LL</sub> , the breaker larger
	than 250A should be used.
	*10: The current measurement display is 4 digits, for instance if the measured current is
	between 10.00A-99.99A, the minimum display digits are 00.01.
	*11: The test efficiency is the maximum output power to linear load when the output voltage sets to 250VAC.
	*12: The operating humidity is in non-condensing state.
	*13: When measuring the accuracy (RMS) in parallel mode, the defined accuracy
	(Peak) spec. needs to add the parallel unit modification. For instance, if the
	accuracy (RMS) is 0.4%+0.3%F.S, it has to be above >N Amp with output voltage
	set to 250VAC and frequency set to 60Hz to meet the specification.(N is the parallel
	unit.)
	*14 The measurement related specifications in parallel mode such current and power
	need multiply the paralleled units, for instance, the output current (RMS) of 5
	paralleled units is 140x5=700A and the output peak current is 1800A.
	*15: See the voltage/current operating diagram below for the Regenerative Grid
	Simulator's output capability.
	*16: The accuracy of test phase variation mode is 250VAC for input voltage and 140A
	for load current. F.S.=360°.
	*17: The option-HV function used in parallel mode only supports the slave device that
	has the same function. For series high voltage mode, it requires two devices with
	option-HV function.



## 1.4 Function Keys

### 1.4.1 Front Panel



Item	Symbol	Description
1		<i>Display screen:</i> 6.5 inch LCD to display the input/output settings and measured result.
2		<i>Display LED</i> : It surrounds the rotary know and indicates the device is on when the light is on.

	$\cap$	RPG rotary knob:
3	(0)	It allows the user to turn the RPG rotary knob to adjust the
		voltage, frequency and input the programmed data or selection.
		SAVE or RECALL key:
4	SAVE / RECALL	Press this key on the MAIN PAGE can save/recall the output
	RECALL	setting (see also 3.10.1) as well as the system data (see also
		3.10.2.)
	LOCAL/	LOCAL/REMOTE key:
5	REMOTE	It switches to the control mode to "LOCAL" or "REMOTE".
6	OUTPUT	OUTPUT SETTING key:
Ŭ	SETTING	It skips to "Output: More Setting" for various functions settings.
		CONFIG key:
7	CONFIG	It skips to "CONFIG PAGE" for various functions settings.
	$\bigcup$	
		PHASE key:
8	PHASE	It sets the phase to single or 3-phase.
	$\bigcirc$	CURSOR key:
9	CURSOR	It shows the cursor to set or adjust the value.
		Numeric and decimal keys:
10	بغرب	The numeric and decimal keys are for the user to input the
	$\left( \cdot \right)$	digital data.
		ENTER key:
11	ENTER	It confirms the setting of parameter.
10	EXIT	EXIT key:
12		It returns to the previous menu.
-		Backspace and decrease key:
13		Backspace and decrease key: Press this key to erase the inputted number. Input minus "-", if
		there is no number before the cursor.
		LOCK key:
14	LOCK	Press it for 1 second to lock all keys and the knob. Press it again
		for 3~4 seconds to unlock it.
┝──┼		OUT/QUIT key:
15		Press this key can output the AC power or stop output voltage.
	A	Cursor movement keys:
16		These four movement keys move the cursor to different
		direction. In normal mode, press any of it will change the cursor
		position.

17	$\left( \right)$
18	Ú

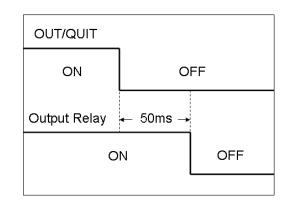
## the screen.

Indication key:

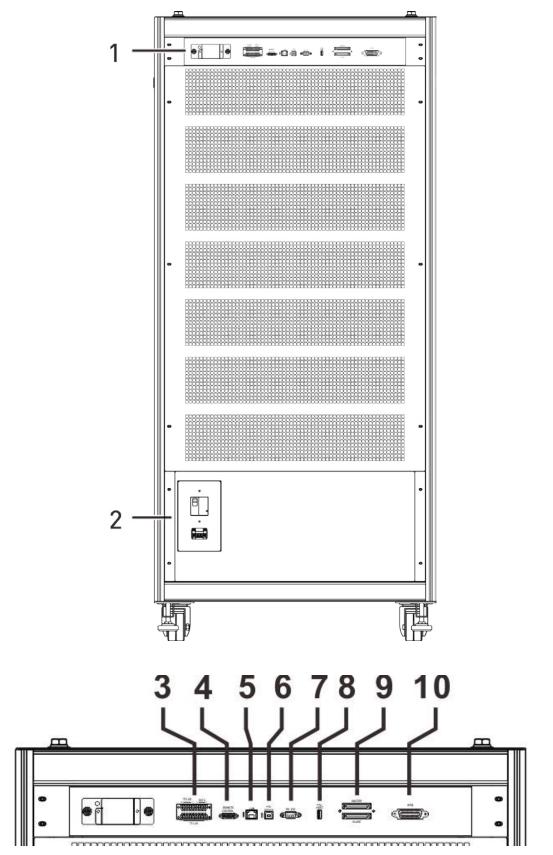
It sets the parameter or function following the description on Main power switch: It powers on or off the Regenerative Grid Simulator.



To extend the usage of output relay, it will delay 50ms for release when QUIT is pressed. If the load connected is inductive load, it will provide a discharge route for inductor current during the delay time due to the characteristics of Inductor current freewheeling.



### 1.4.2 Rear Panel



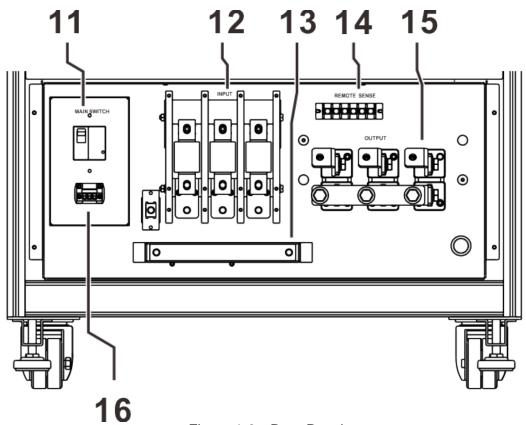


Figure 1-2 Rear Panel

-		able 1-2 Rear Panel Description
Item	Name	Description
1	Rear Panel Control	It contains Ext.Vref/TTL signal connector, remote control,
	Interface	GPIB, USB and RS-232 ports.
	Input/Output Cable	Its internal has 3-phase power input and output terminal, the
2	Connector	mains connector (3-phase) to the power input terminal, the
-	(Safe casing)	power output connector to UUT and input no-fuse leakage
		breaker.
0	Ext. Vref./TTL I/O	The Ext.Vref port inputs analog signals to control the output
3		waveform amplitude and the TTL I/O terminal to transmit the
	Remote Control	I/O control signal (Fault_out, Remote Inhibit & AC_ON.)
4	Remote Control	It is a remote control port to control the AC Source via an optional device.
5	Ethernet	It is the network (LAN) control interface.
5		
6	USB	It is a USB control interface to connect the PC for remote
	DC 000	operation.
7	RS-232	It is a 9-pin D-type male connector for RS-232 interface to connect the PC for remote operation.
8	Host USB	It is a USB control interface to connect the PC for remote
Ŭ		operation.
9	_	It is used to transmit the signal for Master/Slave parallel output.
_	Port	
10		It is a GPIB interface to connect the PC for remote operation.
11	Input No-Fuse	When a 24Vdc voltage is provided externally, it will open the
	Breaker	breaker (which can only be restored by hand) to cut off the
		system power.

 Table 1-2
 Rear Panel Description

12	Power Input Terminal	This input terminal connects the mains 3-phase power.
13	Input/Output Cable Fixing Bar	It fixes the 3-phase input/output connecting cable.
14	Remote Sense	It is the remote voltage sense. It senses the load directly to compensate the voltage drop caused by the cable. Be sure that the "Ls" terminal of the remote sense connects to the "L" terminal of load while the "Ns" connects to the "N" terminal of load. (Do not use reverse polarity for connection.)
15	Power Output Terminal	It is a 3-phase output terminal to connect to the UUT.
16	Trip Breaker Control Terminal	It connects the trip breaker control power.

# 2. Installation

## 2.1 Initial Inspection

Before shipment, this model was inspected and found to be free of mechanical and electrical defects. As soon as the device is unpacked, the user should inspect for any damage that may have occurred in transit. Save all packing materials in case the instrument has to be returned. If damage is found, please file a claim with the carrier immediately. Do not return the product to Chroma without prior approval.

## 2.2 Precautions before Use

- 1. First make sure that the floor is smooth and flat as well as endurable for maximum weight before placing the simulator.
- 2. The simulator has to connect to proper AC line input.
- 3. The Regenerative Grid Simulator is a fan cooling instrument thus needs to be installed in a place with sufficient air flow.
- 4. The operating temperature cannot exceed 40°C.

## 2.3 Input Power Specification

### 2.3.1 Ratings

Input voltage range:

61800-100
438 Max./Phase
(3Ø 200-220V±10%V <sub>LL</sub> )
228A Max./Phase
(3Ø 380-400V±10%V <sub>LL</sub> )
200A Max./Phase
(3Ø 440-480V±10%V <sub>LL</sub> )

- The 61800 Series products have 3 types of input voltage range; be sure to select the correct 3-phase AC voltage before purchase.
- All of the input voltage spec is based on 3-phase AC line voltage (L-L).

Input frequency: 47-63 Hz



It could cause the Regenerative Grid Simulator to be damaged if the input voltage is out of the spec.

### 2.3.2 Connecting for Input

The input connection plate is located at the bottom of the simulator. The power cable should be at least 85°C rated. The power cable input should have rated current larger or equal to the maximum rated current of Regenerative Grid Simulator.

Perform the steps below for connection as Figure 2-1 shows:

- 1. Remove the input cable connecting plate (safe casing) from the bottom of Regenerative Grid Simulator rear panel.
- 2. Connect the power cable to the power terminal of Regenerative Grid Simulator (see Figure 2-1.)
- 3. Slide the input cable connecting plate (safe casing) to cover the Regenerative Grid Simulator.
- 4. Secure the power cables using a fixing bar and lock with screw. •
- 5. Install the input cable connecting plate (safe casing) back.

**CAUTION** To protect the operator, the metal wire connected to GND terminal has to be earth grounded. In no cases the Regenerative Grid Simulator should not be operated without proper earth ground.

Voltage Range	Cable Spec.	Terminal Spec.				
(3Ø 200-220V±10%V <sub>LL</sub> )	150mm²(L1/L2/L3)	95-10(L1/L2/L3)				
(39 200-220 V ± 10 % V LL)	10mm <sup>2</sup> (GND)	10-10(GND)				
(3Ø 380-400V±10%V <sub>11</sub> )	100mm²(L1/L2/L3)	50-10(L1/L2/L3)				
$(3930-400  \text{V} \pm 10  \text{MV}_{LL})$	10mm <sup>2</sup> (GND)	10-10(GND)				
(3Ø 440-480V±10%V <sub>11</sub> )	100mm <sup>2</sup> (L1/L2/L3)	50-10(L1/L2/L3)				
$(30440-4600\pm10\%V_{LL})$	10mm <sup>2</sup> (GND)	10-10(GND)				

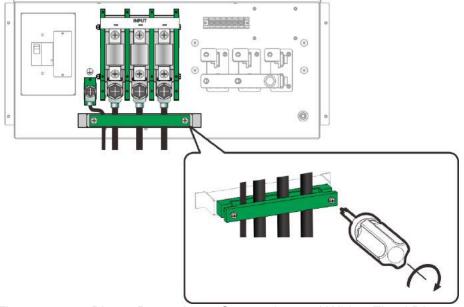


Figure 2-1 3-Phase Power Input Connection and Wiring Fixed Diagram



- 1. The power cable installation has to be performed by professional personnel in compliance with the local electrician regulation.
- 2. All of the input voltage spec is based on 3-phase AC line voltage (L-L).

- 3. Before connecting the input power cable, be aware of the color on the insulation tube and power cable. The brown, black and gray tubes indicate the 3-phase power cable L1. L2 and L3 while the green with yellow inlaid tubes is for GROUND.
- 4. To avoid improper torgue causing excessive contact impedance when wiring the input and output cable, it is suggested the input/output torgue for the M10 screw is 120kgf-cm.

#### **Output Connection** 2.4

The output terminal socket is located at the rear side of Regenerative Grid Simulator. The load is connected to the output terminal. For safety reason, the AC input/output cable must be secured with an appropriate tool and the casing has to be tightened up. The diameter the cable connected to the load has to be large enough so that it won't over heat when the output is over current, see Figure 2-2.



When DC voltage is contained in the output voltage, the output terminal "L" is "+" and "COM/N" is "-".

**WARNING** For the simulator to dissipate heat smoothly, it is necessary to keep at least 1 meter space for the device front and rear panel for ventilation. Do not place the device against the wall or any other objects.

#### 2.5 **Connecting Remote Sense**

The Remote Sense of the Regenerative Grid Simulator monitors the load voltage and compensates automatically to ensure the voltage transmitted to load is the set voltage.

Remove the cable connected to "L1", "L2", "L3" and "COM" from the Remote Sense terminal and change it by connecting to Load as Figure 2-2 shows. As the sense wire only sends a few MA (milliamps current), the sense metal wire is much thinner than the load wire. The sense wire is part of the Regenerative Grid Simulator feedback circuit, thus it has to keep low resistance in order to maintain the best performance. If the sense wire is not connected or opened during operation, the Regenerative Grid Simulator may not be able to output. It is necessary to ensure that the sense wire connection is not opened. The sense wire is twisted to reduce the interference from external voltage and needs to be close to the load as possible.

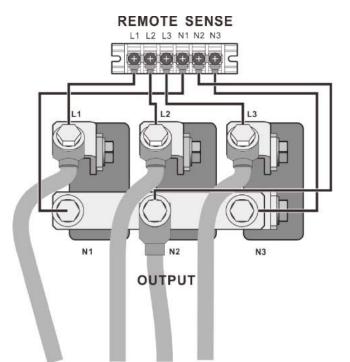


Figure 2-2 Connecting Output and Remote Voltage Sense

When the output sets to single phase, the Remote Sense wire should connect to the output terminal of second phase.

## 2.6 Power-On Procedure

**Notice** 

**CAUTION** Before turning on the instrument, all protective earth terminals, extension cords and devices connected to the instrument must be connected to a protective earth ground. Any interruption of the protective earth ground may cause potential electric shock hazard and result in personal injury.

Connect the power line and turn on the power switch on the front panel. The Regenerative Gird Simulator will begin a series of self tests. The LCD on the front panel will be on and display as below.

	Regenerative Grid Simulator SELF TEST Model:61800-100 SN:Z0001
Chroma	Self test         65%           Display **> OK         Version : 0.00.49           Waveform **>         Version : 0.07.2,0.07.2,0.07.2           Remote **>         Version : 0.04
	OUTPUT INFORMATION Output setting : 3_Phase Power ON Status : Off
	et         Vac         0.0V         F         60.00Hz         Vdc         0.0V           et         Vac         0.0V         F         60.00Hz         Vdc         0.0V           et         Vac         0.0V         F         60.00Hz         Vdc         0.0V           et         Vac         0.0V         F         60.00Hz         Vdc         0.0V
	2019/04/0 15:32:55

In the meantime the Regenerative Gird Simulator executes memory, data and communication self tests. The display shows the Model Number and Regenerative Gird Simulator's Serial No. after executing the self-test routines and each test item will show "OK" on the right if no error is found. It needs about 10 seconds for self-test to finish the routines and then the software version will show on the display.

"ERROR CODE" will appear on the right if one of the test items is failed.

When the self tests of memory, data and communication are done, the Regenerative Gird Simulator will conduct a power output self-test. The output relay is OFF during the procedure to ensure the load connected to the output terminal won't be damaged. The Regenerative Gird Simulator sets the output to 300Vac for voltage measurement. The power self-test fails and the display shows "NG" when the measured voltage is over 300V±100V. If the self-test is OK, the screen will change to the MAIN PAGE automatically.

- **Notice** 1. The user can run self-diagnosis during power on self-test to see if there are any errors or NG (No Good) conditions.
  - 2. The Regenerative Gird Simulator needs about 20 seconds to finish the self-test.

### 2.7 Maintenance and Cleaning

Remove all connected wires and cables on the instrument before cleaning. Use a brush to clean the dust on it and if there are stains on the chassis that cannot be removed by brush, wipe it with a volatile liquid. Do not use any corrosive liquid to avoid damaging the chassis. Use a damp cloth with soap and water or a soft detergent to clean the LCD front panel. Please send it back to the distributors or agents of Chroma for internal cleaning. Do not open the chassis cover arbitrarily

## 2.8 Common Environment Conditions

- 1. In door use only.
- 2. Altitude up to 2000m.
- 3. Temperature 0°C to 40°C.

# 3. Local Operation

## 3.1 Introduction

The Regenerative Grid Simulator can be configured to operate in local or remote mode. This section describes the operation in local mode using the keypad on the front panel for data entry and test. Local operation can be used directly when the Regenerative Grid Simulator is turned on.

## 3.2 Using Keyboard and RPG

The Regenerative Grid Simulator is equipped with a user friendly interface consisting of a keypad and a RPG (Rotary Pulse Generator) on the front panel. The LCD on Regenerative Grid Simulator displays the operations menu.

Figure 3-1 shows the command tree. The following describes how to use both the keypad and the RPG to set the commands. When the power-on procedure is completed (see 2.6), the display will show the MAIN PAGE (3\_Phase Mode/1\_Phase Mode) as below.

3	Pha	se		LOCA	L (	QUI	Г			1_Pha	se		LOCAL	. Q	UIT			
	-	OUTPUT SETTING								Main OUTPUT SETTING								
ē1	Vac	=	0	<u>. 0</u> V	F =	-	60.	00Hz	OUTPUT:	Vac	=	0	<u>. 0</u> V F	=	60.	001	Ηz	OUTPUT:
<b>2</b> 2	Vac	=	0	. 0 V	F =	•	60.	00Hz	More Setting									More Setting
<b>#</b> 3	Vac	=	0	. 0 V	F =	=	60.	00Hz	Measurement									Measurement
	MEASUREMENT							Setting	Setting MEASUREMENT								Setting	
	٧	=	0	.00	Po	=		0.0	Waveform	۷	=	0	.00	Po	=	1	0.0	Waveform
€1	I	=	0.1	000	PF	=	0.	000	Viewer	I	=	0.	000	PF	=	0.0	000	Viewer
	٧	=	0	. 0 0	Po	=		0.0	1000000000	Vac	=	0	.00	Vdc	=	0	.00	12201224
<b>#</b> 2	I	=	0.1	000	PF	=	0.	000	Limitation	Iac	=	0.	000	Idc	=	0.1	000	Limitation
	٧	=	0	. 00	Po	=		0.0	Output	Vpk	=	0	.00	VA	=	1	0.0	Output Mode
<b>4</b> 3	I	=	0.1	000	PF	=	0.	000	Mode	Ipk	=	0.	000	CF	= 0	0.1	0.000	
	V12	= 0.00 V <sub>23</sub> $=$ 0.00				Measurement	Management											
Σ	V 31	=	0	. 0 0	Po	=		0.0	To Page2									
	Recall CH1	Reca CH2		Recall CH3	Recall CH4		Recall CH5	More 1 of 2	2014/12/17	Recall CH1	Rec		Recall CH3	Recall CH4	Rec		More 1 of 2	2014/12/17

Press  $\blacktriangle$ ,  $\bigtriangledown$ ,  $\checkmark$ ,  $\checkmark$ , keys to move the cursor for item selection. Use numeric and decimal keys or RPG to set values and press **ENTER** to confirm them. The user can press the keys located at the LCD bottom or lower right to set the parameters or functions following the description on the screen, or press  $\bigcirc$  to return to the MAIN PAGE.

In the MAIN PAGE, it can press the keys located at the LCD bottom or lower right to select the function list. Use [A],  $[\nabla]$ ,  $[\triangleleft]$ ,  $[\triangleright]$  to move the cursor after entering the function list. For digital setting, use the numeric and decimal keys or the RPG to set the value and then press **ENTER** for confirmation. For text setting, it can turn the RPG for selection and press **ENTER** for confirmation.

### Main Page (Output & Meas. Setting) CONFIGuration

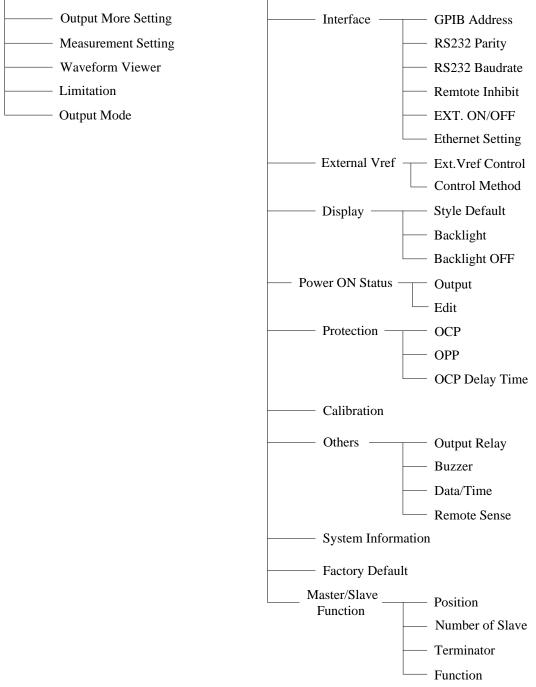


Figure 3-1

SAVE/RECALL	
Save Output Setting	
Save System Data	
Recall Output Setting	
Recall System Data	
Output Setting	
Output More Setting	— Coupling
	— Three Phase Setting
	— Output Waveform Selection
——— Measurement Setting —— ——— Waveform Viewer	V, Vac, Vdc, Vpk, I, Iac, Idc, Ipk, Is, F, P, VA, VAR, PF, CF
Limitation	— Vac $\cdot$ Vdc(+) $\cdot$ Vdc(-) $\cdot$ F
Utput mode	<ul> <li>List Mode</li> <li>Pulse Mode</li> <li>Step Mode</li> <li>Synthesize waveform</li> <li>Interharmonics waveform</li> <li>Harmonic measurement</li> </ul>
Figure 3	

# 3.3 MAIN PAGE (for Output Setting and Measurement)

When the Regenerative Grid Simulator is turned on and finished the self-test, the screen displays the MAIN PAGE (3\_Phase Mode/1\_Phase Mode). The upper section on the screen shows the output setting. The default output setting can be set by the Power ON Status (see 3.4.4) under the CONFIG function key. The MEASUREMENT on the screen shows the items measured by the Regenerative Grid Simulator and each of them has 12 types totaling 3 pages as shown below.

3	Pha	se	L	OCAL	. Q	UIT			3	Pha	se		LOCAL	_ Q	UIT			
					SETTING	100000	001000.000	Main				17.50		SETTING		ara a	STATES (SAIL)	Main
€1	Vac	=	0.	<u>0</u> V	F =	60	.00Hz	OUTPUT:	≣1	Vac	=	0	<u>. 0</u> V	F =	6	50.	00Hz	OUTPUT:
₹2	Vac	=	0.	0 V	F =	60	.00Hz	More Setting	₹2	Vac	=	0	.0V	F =	6	50.	00Hz	More Setting
₫3	Vac	=	0.	0 V	F =	60	.00Hz	Measurement	₫3	Vac	=	0	. OV	F =	e	60.	00Hz	Measurement
				MEASUR	EMENT			Setting					MEASUR	EMENT				Setting
	٧	=	0.	00	Po	=	0.0	Waveform		Vac	=	0	.00	Vdc	=	0	.00	Waveform
€1	I	=	0.0	00	PF	= 0	.000	Viewer	₹1	Iac	=	0.	000	Idc	=	0.	000	Viewer
	٧	=	0.	00	Po	=	0.0	12/2012/02		Vac	=	0	.00	Vdc	=	0	.00	
<b>#</b> 2	I	=	0.0	00	PF	= 0	.000	Limitation	<b>#</b> 2	Iac	=	0.	000	Idc	=	0.	000	Limitation
	V	#	0.	00	Po	=	0.0	Output		Vac	#	0	.00	Vdc	=	0	.00	Output
<b>#</b> 3	I	=	0.0	00	PF	= 0	.000	Mode	<b>#</b> 3	Iac	=	0.	000	Idc	=	0.	000	Mode
	V 12	=	0.	00	V23	=	0.00	Measurement		V 12	=	0	.00	V23	=	0	.00	Measurement
Σ	V 31	=	0.	0 0	Po	=	0.0	To Page2	Σ	V 31	=	0	.00	VA	=		0.0	Te Page3
	Recall CH1	Reca		ecall CH3	Recall CH4	Recall CH5	More 1 of 2	2014/12/17	1	Recall CH1	Rec		Recall CH3	Recall CH4	Rec		More 1 of 2	2014/12/17

3	Pha	se	LOCA	L QL	JIT			1_Pha	se	LOCAL	_ Q	UIT		
	and the		OUTPUT	SETTING	Villetterin	AD1 552 544	Main	5. M.		OUTPUT	SETTING	motor Read	-5.M)	Main
€1	Vac	=	<u>0.0</u> V	F =	60.	00Hz	OUTPUT:	Vac	=	<u>0.0</u> V F	-	60.00	Hz	OUTPUT:
₫2	Vac	=	0.0V	F =	60.	00Hz	More Setting							More Setting
₫3	Vac	=	0.0V	F =	60.	00Hz	Measurement							Measurement
			MEASU	EMENT			Setting			MEASUR	EMENT			Setting
	Vpk	=	0.00	VA	=	0.0	Waveform	٧	=	0.00	Po	=	0.0	Waveform
€1	Ipk	=	0.000	CF	= 0.	000	Viewer	I	=	0.000	PF	= 0.	000	Viewer
as l	Vpk	=	0.00	VA	=	0.0	1.000	Vac	=	0.00	Vdc	= 0	.00	12/2012/2
<b>#</b> 2	Ipk	=	0.000	CF	= 0.	000	Limitation	Iac	=	0.000	Idc	= 0.	000	Limitation
	Vpk	=	0.00	VA	=	0.0	Output	Vpk	=	0.00	VA	=	0.0	Output
<b>#</b> 3	Ipk	=	0.000	CF	= 0.	000	Mode	Ipk	=	0.000	CF	= 0.	000	Mode
Σ							Measurement To Page1							
1	Recall CH1	Rec		Recall CH4	Recall CH5	More 1 of 2	2014/12/17	Recall CH1	Recal CH2	Recall CH3	Recall CH4	Recall CH5	More 1 of 2	2014/12/17

The definition of output parameters:

- Vac : AC output voltage in Volts
- F : Output frequency in Hertz.
- Vdc : DC output voltage in volts.

Press **OUT/QUIT** enables the Regenerative Grid Simulator's output with the set Vac, F and Vdc. Press it again the Regenerative Grid Simulator output is disabled

#### Notice

When Coupling = AC+DC, the output is the sum of Vac and Vdc. However, the combination of peak voltage cannot exceed 424.2V. The output voltage will skip to 0V automatically and trigger the protection (OVP) if it exceeds the voltage limit.

Following lists the definition of measurement parameters:

- V : It is the voltage measurement in Volts. (True RMS measurement)
- F : It is the output frequency in Hertz.
- I : It is the current measurement in Amps. (True RMS measurement)
- P : It is the real power measurement in Volts.
- PF : It is Power Factor and the calculation formula = Real Power / (Vrms × Irms)
- CF : It is Crest Factor and the calculation formula = Ipeak/Irms
- Vdc : It is the DC voltage measurement in Volts.
- Idc : It is the DC current measurement in Amps.
- Ip : It is the peak current measurement in Amps. The Ipeak display is the Ip (+) or Ip (-) whichever is larger.

- Is : It is I surge that is only measured when output changes as defined in section 3.3.2.2.
- VA It is the apparent power in Volt-Ampere and the calculation formula = Vrms × Irms.
- VAR : The calculation formula =  $\sqrt{VA^2 P^2}$

# 3.3.1 OUTPUT: More Setting

Press OUTPUT: More Setting in the MAIN PAGE (3\_Phase Mode/1\_Phase Mode) (see section 3.3); a line of output functions will appear at the bottom of the screen as described below.

3	Phase LOCAL QUIT		1_Phase LOCAL QUIT
₹2	Vac = 0.0V F = 60.00Hz Vac = 0.0V F = 60.00Hz Vac = 0.0V F = 60.00Hz	Setting OUTPUT: More Setting	Vac = 0.0V F = 60.00Hz
43	Vac = 0.0V F = 60.00Hz MORE SETTING	Measurement Setting	MORE SETTING Measurement
<b>e</b> 1	Waveform = A SINE Waveform = A	Waveform Viewer	Waveform = A SINE Viewer
€2 €3	SINE Waveform = A SINE	Limitation	ON Degree = 0.0
	ON Degree = 0.0 OFF Degree = IMMED Vac S/R = 0.000V/ms Vdc S/R = 0.000V/ms	Output Mode	OFF Degree = IMMED Vac S/R = 0.000V/ms Vdc S/R = 0.000V/ms
	F S/R = 0.000Hz/ms Phase angle 1-2 = 120.0 Phase angle 1-3 = 240.0		Vdc S/R = 0.000V/ms F S/R = 0.000Hz/ms
C	upling AC Phase Vaveform AC Setting Selection	2014/12/17 15:35:51	Coupling Output 2014/12/17 AC Selection 15:36:30

## 3.3.1.1 Coupling Output Mode (AC+DC, AC, DC)

The Regenerative Grid Simulator has 3 types of output: AC+DC, AC and DC. The coupling can be set to meet a variety of applications.

The setting procedure from AC to AC+DC is described below:

- 1. Press Coupling at the bottom.
- 2. Turn the RPG to change the selection from AC to AC+DC and press ENTER.

3	Phase	300V	LOCAL	QUIT		3_Phase	300V	LOCAL	QUIT	
₹1 ₹2	Vac = Vac =	0.0V	SETTING F = F =	60.00Hz 60.00Hz	Setting OUTPUT: More Setting	Vac = Vac =	0.01	F =	60.00Hz 60.00Hz	Setting OUTPUT: More Setting
₫3	Vac =	0.0V	F =	60.00Hz	Measurement Setting	B3 Vac =	0.01	F =	60.00Hz	Mcasurement Setting
<b>#1</b>	Waveform = /	INE			Waveform Viewer	Waveform Waveform	SINE			Waveform Viewer
●2 ●3	Waveform = /	INE			Limitation	E2 Waveform	SINE			Limitation
	ON Degree Vac S/R	0.0	OFF Degr Vdc S/R	cc = 0.0 = 0.000V/ms	Output Mode	ON Degre Vac S/R		OFF Deg Is Vdc S/R		Output Mode
	F S/R Phase angle	0.000Hz/ms 1-2 = 120.0		gle 1-3 = 240.0		F S/R Phase ang	= 0.000Hz/ le 1-2 = 120.0		ngie 1-3 = 240.0	
с	oupling Ran AC 300		Output Waveform Selection		2014/08/23 13:34:58		tange Three 300V Settin	Waveform		2014/08/23 13:35:21

3	Phase 3	0 0 V	LOCAL	QUIT	
		OUTPUT	TSETTING		Setting
<b>e</b> 1	Vac = 0.0V	F =	60.00Hz Vd	c = 0.0V	OUTPUT:
₫2	Vac = 0.0V	F =	60.00Hz Vd	c = 0.0V	More Setting
<b>2</b> 3	Vac = 0.0V	F =	60.00Hz Vd	c = 0.0V	Measurement
		MORE	SETTING		Setting
<b>±</b> 1	Waveform = A SINE				Waveform Viewer
₹2	Waveform = A SINE				Viewer
<b>ē</b> 3	Waveform = A SINE				Limitation
		).0 ).000V/ms	OFF Degre Vdc S/R	te = 0.0 = 0.000V/ms	Output Mode
	F S/R = 0 Phase angle 1-2	0.000Hz/m = 120.0	-	gie 1-3 = 240.0	
	oupling Range AC+DC 300V	Three Phase Setting	Output Waveform Selection	10	2014/08/23



Since the Regenerative Grid Simulator does not have as many capacitors as the common DC Power Supply, some voltage fluctuations and transient load characters are not the same. This Regenerative Grid Simulator is able to provide positive and negative voltage without changing the output connector. When the capacitor charging current is too high, it may raise output volatility concerns.

Though the Regenerative Grid Simulator has AC/DC/AC+DC output mode, the features are still different from the common DC Power Supply when in pure DC mode as explained below.

- 1. The output voltage ripple is bigger because there is no output capacitor.
- 2. When the output current reaches the current limit set point, the output voltage will be cut off and in protection mode. It will not stay in constant current mode with a voltage drop like common DC sources.

#### 3.3.1.2 Setting Three Phase Output

Press Three Phase Setting to enter into the function as shown below.

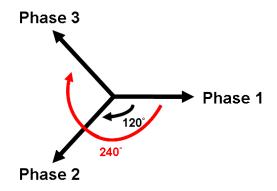
Edit: All, Each

Press Edit to set "Each" or "All" for 3-phase output voltage limit.

3	Phas	e		LOCAL		QU	ΙT			
				OUTPUT :	SETT1	NG	Sec. 1		12241	Setting
ē1	Vac	=	0	. OV	F	=	60	.00	Hz	Edit
2	Vac	=	0	. OV	F	=	60	.00	Hz	Each
¥3	Vac	=	0	. OV	F	=	60	.00	Hz	Sequence
				MORE SI	TTIN	G				Positive
<b>F1</b>	Waveform		A							Three Phases Independ.
<b>₽</b> 2	Waveform	. =	A							- independ.
•3	Waveform		A SINE							
	ON Deg	rcc	= 0	.0	OF	F Degr	cc = I	MMED		Phase
	Vac S/R		= 0	000V/ms	Ve	ic S/R		0.000	)V/ms	Disable
	F S/R		= 0	000Hz/ms						
	Phase a	ngle	1-2 -	120.0	Pł	ase an	igle 1-	3 = 24	10.0	
c	oupling AC	Ph	rce ase ting	Output Waveform Selection						2014/12/17 15:42:41

Sequence: Positive, Negative

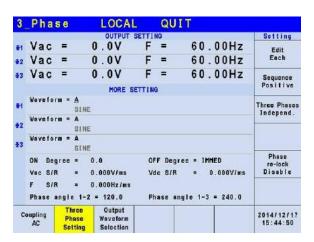
For example, the phase difference degree of 3-phase in positive balance is 120 degrees as shown below.



Press Sequence to set the Positive/Negative sequence for Regenerative Grid Simulator's 3-phase voltage output. The following lists the procedure to set the 3-phase output voltage sequence to Negative.

- 1. Press Sequence on the right.
- 2. Use RPG to select "Negative" and press ENTER.

3	Phase LOCAL QUIT		3_Phase LOCAL QUIT	
	OUTPUT SETTING	Setting	OUTPUT SETTING	Setting
<b>#1</b>	Vac = 0.0V F = 60.00H	Z Edit	🖬 Vac = 0.0V F = 60.00Hz	Edit
₹2	Vac = 0.0V F = 60.00H	Z Each	■2 Vac = 0.0V F = 60.00Hz	Each
<b>±</b> 3	Vac = 0.0V F = 60.00H	Z Sequence	∎3 Vac = 0.0V F = 60.00Hz	Sequence
	MORE SETTING	Positive	MORE SETTING	Negative
<b>e</b> 1	Waveform = A SINE	Three Phases Independ.	Waveform = A SINE	Three Phase Independ.
<b>#</b> 2	Waveform = A SINE		Waveform = A #2 SINE	
<b>#</b> 3	Waveform = A SINE		#3 Waveform = A SINE	
	ON         Degree =         0.0         OFF         Degree =         IMMED           Vec S/R         =         0.000V/ms         Vdc S/R         =         0.000V/ms	Phase re-lock Disable	ON Degree = 0.0 OFF Degree = 1HMED Vac S/R = 0.000V/ms Vde S/R = 0.000V/m	Phase re-lock Disable
	F S/R = 0.000Hz/ms Phase angle 1-2 = 120.0 Phase angle 1-3 = 240.	0	F S/R = 0.000Hz/ms Phase angle 1-2 = 120.0 Phase angle 1-3 = 240.0	
C	AC Sotting Selection	2014/12/17 15:43:32	Coupling AC Setting Selection	2014/12/17 15:44:12

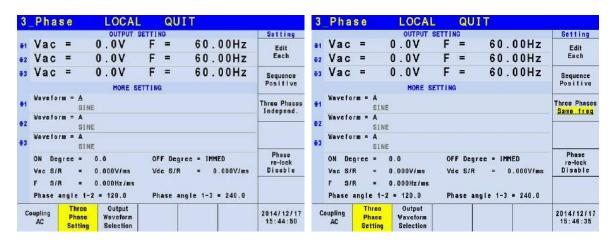


Three Phases: Independ., Same Freq, Balance

Press Three Phases to set the relationship among the Regenerative Grid Simulator 3-phase output voltage, which are Independ., Same Freq and Balance.

Following lists the procedure to set the same frequency for 3-phase voltage output.

- 1. Press Three Phases on the right.
- 2. Use RPG to select "Same freq" and press ENTER.



3	Pha	se		LOCAL	. QU	IT	
	5.011		1932	OUTPUT :		AMARTAN CONTRACTOR	Setting
<b>#1</b>	Vac	=	0	.0V	F =	60.00H	Z Edit
₹2	Vac		0	.0V			Each
<b>#</b> 3	Vac	=	0	. OV			Sequence
				MORE SI	ETTING		Negative
<b>e</b> 1	Wavefor		A				Three Phases Same freg
<b>2</b> 2	Wavefo		A				Jaime Trey
<b>\$</b> 3	Wavefo		A SINE				
	ON Deg	gree	= 0.	0	OFF Deg	rcc = 1MMED	
	Vac S/I	1	= 0.	000V/ms	Vdc S/R	= 0.000V/	ms
	F 5/1	1	= 0.	000Hz/ms			
	Phase a	angle	1-2 =	120.0	Phase a	ngle 1-3 = 240.	0
C	oupling AC	The Pha Set	SC	Output Waveform Selection			2014/12/17 15:51:02

When 3-phase balance is in use, the user may set the output voltage to be Phase Volt or Line Volt. Below is the procedure for setting the 3-phase voltage output to 3-phase balance.

- 1. Press Three Phases on the right.
- 2. Use RPG to select "Balance" and press ENTER.
- 3. Press Voltage set on the right.
- Use RPG to select "Line" and press ENTER.

3	_Phase LOCAL QUIT		3_Phase LOCAL QUIT
	OUTPUT SETTING	Setting	OUTPUT SETTING Setting
€1 €2	Vac = 0.0V F = 60.00Hz Vac = 0.0V	Edit Each	Balanced, Sequence:Negative, Voltage:Phase Vac = 0.0V F = 60.00Hz Each
•3		Sequence Negative	Sequence Negativi
	MORE SETTING Waveform = A	- Second and a second second	MORE SETTING Weyeform = A
<b>e</b> 1	waveform = A Sine Waveform = A	Three Phases Balance	et SINE Three Phases Balance
•2	SINE		•2 DTHE
<b>1</b> 3	Waveform = A SINE		Voltage se Vaveform = A \$3 SINE
	ON Degree = 0.0 OFF Degree = IMMED		ON Degree = 0.0 OFF Degree = IMMED
	Vac S/R = 0.000V/ms Vdc S/R = 0.000V/ms		Vac S/R = 0.000V/ms Vdc S/R = 0.000V/ms
	F S/R = 0.000Hz/ms		F S/R = 0.000Hz/ms
	Phase angle 1-2 = 120.0 Phase angle 1-3 = 240.0		
	oupling Three Output	2014/12/17	Coupling Three Output 2014/12/
	AC Setting Selection	15:51:58	AC Setting Selection 15:53:00
	AC PRISE WSVETOFIE		AC Phase Waveform 15-52-01
	AC Phase Selection Phase LOCAL QUIT OUTPUT SETTING	15:51:58 Setting	AC Setting Selection 15:53:02 3_Phase LOCAL QUIT OUTPUT SETTINO Balanced, Sequence: Near ive, Voltage:Line
	AC Phase Veveral Selection Phase LOCAL QUIT OUTPUT SETTING Balanced, Sequence: Negative, Voltage: Phase	15:51:58 Setting Edit Each Sequence	AC Setting Selection 15:53:00 3_Phase LOCAL QUIT OUTPUT SETTINO Belanced, Sequence:Negative, Voltage:Line Vac = 0.0V F = 60.00Hz Sequence Sequence
	AC Phase Veveral Selection Phase LOCAL QUIT OUTPUT SETTING Balanced, Sequence: Negative, Voltage: Phase	15:51:58 Setting Edit Each	AC     Phase Setting     Waveform Selection     15:53:03       3_Phase     LOCAL     QUIT       OUTPUT SETTINO Belanced, Sequence: Negative, Voltage:Line Vac = 0.0V       Vac = 0.0V     F = 60.00Hz       Sequence Negative
3	AC Setting Waveform Setting Selection Phase LOCAL QUIT OUTPUT SETTING Balanced, Sequence:Negative, Voltage:Phase Vac = 0.0V F = 60.00Hz MORE SETTING Waveform = A SINE	15:51:58 Setting Edit Each Sequence	AC       Phase       Waveform       15:53:03         3_Phase       LOCAL       QUIT         OUTPUT SETTINO         Balanced, Sequence:Negative, Voltage:Line         Vac =       0.0V       F = 60.00Hz         More Setting         MORE SETTING       Sequence         Waveform = A       SINE       Three Phase
3	AC Phase Veveral Selection Phase LOCAL QUIT OUTPUT SETTING Balanced, Sequence:Negative, Voltage:Phase Vac = 0.0V F = 60.00Hz MORE SETTING Waveform = A SINE Waveform = A	15:51:58 Setting Edit Each Sequence Negative Three Phases Balance	AC     Phase Setting     Waveform Selection     15:53:02       3_Phase     LOCAL     QUIT       OUTPUT SETTINO     Setting       Balanced,     Sequence: Negative,     Voltage: Line       Vac =     0.0V     F =     60.00Hz       MORE SETTING       Waveform = A SINE       Waveform =     A SINE       Waveform =     A SINE
3 #1	AC Setting Waveform Setting Selection Phase LOCAL QUIT OUTPUT SETTING Balanced, Sequence:Negative, Voltage:Phase Vac = 0.0V F = 60.00Hz MORE SETTING Waveform = A SINE	15:51:58 Sotting Edit Each Sequence Negative Three Phases	AC       Phase       Waveform       15:53:00         3_Phase       LOCAL       QUIT         OUTPUT SETTINO         Balanced,       Sequence: Negative,       Voltage: Line         Vac       =       0.0V       F       =       60.00Hz         MORE SETTING         Waveform = A       Sine         Waveform = A       Sine       Three Phase
3 #1	AC Setting Waveform Setting Selection Phase LOCAL QUIT OUTPUT SETTING Balanced, Sequence:Negative, Voitage:Phase Vac = 0.0V F = 60.00Hz MORE SETTING Waveform = A SINE Waveform = A SINE Waveform = A	15:51:58 Setting Edit Each Sequence Negative Three Phases Balance Voltage set	AC     Phase Setting     Waveform       3_Phase     LOCAL     QUIT       OUTPUT SETTINO       Balanced,     Sequence: Negative,       Vac =     0.0V     F =       60.00Hz     Sequence: Negative,       Waveform = A     SINE       Waveform = A     SINE       Waveform = A     Voltage set
3 #1 #2	AC Setting Vevenorm Setting Selection Phase LOCAL QUIT OUTPUT SETTING Balanced, Sequence:Negative, Voitage:Phase Vac = 0.0V F = 60.00Hz MORE SETTING Waveform = A SINE Waveform = A SINE	15:51:58 Setting Edit Each Sequence Negative Three Phases Balance Voltage set	AC       Phase Setting       Waveform Selection       15:53:03         3_Phase       LOCAL       QUIT         OUTPUT SETTINO       Setting         Balanced,       Sequence: Negative, Voltage: Line       Edit         Vac =       0.0V       F =       60.00Hz         More SETTING       Sequence       Sequence         Waveform = A       SINE       Salance         Vareform = A       SINE       Voltage or         SINE       SINE       Voltage or
C 3 #1 #2 #3	AC Setting Waveform Setting Selection Phase LOCAL QUIT OUTPUT SETTING Balanced, Sequence:Negative, Voltage:Phase Vac = 0.0V F = 60.00Hz MORE SETTING Waveform = A SINE Waveform = A SINE Waveform = A SINE Waveform = A SINE Waveform = A SINE Waveform = A SINE	15:51:58 Setting Edit Each Sequence Negative Three Phases Balance Voltage set	AC       Phase Softing       Waveform Selection       15:53:02         3_Phase       LOCAL       QUIT         OUTPUT SETTINO       Setting         Balanced,       Sequence: Negative, Voltage: Line       Setting         Vac =       0.0V       F =       60.00Hz         MORE SETTING       More Settive, Voltage: Line       Sequence: Negative, Voltage: Line         Vac =       0.0V       F =       60.00Hz         Sequence:       NORE SETTING       Sequence: Negative, Voltage: Line         Waveform = A       SINE       Sequence: Negative, Voltage: Line         Vac =       0.0V       F =       60.00Hz         Sequence:       Nore Setting       Negative, Voltage: Line         Voltage:       SINE       Voltage: Setting         Vaveform = A       SINE       Uine         ON       OFF Degree =       10HED

Phase re-lock: Enable, Disable

Phase re-lock is used to lock the phase again. Since the output voltage and frequency are set separately when the Regenerative Grid Simulator is in 3-phase mode, users can set the 3-phase for different frequency output. Assuming the 3-phase output frequencies are varied and users set them to the same when the phase re-lock function is disabled, the phase difference of the 3-phase output does not return to default (each phase difference is 120°) as Figure 3-3 shows. The phase difference of 3-phase output will return to default (each phase difference is 120°) as Figure 3-4 shows when the phase re-lock function is enabled.

Press Phase re-lock on the right to enable or disable the function.

3	Pha	se	LOCA	L QU	IT		3	Pha	se		LOCA	L	QU	IT	
			OUTPUT	SETTING	Martin Contractor	Setting		50M		11200	OUTPUT	SETT1	IG	MARTIN CONTRACTOR	Setting
₹1	Vac	=	0.0V	F =	60.00Hz	Edit	₹1	Vac	=	0	. 0 V	F	=	60.00Hz	Edit
₹2	Vac	=	0.0V	F =	60.00Hz	Each	₹2	Vac	=	0	. OV	F	=	60.00Hz	Each
₫3	Vac	=	0.0V	F =	60.00Hz	Sequence	₫3	Vac	=	0	. 0 V	F	=	60.00Hz	Sequence
			MORE	SETTING		Positive					MORE S	ETTIN			Positive
<b>e</b> 1	Wavefo		INE			Three Phases Independ.	<b>#1</b>	Wavefo		ABINE					Three Phases Independ.
₹2	Wavefo		INE			Independ.	₹2	Wavefo		A					Thuepenu.
<b>#</b> 3	Wavefo	rm = A					#3	Wavefo	rm = A						
	ON De	gree =		OFF Deg	rec = IMMED	Phase re-lock		ON De	arce =		)	OF	F Degi	rec = IMMED	Phase re-lock
	Vac SI	R =	0.000V/ms	Vdc S/R	= 0.000V/ms	Disable		Vac S/	R =	0.0	00V/ms	Vd	c S/R	= 0.000V/ms	Enable
	F 5/	R =	0.000Hz/ms					F 5/1	R =	0.0	OOHz/ms				
	Phase	angle	1-2 = 120.0	Phase a	ngle 1-3 = 240.0			Phase	angle	1-2 =	120.0	Ph	ase ar	ngle 1-3 = 240.0	
Co	AC	Thre Phas Setti	e Waveform			2014/12/17 15:55:23	c	oupling AC	Three Phase	se 1	Output Vevelorm Selection				2014/12/17 15:56:12

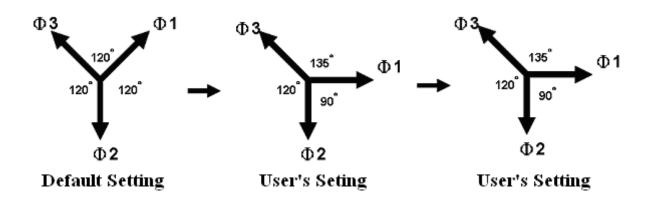


Figure 3-3 Phase Re-lock Disabled

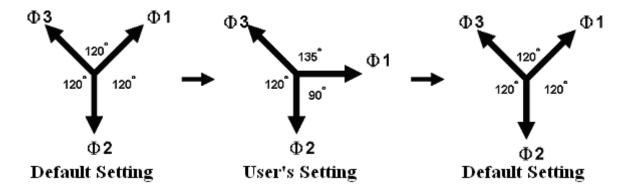


Figure 3-4 Phase Re-lock Enabled

#### 3.3.1.3 Output Degree

The Regenerative Grid Simulator can control the degree of the waveform during output or when stopping the output. In the MAIN PAGE (3\_Phase Mode/1\_Phase Mode) (see 3.3) press OUTPUT: More Setting on the right to set ON Degree and OFF Degree.

Following is the procedure to set the output phase degree to ON Degree = 90 and OFF Degree=180 in 1\_Phase Mode /3\_Phase Mode.

- 1. Press OUTPUT: More Setting on the right.
- 2. Move the cursor to "ON Degree=" command position.
- 3. Press **9**, **0**, and **ENTER** to change the value to "90.0".
- 4. The cursor moves to "OFF Degree=" command position automatically.
- 5. Press **1**, **8**, **0**, and **ENTER** to change the value to "180.0".

1_Phase 300V LOCAL QUIT		1_Phase LOCAL QUIT
Vac = 0.0V F = 60.00Hz	Setting OUTPUT: More Setting	Vac = 0.0V F = 60.00Hz
MORE SETTING	Mcasurement Setting	MORE SETTING Measurement Setting
Waveform = A SINE	Waveform Viewer	Waveform = A SINE
ON Degree = 90.0	Limitation	ON Degree = 90.0
OFF Degree = <u>180.0</u> Vac S/R = 0.000V/ms	Output Mode	OFF Degree = <u>180.0</u> Vac S/R = 0.000V/ms Mode
Vdc S/R = 0.000V/ms F S/R = 0.000Hz/ms		Vdc S/R = 0.000V/ms F S/R = 0.000Hz/ms
Coupling Range Output AC 300V Selection	2014/08/23 13:46:39	Coupling Output Veveform 2014/12/17 AC Selection 15:58:11

**Notice** 

If "OFF Degree=IMMED" when **QUIT** is pressed, the output voltage jumps off immediately. If a degree is already set, it will output voltage till it reaches the set degree. Input "OFF Degree= 360" will turn into "OFF Degree= IMMED".

#### 3.3.1.4 Slew Rate of Output Transient

The Regenerative Grid Simulator has the ability to set the slew rates of the voltage waveform. This is done through 3 commands in OUTPUT: More Setting. They are Vac S/R, F S/R and Vdc S/R, which control the change speed of voltage waveform.

Vac S/R:	It is	the	slew	rate	of	Vac output.
			-			

F S/R: It is the slew rate of frequency output.

Vdc S/R: It is the slew rate of Vdc output.

Change the output setting in MAIN PAGE when the Regenerative Grid Simulator is in OUT mode, the output voltage and frequency will change to follow the setting of Vac S/R, F S/R and Vdc S/R.

The procedure of setting Vac S/R =0.2, F S/R =0.1 and Vdc S/R =1 in 1\_Phase Mode /3\_Phase Mode is described below.

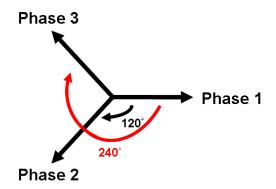
- 1. Move the cursor to  $\frac{Vac S}{R}$  =" command line.
- 2. Press **0**, **.**, **2** and **ENTER** to change the value to "0.2".
- 3. The cursor moves to "F S/R =" command automatically, press **0**, **.**, **1** and **ENTER**.
- 4. The cursor moves to "Vdc S/R =" command automatically, press 1 and ENTER.

3	Phase	LOCAL	QUI	T		1_Phase	LOCAL	QUIT	
	-	OUTPUT SI	ETTING	warman construction	Setting		OUTPUT SETTI		Setting
<b>#1</b>	Vac =	0.0V	F =	60.00Hz	OUTPUT:	Vac =	0.0V F =	60.00Hz	OUTPUT:
2	Vac =	0.0V	F =	60.00Hz	More Setting				More Setting
13	Vac =	0.0V	F =	60.00Hz	Measurement				Measurement
		MORE SET	TTING		Setting		MORE SETTIN	G	Setting
<b>e</b> 1	Waveform = A Si	NE			Waveform Viewer	Wavefor	m = A SINE		Waveform Viewer
2	Waveform = A SI	NE					SINC		
13	Waveform = A SI	NE			Limitation	ON Deg	1000 0000 V	. 0	Limitation
	ON Degree = Vac S/R =	0.0 0.200V/ms	OFF Degree Vdc S/R	= IMMED = 1.000V/ms	Output Mode	OFF Deg Vac S/R	=0	. 200V/ms	Output Mode
	F S/R =_ Phase angle 1	<u>0.100</u> Hz/ws -2 = 120.0	Phase ang	le 1-3 = 240.0		Vdc S/R F S/R		.000V/ms .100Hz/ms	
C	AC Settin	Waveform			2014/12/17 16:00:21	Coupling AC	Output Waveform Selection		2014/12/17 16:01:16

- Notice
- 1. When setting Vac S/R = 0, F S/R = 0, Vdc S/R = 0, the output transient outputs in the highest speed.
- 2. Though the input range of Vac S/R, F S/R, Vdc S/R is quite large when using the software editor, the output voltage may not apply the slew rate properly due to the hardware limit when the Vac S/R, F S/R and Vdc S/R are too large. The maximum of Vac S/R and Vdc S/R is 1200V/ms and the minimum is 0.001V/ms. The maximum of F S/R is 1600Hz/ms and the minimum is 0.001Hz/ms.
- 3. When executing **OUT** on the Regenerative Grid Simulator the output will reach the final state as set. Once QUIT is executed, the output turns to 0V immediately. If the user wishes to output the set slew rate to 0V, it is necessary to key in 0V and press **ENTER** instead of pressing **QUIT** directly.

## 3.3.1.5 Output Degree of 3-Phase Voltage Output

On the other hand the Regenerative Grid Simulator is able to set the phase difference degree for 3-phase output voltage. For instance the phase difference among the 3 phases is 120 degree for the output voltage with 3-phase balance positive sequence as the figure shown below.



Following lists the procedure for setting the output voltage to 3-phase balance with 120 degree phase difference among the 3 phases.

- 1. Move the cursor to <u>"Phase angle 1-2 =" command line.</u>
- 2. Press **1**, **2**, **0** and **ENTER**.

- 3. Move the cursor to "Phase angle 1-3 =" command line.
- 4. Press 2, 4, 0 and ENTER.

3	Phase	300V	LOCAL	QUIT	
	101.0	OUTPUT	SETTING	and the second second	Setting
₫1	Vac =	0.0V	F =	60.00Hz	OUTPUT:
<b>⊉</b> 2	Vac =	0.0V	F =	60.00Hz	More Setting
₫3	Vac =	0.0V	F =	60.00Hz	Measurement
		MORE	SETTING		Setting
₹1	Waveform =	A			Waveform Viewer
₹2	Waveform =	A			Viewa
<b>8</b> 3	Waveform =	A			Limitation
	ON Degree Vac S/R	= 0.0 = 0.000V/ms	OFF Degr Vdc S/R	cc = IMMED = 0.000V/ms	Output Mode
	F S/R	= 0.000Hz/m	-		1
	Phase angl	$e \ 1-2 = 120.0$	Phase an	igle 1-3 = <u>240.0</u>	
c		nge Three Phase DOV Setting	Output Waveform Selection		2014/08/23 13:49:05



Since the 3-phase voltage output of the Regenerative Grid Simulator is running separately, it is able to set the phase difference of 3-phase output to unbalance, such as Phase angle 1-2 = 100, Phase angle 1-3 = 200.

#### 3.3.1.6 Output Waveform Selection

The Regenerative Grid Simulator has two sets of unique waveforms, A and B. Each of them has sine, square, clipped sine waveforms and 30 sets of built-in waveforms along with 6 sets of user defined waveforms.

3	Pha	se	LOCA	L QI	UIT	
			OUTPUT	SETTING	Manage Contraction	Waveform
<b>#1</b>	Vac	=	0.0V	F =	60.00Hz	Edit
₹2	Vac	=	0.0V	F =	60.00Hz	Each
<b>#</b> 3	Vac	=	0.0V	F =	60.00Hz	
			MORE	SETTING		
<b>e</b> 1	Wavefo	rmA=	SINE			View Waveform
-	Wavefo	rm B =	SINE			
	Wavefo	rm A =	SINE			
<b>*</b> 2	Wavefo	rm B =	SINE			
<b>#</b> 3	Wavefo	rm A =	SINE			
	Wavefo	rm B =	SINE			
C	oupling	Three Phase			T	2014/12/1
	AC	Settin				16:03:58

Follow the steps below to set the 3-phase waveform to A and to sine:

- 1. Press Edit on the right and use RPG to change the selection to All.
- 2. Move the cursor to WAVE A command line.
- 3. Turn the RPG to select "SINE" and press ENTER.

The user can press "View Waveform" on the right to view the set waveform.

3	_Pha	se		LOCA	LC	TIUS			3_	Pha	s e		LOCA	L.	QU	ΙT		
	-		17120		SETTING			Waveform		-		max	OUTPUT		NG	(Sparge)	002102020	Waveform
<b>ē</b> 1	Vac	=	0	.0V	F =	•	60.00Hz	Edit	<b>€1</b>	Vac	=	0	. 0 V	F	=	60	.00Hz	Edit
<b>2</b> 2	Vac	=	0	. OV	F =		60.00Hz	Each	#2 \	Vac	=	0	. OV	F	=	60	.00Hz	ALL
₫3	Vac	=	0	. OV	F =	•	60.00Hz		#3 \	Vac	=	0	. 0 V	F	=	60	.00Hz	
				MORE S	ETTING								MORE S	SETTIN	3			
<b>e</b> 1	Wavefo Wavefo		-	-				View Waveform			rm A = rm B =							View Waveform
•2	Wavefo							-	42		rm A =							-
	Wavefo							-			rm B =							-
<b>¥</b> 3	Wavefo Wavefo								<b>#</b> 3		rm A = rm B =							
-	oupling	Thro Phas	T	Output Waveform				2014/12/17		pling AC	Thre Phas Settin	6 1	Output Vaveform					2014/12/1
C	AC	Setti	ng	Selection				A REAL PROPERTY.		63	outin	ig j	Selection					100000000
							QUIT		3_	Pha			LOCA	L	QU	ΙT	1	
3	Ac Pha	5 <del>0</del>	30	OV OUTPUT	SETTING		and the second s	Waveform			se		LOCA OUTPUT	SETT1	NG	Viero	0.011	Waveform
3	Ac Pha Vac	s e =	30 0	0 V output . 0 V	SETTING F =		60.00Hz	Edit	ē1 -	Vac	<mark>se</mark> = _	0	LOCA output .0V	F	NG =	60	.00Hz	Waveform
<b>3</b> #1	Ac Pha Vac Vac	s e = =	30 0 0	0 V output . 0 V . 0 V	SETTING F = F =		60.00Hz 60.00Hz	and the second second	ē1 ē2	Vac Vac	s e = _	0	LOCA OUTPUT .0V .0V	SETTI F F	NG	60 60	.00Hz	Waveform
3	Ac Pha Vac	s e = =	30 0 0	0 V output . 0 V	SETTING F =		60.00Hz	Edit	ē1 ē2	Vac	s e = _	0	LOCA output .0V	F	NG =	60 60		Waveform
3 ₽1 ₽2	Ac Pha Vac Vac	s e = =	30 0 0	0 V 00TPUT . 0 V . 0 V . 0 V	SETTING F = F =		60.00Hz 60.00Hz	Edit	⊕1 ⊕2 ⊕3	Vac Vac Vac	s e = _ =	0 0 0 0 0	LOCA OUTPUT .0V .0V	F F F	NG = = =	60 60 60	.00Hz	Waveform
3 #1 #2	Ac Pha Vac Vac	S C = = = =	30 0 0 0 81NE	0 V 00TPUT . 0 V . 0 V . 0 V MORE S	SETTING F = F = F =		60.00Hz 60.00Hz	Edit	⊕1 ⊕2 ⊕3	Vac Vac Vac	s e = _	0 0 0 0 0	LOCA output .0V .0V .0V	F F F	NG = = =	60 60 60	.00Hz	Waveform
3 11 15 12 15 13	Ac Pha Vac Vac Vac Vac	S	30 0 0 <u>0</u> <u>SINE</u> SINE	0 V 00TPUT . 0 V . 0 V . 0 V MORE S	SETTING F = F = F =		60.00Hz 60.00Hz	Edit Each View	⊕1 ⊕2 ⊕3	Vac Vac Vac	s e = _ =	0 0 0 0 0	LOCA output .0V .0V .0V	F F F	NG = = =	60 60 60	.00Hz	Waveform
3 ₽1 ₽2	AC Phac Vac Vac Vac Vac Wavefor Wavefor	S.C = = = = = = = = = = = = = = = = = = =	30 0 0 0 sine sine sine sine	0 V 00TPUT . 0 V . 0 V . 0 V MORE S	SETTING F = F = F =		60.00Hz 60.00Hz	Edit Each View	⊕1 ⊕2 ⊕3	Vac Vac Vac	s e = _ =	0 0 0 0 0	LOCA output .0V .0V .0V	F F F	NG = = =	60 60 60	.00Hz	Wave for:

Follow the steps below to set the A waveform of 3-phase to clipped sine with a total harmonic distortion of 35%.

- 1. Press Edit on the right and use RPG to change the selection to All.
- 2. Move the cursor to the WAVE A command line and select "CSIN".
- 3. The LCD screen to show MODE and PERCENT.
- 4. Turn the RPG to change MODE to "THD" and press ENTER.
- 5. Press **3**, **5** and **ENTER** to set the THD to be 35%.

3	Pha	se	30	10V	LOCAL	QU	IT		3	Pha	se	30	0 V 0	LOC	AL	QL	JIT	
					SETTING		anna anns	Waveform				240	OUTPUT	T SETTI	NG		2000005	Waveform
₫1	Vac	=	0	. OV	F =	60.	.00Hz	Edit	≣1	Vac	=	0	. OV	F	=	60	.00Hz	Edit
₫2	Vac	=	0	.0V	F =	60.	.00Hz	ALL	<b>⊉</b> 2	Vac	=	0	. OV	F	=	60	.00Hz	ALL
₫3	Vac	=	0	.0V	F =	60.	.00Hz		₫3	Vac	=	0	. O V	F	े 🗕	60	.00Hz	
				MORE	SETTING								MORE	SETTIN	G			
	Wavefo	rmA=	SIN					View Waveform		Wavefo	rm A	= CSIN	Mode	= AMP	Percen	t =	35%	View
<b>2</b> 1	Wavefo	rm B =	SIN					wavetorm	₹1	Wavefo	rm B	SINE						Waveform
	Wavefo	rm A =	SIN							Wavefo	rm A	CSIN	Mode	= AMP	Percen	t =	35%	
₹2	Wavefo	rm 8 =	SIN					2	₹2	Wavefo	rm B	SINE						2
	Wavefo	rm A =	SIN					-		Wavefo	rm A .	= CSIN	Made	= AMP	Percen	• =	35%	-
₫3	Wavefo							43 	<b>4</b> 3	Wavefo								
0	oupling	Rand		Three	Output	-		2014/08/23	-	oupling	Ran		Three		put			2014/08/23
U.	AC	300		Phase Setting	Waveform Selection			13:52:34		AC	30(		Phase Setting		eform ction			13:55:13

3	Pha	se	300V	LOCAL	QUIT	
			OUTPUT	SETTING	and an and a second	Waveform
H	Vac	=	0.0V	F =	60.00Hz	
2	Vac	=	0.0V	F =	60.00Hz	-
3	Vac	=	0.0V	F =	60.00Hz	
			OUTPUT WAVE	FORM A OF #1		
	Wavefor	m A Mod	ic = AMP Per	cent = 35	%	
		-				
	1					
	+	++	+			0.
	1		1			
	1	- 1				1
	1	- 1				
			المسلسين ويشارع ومل	Output		-

- Clipped sine waveform can be programmed via "Amplitude" or "Total Harmonic Distortion". The amplitude range is from 0 to 100% (100%: without clipping) while the Total Harmonic Distortion range is from 0 to 43% (0%: without distortion.)
  - 2. The user defined waveform needs to be defined by and downloaded from the remote PC.
  - 3. For detail DST waveform, please see *Appendix B Built-in DST Waveform*.
- **WARNING** 1. When using the user defined waveform, it may damage the Regenerative Grid Simulator if the waveform frequency exceeds 100Hz.
  - Due to the bandwidth restriction of Regenerative Grid Simulator, distortion may occur on the output especially when the user defined waveform contains high frequency.
  - 3. If the user defined waveform or the set DST waveform exceeds the voltage limit, OUTPUT OVP or DST Protection will occur.

# 3.3.2 Measurement Setting

Press Measurement Setting in the MAIN PAGE (3\_Phase Mode/1\_Phase Mode) to set the measurement as the figure shown below. There are 12 measurement items in the setting screen such as voltage, current, output power and etc. The setting is done by moving the cursor to each item and use the RPG to select the required test item and press **ENTER**.

Below is procedure to change the 3<sup>rd</sup> measurement item from Po to VA in 3-phase mode.

- 1. Press Measurement Setting in the MAIN PAGE (3\_Phase Mode).
- 2. Move the cursor to "Po".

Notice

- 3. Use the RPG to select "VA" and press ENTER.
- 4. Press (D) to return to the MAIN PAGE.

3	Pha	se	LOCAL	_ QL	JIT			3	Pha	s e	1	LOCAL	. QI	JIT		
				SETTING	VANTO	001000000	Setting				11515	OUTPUT S	SETTING	1000014	001000000	Setting
€1	Vac	=	0.0V	F =	60.	00Hz	OUTPUT:	₹1	Vac	=	0	. 0 V	F =	60.	00Hz	OUTPUT:
₹2	Vac	=	0.0V	F =	60.	00Hz	More Setting	₹2	Vac	-	0	. OV	F =	60.	00Hz	More Setting
₫3	Vac	=	0.0V	F =	60.	00Hz	Measurement	₫3	Vac	=	0	. OV	F =	60.	00Hz	Measurement
			MEASUREMEN	T SETTING			Setting				ME	ASUREMEN	T SETTING			Setting
	٧	Po	Vac	Vdc	Vpk	VA	Waveform	- 6	٧	-	VA	Vac	Vdc	Vpk	VA	Waveform
±1	I	PF	Iac	Idc	Ipk	CF	Viewer	±1	I	PF		Iac	Idc	Ipk	CF	Viewer
	V	Po	Vac	Vdc	Vpk	VA	100000		V	Po		Vac	Vdc	Vpk	VA	100000
<b>#</b> 2	I	PF	Iac	Idc	Ipk	CF	Limitation	<b>#</b> 2	I	PF		Iac	Idc	Ipk	CF	Limitation
	٧	Po	Vac	Vdc	Vpk	VA	Output		٧	Po		Vac	Vdc	Vpk	VA	Output
<b>#</b> 3	I	PF	Iac	Idc	Ipk	CF	Mode	<b>#</b> 3	I	PF		Iac	Idc	Ipk	CF	Mode
	V 12	V23	V 12	V23			-		V 12	V2	3	V 12	V23			
Σ	V 31	Po	V 31	VA				Σ	V 31	Po		V 31	VA			
	verage Times	Isurgo Delay 10ms	Isurge Interval 10ms	Edit Al I			2014/12/17 16:19:41		verage Times	Isurg Delay 10n	1 1	Isurge Interval 10ms	Edit Al I			2014/12/17 16:20:39

3	Pha	se	LOCAL	QL	JIT		3	_Pha	se	LOCA	L Q	UIT		
			OUTPUT S	ETTING	and the second second	Setting					SETTING	No. of Concession, Name	1011-002-0040	Main
<b>#1</b>	Vac	=	0.0V	F =	60.00H	Z OUTPUT:	€1	Vac	=	<u>0.0</u> V	F =	60.	00Hz	OUTPUT:
₹2	Vac	-	0.0V	F =	60.00H	Z More Setting	₹2	Vac	=	0.0V	F =	60.	00Hz	More Setting
<b>±</b> 3	Vac	=	0.0V	F =	60.00H	The sourcements	₫3	Vac	=	0.0V	F =	60.	00Hz	Measurement
			MEASUREMENT	SETTING		Setting				MEASU	REMENT			Setting
	٧	VA	Vac	Vdc	Vpk VA	Waveform		۷	=	0.00	VA	=	0.0	Waveform
±1	I	PF	Iac	Idc	Ipk CF		₹1	I	=	0.000	Po	=	0.0	Viewer
sel	٧	VA	Vac	Vdc	Vpk VA			٧	=	0.00	Po	=	0.0	1220123
<b>1</b> 2	I	PF	Iac	Idc	Ipk CF	Limitation	<b>#</b> 2	I	=	0.000	PF	= 0.	000	Limitation
	٧	VA	Vac	Vdc	Vpk VA	Output		٧	=	0.00	Po	=	0.0	Output
<b>#</b> 3	I	PF	Iac	Idc	Ipk CF	Mode	<b>#</b> 3	I	=	0.000	PF	= 0.	000	Mode
	V 12	V23	V 12	V23				V 12	=	0.00	V23	= 0	.00	Measurement
Σ	V 31	Po	V 31	VA			Σ	V 31	=	0.00	Po	=	0.0	To Page2
	verage Times	lsurge Delav	Isurge Interval	Edit		2014/12/17	1	Recall	Rec		Recall	Recall	More	2014/12/17
	1	10ms	10ms	ALI		16:22:47		CH1	СН	2 CH3	CH4	CH5	1 of 2	16:25:53

Below is the procedure to the 2<sup>nd</sup> measurement item from I to Iac in 1 phase mode.

- 1. Press Measurement Setting in the MAIN PAGE (1\_Phase Mode).
- Move the cursor to "l".
   Use the RPG to select "lac" and press ENTER.
   Press (D) to return to the MAIN PAGE.

_Phas	6 e	LOCAL	QL	JIT			1_Phas	6 e	LOCAL	QL	JIT		
Vac	= (	OUTPUT S		60.00	Hz	Setting OUTPUT: More Setting	Vac	=	OUTPUT S	ETTING =	60.00	Hz	Setting OUTPUT: More Setting Measurement
		MEASUREMEN	T SETTING			Setting			MEASUREMENT	SETTING			Setting
<u>V</u> I	P₀ PF	Vac Iac	Vdc Idc	Vpk Ipk	VA CF	Waveform Viewer	V Iac	Po PF	Vac Iac	Vdc Idc	Vpk Ipk	VA CF	Waveform Viewer
						Limitation							Limitation
						Output Mode							Output Mode
Average Times	lsurgs Start	lsurge Interval			1	2014/12/17	Average Times	lsurge Start	lsurge Interval				2014/12/17 16:27:27

1_Pha	s e	LOCAL	QL	JIT			1_Pha	s e	LOCA	L Q	UIT		
Vac	-	0.0V F		60.00	Hz	Setting OUTPUT: More Setting	Vac	=		F =	60.00	)Hz	Main OUTPUT: More Setting
		MEASUREMEN	TSETTING			Measurement Setting			MEAS	UREMENT			Measurement Setting
V Iac	P₀ PF	Vac Iac	Vdc Idc	Vpk Ipk	VA CF	Waveform Viewer	V Iac	=	0.00	P₀ PF	= = 0	0.0	Waveform Viewer
						Limitation	Vac Iac	= =	0.00	Vdc Idc		0.00	Limitation
						Output Mode	Vpk Ipk	=	0.00	VA CF	= 0	0.0	Output Mode
Average Times 1	Isurge Start 10ms	lsurge Interval 10ms				2014/12/17 16:27:27	Recall CH1	Rec		Recall CH4	Recall CH5	More 1 of 2	2014/12/11 16:28:57

#### 3.3.2.1 Average Times

Average Times is the sampling average of voltage/current RMS and voltage/current peak. The Regenerative Grid Simulator uses moving windows for sampling. When "4" is selected for Average Times it indicates it will be sampling 4 times in moving windows.

Press Average Times at the bottom to set the average times for sampling. When the measurement is fluctuated severely, higher sampling average times can be set to improve the measurement accuracy. The average times for sampling to be set are listed below.

Average Times: 1, 2, 4, 8, 16 and 32.

Follow the steps below to set the sampling average times to 1.

- 1. Press Average Times at the bottom.
- 2. Turn RPG to switch to "1" and press ENTER.

3	Pha	se	LOCAL	. QL	JIT		
	-		OUTPUT S	SETTING	Starry 1	ALL REAL PARTY	Setting
<b>#1</b>	Vac	=	0.0V	F =	60.	00Hz	OUTPUT:
₫2	Vac	-	0.0V	F =	60.	00Hz	More Setting
₫3	Vac	=	0.0V	F =	60.	00Hz	Measurement
			MEASUREMEN	T SETTING			Setting
	٧	Po	Vac	Vdc	Vpk	VA	Waveform
€1	I	PF	Iac	Idc	Ipk	CF	Viewer
	V	Po	Vac	Vdc	Vpk	VA	2230233
<b>₹</b> 2	I	PF	Iac	Idc	Ipk	CF	Limitation
	٧	Po	Vac	Vdc	Vpk	VA	Output
<b>#</b> 3	I	PF	Iac	Idc	Ipk	CF	Mode
	V 12	V23	V 12	V23			-
Σ	V 31	Po	V 31	VA			
	verage Times	Isurge Delay 10ms	Isurge Interval 10ms	Edit Each		-	2014/12/17 16:30:36

#### 3.3.2.2 Isurge Delay, Isurge Interval

The Isurge in Measurement Setting is the surge peak current output by the Regenerative Grid Simulator. Isurge measurement starts after Isurge Delay when the voltage output changes. The measurement time is set by Isurge Interval. These two functions can be set by Measurement Setting.

The procedure for setting Isurge Delay = 10 ms, Isurge Interval = 10 ms is described below.

- 1. Move the cursor to "Isurge Delay =" command line.
- 2. Press **1**, **0** and **ENTER** to change the value to "10.0".
- 3. Move the cursor to "Isurge Interval =" command line.
- 4. Press **1**, **0** and **ENTER** to change the value "10.0".

3	Pha	se	LOCAL	. QL	JIT			3	Pha	se	LOCAL	. QU	IT		
	5.011		OUTPUT S	SETTING	Non Tria	00410020040	Setting					SETTING	Silesteria	10040000000	Setting
<b>#1</b>	Vac	=	0.0V	F =	60.	00Hz	OUTPUT:	€1	Vac	=	0.0V	F =	60	00Hz	OUTPUT:
₽2	Vac	=	0.0V	F =	60.	00Hz	More Setting	₹2	Vac	=	0.0V	F =	60	00Hz	More Setting
₫3	Vac	=	0.0V	F =	60.	00Hz	Measurement	₫3	Vac	=	0.0V	F =	60	00Hz	Measurement
			MEASUREMEN	T SETTING			Setting				MEASUREMEN	T SETTING			Setting
-92	۷	Po	Vac	Vdc	Vpk	VA	Waveform	- 81	٧	Po	Vac	Vdc	Vpk	VA	Waveform
<b>±</b> 1	I	PF	Iac	Idc	Ipk	CF	Viewer	₹1	I	PF	Iac	Idc	Ipk	CF	Viewer
2	۷	Po	Vac	Vdc	Vpk	VA	1000000		۷	Po	Vac	Vdc	Vpk	VA	100000
<b>#</b> 2	I	PF	Iac	Idc	Ipk	CF	Limitation	<b>#</b> 2	I	PF	Iac	Idc	Ipk	CF	Limitation
	٧	Po	Vac	Vdc	Vpk	VA	Output		٧	Po	Vac	Vdc	Vpk	VA	Output
<b>#</b> 3	I	PF	Iac	Idc	Ipk	CF	Mode	<b>#</b> 3	I	PF	Iac	Idc	Ipk	CF	Mode
	V 12	V23	V 12	V23					V 12	V23	V 12	V23			
Σ	V 31	Po	V 31	VA				Σ	V 31	Po	V 31	VA			
	verage Times 1	Isurge Delay <u>10</u> ms	Isurge Interval 10ms	Edit Each			2014/12/17 16:31:21		verage Times	Isurgo Delay 10ms	Isurge Interval 10ms	Edit Each			2014/12/17 16:35:01

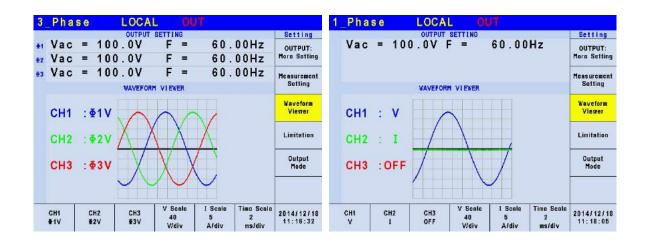
# 3.3.3 Waveform Viewer

Waveform Viewer can be used to see the real time output voltage/ current waveform. There are a total of 3 CH available. Voltage, current and time can be adjusted by the Scale command. The figure below shows the Waveform Viewer.

**Ch1:** Φ1V, Φ2V, Φ3V, Φ1I, Φ2I, Φ3I. **Ch2:** Φ1V, Φ2V, Φ3V, Φ1I, Φ2I, Φ3I. **Ch3:** Φ1V, Φ2V, Φ3V, Φ1I, Φ2I, Φ3I. **V Scale:** 10, 20, 40, 80, 120V/div. **I Scale:** 5, 10, 20, 40, 60A/div. **Time Scale:** 0.2, 0.5, 1, 2, 5, 10, 50, 100, 200ms/div.

The procedure for setting CH1 = $\Phi$ 1V, CH2 = $\Phi$ 2V, CH3 = $\Phi$ 3V, V Scale = 40 V/div, I Scale = 5A/div, Time Scale = 2 ms/div in 1\_Phase Mode /3\_Phase Mode is described as below.

- 1. Press CH1 at the bottom.
- 2. Turn the RPG to change to "Φ1V" and press ENTER
- 3. Press CH2 at the bottom.
- 4. Turn the RPG to change to "Φ2V" and press ENTER.
- 5. Press CH3 at the bottom.
- 6. Turn the RPG to change to "Φ3V" and press ENTER.
- 7. Press V Scale at the bottom.
- 8. Turn the RPG to change to "40" and press ENTER.
- 9. Press I Scale at the bottom.
- 10. Turn the RPG to change to "5" and press ENTER.
- 11. Press Time Scale at the bottom.
- 12. Turn the RPG to change to "2" and press ENTER.



# 3.3.4 Limitation

The Limit of Regenerative Grid Simulator 1-phase/3-phase output mode is set separately. For instance, the Vac Limit setting will apply the settings of the 1-phase mode when changing it from the 3-phase mode.

#### 3.3.4.1 Vac Limit

Vac Limit sets the Vac value in MAIN PAGE (3\_Phase Mode/1\_Phase Mode). Press Limitation on the right in MAIN PAGE (3\_Phase Mode/1\_Phase Mode) to set the Vac Limit. This command protects the planned program instead of the hardware.

Press Edit at the bottom to set the limitation of the 3-phase voltage output for "Each" or "All".

The procedure to set Vac Limit = 300V in 1\_Phase Mode /3\_Phase Mode is described below.

- 1. Move the cursor to "Vac =" command line.
- 2. Press **3**, **0**, **0** and **ENTER** to change the value to "300.0".

3	Phas	e	LOCAL	QU	IT			1_Phase	LOCAL	QUIT		
	-		OUTPUT SI	TTING	Same 1	0100000	Setting		OUTPUT SE		and the second se	Setting
ē1	Vac	=	0.0V	F =	60.	00Hz	OUTPUT:	Vac =	0.0V F	= 60.	00Hz	OUTPUT:
<b>2</b> 2	Vac	=	0.0V	F =	60.	00Hz	More Setting					More Setting
13	Vac	=	0.0V	F =	60.	00Hz	Measurement					Measurement
			LIMITA	TION			Setting		LIMITAT	ION		Setting
€1		=_	<u>300.0</u> V 100.00Hz	Vdc( Vdc(		24.2V 0.0V	Waveform Viewer	Vac =		Vdc(+)= Vdc(-)=		Waveform Viewer
	Vac	=	300.0V	Vdc(	+)= 4	24.2V	Limitation			. ,		Limitation
<b>\$</b> 2	F	=	100.00Hz	Vdc(	- ) =	0.0V	Output Mode					Output Mode
43	Vac	=	300.0V	Vdc(	+)= 4	24.2V						
1.5	F	=	100.00Hz	Vdc(	- ) =	0.0V						
	Edit Al I				Set to Maximum	Set to Minimum	2014/12/17 16:37:35			Set Maxi	10.00	2014/12/17

## 3.3.4.2 Vdc Limit (+), Vdc Limit (-)

Vdc Limit (+) and Vdc Limit (-) restrict the Vdc setting in MAIN PAGE (3\_Phase Mode/1\_Phase Mode). These two items can be set in the Limitation function (see 3.3.4). The Vdc setting can exceed Vdc Limit (+) but cannot be under Vdc Limit (-).

The procedure for setting Vdc (+) = 424.2V, Vdc (-) = 0V in 1\_Phase Mode /3\_Phase Mode is described below.

- 1. Move the cursor to  $\underline{}^{"}Vdc (\underline{+}) = \underline{}^{"}command line.$
- 2. Press **4**, **2**, **4**, **, 2** and **ENTER** to change the value to "424.2".
- 3. Move the cursor to "Vdc (-) =" command line.
- 4. Press **0** and **ENTER** to change the value to "0.0".

3	Phas	s e	30	0 V L	OCAL	QU	IT		1_Pha	s e	300	۷	LOCAL	QUI	T	
	1021		1		BETTING	10000	Varia di s	Setting	112.27			DUTPUT	SETTING			Setting
₫1	Vac	=	0	. 0 V	F =	60.	.00Hz	OUTPUT:	Vac	=	0.	0V	F =	60.00	Hz	OUTPUT:
<b>⊉</b> 2	Vac	=	0	. OV	F =	60.	.00Hz	More Setting								More Setting
₫3	Vac	=	0	. OV	F =	60.	.00Hz	Measurement								Measurement
				LIMIT	ATION			Setting				LIMIT	ATION			Setting
	Vac	=	30	V0.0	Vdc(	+)= 4	124.2V	Waveform	Vac	=	300	. OV	Vdc (	+)=_4	24.2V	Waveform
₹1	F	=			Vdc(		0.0V	Viewer	F	=			z Vdc(	20 Per 200	0.0V	Viewer
	Vac	=	30	0.0V	Vdc(	+)= 4	424.2V	Limitation								Limitation
∎2	F	=			Vdc(	1. Sec. 1. Sec	0.0V									Output
	Vac	2	30	0.0V	Vdc/	+ ) = /	424.2V	Mode								Mode
23						Sec. 1										
	F	=	100	.00Hz	Vdc(	-)=	0.0V									
	Edit Each					Set to Maximum	Set to Minimum	2014/05/16						Set to Maximum	Set to Minimum	2014/05/16

#### **Notice**

It should restrict the Vdc value when the output contains it. It may cause damage if the output polarity is reversed especially the load polarity.

- CAUTION 1. If the set Limitation is smaller than the main menu setting, the set value in main menu will equal to the one set by Limitation when the setting is done.
  - Ex. (1) The original main menu sets Vac = 200V.

3	Pha	se		LOC	AL	QUIT			
				OUTP	UT SETTIN	3			Main
<b>#1</b>	Vac =	200. <b>0</b> V		F =	60.00Hz	Vdc	= 141	.QV	OUTPUT:
₹2	Vac =	200.0V		F =	60.00Hz	Vdc	= 141	. OV	More Setting
<b>₫</b> 3	Vac =	200.0V		F =	60.00Hz	Vdc	= 141	. OV	Measuremen
				MEA	SUREMENT				Setting
ise:	٧	=	0	.00	Po	=		0.0	Waveform
₫1	I	=	0.	000	PF	=	0.	000	Viewer
	٧	=	0	.00	Po	=		0.0	100000
₹2	I	=	0.	000	PF	=	0.	000	Limitation
	٧	=	0	.00	Po	=		0.0	Output
<b>¥</b> 3	1	=	0.	000	PF	=	0.	000	Mode
	V 12	=	0	.00	V23	=	0	.00	Measuremen
Σ	<b>V</b> 31	=	0	.00	P٥	=		0.0	To Page2
	Recall CH1	Reca CH2	27 L	Recal CH3	Rece CH4	C (200	call H5	More 1 of 2	2014/12/13

(2) The Limitation sets Vac Limit =100V.

Pha	se			_0	CA	L	Q	UIT					
				00	TPUT	SETT	NG						Setting
Vac = 3	200. <b>0</b>	v		F =	6	0.00H	z	Vdc	-	141.0\	1		OUTPUT:
Vac = :	200.0	v		F =	6	0.00H	z	Vdc	-	141.0\	1		More Setting
Vac = 3	200. <b>0</b>	v		F =	6	0.00H	z	Vdc	=	141.0\	r -		Measurement
				- 31	LIMIT	TATIO	N						Setting
Vac	=	1	0 0	).	0V	۷	dc	(+)	=_	42	4 . :	<u>2</u> V	Waveform
F	=	10	0	0	0 H	zV	dc	(-)	=		0.0	0 V	Viewer
Vac	4	1	0 0	١.	0 V	v	dc	(+)	=	42	4.:	2 V	Limitation
F	=							S - S)					Output
Vac	=	1	0 (	).	0 V	V	dc	(+)	=	42	4 . :	2 V	Mode
F	=							2 - SI					
Edit			ľ			1		100		54 1 1		75	2014/12/18
	Vac = : Vac = : Vac = : Vac = : Vac F Vac F Vac F Vac F	Vac = 200.0 Vac = 200.0 Vac = F F = Vac = F = Vac = F = Edit	Vac = 200.0V Vac = 200.0V Vac = 200.0V Vac = 1 F = 10 Vac = 1 F = 10 Vac = 1 F = 10 Vac = 1 Edit	Vac = 200.0V Vac = 200.0V Vac = 200.0V Vac = 100 F = 100 Vac = 100 F = 100 Vac = 100 F = 100 Edit	Vac = 200.0V F = Vac = 200.0V F = Vac = 200.0V F = Vac = 100. F = 100.0 Vac = 100. F = 100.0 Vac = 100. F = 100.0 Vac = 100. Edit	OUTPUT           Vac = 200.0V         F = 6           Vac = 200.0V         F = 6           Vac = 200.0V         F = 6           Vac = 100.0V         F = 6           Vac = 100.0V         F = 100.0V           F = 100.0V         F = 100.0V	OUTPUT SETT           Vac = 200.0V         F = 60.00H           Vac = 200.0V         F = 60.00H           Vac = 200.0V         F = 80.00H           LIMITATION         Vac = 100.0V           Vac = 100.0V         V           F = 100.0V         V	OUTPUT SETTING           Vac = 200.0V         F = \$0.00Hz           Vac = 100.0V         Vdc           F         = 100.0V         Vdc           Vac = 100.0V         Vdc           Vac = 100.0V         Vdc           F         = 100.0V         Vdc	OUTPUT SETTING           Vac = 200.0V         F = \$0.00Hz         Vdc           Vac = 100.0V         Vdc (+)         F           F         = 100.0V         Vdc (+)           F         = 100.0V         Vdc (-)           Vac = 100.0V         Vdc (-)           Vac = 100.0V         Vdc (-)           F         = 100.0V         Vdc (-)           F         = 100.0V         Vdc (-)           Edit         B4	Vac = 200.0V  F = 60.00Hz  Vdc = Vac = 200.0V  F = 60.00Hz  Vdc = Vac = 200.0V  F = 60.00Hz  Vdc = LIHITATION $Vac = 100.0V  Vdc(+) = F = 100.0V  Vdc(+) = F = 100.0V  Vdc(-) = Vac = 100.0V  Vdc(-) = Vac = 100.0V  Vdc(-) = F = Edit$	OUTPUT SETTING           Vac = 200.0V         F = $60.00Hz$ Vdc = $141.0V$ Vac = 200.0V         F = $60.00Hz$ Vdc = $141.0V$ Vac = 200.0V         F = $60.00Hz$ Vdc = $141.0V$ Vac = 200.0V         F = $60.00Hz$ Vdc = $141.0V$ Vac = $100.0V$ F = $60.00Hz$ Vdc = $141.0V$ Vac = $100.0V$ Vdc (+) = $42$ F = $100.0V$ Vdc (-) =           Vac = $100.0V$ Vdc (+) = $42$ F = $100.0V$ Vdc (-) =           Vac = $100.0V$ Vdc (+) = $42$ F = $100.0V$ Vdc (-) =           Edit         Set to         Set to	OUTPUT SETTING           Vac = 200.0V         F = $60.00$ Hz         Vdc = $141.0V$ Vac = 200.0V         F = $60.00$ Hz         Vdc = $141.0V$ Vac = 200.0V         F = $60.00$ Hz         Vdc = $141.0V$ Vac = 200.0V         F = $80.00$ Hz         Vdc = $141.0V$ Vac = 200.0V         F = $80.00$ Hz         Vdc = $141.0V$ LIMITATION         Vac = $100.0V$ Vdc(+) = $424.2$ F         = $100.0V$ Vdc(-) = $0.4$ Vac = $100.0V$ Vdc(-) = $0.4$ Vac = $100.0V$ Vdc(-) = $0.4$ F         = $100.0V$ Vdc(-) = $0.4$ Edit         Bat to         Bat to	OUTPUT SETTING           Vac = 200.0V         F = $60.00Hz$ Vdc = $141.0V$ Vac = 200.0V         F = $60.00Hz$ Vdc = $141.0V$ Vac = 200.0V         F = $60.00Hz$ Vdc = $141.0V$ Vac = 200.0V         F = $60.00Hz$ Vdc = $141.0V$ Vac = 200.0V         F = $60.00Hz$ Vdc = $141.0V$ Vac = $100.0V$ Vdc(+) = $424.2V$ F = $100.0V$ Vdc(-) = $0.0V$ Vac = $100.0V$ Vdc(-) = $0.0V$ Vdc(-) = $0.0V$ Vac = $100.0V$ Vdc(+) = $424.2V$ F = $100.0V$ Vdc(-) = $0.0V$ Vac = $100.0V$ Vdc(-) = $0.0V$ Vdc(-) = $0.0V$ Vac = $100.0V$ Vdc(-) = $0.0V$ Vdc(-) = $0.0V$ Edit         Set to         Set to

(3) When return to the main menu, the value will be the one set by Limitation.

3	Pha	se		LOC	AL C	UIT			
				OUTP	JT SETTING				Main
<b>£</b> 1	Vac =	100.0V		F =	60.00Hz	Vdc =	141.0\	1	OUTPUT:
₫2	Vac =	100.0V		F =	60.00Hz	Vdc =	141.0	1	More Setting
<b>Ŧ</b> 3	Vac =	100.0V		F =	60.00Hz	Vdc =	141.0\	r.	Measurement
				MEA	SUREMENT				Setting
88	٧	=	0	.00	Po	=	0	. 0	Waveform
₫1	I	=	0.	000	PF	=	0.0	00	Viewer
	٧	Ŧ	0	.00	Po	=	0	. 0	and and and
₹2	I	=	0.	000	PF	=	0.0	00	Limitation
	٧	=	0	.00	Po	=	0	. 0	Output
<b>Ŧ</b> 3	I	=	0.	000	PF	=	0.0	00	Mode
	V 12	=	0	.00	V23	=	0.	00	Measuremen
Σ	<b>V</b> 31	=	0	.00	P٥	=	0	. 0	To Page2
1	Recall CH1	Reca CH2	22	Recall CH3	Recall CH4	Reca	7777	More 1 of 2	2014/12/11

2. When AC+DC is selected for Coupling output mode, the output voltage will be restricted by voltage specification.

Ex. (1) It is unable to the DC voltage if the AC voltage is set to maximum output voltage. If the AC voltage sets to Vac = 300V, it is unable to set the DC voltage to 0V.

3	Pha	se			LO	IC A	L	G	UIT				
					00	TPUT	1 5	ETTING					Setting
₽1	Vac = 3	300. <b>0</b>	٧		F =		60.	OOHz	Vdc	• 0.	٥٧		OUTPUT:
<b>1</b> 2	Vac = :	300. <b>0</b>	v		F =	- 3	60.	OOHz	Vdc ·	• 0.	٥v		More Setting
<b>±</b> 3	Vac = 3	800. <b>0</b>	v		F =		60.	OOHz	Vdc	= 0.	٥v		Measurement
						LIMI	TA	TION					Setting
	Vac	=	3	0	0.	<u>0</u> V	1	Vdc	(+):	= 4	24	. 2 V	Waveform
€1	F	=	10	0	. 0	0 H	z	Vdc	(-):	=	0	.0V	Viewer
	Vac	#	3	0	D.	0 V	1	Vdc	(+):	= 4	24	. 2 V	Limitation
₽2	F	=	10	0	. 0	0 H	z	Vdc	· ·		0	.0V	Output
	Vac	=	3	0	ο.	0 V	r	Vdc	(+):	= 4	24	. 2 V	Mode
<b>Ŧ</b> 3	F	=						Vdc	ð. 1.		0	. 0 V	
	Edit Al I			Τ			1		Set	to	2.5	ist to	2014/12/18

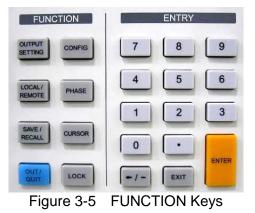
(2) The DC voltage will limit to system protection point if the AC voltage is not set to the maximum output voltage specification. When the AC voltage

3	_Pha	ase		LOC	AL	QUIT			
				OUTP	UT SETTING	3			Main
₩1	Vac =	200. <b>0</b> V		F =	60.00Hz	Vdc =	141.	٥v	OUTPUT:
₫2	Vac =	200.0V		F =	60.00Hz	Vdc =	141.1	ov	More Settin
<b>∰</b> 3	Vac =	200.0V		F =	60.00Hz	Vdc =	141.0	ov	Measuremen
				MEA	SUREMENT				Setting
1.0	٧	=	0	00.0	Po	=	(	0.0	Waveform
₫1	I	=	0.	000	PF	=	0.0	000	Viewer
5.44	٧	=	0	0.00	Po	=	(	0.0	100000000
₹2	I	=	0.	000	PF	=	0.0	000	Limitation
	٧	=	0	0.00	Po	=	(	0.0	Output
<b>#</b> 3	I	=	0.	000	PF	=	0.0	000	Mode
	V 12	=	0	00.0	V23	=	0.	00	Measuremen
Σ	V 31	=	0	0.00	Po	=	(	0.0	To Page2

sets to Vac = 200V, the DC voltage can only set to 141V at a maximum.

# 3.4 CONFIG Function Key

Press **CONFIG** in the **FUNCTION** keys shown below to enter into CONFIG function (3\_Phase Mode/1\_Phase Mode.)



3	Pha	se	LOCA	L QL	JIT		1_Pha	se	LOCA	L QI	JIT		
	and the			SETTING	Marrie Contractor	Config	11920		OUTPUT	SETTING		1129	Config
<b>#1</b>	Vac	=	0.0V	F =	60.00H	Z	Vac	=	0.0V F		60.00	Hz	Interface
₹2	Vac	=	0.0V	F =	60.00H	Z							Interface
₫3	Vac	=	0.0V	F =	60.00H	LA LUI IIIII							External
			MEASU	REMENT		Vref			MEASU	REMENT			Vref
-	٧	=	0.00	Po	= 0.0	1000	٧	=	0.00	Po	=	0.0	-
₹1	I	=	0.000	PF	= 0.000	Display	I	=	0.000	PF	= 0.	000	Display
_	V	=	0.00	Po	= 0.0	PowerON	Vac	=	0.00	Vdc	= 0	.00	PowerON
<b>#</b> 2	I	=	0.000	PF	= 0.000	Status	Iac	=	0.000	Idc	= 0.	000	Status
	٧	=	0.00	Po	= 0.0		Vpk	=	0.00	VA	=	0.0	3
<b>#</b> 3	I	=	0.000	PF	= 0.000	Protection	Ipk	=	0.000	CF	= 0.	000	Protection
	V 12	=	0.00	V23	= 0.00	More							More
Σ	V 31	=	0.00	Po	= 0.0	1 of 2							1 of 2
	GPIB ddress 30	RS2 Pari Non	ty Baudrate	Remote Inhibit Disable	EXT. ON/OFF Ether Disable Setti		GPIB Address 30	RS2 Pari Non	ty Baudrate	Remote Inhibit Disable	EXT. ON/OFF Disable	Ethernet Setting	2014/12/17

# 3.4.1 Interface

#### 3.4.1.1 GPIB Address, RS-232 Parity/Baudrate

The Regenerative Grid Simulator also has remote operation mode that can be activated by the CONFIG function (3\_Phase Mode/1\_Phase Mode.) It is necessary to set GPIB address to 30 before conducting remote operation in 1\_Phase Mode /3\_Phase Mode.

- 1. Press GPIB address at the bottom.
- 2. Turn the RPG to change the address and press **ENTER** to set address 30.

3	Pha	se	300V	LOCAL	QUI	T		1_Pha	se	3 (	V 0 0	LOCAL	(	QUI	Т	
	1022		OUTPL	T SETTING	2000	and the	Config	1020				SETTING	0101000		0.00	Config
₫1	Vac	=	0.0V	F =	60.	00Hz	a second second	Vac	=	0	. OV	F =	60	.00	Hz	Care and a second
<b>⊉</b> 2	Vac	=	0.0V	F =	60.	00Hz	Interface									Interface
<b>₫</b> 3	Vac	=	0.0V	F =	60.	00Hz	External									External
			MEA	SUREMENT			Vref				MEASU	REMENT				Vref
	٧	=	0.00	Po	=	0.0	20/10/	٧	=	0	.00	Po	=		0.0	2005
₹1	I	=	0.000	PF	= 0.	000	Display	I	=	0.	000	PF	=	0.	000	Display
	V	=	0.00	Po	=	0.0	PowerON	Vac	=	0	.00	Vdc	=	0	.00	PowerON
<b>₫</b> 2	I	=	0.000	PF	= 0.	000	Status	Iac	=	0.	000	Idc	=	0.	000	Status
	V	=	0.00	Po	=	0.0	3	Vpk	=	0	.00	VA	=		0.0	3
₫3	I	=	0.000	PF	= 0.	000	Protection	Ipk	=	0.	000	CF	=	0.	000	Protection
	V 12	=	0.00	V23	= 0	.00	More									More
Σ	<b>V</b> 31	=	0.00	Po	=	0.0	1 of 2									1 of 2
	GPIB ddress 30	RS23 Pari Non	ty Baudrat		EXT. ON/OFF Disable	Ethernet Setting	2014/05/16 17:14:30	GPIB Address 30	RS2 Par No	ity	RS232 Baudrate 115200	Remote Inhibit Disable	ON/	(T. OFF able	Ethernet Setting	2014/05/16



The address range is from 1 to 30.

The Regenerative Grid Simulator uses the RS-232C bus to provide remote operation. Follow the steps below to set the communication protocol. Set Parity=None and Baudrate =115200 in 1\_Phase Mode /3\_Phase Mode as described below:

- 1. Press RS232 Parity at the bottom.
- 2. Turn the RPG to select None and press ENTER.
- 3. Press RS232 Baudrate at the bottom. Turn the RPG to "115200" and press ENTER.

1_Pha	se	LOCA	L QI	JIT			1_Pha	se		LOCA	L QI	JIT		
			SETTING	menter histori	- 1	Config	-		1121		SETTING	maria Kara	1212	Config
Vac	-	0.0V I	-	60.00	Hz	Interface	Vac	=	0	. OV F	-	60.00	)Hz	Interface
						External Vref								External Vref
		MEASU	REMENT			Viet				MEASU	REMENT			viet
V	=	0.00	Po	=	0.0	Genter .	۷	=	0	.00	Po	=	0.0	TANK!
I	=	0.000	PF	= 0.	000	Display	I	=	0.0	000	PF	= 0.	000	Display
Vac	=	0.00	Vdc	= 0	.00	PowerON	Vac	=	0	.00	Vdc	= (	0.00	PowerON
Iac	=	0.000	Idc	= 0.	000	Status	Iac	=	0.0	000	Idc	= 0.	000	Status
Vpk	=	0.00	VA	=	0.0	1	Vpk	=	0	.00	VA	=	0.0	
Ipk	=	0.000	CF		000	Protection	Ipk	=	0.0	000	CF	= 0.	000	Protection
						More 1 of 2								More 1 of 2
GPIB Address 30	RS2 Pari Non	ty Baudrate	Remote Inhibit Disable	EXT. ON/OFF Disable	Ethernet Setting	2014/12/17 15:42:29	GPIB Address 30	RS2 Par No	ity I	RS232 Baudrate 115200	Remote Inhibit Disable	EXT. ON/OFF Disable	Ethernet Setting	2014/12/1 16:43:22

			JIT	QL	OCAL	1	se	Pha				JIT	. QI	LOCAL		se	_Phas
Config		Inc. rest.		SETTING		1120			Config		1102400			OUTPUT	10		-
Interface	Hz	. 001	60	-	OV F	0	=	Vac	Interface	Hz	. 00	60	-	0.0V F	1	=	Vac
External Vref									External Vref								
<b>U</b> ICI				EMENT	MEASUR								EMENT	MEASUF			
	0.0	1	=	Po	00	0	=	٧	COLST.	0.0		=	Po	0.00	1	=	۷
Display	000	0.	=	PF	00	0.0	=	I	Display	000	0.	=	PF	. 000	0	=	I
PowerON	.00	0	=	Vdc	00	0	=	Vac	PowerON	.00	0	=	Vdc	0.00		=	Vac
Status	000	0.	=	Idc	00	0.0	=	Iac	Status	000	0.	=	Idc	. 000	0	=	Iac
1	0.0	1	=	VA	00	0	=	Vpk	-	0.0		=	VA	0.00	1	=	Vpk
Protection	000	0.	=	CF	00	0.0	=	Ipk	Protection	000	0.	=	CF	. 000	0	=	Ipk
More 1 of 2									More 1 of 2								
2014/12/1 16:45:13	Ethernet Setting	XT. IOFF able	ON	Remote Inhibit Disable	RS232 audrate 57600		RS2 Parit Non	GPIB Address 30	2014/12/17 16:44:40	Ethernet Setting	(T. OFF able	ON	Remote Inhibit Disable	RS232 Baudrate 9600	232 rity ine	Par	GPIB Address 30

**Notice** 

The baudrate selections are 9600/19200/38400/57600/115200 and the selections for parity are EVEN/ODD/NON.

## 3.4.1.2 Remote Inhibit, EXT. ON/OFF

The output of Regenerative Grid Simulator can be inhibited by external control or manual trigger. The output signal of the remote inhibit (remote control) is received from the TTL terminal on the rear panel (see *Appendix A*.) Remote Inhibit and EXT. ON/OFF are set by the CONFIG function (3\_Phase Mode/1\_Phase Mode). There are two remote inhibit output states: Enable and Disable.

**Remote Inhibit**: When the Remote Inhibit is enabled on the Regenerative Grid Simulator and the Remote Inhibit signal is LOW, the Regenerative Grid Simulator will disable the output. The Regenerative Grid Simulator holds the output disabled even when the Remote Inhibit signal turns to HIGH. In order to re-enable the output, the user must press **OUT/QUIT**.

**EXT. ON/OFF**: When the EXT. ON/OFF is enabled on the Regenerative Grid Simulator and the EXT. ON/OFF signal is LOW, the Regenerative Grid Simulator will disable the output. The Regenerative Grid Simulator will re-enable the output when the EXT. ON/OFF signal turns to HIGH.

The procedure for setting Remote Inhibit/EXT. ON/OFF to disable in 1\_Phase Mode /3\_Phase Mode is described below.

- 1. Press Remote Inhibit/EXT. ON/OFF at the bottom.
- 2. Turn the RPG to change to "Disable" and press ENTER.

3	Pha	se	LOCA	L QL	JIT		3	Pha	se	LOCA	L Q	UIT	
			OUTPUT	SETTING	WARRAN CONTRACTOR	Config				OUTPUT	SETTING		Config
H	Vac	=	0.0V	F =	60.00Hz		€1	Vac	=	0.0V	F =	60.00Hz	
2	Vac	=	0.0V	F =	60.00Hz	Interface	₹2	Vac	=	0.0V	F =	60.00Hz	Interface
3	Vac	=	0.0V	F =	60.00Hz	External	₫3	Vac	=	0.0V	F =	60.00Hz	External
			MEASU	REMENT		Vref				MEASU	REMENT		Vref
	٧	=	0.00	Po	= 0.0	1000		٧	=	0.00	Po	= 0.0	2001
H	I	=	0.000	PF	= 0.000	Display	₹1	I	=	0.000	PF	= 0.000	Display
e <sup>i</sup>	٧	=	0.00	Po	= 0.0	PowerON		٧	=	0.00	Po	= 0.0	PowerON
2	I	=	0.000	PF	= 0.000	Status	<b>#</b> 2	I	=	0.000	PF	= 0.000	Status
	٧	=	0.00	Po	= 0.0			٧	=	0.00	Po	= 0.0	1
3	I	=	0.000	PF	= 0.000	Protection	43	I	=	0.000	PF	= 0.000	Protection
	V 12	=	0.00	V23	= 0.00	More		V 12	=	0.00	V23	= 0.00	More
Σ	V 31	=	0.00	Po	= 0.0	1 of 2	Σ	V 31	=	0.00	Po	= 0.0	1 of 2
	GPIB ddress 30	RS23 Parit Non	y Baudrate	Remote Inhibit Disable	EXT. ON/OFF Disable Setting	2014/12/17 16:46:15		GPIB Idress 30	RS2 Pari Non	ty Baudrate	Remote Inhibit Disable	EXT. ON/OFF Disable Setting	2014/12/1

_Pha	se		LOCA	L Q	JIT			1_Pha	se		LOCA	L (	TIU		
		112		SETTING	Sector Reads	- 11	Config			0.84		SETTING	marine his	S464.515	Config
Vac	=		0.0V	F =	60.00	Hz	Interface	Vac	=	0	0V F	-	60.0	OOHz	Interface
							External Vref								External Vref
				REMENT			0.000				MEASU	1			
۷	=		00.0	Po	=	0.0	1000	V	=	0	.00	Po	=	0.0	Canada III
I	=	0	000	PF	= 0.	000	Display	I	=	0.	000	PF	= (	0.000	Display
Vac	=	1	0.00	Vdc	= 0	.00	PowerON	Vac	=	0	.00	Vdd	; =	0.00	
Iac	=		000	Idc		000	Status	Iac	=		000	Ido		0.000	PowerON Status
Vpk	=	1	0.00	VA	=	0.0	1	Vpk	=	0	.00	VA	=	0.0	-
Ipk	=		000	CF		000	Protection	Ipk	=		000	CF	= (	0.000	Protection
							More 1 of 2								More 1 of 2
GPIB Address 30	RS2 Pari Nor	ity	RS232 Baudrate 115200	Remote Inhibit Disable	EXT. ON/OFF Disable	Ethernet Setting	2014/12/17 16:47:48	GPIB Address 30	RS2 Pari Nor	ty	RS232 Baudrate 115200	Remote Inhibit Disabl	ON/OF	F Setting	2014/12/1 16:48:29

**Notice** 

The output of the Remote Inhibit (Remote Control) transmits the TTL signals via a special I/O connector. See *Appendix A* for the detail TTL signal pin assignments.

## 3.4.1.3 Ethernet Setting

The Regenerative Grid Simulator can be operated remotely through a network once the Ethernet Settings are complete.

Network Setting: Auto, Manual

The procedure for setting Network Settings manually in 1\_Phase Mode/3\_Phase Mode is described below.

- 1. Press Ethernet setting at the bottom.
- 2. Move the cursor to "Network Setting:."
- 3. Turn the RPG to change to Manual and press ENTER.
- 4. Set the IP Address, Net Mask and Gateway.

3	Pha	s e	LOCA	L QI	JIT			3	Pha	se	LOCA	L Q	UIT		
	5.011		OUTPUT	SETTING	Ville Tria	001100-041	Config				OUTPUT	SETTING	Statio -	OTATION CARL	Config
€1	Vac	=	0.0V	F =	60.	00Hz	-	€1	Vac	=	0.0V	F =	60.	00Hz	
₹2	Vac	=	0.0V	F =	60.	00Hz	Set	₹2	Vac	=	0.0V	F =	60.	00Hz	Set
₫3	Vac	=	0.0V	F =	60.	00Hz		₫3	Vac	=	0.0V	F =	60.	00Hz	
			NETWOR	SETTING							NETWORK	SETTING			
	Network	s Settin	g: Auto						Network	Sett	ing:Manual				
	IP Add	P Address : _10 . 1 . 7 . 86							IP Add	ess :	10.1.	7.86			
	Net Ma	<sup>2</sup> Address : <u>10</u> . 1 . 7 . 86 :1 Mask :255 . 255 . 254 . 0							Net Ma	ik :	255 . 255 . 25	54.0			
	Gatevraj		0.1.	7 . 254					Gatevra		10 . 1 .	7 . 254			
	LAN Sta	atus = :	ETTING						LAN St	tus =	SETTING				
							-								
	GPIB ddress 30	RS232 Parity None	RS232 Baudrate 115200	Remote Inhibit Disable	EXT. ON/OFF Disable	Ethernet Setting	2014/12/17 17:00:08		GPIB ddress 30	RS23 Parit Non	y Baudrate	Remote Inhibit Disable	EXT. ON/OFF Disable	Ethernet Setting	2014/12/1 17:00:53

3	Pha	se		LOCA	Ĺ	QU	IT		
				OUTPUT	SETTIN	G	Parameter of	54 554 540	Config
ē1	Vac	=	0	. OV	F	=	60.	00Hz	
2	Vac	=	0	. OV	F	=	60.	00Hz	Set
3	Vac	=	0	. 0 V	F	=	60.	00Hz	
				NETWORK	SETTI	NG			
	Networ	k Set	ting:M	anual					
	IP Add	ress	:_10 .	1.	7. 1	86			
	Net Ma	sk	:255 .	255 . 2	54.	0			
	Gatetra	у	: 10 .	1.	7 . 2	54			
	LAN St	atus	= READ	Y					
	GPIB ddress	RS: Par		RS232 Baudrate	Rem		EXT. ON/OFF	Ethernet	2014/12/1
1	30	No		115200	Disa	7.55	Disable	Setting	17:01:43

1_Phase LOCAL QUIT		1_Phase LOCAL QUIT
Vac = 0.0V F = 60.00Hz	Config Set	Vac = 0.0V F = 60.00Hz Set
NETWORK SETTING		NETWORK SETTING
Network Setting: Auto		Network Setting:Manual IP Address: 10. 1. 7. 86
Net Mask : 255 . 255 . 254 . 0	-	Net Mask :255 . 255 . 254 . 0
Gatevvay : 10 . 1 . 7 . 254		Gatevray : 10 . 1 . 7 . 254
LAN Status = SETTING		LAN Status = SETTING
GPIB R5232 R5232 Remote EXT. Address Parity Baudrate Inhibit ON/OFF Ethernet 30 None 115200 Disable Disable Disable	2014/12/17 17:03:03	GPIB         R5232         RS232         Remote         EXT.           Address         Parity         Baudrate         Inhibit         ON/OFF         Ethernet         2014/12/1           30         None         115200         Disable         Disable         Setting         2014/12/1

Γ.	Pha	s e		LOCA		JIT		
			112		SETTING	mener hears		Config
	Vac	-	0	1.0V	F =	60.00	Hz	Set
				Contract Contract Contract	SETTING			
	Network	k Se	ting:	lanual				
	IP Add	ress	:_10	. 1.	7.86			
	Net Ma	sk	:255	255 . 2	54.0			
	Gaterra	Y	: 10	. 1.	7 . 254			
	LAN Sta	atus	= REAL	DY				1
	GPIB ddress		232 rity	RS232 Baudrate	Remote	EXT. ON/OFF	Ethernet Setting	2014/12/17

# 3.4.2 External Vref

The Regenerative Grid Simulator allows the user to use analog control signals (simulated) from an external device to set its output (optional card is required.) The External Vref terminal socket at the rear panel allows users to apply signals to the Regenerative Grid Simulator for output voltage setting. The External Vref and the Control Method can be set by the CONFIG function (3\_Phase Mode/1\_Phase Mode). External Vref has two coupled modes to indicate the output of Regenerative Grid Simulator: Amplifier and Level. When the user is using single phase Ext. Vref, the signal inputted by terminal pin Ext-V  $\Phi$ 2 is the main control signal. Refer to *Appendix A* for the pin assignment of TTL terminal. The voltage delay time for External-V reference signal input to external output is 70us.

**Amplifier**: The output voltage (Vout) is the composition of the voltage set in MAIN PAGE and the supplemental programmed voltage inputted externally. The external V reference voltage range is from -10 V to 10V. When Vac=0 and Vdc=0 in MAIN PAGE, the following formula can be used to calculate Vout.

Vout (dc) = Vref (dc) / 10 Vdc  $\times$  424.2 Vdc or Vout (ac) = Vref (ac) / 7.072 Vac  $\times$  300 Vac

Ex (1): Set Vout to 100Vdc: The applied external output voltage is V= 2.357Vdc, Vout = 100Vdc

Ex (2): Set Vout to 100Vac: The applied external output voltage is V= 2.357Vac, Vout = 100Vac

**Level**: It is the linear proportional output of output voltage (Vout (ac)) RMS programmed by the DC V reference. The Vreference range is from -10V to 10V. The following formula can be used to calculate Vout:

Vout (ac) = | Vref (dc) | / 10 Vdc × 300Vac

Ex (1): Set Vout to 100Vac: The applied external output voltage is V= 3.333Vdc (or -3.333Vdc), Vout = 100Vac

The setting of Ext. Vref Control = OFF, Control Method = Amplifier is described below.

- 1. Press Ext. Vref Control at the bottom.
- 2. Turn the RPG to change ON to OFF and press ENTER.
- 3. Press Control Method at the bottom.
- 4. Turn the RPG to select Amplifier and press ENTER.

3	Pha	se	300V	LOCAL		QUIT		3	Pha	se	300V	LOCA	L	QUIT	
	1022		OUTP	JT SETTING		Sector Sector Sec	Config		1022		OUTPU			and the second second	Config
₫1	Vac	=	0.0V	F =		60.00Hz	Interface		Vac	=	0.0V	F :	-	60.00Hz	Interface
₫2	Vac	=	0.0V	F =		60.00Hz	Interface	<b>⊉</b> 2	Vac	=	0.0V	F	=	60.00Hz	Interface
₫3	Vac	=	0.0V	F =		60.00Hz	External	<b>₫</b> 3	Vac	=	0.0V	F۰	-	60.00Hz	External
			MEA	SUREMENT			Vref				MEAS	SUREMENT			Vref
es.	۷	=	0.00	Po	=	0.0		Est	٧	=	0.00	Po	=	0.0	
₹1	I	=	0.000	PF	=	0.000	Display	₩1	I	=	0.000	PF	=	0.000	Display
_	٧	=	0.00	Po	=	0.0	PowerON		٧	=	0.00	Po	=	0.0	PowerON
<b>₫</b> 2	I	=	0.000	PF	=	0.000	Status	₫2	I	=	0.000	PF	=	0.000	Status
	۷	=	0.00	Po	=	0.0	2		٧	=	0.00	Po	=	0.0	8
<b>4</b> 3	I	=	0.000	PF	=	0.000	Protection	₫3	I	=	0.000	PF	=	0.000	Protection
	V 12	=	0.00	V23	=	0.00	More		V 12	=	0.00	V23	=	0.00	More
Σ	<b>V</b> 31	=	0.00	Po	=	0.0	1 of 2	Σ	<b>V</b> 31	=	0.00	Po	=	0.0	1 of 2
(	xt.Vref Control Off	Con Met Ampli	hod				2014/05/16 17:35:31	c	xt.Vref Control Off	Met	ntrol Ihad Ificr				2014/05/10

3	Pha	se	3001	LOC	AL	QUIT	
	-1 (172.)		00	TPUT SETT	ING	2010 - 10 - 10 - 10 - 10 - 10 - 10 - 10	Config
€1	Vac	=	0.0	V F	=	60.00Hz	
₹2	Vac	=	0.0	V F	=	60.00Hz	Interface
<b>₽</b> 3	Vac	. =	0.0	V F	=	60.00Hz	External
			1	EASUREMEN	π		Vref
-	٧	=	0.0	0 P	o =	0.0	
€1	I	=	0.00	0 P	F =	0.000	Display
	٧	=	0.0	0 P	o =	0.0	PowerON
<b>₽</b> 2	I	=	0.00	0 P	F =	0.000	Status
	٧	=	0.0	0 P	o =	0.0	0
<b>8</b> 3	I	=	0.00	0 P	F =	0.000	Protection
	V 12	=	0.0	0 V	23 =	0.00	More
Σ	<b>V</b> 31	=	0.0	0 P	o =	0.0	1 of 2
(	xt.Vrsf Control Off	Con Met Ampli	hod				2014/05/16

#### **Notice**

When Ext. Vref Control =ON, Control Method =Level, the output voltage (Vout) can only be controlled by the level of the external DC programming voltage. It is unable to control the Vout amplitude from the front panel keys until Ext. Vref Control=OFF is set.

 When Control Method = Amplifier and the Vref frequency exceeds 100Hz, it could damage the Regenerative Grid Simulator. The user should obey the following formula: When set to Amplifier mode, F>100Hz: must be Vref (pk-pk, V) \* F

(Vref, Hz) < 4000 VHz.

When set to **Level** mode, F>100Hz: must be Vref (pk-pk, V) \* F (Vref, Hz) < 2000 VHz.

- 2. The output may be distorted due to the bandwidth restriction of Regenerative Grid Simulator, especially when the external V reference has too many high frequency components.
- 3. If the output voltage is over the limit, OUTPUT OVP or DST Protection will occur.

# 3.4.3 Display

The brightness of the backlight and power save mode settings of the LCD can be set in the CONFIG function (3\_Phase Mode/1\_Phase Mode.)

**Style:** Default. **Backlight:** Low, Medium and High. **Backlight OFF after:** Never, 1 min, 3 mins, 5 mins, 10 mins, 30 mins, 1 hour and 3 hours.

The procedure for setting Backlight = Medium, Backlight OFF after = Never in 1\_Phase Mode /3\_Phase Mode is listed below.

- 1. Press Backlight at the bottom.
- 2. Turn the RPG to Medium and press ENTER.
- 3. Press Backlight OFF after at the bottom.
- 4. Turn the RPG to select Never and press ENTER.

3	Pha	se	LOCAL	. QI	UIT		1_Pha	se	LOCA	L Q	UIT		
	-		OUTPUT	SETTING	Marrie Constantion	Config			OUTPUT	SETTING	Sec.	No. 2010 M	Config
ē1	Vac	=	0.0V	F =	60.00Hz		Vac	=	0.0V	F =	60	.00Hz	Interface
₹2	Vac	=	0.0V	F =	60.00Hz	Interface							Interface
<b>#</b> 3	Vac	=	0.0V	F =	60.00Hz	External							External
			MEASUR	EMENT		Vref			MEASU	REMENT			Vref
	V	=	0.00	Po	= 0.0	CONTRACT OF	٧	=	0.00	Po	=	0.0	COMPACT OF
₹1	I	=	0.000	PF	= 0.000	Display	I	=	0.000	PF	=	0.000	Display
	٧	=	0.00	Po	= 0.0	PowerON	Vac	=	0.00	Vdc	=	0.00	PowerON
<b>#</b> 2	I	=	0.000	PF	= 0.000	Status	Iac	=	0.000	Idc	=	0.000	Status
	٧	=	0.00	Po	= 0.0	-	Vpk	=	0.00	VA	=	0.0	-
<b>#</b> 3	I	=	0.000	PF	= 0.000	Protection	Ipk	=	0.000	CF	=	0.000	Protection
	V 12	=	0.00	V23	= 0.00	More	12122						More
Σ	V 31	=	0.00	Po	= 0.0	1 of 2							1 of 2
	Style Default	Backlig Med i u				2014/12/17 17:08:42	Style Default	Backl Med					2014/12/11 17:09:27

# 3.4.4 Power ON Status

The user can set the output state of Regenerative Grid Simulator during power on using the Power ON Status in the CONFIG function (3\_Phase Mode/1\_Phase Mode). Once it is set users should save the data before power off. With the output set to Off, the Regenerative Grid Simulator will not enable the output voltage after it is powered on. With it set to On, the Regenerative Grid Simulator will enable the output by default after powered on.

3	Pha	s e	LOCA	L	QU	IT		3	Pha	s e	LOCA	۱L	QL	JIT	
			OUTPUT	SETTI	IG	NAMES OF BRIDE	Config				OUTPUT	SETT	ING	Constant of the second	Config
ē1	Vac	=	0.0V	F	=	60.00Hz	Interface		Vac	=	0.0V	F	=	60.00Hz	Interface
₽2	Vac	=	0.0V	F	=	60.00Hz	Interface	₹2	Vac	=	0.0V	F	=	60.00Hz	Interface
<b>#</b> 3	Vac	=	0.0V	F	=	60.00Hz	External	₫3	Vac	=	0.0V	F	=	60.00Hz	External
			POWER ON ST	TATUS S	ETTIN	IG	Vref				POWER ON S	TATUS	SETTI	NG	Vref
	Vac	=	0.0V	F :	•	60.00Hz	Display		Vac	-	0.0V	F	=	60.00Hz	Display
₹1	Vdc	=	0.0V					₹1	Vdc	=	0.0V				
	Vac	=	0.0V	E :		60.00Hz	PowerON Status		Vac	-	0.0V	F	-	60.00Hz	PowerON Status
12	Vdc	-	0.0V	8				#2	Vdc	-	0.0V				-
	vac		0.00				Protection		vac		0.00				Protection
	Vac	=	0.0V	F :	=	60.00Hz			Vac	=	0.0V	F	=	60.00Hz	
<b>1</b> 3	Vdc	=	0.0V				More 1 of 2	#3	Vdc	=	0.0V				More 1 of 2
	Output	Edit Al I					2014/12/17	(	Output Off	Edit Al I		1			2014/12/17

3	Pha	s e	LOCA	L Q	UIT		1_Phase	LOCAL QUIT	
			OUTPUT	SETTING	NAMES OF TAXABLE PARTY.	Config		OUTPUT SETTING	Config
€1	Vac	=	0.0V	F =	60.00Hz	Interface	Vac =	0.0V F = 60.00Hz	Interface
<b>2</b> 2	Vac	=	0.0V	F =	60.00Hz	Interface			Internace
13	Vac	=	0.0V	F =	60.00Hz	External			External
			POWER ON S	TATUS SETT	I NG	Vref		POWER ON STATUS SETTING	Vref
	Vac	=	0.0V	F =	60.00Hz	Display	Vac =	<u>0.0</u> V F = 60.00Hz	Display
ē1	Vdc	=	0.0V				Vdc =	0.0V	
	Vac	-	0.0V	F =	60.00Hz	PewerON Status			PowerON Status
¥2					00.0012				
	Vdc	=	0.0V			Protection			Protection
	Vac	=	0.0V	F =	60.00Hz				
<b>1</b> 3	Vdc	=	0.0V			More 1 of 2			More 1 of 2
	Output	Edit Each				2014/12/17	Output Of f		2014/12/1

# 3.4.5 Protection

The Regenerative Grid Simulator's Protection for 1-phase/3-phase output mode is set separately. For instance, the Protection will apply the settings of 1-phase when switching from 3-phase to 1-phase mode rather than the Protection settings of any phase under 3-phase mode.

The Protection in the CONFIG function (3\_Phase Mode/1\_Phase Mode) is able to set the limit of the output RMS current (OCP), output power (OPP) and the Delay Time for triggering the current protection. The limit in this command is to protect the program instead of the hardware.

Following shows the procedure of setting the current limit = 140 A (maximum for 61800-100), power limit = 35000VA (maximum for 61800-100), delay time for trigger current protection = 3 sec.

- 1. Move the cursor to "OCP =" command line.
- 2. Press **1**, **4**, **0** and **ENTER** to change the value to "140.0".
- 3. Move the cursor to <u>"OPP ="</u> command line.
- 4. Press **3**, **5**, **0**, **0**, **0**, **ENTER** to change the value to "35000.0".
- 5. Move the cursor to "Delay time =" command line.
- 6. Press **3**, **ENTER** to change the value to "3.0".

3	Phas	e e	1	LOCAL		QI	JIT		
				OUTPUT SI	ETTI	NG		1	Config
<b>1</b>	Vac	#	0	. OV	F	=	60.	00Hz	
∎2	Vac	#	0	0V	F	=	60.	00Hz	Interface
<b>*</b> 3	Vac	=	0	. OV	F	=	60.	00Hz	External
			P	ROTECTION	SET	TING			Vref
	OCP	=_1	40	<u>0</u> A	OF	PP	= 3 5 0 0	0.0VA	Display
<b>#1</b>	OCP	del	ay	time	=		3.0se	с	
	OCP	= 1	40	0 A	OF	р	= 3 5 0 0	0.0VA	PowerON Status
<b>2</b>	OCP	del	ay	time	=		3.0se	с	Protection
	OCP	= 1	40	0.4	OF	р	= 3500	0 OVA	TOTOCOLION
<b>\$</b> 3				time	=		3.0se		More 1 of 2
	Edit Al I						Set to Maximum	Set to Minimum	2014/12/1 17:18:56

#### **Notice**

- 1. When "OCP = 0.0 A", it means the limit of output current equals to the specification limit.
- 2. The setting of the delay time for trigger current protection is only valid when the current is within the specification. When the output exceeds the specification, it is still valid if the current protection delay trigger is between the set 0.1 to1s. However, it will go into protection when it is over 1s. The resolution is 0.1s.



The protection point varies by the measurement error, thus it may act before reaching the protection point set.

# 3.4.6 Others

Press MORE on the right in CONFIG function (3\_Phase Mode/1\_Phase Mode) to go to the second page and press Others on the right to set Output Relay, Buzzer, Date/Time and Remote Sense.

Output Relay: Depend and Always ON. Buzzer: on and off. Date/Time: Year, Month, Day, Hour, Minute and Second. Remote Sense: on, off.

3	Pha	s e	LOCA	L Q	UIT			1_Pha	se		LOCAL	. Q	UIT		
	5. M.		OUTPUT	SETTING		1000 001 000 000	Config			105	OUTPUT S	SETTING		100.000.000	Config
ē1	Vac	=	0.0V	F =	6	0.00Hz	Others	Vac	=	0	).0V F	=	60	.00Hz	Others
₽2	Vac	=	0.0V	F =	6	0.00Hz	others								Others
₫3	Vac	=	0.0V	F =	6	0.00Hz	Calibration								Calibration
			MEASU	REMENT			Ganbration				MEASUR	EMENT			Generation
	۷	=	0.00	Po	=	0.0	System	۷	=	0	0.00	Po	=	0.0	System
₹1	I	=	0.000	PF	-	0.000	Information	I	=	0.	000	PF	=	0.000	Information
2	٧	=	0.00	Po	=	0.0	Factory	Vac	=	0	0.00	Vdc	=	0.00	Factory
<b>1</b> 2	I	=	0.000	PF	=	0.000	Default	Iac	=	0.	000	Idc	=	0.000	Default
	٧	=	0.00	Po	=	0.0	Master/Slave	Vpk	=	0	0.00	VA	=	0.0	Master/Slave
<b>4</b> 3	I	=	0.000	PF	=	0.000	Function	Ipk	=	0.	000	CF	=	0.000	Function
	V 12	=	0.00	V23	-	0.00	More								More
Σ	V 31	=	0.00	Po	=	0.0	2 of 2								2 of 2
1	Output Relay epend.	Buzza	or Date/Time	Remote Sense On			2014/12/17 17:20:05	Output Relay Depend.	Buz Or		Date/Time	Remote Sense On			2014/12/17 17:20:50

The output circuit on the Regenerative Grid Simulator has a relay to connect to the load. When the output relay is "Always ON", it indicates the output relay is closed (connected) even if the Regenerative Grid Simulator output state is in QUIT mode. When the output relay is "Depend.", it indicates the output relay is closed (connected) only when the output state is in OUT mode. If the output state is in QUIT mode, the output relay will be opened (disconnected.) Output relay can be set in the SETUP function.

The procedure for setting the output relay to Always ON in 1\_Phase Mode /3\_Phase Mode is described below.

- 1. Press Output Relay at the bottom.
- 2. Turn the RPG to set the output relay to Always ON and press **ENTER**. When the output relay is working, the Regenerative Grid Simulator will click once.

3	Pha	se	300V	LOCAL		QUIT		1_Pha	se	30	0 V 0	LOCAL		QUIT	and a second second
	1023		OUTP			And and a subscription of the	Config	11920				SETTING	01010000		Config
₫1	Vac	=	0.0V			60.00Hz	Others	Vac	=	0	.01	F =	60	.00Hz	Others
<b>⊉</b> 2	Vac		0.0V	F =		60.00Hz									
<b>₫</b> 3	Vac	=	0.0V	F =		60.00Hz	Calibration								Calibration
			ME)	SUREMENT							MEASU	REMENT			
1913	٧	=	0.00	Po	=	0.0	System	٧	=	0	.00	Po	=	0.0	System
₫1	I	=	0.000	PF	=	0.000	Information	I	=	0.	000	PF	=	0.000	Information
	٧	=	0.00	Po	=	0.0	Factory	Vac	=	0	.00	Vdc	=	0.00	Factory
₫2	I	=	0.000	PF	=	0.000	Default	Iac	=	0.	000	Idc	=	0.000	Default
	٧	=	0.00	Po	=	0.0	Master/Slave	Vpk	=	0	.00	VA	=	0.0	Master/Slave
₫3	I	=	0.000	PF	=	0.000	Function	Ipk	=	0.	000	CF	=	0.000	Function
	V 12	=	0.00	V23	=	0.00	More								More
Σ	<b>V</b> 31	=	0.00	Po	=	0.0	2 of 2								2 of 2
أربي	Dutput Relay vays ON	Buzz On	er Date/Ti	ne Sense On			2014/05/16 17:46:48	Output Relay Always ON	Buz: Or		Date/Time	Remote Sense On			2014/05/16



Check if the Regenerative Grid Simulator has voltage output before powering it off. To ensure the safety of hardware, it is prohibited to power off the Regenerative Grid Simulator in Output state.

Next, the Regenerative Grid Simulator buzzer beeps when the panel keys are pressed or the RPG rotary is turned. If the user does not want the buzzer active, it may be turned off.

Following procedure describes the procedure for turning off the buzzer in 1\_Phase Mode /3\_Phase Mode.

- 1. Press Buzzer at the bottom.
- 2. Turn the RPG to change ON to OFF and press ENTER.

3	_Pha	se		LOCAL		QU	IT			1_Pha	se		LOCAL	. G	UIT		
	5.00		200	OUTPUT	SETTIN	9		Annos and Annos	Config				OUTPUT S	SETTING		Non-America Ma	Config
<b>#1</b>	Vac	=		V0.0	F	=	(	60.00Hz	Others	Vac	=		0.0V F	=	60	.00Hz	Others
₹2	Vac	=	1	V0.0	F	=	(	60.00Hz	Others								UTITICITS
₫3	Vac	=		V0.0	F	=	(	60.00Hz	Calibration								Calibration
				MEASUR	EMENT				Generation				MEASUR	EMENT			Galibration
	٧	=		0.00	Po		=	0.0	System	٧	=	1	0.00	Po	=	0.0	System
₹1	I	=	0	. 000	PF	83	=	0.000	Information	I	=	0	. 000	PF	=	0.000	Information
-	٧	=	1	0.00	Po		=	0.0	Factory	Vac	=	1	0.00	Vdc	=	0.00	Factory
<b>#</b> 2	I	=	0	. 000	PF		=	0.000	Default	Iac	=	0	. 000	Idc	=	0.000	Default
	V	=	1	0.00	Po		=	0.0	Master/Slave	Vpk	=	1	0.00	VA	=	0.0	Master/Slave
<b>#</b> 3	I	=	0	. 000	PF	ŝ -	=	0.000	Function	Ipk	=	0	. 000	CF	=	0.000	Function
	V 12	=	1	0.00	V25		=	0.00	More								More
Σ	V 31	=		0.00	Po		=	0.0	2 of 2								2 of 2
	Output Relay epend.	Buzz Of f		Date/Time	Remo Sens On				2014/12/17 17:25:30	Output Relay Depend.		zer L1	Date/Time	Remote Sense On			2014/12/17 17:26:12

Set the time and date of Regenerative Grid Simulator.

Date/Time: Year, Month, Day, Hour, Minute, Second.

Follow the procedure below to set the time and date in 1\_Phase Mode /3\_Phase Mode.

- 1. Press Date/Time at the bottom.
- 2. Select the item (Year/Month/Day/Hour/Minute/Second) to be set and press the button on the right.
- 3. Use the RPG to change the selected item and press **ENTER**.

3	Pha	se	LOCAL	Q	UIT		1_Pha	s e	LOCAL	. Q	UIT		
	-		OUTPUT S		Maria Marriado	Config			OUTPUT S		100000	hearann h	Config
ē1	Vac	=	0.0V	F =	60.00Hz	Year	Vac	=	0.0V F	=	60	.00Hz	Year
2	Vac	=	0.0V	F =	60.00Hz	2014							2014
<b>¥</b> 3	Vac	=	0.0V	F =	60.00Hz	Month							Month
			MEASUR	EMENT		12			MEASUR	EMENT			12
	٧	=	0.00	Po	= 0.0	Dav	٧	=	0.00	Po	.=	0.0	Day
<b>1</b>	I	=	0.000	PF	= 0.000	Day 17	I	=	0.000	PF	=	0.000	17
	V	=	0.00	Po	= 0.0	Hour	Vac	=	0.00	Vdc	=	0.00	Hour
2	I	=	0.000	PF	= 0.000	17	Iac	=	0.000	Idc	=	0.000	17
	V	-	0.00	Po	= 0.0	Minute	Vpk	=	0.00	VA	=	0.0	Minute
13	I	=	0.000	PF	= 0.000	27	Ipk	=	0.000	CF	=	0.000	27
	V 12	=	0.00	V23	= 0.00	Second							Second
Σ	V 31	=	0.00	Po	= 0.0	16							53
1	Dutput Relay spend.	Buzze On	Date/Time	Remote Sense On		2014/12/17 17:27:31	Output Relay Depend.	Buz O		Remote Sense On			2014/12/17 17:28:10

At last, it can enable the Remote Sense to monitor the load voltage and compensate automatically to make sure the voltage sends to load is the set voltage.

#### Remote Sense: on, off.

Follow the procedure below to enable the remote voltage sense in 1\_Phase Mode /3\_Phase Mode.

- 1. Press Remote Sense at the bottom.
- 2. Turn the RPG to change ON to OFF and press **ENTER**.

3	_Pha	s e		LOCA	L	QUI	Т		3	_Pha	se		LOCAL		QUI	Т	
	-				SETTING	1	MARTIN CONTRACTOR	Config		and the second s			OUTPUT	SETTIN	IG	Charles Construction	Config
€1	Vac	=	(	V0.0	F	=	60.00Hz			Vac	=	(	V0.0	F	=	60.00Hz	
₹2	Vac	=	(	V0.0	F	=	60.00Hz	Others	₹2	Vac	=	(	V0.0	F	=	60.00Hz	Others
<b>#</b> 3	Vac	=	(	V0.0	F	=	60.00Hz	Calibration	₫3	Vac	=	(	V0.0	F	=	60.00Hz	Calibration
				MEASU	REMENT			Gandranon					MEASUR	EMENT			Ganeration
	۷	=	(	00.0	Po	=	0.0	System		۷	=	(	00.0	Po	=	0.0	System
±1	I	=	0	000	PF	=	0.000	Information	₹1	I	=	0	. 000	PF		0.000	Information
	۷	=	(	00.0	Po	=	0.0	Factory		۷	=	(	00.0	Po	=	0.0	Factory
<b>#</b> 2	I	=	0.	. 000	PF	=	0.000	Default	<b>#</b> 2	I	=	0	. 000	PF	: =	0.000	Default
	٧	=	(	00.0	Po	=	0.0	Master/Slave		٧	=	(	00.0	Po	=	0.0	Master/Slave
<b>#</b> 3	I	=	0	000	PF	=	0.000	Function	<b>#</b> 3	I	=	0	. 000	PF	=	0.000	Function
	V 12	=	(	00.0	V23	-	0.00	More		V 12	=	(	0.00	V2	3 =	0.00	More
Σ	V 31	=	(	0.00	Po	=	0.0	2 of 2	Σ	V 31	=	- (	0.00	Po	=	0.0	2 of 2
	Output Relay epend.	Buz O		Date/Time	Remot Sens Of 1	0		2014/12/17 17:29:08		Output Relay spend.	Buz 0		Date/Time	Remo Sent	98		2014/12/17 17:29:57

## 3.4.7 Calibration

See the descriptions in Chapter 4 for the detailed calibration procedures.

## 3.4.8 System Information

Press MORE on the right in the CONFIG function (3\_Phase Mode/1\_Phase Mode) to go to next page. Press System Information on the right to see the system information of the Regenerative Grid Simulator.

3_Phase	LOCAL	QUIT	
	UNIT DA	TA	Config
Model:6	1800-100	SN: Z0001	Others
Display Waveform Remote	Version : 0. Version : 0. Version : 0.	07.2,0.07.2,0.07.2	Calibration
Waveform HDL GRID Firmware GRID HDL	Version : 0. Version : 0.	07 ,0.07 ,0.07 06.2,0.06.2,0.06.2 07 ,0.07 ,0.07	System Information
LAN Firmware	Version : 1.	10	Factory Default
			Master/Slave Function
			More 2 of 2
OPTION Opt AC Source Func			2019/04/0

# 3.4.9 Factory Default

Press MORE on the right in the CONFIG function (3\_Phase Mode/1\_Phase Mode) to go to next page. Press Factory Default on the right and Yes at the bottom to return to the factory default.

3_Phase	LOCAL	QUIT	
	FACTORY DEF	ULT	Cenfig
			Others
			Calibration
Recall Fac	tory Def	ault settin	g? System
			Factory Default
		Master/Slave Function	
			More 2 of 2
Yes		No	2014/12/1 17:31:46

# 3.5 PHASE Function Key

Press **PHASE** function key in Figure 3-5 to go to the switch 3\_Phase Mode/1\_Phase Mode.

## 3.5.1 3\_Phase Mode

The Regenerative Grid Simulator can be set to 3-phase AC power by pressing the **PHASE** function key to switch to 3\_Phase Mode when it is required.

The procedure for setting the Regenerative Grid Simulator to 3-phase mode is described below.

- 1. Press **PHASE** function key.
- 2. Press Three 3\_PHASE on the right.
- 3. Press Yes on the right to confirm the change.

?_Phase LOCAL QUIT		?_Phase LOCAL QUIT
NUMBER OF OUTPUT PHASE SELECTION	Phase	NUMBER OF OUTPUT PHASE SELECTION Phase
	Single 1_PHASE	Warning! You want to change to
The output is in Single Phase		Three Phase(3_Phase) mode.
(1_Phase) mode now.	Three 3_PHASE	It is necessary to check if the output is connected <sup>No</sup>
Select a mode		properly,otherwise the AC source and/or UUT might be damaged.
		Press <yes> to change. Press <no> to exit.</no></yes>
	2014/12/17	2014/12/17 17:34:04

# 3.5.2 1\_Phase Mode

When the 3-phase power of the Regenerative Grid Simulator is not enough to drive the load, the 3-phase output can be paralleled to one of the phases. Pressing the **PHASE** function key can change the Regenerative Grid Simulator setting from 3-phase to 1-phase.

The procedure for setting the Regenerative Grid Simulator to 1-phase mode is described below.

- 1. Press **PAHSE** function key.
- 2. Press Single 1\_PHASE on the right.
- 3. Press Yes on the right to confirm the change.

Phase 300V LOCAL QUIT		?_Phase 300V LOCAL QUIT	
NUMBER OF OUTPUT PHASE SELECTION	Phase	NUMBER OF OUTPUT PHASE SELECTION	Phase
	Single 1_PHASE	Warning! You want to change to	Yes
The output is in Three Phase		Single Phase(1_Phase) mode.	
(3_Phase) mode now.	Three 3_PHASE	It is necessary to check if the output is connected	No
Select a mode	D.	properly,otherwise the AC source and/or UUT might be damaged.	l.
	12	Press <yes> to change. Press <no> to exit.</no></yes>	-
	2014/05/17 09:35:26		2014/05/ 09:39:1



- When switching between 1-phase and 3-phase mode, the set output value will be reset to zero to avoid damaging the Unit Under Test (UUT).
- When loading in single mode, be sure to use three sets of output terminals for connection to avoid causing damage due to excessive differences during current output.

# 3.6 CURSOR Function Key

Press **CURSOR** function key in Figure 3-5 to set the value of a single digit.

The RPG can be used to set the digit of hundred, decade, figure and 1<sup>st</sup> place after the decimal point for voltage or frequency to save time in inputting the values.

The procedure for setting the 1<sup>st</sup> place after the decimal point for output voltage Vac in 1\_Phase Mode /3\_Phase Mode is described below.

- 1. Move the cursor to "Vac =" command line.
- 2. Press **CURSOR** function key.
- 3. The cursor will shorten to one digit range.
- 4. Move the cursor to the 1<sup>st</sup> digit after decimal point and use the RPG to change the value.
- 5. Press **CURSOR** function key again to exit it.

3	Pha	se		LOCAL	. (	QUI	Т			1_Pha	s e		LOCAL	. Q	UIT			
				OUTPUT	SETTING		Vice TV	10041750-0045	Main	1020			OUTPUT S	SETTING	-		1122	Main
ē1	Vac	=	000	. <u>0</u> V	F :	=	60.	00Hz	OUTPUT:	Vac	=	000	. <u>o</u> v f	-	60.	00	Hz	OUTPUT:
₽2	Vac		0		F :	-	60	00Hz	More Setting									More Setting
₫3	Vac	-	0	. 0 V	F٩	=	60	00Hz	Measurement									Measurement
				MEASUR	EMENT				Setting				MEASUR	EMENT				Setting
	V	=	0	.00	Po	=		0.0	Waveform	٧	=	0	.00	Po	=	1	0.0	Waveform
€1	I	=	0.	000	PF	=	0.	000	Viewer	I	=	0.	000	PF	=	0.	000	Viewer
	V	=	0	.00	Po	=		0.0	1.222000 (month)	Vac	=	0	.00	Vdc	=	0	.00	
<b>#</b> 2	I	=	0.	000	PF	=	0	. 0 0 0	Limitation	Iac	=	0.	000	Idc	=	0.	000	Limitation
	٧	#	0	.00	Po	=		0.0	Output	Vpk	=	0	.00	VA	=	1	0.0	Output
<b>#</b> 3	I	=	0.	000	PF	=	0	000	Mode	Ipk	=	0.	000	CF	=	0.	000	Mode
	V12	=	0	.00	V23	=	(	0.00	Measurement	n o testo so								-
Σ	V 31	=	0	.00	Po	=		0.0	To Page2									
	Recall CH1	Re		Recall CH3	Recall CH4		Recall CH5	More 1 of 2	2014/12/17	Recall CH1		call H2	Recall CH3	Recall CH4	Rec		More 1 of 2	2014/12/17

# 3.7 LOCK Function Key

Press **LOCK** function key in Figure 3-5 to lock the function.

Press this key to lock all functions on the panel and making all keys invalid. Press **LOCK** for 3~3.5 seconds to unlock it.

-	Pha		LOCAI OUTPUT		QUI		Main	1_Pha		LOCAL OUTPUT		UIT		Main
<b>E1</b>	Vac	=	0.0V	F =	•	60.00Hz		Vac	=	0.0V F		60	. 00Hz	
2	Vac	-	0.0V	F =		60.00Hz								
3	Vac	=	0.0V	F =		60.00Hz								
			MEASUF	EMENT						MEASUR	EMENT			
	٧	=	0.00	Po	=	0.0		٧	=	0.00	Po	=	0.0	
н	I	=	0.000	PF	=	0.000		I	=	0.000	PF	=	0.000	
	V	=	0.00	Po	=	0.0		Vac	=	0.00	Vdc	=	0.00	_
2	I	-	0.000	PF	=	0.000		Iac		0.000	Idc	=	0.000	
	٧	=	0.00	Po	=	0.0	2	Vpk	=	0.00	VA	=	0.0	8
13	I	=	0.000	PF	=	0.000	-	Ipk	=	0.000	CF	=	0.000	
	V 12	=	0.00	V23	=	0.00	-	100-70-10-10						-
Σ	V 31	=	0.00	Po	=	0.0								

# 3.8 OUTPUT Function Key

Please refer to section 3.3.1 for the detail description of OUTPUT function key.

# 3.9 LOCAL/REMOTE Function Key

Press **LOCAL/REMOTE** function key in Figure 3-5 to switch to remote control.

When the Regenerative Grid Simulator is in REMOTE state and controlled by an external device, press this key to release the REMOTE state and return to LOCAL control.

3	Pha	se	REMO	TE G	UI	Т	
	1022		OUTPUT	SETTING		Antonio America Mari	Main
₫1	Vac	=	0.0V	F =		60.00Hz	
<b>⊉</b> 2	Vac	=	0.0V	F =		60.00Hz	
₫3	Vac	=	0.0V	F =		60.00Hz	
			MEASU	REMENT			
eex.	٧	=	0.00	Po	=	0.0	
₫1	I	=	0.000	PF	=	0.000	
	٧	=	0.00	Po	=	0.0	
₫2	I		0.000	PF	=	0.000	_
	٧	=	0.00	Po	=	0.0	2
₫3	I	=	0.000	PF	=	0.000	
	V 12	=	0.00	V23	=	0.00	-
Σ	<b>V</b> 31	=	0.00	P٥	=	0.0	
-							2014/12/18

# 3.10 SAVE/RECALL Function Key

The Regenerative Grid Simulator has two modes for users to save and recall the output setting or system information as described in section 3.10.1 and 3.10.2. Press **SAVE/RECALL** function key in Figure 3-5 to access the save and recall functions.

# 3.10.1 Save/Recall Output Setting

The Regenerative Grid Simulator has 10 channels for users to save the frequently used Vac, F and Vdc for recall. For example, enter the setting and save it to CH1 memory in MAIN PAGE (3\_Phase Mode) (see 3.3.)

3	Pha	s e	300V	LOCAL	QUIT		3	_Pha	se	300V	LOCAL	QUIT	
<b>₫1</b> <b>₫2</b>	Vac Vac	=	0.0V 0.0V	F =	60.00H 60.00H	Output	<b>垂</b> 1 <b>垂</b> 2	Vac Vac	=	0.0V	SETTING F = F =	60.00Hz 60.00Hz	Save/Recal   Save Output Setting
<b>₫</b> 3	Vac	=	0.0V	F =	60.00H	Z Save System Data	<b>₫</b> 3	Vac	=	0.0V	F =	60.00Hz	Save System Data
€1	V I	-	0.00	P₀ PF	= 0.0 = 0.000		1	Vac = Vac = Vac =	0.0V 0.0V 0.0V	F = 6	0.00Hz Vd	ic = 0.0V ic = 0.0V ic = 0.0V	
<b>₫</b> 2	V I		0.00	P∘ PF	= 0.0 = 0.000	Recall Output Setting	2	Vac = Vac = Vac =	0.0V 0.0V 0.0V	F = 6	0.00Hz Vd	c = 0.0V c = 0.0V c = 0.0V	Recall Output Setting
₫3	V I	-	0.00	P₀ PF	= 0.0 = 0.000	Recall System Data	3	Vac = Vac = Vac =	0.0V 0.0V 0.0V	F = 6	0.00Hz Vd	c = 0.0V c = 0.0V c = 0.0V	Recall System Data
Σ	V 12 V 31	-	0.00 0.00	V23 Po	= 0.00 = 0.0	1	4	Vac = Vac = Vac =	0.0V 0.0V 0.0V	F = 6	0.00Hz Vd	ic = 0.0V ic = 0.0V ic = 0.0V	
						2014/05/17 09:57:00	8	lave to CH1	Save to CH2	Save to CH3	Save to CH4	More	2014/05/17 09:57:27

3_	Phas	e 300V	LOCAL	QUIT	C. R. S. S. Stranger - State	3	Pha	se	300V	LOC	AL	QUIT	
	-1020	00	PUT SETTING	2010/00 0000000000	Save/Recall	1	10720		OUTP	UT SETTI	NG		Save/Recal
₫1	Vac =	= 0.0	V F =	60.00Hz	Save	₫1	Vac	=	0.0V	F	=	60.00Hz	Save
<b>⊉</b> 2	Vac =	= 0.0	VF=	60.00Hz	Output Setting	<b>⊉</b> 2	Vac	=	0.0V	F	=	60.00Hz	Output Setting
₫3	Vac =	= 0.0	VF=	60.00Hz	Save	₫3	Vac	=	0.0V	F	=	60.00Hz	Save
		System Data		CHANNEL DATA						System Data			
							Vac = Vac =	0.0V 0.0V	F =	60.00Hz			
						1	Vac =	0.0V	÷ -	60.00Hz			
	Save output setting	output	put setting	to CH 1	Output 2	Vac = Vac = Vac =	0.0V 0.0V 0.0V	F = F = F =	60.00Hz 60.00Hz 60.00Hz	Vdc :	0.0V 0.0V	Recall Output Setting	
			Recall 3 System Data	Vac = Vac = Vac =	0.0V 0.0V 0.0V	F = F = F =	60.00Hz 60.00Hz 60.00Hz	Vdc Vdc 4	= 0.0V = 0.0V	Recall System Data			
					1 <sup>2</sup>		Vac = Vac =	0.0V 0.0V	F = F =	60.00Hz			72
						-	Vac =	0.0V	F =	60.00Hz	Vdc ·	= 0.0V	
					2014/05/17 09:59:12		CH1	Recall CH2	Recal CH3	I Rec		More	2014/05/17

**Notice** 

- 1. Only the save and recall settings are set in MAIN PAGE. Other parameters are ignored.
- In different output coupling modes (see 3.3.1.1) the missing settings will be adjusted to Vac=0V, F=60Hz, Vdc=0V automatically. For example, when executing save in DC output mode Vac=0V, F=60Hz, Vdc is the setting in MAIN PAGE.

# 3.10.2 Save/Recall System Data

The Regenerative Grid Simulator has 10 groups of memory for users to save and recall system data. System data contains all parameters in the function keys such as MAIN PAGE (see 3.3) and CONFIG (see 3.4). Press **SAVE/RECALL** in MAIN PAGE (3\_Phase Mode) (see 3.3) and press the LCD at the bottom to save the system data as shown below.

3	Pha	se	300V	LOCAL	QUIT		3	Pha	se	300V	LOCAL	QUIT		. In Such Manual Contractor
	10220			T SETTING	And and a second second	Save/Recall		1023		OUTPL	T SETTING	2000		Save/Recal
₫1	Vac	=	0.0V	F =	60.00Hz	Save		Vac	=	0.0V	F =	60.0	OHz	Save
<b>⊉</b> 2	Vac	=	0.0V	F =	60.00Hz	Output Setting	<b>⊉</b> 2	Vac	-	0.0V	F =	60.0	OHz	Output Setting
₫3	Vac	=	0.0V	F =	60.00Hz	Save	₫3	Vac	=	0.0V	F =	60.0	OHz	Save
			MEAS	SUREMENT		System Data				MEA	SUREMENT			System Data
0503	٧	=	0.00	Po	= 0.0		New r	٧	=	0.00	Po	= 0	. 0	-
-∎1	I	=	0.000	PF	= 0.000		₩1	I	=	0.000	PF	= 0.0	00	
	٧	=	0.00	Po	= 0.0	Recall		٧	=	0.00	Po	= 0	. 0	Recall
₫2	I	=	0.000	PF	= 0.000	Output Setting	₫2	I	=	0.000	PF	= 0.0	00	Output Setting
_	۷	=	0.00	Po	= 0.0	Recall	_	٧	=	0.00	Po	= 0	. 0	Recall
<b>£</b> 3	I	=	0.000	PF	= 0.000	System Data	₫3	I	=	0.000	PF	= 0.0	00	System Data
	V 12	=	0.00	V23	= 0.00	12		V 12	=	0.00	V23	= 0.	00	-
Σ	<b>V</b> 31	=	0.00	Po	= 0.0		Σ	<b>V</b> 31	=	0.00	P٥	= 0	. 0	
			11			2014/05/17 10:00:30		ave to ROUP1	Save	A CONTRACT OF		Save to GROUP5	More	2014/05/17 10:00:54

3	Phase	a 300\	LOCA	L QUI	Т		3	Pha	se	30	0 V 0	LOCAL		QUI	Т	
	1020		TPUT SETTING		anna cur	Save/Recall		1023				SETTING		and the second second		Save/Recal
≣1	Vac =	• 0.0	V F	= 60.	00Hz	Save		Vac	=	0	.0V	F =		60.	00Hz	Save
<b>⊉</b> 2	Vac =	0.0	V F	= 60.	00Hz	Output Setting	<b>⊉</b> 2	Vac	=	0	. OV	F =		60.	00Hz	Output Setting
₫3	Vac =	• 0.0	V F	= 60.	00Hz	Save	<b>₫</b> 3	Vac	=	0	. O V	F =		60.	00Hz	Save
		0	HANNEL DATA			System Data					MEAS	UREMENT				System Data
							Nere	٧	=	0	.00	Po	=		0.0	
							-#1	I	=	0.	000	PF	=	0.	000	
						Recall		٧	=	0	.00	Po	=		0.0	Recall
	Save	system	data	to GROU	P 1	Output Setting	₫2	I	=	0.	000	PF	=	0.	000	Output Setting
						Recall		٧	=	0	.00	Po	=		0.0	Recall
						System Data	₫3	I	=	0.	000	PF	=	0.	000	System Data
						12		V 12	=	0	.00	V23	=	0	.00	
							Σ	<b>V</b> 31	=	0	.00	Po	=		0.0	
2		17				2014/05/17		Recall ROUP1	Rec		Recall GROUP3	Recall GROUP4		lecall ROUP5	More	2014/05/17

```
Notice
```

The Regenerative Grid Simulator has 11 groups of memory: GROUP 0, GROUP1~10. GROUP 0 will save the power-on default. The data saved in GROUP 0 will be recalled automatically and loaded when the Regenerative Grid Simulator powers on again. As to the data saved in GROUP 1~10 memory groups, they need to be called manually for loading.

# 3.11 Protection

The Regenerative Grid Simulator has both software and hardware protection. When protection occurs the Regenerative Grid Simulator will stop the output and disconnect the output relay. The display shows that the source is in protection mode. To normal output after the Recovery protection is triggered, please address any issues and press **ENTER** to release protection for normal operation. To normal output after the Latch protection is triggered, remove the error load and restart 0 to release protection for normal operation.

The table below lists the output protection:

Message	Protection		Possible Cause	_	Troubleshooting
	It occurs when the	1.	The UUT	1.	Remove the UUT
	output current		impedance is		and make sure
SYS_OCP(1/2/3)	exceeds the		too low.		the protection
	system set current	2.	Temporary short		value is correctly
	limit. (Recovery)		circuit.		set.
	It occurs when the	3.	The RCD load	2.	Remove the UUT
	transient output		impedance is		and confirm its
	current exceeds the		too small.		correctness.
(φ1/2/3) DA_OCP	module current limit	4.		3.	Add a current limit
	or current		capacitive load		resistor.
	specification.		is too big.	4.	Set the voltage
	(Latch)				slew rate.
	It occurs when the	1.	The UUT	1.	Remove the UUT
	output power		impedance is		and make sure
SYS_OPP(1/2/3)	exceeds the		too low.		the protection
	system set power	2.	Temporary short		value is correctly
	limit. (Recovery)		circuit.		set.
	It occurs when the			2.	Remove the UUT
	transient output				and confirm its
	power exceeds the				correctness.
(φ1/2/3)DA_OPP	module power limit				
	or power				
	specification.				
	(Latch)				
	It occurs when the	1.	The external	1.	Make sure the
	output voltage		source is too		external circuit is
SYS_OVP(1/2/3)	exceeds the	_	large.	_	correct.
	, , , , , , , , , , , , , , , , , , , ,	2.	The external	2.	Check if the
	limit. (Recovery)		inductive load is		circuit is short
	It occurs when the	_	open.	~	circuited.
	transient output	3.	The UUT	3.	Confirm the
	voltage exceeds		capacitive load		external circuit
(φ1/2/3)DA_OVP	the module voltage		is too big.		characteristics.
	limit or voltage				
	specification.				
	(Latch)	4		4	
	It occurs when the	1.	The UUT	Π.	Remove the UUT
	output is short		impedance is too low.		and make sure
	circuited. (Latch)	S			the protection
(φ1/2/3)DA_SHORT		۷.	Temporary short circuit.		value is correctly
			Circuit.	2	set. Remove the UUT
				۷.	and confirm its
					correctness.
	It occurs when the	1	The Remote	1	Confirm the wiring
	remote voltage	<b>'</b> .	sense wire is	<b>'</b> .	connection of
	sense is enabled		disconnected or		Remote sense
(φ1/2/3)DA_SENSE_FAULT	but the signal cable		connected	2	Shorten the
	is disconnected or		wrong.	2.	distance between
	error. (Latch)	2	The remote		UUT and remove
		۷.		1	

			connection		the impedance.
	DC/AC power		impedance is too big. The output relay is failure. The output	3.	Change the broken output relay.
(φ1/2/3)DA_DST_PROT_F	DA_DST_PROT_F module internal parts transient over rated protection. (Recovery)		<ul> <li>the rated DC/AC power module internal parts.</li> <li>The DC/AC module measurement circuit is having error.</li> <li>The DC/AC module digital circuit is having error.</li> </ul>	2.	voltage waveform and frequency.
(φ1/2/3)DA_DST_PROT_S	DC/AC power module internal parts steady state over rated protection. (Recovery)	3.		3.	DC/AC module board that is having protection phase. Check and replace the DC/AC digital module board that is having protection phase. Check and replace the digital module board.
Remote - Inhibit	It occurs when remote is inhibited.				
SYS_UVP(1/2/3)(ACL)	It occurs when the UUT voltage is lower than the set voltage limit. (Recovery)	ou	e external UUT tput is ort-circuited.	2.	Remove the UUT and check its circuit characteristics. Check if the circuit is short-circuited. Check the external circuit characteristics.
(φ1/2/3)DA_UVP(ACL)	It occurs when the UUT transient output voltage is lower than the operating voltage limit. (Latch)				

The table below lists the module protection:

Message	Protection	Possible Cause	Troubleshooting
	It occurs when the	1. The fan is	1. Check the fan
FAN FAIL TR	auxiliary power	blocked due	on the module
	module fan is	foreign object or	having
	malfunction. (Latch)	dust.	protection and
(φ1/2/3)AD_FAN_FAIL	It occurs when the	2. The fan is not	clear the foreign

	AC/DC power	connected.	object.
(φ1/2/3)DA_FAN_FAIL	module fan is malfunction. (Latch) It occurs when the DC/AC power module fan is malfunction. (Latch)	<ol> <li>The fan is broken or invalid.</li> <li>The fan circuit is malfunction.</li> </ol>	<ol> <li>Check the connection of fan on the module having protection.</li> <li>Replace the broken or invalid fan.</li> <li>Replace the fan circuit board.</li> </ol>
(φ1/2/3)AD_DUST	It occurs when the AC/DC module is dusty. (Latch)	The AC/DC module has accumulated dust or foreign object.	Check the AC/DC module of each phase for dust and clean it.
(φ1/2/3)DA_DUST	It occurs when the DC/AC module is dusty. (Latch)	DC/AC module has accumulated dust or foreign object.	Check the DC/AC module of each phase for dust and clean it.
OTP_TR		<ol> <li>The operating environment temperature is over.</li> <li>The power IGBT</li> </ol>	
(φ1/2/3)AD_OTP	It occurs when the AC/DC power module internal temperature is too high. (Latch)	module is having error. 3. The detection circuit is having error.	and replace it. 3. Check the error fan circuit board with sense wire
(φ1/2/3)DA_ΟΤΡ	It occurs when the DC/AC power module internal temperature is too high. (Latch)		and replace them.
(φ1/2/3)AD_OVP_LINE_RS_F (φ1/2/3)AD_OVP_LINE_ST_F (φ1/2/3)AD_OVP_LINE_TR_F	higher than the spec. (Latch)	<ol> <li>Input power error.</li> <li>The AC/DC module measurement</li> </ol>	<ol> <li>Check if the input power meets the rated voltage.</li> <li>Check and</li> </ol>
(φ1/2/3)AD_OVP_LINE_RS_S (φ1/2/3)AD_OVP_LINE_ST_S (φ1/2/3)AD_OVP_LINE_TR_S	It occurs when the circuit steady input voltage is higher than the spec. (Latch)	circuit is having error.	replace the protected AC/DC module board.
(φ1/2/3)AD_UVP_LINE_TR_F	It occurs when the circuit transient input voltage is lower than the spec. (Latch)	<ol> <li>Input power is having error.</li> <li>The AC/DC module input Fuse is broken.</li> </ol>	<ol> <li>Check if the input power meets the rated voltage.</li> <li>Measure the</li> </ol>
(φ1/2/3)AD_UVP_LINE_ST_S	It occurs when the circuit steady input voltage is lower	<ol> <li>The AC/DC module measurement</li> </ol>	AC/DC module input fuse and replace it.

	than the spec. (Latch)	circuit is having error.	<ol> <li>Check and replace the protected AC/DC module board.</li> </ol>
(φ1/2/3)AD_UNBALANCE _LINE	It occurs when the circuit input is unbalanced or open phase. (Latch)	<ol> <li>The input power is connected wrong. (10% line voltage difference)</li> <li>The input power is disconnected (open phase.)</li> <li>The AC/DC module fuse is broken.</li> <li>The AC/DC module fuse is broken.</li> </ol>	input power
FREQ_LINE_ERR(φ1/2/3)	It occurs when circuit input frequency is over the spec. (Latch)	The Mains frequency is incorrect.	Check the Mains frequency. (47Hz-63Hz)
(φ1/2/3)AD_OCP_LINE_R_F (φ1/2/3)AD_OCP_LINE_S_F (φ1/2/3)AD_OCP_LINE_T_F	It occurs when circuit transient input current is over the limit. (Latch)	input current is	1. Remove the UUT and check if the operation is correct.
(φ1/2/3)AD_OCP_LINE_R_S (φ1/2/3)AD_OCP_LINE_S_S (φ1/2/3)AD_OCP_LINE_T_S	It occurs when the circuit steady input current is over the limit (Latch)	over 135Arms.) 2. The AC/DC module measurement circuit is having error.	<ol> <li>Check and replace the protected AC/DC module board.</li> </ol>
(φ1/2/3)AD_OPP_LINE_R_F (φ1/2/3)AD_OPP_LINE_S_F (φ1/2/3)AD_OPP_LINE_T_F	It occurs when the circuit transient input is over power.(Latch)	1. The output transient power is too high. (The input power is	1. Remove the UUT and check if the operation is correct.
(φ1/2/3)AD_OPP_LINE_R_S (φ1/2/3)AD_OPP_LINE_S_S (φ1/2/3)AD_OPP_LINE_T_S	It occurs when the circuit steady input is over power. (Latch)	over 84kW.) 2. The AC/DC module measurement circuit is having error.	<ol> <li>Check and replace the protected AC/DC module board.</li> </ol>
(φ1/2/3)AD_OVP_VDC_F	It occurs when the power module internal DC BUS transient voltage is higher than the spec. (Latch)	1. The output transient power is too high. (The protected phase VDC is higher than 700V.)	<ol> <li>Remove the UUT and check if the operation is correct.</li> <li>Check and replace the</li> </ol>
(φ1/2/3)AD_OVP_VDC_S	It occurs when the power module	(Regen mode) 2. The AC/DC	protected AC/DC module

	internal DC BUS		module		board.
	steady voltage is higher than the spec. (Latch)		measurement circuit is having error.		
(φ1/2/3)AD_UVP_VDC_F		1.	The output transient power is too high. (The protected phase		Remove the UUT and check if the operation is correct. Check and replace the
(φ1/2/3)AD_UVP_VDC_S	It occurs when the power module internal DC BUS steady voltage is lower than the spec. (Latch)	3. 4. 5.	circuit is having error. AC/DC module relay driver signal is incorrect or the relay is broken. The AC/DC module PWM driver signal is incorrect. The AC/DC power module is abnormal or broken.	4.	protected AC/DC module board. Check and replace the protected AC/DC module board. Check and replace the protected AC/DC power module board. Check and replace the protected AC/DC power module board.
(φ1/2/3)AD_OCP_IDC_F	It occurs when the power module internal DC BUS transient state is over current. (Latch)	1.	The output transient power is too high. (The protected phase IDC is higher than 38Arms)		Remove the UUT and check if the operation is correct. Check and replace the
(φ1/2/3)AD_OCP_IDC_S	It occurs when the power module internal DC BUS steady state is over current. (Latch)	3.	(Source /Regen mode) The AC/DC module measurement circuit is having error. The AC/DC power module is abnormal or broken. The DC/AC power module is abnormal or broken.		protected AC/DC module board. Check and replace the protected AC/DC power module board.
(φ1/2/3)AD_OPP_PDC_F	It occurs when the power module internal DC BUS	1.	The output transient power is too high. (The	1.	Remove the UUT and check if the operation

	transient state is over power. (Latch)		protected phase PDC is higher	2	is correct. Check and
(φ1/2/3)AD_OPP_PDC_S	It occurs when the power module internal DC BUS steady state is over power. (Latch)	3.	than 26.25kW.) (Source/ Regen mode)	3.	replace the protected AC/DC module board. Check and replace the protected AC/DC power module board.
SYS SELF_AD_1 SYS SELF_AD_2 SYS SELF_AD_3	It occurs when the auxiliary power of AC/DC power module is running self detect. (Latch)	2.	The AC/DC module auxiliary power is having error. The AC/DC module measurement circuit is having error. The digital module is having error.	2.	Check and replace the AC/DC module auxiliary power board of protected phase. Check and replace the AC/DC module board of protected phase. Check and replace the digital module board.
SYS SELF_DA_1 SYS SELF_DA_2 SYS SELF_DA_3	It occurs when the auxiliary power of DC/AC power module is running self detect. (Latch)	2.	error. The digital module is having error.	2.	Check and replace the DC/AC module auxiliary power board of protected phase. Check and replace the DC/AC module board of protected phase. Check and replace the digital module board.
SYS SELF_CS	It occurs when the	1.	The digital	1.	Check and

	auviliany power of		modulo ouviliani		raplace the
	auxiliary power of digital module is running self detect. (Latch)	3.	module auxiliary power is having error. The digital module measurement circuit is having error. The digital module is having error. The auxiliary	3.	replace the digital module board. Check and replace the digital module board. Check and replace the digital module board. Check and
SYS SELF_E	interface and panel auxiliary power is running self detect. (Latch)	2.	power of digital interface module is having error. The measurement circuit of digital interface module is having error. The digital module is having error.	2.	replace the digital interface module board. Check and replace the digital interface module board. Check and replace the digital module board.
(φ1/2/3)AD_PWM_FAULT (1/2/3)	It occurs when the AC/DC power module driving signal is having error. (Latch)	1.	The driving signal is having error. (The power element is short	1.	Check and replace the power module board of protected
(φ1/2/3)DA_PWM(1/2)_FAULT	It occurs when the DC/AC power module driving signal is having error. (Latch)		circuited.) The AC/DC module measurement circuit is having error. The DC/AC module digital circuit is having error.	3.	phase. Check and replace the AC/DC module digital board of protected phase. Check and replace the DC/AC module digital board of protected phase.
SYS SELF_TEST_NG_1 SYS SELF_TEST_NG_2 SYS SELF_TEST_NG_3	It occurs when the self-test of DC/AC power module output voltage is no good. (Recovery)	2.	The DC/AC module voltage calibration of protected phase is having error. DC/AC module measurement circuit is having error. The DC/AC module digital circuit is having	2.	Execute voltage calibration again. Check and replace the DC/AC module board of protected phase. Check and replace the DC/AC module

		4.	error. The digital module is having error.	digital board of protected phase. 4. Check and replace the digital module board.
SYS_INT_OFF	It occurs when the circuit of auxiliary power module or digital module is having error. (Latch)		The auxiliary power (VD) is having error. The digital module protection circuit is having error.	<ol> <li>Check and replace the auxiliary power module.</li> <li>Check and replace the digital module.</li> </ol>
SYS_INT_AUX_OUT	It occurs when the auxiliary power module is having error. (Latch)		The auxiliary power (VP) is having error. The auxiliary power protective circuit is having error.	Check and replace the auxiliary power module.

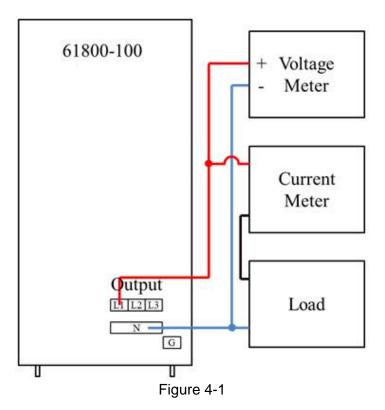
**Notice** 

The protection message is marked \_F(FAST) and \_S(SLOW) by transient and steady state. The protection point varies by the measurement error, thus it may act before reaching the protection point set.

# 4. Calibration

## 4.1 Introduction

The Regenerative Grid Simulator has built in simple procedures for the user to operate for calibrating the output and measuring the accuracy without opening the case. When executing the calibration procedure, the voltmeter, ammeter, appropriate load and +10Vdc power supply are required. See Figure 4-1 for the connection of these instruments. The calibration items contain output voltage, output current and external reference voltage. However, it does not need to calibrate all of the three items at the same time. If desired, it can select one of them for calibration.





- 1. For the environment temperature of 25°C, it is required to warm up for 20 minutes before calibration so that the Regenerative Grid Simulator can reach the normal working temperature and make sure the calibrated values are correct.
- 2. The Voltage Meter cable ensures remote sense also connects to terminal.

# 4.2 Manual Calibration Function

Select "Calibration" in the CONFIG function (3\_Phase Mode/1\_Phase Mode) to input the calibration procedure. For safety reason, the user is required to enter the password to show the calibration items. The password is listed in this manual to ensure the user has read the manual before performing calibration.

CALIBRATION	Config
	Others
Enter Password: <u>****</u>	Calibration
(You can get password in user's manual)	System Information
	Factory Default
	Master/Slave Function
	More 2 of 2
	2014/08/25 14:54:59



- The password for entering the calibration procedure is "3621 ". Input it and press ENTER to confirm it.
- 2. Before calibrating the Regenerative Grid Simulator, the user should read the procedure clearly. Otherwise, the memory data could be lost due to improper operation.

The screen is displayed as below after the correct password is entered. The LCD shows that the calibration can only be performed in 3\_Phase mode and it is prohibited to switch to 1\_Phase mode. Press **ENTER** to continue the calibration procedure.

CALIBRATION	Config
Calibration Program is only running in three phase mode.	
DO NOT connect output in single phase mode.	
Press <enter> to continue.</enter>	
Quít	2014/08/2

The user can choose to calibrate the voltage, current and external reference voltage.

Volta	ge Se			easure	ment:⊉	1
		CALIB	ATION			Calibration
	₫1 V			tting librat		
and	measu	remen	ca	indrat	ION.	
Remo	ve Lo	ad Bet	ore	Calib	rating	
Pres	s <en< td=""><td>TER&gt; 1</td><td>0 00</td><td>ontinu</td><td>е.</td><td>-</td></en<>	TER> 1	0 00	ontinu	е.	-
Pres	s <ex< td=""><td>IT&gt; to</td><td>ski</td><td>ip.</td><td></td><td>0.</td></ex<>	IT> to	ski	ip.		0.
Voltage Setting& Measure.	Current Measure.	External Vref	Level Setting 1750	9		2014/08/25 14:56:46

Voltage setting & Measure: It calibrates the output voltage and the accuracy of voltage measurement.

Current Measure: It calibrates accuracy of current measurement.

External Vref.: It calibrates the external Vref.

Level Setting: It adjusts the response speed.

### 4.2.1 Calibrating Output Voltage and Voltage

### Measurement

After entered the password, the CALIBRATION CHOICES are shown on the screen as described in section 4.2. Press Voltage setting & Measure to output voltage and execute the measurement calibration.

Voltage Setting & Measurement: Φ	1
CALIBRATION	Calibration
300V Range : Offset voltage	
Press <enter> to continue.</enter>	
Press <exit> to skip.</exit>	
•	
	2.
	1
	2014/08/25
	10.14.10

In measurement calibration, it will ask the user if performing Offset voltage calibration for 300V range. Press **ENTER** to continue the Offset voltage calibration. Press **EXIT** to skip the Offset voltage calibrating and enter into the 300V Range Setting & Meas. procedure.

oltage Setting & Measurement	: <b>⊈</b> 1
CALIBRATION	Calibratio
300V Range	
A).Keyin the DVM measured Vdc,then press <enter> Vdc offset =0.0mV</enter>	
(repeat this step until Vdc offset <+-100mV>).	
	-
	-
	2014/10/2

In the calibration procedure step A for 300V Range (Offset voltage), the user should use the DVM to measure the DC output voltage of Regenerative Grid Simulator in the unit of mV and then key in the value on the LCD. Monitor the DVM readings and enter the DC output voltage repeatedly till the DC output is lower than  $\pm 100$  mV.

CALIBRATION	Calibration	CALIBRATION Calibration
300V Range A).Keyin the DVM measured Vdc,then press <enter> Vdc offset = 0.0mV (repeat this step until Vdc offset &lt;+-100mV&gt;). B).Wait 2 seconds,then press <enter>.</enter></enter>		300V Range         A).Keyin the DVM measured Vdc,then press <enter>         Vdc offset = 0.0mV         (repeat this step until Vdc offset &lt;+-100mV&gt;).         B).Wait 2 seconds,then press <enter>.         Vec = 0.00V       Vdc = 0.00V</enter></enter>
	2014/10/27	2014/10/23 15:33:30

In step B, the LCD shows the differences of Vac and Vdc measured by the Regenerative Grid Simulator that are generated internally. Wait for 2 seconds and press **ENTER**, the LCD will show the voltage offset Vac and Vdc calculated by the Regenerative Grid Simulator

Voltage	Setting	&	Measurement	: 01
300V Range A).Keyin th Vdc offs (repeat 1 B).Wait 2 s Vac = C).Calibrat	CALIEN e DVM measured et = 0.0mV his step untif econds, then pro 0.00V Vdc = ion for 300V Rs NTER> to run 30	Vdc Vdc Vdc ss 0 ange	DN ,then press <enter> offset &lt;+-1DOmV&gt;). <enter>.</enter></enter>	Calibration
				2014/10/27 15:33:50

In step C, the LCD shows the calibration for 300V Range offset is completed. Press **EXIT** to enter into the saving screen as shown below or press **ENTER** to continue the 300V setting and measurement calibration.

	Calibration	
Da	4	Yes
data?	to save calibratin	No No
		2014/08/25

Press **EXIT** in step C and the LCD will show for saving. Press Yes on the right to save the calibration results.

Voltage Setting & Measu CALIBRATION	calibration
300V Range : Setting &	Meas.
Press <enter> to conti</enter>	nue.
Press <exit> to skip.</exit>	
	2.
	2014/08/25 15:17:23

When the 300V Range (Offset voltage) calibration is done, the LCD will ask the user if executing the 300V Range Setting & Meas. Press **ENTER** to continue the setting and measurement calibration. Press **EXIT** to skip the Setting & Meas. to enter into the Calibration main screen.

Voltage Setting & Measurement:	§1
CALIBRATION CALIBRATION 300V Range A).Check If the DVM measured value is about 30Vac? If NO, check DVM connection.If YES,press <enter>.</enter>	Calibration
	2014/08/25

In the calibration procedure step A for 300V Range Setting & Measurement, the user should remove the load. Check the digital DVM measured output AC voltage for about 30Vac. This is simply to confirm the connection and then press **ENTER**.

Voltage Setting & Measurement:	⊉1
CALIBRATION 300V Range A).Check if the DVM measured value is about 30Vac? If NO, check DVM connection.If YES,press <enter>. B).Keyin the DVM measured Vac,then press <enter>. Vac =</enter></enter>	Calibration
	2014/08/25 15:18:21

In step B, check the digital DVM measured output voltage for about 240VAC. Enter the digital DVM measured value and press **ENTER**.

Volta	ge S	etting	&	Measu	rement	: <b>⊈</b> 1
A).Che If B).Key Vac C).Key	NO, chec in the D = 0.00	ie DVM measu ik DVM conne IVM measured IVV measured	iction. IVac,i	lue is ab If YES,pr hen press	ess <enter> <enter>.</enter></enter>	Calibration
						2014/08/25 15:18:47

In step C, check the digital DVM measured output voltage for about 300VAC. Enter the digital DVM measured value and press **ENTER**.

Voltage Setting & Measurement: 4	1
CALIBRATION 300V Range A).Check if the DVM measured value is about 30Vac? If NO, check DVM connection.If YES,press <enter>. B).Keyin the DVM measured Vac,then press <enter>. Vac = 0.000V C).Keyin the DVM measured Vac,then press <enter>. Vac = 0.000V D).Calibration for #1 Voltage Sotting &amp; Measurement is completed.Press <enter> to continue.</enter></enter></enter></enter>	Calibration
	2014/08/25 15:19:12

In step D, the LCD shows the calibration for 300V Range Setting & Meas. is completed. Press **EXIT** to enter into the saving screen as shown below or press **ENTER** to continue other voltage calibration.

		CALI	BRATION			Calibration Yes
Do you data?	want	to	save	cali	brating	No
						P
						2014/08/25

Press **EXIT** in step D and the LCD will show for saving. Press Yes on the right to save the calibration results.

**Notice** 

 In the last step, the user can press ENTER to continue calibrating the 2<sup>nd</sup> phase or the 3<sup>rd</sup> phase. 2. In the previous screen, if **EXIT** is pressed but the results are not saved, the calibrated values will remain till the Regenerative Grid Simulator is powered off.

### 4.2.2 Calibrating Current Measurement

After entered the password, the CALIBRATION CHOICES are shown on the screen as described in section 4.2. Press Current Measure to calibrate the current measurement.

		CALIBR	LATION		Calibration
	∯1 C brati		Meas	uremen t	
Remo	ve Lo	ad Bet	ore C	alibrati	ng
- 18 F - F - F	171 - 1877 F. F. F.		o con skip	tinue. •	
Voltage Setting& Measure.	Current Measure	External Vref	Level Setting 1750		2014/08/25

CALIBRATION	Calibration	CALIBRATION	alibration
A).Wait 2 seconds, then press <enter>.</enter>		A).Wait 2 seconds, then press <enter>. Iac = 0.00A Idc =0.00A</enter>	
	1	-	
	2014/08/25		2014/08/25

In the Current Measure. ACCURACY CALI. step A, the LCD shows the differences of lac and ldc measured by the Regenerative Grid Simulator that are generated internally. Wait for 2 seconds and press **ENTER**, the lac = 0.00A and ldc = 0.00A.

Current Measurement:⊉1	
CALIBRATION A).Wait 2 seconds.then press <enter>. Iac = 0.00A Idc =0.00A B).Apply load to output.15A or 0.60 @9Vac</enter>	Calibration
	2014/08/25 15:24:19

In step B, adjust the load to  $0.6\Omega$  for output and press **ENTER**. The Regenerative Grid Simulator will output 9Vac.

Current Measurement: 1	A
CALIBRATION A).Wait 2 seconds,then press <enter>. Iac = 0.00A Idc =0.00A B).Apply load to output.15A or 0.60(489Vac Keyin the measured lac, then press <enter> Iac = 0.000A</enter></enter>	Calibration
	2014/08/25 15:24:41

Use the ammeter (or power analyzer) to measure the output current. Input the measured value and press **ENTER**.

Current Measurement:⊉1	
CALIBRATION A).Wait 2 seconds,then press <enter>. Iac = 0.00A Idc =0.00A B).Apply load to output.15A or 0.6Ω @8Vac Keyin the measured lec, then press <enter> Iac = 0.000A Press <enter> to continue.</enter></enter></enter>	Calibration
	2014/08/25 15:25:08

Press **ENTER** to continue the calibration procedure and disconnect the load now.

CALIBRATION	Calibration	CALIBRATION	Calibration
CALIBRATION A).Wait 2 seconds, then press <enter>.</enter>		A).Wait 2 seconds, then press <enter>. Iac = 0.00A Idc =0.00A</enter>	
	2014/08/25 15:25:34		2014/08/25

In step A, the LCD shows the differences of Iac and Idc measured by the Regenerative Grid Simulator that are generated internally. Wait for 2 seconds and press **ENTER**, the Iac = 0.00A and Idc = 0.00A.

	(	ALIBRATION	Calibrati
	seconds, the	n press <enter>. dc =0.00A</enter>	
B).Apply	oad to out;	ut.30A or 0.60 @18Va	-
			-
	1		2014/08/2

In step B, adjust the load to 0.6 $\Omega$  for output and press **ENTER**. The Regenerative Grid Simulator will output 18Vac  $\circ$ 

Current Measurement:⊕1	
CALIBRATION A).Wait 2 seconds,then press <enter>. Iac = 0.00A Idc =0.00A B).Apply load to output.30A or 0.60 @18Vac Keyin the measured Iac, then press <enter> Iac =</enter></enter>	Celibration
	2014/08/25 15:27:01

Use the ammeter (or power analyzer) to measure the output current. Input the measured value and press **ENTER**.

Current Measurement: 01	
CALIBRATION A).Wait 2 seconds, then press <enter>. Iac = 0.00A Idc =0.00A B).Apply load to output.30A or 0.60 @18Vac Keyin the measured lac, then press <enter> Iac = 0.000A Press <enter> to continue.</enter></enter></enter>	Calibration
	2014/08/25 15:27:28

Press **ENTER** to continue the calibration procedure and disconnect the load now.

Current Measurement:⊉1	14	Current Measurement: 1	5 K
CALIBRATION A).Wait 2 seconds, then press <enter>.</enter>	Calibration	CALIBRATION A).Wait 2 seconds,then press <enter>. Iac = 0.00A Idc =0.00A</enter>	Calibration
	2014/08/25 15:27:48		2014/08/25 15:28:12

In step A, the LCD shows the differences of Iac and Idc measured by the Regenerative Grid Simulator that are generated internally. Wait for 2 seconds and press **ENTER**, the Iac = 0.00A and Idc = 0.00A.

Current Measurement: 1	
CALIBRATION A).Wait 2 seconds, then press <enter>. Isc = 0.00A Idc =0.00A B).Apply load to output.60A or 0.6Ω @38Vac</enter>	Calibration
	2014/08/25 15:28:37

In step B, adjust the load to 0.62 $\Omega$  for output and press **ENTER**. The Regenerative Grid Simulator will output 36Vac  $\circ$ 

**Notice** 

When the Regenerative Grid Simulator is model 61800-100, the simulated power output will be 300Vac.

CALIBRATION	Calibration
<ul> <li>A).Wait 2 seconds then press <enter>. Iac = 0.00A Idc =0.00A</enter></li> <li>B).Apply load to output.60A or 0.60 @36Vac Keyin the measurad lac, then press <enter> Iac = 0.000A</enter></li> </ul>	
	2014/08/25

Use the ammeter (or power analyzer) to measure the output current. Input the measured value and press **ENTER**.

Current Measurement:⊈1	
CALIBRATION A).Wait 2 seconds, then press <enter>. Iac = 0.00A Idc =0.00A B).Apply load to output.60A or 0.6Ω @36Vac Keyin the measured lac, then press <enter> Iac = 0.000A C).Calibration for ≇1 Current Measurement is completed.Press <enter> to continue.</enter></enter></enter>	Calibratio
	2014/08/25 15:29:24

Step C is the last step of Current Measure. ACCURACY CALI. Press **ENTER** to continue the  $2^{nd}$  and  $3^{rd}$  phase current calibration or press **EXIT** to leave this screen. The LCD appears as shown below. Press Yes on the right to save the calibration results.

		CALI	BRATION		Calibratio
					Yes
Do you data?	want	to sav	save	calibrating	ing <sub>No</sub>
					2014/08/25



- The resistance of applied load has to be constant so that the load current and output voltage is proportional. If not, the step B of URRENT MEAS. ACCURACY is meaningless. The user can use the current that meets step C as the calibration value.
- 2. Remove protection temporary when executing the calibration. If the

applied load is inappropriate, it could cause the Regenerative Grid Simulator to be damaged.

### 4.2.3 Calibrating External Vref

After entered the password, the CALIBRATION CHOICES are shown on the screen as described in section 4.2. Press External Vref to calibrate the external Vref.

External Vref:⊈1	A.
CALIBRATION	Calibration
Run ⊉1 External Vref calibration.	
Remove Load Before Calibrating	
Press <enter> to continue. Press <exit> to skip.</exit></enter>	ए. २
Voltage Current External Level Setting& Measure. Vref 1750	2014/08/25 15:30:28
External Vref:⊉1	
CALIBRATION	Calibration
A).Short External Vret pint and pin4 ,then press <enter>.</enter>	
	2014/08/25 15:30:51

Step A: Short circuit the pin 1 and pin 4 on the Ext. Vref input terminal and press **ENTER**.

External Vref:⊉1		External Vref:01	
CALIBRATION A).Short External Vref pint and pin4 ,then press <enter>. B).Wait 2 seconds,then press <enter>.</enter></enter>	Calibration	A).Short External Vrct pint and pin4 ,then press <enter>. B).Wait 2 seconds,then press <enter>. Vdc = 0.00V</enter></enter>	Calibratio
	2014/08/25		2014/08/2 15:31:38

Step B: When the Vref input terminal is short circuited, set the input to 0V and then the LCD

will show the Vdc measured by the Regenerative Grid Simulator. The offset voltage is generated by internal ingredients. Wait for 2 seconds and press **ENTER**, the LCD will show the voltage offset Vdc calculated by the Regenerative Grid Simulator.



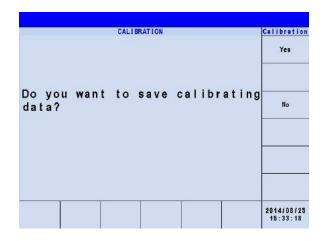
Step C: Disconnect the pin 1 and pin 4 on the Ext. Vref input terminal. Input DC voltage 10Vdc between pin 1 and pin 4 and press **ENTER**.

CALIBRATION	Calibration
A).Short External Vrcf pin1 and pin4 ,then press <enter>.</enter>	
B).Wait 2 seconds,then press <enter>, Vdc = 0.00V</enter>	
C).Apply 10 Vdc between External Vref pin1 and pin4 then press <enter></enter>	
D).Wait 2 seconds,	3
Keyin DVM measured volfage between pin1 and pin4 then press <enter> Vac =0.000V</enter>	

Step D: Use a digital DVM to measure the voltage between pin 1 and pin 4 on the Ext. Vref input terminal. Input the DC voltage and press and press **ENTER**.

CALIBRATION	Calibration
A).Short External Vret pint and pin4 ,then press <enter>.</enter>	
B).Wait 2 seconds,then press <enter>. Vdc = 0.00V</enter>	
C). Apply 10 Vdc between External Vref pin1 and pin4 then press <enter></enter>	
D).Wait 2 seconds, Keyin DVM measured voltage between pin1 and pin4 then press <enter> Vac = 0.000V</enter>	
E).Calibration for ≇1External Vref is completed.	
Press <enter> to continue.</enter>	
	2014/08/25

Step E: It is the last step for External Vref CALI. Press **EXIT** to enter into the saving screen as shown below or press **ENTER** to continue other voltage calibration.



Press **EXIT** in step E and the LCD will show for saving. Press Yes on the right to save the calibration results.

### 4.3 Adjusting Response Speed

After entered the password, the CALIBRATION CHOICES are shown on the screen as described in section 4.2. The Regenerative Grid Simulator allows the user to adjust the bandwidth response speed. The default is 2500 that is varied with the UUT. The output response speed is set by Level which the higher level the faster response speed and vice versa.

CALIBRATION	Calibration			CALIBR	ATION		Calibratio
Run ⊈1 Voltage Setting and Measurement calibration.		This function allows user to adjust the output response speed.					
Remove Load Before Calibrating		to hi	igh,it	t coul	value d be d	,is set cause	
Press <enter> to continue. Press <exit> to skip.</exit></enter>	<u>.</u>	overs	shoot.				
Voltage		Voltage			Level		2020/02/1
Voltage Setting& Current External Setting Measure. Vref 2500	2020/02/12 09:59:50	Voltage Setting& Mcasure.	Current Measure.	External Vref	Level Setting 2500		

Procedure for adjusting the response speed:

- 1. Press Level Setting function key.
- 2. Turn the RPG to change the response speed and press ENTER.

**Notice** 

After changing this Level value, it is necessary to re-calibrate the three-phase voltage value.

For some circumstances, the output voltage could cause Overshoot if the Level setting is too high.

# 5. Application

## 5.1 Overview

The Regenerative Grid Simulator not only can program a stable sinusoidal output voltage and frequency, but also provides powerful features to simulate power line interrupts. Users can change the output using the Sequences in LIST mode (see 5.2), or change the output to step by step in STEP mode (see 5.4.) With these functions, the simulations of conditions such as cycle loss, transient peak and power attenuation are very easy.

The Regenerative Grid Simulator is able to measure the related power parameters provided in MAIN PAGE (see 3.3); also it can provide harmonic measurements up to 50 orders (see 5.7.) In addition, the Regenerative Grid Simulator allows the user to edit different harmonic components to synthesize the harmonic distortion waveform (see 5.5). It has the ability to program the inter-harmonic frequency and components, as well as to sweep and overlap the static fundamental waveforms (see 5.6).

3	Pha	se		L	OCA	L	QL	JIT	ī.		
	1020				OUTPUT	SETTIN	G				Setting
₫1	Vac	=	1	).	0V	F	=		60.	00Hz	OUTPUT:
<b>⊉</b> 2	Vac	=	1	).	0 V 0	F	=		60.	00Hz	More Setting
₫3	Vac	=		).	0V	F	=		60.	00Hz	Measuremen
					MEASU	REMENT					Setting
iere	٧	=		).	00	Po		=		0.0	Waveform
₽1	I	=	0	. 0	00	PF		=	0.	000	Viewer
	V	=	1	).	00	Po		=		0.0	
₫2	I	=	0	. 0	00	PF	8	=	0.	000	Limitation
	٧	=		).	00	Po		=		0.0	Output
₫3	I	=	0	. 0	00	PF	8	=	0.	000	Mode
	V 12	=	1	).	00	V2	3	=	0	.00	1
Σ	<b>V</b> <sub>31</sub>	=	1	).	00	P٥		=		0.0	
	List Mode	Pul	22		Step Mode	Synth	esis		nter- monics	Harmonic Meas.	2014/12/18

# 5.2 List Mode

Press Output Mode on the right on the MAIN PAGE (see 3.3) to go into the Output Mode command line and press List Mode at the bottom to go into the List Mode command line.

3	Pha	se		L I	ST MO	DE:STO	P	QUIT
	11923			OUTPUT	SETTING	2200	Water Car	List Mode
₫1	Vac	=	0	V0.0	F =	60.	00Hz	
<b>⊉</b> 2	Vac	=	(	V0.0	F =	60.	00Hz	Trigger
₫3	Vac	=	(	V0.0	F =	60.	00Hz	Couple
				MEAS	UREMENT			Individual
iere	٧	=	0	0.00	Po	=	0.0	Phase
₹1	I	=	0.	000	PF	= 0.	000	Continue Disable
	٧	=	(	0.00	Po	=	0.0	
₫2	I	-	0.	000	PF	= 0.	000	
	٧	=	(	0.00	Po	=	0.0	3
₫3	I	=	0.	000	PF	= 0.	000	-
	V 12	=	0	0.00	V23	= 0	.00	1
Σ	<b>V</b> <sub>31</sub>	=	(	0.00	P٥	=	0.0	Edit
	List Mode	Pul	32	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/12/18

Press Edit on the right to go to the setting page.

3	Phase		LI	ST MOD	)E		QUIT	
	Vac start	•	LIST MOD 0.0V	E SETTING Vac end		0.0\	,	List Mode
	F start		60.00Hz	F end	-	60.00H		Edit Each
₹1	Vdc start		0.0V		-	0.01	1	
	Degree Time	-	0.0° 0.0ms	Waveform	-	A		Trigger Auto
	Vac start	=	0.0V	Vac end	-	0.01	,	Base
	F start		60.00Hz	F end	=	60.00H	Iz	Time
₫2	Vdc start		0.0V	Vdc end	=	0.01	<i>,</i>	
	Degree	-	240.0°	Waveform	=	A		Count 1
	Time Vac start	-	0.0ms 0.0V	Vac end	=	0.01	,	
	F start	=	60.00Hz	F end	=	60.00H	Iz	Sequence
•3	Vdc start	•	0.0V	Vdc end	-	0.01	1	
	Degree Time	-	120.0" 0.0ms	Waveform	•	A		Execution Page
	IImc		U.UMS	1	-			
		Pulse Mode	Step Mode	Synthesis		inter- rmonics	Harmonic Meas.	2014/12/10

The waveform programming in List mode is a combination of Sequences. The output waveform starts from Sequence = 0 and one Sequence after another until the Time or Cycle = 0, stopping the action. The Sequences following will not be executed. Users can edit the output voltage sequence as needed.

#### Trigger method: Auto / Manual / Excite.

Auto: It finishes all counts when triggered.

Manual: It executes the sequence waveform once, same as Count = 1.

Excite: It is Remote-Excite via the pin 13 of TTL terminal that is triggered by the external trigger signal. See *Appendix A* TTL Signal Pin Assignments for the detail pin assignment.

#### **Couple:** Individual / $\Phi$ 1+ $\Phi$ 2+ $\Phi$ 3.

Individual: The three phases are set separately.

 $\Phi$ 1+ $\Phi$ 2+ $\Phi$ 3: The setting of second/third phase is the same as the setting of the first phase, so the user only needs to set the first phase.

#### Phase Continue: Disable/Enable.

Disable: When set to disable, the starting angle of every sequence will follow the Degree setting for motion.

Enable: When set to enable, the starting angle of every sequence will vary automatically following the last output angle of previous sequence. The Degree of all sequences will be invalid when set to enable.

#### Base sequence unit: Time / Cycle.

Time: The sequence unit is time.

Cycle: The sequence unit is cycle.

**Count:** The entire sequence execution times, Count = 0: unlimited execution.

#### Sequence: Sequence number.

The sequence has to start from 0 and the maximum sequence number is 99. The phase difference of the second/third phase and the first phase of Sequence 0 is fixed to differ 120°. Therefore, the user cannot use the angle of the second/third phase in Sequence 0.

**Degree:** The phase angle when the sequence starts.

Vac start, F start, Vdc start: The initial waveform when the sequence starts. Vac end, F end, Vdc end: The final waveform when the sequence ends.

#### Waveform= A / B: Select waveform (see 3.3.3.)

After setting the sequences, press Execution Page on the right to exit List mode and the LCD will show LIST MODE: STOP on the top. STOP indicates the present trigger state. Users can press Trigger on the right to trigger the output and the LCD will show RUNNING to indicate that the List mode is under execution. At the same time users can press Stop to cease the List waveform output. When the Regenerative Grid Simulator finishes all Sequences and Counts, the LCD will return to its initial state and display STOP. The Regenerative Grid Simulator will QUIT at the same time, as shown below.

3	Pha	se		LI	ST MOL	DE:STO	P	QUIT
	1022			OUTPUT		10000	ana sue	List Mode
₫1	Vac	=	0	1.0V	F =	60.	00Hz	-
<b>⊉</b> 2	Vac	=	0	1.0V	F =	60.	00Hz	Trigger
₫3	Vac	=	0	V0.1	F =	60.	00Hz	Couple
				MEASU	REMENT			Individual
	٧	=	0	.00	Po	=	0.0	Phase
₫1	I	=	0.	000	PF	= 0.	000	Continue Disable
	٧	=	0	.00	Po	=	0.0	
₫2	I	=	0.	000	PF	= 0.	000	
	V	=	0	.00	Po	=	0.0	3
₫3	I	=	0.	000	PF	= 0.	000	
	V 12	=	0	.00	V23	= 0	.00	-
Σ	<b>V</b> <sub>31</sub>	=	0	.00	P٥	=	0.0	Edit
	List Mode	Puls	22 L	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/12/18

3	Pha	se	LI	ST MOD	DE : RUN	NING	OUT
	-1022.0		OUTPUT	SETTING			List Mode
₫1	Vac	=	0.0V	F =	60.	00Hz	
₹2	Vac	=	0.0V	F =	60.	00Hz	Stop
<b>¥</b> 3	Vac	=	0.0V	F =	60.	00Hz	
			MEASU	REMENT			
	٧	=	0.43	Po	=	0.1	
<b>1</b>	I	=	0.235	PF	= 0.	627	-
	٧	=	0.25	Po	= -	0.0	
₽2	I	=	0.017	PF	= -0.	311	
	V	=	0.26	Po	= -	0.0	3
13	I	=	0.029	PF	= -0.	100	
	V 12	=	0.55	V23	= 0	. 27	-
Σ	<b>V</b> 31	=	0.56	Po	=	0.1	
	List Mode	Pul		Synthesis	Inter- harmonics	Harmonic Meas.	2014/05/11

If the Regenerative Grid Simulator is under operation, pressing **OUT/QUIT** will stop the output and the waveform will be zero volts. Press **OUT/QUIT** again and the Regenerative Grid Simulator only outputs the waveform set in MAIN PAGE. Trigger must be pressed to re-trigger the source.

When pressing (D) to exit LIST page, the programmed LIST mode waveform will be closed.

Example of LIST Mode in 1\_Phase Mode:

Trigger: Auto, Base: Time, Count: 1

#### LIST MODE SETTING:

- Sequence 0: Vac start = 20V, Vac end = 100V F start = 50Hz, F end = 50Hz Vdc start = 0V, Vdc end = 0V Degree = 90°, Time = 50ms Waveform = A
- Sequence 1: Vac start = 20V, Vac end = 20V F start = 50Hz, F end = 50Hz Vdc start = 0V, Vdc end = 100V Degree =  $0^{\circ}$ , Time = 50ms Waveform = A
- Sequence 2: Vac start = 20V, Vac end = 120V F start = 50Hz, F end = 100Hz Vdc start = 0V, Vdc end = 0V Degree = 0°, Time = 100ms Waveform = A

Following lists the setting pages of LIST MODE.

Phas	se	LI	ST MOD	)E	QUIT	
		LIST MOL	DE SETTING			List Mode
	start	=	0.0	1.F.1		
Vac	end	=	0.0	V		
F	start	=	60.00	Hz		Trigger
F	end	=	60.00	Hz		Auto
Vdc	start	=	0.0	V		Base Time
Vdc	end	=	0.0	V		11100
Degr	ee	=	0.0	•		Count 1
Wave	form	=	Α			
Time	,	=		0.0ms		Sequence 0
						Execution Page
List Mode	Pulsc Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/05/12

1_	Phas	е	LIS	T MOE	)E	QUIT	
	1023		IST MODE	SETTING			List Mode
	Vac	start	=	0.0	V		a characteristic and a second
	Vac	end	=	0.0	V		
	F	start	= (	60.00	Hz		Trigger
	F	end	= (	60.00	Hz		Auto
	Vdc	start	=	0.0	V		Base Time
	Vdc	end	=	0.0	V		
	Degr	ee	=	0.0	•		Count 1
	Wave	form	= /	A			
	Time		=		0.0ms		Sequence 0
							Execution Page
	List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/05/17 10:11:51

Pha	se	LI	ST MOD	)E	QUIT	
1022		LIST MOL	DE SETTING	0.00		List Mode
Vac	start	=	0.0	V		
Vac	end	=	0.0	V		
F	start	=	60.00	Hz		Trigger
F	end	=	60.00	Hz		Auto
Vdc	start	=	0.0	V		Base Time
Vdc	end	=	0.0	V		111110
Deg	ree	=	0.0	•		Count
	eform	=	Α			
Tim	e	=		0.0ms		Sequence 0
						Execution Page
List Mode	Pulsc Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/05/11

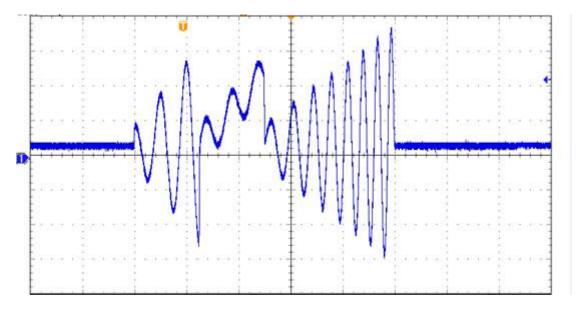
1	Phas	se	LIS	T MOE	)E	QUIT	
	1022		IST MODE	SETTING			List Mode
	Vac	start	=	0.0	v		
	Vac	end	=	0.0	٧		
	F	start	=	60.00	Hz		Trigger
	F	end	=	60.00	Hz		Auto
	Vdc	start	=	0.0	v		Basc Time
	Vdc	end	=	0.0	v		11110
	Degr	ee	=	0.0	•		Count 1
	Wave	form	=	Α			
	Time	,	=		0.0ms		Sequence Q
							Execution Page
	List Mode	Pulsc Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/05/17 10:12:49

1_Pha			ST MOD	DE	QUIT	a constant a transforma	1_Pha			ST MOD	DE	QUIT	
Vac Vac	start	LIST MO	20.0 100.0	1.5.1		List Mode	Vac Vac	start	LIST MOI = =	20.0 20.0	1251		List Mode
F	start end	= =	50.00			Trigger Auto	F	start end	= =	50.00			Trigger Auto
	start end	=	0.0			Basc Time		start end	=	0.0			Basc Time
Deg	ree	=	0.0	30.01		Count 1	Deg	ree	=	0.0	30.00		Count 1
Wav Tim	eform e	=	A 5	i0.0m s		Sequence Q	Wav	eform e	=	A 5	i0.0m s		Sequence 1
						Execution Page							Execution Page
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/12/18 13:32:37	List Mode	Pulsc Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/12/18 13:31:54

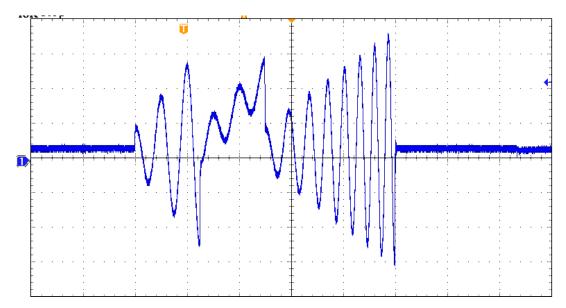
1_Pha	Se	L	IST MOD	DE	QUIT	
1997		IST M	DE SETTING			List Mode
Vac	start	=	20.0	V		
Vac	end	=	120.0	V		
F	start	=	50.00	Hz		Trigger
F	end	=	100.00	Hz		Auto
Vdc	start	=	0.0	V		Base Time
Vdc	end	=	0.0	V		
Deg	ree	=	0.0	•		Count 1
Wav	eform	=	Α			
Tim	e	=	10	0.0ms		Sequence 2
						Execution Page
List Mode	Pulso Mode	Step Mede	Synthesis	Inter- harmonics	Harmonic Meas.	2014/05/11

The trigger waveform when the settings are done is shown below:

Phase Continue Disable:



Phase Continue Enable:



## 5.3 Pulse Mode

Press Output Mode on the right on the MAIN PAGE (see 3.3) to go into the Output Mode command line and press Pulse Mode at the bottom to go into the Pulse Mode command line.

3	Pha	se		PUL	SE MOI	DE:STO	OP	QUIT
	1(12)		-	OUTPUT		10000	Marine Marine	Pulse Mode
₫1	Vac	=	0.	. OV	F =	60.	00Hz	
<b>⊉</b> 2	Vac	=	0	V0	F =	60.	00Hz	Trigger
₫3	Vac	=	0	V0	F =	60.	00Hz	
				MEASU	REMENT			
њя.	٧	=	0	00	Po	=	0.0	
₹1	I	-	0.0	000	PF	= 0.	000	
	٧	=	0	00	Po	=	0.0	
₫2	I	=	0.0	000	PF	= 0.	000	
	۷	=	0	00	Po	=	0.0	2
<b>1</b> 3	I	=	0.0	000	PF	= 0.	000	
	V 12	=	0	00	V23	= (	.00	-
Σ	V 31	=	0	00	Po	=	0.0	Edit
	List Mode	Puls		Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/05/11

3	Phas	е	PUL	SE MOD	)E	QUIT	
			PULSE MO	DE SETTING			Pulse Mode
	Vac	•	0.0V	Vdc	-	0.0V	Edit
	F	=	60.00Hz	Duty cyc	e= 5	0.0%	Each
₹1	Degree		0.0*	Waveform	= A		Trigger
	Period	-	0.0ms				Auto
	Vac	-	0.0V	Vdc	-	0.0V	Count
	F	=	60.00Hz	Duty cyc	e= 5	0.0%	O
22	Degree		0.0*	Waveform	= A		
	Period	-	0.0ms				
	Vac		0.0V	Vdc	=	V0.0	- 5-
	F	-	60.00Hz	Duty cyc	e= 5	0.0%	
<b>±</b> 3	Degree	-	0.0*	Waveform	= A		Execution
	Period		0.0ms				Page
	List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonic	Harmonic s Mcas.	2014/05/1

PULSE mode allows users to program a special waveform and add it to the normal output settings in MAIN PAGE. Waveform programming specifies the time ratio and the duty cycle of the pulse voltage.

Trigger method: Auto / Manual / Excite.

Auto: It finishes all counts when triggered.

Manual: It executes the sequence waveform once, same as Count = 1.

Excite: It is Remote-Excite via the pin 13 of TTL terminal that is triggered by the external trigger signal. See *Appendix A TTL Signal Pin Assignments* for the detail pin assignment.

Count: The count number of pulse.
Vac, F, Vdc: The Vac, F and DC output in pulse voltage.
Duty cycle: The pulse ratio during a duty cycle.
Period: The total length of the duty cycle.
Waveform = A / B: Select waveform (see 3.3.3.)
Degree: The output phase degree of pulse.

After setting the sequences, press Execution Page on the right to exit Pulse mode and the LCD will show PULSE MODE: STOP on the top. STOP indicates the present trigger state. Users can press Trigger on the right to trigger the output and the LCD will show RUNNING to indicate Pulse mode is under execution. The user can also press Stop to cease the Pulse waveform output. When the Regenerative Grid Simulator finishes all Sequences and Counts, the LCD will return to its initial state and display STOP. The Regenerative Grid Simulator will QUIT at the same time, as shown below.

3	Pha	se		PUL	SE MC	DE	STC	P (	QUIT
	1022				SETTING		and and a	Acres and	Pulse Mode
₫1	Vac	=	0	V0.0	F =		60.	00Hz	
<b>⊉</b> 2	Vac	=	(	V0.0	F =		60.	00Hz	Trigger
<b>₽</b> 3	Vac	=	(	V0.0	F =		60.	00Hz	
				MEASU	REMENT				
er:	٧	=	0	00.0	Po	=		0.0	
<b>1</b>	I	=	0.	000	PF	=	0.	000	-
	٧	=	(	0.00	Po	=		0.0	
<b>1</b> 2	I	=	0.	000	PF	=	0.	000	
	٧	=	(	0.00	Po	=		0.0	2
13	I	=	0.	000	PF	=	0.	000	
	V 12	=	(	0.00	V23	=	0	.00	
Σ	<b>V</b> 31	=	(	0.00	Po	=		0.0	Edit
	List Mode	Pul		Step Mode	Synthesi	9	inter- rmonics	Harmonic Meas.	2014/05/11

3	Pha	se		PUL	SE MOI	DE : RUN	NING	OUT
	1022			OUTPUT	SETTING	and a	00000000	Pulse Mode
₫1	Vac	=	0	.0V	F =	60.	00Hz	
<b>⊉</b> 2	Vac	=	0	. OV	F =	60.	00Hz	Stop
₫3	Vac	=	0	. O V	F =	60.	00Hz	
				MEASU	REMENT			
	٧	=	0	.40	Po	=	0.0	
₫1	I	=	0.	235	PF	= 0.	068	-
	٧	=	0	.24	Po	= -	0.0	
₫2	I	=	0.	022	PF	= -0.	510	
	٧	=	0	. 29	Po	= -	0.0	3
<b>2</b> 3	I	=	0.	028	PF	= -0.	119	
	V 12	=	0	. 51	V23	= 0	. 31	1
Σ	<b>V</b> 31	=	0	. 58	Po	=	0.0	
	List Mode	Pul Mor		Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/05/17

If the Regenerative Grid Simulator is operating, pressing **OUT/QUIT** will stop the output and the waveform will be zero volts. Press **OUT/QUIT** again the Regenerative Grid Simulator will output the waveform set in MAIN PAGE. Trigger must be pressed to re-trigger the source.

When pressing (D) to exit PULSE page, the pulse will be closed.

Example of PULSE Mode in 1\_Phase Mode:

**OUTPUT SETTING:** Vac = 50V, F = 50Hz

#### **PULSE MODE SETTING:**

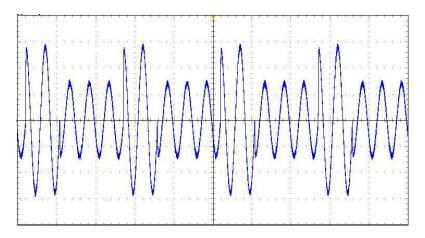
Vac = 100V, Vdc = 0V F = 50Hz, Duty cycle = 35%Period = 100ms, Degree =  $90^{\circ}$ Waveform = A

#### Trigger: Auto, Count: 0

The following lists the setting pages of PULSE MODE.

_Phase	PUL		QUIT	and a stand state of the
Vac	PULSE MO	DE SETTING 0.0V		Pulse Mode
Vdc	=	0.0V		
F	=	60.00Hz		Trigger Auto
Duty cyc	le=	50.0%		
Degree	=	0.0*		Count 0
Waveform	=	A		
Period	=	0.0m s		e.
				Execution Page
List Pulse Mode Mode	Step Mode	Synthesis Inter- harmonics	Harmonic Meas.	2014/05/17 10:29:20
Phase	PUL	SE MODE	QUIT	
Vac	PULSE MO	DE SETTING 0.0V		Pulse Mode
Vdc	-	0.0V		
F	=	60.00Hz		Trigger
Duty cyc	le=	50.0%		Auto
Degree	=	0.0		Count
Waveform	=	A		
Period	=	0.0ms		e.
				Execution Page
List Pulse Mode Mode	Step Mode	Synthesis Inter- harmonics	Harmonic Meas.	2014/05/17 10:29:55
Phase	PUL	SE MODE	QUIT	
Vac	PULSE MO	DE SETTING 100.0V		Pulse Mode
	=	0.0V		
Vdc				
Vdc F	=	50.00Hz		Trigger
1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1				Auto
F		50.00Hz		
F Duty cyc	le= =	50.00Hz 35.0%		Auto
F Duty cyc Degree	le= =	50.00Hz 35.0% 90.0°		Auto
F Duty cyc Degree Waveform	l e = = =	50.00Hz 35.0% 90.0° A		Auto

The trigger waveform when the settings are done is shown below:





The Degree function in Pulse mode can only trigger the pulse mode angle once. To trigger the pulse mode for the same angle every time, it can be implemented via List mode.

### 5.4 Step Mode

Press Output Mode on the right on the MAIN PAGE (see 3.3) to go into the Output Mode command line and press Step Mode at the bottom to go into the Step Mode command line.

3	Pha	se		S	TEP MOI	DE:ST	OP	QUIT
				OUTP	UT SETTING			Step Mode
₽1	Vac =	0.0V		F =	60.00Hz	Vdc =	0.0V	Trigger
₹2	Vac =	0.0V		F =	60.00Hz	Vdc =	0.0V	rrigger
<b>#</b> 3	Vac =	0.0V		F =	60.00Hz	Vdc =	0.0V	
				MEA	SUREMENT			
	٧	=	0	.00	Po	=	0.0	
₫1	I	=	0.	000	PF	= 0	.000	
	٧	=	0	.00	Po	=	0.0	
<b>⊉</b> 2	I	=	0.	000	PF	= 0	.000	
	٧	=	0	.00	Po	=	0.0	3
₫3	I	=	0.	000	PF	= 0	.000	
	V 12	=	0	.00	V23	=	0.00	
Σ	<b>V</b> 31	=	0	.00	Po	=	0.0	Edit
	List Mode	Puls	C	Step Mode	Synthesis	Inter-	Harmonic Meas.	2014/05/17
	nouc	ricui	F	Houe	a an	narmonic	s ricas.	10.42.20

3	Phas	e	\$1	TEP MOL	DE	(	QUIT	
		-		DE SETTING		anato e		Step Mode
	Vac		0.0V	∆Vac	-	0.00		Edit
	F	-	60.00Hz	∆F	=	0.00	Hz	Each
₩1	Vdc	-	0.0V	∆Vdc	=	0.00	1	
	Degree		0.0*	Waveform	-	A		Trigger
	Count	=	0	Dwe I I	=	0	. Oms	Auto
	Vac		0.0V	∆Vac	-	0.00		
	F		60.00Hz	۵F	=	0.00	Hz	
₫2	Vdc =		0.07	∆Vdc	= 0.0V			
	Degree	=	0.0*	Waveform	=	A		
	Count	=	0	Dwe I I	-	0	. Oms	
	Vac	=	0.0V	∆Vac	=	0.00		8
	F	=	60.00Hz	۵F	=	0.00	Hz	
<b>9</b> 3	Vdc		0.0V	∆Vdc	-	0.00		
	Degree =		0.0*	Waveform	-	A		Execution
	Count	-	0	Dwe I I	-	0	. Oms	Page
	List Mode	Pulse Mode	Step Mode	Synthesis		ter- ionics	Harmonic Mcas.	2014/05/17 10:43:47

STEP Mode provides a simple auto switch function to change the output voltage by stepping. Waveform programming sets the item with an initial voltage, specifies the dwell time and the

change of each step as well as the step number. The output voltage will keep the last state after execution.

**Trigger method:** Auto / Manual. Auto: It finishes all counts when triggered. Manual: The output voltage changes a step every time it operates.

**Count:** The count number of each change. **Dwell:** The time for each step. **Vac, F, Vdc:** The Vac, F, DC initial value when STEP mode starts. **AVac, \DeltaF, \DeltaVdc:** The difference value of each step. (It can be negative.) **Waveform = A / B:** Select waveform (see 3.3.3.) **Degree:** The output phase angle of each step.

Press Step Mode at the bottom to go STEP page. The LCD shows STEP MODE: STOP on the top. STOP indicates the present trigger state. Users can press Trigger to trigger the output and the LCD will show RUNNING to indicate Step mode is executing the output. Stop and Pause will show on the screen when the output is triggered. Stop ceases the waveform change of STEP, while Pause keeps the STEP waveform until the user presses TRIG\_CONTINUE. When the Regenerative Grid Simulator finishes all Counts, the LCD will show STOP and the Regenerative Grid Simulator will QUIT.

3	Pha	se		S	TEP MOI	DE:ST	OP	QUIT
				OUTP	UT SETTING			Step Mode
∎1	Vac =	0.0V		F =	60.00Hz	Vdc =	0.0V	Trigger
₹2	Vac =	0.0V		F =	80.00Hz	Vdc =	0.0V	ingger
<b>#</b> 3	Vac =	0.0V		F =	60.00Hz	Vdc =	0.0V	
				ME	SUREMENT			
es:	٧	=	0	.00	Po	=	0.0	
<b>1</b>	I	=	0.	000	PF	= 0	. 0 0 0	
	٧	=	0	.00	Po	=	0.0	
<b>⊉</b> 2	I	=	0.	000	PF	= 0	000	
	٧	=	0	.00	Po	=	0.0	2
<b>#</b> 3	I	=	0.	000	PF	= 0	000	
	V 12	=	0	.00	V23	= (	0.00	1
Σ	<b>V</b> 31	=	0	.00	Po	=	0.0	Edit
	List Mode	Pulse		Step Mode		Inter- harmonics	Harmonic Meas.	2014/05/11

3	Phas	e			S	TEP MOI	DE :	RI	JN	NING	QUIT
				¢	UTP	UT SETTING					Step Mode
<b>±</b> 1	Vac =	0. <b>0</b> V		F	-	60.00Hz	Vdc	-	0.	٥v	Stop
₫2	Vac =	0.0V		E	=	80.00Hz	Vdc	-	0.	ov	alop
<b>£</b> 3	Vac =	0.0V		F	-	60.00Hz	Vdc		0.	ov	Pause
					MEA	SUREMENT					1 4420
	٧	÷	0	. 1	00	Po	=		3	0.0	
₽1	I	-	0.	0	00	PF	=	0	).(	000	
	٧	=	0	.)	00	Po	=		1	0.0	
₫2	I	=	0.	0	0 0	PF	=	0	).(	000	
	٧	=	0	. 1	0 0	Po	=		1	0.0	-
₫3	I	=	0.	0	00	PF	=	0	).(	000	
	V 12	=	0	1	00	V23	=		0	. 00	-
Σ	<b>V</b> 31	=	0	. 1	00	Po	=			0.0	
	List Mode	Pulse			Step 1ode	Synthesis		nter- moni	12	Harmonic Meas.	2014/05/1 10:46:17

If the Regenerative Grid Simulator is outputting, pressing **OUT/QUIT** will stop the output and the waveform will be zero volts. Pressing **OUT/QUIT** again and the Regenerative Grid Simulator will output the waveform set in MAIN PAGE. Users must press Trigger again to re-trigger the output. If the Regenerative Grid Simulator is not outputting, the user can press

**ENTER** to output the STEP waveform directly.

When pressing ( to exit the STEP page, the STEP waveform will stop execution.

The LCD shows Trigger UP and Trigger DOWN when **Trigger = Manual**. The output waveform changes to next voltage if Trigger UP is selected; and the output waveform changes to previous voltage if Trigger DOWN is selected.

3	Pha	se			S	TEP MOL	DE :	RU	INI	VING	OUT
				(	DUTP	UT SETTING					Step Mode
<b>£1</b>	Vac =	0. <b>0</b> V		F	-	60.00Hz	Vdc	•	0.0	v	STOP
₫2	Vac =	0. <b>0</b> V		ंह	=	80.00Hz	Vdc	=	0.0	v	alvr
<b>2</b> 3	Vac =	0.0V		F		60.00Hz	Vdc		0.0	v	Trigger
					MEA	SUREMENT					UP
	٧	=	0		88	Po	=		0	. 2	Trigger
<b>£</b> 1	I	=	0.	2	36	PF	=	0	. 9	139	DOWN
	٧	=	0		28	Po	=		- 0	1.0	
<b>⊉</b> 2	I	=	0.	0	24	PF	=	-0	.1	00	
	٧	=	0		75	Po	=		- 0	0.0	2
<b>4</b> 3	I	=	0.	0	30	PF	=	-0	. 8	20	
	V 12	=	0		99	V23	=		0.	68	12
Σ	<b>V</b> 31	=	0		54	Po	=		0	1.2	
	List Mode	Pulse			Step Node	Synthesis		nter- monic	s	Harmonic Meas.	2014/05/1 10:47:58

Example of STEP Mode in 1\_Phase Mode:

Trigger: Auto

#### **STEP MODE SETTING:**

Vac = 40V,  $\Delta$ Vac = 10V F = 50Hz,  $\Delta$ F = 10Hz Vdc = 0V,  $\Delta$ Vdc = 20V Degree = 90°, Dwell = 60ms Count = 3 , Waveform = A

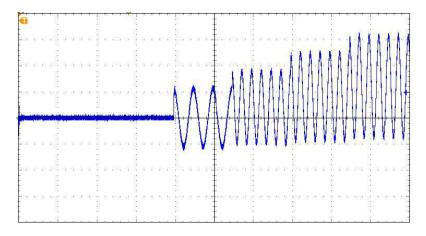
Following lists the setting pages of STEP MODE.

Pha	se	ST	EP MOD	)E	QUIT	
1025		STEP MOI	DE SETTING	0.055		Step Mode
Vac		-	0.0	۷		
∆Va	c	=	0.0	V		
Vdc		=	0.0	V		Trigger
∆Vd	с	=	0.0	V		Auto
F		=	60.00	Hz		
۵F		=	0.0	0Hz		
Deg	ree	=	0.0	•		
Cou	nt	=	0			0.
Wav	eform	=	Α			
Dwe	11	=		0.0ms		Execution Page
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/05/11

Pha	se	\$1	EP MOD	)E	QUIT	
1022		STEP MO	DE SETTING			Step Mode
Vac		=	40.0	V		
∆Vad	3	=	10.0	V		
Vdc		=	0.0	V		Trigger
∆Vdo	;	=	20.0	V		Auto
F		=	50.00	Hz		
۵F		=	50.0	0Hz		
Degi	ree	=	90.0	•		
Cour	1 t	=	3	1		3.
Wave	form	=	Α			
Dwe	11	= -	6	<u>0.0</u> ms		Execution Page
List lode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/05/1 10:54:08

Pha	s e				\$1	ΓEΡ	MO	DE :	STO	DP	•	OUT
1025		12			OUTPUT	a second second		ner en	1875. 18		or all t	Step Mode
Vac	=	7	0		0 V	F	=	10	0.0	0 (	Hz	-
Vdc	=	6	0		0 V							Trigger
					MEAS	UREME	NT					
۷	=	9	1		81	F	<b>)</b> 0	=	1	0	. 7	
I	=	0	ί.	1	71	F	PF	=	0.	6	86	
Vac	=	6	9		46	1	/dc	=	5 9	١.	96	
Iac	=	0	١.	0	17	1	[ dc	=	0.	1	72	
Vpk	=	15	8		94	١	/A	=	1	5	. 7	2
Ipk	=	0	).	2	66	C	CF	=	1.	5	53	
												Edit
 List Mode		ulse ode	1	1	Step Mode	Syi	nthesis		iter- nonics		Harmonic Meas.	2014/05/1 11:01:38

The trigger waveform when the settings are done is shown below:



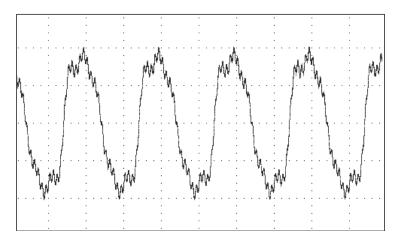
## 5.5 Synthesis Waveform

Press Output Mode on the right in MAIN PAGE (see 3.3) to enter into the Output Mode command line. Next press Synthesis at the bottom to go into the Synthesis command line. Pressing Edit on the right will enter the Synthesis editing window.

3	Phas	e		SYN	THES	IS:S	STO	OP	QUIT
	S	YNTHE	SIS W	AVEFORM	FUNDAMENT/	AL SET	TING		Synthesis
₫1	Vac_func	=	0.0V	F_fund	=60Hz	Vd	c =	0.0V	-
<b>⊉</b> 2	Vac_func	=	0.0V	F_fund	=60Hz	Vd	c =	0.0V	Run
<b>±</b> 3	Vac_func	=	V0.0	F_fund	=60Hz	Vd	c =	0.0V	
		SY	NTHES	S WAVEFO	ORM MEASUR	REMENT			
es:	٧	=	0.	.00	Po	=		0.0	
<b>£</b> 1	I	=	0.0	000	PF	=	0.	000	
	٧	=	0	00	Po	=		0.0	
<b>⊉</b> 2	I	=	0.0	000	PF	=	0.	000	
	٧	=	0	00	Po	=		0.0	2
₫3	I	=	0.0	000	PF	=	0.	000	-
	V 12	=	0	00	V23	=	0	0.00	12
Σ	<b>V</b> 31	=	0	00	Po	=		0.0	Edit
	List Mode	Pulse Mode		Step Mode	Synthesis	Int harmo	7.5.46	Harmonic Meas.	2014/05/11

Synthes		TTING		UNDAMENTA					
Compose		0V 0°		Vdc = Degree =	QV	0. 50Hz		fundame	Vac F
Forcont	θ	%	N	e e	%	N	θ	*	N
Edit	0.0	0.00	36	0.0	0.00	19	0.0	0.00	2
ALL	0.0	0.00	37		0.00	20	0.0	0.00	3
1000	0.0	0.00	38		0.00	21	0.0	0.00	4
	0.0	0.00	39	0.0	0.00	22	0.0	0.00	5
Cicar	0.0	0.00	40		0.00	23	0.0	0.00	6
All	0.0	0.00	41	0.0	0.00	24	0.0	0.00	7
	0.0	0.00	42		0.00	25	0.0	0.00	8
View	0.0	0.00	43	0.0	0.00	26	0.0	0.00	9
Wavefor	0.0	0.00	44	0.0	0.00	27	0.0	0.00	10
	0.0	0.00	45	0.0	0.00	28	0.0	0.00	11
(C)	0.0	0.00	46	0.0	0.00	29	0.0	0.00	12
	0.0	0.00	47	0.0	0.00	30	0.0	0.00	13
	0.0	0.00	48	0.0	0.00	31	0.0	0.00	14
	0.0	0.00	49	0.0	0.00	32	0.0	0.00	15
Executio	0.0	0.00	50	0.0	0.00	33	0.0	0.00	16
Page				0.0	0.00	34	0.0	0.00	17
. age				0.0	0.00	35	0.0	0.00	18
2015/01/	Harmonic	nter-	Ir	Synthesis	P	Ste	Isc	Pu	List

61800 Series Regenerative Grid Simulator provides a Synthesis function for the user to synthesize waveform. The harmonic components range up to 50 orders with the fundamental frequency limited to 50Hz or 60Hz. The user can program the size and phase of each order easily on the LCD. The following is an example figure of the synthesis waveform.



# **Compose = Value-1 / Value-2 / Value-3/ Percent-1 / Percent-2 / Percent-3:** The data form of each harmonic order.

#### Value: The absolute value.

Percent: The percentage of the fundamental frequency voltage.

The user can program 6 types of synthesis waveform to execution or save.

**Vac fundamental:** The fundamental frequency voltage, the maximum is limited by RANGE (see 3.3.1.2.)

**F** fundamental = 50 / 60Hz: The fundamental frequency.

Vdc: The DC voltage component.

Degree: The start angle of the output waveform.

Following is the example of using Synthesis Mode in 1\_Phase Mode:

Pha	se	LOC	AL QI	JIT		
1020		OUTPL	T SETTING	many and	100.00.00	Setting
Vac	=	0.0V	F =	60.0	OHz	OUTPUT: More Setting
						Measurement Setting
		MEA	SUREMENT			Serting
٧	=	0.00	Po	=	0.0	Waveform
I	=	0.000	PF	= 0	.000	Viewer
Vac	=	0.00	Vdc	=	0.00	
Iac	=	0.000	Idc	= 0	.000	Limitation
Vpk	=	0.00	VA	=	0.0	Output
Ipk	=	0.000	CF	= 0	.000	Mode
List Mode	Pul	77 1 7777	Synthesis	Inter-	Harmonic s Meas.	2014/12/18

Press Output Mode on the right in MAIN PAGE to select any Mode for application.

	SYNTHE	SIS	VAVEFOR	M FUNDAMENT.	AL SET	TING		Synthesis
Vac	fur	n d	=	0.0V				Run
F_fu	ınd		=601	Hz Vdo	; =		0.0V	
	SY	NTHE	SIS WAY	EFORM MEASU	REMENT			
۷	=	0	.00	Po	=		0.0	
I	=	0.	000	PF	=	0.	000	
Vac	=	0	.00	Vdc	=	0	.00	
Iac	=	0.	000	Idc	=	0.	000	
Vpk	=	0	.00	VA	=		0.0	3
Ipk	=	0.	000	CF	=	0.	000	
								Edit
List Mode	Puls		Step Mode	Synthesis	5.000	er-	Harmonic Meas,	2014/05/1

Next, press Synthesis at the bottom to go to Synthesis Mode.

Synthesi		TTING		FUNDAMENT/					
Compose Value-1		0V 0*		Vdc = Degree =	.0V	= 100. =60Hz		fundame fundame	Vac F
	θ	٧	N	V O		N	θ	v	N
	0.0	0.00	36	0 0.0	0.0	19	0.0	0.00	2
	0.0	0.00	37	0 0.0	0.0	20	0.0	0.00	3
	0.0	0.00	38	0 0.0	0.0	21	0.0	0.00	4
	0.0	0.00	39	0 0.0	0.0	22	0.0	0.00	5
	0.0	0.00	40	0 0.0	0.0	23	0.0	0.00	6
	0.0	0.00	41	0 0.0	0.0	24	0.0	20.00	7
-	0.0	0.00	42	0 0.0	0.0	25	0.0	0.00	8
View	0.0	0.00	43	0 0.0	0.0	26	0.0	0.00	9
Waveform	0.0	0.00	44	0 0.0	0.0	27	0.0	0.00	10
	0.0	0.00	45	0 0.0	0.0	28	0.0	0.00	11
8.	0.0	0.00	46	0 0.0	0.0	29	0.0	0.00	12
	0.0	0.00	47	0 0.0	0.0	30	0.0	0.00	13
	0.0	0.00	48	0 0.0	0.0	31	0.0	0.00	14
	0.0	0.00	49		0.0	32	0.0	0.00	15
Execution	0.0	0.00	50	0 0.0	0.0	33	0.0	0.00	16
Page					0.0	34	0.0	0.00	17
1 age				0 0.0	0.0	35	0.0	0.00	18
2015/01/0	Harmonic Meas.	nter- nonics		Synthesis		Ste	lsc	123	List Mode

Press Edit on the right to go to editing screen. Use the arrow keys to move the cursor to the appropriate column and use numeric keys to key-in the setting, and then press **ENTER**. The example uses the following settings:

**OUTPUT SETTING:** Vac = 100V, F = 60Hz

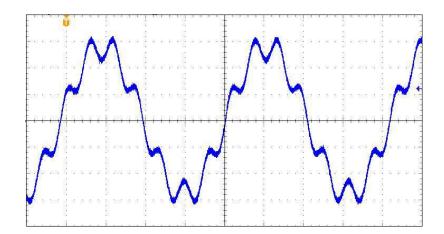
Compose = Percent-1 Edit =  $\Phi$ 3 Vac fundamental = 100.0V F fundamental = 60Hz Vdc = 0.0V Degree = 0.0°



Once the settings are edited, the user can press View Waveform on the right to view the edited output waveform. Press Return to go to previous page.

-					UNDAMENT/	AL SET	TING		Synthesis
Vac	_fu	ınd	=	100	. 0 V				Stop
F_f	unc	ł	= 6	0 H z	Vdd	; =		0.0V	
		SYNTHE	515	WAVEFO	RM MEASU	REMENT			
٧	=	101	. 4	3	Po	=		0.9	
I	=	0.	16	7	PF	=	0.	054	
Vac	=	101	. 4	3	Vdc	=	0	.05	
Iac	=	0.	00	6	Idc	=	0.	168	
Vpk	=	155	. 1	2	VA	=	1	7.0	- 
Ipk	=	0.	26	6	CF	=	1.	590	
									1
List Mode		ulsc		tep	Synthesis	2020	er-	Harmonic Mcas.	2014/05/1

Press Execution Page on the right to return to the Synthesis Mode page. Next, press Run on the right to output the waveform.



The figure above is the output voltage waveform of the Regenerative Grid Simulator, measured by an oscilloscope and is the same as the user edited waveform.

- In order to protect the power stage of Regenerative Grid Simulator for practical use, it is necessary to limit the synthesis value or the percentage of each order.
  - $2 \leq$  order  $\leq 10$ , value  $\leq 90V$  or percentage  $\leq 30\%$ .
  - $11 \leq \text{ order} \leq 20$ , value  $\leq 60V$  or percentage  $\leq 20\%$ .
  - $21 \leq$  order  $\leq$  40, value  $\leq$  30V or percentage  $\leq$  10%.
  - $41 \leq \text{order} \leq 50$ , value  $\leq 15V$  or percentage  $\leq 5\%$ .
- 2. If the synthesis waveform exceeds the voltage limit, OUTPUT OVP or DST Protection will occur.

## 5.6 Inter-harmonics Waveform

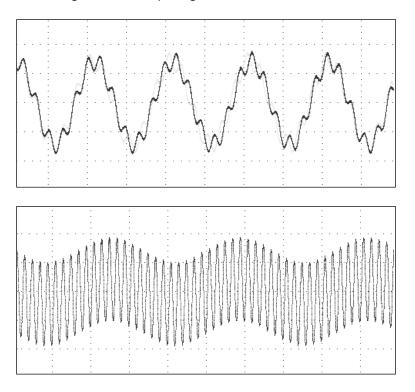
Notice

Press Output Mode on the right in the MAIN PAGE (see 3.3) to enter into the Output Mode command line. Next press Inter-harmonics at the bottom to go to the Inter-harmonics command line. Press Edit on the right to enter the Inter-harmonics editing window.

3	Pha	se	INT	ERHA	RMONI	CS:ST	OP	QUIT
	1028				SETTING	10000	Martin Chin	Interharmo
₫1	Vac	=	0	.0V	F =	60	.00Hz	
<b>⊉</b> 2	Vac	=	0	. OV	F =	60	.00Hz	Trigger
₫3	Vac	=	0	. O V	F =	60	.00Hz	
				MEAS	REMENT			
es.	٧	=	0	.00	Po	=	0.0	
€1	I	=	0.	000	PF	= 0	. 0 0 0	-
	٧	=	0	.00	Po	=	0.0	
<b>⊉</b> 2	I	=	0.	000	PF	= 0	. 0 0 0	
	٧	=	0	.00	Po	=	0.0	2
<b>\$</b> 3	I	=	0.	000	PF	= 0	. 0 0 0	
	V 12	=	0	.00	V23	= 1	0.00	
Σ	<b>V</b> 31	=	0	.00	Po	=	0.0	Edit
	List Mode		lsc de	Step Mode	Synthesis	Inter-	Harmonic Meas.	2014/05/11

<b>.</b>	_ r n a a			RMONIC		QUIT	Interharmon
	F	start	=	States of States of States	1Hz		Edit
	F	end	=	0.0	0.01Hz		
₹1	Time		=	0.0	OSec		
	Leve		=	0.	0%		
	F	start	=	0.0	1Hz		
	F	end	=	0.0	1Hz		
<b>⊉</b> 2	Time		=	0.0	OSec		
	Leve	1	=	0.	0%		
	F	start	=	0.0	1Hz		2
•3	F	end	=	0.0	1Hz		
23	Time		=	0.0	OSec		Execution
	Leve	1	=	0.	0%		Page
	List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/05/17

For the Regenerative Grid Simulator Inter-harmonics function, besides the fundamental voltage output, another frequency of variable voltage component is added to test certain anti-interference. Following is the example figure of an inter-harmonic:



- **F start:** The start frequency of scanning wave. The range is 0.01Hz ~ 3000Hz.
- **F end:** The end frequency of scanning wave. The range is 0.01Hz ~ 3000Hz.
- Level: The rms of scanning wave that is the percentage of fundamental voltage set in MAIN PAGE.
- **Time:** The scanning time from F start to F end.

The following is the example of using Inter-harmonics Mode in 1\_Phase Mode:

			JIT	. QI	OCA.		se	Phas
Setting	a 20		-	BETTING				1020
OUTPUT: More Setting	Hz	.00	60.	=	0V I	0	=	Vac
Measuremen Setting								
Serting				EMENT	MEASU			
Waveform	0.0		=	Po	00	0	=	٧
Viewer	000	0.	=	PF	00	0.	=	I
	. 00	0	=	Vdc	00	0	=	Vac
Limitation	000	0.	=	Idc	00	0.	=	Iac
Output	0.0		=	VA	00	0	=	Vpk
Mode	000	0.	=	CF	00	0.	=	Ipk
2014/12/1	Harmonic Mcas.	ter-	30.00	Synthesis	Step Mode	87 L	Pul	List Mode

Press Output Mode on the right in the MAIN PAGE to select any Mode for application.

Pha	ase	INTERH		CS:STC	P	QUIT
Vac	; =	0.0V	F =	60.00	Hz	Interharmon Trigger
		MEA	SUREMENT			
٧	=	0.00	Po	=	0.0	
I	=	0.000	PF	= 0.	000	
Vac	; =	0.00	Vdc	= 0	.00	
Iac	; =	0.000	Idc	= 0.	000	
Vpk	( =	0.00	VA	=	0.0	8
Ipk		0.000	CF	= 0.	000	
						Edit
List Mode	1.557	lse Step de Mode	Synthesis	Inter- harmonics	Harmonic Mcas.	2014/05/17 11:18:50

Next, press Inter-harmonics at the bottom to go to Inter-harmonics Mode.

1	Phas	se INT	TERHA	RMONIC	S	QUIT	1.55 mil 1 marsh 1 1 marsh
	F	start		WAVEFORM SE			Interharmon
	F	end	=	500.0	0Hz		
	Time	•	=	10.	OSec		
	Leve	e l	= _	20.	<u>0</u> %		
							P.
							Execution Page
	List Mode	Pulsc Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/05/17 11:24:40

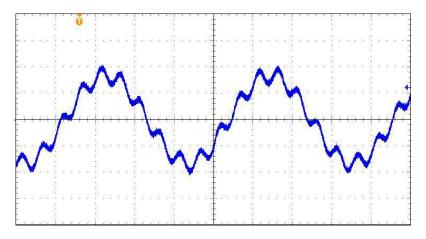
Press Edit on the right to go to the editing screen. Use the arrow keys to move the cursor to the column to be set and use the numeric keys to key-in the setting and then press **ENTER**. The example uses the following settings:

```
OUTPUT SETTING: Vac = 60.0V, F = 60Hz
F start = 500.0Hz
F end = 500.0Hz
Level = 20.0%
```

#### Time = 10.0Sec

	Vac	=	60		O V		TTING =	60	. 0 0	Hz	Interharmo Stop
					MEAS	SURE	MENT				Pausc
	٧	=	59		90		Po	=		0.3	
	I	=	0.	1	64		PF	=	0.	033	
	Vac	=	59	1	90		Vdc	=	-0	.00	
	Iac		0.	0	21		Idc	=	0.	165	
	Vpk	=	92		05		VA	=		9.8	2
	Ipk	=	0.	2	38		CF	=	1.	452	
											už
The second	List Mode	Pul	77		Step Mode	5	Synthesis		er- onics	Harmonic Mcas.	2014/05/11

Press Execution Page on the right to return to the Inter-harmonics Mode page. Next press Trigger on the right to output the waveform.



The figure above is the output voltage waveform of the Regenerative Grid Simulator measured by an oscilloscope and is the same as the user edited waveform.

#### **Notice**

- In order to protect the power stage of Regenerative Grid Simulator for practical use, it is necessary to limit the F start and F end related Level.
  - \* If 0.01Hz  $\leq$  F start or F end  $\leq$  500Hz, Level  $\leq$  30%.
  - If 500Hz  $\overline{<}$  F start or F end  $\underline{<}$  1000Hz, Level  $\underline{<}$  20%.
  - \* If 1000Hz < F start or F end  $\leq$  2400Hz, Level  $\leq$  10%.
  - \* If 2400Hz  $\leq$  F start or F end  $\leq$  3000Hz, Level  $\leq$  5%.
- 2. If the inter-harmonics waveform is over the voltage limit, OUTPUT OVP or DST Protection will occur.

## 5.7 Harmonic Waveform

Press Output Mode on the right in the MAIN PAGE (see 3.3) to enter into the Output Mode command line. Next press Harmonic Meas. at the bottom to go to the I Harmonic Meas. command line. Press Edit on the right to enter the Harmonic Meas. editing window.

3	Ph	a	se H	ARM	ONIC	C ME	AS . : :	STO	P	QUIT
			HA	RMONIC	MEASU	REMENT	SETTING	-		Harmonic
1	THD	=	0.0%	DC		0.07	Fundam	ental	= 0.0V	
2	THD	=	0.0%	DC	-	0.0V	Fundam	ental	= 0.0V	Trigger
3	THD	=	0.0%	DC	=	0.07	Fundam	ental	= 0.0V	
	1	N		%	N	4	6 1	N	%	
	2		0.00	15	0.00	28	0.00	41	0.00	
	3		0.00	16	0.00	29	0.00	42	0.00	-
	4		0.00	17	0.00	30	0.00	43	0.00	DATA
	5		0.00	18	0.00	31	0.00	44	0.00	
	6		0.00	19	0.00	32	0.00	45	0.00	-
	1		0.00	20	0.00	33	0.00	46	0.00	
	8		0.00	21	0.00	34	0.00	47	0.00	
	9		0.00	22	0.00	35	0.00	48	0.00	
	10		0.00	23	0.00	36	0.00	49	0.00	1
	11		0.00	24	0.00	37	0.00	50	0.00	
	12		0.00	25	0.00	38	0.00			-
	13		0.00	26	0.00	39	0.00			Edit
	14		0.00	27	0.00	40	0.00			1000
	List Mode		Pulse Mode		Step Node	Synthe	SIS	ter- onics	Harmonic Meas.	2015/01/08

3	Pha	se HAI	RMONI	C MEAS	8. N	QUIT				
			HARMONIC	MEASUREMENT	_		Harmonic			
<b>#1</b>	Sou	Edit Each								
21	F	F fundamental =60Hz								
	Sou	rce =\	/				Measurement Single			
₽2	F	funda	amen t	al =60	Hz					
	Sou	rce =\	/				0.			
<b>∰</b> 3	F	funda	amen t	al =60	Hz		Execution Page			
	List Mode	Pulsc Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/05/11			

This function can measure the Total Harmonic Distortion (THD) of the fundament frequency 50Hz or 60Hz, the DC current, and the fundamental frequency of output current or voltage, also can measure  $2 \sim 50$  orders of harmonic values.

**Source = V / I:** It measures the source signal output voltage or output current.

V: The output voltage.

I: The output current.

**F fundamental = 50 / 60 Hz:** The fundamental frequency of source signal. **Measurement = Single / Continue:** The way the measurement result displays on LCD.

Single: The display will keep the measured data when set. It takes about 3 seconds to get the results.

Continue: The display updates the measured data when set. It takes about 10 seconds to get stable results.

Parameter = Percent / Value: The data form of each harmonic component.

Percent: The percentage of fundament frequency value. Value: The absolute value.

Following is an example of using Harmonic Meas. Mode in 1\_Phase Mode:

1_Pha	se	LOCA	L Q	UIT	
1023			SETTING	manne secondare	Setting
Vac	=	0.0V I		60.00H;	OUTPUT: More Setting
					Measurement
		MORE S	ETTING		Setting
Wav	eform	n = <u>A</u> SINE			Waveform Viewer
ON	Degr	ee =	0.0		Limitation
OFF			IMMED		Output
Vac	SIR	=	0.0	00V/ms	Mode
Vdc	S/R	=	0.0	00V/ms	12
F	S/R	=	0.0	00Hz/ms	
Coupling AC		Output Waveform Selection			2014/12/18 10:22:36

Press OUTPUT: More Settings on the right in the MAIN PAGE to enter into the output selections page.

1_Phase	LOCAL	QUIT	and the second second second
Vac =	0.0V F =	60.00Hz	Waveform
Waveform A	MORE SETTI	NG	
Waveform B			View Waveform
			9.
Coupling AC	Output Waveform Selection		2014/12/1

Next, press Output Waveform Selection at the bottom to go to the output waveform selection page.

Phase	LOCAL QUIT	
(122)	OUTPUT SETTING	Waveform
Vac =	0.0VF = 60.	0 0 H z
	MORE SETTING	
Waveform A Waveform B		View Waveform
		7
Coupling AC	Output Waveform Selection	2014/12/11 10:24:32

Set the Waveform A to DST04 waveform.

1_Phase	LOCAL	QUIT	
Vac = _ Vdc =	0.0V F		Waveform
Waveform A =	OUTPUT WAVE	FORM A	
$\bigwedge$	н 3 26 31 33 33	X         D           2.50         0           1.90         0           2.50         0           1.90         0           1.90         0           1.10         0           1.10         0	
Coupling AC+DC	Output Waveform Selection		2014/12/13

When the waveform setting is done, press View Waveform on the right to view the output waveform, the ratio of each harmonic order and the output angle.

Pha	se		LOC	AL O	UT		
11733			OUTPU	T SETTING			Main
Vac	=	100	<u>0</u> V	F =	60.0	OHz	OUTPUT: More Setting
							Measurement
			MEA	SUREMENT			Serting
٧	=	100	.03	Po	=	0.6	Waveform
I	=	0.	608	PF	= 0	.009	Viewer
Vac	=	100	.03	Vdc	= -	0.06	
Iac		0.	070	Idc	= -0	.604	Limitation
Vpk	=	142	. 24	VA	=	60.9	Output
Ipk	=	0.	878	CF	= 1	. 443	Mode
							72
Recell CH1	77,49,37	call H2	Recall CH3	Recall CH4	Recall CH5	More 1 of 2	2014/12/18

Press Return to go back to the MAIN PAGE and set the Vac to 100.0V, then press **OUT/QUIT** to output waveform.

=	Pha	5.0		LOC	JT SET		UΤ			Setting
	Vac	=	100	. OV		=	60	. 0 0	Hz	OUTPUT: More Setting
										Measurement Setting
	v	=	0.0	.95	SUREM	Po	-		0.5	
	24)			100		5.00	-	•		Waveform Viewer
	I	=		608		PF	-		009	Viewer
	Vac	=	99	. 99		Vdc	=	0	. 01	
	Iac	=	0.	074		Idc	=	-0.	603	Limitation
	Vpk	=	141	.97		VA	=	6	0.8	Output
	Ipk	=	0.	864		CF	=	1.	422	Mode
- 327	.ist ode		ilsc	Step Mode	S	ynthesis		nter- monics	Harmonic Mcas.	2014/12/18

Press Output Mode on the right in the MAIN PAGE to select any Mode.

	HA	ARMONI	C MEASU	REMENT S	ETTING			Harmonic
THE	) =	0.	0%	DC	; =		0.0V	Trigger
Fur	dame	nta	=	0.	٥٧			
N	VALUE	N	VALUE	N	VALUE	N	VALUE	
2	0.00	15	0.00	28	0.00	41	0.00	
3	0.00	16	0.00	29	0.00	42	0.00	
4	0.00	17	0,00	30	0.00	43	0.00	
5	0.00	18	0.00	31	0.00	44	0.00	
6	0.00	19	0.00	32	0.00	45	0.00	
7	0.00	20	0.00	33	0.00	46	0.00	
8	0.00	21	0.00	34	0.00	47	0.00	
9	0.00	22	0.00	35	0.00	48	0.00	
10	0.00	23	0.00	36	0.00	49	0.00	
11	0.00	24	0.00	37	0.00	50	0.00	
12	0.00	25	0.00	38	0.00	1.00		
13	0.00	26	0.00	39	0.00			Edit
14	0.00	27	0.00	40	0.00			1000
List Mode	Pulse		Step	Synthes	is Inte	0.0	Harmonic Meas.	2015/01/08

Next, press Harmonic Meas. at the bottom to go to the Harmonic Meas. Mode.

1	Pha	se HA	RMONIC	MEAS	S	QUIT	
			HARMONIC M	EASUREMENT			Harmonic
		rce =	_				Parameter Valus Measurement Single
	F	fund	amenta	= 6 0	IHZ		Execution
-	List	Pulse	Step	Synthesis	Inter-	Harmonic	Page 2014/05/17
	Mode	Mode	Mode	o y nillesis	harmonics	Meas.	11:33:48

Press Edit on the right to go to the editing screen. Use the arrow keys to move the cursor to the column to be set and use the numeric keys to enter the setting and then press **ENTER**. The example uses the following settings:

#### Source = V F fundamental = 60 Hz Measurement = Continue Parameter = Percent

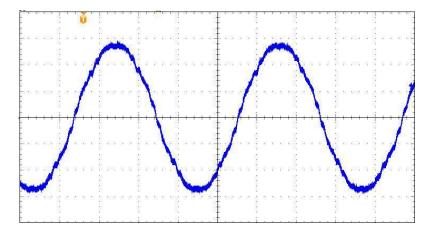
		HARMONI	C MEASU	REMENT S	ETTING			Harmonic
THE	) =	0.	0%	DC	=		0.0V	Trigger
Fun	dam	enta	=	0.	0 V			inggei
N	VALUE	N	VALUE	N	VALUE	N	VALUE	
2	0.00	15	0.00	28	0.00	41	0.00	
3	0.00	16	0.00	29	0.00	42	0.00	-
4	0.00	17	0.00	30	0.00	43	0.00	
5	0.00	18	0.00	31	0.00	44	0.00	
6	0.00	19	0.00	32	0.00	45	0.00	
7	0.00	20	0.00	33	0.00	46	0.00	
8	0.00	21	0.00	34	0.00	47	0.00	
9	0.00	22	0.00	35	0.00	48	0.00	
10	0.00	23	0.00	36	0.00	49	0.00	
11	0.00	24	0.00	37	0.00	50	0.00	
12	0.00	25	0.00	38	0.00			
13	0.00	26	0.00	39	0.00			Edit
14	0.00	27	0.00	40	0.00			0.777.0
List Mode	Puls	2	Step	Synthesi	s Inte harmo	100	Harmonic Meas.	2015/01/02

Press Execution Page on the right to return to the Harmonic Meas. Mode page. Next press

Harmonic			TING	T SET	REME	C MEASU	RMONI	HA	
Stop	0.0V		=	DC		2%	5.	=	THD
onop			V	9.8	9	=	n ta	dame	Fun
	%		N	%		N	*		N
	0.00	41	0.00	0	1	0.01	15	0.03	2
	0.01	42	0.02	0	1	0.02	16	2.53	3
	0.01	43	0.02	0		0.01	17	0.01	4
	0.01	44	1.64	1		0.00	18	1.94	5
	0.01	45	0.04	0		0.01	19	0.02	6
	0.00	46	1.22	1		0.00	20	2.61	7
	0.01	47	0.01	0		0.01	21	0.03	8
	0.01	48	0.01	0		0.02	22	0.00	9
	0.00	49	00.0	0		2.01	23	0.01	10
	0.02	50	0.01	0	1	0.04	24	0.00	11
			0.00	0		1.19	25	0.01	12
			0.01	0		0.01	26	0.00	13
			0.00	C		0.01	27	0.01	14
2015/01/0	Harmonic Meas,	0.0	Inte	nesis	Syr	Step Mode		Pulse Mode	List Mode

Trigger on the right to perform the output voltage harmonic measurement.

After triggered, the user can press DATA on the right to view the measurement of a phase.



The figure above is the output voltage waveform of the Regenerative Grid Simulator measured by an oscilloscope and is the same as the user edited waveform.

**Notice** 

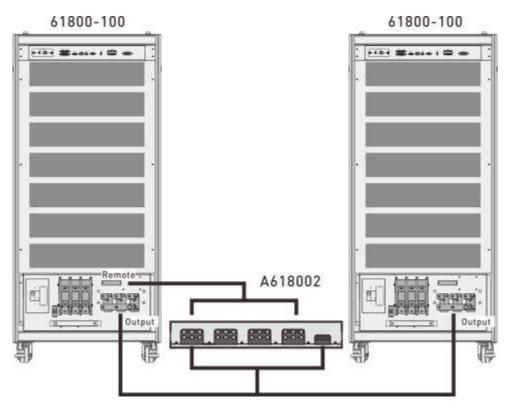
When the user presses Trigger to execute the current harmonic measurement, the Regenerative Grid Simulator will adjust the internal gain automatically by the measured data so that the Regenerative Grid Simulator can get more accurate data of each harmonic. Thus, it is better to wait for the load to be stable before executing the harmonic measurement. In addition, the load cannot be changed during measurement or the retrieved data may lose its accuracy or cause over current protection.

## 6. Parallel/Series (Optional) Operation

## 6.1 Parallel Connection for Regenerative Grid Simulators

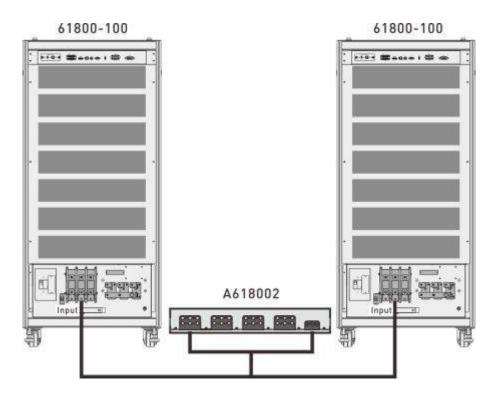
#### 6.1.1 Connecting Two Simulators at Output in Parallel

It can use a fixture of Terminals for Parallel Connection (A618002) to connect the output of two Regenerative Grid Simulators as the figure shown below for parallel mode use.



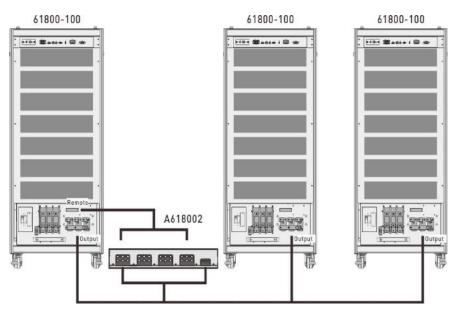
## 6.1.2 Connecting Two Simulators at Input in Parallel

It can use a fixture of Terminals for Parallel Connection (A618002) to connect the input of two Regenerative Grid Simulators as the figure shown below for use in parallel mode.



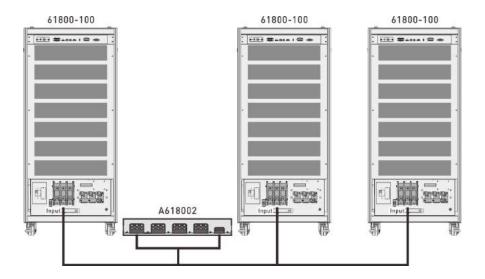
## 6.1.3 Connecting Three Simulators at Output in Parallel

It can use a fixture of Terminals for Parallel Connection (A618002) to connect the output of three Regenerative Grid Simulators as the figure shown below for parallel mode use.



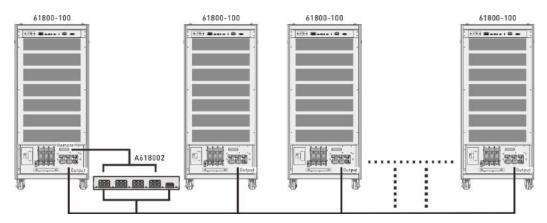
## 6.1.4 Connecting Three Simulators at Input in Parallel

It can use a fixture of Terminals for Parallel Connection (A618002) to connect the input of three Regenerative Grid Simulators as the figure shown below for parallel mode use.



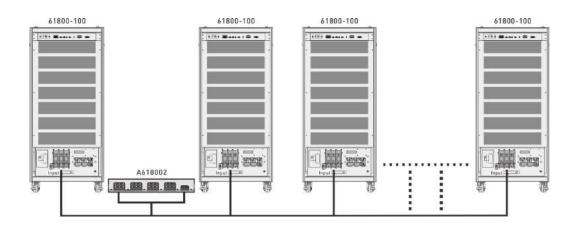
# 6.1.5 Connecting Four or Five Simulators at Output in Parallel

It can use a fixture of Terminals for Parallel Connection (A618002) to connect the output of four or five Regenerative Grid Simulators as the figure shown below for parallel mode use.



# 6.1.6 Connecting Four or Five Simulators at Input in Parallel

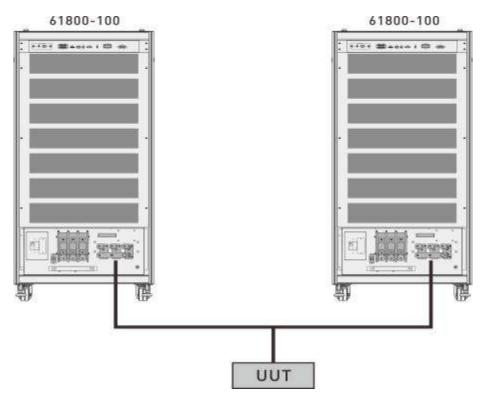
It can use a fixture of Terminals for Parallel Connection (A618002) to connect the input of four or five Regenerative Grid Simulators as the figure shown below for parallel mode use.



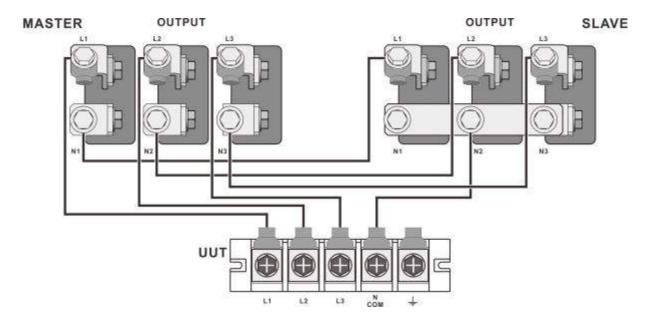
# 6.2 Series Connection for Regenerative Grid Simulators (Optional)

#### 6.2.1 Connecting Two Simulators at Output in Series

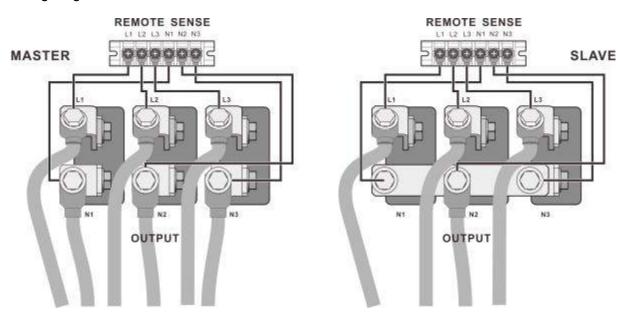
Follow the figure shown below to connect two Regenerative Grid Simulators for use in series mode.



The UUT is connected in between the Master and Slave Regenerative Grid Simulators. The wiring diagram for connecting the output power to the UUT terminals is shown in the figure below.



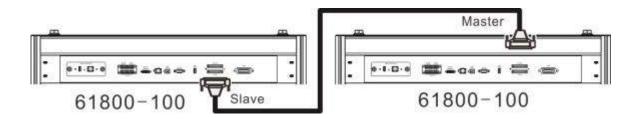
The REMOTE SENSE wires of the Master and Slave Regenerative Grid Simulators are connected to the terminals at the Master and Slave rear in sequence. The REMOTE SENSE wiring diagram is shown below.



## 6.3 Signal Cable Connection for Parallel Mode

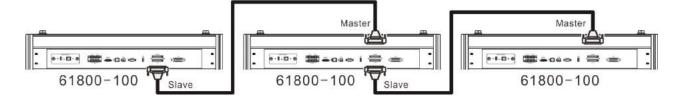
#### 6.3.1 Connecting Cable for Two Units

When the Regenerative Grid Simulators are used in parallel mode, a parallel communication cable is required to transmit the data. The connection is shown below.



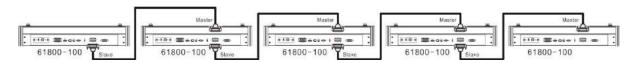
## 6.3.2 Connecting Cables for Three Units

When the Regenerative Grid Simulators are used in parallel mode, two parallel communication cables are required to transmit the data. The connection is shown below.



## 6.3.3 Connecting Cables for Five Units

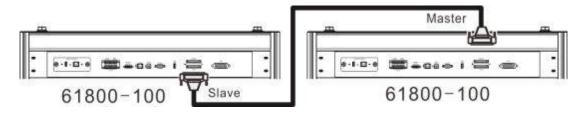
When the Regenerative Grid Simulators are used in parallel mode, four parallel communication cables are required to transmit the data. The connection is shown below.



# 6.4 Signal Cable Connection for Series Mode (Option)

## 6.4.1 Connecting Cable for Two Units

When the Regenerative Grid Simulators are used in series mode, a series communication cable is required to transmit the data. The connection is shown below.



## 6.5 Settings

#### 6.5.1 Setting Regenerative Grid Simulator to Slave

To set a single regenerative grid simulator to Slave, press **CONFIG** in **FUNCTION** menu to enter into the CONFIG menu (Master/Slave Function). Follow the steps below to set the connection of multiple devices to be parallel or series (optional).

- 1. Press Master/Slave Function key.
- 2. Press the Position key at the bottom.
- 3. Turn the RPG to change the Position key to Slave1, and press **ENTER** to confirm it.
- 4. If the device has two terminals, press the Terminator key at the bottom, and turn the RPG to change the Terminator key to Enable.

<b>Notice</b>	1.	The Master and the connected Slave devices are all set to Terminator/Enable.

- 2. Only 2 models are provided for series connection (optional). The Position key can only set to Slave1.
- 3. When paralleling 3 units, see section 6.3.2 for cable connection. When setting Master/Slave, the recommended left-most connection is Master, and then Master, Salve1, and Salve2 from left to right. In this case, the Master and Salve2 are set to Terminator/ Enable.
- 4. When paralleling 5 units, see section 6.3.3 for cable connection. When setting Master/Slave, the recommended left-most connection is Master, and then Master, Salve1, Salve2, Salve3, and Salve4 from left to right. In this case, the Master and Salve4 need to set Terminator/ Enable.

3	Pha	se		LOCAL		QU	IT				3	Pha	se		LOC	AL	QU	IT			
				OUTPUT S	ETTIN	0				Cantig						T SETTIN	10	-			Canfig
-	Vac	=		V0.0	F		6	0.	00Hz	-		Vac	=	0	.0V	F		- 23	60	.00Hz	-
.2	Vac	=	1	V0.0	F	<b>#</b>	6	0.	00Hz	Others	-	Vac	=	0	.0V	F	=	1	60	.00Hz	Others
	Vac	=	1	V0.0	F	#	6	0.	00Hz	Calibration	87	Vac	=	0	. OV	F	=	J.	60	.00Hz	Calibration
				MEASUR	EMENT					2007022000000					MEA	UNEMENT					(A
#1	Y	1	1000	0.00	Po		5		0.0	System	#1	Y		1000	.00	Po		-		0.0	System
	1	-	0	.000	PF			0.	000	Information		1	=	0.	000	PF			Q	.000	Information
	V	=		0.00	Po		=		0.0	Fectory		V	=	0	.00	Po		=		0.0	Factory
¥2	I	=	0	.000	PF		=	0.	000	Default	62	I	=	0.	000	PF		=	0	.000	Default
	٧		1	0.00	Po				0.0	Master/Slave		٧	=	0	.00	Po				0.0	Master/Slave
43	I	=	0	.000	PF		=	0.	000	Function	#3	I	=	0.	000	PF		=	0	.000	function
	V 12	=		0.00	V22		=	0	.00	Hore		Vt2	=	0	.00	V2	3	=	1	00.0	Hore
Σ	V31	=	1	0.00	Po	{	-		0.0	2 of 2	Σ	Va	=	0	.00	Po		-		0.0	2 of 2
	esition laster	Humbe	10	Terminster Enable					Function	2016/05/16		esition lave4	Termi	nator b I o							2016/05/10

## 6.5.2 Setting Regenerative Grid Simulator to Master

Press **CONFIG** in **FUNCTION** menu to enter into the CONFIG menu (Master/Slave Function). Follow the steps below to set the connection of multiple devices to be parallel or series (optional).

- 1. Press the Master/Slave Function key.
- 2. Press the Position key at the bottom.
- 3. Turn the RPG to change the Position key to Master, and press **ENTER** to confirm it.

- 4. Press the Number of Slave key at the bottom.
- 5. Turn the RPG to select the Slave number to be connected in parallel or series (optional), and press **ENTER** to confirm it.
- 6. If the device has two terminals, press the Terminator key at the bottom, and turn the RPG to change the Terminator key to Enable.
- 7. Press the Function key at the bottom.
- 8. If the device is in parallel mode, turn the RPG to change the Function key to Parallel. If the setting device is in series mode (optional), turn the RPG to change the Function key to Series, and press **ENTER** to confirm it.
- 9. The screen returns to the main menu when set to Master, and prompts Slave when set to Slave.

	At least one device has to set to Slave in parallel connection, or "System Connection Fail!" will prompt when setting the Master to Enable. See the section below for troubleshooting. Only 2 models are provided for series connection (optional). The Number of Slave key can only set to 1.
1.	When setting the Number of Slave in Master, the rule is N-1 of total regenerative grid simulators. For instance, when setting two simulators for parallel connection, the Number of Slave is 1, and setting two simulators for series connection, the Number of Slave is 1. Incorrect setting of parallel or series number may result in connection

failure or damaging the device.

2.	The 61800-100 and 61860 Series models cannot be used in parallel /
1	series due to different internal transmission mechanism.

3	Pha	se		LOCAL		QUI	Т			3	Pha	se		LOCAL		QU	IT		
				OUTPUT 1	LITIN	6			Centig					OUTPUT	ETTI	NC _			Config
=1	Vac	=		V0.0	F	=	60	.00Hz			Vac	=	(	V0.0	F	=	60	.00Hz	
.2	Vac	=	- 31	V0.0	F	=	60	.00Hz	Others	+2	Vac	=	(	V0.0	F	=	60	.00Hz	Others
+3	Vac	=	1	V0.0	F	=	60	.00Hz	Calibration	#3	Vac	=	(	V0.0	F	=	60	.00Hz	Calibration
				MEASUR	EMENT				Canbracion					MEASUR	EMENT				1000000000
	V	=		0.00	Po			0.0	System		٧	=	(	00.0	Po	6	=	0.0	System
*1	I	=	0	000	PF	-	0	.000	Information	#1	I	=	0.	000	PI		= 0	.000	Information
	٧			0.00	Po	-		0.0	Factory		٧	=	(	00.0	Po	i.	=	0.0	Factory
+2	I	Ξ.	0	000	PF	=	0	.000	Default	#2	I	=	0.	000	PI	5	= 0	.000	Default
	٧	=		00.0	Po	=		0.0	Haster/Slave		٧		(	0.00	Po	i.		0.0	Master/Slave
•1	I	=	0	000	PF	-	0	.000	Function	+3	I	=	0.	000	PI	•	= 0	.000	Function
	V12	=	1	0.00	V2	3 =		0.00	Hore	-	V 12	=	(	0.00	V2	3	=	0.00	More
Ξ	V 21	=		00.0	Po	=		0.0	2 of 2	I	V31	=	(	0.00	Po	i -	=	0.0	2 af 2
	esition faster	Hunte		Terminator Enable				Function Parallel	2017/12/06		esition aster	Hunte		Terminator Exable				Function Series	2017/12/06

## 6.6 Troubleshooting

When parallel or series (optional) connection is applied to multiple devices, each device must have a parallel/serial cable to transmit the signals. When the Slave number is set wrong for connection or an error message is prompted during connection, follow the procedure listed below for troubleshooting and execute parallel/series connection again.

#### 6.6.1 BUS Wire Loss

If "System Connection Fail!" occurs when enabling the Master connection, check if the parallel/serial cable is properly connected and the fixture for parallel/series connection or another regenerative grid simulator is set to Slave. If OK, press Retry on Master to reconnect it.

OUTPUT SETTING	Contig
	Retry
System Connection Fail!	Cancel
	-
	2014/12/18 10:41:10

If the parallel/series cable is not connected properly or disconnected when enabling the Master connection, a "SYS SYS\_ BUS-WIRE LOSS" warning will appear. First, turn the device off first and check if the parallel/serial cable is connected firmly and reboot for connection again.

3	Pha	s e	1	OCAL		QU	IT		
				OUTPUT	SETTI	10			Main
	Vac		0.	OV	F		60.	.00Hz	
22	Vac	=	0.	OV	F	=	60	00Hz	
	Vac	=	0.	OV	F	#	60	00Hz	1
				PROTE	CTION				
				Mar	nin	-1			-
		SY	s s	War YS_B			E LO	SS	
		SY	s s				E LO	SS	_
		SY	s s'				E LO	SS	
		SY	s s'				E LO	SS	
		SY	S S'				E LO	SS	
		SY	s s'				E LO	ss	2816/85/1

When "SYSTEM SHUTDOWN" warning occurs during connection, turn the device off first and check if the parallel/serial cable is connected firmly and reboot for connection again.

3	Pha	se		REMO	TE	QU	IT			
				OUTPUT	SETTI	NG				Hain
-1	Vac	=	0	.0V	F	=	60.	.00Hz		
¥2	Vac	=	0	. OV	F	=	60.	. 00Hz	8	
•1	Vac	=	0	. OV	F	=	60.	00Hz		
				PROT	ECTION					
				I HAR SHOW	Sector Sector	Garage .				
				war	nin	g				
		S	vs			1.00	ATN			
		S	YS	SYS_		1.00	WN		-	
		S	YS			1.00	WN		+	
		S	YS			1.00	WN			
		S	YS			1.00	WN			
		S	YS			1.00	WN			
		S	YS			1.00	WN			
		S	YS			1.00	WN	1		

# 7. AC Load Mode (Optional)

## 7.1 Switching Method

To set a single regenerative grid simulator to ACL mode, press **CONFIG** in **FUNCTION** menu to enter into the CONFIG menu (System information). Follow the steps below to set the AC load.

AC LOA	D 3_Ph	nase LOC	AL QUI	Т
		UNIT DATA		Config
Model:	61800-	100 <sup>SN:</sup>	96180010000001	Interface
Display Waveform Remote Waveform HD	Vers Vers	ion : 1.05.64 ion : 1.05.8,1 ion : 1.00 ,1	.00	SicwRate
GRID Firmwa GRID HDL	re Vers	ion : 1.00 ,1. ion : 1.01.3,1 ion : 1.00 ,1.	.01.3,1.01.3	System Information
LAN Firmwar	e Vers	ion : 1.10		Display
				Protection
	ption	ensator K 00 Disable		2020/02/03

- 1. Press they System Information key.
- 2. Press the OPTION key.
- 3. Turn the RPG to change OPTION key to AC Load, and press **ENTER**.
- 4. Restart the simulator when the LED screen shows restart message.

**Notice** 

- 1. The load function in 61800-100 and 61860 Series models cannot be set and used in parallel due to different transmission mechanism.
- 2. The AC load mode provides bandwidth response speed adjustment. The default value of Compensator K is 500, which is adjusted according to DUT's test items. The output response speed is set by the K value. The higher the K value, the faster the response speed, and vice versa.

## 7.2 Load Function Interface

When the load mode is turned and self-test procedure is done, the menu will show MAIN PAGE (ACL Mode). To set the load function, it can be done in the CC Rectifier, CP Rectifier, CR, CC Lead/Lag, and CP Lead/Lag function keys at the bottom. The MEASUREMENT menu shows the test items of regenerative AC load, and each phase has 12 types of output test items that are same as the regenerative grid simulator, 3 pages in total (see section 3.3).

## 7.2.1 CC Rectifier Mode

When in CC Rectifier mode, it can change the current amplitude and crest factor (CF) settings , in MAIN PAGE.

1	AC	LOAD	) 3_Phas	e LOCA	AL G	UIT	
			CC-RECTIFI	ED CONDITIO	DN	-	Main
<b>#1</b>	Ia	с =	<u>0.0</u> A	CF	= 1.4	14	
₫2	Ia	c =	0.0A	CF	= 1.4	14	Edit
<b>9</b> 3	Ia	c =	0.0A	CF	= 1.4	14	Measurement
			MEASU	REMENT			Setting
	٧	=	0.24	Po	=	0.0	Waveform
ē1	Ι	=	0.050	VA	=	0.0	Viewer
	٧	=	0.33	Po	=	0.0	
₫2	I	=	0.037	VA	=	0.0	
	٧	=	0.44	Po	=	0.0	
<b>4</b> 3	I	=	0.041	VA	=	0.0	
	V 12	=		V23	=		Measurement
Σ	V31	=	0.03	Po	=	0.0	To Page2
R	CC ectifie		P CR	CC Lead/Lag	CP Lead/Lag		2020/02/10

## 7.2.2 CP Rectifier Mode

When CP Rectifier mode, it can change the power and crest factor (CF) settings in MAIN PAGE.

	AC	LOAD	3_Phas	e LOC	AL (	QUIT	
	22.0010		CP-RECTIFII	ED CONDITI	ON		Main
<b>#1</b>	Ρ	= _	<u>10</u> W	CF :	= 1.41	4	
₫2	Ρ	=	1 O W	CF :	= 1.41	4	Edit
<b>9</b> 3	Ρ		1 O W	CF :	= 1.41	4	Measurement
			MEASU	REMENT			Setting
	٧	=	0.24	Po	=	0.0	Waveform
-	Ι	=	0.050	VA	=	0.0	Viewer
	٧	=	0.33	Po	=	0.0	
₫2	Ι	=	0.035	VA	=	0.0	
	٧	=	0.44	Po	=	0.0	-
<b>Φ</b> 3	I	=	0.039	VA	=	0.0	
	V 12	=	0.03	V23	=	0.04	Measurement
Σ	V31	=	0.04	Po	=	0.0	To Page2
R	CC ectifie	CP r Rectifi	er CR	CC Lead/Lag	CP Lead/Lag		2020/02/10 15:56:05

## 7.2.3 CR Mode

When in CR mode, it can change the resistance settings in MAIN PAGE.

1	AC	LOAD	3_Phas	e LOC	AL (	TIUC	
	11-011		CR CON	DITION			Main
#1	R	= _	<u>300.0</u> Ω				
₫2	R	=	300.00				Edit
<b>9</b> 3	R		300.0Ω				Measuremen
			MEASU	REMENT			Setting
	٧	=	0.24	Po	=	0.0	Waveform
ē1	Ι	=	0.050	VA	=	0.0	Viewer
	٧	=	0.33	Po	=	0.0	-
₫2	Ι	=	0.035	VA	=	0.0	
	٧	=	0.44	Po	=	0.0	-
<b>4</b> 3	I	=	0.038	VA	=	0.0	
	V 12	= -		V23	=	0.03	Measuremen
Σ	V 31	= -		Po	=	0.0	To Page2
8	CC ectifie	CP r Rectif	CR	CC Lead/Lag	CP Lead/Lag		2020/02/1

## 7.2.4 CC Lead/Lag Mode

When in CC Lead/Lag mode, it can change the current amplitude and phase settings in MAIN PAGE. It can change to current mode by removing the Phase limit (>90° or <-90°) following the steps below.

	AC L	OAD	3_Phase	a LOC/	AL (	TIUC	
			CC-LEAD/LAG	CONDITIO	)N	Sec. 1	Main
<b>#1</b>	Iac	= _	0.0A	Deg	=	0°	
<b>4</b> 2	Iac	=	0.0A	Deg	=	0°	Edit
<b>9</b> 3	Iac		0.0A	Deg	=	0 °	Measurement
			MEASUF	EMENT			Setting
	V	=	0.24	Po	=	0.0	Waveform
<b>#</b> 1	Ι	=	0.049	VA	=	0.0	Viewer
	٧	=	0.33	Po	=	0.0	
<b>4</b> 2	Ι	=	0.037	VA	=	0.0	
	٧	=	0.44	Po	=	0.0	1
<b>4</b> 3	I	=	0.039	VA	=	0.0	
	V 12	= -		V23	=	0.03	Measurement
Σ	V31	= -		Po	=	0.0	To Page2
R	CC lectifier	CP Rectifie	CR	CC Lead/Lag	CP Lead/Lag		2020/02/10 15:56:42

- 1. Press **CONFIG** to enter into CONFIG menu.
- 2. Press the Phase limit key.
- 3. Turn the RPG to change Phase limit Disable and press ENTER.

	AC	LOA	D 3_	Phase	LOC	AL (	QUIT	
			CC	-LEAD/LAG	CONDITIO	DN		Config
<b>#1</b>	Ia	с =	0	. 0 A	Deg	=	0°	
₫2	Ia	c =	0	. 0 A	Deg	=	0°	Interface
<b>9</b> 3	Ia	c =	0	. 0 A	Deg	=	0 °	PhaseLimit
				MEASUR	EMENT			Disable
	٧	=		0.24	Po	=	0.0	System
ē1	Ι	=	0	.051	VA	=	0.0	Information
	٧	=		0.33	Po	=	0.0	
₫2	Ι	=	0	.035	VA	=	0.0	Display
	٧	=		0.44	Po	=	0.0	
<b><b>4</b>3</b>	I	=	0	.039	VA	=	0.0	Protection
	V 12	=			V23	=		
Σ	V 31	=			Po	=	0.0	
A	GPIB ddress	P	S232 arity lone	RS232 Baudrate 115200	Remote Inhibit Disable	EXT. ON/OFF Disable	Ethernet Setting	2020/02/10 15:57:48

## 7.2.5 CP Lead/Lag Mode

When in CP Lead/Lag mode, it can change the power and phase settings in MAIN PAGE. It can change to current mode by removing the Phase limit following the steps below.

1	AC	LOAD	3_Phas	e LOO	CAL	QUIT	
	1.001		CP-LEAD/LA	G CONDIT	TON		Main
<b>#1</b>	Ρ	= _	<u>10</u> W	Deg	=	0°	
₫2	Ρ	=	1 O W	Deg	=	0°	Edit
<b>9</b> 3	Ρ		1 O W	Deg	=	0°	Measuremen
			MEASU	REMENT			Setting
	٧	=	0.24	Po	=	0.0	Waveform
ē1	Ι	=	0.050	VA	=	0.0	Viewer
	٧	=	0.33	Po	=	0.0	
₫2	Ι	=	0.035	VA	=	0.0	
	٧	=	0.44	Po	=	0.0	-
<b>4</b> 3	I	=	0.039	VA	=	0.0	
	V 12	= -		V23	=	0.03	Measuremen
Σ	V31	= -		Po	=	0.0	To Page2
R	CC ectifie	CP r Rectif	er CR	CC Lead/La	CP g Lead/L	.ag	2020/02/1

- 1. Press **CONFIG** to enter into CONFIG menu.
- 2. Press the Phase limit key.
- 3. Turn the RPG to change Phase limit Disable and press **ENTER**.

1	AC	LOAD	3_Phas	e LOC	AL (	TIU	
			CP-LEAD/LA	G CONDITI	ON		Config
#1	Ρ	=	1 O W	Deg	= 0	•	
₫2	Ρ	=	1 O W	Deg	= 0	•	Interface
<b>9</b> 3	Ρ		1 O W	Deg	= 0	°	PhaseLimit
			MEASU	REMENT			Disable
	٧	=	0.24	Po	=	0.0	System
ē1	Ι	=	0.049	VA	=	0.0	Information
	٧	=	0.33	Po	=	0.0	
₫2	Ι	=	0.037	VA	=	0.0	Display
	٧	=	0.44	Po	=	0.0	
<b>4</b> 3	I	=	0.039	VA	=	0.0	Protection
	V 12	= -		V23	-	0.03	
Σ	V 31	= -		Po	=	0.0	
A	GPIB ddres 11	RS23 Parit	y Baudrate	Remote Inhibit Disable	EXT. ON/OFF Disable	Ethernet Setting	2020/02/10 15:58:08

# 8. Remote Operation

## 8.1 Introduction

The Regenerative Grid Simulator is able to do remote control via USB, GPIB, RS-232 or Ethernet. The USB interface supports USB 2.0/USB 1.1. The GPIB interface is an 8-bit parallel data bus that is synchronized by the bus command from the host. RS-232C interface is a serial bus with less powerful functions; however, the user can do basic remote control via simple programs.

#### 8.1.1 USB Interface

- (1) Hardware Support: USB 2.0 and USB 1.1
- (2) Software Support: USBTMC class and USB488 subclass
- (3) OS Support: Windows 98/2000/XP/Vista
- (4) Installing Driver: The Regenerative Grid Simulator USB Interface supports USBTMC, so if the PC OS supports USBTMC (installed NI-VISA runtime version 3.00 or above) it is no need to install other drivers. The OS will search for the standard USBTMC driver installation program automatically.

If the PC OS does not support USBTMC, it is suggested to install the NI-VISA runtime version 3.00 or above first. When the installation of NI-VISA runtime is done, the USBTMC driver program is stored in OS. The PC can communicate with the Regenerative Grid Simulator via NI-VISA after using the USB cable to connect them.

Related Documents:

- 1. USB Test and Measurement Class (USBTMC) specification, Revision 1.0, http://www.usb.org
- 2. USB Test and Measurement Class USB488 subclass specification, Revision 1.0, http://www.usb.org

## 8.1.2 GPIB Interface

The default of GPIB address is 30 and it can only be changed from the "CONFIG" function menu (see 3.4.)

<b>GPIB</b> Capability	Description	Interface Function
Talker/Listener	Commands and response messages can be sent and received via the GPIB bus. Status information can be retrieved by serial query.	AH1, SH1, T6, L4
Service Request	The Regenerative Grid Simulator sets the SRQ to be true if there is a service request.	SR1
Remote/Local	When the Regenerative Grid Simulator is powered on in local mode, it can operate the front panel. In remote mode, all other keys are invalid except <b>LOCAL/REMOTE</b> . Press <b>LOCAL/REMOTE</b> can return to local mode.	RL1

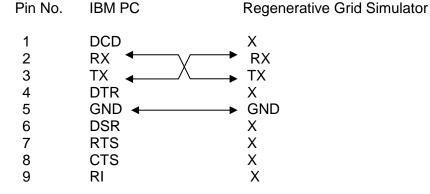
#### 8.1.3 RS-232C Interface

The baud rate of the Regenerative Grid Simulator is set to **115200** with parity set to None. For the RS-232C parameters such as baudrate and parity can be set via "CONFIG" function menu (see section 3.4.)

Only TxD and RxD signals are used for data transmission. The connector is a 9-pin D-subminiature **male** connector. The following table describes the pins and signals of RS-232C connector.

Pin No.	Input/Output	Description
1		No Connection
2	INPUT	RxD
3	OUTPUT	TxD
4		No Connection
5	GND	GND
6		No Connection
7		No Connection
8		No Connection
9		No Connection

Interconnection between the computer (compatible with IBM PC) and the Regenerative Grid Simulator is illustrated below:



#### 8.1.4 Ethernet Interface

To remote program a Regenerative Grid Simulator via a PC with Ethernet interface, it needs to confirm the IP address, Gateway address and Subnet mask in advance. See 3.4.1.3 for detail settings. To ensure reliable data transmission, TCP is used for data transmission and the communication port is 2101.

## 8.2 Introduction to Programming

All commands and response messages are transmitted in ASCII code. The response messages must be read completely before sending a new command; otherwise the remaining response messages will be lost and a query interrupt error will occur.

## 8.2.1 Conventions

Angle brackets Vertical bar	< 	>	Items in angle brackets are parameter abbreviations. Vertical bar separates alternative parameters.
Square brackets	[	]	Items in square brackets are optional. For example,
			OUTP [: STATe] means that : STATe may be omitted.
Braces	{	}	Braces indicate the parameters that may be repeated.
			The notation <a> {&lt;, B&gt;} means that parameter "A" must</a>
			be entered while parameter "B" may be omitted or entered
			once or many times.

#### 8.2.2 Numerical Data Formats

All data programmed to or returned from the Regenerative Grid Simulator are ASCII. The data can be numerical or character string.

Symbol	Description	Example
	It is a digit with no decimal point. The decimal is assumed to be on the right of the least significant digit.	123, 0123
NR2	It is a digit with a decimal point.	12.3, .123
NR3	It is a digit with a decimal point and an exponent.	1.23E+2

## 8.2.3 Boolean Data Format

Boolean parameter <Boolean> applies ON|OFF format only.

## 8.2.4 Character Data Format

The character strings returned by query command may in either of the following forms:<CRD>Character Response Data: character string with maximum length of 12.<SRD>String Response Data: character string.

## 8.2.5 Basic Definition

#### **Command Tree Table:**

The commands of the Regenerative Grid Simulator are structured hierarchically, which is called tree system. Full path must be specified to obtain a particular command. This path is represented in the table by placing the highest node in the farthest left position of the hierarchy. Lower nodes in the hierarchy are indented in the position to the right under the parent node.

#### **Program Header:**

Program header is the key word to identify the command according to the IEEE 488.2 syntax described in section 8.4. The Regenerative Grid Simulator accepts characters in both upper and lower cases without any distinction. Program header consists of two unique types, the common command header and the instrument-controlled header.

#### **Common Command and Query Header:**

The syntax of common commands and query headers are described in IEEE 488.2. They are used along with the IEEE 488.2 defined common commands and queries. The commands with leading "\*" are common commands.

#### Instrument-Controlled Header:

Instrument-controlled header can be applied to all instrument commands. Each header has a long form and a short form. The Regenerative Grid Simulator only accepts the exact short and long forms. A special notation is used to distinguish the short form header from the long one of the same in this section. The short form of header is shown by upper case characters while the rest of the headers are shown in lower case.

#### Program Header Separator (:):

If a command has more than one header, a colon must be used to separate them (FETC: CURR?, VOLT:DC 10). At least one space is required to separate the data and program header.

#### **Program Message:**

The program message consists of many elements including zero sequence or message components that are separated by the separator (semicolon.)

#### **Program Message Component:**

A program component is a single command, programming data, or query.

Example: FREQ?, OUTPut ON.

#### Program Message Component Separator (;):

The separator (semicolon ;) separates the program message components from another in a program message.

Example: VOLT:AC 110;FREQ 120<PMT>

Program Message Terminator (<PMT>):

A program message terminator can end the program message. Three permitted terminators are:

- (1) <END>: end or identify (EOI)
- (2) <NL>: new line which is a single ASCII encoded byte 0A (10 decimals).
- (3)  $\langle NL \rangle \langle END \rangle$ : new line with EOI.



The response message is terminated by <NL> <END> for GPIB, and <NL> for RS-232C.

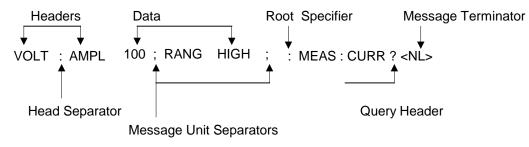


Figure 8-1 Structure of Command Message

## 8.3 Traversal of the Command Tree

Multiple program message units can be sent in one program message. The first command usually refers to the root node. Subsequent commands refer to the tree level same as the previous command in a program message. When the colon is ahead of the program message component it changes the header path to root level.

Example:

OUTPut : PROTection : CLEar OUTPut : PROTection : CLEar; : VOLT : AC 100 All colons are header separators. Only the third colon is a specified root.

## 8.4 Commands of Regenerative Grid Simulator

This section talks about the syntax and parameters of all commands for the Regenerative Grid Simulator. The examples of each command can be used in common.

Syntax Form	Syntax definition is in long format header; however, only short
	format header appears in the examples.
Parameter	Most commands require a parameter.
Return Parameter	All queries return a parameter.
Model	If a command is merely applied to specific models, these models will be
	listed in the Model only entry. If there is no Model only entry, the
	command will be applied to all models.

## 8.4.1 Common Command Dictionary

The common commands begin with a "\*" and consist of three letters and/or one "?" (query). Common commands and queries are listed alphabetically. The command commands and queries are listed in alphabetic order.

*CLS	Clear status This command clears the following registers (1) Questionable Status Event (2) Status Byte (3) Error Queue
*ESE <n></n>	Standard event status enabled This command programs the Standard Event register bits. If one or more enabled events of Standard Event registers are set, the ESB of Status Byte Register is set as well.

Bit Configuration of	Standard Event Status	Enabled Register

							3	
<b>Bit Position</b>	7	6	5	4	3	2	1	0
Bit Name	PON		CME	EXE	DDE	QYE		OPC
CME = Command Error EXE = Execution Error PON = Power On			OPO		ration Co	ndent er ompleted		

*ESE?	Return standa	Return standard event status enabled							
*ESR?	The query rea The bits of co Register.								
*IDN?	Return the Return Param Chroma ATE 61800 123456 01.00	neter Ch : ( : N : S		E,61800 / name me mber	0,123450		string.		
*RCL <n></n>	Restore the v Parameter	alues of 1 - 10	specifie	d group	that stor	ed in me	emory p	reviously	′-
*SAV <n></n>	Save the valu Parameter	ies to a : 1 - 10	specified	l group i	n memo	ry.			
* RST	It resets the F for 3 seconds t		ative Gri end the r			e initial s	states. It	's better	to wait
*SRE	It sets condition enabled even Byte Register	ts of the	Status E						
*SRE?	This query re	turns the	e Service	Reque	st Enabl	ed Regis	ster.		
*STB?	This query re Bit Configurat			-	•				
	Bit Position	7	6	5	4	3	2	1	0
	Condition	••	MSS RQS	ESB	MAV	QUES			
	QUES = Q RQS = R	uestiona equest f	itus Byte able Stat or Servi atus Su	us Sum ce					

- MAV = Message Available
- \* TST? It queries the self-test result of the Regenerative Grid Simulator.

#### 8.4.2 Instrument Command Dictionary

The commands are listed in alphabetical order. Commands followed by question marks (?) are in query forms. When a command has both command and query forms, it is noted in the description of query syntax.

#### 8.4.2.1 SYSTEM Sub-System

#### **SYSTem**

:ERRor? :VERSion? :LOCal :REMote :DATE :TIME

#### SYSTem:ERRor?

Description	: This command queries	the error string of the command parser.
Query Syntax	: SYSTem:ERRor?	
Parameter	: None	
<b>Return Parameter</b>	: Error string response:	No Error
	2 .	Data Format Error

Data Format Error Data Range Error Too Many Errors Execution Error

#### SYSTem:VERSion?

Description	: This query requests the Regenerative Grid Simulator to identify itself.
Query Syntax	: SYSTem:VERSion?
Parameter	: None
Return Paramete	r : Current version (XX.XX)

#### SYSTem:LOCal

Description	: This command can only be used under the control of RS-232C. If SYST : LOC is programmed, the Regenerative Grid Simulator will be set in the LOCAL state, and the front panel will work.
Query Syntax	: None
Parameter	: None
Return Paramet	er : None

#### SYSTem:REMote Description

: This command can only be used under the control of RS-232C. If SYST : REM is programmed, the Regenerative Grid Simulator will be set in the REMOTE state, and the front panel will be disabled except the "<PAGE/EXIT> key.

Query Syntax: NoneParameter: NoneReturn Parameter: None

#### SYSTem:DATE

Description	: This command sets the date of the Regenerative Grid Simulator real
	time clock.
Query Syntax	: SYSTem:DATE?
Parameter	: <year>,<month>,<day></day></month></year>
Return Parameter	r: 2013,01,01

#### SYSTem:TIME

Description	: This command sets the time (24H) of the Regenerative Grid
	Simulator real time clock.
Query Syntax	: SYSTem:TIME?

Parameter : <hour>,<minute>,<second> Return Parameter : 20,30,01

#### 8.4.2.2 INSTRUMENT Sub-System

#### INSTrument

:EDIT :Couple :NSELect :SELect :PHASe :OPTION

#### **INSTrument:EDIT**

Description	: It is very convenient to use a programmed command to set all phases at the same time for a Regenerative Grid Simulator that equipped with multiple phases. If INST:EDIT ALL has been programmed, it will be sent to all phases. INST:EDIT EACH command disables EDIT ALL command.
Query Syntax	: INSTrument:EDIT?
Parameter	: EACH   ALL
Datum Davanat	ar None

Return Parameter : None

#### **INSTrument:COUPle**

Description	: It is easy to use a command to program all phases in a Regenerative Grid Simulator with multiple phases. If INST: COUP ALL is programmed, the command will be sent to all phases. INST: COUP NONE command will cancel COUP ALL command.
Query Syntax	: INSTrument : COUPle?
Parameter Return Paramete	: NONE   ALL r : None

#### INSTrument:NSELect

Description	: This command sets individual output for subsequent commands or queries in the multi-phase model. If INST: COUP NONE has been programmed, the phase selection command will send to a specific output phase set by INSTrument: NSELect. If INST: COUP ALL has been programmed, all remote operation commands will send to all output phases. This command only affects the set voltage and queries the measurement data. For instance, if "INST: COUP ALL ", "INST : NSEL 2" and "Meas : VOLT?" are programmed, the Regenerative Grid Simulator will return $\Phi$ 2 measurement voltage. INST: NSEL follows the number to select phase.
Query Syntax	: INSTrument : NSELect?
Parameter	
Return Paramete	1:1 2 3

#### INSTrument:SELect

Description

: This command sets individual output for subsequent commands or queries in the multi-phase model. If INST: COUP NONE has been programmed, the phase selection command will send to a specific output phase set by INSTrument: SELect. If INST: COUP ALL has been programmed, all remote operation commands will send to all output phases. This command only affects the set voltage and queries the measurement data. For instance, if "INST: COUP ALL ", "INST: SEL OUTPUT2" and "Meas: VOLT?" are programmed, the Regenerative Grid Simulator will return  $\Phi$  2 measurement voltage. INST: SELect follows the number to select phase.

Query Syntax: INSTrument : SELect?Parameter: OUTPUT1 | OUTPUT2 | OUTPUT3Return Parameter : OUTPUT1 | OUTPUT2 | OUTPUT3

#### **INSTrument:PHASe**

 Description
 : This command switches between single phase and three-phase mode.

 Query Syntax
 : INSTrument : PHASe?

 Parameter
 : THREE | SINGLE

 Return Parameter : THREE | SINGLE

#### **INSTrument:OPTION**

Description: This command sets the instrument to be AC Source or AC Load.Query Syntax: INSTrument:OPTION?Parameter: SOURCE | LOADReturn Parameter: SOURCE | LOAD

# 8.4.2.3 FETCH and MEASURE Sub-System

## FETCh | MEASure

[: SCALar]

: CURRent : AC? It queries the rms current of AC component. : DC? It queries the DC current level.  $\cdot$  ACDC? It queries the current (AC+DC) rms. It gueries the peak current. : AMPLitude: MAXimum? It queries the current crest factor. : CREStfactor? It queries the inrush current. : INRush? : FREQuency? It queries the frequency. : POWer : AC [: REAL]? It queries the real power. It queries the apparent power. : APParent? : REACtive? It queries the reactive power. It queries the power factor. : PFACtor? : TOTal? It queries the total power. : TOTal: APParent? It queries the total apparent power. :VOLTage It queries the rms voltage of AC component. : AC? : DC? It gueries the DC voltage. : ACDC? It queries the rms voltage : AMPLitude: MAXimum? It queries the peak voltage. :LINE :V12? It queries the voltage difference of phase 1 & 2. It queries the voltage difference of phase 2 & 3. :V23? It queries the voltage difference of phase 3 & 1. :V31?

This command enables users to get measurement data from the Regenerative Grid Simulator via MEASure and FETCh. MEASure triggers the acquisition to get new data before returning data, while FETCh returns the previously acquired data from measurement buffer.

## FETCh [ : SCALar] : CURRent : AC?

## MEASure [: SCALar]: CURRent: AC?

Description: These queries return the rms current of AC component that is output<br/>from the output terminal.Query Syntax: FETCh : CURRent : AC?, MEASure : CURRent : AC?<br/>Return Parameter : <NR2>

## FETCh [: SCALar]: CURRent: DC?

#### MEASure [: SCALar]: CURRent: DC?

Description		These queries return the DC current that is output from the output terminal.
0		
Query Syntax	•	FETCh : CURRent : DC?, MEASure : CURRent : DC?
Return Parameter	1:	<nr2></nr2>

## FETCh [: SCALar]: CURRent: ACDC?

## MEASure [: SCALar]: CURRent: ACDC?

Description		These queries return the rms current that is output from the output terminal.
Query Syntax	:	FETCh : CURRent : ACDC?, MEASure : CURRent : ACDC?
Return Paramete	r :	<nr2></nr2>

## FETCh [ : SCALar] : CURRent : AMPLitude : MAXimum?

# MEASure [: SCALar] : CURRent : AMPLitude : MAXimum?

Description :	These queries return the absolute value of peak current.
Query Syntax :	FETCh : CURRent : AMPLitude : MAXimum?,
	MEASure : CURRent : AMPLitude : MAXimum?
Return Parameter :	<nr2></nr2>

## FETCh [: SCALar]: CURRent: CREStfactor?

## MEASure [: SCALar]: CURRent: CREStfactor?

Description	:	These queries return the output current crest factor. It is the ratio of
		peak output current to rms output current.
Query Syntax	:	FETCh : CURRent : CREStfactor?
		MEASure : CURRent : CREStfactor?
Return Parameter	r:	<nr2></nr2>

## FETCh [: SCALar]: CURRent: INRush?

## MEASure [: SCALar]: CURRent: INRush?

Description :	These queries return the inrush current that is output from the output terminal.
Query Syntax :	FETCh:CURRent: INRush?, MEASure: CURRent : INRush?
Return Parameter :	<nr2></nr2>

## FETCh [: SCALar]: FREQuency?

## MEASure [: SCALar]: FREQuency?

Description :	:	These queries return the output frequency in Hertz.
Query Syntax :	:	FETCh : FREQuency?
		MEASure : FREQuency?
Return Parameter :		<nr2></nr2>

## FETCh [: SCALar] : POWer : AC [: REAL] ?

MEASure [: SCALar]: POWer: AC [: REAL]?

	· · · · · · · · · · · · · · · · · · ·
Description :	These queries return the real power that is output from the output
	terminals in watt.
Query Syntax :	FETCh : POWer : AC?
Query Cymax	
	MEASure : POWer : AC?
Return Parameter :	<nr2></nr2>

## FETCh [: SCALar] : POWer : AC : APParent?

## MEASure [: SCALar]: POWer: AC: APParent?

Description	:	These queries return the apparent power that is output from the
		output terminals in volt-ampere.
Query Syntax	:	FETCh : POWer : AC : APParent?
		MEASure : POWer : AC : APParent?
<b>Return Parameter</b>	:	<nr2></nr2>

#### FETCh [: SCALar] : POWer : AC : REACtive? MEASure [: SCALar] : POWer : AC : REACtive?

FOWER AG . REACTIVE?
These queries return the reactive power that is output from the output terminals in volt-ampere. Reactive power is calculated by the following formula:
$VAR = \sqrt{APPARENTPOWER^2 - REALPOWER^2}$
FETCh : POWer : AC : REACtive?
MEASure : POWer : AC : REACtive?
<nr2></nr2>

## FETCh [: SCALar] : POWer : AC : PFACtor?

## MEASure [: SCALar]: POWer: AC: PFACtor?

Description :	These queries return the power factor that is output from the output terminals. Power factor is computed by:
	PF = TRUE POWER / APPARENT POWER
Query Syntax :	FETCh : POWer : AC : PFACtor?
	MEASure : POWer : AC : PFACtor?
Return Parameter :	<nr2></nr2>

## FETCh [: SCALar] : POWer : AC : TOTal ?

## MEASure [: SCALar]: POWer: AC: TOTal?

Description :	These queries return the total of real power that is output from
	3-phase output terminal in watt.
Query Syntax :	FETCh : POWer : AC : TOTal?
	MEASure : POWer : AC : TOTal?
Return Parameter :	<nr2></nr2>

#### FETCh [:SCALar]:POWer:AC:TOTal:APParent? MEASure [:SCALar]:POWer:AC:TOTal:APParent?

Description :	These queries return the total apparent power that is output from
	3-phase output terminal in volt-ampere.
Query Syntax :	FETCh:POWer:AC:TOTal:APParent?
	MEASure:POWer:AC:TOTal:APParent?
Return Parameter :	<nr2></nr2>

## FETCh [: SCALar]: VOLTage: AC?

## MEASure [: SCALar]: VOLTage: AC?

Description	These queries return the rms of AC component that is output from
	the output terminal.
Query Syntax	FETCh [ : SCALar] : VOLTage : AC?
	MEASure [ : SCALar] : VOLTage : AC?
<b>Return Parameter</b>	: <nr2></nr2>

#### FETCh [: SCALar] : VOLTage : DC? MEASure [: SCALar] : VOLTage : DC

DC?
eries return the DC composite voltage that is output from
terminal.
SCALar] : VOLTage : DC?
[ : SCALar] : VOLTage : DC?

## FETCh [: SCALar]: VOLTage: ACDC?

#### MEASure [: SCALar]: VOLTage: ACDC?

Description :	These queries return the rms that is output from the output
	terminal.
Query Syntax :	FETCh [ : SCALar] : VOLTage : ACDC?
	MEASure [ : SCALar] : VOLTage : ACDC?
Return Parameter :	

## FETCh [: SCALar]: VOLTage: AMPLitude : MAXimum?

#### MEASure [: SCALar]: VOLTage: AMPLitude: MAXimum?

Description	:	These queries return the absolute value of peak voltage.
•		FETCh : VOLTage: AMPLitude : MAXimum?,
		MEASure : VOLTage : AMPLitude : MAXimum?
Return Parameter	:	5

## FETCh [: SCALar]: LINE: V12?

## MEASure [: SCALar]: LINE: V12?

Description	:	These queries return the line voltage between phase 1 and 2.
Query Syntax	:	FETCh [ : SCALar] : LINE : V12?
		MEASure [ : SCALar] : LINE : V12?
Return Parameter	:	<nr2></nr2>
		MEASure [ : SCALar] : LINE : V12?

## FETCh [: SCALar]: LINE: V23?

## MEASure [: SCALar]: LINE: V23?

Description	These queries return the line voltage between phase 2 and 3.
Query Syntax	FETCh [ : SCALar] : LINE : V23?
	MEASure [ : SCALar] : LINE : V23?
Return Parameter	<nr2></nr2>

## FETCh [: SCALar]: LINE: V31?

## MEASure [: SCALar]: LINE: V31?

Description	These queries return the line voltage between phase 3 and 1.
Query Syntax	FETCh [ : SCALar] : LINE : V31?
	MEASure [ : SCALar] : LINE : V31?
Return Parameter	<nr2></nr2>

# 8.4.2.4 OUTPUT Sub-System

## OUTPut

- [: STATe] : RELay
- : SLEW
  - - : VOLTage : AC
      - : AC
    - :FREQency
- : COUPling
- : MODE
- : PROTection
- :CLEar
- : XHV

## OUTPut [:STATe]

 Description
 : This command enables or disables the output of the Regenerative Grid Simulator. Disabled output is to set the output voltage amplitude to 0 Volt.

 Query Syntax
 : OUTPut [: STATe]?

 Parameter
 : OFF | ON

Return Parameter : OFF | ON

## OUTPut:RELay

Description	: This command sets output relay on or off.
Query Syntax	: OUTPut : RELay?
Parameter	: OFF   ON, ON sets the output relay of the Regenerative Grid
	Simulator on (close), OFF sets the output relay of the Regenerative
	Grid Simulator off (open).
Return Paramete	er: OFF   ON

## **OUTPut:SLEW : VOLTage : AC**

Description	: This command sets the slew rate of the AC output voltage.
Query Syntax	: OUTPut : SLEW : VOLTage : AC?
Parameter	: <nr2>, the valid range is 0.000V/ms ~ 1200.000V/ms.</nr2>
Return Paramete	r : <nr2></nr2>

## OUTPut:SLEW : VOLTage : DC

Description	: This command sets the slew rate of the DC composite voltage.
Query Syntax	: OUTPut : SLEW : VOLTage : DC?
Parameter	: <nr2>, the valid range is 0.000V/ms ~ 1200.000V/ms.</nr2>
Return Parameter	: <nr2></nr2>

## OUTPut:SLEW : FREQuency

Description: This command sets the slew rate of the output frequency.Query Syntax: OUTPut : SLEW : FREQuency?Parameter: <NR2>, the valid range is 0.000 Hz/ms ~ 1600.000Hz/msReturn Parameter : <NR2>

## **OUTPut:COUPling**

Description	: This command selects the coupling of the output signals.
Query Syntax	: OUTPut : COUPling?

Parameter	: AC   DC   ACDC	
Return Paramete	r : AC   DC   ACDC	

#### OUTPut:MODE

Description	: This command sets the operation mode and "FIXED" mode is the
	general operation mode.
Query Syntax	: OUTPut : MODE?
Parameter	: FIXED   LIST   PULSE   STEP   SYNTH   INTERHAR
Return Paramete	r : FIXED   LIST   PULSE   STEP   SYNTH   INTERHAR

#### **OUTPut:PROTection : CLEar**

Description	: This command clears the latch that disables the output when over
	current (OCP), over temperature (OTP), over power (OPP) or remote
	inhibit (RI) is detected. All conditions that generate the faults must be
	resolved before the latch is cleared.
Quary Syntax	· Nono

Query Syntax	÷	None
Parameter	:	None
<b>Return Parameter</b>	:	None

#### OUTPut:XHV

Description	: This command the XHV function to on or off. (Optional)
Query Syntax	: OUTPut : XHV?
Parameter	: OFF   ON, ON enables the simulator's XHV function while OFF
	disables the simulator's XHV function.
Return Parameter	r : OFF   ON

# 8.4.2.5 SOURCE Sub-System

## [SOURce :]

CURRent : LIMit : DELay : INRush : STARt : INTerval FREQency [: {CW | IMMediate}] : LIMit VOLTage [: LEVel][: IMMediate][:AMPLitude] : AC : DC : LIMit : AC : DC : PLUS : MINus POWer : PROTection FUNCtion : SHAPe : SHAPe

: A : A : MODE : THD : AMP : B : B : MODE : THD : AMP

## [SOURce:] CURRent : LIMit

Description	: This command sets the rms current limit of the Regenerative Grid
	Simulator for protection.
Query Syntax	: [SOURce :] CURRent : LIMit?
Parameter	: <nr2>, the valid range is 0.00 ~ maximum current spec. of the</nr2>
	specific model (unit: A.)
Return Paramete	r: <nr2></nr2>

### [SOURce:] CURRent : DELay

Description	: This command sets the time delayed for triggering over current protection.
Query Syntax	: [SOURce :] CURRent : DELay?
Parameter	: <nr2>, the valid range is 0.0 ~ 5.0 (unit: 0.1 second.)</nr2>
Return Parameter	r : <nr2></nr2>

## [SOURce:] CURRent : INRush : STARt

Description	: This command sets the time to start the inrush current measurement.	
Query Syntax	: [SOURce :] CURRent : INRush : STARt?	
Parameter	: <nr2>, the valid range is 0 ~ 9999 (unit: ms.)</nr2>	
Return Parameter : <nr2></nr2>		

#### [SOURce:] CURRent : INRush : INTerval

Description	: This command sets the measuring interval for inrush current
	measurement.
Query Syntax	: [SOURce :] CURRent : INRush : INTerval?
Parameter	: <nr2>, the valid range is 0 ~ 9999 (unit: ms.)</nr2>
Return Paramete	er: <nr2></nr2>

## [SOURce:] FREQuency [: {CW | IMMediate}]

Description	: This command sets the output waveform frequency for the
	Regenerative Grid Simulator in Hz.
Query Syntax	: [SOURce :] FREQuency [: {CW   IMMediate}]?
Parameter	: <nr2>, the valid range is 15.00 ~ 100.00 (unit: Hz.)</nr2>
Return Paramete	er : <nr2></nr2>

## [SOURce:] FREQuency : LIMit

Description	: This command sets the output frequency limit for the Regenerative
	Grid Simulator.
Query Syntax	: [SOURce :] FREQuency : LIMit?
Parameter	: <nr2>, the valid range is 15.00 ~ 100.00 (unit: Hz)</nr2>
Return Parameter : <nr2></nr2>	

## [SOURce:] POWer:PROTection

Description	: This command sets the OPP (Over Power Protection) for the
	Regenerative Grid Simulator.
Query Syntax	: [SOURce :] POWer:PROTection?
Parameter	: <nr2>, the valid range is 0.0 ~ maximum power of specific model</nr2>
	(unit: W.)
Return Parameter	: <nr2></nr2>

## [SOURce:] VOLTage [: LEVel][: IMMediate][: AMPLitude] : AC

Description: This command sets the AC composite output voltage in Volts.Query Syntax: [SOURce :] VOLTage [: LEVel][: IMMediate][: AMPLitude] : AC?Parameter: <NR2>, the valid range is 0.0 ~ 300.0.Return Parameter : <NR2>

## [SOURce:] VOLTage [: LEVel][: IMMediate][: AMPLitude] : DC

Description: This command sets the DC composite output voltage in Volts.Query Syntax: [SOURce :] VOLTage [: LEVel][: IMMediate][: AMPLitude] : DC?Parameter: <NR2>, the valid range is -424.2 ~ 424.2.Return Parameter : <NR2>

## [SOURce:] VOLTage : LIMit : AC

Description	: This command sets the Vac LIMIT to restrict the value of Vac.
Query Syntax	: [SOURce :] VOLTage : LIMit : AC?
Parameter	: <nr2>, the valid range is 0.0 ~ 300.0 (unit: V.)</nr2>
Return Parameter : <nr2></nr2>	

#### [SOURce:] VOLTage : LIMit : DC : PLUS

Description	: This command sets the Vdc Limit(+).
Query Syntax	: [SOURce :] VOLTage : LIMit : DC : PLUS?
Parameter	: <nr2>, the valid range is -424.2 ~ 424.2 (unit: V)</nr2>
	PS: The lower limit cannot exceed Vdc Limit(-).
Return Paramete	er : <nr2></nr2>

## [SOURce:] VOLTage : LIMit : DC : MINus

Description	: This command sets the Vdc Limit(-).
Query Syntax	: [SOURce :] VOLTage : LIMit : DC : MINus?
Parameter	: <nr2>, the valid range is -424.2 ~ -424.2 (unit: V)</nr2>
	PS: The upper limit cannot exceed Vdc Limit(+).
Return Paramete	r: <nr2></nr2>

## [SOURce:] FUNCtion : SHAPe

Description	: This command specifies the waveform buffer. The Regenerative Grid Simulator output has two buffers and users need to specify to use the contents of the waveform buffer A or B.
	the contents of the waveform buller A of B.
Query Syntax	: [SOURce :] FUNCtion : SHAPe?
Parameter	: A   B
Return Paramete	er:A B

## [SOURce:] FUNCtion : SHAPe : A

Description	: This command specifies the waveform buffer A for use.
Query Syntax	[SOURce :] FUNCtion : SHAPe : A?
Parameter	: SINE   SQUA   CSIN   DST<0130>   USR<0106>
Return Parameter	: SINE   SQUA   CSIN   DST<0130>   USR<0106>

## [SOURce:] FUNCtion : SHAPe : A : MODE

Description	: This command selects the mode for the clipping in waveform buffer
	A for use.
Query Syntax	: [SOURce :] FUNCtion : SHAPe : A : MODE?
Parameter	: AMP   THD
Return Parameter	: AMP   THD

#### [SOURce:] FUNCtion : SHAPe : A : THD

Description	: This command sets the clipped THD percentage for the clipping in
	waveform buffer A.
Query Syntax	: [SOURce :] FUNCtion : SHAPe : A : THD?
Parameter	: <nr2>, the valid range is 0.0% ~ 43%.</nr2>
Return Parameter	: <nr2></nr2>

#### [SOURce:] FUNCtion : SHAPe: A : AMP

Description	: This command sets the clipped peak percentage for the clipping in
	waveform buffer A.
Query Syntax	: [SOURce :] FUNCtion : SHAPe : A : AMP?
Parameter	: <nr2>, the valid range is 0.0% ~ 100%.</nr2>
Return Parameter	: <nr2></nr2>

## [SOURce:] FUNCtion : SHAPe : B

Description	: This command specifies the waveform buffer B for use.
Query Syntax	: [SOURce :] FUNCtion : SHAPe : B?
Parameter	: SINE   SQUA   CSIN   DST<0130>   USR<0106>
<b>Return Parameter</b>	: SINE   SQUA   CSIN   DST<0130>   USR<0106>

## [SOURce:] FUNCtion : SHAPe : B : MODE

Description: This command selects the mode for the clipping in waveform buffer<br/>B for use.Query Syntax: [SOURce :] FUNCtion : SHAPe : B : MODE?Parameter: AMP | THDReturn Parameter: AMP | THD

#### [SOURce:] FUNCtion : SHAPe : B : THD

Description: This command sets the clipped THD percentage for the clipping in<br/>waveform buffer B.Query Syntax: [SOURce :] FUNCtion : SHAPe : B : THD?<br/>: <NR2>, the valid range is 0.0% ~ 43%.Return Parameter: <NR2>

#### [SOURce:] FUNCtion : SHAPe: B : AMP

Description	: This command sets the clipped peak percentage for the clipping in
	waveform buffer B.
Query Syntax	: [SOURce :] FUNCtion : SHAPe : B : AMP?
Parameter	: <nr2>, the valid range is 0.0% ~ 100%.</nr2>
Return Parameter	: <nr2></nr2>

# 8.4.2.6 CONFIGURE Sub-System

## [SOURce:]

CONFigure

- : INHibit
- : EXTernal
- : COUPling
- : EXTON

## [SOURce:] CONFigure : INHibit

Description: This command sets the Remote Inhibit function.Query Syntax: [SOURce :] CONFigure : INHibit?Parameter: DISABLE | ENABLEReturn Parameter: DISABLE | ENABLE

## [SOURce:] CONFigure : EXTernal

Description	: This command sets if enabling the External-V Reference function.
Query Syntax	: [SOURce :] CONFigure : EXTernal?
Parameter	: OFF   ON
Return Parameter	: OFF   ON

## [SOURce:] CONFigure : COUPling?

Description	: This command sets the External-V Reference to be AC_AMPLIFIER or DC_LEVEL to control the Regenerative Grid Simulator output.
Query Syntax Parameter	: [SOURce :] CONFigure : COUPling? : AC   DC
Return Parameter	: AC   DC

## [SOURce:] CONFigure : EXTON

Description: This command sets the External ON/OFF control.Query Syntax: [SOURce :] CONFigure : EXTON?Parameter: DISABLE | ENABLEReturn Parameter: DISABLE | ENABLE

## 8.4.2.7 PHASE Sub-System

## [SOURce:]

PHASe : ON : OFF : P12 : P13 : SEQuence : THREE

: RELOCK

:BALanced

:RELOCK

## [SOURce:] PHASe: ON

Description	: This command sets the transition angle when the waveform shifts.
	The default is ON meaning 0 degree.
Query Syntax	: [SOURce :] PHASe : ON?

Parameter : <NR2>, the valid range is 0.0 ~ 359.9. Return Parameter : <NR2>

#### [SOURce:] PHASe: OFF

Description: This command sets the transition angle when the waveform ends.Query Syntax: [SOURce :] PHASe : OFF?Parameter: <NR2>, the valid range is 0.0 ~ 360.0, 360.0: means IMMED.Return Parameter : <NR2>

#### [SOURce:]PHASe:P12

Description: This command sets the phase difference of Φ1 and Φ2.Query Syntax: [SOURce :]PHASe:P12?Parameter: <NR2>, the valid range is 0.0 ~ 359.9.Return Parameter : <NR2>

#### [SOURce:]PHASe:P13

Description: This command sets the phase difference of Φ1 and Φ3.Query Syntax: [SOURce :]PHASe:P13?Parameter: <NR2>, the valid range is 0.0 ~ 359.9.Return Parameter : <NR2>

#### [SOURce:]PHASe:SEQuence

Description: This command sets the phase sequence in 3-phase mode.Query Syntax: [SOURce :]PHASe:SEQuence?Parameter: POS | NEGReturn Parameter : POSITIVE | NEGATIVE

#### [SOURce:]PHASe:RELOCK

Description: This command sets the relock function in 3-phase mode.Query Syntax: [SOURce :]PHASe:RELOCK?Parameter: ENABLE | DISABLEReturn Parameter : ENABLE | DISABLE

#### [SOURce:]PHASe:THREE

Description: This command sets the operation mode in 3-phase mode.Query Syntax: [SOURce :]PHASe:THREE?Parameter: INDEPEND | SAMEFREQ | BALANCEReturn Parameter: INDEPEND | SAMEFREQ | BALANCE

## [SOURce:]PHASe:THREE:BALanced

Description	: This command sets the voltage operation mode in 3-phase balanced
	mode.
Query Syntax	: [SOURce :]PHASe:THREE:BAL?
Parameter	: PHASE   LINE

# 8.4.2.8 STATUS Sub-system

## STATus

- : OPERation
  - [: EVENt]?
  - : ENABle
- : QUEStionable
  - : CONDition
  - [: EVENt]?
  - : ENABle
  - : NTRansition
  - : PTRansition

## STATus : OPERation [: EVENt]?

Description	: This command queries the Operation Status register.
Query Syntax	: STATus : OPERation [: EVENt]?
Parameter	: None
Return Paramete	r : Always 0.
Tue ODEDetien	

## STATus : OPERation : ENABle

Description	: This command sets the Operation Status Enable register. The register is the shield when specific bit is enabled from Operation Status register.	
Query Syntax	: STATus : OPERation : ENABle?	
Parameter	: <nr1>, the valid range is 0 ~ 255.</nr1>	
Return Parameter : Always 0.		

## STATus : QUEStionable : CONDition?

Description	: This query command returns the value of Questionable Condition register. It is a read only register that saves the questionable	
	condition of Regenerative Grid Simulator in real time.	
Query Syntax	: STATus : QUEStionable : CONDition?	
Parameter	: NONE	
Return Parameter: <nr1>, the valid range is 0 ~ 511.</nr1>		

## STATus : QUEStionable [: EVENt] ?

Description	: This query command returns the value of Questionable Event register. It is a read only register that saves all items that passed Questionable NTR and/or PTR filter. If the QUES bit in Service		
	Request Enabled register has been set and Questionable Event		
	register > 0, the QUES of Status Byte register will be set too.		
Query Syntax	: STATus : QUEStionable [: EVENt]?		
Parameter	: NONE		
Return Paramete	Return Parameter : <nr1>, the valid range is 0 ~ 511.</nr1>		

## STATus : QUEStionable : ENABle

Description	: The command sets or reads the value of Questionable Enable register. The register is the shield when specific bit is enabled to set the QUES bit of Status Byte register from Operation Status register.	
Query Syntax	: STATus : QUEStionable : ENABle?	
Parameter	: <nr1>, the valid range is 0 ~ 511.</nr1>	
Return Parameter: <nr1></nr1>		

## STATus : QUEStionable : NTRansition

Description

: These commands set or read the value of register.

The operation of these registers is the same as polarity filter of Questionable Enable and Questionable Event registers that lead the following actions:

- \* When a bit of the Questionable NTR register is set to 1, a 1-to-0 transition of the corresponding bit in the Questionable Condition register will make that bit in the Questionable Event register to be set.
- \* When a bit of the Questionable PTR register is set to 1, a 0-to-1 transition of the corresponding bit in the Questionable Condition register will make that bit in the Questionable Event register to be set.
- \* If the two same bits in both NTR and PTR registers are set to 0, none transition of that bit in the Questionable Condition register can set the corresponding bit in the Questionable Event register.

			iyura		Que	Stiona		laius	Negister	
Bit	15-9	8	7	6	5	4	3	2	1	0
Position										
Condition		OVP	INP	OCP	FAN	SHT	OTP	OPP		

- Bit Configuration of Questionable Status Register
- OVP: Output voltage protection
- INP: Line input protection.
- OCP: Over current protection.
- FAN: Fan failure.
- SHT: Output short protection.
- OTP: Over temperature protection.
- OPP: Over power protection.

Query Syntax : STATus : QUEStionable : NTRansition?

Parameter : <NR1>, the valid range is 0 ~ 511.

Return Parameter : <NR1>

## **STATus : QUEStionable : PTRansition**

Description	: These commands set or read the values of Questionable PTR	
	register. Please refer to the description of previous command.	
Query Syntax	: STATus : QUEStionable : PTRansition?	
Parameter	: <nr1>, the valid range is 0 ~ 511.</nr1>	
Return Parameter: <nr1></nr1>		

# 8.4.2.9 TRACE Sub-system

## TRACe

: RMS

## TRACe

Description	: This command sets the user-defined waveform data. It needs 1024 data points to create a period of waveform. Users have to normalize the data and make the maximum point equal to 32767 or the minimum point equal to -32767.
Syntax	: TRACe <waveform_name>, <amplitude> {,<amplitude>}</amplitude></amplitude></waveform_name>
Parameter	: <waveform_name>:US<n>, n=1~6, <amplitude>:<nr1>, the valid range is -32767 ~ 32767.</nr1></amplitude></n></waveform_name>
Example	: TRĂCe US1 100 20032767 500 800 <= 1024 points
	This command requires about 1 second for execution.
TRACe : RMS	
Description	: This command sets the rms value of user's waveform. Users need to calculate the root mean square value for 1024 data points.
Syntax	: TRACe : RMS <waveform_name>, <rms></rms></waveform_name>
Parameter	: <waveform_name>:US<n>, n=1~6, <rms>:<nr1>, the valid range is 0 ~ 32767.</nr1></rms></n></waveform_name>
Example	: TRACe : RMS US1 27000

# 8.4.2.10 LIST Sub-system

#### [SOURce:] LIST

: COUPling :TRIG : POINts? : COUNt : DWELI : SHAPe : BASE : VOLTage : AC : STARt : END : DC : STARt : END : FREQuency : STARt : END : DEGRee OUTPut : MODE

TRIG

TRIG : STATE?

## [SOURce:]LIST : COUPling

Description	: This command sets the function of list mode.
Query Syntax	: [SOURce:] LIST : Coupling?
Parameter	: ALL   NONE
Return Parameter	: ALL   NONE

#### [SOURce:]LIST : TRIG

Description	: This command sets the trigger type of list mode.
Query Syntax	: [SOURce:] LIST : TRIG?
Parameter	: AUTO   MANUAL EXCITE
Return Parameter	: AUTO   MANUAL EXCITE

#### [SOURce:] LIST : POINts?

Description	: This command returns the valid order number of list mode.
Query Syntax	: [SOURce:] LIST : POINts?
Parameter	: None
<b>Return Parameter</b>	: <nr1>, the valid range is 0 ~ 100.</nr1>

#### [SOURce :] LIST : COUNt

Description	: This command sets the number of times the list executed before completion.
Query Syntax	: [SOURce :] LIST : COUNt?
Parameter	: <nr1>, the valid range is 0 ~ 65535.</nr1>
Return Parameter	: <nr1></nr1>

#### [SOURce :] LIST : DWELI

Description: This command sets the sequence of dwell time list points.Query Syntax: [SOURce:] LIST : DWELI?Parameter: <NR2>, ..., <NR2>, the valid range is 0 ~ 99999999.9 (unit: ms.)Return Parameter : <NR2>, ..., <NR2>

#### [SOURce :] LIST : SHAPe

Description: This command sets the sequence of waveform buffer list points.Query Syntax: [SOURce:] LIST : SHAPe?Parameter: A|B, ..., A|BReturn Parameter: A|B, ..., A|B

#### [SOURce :] LIST : BASE

Description	: This command sets the time base of list.
Query Syntax	: [SOURce:] LIST : BASE?
Parameter	: TIME   CYCLE
Return Parameter	: TIME   CYCLE

#### [SOURce :] LIST : VOLTage : AC : STARt

Description	: This command sets the sequence of AC start voltage list points.
Query Syntax	: [SOURce:] LIST : VOLTage : AC : STARt?
Parameter	: <nr2>,, <nr2>, the valid range is 0.0 ~ 300.0.</nr2></nr2>
Return Parameter	: <nr1>,, <nr2></nr2></nr1>

#### [SOURce :] LIST : VOLTage : AC : END

Description	: This command sets the sequence of AC end voltage list points.
Query Syntax	: [SOURce:] LIST : VOLTage : AC : END?
Parameter	: <nr2>,, <nr2>, the valid range is 0.0 ~ 300.0.</nr2></nr2>
Return Parameter	: <nr2>,, <nr2></nr2></nr2>

## [SOURce :] LIST : VOLTage : DC : STARt

Description	: This command sets the sequence of DC start voltage list points.
Query Syntax	: [SOURce:] LIST : VOLTage : DC : STARt?
Parameter	: <nr2>,, <nr2>, the valid range is -424.2 ~ 414.2.</nr2></nr2>
Return Parameter	: <nr1></nr1>

## [SOURce :] LIST : VOLTage : DC : END

Description	: This command sets the sequence of DC end voltage list points.
Query Syntax	: [SOURce:] LIST : VOLTage : DC : STARt?
Parameter	: <nr2>,, <nr2>, the valid range is -424.2 ~ 414.2.</nr2></nr2>
Return Parameter	: <nr2>,, <nr2></nr2></nr2>

## [SOURce :] LIST : FREQuency : STARt

Description	: This command sets the sequence of start frequency list points.
Query Syntax	: [SOURce:] LIST : FREQuency : STARt?
Parameter	: <nr2>,, <nr2>, the valid range is 15.00 ~ 100.00 (unit: Hz.)</nr2></nr2>
Return Parameter	: <nr2>,, <nr2></nr2></nr2>

## [SOURce :] LIST : FREQuency : END

Description	: This command sets the sequence of end frequency list points.
Query Syntax	: [SOURce:] LIST : FREQuency : END?
Parameter	: <nr2>,, <nr2>, the valid range is 15.0 ~ 100.00 (unit: Hz.)</nr2></nr2>
Return Parameter	: <nr2>,, <nr2></nr2></nr2>

#### [SOURce :] LIST : DEGRee

: This command sets the sequence of phase angle list points.
: [SOURce:] LIST : DEGRee?
: <nr2>,, <nr2>, the valid range is 0.0 ~ 359.9.</nr2></nr2>
: <nr2>,, <nr2></nr2></nr2>

## OUTPut : MODE

Description	: This command sets the operation mode.
Query Syntax	: OUTPut : MODE?
Parameter	: FIXED   LIST   PULSE   STEP   SYNTH   INTERHAR
Return Parameter	: FIXED   LIST   PULSE   STEP   SYNTH   INTERHAR

## TRIG

Description	: This command sets LIST mode in OFF, ON execution state after setting OUTPut: MODE LIST. If users wish to change the parameters, it's necessary to set TRIG OFF then OUTPut: MODE FIXED. Then, set OUTPut : MODE LIST again to get ready to set TRIG ON.
Query Syntax	: TRIG : STATE?
Parameter	: OFF   ON
Return Parameter	: OFF   RUNNING

# 8.4.2.11 PULSE Sub-system

[SOURce :]

PULSe : VOLTage : AC : DC : FREQuency : SHAPe : SPHase : COUNt : DCYCle : PERiod : TRIG

#### OUTPut

: MODE

TRIG TRIG : STATE?

#### [SOURce :] PULSe : VOLTage : AC

Description	: This command sets AC voltage for the duty cycle of PULSE mode.
Query Syntax	: [SOURce :] PULSE : VOLTage : AC?
Parameter	: <nr2>, the valid range is 0.0 ~ 300.0.</nr2>
<b>Return Parameter</b>	: <nr2></nr2>

## [SOURce :] PULSe : VOLTage : DC

Description: This command sets the DC voltage for the duty cycle of PULSE<br/>mode.Query Syntax: [SOURce :] PULSE : VOLTage : DC?Parameter: <NR2>, the valid range is -424.2 ~ 424.2.Return Parameter: <NR2>

## [SOURce :] PULSe : FREQuency

Description: This command sets the frequency for the duty cycle of PULSE<br/>mode.Query Syntax: [SOURce :] PULSE : FREQuency?Parameter: <NR2>, the valid range is 15.0 ~ 100.00 (unit: Hz.)Return Parameter: <NR2>

## [SOURce :] PULSe : SHAPe

Description	: This command selects the waveform buffer for PULSE mode.
Query Syntax	: [SOURce :] PULSE : SHAPe?
Parameter	: A   B
Return Parameter	: A   B

#### [SOURce :] PULSe : SPHase

: This command sets the start phase angle of duty cycle for PULSE
mode.
: [SOURce :] PULSE : SPHase?
: <nr2>, the valid range is 0.0 ~ 359.9.</nr2>
: <nr2></nr2>

## [SOURce :] PULSe : COUNt

Description	: This command sets the number of times the pulse executed before completion.
Query Syntax	: [SOURce :] PULSE : COUNt?
Parameter	: <nr2>, the valid range is 0 ~ 65535.</nr2>

Return Parameter : <NR2>

## [SOURce :] PULSe : DCYCle

Description	: This command sets the duty cycle of PULSE mode.
Query Syntax	: [SOURce :] PULSE : DCYCle?
Parameter	: <nr2>, the valid range is 0 % ~ 100 %.</nr2>
Return Parameter	: <nr2></nr2>

#### [SOURce :] PULSe : PERiod

Description	: This command sets the period of the PULSE mode.
Query Syntax	: [SOURce :] PULSE : PERiod?
Parameter	: <nr2>, the valid range is 0 ~ 99999999.9 (unit: ms.)</nr2>
Return Parameter	: <nr2></nr2>

## [SOURce:]PULSe : TRIG

Description	: This command sets the TRIG type of PULSE mode.
Query Syntax	: [SOURce:] PULSe : TRIG?
Parameter	: AUTO   MANUAL EXCITE
Return Parameter	: AUTO   MANUAL EXCITE

#### **OUTPut : MODE**

Description	: This command sets the operation mode.		
Query Syntax	: OUTPut : MODE?		
Parameter	: FIXED   LIST   PULSE   STEP   SYNTH   INTERHAR		
<b>Return Parameter</b>	: FIXED   LIST   PULSE   STEP   SYNTH   INTERHAR		

#### TRIG

parameters, it's necessary to set TRIG OFF then OUTPut : MODE FIXED. Then, set OUTPut : MODE PULSE again to get ready to set TRIG ON.
 : TRIG : STATE? : OFF   ON : OFF   RUNNING

# 8.4.2.12 STEP Sub-system

## [SOURce:]

## STEP

: VOLTage : AC : DC : FREQuency : SHAPe : SPHase : DVOLtage

- : AC
- : DC
- : DFRequency
- : DWELİ
- : COUNt
- : TRIG

OUTPut

: MODE TRIG

TRIG: STATE?

## [SOURce :] STEP : VOLTage : AC

Description: This command sets the initial AC voltage of STEP mode.Query Syntax: [SOURce :] STEP : VOLTage : AC?Parameter: <NR2>, the valid range is 0.0 ~ 300.0.Return Parameter : <NR2>

## [SOURce :] STEP : VOLTage : DC

Description: This command sets the initial DC voltage of STEP mode.Query Syntax: [SOURce :] STEP : VOLTage : DC?Parameter: <NR2>, the valid range is -424.2 ~ 424.2.Return Parameter : <NR2>

## [SOURce :] STEP : FREQuency

Description: This command sets the initial frequency of STEP mode.Query Syntax: [SOURce :] STEP : FREQuency?Parameter: <NR2>, the valid range is 15.0 ~ 100.00 (unit: Hz.)Return Parameter : <NR2>

## [SOURce :] STEP : SHAPe

Description: This command selects the waveform buffer of STEP mode.Query Syntax: [SOURce :] STEP : SHAPe?Parameter: A | BReturn Parameter : A | B

## [SOURce :] STEP : SPHase

Description: This command sets the start phase angle of STEP mode.Query Syntax: [SOURce :] STEP : SPHase?Parameter: <NR2>, the valid range is 0.0 ~ 359.9.Return Parameter : <NR2>

## [SOURce :] STEP : DVOLtage : AC

Description: This command sets the AC voltage change in each step.Query Syntax: [SOURce :] STEP : DVOLtage : AC?Parameter: <NR2>, the valid range is -300.0 ~ 300.0.Return Parameter : <NR2>

## [SOURce :] STEP : DVOLtage : DC

Description: This command sets the DC voltage change in each step.Query Syntax: [SOURce :] STEP : DVOLtage : DC?Parameter: <NR2>, the valid range is -424.2 ~ 424.2.Return Parameter : <NR2>

## [SOURce :] STEP : DFRequency

Description: This command sets the frequency change in each step.Query Syntax: [SOURce :] STEP : DFRequency?Parameter: <NR2>, the valid range is -100.00 ~ 100.00 (unit: Hz.)Return Parameter : <NR2>

## [SOURce :] STEP : DWELI

Description: This command sets the dwell time in each step.Query Syntax: [SOURce :] STEP : DWELI?Parameter: <NR2>, the valid range is 0 ~ 99999999.9 (unit: ms.)Return Parameter : <NR2>

## [SOURce :] STEP : COUNt

Description: This command sets the number of times the step executed before<br/>completion.Query Syntax: [SOURce :] STEP : COUNt?Parameter: <NR2>, the valid range is 0 ~ 65535.Return Parameter : <NR2>

## [SOURce:] STEP : TRIG

Description : This command sets the TRIP type of STEP mode. Query Syntax : [SOURce:] STEP : TRIG? Parameter : AUTO | MANUAL Return Parameter : AUTO | MANUAL

## **OUTPut : MODE**

Description : This command sets the operation mode.	
Query Syntax	: OUTPut : MODE?
Parameter	: FIXED   LIST   PULSE   STEP   SYNTH   INTERHAR
<b>Return Parameter</b>	: FIXED   LIST   PULSE   STEP   SYNTH   INTERHAR

## TRIG

 Description
 : This command sets STEP mode in OFF, ON execution state after setting OUTPut : MODE STEP. If users want to change the parameters, it's necessary to set TRIG OFF then OUTPut : MODE FIXED. Then, set OUTPut : MODE STEP again to get ready to set TRIG ON.

 Query Syntax
 : TRIG : STATE?

 Parameter
 : OFF | ON

 Return Parameter : OFF | RUNNING

## 8.4.2.13 SYNTHESIS Sub-system

## [SOURce:]

#### SYNThesis

: COMPose : AMPLitude : PHASe : FUNDamental : DC : FREQuency : SPHase

#### OUTPut

: MODE

## TRIG TRIG: STATE?

#### [SOURce :] SYNThesis : COMPose

Description	: This command sets the data format of each harmonic order. VALUE: absolute value, PERCENT: basic computer percentage. Users can program 6 waveforms for execution.
	Users can program o waveronns for execution.
Query Syntax	: [SOURce :] SYNThesis : COMPose?
Parameter	: VALUE1   VALUE2   VALUE3
	PERCENT1   PERCENT2   PERCENT3
Return Paramete	r : VALUE1   VALUE2   VALUE3
	PERCENT1   PERCENT2   PERCENT3

## [SOURce :] SYNThesis : AMPLitude

Description	: This command sets the amplitude of each harmonic order.
	The maximum order is 50.
Query Syntax	: [SOURce :] SYNThesis : AMPLitude?
Parameter	: <nr2>,, <nr2></nr2></nr2>
	Valid range:

Order	Value	Percentage
2 ~ 10	0 ~ 90.0	0 ~ 30.00
11 ~ 20	0 ~ 60.0	0 ~ 20.00
21 ~ 30	0 ~ 30.0	0 ~ 10.00
31 ~ 40	0 ~ 30.0	0 ~ 10.00
41 ~ 50	0 ~ 15.0	0 ~ 5.00

Return Parameter : <NR2>, ...,<NR2>

## [SOURce :] SYNThesis : PHASe

Description: This command sets the phase angle of each harmonic order.Query Syntax: [SOURce :] SYNThesis : PHASe?Parameter: <NR2>, ..., <NR2>, the valid range: 0.0 ~ 359.9Return Parameter : <NR2>, ..., <NR2>

## [SOURce :] SYNThesis : FUNDamental

Description	: This command sets the fundamental AC voltage in SYNTHESIS
	mode.
Query Syntax	: [SOURce :] SYNThesis : FUNDamental?
Parameter	: <nr2>, the valid range: 0.0 ~ 300.0.</nr2>
Return Parameter : <nr2></nr2>	

## [SOURce :] SYNThesis : DC

Description	: This command sets the DC voltage to add the voltage waveform in
	SYNTHESIS mode.
Query Syntax	: [SOURce :] SYNThesis : DC?
Parameter	: <nr2>, the valid range: -424.2 ~ 424.2.</nr2>
Return Paramet	er: <nr2></nr2>

## [SOURce :] SYNThesis : FREQuency

Description	: This command sets the fundamental frequency in SYNTHESIS
	mode.
Query Syntax	: [SOURce :] SYNThesis : FREQuency?
Parameter	: 50   60
<b>Return Parameter</b>	: 50   60

## [SOURce :] SYNThesis : SPHase

Description	: This command sets the start phase angle in SYNTHESIS mode.
Query Syntax	: [SOURce :] SYNThesis : SPHase?
Parameter	: <nr2>, the valid range: 0.0 ~ 359.9</nr2>
Return Parameter : <nr2></nr2>	

## **OUTPut : MODE**

Description	: This command sets the operation mode. User should quit output before setting OUTPut : MODE SYNTH.
Query Syntax	: OUTPut : MODE?
Parameter	: FIXED   LIST   PULSE   STEP   SYNTH   INTERHAR
Return Paramete	r : FIXED   LIST   PULSE   STEP   SYNTH   INTERHAR

## TRIG

Description	: This command sets SYNTHESIS mode in OFF, ON execution state after setting OUTPut : MODE SYNTH. If users want to change the parameters, it's necessary to set TRIG OFF then OUTPut : MODE FIXED. Then, set OUTPut : MODE SYNTH again to get ready to set TRIG ON.
Query Syntax	: TRIG : STATE?
Parameter	: OFF   ON
Return Paramete	r : OFF   RUNNING

# 8.4.2.14 INTERHARMONICS Sub-system

## [SOURce :] INTERHARmonics : FREQuency : STARt : END : LEVel : DWELI

## OUTPut

: MODE

### TRIG TRIG : STATE?

## FETCh | MEASure

: INTERHARmonics : FREQuency?

It queries the sweeping frequency.

## [SOURce :] INTERHARmonics : FREQuency : STARt

Description : This command sets the start frequency of sweep wave for

INTERHARMONICS mode.Query Syntax: [SOURce :] INTerharmonics : FREQuency : STARt?Parameter: <NR2>, the valid range is 0.01 ~ 3000.0 (unit: Hz.)Return Parameter : <NR2>

## [SOURce :] INTERHARmonics: FREQuency : END

Description	: This command sets the end frequency of sweep wave for
	INTERHARMONICS mode.
Query Syntax	: [SOURce :] INTerharmonics : FREQuency : END?
Parameter	: <nr2>, the valid range is 0.01 ~ 3000.00 (unit: Hz.)</nr2>
Return Paramete	r: <nr2></nr2>

## [SOURce :] INTERHARmonics: LEVel

Description: This command sets the rms. range of sweep wave in percentage<br/>level.Query Syntax: [SOURce :] INTerharmonics : LEVEI?Parameter: <NR2>, the valid range is 0% ~ 30% in 0.01 Hz ~ 500 Hz<br/>0% ~ 20% in 500.01 Hz ~ 1000 Hz<br/>0% ~ 10% in 1000.01 Hz ~ 2400 Hz<br/>0% ~ 5% in 2400.01 Hz ~ 3000 Hz

Return Parameter : <NR2>

## [SOURce :] INTERHARmonics: DWELI

Description	: This command sets the dwell time of sweep wave.
Query Syntax	: [SOURce :] INTerharmonics : DWELI?
Parameter	: <nr2>, the valid range is 0.00 ~ 99999.99 (unit: sec.)</nr2>
Return Parameter: <nr2></nr2>	

## OUTPut : MODE

Description	: This command sets the operation mode.
Query Syntax	: OUTPut : MODE?
Parameter	: FIXED   LIST   PULSE   STEP   SYNTH   INTERHAR
Return Parameter : FIXED   LIST   PULSE   STEP   SYNTH   INTERHAR	

## TRIG

Description	: This command sets INTERHARMONICS mode in OFF, ON, PAUSE or CONTINUE execution state after setting OUTPut : MODE INTERHAR. If users wish to change the Parameter, it has to set TRIG OFF and OUTPut : MODE FIXED, next OUTPut : MODE
	INTERHAR in order to set TRIG ON.
Query Syntax	: TRIG : STATE?
Parameter	: OFF   ON   PAUSE   CONTINUE
Return Paramete	r : OFF   RUNNING   PAUSE

#### FETCh [:SCALar] : INTERHARmonics: FREQuency? MEASure [:SCALar] : INTERHARmonics: FREQuency?

Description	: These query commands return the sweep frequency stacked on base
	voltage.
Query Syntax	: FETCh : INTERHARMonics : FREQuency?
	MEASure : INTERHARMonics : FREQuency?
Return Paramete	er: <nr2></nr2>

# 8.4.2.15 Harmonic Sense Sub-system

## [SOURce:]

## CONFigure

- : HARMonic
  - : SOURce
  - : TIMES
  - : PARameter
  - : FREQuency

## SENSe

: HARMonic

## FETCh | MEASure

[: SCALar]

: HARMonic

: THD?

: FUNDamental? : ARRay? It returns the % of total harmonic distortion. It returns the fundamental frequency. It returns the array of all harmonic orders.

## [SOURce :] CONFigure : HARMonic : SOURce

Description	: This command sets the measured power source in harmonic analysis mode.
Query Syntax	: [SOURce :] CONFigure : HARMonic : SOURce?
Parameter	: VOLT   CURR
Return Paramete	r: VOLT CURR

## [SOURce :] CONFigure : HARMonic : TIMES

 Description
 : This command sets the way the measurement result of harmonic analysis displayed on LCD.

 SINGLE: It keeps the measured data on the display when set.

 CONTINUE: It updates the measured data on the display when set.

 Query Syntax
 : [SOURce :] CONFigure : HARMonic : TIMes?

 Parameter
 : SINGLE | CONTINUE

 Return Parameter : SINGLE | CONTINUE

## [SOURce :] CONFigure : HARMonic : PARameter

Description : This command sets the data format for each harmonic order. Query Syntax : [SOURce :] CONFigure : HARMonic : PARameter? Parameter : VALUE | PERCENT Return Parameter : VALUE | PERCENT

## [SOURce :] CONFigure : HARMonic : FREQuency

Description	: This command sets the fundamental frequency of original waveform.
Query Syntax	: [SOURce :] CONFigure : HARMonic : FREQuency?
Parameter	: 50   60
Return Parameter	r : 50   60

## SENSe : HARMonic

Description	: This command sets the harmonic measurement on/off. It has to execute "ON" before every new search or measurement. Only 3
	seconds are required for the result. The parameter has to set to "OFF" if users wish to measure other data.
Query Syntax Parameter	: SENSe : HARMonic? : ON   OFF

Return Parameter : ON | OFF

# FETCh [:SCALar] : HARMonic : THD?

MEASure [:SCALar] : HARMonic : THD?

Description : This query command returns the % of total harmonic distortion. Query Syntax : FETCh : HARMonic : THD? MEASure : HARMonic : THD? Return Parameter : <NR2>

FETCh [:SCALar] : HARMonic : FUNDamental?

## MEASure [:SCALar] : HARMonic : FUNDamental?

Description	: This query command returns the fundamental frequency output
	current or voltage.
Query Syntax	: FETCh : HARMonic : FUNDamental?
	MEASure : HARMonic : FUNDamental?
Return Paramete	er : <nr2></nr2>

#### FETCh [:SCALar] : HARMonic : ARRay? MEASure [:SCALar] : HARMonic : ARRay?

Description : This query command returns the array of all harmonic orders. Query Syntax : FETCh : HARMonic : ARRay? MEASure : HARMonic : ARRay? Return Parameter : <NR2>

# 8.4.2.16 ACL Subsystem (Optional)

## LOAD:

:MODE CCREctifier :CURRent :CREStfactor CPREctifier :POWer :CREStfactor

CR

:RESistor CCPHase :CURRent :DEGRee CPPHase :POWer :DEGRee :PF :MODE

## PHASe

:LIMit

## LOAD:MODE

Description Query Syntax

: This command sets the ACL operating mode. : LOAD: MODE?

Parameter	: CCRE	CPRE	CR	CCPH	CPPH
<b>Return Parameter</b>	: CCRE	CPRE	CR	CCPH	CPPH

## LOAD:CCREctifier:CURRent

Description	: This command sets the loading current in CCREctifier mode.
Query Syntax	: LOAD: CCREctifier : CURRent?
Parameter	: <nr2>, valid range: 0.0 ~ 100.0 (unit: A)</nr2>
Return Parameter	: <nr2></nr2>

#### LOAD:CCREctifier:CRES

Description	: This command sets the current crest factor in CCREctifier mode.
Query Syntax	: LOAD: CCREctifier : CRES?
Parameter	: <nr2>, valid range: 1.414 ~ 2.57</nr2>
Return Parameter	: <nr2></nr2>

## LOAD:CPREctifier:POWer

Description	: This command sets the loading power in CPREctifier mode.
Query Syntax	: LOAD: CPREctifier: POWer?
Parameter	: <nr2>, valid range: 10 ~ 20000 (unit: W)</nr2>
Return Parameter	: <nr2></nr2>

#### LOAD:CPREctifier:CRES

Description	: This command sets the current crest factor of loading power	in
	CPREctifier mode.	
Query Syntax	: LOAD: CPREctifier: CRES?	
Parameter	: <nr2>, valid range: 1.414 ~ 2.57</nr2>	
Return Parameter	: <nr2></nr2>	

## LOAD:CR:RESistor

Description	: This command sets the corresponding resistance value when
	loading in CR mode.
Query Syntax	: LOAD: CR: RESistor?
Parameter	: <nr2>, valid range: 1 ~ 300 (unit: Ohm)</nr2>
Return Parameter	: <nr2></nr2>

## LOAD:CCPHase:CURRent

Description	: This command sets the loading current in CCPHase mode.
Query Syntax	: LOAD: CCPHase: CURRent?
Parameter	: <nr2>, valid range: 0.0 ~ 100.0 (unit: A)</nr2>
Return Parameter	: <nr2></nr2>
Query Syntax Parameter	: LOAD: CCPHase: CURRent? : <nr2>, valid range: 0.0 ~ 100.0 (unit: A)</nr2>

#### LOAD:CCPHase:DEGRee

AD:CCPHase:DEGF	<b>Kee</b>
Description	: This command sets the phase degree of loading current and DUT voltage in CCPHase mode.
Query Syntax	: LOAD: CCPHase: DEGRee?
Parameter	: Phase Limit is ON: <nr2>, valid range: -90.0 ~ 90.0 (unit: Degree) Phase Limit is OFF: <nr2>, valid range: -180.0 ~ 180.0 (unit: Degree)</nr2></nr2>
Return Parameter	: <nr2></nr2>

## LOAD:CPPHase:PF

Description	: This command sets the PF value of loading current and DUT
	voltage in <b>CPPHase</b> mode. This setting is linked to
	LOAD:CCPHase: DEGRee.

Query Syntax	: LOAD: CPPHase: PF?
Parameter	: valid range: 0.707~1
Return Parameter	: <nr2></nr2>

#### LOAD:CPPHase:PF:MODE

Description	: This command sets the loading current to be ahead or behind the DUT voltage in <b>CPPHase</b> mode. This setting is linked to <b>LOAD:CCPHase:DEGRee</b> .	
	LOAD.OOI Mase.DEOICee.	
Query Syntax	: LOAD: CPPHase: PF: MODE?	
Parameter	: LEAD   LAG	
Return Parameter	: LEAD   LAG	

#### LOAD:CPPHase:POWer

Description	: This command sets the loading power in CCPHase mode.
Query Syntax	: LOAD: CPPHase: POWer?
Parameter	: <nr2>, valid range: 10 ~ 20000 (unit: W)</nr2>
Return Parameter	: <nr2></nr2>

#### LOAD:CPPHase:DEGRee

Description	: This command sets the phase degree of loading current and DUT	
	voltage phase in <b>CPPHase</b> mode	
Query Syntax	: LOAD: CPPHase: DEGRee?	
Parameter	: Phase Limit is ON: <nr2>, valid range: -45.0 ~45.0 (unit: Degree) Phase Limit is OFF: <nr2>, valid range: 135.0 ~ 225.0 (unit:</nr2></nr2>	
	Degree)	
Return Parameter	: <nr2></nr2>	

## LOAD:PHASe: LIMit

Description	: This command sets the range of on/off angle when phase mode is set.
Query Syntax	: LOAD: PHASe: LIMit?
Parameter	: ON   OFF
Return Parameter	: ON OFF

# 8.5 Command Summary

## **Common Commands**

lear status

- \* ESE<n> Enable standard event status
- \* ESE? Return enabled standard event status
- \* IDN? Return the Regenerative Grid Simulator ID
- \* RCL<n> Recall the Regenerative Grid Simulator file
- \* RST Reset the Regenerative Grid Simulator to initial states
- \* SAV<n> Save the Regenerative Grid Simulator status
- \* SRE Set request enable register
- \* STB? Return status byte
- \* TST? Return the self-test result of Regenerative Grid Simulator

#### Instrument Commands

## SYSTem

- : ERRor?
- : VERSion?
- : LOCal
- : REMote
- : DATE
- : TIME

## INSTrument

- : EDIT
- : Couple
- : NSELect
- : SELect
- : PHASe

## FETCh | MEASure

- [: SCALar]
  - : CURRent
    - : AC?
      - : DC?
      - : ACDC?
      - : AMPLitude:MAXimum?
    - : CREStfactor?
    - : INRush?
  - : FREQuency?
  - : POWer
    - : AC
      - [: REAL]?
      - : APParent?
      - : REACtive?
      - : PFACtor?
      - : TOTal?
      - : TOTal: APParent?
  - :VOLTage
    - : AČ?
    - : DC?
    - : ACDC?
    - : AMPLitude:MAXimum?
  - :LINE
    - :V12? :V23?
    - :V31?

## OUTPut

- [: STATe] : RELay : SLEW : VOLTage : AC : DC
- :FREQency
- : COUPling

: MODE : PROTection :CLEar [SOURce:] CURRent : LIMit : DELay : INRush : STARt : INTerval FREQency [: {CW | IMMediate}] : LIMit VOLTage [: LEVel][: IMMediate][:AMPLitude] : AC : DC : LIMit : AC : DC : PLUS : MINus POWer : PROTection FUNCtion : SHAPe : SHAPe : A : A : MODE : THD : AMP : B : B : MODE : THD : AMP LIST : Coupling : TRIG : POINts? : COUNt : DWELI : SHAPe : BASE : VOLTage : AČ

: END : DC : STARt : END : FREQuency : STARt : END : DEGRee PULSe : VOLTage : AC : DC : FREQuency : SHAPe : SPHase : COUNt : DCYCle : PERiod STEP : VOLTage : AC : DC : FREQuency : SHAPe : SPHase : DVOLtage : AC : DC : DFRequency : DWELI : COUNt **SYNThesis** : COMPose : AMPLitude : PHASe : FUNDamental : DC : FREQuency : SPHase **INTERHARrmonics** : FREQuency : STARt : END : LEVEI : DWELI : MODe [SOURce:] PHASe : ON : OFF

[SOURce:]

CONFigure : INHibit

## STATus

- : OPERation [: EVENt]?
  - : ENABle
- : QUEStionable
  - : CONDition
  - [: EVENt]?
  - : ENABle
  - : NTRansition
  - : PTRansition

## TRACe

: RMS

TRIG TRIG: STATE?

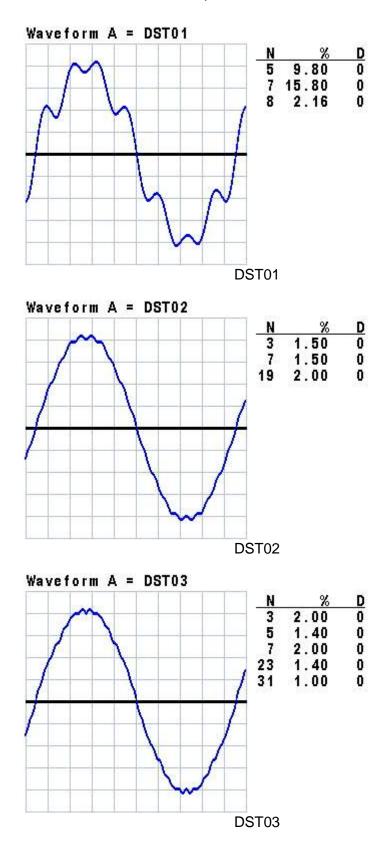
# Appendix A TTL Signal Pin Assignments

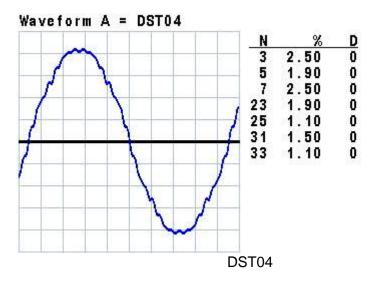
Green terminal with female connector:

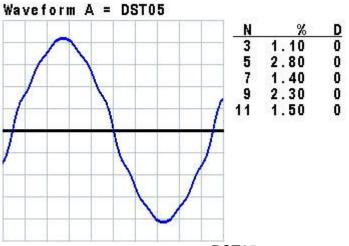
Pin No.	Signal	Description
1	Ext-V Ф1	Φ1 External-V Reference signal input (-10V~10V)
2	Ext-V Φ2	Φ2 External-V Reference signal input (-10V~10V)
		This is the input pin of external voltage signal for single
		phase use.
3	Ext-V ФЗ	Φ3 External-V Reference signal input (-10V~10V)
4	AGND	External-V Reference signal grounding
5	+12V	12V voltage output (providing current 1A)
6	Reserved	
7	AGND	External-V Reference signal grounding.
8	AGND	External-V Reference signal grounding.
9	AC-ON	This pin turns to HIGH when the Regenerative Grid Simulator outputs voltage and turns to LOW when quits output.
10	/ FAULT-OUT	The voltage level of this pin is HIGH when the Regenerative Grid Simulator is in normal mode, it will turn to LOW when the Regenerative Grid Simulator is in protection mode.
11	/ Ext-ONOFF	When EXT-ONOFF is enabled and the voltage level of this pin turns to LOW, the Regenerative Grid Simulator output will be open and it will close on the contrary.
12	/ Remote-Inhibit	When the voltage level of this pin turns to LOW, it can inhibit the Regenerative Grid Simulator output or trigger mode.
13	/Remote-Excite	When this pin receives a negative edge signal (from High to Low), it can trigger the transient output of Regenerative Grid Simulator.
14	/Transient	When the output of Regenerative Grid Simulator changes, this pin will send out a low level 64us or remain at high level.
15	Reserved	
16	Reserved	
17	Reserved	
18	Reserved	
19	Reserved	
20	AGND	
21	Reserved	
22	Reserved	
23	Reserved	
24	AGND	

# Appendix B Built-in DST Waveform

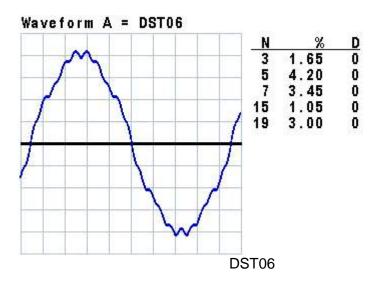
The ratios of all built-in waveforms' steps are measured under no load.

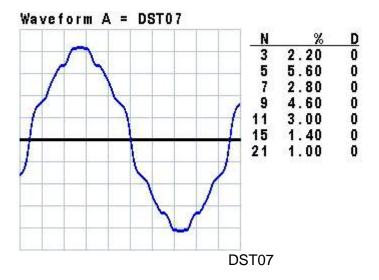


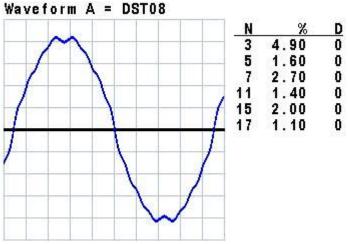




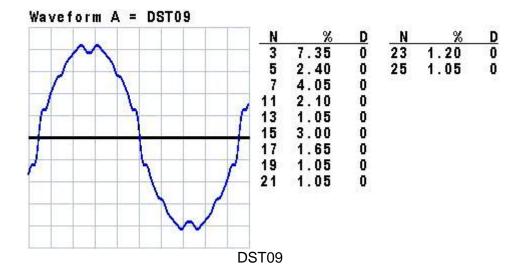




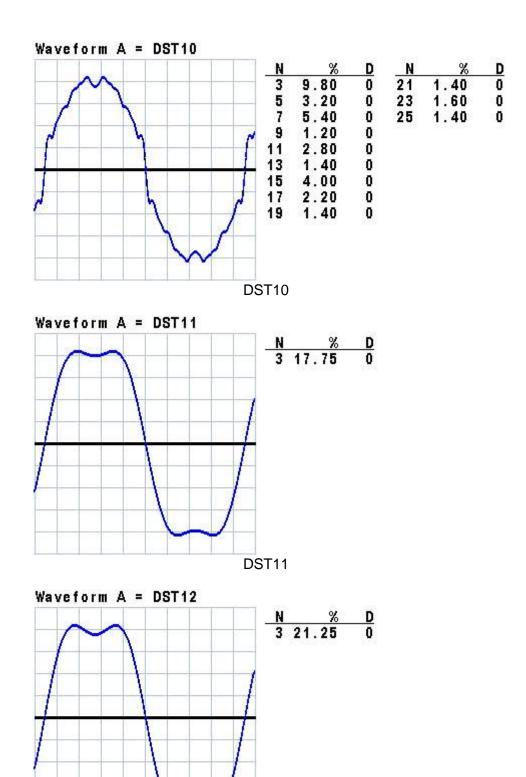




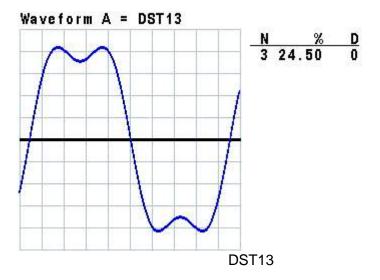




B-3

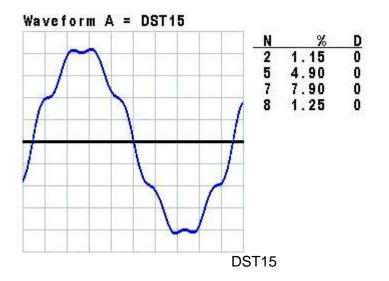


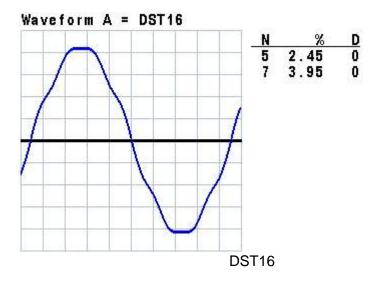
DST12

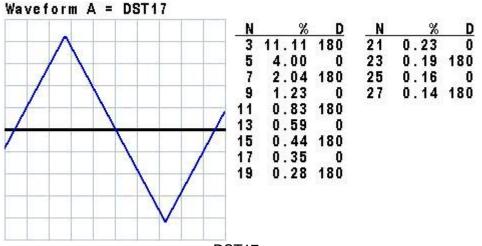




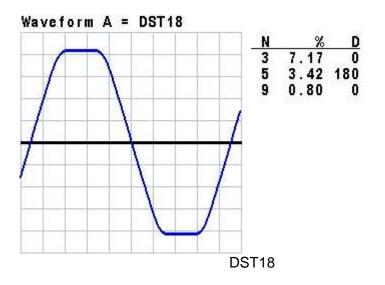


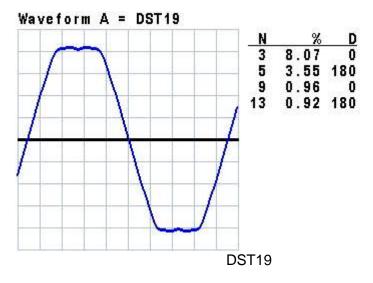


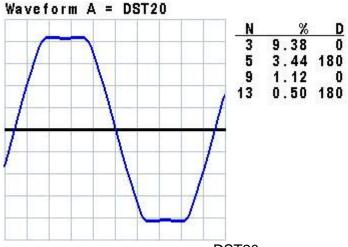




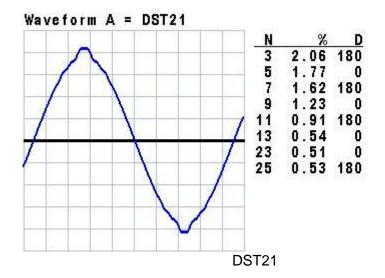


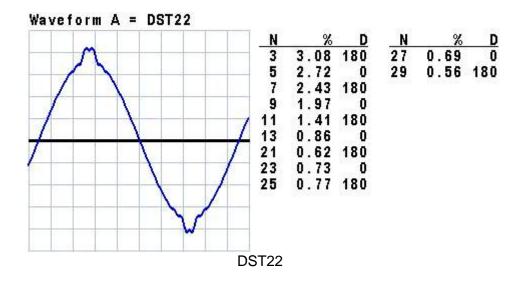


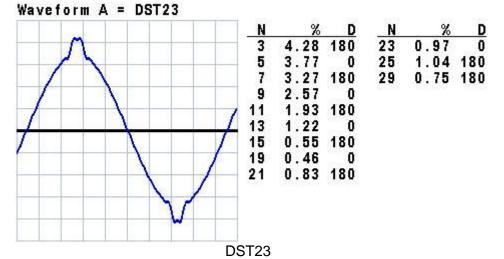


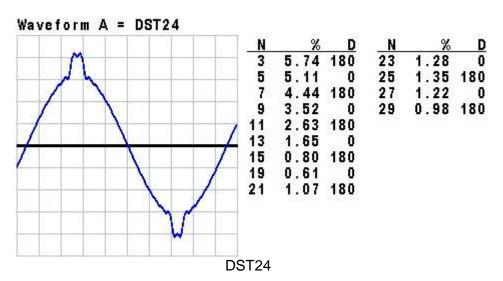




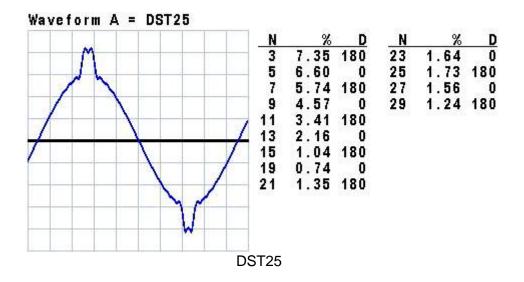


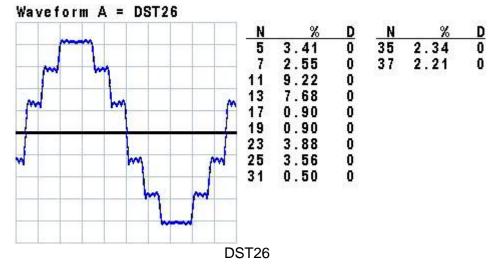


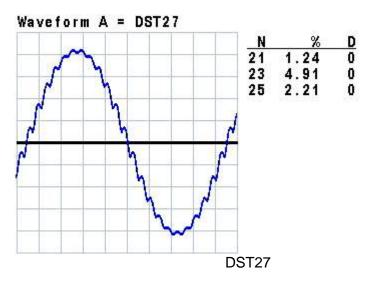




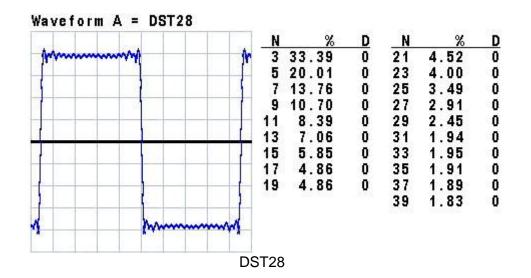
B-8

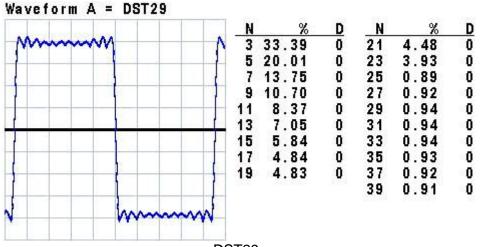




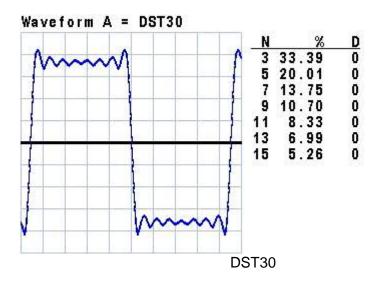


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