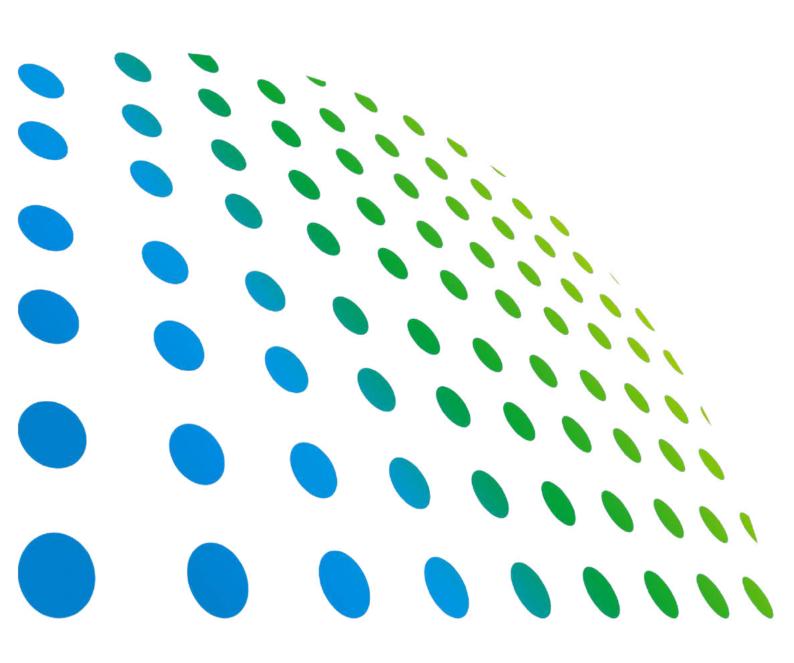
Chroma

Regenerative Grid Simulator 61830/61845/61860 User's Manual





Distributed by:

Get more information by downloading Chroma ATE Solutions APP





Regenerative Grid Simulator 61830/61845/61860 User's Manual

Chroma			
		3 	

Version 1.7 April 2020

Legal Notices

The information in this document is subject to change without notice.

Chroma ATE INC. makes no warranty of any kind with regard to this manual, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Chroma ATE INC. shall not be held liable for errors contained herein or direct, indirect, special, incidental or consequential damages in connection with the furnishing, performance, or use of this material.

CHROMA ATE INC.

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

Copyright Notices. Copyright 2013 Chroma ATE INC., all rights reserved. Reproduction, adaptation, or translation of this document without prior written permission is prohibited, except as allowed under the copyright laws.

Warranty

All of Chroma's instruments are warranted against defects in material and workmanship for a period of one year from date of shipment. Chroma agrees to repair or replace any assembly or component found to be defective, under normal use during this period. Chroma's obligation under this warranty is limited solely to repairing any such instrument, which in Chroma's sole opinion proves to be defective within the scope of the warranty when returned to the factory or to an authorized service center. Purchaser is responsible for the shipping and cost of the service item to Chroma factory or service center. Shipment should not be made without prior authorization by Chroma.

This warranty does not apply to any products repaired or altered by persons not authorized by Chroma, or not in accordance with instructions furnished by Chroma. If the instrument is defective as a result of misuse, improper repair, or abnormal conditions or operations, repairs will be billed at cost.

Chroma assumes no responsibility for its product being used in a hazardous or dangerous manner either alone or in conjunction with other equipment. High voltage used in some instruments may be dangerous if misused. Special disclaimers apply to these instruments. Chroma assumes no liability for secondary charges or consequential damages and in any event, Chroma's liability for breach of warranty under any contract or otherwise, shall not exceed the purchase price of the specific instrument shipped and against which a claim is made.

Any recommendations made by Chroma regarding the use of its products are based upon tests believed to be reliable; Chroma makes no warranty of the results to be obtained. This warranty is in lieu of all other warranties, expressed or implied, and no representative or person is authorized to represent or assume for Chroma any liability in connection with the sale of our products other than set forth herein.

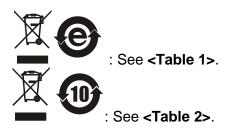
CHROMA ATE INC.

66 Huaya 1st Road, Guishan, Taoyuan 33383, Taiwan Tel: 886-3-327-9999 Fax: 886-3-327-8898 e-mail: info@chromaate.com

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 ⁶⁺	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>

	Hazardous Substances					
Part Name	Lead	Mercury	Cadmium	Hexavalent Chromium		Selected Phthalates Group
	Dh	Цa	Cd	Cr ⁶⁺		
	Pb	Hg	Ca	Ur	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.



www.chromaate.com

Declaration of Conformity

For the following equipment :

Regenerative Grid Simulator

(Product Name/ Trade Name)

61860, 61845, 61830, 61860HV, 61845HV, 61830HV

(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 61326-2-2:2013

CISPR11:2009+A1:2010, Group1, Class A, EN 61000-3-12:2011, EN 61000-3-11:2000,

IEC 61000-4-2:2008 ED2.0, IEC 61000-4-3:2010 ED3.2, IEC 61000-4-4:2012 ED3.0,

IEC 61000-4-5:2005 ED2.0, IEC 61000-4-6:2013 ED4.0, IEC 61000-4-8:2009 ED2.0,

IEC 61000-4-11:2004 ED2.0

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 1st Road, Guishan, Taoyuan 33383, Taiwan

(Company Address)

Person responsible for this declaration:

Mr. Vincent Wu

(Name, Surname)

T&M BU Vice President

(Position/Title)

Taiwan	2017.02.21	Vinat 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.

~]=	BEFORE APPLYING POWER Verify that the power is set to match the rated input of this power supply.
	PROTECTIVE GROUNDING Make sure to connect the protective grounding to prevent an electric shock before turning on the power.
	NECESSITY OF PROTECTIVE GROUNDING 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.
	FUSES 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.
	DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE Do not operate the instrument in the presence of flammable gases or fumes. The instrument should be used in an environment of good ventilation.
	DO NOT REMOVE THE COVER OF THE INSTRUMENT 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	DO NOT MOVE THE EQUIPMENT ON SLOPE PAVEMENT 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.
	DO NOT MOVE THE EQUIPMENT ON BUMPY PAVEMENT 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.
AWARNING	 Lethal voltage, the output is up to 426V peak voltage. If the output terminal and circuit are connected to output when the power is on, it could cause death if touches it. 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). The load bearing of each foot pad is about 250kg. Considering the floor structure, it is suggested to use an iron plate of 350mm/350mm/10t to disperse the pressure.

Safety Symbols

<u>A</u>	DANGER – High voltage.
\triangle	Explanation: To avoid injury, death of personnel, or damage to the instrument, the operator must refer to an explanation in the instruction manual.
	High temperature: This symbol indicates the temperature is now higher than the acceptable range of human. Do not touch it to avoid any personal injury.
	Protective grounding terminal: 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.
<u> </u>	Functional grounding: 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.
\rightarrow	Frame or chassis: To identify a frame or chassis terminal.
\sim	Alternating Current (AC)
\sim	Direct Current (DC) / Alternating Current (AC)
	Direct Current (DC)
л По	Push-on/Push-off power switch
	The WARNING 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 WARNING sign until the indicated conditions are fully understood and met.
CAUTION	The CAUTION 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 Notice 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
Nov. 2013	1.0	Complete this manual.
Sep. 2014	1.1	Replace the screen figures in the manual.
		Add a new "Parallel Operation" chapter.
		Modify the commands in "Commands of Regenerative Grid Simulator"
		section in "Remote Operation" chapter.
Apr. 2015	1.2	Replace the screen figures in the manual.
		Modify the following sections:
		 "Specification" in "Overview" chapter.
		 "MAIN PAGE (for Output Setting and Measurement)", "CONFIG
		Function Key" and "Protection" in "Local Operation" chapter.
		 "Introduction" in "Calibration" chapter.
		 "List Mode" and "Pulse Mode" in "Application" chapter.
		 "Commands of Regenerative Grid Simulator" in "Remote
		Operation" chapter.
Nov. 2015	1.3	Add a new model 61830 and its specifications.
Oct. 2016	1.4	Update CE "Declaration of Conformity".
Apr. 2017	1.5	Update "Material Contents Declaraction".
		Update CE "Declaration of Conformity".
	4.0	Add cables connection for paralleling five units and the specifications.
Jan. 2018	1.6	Update "Protection" section in "Local Operation" chapter.
		Update ACL mode and its functions descriptions as option.
		Add "Load Mode" chapter and ACL subsystem related description in
Apr 2020	17	"Instrument Command Dictionary" section.
Apr. 2020	1.7	Modify the following: "Specification" and "Rear Panel" in "Overview" chapter
		 Specification and Near Parel in Overview chapter "Connecting Remote Sense" in "Installation" chapter
		 "Parallel/Series (Optional) Operation" chapter
		 "Instrument Command Dictionary" and "Command Summary" in
		"Remote Operation" chapter
		Add
		 Moving and cleaning description
		 "Series Connection for Regenerative Grid Simulators (Optional)"
		and "Signal Cable Connection for Series Mode (Optional)" to
		"Parallel/Series (Optional) Operation" chapter

"Parallel/Series (Optional) Operation" chapter

Table of Contents

1.		Overview	
	1.1	Introduction	
	1.2	Feature	
	1.3	Specification.	
	1.4	Function Keys	
	1.4.1 1.4.2		-
	1.4.2	Rear Panel	1-10
2.		Installation	. 2-1
	2.1	Initial Inspection	. 2-1
	2.2	Precautions before Use	. 2-1
	2.3	Input Power Specification	. 2-1
	2.3.1		
	2.3.2		
	2.4	Output Connection	
	2.5	Connecting Remote Sense	
	2.6	Power-On Procedure	
	2.7	Maintenance and Cleaning	
	2.8	Common Environment Conditions	. 2-7
3.		Local Operation	. 3-1
•	3.1		
	3.2	Using Keyboard and RPG	
	3.3	MAIN PAGE (for Output Setting and Measurement)	
	3.3.1		
	3.3.2	•	
	3.3.3	Waveform Viewer	3-18
	3.3.4	Limitation	3-19
	3.4	CONFIG Function Key	3-22
	3.4.1	Interface	3-23
	3.4.2		
	3.4.3	-1 -7	
	3.4.4		
	3.4.5		
	3.4.6		
	3.4.7		
	3.4.8		
	3.4.9		
	3.5	PHASE Function Key	
	3.5.1	3_Phase Mode	
	3.5.2 3.6	—	
	3.0 3.7	CURSOR Function Key	
	3.8	OUTPUT Function Key	
	3.0 3.9	LOCAL/REMOTE Function Key	
	3.9 3.10	SAVE/RECALL Function Key	
	3.10		
	3.10.		
	3.11	Protection	
_			
4.		Calibration	
	4.1	Introduction	. 4-1

	4.2	Manual Calibration Function	. 4-2
	4.2.1	Calibrating Output Voltage and Voltage Measurement	. 4-3
	4.2.2		
	4.2.3	0	
	4.3	Adjusting Response Speed	4-15
5.		Application	5-1
5.		Overview	
		List Mode	
	-	Pulse Mode	
		Step Mode	
		Synthesis Waveform	
		Inter-harmonics Waveform	
		Harmonic Waveform	
6.		Parallel/Series (Optional) Operation	6.1
0.		Parallel Connection for Regenerative Grid Simulator	
	6.1.1	Connecting Two Parallel Units for Output	
	6.1.2	0	
	6.1.3	Connecting Three Parallel Units for Output	
	6.1.4	Connecting Three Parallel Units for Input	
	6.1.5	Connecting Four or Five Parallel Units for Output	
	6.1.6		
		Series Connection for Regenerative Grid Simulators (Optional)	
	6.2.1	Connecting Two Simulators at Output in Series	. 6-4
	6.3	Cables Connection for Parallel Signal	
	6.3.1	Cables Connection for Paralleling Two Units	. 6-6
	6.3.2		. 6-6
	6.3.3		. 6-7
	6.3.4	U	
		Signal Cable Connection for Series Mode (Optional)	
	6.4.1	Connecting Cable for Two Units	
		Setting	
	6.5.1	Setting Regenerative Grid Simulator to Slave	
	6.5.2		
		Troubleshooting	. 6-9
	6.6.1	When the Connecting Cable is Off	. 6-9
7.		AC Load Mode (Option)	. 7-1
		Switching to Load Mode	
	7.2	Load Function Interface	. 7-1
	7.2.1	CC Rectifier Mode	
	7.2.2		
	7.2.3		
	7.2.4	5	
	7.2.5	CP Lead/Lag Mode	. 7-3
8.		Remote Operation	. 8-1
	8.1	Introduction	. 8-1
	8.1.1	USB Interface	. 8-1
	8.1.2		
	8.1.3	RS-232C Interface	
	8.1.4	Ethernet Interface	
		Introduction to Programming	
	8.2.1	Conventions	
	8.2.2	Numerical Data Formats	. 8-3

8.2.3	Boolean Data Format	
8.2.4	Character Data Format	
8.2.5	Basic Definition	
8.3	Traversal of the Command Tree	
8.4	Commands of Regenerative Grid Simulator	
8.4.1	Common Command Dictionary	
8.4.2	Instrument Command Dictionary	
8.5	Command Summary	8-36
Appendix A	TTL Signal Pin Assignments	A-1
Appendix B	Built-in DST Waveform	B-1

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
- Parallel mode support for high power output (valid for 3-phase only)

1.3 Specification

The following table lists the specification of Chroma 61830/61845/61860 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	61830	61845	61860
	AC Ou	Itput Rating	
1-Phase Power	30kVA	45kVA	60kVA
3-Phase Total Power	30kVA	45kVA	60kVA
Power per Phase	10kVA	15kVA	20kVA
-	V	oltage	
Output Voltage		0~300V _{LN}	
		Option-HV:0~400V _{LN}	
Accuracy ^{*1}		0.1%+0.2%F.S.	
Resolution		0.1 V	
Distortion *1*2	< 0.5% @50/60Hz < 0.8% @30Hz~100Hz (Option-HV up to 150Hz)	< 0.5% @50/60Hz < 0.8% @30Hz~100Hz (Option-HV up to 150Hz)	< 0.5% @50/60Hz < 0.8% @30Hz~100Hz (Option-HV up to 150Hz)
Line Regulation		0.10%	
Load Regulation ^{*3}		0.20%	
	Maximum C	urrent (1-Phase) ^{*4}	
Output Current (RMS)	150A	225A	300A
Output Current (Peak)	450A	675A	900A
	Maximum Current	t (3-Phase/per phase) ^{*5}	
Output Current (RMS)	50A	75A	100A
Output Current (Peak)	150A	225A	300A
	Fre	equency	
Range	C	DC, 30Hz ~ 100Hz Option-HV: DC, 30~150H	7
Accuracy ^{*1}	0.01%F.S	0.01% F.S	0.01% F.S
Resolution	0.01Hz	0.01Hz	0.01HZ
	DC Output F	Rating (1-Phase) ^{*4}	
Power	15kW	22.5kW	30kW
Voltage ^{*6}	424V	424V	424V
_	Option-HV:565V	Option-HV:565V	Option-HV:565V
Current	75A	112.5A	150A
Bower		(3-Phase/per phase) ^{*7}	104/
Power	5kW 424V	7.5kW 424V	10kW 424V
Voltage ^{*6}	424 v Option-HV:565V	Option-HV:565V	424V Option-HV:565V
Current	25A	37.5A	50A
		cycling Function	
Current Harmonic Distortion ^{*8}	10%(Typical)	7%(Typical)	5%(Typical)
Power Factor		0.97 (Typical)	
	Input 3-Phase	Rating (Each Phase)	
Voltage Range ^{*9}		3Ø 200-220V±10%V _{LL} 3Ø 380-400V±10%V _{LL}	
Froquency Benga		3Ø 440-480V±10%V _{LL} 47-63 Hz	
Frequency Range Maximum Current	125A Max./Phase	47-63 HZ 190A Max./Phase	250A Max./Phase
	1207 111036	1307 Max./11038	2007 Wax./F11058

Model	61830	61845	61860			
	(3Ø200-220V±10%V _{LL})	(3Ø 200-220V±10%V _{LL})	(3Ø 200-220V±10%V _{LL})			
	68A Max./Phase	100A Max./Phase	130A Max./Phase			
	(3Ø 380-400V±10%V _{LL})	(3Ø 380-400V±10%V _{LL})	(3Ø 380-400V±10%V _{LL})			
	60A Max./Phase	87A Max./Phase	115A Max./Phase			
	(3Ø 440-480V±10%V _{LL})	(3Ø 440-480V±10%V _{LL})	(3Ø 440-480V±10%V _{LL})			
Power Factor		0.99 (Typical)				
		surement				
	V	/oltage				
Range		0~300V _{LN}				
Range		Option-HV:0~400V _{LN}				
Accuracy		0.1%+0.2%F.S.				
Resolution		0.01 V				
	Current ^{*1}	⁰ (Each Phase)				
Range	150A	225A	300A			
Accuracy (RMS)	Accuracy (RMS) 0.4%+0.3%F.S.					
Accuracy (Peak)		0.4%+0.6%F.S.				
Resolution ^{*12}		0.01 A				
		Power				
Accuracy		0.4%+0.4% F.S.				
Resolution		0.1 W				
	(Others				
Efficiency ^{*13}		80%(Typical)				
Dimension	780 x 1000 x 1740 mm	780 x 1000 x 1740 mm	780 x 1000 x 1740 mm			
(W×D×H)	30.70×39.37×68.50 in.	30.70×39.37×68.50 in.	30.70×39.37×68.50 in.			
Weight	840kg / 1850 lbs	840kg / 1850 lbs	860kg / 1896 lbs			
Protection	0	OVP, OCP, OPP, OTP, FAN				
Remote Interface						
	Temperature Range					
Operating	0°C to 40°C					
Storage		-40°C to 85°C				
Humidity ^{*14}	0% to 95%					
Safety & EMC		CE				

Regenerative AC Load (ACL Option)

Model	61830	61845	61860	
	Loading Current (Each Phase)			
Current	50A	75A	100A	
Max. Current	150A _{peak}	225A _{peak}	300A _{peak}	
	Operat	ting Voltage		
Range 50~300V _{LN} Option-HV: 50~400V _{LN}				
Max. Voltage 424V _{peak} Option-HV: 566V _{peak}				
	Operatii	ng Frequency		
Range	30Hz ~ 100Hz			
Accuracy	0.01%			
Resolution	0.1Hz			

Constant Current Rectifier Mode (Each Phase)				
Current Range				
	0.3% + 0.5%F.S.	0.3% + 0.5%F.S.	0.3% + 0.5%F.S.	
	(above 2A)	(above 2A)	(above 2A)	
Accuracy	Option-HV: 0.3% +	Option-HV: 0.3% +	Option-HV: 0.3% +	
	0.7%F.S.	0.7%F.S.	0.7%F.S.	
	(above 2A)	(above 2A)	(above 2A)	
Resolution	0.1A	0.1A	0.1A	
Crest Factor Range	1.414~3.0	1.414~3.0	1.414~3.0	
Crest Factor Resolution	0.001	0.001	0.001	
	Constant Power Re	ctifier Mode (Each Phas	se)	
Power Range	0~10kW	0~15kW	0~20kW	
	0.3% + 0.6%F.S.	0.3% + 0.6%F.S.	0.3% + 0.6%F.S.	
	(above 200W)	(above 200W)	(above 200W)	
Accuracy	Option-HV: 0.3% +	Option-HV: 0.3% +	Option-HV: 0.3% +	
	0.7%F.S.	0.7%F.S.	0.7%F.S.	
	(above 200W)	(above 200W)	(above 200W)	
Resolution	10W	10W	10W	
Crest Factor Range	1.414~3.0	1.414~3.0	1.414~3.0	
Crest Factor	0.001	0.001	0.001	
Resolution	0.001	0.001	0.001	
	Constant Current Phase	e Change Mode (Each F	hase)	
Current Range	0~50A	0~75A	0~100A	
	0.3% + 0.5%F.S.	0.3% + 0.5%F.S.	0.3% + 0.5%F.S.	
	(above 2A)	(above 2A)	(above 2A)	
Accuracy	Option-HV: 0.3% +	Option-HV: 0.3% +	Option-HV: 0.3% +	
	0.7%F.S.	0.7%F.S.	0.7%F.S.	
	(above 2A)	(above 2A)	(above 2A)	
Resolution	0.1A	0.1A	0.1A	
	-45deg ~ 0deg &	-45deg ~ 0deg &	-45deg ~ 0deg &	
	+45deg ~ 0deg	+45deg ~ 0deg	+45deg ~ 0deg	
Phase Range	(current source mode	(current source mode	(current source mode	
i naco i tango	+135deg ~ +180deg	+135deg ~ +180deg	+135deg ~ +180deg	
	& -135deg ~ -180deg)	& -135deg ~ -180deg)	& -135deg ~ -180deg)	
*40	0.6%F.S.(30~70Hz)	0.6%F.S.(30~70Hz)	0.6%F.S.(30~70Hz)	
Accuracy *16	1.0%F.S.(71Hz~100Hz)	· · · · · · · · · · · · · · · · · · ·	1.0%F.S.(71Hz~100Hz)	
Resolution	0.1deg	0.1deg	0.1deg	
	<u> </u>	<u> </u>		
Power Range	Constant Power Phase Change Mode (Each Phase) Power Range 0~10kW 0~15kW 0~20kW			
	0.3% + 0.6%F.S.	0.3% + 0.6%F.S.	0.3% + 0.6%F.S.	
	(above 200W)	(above 200W)	(above 200W)	
Accuracy	Option-HV: 0.3% +	Option-HV: 0.3% +	(above 2000) Option-HV: 0.3% +	
Accuracy	0.7%F.S.	0.7%F.S.	0.7%F.S.	
Decolution	(above 200W)	(above 200W)	(above 200W)	
Resolution	10W	10W	10W	
	-90deg ~ +90deg	-90deg ~ +90deg	-90deg ~ +90deg	
Phase Range	(current mode	(current mode	(current mode	
	+90.1deg ~ +180deg	+90.1deg ~ +180deg	+90.1deg ~ +180deg	
	& -90.1deg ~ -180deg)	& -90.1deg ~ -180deg)	& -90.1deg ~ -180deg)	

Accuracy *16	0.6%F.S.(30~60Hz)	0.6%F.S.(30~60Hz)	0.6%F.S.(30~60Hz)
Accuracy	0.8%F.S.(61Hz~100Hz)	0.8%F.S.(61Hz~100Hz)	0.8%F.S.(61Hz~100Hz)
Resolution	0.1deg	0.1deg	0.1deg
	Constant Rsistar	nce Mode (Each Phase)	
Range	1~300ohm	1~300ohm	1~300ohm
	Convert to current value	Convert to current value	Convert to current value
	0.3% + 0.7%F.S.	0.3% + 0.7%F.S.	0.3% + 0.7%F.S.
Δοουτοον	(above 2A)	(above 2A)	(above 2A)
Accuracy	Option-HV: 0.3% +	Option-HV: 0.3% +	Option-HV: 0.3% +
	0.9%F.S.	0.9%F.S.	0.9%F.S.
	(above 2A)	(above 2A)	(above 2A)
Resolution	0.1ohm	0.1ohm	0.1ohm
Current Harmonic	<3% (Full load at	<3% (Full load at	<3% (Full load at
	250V/50Hz/sinewave)	250V/50Hz/sinewave)	250V/50Hz/sinewave)

120kVA 800VLN Series High Voltage Function (XHV Option)

AC Output Rating			
3-Phase Total	120kVA		
Power			
Power per Phase	40KVA		
	Voltage		
Output Voltage	0~800V _{LN}		
Accuracy ^{*1}	0.1%+0.2%F.S.		
Resolution	0.1 V		
Distortion *1*2	< 0.8% @50/60Hz < 1.0% @30Hz~150Hz		
Line Regulation	0.10%		
Load Regulation ^{*3}	0.20%		
	Maximum Current (3-Phase/per phase) ^{*5}		
Output Current (RMS)	100A		
Output Current (Peak)	300A		
	Frequency		
Range	DC, 30Hz ~ 150Hz		
Accuracy ^{*1}	0.01% F.S.		
Resolution	0.01Hz		
	DC Output Rating (3-Phase/per phase) *7		
Power	20kW		
Voltage ^{*6}	1131V		
Current	50A		
Energy Recycling Function			
Current Harmonic Distortion ^{*8}	5%(Typical)		
Power Factor	0.97 (Typical)		
	Input 3-Phase Rating (Each Phase)		
	3Ø 200-220V±10%VLL		
Voltage Range ^{*9}	3Ø 380-400V±10%V _{LL}		
	3Ø 440-480V±10%V _{LL}		

Frequency Range	47-63 Hz	
	250A Max./Phase (3Ø 200-220V±10%V _{LL})130A Max./Phase (3Ø	
Maximum Current	380-400V±10%V _{LL})	
	115A Max./Phase (3Ø 440-480V±10%V _{LL})	
Power Factor	0.99 (Typical)	
	Measurement	
	Voltage	
Range	0~800V _{LN}	
Accuracy	0.1%+0.2%F.S.	
Resolution	0.01 V	
	Current ¹⁰ (Each phase)	
Range	300A	
Accuracy (RMS)	0.4%+0.3%F.S.	
Accuracy (Peak)	0.4%+0.6%F.S.	
Resolution ^{*12}	Resolution ^{*12} 0.01 A	
	Power	
Accuracy	0.4%+0.4% F.S.	
Resolution	0.1 W	
	Others	
Efficiency ^{*13}	80%(Typical)	
Dimension	1700 x 1000 x 1740 mm62.99×39.37×68.50 in.	
(W×D×H)	1700 X 1000 X 1740 1111102.39×39.37×08.30 11.	
Weight	1740kg / 3836 lbs	
Protection	OVP, OCP, OPP, OTP, FAN	
Remote Interface	GPIB, RS-232, USB, Ethernet	
Temperature Range		
Operating	0°C to 40°C	
Storage	-40°C to 85°C	
Humidity ^{*14}	0% to 95%	
Safety & EMC	CE	

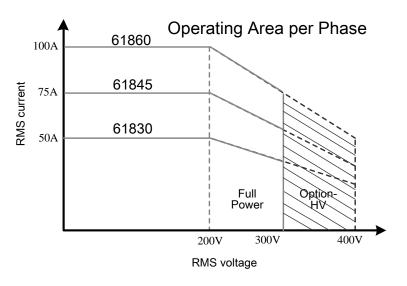
Note *1: The accuracy of voltage, frequency and maximum distortion tests use Power Analyzer Line Filter=50kHz and Update rate=250ms to measure the linear load. The referenced instrument is Model: YOKOGAWA WT3000.

- *2: The maximum distortion test is the maximum output power to linear load when the output voltage is set to 250VAC. In parallel mode the specification requires to increase 0.03xN% where N is the paralleled device number. Ex. The maximum distortion is (0.5+0.03x5)%=0.65% when 5 sets of model 61860 are paralleled under 50/60Hz.
- *3: The load regulation condition is to set the sine wave output.
- *4: Multiple devices parallel mode do not support single phase.
- *5: In parallel mode the maximum current is N times of the standalone device's maximum current. Ex. The output current (RMS) of 5 paralleled 61860 is 100x5=500A and the output current peak is 1500A.
- *6: The purpose of DC voltage output is to set the DC-bias for AC+DC.
- *7: In parallel mode the DC output rating (every phase in 3-phase mode) is N times of the standalone device. Ex. The DC output current of 5 paralleled 61860 is 50x5=250A.
- *8: The current harmonic distortion in Energy Recycling Mode is at 3Ø
- 400V_{LL}@50Hz input voltage.

- *9: If an extra breaker is required for wiring, the input specification 3Ø
- 200-220V±10%V_{LL} must use the breaker larger than 250A (the operating characteristics must be 8 times the rated current and the action time is 10ms), for the input specification 3Ø 380-400V±10% V_{LL} and 3Ø 440-480V±10%V_{LL}, the breaker larger than 150A should be used (the operating characteristics must be 15 times the rated current and the action time is 10ms). The referenced device models:

EW250EAG-3P200K,FUJI@380-400 V_{LL}/440-480 V_{LL},

- EW250EAG-3P250K,FUJI@200-220 VLL
- *10: In parallel mode the measurement specification such as current and power need to refer to * 5 multiplied by the number of paralleled.
- *11: The parallel mode not only measures the accuracy (RMS), the accuracy (Peak) needs to add the correction value of paralleled device, for instance when the accuracy (RMS) is 0.4%+0.3%F.S, the accuracy (Peak) must be >N Amp with output voltage and frequency set at 250VAC and 60Hz respectively to meet the specification. (N is the number of paralleled device.)
- *12: 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.
- *13: The test efficiency is the maximum output power to linear load when the output voltage sets to 250VAC.
- *15: See the voltage/current operating diagram below for the Regenerative Grid Simulator's output capability.
- *16: It tests the phase change mode accuracy at 200VAC input voltage and 100A loading current.
 - F.S.= 360 degree.
- *17: The optional HV only supports the slave model that has the same HV function when using in parallel mode. When in regenerative AC load mode, same power models are required for parallel mode, while two units of the same power are required when applying to series high voltage mode.



Voltage/Current Operating Range

1.4 Function Keys

1.4.1 Front Panel

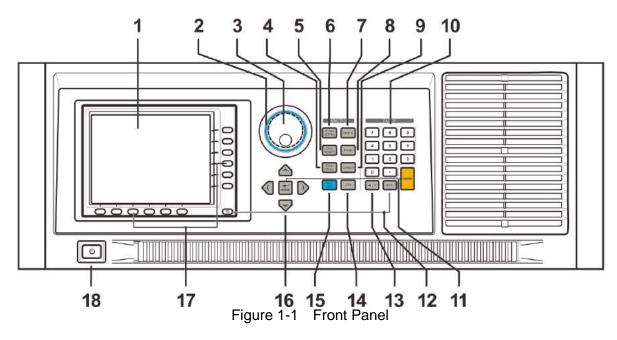


Table 1-1 Front Panel Description

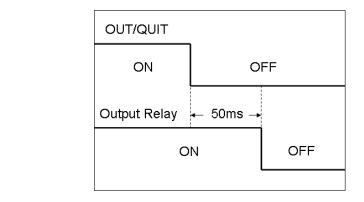
Item	Symbol	Description	
1		<i>Display screen:</i> 6.5 inch LCD to display the input/output settings and measured result.	
2	\bigcirc	<i>Display LED</i> : It surrounds the rotary know and indicates the device is on when the light is on.	
3	\bigcirc	RPG rotary knob: It allows the user to turn the RPG rotary know to adjust the voltage, frequency and input the programmed data or selection.	
4	SAVE / RECALL	SAVE or RECALL key: Press this key on the MAIN PAGE can save/recall the output setting (see also 3.10.1) as well as the system data (see also 3.10.2.)	
5	LOCAL / REMOTE	LOCAL/REMOTE key: It switches to the control mode to "LOCAL" or "REMOTE".	
6	OUTPUT SETTING	OUTPUT SETTING key: It skips to "Output: More Setting" for various functions settings.	
7	CONFIG	CONFIG key: It skips to "CONFIG PAGE" for various functions settings.	

		
8	PHASE	PHASE key: It sets the phase to single or 3-phase.
9	CURSOR	<i>CURSOR key:</i> It shows the cursor to set or adjust the value.
10	() () () () () () () () () () () () () (<i>Numeric and decimal keys:</i> The numeric and decimal keys are for the user to input the digital data.
11	ENTER	ENTER <i>key:</i> It confirms the setting of parameter.
12	EXIT	<i>EXIT key:</i> It returns to the previous menu.
13	(+ / -)	Backspace and decrease key: Press this key to erase the inputted number. Input minus "-", if there is no number before the cursor.
14	LOCK	LOCK key: Press it for 1 second to lock all keys and the knob. Press it again for 3~4 seconds to unlock it.
15		<i>OUT/QUIT key:</i> Press this key can output the AC power or stop output voltage.
16		<i>Cursor movement keys:</i> These four movement keys move the cursor to different direction. In normal mode, press any of it will change the cursor position.
17	\bigcirc	<i>Indication key:</i> It sets the parameter or function following the description on the screen.
18	Ċ	<i>Main power switch</i> : It powers on or off the Regenerative Grid Simulator.

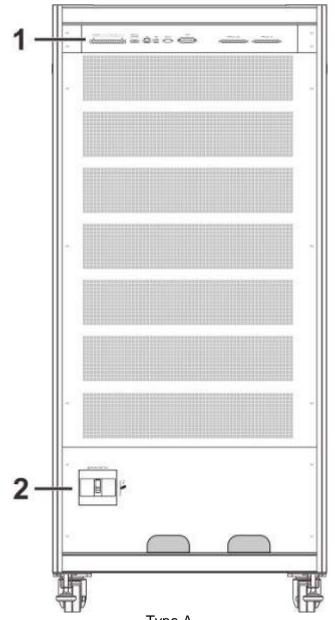
Notice

i

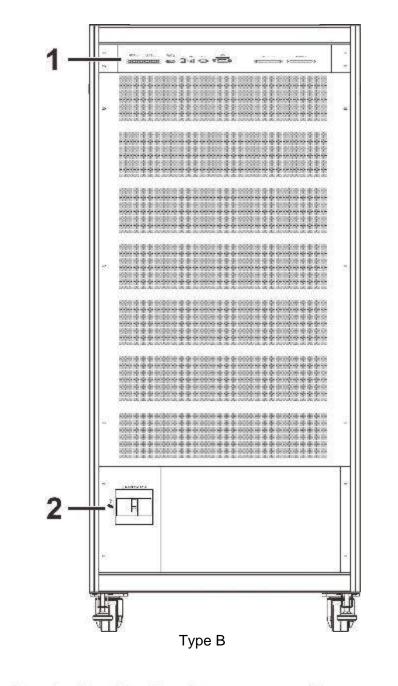
To extend the usage of output relay, it will delay 50ms for release when **QUIT** is pressed. If the load connected is inductive load, it will provide a discharge route for inductor current during the delay time due to the characteristics of Inductor current freewheeling.

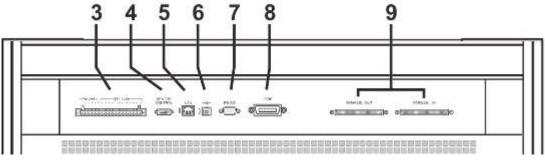


1.4.2 Rear Panel

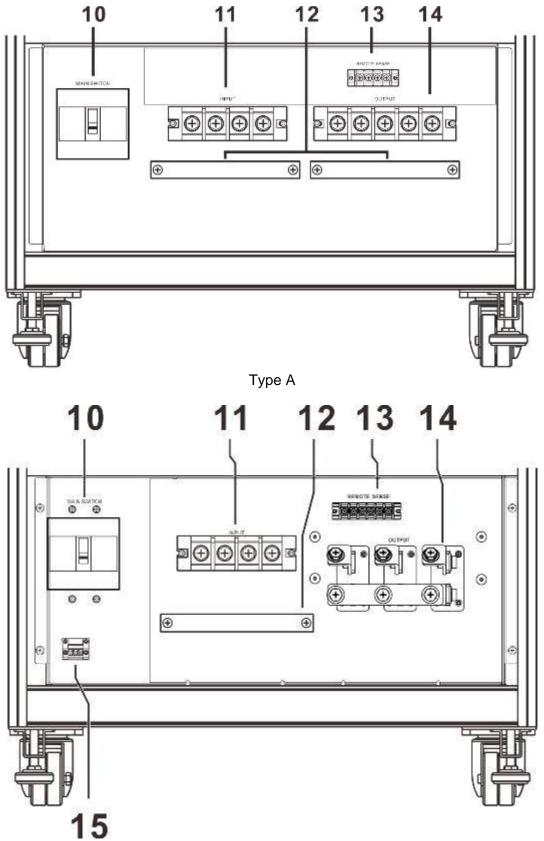


Туре А





1-11



Type B Figure 1-2 Rear Panel

		Table 1-2 Rear Panel Description	
Item	Symbol	Description	
1	Rear Panel Control Interface	It contains Ext.Vref/TTL signal connector, remote control, GPIB, USB and RS-232 ports.	
2	Input/Output Cable Connector (Safe casing)	Its internal has 3-phase power input and output terminal, the mains connector (3-phase) to the power input terminal, the power output connector to UUT and input no-fuse leakage breaker.	
3	Ext. Vref./TTL I/O	The Ext.Vref port inputs analog signals to control the output waveform amplitude and the TTL I/O terminal to transmit the I/O control signal (Fault_out, Remote Inhibit & AC_ON.)	
4	Remote Control	It is a remote control port that can control the Regenerative Grid Simulator via an optional device.	
5	Ethernet	It is the network (LAN) control interface.	
6	USB	It is the USB control interface that can connect to the PC for remote operation.	
7	RS-232	It is a 9 pin D-type male connector for RS-232 interface that can connect to the PC for remote operation.	
8	GPIB Connector	It is the GPIB interface that can connect to the PC for remote operation.	
9	Parallel Signal Comm. Port	It is used to transmit the signal for Master/Slave parallel output.	
10	Input No-Fuse Leakage Breaker	This breaker provides leakage current protection. When the leakage current is bigger than the set vale, the breaker will activate protection.	
11	Power Input Terminal	This input terminal connects the mains 3-phase power.	
12	Input/Output Cable Fixing Bar	It fixes the 3-phase input/output connecting cable.	
13	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.)	
14	Power Output Terminal	It is a 3-phase output terminal that connects to the UUT.	
15	Trip Switch Control Terminal	The switch control power is tripped to this terminal.	

Table 1-2	Rear Panel Description



The type A and B of rear panels are both standard types where type B is applied to the models shipped after May 31, 2019.

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:

61830	61845	61860
125A Max./Phase	190A Max./Phase	250A Max./Phase
(3Ø 200-220V±10%V _{LL})	(3Ø 200-220V±10%V _{LL})	(3Ø 200-220V±10%V _{LL})
68A Max./Phase	100A Max./Phase	130A Max./Phase
(3Ø 380-400V±10%V _{LL})	(3Ø 380-400V±10%V _{LL})	(3Ø 380-400V±10%V _{LL})
60A Max./Phase	87A Max./Phase	115A Max./Phase
(3Ø 440-480V±10%V _{LL})	(3Ø 440-480V±10%V _{LL})	(3Ø 440-480V±10%V _{LL})

- 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 _□)	100mm ² (L1/L2/L3)	95-10(L1/L2/L3)
(3Ø 200-220V±10 %VLL)	10mm ² (GND)	10-10(GND)
(3Ø 380-400V±10%V ₁₁)	50mm ² (L1/L2/L3)	50-10(L1/L2/L3)
$(39300-4000\pm10\%V_{LL})$	10mm ² (GND)	10-10(GND)
(3Ø 440-480V±10%V _{LL})	50mm ² (L1/L2/L3)	50-10(L1/L2/L3)
$(39440-4800\pm10\%V_{LL})$	10mm ² (GND)	10-10(GND)

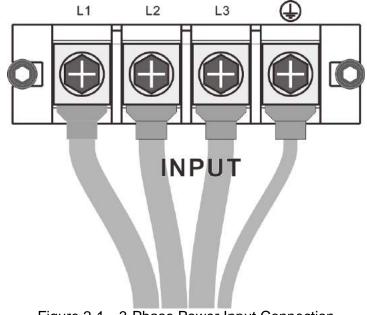


Figure 2-1 3-Phase Power Input Connection

Notice

- 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.

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 a fixing bar 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.



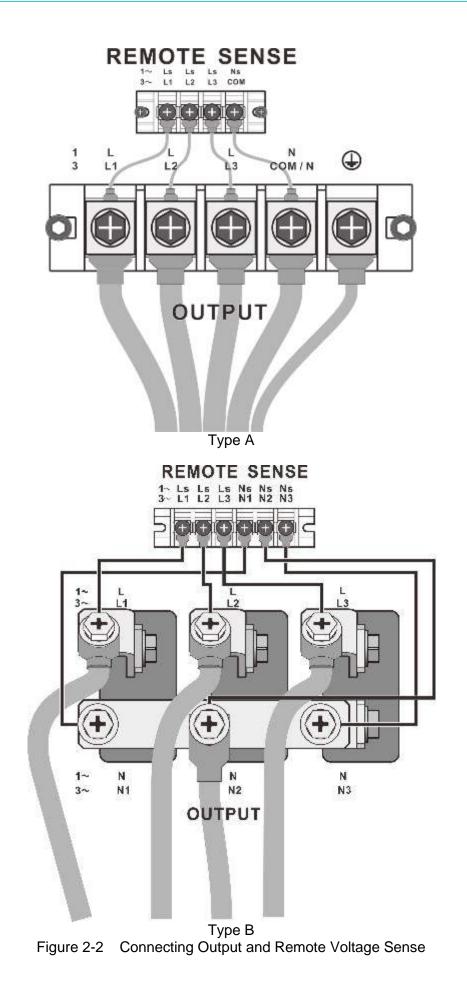
When DC voltage is contained in the output voltage, the output terminal "L" is "+" and "COM/N" is "-".

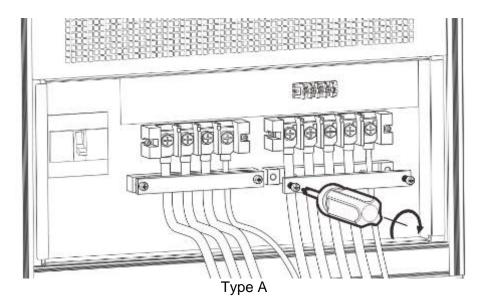
WARNING For the simulator to dissipate heat smoothly, it is necessary to keep at least 1 meter space for the device front and rear panel for ventilation. Do not place the device against the wall or any other objects.

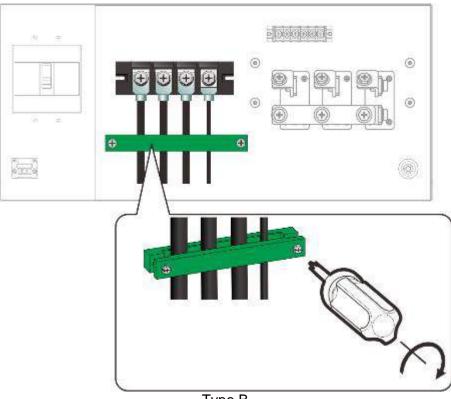
2.5 **Connecting Remote Sense**

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.







Type B Figure 2-3 Securing Input/Output Wiring



- When the output sets to single phase, the Remote Sense wire should connect to the output terminal of second phase.
- 2. The type A and B of rear panels are both standard types where type B is applied to the models shipped after May 31, 2019.

2.6 Power-On Procedure

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.



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			
	-		11505		SETTING		Sec. 1	001002040	Main			0.00	OUTPUT S	SETTING	and the second	i sectore i s	12	Main
ē1	Vac	=	0	<u>. 0</u> V	F =	-	60.	00Hz	OUTPUT:	Vac	=	0	<u>. 0</u> V F	=	60.	001	Ηz	OUTPUT:
2 2	Vac	=	0	. 0 V	F =	•	60.	00Hz	More Setting									More Setting
# 3	Vac	=	0	. 0 V	F =	=	60.	00Hz	Measurement									Measurement
				MEASU	REMENT				Setting				MEASUR	EMENT				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	Ι	=	0.	000	PF	=	0.0	000	Viewer
	٧	=	0	. 0 0	Po	=		0.0	1000000000	Vac	=	0	.00	Vdc	=	0	.00	
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
4 3	I	=	0.1	000	PF	=	0.	000	Mode	Ipk	=	0.	000	CF	=	0.1	000	Mode
	V12	=	0	. 0 0	V23		0	.00	Measurement									
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 , \blacklozenge , 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

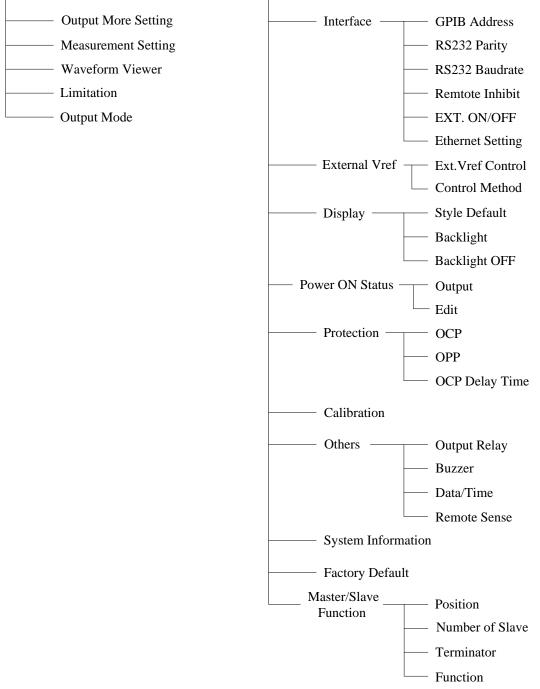


Figure 3-1

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
	$$ Vac \cdot Vdc(+) \cdot Vdc(-) \cdot F
Output mode	 List Mode Pulse Mode Step Mode Synthesize waveform Interharmonics waveform
Figure	Harmonic measurement
i igui	

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	LOCA	L QI	JIT			3	Pha	se		LOCAL	L Q	UIT		
			OUTPUT	SETTING			Main				1000	OUTPUT	SETTING	and and a second		Main
ē 1	Vac	=	<u>0.0</u> V	F =	60.	00Hz	OUTPUT:	€1	Vac	=	0	<u>. 0</u> 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	. 0 V	F =	60	.00Hz	Measurement
			MEASU	EMENT			Setting	MEASUREMENT							Setting	
	V	=	0.00	Po	=	0.0	Waveform		Vac	=	0	.00	Vdc	=	0.00	Waveform
₹1	I	=	0.000	PF	= 0.	000	Viewer	₹1	Iac	=	0.	000	Idc	= 0	.000	Viewer
	٧	=	0.00	Po	=	0.0	Limitation 72		Vac	=	0	.00	Vdc	=	0.00	Limitation
# 2	I	=	0.000	PF	= 0.	000		# 2	Iac	=	0.	000	Idc	= 0	.000	
	V	=	0.00	Po	=	0.0	Output		Vac	=	0	.00	Vdc	=	0.00	Output
# 3	I	=	0.000	PF	= 0.	000	Mode	# 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	=	0.00	Po	=	0.0	To Page2	Σ	V 31	=	0	. 0 0	VA	=	0.0	To Page3
	Recall CH1	Reca CH2		Recall CH4	Recall CH5	More 1 of 2	2014/12/17	1	Recall CH1	Rec		Recall CH3	Recall CH4	Recall CH5	More 1 of 2	2014/12/17

3	Pha	se	LOCA	L Q	UIT			1_Pha	se	LOCA	L Q	UIT			
	-		OUTPUT	SETTING	No. of Street, or Stre	0000000000	Main			OUTPUT	SETTING				Main
₹1	Vac	=	<u>0.0</u> V	F =	60.	00Hz	OUTPUT:	Vac	=	<u>0.0</u> V	F =	60.	00H	z	OUTPUT:
₹2	Vac	=	0.0V	F =	60.	00Hz	More Setting								More Setting
# 3	Vac	=	0.0V	F =	60.	00Hz	Measurement								Measurement
			MEASU	EMENT			Setting			MEASU	REMENT				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	=	0.0	00	Viewer
sel	Vpk	=	0.00	VA	=	0.0	1.000	Vac	=	0.00	Vdc	=	0.	00	220224
# 2	Ipk	=	0.000	CF	= 0.	000	Limitation	Iac	=	0.000	Idc	=	0.0	00	Limitation
	Vpk	=	0.00	VA	=	0.0	Output	Vpk	=	0.00	VA	=	0	. 0	Output
# 3	Ipk	=	0.000	CF	= 0.	000	Mode	Ipk	=	0.000	CF	=	0.0	00	Mode
Σ							Measurement To Page1								
1	Recall CH1	Rec		Recall CH4	Recall CH5	More 1 of 2	2014/12/17	Recall CH1	Reca		Recall CH4	Rec		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	1.	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
	2	protection (OVP) if it exceeds the voltage limit.

2. When switching to ACL mode (option), if the phase frequency of UUT voltage is having more than 1Hz error, the line voltage V_{12} , V_{23} and V_{31} measurement will not display.

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
	OUTPUT SETTING	Setting	OUTPUT SETTING Setting
€1	Vac = 0.0V F = 60.00Hz	OUTPUT:	Vac = 0.0V F = 60.00Hz
₫2	Vac = 0.0V F = 60.00Hz	More Setting	More Setting
₫3	Vac = 0.0V F = 60.00Hz	Measurement	Measurement
	MORE SETTING	Setting	MORE SETTING Setting
e 1	Waveform = A SINE	Waveform Viewer	Waveform = A SINE Viewer
# 2	Waveform = A SINE		SINC
# 3	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
	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	AC Setting Selection	2014/12/17 15:35:51	Coupling Output Waveform 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	Pha	se	300V	LOCAL	QUIT	
	101510	OUTPUT	T SETTING		Setting		100.0		OUTPUT	SETTING	and the second second	Setting
#1	Vac =	0.0V	F =	60.00Hz	OUTPUT:		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
		MORE	SETTING		Setting	MORE SETTING						Setting
±1	Waveform = #	Waveform Viewer	₹1	Waveform = A SINE					Waveform Viewer			
₩2	Waveform = A	Viewel	₫2	Wavefor								
**		INE			Limitation	**	Marrieday		SINE			Limitation
4 3	Waveform = A	INE	Charterton	₫3	Waveform = A SINE				Linitation			
	ON Degree = Vac S/R =		OFF Deg Vdc S/R	rec = 0.0 = 0.000V/ms	Output Mode		ON De Vac S/I	gree = } =	0.0 0.000V/ms	OFF Deg Vdc S/R		Output Mode
	F S/R =	0.000Hz/m	5				F 5/8		0.000Hz/ms			1
	Phase angle	1-2 = 120.0 Phase angle 1-3 = 240.0				Phase angle		1-2 = 120.0	Phase a	ngle 1-3 = 240.0		
(Coupling Ran AC 300		Output Waveform Selection		2014/08/23 13:34:58		oupling AC+DC	Ran 300		Output Waveform Selection		2014/08/23

3	Phas	e	300	٧	LOCAL		QU	IT	
			(UTPUT	SETTING				Setting
₽1	Vac =	0.0V	F		60.00Hz	Vdc	•	0.0V	OUTPUT:
₫2	Vac =	0.0V	F	=	60. 00 Hz	Vdc	-	0.0V	More Setting
9 3	Vac =	0.0V	F	-	60.00Hz	Vdc		0.0V	Measurement
				MORE	SETTING				Setting
± 1	Wavefor	10000	NE						Waveform Viewer
₹2	Wavefor		NE						Viewei
ē 3	Waveform		NE						Limitation
	ON Deg Vac S/R	-		0V/ms	Vdc	Degree S/R	-	0.0 0.000V/ms	Output Mode
	F S/R Phase ai	= ngle 1		0Hz/m 20.0	-	e angl	e 1-	3 = 240.0	
	oupling AC+DC	Range 300V	- F	hree hase etting	Output Waveford Selection				2014/08/23 13:35:48

Notice

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.

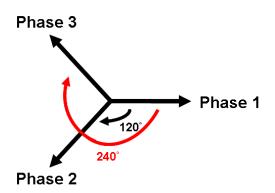
Edit: All, Each

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

3	Phase	LOCAL		QU	IT	
	am	OUTPUT :	SETT1	NG	WARTER CONTRACTOR	Setting
ē 1	Vac =	0.0V	F	=	60.00Hz	Edit
2	Vac =	0.0V	F	=	60.00Hz	Each
± 3	Vac =	0.0V	F	=	60.00Hz	Sequence
		MORE SI	TTIN	3		Positive
e 1	Waveform :	SINE				Three Phase Independ.
1 2	Waveform :	SINE				- Independ.
13	Waveform :	SINE				
	ON Degree Vac S/R	s = 0.0 = 0.000V/ms		F Degi ic S/R	cc = IMMED = 0.000V/ms	Phase re-lock Disable
	F S/R Phase angl	= 0.000Hz/ms le 1-2 = 120.0	Pł	iase ai	ngle 1-3 = 240.0	
C	oupling P	Three Output These Waveform etting 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
€1	Vac = 0.0V F = 60.00Hz	Edit	er Vac = 0.0V F = 60.00Hz Edit
₹2	Vac = 0.0V F = 60.00Hz	Each	∎2 Vac = 0.0V F = 60.00Hz Each
± 3	Vac = 0.0V F = 60.00Hz	Sequence	■3 Vac = 0.0V F = 60.00Hz Sequence
	MORE SETTING	Positive	MORE SETTING Negative
#1	Waveform = A SINE	Three Phases	Waveform = A SINE Three Phases Independ.
₹2	Waveform = A SINE	Thucpente.	Vaveform = A
# 3	Waveform = A SINE		Waveform = A #3 SINE
	ON Degree = 0.0 OFF Degree = IMMED Vac S/R = 0.000V/ms Vdc S/R = 0.000V/ms	Phase re-lock Disable	ON Degree = 0.0 OFF Degree = 1HHED Phase re-lock 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		F S/R = 0.000Hz/ms Phase angle 1–2 = 120.0 Phase angle 1–3 = 240.0
C	upling AC Setting Selection	2014/12/17 15:43:32	Coupling AC Setting Selection Selection

3	Pha	se		LOCAL		QU	IΤ		
	-		700	OUTPUT	SETTI	IG		11000 0000	Setting
#1	Vac	=	0	.0V	F	=	60.0	0Hz	Edit
2	Vac	=	0	. OV	F	=	60.0	OHz	Each
1 3	Vac	=	0	. OV	F	=	60.0	OHz	Sequence
				MORE S	ETTIN	3			Positive
F1	Wavefo	rm =	A SINE						Three Phase Independ.
₽ 2	Wavefo	rm =	A						Independ.
13	Wavefo	rm =	A						
	ON Der Vac S/I F S/I		= 0	0 000V/ms 000Hz/ms		F Degi c S/R	cc = 1MME = 0.	D 000V/ms	Phase re-lock Disable
	Phase :	angl	e 1-2 :	120.0	Pł	ase ar	ngle 1-3 =	240.0	
c	oupling AC	Ph	nce Iase Itting	Output Waveform Selection					2014/12/17 15:44:50

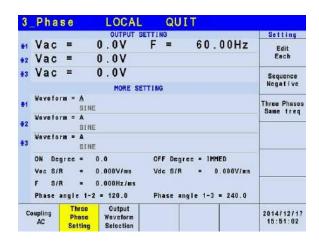
Three Phases: Independ., Same Freq, Balance

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.
- Use RPG to select "Same freq" and press ENTER.

3	Phase LOCAL	QUIT		3_Phase LOCAL QUIT	
	OUTPUT SET		Setting		etting
#1	Vac = 0.0V	F = 60.00Hz	Edit	🖬 Vac = 0.0V F = 60.00Hz	Edit
₹2	Vac = 0.0V	F = 60.00Hz	Each	∎2 Vac = 0.0V F = 60.00Hz	Each
₫3	Vac = 0.0V	F = 60.00Hz	Sequence	∎3 Vac = 0.0V F = 60.00Hz s	equence
	MORE SETT	ING	Positive	MORE SETTING	ositive
ē 1	Waveform = A SINE		Three Phases Independ.	SINE	Three Phases Same freq
₹2	Waveform = A SINE			Waveform = A SINE	
# 3	Waveform = A SINE			Waveform = A 53 SINE	
	ON Degree = 0.0 Vec S/R = 0.000V/ms	OFF Degree = IMMED Vdc S/R = 0.000V/ms	Phase re-lock Disable		Phase re-lock lisable
	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 Setting Selection		2014/12/17 15:44:50		14/12/17 5:46:35



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.
- 4. Use RPG to select "Line" and press ENTER.

3_Phase LOCAL QUIT		3_Phase LOCAL QUIT	
OUTPUT SETTING	Setting	OUTPUT SETTING	Setting
H Vac = 0.0V F = 60.00Hz	Edit	Balanced, Sequence:Negative, Voltage:Phase	Edit
•2 Vac = 0.0V	Each	Vac = 0.0V F = 60.00Hz	Each
#3 Vac = 0.0V	Sequence Negative		Sequence Negative
MORE SETTING		MORE SETTING	
Waveform = A SINE	Three Phases Balance	41 Waveform = A SINE	Three Phases Balance
Waveform = A		Waveform = A	
Waveform = A #3 SINE	-	Vaveform = A SINE	Voltage set Phase
ON Degree = 0.0 OFF Degree = IMMED	- 7	ON Degree = 0.0 OFF Degree = IMMED	1
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	
		1 3/N = 0.000Hz/#5	
Phase angle 1-2 = 120.0 Phase angle 1-3 = 240.0			1
Coupling Three Output AC Phase Waveform AC Satting Selection	2014/12/17 15:51:58	Coupling Three Output AC Setting Selection	2014/12/17 15:53:02
3_Phase LOCAL QUIT		3_Phase LOCAL QUIT	
OUTPUT SETTING	Setting	OUTPUT SETTING	Setting
Balanced, Sequence:Negative, Voltage:Phase	Edit	Balanced, Sequence:Negative, Voltage:Line	Edit
Vac = 0.0V F = 60.00Hz	Each	Vac = 0.0V F = 60.00Hz	Each
	Sequence		Sequence
MORE SETTING	Negative	MORE SETTING	Negative
Waveform = A	Three Phases	Waveform = A	Three Phases
SINE Waveform = A	Balance	SINE Waveform = A	Balance
12 SINE		e2 BINE	
Waveform = A	Voltage set	Waveform = A	Voltage set
\$3 SINE		\$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	
Coupling AC Setting Selection	2014/12/17	Coupling Three Output Phase Waveform AC Setting Selection	2014/12/17

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.

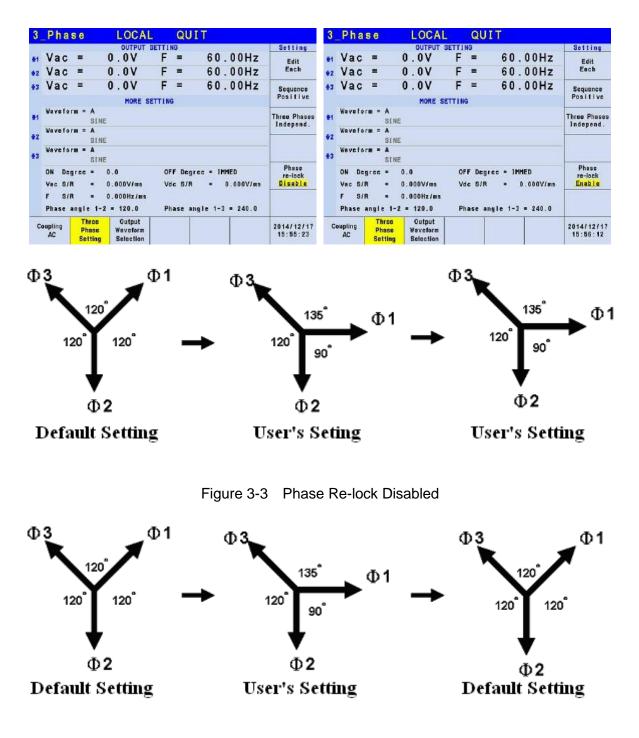


Figure 3-4 Phase Re-lock Enabled

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 <u>"OFF D</u>egree=" command position automatically.
- 5. Press **1**, **8**, **0**, and **ENTER** to change the value to "180.0".

Phase 300V LOCAL QUIT		1_Phase LOCAL QUIT	
Vac = 0.0V F = 60.00H;	Setting OUTPUT: More Setting	Vac = 0.0VF = 60.00Hz	Setting OUTPUT: More Settin
MORE SETTING	Measurement Setting	MORE SETTING	Measuremen Setting
Waveform = A SINE	Waveform Viewer	Waveform = A SINE	Waveform Viewer
ON Degree = 90.0	Limitation	ON Degree = 90.0	Limitation
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	Output Mode
Vdc S/R = 0.000V/ms F S/R = 0.000Hz/ms	1	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 AC Selection	2014/12/1 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 1_Phase Mode /3_Phase Mode is described below.

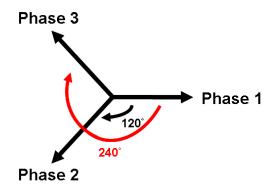
- 1. Move the cursor to "Vac S/R =" command line.
- 2. Press **0**, **.**, **2** and **ENTER** to change the value to "0.2".
- 3. The cursor moves to "F S/R =" command automatically, press 0, ., 1 and ENTER.
- 4. The cursor moves to "Vdc S/R =" command automatically, press 1 and ENTER.

3	_Phase LOCAL	QUIT		1_Phase	LOCAL QUIT	
	OUTPUT SETTI		Setting		OUTPUT SETTING	Setting
€1	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
# 3	Vac = 0.0V F	= 60.00Hz	Measurement			Measurement
	MORE SETTIN	G	Setting		MORE SETTING	Setting
e 1	Waveform = A SINE		Waveform Viewer	Wavefor	m = A SINE	Waveform Viewer
12	Waveform = A SINE				SINE	
# 3	Waveform = A SINE		Limitation	ON Deg		Limitation
	ON Degree = 0.0 OF	F Degree = IMMED ic S/R = 1.000V/ms	Output Mode	OFF Deg Vac S/R	= <u>0,200</u> V/ms	Output Mode
	F S/R = <u>0.100</u> Hz/ms Phase angle 1-2 = 120.0 Pf	nase angle 1-3 = 240.0		Vdc S/R F S/R	= 1.000V/ms = 0.100Hz/ms	
C	oupling Three Output AC Phase Waveform Setting Selection		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:
⊉ 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
8 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
#1	Vac	=	0.0V	F =	60.00Hz	Edit
₹2	Vac	=	0.0V	F =	60.00Hz	Each
# 3	Vac	=	0.0V	F =	60.00Hz	
			MORE	SETTING		
e 1	Wavefo	rmA=	SINE			View Waveform
-	Wavefo	rm B =	SINE			
	Wavefo	rm A =	SINE			
* 2	Wavefo	rm B =	SINE			
# 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	1	OCAI	L QI	JIT			3_Ph	ase		LOCA	L	QU	ΙT		
	-				SETTING	10000	021022021	Waveform	-		0.22	OUTPUT		NG	1020120	10102101	Waveform
#1	Vac	=		01	F =	27.07.22	00Hz	Edit	🖬 Va	c =	0	.0V	F	=	60.	00Hz	Edit
₹2	Vac	=	0.	0 V	F =	60.	00Hz	Each	•2 Va	c =	0	.0V	F	=	60.	00Hz	ALL
± 3	Vac	=	0.	0V	F =	60.	00Hz		∎3 Va	c =	0	.0V	F	=	60.	00Hz	
				MORE S	ETTING							MORE	SETTIN	G			
	Wavefo	rma =	SINE					View	Wave	form A	= SINE						View
₽1		rm B =	1000					Waveform	🖬 Wave	form B	= SINE	E					Waveform
	Wavefo	rm A =	SINE						Wave	form A	= SINE						-
4 2	Wavefo	rm B =	SINE					-	●2 Wave	form B	= SINE						1
₽ 3	Wavefo	rmA=	SINE						•3 Wave	form A	= SINE	-					
	Wavefo	rm B =	SINE							form B	= SINE						
	oupling	Three Phase		Output aveform				2014/12/17	Couplin	Р	hree hase	Output Waveform					2014/12/1
С	AC	Settin	ig S	election				10.03.00	202	Se	tting	Selection					
с 3		Settin	^{1g} 5			QUI	T	10.03.00	3_P1	ase		LOCA	L	QU	IT		
3	AC Pha	Settin S C	300	V L	SETTING			Waveform	-	ase		LOCA OUTPUT	SETTI	NG	Solite Trade		
3	AC Pha Vac	Settin S C =	300 0.	V 1 output 0 V	SETTING F =	60.	00Hz	Waveform Edit	•1 Va	ase c =	0	LOCA OUTPUT	F	NG =	60.	. 00Hz	
3 ≆1 ₹2	AC Pha Vac Vac	Settin S C = =	300 0. 0.	OV I Output OV OV	F =	60. 60.	00Hz 00Hz	Waveform	ei Va ez Va	ase c = c =	0	LOCA output 1.0V	SETTI	NG	60. 60.	00Hz	Waveform
3	AC Pha Vac	Settin S C = =	300 0. 0.	V 1 output 0 V	SETTING F =	60. 60.	00Hz	Waveform Edit	•1 Va	ase c = c =	0	LOCA OUTPUT	F	NG =	60. 60.		
3 #1	AC Pha Vac Vac	Settin S C = =	300 0. 0.	OV I Output OV OV	F = F = F =	60. 60.	00Hz 00Hz	Waveform Edit	ei Va ez Va	ase c = c =	0	LOCA output 1.0V	SETTI F F	NG = = =	60 60 60	00Hz	
3 11 152 153	AC Pha Vac Vac	Settin S C = = = rm A =	300 0. 0. 0. <u>SINE</u>	V OUTPUT OV OV OV	F = F = F =	60. 60.	00Hz 00Hz	Waveform Edit	e1 Va e2 Va e3 Va	ase c = c = c =	0	LOCA output . 0V . 0V . 0V	SETTI F F	NG = = =	60 60 60	00Hz	
3 11 152 153	AC Pha Vac Vac Vac Vac	Sottin SC = = = = rm A = rm B =	300 0. 0. <u>0.</u> 51NE	V OUTPUT OV OV OV	F = F = F =	60. 60.	00Hz 00Hz	Waveform Edit Each View	e1 Va e2 Va e3 Va	ase c = c = c =	0 0 0 ou	LOCA output . 0V . 0V . 0V	SETTI F F	NG = = =	60 60 60	00Hz	
3 #1	AC Pha Vac Vac Vac Vac	Settin S C = = = rm A = rm B = rm A =	300 0. 0. <u>0.</u> <u>SINE</u> SINE	V OUTPUT OV OV OV	F = F = F =	60. 60.	00Hz 00Hz	Waveform Edit Each View	e1 Va e2 Va e3 Va	ase c = c = c =	0 0 0 ou	LOCA output . 0V . 0V . 0V	SETTI F F	NG = = =	60 60 60	00Hz	
3 #1 #2 #3	Ac Pha Vac Vac Vac Vac Vac Vac	Sottin S C = = rm A = rm B = rm B = rm B = rm A =	300 0. 0. <u>0.</u> <u>51NE</u> <u>51NE</u> <u>51NE</u> <u>51NE</u>	V OUTPUT OV OV OV	F = F = F =	60. 60.	00Hz 00Hz	Waveform Edit Each View	e1 Va e2 Va e3 Va	ase c = c = c =	0 0 0 ou	LOCA output . 0V . 0V . 0V	SETTI F F	NG = = =	60 60 60	00Hz	

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	Phas	e	300V	LOCAL	QUIT	- 14	3	Pha	se	30	0 V 0	LOC	AL	QL	TIT	
	22.22			SETTING	a man anna a	Waveform		1121		121	OUTPUT		NG	Second Second	200203	Waveform
₫1	Vac	=	0.0V	F =	60.00Hz	Edit		Vac	=	0	. OV	F	=	60	.00Hz	Edit
⊉ 2	Vac	=	0.0V	F =	60.00Hz	ALL	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			-
	Waveform	A = S	INE			View Waveform		Wavefo	rm A =	CSIN	Mode	= AMP	Percent		35%	View
2 1	Waveform	B = S	INE			wavetorm	₩1	Wavefo	rm 8 =	SINE						Waveform
	Waveform	A = S	INE					Wavefo	rm A =	CSIN	Mode	= AMP	Percent	=	35%	-
₹2	Waveform	B = S	INE				₹2	Wavefo	rm B =	SINE						1
	Waveform	A = 5	INE			-		Wavefo	rm A =	CSIN	Mode	= AMP	Percent	-	35%	
4 3	Waveform					- 6	₫ 3	Wavefo								
			Three	Output	4				2200		Three	Out	out			- Carrona and a series
c	AC	Range 300V	Phase Setting	Waveform Selection		2014/08/23 13:52:34	c	oupling AC	Ran 300		Phase Setting	Wave	form			2014/08/23

3	Pha	se	300V	LOCAL	QUIT	
			OUTPUT	SETTING	and the 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 3rd 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		LOCAL	QL	JIT		
			OUTPUT S	SETTING	1000000	001000000	Setting				11.505	OUTPUT S	ETTING	100000	001000000	Setting
#1	Vac	=	0.0V	F =	60.	00Hz	OUTPUT:	₩1	Vac	=	0	. OV	F =	60.	00Hz	OUTPUT:
₫2	Vac	=	0.0V	F =	60.	00Hz	More Setting	₹2	Vac	=	0	. O V	F =	60.	00Hz	More Setting
₫3	Vac	=	0.0V	F =	60.	00Hz	Measurement	₫3	Vac	=	0	. O V	F =	60.	00Hz	Measurement
			MEASUREMEN	T SETTING			Setting				ME	ASUREMEN	T SETTING			Setting
-	۷	Po	_ Vac	Vdc	Vpk	VA	Waveform	*1	۷	Construction of the	VA	Vac	Vdc	Vpk	VA	Waveform
	1	PF	Iac	Idc	Ipk	CF	Viewer		1	PF		Iac	Idc	Ipk	CF	Viewer
¥2	۷	Po	Vac	Vdc	Vpk	VA	1.1-14-11-1		۷	Po		Vac	Vdc	Vpk	VA	11-14-14-14
•2	I	PF	Iac	Idc	Ipk	CF	Limitation	# 2	I	PF		Iac	Idc	Ipk	CF	Limitation
	V	Po	Vac	Vdc	Vpk	VA	Output		V	Po		Vac	Vdc	Vpk	VA	Output
# 3	I	PF	Iac	Idc	Ipk	CF	Mode	# 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	Isurgo Delay 10ms	lsurge Interval 10ms	Edit Al I			2014/12/17 16:19:41		verage Times	Isurga Delay 10m		Isurge Interval 10ms	Edit Al I			2014/12/17 16:20:39

3	Pha	5 O	LOCAL	Q	JIT			3	_Pha	se		LOCA	L Q	UIT		
			OUTPUT S	ETTING	NA STATES	0000000000	Setting		-			OUTPUT	SETTING	Sec. 1		Main
€1	Vac	=	0.0V	F =	60.	00Hz	OUTPUT:		Vac	=	(<u>vo. c</u>	F =	60	.00Hz	OUTPUT:
₹2	Vac	=	0.0V	F =	60.	00Hz	More Setting	₹2	Vac	=	(V0.0	F =	60	.00Hz	More Setting
₫3	Vac	=	0.0V	F =	60.	00Hz	Measurement	₫3	Vac	=	(V0.0	F =	60	.00Hz	Measurement
			MEASUREMENT	SETTING			Setting					MEASUR	REMENT			Setting
	٧	VA	Vac	Vdc	Vpk	VA	Waveform		۷	=	(0.00	VA	=	0.0	Waveform
₹1	I	PF	Iac	Idc	Ipk	CF	Viewer	±1	I	=	0	. 000	Po	=	0.0	Viewer
s.	٧	VA	Vac	Vdc	Vpk	VA	1000000		٧	=	(0.00	Po	=	0.0	1000000
# 2	I	PF	Iac	Idc	Ipk	CF	Limitation	# 2	I	=	0	. 000	PF	= 0	.000	Limitation
	٧	VA	Vac	Vdc	Vpk	VA	Output		V	=	(0.00	Po	=	0.0	Output
# 3	I	PF	Iac	Idc	Ipk	CF	Mode	# 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	lsurgo Delay 10ms	Isurge Interval 10ms	Edit Al I			2014/12/17	1	Recall CH1	Rec		Recall CH3	Recall CH4	Recall CH5	More 1 of 2	2014/12/17

Below is the procedure to the 2nd 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.

	QUIT	LOCAL	se	1_Pha			JIT	QL	LOCAL	6 O	Pha
00Hz out More		OUTPUT SE	=	Vac	Setting OUTPUT: More Setting	Hz	60.00	ETTING =	OUTPUT S	-	Vac
Measu		MEASUREMENT			Measurement				MEASUREMEN		
	Vdc Vp Idc Ip	Vac Iac	P₀ _ PF	V <u>Iac</u>	Waveform Viewer	VA CF	Vpk Ipk	Vdc Idc	Vac Iac	P₀ PF	V I
Limi					Limitation						
Ou M					Output Mode						
		Isurge	Isurgo	Average		1			Isurge	laurgo	verage
2014		Interval 10ms	Start 10ms	Times 1	2014/12/17 16:26:46				Interval 10ms	Start 10ms	Times 1

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
#1	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
₹ 2	I	PF	Iac	Idc	Ipk	CF	Limitation
	٧	Po	Vac	Vdc	Vpk	VA	Output
# 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		
			OUTPUT	SETTING	State of a	1011022040	Setting		and the			SETTING	Siles Tria	0010020000	Setting
€1	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	Measuremen
			MEASUREMEN	T SETTING			Setting				MEASUREMEN	T SETTING			Setting
-	٧	Po	Vac	Vdc	Vpk	VA	Waveform	- 81	٧	Po	Vac	Vdc	Vpk	VA	Waveform
±1	I	PF	Iac	Idc	Ipk	CF	Viewer	₹1	I	PF	Iac	Idc	Ipk	CF	Viewer
	۷	Po	Vac	Vdc	Vpk	VA	Limitation		٧	Po	Vac	Vdc	Vpk	VA	100000
# 2	I	PF	Iac	Idc	Ipk	CF	Limitation	# 2	I	PF	Iac	Idc	Ipk	CF	Limitation
	٧	Po	Vac	Vdc	Vpk	VA	Output		٧	Po	Vac	Vdc	Vpk	VA	Output
# 3	I	PF	Iac	Idc	Ipk	CF	Mode	# 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	Isurge Delay <u>10</u> ms	Isurge Interval 10ms	Edit Each		1	2014/12/17 16:31:21		verage Times	Isurgo Delay 10ms	Isurge Interval 10ms	Edit Each	at .		2014/12/1

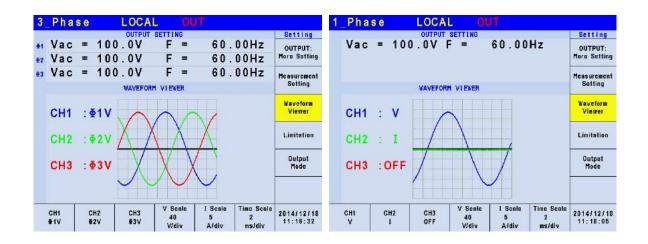
3.3.3 Waveform Viewer

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 = Φ 1V, CH2 = Φ 2V, CH3 = Φ 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:
2 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
\$ 2	F	=	100.00Hz	Vdc(-) =	0.0V	Output Mode					Output Mode
43	Vac	=	300.0V	Vdc(+)= 4	24.2V						
	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	Pha	s e	300V	LO	CAL	QUI	IT.		1_Pha	se	300	V 1	OCAL	QUI	T	
	1021		OUTF			1000	Var. 2 1 1	Setting	1122		0	UTPUT	SETTING			Setting
₫1	Vac	=	0.01	F	F =	60.	00Hz	OUTPUT:	Vac	=	0.0	DV F		60.00	Hz	OUTPUT:
⊉ 2	Vac	=	0.01	' F	F =	60.	00Hz	More Setting								More Setting
₫3	Vac	=	0.01	' F	F =	60.	00Hz	Measurement								Measurement
			LI	MITATIC	DN			Setting				LIMIT	ATION			Setting
	Vac	=	300.0	V V	Vdc(-	+)= 4	24.2V	Waveform	Vac	-	300	0V	Vdc (+)=_4	24.2V	Waveform
₫1	F	=	100.00				0.0V	Viewer	F	=			Vdc (1 01 148 144	0.0V	Viewer
	Vac	¥	300.0	v v	vdc(-	+)= 4	24.2V	Limitation								Limitation
2	F					- 19 August 19 A										
	F	=	100.00	ΠZ	vac(.	-)-	0.0V	Output Mode								Output Mode
	Vac	=	300.0	٧ ١	Vdc(-	+)= 4	24.2V									
1 3	F	=	100.00	Hz \	Vdc(-)=	0.0V									
	Edit		1			Set to	Set to	2014/05/16	-	_				Set to	Set to	2014/05/16
1	Each					Maximum	Minimum	17:11:32						Maximum	Minimum	17:12:13

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
± 1	Vac =	200. 0 V		F =	60.00Hz	Vdc	= 141	.QV	OUTPUT:
₹2	Vac =	200.0V		F =	60.00Hz	Vdc	= 141	. OV	More Setting
₫ 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
¥ 3	1	=	0.	000	PF	=	0.	000	Mode
	V 12	=	0	.00	V23	=	0	.00	Measuremen
Σ	V 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. 0	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. 0	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		1.11		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 F = 100 F = 100 F = 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 Edit Edit Edit	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(-) = $0.0V$ Vac = $100.0V$ Vdc(-) = $0.0V$ Vdc(-) = $0.0V$

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

3	Pha	se		LOC	AL (TIU		
				OUTP	JT SETTING			Main
∎1	Vac =	100.0V		F =	60.00Hz	Vdc = 14	1.0V	OUTPUT:
₹2	Vac =	100.0V		F =	60.00Hz	Vdc = 141	1.0V	More Setting
± 3	Vac =	100.0V		F =	60.00Hz	Vdc = 14	I. OV	Measuremen
				MEA	SUREMENT			Setting
	٧	=	0	.00	Po	=	0.0	Waveform
₹1	I	=	0.	000	PF	= 0.	000	Viewer
	٧	=	0	.00	Po	=	0.0	and the second second
₹2	I	=	0.	000	PF	= 0.	000	Limitation
	٧	=	0	.00	Po	=	0.0	Output
Ŧ 3	I	=	0.	000	PF	= 0.	000	Mode
	V 12	=	0	.00	V23	= (0.00	Measuremen
Σ	V 31	=	0	.00	P٥	=	0.0	To Page2
	tecall CH1	Recal	u	Recall CH3	Recall CH4	Recall CH5	More	2014/12/1

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			LC	C	AL		Q	UI	Г				
					0	JTP	UT S	ETTI	NG						Setting
₽1	Vac = 3	300. 0	٧		F	-	60	. 00Hz		Vdd	•	0.0	۷		OUTPUT:
₹2	Vac = :	300. 0	v		F	•	60	. 00Hz		Vdd		0.0	v		More Setting
₫ 3	Vac = 3	300. 0	v		F	=	60	. 00Hz		Vdo	=	0.0	v		Measurement
						LI	MI TA	TION							Setting
	Vac	=	3	30	0.	0	۷	V	dc	(+)) =	42	4	. 2 V	Waveform
€1	F	=	10	0	. 0	0	Ηz	V	dc	(-)) =		0	. O V	Viewer
	Vac	÷	3	80	Ο.	0	v	V	dc	(+) =	42	4	. 2 V	Limitation
₫2	F	=	10	0	. 0	0	Ηz	۷	dc	(-)) =		0	. O V	Output
	Vac	=	3	30	ο.	0	٧	V	dc	(+) =	42	4	2V	Mode
Ŧ 3	F	=	10	0	. 0	0	Ηz	V		2				. O V	
	Edit Al I			1							Set 1 axim		0.777	t 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

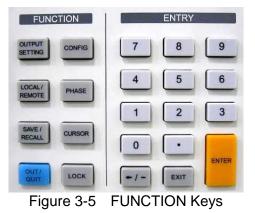
#1							
-			OUTPU	JT SETTING			Main
	Vac = 200	.0V	F =	60.00Hz	Vdc = 141	.QV	OUTPUT:
₹2	Vac = 200	. OV	F =	60.00Hz	Vdc = 141	. OV	More Setting
₫ 3	Vac = 200	. OV	F =	60.00Hz	Vdc = 141	. OV	Measurement
			MEA	SUREMENT			Setting
050	۷ =	- 0	00.0	Po	=	0.0	Waveform
₫1	I =	= 0.	000	PF	= 0.	000	Viewer
	۷ =	- 0	00.0	Po	=	0.0	102/03/0
₹2	I =	· 0.	000	PF	= 0.	000	Limitation
	۷ =	= 0	0.00	Po	=	0.0	Output
# 3	I =	= 0.	000	PF	= 0.	000	Mode
	V 12 =	- 0	00.0	V23	= 0	.00	Measurement
Σ	V 31 =	- 0	00.0	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

i

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
#1	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
# 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
# 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	
	1023		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
⊉ 2	Vac	=	0.0V	F =	60.	00Hz	Interface									Interface
₫ 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
⊉ 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	V 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	General Contract	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	. QI	DCAI	L(se	_Pha				JIT	. QI	LOCAL		e	Phas
Config		nesearc		SETTING			112			Config		nesean	-		OUTPUT	174		
Interface	Hz	. 001	60	-	OV F	0.0	(-	Vac	Interface	Iz	00	60	-).0V F	0	=	Vac
External Vref										External Vref								
VICI				EMENT	MEASUF					U ICI				EMENT	MEASUR			
1000	0.0	1	=	Po	0	0.0	(=	۷	Care I	0.0		=	Po	0.00	0	=	٧
Display	000	0.0	=	PF	0 (. 00	0	=	I	Display	000	0.	=	PF	000	0.	=	I
PowerON	.00	0	=	Vdc	0	0.0	(=	Vac	PowerON	.00	0	=	Vdc	00.0	0	=	Vac
Status	000	0.1	=	Idc	00	. 00	0	=	Iac	Status	000	0.	=	Idc	000	0.	=	Iac
-	0.0	1	=	VA	00	0.0	(=	Vpk	-	0.0		=	VA	00.0	0	=	Vpk
Protection	000	0.1	=	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	CT. OFF able	ON	Remote Inhibit Disable	5232 Idrate	Bai	ity	RS: Par No	GPIB Address 30	2014/12/17 16:44:40	Ethernet Setting	T. OFF able	ON	Remote Inhibit Disable	RS232 Baudrate 9600	y	RS23 Parit Non	GPIB ddress 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 ⁱ	٧	=	0.00	Po	= 0.0	PowerON		٧	=	0.00	Po	= 0.0	PowerON
2	I	=	0.000	PF	= 0.000	Status	# 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 Reader	- 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	se	LOCA	AL QI	JIT			3	Pha	se	LOCAI	LG	UIT		
	Ser.		OUTPUT	SETTING		00000000000	Config					SETTING	None of the	64.002.0040	Config
ē1	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	K SETTING							NETWORK	SETTING			
	Network	k Setti	ng: Aute						Network	Sett	ing:Manual				
	IP Add	ress :_	10.1.	7.86					IP Add	ess :	10.1.	7 . 86			
	Net Mas	sk :2	55 . 255 .	254 . 0					Net Mas	ik d	255 . 255 . 25	i4. 0			
	Gateway	y :	10.1.	7 . 254					Gatevraj	()	10 . 1 .	7 . 254			
	LAN Sta	atus =	SETTING						LAN Sta	tus =	SETTING				
	GPIB	R 523		Remote	EXT.	Ethernet	2014/12/17		GPIB	RS23		Remote	EXT.	Ethernet	2014/12/1
A	ddress 30	Parity None			ON/OFF Disable	Setting	17:00:08	A	ddress 30	Parit		Inhibit Disable	ON/OFF Disable	Setting	17:00:53

3	Pha	se		LOCA	L	QU	TI		
				OUTPUT	SETTIN	IG	Marrie 1	811 TO A 1941	Config
ē 1	Vac	=	0	.0V	F	=	60.	00Hz	
2	Vac	=	0	. OV	F	=	60.	00Hz	Set
3	Vac	=	0	. 0 V	F	=	60.	00Hz	
				NETWORK	SETTI	NG			
	Network	k Set	ting:M	anual					
	IP Add	ress	_10 .	1.	7.1	86			
	Net Ma	sk	255 .	255 . 21	54.	0			
	Gaterra	y	10 .	1.	7 . 2	54			
	LAN St	atus =	READ	Y					
_									
	GPIB ddress 30	RS2 Pari No	ity	RS232 Bsudrate 115200	Rem Inhi Disa	bit	EXT. ON/OFF Disable	Ethernet Setting	2014/12/1 17:01:43

		UIT			1_Pha	s e	LOCA		JIT		
	UTPUT SETTING			Config				SETTING			Config
Vac = 0.	0VF =	60.001	ΗZ	Set	Vac	-	0.0V		60.00	HZ	Set
	ETWORK SETTING						NETWORK	SETTING			
Network Setting: Au	10				Network	Setti	ng:Manual				
IP Address : 10 .	1.7.86				IP Add	ess :_	10.1.	7.86			
Net Mask :255 . 2	55.254.0				Net Ma	sk :2	55 . 255 . 2	54.0			
Gateway : 10 .	1. 7.254				Gatewa		10.1.	7 . 254			
LAN Status = SETTIN	3				LAN St	tus =	SETTING				
Address Parity Ba	S232 Remote udrate Inhibit 15200 Disable	EXT. ON/OFF Disable	Ethernet Setting	2014/12/17	GPIB Address 30	RS232 Parity None	Baudrate	Remote Inhibit Disable	EXT. ON/OFF Disable	Ethernet Setting	2014/12/1

1 _ P h a	100		LOCA	SETTING	JIT		Config
Vac	-	0	. 0V I		60.00	Hz	Set
Netwo	rk Sett	tina:M		SETTING			
	dress			7 . 86			
Net M		marine	255 . 21				
Gaten	ay :	10 .	1.	7 . 254			
LAN S	tatus =	READ	Y				1
GPIB Address 30	RS2 Pari	ity	RS232 Baudrate 115200	Remote Inhibit Disable	EXT. ON/OFF Disable	Ethernet Setting	2014/12/17 17:05:01

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 Φ 2 is the main control signal. Refer to *Appendix A* for the pin assignment of TTL terminal. The voltage phase difference from External-V Reference signal input to external output is 100us.

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	LOCAL		QUIT	
	1020		OUTPU	T SETTING		And	Config		10220		OUTPU	T SETTING		And	Config
₫1	Vac	=	0.0V	F =		60.00Hz			Vac	=	0.0V	F =		60.00Hz	Sector Sector
⊉ 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
			MEA	SUREMENT			Vref				MEAS	UREMENT			Vref
23	۷	=	0.00	Po	=	0.0	2205	And the second	۷	=	0.00	Po	=	0.0	
8 1	I	=	0.000	PF	=	0.000	Display	₩1	Ι	=	0.000	PF	=	0.000	Display
_	٧	=	0.00	Po	=	0.0	PowerON	_	٧	=	0.00	Po	=	0.0	PewerON
₽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	2
13	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	V 31	=	0.00	Po	=	0.0	1 of 2	Σ	V 31	=	0.00	Po	=	0.0	1 of 2
(xt.Vrsf Control Off	Con Met Ampli	hod				2014/05/16 17:35:31	c	xt.Vref Control Off	Met	itrol hod ificr		Ĩ		2014/05/16

3	Pha	se	300V	LOC	AL	QUIT	
	1020		OUT	PUT SETTIN	NG	2000 - 100 -	Config
₫1	Vac	=	0.01	/ F	-	60.00Hz	
⊉ 2	Vac	=	0.01	/ F	=	60.00Hz	Interface
₫3	Vac	=	0.01	/ F	=	60.00Hz	External
			ME	ASUREMENT			Vref
-	٧	=	0.00	Po	=	0.0	1 200
€1	I	=	0.000	PF	= =	0.000	Display
	٧	=	0.00	Po	=	0.0	PowerON
⊉ 2	I	=	0.000	PF		0.000	Status
	٧	=	0.00	Po	=	0.0	-
8 3	I	=	0.000	PF	= =	0.000	Protection
	V 12	=	0.00	V2	3 =	0.00	More
Σ	V 31	=	0.00	Po	=	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 1000Hz, 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.

- 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.
- 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	_ QL	JIT		1_Pha	se	LOCA	L Q	UIT		
	a.m.		OUTPUT	SETTING	AMATERS CONTRACTOR	Config				SETTING		A STATISTICS IN	Config
ē1	Vac	=	0.0V	F =	60.00Hz	Interface	Vac	=	0.001	F =	60	.00Hz	Interface
₽2	Vac	=	0.0V	F =	60.00Hz	Interface							Interface
¥ 3	Vac	=	0.0V	F =	60.00Hz	External							External
			MEASUR	EMENT		Vref			MEASU	REMENT			Vref
	٧	=	0.00	Po	= 0.0	1.00000	٧	=	0.00	Po	=	0.0	SMINE
€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
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	-
4 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
	Style Jefault	Backlig Med i u				2014/12/17 17:08:42	Style Default	Back Med					2014/12/17 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	se	LOCA	L	QU	IT		3	Pha	se	LOCA	L	QL	JIT	
			OUTPUT	SETTI	10	NAMES OF BRIDE	Config		-		OUTPUT	SETT	NG	Manager of the second	Config
€1	Vac	=	0.0V	F	=	60.00Hz	Interface	€1	Vac	=	0.0V	F	=	60.00Hz	Interface
₹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
			POWER ON ST	TATUS S	ETTIN	IG	Vref				POWER ON ST	ATUS	SETTI	NG	Vref
	Vac	=	0.0V	F =	•	60.00Hz	Display		Vac	-	0.0V	F	=	60.00Hz	Display
ē 1	Vdc	=	0.0V					± 1	Vdc	=	0.0V				
	Vac	-	0.0V	E :		60.00Hz	PowsrON Status		Vac	2	0.0V	F	-	60.00Hz	PowsrON Status
4 2	Vdc	-	0.0V	8				₩2	Vdc	=	0.0V	•			-
	vuc	-	0.00				Protection		vuc		0.00				Protection
	Vac	=	0.0V	F =	ŧ.	60.00Hz			Vac	=	0.0V	F	=	60.00Hz	
± 3	Vdc	=	0.0V				More 1 of 2	#3	Vdc	=	0.0V				More 1 of 2
	Output Off	Edit Al I					2014/12/17		output Off	Edit Al I					2014/12/17

3	Pha	se	LOCA	L QI	JIT		1_Phase	LOCAL QUIT	
			OUTPUT	SETTING	Margar Margaran	Config		OUTPUT SETTING	Config
#1	Vac	=	0.0V	F =	60.00Hz	Interface	Vac =	0.0V F = 60.00Hz	Interface
₽2	Vac	=	0.0V	F =	60.00Hz	Internet			Internet
₫3	Vac	=	0.0V	F =	60.00Hz	External			External
			POWER ON S	TATUS SETTI	NG	Vref		POWER ON STATUS SETTING	Vref
	Vac	=	0.0V	F =	60.00Hz	Display	Vac =_	<u>0.0</u> V F = 60.00Hz	Display
ē 1	Vdc	=	0.0V			section	Vdc =	0.0V	coopies
	Vac	20	0.0V	F =	60.00Hz	PewerON Status			PowerON Status
4 2				F -	60.00HZ	otatus			Otatus
	Vdc	=	0.0V			Protection			Protection
	Vac	=	0.0V	F =	60.00Hz				
1 3	Vdc	=	0.0V			More 1 of 2			More 1 of 2
	Dutput	Edit	1	1		2014/12/17	Output		2014/12/1
	Off	Each	1			17:14:10	Off		17:15:29

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 = 100A (50A for 61830; 75A for 61845; 100A for 61860), power limit = 20000VA (10000VA for 61830; 15000VA for 61845; 20000VA for 61860), delay time for trigger current protection = 3 sec.

- 1. Move the cursor to "OCP =" command line.
- 2. Press **1**, **0**, **0** and **ENTER** to change the value to "100.0".
- 3. Move the cursor to "OPP =" command line.
- 4. Press **2**, **0**, **0**, **0**, **0**, **ENTER** to change the value to "20000.0".
- 5. Move the cursor to "Delay time =" command line.
- 6. Press **3**, **ENTER** to change the value to "3.0".

3	Phas	6 e	LOCAL		QL	JIT		
			OUTPUT S	ETTI	IG	Constant of	ALC: NOT	Config
£ 1	Vac	=	0.0V	F	=	60.	00Hz	
₹2	Vac	=	0.0V	F	=	60.	00Hz	Interface
# 3	Vac	=	0.0V	F	=	60.	00Hz	External
			PROTECTION	I SETT	TING			Vref
	OCP	= 10	0 <u>.0</u> A	OF	р	=2000	0.0VA	Display
₹1	OCP	dela	y time	=		3.0se	с	
	OCP	= 10	A 0.0	OF	р	=2000	0.0VA	PowerON Status
\$ 2	OCP	dela	y time	=		3.0se	с	Protection
	OCP	= 10	A0.0	OF	р	=2000	0.0VA	
\$ 3	OCP		y time			3.0se	c	More 1 of 2
	Edit Al I					Set to Maximum	Set to Minimum	2014/12/1 17:18:56

Notice

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.
- 3. When switched to ACL mode (option), set the current limit example = 105A (max. 55A for 61830, max. 80A for 61845, and max. 105A for 61860), set the power limit example = 21000VA (max. 11000VA for 61830, max. 16000VA for 61845, and max. 21000VA for 61860).

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	se	LOCA	L Q	UIT		1_Pha	se	LOCAL	Q	UIT		
	-		OUTPUT	SETTING	NAMES OF STREET	Config			OUTPUT S	ETTING		North Address of the	Config
€1	Vac	=	0.0V	F =	60.00Hz	Others	Vac	=	0.0V F	-	60.	00Hz	Others
₫2	Vac	=	0.0V	F =	60.00Hz	Others							OTHERS
₫3	Vac	=	0.0V	F =	60.00Hz	Calibration							Calibration
			MEASU	EMENT		Galibration			MEASUR	EMENT			Ganbration
-	۷	=	0.00	Po	= 0.0	System	۷	=	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	V 31	=	0.00	Po	= 0.0	2 of 2							2 of 2
	Dutput Relay spend.	Buzze On	Date/Time	Remote Sense On		2014/12/17 17:20:05	Output Relay Depend.	Buzz On		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

3	Pha	se	300V	LOCAL	QUIT		1_Pha	se	300V L	OCAL		QUIT	
	1025		OUTPU	SETTING	and and an and the	Config	1020		OUTPUT	SETTING	0502507	1	Config
₫1	Vac	=	0.0V	F =	60.00Hz		Vac	=	0.0V F	-	60	.00Hz	-
⊉ 2	Vac	-	0.0V	F =	60.00Hz	Others							Others
₫ 3	Vac	=	0.0V	F =	60.00Hz	Calibration							Calibration
			MEAS	UREMENT		Cambranon			MEASUR	EMENT			Canbranon
	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	and the second						More
Σ	V 31	=	0.00	Po	= 0.0	2 of 2							2 of 2
and the	Dutput Relay mays ON	Buzza On	T Date/Tim	Remote Sense On		2014/05/16 17:46:48	Output Relay Always ON	Buzza	er Date/Time	Remote Sense On			2014/05/16 17:47:21

relay is working, the Regenerative Grid Simulator will click once.



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	. Q	UIT		1_Pha	se	LOCAL	. Q	UIT		
	and the		OUTPUT	SETTING	NAME OF BRIDE	Config			OUTPUT S	SETTING		Log da la la	Config
€1	Vac	=	0.0V	F =	60.00Hz		Vac	=	0.0V F	=	60	.00Hz	Constant of the
₽2	Vac	=	0.0V	F =	60.00Hz	Others							Others
₫3	Vac	=	0.0V	F =	60.00Hz	Calibration							Calibration
			MEASUF	EMENT		Gampration			MEASUR	EMENT			Generation
	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
1 2	I	=	0.000	PF	= 0.000	Default	Iac	=	0.000	Idc	=	0.000	Default
	V	=	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	V 31	=	0.00	Po	= 0.0	2 of 2							2 of 2
1	Output Relay epend.	Buzze Off	r Date/Time	Remote Sense On		2014/12/17 17:25:30	Output Relay Depend.	Buz: Of	liste/ lime	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	. QI	JIT		1_Pha	se	LOCAL	Q	UIT		
	-		OUTPUT	SETTING	MARTIN CONTRACTOR	Config			OUTPUT S	ETTING		Logar Com	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
# 3	Vac	=	0.0V	F =	60.00Hz	Month							Month
			MEASUR	EMENT		12			MEASUR	EMENT			12
	V	=	0.00	Po	= 0.0	Day	٧	=	0.00	Po	=	0.0	Day
2 1	I	=	0.000	PF	= 0.000	17	I	=	0.000	PF	=	0.000	17
	٧	=	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
	٧	=	0.00	Po	= 0.0	Minute	Vpk	=	0.00	VA	=	0.0	Minute
4 3	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	Output Relay spend.	Buzze On	r Date/Time	Remote Sense On		2014/12/17 17:27:31	Output Relay Depend.	Buzz	er Dete/Time	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		LOCAL	2 1	QUI	Т		3	_Pha	s e		LOCAL		QU	ΙT		
	5.00	-	0.00	OUTPUT S	SETTING		WARTER CONTRACTOR	Config				773		SETT1	NG		1021 1001002-000	Config
€1	Vac	=	0	. 0 V	F	=	60.00Hz		≣1	Vac	=	(V0.0	F	=	6	0.00H	Z
₹2	Vac	=	0	. OV	F	=	60.00Hz	Others	₹2	Vac	=	(V0.0	F	=	6	0.00H	Z Others
# 3	Vac	=	0	. 0 V	F	=	60.00Hz	Calibration	₫3	Vac	=	(V0.0	F	=	6	0.00H	Z Calibration
				MEASUR	EMENT			Juneration					MEASUR	EMENT				Janoranon
	٧	=	0	.00	Po	=	0.0	System		٧	=	(0.00	Po		6	0.0	System
±1	I	=	0.	000	PF	=	0.000	Information	₹1	I	=	0	000	PF			0.000	Information
	٧	=	0	. 00	Po	=	0.0	Factory		V	=	(0.00	Po			0.0	Factory
# 2	I	=	0.1	000	PF	=	0.000	Default	# 2	I	=	0	000	PF	1. I.		0.000	Default
	٧	=	0	. 00	Po	=	0.0	Master/Slave		٧	=	(0.00	Po	-		0.0	Master/Slave
# 3	I	=	0.	000	PF	=	0.000	Function	# 3	I	=	0	000	PF			0.000	Function
	V 12	=	0	. 00	V23	-	0.00	More		V 12	=	(0.00	V2	3 =		0.00	More
Σ	V 31	=	0	. 0 0	Po	=	0.0	2 of 2	Σ	V 31	=	(0.00	Po	-		0.0	2 of 2
	Output Relay epend.	Buzz Or)ste/Time	Remot Sens Of 1	0		2014/12/17 17:29:08		Output Relay epend.	Buz O		Date/Time	Rem Sen O	88			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.

Phase	LOCAL	QUIT	
and the second	UNIT DAT.		Config
Model:61	860 SN:0	00002	Others
Display Waveform Remote		00 Dec 17 2014 0 ,1.00 ,1.00 0 .0.05#	Calibration
Waveform HDL GRID Firmware GRID HDL	Version : 1.0 Version : 1.0 Version : 1.0	0 ,1.00 ,1.00 0 ,1.00 ,1.00	System Information
LAN Firmware	Version : 1.0	0	Factory Default
			Master/Slav Function
			More 2 of 2
			2014/12/1

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	AULT		Config
				Others
				Calibration
Recall Fac	tory Def	ault se	tting?	System Information
		Factory Default		
				Master/Slave Function
				More 2 of 2
Yes		No		2014/12/11 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 ^{No}
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	- Alexandre and a second	?_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	2	properly,otherwise the AC source and/or UUT might be damaged.	
	72	Press <yes> to change. Press <no> to exit.</no></yes>	-
	2014/05/17 09:35:26		2014/05/1



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).

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 1st place after the decimal point for voltage or frequency to save time in inputting the values.

The procedure for setting the 1st 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 1st 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	. (UIT			1_Pha	s e		LOCAL	. Q	UIT			
				OUTPUT	SETTING	No.	04 - 000 ESO 2000	Main	1020			OUTPUT S	SETTING	-			Main
€1	Vac	=	000	. <u>0</u> V	F =	61	0.00Hz	OUTPUT:	Vac	=	000	. <u>o</u> v f	-	60.	001	١z	OUTPUT:
₫2	Vac		0	. OV	F =	61	0.00Hz	More Setting									More Setting
₫3	Vac	=	0	. OV	F =	61	0.00Hz	Measurement									Measurement
				MEASUR	EMENT			Setting				MEASUR	EMENT				Setting
	V	=	0	.00	Po	=	0.0	Waveform	٧	=	0	.00	Po	=	(0.0	Waveform
±1	I	=	0.	000	PF	= (0.000	Viewer	I	=	0.	000	PF	=	0.0	000	Viewer
	V	=	0	.00	Po	=	0.0	1.000000000	Vac	=	0	.00	Vdc	=	0.	.00	
# 2	I	=	0.	000	PF	= (0.000	Limitation	Iac	=	0.	000	Idc	=	0.0	000	Limitation
	٧	=	0	.00	Po	=	0.0	Output	Vpk	=	0	.00	VA	=	(0.0	Output
# 3	I	=	0.	000	PF	= (0.000	Mode	Ipk	=	0.	000	CF	=	0.0	000	Mode
	V 12	=	0	.00	V23	=	0.00	Measurement	n o testo so								-
Σ	V 31	=	0	.00	Po	=	0.0	To Page2									
1	Recall CH1	Re		Recall CH3	Recall CH4	Recal CH5	II 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
E1	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	
	٧	=	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	
⊉ 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	V 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	se	300V	LOCAL	QUIT		3	Pha	se	300V	LOCAL	QUIT	
₫1 ₫2	Vac Vac	=	0.0V 0.0V 0.0V	F =	60.00Hz 60.00Hz	Outout	垂 1 垂 2		=	0.0V	F =	60.00Hz 60.00Hz	Save/Recall Save Output Setting
₫ 3	Vac	=	0.0V	F =	60.00Hz	Savc System Data	₫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	60.00Hz Va	IC = 0.0V IC = 0.0V IC = 0.0V	
⊉ 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	50.00Hz Va	lc = 0.0V lc = 0.0V lc = 0.0V	Recall Output Setting
₫3	V I	-	0.00	P₀ PF	= 0.0 = 0.000	Recail System Data	3	Vac = Vac = Vac =	0.0V 0.0V 0.0V	F = 6	50.00Hz Va	IC = 0.0V IC = 0.0V IC = 0.0V	Recall System Data
Σ	V 12 V 31	=	0.00 0.00	V23 P0	= 0.00 = 0.0		4	Vac = Vac = Vac =	0.0V 0.0V 0.0V	F = 6	60.00Hz Va	lc = 0.0V lc = 0.0V lc = 0.0V	
			11			2014/05/17 09:57:00	8	Save to CH1	Save to CH2	Save to CH3	Save to CH4	More	2014/05/17 09:57:27

3_	Phase	a 300V	LOCAL	QUIT		3	Pha	se	300V	LOCA	AL.	QUIT	17 8 17 17 1 mar 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
-	-5020	OUTPU	T SETTING	A CONTRACTOR OF A	Save/Recall	1	-1023		OUTPU	T SETTIN	IG		Save/Recall
₫1	Vac =	V0.0	F =	60.00Hz	Save	₫1	Vac	=	0.0V	F	=	60.00Hz	Save
⊉ 2	Vac =	0.0V	F =	60.00Hz	Output Setting	⊉ 2	Vac	=	0.0V	F	=	60.00Hz	Output Setting
₫3	Vac =	0.0V	F =	60.00Hz	Save	₫3	Vac	=	0.0V	F	=	60.00Hz	Save
		CHAN	NEL DATA		System Data				CHAN	NEL DATA	L.		System Data
						1	Vac = Vac = Vac =	0.0V 0.0V 0.0V	F = F = F =	60.00Hz 60.00Hz 60.00Hz	Vdc Vdc Vdc	= 0.0V	
	Save	output s	etting	to CH 1	Recall Output Setting	2	Vac = Vac = Vac =	0.0V 0.0V 0.0V	F = F = F =	60.00Hz 60.00Hz 60.00Hz	Vdc Vdc Vdc	= 0.0V	Recall Output Setting
					Recall System Data	3	Vac = Vac = Vac =	0.0V 0.0V 0.0V	F = F = F =	60.00Hz 60.00Hz 60.00Hz	Vdc Vdc Vdc	= 0.0V	Recall System Data
					1	4	Vac = Vac = Vac =	V0.0 V0.0 V0.0	F = F = F =	60.00Hz 60.00Hz 60.00Hz	Vdc Vdc Vdc	= 0.0V	72
					2014/05/17 09:59:12		Recell CH1	Recall CH2	Recall CH3	Rec		More	2014/05/17 09:59:48

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 Barrier and a state
	10220			T SETTING	And and a second second	Save/Recall		1023		OUTPL	T SETTING	2000		Save/Recal
	Vac	=	0.0V	F =	60.00Hz	Save		Vac	=	0.0V	F =	60.0	OHz	Save
⊉ 2	Vac	=	0.0V	F =	60.00Hz	Output Setting	⊉ 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
£ 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	V 31	=	0.00	Po	= 0.0		Σ	V 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		marks a		Save/Recal
≣1	Vac =	• 0.0	V F	= 60.	00Hz	Save		Vac	=	0	.0V	F =		60.	00Hz	Save
⊉ 2	Vac =	0.0	V F	= 60.	00Hz	Output Setting	⊉ 2	Vac	=	0	. OV	F =		60.	00Hz	Output Setting
₫3	Vac =	• 0.0	V F	= 60.	00Hz	Save	₫ 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	V 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			З.	Add a current limit
	or current		capacitive load		resistor.
	specification.		is too big.	4.	Set the voltage
	(Latch)		5		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.
	system set voltage	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		5		
	specification.				
	(Latch)				
	It occurs when the	1.	The UUT	1.	Remove the UUT
	output is short		impedance is		and make sure
	circuited. (Latch)		too low.		the protection
		2.	Temporary short		value is correctly
(φ1/2/3)DA_SHORT			circuit.		set.
				2.	Remove the UUT
					and confirm its
					correctness.
	It occurs when the	1.	The Remote	1.	Confirm the wiring
	remote voltage		sense wire is		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.		distance between
	error. (Latch)	2.	The remote		UUT and remove

			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	module internal parts transient over rated protection. (Recovery)		voltage waveform and frequency set by	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.	power module internal parts. The DC/AC module measurement circuit is having error. The DC/AC module digital circuit is having error. The digital module is having error.	3.	replace the DC/AC digital module board that is having protection phase.
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)	invalid. 4. The fan circuit is malfunction.	 Check the connection of fan on the module having protection. Replace the broken or invalid fan. Replace the fan circuit board.
(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		DC/AC module has accumulated dust or foreign object.	Check the DC/AC module of each phase for dust and clean it.
OTP_TR		 The operating environment temperature is over. The power IGBT 	
(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_OTP	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	It occurs when the circuit transient input voltage is higher than the spec. (Latch)	 Input power error. The AC/DC module measurement 	 Check if the input power meets the rated voltage. Check and
(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)		 Check if the input power meets the rated voltage. Measure the
(φ1/2/3)AD_UVP_LINE_RS_S (φ1/2/3)AD_UVP_LINE_ST_S (φ1/2/3)AD_UVP_LINE_TR_S	It occurs when the circuit steady input voltage is lower	3. The AC/DC module measurement	AC/DC module input fuse and replace it.

	than the spec. (Latch)	circuit is having error.	 Check and replace the protected AC/DC module board.
(φ1/2/3)AD_UNBALANCE _LINE	It occurs when the circuit input is unbalanced or open phase. (Latch)	 The input power is connected wrong. (10% line voltage difference) The input power is disconnected (open phase.) The AC/DC module fuse is broken. The AC/DC module fuse is broken. 	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.	 Check and replace the protected AC/DC module board.
(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.	 Check and replace the protected AC/DC module board.
(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.)	 Remove the UUT and check if the operation is correct. Check and replace the
(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	It occurs when the power module internal DC BUS transient voltage is lower than the spec. (Latch)	1.	The output transient power is too high. (The protected phase VDC is lower than 600V)		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	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 ouviliari		roplace the
	auxiliary power of digital module is running self detect. (Latch)		module auxiliary power is having error. The digital module measurement circuit is having error. The digital module is having error.		replace the digital module board. Check and replace the digital module board. Check and replace the digital module board.
SYS SELF_E	It occurs when the Interface and panel auxiliary power is running self detect. (Latch)	2.	The auxiliary 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.	Check and 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) It occurs when the DC/AC power module driving signal is having		The driving signal is having error. (The power element is short circuited.) The AC/DC module measurement		Check and replace the power module board of protected phase. Check and replace the AC/DC module
(φ1/2/3)DA_PWM(1/2)_FAULT	error. (Latch)		circuit is having error. The DC/AC module digital circuit is having error.		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.	 Check and replace the auxiliary power module. Check and replace the digital module.
SYS_INT_AUX_OUT	It occurs when the auxiliary power module is having error. (Latch)			Check and replace the auxiliary power module.
SYS_SHUTDOWN	It occurs when paralleling the Master or Slave units. (Latch)	2.	The Mains is having error when paralleling the Master or Slave. The auxiliary power module is having error when paralleling the Master or Slave. The cables fell off when paralleling the Master or Slave.	 Check if the Mains is having error when paralleling the Master or Slave. Check or replace the auxiliary power module. Check if the cables are connected firmly when paralleling the Master or Slave.

Notice

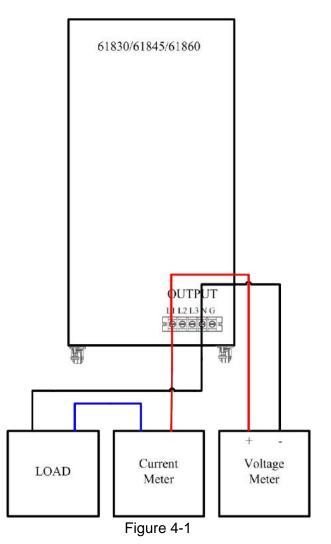
The protection message is marked _F(FAST) and _S(SLOW) by transient and steady state.

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.



Notice

- 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
	Default
	Default Master/Slave



- 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>	-
Quit	2014/08/2

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

/olta	ge Se	tting CALIBE		surer	nent:⊉	1 Calibration
		CALIDA	INTION			CHITDIALIU
Run	⊈1 V	oltage	Sett	ing		
and	Measu	r emen t	cali	brati	on.	-
Remo	ve Lo	ad Bef	ore C	alibr	ating	
Pres	s cFN	TER> (o con	tinue		2
100 500	(71) A (77) C (7)	Transfer and the second	skip	2010 C		2
						a)
Voltage Setting&	Current	External	Level Setting		1	2014/08/25

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

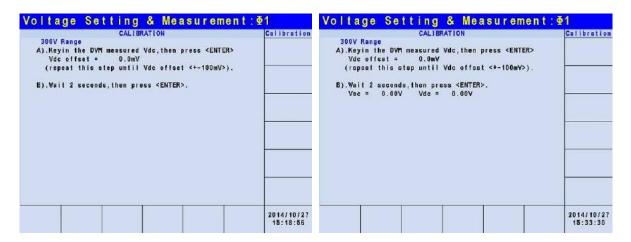
After entered the password, the CALIBRATION CHOICES are shown on the screen as described in section 4.2. Press Voltage setting & Measure to output voltage and execute the measurement calibration.

Voltage Setting & Measurement:	§1
CALIBRATION 300V Range : Offset voltage Press <enter> to continue. Press <exit> to skip.</exit></enter>	Calibration
	2014/08/25 15:14:15

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.

Voltage	Settin	g &	Measurement:	₫1
	CAL	IBRATI		Calibration
300V Range			New York Concerning Street Street	
	et= 0.0		, then press <enter></enter>	
			offset <+−100mV>).	
				-
				2014/10/27 14:59:39

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 ± 100 mV.



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	Setti	ng &	Mea	suren	nent: Φ	1
300V Range A).Keyin ti Vdc offs (repeat i B).Wait 2 s Vac = C).Calibrai	C ne DVM meas set = 0 this step u seconds,the 0.00V V tion for 30 ENTER> to r	ALIBRATI ured Vdc .0mV ntil Vdc n press dc = 0 0V Range	ON ,1hen pi offset <enter> .00V offset</enter>	ress <ent <+-100mV is compl</ent 	ER> (>).	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	Calibration Yes
Do you want to save calibrating data?	No
	2014/08/25 15:22:18

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

Voltage Setting & Measurement:	₽1
CALIBRATION	Calibration
300V Range : Setting & Meas.	
Press <enter> to continue.</enter>	
Press <exit> to skip.</exit>	-
	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	Settin	g &	Measurement:	Φ 1
300V Range A).Check if	CAL the DVM meas	BRATI		Calibration
				2014/08/25 15:17:51

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.

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

Volta	ge	Se	ttin	ng d	& Me	asu	emen	t:@1
A).Che If B).Key Vac C).Key	NO, c (in th = 0	heck 6 DVM .000V e DVM	DVM me DVM co measu measu	nnect red V	d value ion.11 ac,ther	YES,pre press	ui 30Vac? ss <enter <enter> <enter></enter></enter></enter 	Celibration
								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:	ē1
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 & 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.

CALIBRATION							
						Yes	
Do you data?	want	to	save	cal	ibrati	ng No	
						2014/08/25 15:22:18	

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



- In the last step, the user can press ENTER to continue calibrating the 2nd phase or the 3rd phase.
 In the previous screen, if EXIT is pressed but the results are not
- 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.

Curre	nt Me	asurer	nent: 4	21		- Te
		CALIBR	ATION			Calibration
	⊈1 C brati		Meas	ureme	n t	
Remo	ve Lo	ad Bet	ore C	alibr	ating	
1.5. E.S.	s <en s <ex< td=""><td>100000000000000000000000000000000000000</td><td></td><td>5775 C. C. C. S. S. L. S.</td><td></td><td>0</td></ex<></en 	100000000000000000000000000000000000000		5775 C. C. C. S. S. L. S.		0
Voltage Setting& Measure.	Current Measure,	External Vref	Level Setting 1750			2014/08/25 15:23:05

Current Measurement: 1	Calibration	Current Measurement : 1	Callibration
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>	Calibratio
	2014/08/25 15:23:27		2014/08/25 15:23:51

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.

CALIBRATION	Calibration
A).Wait 2 seconds, then press <enter>. Iac = 0.00A Idc =0.00A B).Apply load to output.15A or 0.6Ω @9Vac</enter>	
	2014/08/25

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

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 Keyin the measured lac, then press <enter> Iac =</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**.

Curre	nt Me	asurei	ment: §	§1	
Iac B).App Key Iac	t 2 second = 0.00A Iy load to in the mes = 0.000A <enter> to</enter>	s,then pro Idc =(output.11 sured lac).00A 5A or 0.6Ω , then pres	@9Vac	Calibration
-					2014/08/25 15:25:08

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

Current Measurement:⊈1	- 1.5	Current Measurement:⊉1	5
CALIBRATION A).Weit 2 seconds,then press <enter>.</enter>	Calibration		Calibration
· · · · · · · · · · · · · · · · · · ·			
	2014/08/25 15:25:34		2014/08/25 15:25:55

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>. Iac = 0.00A Idc =0.00A B).Apply load to output.30A or 0.60 @18Vac</enter>	Callbration
	2014/08/25 15:26:40

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

CALIBRATION	Calibration
A).Wait 2 seconds, then press <enter>.</enter>	
Iac = 0.00A Idc =0.00A	
B).Apply load to output.30A or 0.6Ω@18Vac	
Keyin the measured lac, then press <enter></enter>	
lac = 0.000A	
	2
r r r	2014/08/2

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.30A or 0.60 @18Yac Keyin the measured lec, 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		Current Measurement:⊉1	
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>	Callbration
	2014/08/25 15:27:48		2014/08/25 15:28:12

In 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.

CALIBRATION	Calibratio
A).Wait 2 seconds, then press <enter>.</enter>	
Iac = 0.00A Idc =0.00A	
B).Apply load to output.60A or 0.6Ω @36Vac	
B). Apply load to output. Oux of 0. 61 0.50 0.50 ac	
	5
	2
	-

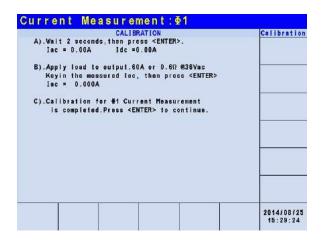
In step B, adjust the load to 0.62 Ω for output and press **ENTER**. The Regenerative Grid Simulator will output 36Vac \circ



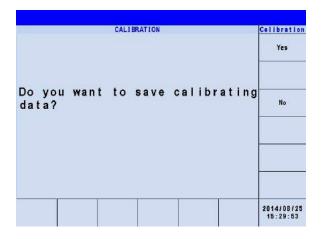
When the Regenerative Grid Simulator is model 61830, the simulated power output will be 27Vac.

Current Measurement:⊈1	
CALIBRATION A).Wait 2 seconds,then press <enter>. Iac = 0.00A Idc =0.00A B).Apply load to output.60A or 0.602 0236Vac Keyin the measured Isc, then press <enter> Iac = 0.000A</enter></enter>	Calibratio
	2014/08/25

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



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.





- 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.
- 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.

Exter	nal V	ref:∳	1			
		CALIBR	ATION			Calibration
	o⊉1 E: bratio		al Vre	f		
Remo	ve Lo	ad Bet	ore (Calibr	ating	
1000000	s <en s <ex< td=""><td>The state of the second</td><td></td><td></td><td>۱.</td><td>- </td></ex<></en 	The state of the second			۱.	-
Voltage Setting& Measure.	Current Measure.	External Vref	Level Setting 1750			2014/08/25 15:30:28

CALIBRATION	Calibration
A).Short External Vrcf pin1 and	pin4
, then press <enter>.</enter>	
	2014/08/23

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

External Vref:⊉1		External Vref:@1	1
CALIBRATION A).Short External Vref pin1 and pin4 ,then press <enter>. B).Wait 2 seconds,then press <enter>.</enter></enter>	Calibration	CALIBRATION A).Short External Vrcf pin1 and pin4 ,then press <enter>. B).Wait 2 seconds,then press <enter>. Vdc = 0.00V</enter></enter>	Calibration
	2014/08/25 15:31:17		2014/08/25 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.

External Vref:Φ1	
CALIBRATION A).Short External Vref pint and pin4 ,then press <enter>. B).Wait 2 seconds,then press <enter>. Vdc = 0.00V C).Apply 10 Vdc between External Vref pin1 and pin4 then press <enter></enter></enter></enter>	Calibration
	2014/08/25 15:32:00

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**.

External Vref: 01	Calibration
A).Short External Vref 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, Keyin DVM measured voltage between pin1 and pin4 then press <enter> Vac =<u>0.000</u>V</enter>	
	2014/08/25 15:32:22

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 Vref 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, 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.

	CALIBRATION	Calibration
		Yes
Do you want data?	to save calibratin	ng No
		2014/08/25

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 1750 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	bration CALIBRATION Calibration
Run ⊈1 Voltage Setting and Measurement calibration.	This function allows user to adjust the output response speed.
Remove Load Before Calibrating Press <enter> to continue.</enter>	When the Level value,is set to high,it could be cause overshoot.
Press <exit> to skip</exit>	
	Voltage Current External Level 2000/01/0 :11:39 Setting& Measure. Vref 1/50 01:12:63

Procedure for adjusting the response speed:

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

WARNING 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:
⊉ 2	Vac	=	1).	0 V	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	V ₃₁	=	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	2.200	Water State	List Mode
₫1	Vac	=	0	V0.0	F =	60.	00Hz	
⊉ 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	V 31	=	(0.00	P٥	=	0.0	Edit
	List Mode	Pul	32	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/12/18

3 Phase LIST MODE QUIT List Mode LIST MODE SETTING 0.0V Vac end = Vac start = 0.0V 0.0V Edit F start = 60.00Hz F end = 60.00Hz Vdc start = 0.0V Vdc end = 0.0V Degree = 0.0 Waveform = Α Trigger Time 0.0ms Vac start = 0.0V Vac end = 0.0V Basc Time start = 60.00Hz F end = 60.00Hz ₽2 Vdc start = 0.0V 0.0V Vdc end = Degree 240.0° Waveform = A Count 0.0ms Time Vac start = Vac end = 0 0V 0.0V Sequence F start = 60.00Hz 60.00Hz F end = 3 Vdc start = 0.0V Vdc end = 0.0V 120.0* Degree Waveform = A Execution Page Time -0.0ms Inter-List Pulse Step Harmonic 2014/12/18 10:12:17 Synthesis Mode harmonics Mode Mode Meas.

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

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 / Φ 1+ Φ 2+ Φ 3.

Individual: The three phases are set separately.

 Φ 1+ Φ 2+ Φ 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 MO	DE:STO	P	QUIT
	1022		54	OUTPUT			and the	List Mode
₫1	Vac	=	0	. OV	F =	60.	00Hz	
⊉ 2	Vac	=	0	. OV	F =	60.	00Hz	Trigger
₫3	Vac	=	0	. OV	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	V ₃₁	=	0	.00	Po	=	0.0	Edit
	List Mode	Puls	32	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/12/18

3	Pha	se	LI	ST MOD	DE : RUN	NING	OUT
	1020		OUTPUT	SETTING			List Mode
₫1	Vac	=	0.0V	F =	60.	00Hz	
₹2	Vac	=	0.0V	F =	60.	00Hz	Stop
₽ 3	Vac	=	0.0V	F =	60.	00Hz	
			MEASU	REMENT			
	٧	=	0.43	Po	=	0.1	
1	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	8
13	I	=	0.029	PF	= -0.	100	
	V 12	=	0.55	V23	= 0	. 27	ri:
Σ	V 31	=	0.56	Po	=	0.1	
	List Mode	Puls		Synthesis	Inter- harmonics	Harmonic Meas.	2014/05/13

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°, 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	e e	LI	ST MOD)E	QUIT	
	1023		LIST MOD	E SETTING			List Mode
	Vac	start	=	0.0	V		
1	Vac	end	=	0.0	V		
	F	start	=	60.00	Hz		Trigger
1	F	end	=	60.00	Hz		Auto
	Vdc	start	=	0.0	V		Basc Time
1	Vdc	end	=	0.0	٧		0.000
1	Degr	ee	=	0.0	•		Count 1
١	Wave	form	=	Α			Sequence
	Time	E.	=		0.0ms		0 0
							Execution Page
	.ist ode	Pulsc Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/05/12

1_	Phas	e e	LIS	ST MOD)E	QUIT	and a second subscription of the large
	1023		LIST MODE	SETTING			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		Basc Time
	Vdc	end	=	0.0	V		<u></u>
	Degr	ee	=	0.0	•		Count 1
	Wave	form	=	A			
	Time	E.	=		0.0ms		Sequence 0
							Execution Page
	List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/05/17

Pha	ase	LI	ST MOD)E	QUIT	والمتعادية
1022		LIST MO	DE SETTING			List Mode
Vac	start:	=	0.0	V		
Vac	end 🛛	=	0.0	V		
F	start	=	60.00	Hz		Trigger
F	end	=	60.00	Hz		Auto
Vdd	start	=	0.0	V		Basc Time
Vdd	end:	=	0.0	V		1 THE
Deg	ree	=	0.0	•		Count
Way	, eform	=	Α			
Tin	ne	=		0.0ms		Sequence 0
						Execution Page
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/05/11 10:12:16

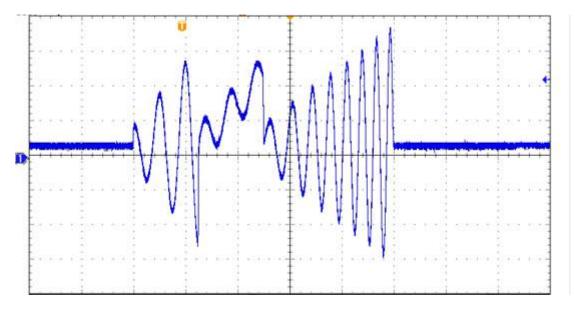
1	Pha	5 O	LIS	T MOD)E	QUIT	
	Vac	start	.IST MODE	SETTING 0.0	v		List Mode
	Vac	end	=	0.0	v		
	F	start	=	60.00	Hz		Trigger
	F	end	=	60.00	Hz		Auto
	Vdc	start	=	0.0	٧		Basc Time
	Vdc	end	=	0.0	٧		
	Degi	ree	=	0.0	•		Count 1
	Wave	form	=	Α			Sequence
	Time)	=		0.0ms		_0
							Execution Page
	List Mode	Pulsc Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/05/17 10:12:49

1_Pha			ST MOD	DE	QUIT		1_Pha			ST MO	DE	QUIT	
Vac Vac	start	LIST MO = =	20.0 100.0	1.5.		List Mode		start	LIST MOI = =	20.0 20.0			List Mode
F F	start end	= =	50.00 50.00			Trigger Auto	F	start end	= =	50.00			Trigger Auto
	start end	=	0.0			Basc Time		start end	=	0.0 100.0			Basc Time
Deg	ree	=	0.0	8.7.8		Count 1	Deg		=	0.0	3070		Count 1
Wav Tim	eform e	=	<u>A</u> 5	i0.0m s		Sequence Q	Wav Tim	eform e	=	A t	i0.0ms		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

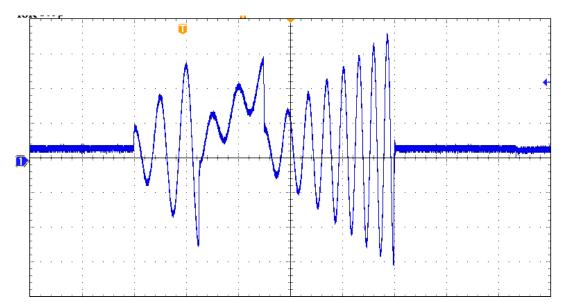
1_Pha	Se	L	IST MOD)E	QUIT	
LALVO		LIST MO	DE SETTING	1910		List Mode
Vac	start	=	20.0	V		
Vac	end	=	120.0	٧		
F	start	=	50.00	Hz		Trigger
F	end	=	100.00	Hz		Auto
Vdc	start	=	0.0	V		Base Time
Vdc	end	=	0.0	V		
Deg	ree	=	0.0	•		Count 1
Wav	eform	=	Α			
Tim	e	=	10	0.0ms		Sequence 2
						Execution Page
List Mede	Pulso Mode	Step Mode	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 MO	DE:ST	OP	QUIT
	1025			OUTPUT	SETTING	10100	Specie Che	Pulse Mode
₹1	Vac	=	0.	. OV	F =	60	.00Hz	
⊉ 2	Vac	=	0	. OV	F =	60	.00Hz	Trigger
₽ 3	Vac	=	0	. O V	F =	60	.00Hz	
				MEASU	REMENT			
20	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
23	I	=	0.0	000	PF	= 0	.000	
	V 12	=	0	.00	V23	=	0.00	-
Σ	V 31	=	0	. 0 0	Po	=	0.0	Edit
	List Mode	Puls		Step Mode	Synthesis	Inter-	Harmonic Meas.	2014/05/11

3	Phas	е	PUL	SE MOD)E	(TIUC	
			PULSE MO	DE SETTING				Pulse Mode
	Vac	-	0.0V	Vdc		0.0	v	Edit
	F	=	60.00Hz	Duty cyc	e=	50.0	%	Each
₹1	Degree	-	0.0*	Waveform	-	A		Trigger
	Period	-	0.0ms					Auto
	Vac		0.0V	Vdc	-	0.0	v	Count
	F	=	60.00Hz	Duty cyc	6=	50.0	x	0
22	Degree	-	0.0*	Waveform	-	A		
	Period	-	0.0ms					
	Vac		0.0V	Vdc	=	0.0	V	3
	F	=	60.00Hz	Duty cyc	6=	50.0	x	
± 3	Degree	-	0.0*	Waveform	-	A		Execution
	Period		0.0 ms					Page
	List Mode	Pulse Mode	Step Mode	Synthesis	Inte		Harmonic Meas.	2014/05/11

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 MOI	DE:ST	OP	QUIT
	1022			OUTPUT	SETTING	101010	Second Street	Pulse Mode
≣1	Vac	=	0	.0V	F =	60	.00Hz	
₽ 2	Vac	=	0	. OV	F =	60	.00Hz	Trigger
₽ 3	Vac	=	0	.0V	F =	60	.00Hz	
				MEASU	REMENT			
	٧	=	0	.00	Po	=	0.0	
1	I	=	0.	000	PF	= 0	.000	_
	٧		0	.00	Po	=	0.0	
1 2	I	=	0.	000	PF	= 0	.000	
	V	=	0	.00	Po	=	0.0	3
13	I	=	0.	000	PF	= 0	.000	
	V 12	=	0	.00	V23	=	0.00	-
Σ	V ₃₁	=	0	.00	Po	=	0.0	Edit
	List Mode	Pul		Step Mode	Synthesis	Inter-	Harmonic Meas.	2014/05/11

3	Pha	se		PUL	SE MOI	DE:RUN	NING	OUT
	1020			OUTPUT	SETTING			Pulse Mode
₫1	Vac	=	0	. OV	F =	60.	00Hz	-
⊉ 2	Vac	=	0	. OV	F =	60.	00Hz	Stop
₫3	Vac	=	0	. OV	F =	60.	00Hz	
				MEAS	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	
	۷	=	0	. 29	Po	= -	0.0	3
₫3	I	=	0.	028	PF	= -0.	119	
	V 12	=	0	. 51	V23	= 0	. 31	-
Σ	V ₃₁	=	0	. 58	P٥	=	0.0	
	List Mode	Pul		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:

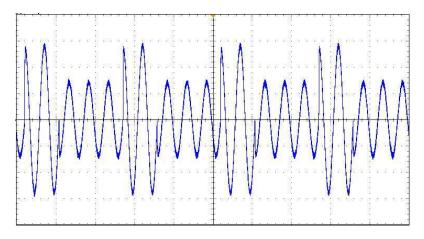
Vac = 100V, Vdc = 0V F = 50Hz, Duty cycle = 35%Period = 100ms, Degree = 90° Waveform = A

Trigger: Auto, Count: 0

The following lists the setting pages of PULSE MODE.

1_Phase	PUL	SE MODE	QUIT	and a state of a state of the
Vac	PULSE MO	DE SETTING D.OV		Pulse Mode
Vdc	=	0.0V		
F	=	60.00Hz		Trigger
Duty cyc	le=	50.0%		Auto
Degree	=	0.0°		Count 0
Waveform	=	A		
Period	=	0.0	ns	
				Execution Page
List Pulse Mode Mode	Step Mode	Synthesis Inter harmon		2014/05/17 10:29:20
1_Phase	PUL PULSE FO	SE MODE	QUIT	Pulse Mode
Vac	=	0.0V		Furse node
Vdc	=	0.0V		
F	=	60.00Hz		Trigger Auto
Duty cyc	le=	50.0%		Count
Degree	=	0.0°		0
Waveform	=	A		
Period	=	0.0	ns	2
				Execution Page
List Pulsc Node Mode	Step Mode	Synthesis Inter harmon		2014/05/17 10:29:55
9686000 - 16669				
1_Phase	PUL		QUIT	
Vac	PULSE MO	DE SETTING 100.0V		Pulse Mode
Vdc	=	0.0V		
F	=	50.00Hz		Trigger
Duty cyc	le=	35.0%		
Degree	=	90.0°		Count 0
Waveform	=	Α		
Period	=	100.0	ns	0
				Execution Page
	Step	Inter	- Harmonic	2014/05/17

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 MO	DE:S1	TOP	QUIT
				OUTP	UT SETTING			Step Mode
1	Vac =	0.0V		F =	60.00Hz	Vdc =	0.0V	Trigger
₹2	Vac =	0.OV		F =	80.00Hz	Vdc =	0.0V	ingger
3	Vac =	0.0V		F =	60.00Hz	Vdc =	0.0V	
				MEA	SUREMENT			
ers:	٧	=	0	.00	Po	=	0.0	
H	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	
13	I	=	0.	000	PF	= 0	.000	
	V 12	=	0	.00	V23	=	0.00	12
Σ	V 31	=	0	.00	Po	=	0.0	Edit
	List Mode	Puls		Step Mode	Synthesis	Inter-	Harmonic S Meas.	2014/05/17

3	Phas	e	\$1	TEP MOL	DE	QUIT	
		202		DE SETTING		Sector and	Step Mode
	Vac	-	0.0V	∆Vac	-	0.0V	Edit
	F	-	60.00Hz	۵F	=	0.00Hz	Each
#1	Vdc	=	0.0V	∆Vdc	=	0.0V	and the second s
	Degree		0.0*	Waveform	-	A	Trigger
	Count	=	0	Dwe I I	=	0.0 ms	Auto
	Vac	-	0.0V	∆Vac	-	0.0V	
	F		60.00Hz	ΔF	=	0.00Hz	
₫2	Vdc	=	0.0V	∆Vdc	=	0.0V	
	Degree	=	0.0*	Waveform	=	A	
	Count	=	0	Dwe I I	=	0.0ms	-
	Vac	=	0.0V	∆Vac	=	0.0V	3.
	F	=	60.00Hz	۵F	=	0.00Hz	
23	Vdc		0.0V	∆Vdc	-	0.0V	
	Degree	=	0.0*	Waveform	-	A	Execution
	Count	=	0	Dwe I I	•	0.0ms	Page
	List Mode	Pulsc Mode	Step Mode	Synthesis		nter- Harmonic nonics Meas.	2014/05/11

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.
ΔVac, ΔF, ΔVdc: 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		5	TEP MOI	DE:ST	OP	QUIT
				OUT	UT SETTING			Step Mode
∎1	Vac =	0. 0 V		F =	60.00Hz	Vdc =	0.0V	Trigger
₹2	Vac =	0. 0 V		F =	60.00Hz	Vdc =	0.0V	ingger
# 3	Vac =	0.0V		F =	60.00Hz	Vdc =	0.0V	
				ME	ASUREMENT			
es:	٧	=	0	.00	Po	=	0.0	
1	I	=	0.	000	PF	= 0	. 0 0 0	
	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	1
Σ	V 31	=	0	.00	Po	=	0.0	Edit
	List Mode	Pulse Mode		Step Mode		Inter- harmonics	Harmonic Meas.	2014/05/11

3	Pha	se	S	TEP MOI	DE : RUN	NING	QUIT
			OUTPL	JT SETTING			Step Mode
∎1	Vac =	0.0V	F =	60.00Hz	Vdc = 0	0V	Stop
₫2	Vac =	0.0V	F =	60.00Hz	Vdc = 0	. OV	atop
9 3	Vac =	0.0V	F =	60.00Hz	Vdc = 0	. ov	Pause
			MEA	SUREMENT			1 48.20
	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	8
# 3	I	= (0.000	PF	= 0.	000	
	V 12	=	0.00	V23	= 0	.00	-
Σ	V 31	=	0.00	Po	=	0.0	
	List Mode	Pulsc Mode	Step Mode	Synthesis	Inter- harmonics	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	Phas	e			S	TEP MOL	DE :	RU	IN	NING	OUT
				¢	UTP	UT SETTING					Step Mode
£1	Vac =	0. 0 V		F	-	60.00Hz	Vdc	•	0.	٥v	STOP
₫2	Vac =	0.0V		E	=	80.00Hz	Vdc	=	0.	ov	alvr
2 3	Vac =	0.0V		F		60.00Hz	Vdc		0.	ov	Trigger
					MEA	SUREMENT					UP
1015	۷	=	0		88	Po	=		().2	Trigger
₽1	I	=	0.	2	36	PF	=	0	. 9	939	DOWN
	٧	=	0		28	Po	=		-(0.0	
⊉ 2	I	=	0.	0	24	PF	=	-0	.1	00	
	٧	=	0		75	Po	=		-(0.0	2
4 3	I	=	0.	0	30	PF	=	-0	. 8	320	
	V 12	-	0		99	V23	=		0	68	1
Σ	V 31	=	0		54	Po	=		().2	
	List Mode	Pulse Mode			Step 1ode	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, Δ Vac = 10V F = 50Hz, Δ F = 10Hz Vdc = 0V, Δ Vdc = 20V Degree = 90°, Dwell = 60ms Count = 3 , Waveform = A

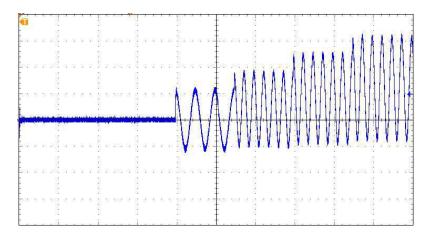
Following lists the setting pages of STEP MODE.

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	ST	EP MOI	DE	QUIT	
1020		STEP MO	DE SETTING			Step Mode
Vac		=	40.0	٧C		
∆Va	c	=	10.0	v		
Vdc		=	0.0	v		Trigger
∆Vd	с	=	20.0	v		Auto
F		=	50.00	Hz		
۵F		=	50.0	0Hz		
Deg	ree	=	90.0) °		
Cou	n t	=	1	3		3.
Wav	eform	=	Α			
Dwe	11		(<u>60.0</u> m s		Execution Page
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/05/1 10:54:08

Pha	s e				\$1	ΓEΡ	MC	DE	: \$1	ГС	P		OUT
10220		1.24		(UTPUT	T SETT	TING	inter a			Viene	-	Step Mode
Vac	=	7	0		0 V	F	=	10	0.	0	OF	lz	
Vdc	=	6	0	•	0 V 0								Trigger
					MEAS	UREME	NT						
V	=	9	1		81	F	> 0	=		1	0.	.7	
I	=	0		1	71	F	PF	=	0		68	86	
Vac	=	6	9		46	١	/dc	=	5	9	. 5	6	
Iac	=	0		0	17	:	Ido	=	0		17	2	
Vpk	=	15	8		94	3	VA	=		1	5.	.7	8
Ipk	=	0		2	66	(CF	=	1		5 5	53	
													Edit
 List Mode		ulse ode			Step Node	Sy	nthesi	0	nter- monie		1.055	armonic Meas.	2014/05/1

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



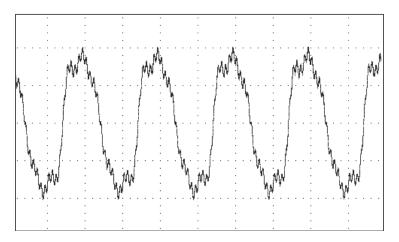
5.5 Synthesis Waveform

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	е			SYN	THES	IS	:ST	0	P	QUIT
	S	YNTH	ESIS	WAV	EFORM	FUNDAMENT.	AL S	ETTIN	G		Synthesis
± 1	Vac_fund	=	0.0	¥	F_fund	=60Hz		Vdc =		0.0V	Run
⊉ 2	Vac_fund	=	0.0	٧	F_fund	=60Hz		Vdc =		0.0V	Kun
₫3	Vac_fund	=	0.0	v	F_fund	=60Hz		Vdc =		0.0V	
		S	YNTHE	SIS	WAVEF	ORM MEASU	REME	NT			
es.	٧	=	0).	00	Po	=		-	0.0	
₽1	I	=	0.	0	00	PF	=	0		000	
	٧	=	0).	00	Po	=		and a	0.0	
⊉ 2	I	=	0.	0	00	PF	=	0		000	
	٧	=	0).	0 0	Po	=		100	0.0	8
₫3	I	=	0.	0	00	PF	=	0		000	
	V 12	=	0).	00	V23	=		0	.00	-
Σ	V 31	=	0).	00	Po	=			0.0	Edit
	List Mode	Puls	22 L		Step Mode	Synthesis		Inter- rmonics	5	Harmonic Meas.	2014/05/11

					UNDAMENT		TTING		Synthesis
Vac F	fundame fundame		0 50Hz	.0V	Vdc = Degree =		. 0V . 0°		Compose Percent-1
N	%	θ	N	5	6 0	N	%	θ	
2	0.00	0.0	19	0.0	0.0	36	0.00	0.0	Edit
3	0.00	0.0	20	0.00	0.0	37	0.00	0.0	ALL
4	0.00	0.0	21	0.00	0.0	38	0.00	0.0	1000
5	0.00	0.0	22	0.00	0.0	39	0.00	0.0	
6	0.00	0.0	23	0.00	0.0	40	0.00	0.0	Cicar
7	0.00	0.0	24	0.01	0.0	41	0.00	0.0	All
8	0.00	0.0	25	0.00	0.0	42	0.00	0.0	
9	0.00	0.0	26	0.01	0.0	43	0.00	0.0	View
10	0.00	0.0	27	0.01	0.0	44	0.00	0.0	Waveform
11	0.00	0.0	28	0.00	0.0	45	0.00	0.0	a a rentran
12	0.00	0.0	29	0.01	0.0	46	0.00	0.0	0.
13	0.00	0.0	30	0.0	0.0	47	0.00	0.0	
14	0.00	0.0	31	0.0	0.0	48	0.00	0.0	
15	0.00	0.0	32	0.0	0.0	49	0.00	0.0	-
16	0.00	0.0	33	0.04	0.0	50	0.00	0.0	Execution
17	0.00	0.0	34	0.01	0.0				Page
18	0.00	0.0	35	0.0	0.0				rage
List	Pu	Isc	Ste	p	Synthesis	I	nter-	Harmonic	2015/01/0

61830/61845/61860 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	UIT			
11122.0			T SETTING	-		a.29	Setting
Vac	=	0.0V	F =	60.	001	Hz	OUTPUT: More Setting
							Measurement Setting
		MEA	SUREMENT				Serting
٧	=	0.00	Po	=	- 3	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	=	1	0.0	Output
Ipk	=	0.000	CF	=	0.	000	Mode
List Mode	Pul	77 1 7777	Synthesis	Inte	100	Harmonic Meas.	2014/12/18

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

_PI	has					SYN			- C		0P	QUIT
	S	YNTHE	SIS	W	AVEF	ORM F	UNDAM	IENTA	L SE	TTING		Synthesis
Va	1 C _	fun	d		-	0	. 0 \	1				Run
F_	fu	n d			= 6	0Hz	٧	/dc	=		0.0V	
		SY	NTH	ES	15 1	AVEFO	RM ME	ASUR	EMEN	T		
۷		=	d.	0	. 0	0	Po		=		0.0	
Ι		=	0	. (00	0	PF	1	=	0.	000	
Va	IC	=		0	. 0	0	Vo	lc	=	0	.00	
Ia	C	=	0	. (00	0	Ιc	lc	=	0.	000	
Vp	k	Ħ	1	0	. 0	0	VA	١	=		0.0	2
Ip	k	=	0	. (00	0	CF		=	0.	000	
												Edit
List Mode		Pulse			Ste		Synth	esis	5.53	iter- ionics	Harmon Meas.	

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

Synthesi		TTING		UNDAMENT/					
Compose		0V 0°		Vdc =				fundame fundame	Vac
Value-1		U	υ.	Degree =		BUHZ	ntai =	TUNCAME	<u>r</u>
	θ	٧	N	θ	V	N	θ	٧	N
	0.0	0.00	36	0.0	0.00	19	0.0	0.00	2
	0.0	0.00	37	0.0	0.00	20	0.0	0.00	3
	0.0	0.00	38	0.0	0.00	21	0.0	0.00	4
	0.0	0.00	39		0.00	22	0.0	0.00	5
	0.0	0.00	40		0.00	23	0.0	0.00	6
	0.0	0.00	41	0.0	0.00	24	0.0	20.00 _	7
-	0.0	0.00	42	0.0	0.00	25	0.0	0.00	8
View	0.0	0.00	43		0.00	26	0.0	0.00	9
Waveform	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
2	0.0	0.00	46		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		0.00	31	0.0	0.00	14
-	0.0	0.00	49		0.00	32	0.0	0.00	15
Execution	0.0	0.00	50		0.00	33	0.0	0.00	16
Page					0.00	34	0.0	0.00	17
. age				0.0	0.00	35	0.0	0.00	18
2015/01/0	Harmonic	nter-	Ir	Synthesis	p	Ste	se	Pu	List

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

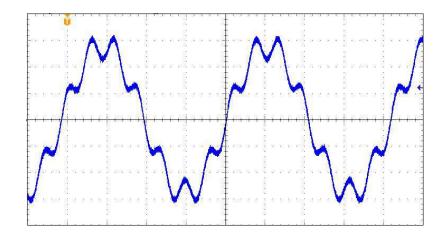
Compose = Percent-1 Edit = Φ 3 Vac fundamental = 100.0V F fundamental = 60Hz Vdc = 0.0V Degree = 0.0°



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 SEI	TING		Synthesis
Vac	_fu	Ind	=	100	.0V				Stop
F_f	unc	ł	= 6	OHz	Vdd	; =		0.0V	
		SYNTHE	SIS	WAVEFO	RM MEASUR	EMENT			
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	0
Ipk	=	0.	26	6	CF	=	1.	590	
									12
List Mode		lisc ode		lep	Synthesis	5.050	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 ≤ 10 , value $\leq 90V$ or percentage $\leq 30\%$.
 - $11 \leq \text{ order} \leq 20$, value $\leq 60V$ or percentage $\leq 20\%$.
 - $21 \leq \text{order} \leq 40$, value $\leq 30V$ or percentage $\leq 10\%$.
 - $41 \leq$ order \leq 50, value \leq 15V or percentage \leq 5%.
- If the synthesis waveform exceeds the voltage limit, OUTPUT OVP or DST Protection will occur.

5.6 Inter-harmonics Waveform

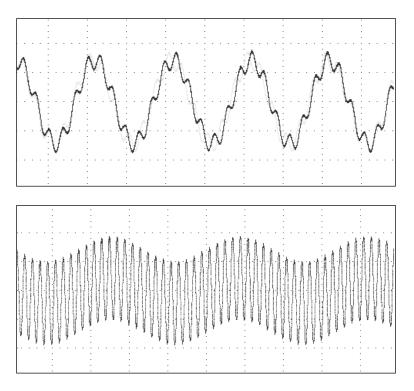
Notice

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:	STC)P	QUIT
	1022			OUTPUT	SETTING		and the second second	Acres and	Interharmo
₫1	Vac	=	0	.0V	F =		60.	00Hz	
⊉ 2	Vac	=	0	. OV	F =		60.	00Hz	Trigger
₫3	Vac	=	0	. O V	F =		60.	00Hz	
				MEAS	REMENT				
	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	V 31	=	0	.00	Po	=		0.0	Edit
	List Mode	Pu Ma	lsc dc	Step Mode	Synthesis		nter- monics	Harmonic Meas.	2014/05/11

	-	INTERHA		WAVEFORM SE			Interharmo
	F	start	-	0.0	1Hz		Edit
	F	end	=	0.0	1Hz		Each
ē1	Time)	=	0.0	OSec		
	Leve		=	0.	0%		
	F	start	=	0.0	1Hz		
	F	end	=	0.0	1Hz		
₹2	Time	•	=	0.0	OSec		
	Leve	el 👘	=	0.	0%		
	F	start	=	0.0	1Hz		3
3	F	end	=	0.0	1Hz		
23	Time	1	=	0.0	OSec		Execution
	Leve	e l	=	0.	0%		Page
	List Mode	Pulsc Mode	Step Mode	Synthesis	Inter-	Harmonic Mcas,	2014/05/12

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:

1_	Pha	se		LOC/	AL QI	JIT			
	1020				T SETTING	1101000		91 20	Setting
	Vac	=	0	.0V	F =	60.	00	Hz	OUTPUT: More Setting
									Measurement Setting
				MEAS	SUREMENT				Serring
	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	32	Step Mode	Synthesis	Int	75.0	Harmonic Meas.	2014/12/18

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	e INT	ERHA	RMONIC	:S	QUIT	
	F	INTERHA start	RMONIC W =	AVEFORM SE			Interharmon
	F	end	=	500.0	0Hz		
	Time	•	=	10.	OSec		
	Leve	e I		20.	0%		
							2
							Execution Page
	List Mode	Pulsc Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/05/17 11:24:40

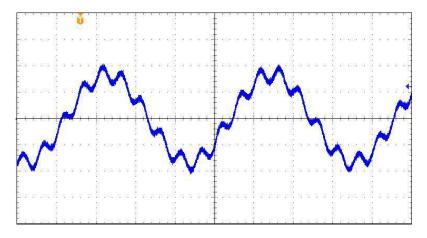
Press Edit on the right to go to the editing screen. Use the arrow keys to move the cursor to the column to be set and use the numeric keys to key-in the setting and then press **ENTER**. The example uses the following settings:

```
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 \leq F start or F end \leq 1000Hz, Level \leq 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	ARN	ONI	C	ME	AS	. : 8	STO	Ρ		QUIT
01				. H/	RMONI				SET	TING				Harmonic
н	THD	=	0.	0%	DC		0.0	¥	Fu	ndame	ntal	=	0.0V	
2	THD	=	0.	0%	DC	=	0.0	v	Fu	ndame	ntal	=	0.0V	Trigger
3	THD	=	0.	0%	DC	=	0.0	¥	Fu	n dame	ntal	=	0.0V	
	-	N			%	N	(0)	,		N			%	
	2		0.0	0	15	0.00		28	0	. 00	41		0.00	
	3		0.0	0	16	0.00		29	0	.00	42		0.00	
	4		0.0	0	17	0.00		30	0	.00	43		0.00	DATA
	5		0.0	0	18	0.00		31	0	.00	44		0.00	₹1
	6		0.0	0	19	0.00		32	0	.00	45		0.00	-
	1		0.0	0	20	0.00		33	0	.00	46		0.00	
	8		0.0	0	21	0.00		34	0	.00	47		0.00	
	9		0.0	0	22	0.00		35	0	.00	48		0.00	
	10		0.0	0	23	0.00		36	0	.00	49		0.00	
	11		0.0	0	24	0.00		37	0	.00	50		0.00	
	12		0.0	0	25	0.00		38	0	.00				0
	13		0.0	0	26	0.00		39	0	.00				Edit
	14		0.0	0	27	0.00		40	0	.00			_	1000
	List Mode		1.12	ulsc odc		Step Mode	Sy	nthe	is	Int		- 77	armonic Meas.	2015/01/0

3	Pha	se HAI	RMONI	C MEAS	8 . – M	QUIT	
			HARMONIC	MEASUREMENT			Harmonic
	Sou	rce = <u>)</u>	L				Edit Each
₹1	F	funda	ament	al =60	Hz		Parameter Value
	Sou	rce =\	/				Measurement Single
₽2	F	funda	amen t	al =60	Hz		
	Sou	rce =\	/				0.
∰ 3	F	funda	amen t	al =60	Hz		Execution Page
	List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/05/17 11:27:38

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:

Pha	se	LOCA	LG	UIT	
-1073		OUTPUT	SETTING		Setting
Vac	=	0.0V	F =	60.00	Hz OUTPUT: More Settin
					Measuremen Setting
		Sector Co	SETTING		oerung
Wav	eform	SINE			Waveform Viewer
ON	Degr		0.0		Limitation
	Degr	ee =	IMMED		Output
Vac	SIR	=	0.0	00V/ms	Mode
Vdc	S/R	=	0.0	00V/ms	
F	S/R	=	0.0	00Hz/m	IS
					-
Coupling AC		Output Waveform Selection			2014/12/1 10:22:36

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

Phase	LOCAL	QUIT	and the second second second second
Vac =	0.0V F =	60.00Hz	Waveform
Waveform A	MORE SETTING		
Waveform B	= SINE		View Waveform
			0.
Counting	Output		
Coupling AC	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 Q	UIT	
Vac = Vdc =	0.0V F = 0.0V	60.00Hz	Waveform
Waveform A = 1	OUTPUT WAVEFORM A		
\bigwedge	N Z 3 2.50 5 3.2.50 7 2.50 23 1.90 25 1.90 31 1.60 33 1.10	 0 0 0 0 0 0 0 0	0. 12
Coupling AC+DC	Output Waveform Selection		2014/12/18

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.

1	Pha	s e		LOC	AL O				
	-(172)		57600		T SETTING	05035522	-	9.27	Main
	Vac	=	100	<u>0</u> V	F =	60	.00	Hz	OUTPUT: More Setting
									Measurement Setting
				MEA	SUREMENT				ouring
	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	=	6	0.9	Output
	Ipk	=	0.	878	CF	=	1.	443	Mode
1	Recell CH1	11.49.37	call H2	Recall CH3	Recall CH4	1 222	call H5	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	s e		LOC	AL O	UT		
1925				T SETTING		61.27	Setting
Vac	=	100	. OV	F =	60.00	Hz	OUTPUT: More Setting
							Measurement Setting
			MEAS	SUREMENT			ouring
٧	=	99	.95	Po	=	0.5	Waveform
I	=	0.	608	PF	= 0.	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
 List Mode		ilsc	Step Mode	Synthesis	Inter-	Harmonic Mcas.	2014/12/18

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

	Pha	asel	HARI	NONIC	; MEA	15.18	510	P	QUIT
		ł	ARMON	IC MEASU	REMENT S	ETTING			Harmonic
	THE) =	0	.0%	DC	=		0.0V	Trigger
	Fur	ndame	enta	al =	0.	0V			
	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			0.7750
1	List Mode	Puls	2 1	Step	Synthesi	s Inte	100	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	8. S	QUIT	
			HARMONIC M	EASUREMENT			Harmonic
		rce =	_				Parameter Value Measurement Single
	F	tuna	amenta	1 = 6 U	HZ		Execution
							Page
	List Mode	Pulsc Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2014/05/17 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

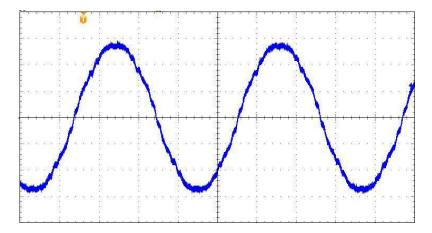
	1	ARMONI	C MEASU	REMENT SI	ETTING			Harmonic
THE) =	0.	0%	DC	=		0.0V	Trigger
Fun	dame	enta	= 1	0.	0 V 0			ingge.
N	VALUE	N	VALUE	N	VALUE	N	VALUE	
2	0.00	15	0.00	28	0.00	41	0.00	
3	0.00	16	0.00	29	0.00	42	0.00	
4	0.00	17	0.00	30	0.00	43	0.00	
5	0.00	18	0.00	31	0.00	44	0.00	
6	0.00	19	0.00	32	0.00	45	0.00	
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	1000		
13	0.00	26	0.00	39	0.00			Edit
14	0.00	27	0.00	40	0.00			10000
List Mode	Puls	5 1	Step Mode	Synthesis	a Inte	100	Harmonic Meas.	2015/01/02

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

Harmonic			TING	IT SET	RE	C MEASU	RMONI	HA	
Stop	0.0V		=	DC		2%	5.	=	THD
otop			V	9.8		=	n ta	dame	Fun
	%	Ř <u>–</u> –	N	76		N	*		N
	0.00	41	0.00	8 (0.01	15	0.03	2
	0.01	42	0.02	9 (0.02	16	2.53	3
	0.01	43	0.02	0 (0.01	17	0.01	4
	0.01	44	1.64	1 1		0.00	18	1.94	5
	0.01	45	0.04	2 (0.01	19	0.02	6
	0.00	46	1.22	3		0.00	20	2.61	7
	0.01	47	0.01	4 (0.01	21	0.03	8
	0.01	48	0.01	5 (0.02	22	0.00	9
	0.00	49	00.0	6 (2.01	23	0.01	10
	0.02	50	9.01	7 (0.04	24	0.00	11
			00.0	8 (1.19	25	0.01	12
			0.01	9 (0.01	26	0.00	13
			00.00	0 (0.01	27	0.01	14
2015/01/0	Harmonic Meas,	200	Inte	thesis	s	Step Mode		Pulse Mode	List 1ode

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

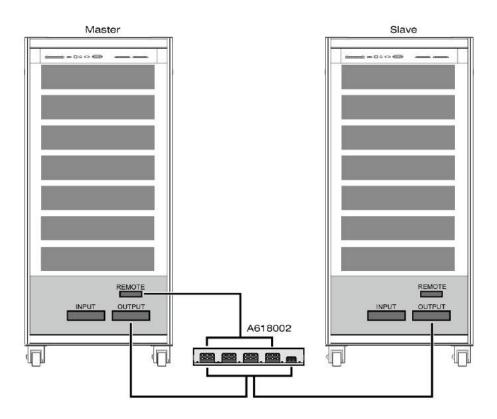
When the user presses Trigger to execute the current harmonic measurement, the Regenerative Grid Simulator will adjust the internal gain automatically by the measured data so that the Regenerative Grid Simulator can get more accurate data of each harmonic. Thus, it is better to wait for the load to be 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 Simulator

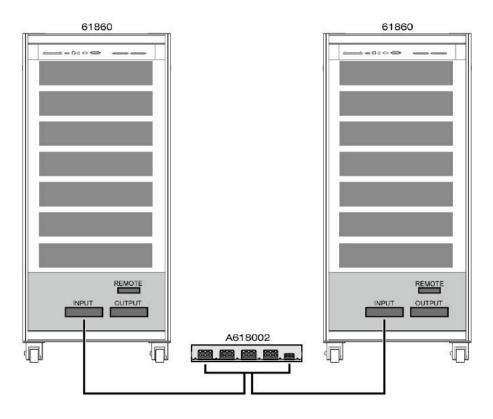
6.1.1 Connecting Two Parallel Units for Output

When two Regenerative Grid Simulators are to be connected in parallel mode, it can use the fixture A618002 (Input/Output Terminals for Parallel Connecting) to connect the output of two Regenerative Grid Simulators as the figure shown below.



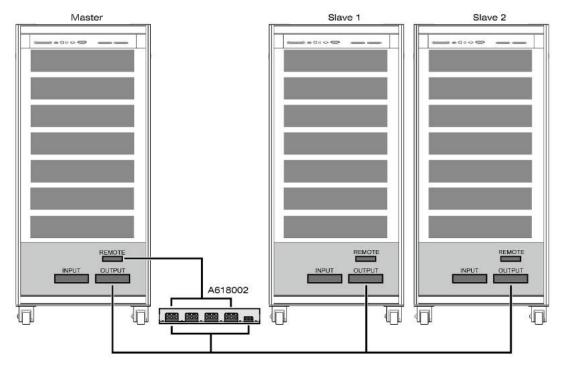
6.1.2 Connecting Two Parallel Units for Input

When two Regenerative Grid Simulators are to be connected in parallel mode, it can use the fixture A618002 (Input/Output Terminals for Parallel Connecting) to connect the input of two Regenerative Grid Simulators as the figure shown below.



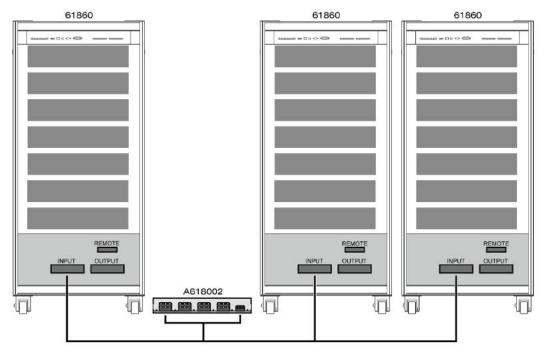
6.1.3 Connecting Three Parallel Units for Output

When three Regenerative Grid Simulators are to be connected in parallel mode, it can use the fixture A618002 (Input/Output Terminals for Parallel Connecting) to connect the output of three Regenerative Grid Simulators as the figure shown below.



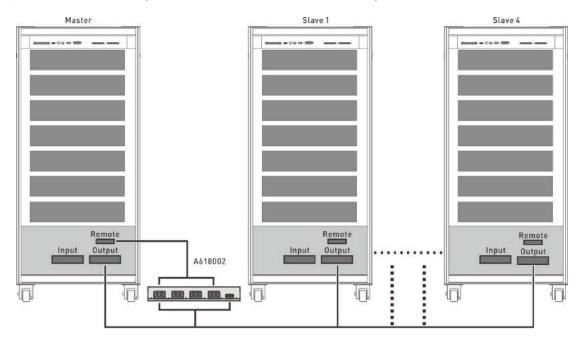
6.1.4 Connecting Three Parallel Units for Input

When three Regenerative Grid Simulators are to be connected in parallel mode, it can use the fixture A618002 (Input/Output Terminals for Parallel Connecting) to connect the input of three Regenerative Grid Simulators as the figure shown below.



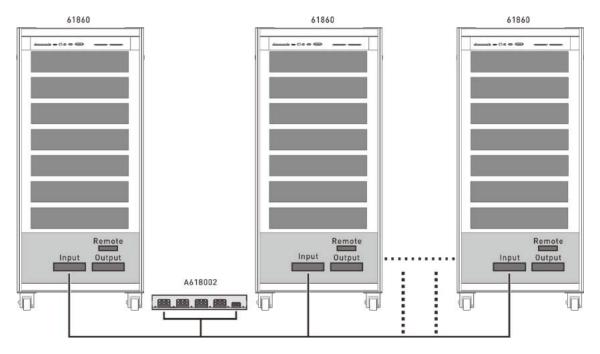
6.1.5 Connecting Four or Five Parallel Units for Output

When four or five Regenerative Grid Simulators are to be connected in parallel mode, it can use the fixture A618002 (Input/Output Terminals for Parallel Connecting) to connect the output of four or five Regenerative Grid Simulators as the figure shown below.



6.1.6 Connecting Four or Five Parallel Units for Input

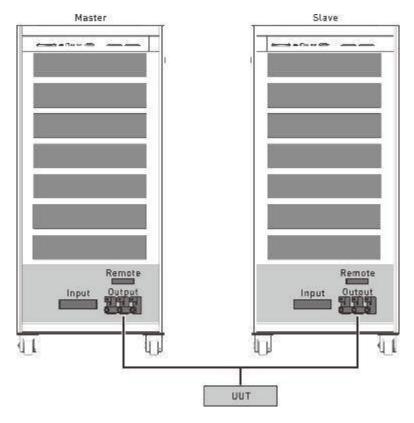
When four or five Regenerative Grid Simulators are to be connected in parallel mode, it can use the fixture A618002 (Input/Output Terminals for Parallel Connecting) to connect the input of four or five Regenerative Grid Simulators as the figure shown below.



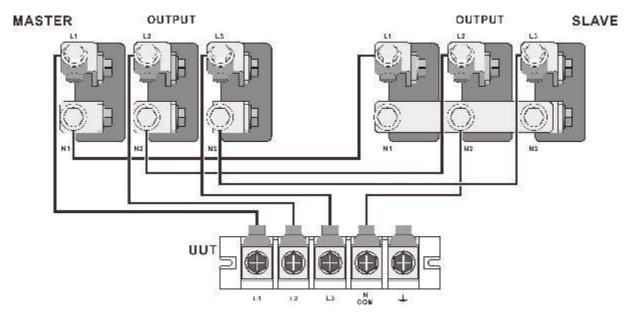
6.2 Series Connection for Regenerative Grid Simulators (Optional)

6.2.1 Connecting Two Simulators at Output in Series

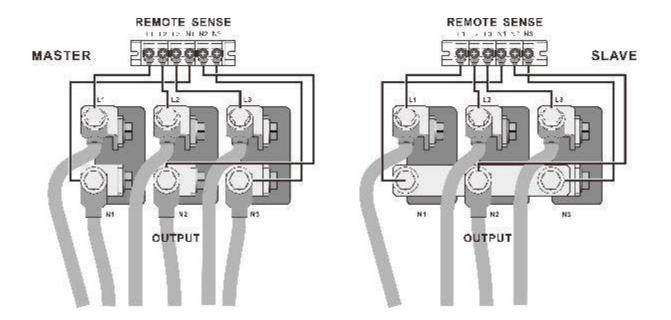
Follow the figure shown below to connect two Regenerative Grid Simulators for use in series mode.



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.



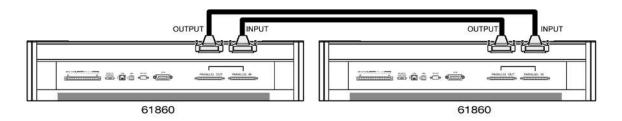
The REMOTE SENSE wires of the Master and Slave Regenerative Grid Simulators are connected to the terminals at the Master and Slave rear in sequence. The REMOTE SENSE wiring diagram is shown below.



6.3 Cables Connection for Parallel Signal

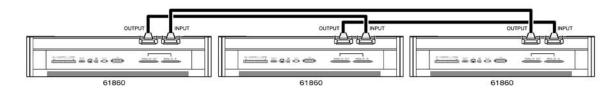
6.3.1 Cables Connection for Paralleling Two Units

When the Regenerative Grid Simulator is applied to parallel mode, cables are required for transmitting the data in parallel. The connection is as the figure shown below.



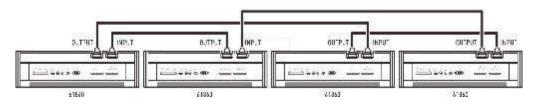
6.3.2 Cables Connection for Paralleling Three Units

When the Regenerative Grid Simulator is applied to parallel mode, parallel cable is required for transmitting the data and the connection is as the figure shown below. Be sure to follow the cable connection as stated if more power modules of Regenerative Grid Simulators (61830/61845/61860) are to be connected in parallel.



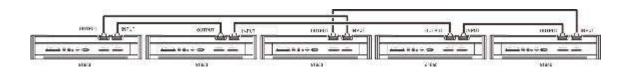
6.3.3 Cables Connection for Paralleling Four Units

When the Regenerative Grid Simulator is applied to parallel mode, parallel cable is required for transmitting the data and the connection is as the figure shown below. Be sure to follow the cable connection as stated if more power modules of Regenerative Grid Simulators (61830/61845/61860) are to be connected in parallel.



6.3.4 Cables Connection for Paralleling Five Units

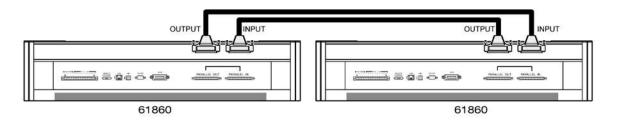
When the Regenerative Grid Simulator is applied to parallel mode, it can support up to five units in parallel, and the connection is as the figure shown below. Be sure to follow the cable connection as stated if more power modules of Regenerative Grid Simulators (61830/61845/61860) are to be connected in parallel.



6.4 Signal Cable Connection for Series Mode (Optional)

6.4.1 Connecting Cable for Two Units

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



6.5 Setting

6.5.1 Setting Regenerative Grid Simulator to Slave

To set a Regenerative Grid Simulator to Slave, press **CONFIG** in **FUNCTION** menu and select Master/Slave Function in CONFIG menu setting the connection to parallel or series (optional). The setup sequences are listed as below.

- 1. Press Master/Slave Function.
- 2. Press Position at the bottom.
- 3. Turn the RPG to change the Position to Slave1 and press **ENTER** to set it.
- 4. If the device to be setup is located at the two ends, press Terminator at the bottom and turn the RPG to change the Terminator to Enable.

Notice	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		QL	IT			3	Pha	se		LOCA	L	QUI	Т				
			- 22	OUTPUT S	ETTI	IG		10.000000	Config					OUTPUT	SETTI	łG			Config		
ē1	Vac	-	().OV	F	=	60.	00Hz		€1	Vac	=	0).OV	F	=	60	.00Hz			
2	Vac	-	(V0.0	F	=	60.	00Hz	Others	#2	Vac	=	0	V0.0	F	=	60	.00Hz	Others		
B 3	Vac	-	(V0.0	F	=	60.	00Hz	Calibration	₹3	Vac	=	0	V0.0	F	=	60	.00Hz	Celibration		
				MEASUR	EMENT				Canoration					MEASU	REMENT				Centration		
	٧	=	(0.00	Po		=	0.0	System		٧	=	0	0.00	Po	=		0.0	System		
1	I	=	0	. 000	PF		= 0.	000	Information	±1	I	=	0.	000	PF	= =	0	.000	Information		
	۷	=	(0.00	Po		=	0.0	Factory		۷	=	0	0.00	Po	=		0.0	Factory		
2	I	=	0	000	PF		= 0.	000	Default	₹2	I	=	0.	000	PF	= =	0	.000	Default		
	۷	=	(0.00	Po		=	0.0	Master/Slave		۷	=	0	0.00	Po	=		0.0	Master/Slave		
-3	I	=	0	. 000	PF		= 0.	000	Function	₩3	I	=	0.	000	PF	= =	0	.000	Function		
	V 12	=	(0.00	V2	3	= 0	.00	More		V 12	=	0	0.00	V2	3 =		0.00	More		
Σ	V 31	=	(0.00	Po		=	0.0	2 of 2	Σ	V 31	=	0	0.00	Po	=		0.0	2 of 2		
	osition laster	Numbo Slav		Terminator Enable				Function Enable	2016/05/16 13:21:04		osition I a ve 4	Termin Enat							2016/05/16		

6.5.2 Setting Regenerative Grid Simulator to Master

In **FUNCTION** menu, press **CONFIG** and select Master/Slave Function in CONFIG menu to connect multiple devices in parallel or series (optional). The setup sequences are listed as below.

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

- 4. Press Number of Slave at the bottom.
- 5. Turn the RPG to select the Slave number for parallel or series (optional) and press **ENTER** to set it.
- 6. If the device to be setup is located at the two ends, press Terminator at the bottom and turn the RPG to change the Terminator to Enable.
- 7. Press Function at the bottom.
- 8. Turn the RPG to change Function to Parallel if in parallel mode or to Series (optional) if in series mode, and press **ENTER** to set it.
- 9. Now, it will return to the main menu when set to Master and show a screen with Slave pattern on it when set to Slave.
 - At least one device needs to be to Slave for parallel application, or it will show "System Connection Fail!" when setting the Master to Enable. See the detailed troubleshooting information in the following section.
 - 2. Only 2 models are provided for series connection (optional). The Number of Slave key can only set to 1.

Notice

When setting the Number of Slave in Master, the rule is N-1 of Regenerative Grid Simulator units. For instance, the Number of Slave should set to 4 when 5 units are paralleled and 1 when 2 units of connected in series (optional). Incorrect unit number may cause failure in parallel or series connection or damage the device.

6.6 Troubleshooting

When connecting multiple devices for parallel/series (optional) usage, a parallel/series cable is required by each device to transmit the signals. When the set Slave number does not match the actual amount and communication error occurs during connection, follow the troubleshooting procedure described below to solve the problem and execute parallel/series connection again.

6.6.1 When the Connecting Cable is Off

If "System Connection Fail!" occurs when the Master connection is enabled, first check if the parallel/series cable is connected firmly and there is a device dedicated to sarallel/series connection or another Regenerative Grid Simulator is set to Slave. If yes, press Retry on the Master to reconnect it.

OUTPUT SETTING	Config
	Retry
System Connection Fail!	Cancel
	7
	2014/12/18 10:41:10

If the parallel/series signal cable is not correctly connected or disconnected when the Master connection is enabled, a warning "SYS SYS_BUS-WIRE LOSS" will appear. First, check if the parallel/series cable is connected firmly and then reboot the simulator to execute connection again.

3	Pha	se	LC	CAL	(QUIT				
				TPUT SET						Main
ē1	Vac	=	0.0	V	F١	- :: (60.	001	z	
2	Vac	=	0.0	٧	F :	= ()	60	00H	z	
₹3	Vac	=	0.0	۷	F١	-	60.	001	z	
				PROTECTI	ON					
			1	Varni	ng	11.				
		SYS	SY	S_BUS	5-W	IRE	LO	SS		
										-
										-

When "SYSTEM SHUTDOWN" occurs during connection, power the device off first and check if the parallel/series cable is connected firmly. When done, reboot the device and perform the connection again.

3	Pha	se	REMO	ГΕ	QU	IT		
	1000		OUTPUT			2.11221	10000000	Main
ē1	Vac	=	0.0V	F	=	60.	00Hz	
₹2	Vac	=	0.0V	F	=	60.	00Hz	
₫3	Vac	=	0.0V	F	=	60.	00Hz	
			PROTE	CTION				
			War	nin	a !			
						LINE .		
		5	YS SYS_S	SHU	ID0	WN		-
								-
-				0			1	
								2014/12/18 10:59:32

7. AC Load Mode (Option)

7.1 Switching to Load Mode

To set the Regenerative Grid Simulator to ACL mode, press **CONFIG** in the **FUNCTION** menu, and select System Information to set the ACL function by the procedure listed below.

HO LO				QUIT	
Sec. 12. 12	1.0	UNIT			Config
Model	:618	60 SN	:000066		Interface
Display Waveform		Version :	1.10Bets-ACLos 1.02.1,1.02.1,	T	External Iref
Remote			1.01 ,1.02		0000000
Waveform			1.01 ,1.01 ,1.		System
GRID Firm	wa r e		1.01 ,1.01 , 1.01 ,1.01 ,1.		Information
LAN Firmu	are	Version :	1.10		Display
					Protection
					More 1 of 2
OPTION C Load	Option Function				2017/08/28

- 1. Press System Information.
- 2. Press OPTION at the bottom.
- 3. Turn the RPG to change OPTION to AC Load, and press **ENTER**.
- 4. Reboot the simulator when the message shows on the LED screen.

7.2 Load Function Interface

When in Load mode and the self-test procedures are done, the screen shows MAIN PAGE (ACL Mode). There are CC Rectifier, CP Rectifier, CR, CC Lead/Lag and CP Lead/Lag 5 functions at the bottom for selection. The regenerative AC load measurement items are displayed under MEASUREMENT. Each output phase has 12 measurement items in total 3 pages which are the same as the Regenerative Grid Simulator (see 3.3).

7.2.1 CC Rectifier Mode

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

	AC I	LOAD	3	Phas	e LOCA	4L	QL	JIT		
	0501		1000		ED CONDITI)N	1196. 201	ANTAN .	Main	
1	Iac	; = _	0	<u>).0</u> A	CF	=	1.4	14		
₹2	Iac	; =	0	A0.0	CF	=	1.4	14		
₽ 3	Iad	; =	0	A0.0	CF	=	1.4	14	Measuremen	
				MEASU	REMENT				Setting	
-	٧	=	0	0.00	Po	=		0.0	Waveform	
€1	Ι	=	0.	000	PF	=	0.	000	Viewer	
	٧	=	0	0.00	Po	=		0.0		
₹2	I	=	0.	000	PF	=	0.	000		
	٧	=	0	0.00	Po	=		0.0	2	
13	Ι	=	0.	000	PF	=	0.	000		
	V 12	=	0	0.00	V23	=	0	.00	Measuremen	
Σ	V 31	=	0	0.00	Po	=	0	. 0	To Page2	
R	CC ectifier	CP Rectif	ler	CR	CC Lead/Lag	Le	CP ad/Lag		2017/08/2	

7.2.2 CP Rectifier Mode

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

	AC	LOAD	3_Phas	e LOCA	L QUIT	
				ED CONDITIO		Main
₫1	Ρ	= _	<u> 10</u> W	CF =	1.414	
₹2	Ρ	=	1 O W	CF =	1.414	
₫3	Ρ	=	1 O W	CF =	1.414	Measurement
			MEASU	IREMENT		Setting
	V	=	0.00	P₀	= 0.0	Waveform
₫1	Ι	=	0.000	PF	= 0.000	Viewer
	۷	=	0.00	P٥	= 0.0	
₫2	Ι	=	0.000	PF	= 0.000	
	۷	=	0.00	P₀	= 0.0	
₫3	Ι	=	0.000	PF	= 0.000	
	V12	. =	0.00	V23	= 0.00	Measurement
Σ	٧3		0.00	P٥	= 0.0	To Page2
R	CC lectific	CP Rectifi	ier CR	CC Lead/Lag	CP Lead/Lag	2017/11/21 17:37:08

7.2.3 CR Mode

When in CR mode, it can change the setting of resistance value in the MAIN PAGE.

	AC	LOAD	3_	Phase	e LOCA	۱L	QU	IT	
				CR CON	DITION				Main
₫1	R	= _	30	<u>0.0</u> Ω					
₫ 2	R	=	30	0.0Ω					
₫3	R	=	30	0.0Ω					Measurement
				MEASUF	EMENT				Setting
	٧	=	0	.00	P٥	=		0.0	Waveform
₫1	Ι	=	0.	000	PF	=	0.	000	Viewer
	٧	=	0	.00	P٥	=		0.0	
₹2	Ι	=	0.	000	PF	=	0.	000	
	٧	=	0	.00	P٥	=		0.0	
₫3	Ι	=	0.	000	ΡF	=	0.	000	
	V 12	=	0	.00	V23	=	0	.00	Measurement
Σ	V 31	=	0	.00	P٥	=	0	. 0	To Page2
_	cc	CP		CR	cc		P		2017/11/21
R	ectifier	Rectifi	er		Lead/Lag	Lead	d/Lag		17:37:29

7.2.4 CC Lead/Lag Mode

When in CC Lead/Lag mode, it can change the current amplitude and phase setting in the MAIN PAGE. It can also change to current source mode by releasing the phase limit (>90° or <-90°) using the following procedure.

1	AC L	OAD	3	Phas	e LOCA	٩L	QU	IΤ		
	1221		1000	-LEAD/LA	C. 1000000000000000000000000000000000000	DN			Main	
₫1	Iac	= _	(<u>).0</u> A	Deg	=) °		
⊉ 2	Iac	=	0	A0.0	Deg	=	() °		
₫3	Iac	=	0	A0.0	Deg	=	C) °	Measuremen	
				MEASU	REMENT				Setting	
iere	٧	=	0	0.00	Po	=	0	0.0	Waveform	
€1	I	=	0.	000	PF	=	0.0	000	Viewer	
	٧	=	0	0.00	Po	=	C	0.0		
₹ 2	I	=	0.	000	PF	=	0.0	000		
	٧	=	(0.00	Po	=	0	0.0	-	
1 3	I	=	0.	000	PF	=	0.0	000		
	V 12	=	0	0.00	V23	=	0.	00	Measuremen	
Σ	V 31	=	(0.00	Po	=	0.	0	To Page2	
R	CC ectifier	CP Rectif	ier	CR	CC Lcad/Lag		CP ad/Lag		2017/08/22	

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

	AC L	OAD	3_Phase	LOC/	AL QI	JIT	
			CC-LEAD/LAG	CONDITIC	DN		Config
₫ 1	Iac	=	0.0A	Deg	=	0°	Interface
₹ 2	Iac	=	0.0A	Deg	=	0°	Internace
₫3	Iac	=	0.0A	Deg	=	0°	PhaseLimit
			MEASUR	EMENT			<u>Enable</u>
	٧	=	0.00	P٥	=	0.0	System
₫1	I	=	0.000	PF	= 0.	.000	Information
	٧	=	0.00	P٥	=	0.0	
₫2	I	=	0.000	PF	= 0.	. 0 0 0	Display
	٧	=	0.00	P٥	=	0.0	
₫3	I	=	0.000	PF	= 0.	.000	Protection
	V 12	=	0.00	V23	= ().00	More
Σ	V 31	=	0.00	P٥	= ().0	1 of 2
	GPIB	RS23		Remote	EXT. ON/OFF	Ethernet	2017/11/21
A	ddress 30	Parit) None		Inhibit Disable	Disable	Setting	17:39:23

7.2.5 CP Lead/Lag Mode

When in CP Lead/Lag mode, it can change the power and phase setting in the MAIN PAGE. It can also change to current source mode by releasing the phase limit (>90° or <-90°) using the following procedure.

	AC	LOAD	3_Phas	e LOCA	L QUIT	
CP-LEAD/LAG CONDITION					Main	
₫1	Ρ	= _	<u> </u>	Deg =	0 °	
₫2	Ρ	=	1 O W	Deg =	0°	-
₫3	Ρ	=	1 O W	Deg =	0 °	Measurement
			MEASU	REMENT		Setting
	V	=	0.00	Po ÷	= 0.0	Waveform
₫1	Ι	=	0.000	PF :	= 0.000	Viewer
	۷	=	0.00	Po :	= 0.0	
₫2	Ι	=	0.000	PF =	= 0.000	
	٧	=	0.00	Po :	= 0.0	
₫3	Ι	=	0.000	PF =	= 0.000	
	V12	=	0.00	V23 :	= 0.00	Measurement
Σ	V 31	=	0.00	Po ≕	= 0.0	To Page2
R	CC ectifie	CP er Rectifi	er CR	CC Lead/Lag	CP Lead/Lag	2017/11/21 17:38:05

- Press CONFIG to enter into CONFIG menu.
 Press Phase limit on the right.
 Turn the RPG to change the Phase limit to Disable and press ENTER.

	AC	LOAD	3_Phase	e LOCA	L QUIT	
			CC-LEAD/LAG	CONDITION		Config
₫1	Ia	c =	0.0A	Deg =	•	Interface
₫2	Ia	; =	0.0A	Deg =	v	Interface
₫3	Ia	; =	0.0A	Deg =	= 0°	PhaseLimit
			MEASUR	REMENT		<u>Enable</u>
	٧	=	0.00	Po =	= 0.0	System
₫1	Ι	=	0.000	PF =	= 0.000	Information
	٧	=	0.00	Po =	= 0.0	_
₹2	I	=	0.000	PF =	= 0.000	Display
	٧	=	0.00	Po =	= 0.0	
₫3	I	=	0.000	PF =	= 0.000	Protection
	V 12	=	0.00	V23 =	= 0.00	More
Σ	V 31	=	0.00	Po =	= 0.0	1 of 2
	GPIB \ddress	RS23		Remote Inhibit	EXT. ON/OFF Ethernet	2017/11/21
,	address 30	Parit Non		Disable	Disable Setting	17:39:23

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.)

GPIB 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 LOCAL/REMOTE . Press LOCAL/REMOTE can return to local mode.	RL1

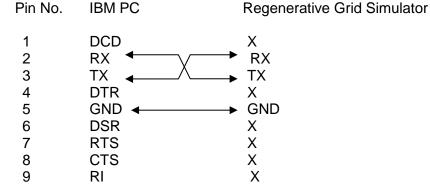
8.1.3 RS-232C Interface

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> {<, B>} means that parameter "A" must
			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.

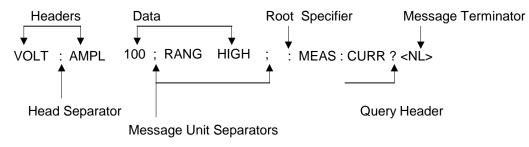


Figure 8-1 Structure of Command Message

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 o	f Standard Event Status	s Enabled Register

Bit Position	7	6	5	4	3	2	1	0
Bit Name	PON		CME	EXE	DDE	QYE		OPC
CME = Command Error				DDE	E = Devi	ce-depe	ndent er	ror
EXE = Execu	cution Error OPC = Operation Completed			k				
PON = Power On				QY	E = Que	ry Error		

*ESE?	Return stand	ard ever	nt status	enabled					
*ESR?	The query rea The bits of co Register.								
*IDN?	Return the Return Paran Chroma ATE 61800 123456 01.00	neter Ch : (: N : S		TE,61800 y name Ime mber	0,123450		string.		
*RCL <n></n>	Restore the v Parameter	alues of 1 - 10	specifie	d group	that stor	red in me	emory p	reviously	<i>י</i> .
*SAV <n></n>	Save the valu Parameter	ues to a 1 - 10	specified	d group i	n memo	ry.			
* RST	It resets the F for 3 seconds		ative Gri end the i			e initial :	states. It	's better	to wait
*SRE	It sets conditi enabled even Byte Register	ts of the	Status I						
*SRE?	This query re	turns the	e Service	e Reque	st Enabl	ed Regis	ster.		
*STB?	This query re Bit Configura				•				
	Bit Position	7	6	5	4	3	2	1	0
	Condition		MSS RQS	ESB	MAV	QUES			
	QUES = C RQS = R	Questiona Request f	atus Byte able Stat for Servi tatus Su	tus 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 t	he error string of the command parser.
Query Syntax	: SYSTem:ERRor?	
Parameter	: None	
Return Parameter	: Error string response:	No Error
		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 Parameter	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	·: 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
Parameter: INSTrument:EDIT?
: EACH | ALL

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 Φ 2 measurement voltage. INST: NSEL follows the number to select phase.
Query Syntax	: INSTrument : NSELect?
Parameter	: 1 2 3
Return Paramete	r: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 Φ 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: It switches between single phase and three-phase mode.Query Syntax: INSTrument : PHASe?Parameter: THREE | SINGLEReturn Parameter : THREE | SINGLE

INSTrument:OPTION

Description: It sets the device to be ACSource or ACLoad mode.Query Syntax: INSTrument:OPTION?Parameter: SOURCE | LOADReturn Parameter : SOURCE | LOAD

8.4.2.3 FETCH and MEASURE Sub-System

FETCh | MEASure

[

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

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 from the output terminal. Query Syntax : FETCh : CURRent : AC?, MEASure : CURRent : AC?

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.
Query Syntax Return Paramete		FETCh : CURRent : DC?, MEASure : CURRent : DC?

FETCh [: SCALar]: CURRent: ACDC?

MEASure [: SCALar]: CURRent: ACDC?

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

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 Paramete	er:	<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 Paramete	er:	<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?
	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? Return Parameter : <NR2>

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

/	ASure [: SCALar]	POWer : AC : REACtive?
	Description	: These queries return the reactive power that is output from the output terminals in volt-ampere. Reactive power is calculated by the following formula:
		$VAR = \sqrt{APPARENTPOWER^2 - REALPOWER^2}$
	Query Syntax	FETCh : POWer : AC : REACtive?
		MEASure : POWer : AC : REACtive?
	Return Parameter	: <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 Paramete	er :	<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?

Return Parameter : <NR2>

FETCh [: SCALar]: VOLTage: DC?

MEASure [: SCALar]: VOLTage: DC?

Description :	These queries return the DC composite voltage that is output from
	the output terminal.
Query Syntax :	FETCh [: SCALar] : VOLTage : DC?
	MEASure [: SCALar] : VOLTage : DC?
Return Parameter :	<nr2></nr2>

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		<nr2></nr2>

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

ASure [: SCALar] :	VOLTAGE : AMPLITUDE : MAXIMUM?
Description :	These queries return the absolute value of peak voltage.
Query Syntax :	FETCh : VOLTage: AMPLitude : MAXimum?,
	MEASure : VOLTage : AMPLitude : MAXimum?
Return Parameter :	<nr2></nr2>

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>

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 : DC :FREQency : COUPling : MODE
- : PROTection
 - :CLEar

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 Parameter : 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 Parameter	: <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 Paramete	r : <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/ms</nr2>
Return Parameter	:: <nr2></nr2>

OUTPut : COUPling

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

Return Parameter : 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.

Query Syntax : None Parameter : None Return Parameter : None

8.4.2.5 SOURCE Sub-System

[SOURce :] CURRent : LIMit : DELav : 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 Parameter	: <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 : <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}]

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

[SOURce:] FREQuency : LIMit

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

Return Parameter : <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.
Query Syntax Parameter	: [SOURce :] FUNCtion : SHAPe? : A B
Return Paramete	er:AB

[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>
Return Parameter	: SINE SQUA CSIN DST<0130> USR<0106>

[SOURce:] FUNCtion : SHAPe : B : MODE

Description: This command selects the mode for the clipping in waveform buffer
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 waveform buffer B.
Query Syntax	: [SOURce :] FUNCtion : SHAPe : B : THD?
Parameter	: <nr2>, the valid range is 0.0% ~ 43%.</nr2>
Return Parameter	: <nr2></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	ENABLE
Return 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	: [SOURce :] CONFigure : COUPling?
Parameter	: 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 $\Phi 1$ and $\Phi 2$.

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 | NEG Return Parameter : POSITIVE | NEGATIVE

[SOURce:]PHASe:RELOCK

Description : This command sets the relock function in 3-phase mode. Query Syntax : [SOURce :]PHASe:RELOCK? Parameter : ENABLE | DISABLE Return 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: NoneReturn Parameter : Always 0.

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.

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	er : <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.

	Bit	t Conf	igura	tion of	Que	stiona	ble S	tatus	Register	
Bit	15-9	8	7	6	5	4	3	2	1	0
Position										
Condition		OVP	INP	OCP	FAN	SHT	OTP	OPP		

OVP:	Output voltage	protection
O VI .	output voltago	protootion

- 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.</nr1>
Return Paramete	r : <nr1></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 Parameter Return Paramete	: STATus : QUEStionable : PTRansition? : <nr1>, the valid range is 0 ~ 511.</nr1>

8.4.2.9 TRACE Sub-system

TRACe

: RMS

TRACe

INAUC	
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	: TRACe 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
 - : 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 | NONEReturn 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
Return Parameter	: <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

: This command sets the sequence of start frequency list points.
: [SOURce:] LIST : FREQuency : STARt?
: <nr2>,, <nr2>, the valid range is 15.00 ~ 100.00 (unit: Hz.)</nr2></nr2>
: <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 Description : This command sets the sequence of phase angle list points. Query Syntax : [SOURce:] LIST : DEGRee? Parameter : <NR2>, ..., <NR2>, the valid range is 0.0 ~ 359.9. 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 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.Return Parameter: <NR2>

[SOURce :] PULSe : VOLTage : DC

Description : This command sets the DC voltage for the duty cycle of PULSE mode.

Query Syntax	: [SOURce :] PULSE : VOLTage : DC?
Parameter	: <nr2>, the valid range is -424.2 ~ 424.2.</nr2>
Return Parameter	: <nr2></nr2>

[SOURce :] PULSe : FREQuency

Description	: This command sets the frequency for the duty cycle of PULSE
	mode.
Query Syntax	: [SOURce :] PULSE : FREQuency?
Parameter	: <nr2>, the valid range is 15.0 ~ 100.00 (unit: Hz.)</nr2>
Return Parameter	: <nr2></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

Description	: This command sets the start phase angle of duty cycle for PULSE
	mode.
Query Syntax	: [SOURce :] PULSE : SPHase?
Parameter	: <nr2>, the valid range is 0.0 ~ 359.9.</nr2>
Return Parameter	: <nr2></nr2>

1 10ccrintion	
Description	
•	

[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></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
Return Parameter	: FIXED LIST PULSE STEP SYNTH INTERHAR

TRIG

Description	: This command sets PULSE mode in OFF execution state after setting OUTPut : MODE PULSE. If users want to change the 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.
Query Syntax Parameter	: TRIG : STATE? : OFF ON
Return Parameter	: OFF RUNNING

8.4.2.12 STEP Sub-system

[SOURce:]

STEP : VOLTage : AC : DC : FREQuency : SHAPe : SPHase : DVOLtage : AC : DC : DFRequency : DWELI : 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
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 | INTERHARReturn Parameter : 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 Paramete	er : 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.
Query Syntax	: [SOURce :] SYNThesis : COMPose?
Parameter	: VALUE1 VALUE2 VALUE3
	PERCENT1 PERCENT2 PERCENT3
Return Paramete	er : 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:

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.Return Parameter : <NR2>

[SOURce :] SYNThesis : DC

: This command sets the DC voltage to add the voltage waveform in
SYNTHESIS mode.
: [SOURce :] SYNThesis : DC?
: <nr2>, the valid range: -424.2 ~ 424.2.</nr2>
r: <nr2></nr2>

[SOURce :] SYNThesis : FREQuency

Description: This command sets the fundamental frequency in SYNTHESIS
mode.Query Syntax: [SOURce :] SYNThesis : FREQuency?Parameter: 50 | 60Return Parameter : 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 ~ 359.9Return Parameter : <NR2>

OUTPut : MODE

Description	: This command sets the operation mode. User should quit output before setting OUTPut : MODE SYNTH.
	before setting OUTFull. MODE STITTE
Query Syntax	: OUTPut : MODE?
Parameter	: FIXED LIST PULSE STEP SYNTH INTERHAR
Return Parameter	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	er : 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?

Quency? 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.)</nr2>
Return Paramete	r: <nr2></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 Parameter : <nr2></nr2>	

[SOURce :] INTERHARmonics: LEVel

Description: This command sets the rms. range of sweep wave in percentage
level.Query Syntax: [SOURce :] INTerharmonics : LEVEI?Parameter: <NR2>, the valid range is 0% ~ 30% in 0.01 Hz ~ 500 Hz
0% ~ 20% in 500.01 Hz ~ 1000 Hz
0% ~ 10% in 1000.01 Hz ~ 2400 Hz
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 Poturn Paramet	: OFF ON PAUSE CONTINUE er : OFF RUNNING PAUSE
Retuin Falamet	

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.
Query Syntax	SINGLE: It keeps the measured data on the display when set. CONTINUE: It updates the measured data on the display when set. : [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 Paramete	er : 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	: SENSe : HARMonic?
Parameter	: ON OFF
Return Paramete	er : 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 Paramete	er: <nr2></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 Parameter : <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></nr2>	

8.4.2.16 ACL Subsystem (Option)

LOAD:

:MODE CCREctifier :CURRent :CREStfactor

CPREctifier

: POWer :CREStfactor

CR

:RESistor

CCPHase

: CURRent :DEGRee

CPPHase

:POWer :DEGRee :PF :MODE

PHASe

:LIMit

LOAD: MODE

command sets the ACL operating mode.
D: MODE?
E CPRE CR CCPH CPPH
E CPRE CR CCPH CPPH

LOAD: CCREctifier: CURRent

Description	: This command sets the loading current for 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 for CCREctifier mode.
Query Syntax	: LOAD: CCREctifier : CRES?
Parameter	: <nr2>, valid range: 1.414 ~ 3.000</nr2>
Return Parameter	: <nr2></nr2>

LOAD: CPREctifier: POWer

Description	: This command sets the loading power for 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 for CPREctifier mode.
Query Syntax	: LOAD: CPREctifier: CRES?
Parameter	: <nr2>, valid range: 1.414 ~ 3.000</nr2>
Return Parameter	: <nr2></nr2>

LOAD: CR: RESistor

Description	: This command sets the loading resistance value for 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 for CCPHase mode.
Query Syntax	: LOAD: CCPHase: CURRent?
Parameter	: <nr2>, valid range: 0.0 ~ 100.0 (unit: A)</nr2>
Return Parameter	: <nr2></nr2>
Return Parameter	: <nr2></nr2>

LOAD: CCPHase: DEGRee

Description	: This command sets the phase difference between the loading current and the UUT voltage for 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: POWer

Description	: This command sets the loading power for 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 difference between the loading
	current and the UUT voltage for CPPHase mode.
Query Syntax	: LOAD: CPPHase: DEGRee?
Parameter	: Phase Limit is ON : <nr2>, valid range: -45.0 ~ 45.0 (unit: Degree)</nr2>
	Phase Limit is OFF : <nr2>, valid range: 135.0 ~ 225.0 (unit:</nr2>
	Degree)
Return Parameter	: <nr2></nr2>

LOAD: CPPHase: PF

Description	: This command sets the PF value between the loading current of CPPHase mode and the UUT voltage. This setting is linked with 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 of CPPHase mode ahead or
	behind the UUT voltage. This setting is linked with LOAD:
	CCPHase: DEGRee.
Query Syntax	: LOAD: CPPHase: PF: MODE?
Parameter	: LEAD LAG
Return Parameter	: LEAD LAG

LOAD:PHASe: LIMit

Description : This command sets the phase limit to be enabled or disabled.

Query Syntax: LOAD: PHASe: LIMit?Parameter: ON | OFFReturn Parameter: ON | OFF

8.5 Command Summary

Common Commands

- * CLS Clear 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
- : OPTION

FETCh | MEASure

[: SĊALar]

- : 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
 - : AČ
 - : 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 : AC : STARt : 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?

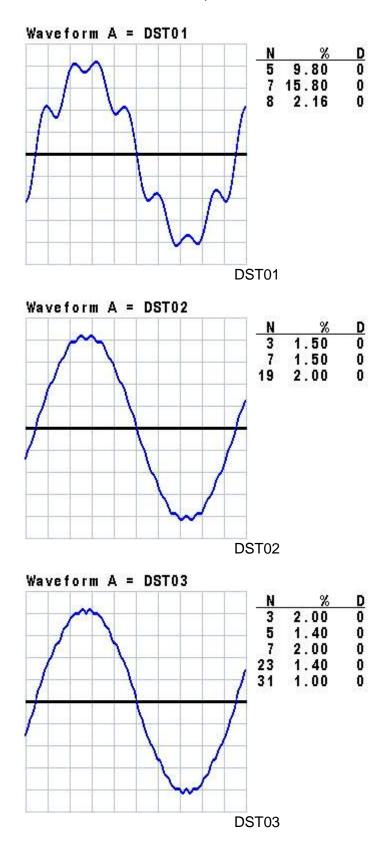
Appendix A TTL Signal Pin Assignments

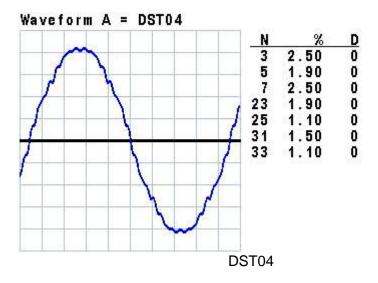
Green terminal with female connector:

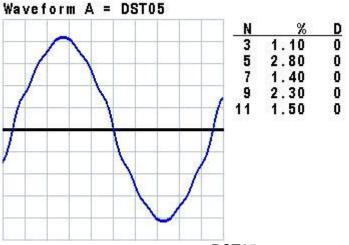
Pin No.	Signal	Description
1	Ext-V Φ1	Φ1 External-V Reference signal input (-10V~10V)
2	Ext-V Φ2	Φ2 External-V Reference signal input (-10V~10V)
		This is the input pin of external voltage signal for single
		phase use.
3	Ext-V ФЗ	Φ3 External-V Reference signal input (-10V~10V)
4	AGND	External-V Reference signal grounding
5	+12V	12V voltage output (providing current 1A)
6	Reserved	
7	DGND	Digital signal grounding
8	DGND	Digital 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
4.4		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
12		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
ļ		level.
15	Reserved	
16	Reserved	
17	Reserved	
18	Reserved	

Appendix B Built-in DST Waveform

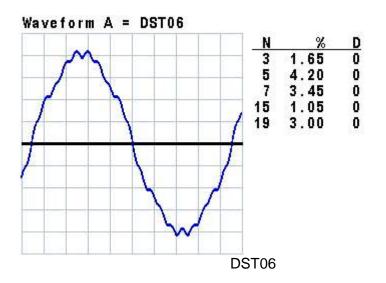
The ratios of all built-in waveforms' steps are measured under no load.

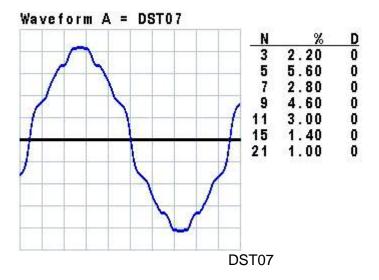


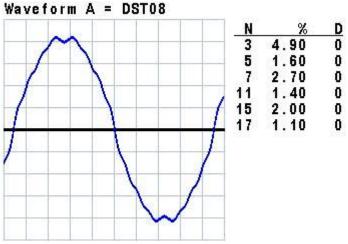




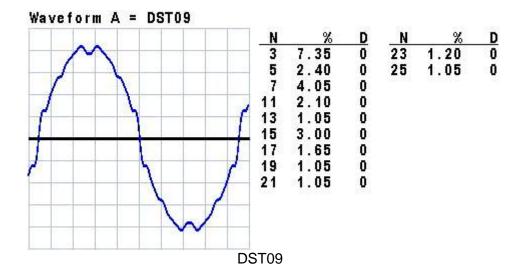




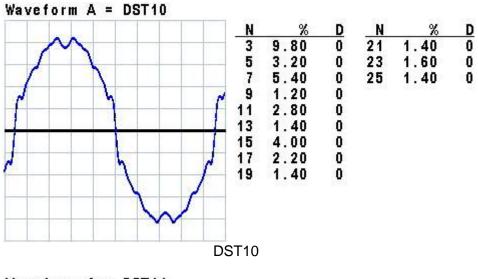


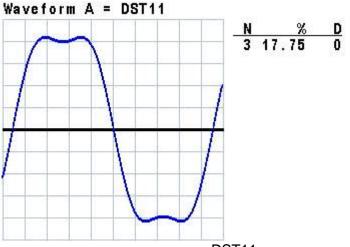




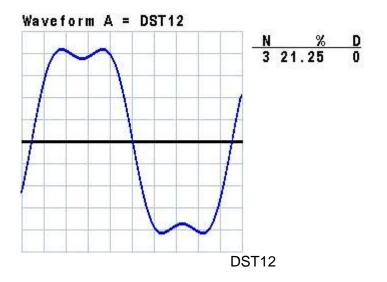


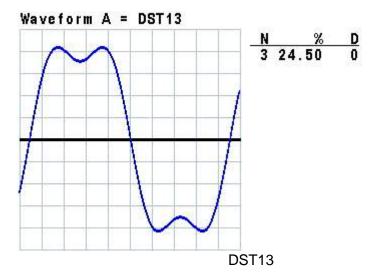
B-3

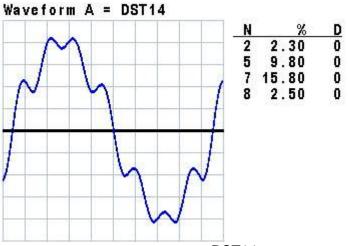




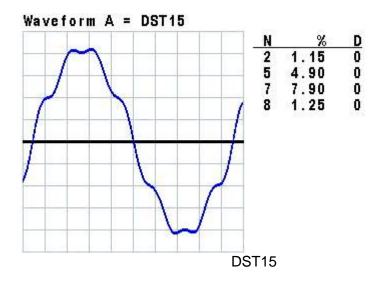


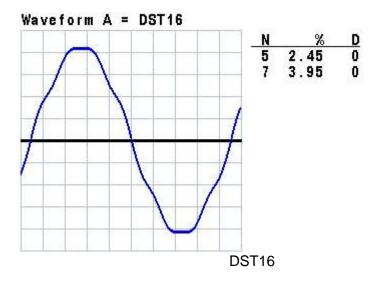


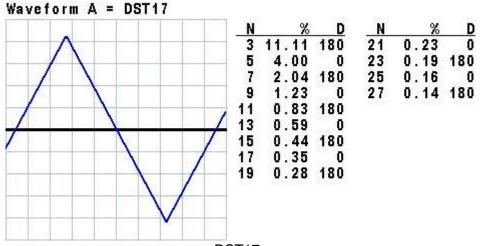




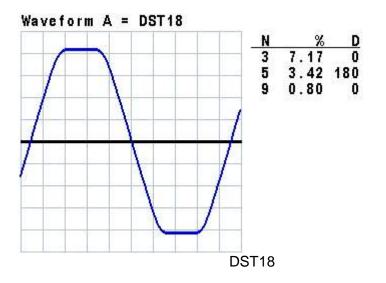


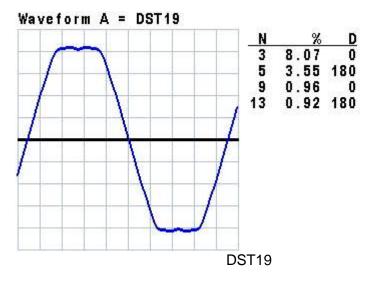


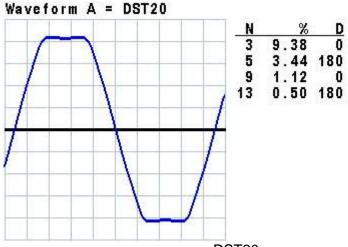




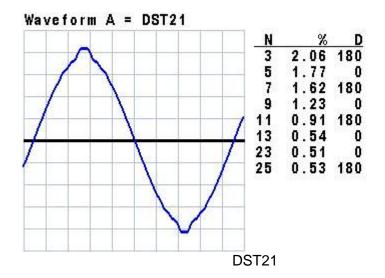


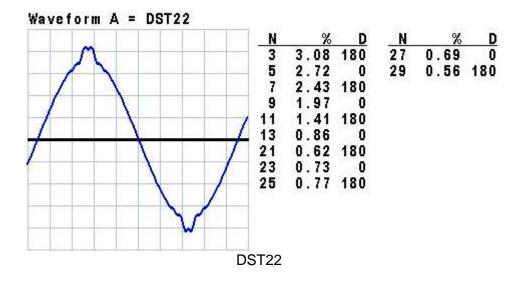


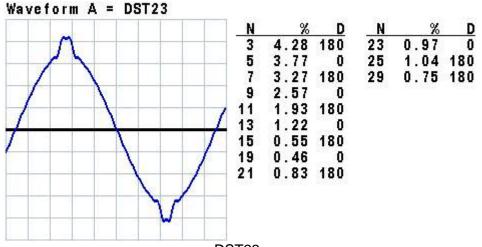




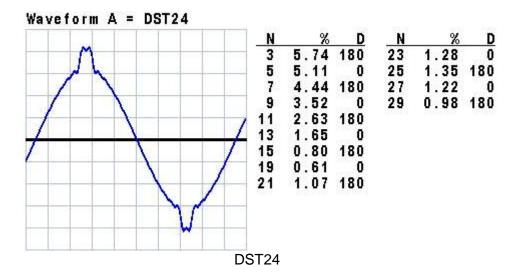


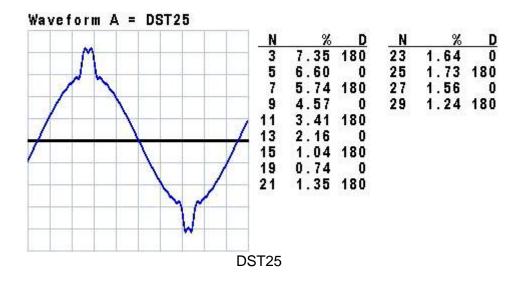


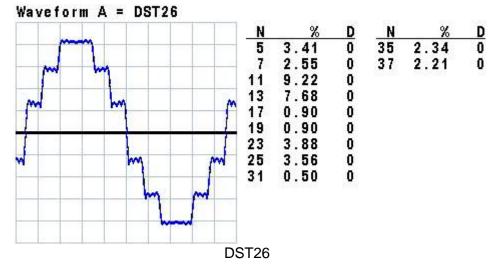


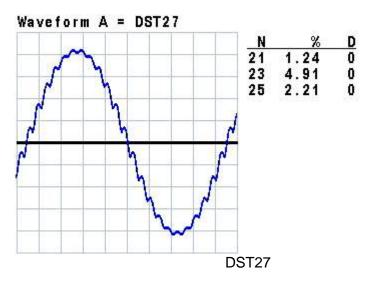




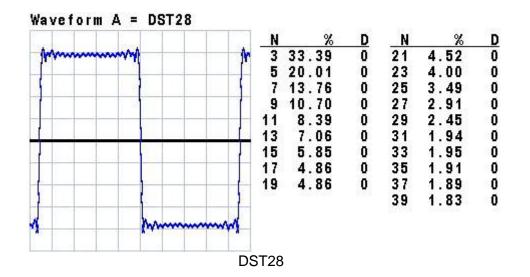


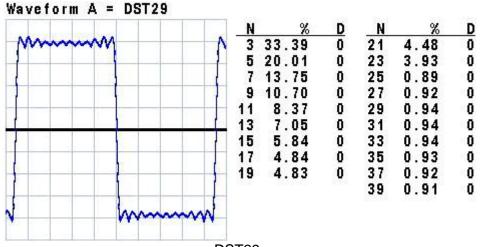




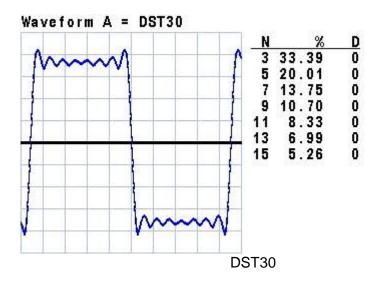


B-9









Chroma's Continuous Quality Process User Manual Customer Feedback

Chroma welcomes all comments and recommendations to improve this publication in the future editions. Please scan the QR code below or click the URL http://www.chromaate.com/survey?n=793ce6db-17ef-4cd3-b0de-8bbd09aa38e0 to fill in the customer feedback form. Thank you!





CHROMA ATE INC. 致茂電子股份有限公司 66 Huaya 1st Road, Guishan, Taoyuan 33383, Taiwan 台灣桃園市 33383 龜山區 華亞一路 66 號 T +886-3-327-9999 F +886-3-327-8898 Mail: info@chromaate.com http://www.chromaate.com

All other trade names referenced are the properties of their respective companies.

Distributed by: