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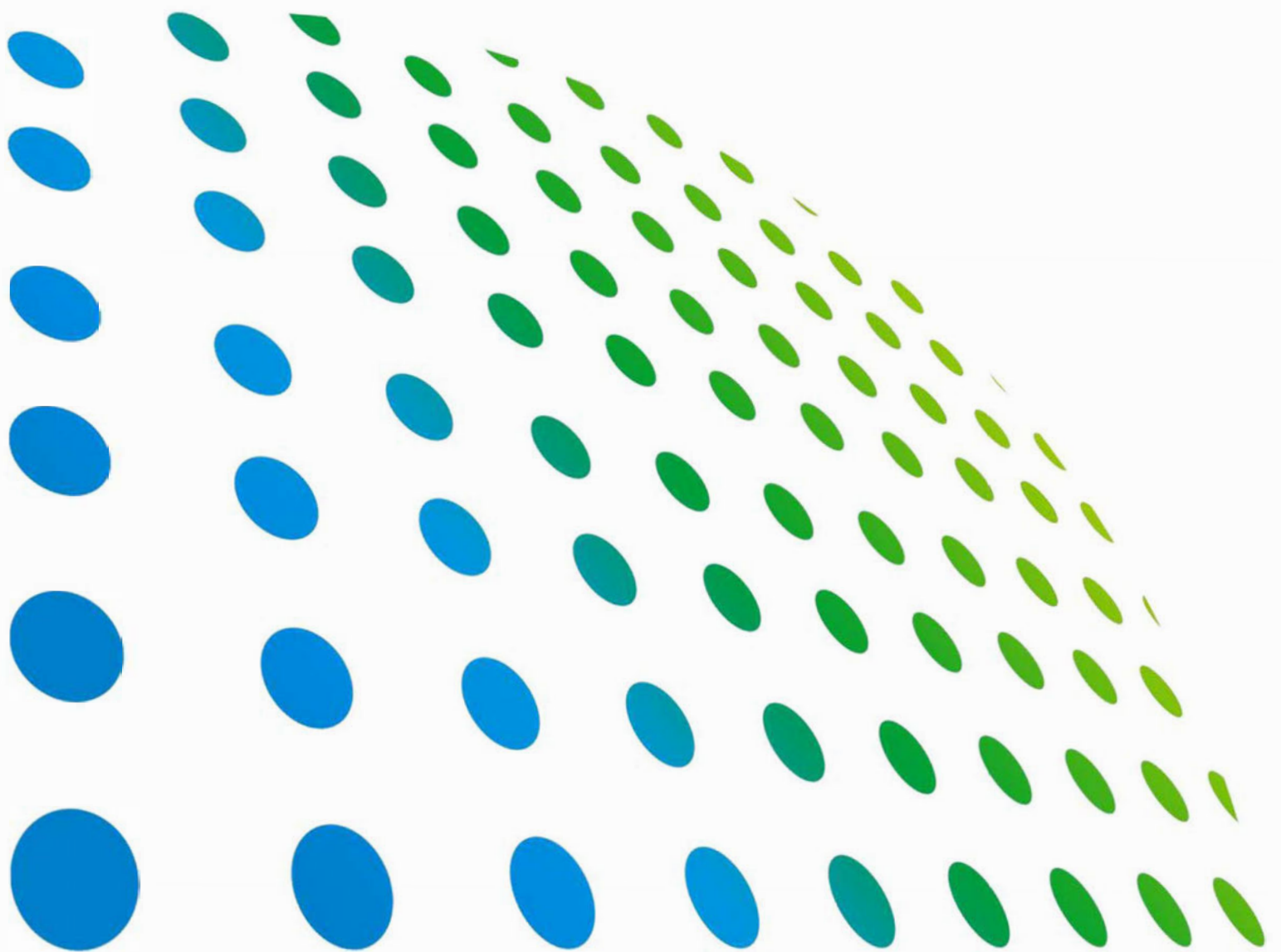
## **Regenerative AC Electronic Load**

**63809R-350-87**

**63812R-350-96**

**63815R-350-105**

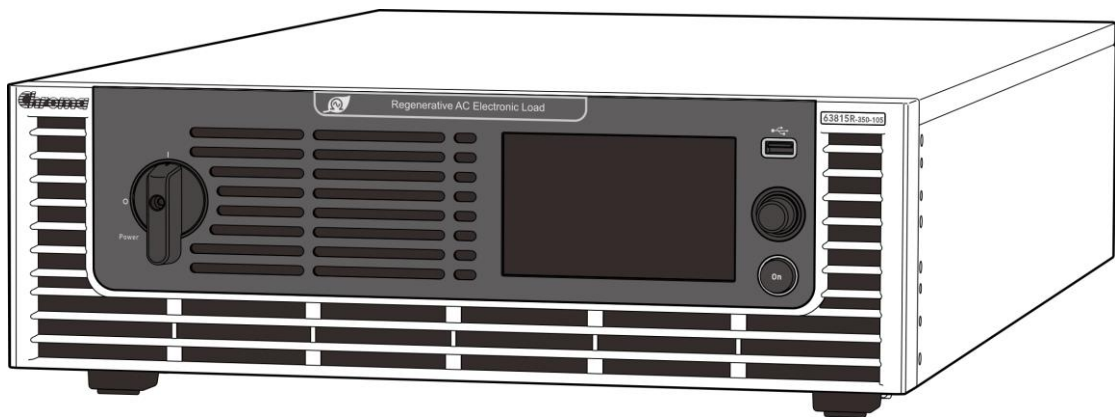
**User's Manual**



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Regenerative AC Electronic Load  
63809R-350-87  
63812R-350-96  
63815R-350-105  
User's Manual



Version 1.0  
April 2022

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## **CHROMA ATE INC.**

88 Wenmao Rd., Guishan Dist., Taoyuan City 333001, Taiwan

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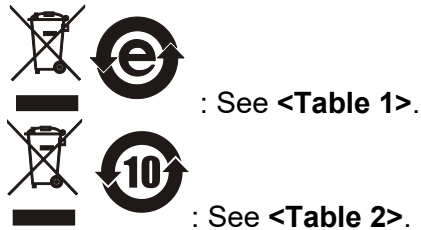
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# Material Contents Declaration

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



<Table 1>

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

“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.

“X” 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>

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

“○” 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.

“×” 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.





# Declaration of Conformity

For the following equipment :

**Regenerative Grid Simulator, Regenerative AC Electronic Load**

(Product Name/ Trade Name)

61805, 61809, 61810, 61812, 61815, 63809R-350-87, 63812R-350-96, 63815R-350-105

(Model Designation)

**Chroma ATE Inc.**

(Manufacturer Name)

88 Wenmao Rd., Guishan Dist., Taoyuan City 333001, 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 55011:2016+A1:2017+A11:2020+A2:2021 Group 1 Class A**

**EN IEC 61326-1:2021 Class A, EN IEC 61326-2-1:2021**

**EN 61000-3-12:2011, EN IEC 61000-3-11:2019**

**EN IEC 61326-1:2021/ BS EN IEC 61326-1:2021 (industrial electromagnetic environment)**

EN 61000-4-2:2009, EN IEC 61000-4-3:2020, EN 61000-4-4:2012,

EN 61000-4-5:2014+A1:2017, EN 61000-4-6:2014, EN 61000-4-8:2010

EN 61000-4-34:2007+A1:2009

**IEC 61010-1:2010+A1:2016(Edition 3.1), EN / BS EN 61010-1:2010+A1:2019**

The equipment describe above is in conformity with Directive 2011/65/EU and 2015/863/EU of the European Parliament and of the Council 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 Europe B.V.**

(Authorized Representative Name)

Morsestraat 32, 6716 AH Ede, The Netherlands

(Authorized Representative Address)

Person responsible for this declaration:

**Mr. Vincent Wu**

(Name, Surname)

**T&M BU/Vice President**

(Position/Title)

**Taiwan**

(Place)

**2022.04.19**

(Date)

(Legal Signature)



# Safety Summary

The following general safety precautions must be observed during all phases of operation, service, and repair of this product. 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.



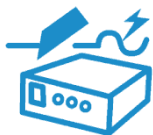
## BEFORE APPLYING POWER

Verify that the power is set to match the rated input of this device.



## 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.

## **⚠ WARNING**

1. Lethal voltage, the output is up to 495V peak voltage.
2. If the output terminal and circuit are connected to output when the power is on, it could cause death if touches it.
3. Note that when in Y connection, including L1/L2/L3, NEU also has the maximum current generated; therefore, all the wire diameters used must meet the maximum current requirement.
4. The equipment should be placed horizontally during transportation, and it is strictly forbidden to move it with side placement, which may cause damage to the machine.

# Safety Symbols



**DANGER** – High voltage.



**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 hazardous. Do not touch to avoid 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.



**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.



**Frame or chassis:** To identify a frame or chassis terminal.



**Alternating Current (AC)**



**Direct Current (DC) / Alternating Current (AC)**



**Direct Current (DC)**



**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.



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.



The **Notice** sign denotes important information in procedures, applications or the areas that require special attention. Be sure to read it carefully.

# Revision History

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

<b>Date</b>	<b>Version</b>	<b>Revised Sections</b>
Apr. 2022	1.0	Complete this manual.



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# 1. Overview

## 1.1 Introduction

Chroma 638XXR Series Regenerative AC Electronic Loads are equipped with CC Rectifier, CC Phase lead/lag, CS Rectifier, CS Phase lead/lag, CC, CP, and CR modes that can apply to BOBC(V2H/L), AC EVSE\*<sup>1</sup>, hybrid PV inverter(off-grid type), home energy storage inverter, UPS, and fuel cell AC generator for testing their power loading capability and durability. In addition, the energy can be efficiently converted and fed back to the mains through the regenerative function. It not only solves the problem of wasting heat but also simultaneously achieves environmental protection by the utilization of energy. The Regenerative AC Electronic Load is more energy-saving and carbon-saving compared with traditional AC load.

**Note** : \*1: Inrush Current Box is required for testing an AC EVSE.

## 1.2 Features

- Input voltage range: 30~350V
- Input frequency range: 30~100Hz
- Provides rated apparent power recharge capability, which can be recycled to the grid with high efficiency after conversion
- Conform to test applications of BOBC, EVSE and EV associate products
- Selectable 1-phase/3-phase AC output
- Controllable rates of change of current and power commands
- Settable output limit of power/apparent power, current, C.F., and P.F.
- Voltage waveform setting for 0~359.99 degrees
- Sync TTL signal output for changed current
- Provide power down and power on auto loading function for Standby mode.
- Provide linear and nonlinear load testing
- Provide inductive and capacitive load testing
- Over 90% of energy efficiency can be recycled to the grid in all modes.
- Digital interface: GPIB, CAN, USB, LAN

## 1.3 Specifications

The following table lists the specifications of Chroma 63809R-350-87/63812R-350-96/63815R-350-105 Regenerative AC Electronic Loads. 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  $25 \pm 1^{\circ}\text{C}$  with a resistive load.

Model	63809R-350-87	63812R-350-96	63815R-350-105
<b>Operating Range (Each Phase)</b>			
Max. Current (RMS)	29Arms	32Arms	35Arms
Max. Current (Peak)	87Apeak	96Apeak	105Apeak
Voltage	30 ~ 350Vrms	30 ~ 350Vrms	30 ~ 350Vrms
Frequency	30 ~ 100Hz	30 ~ 100Hz	30 ~ 100Hz
<b>CC/CS Rectified Mode (Each Phase)</b>			
Current	0 ~ 29Arms	0 ~ 32Arms	0 ~ 35Arms
Accuracy (A) <sup>*1</sup>	0.3%+ 0.5%F.S.	0.3%+ 0.5%F.S.	0.3%+ 0.5%F.S.
Resolution (A)	0.01Arms	0.01Arms	0.01Arms
Power	0 ~ 3kVA	0 ~ 4kVA	0 ~ 5kVA <sup>*8</sup>
Accuracy (VA) <sup>*2</sup>	0.3% + 0.3%F.S.	0.3% + 0.3%F.S.	0.3% + 0.3%F.S.
Resolution (VA)	1VA	1VA	1VA
Crest Factor	1.414 ~ 3.000	1.414 ~ 3.000	1.414 ~ 3.000
Accuracy (CF) <sup>*3</sup>	3.0%F.S.	3.0%F.S.	3.0%F.S.
Resolution (CF)	0.001	0.001	0.001
<b>CC Phase Lead / Lag Mode (Each Phase)</b>			
Current	0 ~ 29Arms	0 ~ 32Arms	0 ~ 35Arms
Accuracy (A) <sup>*1</sup>	0.3% + 0.5%F.S.	0.3% + 0.5%F.S.	0.3% + 0.5%F.S.
Resolution (A)	0.01Arms	0.01Arms	0.01Arms
Angle <sup>*6</sup>	-90° ~ +90° (Current source mode: +90.01° ~ +180° & - 90.01° ~ -180°)	-90° ~ +90° (Current source mode: +90.01° ~ +180° & - 90.01° ~ -180°)	-90° ~ +90° (Current source mode: +90.01° ~ +180° & - 90.01° ~ -180°)
Accuracy (deg)	1%F.S.	1%F.S.	1%F.S.
Resolution (deg)	0.01°	0.01°	0.01°
<b>CS Phase Lead / Lag Mode (Each Phase)</b>			
Power	0 ~ 3kVA	0 ~ 4kVA	0 ~ 5kVA <sup>*8</sup>
Accuracy (VA) <sup>*2</sup>	0.3%+ 0.3%F.S.	0.3%+ 0.3%F.S.	0.3%+ 0.3%F.S.
Resolution (VA)	1VA	1VA	1VA
Angle	-84.26°~ +84.26°	-84.26°~ +84.26°	-84.26°~ +84.26°
Accuracy (deg) <sup>*4</sup>	1%F.S.	1%F.S.	1%F.S.
Resolution (deg)	0.01°	0.01°	0.01°
Power Factor <sup>*7</sup>	0.100 ~ 1.000 (Lead/Lag)	0.100 ~ 1.000 (Lead/Lag)	0.100 ~ 1.000 (Lead/Lag)
Accuracy (PF)	1% F.S.	1% F.S.	1% F.S.
Resolution (PF)	0.001	0.001	0.001
<b>CR Mode (Each Phase)</b>			
Resistance	1~ 300Ω	1~ 300Ω	1~ 300Ω
Accuracy (Ω) <sup>*4</sup>	0.3% + 0.5%F.S.	0.3% + 0.5%F.S.	0.3% + 0.5%F.S.
Resolution (Ω)	0.01Ω	0.01Ω	0.01Ω
<b>CC/CP Mode (Each Phase)</b>			
Current	0 ~ 29Arms	0 ~ 32Arms	0 ~ 35Arms
Accuracy (A) <sup>*1</sup>	0.3%+ 0.5%F.S.	0.3%+ 0.5%F.S.	0.3%+ 0.5%F.S.
Resolution (A)	0.01Arms	0.01Arms	0.01Arms
Power	0 ~ 3kW	0 ~ 4kW	0 ~ 5kW <sup>*8</sup>
Accuracy (W) <sup>*5</sup>	0.3% + 0.3%F.S.	0.3% + 0.3%F.S.	0.3% + 0.3%F.S.
Resolution (W)	1W	1W	1W
Crest Factor	1.414 ~ 3.000	1.414 ~ 3.000	1.414 ~ 3.000

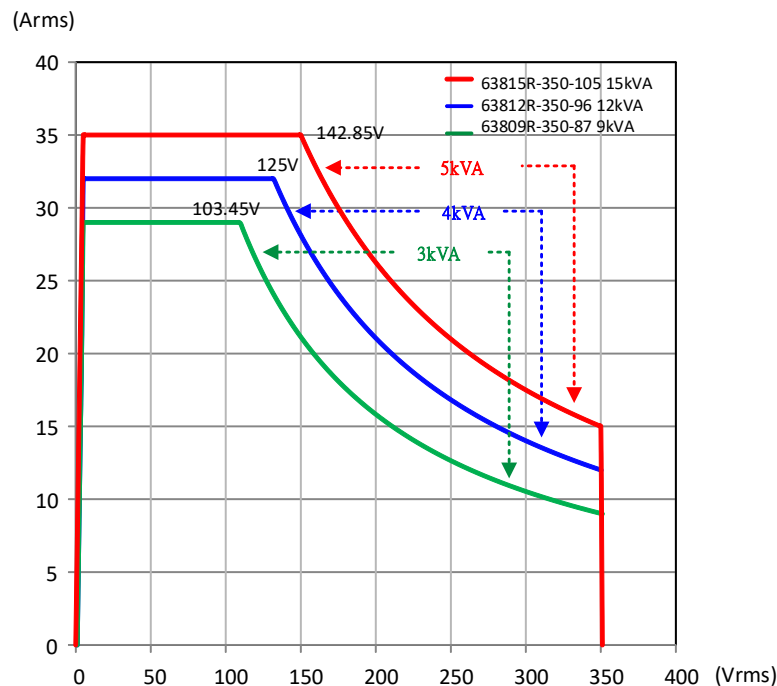


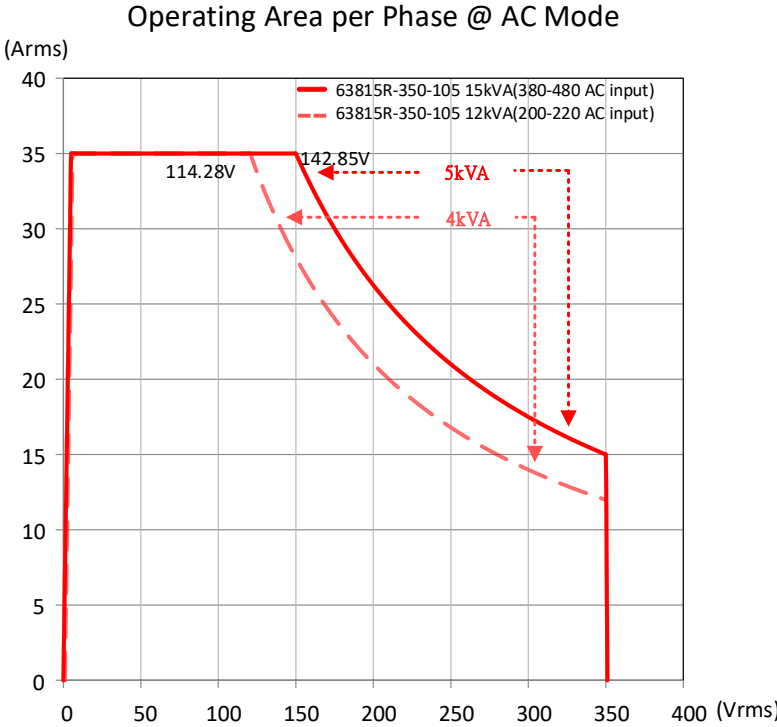
Model	63809R-350-87	63812R-350-96	63815R-350-105
Accuracy (CF) <sup>*3</sup>	3.0%F.S.	3.0%F.S.	3.0%F.S.
Resolution (CF)	0.001	0.001	0.001
Power Factor	0.100 ~ 1.000 (Lead/Lag)	0.100 ~ 1.000 (Lead/Lag)	0.100 ~ 1.000 (Lead/Lag)
Accuracy (PF) <sup>*4</sup>	1% F.S.	1% F.S.	1% F.S.
Resolution (PF)	0.001	0.001	0.001
<b>Measurement</b>			
<b>Voltage Reading</b>			
Voltage	0 ~ 350Vrms	0 ~ 350Vrms	0 ~ 350Vrms
Resolution	0.01Vrms	0.01Vrms	0.01Vrms
Accuracy (RMS)	0.1% + 0.2%F.S.	0.1% + 0.2%F.S.	0.1% + 0.2%F.S.
<b>Current Reading</b>			
Current	0 ~ 29Arms	0 ~ 32Arms	0 ~ 35Arms
Resolution	0.01Arms	0.01Arms	0.01Arms
Accuracy (RMS)	0.4%+0.3%F.S.	0.4%+0.3%F.S.	0.4%+0.3%F.S.
Peak Current	0 ~ 87Apeak	0 ~ 96Apeak	0 ~ 105Apeak
Resolution	0.01A	0.01A	0.01A
Accuracy (Peak)	0.4%+0.6%F.S.	0.4%+0.6%F.S.	0.4%+0.6%F.S.
<b>Real Power Reading</b>			
Real Power	0 ~ 3kW	0 ~ 4kW	0 ~ 5kW
Accuracy <sup>*2</sup>	0.4%+0.8%F.S.	0.4%+0.8%F.S.	0.4%+0.8%F.S.
<b>Reactive Power Reading</b>			
Reactive	0 ~ 3kVAR	0 ~ 4kVAR	0 ~ 5kVAR
Accuracy <sup>*2</sup>	0.4%+0.8%F.S.	0.4%+0.8%F.S.	0.4%+0.8%F.S.
<b>Apparent Power</b>			
Apparent Power	0 ~ 3kVA	0 ~ 4kVA	0 ~ 5kVA
Accuracy <sup>*2</sup>	0.4%+0.8%F.S.	0.4%+0.8%F.S.	0.4%+0.8%F.S.
<b>Frequency Reading</b>			
Frequency	30 ~ 100Hz	30 ~ 100Hz	30 ~ 100Hz
Resolution	0.01Hz	0.01Hz	0.01Hz
Accuracy <sup>*4</sup>	0.1%F.S.	0.1%F.S.	0.1%F.S.
<b>Power Factor Reading</b>			
Power Factor	0.100 ~ 1.000	0.100 ~ 1.000	0.100 ~ 1.000
Resolution	0.001	0.001	0.001
Accuracy <sup>*4</sup>	1% F.S.	1% F.S.	1% F.S.
<b>Crest Factor Reading</b>			
Crest Factor	1.414 ~ 3.000	1.414 ~ 3.000	1.414 ~ 3.000
Resolution	0.001	0.001	0.001
Accuracy <sup>*3</sup>	3.0%F.S.	3.0%F.S.	3.0%F.S.

- Note**
- \*1: Condition to meet specification:  $I_{rms} \geq 0.5A$  and the UUT is a sinusoidal voltage.
  - \*2: Condition to meet specification:  $S \geq 100VA$  and the UUT is a sinusoidal voltage.
  - \*3: Condition to meet specification:  $I_{rms} \geq 2A$  and the UUT is a sinusoidal voltage ( $V_{UUT} \geq 50V_{rms}$ ). The UUT voltage and the Regenerative AC Electronic Load current must be in the same phase.
  - \*4: Conditions to meet specification:  $I_{rms} \geq 2A$  and the UUT is a sinusoidal voltage ( $V_{UUT} \geq 50V_{rms}$ ).
  - \*5: Conditions to meet specification:  $P \geq 100W$  and the UUT is a sinusoidal voltage. The UUT voltage and the Regenerative AC Electronic Load current must be in the same phase.
  - \*6: Supports current source mode and needs to set Phase limit to OFF. See section

- 3.4.4.1 for the setting method.
- \*7: Supports PF setting mode and needs to set Power Factor to ON. See section 3.4.5.1 for the setting method.
- \*8: When the input of model 63815R-350-105 Regenerative AC Electronic Load is 3Φ 200Vac-240Vac, its load power will be derated to 80%.
- \*9: The load regulation condition is to set the sine wave output.
- \*10: If an extra breaker is required for wiring, be sure to use a circuit breaker larger than 50A.
- \*11: 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.
- \*12: The test efficiency is the maximum output power to linear load when the output voltage sets to 250VAC.
- \*13: The operating humidity is in non-condensing state.
- \*14: The input voltage range of 63815R-350-105 is 3Φ 200Vac - 240Vac ± 10% with 12kVA maximum output power at 47-63Hz.
- \*15: When measuring the accuracy (RMS) in parallel mode, the defined accuracy (Peak) spec. needs to add the parallel unit modification. For instance, if the accuracy (RMS) is 0.4%+0.3%F.S, it has to be above >N Amp with output voltage set to 250VAC and frequency set to 60Hz to meet the specification.(N is the parallel unit.)
- \*16: The measurement related specifications in parallel mode such current and power need multiply the paralleled units, for instance, the output current (RMS) of 3 paralleled units is 35x3=105A and the output peak current is 315A.
- \*17: When the input of model 63815R-350-105 Regenerative AC Electronic Load is 3Φ 200Vac-240Vac, its output power will be derated to 80%.
- \*18: See the voltage/current operating diagram below for the Regenerative AC Electronic Load's output capability.

Voltage / Current Operating Area  
 Operating Area per Phase @ AC Mode





## 1.4 Function Keys

### 1.4.1 Front Panel

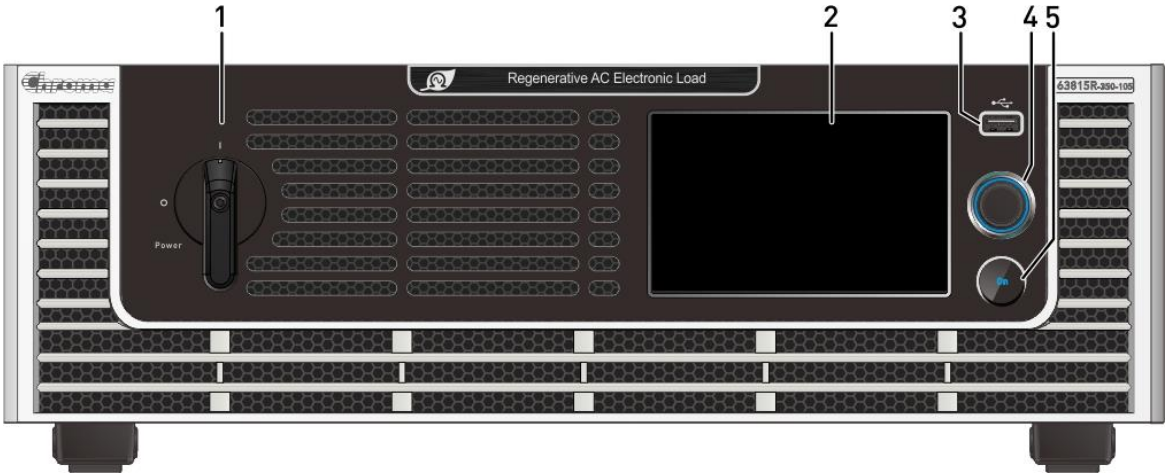







Figure 1-1 Front Panel

Table 1-1 Front Panel Description

Item	Symbol	Description
1		<b>Main Power Switch:</b> Powers the Regenerative AC Electronic Load on and off.
2		<b>LCD Touch Panel:</b> 5.0 inch LCD displays output settings and measurement results.
3		<b>USB HOST:</b> Captures the LCD screen. Only for use with a flash (thumb) drive to record data. See warning below.
4		<b>RPG rotary knob:</b> Turning the RPG rotary knob allows for adjustments to voltage and frequency and allows for inputting programmed data.
5		<b>Output On button:</b> Allows for output to be turned on and off without turning off instrument. Light on means the output is ON and light off means the output is OFF.

**⚠ WARNING** : The USB HOST on the front panel can only be used to connect USB flash drive. Do not connect to power banks and other 3C products.

## 1.4.2 Rear Panel

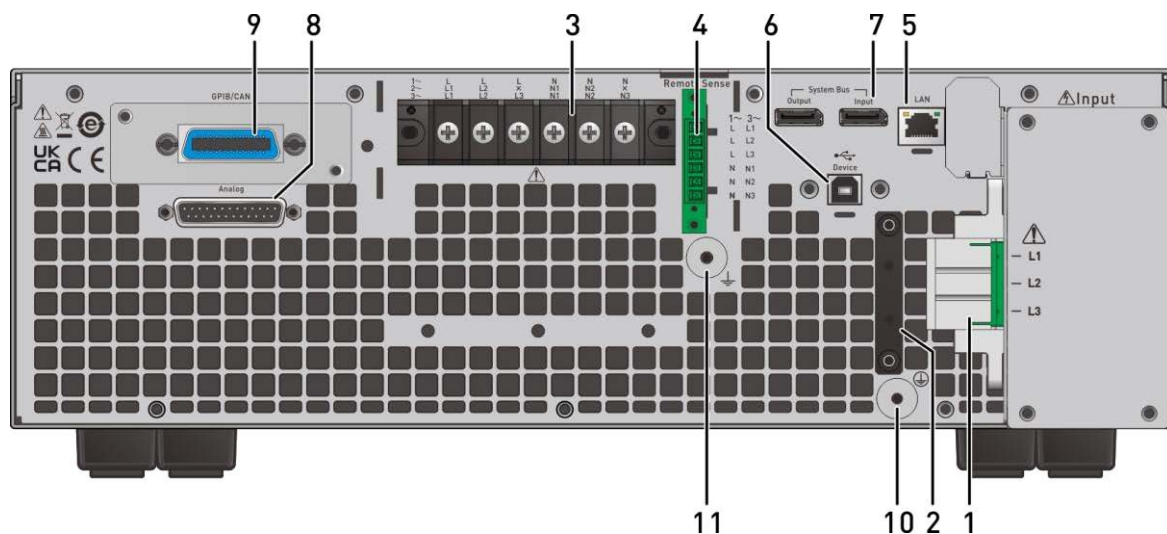


Figure 1-2 Rear Panel

Table 1-2 Rear Panel Description

Item	Name	Description
1	Input Connector	Used to connect the Regenerative AC Electronic Load to the utility mains.
2	Power Input Wire Fixing Bar	Allows for convenient connections to input connecting wires.
3	Output Connector	The output terminal of the Regenerative AC Electronic Load connects to the UUT.
4	Remote Sense	Remote voltage sense connection. Used to connect remote sense lines to the load to compensate for voltage drop

		caused by the output cable. Be sure that the “L1” terminal of the remote sense connects to the “L1” terminal of load while the “N” connects to the “N” terminal of load. (Do not use reverse polarity for connection.)
5	LAN	Used to connect to a network (LAN) control interface.
6	USB	USB control interface to connect an external PC for remote operation.
7	Parallel Signal Comm. Port	Used to interconnect devices for Master/Slave parallel operation.
8	Analog	The TTL I/O terminal transmits the I/O control signal (Fault_out, Remote Inhibit & AC_ON.) See <i>Appendix A</i> for the detailed pin assignment.
9	GPIB/CAN Connector (Option)	GPIB/CAN interface to connect the PC for remote operation.
10	Input Ground Terminal	Input ground terminal of regenerative AC electronic load to connect the earth.
11	Output Ground Terminal	Output ground terminal of regenerative AC electronic load to connect the earth.

 **Notice**

1. Figure 1-3 shows the optional GPIB/CAN interface of model 63815R-350-105 (item 9). A cover plate is provided if this option is not ordered.

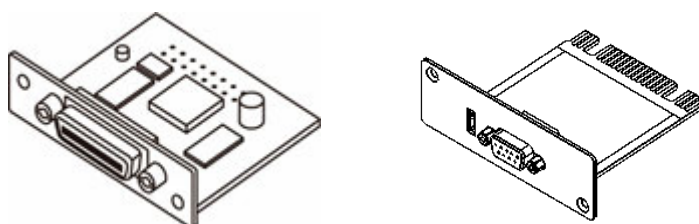


Figure 1-3 GPIB/CAN Interface

2. Figure 1-4 shows the docking board of Analog terminal on the rear panel. The installation is shown below.

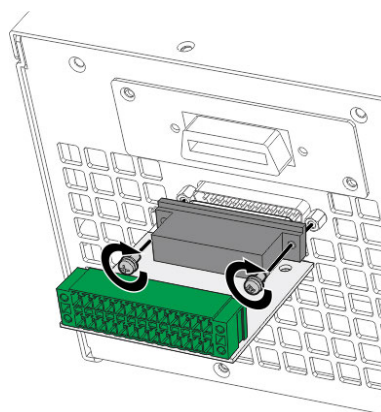


Figure 1-4 Installing Analog Terminal Docking Board

## 1.5 Dimension

- Model 63809R-350-87/63812R-350-96/63815R-350-105 (Unit: mm)

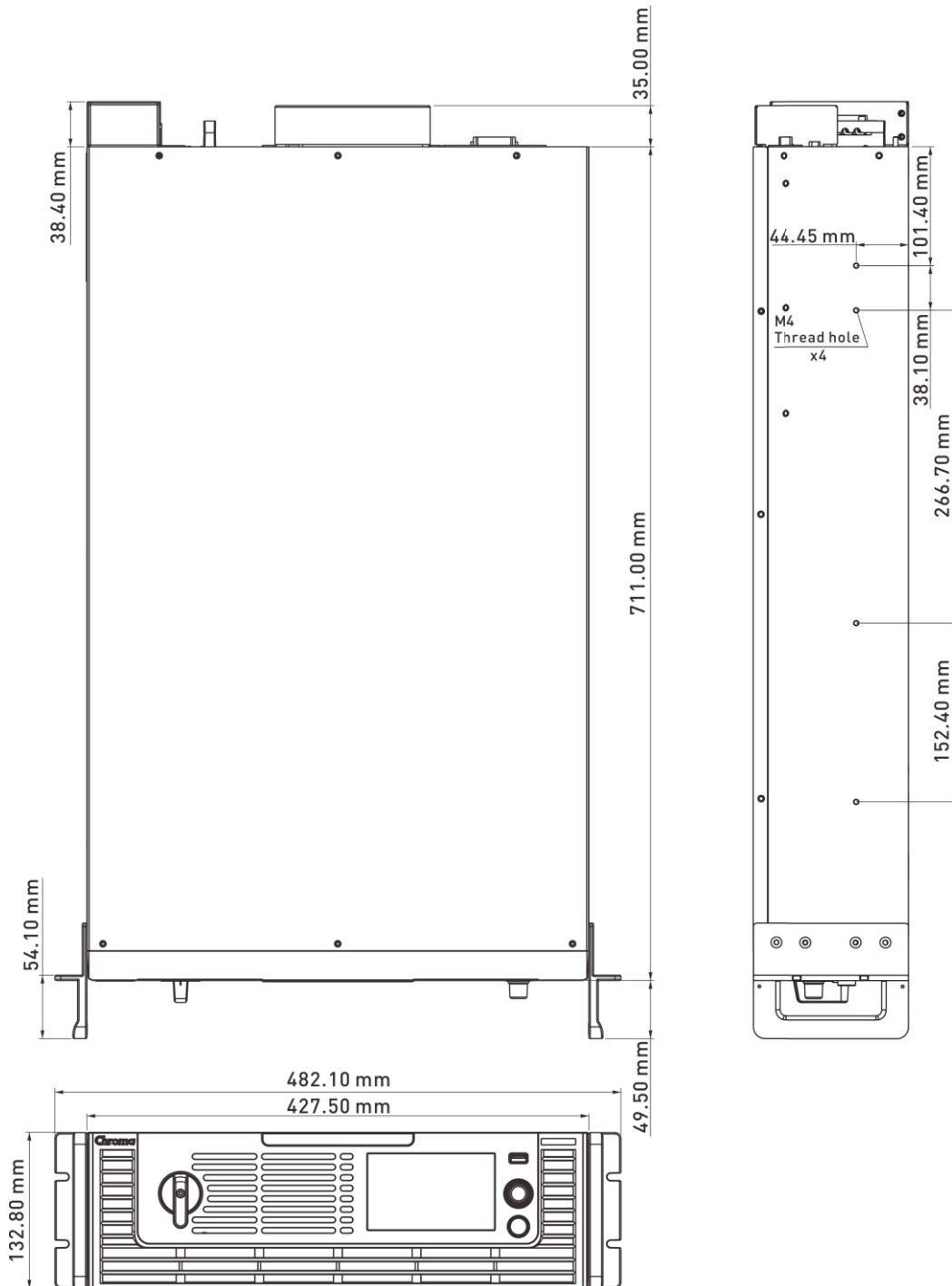


Figure 1-5 Dimension of 63809R-350-87/63812R-350-96/63815R-350-105

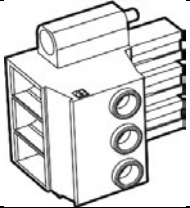







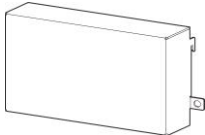

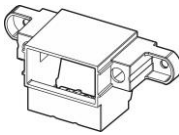
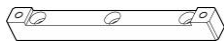
## 2. Installation

### 2.1 Initial Inspection


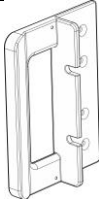

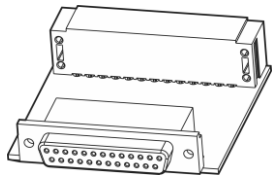


Before shipment, this device was inspected and found to be free of mechanical and electrical defects. When unpacking, inspect for damage that may have occurred in transit. Save all packing materials in case the instrument needs to be returned. If damage is found, file a claim with the carrier immediately. Do not return the product to Chroma without prior approval.

- (1) Please check if there is any damage during transportation or missing accessories after unpacking.
- (2) If any damage is found, file a return shipping request to “Chroma RMA” in order to receive authorization to return the device.

The accessories of model 63809R-350-87/63812R-350-96/63815R-350-105 are listed in the table below.

Standard Accessories				
Item				
Name	Input terminal block *1pcs	Capacitive Stylus pen *1pcs	M4*12 Screw *3pcs	M4 Hex nut(GND) *1pcs
P/N	W52-000098	A55-000289	H69-401290	H71-000035
Item				
Name	M4*16 screw *2pcs	M3*8 screw *2pcs	M4*12 screw *8pcs	M5*10 Screw *1pcs
P/N	H69-401550	H69-300850	H61-401220	H61-501020
Item				
Name	Output terminal block *1pcs	Output busbar *1pcs	Input terminal block *1pcs	Output cable cleat *1pcs
P/N	G29-000116	G52-000351	G29-000106	G32-015248



Item				
Name	Output cable cleat *1pcs	Rack mounting kit *2pcs	Stylus lanyard *1pcs	Docking board for APG signal*1pcs
P/N	G32-015296	G28-000146	G55-001131	8-61810026
Item				
Name	#4-40*7.93 screw *2pcs s	M4*10 screw *2pcs		
P/N	H66-000021	H61-401052		

 **Notice**

1. Please keep all of the packing materials in case the device has to be returned for repair.
2. Do not return the instrument to the factory without obtaining prior RMA acceptance from Chroma.
3. Check if all accessories that are listed in the packing list are all received.

 **CAUTION**

The Regenerative AC Electronic Load is too heavy for one person to safely lift and assemble. To avoid injury, ask for assistance during installation.

## 2.2 Precautions before Use

The Regenerative AC Electronic Load has to properly connect to an AC source for operation. Since the device is fan cooled, install in a location with sufficient air flow. The environment temperature should be under 40°C. When the instrument input configuration is a Y connection, ensure that L1/L2/L3 and NEU are in proper wire diameters to meet the maximum current requirements.

 **CAUTION**

1. The weight of the electronic load upper cover cannot exceed 10Kg (22lbs).
2. The Regenerative AC Electronic Load must be connected to an appropriate AC power input.
3. The Regenerative AC Electronic Load is a fan cooled instrument thus needs to be installed in a place with sufficient air flow.
4. The ambient operating air temperature cannot exceed 40°C.



## 2.3 Input Power Specification

### 2.3.1 Ratings

Input voltage range:

63809R-350-87	63812R-350-96	63815R-350-105
3Ø 200-240V±10%V <sub>LL</sub> (39A Max./Phase)	3Ø 200-240V±10%V <sub>LL</sub> (51A Max./Phase)	3Ø 200-240V±10%V <sub>LL</sub> (51A Max./Phase)
3Ø 380-480V±10%V <sub>LL</sub> (21A Max./Phase)	3Ø 380-480V±10%V <sub>LL</sub> (27A Max./Phase)	3Ø 380-480V±10%V <sub>LL</sub> (34A Max./Phase)

All of the input voltage specifications are based on 3-phase AC line voltage (L-L).

Input frequency: 47-63 Hz



The Regenerative AC Electronic Load could be damaged if the input voltage is out of the specification.

### 2.3.2 Input Connection

The input connection is located on the right of the instrument rear panel. The power cable should be at least 105°C rated. The power cable input should have rated current larger or equal to the maximum rated current of Regenerative AC Electronic Load.

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

- Secure the power cable to the AC power terminal.
- Insert the AC power terminal into the AC terminal block and lock the power input protection cover.
- Secure the grounding terminal of input power supply to the copper column on the chassis (a M4\*0.7 flange nut is used).
- Lock the safety anti-pull device to prevent the AC power terminal from falling off.



#### CAUTION

- To protect the operator, the metal wire connected to GND terminal has to be earth grounded. In no cases should the Regenerative AC Electronic Load be operated without proper earth ground.
- The power cable installation has to be performed by professional personnel in compliance with the local electrician regulation.

Voltage Range	Cable Spec.	Terminal Spec.
(3Ø 200-240V±10%V <sub>LL</sub> 380-480V±10%V <sub>LL</sub> )	8AWG (L1/L2/L3/GND)	E10-12(L1/L2/L3) 8-6(GND)

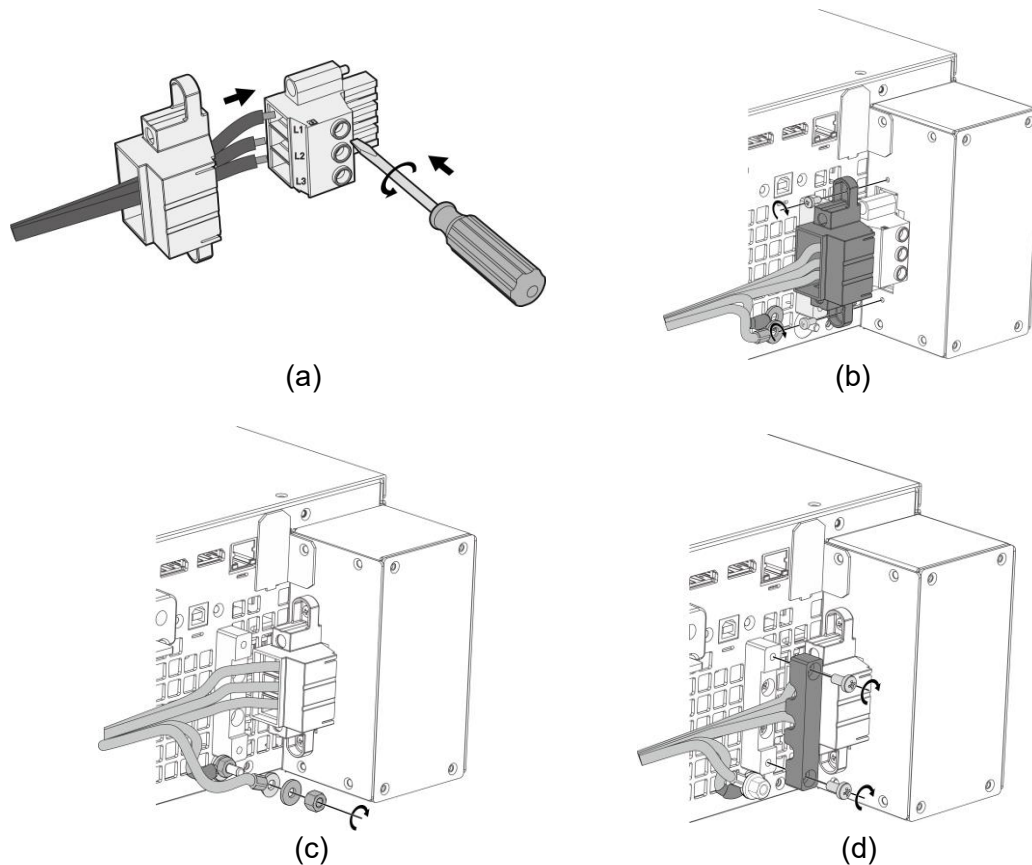


Figure 2-1 Input Power Connection and Wiring Fixed Diagram

**Notice**

1. The input voltage specifications are based on 3-phase AC line voltage (L-L).
2. The green or green with yellow inlaid grounding wire is to be connected to the  $\text{⏏}$  terminal.
3. The red, black or blue power wire is to be connected to L1, L2, and L3 terminals.

**WARNING**

1. To protect the operator, the metal wire connected to GND  $\text{⏏}$  terminal has to be earth grounded. In no cases should the Regenerative AC Electronic Load be operated without proper earth ground.
2. The power cable installation has to be performed by professional personnel in compliance with the local electrician regulation.

**CAUTION**

1. Be sure to select the input wire with appropriate withstand voltage based on the input voltage.
2. To ensure safe operation, please select the breaker closest to the current rating of each phase based on the input power during installation, and connect it in series before the input terminal.
3. The breaker should be installed within the building for safe operation, please refer to Table 2-3 for related ratings.

The section area of input current conductor and the outer diameter of anti-pull wire should to comply with the safe currents listed in Table 2-1

Table 2-1 Recommended Wire Spec.

Conductor Area Section Area mm <sup>2</sup>	Save Current (A)	Anti-pull Diameter (mm)
	Copper Conductor	
8.0	55	6.65 ± 0.15

Table 2-2 lists the PVC (105°C) wire specifications when the ambient temperature is 30°C.

Table 2-2 PVC (105°C) Wire Spec.

Conductor Area Section Area mm <sup>2</sup>	Save Current (A)	
	Copper Conductor	Aluminum Conductor
1.25	15	--
2.0	20	--
3.5	30	--
5.5	40	--
8.0	55	--
14	70	50
22	90	70
30	120	90
38	145	100
50	175	120
80	230	150
100	260	200
125	300	240
150	350	270
200	425	330
250	500	380
325	600	450
400	700	500
500	800	600

Table 2-3 Breaker Rating

Model	Breaker Rating(A)
63815R-350-105	51A max.@ 3Ø 200-240V±10%V <sub>LL</sub> 34A max.@3Ø 380-480V±10%V <sub>LL</sub>
63812R-350-96	51A max.@ 3Ø 200-240V±10%V <sub>LL</sub> 27A max.@3Ø 380-480V±10%V <sub>LL</sub>
63809R-350-87	39A max.@ 3Ø 200-240V±10%V <sub>LL</sub> 21A max.@3Ø 380-480V±10%V <sub>LL</sub>

## 2.4 Output Connection

The output terminal socket is located at the rear side of Regenerative AC Electronic Load. The load is connected to the output terminal. For safety, the AC input/output cable must be secured with an appropriate tool and the casing has to be tightened up securely. The cable diameter connected to the load has to be large enough so that it will not over heat if the output is over current, see Figure 2-2.

### Notice

1. The output terminal "L" means "+" and "N" means "-".
2. This Regenerative AC Electronic Load can output 1-/3-phase. When set to 1-phase mode, the short circuit copper bar must be used to short-circuit the L1/L2/L3 output. The UUT L/N points are connected to the L1/L2/L3 and GROUND short circuit copper bar respectively as shown in Figure 2-2.
3. The regenerative AC electronic load supports loading and use of UUT in Y-connection (with neutral line N) but not  $\Delta$  connection (without neutral line N). \*\*

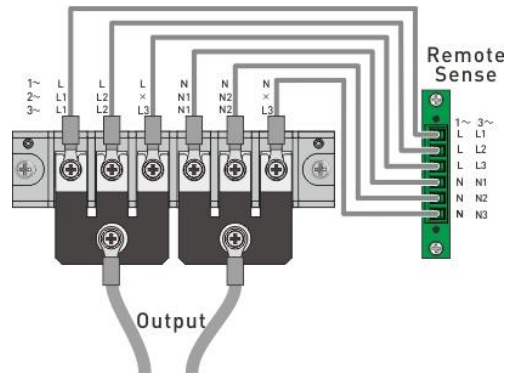
### WARNING

For the electronic load to dissipate heat properly, it is necessary to keep at least 1 meter space free of obstruction in front and in the rear panel for ventilation. Do not place the device against a wall or any other objects.

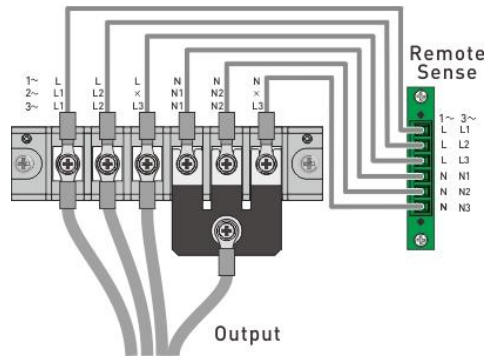
## 2.5 Connecting Remote Sense

The Remote Sense of the Regenerative AC Electronic Load monitors the UUT voltage to ensure the voltage transmitted to the load is the set voltage. The correct load value can be calculated only when CS, CP, and CR modes are executed. The reason that the voltage to the Regenerative AC Electronic Load does not equal the UUT set voltage is often due to the transmission cable being too long and there being a voltage drop.

Remove the cable connected to "L1", "L2", "L3", "N1", "N2" and "N3" from the Remote Sense terminal and change it by connecting to Load as Figure 2-3 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 AC Electronic Load feedback circuit, thus it has to keep low resistance in order to maintain the best performance. If the sense wire is not connected or becomes open during operation, the Regenerative AC Electronic Load may not output voltage. It is necessary to ensure that the sense wire connection is secure and cannot open during operation. The sense wire should be twisted to reduce interference from external voltage and needs to be as short as possible.

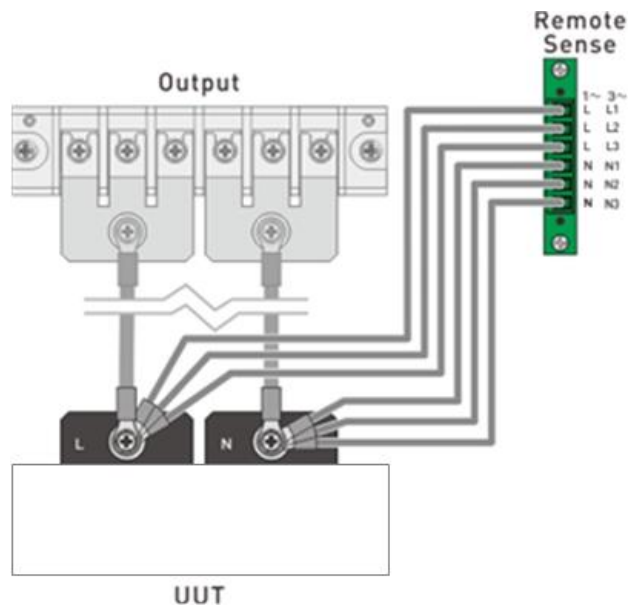


(a) 1-Phase



(b) 3-Phase

Figure 2-2 Connecting Output and Local Voltage Sense



(a) 1-Phase

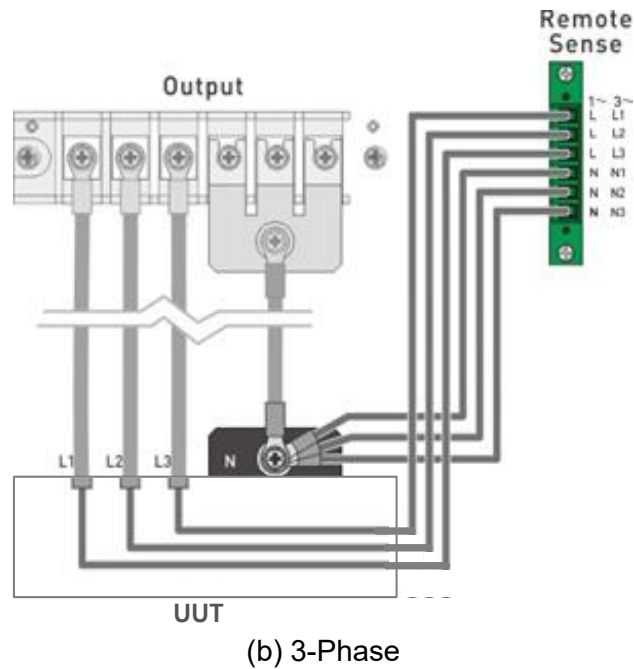


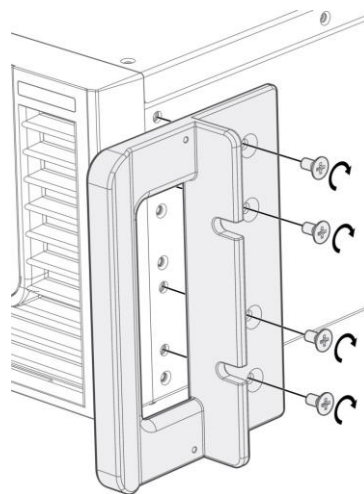
Figure 2-3 Connecting Output and Remote Voltage Sense

**Notice**

1. The sensing leads should be as close as possible to the load and twisted together to reduce external voltage interference. The sensing leads only transmits a small amount of current (mA current), thus 18 AWG wire is recommended.
2. The output power cable of the Regenerative AC Electronic Load is at N contact. Since it will withstand 3 times of L current during 1-phase connection, it is recommended to use 2AWG wire.

## 2.6 Installing the Handle

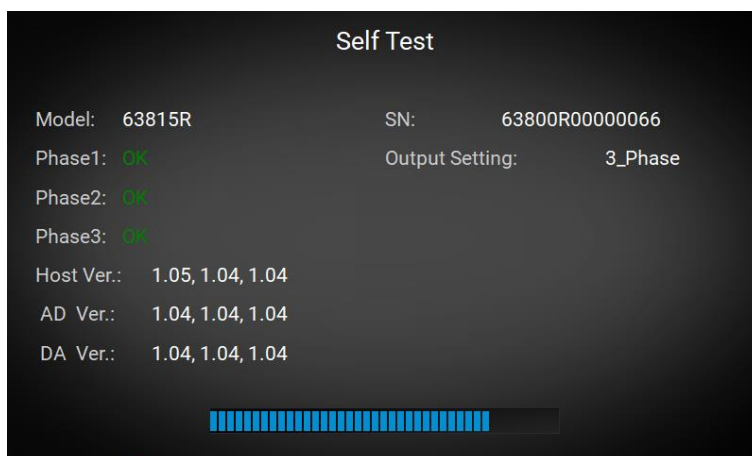
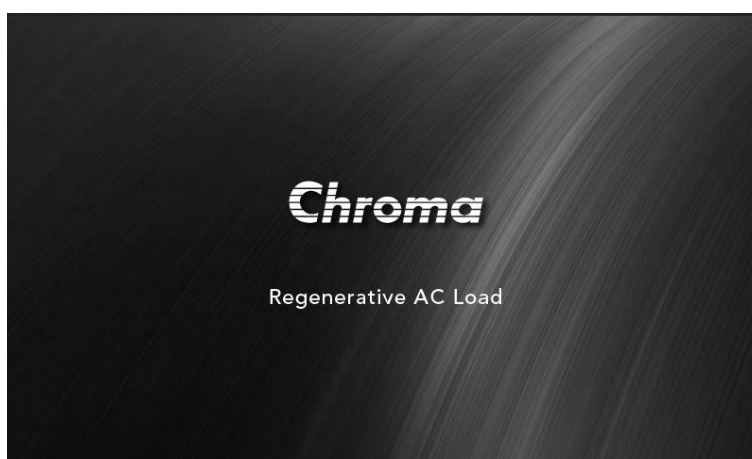
Use for M4x12 flat-head screws to attached the handle of the rack mounting kit when installing as shown in Figure 2-4.

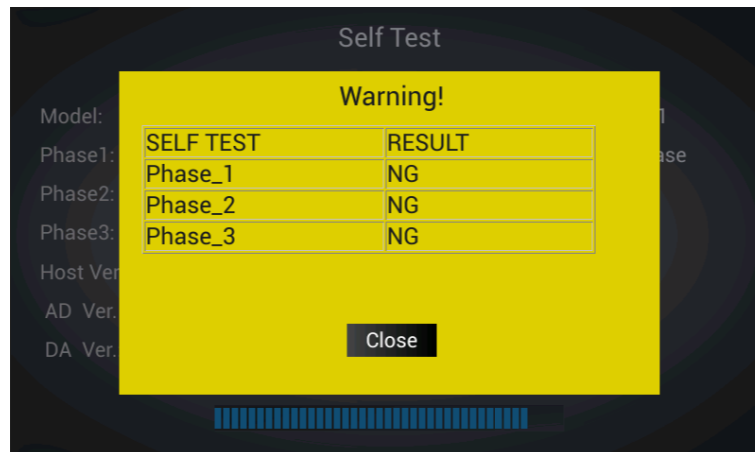


## 2.7 Power-On Procedure

**⚡ 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 or death

Connect the power line and turn on the power switch located on the front panel. The Regenerative AC Electronic Load will begin a series of self tests. The LCD on the front panel will be on and display will appear as shown below.





During initialization the Regenerative AC Electronic Load executes memory, data and communication self tests. The display shows the Model Number and Regenerative AC Electronic Load's Serial Number after executing the self-test routines and each test item will show "OK" on the right if no error is found. The software version will show on the display.

When the self tests of memory, data and communication are done, the Regenerative AC Electronic Load will conduct a power output self-test. The output relay is OFF during the procedure to ensure the load connected to the output terminal will not be accidentally damaged to avoid injury to operators. The Regenerative AC Electronic Load sets the output to 300Vac for the voltage measurement. If the power self-test fails, the display shows "NG" when the measured voltage is over  $300V \pm 30V$ . If the self-test is OK, the screen will change to the MAIN PAGE automatically.

#### Notice

1. You can run self-diagnosis during power on self-test to see if there are any error conditions.
2. Self-test requires about 20 seconds to complete.

## 2.8 Maintenance and Cleaning

Remove all connected wires and cables from the instrument before cleaning. Use a brush to clean dust and if there are stains on the chassis that cannot be removed by brush, wipe with a volatile liquid. Do not use any corrosive liquid to avoid damaging the chassis and do not open the chassis arbitrarily. Use a damp cloth with soap and water or a soft detergent to clean the VFD front panel display or a screen cleaner designed for displays. Please send unit back to the Chroma if internal cleaning is needed.

## 2.9 Common Environment Conditions

1. In door use only.
2. Altitude up to 2000 meters.
3. Be sure to place the device on a horizontal surface and do not use it vertically.
4. Operating temperature is  $0^{\circ}\text{C}$  to  $40^{\circ}\text{C}$ .
5. Operating humidity is 0%rh to 90%rh (non-condensing).
6. Storage temperature is  $-25^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .
7. Storage humidity is 0%rh to 90%rh (non-condensing).



8. The input AC power voltage fluctuates up to  $\pm 10\%$  of the rated voltage.
9. The transient overvoltage is CAT II pulse withstand voltage.
10. The pollution degree is II.



# 3. Using Regenerative AC Electronic Load

## 3.1 Function Modes

On the screen, it shows the MAIN PAGE (3\_Phase Mode/1\_Phase Mode). Selecting the CC Rectifier, CS Rectifier, CR, CC Lead/Lag, CS Lead/Lag, CP, and CC indicators displayed on the upper right can set the load function mode. The MEAS. area on the screen shows the measurement items of Regenerative AC Electronic Load. There are a total of 15 kinds of output measurement items per phase distributed on 3 pages (see section 3.3.2). When powered on, the Regenerative AC Electronic Load can be operated manually, and the command tree diagram is shown in Figure 3-1.

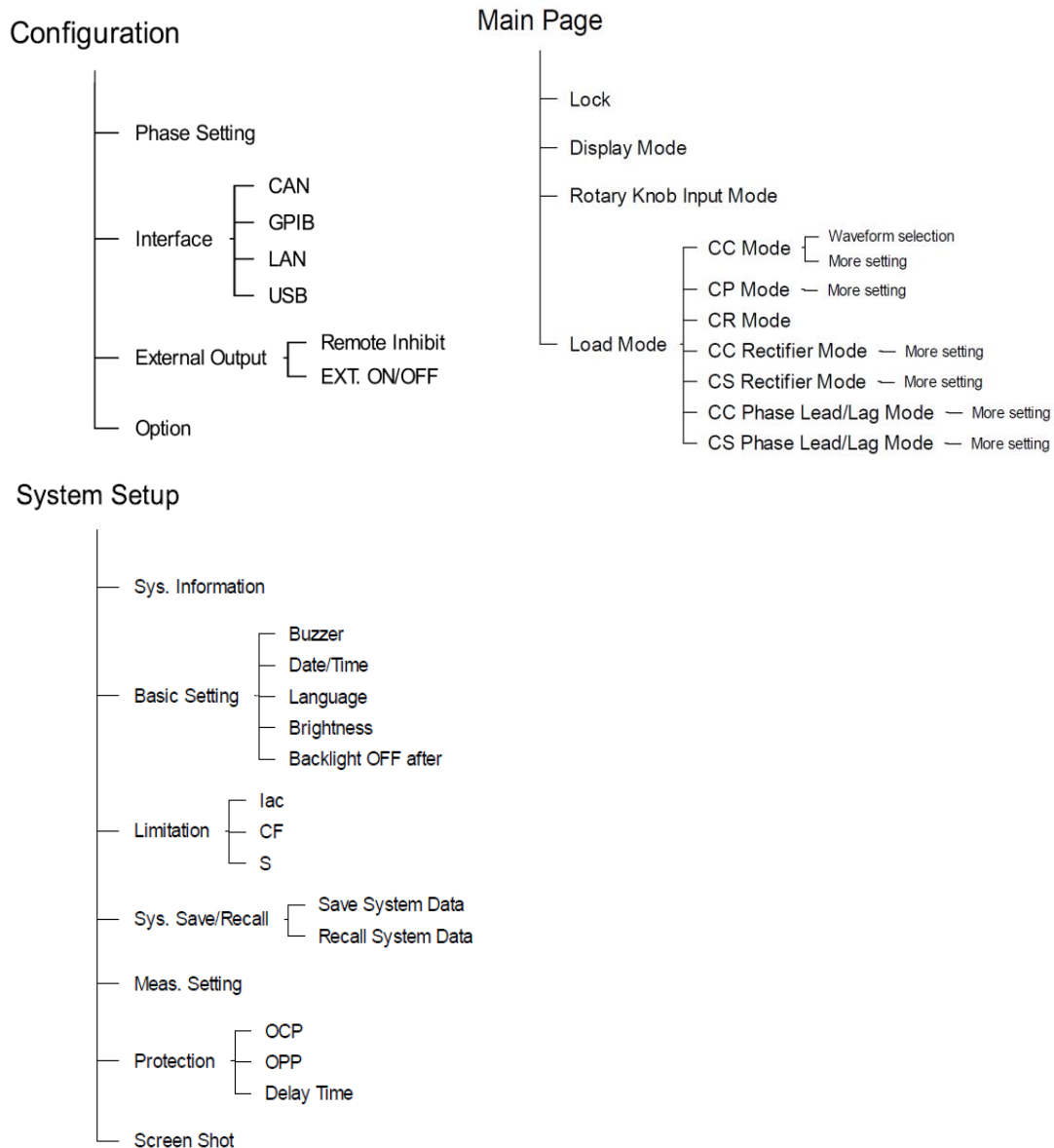


Figure 3-1

## 3.2 Relationship between Crest Factor and Power Factor

The crest factor is the peak current divided by the RMS (root mean square) current. When the crest factor is set to 1.414, it means that the DSP will produce a sinusoidal current waveform.

The definition of power factor is real power divided by apparent power. If the PF is different from the set value, the DSP will correct the current waveform position to match the PF value. For resistive loads, the power factor is 1. If the values of  $V_{rms}$  and  $I_{rms}$  are constant and the decrease of power factor is due to the increase of peak factor, the effective product of voltage and current will also decrease accordingly.

The relationship between PF and CF shown below is based on the voltage waveform of the input voltage as a sine wave. The estimation theory is based on the input voltage waveform and the load current waveform is a sinusoidal waveform or a modified sinusoidal waveform. When the maximum power factor of a fixed crest factor occurs at the maximum overlap of the input voltage waveform and the load current waveform, this means the voltage and current peaks occur simultaneously. When the minimum power factor occurs at the minimum overlap of the input voltage waveform and the load current waveform, this means the zero-crossing points of the voltage and current waveforms are the same. These two situations are shown in Figure 3-2 and Figure 3-3.

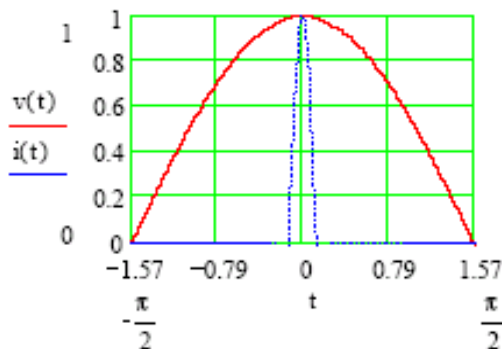


Figure 3-2 Maximum PF Passes Fixed CF

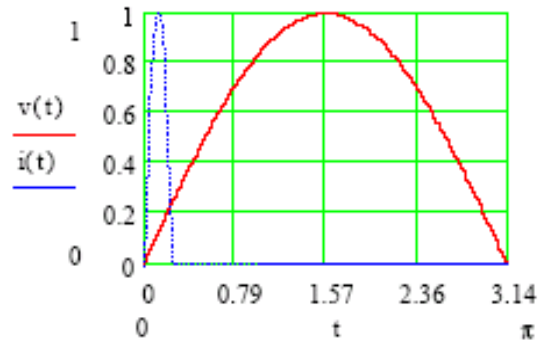


Figure 3-3 Minimum PF Passes Fixed CF

According to the theory, Figure 3-4 shows the relationship between PF and CF.

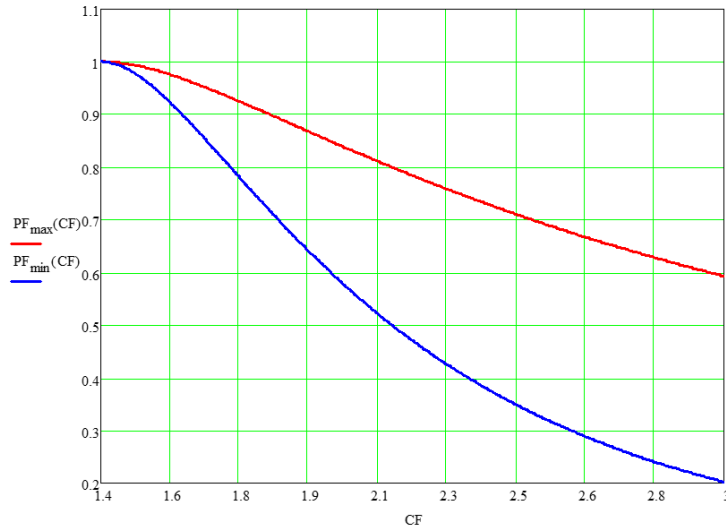


Figure 3-4 Relationship between PF and CF

**Notice**

- Figure 3-2 explains setting the maximum PF in the CF state in CC Rectifier mode (see section 3.4.1) and CS Rectifier mode (see section 3.4.2).
- When Both is selected in CC (see section 3.4.6) and CP mode (see section 3.4.7), the CF and PF values need to be entered at the same time and their priority has to be set again in Both mode. If the setting is over the range shown in Figure 3-4, the Regenerative AC Electronic Load will automatically modify the user-defined range to a valid range. A further illustration is shown in the following 2 examples.

Example 1: (When the priority is CF and the UUT output voltage is 200  $V_{rms}$ )

- If CF=1.5 and PF=1 are set and the allowable PF value is CF=1.5, the valid range is 0.977 ~ 0.993. The system will load with the closest allowable PF value, in this case a PF value of 0.993 will be used.
- If CF=1.5 and PF=0.8 are set and the allowable PF value is CF=1.5, the valid range is 0.977 ~ 0.993. The system will load with the closest allowable PF value, in this case a PF value of 0.977 will be used.
- If CF=3 and PF=0.1 are set and the allowable PF value is CF=3, the valid range is 0.219 ~ 0.593. The system will load with the closest allowable PF value, in this case a PF value of 0.219 will be used.
- If CF=3 and PF=0.7 are set and the allowable PF value is CF=3, the valid range is 0.219 ~ 0.593. The system will load with the closest allowable PF value, in this case a PF value of 0.593 will be used.

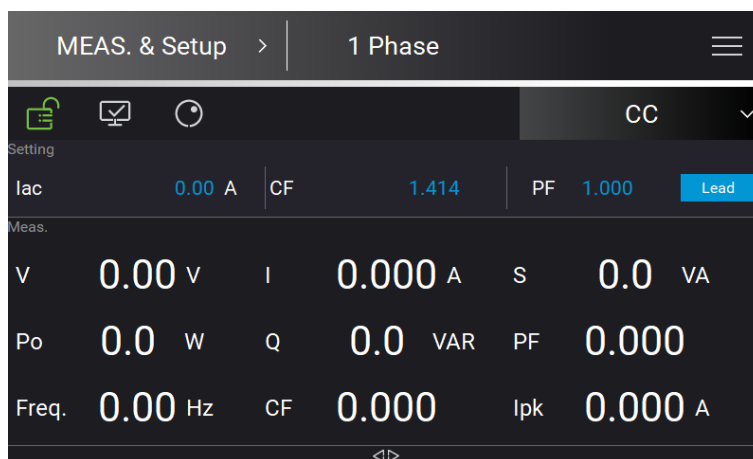
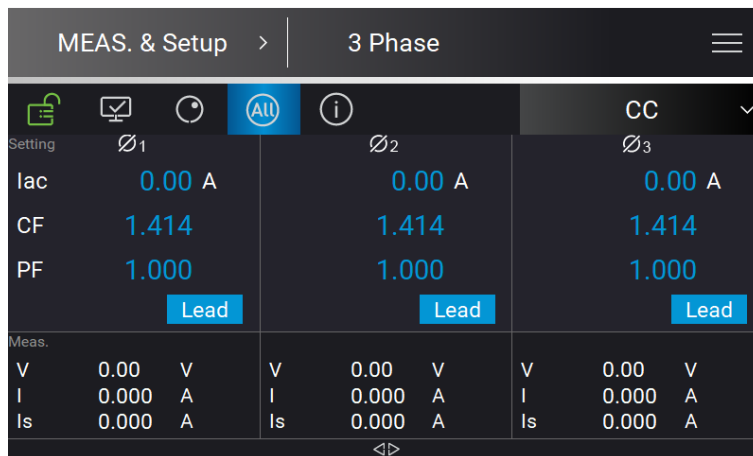
Example 2: (When the priority is PF and the UUT output voltage is 200  $V_{rms}$ )

- If PF=0.8 and CF=3 are set and the allowable CF value is PF=0, the valid range is 1.750 ~ 2.153. The system will load with the closest allowable CF value, in this case a CF value of 2.153 will be used.
- If PF=0.8 and CF=1.5 are set and the allowable CF value is PF=0.8,

- the valid range is 1.750 ~ 2.153. The system will load with the closest allowable CF value, in this case a CF value of 1.750 will be used.
- c. If PF=0.6 and CF=3 are set and the allowable CF value is PF=0.6, the valid range is 1.972 ~ 2.866. The system will load with the closest allowable CF value, in this case a CF value of 2.866 will be used.
  - d. If PF=0.6 and CF=1.5 are set and the allowable CF value is PF=0.6, the valid range is 1.972 ~ 2.866. The system will load with the closest allowable CF value, in this case a CF value of 1.972 will be used.

### 3.3 Using Meas. & Setup

When the Regenerative AC Electronic Load is turned on and self-test is completed, the screen displays the Meas. & Setup (3\_Phase Mode/1\_Phase Mode) main page as shown below.




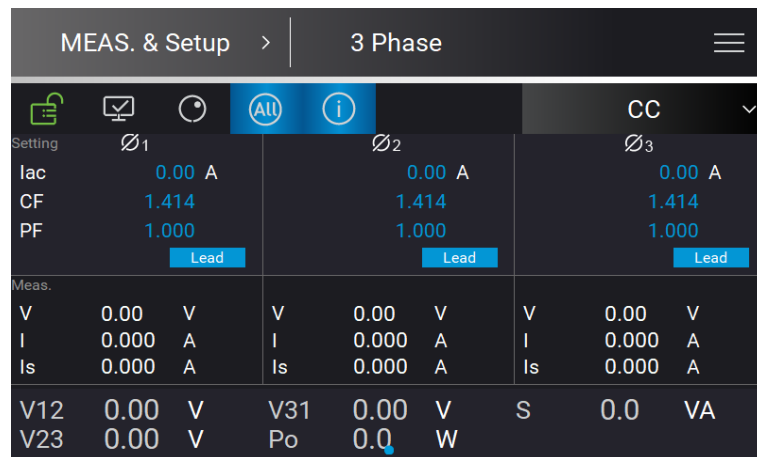
The definition of output parameters on the main page:

- Iac : Input AC current in amperes.
- P : Input real power in watts.
- S : Input the apparent power in volt-amperes.
- R : Input resistance in ohms.
- CF : Set the crest factor.
- Deg : Input the current angle difference in degrees
- PF : Set the power factor.
- Lead/Lag : Set the power factor to lead (inductive) and lag (capacitive) .

Tapping **ON/OFF** enables the Regenerative AC Electronic Load to load based on the set parameters. Tap **ON/OFF** again to stop loading.

### Notice

On the main page, tap  to display the hidden V12, V23, V31, S, and Po measurements.







MEAS. & Setup		3 Phase	
Setting		CC	
	Ø1	Ø2	Ø3
Iac	0.00 A	0.00 A	0.00 A
CF	1.414	1.414	1.414
PF	1.000	1.000	1.000
	Lead	Lead	Lead
Meas.			
V	0.00 V	0.00 V	0.00 V
I	0.000 A	0.000 A	0.000 A
Is	0.000 A	0.000 A	0.000 A
V12	0.00 V	V31	0.00 V
V23	0.00 V	Po	0.0 W
		S	0.0 VA

The Regenerative AC Electronic Load provides an easy-to-use programming interface. Simply use the touch screen on the front panel and the RPG (rotary pulse generator) knob to complete operations and enter data. The following describes the usage of Meas. & Setup.

### Numeric Keypad

In the main page, numeric values can be entered using the touch screen keypad to enter


values, tap  when done. Tap  to cancel the value entered value and return to the previous page. The measured value is displayed on the top of the screen. Tap  and  during data input to modify and clear the settings.

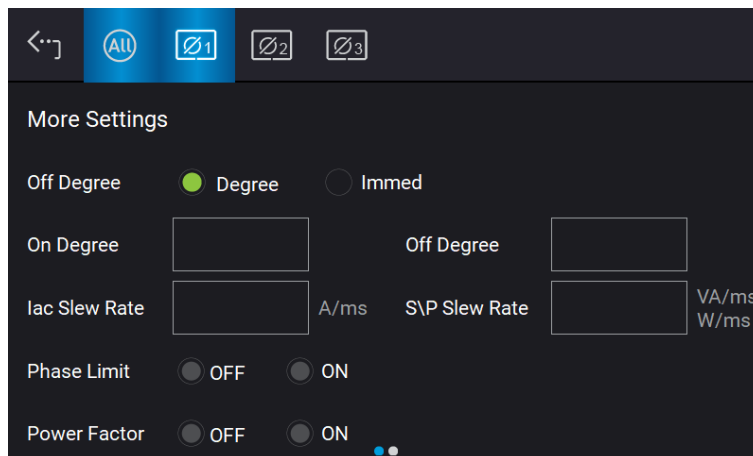


**Notice**

The user can set the value based on the value displayed on upper left of the numeric keypad, and use the **Max** and **Min** keys to quickly set to the maximum and minimum values available for the command.

### 3.3.1 More Setting

In Meas. & Setup (3\_Phase Mode/1\_Phase Mode) page, tap  to enter the menu and select More Setting to perform advanced settings as described below.





#### 3.3.1.1 Load Degree

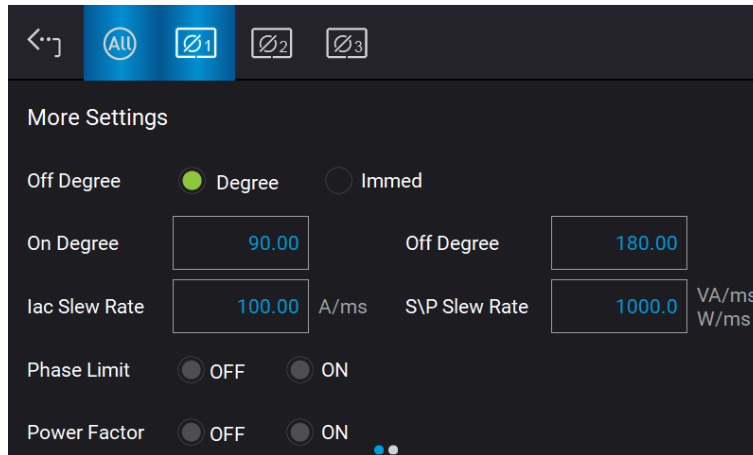
The Regenerative AC Electronic Load is able to control the angle of the loading current waveform at turning on or off. Use ON Degree and OFF Degree on the screen to enable and disable the feature.

The following is the procedure to set the output phase angle to turn on at 90 degrees, and off at 180 degrees in 1\_Phase Mode /3\_Phase Mode.

1. Tap "On Degree".



2. Tap **9**, **0**, and  to change the value to “90.0”.
3. Tap “Off Degree”.
4. Tap **1**, **8**, **0**, and  to change the value to “180.0”.



#### Notice

If "OFF Degree=IMMED", when **QUIT** is tapped the loading current will shut off immediately and Off Degree is invalid for setting.

### 3.3.1.2 SleW Rate of Load Transient



The Regenerative AC Electronic Load is able to adjust the slew rates of output transient waveform. There are Iac slew rate and S/P slew rate to control the voltage waveform when the output commands change.

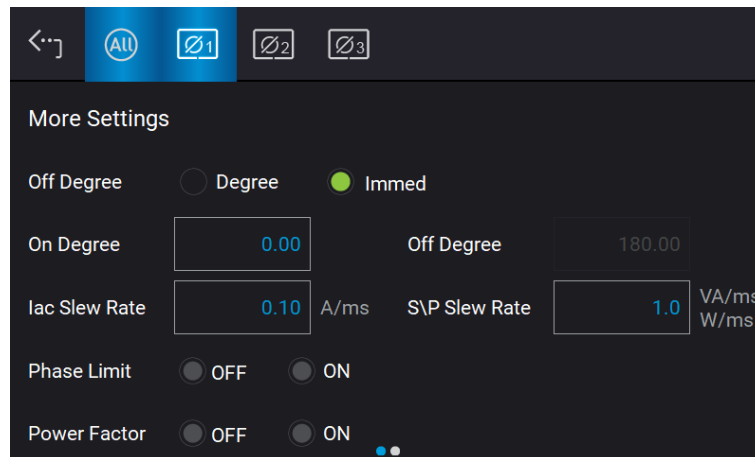
Iac slew rate : Slew rate of current.

S/P slew rate : Slew rate of output frequency.


If the output setting is changed in main page when the Regenerative AC Electronic Load is in Load On state, the output voltage and frequency will change according to the Iac and S/P slew rate settings.

The procedure to set Iac slew rate =0.1, S/P slew rate =1 in 1\_Phase Mode /3\_Phase Mode is described below.


1. Tap “Iac slew rate”.
2. Tap **0**, **.**, **1**, and  to change the value to “0.1”.
3. Tap “S/P slew rate”.
4. Tap **1**, and  to change the value to “1”.



**Notice**

1. Though the input range of Iac slew rate and S/P slew rate is quite large when using the software editor, the loading current may not apply the slew rate properly due to the hardware limit when the Iac slew rate and S/P slew rate are too large.
2. The Iac slew rate maximum is 800 A/ms, the minimum is 0.01 A/ms while the default is 100 A/ms, and only applicable to CC Rectifier, CC Phase Lead/Lag, and CC mode.
3. The S slew rate maximum is 80k VA/ms, the minimum is 0.1 VA/ms while the default is 1000 VA/ms, and only applicable to CS Rectifier and CS Phase Lead/Lag mode.
4. The P slew rate maximum is 80k W/ms, the minimum is 0.1 W/ms while the default is 1000 W/ms, and only applicable to CP mode.
5. The Iac slew rate or S/P slew rate cannot be adjusted in CR mode.
6. When **ON** is executed on the Regenerative AC Electronic Load, the output will reach the final state as set. Once OFF is executed, the output turns to 0V immediately. If you wish to set the slew rate to 0V, it is necessary to enter 0V and tap  instead of executing **OFF** directly.

### 3.3.2 Meas. Selection


In Meas. & Setup (3\_Phase Mode/1\_Phase Mode) page, tap  Meas. Selection to enter the output waveform selection as the figure shown below. There are total 15 measurement items in the setting screen including voltage, current, and output power, etc. Each phase can set 3 different measurement items to display on the main page.

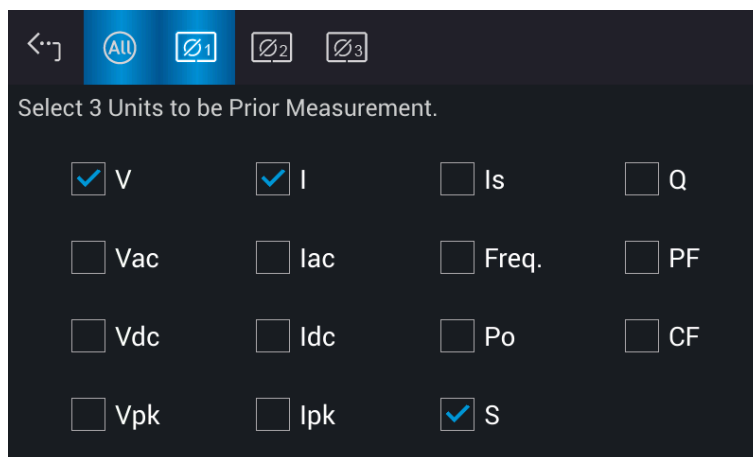
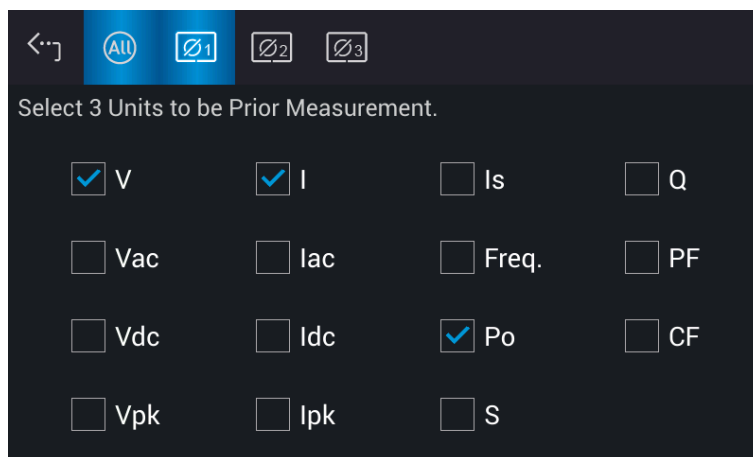
The definition of parameters:

- V : It is the voltage measurement in Volts. (RMS measurement)
- Freq. : It is the output frequency in Hertz.
- I : It is the current measurement in Amps. (RMS measurement)
- Vac : It is the AC voltage measurement in Volts and the calculation formula =  $V_{ac} = \sqrt{(V_{rms}^2 - V_{dc}^2)}$
- Iac : It is the AC current measurement in Amps and the calculation formula =  $I_{ac} = \sqrt{(I_{rms}^2 - I_{dc}^2)}$
- PF : It is Power Factor and the calculation formula = Real Power / (Vrms × Irms)


- CF : It is Crest Factor and the calculation formula =  $I_{peak}/I_{rms}$
- Vdc : It is the DC voltage measurement in Volts.
- Idc : It is the DC current measurement in Amps.
- Vpk : It is the peak voltage measurement in Volts. The Vpeak display is the Vp(+) or Vp(-) whichever is larger.
- Ipk : 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.
- Po : It is the real power measurement in Watt.
- Q : It is the reactive power in VAR and the calculation formula =  $\sqrt{(V_{rms} I_{rms})^2 - P_o^2}$
- S : It is the apparent power in volt-amperes and the calculation formula =  $V_{rms} \times I_{rms}$

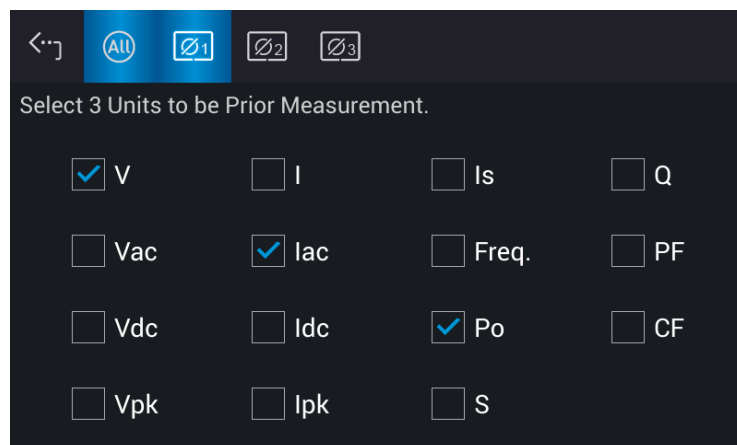
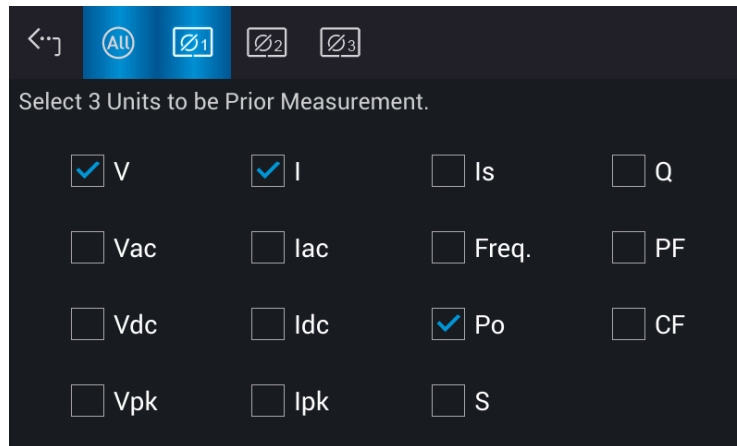
Below is the procedure to change the 3<sup>rd</sup> measurement item from Po to S in 3-phase mode.

1. In Meas. & Setup (3\_Phase Mode/1\_Phase Mode) page, tap  Meas. Selection.
2. Tap ALL icon.
3. Unselect "Po".
4. Select "S".



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


1. In Meas. & Setup (3\_Phase Mode/1\_Phase Mode) page, tap  Meas. Selection.
2. Unselect "I".
3. Select "Iac".



 **Notice**

When changing the selected measurement items, it is necessary to delete one before adding a new item if three items have already been selected

### 3.3.3 Waveform Viewer

In Meas. & Setup (3\_Phase Mode/1\_Phase Mode) page, tap  Waveform Viewer to view the real-time output voltage/current waveform. There are a total of 3 channels available. Voltage, current and time can be adjusted by the scale. The figure below shows the Waveform Viewer.

**Ch1:** #1V, #2V, #3V, #1I, #2I, #3I.

**Ch2:** #1V, #2V, #3V, #1I, #2I, #3I.

**Ch3:** #1V, #2V, #3V, #1I, #2I, #3I.

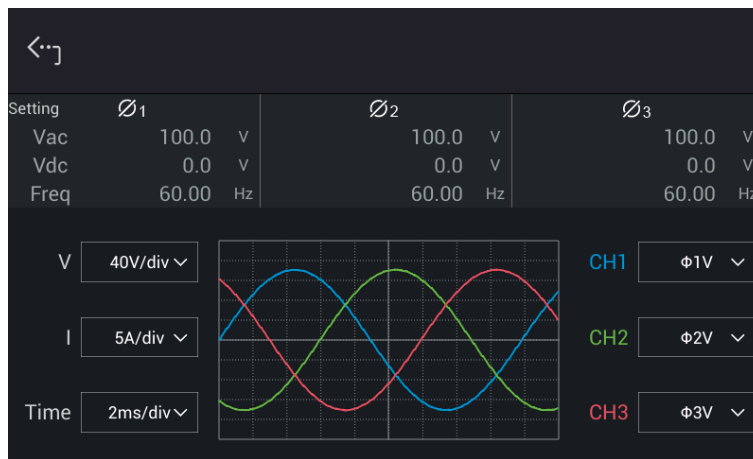
**V (Scale):** 10, 20, 40, 80, 120V/div.

**I (Scale):** 5, 10, 20, 40, 60A/div.

**Time (Scale):** 0.2, 0.5, 1, 2, 5, 10, 50, 100, 200ms/div.

The procedure to set CH1 =#1V, CH2 =#2V, CH3 =#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. Tap CH1 on the right.
2. Select "#1V".
3. Tap CH2 on the right.
4. Select "#2V".
5. Tap CH3 on the right.
6. Select "#3V".
7. Tap V on the left.
8. Select "40V/div" to complete the setting.
9. Tap I on the left.
10. Select "5A/div" to complete the setting.
11. Tap Time on the left.
12. Select "2ms/div" to complete the setting.



### 3.3.4 Output Save/Recall

The Regenerative AC Electronic Load has 10 groups of memory to save the frequently used Iac, P, S, R, CF, Deg, PF, and Lead/Lag for later recall. Below is an example to save these parameters to Group\_001 memory.



The screenshot shows the 'Output Save & Recall' menu. It contains a table with the following data:

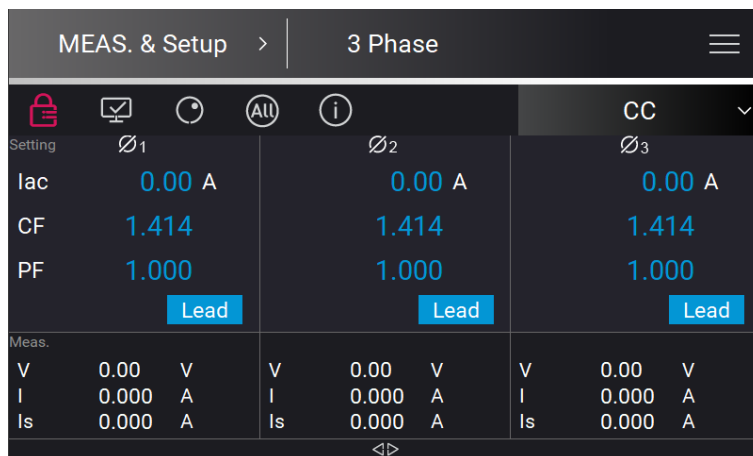
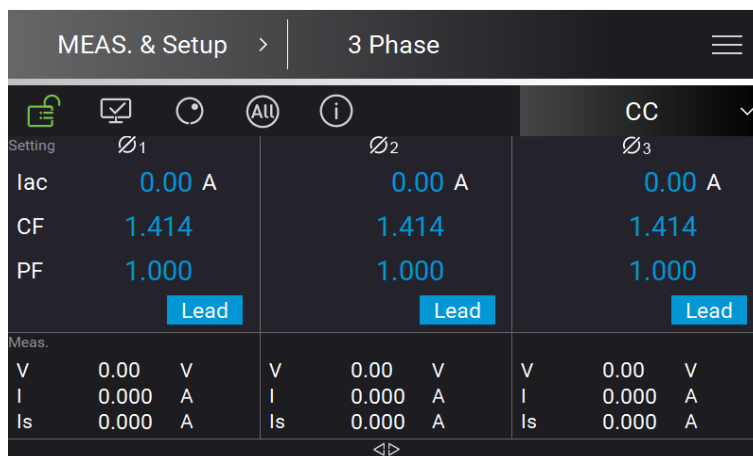
Name	Date	Save	Recall
Group_001	2020/08/04 10:36	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Group_002	2020/08/04 10:36	<input type="checkbox"/>	<input type="checkbox"/>
Group_003	2020/08/04 10:36	<input type="checkbox"/>	<input type="checkbox"/>
Group_004	2020/08/04 10:36	<input type="checkbox"/>	<input type="checkbox"/>
Group_005	2020/08/04 10:36	<input type="checkbox"/>	<input type="checkbox"/>
Group_006	2020/08/04 10:36	<input type="checkbox"/>	<input type="checkbox"/>

**Notice**



1. The save and recall output setting function can only be set in MEAS. & Setup menu.
2. The recall function is not valid when the loading mode changes (see section 3.3.8). For example, when the user saves the parameters in CC Rectifier mode, the system will remember the parameters of 7 modes (see section 3.3.8). However, if the user changes to CS Rectifier mode for execution, the recall function will remain in CS Rectifier mode.

### 3.3.5 Lock Button

In Meas. & Setup (3\_Phase Mode/1\_Phase Mode) page, tap  to lock the panel selection functions. All touch functions are disabled except the lock key. Tap  again to unlock it.




### 3.3.6 Display Mode

In Meas. & Setup (3\_Phase Mode/1\_Phase Mode) page, tap  to display the measurements, tap  to return to the main page.

Display Mode					
$\varnothing_1$		$\varnothing_2$		$\varnothing_3$	
V	0.00 V	V	0.00 V	V	0.00 V
I	0.000 A	I	0.000 A	I	0.000 A
Po	0.0 W	Po	0.0 W	Po	0.0 W
V12	0.00 V	V31	0.00 V	S	0.0 VA
V23	0.00 V	Po	0.0 W		

### 3.3.7 Rotary Knob Input Mode


In Meas. & Setup (3\_Phase Mode/1\_Phase Mode) page, tap  to use the rotary knob function. Tap to select the voltage or frequency to be set. When the cursor appears, press down the rotary knob and the cursor can be moved to set the number of digits to be entered.

MEAS. & Setup		3 Phase		
Setting		$\varnothing_1$	$\varnothing_2$	$\varnothing_3$
Iac	000.00 A	0.00 A	0.00 A	0.00 A
CF	1.414	1.414	1.414	1.414
PF	1.000	1.000	1.000	1.000
	Lead	Lead	Lead	Lead
Meas.		V	V	V
V	0.00 V	V	0.00 V	V
I	0.000 A	I	0.000 A	I
Is	0.000 A	Is	0.000 A	Is

### 3.3.8 Output Mode Setting

The Regenerative AC Electronic Load has 7 output modes: CC Rectifier, CS Rectifier, CR, CC Lead/Lag, CS Lead/Lag, CC, and CP. The user can use the output mode setting indicator (as shown below) on the upper right of the main screen to set the desired application.

The setting procedure from CC to CC Rectifier is described below:

1. Tap the output mode indicator  on the upper right.
2. Select "CC Rectifier".

MEAS. & Setup >		3 Phase		CC		
Setting	Ø1	Ø2	Ø3			
Iac	35.00 A	35.00 A	35.00 A			
CF	1.414	1.414	1.414			
PF	1.000	1.000	1.000			
	Lead	Lead	Lead			
Meas.	V	I	Is	V	I	Is
	0.00	0.000 A	0.000 A	0.00	0.000 A	0.000 A

MEAS. & Setup >		3 Phase		CC Rectified		
Setting	Ø1	Ø2	Ø3			
Iac	35.00 A	35.00 A	35.00 A			
CF	1.414	1.414	1.414			
Meas.	V	I	Is	V	I	Is
	0.00	0.000 A	0.000 A	0.00	0.000 A	0.000 A

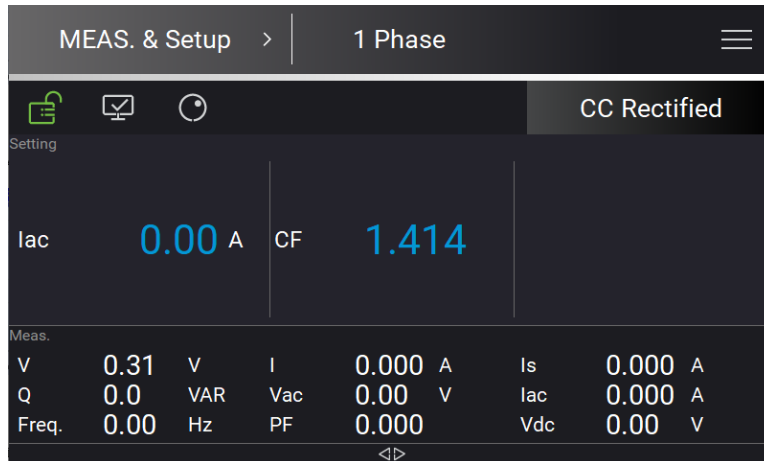
### 3.4 Manual Operation

#### 3.4.1 CC Rectifier Mode


When in CC Rectifier mode, it can change the setting of loading current RMS amplitude (Iac) and crest factor (CF) in the main page.

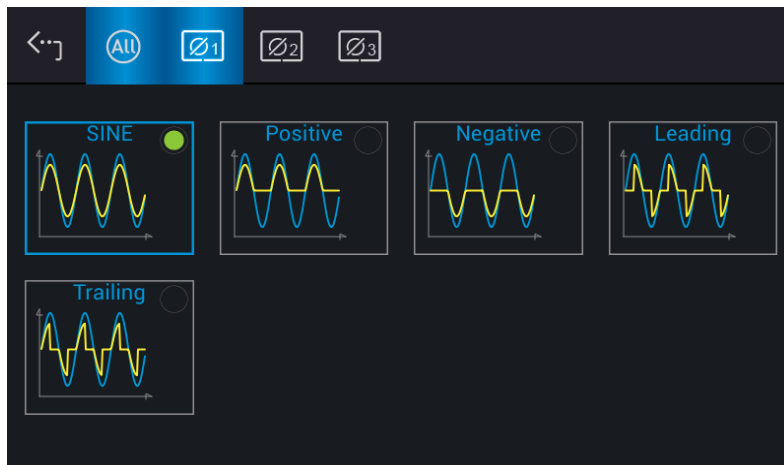
MEAS. & Setup >		3 Phase		CC Rectified		
Setting	Ø1	Ø2	Ø3			
Iac	0.00 A	0.00 A	0.00 A			
CF	1.414	1.414	1.414			
Meas.	V	I	Is	V	I	Is
	0.44	0.000 A	0.000 A	0.15	0.000 A	0.000 A






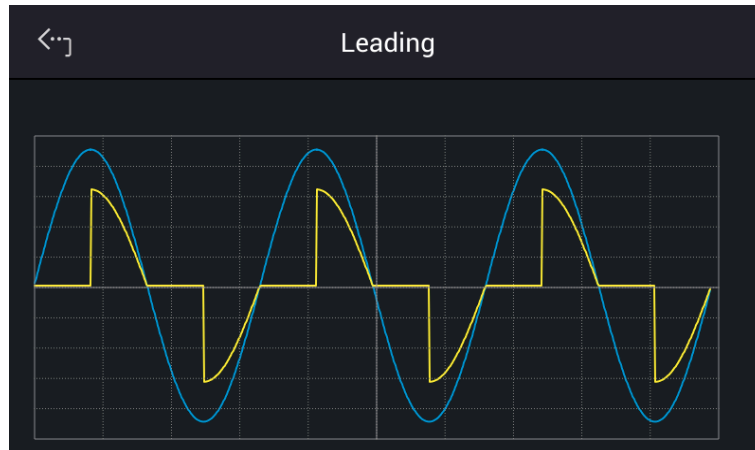
### 3.4.1.1 Wave Selection

The Regenerative AC Electronic Load provides various output waveforms selection for each phase. In Meas. & Setup (3\_Phase Mode/1\_Phase Mode) menu, tap  to choose Waveform Selection. There are sine wave, positive half cycle wave, negative half cycle wave, Leading-edge wave and Trailing-edge wave 5 types for selection.



Set the 3-phase waveform to Leading-edge wave at the same time:


1. Tap  on the top to set the output to All.
2. Tap "Leading" icon.
3. Long-press the "Leading" icon for 1 second can zoom in the set waveform for viewing.

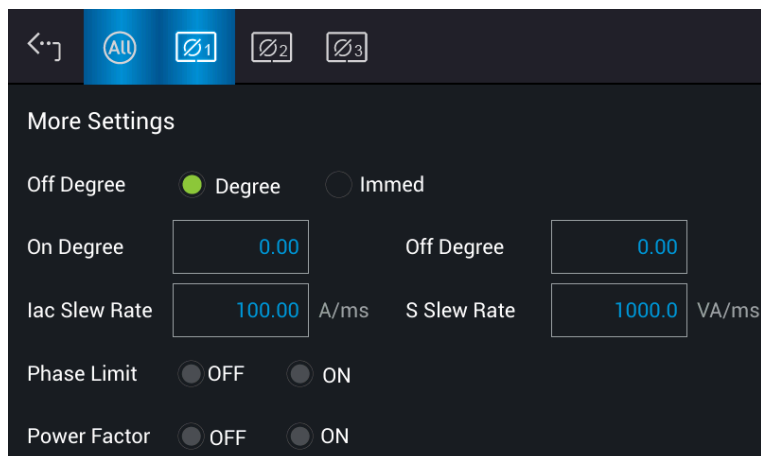


**Notice**

The loading waveform is only provided when the CC Rectifier mode is selected.

### 3.4.1.2 More Settings in CC Rectifier Mode

In Meas. & Setup (3\_Phase Mode/1\_Phase Mode) page, tap  to enter the menu and select More Settings to perform advanced settings as described below.



**Notice**



1. When the selected loading waveform is not a sine wave, "More settings" is invalid.
2. CF setting is not provided when the selected loading waveform is not a sine wave. For example, the CF setting will be grayed out and executed using CF=1.414 when returning to Meas. & Setup page after Trailing is selected as the figures shown below.

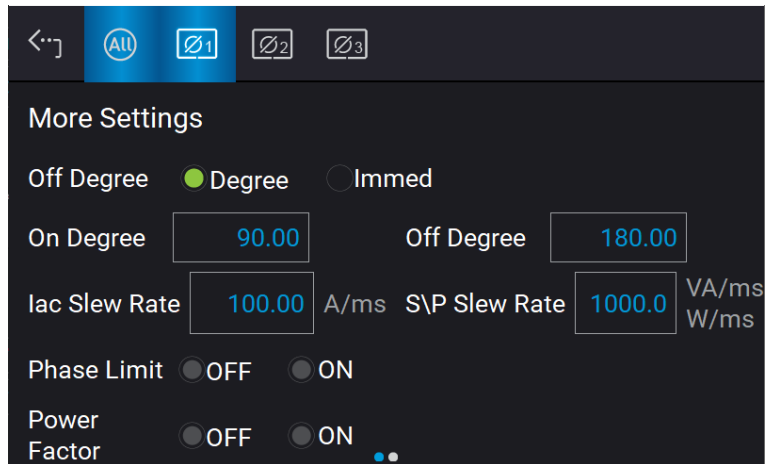


#### A. On/Off Degree

The Regenerative AC Electronic Load in CC and CS Rectifier Mode controls the output and stop outputting angle when loading current waveform. Use On Degree and Off Degree on the screen to enable and disable this feature.

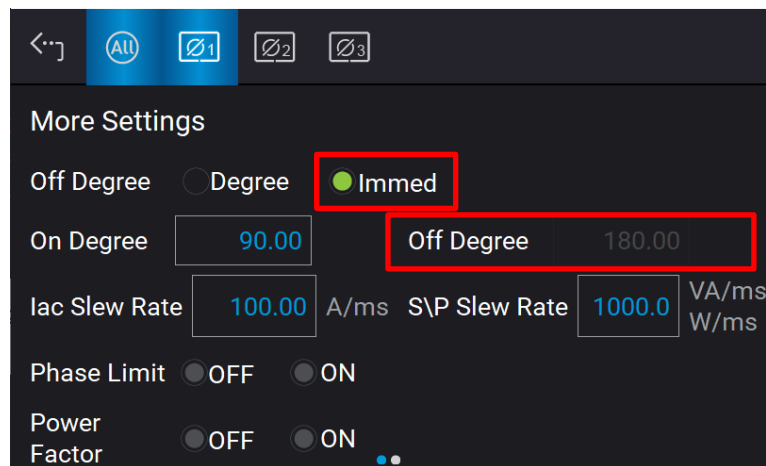
The following is the procedure to set the output phase angle to turn on at 90 degrees, and off at 180 degrees in 1\_Phase Mode /3\_Phase Mode.

1. Tap “On Degree”.
2. Tap **9**, **0**, and  to change the value to “90.0”.
3. Tap “Off Degree”.
4. Tap **1**, **8**, **0**, and  to change the value to “180.0”.



**Notice**

When **QUIT** is tapped, if " OFF Degree = IMMED", the loading current will be skipped immediately. In the meantime, the Off Degree is grayed out to be invalid for setting.



**B. Slew Rate**

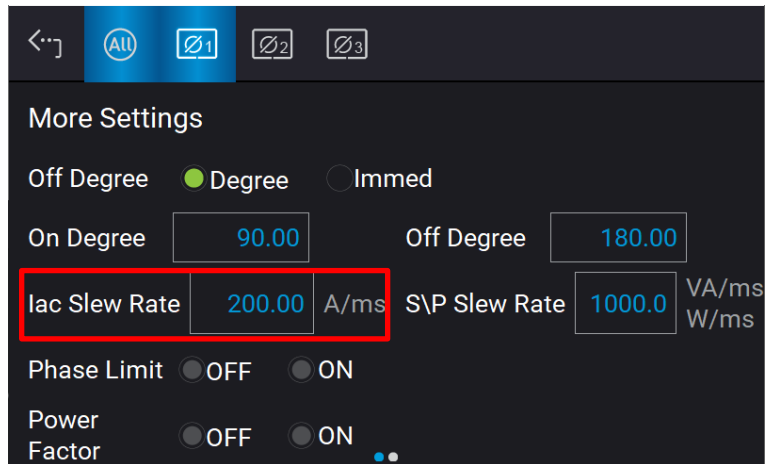
The Regenerative AC Electronic Load can adjust the slew rate of load transient to control the current waveform slew rate. There are Iac slew rate and S/P slew rate to control the voltage waveform when the load current and apparent power change.

Iac Slew Rate: Slew rate of loading Iac.

When the Regenerative AC Electronic Load is in Load On state, the setting of load current in the main page is varied by the Iac slew rate set.

The procedure of setting Iac Slew Rate =200 in 1\_Phase Mode /3\_Phase Mode is described below.

1. Tap "Iac Slew Rate".
2. Tap **2**, **0**, **0**, and **<** to change the value to "200".

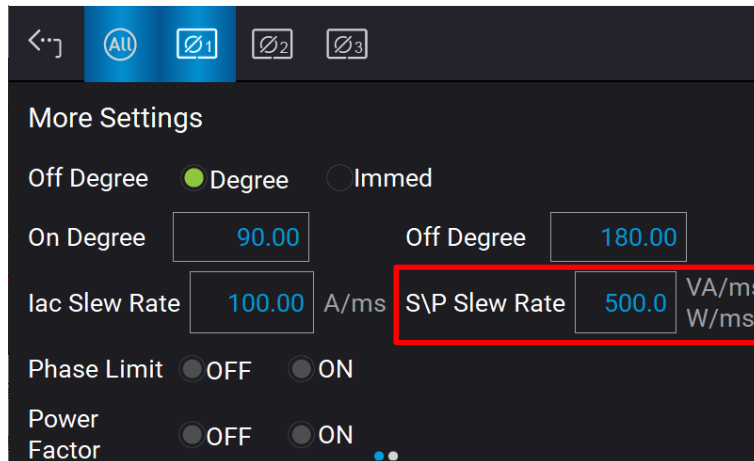


S/P Slew Rate: Slew rate of loading S/P.


When the Regenerative AC Electronic Load is in Load On state, the setting of load current in the main page is varied by the S/P slew rate set.

The procedure of setting S/P Slew Rate =500 in 1\_Phase Mode /3\_Phase Mode is described below.

1. Tap "S/P Slew Rate".
2. Tap **5**, **0**, **0**, and  to change the value to "500".



#### Notice

1. The maximum setting of Iac slew rate is 800A/ms and the minimum is 0.01A/ms.
2. When the Regenerative AC Electronic Load is **ON**, the output end immediately as set. When **OFF** is executed, the load will change to 0A immediately. If changing the slew rate to 0A is desired, you should key in 0A and tap  instead of executing **OFF**.

### 3.4.2 CS Rectifier Mode

When in CS Rectifier mode, it can change the setting of apparent power (S) and crest factor (CF) in the main page.

MEAS. & Setup		3 Phase			
Setting		Ø1	Ø2	Ø3	
S	0.0 VA	0.0 VA	0.0 VA	0.0 VA	
CF	1.414	1.414	1.414	1.414	
Meas.					
V	0.95 V	V	0.66 V	V	0.91 V
I	0.000 A	I	0.000 A	I	0.000 A
Is	0.000 A	Is	0.000 A	Is	0.000 A

MEAS. & Setup		1 Phase	
Setting			
S	0.0 VA	CF	1.414
Meas.			
V	0.43 V	I	0.000 A
Q	0.0 VAR	Vac	0.00 V
Freq.	0.00 Hz	PF	0.000
		Is	0.000 A
		Iac	0.000 A
		Vdc	0.00 V

**Notice**

Refer to section 3.2 for the mapping diagram of the maximum measured PF when setting in CF state.

#### 3.4.2.1 More Settings in CS Rectifier Mode

See section 3.4.1.2 for detailed description.

### 3.4.3 CR Mode

When in CR mode, it can change the resistance (R) in the main page.

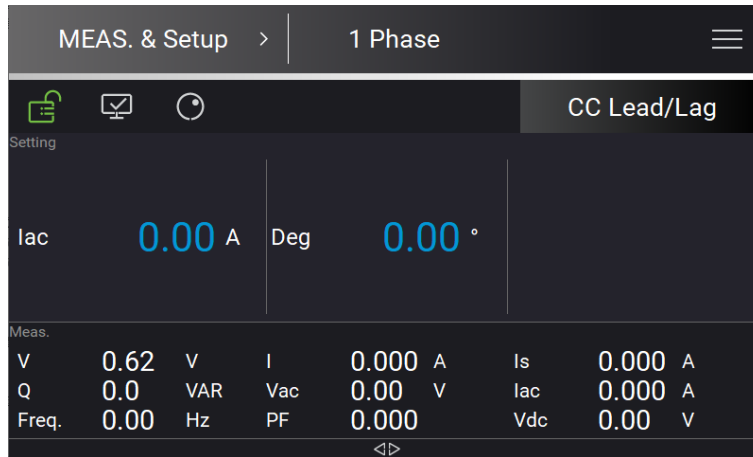
MEAS. & Setup >		3 Phase	
Setting		$\varnothing_1$	$\varnothing_2$
R	300.0 $\Omega$	300.0 $\Omega$	300.0 $\Omega$
Meas.		$\varnothing_3$	CR
V	0.00 V	V	-0.00 V
I	-0.002 A	I	0.000 A
Po	0.0 W	Po	0.0 W

MEAS. & Setup >		1 Phase	
Setting		CR	
R	300.0 $\Omega$		
Meas.			
V	0.91 V	I	0.000 A
Q	0.0 VAR	Vac	0.00 V
Freq.	0.00 Hz	PF	0.000


### 3.4.4 CC Phase Lead/Lag Mode

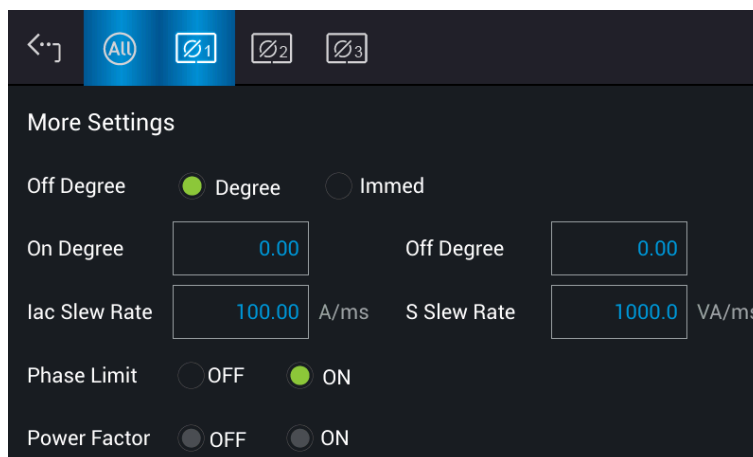
When in CC Phase Lead/Lag mode, it can change the current amplitude and phase setting in the main page.

MEAS. & Setup >		3 Phase	
Setting		CC Lead/Lag	
$\varnothing_1$	$\varnothing_2$	$\varnothing_3$	
Iac	0.00 A	0.00 A	0.00 A
Deg	0.00 $^\circ$	0.00 $^\circ$	0.00 $^\circ$
Meas.			
I	0.000 A	I	0.000 A
Is	0.000 A	Is	0.000 A
Q	0.0 VAR	Q	0.0 VAR



### 3.4.4.1 More Settings in CC Phase Lead/Lag Mode

In Meas. & Setup (3\_Phase Mode/1\_Phase Mode) page, tap  to enter the menu and select More Setting to perform advanced settings as described below.










#### A. On/Off Degree

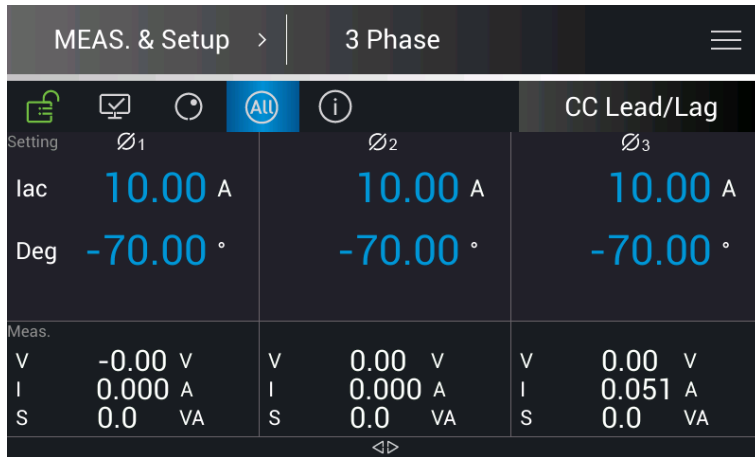
See section 3.4.1.2 for the detailed description.

#### Notice

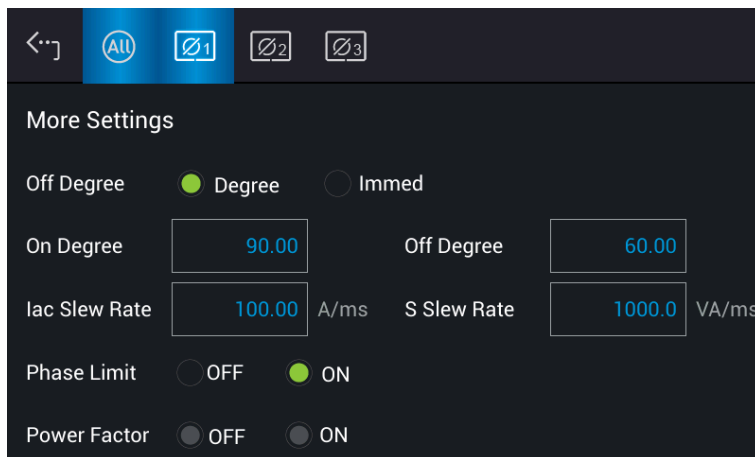
The procedure to set the phase (Deg) in MAIN PAGE and On/Off degree in More Settings at the same time, for example, to set I=10A, Deg =-70, On degree=90, and Off degree=60 in 3-phase, is as described below.

1. Tap "I" in the MAIN PAGE.
2. Tap , , and  to change the value to "10".
3. Tap "Deg" in the MAIN PAGE.
4. Tap , , , and  to change the value to "-70".

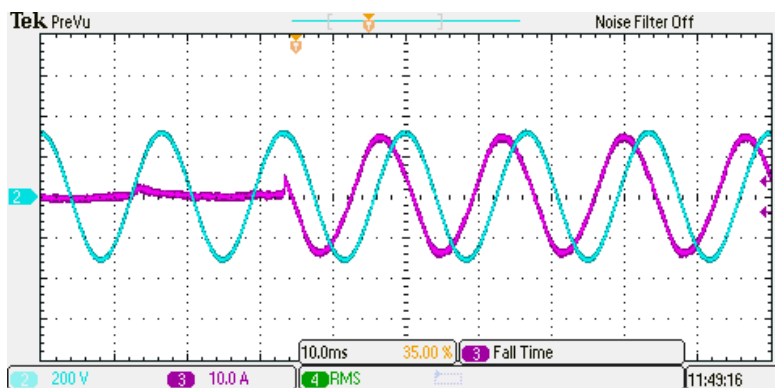


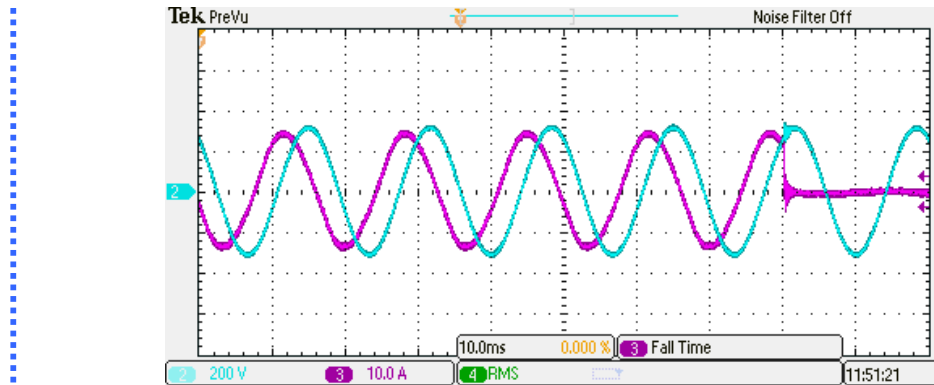


5. Tap to go to More Settings menu.
6. Tap "On Degree" in More Settings.
7. Tap **9**, **0**, and to change the value to "90".
8. Tap "Off Degree" in More Settings.
9. Tap **6**, **0**, and to change the value to "60".



The measured results are as follows according to the above steps when the UUT is in 220V phase voltage.





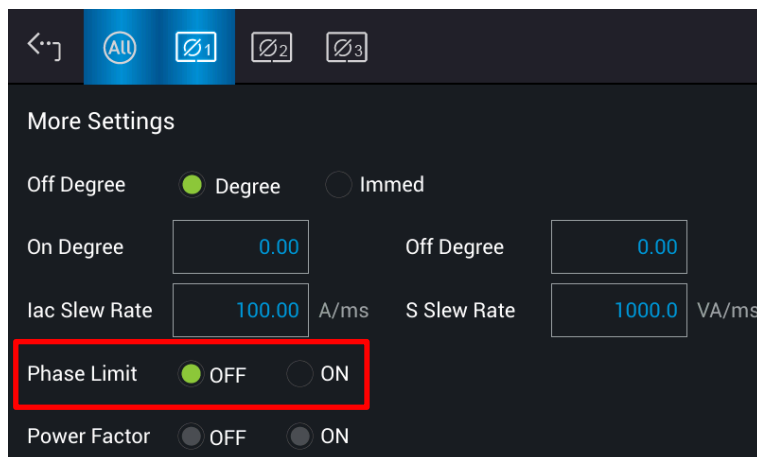
### B. Slew Rate

See section 3.4.1.2 for the detailed description.

### C. Phase Limit (default is ON)

The Regenerative AC Electronic Load in CC and CS Phase Lead/Lag Mode can change to Current Source Mode by setting Phase limit OFF (to  $>90^\circ$  or  $<-90^\circ$  range). The setting sequence is as follows.

1. Tap OFF on the Phase Limit to remove the phase setting limit.
2. Return to Meas. & Setup to set the required phase.



MEAS. & Setup >		3 Phase		CC Lead/Lag		
Setting	Ø1	Ø2	Ø3	Ø1	Ø2	Ø3
Iac	10.00 A	10.00 A	10.00 A	10.00 A	10.00 A	10.00 A
Deg	100.00 °	100.00 °	100.00 °	100.00 °	100.00 °	100.00 °
Meas.						
V	0.00 V	0.00 V	0.00 V	0.00 V	0.00 V	0.00 V
I	0.019 A	0.000 A	0.000 A	0.000 A	0.000 A	0.000 A
Po	-0.0 W	0.0 W	0.0 W	0.0 W	0.0 W	0.0 W

MEAS. & Setup >		3 Phase	
Setting	Ø1	Ø2	Ø3
Iac	10.00 A	10.00 A	10.00 A
Deg	-100.0 °	-100.0 °	-100.0 °
Meas.			
V	0.00 V	0.00 V	0.00 V
I	0.020 A	0.000 A	0.000 A
Po	-0.0 W	0.0 W	0.0 W

**Notice**

When the Phase Limit is set to OFF, set the phase to  $>90^\circ$  or  $<-90^\circ$ , and then set the Phase Limit to ON, the phase set by Meas. & Setup will return to  $0^\circ$ .

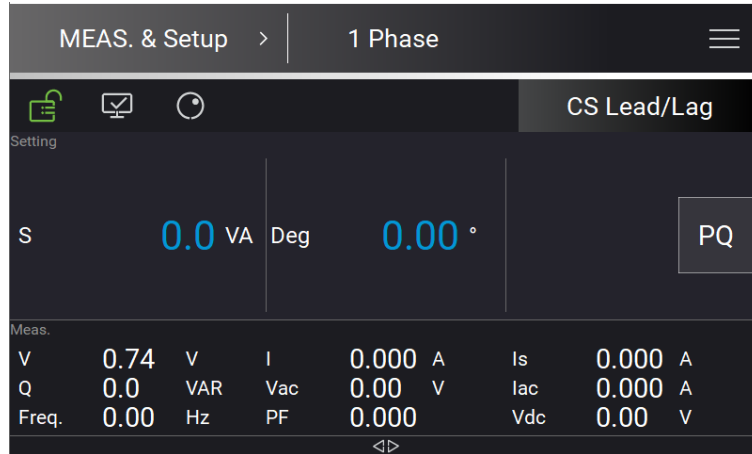
**WARNING**

When the Phase Limit is set to OFF, the phase setting range can be greater than  $90^\circ$  or less than  $-90^\circ$ . The Regenerative AC Electronic Load at this time is a current source output, which will feed back power to the UUT. Be sure to confirm the characteristics of the UUT that must have recharge power consumption or power regenerative function to avoid damaging the equipment.

### 3.4.5 CS Phase Lead/Lag Mode

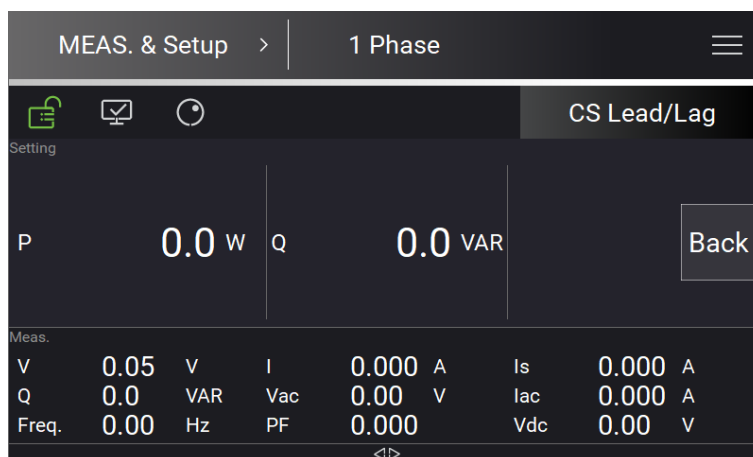
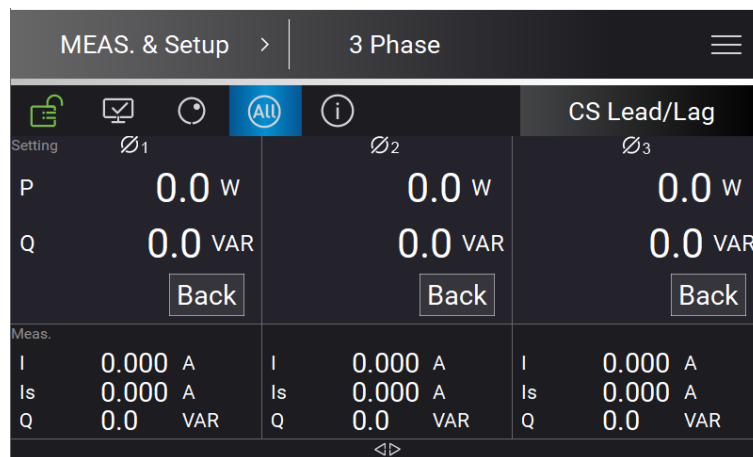
When in CS Phase Lead/Lag mode, it can change the apparent power and phase setting in the main page.

MEAS. & Setup >		3 Phase	
Setting	Ø1	Ø2	Ø3
S	0.0 VA	0.0 VA	0.0 VA
Deg	0.00 °	0.00 °	0.00 °
	PQ	PQ	PQ
Meas.			
I	0.000 A	0.000 A	0.000 A
Is	0.000 A	0.000 A	0.000 A
Q	0.0 VAR	0.0 VAR	0.0 VAR




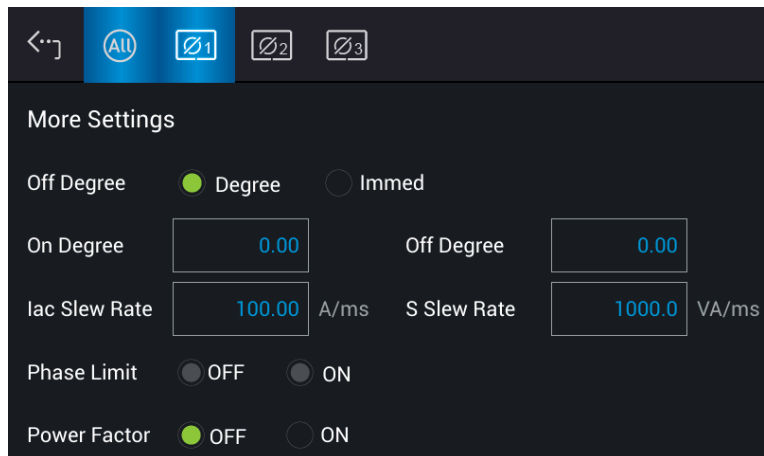
**Notice**

Tap **PQ** in the main page, it can confirm the Real power (P) and virtual power (Q). Tap **Back** to return to the setup menu.



### 3.4.5.1 More Settings in CS Phase Lead/Lag Mode

In Meas. & Setup (3\_Phase Mode/1\_Phase Mode) page, tap  to enter the menu and select More Setting to perform advanced settings as described below.



A. On/Off Degree

See section 3.4.1.2 for the detailed description.

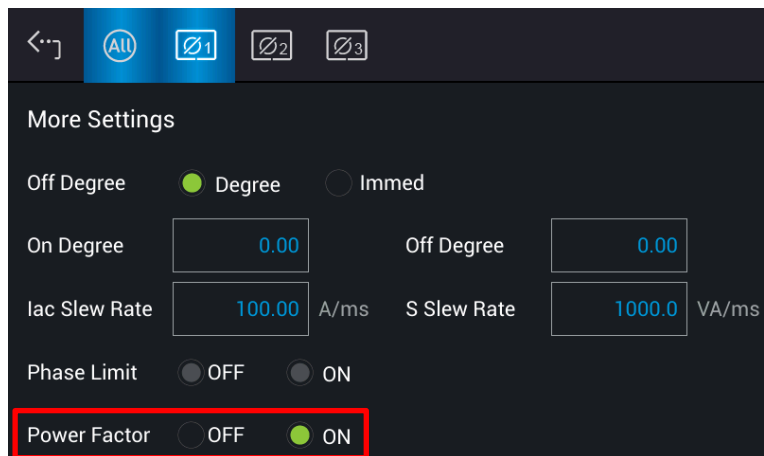
B. Slew Rate

See section 3.4.1.2 for the detailed description.

C. Power Factor (default is OFF)

The Regenerative AC Electronic load in CS Phase Lead/Lag mode provides Power Factor (PF) for setting as described below.

1. Tap OFF on the Power Factor to enable the PF setting.



2. Return to Meas. & Setup to set the required PF.
3. When set to Lead, it means the phase of the load current is ahead of the UUT voltage phase. When set to Lag, it means the phase of the load current lags behind the UUT voltage phase.

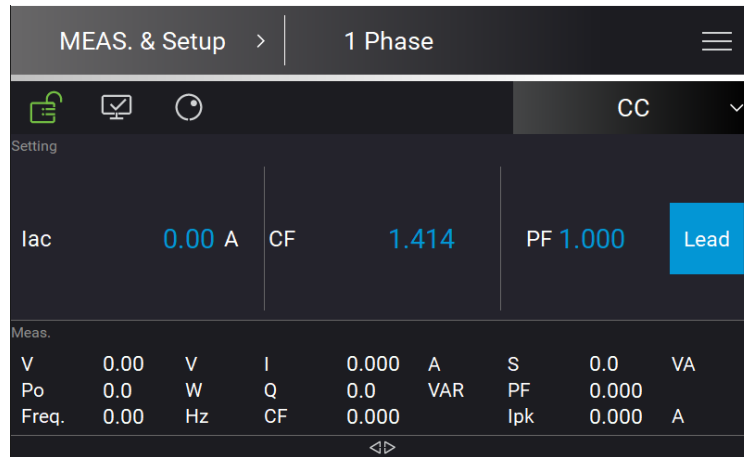
MEAS. & Setup >		3 Phase		CS Lead/Lag		
Setting	Ø1	Ø2	Ø3			
S	0.0 VA	0.0 VA	0.0 VA			
PF	0.000	0.000	0.000			
	Lead PQ	Lead PQ	Lead PQ			
Meas.						
I	0.000 A	0.000 A	0.000 A			
Is	0.000 A	0.000 A	0.000 A			
Q	0.0 VAR	0.0 VAR	0.0 VAR			

MEAS. & Setup >		1 Phase		CS Lead/Lag		
Setting						
S	0.0 VA	PF	0.000	Lead PQ		
Meas.						
V	0.25 V	I	0.000 A	Is	0.000 A	
Q	0.0 VAR	Vac	0.00 V	Iac	0.000 A	
Freq.	0.00 Hz	PF	0.000	Vdc	0.00 V	

### 3.4.6 CC Mode


When in CC Mode, it can change the current amplitude, CF and PF settings in the main page.

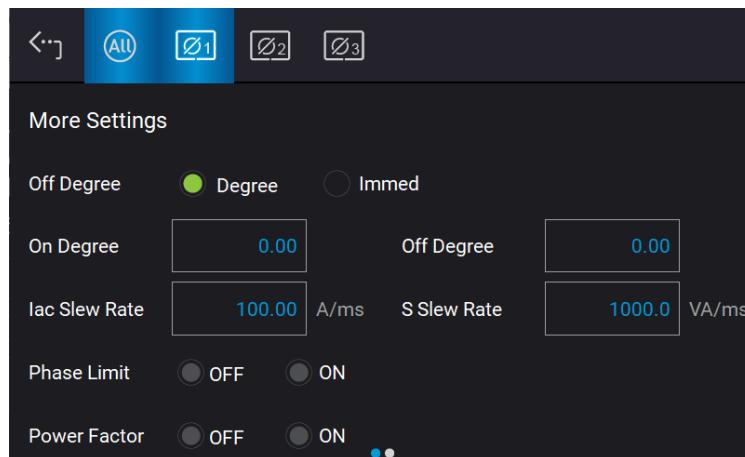
MEAS. & Setup >		3 Phase		CC		
Setting	Ø1	Ø2	Ø3			
Iac	0.00 A	0.00 A	0.00 A			
CF	1.414	1.414	1.414			
PF	1.000	1.000	1.000			
	Lead	Lead	Lead			
Meas.						
V	0.00 V	V	0.00 V	V	0.00 V	
I	0.000 A	I	0.000 A	I	0.000 A	
Is	0.000 A	Is	0.000 A	Is	0.000 A	



When set to Lead, it means that the current loading phase leads the UUT voltage phase. When set to Lag, it means the current loading phase lags behind the UUT voltage phase.

### 3.4.6.1 More Settings in CC Mode

In Meas. & Setup (3\_Phase Mode/1\_Phase Mode) menu, tap  to enter the menu and select More Settings to perform advanced settings as described below.



#### A. On/Off Degree

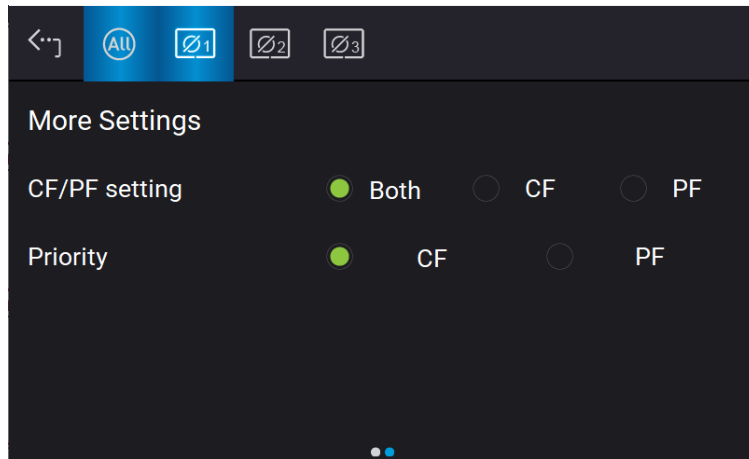
See section 3.4.1.2 for the detailed description.

#### B. Slew Rate

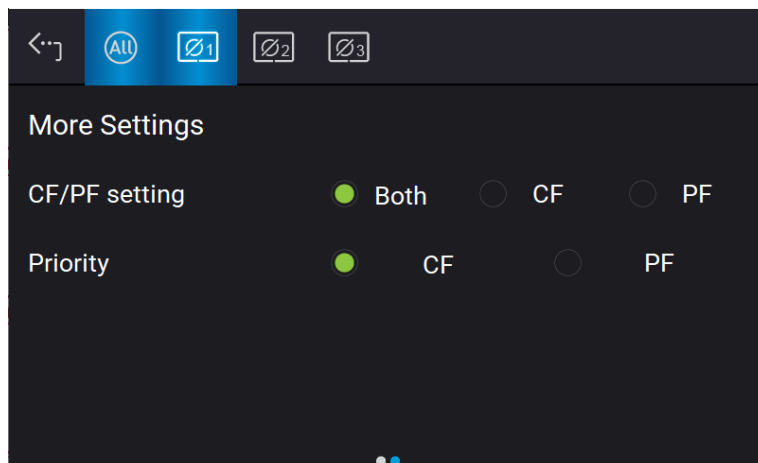
See section 3.4.1.2 for the detailed description.

#### C. CF/PF

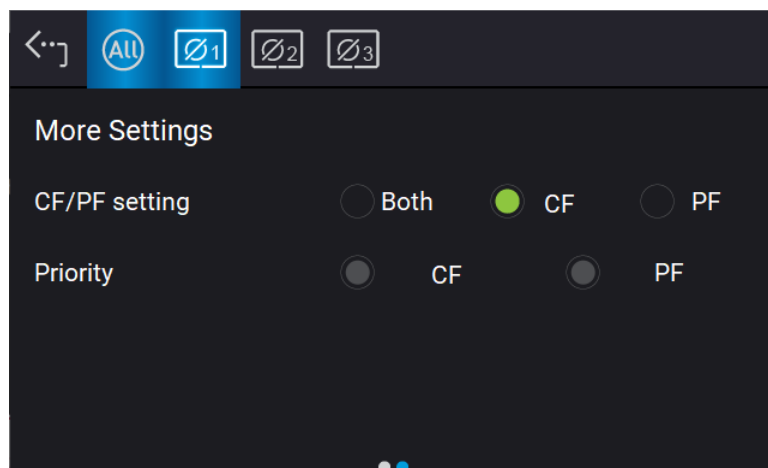
Slide to second page of More Settings to perform CF/PF settings. In CC mode, there are CF, PF, and Both 3 parameters for setting.



1. Both (default)  
When set to Both, it requires to set the priority. When the priority is set to CF, the PF setting range is limited by CF setting value (see Figure 3-4). On the contrary, if the priority is set to PF, the CF setting range will be limited by the PF setting value (see Figure 3-4).

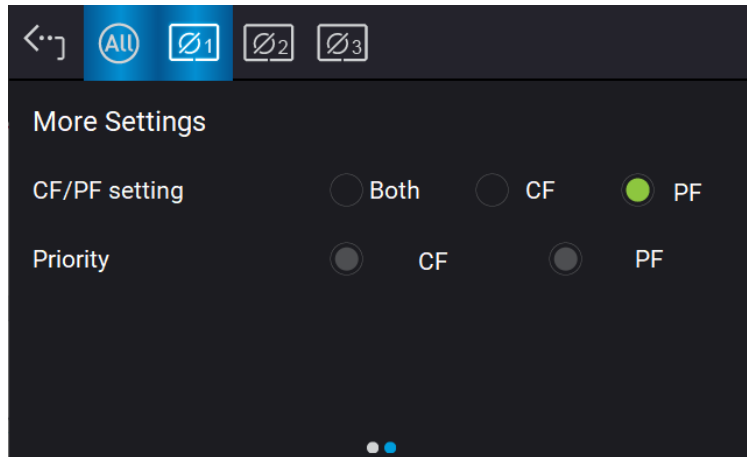


2. CF  
When CF only is selected, the PF will be set to the maximum corresponding to the current CF setting (Figure 3-4) and cannot be changed.



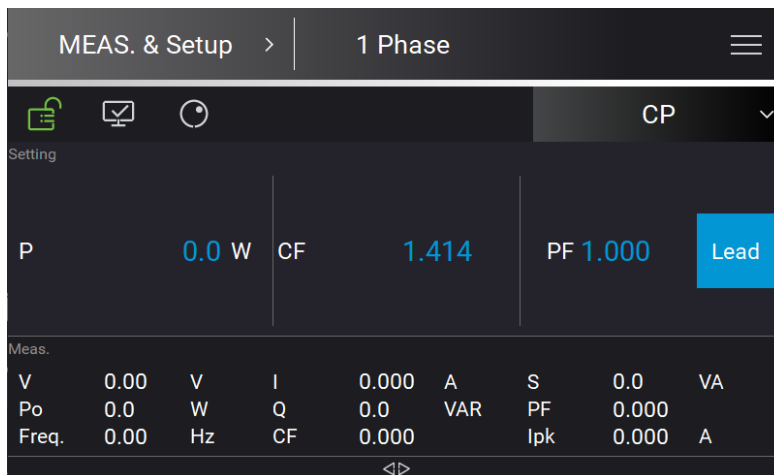
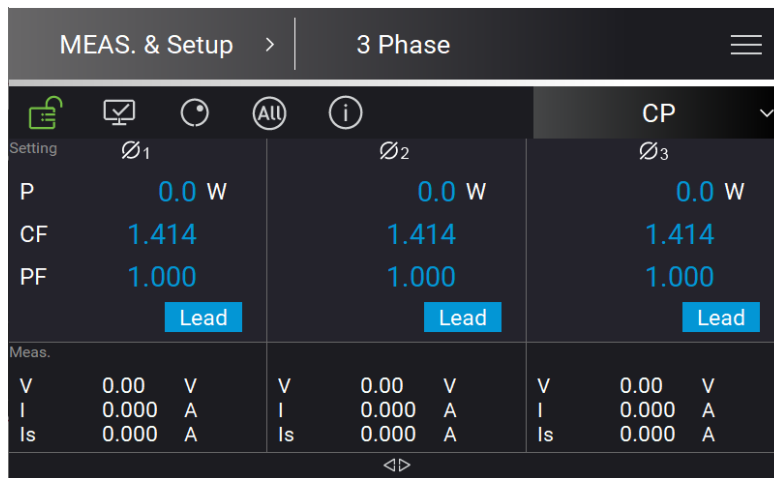


3. PF  
When PF only is selected, the CF will be set to the maximum corresponding to the current PF setting (Figure 3-4) and cannot be changed.




### 3.4.7 CP Mode

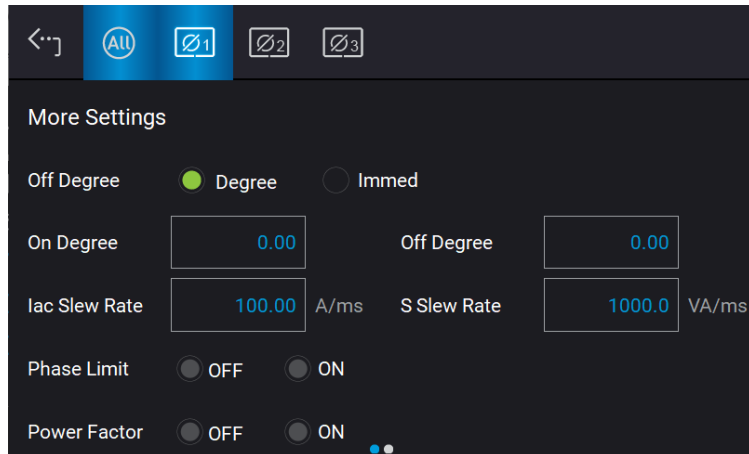
When in CP Mode, it can change the power amplitude, CF and PF settings in the main page.



When set to Lead, it means that the current loading phase leads the UUT voltage phase. When set to Lag, it means the current loading phase lags behind the UUT voltage phase.

### 3.4.7.1 More Settings in CP Mode

In Meas. & Setup (3\_Phase Mode/1\_Phase Mode) menu, tap  to enter the menu and select More Settings to perform advanced settings as described below.



#### A. On/Off Degree

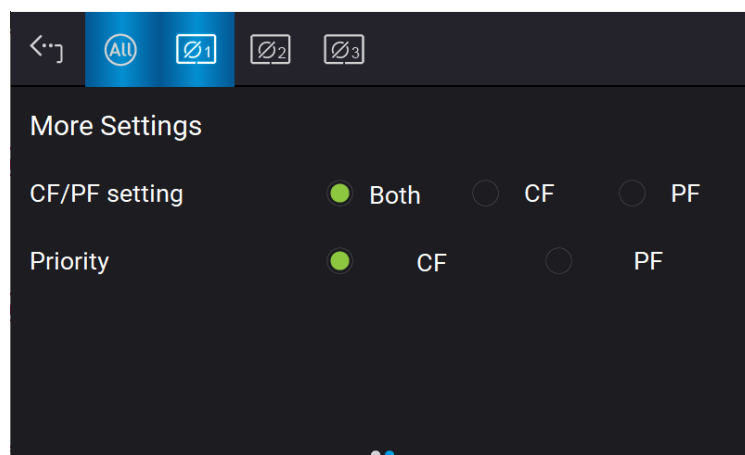
See section 3.4.1.2 for the detailed description.

#### B. Slew Rate

See section 3.4.1.2 for the detailed description.

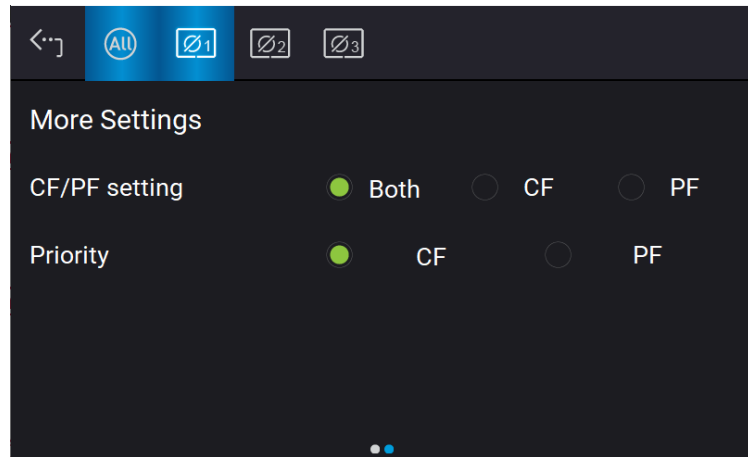
#### C. CF/PF

Slide to second page of More Settings to perform CF/PF settings. In CP mode, there are CF, PF, and Both 3 parameters for setting.



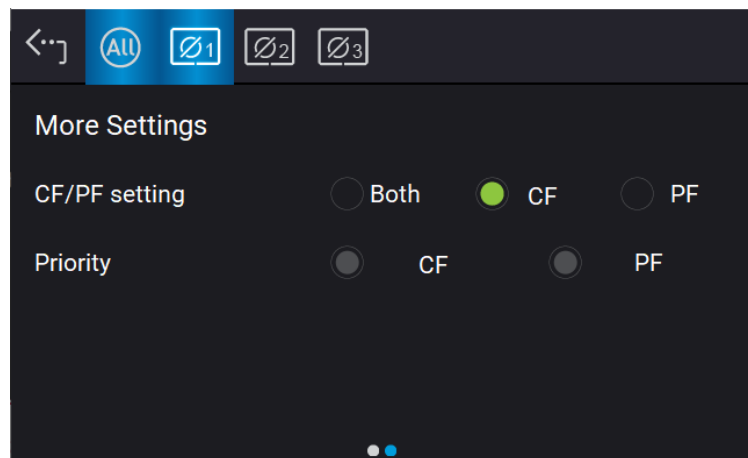
1. Both (default)

When set to Both, it requires to set the priority. When the priority is set to CF, the PF setting range is limited by CF setting value (see Figure 3-4). On the contrary, if the priority is set to PF, the CF setting range will be limited by the PF setting value (see Figure 3-4).

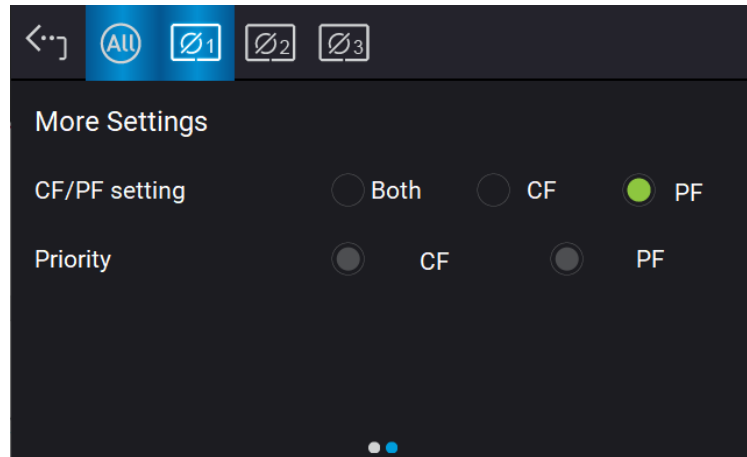


1. CF

When CF only is selected, the PF will be set to the maximum corresponding to the current CF setting (Figure 3-4) and cannot be changed.



2. PF  
When PF only is selected, the CF will be set to the maximum corresponding to the current PF setting (Figure 3-4) and cannot be changed.



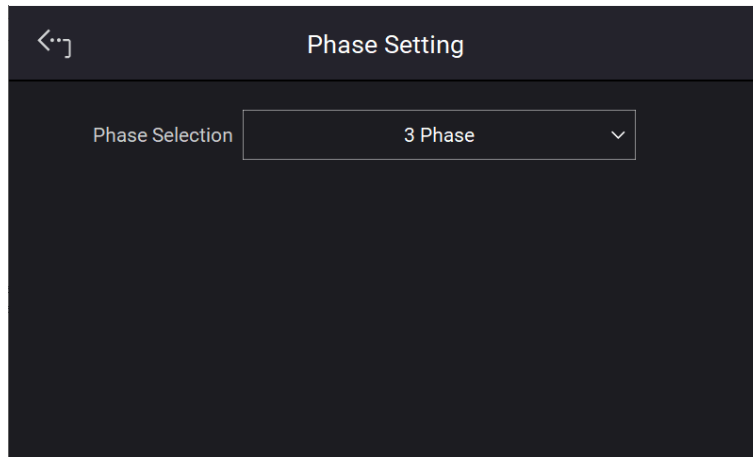
## 3.5 Configuration Menu

Tap Menu and select Configuration to show the Configuration menu. There are Phase Setting, Interface, Remote Output, and Stand-by 4 functions available for use.



### 3.5.1 Phase Setting

Tap Menu and select Configuration to show the Phase Setting menu. Users can also switch the mode to 3-phase or 1-phase.

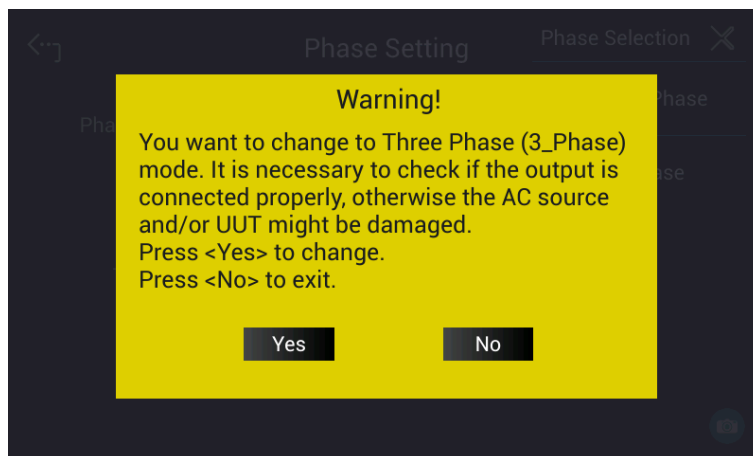


### 3.5.1.1 Three Phase Mode

The Regenerative AC Electronic Load can be set to 3-phase AC load by tapping the Menu and selecting Configuration to show the Phase Setting menu and switch to 3-phase mode if desired.

The procedure for setting the Regenerative AC Electronic Load to 3-phase mode is described below.

1. Tap Phase Selection
2. Select "3 Phase" mode.
3. Make sure the output connection is in 3-phase mode and tap Yes to change it.

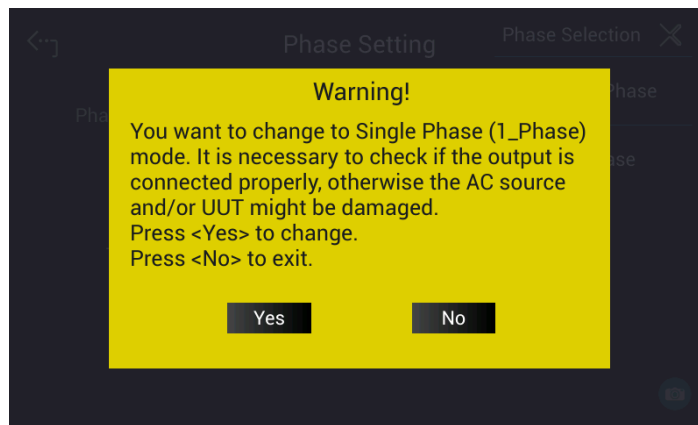


### 3.5.1.2 Single Phase Mode

The Regenerative AC Electronic Load can be set to 1-phase AC load by tapping Menu and select Configuration to show the Phase Setting menu and switch to 1-phase mode when it is required.

The procedure for setting the Regenerative AC Electronic Load to 1-phase mode is described below.

1. Tap Phase Selection.
2. Select "Single Phase" mode.
3. Make sure the output connection is in 1-phase mode and tap Yes to change it.



 **Notice**

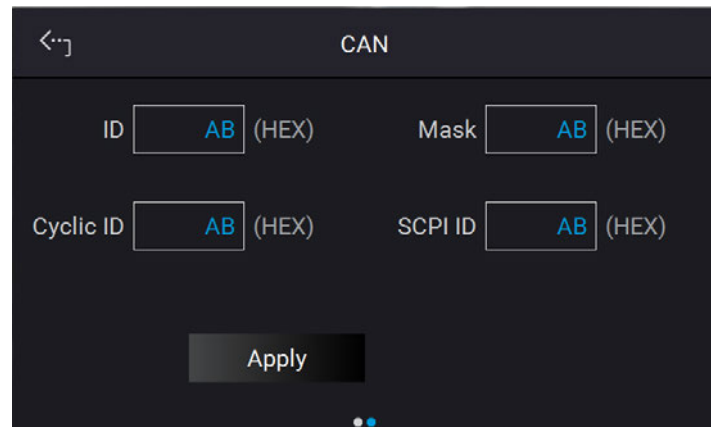
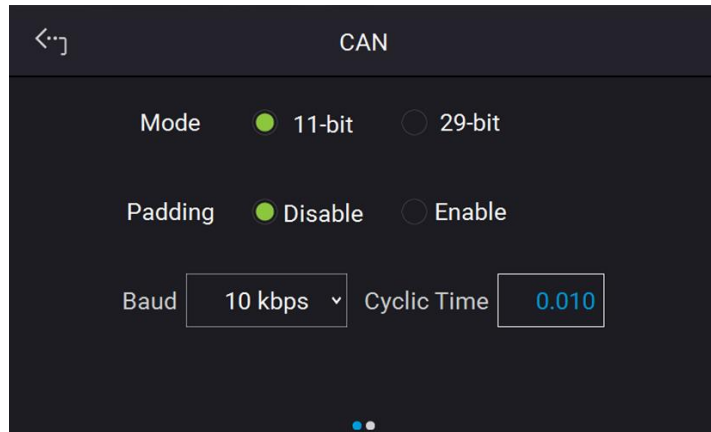
1. When switching between 1-phase and 3-phase mode, the set output value will be reset to zero to avoid damaging the UUT.
2. When switching 1-phase mode to 3-phase mode, the user should check if the output L<sub>1</sub>, L<sub>2</sub>, and L<sub>3</sub> short-circuit copper bars are removed to prevent the Regenerative AC Electronic Load from triggering a protection error.

## 3.5.2 Interface for Remote Operation

### 3.5.2.1 CAN

Tap Menu, select Configuration and Interface to show the Interface Select menu. Select CAN to perform the settings starting with the baudrate.

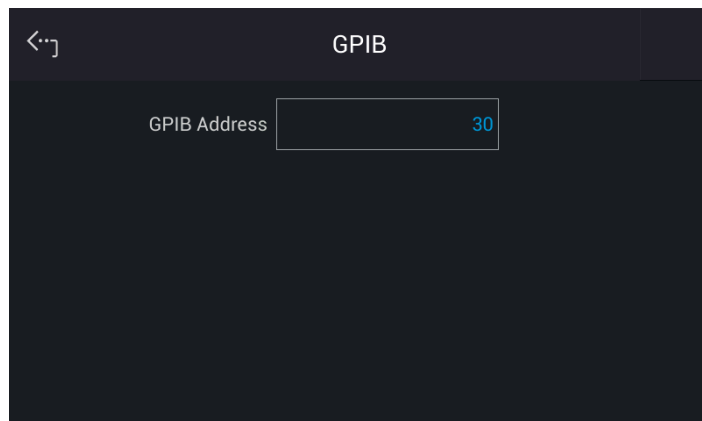
1. Tap CAN in "Interface" menu.
2. Tap the bit number for Mode.
3. Tap Disable or Enable for Padding.
4. Tap Baud to select the baud rate.
5. Tap Cyclic Time to set the desired time.
6. Swipe left to the second page, tap ID to set the position.
7. Tap Mask to set the position.
8. Tap Cyclic ID to set the position.
9. Tap SCPI ID to set the position.
10. Tap Apply to execute each parameter setting.
11. Touch the upper left corner to return to Menu setting.
12. Tap "MEAS. & Setup" to return to the main screen.



### 3.5.2.2 GPIB

Tap Menu, select Configuration and Interface to show the Interface Select menu. Tap GPIB to enable. It is necessary to set GPIB address to 30 before conducting remote operation in 1\_Phase Mode /3\_Phase Mode.

1. Tap GPIB address.
2. Input value 30 to complete the setting.



**Notice**

⋮ The address range is from 1 to 30.

### 3.5.2.3 LAN

Tap Menu, Configuration and Interface to show Interface Select menu. Tap LAN to set it.

#### Notice

1. The user needs to connect the network cable to the Regenerative AC Electronic Load for auto detection.
2. If the network cable is not connected properly, it may cause the Regenerative AC Electronic Load screen to show abnormally. Turn off the Regenerative AC Electronic Load to resolve the network cable problem and reboot it to clear the abnormal screen.

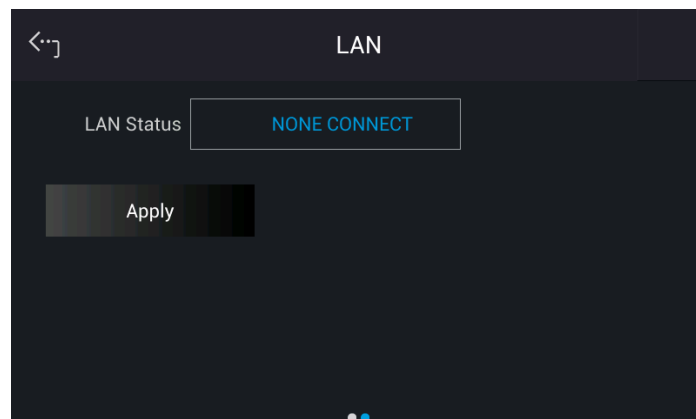
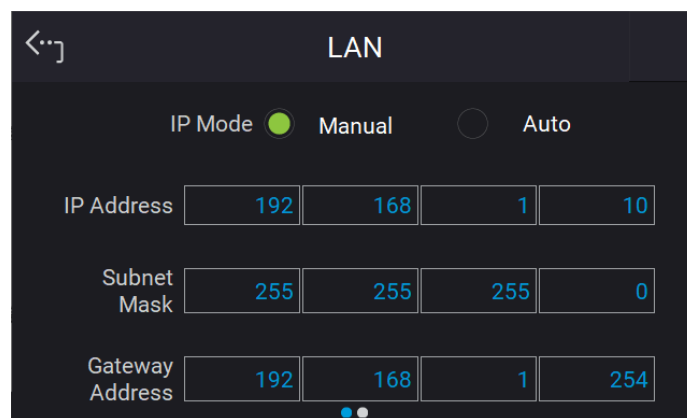
1. Tap LAN to enter into the address setting screen.

Auto Detect:

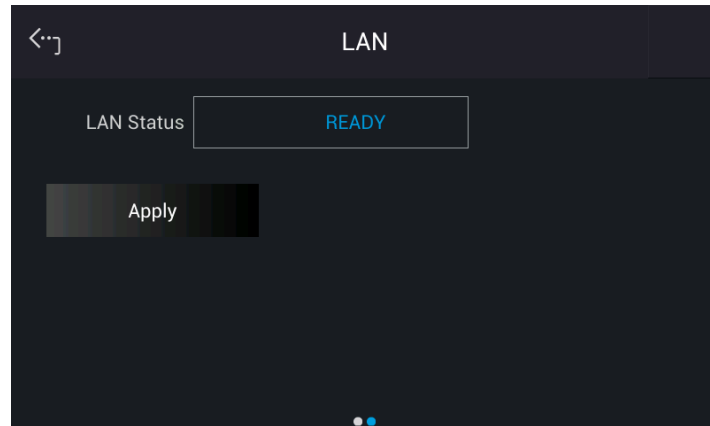
The default of IP mode is Auto. Swipe left to second page, the Regenerative AC Electronic Load will automatically detect external network address.

Manual Detect:

1. Tap IP Mode to set it to Manual.
2. Tap IP Address and set it.
3. Tap Subnet Mask and set it.
4. Swipe left to the second page, tap Gateway Address and set it.
5. Tap "Apply" and wait for connection.
6. Touch the upper left corner to return to Menu setting.
7. Tap "MEAS. & Setup" to return to the main page.







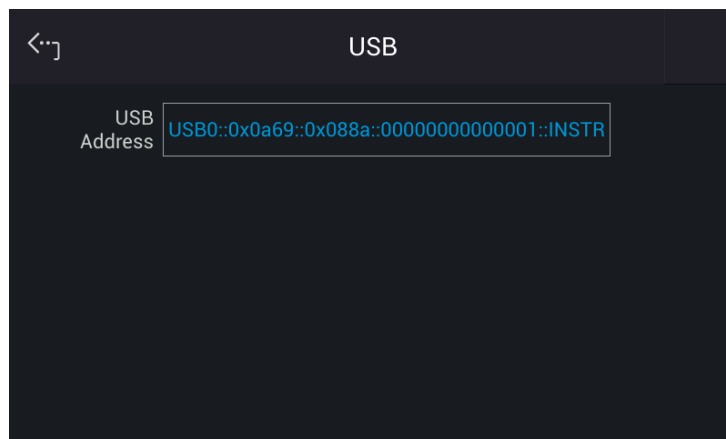
### Notice


1. The LAN STATUS is displayed automatically in the following 5 types:  
 READY: Network is connected.  
 CONNECTING. . . .: Network is connecting.  
 NONE CONNECT: Network is not connected.  
 SETTING. . . .: Network is under setting.  
 ETHERNET MODULE FAIL: Network module is fail.  
 DUPLICATE IP: IP setting is duplicated.  
 RENEWAL FAIL: DHCP renewal is failed.  
 IDENTIFY: It means the identification is performing.  
 DECONFIG: Network configuration is changed.
2. The ETHERNET IP address is 0~255. In ETHERNET setting, IP MODE=Auto will get the address automatically and IP MODE=Manual will get the address manually. Once the IP address is set, it needs to set APPLY=YES for the address to be in effect.

### 3.5.2.4 USB

Tap Menu, select Configuration and Interface to show the Interface Select menu. Tap USB to query the USB address.

1. In “Interface” page, select USB to enter into the USB Address screen.
2. Touch the upper left corner to return to Menu setting.
3. Tap “MEAS. & Setup” to return to the main page.



 **Notice** This function is for users to query the USB Address only.

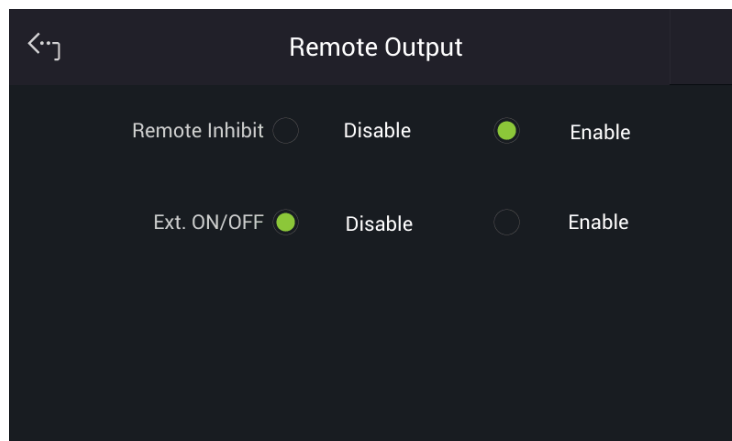
### 3.5.3 Remote Output

The output of Regenerative AC Electronic Load can be inhibited by external control or manual trigger. To remotely inhibit the device a TTL signal is applied to the terminal on the rear panel (see *Appendix A*) Remote Inhibit and EXT. ON/OFF must be set in the Remote Output menu by tapping Menu in the upper left corner and selecting the Configuration menu. There are two remote inhibit output states: Enable and Disable.

**Remote Inhibit:** When the Remote Inhibit is enabled and the remote inhibit signal is LOW, this will disable the output. The device remains disabled even when the Remote Inhibit returns to HIGH. You must tap **ON/OFF** to enable the output again.

The procedure for setting Remote Inhibit to enable for 1-phase/3-phase modes are described below.

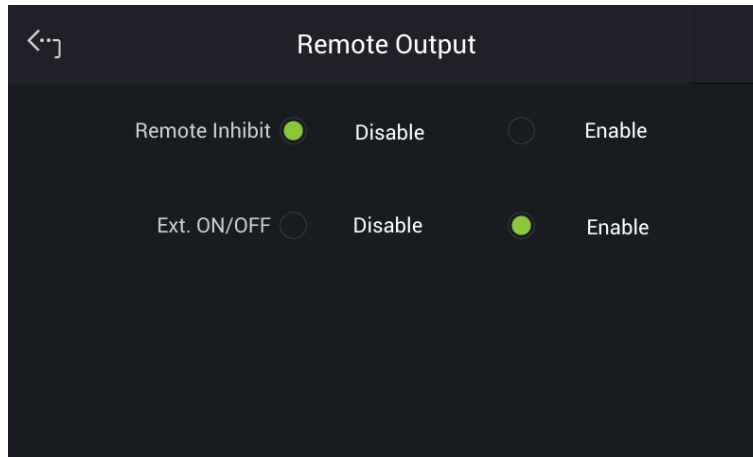
Select “Enable” for Remote Inhibit.



**EXT. ON/OFF:** When the EXT. ON/OFF is enabled on the Regenerative AC Electronic Load and the EXT. ON/OFF signal is LOW, the Regenerative AC Electronic Load will disable the output. The Regenerative AC Electronic Load will automatically restart the output when the EXT. ON/OFF signals turns to HIGH.

The procedure to set EXT. ON/OFF to enable in 1-phase/3-phase mode is described below.

Select “Enable” for Ext. ON/OFF.

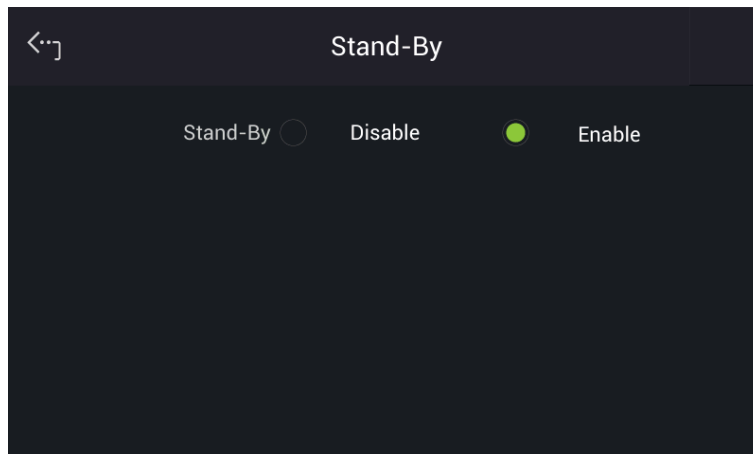


### Notice

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

## 3.5.4 Stand-By

Tap Menu and Configuration on the upper left corner to select Stand-By function for setting.



Stand-By mode: Enable

The Stand-By mode is default set to Enable. When the UUT voltage is abnormal, the Regenerative AC Electronic Load will enter into Standby mode if it is enabled. The LED of output “On” button on the front panel is always on. Once the UUT output voltage reached the loading state, the Regenerative AC Electronic Load will use the settings in main page to perform loading.

### Notice

When the UUT output voltage is generated to loadable state, the Regenerative AC Electronic Load will assess it and starting loading 1s after the voltage is rebuilt.

Stand-By mode: Disable

When the UUT voltage is lower than the operable range of Regenerative AC Electronic Load,

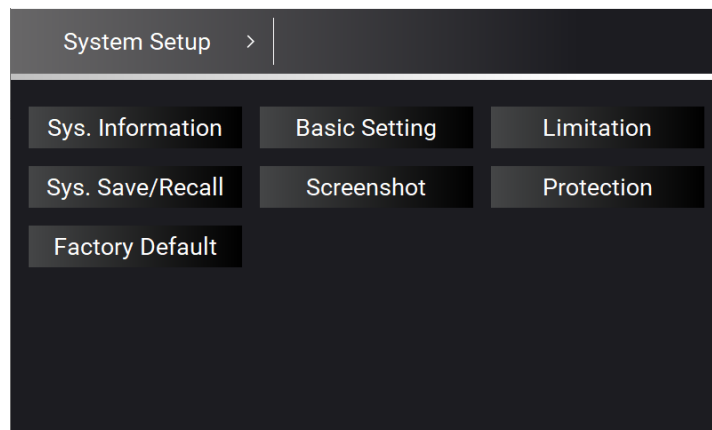
the Regenerative AC Electronic Load will occur low voltage protection (DA\_UUT\_UVP) if this function is enabled. The protection can be cleared by command. The user must confirm the UUT voltage status at present. If the UUT voltage outputs normally, clear the protection and the loading can be performed as usual.

 **Notice**

When performing the regulation test of voltage drop within a short time (ex: UL-2231-2, SAE-J1772), be sure to disable this function. It is suggested to use CR mode for testing.

## 3.6 System Setup Menu

Tap Menu and select System Setup to show the System Setup menu. There are Sys. Information, Sys. Save/Recall, Factory Default, Basic Setting, Screenshot, Limitation, and Protection 7 functions available for use.



### 3.6.1 Sys. Information

Tap Menu, System Setup and Sys. Information to view the Regenerative AC Electronic Load system information.

### 3.6.2 Basic Setting

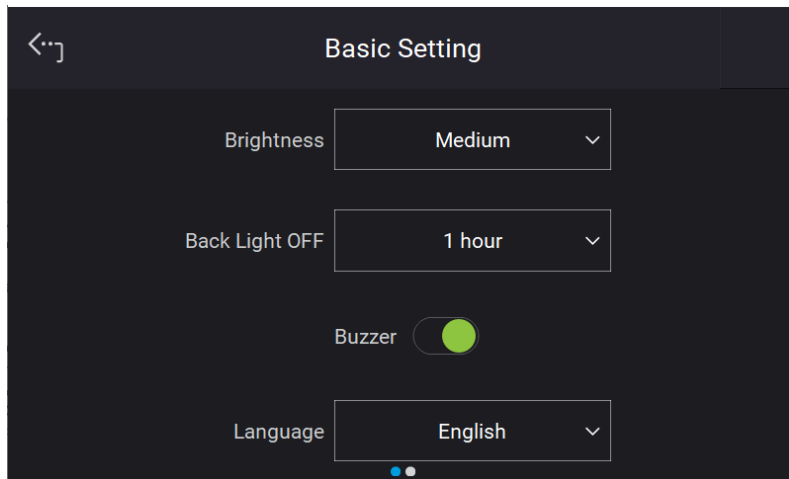
Tap Menu, System Setup and Basic Setup to set the LCD backlight brightness, eco mode, buzzer, language, and time/date.

**Backlight:** Low, Medium, High


**Backlight OFF:** Never, 1 min, 3 mins, 5 mins, 10 mins, 30 mins, 1 hour, 3 hours

Follow the procedure below to set the Brightness = Medium, Backlight OFF = Never in 1\_Phase Mode /3\_Phase Mode.

1. Tap Brightness.
2. Select "Medium" to complete the setting.
3. Tap Backlight OFF.
4. Select "1hour" to complete the setting.



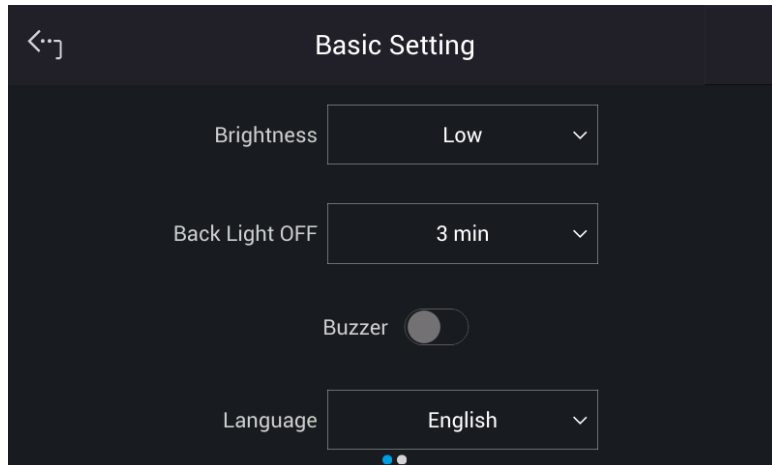
**Notice**

The user can press down the RPG rotary  on the front panel to wake up the Regenerative AC Electronic Load during Back Light OFF.

When tapping the menu on the front panel or turning the RPG rotary knob, a buzzer on the Regenerative AC Electronic Load will beep. This can be turned off.

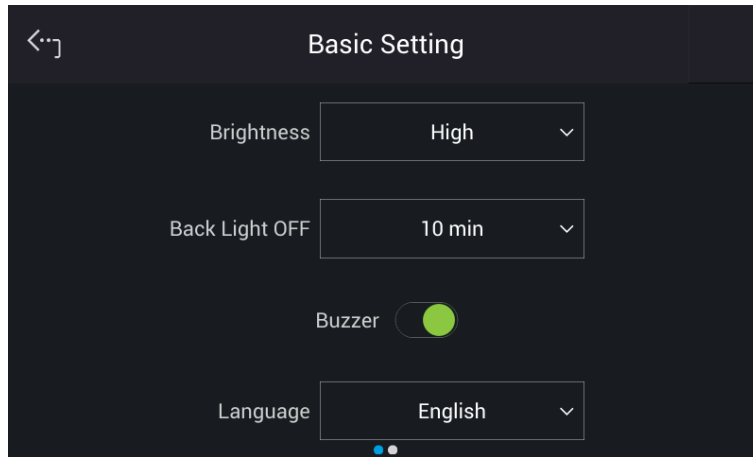
Follow the procedure below to turn off the buzzer 1\_Phase Mode /3\_Phase mode.

Slide Buzzer indicator left to disable it.



Follow the procedure below to switch the language to English in 1\_Phase Mode /3\_Phase mode.

1. Tap Language.
2. Select "English".



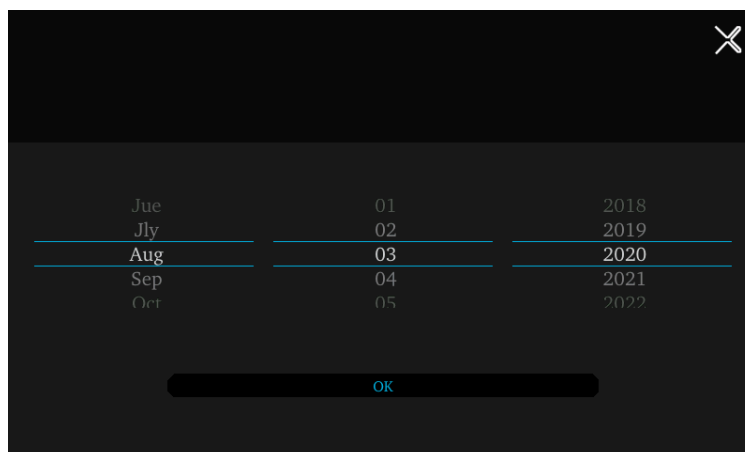
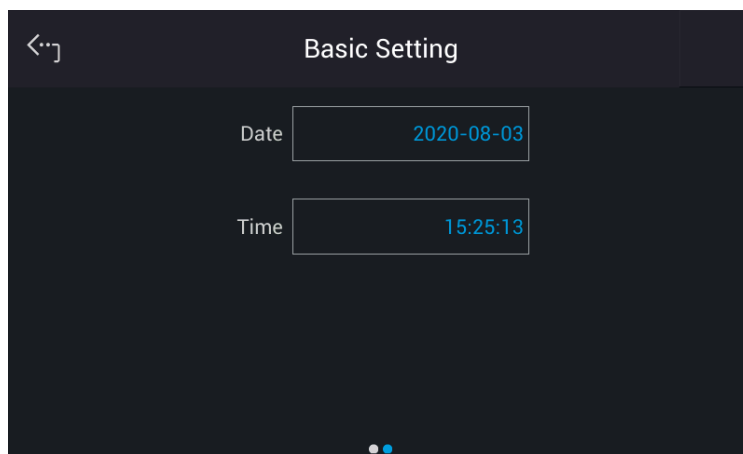
Set the time and date as follows:

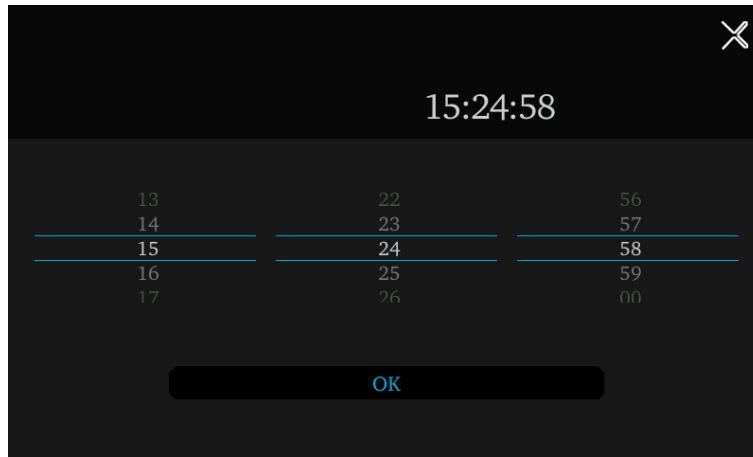
**Time:** Hour, Minute

**Date:** Month, Day, Year

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

1. Slide the screen to second page for setting Date and Time.
2. Tap Date or Time indicator.
3. Select the desired item (Year/Month/Day/Hour/Minute/Second) to begin the setting.





### 3.6.3 Limitation

The limitation of the Regenerative AC Electronic Load for 1-phase and 3-phase is set individually. For instance, the Iac Limit setting will apply the settings of the 1-phase mode when changing it from the 3-phase mode. Tap Menu, System Setup and Limitation to set Iac Limit, CF Limit, and S Limit. This command protects the user's program instead of hardware.

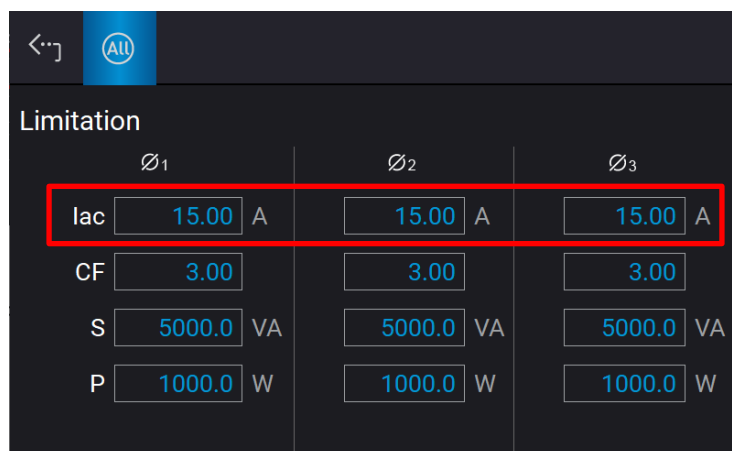
#### 3.6.3.1 Iac Limit

The Iac Limit restricts the Iac value in the main page (3\_Phase Mode/1\_Phase Mode).

Tap ALL to set the limitation of the 3-phase loading voltage for each or all.

The procedure to set Iac Limit = 15A in 3\_Phase Mode is described below.

1. Tap ALL.
2. Tap "Iac".
3. Enter **1**, **5**, and tap  to change the value to "15.0".

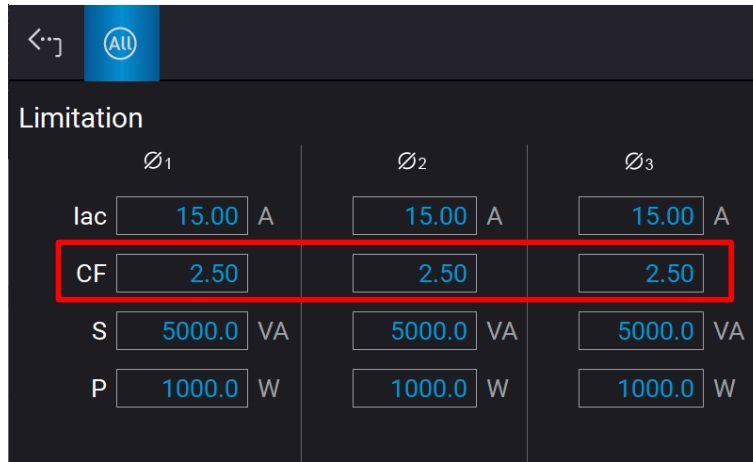


### 3.6.3.2 CF Limit

The CF Limit restricts the CF setting in the main page (3\_Phase Mode/1\_Phase Mode).

The procedure for setting CF = 2.5 in 3\_Phase mode is described below.

1. Tap ALL.
2. Tap "CF".
3. Tap ,  ,  and tap  to change the value to "2.5".

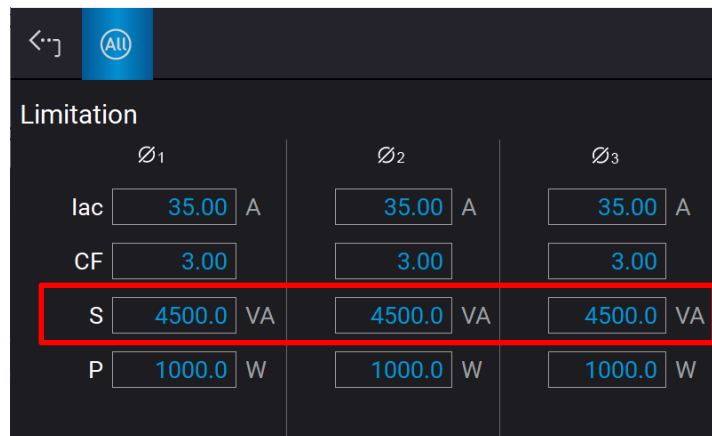


### 3.6.3.3 S Limit

The S Limit restricts the S value in the main page (3\_Phase Mode/1\_Phase Mode).

Tap ALL to set the limitation of the 3-phase loading voltage for each or all. The procedure to set S Limit = 4500VA in 3\_Phase Mode is described below.

1. Tap ALL.
2. Tap "S".
3. Enter , , , , and tap  to change the value to "4500.0".



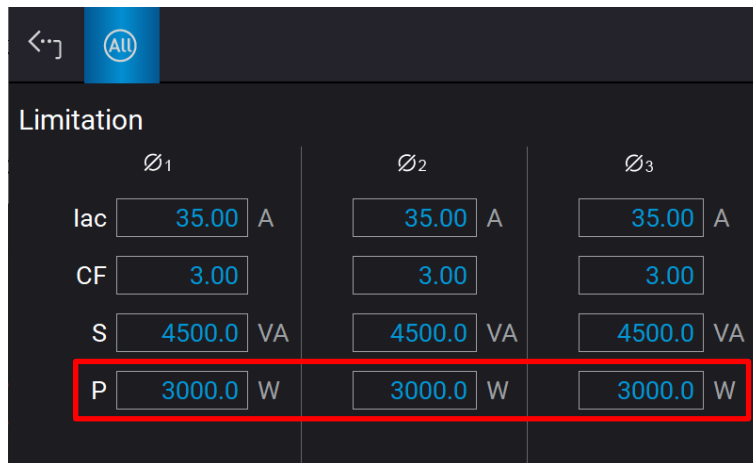


### 3.6.3.4 P Limit

The P Limit restricts the P value in the main page (3\_Phase Mode/1\_Phase Mode).

Tap ALL to set the limitation of the 3-phase loading power for each or all. The procedure to set P Limit = 3000W in 3\_Phase Mode is described below.

1. Tap ALL.
2. Tap “P”.
3. Enter , , , , and tap  to change the value to “3000.0”.



### 3.6.4 Sys. Save/Recall

See section 3.3.4 for the detailed description.

### 3.6.5 Meas. Setting

#### 3.6.5.1 Average Times

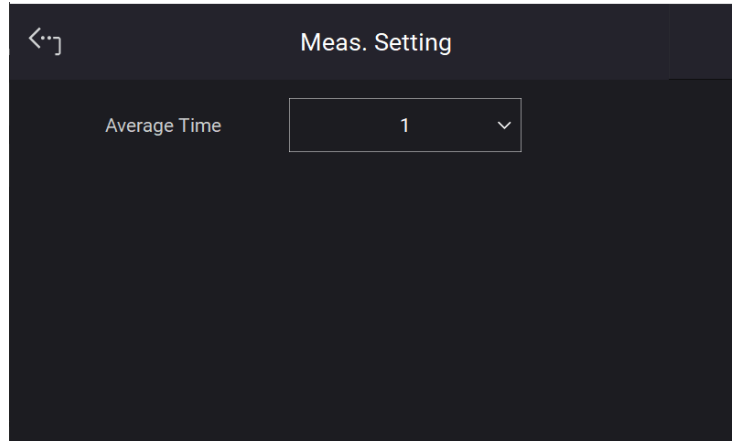
Tap Menu, System Setup and Meas. The “Average Times” sets the sampling average of voltage/current RMS and voltage/current peak. The Regenerative AC Electronic Load uses moving windows for sampling. When “4” is selected for Average Times it indicates it will be sampling 4 times in moving windows.

Tap Average Times to set the average times for sampling. When a measurement is fluctuating 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. (The default is 8.)

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

1. Tap Average Times
2. Select “1”.






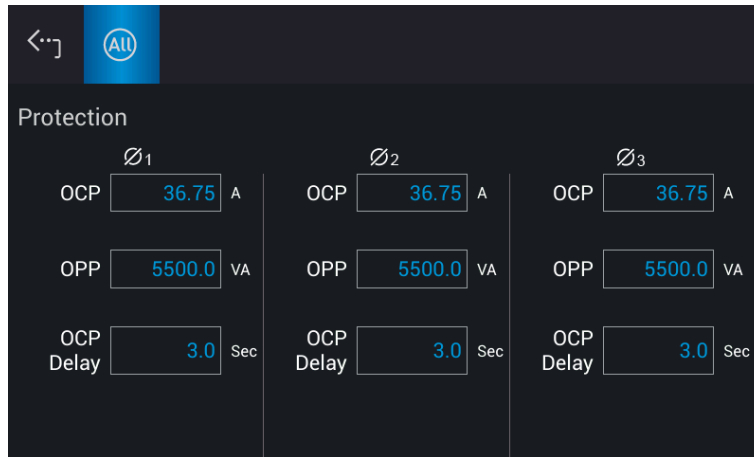
### 3.6.6 Protection

The Regenerative AC Electronic Load's protection for 1-phase/3-phase output mode is set separately. For instance, the protection settings will apply the settings of 1-phase mode without applying the protection settings of any phase in 3-phase mode when switching from 3-phase to 1-phase mode.

Tap Menu, System Setup and Protection to set the limit of the output RMS current (OCP), output power (OPP) and the Delay Time for triggering the current protection. The protection is only valid in Meas. & Setup (3\_Phase Mode/1\_Phase Mode). The purpose of this command is to protect the UUT.

Following shows the procedure of setting the current limit = 36.75 A (maximum for model 63815R-350-105), power limit = 5500VA VA (maximum for model 63815R-350-105), delay time for trigger current protection = 3 sec.

1. Tap ALL.
2. Select "OCP" of phase 1
3. Enter , , , , , and tap  to change the value to "36.75".
4. Tap "OPP" of phase 1.
5. Enter , , , , and tap  to change the value to "5500".
6. Tap "Delay time" of phase 1.
7. Enter , and tap  to change the value to "3.0".



#### Notice

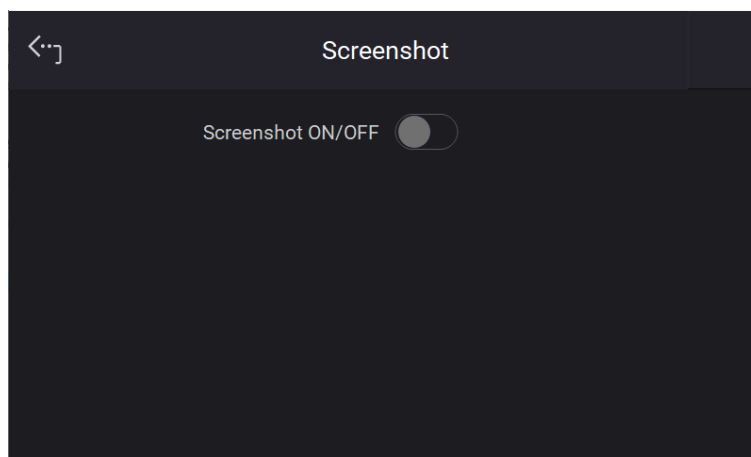
1. The setting of the delay time for current protection is only valid when the current is within the specification. When the output exceeds the specification, it is still valid if the current protection delay trigger is between the set 0.1 to 1s. However, device will enter protection mode when if it exceeds 1s. The resolution is 0.1s.
2. The protection point varies by the measurement error, thus it may act before reaching the protection point set.

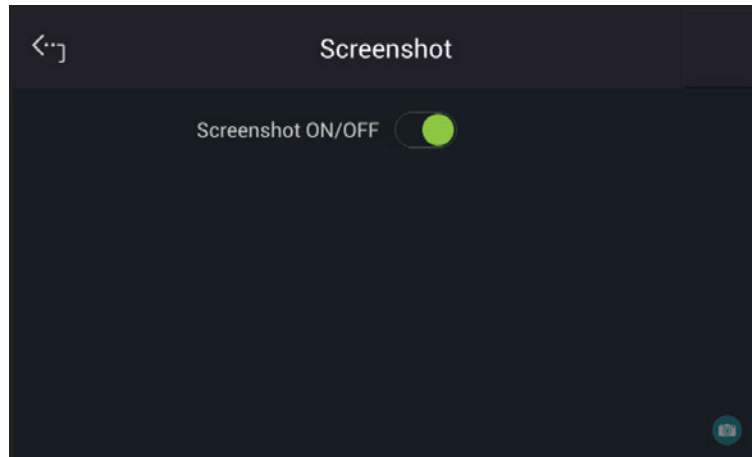
#### Notice



When switching between 1-phase and 3-phase mode, the setting will be reset to zero to avoid damaging the Unit Under Test (UUT).

### 3.6.7 Screenshot

Tap Menu, System Setup and Screenshot to perform the screenshot of Regenerative AC Electronic Load.





When the Screenshot ON/OFF is turned to ON, a camera icon  will appear at the lower right corner on the screen. Insert a USB2.0 flash drive to the USB HOST on the front panel to save the file. Click the camera icon  to perform the screenshot as desired.

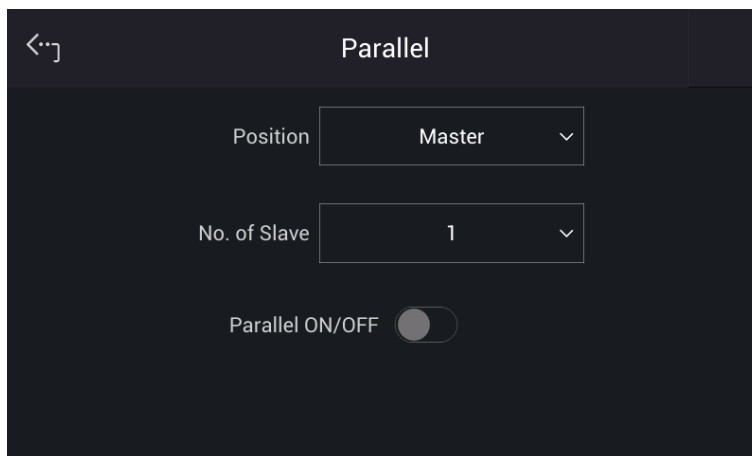
## 3.7 Setup for Parallel

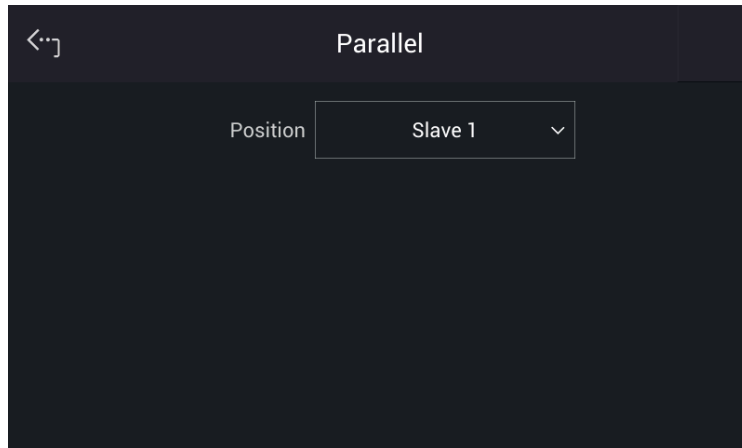
### 3.7.1 Paralleling by UI

#### 3.7.1.1 Setting Regenerative AC Electronic Load to Slave

When setting the Regenerative AC Electronic Load to Slave, you can select Configuration from the Menu on the upper left corner to enter the Parallel menu. Follow the steps below to set the parallel function for connecting multiple devices.

1. Tap Position.
2. Select "Slave 1".





### 3.7.1.2 Setting Regenerative AC Electronic Load to Master

When setting the Regenerative AC Electronic Load to Master, you can select Configuration from the Menu on the upper left corner to enter the Parallel menu. Follow the steps below to set the parallel function for connecting multiple devices.

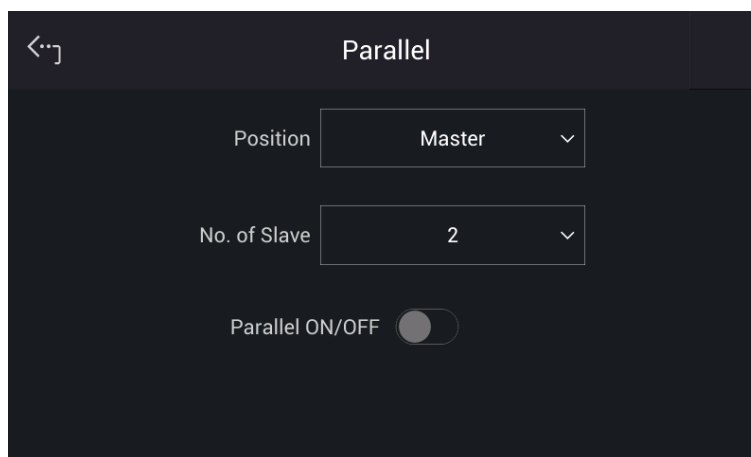
1. Tap Position.
2. Select "Master".
3. Tap No. of Slave.
4. Select the number of Slave to be paralleled.
5. Enable Parallel ON/OFF.
6. It will return to the main screen if set to Master, and Slave will show on the screen when set to Slave.

#### Notice

For parallel, at least one of them must be set to Slave, otherwise "System Connection Fail!" will appear when Master is set to Enable. Refer to section 3.8 for the details of troubleshooting.

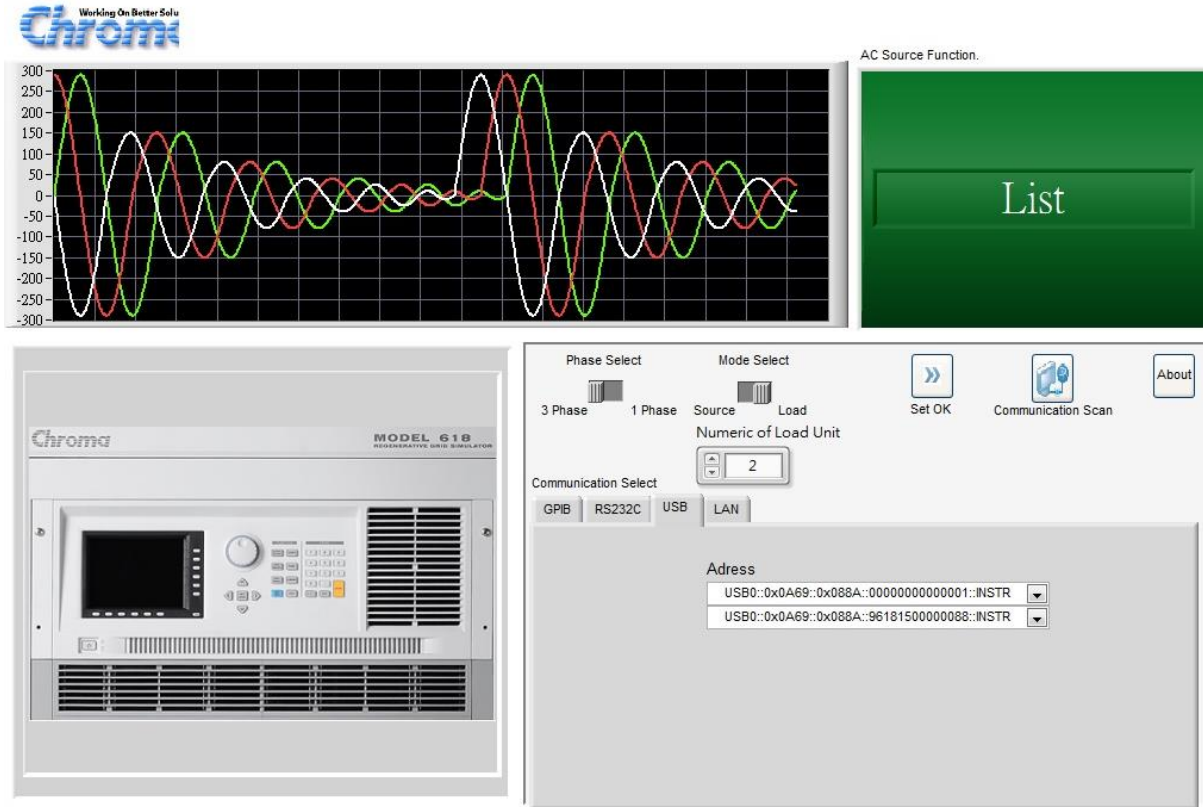
#### WARNING

When setting the Number of Slave for Master, the rule is N-1 for the total number of Regenerative AC Electronic Loads. For example, when two units are connected in parallel, the Number of Slave must be set to 1. If the parallel number is set incorrectly, the connection may fail or the device is at risk of damage.



## 3.7.2 Controlling by SoftPanel

The Regenerative AC Electronic Load uses SoftPanel to control multiple devices. The procedure for controlling 2 devices via USB is described below.



1. Enter into the SoftPanel UI.
2. Click "USB" from Communication Select.
3. Click "3 Phase" from Phase Select.
4. Click "Load" from Mode Select.
5. Set "2" in Number of Load Unit (maximum 3 units).
6. Click Set OK.

**Notice** When controlling by SoftPanel, each Regenerative AC Electronic Load must be operated under the same communication interface. The parallel connection will fail if different communication interface is used.

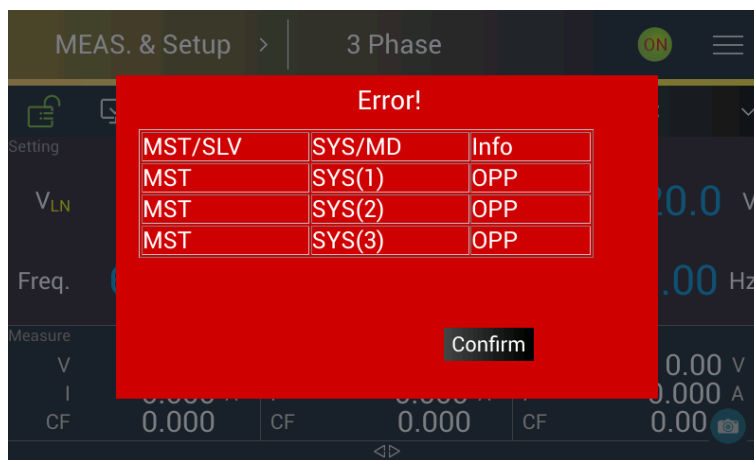
**Notice** There are electrical differences between SoftPanel control and paralleling by standalone units. When loading the voltage source on the same DUT, the SoftPanel control in phase-lock synchronization and transient performance are not the same as that of paralleling by standalone units. If there is a need for loading start angle and synchronization of initial commands, it is necessary to use the UI parallel mode on the standalone device, see section 3.7.1 for the detailed information.

**Notice** When controlling by SoftPanel, the Stand-By mode is disabled by default. If it is required to use the Stand-By mode in a parallel state, use UI for paralleling instead (see section 3.7.1).

**⚠ WARNING** Please refer to section 2.5 for wiring the output terminal of each Regenerative AC Electronic Load. If the wiring is not correct, it may cause control failure or risk of damaging the device.

## 3.8 Protection

The Regenerative AC Electronic Load has both software and hardware protection. When protection errors occur, the Regenerative AC Electronic Load will disable the output and disconnect the output relay. The display will show the protection status. There are recovery and latch two types of protections. For recovery protection, please remove the error load and tap **Confirm** to release protection for normal operation.



For latch protection, it is unable to release the protection by tapping **Confirm**. Please remove the error load and restart the Regenerative AC Electronic Load to regain normal operation.

The table below lists the output protection:

Message	Protection	Possible Cause	Troubleshooting
SYS_FANFAIL	It occurs when the fan is checked during power-on. (Latch)	1. The fan is blocked due to foreign object or dust.	1. Check the fan on the module having protection and clear the foreign object.
SYS_FANLOCK	1. It prevents damage to compulsory cooling components. 2. Prevents the fan from blocking due to foreign objects or abnormal circuit. (Latch)	2. The fan is not connected. 3. The fan is broken or invalid. 4. The fan circuit is malfunction.	2. Check the connection of fan on the module having protection. 3. Replace the broken or invalid fan. 4. Replace the fan circuit board.
SYS_ISHARE_ERR_SIN	1. Prevents you from incorrectly connecting the	1. Each power module is abnormal.	1. Replace the power module. 2. Inspect the

	<p>output.                  2. Prevents module errors to cause unbalanced current sharing.                  Only valid for a standalone unit in 1-phase.                  (Recovery)</p>	<p>2. The current sharing circuit is abnormal.                  3. The digital communication is abnormal.</p>	<p>communication cable and make sure the connection is correct.</p>
SYS_ISHARE_ERR_PAR	<p>1. Prevents you from incorrectly connecting the output.                  2. Prevents module errors to cause unbalanced current sharing.                  Only valid when paralleled in multiple devices.                  (Recovery)</p>	<p>1. Each power module is abnormal.                  2. The current sharing circuit is abnormal.                  3. The digital communication is abnormal.</p>	<p>1. Replace the power module.                  2. Inspect the communication cable and make sure the connection is correct.</p>
SYS_OVP(1/2/3)	<p>It occurs when the output voltage exceeds the system set voltage limit. (Recovery)</p>	<p>1. The external source is too large.                  2. The external inductive load is open.                  3. The UUT capacitive load is too big.</p>	<p>1. Make sure the external circuit is correct.                  2. Check if the circuit is short circuited.                  3. Confirm the external circuit characteristics.</p>
SYS_OCP(1/2/3)	<p>It occurs when the output current exceeds the system set current limit. (Recovery)</p>	<p>1. The UUT impedance is too low.                  2. Temporary short circuit.                  3. The RCD load impedance is too small.                  4. The UUT capacitive load is too big.</p>	<p>1. Remove the UUT and make sure the protection value is correctly set.                  2. Remove the UUT and confirm its correctness.                  3. Add a current limit resistor.                  4. Set the voltage slew rate.</p>
SYS_OPP(1/2/3)	<p>It occurs when the output power exceeds the system set power limit. (Recovery)</p>	<p>1. The UUT impedance is too low.                  2. Temporary short circuit.</p>	<p>1. Remove the UUT and make sure the protection value is correctly set.                  2. Remove the UUT and confirm its correctness.</p>
SELF_TEST_NG(1/2/3)	<p>It occurs when the</p>	<p>1. The auxiliary</p>	<p>1. Check and</p>



	auxiliary power of DC/AC power module is running self detect protection.(Latch)	<p>power of DC/AC module is abnormal.</p> <ol style="list-style-type: none"> <li>2. The measurement circuit of DC/AC module is having error.</li> <li>3. The digital module is having error.</li> </ol>	<p>replace the auxiliary power on the DC/AC module board.</p> <ol style="list-style-type: none"> <li>2. Check and replace the DC/AC module board.</li> <li>3. Check and replace the digital module board.</li> </ol>
SYS_DA_COM_ERR(1/2/3)	It occurs when checking the communication status between the Host and the DC/AC module. (Latch)	<ol style="list-style-type: none"> <li>1. The auxiliary power of DC/AC module is abnormal.</li> <li>2. The Host auxiliary power is abnormal.</li> <li>3. The communication cable is abnormal.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check and replace the auxiliary power on the DC/AC module board.</li> <li>2. Check and replace the digital module board.</li> <li>3. Check and replace the DC/AC module board.</li> <li>4. Check if the communication cable is correctly connected.</li> </ol>
SYS_AD_COM_ERR(1/2/3)	Occurs when checking the communication status between the Host and the AC/DC module. (Latch)	<ol style="list-style-type: none"> <li>1. The auxiliary power of AC/DC module is abnormal.</li> <li>2. The Host auxiliary power is abnormal.</li> <li>3. The communication cable is abnormal.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check and replace the auxiliary power on the AC/DC module board.</li> <li>2. Check and replace the digital module board.</li> <li>3. Check and replace the AC/DC module board.</li> <li>4. Check if the communication cable is correctly connected.</li> </ol>
SYS_PAR_COM_CAN_ERR	The occurred digital communication error causes abnormal parallel output when paralleled multiple devices.	<ol style="list-style-type: none"> <li>1. The auxiliary power of DC/AC module is abnormal.</li> <li>2. The Host auxiliary power is abnormal.</li> <li>3. The communication</li> </ol>	<ol style="list-style-type: none"> <li>1. Check and replace the auxiliary power on the DC/AC module board.</li> <li>2. Check and replace the digital module board.</li> <li>3. Check and</li> </ol>
SYS_PAR_COM_ERR	(Recovery)		

SYS_PAR_WIRE_LOSS		cable is abnormal.	replace the DC/AC module board. 4. Check if the communication cable is correctly connected.
SYS_REMOTE_INHIBIT	Occurs when remote is inhibited.		
SYS_AD_NO_MAIN	The main program for power-on AC/DC module self-test is abnormal.	The AC/DC module triggers protection.	1. Upgrade the firmware and reboot. 2. Check if the comm. cable of internal AC/DC is well connected.
SYS_DA_NO_MAIN	The main program for power-on DC/AC module self-test is abnormal.	The DC/AC module triggers protection.	1. Upgrade the firmware and reboot. 2. Check if the comm. cable of internal DC/AC is well connected.
SYS_DSP_NO_MAIN	The main program for power-on HOST self-test is abnormal.	The HOST triggers protection.	1. Upgrade the firmware and reboot. 2. Check if the SD card inside is well inserted.
SYS_CALI_BND_ERR	The calibrated value of power-on test is out of range.	The HOST triggers protection.	1. Recalibrate it. 2. Make sure the device cables are correctly connected.

The table below lists the module protection:

Message	Protection	Possible Cause	Troubleshooting
AD_VDC_OVP(1/2/3)	Occurs when the AC/DC power module outputs over VDC voltage. (Latch)	1. The output transient power is too high (the protection phase VDC is over 850V.) (Regen mode) 2. The AC/DC module measurement circuit is abnormal.	1. Remove the UUT and make sure the operation is correct. 2. Check and replace the AC/DC module board that has protection occurred.
AD_VDC_UVP(1/2/3)	Occurs when the AC/DC power module outputs	1. The output transient power is too high (the	1. Remove the UUT and make sure the operation is

	under VDC voltage. (Latch)	<p>protection phase VDC is under 720V.) (Source mode)</p> <ol style="list-style-type: none"> <li>2. The AC/DC module measurement circuit is abnormal.</li> <li>3. The AC/DC module relay drive signal is abnormal or the relay is damaged</li> <li>4. The AC/DC module PWM drive signal is abnormal.</li> <li>5. The AC/DC power module is abnormal or damaged.</li> </ol>	<p>correct.</p> <ol style="list-style-type: none"> <li>2. Check and replace the AC/DC module board that has protection occurred.</li> <li>3. Check and replace the AC/DC module board that has protection occurred.</li> <li>4. Check and replace the AC/DC power module board that has protection occurred.</li> <li>5. Check and replace the AC/DC power module board that has protection occurred.</li> </ol>
AD_VAC_UBL(1/2/3)	It indicates that the line input is unbalanced or phase failure. (Latch)	<ol style="list-style-type: none"> <li>1. The input power supply is connected wrong (<math>V_{LL}</math> difference 10%).</li> <li>2. The input power has phase failure.</li> <li>3. The AC/DC module fuse is broken.</li> <li>4. The AC/DC module measurement circuit is abnormal.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check if the 3-phase input line voltage meets the rated value.</li> <li>2. Measure the AC/DC module fuse and replace it.</li> <li>3. Check and replace the AC/DC module board that has protection occurred.</li> </ol>
AD_VRS_OVP(1/2/3) AD_VTR_OVP(1/2/3) AD_VST_OVP(1/2/3) AD_Vd_OVP(1/2/3)	It indicates that the line input voltage is over the specification. (Latch)	<ol style="list-style-type: none"> <li>1. The input power is abnormal.</li> <li>2. The AC/DC module measurement circuit is abnormal.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check if the input power meets the rated value.</li> <li>2. Check and replace the AC/DC module board that has protection occurred.</li> </ol>
AD_VRS_UVP(1/2/3)	It indicates that the	1. The input power	1. Check if the input

AD_VTR_UVP(1/2/3) AD_VST_UVP(1/2/3) AD_Vd_UVP(1/2/3)	line input voltage is under the specification. (Latch)	is abnormal. 2. The AC/DC module input fuse is broken. 3. The AC/DC module measurement circuit is abnormal.	power meets the rated value. 2. Measure the AC/DC module input fuse and replace it. 3. Check and replace the AC/DC module board that has protection occurred.
AD_IR_OCP(1/2/3) AD_IS_OCP(1/2/3) AD_IT_OCP(1/2/3)	It indicates that the line input current is over the limit. (Latch)	1. The output transient power is too high. 2. The AC/DC module measurement circuit is abnormal.	1. Remove the UUT and make sure the operation is correct. 2. Check and replace the AC/DC module board that has protection occurred.
AD_OTP(1/2/3)	It occurs when the internal temperature of AC/DC power module is too high. (Latch)	1. The operating environment temperature is over. 2. The module power switch is abnormal.	1. Eliminate the ambient overheating problem. 2. Check the abnormal phase power module and replace it.
DA_OTP(1/2/3)	It occurs when the internal temperature of DC/AC power module is too high. (Latch)	3. The circuit detection is malfunction.	3. Check the abnormal fan circuit board and sensing wire, and replace them.
DA_UTP(1/2/3)	It occurs when the internal temperature of DC/AC power module is too low. (Latch)		
AD_FRE_ERR(1/2/3)	It protects the module side when the AC/DC power module input voltage and frequency are abnormal. (Latch)	1. The input power is abnormal. 2. The AC/DC module input fuse is broken. 3. The AC/DC module measurement circuit is abnormal.	1. Check if the input power meets the rated value. 2. Measure the AC/DC module fuse and replace it. 3. Check and replace the AC/DC module board that has protection occurred.

AD_PFC_STARTFAIL(1/2/3)	It protects the module side when the AC/DC power module start fails.(Latch)	<ol style="list-style-type: none"> <li>1. The input power is abnormal.</li> <li>2. The AC/DC module input fuse is broken.</li> <li>3. The AC/DC module measurement circuit is abnormal.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check if the input power meets the rated value.</li> <li>2. Measure the AC/DC module input fuse and replace it.</li> <li>3. Check and replace the AC/DC module board that has protection occurred.</li> </ol>
AD_AC_STARTFAIL(1/2/3)			
DD_LLC_STARTFAIL(1/2/3)			
DD_LLC_STARTFAIL(1/2/3)			
AD_MEM_ERR(1/2/3)	The AC/DC power module CPU self-tests if the memory is operating normally. (Latch)	<ol style="list-style-type: none"> <li>1. The digital circuit of power supply module is abnormal.</li> <li>2. The AC/DC module CPU is abnormal.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check if it is the auxiliary power problem on the single board.</li> <li>2. Check and replace the digital control board of AC/DC module that has protection occurred.</li> </ol>
AD_MODEL_RES_ERR(1/2/3)	It identifies the single model of AC/DC power module.(Latch)	<ol style="list-style-type: none"> <li>1. The hardware resistance for identification is broken.</li> <li>2. The AC/DC module digital control board is abnormal.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check and identify if the GPIO pins used by AC/DC power module are correct.</li> <li>2. Check if the hardware resistance is normal and exists.</li> </ol>
AD_PWM_TOP_FAULT(1/2/3)	It is the AC/DC power module drives signal protection. (Latch)	<ol style="list-style-type: none"> <li>1. The drive signal is abnormal (the power parts are short-circuited.)</li> <li>2. The AC/DC module digital circuit is abnormal.</li> <li>3. The DC/AC module digital circuit is abnormal.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check or replace the power module board that has protection occurred.</li> <li>2. Check and replace the digital board of AC/DC module that has protection occurred.</li> <li>3. Check and replace the digital board of DC/AC module that has protection occurred.</li> </ol>
AD_PWM_BOT_FAULT(1/2/3)			
DA_PWM_R_FAULT(1/2/3)	It is the DC/AC power module drives signal protection. (Latch)		
DA_PWM_L_FAULT(1/2/3)			
DD_IP_OCP(1/2/3)	DC/DC power	<ol style="list-style-type: none"> <li>1. The output</li> </ol>	<ol style="list-style-type: none"> <li>1. Remove the UUT</li> </ol>

	module primary side over current protection. (Latch)	transient power is too high. 2. The DC/DC module measurement circuit is abnormal.	and make sure the operation is correct. 2. Check and replace the DC/DC module board that has protection occurred.
DD_IO_SRC_OCP(1/2/3)	It is the DC/DC power module secondary side over current protection. (Latch)	1. The output transient power is too high. 2. The DC/DC module measurement circuit is abnormal.	1. Remove the UUT and make sure the operation is correct. 2. Check and replace the DC/DC module board that has protection occurred.
DD_IO_REG_OCP(1/2/3)			
DD_VO_OVP_F(1/2/3)	It is the DC/DC power module secondary side over voltage protection in transient state. (Latch)	1. The input power is abnormal. 2. The DC/DC module measurement circuit is abnormal.	1. Check if the input power meets the rated value. 2. Check and replace the DC/DC module board that has protection occurred.
DD_VO_UVP_S(1/2/3)	It is the DC/DC power module secondary side under voltage protection in steady state. (Latch)	1. The input power is abnormal. 2. The AC/DC module input fuse is broken. AC/DC	1. Check if the input power meets the rated value. 2. Measure the AC/DC module input fuse and replace it.
DD_VO_UVP_F(1/2/3)	It is the DC/DC power module secondary side under voltage protection in transient state. (Latch)	3. The DC/DC module measurement circuit is abnormal.	3. Check and replace the DC/DC module board that has protection occurred.
DD_SHORT(1/2/3)	It is the primary side over current protection of DC/DC power module. (Latch)	1. The DC/DC power module drive signal is abnormal (the power parts are short-circuited.) 2. The DC/AC power module output is abnormal.	1. Check and replace the DC/DC power module board that has protection occurred. 2. Check and replace the DC/AC power module board that has

			<p>protection occurred.</p> <ol style="list-style-type: none"> <li>3. Check and replace the digital board of AC/DC module that has protection occurred.</li> <li>4. Check and replace the digital board of DC/AC module that has protection occurred.</li> </ol>
DA_OVP(1/2/3)	Occurs when the transient output voltage exceeds the module voltage limit or voltage specification. (Latch)	<ol style="list-style-type: none"> <li>1. The external source is too large.</li> <li>2. The external inductive load is open.</li> <li>3. The UUT capacitive load is too big.</li> </ol>	<ol style="list-style-type: none"> <li>1. Make sure the external circuit is correct.</li> <li>2. Check if the circuit is short circuited.</li> <li>3. Confirm the external circuit characteristics.</li> </ol>
DA_OCP(1/2/3)	It occurs when the transient output current exceeds the module current limit or current specification. (Latch)	<ol style="list-style-type: none"> <li>1. The UUT impedance is too low.</li> <li>2. Temporary short circuit.</li> <li>3. The RCD load impedance is too small.</li> <li>4. The UUT capacitive load is too big.</li> </ol>	<ol style="list-style-type: none"> <li>1. Remove the UUT and make sure the protection value is correctly set.</li> <li>2. Remove the UUT and confirm its correctness.</li> <li>3. Add a current limit resistor.</li> <li>4. Set the voltage slew rate.</li> </ol>
DA_OCP_S(1/2/3)	It occurs when the transient RMS output current exceeds the module current limit or current specification. (Latch)	<ol style="list-style-type: none"> <li>1. The UUT impedance is too low.</li> <li>2. The temporary loading RMS current is too large to cause SYS_OCP (1/2/3) and the protection speed is not enough.</li> </ol>	<ol style="list-style-type: none"> <li>1. Remove the UUT and make sure the protection value is correctly set.</li> <li>2. Remove the UUT and confirm its correctness.</li> </ol>
DA_OPP(1/2/3)	It occurs when the transient output power exceeds the module power limit or power specification. (Latch)	<ol style="list-style-type: none"> <li>1. The UUT impedance is too low.</li> <li>2. Temporary short circuit.</li> </ol>	<ol style="list-style-type: none"> <li>1. Remove the UUT and make sure the protection value is correctly set.</li> <li>2. Remove the UUT and confirm its</li> </ol>

			correctness.
DA_SENSE_FAULT(1/2/3)	It occurs when the remote voltage sensing function is on and the signal line is not connected or wrong. (Recovery)	<ol style="list-style-type: none"> <li>1. The remote sense wiring is not connected or connected wrong.</li> <li>2. The remote connection impedance is too large.</li> <li>3. The output relay is malfunction.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the remote sense wiring.</li> <li>2. Shorten the distance to UUT and eliminate the impedance.</li> <li>3. Replace the damaged output relay.</li> </ol>
DA_SHORT(1/2/3)	It occurs when the output is short circuited. (Recovery)	<ol style="list-style-type: none"> <li>1. The UUT impedance is too low.</li> <li>2. Temporary short circuit.</li> </ol>	<ol style="list-style-type: none"> <li>1. Remove the UUT and confirm its correctness.</li> <li>2. Make sure the external connection is correct.</li> </ol>
DA_HARD_ERR(1/2/3)	It prevents the AC/DC power module or the digital power supply from being abnormal, causing the DC/AC power module to output abnormal voltage.	<ol style="list-style-type: none"> <li>1. The auxiliary power supply on digital board is abnormal.</li> <li>2. The AC/DC module triggers protection.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check if the digital auxiliary power supply meets the rated value.</li> <li>2. Check and replace the AC/DC module board that has protection occurred.</li> </ol>
DA_FW_PWMSHORT(1/2/3)	It indicates that the digital control signal of the DC/AC power module is abnormal.(Latch)	<ol style="list-style-type: none"> <li>1. The DC/AC power module digital control board is broken.</li> <li>2. The auxiliary power supply on the DC/AC power module digital board is abnormal.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check if the digital auxiliary power supply meets the rated value.</li> <li>2. Check and replace the digital control board on DC/AC module that has protection occurred.</li> </ol>
DA_ISHARE_ERR_F(1/2/3)	<ol style="list-style-type: none"> <li>1. It prevents you from incorrectly connecting the output.</li> <li>2. It prevents module errors to cause unbalanced current sharing. (Recovery)</li> </ol>	<ol style="list-style-type: none"> <li>1. The digital control board on DC/AC power module is broken.</li> <li>2. The measurement circuit on DC/AC power module board is abnormal.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check and replace the DC/AC power module board that has protection occurred.</li> <li>2. Check and replace the DC/AC power module digital</li> </ol>



		3. The output relay is malfunction.	board that has protection occurred.
DA_IC_OCP(1/2/3)	It prevents damage to the components of DC/AC power modules. (Recovery)	1. The digital control board on DC/AC power module is broken.	1. Check and replace the DC/AC power module board that has protection occurred.
DA_Vdamp_OVP(1/2/3)	It prevents damaging the damping resistance under abnormal operation. (Recovery)	2. The passive component circuit on DC/AC power module is abnormal. 3. The measurement circuit on DC/AC power module board is abnormal.	2. Check and replace the DC/AC power module digital board that has protection occurred.
DA_UUT_UVP(1/2/3)	It means the UUT voltage is too low.	The DC/AC module triggers protection.	1. Remove the UUT and confirm its correctness. 2. Make sure the external connection is correct.
DA_UUT_OFPP(1/2/3)	It means the UUT voltage frequency is over the operating range.		
DA_UUT_UFP(1/2/3)	It means the UUT voltage frequency is under the operating range.		
DA_UUT_OVP_VDC(1/2/3)	It means the UUT voltage has too much DC voltage component.		
DA_UUT_fault	It means the UUT frequency has changed too much, and it cannot be restored to carry on loading.	The DC/AC module triggers protection.	1. Remove the UUT and confirm its correctness. 2. Make sure the external connection is correct.
DA_PLL_FAIL	It means the DC/AC module phase lock is abnormal.	The DC/AC module triggers protection.	1. Measure the error circuit. 2. Remove the UUT and confirm its correctness. 3. Make sure the external connection is correct.
DA_SRAM_ERR	It means the DA_SRAM power-on test is abnormal.	The DC/AC module triggers protection.	1. Replace the CD board. 2. Upgrade the FW and reboot.

**Notice**

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

## 3.9 Verification

### 3.9.1 Introduction

This chapter contains test procedures for checking the operation and specification of Chroma 63800 Series Regenerative AC Electronic Load. The tests are performed using the 63800 Series models and some required equipment. The required test equipment is listed in Table 3-1. Please refer to *Performance Tests* section for equipment connection and test procedure. The user can use verification tables included at measurement verification section to validate the specification. For the detailed information of operation and programming please refer to the *Chapter 3 and Chapter 5*.

If any of the models covered in the manual (63809R-350-87/63812R-350-96/63815R-350-105) require service, refer to the list of Chroma Sales and Support Offices at the web site:

[www.chromaate.com/english/contact/default.asp](http://www.chromaate.com/english/contact/default.asp).

### 3.9.2 Equipment Required

The following table lists the equipment or its equivalent required for verification.

Table 3-1 Equipment Recommended for Verification

Equipment	Characteristics	Recommended Model
Current Transducer	400A	DC-CT(IT 400-S)
Power Analyzer		Chroma 66204*1 set Chroma A662020*1 set (DC-CT Power)
AC Source	105Apeak 0-35Arms 0-350Vrms 30-100Hz,DC	Chroma 63815R-350-105*1 set
Regenerative AC Electronic Load		Chroma 63809R-350-87/63812R-350-96/63815R-350-105

#### Connection

Connect the Regenerative AC Electronic Load, AC Source, Power Analyzer, and Current Transducer as shown in Figure 3-5.

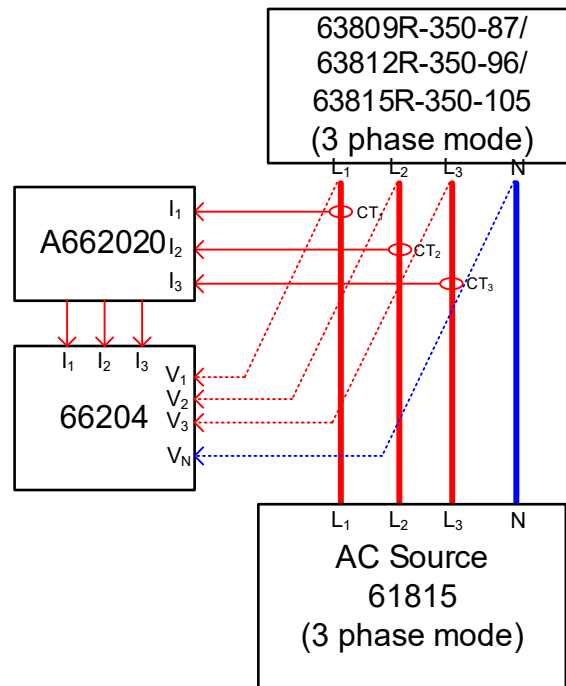


Figure 3-5

**Notice**

When verifying the Chroma 63800 Series Regenerative AC Electronic Loads, be sure to connect the remote sense cable to the AC Source output terminal. Refer to section 2.5 for the connection in detail.

### 3.9.3 Performance Tests

#### 3.9.3.1 Current and CF Setting and Measurement Verification in CC Rectifier Mode

This test verifies if the current setting and measurement accuracy are within specifications when operating in Meas. & Setup (3\_Phase) CC Rectifier mode. For each Power Analyzer reading, the front panel display of current measurement should be within the specification.

Regenerative AC Electronic Load reading amps = current setting  $\pm$  inaccuracy

PA (Vac): Vrms voltage measurement of Power Analyzer AC voltage

PA (Iac): Irms current measurement of Power Analyzer AC current

PA (CF): CF measurement of Power Analyzer AC current

#### Checking current

- Connect the Regenerative AC Electronic Load, AC Source, Power Analyzer, and Current Transducer as shown in Figure 3-5. Use the Power Analyzer to measure the AC Iac current.
- Enter into Meas. & Setup (3\_Phase Mode) to start performing the load verification listed in Table 3-2.

- C. Load the test current. Power on the AC Source and set the output voltage (sinewave) as shown in Table 3-2. The current protection of AC Source must be greater than 35Arms with power protection larger than 5kVA.

Table 3-2 Current Setting and Measurement Verification Table (with Load)

Φ1									
Model	Current (std.)	Output Voltage	CF	Current Accuracy		PA(lac) Current	Panel Measured Current	Panel Display Current Spec.	CF Spec. 3% F.S PA(CF)
				Max.	Min.				
63809R-350-87	29A	50V	2.000	29.23A	28.76A			Std. ±0.20A	
	20A	150V	2.000	20.20A	19.79A			Std. ±0.16A	
	12A	250V	2.000	12.18A	11.81A			Std. ±0.13A	
	8A	350V	2.000	8.16A	7.83A			Std. ±0.11A	
63812R-350-96	32A	50V	2.000	32.25A	31.74A			Std. ±0.22A	
	25A	150V	2.000	25.23A	24.76A			Std. ±0.19A	
	16A	250V	2.000	16.20A	15.79A			Std. ±0.16A	
	11A	350V	2.000	11.19A	10.80A			Std. ±0.14A	
63815R-350-105	35A	50V	2.000	35.28A	34.72A			Std. ±0.24A	
	25A	150V	2.000	30.26A	29.73A			Std. ±0.20A	
	18A	250V	2.000	18.22A	17.77A			Std. ±0.17A	
	12A	350V	2.000	12.21A	11.78A			Std. ±0.15A	
Φ2									
Model	Current (std.)	Output Voltage	CF	Current Accuracy		PA(lac) Current	Panel Measured Current	Panel Display Current Spec.	CF Spec. 3% F.S PA(CF)
				Max.	Min.				
63809R-350-87	29A	50V	2.000	29.23A	28.76A			Std. ±0.20A	
	20A	150V	2.000	20.20A	19.79A			Std. ±0.16A	
	12A	250V	2.000	12.18A	11.81A			Std. ±0.13A	
	8A	350V	2.000	8.16A	7.83A			Std. ±0.11A	
63812R-350-96	32A	50V	2.000	32.25A	31.74A			Std. ±0.22A	
	25A	150V	2.000	25.23A	24.76A			Std. ±0.19A	
	16A	250V	2.000	16.20A	15.79A			Std. ±0.16A	
	11A	350V	2.000	11.19A	10.80A			Std. ±0.14A	
63815R-350-105	35A	50V	2.000	35.28A	34.72A			Std. ±0.24A	
	25A	150V	2.000	30.26A	29.73A			Std. ±0.20A	
	18A	250V	2.000	18.22A	17.77A			Std. ±0.17A	
	12A	350V	2.000	12.21A	11.78A			Std. ±0.15A	
Φ3									
Model	Current (std.)	Output Voltage	CF	Current Accuracy		PA(lac) Current	Panel Measured Current	Panel Display Current Spec.	CF Spec. 3% F.S PA(CF)
				Max.	Min.				
63809R-350-87	29A	50V	2.000	29.23A	28.76A			Std. ±0.20A	
	20A	150V	2.000	20.20A	19.79A			Std. ±0.16A	
	12A	250V	2.000	12.18A	11.81A			Std. ±0.13A	
	8A	350V	2.000	8.16A	7.83A			Std. ±0.11A	
63812R-350-96	32A	50V	2.000	32.25A	31.74A			Std. ±0.22A	
	25A	150V	2.000	25.23A	24.76A			Std. ±0.19A	
	16A	250V	2.000	16.20A	15.79A			Std. ±0.16A	
	11A	350V	2.000	11.19A	10.80A			Std. ±0.14A	
63815R-350-105	35A	50V	2.000	35.28A	34.72A			Std. ±0.24A	
	25A	150V	2.000	30.26A	29.73A			Std. ±0.20A	
	18A	250V	2.000	18.22A	17.77A			Std. ±0.17A	
	12A	350V	2.000	12.21A	11.78A			Std. ±0.15A	

### 3.9.3.2 Power and CF Setting and Measurement Verification in CS Rectifier Mode CS Rectifier

This test verifies if the power setting and measurement accuracy are within specifications when operating in Meas. & Setup (3\_Phase) CS Rectifier mode. For each Power Analyzer reading, the front panel display of power measurement should be within the specification.

Regenerative AC Electronic Load reading power = power setting  $\pm$  inaccuracy

PA (Vac): Vrms voltage measurement of Power Analyzer AC voltage

PA (S): VA measurement of Power Analyzer apparent power S

PA (CF): CF measurement of Power Analyzer AC voltage

#### Checking current

- Connect the Regenerative AC Electronic Load, AC Source, Power Analyzer, and Current Transducer as shown in Figure 3-5. Use the Power Analyzer to measure the apparent power S.
- Enter into Meas. & Setup (3\_Phase Mode) to start performing the verification listed in Table 3-3.
- Turn on the AC Source and set the output voltage (sinewave) as Table 3-3 shows. The current protection of AC Source must be greater than 35Arms with power protection larger than 5kVA.

Table 3-3 Power Measurement Verification Table

$\Phi 1$									
Model	Power (std.)	Output Voltage	CF	Power Accuracy		PA(S) Power	Panel Measured power	Panel Display Power Spec.	CF Spec. 3% F.S PA(CF)
				Max.	Min.				
63809R-350-87	1200VA	50V	1.414	1212.6VA	1187.4VA			Std. $\pm 28.8VA$	
	2000VA	150V	1.414	2015.0VA	1985.0VA			Std. $\pm 32.0VA$	
	2500VA	250V	1.414	2516.5VA	2483.5VA			Std. $\pm 34.0VA$	
	3000VA	350V	1.414	3018.0VA	2982.0VA			Std. $\pm 36.0VA$	
63812R-350-96	1500VA	50V	1.414	1516.5VA	1483.5VA			Std. $\pm 38.0VA$	
	2500VA	150V	1.414	2519.5VA	2480.5VA			Std. $\pm 42.0VA$	
	3000VA	250V	1.414	3021.0VA	2979.0VA			Std. $\pm 44.0VA$	
	4000VA	350V	1.414	4024.0VA	3976.0VA			Std. $\pm 48.0VA$	
63815R-350-105	1600VA	50V	1.414	1619.8VA	1580.2VA			Std. $\pm 46.4VA$	
	2500VA	150V	1.414	2522.5VA	2477.5VA			Std. $\pm 50.0VA$	
	3500VA	250V	1.414	3525.5VA	3474.5VA			Std. $\pm 54.0VA$	
	5000VA	350V	1.414	5030.0VA	4970.0VA			Std. $\pm 60.0VA$	

$\Phi 2$									
Model	Power (std.)	Output Voltage	CF	Power Accuracy		PA(S) Power	Panel Measured power	Panel Display Power Spec.	CF Spec. 3% F.S PA(CF)
				Max.	Min.				
63809R-350-87	1200VA	50V	1.414	1212.6VA	1187.4VA			Std. $\pm 28.8VA$	
	2000VA	150V	1.414	2015.0VA	1985.0VA			Std. $\pm 32.0VA$	
	2500VA	250V	1.414	2516.5VA	2483.5VA			Std. $\pm 34.0VA$	
	3000VA	350V	1.414	3018.0VA	2982.0VA			Std. $\pm 36.0VA$	
63812R-350-96	1500VA	50V	1.414	1516.5VA	1483.5VA			Std. $\pm 38.0VA$	
	2500VA	150V	1.414	2519.5VA	2480.5VA			Std. $\pm 42.0VA$	
	3000VA	250V	1.414	3021.0VA	2979.0VA			Std. $\pm 44.0VA$	
	4000VA	350V	1.414	4024.0VA	3976.0VA			Std. $\pm 48.0VA$	
63815R-350-105	1600VA	50V	1.414	1619.8VA	1580.2VA			Std. $\pm 46.4VA$	
	2500VA	150V	1.414	2522.5VA	2477.5VA			Std. $\pm 50.0VA$	
	3500VA	250V	1.414	3525.5VA	3474.5VA			Std. $\pm 54.0VA$	
	5000VA	350V	1.414	5030.0VA	4970.0VA			Std. $\pm 60.0VA$	
$\Phi 3$									
Model	Power (std.)	Output Voltage	CF	Power Accuracy		PA(S) Power	Panel Measured power	Panel Display Power Spec.	CF Spec. 3% F.S PA(CF)
				Max.	Min.				
63809R-350-87	1200VA	50V	1.414	1212.6VA	1187.4VA			Std. $\pm 28.8VA$	
	2000VA	150V	1.414	2015.0VA	1985.0VA			Std. $\pm 32.0VA$	
	2500VA	250V	1.414	2516.5VA	2483.5VA			Std. $\pm 34.0VA$	
	3000VA	350V	1.414	3018.0VA	2982.0VA			Std. $\pm 36.0VA$	
63812R-350-96	1500VA	50V	1.414	1516.5VA	1483.5VA			Std. $\pm 38.0VA$	
	2500VA	150V	1.414	2519.5VA	2480.5VA			Std. $\pm 42.0VA$	
	3000VA	250V	1.414	3021.0VA	2979.0VA			Std. $\pm 44.0VA$	
	4000VA	350V	1.414	4024.0VA	3976.0VA			Std. $\pm 48.0VA$	
63815R-350-105	1600VA	50V	1.414	1619.8VA	1580.2VA			Std. $\pm 46.4VA$	
	2500VA	150V	1.414	2522.5VA	2477.5VA			Std. $\pm 50.0VA$	

	3500VA	250V	1.414	3525.5VA	3474.5VA			Std. ±54.0VA	
	5000VA	350V	1.414	5030.0VA	4970.0VA			Std. ±60.0VA	

### 3.9.3.3 Resistance Setting and Measurement Verification in CR Mode CR mode

This test verifies if the resistance setting and measurement accuracy are within specifications when operating in Meas. & Setup (3\_Phase) CR mode. For each Power Analyzer reading, the front panel display of current measurement should be within the specification.

Regenerative AC Electronic Load reading current = resistance setting (convert to current) ± inaccuracy

PA (Vac): Vrms voltage measurement of Power Analyzer AC voltage

PA (Iac): Irms measurement of Power Analyzer AC current

ACL (F): Frequency measurement of AC voltage of Regenerative AC Electronic Load

#### Checking current

- Connect the Regenerative AC Electronic Load, AC Source, Power Analyzer, and Current Transducer as shown in Figure 3-5. Use the Power Analyzer to measure the AC Irms.
- Enter into Meas. & Setup (3\_Phase Mode) to start performing the verification listed in Table 3-4.
- Turn on the AC Source and set the output voltage (sinewave) as Table 3-4 shows. The current protection of AC Source must be greater than 35Arms with power protection larger than 5kVA.

Table 3-4 Resistance Setting and Measurement Verification Table (with Load)

Φ1								
Model	Resistance (std.)	Output Voltage	Current Accuracy		PA(Iac) Current	Panel Measured Current	Panel Display Current Spec.	CF Spec. 3% F.S PA(CF)
			Max.	Max.				
63809R-350-87	1.72Ω	50V	29.23A	28.76A			Std. ±0.20A	
	7.5Ω	150V	20.20A	19.79A			Std. ±0.16A	
	20.83Ω	250V	12.18A	11.81A			Std. ±0.13A	
	43.75Ω	350V	8.16A	7.83A			Std. ±0.11A	
63812R-350-96	1.56Ω	50V	32.25A	31.74A			Std. ±0.22A	
	6Ω	150V	25.23A	24.76A			Std. ±0.19A	
	15.62Ω	250V	16.20A	15.79A			Std. ±0.16A	
	31.81Ω	350V	11.19A	10.80A			Std. ±0.14A	
63815R-350-105	1.42Ω	50V	35.28A	34.72A			Std. ±0.24A	
	6Ω	150V	30.26A	29.73A			Std. ±0.20A	
	13.88Ω	250V	18.22A	17.77A			Std. ±0.17A	
	29.16Ω	350V	12.21A	11.78A			Std. ±0.15A	

Φ2								
Model	Resistance (std.)	Output Voltage	Current Accuracy		PA(lac) Current	Panel Measured Current	Panel Display Current Spec.	CF Spec. 3% F.S PA(CF)
			Max.	Max.				
63809R-350-87	1.72Ω	50V	29.23A	28.76A			Std. ±0.20A	
	7.5Ω	150V	20.20A	19.79A			Std. ±0.16A	
	20.83Ω	250V	12.18A	11.81A			Std. ±0.13A	
	43.75Ω	350V	8.16A	7.83A			Std. ±0.11A	
63812R-350-96	1.56Ω	50V	32.25A	31.74A			Std. ±0.22A	
	6Ω	150V	25.23A	24.76A			Std. ±0.19A	
	15.62Ω	250V	16.20A	15.79A			Std. ±0.16A	
	31.81Ω	350V	11.19A	10.80A			Std. ±0.14A	
63815R-350-105	1.42Ω	50V	35.28A	34.72A			Std. ±0.24A	
	6Ω	150V	30.26A	29.73A			Std. ±0.20A	
	13.88Ω	250V	18.22A	17.77A			Std. ±0.17A	
	29.16Ω	350V	12.21A	11.78A			Std. ±0.15A	
Φ3								
Model	Resistance (std.)	Output Voltage	Current Accuracy		PA(lac) Current	Panel Measured Current	Panel Display Current Spec.	CF Spec. 3% F.S PA(CF)
			Max.	Max.				
63809R-350-87	1.72Ω	50V	29.23A	28.76A			Std. ±0.20A	
	7.5Ω	150V	20.20A	19.79A			Std. ±0.16A	
	20.83Ω	250V	12.18A	11.81A			Std. ±0.13A	
	43.75Ω	350V	8.16A	7.83A			Std. ±0.11A	
63812R-350-96	1.56Ω	50V	32.25A	31.74A			Std. ±0.22A	
	6Ω	150V	25.23A	24.76A			Std. ±0.19A	
	15.62Ω	250V	16.20A	15.79A			Std. ±0.16A	
	31.81Ω	350V	11.19A	10.80A			Std. ±0.14A	
63815R-350-105	1.42Ω	50V	35.28A	34.72A			Std. ±0.24A	
	6Ω	150V	30.26A	29.73A			Std. ±0.20A	
	13.88Ω	250V	18.22A	17.77A			Std. ±0.17A	
	29.16Ω	350V	12.21A	11.78A			Std. ±0.15A	



## 4. Parallel Operation

### 4.1 Signal Cable Connection for Parallel Mode

#### 4.1.1 Connecting Cable for Two Units

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

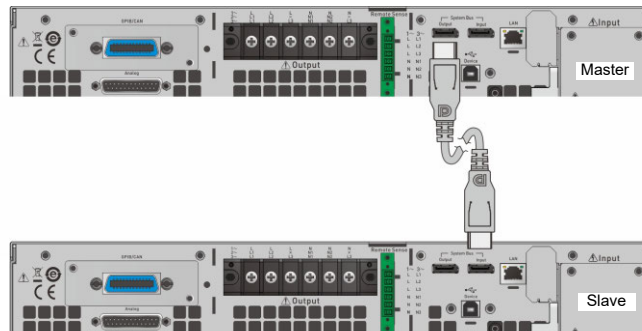


Figure 4-1 Diagram for Connecting Two Units in Parallel

#### 4.1.2 Connecting Cables for Three Units

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

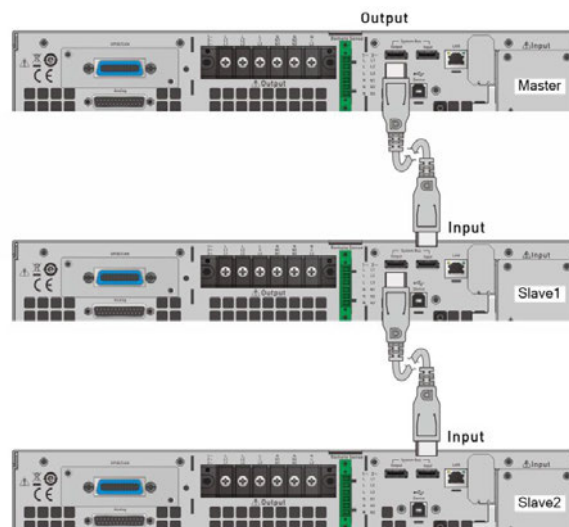


Figure 4-2 Diagram for Connecting Three Units in Parallel

#### Notice

1. When multiple electronic loads are operated in parallel, the coupling of Master and Slave must be conducted under the same conditions. It is forbidden to change settings between operations, otherwise it will cause error output.

2. When the 63800R series are operated in parallel, the maximum output current per phase is 315A as shown in Table 4-1.

Table 4-1

63800R Series Model	Parallel Mode	
	Max. Parallel No.	Max. Output Current (A) per Phase
63809R-350-87	3	261
63812R-350-96	3	288
63815R-350-105	3	315

3. Different models cannot be paralleled for use.
4. When parallel is in use, make sure the capacity of the circuit breaker is sufficient, and the power cord earth wire is connected to the same point and grounded correctly.
5. Same models in the 63800R series can be connected in parallel, and the maximum number is 3 units. When more than 3 units are planned for paralleling, please contact the sales service or agents of Chroma.

## 4.2 Settings

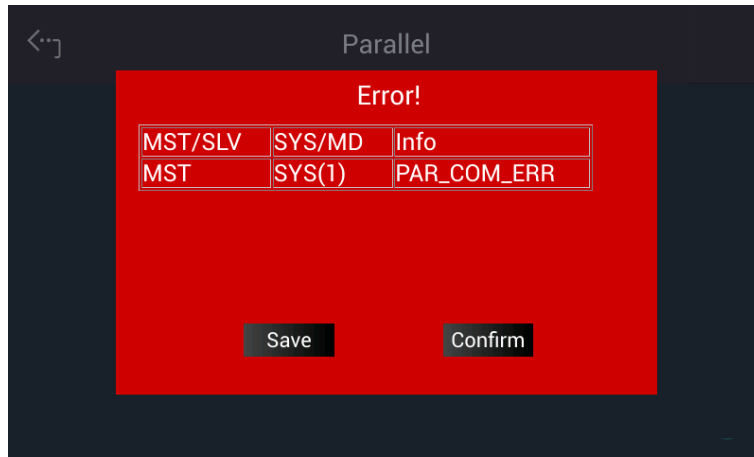
See section [錯誤! 找不到參照來源。](#) for the detailed setting information.

## 4.3 Troubleshooting

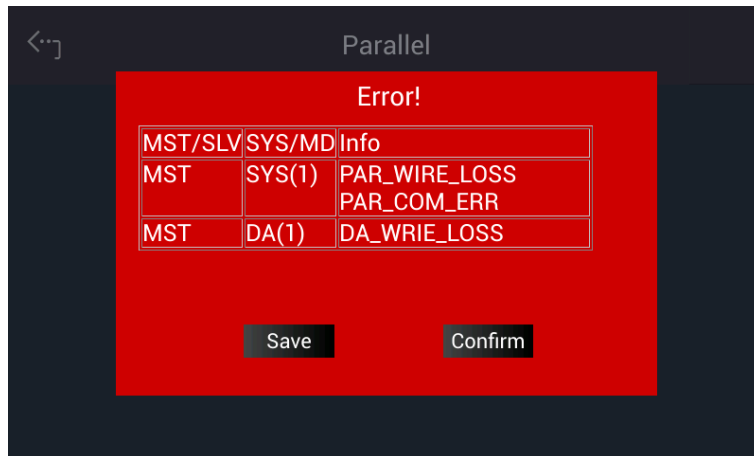
When paralleling multiple devices, each device must have a parallel cable to transmit the signals. When the Slave number is set incorrectly an error message will result, follow the procedure below for troubleshooting and re-execute parallel/series connection as needed.

### 4.3.1 Wire Loss

If "SYS\_PAR\_COM\_ERR" occurs when enabling the Master connection, check to see if the parallel/serial cable is properly connected and the fixture for parallel/series connection is properly installed. Also, check to see if another Regenerative AC Electronic Load is set to Slave.



If the parallel/series cable is not connected properly or disconnected when enabling the Master connection, a “SYS\_PAR\_WIRE\_LOSS” a warning will appear. In this case, turn the device off first and check if the parallel/serial cable is connected firmly and reboot.





## 5. Remote Operation

### 5.1 Introduction

The Regenerative AC Electronic Load can be controlled remotely via USB, GPIB, or LAN.

The USB interface supports USB 2.0/USB 1.1 while the GPIB interface is an 8-bit parallel data bus that is synchronized by the bus command from the host.

#### 5.1.1 USB Interface

- (1) Hardware Support: USB 2.0 and USB 1.1
- (2) Software Support: USBTMC class and USB488 subclass
- (3) OS Support: Windows 7/10
- (4) Installing Driver: The USB Interface of Regenerative AC Electronic Load supports USBTMC, so if the PC's operating system (OS) supports USBTMC (installed NI-VISA runtime version 3.00 or above) there is no need to install other drivers. The operating system 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 AC Electronic Load via NI-VISA after using USB once connected.

Related Documents:

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

#### 5.1.2 GPIB Interface

The default GPIB address is 30 and it can be changed from the "Configuration" menu (see 3.5.2.2.)

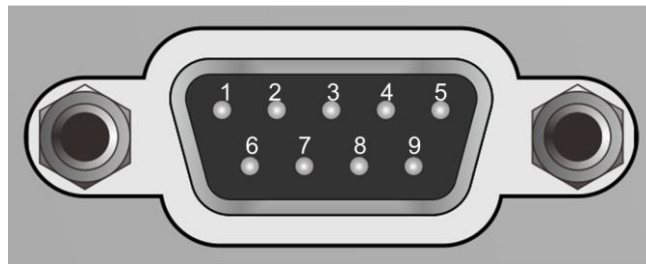
GPIB Capability	Description	Interface Function
Talker/Listener	Commands and response messages can be sent and received via the GPIB bus. Status information can be retrieved by serial query.	AH1, SH1, T6, L4
Service Request	The Regenerative AC Electronic Load sets the SRQ to be true if there is a service request.	SR1
Remote/Local	When the Regenerative AC Electronic Load is turned on in local mode, it can operate the front panel. In remote mode, all other touch buttons are invalid except  . Tapping  can return to local mode.	RL1

### 5.1.3 LAN Interface

To remote program a Regenerative AC Electronic Load via a PC with LAN interface, confirm the IP address, Gateway address and Net Mask in advance. See 3.5.2 for detail settings. To ensure reliable data transmission, TCP is used for data transmission and the communication port is 5025.

### 5.1.4 CAN Interface

The pin definition is listed in the table below.



Pin	Signal	Direction	Description
1	NC	-	Not connected
2	CAN_L	Input or Output	CAN Differential Signal (Low)
3	DGND	-	Digital Ground
4	NC	-	Not connected
5	NC	-	Not connected
6	NC	-	Not connected
7	CAN_H	Input or Output	CAN Differential Signal (High)
8	NC	-	Not connected
9	NC	-	Not connected

## 5.2 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.

### 5.2.1 Conventions

Angle brackets	<	>	Items in angle brackets are parameter abbreviations.
Vertical bar			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.

## 5.2.2 Numerical Data Formats

All data programmed to or returned from the Regenerative AC Electronic Load are in ASCII format. The data can be numerical or character string.

Symbol	Description	Example
NR1	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

## 5.2.3 Boolean Data Format

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

## 5.2.4 Character Data Format

The character strings returned by query command may be in either of the following forms:

<CRD> Character Response Data: character string with maximum length of 12.  
 <SRD> String Response Data: character string.

## 5.2.5 Basic Definition

### Command Tree Table:

The commands of the Regenerative AC Electronic Load are structured hierarchically (i.e. tree system). The full path must be specified to obtain a particular command. The 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 5.4. The Regenerative AC Electronic Load 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 AC Electronic Load 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. There are three permitted terminators:

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

**Notice** The response message is terminated by <NL> <END> for GPIB, and <NL> for USB and LAN.

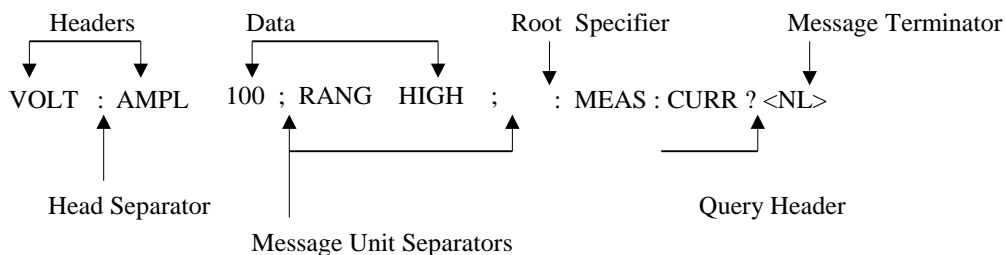


Figure 5-1 Structure of Command Message

### 5.3 Traversal of the Command Tree

Multiple 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.



## 5.4 Commands of Regenerative AC Electronic Load

This section addresses syntax and parameters of all commands for the Regenerative AC Electronic Load. The examples are common for each command.

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.

### 5.4.1 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 common 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>	This command sets the value of standard event status enabled register. This command programs the Standard Event register bits. If one or more enabled events of Standard Event registers are set, the ESB of Status Byte Register is set as well.

Bit Configuration of Standard Event Status Enabled Register

Bit Position	7	6	5	4	3	2	1	0
Bit Name	PON	---	CME	EXE	DDE	QYE	---	OPC
CME = Command Error				DDE = Device-dependent error				
EXE = Execution Error				OPC = Operation Completed				
PON = Power On				QYE = Query Error				

*ESE?	This command queries the value of standard event status enabled register.
*ESR?	This command queries the standard event register and automatically clears it to 0 after queried. The bits of configuration are the same as Standard Event Status Enabled register.
*IDN?	This command queries the manufacturer, model no., serial no., and firmware version of Regenerative AC Electronic Load. Return Parameter Chroma,63815R-350-105,00000000123456,1.00 Chroma : Manufacturer 63815R-350-105 : Model no. 00000000123456 : Serial no. 1.00 : Firmware version

- \*RCL 0      This command is used to restore the factory default state.
- \*RST      It resets the Regenerative AC Electronic Load to the initial states. It's better to wait for 3 seconds to send the next command.
- \*SRE      It sets conditions of Service Request Enabled Register. If one or more of the enabled events of the Status Byte Register is set, the MSS and RQS of Status Byte Register are set as well.
- \*SRE?      This query returns the Service Request Enabled Register.
- \*STB?      This query returns the Status Byte Register.

Bit Configuration of Status Byte Register

Bit Position	7	6	5	4	3	2	1	0
Condition	--	MSS RQS	ESB	MAV	QUES	--	--	--

- ESB      = Event Status Byte Summary
- QUES     = Questionable Status Summary
- RQS      = Request for Service
- MSS      = Master Status Summary
- MAV      = Message Available

- \*TST?      It queries the self-test result of the Regenerative AC Electronic Load.

## 5.4.2 Instrument Command Dictionary

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.

### 5.4.2.1 SYSTEM Subsystem

#### SYSTEM

- :ERRor?
- :VERSion?
- :INTernal?
- :LOCal
- :REMote
- :DATE
- :TIME
- :MODule
- :VERSion?

#### SYSTEM:ERRor?

- Description            : This command queries the error string of the command parser.
- Query Syntax            : SYSTEM:ERRor?
- Parameter               : None
- Return Parameter        : Error string response as follows:

0,"No error"	-113,"Undefined header"	-211,"Data stale"
-101,"Invalid character"	-121,"Invalid character in number"	-221,"Setting conflict"
-102,"Syntax error"	-123,"Numeric overflow"	-222,"Data out of range"
-103,"Invalid separator"	-124,"Too many digits"	-223,"Too much data"
-104,"Data type error"	-131,"Invalid suffix"	-224,"Self-test failed"
-105,"GET not allowed"	-141,"Invalid character data"	-225,"Too many errors"
-106,"Illegal parameter value"	-148,"Character data not allowed"	-226,"Data exceed Vpeak value"
-108,"Parameter not allowed"	-151,"Invalid string data"	-410,"INTERRUPTED"
-109,"Missing parameter"	-158,"String data not allowed"	-430,"DEADLOCKED"
-112,"Program mnemonic too long"	-203,"Command protected"	-440,"UNTERMINATED"

**SYSTem:VERSion?**

Description : This query requests the version of Regenerative AC Electronic Load that is compatible with the SCPI specification.

Query Syntax : SYSTem:VERSion?

Parameter : None

Return Parameter : Current version (XX.XX)

**SYSTem:LOCal**

Description : This command can only be used under the control of LAN and USB. If SYST:LOC is programmed, the Regenerative AC Electronic Load will be set in the LOCAL state, and the front panel will work.

Query Syntax : None

Parameter : None

Return Parameter : None

**SYSTem:REMOte**

Description : This command can only be used under the control of LAN and USB. If SYST:REM is programmed, the Regenerative AC Electronic Load will be set in the REMOTE state, and the front panel will be disabled except the "LOCAL/REMOTE" button.

Query Syntax : None

Parameter : None

Return Parameter : None

**SYSTem:DATE**

Description : This command sets the date of the Regenerative AC Electronic Load real time clock.

Query Syntax : SYSTem:DATE?

Parameter : <year>,<month>,<day>

Return Parameter : 2013,01,01

**SYSTem:TIME**

Description : This command sets the time (24H) of the Regenerative AC Electronic Load real time clock.

Query Syntax : SYSTem:TIME?

Parameter : <hour>,<minute>,<second>

Return Parameter : 20,30,01

### **SYSTem:VERSion:INTernal? [<n>]**

Description : This query requests the Regenerative AC Electronic Load to identify the HOST subsystem version.  
Query Syntax : SYSTem:VERSion:INTernal? [<n>]  
Parameter : <n>: It selects the HOST subsystem, range: 1~2, 1: DSP-CPU1, 2: DSP-CPU2.  
Return Parameter : Current version (XX.XX)

### **SYSTem:MODule:VERSion? <n>[,<m>]**

Description : This query requests the Regenerative AC Electronic Load to identify the subsystem version of internal power module.  
Query Syntax : SYSTem:MODule:VERSion? <n>[,<m>]  
Parameter : <n>: It selects the phase of a power module, range: 1~3.  
<m>: It selects the subsystem of power module, range: 1~2, 1: AD, 2: DA.  
Return Parameter : Current version (XX.XX)

## **5.4.2.2 INSTRUMENT Subsystem**

### **INSTrument**

:EDIT  
:Couple  
:NSElect  
:SElect  
:PHASe  
:STATus?

### **INSTrument:EDIT**

Description : It is very convenient to use a programmed command to set all phases at the same time for a Regenerative AC Electronic Load that is equipped with multiple phases. If INST:EDIT ALL has been programmed, it will sent all phases. INST:EDIT EACH command disables EDIT ALL command.  
Query Syntax : INSTrument:EDIT?  
Parameter : EACH | ALL  
Return Parameter : EACH | ALL

### **INSTrument:COUPle**

Description : It is easy to use a command to program all phases in a Regenerative AC Electronic Load with multiple phases. If INST:COUP ALL is programmed, this command will be sent to all phases. INST:COUP NONE command will cancel COUP ALL command.  
Query Syntax : INSTrument:COUPle?  
Parameter : NONE | ALL  
Return Parameter : NONE | ALL

### **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 AC Electronic Load will return  $\Phi$  2 measurement voltage. INST:NSEL follows the number to select phase.

Query Syntax : INSTrument:NSElect?  
 Parameter : 1 | 2 | 3  
 Return Parameter : 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 AC Electronic Load will return  $\Phi$  2 measurement voltage. INST:SElect follows the number to select phase.

Query Syntax : INSTrument:SElect?  
 Parameter : OUTPUT1 | OUTPUT2 | OUTPUT3  
 Return Parameter : OUTPUT1 | OUTPUT2 | OUTPUT3

**INSTrument:PHASe**

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

Query Syntax : INSTrument:PHASe?  
 Parameter : THREE | SINGLE  
 Return Parameter : THREE | SINGLE

**INSTrument : STATus?**

Description : The command queries the power module status of each phase in Regenerative AC Electronic Load.

Bit Configuration of Protection Status Register for Each Phase Power Module

<b>Bit Position</b>	15-10	9	8	7	6	5	4	3	2	1	0
<b>State</b>	---	INHIBIT	OVP	INP	OCP	FAN	SHT	OTP	OPP	INT-DA	INT-AD

INHIBIT: Remote Inhibit  
 OVP: Output Voltage Protection  
 INP: Line Input Protection  
 OCP: Over Current Protection  
 FAN: Fan Failure  
 SHT: Output Short Circuit Protection  
 OTP: Over Temperature Protection  
 OPP: Over Power Protection  
 INT-DA: DC/AC Power Module Protection  
 INT-AD: AC/DC Power Module Protection

Query Syntax : INSTRument:STATus?  
Return Parameter : 0 ~ 65535 ( $2^{16}-1$ )

#### INSTRument:STATus:AD?

Description : This command queries the AC/DC power module status of each phase in Regenerative AC Electronic Load.

Query Syntax : INSTRument:STATus:AD?  
Return Parameter : 0 ~ 4294967295 ( $2^{32}-1$ )

Bit[n]	Description	Bit[n]	Description	Bit[n]	Description	Bit[n]	Description
0	AD_VDC_OVP	8	DD_VO_OVP_F	16	DD_IO_REG_OCP	24	AD_MODEL_RES_ERR
1	AD_VDC_UVP	9	DD_VO_UVP_F	17	AD_RLY_STARTFAIL	25	DD_SHORT
2	AD_VRS_OVP	10	AD_IR_OCP	18	AD_PWM_TOP_FAULT	26	AD_MEM_ERR
3	AD_VTR_OVP	11	AD_IT_OCP	19	AD_PWM_BOT_FAULT	27	DD_LLC_STARTFAIL
4	AD_VST_OVP	12	AD_IS_OCP	20	AD_AC_STARTFAIL	28	AD_VAC_UBL
5	AD_VRS_UVP	13	AD_Vd_OVP	21	AD_PFC_STARTFAIL	29	DD_IP_OCP
6	AD_VTR_UVP	14	DD_IO_SRC_OCP	22	AD_HARD_ERR	30	AD_Vd_UVP
7	AD_VST_UVP	15	AD_OTP	23	DD_VO_UVP_S	31	AD_FRE_ERR

#### INSTRument:STATus:DA?

Description : This command queries the DC/AC power module status of each phase in Regenerative AC Electronic Load.

Query Syntax : INSTRument:STATus:DA?  
Return Parameter : 00 ~ 4294967295 ( $2^{32}-1$ )

Bit[n]	Description	Bit[n]	Description	Bit[n]	Description	Bit[n]	Description
0	DA_OCP	8	DA_HARD_ERR	16	DA_IC_OCP	24	DA_SRAM_ERR
1	DA_UUT_OVP_VLN	9	DA_PWM_R_FAULT	17	DA_VDAMP_OVP	25	DA_CALIB_ERR
2	DA_OVP	10	DA_PWM_L_FAULT	18	DA_OCP_S	26	-
3	DA_FW_PWMSHORT	11	DA_OTP	19	DA_WIRE_LOSS	27	-
4	DA_UUT_OVP_VLL	12	DA_UUT_UVP	20	DA_UTP	28	-
5	DA_OPP	13	DA_SHORT	21	DA_UUT_OVP_VDC	29	-
6	DA_SENSE_FAULT	14	DA_UUT_OFP	22	DA_UUT_FAULT	30	-
7	DA_ISHARE_ERR_F	15	DA_UUT_UFP	23	DA_PLL_FAIL	31	-

### 5.4.2.3 FETCH and MEASURE Subsystem

#### FETCH | MEASURE

[:SCALar]

: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.

: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 you to get measurement data from the Regenerative AC Electronic Load 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 AC current 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 : FETCh:CURRent:DC?, MEASure:CURRent:DC?

Return Parameter : <NR2>

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

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

Description : These queries return the rms current that is output from the output terminal.

Query Syntax : FETCh:CURRent:ACDC?, MEASure:CURRent:ACDC?

Return Parameter : <NR2>

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

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

Description : These queries return the peak current that is output from the output terminal.

Query Syntax : FETCh:CURRent:AMPLitude:MAXimum?,  
MEASure:CURRent:AMPLitude:MAXimum?

Return Parameter : <NR2>

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

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

Description : These queries return the current crest factor that is output from the output terminal.

Query Syntax : FETCh:CURRent:CREStfactor?  
MEASure:CURRent:CREStfactor?

Return Parameter : <NR2>

**FETCh[:SCALar]:FREQUency?**

**MEASure[:SCALar]:FREQUency?**

Description : These queries return the frequency of the voltage that is output from the output terminal.

Query Syntax : FETCh:FREQUency?  
MEASure:FREQUency?

Return Parameter : <NR2>

**FETCh[:SCALar]:POWER:AC[:REAL]?**

**MEASure[:SCALar]:POWER:AC[:REAL]?**

Description : These queries return the real power that is output from the output terminal.

Query Syntax : FETCh:POWER:AC?  
MEASure:POWER:AC?

Return Parameter : <NR2>

**FETCh[:SCALar]:POWER:AC:APParent?**

**MEASure[:SCALar]:POWER:AC:APParent?**

Description : These queries return the apparent power that is output from the output terminal.

Query Syntax : FETCh:POWER:AC:APParent?  
MEASure:POWER:AC:APParent?

Return Parameter : <NR2>

**FETCh[:SCALar]:POWER:AC:REACTIVE?**

**MEASure[:SCALar]:POWER:AC:REACTIVE?**

Description : These queries return the reactive power that is output from the output terminal. 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>

**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>

**FETCh[:SCALar]:POWER:AC:TOTAL?**

**MEASure[:SCALar]:POWER:AC:TOTAL?**

Description : These queries return the total of real power that is output from the output terminal.

Query Syntax : FETCh:POWER:AC:TOTAL?  
MEASure:POWER:AC:TOTAL?

Return Parameter : <NR2>



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

Description : These queries return the total of apparent power that is output from the output terminal.

Query Syntax : FETCh:POWer:AC:TOTal:APParent?  
MEASure:POWer:AC:TOTal:APParent?

Return Parameter : <NR2>

**FETCh[:SCALar]:VOLTage:AC?****MEASure[:SCALar]:VOLTage:AC?**

Description : These queries return the AC voltage 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 voltage that is output from the output terminal.

Query Syntax : FETCh[:SCALar]:VOLTage:DC?  
MEASure[:SCALar]:VOLTage:DC?

Return Parameter : <NR2>

**FETCh[:SCALar]:VOLTage:ACDC?****MEASure[:SCALar]:VOLTage:ACDC?**

Description : These queries return the rms voltage that is output from the output terminal.

Query Syntax : FETCh[:SCALar]:VOLTage:ACDC?  
MEASure[:SCALar]:VOLTage:ACDC?

Return Parameter : <NR2>

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

Description : These queries return the peak voltage that is output from the output terminal.

Query Syntax : FETCh:VOLTage:AMPLitude:MAXimum?  
MEASure:VOLTage:AMPLitude:MAXimum?

Return Parameter : <NR2>

**FETCh[:SCALar]:LINE:V12?****MEASure[:SCALar]:LINE:V12?**

Description : These queries return the line voltage between phase 1 and 2 of the output terminal.

Query Syntax : FETCh[:SCALar]:LINE:V12?  
MEASure[:SCALar]:LINE:V12?

Return Parameter : <NR2>

**FETCh[:SCALar]:LINE:V23?****MEASure[:SCALar]:LINE:V23?**

Description : These queries return the line voltage between phase 2 and 3 of the output terminal.

Query Syntax : FETCh[:SCALar]:LINE:V23?  
MEASure[:SCALar]:LINE:V23?

Return Parameter : <NR2>

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

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

Description : These queries return the line voltage between phase 3 and 1 of the output terminal.

Query Syntax : FETCh[:SCALar]:LINE:V31?  
 MEASure[:SCALar]:LINE:V31?

Return Parameter : <NR2>

### 5.4.2.4 OUTPUT Subsystem

**OUTPut**

[:STATe]  
 :PROTection  
 :CLEAr  
 :STATe?

**OUTPut[:STATe]**

Description : This command enables or disables the output of the Regenerative AC Electronic Load.

Query Syntax : OUTPut[:STATe]?

Parameter : OFF | ON

Return Parameter : OFF | ON

**OUTPut:PROTection:CLEAr**

Description : This command clears the warning status of protection. All conditions that generate the faults must be re solved before the protection is cleared.

Query Syntax : None

Parameter : None

Return Parameter : None

**OUTPut:PROTection:STATe?**

Description : This command queries the value of the protection status register.

Bit Configuration of Protection Status Register for Each Phase Power Module

Bit Position	15-10	9	8	7	6	5	4	3	2	1	0
State	---	INHIBIT	OVP	INP	OCP	FAN	SHT	OTP	OPP	INT-DA	INT-AD

- INHIBIT: Remote Inhibit
- OVP: Output voltage protection
- INP: Line input protection
- OCP: Over current protection
- FAN: Fan failure
- SHT: Output short circuit protection
- OTP: Over temperature protection
- OPP: Over power protection
- INT-DA: DC/AC power module protection
- INT-AD: AC/DC power module protection

Query Syntax : OUTPut:PROTection:STATe?  
 Parameter : None  
 Return Parameter : <NR1>, 0 ~ 65535 ( $2^{16}-1$ )

### 5.4.2.5 MSTSLV Subsystem

#### MSTSLV

:FUNC  
 :STATus  
 :SEL  
 :SLVNUM

#### MSTSLV:FUNC

Description : This command sets parallel or unparallel the Regenerative Electronic Loads.  
 Query Syntax : MSTSLV:FUNC?  
 Parameter : DISABLE | ENABLE  
 Return Parameter : DISABLE | ENABLE

#### MSTSLV:FUNC:STATus?

Description : This command queries the parallel status at present. It returns WAIT to indicate that the device is under paralleling or unparalleling.  
 Query Syntax : MSTSLV:FUNC:STATus?  
 Parameter : None  
 Return Parameter : DISABLE | ENABLE | WAIT

#### MSTSLV:SEL

Description : This command sets the role for paralleling.  
 Query Syntax : MSTSLV:SEL?  
 Parameter : <NR1>, range: 0~2, 0:MASTER, 1:SLAVE01, 2:SLAVE02.  
 Return Parameter : <NR1>

#### MSTSLV:SLVNUM

Description : If MSTSLV:SEL 0 is set , this command can set the number of SLAVEs.  
 Query Syntax : MSTSLV:SLVNUM?  
 Parameter : <NR1>, range: 1~2 , 1:SLAVE no. is 1, 2:SLAVE no. is 2.  
 Return Parameter : <NR1>

### 5.4.2.6 SOURCE Subsystem

#### [SOURce:]

CURRent  
 :LIMit  
 :DELay  
 :PROTection  
 POWer  
 :PROTection

#### [SOURce:]CURRent:LIMit

Description : This command sets the value for over current protection.

Query Syntax : [SOURce:]CURRent:LIMit?  
Parameter : <NR2>, valid range: 0.01 ~ the model's maximum current  
specification (unit: A).  
Return Parameter : <NR2>

#### **[SOURce:]CURRent:DELay**

Description : This command sets the time delayed for triggering over current  
protection.  
Query Syntax : [SOURce:]CURRent:DELay?  
Parameter : <NR2>, valid range: 0.1 ~ 3.0 (unit: 0.1 second).  
Return Parameter : <NR2>

#### **[SOURce:]CURRent:PROTection**

Description : This command sets the value for over current protection.  
Query Syntax : [SOURce:]CURRent:PROTection?  
Parameter : <NR2>, valid range: 0.01 ~ the model's maximum operable current  
\*1.05% (unit: A).  
Return Parameter : <NR2>

#### **[SOURce:]POWer:PROTection**

Description : This command sets the value for over power protection.  
Query Syntax : [SOURce:]POWer:PROTection?  
Parameter : <NR2>, valid range: 0.1 ~ the model's maximum power specification  
(unit: W).  
Return Parameter : <NR2>

### **5.4.2.7 CONFIGURE Subsystem**

#### **[SOURce:]**

CONFigure  
:INHibit  
:EXTON  
:AVERage

#### **[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:EXTON**

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

#### **[SOURce:]CONFigure:AVERage**

Description : This command sets the average times for measurement.  
Query Syntax : [SOURce:]CONFigure:AVERage?  
Parameter : 1 | 2 | 4 | 8 | 16 | 32  
Return Parameter: 1 | 2 | 4 | 8 | 16 | 32

## 5.4.2.8 STATUS Subsystem

### STATUs

:OPERation  
 [:EVENT]?  
 :ENABle  
 :QUESTionable  
 :CONDition  
 [:EVENT]?  
 :ENABle  
 :NTRansition  
 :PTRansition

#### STATUs:OPERation[:EVENT]?

Description : This command queries the Operation Status register.  
 Query Syntax : STATUs:OPERation[:EVENT]?  
 Parameter : None  
 Return 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>, valid range: 0 ~ 65535  
 Return Parameter : <NR1>

#### STATUs:QUESTionable:CONDition?

Description : This query returns the value of Questionable Condition register. It is a read only register that saves the questionable condition of Regenerative AC Electronic Load in real-time.  
 Query Syntax : STATUs:QUESTionable:CONDition?  
 Parameter : None  
 Return Parameter : <NR1>

#### STATUs:QUESTionable[:EVENT] ?

Description : This query 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 as well.  
 Query Syntax : STATUs:QUESTionable[:EVENT]?  
 Parameter : None  
 Return Parameter : <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>, valid range: 0 ~ 65535  
 Return Parameter : <NR1>

**STATus:QUESTIONable:NTRansition**

Description : This command sets or reads the value of Questionable NTR registers.  
 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 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.
- \* 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 Configuration of Questionable Status Register

<b>Bit Position</b>	15-10	9	8	7	6	5	4	3	2	1	0
<b>Condition</b>	---	INHIBIT	OVP	INP	OCP	FAN	SHT	OTP	OPP	INT-DA	INT-AD

- INHIBIT: Remote Inhibit
- OVP: Output voltage protection
- INP: Line input protection.
- OCP: Over current protection.
- FAN: Fan failure.
- SHT: Output short protection.
- OTP: Over temperature protection.
- OPP: Over power protection.
- INT-DA: DC/AC power module protection
- INT-AD: AC/DC power module protection

Query Syntax : STATus:QUESTIONable:NTRansition?  
 Parameter : <NR1>, valid range: 0 ~ 65535  
 Return Parameter : <NR1>

**STATus:QUESTIONable:PTRansition**

Description : This command sets or reads the values of Questionable PTR register. Please refer to the description of previous command.

Query Syntax : STATus:QUESTIONable:PTRansition?  
 Parameter : <NR1>, valid range: 0 ~ 65535  
 Return Parameter : <NR1>

## 5.4.2.9 LOAD Subsystem

### LOAD

- :MODE
- :CCREctified
  - :CURRent
  - :CREStfactor
  - :SHAPE
- :CPREctified
  - :POWEr
  - :CREStfactor
- :CR
  - :RESistor
- :CCPHase
  - :CURRent
  - :DEGREE
- :CPPHase
  - :POWEr
    - :REAL?
    - :REACTIVE?
  - :DEGREE
  - :PF
  - :MODE
- :CCConstant
  - :CURRent
  - :CREStfactor
  - :PF
  - :MODE
- :CPCConstant
  - :POWEr
  - :CREStfactor
  - :PF
  - :MODE
- :CONStant
  - :MODE
  - :PRIORity
- :PHASe
- :LIMit
  - :ON
  - :OFF
- :SLEW
  - :CURRent
  - :POWEr
- :LIMit
- :CURRent
  - :CREStfactor
  - :POWEr
    - :APPArnet
    - :REAL
- :STANdby
- :SCIRcuit

### **LOAD:MODE**

Description : This command sets the Load operating mode.  
Query Syntax : LOAD:MODE?  
Parameter : CCRE | CPRE | CR | CCPH | CPPH | CCCO | CPCO  
Return Parameter : CCRE | CPRE | CR | CCPH | CPPH | CCCO | CPCO

### **LOAD:CCREctified:CURRent**

Description : This command sets the loading current in CC rectified mode.  
Query Syntax : LOAD:CCREctified:CURRent?  
Parameter : <NR2>, valid range: 0.0 ~ 35.00 (unit: A)  
Return Parameter : <NR2>

### **LOAD:CCREctified:CREStfactor**

Description : This command sets the crest factor in CC rectified mode.  
Query Syntax : LOAD:CCREctified:CREStfactor?  
Parameter : <NR2>, valid range: 1.414 ~ 3.000  
Return Parameter : <NR2>

### **LOAD:CCREctified:SHAPE**

Description : This command sets the waveform shape of loading current in CC rectified mode.  
Query Syntax : LOAD:CCREctified:SHAPE?  
Parameter : SINE | POS | NEG | LEAD | LAG  
Return Parameter : SINE | POS | NEG | LEAD | LAG

### **LOAD:CPREctified:POWER**

Description : This command sets the loading power in CS rectified mode.  
Query Syntax : LOAD:CPREctified:POWER?  
Parameter : <NR2>, valid range: 0.0 ~ 5000.0 (unit: VA)  
Return Parameter : <NR2>

### **LOAD:CPREctified:CREStfactor**

Description : This command sets the crest factor of loading current in CS rectified mode.  
Query Syntax : LOAD:CPREctified:CREStfactor?  
Parameter : <NR2>, valid range: 1.414 ~ 3.000  
Return Parameter : <NR2>

### **LOAD:CR:RESistor**

Description : This command sets the loading resistance in CR mode.  
Query Syntax : LOAD:CR:RESistor?  
Parameter : <NR2>, valid range: 1 ~ 300 (unit: Ohm)  
Return Parameter : <NR2>

### **LOAD:CCPHase:CURRent**

Description : This command sets the loading current in CC Lead/Lag mode.  
Query Syntax : LOAD:CCPHase:CURRent?  
Parameter : <NR2>, valid range: 0.0 ~ 35.00 (unit: A)  
Return Parameter : <NR2>

### **LOAD:CCPHase:DEGREE**

Description : This command sets the phase degree between loading current and UUT voltage in CC Lead/Lag mode.  
Query Syntax : LOAD:CCPHase:DEGREE?



Parameter : Phase Limit ON :<NR2>, valid range: -90.0 ~ 90.0 (unit: Degree)  
Phase Limit OFF :<NR2>, valid range: -180.0 ~ 180.0 (unit: Degree)  
Return Parameter : <NR2>

**LOAD:CPPHase:POWer**

Description : This command sets the loading power in CS Lead/Lag mode.  
Query Syntax : LOAD:CPPHase:POWer?  
Parameter : <NR2>, valid range: 0.0 ~ 5000.0 (unit: VA)  
Return Parameter : <NR2>

**LOAD:CPPHase:DEGRee**

Description : This command sets the phase degree between loading current and UUT voltage in CS Lead/Lag mode.  
Query Syntax : LOAD:CPPHase:DEGRee?  
Parameter : <NR2>, valid range: -84.26 ~ 84.26 (unit: Degree)  
Return Parameter : <NR2>

**LOAD:CPPHase:PF**

Description : This command sets the PF value of loading current and UUT voltage in CS Lead/Lag mode. This setting is linked to LOAD:CPPHase:DEGRee.  
Query Syntax : LOAD:CPPHase:PF?  
Parameter : <NR2>, valid range: 0.1~1  
Return Parameter : <NR2>

**LOAD:CPPHase:PF:MODE**

Description : This command sets the current in CP phase mode to lead or lag behind the UUT voltage. This setting is linked to LOAD:CPPHase:DEGRee.  
Query Syntax : LOAD:CPPHase:PF:MODE?  
Parameter : LEAD | LAG  
Return Parameter : LEAD | LAG

**LOAD:CPPHase:POWer:REAL?**

Description : This command queries the loading equivalent real power in CS Lead/Lag mode.  
Query Syntax : LOAD:CPPHase:POWer:REAL?  
Parameter : None  
Return Parameter : <NR2>

**LOAD:CPPHase:POWer:REACTIVE?**

Description : This command queries the loading equivalent reactive power in CS Lead/Lag mode.  
Query Syntax : LOAD:CPPHase:POWer:REACTIVE?  
Parameter : None  
Return Parameter : <NR2>

**LOAD:CCConstant:CURRent**

Description : This command sets the CC mode loading current.  
Query Syntax : LOAD:CCConstant:CURRent?  
Parameter : <NR2>, valid range: 0.0 ~ 35.00 (unit: A)

Return Parameter : <NR2>

**LOAD:CCConstant:CREStfactor**

Description : This command sets the loading crest factor in CC mode. Its high and low limits are linked to the PF setting value.

Query Syntax : LOAD:CCConstant:CREStfactor?

Parameter : <NR2>, valid range: 1.414 ~ 3.000

Return Parameter : <NR2>

**LOAD:CCConstant:PF**

Description : This command sets the PF value of CC mode loading current and UUT voltage. Its high and low limits are linked to the CREStfactor setting value.

Query Syntax : LOAD:CCConstant:PF?

Parameter : <NR2>, valid range: 0.1~1

Return Parameter : <NR2>

**LOAD:CCConstant:PF:MODE**

Description : This command sets the CC mode loading current leads or lags the UUT voltage.

Query Syntax : LOAD:CCConstant:PF:MODE?

Parameter : LEAD | LAG

Return Parameter : LEAD | LAG

**LOAD:CPCConstant:POWer**

Description : This command sets the CP mode loading power.

Query Syntax : LOAD:CPCConstant:POWer?

Parameter : <NR2>, valid range: 0.0 ~ 5000.0 (unit: W)

Return Parameter : <NR2>

**LOAD:CPCConstant:CREStfactor**

Description : This command sets the loading crest factor in CP mode. Its high and low limits are linked to the PF setting value.

Query Syntax : LOAD:CPCConstant:CREStfactor?

Parameter : <NR2>, valid range: 1.414 ~ 3.000

Return Parameter : <NR2>

**LOAD:CPCConstant:PF**

Description : This command sets the PF value of CP mode loading current and UUT voltage. Its high and low limits are linked to the CREStfactor setting value.

Query Syntax : LOAD:CPCConstant:PF?

Parameter : <NR2>, valid range: 0.1~1

Return Parameter : <NR2>

**LOAD:CPCConstant:PF:MODE**

Description : This command sets the CP mode loading current leads or lags the UUT voltage.

Query Syntax : LOAD:CPCConstant:PF:MODE?

Parameter : LEAD | LAG

Return Parameter : LEAD | LAG

**LOAD:CONStant:MODE**

Description : This command sets the operating mode for setting the CF and PF

value in CC/CP mode.  
 Query Syntax : LOAD:CONStant:MODE?  
 Parameter : BOTH | CF | PF  
 Return Parameter : BOTH | CF | PF

**LOAD:CONStant:MODE:PRIOrity**

Description : This command sets the priority order of CF and PF value in CC and CP mode when the operation mode of CF and PF is set to BOTH.  
 Query Syntax : LOAD:CONStant:PRIOrity?  
 Parameter : CF | PF  
 Return Parameter : CF | PF

**LOAD:PHASe:LIMit**

Description : This command switches the input range of the phase parameter.  
 Query Syntax : LOAD:PHASe:LIMit?  
 Parameter : ON | OFF  
 Return Parameter : ON | OFF

**LOAD:PHASe:ON**

Description : This command sets the start angle of current waveform.  
 Query Syntax : LOAD:PHASe:ON?  
 Parameter : <NR2>, valid range: 0.0 ~ 359.99  
 Return Parameter : <NR2>

**LOAD:PHASe:OFF**

Description : This command sets the end angle of current waveform.  
 Query Syntax : LOAD:PHASe:OFF?  
 Parameter : <NR2>, valid range: 0.0 ~ 360.00  
 Return Parameter : <NR2>

**LOAD:SLEW:CURREnt**

Description : This command sets the current slew rate in CC/CCRE/CCPH mode.  
 Query Syntax : LOAD:SLEW:CURREnt?  
 Parameter : <NR2>, valid range: 0.01 ~ 800.0 A/ms  
 Return Parameter : <NR2>

**LOAD:SLEW:POWer**

Description : This command sets the power slew rate in CP/CPRE/CPPH mode.  
 Query Syntax : LOAD:SLEW:POWer?  
 Parameter : <NR2>, valid range: 0.1 ~ 80000.0 VA/ms  
 Return Parameter : <NR2>

**LOAD:LIMit:CURREnt**

Description : This command limits the current setting range.  
 Query Syntax : LOAD:LIMit:CURREnt?  
 Parameter : <NR2>, valid range: 0.0~ 35.00 (unit: A)  
 Return Parameter : <NR2>

**LOAD:LIMit:CREStfactor**

Description : This command limits the CF setting range.  
 Query Syntax : LOAD:LIMit:CREStfactor?

Parameter : <NR2>, valid range: 1.414 ~ 3.000  
Return Parameter : <NR2>

**LOAD:LIMit:POWer:APParent**

Description : This command limits the apparent power setting range.  
Query Syntax : LOAD:LIMit:POWer:APParent?  
Parameter : <NR2>, valid range: 0.0 ~ 5000.0 (unit: VA)  
Return Parameter : <NR2>

**LOAD:LIMit:POWer:REAL**

Description : This command limits the real power setting range.  
Query Syntax : LOAD:LIMit:POWer:REAL?  
Parameter : <NR2>, valid range: 0.0 ~ 5000.0 (unit: W)  
Return Parameter : <NR2>

**LOAD:STANdby**

Description : This command enables or disables the Stand-by function.  
Query Syntax : LOAD:STANdby?  
Parameter : ENABLE | DISABLE  
Return Parameter : ENABLE | DISABLE

**[LOAD:]SCIRcuit**

Description : This enables or disables the short circuit simulation function.  
Query Syntax : [LOAD:]SCIRcuit?  
Parameter : 0 | OFF, 1 | ON  
Return Parameter : 0 | 1

## Appendix A TTL Signal Pin Assignments

The Analog Interface is a 25-pin terminal located on the rear panel as shown in Figure A-1.

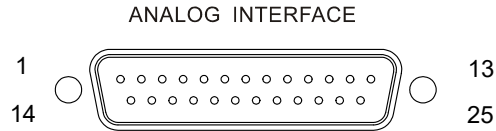


Figure A-1

Pin No.	Signal	Description
1	NA	NA
2	AC-ON	This pin turns to HIGH when the Regenerative AC Electronic Load outputs voltage and turns to LOW when quits output.
3	Reserved	NA
4	Phase	1-phase/3-phase mode relay signal switch for external controller. When the Phase signal is LOW, the Regenerative AC Electronic Load is in 3-phase output mode, and if the Phase signal is HIGH, the Regenerative AC Electronic Load is in 1-phase output mode.
5	Reserved	NA
6	/ Remote-Inhibit	Controls the Remote Inhibit signal. When the Remote Inhibit signal is LOW, the Regenerative AC Electronic Load stops output; however, if the Remote Inhibit signal turns HIGH now the simulator remains no output until the ON/OFF button is tapped to restart output.
7	Reserved	NA
8	NA	NA
9	NA	NA
10 <sup>*1*4</sup>	IMON $\Phi$ 1	Current monitoring output signal of $\Phi$ 1, the output range is -10V~10V.
11 <sup>*1*4</sup>	IMON $\Phi$ 3	Current monitoring output signal of $\Phi$ 3, the output range is -10V~10V.
12 <sup>*2</sup>	VMON $\Phi$ 1	Voltage monitoring output signal of $\Phi$ 1, the output range is -10V~10V.
13 <sup>*2</sup>	VMON $\Phi$ 3	Voltage monitoring output signal of $\Phi$ 3, the output range is -10V~10V.
14	/ FAULT-OUT	The voltage level of this pin is HIGH when the Regenerative AC Electronic Load is in normal mode, it will turn to LOW when the Regenerative AC Electronic Load is in protection mode.
15	NA	NA
16	APIDGND	I/O digital signal grounding.
17	Short	The Relay signal for controller external short circuit test, HIGH is Relay on.
18	/ Ext-ONOFF	It controls the External AC ON/OFF where HIGH is AC OFF and LOW is AC ON.
19	APIDGND	I/O digital signal grounding.
20	Reserved	NA
21	NA	NA

22	APIGND	External-V Reference signal grounding.
23 <sup>*1*3*4</sup>	IMON $\Phi$ 2	Current monitoring output signal of $\Phi$ 2, the output range is -10V~10V.
24	APIGND	V & IMON signal grounding.
25 <sup>*2</sup>	VMON $\Phi$ 2	Voltage monitoring output signal of $\Phi$ 2, the output range is -10V~10V.

- Note**
- \*1: IMON $\Phi$ 123 monitors the output line current ( $I_{\Phi 1, 2, 3}$ ) of the Regenerative AC Electronic Load, and its current monitoring range is -120A to 120A.
  - \*2: VMON $\Phi$ 123 monitors the output phase voltage ( $V_{L1N, L2N, L3N}$ ) of the Regenerative AC Electronic Load, and its current monitoring range is -550V to 550V.
  - \*3: In stand-alone 1-phase mode, IMON $\Phi$ 2 monitors the output line current of the Regenerative AC Electronic Load, and its monitoring current range is -360A to 360A.
  - \*4: In the multiple units 3-phase parallel mode, the IMON $\Phi$ 123 of the Master monitors the total output line current of the Regenerative AC Electronic Load, and its current monitoring range is -120A\*N (total paralleled units) to 120A\* N (total paralleled units). The IMON $\Phi$ 123 of Slave devices monitors the output line current ( $I_{\Phi 1, 2, 3}$ ) of the Regenerative AC Electronic Load itself, and its current monitoring range is -120A to 120A.
  - \*5: The pin function that can be supported by the Regenerative AC Electronic Load.





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