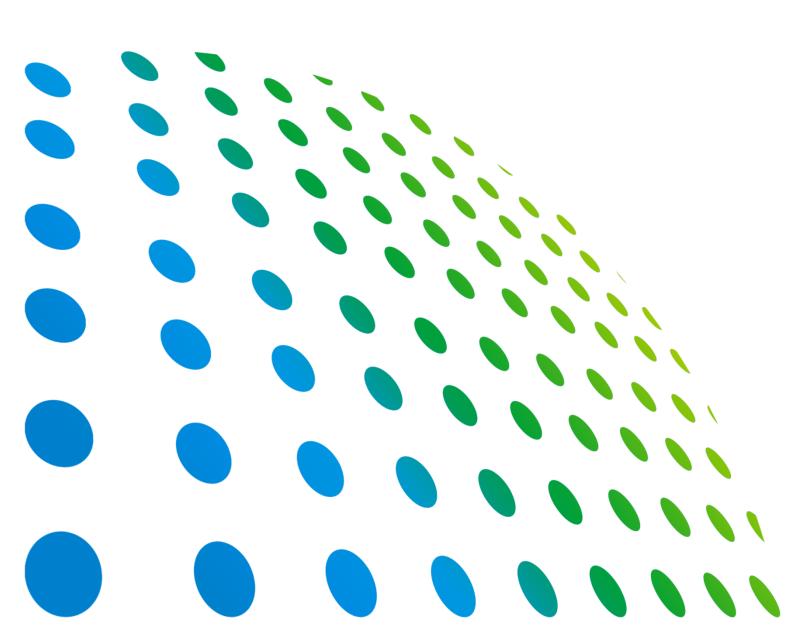
Chroma

Programmable AC Source 61507/61508/61509 User's Manual



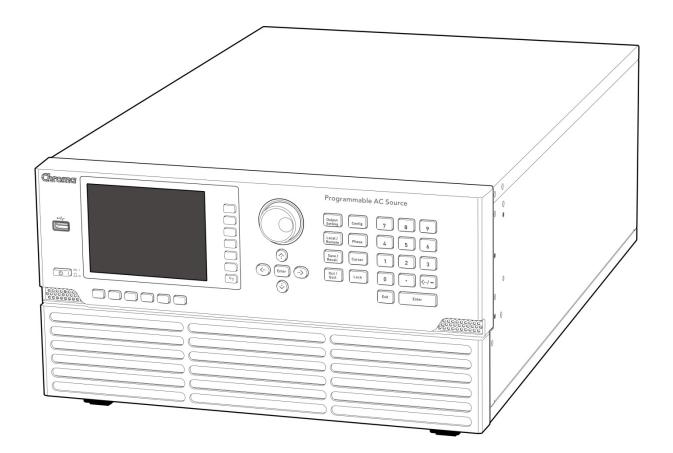


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Programmable AC Source 61507/61508/61509 User's Manual



Version 1.1 November 2019

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CHROMA ATE INC.

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

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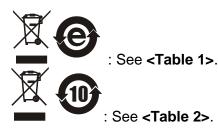
CHROMA ATE INC.

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

http://www.chromaate.com

Material Contents Declaration

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



<Table 1>

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

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

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

Remarks:

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

Disposal

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



<Table 2>

		Hazardous Substances				
Part Name	Lead	Mercury	Cadmium	Hexavalent Chromium		Selected Phthalates Group
	Dh	Цa	Cd	Cr ⁶⁺		
	Pb	Hg	Ca	Ur	PBB/PBDE	DEHP/BBP/DBP/DIBP
PCBA	×	0	0	0	0	0
CHASSIS	×	0	0	0	0	0
ACCESSORY	×	0	0	0	0	0
PACKAGE	0	0	0	0	0	0

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

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

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

Disposal

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



CE Declaration of Conformity			
For the following equipment :			
Programmable AC Source			
(Product Name/ Trade Name)			
61509, 61508, 61507, 61609, 61608, 61607			
(Model Designation)			
CHROMA ATE INC.			
(Manufacturer Name)			
66 Huaya 1 st Road, Guishan, Taoyuan 33383, Taiwan			
(Manufacturer Address)			
Is herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Laws of the Member States relating to Electromagnetic Compatibility (2014/30/EU) and Low Voltage Directive (2014/35/EU). For the evaluation regarding the Directives, the following standards were applied : EN 61326-1:2013 Class A			
EN 61326-1:2013(industrial locations)			
EN 61000-4-2:2009, EN 61000-4-3:2006+A1:2008+A2:2010,			
EN 61000-4-2:2003, EN 61000-4-5:2014, EN 61000-4-6:2014,			
EN 61000-4-8:2010, EN 61000-4-11:2004			
EN 61010-1:2010			
The equipment describe above is in conformity with Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.			
The following importer/manufacturer or authorized representative established within the EUT is responsible for this declaration :			
CHROMA ATE INC.			
(Company Name)			
66 Huaya 1 st Road, Guishan, Taoyuan 33383, Taiwan			
(Company Address)			
Person responsible for this declaration:			
Mr. Vincent Wu			
(Name, Sumame)			
T&M BU Vice President			
(Position/Title)			
Taiwan 2018.03.12 Vincht Wh			
(Place) (Date) (Legal Signature)			

Safety Summary

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

BEFORE APPLYING POWER

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



PROTECTIVE GROUNDING

Make sure to connect the protective grounding to prevent an electric shock before turning on the power.



NECESSITY OF PROTECTIVE GROUNDING

Never cut off the internal or external protective grounding wire, or disconnect the wiring of protective grounding terminal. Doing so will cause a potential shock hazard that may bring injury to a person.



FUSES

Only fuses with the required rated current, voltage, and specified type (normal blow, time delay, etc.) should be used. Do not use repaired fuses or short-circuited fuse holders. To do so could cause a shock or fire hazard.



DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Do not operate the instrument in the presence of flammable gases or fumes. The instrument should be used in an environment of good ventilation.



DO NOT REMOVE THE COVER OF THE INSTRUMENT

Operating personnel must not remove the cover of the instrument. Component replacement and internal adjustment can be done only by qualified service personnel.

WARNING

- 1. Lethal voltage. AC source may output 495 V peak voltage.
- 2. Touching the connected circuit or output terminal on the front or rear panel when power is on may result in death.
- 3. Be noted that the L1/L2/L3 and NEU may generate maximum current when the configuration is Y connection. Thus, the wire diameter should meet the maximum current requirement.
- 4. The equipment should be placed horizontally during transportation. It is strictly prohibited to place on the side. Transportation by the side may cause damage to the device.

Safety Symbols

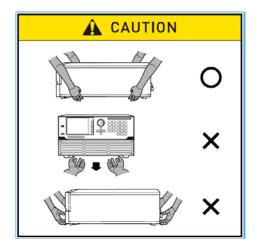
Â	DANGER – High voltage.
	Explanation: To avoid injury, death of personnel, or damage to the instrument, the operator must refer to the explanation in the instruction manual.
	High temperature: This symbol indicates the temperature is hazardous to human beings. Do not touch it to avoid any personal injury.
	Protective grounding terminal: This symbol indicates that the terminal must be connected to ground before operation of the equipment to protect against electrical shock in case of a fault.
Ţ	Functional grounding: To identify an earth (ground) terminal in cases where the protective ground is not explicitly stated. This symbol indicates the power connector does not provide grounding.
\rightarrow	Frame or chassis: To identify a frame or chassis terminal.
\sim	Alternating Current (AC)
\sim	Direct Current (DC) / Alternating Current (AC)
	Direct Current (DC)
<u>م</u> ا	Push-on/Push-off power switch
Пo	
	The WARNING sign highlights an essential operating or maintenance procedure, practice, condition, statement, etc., which if not strictly observed, could result in injury to, or death of, personnel or long term health hazards.
CAUTION	The CAUTION sign highlights an essential operating or maintenance procedure, practice, condition, statement, etc., which if not strictly observed, could result in damage to, or destruction of, equipment.
Notice	The Notice sign highlights an essential operating or maintenance procedure, condition, or statement.

ACOUSTIC NOISE INFORMATION

This product has a sound pressure emission (at the operator's side) < 70dB(A).

Moving

Since the AC Source has a certain weight, it should be carried out by two people as shown in the diagram below for movement.



The AC Source should always be placed horizontally during transportation and use. It is strictly prohibited to place it on the side, otherwise it may cause the AC Source to be damaged.

Cleaning

It is recommended to perform internal maintenance and cleaning regularly. The standard recommendation period is 1 year; however, the maintenance period may adjust based on the environment in use. For any related service request, please contact local technical service personnel.

Revision History

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

Date	Version	Revised Sections
Aug. 2018	1.0	Complete this manual.
Nov. 2019	1.1	Modify the following:
		 "Specifications" section in "General Information" chapter
		 "Main Page (Output Setting and Measurement)" section in "Local Operation" chapter
		 Appendix "TTL Signal Pin Assignments" Add "Programmable Output Impedance" section to "Local Operation" chapter

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1. General Information

1.1 Introduction

The Chroma 61507/61508/61509 Series AC Source is a highly efficient programmable instrument which provides a low distortion sine wave output. The Digital Signal Processor (DSP) microprocessor generates an accurate, stable output voltage and frequency. The Pulse Width Modulation (PWM) designed power stage provides apparent power into loads. The front panel has a Rotary Pulse Generator (RPG) and keypad control for setting the output voltage and frequency, while the Liquid Crystal Display (LCD) displays the operating status. Remote programming is accomplished using the GPIB bus, RS-232C serial port, USB port, or ETHERNET port.

1.2 Key Features

A. Configuration

- Local operation using the keypad on the front panel
- Remote operation via GPIB, RS-232C, USB, or ETHERNET interface
- Protection against over power, over current, over temperature, and fan failure
- Thermostatically controlled fan speed
- Built-in output isolation relays

B. Input / Output

- Selectable output voltage with full scale of 175V/350V/Auto (3 ranges)
- Analog (simulation) reference voltage for remote control
- V, I, Po, F, CF, PF, Idc, Vdc, Vac, Iac, Ipk, Vpk, VA, and Isurge measurements
- Remote inhibited control
- AC ON/OFF output signal

1.3 Specifications

The specifications for the 61507/61508/61509 models are listed below. All specifications are tested using Chroma's standard test procedures at $25 \pm 1^{\circ}$ C with a resistive load unless specified otherwise.

Model	61507	61508	61509		
		AC Output Rating			
Output Phase	1 or 3 selectable	1 or 3 selectable	1 or 3 selectable		
Total Power	3kVA	4.5kVA	6kVA		
Per Phase Power	1kVA	1.5kVA	2kVA		
	Voltage				
Range		175V/350V/Auto			
Output Voltage (Standard)	0~175V / 0~350V (@15~2000Hz)				
Output	0~1	75V / 0~350V (@15~3000)Hz)		

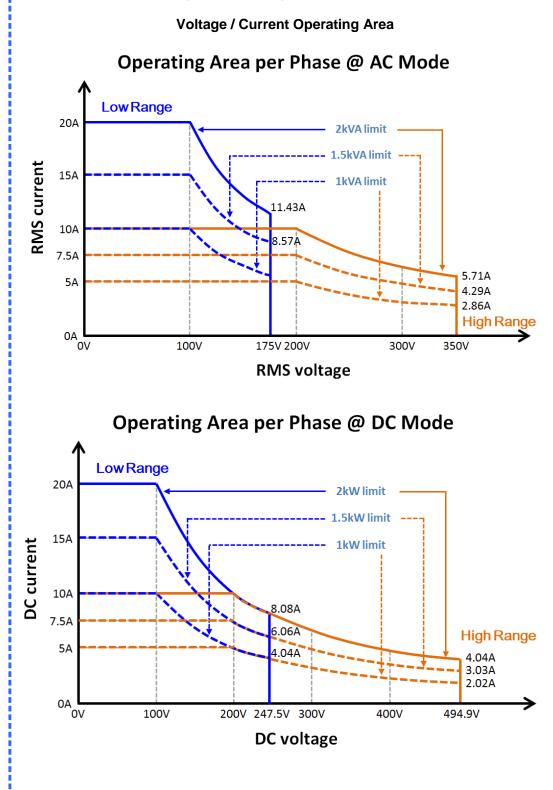
Voltage	0~11	5V / 0~230V (@3001~500)0Hz)	
(5kHz				
Option)				
Accuracy	0.1% of RD +0.2% of F.S.			
	Above 1 kHz, add	d 0.2%/kHz to FS up to 5kl	Hz (5KHZ Option)	
Resolution		0.1 V		
Distortion ^{*1}	< 0.3% @50/60Hz,			
DISIONION	1% maximum to 50(1%@15- 500Hz , 0Hz, add 0.5%/kHz up to 5	kHz (5kHz Option)	
Line	170 110 111 10 300	•		
Regulation		0.10%		
Load		0.000/		
Regulation ^{*2}		0.20%		
	Max	timum Current (1-Phase	Mode)	
Output	30A/15A	45A/22.5A	60A/30A	
Current (RMS)	30A/13A	437/22.37	004304	
Output				
Current	120A/60A	180A/90A	240A/120A	
(Peak)	Maximum	Numerat (2 Dhase Made	/ ner nhees)	
Output	Maximum C	Current (3 – Phase Mode	/ per pnase)	
Output Current (RMS)	10A/5A	15A/7.5A	20A/10A	
Output				
Current	40A/20A	60A/30A	80A/40A	
(Peak)	10/120/1			
		Frequency		
Bongo		15Hz ~ 2000Hz (Standard)	
Range	15Hz ~ 5000Hz (Option)			
Accuracy		0.01%		
		Phase		
Range		0 ~ 359.9°		
Resolution		0.1°		
		DC Output (1- Phase Mod		
Power	3.0kW	4.5kW	6.0kW	
Voltage	247.5V/494.9V	247.5V/494.9V	247.5V/494.9V	
Current	30A/15A	45A/22.5A	60A/30A	
Power	1.0kW	phase Mode / per phase) 1.5kW	2.0kW	
Voltage		247.5V/494.9V	247.5V/494.9V	
Output		247.37/494.97	247.3 \/494.9 \	
Current	10A/5A	15A/7.5A	20A/10A	
Carron		Harmonic Function	1	
Waveform				
Synthesis		50 order @50/60 Hz		
	Prog	grammable Output Imped	dance	
Range		R: 0Ω – 1Ω		
i tange	L: 0.2mH – 2mH			
		t 3-Phase Rating (Each F		
Input Type	3-Phase 4 Wire ,Delt	a Connection or 3-Phase	5 Wire ,Y Connection	
Voltage	04 000 0		X. I. NI\ *3	
operation	3Ф 200-2	240V±10% V _{LN} (Delta: L-L,	Y:L-N) °	
Range				

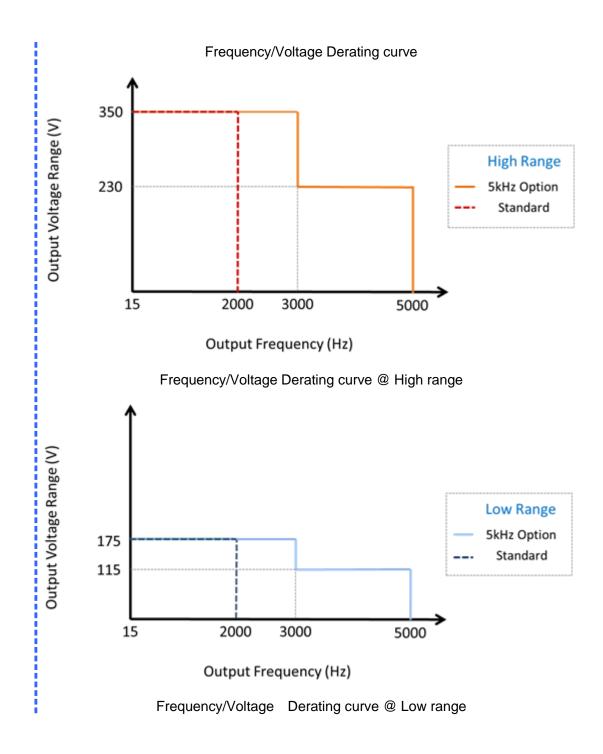
Frequency		47-63 Hz			
Range		47-03 HZ			
Maximum	15A Max./Phase	20A Max./Phase	25A Max./Phase		
Current	(3Ø 200-240V±10%VLL)	(3Ø 200-240V±10%VLL)	(3Ø 200-240V±10%VLL)		
Power Factor					
	Measurement				
		Voltage			
Range		175V / 350V/Auto			
Accuracy		0.1% of RD+0.2% of FS			
	Above 1 kHz, add	0.2(%/kHz) to FS up to 5	(Hz (5kHz Option)		
Resolution		0.1 V			
		Current (Each Phase)	100 0 (00 0		
Range(Peak)	60A/30A	90A/45A	120A/60A		
Accuracy(RMS)	Above 1 kHz. add	0.2% of RD+0.2% of F.S. 0.2(%/kHz) to FS up to 5			
		0.2% of RD+0.4% of F.S.			
Accuracy(Peak)	Above 1 kHz, add	0.2(%/kHz) to FS up to 5			
	· · · · · · · · · · · · · · · · · · ·	Power	· · · · · · · · · · · · · · · · · · ·		
Accuracy		0.2% of RD+0.4% of F.S.			
Accuracy	Above 1 kHz, add	0.2(%/kHz) to FS up to 5k	KHz (5kHz Option)		
		Others			
Remote	F	RS 232/USB/GPIB/Etherne	at		
Interface					
	Parallel F	unction (Master/Slave) up	to 2 units		
	EXT V Ref Port				
Other feature	Remote Inhibit Port				
		USB Host			
Efficiency*4		Trigger Function >80%(Typical)			
Protection		OVP,OCP,OPP,OTP,FAN	1		
Safety & EMC		CE mark	۹		
Dimension	221.5×425×680mm	221.5×425×680mm	221.5×425×680 mm		
(WxDxH)	8.72×16.73×26.77 inch				
Weight	50 kg / 110 lbs	50 kg / 110 lbs	50 kg / 110 lbs		
		Temperature Range			
Operation		0°C to 40°C			
Storage		-40°C to 85°C			
Humidity		30 % to 90 %			
, í	All specifications are subje	ect to change without notice	e. Please visit our website		
	for the most up to date spe	ecifications.			
		on is tested on 250Vac/125	Vac with maximum current		
	to linear load	and the state of the DO t			
		Note 2 : The DC function is capable of meeting DC to DC converter test			
	requirement	n output voltage can be full	out at High and Low range		
		ion when output frequency			
		out at High and Low range,			
	over 3000.1~5000.0Hz that	at output voltage will be red			
	High/Low range.	-			



*1: Maximum distortion is tested at 125Vac (175V RANGE) and 250Vac (350V RANGE) with maximum current to a linear load.

- *2: Load regulation is tested using a sine wave under linear load.
- *3: 3-phase voltage input Y connection is 3-phase / 5-wire, while Delta connection is 3 phase / 4-wire.
- *4: Efficiency is tested using an input voltage of 220Vac sine wave under linear load.





1.4 Names of Parts

1.4.1 Front Panel

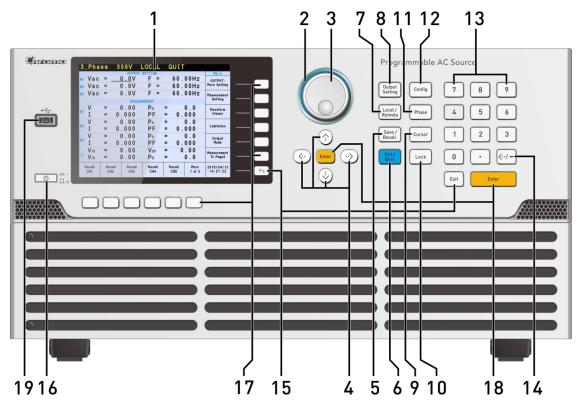


Figure 1-1 Front Panel

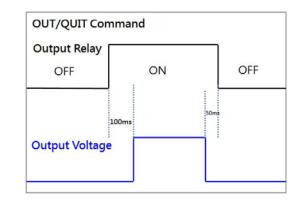
Table 1-1	Front Panel	Description
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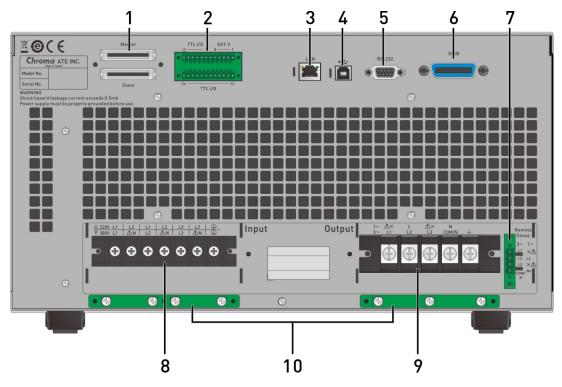
ltem	lcon	Description
1		<i>Display:</i> The 5.7" LCD displays the configuration, output setup, and measurement results.
2		<i>Indicator LED:</i> The Power-On indicator surrounds the rotary knob showing the activation status.
3		RPG Rotary : Turn the RPG rotary knob to adjust the voltage or frequency, and input programmed data or options.
4	© © © ©	<i>Cursor Movement Keys</i> : These four keys move the cursor in different directions. In normal mode, pressing any of these four keys will change the cursor position.
5	Save / Recall	Save or Recall: Press this key in the MAIN PAGE to save the output settings (see section 3.10.1). Press this key in the CHOICE PAGE to save the system data (see section 3.10.2).
6	Out / Quit	<i>Out/Quit :</i> Press this key to Enable/Disable the output voltage of the AC source.
7	Local / Remote	<i>Local/Remote :</i> Press this key to switch the "Remote" control mode to "LOCAL" for front panel input.

8	Output Setting	<i>Output Setting:</i> Changes the screen to "Output: More Setting" for additional settings.
9	Cursor	<i>Cursor:</i> Used to set or adjust the value.
10	Lock	<i>Lock:</i> Press for 1 second to lock up "all keys" and the "rotary" knob. Press for 3~3.5 seconds to unlock them.
11	Phase	<i>Phase:</i> Sets single/3-phase.
12	Config	Config: Switches the screen to the "CONFIG" screen for various settings.
13	● to [●] and ・	<i>Numeric and Decimal:</i> Use the "numeric" and "decimal" keys to input digital data.
14	-</td <td>Backward and Decreasing: Press this key to delete an entered number. The LCD displays " - " if no number exists.</td>	Backward and Decreasing: Press this key to delete an entered number. The LCD displays " - " if no number exists.
15	Exit and	<i>Exit and return:</i> Press to return to the previous screen.
16	Ċ	Main Power Switch: Turns the power ON or OFF.
17	0	<i>Indicator:</i> Refers to the description on screen for parameter and function setting.
18	Enter	Enter: Confirms the parameter setting.
19		USB HOST : LCD screen capture.



To extend the product life of the output relay, it will delay 50ms before releasing after pressing **QUIT**. When an inductive load is connected, a discharge path will be provided for the inductive current to decay during the delay period.





1.4.2 Rear Panel

Figure 1-2 Rear Panel

Table 1-2	Rear Panel Description
-----------	------------------------

Item Name		Description					
1	Master/Slave Port	Used for signal transmission between 2 AC Sources connected in parallel.					
2	Ext. Vref./TTL I/O	Inputs the control waveform amplitude from an external analog (simulated) signal with a TTL transmission control signal (Fault_out, Remote inhibit and AC_ON.)					
3	Ethernet	The network (LAN) control terminal.					
4	USB	Connects the remote controller to a computer for remote operation.					
5	RS-232C	9-pin D type male connector that transmits control commands among distant PCs for remote operation.					
6	GPIB Connector	The remote controller uses the GPIB bus to connect the PC via the connector for remote operation.					
7	Remote Sense	Terminal that senses the load directly to ignore any voltage drop across the connecting cable. Ensure the "L1" terminal of the Remote Sense connector is connected to the "L1" terminal of the Load, and the "N" terminal is connected to the "N" terminal of the Load. Do not reverse the polarity.					
8	Input Connecting Terminal	Connects the mains to the AC Source.					
9	Output Connection Terminal	Connects the AC Source output to the UUT.					
10	I/O Cable Secure Strip	Secures the input/output connection cable.					

CAUTION When connecting the Ext. Vref./TTL I/O cable, first remove the connected terminal and then secure it on the host for operation.

2. Installation

2.1 Initial Inspection

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

2.2 Preparation for Use

Connect the AC source to an appropriate AC line input. The instrument is cooled by fans; install it in a place with good air circulation. It should be in an area where the ambient temperature does not exceed 40°C. The L1/L2/L3 and NEU may generate maximum current when using a Y connection; insure the wire diameter meets the maximum current requirement.

CAUTION The carring weight of the AC Source cover must not exceed 5KG.

2.3 Requirements for Input Power

2.3.1 Ratings

Input Voltage Range:

61507	61508	61509			
15A Max./Phase	20A Max./Phase	25A Max./Phase			
(3Ø 200-240V±10%V _{LL} Δ)	(3Ø 200-240V±10% V _{LL} Δ)	(3Ø 200-240V±10% V _{LL} Δ)			
12A Max./Phase	16A Max./Phase	20A Max./Phase			
(3Ø 200-240V±10%V _{LN} Y)	(3Ø 200-240V±10%V _{LN} Y)	(3Ø 200-240V±10%V _{LN} Y)			

Input Frequency: 47-63 Hz



The AC Source may be damaged and unable to power on if the input voltage exceeds the configured range.

2.3.2 Input Connection

The input terminal block is located beneath the device's rear panel. The power cord should be rated for at least 85°C and the current rating of the power line input must be equal to or greater than the maximum current rating of the AC Source. Do not use three separate lead wires to connect the power to the AC power supply's input. Adjust the short circuit connector according to the power input (Delta or Y) method.

CAUTION Select the model in accordance with the local voltage specification. The 200-240V_{LL} 3-phase 4-wire (Delta) and 380-400V_{LL} 3-phase 5-wire (Y) can be selected during the input wiring selection before power-on. Select the correct iron tagger and secure the power wire to the AC Source input terminal.

Perform the steps below:

- 1. Remove the safety cover from the back of the AC Source.
- 2. Connect the wires to the AC Source terminal blocks (see Figure 2-1 and Figure 2-2).
- 3. Secure it with the I/O cable trim strip and screws.
- 4. Attach the safety cover to the back of the AC Source.

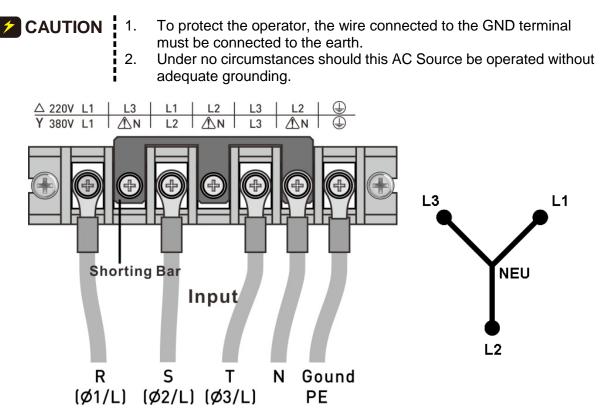


Figure 2-1 3-Phase 380V Power Input Connection (Y Connection)

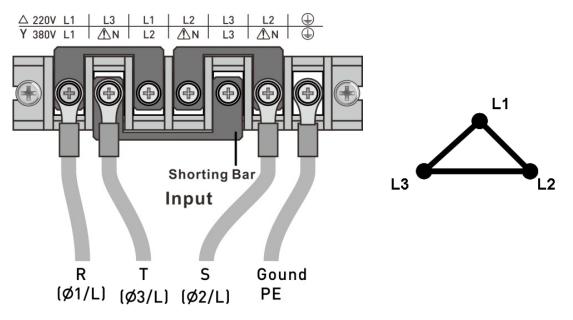


Figure 2-2 3-Phase 220V Power Input Connection (Delta Connection)

Voltage F	Range	Wire Spec.	Terminal Spec.			
3Ø 200-240V (Delta:L-L,		14AWG (L1/L2/L3/NEU/GND)	3-5(L1/L2/L3/NEU/GND)			
Notice	 accordir If the inp Circuit E 220Vac, If the inp Circuit E 380Vac, If the inp (L1/L12, Be away before c wire is u 	ion of the wires must be performend to the device required voltage. but wiring selection is 220V 3~ (Δ Breaker configured for the Δ type /20A (61507), 220Vac/30A (6150) but wiring selection is 380V 3~ (Y Breaker configured for the Y type /20A(61507), 380Vac/20A(61508) but wiring selection is Y type, be selection is Y type, be selection is Y type, be selection between connecting the power wire. The blue in the color distinction between connecting the power wire. The blue in the NEU, while the green insulation ND.	A type), the specification of the needs to be at least 8), and 220Vac/30A (61509). 7 type), the specification of the needs to be at least), and 380Vac/30A(61509). Sure to select 4P type ge circuit breaker. In the insulation tube or wire lack insulation tube or power nsulation tube or power wire is			

2.4 **Output Connection**

ł

The output terminal block is located on the rear of the AC Source. The Load is connected to the output terminals. To meet the safety requirements, the I/O input/output wires need to be tied together by a safety strip and the cover must be secured. The diameter of the wire connected to the load should be large enough so that it will not overheat when conducting current (see Figure 2-5).



1. The output terminal labeled "L" is the "+" terminal and the output terminal labeled "COM/N" is the "-" terminal when the output voltage contains a DC component.

2. This AC source can perform 1-phase/3-phase output. When set to single-phase mode, the internal relay will guide L1 and L3 to L2 (note that the L1 and L3 terminals will still be charged during output) as it allows the user to short circuit the output terminal L1/L2/L3 on the UUT or connect the L2/N two dots to UUT (be aware of the wire diameter for current withstand capacity is enough in this connection).

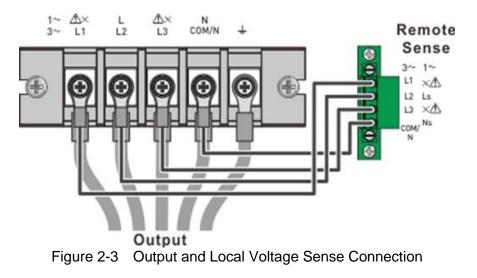


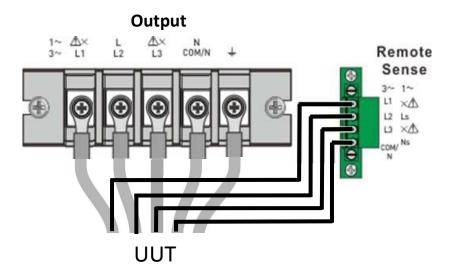
For proper ventilation, the UUT should be placed at least 1 meter distance from the front and rear panels of the AC source. Do not place the AC source against the wall or other objects.

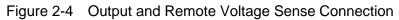
2.5 Remote Sense Connection

The remote sense function of the AC Source monitors the voltage at the load and the automatic compensation ensures the voltage delivered to the load is the one programmed.

Remove the connecting wires "L1", "L2", "L3" and "COM" from the Remote Sense terminal and connect the remote sense to the load as shown in Figure 2-3. The sensing leads are part of the feedback circuit of the AC Source, so they must be low resistance for the best performance. Connect the sensing leads carefully so that they will not be open-circuited. If the sensing leads are disconnected or become open-circuited during operation, the AC Source may be unable to output any voltage.







Notice

The sensing leads must be a twisted pair to minimize the interference from external voltages. The sensing leads need to be connected as close as possible to the load. As the sensing leads carry only a few milliamperes, it is suggested to use 18 AWG wire.

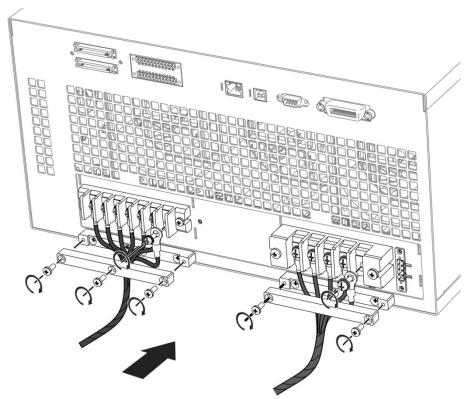
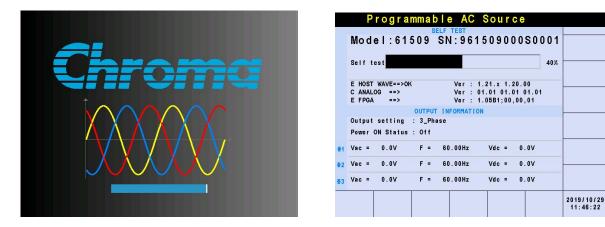


Figure 2-5 Input / Output Wire Securing Diagram

2.6 Power on Procedure

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

Connect the power line and turn on the power switch on the front panel. The AC Source will begin a series of self-tests. The LCD on the front panel will display the following:



During this time the AC Source executes memory, data, and communication self-tests. The display shows the Model Number and the AC Source's Serial No. after executing the self-test routines. Each test item will show "OK" on the right if no error is found. It takes about 10 seconds for self-test to finish the routines and then the software version will show on the display.

"ERROR CODE" will appear on the right if one of the test items has failed (see section 8.2 *Self Test* for detailed information).

When the memory, data, and communication self-tests are done, the AC Source 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 damaged. The AC Source sets the output to 350Vac and if the measured voltage exceeds 350V±100V, the power self-test fails and the display shows "SELF TEST NG". If everything passes self-test, the screen will switch to the MAIN PAGE automatically.

Notice

- 1. Self diagnostics can be run during the power-on self-test to see if there are any errors or NG (No Good) conditions (see section 8.2 Self Test for detailed information).
- 2. The AC Source needs about 20 seconds to finish the self-test.

2.7 Maintenance and Cleaning

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

2.8 Common Environment Conditions

- 1. In-door use only.
- 2. Altitude up to 2000m.
- 3. Temperature 0°C to 40°C.
- 4. Transient over voltage is CAT II impulse withstand.
- 5. Pollution degree 2.

3. Local Operation

3.1 Introduction

The AC Source can be configured to operate in local or remote mode. The remote mode operation is through a remote GPIB or RS-232C interface as described in Chapter 9.

This section describes the operation in local mode using the keypad on the front panel for data entry and test. Local operation can be used directly when the AC Source is turned on.

3.2 Using Keyboard and RPG

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

Figure 3-1 shows the command tree. The following describes how to use both the keypad and the RPG to set the commands. When the power-on procedure has completed (see 0), the display will show the MAIN PAGE (3_Phase Mode/1_Phase Mode) seen below:

	B_Pha	se	350V	LOCAL	QUIT		1	_Pha	s e	350V I	LOCAL	QUIT		
			OUTPU	JT SETTING		Main				OUTPUT			-	Main
•			<u>0.0</u> V	F =	60.00Hz	OUTPUT:		Vac	=	0.0V F		60.00	Hz	OUTPUT: More Setting
₫	2 Vac	: =	0.0V	F =	60.00Hz	More Setting								Hore Setting
₫	3 Vac	; =	0.0V	F =	60.00Hz	Measurement								Measurement
			MEA	SUREMENT		Setting				MEASUF	REMENT			Setting
	V	=	0.00	Po	= 0.0	Waveform		٧	=	0.00	P٥	=	0.0	Waveform
₫	¹ I	=	0.000	PF	= 0.000	Viewer		I	= 1	0.000	PF	= 0.	000	Viewer
	V	=	0.00	P٥	= 0.0			Vac	=	0.00	Vdc	= 0	.00	
₫	² I	=	0.000	PF	= 0.000	Limitation		Iac	= 1	0.000	0.000 Idc = 0.000	000	Limitation	
	V	=	0.00	P٥	= 0.0	Output		Vpk	=	0.00	VA	=	0.0	Output
₫	³ I	=	0.000	PF	= 0.000	Mode		Ipk	= 1	0.000	CF	= 0.	000	Mode
	V 12	=	0.00	V23	= 0.00	Measurement								Print
2	V 31	=	0.00	P٥	= 0.0	To Page2								Screen On
	Recall	Rec	all Recall	Recall	Recall More	2019/04/03		Recall	Recall	Recall	Recall	Recall	More	2019/04/23
	CH1	СН	12 CH3	CH4	CH5 1 of 2	14:46:20		CH1	CH2	СНЗ	CH4	CH5	1 of 2	11:41:07

Press the \blacktriangle , \bigtriangledown , \blacksquare , keys to move the cursor for item selection. Use the numeric and decimal keys or RPG to set values and press **ENTER** to confirm them. Use the indicators located at the bottom or lower right of the LCD to set the parameters or functions following the description at the bottom or lower right of the screen, or press \boxdot to return to MAIN PAGE.

In MAIN PAGE, press the indicators located at the bottom or lower right of the LCD to select the function list. Use \blacktriangle , \bigtriangledown , \blacklozenge , \blacklozenge , \blacklozenge , to move the cursor after inputting each list. For digital settings use the numeric and decimal keys or the RPG to set the value and then press **ENTER** for confirmation. For text setting, turn the RPG for selection and press **ENTER** for confirmation.

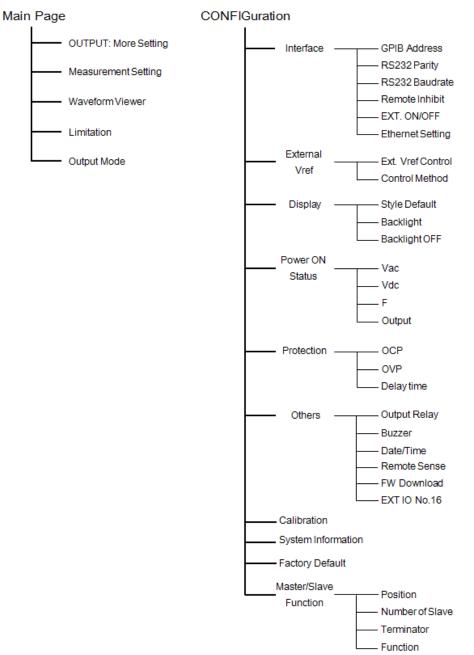


Figure 3-1

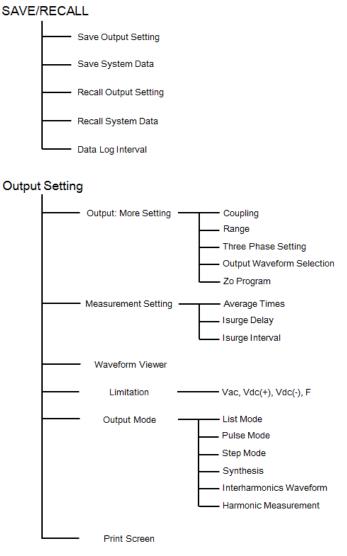


Figure 3-2

3.3 Main Page (Output Setting and Measurement)

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

3	_Pha	se	350V	LOCAL	QUIT			3	_Pha	se	350V	LOCAL	QUIT		
₫ 1 ₫ 2		= .	0.0V 0.0V	F =		00Hz 00Hz	Main OUTPUT: More Setting	₫ 1 ₫ 2		= .	0.0V	F =		00Hz 00Hz	Main OUTPUT: More Setting
æ 3	Vac	-	0.0V	F =	60.	00Hz	Measurement Setting	₫3	Vac	=	0.0V	F =	60.	00Hz	Measurement Setting
₫1	1	=	0.00 0.000	P₀ PF		0.0 000	Waveform Viewer	₫1	Vac Iac	= =	0.00 0.000	Vdc Idc		.00 000	Waveform Viewer
₫2	1	=	0.00 0.000	P₀ PF	= 0.	0.0 000	Limitation	₹2	lac	=	0.00 0.000	Vdc Idc		.00 000	Limitation
æ 3	1	=	0.00 0.000	P₀ PF	= 0.	0.0 000	Output Mode	₫3	lac	=	0.00 0.000	Vdc Idc	= 0.	.00 000	Output Mode
Σ	V 12 V 31	-	0.00 0.00	V23 Po		.00 0.0	Measurement To Page2	Σ	V 12 V 31	=	0.00 0.00	V23 VA		.00 0.0	Measurement To Page3
	Recall CH1	Rec: CH:		Recall CH4	Recall CH5	More 1 of 2	2019/04/03 14:46:51		Recall CH1	Rec: CH:		Recall CH4	Recall CH5	More 1 of 2	2019/04/03 14:46:54
1															

	3_	Pha	se	3 (50V	LOCAL	QUIT			1	Pha	se	3 5	50V	LOCAL	QU	IT	
					OUTPU	T SETTING			Main						TSETTING			Main
đ	11	Vac	=		<u>0.0</u> V	F =	60.	00Hz	OUTPUT:		Vac	=	0	.0V	F =	60.0	00Hz	OUTPUT:
₫	2	Vac	=	C	0.0V	F =	60.	00Hz	More Setting									More Setting
Ŧ	3	Vac	=	C	0.0V	F =	60.	00Hz	Measurement									Measurement
					MEAS	UREMENT			Setting					MEAS	SUREMENT			Setting
		Vpk	=	C	00.0	VA	=	0.0	Waveform		۷	=	0	.00	Po	=	0.0	Waveform
đ	1	Ipk	=	0.	000	CF	= 0.	000	Viewer		Ι	=	0.	000	PF	= (0.000	Viewer
		Vpk	=	C	0.00	VA	=	0.0			Vac	=	0	.00	Vdc	=	0.00	
₫	2	Ipk	=	0.	000	CF	= 0.	000	Limitation		Iac	=	0.	000	Idc	= (0.000	Limitation
		Vpk	=	C	0.00	VA	=	0.0	Output		Vpk	=	0	.00	VA	=	0.0	Output
	3	Ipk	=	0.	000	CF	= 0.	000	Mode		Ipk	=	0.	000	CF	= (0.000	Mode
									Measurement									Print
	Σ								To Page1									Screen On
	R	Recall	Red	all	Recall	Recall	Recall	More	2019/04/03	F	Recall	Rec	all	Recall	Recall	Reca	ll More	2019/04/23
		CH1	CH	12	CH3	CH4	CH5	1 of 2	14:46:56		CH1	CH	2	CH3	CH4	CH5	1 of 2	11:41:07

On the top of the screen, the range displayed (350V) is the Range status (see 0). There are 3 ranges:

- 1. 175V Range
- 2. 350V Range
- 3. AUTO Range

Output parameter definitions:

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

Pressing **OUT/QUIT** enables the AC Source's output using the previously set Vac, F, and Vdc values. Press it again and the AC Source output is disabled.

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Notice
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When Coupling = AC+DC the output is the sum of Vac and Vdc. The combination of peak voltages cannot exceed the limit of each range (range 175V : 247.5V and range 350V : 494.9V.) The output voltage will drop to 0V automatically and trigger the protection circuit if the voltage limit (OVP) is exceeded.

Measurement parameter definitions:

- V : Voltage measurement in Volts. (True RMS measurement)
- F : Output frequency in Hertz.

- I : Current measurement in Amps. (True RMS measurement)
- P : Real power measurement in Volts.
- PF : Power Factor [calculation formula = Real Power / (Vrms × Irms)]
- CF : Crest Factor [calculation formula = lpeak/lrms]
- Vdc : DC voltage measurement in Volts.
- Idc : DC current measurement in Amps.
- Ip : Peak current measurement in Amps. The Ipeak display is the Ip (+) or Ip (-), whichever is larger.
- Is : I surge that only measured when output changes.
- VA Apparent power in Volt-Ampere [calculation formula = Vrms × Irms]
- VAR : The calculation formula = $\sqrt{VA^2 P^2}$

3.3.1 OUTPUT: More Setting

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

3	Phase 350V LOCAL QUIT		1_Phase 350V LOCAL QUIT	
	Vac = 0.0V F = 60.00Hz Vac = 0.0V F = 60.00Hz	OUTPUT: More Setting	Vac = 0.0VF = 60.00Hz	Setting OUTPUT: More Setting
æ 3	Vac = 0.0V F = 60.00Hz	Measurement Setting	MORE SETTING	Measurement Setting
₫1	Waveform = A SINE Waveform = A	Waveform Viewer	Waveform = A SINE	Waveform Viewer
₩2 ₩3	SINE Waveform = A SINE	Limitation	ON Degree = 0.0 OFF Degree = IMMED Vac S/R = 0.000V/ms	Limitation
	ON Degree = 0.0 OFF Degree = IMMED Vac S/R = 0.000V/ms VdcR S/R = 0.000V/ms	Output Mode	VdcR S/R = 0.000V/ms F S/R = 0.000Hz/ms VdcF S/R = 100.000V/ms	Output Mode
	F S/R = 0.000Hz/ms VdcF S/R = 100.000V/ms Phase angle 1-2 = 120.0 Phase angle 1-3 = 240.0	Print Screen On	-	Print Screen On
1	AC 350V Setting Selection Disable	2019/04/23 11:42:58	Coupling Range Output AC 350V Waveform Selection	2019/04/23 11:42:45

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

There are 3 types of AC Source output: AC+DC, AC, and DC. The coupling can be set to meet a variety of applications.

The procedure for switching from AC to DC is described below:

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

3	_Phase	350V	LOCAL	QUIT		3	Pha	se	350V	LOCAL	QUI	Т	
		OUTPUT	SETTING		Setting				OUTP	UT SETTING			Setting
	Vac =	0.0V	F =	60.00Hz	OUTPUT:	₫1	Vac =	0.0V	F =	60.00Hz	Vdc =	0.0V	OUTPUT:
₹2	Vac =	0.0V	F =	60.00Hz	More Setting	₹2	Vac =	0.0V	F =	60.00Hz	Vdc =	0.0V	More Setting
₫3	Vac =	0.0V	F =	60.00Hz	Measurement	₩3	Vac =	0.0V	F =	60.00Hz	Vdc =	0.0V	Measurement
		MORE	SETTING		Setting				MOR	E SETTING			Setting
	Waveform = A				Waveform		Wavefo	rm = <u>A</u>					Waveform
		INE			Viewer	T 1		SI	NE				Viewer
₹2	Waveform = A					₹2	Wavefo	orm = A					
	Waveform = A	INE			Limitation		Wavefo	si rm = A	NE				Limitation
₫3		INE				₫3	anon	SI	NE				
	ON Degree =	0.0	OFF Deg	ree = IMMED	Output		ON De	gree =	0.0	OFF D	egree = II	IMED	Output
	Vac S/R =		VdcR S/		Mode		Vac S	-	0.000V/m			0.000V/ms	Mode
	F S/R =				Print			'R =	0.000Hz/			00.000V/ms	Print
	Phase angle			ngle 1-3 = 240.0	Screen				-2 = 120.0			3 = 240.0	Screen
	rnase angle	1-2 - 120.0	rnase a	ngre 1-3 = 240.0	On		FIIdSt	anyle	-2 - 120.0	Phase	angre 1-	5 - 240.0	On
	Coupling Rang		Output Waveform Selection	Zo Program Disable	2019/04/23 11:43:33		upling <u>C+DC</u>	Range 350V		e Waveform	Zo Program Disable		2019/04/23 11:43:42

3	Phase 3	350V LO	DCAL QUIT	
		OUTPUT SE	TTING	Setting
₫ 1	Vdc =	0.0V		OUTPUT:
₹2	Vdc =	0.0V		More Setting
₫3	Vdc =	0.0V		Measurement
		MORE SET	TING	Setting
₫ 1	Waveform = A SIN	E		Waveform Viewer
	Waveform = A			
₹2	SIN	E		
₫3	Waveform = A SIN	E		Limitation
	ON Degree =	0.0	OFF Degree = IMMED	Output
	Vac S/R =	0.000V/ms	VdcR S/R = 0.000	V/ms Mode
	F S/R =	0.000Hz/ms	VdcF S/R = 100.000	V/ms Print
	Phase angle 1-:	2 = 120.0	Phase angle 1-3 = 24	0.0 Screen On
C	DC Range		Output Zo /aveform Program Selection Disable	2019/04/23 11:43:49

Notice

- Since the AC Source does not have as many capacitors as the common DC Power Supply, some voltage fluctuations and transient load characteristics are not the same. This AC Source is able to provide positive and negative voltage without changing the output connector. The output capacitance cannot exceed 240mC (for DC output, the external electrolytic capacitor restrictions are 175V Range <1200uF, 350V Range <390uF) according to the Q=CV formula as it may cause the device to be damaged due to unstable output.
- 2. For parallel operation, the coupling of Master and Slave can only be set under the same condition and no changes during operation, otherwise it may cause output error.

Even though the AC Source has AC/DC/AC+DC output modes, these features are still different from the common DC Power Supply when in pure DC mode, as explained below:

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

3.3.1.2 Range

The AC Source has full scale voltage ranges of 175V, 350V, and AUTO. Set the Range using the function OUTPUT: More Setting. This parameter controls the power stage relay for parallel (range 175V) or series (range 350V) for more current or higher voltage. AUTO range indicates the output range will change between 175V and 350V automatically as required.

Set the output voltage range to 175V as described below:

- 1. Press 'Range' at the bottom.
- 2. Turn the RPG to change "350V" to "175V" and press ENTER.

3	_Phase 350V LOCAL QUIT		3_Phase 175V LOCAL QUIT	
	Vac = 0.0V F = 60.00H Vac = 0.0V F = 60.00H	- Ourpur.	e1 Vac = 0.0V F = 60.00Hz 22 Vac = 0.0V F = 60.00Hz	Setting OUTPUT: More Setting
₫3	Vac = 0.0V F = 60.00H	Z Measurement Setting	■3 Vac = 0.0V F = 60.00Hz	Measurement Setting
₫1	Waveform = A SINE Waveform = A	Waveform Viewer	Waveform = A SINE Waveform = A	Waveform Viewer
₹ 2 ₹ 3	SINE Waveform = A SINE	Limitation	22 SINE Waveform = A SINE	Limitation
	ON Degree = 0.0 OFF Degree = IMMED Vac S/R = 0.000V/ms VdcR S/R = 0.000V/	Output Mode	ON Degree = 0.0 OFF Degree = IMMED Vac S/R = 0.000V/ms VdcR S/R = 0.000V/ms	Output Mode
	F S/R = 0.000Hz/ms VdcF S/R = 100.000V/ Phase angle 1-2 = 120.0 Phase angle 1-3 = 240.	Screen	F S/R = 0.000Hz/ms VdcF S/R = 100.000V/ms Phase angle 1–2 = 120.0 Phase angle 1–3 = 240.0	Print Screen On
(oupling Range Three Output Zo Phase Waveform Program AC <u>350V</u> Setting Selection Disable	2019/04/23 11:44:19	Coupling AC Range 175V Three Phase Setting Output Vaveform Zo Program 2	2019/04/23 11:44:24

3	Phase	Auto	LOCAL	QUIT	
		OUTPUT	SETTING		Setting
₫ 1	Vac =	0.0V	F =	60.00Hz	OUTPUT:
₹2	Vac =	0.0V	F =	60.00Hz	More Setting
₫3	Vac =	0.0V	F =	60.00Hz	Measurement
		MORE	SETTING		Setting
₫1	Waveform = .	A SINE			Waveform Viewer
₫ 2	Waveform = .	A SINE			
₫ 3	Waveform = .	A. SINE			Limitation
	ON Degree		OFF Deg		Output Mode
	Vac S/R	= 0.000V/ms	VdcR S/	R = 0.000V/ms	
	F S/R	= 0.000Hz/ms	VdcFS/	R = 100.000V/ms	Print
	Phase angle	1-2 = 120.0	Phase a	ngle 1-3 = 240.0	Screen On
C	oupling Ran AC <mark>Au</mark>		Output Waveform Selection	Zo Program Disable	2019/04/23 11:44:29



The output voltage will be set to 0V before the range changes to eliminate the peak voltage, and then the output voltage will be set. Note that it may cause the UUT to be suspended and/or damaged when changing the range.

3.3.1.3 Setting Three Phase Output

Press 'Three Phase Setting' to enter into the function, as shown below:

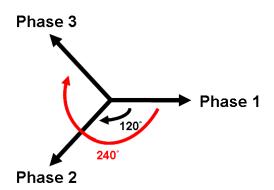
Edit: All and Each.

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

3	Phase	35(V	LOCAL	QUIT		3	_Pha	se	35	0 V	LOCAL	QUIT		
			OUTPUT	SETTING		Setting					OUTPUT	T SETTING			Setting
₫ 1	Vac =	0.	0 V 0	F =	60.00Hz	Edit	₫1	Vac	: =	0	. O V	F =	60.0	0Hz	Edit
₹2	Vac =	0.	٥٧	F =	60.00Hz	Each	₹2	Vac	: =	0	. O V	F =	60.0	0Hz	ALL
₫3	Vac =	0.	0 V 0	F =	60.00Hz	Sequence	₫3	Vac	=	0	. O V	F =	60.0	0Hz	Sequence
			MORE	SETTING		Positive					MORE	SETTING			Positive
₫1	Waveform =	A SINE				Three Phases Independ.	₫1	Wavef	orm =	A SINE					Three Phases Independ.
₹2	Waveform =	A SINE					₹2	Wavef	orm =	A SINE					
@ 3	Waveform =	A SINE					₫3	Wavef	orm =	A SINE					
	ON Degree	= 0.0		OFF De	gree = IMMED	Phase re-lock		ON D	egree	= 0.	0	OFF De	gree = IMMED		Phase re-lock
	Vac S/R	= 0.0)0V/ms	VdcR S	/R = 0.000V/ms	Disable		Vac S	/R	= 0.	000V/ms	VdcR S	/R = 0.0	00V/ms	Disable
	F S/R	= 0.0)0Hz/ms	VdcF S	/R = 100.000V/ms			F S	/R	= 0.	000Hz/m	s VdcFS	/R = 100.0	00V/ms	
	Phase ang	e 1-2 =	120.0	Phase	angle 1-3 = 240.0			Phase	angle	9 1-2 =	120.0	Phase	angle 1-3 =	240.0	
Co			Three Phase Setting	Output Waveform Selection	Zo Program Disable	2019/04/03 15:12:02	C	oupling AC		nge 50V	Three Phase Setting	Output Waveform Selection	Zo Program Disable		2019/04/03 15:12:05

Sequence: Positive and Negative.

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



Press 'Sequence' to set the Positive/Negative sequence for the AC Source's 3-phase voltage output. The following describes the procedure to set the 3-phase output voltage sequence to Negative.

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

	B_Phase 350V LOCAL QUIT		3_Phase 350V LOCAL QUIT	
	OUTPUT SETTING	Setting	OUTPUT SETTING	Setting
4	Vac = 0.0V F = 60.00Hz	Edit	■ Vac = 0.0V F = 60.00Hz	Edit
4	2 Vac = 0.0V F = 60.00Hz	Each	■2 Vac = 0.0V F = 60.00Hz	Each
đ	₃Vac = 0.0V F = 60.00Hz	Sequence	■3 Vac = 0.0V F = 60.00Hz	Sequence
	MORE SETTING	<u>Positive</u>	MORE SETTING	<u>Negative</u>
g	Waveform = A 1 SINE	Three Phases		hree Phases
	Waveform = A	Independ.	Waveform = A	Independ.
ġ	SINE		SINE	
đ	Waveform = A 3 SINE		Waveform = A 43 SINE	
	ON Degree = 0.0 OFF Degree = IMMED	Phase re-lock	ON Degree = 0.0 OFF Degree = IMMED	Phase re-lock
	Vac S/R = 0.000V/ms VdcR S/R = 0.000V/ms	Disable	Vac S/R = 0.000V/ms VdcR S/R = 0.000V/ms	Disable
	F S/R = 0.000Hz/ms VdcF S/R = 100.000V/ms		F S/R = 0.000Hz/ms VdcF S/R = 100.000V/ms	
	Phase angle 1-2 = 120.0 Phase angle 1-3 = 240.0		Phase angle 1-2 = 120.0 Phase angle 1-3 = 240.0	
	Coupling Range Three Output Zo AC 350V Setting Selection Disable	2019/04/03 15:12:21		2019/04/03 15:12:23

Three Phases: Independ, Same Freq and Balance.

Press 'Three Phases' to set the relationship among the AC Source 3-phase output voltages, which are Independ, Same Freq, and Balance.

The following procedure describes how to set the same frequency for 3-phase voltage output.

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

	B_Phase	350V	LOCAL	QUIT		3_	Pha	se	350V	LOCAL	QUIT	
		OUTPUT	SETTING		Setting				OUTPUT	SETTING		Setting
Ŧ	Vac =	0.0V	F =	60.00Hz	Edit	₫1	Vac	=	0.0V	F =	60.00Hz	Edit
₫	2 Vac =	0.0V	F =	60.00Hz	ALL	₹2	Vac	=	0.0V	F =	60.00Hz	ALI
Ŧ	3 Vac =	0.0V	F =	60.00Hz	Sequence	₫3	Vac	=	0.0V	F =	60.00Hz	Sequence
		MORE S	SETTING		Positive				MORE	SETTING		Positive
Ŧ	Waveform = A	INE			Three Phases Independ.	₫1	Wavefo		A SINE			Three Phases Same freq
æ	Waveform = A	INE				₫2	Wavefo		A SINE			
æ	Waveform = A					₫3	Wavefo	rm = /				
	ON Degree =	0.0	OFF Degre	e = IMMED	Phase re-lock		ON De	gree :	= 0.0	OFF Deg	ree = IMMED	Phase re-lock
	Vac S/R =	0.000V/ms	VdcR S/R	= 0.000V/ms	Disable		Vac S/	Ri	= 0.000V/ms	VdcR S/	R = 0.000V/ms	Disable
	FS/R =	0.000Hz/ms	VdcF S/R	= 0.000V/ms			F S/	R :	= 0.000Hz/ms	VdcF S/	R = 0.000V/ms	
	Phase angle	1-2 = 120.0	Phase ang	ie 1-3 = 240.0			Phase	angle	1-2 = 120.0	Phase a	ngle 1-3 = 240.0	
	Coupling Ran AC 350		Output Waveform Selection		2018/04/13 14:54:36	Co	upling AC	Ran 350		Output Waveform Selection		2018/04/13 14:54:44

3	_Pha	se	350V	LOCAL	QUIT	
			OUTP			Setting
₫ 1	Vac	=	0.0V	F =	60.0	Luit
₹2	Vac	=	0.0V			ALI
₫3	Vac	=	0.0V			Sequence
			MOR	E SETTING		Positive
₫1	Wavefo		INE			Three Phases Same freq
₹2	Wavefo		INE			
@ 3	Wavefo		INE			
	ON De	gree =	0.0	OFF De	gree = IMMED	
	Vac S/	R =	0.000V/m	s VdcR S	/R = 0.00)0V/ms
	F 5/	R =	0.000Hz/	ms VdcFS	/R = 0.00)0V/ms
	Phase	angle	1-2 = 120.0	Phase	angle 1-3 = :	240.0
c	oupling AC	Ranç 350		Waveform		2018/04/16 09:21:02

3	_Pha	se	3 (50V	LOCAL	QUIT	
				OUTPUT	SETTING		Setting
₫ 1	Vac	=	C	0.0V	F =	60.00Hz	Edit
₫2	Vac	=	C).0V	F =	60.00Hz	Each
₫ 3	Vac	=	C	0.0V	F =	60.00Hz	Sequence
				MORE S	SETTING		Positive
₫1	Wavefo		A SINE				Three Phases Independ.
₹2	Wavefo		A BINE				Incopone.
₫3	Wavefo		A BINE				
	ON De	gree =	= 0	. 0	OFF De	gree = IMMED	Phase re-lock
	Vac S/	R =	= 0	.000V/ms	VdcR S	/R = 0.000V/ms	Disable
	F 8/	R :	= 0	. 000Hz/ms	VdcF S	/R = 100.000V/ms	
	Phase	angle	1-2	= 120.0	Phase	angle 1-3 = 240.0	
C	oupling AC	Ran 35(Three Phase Setting	Output Waveform Selection	Zo Program Disable	2019/04/03 15:12:41

3	_Pha	se	3	5 O V	LOCAL	QUIT		
				OUTPUT	SETTING			Setting
₫ 1	Vac	=	().OV	F =	60.	00Hz	Edit
₫2	Vac	=	. ().OV				Each
₫ 3	Vac	=	().OV				Sequence
				MORE	SETTING			Positive
₫ 1	Wavefo		A SINE					Three Phases Same freq
₹2	Wavefo		A SINE					
₫3	Wavefo		A SINE					
	ON De	gree	= 0	.0	OFF De	gree = IMM	ED	
	Vac S/	R	= 0	.000V/ms	VdcR S	/R = 0	.000V/ms	
	F 8/	R	= 0	.000Hz/ms	VdcF S	/R = 100	.000V/ms	
	Phase	angle	1-2	= 120.0	Phase	angle 1-3	= 240.0	
C	oupling AC	Ra 35	nge OV	Three Phase Setting	Output Waveform Selection	Zo Program Disable		2019/04/03 15:12:45

3	Phase	350V	LOCAL	QUIT	
		OUTPUT	SETTING		Setting
₫1	Vac =	0.0V	F =	60.00H	
₹2	Vac =	0.0V			ALL
₽3	Vac =	0.0V			Sequence
		MORE	SETTING		Positive
∎1	Waveform = <u>/</u>	A SINE			Three Phases Same freq
2	Waveform = /	A SINE			Jame Treq
83	Waveform = /	A BINE			
	ON Degree	= 0.0	OFF Deg	gree = IMMED	
	Vac S/R	= 0.000V/ms	VdcR S.	R = 0.000\	//ms
	F S/R :	= 0.000Hz/m	s VdcFS.	R = 100.000\	//ms
	Phase angle	1-2 = 120.0	Phase a	angle 1-3 = 240).0
C	oupling Ran AC 350		Output Waveform Selection	Zo Program Disable	2019/04/24 13:11:34

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

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

3_	Pha	se	350V	LOCAL	QUIT	
			OUTPL	TSETTING		Setting
∎1	Vac	=	0.0V	F =	60.00Hz	Edit
2	Vac	=	0.0V	F =	60.00Hz	ALL
3	Vac	=	0.0V	F =	60.00Hz	Sequence
			MORE	SETTING		Positive
F1	Wavefo		INE			Three Phases Balance
2	Wavefo		INE			
3	Wavefo		INE			
	ON De	gree =	0.0	OFF Deg	ree = IMMED	Phase re-lock
	Vac S/	R =	0.000V/ms	VdcR S/	'R = 0.000V/ms	Disable
	F 5/	R =	0.000Hz/r	ıs VdcFS/	'R = 0.000V/ms	
	Phase	angle	1-2 = 120.0	Phase a	angle 1-3 = 240.0	
Co	AC	Rang 350		Output Waveform Selection		2018/04/13 14:54:49

350V LOCAL

MORE SETTING

F =

OFF Deg

VdcR S/

VdcF S/

Output

Waveform Selection

Balanced, Sequence:Positive, Volta

0.0V

0.000V/ms

0.000Hz/ms

Three

Phase

Setting

angle 1-3 = 240.0			1 3.			7.0001127ms	Vuci S/K	- 0.0007/ms	
	2018/04/13 14:54:49	Ca	upling AC		inge 50V	Three Phase Setting	Output Waveform Selection		
QUIT		3_	Pha	se	3	50V I	LOCAL	QUIT	
100	Setting			32		OUTPUT			
ige:Phase	Edit		Balan	ced,	Seque	ence:Positi	ive, Voltage	:Line	
60.00Hz	ALI		Vac	=		0.0V	F =	60.00Hz	
	Sequence								
	Positive					MORE S	ETTING		
	Three Phases Balance	₫1	Wavef	orm =	A SINE				
		₹2	Wavef	orm =					
	Voltage set	*2			SINE				
	Line	₫3	Wavef	orm =	A				
gree = IMMED	1		ON D	egree).0	OFF Dear	ee = IMMED	
			Vac S.	•).000V/ms	VdcR S/R		
/R = 0.000V/ms			F S.	/R	= ().000Hz/ms	VdcF S/R	= 0.000V/ms	
	2018/04/13 14:56:30	Ca	upling AC		inge 50V	Three Phase Setting	Output Waveform Selection		

350V LOCAL 3 Phase QUIT Setting Balanced, Sequence:Positive, Voltage:Phase Edit Al I 60.00Hz 0.0V F = Vac = Sequence Positive MORE SETTING Waveform = <u>A</u> Three Phases Balance SINE form = A SINE Voltage set Phase Waveform = A SINE ON Degree = 0.0 OFF Degree = IMMED VdcR S/R = 0.000V/ms Vac S/R = 0.000V/ms F S/R = 0.000Hz/ms VdcF S/R = 0.000V/ms 2018/04/13 14:56:00

> Edit Al I

Sequence Positive

Three Phases Balance

Voltage set Line

2018/04/13 14:57:02

3 Phase

Vac =

Waveform = A

Waveform = A

Waveform = A

Vac S/R

F S/R

Coupling AC SINE

SINE

SINE ON Degree = 0.0

=

-

Range 350V

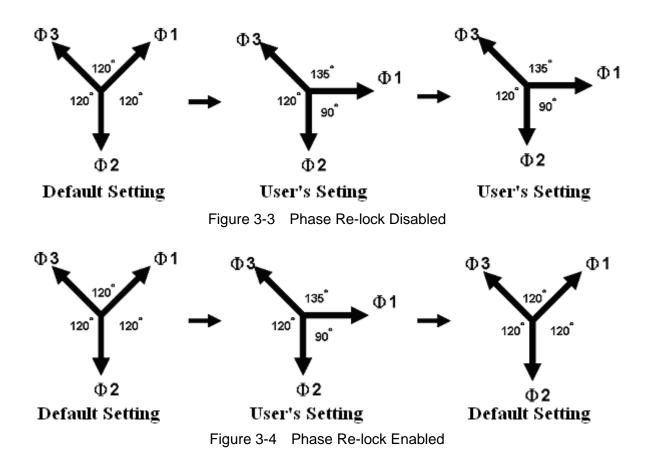
3	Pha				-OCA		QUI			3	_Ph	ase	3	50V		OCA		QUI	Т		
			-	OUTPUT					Setting							SETTIN					Setting
	Vac Vac	=		.0V .0V		= =		.00Hz .00Hz	Edit Each			nced, C =		ence:Po		ve, v F			00	Hz	Edit Each
₫3	Vac	-	0	. O V		-	60	00Hz	Sequence Positive												Sequence Positive
				MORE S	ETTING				10011110					MO	RE SE	TTING					10311110
₫1		5	SINE						Three Phases Balance	₫ 1		form =	SINE								Three Phases Balance
₹2	Wavefo	5	SINE							₹2		form =	SINE								Voltage set
₫3	Wavefo		A SINE							₫3	Wavet	form =	A SINE								Phase
	ON Deg Vac S/F			0 000V/ms		Degre R S/R		MED 0.000V/ms	Phase re-lock Disable		ON D	Degree		0.0 0.000V/			Degre RS/R		MMED 0.000	0)//wa	
	F S/F			00007/ms 000Hz/ms		F S/R		0.000V/ms	DISADIC			S/R		0.000W/			F S/R		00.000		
	Phase a	angle	1-2 =				le 1-3	= 240.0													
с	oupling	Ran		Three Phase	Outpu Wavefo				2019/04/03	С	oupling AC		ange 50V	Thre Phas		Outp Wavefo	rm				2019/04/03
3	AC	350		Setting	Selecti			T	16:54:08	3				Setti	9	Select			т		10.04.10
3	_Pha	s e	3 5	Setting	Selecti		QUI Phase	T	Setting	3	_Ph	ase	3	50V	PUT S			QUI :Line	Т		Setting
3	_Pha	S C ad, S	<mark>35</mark> Sequer	Setting OV OUTPUT	Selecti	Land Ditage	Phase	T . 00Hz		3	_ Ph Balar	ase	S equ	50V	PUT S		Land Goltage	:Line	T . 0 0	Hz	
3	Pha Balance	S C ad, S	<mark>35</mark> Sequer	Setting OV OUTPUT Ice:Positi	Selecti LOCA SETTING ve, Vo F	Land Ditage	Phase		Setting Edit	3	_ Ph Balar	<mark>a s e</mark> nced,	S equ	0.01	PUT S sitiv	OCA SETTING Ve, V	Land Goltage	:Line		Hz	Setting Edit
3	Pha Balance Vac	SC ad, 8 =	35 Sequer O	Setting OV OUTPUT Ice:Positi	Selecti LOCA SETTING ve, Vo F	Land Ditage	Phase		Setting Edit Each Sequence	3	_Ph ^{Balar} Va(ase nced, c =	Sequ	0.01	PUT S sitiv	.OCA Setting Ve, V	Land Goltage	:Line		Hz	Setting Edit Each Sequence
3	_Pha Balance Vac	S C ed, S = rm = 4	35 Sequer O SINE	Setting OV OUTPUT Ice:Positi	Selecti LOCA SETTING ve, Vo F	Land Ditage	Phase		Setting Edit Each Sequence	<mark>3</mark> . ∉1	Ph Balar Va(ase nced, c = form =	Sequ Sequ	00000000000000000000000000000000000000	PUT S sitiv	OCA SETTING Ve, V	Land Goltage	:Line		Hz	Setting Edit Each Sequence Positive
3 ₹1 ₹2	Pha Balance Vac	S C ad, S = rm = 4 s rm = 4 s	35 Sequer O SiNE	Setting OV OUTPUT Ice:Positi	Selecti LOCA SETTING ve, Vo F	Land Ditage	Phase		Setting Edit Each Sequence Positive Three Phases Balance	₫2	Ph Balar Va(Wave	ase nced, c =	Sequ Sequ : A SINE : A SINE	0000 0000 0.0 MOI	PUT S sitiv	OCA SETTING Ve, V	Land Goltage	:Line		θHz	Setting Edit Each Sequence Positive Three Phase Balance Voltage set
3 ₹1 ₹2	Pha Balance Vac Wavefor Wavefor	S C = = = = = = = = = = = = = = = = = = =	35 Sequen O Sine Sine Sine	Setting OV OUTPUT Icce: Positi . OV MORE S	Selecti COCA SETTING Ve, Ve F ETTING	L soltage	Phase 60	.00Hz	Setting Edit Each Sequence Positive Three Phases Balance	_	Ph Balar Vac Wave Wave	ase nced, c = form = form =	Seque Seque SINE A SINE A SINE	6 5 0 V OUT ence : Po 0 . 0 V	PUT S sitiv	OCA SETTING Ve, V F	L (:Line 60	. 0 0	Hz	Setting Edit Each Sequence Positive Three Phase Balance
3 ₹1 ₹2 ₹3	Pha Balance Vac Wavefor Wavefor	S C == rm = 4 rm = 4 rm = 4 s rm = 4 s gree =	3 5 Sequer O A SINE A SINE A SINE 0.	Setting OV OUTPUT Icce: Positi . OV MORE S	Selecti COCA SETTING Ve, Ve F ETTING	Land Ditage	e = IM	.00Hz	Setting Edit Each Sequence Positive Three Phases Balance	₫2	Ph Balar Vac Wave Wave	ase nced, C = form = form =	Seque Seque SINE SINE SINE SINE SINE	000 ence : Po 0 . 0 \ MOI	PUT Sitin	OCA SETTING Ve, V F ETTING	Land Goltage	: Line 60	. 0 0		Setting Edit Each Sequence Positive Three Phase Balance Voltage set
3 ●1	Pha Balance Vac Wavefor Wavefor ON Deg	S C ad, S = rm = 4 s rm = 4 s gree = 3 =	35 Sequer O Sine A Sine A Sine = 0.	Setting OUTPUT Icce: Positi . OV MORE S	Selecti COCA SETTING F ETTING OFF Vdc	L of tage	e = IM	. 0 0 H z	Setting Edit Each Sequence Positive Three Phases Balance	₫2	Pha Balar Vac Wavet Wavet ON C	ase nced, C = form = form =	Sequ Sequ SEQU SINE SINE SINE SINE	6 5 0 V OUT ence : Po 0 . 0 V MOI	PUT S siti	OC A BETTING Ve, V F ETTING	L (oltage =	: Line 60 e = II	. 0 0	0V/ms	Setting Edit Each Sequence Positive Three Phase Balance Voltage set

Phase re-lock: Enable and Disable.

Phase re-lock is used to lock the phases again. Since the output voltage and frequency are set separately when the AC Source is in the 3-phase mode, the three phases may have different frequencies. Assuming the 3-phase output frequencies are different and they are set to the same frequency when the phase re-lock function is disabled, the phase difference of the 3-phase output does not return to default (each phase difference is 120°) as Figure 3-3 shows. The phase differences of the 3-phase output will return to default (each phase difference is 120°) as shown in Figure 3-4 when the phase re-lock function is enabled.

	B_Phase	350V	LOCAL	QUIT		3	_Pha	se	350V	LOCAL	QUIT	
		OUTPUT	SETTING		Setting				OUTPUT	SETTING		Setting
9	1 Vac =	0.0V	F =	60.00Hz	Edit	₫ 1	Vac	=	0.0V	F =	60.00Hz	Edit
9	2 Vac =	0.0V	F =	60.00Hz	Each	₫ 2	Vac	=	0.0V	F =	60.00Hz	Each
3	3 Vac =	0.0V	F =	60.00Hz	Sequence	₫3	Vac	=	0.0V	F =	60.00Hz	Sequence
		MORE S	SETTING		Positive				MORE	SETTING		Positive
g		INE			Three Phases Independ.	₫1	Wavefo	SI	NE			Three Phases Independ.
3	Waveform = A	INE				₹2	Wavefo	rm = A SI	115			
4	Waveform = A					₫3	Wavefo					
	ON Degree :	0.0	OFF Deg	ree = IMMED	Phase re-lock		ON De	gree =	0.0	OFF Deg	ree = IMMED	Phase re-lock
	Vac S/R =	0.000V/ms	VdcR S/	R = 0.000V/ms	Disable		Vac S/	R =	0.000V/ms	VdcR S/	R = 0.000V/ms	Enable
	F S/R =	0.000Hz/ms	VdcF S/	R = 100.000V/ms			F 5/	R =	0.000Hz/m	s VdcFS/	R = 100.000V/ms	
	Phase angle	1-2 = 120.0	Phase a	ngle 1-3 = 240.0			Phase	angle 1	-2 = 120.0	Phase a	ngle 1-3 = 240.0	
	Coupling Ran AC 350		Output Waveform Selection	Zo Program Disable	2019/04/03 15:15:29	C	oupling AC	Range 350V		Output Waveform Selection	Zo Program Disable	2019/04/03 15:15:40

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



3.3.1.4 Output Degree

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

The procedure for setting the output phase degree to ON (Degree = 90) and OFF (Degree=180) in 1_Phase Mode /3_Phase Mode is shown below:

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

Image: Sine state s	3	_Phase	350V	LOCAL	QUIT	
ac = 0.0V $F = 60.00Hz$ More Setting $ac = 0.0V$ $F = 60.00Hz$ Measurement $ac = 0.0V$ $F = 60.00Hz$ Measurement wore form = A Waveform Waveform $sine$ Uimitation Uimitation $reform = A$ Limitation Uimitation $sine$ 0FF Degree = 180.0 Output $begree = 30.0$ 0FF Degree = 180.0 Output $siNe$ 0.000V/ms VdcR S/R = 0.0000V/ms Print $siRe$ 0.000V/ms VdcR S/R = 100.000V/ms Print $sise$ angle 1-2 = 120.0 Phase angle 1-3 = 240.0 On On ng Range Three Output Zo Soutput Soutput $gisting 3Div$ Phase Output Zo Soutput Soutput Coupling	v	ac =			60 00Hz	
a C =0.0VF =60.00HzMeasurement SettingMORE SETTINGWord of the settingWaveform SINEVeform = A SINEWaveform ViewerVeform = A SINEDegree = 90.0OFF Degree = 180.0Output ModeOutput ModeOFF Degree = 180.0Output ModeOutput ModeSIREDegree = 90.0OFF Degree = 180.0Output ModeSIREOutput ModeSIREOutput SineSIREOutput SineSineOutput ModeSineOutput SineSineOutput To Soreen OnSineOutput To Soreen OnOutput To To Soreen OnOutput ToTo To 						
MORE SETTING Waveform a aveform = A Waveform SINE Viewer aveform = A Limitation SINE Limitation N Degree = <u>90.0</u> OFF Degree = 180.0 Output Ac S/R 0.000V/ms VdcR S/R 0.000V/ms S/R 0.000V/ms VdcR S/R 0.000V/ms S/R 0.000V/ms VdcR S/R 100.000V/ms S/R 0.000V/ms VdcR S/R 100.000V/ms S/R 0.000V/ms VdcF S/R 100.000V/ms S/R 0.000V/ms VdcF S/R 100.000V/ms S/R 0.000V/ms VdcF S/R 100.000V/ms S/R 0.000V/ms Vdcr S/R 100.000V/ms S/R 0.000V/ms 2019/04/23 Coupling S/R 0.000V/ms 110.07.153 Ac			0.0V	F =	60.00Hz	Measurement
SINE Waveform Viewer Waveform = A Viewer ON Degree SINE SINE Limitation ON Degree Waveform = A SINE Limitation ON Degree Waveform = A SINE Limitation VdcR S/R VdcR S/R ON Degree =			MORE	SETTING		Setting
Waveform = A Viewer Waveform = A Limitation Waveform = A Limitation Waveform = A Limitation SINE Limitation ON Degree = 90.0 OFF Degree = 180.0 Output Mode Vac S/R 0.000V/ms VdcR S/R 0.000V/ms F S/R 0.000Hz/ms VdcF S/R 100.000V/ms Phase angle 1-2 = 120.0 Phase angle 1-3 = 240.0 oupling Range Phase Waveform Waveform 2019/04/23 Coupling Range Phase Waveform		Waveform =	_			
OFF Degree = Waveform = A Limitation OFF Degree = Vac S/R Vac S/R <th< td=""><td></td><td>Waveform =</td><td></td><td></td><td></td><td>Viewer</td></th<>		Waveform =				Viewer
3 SINE Vac S/R SINE ON Degree = <u>90.0</u> OFF Degree = 180.0 Output Mode Vac S/R	2					Limitation
ON Degree = 90.0 OFF Degree = 180.0 Output Mode F S/R = VdcF S/R = 1000V/ms Mode F S/R = 1000V/ms Print Screen On Print Screen Screen On Print Screen Screen Screen Print Screen Screen Screen Screen Screen Screen Screen Screen Screen Scren Scren Scren	3	waverorm -				
Vac S/R = 0.000V/ms VdcR S/R = 0.000V/ms Print F S/R = 0.000V/ms Print Screen Or Phase angle 1-2 = 120.0 Phase angle 1-3 = 240.0 On Coupling Range Three Output Zo 2019/04/23 Coupling Range AC 350.V Phase Waveform Program 15.07.53 AC 350.V		ON Degree	= 90.0	OFF Deg	ree = 180.0	
Phase angle 1-2 = 120.0 Phase angle 1-3 = 240.0 Screen On Screen On Coupling AC Three 9560V Output Waveform Zo Program 2019/04/23 Coupling AC Range 350V Range 350V Range 350V 2019/04/23 Coupling AC Range 350V Range		Vac S/R	= 0.000V/ms	VdcRS/	R = 0.000V/ms	riode
Coupling Range Three Output Zo 2019/04/23 Coupling Range AC 35.0V Phase Waveform Program 15:07:53 AC 35.0V						
Coupling Range Phase Waveform Program 2019/04/23 Coupling Range		Phase angl	e 1-2 = 120.0	Phase a		On
	C		nge Phase	Waveform	Program	

Notice

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

3.3.1.5 Slew Rate of Output Transient

The AC Source has the ability to set the slew rates of the voltage waveform. This is done through 4 commands in the OUTPUT: More Setting, which are Vac S/R, F S/R, VdcR S/R, and VdcF S/R, which control the slew rate changes of the voltage waveform.

Vac S/R	: Slew rate of Vac output.
F S/R	: Slew rate of frequency output.
VdcR S/R	: Rising slew rate of Vdc output.
VdcF S/R	: Falling slew rate of Vdc output.

Change the output setting in MAIN PAGE. When the AC Source is in OUT mode, the output voltage and frequency will change to follow the Vac S/R, F S/R, VdcR S/R, and VdcF S/R settings.

The procedure to set Vac S/R =0.2, F S/R =0.1, and VdcF S/R =1 in 1_Phase Mode /3_Phase Mode is described below:

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

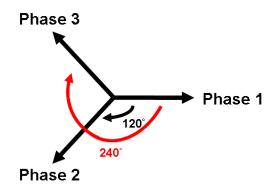
3	Phase	350V	LOCAL	QUIT		1_Pha	se 3	50V	LOCAL	QUIT	
и	Vac =	0.0V	F SETTING	60.00Hz	Setting OUTPUT:	Vac	=	0.0V	F =	60.00H	z
	Vac =	0.0V	F =	60.00Hz	More Setting						
•3	Vac =	0.0V	F =	60.00Hz	Measurement Setting			MORE	SETTING		
1		SINE			Waveform Viewer	Wavefo	rm = A SINE				
2	Waveform = / Waveform = /	INE			Limitation		gree = IM	0.0 MED 0.200V/m	_		
23	ON Degree	SINE • 0.0	OFF Deg	ree = IMMED	Output	VdcRS FS/	/R = R =	1.000V/m 0.100Hz/	s ms		
	140 0111	0.200V/ms			Print	VdcF S	/K = 10	0.000V/m	s		
	F S/R = Phase angle	<u>0.100</u> Hz/m 1-2 = 120.0		R = 100.000V/ms ngle 1-3 = 240.0	Screen						
с	oupling Ran AC 350		Output Waveform Selection	Zo Program Disable	2019/04/23 15:09:41	Coupling AC	Range 350V		Output Waveform Selection		

*	No	tice
---	----	------

- 1. If Vac S/R = 0, F S/R = 0, Vdc S/R = 0, the output slew rate is set to the maximum rate.
- 2. Though the input range of Vac S/R, F S/R, and VdcR S/R is quite large when using the software editor, the output voltage may not apply the slew rate properly due to the hardware limit when the Vac S/R, F S/R, and Vdc S/R are too large. The maximum for Vac S/R is is 1200V/ms and the minimum is 0.001V/ms. The maximum of VdcR S/R and VdcF S/R is 1200V/ms and the minimum is 0.001V/ms. The maximum for F S/R is 1600Hz/ms and the minimum is 0.001Hz/ms.
- When executing OUT on the AC Source the output will reach the final state as set. When QUIT is executed, the output drops to 0V immediately. To reduce the voltage to 0V using the set slew rate, key in 0V and press ENTER instead of pressing QUIT.

3.3.1.6 Output Degree of 3-phase Voltage Output

The AC Source can set the phase angles individually for each of the phases of the 3-phase output voltage. For instance, the phase difference between the 3 phases is 120 degrees for the output voltage with the 3-phase balance positive sequence shown below:



The procedure for setting the output voltage to 3-phase balance with a 120 degree phase difference between the 3 phases is shown below:

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

4. Press **2**, **4**, **0** and **ENTER**.

3	_Pha	se	3	50V I	LOCAL	QUIT		
					SETTING			Setting
₫ 1	Vac	=	1	0.0V	F =	60.	00Hz	OUTPUT:
₹2	Vac	=	1	0.0V	F =	60.	00Hz	More Setting
₫3	Vac	=	1	0.0V	F =	60.	00Hz	Measurement
				MORE S	ETTING			Setting
₫ 1	Wavefo	rm =	A SINE					Waveform Viewer
₹2	Wavefo	rm =	A SINE					
₫3	Wavefo	rm =	A SINE					Limitation
	ON De	gree	= 0	.0	OFF De	gree = IMM	ED	Output
	Vac S/	R	= 0	.000V/ms	VdcR S	/R = 0	.000V/ms	Mode
	F 5/	R	= 0	.000Hz/ms	VdcF S	/R = 100	.000V/ms	Print
	Phase	angl	e 1-2	= 120.0	Phase	angle 1-3	= <u>240.0</u>	Screen On
c	oupling AC		inge 50V	Three Phase Setting	Output Waveform Selection	Zo Program Disable		2019/04/23 15:10:41



Since each phase of the 3-phase voltage output of the AC Source is running independently, it is possible to set the phase differences of the 3-phase output to be unbalanced, such as Phase angle 1-2 = 100, Phase angle 1-3 = 200.

3.3.1.7 Output Waveform Selection

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

3	_Pha	se 3	350V	LOCAL	QUIT	
	Maa	-		SETTING	CO 0011-	Waveform
120	Vac		0.0V	<u>F</u> =	60.00Hz	Edit
₫2	Vac	=	0.0V	F =	60.00Hz	Each
₫3	Vac	=	0.0V	F =	60.00Hz	
			MORE	SETTING		
	Wavefo	rm A = <u>S</u>				View
₫1	Wavefo	rm B = S	NE			Waveform
5 2	Wavefo	rm A = S	NE			
ΨZ	Wavefo	rm B = S	NE			
ā 3	Wavefo	rm A = S	NE			
20	Wavefo	rm B = S	NE			
C	oupling	Range	Three	Output	Zo	2019/04/03
	AC	350V	Phase Setting	Waveform Selection	Program Disable	15:20:10

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

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

Press "View Waveform" on the right to view the set waveform.

3	_Pha	se	3 5	0 V	LOCAL	QUI	Г		3	_Pha	se	35		LOC		QUIT	Г	
			1		SETTING			Waveform						SETTI				Waveform
₫1		=	0	. O V	F =	60	.00Hz	Edit	₫1	Vac	=	0.	. O V	F	=	60.	00Hz	Edit
₫2	Vac	=	0	. O V	F =	60	.00Hz	Each	₹2	Vac	=	0.	. O V	F	=	60.	00Hz	<u>Al I</u>
₫ 3	Vac	=	0	.0V	F =	60	.00Hz		₫3	Vac	=	0.	. O V	F	=	60.	00Hz	
				MORE	SETTING								MORE	SETTIN	G			
 €1	Wavefo Wavefo							View Waveform	₫1		rmA= rmB=							View Waveform
	Wavefo	rmA=	SINE							Wavefo	rmA=	SINE						-
₹2	Wavefo	rmB=	SINE						₹2	Wavefo	rmB=	SINE						
	Wavefo	rmA=	SINE							Wavefo	rmA=	SINE						-
₫3	Wavefo	rm B =	SINE	E					₫3	Wavefo	rmB=	SINE						
С	oupling AC	Rang 350		Three Phase Setting	Output Wavefori Selectio			2019/04/03 15:20:10	c	oupling AC	Rang 350'	v I	Three Phase Setting	Out Wave Selec	form	Zo Program Disable		2019/04/03 15:20:30
2	Pha		3.5	0 V	LOCAL	QUI	г		3	_Pha	8.0	35	n v	LOC	A I	QUIT	Г	
.	_r n a	96	00		SETTING			Marca Course	×.	_r 11 a	96			SETTI		601		Maria 6 a sur
	Vac	-	0	.01	F =	6.0	.00Hz	Waveform		Vac	=	0	. 0 V	F		6.0	00Hz	Waveform
¥1	Vac	-		.0V	F =		.00Hz	Edit Each	¥1 52		_		<u>0</u> V	F	=		00Hz	
4 3	Vac	=		.0V	F =		00Hz			Vac			ÖV	F	=		00Hz	
				MORE	SETTING							OUTP	UT WAVE	FEORM A	OF a	51		
				HUIL	our rino					Wavefo	rmA=		or man	Li olul z				
₫ 1	Wavefo Wavefo							View Waveform										
	Wavefo	rmA=	SINE					-										
₹2	Wavefo	rm B =	SINE								1	-						
₫3	Wavefo Wavefo																	
с	oupling AC	Rang 350\		Three Phase Setting	Output Wavefori Selectio			2019/04/03 15:20:10	с	oupling AC	Rang 350'	v I	Three Phase Setting	Out Wave Seler	form	Zo Program Disable		2019/04/03 15:20:47

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

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

Press "View Waveform" on the right to view the set waveform.

	3_Pha	se 3	50V	LOCAL	QUIT		3	_Pha	se	350V	LOCAL	QUIT		
				SETTING		Waveform					T SETTING			Waveform
	Vac	=	0.0V	F =	60.00Hz	Edit		Vac	=	0.0V	F =	60.	00Hz	Edit
	2 Vac	=	0.0V	F =	60.00Hz	ALL	₹2	Vac	=	0.0V	F =	60.	00Hz	ALI
	B Vac	=	0.0V	F =	60.00Hz		₫3	Vac	=	0.0V	F =	60.	00Hz	
			MORE	SETTING						MORE	SETTING			
		rm A = SI	NE			View		Wavefo	rmA =	CSIN Mode	=THD Perce	nt = 35	i%	View
100	₽1 Wavefo	rm B = SI	NE			Waveform	₫1	Wavefo	rm B =	SINE				Waveform
						-								
	Wavefo 2	rm A = SI	NE				5 2	Wavefo	rmA =	CSIN Mode	= THD Perce	nt = 35	1%	
	Wavefo	rm B = SI	NE				**	Wavefo	rm B =	SINE				
	Wavefo	rm A = SI	NF			-		Wavefo	rmA=	CSIN Mode	=THD Perce	nt = 35	1%	
	23						₫3							
	Wavefo	rm B = SI	NE					Wavefo	rm B =	SINE				
-			Three	Output	Zo					Three	Output	Zo		
	Coupling	Range	Phase	Waveform	Program	2019/04/03	С	oupling	Range	Phase	Waveform	Program		2019/04/03
	AC	350V	Setting	Selection	Disable	15:20:30		AC	350V	Setting	Selection	Disable		15:21:45

3_	Pha	se 3	50V	LOCAL	QUIT	
			OUTPUT	SETTING		Waveform
1	Vac	=	<u>0.0</u> V	F =	60.00H;	z
2	Vac	=	0.0V	F =	60.00H;	z
3	Vac	=	0.0V	F =	60.00H;	z
		0	UTPUT WAVE	FORM A OF	1	
	Wavefo	rm A Mode	=THD Per	cent = 3	15%	
			1			
	+					
	1					
	1					
	1					
Co	upling	Range	Three	Output	Zo	2019/04/0
00	AC	350V	Phase	Waveform	Program	2013/04/0

- **Notice**
- The clipped sine waveform can be programmed via "Amplitude" or "Total Harmonic Distortion". The amplitude range is from 0 to 100% (100%: without clipping) while the Total Harmonic Distortion range is from 0 to 43% (0%: without distortion.)
- 2. A user defined waveform needs to be defined by and downloaded from the remote PC.
- 3. For a detailed waveform, see Appendix B Built-in Waveforms.
- **CAUTION** 1. When using a user defined waveform, the AC Source may be damaged if the waveform frequency exceeds 1000Hz.
 - 2. Due to the bandwidth restriction of the AC Source, distortion may occur on the output, especially when the user defined waveform contains high frequency.

3.3.1.8 Programmable Output Impedance

The output impedance of AC source is very low; however the user may require special output impedance in some test conditions. Using the Zo Program in OUTPUT menu (see section 3.3.1) can edit the output impedance in certain range.

3	Phase	350V	LOCAL	QUIT	
		OUTPU	T SETTING		Setting
₫ 1	Vac =	0.0V	F =	60.00Hz	OUTPUT:
₹2	Vac =	0.0V	F =	60.00Hz	More Setting
₫3	Vac =	0.0V	F =	60.00Hz	Measurement
		MORE	SETTING		Setting
 €1	Waveform = <u>/</u>	A BINE			Waveform Viewer
₫ 2	Waveform = A	A BINE			
₫ 3	Waveform = A	A SINE			Limitation
	ON Degree =		OFF Deg		Output Mode
	Vac S/R =	• 0.000V/ms	VdcR S/	'R = 0.000V/ms	
	F S/R =		a aaa aa		Print Screen
	Phase angle	1-2 = 120.0	Phase a	ingle 1-3 = 240.0	On
C	oupling Ran AC 350		Output Waveform Selection	Zo Program Disable	2019/04/25 16:09:11

Set Zo Program = Enable, $R = 1.0\Omega$, and L = 1.0mH as described below.

- 1. Press the key that maps to Zo Program.
- 2. Turn RPG to switch it to "Enable" and press ENTER.

- 3. The cursor automatically moves to "Zo_R = " command line.
- 4. Press $|\mathbf{1}|$, $|\mathbf{.}|$, $|\mathbf{0}|$ and **ENTER** to change Zo_R to "1.0 Ω ".
- 5. Press | 1 |, | . |, | 0 | and ENTER to change Zo_L to "1.0 mH".

2	Dha		25.01/		OULT			2	Dha		25.01/	LOCAL	OULT		
3	_Pha	se	350V		QUIT			3	_Pha	se	350V		QUII		
	Maa	=		SETTING	60.0		Setting		Maa	_	0.0V	SETTING	6.0	00Hz	Setti
	Vac		0.0V				OUTPUT:		Vac			-			OUTPU
₹2	Vac	=	0.0V	F =	60.0	00Hz	More Setting	₫2	Vac	=	0.0V	F =	60.	00Hz	More Se
₫3	Vac	=	0.0V	F =	60.0	0Hz	Measurement	₫3	Vac	=	0.0V	F =	60.	00Hz	Measure
			MORE	SETTING			Setting				MORE	SETTING			Setti
		orm = <u>A</u>					Waveform	₫1	Wavefo						Wavef
		7.	INE				Viewer			SI	NE				View
₹2	Waveto	orm = A	INE					₹2	Wavefo	rm = A SII	NE				
	Wavefr	orm = A	THE				Limitation		Wavefo		INC				Limitat
₫3			INE					₫3		SII	NE				
	ON De	gree =	0.0	OFF Deg	ree = IMME	D	Output		ON De	gree =	0.0	OFF De	gree = IMM	ED	Outp
	Vac S	'R =	0.000V/ms	VdcR S/	'R = 0.	000V/ms	Mode		Vac S/	- R =	0.000V/ms	VdcR S	/R = 0	.000V/ms	Mod
	F S	'R =	0.000Hz/ms	VdcF S/	R = 100.	000V/ms	Print		F S/	R =	0.000Hz/ms	VdcF S	/R = 100	.000V/ms	Prin
	Phase	angle	1-2 = 120.0	Phase a	ingle 1-3 =	240.0	Screen On		Phase	angle 1·	-2 = 120.0	Phase	angle 1-3	= 240.0	Scree
c	oupling	Rang	Three	Output	Zo		2019/04/25	0	oupling	Range	Three	Output	Zo		2019/0
	AC	350		Waveform Selection	Program Disable		16:09:11	-	AC	350V		Waveform Selection	Program Enable		16:09

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ation

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3	Phase 350V	LOCAL QUIT		3_Phase 350V LOCAL QUIT	
	OUTPUT	SETTING	Setting	OUTPUT SETTING	Setting
₫	Vac = 0.0V	F = 60.00Hz	OUTPUT:	∎ Vac = 0.0V F = 60.00Hz	OUTPUT:
•	2 Vac = 0.0V	F = 60.00Hz	More Setting	■2 Vac = 0.0V F = 60.00Hz	More Setting
•	Vac = 0.0V	F = 60.00Hz	Measurement	■3 Vac = 0.0V F = 60.00Hz	Measurement
	MORE	SETTING	Setting	MORE SETTING	Setting
Ŧ	Waveform = A SINE	Zo_R =0.00Ω	Waveform	Waveform A Zo_R = 1.00Ω Φ1 SINE Zo_L = 1.00mH	Waveform
	Waveform = A	Zo_L =0.00mH Zo_R =0.00Ω	Viewer	SINE Zo_L = 1.00mH Waveform = A Zo_R = 1.00Ω	Viewer
₫	SINE	Zo_L =0.00mH			
Ŧ	Waveform = A	Zo_R =0.00Ω	Limitation	Waveform = A Zo_R =1.00Ω	Limitation
2	SINE	Zo_L =0.00mH		SINE Zo_L =1.00mH	
	ON Degree = 0.0	OFF Degree = IMMED	Output	ON Degree = 0.0 OFF Degree = IMMED	Output
	Vac S/R = 0.000V/ms	VdcR S/R = 0.000V/ms	Mode	Vac S/R = 0.000V/ms VdcR S/R = 0.000V/ms	Mode
	F S/R = 0.000Hz/ms	VdcF S/R = 100.000V/ms	Print	F S/R = 0.000Hz/ms VdcF S/R = 100.000V/ms	Print
	Phase angle 1-2 = 120.0	Phase angle 1-3 = 240.0	Screen On	Phase angle 1-2 = 120.0 Phase angle 1-3 = 240.0	Screen On
	Coupling Range Three AC 350V Setting	Output Zo Waveform Program Selection <mark>Enable</mark>	2019/04/25 16:09:59	Coupling Range Three Output Zo AC 350V Setting Selection Enable	2019/04/25 16:10:31

- Notice
- When Zo Program = Enable, the AC source will reprogram the output waveform to meet the setting via current feedback. However, when the Zo Program = Disable, the output impedance will be the original value of AC source.
- 2. The programmable output impedance function is invalid for DC output.
- 3. The programmable output impedance function is invalid for standalone unit in single phase mode and multiple units in parallel mode.

The maximum values of Zo_R and Zo_L are 1.0Ω and 2.0 mH. However, if L is over 0.5 mH and the output voltage is too low (<100Vac), it could cause the AC source to be unstable especially when the output current is too big. The user has to program the inductance to the desired level slowly. If there is abnormal high frequency voltage output or noise, monitor the output voltage and the AC source noise. Do not program the output impedance but use external impedance circuit if instability occurs.

3.3.2 Measurement Setting

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

Follow the procedure below to change the 3^{rd} measurement item from Po to VA in 3-phase mode.

- 1. Press 'Measurement Setting' on the right in MAIN PAGE (3_Phase Mode).
- 2. Move the cursor to "Po".
- 3. Use the RPG to select "VA" and press ENTER.
- 4. Press 🔄 to return to MAIN PAGE.

3	_Pha	se 3	50V	LOCAL	QUIT		
			OUTPUT	SETTING	20.02		Setting
₫ 1	Vac	=	0.0V	F =	60.	00Hz	OUTPUT:
₹2	Vac	=	0.0V	F =	60.	00Hz	More Setting
₫3	Vac	=	0.0V	F =	60.	00Hz	Measurement
			MEASUREME	NT SETTING			Setting
₹1	٧	Po	_ Vac	Vdc	Vpk	VA	Waveform
ΨI	I	PF	Iac	Idc	Ipk	CF	Viewer
	V	P٥	Vac	Vdc	Vpk	VA	
₹2	I	PF	Iac	Idc	Ipk	CF	Limitation
	٧	Po	Vac	Vdc	Vpk	VA	Output
₫3	Ι	PF	Iac	Idc	Ipk	CF	Mode
	V 12	V23	V 12	V23			Print
Σ	V 31	P٥	V 31	VA			Screen On
		Average	Isurge	Isurge Interval	Edit		2019/04/23
		Times 1	Delay 10ms	10ms	Each		15:12:41

3	_Pha	se 3	50V	LOCAL	QUIT		
			OUTPUT	SETTING			Setting
₫1	Vac	= (0.0V	F =	60.	00Hz	OUTPUT:
⊉ 2	Vac	= (0.0V	F =	60.	00Hz	More Setting
₫ 3	Vac	= (0.0V	F =	60.	00Hz	Measurement
			MEASUREME	NT SETTING			Setting
	٧	V/	A Vac	Vdc	Vpk	VA	Waveform
₫1	I	PF	Iac	Idc	Ipk	CF	Viewer
	٧	P٥	Vac	Vdc	Vpk	VA	
₹2	I	PF	Iac	Idc	Ipk	CF	Limitation
	٧	P٥	Vac	Vdc	Vpk	VA	Output
₫3	Ι	PF	Iac	Idc	Ipk	CF	Mode
	V 12	V23	V 12	V23			Print
Σ	V 31	P٥	V 31	VA			Screen On
		Average	Isurge	Isurge	Edit		2019/04/23
		Times 1	Delav 10ms	Interval 10ms	Each		15:12:47

3	_Pha	s e	350V	LOCAL	QUIT			3	_Pha	se	350V	LOCAL	QUIT		
			OUTPU	SETTING			Setting				OUTPUT	SETTING			Main
₫1	Vac	=	0.0V	F =	60.	00Hz	OUTPUT:	₫1	Vac	= _	<u>0.0</u> V	F =	60.0	00Hz	OUTPUT:
₹2	Vac	=	0.0V	F =	60.	00Hz	More Setting	₫2	Vac	=	0.0V	F =	60.0	00Hz	More Setting
₫3	Vac	=	0.0V	F =	60.	00Hz	Measurement	₫ 3	Vac	=	0.0V	F =	60.0	00Hz	Measurement
			MEASUREM	ENT SETTING			Setting				MEAS	JREMENT			Setting
	۷	VA	Vac	_ Vdc	Vpk	VA	Waveform		٧	=	0.00	VA	= (0.0	Waveform
₫1	I	PF	Iac	Idc	Ipk	CF	Viewer	₫1	I	=	0.000	PF	= 0.0	000	Viewer
	٧	P٥	Vac	Vdc	Vpk	VA			٧	=	0.00	P٥	= (0.0	
₹2	I	PF	Iac	Idc	Ipk	CF	Limitation	₹2	I	=	0.000	PF	= 0.0	000	Limitation
	V	P٥	Vac	Vdc	Vpk	VA	Output		٧	=	0.00	P٥	= (0.0	Output
₫3	1	PF	Iac	Idc	Ipk	CF	Mode	₫3	I	=	0.000	PF	= 0.0	000	Mode
	V 12	V23	V 12	V23			Print		V 12	=	0.00	V23	= 0	.00	Measurement
Σ	V 31	P٥	V 31	VA			Screen On	Σ	V 31	=	0.00	Po	= (0.0	To Page2
		Average Times	Delay	Isurge Interval	Edit Each		2019/04/23		Recall CH1	Reca CH2		Recall CH4	Recall CH5	More 1 of 2	2019/04/23
					Edit Each							Recall CH4			

Follow the procedure below to change the 2nd measurement item from I to Iac in 1-phase mode.

- 1. Press 'Measurement Setting' on the right in MAIN PAGE (1_Phase Mode).
- 2. Move the cursor to "I".
- 3. Use the RPG to select "lac" and press ENTER.
- 4. Press 🔄 to return to MAIN PAGE.

1_Phase 350V LOCAL QUIT		1_Phase 350V LOCAL QUIT
Vac = 0.0V F = 60.00Hz	Setting OUTPUT: More Setting	Vac = 0.0V F = 60.00Hz
MEASUREMENT SETTING	Measurement Setting	MEASUREMENT SETTING Setting
V P₀ Vac Vdc Vpk VA <u>I</u> PF Iac Idc Ipk CF	Waveform Viewer	V Po Vac Vdc Vpk VA <u>Iac</u> PF Iac Idc Ipk CF ^{Wavefor}
	Limitation	Limitatio
	Output Mode	Output Mode
	Print Screen On	Print Screen On
Average Isurge Isurge Times Start Interval 1 10ms 10ms	2019/04/23 15:14:06	Average Isurge Isurge 2019/04. Times Start Interval 15:14: 1 10ms 10ms 10ms
1 Phase 350V LOCAL QUIT		
LINASC SSOF LOOME GOIL		1_Phase 350V LOCAL QUIT
OUTPUT SETTING	Setting	OUTPUT SETTING Main
	Setting OUTPUT: More Setting	
OUTPUT SETTING	OUTPUT:	Vac = <u>0.0</u> V F = 60.00Hz
Vac = 0.0V F = 60.00Hz	OUTPUT: More Setting Measurement	Vac = <u>0.0</u> V F = 60.00Hz
Vac = $0.0VF = 60.00Hz$ MEASUREMENT SETTING V Po Vac Vdc Vpk VA	OUTPUT: More Setting Measurement Setting Waveform	Vac = 0.0VF = 60.00Hz $Vac = 0.0VF = 60.00Hz$ $Measurement$ $V = 0.00F = 0.00F = 0.0F = 0.0F = 0.0F = 0.0F = 0.00F = 0.0F = 0.00F =$
Vac = $0.0VF = 60.00Hz$ MEASUREMENT SETTING V Po Vac Vdc Vpk VA	OUTPUT: More Setting Measurement Setting Waveform Viewer	$Vac = \underbrace{0.0V}_{Measureement} VF = 60.00Hz$ $Vac = \underbrace{0.0V}_{More Set} F = 60.00Hz$ $\underbrace{00TPUT}_{More Set}$ $\underbrace{Measureement}_{Vac} V = 0.000 Po = 0.0$ $\underbrace{Vac}_{Vac} = 0.000 PF = 0.000$ $\underbrace{Vac}_{Vac} = 0.000 Vdc = 0.000$
Vac = $0.0VF = 60.00Hz$ MEASUREMENT SETTING V Po Vac Vdc Vpk VA	OUTPUT: More Setting Measurement Setting Waveform Viewer Limitation Output	$Vac = \underbrace{0.0V}_{Measureement} F = 60.00Hz$ $Vac = \underbrace{0.0V}_{More Sett} F = 60.00Hz$ $\underbrace{00TPUT}_{More Sett}$ $\underbrace{Weasureem}_{Measureement} F = 0.000$ $\underbrace{Vac = 0.000}_{Vac = 0.000} F = 0.000$ $\underbrace{Vac = 0.000}_{Vac = 0.000} Vdc = 0.000$ $\underbrace{Limitatic}_{Vpk = 0.00} VA = 0.0$ $\underbrace{Vac = 0.00}_{Output}$

3.3.2.1 Average Times

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

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

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

The steps for setting the sampling average times to 1 are described below.

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

3	_Pha	se 3	50V	LOCAL	QUIT		
			OUTPUT	SETTING			Setting
₫ 1	Vac	=	0.0V	F =	60.	00Hz	OUTPUT:
₹2	Vac	=	0.0V	F =	60.	00Hz	More Setting
₫3	Vac	-	0.0V	F =	60.	00Hz	Measurement
			MEASUREME	NT SETTING			Setting
	٧	VA	Vac	Vdc	Vpk	VA	Waveform
₫1	I	PF	Iac	Idc	Ipk	CF	Viewer
	٧	P٥	Vac	Vdc	Vpk	VA	
₹2	I	PF	Iac	Idc	Ipk	CF	Limitation
	٧	P٥	Vac	Vdc	Vpk	VA	Output
₫3	Ι	PF	Iac	Idc	Ipk	CF	Mode
	V 12	V23	V 12	V23			Print
Σ	V 31	P٥	V 31	VA			Screen On
		Average Times	Isurge	Isurge Interval	Edit		2019/04/23
		1 imes	Delav 10ms	10ms	Each		15:38:11

3.3.2.2 Isurge Delay, Isurge Interval

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

The procedure for setting Isurge Delay = 10 ms and Isurge Interval = 10 ms is described below:

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

3	_Pha	se :	350V I	LOCAL	QUIT			3	_Pha	se 3	50V I	LOCAL	QUIT		
₫1		=	0.0V	SETTING F =		00Hz	Setting OUTPUT: More Setting	₫1	Vac		0.0V	SETTING F =		00Hz	Setting OUTPUT: More Setting
₩2 ₩3		-	0.0V 0.0V	F = F =		00Hz 00Hz	Measurement Setting	₫ 2 ₫ 3			0.0V 0.0V	F = F =		00Hz 00Hz	Measurement Setting
₫1	V T	VA PF	Vac Iac	Vdc Idc	Vpk Ipk	VA CF	Waveform Viewer	₫1	V I	VA PF	Vac Iac	Vdc Idc	Vpk Ipk	VA CF	Waveform Viewer
# 2	V I	P₀ PF	Vac Iac	Vdc Idc	Vpk Ipk	VA CF	Limitation	₹2	V I	P₀ PF	Vac Iac	Vdc Idc	Vpk Ipk	VA CF	Limitation
æ 3	1	P₀ PF	Vac Iac	Vdc Idc	Vpk Ipk	VA CF	Output Mode	₫3	V I	P₀ PF	Vac Iac	Vdc Idc	Vpk Ipk	VA CF	Output Mode
Σ	V 12 V 31	V23 Po	V 12 V 31	V23 VA			Print Screen On	Σ	V 12 V 31	V23 P0	V 12 V 31	V23 VA			Print Screen On
		Average Times 1	Isurge Delav <mark>10_</mark> ms	Isurge Interval 15ms	Edit Each		2019/04/23 15:39:59			Average Times 1	Isurge Delay 10ms	Isurge Interval <mark>10_</mark> ms	Edit Each		2019/04/23 15:40:15

3.3.3 Waveform Viewer

The Waveform Viewer can be used to see 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 command. The figure below shows the Waveform Viewer.

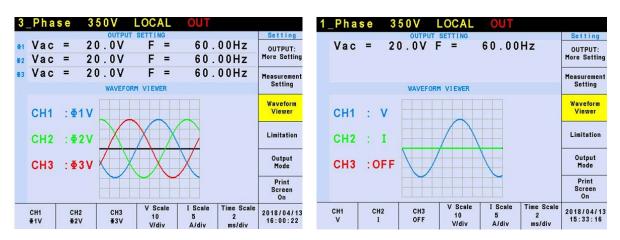
Ch1:	Φ 1V,	Φ 2 V,	Φ 3 V,	Φ1I,	Φ 2l,	Φ 3l.
Ch2:	Φ 1V,	Φ 2V,	Φ 3V,	Φ 1l,	Φ 2l,	Φ 3l.

Ch3: Φ 1V, Φ 2V, Φ 3V, Φ 1I, Φ 2I, Φ 3I.

V Scale: 10, 20, 40, 80, 120V/div. **I Scale:** 1, 2, 5, 10, 20A/div **Time Scale:** 0.2, 0.5, 1, 2, 5, 10, 50, 100, 200ms/div.

The procedure for setting CH1 = \oplus 1V, CH2 = \oplus 2V, CH3 = \oplus 3V, V Scale = 10 V/div, I Scale = 5A/div, and Time Scale = 2 ms/div in 1_Phase Mode /3_Phase Mode is described below:

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



3.3.4 Limitation

The limits for the AC Source 1-phase/3-phase output modes are set separately. For instance, the Vac Limit setting will use the settings of the 1-phase mode when changing from the 3-phase mode.

3.3.4.1 Vac Limit

Vac Limit sets the Vac value in MAIN PAGE (3_Phase Mode/1_Phase Mode). Press 'Limitation' on the right in MAIN PAGE (3_Phase Mode/1_Phase Mode) to set the Vac Limit.

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

The procedure to set Vac Limit = 350V in 1_Phase Mode /3_Phase Mode is described below:

- 1. Move the cursor to the "Vac =" command line.
- Press **3**, **5**, **0** and **ENTER** to change the value to "350.0". 2.

3	_Pha	se 350V	LOCAL	QUIT			1_	Pha	s e	350V	LOCAL	QUIT		
₫ 1 ₫ 2	Vac Vac	= 100.0V = 100.0V	F =	60.0 60.0		Setting OUTPUT: More Setting		Vac	=	0.0V	F =	60.00	Hz	Setting OUTPUT: More Setting
₫3	Vac	= 100.0V	F =	60.0	0Hz	Measurement Setting				LIM	ITATION			Measurement Setting
₫1	Vac F	= <u>350.0</u> =2000.00			94.9V 0.0V	Waveform Viewer		Vac F		<u>350.0</u> \ 00.00H	/ Vdc+ -lz Vdc-		4.9V 0.0V	Waveform Viewer
₹2	Vac F	= 350.0 ¹ = 2000.00			94.9V 0.0V	Limitation Output								Limitation Output
₹3	Vac F	= 350.0 = 2000.00			94.9V 0.0V	Mode Print Screen On								Mode Print Screen On
	Edit Al I			Set to Maximum	Set to Minimum	2019/04/23 15:43:30						Set to Maximum	Set to Minimum	2019/04/24 13:26:25

Notice

The Vac Limit setting is not restricted by the range; however, the Vac in MAIN PAGE is restricted by the range. For example, assuming the range is 175V, even though Vac Limit = 350V, the maximum Vac setting is 175V.

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

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

The procedure for setting Vdc (+) = 494.9V, Vdc (-) = 0V in 1_Phase Mode /3_Phase Mode is described below:

- Move the cursor to the "Vdc (+) =" command line. 1.
- Press **4**, **9**, **4**, **.**, **9** and **ENTER** to change the value to "494.9". 2.
- 3.
- Move the cursor to the "Vdc (-) =" command line. Press \bigcirc and **ENTER** to change the value to "0.0". 4.

3	_Pha	se 3	50V	LOCAL	QUIT			1_Phase 350V LOCAL QUIT	
	Vac	=	0.0V	IT SETTING	6.0	00Hz	Setting	Vac = $0.0VF = 60.00Hz$	Setting
•			0.0V	F =		00Hz	OUTPUT: More Setting		OUTPUT: More Setting
•	Vac	=	0.0V	F =	60.	00Hz	Measurement		Measurement
			LI	ITATION			Setting	LIMITATION	Setting
-	Vac	= 3	50.0	V Vdc+	= 4	94.9V	Waveform Viewer	Vac = 350.0V Vdc+ = 494.9V	Waveform Viewer
	F	= 2 0 0	0.00	⊣z Vdc-	=	<u>0.0</u> V	TICHCI	F =2000.00Hz Vdc- = <u>0.0</u> V	FICHCI
	Vac	= 3	50.0	V Vdc+	= 4	94.9V	Limitation		Limitation
•	F	= 200	0.00		=	0.0V	Output		Output
	Vac	= 3	50.0	V Vdc+	= 4	94.9V	Mode		Mode
æ :	F			v vdc∙ −z Vdc−		0.0V	Print Screen		Print Screen
	•	-200	0.00	12 840		0.04	On		On
	Edit Al I				Set to Maximum	Set to Minimum	2019/04/23 15:44:07	Set to Set to Maximum Minimum	2019/04/23



1. The Vdc Limit setting is not restricted by range; however, the Vdc in MAIN PAGE is restricted by the range. For example, assuming the

range is 175V, even though Vdc Limit=494.9V, the maximum Vdc setting is 247.5V.

- 2. The Vdc value setting should be restricted to the range. Damage to the equipment/UUT may occur if the output polarity is reversed,
 - especially the load polarity.

3.3.5 Output Mode

In Output Mode, there are List Mode, Pulse Mode, Step Mode, Synthesis, Inter-harmonics, and Harmonic Measurement functions for selection. See Chapter 5 for detailed description of mode usage.

3	_Pha	se	3	5 O V	LOCAL	QUIT		
				OUTPUT	SETTING			Setting
₫1	Vac	=	().OV	F =	60.	00Hz	OUTPUT:
₹ 2	Vac	=	().0V	F =	60.	00Hz	More Setting
₫3	Vac	=	().OV	F =	60.	00Hz	Measurement
				MEAS	UREMENT			Setting
₹1	۷	=	(0.00	VA	=	0.0	Waveform
21	I	=	0	000	PF	= 0.	000	Viewer
	۷	=	().00	P٥	=	0.0	
₹2	I	=	0	000	PF	= 0.	000	Limitation
	٧	=	(0.00	Po	=	0.0	Output
₫3	I	=	0	000	PF	= 0.	000	Mode
	V 12	=	().00	V23	= 0	.00	Print
Σ	V 31	=	().00	P٥	=	0.0	Screen On
	List Mode	Puls Mod	-	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2019/04/23 15:44:27

3.3.6 Print Screen

This function captures the LCD screen when it is on. Press Local/Remote FUNCTION key to capture the screen.

3	_Pha	se	3 (50V	LOCAL	QUIT			3	_Pha	se	350V	LO	CAL	QUIT		
	Vac Vac	=		00000000000000000000000000000000000000	SETTING F = F =		00Hz 00Hz	Setting OUTPUT: More Setting		Vac Vac		0 . 0		TING E =		00Hz 00Hz	Setting OUTPUT: More Setting
₫3	Vac	=	C	. OV	F =	60.	00Hz	Measurement Setting	₫3	Vac	=	0.0\ MO	RE SETT	F =	60.	00Hz	Measurement Setting
₫1	Wavefo	S	INE					Waveform Viewer	 ₫1	Wave fo Wave fo	5	SINE					Waveform Viewer
₹ 2 ₹ 3	Wavefo	s rm = A	INE					Limitation	₫ 2 ₫ 3	Wavefo	9 rm = 4	BINE					Limitation
	ON De Vac S/F	gree =	0	.0 .000V/ms	OFF De VdcR S	gree = IMM /R = 0	ED . 000V/ms	Output Mode		ON De Vac S/	gree =			OFF De VdcR S	gree = IMM /R = 0	ED .000V/ms	Output Mode
	F S/F Phase a			.000Hz/ms = 120.0	VdcF S Phase	/R = 100 angle 1-3	.000V/ms = 240.0	Print Screen <u>Off</u>		F S/ Phase		= 0.000Hz 1-2 = 120.		VdcF S Phase	/R = 100 angle 1-3	.000V/ms = 240.0	Print Screen <mark>On</mark>
С	oupling AC	Ranı 350		Three Phase Setting	Output Waveform Selection	Zo Program Disable		2019/04/23 15:44:54	C	oupling AC	Ran 35(se Wa	utput veform lection	Zo Program Disable		2019/04/23 15:44:46

3	_Pha	se	350V	LOCAL	QUIT		
			OUTPUT	SETTING			Setting
₫1	Vac	=	0.0V	F =	60.	00Hz	OUTPUT:
₫2	Vac	=	0.0V	F =	60.	00Hz	More Setting
₫3	Vac	=	0.0V	F =	60.	00Hz	Measurement
			MEAS	JREMENT			Setting
	٧	=	0.00	VA	=	0.0	Waveform
₫1	Ι	=	0.000	PF	= 0.	000	Viewer
	٧	=	0.00	P٥	=	0.0	
₹2	Ι	=	0.000	PF	= 0.	000	Limitation
	٧	=	0.00	Po	=	0.0	Output
₫3	Ι	=	0.000	PF	= 0.	000	Mode
	V 12	=	0.00	V23	= 0	.00	Print
Σ	V 31	=	0.00	P٥	=	0.0	Screen On
\otimes	SAVE	TO	USB ERR!	Synthesis	Inter-	Harmonic	2019/04/23
	Mode	Moc	le Mode	Synthesis	harmonics	Meas.	15:58:01

Notice

The Local/Remote cannot capture the screen when the AC Source is in Remote mode as it is controlled by remote device. The Local/Remote key can only release the remote control function at this time.

3.4 CONFIG Function Key

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





3	_Pha	se	350V	LOCAL	QUIT		1	_Pha	se 3	50V	LOCAL	QUIT		
			OUTPUT	SETTING		Config				OUTPUT	SETTING			Config
Ŧ	Vac	=	0.0V	F =	60.00Hz	Interface		Vac	=	0.0V	F =	60.00	Hz	Interface
•	Vac	=	0.0V	F =	60.00Hz	Interface								Interface
•	Vac	=	0.0V	F =	60.00Hz	External								External
			MEAS	UREMENT		Vref				MEASU	REMENT			Vref
	V	=	0.00	VA	= 0.0	Disalau		V	=	0.00	Po	=	0.0	Diselau
•	I	=	0.000	PF	= 0.000	Display		Iac	= 0	.000	PF	= 0.	000	Display
	٧	=	0.00	VA	= 0.0	PowerON		Vac	=	0.00	Vdc	= 0	.00	PowerON
•	Ι	=	0.000	PF	= 0.000	Status		Iac	= 0	.000	Idc	= 0.	000	Status
	٧	=	0.00	VA	= 0.0			Vpk	=	0.00	VA	=	0.0	
•	I	=	0.000	PF	= 0.000	Protection		Ipk	= 0	.000	CF	= 0.	000	Protection
	V 12	=	0.00	V23	= 0.00	More								More
Σ	V 31	=	0.00	P٥	= 0.0	1 of 2								1 of 2
	GPIB	RS23		Remote	EXT. Ethernet	2018/04/13		GPIB	RS232	RS232	Remote	EXT.	Ethernet	2018/04/13
	Address 30	Parii Non		Inhibit Disable	ON/OFF Setting	16:27:35	'	Address 30	Parity None	Baudrate 115200	Inhibit Disable	ON/OFF Disable	Setting	16:27:47
			-											

3.4.1 Interface

3.4.1.1 GPIB Address, RS-232C Parity/Baudrate

The AC Source has a remote operation mode that can be activated by the CONFIG function (3_Phase Mode/1_Phase Mode). Set the GPIB address to 30 before conducting remote operation in 1_Phase Mode /3_Phase Mode.

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

3	_Pha	s e		OCAL	QUIT		1	l_Pha	se		OCAL	QUIT		
 ⊈1 ⊋2	Vac Vac	=	0.0V 0.0V	F =	60.00Hz 60.00Hz	Config Interface		Vac	=	0.0V F	SETTING	60.00	Hz	Config Interface
₹3	Vac	=	0.0V MEASUF	F =	60.00Hz	External Vref				MEASUR	EMENT			External Vref
₫1	V I	=	0.00 0.000		= 0.0 = 0.000	Display		V Iac	= =	0.00 0.000	P₀ PF		0.0 000	Display
₹2	V I	=	0.00 0.000		= 0.0 = 0.000	PowerON Status		Vac Iac	= =	0.00 0.000	Vdc Idc		.00 000	PowerON Status
₫3	V I	=	0.00 0.000	VA PF	= 0.0 = 0.000	Protection		Vpk Ipk	=	0.00 0.000	VA CF		0.0 000	Protection
Σ	V 12 V 31	=	0.00 0.00	V23 Po	= 0.00 = 0.0	More 1 of 2								More 1 of 2
ļ	GPIB .ddress <u>30</u>	RS2: Pari Non	ty Baudrate	Remote Inhibit Disable	EXT. ON/OFF Disable	2018/04/13 16:28:21		GPIB Address <u>30</u>	RS232 Parity None	/ Baudrate	Remote Inhibit Disable	EXT. ON/OFF Disable	Ethernet Setting	2018/04/13 16:28:12

Notice

The address range is from 1 to 30.

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

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

3	Pha	se	350V	LOCAL	QUIT			3
			OUTPU"	r setting			Config	
₹ 1	Vac	=	0.0V	F =	60.0	0Hz	Interface	Ŧ
₹2	Vac	=	0.0V	F =	60.0	0Hz	Interface	•
₫3	Vac	=	0.0V	F =	60.0	0Hz	External	•
			MEAS	UREMENT			Vref	
	٧	=	0.00	VA	= 0	0.0	Disalau	
₫1	I	=	0.000	PF	= 0.0	00	Display	5
	٧	=	0.00	VA	= 0	0.0	PowerON	ē
₹2	I	=	0.000	PF	= 0.0	00	Status	2
	٧	=	0.00	VA	= 0	0.0		
₫3	I	=	0.000	PF	= 0.0	00	Protection	•
	V 12	=	0.00	V23	= 0.	00	More	
Σ	V 31	=	0.00	P٥	= 0	0.0	1 of 2	Σ
	GPIB	RS23		Remote	EXT.	Ethernet	2018/04/13	
A	ddress 30	Parity <u>None</u>		Inhibit Disable	ON/OFF Disable	Setting	16:28:59	

3	_Pha	se	350\	/ LOC	AL C	ΩUIT		
(here)				ITPUT SETTI				Config
₫ 1	Vac	=	0.0	V F	=	60.0	OHz	Interface
₹2	Vac	=	0.0	V F	=	60.0	0Hz	Interrace
₫3	Vac	=	0.0	V F	=	60.0	0Hz	External
				MEASUREMEN	г			Vref
	٧	=	0.0	0 V	A =	C	0.0	D ¹
₫1	Ι	=	0.00	0 P	F =	0.0	00	Display
	٧	=	0.0	0 V	A =	C	0.0	PowerON
₫2	Ι	=	0.00	0 P	F =	0.0	00	Status
	٧	=	0.0	0 V	A =	C	0.0	
₫3	Ι	=	0.00	0 P	F =	0.0	00	Protection
-	V 12	=	0.0	0 V	23 =	0.	00	More
Σ	V 31	=	0.0	0 P	o =	C	0.0	1 of 2
_	GPIB	RS23	-			EXT.	Ethernet	2018/04/13
A	ddress 30	Parit Non				N/OFF sable	Setting	16:29:09

1	_Pha	se	350V	LOCAL	QUIT			1	_Pha	se	350V	LOCAL	QUIT		
	Vac	=	0.0V	SETTING = =	60.00	Hz	Config Interface		Vac	=		SETTING = =	60.00	Hz	Config Interface
			MEASU	REMENT			External Vref				MEASU	REMENT			External Vref
	V Iac	=	0.00 0.000	P₀ PF		0.0 000	Display		V Iac	=	0.00 0.000	P₀ PF		0.0 000	Display
	Vac Iac	-	0.00 0.000	Vdc Idc	-	.00 000	PowerON Status		Vac Iac	=	0.00 0.000	Vdc Idc		.00 000	PowerON Status
	Vpk Ipk	=	0.00 0.000	VA CF		0.0 000	Protection		Vpk Ipk	=	0.00 0.000	VA CF		0.0 000	Protection
							More 1 of 2								More 1 of 2
	GPIB Address 30	RS232 Parity <u>None</u>		Remote Inhibit Disable	EXT. ON/OFF Disable	Ethernet Setting	2018/04/13 16:29:19	4	GPIB Address 30	RS232 Parity None		Remote Inhibit Disable	EXT. ON/OFF Disable	Ethernet Setting	2018/04/13 16:29:24

Notice

The baudrate selections are 9600/19200/38400/57600/115200 and the selections for parity are EVEN/ODD/NONE.

3.4.1.2 Remote Inhibit, EXT. ON/OFF

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

Remote Inhibit: When the Remote Inhibit is enabled on the AC Source and the Remote Inhibit signal is LOW, the AC Source will disable the output. The AC Source keeps the output disabled even when the Remote Inhibit signal goes HIGH. In order to re-enable the output, the user must press **OUT/QUIT**.

EXT. ON/OFF: When the EXT. ON/OFF is enabled on the AC Source and the EXT. ON/OFF signal is LOW the AC Source will disable the output. The AC Source will re-enable the output when the EXT. ON/OFF signal goes HIGH.

The procedure for setting Remote Inhibit/EXT. ON/OFF to disable in1_Phase Mode /3_Phase Mode is described below:

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

3	_Pha	s e	350V	LOCAL	QUIT		3	_Pha	se	350V	LOCAL	QUIT	
				SETTING		Config					SETTING		Config
₫1	Vac	=	0.0V	F =	60.00Hz	Interface	₫1	Vac	=	0.0V	F =	60.00Hz	Interface
₹2	Vac	=	0.0V	F =	60.00Hz	Interface	₫2	Vac	=	0.0V	F =	60.00Hz	Interface
₫3	Vac	=	0.0V	F =	60.00Hz	External	₩3	Vac	=	0.0V	F =	60.00Hz	External
			MEASU	REMENT		Vref				MEASU	REMENT		Vref
	٧	=	0.00	VA	= 0.0			٧	=	0.00	VA	= 0.0	
₫1	Ι	=	0.000	PF	= 0.000	Display	₫1	Ι	=	0.000	PF	= 0.000	Display
	٧	=	0.00	VA	= 0.0	PowerON		V	=	0.00	VA	= 0.0	PowerON
₫2	Ι	=	0.000	PF	= 0.000	Status	₹2	Ι	=	0.000	PF	= 0.000	Status
	٧	=	0.00	VA	= 0.0			٧	=	0.00	VA	= 0.0	
₫3	Ι	=	0.000	PF	= 0.000	Protection	₫3	Ι	=	0.000	PF	= 0.000	Protection
	V 12	=	0.00	V23	= 0.00	More		V 12	=	0.00	V23	= 0.00	More
Σ	V 31	=	0.00	P٥	= 0.0	1 of 2	Σ	V 31	=	0.00	P٥	= 0.0	1 of 2
	GPIB	RS23 Parity		Remote Inhibit	EXT. ON/OFF Ethernet	2018/04/16		GPIB ddress	RS232 Parity		Remote Inhibit	EXT. ON/OFF Ethernet	2018/04/16
	30	None		Disable	Disable Setting	09:27:21		30	None	115200	Disable	Disable Setting	09:27:23

1_P	has	e 3	50V I	LOCAL	QUIT			1_Pha	se	350V I	LOCAL	QUIT		
V	ac	=	0.0V F	SETTING	60.00	Hz	Config Interface	Vac	=	O.OV F	SETTING	60.00	Hz	Config Interface
			MEASU	REMENT			External Vref			MEASUF	REMENT			External Vref
V I:	ac		0.00	P₀ PF		0.0 000	Display	V Iac	=	0.00	P₀ PF		0.0 000	Display
<u> </u>	a c a c		0.00	Vdc Idc		.00 000	PowerON Status	Vac Iac	= =	0.00	Vdc Idc		.00 000	PowerON Status
and the second se	pk pk		0.00	VA CF		0.0 000	Protection	Vpk Ipk	=	0.00 0.000	VA CF		0.0 000	Protection
							More 1 of 2							More 1 of 2
GPIE Addre 30	ss	RS232 Parity None	RS232 Baudrate 115200	Remote Inhibit <mark>Disable</mark>	EXT. ON/OFF Disable	Ethernet Setting	2018/04/13 16:34:30	GPIB Address 30	RS232 Parity None		Remote Inhibit Disable	EXT. ON/OFF <u>Disable</u>	Ethernet Setting	2018/04/13 16:34:32

Notice

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

3.4.1.3 Ethernet Setting

The AC Source can be operated remotely through a network once the Ethernet Settings are complete.

Network Setting: Auto and Manual.

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

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

3	Pha	se	350V	LOCAL	QUIT								
			OUTPUT	SETTING			Config						
₫1	Vac	=	0.0V	F =	60.	00Hz							
₹2	Vac	=	0.0V	F =	60.	00Hz	Set						
₫3	Vac	-	0.0V	F =	60.	00Hz							
			NETWORK	SETTING									
	Ne two r	k Settir	ng: <u>Manual</u>										
IP Address : 192 . 168 . 1 . 12													
	LAN St	atus = F	READY										
	GPIB ddress	RS232 Parity	RS232 Baudrate	Remote Inhibit	EXT. ON/OFF	Ethernet Setting	2018/04/16 09:40:10						
	30	None	115200	Disable	Disable	Serting	00.40.10						

3.4.2 External Vref

The AC Source accepts analog control signals (simulated) from an external device to set its output (optional card is required) through the External Vref terminal socket on the rear panel. The External Vref and the Control Method can be set by the CONFIG function (3_Phase Mode/1_Phase Mode). External Vref has two coupled modes to indicate the output of the AC Source: Amplifier and Level. When using single phase Ext. Vref, the signal received by terminal pin Ext-V Φ 2 is the main control signal. Refer to Appendix A for the pin assignment of the TTL terminal.

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

Vout (dc) = Vref (dc) / 10 Vdc \times 494.9 Vdc (range 350V) Vout (dc) = Vref (dc) / 10 Vdc \times 247.5 Vdc (range 175V) or Vout (ac) = Vref (ac) / 7.072 Vac \times 350 Vac (range 350V) Vout (ac) = Vref (ac) / 7.072 Vac \times 175 Vac (range 175V)

Ex (1): Set Vout to 100Vdc:

- 1. When selecting the 350V range in the SETUP function, the applied external output voltage is V= 2.021Vdc, Vout = 100Vdc.
- 2. When selecting the 175V range in the SETUP function, the applied external output voltage is V= 4.040Vdc, Vout = 100Vdc.

Ex. (2): Set Vout to 100Vac:

- 1. When selecting the 350V range in the SETUP function, the applied external output voltage is V= 2.021Vac, Vout = 100Vac.
- 2. When selecting the 175V range in the SETUP function, the applied external output voltage is V= 4.040Vac, Vout = 100Vac.

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

Vout (ac) = | Vref (dc) | / 10 Vdc × 350Vac (range 350V)

Vout (ac) = | Vref (dc) | / 10 Vdc × 175Vac (range 175V)

Ex. (1): Set Vout to 100Vac:

- 1. When selecting the 350V range in the SETUP function, the applied external output voltage is V= 2.857Vdc (or -2.857Vdc), Vout = 100Vac.
- When selecting the 175V range in the SETUP function, the applied external output voltage is V= 5.714Vdc (or -5.714Vdc), Vout = 100Vac.

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

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

3	_Pha	se	350V	LOCAL	QUIT		3	_Pha	s e	350V	LOCAL	QUIT	
			OUTPUT	SETTING		Config				OUTPUT	SETTING		Config
Đ.	Vac	=	0.0V	F =	60.00Hz	T. 4-14-1-	₹1	Vac	=	0.0V	F =	60.00Hz	1.1
•	Vac	=	0.0V	F =	60.00Hz	Interface	₹2	Vac	=	0.0V	F =	60.00Hz	Interface
•	Vac	=	0.0V	F =	60.00Hz	External	₫3	Vac	=	0.0V	F =	60.00Hz	External
			MEAS	UREMENT		Vref				MEAS	UREMENT		Vref
	٧	=	0.00	VA	= 0.0			V	=	0.00	VA	= 0.0	
•	Ι	=	0.000	PF	= 0.000	Display	₫1	I	=	0.000	PF	= 0.000	Display
	٧	=	0.00	VA	= 0.0	PowerON		٧	=	0.00	VA	= 0.0	PowerON
•	Ι	=	0.000	PF	= 0.000	Status	₫2	I	=	0.000	PF	= 0.000	Status
	٧	=	0.00	VA	= 0.0			٧	=	0.00	VA	= 0.0	
•	I	=	0.000	PF	= 0.000	Protection	₫3	I	=	0.000	PF	= 0.000	Protection
	V 12	=	0.00	V23	= 0.00	More		V 12	=	0.00	V23	= 0.00	More
Σ	V 31	=	0.00	P٥	= 0.0	1 of 2	Σ	V 31	=	0.00	Po	= 0.0	1 of 2
	Ext.Vref Control <u>Off</u>	Met	itrol hod ifier			2018/04/13 16:45:06		xt.Vref Control Of f	Con Met <u>Ampli</u>	hod			2018/04/16 09:27:54

3	_Pha	se	350V	LOCAL	G	QUIT	
			OUTPU'	T SETTING			Config
₹ 1	Vac	=	0.0V	F =		60.00Hz	Interface
₹2	Vac	=	0.0V	F =		60.00Hz	Interrace
₫3	Vac	=	0.0V	F =		60.00Hz	External
			MEAS	UREMENT			Vref
	٧	=	0.00	VA	=	0.0	D : 1
₫1	I	=	0.000	PF	=	0.000	Display
	٧	=	0.00	VA	=	0.0	PowerON
₫2	I	=	0.000	PF	=	0.000	Status
	٧	=	0.00	VA	=	0.0	
₫3	I	=	0.000	PF	=	0.000	Protection
	V 12	=	0.00	V23	=	0.00	More
Σ	V 31	=	0.00	P٥	=	0.0	1 of 2
	xt.Vref	Cont					2018/04/13
Ľ	Control Off	Meth Ampli					16:45:21

5. Press Exit to return to the Main screen. The output parameter F for the measurement frequency should be the same as the Ext.V input frequency.



When Ext. Vref Control = ON and Control Method = Level, the output voltage (Vout) can only be controlled by the level of the external DC programming voltage. The output voltage (Vout) can only be controlled from the front panel keys when Ext. Vref Control=OFF.

CAUTION 1. When Control Method = Amplifier and the Vref frequency exceeds 2000Hz, the AC Source could be damaged. This formula should be followed exactly – Vref (pk-pk, V) × F (Vref, Hz) < 10000 VHz.

- 2. The output may be distorted due to the bandwidth restriction of the AC Source, especially when the external V reference has too many high frequency components.
- 3. If the input voltage range exceeds ±10V (exceeding ±12V could damage the AC Source), the AC Source will trigger Over Voltage
- Protection (OVP).

3.4.3 Display

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

Style: Default.

Backlight: Low, Medium, and High.

Backlight OFF after: Never, 1 min, 3 mins, 5 mins, 10 mins, 30 mins, 1 hour, and 3 hours.

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

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

3	_Pha	se	350V	LOCAL	QUIT		3	_Pha	se	350V	LOCAL	QUIT	
				SETTING		Config					SETTING		Config
	Vac	=	0.0V	F =	60.00Hz	Interface	₫1	Vac	=	0.0V	F =	60.00Hz	Interface
₹2	Vac	=	0.0V	F =	60.00Hz	Interface	₹2	Vac	=	0.0V	F =	60.00Hz	Interface
₫3	Vac	=	0.0V	F =	60.00Hz	External	₫3	Vac	=	0.0V	F =	60.00Hz	External
			MEASU	IREMENT		Vref				POWER ON ST	ATUS SETTIN	G	Vref
₫1	٧	=	0.00	VA	= 0.0	Display		Vac	=	0.0V	F =	60.00Hz	Display
	I	=	0.000	PF	= 0.000		₫1	Vdc	=	0.0V			
₹2	V	=	0.00	VA	= 0.0	PowerON							PowerON
22	I	=	0.000	PF	= 0.000	Status		Vac	=	0.0V	F =	60.00Hz	Status
	V	=	0.00	VA	= 0.0		₹2	Vdc	=	0.0V			
₫3	I	=	0.000	PF	= 0.000	Protection					-		Protection
	V 12	=	0.00	V23	= 0.00	More	# 3	Vac	=	0.0V	F =	60.00Hz	More
Σ	V 31	=	0.00	P٥	= 0.0	1 of 2		Vdc	=	0.0V			1 of 2
	Style	Backl				2018/04/13		Output	Edi				2018/04/13
	Default	Medi	um Never			16:47:05		<u>Off</u>	ALI				16:48:09

3.4.4 Power ON Status

The output state of the AC Source at power-on can be set using the Power ON Status in the CONFIG function (3_Phase Mode/1_Phase Mode). Once it is set, save the data before turning off the source. With the output set to OFF, the AC Source will not enable the output voltage after it is powered on. With it set to ON, the AC Source will enable the output by default after it is powered on.

) =) =) =	0.0V 0.0V 0.0V 0.0V	F = F = F =	60.00Hz 60.00Hz	Config Interface		Vac =	0.0V	F =	60.00Hz	Config
; =	0.0V 0.0V	F =	60.00Hz	Interface			0.00	F =	60.00HZ	
	0.0V							_		Interface
; =		F =			₫2	Vac =	0.0V	F =	60.00Hz	
			60.00Hz	External	₫3	Vac =	0.0V	F =	60.00Hz	External
	POWER ON S	TATUS SETTIN	IG	Vref			POWER ON S	TATUS SETTIN	G	Vref
; =	0.0V	F =	60.00Hz	Display		Vac =	0.0V	F =	60.00Hz	Display
. –	0 01/			Display	₫1	Vdo -				Display
. –	0.04			PowerON		vuc -	0.04			PowerON
; =	0.0V	F =	60.00Hz	Status		Vac =	0.0V	F =	60.00Hz	Status
. =	0 NV				₹2	Vdc =	0 0V			
				Protection			•.••			Protection
; =	0.0V	F =	60.00Hz		2.2	Vac =	0.0V	F =	60.00Hz	
; =	0.0V			More 1 of 2	¥3	Vdc =	0.0V			More 1 of 2
				2018/04/13 16:48:09						2018/04/13 16:48:44
	- = = = = = = = = = = = = = = = = = = =	c = 0.0V c = 0.0V c = 0.0V c = 0.0V c = 0.0V	c = 0.0V $c = 0.0V$ $F = 0.0V$ $c = 0.0V$ $F = 0.0V$ $c = 0.0V$ $F = 0.0V$ $Edit$	c = 0.0V $c = 0.0V F = 60.00Hz$ $c = 0.0V F = 60.00Hz$ $c = 0.0V F = 60.00Hz$ $c = 0.0V$	$c = 0.0V$ $c = 0.0V F = 60.00Hz$ $c = 0.0V F = 60.00Hz$ $rotection$ $c = 0.0V F = 60.00Hz$ $rotection$ $\frac{More}{1 \text{ of } 2}$ Edit $2018/04/13$	c = 0.0V $c = 0.0V F = 60.00Hz$ $c = 0.0V F = 60.00Hz$ $rotection$ $c = 0.0V F = 60.00Hz$ $rotection$ $rote 1 of 2$ $Edit$ $2018/04/13$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$

1_Phase	350V LOCAL QUIT		1_Phase 350V LOCAL QUIT
	OUTPUT SETTING	Config	OUTPUT SETTING Config
Vac =	0.0VF = 60.00Hz	Interface	Vac = 0.0V F = 60.00Hz
		External	External
	POWER ON STATUS SETTING	Vref	POWER ON STATUS SETTING Vref
Vac = Vdc =	0.0V F = 60.00Hz 0.0V	Display	Vac = <u>0.0</u> V F = 60.00Hz Vdc = 0.0V
		PowerON Status	PowerON Status
		Protection	Protection
		More 1 of 2	More 1 of 2
Output <mark>Of f</mark>		2018/04/13 16:49:09	Output Off 2018/04/13 16:49:14

3.4.5 Protection

The AC Source's Protection for the 1-phase and 3-phase output modes is set separately. For instance, the Protection will apply the 1-phase settings when switching from 3-phase to 1-phase mode rather than the Protection settings of any phase under 3-phase mode.

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

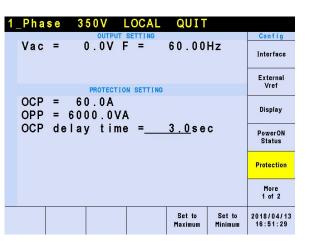
The procedure for setting the current limit = 20A (15A for 61508 and 10A for 61507), power limit = 2000VA (1500VA for 61508 and 1000VA for 61507), and delay time for trigger current protection = 3 sec. for 61509 in 3_Phase Mode is shown below:

- 1. Move the cursor to the "OCP =" command line.
- 2. Press **2**, **0** and **ENTER** to change the value to "20.0".
- 3. Move the cursor to the "OPP =" command line.
- 4. Press **2**, **0**, **0**, **0**, **ENTER** to change the value to "2000.0".
- 5. Move the cursor to the "Delay time =" command line.
- 6. Press **3**, **ENTER** to change the value to "3.0".

3	_Pha	se	350\	/ L	OCAL	QUIT		
			01	JTPUT SE	ETTING			Config
₫1	Vac	=	0.0	٧	F =	60.	00Hz	Interface
₫2	Vac	=	0.0	١V	F =	60.	00Hz	Intertace
₫3	Vac	=	0.0	V	F =	60.	00Hz	External
			PROT	FECTION	SETTING			Vref
	OCP	=	20.0	A	OPP	= 200	0.0VA	Display
₫1	OCP	del	lay t	ime	=	<u>3.0</u> se	с	
	000							PowerON
₹2	OCP	=	20.0	IA	066	= 200	U.UVA	Status
92	OCP	del	lay t	ime	=	3.0se	c	Protection
	OCP	=	20.0	Δ	OPP	= 200		
₫ 3								More
	OCP	del	ay t	Ime	=	3.0se	C	1 of 2
	Edit					Set to	Set to	2018/04/13
	ALL					Maximum	Minimum	16:51:51

The procedure for setting the current limit = 60A (45A for 61508, 30A for 61507), power limit = 6000VA (4500VA for 61508, 3000VA for 61507), and delay time for trigger current protection = 3 sec. for 61509 in 1_Phase Mode is shown below:

- 1. Move the cursor to the "OCP =" command line.
- 2. Press **6**, **0** and **ENTER** to change the value to "60.0".
- 3. Move the cursor to the "OPP =" command line.
- 4. Press **6**, **0**, **0**, **0**, **ENTER** to change the value to "6000.0".
- 5. The cursor moves to the "Delay time =" command line automatically.
- 6. Press **3**, **ENTER** to change the value to "3.0".





- 1. When "OCP = 0.0 A", the output current limit is set to the specification limit.
- 2. The delay time setting for trigger current protection is only valid when the current is within the specification. When the output is over the specification, the time delay set between 0.1 and 1s for triggering current protection is valid. However, if the current is over the output specification and the protection delay time is set to more than 1s, then 1s will be the maximum delay protection time. The resolution is 0.1s.
- 3. The protection point varies by the measurement error, thus it may act before reaching the protection point set.

3.4.6 Others

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

Output Relay: Depend and Always ON. Buzzer: ON and OFF. Date/Time: Year, Month, Day, Hour, Minute, and Second. Remote sense: On, Off. FW Download: E_FPGA, E_HOST, E_WAVE, and C_ANALOG. EXT IO No.16: Default , Phase.

3	_Pha	s e	350V	LOCAL	QUIT		1	_Pha	se 3	350V L	OCAL	QUIT		
₫ 1 ₫ 2		=	0.0V	F =	60.00Hz 60.00Hz	Config Others		Vac	=	0.0V F		60.00	Hz	Config Others
4 3		=	0.0V	F =	60.00Hz	Calibration				MEASUR	EMENT			Calibration
₫1	V I	=	0.00	VA PF	= 0.0 = 0.000	System Information		V Iac		0.00	P₀ PF		0.0 000	System Information
₫2	1	=	0.00 0.000	P₀ PF	= 0.0 = 0.000	Factory Default		Vac Iac	= = 0	0.00 0.000.0	Vdc Idc		.00 000	Factory Default
₫3	V I	=	0.00 0.000	P₀ PF	= 0.0 = 0.000	Master/Slave Function		Vpk Ipk	= = 0	0.00 0.000	VA CF		0.0 000	Master/Slave Function
Σ	V 12 V 31	=	0.00 0.00	V23 Po	= 0.00 = 0.0	More 2 of 2								More 2 of 2
	Output Relay epend.	Buzz Of		Remote Sense On	FW EXT IO No.16 Download Default	2019/04/24 13:30:03		Output Relay Depend.	Buzzer Off	Date/Time	Remote Sense On	FW Download	EXT IO No.16 Default	2019/04/24 13:30:10

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

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

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

3	_Pha	se	350V	LOCAL	QUIT		3	_Pha	se	350V	LOCAL	QUIT	
			OUTPUT	SETTING		Config				OUTPUT	SETTING		Config
₫	Vac	=	0.0V	F =	60.00Hz	Others	₹1	Vac	=	0.0V	F =	60.00Hz	Others
•	Vac	=	0.0V	F =	60.00Hz	others	₹2	Vac	=	0.0V	F =	60.00Hz	others
₫	Vac	=	0.0V	F =	60.00Hz	Calibration	₫3	Vac	=	0.0V	F =	60.00Hz	Calibration
			MEAS	JREMENT						MEAS	UREMENT		
ē	V	=	0.00	VA	= 0.0	System	₫1	۷	=	0.00	VA	= 0.0	System
	1	=	0.000	PF	= 0.000	Information	21	1	= ().000	PF	= 0.000	Information
	V	=	0.00	P٥	= 0.0	Factory		V	=	0.00	Po	= 0.0	Factory
•	I	=	0.000	PF	= 0.000	Default	₫2	I	= (0.000	PF	= 0.000	Default
_	٧	=	0.00	Po	= 0.0	Master/Slave		٧	=	0.00	Po	= 0.0	Master/Slave
•	I	=	0.000	PF	= 0.000	Function	₫3	I	= (0.000	PF	= 0.000	Function
	V 12	=	0.00	V23	= 0.00	More		V 12	=	0.00	V23	= 0.00	More
Σ	V 31	=	0.00	P٥	= 0.0	2 of 2	Σ	V 31	=	0.00	P٥	= 0.0	2 of 2
A	Output Relay Iways ON	Buzz Of		Remote Sense On	FW EXTIO No.16 Download Default	2019/04/24 13:30:44		Output Relay ways ON	Buzzer Off	Date/Time	Remote Sense On	FW EXT IO No.16 Default	2019/04/24 13:30:46

1	_Phas	se	350V L	OCAL	QUIT			1	_Pha	se	350V L	LOCAL	QL	JIT		
	Vac	=	0.0V F		60.00	Hz	Config Others		Vac	=	0.0V F		60.	00	Hz	Config Others
			MEASUR	EMENT			Calibration				MEASUR	EMENT				Calibration
	V Iac	= =	0.00	P₀ PF		0.0 000	System Information		V Iac	= =	0.00	P₀ PF	= =		0.0 000	System Information
	Vac Iac	=	0.00	Vdc Idc	-	.00 000	Factory Default		Vac Iac	=	0.00	Vdc Idc	=	-	.00 000	Factory Default
	Vpk Ipk	= =	0.00	VA CF		0.0 000	Master/Slave Function		Vpk Ipk	= =	0.00 0.000	VA CF	= =		0.0 000	Master/Slave Function
							More 2 of 2									More 2 of 2
A	Output Relay Iways ON	Buzzer Off	Date/Time	Remote Sense On	FW Download	EXT IO No.16 Default	2019/04/24 13:30:59		Output Relay ways ON	Buzze Off	r Date/Time	Remote Sense On	F ¹ Down		EXTIO No.16 Default	2019/04/24 13:31:02

CAUTION Check if the AC Source is outputting voltage before powering it off. To ensure the safety of the hardware, DO NOT power off the AC Source when it is still outputting a voltage.

The AC Source buzzer beeps when the panel keys are pressed or the RPG rotary is turned. If desired, the buzzer may be turned off.

The following procedure describes the procedure for turning off the buzzer in 1_Phase Mode /3_Phase Mode:

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

3	_Phas	s e	350V	LOCAL	QUIT		3	_Pha	se	350V	LOCAL	QUIT		
				SETTING		Config					SETTING			Config
₫	Vac	=	0.0V	F =	60.00	Z	₫1	Vac	=	0.0V	F =	60.	00Hz	Others
•	Vac	=	0.0V	F =	60.00	1z	₹2	Vac	=	0.0V	F =	60.	00Hz	Others
•	Vac	-	0.0V	F =	60.00	Z	₫3	Vac	=	0.0V	F =	60.	00Hz	Calibration
			MEASU	REMENT						MEAS	JREMENT			
	٧	=	0.00	VA	= 0.	System		٧	=	0.00	VA	=	0.0	System
Ŧ	I	=	0.000	PF	= 0.00		至1	I	=	0.000	PF	= 0.	000	Information
	٧	=	0.00	P٥	= 0.	Factory		٧	=	0.00	P٥	=	0.0	Factory
•	I	=	0.000	PF	= 0.00		₹2	I	=	0.000	PF	= 0.	000	Default
	٧	=	0.00	Po	= 0.	Master/Slave		٧	=	0.00	Po	=	0.0	Master/Slave
•	I	=	0.000	PF	= 0.00		₫3	I	=	0.000	PF	= 0.	000	Function
	V 12	=	0.00	V23	= 0.0	More		V 12	=	0.00	V23	= 0	.00	More
Σ	V 31	=	0.00	P٥	= 0.		Σ	V 31	=	0.00	P٥	=	0.0	2 of 2
A	Output Relay ways ON	Buzze <mark>Off</mark>	r Date/Time	Remote Sense On	FW N	TIO 2019/04/24 13:31:28		Output Relay ways ON	Buzze Off	r Date/Time	Remote Sense On	FW Download	EXT IO No.16 Default	2019/04/24 13:31:30

1	l_Phas	s e	350V L	OCAL	QUIT			1	_Pha	se	350V	LOCAL	QUI	Т	
	Vac	=	0.0V F	SETTING	60.00	Hz	Config		Vac	=	0.0V	F =	60.0)Hz	Config
			0.01 1				Others		·uv		•.•.	-1 - C			Others
							Calibration								Calibration
			MEASUR	EMENT			Campration				MEAS	UREMENT			Calibration
	٧	=	0.00	P٥	=	0.0	System		٧	=	0.00	Po	=	0.0	System
	Iac	=	0.000	PF	= 0.	000	Information		Iac	= (0.000	PF	= 0	. 0 0 0	Information
	Vac	=	0.00	Vdc	= 0	.00	Factory		Vac	=	0.00	Vdc	= 1	0.00	Factory
	Iac	=	0.000	Idc	= 0.	000	Default		Iac	= (0.000	Idc	= 0	.000	Default
	Vpk	=	0.00	VA	=	0.0	Master/Slave		Vpk	=	0.00	VA	=	0.0	Master/Slave
	Ipk	=	0.000	CF	= 0.	000	Function		Ipk	= (0.000	CF	= 0	. 0 0 0	Function
							More								More
							2 of 2								2 of 2
	Output	Buzzer	Date/Time	Remote Sense	FW	EXT IO No.16	2019/04/24		Output	Buzzer	Date/Tim	Remote e Sense	FW	EXT IO No.16	2019/04/24
A	Relay Iways ON	<u>0ff</u>	Date/Thile	On	Download	Default	13:31:18	A	Relay Iways ON	011	Date/ Tim	On	Download	Default	13:31:20

Set the time and date of the AC Source.

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

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

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

3	_Phas	se	350V	LOCAL	QUIT		1_Ph	ase	350V	LOCAL	QUIT		
			OUTPUT	SETTING		Config			OUTPUT	SETTING			Config
₫1	Vac	=	0.0V	F =	60.00Hz	Year	Va	c =	0.0V	F =	60.00	Hz	Year
₹2	Vac	=	0.0V	F =	60.00Hz	2019							2019
•	Vac	=	0.0V	F =	60.00Hz	Month							Month
			MEASU	REMENT		4			MEASU	REMENT			4
	٧	=	0.00	VA	= 0.0	Day	۷	=	0.00	Po	=	0.0	Day
•	I	=	0.000	PF	= 0.000	24	Ia	c = (0.000	PF	= 0.	000	24
	٧	=	0.00	P٥	= 0.0	Hour	Va	c =	0.00	Vdc	= 0	.00	Hour
₩2	I	=	0.000	PF	= 0.000	13	Ia	c = (0.000	Idc	= 0.	000	13
	۷	=	0.00	P٥	= 0.0	Minute	Vp	k =	0.00	VA	=	0.0	Minute
•3	I	=	0.000	PF	= 0.000	31	Ip	k = (0.000	CF	= 0.	000	31
	V 12	=	0.00	V23	= 0.00	Second							Second
Σ	V 31	=	0.00	P٥	= 0.0	40							54
A	Output Relay ways ON	Buzz Of		Remote Sense On	FW EXTIO No.16 Download Default	2019/04/24 13:31:42	Output Relay Always (Buzzer Off	Date/Time	Remote Sense On	FW Download	EXT IO No.16 Default	2019/04/24 13:31:56

The AC source has remote compensation function (factory default is on). For some particular tests, the remote compensation function can be disabled if not required.

Remote sense: on, off

Set voltage compensation in single/3-phase mode as described below.

- 1. Press the key that maps to Remote sense.
- 2. Use RPG to change the selected item and press ENTER.

3	_Pha	se	350V L	OCAL	QUI	Т	Con () o	3	_Pha	s e	350V		QU	IT	Contin
₫ 1	Vac	=	0.0V 0.0V	F = F		.00Hz .00Hz	Config Others	₫ 1 ₫ 2	Vac Vac	=	0.0V 0.0V	F =		0.00Hz 0.00Hz	Config Others
₫3	Vac	=	0.0V	F =	60	.00Hz	Calibration	₫ 3	Vac	=	0.0V	F =	6	0.00Hz	Calibration
₫1	V I	=	0.00	VA PF	= = 0	0.0	System Information	₹1	V I	=	0.00	VA PF	-	0.0	System Information
₹2	V I	=	0.00	P₀ PF	= = 0	0.0	Factory Default	₫2	V I	=	0.00	P₀ PF	=	0.0	Factory Default
₫3	V I	=	0.00	P₀ PF	= = 0	0.0	Master/Slave Function	₫3	V I	=	0.00	P₀ PF	-	0.0	Master/Slave Function
Σ	V 12 V 31	=	0.00	V23 Po	= (0.00 0.0	More 2 of 2	Σ	V 12 V 31	=	0.00	V23 Po	=	0.00	More 2 of 2
	Output Relay ways ON	Buzz Off		Remote Sense <u>On</u>	FW Download	EXT IO No.16 Phase	2019/04/24 14:59:38)utput Relay vays ON	Buzze		Remote Sense Off	FW Downl		2019/04/24 14:59:49
1	Pha	se	350V L	OCAL	QUI	Т		1	Pha	se	350V	LOCAL	QU	ПТ	
1	_Pha	se	350V L		QUI	T	Config	1	_Pha	se	350V		QU	ΙТ	Config
1	_Pha Vac	s e =		SETTING	QUI 60.00		Config Others	1.	Pha Vac	s e =	OUTPU			IT 00Hz	Config Others
1			OUTPUT S	ETTING =				1.			0.0V	SETTING			
1			0.0V F	ETTING =	60.00		Others	1			0.0V	F =	60. =		Others
1	Vac V	=	0.0V F 0.0V F MEASUR 0.00	EMENT Po	60.00 = = 0 = (0 Hz	Others Calibration System	1	Vac V	=	0.0V	F = UREMENT Po	60. = = =	00Hz 0.0	Others Calibration System
1	Vac V Iac Vac	-	0.0V F 0.0V F 0.00 0.00 0.00 0.00	EMENT Po PF Vdc	60.00 = = 0 = 0 =	0 Hz 0 . 0 . 000 0 . 00	Others Calibration System Information Factory	1	Vac V Iac Vac	-	OUTPU 0.0V MEAS 0.00 0.000 0.000	F = UREMENT Po PF Vdc	60. = = = = =	00Hz 0.0 0.000 0.000	Others Calibration System Information Factory
1	Vac V Iac Vac Iac Vpk	= = = = =	0.0V F 0.0V F 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	EMENT Po PF Vdc Idc VA	60.00 = = 0 = 0 =	0.0 .000 .000 .000 .000 0.00	Others Calibration System Information Factory Default Master/Slave	1	Vac V Iac Vac Iac Vpk	-	000000 0.000 0.000 0.000 0.000 0.000 0.000	F = UREMENT Po PF Vdc Idc VA	60. = = = = =	00Hz 0.00 0.000 0.000 0.000 0.00	Others Calibration System Information Factory Default Master/Slave

The AC source provides this selection for Chroma service center to upgrade the device when a new version of firmware is released. (This item must be preformed by Chroma's engineer.)

FW Download:

3	_Pha	se	350V I	LOCAL	QUIT		
			OUTPUT	SETTING			Config
₫ 1	Vac	=	0.0V	F =	60.	00Hz	Others
₹2	Vac	=	0.0V	F =	60.	00Hz	Others
₫3	Vac	=	0.0V	F =	60.	00Hz	Calibration
			MEASUR	REMENT			Cambration
	٧	=	0.00	Po	=	0.0	System
₫1	Ι	=	0.000	PF	= 0.	000	Information
	٧	=	0.00	P٥	=	0.0	Factory
₫2	I	=	0.000	PF	= 0.	000	Default
	٧	=	0.00	P٥	=	0.0	Master/Slave
₫3	I	=	0.000	PF	= 0.	000	Function
	V 12	=	0.00	V23	= 0	.00	More
Σ	V 31	=	0.00	P٥	=	0.0	2 of 2
J	Dutput Relay epend.	Buzzer On	Date/Time	Remote Sense On	FW Download	EXT IO No.16 Default	2019/05/02 14:08:26

As the AC source has 3_Phase/1_Phase output selection and the EXT IO Pin.16 has 1 set of linkage control output signal mapping to the work status of 3_Phase/1_Phase, when Phase is selected, the pin output will be logic High leve in 3_Phase output mode and logic Low level in 1_Phase output mode.

EXT IO No.16: Default, Phase.

Set the EXT IO No.16 pin working mode as described below.

- 1. Press the key that maps to EXT IO No.16.
- 2. Use RPG to change the selected item to Phase and press **ENTER**.

3	_Pha	se	350V	LOCAL	QUIT		3	_Pha	se 🤅	350V	LOCAL	QUIT		
			OUTPUT	SETTING		Config				OUTPUT	SETTING			Config
₫1	Vac	=	0.0V	F =	60.00Hz		₫1	Vac	=	0.0V	F =	60.0	0Hz	
•	Vac	=	0.0V	F =	60.00Hz	Others	₫2	Vac	=	0.0V	F =	60.0	0Hz	Others
•	Vac	=	0.0V	F =	60.00Hz	Calibration	₹ 3	Vac	=	0.0V	F =	60.0	0Hz	Calibration
			MEAS	UREMENT		Calibration				MEASU	REMENT			Calibration
	٧	=	0.00	VA	= 0.0	System		٧	=	0.00	VA	= 0	. 0	System
₫1	I	=	0.000	PF	= 0.000	Information	₫1	I	= (0.000	PF	= 0.0	00	Information
	V	=	0.00	P٥	= 0.0	Factory		٧	=	0.00	P٥	= 0	. 0	Factory
₩2	I	=	0.000	PF	= 0.000	Default	₹2	Ι	= (0.000	PF	= 0.0	00	Default
	٧	=	0.00	P٥	= 0.0	Master/Slave		٧	=	0.00	P٥	= 0	. 0	Master/Slave
₫3	I	=	0.000	PF	= 0.000	Function	₫3	Ι	= (0.000	PF	= 0.0	00	Function
	V 12	=	0.00	V23	= 0.00	More		V 12	=	0.00	V23	= 0.	00	More
Σ	V 31	=	0.00	Po	= 0.0	2 of 2	Σ	V 31	=	0.00	Po	= 0	. 0	2 of 2
A	Output Relay ways ON	Buzz Of		Remote Sense On	FW EXT IO No.16 Download Default	2019/04/24 14:24:23		Dutput Relay ways ON	Buzzer Off	Date/Time	Remote Sense On	FW Download	EXT IO No.16 <u>Phase</u>	2019/04/24 14:24:33



When the Ext. IO output current is a voltage signal, the drive capability is 10mA.

3.4.7 Calibration

For detailed calibration procedures, refer to Chapter 4.

3.4.8 System Information

Press 'MORE' on the right in the CONFIG function (3_Phase Mode/1_Phase Mode) to go to the next page. Press 'System Information' on the right to display the system information of the AC Source.

I	3_Phase 350V LOCAL QUIT	
	UNIT DATA	Config
	Model:61509 SN:S1234	Others
	B Board Ver : 1.01.8 1.01.07 A Board Ver : 01.01 01.01 01.01 FPGA Ver : 0.13 ; 00,00	Calibration
		System Information
		Factory Default
		Master/Slave Function
		More 2 of 2
		2018/04/13 17:02:29

3.4.9 Factory Default

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

3_Phase		LOCAL	QUIT	
	FACTOR	Y DEFAULT		Config Others
				Calibration
Recall F	actory	Defaul	t setting?	System Information
				Factory Default
				Master/Slave Function
				More 2 of 2
Yes		No		2018/04/13 17:03:09

3.4.10 Master/Slave Function

When the 61507/61508/61509 AC Sources are required to be paralleled for use, press 'MORE' on the right in the CONFIG function (3_Phase Mode/1_Phase Mode) to go to the next page, and then press Master/Slave Function on the right to turn on the parallel function. See Chapter 6 for detailed operating procedure.

3.5 PHASE Function Key

Press the **PHASE** function key (shown in Figure 3-5) to switch the 3_Phase Mode/1_Phase Mode.

3.5.1 3_Phase Mode

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

The procedure for setting the AC Source to 3-phase mode is described below:

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

?_Phase 350V LOCAL QUIT	Phase	Phase 350V LOCAL QUIT	Phase
	Single 1_PHASE	Warning! You want to change to Three Phase(3_Phase) mode.	Yes
The output is in Single Phase (1_Phase) mode now. Select a mode	Three 3_PHASE	It is necessary to check if the output is connected properly,otherwise the AC	No
		source and/or UUT might be damaged.	
		Press <yes> to change. Press <no> to exit.</no></yes>	
	2018/04/13 17:19:08		2018/04/13 17:19:20

3.5.2 1_Phase Mode

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

The procedure for setting the AC Source to 1-phase mode is described below:

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

?_Phase 350V LOCAL QUIT		?_Phase 350V LOCAL QUIT	
NUMBER OF OUTPUT PHASE SELECTION	Phase	NUMBER OF OUTPUT PHASE SELECTION	Phase
	Single 1_PHASE	Warning! You want to change to	Yes
The output is in Three Phase		Single Phase(1_Phase) mode.	
(3_Phase) mode now.	Three 3_PHASE	It is necessary to check if the output is connected	No
Select a mode		properly,otherwise the AC source and/or UUT might	
		be damaged.	
		Press <yes> to change.</yes>	
		Press <no> to exit.</no>	
	2018/04/13 17:19:35		2018/04/13 17:19:41

Notice

When switching between 1-phase and 3-phase mode, the set output value will be reset to zero to avoid damaging the Unit Under Test (UUT). Switch phase should be done when the output is quit. It could cause the AC source or UUT to be damaged when switching phase during output.

3.6 CURSOR Function Key

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

The RPG can be used to set the hundred, decade, figure, and 1st place after the decimal point

digits for voltage or frequency to save time in inputting the values.

The procedure for setting the 1st place after the decimal point for Vac output voltage in 1_Phase Mode /3_Phase Mode is described below:

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

3	_Pha	se	350V	LOCAL	QUIT		1_Phase 350V LOCAL QUIT	
	Vac Vac		000.0V	F =	60.00Hz 60.00Hz	Main OUTPUT: More Setting	Vac = 000. $\underline{0}$ V F = 60.00Hz	Main OUTPUT: More Setting
	Vac	=	0.0V	F =	60.00Hz	Measurement Setting	MEASUREMENT	Measurement Setting
₫1	V I	=	0.00 0.000	VA PF	= 0.0 = 0.000	Waveform Viewer	$V = 0.00 P_0 = 0.0$ Iac = 0.000 PF = 0.000	Waveform Viewer
₫2	V I	=	0.00 0.000	VA PF	= 0.0 = 0.000	Limitation	Vac = 0.00 Vdc = 0.00 Iac = 0.000 Idc = 0.000	Limitation
₫3	V I	=	0.00 0.000	VA PF	= 0.0 = 0.000	Output Mode	Vpk = 0.00 VA = 0.0 Ipk = 0.000 CF = 0.000	Output Mode
Σ	V 12 V 31	=	0.00 0.00	V23 Po	= 0.00 = 0.0	Measurement To Page2		
	Recall CH1		call Recall H2 CH3	Recall CH4	Recall More CH5 1 of 2	2018/04/13 17:20:08	Recall Recall Recall Recall More CH1 CH2 CH3 CH4 CH5 1 of 2	2018/04/13 17:20:22

3.7 LOCK Function Key

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

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

3	_Pha	se	350V	LOCAL	QUIT			1	_Pha	se	3 5	0 V	LOCAL	QU	IT	
	Vac	=	000,0V	UT SETTING	60	00Hz	Main		Vac	=	000		SETTING	60	00Hz	Main
•			0.0V			00Hz	OUTPUT: More Setting							•••	••••=	OUTPUT: More Setting
•	Vac	-	0.0V	F =	60.	00Hz	Measurement									Measurement
				SUREMENT			Setting						UREMENT			Setting
Ŧ	V	=	0.00			0.0	Waveform		V	=	-	.00	P٥	=	0.0	Waveform
-	1	=	0.000	PF	= 0.	000	Viewer		Iac	=	0.	000	PF	= 1	0.000	Viewer
	٧	=	0.00	Po	=	0.0			Vac	=	0	.00	Vdc	=	0.00	
•	I	=	0.000	PF	= 0.	000	Limitation		Iac	=	0.	000	Idc	= 1	0.000	Limitation
	٧	=	0.00	P٥	=	0.0	Output		Vpk	=	0	.00	VA	=	0.0	Output
₫:	Ι	=	0.000	PF	= 0.	000	Mode		Ipk	=	0.	000	CF	= 1	0.000	Mode
	V 12	=	0.00	V23	= 0	.00	Measurement									Print
Σ	V 31	=	0.00	P٥	=	0.0	To Page2									Screen On
	Recall		call Reca		Recall	More	2019/04/23		Recall		call	Recall	Recall	Reca		2019/04/23
	CH1	c	H2 CH3	CH4	CH5	1 of 2	16:09:24		CH1	CI	H2	CH3	CH4	CH5	1 of 2	16:09:31

3.8 OUTPUT Function Key

Refer to section 3.3.1 for a detailed description of the OUTPUT function key.

3.9 LOCAL/REMOTE Function Key

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

When the AC Source is in the REMOTE state and controlled by an external device, press this key to cancel the REMOTE state and return to LOCAL control.

3	Pha	se	350V	REMOTE	QUIT	
			OUTPUT	SETTING		Main
-1	Vac	=	0.0V	F =	60.00Hz	
•2	Vac	=	0.0V	F =	60.00Hz	
# 3	Vac	=	0.0V	F =	60.00Hz	
			MEAS	REMENT		
	V	=	0.00	Po :	= 0.0	
₹1	I	=	0.000	PF	= 0.000	
	V	=	0.00	Po :	= 0.0	
#2	I	=	0.000	PF	= 0.000	
	V	=	0.00	Po	= 0.0	
÷3	I	=	0.000	PF	= 0.000	
	V12	=	0.00	V23	= 0.00	
Σ	V31	=	0.00	Po	= 0.0	
						2018/06/07 11:07:48

3.10 SAVE/RECALL Function Key

The AC Source has two modes to save and recall the output settings or system information as described in section 3.10.1 and 3.10.2. Press the **SAVE/RECALL** function key can access the save and recall functions.

3.10.1 Save/Recall Output Setting

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

3	_Pha	se	350V	LOCAL	QUIT		3	_Pha	se 3	50V	LOCAL	QUIT	
				SETTING		Save/Recall					SETTING		Save/Recall
Ŧ	Vac	=	0.0V	F =	60.00Hz	Save	₫1	Vac	=	0.0V	F =	60.00Hz	Save
•	Vac	=	0.0V	F =	60.00Hz	Output Setting	₹2	Vac	=	0.0V	F =	60.00Hz	Output Setting
•	Vac	=	0.0V	F =	60.00Hz	Save	₫3	Vac	=	0.0V	F =	60.00Hz	Save
			MEAS	UREMENT		System Data				CHANNE	L DATA		System Data
	٧	=	0.00	VA	= 0.0			Vac =	52.0V			c = 0.0V	
ē.	Ι	=	0.000	PF	= 0.000		1	Vac = Vac =	52.0V 52.0V			c = 0.0V c = 0.0V	
	٧	=	0.00	VA	= 0.0	Recall		Vac =	0.0V			c = 0.0V	Recall
•	I	=	0.000	PF	= 0.000	Output Setting	2	Vac = Vac =	0.0V 0.0V			c = 0.0V c = 0.0V	Output Setting
	V	=	0.00	VA	= 0.0	Recall		Vac =	100.0V			c = 0.0V	Recall
•	I	=	0.000	PF	= 0.000	System Data	3		100.0V 100.0V			c = 0.0V c = 0.0V	System Data
	V12	=	0.00	V23	= 0.00	Data Log		Vac =	0.0V			c = 0.0V	Data Log
Σ	V 31	=	0.00	P٥	= 0.0	Interval OFF	4	Vac = Vac =	0.0V 0.0V	2/2		c = 0.0V c = 0.0V	Interval OFF
						2018/04/13 17:26:12	S	Save to CH1	Save to CH2	Save to CH3	Save to CH4	More	2018/04/13 17:26:37

3	_Phase	350V	LOCAL	QUIT		3	Pha	se	350V	LOCAL	QUIT	
ō1	Vac =	0.0V	SETTING	60.00Hz	Save/Recall Save	ē 1	Vac	=	0.0V	T SETTING	60.00Hz	Save/Recall Save
₹2		0.0V	F =	60.00Hz	Output Setting		Vac		0.0V	F =	60.00Hz	Output Setting
₫3	Vac =	0.0V	F =	60.00Hz	Save System Data	₫ 3	Vac	-	0.0V	F =	60.00Hz	Save System Data
		CHANNE	EL DATA				Vac =	0.0V	F =		lc = 0.0V	
						1	Vac = Vac =	0.0V 0.0V	F =	60.00Hz Va	IC = 0.0V IC = 0.0V	
	Save ou	utput se	ettina	to CH 1	Recall Output Setting	2	Vac = Vac = Vac =	0.0V 0.0V 0.0V	F =	60.00Hz Vo	lc = 0.0V lc = 0.0V lc = 0.0V	Recall Output Setting
					Recall	3	Vac =	100.0V 100.0V	F =	60.00Hz Va	IC = 0.0V IC = 0.0V	Recall
					System Data		Vac = Vac =		F =	60.00Hz Vo	Ic = 0.0V Ic = 0.0V	System Data
					Data Log Interval OFF	4	Vac = Vac =	0.0V 0.0V	F =	60.00Hz Vo	IC = 0.0V IC = 0.0V	Data Log Interval OFF
					2018/04/13 17:29:25	1	Recall CH1	Recall CH2	Recall CH3	Recall CH4	More	2018/04/16 09:29:21



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

3.10.2 Save/Recall System Data

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

3	_Pha	se	350V	LOCAL	QUIT		3	_Pha	se	350V	LOCAL	QUIT	
₫1	Vac	=	0.0V	F =	60.00Hz	Save/Recall Save	₫1	Vac	=	0.0V	SETTING F =	60.00Hz	Save/Recall Save
₹2	Vac	=	0.0V	F =	60.00Hz	Output Setting	₹2	Vac	=	0.0V	F =	60.00Hz	Output Setting
₫3	Vac	=	0.0V	F =	60.00Hz	Save	₫3	Vac	=	0.0V	F =	60.00Hz	Save
			MEAS	UREMENT		System Data				MEASU	JREMENT		System Data
₫1	V	=	0.00	• • •	= 0.0		₫1	V	=	0.00	• • •	= 0.0	
21	I	=	0.000		= 0.000		21	I	=	0.000	PF	= 0.000	
₹2	V	=	0.00	• • •	= 0.0	Recall	₹2	٧	=	0.00	• • •	= 0.0	Recall
	I	=	0.000	PF	= 0.000	Output Setting	22	I	=	0.000	PF	= 0.000	Output Setting
4 3	V	=	0.00	VA	= 0.0	Recall	₫3	V	=	0.00	VA	= 0.0	Recall
23	I	=	0.000	PF	= 0.000	System Data	93	I	=	0.000	PF	= 0.000	System Data
-	V 12	=	0.00	V23	= 0.00	Data Log	-	V 12	=	0.00	V23	= 0.00	Data Log
Σ	V 31	=	0.00	P٥	= 0.0	Interval OFF	Σ	V 31	=	0.00	P٥	= 0.0	Interval OFF
						2018/04/13 17:26:12		ave to ROUP1	Save GROUI		Save to GROUP4	Save to GROUP5 More	2018/04/13 17:27:01

3	_Phas	е	350V	LOCAL	QUIT		3	_Pha	se	350V	LOCAL	QUIT	
				SETTING		Save/Recall	1				SETTING	N 2 10 10 10 10	Save/Recall
₫1	Vac	=	0.0V	F =	60.00Hz	Save	₫1	Vac	=	0.0V	F =	60.00Hz	Save
₹2	Vac	=	0.0V	F =	60.00Hz	Output Setting	₹2	Vac	=	0.0V	F =	60.00Hz	Output Setting
₫3	Vac	=	0.0V	F =	60.00Hz	Save	₫3	Vac	=	0.0V	F =	60.00Hz	Save
			CHANNE	L DATA		System Data				MEASU	REMENT		System Data
								V	=	0.00	VA	= 0.0	
							₫1	Ι	=	0.000	PF	= 0.000	
						Recall		٧	=	0.00	VA	= 0.0	Recall
	Save	sj	ystem da	ata to	GROUP 1	Output Setting	₹2	Ι	=	0.000	PF	= 0.000	Output Setting
						Recall		٧	=	0.00	VA	= 0.0	Recall
						System Data	₫3	Ι	=	0.000	PF	= 0.000	System Data
						Data Log		V 12	=	0.00	V23	= 0.00	Data Log
						Interval OFF	Σ	V 31	=	0.00	P٥	= 0.0	Interval OFF
						2018/04/13		Recall	Recall	Recall	Recall	Recall More	2018/04/13
						17:27:34	G	ROUP1	GROUP2	2 GROUP3	GROUP4	GROUP5 More	17:28:26



The AC Source has 11 groups of memory: GROUP 0 and GROUPs 1-10. GROUP 0 will save the power-on default. The data saved in GROUP 0 will be recalled automatically and loaded when the AC Source powers on again. The data saved in GROUPs 1-10 need to be loaded manually.

3.11 Protection

The AC Source has both software and hardware protection. When protection occurs the AC Source will stop the output and disconnect the output relay. The display shows that the source is in protection mode. To return to normal output after the protection is triggered for recovery, remove the error load and press **ENTER** to release protection for normal operation. To return to normal output after the protection is triggered for latch, remove the error load and press

to restart and release protection for normal operation.

The table below lists the software protection:

Protection	Description
SYS OCP(1/2/3)	Occurs when the output current exceeds the limit or specification.
SYS OPP(1/2/3)	Occurs when the output power exceeds specification.
SYS OVP(1/2/3)	Occurs when the output voltage exceeds the limit of each range.
Remote - Inhibit	Executes remote inhibit.
SYS SENSE FAULT	The REMOTE SENSE is not connected or the voltage compensation is over 10V.
SYS SELF-TEST NG(1/2/3)	The power on self-test has output error.

The table below lists the hardware protection:

Protection	Description
(Φ1/2/3) AD_FAN FAIL	AC/DC stage fan failure protection.
(Φ1/2/3) DA_FAN FAIL	DC/AC stage fan failure protection.
(Ф1/2/3) AD_PFC_OVP	The internal AD power stage protection indicating the output voltage is over the specification.
(Φ1/2/3) AD_PFC_UVP	The internal AD power stage protection indicating the output voltage is under the specification.
(Φ1/2/3) DD_VDC1_OVP	The internal DD power stage protection indicating the output

	voltage is over the specification.
(Φ1/2/3) DD_VDC1_UVP	The internal DD power stage protection indicating the output voltage is under the specification.
(Φ1/2/3) DD_VDC2_OVP	The internal DD power stage protection indicating the output voltage is over the specification.
(Φ1/2/3) DD_VDC2_UVP	The internal DD power stage protection indicating the output voltage is under the specification.
SYS SHORT(1/2/3)	Short circuit protection.
SYS INT_ LINE	Occurs when the line input voltage is under 170Vac or over 270Vac.
OTP	Occurs when the AC Source's internal temperature is too high.

3	Pha	s e	350V	LOCAL	QUIT		
-	Maa	_		SETTING F =	CO 0011-	Main	
	Vac	=			60.00Hz		
		=	0.0V	F =	60.00Hz		
₫3	Vac	=	0.0V	F =	60.00Hz		
			PROTE	CTION			
SYS INT_LINE							
						2018/04/16 10:34:25	

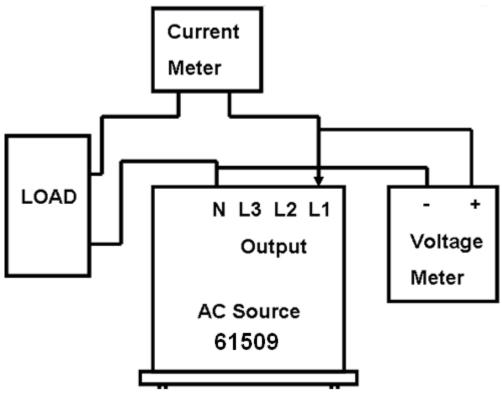


The protection point varies by the measurement error; it may act before reaching the protection point set.

4. Calibration

4.1 Introduction

The AC Source has a simple built-in procedure to calibrate the output and measure the accuracy without opening the chassis. Simply follow the procedure step by step for operation. A voltage meter, current meter, and an adequate load with a +10V dc power supply are required to perform the calibration. For the connections of these instruments refer to Figure 4-1. There are 3 items required for calibration: output voltage, output current and external reference. They do not need to be calibrated at the same time. Select them for calibration as needed.





Notice

If the ambient temperature is $\leq 25^{\circ}$ C, the AC source needs to warm up for 20 minutes before calibration to allow the internal temperature to reach the normal operating temperature to ensure the calibration is correct.

4.2 Manual Calibration

Select "Calibration" in the CONFIG function (3_Phase Mode/1_Phase Mode) to enter the calibration procedure. Before any calibration items appear, input the password. The password is included in the manual to ensure this manual is read before executing the calibration procedure.

CALIBRATION	Config
	Others
Enter Password: <u>****</u>	Calibration
(You can get password in user's manual)	System Information
	Factory Default
	Master/Slave Function
	More 2 of 2
	2018/04/16 17:21:53

Notice

- The password for the calibration procedure is "3621", press ENTER to confirm it.
- 2. Read the procedure clearly before calibrating the AC Source, or partial memory data could be lost due to incorrect operation.

Once the correct password is entered, the LCD shows that the calibration procedure can only be run in 3-phase mode and is prohibited in 1-phase mode. Press **ENTER** to continue the calibration procedure.

CALIBRATION	Config
Calibration Program is only	
running in three phase mode.	
DO NOT connect output in	
single phase mode.	
Press <enter> to continue.</enter>	
Quit	2018/04/16 17:21:58

Select the voltage, current, and external reference voltage for calibration.

	3		RATION	asuren		Calibration
	∳1 V Measu				on.	
Remo	ve Lo	ad Be	fore (alibr	ating	
	s <en s <ex< th=""><th></th><th></th><th></th><th></th><th></th></ex<></en 					

Voltage setting & Measure: This is the calibration for output voltage and measurement accuracy.

Current Measure: This is the calibration for current measurement accuracy. External Vref.: This is the calibration of external Vref.

4.2.1 Output Voltage and Measurement Calibration

CALIBRATION CHOICE can be selected after the password has been entered (see section 4.2). Press 'Voltage Setting & Measure' at the bottom to calibrate the output voltage and measurement.

Voltage Setting & Measureme	
CALIBRATION 175V Range : Offset voltag Press <enter> to continue. Press <exit> to skip.</exit></enter>	
	2018/06/06 16:31:49

The Voltage Setting & Measurement Calibration screen provides the option of conducting the 175V Range Offset voltage calibration or the 175V Range Voltage Setting calibration. Press **ENTER** to continue to the Offset voltage calibration or press **EXIT** to go into the 175V Range Voltage Setting & Measurement calibration procedure.

Voltage Setting & Measurement:⊉	1
CALIBRATION	Calibration
175V Range A).Keyin the DVM measured Vdc,then press <enter> Vdc offset =<u>0,0</u>mV (repeat this step until Vdc offset <+-10mV>).</enter>	
	2018/04/20 11:22:48

For step A in the 175V Range Offset voltage calibration procedure, use a Digital Voltage Meter (DVM) to measure the AC Source's output DC voltage in mV and key in the measured value. Keep monitoring/entering the DVM readings and input/output of the DC voltage until the DC offset is lower than ± 10 mV.

Notice

- The Vdc offset can be positive or negative. Connect the positive terminal of the DVM to the AC Source's Line output and the negative terminal to the AC Source's Neutral output as shown in Figure 4-1.
 The load must be off for all of the steps in ACCURACY CALI under
- Voltage setting & Measurement.

For step B in the 175V Range Offset voltage calibration procedure, wait for 2 seconds and press **ENTER**; the display will show the current Vac and Vdc offset voltages calculated by the AC Source.

Voltage Setting & Measurement: •	1
	Calibration
 175V Range A).Keyin the DVM measured Vdc,then press <enter> Vdc offset = -1.0mV (repeat this step until Vdc offset <+-10mV>).</enter> B).Wait 2 seconds,then press <enter>. Vac = 0.00V Vdc = 0.00V</enter> 	
	2018/04/20 11:23:56

For step C in the 1750V Range Offset voltage calibration procedure, the display shows the 175V Range Offset voltage calibration has been completed. Press **EXIT** to go into the save screen as shown below, or press **ENTER** to continue to the 175V Range Voltage setting and measurement calibration procedure.

Voltage Setting & Measurement	
CALIBRATION 175V Range	Calibratio
 A).Keyin the DVM measured Vdc,then press <enter> Vdc offset = -1.0mV (repeat this step until Vdc offset <+-10mV>).</enter> B).Wait 2 seconds,then press <enter>. Vac = 0.00V Vdc = 0.00V</enter> C).Calibration for 175V Range offset is completed, press <enter> to run 175V setting & meas. calibration.</enter> 	
	2018/04/20

Press 'Yes' on the right to save the calibration result.

		CALIBRA	TION			Calibration
						Yes
De vev		4				
Do you data?	want	to \$	ave (calibr	ating	No
r i						
						2018/04/16 17:39:14



The AC Source calibration procedure steps can be executed separately; however, it is better to follow the calibration sequence step by step (step A, step B ...) or it may cause an output and measurement error.

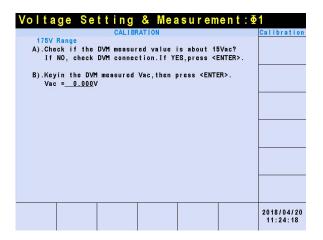
Once the 175V Range Offset voltage calibration is done, the screen provides the option of conducting the 175V Range Setting & Meas. Calibration or going to the 350V Range Offset calibration. Press **ENTER** to continue to the Setting & Meas. calibration or press **EXIT** to go to the 350V Range Offset voltage calibration procedure.

Volta	ge Setting	& Measuren	nent:⊈1
175V		etting & Me	as.
	s <enter> s <exit> t</exit></enter>	to continue o skip.	
			2018/06/06 16:34:06

For step A in the 175V Range Setting & Meas. calibration procedure, remove the load. Check if the output AC voltage measured by the DVM is about 15Vac. This is to confirm the connection is correct. Press **ENTER**.

۷	oltage	Settin	g & Mea	asurem	ent:∳∕	1
		CAL	IBRATION			Calibration
	175V Range A).Check if If NO, ch		sured value nection.If Y			
					-	
						2018/04/20 11:24:15

For step B in the 175V Range Setting & Meas. calibration procedure, check if the DVM measured output voltage is about 120Vac. Input the value measured by the DVM and press **ENTER**.



For step C in the 175V Range Setting & Meas. calibration procedure, check if the DVM measured output voltage is about 175Vac. Input the value measured by the DVM and press **ENTER**.

Voltage Setting & Measurement:Φ	1
CALIBRATION	Calibration
175V Range A).Check if the DVM measured value is about 15Vac? If NO, check DVM connection.If YES,press <enter>.</enter>	
B).Keyin the DVM measured Vac,then press <enter>. Vac =119.030V</enter>	
C).Keyin the DVM measured Vac,then press <enter>. Vac =<u>0.000</u>V</enter>	
	2018/04/20 11:25:14

For step D in the 175V Range Setting & Meas. calibration procedure, the display shows the 175V Range Setting & Meas. calibration has been completed. Press **EXIT** to go into the save screen as shown below, or press **ENTER** to continue to the 350V Range Offset Voltage calibration.

Voltage	Setting	g & Mea	surem	ient:⊉	1
	CAL	BRATION			Calibratio
175V Range					
	the DVM meas neck DVM conr				
B).Keyin the Vac =119.	e DVM measure .030V	ed Vac,then p	oress <enti< td=""><td>ER>.</td><td></td></enti<>	ER>.	
C).Keyin the Vac =173.	e DVM measure .550V	ed Vac,then p	oress <enti< th=""><th>ER>.</th><th></th></enti<>	ER>.	
	ion for 175V NTER> to run			ı.	
					2018/04/20 11:25:26

Press 'Yes' on the right to save the calibration result.

		CALI	BRATION			Calibration
						Yes
	ı wan	t to	save	calibr	ating	
data?						No
						2018/04/16 17:39:14

Once the 175V Range Setting & Measurement calibration is done, the screen provides the option of conducting the 350V Range Offset calibration or the 350V Range Setting & Measurement calibration. Press **ENTER** to continue to the 350V Range Offset voltage calibration or press **EXIT** to go to the 350V Range Setting & Measurement calibration.

Voltage Setting & Measurement:	§1
CALIBRATION	Calibration
350V Range : Offset voltage	
Press <enter> to continue. Press <exit> to skip.</exit></enter>	
	2018/06/06 16:34:14

For step A in the 350V Range Offset voltage calibration procedure, use a Digital Voltage Meter (DVM) to measure the AC Source's output DC voltage in mV and key in the measured value. Keep monitoring/entering the DVM readings and input/output of the DC voltage until the DC offset is lower than ± 10 mV.

Voltage Setting & Measurement	: ⊈1
CALIBRATION	Calibration
350V Renge A).Keyin the DVM measured Vdc,then press <enter> Vdc offset =0.0mV (repeat this step until Vdc offset <+-10mV>).</enter>	
	2018/04/20 11:25:33

For step B in the 350V Range Offset voltage calibration procedure, wait for 2 seconds and press **ENTER**; the display will show the current Vac and Vdc offset voltages calculated by the AC Source.

Voltage Setting & Measurement:Φ	1
CALIBRATION	Calibration
350V Range	
A).Keyin the DVM measured Vdc,then press <enter></enter>	
Vdc offset = 7.3mV	
(repeat this step until Vdc offset <+-10mV>).	
B).Wait 2 seconds,then press <enter>.</enter>	
Vac = 0.04V Vdc = 0.02V	
	2018/04/20
	11:26:13

For step C in the 350V Range Offset voltage calibration procedure, the display shows the 350V range Offset voltage calibration has been completed. Press **EXIT** to go to the save screen as shown below, or press **ENTER** to continue to the 350V Range voltage setting and measurement calibration procedure.

Voltage Setting & Measurement: Φ	1
CALIBRATION	Calibration
350V Range	
A).Keyin the DVM measured Vdc,then press <enter> Vdc offset = 7.3mV</enter>	
(repeat this step until Vdc offset <+-10mV>).	
(
B).Wait 2 seconds,then press <enter>.</enter>	
Vac = 0.04V Vdc = 0.02V	
C).Calibration for 350V Range offset is completed,	
press <enter> to run 350V setting & meas.</enter>	
calibration.	
	2018/04/20
	11:26:17

Press 'Yes' on the right to save the calibration result.

		CALIBR	RATION			Calibration
						Yes
Do you data?	want	to s	save	calibr	ating	No
						2018/04/16 17:39:14

Once the 350V Range Offset voltage calibration is done, the screen will provide the option of conducting the 350V Range Setting & Measurement calibration or going to the calibration main screen. Press **ENTER** to continue to the Setting & Measurement calibration or press **EXIT** to go into the calibration main screen.

Voltage Setting & Measureme	ent:⊈1
CALIBRATION	Calibration
350V Range : Setting & Mea	is.
Press <enter> to continue.</enter>	
Press <exit> to skip.</exit>	
	2018/06/06 16:34:23

For step A in the 350V Range Setting & Measurement calibration procedure, remove the load. Check if the output AC voltage measured by the DVM is about 30Vac. This is to confirm the connection is correct. Press **ENTER**.

Volta	ge Se	ettin	g &	Mea	surer	nent:∙	1
		CAL	I BRAT I	ON			Calibration
350V	Range						
A).Che	ck if the	e DVM mea	sured	value i	s about 3	OVac?	
If	NO, check	DVM con	nectio	n.If YE	S,press <	ENTER>.	
						1	
							2018/04/20
							11:26:26

For step B in the 350V Range Setting & Measurement calibration procedure, check if the DVM measured output voltage is about 240Vac. Input the value measured by the DVM and press **ENTER**.

Volta	ge Se	tting	& Mea	surem	ient:Φ	1
		CALIB	RATION			Calibration
A).Che		DVM measur DVM connec				
	in the DVN = 0.000\	1 measured /	Vac, then	press <enti< td=""><td>ER>.</td><td></td></enti<>	ER>.	
						2018/04/20 11:26:33

For step C in the 350V Range Setting & Measurement calibration procedure, check if the DVM measured output voltage is about 350Vac. Input the value measured by the DVM and press **ENTER**.

Voltage Setting & Measurement: Φ	1
CALIBRATION	Calibration
350V Range	
A).Check if the DVM measured value is about 30Vac? If NO, check DVM connection.If YES,press <enter>.</enter>	
B).Keyin the DVM measured Vac,then press <enter>. Vac =237.950V</enter>	
C).Keyin the DVM measured Vac,then press <enter>. Vac =<u>0.000</u>V</enter>	
	2018/04/20 11:26:43

For step D in the 350V Range Setting & Meas. calibration procedure, the display shows the 350V Range Setting & Meas. calibration has been completed. Press **EXIT** to go to the save screen as shown below, or press **ENTER** to continue voltage calibration for other phases.

Voltage Setting & Measurement:⊉	
CALIBRATION	Calibration
350V Range A).Check if the DVM measured value is about 30Vac? If NO, check DVM connection.If YES,press <enter>.</enter>	
B).Keyin the DVM measured Vac, then press <enter>. Vac =237.950V</enter>	
C).Keyin the DVM measured Vac,then press <enter>. Vac =346.940V</enter>	
D).Calibration for 垂1 Voltage Setting & Measurement is completed.Press <enter> to continue.</enter>	
	2018/04/20 11:26:55

Press 'Yes' on the right to save the calibrated result.

		CALIBRATION			Calibration
					Yes
Do you data?	want	to save	e calibı	rating	No
					2018/04/16 17:39:14

- Notice 1. Press ENTER at the last step to continue calibrating the 2nd and 3rd phases.
 - 2. If **EXIT** is pressed without saving the result, the calibration result is kept until the power is turned off.

4.2.2 Current Measurement Calibration

CALIBRATION CHOICE can be selected after the password has been entered (see section 4.2). Press 'Current Measure' at the bottom to calibrate the current measurement. The calibration value is different for the 61509 and will be specified in each step.

Current Measurement:⊈1	
CALIBRATION	Calibration
Run ⊈1 Current Measurement calibration.	
Remove Load Before Calibrating	
Press <enter> to continue.</enter>	
Press <exit> to skip.</exit>	
Voltage Current External DC Gain	0040400400
Settings Current External DC Gain Measure. Vref SEL1	2018/06/06 17:33:05

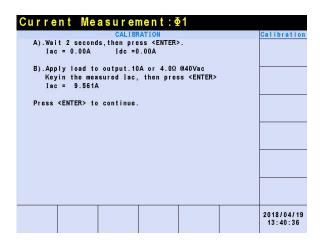
For step A of ACCURACY CALI in Current Measure, wait for 2 seconds and press **ENTER**; the display will show the current values for Iac = 0.00A and Idc = 0.00A measured by the AC Source.

Current			
	seconds,the 0.00A I		Calibration
			2018/04/19 13:38:02

For step B, adjust the load to 4Ω for output and press **ENTER**. The AC Source will output 40Vac for the 61509. Use a Current Meter (or Power Analyzer) to measure the output current. Enter the measured value and press **ENTER**.

Current Measurement:⊉1	
CALIBRATION	Calibration
A).Wait 2 seconds,then press <enter>. Iac = 0.00A Idc =0.00A</enter>	
B).Apply load to output.10A or 4.0Ω @40Vac Keyin the measured Iac, then press <enter> Iac =<u>0.000</u>A</enter>	
	2018/04/19 13:40:70

Press **ENTER** to continue the calibration procedure. The load will be disconnected.



In step A, wait for 2 seconds and press **ENTER**; the display shows lac = 0.00A and ldc = 0.00A, as measured by the AC Source.

Cur	rent N	leasu	remen	t : ⊉ 1	
A)	.Wait 2 sec Iac = 0.00	onds, ther			Calibration
					2018/04/19 13:40:49

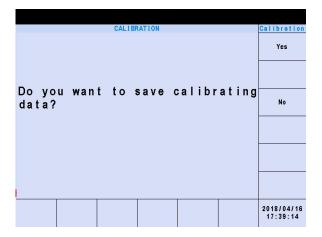
For step B, adjust the load to 4Ω for output and press **ENTER**. The AC Source will output 80Vac for the 61509. Use a Current Meter (or Power Analyzer) to measure the output current. Enter the measured value and press **ENTER**.

Current Measurement:⊈1	
CALIBRATION	Calibration
A).Wait 2 seconds,then press <enter>. Iac = 0.00A Idc =0.00A</enter>	
B).Apply load to output.20A or 4.0Ω @80Vac	
	2018/04/19 13:40:52

Step C is the last step of ACCURACY CALI in Current Measure. Press **ENTER** to continue calibrating the 2^{nd} and 3^{rd} phases or press **EXIT** to leave this page.

Current Measurement:⊉1	
Current measurement. Yr	
CALIBRATION	Calibration
A).Wait 2 seconds,then press <enter>.</enter>	
Iac = 0.00A Idc =0.00A	
B).Apply load to output.20A or 4.0Ω @80Vac	
Keyin the measured Iac, then press <enter></enter>	
lac = 19.250A	
C).Calibration for ⊕1 Current Measurement	
is completed.Press <enter> to continue.</enter>	
to compreted. Treas (ExtEnt) to continue.	
	2018/04/19 13:41:19
	13:41:19

Press 'Yes' on the right to save the calibration results.





- The resistance of the external load has to be constant; therefore, the load current and output voltage should be proportional or step B of CURRENT MEAS. ACCURACY will be meaningless.
- 2. Protection is removed temporarily when the calibration procedure is running. It may cause the AC Source to be damaged if the incorrect load is applied.

4.2.3 External Vref Calibration

CALIBRATION CHOICE can be selected after the password is entered (see section 4.2). Press External Vref at the bottom to conduct the external Vref calibration as shown below:

External Vref: 1							
CALIBRATION	Calibration						
Run ∳1 External Vref calibration.							
Remove Load Before Calibrat	ina						
Press <enter> to continue.</enter>							
Press <exit> to skip.</exit>							
Voltage Setting& Current External DC Gain Measure. Vref SEL1	2018/06/06 17:33:08						

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

	Calibratio
A).Short External Vref pin1 and pin4 ,then press <enter>.</enter>	

Step B: After short circuiting the external Vref input terminal, make the input 0V and the display will show the AC Source's measured Vdc. Wait for 2 seconds and press **ENTER**; the display will show the current Vdc offset voltage calculated by the AC Source.

External Vref:⊉1	
CALIBRATION	Calibration
A).Short External Vref pin1 and pin4 ,then press <enter>.</enter>	
B).Wait 2 seconds,then press <enter>. Vdc = 0.00V</enter>	
	2018/06/01 13:43:26

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

I	External Vr					
	A).Short External ,then press <e< th=""><th></th><th>n 4</th><th></th><th>Calibration</th></e<>		n 4		Calibration	
	B).Wait 2 seconds,then press <enter>. Vdc = 0.00V</enter>					
	C).Apply 10 Vdc b then press <en< td=""><td></td><td>ret pin1 an</td><td>d pin4</td><td></td></en<>		ret pin1 an	d pin4		
					2018/06/01 13:43:29	

Step D: Use a DVM to measure the voltage between pin 1 and pin 4 of the Ext. Vref input terminal, then enter the DC voltage value and press **ENTER**.

			_			
Exter	nal V	ref:Φ′				
		CALIB	RATION		1	Calibration
	rt Externa en press <		1 and pin4	l		
	t 2 second = 0.00V	s, then pre	ss <enter></enter>	••		
	ly 10 Vdc n press <e< th=""><th></th><th>ternal Vre</th><th>ef pin1 and</th><th>1 pin4</th><th></th></e<>		ternal Vre	ef pin1 and	1 pin4	
Key the	t 2 second in DVM mea n press <e =<u>0.000</u>\</e 	sured volt NTER>	age betwee	n pin1 anı	1 pin4	
						2018/06/01 13:43:33

Step E: Press **EXIT** to go into the save screen as shown below, or press **ENTER** to continue the voltage calibration of the other phases.

External Vref:⊈1	
CALIBRATION	Calibration
A).Short External Vref pin1 and pin4 ,then press <enter>.</enter>	
B).Wait 2 seconds,then press <enter>. Vdc = 0.00V</enter>	
C).Apply 10 Vdc between External Vref pin1 and pin4 then press <enter></enter>	
D).Wait 2 seconds, Keyin DVM measured voltage between pin1 and pin4 then press <enter> Vdc = 10.008V</enter>	
E).Calibration for 叠1External Vref is completed.	
Press <enter> to continue.</enter>	
	2018/06/06 16:34:58

Pressing 'Yes' on the right will save the calibrated result.

		CALIE	RATION			Calibration
						Yes
-						
Do yo data?	u wan	t to	save	calibr	ating	No
						2018/04/16 17:39:14



- Connect the Ext. Vref input terminal to the corresponding pin when calibrating other phases.
 Connect the Ext. Vref input terminal to the 2nd phase pin when calibrating 1-phase.

5. Application

5.1 Overview

The 61507/61508/61509 AC Sources can not only program a stable sinusoidal output voltage and frequency, but also provide powerful features to simulate power line interrupts. The output can be changed using the Sequences in LIST mode (see 5.2), or changed to step by step in STEP mode (see 5.4.) With these functions, simulations of conditions such as cycle loss, transient peak, and power attenuation are very easy.

The 61507/61508/ 61509 AC Sources are able to measure the related power parameters provided in MAIN PAGE (see 3.3); they also provide harmonic measurements up to 50 orders (see 5.7). In addition, the AC Sources allow the user to edit different harmonic components to synthesize the harmonic distortion waveform (see 5.5). They have the ability to program the inter-harmonic frequency and components, as well as to sweep and overlap the static fundamental waveforms (see 5.6).

3	_Pha	se	35	0 V 0	LOCAL	Q	UIT		
				OUTPU	T SETTING				Setting
₫1	Vac	=	0	. O V	F =		60.	00Hz	OUTPUT:
₫2	Vac	=	0	. O V	F =		60.	00Hz	More Setting
₫3	Vac	=	0	. O V	F =		60.	00Hz	Measurement
				MEAS	UREMENT				Setting
	۷	=	0	.00	VA	=		0.0	Waveform
₹1	I	=	0.	000	PF	=	0.	000	Viewer
	۷	=	0	.00	Po	=		0.0	
₹2	I	=	0.	000	PF	=	0.	000	Limitation
	٧	=	0	.00	P٥	=		0.0	Output
₫3	I	=	0.	000	PF	=	0.	000	Mode
1.0	V 12	=	0	.00	V23	=	0	.00	Print
Σ	V 31	=	0	.00	P٥	=		0.0	Screen On
	List Mode	Puls Mod	-	Step Mode	Synthesis		nter- nonics	Harmonic Meas.	2018/04/23 14:15:17

5.2 List Mode

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

3	_Pha	se	LI	ST MOE	DE:STO	P	QUIT
			OUTPUT	SETTING			List Mode
₫1	Vac	=	0.0V	F =	60.	00Hz	Time
₹2	Vac	=	0.0V	F =	60.	00Hz	Trigger
₫3	Vac	=	0.0V	F =	60.	00Hz	Couple
			MEASU	REMENT			Individual
	V	=	0.00	Po	=	0.0	Phase
₫1	I	=	0.000	PF	= 0.	000	Continue Disable
	٧	=	0.00	Po	=	0.0	
₹2	I	=	0.000	PF	= 0.	000	
	٧	=	0.00	P٥	=	0.0	
₫3	I	=	0.000	PF	= 0.	000	
	V 12	=	0.00	V23	= 0	.00	
Σ	V 31	=	0.00	P٥	=	0.0	Edit
	List Mode	Pulse Mode		Synthesis	Inter- harmonics	Harmonic Meas.	2017/11/30 13:19:50

3	_Ph	a	s e			LIST	MO	DE		QUIT	
			20		LIST	MODE SE	TTING			9.77	List Mode
	Vac	sta	ar t		<u>0.0</u> V	Va	c end	=	0.0	۷	Edit
	F	sta	ar t	-	60.00Hz	F	end	=	60.00	Hz	Each
₫1	Vdc	sta	ar t	=	0.0V	Vd	c end	=	0.0	v	
	Degi	ee		=	0.0°	Wa	veform	n =	А		Trigger
	Time			-	0.	Oms					Auto
	Vac	sta	ar t	-	0.0V	Va	c end	=	0.0	٧	
	F	sta	ar t	=	60.00Hz	F	end	=	60.00	Hz	Base Time
₹2	Vdc	sta	ar t	=	0.0V	Vd	c end	=	0.0	v	
	Degi	ee		=	240.0°	Wa	veform	n =	A		Count
	Time			=	0.	Oms					1
	Vac	sta	ar t	-	0.0V	Va	c end	=	0.0	V	
	F	sta	ar t	=	60.00Hz	F	end	=	60.00	Hz	Sequence
₫3	Vdc	sta	ar t	=	0.0V	Vd	c end	=	0.0	v	
	Degi	ee		=	120.0°	Wa	veform	n =	А		Execution
	Time	•		=	0.	Oms					Page
	List		F	ulse	St	ep			Inter-	Harmonic	2017/11/30
	Mode		1	lode	Mo		nthesis	h	armonics	Meas.	13:20:01

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

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

Trigger method: Auto / Manual / Excite.

Auto: Finishes all counts when triggered.

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

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

Couple: Individual / Φ 1+ Φ 2+ Φ 3.

Individual: The three phases are set separately.

 Φ 1+ Φ 2+ Φ 3: The settings of the second and third phases are the same as the settings of the first phase; only the first phase needs to be set.

Phase Continue: Disable/Enable.

Disable: The start angle of every Sequence will follow the Degree setting of each Sequence setting.

Enable: The start angle of every Sequence will automatically change based on the last output angle of the previous Sequence. The Degree setting of every Sequence will be ignored when Enable is set.

Base sequence unit: Time / Cycle.

Time: The sequence unit is time. Cycle: The sequence unit is cycle.

Count: The number of sequence execution times. Count = 0: unlimited execution.

Sequence: Sequence number.

The sequence starts at 0 and the maximum number of sequences is 99. The phase difference of the second/third phase and the first phase of Sequence 0 is fixed at 120°. The angle of the second/third phase cannot be used in Sequence 0.

Degree: The phase angle when the sequence starts.

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

Vac end, F end, Vdc end: The final waveform when the sequence ends. Waveform= A / B: Select waveform (see 3.3.3.)

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

3	_Pha	s e			E:STOP	QUIT	3	B_Pha	s e			E:RUNNING	OUT
₫1	Vac	=	0.0V	F =	60.00Hz	List Mode	Ŧ	Vac	=	0.0V	SETTING F =	60.00Hz	List Mode
₹2	Vac	=	0.0V	F =	60.00Hz	Trigger	ē	2 Vac	=	0.0V	F =	60.00Hz	Stop
₫3	Vac	=	0.0V	F =	60.00Hz	Couple	ē	3 Vac	=	0.0V	F =	60.00Hz	
			MEASU	REMENT		Individual				MEASU	REMENT		
	٧	=	0.00	P٥	= 0.0	Phase Continue		V	=	0.00	Po	= 0.0	
₫1	I	=	0.000	PF	= 0.000	Disable	Ŧ	ΊΙ	=	0.000	PF	= 0.000	
	V	=	0.00	P٥	= 0.0			V	=	0.00	P٥	= 0.0	
₹2	I	=	0.000	PF	= 0.000		•	² I	=	0.000	PF	= 0.000	
	٧	=	0.00	P٥	= 0.0			٧	=	0.00	P٥	= 0.0	
₫3	Ι	=	0.000	PF	= 0.000		•	³ I	=	0.000	PF	= 0.000	
	V 12	=	0.00	V23	= 0.00			V 12	=	0.00	V23	= 0.00	
Σ	V 31	=	0.00	P٥	= 0.0	Edit	Σ	V 31	=	0.00	P٥	= 0.0	
	List Mode	Pul: Mod		Synthesis	Inter- Harmonic harmonics Meas.	2017/11/30 13:19:50		List Mode	Puls Mode		Synthesis	Inter- Harmonic harmonics Meas.	2017/11/30 20:08:12

If the AC Source is operating, pressing **OUT/QUIT** will stop the output and the waveform will drop to zero volts. Press **OUT/QUIT** again and the AC Source only outputs the waveform set in MAIN PAGE. 'Trigger' must be pressed to re-trigger the source. When pressing **Source** to exit the LIST page, the programmed LIST mode waveform will be closed.

Example of LIST Mode in 1_Phase Mode:

Trigger: Auto, Base: Time, Count: 1

LIST MODE SETTING:

```
Sequence 0: Vac start = 20V, Vac end = 100V
F start = 50Hz, F end = 50Hz
Vdc start = 0V, Vdc end = 0V
Degree = 90^{\circ}, Time = 75ms
Waveform = A
```

- Sequence 1: Vac start = 20V, Vac end = 20V F start = 50Hz, F end = 50Hz Vdc start = 0V, Vdc end = 100V Degree = 0°, Time = 80ms Waveform = A
- Sequence 2: Vac start = 20V, Vac end = 120V F start = 50Hz, F end = 500Hz Vdc start = 0V, Vdc end = 0V Degree = 0° , Time = 100ms Waveform = A

The following screens show the page settings for LIST MODE:

Vac start = Vac end =	= 0.0V = 60.00Hz	List Mode Trigger Auto	1_PhaseLIST MODEQUITVac start =0.0VVac end =0.0VF start =60.00HzF end =60.00Hz	List Mode Trigger Auto
	= 0.0V = 0.0° = A	Base Time Count 1 Sequence 0	Vdc start = 0.0V Vdc end = 0.0V Degree = 0.0° Waveform = A Time = 0.0ms	Base Time Count 1 Sequence 0
	itep Synthesis Inter- Harmonic ode Meas.	Execution Page 2017/11/30 13:20:58	List Pulse Step Synthesis Inter- Harmonic Mode Mode Mode	Execution Page 2017/11/30 13:21:01

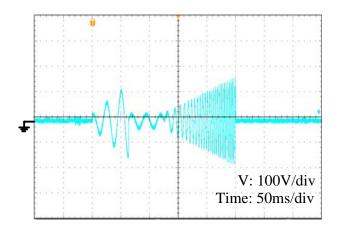
1	_Phas	e	LI	ST MOE)E	QUIT		1	_Pha	s e	LI	ST MOD	DE	QUIT	
	Vac	start		E SETTING 0.0	v		List Mode		Vac	start		E SETTING 0.0	v		List Mode
	Vac	end	=	0.0	v				Vac	end	=	0.0	v		
	-	start	=	60.00	Hz		Trigger Auto		F	start	=	60.00	Hz		Trigger Au t o
		end	=	60.00					F	end	=	60.00			
	(E. (EE)(E))	start		0.0			Base Time			start		0.0	24572		Base Time
	Vdc		=	0.0			Count			end	=	0.0 0.0			Count
	Degr Wave		-	A 0.0			1		Deg	eform	-	A 0.0			1
	Time		=		0.0ms		Sequence 0		Tim		=	~	0.0ms		Sequence 0
							Execution Page								Execution Page
	List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2017/11/30 13:21:06		List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2017/11/30 13:21:13

1_Phase		ST MODE	QUIT		1_Phas	s e	LI)E	QUIT	
Vac start	ST MOD	20.0V		List Mode	Vac	start	LIST MOD	E SETTING 20.0	V		List Mode
Vac end	=	100.0V			Vac	end	=	20.0	v		
F start	=	50.00Hz		Trigger Auto	F	start	=	50.00	Hz		Trigger Auto
F end	=	50.00Hz		Auto	F	end	=	50.00	Hz		Auto
Tuo otuit	=	0.0V		Base Time		start	=	0.0	- T-		Base Time
Vdc end	=	0.0V		Count	Vdc	end	=	100.0			Count
Dogroo	=	90.0°		1	Degr		=	0.0	•		1
Waveform	=	Δ		Sequence		eform	=	A			Sequence
Time	=	75.0m	S	0	Time)	=	8	<u>0.0</u> ms		1
				Execution Page							Execution Page
	Step Mode	Synthesis Inter- harmonic	Harmonic s Meas.	2017/11/30 13:22:10	List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2017/11/30 13:23:32

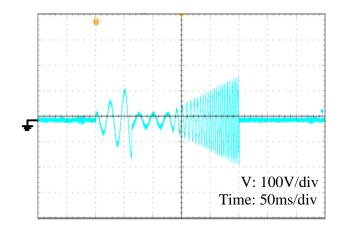
1_Pha	s e		ST MOE)E	QUIT	
Vac	star		E SETTING 20.0	v		List Mode
Vac			120.0			
F	star		50.00	-		Trisser
F	end	-	500.00			Trigger Auto
	star		0.0			Base
				- .		Time
	end		0.0			Count
Deg		=	0.0			1
	eform	=	Α			Sequence
Tim	е	=	10	0.0ms		2
						Execution Page
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2017/11/30 13:24:16

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

Phase Continue Disable



Phase Continue Enable



5.3 Pulse Mode

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

3	_Pha	se	PUL	SE MOD	E:STOP	QUIT	3	_Pha	se	PUL	SE MODE	QUIT	
	Vac		0.0V	SETTING	60.0	OLL-	e	Vac		PULSE MOD 50.0V		= 0.0V	Pulse Mode
4		-	0.0V	F =	60.0	Trigger		F	-	50.00Hz	Duty cycle=		Edit Each
194	Vac	-	0.0V	F =	60.0		<u></u> ₹1	Degree	-	0.0°	Waveform =		Telever
1				REMENT				Period	-	100.0ms			Trigger Auto
	٧	=	0.00	Po	= 0	. 0	-	Vac	-	50.0V	Vdc =	= 0.0V	Count
•	I	=	0.000	PF	= 0.0	00	52	F	=	50.00Hz	Duty cycle=	= 50.0%	0
Ŧ	٧	=	0.00	Po		. 0		Degree	=	0.0°	Waveform =	= A	
	1	=	0.000	PF	= 0.0		_	Period Vac	-	100.0ms 50.0V	Vdc =	= 0.0V	_
•	V	-	0.00	P₀ PF	= 0.0	.0		F	-	50.00Hz	Duty cycle=		
	1 V ₁₂	-	0.000	V23	= 0.0		2 3	Degree		0.0°	Waveform =		
Σ	V 31	-	0.00	Po		.0 ^{Edit}		Period		100.0ms			Execution Page
	List Mode	Puls Mod		Synthesis	Inter- H harmonics	Harmonic 2017/11/3 Meas. 13:24:35		List Mode	Puise Mode		Synthesis h	Inter- Harmonic narmonics Meas.	2017/11/30 13:24:40

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

Trigger method: Auto / Manual / Excite.

Auto: Finishes all counts when triggered.

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

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

Count: The number of pulses.

Vac, F, Vdc: The Vac, F, and Vdc output pulse voltage and frequency.

Duty cycle: The pulse ratio during a duty cycle.

Period: The total length of the duty cycle.

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

Degree: The output pulse phase degree.

After setting the sequences, press 'Execution Page' on the right to exit the Pulse mode and the LCD will show PULSE MODE : STOP on the top. STOP indicates the present trigger state. Press 'Trigger' on the right to trigger the output and the LCD will show RUNNING to indicate Pulse mode is being executed. Press Stop to cease the Pulse waveform output. When the AC Source finishes all Sequences and Counts, the LCD will return to its initial state and display STOP. The AC Source will QUIT at the same time, as shown below:

3	_Pha	se	PUL	SE MOD	E:STOP	QUIT	3	_Pha	se	PUL	SE MOD	E:RUNNING	OUT
				SETTING		Pulse Mode		1900			SETTING		Pulse Mode
₫1	Vac	=	0.0V	F =	60.00Hz	Trimer	₫1	Vac	=	0.0V	F =	60.00Hz	84
•	Vac	=	0.0V	F =	60.00Hz	Trigger	₹2	Vac	=	0.0V	F =	60.00Hz	Stop
æ 3	Vac	=	0.0V	F =	60.00Hz		₫3	Vac	=	0.0V	F =	60.00Hz	
			MEASU	REMENT						MEASU	REMENT		
	V	=	0.00	Po	= 0.0			٧	=	38.73	Po	= -0.0	
₫1	I	=	0.000	PF	= 0.000		₫1	I	=	0.060	PF	= -0.002	
	٧	=	0.00	Po	= 0.0			٧	=	38.69	Po	= -0.0	
# 2	I	=	0.000	PF	= 0.000		₫2	I	=	0.016	PF	= -0.000	
	٧	=	0.00	P٥	= 0.0			٧	=	38.91	Po	= 0.0	
Φ 3	I	=	0.000	PF	= 0.000		₫3	Ι	=	0.120	PF	= 0.000	
	V 12	=	0.00	V23	= 0.00	100000	1.000	V 12	=	0.36	V23	= 0.53	
Σ	V 31	=	0.00	P٥	= 0.0	Edit	Σ	V 31	=	0.27	Po	= -0.0	
	List Mode	Pul		Synthesis	Inter- Harmonic harmonics Meas.	2017/11/30 20:17:27		List Mode	Pulse Mode		Synthesis	Inter- harmonics Meas.	2017/11/30 13:25:19

If the AC Source is operating, pressing **OUT/QUIT** will stop the output and the waveform will drop to zero volts. Press **OUT/QUIT** again and the AC Source will output the waveform set in MAIN PAGE. Trigger must be pressed to re-trigger the source. When pressing **Source** to exit the PULSE page, the pulse will be ended.

Example of PULSE Mode in 1_Phase Mode:

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

PULSE MODE SETTING:

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

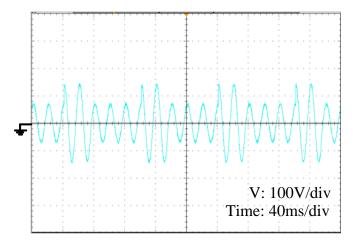
Trigger: Auto, Count: 0

The following screens show the page settings for PULSE MODE:

1_Pha		SE MODE	QUIT		1	1_Pha	se		SE MOD)E	QUIT	
Vac	PULSE MC	0.0V		Pulse Mode		Vac		PULSE MOD	E SETTING 0.0	٧		Pulse Mode
Vdc	=	0.0V				Vdc		=	0.0	٧		
F	=	50.00Hz		Trigger Auto		F		=	50.00	Hz		Trigger Au t o
Dut	/ cycle=	50.0%		Count		Dut	у сус	le=	50.0	%		Count
Deg	ree =	0.0°		0		Deg	ree	=	0.0	•		0
Wav	eform =	А				Wav	eform	=	Α			
Per	iod =	0.0ms	;			Per	iod	=		0.0ms		
				Execution Page								Execution Page
List Mode	Pulse Step Mode Mode	Synthesis Inter- harmonics	Harmonic Meas.	2017/11/30 20:51:09		List Mode	Puise Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2017/11/30 20:51:45

1_Pha	se	PUL	SE MOE)E	QUIT	
Vac	1	PULSE MOD	E SETTING	v		Pulse Mode
Vdc		=	0.0	-		
F		=	50.00	Hz		Trigger Au t o
Dut	у сус	le=	35.0	%		
Deg	ree	=	90.0	•		Count 0
Wav	eform	=	Α			
Per	iod	=	10	<u>0.0</u> ms		
						Execution Page
List Mode	Puise Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2017/11/30 13:26:25

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



5.4 Step Mode

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

3	_Pha	se		S	TEP MO	DE : S	вто	P	QUIT	3	B_Ph	se	ST	EP MO	DE	QUIT	
				OUTP	UT SETTING				Step Mode					DE SETTING			Step Mode
	Vac =	0.0V		F =	60.00Hz	Vdc =	0.	0V			Vac	= .	<u>0.0</u> V	∆Vac	= 0.	0V	Edit
	Vac =	0.0V		F =	60.00Hz	Vdc =		0V	Trigger		F	=	60.00Hz	۵F	= 0.	OOHz	Each
₹2	Vac =	0.00		r =	60.00HZ	vac =	υ.	0.0		Ŧ	1 Vdc	=	0.0V	∆Vdc	= 0.	0V	
₫3	Vac =	0.0V		F =	60.00Hz	Vdc =	0.	٥٧			Degre	e =	0.0°	Waveform	= A		Trigger
				MEA	SUREMENT						Count	-	0	Dwe I I	-	0.0ms	Auto
	V	=	1	0.00	Po	=		0.0			Vac	=	0.0V	∆Vac	= 0.	0V	
₫1	T	=		.000	PF	=		000			F	=	60.00Hz	۵F	= 0.	00Hz	
	<u> </u>									Ŧ	2 Vdc	=	0.0V	∆Vdc	= 0.	0V	
	٧	=		0.00	Po	=		0.0			Degre	e =	0.0°	Waveform	= A		
₹2	I	=	0	.000	PF	=	0.	000			Count	-	0	Dwe I I	-	0.0ms	
	v	=	1	0.00	Po	=		0.0			Vac	-	0.0V	∆Vac	= 0.	0V	
₫3	÷	=				-		E 1 E 1 E 1			F	=	60.00Hz	۵F	= 0.	00Hz	
	1	-		.000	PF			000		-	Vdc	-	0.0V	∆Vdc	= 0.	ov	
and the second	V 12	=	- (0.00	V23	=	0	.00	10000	10	Degre	e =	0.0°		= A		Execution
Σ	V 31	=	- (0.00	P٥	=		0.0	Edit		Count	-	0	Dwell	-	0.0ms	Page
	List Mode	Puls Mod		Step Mode		Int harmo	70	Harmonic Meas.	2017/11/30 13:26:38		List Mode	Puls Mod		Synthesis	Inter- harmonics	Harmonic Meas.	2017/11/30 13:26:46

STEP Mode provides a simple auto switch function to change the output voltage in steps. Waveform programming sets the item with an initial voltage, specifies the dwell time and the change of each step, as well as the step number. The output voltage will remain in the last state after execution.

Trigger method: Auto / Manual.

Auto: Finishes all counts when triggered.

Manual: The output voltage changes a step every time it operates.

Count: The count number of each change.

Dwell: The time for each step.

Vac, F, Vdc: The Vac, F, and Vdc initial values when the STEP mode starts.

 $\Delta Vac, \Delta F, \Delta Vdc$: The difference value of each step (it can be negative).

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

Degree: The output phase angle of each step.

Press 'Step Mode' at the bottom to go to the STEP page. The LCD shows STEP MODE: STOP on the top. STOP indicates the present trigger state. Press Trigger to trigger the output and the LCD will show RUNNING to indicate Step mode is executing the output. Stop and Pause will show on the screen when the output is triggered. Stop ceases the waveform change of STEP, while Pause keeps the STEP waveform until TRIG_CONTINUE is pressed. When the AC Source finishes all Counts, the LCD will show STOP and the AC Source will QUIT.

3	_Pha	se		S	TEP MO	DE : S	бтор	QUIT	3	_Pha	se	ST	EP MOD	DE : RUN	INING	OUT
				OUTP	UT SETTING			Step Mode				OUTPUT	SETTING			Step Mode
₫1	Vac =	0.0V		F =	60.00Hz	Vdc =	0.0V	Trigger	₫1	Vac =	0.0V	F = 0	60.00Hz	Vdc = 0	. OV	Stop
₹2	Vac =	0.0V		F =	60.00Hz	Vdc =	0.0V		₫2	Vac =	0.0V	F = 1	60.00Hz	Vdc = 0	. OV	
₫3	Vac =	0.0V		F =	60.00Hz	Vdc =	0.0V		₫3	Vac =	0.0V	F = 1	60.00Hz	Vdc = 0	. OV	Pause
				ME/	SUREMENT							MEAS	UREMENT			
_	٧	=	0	.00	Po	=	0.0			٧	=	0.05	Po	= -	0.0	
₫1	Ι	=	0.	000	PF	=	0.000		₫1	I	=	0.060	PF	= -1.	000	
	۷	=	0	.00	P٥	=	0.0			٧	=	0.39	Po	= -	0.0	
₹2	I	=	0.	000	PF	=	0.000		₹2	I	=	0.016	PF	= -0.	996	
# 3	٧	=	0	.00	P٥	=	0.0			٧	=	0.10	P٥	= -	0.0	
23	Ι	=	0.	000	PF	=	0.000		₫3	Ι	=	0.120	PF	= -0.	526	
	V 12	=	0	.00	V23	=	0.00	2001/10/20		V 12	=	0.35	V23	= 0	. 46	
Σ	V 31	=	0	.00	P٥	=	0.0	Edit	Σ	V 31	=	0.19	Po	= -	0.0	
	List Mode	Puls Mod		Step Mode		Inte harmo		2017/11/30 13:26:58		List Mode	Pulse Mode		Synthesis	Inter- harmonics	Harmonic Meas.	2017/11/30 13:27:24

If the AC Source is outputting, pressing **OUT/QUIT** will stop the output and the waveform will drop to zero volts. Press **OUT/QUIT** again and the AC Source will output the waveform set in MAIN PAGE. Press Trigger again to re-trigger the output. If the AC Source is not outputting, the user can press **ENTER** to output the STEP waveform directly. When pressing **STEP** to exit the STEP page, the STEP waveform will stop execution.

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

3	_Pha	se	S	TEP MOI	DE : RUN	NING	OUT
			OUTPU	TSETTING			Step Mode
₫ 1	Vac =	0.0V	F =	60.00Hz	Vdc = 0	. OV	STOP
₹2	Vac =	0.0V	F =	60.00Hz	Vdc = 0	. OV	
₫3	Vac =	0.0V	F =	60.00Hz	Vdc = 0	. OV	Trigger
			MEAS	SUREMENT			UP
_	٧	=	0.08	Po	= -	0.0	Trigger
₫1	Ι	=	0.059	PF	= -0.	888	DOWN
	٧	=	0.39	Po	= -	0.0	
₹2	I	=	0.016	PF	= -1.	000	
	٧	=	0.10	P٥	= -	0.0	
₫3	Ι	=	0.120	PF	= -0.	552	
	V 12	=	0.35	V23	= 0	.46	
Σ	V 31	=	0.19	P٥	= -	0.0	
	List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2017/11/30 13:28:42

Example of STEP Mode in 1_Phase Mode:

Trigger: Auto

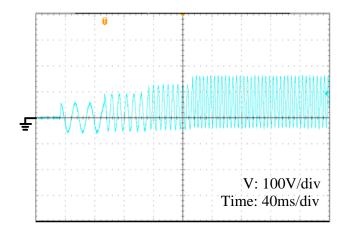
STEP MODE SETTING:

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

The following screen captures show the setting screens of STEP MODE.

1_Phas	е	ST	EP MOD	E	QUIT		1_Pha	se	ST	EP MOD	DE	QUIT	
Vac		STEP MOD	ESETTING 0.0	v		Step Mode	Vac		STEP MOD	E SETTING 40.0	v		Step Mode
∆Vac		=	0.0				∆Va	с	=	10.0			
Vdc		=	0.0	-		Trigger	Vdc	-	=	0.0	-		Trigger
∆Vdc		=	0.0	v		Auto	∆Vd	с	=	20.0	v		Auto
F		=	60.00	Hz			F		=	50.00	Hz		
∆F		=	0.0	0Hz			۵F		=	50.0	0Hz		
Degr	ee	=	0.0	•			Deg	ree	=	90.0	°		
Coun	t	=	0				Cou	n t	=	3	1		
Wave	form	=	Α				Wav	eform	=	Δ			
Dwel	I	=		0.0ms		Execution Page	Dwe	11	=	6	0.0ms		Execution Page
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2017/11/30 13:29:08	List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2017/11/30 20:22:32

1	_Pha	se		ST	EP MOD	DE:STC	P	OUT
				OUTPUT	SETTING		A.L.	Step Mode
	Vac	=).0V	F =	200.0	OHZ	Trigger
	Vdc	=	6 ().OV				1119901
				MEASU	REMENT			
	٧	=	92	2.39	Po	=	3.6	
	I	=	0	064	PF	= 0.	612	
	Vac	=	6 9	9.94	Vdc	= 60	. 38	
	Iac	=	0.	. 0 2 4	Idc	= 0.	059	
	Vpk	=	159	9.56	VA	=	5.9	
	Ipk	=	0	. 111	CF	= 1.	735	
								Edit
	List Mode	Pul Mo		Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2017/11/30 20:22:46



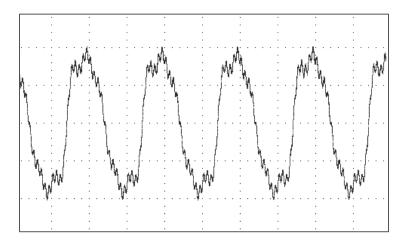
The trigger waveform when the settings are done is shown below:

5.5 Synthesis Waveform

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

3	_Pha	se	5	SYNTHES	IS:STC	P	QUIT	3_	Ρh	ase		S	SYN	THES	IS		QUIT	
		SYNTH	ESIS WAVEF	ORM FUNDAMENT	AL SETTING)	Synthesis							UNDAMENT/		TTING		Synthesis
₫1	Vac_fu	nd =	0.0V F_	fund =60Hz	Vdc =	0.0V	Run			fundame		1	<u>0</u> V	Vdc =		0V		Compose
₫2	Vac_fu	nd =	0.0V F_	fund =60Hz	Vdc =	0.0V		F		fundame V				Degree =	0.	v	0	Value-1
₫3	Vac_fu	nd =	0.0V F_	fund =60Hz	Vdc =	0.0V		-	N 2	0.00	0.0	N 19	0.0	0 0.0	36	0.00	0.0	Edit
		S	YNTHESIS W	VEFORM MEASU	REMENT				3	0.00	0.0	20	0.0		37 38	0.00	0.0	ALL
	٧	=	0.00	Po	=	0.0			5	0.00	0.0	22 23	0.0	0 0.0	39 40	0.00	0.0	Clear
₫1	I	=	0.000	PF	= 0.	000			7	0.00	0.0	24	0.0	0 0.0	41	0.00	0.0	All
	٧	=	0.00	Po	=	0.0			8 9	0.00	0.0	25 26	0.0		42 43	0.00	0.0 0.0	View
₩2	I	=	0.000	PF	= 0.	000		1		0.00	0.0	27	0.0		44 45	0.00	0.0	Waveform
	٧	=	0.00	Po	=	0.0		1	23	0.00	0.0	29 30	0.0	0 0.0	46	0.00	0.0	
₫3	Ι	=	0.000	PF	= 0.	000		1	4	0.00	0.0	31	0.0	0 0.0	48	0.00	0.0 0.0	
	V 12	=	0.00	V23	= 0	.00		1	5	0.00	0.0	32	0.0		49 50	0.00	0.0	Execution
Σ	V 31	=	0.00	Po	-	0.0	Edit	1		0.00 0.00	0.0	34 35	0.0	0 0.0				Page
	List Mode	Puls Mod			Inter- harmonics	Harmonic Meas.	2017/11/30 20:23:16		ist ode	Pul Mo		Ster Mode		Synthesis		iter- nonics	Harmonic Meas.	2017/11/30 20:23:20

The 61507/61508/61509 AC Source provides a Synthesis function to synthesize a waveform. The harmonic components range up to the 50th order with the fundamental frequency limited to 50Hz or 60Hz. The size and phase of each order can be easily programmed on the LCD. The following is an example figure of the synthesis waveform.



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

Value: The absolute value.

Percent: The percentage of the fundamental frequency voltage.

6 types of synthesis waveforms can be programmed for execution or saving.

Vac fundamental: The fundamental frequency voltage; the maximum is limited by RANGE (see 0.)

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

Vdc: The DC voltage component.

Degree: The start angle of the output waveform.

The following is an example of using Synthesis Mode in 1_Phase Mode:

1	_Pha	se	350	V I	LOCAL	QU	IT	
	1000				SETTING			Setting
	Vac	=	0.	OV F	= =	60.0	0Hz	OUTPUT: More Setting
								Measurement
				MEASU	REMENT			Setting
	٧	=	0.	00	Po	=	0.0	Waveform
	I	=	0.0	00	PF	= 0	.000	Viewer
	Vac	=	0.	00	Vdc	=	0.00	Limitation
	Iac	=	0.0	00	Idc	= 0	.000	Limitation
	Vpk	=	0.	00	VA	=	0.0	Output
	Ipk	=	0.0	00	CF	= 0	.000	Mode
	List Mode	Pul: Mod		Step Mode	Synthesis	Inter- harmonic	Harmonic s Meas.	2017/11/30 20:24:18

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

1_Ph	se	SY	NTHESI	S:STC	Ρ	QUIT
	SYNTHESI		FUNDAMENTA	L SETTING		Synthesis
Vac	_fund	= 1	0.0V			Run
F_f	und	=60H:	z Vdo	=	0.0V	
	SYNT	HESIS WAVE	FORM MEASUR	EMENT		
V	=	0.00	Po		0.0	
Ι		.000	PF		000	
Vac		0.00		-	.00	
Iac		.000		= 0.		
Vpk		0.00	VA		0.0	
Ipk	= 0	.000	CF	= 0.	000	
						Edit
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2017/11/30 20:23:46

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

Synthesi	QUIT	TTING					HESIS	ase syn	
Compose Value-1		. 0V . 0°	12	Vdc = Degree =	<u>.0</u> V			fundam fundam	Vac F
	θ	V	N	ν θ		N	θ	v	N
	0.0	0.00	36	0 0.0	0.0	19	0.0	0.00	2
	0.0	0.00	37	0 0.0	0.0	20	0.0	0.00	3
	0.0	0.00	38	0 0.0	0.0	21	0.0	0.00	4
	0.0	0.00	39	0 0.0	0.0	22	0.0	0.00	5
	0.0	0.00	40	0 0.0	0.0	23	0.0	0.00	6
	0.0	0.00	41		0.0	24	0.0	0.00	7
	0.0	0.00	42	0 0.0	0.0	25	0.0	0.00	8
View	0.0	0.00	43		0.0	26	0.0	0.00	9
Waveform	0.0	0.00	44		0.0	27	0.0	0.00	10
	0.0	0.00	45		0.0	28	0.0	0.00	11
	0.0	0.00	46		0.0	29	0.0	0.00	12
	0.0	0.00	47		0.0	30	0.0	0.00	13
	0.0	0.00	48		0.0	31	0.0	0.00	14
	0.0	0.00	49		0.0	32	0.0	0.00	15
Execution	0.0	0.00	50		0.0	33	0.0	0.00	16
Page					0.0	34	0.0	0.00	17
U				0 0.0	0.0	35	0.0	0.00	18
2017/11/ 20:24:3	Harmonic Meas.	nter- monics		Synthesis		Ste Mod	llse ode		List Mode

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

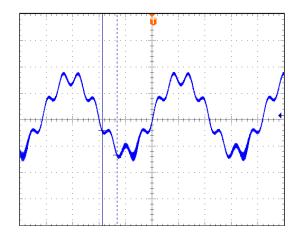
OUTPUT SETTING: Vac = 100V, F = 60Hz

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



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

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



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

Notice
 In order to protect the power stage of the AC Source it is necessary to limit the synthesis value or the percentage of each order.
 2 ≤ order ≤ 10, value ≤ 150V or percentage ≤ 100%.

- $11 \leq \text{order} \leq 20$, value ≤ 120 V or percentage $\leq 50\%$.
- $21 \le \text{order} \le 30$, value $\le 80V$ or percentage $\le 30\%$.
- $31 \leq \text{order} \leq 40$, value $\leq 45V$ or percentage $\leq 15\%$.
- 41 \leq order \leq 50, value \leq 30V or percentage \leq 10%.
- 2. If the synthesis waveform exceeds the voltage limit, 494V for 350V range or 247V for 175V range, OUTPUT OVP will occur.

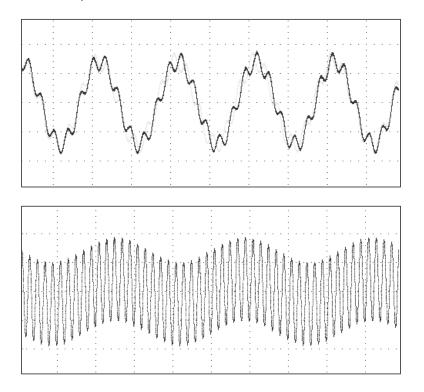
5.6 Inter-harmonics Waveform

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

3	_Pha	se	INT	FERHA	RMONI	CS:ST	OP	QUIT
1				OUTPUT	SETTING	1000		Interharmon
₫1	Vac	=	0	. O V	F =	200	.00Hz	Tuisses
•2	Vac	=	0	. O V	F =	60	.00Hz	Trigger
•	Vac	=	0	. O V	F =	200	.00Hz	
				MEASU	REMENT			
	٧	=	0	.00	Po	=	0.0	
₫1	Ι	=	0.	000	PF	= 0	.000	
	٧	=	0	.00	Po	=	0.0	
₫2	Ι	=	0.	000	PF	= 0	.000	
	٧	=	0	.00	P٥	=	0.0	
# 3	I	=	0.	000	PF	= 0	.000	
	V 12	=	0	.00	V23	=	0.00	
Σ	V 31	=	0	.00	Po	=	0.0	Edit
	List Mode	Pul Mo		Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2017/11/30 20:30:26

I	3	_Pha			RMONIC		QUIT	
		-			AVEFORM SE			Interharmon
		F	star	t =	144	<u>0</u> Hz		Edit Each
	₫1	F	end	=		0Hz		Laci
		Tim	e	=	0.0	OSec		
		Lev	el	=	0.	0%		
		F	star	t =	0.1	0Hz		
		F	end	=	0.1	0Hz		
	₹2	Tim	е	=	0.0	OSec		
		Lev	el	=	0.	0%		
		F	star	t =	0.1	0Hz		
		F	end	=	0.1	0Hz		
1	₫3	Tim	е	=	0.0	OSec		Execution
		Lev	el	=	0.	0%		Page
		List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2017/11/30 20:31:13

For the AC Source Inter-harmonics function, besides the fundamental voltage output, another frequency with a variable voltage component is added to test certain anti-interference. The following figure is an example of an inter-harmonic:



- **F start :** The start frequency of the scanning wave. The range is 0.01Hz 2400Hz.
- **F end :** The end frequency of the scanning wave. The range is 0.01Hz 2400Hz.
- **Level :** The RMS of the scanning wave that is the percentage of the fundamental voltage set in MAIN PAGE.
- **Time :** The scanning time from F start to F end.

The following is an example using Inter-harmonics Mode in 1_Phase Mode:

1	_Pha	se	3	5 O V	LOCA	٨L	QUI	Т	
	Vac	-	(F =		.00	Hz	Setting OUTPUT: More Setting
				ME	ASUREMENT				Measurement Setting
	V I	=	1.00	0.00	Po	=		0.0	Waveform Viewer
	Vac Iac	=	(0.00	Vd	lc =	0	.00	Limitation
	Vpk Ipk	=	1.00	0.00 .000				0.0	Output Mode
	List Mode	Puls Mod		Ster Mode		esis .	nter- monics	Harmonic Meas.	2017/11/30 20:31:56

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

1	_Pha	se	INT	ERHA	RMONIC	CS:STC	P	QUIT
	Vac	-	0	. 0 V		60.00	Hz	Interharmon Trigger
				MEAS	JREMENT			
	٧	=	0	.00	Po	=	0.0	
	I	=	0.	000	PF	= 0.	000	
	Vac	=	0	.00	Vdc	= 0	.00	
	Iac	=	0.	000	Idc	= 0.	000	
	Vpk	=	0	.00	VA	=	0.0	
	Ipk	=	0.	000	CF	= 0.	000	
								Edit
	List Mode	Pu Mo	0.0.0	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2017/11/30 20:31:40

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

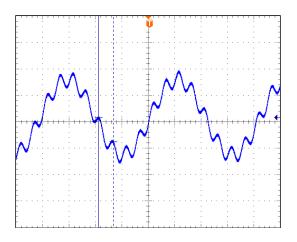
1_Pha			RMONIC	S	QUIT	
F	star		SOD.0	OHZ		Interharmon
F	end	=	500.0	0Hz		
Tim	е	=	20.	OSec		
Lev	el	=	10.	<u>0</u> %		
						Execution Page
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2017/11/30 20:32:29

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

OUTPUT SETTING: Vac = 60.0V F = 60Hz F start = 500.0Hz F end = 500.0Hz Level = 20.0% Time = 10.0Sec

1	_Pha	se	IN	TER	HAF	RMONI	CS:	RUN	NING	OUT
						SETTING				Interharmon
	Vac	=		0.0	VF	-	60	.00	Hz	Stop
				,	IFASUE	EMENT				Pause
	V	_		0.4		Po	=		0.0	
		_	100							
	I	=	0	.06	1	PF	=	1.	000	
	Vac	=	(0.0	0	Vdc	=	0	. 42	
	Iac	=	0	. 0 0	5	Idc	=	0.	061	
	Vpk	=		1.1	2	VA	=		0.0	
	Ipk	=	0	. 08	0	CF	=	1.	311	
	List Mode	Pu Mo	lse de		ep de	Synthesis		ter- ionics	Harmonic Meas.	2017/11/30 20:32:53

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



The figure above is the output voltage waveform of the AC Source measured by an oscilloscope and is the same as the user edited waveform.



In order to protect the power stage of the AC Source it is necessary to limit the F start and F end related Level. If $0.01Hz \le F$ start or F end $\le 500Hz$, Level $\le 30\%$. If 500Hz < F start or F end $\le 1000Hz$, Level $\le 20\%$. If 1000Hz < F start or F end $\le 2400Hz$, Level $\le 10\%$.

5.7 Harmonic Waveform

Press Output Mode on the right in the MAIN PAGE (see 3.3) to enter into the Output Mode command line. Next press Harmonic Meas. at the bottom to go to the I Harmonic Meas. command line. This function can measure the Total Harmonic Distortion (THD) of the fundament frequency (50Hz or 60Hz), the DC current, the fundamental frequency of the output current or voltage, and measure 2 - 50 orders of harmonic values. Press Edit on the right to enter the Harmonic Meas. editing window.

3	_Pha	se H	ARMO	DNIC	ME.	AS.:S	TO	P	QUIT
	1000000	HA	RMONIC	MEASU	REMENT	SETTING	30 M.		Harmonic
₫1	THD =	0.0%	DC	=	0.0V	Fundame	ntal	= 0.0V	
₫2	THD =	0.0%	DC	=	0.0V	Fundame	ntal	= 0.0V	Trigger
₫3	THD =	0.0%	DC	=	0.0V	Fundame	ntal	= 0.0V	
	N	VALUE	N	VALUE	N	VALUE	N	VALUE	
	2	0.00	15	0.00	28	0.00	41	0.00	
	3	0.00	16	0.00	29	0.00	42	0.00	
	4	0.00	17	0.00	30	0.00	43	0.00	DATA
	5	0.00	18	0.00	31	0.00	44	0.00	₫1
	6	0.00	19	0.00	32	0.00	45	0.00	
	7	0.00	20	0.00	33	0.00	46	0.00	
	8	0.00	21	0.00	34	0.00	47	0.00	
	9	0.00	22	0.00	35	0.00	48	0.00	
	10	0.00	23	0.00	36	0.00	49	0.00	
	11	0.00	24	0.00	37	0.00	50	0.00	
	12	0.00	25	0.00	38	0.00			
	13	0.00	26	0.00	39	0.00			Edit
	14	0.00	27	0.00	40	0.00			
	List Mode	Pulse Mode		tep ode	Synthe	sis Inte harmo		Harmonic Meas.	2017/11/30 20:33:45

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

V: The output voltage.

I: The output current.

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

Single: The display will keep the measured data. It takes about 3 seconds to get the results. Continue: The display updates the measured data. It takes about 10 seconds to get stable results.

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

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

	3	Pha	se HA	RMONIC	C MEAS		QUIT	
				HARMONIC M	EASUREMENT	ſ		Harmonic
	ē 1	Sou	rce = <u>'</u>	V				Edit Each
	* 1	Parameter Value						
	ā 2	Sou	rce ='	v				Measurement Single
		Sou	rce ='	v				
	₫3	F	fund	amenta	al =60	Hz		Execution Page
		List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2017/11/30 20:33:58

The following is an example using Harmonic Meas. Mode in 1_Phase Mode:

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

1_Pha	se 3	50V L	OCAL	QUIT		
Vac	=	0.0V F		60.00	Hz	Setting OUTPUT:
						More Setting
		-				Measurement Setting
		MORE S	ETTING			
Waveto	rm = <u>A</u> SINE					Waveform Viewer
OFF De	gree = IMM					Limitation
Vac S/ VdcR S).000V/ms).000V/ms				
	R = ().000V/ms).000Hz/ms).000V/ms				Output Mode
Coupling AC	Range 350V		Output Waveform Selection			2018/04/23 14:47:45

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

1_Pha	se 3	50V	LOCAL	QUI	Т	
Vac	=	0.0V	SETTING F =	60.00	Hz	Waveform
		MORE	SETTING			
	rm A = <u>SI</u> rm B = SII					View Waveform
Coupling AC	Range 350V		Output Waveform Selection			2017/11/30 20:34:55

Set the Waveform A to DST04 waveform.

1_Pha	se 3	50V	LOCAL	QUI	Т
Vac	_		SETTING	60.00	Waveform
vac	-	0.04	F -	00.001	ΠZ
			SETTING		
	rm A = <u>DS</u> rm B = SI				View Waveform
Coupling AC	Range 350V		Output Waveform Selection		2017/11/30 20:35:13

When the waveform setting is done, press View Waveform on the right to view the output

1_Phase 350V		
Vac = <u>0.0</u> V		Waveform
	VAVEFORM A	
Waveform A = DST04	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	
Coupling Range AC 350V	Output Waveform Selection	2018/04/23 14:48:28

waveform, the ratio of each harmonic order, and the output angle.

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

1	_Pha	s e	3	5 O V	LOCAL	OU	Т	
	Vac	=	<u>10(</u>	00TPU1 0.0V	F =	60.0	Hz	Main OUTPUT: More Setting
				MEAS	UREMENT			Measurement Setting
	V I	=		9.88	P₀ PF	= = 0	0.1 .023	Waveform Viewer
	Vac Iac	=		9.88	Vdc Idc		0.43 .061	Limitation
	Vpk Ipk	=		9.19 .108	VA CF	= = 1	6.3 .725	Output Mode
I	Recall CH1		call H2	Recall CH3	Recall CH4	Recall CH5	More 1 of 2	2017/11/30 20:36:15

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

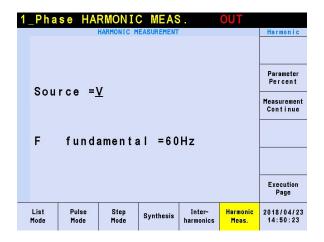
1	_Pha	se	3	50V	LOCAL	OUT		
	Vac	=	100	00000000000000000000000000000000000000	F =	60.00	Hz	Setting OUTPUT: More Setting
				MEAS	UREMENT			Measurement Setting
	V I	=		9.88	P₀ PF		0.1 022	Waveform Viewer
	Vac Iac	=		9.88	Vdc Idc	-	.43 061	Limitation
	Vpk Ipk	=		9.42 .114	VA CF		6.3 826	Output Mode
	List Mode		lse ode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2017/11/30 20:36:10

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

1_Pha					P	OUT Harmonic
THD		0.0%	DC 0.0	=	0.0V	Trigger
N	VALUE	N VALUE		ALUE N	VALUE	
2	0.00	15 0.00	28	0.00 41	0.00	
3	0.00	16 0.00	29).00 42	0.00	
4	0.00	17 0.00	30).00 43	0.00	
5	0.00	18 0.00	31).00 44	0.00	
6	0.00	19 0.00	32).00 45	0.00	
7	0.00	20 0.00	33).00 46	0.00	
8	0.00	21 0.00	34).00 47	0.00	
9	0.00	22 0.00	35).00 48	0.00	
10	0.00	23 0.00	36).00 49	0.00	
11	0.00	24 0.00	37).00 50	0.00	
12	0.00	25 0.00	38	0.00		
13	0.00	26 0.00	39	0.00		Edit
14	0.00	27 0.00	40	0.00		
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2018/04/23 14:49:53

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

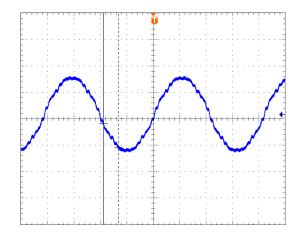
Source = V F fundamental = 60 Hz Measurement = Continue Parameter = Percent



Press Execution Page on the right to return to the Harmonic Meas. Mode page. Press Trigger on the right to perform the output voltage harmonic measurement. After triggering, press DATA on the right to view the measurement of a phase.

1_Pha	se H	ARMONI	C MEAS	5.:RUN	NING	OUT
	HAI	RMONIC MEASU	JREMENT SET	TTING		Harmonic
THD	=	4.7%	DC	=	0.0V	Stop
Fun	dameı	ntal =	99.9	V		3100
N		% N	%		%	
2	0.04	15 0.03	28	0.01 41	0.01	
3	2.49	16 0.02	29	0.01 42	0.01	
4	0.04	17 0.02	30	0.01 43	0.01	
5	1.92	18 0.02	31	1.27 44	0.01	
6	0.03	19 0.02	32	0.01 45	0.01	
7	2.45	20 0.02	33	0.91 46	0.01	
8	0.03	21 0.02	34	0.01 47	0.01	
9	0.04	22 0.02	35	0.01 48	0.01	
10	0.03	23 1.74	36	0.01 49	0.01	
11	0.03	24 0.01	37	0.01 50	0.01	
12	0.03	25 0.97	38	0.01		
13	0.03	26 0.02	39	0.02		
14	0.03	27 0.02	40	0.01		
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2018/04/23 14:51:15

The figure above is the output voltage waveform of the AC Source measured by an oscilloscope and is the same as the user edited waveform.



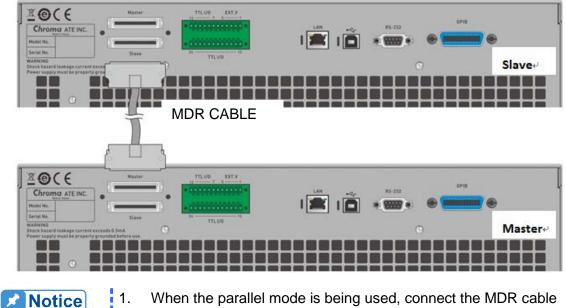


When Trigger is pressed to execute the current harmonic measurement, the AC Source will automatically adjust its internal gain based on the measured data so that the AC Source can get more accurate data of each harmonic. Wait for the load to be stable before executing the harmonic measurement. The load cannot be changed during a measurement or the retrieved data may lose its accuracy or cause an over current protection fault.

6. Parallel Operation

6.1 Parallel Connection of AC Sources

When two AC Sources (61507/61508/61509) are connected in parallel mode, they use an MDR cable to transmit parallel data. The following figure shows the parallel connecting diagram. Maximum one AC Source can be paralleled at present.



- 1. When the parallel mode is being used, connect the MDR cable correctly or it will cause a system connection error.
- 2. Before operating in parallel, the coupling setting of 2 AC sources needs be the same,otherwise it may cause output error.

6.2 Setting Up

6.2.1 Setting the AC Source to Slave

To set an AC Source to Slave, press **CONFIG** in the **FUNCTION** keys to enter into the CONFIG function and select the Master/Slave Function to set the parallel connection. The procedure is listed below:

- 1. Press Position at the bottom.
- 2. Turn the RPG to change the Position to Slave and press **ENTER** to set it to Slave.
- 3. If the AC Source to be set is located between two terminals, press Terminator Disable and turn the RPG to change the Terminator to Enable and then press **ENTER** to set it.

3	_Pha	se	350V	LOCAL	QUIT		3	_Pha	se	350V	LOCAL	QUIT	
				SETTING	20 M 20 M 20 M 20 M	Config					SETTING		Config
₫	Vac	=	0.0V	F =	60.00Hz	Others	₫1	Vac	=	0.0V	F =	60.00Hz	Others
•	Vac	=	0.0V	F =	60.00Hz	others	₹2	Vac	=	0.0V	F =	60.00Hz	Others
₫:	Vac	-	0.0V	F =	60.00Hz	Calibration	₫3	Vac	=	0.0V	F =	60.00Hz	Calibration
			MEASU	REMENT		Cambration				MEAS	UREMENT		Cambration
	V	=	0.00	Po	= 0.0	System		٧	=	0.00	Po	= 0.0	System
Φ	I	=	0.000	PF	= 0.000	Information	€1	I	=	0.000	PF	= 0.000	Information
	٧	=	0.00	Po	= 0.0	Factory		٧	=	0.00	Po	= 0.0	Factory
ē :	I	=	0.000	PF	= 0.000	Default	₹2	Ι	=	0.000	PF	= 0.000	Default
	٧	=	0.00	P٥	= 0.0	Master/Slave		٧	=	0.00	P٥	= 0.0	Master/Slave
₫:	I	=	0.000	PF	= 0.000	Function	₫3	Ι	=	0.000	PF	= 0.000	Function
	V 12	=	0.00	V23	= 0.00	More		V 12	=	0.00	V23	= 0.00	More
Σ	V 31	=	0.00	P٥	= 0.0	2 of 2	Σ	V 31	=	0.00	P٥	= 0.0	2 of 2
	Position <mark>Slave1</mark>	Numbe Slav 1	Terminetor		Function Disable	2018/04/25 14:05:16		osition I a ve 1	Termin Enab				2018/04/25 14:05:26

Notice

This series of AC source can be used in parallel with a slave device.

6.2.2 Setting the AC Source to Master

Press **CONFIG** in the **FUNCTION** keys to enter into the CONFIG function and select Master/Slave Function for parallel connection setting. The procedure is shown below:

- 1. Press Position at the bottom.
- 2. Turn the RPG to change the Position to Master and press **ENTER** to set it to Master.
- 3. Press Number of Slave at the bottom.
- 4. Turn the RPG to select the quantity of Slaves to connect in parallel and press **ENTER** to set it.
- 5. If the AC Source to be set is located between two terminals, press Terminator and turn the RPG to change the Terminator to Enable and then press **ENTER** to set it.
- 6. Press Function at the bottom.
- 7. Turn the RPG to change the Function to Enable and press **ENTER** to set it.
- 8. The device set to Master will return to the main menu and the one set to Slave will show Slave on the screen.



At least one device needs to be set as Slave in a parallel application or it will show "System Connection Fail!" when setting the Master Enable. See the section below for a detailed description of troubleshooting.

3	_Pha	se	350V	LOCAL	QUI	T		3	_Pha	se	350V	LOC
₫1	Vac	=	0.0V	SETTING F =	60	.00Hz	Config	₫1	Vac	=	0.0V	t sett F
₹2	Vac	=	0.0V	F =	60	.00Hz	Others	₹2	Vac	=	0.0V	F
₫3	Vac	=	0.0V	F =	60	.00Hz	Calibration	₫3	Vac	-	0.0V	F
			MEASU	JREMENT			Calibration				MEAS	SUREMEN
	٧	=	0.00	Po	=	0.0	System		٧	=	0.00	P
21	Ι	=	0.000	PF	= 0	.000	Information	₫1	I	=	0.000	P
₹2	٧	=	0.00	P٥	=	0.0	Factory	₹2	٧	=	0.00	P
22	I	=	0.000	PF	= 0	.000	Default	22	I	=	0.000	P
	٧	=	0.00	P٥	=	0.0	Master/Slave		٧	=	0.00	P
₫3	Ι	=	0.000	PF	= 0	.000	Function	₫3	I	=	0.000	P
	V 12	=	0.00	V23	=	0.00	More		V 12	=	0.00	٧
Σ	V 31	=	0.00	P٥	=	0.0	2 of 2	Σ	V 31	=	0.00	P
	Position 1aster	Numb Sla 1	Terminator			Function Disable	2018/04/25 14:06:22		Position 1aster	Numbe Slav 1		

Config Others Calibration
O all has diam
Calibration
System
Information
Factory
Default
Master/Slave
Function
More
2 of 2
2018/04/25



6.3 Troubleshooting

When multiple devices are connected in parallel, each standalone device has to have an MDR cable to transmit the signal. If the connection is busy or errors occurred during connection, follow the troubleshooting procedures below to resolve the problem and redo the parallel connection.

6.3.1 When the Connecting Cable Falls

If "System Connection Fail!" occurs when initiating the Master connection, check if the MDR cable is firmly connected and the other AC Source is set to Slave. When confirmed, press Retry on the Master to redo the connection.

OVTPUT SETTING	Centig
	Retry
System Connection Fail!	Cancel
	-
	2018/04/25

If "SYSTEM SHUTDOWN" occurs during connection, power the source off first and check if the MDR cable is firmly connected. If yes, reboot it and redo the connection.

3	Phas	se	175V	LOCA	L	QUIT	
			OUTPU	T SETTING	6		Hain
	Vac	=	0.0V	F	=	60.00H;	z
12	Vac	=	0.0V	F	=	60.00H;	z
12	Vac	=	0.0V	F	=	60.00H;	z
			PRO	TECTION			
		SY	'S SYS_	u-Manana Manana	oow	N	
		SY	'S SYS_	u-Manana Manana	woo	IN	2018/06/0

6.3.2 Parallel Setting Error

If a "System Connection Fail!" occurred when connecting the Master, it could be a connection setting error. First, check if the Master connected devices (number of slaves) is the same as the actual number of slaves. Next, check if a parallel slave position is duplicated. The position set for slave cannot be duplicated. When confirmed, press Retry on the Master to attempt the connection again.

OVTPUT SETTING	Centig
	Retry
System Connection Fail!	Cancel
	2018/04/25

7. Theory of Operation

7.1 Overview

The 61507/61508/61509 AC source consists of several Printed Circuit Boards (PCB) and other components. Each of the PCBs has specific functions that are described in the following sections.

7.2 Description of Overall System

Figure 7-1 is an overall system diagram that is composed of the following portions:

Input Stage I Board

The I board converts the AC power to DC power with the active PFC function and isolates its output with regulation function. It can also provide the inverter a stable input DC source.

- Output Stage H/O/A Boards These boards are composed of an inverter that draws power from the I board allowing the 61507/61508/61509 to output DC or AC power.
- Auxiliary Power Z Board The Z board is an isolation DC/DC converter that converts the J board output to ±12Vdc and +5Vdc power to drive the ICs of the various PCBs and other components.
- Mains Detector J Board The J board detects if the mains is within the operating range. It cuts off the main circuit from the mains when abnormality occurs.
- EMI Filter L Board The L board is equipped with EMI filter and input fuse.
- Digital Signal Processor E Board The E board contains DSP, FPGA, and CPLD control elements that are responsible for the actions and measurements of the 61507/61508/61509 AC source. It is also has communication interfaces such as GPIB, RS-232, USB.....and sends the signals back to the E board to accomplish the remote control function.
- Power Switch S Board The combination of S board and power switch transmits the start signal to J board that controls the on and off of the instrument.
- Key Input K/KL/KR Board The front panel key controls for the above PCBs that send the inputted signals to the E board.
- USB Port KU Board The USB HOST port connects to E board that can capture the screen patterns for storage.

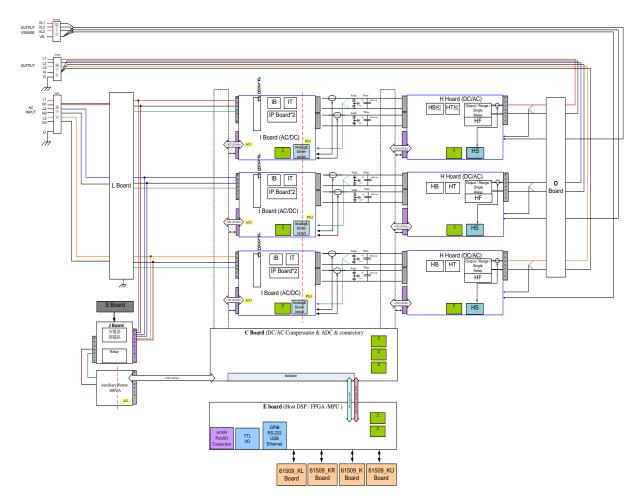


Figure 7-1 Overall System Diagram

8. Self Test and Troubleshooting

8.1 Overview

This chapter describes the self-test procedures and provides suggestions for troubleshooting when the AC Source is not operating normally. If the information provided here does not resolve the problem, contact your local Chroma distributor.

8.2 Self Test

The AC Source runs a series of self-tests during power-on. First, it executes the memory, data, and communication self-tests for the DISPLAY, WAVEFORM, and REMOTE. If any failure is detected in a certain item, an "error code" will display to the right of the item. The following table lists all of the error messages.

Error Code	Description	Remark
Bit 0	Memory error	0 – OK, 1 – ERROR
Bit 1	Waveform Generator error	0 – OK, 1 – ERROR
Bit 2	DATA error	0 – OK, 1 – ERROR
Bit 3	Communication error	0 – OK, 1 – ERROR
Bit 4	Output test result	0 – OK, 1 – ERROR
Bit 5	Reserved	
Bit 6	Reserved	
Bit 7	Reserved	

Example: If an error code shows " ERROR = 05 ", it is "00000101" in binary. Bit 0 and Bit 2 are "1". So "ERROR = 05" means a memory error and a DATA error occurred.

Error Message	Description	Resolution
Memory error	Memory test failed.	Consult your dealer for further support
Waveform Generator error	Waveform generator test failed.	Consult your dealer for further support.
DATA error	The data in Flash or EEPROM test failed.	Consult your dealer for further support.
Communication error	Unable to send.	 Power off the AC Source and wait for three seconds before powering it on again. Consult your dealer for further support.

After the self-tests for memory, data, and communication, the AC Source executes the power output self-test. In this test, the output relays are OFF to protect any load connected to the output terminal from damage. An error message will appear on the panel if an abnormal condition is encountered during self-test.

8.3 Troubleshooting

The following table lists possible operating problems and suggested corrective actions:

Problem	Cause	Resolution
Poor measurement	Aged components result in	Periodic calibration is required.
of V, I.	deviation of characteristics.	Refer to Chapter 4 Calibration.
Output distortion	 The output voltage of AC Source is too low. The rectified load is too large during high frequency. 	 Program higher output voltage. Reduce the load or output frequency.
Over Temperature Protection (OTP)	 The ambient temperature is too high. The airway is obstructed. 	 Operate the unit between 0 - 40°C. Unblock the airway.
Over Power Protection (SYS OPP)	The output power exceeds the specification.	Reduce the output power or output voltage.
Over Current Protection (SYS OCP)	The output current exceeds the specification or I LIMIT.	Remove the overload or expand the I LIMIT.
Output Short Protection (SYS SHORT)	 The output is shorted. External current reversed. 	 Remove the short state. Remove the load.
	The line input voltage of the AC	Measure the input voltage and
(SYS INT_LINE)	Source is too low or too high.	regulate it if over specification.
AD_PFC_OVP AD_PFC_UVP protection	 Cycle dropout for line input voltage. Instant over current during output. The AD power stage is damaged. 	 Check the stability of the input voltage. Remove the load. If the protection cannot be reset, consult the dealer for assistance.
DD_VDC1_OVP DD_VDC1_UVP DD_VDC2_OVP DD_VDC2_UVP protection	 Cycle dropout for line input voltage. Instant over current during output. The DD power stage is damaged. 	 Check the stability of the input voltage. Remove the load. If the protection cannot be reset, consult the dealer for assistance.
SENSE FAULT protection	 Remote Sense is open. Output voltage peak exceeds the range. 	 Connect the output to Remote Sense terminals. Check the settings of Vac and Vdc on MAIN PAGE.
AD_FAN_FAIL DA_FAN_FAIL fan protection	 The fan stops operation due to obstruction. The fan is not inserted. 	 Clear the fan obstruction. If the protection cannot be reset, consult the dealer for assistance.
Unable to control AC Source via GPIB	 The address of AC Source is incorrect. GPIB cable is loose at rear. 	 Update the address. Check the connection and tighten the screws.

9. Remote Operation

9.1 Introduction

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

9.1.1 USB Interface

- (1) Hardware Support: USB 2.0 and USB 1.1
- (2) Software Support: USBTMC class and USB488 subclass
- (3) OS Support:
- (4) Installing Driver:

Windows 98/2000/XP/Vista The AC Source USB Interface supports USBTMC, so if the PC OS supports USBTMC (installed NI-VISA runtime version 3.00 or above) there is no need to install other drivers. The OS will search for the standard USBTMC driver installation program automatically.

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

Related Documents:

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

9.1.2 GPIB Interface

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

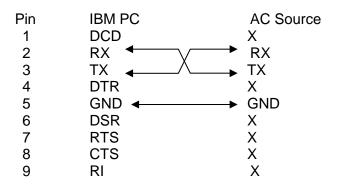
GPIB Capability	Description	Interface Function
Talker/Listener	Commands and response messages can be sent and received via the GPIB bus. Status information can be retrieved by serial query.	AH1, SH1, T6, L4
Service Request	The AC Source sets the SRQ to be true if there is a service request.	SR1
Remote/Local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

9.1.3 RS-232C Interface

The baud rate of the AC Source is set to **115200** with parity set to None. For the RS-232C, parameters such as baud rate and parity can be set via the "CONFIG" function menu (see section 3.4.) Only TxD and RxD signals are used for data transmission. The connector is a 9-pin D-subminiature male connector. The following table describes the pins and signals of the RS-232C connector.

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

Interconnection between the computer (compatible with IBM PC) and the AC Source is illustrated below:



9.1.4 Ethernet Interface

To remote program an AC Power Supply via a PC through an Ethernet interface, the IP address, Gateway address, and Subnet mask need to be defined in advance (see 3.4.1.3 for detailed settings). TCP is used to ensure reliable data transmission. The communication port is 2101.

9.2 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.

9.2.1 Conventions

Angle brackets Vertical bar	< 	>	Items in angle brackets are parameter abbreviations. Vertical bar separates alternate 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 $\langle A \rangle \{\langle, B \rangle\}$ means that parameter "A" must be entered while parameter "B" may be omitted or entered one or more times.

9.2.2 Numerical Data Formats

All data programmed to or returned from the AC Source are in ASCII. The data can be numerical or character string.

Symbol	Description	Example
NR1	A digit with no decimal point. The decimal is assumed to	123, 0123
	be on the right of the least significant digit.	
NR2	A digit with a decimal point.	12.3, .123
NR3	A digit with a decimal point and an exponent.	1.23E+2

9.2.3 Boolean Data Format

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

9.2.4 Character Data Format

The character strings returned by a 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.

9.2.5 Basic Definition

Command Tree Table:

The commands of the AC Source are structured hierarchically, which is referred to as a 'tree system'. The full path must be specified to obtain a particular command. This path is represented in the table by placing the highest node in the farthest left position of the hierarchy. Lower nodes in the hierarchy are indented in a position to the right under the parent node.

Program Header:

Program header is the key word used to identify the command according to the IEEE 488.2 syntax described in section 9.5. The AC Source accepts characters in both upper and lower cases without any distinction. The 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:

An instrument-controlled header can be applied to all instrument commands. Each header has a long form and a short form. The AC Source 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 type in this section. The short form of the 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 one another in a program message.

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

Program Message Terminator (<PMT>):

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

- (1) <END>: end or identify (EOI)
- (2) <NL>: new line, which is a single ASCII encoded byte 0A (decimal10).
- (3) <NL> <END>: new line with EOI.



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

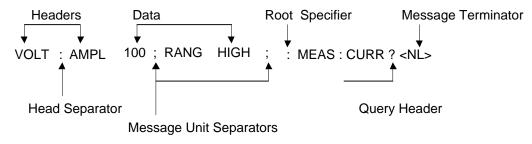


Figure 9-1 Structure of Command Message

9.3 Traversal of the Command Tree

Multiple program message units can be sent in one program message. The first command usually refers to the root node. Subsequent commands refer to the tree level the 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.

9.4 Execution Order

The AC Source executes program messages in the order received. Problems may occur if the sequence is not followed.

For example, if the current output voltage range is set to LOW, and the desired output voltage range for the new state is HIGH with amplified 220 Volt, and the commands

VOLTage : AC 220<PMT> VOLTage : RANGe HIGH<PMT>

are sent out, an out of range error will appear.

9.5 AC Source Commands

This section describes the syntax and parameters of all the commands for the AC Source.

Syntax FormThe long format header is used for syntax definition; however, only the
short format header syntax appears in the examples.ParameterMost commands require a parameter.Return ParameterAll queries return a parameter.ModelIf a command applies to specific models, these models will be listed in the
Model only entry. If there is no Model only entry, the command applies to
all models.

9.5.1 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.

*CLS Clear status

This command clears the following registers:

- (1) Questionable Status Event
- (2) Status Byte
- (3) Error Queue

*ESE<n> Standard event status enabled This command programs the Standard Event register bits. If one or more enabled events of the Standard Event registers are set, the ESB of the Status Byte Register is set as well.

Bit Configuration of Standard Event Status Enabled Register	r
---	---

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 = Execut	EXE = Execution Error			OPC = Operation Completed				
PON = Power On			QY	E = Que	ry Error	-		

- *ESE? Returns standard event status enabled.
- *ESR? The query reads the Standard Event settings of the Event register and clears it. The bits of configuration are the same as the Standard Event Status Enabled Register.

*IDN? Returns the AC Source identification string. Returned parameter Chroma ATE,61500,123456,01.00 Chroma ATE : Company name 61500 : Model name 123456 : Serial number 01.00 : Firmware version

- *RCL<n> Restores the values of the specified group previously stored in memory. Parameter 1 - 10
- *SAV<n> Saves the values to a specified group in memory. Parameter 1 - 10
- * RST Resets the AC Source to its initial state. Wait for 3 seconds before sending the next command.
- *SRE Sets the conditions of the Service Request Enabled Register. If one or more of the enabled events of the Status Byte Register is set, the MSS and RQS of the 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	ESB	MAV	QUES			
		RQS						

ESB	= Event Status Byte Summary
-----	-----------------------------

QUES = Questionable Status Summary

RQS = Request for Service

- MSS = Master Status Summary
- MAV = Message Available

* TST? Queries the self-test result of the AC Source.

9.5.2 Instrument Command Dictionary

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

9.5.2.1 SYSTEM Subsystem

SYSTem

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

SYSTem:ERRor?

Description Query Syntax	: This command queries : SYSTem:ERRor?	the error string of the command parser.
Parameter	: None	
Return Paramet	er : Error string response:	No Error

Data Format Error Data Range Error Too Many Errors Execution Error

SYSTem:VERSion?

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

SYSTem:LOCal

 Description
 : This command is only valid when the AC Source is being controlled through the RS-232C interface. If SYST: LOC is programmed, the AC source 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 is only valid when the AC Source is being controlled through the RS-232C interface. If SYST: REM is programmed, the AC source will be set in the REMOTE state, and the front panel will be disabled except the "<PAGE/EXIT> key. Query Syntax : None

Parameter : None Return Parameter : None

SYSTem:DATE

Description: This command sets the date of the AC Source real time clock.Query Syntax: SYSTem:DATE?Parameter: <year>,<month>,<day>Return Parameter : 2008,01,01

SYSTem:TIME

Description: This command sets the time (24H) of the AC Source real time clock.Query Syntax: SYSTem:TIME?Parameter: <hour>,<minute>,<second>Return Parameter: 20,30,01

9.5.2.2 INSTRUMENT Subsystem

INSTrument

:EDIT :Couple :NSELect :SELect :PHASe

INSTrument:EDIT

Description
 : This command sends a programmed command to set all phases at the same time for an AC Source that is equipped with multiple phases. If INST: EDIT ALL has been programmed, the command will be sent to all phases. INST: EDIT EACH command disables the EDIT ALL command.
 Query Syntax
 : INSTrument:EDIT?
 : EACH | ALL

Return Parameter : None

INSTrument : COUPle

Description
 This command sends a programmed command to set all phases at the same time for an AC Source that is equipped with multiple phases. If INST: COUP ALL has been programmed, the command will be sent to all phases. INST: COUP NONE command disables the COUP ALL command.
 Query Syntax
 INSTrument : COUPIe?
 Parameter
 : NONE | ALL

Return Parameter : None

INSTrument : NSELect

Description : This command sets individual outputs for subsequent commands or queries in a multi-phase model. If INST: COUP NONE has been programmed, the phase selection command will be sent to the specific output phase set by INSTrument: NSELect. If INST: COUP ALL has been programmed, all remote operation commands will be sent 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 AC Source will return the Φ 2 measurement voltage. INST: NSEL

uses the number to select the phase.Query Syntax: INSTrument : NSELect?Parameter: 1 | 2 | 3Return Parameter : 1 | 2 | 3

INSTrument : SELect

Description	: This command sets individual outputs for subsequent commands or queries in the multi-phase model. If INST: COUP NONE has been programmed, the phase selection command will be sent to the 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 AC Source will return the Φ 2 measurement voltage. INST: SELect uses the number to select the phase.
Query Syntax	: None
Parameter	: OUTPUT1 OUTPUT2 OUTPUT3
Return Paramete	er : None

INSTrument : PHASe

Description	: Switches between single phase and three-phase mode.
Query Syntax	: INSTrument : PHASe?
Parameter	: THREE SINGLE
Return Paramete	r : THREE SINGLE

9.5.2.3 FETCH and MEASURE Subsystem

FETCh | MEASure

ſ	:	SCALar]	

: CURRent	
: AC?	Queries the RMS current of the AC component.
: DC?	Queries the DC current level.
: ACDC?	Queries the current (AC+DC) RMS.
: AMPLitude : MAXimum?	Queries the peak current.
: CREStfactor?	Queries the current crest factor.
: INRush?	Queries the inrush current.
: FREQuency?	Queries the frequency.
: POWer	
: AC	
[: REAL]?	Queries the real power.
: APParent?	Queries the apparent power.
: REACtive?	Queries the reactive power.
: PFACtor?	Queries the power factor.
: TOTal?	Queries the total power.
: TOTal : APParent?	Queries the total apparent power.
:VOLTage	
: AČ?	Queries the RMS voltage of the AC component.
: DC?	Queries the DC voltage.
: ACDC?	Queries the RMS voltage
: AMPLitude : MAXimum?	Queries the peak voltage.
:LINE	

:V12?	Queries the voltage difference of phase 1 & 2.
:V23?	Queries the voltage difference of phase 2 & 3.
:V31?	Queries the voltage difference of phase 3 & 1.

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

FETCh [: SCALar]: CURRent: AC?

MEASure [: SCALar]: CURRent: AC?

Description : These queries return the RMS current of the AC component that is output from the output terminal.

Query Syntax : FETCh : CURRent : AC?, MEASure : CURRent : AC? Return Parameter : <NR2>

FETCh [: SCALar]: CURRent: DC?

MEASure [: SCALar]: CURRent: DC?

Description : These queries return the DC current that is output from the output terminal. Query Syntax : 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 absolute value of the peak current. 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 output current crest factor. It is the ratio of
	peak output current to RMS output current.
Query Syntax	: FETCh : CURRent : CREStfactor?
	MEASure : CURRent : CREStfactor?
Return Paramete	er : <nr2></nr2>

FETCh [: SCALar] : CURRent : INRush?

MEASure [: SCALar]: CURRent: INRush?

Description: These queries return the inrush current that is output from the output
terminal.Query Syntax: FETCh:CURRent: INRush?, MEASure: CURRent : INRush?
Return Parameter : <NR2>

FETCh [: SCALar]: FREQuency?

MEASure [: SCALar]: FREQuency?

Description : These queries return the output frequency in Hertz. 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 terminals in watts. 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 terminals in volt-amperes.
Query Syntax	FETCh : POWer : AC : APParent?
	MEASure : POWer : AC : APParent?
Return Parameter	: <nr2></nr2>

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

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

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

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

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

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

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

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

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

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

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

Query Syntax :	the 3-phase output terminal in volt-amperes. FETCh:POWer:AC:TOTal:APParent? MEASure:POWer:AC:TOTal:APParent?
Return Parameter :	

FETCh [: SCALar]: VOLTage: AC?

MEASure [: SCALar]: VOLTage: AC?

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

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

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

FETCh [: SCALar]: VOLTage: ACDC?

MEASure [: SCALar]: VOLTage: ACDC?

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

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

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

Description	:	These queries return the absolute value of the peak voltage.
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.
Query Syntax :	FETCh [: SCALar] : LINE : V12?
	MEASure [: SCALar] : LINE : V12?
Return Parameter :	<nr2></nr2>

FETCh [: SCALar]: LINE: V23?

MEASure [: SCALar] : LINE : V23?

Description		These queries return the line voltage between phase 2 and 3.
•		
Query Syntax	:	FETCh [: SCALar] : LINE : V23?
		MEASure [: SCALar] : LINE : V23?
Return Parameter	: 1	<nr2></nr2>

FETCh [: SCALar]: LINE: V31?

MEASure [: SCALar]: LINE: V31?

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

Query Syntax : FETCh [: SCALar] : LINE : V31? MEASure [: SCALar] : LINE : V31? Return Parameter : <NR2>

9.5.2.4 OUTPUT Subsystem

OUTPut

- [: STATe]
- RELay
- : SLEW
 - : VOLTage
 - : AC
 - : DC
 - :FREQency
- : COUPling
- : MODE
- : PROTection
 - :CLEar
- : IMPedance
 - : STATe
 - : RESistor
 - : INDuction

OUTPut [: STATe]

Description

	Disabled output sets the output voltage amplitude to 0 Volt.
Query Syntax	: OUTPut [: STATe]?
Parameter	: OFF ON
Return Parameter	COFF ON

OUTPut : RELay

Description	: This command sets the output relay ON or OFF.
Query Syntax	: OUTPut : RELay?
Parameter	: OFF ON, ON sets the output relay of the AC Source ON (closed),
	OFF sets the output relay of the AC source OFF (open).
Return Paramete	er:OFF ON

: This command enables or disables the output of the AC Source.

OUTPut : SLEW : VOLTage : AC

Description: This command sets the slew rate of the AC output voltage.Query Syntax: OUTPut : SLEW : VOLTage : AC?Parameter: <NR2>, the valid range is 0.000V/ms - 1200.000V/ms.Return Parameter : <NR2>

OUTPut : SLEW : VOLTage : DC

Description: This command sets the slew rate of the DC composite voltage.Query Syntax: OUTPut : SLEW : VOLTage : DC?Parameter: <NR2>, the valid range is 0.000V/ms - 1200.000V/ms.Return Parameter : <NR2>

OUTPut : SLEW : FREQuency

Description	: This command sets the slew rate of the output frequency.
Query Syntax	: OUTPut : SLEW : FREQuency?

Parameter : <NR2>, the valid range is 0.000 Hz/ms - 1600.000Hz/ms Return Parameter : <NR2>

OUTPut : COUPling

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

OUTPut : MODE

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

OUTPut : PROTection : CLEar

Description: This command clears the latch that disables the output when over
current (OCP), over temperature (OTP), over power (OPP), or
remote inhibit (RI) is detected. All conditions that generate the faults
must be resolved before the latch is cleared.Query Syntax: NoneParameter: NoneReturn Parameter : None

9.5.2.5 SOURCE Subsystem

[SOURce :]

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

POWer

: PROTection

FUNCtion

: SHAPe

: SHAPe

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

[SOURce :] CURRent : LIMit

Description	: This command sets the RMS current limit of the AC Source for over	
	current protection.	
Query Syntax	: [SOURce :] CURRent : LIMit?	
Parameter	: <nr2>, the valid range is 0.00 - maximum current spec. of the</nr2>	
	specific model (unit: A.)	
Return Parameter : <nr2></nr2>		

[SOURce :] CURRent : DELay

Description	: This command sets the time delay for triggering over current
	protection.
Query Syntax	: [SOURce :] CURRent : DELay?

Parameter : <NR2>, the valid range is 0.0 - 5.0 (unit: 0.1 second.) Return Parameter : <NR2>

[SOURce :] CURRent : INRush : STARt

Description: This command sets the time to start the inrush current measurement.Query Syntax: [SOURce :] CURRent : INRush : STARt?Parameter: <NR2>, the valid range is 0 - 9999 (unit: ms.)Return Parameter : <NR2>

[SOURce :] CURRent : INRush : INTerval

Description: This command sets the measuring interval for the inrush current
measurement.Query Syntax: [SOURce :] CURRent : INRush : INTerval?Parameter: <NR2>, the valid range is 0 - 9999 (unit: ms.)Return Parameter : <NR2>

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

Description: This command sets the output waveform frequency of the AC Source
in Hz.Query Syntax: [SOURce :] FREQuency [: {CW | IMMediate}]?Parameter: <NR2>, the valid range is 15.00 - 2000.0 (unit: Hz.)Return Parameter : <NR2>

[SOURce :] FREQuency : LIMit

Description	: This command sets the output frequency limit of the AC Source.
Query Syntax	: [SOURce :] FREQuency : LIMit?
Parameter	: <nr2>, the valid range is 15.00 - 2000.00 (unit: Hz)</nr2>
Return Parameter	r: <nr2></nr2>

[SOURce :] POWer:PROTection

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

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

Description Query Syntax Parameter : This command sets the AC composite output voltage in Volts. : [SOURce :] VOLTage [: LEVel][: IMMediate][: AMPLitude] : AC? : <NR2>, the valid range is 0.0 - 175.0 (low range), 0.0 - 350.0 (high range.) Return Parameter : <NR2>

[SOURce :] VOLTage [: LEVel][: IMMediate][· AMPI itude] · DC

UNCE J VOLIAYE	[. LL Vei][. ININIediale][. ANIF LILUde]. DC
Description	: This command sets the DC composite output voltage in Volts.
Query Syntax	: [SOURce :] VOLTage [: LEVel][: IMMediate][: AMPLitude] : DC?
Parameter	: <nr2>, the valid range is -247.5 to +247.5 (low range), -494.9 to</nr2>
	+494.9 (high range.)

Return Parameter : <NR2>

[SOURce :] VOLTage : LIMit : AC

Description	: This command sets the Vac LIMIT to restrict the value of Vac.
Query Syntax	: [SOURce :] VOLTage : LIMit : AC?

Parameter : <NR2>, the valid range is 0.0 - 350.0 (unit: V.) Return Parameter : <NR2>

[SOURce :] VOLTage : LIMit : DC : PLUS

Description	: This command sets the VdcLimit(+).
Query Syntax	: [SOURce :] VOLTage : LIMit : DC : PLUS?
Parameter	: <nr2>, the valid range is -494.9 to +494.9 (unit: V)</nr2>
	PS: The lower limit cannot exceed Vdc Limit(-).
Return Paramet	er : <nr2></nr2>

[SOURce :] VOLTage : LIMit : DC : MINus

Description	: This command sets the Vdc Limit(-).
Query Syntax	: [SOURce :] VOLTage : LIMit : DC : MINus?
Parameter	: <nr2>, the valid range is -494.9 to +494.9 (unit: V)</nr2>
	PS: The upper limit cannot exceed Vdc Limit(+).
Return Paramet	er : <nr2></nr2>

[SOURce :] VOLTage : RANGe

Description: This command sets the output voltage range to LOW (175 V) or
HIGH (350 V) or AUTO.Query Syntax: [SOURce :] VOLTage : RANGe?Parameter: LOW | HIGH | AUTOReturn Parameter : LOW | HIGH | AUTO

[SOURce :] FUNCtion : SHAPe

Description: This command selects which waveform buffer (A or B) to use.Query Syntax: [SOURce :] FUNCtion : SHAPe?Parameter: A | BReturn Parameter : A | B

[SOURce :] FUNCtion : SHAPe : A

Description: This command selects the type of waveform to use in buffer A.Query Syntax[SOURce :] FUNCtion : SHAPe : A?Parameter: SINE | SQUA | CSIN | DST<01..30> | USR<01..30>Return Parameter : SINE | SQUA | CSIN | DST<01..30> | USR<01..30>

[SOURce :] FUNCtion : SHAPe : A : MODE

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

[SOURce :] FUNCtion : SHAPe : A : THD

Description: This command sets the clipped THD percentage to use in buffer A.Query Syntax: [SOURce :] FUNCtion : SHAPe : A : THD?Parameter: <NR2>, the valid range is 0.0% - 43%.Return Parameter: <NR2>

[SOURce :] FUNCtion : SHAPe: A : AMP

Description	: This command sets the clipped peak percentage to use in buffer A.
Query Syntax	: [SOURce :] FUNCtion : SHAPe : A : AMP?
Parameter	: <nr2>, the valid range is 0.0% - 100%.</nr2>
Return Paramete	r : <nr2></nr2>

[SOURce :] FUNCtion : SHAPe : B

Description: This command selects the type of waveform to use in buffer B.Query Syntax: [SOURce :] FUNCtion : SHAPe : B?Parameter: SINE | SQUA | CSIN | DST<01..30> | USR<01..30>Return Parameter : SINE | SQUA | CSIN | DST<01..30> | USR<01..30>

[SOURce :] FUNCtion : SHAPe : B : MODE

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

[SOURce :] FUNCtion : SHAPe : B : THD

Description: This command sets the clipped THD percentage to use in buffer B.Query Syntax: [SOURce :] FUNCtion : SHAPe : B : THD?Parameter: <NR2>, the valid range is 0.0% - 43%.Return Parameter : <NR2>

[SOURce :] FUNCtion : SHAPe: B : AMP

Description: This command sets the clipped peak percentage to use in buffer B.Query Syntax: [SOURce :] FUNCtion : SHAPe : B : AMP?Parameter: <NR2>, the valid range is 0.0% - 100%.Return Parameter : <NR2>

9.5.2.6 CONFIGURE Subsystem

[SOURce :]

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

[SOURce :] CONFigure : INHibit

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

[SOURce :] CONFigure : EXTernal

Description	: This command enables/disables the External-V Reference function.
Query Syntax	: [SOURce :] CONFigure : EXTernal?
Parameter	: OFF ON
Return Parameter	: OFF ON

[SOURce :] CONFigure : COUPling?

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

[SOURce :] CONFigure : EXTON

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

9.5.2.7 PHASE Subsystem

[SOURce:]

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

[SOURce:] PHASe: ON

Description: This command sets the transition angle when the waveform shifts.
The default is ON (0 degrees).Query Syntax: [SOURce :] PHASe : ON?Parameter: <NR2>, the valid range is 0.0 - 359.9.Return Parameter : <NR2>

[SOURce:] PHASe: OFF

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

[SOURce:]PHASe:P12

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

[SOURce:]PHASe:P13

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

[SOURce:]PHASe:SEQuence

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

[SOURce:]PHASe:RELOCK

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

Parameter	:	ENABLE	DISABLE
Return Parameter	:	ENABLE	DISABLE

[SOURce:]PHASe:THREE

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

9.5.2.8 STATUS Subsystem

STATus

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

 - : NTRansition : PTRansition
 - . I ITANSMON

STATus : OPERation [: EVENt]?

Description: This command queries the Operation Status register.Query Syntax: STATus : OPERation [: EVENt]?Parameter: NoneReturn Parameter : Always 0.

STATus : OPERation : ENABle

Description: This command sets the Operation Status Enable register. The
register is a mask when the specific bit is enabled from the
Operation Status register.Query Syntax: STATus : OPERation : ENABle?
: <NR1>, the valid range is 0 - 255.
Return Parameter : Always 0.

STATus : QUEStionable : CONDition?

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

STATus : QUEStionable [: EVENt] ?

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

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

STATus : QUEStionable : ENABle

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

STATus : QUEStionable : NTRansition

Description

: These commands set or read the value of the register.

The operation of these registers is the same as the polarity filter of the Questionable Enable and Questionable Event registers that enable 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 set that bit in the Questionable Event register.
- When a bit of the Questionable PTR register is set to 1, a 0-to-1 transition of the corresponding bit in the Questionable Condition register will set that bit in the Questionable Event register.
- * If the same two bits in both the NTR and PTR registers are set to 0, no 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

Bit Position	15-9	8	7	6	5	4	3	2	1	0
Condition		OVP	INP	OCP	FAN	SHT	OTP	OPP	INT-DD	INT-AD

OVP: INP:	Output voltage protection Line input protection.
OCP:	Over current protection.
FAN:	Fan failure.
SHT:	Output short protection.
OTP:	Over temperature protection.
OPP:	Over power protection.
INT-DD:	Inner DD power stage protection
INT-AD:	Inner AD power stage protection

Query Syntax: STATus : QUEStionable : NTRansition?Parameter: <NR1>, the valid range is 0 - 511.Return Parameter : <NR1>

STATus : QUEStionable : PTRansition

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

9.5.2.9 **TRACE Subsystem**

TRACe

: RMS

TRACe

Description	: This command sets the user-defined waveform data. 1024 data points are required to create one period of the waveform. Normalize the data and make the maximum point equal to 32767 or the minimum point equal to -32767.
Syntax	: TRACe <waveform_name>, <amplitude> {,<amplitude>}</amplitude></amplitude></waveform_name>
Parameter	: <waveform_name>:US<n>, n=1-30, <amplitude>:<nr1>, the valid range is -32767 to +32767.</nr1></amplitude></n></waveform_name>
Example	: TRACe US1 100 20032767 500 800 <= 1024 points This command requires about 5 seconds for execution.
TRACe : RMS	
Description	: This command sets the RMS value of the waveform. Calculate the root mean square value for 1024 data points.
Syntax	: TRACe : RMS <waveform_name>, <rms></rms></waveform_name>
Parameter	: <waveform_name>:US<n>, n=1-30, <rms>:<nr1>, the valid range is 0 - 32767.</nr1></rms></n></waveform_name>

Example : TRACe : RMS US1 27000

> : STARt : END

: STARt : END

9.5.2.10 LIST Subsystem

[SOURce :] LIST : COUPling :TRIG : POINts? : COUNt : DWELI : SHAPe : BASE : VOLTage : AC : DC : FREQuency : STARt : END : DEGRee

OUTPut

: MODE

TRIG **TRIG: STATE?**

[SOURce:]LIST : COUPling : This command sets the function of the list mode. Description Query Syntax : [SOURce:] LIST : Coupling? Parameter : ALL | NONE Return Parameter : ALL | NONE [SOURce:]LIST : TRIG Description : This command sets the trigger type for the list mode. Query Syntax : [SOURce:] LIST : TRIG? Parameter : AUTO | MANUAL|EXCITE Return Parameter : AUTO | MANUAL|EXCITE [SOURce:] LIST : POINts? Description : This command returns the valid order number of the list mode. Query Syntax : [SOURce:] LIST : POINts? : None Parameter Return Parameter : <NR1>, the valid range is 0 - 100. [SOURce :] LIST : COUNt Description : This command sets the number of times the list is executed before completion. : [SOURce :] LIST : COUNt? Query Syntax Parameter : <NR1>, the valid range is 0 - 65535. Return Parameter : <NR1> [SOURce :] LIST : DWELI Description : This command sets the sequence of the dwell time list points. : [SOURce:] LIST : DWELI? Query Syntax : <NR2>, ..., <NR2>, the valid range is 0 - 99999999.9 (unit: ms.) Parameter Return Parameter : <NR2>, ..., <NR2> [SOURce :] LIST : SHAPe Description : This command sets the sequence of the waveform buffer list points. Query Syntax : [SOURce:] LIST : SHAPe? Parameter : A|B, ..., A|B Return Parameter : A|B, ..., A|B [SOURce :] LIST : BASE Description : This command sets the time base of the list. Query Syntax : [SOURce:] LIST : BASE? Parameter : TIME | CYCLE Return Parameter : TIME | CYCLE [SOURce :] LIST : VOLTage : AC : STARt Description : This command sets the sequence of the AC start voltage list points. Query Syntax : [SOURce:] LIST : VOLTage : AC : STARt? Parameter : <NR2>, ..., <NR2>, the valid range is 0.0 - 175.0 (low range), 0.0 -350.0 (high range.) Return Parameter : <NR1>, ..., <NR2> [SOURce :] LIST : VOLTage : AC : END : This command sets the sequence of the AC end voltage list points. Description Query Syntax : [SOURce:] LIST : VOLTage : AC : END?

Parameter	: <nr2>,, <nr2>, the valid range is 0.0 - 175.0 (low range), 0.0 -</nr2></nr2>
	350.0 (high range.)
Return Parameter	: <nr2>,, <nr2></nr2></nr2>

[SOURce :] LIST : VOLTage : DC : STARt

Description	: This command sets the sequence of the DC start voltage list points.
Query Syntax	: [SOURce:] LIST : VOLTage : DC : STARt?
Parameter	: <nr2>,, <nr2>, the valid range is -247.5 to +247.5 (low range),</nr2></nr2>
	-494.9 to +494.9 (high range.)
Return Parameter	: <nr1></nr1>

[SOURce :] LIST : VOLTage : DC : END

Description	: This command sets the sequence of the DC end voltage list points.
Query Syntax	: [SOURce:] LIST : VOLTage : DC : STARt?
Parameter	: <nr2>,, <nr2>, the valid range is -247.5 to +247.5 (low range),</nr2></nr2>
	-494.9 to +494.9 (high range.)
Return Parameter	: <nr2>,, <nr2></nr2></nr2>

[SOURce :] LIST : FREQuency : STARt

Description	: This command sets the sequence of the start frequency list points.
Query Syntax	: [SOURce:] LIST : FREQuency : STARt?
Parameter	: <nr2>,, <nr2>, the valid range is 15.00 - 2000.00 (unit: Hz.)</nr2></nr2>
Return Parameter	: <nr2>,, <nr2></nr2></nr2>

[SOURce :] LIST : FREQuency : END

Description	: This command sets the sequence of the end frequency list points.
Query Syntax	: [SOURce:] LIST : FREQuency : END?
Parameter	: <nr2>,, <nr2>, the valid range is 15.0 - 2000.0 (unit: Hz.)</nr2></nr2>
Return Parameter	: <nr2>,, <nr2></nr2></nr2>

[SOURce :] LIST : DEGRee

Description	: This command sets the sequence of the phase angle list points.
Query Syntax	: [SOURce:] LIST : DEGRee?
Parameter	: <nr2>,, <nr2>, the valid range is 0.0 - 359.9.</nr2></nr2>
Return Parameter	: <nr2>,, <nr2></nr2></nr2>

OUTPut : MODE

Description	: This command sets the operation mode.
Query Syntax	: OUTPut : MODE?
Parameter	: FIXED LIST PULSE STEP SYNTH INTERHAR
Return Parameter	: FIXED LIST PULSE STEP SYNTH INTERHAR

TRIG

Description	: This command sets the LIST mode in the OFF - ON execution state after setting the OUTPut: MODE LIST. To change the parameters, set TRIG OFF then OUTPut: MODE FIXED. Then, set OUTPut : MODE LIST again to to set TRIG ON.
Query Syntax	: TRIG : STATE?
Parameter	: OFF ON
Return Parameter	: OFF RUNNING

9.5.2.11 PULSE Subsystem

[SOURce :]

PULSe : VOLTage : AC : DC : FREQuency : SHAPe : SPHase : COUNt : DCYCle : PERiod : TRIG

OUTPut

: MODE

TRIG TRIG : STATE?

[SOURce :] PULSe : VOLTage : AC

Description	: This command sets the AC voltage for the duty cycle of the PULSE
	mode.
Query Syntax	: [SOURce :] PULSE : VOLTage : AC?
Parameter	: <nr2>, the valid range is 0.0 - 175.0 (low range), 0.0 - 350.0 (high</nr2>
	range.)
Return Parameter	: <nr2></nr2>

[SOURce :] PULSe : VOLTage : DC

Description	: This command sets the DC voltage for the duty cycle of the PULSE mode.
Query Syntax	: [SOURce :] PULSE : VOLTage : DC?
Parameter	: <nr2>, the valid range is -247.5 to +247.5 (low range), -494.9 to +494.9 (high range.)</nr2>
Return Parameter	

[SOURce :] PULSe : FREQuency

Description	: This command sets the frequency for the duty cycle of the PULSE
	mode.
Query Syntax	: [SOURce :] PULSE : FREQuency?
Parameter	: <nr2>, the valid range is 15.0 - 2000.0 (unit: Hz.)</nr2>
Return Parameter	: <nr2></nr2>

[SOURce :] PULSe : SHAPe

Description	: This command selects the waveform buffer for the PULSE mode.
Query Syntax	: [SOURce :] PULSE : SHAPe?
Parameter	: A B
Return Parameter	: A B

[SOURce :] PULSe : SPHase

Description	: This command sets the start phase angle of the duty cycle for the
	PULSE mode.
Query Syntax	: [SOURce :] PULSE : SPHase?

Parameter	: <nr2>, the valid range is 0.0 - 359.9.</nr2>
Return Parameter	: <nr2></nr2>

[SOURce :] PULSe : COUNt

Description	: This command sets the number of times the pulse is executed
	before completion.
Query Syntax	: [SOURce :] PULSE : COUNt?
Parameter	: <nr2>, the valid range is 0 - 65535.</nr2>
Return Parameter	: <nr2></nr2>

[SOURce :] PULSe : DCYCle

Description	: This command sets the duty cycle of the PULSE mode.
Query Syntax	: [SOURce :] PULSE : DCYCle?
Parameter	: <nr2>, the valid range is 0 % - 100 %.</nr2>
Return Parameter	: <nr2></nr2>

[SOURce :] PULSe : PERiod

Description	: This command sets the period of the PULSE mode.
Query Syntax	: [SOURce :] PULSE : PERiod?
Parameter	: <nr2>, the valid range is 0 - 99999999.9 (unit: ms.)</nr2>
Return Parameter	: <nr2></nr2>

[SOURce:]PULSe : TRIG

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

OUTPut : MODE

Description	: This command sets the operation mode.
Query Syntax	: OUTPut : MODE?
Parameter	: FIXED LIST PULSE STEP SYNTH INTERHAR
Return Parameter	: FIXED LIST PULSE STEP SYNTH INTERHAR

TRIG

Description	: This command sets the PULSE mode in the OFF execution state after setting OUTPut : MODE PULSE. To change the parameters, set TRIG OFF then OUTPut : MODE FIXED. Then, set OUTPut : MODE PULSE again to get ready to set TRIG ON.
Query Syntax	: TRIG : STATE?
Parameter	: OFF ON
Return Parameter	: OFF RUNNING

9.5.2.12 STEP Subsystem

[SOURce :] STEP

F : VOLTage : AC : DC : FREQuency : SHAPe

- : SPHase
- : DVOLtage
 - : AC
 - : DC
- : DFRequency
- : DWELI
- : COUNt
- : TRIG

OUTPut

: MODE

TRIG **TRIG : STATE?**

[SOURce :] STEP : VOLTage : AC

Description	: This command sets the initial AC voltage of the STEP mode.
Query Syntax	: [SOURce :] STEP : VOLTage : AC?
Parameter	: <nr2>, the valid range is 0.0 - 175.0 (low range), 0.0 - 350.0 (high</nr2>
	range.)
Return Paramete	r: <nr2></nr2>

[SOURce :] STEP : VOLTage : DC

Description	: This command sets the initial DC voltage of the STEP mode.
Query Syntax	: [SOURce :] STEP : VOLTage : DC?
Parameter	: <nr2>, the valid range is -247.5 ~ +247.5 (low range), -494.9 ~</nr2>
	+494.9 (high range.)
Return Paramete	

Return Parameter : <NR2>

[SOURce :] STEP : FREQuency

Description : This command sets the initial frequency of the STEP mode. Query Syntax : [SOURce :] STEP : FREQuency? Parameter : <NR2>, the valid range is 15.0 - 2000.0 (unit: Hz.) Return Parameter : <NR2>

[SOURce :] STEP : SHAPe

Description : This command selects the waveform buffer of the STEP mode. Query Syntax : [SOURce :] STEP : SHAPe? : A | B Parameter Return Parameter: A | B

[SOURce :] STEP : SPHase

Description : This command sets the start phase angle of the STEP mode. : [SOURce :] STEP : SPHase? Query Syntax : <NR2>, the valid range is 0.0 - 359.9. Parameter Return Parameter : <NR2>

[SOURce :] STEP : DVOLtage : AC

Description	: This command sets the AC voltage change in each step.
Query Syntax	: [SOURce :] STEP : DVOLtage : AC?
Parameter	: <nr2>, the valid range is -175.0 to +175.0 (low range), -350.0 to</nr2>
	+350.0 (high range.)
Return Paramete	r: <nr2></nr2>

[SOURce :] STEP : DVOLtage : DC

Description	This command sets the DC voltage change in each step.
Query Syntax	: [SOURce :] STEP : DVOLtage : DC?
Parameter	: <nr2>, the valid range is -247.5 to +247.5 (low range), -494.9 to</nr2>
	+494.9 (high range.)
Poturn Paramotor	

Return Parameter : <NR2>

[SOURce :] STEP : DFRequency

Description	: This command sets the frequency change in each step.
Query Syntax	: [SOURce :] STEP : DFRequency?
Parameter	: <nr2>, the valid range is -2000.00 to +2000.0 (unit: Hz.)</nr2>
Return Paramete	r : <nr2></nr2>

[SOURce :] STEP : DWELI

Description	: This command sets the dwell time in each step.
Query Syntax	: [SOURce :] STEP : DWELI?
Parameter	: <nr2>, the valid range is 0 - 99999999.9 (unit: ms.)</nr2>
Return Parameter : <nr2></nr2>	

[SOURce :] STEP : COUNt

Description	: This command sets the number of times the step is executed before
	completion.
Query Syntax	: [SOURce :] STEP : COUNt?
Parameter	: <nr2>, the valid range is 0 - 65535.</nr2>
Return Paramete	r: <nr2></nr2>

[SOURce:] STEP : TRIG

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

OUTPut : MODE

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

TRIG

Description	: This command sets the STEP mode in the OFF - ON execution state after setting OUTPut : MODE STEP. To change the parameters, set TRIG OFF then OUTPut : MODE FIXED. Then, set OUTPut : MODE STEP again to get ready to set TRIG ON.
Query Syntax	: TRIG : ŠTATE?
Parameter	: OFF ON
Return Paramete	er: OFF RUNNING

9.5.2.13 SYNTHESIS Subsystem

[SOURce :]

SYNThesis

- : COMPose
- : AMPLitude
- : PHASe
- : FUNDamental
- : DC
- : FREQuency
- : SPHase

OUTPut

: MODE

TRIG **TRIG: STATE?**

[SOURce :] SYNThesis : COMPose

Description : This com	mand sets the data format of each harmonic order.
	absolute value, PERCENT: basic computer percentage. 6
waveform	ns can be programmed for execution.
Query Syntax : [SOURce	e :] SYNThesis : COMPose?
Parameter : VALUE1	VALUE2 VALUE3
PERCEN	IT1 PERCENT2 PERCENT3
Return Parameter : VALUE1 VALUE2 VALUE3	
PERCEN	IT1 PERCENT2 PERCENT3

[SOURce :] SYNThesis : AMPLitude Descript

Description	: This command sets the amplitude of each harmonic order.
	The maximum number of orders is 40.
Query Syntax	: [SOURce :] SYNThesis : AMPLitude?

ax	: [SOURc	e :] SYNThesis :	AMPLi
----	----------	------------------	-------

Parameter

: <NR2>, ..., <NR2> Valid range:

Order	Value	Percentage
2 ~ 10	0 ~ 150.0	0 ~ 100.00
11 ~ 20	0 ~ 120.0	0 ~ 50.00
21 ~ 30	0 ~ 80.0	0 ~ 30.00
31 ~ 40	0 ~ 45.0	0 ~ 15.00

Return Parameter : <NR2>, ...,<NR2>

[SOURce :] SYNThesis : PHASe

Description	: This command sets the phase angle of each harmonic order.
Query Syntax	: [SOURce :] SYNThesis : PHASe?
Parameter	: <nr2>,, <nr2>, the valid range: 0.0 - 359.9</nr2></nr2>
Return Paramete	r: <nr2>,, <nr2></nr2></nr2>

[SOURce :] SYNThesis : FUNDamental

Description	: This command sets the fundamental AC voltage in the SYNTHESIS mode.
Query Syntax	: [SOURce :] SYNThesis : FUNDamental?
Parameter	: <nr2>, the valid range: 0.0 - 175.0 (low range), 0.0 - 350.0 (high</nr2>

range) Return Parameter : <NR2>

[SOURce :] SYNThesis : DC

Description	: This command sets the DC voltage to add to the voltage waveform in
	the SYNTHESIS mode.
Query Syntax	: [SOURce :] SYNThesis : DC?
Parameter	: <nr2>, the valid range: -247.5 to +247.5 (low range), -494.9 to</nr2>
	+494.9 (high range)
Return Paramete	er: <nr2></nr2>

[SOURce :] SYNThesis : FREQuency

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

[SOURce :] SYNThesis : SPHase

Description	: This command sets the start phase angle in the SYNTHESIS mode.
Query Syntax	: [SOURce :] SYNThesis : SPHase?
Parameter	: <nr2>, the valid range: 0.0 - 359.9</nr2>
Return Paramete	r: <nr2></nr2>

OUTPut : MODE

Description	: This command sets the operation mode. The output should be
	stopped before setting OUTPut : MODE SYNTH.
Query Syntax	: OUTPut : MODE?
Parameter	: FIXED LIST PULSE STEP SYNTH INTERHAR
Return Parameter	: FIXED LIST PULSE STEP SYNTH INTERHAR

TRIG

Description	: This command sets the SYNTHESIS mode in the OFF - ON execution state after setting OUTPut : MODE SYNTH. To change the parameters, set TRIG OFF then OUTPut : MODE FIXED. Then, set OUTPut : MODE SYNTH again to get ready to set TRIG ON.
Query Syntax Parameter	: TRIG : STATE? : OFF ON
Return Paramete	r : OFF RUNNING

9.5.2.14 INTERHARMONICS Subsystem

[SOURce :]

INTERHARmonics

: FREQuency : STARt : END : LEVel : DWELI

OUTPut

: MODE

TRIG TRIG : STATE?

FETCh | MEASure

: INTERHARmonics : FREQuency?

Queries the sweeping frequency.

[SOURce :] INTERHARmonics : FREQuency : STARt

Description: This command sets the start frequency of the sweep wave for the
INTERHARMONICS mode.Query Syntax: [SOURce :] INTerharmonics : FREQuency : STARt?
ParameterParameter: <NR2>, the valid range is 0.01 - 2400.0 (unit: Hz.)
Return Parameter : <NR2>

[SOURce :] INTERHARmonics: FREQuency : END

Description: This command sets the end frequency of the sweep wave for the
INTERHARMONICS mode.Query Syntax: [SOURce :] INTerharmonics : FREQuency : END?
: <NR2>, the valid range is 0.01 - 2400.00 (unit: Hz.)Return Parameter : <NR2>

[SOURce :] INTERHARmonics: LEVel

Description	: This command sets the RMS range of the sweep wave in	
	percentage.	
Query Syntax	: [SOURce :] INTerharmonics : LEVel?	
Parameter	: <nr2>, the valid range is 0% - 30% in 0.01 Hz - 500 Hz</nr2>	
	0% - 20% in 500.01 Hz - 1000 Hz	
	0% - 10% in 1000.01 Hz - 2400 Hz	

Return Parameter : <NR2>

[SOURce :] INTERHARmonics: DWELI

Description	: This command sets the dwell time of the sweep wave.	
Query Syntax	: [SOURce :] INTerharmonics : DWELI?	
Parameter	: <nr2>, the valid range is 0.00 - 99999.99 (unit: sec.)</nr2>	
Return Parameter: <nr2></nr2>		

OUTPut : MODE

Description	: This command sets the operation mode.	
Query Syntax	: OUTPut : MODE?	
Parameter	: FIXED LIST PULSE STEP SYNTH INTERHAR	
Return Parameter : FIXED LIST PULSE STEP SYNTH INTERHAR		

TRIG

Description	: This command sets the INTERHARMONICS mode in the OFF - ON,
•	PAUSE, or CONTINUE execution state after setting OUTPut : MODE
	INTERHAR. To change the parameter, set TRIG OFF and OUTPut :
	MODE FIXED, next set OUTPut : MODE INTERHAR in order to set
	TRIG ON.
Query Syntax	: TRIG : STATE?
Parameter	: OFF ON PAUSE CONTINUE
Return Parameter	: OFF RUNNING PAUSE

FETCh [:SCALar] : INTERHARmonics: FREQuency? MEASure [:SCALar] : INTERHARmonics: FREQuency?

 Description
 : These query commands return the sweep frequency stacked on the base voltage.

 Query Syntax
 : FETCh : INTERHARMonics : FREQuency? MEASure : INTERHARMonics : FREQuency?

 Return Parameter : <NR2>

9.5.2.15 Harmonic Sense Subsystem

[SOURce :]

CONFigure

: HARMonic

- : SOURce
- : TIMES
- : PARameter
- : FREQuency

SENSe

: HARMonic

FETCh | MEASure

[: SCALar]

: HARMonic

: THD?

: FUNDamental?

: ARRay?

Returns the % of total harmonic distortion. Returns the fundamental frequency. Returns the array of all harmonic orders.

[SOURce :] CONFigure : HARMonic : SOURce

Description : This command sets the measured power source in the harmonic analysis mode. Query Syntax : [SOURce :] CONFigure : HARMonic : SOURce? Parameter : VOLT | CURR Return Parameter : VOLT | CURR

[SOURce :] CONFigure : HARMonic : TIMES

 Description
 : This command sets the way the measurement result of harmonic analysis is displayed on the LCD.

 SINGLE: keeps the measured data on the display when set.

 CONTINUE: updates the measured data on the display when set.

 Query Syntax
 : [SOURce :] CONFigure : HARMonic : TIMes?

 Parameter
 : SINGLE | CONTINUE

 Return Parameter : SINGLE | CONTINUE

[SOURce :] CONFigure : HARMonic : PARameter

Description: This command sets the data format for each harmonic order.Query Syntax: [SOURce :] CONFigure : HARMonic : PARameter?Parameter: VALUE | PERCENTReturn Parameter : VALUE | PERCENT

[SOURce :] CONFigure : HARMonic : FREQuency

Description : This command sets the fundamental frequency for the original waveform.

Query Syntax: [SOURce :] CONFigure : HARMonic : FREQuency?Parameter: 50 | 60Return Parameter : 50 | 60

SENSe : HARMonic

Description : This command sets the harmonic measurement ON/OFF. It executes "ON" before every new search or measurement. Only 3 seconds are required for the result. The parameter needs to be set to "OFF" if other data is to be measured.
 Query Syntax : SENSe : HARMonic?
 Parameter : ON | OFF
 Return Parameter : ON | OFF

FETCh [:SCALar] : HARMonic : THD? MEASure [:SCALar] : HARMonic : THD?

Description : This query command returns the % of total harmonic distortion. Query Syntax : FETCh : HARMonic : THD? MEASure : HARMonic : THD?

Return Parameter : <NR2>

FETCh [:SCALar] : HARMonic : FUNDamental?

MEASure [:SCALar] : HARMonic : FUNDamental?

Description	: This query command returns the fundamental frequency output
	current or voltage.
Query Syntax	: FETCh : HARMonic : FUNDamental?
	MEASure : HARMonic : FUNDamental?
Return Paramet	er : <nr2></nr2>

FETCh [:SCALar] : HARMonic : ARRay?

MEASure [:SCALar] : HARMonic : ARRay?

Description : This query command returns the array of all harmonic orders. Query Syntax : FETCh : HARMonic : ARRay? MEASure : HARMonic : ARRay? Return Parameter : <NR2>

9.6 Command Summary

Common Commands

* CLS	Clear status

- * ESE<n> Enable standard event status
- * ESE? Return enabled standard event status
- * IDN? Return the AC Source ID
- * RCL<n> Recall the AC Source file
- * RST Reset the AC Source to initial states
- * SAV<n> Save the AC Source status
- * SRE Set request enable register
- * STB? Return status byte
- * TST? Return the self-test result of AC Source

Instrument Commands

SYSTem

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

INSTrument

- : EDIT
- : Couple
- : NSELect
- : SELect
- : PHASe

FETCh | MEASure

- [: SCALar]
 - : CURRent
 - : AC?
 - : DC?
 - : ACDC?
 - : AMPLitude:MAXimum?
 - : CREStfactor?
 - : INRush?
 - : FREQuency?
 - : POWer
 - : AC
 - [: REAL]?
 - : APParent?
 - : REACtive?
 - : PFACtor?
 - : TOTal?
 - : TOTal: APParent?
 - :VOLTage
 - : AČ?
 - : DC?
 - : ACDC?
 - : AMPLitude:MAXimum?
 - :LINE
 - :V12? :V23?
 - :V31?

OUTPut

- [: STATe] : RELay : SLEW : VOLTage : AC : DC
- :FREQency
- : COUPling

: MODE : PROTection :CLEar : IMPedance : STATe : RESistor : INDuction [SOURce :] CURRent : LIMit : DELay : INRush : STARt : INTerval :RANGe FREQency [: {CW | IMMediate}] : LIMit VOLTage [: LEVel][: IMMediate][:AMPLitude] : AC : DC : LIMit : AC : DC : PLUS : MINus : RANGe POWer : PROTection **FUNCtion** : SHAPe : SHAPe : A : A : MODE : THD : AMP : B : B : MODE : THD : AMP LIST : Coupling :TRIG : POINts? : COUNt : DWELI : SHAPe

: BASE : VOLTage : AC : STARt : END : DC : STARt : END : FREQuency : STARt : END : DEGRee PULSe : VOLTage : AC : DC : FREQuency : SHAPe : SPHase : COUNt : DCYCle : PERiod STEP : VOLTage : AC : DC : FREQuency : SHAPe : SPHase : DVOLtage : AC : DC : DFRequency : DWELI : COUNt **SYNThesis** : COMPose : AMPLitude : PHASe : FUNDamental : DC : FREQuency : SPHase **INTERHARrmonics** : FREQuency : STARt : END : LEVEI : DWELI : MODe

[SOURce :]

PHASe : ON

: OFF

[SOURce :]

CONFigure : INHibit

STATus

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

TRACe

: RMS

TRIG TRIG : STATE?

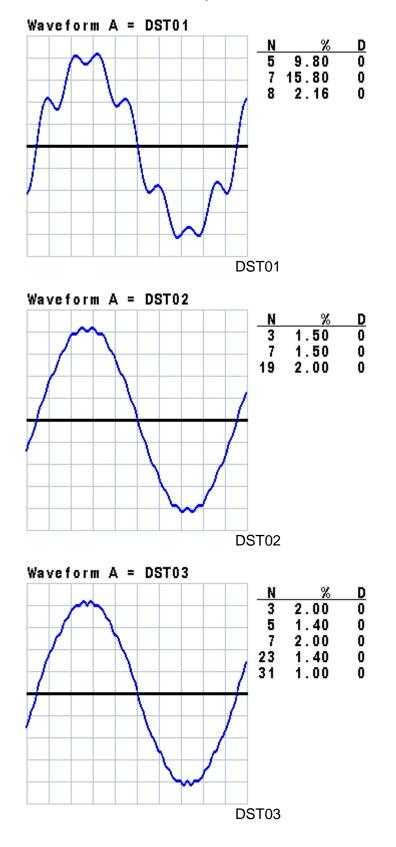
Appendix A TTL Signal Pin Assignments

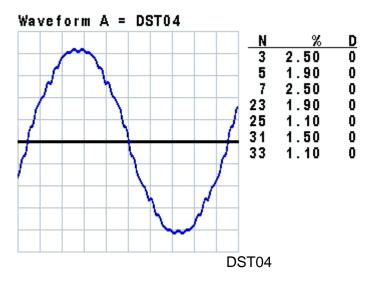
Green terminal with female connector:

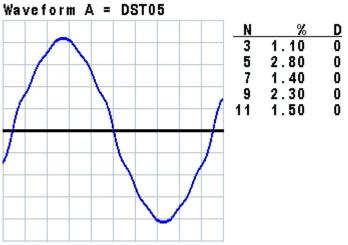
Pin No.	Signal	Description
1	Ext-V Ф1	Φ1 External-V Reference signal input (-10V to +10V)
2	Ext-V Φ2	Φ2 External-V Reference signal input (-10V to +10V)
		This is the input pin of the external voltage signal for single
		phase use.
3	Ext-V Ф3	Φ3 External-V Reference signal input (-10V to +10V)
4	AGND	External-V Reference signal grounding
5	+12V	12V voltage output (providing current 0.5A)
6	AGND_ISO	12V power grounding.
7	AGND	Signal grounding.
8	AGND	Signal grounding.
9	AC-ON	This pin goes HIGH when the AC Source outputs voltage
		and goes LOW when the output stops.
10	/ FAULT-OUT	The voltage level of this pin is HIGH when the AC Source is
		in normal mode. It will go LOW when the AC Source is in
	(=	protection mode.
11	/ Ext-ONOFF	When the EXT. ON/OFF is enabled on the AC Source and
		the EXT. ON/OFF signal is LOW, the AC Source will disable
		the output. The AC Source will re-enable the output when
12	/ Remote-Inhibit	the EXT. ON/OFF signal goes HIGH When the voltage level of this pin goes LOW, it inhibits the
12	/ Remote-initibit	AC Source output or trigger mode.
13	/Remote-Excite	When this pin receives a negative edge signal (from High to
15		Low), it triggers the transient output of the AC Source.
14	/Transient	When the output of the AC Source changes, this pin will go
17	/ mansient	low for 64us.
15	Reserved	
16	Reserved	
17	Reserved	
18	Reserved	
19	Reserved	
20	AGND	Signal grounding.
21	Reserved	
22	Reserved	
23	Reserved	
24	AGND	Signal grounding.

Appendix B Built-in Waveforms

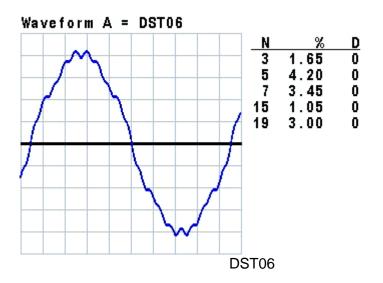
The ratios of all built-in waveforms' steps are measured under no load.

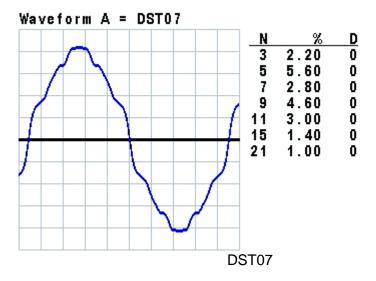


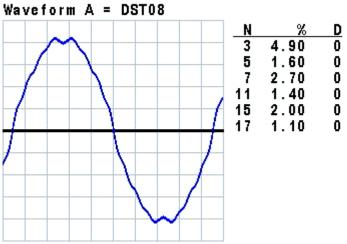




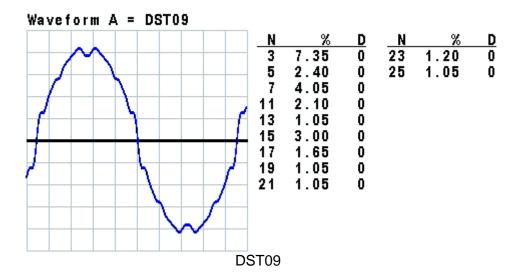


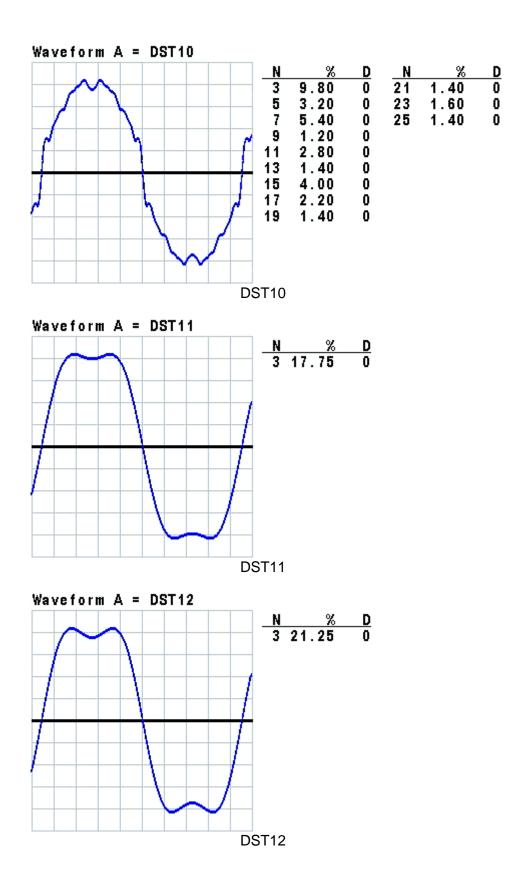


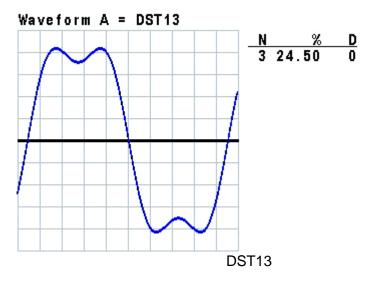


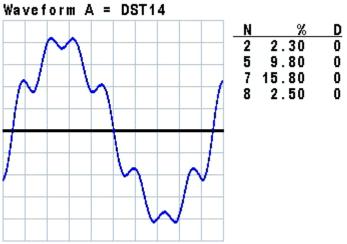




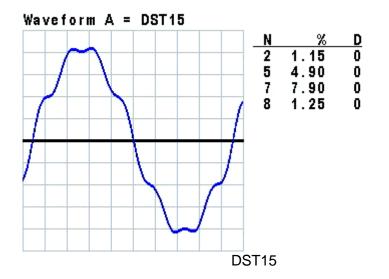


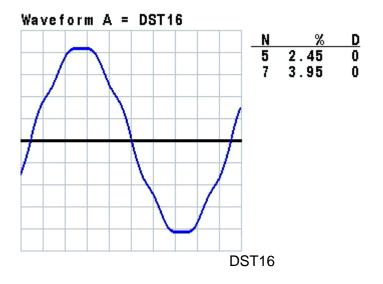


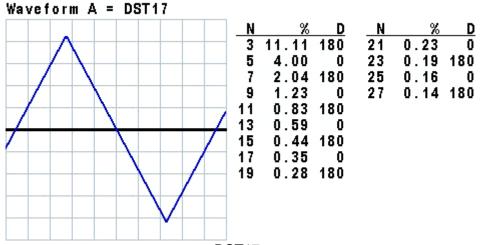




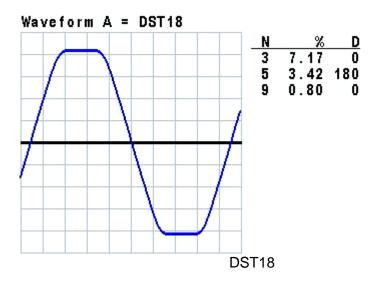


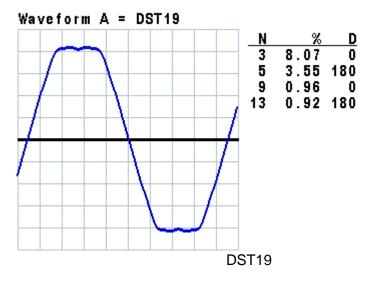


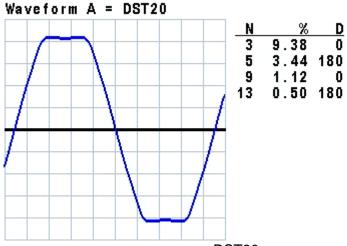




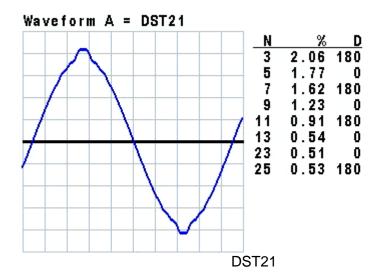


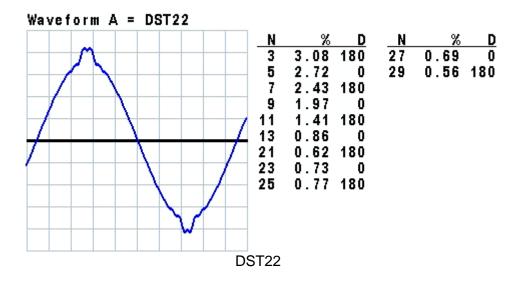


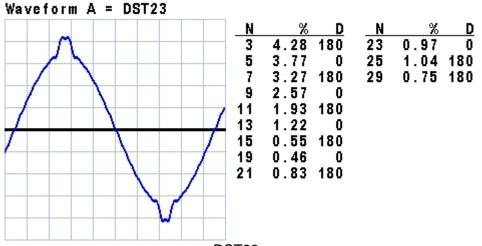




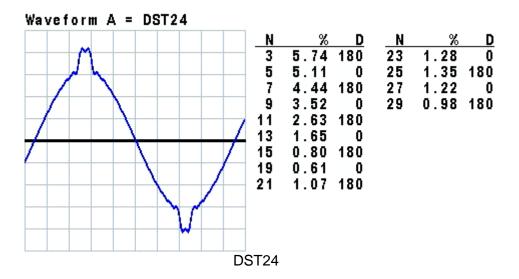


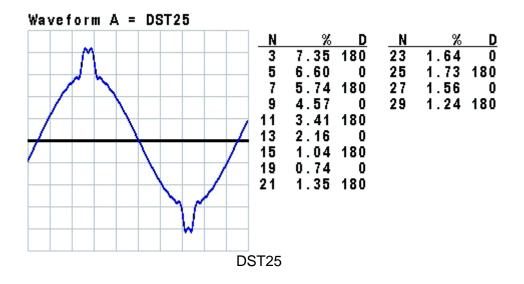


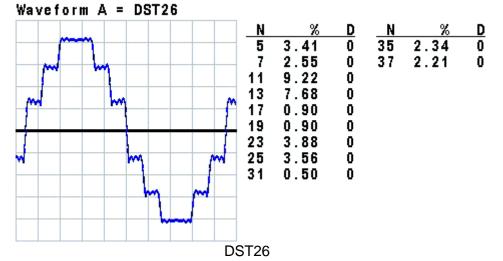


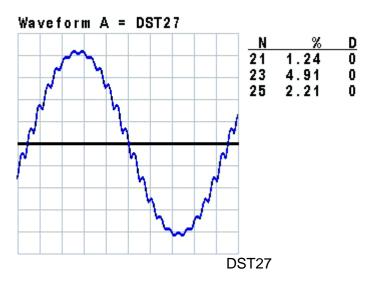




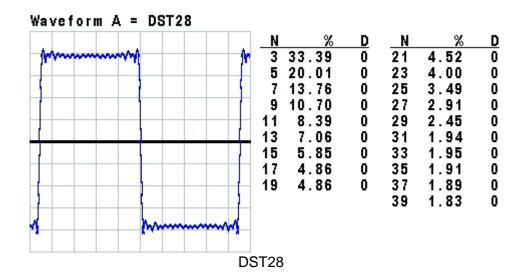


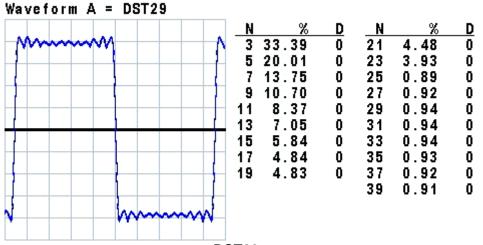




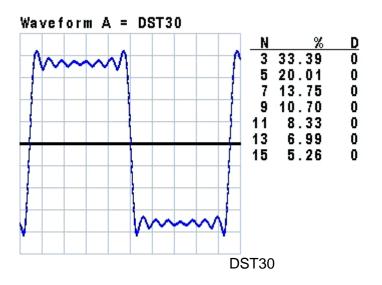


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CHROMA ATE INC. 致茂電子股份有限公司 66 Huaya 1st Road, Guishan, Taoyuan 33383, Taiwan 台灣桃園市 33383 龜山區 華亞一路 66 號 T +886-3-327-9999 F +886-3-327-8898 Mail: info@chromaate.com http://www.chromaate.com