

Programmable AC Source 61511/61512 User's Manual

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Material Contents Declaration

A regulatory requirement of The People's Republic of China defined by specification SJ/T 11364-2006 mandates that manufacturers provide material contents declaration of electronic products, and for Chroma products are as below:

			На	zardous Sul	ostances	
Part Name	Lead	Mercury	Cadmium	Hexavalent Chromium	Polybrominated Biphenyls	Polybromodiphenyl Ethers
	Pb	Hg	Cd	Cr ⁶⁺	PBB	PBDE
PCBA	×	О	О	О	О	О
CHASSIS	×	О	О	О	О	О
ACCESSORY	×	О	О	О	О	О
PACKAGE	О	О	О	О	О	О

[&]quot;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 and EU 2005/618/EC.

"×" indicates that the level of the specified chemical substance exceeds the threshold level specified in the standards of SJ/T-11363-2006 and EU 2005/618/EC.

- 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.

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.



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.

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. Removing any covers without written consent will void the warranty.

WARNING

- 1. Lethal voltage. AC Source may output 426 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.

Safety Symbols

(A)	DANGER – High voltage.		
<u></u>	Explanation: To avoid injury, death of personnel, or damage to the instrument, the operator must refer to an explanation in the instruction manual.		
	Protective grounding terminal: To protect against electrical shock in case of a fault. This symbol indicates that the terminal must be connected to ground before operation of equipment.		
The WARNING sign denotes a hazard. It calls attention to a property of the like, which, if not correctly performed or adhered result in personal injury. Do not proceed beyond a WARNING the indicated conditions are fully understood and met.			
∦ CAUTION	The CAUTION sign denotes a hazard. It may result in personal injury or death if not noticed timely. It calls attention to procedures, practices and conditions.		

Revision History

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

Date	Version	Revised Sections
Aug. 2009	1.0	Complete this manual.
Aug. 2009	1.1	Add a NOTICE in the section of "Front Panel" under the chapter of
_		"General Information."



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1. General Information

1.1 Introduction

The Chroma 61511/61512 Series is a highly efficient programmable AC Source, which provides a low distortion sine wave output for power accuracy. The DSP microprocessor generates an accurate stable output voltage and frequency. The PWM designed power stage allows apparent power into loads. Its front panel has a RPG (Rotary Pulse Generator) and keypad control for setting the output voltage and frequency, while the LCD gives users complete operating status. Remote programming is accomplished by the GPIB bus, RS-232C serial port or USB port.

1.2 Key Features

A. Configuration

- Local operation by the keypad on the front panel
- Remote operation via GPIB or RS-232C or USB interface
- Remote control a terminal on front or rear panel using the Chroma Digital Controller A615101 (optional)
- 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 150V/300V/Auto (3 ranges)
- Analog (simulation) reference voltage for remote control
- V, I, Po, CF, PF, Idc, Vdc, Vac, Iac, Ipk, Vpk and VA measurements
- Remote inhibited control
- AC ON/OFF output signal

1.3 Specifications

Following lists the specifications of model 61511/61512. All specifications are tested by Chroma's standard test procedures and follow remote sense for connection under the condition of 25 ± 1 °C and resistive load unless specified otherwise.

Model	61511	61512	
	AC OUTPU	UT RATING	
Single Phase Power	12K VA	18K VA	
3-Phase Power	12K VA	18K VA	
Power per Phase	4K VA	6K VA	
	VOL	TAGE	
Range	150V/3	300V/Auto	
Output Voltage		7 / 0~300V	
Accuracy	0.2%+	-0.2%F.S.	
Resolution	0	0.1 V	
Distortion *1	0.3% @50/60Hz , 1%@)15- 1KHz , 1.5%@>1KHz	
Line Regulation	0	0.1%	
Load Regulation *2	0	0.2%	
Temp. Coefficient	0.02% per de	egree from 25°C	
	MAXIMUM CURI	RENT (single phase)	
RMS	96A / 48A	144A / 72A	
Peak (CF=4)	384A / 192A	576A / 288A	
	MAXIMUM CURRI	ENT (each of 3-phase)	
RMS	32A / 16A	48A / 24A	
Peak (CF=4)	128A / 64A	192A / 96A	
	FREQUENCY		
Range	•	5-1.5KHz	
Accuracy		.15%	
		ANGLE	
Range		~ 360°	
Resolution		0.3°	
Accuracy	<0.8°@50/60Hz		
		ΓING (single phase)	
Power	6K VA	9K VA	
Voltage	212V / 424V	212V / 424V	
Current	48A / 24A	72A / 36A	
		NG (each of 3-phase)	
Power	2K VA	3K VA	
Voltage	212V / 424V	212V / 424V	
Current	16A / 8A	24A / 12A	
		RATING (per phase)	
Power Type	3-phase, Delta or Y connection		
Voltage Range	190-250V (Delta: L-L, Y: L-N)		
Frequency Range		-63 Hz	
Max. Current	Delta: 80A Y: 70A	Delta: 120A Y: 90A	
		REMENT TACE	
Range	VOLTAGE 150V / 300V		
Accuracy	0.2%+0.2%F.S.		
Resolution		1 V	
resolution	<u> </u>	1 Y	

	CURRENT (per phase)		
Range	8A/32A/128Apeak	12A/48A/192Apeak	
Peak per Phase	128A	192A	
Accuracy (rms)	0.4%+(0.3% F.S.	
Accuracy (peak)	0.4%+(0.6% F.S.	
Resolution	0.006A / 0	.025A / 0.1A	
	PO	WER	
Accuracy	0.4%+(0.4% F.S.	
Resolution	0.	1 W	
OTHERS			
Efficiency *3	0.75 (Typical)	
Siza (HVWVD)	1163×546×700 mm	1163×546×700 mm	
Size (H×W×D)	45.78×21.5×27.56 inch	45.78×21.5×27.56 inch	
Weight	220 kg / 505.29 lbs	240 kg / 533.92 lbs	
Protection	OVP, OCP, OPP	, OTP, FAN-FAIL	
Remote Interface	GPIB, RS-232	2, USB, Ethernet	
	TEMPERATURE RANGE		
Operation	0 °C to 40 °C		
Storage	-40 °C to 85 °C		
Humidity	30 % to 90 %		
Safety & EMC	CE		

Notes:

^{*1 :} Maximum distortion is tested under output 125VAC (150V RANGE) and 250VAC (300V RANGE) with maximum current to linear load.

*2: Load regulation is tested by sine wave and remote sense.

*3: Efficiency is tested on input voltage: 230V.

1.4 Names of Parts

1.4.1 Front Panel

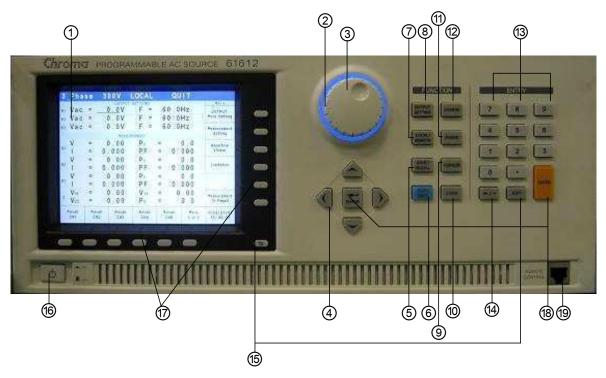


Figure 1-1 Front Panel

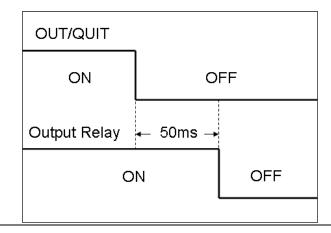
Item	Symbol	Description
1		Display: The 6.5" LCD displays the configuration, output
		setup, and measurement results.
2		<i>Indicator LED:</i> It is the Power On indicator surroounding the
<u> </u>		rotary knob showing the activation status.
3		RPG Rotary : Users can turn the RPG rotary to adjust the
		voltage, frequency and input programmed data or options.
	۵	Cursor Movement Keys: These four keys move the cursor in
4	∅ ▷	different directions. In normal mode, pressing any of these
	·	four keys will change the cursor position.
		SAVE or RECALL: Press this on MAIN PAGE can save the
5	SAVE/RECALL	output setting. By pressing this key on CHOICE PAGE
		users can save the system data.
6	OUT/QUIT	<i>OUT/QUIT:</i> Press this key to Enable/Disable the output
0	001/Q011	voltage of the AC source.
7	LOCAL/REMOTE	LOCAL/REMOTE: Switches the "Remote" control mode
,	LOCAL/REMOTE	to"LOCAL" from front panel input.
		OUTPUT SETTING:
8	OUTPUT SETTING	Changes the screen to "Output: More Setting" for additional
		settings.
9	CURSOR	CURSOR: It is used to set or adjust the value.

	i e e e e e e e e e e e e e e e e e e e	
10	LOCK	LOCK: Press it for 1 second can lock up "all keys" and the "rotary". Press it for 3~3.5 seconds to unlock them.
11	PHASE	PHASE: It sets single/3-phase.
12	CONFIG	CONFIG: It changes the screen to "config choose page" for various settings.
13	o to and	Numeric and Decimal: Users can use "numeric keys" and "decimal key" to input digital data.
14	⟨=/-	Backward and Decreasing: Press this key to delete the inputted number. It shows " - " if no number exists.
15	EXIT and (5)	EXIT: Press it to return to previous screen.
16	Ф	<i>Main Power Switch:</i> It turns on or shut off the power.
17		<i>Indicator:</i> It refers to the description on screen for parameter and function setting.
18	ENTER ,	ENTER : It confirms the setting of parameter.
19	REMOTE CONTROL	Remote Control Terminal: It can work with Chroma Digital Controller A615101 (optional) for remote control.

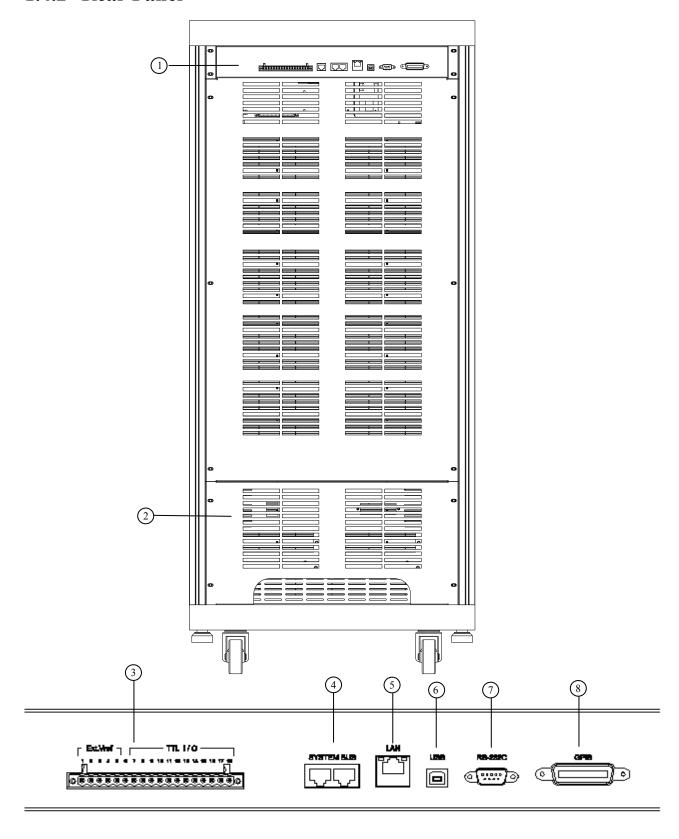
Table 1-1 Front Panel Description

(i) NOTICE

To extend the product life of output relay, it will delay 50ms for release after pressing **QUIT**. When inductive load is connected, a discharge path will be provided for the inductive current within the period of time delayed due the feature of continuous flow.



1.4.2 Rear Panel



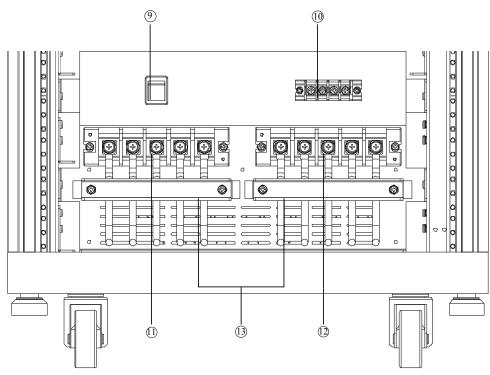


Figure 1-2 Rear Panel

Item	Symbol	Description
1	Rear Panel Output Interface	It includes Ext.V/TTL, Remote Control, GPIB and USBetc.
2	I/O Terminal Case	It has the input/output terminal. The connector inputs power source from the mains (3-phase power) and outputs power source to the UUT.
3	Ext. Vref./TTL I/O	It inputs the control waveform amplitude from external analog (simulated) signal with TTL transmission control signal (Fault_out, Remote inhibit and AC_ON.)
4	SYSTEM BUS	It is applicable for signal transmission in between 2 AC Sources connected in parallel.
5	Ethernet	It is the terminal that can be controlled by a network (LAN).
6	USB	It is used to connect the remote controller to computer for remote operation.
7	RS232C	It is a 9-pin D type male connector that transmits control commands among distant PCs for remote operation.
8	GPIB Connector	Remote controller uses GPIB bus to connect the PC via the connector for remote operation.
9	Cable Connector	Select the mapping cable connector for different input cable $(\triangle - Y)$.
10	Remote Sense Connector	It is the terminal that senses the load directly to avoid any voltage drop when connecting cable. Ensure the "SL" terminal of remote sense connector is connected to the "L" terminal of Load, and the "SN" is connected to the "N" of Load. Reverse polarity cannot be connected.

Ī	11	Input Connecting	It connects the mains to AC Source as input.
	11	Terminal	
	12	Output Connection	It connects to UUT for output.
	12	Terminal	
ľ	12	I/O Cable Secure	It secures the input/output connection cable.
	13	Strip	

Table 1-2 Rear Panel Description

2. Installation

2.1 Initial Inspection

Before shipment, this instrument was inspected 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 has to be returned. If damage is found, please file claim with carrier immediately. Do not return the instrument to Chroma without prior approval.

2.2 Preparation for Use

First the instrument must be connected to an appropriate AC line input. Since the instrument is cooling by fans, it must be installed in a place with good circulation of air. It should be in an area where the ambient temperature does not exceed 40°C.

2.3 Requirements for Input Power

2.3.1 Ratings

Input Voltage Range : 190-250 V, (Delta: L-L; Y: L-N) or

329-433 V_{LL}, 3-phase 5-wire Y

Input Frequency : 47-63 Hz

Maximum Current : 61511 Δ: 80A, Y: 70A

61512 Δ: 120A, Y: 90A

☞ WARNING

The AC Source may be damaged 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 at least 85°C and the current rating of power line input must be greater than or equal to the maximum current rating of AC Source. The input selector is located on the rear panel (see Figure 2-2.) Adjust the selector according to the power input (Delta or Y) method.

☞ WARNING

There are two different input voltage ratings. One is 380 V_{LL} 3-phase with 5-wire (Y), and the other is 220 V_{LL} 3-phase with 4-wire (Δ). Be sure to verify the main voltage before use. The connection for both is the same; however, it is necessary to switch the Δ - Y switch on the rear panel to appropriate position.

See Figure 2-2 and perform the steps below accordingly:

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

★ CAUTION

To protect the operators, the wire connected to GND terminal must be connected to the earth. Under no circumstances shall this AC Source be operated without grounding adequately.



Figure 2-1 Input Selector

(i) NOTICE

If users turn the \triangle -Y switch to \triangle , but the actual input wiring is Y, the AC Source will beep to warn the error. Users need to power it off first and turn the \triangle -Y switch to Y to resolve the problem.

(i) NOTICE

- 1. Installation of the wire must be conducted by professional personnel complying with local electrical codes.
- 2. If the input wiring selection is 220V 3~ (△ type) Max 120A/Phase, the specification of Circuit Breaker configured for △ type needs to be 220Vac/80A (61511) & 120A (61512) at least.
- 3. If the input wiring selection is 380V 3~ (Y type) Max 70A/Phase, the specification of Circuit Breaker configured for Y type needs to be 380Vac/70A (61511) & 90A (61512) at least.

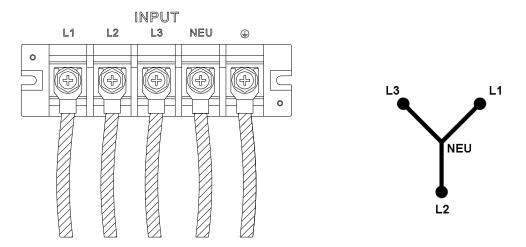


Figure 2-2 3-Phase Power Input Connection (Y Connection) 190-250 V

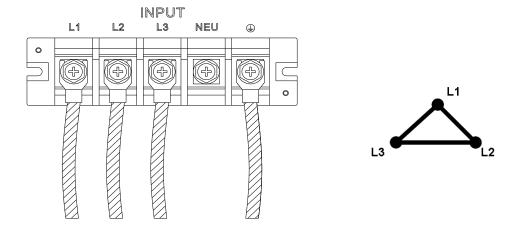


Figure 2-3 3-Phase Power Input Connection (Delta Connection) 190-250 V

(i) NOTICE

Please be aware of the color distinction of insulation tube or the wire before connecting the power wire. The black insulation tube or power wire is used for L1, L2 and L3, the blue insulation tube or power wire is used for NEU while the green insulation tube or power wire is used for GROUND.

2.4 Output Connection

The output terminal block is located at the rear of 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 up by a safety strip and the cover must be secured. The wire diameter should be large enough to connect to the load so that it will not overheat when outputting current, see Figure 2-5.

(i) NOTICE

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

☞ WARNING

For propoer ventilation, the hardware should be placed at least 1 meter distance from the device front and rear panel. Do not place the hardware against the wall or other objects.

2.5 Remote Sense Connection

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

Remove the connecting wires " ψ 1", " ψ 2", " ψ 3" and "COM" from Remote Sense terminal, and connect remote sense to load as Figure 2-4 shows. As the sensing leads transmit only a few milliamperes, the sensing wires are much thinner than the load leads. The sensing leads are part of the feedback circuit of 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 unable to output. The sensing leads must be a twisted pair to minimize the interference from external voltages. The sensing leads need to be connected to the load as close as possible.

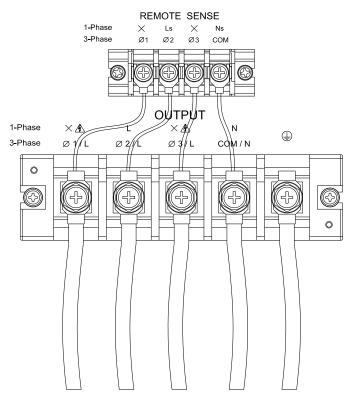


Figure 2-4 Output & Remote Sense Connection

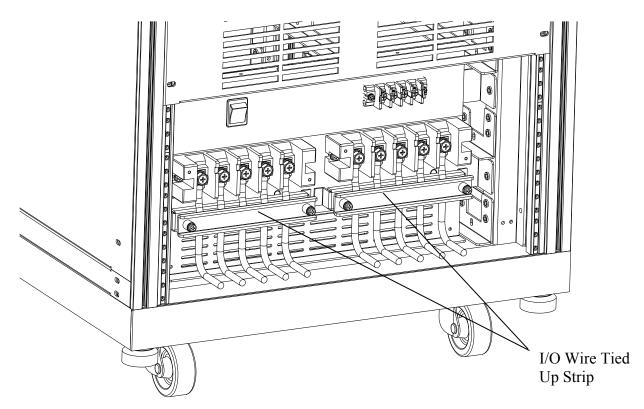


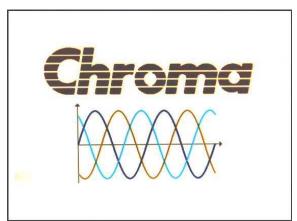
Figure 2-5 Input/Output Wire Securing Diagram

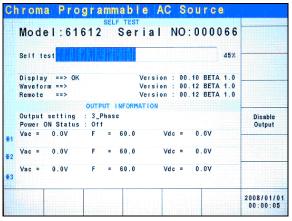
2.6 Power On Procedure

★ 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 potential electric shock hazard that could result in personal injury.

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 be on and display as the following.





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

"ERROR CODE" will appear on the right if one of the test items is failed, see section 8.2 Self Test for detail information.

When the self tests of memory, data and communication 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 won't be damaged. The AC Source sets the output to 300 Vac and if the measured voltage exceeds $300 \text{V} \pm 100 \text{V}$, the power self test fails and the display shows "NG". If everything passes self test, the screen will change to the MAIN PAGE automatically.

(i) NOTICE

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

2.7 Maintenance & Cleaning

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

2.8 Common Environment Conditions

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

The AC Source is equipped with a user friendly interface consisting of a keypad and a RPG (Rotary Pulse Generator) on the front panel. The LCD on 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 is completed (see 2.6), the display will show the MAIN PAGE (3 Phase Mode/1 Phase Mode) as below.

3	_Pha	s e	300V	LOCAL	QUI	T		1_Pha	s e	300V	LOCAL	QUI	T	
	W0000		OUTPUT		24 (6) (6)	and the	Main			OUTPUT				Main
152000	Vac	= .	<u>0.0</u> V	F =	60.0		OUTPUT:	Vac	= _	<u>0.0</u> V	F = 6	0.0Hz		OUTPUT:
€2	Vac	=	0.0V	F =	60.0		More Setting							More Setting
⊕ 3	Vac	=	0.0V	F =	60.0	Hz	Measurement							Measurement
			MEAS	UREMENT			Setting			MEAS	UREMENT			Setting
⊕1	٧	=	0.00	Po	=	0.0	Waveform	V	=	0.00	P٥		0.0	Waveform
*1	1	=	0.000	PF	= 0.	000	Viewer		=	0.000	PF	= 0.	000	Viewer
	٧	=	0.00	Po	=	0.0	Limitation	Vac	=	0.00	Vdc	= 0	.00	
€2	1	=	0.000	PF	= 0.	000	Limitation	lac	=	0.000	ldc	= 0.	000	Limitation
	٧		0.00	Po	=	0.0	Output	Vpk	=	0.00	VA	=	0.0	Output
⊕ 3	1	=	0.000	PF	= 0.	000	Mode	lpk	=	0.000	CF	= 0.	000	Mode
_	V 12	=	0.00	V 31	= 0	.00	Measurement							
Σ	V23	=	0.00	Po	=	0.0	To Page2							
	Recall CH1	Rece		Recall CH4	Recall CH5	More 1 of 2	2008/10/13 18:28:14	Recall CH1	Reca CH2		Recall CH4	Recall CH5	More 1 of 2	2008/10/13 18:28:37

Press A, V, A, keys to move the cursor for item selection. Use numeric and decimal keys or RPG to set values and press **ENTER** to confirm them. Users can 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 to return to MAIN PAGE.

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

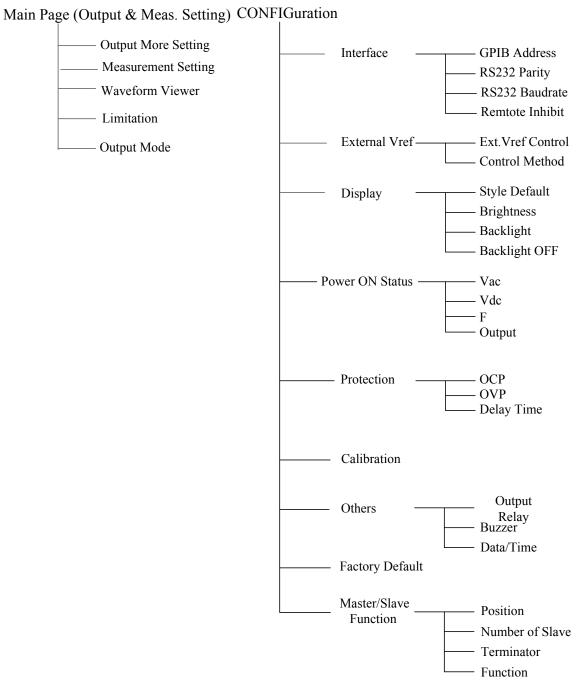
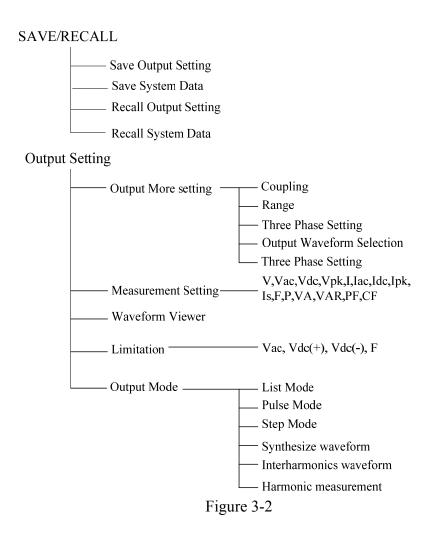


Figure 3-1



3.3 MAIN PAGE (Output Setting & Measurement)

When the AC Source is turned on and finished 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	s e	300V	LOCAL	QU	ΙT		3	_Pha	s e	300V	LOCAL	QUI	T	
			OUTPU'				Main				OUTPU	T SETTING			Main
⊕1	Vac	= .	<u>0.0</u> V	F =	60.0		OUTPUT:	⊕1	Vac	=_	<u>0.0</u> V	F =	60.0		OUTPUT:
€2	Vac	=	0.0V	F =	60.0	Hz	More Setting	€2	Vac	=	0.0V	F =	60.0	Hz	More Setting
⊕ 3	Vac	=	0.0V	F =	60.0	Hz	Measurement	⊕ 3	Vac	=	0.0V	F =	60.0	Hz	Measurement
			MEAS	UREMENT			Setting				MEAS	UREMENT			Setting
1	٧	=	0.00	Po	=	0.0	Waveform	l	Vac	=	0.00	lac	= 0.	000	Waveform
₫1	1	=	0.000	PF	= 0	.000	Viewer	€1	Vdc	=	0.00	ldc	= 0.	000	Viewer
	٧	=	0.00	Po	=	0.0	V1811941119		Vac	=	0.00	lac	= 0.	000	
€2	1	=	0.000	PF	= 0	.000	Limitation	€2	Vdc	=	0.00	ldc	= 0.	000	Limitation
	٧	=	0.00	P٥	-	0.0	Output		Vac	=	0.00	lac	= 0.	000	Output
₫3	1	=	0.000	PF	= 0	.000	Mode	⊕ 3	Vdc	=	0.00	ldc	= 0.	000	Mode
	V 12	=	0.00	V ₃₁	= (0.00	Measurement		V 12	=	0.00	V ₂₃	= 0	.00	Measurement
Σ	V23	=	0.00	Po	=	0.0	To Page2	Σ	V ₃₁	=	0.00	VA	=	0.0	To Page3
ı	Recall CH1	Rece CH2		Recall CH4	Recall CH5	More 1 of 2	2008/10/13 18:30:14		Recall CH1	Recall CH2	Recall CH3	Recall CH4	Recall CH5	More 1 of 2	2008/10/13 18:30:30

3	Pha	s e	300V	LOCAL	QUI	T	
	40.000		OUTPU	T SETTING	24 70 00	NAME OF TAXABLE PARTY.	Main
⊕1	Vac	= _	0.0V	F =	60.0	Hz	OUTPUT:
€2	Vac	=	0.0V	F =	60.0	Hz	More Setting
∓ 3	Vac	=	0.0V	F =	60.0	Hz	Measurement
			MEAS	BUREMENT			Setting
	Vpk	=	0.00	lpk	= 0.	000	Waveform
₫1	VA	=	0.0	CF	= 0.	000	Viewer
	Vpk	Ħ	0.00	lpk	= 0.	000	Ungarous regions
₹2	VA	=	0.0	CF	= 0.	000	Limitation
	Vpk	=	0.00	lpk	= 0.	000	Output
₩3	VA	=	0.0	CF	= 0.	000	Mode
Σ							Measurement To Page1
į	Recall CH1	Recall CH2	Recall CH3	Recall CH4	Recall CH5	More 1 of 2	2008/10/13 18:30:41

1	_Pha	s e	30	0 V	LOCAL		QUI	T	
				OUTPUT	SETTING				Main
	Vac	=	0	<u>. 0</u> V	F = 6	0.	0Hz		OUTPUT: More Setting
									Measurement Setting
					UREMENT				
	٧	=	0	.00	Po	=		0.0	Waveform
	ı	=	0.	000	PF	=	0.	000	Viewer
	Vac	=	0	.00	Vdc	=	0	.00	
	lac	=	0.	000	l d c	=	0.	000	Limitation
	Vpk	=	0	. 00	VA	=		0.0	Output
	lpk	=	0.	000	CF	=	0.	000	Mode
1	Recall CH1	Rec CH		Recall CH3	Recall CH4		ecall CH5	More 1 of 2	2008/10/13 18:31:05

On top of the screen, the range displayed 300V is the Range status (see 3.3.1.2). There are 3 Ranges

- 1. 150V Range
- 2. 300V Range
- 3. AUTO Range

The definition of output parameters:

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

Press **OUT/QUIT** enables the AC Source's output with the set Vac, F and Vdc. Press it again the AC Source ouput is disabled

(i) NOTICE

When Coupling = AC+DC the output is the sum of Vac and Vdc. However, the combination of peak voltage cannot exceed the limit of each range (range 150V: 212.1V and range 300V: 424.2V.) The output voltage will skip to 0V automatically and trigger protection if it exceeds the voltage limit (OVP).

Following lists the definition of measurement parameters:

V : It is the voltage measurement in Volts. (True RMS measurement)

F : It is the output frequency in Hertz.

I : It is the current measurement in Amps. (True RMS measurement)

P: It is the real power measurement in Volts.

PF : It is Power Factor and the calculation formula = Real Power / ($Vrms \times Irms$)

CF : It is Crest Factor and the calculation formula = Ipeak/Irms

Vdc : It is the DC voltage measurement in Volts.

Idc : It is the DC current measurement in Amps.

Ip : It is the peak current measurement in Amps. The Ipeak display is the Ip (+) or Ip (-)

whichever is larger.

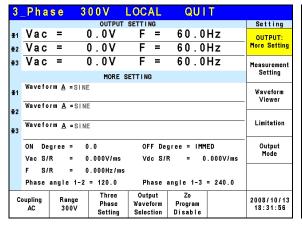
Is : It is I surge that is only measured when output changes as defined in section 3.3.2.3.

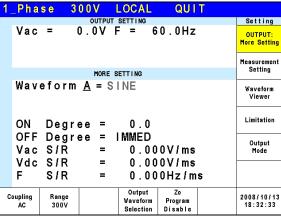
VA It is the apparent power in Volt-Ampere and the calculation formula = $Vrms \times Irms$.

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.



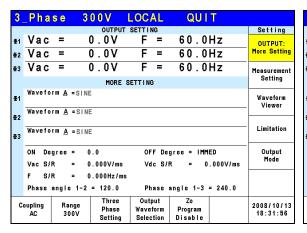


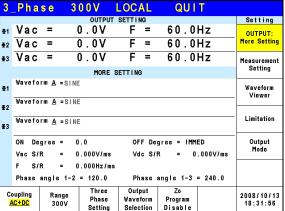
3.3.1.1 Coupling Output Mode (AC+DC, AC, DC)

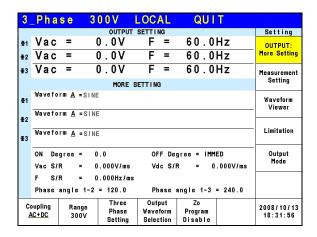
There are 3 types of AC Source output: AC+DC, AC and DC. The coupling can be set to meet a variety of applications.

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

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





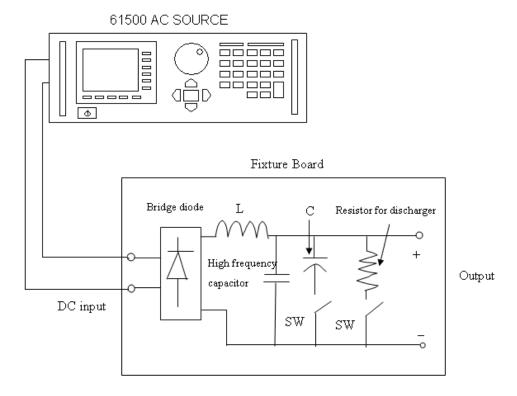


(i) NOTICE

Since the AC Source does not have as many capacitors as the common DC Power Supply, some voltage fluctuations and transient load characters 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 20uF as it may cause the device to be damaged due to unstable output.

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

- 1. The output voltage ripple is bigger because there is no output capacitor.
- 2. When the output current reaches the current limit set point, the output voltage will be cut off and in protection mode. It will not stay in constant current mode with a voltage drop like common DC sources.
- 3. It is necessary to connect the fixture as shown below if more than 20uF is to be used.



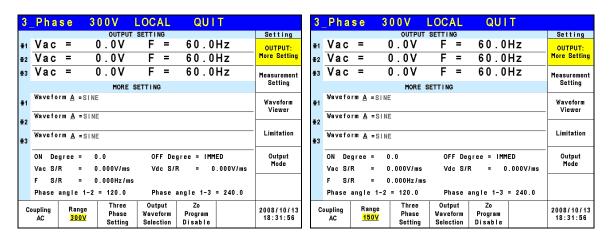
4. The output has DC bias that is smaller than 15mV@150V range (temperature coefficient is 2.5mV/°C typical) or smaller than 30mV@300V range (temperature coefficient is 5mV/°C typical.)

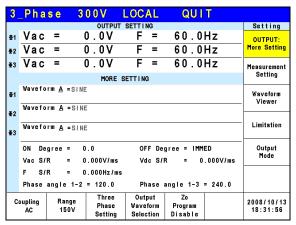
3.3.1.2 Range

The AC Source has full scale voltage ranges of 150 V, 300 V and AUTO. Users can set Range by the function OUTPUT: More Setting. This parameter controls the power stage relay for parallel (range 150V) or series (range 300V) for more current or higher voltage. AUTO range indicates the output range will change between 150V and 300V automatically as need.

Set the output voltage range to 150V as instructed below.

- 1. Press Range at the bottom.
- 2. Turn the RPG to change "300V" to "150V" and press **ENTER**.





(i) NOTICE

The output voltage will set to 0V before the range changes to eliminate the peak voltage; and then set the output voltage. Please 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.

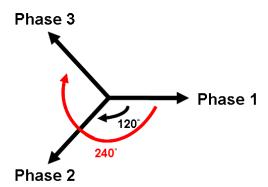
Edit: All and Each.

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

3	Pha	s e	3 (0 0 V	LOC	٩L	QU	ΙΤ	
				OUTPUT	SETTI	√G			Setting
⊕1	Vac	=		0.0V	F	=	60.0		Edit
⊕2	Vac	=	().OV	F	=	60.0	Hz	Each
⊕ 3	Vac	=	().OV	F	=	60.0	Hz	Sequence
				MORE	SETTING	3			Positive
垂1	Wavefo	rm <u>A</u>	=SINE						Three Phases Independ.
⊕2	Wavefo	rm <u>A</u>	=SINE						
⊕ 3	Wavefo	rm <u>A</u>	=SINE						
	ON De	gree	= 0	. 0	OF	F De	gree = IMP	1ED	Phase re-lock
	Vac S/	R	= 0	.000V/ms		c S/F).000V/ms	Disable
	F 8/	R	= 0	.000Hz/ms					
	Phase	angle	1-2	= 120.0	Ph	ase a	angle 1-3	= 240.0	
C	oupling AC	Rar 30		Three Phase Setting	Outj Wave Selec	form	Zo Program Disable		2008/10/13 18:36:36

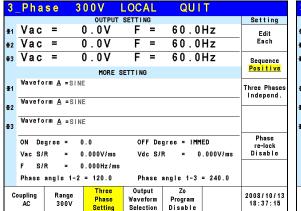
Sequence: Positive and Negative.

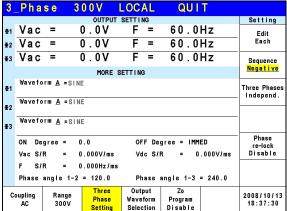
For example, the phase difference degree of 3-phase in positive balance is 120 degrees as shown below.

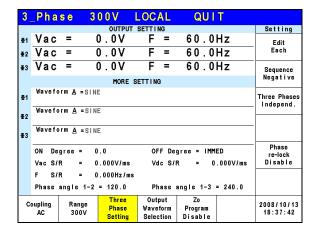


Press Sequence to set the Positive/Negative sequence for AC Source's 3-phase voltage output. The following lists the procedure to set the 3-phase output voltage sequence to Negative.

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







Three Phases: Independ, Same Freq and Balance.

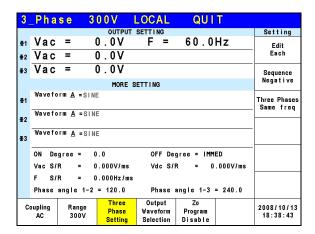
Press Three Phases to set the relationship among the AC Source 3-phase output voltage, which are Independ, Same Freq and Balance.

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

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

3	_Pha	se	300V	LOCAL	QUIT	
			OUTPUT	SETTING		Setting
⊕1	Vac	=	0.0V	F =	60.0Hz	Edit
⊕2	Vac	=	0.0V	F =	60.0Hz	Each
₫3	Vac	=	0.0V	F =	60.0Hz	Sequence
			MORE	SETTING		Negative
⊕ 1	Wavefo	orm A = S	SINE			Three Phases
Φ2	Wavefo	orm <u>A</u> = :	BINE			
⊕ 3	Wavefo	orm <u>A</u> = :	BINE			
	ON De	gree =	0.0	OFF D	egree = IMMED	Phase re-lock
	Vac S/	R =	0.000V/ms	Vdc S	/R = 0.000V/ms	Disable
	F 8/	R =	0.000Hz/m	s		
	Phase	angle 1	-2 = 120.0	Phase	angle 1-3 = 240.0	
C	oupling AC	Range 300V		Output Waveform Selection	Zo Program Disable	2008/10/13 18:38:21

3	_Pha	s e	300V	LOCAL	QUIT	
			OUTPUT	SETTING		Setting
⊕ 1	Vac	=	0.0V	F =	60.0Hz	Edit
⊕2	Vac	=	0.0V	F =	60.0Hz	Each
⊕ 3	Vac	=	0.0V	F =	60.0Hz	Sequence
,			MORE	SETTING		Negative
⊕1	Wavefo	orm <u>A</u> =	SINE			Three Phases
₩2	Wavefo	orm <u>A</u> =	SINE			
⊕ 3	Wavefo	orm <u>A</u> =	SINE			
	ON De	gree =	0.0	OFF De	gree = IMMED	Phase re-lock
	Vac S/	R =	0.000V/ms	Vdc S/	R = 0.000V/ms	Disable
	F S/	R =	0.000Hz/m	s		
	Phase	angle	1-2 = 120.0	Phase	angle 1-3 = 240.0	
Co	oupling AC	Rang 300'		Output Waveform Selection	Zo Program Disable	2008/10/13 18:38:33

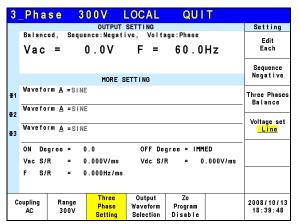


When 3-phase balance is in use, the user may set the output voltage to be Phase Volt or Line Volt. Below is the procedure for setting the 3-phase voltage output to 3-phase balance.

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

3_	Pha	s e	300V	LOCAL	QUI	T	
			OUTPUT	SETTING			Setting
⊕1	Vac	=	0.0V	F =	60.0	Hz	Edit
€2	Vac	=	0.0V	F =	60.0	Hz	Each
₽3	Vac	=	0.0V	F =	60.0	Hz	Sequence
			MORE	SETTING			Negative
Ē 1	Wavefo	rm <u>A</u> = (SINE				Three Phases
2	Wavefo	rm <u>A</u> =:	SINE				
₽3	Wavefo	rm <u>A</u> = :	SINE				
	ON De	gree =	0.0	OFF De	gree = IMM	ED	Phase re-lock
	Vac S/	R =	0.000V/ms	Vdc 8/	R = 0	.000V/ms	Disable
	F 8/	R =	0.000Hz/m	S			
	Phase	angle 1	-2 = 120.0	Phase	angle 1-3	= 240.0	
Co	oupling AC	Range 300\		Output Waveform Selection	Zo Program Disable		2008/10/13

3	_Pha	s e	30	0 V	LOCAL	QUI	T	
				OUTPUT	SETTING			Setting
	Balanc Vac	- 1	•	•	ve, Volta F =		U -	Edit Each
	vac	-	U	. 0 9	г -	00.0	п∠	Luon
								Sequence Negative
				MORE S	ETTING			Negative
⊕ 1	Wavefo	rm <u>A</u> =	SINE					Three Phases
⊕ 2	Wavefo	rm <u>A</u> =	SINE					Voltage set
⊕ 3	Wavefo	rm <u>A</u> =	SINE					Phase
	ON De	gree =	0.	0	OFF De	gree = IMM	ED	
	Vac S/	R =	0.	000V/ms	Vdc S/I	R = 0	.000V/ms	
	F 8/	R =	0.	000Hz/ms				
				Three	Outnut	Zo		
C	oupling AC	Rang 300		Phase Setting	Output Waveform Selection	20 Program Disable		2008/10/13 18:39:31

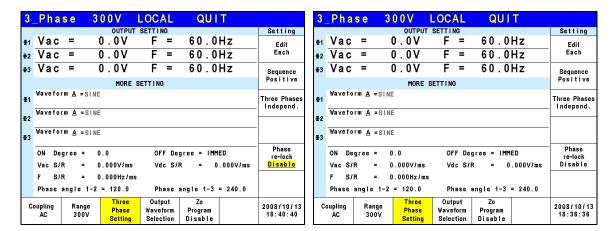


3	Pha	s e	3 (0 0 V I	LOCAL	QUI	T	
				OUTPUT	SETTING			Setting
	Balanc	Edit						
	Vac	=	() . OV	F =	60.0	Hz	Each
								Sequence
				MORE S	ETTING			Negative
Φ 1	Wavefo	rm <u>A</u>	=SINE					Three Phases
⊕2	Wavefo	rm <u>A</u>	=SINE					Voltage set
⊕ 3	Wavefo	rm <u>A</u>	=SINE					Line
	ON De	gree	= 0	. 0	OFF De	gree = IMM	ED	
	Vac S/	R :	= 0	.000V/ms	Vdc S/I	R = 0	.000V/ms	
	F 8/	R :	= 0	.000Hz/ms				
C	Coupling AC 300V Phase Setting Selection Disable							

Phase re-lock: Enable and Disable.

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

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



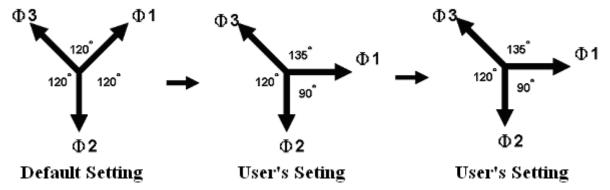


Figure 3-3 Phase Re-lock Disabled

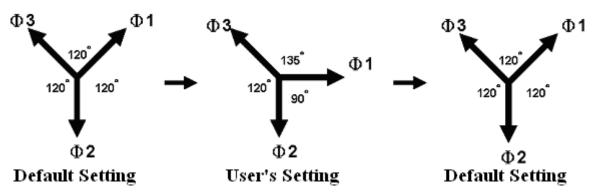


Figure 3-4 Phase Re-lock Enabled

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.

Following lists the procedure for setting the output phase degree to ON Degree = 90 and OFF Degree=180 in 1 Phase Mode /3 Phase Mode.

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

3	Pha	s e	3 (0 V	LOC	AL.	QUI	T	
	_			OUTPUT	SETTIN	IG			Setting
⊉ 1	Vac	=	0	. 0 V	F	=	60.0	Hz	OUTPUT:
₽2	Vac	=	0	. 0 V	F	=	60.0	Hz	More Setting
₽3	Vac	=	0	. 0 V	F	=	60.0	Hz	Measurement
				MORE S	SETTING	;			Setting
E 1	Wavefo	rm <u>A</u> =	SINE						Waveform Viewer
2	Wavefo	rm <u>A</u> :	SINE						VICEC
ē3	Wavefo	rm <u>A</u> :	SINE						Limitation
	ON Deg	gree =		.0 .000V/ms		F Deg	ree = 180	.0	Output Mode
	F S/F	₹ =	. 0	.000Hz/ms					
	Phase a	angle	1-2 =	120.0	Ph	ase a	ingle 1-3	= 240.0	
C	oupling AC	Rang 300		Three Phase Setting	Out; Wave Selec	form	Zo Program Disable		2008/10/13 18:44:37

1.	_Phas	se 3	0 0 V	LOCAL	QUI	T	
			OUTPUT	SETTING			Setting
	Vac	=	0.0V	F = 6	0.0Hz		OUTPUT: More Setting
							Measurement Setting
				SETTING			
	Wave	form	<u>A</u> = S	INE			Waveform Viewer
	ON	_		90.0			Limitation
	Vac		=		0V/ms		Output Mode
	Vdc	SIR	=	0.00	0 V / ms		
	F	SIR	=	0.00	0 H z / m	s	
C	oupling AC	Range 300V		Output Waveform Selection	Zo Program Disable		2008/10/13 18:43:31

(i) NOTICE

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

3.3.1.5 Slew Rate of Output Transient

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

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

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

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

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

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

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

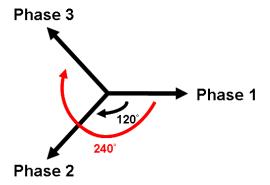
3_	_Ph a	s e	3 (0 0 V	LOC	AL	QUI	T	
				OUTPUT					Setting
§ 1	Vac	=	().OV	F	=	60.0	Hz	OUTPUT:
₽2	Vac	=	().0V	F	=	60.0	Hz	More Setting
€3	Vac	=	().OV	F	=	60.0	Hz	Measurement
				MORE	SETTIN	3			Setting
1	Wavefo	rm <u>A</u> :	SINE						Waveform Viewer
2	Wavefo	rm <u>A</u> :	SINE						710001
3	Wavefo	rm <u>A</u> :	SINE						Limitation
	ON De	gree :		.0 .200V/ms		F Deg	ree = IMM = 1	IED .000V/ms	Output Mode
	F 8/	R =		<u>. 100</u> Hz/ms					
	Phase	angle	1-2	= 120.0	Ph	ase a	ingle 1-3	= 240.0	
Co	oupling AC	Ran 30(Three Phase Setting	Out Wave Selec	form	Zo Program Disable		2008/10/13 18:45:20

1_P	ase 3	00V	LOCAL	QUI	T	
		OUTPUT	SETTING			Setting
Va	c =	0.0V F	= 6	0.0Hz		OUTPUT: More Setting
						Measurement Setting
			ETTING			Serring
Wa	veform	<u>A</u> = S	INE			Waveform Viewer
01	5 -					Limitation
Va	F Degr c S/R c S/R	ee = = =		0 V / ms		Output Mode
F	SIR	=	U.10	0 H z / ms	5	
Couplin	Range 300V		Output Waveform Selection	Zo Program Disable		2008/10/13 18:45:47

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

3.3.1.6 Output Degree of 3-phase Voltage Output

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



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

- Move the cursor to "Phase angle 1-2 =" command line. Press $\boxed{1}$, $\boxed{2}$, $\boxed{0}$ and $\boxed{\text{ENTER}}$. 1.
- 2.
- Move the cursor to "Phase angle 1-3 =" command line. 3.
- Press 2, 4, 0 and ENTER.

3	Pha	se	300V	LOCAL	QUIT	
			OUTPUT	SETTING		Setting
⊕1	Vac	=	0.0V	F =	60.0Hz	OUTPUT:
⊕2	Vac	=	0.0V	F =	60.0Hz	More Setting
⊕ 3	Vac	=	0.0V	F =	60.0Hz	Measurement
			MORE	SETTING		Setting
⊕ 1	Wavefo	rm <u>A</u> = 9	SINE			Waveform Viewer
⊕2	Wavefo	rm <u>A</u> = 3	SINE			
⊕ 3	Wavefo	rm <u>A</u> = 9	SINE			Limitation
		gree =	0.0		gree = IMMED	Output Mode
	Vac S/	• • • • • • • • • • • • • • • • • • • •	0.000V/ms	Vdc S/I	R = 0.000V/ms	
	F S/	R =	0.000Hz/ms	;		
	Phase	angle 1	-2 = 120.0	Phase	angle 1-3 = <u>240.0</u>	
C	oupling AC	Rang 300\		Output Waveform Selection	Zo Program Disable	2008/10/13 18:46:38

(i) NOTICE

Since the 3-phase voltage output of the AC Source is running independently, it is able to set the phase difference of 3-phase output to unbalance, such as Phase angle 1-2 = 100, Phase angle 1-3 = 200.

3.3.1.7 Output Waveform Selection

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

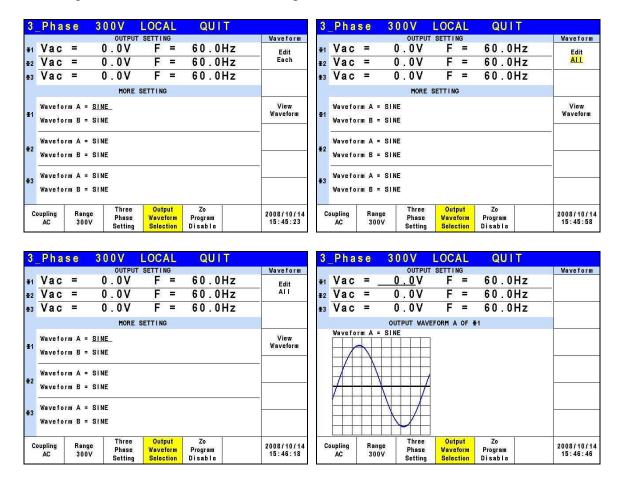
3	Pha	se	300	V	LOC	AL	QU	IT	
	\$1000 K		ay.		SETTI		Sec. 100		Waveform
⊕1	Vac	=	0.	. 0 V	F	=	60.	0Hz	Edit
€2	Vac	=	0.	. 0 V	F	=	60.	0Hz	Each
⊕ 3	Vac		0.	. 0 V	F	=	60.	0Hz	
				MORE	SETTIN	G			
	Wavefo	rm A =	SINE						View
⊕ 1	Wavefo	rmB=	SINE						Waveform
23	Wavefo	rm A =	SINE						
₹2	Wavefo	rm B =	SINE						
4 3	Wavefo	rm A =	SINE						3
=3	Wavefo	rmB=	SINE						
C	oupling	Rano	16	Three	Out		Zo		2008/10/1
	AC	300	v	Phase Setting	Wave Selec		Program Disable		15:45:23

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

- Press Edit on the right and use RPG to change the selection to All.
- Move the cursor to WAVE A command line.

3. Turn the RPG to select "SINE" and press **ENTER**.

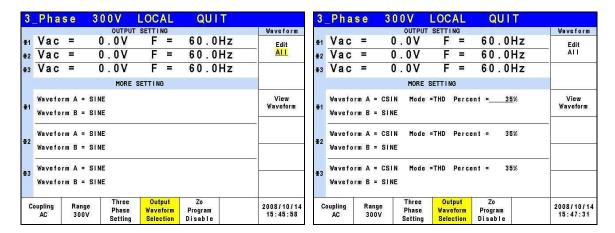
Users can press "View Waveform" on the right to view the set waveform.

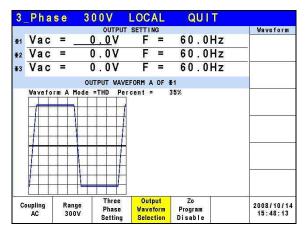


Follow the steps below to set the A waveform of 3-phase to clipped sine with a total harmonic distortion of 35%.

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

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





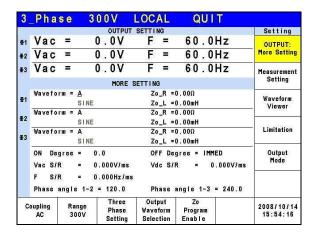
- 1. Clipped sine waveform can be programmed via "Amplitude" or "Total Harmonic Distortion". The amplitude range is from 0 to 100% (100%: without clipping) while the Total Harmonic Distortion range is from 0 to 43% (0%: without distortion.)
- 2. User defined waveform needs to be defined by and downloaded from the remote PC.
- 3. For detail DST waveform, please see Appendix B Built-in DST Waveform.

WARNING

- 1. When using the user defined waveform, it may cause the AC Source to be damaged if the waveform frequency exceeds 1000Hz.
- 2. Due to the bandwidth restriction of AC Source, distortion may occur on the output especially when the user defined waveform contains high frequency.

3.3.1.8 Zo Program Enable

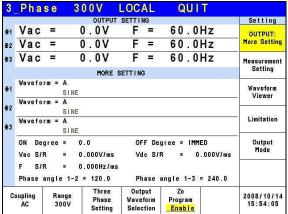
The output impedance of AC Source is very low; however users may need special output impedances in certain test conditions. The output impedance can be programmed within a certain range using the Zo Program under OUTPUT SETTING (3.3.1) in the AC Source.

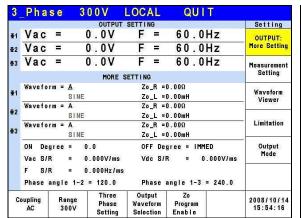


Follow the steps below to set the output impedance Zo Program = Enable, $R = 1.0\Omega$, and L = 1.0mH:

- 1. Press Zo Program at the bottom.
- 2. Turn RPG to switch to "Enable" and press **ENTER**.
- 3. The cursor moves to " $Zo_R =$ " command line automatically.
- 4. Press $\boxed{1}$, $\boxed{.}$, $\boxed{0}$, and \boxed{ENTER} to change Zo_R to "1.0 Ω ."
- 5. Press **1**, ..., **0**, and **ENTER** to change Zo_L to "1.0 mH."

3 _	Phase	300V	LOCAL	QUIT	
	A-1-2-2	OUTPL	IT SETTING		Setting
1	Vac =	0.0V	F =	60.0Hz	оитрит:
2	Vac =	0.07	F =	60.0Hz	More Setting
3	Vac =	0.0V	F =	60.0Hz	Measurement
		MORE	SETTING		Setting
Ī	Waveform =	A			Waveform
		SINE			Waveform Viewer
2	Waveform =	A			N INTERPRET
		SINE			
3	Waveform =				Limitation
il.		SINE			_
	ON Degree	= 0.0	OFF De	gree = IMMED	Output
	Vac S/R	= 0.000V/ms	Vdc S/	R = 0.000V/m	s Mode
	F S/R	= 0.000Hz/i	ns		
	Phase angl	e 1-2 = 120.0	Phase	angle 1-3 = 240.0	
Co		nnge Three Phase	Output Waveform Selection	Zo Program Disable	2008/10/14 15:53:23





3	Phase	300V	LOCAL	QUIT	
		OUTPUT	SETTING	partial schools	Setting
⊕1	Vac =	0.0V	F =	60.0Hz	OUTPUT:
€2	Vac =	0.0V	F =	60.0Hz	More Setting
₫3	Vac =	0.07	F =	60.0Hz	Measurement
		MORE	SETTING		Setting
⊕1	Waveform =	A SINE	Zo_R = 1. Zo_L = 1.		Waveform Viewer
	Waveform =	Α.	Zo_R =0.	.00Ω	Viewei
€2		SINE	Zo_L =0.	. O O m H	2 CARROLA TRANSICA
⊕ 3	Waveform =	SINE	Zo_R = 0. Zo L = 0.		Limitation
2000	ON Degree	702220	(3/3/W 15 /0 2000	ee = IMMED	Output Mode
	F S/R Phase angl	= 0.000Hz/ms e 1-2 = 120.0		ngle 1-3 = 240.0	
C		ange Three Phase Setting	Output Waveform Selection	Zo Program Enable	2008/10/14 15:55:04

- 1. When Zo Program = Enable, the AC Source uses current feedback to reprogram the output waveform to meet the setting. However, the output impedance is the AC Source's original reading if Zo Program = Disable.
- 2. The programmable output impedance function is invalid for DC outputs.
- 3. The programmable output impedance function is invalid for 1 Phase Mode.

☞ WARNING

The maximum of Zo_R and Zo_L is 1.0Ω and 1.0 mH. However, if L is over 0.5 mH and the output voltage is too low (<100Vac), it may cause the AC Source to be unstable, especially when the output current is too great. Users have to program the inductance to the desired level slowly. If there is incorrect high frequency/voltage output or noise, monitor the output voltage and the sound of the AC Source. Do not use output impedance program but external impedance circuit when unstable condition occurs.

3.3.2 Measurement Setting

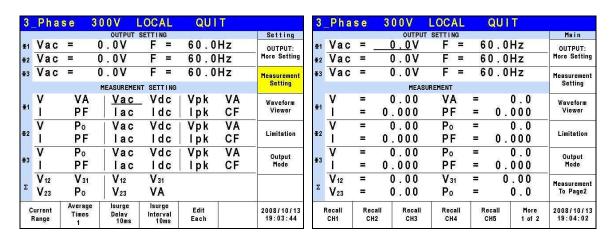
Press Measurement Setting on the right in MAIN PAGE (3_Phase Mode/1_Phase Mode) to set the measurement as the figure shown below. There are 12 measurement items in the setting screen such as voltage, current, output power and etc. The setting is done by moving the cursor to each item and use the RPG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

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

- 1. Press Measurement Setting 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	00V	LOCAL	QUI	T	
			OUTPUT	SETTING		1000	Setting
1	Vac	=	0.0V	F =	60.0	Hz	оитрит:
2	Vac	=	0.0V	F =	60.0	Hz	More Setting
3	Vac	=	0.0V	F =	60.0	Hz	Measurement
			MEASUREME	NT SETTING			Setting
	٧	Po	_ Vac	Vdc	Vpk	VA	Waveform
ē1	1	PF	lac	ldc	lpk	CF	Viewer
	٧	Po	Vac	Vdc	Vpk	VA	
2	1	PF	lac	ldc	lpk	CF	Limitation
	γ	Po	Vac	Vdc	Vpk	VA	Output
3	1	PF	lac	ldc	lpk	CF	Mode
<u></u>	V ₁₂	V ₃₁	V ₁₂	V ₃₁			
Σ	V23	Po	V23	VA			
	urrent Range	Average Times 1	Isurge Delay 10ms	Isurge Interval 10ms	Edit Each		2008/10/13 18:47:36

3	_Pha	se 3	0 0 V	LOCAL	QUI	T	
	(a) (a) (a)		OUTPUT	SETTING	700 (n)	2000	Setting
₫1	Vac	=	0.0V	F =	60.0	Hz	оитрит:
€2	Vac	=	0.0V	F =	60.0	Hz	More Setting
⊕ 3	Vac	=	0.0V	F =	60.0	Hz	Measurement
			MEASUREME	NT SETTING			Setting
	γ	V	A Vac	Vdc	Vpk	VA	Waveform
⊕1	Ì	PF	lac	ldc	lpk	CF	Viewer
	٧	Po	Vac	Vdc	Vpk	VA	- Carron Maria
€2	1	PF	lac	ldc	lpk	CF	Limitation
	٧	Po	Vac	Vdc	Vpk	VA	Output
₫3	Ì	PF	lac	ldc	lpk	CF	Mode
	V 12	V ₃₁	V ₁₂	V ₃₁			
Σ	V23	Po	V23	VA			
	urrent Range	Average Times 1	Isurge Delay 10ms	Isurge Interval 10ms	Edit Each		2008/10/13 19:03:30

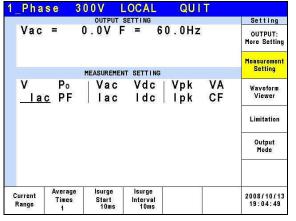


Below is the procedure to the 2nd measurement item from I to Iac in 1 phase mode.

- 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 "Iac" and press **ENTER**.
- 4. Press to return to MAIN PAGE.

		OUTPUT		a comme		Setting
Vac	=	0.0V F	= 60).0Hz		OUTPUT: More Setting
		MEASUREMEN	IT SETTING			Measurement Setting
ν <u>Ι</u>	Po PF		Vdc Idc	Vpk lpk	VA CF	Waveform Viewer
						Limitation
						Output Mode

_Pha	se 3	00V I	LOCAL	QUI	T	
14 MOVEM		OUTPUT		os paresos		Setting
Vac	=	0.0V F	= 61	0.0Hz		OUTPUT: More Setting
		MEASUREMEN	IT OFTINO			Measuremen Setting
	_					
V la	P₀ <u>c</u> PF	Vac	Vdc Idc	Vpk Ipk	VA CF	Waveform Viewer
						Limitation
						Output Mode
Current Range	Average Times	Isurge Start 10ms	Isurge Interval 10ms			2008/10/1: 19:04:42



1	_Pha	s e	31	0 0 V	LOCAL		QUI	T	
				OUTPU	T SETTING				Main
	Vac	=	(<u>0 . 0</u> V	F = 6	0.	0Hz		OUTPUT: More Setting
									Measurement Setting
				MEAS	BUREMENT				Serring
	٧	=		0.00	P₀	=		0.0	Waveform
	lac	=		.000	PF	=		000	Viewer
	Vac	=		0.00	Vdc	=	-	.00	Limitation
	lac	=		.000	ldc	=		000	Limitation
	Vpk	=		0.00	VA	=		0.0	Output
	lpk	=	0	.000	CF	=	0.	000	Mode
I	Recall CH1	Red CH		Recall CH3	Recall CH4		ecall CH5	More 1 of 2	2008/10/13 19:05:35

3.3.2.1 Current Range

Press Current Range at the bottom to set the current detection range. Setting appropriate current range will result in a more accurate current measurement. The current value of each range is the maximum value it can detect. If the output current is larger than the maximum current the range can detect, the screen will show I = OVR ange. The current detection ranges are listed below.

61512:

Φ1 Range: 12A, 48A, 192A, Auto. **Φ2 Range:** 12A, 48A, 192A, Auto. **Φ3 Range:** 12A, 48A, 192A, Auto.

61511:

Φ1 Range: 8A, 32A, 128A, Auto. Φ2 Range: 8A, 32A, 128A, Auto. Φ3 Range: 8A, 32A, 128A, Auto.

Following lists the procedure for setting the current detection range of the 1st phase to 12A.

- 1. Press Current Range at the bottom.
- 2. Press Φ 1 Range on the right.
- 3. Turn the RPG to change to "12A" and press **ENTER**.

3	_Pha	se 🤅	300V	LOCAL	QUI	T	
	40.707.0		OUTPUT	SETTING		V-1.00	Setting
E 1	Vac	=	0.0V	F =	60.0	Hz	₫1 Range
2	Vac	=	0.0V	F =	60.0	Hz	192A
3	Vac	=	0.0V	F =	60.0	Hz	
			MEASUREME	NT SETTING			
	V	_ VA	∣ Vac	Vdc	Vpk	VA	₫2 Range
1	Ì	PF	lac	ldc	lpk	CF	192A
	V	Po	Vac	Vdc	Vpk	VA	_
2	1	PF	lac	ldc	lpk	CF	
	٧	Po	Vac	Vdc	Vpk	VA	∰3 Range
3	1	PF	lac	ldc	lpk	CF	192A
	V ₁₂	V ₃₁	V ₁₂	V ₃₁			
Ε	V23	Po	V23	VA			
225	urrent Range	Average Times	Isurge Delay 10ms	Isurge Interval 10ms	Edit Each		2008/10/13 19:06:02

3	Pha	se (300V	LOCAL	QUI	T	
	1423423			SETTING	19 (e 5)	anana	Setting
⊕1	Vac	=	0.0V	F =	60.0	Hz	₫1 Range
⊕2	Vac	=	0.0V	F =	60.0	Hz	192A
⊕ 3	Vac	=	0.0V	F =	60.0	Hz	
4			MEASUREME	NT SETTING			
1	٧	VA	∣ Vac	Vdc	Vpk	VA	∯2 Range
⊕1	Ì	PF	lac	ldc	lpk	CF	192A
	٧	Po	Vac	Vdc	Vpk	VA	
€2	1	PF	lac	ldc	lpk	CF	
	٧	Po	Vac	Vdc	Vpk	VA	∰3 Range
₫3	Ì	PF	lac	ldc	lpk	CF	192A
	V 12	V 31	V ₁₂	V ₃₁			
Σ	V23	Po	V23	VA			
100	urrent Range	Average Times 1	Isurge Delay 10ms	Isurge Interval 10ms	Edit Each		2008/10/13 19:06:25

3	Pha	s e	300V	LOCAL	QUI	T	
	4000		OUTPUT	SETTING	20 (0 00	20/2/20	Setting
₫1	Vac	=	0.0V	F =	60.0	Hz	₫1 Range
€2	Vac	=	0.0V	F =	60.0	Hz	12A
⊕ 3	Vac	=	0.0V	F =	60.0	Hz	
			MEASUREM	ENT SETTING			
	٧	٧A	∣ Vac	Vdc	Vpk	VA	₫2 Range
⊕1	Ì	PF	lac	ldc	lpk	CF	192A
-2-2	٧	Po	∣ Vac	Vdc	Vpk	VA	7
€2	Ì	PF	lac	ldc	lpk	CF	
	ν	Po	Vac	Vdc	Vpk	VA	₫3 Range
₫3	Ì	PF	lac	ldc	lpk	CF	192A
	V ₁₂	V 31	V ₁₂	V ₃₁			
Σ	V23	Po	V23	VA			
100	urrent Range	Average Times 1	lsurge Delay 10ms	Isurge Interval 10ms	Edit Each		2008/10/13 19:06:41

₽.	_Fna	5 e J	UUV	LUCAL	QUI		
	(p) (up).		OUTPUT	SETTING	500 (pt = 100	2040	Setting
 1	Vac	=	0.0V	F =	60.0	Hz	₫1 Range
₽2	Vac	=	0.0V	F =	60.0	Hz	12A
₽3	Vac	=	0.0V	F =	60.0	Hz	
			MEASUREME	NT SETTING			
	V	_ VA	∣ Vac	Vdc	Vpk	VA	₫2 Range
⊉ 1	1	PF	lac	ldc	lpk	CF	192A
	٧	Po	Vac	Vdc	Vpk	VA	
₽2	ì	PF	lac	ldc	lpk	CF	
	٧	Po	Vac	Vdc	Vpk	VA	∰3 Range
₽3	Ì	PF	lac	ldc	lpk	CF	192A
	V 12	V ₃₁	V ₁₂	V ₃₁			
Σ	V23	Po	V23	VA			
	urrent Range	Average Times 1	Isurge Delay 10ms	Isurge Interval 10ms	Edit Each		2008/10/13 19:06:52

3.3.2.2 Average Times

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

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

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

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

1. Press Average Times at the bottom.

2. Turn RPG to switch to "1" and press **ENTER**.

3	Pha	se :	300V	LOCAL	QUI	T	
	40.000		OUTPUT	SETTING	10.00		Setting
⊕1	Vac	=	0.0V	F =	60.0	Hz	OUTPUT:
€2	Vac	=	0.0V	F =	60.0	Hz	More Setting
₫3	Vac		0.0V	F =	60.0	Hz	Measurement
			MEASUREME	NT SETTING			Setting
	ν	VA	∣ Vac	Vdc	Vpk	VA	Waveform
₫1	Ì	PF	lac	ldc	lpk	CF	Viewer
	٧	Po	Vac	Vdc	Vpk	VA	CAMPAGNA SHIP (CM)
€2	1	PF	lac	ldc	lpk	CF	Limitation
	٧	Po	Vac	Vdc	Vpk	VA	Output
⊕ 3	j	PF	lac	ldc	lpk	CF	Mode
	V ₁₂	V ₃₁	V ₁₂	V ₃₁	20 MARTE 17		
Σ	V23	Po	V ₂₃	VA			
27/3	urrent Range	Average Times	Isurge Delay 10ms	Isurge Interval 10ms	Edit Each		2008/10/13 19:07:48

3.3.2.3 Isurge Delay, Isurge Interval

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

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

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

3	Pha	se (300V	LOCAL	QUI	T	
	44700		OUTPUT	SETTING			Setting
₽1	Vac	=	0.0V	F =	60.0	Hz	OUTPUT:
E 2	Vac	=	0.0V	F =	60.0	Hz	More Setting
₽3	Vac	=	0.0V	F =	60.0	Hz	Measurement
			MEASUREME	ENT SETTING			Setting
	ν	٧A	∣ Vac	Vdc	Vpk	VA	Waveform
₽1	Ì	PF	lac	ldc	lpk	CF	Viewer
	٧	Po	Vac	Vdc	Vpk	VA	CAUCAGO NA SAMO ACINA.
2	1	PF	lac	ldc	lpk	CF	Limitation
	V	Po	Vac	Vdc	Vpk	VA	Output
₽3	Ì	PF	lac	ldc	lpk	CF	Mode
	V 12	V 31	V ₁₂	V ₃₁			
Σ	V23	Po	V23	VA			
- 225	Current Range	Average Times	Isurge Delay 10ms	Isurge Interval 10ms	Edit Each		2008/10/13 19:08:25

3	Pha	se 3	00V	LOCAL	QUI	T	
	W700		OUTPUT	SETTING	50 (a	10 C C C C C C C C C C C C C C C C C C C	Setting
⊕1	Vac	=	0.0V	F =	60.0	Hz	OUTPUT:
€2	Vac	Ħ	0.0V	F =	60.0	Hz	More Setting
⊕ 3	Vac		0.0V	F =	60.0	Hz	Measurement
			MEASUREME	NT SETTING			Setting
	ν	VA	∣ Vac	Vdc	Vpk	VA	Waveform
₫1	1	PF	lac	ldc	lpk	CF	Viewer
	٧	Po	Vac	Vdc	Vpk	VA	62400025348500000000
₹2	ì	PF	lac	ldc	lpk	CF	Limitation
	٧	Po	Vac	Vdc	Vpk	VA	Output
₫3	Ì	PF	lac	ldc	lpk	CF	Mode
	V ₁₂	V ₃₁	V ₁₂	V ₃₁			
Σ	V23	Po	V ₂₃	VA			
275	urrent Range	Average Times	Isurge Delay 10ms	Isurge Interval 10ms	Edit Each		2008/10/13 19:08:48

3.3.3 Waveform Viewer

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

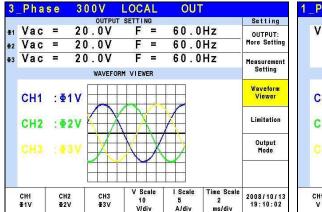
Ch1: Φ 1V, Φ 2V, Φ 3V, Φ 1I, Φ 2I, Φ 3I. **Ch2:** Φ 1V, Φ 2V, Φ 3V, Φ 1I, Φ 2I, Φ 3I. **Ch3:** Φ 1V, Φ 2V, Φ 3V, Φ 1I, Φ 2I, Φ 3I.

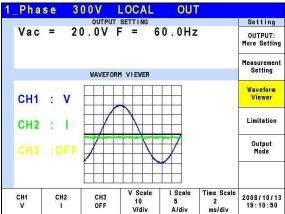
V Scale: 10, 20, 40, 80, 120V/div. **I Scale:** 5, 10, 20, 40, 60A/div.

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

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

- 1. Press CH1 at the bottom.
- 2. Turn the RPG to change to " $\Phi 1V$ " and press **ENTER**
- 3. Press CH2 at the bottom.
- 4. Turn the RPG to change to " Φ 2V" and press **ENTER**.
- 5. Press CH3 at the bottom.
- 6. Turn the RPG to change to " Φ 3V" 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 Limit of AC Source 1-phase/3-phase output mode is set separately. For instance, the Vac Limit setting will apply the settings of the 1-phase mode when changing it from the 3-phase mode.

3.3.4.1 Vac Limit

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

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

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

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

3	_Pha	s e	300V	LOCAL	QUI	T	
			OUTP				Setting
	Vac	=	0.0V	•	60.0	Hz	OUTPUT:
€2	Vac	=	0.0V	F =		Hz	More Setting
⊕ 3	Vac	=	0.0V	F =	60.0	Hz	Measurement
			LII	1ITATION			Setting
	Vac	=_3	<u> 300.0</u> V	Vdc(+	+)= 42	4.2V	Waveform
⊕ 1	F	=15	600.0H	z Vdc(-	-) =	0.0V	Viewer
	Vac		200 03/	Vdc(+	. \ = 12	4 21/	Limitation
₩2				•	•		
	F	=15	500.0H	z Vdc(-	-) =	0.0V	Output Mode
	Vac	= 3	300.0V	Vdc(+	-)= 42	4.2V	11000
₩3	F			z Vdc(-	,		
	•		, 0 0 . 011	40(,		
	Edit				Set to	Set to	2008/11/20 18:56:46
	Each				Maximum	Minimum	10:06:46

1.	_Pha	s e	3001		LOCAL	_	QUI	T	
					SETTING				Setting
	Vac	=	0.0	V	= =	60	.0Hz		OUTPUT: More Setting
				LIMIT	ATION				Measurement Setting
	Vac F		<u>300.0</u> 500.0		,	•			Waveform Viewer
	•		000.0	112	*40(, ,		0.01	Limitation
									Output Mode
						- 1 -	Set to aximum	Set to Minimum	2008/11/20 19:01:00

The setting of Vac Limit is not restricted by range; however, the Vac in MAIN PAGE is restricted by the range. For example, assuming the range is 150V, though Vac Limit = 300V the maximum Vac setting is 150V.

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

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

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

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

3	_Pha:	s e	300V	LOCAL	QUI	T	
				SETTING			Setting
	Vac			F =			OUTPUT:
			0.07			Hz	More Setting
3	Vac	=	0.0V	F =	60.0	Hz	Measurement
			LIMI	TATION			Setting
	Vac	= ;	300.0V	Vdc(+) = 42	4 . 2V	Waveform
1			500.0Hz	-	-		Viewer
	•			,	,	• . • •	
	Vac	= ;	300.0V	Vdc(+) = 42	4.2V	Limitation
2	F	=1 (500.0Hz	Vdc(-) =	0.0V	Output
					`		Mode
3	vac	= ,	300.0V	vac(+) = 42	4 . 2 V	
	F	=1 (500.0Hz	Vdc(-) =	0.0V	
	Edit				Set to	Set to	2008/11/20
	Each				Maximum	Minimum	19:02:18

1.	_Pha	s e	300V	LOCAL	QUI	Τ	
				IT SETTING			Setting
	Vac	=	0.0V	F =	60.0Hz		OUTPUT: More Setting
			LIM	IITATION			Measurement Setting
	Vac F		300.0V 500.0H				Waveform Viewer
	•	_'	300.011	z vact	,-	0.01	Limitation
							Output Mode
					Set to Maximum	Set to Minimum	2008/11/20 19:01:48

(i) NOTICE

- 1. The setting of Vdc Limit is not restricted by range; however, the Vdc in MAIN PAGE is restricted by the range. For example, assuming the range is 150V, though Vdc Limit=424.2V the maximum Vdc setting is 212.1V.
- 2. It is better to restrict the Vdc value when the output contains it. It may cause damage if the output polarity is reversed especially the load polarity.

3.4 CONFIG Function Key

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

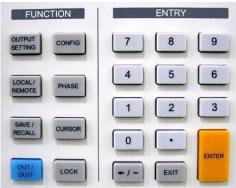
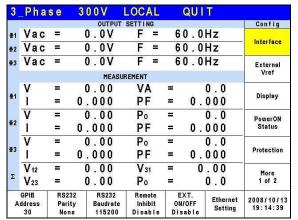
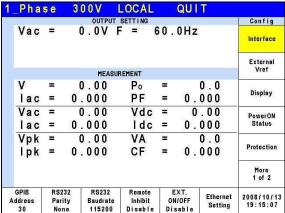


Figure 3-5 FUNCTION Keys





3.4.1 Interface

3.4.1.1 GPIB Address, RS-232C Parity/Baudrate

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

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

3	_Pha	s e	3	0 0 V	- 1	LOC	AL		QUI	T	
	A1747 A			001	PUT	SETTII	NG		1/2		Config
⊕1	Vac	=	- (0.0	٧	F	=	6	0.0	Hz	Interface
₽2	Vac	=	- (0.0	٧	F	=	6	0.0	Hz	Interrace
₽3	Vac	=	(0.0	V	F	=	6	0.0	Hz	External
				М	EASUF	REMENT					Vref
	γ	=	(0.0	0	V	4			0.0	422 20
₽1	Ì	=	0	.00	0	PΙ		=	0.	000	Display
274	٧	=	(0.0	0	Po	i	=		0.0	PowerON
₽2	1	=	0	.00	0	PI	=	=	0.	000	Status
	٧		(0.0	0	Po	E	=		0.0	
₽3	Ì	=	0	.00	0	PI		=	0.	000	Protection
	V 12		- (0.0	0	V ₃	11	=	0	.00	More
Σ	V23	=	ĺ	0.0	0	Po	į.	=		0.0	1 of 2
	GPIB ddress 30	RS2 Pari No	ty	RS2 Baud 115:	rate	Rem Inhi Disa	bit	ON	XT. I/OFF	Ethernet Setting	2008/10/13 19:16:15

1	Pha	s e	3 (0 0 V	LOCAL		QUI	T	
	AND DESCRIPTION OF THE PERSON			OUTPU			Total Park Co.		Config
	Vac	=	C) . 0 V	F =	60.	0Hz		Interface
				MEX	SUREMENT				External Vref
	M	1022	,			120		0 0	
	٧	=	53	0.00	Po	=		0.0	Display
	lac	=	0.	000	PF	=	0.	000	Dioping
	Vac	=	C	0.00	Vdc	=	0	.00	PowerON
	lac	=	0.	000	ldc	=	0.	000	Status
	Vpk	=	C	00.0	VA	=		0.0	
	lpk	=	0.	000	CF	=	0.	000	Protection
									More 1 of 2
	GPIB	RS2	5000	RS232 Baudrat	Remote		XT.	Ethernet	2008/10/13
A	ddress 30	Pari No:		115200			/OFF able	Setting	19:15:39

The address range is from 1 to 30.

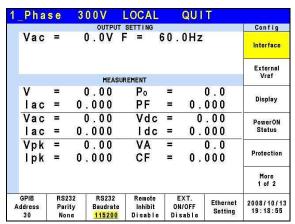
The AC Source uses the RS-232C bus to provide remote operation. Follow the steps below to set the communication protocol. Set Parity=None and Baudrate =115200 in 1_Phase Mode /3 Phase Mode as described below:

- 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	s e	300V	LOCAL	QU	ΙΤ	
	5100000		OUTP	UT SETTING	54 SA S		Config
⊕1	Vac	=	0.07	F =	60.0)Hz	Interface
€2	Vac	=	0.07	F =	60.0)Hz	Interrace
∓ 3	Vac	=	0.0V	F =	60.0)Hz	External
			ME	ASUREMENT			Vref
	٧	=	0.00	VA		0.0	672 60
₫1	Ì	=	0.000	PF	= 0.	000	Display
	٧	=	0.00	Po		0.0	PowerON
₽2	1	=	0.000	PF	= 0.	000	Status
	٧	=	0.00	Po		0.0	
₽3	Ĵ	=	0.000	PF	= 0.	000	Protection
	V ₁₂	=	0.00	V ₃₁	= (0.00	More
Σ	V23	=	0.00	Po	=	0.0	1 of 2
A	GPIB ddress 30	RS2 Pari	ty Baudra	te Inhibit	EXT. ON/OFF Disable	Ethernet Setting	2008/10/13 19:17:27

3	Pha	s e	300V	LOCAL	QUI	T	
	40.707.0		OUTPU	T SETTING	10 10 10		Config
⊕1	Vac	=	0.0V	F =	60.0	Hz	5 4 4
€2	Vac	=	0.07	F =	60.0	Hz	Interface
∓ 3	Vac		0.0V	F =	60.0	Hz	External
			MEAS	BUREMENT			Vref
	٧	=	0.00	VA	=	0.0	9570 90
⊉ 1	Ì	=	0.000	PF	= 0.	000	Display
	٧	=	0.00	Po	=	0.0	PowerON
₽2	ì	=	0.000	PF	= 0.	000	Status
	٧	=	0.00	Po	=	0.0	
₽3	j	=	0.000	PF	= 0.	000	Protection
	V 12	=	0.00	V ₃₁	= 0	.00	More
Σ	V23	=	0.00	Po	=	0.0	1 of 2
Α	GPIB ddress 30	RS2 Pari Nor	ty Baudrate		EXT. ON/OFF Disable	Ethernet Setting	2008/10/13 19:18:19

1 _	Pha	s e	3 (0 O V	LOCA	L	QUI	T	
	101				T SETTING		Total Parket		Config
	Vac	=	() . OV	F =	60.	0Hz		Interface
				00000					External Vref
					SUREMENT				12,000,000
	V	=	(00.0	Po	=		0.0	20.00
	lac	=	0.	000	PF	=	0.	000	Display
3	Vac	=	(0.00	Vd	c =	0	.00	PowerON
	lac	=	0.	000	١d	c =	0.	000	Status
-	Vpk	=	(00.0	VA	=		0.0	
	lpk	=	0.	000	CF	=	0.	000	Protection
									More 1 of 2
Add	PIB iress 30	RS2 Pari	ity	RS232 Baudrat 11520	e Inhibi	it ON	XT. I/OFF	Ethernet Setting	2008/10/13 19:18:45



(i) NOTICE

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

3.4.1.2 Remote Inhibit, EXT. ON/OFF

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

(3_Phase Mode/1_Phase Mode). There are two remote inhibit output states: Enable and Disable.

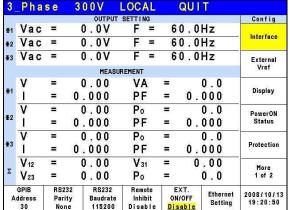
Remote Inhibit: When the Remote Inhibit is enabled on the AC Source and the Remote Inhibit signal is LOW, the AC Source will disable the output. The AC Source holds the ouput disabled even when the Remote Inhibit signal turns to HIGH. In order to re-enable the output, the user must press **OUT/QUIT**.

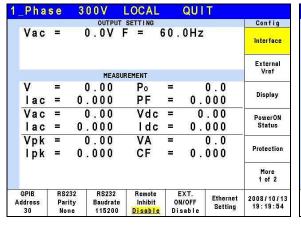
EXT. ON/OFF: When the EXT. ON/OFF is enabled on the AC Source and the EXT. ON/OFF signal is LOW the AC Source will disable the output. The AC Source will re-enable the output when the EXT. ON/OFF signal turns to HIGH.

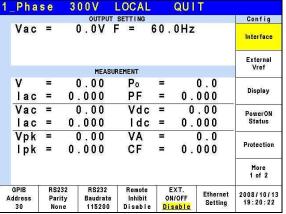
The procedure for setting Remote Inhibit/EXT. ON/OFF to disable in1_Phase Mode /3_Phase Mode is described below.

- 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	300V	LOC	AL	QUIT		
	#100 pp.		ou	PUT SETTI	NG			Config
₫1	Vac	=	0.0	V F	= 6	0.0Hz	<u>.</u>	12 10 100
€2	Vac	=	0.0	V F	= 6	0.0Hz	2	Interface
⊉ 3	Vac	=	0.0	V F	= 6	0.0Hz	2	External
			М	EASUREMENT	į.			Vref
	٧	=	0.0	0 V	A =	0.	. 0	
₫1	Ì	=	0.00	0 PI	F =	0.00	0 (Display
	٧	=	0.0	0 Pa	o =	0.	. 0	PowerON
₹2	ì	=	0.00	0 PI	F =	0.00	0 (Status
	٧	=	0.0	0 Pc	o =	0.	. 0	
₽3	j	=	0.00	0 PI	F =	0.00	0 (Protection
	V 12	Ħ	0.0	0 V:	31 =	0.0	0 (More
Σ	V23	=	0.0	0 Pa	o =	0.	. 0	1 of 2
A	GPIB ddress 30	RS2 Pari Nor	ty Baud	rate Inh	ibit ON	OFF -	thernet Setting	2008/10/13 19:20:41







① NOTICE

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

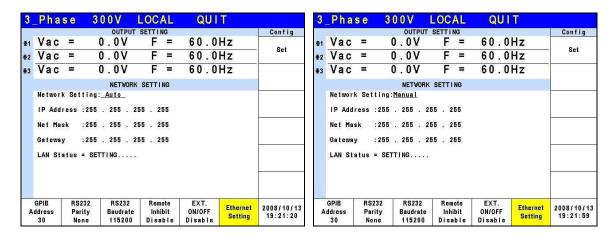
3.4.1.3 Ethernet Setting

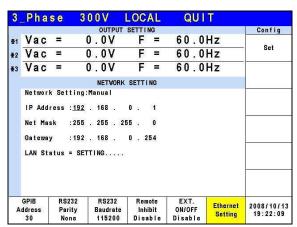
The AC Source can be operated remotely through a network once the Ethernet Settings are complete.

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.





1_Pha			LOCAL SETTING = 6	QUI 0.0Hz		Config Set	1_Pha			LOCAL SETTING = 6	QU I 0 . 0Hz		Config Set
		NETWORK	SETTING				1		NETWORK	SETTING			
Ne two r l	Setting:	Auto					Ne t wo	k Setti	ng: <u>Manual</u>				
IP Addi	ress : 255	. 255 . 25	55 . 255				IP Add	lress :2	55 . 255 . 2	55 . 255			
Net Mas	sk :255	. 255 . 25	55 . 255				Net Ma	ısk :2	55 . 255 . 2	55 . 255			
Gateway	:255	. 255 . 25	55 . 255				Gatewa	y :2	55 . 255 . 2	55 . 255			
LAN Sta	atus = SET	TING					LAN S	atus =	SETTING				
GPIB Address 30	RS232 Parity None	RS232 Baudrate 115200	Remote Inhibit Disable	EXT. ON/OFF Disable	Ethernet Setting	2008/10/13 19:22:32	GPIB Address 30	RS232 Parity None	/ Baudrate	Remote Inhibit Disable	EXT. ON/OFF Disable	Ethernet Setting	2008/10/13 19:22:44

l_Pha	se 3	00V	LOCAL	QUI	T	
		OUTPUT	SETTING	VALUE DESCRIPTION		Config
Vac	=	0.0V I	= 6	0.0Hz		Set
			SETTING			
Ne t wo r	k Setting	:Manual				
IP Add	ress : <u>192</u>	. 168 .	0.1			
Net Ma	sk :255	. 255 . 2	55 . 0			
Gatewa	y :192	. 168 .	0 . 254			
LAN St	atus = SE	TTING				
GPIB Address 30	RS232 Parity None	RS232 Baudrate 115200	Remote Inhibit Disable	EXT. ON/OFF Disable	Ethernet Setting	2008/10/1 19:22:54

3.4.2 External Vref

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

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

```
Vout (dc) = Vref (dc) / 10 Vdc × 424.2 Vdc (range 300V)

Vout (dc) = Vref (dc) / 10 Vdc × 212.1 Vdc (range150V)

or

Vout (ac) = Vref (ac) / 7.072 Vac × 300 Vac (range300V)

Vout (ac) = Vref (ac) / 7.072 Vac × 150 Vac (range150V)
```

Ex (1): Set Vout to 100Vdc:

- 1. When selecting range 300V in SETUP function, the applied external output voltage is V = 2.357Vdc, Vout = 100Vdc.
- 2. When selecting range 150V in SETUP function, the applied external output voltage is V = 4.715Vdc, Vout = 100Vdc.

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

- 1. When selecting range 300V in SETUP function, the applied external output voltage is V = 2.357Vac, Vout = 100Vac.
- 2. When selecting range 150V in SETUP function, the applied external output voltage is V = 4.715 Vac, V = 100 Vac.

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

Vout (ac) =
$$| \text{Vref (dc)} | / 10 \text{ Vdc} \times 300 \text{Vac (range 300V)}$$

Vout (ac) = $| \text{Vref (dc)} | / 10 \text{ Vdc} \times 150 \text{Vac (range 150V)}$

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

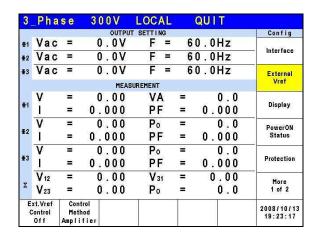
- 1. When selecting range 300V in SETUP function, the applied external output voltage is V = 3.333Vdc (or -3.333Vdc), Vout = 100Vac.
- 2. When selecting range 150V in SETUP function, the applied external output voltage is V= 6.667Vdc (or -6.667Vdc), Vout = 100Vac.

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

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

3	Pha	se	300V	LOCAL		QUIT	
			OUTPU	T SETTING	-	100	Config
 1	Vac	=	0.07	F =	6	0.0Hz	16 10 100
E 2	Vac	=	0.0V	F =	6	0.0Hz	- Interface
₽3	Vac	=	0.0V	F =	6	0.0Hz	External
			MEAS	SUREMENT			Vref
	٧	=	0.00	VA		0.0	
₽1	Ì	=	0.000	PF	=	0.000	Display
	٧	=	0.00	Po	=	0.0	PowerON
₽2	1	=	0.000	PF	=	0.000	Status
	٧	=	0.00	Po	=	0.0	
₽3	Ĩ	=	0.000	PF	=	0.000	Protection
	V 12	=	0.00	V ₃₁	=	0.00	More
Σ	V23	=	0.00	Po	=	0.0	1 of 2
	xt.Vref	Cont					2008/10/13
225	Of f	Ampli	2010				19:23:48

3	_Pna	s e	3000	LOCAL	Q	UII	
			OUTPU	T SETTING			Config
⊕1	Vac	=	0.0V	F =	60	.0Hz	Interface
⊕2	Vac	=	0.0V	F =	60	.0Hz	interrace
⊕ 3	Vac	=	0.0V	F =	60	.0Hz	External
			MEAS	UREMENT			Vref
	٧	=	0.00	VA	=	0.0	Di1
⊕1	I	=	0.000	PF	= (0.000	Display
	٧	=	0.00	Po	=	0.0	PowerON
₹2	1	=	0.000	PF	= (0.000	Status
	٧	=	0.00	Po	=	0.0	
Φ 3	1	=	0.000	PF	= (0.000	Protection
	V 12	=	0.00	V ₃₁	=	0.00	More
Σ	V_{23}	=	0.00	Po	=	0.0	1 of 2
	xt.Vref	Cont					2008/10/13
١,	ontrol Of f	Meth Ampli					19:23:48



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

☞ WARNING

- 1. When Control Method = Amplifier and the Vref frequency exceeds 1000Hz, it could damage the AC Source. This formula should be followed exactly when F>1000Hz it has to be Vref (pk-pk, V) × F (Vref, Hz) < 10000 VHz.
- 2. The output may be distorted due to the bandwidth restriction of AC Source, especially when the external V reference has too many high frequency components.

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	300V	LOCAL		QUIT	
	407.07		OUTP	JT SETTING			Config
⊉ 1	Vac	=	0.0V	F =	6	0.0Hz	19 50 1991
E 2	Vac	=	0.07	F =	6	0.0Hz	- Interface
₽3	Vac	=	0.0V	F =	6	0.0Hz	External
			MEA	SUREMENT			Vref
	٧	=	0.00	VA	=	0.0	20X - 2
₽1	Ì	=	0.000	PF	=	0.000	Display
	٧	=	0.00	Po	=	0.0	PowerON
₽2	1	=	0.000	PF	=	0.000	Status
	V	=	0.00	Po	=	0.0	
₽3	j	=	0.000	PF	=	0.000	Protection
	V ₁₂	=	0.00	V ₃₁	=	0.00	More
Σ	V23	=	0.00	Po	=	0.0	1 of 2
	Style Default	Backi Med i		er			2008/10/13 19:25:03

1_Pha	se	300V	LOCAL		QUIT	
		OUTP	UT SETTING	2722272	Interview.	Config
Vac	=	0.0V	F =	60.	0Hz	Interface
						External Vref
		ME	SUREMENT			1101
V	=	0.00	Po	=	0.0	1500 T- 20
lac	=	0.000	PF	=	0.000	Display
Vac	=	0.00	Vdc	; =	0.00	PowerON
lac	=	0.000	ldo	; =	0.000	Status
Vpk	=	0.00	VA	=	0.0	
lpk	=	0.000	CF	=	0.000	Protection
						More 1 of 2
Style Default	Back Med		ter			2008/10/13 19:24:39

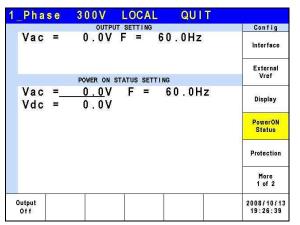
3.4.4 Power ON Status

Users can set the output state of AC Source during power on using the Power ON Status in the CONFIG function (3_Phase Mode/1_Phase Mode). Once it is set users should save the data before power off. With the output set to Off, the 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 powered on.

3	Pha	s e	300V	LOCAL	QUIT	
			OUTPU	T SETTING		Config
● 1	Vac	=	0.0V	F =	60.0Hz	19 0/ 1981
€2	Vac	=	0.07	F =	60.0Hz	Interface
₽3	Vac	=	0.0V	F =	60.0Hz	External
			POWER ON S	STATUS SETTI	NG	Vref
	Vac	=	<u>0.0</u> V	F =	60.0Hz	Display
E 1	Vdc	=	0.0V			V-300-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-
	Vac		0.0V	F =	60.0Hz	PowerON Status
2	Vdc	=	0.0V			Protection
	Vac	=	0.0V	F =	60.0Hz	2)
3	Vdc	=	0.0V			More 1 of 2
C	Output Of f	Edit Each				2008/10/13 19:25:31

3	Phas	s e	300V	LOCAL	QUIT	
			OUTPU	T SETTING		Config
 1	Vac	=	0.0V	F =	60.0Hz	19 20 1981
₽2	Vac	=	0.0V	F =	60.0Hz	- Interface
₽3	Vac		0.0V	F =	60.0Hz	External
			POWER ON S	STATUS SETTI	NG	Vref
	Vac	=	0.0V	F =	60.0Hz	Display
⊉1	Vdc	=	0.0V			
	Vac		0.0V	F =	60.0Hz	PowerON Status
₽2	Vdc	=	0.0V			Protection
	Vac	=	0.0V	F =	60.0Hz	***************************************
₽3	Vdc	=	0.0V			More 1 of 2
C	Output Of f	Edit Each				2008/10/13 19:25:52

3	Pha	s e	300V	LOCAL	QUIT	
	error.		OUTPU	T SETTING		Config
● 1	Vac	=	0.0V	F =	60.0Hz	19 20 1981
E 2	Vac	=	0.0V	F =	60.0Hz	- Interface
₽3	Vac	=	0.0V	F =	60.0Hz	External
			POWER ON S	TATUS SETTI	NG	Vref
	Vac	=	0.0V	F =	60.0Hz	Display
E 1	Vdc	=	0.0V			(7.409/E0000/E001
	Vac		0.0V	F =	60.0Hz	PowerON Status
2	Vdc	=	0.0V			Protection
	Vac	=	0.0V	F =	60.0Hz	
3	Vdc	=	0.0V	~~		More 1 of 2
(otput Of f	Edit Each				2008/10/13



3.4.5 Protection

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

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

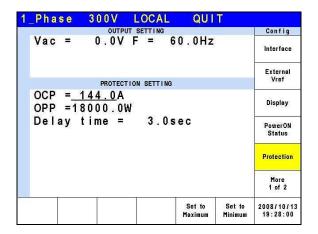
Following shows the procedure of setting the current limit = 48A (32A for 61511), power limit = 6000W (4000W for 61511), delay time for trigger current protection = 3 sec. for 61512 in 3_Phase Mode.

- 1. Move the cursor to "OCP = " command line.
- 2. Press 4, 8 and ENTER to change the value to "48.0".
- 3. Move the cursor to "OPP = " command line.
- 4. Press **6**, **0**, **0**, **0**, **ENTER** to change the value to "6000.0".
- 5. Move the cursor to "Delay time =" command line.
- 6. Press **3**, **ENTER** to change the value to "3.0".

3	Phase	300V	LOCAL	QUI	T	
		OUTPU	TSETTING	par par side	0434	Config
₫1	Vac =	0.0V	F =	60.0	Hz	14 14 141
⊕ 2	Vac =	0.07	F =	60.0	Hz	Interface
⊕ 3	Vac =	0.0V	F =	60.0	Hz	External
		PROTECT	ION SETTING			Vref
	OCP =_	<u>48.0</u> A	OPP	=6000	. OW	Display
⊕1	Delay	time =	3.0s	ec		VIV. EXCENSE A ELLE
	OCP =	48.0A	OPP	=6000	. 0W	PowerON Status
₽2	Delay	time =	3.0s	ec		Protection
	OCP =	48.0A	OPP	=6000	n₩	
₽ 3	Delay	time =	3.0s		. • • •	More 1 of 2
	Edit Each			Set to Maximum	Set to Minimum	2008/10/13 19:27:29

Following shows the procedure of setting the current limit = 144A (96A for 61511), power limit = 18000W (12000W for 61511), delay time for trigger current protection = 3 sec. for 61512 in 1_Phase Mode.

- 1. Move the cursor to "OCP = " command line.
- 2. Press 1, 4, 4 and ENTER to change the value to "144.0".
- 3. Move the cursor to "OPP = " command line.
- 4. Press 1,8,0,0,0,ENTER to change the value to "18000.0".
- 5. The cursor moves to "Delay time = " command line automatically.
- 6. Press 3, **ENTER** to change the value to "3.0".



- 1. When "OCP = 0.0 A", it means the limit of output current equals to the specification limit.
- 2. The setting of the delay time for trigger current protection is only valid when the current is within the specification. It does not work when the output exceeds the specification. The resolution is 0.1s.

(i) NOTICE

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

3.4.6 Others

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

Output Relay: Depend and Always ON.

Buzzer: on and off.

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

3	Pha	se	3	00V	LOC	AL		QUI	T	
	(2702)			OUTPUT	SETTI	NG	24	74 44	100000	Config
₫1	Vac	=		0.0V	F	=	6	0.0	Hz	200
€2	Vac			0.0V	F	=	6	0.0	Hz	Others
₫3	Vac	=		0.0V	F	=	6	0.0	Hz	Calibration
				MEAS	UREMENT	ž.				Cambration
	٧	=		0.00	V	Ą	=		0.0	System
⊕1	Ì	=	0	.000	P	F	=	0.	000	Information
	٧	=		0.00	Po)	=		0.0	Factory
€2	Ì	=	0	.000	P	F	=	0.	000	Default
	γ	=		0.00	Po)	=		0.0	
₫3	Ì	=	0	.000	P	F	=	0.	000	
	V 12	=		0.00	٧:	31	=	0	.00	More
Σ	V23	=		0.00	Po)	=		0.0	2 of 2
	Output Relay epend.	Buz:	809.00	Date/Time	e e					2008/10/13 19:28:34

1_Pha	se	300V	LOCAL		QUIT	
14 (AC) (AC)		OUT	PUT SETTING	1949/14	(end/del/del	Config
Vac	=	0.01	/ F = (50.	0Hz	Others
		MI	EASUREMENT			Calibration
V		0.00) Po	=	0.0	
lac	=	0.000		=	0.000	System Information
Vac	=	0.00) Vdc	=	0.00	Factory
lac	=	0.000) Idc	=	0.000	Default
Vpk	=	0.00) VA	=	0.0	
lpk		0.000) CF	=	0.000	
						More 2 of 2
Output Relay Depend .	Buz:		[ime			2008/10/13 19:28:58

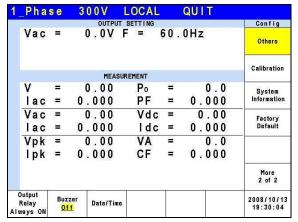
The output circuit on the AC Source has a relay to connect to the load. When the output relay is "Always ON", it indicates the output relay is closed (connected) even if the AC

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.) Output relay can be set in the SETUP function.

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

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

3	Pha	s e	300V	LOCAL		QUIT	
			OUTP	UT SETTING			Config
⊕1	Vac	=	0.0V	F =	6	0.0Hz	10000
€2	Vac	=	0.07	F =	6	0.0Hz	- Others
⊕ 3	Vac	=	0.0V	F =	6	0.0Hz	Calibration
			MEA	ASUREMENT			Cambration
	٧	=	0.00	VA	=	0.0	System
⊕1	j	=	0.000	PF	=	0.000	Information
	٧	Ħ	0.00	Po	=	0.0	Factory
€2	Ì	=	0.000	PF	=	0.000	Default
	٧	=	0.00	Po	=	0.0	
⊕ 3	Ì	=	0.000	PF	=	0.000	
	V 12	=	0.00	V 31	=	0.00	More
Σ	V23	=	0.00	Po	=	0.0	2 of 2
	Dutput Relay ways ON	Buz:	- Date(Ti	me			2008/10/13



(i) NOTICE

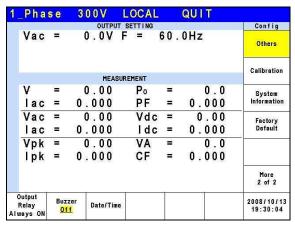
Check if the AC Source has voltage output before powering it off. To ensure the safety of hardware, it is prohibited to power off the AC Source in Output state.

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

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

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

3	_Pha	s e	300V	LOCAL		QUIT	
	210000		OUTP	UT SETTING	24	12 1000-000	Config
₫1	Vac	=	0.07	F =	6	0.0Hz	Others
€2	Vac		0.0V	F =	6	0.0Hz	Uthers
⊕ 3	Vac	=	0.0V	F =	6	0.0Hz	Calibration
			MEA	SUREMENT			Calibration
	٧		0.00	VA	=	0.0	System
₫1	ì	=	0.000	PF	=	0.000	Information
	٧	=	0.00	Po	=	0.0	Factory
₹2	1	=	0.000	PF	=	0.000	Default
	٧	=	0.00	Po	=	0.0	
₫3	Ì	=	0.000	PF	=	0.000	
	V 12	=	0.00	V ₃₁	=	0.00	More
Σ	V23	=	0.00	Po	=	0.0	2 of 2
	Output Relay ways ON	Buz:		пе			2008/10/13 19:31:07



At last, set the time and date of 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**.

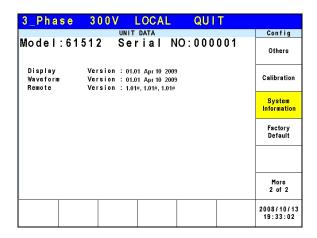
3	Pha	s e	300	V	LOCAL		QUIT		1_Pha	s e	300V	LOCAL		QUIT	
	60707 A		0	UTPUT	SETTING			Config			OUTPU	T SETTING		(managed to the	Config
⊕1	SC 11400 (SA)	Ξ	0.0		F =	2202	0.0Hz	Year 2008	Vac	=	0.0V	F =	60.	0Hz	Year 2008
€2	Vac	=	0.0		F =	7723	0.0Hz	2000							2000
⊕ 3	Vac	=	0.0	V	F =	6	0.0Hz	Month 10							Month
				MEASU	REMENT			10			MEAS	SUREMENT			10
⊕1	٧	=	0.0	0 0	VA	=	0.0	Day	V	=	0.00	Po	=	0.0	Day
ΨI	1	=	0.00	0 0	PF	=	0.000	13	lac	=	0.000	PF	=	0.000	13
€2	٧	=	0.0		Po	=	0.0	Hour	Vac	=	0.00	Vdc	=	0.00	Hour
42	1	=	0.00	0 0	PF	=	0.000	19	lac	=	0.000	ldc	=	0.000	19
⊕ 3	V	-	0.0	0 0	Po	1000	0.0	Minute	Vpk		0.00	VA	=	0.0	Minute
9 3	1	=	0.00	0 0	PF	=	0.000	32	lpk	=	0.000	CF	=	0.000	32
	V 12	=	0.0	0 0	V 31	=	0.00	Second							Second
Σ	V23	=	0.0	0 0	Po	=	0.0	4							24
	Output Relay vays ON	Buzz Of		e/Time				2008/10/13 19:32:08	Output Relay Always ON	Buz: Of		e			2008/10/13 19:32:27

3.4.7 Calibration

For detail calibration procedure please refer to the description in Chapter 4.

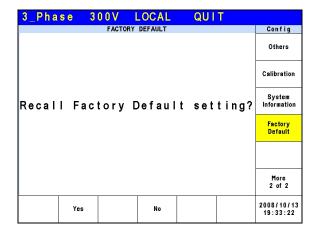
3.4.8 System Information

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



3.4.9 **Factory Default**

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



3.5 **PHASE Function Key**

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

3.5.1 3 Phase Mode

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

Phase Suuv Local Quii		Phase Sunv Local Quit
NUMBER OF OUTPUT PHASE SELECTION	Phase	NUMBER OF OUTPUT PHASE SELECTION
	Single 1_PHASE	Warning! You want to change to
The output is in Single Phase		Three Phase (3_Phase) mode.
(1_Phase) mode now.	Three 3_PHASE	It is necessary to check if the output is connected
Select a mode		properly, otherwise the AC source and/or UUT might be damaged.
		Press <yes> to change. Press <no> to exit.</no></yes>
	2008/10/13 19:34:01	

Yes

No

2008/10/13 19:34:37

QUIT

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

?_Phase 300V LOCAL QUIT		?_Phase 300V LOCAL QUIT	
NUMBER OF OUTPUT PHASE SELECTION	Phase	NUMBER OF OUTPUT PHASE SELECTION	Phase
	Single 1_PHASE	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>	
	2008/10/13 19:35:15		2008/10/13 19:35:34

(i) 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).

3.6 CURSOR Function Key

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

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

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

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

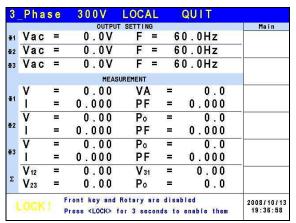
3	Pha	s e	300	V	LOC	AL.	QU	ΙŤ		
	and the same of			OUTPUT	SETTIN	IG		WW. 27.00		Main
⊕ 1	Vac	=	000.	<u>0</u> V	F	= 1	60.	OH:	Z	OUTPUT:
€2	Vac	=	0.	0 V	F	= 1	60.	0 H	z	More Setting
₽ 3	Vac	=	0.	0 V	F	= 1	60.	0 H	Z	Measurement
				MEAS	UREMENT					Setting
	٧	=	0.	00	٧A	\ =		0	. 0	Waveform
1	Ì	=	0.0	00	PF	: =	0	. 0	0 0	Viewer
	٧	=	0.	00	Po	=		0	. 0	CANDON NO. 1000 CO.
₽2	Ì	=	0.0	00	PF	-	0	. 0	0 0	Limitation
	V	=	0.	00	Po	=		0	. 0	Output
₽3	Ì	=	0.0	00	PF	: =	0	. 0	0 0	Mode
	V 12	=	0.	00	V ₃	1 =	- 1	0.	0 0	Measurement
Σ	V23	=	0.	00	Po	=		0	. 0	To Page2
į	Recall CH1		call H2	Recall CH3	Rec	3559 E	Recall CH5		More 1 of 2	2008/10/13

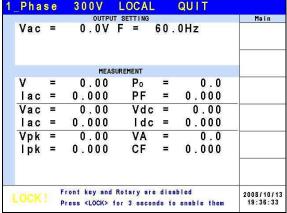
1	Pha	s e	31	0 0 V	LOCAL		QUI	T			
					IT SETTING				Main		
	Vac	=	000	0 . <u>0</u> V	F =	60.	0Hz		OUTPUT: More Setting		
									Measurement		
				MEA	BUREMENT				Setting		
	٧	=	(0.00	P۰	=		0.0	Waveform		
	lac	=	0	.000	PF	=	0.	000	Viewer		
	Vac	=	(0.00	Vdc	; =	0	.00			
	lac	=	0	.000	ldo	; =	0.	000	Limitation		
	Vpk	=	(0.00	VA	=		0.0	Output		
	lpk	=	0	.000	CF	=	0.	000	Mode		
1	Recall CH1		call H2	Recall CH3	Recall CH4		Recall CH5	More 1 of 2	2008/10/13 19:36:19		

3.7 LOCK Function Key

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

Press this key to lock all functions on the panel and making all keys invalid. Press **LOCK** for $3\sim3.5$ seconds to unlock it.





3.8 **OUTPUT Function Key**

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

3.9 LOCAL/REMOTE Function Key

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

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

3	Pha	s e	300V	REMOTE	QUIT	
	(a) (b) (b)		OUTPU	T SETTING	10 (a	Main
⊉ 1	Vac	=	0.0V	F =	60.0Hz	
E 2	Vac	=	0.0V	F =	60.0Hz	
₽3	Vac	=	0.0V	F =	60.0Hz	
			MEAS	BUREMENT		
	٧	=	0.00	Po :	= 0.0	
₫1	Ì	=	0.000	PF :	= 0.000	
	٧	=	0.00	Po :	= 0.0	
₽2	1	=	0.000	PF :	= 0.000	
	٧	=	0.00	Po :	= 0.0	
₽3	Ì	=	0.000	PF :	= 0.000	
	V 12	=	0.00	V31 :	= 0.00	
Σ	V ₂₃	=	0.00	Po :	= 0.0	
						2008/10/1:

3.10 SAVE/RECALL Function Key

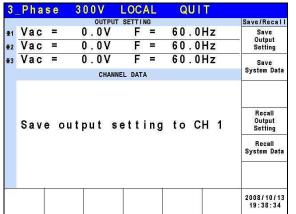
The AC Source has two modes for users to save and recall the output setting or system information as described in section 3.10.1 and 3.10.2. Press **SAVE/RECALL** function key in Figure 3-5 to access the save and recall functions.

3.10.1 Save/Recall Output Setting

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

3	Pha	s e	300V	LOCAL	QUIT		
	447474		OUTPU	T SETTING	10.10	Save/Recal	
₽1	Vac	=	0.0V	F =	60.0Hz	Save	
E 2	Vac	=	0.07	F =	60.0Hz	Output Setting	
₽3	Vac	=	0.0V	F =	60.0Hz	Save	
			MEAS	SUREMENT		System Data	
	V	=	0.00	VA	= 0.0		
₫1	Ì	=	0.000	PF	= 0.000		
	٧	=	0.00	Po	= 0.0	Recall	
₽2	Ì	=	0.000	PF	= 0.000	Output Setting	
	V	=	0.00	Po	= 0.0	Recall	
₽ 3	Ì	=	0.000	PF	= 0.000	System Data	
	V 12	=	0.00	V ₃₁	= 0.00		
Σ	V23	=	0.00	Po	= 0.0		
						2008/10/13 19:37:34	

3	_Pha	s e	300	V	LOC	AL		QUI	Т	
	F100000			OUTP	UT SETTI	NG		10.10	200	Save/Recal
₫1	Vac	=	0.	0 V	F	=		60.0	Hz	Save
€2	Vac	=	0.	0 V	F	=		60.0	Hz	Output Setting
⊕ 3	Vac	=	0.	0 V	F	=		60.0	Hz	Save
				CHA	NNEL DAT	Α				System Data
	Vac =	0.0V	F		60.0Hz	Vdc	=	0.0V		
1	Vac =	0.0V	F	=	60.0Hz	Vdc	=	0.0V		
	Vac =	0.0V	F	=	60.0Hz	Vdc	=	0.0V		
	Vac =	0.0V	F	=	60.0Hz	Vdc	=	0.0V		Recall
2	Vac =	0.0V	F	=	60.0Hz	Vdc	=	0.0V		Output
	Vac =	0.0V	F	=	60.0Hz	Vdc	Ħ	0.0V		Setting
	Vac =	0.0V	F	-	60.0Hz	Vdc	=	0.0V		- 127
3	Vac =	0.0V	F	=	60.0Hz	Vdc	=	0.0V		Recall
	Vac =	0.0V	F	=	60.0Hz	Vdc	=	0.0V		System Data
	Vac =	0.0V	F	-	60.0Hz	Vdc	÷	0.07		
4	Vac =	0.0V	F	=	60.0Hz	Vdc	=	0.0V		
	Vac =	0.0V	F	ŧ	60.0Hz	Vdc	•	0.0V		_
S	ave to	Save to	0 8	Save CH3	to Sav				More	2008/10/13 19:38:20

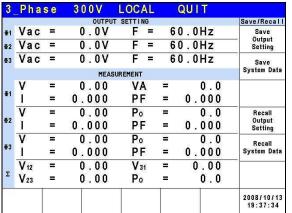


3	P	h	a s	е	30	01	1	LOC	AL		QUIT	Ī	
	and the second				- 20	01	JTPU	T SETTI	NG		50 (n. 1900)	10	Save/Recal I
₫1	V	a	С	=	0	. 0	V	F	=		60.0H	z	Save
€2	V	a	С	=	0	. 0	٧	F	=		60.0H	lz	 Output Setting
⊕ 3	V	a	С	=	0	. 0	٧	F	=		60.0H	lz	Save
						(HAN	NEL DAT	Α				System Data
	Vac	:	-	0.0V	F		= 6	0.0Hz	Vdc	Ħ	0.0V		
1	Vac	:	=	0.0V	F		= 6	0.0Hz	Vdc	=	0.0V		
	Vac	:	=	0.0V	F		= 6	0.0Hz	Vdc	=	0.0V		
	Vac	:	=	0.0V	F		= 6	0.0Hz	Vdc	=	0.0V		Recall
2	Vac	:	=	0.0V	. F	1	= 6	0.0Hz	Vdc	=	0.0V		Output
	Vac	:	=	0.0V	F		= 6	0.0Hz	Vdc	=	0.0V		Setting
	Vac	:	=	0.0V	F		- 6	0.0Hz	Vdc	=	0.0V		
3	Vac	:	=	0.0V	F		= 6	0.0Hz	Vdc	=	0.0V		Recall
	Vac	:	=	0.0V	F	8 4	= 6	0.0Hz	Vdc	=	0.0V		System Data
	Vac		=	0.0V	F		= 6	0.0Hz	Vdc	H	0.0V		T
4	Vac	3	=	0.0V	F		= 6	0.0Hz	Vdc	=	0.0V		
	Vac	:	=	0.0V	F		= 6	0.0Hz	Vdc		0.0V		-
ļ	Reca CH1			Recal CH2	500	33.33	call H3	254500	call H4			More	2008/10/13

- 1. Only the save and recall settings are set in MAIN PAGE. Other parameters are ignored.
- 2. 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 for users to save and recall system data. System data contains all parameters in the function keys such as MAIN PAGE (see 3.3) and CONFIG (see 3.4). Press **SAVE/RECALL** in MAIN PAGE (3_Phase Mode) (see 3.3) and press the LCD at the bottom to save the system data as shown below.



3	_Pha	s e	300V	LOCA	L	QUIT					
			OUTF	UT SETTING				Save/Recall			
⊕ 1	Vac	=	0.0V	' F =	= 6	0.0Hz		Save Output			
⊕2	Vac	=	0.0V	F =	= 6	0.0Hz		Setting			
⊕ 3	Vac	=	0.0V	F =	= 6	0.0Hz		Save			
			ME	ASUREMENT				System Data			
l	٧	=	0.00	VA	=	0.	0				
⊕1	ı	=	0.000	PF	=	0.00	0				
	V	=	0.00	P₀	=	0.	0	Recall			
€2	ı	=	0.000	PF	=	0.00	0	Output Setting			
	V	=	0.00	P₀	=	0.	0	Recall			
Φ 3	ı	=	0.000	PF	=	0.00	0	System Data			
	V ₁₂	=	0.00	V ₃₁	=	0.0	0				
Σ	V ₂₃	=	0.00	Po	=	0.	0				
	Save to SROUP1	Save GROU			- 1	ı	More	2008/10/13 19:40:21			

3	Pha	s e	3	00	V	LO	C/	\L	(רוטג			3	_Pha	s e	3	0 0 V	LOCAL		QUI	T	
	one s			0	UTPUT	SETT	TIN	G	24 2		70	Save/Recall					OUTPUT	SETTING				Save/Recall
₫1	Vac	=	- 1	0.(V	I		=	60	. 0 H	z	Save	⊕1	Vac	=		0.0V	F =	6	0.0	Hz	Save
€2	Vac	=		0.0	V	Ī		=	6 0	. 0 F	z	- Output Setting	€2	Vac	=		0.0V	F =	6	0.0	Hz	Output Setting
⊕ 3	Vac	=	-	0.0	V	Ī	-		60	. 0 F	z	Save	₩3	Vac	=		0.0V	F =	6	0.0	Hz	Save
	CHANNEL DATA							System Data					MEAS	UREMENT				System Data				
														٧	=		0.00	VA	=		0.0	
								⊕1	' I	=	0	.000	PF	=	0.	000						
												Recall		V	=		0.00	Р∘	=		0.0	Recall
	Sav	е	sys	t er	n d	ata	a	t o	GR	OUP	1	Output Setting	₩2	l	=	0	.000	PF	=	0.	000	Output Setting
												Recall		V	=		0.00	Po	=		0.0	Recall
												System Data	₫3	1	=	0	.000	PF	=	0.	000	System Data
														V ₁₂	=		0.00	V 31	=	0	.00	
							Σ	V ₂₃	=		0.00	Po	=		0.0							
												2008/10/13 19:40:40		Recall GROUP1		call OUP2	Recall GROUP3	Recall GROUP4			More	2008/10/13 19:40:54

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

3.11 Protection

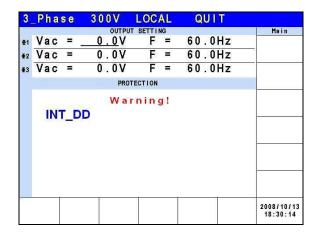
The AC Source has both software and hardware protection. When protection occurs the AC Source will stop the output and disconnect the output relay. The display shows that the source is in protection mode. To return to normal output after the protection is triggered, please address any issues and press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

The table below lists the software protection:

Protection	Description
OCP	It occurs when output current exceeds the limit or specification.
OPP	It occurs when output power exceeds specification.
OVP	It occurs when output voltage exceeds the limit of each range.
Remote - Inhibit	It executes remote inhibit.

The table below lists the hardware protection:

Protection	Description
FAN - FAIL	It occurs when the cooling fan is out of order.
INT - AD	It is the internal AD power stage protection indicating the output
IIVI - AD	voltage is over or under the specification.
INT - DD	It is the internal DD power stage protection indicating the output
INT - DD	voltage is over or under the specification.
INT - SHORT	It is the short circuit protection.
INT - LINE	It occurs when the line input voltage is over or under specification.
OTP	It occurs when the AC Source's internal temperature is too high.



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



4. Calibration

4.1 Introduction

The AC Source has a simple procedure built in to calibrate the output and measure the accuracy without opening the chassis. Users simply need to follow the procedure step by step for operation. A voltage meter, current meter and an adequate load with a + 5V DC power supply are required to perform the calibration. For the connections of these instruments please refer to Figure 4-1. There are 3 items required for calibration: output voltage, output current and external reference. However, they don't need to be calibrated at the same time. Select one of them for calibration is needed.

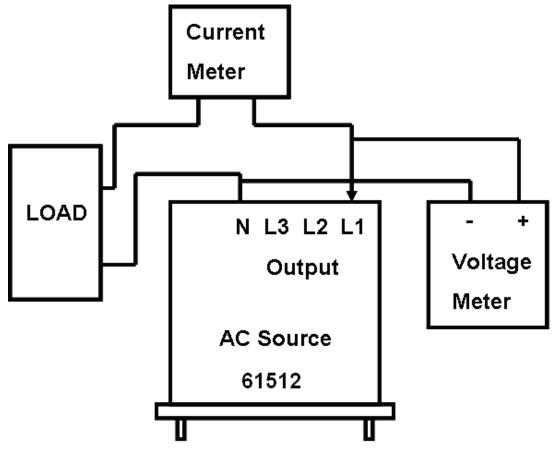


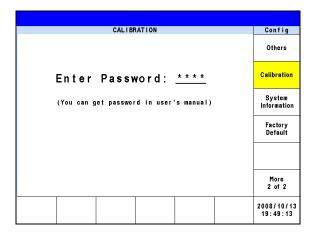
Figure 4-1

(i) NOTICE

When in the ambient temperature 25°C, it needs to warm up for 20 minutes before calibration to allow the device internal to reach the normal operation temperature and ensure the calibration is correct.

4.2 Manual Calibration

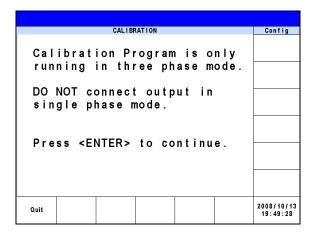
Select "Calibration" in CONFIG function (3_Phase Mode/1_Phase Mode) to input the calibration procedure. Before any calibration items appear, users have to input a password to eliminate accidental input. The password is included in the manual to ensure users read this manual before executing the calibration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



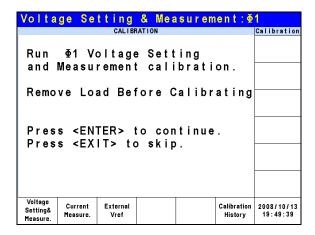
(i) NOTICE

- 1. The password for calibration procedure is "3621", press **ENTER** to confirm it.
- 2. Users should 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 runin 3-phase mode and is prohibited in 1-phase mode. Press **ENTER** to continue the calibration procedure.



Next users can select the voltage, current and external reference voltage for calibration.



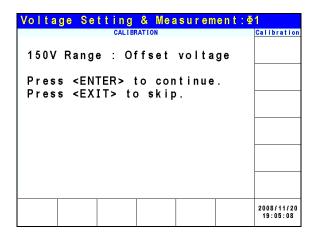
Voltage setting & Measure: This is the calibration for output voltage and measurement accuracy.

Current Measure: This is the calibration for current measurement accuracy.

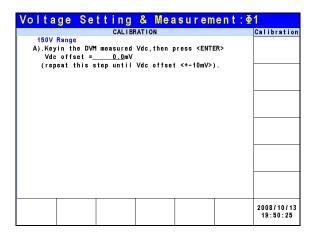
External Vref.: This is the calibration of external Vref.

4.2.1 Output Voltage and Measurement Calibration

CALIBRATION CHOICE can be input after you enter the password, see section 4.2. Press Voltage setting & Measure at the bottom to calibrate the output voltage and measurement.



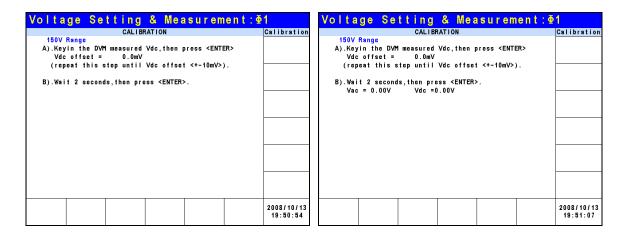
When in Voltage Setting & Measurement Calibration, the screen will ask the user if conducting the 150V Range Offset voltage calibration. Press **ENTER** to continue the offset voltage calibration and press **EXIT** to skip it to go into 150V Range Voltage Setting & Meas. calibration procedure.



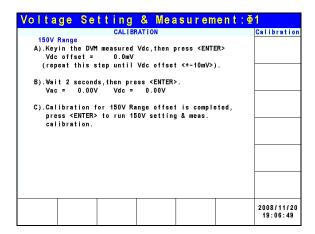
For step A in 150V Range Offset voltage calibration procedure, users should use a Digital Voltage Meter (DVM) to measure the AC Source's output DC voltage with the unit of mV and key in the measured value to LCD. Keep monitoring the DVM readings and input/output of the DC voltage repeatedly until the DC output is lower than ± 10 mV.

(i) NOTICE

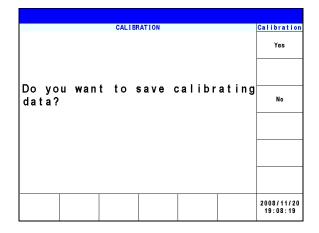
- 1. The Vdc offset can be positive or negative. Connect the positive terminal of DVM to the AC Source's Line output and the negative terminal to the AC Source's Neutral output as shown in Figure 4-1.
- 2. The load must be off for all of the steps in ACCURACY CALI under Voltage setting & Measure.



For step B in 150V Range Offset voltage calibration procedure, the display shows the difference between Vac and Vdc measured by the AC Source. It is generated by an internal component. Wait for 2 seconds and press **ENTER**, the display will show the offset voltage Vac and Vdc calculated by the AC Source at present.



For step C in 150V Range Offset voltage calibration procedure, the display shows the 150V range offset voltage calibration has been done. Press **EXIT** to go into save screen as shown below, or press **ENTER** to continue for next 150V range voltage setting and measurement calibration procedure.



In step C, press **EXIT** the display will show the save screen and press Yes on the right can save the calibrated result.

(i) NOTICE

The AC Source calibration procedure 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.

Voltage Setting & Measurement: Ф	1
CALIBRATION	Calibration
150V Range : Setting & Meas.	
Press <enter> to continue. Press <exit> to skip.</exit></enter>	
FIGSS SEATING SKIP.	
	2008/11/20 19:09:10

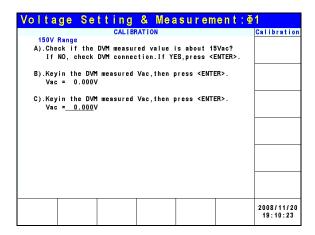
Once the 150V Range Offset voltage calibration is done, the screen will ask the user if conducting the 150V Range Setting & Meas. calibration. Press **ENTER** to continue the Setting & Meas. calibration and press **EXIT** to skip it to go into 300V Range Offset voltage calibration procedure.

Voltage Se	tting & Measu	ırement: Φ1
	CALIBRATION	Calibration
	DVM measured value is a DVM connection. If YES, p	
		2008/11/20 19:09:40

For step A in the 150V Range Setting & Meas. calibration procedure, the user should remove the load. Check if the output AC voltage measured by the DVM is about 15Vac. This is to confirm the connection is correct, and press **ENTER**.

Volta	ge Se	tting	& Mea	sure	ment:	∮1
		CALIB	RATION			Calibration
If B).Key	ck if the NO, check	DVM connect I measured	red value i ction.If Yi Vac,then p	ES, press	<enter>.</enter>	
						2008/11/20 19:10:06

For step B in the 150V Range Setting & Meas. calibration procedure, check if the DVM measured output voltage is about 120VAC. Input the correct value measured by the DVM and press **ENTER**.



For step C in the 150V Range Setting & Meas. calibration procedure, check if the DVM measured output voltage is about 150VAC. Input the correct value measured by the DVM and press **ENTER**.

Voltage Setting & Measurement: 4	1
CALIBRATION	Calibration
150V 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 = 0.000V</enter>	
C).Keyin the DVM measured Vac, then press <enter>. Vac = 0.000V</enter>	
D).Calibration for 150V Range is completed, press <enter> to run 300V Range calibration.</enter>	
	2008/11/20 19:10:45

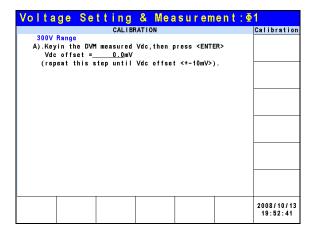
For step D in 150V Range Setting & Meas. calibration procedure, the display shows the 150V Range Setting & Meas. calibration has been done. Press **EXIT** to go into save screen as shown below, or press **ENTER** to continue for next 300V Range offset voltage calibration.

		CALIB	RATION			Calibration
						Yes
	4					
Do you data?	want	to	save	calibr	ating	No
						2008/11/20 19:08:19

In step D, press **EXIT** the display will show the save screen and press Yes on the right can save the calibrated result.

Voltage Setting & Measurement: Φ	1
CALIBRATION	Calibration
300V Range : Offset voltage	
Press <enter> to continue. Press <exit> to skip.</exit></enter>	
	2008/11/20 19:11:12

Once the 150V Range Setting & Meas. calibration is done, the screen will ask the user if conducting the 300V Range Offset voltage calibration. Press **ENTER** to continue the Offset voltage calibration and press **EXIT** to skip it to go into 300V Range Setting & Meas. calibration.



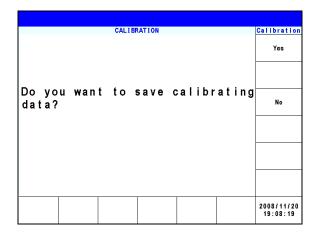
For step A in the 300V range Offset voltage calibration procedure, users should use a Digital Voltage Meter (DVM) to measure the AC Source's output DC voltage with the unit of mV and key in the measured value to the LCD. Keep monitoring the DVM readings, and the input/output and the DC voltage repeatedly until the DC output is lower than ± 10 mV.

Voltage Setting & Measurement: •	1	Voltage Setting & Measurement: •	1
CALIBRATION	Calibration	CALIBRATION	Calibration
300V Range A). Keyin the DVM measured Vdc, then press <enter> Vdc offset = 0.0mV (repeat this step until Vdc offset <+-10mV>). B). Wait 2 seconds, then press <enter>.</enter></enter>		300V Range A).Keyin the DVM measured Vdc, then press <enter> Vdc offset = 0.0mV (repeat this step until Vdc offset <+-10mV>). B).Wait 2 seconds, then press <enter>. Vac = 0.00V Vdc =0.00V</enter></enter>	
	2008/10/13 19:52:55		2008/10/13 19:53:07

For step B in the 300V range Offset voltage calibration procedure, the display shows the difference betweenVac and Vdc measured by the AC Source. It is generated by an internal component. Wait for 2 seconds and press **ENTER**, the display will show the offset voltage Vac and Vdc calculated by the AC Source at present.

Voltage Setting & Measurement:	 1
CALIBRATION 300V Range	Calibration
A).Keyin the DVM measured Vdc,then press <enter> Vdc offset = 0.0mV (repeat this step until Vdc offset <+-10mV>).</enter>	
B).Wait 2 seconds, then press <enter>. Vac = 0.04V Vdc = 0.02V</enter>	
C).Calibration for 300V Range offset is completed, press <enter> to run 300V setting & meas. calibration.</enter>	
	2008/11/20 19:11:57

For step C in 300V range Offset voltage calibration procedure, the display shows the 300V range offset voltage calibration has been done. Press **EXIT** to go into save screen as shown below, or press **ENTER** to continue for next 300V range voltage setting and measurement calibration procedure.



In step C, press **EXIT** the display will show the save screen and press Yes on the right can save the calibrated result.

Voltage Setting & Measurement:	∮ 1
CALIBRATION	Calibration
300V Range : Setting & Meas.	
Press <enter> to continue.</enter>	
Press <exit> to skip.</exit>	
	2008/11/20 19:12:21

Once the 300V Range Offset voltage calibration is done, the screen will ask the user if conducting the 300V Range Setting & Meas. calibration. Press **ENTER** to continue the Setting & Meas. calibration and press **EXIT** to skip it to go into the calibration main screen.

Voltage Setting & Measuren	nent: ⊈1
CALIBRATION	Calibration
300V Range A).Check if the DVM measured value is about 3 If NO, check DVM connection.If YES, press <	OVac?
	2008/11/20 19:12:41

For step A in the 300V Range Setting & Meas. calibration procedure, the user should remove the load. Check if the output AC voltage measured by the DVM is about 30Vac. This is to confirm the connection is correct, and press **ENTER**.

Voltage Setting & Measurement:	1
CALIBRATION	Calibration
300V Range A).Check if the DVM measured value is about 30Vac? If NO, check DVM connection.If YES,press <enter>. B).Keyin the DVM measured Vac,then press <enter>. Vac =0.000V</enter></enter>	
	2008/11/20 19:13:14

For step B in the 300V Range Setting & Meas. calibration procedure, check if the DVM measured output voltage is about 240VAC. Input the correct value measured by the DVM and press **ENTER**.

Voltage Setting & Measurement: Φ	1
	Calibration
300V 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 = 0.000V</enter>	
C).Keyin the DVM measured Vac,then press <enter>. Vac = <u>0.000</u>V</enter>	
	2008/11/20 19:13:34

For step C in the 300V Range Setting & Meas. calibration procedure, check if the DVM measured output voltage is about 300VAC. Input the correct value measured by the DVM and press **ENTER**.

Voltage Setting & Measurement: Φ	1
CALIBRATION	Calibration
300V Range A).Check if the DVM measured value is about 30Vac? If NO, check DVM connection.If YES,press <enter>. B).Keyin the DVM measured Vac,then press <enter>.</enter></enter>	
Vac = 0.000V	
C).Keyin the DVM measured Vac,then press <enter>. Vac = 0.000V</enter>	
D).Calibration for ∰1 Voltage Setting & Measurement is completed.Press <enter> to continue.</enter>	
	2008/11/20 19:13:57

For step D in 300V Range Setting & Meas. calibration procedure, the display shows the 300V Range Setting & Meas. calibration has been done. Press **EXIT** to go into save screen as shown below, or press **EXIT** to continue voltage calibration for other phases.

		Calibration Yes				
Do you data?	want	to	save	calibr	ating	No
						2008/11/20 19:08:19

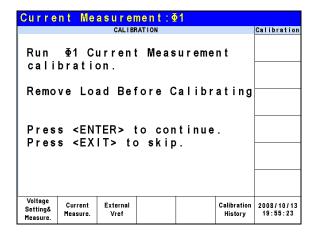
In step D, press **EXIT** the display will show the save screen and press Yes on the right can save the calibrated result.

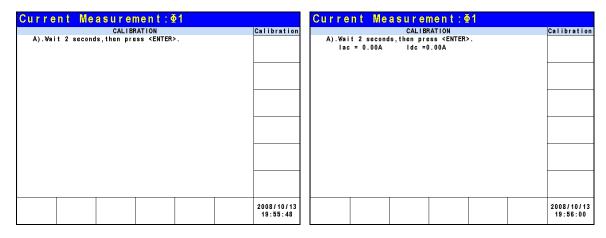
(i) NOTICE

- 1. Users can press **ENTER** at the last step to continue calibrating the 2nd and 3rd phase.
- 2. If **EXIT** is pressed without saving the result, the calibration result is kept till power-off.

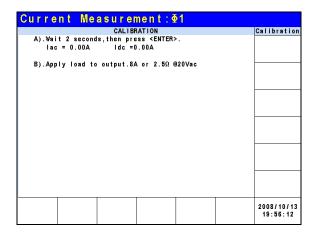
4.2.2 Current Measurement Calibration

CALIBRATION CHOICE can be input after the password is entered, see section 4.2. Press Current Measure at the bottom to calibrate the current measurement. The calibration value is different for the 61511 and the 61512 and will be specified in each step.





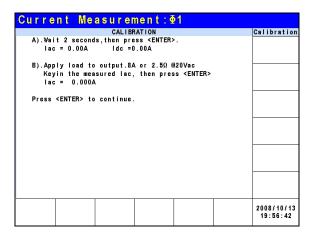
For step A of ACCURACY CALI in Current Measure the display shows the difference between Iac and Idc measured by the AC Source. It is generated by an internal component. Wait for 2 seconds and press $\boxed{\text{ENTER}}$, the Iac = 0.00A and Idc = 0.00A.



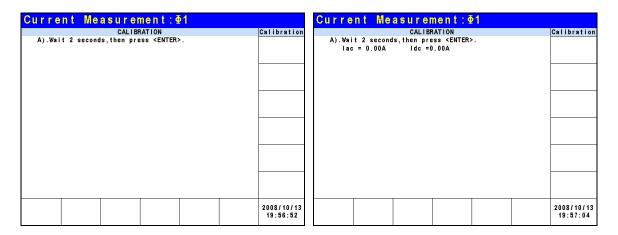
For step B, adjust the load to 2.5Ω for output and press **ENTER**. The AC Source will output 20Vac for the 61512 and 12.5Vac for the 61511.

Current Measurement: ±1	
CALIBRATION	Calibration
A).Wait 2 seconds,then press <enter>. lac = 0.00A ldc =0.00A</enter>	
B). Apply load to output. 8A or 2.5Ω @20Vac Keyin the measured lac, then press <enter> lac = <u>0.000</u>A</enter>	
	2008/10/13 19:56:26

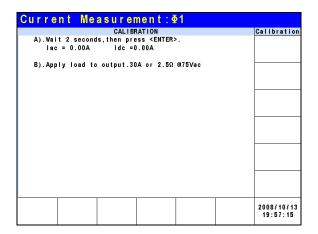
Use a Current Meter (or Power Analyzer) to measure the output current. Input the measured value and press **ENTER**.



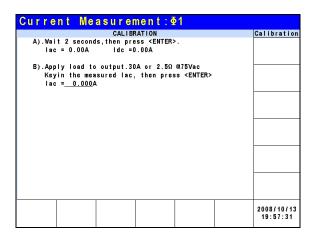
Press **ENTER** to continue the calibration procedure. The load will be disconnected.



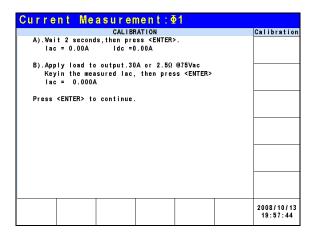
In step A the display shows the difference between Iac and Idc measured by the AC Source. It is generated by an internal component. Wait for 2 seconds and press $\boxed{\textbf{ENTER}}$, the Iac = 0.00A and Idc = 0.00A.



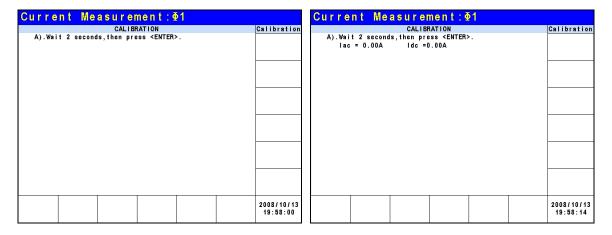
For step B, adjust the load to 2.5Ω for output and press **ENTER**. The AC Source will output 75Vac for the 61512 and 50Vac for the 61511.



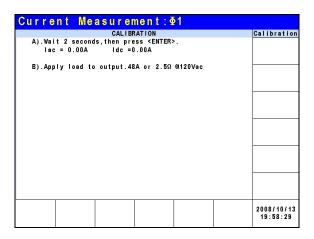
Use a Current Meter (or Power Analyzer) to measure the output current. Input the measured value and press **ENTER**.



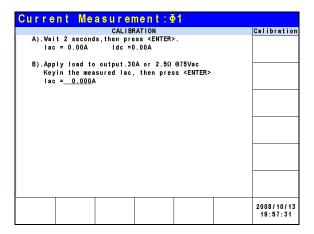
Press **ENTER** to continue the calibration procedure. The load will be disconnected at this time.



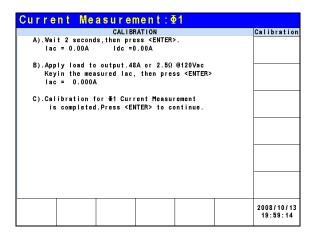
In step A the display shows the difference betweeenIac and Idc measured by the AC Source. It is generated by an internal component. Wait for 2 seconds and press $\boxed{\texttt{ENTER}}$, the Iac = 0.00A and Idc = 0.00A.



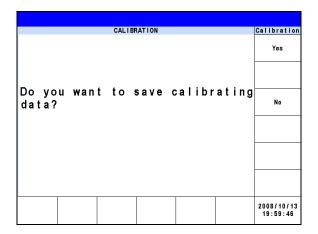
For step B, adjust the load to 2.5Ω for output and press **ENTER**. The AC Source will output 120Vac for the 61512 and 80Vac for the 61511.



Use a Current Meter (or Power Analyzer) to measure the output current. Input the measured value and press **ENTER**.



Step C is the last step of ACCURACY CALI in Current Measure. Press **ENTER** to continue calibrating the 2nd and 3rd phase or press **EXIT** to leave this page. The display shows the following. Press Yes on the right to save the calibration results.



(i) NOTICE

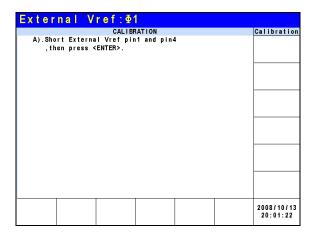
1. The resistance of the external load has to be constant; therefore the load current and output voltage should be proportional or step B of CURRENT MEAS. ACCURACY will be meaningless. Only when the current complies with step C (output voltage is

- 125VAC) can this be used for calibration.
- 2. Protection is removed temporary 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 input after the password is entered, see 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 Calibrati	n a
Remove Load Before Caribrati	" y
Press <enter> to continue. Press <exit> to skip.</exit></enter>	
Voltage Setting& Current External Calibre Measure. Vref Histo	



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

External Vref: ⊕1		External Vref: ¶1	
CALIBRATION A) .Short External Vref pin1 and pin4 , then press <enter>. B) .Wait 2 seconds, then press <enter>.</enter></enter>	Calibration	CALIBRATION A) .Short External Vref pin1 and pin4 , then press <enter>. B) .Wait 2 seconds, then press <enter>. Vdc = 0.00V</enter></enter>	Calibration
	2008/10/13 20:01:39		2008/10/13 20:01:52

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. The offset voltage is generated by internal components. Wait for 2 seconds and press **ENTER**, the display will show the offset voltage Vdc calculated the AC Source at present.

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>	
	2008/10/13 20:02:03

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

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> Vac = 0.000V</enter>	
	2008/10/13 20:02:16

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

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> Vac = 0.000V</enter>	
E).Calibration for ∰1External Vref is completed.	
Press <enter> to continue.</enter>	
	2008/10/13 20:02:33

Step E: It is the last step of External Vref CALI. Press **EXIT** to go into the save screen as shown below, or press **ENTER** to continue the voltage calibration of other phases.

		CALIE	BRATION			Calibration
		Yes				
Do you data?	want	t o	save	calibr	ating	No
						2008/10/13 20:02:48

In step E, press **EXIT** the display will show the save screen and press Yes on the right can save the calibrated result.



5. Application

5.1 Overview

The AC Source model 61511/61512 not only can program a stable sinusoidal output voltage and frequency, but also provides powerful features to simulate power line interrupts. Users can change the output using the Sequences in LIST mode (see 5.2), or change the output to step by step in STEP mode (see 5.4.) With these functions, the simulations of conditions such as cycle loss, transient peak and power attenuation are very easy.

The AC Source model 61511/651512 is able to measure the related power parameters provided in MAIN PAGE (see 3.3), also it can provide harmonic measurements up to 40 orders (see 5.7.) In addition, the AC Source allows the user to edit different harmonic components to synthesize the harmonic distortion waveform (see 5.5). It has the ability to program the inter-harmonic frequency and components, as well as to sweep and overlap the static fundamental waveforms (see 5.6).

3	Pha	s e	300V	LOCAL	QUI	T	
			OUTPU	T SETTING	10.00		Setting
⊕1	Vac	=	0.07	F =	60.0	Hz	OUTPUT:
€2	Vac	=	0.07	F =	60.0	Hz	More Setting
₫3	Vac		0.0V	F =	60.0	Hz	Measurement
			MEAS	SUREMENT			Setting
	٧	=	0.00	Po	=	0.0	Waveform
₫1	Ì	=	0.000	PF	= 0.	000	Viewer
	٧	=	0.00	Po	=	0.0	0.0000000000000000000000000000000000000
₹2	1	=	0.000	PF	= 0.	000	Limitation
	٧	=	0.00	Po		0.0	Output
₫3	j	=	= 0.000	PF	= 0.	000	Mode
	V ₁₂	=	0.00	V ₃₁	= 0	.00	
Σ	V23	=	0.00	Po	=	0.0	
	List Mode	Pul	5788 B 5785 B	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/13 20:03:13

5.2 List Mode

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

3	Pha	s e	LI	ST MOD	DE:STO)P	QUIT
			OUTPUT	SETTING			List Mode
⊕1	Vac	=	0.0V	F =	60.0	Hz	A22404
₽2	Vac	=	0.0V	F =	60.0	Hz	Trigger
₽ 3	Vac	=	0.0V	F =	60.0	Hz	Couple
			MEASU	REMENT			Individual
	٧	=	0.00	Po	=	0.0	
₽1	Ì	=	0.000	PF	= 0.	000	
	٧	=	0.00	Po		0.0	
₽2	1	=	0.000	PF	= 0.	000	
	ν		0.00	Po	=	0.0	
₽3	Ì	=	0.000	PF	= 0.	000	
	V ₁₂	=	0.00	V ₃₁	= 0	.00	100,000
Σ	V23	=	0.00	Po	=	0.0	Edit
-	List Mode	Pul		Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/13

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

Pha	s e			LIS	T MOI	ÞΕ	QUIT	
								List Mode
								Edit
								Each
Vdc st	art	-						
Degree		=		Wa	veform	= A		Trigger Auto
Time	-							Auto
Vac st	art	-	0.0V	Va	c end =	0.0V		Base
F st	art	=	60.0Hz	F	end =	60.0Hz		Time
Vdc st	art	-	0.0V	Vo	c end =	0.0V		
Degree		=	0.0°	Wa	veform	= A		Count
Time	=		0.0ms					1
Vac st	art	-	0.0V	Va	c end =	0.0V		Sequence
F st	art	-	60.0Hz	F	end =	60.0Hz		0 0
Vdc st	art	=	0.0V	Vo	c end =	0.0V		
Degree		=	0.0°	Wa	veform	= A		Execution
Time	=		0.0ms					Page
Liet		Dulce	Ste	en		Inter-	Harmonic	2008/10/13
Mode					Synthesis	harmonics	Meas.	20:04:07
	Vac st F st Vdc st Degree Time Vac st Compared Time Vac st F st Vdc st Degree Time Vac st F st Vdc st List	Vac start F start Vdc start Degree Time = Vac start F start Vdc start Degree Time = Vac start Degree Time = Vac start Vdc start Undc start T start Vdc start List F start List F start	Vdc start = Degree = Time = Vac start = F start = Vdc start = Degree = Time = Vac start = F start = Vdc start = Degree = Time = List Pulse	Vac start = 0.0 V	Vac start = 0.0V Vac F start = 0.0V Vac Vdc start = 0.0V Vac Degree = 0.0° Waa Time = 0.0ms Vac start = 0.0V Vac Vdc start = 0.0V Vac F start = 60.0Hz Vac Vdc start = 0.0V Vac Degree = 0.0° Wa Time = 0.0ms Vac start = 0.0V Vac F start = 60.0Hz Vac Time = 0.0ms Vac start = 0.0V Vac Vac start = 0.0V Vac Time = 0.0W Vac Time = 0.0W Vac Time = 0.0V Vac Degree = 0.0° Wa Time = 0.0W Vac Degree = 0.0° Wa Time = 0.0ms	LIST MODE SETTING	LIST MODE SETTING	LIST MODE SETTING

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

Trigger method: Auto / Manual / Excite.

Auto: It finishes all counts when triggered.

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

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

Couple: Individual / Φ 1+ Φ 2+ Φ 3.

Individual: The three phases are set separately.

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

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

Count: The entire sequence execution times.

Count = 0: unlimited execution.

Sequence: Sequence number.

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

Degree: The phase angle when the sequence starts.

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

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

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

After setting the sequences, press Execution Page on the right to exit List mode and the LCD will show LIST MODE: STOP on the top. STOP indicates the present trigger state. Users can press Trigger on the right to trigger the output and the LCD will show RUNNING to indicate that the List mode is under execution. At the same time users can press Stop to cease the List waveform output. When the 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	LI	ST MOD	DE:STO	P	QUIT
	A-7272		оитрит	SETTING	10. 10. 10.	4.45	List Mode
Φ 1	Vac	=	0.0V	F =	60.0	Hz	122001
₽2	Vac	=	0.07	F =	60.0	Hz	- Trigger
₽3	Vac	=	0.0V	F =	60.0	Hz	*
			MEAS	UREMENT			
	٧	=	0.00	Po	=	0.0	
1	Ì	=	0.000	PF	= 0.	000	
	٧	=	0.00	Po	=	0.0	
₽2	Ì	=	0.000	PF	= 0.	000	
	٧	=	0.00	Po	=	0.0	
₽3	Ĵ	=	0.000	PF	= 0.	000	
	V 12	=	0.00	V ₃₁	= 0	.00	
Σ	V23	=	0.00	Po	=	0.0	Edit
	List Mode	Pul	577X 177555 Fr	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/1 20:04:48

3	_Pha	s e	LI	ST MOD	DE:RUN	NING	OUT
	21000X		OUTPUT	SETTING	54 (a		List Mode
⊕1	Vac	=	0.0V	F =	60.0	Hz	1220
€2	Vac	=	0.07	F =	60.0	Hz	Stop
₽3	Vac	=	0.0V	F =	60.0	Hz	
			MEASI	JREMENT			
	٧		0.04	Po	= -	0.0	
● 1	Ì	=	0.001	PF	= -2.	182	
	٧	=	0.06	Po	=	0.0	
₽2	1	=	0.330	PF	= 0.	276	
	٧	=	0.08	Po	=	0.0	
₽3	Ì	=	0.712	PF	= 0.	088	
	V 12	=	0.53	V ₃₁	= 0	. 52	
Σ	V23	=	0.53	Po	=	0.0	
	List Mode	Pul	5770 BOSS 9	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/1

If the AC Source is under operation, pressing **OUT/QUIT** will stop the output and the waveform will be 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 to exit LIST page, the programmed LIST mode waveform will be closed.

Example of LIST Mode in 1 Phase Mode:

Trigger: Auto, Base: Time, Count: 1

LIST MODE SETTING:

Sequence 0: Vac start = 20V, Vac end = 100V F start = 50Hz, F end = 50Hz Vdc start = 0V, Vdc end = 0V Degree = 90°, Time = 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

Following lists the setting pages of LIST MODE.

1_Pha	se	LTS	ST MOE	E	QUIT					
			E SETTING			List Mode				
Vac	start	=	0.0V	1						
Vac	e n d	=	0.0V	•						
F	start	=	60.0H	z		Trigger				
F	e n d	=	60.0H	z		Auto				
Vdc	start	=	0.0V	,		Base Time				
Vdc	e n d	=	0.0	,						
Deg	ree	=	= 0.0°			Count 1				
Wav	eform	= A				Sequence				
Tim	е	=	0.0	ms		0				
	. , , , , ,									
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/13 20:06:33				

1_Pha	s e	LI	ST MOE	E	QUIT	
		LIST MOD	E SETTING			List Mode
Vac	start	=	0.0V	'		
Vac	e n d	=	0.0	,		
F	start	=	60.0H	z		Trigger
F	end	=	60.0H	z		Auto
Vdc	start	=	0.0V	Ī		Base Time
Vdc	e n d	=	0.0V	Ī		
Deg	ree	=	= 0.0°			Count 1
Wav	eform	= A				Sequence
Tim	е	=	0.0	ms		0 0
						Execution Page
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/13 20:06:48

1_Pha	s e	LT	ST MOE	E	QUIT		
Vac Vac F		=	0.0V 0.0V 0.0V 60.0H	•		List Mode	
F	end	=	60.0H	lz		Trigger Auto	
Vdc	start end	=	0.0V	'		Time Count	
	eform	= = A	= 0.0° = A				
Tim	е	=	0.0	ms		Execution Page	
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/13 20:06:59	

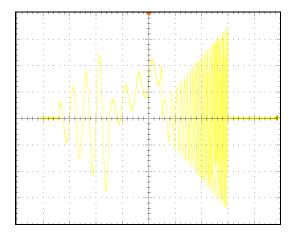
1 _ P h a	s e	LT	ST MOD	E	QUIT	
.,			E SETTING			List Mode
Vac	start	=	0.0V	•		
Vac	e n d	=	0.0V	'		
F	start	=	60.0H	z		Trigger
F	e n d	=	60.0H	z		Auto
Vdc	start	=	0.0V	,		Base
	end	=	0.00			Time
						Count
Deg			= 0.0°			1
Wav Tim	eform e	= A =	0.0	ms		Sequence 0
						Execution Page
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/1: 20:07:40

1_Pha	s e	LIS	ST MOD	E	QUIT					
			SETTING			List Mode				
Vac	start	=	20.0V	'						
Vac	end	= 1	00.0V	•						
F	start	=	50.0H	z		Trigger				
F	e n d	=	50.0H	z		Auto				
Vdc	start	=	0.0V	,		Base Time				
Vdc	e n d	=	0.0V	,						
Deg	ree	=	90.0°		Count 1					
Wav Tim	eform e	= <u>A</u> =								
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/13 20:08:34				

1_Pha	s e	LTS	ST MOE	E	QUIT					
			SETTING			List Mode				
Vac	start	: =	20.0V							
Vac	end	=	20.0V	•						
F	start	=	50.0H	z		Trigger				
F	e n d	=	50.0H	z		Auto				
Vdc	start	: =	0.0	'		Base Time				
Vdc	Vdc end = 100.0V									
Deg	ree	=	0.0°			Count 1				
	Waveform = <u>A</u> Time = 80.0ms									
	Execution Page									
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/13 20:09:08				

1_Pha	s e	LTS	ST MOE	E	QUIT	
			E SETTING			List Mode
Vac	start	=	20.0V	,		
Vac	end	= 1	120.0V	•		
F	start	=	50.0H	z		Trigger
F	e n d	= {	500.0H	z		Auto
Vdc	start	=	0.0	'		Base Time
Vdc	e n d	=	0.0V	•		
Deg	ree	=	0.0°			Count 1
Wav	eform	= <u>A</u>	_			Sequence
Tim	е	=	100.0	ms		2
						Execution Page
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/13 20:09:48

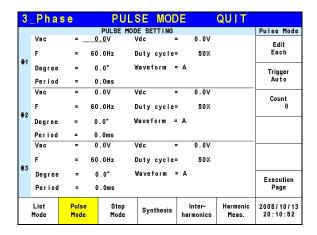
The trigger waveform when the settings are done is shown below:



5.3 Pulse Mode

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

3	_Pha	s e		PUL	SE MOL	DE:ST	OP	QUIT
	\$1000 K				SETTING	512 (G	(100 to 100 to 1	Pulse Mode
₫1	Vac	=	0.	0 V	F =	60.0)Hz	
₫2	Vac	=	0.	0 V	F =	60.0)Hz	- Trigger
⊕ 3	Vac	=	0.	0 V	F =	60.0)Hz	
				MEASU	JREMENT			
	٧	=	0.	00	Po	=	0.0	
Φ 1	Ì	=	0.0	0.0	PF	= 0	000	
	٧	=	0.	00	Po	=	0.0	2
₹2	1	=	0.0	0.0	PF	= 0	000	
	V	=	0.	0.0	Po	=	0.0	
⊕ 3	Ĵ	=	0.0	0.0	PF	= 0	000	
	V 12	=	0.	00	V ₃₁	= (0.00	******************************
Σ	V23	=	0.	00	Po	=	0.0	Edit
	List Mode	Puls Mod	570 I	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/13 20:10:30



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

Trigger method: Auto / Manual / Excite.

Auto: It finishes all counts when triggered.

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

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

Count: The count number of pulse.

Vac, F, Vdc: The Vac, F and DC output in pulse voltage.

Duty cycle: The pulse ratio during a duty cycle.

Period: The total length of the duty cycle.

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

Degree: The output phase degree of pulse.

After setting the sequences, press Execution Page on the right to exit Pulse mode and the LCD will show PULSE MODE: STOP on the top. STOP indicates the present trigger state. Users can press Trigger on the right to trigger the output and the LCD will show RUNNING to indicate Pulse mode is under execution. The user can also press Stop to cease the Pulse waveform output. When the 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	PUL	SE MOD	DE:STO	P	QUIT
			OUTPUT	SETTING	10.10	444	Pulse Mode
⊕ 1	Vac	=	0.0V	F =	60.0	Hz	A22001
€2	Vac	=	0.07	F =	60.0	Hz	Trigger
⊉ 3	Vac	=	0.0V	F =	60.0	Hz	
			MEASU	JREMENT			
	٧	=	0.00	Po	=	0.0	
₫1	Ì	=	0.000	PF	= 0.	000	
	٧	=	0.00	Po	=	0.0	
₽2	1	=	0.000	PF	= 0.	000	
	٧	=	0.00	Po	=	0.0	
₽3	j	=	0.000	PF	= 0.	000	
	V 12	=	0.00	V ₃₁	= 0	.00	PENGO
Σ	V23	=	0.00	Po	=	0.0	Edit
	List Mode	Pul		Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/13 20:11:04

3	Pha	s e		PUL	SE MOD	E:RUN	NING	OUT
	\$1000 X		ay.	OUTPUT	SETTING	10 (a	14,75	Pulse Mode
₫1	Vac	=	0.	0 V	F =	60.0	Hz	12.0
€2	Vac	=	0.	0 V	F =	60.0	Hz	Stop
⊕ 3	Vac	=	0.	0 V	F =	60.0	Hz	
				MEASU	JREMENT			
	٧	=	0.	04	Po	= -	0.0	
Φ 1	Ì	=	0.0	11	PF	= -0.	744	
	٧	=	0.	01	Po	=	0.0	
€2	1	=	0.3	22	PF	= 0.	813	
	٧	=	0.	05	Po	= -	0.0	
₫3	Ì	=	0.7	07	PF	= -0.	050	
	V 12	=	0.	53	V 31	= 0	. 52	
Σ	V23	=	0.	53	Po	= -	0.0	
	List Mode	Puls	570 I	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/13 20:11:24

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

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

Example of PULSE Mode in 1 Phase Mode:

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

PULSE MODE SETTING:

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

Trigger: Auto, Count: 0

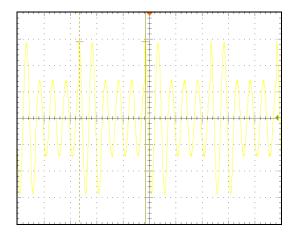
The following lists the setting pages of PULSE MODE.

1_Pha	se	PULS	SE MOE	E	QUIT	
		PULSE MOD	E SETTING			Pulse Mode
Vac		=	0.0V	•		
Vdc		=	0.0V	•		
F		=	60.0H	z		Trigger <u>Auto</u>
Dut	у сус	le=	50%)		Count
Deg	ree	=	0.0°			0
Wav	eform	= A				
Per	iod	=	0.0m	ıs		
						Execution Page
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/13 20:12:01

1_Pha	s e	PULS	SE MOD	E	QUIT	
		PULSE MOD				Pulse Mode
Vac		=	0.0V	1		
Vdc		=	0.0V	•		
F		=	60.0H	lz		Trigger Auto
Dut	у сус	le=	50%	•		
Deg	ree	=	0.0°			Count 0
Wav	eform	= A				
Per	iod	=	0.0m	ıs		
						Execution Page
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/13 20:12:12

1_Pha	s e	PUL	SE MOD	E	QUIT	
		PULSE MOD				Pulse Mode
Vac		= 1	100.0V			
Vdc		=	0.0V	,		
F		=	50.0H	z		Trigger Auto
Dut	у сус	le=	35%	ı		04
Deg	ree	=	90.0°			Count 0
Wav	eform	= <u>A</u>				
Per	iod	= 1	100.0m	ıs		
						Execution Page
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/13 20:12:56

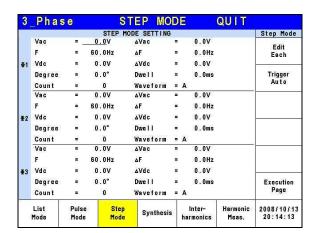
The trigger waveform when the settings are done is shown below:.



5.4 Step Mode

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

3	Ph	as	е			STE	Р	MO	DE	: 8	TC)P		QUIT
	ann.		AND THE SE			OUTPUT :					0.			Step Mode
₫1	Vac	-	0.07	F		60.0Hz		Vdc	=	0.0	/			A22001
€2	Vac	=	0.0V	1		60.0Hz		Vdc	=	0.0	/			Trigger
∓ 3	Vac	-	0.0V	F	-	60.0Hz		Vdc	-	0.0	/			
						MEASUR	EMENT	Ē						
	٧		=		0.	00	P)	=			0	. 0	
₫1	1		=	0	. 0	0.0	Ρ	F	=	() .	0	00	
	٧		=		0 .	00	P)	=			0	. 0	
₽2	1		=	0	. 0	00	Ρ	F	=	() .	0	00	
	٧				0.	00	P)	=			0	. 0	
₽ 3	Ì		=	0	. 0	0.0	P	F	=	() .	0	00	
	V 12		=		0 .	00	V	31	=		0		00	POLYGGA
Σ	V ₂₃		=		0.	00	P	0	=			0	. 0	Edit
0.00	List Mode		Pulse			Step Mode	Synt	hesis	ha	Inter			Harmonic Meas.	2008/10/13 20:13:48



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

Trigger method: Auto / Manual.

Auto: It finishes all counts when triggered.

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

Count: The count number of each change.

Dwell: The time for each step.

Vac, F, Vdc: The Vac, F, DC initial value when STEP mode starts. ΔVac, ΔF, ΔVdc: The difference value of each step. (It can be negative.)

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

Degree: The output phase angle of each step.

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

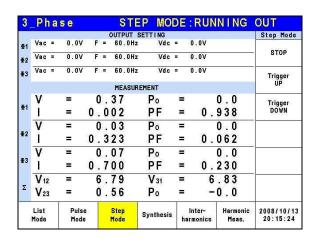
3	Pha	se		STE	P MOD	DE	:STO	P	QUIT
		100 to 1000		OUTPUT	SETTING		1000 0000		Step Mode
₫1	Vac =	0.00	F =	60.0Hz	Vdc	-	0.0V		12200
€2	Vac =	0.0V	F=	60.0Hz	Vdc	•	0.0V		- Trigger
₫3	Vac =	0.0V	F=	60.0Hz	Vdc	•	0.0V		
				MEASUR	EMENT				
	٧	=	0.	00	Po	=		0.0	
⊕1	Ì	=	0.0	00	PF	=	0.	000	
	٧	=	0.	00	Po	=		0.0	
₹2	Ì	=	0.0	00	PF	=	0.	000	
	٧		0.	00	Po	=		0.0	
₫3	Ì	=	0.0	00	PF	=	0.	000	
	V 12	=	0.	00	V ₃₁	=	0	.00	120,0000
Σ	V ₂₃	=	0.	00	P_0	=		0.0	Edit
	List Mode	Puls Mod	72/2	Step Mode	Synthesis	140000	Inter- rmonics	Harmonic Meas.	2008/10/13 20:14:33

3	_Pha	se		ST	EP MO	DE	:RUN	NING	OUT
	600	AND 1000			SETTING		ATC 600		Step Mode
₫1	Vac =	0.00	F =	60.0	Hz Vdc	-	0.0V		1000
€2	Vac =	0.00	F =	60.0	Hz Vdc	=	0.0V		Stop
∓ 3	Vac =	0.00	F-	60.0	Hz Vdc		0.0V		Pause
				MEAS	UREMENT				rause
	٧	=	0	. 04	Po	=	-	0.0	
● 1	Ì	=	0.0	012	PF	=	-0.	228	
	٧	=	0	. 0 5	Ро	E		0.0	
₽2	1	=	0.3	321	PF	=	0.	061	
	٧	=	0	. 04	Po	=	j. —	0.0	
₽3	1	=	0.0	699	PF	=	-0.	281	
	V 12	=	0	. 53	V ₃₁	=	0	. 52	
Σ	V23	=	0	. 53	Po	=	_	0.0	
	List Mode	Puls Mod	700	Step Mode	Synthesis	ha	Inter-	Harmonic Meas.	2008/10/13

If the AC Source is outputting, pressing **OUT/QUIT** will stop the output and the waveform will be zero volts. Pressing **OUT/QUIT** again and the AC Source will output the waveform set in MAIN PAGE. Users must 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 to exit the STEP page, the STEP waveform will stop execution.

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



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

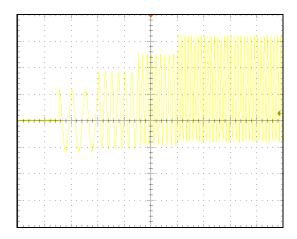
Following lists the setting pages of STEP MODE.

1_Pha	se	STI	EP MOD	E	QUIT	
.,		STEP MODE				Step Mode
Vac		=	0.0V	•		
∆Va	С	=	0.0	'		
Vdc		=	0.0V	•		Trigger
∆Vd	С	=	0.0V	•		Auto
F		=	60.0H	lz		
ΔF		=	0.0H	lz		
Deg	ree	=	0.0°			
Cou	n t	=	0			
Wav	eform	= A				
Dwe	П	=	0.0m	ıs		Execution Page
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/13 20:15:59

1_Pha	se	ST	EP MOE	E	QUIT	
		STEP MOD	E SETTING			Step Mode
Vac		=	40.0V	1		
∆Va	С	=	10.0V	•		
Vdc		=	0.0	'		Trigger
∆Vd	С	=	20.0V	•		Auto
F		=	50.0H	z		
ΔF		=	50.0H	z		
Deg	ree	=	90.0°			
Cou	n t	=	3			
Wav	eform	= <u>A</u>				
Dwe	11	=	60.0m	IS		Execution Page
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/13 20:16:58

l_Pha	se		ST	EP MOD	E:RUN	NING	OUT
- 100 M C			OUTPUT	SETTING			Step Mode
Vac	=	70	. 0 V	F = 2	10.0H	Z	COMM
Vdc		60	. 0 V				Stop
							Pause
			MEASI	JREMENT			107411000
٧	=	0	.03	Po	= -	0.0	
1	=	1.	112	PF	= -0.	050	
Vac	=	0	.03	Vdc	= 0	.00	
lac	=	0.	263	ldc	= -1.	081	
Vpk	=	0	. 78	VA	=	0.0	
lpk	=	1.	786	CF	= 1.	606	
List Mode	Pul	352	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/13

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



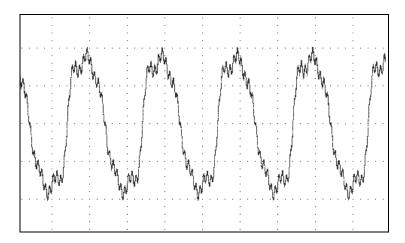
5.5 Synthesis Waveform

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			SYI	THES	IS	:STC)P	QUIT
		AYS	ITHESI	S W	AVEFORM	FUNDAMENTA	AL S	SETTING		Synthesis
⊕1	Vac_f	und :	= 0.	0٧	F_fund	=60Hz		Vdc =	0.0V	12
€2	Vac_f	und :	= 0.	0٧	F_fund	=60Hz		Vdc =	0.0V	Run
∓ 3	Vac_f	und :	= 0.	0٧	F_fund	=60Hz		Vdc =	0.0V	
			SYNT	HES	IS WAVEF	ORM MEASUR	REME	NT		
	٧	=		0	. 0 0	Po	=		0.0	
₫1	Ì	=	0	. (000	PF	=	0.	000	
	٧	=		0	.00	Po	=		0.0	
₽2	1	=	0	. (000	PF	=	0.	000	
	٧	=		0	. 0 0	Po	=		0.0	
₽3	1	=	0	. (000	PF	=	0.	000	
	V 12	=		0	. 0 0	V ₃₁	=	0	.00	PERMISA
Σ	V23	=		0	. 0 0	Po	=		0.0	Edit
0.00	List Mode	100	Pulse Mode		Step Mode	Synthesis	ha	Inter- irmonics	Harmonic Meas.	2008/10/13

Synthesis		TTING	L SE	INDAMENTA	ORM FU	WAVEF	HESIS	SYNTI	
Compose Value-1		.0V .0°	1211	Vdc = Degree =	<u>0</u> V	0. 60Hz	0000000	fundame fundame	Vac F
	θ	V	N	θ	V	N	θ	V	N
Edit	0.0	0.00	28	0.0	0.00	15	0.0	0.00	2
ALL	0.0	0.00	29	0.0	0.00	16	0.0	0.00	3
2006	0.0	0.00	30	0.0	0.00	17	0.0	0.00	4
Clear	0.0	0.00	31	0.0	0.00	18	0.0	0.00	5
All	0.0	0.00	32	0.0	0.00	19	0.0	0.00	6
14 (44:37.19)	0.0	0.00	33	0.0	0.00	20	0.0	0.00	7
View Waveform	0.0	0.00	34	0.0	0.00	21	0.0	0.00	8
THE VETOTIL	0.0	0.00	35	0.0	0.00	22	0.0	0.00	9
	0.0	0.00	36	0.0	0.00	23	0.0	0.00	10
	0.0	0.00	37	0.0	0.00	24	0.0	0.00	11
	0.0	0.00	38	0.0	0.00	25	0.0	0.00	12
Execution	0.0	0.00	39	0.0	0.00	26	0.0	0.00	13
Page	0.0	0.00	40	0.0	0.00	27	0.0	0.00	14
2008/10/1	Harmonic Meas.	nter- monics		Synthesis		Ste	10072	Pu Mo	List Mode

61500 Series AC Source provides a Synthesis function for users to synthesize waveform. The harmonic components range up to 40th order with the fundamental frequency limited to 50Hz or 60Hz. Users can program the size and phase of each order easily on the LCD. The following is an example figure of the synthesis waveform.



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

Value: The absolute value.

Percent: The percentage of the fundamental frequency voltage.

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

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

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

Vdc: The DC voltage component.

Degree: The start angle of the output waveform.

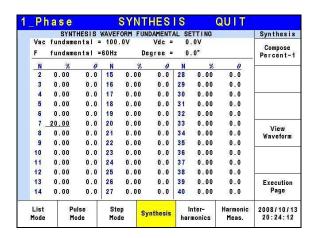
Following is the example of using Synthesis Mode in 1_Phase Mode:

	Pha	s e	300V	LOCAL		QUI	T	
ľ	4000		OUTPL	IT SETTING		Transport of		Setting
	Vac	=	0.0V	F = 6	0.	0Hz		OUTPUT: More Setting
								Measurement Setting
			MEA	BUREMENT				Sering
	٧	=	0.00	Po	=		0.0	Waveform
	ì	=	0.000	PF	=	0.	000	Viewer
	Vac	=	0.00	Vdc	=	0	.00	C240002003-W489-0090
	lac	=	0.000	ldc	=	0.	000	Limitation
	Vpk	=	0.00	VA	=		0.0	Output
	lpk	=	0.000	CF	=	0.	000	Mode
37,000	List Mode	Pul	55° 255 5 5	Synthesis	1000000000	nter- monics	Harmonic Meas.	2008/10/13

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

_Pha	s e			SYN	THES	18:	STO)P	QUIT
	SYNTH	ESIS	WAVE	FORM F	UNDAMENT	AL SET	TING		Synthesis
Vac	_f u	n d	=	0	. O V				Run
F_fı	ı n d		= 6	0Hz	Vd	c =		0.0V	
	8	YNTHE	ESIS	WAVEFO	RM MEASU	REMENT			
V	=	(0.0	0	Po	=		0.0	
ĵ	=	0.	00	0	PF	=	0.	000	
Vac	=	(0.0	0	Vdc	=	0	.00	
lac	=	0.	00	0	ldc	=	0.	000	
Vpk	=	(0.0	0	VA	=		0.0	
lpk	=	0.	00	0	CF	=	0.	000	
									Edit
List Mode	Pul	550	St Mo		Synthesis		ter- onics	Harmonic Meas.	2008/10/13

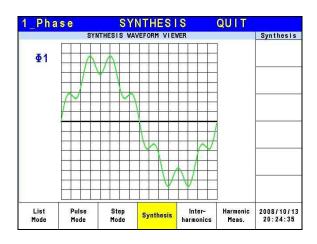
Next, press Synthesis at the bottom to go to Synthesis Mode.



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

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

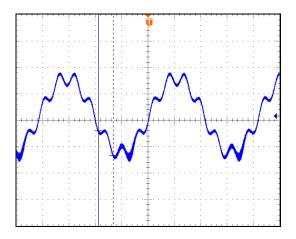
Compose = Percent-1 Edit = $\Phi 3$ Vac fundamental = 100.0VF fundamental = 60HzVdc = 0.0VDegree = 0.0°



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

1_Pha				YNTHES			NING	
	SYNTH	ESIS	WAVEFO	RM FUNDAMEN	TAL SET	TING		Synthesis
Vac	_ f u	n d	= 1	00.0V				Stop
F_f	u n d		= 6 0	Hz Vd	c =	į	0.0V	
	S	YNTHE	SIS WA	VEFORM MEAS	UREMENT			
٧	=	0	.02	Po	=		0.0	
Ì	=	0.	974	PF	=	0.	676	
Vac	=	0	. 01	Vdc	=	-0	. 01	
lac	=	0.	267	ldo	= -	0.	937	
Vpk	=	0	.85	VA	=		0.0	
lpk	=	1.	613	CF	=	1.	655	
List Mode	Pul	552	Step		s Int	TO COMPANY OF THE PARTY OF THE	Harmonic Meas.	2008/10/1 20:24:59

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.

(i) NOTICE

- 1. In order to protect the power stage of AC Source for practical use, it is necessary to limit the synthesis value or the percentage of each order.
 - $2 \le \text{ order} \le 10$, value $\le 150\text{V}$ or percentage $\le 100\%$.
 - 11 < order < 20, value < 120V or percentage < 50%.
 - $21 \le \text{ order} \le 30$, value $\le 80\text{V}$ or percentage $\le 30\%$.
 - $31 \le \text{ order} \le 40$, value $\le 45\text{V}$ or percentage $\le 15\%$.
- 2. If the synthesis waveform exceeds the voltage limit, 424V for 300V range or 212V for 150V range, OUTPUT OVP will occur.

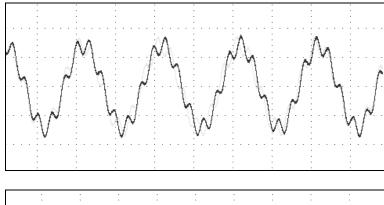
5.6 Inter-harmonics Waveform

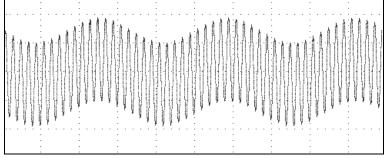
Press Output Mode on the right in the MAIN PAGE (see 3.3) to enter into the Output Mode command line. Next press Inter-harmonics at the bottom to go to the Inter-harmonics command line. Press Edit on the right to enter the Inter-harmonics editing window.

3	Pha	s e	INTERHA	RMONIC	CS:ST	OP	QUIT
			OUTPUT	SETTING	100 100		Interharmon
₫1	Vac	=	0.0V	F =	60.	0Hz	10000
€2	Vac	Ħ	0.07	F =	60.	0Hz	Trigger
⊕ 3	Vac	=	0.0V	F =	60.	0Hz	
			MEASU	JREMENT			
	٧	=	0.00	Po	=	0.0	
⊕1	Ì	=	0.000	PF	= 0	.000	
	٧	=	0.00	Po	=	0.0	
₹2	1	=	0.000	PF	= 0	.000	
	٧	=	0.00	Po		0.0	
₩3	j	=	0.000	PF	= 0	.000	
Σ	V 12	=	0.00	V ₃₁	= 1	0.00	PERMIT
	V23	=	0.00	Po	=	0.0	Edit
2000	List Mode	Pul Mo	572	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/13 20:25:27

3	Pha	se INT	ERHA	RMONIC	S	QUIT	
		INTERHA	RMONIC	WAVEFORM SE	TTING		Interharmon
	F			= <u>0.1</u> Hz			Edit
⊕1	F	end	=	0.1	Hz		Each
	Lev	e l	=	0.0	%		
	Tim	е	=	0.0	Sec		
	F	start	=	0.1	Hz		
200	F	end	=	0.1	Hz		
₹2	Lev	e l		0.0	%		
	Tim	е	=	0.0	Sec		
	F	F start		0.1	Hz		
22.20	F end		= 0.1Hz				
₩3	Level			= 0.0%			Execution
	Time		=	0.0	Sec		Page
	List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/13 20:26:38

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





F start : The start frequency of scanning wave. The range is $0.01 \text{Hz} \sim 2400 \text{Hz}$. **F end :** The end frequency of scanning wave. The range is $0.01 \text{Hz} \sim 2400 \text{Hz}$.

Level: The rms of scanning wave that is the percentage of fundamental voltage set in

MAIN PAGE.

Time: The scanning time from F start to F end.

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

1_Pha	s e	300V	LOCAL	QUI	T	
			UT SETTING	and the second		Setting
Vac	=	0.0V	F = 6	0.0Hz		OUTPUT: More Setting
						Measurement Setting
		MEA	SUREMENT			Setting
٧	=	0.00	Po	=	0.0	Waveform
Ì	=	0.000	PF	= 0.	000	Viewer
Vac	=	0.00	Vdc	= 0	.00	62400040244-0040
lac	=	0.000	ldc	= 0.	000	Limitation
Vpk	=	0.00	VA	=	0.0	Output
lpk	=	0.000	CF	= 0.	000	Mode
List Mode	Puls	1777 TOTAL TO	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/13 20:27:05

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

_Pha	se	INTERH		CS:	STO	P	QUIT
- WOMEN			T SETTING	094004	(100000000)		Interharmo
Vac	=	0.0V	F = 6	SO.	0Hz		Trigger
		MEA	SUREMENT				
V	=	0.00	Po	=		0.0	
Ì	=	0.000	PF	=	0.	000	
Vac	=	0.00	Vdc	=	0	.00	
lac	=	0.000	ldc	=	0.	000	
Vpk	=	0.00	VA	=		0.0	
lpk	=	0.000	CF	=	0.	000	
							Edit
List Mode	Pu Mo	557× 5755 5	Synthesis	- mar 50	nter-	Harmonic Meas.	2008/10/13

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

1_Pha	se INT	ERHA	RMONIC	S	QUIT	
19:			WAVEFORM SE			Interharmon
F	start	=	500.0	Hz		
F	e n d	=	500.0	Hz		
Lev	e I	=	20.0	%		
Tim	ie	= _	10.0	Sec		
						Execution Page
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/13 20:27:55

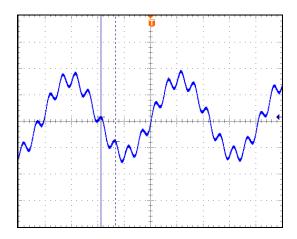
Press Edit on the right to go to the editing screen. Use the arrow keys to move the cursor to the column to be set and use the numeric keys to key-in the setting, then press **ENTER**. The example uses the following settings:

OUTPUT SETTING: Vac = 60.0V F = 60Hz

F start = 500.0Hz F end = 500.0Hz Level = 20.0% Time = 10.0Sec

1	_Pha	s e	IN.	TERH	ARMONI	ICS	:RUN	NING	OUT
				OUTPU	T SETTING				Interharmon
	Vac	=	6 () . 0 V	F =	60.	0Hz		Stop
				MEAG	SUREMENT				Pause
	٧	=	(0.06	Р∘	=		0.0	
	1	=	0	. 974	PF	=	0.	146	
	Vac	=	(0.06	Vdc	; =	-0	. 01	
	lac	=	0	. 268	Ido	; =	-0.	937	
	Vpk	=	(0.85	VA	=		0.1	
	lpk	=	1	. 591	CF	=	1.	633	
	List Mode	Pul Mo		Step Mode	Synthesi	ie	Inter- rmonics	Harmonic Meas.	2008/10/13 20:28:24

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.

(i) NOTICE

In order to protect the power stage of AC Source for practical use, it is necessary to limit the F start and F end related Level.

If 0.01Hz \leq F start or F end \leq 500Hz, Level \leq 30%.

If 500Hz < F start or F end < 1000Hz, Level < 20%.

If 1000Hz < F start or F end ≤ 2400 Hz, 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. Press Edit on the right to enter the Harmonic Meas. editing window.

3	_Pha	se HAI	RMON	IC ME	AS . : STC)P	QUIT
	C10000000	HARM	ONIC ME	ASUREMENT S	SETTING		Harmonic
重 1	THD =	0.0%	DC =	0.07	Fundamental	= 0.0V	
E 2	THD =	0.0%	DC =	0.07	Fundamental	= 0.0V	Trigger
₽3	THD =	0.0%	DC =	0.0V	Fundamental	= 0.0V	3887720
	N	٧	N	V	N	V	
	2	0.00	15	0.00	28	0.00	
	3	0.00	16	0.00	29	0.00	
	4	0.00	17	0.00	30	0.00	DATA
	5	0.00	18	0.00	31	0.00	₫1
	5 6 7	0.00	19	0.00	32	0.00	
	7	0.00	20	0.00	33	0.00	
	8 9	0.00	21	0.00	34	0.00	
	9	0.00	22	0.00	35	0.00	
	10	0.00	23	0.00	36	0.00	
	11	0.00	24	0.00	37	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	100 Till 100
	List Mode	Pulse Mode	Step Mode	Synthes	is Inter-	Harmonic Meas.	2008/10/1: 20:29:25

3	Pha	se HAI	RMONI	C MEAS	3	QUIT	
			HARMONIC	MEASUREMENT			Harmonic
	Sou	rce = <u>\</u>	L				Edit Each
Φ 1	F	funda	amen t	al =60	Hz		Parameter Value
	Sou	rce =\	1				Measurement Single
₩2	F	funda	ament	al =60	Hz		
	Sou	rce =\	1			3	
⊕ 3	Execution Page						
	List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/13 20:29:48

This function can measure the Total Harmonic Distortion (THD) of the fundament frequency 50Hz or 60Hz, the DC current, and the fundamental frequency of output current or voltage, also can measure $2 \sim 40$ orders of harmonic values.

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

V: The output voltage.

I: The output current.

F fundamental = 50 / 60 Hz: The fundamental frequency of source signal.

Measurement = Single / Continue: The way the measurement result displays on LCD.

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

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

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

Percent: The percentage of fundament frequency value.

Value: The absolute value.

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

1_Phas	e 300V	LOCAL	QUIT	
	OUTP	UT SETTING	The second second	Setting
Vac :	= 0.0V	F = 61	0.0Hz	OUTPUT: More Setting
				Measurement
	MOR	E SETTING		Setting
Wave	form = <u>A</u> SINE			Waveform Viewer
	Degree =	.		Limitation
Vac s		0.000	OV/ms	Output Mode
Vdc 9	S/R =	0.000	0V/ms	
F S	S/R =	0.000)Hz/ms	
Coupling AC	Range 300V	Output Waveform Selection	Zo Program Disable	2008/10/13 20:30:24

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

1_Pha	se	300V	LOCAL	QUIT	
			T SETTING	Carlotta (analysis)	Waveform
Vac	=	0.0V	F = 6	0.0Hz	
		MORE	SETTING		
	rm A = <u>\$</u> rm B = \$				View Waveform
Coupling AC	Range 300V		Output Waveform Selection	Zo Program Disable	2008/10/1 20:30:40

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

l_Pha	se 300\	/ LOCAL	QUIT	
Vac		OV F =	60.0Hz	Waveform
		10RE SETTING		
	rm A = <u>DSTO4</u> rm B = SINE			View Waveform
Coupling AC	Range 300V	Output Waveform Selection	Zo Program Disable	2008/10/1 20:31:01

Set the Waveform A of Φ 3 to DST04 waveform.

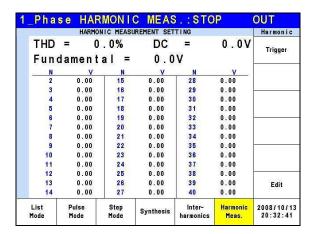
When the waveform setting is done, press View Waveform on the right to view the output waveform, the ratio of each harmonic order and the output angle.

1.	Pha	s e	3	0 0 V	LOCAL		OUT		
				OUTPU	JT SETTING				Main
	Vac	=	100	<u>0 . 0</u> V	F = (60.	.0Hz		OUTPUT: More Setting
									Measurement Setting
				MEA	SUREMENT				
	٧	=	9 9	9.98	P∘	=		0.2	Waveform
	1	=	0	. 993	PF	=	0.	002	Viewer
	Vac	=	9 9	9.98	Vdc	=	-0	. 0 0	
	lac	=	0	. 280	ldc	=	-0.	953	Limitation
	Vpk	=	139	9.83	VA	=	9	9.3	Output
	lpk	=	1	.880	CF	=	1.	894	Mode
	Recall		call	Recall	Recall	F	Recall	More	2008/10/13
	CH1	С	H2	CH3	CH4		CH5	1 of 2	20:31:53

Press Return to go back to the MAIN PAGE and set the Vac of Φ 3 to 100.0V, then press $\boxed{\text{OUT/QUIT}}$ to output waveform.

Pha	se	3 (0 V	LOCAL		OUT		
			OUTPL	IT SETTING	******	in removal		Setting
Vac	=	100	. 0 V	F = (0.	0Hz		OUTPUT: More Setting
			MEX	SUREMENT				Measurement Setting
100	(g) 23				60,63		^ ^	
٧	=		. 98	Po	=		0.2	Waveform
1	=	1.	000	PF	=	0.	002	Viewer
Vac	=	99	.98	Vdc	=	-0	. 01	CHENT CONTROL OF THE
lac	=	0.	280	ldc	=	-0.	960	Limitation
Vpk	=	139	.94	VA	=	10	0.0	Output
lpk	=	1.	960	CF	=	1.	960	Mode
	T			1	1 .	1		
List Mode	100.00	ilse ode	Step Mode	Synthesis		nter- monics	Harmonic Meas.	2008/10/13 20:32:19

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



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

_Pha	se HA	RMONI	C MEAS	S .	OUT	
ī		HARMONIC I	1EASUREMENT			Harmonic
Sou	rce = <u>'</u> funda		al =60	Hz		Parameter Percent Measuremen Continue
						Execution Page
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/1:

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, then press **ENTER**. The example uses the following settings:

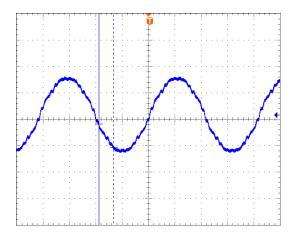
Source = V F fundamental = 60 Hz Measurement = Continue Parameter = Percent

			C MEAS			OUT Harmonic
	977	1 Demokratika	DATE OF THE PARTY OF			патшоптс
THD	= 0	. 0%	DC	=	0.0V	Trigger
Fund	lament	al =	0.0	٧		55-
N	%	N	%	N	%	
2	0.00	15	0.00	28	0.00	
3	0.00	16	0.00	29	0.00	
4	0.00	17	0.00	30	0.00	
5	0.00	18	0.00	31	0.00	
6	0.00	19	0.00	32	0.00	
7	0.00	20	0.00	33	0.00	
8	0.00	21	0.00	34	0.00	
9	0.00	22	0.00	35	0.00	
10	0.00	23	0.00	36	0.00	
11	0.00	24	0.00	37	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	93090000
List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/1:

Press Execution Page on the right to return to the Harmonic Meas. Mode page. Next press Trigger on the right to perform the output voltage harmonic measurement.

1	_Phas				: : RUN	NING	OUT
		HARMO	NIC MEASUR	EMENT SET	TING		Harmonic
	THD	= 4	. 1%	DC	=	0.0V	Stop
	Fund	ament	al =	99.9	٧		
	N	%	N	%	N	%	
	2	0.04	15	0.11	28	0.02	
	3	1.98	16	0.02	29	0.02	
	3	0.03	17	0.03	30	0.02	
	5	1.55	18	0.03	31	1.33	
	5 6 7	0.00	19	0.05	32	0.02	
	7	2.03	20	0.02	33	1.01	
	8	0.00	21	0.04	34	0.03	
	8	0.02	22	0.03	35	0.03	
	10	0.01	23	1.64	36	0.01	
	11	0.06	24	0.01	37	0.02	
	12	0.03	25	0.97	38	0.02	
	13	0.03	26	0.02	39	0.02	
	14	0.03	27	0.04	40	0.03	
	List Mode	Pulse Mode	Step Mode	Synthesis	Inter- harmonics	Harmonic Meas.	2008/10/13 20:33:50

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



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.

(i) NOTICE

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



6. Parallel Operation

6.1 Parallel Connection of AC Source

When two AC Sources or one AC Source with one Power Stage Unit are applied in parallel mode, it can use an Input/Output Terminal Box for Parallel Connection (2 Units) (A615104) to connect the AC Source and Power Stage Unit (A615103) or another AC Source as the figure shown below. Use the Input/Output Terminal Box for Parallel Connection (3 Units) (A615105) when connecting 3 devices in parallel.

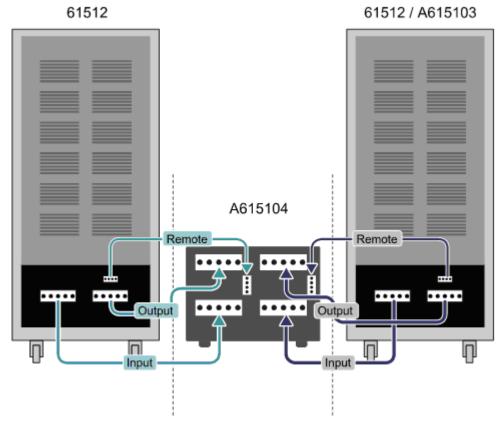


Figure 6-1 Master/Slave Connecting Diagram

6.2 Parallel Connection

When the AC Source and the Power Stage Unit are applied in parallel mode, it needs to use the System Bus and DVI communication cable to transmit parallel data. The following figure shows the parallel connencting diagram when connecting the AC Source and Power Stage Unit. If more AC Sources (61511/61512/61611/61612) or A615103 Power Stage Units are required for parallel connection, just follow the way shown below to connect them.

(i) NOTICE

When the parallel mode is in use, it is necessary to connect the System Bus and DVI cables correctly or it will cause the system connection error.

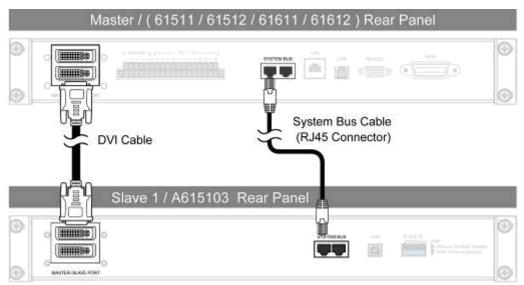


Figure 6-2 Parallel Connection of AC Source and Power Stage Unit

6.3 Setting Up

6.3.1 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 Master/Slave Function for parallel connection setting. The procedures are listed below.

- 1. Press Master/Slave Function.
- 2. Press Position at the bottom.
- 3. Turn the RPG to change the Position to Slave and press **ENTER** to set it to Slave.
- 4. 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.

(i) NOTICE

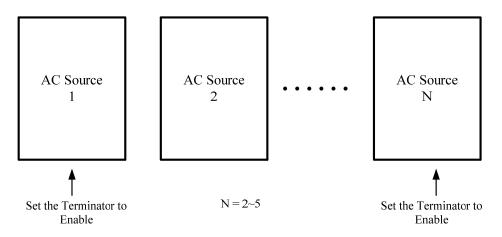
At least one device needs to be set as Slave when applying the parallel connection.

3 _	_Pha	s e	300V	LOCAL		QUIT	
			OUTPU	T SETTING			Config
₫1	Vac	=	0.0V	F =	6	0.0Hz	Others
₹2	Vac	=	0.07	F =	6	0.0Hz	Others
⊕ 3	Vac	=	0.0V	F =	6	0.0Hz	Calibration
			MEAS	UREMENT			0
	٧	=	0.00	. VA	=	0.0	System
⊕ 1	ı	=	0.000	PF	=	0.000	Information
	٧	=	0.00	P٥	=	0.0	Factory
₹2	1	=	0.000	PF	=	0.000	Default
	٧	=	0.00	P٥	=	0.0	Master/Slave
₫3	ı	=	0.000	PF	=	0.000	Function
	V 12	=	0.00	V 31	=	0.00	More
Σ	V_{23}	=	0.00	P٥	=	0.0	2 of 2
	sition	Numb	, l erminat			Function	2008/10/13
N	laster	31a\ 1	Disable	•		Disable	19:28:34

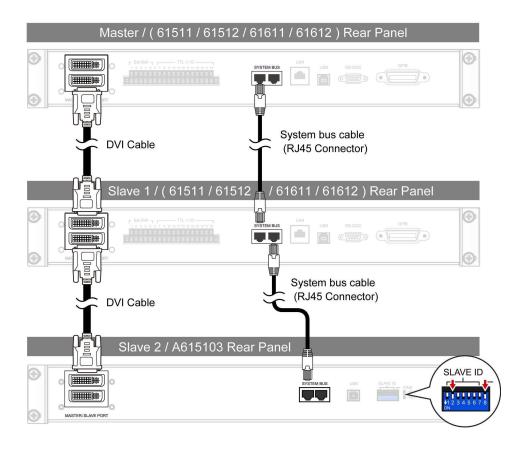
3	_Pha	se	30	JUV	LOCAL		QUII	
				OUTPU	IT SETTING			Config
 1	Vac	=	0	.07	F =	6	0.0Hz	Others
⊕2	Vac	=	0	. 0V	F =	6	0.0Hz	Others
⊕ 3	Vac	=	0	.07	F =	6	0.0Hz	Calibration
				MEA	BUREMENT			
	٧	=	0	.00	VA	=	0.0	System
⊕1	ı	=	0.	000	PF	=	0.000	Information
₩2	٧	=	0	.00	P∘	=	0.0	Factory
92	ı	=	0.	000	PF	=	0.000	Default
	٧	=	0	.00	P₀	=	0.0	Master/Slave
Φ 3	ı	=	0.	000	PF	=	0.000	Function
	V ₁₂	=	0	.00	V ₃₁	=	0.00	More
Σ	V ₂₃	=	0	.00	Po	=	0.0	2 of 2
	osition	Termi						2008/10/13
	Slave1	Disa	able					19:28:34

6.3.2 Setting the Slave of Mixed AC Source and A615103

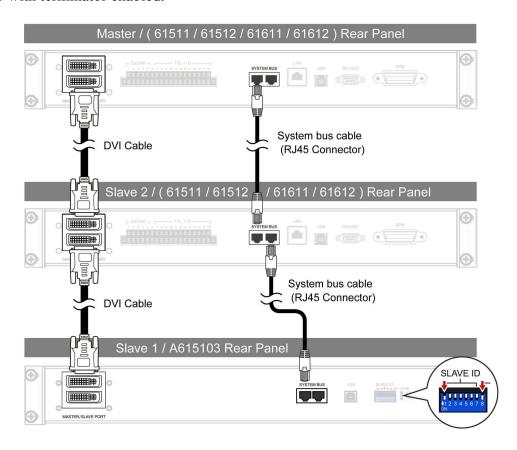
When the parallel connection is mixed with A615103 and AC Source as the Slave, the terminator of these two terminal devices must be enabled as the figure shown below. The maximum AC Sources to be connected in parallel is N = 5. Please refer to the User's Manual of latest version for any changes.



Example 1: if the system has a Slave AC Source and an A615103 parallelable power stage unit, the connection is shown in the figure below. Set the terminator of Master to "Enable" and the "Position" of Slave AC Source to "Slave1". Also set the Slave ID of A615103 to Slave2 with terminator enabled.



Example 2: if the system has a Slave AC Source and an A615103 parallelable power stage unit, the connection is shown in the figure below. Set the terminator of Master to "Enable" and the "Position" of the Slave AC Source to "Slave2". Also set the Slave ID of A615103 to Slave1 with terminator enabled.



6.3.3 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 procedures are listed below.

- 1. Press Master/Slave Function.
- 2. Press Position at the bottom.
- 3. Turn the RPG to change the Position to Master and press **ENTER** to set it to Master.
- 4. Press Number of Slave.
- 5. Turn the RPG to select the quantity of Slaves to connect in parallel and press **ENTER** to set it
- 6. 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.
- 7. Press Function bottom.
- 8. Turn the RPG to change the Function to Enable and press **ENTER** to set it.
- 9. Now, the device set to Master will retrun to the main menu and the one set to Slave will show Slave on the screen.

3	Pha	s e	3 (0 0 V	_OC	AL		QUI	Т	
				OUTPUT	SETTII	4G				Config
⊕ 1	Vac	=	(0.0V	F	=	6	0.0	Hz	Others
€2	Vac	=	(0.0V	F	=	6	0.0	Hz	Others
⊕ 3	Vac	=	(0.0V	F	=	6	0.0	Hz	Calibration
				MEASUR	REMENT					
	٧	=	(0.00	, V	١	=		0.0	System
⊕ 1	I	=	0	.000	PΙ	•	=	0.	000	Information
⊕ 2	٧	=	(0.00	Ро		=		0.0	Factory
9 2	ı	=	0	.000	PΙ	=	=	0.	000	Default
⊕ 3	٧	=	(0.00	Po		=		0.0	Master/Slave
23	ı	=	0	.000	PΙ	=	=	0.	000	Function
_	V 12	=	(0.00	V a	1	=	0	.00	More
Σ	V_{23}	=	(0.00	Po		=		0.0	2 of 2
	osition laster	Number Slav 1		Terminator Disable					Function Disable	2008/10/13 19:28:34

3	Pha	s e	300V	LOCAL	QUI	T	
			OUTPUT	SETTING			Config
⊕1	Vac	=	0.0V	F =	60.0	Hz	Others
⊕2	Vac	=	0.0V	F =	60.0	Hz	Others
⊕ 3	Vac	=	0.0V	F =	60.0	Hz	Calibration
			MEAS	UREMENT			Cumbration
	٧	=	0.00	, VA	=	0.0	System
Φ 1	1	=	0.000	PF	= 0.	000	Information
	٧	=	0.00	P₀	=	0.0	Factory
⊕2	1	=	0.000	PF	= 0.	000	Default
	٧	=	0.00	P₀	=	0.0	Master/Slave
⊕ 3	1	=	0.000	PF	= 0.	000	Function
	V 12	=	0.00	V 31	= 0	. 0 0	More
Σ	V23	=	0.00	Po	=	0.0	2 of 2
	osition Aaster	Numbe Slav 1		r		Function Enable	2008/10/13 19:28:34

Slave 1

(i) NOTICE

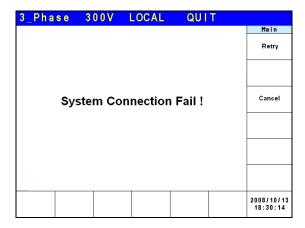
At least one device needs to be set as Slave when in parallel application, or it will show "System Connection Fail!" when setting the Master Enable. See the section below for the detail description of troubleshooting.

6.4 Troubleshooting

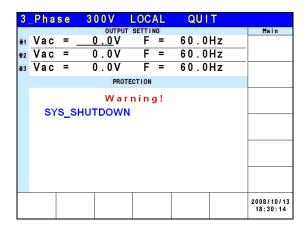
When multiple devices are conneted in parallel for use, each standalone device has to have a System bus and a DVI cable to transmit the signal, or the quantity of the Slave set for connection does not match the one in actual. If the connection is busy or errors occurred during connection, follow the troubleshooting procedure to resolve the problem and redo the parallel connection.

6.4.1 When the Connecting Cable Falls

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

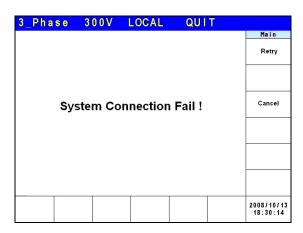


If "SYSTEM SHUTDOWN" occurs during connection, power it off first and check if the DVI cable is connected firmly. If yes, reboot it and redo the connection.



6.4.2 Parallel Setting Error

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



7. Theory of Operation

7.1 Overview

The 61511/61512 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:
 - It converts the AC power to DC power with passive PFC function.
- Isolation Converter G/GD Board:
 - The isolation DC/DC converter isolates the I board output with regulation function. It can also provide the inverter a stable input DC source.
- Output Stage HB/HT/O/A board:
 - The above boards are composed of an inverter that draws power from G/GD board to provide 61511/61512 to output DC or AC power.
- Auxiliary Power J/Z board:
 - J board converts the mains to a 16-17V DC power for the ICs and fans of entire device use. Z board is an isolation DC/DC converter that converts the J board output to $\pm 12V$ and $\pm 5V$ power to drive the IC of various PCB and other components.
- Fan Control Circuit R Board:
 - R board detects the temperature of each power stage and adjusts the fan speed automatically to control the temperature of entire device. This circuit has Over Temperature Protection (OTP) and FAN- LOCK protection.
- Digital Signal Processor B board:
 - B board contains DSP, FPGA and CPLD control elements that are responsible for the actions and measurements of 61511/61512's entire device.
- Communication Interface E board:
 - E board connects all of the 61511/61512 communication interfaces such as GPIB, RS-232, USB.....and sends the signals back to B board to accomplish the remote control function.
- Signal Transmission C Board:
 - The C board is responsible for transmitting the signals from B board and other PCBs.

- Key input KA/KC/KR/KS board:
 It is the front panel key controls for the above PCBs that send the inputted signals to B board.
- 1-phase Output Connecting Device L Board: When L board is in 1-phase output, short circuit L1~L3 3 outputs for user wiring.
- Input Wire Selection Switch (Δ -Y wiring selection switch): Users can follow the actual power system to change the 61511/61512 internal input connection that enables 61511/61512 to accept the input from Δ or Y.

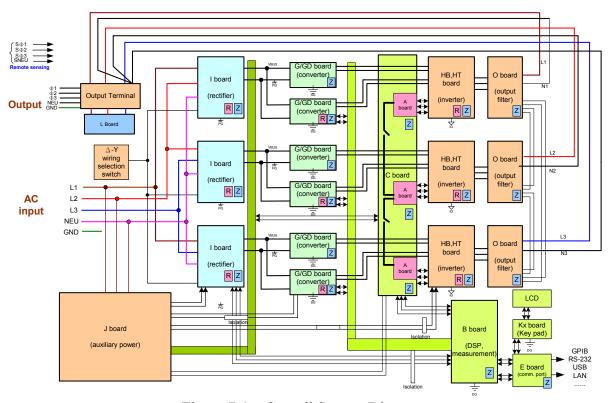


Figure 7-1 Overall System Diagram

8. Self Test and Troubleshooting

8.1 Overview

This chapter describes the procedures of self test and suggestions for troubleshooting when the AC Source is unable to operate normally. If the information provided here is unable to resolve the problem, please contact the 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 items of DISPLAY, WAVEFORM, and REMOTE. If any failure is detected on a certain item, an "error code" will show on 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. The bit 0 and bit 2 are "1". So "ERROR = 05" means memory error and DATA error occurs.

Error Message	Description	Resolution
Memory error	Memory tested fail.	Consult your dealer for further support
Waveform	Waveform generator	Consult your dealer for further support.
Generator error	tested fail.	
DATA error	The data in Flash or	Consult your dealer for further support.
	EEPROM tested fail.	
Communication	Unable to send.	1. Power off the AC Source and wait for three
error		seconds to power it on again.
		2. Consult your dealer for further support.

After the self test of memory, data and communication, the AC Source executes the power output self test. In this procedure, the output relays are OFF to prevent the load connected to the output terminal from damage. An error message will appear on the panel if abnormal is encountered during self test.

8.3 Troubleshooting

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

Problem	Cause	Resolution
Poor measurement of	Aged components result in	Periodic calibration is required.
V, I.	deviation of characteristics.	Refer to Chapter 4 <i>Calibration</i> .
Output distortion	1. The output voltage of AC	1. Program higher output
T T	Source is too low.	voltage.
	2. The rectified load is too large	2. Reduce the load or output
	during high frequency.	frequency.
Over Temperature	1. The ambient temperature is too	1. Operate the unit between 0 ~
Protection (OTP)	high.	40°C.
	2. The airway is obstructed.	2. Unblock the airway.
Over Power	The output power exceeds	Remove the output power or
Protection (OPP)	specification.	output voltage.
Over Current	The output current exceeds	Remove the overload or expand
Protection (OCP)	specification or I LIMIT.	the I LIMIT.
Output Short	1. The output is shorted.	1. Remove the short state.
Protection (Short)	2. External current reversed.	2. Remove the load.
Input error protection	The line input voltage of AC	Measure the input voltage and
(INT_LINE)	Source is too low or too high.	regulate it if over specification.
AUX output error	The internal auxiliary power	If it is unable to reset the
protection (INT_OFF)	outputs abnormally.	protection, consult the dealer for
		assistance.
INT _ AD protection	1. The cycle dropout for line	1. Check the stability of input
	input voltage.	voltage.
	2. Instant over current during	2. Remove the load.
	output.	3. If it is unable to reset the
	3. The AD power stage is	protection, consult the dealer
	damaged.	for assistance.
INT _ DD protection	1. The cycle dropout for line	1. Check the stability of input
	input voltage.	voltage.
	2. Instant over current during	2. Remove the load.
	output.	3. If it is unable to reset the
	3. The DD power stage is	protection, consult the dealer
OUTDUT OVE	damaged.	for assistance.
OUTPUT OVP	1. Remote sense is open.	1. Connect the output to remote
protection	2. Output voltage peak exceeds	sense terminals. Chack the settings of Vac and
	the range.	2. Check the settings of Vac and Vdc on MAIN PAGE.
Cooling fan protection	1. The fan stops operation due	1. Clear the fan.
(FAN-FAIL)	obstruction.	2. If it is unable to reset the
(I AIN-I'AIL)	2. The fan is not inserted.	protection, consult the dealer
	2. The fair is not inserted.	for assistance.
Unable to control AC	1. The address of AC Source is	1. Update the address.
Source via GPIB	incorrect.	2. Check the connection and
Source via Of 1D	2. GPIB cable is loose at rear.	tighten the screws.
	=. SI ID vacio is loose at leat.	2511011 1110 5010 115.

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 command from the host. RS-232C interface is a serial bus with less powerful functions; however, the user can do basic remote control via simple programs.

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: Windows 98/2000/XP/Vista

(4) Installing Driver: The AC Source USB Interface supports USBTMC, so if the PC

OS supports USBTMC (installed NI-VISA runtime version 3.00 or above) it is no need to install other drivers. The OS will search for the standard USBTMC driver installation program

automatically.

If the PC OS does not support USBTMC, it is suggested to install the NI-VISA runtime version 3.00 or above first. When the installation of NI-VISA runtime is done, the USBTMC driver program is stored in OS. The PC can communicate with 62000P Series via NI-VISA after using the USB cable to connect them.

Related Documents:

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

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

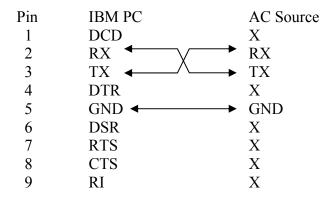
other	keys are invalid except LOCAL/RE	EMOTE.
Press	LOCAL/REMOTE can return to lo	ocal mode.

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 baudrate and parity can be set via "CONFIG" function menu (see section 3.4.) Only TxD and RxD signals are used for data transmission. The connector is a 9-pin D-subminiature male connector. The following table describes the pins and signals of RS-232C connector.

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

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



9.1.4 Ethernet Interface

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

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

9.2.2 Numerical Data Formats

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

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

9.2.3 Boolean Data Format

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

9.2.4 Character Data Format

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

<crd></crd>	Character Response Data: character string with maximum length of 12.
<srd></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 called tree system. Full path must be specified to obtain a particular command. This path is represented in the table by placing the highest node in the farthest left position of the hierarchy. Lower nodes in the hierarchy are indented in the position to the right under the parent node.

Program Header:

Program header is the key word to identify the command according to the IEEE 488.2 syntax described in section 9.5. The AC Source accepts characters in both upper and lower cases without any distinction. Program header consists of two unique types, the common command header and the instrument-controlled header.

Common Command and Query Header:

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

Instrument-Controlled Header:

Instrument-controlled header can be applied to all instrument commands. Each header has a long form and a short form. The 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 in this section. The short form of header is shown by upper case characters while the rest of the headers are shown in lower case.

Program Header Separator (:):

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

Program Message:

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

Program Message Component:

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

Example: FREQ?, OUTPut ON.

Program Message Component Separator (;):

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

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

Program Message Terminator (<PMT>):

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

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

(i) NOTICE

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

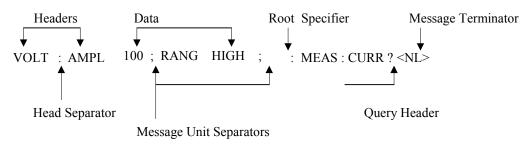


Figure 9-1 Structure of Command Message

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 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 All colons are header separators.

OUTPut: PROTection: CLEar; : VOLT: AC 100 Only the third colon is a specified root.

9.4 Execution Order

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

For example, assuming the current output voltage range is LOW, the output voltage range desired for new state is HIGH with amplified 220 Volt. If the commands

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

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

9.5 Commands of AC Source

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

Syntax Form Syntax definition is in long format header; however, only short

format header appears in the examples.

Parameter Most commands require a parameter.

Return Parameter All queries return a parameter.

Model If a command is merely applied to specific models, these models will be

listed in the Model only entry. If there is no Model only entry, the

command will be applied to all models.

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. The command commands and queries are listed in alphabetic order.

*CLS Clear status

This command clears the following registers

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

*ESE<n> Standard event status enabled

This command programs the Standard Event register bits. If one or more enabled events of Standard Event registers are set, the ESB of Status Byte Register is set as well.

Bit Configuration of Standard Event Status Enabled Register

Bit Position	7	6	5	4	3	2	1	0	
Bit Name	PON		CME	EXE	DDE	QYE		OPC	
CME = Com	DDE = Device-dependent error								
EXE = Execution Error				OPC = Operation Completed					
PON = Powe		(QYE = Q	uery En	cor				

*ESE? Return standard event status enabled

*ESR? The query reads the Standard Event readings of Event register and clears it.

The bits of configuration are the same as Standard Event Status Enabled

Register.

*IDN? Return the AC Source identification string.

Return Parameter Chroma ATE,61500,123456,01.00

Chroma ATE : Company name 61500 : Model name

123456 : Serial number 01.00 : Firmware version

*RCL<n> Restore the values of specified group that stored in memory previously.

Parameter 1 - 10

*SAV<n> Save the values to a specified group in memory.

Parameter 1 - 10

* RST It resets the AC Source to the initial states. It's better to wait for 3 seconds to

send the next command.

*SRE It sets conditions of Service Request Enabled Register. If one or more of the

enabled events of the Status Byte Register is set, the MSS and RQS of Status

Byte Register are set too.

*SRE? This guery 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
OUES = Ouestionable Status Summary

RQS = Request for Service
MSS = Master Status Summary
MAV = Message Available

9.5.2 Instrument Command Dictionary

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

^{*} TST? It queries the self-test result of the AC Source.

9.5.2.1 SYSTEM Sub-System

SYSTem

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

SYSTem:ERRor?

Description : This command queries the error string of the command parser.

Query Syntax : SYSTem:ERRor?

Parameter : None

Return Parameter: 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: Current version (XX.XX)

SYSTem:LOCal

Description : This command can only be used under the control of RS-232C. If

SYST: LOC is programmed, the 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 can only be used under the control of RS-232C. 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.

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 Sub-System

INSTrument

:EDIT :Couple

:NSELect

:PHASe

INSTrument:EDIT

Description : It is very convenient to use a programmed command to set all phases

at the same time for an AC Source that equipped with multiple phases. If INST:EDIT ALL has been programmed, it will be sent to all phases. INST:EDIT EACH command disables EDIT ALL

command.

Query Syntax : INSTrument:EDIT?

Parameter : EACH | ALL

Return Parameter: None

INSTrument: COUPle

Description : It is easy to use a command to program all phases in an AC Source

with multiple phases. If INST: COUP ALL is programmed, the command will be sent to all phases. INST: COUP NONE command

will cancel COUP ALL command.

Query Syntax : INSTrument : COUPle?

Parameter : NONE | ALL

Return Parameter: None

INSTrument: NSELect

Description : This command sets individual output for subsequent commands or

queries in the multi-phase model. If INST: COUP NONE has been programmed, the phase selection command will send to a specific output phase set by INSTrument: NSELect. If INST: COUP ALL has been programmed, all remote operation commands will send to all output phases. This command only affects the set voltage and queries the measurement data. For instance, if "INST: COUP ALL", "INST: NSEL 2" and "Meas: VOLT?" are programmed, the AC Source will return Φ 2 measurement voltage. INST: NSEL

follows the number to select phase.

Query Syntax : INSTrument : NSELect?

Parameter : 1 | 2 | 3 Return Parameter : 1 | 2 | 3

INSTrument: SELect

Description : This command sets individual output for subsequent commands or

queries in the multi-phase model. If INST: COUP NONE has been programmed, the phase selection command will send to a specific output phase set by INSTrument: SELect. If INST: COUP ALL has been programmed, all remote operation commands will send to all output phases. This command only affects the set voltage and queries the measurement data. For instance, if "INST: COUP ALL", "INST: SEL OUTPUT2" and "Meas: VOLT?" are

programmed, the AC Source will return $\boldsymbol{\Phi}$ 2 measurement voltage.

INST: SELect follows the number to select phase.

Query Syntax : None

Parameter : OUTPUT1 | OUTPUT2 | OUTPUT3

Return Parameter: None

INSTrument: PHASe

Description : It switches between single phase and three-phase mode.

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

9.5.2.3 FETCH & MEASURE Sub-System

FETCh | MEASure

[: SCALar]

: CURRent

: AC? It queries the rms current of AC component.

: DC? It queries the DC current level. : ACDC? It queries the current (AC+DC) rms.

: AMPLitude : MAXimum? It queries the peak current.

: CREStfactor? It queries the current crest factor.
: INRush? It queries the inrush current.
: FREQuency? It queries the frequency.

: POWer

: AC

[: REAL]? It queries the real power.
: APParent? It queries the apparent power.
: REACtive? It queries the reactive power.
: PFACtor? It queries the power factor.
: TOTal? It queries the total power.

: TOTal : APParent? It queries the total apparent power.

:VOLTage

: AC? It queries the rms voltage of AC component.

: DC?: ACDC?: AMPLitude : MAXimum?It queries the DC voltage.It queries the rms voltage.It queries the peak voltage.

:LINE

:V12? It queries the voltage difference of phase 1 and

2.

:V23? It queries the voltage difference of phase 2 and

3.

:V31? It queries the voltage difference of phase 3 and

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 measurement buffer.

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

Description : These queries return the rms current of AC component that is output

from the output terminal.

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

Return Parameter: <NR2>

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

Description : These queries return the DC current that is output from the output

terminal.

Query Syntax : 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 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 Parameter: <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 watt.

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-ampere.

Query Syntax : FETCh : POWer : AC : APParent?

MEASure: POWer: AC: APParent?

Return Parameter: <NR2>

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

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

output terminals in volt-ampere. Reactive power is calculated by

the following formula:

 $VAR = \sqrt{APPARENTPOWER^2 - REALPOWER^2}$

Query Syntax : FETCh : POWer : AC : REACtive?

MEASure: POWer: AC: REACtive?

Return Parameter: <NR2>

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

Description : These queries return the power factor that is output from the output

terminals. Power factor is computed by: PF = TRUE POWER / APPARENT POWER

: FETCh : POWer : AC : PFACtor?

MEASure: POWer: AC: PFACtor?

Return Parameter: <NR2>

Query Syntax

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

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

3-phase output terminal in watt.

Query Syntax : FETCh : POWer : AC : TOTal?

MEASure: POWer: AC: TOTal?

Return Parameter : <NR2>

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

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

3-phase output terminal in volt-ampere.

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

MEASure:POWer:AC:TOTal:APParent?

Return Parameter : <NR2>

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

Description : These queries return the rms of AC component that is output from

the output terminal.

Query Syntax : FETCh [: SCALar]: VOLTage : AC?

MEASure [: SCALar] : VOLTage : AC?

Return Parameter: <NR2>

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

Description : These queries return the DC composite voltage that is output from

the output terminal.

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

MEASure [: SCALar] : VOLTage : DC?

Return Parameter: <NR2>

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>

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

Description : These queries return the absolute value of peak voltage.

Query Syntax : FETCh : **VOLTage**: AMPLitude : MAXimum?,

MEASure: **VOLTage**: AMPLitude: MAXimum?

Return Parameter: <NR2>

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>

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

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

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

MEASure [: SCALar] : LINE : V23?

Return Parameter: <NR2>

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 Sub-System

OUTPut

[: STATe] : RELay

: SLEW

: VOLTage : AC : DC :FREQency

: COUPling

: MODE

: PROTection

:CLEar

: IMPedance

: STATe

: RESistor

: INDuction

OUTPut [: STATe]

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

Disabled output is to set the output voltage amplitude to 0 Volt.

Query Syntax : OUTPut [: STATe]?

Parameter : OFF | ON Return Parameter : OFF | ON

OUTPut: RELay

Description : This command sets output relay on or off.

Query Syntax : OUTPut : RELay?

Parameter : OFF | ON, ON sets the output relay of the AC Source on (close),

OFF sets the output relay of the AC source off (open).

Return Parameter : OFF | ON

OUTPut : SLEW : VOLTage : AC

Description : This command sets the slew rate of the AC output voltage.

Query Syntax : OUTPut : SLEW : VOLTage : AC?

Parameter : $\langle NR2 \rangle$, the valid range is $0.000V/ms \sim 1200.000V/ms$.

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 : $\langle NR2 \rangle$, the valid range is $0.000V/ms \sim 1200.000V/ms$.

Return Parameter: <NR2>

OUTPut: SLEW: FREQuency

Description : This command sets the slew rate of the output frequency.

Query Syntax : OUTPut : SLEW : FREQuency?

Parameter : $\langle NR2 \rangle$, the valid range is 0.000 Hz/ms ~ 1600.000 Hz/ms

Return Parameter: <NR2>

OUTPut: COUPling

Description : This command selects the coupling of the output signals.

Query Syntax : OUTPut : COUPling?
Parameter : AC | DC | ACDC
Return Parameter : AC | DC | ACDC

OUTPut: MODE

Description : This command sets the operation mode and "FIXED" mode is the

general operation mode.

Query Syntax : OUTPut : MODE?

Parameter : FIXED | LIST | PULSE | STEP | SYNTH | INTERHAR Return Parameter : FIXED | LIST | PULSE | STEP | SYNTH | INTERHAR

OUTPut: PROTection: CLEar

Description : This command clears the latch that disables the output when over

current (OCP), over temperature (OTP), over power (OPP) or remote inhibit (RI) is detected. All conditions that generate the faults must

be resolved before the latch is cleared.

Query Syntax : None Parameter : None Return Parameter : None

OUTPut: IMPedance: STATe

Description : This command sets if enabling the output impedance control.

Query Syntax : OUTPut : IMPedance : STATe?

Parameter : ON | OFF Return Parameter : ON | OFF

OUTPut: IMPedance: RESistor

Description : This command sets the resistance of output impedance.

Query Syntax : OUTPut : IMPedance : RESistor?

Parameter : $\langle NR2 \rangle$, the valid range is $0.00\Omega \sim 1.00\Omega$.

Return Parameter : <NR2>

OUTPut: IMPedance: INDuction

Description : This command sets the inductance of output impedance.

Query Syntax : OUTPut : IMPedance : INDuction?

Parameter : $\langle NR2 \rangle$, the valid range is $0.00 \text{mH} \sim 1.00 \text{mH}$.

Return Parameter : <NR2>

9.5.2.5 SOURCE Sub-System

```
[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

[SOURce:] CURRent: LIMit

Description : This command sets the rms current limit of the AC Source for

protection.

Query Syntax : [SOURce :] CURRent : LIMit?

Parameter : $\langle NR2 \rangle$, the valid range is $0.00 \sim$ maximum current spec. of the

specific model (unit: A.)

Return Parameter: <NR2>

[SOURce:] CURRent: DELay

Description : This command sets the time delayed for triggering over current

protection.

Query Syntax : [SOURce :] CURRent : DELay?

Parameter : $\langle NR2 \rangle$, the valid range is $0.0 \sim 5.0$ (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 inrush current

measurement.

Query Syntax : [SOURce :] CURRent : INRush : INTerval? Parameter : <NR2>, the valid range is 0 ~ 9999 (unit: ms.)

Return Parameter : <NR2>

[SOURce:]CURRent:RANGe

Description : This command sets the current measurement range for output.

Query Syntax : [SOURce:]CURRent:RANGe?

Parameter

Para.	1	2	3	AUTO
Model				
61512	12A	48A	192A	Auto
61511	8A	32A	128A	Auto
61612	12A	48A	192A	Auto
61611	8A	32A	128A	Auto

Return Parameter :1 |2 |3 | Auto

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

Description : This command sets the output waveform frequency for the AC

Source in Hz.

Query Syntax : [SOURce :] FREQuency [: {CW | IMMediate}]? Parameter : <NR2>, the valid range is 15.00 ~ 1500.0 (unit: Hz.)

Return Parameter : <NR2>

[SOURce:] FREQuency: LIMit

Description : This command sets the output frequency limit for the AC Source.

Query Syntax : [SOURce :] FREQuency : LIMit?

Parameter : $\langle NR2 \rangle$, the valid range is $15.00 \sim 1500.00$ (unit: Hz)

Return Parameter : <NR2>

[SOURce:] POWer:PROTection

Description : This command sets the OPP (Over Power Protection) for AC

Source.

Query Syntax : [SOURce :] POWer:PROTection?

Parameter : $\langle NR2 \rangle$, the valid range is $0.0 \sim$ maximum power of specific model

(unit: W.)

Return Parameter : <NR2>

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

Description : This command sets the AC composite output voltage in Volts.

Query Syntax : [SOURce :] VOLTage [: LEVel][: IMMediate][: AMPLitude] : AC? Parameter : <NR2>, the valid range is 0.0 ~ 150.0 (low range), 0.0 ~ 300.0 (high

range.)

Return Parameter: <NR2>

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

Description : This command sets the DC composite output voltage in Volts.

Query Syntax : [SOURce :] VOLTage [: LEVel][: IMMediate][: AMPLitude] : DC? Parameter : <NR2>, the valid range is -212.1 ~ 212.1 (low range), -424.2 ~ 424.2

(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 : $\langle NR2 \rangle$, the valid range is $0.0 \sim 300.0$ (unit: V.)

Return Parameter : <NR2>

[SOURce:] VOLTage: LIMit: DC: PLUS

Description : This command sets the Vdc Limit(+).

Query Syntax : [SOURce :] VOLTage : LIMit : DC : PLUS? Parameter : $\langle NR2 \rangle$, the valid range is -424.2 \sim 424.2 (unit: V)

PS: The lower limit cannot exceed Vdc Limit(-).

Return Parameter: <NR2>

[SOURce:] VOLTage: LIMit: DC: MINus

Description : This command sets the Vdc Limit(-).

Query Syntax : [SOURce :] VOLTage : LIMit : DC : MINus? Parameter : <NR2>, the valid range is -424.2 ~ -424.2 (unit: V)

PS: The upper limit cannot exceed Vdc Limit(+).

Return Parameter: <NR2>

[SOURce:] VOLTage: RANGe

Description : This command sets the output voltage range to LOW (150 V) or

HIGH (300 V) or AUTO 3 selections.

Query Syntax : [SOURce :] VOLTage : RANGe?

Parameter : LOW | HIGH Return Parameter : LOW | HIGH

[SOURce:] FUNCtion: SHAPe

Description : This command specifies the waveform buffer. The AC Source output

has two buffers and users need to specify to use the contents of the

waveform buffer A or B.

Query Syntax : [SOURce :] FUNCtion : SHAPe?

 $\begin{array}{ll} \text{Parameter} & : A \mid B \\ \text{Return Parameter} & : A \mid B \end{array}$

[SOURce:] FUNCtion: SHAPe: A

Description : This command specifies the waveform buffer A for use.

Query Syntax [SOURce :] FUNCtion : SHAPe : A?

Parameter : SINE | SQUA | CSIN | DST<01..30> | USR<01..06> Return Parameter : SINE | SQUA | CSIN | DST<01..30> | USR<01..06>

[SOURce:] FUNCtion: SHAPe: A: MODE

Description : This command selects the mode for the clipping in waveform

buffer A for use.

Query Syntax : [SOURce :] FUNCtion : SHAPe : A : MODE?

Parameter : AMP | THD Return Parameter : AMP | THD

[SOURce:] FUNCtion: SHAPe: A: THD

Description : This command sets the clipped THD percentage for the clipping in

waveform buffer A.

Query Syntax : [SOURce :] FUNCtion : SHAPe : A : THD? Parameter : <NR2>, the valid range is 0.0% ~ 43%.

Return Parameter : <NR2>

[SOURce:] FUNCtion: SHAPe: A: AMP

Description : This command sets the clipped peak percentage for the clipping in

waveform buffer A.

Query Syntax : [SOURce :] FUNCtion : SHAPe : A : AMP? Parameter : $\langle NR2 \rangle$, the valid range is $0.0\% \sim 100\%$.

Return Parameter : <NR2>

[SOURce:] FUNCtion: SHAPe: B

Description : This command specifies the waveform buffer B for use.

Query Syntax : [SOURce :] FUNCtion : SHAPe : B?

Parameter : SINE | SQUA | CSIN | DST<01..30> | USR<01..06> Return Parameter : SINE | SQUA | CSIN | DST<01..30> | USR<01..06>

[SOURce:] FUNCtion: SHAPe: B: MODE

Description : This command selects the mode for the clipping in waveform buffer

B for use.

Query Syntax : [SOURce :] FUNCtion : SHAPe : B : MODE?

Parameter : AMP | THD Return Parameter : AMP | THD

[SOURce:] FUNCtion: SHAPe: B: THD

Description : This command sets the clipped THD percentage for the clipping in

waveform buffer B.

Query Syntax : [SOURce :] FUNCtion : SHAPe : B : THD? Parameter : <NR2>, the valid range is 0.0% ~ 43%.

Return Parameter : <NR2>

[SOURce:] FUNCtion: SHAPe: B: AMP

Description : This command sets the clipped peak percentage for the clipping in

waveform buffer B.

Query Syntax : [SOURce :] FUNCtion : SHAPe : B : AMP? Parameter : <NR2>, the valid range is 0.0% ~ 100%.

Return Parameter : <NR2>

9.5.2.6 CONFIGURE Sub-System

[SOURce :]

CONFigure

: INHibit : EXTernal : COUPling : EXTON

[SOURce :] CONFigure : INHibit

Description : This command sets the Remote Inhibit function.

Query Syntax : [SOURce :] CONFigure : INHibit?

Parameter : DISABLE | ENABLE Return Parameter : DISABLE | ENABLE

[SOURce:] CONFigure: EXTernal

Description : This command sets if enabling the External-V Reference function.

Query Syntax : [SOURce :] CONFigure : EXTernal?

Parameter : OFF | ON Return Parameter : OFF | ON

[SOURce:] CONFigure: COUPling?

Description : This command sets the External-V Reference to be

AC_AMPLIFIER or DC_LEVEL to control the 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 | ENABLE Return Parameter : DISABLE | ENABLE

9.5.2.7 PHASE Sub-System

[SOURce:]

PHASe

:ON

:OFF

:P12

:P13

:SEOuence

:THREE

:RELOCK

[SOURce:] PHASe: ON

Description : This command sets the transition angle when the waveform shifts.

The default is ON meaning 0 degree.

Query Syntax : [SOURce :] PHASe : ON?

Parameter : $\langle NR2 \rangle$, the valid range is $0.0 \sim 359.9$.

Return Parameter: <NR2>

[SOURce:] PHASe: OFF

Description : This command sets the transition angle when the waveform ends.

Query Syntax : [SOURce :] PHASe : OFF?

Parameter : $\langle NR2 \rangle$, the valid range is $0.0 \sim 360.0$, 360.0: means IMMED.

Return Parameter: <NR2>

[SOURce:]PHASe:P12

Description : This command sets the phase difference of $\Phi 1$ and $\Phi 2$.

Query Syntax : [SOURce :]PHASe:P12?

Parameter : $\langle NR2 \rangle$, the valid range is $0.0 \sim 359.9$.

Return Parameter: <NR2>

[SOURce:]PHASe:P13

Description : This command sets the phase difference of $\Phi 1$ and $\Phi 3$.

Query Syntax : [SOURce :]PHASe:P13?

Parameter : $\langle NR2 \rangle$, the valid range is $0.0 \sim 359.9$.

Return Parameter : <NR2>

[SOURce:]PHASe:SEQuence

Description : This command sets the phase sequence in 3-phase mode.

Query Syntax : [SOURce :]PHASe:SEQuence?

Parameter : POS | NEG

Return Parameter: POSITIVE | NEGATIVE

[SOURce:]PHASe:RELOCK

Description : This command sets the relock function in 3-phase mode.

Query Syntax : [SOURce :]PHASe:RELOCK?

Parameter : ENABLE | DISABLE Return Parameter : ENABLE | DISABLE

[SOURce:]PHASe:THREE

Description : This command set the operation mode in 3-phase mode.

Query Syntax : [SOURce :]PHASe:THREE?

Parameter : INDEPEND | SAMEFREQ | BALANCE Return Parameter : INDEPEND | SAMEFREQ | BALANCE

9.5.2.8 STATUS Sub-system

STATus

: OPERation

[: EVENt]? : ENABle

: QUEStionable

: CONDition

[: EVENt]?

: ENABle

: NTRansition

: PTRansition

STATus : OPERation [: EVENt]?

Description : This command queries the Operation Status register.

Query Syntax : STATus : OPERation [: EVENt]?

Parameter : None Return Parameter : Always 0.

STATus: OPERation: ENABle

Description : This command sets the Operation Status Enable register. The

register is the shield when specific bit is enabled from Operation

Status register.

Query Syntax : STATus : OPERation : ENABle? Parameter : $\langle NR1 \rangle$, the valid range is $0 \sim 255$.

Return Parameter: Always 0.

STATus: QUEStionable: CONDition?

Description : This query command returns the value of Questionable Condition

register. It is a read only register that saves the questionable

condition of AC Source in real time.

Query Syntax : STATus : QUEStionable : CONDition?

Parameter : NONE

Return Parameter : $\langle NR1 \rangle$, the valid range is $0 \sim 511$.

STATus: QUEStionable [: EVENt]?

Description : This query command returns the value of Questionable Event

register. It is a read only register that saves all items that passed Questionable NTR and/or PTR filter. If the QUES bit in Service Request Enabled register has been set and Questionable Event register > 0, the QUES of Status Byte register will be set too.

Query Syntax : STATus : QUEStionable [: EVENt]?

Parameter : NONE

Return Parameter : $\langle NR1 \rangle$, the valid range is $0 \sim 511$.

STATus: QUEStionable: ENABle

Description : The command sets or reads the value of Questionable Enable register.

The register is the shield when specific bit is enabled to set the QUES

bit of Status Byte register from Operation Status register.

Query Syntax : STATus : QUEStionable : ENABle? Parameter : $\langle NR1 \rangle$, the valid range is $0 \sim 511$.

Return Parameter: <NR1>

STATus: QUEStionable: NTRansition

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

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

following actions:

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

Bit 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 : Output voltage protectionINP : 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 : $\langle NR1 \rangle$, the valid range is $0 \sim 511$.

Return Parameter: <NR1>

STATus: QUEStionable: PTRansition

Description : These commands set or read the values of Questionable PTR register.

Please refer to the description of previous command.

Query Syntax : STATus : QUEStionable : PTRansition? Parameter : $\langle NR1 \rangle$, the valid range is $0 \sim 511$.

Return Parameter: <NR1>

9.5.2.9 TRACE Sub-system

TRACe

: RMS

TRACe

Description : This command sets the user-defined waveform data. It needs 1024

data points to create a period of waveform. Users have to

normalize the data and make the maximum point equal to 32767 or

the minimum point equal to -32767.

Syntax : **TRACe** <waveform_name>, <amplitude> {,<amplitude>}

Parameter : <waveform name>:US<n>, n=1~6, <amplitude>:<NR1>, the valid

range is $-32767 \sim 32767$.

Example : **TRACe** US1 100 200 ...32767... 500 800 <= 1024 points

This command requires about 5 seconds for execution.

TRACe: RMS

Description : This command sets the rms value of user's waveform. Users need

to calculate the root mean square value for 1024 data points.

Syntax : **TRACe : RMS** <waveform_name>, <rms>

Parameter : <waveform_name>:US<n>, n=1~6, <rms>:<NR1>, the valid range is

 $0 \sim 32767$.

Example : **TRACe** : **RMS** US1 27000

9.5.2.10 LIST Sub-system

```
[SOURce:]
    LIST
         : COUPling
         :TRIG
         : POINts?
         : COUNt
         : DWEL1
         : SHAPe
         : BASE
         : VOLTage
             : AC
                  : STARt
                  : END
             : DC
                  : STARt
                  : END
         : FREQuency
             : STARt
             : END
         : DEGRee
OUTPut
    : MODE
TRIG
TRIG: STATE?
[SOURce: LIST: COUPling
    Description
                     : This command sets the function of list mode.
    Query Syntax
                     : [SOURce:] LIST : Coupling?
    Parameter
                     : ALL | NONE
    Return Parameter: ALL | NONE
[SOURce: LIST: TRIG
    Description
                     : This command sets the trigger type of list mode.
                     : [SOURce:] LIST: TRIG?
    Query Syntax
                     : AUTO | MANUAL|EXCITE
    Parameter
    Return Parameter: AUTO | MANUAL | EXCITE
[SOURce:] LIST: POINts?
    Description
                     : This command returns the valid order number of list mode.
    Query Syntax
                     : [SOURce:] LIST : POINts?
    Parameter
                     : None
    Return Parameter : \langle NR1 \rangle, the valid range is 0 \sim 100.
[SOURce:] LIST: COUNt
    Description
                     : This command sets the number of times the list executed before
                      completion.
    Query Syntax
                     : [SOURce :] LIST : COUNt?
```

Parameter : $\langle NR1 \rangle$, the valid range is $0 \sim 65535$.

Return Parameter: <NR1>

[SOURce:] LIST: DWELI

Description : This command sets the sequence of dwell time list points.

Query Syntax : [SOURce:] LIST : DWEL1?

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

[SOURce:] LIST: SHAPe

Description : This command sets the sequence of waveform buffer list points.

Query Syntax : [SOURce:] LIST : SHAPe?

Parameter : A|B, ..., A|BReturn Parameter : A|B, ..., A|B

[SOURce:] LIST: BASE

Description : This command sets the time base of list.

Query Syntax : [SOURce:] LIST : BASE?

Parameter : TIME | CYCLE Return Parameter : TIME | CYCLE

[SOURce:] LIST: VOLTage: AC: STARt

Description : This command sets the sequence of AC start voltage list points.

Query Syntax : [SOURce:] LIST : VOLTage : AC : STARt?

Parameter : $\langle NR2 \rangle$, ..., $\langle NR2 \rangle$, the valid range is $0.0 \sim 150.0$ (low range), $0.0 \sim$

300.0 (high range.)

Return Parameter : <NR1>, ..., <NR2>

[SOURce:] LIST: VOLTage: AC: END

Description : This command sets the sequence of AC end voltage list points.

Query Syntax : [SOURce:] LIST : VOLTage : AC : END?

Parameter : $\langle NR2 \rangle$, ..., $\langle NR2 \rangle$, the valid range is $0.0 \sim 150.0$ (low range), $0.0 \sim$

300.0 (high range.)

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

[SOURce:] LIST: VOLTage: DC: STARt

Description : This command sets the sequence of DC start voltage list points.

Query Syntax : [SOURce:] LIST : VOLTage : DC : STARt?

Parameter : $\langle NR2 \rangle$, ..., $\langle NR2 \rangle$, the valid range is $-212.1 \sim 212.1$ (low range),

 $-424.2 \sim 414.2$ (high range.)

Return Parameter: <NR1>

[SOURce : LIST : VOLTage : DC : END

Description : This command sets the sequence of DC end voltage list points.

Query Syntax : [SOURce:] LIST : VOLTage : DC : STARt?

Parameter : $\langle NR2 \rangle$, ..., $\langle NR2 \rangle$, the valid range is $-212.2 \sim 212.1$ (low range),

 $-424.2 \sim 414.2$ (high range.)

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

[SOURce:] LIST: FREQuency: STARt

Description : This command sets the sequence of start frequency list points.

Query Syntax : [SOURce:] LIST : FREQuency : STARt?

Parameter : $\langle NR2 \rangle$, ..., $\langle NR2 \rangle$, the valid range is $15.00 \sim 1000.00$ (unit: Hz.)

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

[SOURce:] LIST: FREQuency: END

Description : This command sets the sequence of end frequency list points.

Query Syntax : [SOURce:] LIST : FREQuency : END?

Parameter : $\langle NR2 \rangle$, ..., $\langle NR2 \rangle$, the valid range is $15.0 \sim 1500.0$ (unit: Hz.)

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

[SOURce:] LIST: DEGRee

Description : This command sets the sequence of phase angle list points.

Query Syntax : [SOURce:] LIST : DEGRee?

Parameter : $\langle NR2 \rangle$, ..., $\langle NR2 \rangle$, the valid range is $0.0 \sim 359.9$.

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

OUTPut: MODE

Description : This command sets the operation mode.

Query Syntax : OUTPut : MODE?

Parameter : FIXED | LIST | PULSE | STEP | SYNTH | INTERHAR Return Parameter: FIXED | LIST | PULSE | STEP | SYNTH | INTERHAR

TRIG

Description : This command sets LIST mode in OFF, ON execution state after

setting **OUTPut**: **MODE LIST**. If users wish to change the parameters, it's necessary to set **TRIG OFF** then **OUTPut**: **MODE FIXED**. Then, set **OUTPut**: **MODE LIST** again to get ready to set

TRIG ON.

Query Syntax : TRIG : STATE?

Parameter : OFF | ON

Return Parameter: OFF | RUNNING

9.5.2.11 PULSE Sub-system

[SOURce:]

PULSe

: VOLTage

: AC

: DC

: FREQuency

: SHAPe

: SPHase

: COUNt

. COUNT

: DCYCle

: PERiod : TRIG

OUTPut

: MODE

TRIG

TRIG: STATE?

[SOURce:] PULSe: VOLTage: AC

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

Query Syntax : [SOURce :] PULSE : VOLTage : AC?

Parameter : $\langle NR2 \rangle$, the valid range is $0.0 \sim 150.0$ (low range), $0.0 \sim 300.0$ (high

range.)

Return Parameter: <NR2>

[SOURce :] PULSe : VOLTage : DC

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

mode.

Query Syntax : [SOURce :] PULSE : VOLTage : DC?

Parameter : <NR2>, the valid range is -212.1 \sim 212.1 (low range), -424.2 \sim 424.2

(high range.)

Return Parameter : <NR2>

[SOURce:] PULSe: FREQuency

Description : This command sets the frequency for the duty cycle of PULSE

mode.

Query Syntax : [SOURce :] PULSE : FREQuency?

Parameter : $\langle NR2 \rangle$, the valid range is $15.0 \sim 1500.0$ (unit: Hz.)

Return Parameter: <NR2>

[SOURce:] PULSe: SHAPe

Description : This command selects the waveform buffer for PULSE mode.

Query Syntax : [SOURce :] PULSE : SHAPe?

Parameter : $A \mid B$ Return Parameter : $A \mid B$

[SOURce :] PULSe : SPHase

Description : This command sets the start phase angle of duty cycle for PULSE

mode.

Query Syntax : [SOURce :] PULSE : SPHase?

Parameter : $\langle NR2 \rangle$, the valid range is $0.0 \sim 359.9$.

Return Parameter: <NR2>

[SOURce:] PULSe: COUNt

Description : This command sets the number of times the pulse executed before

completion.

Query Syntax : [SOURce :] PULSE : COUNt? Parameter : <NR2>, the valid range is 0 ~ 65535.

Return Parameter: <NR2>

[SOURce:] PULSe: DCYCle

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

Query Syntax : [SOURce :] PULSE : DCYCle?

Parameter : $\langle NR2 \rangle$, the valid range is 0 % \sim 100 %.

Return Parameter: <NR2>

[SOURce:] PULSe: PERiod

Description : This command sets the period of the PULSE mode.

Query Syntax : [SOURce :] PULSE : PERiod?

Parameter : $\langle NR2 \rangle$, the valid range is $0 \sim 999999999.9$ (unit: ms.)

Return Parameter: <NR2>

[SOURce:]PULSe: TRIG

Description : This command sets the TRIG type of PULSE mode.

Query Syntax : [SOURce:] PULSe : TRIG?
Parameter : AUTO | MANUAL|EXCITE
Return Parameter: AUTO | MANUAL|EXCITE

OUTPut: MODE

Description : This command sets the operation mode.

Query Syntax : OUTPut : MODE?

Parameter : FIXED | LIST | PULSE | STEP | SYNTH | INTERHAR Return Parameter : FIXED | LIST | PULSE | STEP | SYNTH | INTERHAR

TRIG

Description : This command sets PULSE mode in OFF execution state after

setting **OUTPut**: **MODE PULSE**. If users want to change the parameters, it's necessary to set **TRIG OFF** then **OUTPut**: **MODE FIXED**. Then, set **OUTPut**: **MODE PULSE** again to get ready

to set TRIG ON.

Query Syntax : TRIG : STATE?

Parameter : OFF | ON

Return Parameter: OFF | RUNNING

9.5.2.12 STEP Sub-system

[SOURce :] STEP

: VOLTage

: AC

: DC

: FREQuency

: SHAPe

: SPHase

: DVOLtage

: AC

: DC

: DFRequency

: DWEL1 : COUNt : TRIG

OUTPut

: MODE

TRIG

TRIG: STATE?

[SOURce:] STEP: VOLTage: AC

Description : This command sets the initial AC voltage of STEP mode.

Query Syntax : [SOURce :] STEP : VOLTage : AC?

Parameter : $\langle NR2 \rangle$, the valid range is $0.0 \sim 150.0$ (low range), $0.0 \sim 300.0$ (high

range.)

Return Parameter : <NR2>

[SOURce:] STEP: VOLTage: DC

Description : This command sets the initial DC voltage of STEP mode.

Query Syntax : [SOURce :] STEP : VOLTage : DC?

Parameter : $\langle NR2 \rangle$, the valid range is $-212.1 \sim 212.1$ (low range), $-424.2 \sim 414.2$

(high range.)

Return Parameter : <NR2>

[SOURce :] STEP : FREQuency

Description : This command sets the initial frequency of STEP mode.

Query Syntax : [SOURce :] STEP : FREQuency?

Parameter : $\langle NR2 \rangle$, the valid range is $15.0 \sim 1500.0$ (unit: Hz.)

Return Parameter: <NR2>

[SOURce:] STEP: SHAPe

Description : This command selects the waveform buffer of STEP mode.

Query Syntax : [SOURce :] STEP : SHAPe?

 $\begin{array}{ll} Parameter & : A \mid B \\ Return \ Parameter & : A \mid B \end{array}$

[SOURce:] STEP: SPHase

Description : This command sets the start phase angle of STEP mode.

Query Syntax : [SOURce :] STEP : SPHase?

Parameter : $\langle NR2 \rangle$, the valid range is $0.0 \sim 359.9$.

Return Parameter: <NR2>

[SOURce : | STEP : DVOLtage : AC

Description : This command sets the AC voltage change in each step.

Query Syntax : [SOURce :] STEP : DVOLtage : AC?

Parameter : $\langle NR2 \rangle$, the valid range is -150.0 \sim 150.0 (low range), -300.0 \sim 300.0

(high range.)

Return Parameter: <NR2>

[SOURce :] STEP : DVOLtage : DC

Description : This command sets the DC voltage change in each step.

Query Syntax : [SOURce :] STEP : DVOLtage : DC?

Parameter : $\langle NR2 \rangle$, the valid range is $-212.2 \sim 212.1$ (low range), $-424.2 \sim 424.2$

(high range.)

Return Parameter: <NR2>

[SOURce:] STEP: DFRequency

Description : This command sets the frequency change in each step.

Query Syntax : [SOURce :] STEP : DFRequency?

Parameter : $\langle NR2 \rangle$, the valid range is $-1500.00 \sim 1500.0$ (unit: Hz.)

Return Parameter: <NR2>

[SOURce:] STEP: DWELI

Description : This command sets the dwell time in each step.

Query Syntax : [SOURce :] STEP : DWEL1?

Parameter : $\langle NR2 \rangle$, the valid range is $0 \sim 999999999.9$ (unit: ms.)

Return Parameter: <NR2>

[SOURce:] STEP: COUNt

Description : This command sets the number of times the step executed before

completion.

Query Syntax : [SOURce :] STEP : COUNt?

Parameter : $\langle NR2 \rangle$, the valid range is $0 \sim 65535$.

Return Parameter: <NR2>

[SOURce:] STEP: TRIG

Description : This command sets the TRIP type of STEP mode.

Query Syntax : [SOURce:] STEP : TRIG?

Parameter : AUTO | MANUAL Return Parameter : AUTO | MANUAL

OUTPut: MODE

Description : This command sets the operation mode.

Query Syntax : OUTPut : MODE?

Parameter : FIXED | LIST | PULSE | STEP | SYNTH | INTERHAR Return Parameter : FIXED | LIST | PULSE | STEP | SYNTH | INTERHAR

TRIG

Description : This command sets STEP mode in OFF, ON execution state after

setting **OUTPut**: **MODE STEP**. If users want to change the parameters, it's necessary to set **TRIG OFF** then **OUTPut**: **MODE FIXED**. Then, set **OUTPut**: **MODE STEP** again to get ready to

set TRIG ON.

Query Syntax : TRIG : STATE?

Parameter : OFF | ON

Return Parameter: OFF | RUNNING

9.5.2.13 SYNTHESIS Sub-system

[SOURce:]

SYNThesis

: COMPose : AMPLitude · PHASe

: FUNDamental

: DC

: FREQuency : SPHase

OUTPut

: MODE

TRIG

TRIG: STATE?

[SOURce :] SYNThesis : COMPose

Description : This command sets the data format of each harmonic order.

VALUE: absolute value, PERCENT: basic computer percentage.

Users can program 6 waveforms for execution.

Query Syntax : [SOURce :] SYNThesis : COMPose? Parameter : VALUE1 | VALUE2 | VALUE3 |

PERCENT1 | PERCENT2 | PERCENT3

Return Parameter: VALUE1 | VALUE2 | VALUE3 |

PERCENT1 | PERCENT2 | PERCENT3

[SOURce:] SYNThesis: AMPLitude

Description : This command sets the amplitude of each harmonic order.

The maximum order is 40.

Query Syntax : [SOURce :] SYNThesis : AMPLitude?

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

Valid range:

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

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

[SOURce:] SYNThesis: PHASe

Description : This command sets the phase angle of each harmonic order.

Query Syntax : [SOURce :] SYNThesis : PHASe?

Parameter : $\langle NR2 \rangle$, ..., $\langle NR2 \rangle$, the valid range: $0.0 \sim 359.9$

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

[SOURce:] SYNThesis: FUNDamental

Description : This command sets the fundamental AC voltage in SYNTHESIS

mode.

Query Syntax : [SOURce :] SYNThesis : FUNDamental?

Parameter : $\langle NR2 \rangle$, the valid range: $0.0 \sim 150.0$ (low range), $0.0 \sim 300.0$ (high

range)

Return Parameter: <NR2>

[SOURce :] SYNThesis : DC

Description : This command sets the DC voltage to add the voltage waveform in

SYNTHESIS mode.

Query Syntax : [SOURce :] SYNThesis : DC?

Parameter : $\langle NR2 \rangle$, the valid range: $-212.1 \sim 212.1$ (low range), $-424.2 \sim 424.2$

(high range)

Return Parameter: <NR2>

[SOURce:] SYNThesis: FREQuency

Description : This command sets the fundamental frequency in 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 SYNTHESIS mode.

Query Syntax : [SOURce :] SYNThesis : SPHase? Parameter : <NR2>, the valid range: 0.0 ~ 359.9

Return Parameter : <NR2>

OUTPut: MODE

Description : This command sets the operation mode. User should quit output

before setting **OUTPut**: **MODE SYNTH**.

Query Syntax : OUTPut : MODE?

Parameter : FIXED | LIST | PULSE | STEP | SYNTH | INTERHAR Return Parameter : FIXED | LIST | PULSE | STEP | SYNTH | INTERHAR

TRIG

Description : This command sets SYNTHESIS mode in OFF, ON execution state

after setting **OUTPut**: **MODE SYNTH**. If users want to change the parameters, it's necessary to set **TRIG OFF** then **OUTPut**: **MODE FIXED**. Then, set **OUTPut**: **MODE SYNTH** again to

get ready to set TRIG ON.

Query Syntax : TRIG : STATE?

Parameter : OFF | ON

Return Parameter: OFF | RUNNING

9.5.2.14 INTERHARMONICS Sub-system

[SOURce :]

INTERHARmonics

: FREQuency : STARt : END : LEVel : DWEL1

OUTPut

: MODE

TRIG

TRIG: STATE?

FETCh | MEASure

: INTERHARmonics

: FREQuency? It queries the sweeping frequency.

[SOURce:] INTERHARmonics: FREQuency: STARt

Description : This command sets the start frequency of sweep wave for

INTERHARMONICS mode.

Query Syntax : [SOURce :] INTerharmonics : FREQuency : STARt? Parameter : <NR2>, the valid range is 0.01 ~ 2400.0 (unit: Hz.)

Return Parameter: <NR2>

[SOURce :] INTERHARmonics: FREQuency : END

Description : This command sets the end frequency of sweep wave for

INTERHARMONICS mode.

Query Syntax : [SOURce :] INTerharmonics : FREQuency : END? Parameter : <NR2>, the valid range is 0.01 ~ 2400.00 (unit: Hz.)

Return Parameter: <NR2>

[SOURce : | INTERHARmonics: LEVel

Description : This command sets the rms. range of sweep wave in percentage

level.

Query Syntax : [SOURce :] INTerharmonics : LEVEl?

Parameter : $\langle NR2 \rangle$, the valid range is $0\% \sim 30\%$ in 0.01 Hz ~ 500 Hz

 $0\% \sim 20\%$ in 500.01 Hz ~ 1000 Hz $0\% \sim 10\%$ in 1000.01 Hz ~ 2400 Hz

Return Parameter: <NR2>

[SOURce:] INTERHARmonics: DWEL1

Description : This command sets the dwell time of sweep wave.

Query Syntax : [SOURce :] INTerharmonics : DWEL1?

Parameter : $\langle NR2 \rangle$, the valid range is $0.00 \sim 99999.99$ (unit: sec.)

Return Parameter: <NR2>

OUTPut: MODE

Description : This command sets the operation mode.

Query Syntax : OUTPut : MODE?

Parameter : FIXED | LIST | PULSE | STEP | SYNTH | INTERHAR Return Parameter : FIXED | LIST | PULSE | STEP | SYNTH | INTERHAR

TRIG

Description : This command sets INTERHARMONICS mode in OFF, ON,

PAUSE or CONTINUE execution state after setting **OUTPut**: **MODE INTERHAR**. If users wish to change the Parameter, it has to set **TRIG OFF** and **OUTPut**: **MODE FIXED**, next **OUTPut**:

MODE INTERHAR in order to set TRIG ON.

Query Syntax : TRIG : STATE?

Parameter : OFF | ON | PAUSE | CONTINUE

Return Parameter: OFF | RUNNING | PAUSE

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

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

voltage.

Query Syntax : FETCh : INTERHARMonics : FREQuency?

MEASure: INTERHARMonics: FREQuency?

Return Parameter: <NR2>

9.5.2.15 Harmonic Sense Sub-system

[SOURce:]

CONFigure

: HARMonic

: SOURce : TIMES : PARameter : FREQuency

SENSe

: HARMonic

FETCh | MEASure

[: SCALar]

: HARMonic

: THD? It returns the % of total harmonic distortion.

: FUNDamental? It returns the fundamental frequency. : ARRay? It returns the array of all harmonic orders.

[SOURce :] CONFigure : HARMonic : SOURce

Description : This command sets the measured power source in harmonic analysis

mode.

Query Syntax : [SOURce :] CONFigure : HARMonic : SOURce?

Parameter : VOLT | CURR Return Parameter : VOLT | CURR

[SOURce:] CONFigure: HARMonic: TIMES

Description : This command sets the way the measurement result of harmonic

analysis displayed on LCD.

SINGLE: It keeps the measured data on the display when set. CONTINUE: It updates the measured data on the display when set.

Query Syntax : [SOURce :] CONFigure : HARMonic : TIMes?

Parameter : SINGLE | CONTINUE Return Parameter : SINGLE | CONTINUE

[SOURce :] CONFigure : HARMonic : PARameter

Description : This command sets the data format for each harmonic order.

Query Syntax : [SOURce :] CONFigure : HARMonic : PARameter?

Parameter : VALUE | PERCENT Return Parameter : VALUE | PERCENT

[SOURce:] CONFigure: HARMonic: FREQuency

Description : This command sets the fundamental frequency of original waveform.

Query Syntax : [SOURce :] CONFigure : HARMonic : FREQuency?

Parameter : 50 | 60 Return Parameter : 50 | 60

SENSe: HARMonic

Description : This command sets the harmonic measurement on/off. It has to

execute "ON" before every new search or measurement. Only 3 seconds are required for the result. The parameter has to set to

"OFF" if users wish to measure other data.

Query Syntax : SENSe : HARMonic?

Parameter : ON | OFF Return 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 Parameter: <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

: AMPLitude: MAXimum?

: CREStfactor?

: INRush?

```
: FREQuency?
        : POWer
             : AC
                 [: REAL]?
                 : APParent?
                 : REACtive?
                 : PFACtor?
                 : TOTal?
                 : TOTal:APParent?
        :VOLTage
             : AC?
             : 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
    : DWEL1
    : 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
        : DWEL1
        : COUNt
SYNThesis
        : COMPose
        : AMPLitude
        : PHASe
        : FUNDamental
        : DC
        : FREQuency
        : SPHase
    INTERHARrmonics
        : FREQuency
            : STARt
            : END
        : LEVEl
        : DWEL1
        : MODe
[SOURce:]
     PHASe
        : ON
        : OFF
[SOURce:]
     CONFigure
        : INHibit
```

STATus

: OPERation

[: EVENt]?

: ENABle

: QUEStionable

: CONDition

[: EVENt]?

: ENABle

: NTRansition

: PTRansition

TRACe

: RMS

TRIG

TRIG: STATE?



Appendix A TTL Signal Pin Assignments

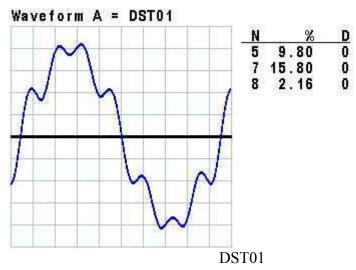
Green terminal with female connector:

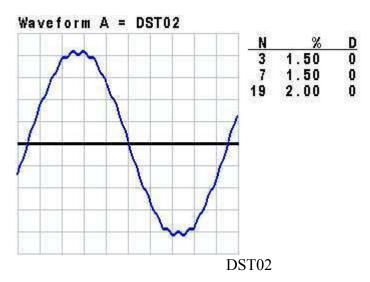
Pin No.	Signal	Description
1	Ext-V Φ1	Φ1 External-V Reference signal input (-10V~10V)
2	Ext-V Ф2	Φ2 External-V Reference signal input (-10V~10V)
		This is the input pin of external voltage signal for single
		phase use.
3	Ext-V Ф3	Φ3 External-V Reference signal input (-10V~10V)
4	AGND	External-V Reference signal grounding
5	+12V	12V voltage output (providing current 1A)
6	Reserved	
7	DGND	Digital signal grounding
8	DGND	Digital signal grounding
9	AC-ON	This pin turns to HIGH when the AC Source outputs
		voltage and turns to LOW when quits output.
10	/ FAULT-OUT	The voltage level of this pin is HIGH when the AC Source
		is in normal mode, it will turn to LOW when the AC
		Source is in protection mode.
11	/ Ext-ONOFF	When EXT-ONOFF is enabled and the voltage level of
		this pin turns to LOW, the AC Source output will be open
		and it will close on the contrary.
12	/ Remote-Inhibit	When the voltage level of this pin turns to LOW, it can
		inhibit the AC Source output or trigger mode.
13	/Remote-Excite	When this pin receives a negative edge signal (from High
		to Low), it can trigger the transient output of AC Source.
14	/Transient	When the output of AC Source changes, this pin will send
		out a low level 1us or remain at high level.
15	Reserved	
16	Reserved	
17	Reserved	
18	Reserved	

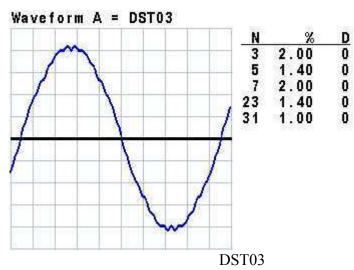


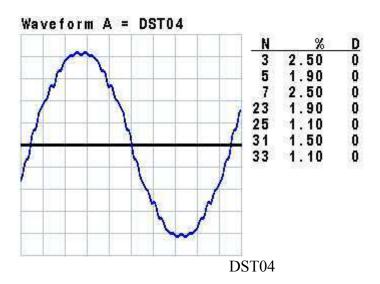
Appendix B Built-in DST Waveform

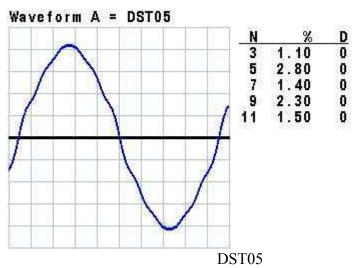
The ratios of all built-in waveforms' steps are measured under no load.

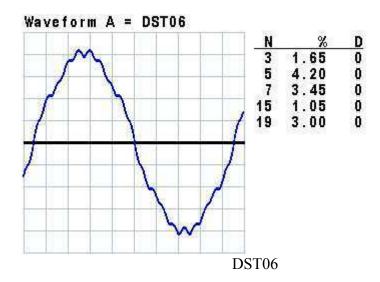


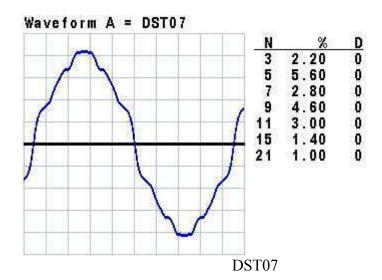


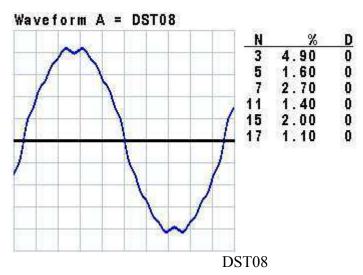


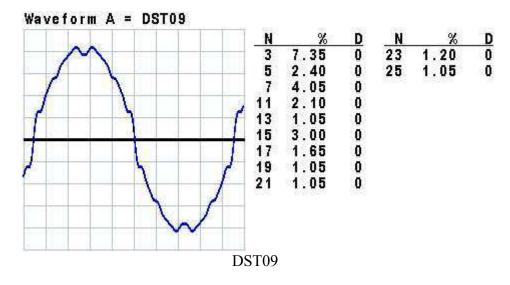


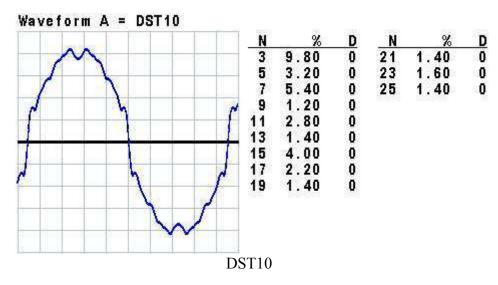


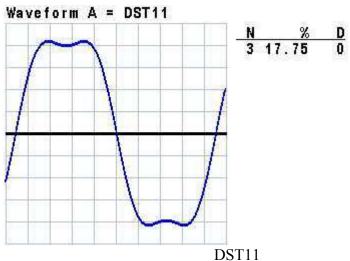


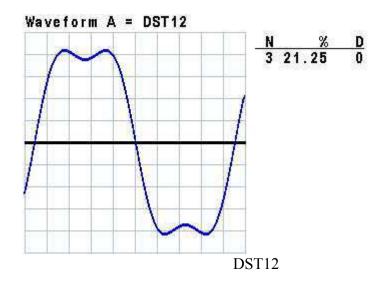


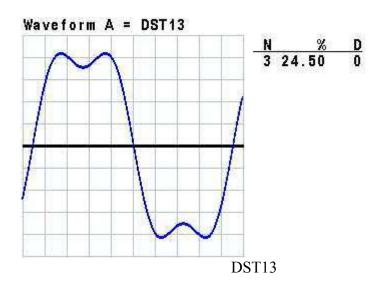


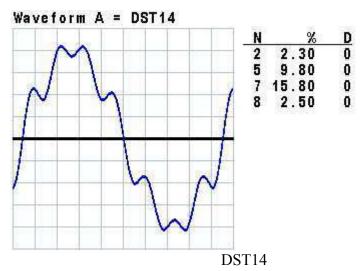


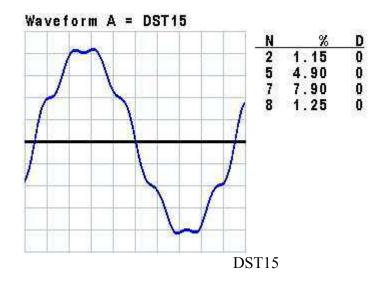


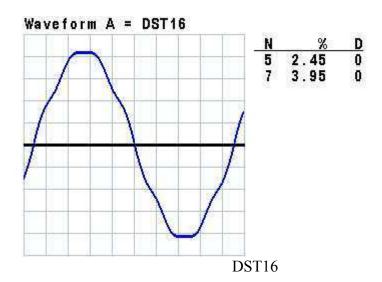


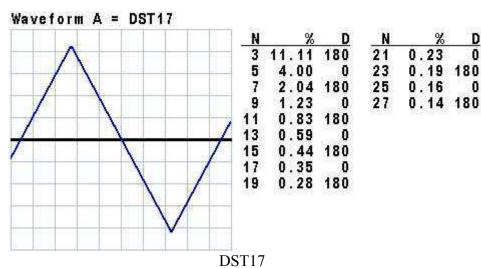


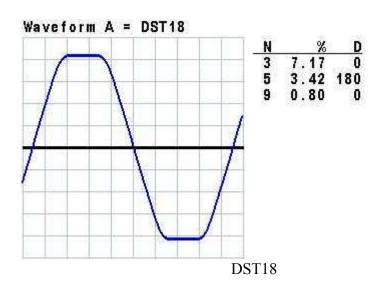


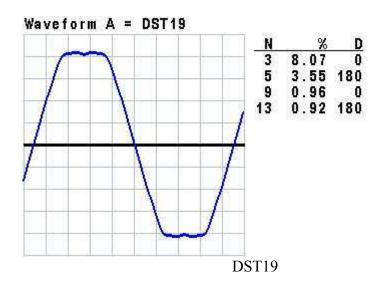


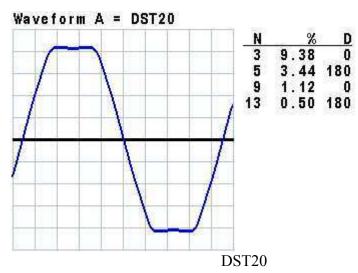


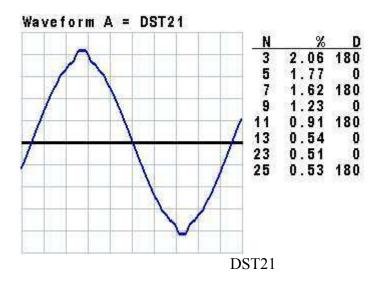


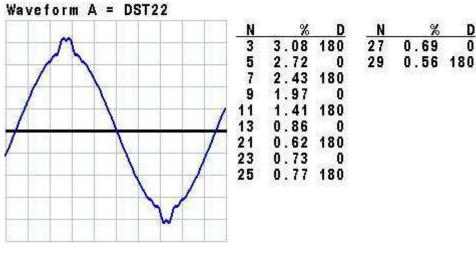












DST22

