



A1500

AC Power Source

User Manual

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Warranty

The Scope of Rights:

1. All Delta instruments are warranted against defects in material and workmanship for a period of one year after date of shipment.
2. Please contact service center or Delta electronics immediately if malfunctions are found.
3. If malfunctioned products is not located at where it was purchased. You can contact worldwide Delta electronics branches to get service.

Warranty Coverage

Warranty Coverage

1. Products repaired or altered by persons not authorized by Delta, or not in accordance with instructions provided by Delta.
2. Products failure caused by nature disaster or hazardous / dangerous environments: earthquake, typhoon, thunder-strike, voltage abnormal, collusion chemical, oil, in the presence of mice or bugs.
3. Out looking aged by normal operation.
4. Consumables parts and accessories.

Delta will not provide free service under following conditions:

1. Warranty expired.
2. Within warranty limited, customer did not adapt correct operation procedure after Delta provide free training.
3. Product list in warranty book does not match with real product.

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.

Delta assumes no liability for the customer's failure to comply with these requirements.

BEFORE APPLYING POWER

Verify that the product is set to match with the line voltage.

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.) can be used. Do not use different fuses or short-circuited fuse holders. To do so might 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 by qualified service personnel only.

When install or take off external terminals with hazard voltage, AC input voltage must be cut off or take action to make safety isolation.

Safety Symbols



DANGER - High voltage.

Output of AC power source can provide peak voltage up to 426V, touched by personnel may lead to death



Attention: 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.



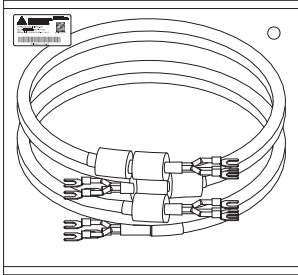
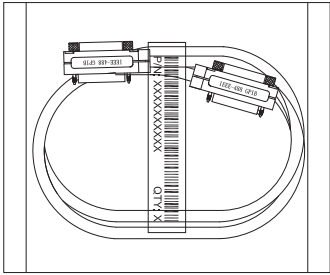
A **WARNING** sign denotes a hazard. It calls attention to a procedure, practice, condition or the like which may result in injury or death of personnel if it is not rightly observed.

Acoustic noise information

This product has sound pressure release holes (which located at same side as operator) with acoustic noise <65dB (A)

Accessories

Please check the following accessories are included and not damaged during shipment. If there are damaged or shortage of the accessories, please contact Delta Electronics or sales agent for help.

	
■ INPUT/OUTPUT CABLE P/N : 364440990X (1.5m)	□ GPIB CABLE P/N : 308006110X (0.5m) P/N : 308006150X (1.0m) P/N : 308006140X (2.0m) P/N : 308006130X (4.0m) P/N : 308006120X (8.0m)

Note 1. ■ standard parts.

Note 2. □ options.

Revision History

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

Version	Date	Revised section
00	June 13th, 2018	issue
01	April 8th, 2019	Correct DC output current accuracy

1. General Information

1.1 Introduction

This manual describes the specifications, installation and operation instructions of Delta A1500 SERIES Programmable AC/DC Power Source. In this manual the term, AC/DC Source, stands for Delta A1500 SERIES Programmable AC/DC Source.

The series of AC source is a high efficiency programmable ac power source, which provide low distortion sinusoid AC voltage output and measurement. Stable voltage and frequency are obtained through accurate digital calculation provided by DSP IC. Remote programming is accomplished either by the GPIB bus or the RS-232C serial port.

1.2 Key Features

A. Configuration

- Local operation from the front panel keypad
- Protection against Over-power, Over-load, Over-temperature, and Fan-fail
- Fan speed controlled by output power
- Built-in isolation output relays
- Remote operation via GPIB or RS-232C interface

B. Input/output

- Selective output voltage ranges with full scale of 150V/15A and 300V/7.5A
- V, I, F, P, CF, PF, Ip, Is, VA, and VAR measurements
- Remote inhibit control
- AC ON/OFF, DC ON/OFF, FAULT OUT TTL output signal.

1.3 Specifications

The operation specifications of A1500 SERIES Programmable AC Power Source are listed below. All specifications have been tested according to the standard of Delta test procedures. All specifications are based on resistor load with remote sense connection, under $25\pm 2^{\circ}\text{C}$ unless specified otherwise.

Model	DME-ACS1152B SERIES
AC input	
Rating Voltage	100-240 V , single phase
Voltage range	90-254 V
Frequency range	47-63 Hz
Surge Current	100A Max.
Maximum current	22A Max.
Power Factor	0.98 Min.
Efficiency	78% typ. (Full load at 110Vac input voltage)

AC output	
Power	1500VA Max.
Accuracy	$\pm 1.5 \% \text{ F.S.}$
Resolution	0.1 W
Voltage	
Range	150V / 300V
Accuracy	$\pm(0.2\%+0.2\%\text{F.S})$
Resolution	0.1 V
Dsitortion	0.5% @ 50/60Hz ; 1% @ 15- 1K Hz
Line regulation	0.1%
Load regulation	0.2%
Temperature coefficient	0.02% per degree from 25°C
Current	
Range	150V / 300V
I(rms)	15A / 7.5A
I(Peak)	100A / 50A
Accuracy	$\pm(0.4\%+0.3\%\text{F.S})$
Resolution	0.01 A
Frequency	
Range	30-1k Hz
Accuracy	0.15%
Resolution	0.1 Hz
DC output	
Power	750VA Max.
Accuracy	$\pm 1.5\%\text{F.S}$
Resolution	0.1 W
Voltage	
Range	$\pm 212\text{V}/\pm 424\text{V}$ (L terminal is DC positive ;N terminal is DC negative)
Accuracy	$\pm(0.2\%+0.2\%\text{F.S})$.
Resolution	0.1 V
Line regulation	0.1%
Load regulation	0.2%
Temperature coefficient	0.02% per degree from 25°C
Current	
Range	212V / 424V
I(average)	7A / 3.5A
Accuracy	$\pm(0.8\%+0.6\%\text{F.S})$. F.S=7A for 212V mode (150V range), 3.5A for 424V mode(300V range)
Resolution	0.01 A

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AC/DC output	
Power	750W Max.
Accuracy	$\pm 1.5\% \text{F.S}$
Resolution	0.1 W
Voltage	
Range	212V / 424V(L terminal is DC positive ;N terminal is DC negative)
Accuracy	$\pm(0.2\%+0.2\% \text{F.S})$
Resolution	0.1 V
Line regulation	0.1%
Load regulation	0.2%
Temperature coefficient	0.02% per degree from 25°C
Current	
Range	212V / 424V
I(ave)	7A / 3.5A
Accuracy	$\pm(0.4\%+0.3\% \text{F.S})$ F.S=14A for 212V mode (low voltage range), 7A for 424V mode(high voltage range)
Resolution	0.01 A
Protection	
UVP, OCP, OPP, SCP, OTP, FAN FAIL	
Temperature range	
Operation	0° C ~ 40° C
Storage	-40° C ~ 85° C
Relative humidity	30 % ~ 90 %
Others	
Interface	GPIB, RS-232
Safety	CE
Dimension(L*W*H)	525 * 425 * 133 mm 540 * 482 * 147 mm (include handle and foot stand)
Weight	22Kg

1.4 Name of Parts

1.4.1 The Front Panel

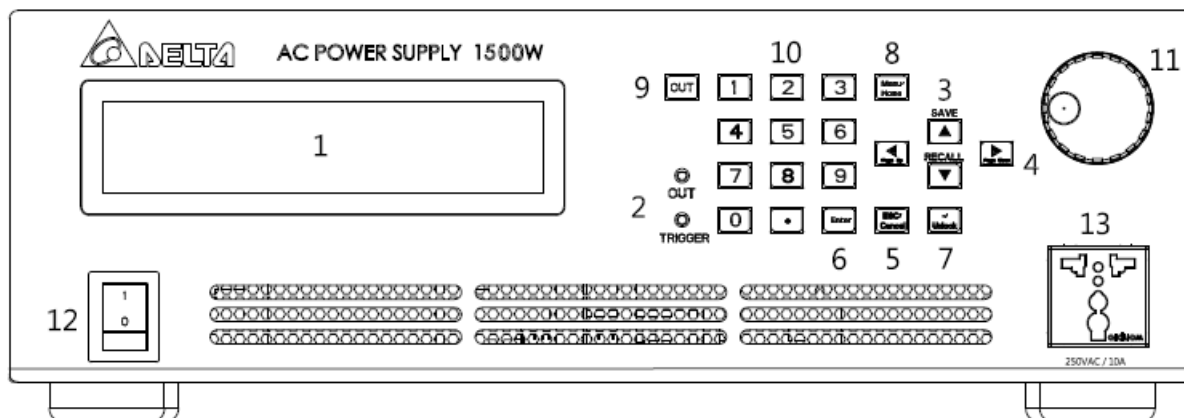


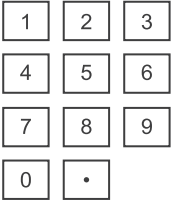
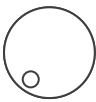
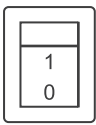
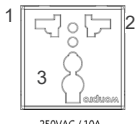
Figure 1-1 the Front Panel

Front Panel Description

Item	Symbol	Description
1		LCD panel, display setting and measurement results.
2	 OUT TRIGGER	LED indicator: • OUT (green) indicates AC source normal output • TRIGGER (yellow) indicates LIST、PULSE、STEP output
3	 Save Recall	Short press: Cursor move upward or downward. Long press : long press at 「 main manual 」 , 「 advanced parameters setting manual」 pages, will enter 「save, restore」 page
4	 Page up Page down	Page switches, digital number selection
5	 ESC/ Cancel	Escape current page (ESC) or cancel current settings (Cancel)
6	 Enter	Confirm parameter setting

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7		Back to local control in remote mode Negative sign in panel control
8		At main manual page, press this key to enter "advanced parameter setting" page; at other pages, press this key to return to main manual
9		Press this key to control ON/OFF state of AC output voltage
10		Digital numerical keypad group: Used for parameter setting
11		Knob: Used for parameters setting or selection
12		Main switch: Turn on/off the AC power input
13		Worldwide Output connector : 100V~240V/10A max DME-ACS1152B A (1:L 2:N 3:PE) DME-ACS1152B B (1:N 2:L 3:PE)

1.4.2 The Rear Panel

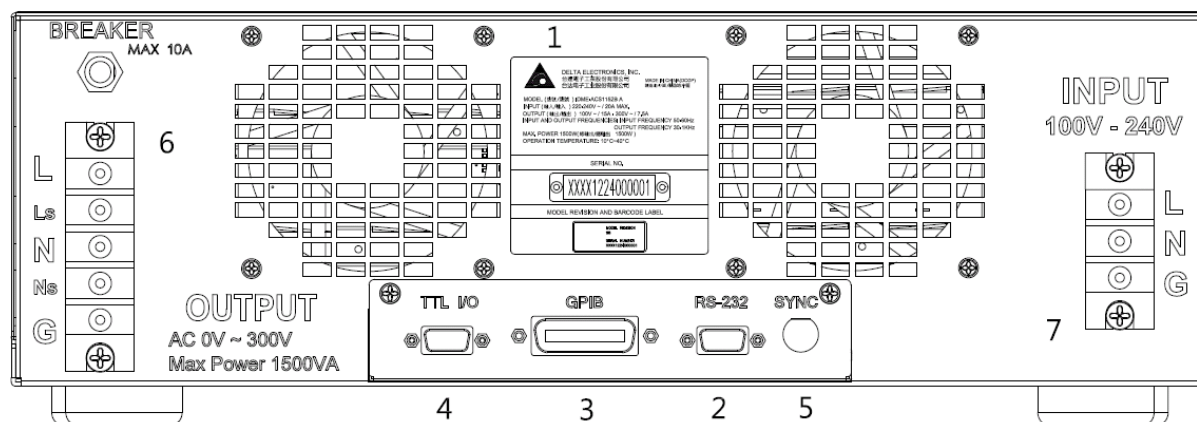


Figure 1-2 the Rear Panel

Rear Panel Description

Item	Name	Description
1	Mark	
2	RS-232	D type 9Pin female connector, for remote control.
3	GPIB connector	IEEE 488 standard connector, for remote control.
4	TTL I/O	The 9-pin, D-type female connector conveys TTL signals (AC_ON, FAULT_OUT and REMOTE_INHIBIT).
5	SYNC	When output change according new parameter setting, SYNC will output Synchronized signal.
6	Output connector	Output connector. Outputs power to the loading device.
7	Power Line input Connector	Input connector. Please refer to paragraph 2.3.2 for connection.

2. Installation

2.1 Inspection

First, inspect any damage that may have occurred during the shipment after unpacking the instrument. Save all packing materials in case the instrument has to be returned.

If any damage is found, please file a claim against the carrier immediately. Do not return the instrument to the factory without obtaining the prior RMA acceptance from Delta.

2.2 Preparation for Use

Before start using, the instrument must be connected with an appropriate AC line input. As the instrument is cooled by fans, it must be installed in an area with sufficient space for air circulation. It should be used in an area where the environment temperature does not exceed 40°C .

2.3 Requirements of Input Power

2.3.1 Ratings

Input Voltage Range: 100-240 Vac, 1 phase 3 wires

Input Frequency: 47-63Hz

Max. Current/Phase: 22A



*** CAUTION ***

The AC source may be damaged if it is operated at an input voltage that is over its configured input range.

2.3.2 Input Connection

The input terminal block is located on the instrument rear panel. The temperature rating of the power cord must be rated at least for 85 °C . The current rating of input power line must be greater than or equal to the maximum current rating of the AC source. to put a 30A breaker (ABT A) (30A breaker (ABT B)) at AC input side.

See Figure 2.3.2.1~2.3.2.4 and do the following steps one by one:

1. Remove the safety cover at the back side of AC source.
2. Connect the ac lines to the terminal blocks of the AC source as Figure 2.3.2.1/2.3.2.3 shows.
3. Make sure the removable safety cover does fully cover the AC input terminal.
4. Turn off AC power supply to AC source or make safety isolation before installing or taking off external terminal with hazard voltages.

A1500
AC Power Source***** CAUTION *****

To protect operators the wire connected to the GND terminal must be connected to the ground. Under no circumstances shall this AC source be operated without an adequate ground connection.

Installation of the AC input power cord must be done by a professional personnel in accordance with local electrical codes.

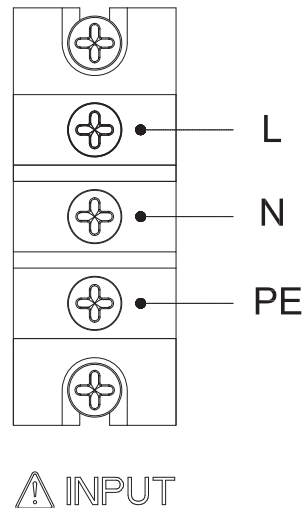


Figure 2.3.2.1 220Vac single-phase input connection

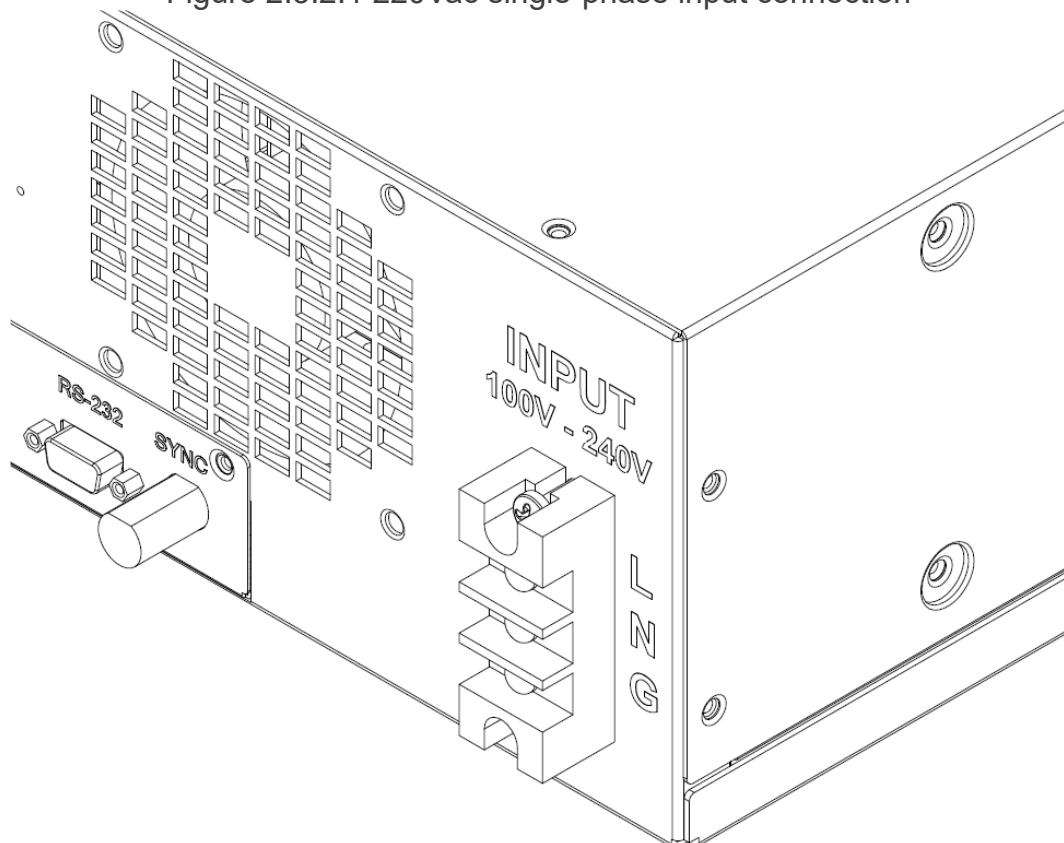


Figure 2.3.2.2 100-240Vac input terminal

2.4 Output Connection

2.4.1 Output connection

The output terminal block is located at the rear of the AC source. Load connecting to the "N" and "L" is done at the output terminals. To meet the safety requirements, the safety cover must be fastened. The wires to the load must be sufficiently large gauges, so they will not overheat while carrying the output current. Please see Figure 2.5.1 on the next page. For most users, if the current for product under test is not high, there is one outlet with 10 amperes rating at front panel can be used.

2.5 Remote Sense Connection

The AC source remote sense function monitors the load terminal voltage instead of the AC source output terminal. It ensures the delivery of accurate voltage as programmed at the load by compensating the output voltage drop over the connecting cable automatically. You have to set Remote Sense ON so as to enable this function.

Connect the sensing wires from "Ls" and "Ns" terminals to the load as shown in Figure 2.5.1. As the sensing wires carry only a few milli- amperes, the wire gauges are much smaller than the load cables. The sensing wires are part of the feedback path of the AC source. They must be kept at a low resistance in order to maintain the best performance. Connect the sensing wires carefully so that they will not be open-circuited. If the sensing wires are left unconnected or become open-circuited during operation, the AC source will disable the output. The sensing wires must be a twisted pair to minimize the pickup of external noise. The sensing wires need to be connected as close to the load input terminal as possible.

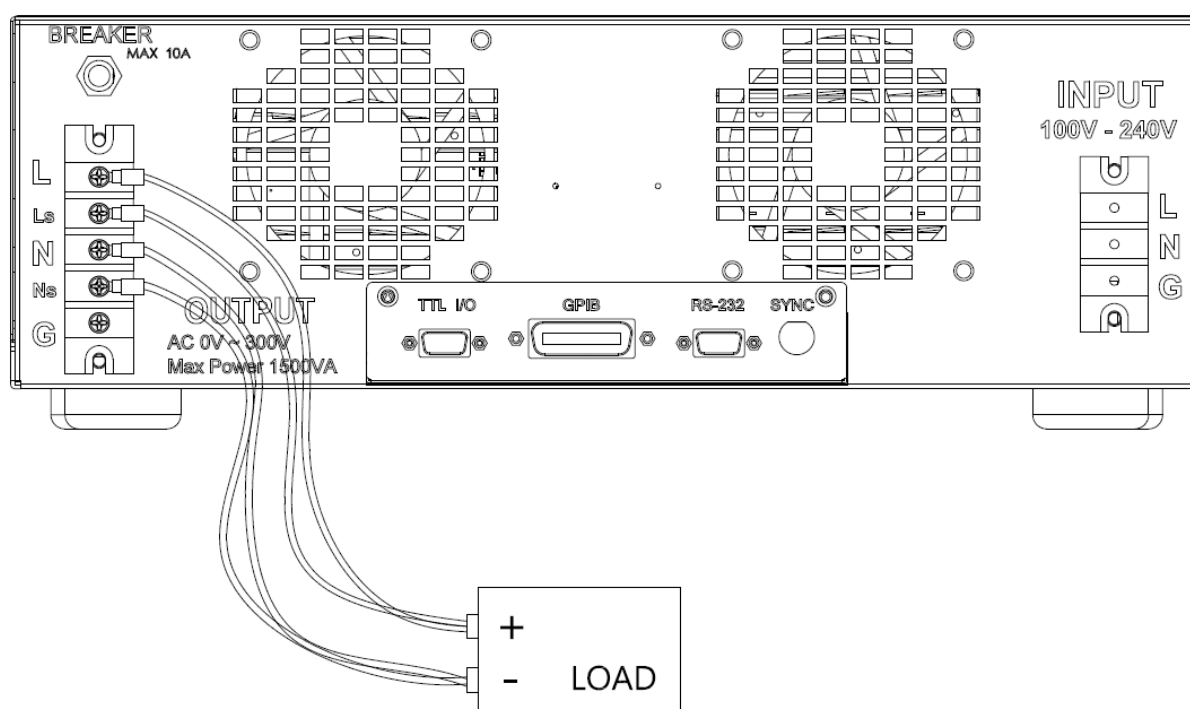


Figure 2.5.1 DE-ACS1152B X

2.6 The Procedures to Power-on



*** CAUTION ***

Before turning on the instrument, all protective earth terminals, extension cords, and devices connected to the instrument must be connected to a protective ground. Any interruption of the protective grounding will cause a potential shock hazard that might injure people.

Connect the AC voltage, and turn on the power switch on the front panel. The AC source will do a series of self-tests every time it is turned on. The LCD on the front panel will light up and display as below under normal condition:

```
DME - ACS1152B A
Waiting for Self Test!
Firmware Version (DSP: Sxx.xx   UI: Sxx.xx)
Waiting for Hardware Initial
```

After self-testing, AC source will enter main setting page which is shown as below.

```
SET MODE   V:    0.0   IP: 0.00   VA :    0.0
V:    110.0   I:    0.00   Is: 0.00   VAR:    0.0
F:    1000.0           F:    0.0   PF : 0.000
P:    0.0   CF : 0.000
```



*** CAUTION ***

1. Error messages will show on the LCD panel if error occurs during turn on process. Please check section 3.7 for error code.
2. Digital circuit inside AC source may not operate properly if turn on AC source immediately after turn off. Recommend to wait 10 seconds to turn on AC source after it was turned off.

3. Local Operation

3.1 Introduction

The AC source can be configured to operate in local or remote mode. The operation in remote mode through GPIB controller or RS-232C will be described in Chapter 4. This chapter describes the operation in local mode through the keypad on the front panel for data entry and test. If remote control cable are not connected, the AC source is configured for local operation after AC switch is on.

LCD panel will show the self-test message as below after AC switch is on.

```

DME - ACS1152B A
Waiting for Self Test!
Firmware Version (DSP: Sxx.xx   UI: Sxx.xx)
Waiting for Hardware Initial
  
```

Then will enter main manual setting page as below. Operator can set output voltage and frequency for three phase.

```

SET MODE   V:    0.0  IP:  0.00  VA :    0.0
V:    110.0  I:    0.00  Is:  0.00  VAR:    0.0
F:    1000.0                F:    0.0  PF :  0.000
P:    0.0  CF :  0.000
  
```

3.2 Operation through Keypad and Knob

A1500 series provides a user-friendly programming interface by using the keypad on the front panel.

Press   move cursor between voltage and frequency to make selection. Use numerical and decimal point key or knob to set number, press  to confirm selection.

User can press  to enter screen as below: user can enter advanced parameter setting manual to make more detail setting from this page, or press  again back to main manual.

```

PAGE SELECT :
1 . S E T U P      2 . C O N F I G
3 . L I S T        4 . P U L S E      5 . S T E P
6 . S Y N T H E S I S

```

At the list selection manual as above, user can press numerical key to do the selection, then press  to enter advanced parameter setting manual. After entering advanced

setting manual, press   to move cursor to item which wants to modify, use

numerical key or knob to do the modification, then press  to confirm.

If there are [Press ◀▶ to switch page] shown at the bottom of the manual,

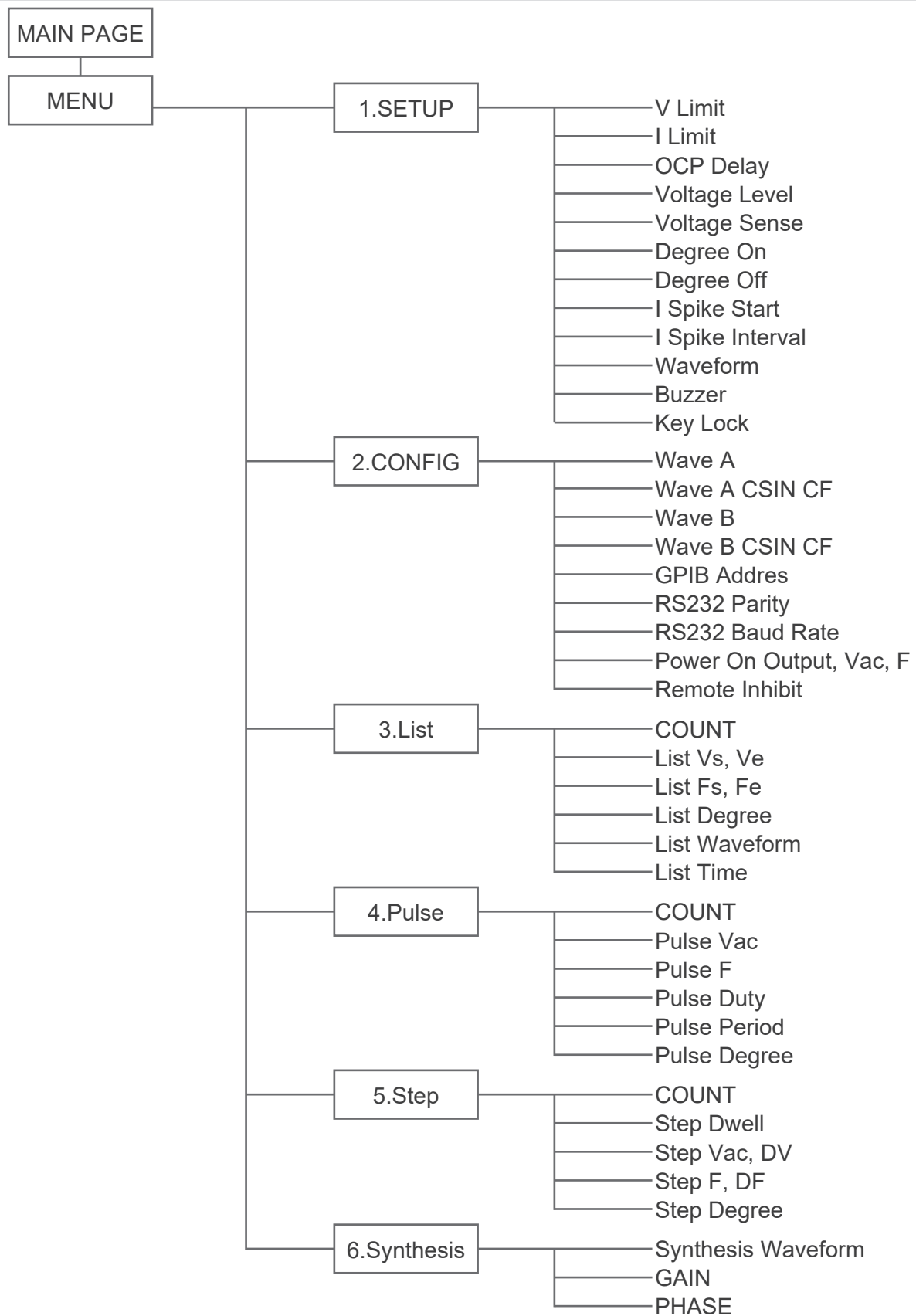
use   to switch pages. When setting is finished, press  back to list

selection manual, or press  back to main manual.

The command tree is shown as below:

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3.3 Main Manual Setting

After the AC source is on and initialization is finished, screen will show the main manual. Default output voltage and frequency is 110V and 60Hz. Voltage and frequency setting are shown on the left side of the screen, the right side of the screen shows the measurement value, example shown as below.

S E T	M O D E	V :	0 . 0	I P :	0 . 0 0	V A :	0 . 0
V :	1 1 0 . 0	I :	0 . 0 0	I s :	0 . 0 0	V A R :	0 . 0
F :	1 0 0 0 . 0			F :	0 . 0	P F :	0 . 0 0 0
				P :	0 . 0	C F :	0 . 0 0 0

Display at upper left

- SET MODE: Setting mode, no voltage output from AC source.
- OUT MODE: Output mode. When user press  at SET MODE, AC source outputs voltage.

Parameter definition of output setting :

- V : Alternative current output voltage (Vrms), unit is volt.
- F : Output frequency, unit is Hertz.

Parameter definition of measurement :

- V : Voltage (Vrms), voltage measurement value (root mean square), unit is Volt.
- I : Current (Irms), measurement value use Irms as unit.
- F : Frequency, measurement value use Hz as unit.
- P : Power, measurement vale use Watt as unit.
- Ip : Peak current measurement value. Unit is Ampere.
- Is : Surge current measurement value. Unit is Ampere.
- PF : Power Factor measurement value. Calculation equation is Real power/(Vrms x Irms).
- CF : Crest Factor, calculation equation is Ipeak/Irms.
- VA : Apparent power, calculation equation is Vrms x Irms.
- VAR : Reactive power. Calculation equation is $\sqrt{VA^2 - P^2}$

3.4 Advanced Parameter Setting Manual

Press  at main manual to enter advanced parameter setting manual.

```
PAGE SELECT:
1.SETUP  2.CONFIG
3.LIST   4.PULSE  5.SETUP
6.SYNTHESIS
```

User can choose item 1~6, then press  enter detail setting manual; Or

press  back to main manual.

When screen is not at main manual, press  will back to main manual no matter

which page it is at. Press  will back to advanced parameter setting manual.

3.5 SETUP Function

1. At advanced parameter setting manual, press  to choose SETUP, then

press  enter SETUP manual.

```
→ Degree ON : 359.9      V Limit: 300.0 V
Degree OFF : 359.9      I Limit: 32.00 A
Is Start : 1000.0ms     Delay : 5.0 s
Is Interval: 1000.0ms   PAGE 1 >
```

2. press  to move to next page

```
→ Voltage Level: 300 V      Waveform: A
Voltage Sense: Vsense      Buzzer : OFF
Vdc Limit P : 424.2        Key lock : OFF
Vdc Limit N : -424.2       PAGE < 2
```

3. Press  back to previous page

```

→ Degree ON : 359.9      V Limit: 300.0 V
Degree OFF : 359.9      I Limit: 32.00 A
Is Start : 1000.0 ms    Delay : 5.0 s
Is Interval: 1000.0 ms  PAGE 1 >

```

Definitions for all parameters are listed as below:

Parameter	Definition	Setting Range		Unit
		Min	Max	
V Limit	Maximum voltage setting for all pages	0.0	150.0 / 300.0	V
I Limit	Maximum output Irms	0.0	16.0 / 8.0	A
OCP Delay	Delay time for over current protection	0.0	5.0	Sec
Voltage Level	Output voltage range	150 V / 300 V		
Voltage Sense	Output voltage measurement point: AC source output/ input of testing product	Voltage Sense / Remote Sense		
Degree On	Start phase angle of output voltage	0.0	359.9	degree
Degree Off	Stop phase angle of output voltage	0.0	360.0	degree
Is Start	Delay time to start measuring output surge current	0.0	1000.0	msec
Is Interval	Duration to measure surge current	0.0	1000.0	msec
Waveform	Output waveform set at main manual	A / B		
Buzzer	Toggle switch for Buzzer	ON / OFF		
Keylock	Lock settings at main manual	ON / OFF		

3.5.1 Voltage Limit

To limit the maximum output voltage for all pages, Vdc Limit P and Vdc Limit N limit the maximum positive and negative DC voltage. It is related to Voltage Level parameter, resolution is 0.1V:

It is Firmware to set the limitation instead of by Hardware.

The process to set Voltage Limit = 200V shows as below:

1. Press  or  to move cursor to V Limit

Degree ON	: 359.9	→ V Limit	: 300.0 V
Degree OFF	: 359.9	I Limit	: 8.00 A
I s Start	: 1000.0 mS	Delay	: 5.0 S
I s Interval	: 1000.0 mS	PAGE	1 >

2. Change to 200.0V by numerical key or knob, press  key

Degree ON	: 359.9	→ V Limit	: 300.0 V
Degree OFF	: 359.9	I Limit	: 8.00 A
I s Start	: 1000.0 mS	Delay	: 5.0 S
I s Interval	: 1000.0 mS	PAGE	1 >

PS1: AC voltage limit setting is related to voltage level range. Maximum limit AC voltage at 300V range is 300V, while is 150V at 150V output range.

PS2: Maximum current limit at 300V range is 8A, and is 16A at 150V range. Maximum output power is 1500W

The process to set DC positive Vdc Limit P = 180V and DC negative Vdc Limit N=-150 shows as below

1. Press  or  to move cursor to Vdc Limit P

Voltage Level	: 300 V	Waveform	: A
Voltage Sense	: Vsense	Buzzer	: OFF
→ Vdc Limit P	: 424.2	Key lock	: OFF
Vdc Limit N	: -424.2	PAGE	< 2

2. Change parameter to 180.0V by numerical key or knob, press  key

Voltage Level	: 300 V	Waveform	: A
Voltage Sense	: Vsense	Buzzer	: OFF
→ Vdc Limit P	: 180.0	Key lock	: OFF
Vdc Limit N	: -424.2	PAGE	< 2

3. Move cursor to Vdc Limit N

Voltage Level	: 300 V	Waveform	: A
Voltage Sense	: Vsense	Buzzer	: OFF
Vdc Limit P	: 180.0	Key lock	: OFF
→ Vdc Limit N	: -424.2	PAGE	< 2

4. By numerical key and cooperating with  key to change parameter to -150.0V, press  to confirm

V o l t a g e L e v e l : 3 0 0 V	W a v e f o r m : A
V o l t a g e S e n s e : V s e n s e	B u z z e r : O F F
V d c L i m i t P : 1 8 0 . 0	K e y l o c k : O F F
→ V d c L i m i t N : - 1 5 0 . 0	P A G E < 2

PS: DC Voltage limit also is related to Voltage Level range. Maximum DC limit voltage at 300V range is $\pm 424.2V$, and is $\pm 212.1V$ at 150V output range.

3.5.2 I Limit, OCP Delay

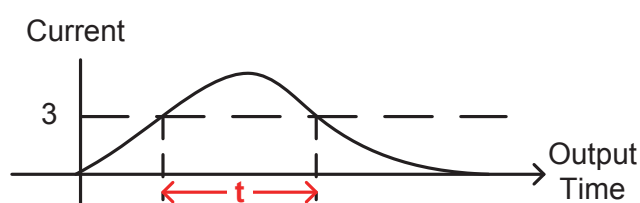
I Limit represents Current Limit, it is used to set the maximum output current (rms). Its range is related to Voltage Level setting:

Voltage Level	I Limit
300V	0.0~8.0 A
150V	0.0~16.0 A

OCP Delay represents Over Current Protection (OCP) Delay Time, it is the delay time to shut down output voltage after output current reaches OCP point. Its range is between 0~5 seconds, resolution is 0.1second. Both I Limit and OCP Delay are controlled by FW instead of by HW.

Operation of OCP Delay Time: When output current (rms) measurement is over I Limit parameter, OCP delay time start to count. If OCP last t seconds, then:

- $t > \text{OCP Delay parameter} \rightarrow$ Output shuts down. Screen shows "Software OCP".
- $t < \text{OCP Delay parameter} \rightarrow$ Output continues, no protections or reports.



Operation for I Limit is 3A, OCP delay time is 1.5s shows as below:

1. Press  or  to move cursor to I Limit

Degree ON	: 359.9	V Limit:	300.0 V
Degree OFF	: 359.9	→I Limit:	8.00 A
Is Start	: 1000.0ms	Delay	: 5.0 S
Is Interval	: 1000.0ms	PAGE	1 >

2. Change to 3A by numerical key or knob, then press  key to confirm the setting

Degree ON	: 359.9	V Limit:	300.0 V
Degree OFF	: 359.9	→I Limit:	3.00 A
Is Start	: 1000.0ms	Delay	: 5.0 S
Is Interval	: 1000.0ms	PAGE	1 >

3. Press  or  to move cursor to OCP Delay

Degree ON	: 359.9	V Limit:	300.0 V
Degree OFF	: 359.9	I Limit:	3.00 A
Is Start	: 1000.0ms	→Delay	: 5.0 S
Is Interval	: 1000.0ms	PAGE	1 >

4. Change to 1.5s by numerical key or knob, then press  key to confirm the setting

Degree ON	: 359.9	V Limit:	300.0 V
Degree OFF	: 359.9	I Limit:	3.00 A
Is Start	: 1000.0ms	→Delay	: 1.5 S
Is Interval	: 1000.0ms	PAGE	1 >

3.5.3 Voltage Level Setting

A1500 SERIES provide two output voltage levels used for low voltage and high voltage applications. At 300V level, AC source can provide 8.0A in total; At 150V level 16.0A in total can be provided, maximum output power is 1500VA.

When switched from 300V to 150V level, AC source will check all voltage settings, and change the setting to 150V if any voltage setting checked is higher than 150V.

When switched from 150V to 300V level, AC source will check all I Limit settings, and change the setting to 16.0A if any current setting checked is higher than 16.0A.

Following processes demonstrate how to change output voltage level (300V → 150V):

1. Press  or  to move cursor to Voltage Level

```

→ Voltage Level : 300 V      Waveform : A
Voltage Sense : Vsense      Buzzer   : OFF
Vdc Limit P   : 424.2       Keylock  : OFF
Vdc Limit N   : -424.2      PAGE    < 2
  
```

2. Rotate knob to change <300V> to<150V>, then press  to confirm setting

```

→ Voltage Level : 150 V      Waveform : A
Voltage Sense : Vsense      Buzzer   : OFF
Vdc Limit P   : 212.1       Keylock  : OFF
Vdc Limit N   : -212.1      PAGE    < 2
  
```

3.5.4 Voltage Sense

Voltage Sense determine output voltage measurement point is at AC output terminal (Vout) or input terminal at product under testing (Vsense). If it is set at Vsense, Remote Sense wire must be connected first, otherwise compensate error will occur. AC source will compensate the voltage drop of the output cable if Vsense is selected.

Following processes demonstrate how to set Volage Sense as Remote Sense:

1. Press  or  to move cursor to Voltage Sense

```

Voltage Level : 150 V      Waveform : A
→ Voltage Sense : Vout      Buzzer   : OFF
Vdc Limit P   : 212.1       Keylock  : OFF
Vdc Limit N   : -212.1      PAGE    < 2
  
```

2. By rotating knob to change parameter to Vsense, then press  to confirm the change

```

→ V o l t a g e   L e v e l : 3 0 0 V           W a v e f o r m : A
V o l t a g e   S e n s e : V s e n s e       B u z z e r   : O F F
V d c   L i m i t   P   : 4 2 4 . 2         K e y l o c k   : O F F
V d c   L i m i t   N   : - 4 2 4 . 2       P A G E       < 2

```

3.5.5 Degree On, Off

A1500 SERIES can control the start phase angle (Degree On) or stop phase angle (Degree Off) of the output voltage waveform. Range for Degree On is 0.0~359.9, and is 0.0~360.0 for Degree Off. When Degree Off parameter is 0, the output stopped immediately no matter which output status is at. If 0.0 degree for stop phase angle is needed, please set Degree Off to 360.0.

Following processes demonstrate how to set phase angle Degree On = 100 and Degree Off = 200:

1. Move cursor to Degree On

```

→ D e g r e e   O N   : 3 5 9 . 9           V L i m i t : 3 0 0 . 0 V
D e g r e e   O F F   : 3 5 9 . 9           I L i m i t :   8 . 0 0 A
I s   S t a r t       : 1 0 0 0 . 0 m S      D e l a y   :   5 . 0 S
I s   I n t e r v a l : 1 0 0 0 . 0 m S      P A G E     1 >

```

2. Change parameter to 100 by numerical key or knob rotating, then press  to confirm setting

```

→ D e g r e e   O N   : 1 0 0 . 0           V L i m i t : 3 0 0 . 0 V
D e g r e e   O F F   : 3 5 9 . 9           I L i m i t :   8 . 0 0 A
I s   S t a r t       : 1 0 0 0 . 0 m S      D e l a y   :   5 . 0 S
I s   I n t e r v a l : 1 0 0 0 . 0 m S      P A G E     1 >

```

3. Press  or  to move cursor to Degree Off

```

D e g r e e   O N   : 1 0 0 . 0           V L i m i t : 3 0 0 . 0 V
→ D e g r e e   O F F   : 3 5 9 . 9           I L i m i t :   8 . 0 0 A
I s   S t a r t       : 1 0 0 0 . 0 m S      D e l a y   :   5 . 0 S
I s   I n t e r v a l : 1 0 0 0 . 0 m S      P A G E     1 >

```

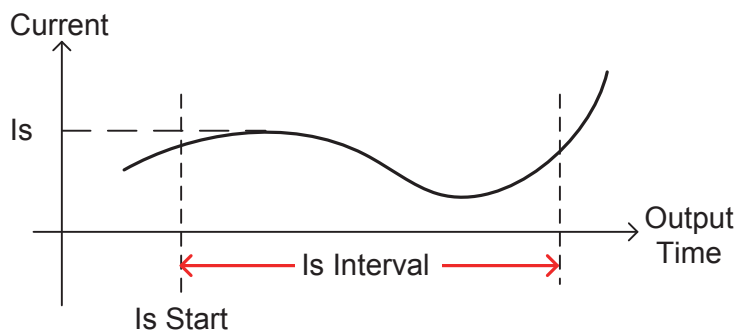

4. Change parameter to 200 by numerical key or knob rotating, then press Enter to confirm the setting

Degree ON	: 100.0	V Limit	: 300.0 V
→ Degree OFF	: 200.0	I Limit	: 8.00 A
Is Start	: 1000.0 ms	Delay	: 5.0 S
Is Interval	: 1000.0 ms	PAGE	1 >

3.5.6 Is Start, Is Interval

Both the parameter ranges for Is Start and Is Intervals are 0.0~1000.0 msec, these parameters are used for the surge current measurement.

Figure shown below indicates the measurement of the surge current starting at Is Start after output enabled, and measurement time is Is Interval:



For example: if Is Start = 500ms, Is Interval = 200ms, then Is measurement shown on main manual is the maximum current measured between 500~700ms after output enabled. Following processes demonstrate how to set Is Start = 500ms and Is Interval = 200ms:

1. Press ▲ or ▼ to move cursor to Is Start

Degree ON	: 359.9	V Limit	: 300.0 V
Degree OFF	: 359.9	I Limit	: 8.00 A
→ Is Start	: 1000.0 ms	Delay	: 5.0 S
Is Interval	: 1000.0 ms	PAGE	1 >

2. Change parameter to 500.0 by numerical key or knob, then press  to confirm the change

Degree ON	:	359.9	V Limit	:	300.0 V
Degree OFF	:	359.9	I Limit	:	8.00 A
→ Is Start	:	500.0 ms	Delay	:	5.0 S
Is Interval	:	1000.0 ms			PAGE 1 >

3. Press  or  to move the cursor to Is Interval

Degree ON	:	359.9	V Limit	:	300.0 V
Degree OFF	:	359.9	I Limit	:	8.00 A
Is Start	:	500.0 ms	Delay	:	5.0 S
→ Is Interval	:	1000.0 ms			PAGE 1 >

4. Change parameter to 200 by numerical key or knob, then press  to confirm the change

Degree ON	:	359.9	V Limit	:	300.0 V
Degree OFF	:	359.9	I Limit	:	8.00 A
Is Start	:	500.0 ms	Delay	:	5.0 S
→ Is Interval	:	200.0 ms			PAGE 1 >

3.5.7 Waveform Selection

A3000 SERIES provide two sets built in waveforms A and B. User can select Sin, CSin, Squa or other self-defined waveform from A or B set at CONFIG page, then go to SETUP page to set output voltage waveform for main manual.

Following processes demonstrate how to change output waveform from A to B:

1. Press  move to next page

Voltage Level	:	300 V	→ Waveform	:	A
Voltage Sense	:	Vsense	Buzzer	:	OFF
Vdc Limit P	:	424.2	Key lock	:	OFF
Vdc Limit N	:	-424.2			PAGE < 2

2. Rotate knob to change <A>to, press  to confirm

Voltage Level : 300 V	→ Waveform : B
Voltage Sense : Vsense	Buzzer : OFF
Vdc Limit P : 424.2	Key lock : OFF
Vdc Limit N : -424.2	PAGE < 2

PS: Press  at main manual, only A or B can be selected. If using List function, then A or B waveform can be output alternatively.

3.5.8 Buzzer

When user press numerical key or rotate knob, there is sound from buzzer to confirm the operation, it can be muted if the confirmation is not needed.

Following processes demonstrate how to mute the buzzer:

1. Press  or  to move cursor to Buzzer

Voltage Level : 300 V	Waveform : A
Voltage Sense : Vsense	→ Buzzer : ON
Vdc Limit P : 424.2	Key lock : OFF
Vdc Limit N : -424.2	PAGE < 2

2. Rotate knob to change <ON>to<OFF>, press  to confirm the change

Voltage Level : 300 V	Waveform : A
Voltage Sense : Vsense	→ Buzzer : OFF
Vdc Limit P : 424.2	Key lock : OFF
Vdc Limit N : -424.2	PAGE < 2

3.5.9 Disable (Lock) the Keys at Front Panel

A3000 SERIES allow the user to lock the parameters at front panel to avoid being changed accidentally. After the parameters are locked, only  and  keys are

enabled.  Let user back to SETUP manual to enable or disable lock,  enable or disable the output.

Following are the processes to demonstrate how to set keys at front panel from OFF to ON:

1. Press  or  to move cursor to Keylock

```

V o l t a g e   L e v e l : 3 0 0 V           W a v e f o r m : A
V o l t a g e   S e n s e : V s e n s e       B u z z e r   : O F F
V d c   L i m i t   P       : 4 2 4 . 2     → K e y l o c k   : O F F
V d c   L i m i t   N       : - 4 2 4 . 2     P A G E       < 2

```

2. Rotate knob to change <Off> to <On>, press  to confirm

```

V o l t a g e   L e v e l : 3 0 0 V           W a v e f o r m : A
V o l t a g e   S e n s e : V s e n s e       B u z z e r   : O F F
V d c   L i m i t   P       : 4 2 4 . 2     → K e y l o c k   : O F F
V d c   L i m i t   N       : - 4 2 4 . 2     P A G E       < 2

```

3.6 CONFIG Function

1. At advanced parameter setting manual, press  to select CONFIG

```

PAGE SELECT:2
1.SETUP  2.CONFIG
3.LIST   4.PULSE  5.SETUP
6.SYNTHESIS

```

2. Press  to enter CONFIG page

```

→Wave A:SIN      GPIB ADDRESS   :30
                   RS232 Parity   :NONE
Wave B:SIN      RS232 Baud Rate:9600
                                PAGE 1>

```

3. Press  to enter page 2.

```

→ Couple          : AC
Remote Inhibit    : OFF
                                PAGE < 2 >

```

4. Press  to enter page 3.

```

- - - - - Power On State - - - - -
→ V   : 110.0 V      Output : OFF
Vdc   : -424.2 V     Couple  : AC+DC
F     : 1000.0 Hz
                                PAGE < 3 >

```

Definitions for all parameters are listed as below:

Name of parameter	definition	Setting Range	
		Minimum	Maximum
Wave A	Stored group A waveform	Sin, C Sin, SQUA, DST0~DST31	
Wave B	Stored group B waveform	Sin, C Sin, SQUA, DST0~DST31	
GPIB ADDR	Address of GPIB	1	30
RS232 BaudRate	Baud Rate of RS232	9600 / 19200	
RS232 Parity	RS232 Odd/Even parity check	NONE EVEN ODD	
Remote Inhibit	External TTL signal to control output	OFF LIVE TRIG EXCITE	
Output	Output status for next time after AC on	ON / OFF	

3.6.1 Waveform A, B Generator

A1500 SERIES provide memories to store group A and B waveforms, both A and B groups have waveforms as below

- Sinusoidal (Sine)
- Cut sinusoidal (Cut Sine)
- 30 sets built in waveforms (DST0~DST29) : See appendix B for details.
- 2 sets user defined waveforms (DST30~DST31)

Following processes demonstrate how to set group A waveform as built in waveform number 20:

1. Press  or  to move cursor to Wave A

```
→Wave A:SIN          GPIB ADDRESS   :30
                      RS232 Parity    :NONE
Wave B:SIN           RS232 Baud Rate:9600
                                PAGE  1>
```

2. Rotate Knob to change <SIN>to<DST20>, press  to confirm the change

```
→Wave A:DIS20        GPIB ADDRESS   :30
                      RS232 Parity    :NONE
Wave B:SIN           RS232 Baud Rate:9600
                                PAGE  1>
```

Following processes demonstrate how to set group B waveforms as cut sinusoidal waveform (Cut Sine) with CF 1.300:

1. Press  or  to move cursor to Wave B

```
Wave A:DIS20         GPIB ADDRESS   :30
                      RS232 Parity    :NONE
→Wave B:SIN          RS232 Baud Rate:9600
                                PAGE  1>
```

2. Rotate knob to change <SIN>to<CSIN>, press  to confirm the change. CF parameter appears when <CSIN> selected

```
Wave A:DIS20         GPIB ADDRESS   :30
                      RS232 Parity    :NONE
→Wave B:CSIN         RS232 Baud Rate:9600
CSIN CF:1.200                                PAGE  1>
```

3. Press  or  to move cursor to CSIN CF

```
Wave A:DIS20      GPIB ADDRESS   :30
                  RS232 Parity    :NONE
Wave B:CSIN       RS232 Baud Rate:9600
→CSIN CF:1.200                                PAGE 1>
```

4. By pressing numerical key or rotating knob, change parameter to 1.300, press  to confirm the setting

```
Wave A:DIS20      GPIB ADDRESS   :30
                  RS232 Parity    :NONE
Wave B:CSIN       RS232 Baud Rate:9600
→CSIN CF:1.300                                PAGE 1>
```

3.6.2 GPIB, RS232 Communication Setting

A1500 SERIES provide remote control operation, there are GPIB or RS232 interface for selection. Only one interface can be activated at the same time:

Operation mode \ Controller	Manual (front panel)	Remote (GPIB)	Remote (RS232)
Manual(front panel)	○	×	×
Remote(GPIB)	×	○	×
Remote(RS232)	×	×	○

How to switch manual to remote control: Send any command to AC source directly, AC source enter remote control mode automatically.

Two ways to Switch from remote to local control: 1. Stop remote control, press



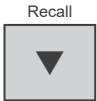
longer than 2 seconds until " SET MODE" shown on upper left on the screen; 2. Send *CLS command.

Switch remote control between GPIB or RS232: Back to manual operation as demonstrated above, then use another communication interface to do the control.

Parameters setting for two interfaces:

GPIB	RS232	
Address	Odd/Even parity check (Parity)	Baud rate (Baud Rate)
● 1~30	● Even parity check (EVEN) ● Odd parity check (ODD) ● No parity check (NONE)	● 9600 ● 19200

Example how to set GPIB Address to 20:

1. Press  or  to move to GPIB ADDR

```
Wave A:SIN      →GPIB ADDRESS    :30
                  RS232 Parity     :NONE
Wave B:SIN      RS232 Baud Rate:9600
                                  PAGE 1>
```

2. By pressing numerical key or rotating knob to change parameter to 20, press  to confirm

```
Wave A:SIN      →GPIB ADDRESS    :20
                  RS232 Parity     :NONE
Wave B:SIN      RS232 Baud Rate:9600
                                  PAGE 1>
```

PS: The range of address is 1-30.

Example how to set RS232 Baud rate = 19200, Odd/Even parity check = (ODD):

1. Press  or  to move cursor to RS232 Baud Rate

```
Wave A:SIN      GPIB ADDRESS     :30
                  RS232 Parity     :ODD
Wave B:SIN      →RS232 Baud Rate:9600
                                  PAGE 1>
```


2. Rotate knob to change parameter from <9600>to<19200>, press  to confirm

```
Wave A:SIN      GPIB ADDRESS   :30
                  RS232 Parity   :ODD
Wave B:SIN      →RS232 Baud Rate:19200
                                  PAGE 1>
```

3. Press  or  to move cursor to RS232 Parity

```
Wave A:SIN      GPIB ADDRESS   :30
                  →RS232 Parity  :NONE
Wave B:SIN      RS232 Baud Rate:9600
                                  PAGE 1>
```

4. Rotate knob to change parameter from<NONE>to<ODD>, press  to confirm the change

```
Wave A:SIN      GPIB ADDRESS   :30
                  →RS232 Parity  :ODD
Wave B:SIN      RS232 Baud Rate:9600
                                  PAGE 1>
```

3.6.3 Couple (output mode selection)

AC/DC source can output AC, DC, AC+DC three kinds of output voltage. User can set the output mode at CONFIG manual.

How to set Couple as AC+DC Mode:

1. Move cursor to Couple

```

→ Couple           : AC
 Remote Inhibit : OFF
                                     PAGE < 2 >
  
```

2. Rotate knob to change <OFF>to <TRIG>, press  to confirm change

```

→ Couple           : AC + DC
 Remote Inhibit : OFF
                                     PAGE < 2 >
  
```

3.6.4 Inhibit Output by Remote Control Signal (Remote Inhibit)

Remote Inhibit is a [Active HIGH] TTL signal, high level is 5V, low level is 0V. Its signals send to 9 pin TTL signal connector (D-SUB) at back panel of the AC source. Please refer appendix A for pin assignment.

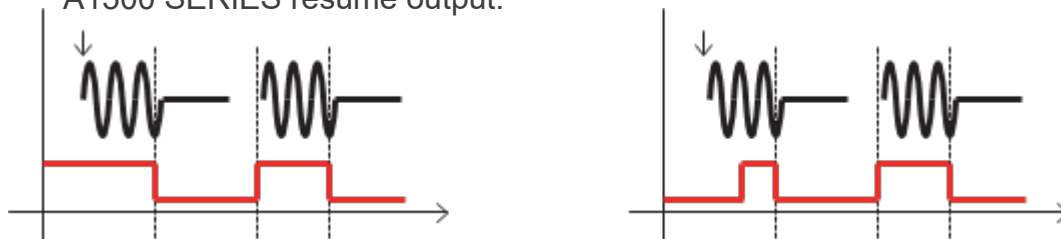
After Remote Inhibit initialized, output control priorities for AC source are as below:

Front panel
Remote Control > TTL signal

- When both front panel and remote control are idle, output of A1500 SERIES is according to external TTL ON/OFF signal.
- When user press [OUT] from front panel or by remote control, TTL signal has no effect on the operation.

There are four Remote inhibit output status: OFF, LIVE, TRIG, EXCITE.

- OFF: Turn off remote inhibit function.
- LIVE: two conditions
 - TTL signal changes from HIGH → LOW, and stays low longer than 1ms, A1500 SERIES turn off output.
 - TTL signal changes from LOW → HIGH, and stays high longer than 1mcs, A1500 SERIES resume output.



- TRIG: TTL signal changes from HIGH → LOW, and keeps low longer than 1ms, A1500 SERIES turn off output, and stop detecting TTL signal, output stays at off state even TTL signal changes to high. User must press to resume output and enable TTL signal detecting.
- EXCITE: When user is using LIST, PULSE or STEP modes, output ON/OFF of A1500 SERIES can be triggered by rising edge of TTL signal (LOW → HIGH) at trigger page (please refer to 3.8.2~3.8.4 for trigger page). The pulse signal must keep at least 1ms when the signal changes.
 - When output of AC source is at off state, it will be triggered to on state if TTL signal changes from LOW → HIGH. There will be two conditions introduced as below.
 - ◆ If output sequences finishes and TTL signal changes from LOW → HIGH again, the output will be triggered to on state and repeat the sequences again.
 - ◆ If TTL signal changes from LOW → HIGH when output sequences are not finished yet, output will turn off.

Example how to change Remote Inhibit setting from OFF to TRIG:

1. Press  or  to move cursor to Remote Inhibit

```

C o u p l e           : A C
→ R e m o t e   I n h i b i t : O F F

                                     P A G E   < 2 >
  
```

2. Rotate knob to change <OFF> to <TRIG>, press  to confirm the change

```

Couple      : AC
→ Remote Inhibit : TRIG
P A G E    < 2 >

```

3.6.5 Power On State

A1500 SERIES may set different operation modes or enable turn on output immediately next time after AC is on. Output voltage and frequency depend on stored parameter before AC input is off.

Example below shows how to set output is ON, output mode is AC+DC, AC voltage is 100Vac, DC voltage is 50Vdc, frequency is 50Hz for next time after AC is on:

1. Press  or  to move cursor to Output

```

- - - - - Power On State - - - - -
V   : 110.0 V      → Output : OFF
V d c : 424.2 V      Couple : AC
F   : 1000.0 Hz
P A G E    < 3

```

2. Rotate knob to change <Off> to <On>, press  to confirm the change

```

- - - - - Power On State - - - - -
V   : 110.0 V      → Output : OFF
V d c : 424.2 V      Couple : AC
F   : 1000.0 Hz
P A G E    < 3

```

3. Press  or  to move cursor to V.

```

- - - - - Power On State - - - - -
V   : 110.0 V      → Output : OFF
V d c : 424.2 V      Couple : AC
F   : 1000.0 Hz
P A G E    < 3

```

4. Press numeric key or rotate knob to change parameter to 100.0V, then press  to

confirm the change.

```

- - - - - Power On State - - - - -
V : 110.0V → Output: OFF
Vdc: -424.2V Couple: AC
F : 1000.0Hz PAGE < 3

```

5. Move cursor to Vdc

```

- - - - - Power On State - - - - -
V : 110.0V → Output: OFF
Vdc: -424.2V Couple: AC
F : 1000.0Hz PAGE < 3

```

6. Press numeric key or rotate knob to change parameter to 50.0V, then press  to

confirm the change.

```

- - - - - Power On State - - - - -
V : 100.0V Output: ON
→ Vdc: 50.0V Couple: AC
F : 1000.0Hz PAGE < 3

```

7. Move cursor to F

```

- - - - - Power On State - - - - -
V : 100.0V Output: ON
→ Vdc: 50.0V Couple: AC
F : 1000.0Hz PAGE < 3

```

8. By numerical key or rotating knob, change parameter to 50, then press  to confirm

```

- - - - - Power On State - - - - -
V : 100.0V Output: ON
→ Vdc: 50.0V Couple: AC
F : 1000.0Hz PAGE < 3

```

9. 9. Move cursor to Couple

```

- - - - - P o w e r   O n   S t a t e - - - - -
V       : 1 0 0 . 0 V           O u t p u t : O N
→ V d c :   5 0 . 0 V           C o u p l e : A C
F       : 1 0 0 0 . 0 H z
P A G E   < 3

```

10. Rotate knob, change parameter to AC+DC , then press to confirm

```

- - - - - P o w e r   O n   S t a t e - - - - -
V       : 1 0 0 . 0 V           O u t p u t : O N
→ V d c :   5 0 . 0 V           C o u p l e : A C
F       : 1 0 0 0 . 0 H z
P A G E   < 3

```

11. Refer 3.9.1.1 about Group save function, save all settings to Group1, it will take effective next time after AC is on.

3.7 Protection

A1500 SERIES provide software and hardware protections. A1500 SERIES will disconnect output relay to turn off output and display protection status on screen when protection happens. To resume the output, following three errors can be released by long press any key. For other errors, turn off AC source, make correction for abnormal load or wrong AC mains voltage, and turn on AC source again to resume output.

- Software OCP
- D2A OCP Fault
- D2A OPP Fault

Errors	Status description
DSP initial Fault	DSP initialization error occurs
EEPROM Fault	When memory has errors
I2C ERROR Fault	Abnormal internal communication
REMOTE SENSE Fault	Voltage compensation exceeds max/min limitation
Iout limit Fault	Output current is over limitation (I Limit)
Vout limit Fault	Output voltage is over limitation (V Limit)

● Protections by hardware :

Errors	Status description
AUX PG Fault	Abnormal aux power output
D2A IC Fault	Voltage / current detection IC malfunction
D2A OCP Fault	Over current for D2A Board ²
D2A OPP Fault	Over power for D2A Board
D2A OTP Fault	Over temperature for D2A Board
D2D OTP Fault	Over temperature for D2D Board
D2D PG Fault	Output abnormal for D2D Board
FAN Fault	Fan malfunction
Input OCP	Input current reaches trip point of built in no fuse breaker ¹
PFC AC Fault	AC mains voltage higher or lower than rating ranges
PFC OVP Fault	Over voltage for PFC Board
PFC OTP Fault	Over temperature for PFC Board
PFC PG Fault	Output abnormal for PFC Board

Notes:



1. D2A OCP ranges: When Voltage Level is 300V, OCP trigger point is 8A. It is 16A when voltage Level is set at 150V.

3.8 Applications

3.8.1 Introduction

A1500 SERIES provides not only stable AC voltage but also three kinds of programmable dynamic output. Following paragraphs explain the definition of parameters and how to do the setting:

- LIST mode: Let user to set 10 sets of user-defined voltage, frequency. This mode can make 10 different outputs consecutively.
- PULSE mode: Simulate repeatedly changed output voltage.
- STEP mode: Simulate gradually changed output voltage.

A1500 SERIES also provide 39 orders of amplitude and phase angle settings for user to make self-defined waveforms. It can be used at all output modes once the self-defined waveforms is created.

3.8.2 LIST Mode

1. At advanced parameter setting page, press **3** to select LIST

```
PAGE SELECT:3
1.SETUP  2.CONFIG
3.LIST    4.PULSE  5.SETUP
6.SYNTHESIS
```

2. Press  to enter LIST page

```
→Count:      1
Go to Trigger Mode

PAGE 1>
```

3. Press  enter next page shown as below

```
[SEQ 0]      →Vs: 300.0V    →DCs: 300.0V
→Degree: 359.9  Ve: 300.0V    DCe: 300.0V
Wave:      A      Fs: 1000.0Hz
Time: 60000ms    Fe: 1000.0Hz    PAGE <2>
```

LIST mode provide 10 sets of programmable waveform (SEQ-0 ~ SEQ-9) . Output

waveforms start from SEQ-0, then SEQ-1, SEQ-2... in orders until time parameter (Time) of SEQ-n being processed is 0 or SEQ-9 is finished outputting, then one List waveform output is completed.

Following are definitions for all parameters:

Parameter	Definition	Range	
		Min	Max
Count	Execution times for one complete List waveform. When 0 is setting, output recycles endless until user press  to stop.	0	10000
V Start	Start voltage(V): (high voltage range) : (low voltage range)	0.0 0.0	300.0 150.0
V End	Stop voltage(V): (high voltage range) : (low voltage range)	0.0 0.0	300.0 150.0
F Start	Start frequency(Hz)	30.0	1000.0
F End	Stop Frequency(Hz)	30.0	1000.0
DC Start		0.0	±424.0
DC End		0.0	±424.0
Time	Output duration (msec)	0	60000
Waveform	Output waveform selection	A or B	
Degree On	Start phase angle for output waveform(deg)	0.0	359.9

After SEQ setting is completed, press  to return to LIST mode initialization page as below:

```
Count:    1
→Go to Trigger Mode

PAGE  1>
```

Press  to enter Trigger page as below:

```
[LIST]      V:   0.0 Ip: 0.00 VA :   0.0
Trigger ON  I:   0.0 Is: 0.00 VAR:   0.0
              F:   0.0 PF : 0.000
Stop        P:   0.0 CF : 0.000
```

Screen shows Trigger On, Stop is current output status. Press  to trigger output.

Then screen shows as below, Trigger Off and Running are displayed, waiting user to stop LIST output. When all sequences and Count are executed completed, AC output turned off, and screen shows Stop.

```
[ L i s t ]      O U T   V :   x x x . x   I P : x x . x x   V A   : x x x x . x
T r i g g e r   O F F   I :   x x . x x   I s : x x . x x   V A R : x x x x . x
R u n n i n g                               F : x x x x . x   P F   :   x . x x x
                                           P : x x x x . x   C F   :   x . x x x
```

When AC source is at Running (triggered on) status, press  can disable output.

Press  the outputs are according those settings at main manual, press  can

switch output settings from main manual LIST mode. Press  will leave LIST execution mode and back to LIST setting mode.

LIST mode example:

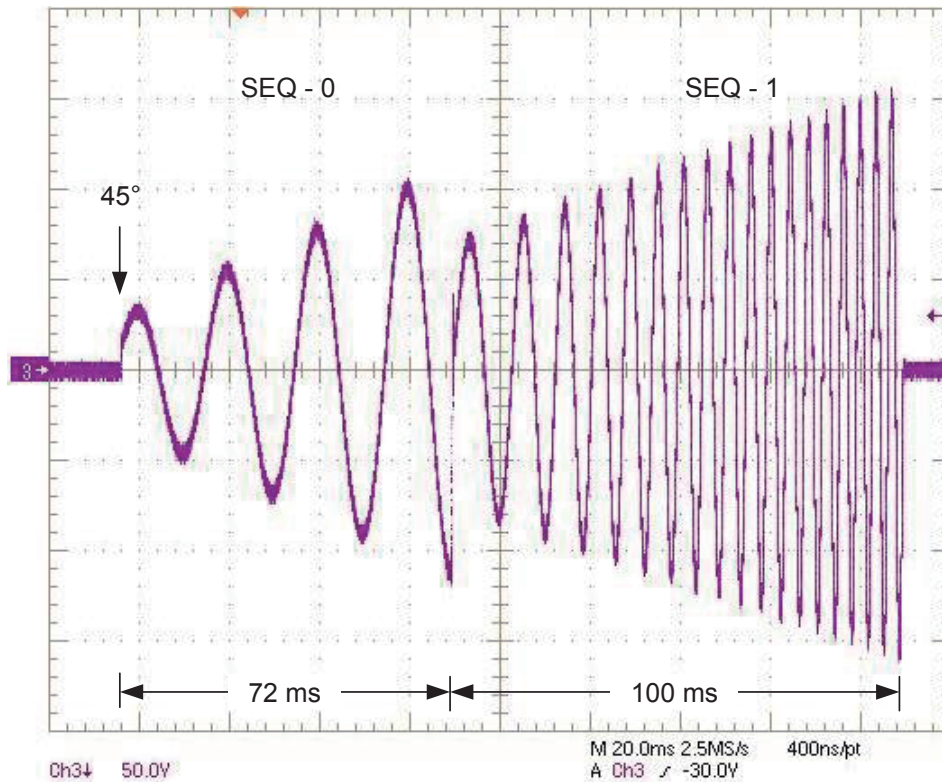
Parameter setting:

```
→ C o u n t :      1
  G o   t o   T r i g g e r   M o d e
                                           P A G E      1 >
```

```
[ S E Q   0 ]      → V s :      5 0 . 0 V      → D C s :      2 0 . 0 V
→ D e g r e e :    9 0 . 0      V e :    1 0 0 . 0 V      D C e :    - 2 0 . 0 V
  W a v e :         A          F s :      3 0 . 0 H z
  T i m e :      5 0 0 m s      F e :    1 0 0 . 0 H z      P A G E   < 2 >
```

```
[ S E Q   1 ]      → V s :    1 0 0 . 0 V      → D C s :    - 5 0 . 0 V
→ D e g r e e :      0 . 0      V e :     5 0 . 0 V      D C e :      5 0 . 0 V
  W a v e :         A          F s :      3 0 . 0 H z
  T i m e :      5 0 0 m s      F e :      3 0 . 0 H z      P A G E   < 3 >
```

Output waveform:



3.8.3 PULSE Mode

1. At advanced parameter setting page, press **4** to select PULSE

```

PAGE SELECT:4
1.SETUP  2.CONFIG
3.LIST   4.PULSE  5.SETUP
6.SYNTHESIS
  
```

2. Press **Enter** to enter PULSE page

```

→Count : 10000      →Period : 60000ms
V       : 110.0V     Duty   : 59999ms
F       : 1000.0Hz    Vdc   : 110.0V
Degree : 359.9       Go to Trigger Mode
  
```

PULSE mode lets user insert fixed period, programmed special waveform to output waveform set at main manual.

Parameter	definition	Range	
		Min	Max
Count	How many times to output programmed Pulse waveform. If setting is 0, Pulse waveform will output endless until  pressed	0	10000
Vac	Voltage of Pulse: (high voltage range) : (low voltage range)	0.0 0.0	300.0 150.0
F	Frequency of Pulse	30.0	1000.0
Period	Duration of total period	2	60000
Duty	Duration time of Pulse, its value can not be greater than the Period.	1	59999
Degree On	Start phase angle of Pulse output	0.0	359.9

Select Go to Trigger Mode, press  to do the setting. Screen shows information as below at trigger page:

```
[ P u l s e ] O U T V :    0 . 0   I P :  0 . 0 0   V A :    0 . 0
T r i g g e r  O N   I :    0 . 0 0   I s :  0 . 0 0   V A R :    0 . 0
                               F :    0 . 0   P F :  0 . 0 0 0
S t o p                               P :    0 . 0   C F :  0 . 0 0 0
```

"Trigger On" represents that the trigger is ready. "Stop" is the current output state.

Press  key to trigger. And then the screen will display "Trigger OFF" and "Running" as shown below. When the user stop the PULSE wave output or the AC power supply finishes executing the all times of Count, the screen will display "Stop".

```
[ P u l s e ] O U T V :  x x x . x   I P : x x . x x   V A : x x x x . x
T r i g g e r  O F F I :  x x . x x   I s : x x . x x   V A R : x x x x . x
                               F : x x x x . x   P F :  x . x x x
R u n n i n g                               P : x x x x . x   C F :  x . x x x
```

When the output state of AC source is triggered, pressing **OUT** key can stop the output.

Press **OUT** button again, the AC source will output the waveform according to the main page setting. Then press **Enter** key, the output state can be triggered from the main page output state to the PULSE mode output state.

Pressing **ESC/Cancel** key will exit the PULSE execution mode and back to the PULSE setting mode.

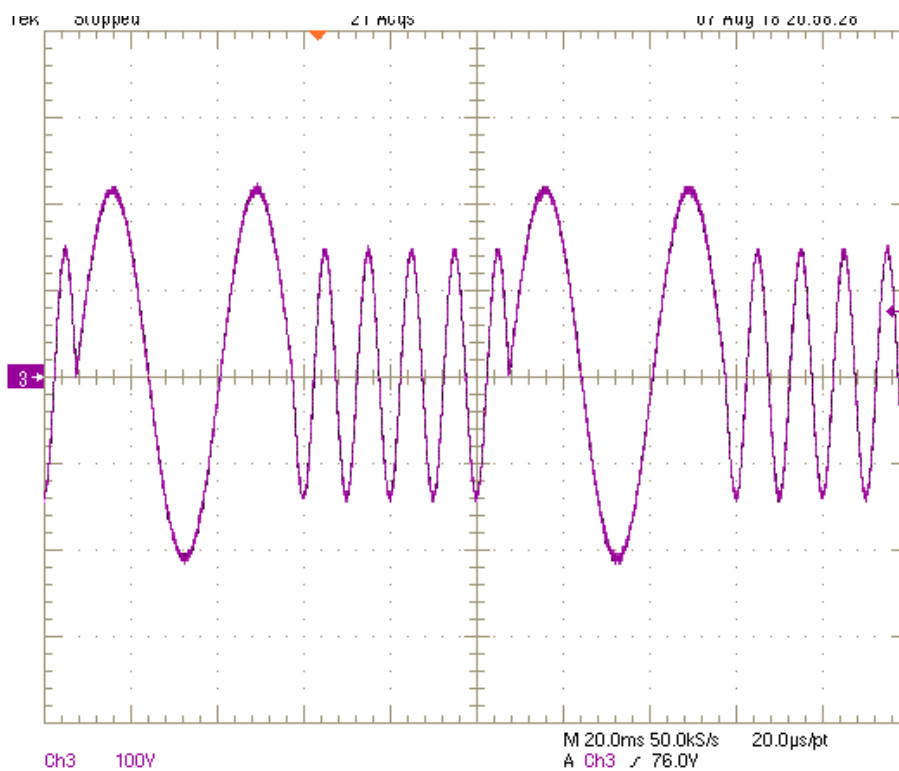
PULSE mode example:

Parameter setting:

SET	MODE	V:	0.0	IP:	0.00	VA:	0.0
V:	100.0	I:	0.00	Is:	0.00	VAR:	0.0
F:	100.0	F:	0.0	PF:	0.000		
		P:	0.0	CF:	0.000		

→ Count :	10000	→ Period :	100ms
V :	150.0V	Duty :	50ms
F :	30.0Hz	Vdc :	0.0V
Degree :	0.0	Go to Trigger Mode	

Output waveform:



3.8.4 STEP Mode

1. At advanced parameters setting page, press **5** to select STEP

```
PAGE SELECT:5
1.SETUP  2.CONFIG
3.LIST   4.PULSE  5.SETUP
6.SYNTHESIS
```

2. press **Enter** to enter STEP page

```
→ V : 110.0V → F: 1000.0Hz → Degree: 359.9
dV : 150.0V dF: -150.0Hz Count : 10000
DC: 110.0V Dwell : 60000ms
dDC: 150.0V Go to Trigger Mode
```

Voltage and frequency are same for each step in STEP mode, but may be different in different steps. Definitions for all parameters are:

Parameters	Definition	Range	
		Min	Max
Count	How many steps	0	10000
V	Voltage amplitude at first step: (high voltage range) : (low voltage range)	0.0 0.0	300.0 150.0
dV	Voltage amplitude change for each step. May be positive or negative	-150.0	150.0
DC		-424.2	+424.2
dDC		-424.2	+424.2
F	Start frequency at first step	30.0	1000.0
dF	Frequency change for each step. May be positive or negative	-150.0	150.0
Dwell	Output duration for each step	1	60000
Degree On	Initial phase angle for each STEP	0.0	359.9

For each STEP, voltage waveform changes satisfy following equation:

- $V_t = V_{t-1} + dV$

→ Voltage amplitude of next STEP = current voltage amplitude + STEP amplitude change

- $F_t = F_{t-1} + dF$

→ Voltage frequency of next STEP = current voltage frequency + STEP frequency change

Select Go to Trigger Mode, press  to enter Trigger page shown as below:

```
[STEP]      V:   0.0 Ip: 0.00 VA :   0.0
Trigger ON  I:   0.00 Is: 0.00 VAR:   0.0
              F:   0.0 PF : 0.000
Stop        P:   0.0 CF : 0.000
```

"Trigger On" represents that the trigger is ready. "Stop" is the current output state.

Press  key to trigger. And then the screen will display "Trigger OFF" and "Running" as shown below. When the user stop the STEP wave output or the AC power supply finishes executing the all times of Count, the screen will display "Stop".

```
[Step]      OUT V:  x x x . x  I P : x x . x x  V A : x x x x . x
Trigger OFF I:  x x . x x  I s : x x . x x  V A R : x x x x . x
              F : x x x x . x  P F :  x . x x x
Running     P : x x x x . x  C F :  x . x x x
```

When the output state of AC source is triggered, pressing  key can stop the output.

Press  button again, the AC source will output the waveform according to the main page setting. Then press  key, the output state can be triggered from the main page output state to the STEP mode output state.

Pressing  key will exit the STEP execution mode and back to the STEP setting mode.

A1500

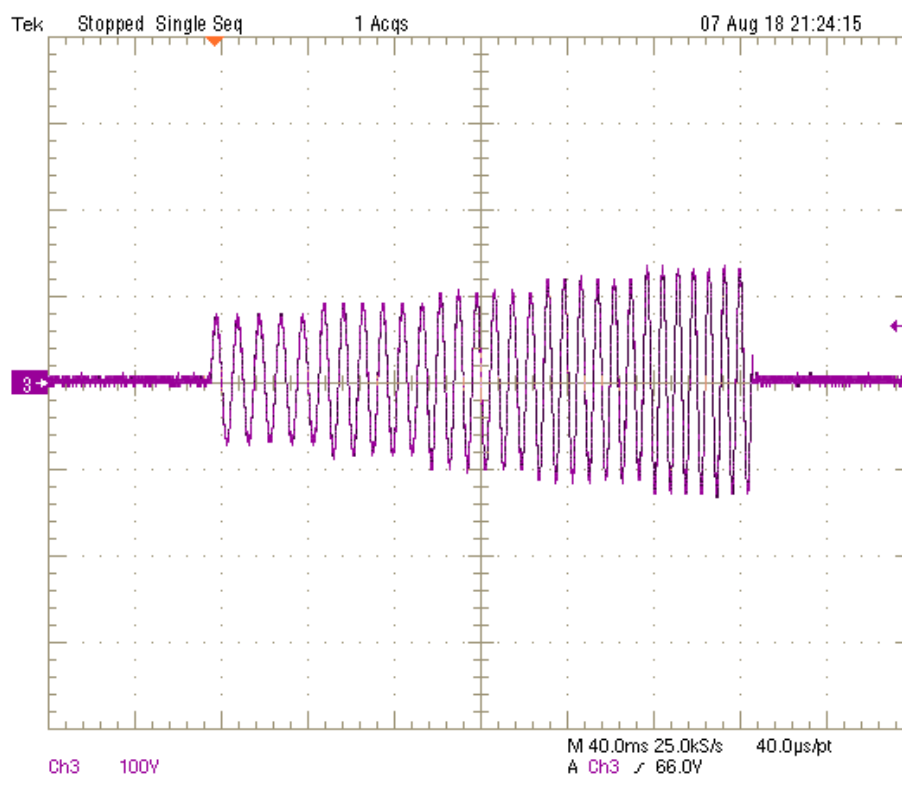
AC Power Source

STEP mode example:

Parameter setting:

→ V :	50.0 V	→ F :	60.0 Hz	→ Degree :	0.0
d V :	10.0 V	d F :	10.0 Hz	Count :	4
D C :	0.0 V			Dwell :	50 mS
d D C :	0.0 V			Go to Trigger Mode	

Output waveform:



3.8.5 SYNTHESIS Self-Defined Waveform Mode

1. At advanced parameters setting page, press **6** to select SYNTHESIS

```
PAGE SELECT:6
1.SETUP  2.CONFIG
3.LIST   4.PULSE  5.SETUP
6.SYNTHESIS
```

2. Press **Enter** key to enter SYNTHESIS page

```
→Waveform:DIS30
Save Synthesis Parameter

PAGE 1>
```

- WAVEFORM: AC power supply provides two self-defined waveforms for user to set. The waveforms are DIS30 and DIS31.
- Save Synthesis Parameter: After setting the amplitude and phase of each order, it is necessary to press **Enter** key, and the parameters will be loaded to DSP. Otherwise, the DSP will retain the old parameters without any amendment.

In SYNTHESIS self-defined waveform mode, voltage and frequency of fundamental waveform is sinusoidal defined at main manual. User can edit amplitude and phase angle of harmonic waveform up to 39 order of fundamental wave. Editing can be done by front panel or remote control.

Parameters	Definition	Range	
		Min	Max
Waveform	Name for two sets of SYNTHESIS waveform	DST30 / DST31	
Gain	Voltage amplitude ratio of Harmonic to fundamental wave for each order.	Order 2~20	
		0	33.33
		Order 21~30	
		0	30.00
		Order 31~39	
		0	15.00
Phase	Start phase angle of harmonic wave for each order	0.0	359.9

Press



to enter the next page, as shown below.

N	Gain	Phase	N	Gain	Phase
2→	0.00%	0.0	5	0.00%	0.0
3	0.00%	0.0	6	0.00%	0.0
4	0.00%	0.0	PAGE <2>		

After finishing setting, press



key to return to the initial page. Select "Save Synthesis Parameter" to complete the setting.

It takes about 8 seconds to do the calculation and saving. It will back to first page of SYNTHESIS when saving is completed. For protection purpose, amplitude for each order must not exceed limitation as below.

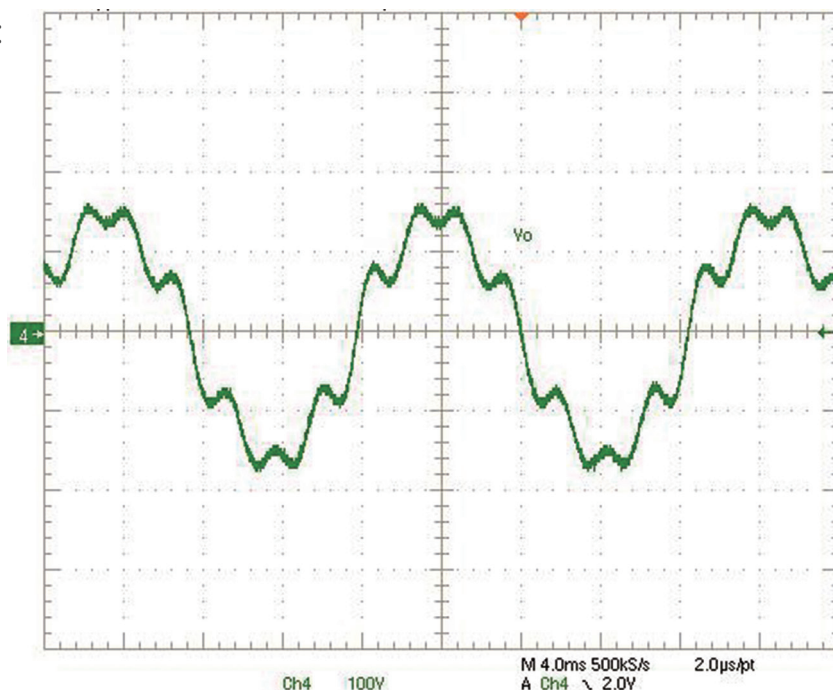
Orders	Gain limit
2 ~ 20	33.33%
21 ~ 30	30.00%
31 ~ 39	15.00%

Example of SYNTHESIS mode:

Order	Gain	Phase
2	2.07	0.0
5	9.80	0.0
7	15.80	0.0
8	2.16	0.0

Output waveform = $110 \times$

$$\left[\begin{array}{l} n(w) + \\ 2.07 \times n(2w + 0.0) + \\ 9.80 \times n(5w + 0.0) + \\ 15.80 \times n(7w + 0.0) + \\ 2.16 \times n(8w + 0.0) \end{array} \right]$$



3.9 Save and Recall Functions

AC power supply provides two modes for users to save and recall the output setting or the system information.

3.9.1 Save and Recall the Main Page Setting

A1500 SERIES provides 9 channels for users to save V and F. Users can save or recall the specific parameters at any time.

3.9.1.1 Save the Main Page Setting

Following is the example of saving V=150V and F=80Hz to Channel 2 Memory.

- Press  key about 2 seconds in the main page, then it will enter the storage page as shown below.

```

P r e s s   1 - 9 , S a v e   M a i n   P a g e   D a t a :  ←
1  V :      0 . 0   F :      3 0 . 0   4  V :      0 . 0   F :      3 0 . 0
2  V :      0 . 0   F :      3 0 . 0   5  V :      0 . 0   F :      3 0 . 0
3  V :      0 . 0   F :      3 0 . 0                                     P A G E   1 >
  
```

- Press  and  keys to select Channel 2 Memory.

```

P r e s s   1 - 9 , S a v e   M a i n   P a g e   D a t a : 2
1  V :      0 . 0   F :      3 0 . 0   4  V :      0 . 0   F :      3 0 . 0
2 →V :      0 . 0   F :      3 0 . 0   5  V :      0 . 0   F :      3 0 . 0
3  V :      0 . 0   F :      3 0 . 0                                     P A G E   1 >
  
```

- Set V=150V and F=80Hz, then press  key to complete the saving operation.

```

P r e s s   1 - 9 , S a v e   M a i n   P a g e   D a t a : 2
1  V :      0 . 0   F :      3 0 . 0   4  V :      0 . 0   F :      3 0 . 0
2 →V :    1 5 0 . 0   F :      8 0 . 0   5  V :      0 . 0   F :      3 0 . 0
3  V :      0 . 0   F :      3 0 . 0                                     P A G E   1 >
  
```

3.9.1.2 Recall the Main Page Setting

Following is the example of recalling the setting stored in Channel 2 Memory (V=150V, F=80Hz) to the main page.

1. Press  key about 2 seconds in the main page, then it will enter the storage page as shown below.

P r e s s 1 - 9 , R e c a l l M a i n P a g e D a t a : ←											
1	V :	0 . 0	F :	3 0 . 0	4	V :	0 . 0	F :	3 0 . 0		
2	V :	1 5 0 . 0	F :	8 0 . 0	5	V :	0 . 0	F :	3 0 . 0		
3	V :	0 . 0	F :	3 0 . 0						P A G E	1 >

2. Press 2 and  keys to select Channel 2 Memory.

P r e s s 1 - 9 , R e c a l l M a i n P a g e D a t a : ←											
1	V :	0 . 0	F :	3 0 . 0	4	V :	0 . 0	F :	3 0 . 0		
2	V :	1 5 0 . 0	F :	8 0 . 0	5	V :	0 . 0	F :	3 0 . 0		
3	V :	0 . 0	F :	3 0 . 0						P A G E	1 >

3. The screen will automatically return to the main page with V and F set to 150V and 80Hz respectively.

S E T	M O D E	V :	0 . 0	I p :	0 . 0 0	V A :	0 . 0
→ V :	1 5 0 . 0	I :	0 . 0 0	I s :	0 . 0 0	V A R :	0 . 0
F :	8 0 . 0	F :	0 . 0	P F :	0 . 0 0 0		
		P :	0 . 0	C F :	0 . 0 0 0		

PS: If the recalled voltage is greater than the voltage limit (V Limit), the output voltage will be automatically limited to V Limit.

3.9.2 Save and Recall the System Setting

A1500 SERIES provides 3 groups of memory for users to save the system data. System data contains the parameters in SETUP and CONFIG pages. First, entering the PAGE SELECT screen, as shown below.

```

PAGE SELECT:
1.SETUP  2.CONFIG
3.LIST   4.PULSE  5.SETUP
6.SYNTHESIS

```

3.9.2.1 Save System Setting

1. Press  key about 2 seconds in "PAGE SELECT" page, then it will enter the system data storage mode, as shown below.

```

P r e s s   1 - 3 ,
S a v e   a l l   P a r a m e t e r s   t o   G r o u p   :

```

2. Choose a group of Group 1 to Group 3 and press  key, then the system data will be saved into the memory of the chosen group. The following figure is the example of saving system data into Group 2 Memory.

```

Press 1-3,
Save all Parameters to Group:2

```

3. Screen will display the waiting information. It will take a few seconds to complete saving data and return to "PAGE SELECT" page.

Saving all Parameters right now!
Please don't Shut Down Power!

PAGE SELECT:
1.SETUP 2.CONFIG
3.LIST 4.PULSE 5.SETUP
6.SYNTHESIS

3.9.2.2 Recall System Setting

1. Press  key about 2 seconds in "PAGE SELECT" page, then it will enter the system data recalling mode, as shown below.

Press 1-3,
Recall all Parameters to Group:

2. Choose a group of Group 1 to Group 3 and press  key, then the system data saved in the memory of the chosen group will be recalled. The following figure is the example of recalling system data in Group 3 Memory.

Press 1-3,
Recall all Parameters to Group:3

3. Screen will display the waiting information. It will take a few seconds to complete recalling data and return to "PAGE SELECT" page.

Recalling all Parameters right now!
Please don't Shut Down Power!

PAGE SELECT:
1.SETUP 2.CONFIG
3.LIST 4.PULSE 5.SETUP
6.SYNTHESIS

4. Remote operation

4.1 Introduction

A1500 SERIES can be remotely controlled by GPIB or RS-232. GPIB interface is an 8-bit parallel data bus with other control lines to manage communication. RS-232 transmits data in series so communication speed is slower.

If transmission speed is faster than data processing speed of micro-processor, micro-processor will neglect new received command when there is command under processing.

4.1.1 Set GPIB address and RS-232 Parameters

GPIB and RS-232 parameters can be set at CONFIG page. Default address of GPIB is 30, baud rate of RS232 is 9600, and Even/odd parity check of RS232 is NONE.

4.1.2 RS-232 pin definition

RS-232 interface uses RXD and TXD signals only. RS-232 implements 9PIN D-SUB type female connector, pin definition is listed as below.

Pin	Input/Output	Definition
1	NC	NC
2	OUTPUT	TXD
3	INPUT	RXD
4	NC	NC
5	GND	GND
6	NC	NC
7	NC	NC
8	NC	NC
9	NC	NC

4.1.3 GPIB Interface

GPIB function	Explanation	Interface function
Sender/receiver	GPIB bus may transmit or receive data by this function. Use following commands to read information.	AH1, SH1, T6, L4
Service request	AC source will pull SRQ pin to low voltage when interfaced instruments have service request.	SR1
Remote/local control	AC source can be controlled by front panel locally or GPIB remotely. Press Unlock key to switch from remote control back to local control, other keys are inactive during remote control.	RL1

Screen shows >REMOTE< when AC source is in remote control as below:

>REMOTE<	V:	0.0	Ip:	0.00	VA :	0.0	
→V:	110.0	I:	0.00	Is:	0.00	VAR:	0.0
F:	60.0		F:	0.0	PF :	0.000	
			P:	0.0	CF :	0.000	

4.2 Programming

All commands and responses are transferred in the form of ASCII code. Response must be received completely before sending a new command. Otherwise, error will occur due to message disorder.

4.2.1 Conventions

Angle bracket <> : Items in angle brackets are abbreviations for parameter.

Vertical Bar | : To separate multiple selections

Square bracket [] : Contents within the square bracket are optional.

Curve bracket {} : Parameter inside curve bracket can be repeated or omitted.

4.2.2 Numerical Data Formats

All data used for programming are ASCII codes. They can be number or character string with following format:

Symbol	Explanation	Example
NR1	Number without decimal point	1234, 0246
NR2	Number with decimal point	1.23, .456
NR3	Number with decimal point and exponent	1.234E+5

4.2.3 Boolean Data Format

The Boolean parameter <Boolean> uses the form ON|OFF only.

4.2.4 Basic Definition of Command

Construction of A1500 SERIES remote control command is based on tree system, every command must have a full path so instrument can receive it.

Tree structure use " : " as node. Command or data at left side of node is in higher level while at right side is in detail level. The higher level commands are more close to left side, and the more detailed commands are more close to right side.

A1500 SERIES includes two distinctive types of command. The first one is command described in IEEE 488.2, it is common commands for GPIB, represented by " * " at beginning of the command. The second one is instruments self-defined commands. All commands are not upper/ lower case sensitive.

There are some special symbols in commands:

- Colon (:): Colon represents node for tree system, use colon to separate different parameter until complete command constructed. For example: VOLT:AC?
- Question mark (?): Question mark represents this message is question, instruments will prepare the answers for sender to read. If sender does not read after sending questions, instrument will reserve the answer for last question command.

Example: Computer side: VOLT:AC?

Instrument side: 150.0

- semicolon(;): there are two usages for semicolon:

1. First usage: back to previous node,

Example: VOLT:AC 100;LIM:AC 200

Explanation: The above instruction has two commands which are VOLT:AC 100 and VOLT:LIM:AC 200 (;) can save one repeated string VOLT and complete two commands in one instruction, instrument will execute commands in sequence.

2. Second usage: first input semicolon then colon, represents command branches from beginning.

Example: VOLT:AC 100;;FETCh:CURRent:AC?

Explanation: The above instruction has two commands which are VOLT:AC 100 and FETCh:CURRent:AC?. Using (;:) can connect commands more than two.

- Space(): Space is used to separate command and number or string after it. Instrument differentiate command and data by space.

Example: VOLT:AC 100

- Star(*): Star represents this command is follow the standard of IEEE 488.2, it can be used for all instruments support IEEE 488.2 command.

Example: *IDN?

Explanation: Common command to query instrument name. Instrument will answer its series number. DE-A3000AB X,000,000 will be the answer for this AC source.

4.3 Command for Remote Control

4.3.1 IEEE 488.2 Standard Command

*ESE <n> Set flag mask of standard event status register.

This command is for a register used for IEEE488.2 defined standard events. It is used for flag mask or control enable. Set by 1 enables target event detection, and event detection is masked if setting is 0. No response to target events when 0 is set. Bits configuration for standard events register are:

bit	7	6	5	4	3	2	1	0
Bit name	PON	----	CME	EXE	DDE	QYE	----	OPC
Bit definition	Power on		Command error	Execution error	Error related to instrument	Query error		Operation completed

*ESE? Query flag mask for standard event status register.

*ESR? Query value stored in standard events status register, 1 represents event occurs.

*IDN? Return string of AC source identification.

Parameter returns : DME-ACS1152B X,000,000

● DME-ACS1152B X : Name of AC source

● 000,000 : Version of firmware

*RCL <n> Recall stored system setting.

parameter: 1~3

*SAV <n> Save system setting

parameter: 1~3

*SRE <n> Flag mask setting for service events status register

This command is for a register used for IEEE488.2 and instrument defined service events. It is used for flag mask or control enable. Set by 1 enables target event detection, and event detection is masked if setting is 0. No response to target events when 0 is set. Bits configuration for service events register:

Bit	7	6	5	4	3	2	1	0
name	----	MSS/SRQ	ESB	MAV	----	----	----	----
definition		Service request	Brief info. For service event register	Info. available				

- *SRE? Return status of flag mask status for service events.
- *STB? Query value stored in service event register, 1 represents event occurs.
- *CLS Clear status. Following operation may execute depends on different conditions.
 1. Leave REMOTE control, back to panel control.
 2. When one of the following error occurs, AC source will turn off output, clear error status and return to main page.
 - Software OCP
 - D2A OCP Fault
 - D2A OPP Fault

4.3.2 Instrument Commands

4.3.2.1 FETCH and MEASURE Subsystem

Differences between FETCH and MEASURE are: FETCH reads existing measurements value. Execution time is shorter because data is available immediately but the data may not be the newest. Instrument will send the next sampling data to the computer after receiving MEASURE command. There is time delay so 100ms time interval between MEASURE command and query command is recommended. MEASURE command is suitable for the requirement of updated measurement value after power supply out status changed.

Following are tree diagram for FETCH and MEASURE commands:

FETCH | MEASURE

:CURRENT

- | | |
|---------------------|--------------------------------------|
| :AC? | Query the total AC rms current |
| :AMPLitude:MAXimum? | Query the total peak current |
| :CRESTfactor? | Query the total current crest factor |
| :INRush? | Query the total inrush current |
| :FREQUENCY? | Query average frequency |

:POWER

- | | |
|------------|----------------------------|
| :AC | |
| [:REAL]? | Query total real power |
| :APPARENT? | Query total apparent power |
| :PFACtor? | Query average power factor |

:REACtive?	Query total reactive power
:VOLTagE	
:ACDC?	Query average AC Vrms

Following examples explain FETCH and MEASURE command and returned parameter:

FETCH:CURRent:AC?

MEASure:CURRent:AC?

Function : Query total output AC Irms.

Example : FETCH:CURRent:AC?

MEASure:CURRent:AC?

Parameter returns : <NR2>

FETCH:CURRent:AMPLitude:MAXimum?

MEASure:CURRent:AMPLitude:MAXimum?

Function : Query total output peak current

Example : FETCH:CURRent:AMPLitude:MAXimum?

MEASure:CURRent:AMPLitude:MAXimum?

Parameter returns : <NR2>

FETCH:CURRent:CREStfactor?

MEASure:CURRent:CREStfactor?

Function : Query output current crest factor

Example : FETCH:CURRent:CREStfactor?

MEASure:CURRent:CREStfactor?

Parameter returns : <NR2>

FETCH:CURRent:INRush?

MEASure:CURRent:INRush?

Function : Query output inrush current

Example : FETCh:CURRent:INRush?
MEASure:CURRent:INRush?

Parameter returns : <NR2>

FETCh:FREQuency?

MEASure:FREQuency?

Function : Query average output frequency

Example : FETCh:FREQuency?
MEASure:FREQuency?

Parameter returns : <NR2>

FETCh:POWer:AC[:REAL]?

MEASure:POWer:AC[:REAL]?

Function : Query output real power

Example : FETCh:POWer:AC?
MEASure:POWer:AC:REAL?

Parameter returns : <NR2>

FETCh:POWer:AC:APParent?

MEASure:POWer:AC:APParent?

Function : Query output apparent power

Example : FETCh:POWer:AC:APParent?
MEASure:POWer:AC:APParent?

Parameter returns : <NR2>

FETCh:POWer:AC:PFACtor?

MEASure:POWer:AC:PFACtor?

Function : Query output power factor

Example : FETCh:POWer:AC:PFACtor?
MEASure:POWer:AC:PFACtor?

Parameter returns : <NR2>

FETCH:POWer:AC:REACtive?

MEASure:POWer:AC:REACtive?

Function : Query output reactive power

Example : FETCH:POWer:AC:REACtive?

MEASure:POWer:AC:REACtive?

Parameter returns : <NR2>

FETCH:VOLTag:e:ACDC?

MEASure:VOLTag:e:ACDC?

Function : Query average output voltage Vrms

Example : FETCH:VOLTag:e:AC?

MEASure:VOLTag:e:AC?

Parameter returns : <NR2>

4.3.2.2 OUTPUT Subsystem

Following are tree system for OUTPUT command:

OUTPut Set or query output status

: MODE Set or query output mode

Following are functions, examples and returned parameter of OUTPUT command:

OUTPut

Function : Turn on or turn off output

Example : OUTPut? Query output status

OUTPut ON turn on output

Parameter: OFF | ON

Parameter returns : OFF | ON

OUTPut:MODE

Function : Set output mode. "FIXED" mode output fixed voltage waveform

Example : OUTPut:MODE? Query output mode
 OUTPut:MODE LIST set output as LIST mode
 Parameter: FIXED | LIST | PULSE | STEP
 Parameter returns : FIXED | LIST | PULSE | STEP

OUTPut:COUPling

Function : Set output coupling mode
 Example : OUTPut:COUPling? Query output coupling mode
 OUTPut:COUPling AC set output coupling mode as AC
 Parameter: AC | DC | ACDC
 Parameter returns : AC | DC | ACDC

4.3.2.3 SOURCE Subsystem

Following are tree system for SOURCE command:

[SOURce:]

CURRent

:LIMit Set(query) total output rms current limitation
 :DELay Set(query) delay time to trigger over current protection
 :INRush
 :STARt Set(query) time to start to measure inrush current
 :INTerval Set(query) inrush current measurement time

FREQuency Set(query) frequency of output voltage

FUNCTion

:SHAPE Set(query) waveform buffer A or B
 :A Set(query) waveform of buffer A
 :CF Set(query) CF of cut sin waveform for buffer A
 :B Set(query) waveform of buffer B
 :CF Set(query) CF of cut sin waveform for buffer B

VOLTage

:AC Set(query) AC voltage setting

:LIMit:AC	Set(query) limitation of AC Vrms
:DC	Set(query) DC voltage setting
:LIMit:DC:PLUS	Set(query) positive DC voltage limitation
:LIMit:DC:MINUs	Set(query) negative DC voltage limitation
:RANGe	Set(query) AC voltage output range
:SENSe	Set(query) remote voltage sense function
CONFigure	
:INHibit	Set(query) external TTL status
PHASe	
:ON	Set(query) output voltage start phase angle set at main manual
:OFF	Set(query) output voltage stop phase angle set at main manual
LIST	
:COUNT	Set(query) how many times to execute effective sequences.
:DWELI	Set(query) execution time of each sequence
:SHAPE	Set(query) voltage waveform buffer of each sequence
:VOLTage	
:AC	
:START	Set(query) start AC voltage of each sequence
:END	Set(query) stop AC voltage of each sequence
:DC	
:START	Set(query) start DC voltage of each sequence
:END	Set(query) stop DC voltage of each sequence
:FREQuency	
:START	Set(query) start frequency of each sequence
:END	Set(query) stop frequency of each sequence
:DEGRee	Set(query) start phase angle of each sequence
PULSE	
:VOLTage	
:AC	Set(query) PULSE AC voltage
:DC	Set(query) PULSE DC voltage
:FREQuency	Set(query) PULSE frequency
:SPHase	Set(query) start phase angle of AC voltage of PULSE
:COUNT	Set(query) how many times to execute PULSE

:DCYCl	Set(query) output duration of PULSE waveform, cannot be longer than total period
:PERiod	Set(query) total period
STEP	
:VOLTage	
:AC	Set(query) start AC voltage of the first step in STEP mode
:DC	Set(query) start DC voltage of the first step in STEP mode
:DVOLTage	
:AC	Set (query) AC voltage change of each step at STEP mode
:DC	Set (query) DC voltage change of each step at STEP mode
:FREQuency	Set (query) start frequency of the first step in STEP mode
:DFREquency	Set (query) frequency change of each step at STEP mode
:SPHase	Set (query) start phase angle at STEP mode
:DWELI	Set (query) output duration of each step at STEP mode
:COUNT	Set (query) how many steps to be executed in STEP mode
SYNThesis	Set (query) which synthesis waveform to use.
:AMPLitude	Set (query) harmonic voltage amplitude of each order
:PHASe	Set (query) harmonic phase angle of each order
TRIG	Set Trig events of PULSE, LIST, STEP mode

Following are functions, examples and returned parameters for SOURCE command:

[SOURce:]CURRent:LIMit

Function : Set (query) total output rms current limit

Example : [SOURce:]CURRent:LIMit?

[SOURce:]CURRent:LIMit 25.5

Parameter : <NR2>, effective range: 0.00 ~ 16.00 (150V range),
0.00 ~ 8.00 (300V range)

Parameter returns : <NR2>

[SOURce:]CURRent:DELay

Function : Set (query) delay time to trigger software over current protection

Example : [SOURce:]CURRent:DELay?

[SOURce:]CURRent:DELay 1.2

Parameter: <NR2>, Effective range: 0.0 ~ 5.0 (unit: sec)

Parameter returns : <NR2>

[SOURce:]CURRent:INRush:STARt

Function : Set (query) time to start measure inrush current

Example : [SOURce:]CURRent:INRush:STARt?

[SOURce:]CURRent:INRush:STARt 200.3

Parameter: <NR2>, effective range: 0.0 ~ 999.9 (unit: msec)

Parameter returns : <NR2>

[SOURce:]CURRent:INRush:INTerval

Function : Set (query) inrush current measurement time

Example : [SOURce:]CURRent:INRush:INTerval?

[SOURce:]CURRent:INRush:INTerval 400.8

Parameter: <NR2>, effective range: 0.0 ~ 999.9 (unit: msec)

Parameter returns : <NR2>

[SOURce:]FREQuency

Function : Set (query) frequency of output waveform

Example : [SOURce:]FREQuency?

[SOURce:]FREQuency 50.8

Parameter: <NR2>, effective range: 30.0 ~ 1000.0 (unit: Hz)

Parameter returns : <NR2>

[SOURce:]FUNCTion:SHAPE

Function : Set (query) waveform buffer. AC source provides two waveform buffers, user has to select A or B waveform buffer.

Example : [SOURce:]FUNCTion:SHAPE?

[SOURce:]FUNCTion:SHAPE A

Parameter: A | B

Parameter returns : A | B

[SOURce:]FUNCTION:SHAPE:A

Function : Set (query) waveform of waveform buffer A.

Example : [SOURce:]FUNCTION:SHAPE:A?

[SOURce:]FUNCTION:SHAPE:A CSIN

Parameter: SINE | CSIN | DST<00~31>

Parameter returns : SINE | CSIN | DST<00~31>

[SOURce:]FUNCTION:SHAPE:A:CF

Function : Set (query) CF of the cut sin waveform in waveform buffer A. It is effective only when CSIN is selected for waveform buffer A.

Example : [SOURce:]FUNCTION:SHAPE:A:CF?

[SOURce:]FUNCTION:SHAPE:A:CF 1.234

Parameter: <NR2>, effective range: 1.200 ~ 1.414

Parameter returns : <NR2>

[SOURce:]FUNCTION:SHAPE:B

Function : Set (query) waveform of waveform buffer B.

Example : [SOURce:]FUNCTION:SHAPE:B?

[SOURce:]FUNCTION:SHAPE:B CSIN

Parameter: SINE | CSIN | DST<00~31>

Parameter returns : SINE | CSIN | DST<00~31>

[SOURce:]FUNCTION:SHAPE:B:CF

Function : Set (query) CF of the cut sin waveform in waveform buffer B. It is effective only when CSIN is selected for waveform buffer B.

Example : [SOURce:]FUNCTION:SHAPE:B:CF?

[SOURce:]FUNCTION:SHAPE:B:CF 1.234

Parameter: <NR2>, effective range: 1.200 ~ 1.414

Parameter returns : <NR2>

[SOURce:]VOLTage:AC

Function : Set (query) output AC voltage

Example : [SOURce:]VOLTage :AC?

[SOURce:]VOLTage :AC 200.5

Parameter: <NR2>, effective range: 0.0 ~ 150.0 (low voltage range), 0.0 ~ 300.0 (high voltage range)

Parameter returns : <NR2>

[SOURce:]VOLTage:LIMit:AC

Function : Set (query) voltage limit.

Example : [SOURce:]VOLTage:LIMit:AC?

[SOURce:]VOLTage:LIMit:AC 300.0

Parameter: <NR2>, effective range: 0.0 ~ 150.0 (low voltage range), 0.0 ~ 300.0 (high voltage range)

Parameter returns : <NR2>

[SOURce:]VOLTage:DC

Function : Set DC output voltage

Example : [SOURce:]VOLTage :DC?

[SOURce:]VOLTage :DC 100.5

Parameter: <NR2>, effective range: ± 212.1 (low voltage range),
 ± 424.2 (high voltage range)

Parameter returns : <NR2>

[SOURce:]VOLTage:LIMit:DC:PLUS

Function : Set Vdc maximum positive value

Example : [SOURce:]VOLTage:LIMit:DC:PLUS?

[SOURce:]VOLTage:LIMit:DC :PLUS 100.0

Parameter: <NR2>, effective range: 0.0~424.2 (high voltage range),
0.0~212.1 (low voltage range)

Parameter returns : <NR2>

[SOURce:]VOLTage:LIMit:DC:MINUs

Function : Set Vdc minimum negative value

Example : [SOURce:]VOLTage:LIMit:DC:MINUs?

[SOURce:]VOLTage:LIMit:DC :MINUs -100.0

Parameter: <NR2>, effective range: 0.0~-424.2 (high voltage range),
0.0~-212.1 (low voltage range)

Parameter returns : <NR2>

[SOURce:]VOLTage:RANGe

Function : Set (query) output voltage range

LOW		HIGH	
Voltage range(V)	Current range(A)	Voltage range(V)	Current range(A)
0.0 ~ 150.0	0.0 ~ 16.0	0.0 ~ 300.0	0.0 ~ 8.0

Example : [SOURce:]VOLTage:RANGe?

[SOURce:]VOLTage:RANGe HIGH

Parameter: LOW | HIGH

Parameter returns : LOW | HIGH

[SOURce:]VOLTage:SENSe

Function : Set (query) remote sense function. REMOTE is in enable, VOUT is in disable.

Example : [SOURce:]VOLTage:SENSe?

[SOURce:]VOLTage:SENSe REMOTE

Parameter: VOUT | REMOTE

Parameter returns : VOUT | REMOTE

[SOURce:]CONFigure:INHibit?

Function : Set (query) remote TTL inhibition operation. Refer paragraph 3.6.4 for details.

Example : [SOURce:]CONFigure:INHibit?

[SOURce:]CONFigure:INHibit LIVE

Parameter: OFF | LIVE | TRIG | EXCITE

Parameter returns : OFF | LIVE | TRIG | EXCITE

[SOURce:]PHASe:ON

Function : Set (query) waveform start phase angle set at main manual.

Example : [SOURce:]PHASe:ON?

[SOURce:]PHASe:ON 200.5

Parameter : <NR2>, effective range: 0.0 ~ 359.9

Parameter returns : <NR2>

[SOURce:]PHASe:OFF

Function : Set (query) waveform stop phase angle set at main manual.

Example : [SOURce:]PHASe:OFF?

[SOURce:]PHASe:OFF 250.5

Parameter : <NR2>, effective range: 0 ~ 360.0, 360.0 representing turn off immediately

Parameter returns : <NR2>

[SOURce:]LIST:COUNT

Function : Set (query) how many times to execute effective sequences in LIST mode.

Example : [SOURce:]LIST:COUNT?

[SOURce:]LIST:COUNT 100

parameter : <NR1>, effective range: 0 ~ 10000

Parameter returns : <NR1>

[SOURce:]LIST:DWELI

Function : Set (query) execution time of 10 individual sequences in LIST mode.

Example : [SOURce:]LIST:DWELI?

[SOURce:]LIST:DWELI 60000 1 23 95

parameter : <NR2>, ..., <NR2> effective range: 0 ~ 60000 (unit: msec)

Parameter returns : <NR2>, ..., <NR2>

[SOURce:]LIST:SHAPE

Function : Set (query) waveform buffer used for 10 individual sequences in LIST mode.

Example : [SOURce:]LIST:SHAPE?
[SOURce:]LIST:SHAPE A B A A A

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

Parameter returns : A|B, ..., A|B

[SOURce:]LIST:VOLTage:AC: START

Function : Set (query) start voltage of 10 individual sequences in LIST mode.

Example : [SOURce:]LIST:VOLTage:AC: START?
[SOURce:]LIST:VOLTage:AC: START 110 22.5 55.6

Parameter : <NR2>, ..., <NR2> effective range: 0.0 ~ 150.0 (low voltage range),
0.0 ~300.0 (high voltage range)

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

[SOURce:]LIST:VOLTage:AC: END

Function : Set (query) stop voltage of 10 individual sequences in LIST mode.

Example : [SOURce:]LIST:VOLTage:AC: END?
[SOURce:]LIST:VOLTage:AC: END 1.2 50 66.6

Parameter : <NR2>, ..., <NR2> effective range: 0.0 ~ 150.0 (low voltage range),
0.0 ~300.0 (high voltage range)

Parameter returns : <NR2>, ..., <NR2>

[SOURce:]LIST:VOLTage:DC: START

Function : Set DC start voltage for each sequence at LIST mode.

Example : [SOURce:]LIST:VOLTage:DC: START?
[SOURce:]LIST:VOLTage:DC: START -110 22.5 -55.6

Parameter : <NR2>, ..., <NR2> effective range: ± 212.1 (low voltage range),
 ± 424.2 (high voltage range)

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

[SOURce:]LIST:VOLTage:DC: END

Function : Set DC end voltage for each sequence at LIST mode.

Example : [SOURce:]LIST:VOLTage:AC: END?

[SOURce:]LIST:VOLTage:AC: END 1.2 -50 66.6

Parameter: <NR2>, ..., <NR2> effective range: ± 212.1 (low voltage range),
 ± 424.2 (high voltage range)

Parameter returns : <NR2>, ..., <NR2>

[SOURce:]LIST:FREQuency: START

Function : Set (query) start frequency of 10 individual sequences in LIST mode.

Example : [SOURce:]LIST:FREQuency: START?

[SOURce:]LIST:FREQuency: START 50.8 80.5 2.2

Parameter: <NR2>, ..., <NR2> effective Range: 30.0 ~ 1000.0 (unit: Hz)

Parameter returns : <NR2>, ..., <NR2>

[SOURce:]LIST:FREQuency: END

Function : Set (query) start frequency of 10 individual sequences in LIST mode.

Example : [SOURce:]LIST:FREQuency: END?

[SOURce:]LIST:FREQuency: END 20.5 30.8 77.8

Parameter: <NR2>, ..., <NR2> effective range: 30.0 ~ 1000.0 (unit: Hz)

Parameter returns : <NR2>, ..., <NR2>

[SOURce:]LIST:DEGRee

Function : Set (query) start phase angle of 10 individual sequences in LIST mode.

Example : [SOURce:]LIST:DEGRee?

[SOURce:]LIST:DEGRee 30.6 96.5 88.0 71

Parameter: <NR2>, ..., <NR2> effective range: 0.0 ~ 359.9

Parameter returns : <NR2>, ..., <NR2>

[SOURce:]PULSE:VOLTage:AC

Function : Set (query) AC voltage of PULSE waveform.

Example : [SOURce:]PULSE:VOLTage:AC?

[SOURce:]PULSE:VOLTage:AC 250.1

Parameter: <NR2> effective range: 0.0 ~ 150.0 (low voltage range),

0.0 ~ 300.0 (high voltage range)

Parameter returns : <NR2>

[SOURce:]PULSe:VOLTage:DC

Function : Set (query) DC voltage of PULSE waveform.

Example : [SOURce:]PULSE:VOLTage:DC?

[SOURce:]PULSE:VOLTage:DC -200.1

Parameter: <NR2> effective range: ± 212.1 (low voltage range),
 ± 424.2 (high voltage range)

Parameter returns : <NR2>

[SOURce:]PULSe:FREQuency

Function : Set (query) frequency of PULSE waveform.

Example : [SOURce:]PULSE:FREQuency?

[SOURce:]PULSE:FREQuency 50.0

Parameter: <NR2> effective range: 30.0 ~ 1000.0 (unit: Hz)

Parameter returns : <NR2>

[SOURce:]PULSe:SPHase

Function : Set (query) start phase angle of PULSE waveform.

Example : [SOURce:]PULSE:SPHase?

[SOURce:]PULSE:SPHase 60.0

Parameter: <NR2> effective range: 0.0~ 359.9

Parameter returns : <NR2>

[SOURce:]PULSe:COUNt

Function : Set (query) how many times to execute PULSE voltage.

Example : [SOURce:]PULSE:COUNt?

[SOURce:]PULSE:COUNt 500

Parameter: <NR1> effective range: 0 ~ 10000

Parameter returns : <NR1>

[SOURce:]PULSe:DCYClc

Function : Set (query) execution time of PULSE waveform, it must be no longer than total period in PULSE mode.

Example : [SOURce:]PULSE:DCYCLE?
[SOURce:]PULSE:DCYCLE 300

Parameter : <NR1>, effective range: 1 ~ 59999 (unit: msec)

Parameter returns : <NR1>

[SOURce:]PULSE:PERiod

Function : Set (query) total period of PULSE mode

Example : [SOURce:]PULSE:PERiod?
[SOURce:]PULSE:PERiod 600

Parameter : <NR1> effective range: 2 ~ 60000 (unit: msec)

Parameter returns : <NR1>

[SOURce:]STEP:VOLTage:AC

Function : Set (query) start voltage for STEP mode.

Example : [SOURce:]STEP:VOLTage:AC?
[SOURce:]STEP:VOLTage:AC 150.5

Parameter : <NR2> effective range: 0.0 ~ 150.0 (low voltage range),
0.0 ~ 300.0 (high voltage range)

Parameter returns : <NR2>

[SOURce:]STEP:VOLTage:DC

Function : Set (query) start voltage for STEP mode.

Example : [SOURce:]STEP:VOLTage:DC?
[SOURce:]STEP:VOLTage:DC -150.5

Parameter : <NR2> effective range: ± 212.1 (low voltage range),
 ± 424.2 (high voltage range)

Parameter returns : <NR2>

[SOURce:]STEP:DVOLTage:AC

Function : Set (query) voltage change of each step in STEP mode.

Example : [SOURce:]STEP:DVOLTage:AC?

[SOURce:]STEP:DVOLTage:AC 20.5

Parameter: <NR2> effective range: -150.0 ~ 150.0(unit: Volt)

Parameter returns : <NR2>

[SOURce:]STEP:DVOLTage:DC

Function : Set (query) voltage change of each step in STEP mode.

Example : [SOURce:]STEP:DVOLTage:DC?

[SOURce:]STEP:DVOLTage:DC -20.5

Parameter: <NR2> effective range: ± 212.1 (low voltage range),
 ± 424.2 (high voltage range)

Parameter returns : <NR2>

[SOURce:]STEP:FREQuency

Function : Set (query) start frequency for STEP mode

Example : [SOURce:]STEP:FREQuency?

[SOURce:]STEP:FREQuency 80.5

Parameter: <NR2> effective range: 30.0 ~ 1000.0 (unit : Hz)

Parameter returns : <NR2>

[SOURce:]STEP:DFREquency

Function : Set (query) frequency change of each step in STEP mode.

Example : [SOURce:]STEP:DFREquency?

[SOURce:]STEP:DFREquency -10.5

Parameter: <NR2> effective range: -150.0 ~ 150.0(unit: Hz)

Parameter returns : <NR2>

[SOURce:]STEP:SPHase

Function : Set(query) start phase angle at STEP mode.

Example : [SOURce:]STEP:SPHase?

[SOURce:]STEP:SPHase 80.5

Parameter: <NR2> effective range: 0.0 ~ 359.9

Parameter returns : <NR2>

[SOURce:]STEP:DWELI

Function : Set (query) output duration time of each step in STEP mode.

Example : [SOURce:]STEP:DWELI?

[SOURce:]STEP:DWELI 1000.5

Parameter: <NR2> effective range: 1 ~ 60000.0 (unit: msec)

Parameter returns : <NR2>

[SOURce:]STEP:COUNT

Function : Set (query) how many steps to execute in STEP mode.

Example : [SOURce:]STEP:COUNT?

[SOURce:]STEP:COUNT 500

Parameter: <NR1> effective range: 0 ~ 10000

Parameter returns : <NR1>

[SOURce:]SYNThesis

Function : Set (query) which synthesis waveform to use. There are DIS30 and DIS31 available.

Example : [SOURce:]SYNThesis ?

[SOURce:]SYNThesis DST30

Parameter: DST30 | DST31

[SOURce:]SYNThesis:AMPLitude

Function : Set (query) voltage amplitude for each order of harmonic waveforms.
Maximum order is 39.

Example : [SOURce:]SYNThesis:AMPLitude?

[SOURce:]SYNThesis:AMPLitude 20.55 33.10 2.55

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

Effective range :

Order	Gain limit
N=2~N=20	33.33%
N=21~N=30	30.00%
N=31~N=39	15.00%

Parameter returns : <NR2>, ..., <NR2>

[SOURce:]SYNThesis:PHASe

Function : Set (query) phase for each order of harmonic waveforms.

Example : [SOURce:]SYNThesis:PHASe?

[SOURce:]SYNThesis:PHASe 100.5 20.8 60.5 77.8

Parameter: <NR2>, ..., <NR2> effective range: 0.0 ~ 359.9

Parameter returns : <NR2>, ..., <NR2>

4.3.2.4 Other Commands

Followings are other commands instruction, example and returned parameter:

TRIG

Function : Set (query) trigger status. Disabled when OUTPut:MODE = FIXE

Example : TRIG?

TRIG ON

Parameter: OFF | ON

Parameter returns : OFF | RUNNING

VERion:DSP?

Function : Query firmware version.

Example : VERion:DSP?

Parameter returns : S00E02

VERion:LCM?

Function : Query firmware version used for LCM.

Example : VERion:LCM?

Parameter returns : S00E02

VERion:UI?

Function : Query firmware version of UI.

Example : VERion:UI?

Parameter returns : S00E02

4.3.3 Summary of Commands

- Common commands

*ESE <n>	Set flag mask of standard event status register
*ESE?	Query flag mask of standard event status register
*ESR?	Query value stored in standard event register, 1 represents event occurs.
*IDN?	Query series number of AC source
*RCL <n>	Recall previously stored system setting
*SAV <n>	Save system setting into a specific group in memory.
*SRE <n>	Set flag mask for service events register
*SRE?	Query flag mask for service events register
*STB?	Query value stored in service event register, 1 represents event occurs.
*CLS	Leave REMOTE mode, back to front panel control

- Instrument command

FETCh | MEASure

:CURRent

:AC?	Query the total AC rms current
:AMPLitude:MAXimum?	Query the total peak current
:CREStfactor?	Query the total current crest factor
:INRush?	Query the total inrush current
:FREQuency?	Query average frequency
:POWEr	
:AC	
[:REAL]?	Query total real power
:APParent?	Query total apparent power
:REACtive?	Query total reactive power
:PFACtor?	Query average power factor

:VOLTage

:ACDC? Query average AC Vrms

OUTPut Set or query output status

:MODE Set or query output mode

[SOURce:]**CURRent**

:LIMit	Set(query) total output rms current limitation
:DELay	Set(query) delay time to trigger over current protection
:INRush	
:START	Set(query) time to start to measure inrush current
:INTerval	Set(query) inrush current measurement time

FREQuency

Set(query) frequency of output voltage

FUNCtion

:SHAPE	Set(query) waveform buffer A or B
:A	Set(query) waveform of buffer A
:CF	Set(query) CF of cut sin waveform for buffer A
:B	Set(query) waveform of buffer B
:CF	Set(query) CF of cut sin waveform for buffer B

VOLTage

:AC	Set(query) AC voltage setting
:LIMit:AC	Set(query) limitation of AC Vrms
:DC	Set(query) DC voltage setting
:LIMit:DC:PLUS	Set(query) positive limitation of DC voltage
:LIMit:DC:MINUs	Set(query) negative limitation of DC voltage
:RANGE	Set(query) AC voltage output range
:SENSe	Set(query) remote voltage sense

CONFigure

:INHibit	Set(query) external TTL status
----------	--------------------------------

PHASe

:ON	Set(query) output voltage start phase angle set at main manual
:OFF	Set(query) output voltage stop phase angle set at main manual

LIST

:POINTs?	Query how many sequences set in LIST mode
:COUNT	Set(query) how many times to execute effective

	sequences in LIST mode.
:DWELI	Set (query) execution time of 10 individual sequences in LIST mode.
:SHAPE	Set (query) waveform buffer used for 10 individual sequences in LIST mode.
:VOLTage	
:AC	
:START	Set (query) start voltage of 10 individual sequences in LIST mode.
:END	Set (query) stop voltage of 10 individual sequences in LIST mode.
:DC	
:START	Set (query) DC start voltage of 10 individual sequences in LIST mode.
:END	Set (query) DC stop voltage of 10 individual sequences in LIST mode.
:FREQUENCY	
:START	Set (query) start frequency of 10 individual sequences in LIST mode.
:END	Set (query) stop frequency of 10 individual sequences in LIST mode.
:DEGREE	Set (query) start phase angle of 10 individual sequences in LIST mode.
PULSE	
:VOLTage	
:AC	Set(query) AC voltage of PULSE mode
:DC	Set(query) DC voltage of PULSE mode
:FREQUENCY	Set(query) frequency of PULSE waveform
:SPHase	Set(query) start phase angle of PULSE waveform
:COUNT	Set(query) how many times to execute PULSE waveform
:DCYCLE	Set (query) execution time of PULSE waveform, it must be no longer than total period in PULSE mode
:PERIOD	Set(query) total period of PULSE mode
STEP	
:VOLTage	

:AC	Set(query) start AC voltage of the first step in STEP mode
:DC	Set(query) start DC voltage of the first step in STEP mode
:DVOLtage	
:AC	Set (query) AC voltage change of each step in STEP mode
:DC	Set (query) DC voltage change of each step in STEP mode
:FREQuency	Set(query) start frequency of the first step in STEP mode.
:DFRequency	Set(query) frequency change of each step in STEP mode.
:SPHase	Set(query) start phase angle at STEP mode.
:DWELI	Set(query) output duration of each step in STEP mode.
:COUNT	Set(query) how many steps to execute in STEP mode.
SYNThesis	Set(query) which synthesis waveform to use. There are DST30、DST31available
:AMPLitude	Set (query) voltage amplitude for each order of harmonic waveforms.
:PHASe	Set (query) phase for each order of harmonic waveforms.
TRIG	Set (query) trigger status. Disabled when OUTPut:MODE = FIXE
NPHase	Set(query) output mode:
VERion:DSP	Query firmware version.
VERion:LCM	Query firmware version used for LCM.
VERion:UI	Query firmware version of UI.
INSTrument:NSElect	Set specific output phase to response queries
SYSTem:ERRor	Query error status

Appendix A TTL Pin Assignment

● 9-PIN D-SUB female connector

Pin number	1	2	3	4	5	6	7	8	9
signal	GND	Remote Inhibit	GND	AC-ON	---	GND	GND	FAULT-OUT	---

Remote Inhibit:

- OFF : Disable remote inhibit output function.
- LIVE : AC source will turn off (turn on) output when TTL signal is low (high).
- TRIG : When TTL signal changed from HIGH → LOW, and keep at low status longer than 1ms, output will be turned off and stop detecting TTL signal. User must press  to resume output and enable TTL detection.
- EXCITE : In operation of LIST, PULSE or STEP modes, when at triggering page (please refer paragraph 3.8.2~3.8.4), AC source output will be triggered on/off by positive edge TTL trigger signal (LOW → HIGH). Pulse signal must stay at high level at least 1ms.

AC-ON:

HIGH (LOW) level when AC source output status is ON/OFF.

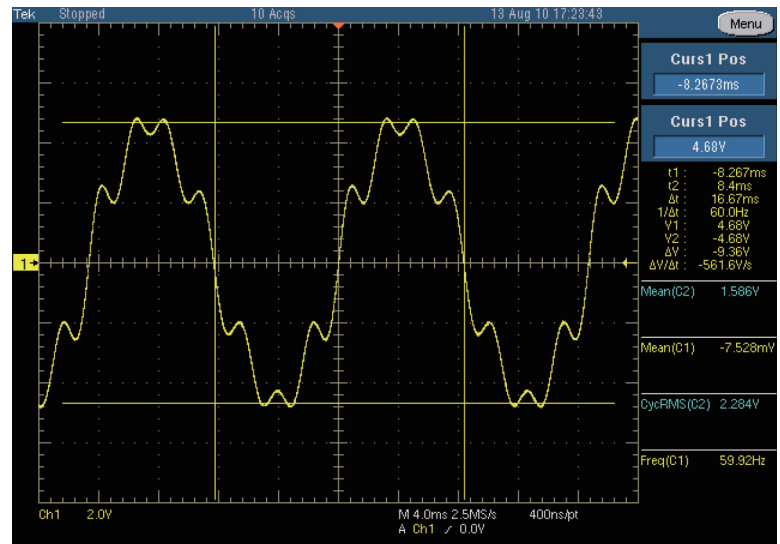
FAULT-OUT:

LOW (HIGH) when AC source is in normal (protection status due to error)

Appendix B Built In Waveforms

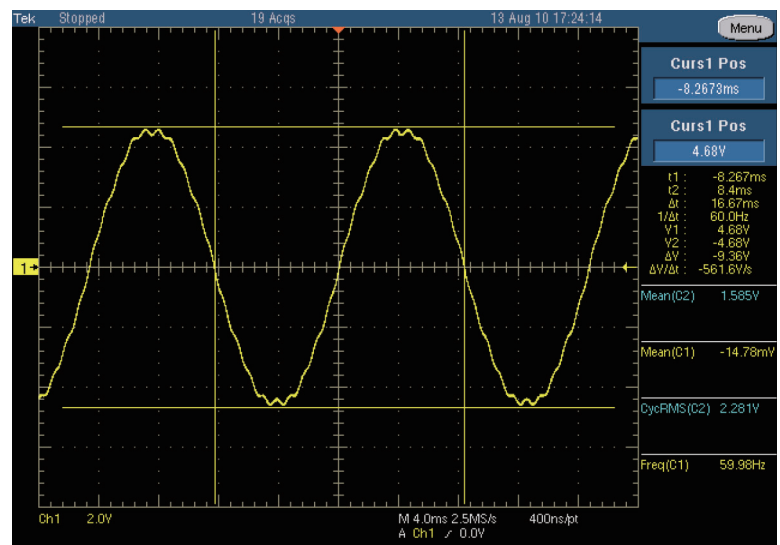
DST 0

Order	Gain	Phase
2	2.07	0.0
5	9.80	0.0
7	15.80	0.0
8	2.16	0.0



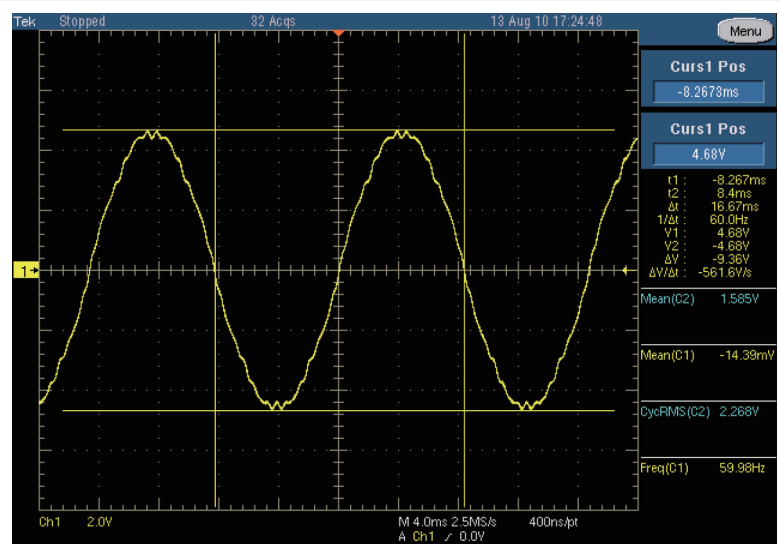
DST 1

Order	Gain	Phase
3	1.50	0.0
7	1.50	0.0
19	2.00	0.0



DST 2

Order	Gain	Phase
3	2.00	0.0
5	1.40	0.0
7	2.00	0.0
23	1.40	0.0
31	1.00	0.0

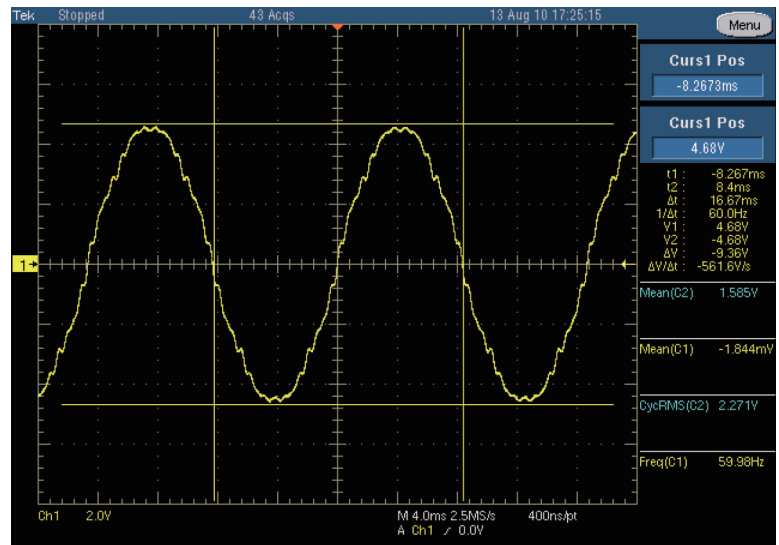


A1500

AC Power Source

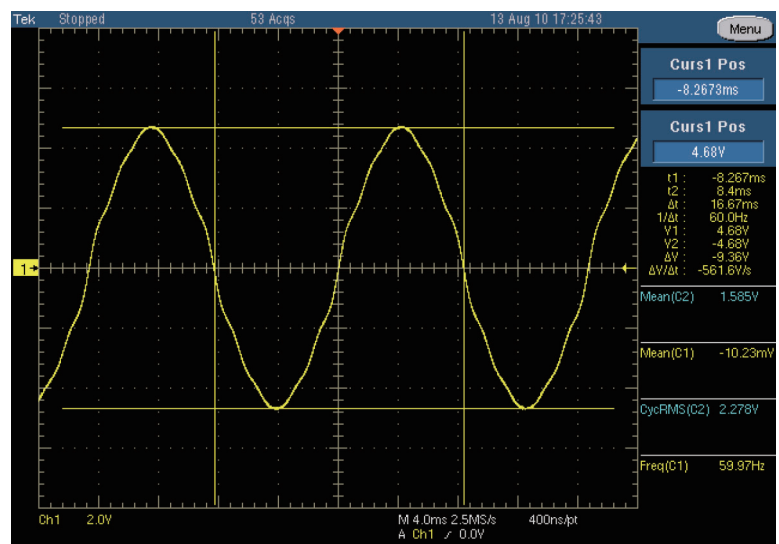
DST 3

Order	Gain	Phase
3	2.50	0.0
5	1.90	0.0
7	2.50	0.0
23	1.90	0.0
25	1.10	0.0
31	1.50	0.0
33	1.10	0.0



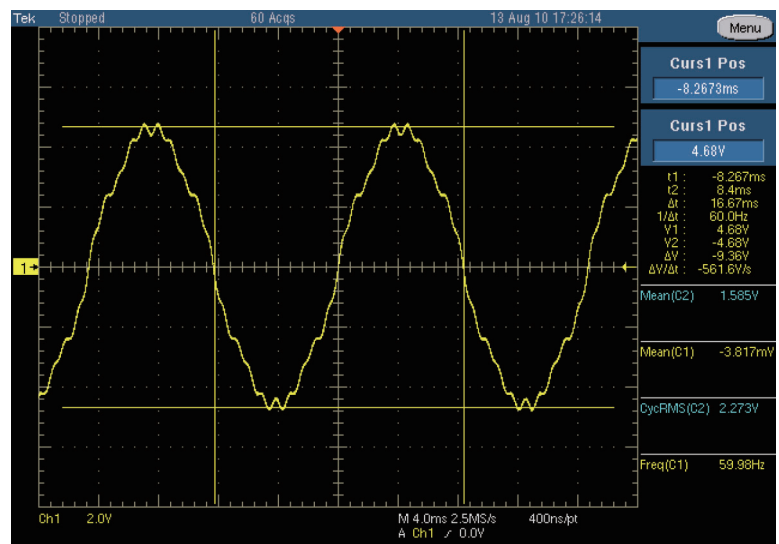
DST 4

Order	Gain	Phase
3	1.10	0.0
5	2.80	0.0
7	1.40	0.0
9	2.30	0.0
11	1.50	0.0



DST 5

Order	Gain	Phase
3	1.65	0.0
5	4.20	0.0
7	3.45	0.0
15	1.05	0.0
19	3.00	0.0

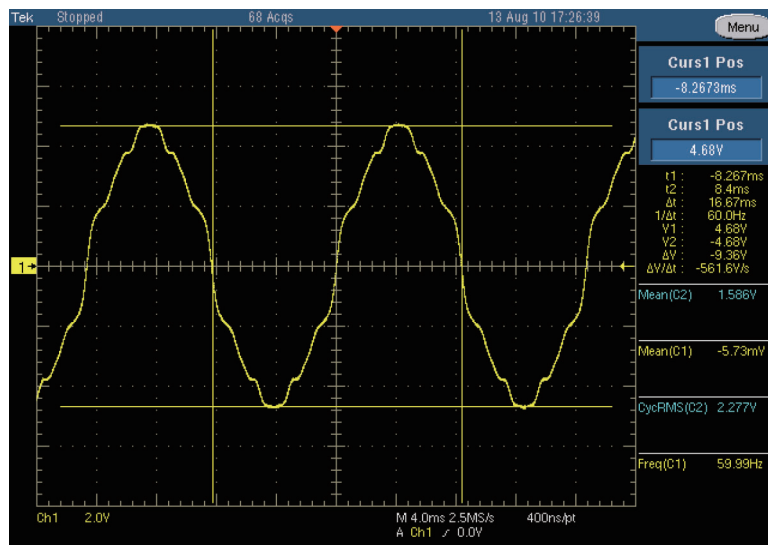


A1500

AC Power Source

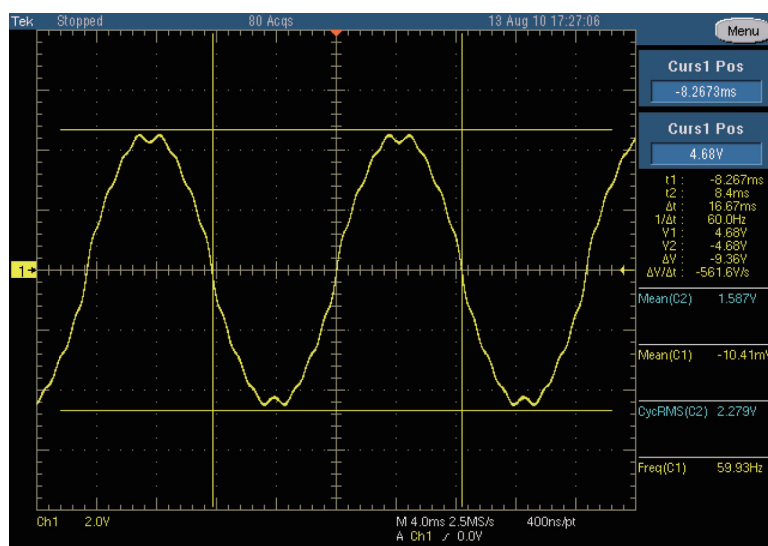
DST 6

Order	Gain	Phase
3	2.20	0.0
5	5.60	0.0
7	2.80	0.0
9	4.60	0.0
11	3.00	0.0
15	1.40	0.0
21	1.00	0.0



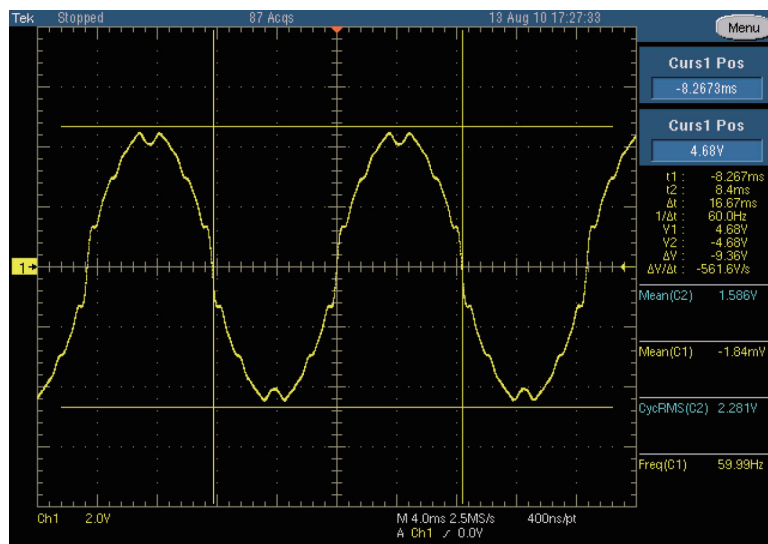
DST 7

Order	Gain	Phase
3	4.90	0.0
5	1.60	0.0
7	2.70	0.0
11	1.40	0.0
15	2.00	0.0
17	1.10	0.0



DST 8

Order	Gain	Phase
3	7.35	0.0
5	2.40	0.0
7	4.05	0.0
11	2.10	0.0
13	1.05	0.0
15	3.00	0.0
17	1.65	0.0
19	1.05	0.0
21	1.05	0.0
23	1.20	0.0
25	1.05	0.0

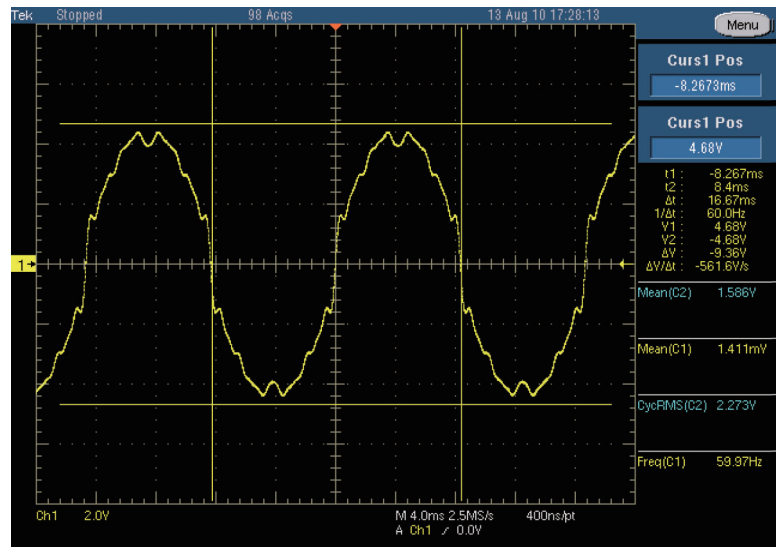


A1500

AC Power Source

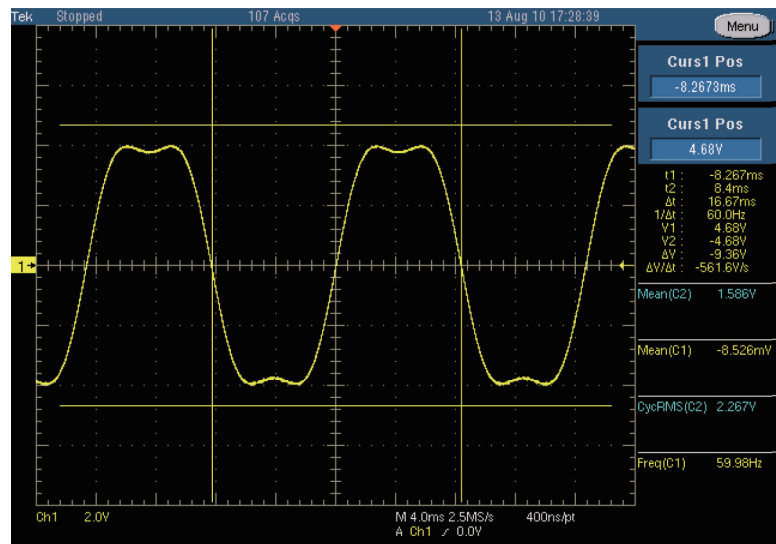
DST 9

Order	Gain	Phase
3	9.80	0.0
5	3.20	0.0
7	5.40	0.0
9	1.20	0.0
11	2.80	0.0
13	1.40	0.0
15	4.00	0.0
17	2.20	0.0
19	1.40	0.0
21	1.40	0.0
23	1.60	0.0
25	1.40	0.0



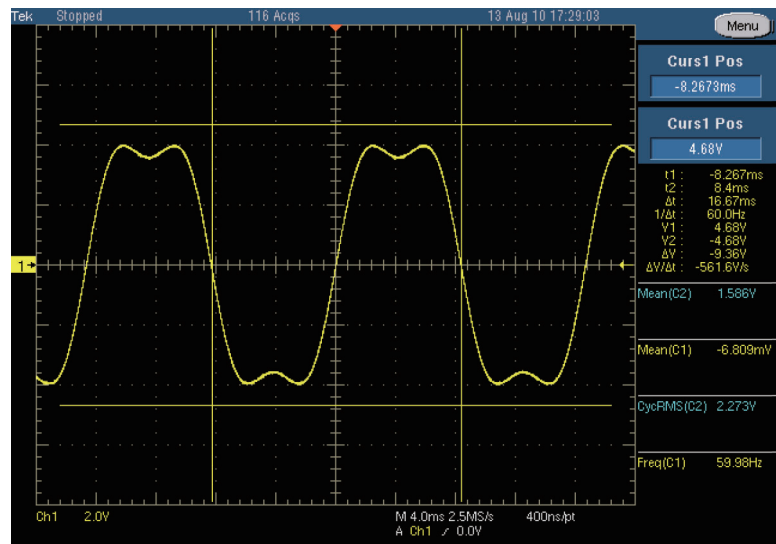
DST 10

Order	Gain	Phase
3	17.75	0.0



DST 11

Order	Gain	Phase
3	21.25	0.0

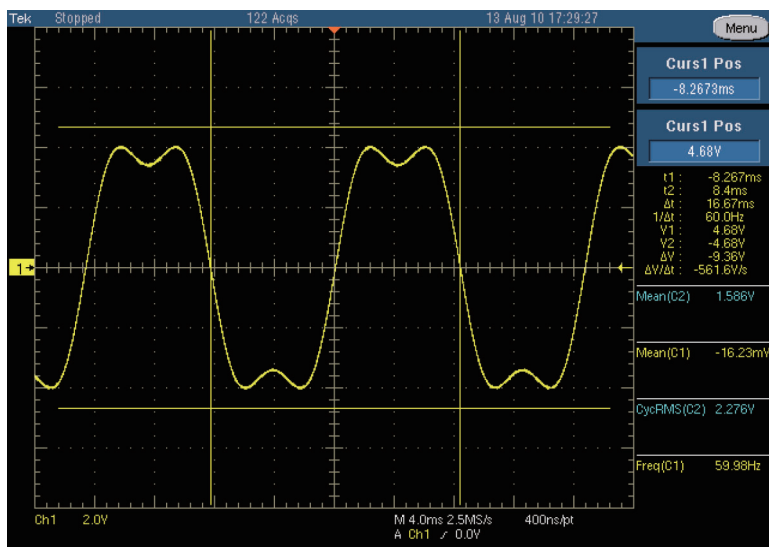


A1500

AC Power Source

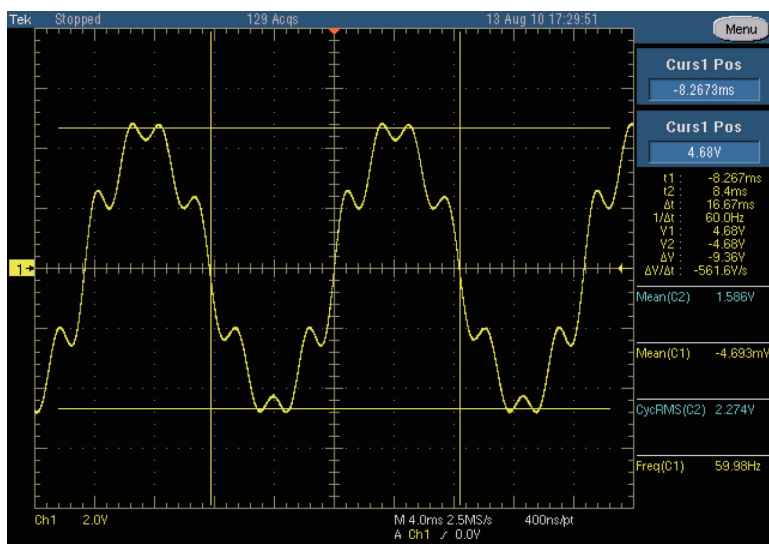
DST 12

Order	Gain	Phase
3	24.50	0.0



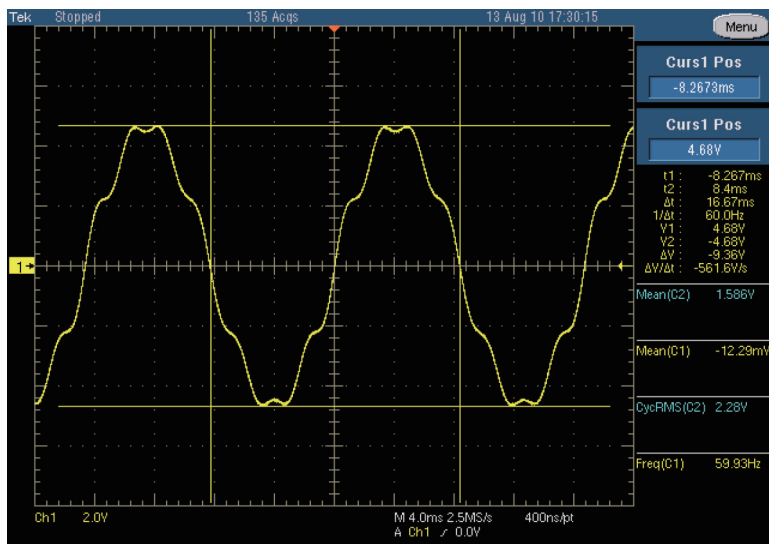
DST 13

Order	Gain	Phase
2	2.30	0.0
5	9.80	0.0
7	15.80	0.0
8	2.50	0.0



DST 14

Order	Gain	Phase
2	1.15	0.0
5	4.90	0.0
7	7.90	0.0
8	1.25	0.0

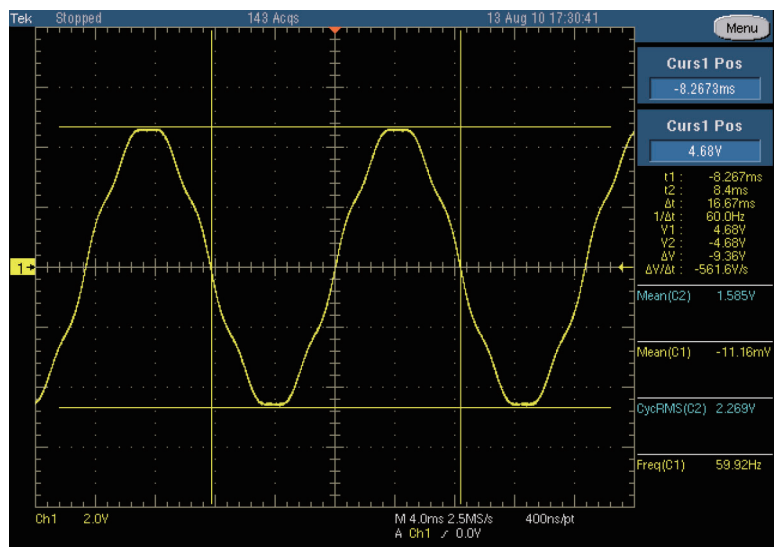


A1500

AC Power Source

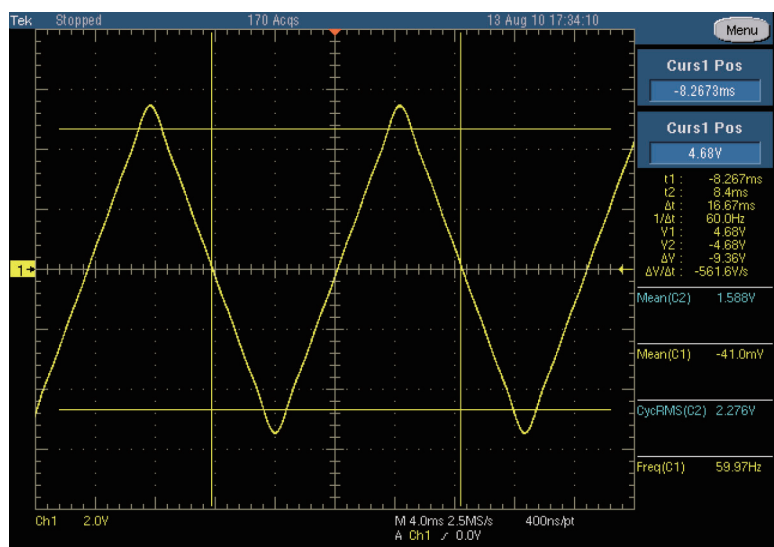
DST 15

Order	Gain	Phase
5	2.45	0.0
7	3.95	0.0



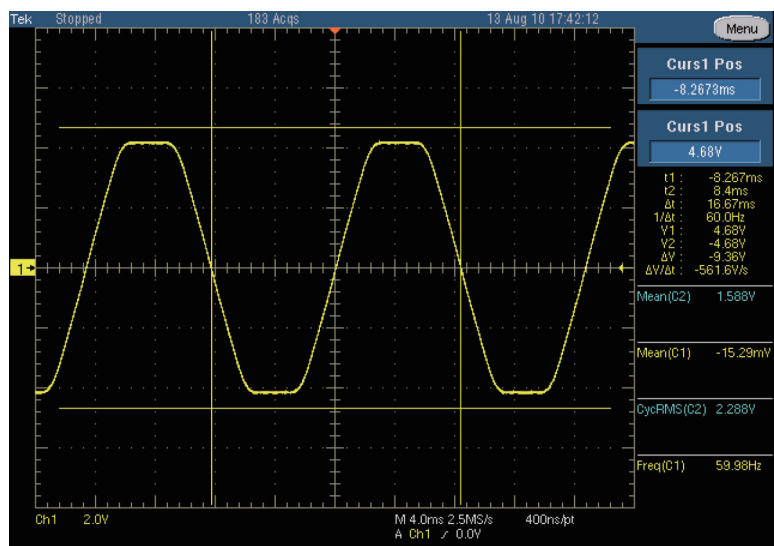
DST 16

Order	Gain	Phase
3	11.00	180.0
5	4.05	0.0
7	2.00	180.0
9	1.30	0.0



DST 17

Order	Gain	Phase
3	7.17	0.0
5	3.42	180.0
9	0.80	0.0

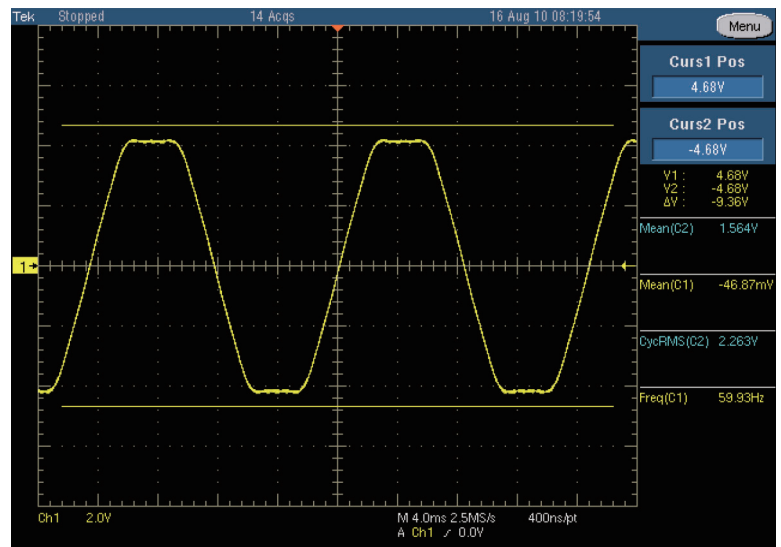


A1500

AC Power Source

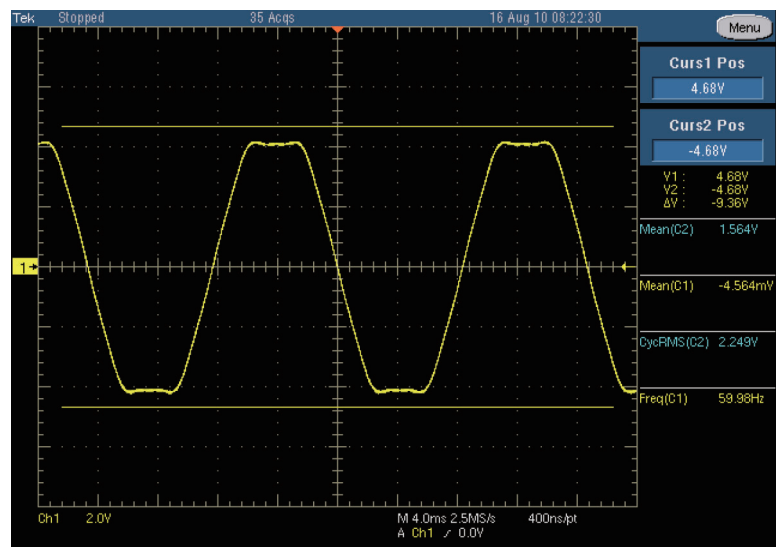
DST 18

Order	Gain	Phase
3	8.11	0.0
5	3.48	180.0
9	1.00	0.0



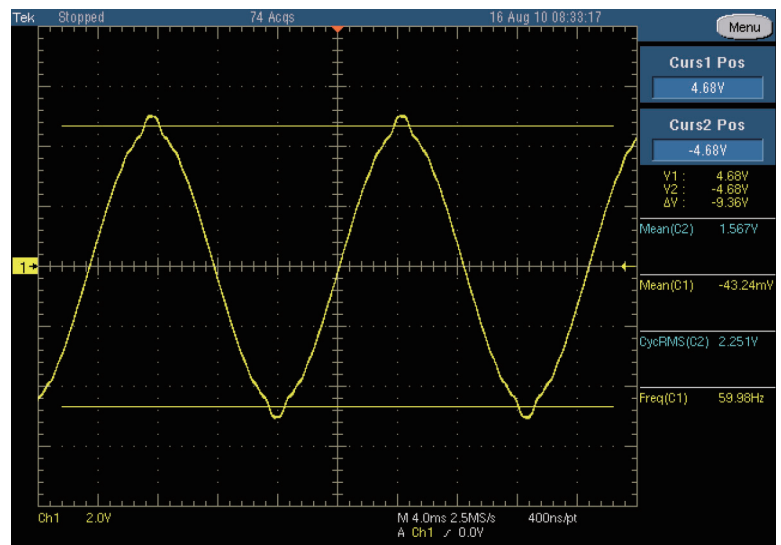
DST 19

Order	Gain	Phase
3	9.38	0.0
5	3.44	180.0
9	1.15	0.0



DST 20

Order	Gain	Phase
3	2.06	180.0
5	1.77	0.0
7	1.62	180.0
9	1.23	0.0
11	0.91	180.0
13	0.54	0.0
23	0.51	0.0
25	0.53	180.0

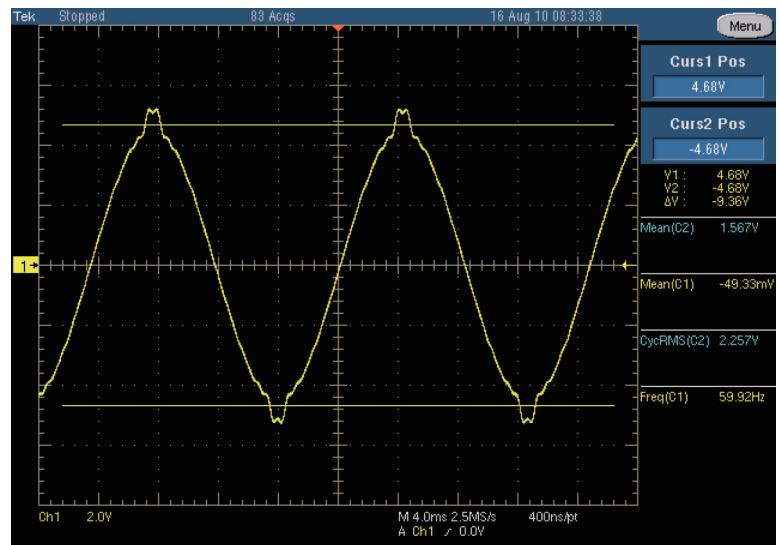


A1500

AC Power Source

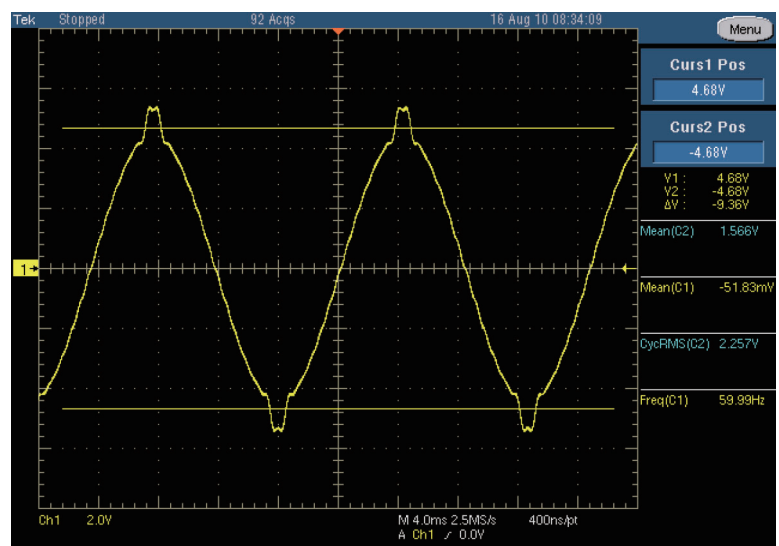
DST 21

Order	Gain	Phase
3	3.08	180.0
5	2.72	0.0
7	2.43	180.0
9	1.97	0.0
11	1.41	180.0
13	0.86	0.0
21	0.62	180.0
23	0.73	0.0
25	0.77	180.0
27	0.69	0.0
29	0.56	180.0



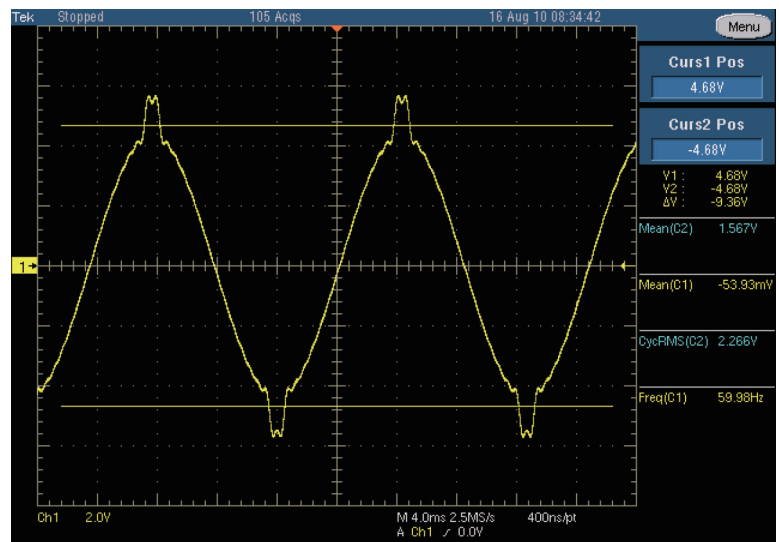
DST 22

Order	Gain	Phase
2	0.13	180.0
3	4.28	180.0
5	3.77	0.0
7	3.27	180.0
9	2.57	0.0
11	1.93	180.0
13	1.22	0.0
15	0.55	180.0
19	0.46	0.0
21	0.83	180.0
23	0.97	0.0
25	1.04	180.0
29	0.75	180.0



DST 23

Order	Gain	Phase
3	5.74	180.0
5	5.11	0.0
7	4.44	180.0
9	3.52	0.0
11	2.63	180.0
13	1.65	0.0
15	0.80	180.0
19	0.61	0.0
21	1.07	180.0
23	1.28	0.0
25	1.35	180.0
27	1.22	0.0
29	0.98	180.0

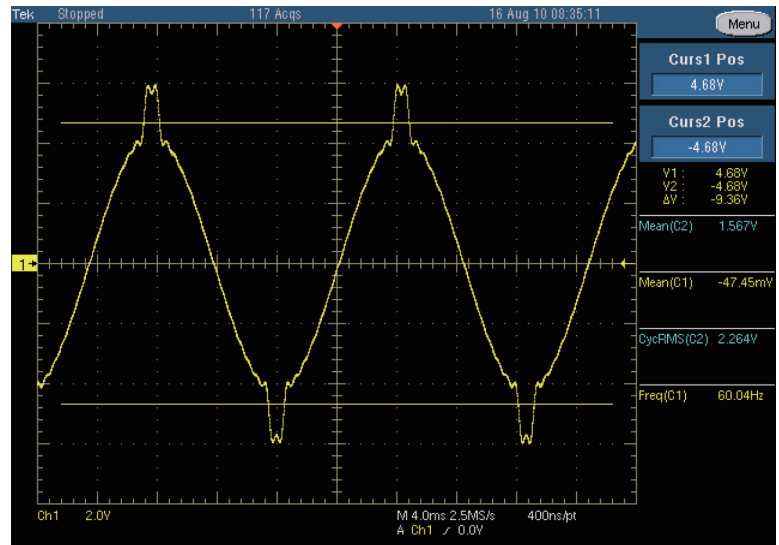


A1500

AC Power Source

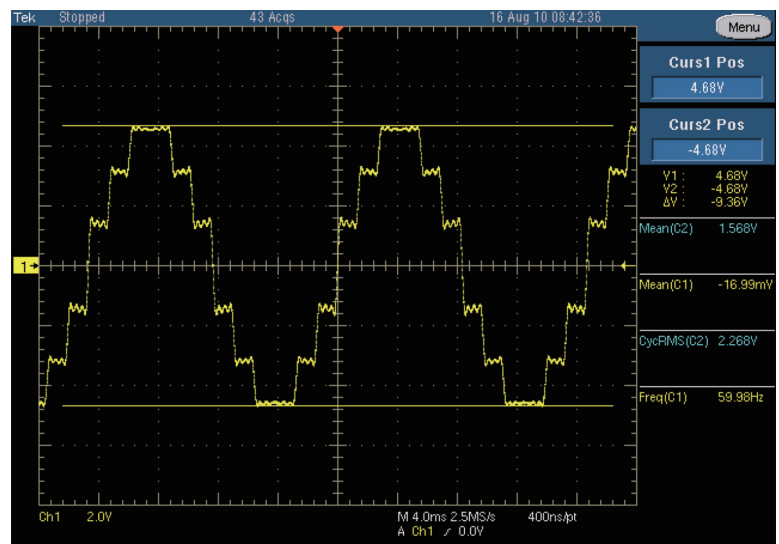
DST 24

Order	Gain	Phase
3	7.35	180.0
5	6.60	0.0
7	5.74	180.0
9	4.57	0.0
11	3.41	180.0
13	2.16	0.0
15	1.04	180.0
19	0.74	0.0
21	1.35	180.0
23	1.64	0.0
25	1.73	180.0
27	1.56	0.0
29	1.24	180.0



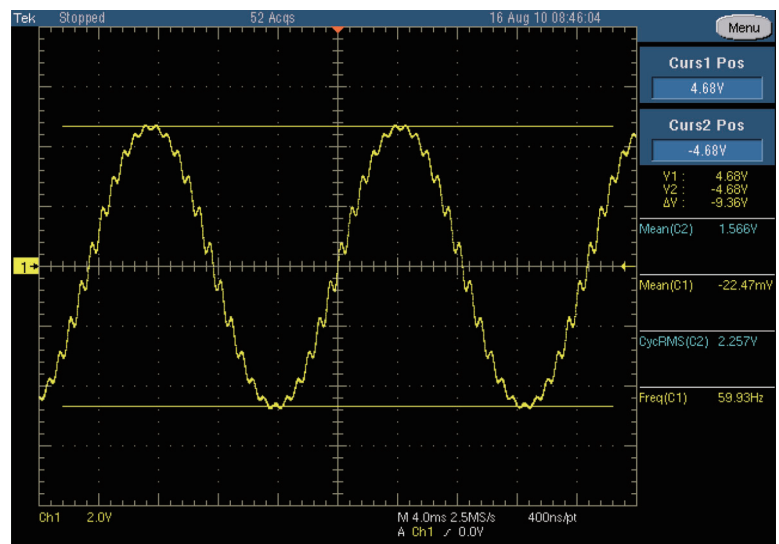
DST 25

Order	Gain	Phase
5	3.41	0.0
7	2.55	0.0
11	9.22	0.0
13	7.68	0.0
17	0.90	0.0
19	0.90	0.0
23	3.88	0.0
25	3.56	0.0
31	0.50	0.0
35	2.34	0.0
37	2.21	0.0



DST 26

Order	Gain	Phase
21	1.38	0.0
23	5.39	0.0
25	2.29	0.0

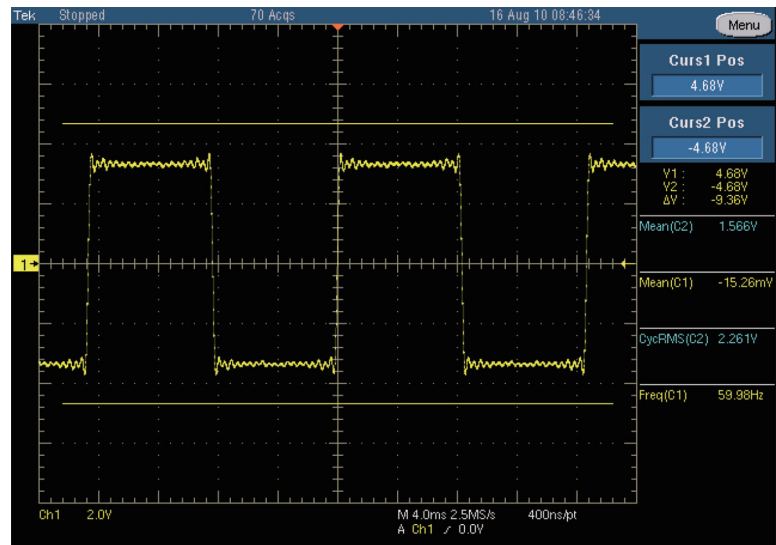


A1500

AC Power Source

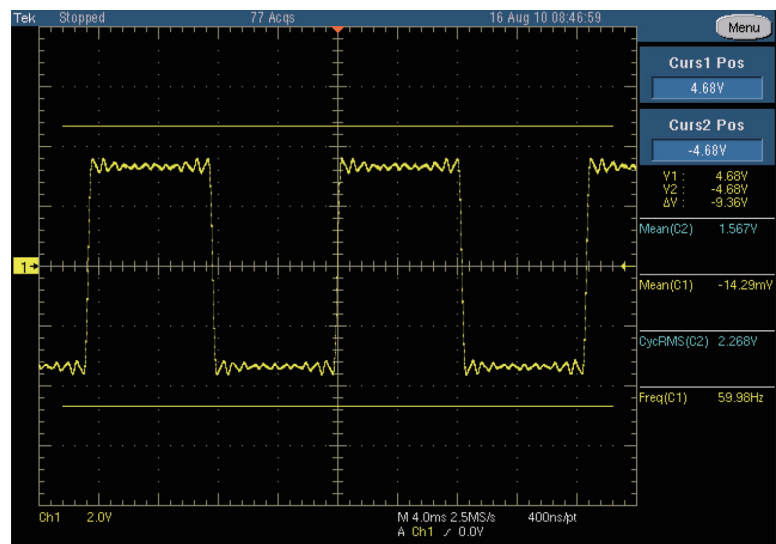
DST 27

Order	Gain	Phase
3	33.33	0.0
5	20.00	0.0
7	13.80	0.0
9	10.80	0.0
11	8.50	0.0
13	7.20	0.0
15	6.00	0.0
17	5.00	0.0
19	5.00	0.0
21	4.50	0.0
23	4.00	0.0
25	3.50	0.0
27	2.95	0.0
29	2.50	0.0
31	2.00	0.0
33	2.00	0.0
35	2.00	0.0
37	2.00	0.0
39	2.00	0.0



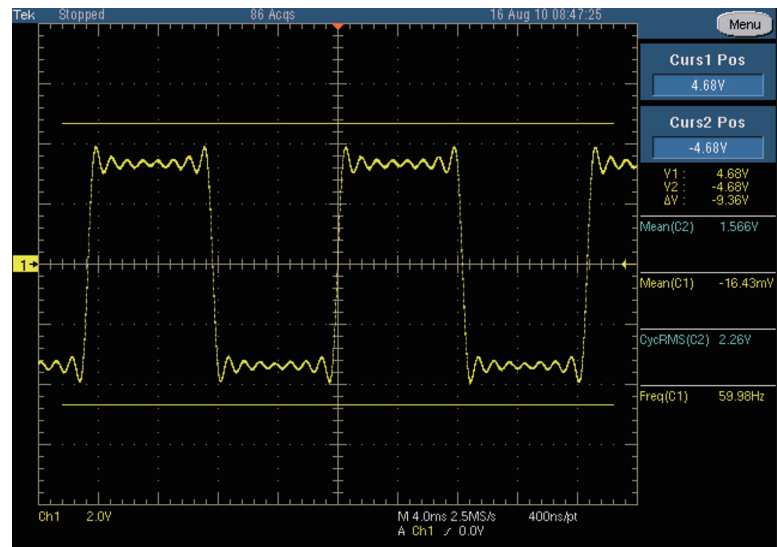
DST 28

Order	Gain	Phase
3	33.33	0.0
5	20.00	0.0
7	13.80	0.0
9	10.80	0.0
11	8.50	0.0
13	7.20	0.0
15	6.00	0.0
17	5.00	0.0
19	5.00	0.0
21	4.50	0.0
23	4.00	0.0
25	1.00	0.0
27	1.00	0.0
29	1.00	0.0
31	1.00	0.0
33	1.00	0.0
35	1.00	0.0
37	1.00	0.0
39	1.00	0.0



DST 29

Order	Gain	Phase
3	33.33	0.0
5	20.00	0.0
7	13.80	0.0
9	10.80	0.0
11	8.50	0.0
13	7.20	0.0
15	5.50	0.0





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