Programmable AC Power Supply

ASD-1150

USER MANUAL

ISO-9001 CERTIFIED MANUFACTURER

GW INSTEK

Good Will Instrument Co., Ltd.
No. 7-1, Jhongsing Rd., Tucheng Dist., New Taipei City 236, Taiwan.

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SAFETY INSTRUCTIONS

This chapter contains important safety instructions that you must follow during operation and storage. Read the following before any operation to insure your safety and to keep the instrument in the best possible condition.

Safety Symbols

These safety symbols may appear in this manual or on the instrument.

 WARNING	Warning: Identifies conditions or practices that could result in injury or loss of life.
 CAUTION	Caution: Identifies conditions or practices that could result in damage to the ASD-1150 or to other properties.
	DANGER High Voltage
	Attention Refer to the Manual
	Protective Conductor Terminal
	Earth (ground) Terminal
	Do not dispose electronic equipment as unsorted municipal waste. Please use a separate collection facility or contact the supplier from which this instrument was purchased.

Safety Guidelines

General Guideline ⚠ CAUTION	• Do not place any heavy object on the ASD-1150. • Avoid severe impact or rough handling that leads to damaging the ASD-1150. • Do not discharge static electricity to the ASD-1150. • Use only mating connectors, not bare wires, for the terminals. • Do not block the cooling fan opening. • Do not disassemble the ASD-1150 unless you are qualified. (Measurement categories) EN61010-1:2010 and EN61010-2-030 specifies the measurement categories and their requirements as follows. The ASD-1150 falls under category II. • Measurement category IV is for measurement performed at the source of low-voltage installation. • Measurement category III is for measurement performed in the building installation. • Measurement category II is for measurement performed on the circuits directly connected to the low voltage installation. • 0 is for measurements performed on circuits not directly connected to Mains.
Power Supply ⚠ WARNING	• AC Input voltage range: 85Vac~265Vac • Frequency: 47Hz to 63Hz • To avoid electrical shock connect the protective grounding conductor of the AC power cord to an earth ground.
Cleaning the ASD-1150	• Disconnect the power cord before cleaning. • Use a soft cloth dampened in a solution of mild detergent and water. Do not spray any liquid. • Do not use chemicals containing harsh material such as benzene, toluene, xylene, and acetone.

Operation Environment	• Location: Indoor, no direct sunlight, dust free, almost non-conductive pollution (Note below) • Relative Humidity: 20%~ 85% (no condensation) • Altitude: < 2000m • Temperature: 0°C to 50°C (Pollution Degree) EN61010-1:2010 and EN61010-2-030 specifies the pollution degrees and their requirements as follows. The ASD-1150 falls under degree 2. Pollution refers to "addition of foreign matter, solid, liquid, or gaseous (ionized gases), that may produce a reduction of dielectric strength or surface resistivity". • Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence. • Pollution degree 2: Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected. • Pollution degree 3: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation which is expected. In such conditions, equipment is normally protected against exposure to direct sunlight, precipitation, and full wind pressure, but neither temperature nor humidity is controlled.
Storage environment	• Location: Indoor • Temperature: -25°C to 70°C • Relative Humidity: ≤90%(no condensation)
Disposal 	Do not dispose this instrument as unsorted municipal waste. Please use a separate collection facility or contact the supplier from which this instrument was purchased. Please make sure discarded electrical waste is properly recycled to reduce environmental impact.

Power cord for the United Kingdom

When using the power supply in the United Kingdom, make sure the power cord meets the following safety instructions.

NOTE: This lead/appliance must only be wired by competent persons

⚠ WARNING: THIS APPLIANCE MUST BE EARTHED

IMPORTANT: The wires in this lead are coloured in accordance with the following code:

Green/ Yellow:	Earth
Blue:	Neutral
Brown:	Live (Phase)

As the colours of the wires in main leads may not correspond with the coloured marking identified in your plug/appliance, proceed as follows:

The wire which is coloured Green & Yellow must be connected to the Earth terminal marked with either the letter E, the earth symbol ⏚ or coloured Green/Green & Yellow.

The wire which is coloured Blue must be connected to the terminal which is marked with the letter N or coloured Blue or Black.

The wire which is coloured Brown must be connected to the terminal marked with the letter L or P or coloured Brown or Red.

If in doubt, consult the instructions provided with the equipment or contact the supplier.

This cable/appliance should be protected by a suitably rated and approved HBC mains fuse: refer to the rating information on the equipment and/or user instructions for details. As a guide, a cable of 0.75mm^2 should be protected by a 3A or 5A fuse. Larger conductors would normally require 13A types, depending on the connection method used.

Any exposed wiring from a cable, plug or connection that is engaged in a live socket is extremely hazardous. If a cable or plug is deemed hazardous, turn off the mains power and remove the cable, any fuses and fuse assemblies. All hazardous wiring must be immediately destroyed and replaced in accordance to the above standard.

GETTING STARTED

This manual describes the specifications, installation and operation instructions of GW Instek ASD-1150 programmable AC/DC Power Source. In this manual the term, AC/DC Source, stands for GW Instek ASD-1150 programmable AC/DC Source.

The AC source is a high efficiency programmable AC power source, which provides 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.

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Main Features

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.
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.

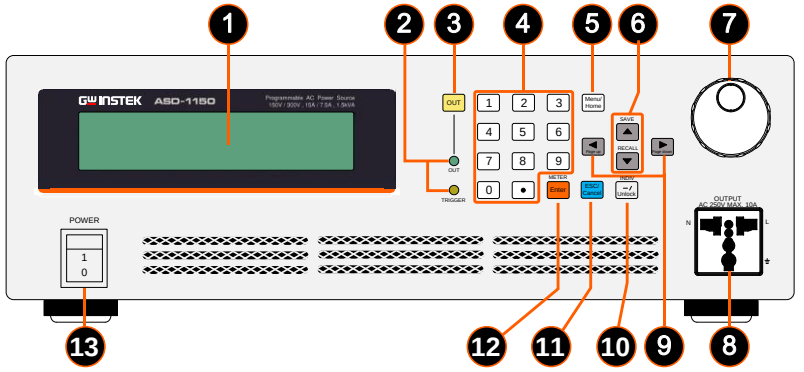
Accessories

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

Standard Accessories	Part number	Description	Qty.
	364440990X	Input/ Output cable (1.5m)	1
Optional Accessories	Part number	Description	
	308006150X	GPIB cable(1.0m)	1
	308006140X	GPIB cable(2.0m)	1
	308006130X	GPIB cable(4.0m)	1
	308006120X	GPIB cable(8.0m)	1
	308006110X	GPIB cable(0.5m)	1

Appearance

Front Panel



Item	Symbol	Description
1		LCD panel, display setting and measurement results.
2	Trigger	LED indicator: • OUT(green)indicates AC source normal output • TRIGGER(yellow)indicates LIST, PULSE, STEP output
3	OUT	Press this key to control ON/OFF state of AC output voltage
4	1 2 3 4 5 6 7 8 9 0 •	Digital numerical keypad group: Used for parameter setting

5 Menu/ Home

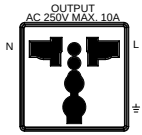
At main menu page, press this key to enter "advanced parameter setting" page; at other pages, press this key to return to main menu.

6 SAVE ▲ RECALL ▼

Short press: Cursor move upward or downward.
Long press: long press at "main menu" "advanced parameters setting menu" pages, will enter "save, restore" page.

7 

Knob: Used for parameters setting or selection

8 

Worldwide Output connector:
100V~240V/10A max
When AC output is used, the lower contact is PE; the upper right is L; the upper left is N.

When DC output is used, the lower contact is PE; the upper right is positive; the upper left is negative.

9 ◀ Page up ▶ Page down

At main menu page, press this key to enter "advanced parameter setting "page; at other pages, press this key to return to main menu

10 — / Unlock

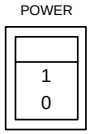
Back to local control in remote mode, negative sign in panel control

11 ESC/ Cancel

Escape current page (ESC)or cancel current settings (Cancel)

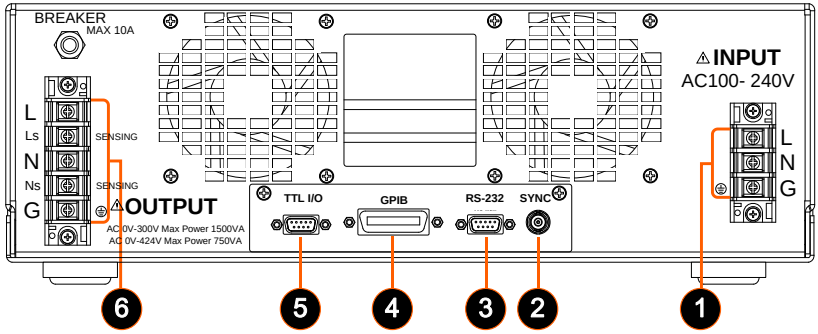
12 Enter

Confirm parameter setting

13 

Main switch: Turn on/off the AC power input

Rear Panel



Item	Name	Description
1	Power Line input Connector	Input connector. Please refer to page 18 for connection
2	SYNC port	When output change according new parameter setting, SYNC will output Synchronized signal.
3	RS-232 port	D type 9 pin female connector, for remote control.
4	GPIB connector	IEEE 488 standard connector, for remote control.
5	TTL I/O port	The 9-pin, D-type female connector conveys TTL signals (AC_ ON, FAULT_OUT and REMOTE_INHIBIT)
6	Output connector	Output connector. Outputs power to the loading device.

INSTALLATION

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 GW Instek.

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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.

Requirements of Input Power

Rating

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.

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.

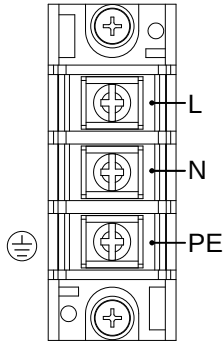
To put a 30A breaker (ABT A) (30A breaker (ABT B)) at AC input side.

See figures below and do the following steps one by one:

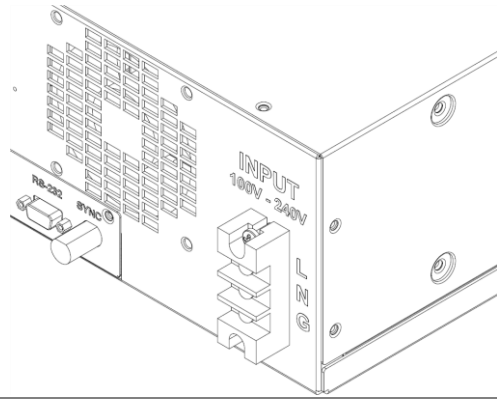
Steps

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.
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.

220Vac single-phase input connection



100-240Vac input terminal



⚠ 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 professional personnel in accordance with local electrical codes.

Output Connection

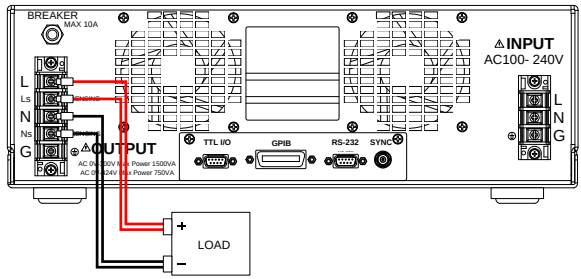
The output terminal block is located at the rear of the AC source. Load connecting to the "N" and "L" is done at the output terminals. To meet the safety requirements, the safety cover must be fastened. The wires to the load must be sufficiently large gauges, so they will not overheat while carrying the output current. 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.

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 below. 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.

Output connection



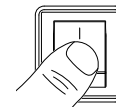
Power on

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.

Steps

1. Connect the AC voltage.
2. Turn on the power switch on the front panel.



3. The AC source will do a series of self-tests when every time it is turned on. The LCD on the front panel will light up and display as below under normal condition.

```
GWINSTEK ASD-1150
Waiting for Self Test!
Firmware Version (DSP:SXXEXX UI:SXXEXX)
Waiting for Hardware Initial
```

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

Main setting page

```
 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	Error messages will show on the LCD panel if error occurs during turn on process. Please refer to page 115 for error code. 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.

LOCAL OERATION

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 next chapter. This chapter describes the operation in local mode through the keypad on the front panel for data entry and test. If remote control cable isn't connected, the AC source is configured for local operation after AC switch is on.

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Operation through Keypad and Knob

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

```
GWINSTEK ASD-1150
Waiting for Self Test!
Firmware Version (DSP:SXXEXX UI:SXXEXX)
Waiting for Hardware Initial
```

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

ASD-1150 provides a user-friendly programming interface by using the keypad on the front panel.

Main menu setting page

```
 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
```

- Press ▲ Up arrow or ▼ Down arrow key to move cursor between voltage and frequency to make selection.
- Use numerical and decimal point key or knob to set number.
- Press Enter key to confirm setting.
- Press to Menu/ Home key to enter advanced parameter setting menu as below.

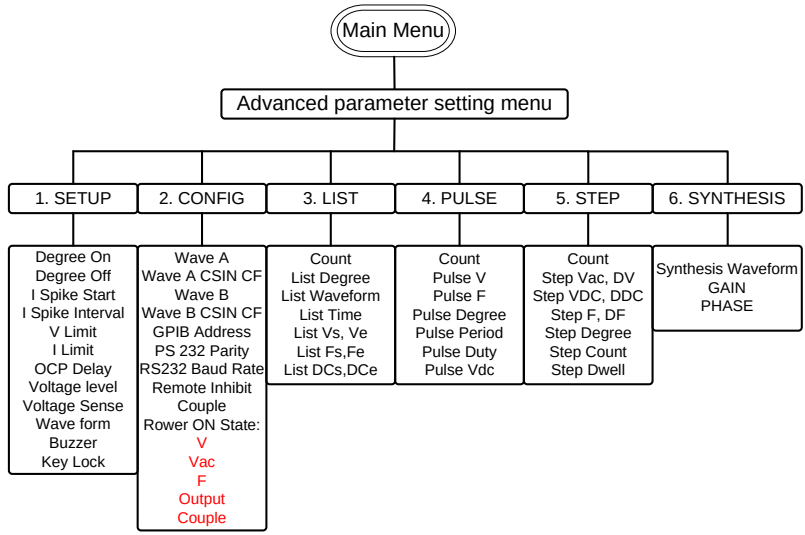
Advanced parameter setting menu

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

- User can make more detail setting from advanced parameter setting menu, or press Menu/ Home key again to return to main menu.
- On advanced parameter setting menu, user can press numerical key to do a selection.

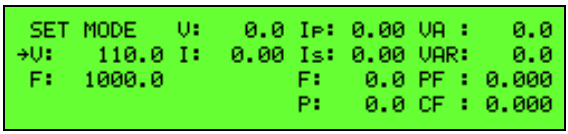
- Press Enter key to enter individual parameter setting menu.
- After entering individual setting menu, press ▲ Up arrow or ▼ Down arrow key to move cursor to item which wants to modify.
- Use numerical key or knob to do the modification.
- Press Enter key to confirm setting.
- If there is "Press ◄►to switch page" shown at the bottom of menu, use ◄ Page up or ► Page down arrow key to switch menu page.
- When setting is finished, press ESC/ Cancel key to return back to advanced parameter setting menu, or press Menu/ Home key back to main menu.

Menu Tree


Main Menu
Advanced parameter setting menu
1. SETUP
2. CONFIG
3. LIST
4. PULSE
5. STEP
6. SYNTHESIS
Degree On
Degree Off
I Spike Start
I Spike Interval
V Limit
I Limit
OCP Delay
Voltage level
Voltage Sense
Wave form
Buzzer
Key Lock
Wave A
Wave A CSIN CF
Wave B
Wave B CSIN CF
GPIB Address
PS 232 Parity
RS232 Baud Rate
Remote Inhibit
Couple
Rower ON State:
V
Vac
F
Output
Couple
Count
List Degree
List Waveform
List Time
List Vs, Ve
List Fs,Fe
List DCs,DCe
Count
Pulse V
Pulse F
Pulse Degree
Pulse Period
Pulse Duty
Pulse Vdc
Count
Step Vac, DV
Step VDC, DDC
Step F, DF
Step Degree
Step Count
Step Dwell
Synthesis Waveform
GAIN
PHASE

Main Menu Setting

After the AC source is on and initialization is finished, screen will show the main menu. 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.



Displayed mode at upper left corner	• SET MODE: Setting mode, no voltage output from AC source. • OUT MODE: Output mode. When user press OUT key 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, Hz is used as measurement value 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

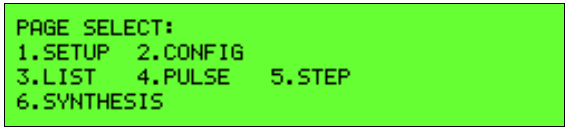
Ipeak/Irms.

- VA: Apparent power, calculation equation is Vrms x Irms.
- VAR: Reactive power. Calculation equation is $\sqrt{VA^2 - P^2}$

Advanced Parameter Setting Menu

Operation step

- Press Menu/ Home key at main menu to enter advanced parameter setting menu.

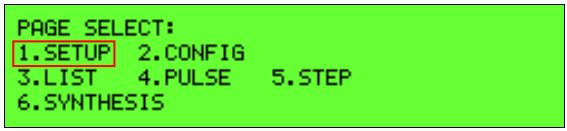


- User can select an item from item 1~6, then press Enter key to enter individual setting menu; or press Menu/ Home key to return main menu.
- When screen is not at main menu, press Menu/ Home key will return to main menu no matter which page it is at.
- Press ESC/ Cancel key will back to advanced parameter setting menu.

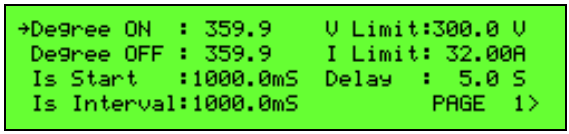
SETUP Function

Operation step

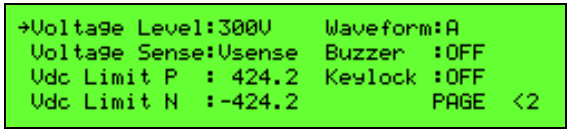
1. Press numerical key ❶ on the front panel to select *SETUP* option when the advanced parameter setting menu appears.



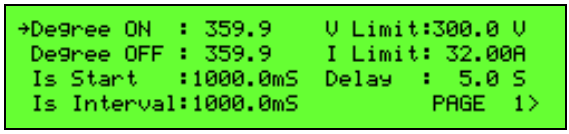
2. Press Enter key to enter SETUP setting menu shown as figure below.



3. Press ▶ Page down key to move to next page.



4. Press ◀ Page up key to return to previous page.



Definitions for all parameters on SETUP setting menu

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		
Waveform	Output waveform set at main menu	A / B		
Buzzer	Toggle switch for Buzzer	ON/ OFF		
Keylock	Lock settings at main menu	ON/ OFF		
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

Voltage Level Setting

ASD-1150 provides 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.

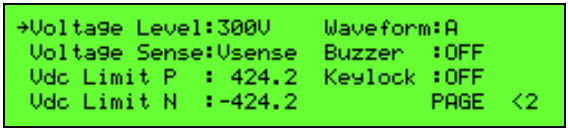
When switched from 300V to 150V level, AC source will check all voltage settings, and change the setting to 150V if any voltage setting checked is higher than 150V.

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.

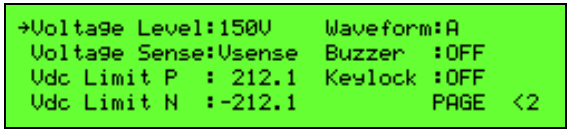
Example	Set output voltage level to 150V

Operation step

1. Press ▶ Page down arrow key to move to next page.
2. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *Voltage Level*.



3. Rotate knob to change *Voltage Level* to 150V, then press Enter key to confirm setting.



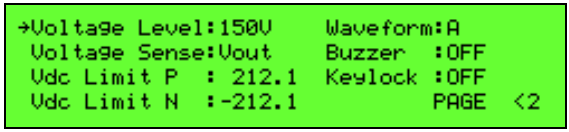
Voltage Sense

Voltage Sense determines 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.

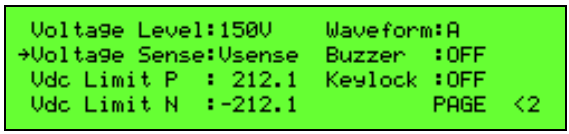
Example	Set Voltage Sense to from *Vout* to *Vsense*.

Operation step

1. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *Voltage Sense*.



2. By rotating knob to change parameter to *Vsense*, then press Enter key to confirm setting.



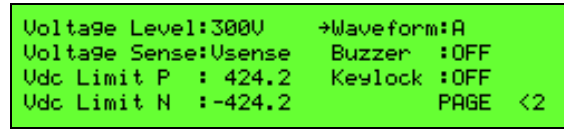
Waveform Selection

ASD-1150 provides 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 menu.

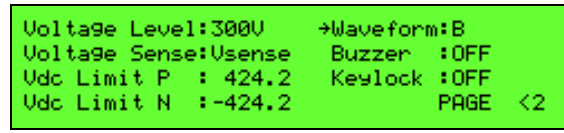
Example	Set waveform from A to B

Operation step

1. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *Waveform*.



2. Rotate knob to change *A* to *B*, then press Enter key to confirm setting.



Note

Press OUT key when main menu appears, only A or B can be selected. If using LIST function, then A or B waveform can be output alternatively.

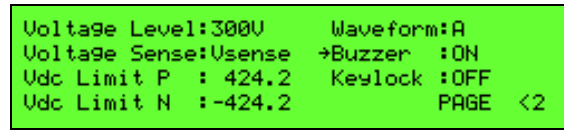
Buzzer

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.

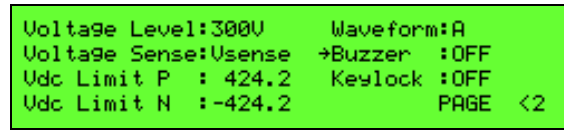
Example	Mute the buzzer

Operation Step

1. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *Buzzer*.



2. Rotate knob to change *ON* to *OFF*, then press Enter key to confirm setting.



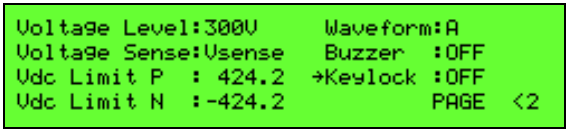
Disable (Lock) the Keys at Front Panel

ASD-1150 allows the user to lock the parameters at front panel to avoid being changed accidently. After the parameters are locked, only Menu/ Home key and OUT key are enabled. Menu/ Home key allows user to return to SETUP menu to enable or disable lock. OUT key enables or disables the output.

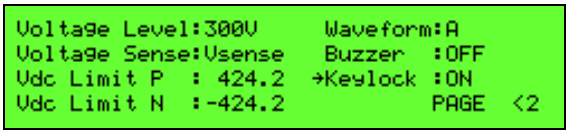
Example: Set keys on front panel from OFF to ON.

Operation Step

1. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *Keylock*.



2. Rotate knob to change *ON* to *OFF* , then press Enter key to confirm setting.



Voltage Limit

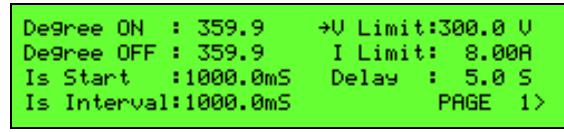
To limit the maximum output voltage for all pages, Vdc Limit P and Vdc Limit N limit the maximum positive and negative DC voltage. It is related to Voltage Level parameter, resolution is 0.1V.

It is firmware to set the limitation instead of by hardware.

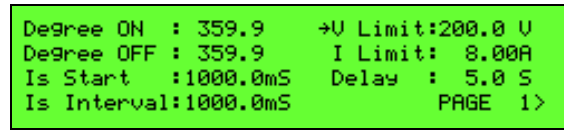
Example: The process to set Voltage Limit = 200V shows as below.

Operation step

1. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *V Limit*.



2. Change value to 200.0V by numerical key or knob, then press Enter key to confirm setting.



Caution

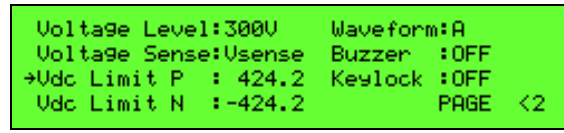
- AC voltage limit setting is related to voltage level range. Maximum limit AC voltage at 300V range is 300V, while is 150V at 150V output range.
- Maximum current limit at 300V range is 8A, and is 16A at 150V range. Maximum output power is 1500W

Example

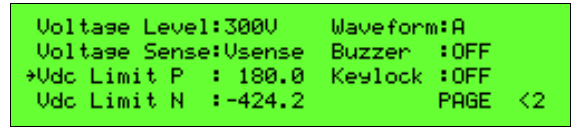
Set DC positive Vdc Limit P = 180V and DC negative Vdc Limit N=-150

Operation step

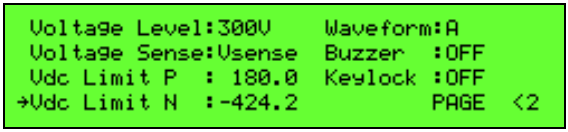
1. Press ▶ Page down arrow key to move to next page.
2. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *Vdc Limit P*.



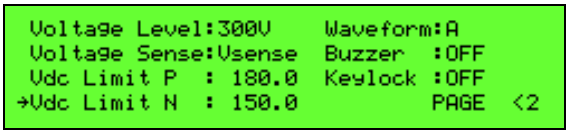
3. Change value to 180.0V by numerical key or knob, then press Enter key to confirm setting.



4. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *Vdc Limit N*.



5. Change parameter to -150.0V by using numerical key and - / Unlock key, then press Enter key to confirm setting.



Caution

DC Voltage limit also is related to Voltage Level range. Maximum DC limit voltage at 300V range is ±424.2V, and is ±212.1V at 150V output range.

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.

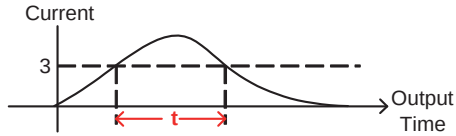
Voltage Level	I Limit
300V	0.0~8.0 A
I50V	0.0~16.0 A

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 > OCP Delay parameter ➔ Output shuts down. Screen shows "Software OCP"
- t < OCP Delay parameter ➔ Output continues, no protections or reports.



Example Set I Limit is to 3A, OCP delay time to 1.5s.

Operation step

1. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *I Limit*.

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

2. Change value to 3A by numerical key or knob. Then press Enter key to confirm setting.

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

3. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *Delay*.

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

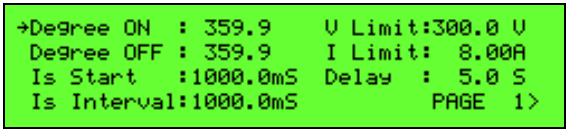
4. Change value to 1.5s by numerical key or knob. Then press Enter key to confirm setting.

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

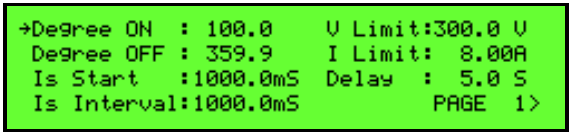
Degree On, Off

ASD-1150 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.

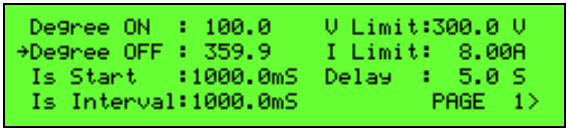
Example	Set phase angle Degree On = 100 and Degree Off = 200
Operation step	1. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *Degree ON*.



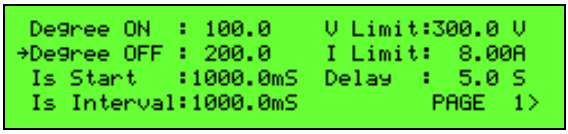
2. Change parameter to 100 by numerical key or knob. Then press Enter key to confirm setting.



3. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *Degree OFF*.



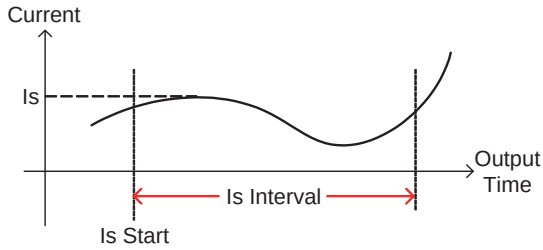
4. Change parameter to 200 by numerical key or knob. Then press Enter key to confirm setting.



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.

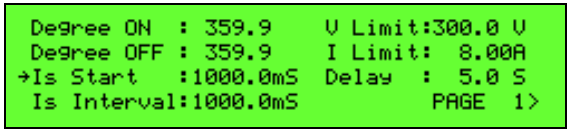


If Is Start = 500ms, Is Interval = 200ms, then Is measurement shown on main menu is the maximum current measured between 500~700ms after output enabled.

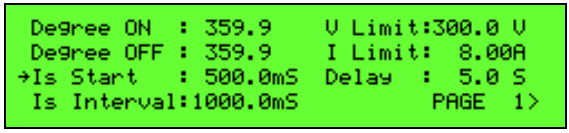
Example	Set Is Start = 500ms and Is Interval = 200ms

Operation step

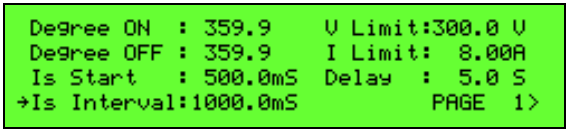
1. Press ▲ Up arrow or ▼ Down arrow key to move cursor to to *Is Start*.



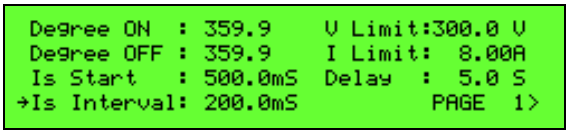
2. Change parameter to 500.0 by numerical key or knob. Then press Enter key to confirm setting.



3. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *Is Interval*.



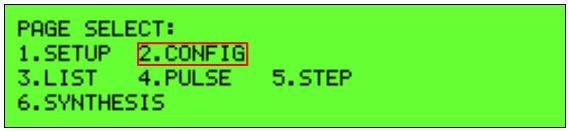
4. Change parameter to 200 by numerical key or knob. Then press Enter key to confirm setting.



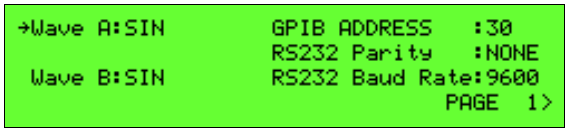
CONFIG Function

Operation step

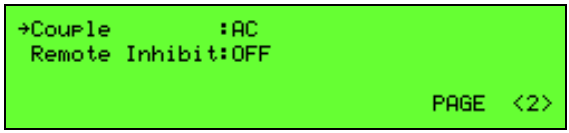
1. Press numerical key ❷ on the front panel to select *CONFIG* option when the advanced parameter setting menu appears.



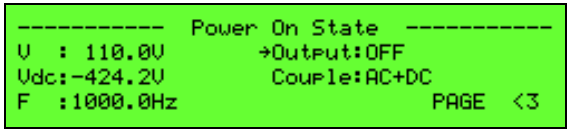
2. Press Enter key to enter CONFIG setting menu shown as figure below.



3. Press ▶ Page down key to enter page 2.



4. Press ▶ Page down key to enter page 3.



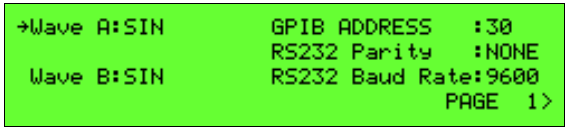
Definitions for all parameters on CONFIG setting menu

Parameter	Definition	Setting Range	
		Minimum	Maximum
Wave A	Stored group A waveform	Sin, CSin, SQUA, DST0 ~ DST31	
Wave B	Stored group B waveform		
GPIB ADDR	Address of GPIB	1	35
RS232 Parity	RS232 Odd/Even parity check	NONE, EVEN, ODD	
RS232 Baud Rate	Baud Rate of RS232	9600/ 19200	
Remote Inhibit	External TTL signal to control output	OFF, LIVE, TRIG, EXCITE	
Output	Output status for next time after AC on	ON/ OFF	

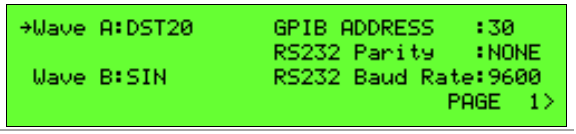
Waveform A, B Generator

ASD-1150 provides memories to store group A and B waveforms, both A and B groups have waveforms as below

Waveforms	• Sinusoidal (Sine) • Cut sinusoidal (Cut Sine) • 30 sets built in waveforms (DST0~DST29). See appendix "Built In Waveforms" on page 122 for details. • 2 sets user defined waveforms(DST30~DST31)
Example	The processes to set group A waveform as built in waveform number 20
Operation step	1. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *Wave A*.



2. Rotate Knob to change *SIN* to *DST20*. Then press Enter key to confirm setting.

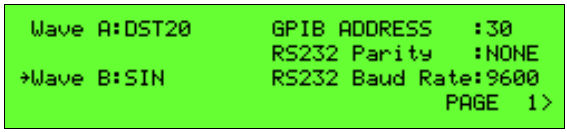


Example

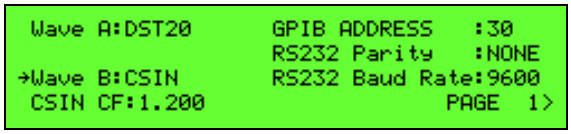
The processes to set group B waveform as cut sinusoidal waveform (Cut Sine) with CF 1.300.

Operation step

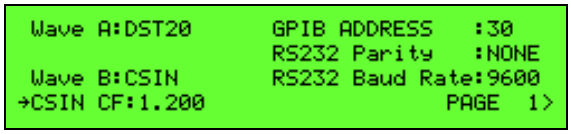
1. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *Wave B*.



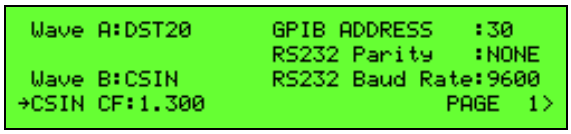
2. Rotate Knob to change *SIN* to *CSIN*. Press Enter key to confirm setting. CS parameter appears when <CSIN> selected.



3. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *CSIN CF*.



4. Change parameter to 1.300 by using numerical key or knob. Then press Enter key to confirm setting.



GPIB, RS232 Communication Setting

ASD-1150 provides remote control operation, there are GPIB or RS232 interface for selection. Only one interface can be activated at the same time.

Operation Mode \ Controller	Menu (front panel)	Remote (GPIB)	Remote (RS232)
Menu (front panel)	O	X	X
Remote (GPIB)	X	O	X
Remote (RS232)	X	X	O

Switch menu to remote control

Send any command to AC source directly, AC source enter remote control mode automatically.

Switch from remote to local control

Methods

- Stop remote control, press - / Unlock key longer than 2 seconds until "SET MODE" shown on upper left on the screen.
- Send *CLS command.

Switch remote control between GPIB or RS232

Back to menu 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	Set GPIB address to 20
Operation step	1. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *GPIB ADDR*.

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

2. Change parameter to 20 by using numerical key or knob. Then press Enter key to confirm setting.

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

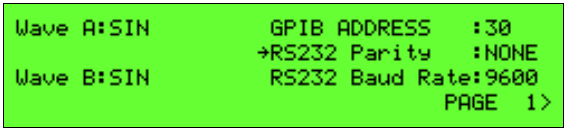
⚠ Note	The range of address is 1-30.
Example	The processes to set RS232 Baud rate = 19200, Odd/Even parity check = (ODD)
Operation step	1. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *RS232 Baud Rate*.

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

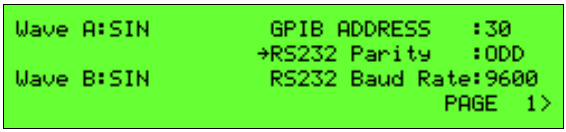
2. Rotate Knob to change parameter value from *9600* to *19200*. The press Enter key to confirm setting.

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

3. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *RS232 Parity*.



4. Rotate Knob to change parameter from *NONE* to *ODD*. Then press Enter key to confirm setting.

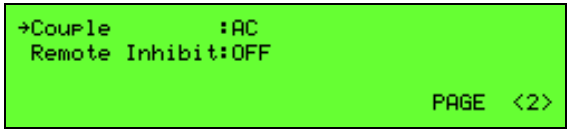


Couple (output mode selection)

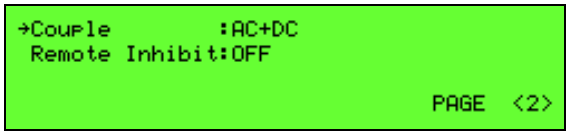
AC/DC source can output AC, DC, AC+DC three kinds of output voltage. User can set the output mode at CONFIG menu.

Example	Set Couple as AC+DC Mode
Operation step	1. Press ▶ Page down arrow key to switch page 2.

2. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *Couple*.



3. Rotate Knob to change parameter value from *AC* to *AC+DC*. Then press Enter key to confirm setting.



Inhibit Output by Remote Control Signal (Remote Inhibit)

Remote Inhibit is an "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 to appendix "TTL Pin Assignment" on page 122 for details.

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

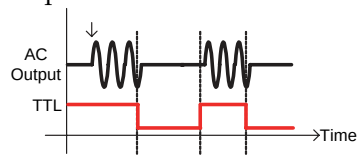
Front panel
Remote Control > TTL signal

- When both front panel and remote control are idle, output of ASD-1150 is according to external TTL ON/OFF signal.
- When user press OUT key from front panel or by remote control, TTL signal has no effect on the operation.

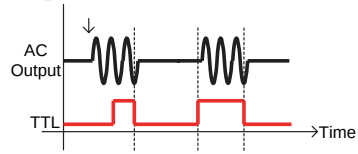
There are four Remote inhibit output status.

- OFF: Turn off remote inhibit function.
- LIVE: two conditions

  TTL signal changes from HIGH to LOW, and stays low longer than 1ms, ASD-1150 turn off output.



  TTL signal changes from LOW to HIGH, and stays high longer than 1ms, ASD-1150 resume output.



- TRIG: TTL signal changes from HIGH to LOW, and keeps low longer than 1ms, ASD-1150 turn off output, and stop detecting TTL signal, output stays at off state even TTL signal changes to high. User must press OUT key to resume output and enable TTL signal detecting.
- EXCITE: When user is using LIST, PULSE or STEP modes, output ON/OFF of ASD-1150 can be triggered by rising edge of TTL signal (LOW to HIGH) at trigger page (please refer to section LIST Mode until STEP Mode on page 55 for details). 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 to HIGH. There will be two conditions introduced as below.

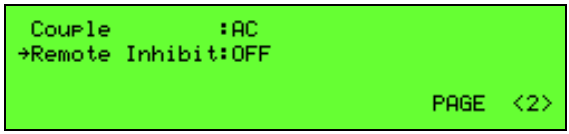
- If output sequences finishes and TTL signal changes from LOW to HIGH again, the output will be triggered to on state and repeat the sequences again.
- If TTL signal changes from LOW to HIGH when output sequences are not finished yet, output will turn off.

Example

The processes to change Remote Inhibit setting from *OFF* to *TRIG*.

Operation step

1. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *Remote Inhibit*.



2. Rotate Knob to change parameter value from *OFF* to *TRIG*. Then press Enter key to confirm setting.

```
 Couple         :AC
→Remote Inhibit:TRIG

                                PAGE  <2>
```

Power On State

ASD-1150 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	The process 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.

Operation step

1. Press ▶ Page down arrow key to switch page 3.
2. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *Output*.

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

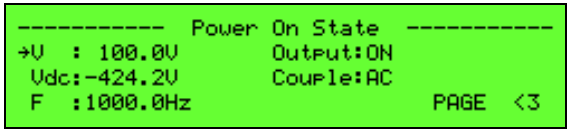
3. Rotate Knob to change parameter value from *OFF* to *ON*. Then press Enter key to confirm setting.

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

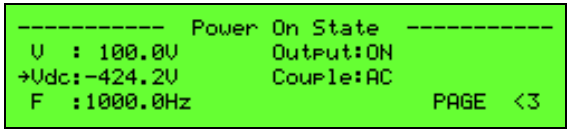
4. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *V*.

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

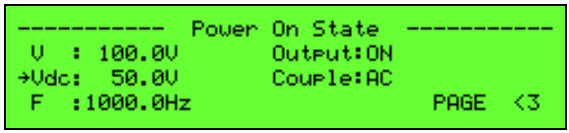
5. Change parameter value to *100.0V* by using numerical key or knob. Then press Enter key to confirm setting.



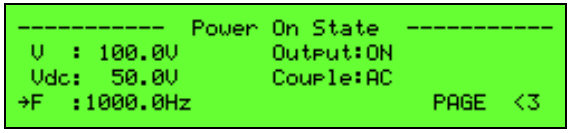
6. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *Vdc*.



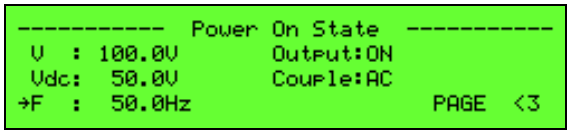
7. Change parameter value to *50* by using numerical key or knob. Then press Enter key to confirm setting.



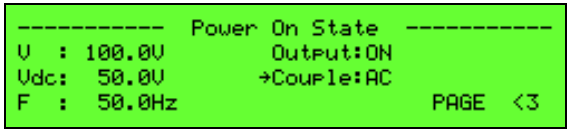
8. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *F*.



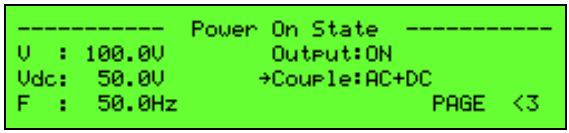
9. Change parameter value to *50* by using numerical key or knob. Then press Enter key to confirm setting.



10. Press ▲ Up arrow or ▼ Down arrow key to move cursor to *Couple*.



11. Rotate Knob to change parameter value from *AC* to *AC+DC*. Then press Enter key to confirm setting.



Refer to section "Save the main page setting" on page 69 for Group save function, save all settings to Group 1, it will take effect next time after AC is on.

APPLICAION

ASD-1150 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.

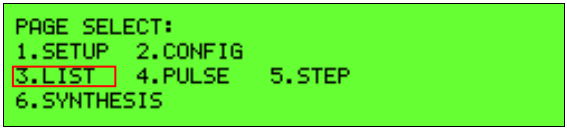
LIST Mode 55
Definitions for all parameters on LIST setting menu 56
PULSE Mode 59
Definitions for all parameters on PULSE setting menu 59
STEP Mode 62
Definitions for all parameters on STEP setting menu 62
SYNTHESIS Self-Defined Waveform Mode 65
Definitions for all parameters on STEP setting menu 66

LIST Mode

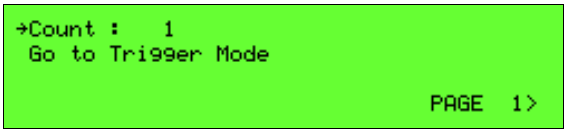
Let user to set 10 sets of user-defined voltage, frequency. This mode can make 10 different outputs consecutively.

Operation step

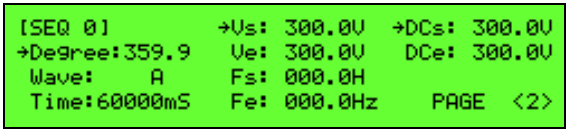
1. Press numerical key ❸ on the front panel to select *LIST* option when the advanced parameter setting menu appears.



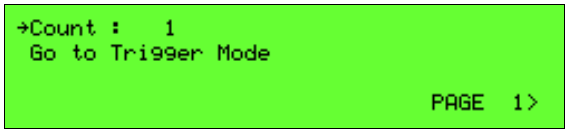
2. Press Enter key to enter LIST setting menu shown as figure below.



3. Press ▶ Page down key to move to next page.



4. Press ◀ Page up key to return to previous page.



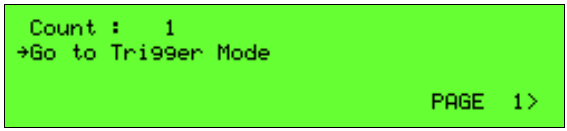
LIST mode provides 10 sets of programmable waveform (SEQ-0 ~ SEQ-9). Output waveforms start from SEQ-0, then SEQ-1, SEQ-2… in orders until time parameter (Time) of SEQ-n being processed is 0 or SEQ-9 is finished outputting, then one List waveform output is completed.

Definitions for all parameters on LIST setting menu

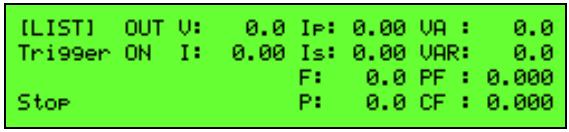
Parameter	Definition	Setting Range Min.	Max.
Count	Execution times for one complete List waveform. When 0 is setting, output recycles endless until user presses Enter key to stop.	0	10000
V Start	Start voltage(V): (high voltage range) : (low voltage range)	0.0 0.0	300.0 150.0
V End	Stop voltage(V): (high 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	DC starting voltage	0.0	±424.0
DC End	DC end voltage	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

Operation step

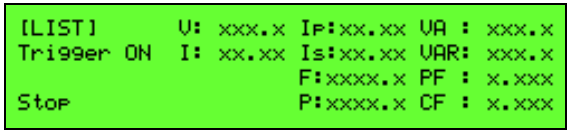
- After SEQ setting is completed, press ESC/ Cancel key to return to LIST mode initialization page as below.



- Press Enter key to enter Trigger setting page shown as figure below.



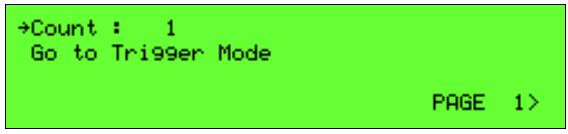
- Screen shows Trigger On, Stop is current output status.
- Press Enter key to trigger output.
- Then screen shows as below, Trigger Off and Running are displayed, waiting user to stop LIST output. When all sequences and Count are executed completed, AC output turned off, and screen shows Stop.

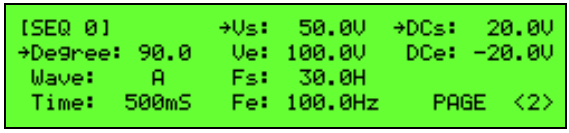


- When AC source is at Running (triggered on) status, press OUT key can stop the output. Press OUT key again, the outputs are according those settings at main menu.
- Press Enter key can switch output settings from main menu LIST mode.
- Press ESC/ Cancel key will exit LIST execution mode and return to LIST setting mode.

Example

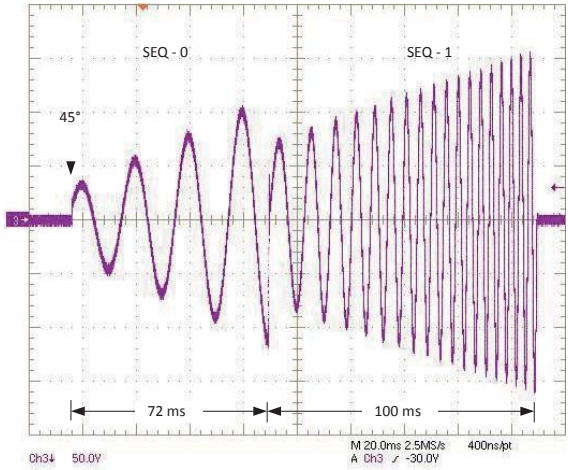
Parameter setting





[SEQ 1]		→Vs: 100.0V	→DCs:	50.0V
→Degree:	0.0	Ve: 50.0V	DCe:	-50.0V
Wave:	A	Fs: 30.0Hz		
Time:	500mS	Fe: 30.0Hz	PAGE	<3>

Output waveform

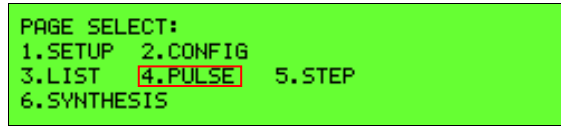


PULSE Mode

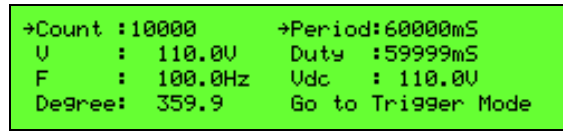
Simulate repeatedly changed output voltage.

Operation step

1. Press numerical key ❹ on the front panel to select *PULSE* option when the advanced parameter setting menu appears.



2. Press Enter key to enter PULSE setting menu shown as figure below.



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

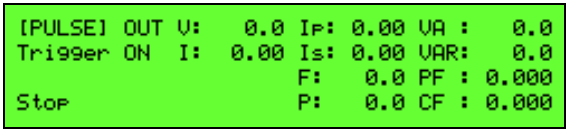
Definitions for all parameters on PULSE setting menu

Parameter	Definition	Setting Range	
		Min.	Max.
Count	How many times to output programmed Pulse waveform. If setting is 0, Pulse waveform will output endless until Enter key is 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't be greater than the Period.	1	59999

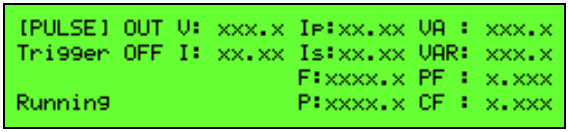
Degree On	Start phase angle of Pulse output	0.0 359.9

Operation step

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



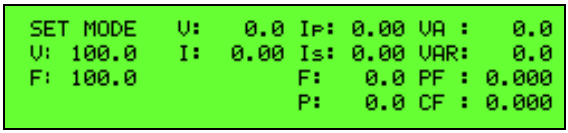
- "Trigger On" represents that the trigger is ready. "Stop" is the current output state.
- Press Enter key to trigger.
- And then the screen will display "Trigger OFF" and "Running" as shown below. When the user stop the PULSE wave output or the AC power supply finishes executing the all times of Count,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



- When AC source is at Running (triggered on) status, press OUT key can stop the output. Press OUT key again, the outputs are according those settings at main menu.
- Press Enter key can switch output settings from main menu PULSE mode.
- Press ESC/ Cancel key will exit PULSE execution mode and return to PULSE setting mode.

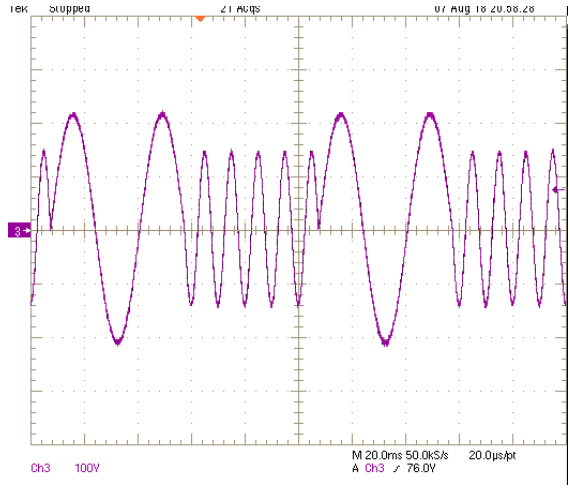
Example

Parameter setting



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

Output waveform

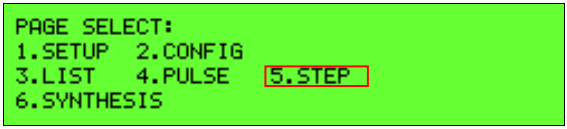


STEP Mode

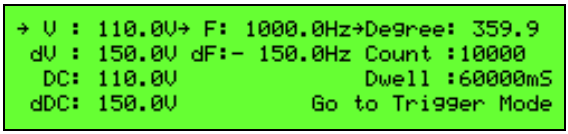
Simulate gradually changed output voltage.

Operation step

1. Press numerical key ❺ on the front panel to select *STEP* option when the advanced parameter setting menu appears.



2. Press Enter key to enter STEP setting menu shown as figure below.



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

Definitions for all parameters on STEP setting menu

Parameter	Definition	Setting 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	DC starting voltage, which can be negative.	-424.2	+424.2
dDC	The DC voltage for each step change, which can be negative.	-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.

Operation step

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

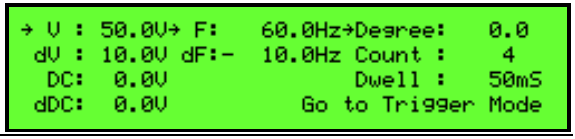
```
[STEP]  OUT V:    0.0 Ip: 0.00 VA :    0.0
Trigger ON  I:   0.00 Is: 0.00 VAR:    0.0
                      F:    0.0 PF : 0.000
Stop                  P:    0.0 CF : 0.000
```

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

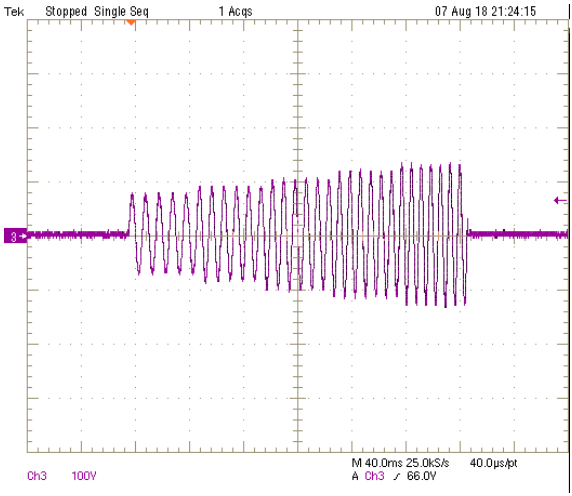
```
[STEP]  OUT V: xxx.x Ip:xx.xx VA : xxx.x
Trigger OFF I: xx.xx Is:xx.xx VAR: xxx.x
                     F:xxxx.x PF : x.xxx
Running              P:xxxx.x CF : x.xxx
```

- When AC source is at Running (triggered on) status, press OUT key can stop the output. Press OUT key again, the outputs are according those settings at main menu.
- Press Enter key can switch output settings from main menu STEP mode.
- Press ESC/ Cancel key will exit STEP execution mode and return to STEP setting mode.

Example Parameter setting



Output waveform

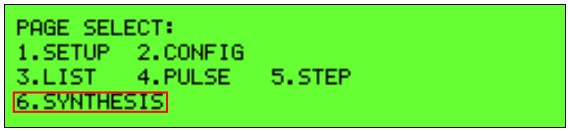


SYNTHESIS Self-Defined Waveform Mode

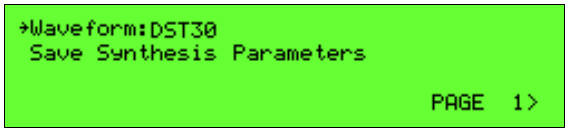
ASD-1150 also provides 39 orders of amplitude and phase angle settings for user to make self-defined waveforms. It can be used at all output modes once the self-defined waveforms are created.

Operation step

1. Press numerical key ❻ on the front panel to select *STEP* option when the advanced parameter setting menu appears.



2. Press Enter key to enter SYNTHESIS setting menu shown as figure below.



- WAVEFORM
  AC power supply provides two self-defined waveforms for user to set. The waveforms are DST30 and DST31.
- Save Synthesis Parameter
  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.

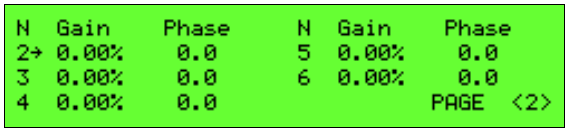
In SYNTHESIS self-defined waveform mode, voltage and frequency of fundamental waveform is sinusoidal defined at main menu. User can edit amplitude and phase angle of harmonic waveform up to 39 order of fundamental wave. Editing can be done by front panel or remote control.

Definitions for all parameters on STEP setting menu

Parameter	Definition	Setting 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	359.9

Operation step

- Press ▶ Page down key to move to next page, as shown below.



- After finishing setting, press ESC/ Cancel 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.

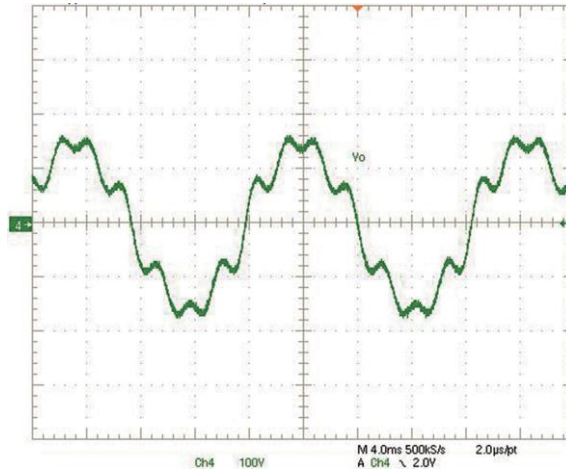
Orders	Gain limit
2~20	33.33%
21~30	30.00%
31~39	15.00%

Example SYNTHESIS mode

N	Gain	Phase	N	Gain	Phase
2	2.07%	0.0	8	2.16%	0.0
5	9.80%	0.0			
7	15.8%	0.0			PAGE <2>

Output waveform

$$\begin{bmatrix} n(w) + \\ 2.07 \times n(2w + 0.0) + \\ 9.80 \times n(5w + 0.0) + \\ 15.80 \times n(7w + 0.0) + \\ 2.16 \times n(8w + 0.0) \end{bmatrix}$$



SAVE AND RECALL

ASD-1150 provides two modes for users to save and recall the output setting or the system information.

Save and recall the main page setting 69
Save the main page setting 69
Recall the main page setting 70
Save and recall the system setting 71
Save the System Setting 71
Recall the System Setting 72

Save and recall the main page setting

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

Save the main page setting

ASD-1150 provides 9 channels for users to save V and F. Users can save or recall the specific parameters at any time.

Example	The process to save V=150V and F=80Hz to Channel 2 memory.
Operation step	1. Press ▲ Save key about 2 seconds in the main page, then it will enter the storage page as shown below.

```
Press 1-9,Save Main Page Data: ←
1 V:   0.0 F:   30.0  4 V:   0.0 F:   30.0
2 V:   0.0 F:   30.0  5 V:   0.0 F:   30.0
3 V:   0.0 F:   30.0              PAGE  1>
```

2. Press ❷ and then press Enter key select Channel 2 Memory.

```
Press 1-9,Save Main Page Data: 2
1 V:   0.0 F:   30.0  4 V:   0.0 F:   30.0
2→V:   0.0 F:   30.0  5 V:   0.0 F:   30.0
3 V:   0.0 F:   30.0              PAGE  1>
```

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

```
Press 1-9,Save Main Page Data: 2
1 V:   0.0 F:   30.0  4 V:   0.0 F:   30.0
2→V: 150.0 F:   80.0  5 V:   0.0 F:   30.0
3 V:   0.0 F:   30.0              PAGE  1>
```

Recall the main page setting

Example	The process to recall the setting stored in Channel 2 Memory (V=150V, F=80Hz) to the main page.
Operation step	1. Press ▼ Recall key about 2 seconds in the main page, then it will enter the storage page as shown below.

```
Press 1-9,Recall Main Page Data: ←
1 V:  0.0 F:  30.0  4 V:  0.0 F:  30.0
2 V:150.0 F:  80.0  5 V:  0.0 F:  30.0
3 V:  0.0 F:  30.0            PAGE  1>
```

2. Press ❷ and Enter keys to select Channel 2 memory.

```
Press 1-9,Recall Main Page Data:2←
1 V:  0.0 F:  30.0  4 V:  0.0 F:  30.0
2 V:150.0 F:  80.0  5 V:  0.0 F:  30.0
3 V:  0.0 F:  30.0            PAGE  1>
```

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

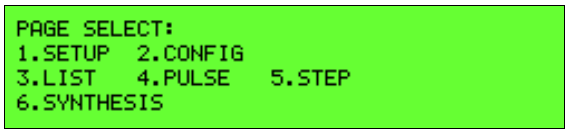
```
 SET MODE   V:   0.0 Ip: 0.00 VA :   0.0
→V:   150.0 I:  0.00 Is: 0.00 VAR:   0.0
 F:    80.0          F:   0.0 PF : 0.000
                     P:   0.0 CF : 0.000
```

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

Save and recall the system setting

ASD-1150 provides 3 groups of memory for users to save the system data. System data contains the parameters in SETUP and CONFIG pages.

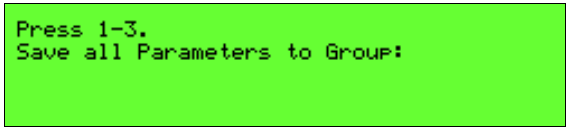
Operation step Enter the PAGE SELECT screen, as shown below.



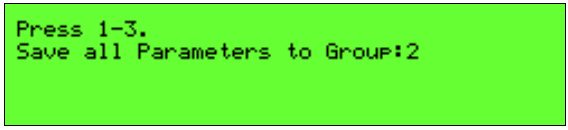
Save the System Setting

Operation step

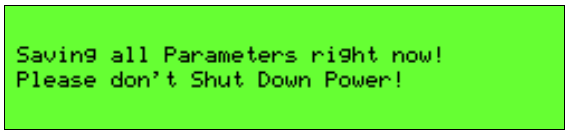
1. Press ▲ Save key about 2 seconds in *PAGE SELECT* page, then it will enter the system data storage mode, as shown below.

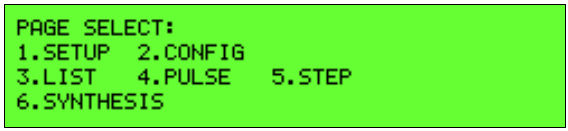


2. Choose a group of Group 1 to Group 3. Press Enter key and then the system data will be saved into the memory of the chosen group. The following figure is the example of saving system data into Group 2 memory.



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

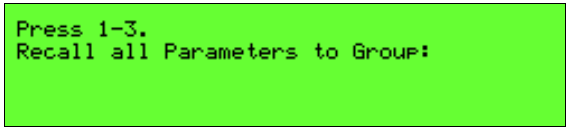




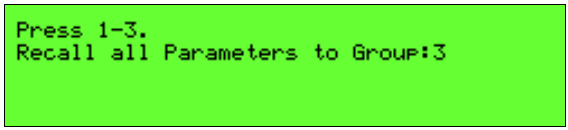
Recall the System Setting

Operation step

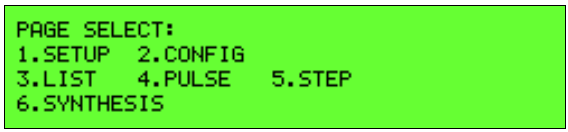
1. Press ▼ Recall key about 2 seconds in *PAGE SELECT* page, then it will enter the system data recalling mode, as shown below.



2. Choose a group of Group 1 to Group 3. Press Enter key and then the system data will 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.



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


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

REMOTE OPERAION

ASD-1150 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.

Set GPIB address and RS-232 Parameters 75
RS-232 pin definition 75
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Programming 77
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Numerical Data Formats 77
Boolean Data Format 77
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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.

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.

Orders	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

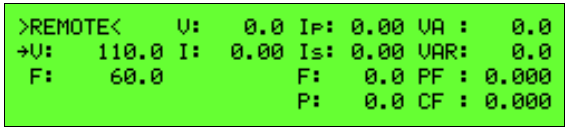
GPIB Interface

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	RL1

	remotely. Press - / Unlock key to switch from remote control back to local control, other keys are inactive during remote control.

Operation step

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



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.

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.

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

Boolean Data Format

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

Basic Definition of Command

Construction of ASD-1150 remote control command is based on tree systems and 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.

ASD-1150 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. 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. 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 differentiates 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. GW-INSTEK, ASD-1150,V1.0 will be the answer for this AC source.

Command List

IEEE 488.2 Standard Commands

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*ESR 84
*IDN 84
*RCL 84
*SAV 85
*SRE 85
*STB 86
*CLS 86

FETCH and MEAURE Commands

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:FETCh:CURRent:INRush
:MEASure:CURRent:INRush 88
:FETCh:FREQuency :MEASure:FREQuency 88
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:MEASure:POWer:AC[:REAL] 89
:FETCh:POWer:AC:APParent
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:FETCh:POWer:AC:PFACtor
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[:SOURce]:CURRent:DELay 94
[:SOURce]:CURRent:INRush:STARt 95
[:SOURce]:CURRent:INRush:INTerval 95
[:SOURce]:FREQuency 95
[:SOURce]:FUNCtion:SHAPe 96
[:SOURce]:FUNCtion:SHAPe:A 96

[:SOURce]:FUNCtion:SHAPe:A:CF 96
[:SOURce]:FUNCtion:SHAPe:B 97
[:SOURce]:FUNCtion:SHAPe:B:CF 97
[:SOURce]:VOLTage:AC 97
[:SOURce]:VOLTage:LIMit:AC 98
[:SOURce]:VOLTage:DC 98
[:SOURce]:VOLTage:LIMit:DC:PLUS 99
[:SOURce]:VOLTage:LIMit:DC:MINUs 99
[:SOURce]:VOLTage:RANGe 99
[:SOURce]:VOLTage:SENSe 100
[:SOURce]:CONFigure:INHibit 100
[:SOURce]:PHASe:ON 101
[:SOURce]:PHASe:OFF 101
[:SOURce]:LIST:COUNt 101
[:SOURce]:LIST:DWELl 102
[:SOURce]:LIST:SHAPe 102
[:SOURce]:LIST:VOLTage:AC:STARt 102
[:SOURce]:LIST:VOLTage:AC:END 103
[:SOURce]:LIST:VOLTage:DC:STARt 103
[:SOURce]:LIST:VOLTage:DC:END 104
[:SOURce]:LIST:FREQency:STARt 104
[:SOURce]:LIST:FREQency:END 104
[:SOURce]:LIST:DEGRee 105
[:SOURce]:PULSe:VOLTage:AC 105
[:SOURce]:PULSe:VOLTage:DC 105
[:SOURce]:PULSe:FREQency 106
[:SOURce]:PULSe:SPHase 106
[:SOURce]:PULSe:COUNt 106
[:SOURce]:PULSe:DCYCle 107
[:SOURce]:PULSe:PERiod 107
[:SOURce]:STEP:VOLTage:AC 107
[:SOURce]:STEP:VOLTage:DC 108
[:SOURce]:STEP:DVOLTage:AC 108
[:SOURce]:STEP:DVOLTage:DC 108
[:SOURce]:STEP:FREQency 109
[:SOURce]:STEP:DFREQency 109
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Command for Remote Control

IEEE 488.2 Standard Commands

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*ESR 84
*IDN 84
*RCL 84
*SAV 85
*SRE 85
*STB 86
*CLS 86

*ESE

→(Query)

Description

Set and query flag mask for 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 as follow.

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

	7	PON	Power on

Syntax	*ESE<NR1>
Query Syntax	*ESE?
Parameter/ Return parameter	<NR1>

*ESR

Query

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

*IDN

Query

Description	Return string of AC source identification.	
Query Syntax	*IDN?	
Return parameter	<string>	Returns the instrument identification as a string in the following format: GW-INSTEK, ASD-1150, V1.0 Manufacturer: GW-INSTEK Model number: ASD-1150 Firmware version: V1.0

*RCL

Set

Description	Recalls stored system setting.
Syntax	*RCL<NR1>
Parameter	1 2 3

*SAV

Set

Description	Save system setting
Syntax	*SAV<NR1>
Return parameter	1 2 3

*SRE

Set

Query

Description

Set and return status of flag mask status for service events.

This command is for a register used for IEE488.2 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 are as follow.

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

Syntax	*SRE <NR1>
Query Syntax	*SRE?
Parameter/ Return parameter	<NR1>

*STB

Query

Description	Query value stored in service event register, 1 represents event occurs.
Query Syntax	*STB?
Return parameter	<NR1>

*CLS

Set

Description	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
Syntax	*CLS

FETCH and MEAURE Commands

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.

:FETCh:CURRent:AC :MEASure:CURRent:AC 87
:FETCh:CURRent:AMPLitude:MAXimum
:MEASure:CURRent:AMPLitude:MAXimum 88
:FETCh:CURRent:CREStfactor
:MEASure:CURRent:CREStfactor 88
:FETCh:CURRent:INRush
:MEASure:CURRent:INRush 88
:FETCh:FREQuency :MEASure:FREQuency 88
:FETCh:POWer:AC[:REAL]
:MEASure:POWer:AC[:REAL] 89
:FETCh:POWer:AC:APParent
:MEASure:POWer:AC:APParent 89
:FETCh:POWer:AC:PFACtor
:MEASure:POWer:AC:PFACtor 89
:FETCh:POWer:AC:REACtive
:MEASure:POWer:AC:REACtive 89
:FETCh:VOLTage:ACDC
:MEASure:VOLTage:ACDC 90

:FETCh:CURRent:AC
:MEASure:CURRent:AC

→(Query)

Description	Query total output AC Irms.
Syntax	:FETCh:CURRent:AC? :MEASure:CURRent:AC?
Return Parameter	<NR2>

:FETCh:CURRent:AMPLitude:MAXimum
:MEASure:CURRent:AMPLitude:MAXimum → Query

Description	Query total output peak current
Syntax	:FETCh:CURRent:AMPLitude:MAXimum? :MEASure:CURRent:AMPLitude:MAXimum?
Return Parameter	<NR2>

:FETCh:CURRent:CREStfactor
:MEASure:CURRent:CREStfactor → Query

Description	Query output current crest factor
Syntax	:FETCh:CURRent:CREStfactor? :MEASure:CURRent:CREStfactor?
Return Parameter	<NR2>

:FETCh:CURRent:INRush
:MEASure:CURRent:INRush → Query

Description	Query output inrush current
Syntax	:FETCh:CURRent:INRush? :MEASure:CURRent:INRush?
Return Parameter	<NR2>

:FETCh:FREQuency :MEASure:FREQuency → Query

Description	Query average output frequency
Syntax	:FETCh:FREQuency? :MEASure:FREQuency?
Return Parameter	<NR2>

:FETCh:POWer:AC[:REAL]
:MEASure:POWer:AC[:REAL] → Query

Description	Query output real power
Syntax	:FETCh:POWer:AC? :MEASure:POWer:AC:REAL?
Return Parameter	<NR2>

:FETCh:POWer:AC:APParent
:MEASure:POWer:AC:APParent → Query

Description	Query output apparent power
Syntax	:FETCh:POWer:AC:APParent? :MEASure:POWer:AC:APParent?
Return Parameter	<NR2>

:FETCh:POWer:AC:PFACtor
:MEASure:POWer:AC:PFACtor → Query

Description	Query output power factor
Syntax	:FETCh:POWer:AC:PFACtor? :MEASure:POWer:AC:PFACtor?
Return Parameter	<NR2>

:FETCh:POWer:AC:REACtive
:MEASure:POWer:AC:REACtive → Query

Description	Query output reactive power
Syntax	:FETCh:POWer:AC:REACtive? :MEASure:POWer:AC:REACtive?
Return Parameter	<NR2>

:FETCh:VOLTage:ACDC
:MEASure:VOLTage:ACDC

→ Query

Description	Query average output voltage Vrms
Syntax	:FETCh:VOLTage:ACDC?:MEASure:VOLTage:ACDC?
Return Parameter	<NR2>

OUTPUT Commands

:OUTPut 91
:OUTPut:MODE 91
:OUTPut:COUPling 92

:OUTPut

Set → Query

Description	Set or query status of turning on or turning off output.
Syntax	OUTPut
Query Syntax	OUTPut?
Parameter/Return parameter	OFF ON
Example	OUTPut? OUTPut ON Query output status. Turn on output.

:OUTPut:MODE

Set → Query

Description	Set or query output mode. "FIXED" mode output fixed voltage waveform.
Syntax	OUTPut:MODE
Query Syntax	OUTPut:MODE?
Parameter/Return parameter	FIXED LIST PULSE STEP

Example	OUTPut:MODE? OUTPut:MODE LIST Query output mode. Set output as LIST mode.

:OUTPut:COUPling

Set → / → Query

Description	Set of query output coupling mode.
Syntax	OUTPut:COUPling
Query Syntax	OUTPut:COUPling?
Parameter/Return parameter	AC DC
	ACDC
Example	OUTPut:COUPling? OUTPut:COUPling AC Query output coupling mode. Set output coupling mode as AC.

SOURCE Commands

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[:SOURce]:CURRent:LIMit

Set → Query

Description	Set or query total output rms current limit	
Syntax	[:SOURce:]CURRent:LIMit	
Query Syntax	[:SOURce:]CURRent:LIMit?	
Parameter/ Return parameter	<NR2>	Effective rang: 0.00 ~ 16.00 (150V range), 0.00 ~ 8.00 (300V range)
Example	[:SOURce:]CURRent:LIMit 25.5	

[:SOURce]:CURRent:DELay

Set → Query

Description	Set or query delay time to trigger software over current protection.	
Syntax	[:SOURce:]CURRent:DELay	
Query Syntax	[:SOURce:]CURRent:DELay?	
Parameter/ Return parameter	<NR2>	Effective range: 0.0 ~ 5.0 (unit: sec)
Example	[:SOURce:]CURRent:DELay? 1.2	

[:SOURce]:CURRent:INRush:STARt

Set → / → Query

Description	Set or query time to start measure inrush current.	
Syntax	[:SOURce:]CURRent:INRush:STARt	
Query Syntax	[:SOURce:]CURRent:INRush:STARt?	
Parameter/ Return parameter	<NR2>	Effective rang: 0.0 ~ 999.9 (unit: msec)
Example	[:SOURce:]CURRent:INRush:STARt? 200.3	

[:SOURce]:CURRent:INRush:INTerval

Set → / → Query

Description	Set or query inrush current measurement time.	
Syntax	[:SOURce:]CURRent:INRush:INTerval	
Query Syntax	[:SOURce:]CURRent:INRush:INTerval?	
Parameter/ Return parameter	<NR2>	Effective rang: 0.0 ~ 999.9 (unit: msec)
Example	[:SOURce:]CURRent:INRush:INTerval? 400.8	

[:SOURce]:FREQuency

Set → / → Query

Description	Set or query frequency of output waveform.	
Syntax	[:SOURce:]FREQuency	
Query Syntax	[:SOURce:]FREQuency?	
Parameter/ Return parameter	<NR2>	Effective rang: 30.0 ~ 1000.0 (unit: Hz)
Example	[:SOURce:]CURRent:INRush:INTerval? 50.8	

[:SOURce]:FUNCtion:SHAPe

Set → Query

Description	Set or query waveform buffer. AC source provides two waveform buffers, user has to select A or B waveform buffer.
Syntax	[:SOURce:]FUNCtion:SHAPe
Query Syntax	[:SOURce:]FUNCtion:SHAPe?
Parameter/Return parameter	A B
Example	[:SOURce:]FUNCtion:SHAPe? A

[:SOURce]:FUNCtion:SHAPe:A

Set → Query

Description	Set or query waveform of waveform buffer A.
Syntax	[:SOURce:]FUNCtion:SHAPe:A
Query Syntax	[:SOURce:]FUNCtion:SHAPe:A?
Parameter/ Return parameter	SINE CSIN DST<00~31>
Example	[:SOURce:]FUNCtion:SHAPe:A? CSIN

[:SOURce]:FUNCtion:SHAPe:A:CF

Set → Query

Description	Set or query CF of the cut sin waveform in waveform buffer A. It is effective only when CSIN is selected for waveform buffer A.
Syntax	[:SOURce:]FUNCtion:SHAPe:A:CF
Query Syntax	[:SOURce:]FUNCtion:SHAPe:A:CF?

Parameter/ Return parameter	<NR2>	Effective rang: 1.200 ~ 1.414
Example	[:SOURce:]FUNCtion:SHAPe:A:CF? 1.234	

[:SOURce]:FUNCtion:SHAPe:B

Set / Query

Description	Set or query waveform of waveform buffer B.
Syntax	[:SOURce:]FUNCtion:SHAPe:B
Query Syntax	[:SOURce:]FUNCtion:SHAPe:B?
Parameter/ Return parameter	SINE CSIN DST<00~31>
Example	[:SOURce:]FUNCtion:SHAPe:B? CSIN

[:SOURce]:FUNCtion:SHAPe:B:CF

Set / Query

Description	Set or query CF of the cut sin waveform in waveform buffer B. It is effective only when CSIN is selected for waveform buffer B.	
Syntax	[:SOURce:]FUNCtion:SHAPe:B:CF	
Query Syntax	[:SOURce:]FUNCtion:SHAPe:B:CF?	
Parameter/ Return parameter	<NR2>	Effective rang: 1.200 ~ 1.414
Example	[:SOURce:]FUNCtion:SHAPe:B:CF? 1.234	

[:SOURce]:VOLTage:AC

Set / Query

Description	Set or query AC output voltage.

Syntax	[:SOURce:]VOLTage:AC	
Query Syntax	[:SOURce:]VOLTage:AC?	
Parameter/ Return parameter	<NR2>	Effective range: 0.0 ~ 150.0 (low voltage range), 0.0 ~ 300.0 (high voltage range)
Example	[:SOURce:]VOLTage:AC? 200.5	

[:SOURce]:VOLTage:LIMit:AC

Set → Query

Description	Set or query voltage limit.	
Syntax	[:SOURce:]VOLTage:LIMit:AC	
Query Syntax	[:SOURce:]VOLTage:LIMit:AC?	
Parameter/ Return parameter	<NR2>	Effective range: 0.0 ~ 150.0 (low voltage range), 0.0 ~ 300.0 (high voltage range)
Example	[:SOURce:]VOLTage:LIMit:AC? 300.0	

[:SOURce]:VOLTage:DC

Set → Query

Description	Set or query DC output voltage.	
Syntax	[:SOURce:]VOLTage:DC	
Query Syntax	[:SOURce:]VOLTage:DC?	
Parameter/ Return parameter	<NR2>	Effective range: ±212.1 (low voltage range), ±424.2 (high voltage range)
Example	[:SOURce:]VOLTage:DC? 100.5	

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

Set → / → Query

Description	Set or query Vdc maximum positive value.	
Syntax	[:SOURce:]VOLTage:LIMit:DC:PLUS	
Query Syntax	[:SOURce:]VOLTage:LIMit:DC:PLUS?	
Parameter/ Return parameter	<NR2>	Effective range: 0.0~424.2 (high voltage range), 0.0~212.1 (low voltage range)
Example	[:SOURce:]VOLTage:LIMit:DC:PLUS? 100.0	

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

Set → / → Query

Description	Set or query Vdc minimum negative value.	
Syntax	[:SOURce:]VOLTage:LIMit:DC:MINUs	
Query Syntax	[:SOURce:]VOLTage:LIMit:DC:MINUs?	
Parameter/ Return parameter	<NR2>	Effective range: 0.0~-424.2 (high voltage range), 0.0~-212.1 (low voltage range)
Example	[:SOURce:]VOLTage:LIMit:DC:MINUs? -100.0	

[:SOURce]:VOLTage:RANGe

Set → / → Query

Description	Set or query output voltage range.		
		Voltage range(V)	Current range(A)
	LOW	0.0 ~ 150.0	0.0 ~ 16.0
	HIGH	0.0 ~ 300.0	0.0 ~ 8.0
Syntax	[:SOURce:]VOLTage:RANGe		
Query Syntax	[:SOURce:]VOLTage:RANGe?		
Parameter/	LOW		

Return parameter	HIGH
Example	[:SOURce:]VOLTage:RANGe? HIGH

[:SOURce]:VOLTage:SENSe

Set → / → Query

Description	Set or query remote sense function. REMOTE is in enable, VOUT is in disable
Syntax	[:SOURce:]VOLTage:SENSe
Query Syntax	[:SOURce:]VOLTage:SENSe?
Parameter/ Return parameter	VOUT REMOTE
Example	[:SOURce:]VOLTage:SENSe? REMOTE

[:SOURce]:CONFigure:INHibit

Set → / → Query

Description	Set or query remote TTL inhibition operation. Refer to page 49 for details.
Syntax	[:SOURce:]CONFigure:INHibit
Query Syntax	[:SOURce:]CONFigure:INHibit?
Parameter/ Return parameter	OFF LIVE TRIG EXCITE
Example	[:SOURce:]CONFigure:INHibit? LIVE

Set → / → Query

[:SOURce]:PHASe:ON

Description	Set or query waveform start phase angle set at main menu.	
Syntax	[:SOURce:]PHASe:ON	
Query Syntax	[:SOURce:]PHASe:ON?	
Parameter/ Return parameter	<NR2>	Effective rang: 0.0 ~ 359.9
Example	[:SOURce:]PHASe:ON? 200.5	

Set → / → Query

[:SOURce]:PHASe:OFF

Description	Set or query waveform stop phase angle set at main menu.	
Syntax	[:SOURce:]PHASe:OFF	
Query Syntax	[:SOURce:]PHASe:OFF?	
Parameter/ Return parameter	<NR2>	Effective rang: 0 ~ 360.0, 360.0 representing turn off immediately
Example	[:SOURce:]PHASe:OFF? 250.5	

Set → / → Query

[:SOURce]:LIST:COUNt

Description	Set or query how many times to execute effective sequences in LIST mode.	
Syntax	[:SOURce:]LIST:COUNt	
Query Syntax	[:SOURce:]LIST:COUNt?	
Parameter/ Return parameter	<NR1>	Effective rang: 0 ~ 10000

Example	[:SOURce:]LIST:COUNt? 100

Set → Query

[:SOURce]:LIST:DWELl

Description	Set or query execution time of 10 individual sequences in LIST mode.
Syntax	[:SOURce:]LIST:DWELl
Query Syntax	[:SOURce:]LIST:DWELl?
Parameter/ Return parameter	<NR2>... Effective rang: 0 ~ 60000 (unit: msec) <NR2>
Example	[:SOURce:]LIST:DWELl? 60000 1 23 95

Set → Query

[:SOURce]:LIST:SHAPe

Description	Set or query waveform buffer used for 10 individual sequences in LIST mode.
Syntax	[:SOURce:]LIST:SHAPe
Query Syntax	[:SOURce:]LIST:SHAPe?
Parameter/ Return parameter	A|B... A|B
Example	[:SOURce:]LIST:SHAPe? A B A A A

Set → Query

[:SOURce]:LIST:VOLTage:AC:STARt

Description	Set or query start voltage of 10 individual sequences in LIST mode.
Syntax	[:SOURce:]LIST:VOLTage:AC:STARt
Query Syntax	[:SOURce:]LIST:VOLTage:AC:STARt?

Parameter/ Return parameter	<NR2>... <NR2>	Effective rang: 0.0 ~ 150.0 (low voltage range), 0.0 ~ 300.0 (high voltage range)
Example	[:SOURce:]LIST:VOLTage:AC:STARt? 110 22.5 55.6	

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

Set / Query

Description	Set or query stop voltage of 10 individual sequences in LIST mode.
Syntax	[:SOURce:]LIST:VOLTage:AC:END
Query Syntax	[:SOURce:]LIST:VOLTage:AC:END?

Parameter/ Return parameter	<NR2>... <NR2>	Effective rang: 0.0 ~ 150.0 (low voltage range), 0.0 ~ 300.0 (high voltage range)
Example	[:SOURce:]LIST:VOLTage:AC:END? 1.2 50 66.6	

[:SOURce]:LIST:VOLTage:DC:STARt

Set / Query

Description	Set or query DC start voltage for 10 individual sequences in LIST mode.
Syntax	[:SOURce:]LIST:VOLTage:DC:STARt
Query Syntax	[:SOURce:]LIST:VOLTage:DC:STARt?

Parameter/ Return parameter	<NR2>... <NR2>	Effective rang: ±212.1 (low voltage range), ±424.2 (high voltage range)
Example	[:SOURce:]LIST:VOLTage:DC:STARt? -110 22.5 -55.6	

[:SOURce]:LIST:VOLTage:DC:END

Set → / → Query

Description	Set or query DC end voltage for 10 individual sequences in LIST mode.
Syntax	[:SOURce:]LIST:VOLTage:DC:END
Query Syntax	[:SOURce:]LIST:VOLTage:DC:END?
Parameter/ Return parameter	<NR2>... <NR2> Effective rang: ±212.1 (low voltage range), ±424.2 (high voltage range)
Example	[:SOURce:]LIST:VOLTage:DC:END? 1.2 -50 66.6

[:SOURce]:LIST:FREQency:STARt

Set → / → Query

Description	Set or query start frequency of 10 individual sequences in LIST mode.
Syntax	[:SOURce:]LIST:FREQency:STARt
Query Syntax	[:SOURce:]LIST:FREQency:STARt?
Parameter/ Return parameter	<NR2>... <NR2> Effective rang: 30.0 ~ 1000.0 (unit: Hz)
Example	[:SOURce:]LIST:FREQency:STARt? 50.8 80.5 2.2

[:SOURce]:LIST:FREQency:END

Set → / → Query

Description	Set or query stop frequency of 10 individual sequences in LIST mode.
Syntax	[:SOURce:]LIST:FREQency:END
Query Syntax	[:SOURce:]LIST:FREQency:END?
Parameter/ Return parameter	<NR2>... <NR2> Effective rang: 30.0 ~ 1000.0 (unit: Hz)

Example	[:SOURce:]LIST:FREQency:END? 20.5 30.8 77.8

[:SOURce]:LIST:DEGRee

Set → Query

Description	Set or query start phase angle of 10 individual sequences in LIST mode.	
Syntax	[:SOURce:]LIST:DEGRee:END	
Query Syntax	[:SOURce:]LIST:DEGRee:END?	
Parameter/ Return parameter	<NR2>... <NR2>	Effective rang: 0.0 ~ 359.9
Example	[:SOURce:]LIST:DEGRee:END? 30.6 96.5 88.0 71	

[:SOURce]:PULSe:VOLTage:AC

Set → Query

Description	Set or query AC voltage of PULSE waveform.	
Syntax	[:SOURce:]PULSe:VOLTage:AC	
Query Syntax	[:SOURce:]PULSe:VOLTage:AC?	
Parameter/ Return parameter	<NR2>... <NR2>	Effective rang: 0.0 ~ 150.0 (low voltage range), 0.0 ~ 300.0 (high voltage range)
Example	[:SOURce:]PULSe:VOLTage:AC? 250.1	

[:SOURce]:PULSe:VOLTage:DC

Set → Query

Description	Set or query DC voltage of PULSE waveform.
Syntax	[:SOURce:]PULSe:VOLTage:DC
Query Syntax	[:SOURce:]PULSe:VOLTage:DC?

Parameter/ Return parameter	<NR2>... <NR2>	Effective rang: ±212.1 (low voltage range), ±424.2 (high voltage range)
Example	[:SOURce:]PULSe:VOLTage:DC? -200.1	

[:SOURce]:PULSe:FREQency

Set → Query →

Description	Set or query frequency of PULSE mode.	
Syntax	[:SOURce:]PULSe:FREQency	
Query Syntax	[:SOURce:]PULSE:FREQency?	
Parameter/ Return parameter	<NR2>	Effective rang: 30.0 ~ 1000.0 (unit: Hz)
Example	[:SOURce:]PULSe:FREQency? 50.0	

[:SOURce]:PULSe:SPHase

Set → Query →

Description	Set or query start phase angle of PULSE mode.	
Syntax	[:SOURce:]PULSe:SPHase	
Query Syntax	[:SOURce:]PULSE:SPHase?	
Parameter/ Return parameter	<NR2>	Effective rang: 0.0~ 359.9
Example	[:SOURce:]PULSe:SPHase? 60.0	

[:SOURce]:PULSe:COUNt

Set → Query →

Description	Set or query how many times to execute PULSE voltage.
Syntax	[:SOURce:]PULSe:COUNt
Query Syntax	[:SOURce:]PULSE:COUNt?

Parameter/ Return parameter	<NR1>	Effective rang: 0 ~ 10000
Example	[:SOURce:]PULSe:COUNt?	
	500	

[:SOURce]:PULSe:DCYCle

Set → Query

Description	Set or query execution time of PULSE waveform, it must be no longer than total period in PULSE mode.
Syntax	[:SOURce:]PULSe:DCYCle
Query Syntax	[:SOURce:]PULSE:DCYCle?
Parameter/ Return parameter	<NR1> Effective rang: 1 ~ 59999 (unit: msec)
Example	[:SOURce:]PULSe:DCYCle?
	300

[:SOURce]:PULSe:PERiod

Set → Query

Description	Set or query total period of PULSE mode
Syntax	[:SOURce:]PULSe:PERiod
Query Syntax	[:SOURce:]PULSE:PERiod?
Parameter/ Return parameter	<NR1> Effective rang: 2 ~ 60000 (unit: msec)
Example	[:SOURce:]PULSe:PERiod?
	600

[:SOURce]:STEP:VOLTage:AC

Set → Query

Description	Set or query start voltage for STEP mode.
Syntax	[:SOURce:]STEP:VOLTage:AC
Query Syntax	[:SOURce:]STEP:VOLTage:AC?

Parameter/ Return parameter	<NR2>	Effective rang: 0.0 ~ 150.0 (low voltage range), 0.0 ~ 300.0 (high voltage range)
Example	[:SOURce:]STEP:VOLTage:AC? 150.5	

[:SOURce]:STEP:VOLTage:DC

Set → / → Query

Description	Set or query start voltage for STEP mode.	
Syntax	[:SOURce:]STEP:VOLTage:DC	
Query Syntax	[:SOURce:]STEP:VOLTage:DC?	
Parameter/ Return parameter	<NR2>	Effective rang: ±212.1 (low voltage range), ±424.2 (high voltage range)
Example	[:SOURce:]STEP:VOLTage:DC? -150.5	

[:SOURce]:STEP:DVOLTage:AC

Set → / → Query

Description	Set or query change of each step in STEP mode.	
Syntax	[:SOURce:]STEP:DVOLtage:AC	
Query Syntax	[:SOURce:]STEP:DVOLtage:AC?	
Parameter/ Return parameter	<NR2>	Effective rang: -150.0 ~ 150.0(unit: Volt)
Example	[:SOURce:]STEP:DVOLTage:DC? 20.5	

[:SOURce]:STEP:DVOLTage:DC

Set → / → Query

Description	Set or query change of each step in STEP mode.
Syntax	[:SOURce:]STEP:DVOLtage:DC
Query Syntax	[:SOURce:]STEP:DVOLtage:DC?

Parameter/ Return parameter	<NR2>	Effective rang: ±212.1 (low voltage range), ±424.2 (high voltage range)
Example	[:SOURce:]STEP:DVOLTage:DC? -20.5	

[:SOURce]:STEP:FREQency

Set → / → Query

Description	Set or query start frequency for STEP mode.	
Syntax	[:SOURce:]STEP:FREQency	
Query Syntax	[:SOURce:]STEP:FREQency?	
Parameter/ Return parameter	<NR2>	Effective rang: 30.0 ~ 1000.0 (unit: Hz)
Example	[:SOURce:]STEP:FREQency? 80.5	

[:SOURce]:STEP:DFREQency

Set → / → Query

Description	Set or query frequency change of each step in STEP mode.	
Syntax	[:SOURce:]STEP:DFREQency	
Query Syntax	[:SOURce:]STEP:DFREQency?	
Parameter/ Return parameter	<NR2>	Effective rang: -150.0 ~ 150.0(unit: Hz)
Example	[:SOURce:]STEP:DFREQency? -10.5	

[:SOURce]:STEP:SPHase

Set → / → Query

Description	Set or query start phase angle at STEP mode.
Syntax	[:SOURce:]STEP:SPHase
Query Syntax	[:SOURce:]STEP:SPHase?

Parameter/ Return parameter	<NR2>	Effective rang: 0.0~ 359.9
Example	[:SOURce:]STEP:SPHase?	
	80.5	

[:SOURce]:STEP:DWELl

Set → Query

Description	Set or query output duration time of each step in STEP mode.
Syntax	[:SOURce:]STEP:DWELl
Query Syntax	[:SOURce:]STEP:DWELl?

Parameter/ Return parameter	<NR2>	Effective rang: 1 ~ 60000.0 (unit: msec)
Example	STEP:SPHase?	
	1000.5	

[:SOURce]:STEP:COUNt

Set → Query

Description	Set or query how many steps to execute STEP mode.
Syntax	[:SOURce:]STEP:COUNt
Query Syntax	[:SOURce:]STEP:COUNt?

Parameter/ Return parameter	<NR1>	Effective rang: 0 ~ 10000
Example	[:SOURce:]STEP:COUNt?	
	500	

[:SOURce]:SYNThesis

Set → Query

Description	Set or query which synthesis waveform to use. There are DIS30 and DIS31 available.

Syntax	[:SOURce:]SYNThesis	
Query Syntax	[:SOURce:]SYNThesis?	
Parameter/ Return parameter	DST30	
	DST31	
Example	[:SOURce:]SYNThesis? DST30	

[:SOURce]:SYNThesis:AMPLitude

Set → / → Query

Description	Set or query voltage amplitude for each order of harmonic waveforms. Maximum order is 39.	
Syntax	[:SOURce:]SYNThesis:AMPLitude	
Query Syntax	[:SOURce:]SYNThesis:AMPLitude?	
	<NR2>...	Effective rang
	<NR2>	Order N=2~N=20, Gain limit 33.33%
		Order N=21~N=30, Gain limit 30.00%
		Order N=31~N=39, Gain limit 15.00%
	[:SOURce:]SYNThesis:AMPLitude? 20.55 33.10 2.55	

[:SOURce]:SYNThesis:PHASe

Set → / → Query

Description	Set or query phase for each order of harmonic waveforms.	
Syntax	[:SOURce:]SYNThesis:PHASe	
Query Syntax	[:SOURce:]SYNThesis:PHASe?	
	<NR2>...	Effective rang: 0.0 ~ 359.9
	<NR2>	
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Other Commands

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:VERion:DSP? 112
:VERion:LCM? 112
:VERion:UI? 113

:TRIG

Set → / → Query

Description	Set or query trigger status. Disabled when OUTPut:MODE = FIXE.
Syntax	:TRIG
Query Syntax	:TRIG?
Parameter	OFF
	ON
Return parameter	OFF
	RUNNING
Example	TRIG? TRIG ON

:VERion:DSP?

→ Query

Description	Query firmware version.
Syntax	:VERion:DSP?
Return Parameter	S00E02
Example	:VERion:DSP? S00E02

:VERion:LCM?

→ Query

Description	Query firmware version used for LCM.
Syntax	:VERion:LCM?

Return Parameter	S00E02
Example	:VERion:LCM? S00E02

:VERion:UI? → Query

Description	Query firmware version of UI.
Syntax	:VERion:UI?
Return Parameter	S00E02
Example	:VERion:UI? S00E02

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Protection

ASD-1150 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*
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*
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

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

Specifications

The operation specifications of ASD-1150 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±2°C unless specified otherwise.

Input ratings (AC rms)		
Nominal input voltage		100 Vac to 240 Vac (single phase)
Input voltage range		90 Vac to 254 Vac
Phase		Single phase, Three-wire
Nominal input Frequency		50 Hz to 60 Hz
Input frequency range		47 Hz to 63 Hz
Max. power consumption		1875 VA or less
Power factor		0.98 Min.
Max. input current		90Vac: 22A
AC mode output ratings (AC rms)		
Voltage	Setting Range	0.0 V to 150.0 V 0.0 V to 300.0 V
	Setting Resolution	0.1V
	Accuracy	± (0.2 % of set + 0.3 V/ 0.6 V)
Output phase		Single phase, Three-wire
Maximum current	150V	15 A (150V)
	300V	7.5 A (300V)
Maximum peak current	150V	90 A (30Hz~100Hz) 75A (>100Hz~1kHz)
	300V	45 A (30Hz~100Hz) 38A (>100Hz~1kHz)
Load power factor		0 to 1(leading phase or lagging phase)
Power capacity		1500 VA
Frequency	Setting range	AC Mode: 30.0 Hz to 1000.0 Hz, AC+DC Mode: 1 Hz to 1000.0 Hz

	Setting resolution	0.1 Hz (30.0 to 1000.0 Hz)
	Accuracy	0.15%
Output on phase		0.0° to 359.9° variable (setting resolution 0.1°)
Output rating for DC mode		
Voltage	Setting Range	-212 V to +212 V/ -424 V to +424 V
	Setting Resolution	0.1 V
	Accuracy	± (0.2 % of set + 0.424 V/ 0.848 V)
Maximum current	150 V	7 A
	300 V	3.5 A
Maximum peak current	150 V	14 A
	300 V	7 A
Power capacity		0.1%
Output voltage stability		
Line regulation	0.1%	
Load regulation	0.2%	
Output voltage waveform distortion ratio, Output voltage response time, Efficiency		
Output voltage waveform distortion ratio	1% or less	
Output voltage response time	100 us (TYP)	
Efficiency	78 % typ. At full load, 110Vac input voltage	
Measured value display		
Voltage	RMS, AVG value Resolution	0.1 V
	PEAK value Resolution	0.1 V
Current	RMS, AVG value Resolution	0.01 A
	PEAK value Resolution	0.01 A
Power	Active (W) Resolution	0.1W
	Apparent (VA) Resolution	0.1 VA
	Reactive (VAR) Resolution	0.1 VAR

Load power factor	Range	0.000 to 1.000
	Resolution	0.001
Load crest factor	Range	1.2 to 1.414
	Resolution	0.001
Harmonic voltage	Range	Up to 39th order of the fundamental wave
Others		
Protections	UVP, OCP, OPP, SCP, OTP, FAN FAIL	
Display	STN-LCD, 6 inch	
Memory Function	Store and recall settings, Basic settings: 4 (0~3 numeric keys)	
Arbitrary Wave Number of memories	30 (nonvolatile)	
General Specifications		
Interface	GPIB	IEEE 488.2 compliant interface
	RS-232C	Complies with the EIA-RS-232 specifications
	EXT Control	External Control I/O
Withstand voltage	Between input and chassis, output and chassis, input and output	2210 Vac, 1 minute
EMC	EN 61326-1	
	EN 61326-2-2	
	EN 61000-3-2 (Class D)	
	EN 61000-3-3	
	EN 61000-4-2/-4-3/-4-4/-4-5/-4-6/-4-8/-4-11 (Class A, Group 1)	
	EN 55011 (Class A, Group1)	

Safety	EN 61010-1	
Environment	Operating environment	Indoor use, Overvoltage Category II
	Operating temperature range	0 °C to 40 °C
	Storage temperature range	-40 °C to 85 °C
	Storage humidity range	90 % RH or less (no condensation)
	Altitude	Up to 2000 m
Dimensions (mm)		425(W) × 133(H) × 525(D)
Weight		22kg

Certificate Of Compliance

We

GOOD WILL INSTRUMENT CO., LTD.

declare that the CE marking mentioned product

satisfies all the technical relations application to the product within the scope of council:

Directive: EMC; LVD; WEEE; RoHS

The product is in conformity with the following standards or other normative documents:

◎ EMC	
EN 61326-1	Electrical equipment for measurement, control and laboratory use –– EMC requirements
Conducted & Radiated Emission EN 55011 / EN 55032	Electrical Fast Transients EN 61000-4-4
Current Harmonics EN 61000-3-2 / EN 61000-3-12	Surge Immunity EN 61000-4-5
Voltage Fluctuations EN 61000-3-3 / EN 61000-3-11	Conducted Susceptibility EN 61000-4-6
Electrostatic Discharge EN 61000-4-2	Power Frequency Magnetic Field EN 61000-4-8
Radiated Immunity EN 61000-4-3	Voltage Dip/ Interruption EN 61000-4-11 / EN 61000-4-34
◎ Safety	
EN 61010-1 :	Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements

GOODWILL INSTRUMENT CO., LTD.
No. 7-1, Jhongsing Road, Tucheng District, New Taipei City 236, Taiwan
Tel: +886-2-2268-0389 Fax: +886-2-2268-0639
Web: http://www.gwinstek.com Email: marketing@goodwill.com.tw
GOODWILL INSTRUMENT (SUZHOU) CO., LTD.
No. 521, Zhujiang Road, Snd, Suzhou Jiangsu 215011, China
Tel: +86-512-6661-7177 Fax: +86-512-6661-7277
Web: http://www.instek.com.cn Email: marketing@instek.com.cn
GOODWILL INSTRUMENT EURO B.V.
De Run 5427A, 5504DG Veldhoven, The Netherlands
Tel: +31-(0)40-2557790 Fax: +31-(0)40-2541194
Email: sales@gw-instek.eu

TTL Pin Assignment

9-PIN D-SUB female connector

Pin number	1	2	3	4
Signal	GND	Remote inhibit	GND	AC-ON

Pin number	5	6	7	8	9
Signal	---	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 OUT key to resume output and enable TTL detection.
- EXCITE: In operation of LIST, PULSE or STEP modes, when at triggering page (please refer to section LIST Mode until STEP Mode on page 55 for details), 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.

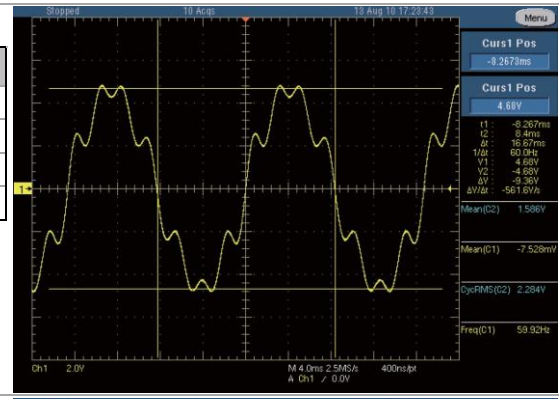
FAULT-OUT

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

Built In Waveforms

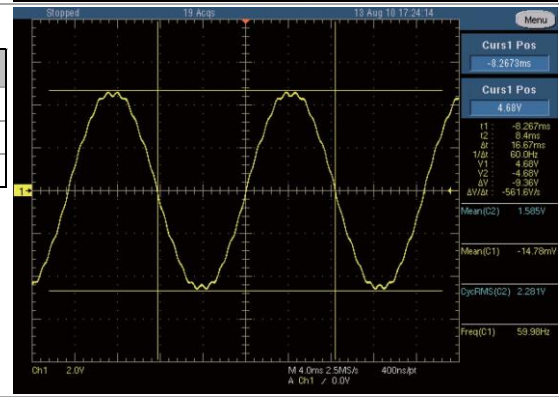
DST 0

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



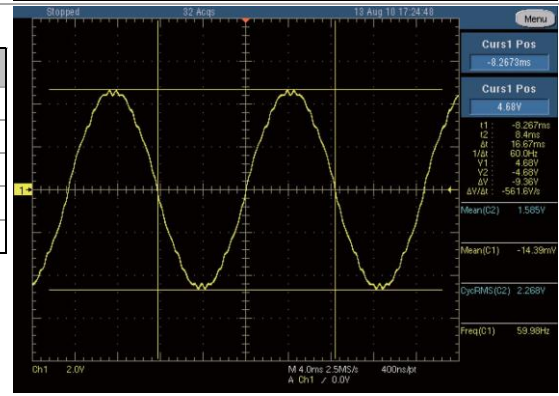
DST 1

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



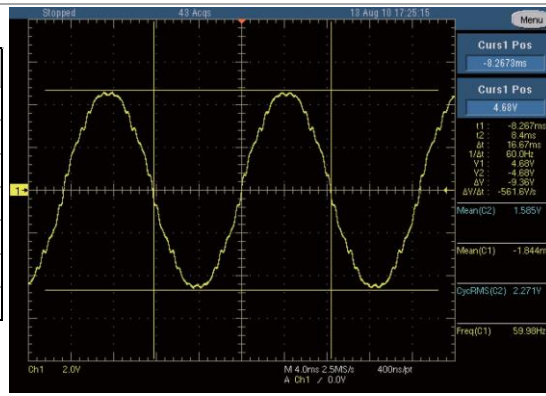
DST 2

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



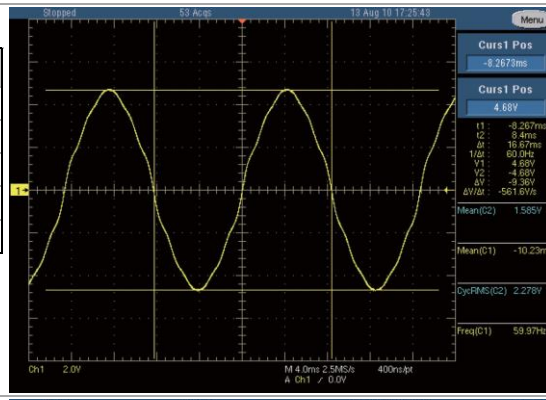
DST 3

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



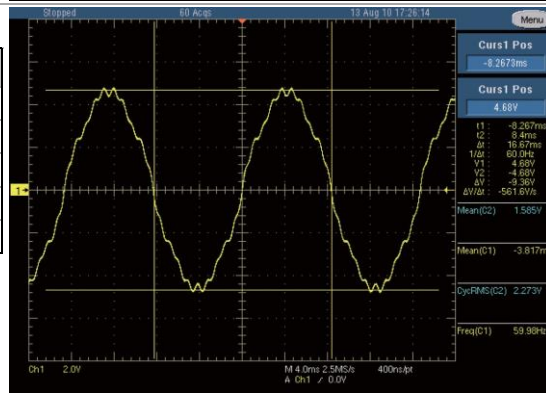
DST 4

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



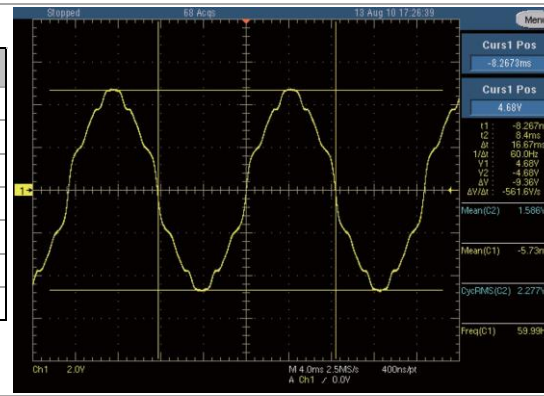
DST 5

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



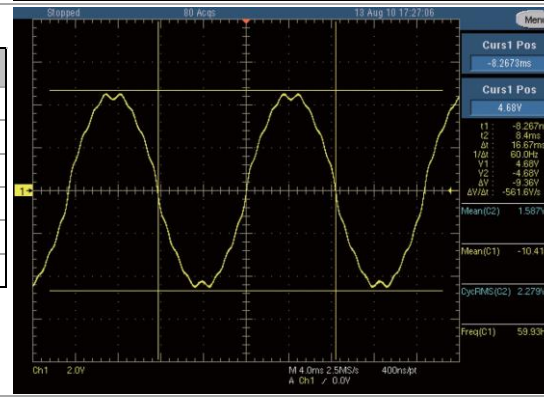
DST 6

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



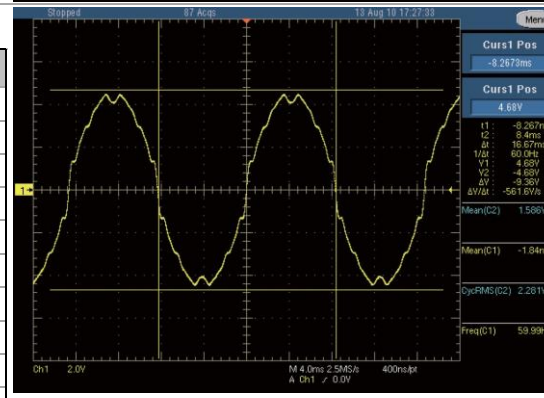
DST 7

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



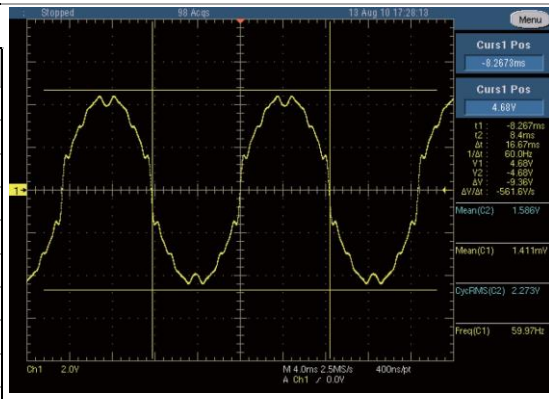
DST 8

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



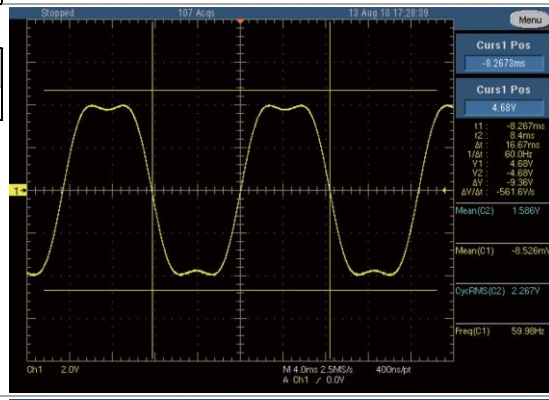
DST 9

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



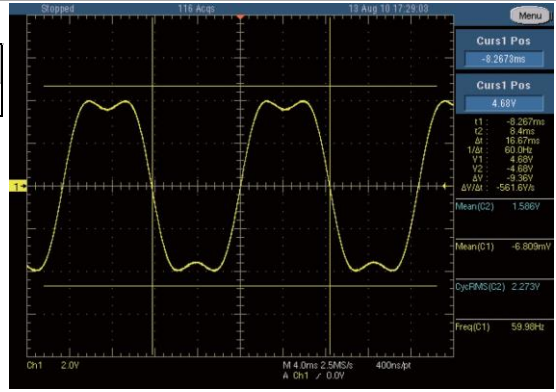
DST 10

Order	Gain	Phase
3	17.75	0.0



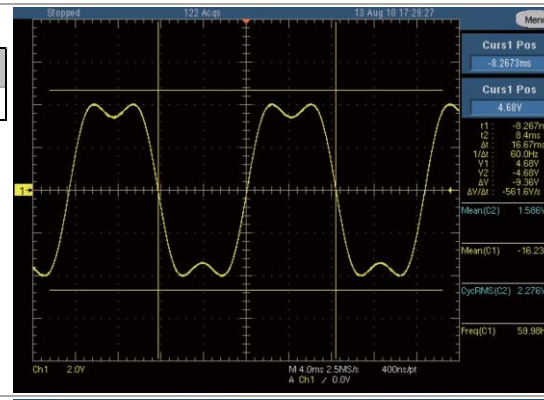
DST 11

Order	Gain	Phase
3	21.25	0.0



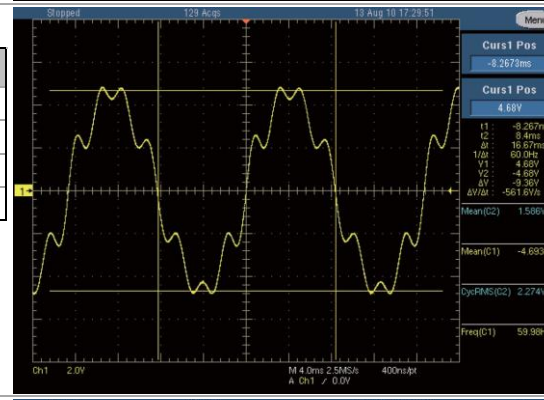
DST 12

Order	Gain	Phase
3	24.50	0.0



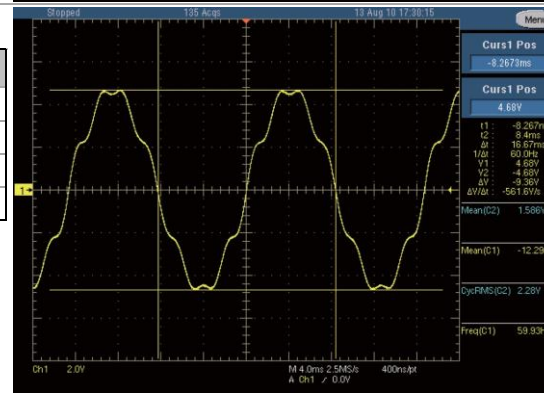
DST 13

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



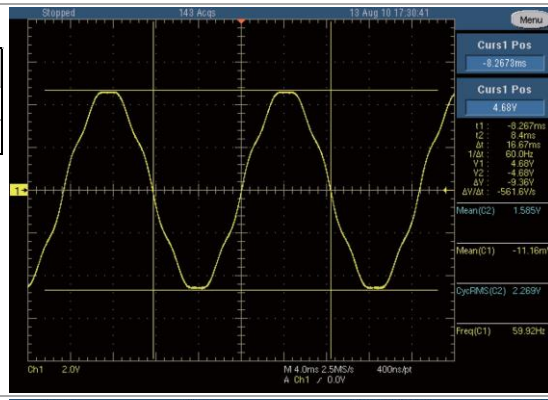
DST 14

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



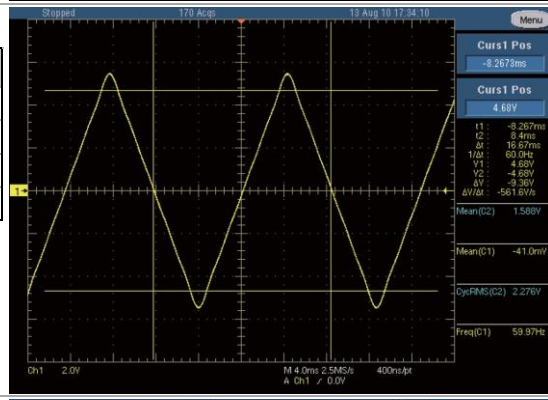
DST 15

Order	Gain	Phase
5	1.15	0.0
7	4.90	0.0



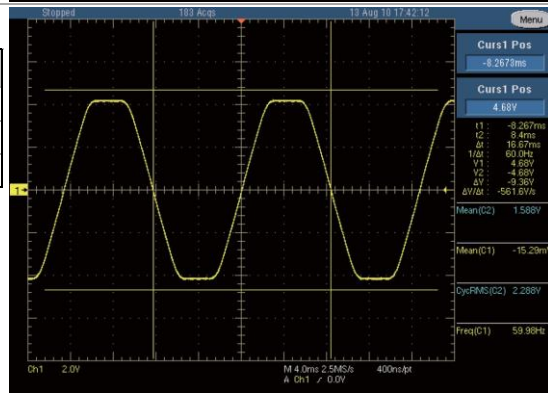
DST 16

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



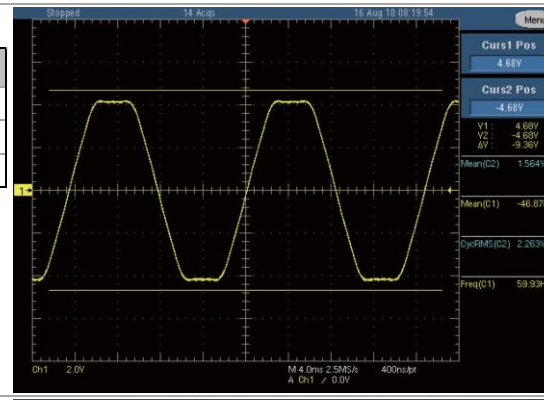
DST 17

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



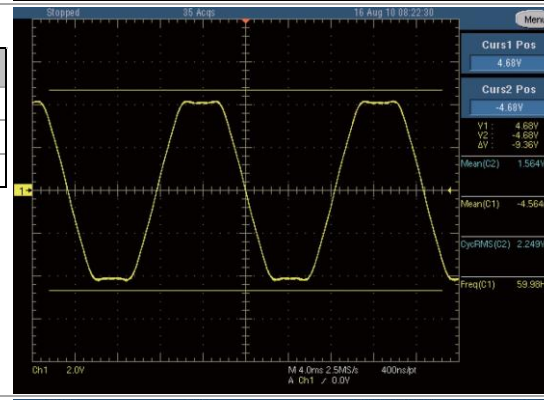
DST 18

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



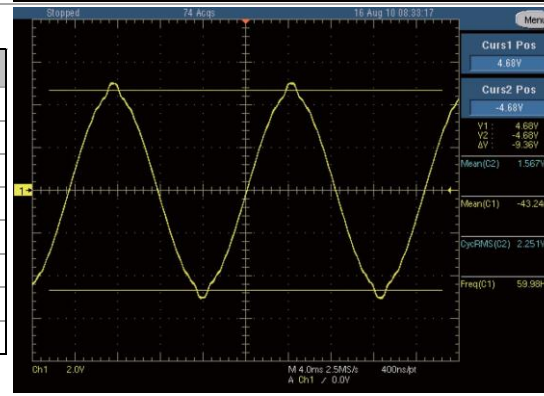
DST 19

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



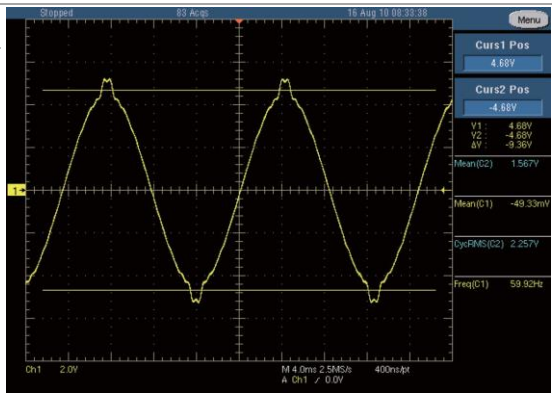
DST 20

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



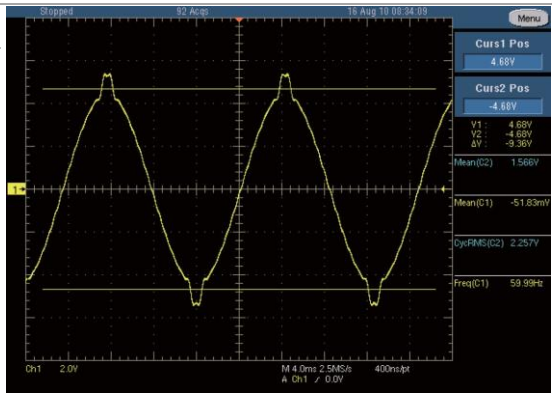
DST 21

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



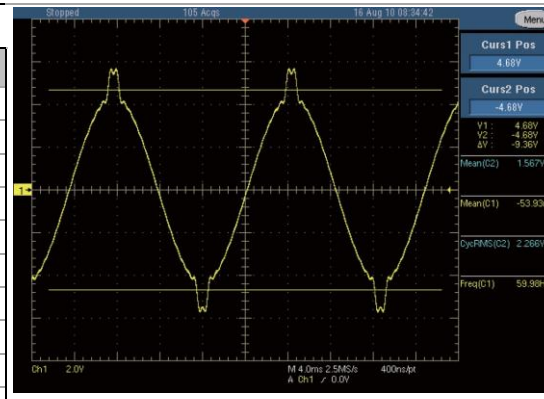
DST 22

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



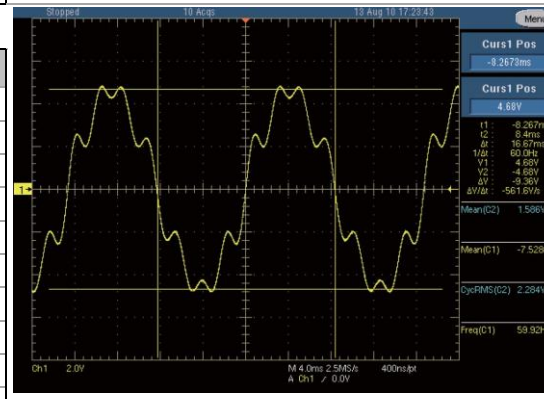
DST 23

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	0.8	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



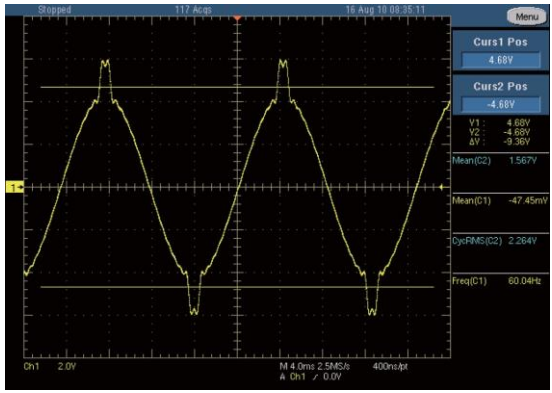
DST 24

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



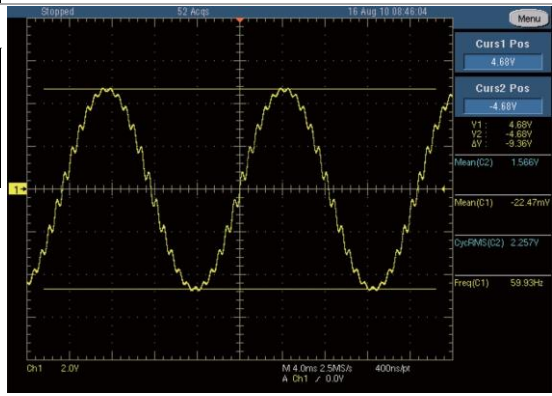
DST 25

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



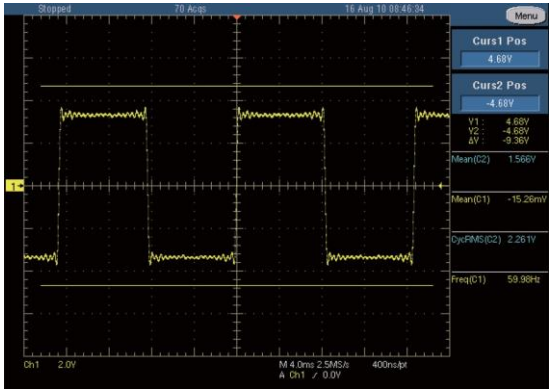
DST 26

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



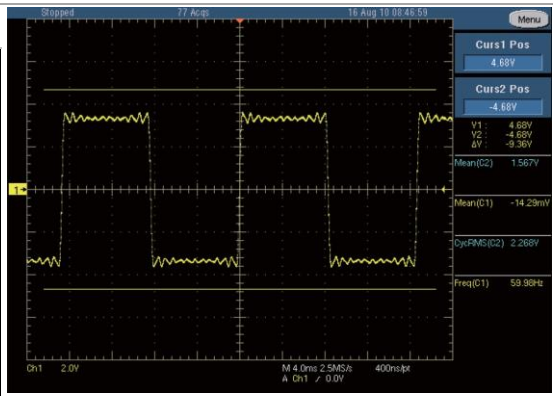
DST 27

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