Programmable AC Power Source

User′s manual

APS-7000 series

MATRIX TECHNOLOGY INC.

CONTENTS

SAFETY INSTRUCTION

This chapter contains important safety instructions that you must follow when operating the AC power source and when keeping it in storage. Read the following before any operation to insure your safety and to keep the best condition for the instrument.

Safety Symbols

The following safety symbols may appear in this manual or on the instrument:

	**WARNING**	Identifies conditions or practices that could result in injury or loss of life.
	**CAUTION**	Identifies conditions or practices that could result in damage to the instrument or to other properties.
	**DANGER**	High voltage
	**ATTENTION**	Refer to the manual
		Protective conductor terminal
		Earth ground

Safety Guidelines

	● Before plugging into local AC mains, check and make sure that the output voltage is compatible to the load. (It is suggested to disconnect a load before plugging into local AC mains. ● Do not use this instrument near water. ● Do not operate or touch this instrument with wet hands. ● Do not open the casing of the instrument when it is connected to AC mains. ● Avoid touch the metal contact part of the output terminals. ● Do not use the instrument in an atmosphere which contains sulfuric acid mist or other substances which cause corrosion to metal. ● Do not use the instrument in a dusty place or a highly humid place as such will cause instrument reliability degradation and instrument failures. ● Install the instrument in a place where is free from vibration. ● Install the instrument in a place where the ambient temperature is in range of -20~60˚C. Note that the instrument operation may become unstable if it is operated in an ambient temperature exceeding the range of 0~40˚C
AC power source 	AC Input voltage: 220V (single phase) ±10%, 47-63Hz Connect the protective grounding conductor of the AC power cord to an earth ground to avoid electrical shock.
Fuse 	● Make sure the correct type of fuse is installed before power up. ● Replace the AC fuse with the same type and rating as the original fuse. ● Disconnect the power cord before fuse replacement. ● Make sure the cause of fuse blowout is fixed before fuse replacement.

1. KEY POINTS TO INSTALLATION

This chapter introduces the rules of product unpacking, examination, preparation of pre-use and storage.

1.1 Unpacking and Examination

1. Unpack the AC power source and check the enclosed accessories.
2. The product is sealed in a packing carton which is protected by EPE foam. If there are any damages with the packing carton, please check the AC power source and see if there is any deformation, scratch or panel damaged.
3. In case of any damage, please inform us or local distributor immediately. Our service center will maintain it or replace it with a new one. However, please do not return it without a notification to us or local distributor.

Packing list:

AC power source: 1 unit RS-232 cable: 1pc (optional)

Operation manual: 1 pc

1.2 Preparation before Use

Input Power

The input power requirements of the instrument are 110Vac or 220Vac±10% (47-63Hz) single phase. Please use a proper input power before turn on the AC power source, and use a fuse with same specification of the original. The fuse specification is indicated on the rear panel of the AC power source.

 **WARNING**	Disconnect the power cord before fuse replacement.
 **WARNING**	Always keep good connection of the grounding wire and make sure to connect the grounding wire to the earth. The 3-pin power plug of the AC power source must be connected to a socket with grounding wire. To use a longer wire, make sure it is perfectly grounded to the earth. When the 3-pin power plug of the AC power source is plugged into a socket with grounding wire, the AC power source has been grounded to the earth.

Operation Environment

Location: The installation sites must be away from chemical deposition, explosive material, sulfuric acid mist or other substances which cause corrosion to metal. The installation site shall always keep lean and dry, and free from dusty, high humidity and vibration.

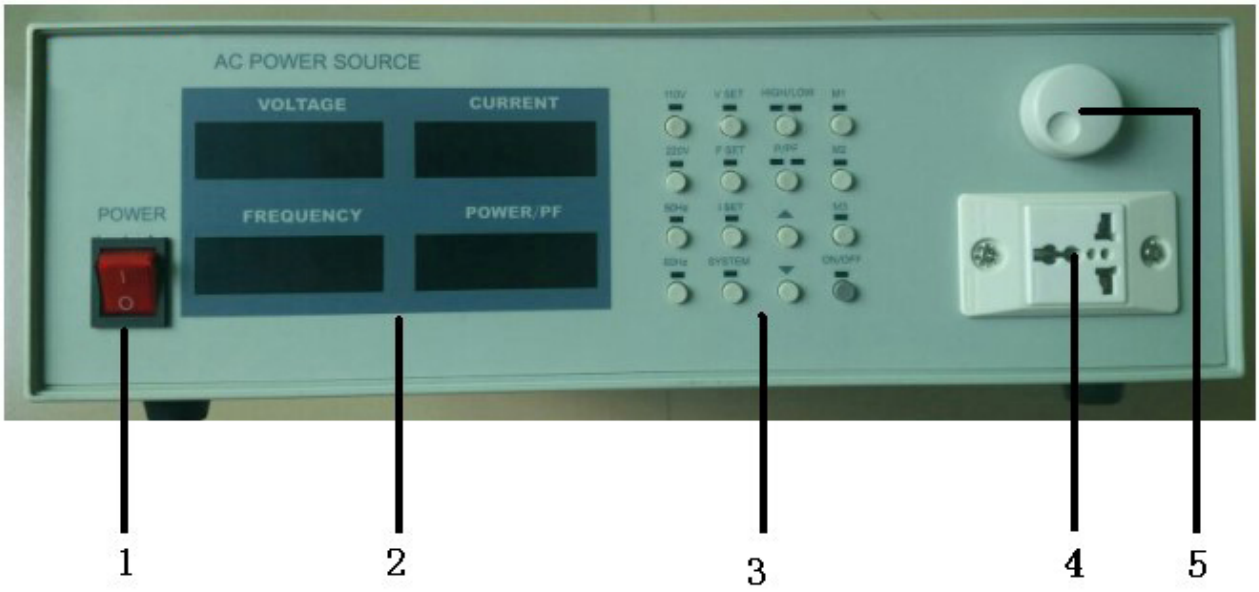
Temperature: 0˚C to 40˚C Relative Humidity: 10%~ 90% Altitude: <2000 feet

2. SPECIFICATIONS

Model		APS-4000A	APS-4000B	APS-4000C	APS-7105	APS-7100	APS-7200	APS-7300	APS-7500
Capacity		350VA	700VA	1200VA	500VA	1KVA	2KVA	3KVA	5KVA
Circuit mode		IGBT/SPWM							
Input		Single phase 110V/220V±10%, 47-63Hz							
Output									
Phase		Single phase							
Voltage		Low range 1.00V-150.00V / High range 1.00V-300.00V							
Frequency		45-250Hz, step 0.1Hz							
Max. current	Low range	3A	6A	10A	4.2A	8.4A	16.8A	25A	42A
	High range	1.5A	3A	5A	2.1A	4.2A	8.4A	12.5A	21A
Load regulation		≤1%							
Line regulation		≤1%							
Harmonic distortion		≤2% (resistive load, L=120V, H=240V)							
Frequency stability		≤0.01%							
Crest factor		1.41±0.10							
Efficiency		≥75%							
Response time		Max. 20ms							
Frequency resolution		0.01Hz							
Voltage resolution		0.01V							
Current resolution		0.001A							
Power resolution		4 digits LED, resolution 0.001W /0.001kW							
Power factor resolution		3 digits LED, resolution 0.01							
Measuring accuracy	Voltage	±0.5%full scale +5 digit							
	Current	±0.5%full scale +5 digit							
	Frequency	±0.01%full scale +5 digit							
	Power	±0.5%full scale +5 digit							
Setting accuracy	Voltage	±1%full scale							
	Frequency	±0.1%full scale							
Communication interface		N/A			RS232				
Preset function		Preset output voltage, output frequency							
Fast key function		Fast key for 110V / 220V, 50Hz /60Hz							
Alarm function		Audible and visual alarm once protective activated; display error code on LED							
Protection		Fast-response circuit to detect over current, over load, over temperature and short circuit; Output will be shut down in protection mode.							
Cooling		Cooling fan							
Operation environment		0°C-40°C, ≤90% RH(Non-condensing), Altitude: 2000 feet							
Dimension (mm)		365Wx145Hx450D			430Wx133xH480D		430Wx222Hx480D		
Weight (kg)		13.5	16	20	20	25	30	50	80

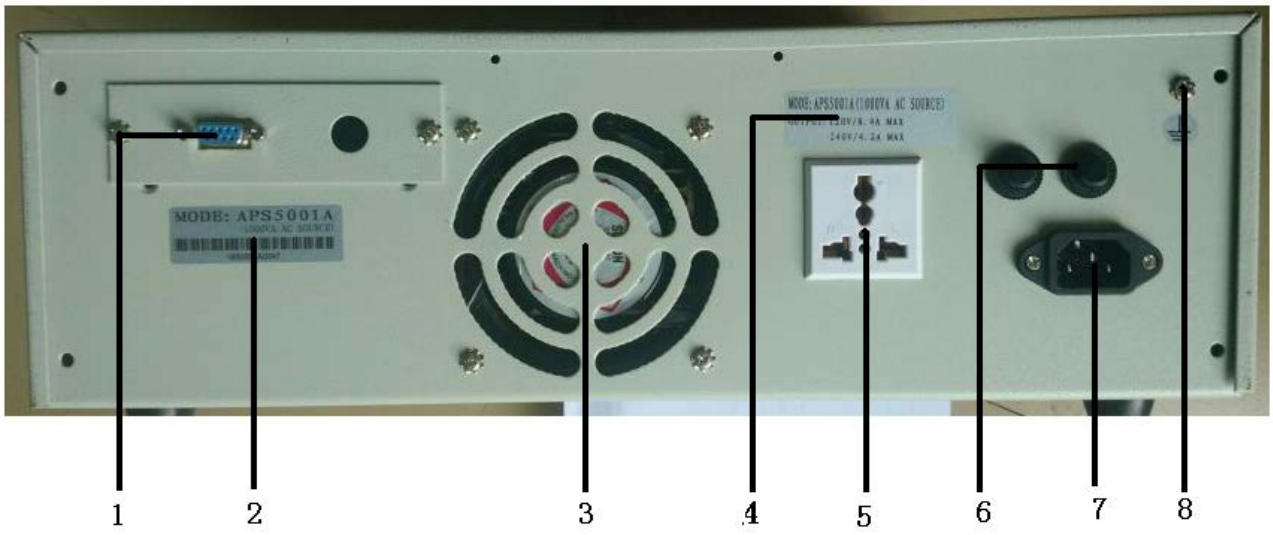
3. PANEL DESCRIPTION

3.1 Front Panel Description



1	Power switch	4	Output socket
2	Display meter	5	Rotary knob
3	Function keys		

3.2 Rear Panel Description



1	RS232 interface	5	Output socket
2	Serial number	6	Over current protector
3	Cooling fan	7	Input socket
4	Rating label	8	GND terminal

3.3 Function Keys

Keys	Description
110V	Fast key for 110V voltage output.
220V	Fast key for 220V voltage output.
50Hz	Fast key for 50Hz frequency output.
60Hz	Fast key for 60Hz frequency output.
V Set	Press it to enter voltage setting mode.
F Set	Press it to enter frequency setting mode.
I Set	Press it to enter current limit (maximum current) setting mode.
SYSTEM	Press it to enter set system configuration.
HIGH/LOW	Press it to switch between high range and low range. It is default at high range and its indicator lights on.
P/PF	Press it to switch display between power and power factor on the watt meter. It is default for power display and its indicator lights on.
▲	Upper key. Press it to increase parameter (voltage/frequency/current) value.
▼	Lower key. Press it to decrease parameter (voltage/frequency/current) value.
M1, M2, M3	Memory keys. Make a short press to recall parameters. Make a long press (>1s) to store parameters.
ON/OFF	Press it to turn on or off the output.

4. OPERATION INSTRUCTIONS

WARNING

- Before connecting to local AC mains, check and make sure to use correct AC power input (110V or 220V).
- To avoid electrical shock, connect the protective grounding conductor of the AC power cord to an earth ground.
- Switch off all front panel keys.
- Ensure 200mm space for front and back sides of the AC power source to ensure good ventilation.
- Do not use the AC power source when there is thundery weather.

4.1 Set Voltage

In standby mode or output mode, press **V SET** key to enter voltage setting mode. Press ▲or ▼ key to increase or decrease voltage value. There are four adjustment steps for the two keys: 0.01V, 0.1V, 1V and 10V. Press the key for one time, then the voltage changes by 0.01V. If long press the key, the adjustment step changes from low to high every 0.3 second. The voltage changes faster and faster. If the new voltage value remains for 2s without change, the voltage meter flashes for two times and then the new voltage is output and displayed.

In voltage setting mode, the voltage can also be set by the rotary knob. According to rotary speed from slow to fast, the adjustment step is 0.01V, 0.1V and 1V. With faster rotary speed, the adjustment step changes from 0.01V to 1V.

There are two ranges for output voltage: low range 0-150V and high range 0-300V. The voltage range is default at high range. The output voltage can be adjusted within the selected range.

4.2 Set Frequency

In standby mode or output mode, press **F SET** key to enter frequency setting mode. The output frequency can be set from 45Hz to 250Hz, with adjustment step 0.1Hz, 1Hz and 10Hz. Frequency adjustment is in the same way as voltage adjustment.

4.3 Set Current Limit

In standby mode or output mode, press **I SET** key to enter current limit setting mode. For different models, the maximum current limit is different. Please refer to specifications. The current limit

adjustment step differs for different models too, 0.001A, 0.01A, 0.1A and 1A. The current limit adjustment is in the same way as voltage adjustment.

4.4 High/Low Switch

Press the **HIGH/LOW** key to switch between high range and low range. The rated current in high range is half of the rated current in low range. Please refer details of rated current to specifications.

DO NOT switch voltage range when the output is ON. Such operation will cause output shutdown for about 20ms and may cause unstable output.

There are two ranges for output voltage: low range 0-150V and high range 0-300V. The voltage range is default at high range. The output voltage can be adjusted within the selected range.

4.5 ON/OFF Key

Press the **ON/OFF** key to turn on or off output. When the **ON/OFF** indicator lights on, the output is on. When the **ON/OFF** indicator lights off, the output is off.

In output mode, if error happens during output, the output will be shut down immediately. The output indicator will flash and the beeper will alarm. To stop beeper alarm, press **ON/OFF** key. To reset, press **ON/OFF** key again. To start output, press **ON/OFF** key once more.

4.6 Memory Key

There AC power source can store three sets of voltage and frequency settings. There are one key for each memory: **M1**, **M2** and **M3**. After setting up voltage and frequency values, press one of the memory keys to store the settings. The stored settings can be recalled by making a short press on its memory key.

4.7 System Setup

In standby mode, press **SYSTEM** key to enter system setup mode. Make a short press on **SYSTEM** key one by one to display parameter in the sequence of baud rate, panel lock, output, commands, delay time and address.

When a parameter is displayed, press ▲or ▼ key to change its setting.

Parameter	**Display**	**Description**
Baud rate		Press ▲or ▼ key to change baud rate as 2400, 4800, 9600, 19200 or 38400. Default: 9600
Panel lock		The panel lock can be set at ON or OFF by pressing ▲or ▼ key. When it is at ON, the front panel keys are locked. Only “ON/OFF” key and “SYSTEM” key can be used. Default: OFF
Output status		The output status can be set at ON or OFF by pressing ▲or ▼ key. When it is at ON, the AC power source makes output right after it is powered on. The front panel keys are locked. Default: OFF
Commands		The commands used for this AC power source can be chosen by pressing ▲or ▼ key from 3 modes: “0”: turn off remote communication “1”: use ASCII commands “2”: use HEX commands Default: 1
		Undeveloped codes
Delay time		The output delay time can be set by pressing ▲or ▼ key from 0.001s to 99.999s. Default: 0.3s
Address		The communication address can be set by pressing ▲or ▼ key from 0 to 30. Default: 1

5. REMOTE CONTROL

5.1 Serial Port

The power supply is equipped with RS232 interface, supporting commands in ASCII and HEX codes. There is PC software to facilitate remote control by PC.

5.2 Communication Commands

5.2.1 Commands to Query Parameters

Commands	**Parameters**	**Description**
?MAXPOW		To query maximum power.
?MAXVOL		To query maximum voltage.
?MAXCUR		To query maximum current.
?MAXFRE		To query maximum frequency.
?MINFRE		To query minimum frequency.

5.2.2 Commands to Set Parameters

Commands	Parameters	Description
PON		To turn on output.
POFF		To turn off output.
SVOL n		To set voltage.
SFRE n		To set frequency.
SCUR N		To set current limit.
?SVOL		To query the present setting voltage.
?SFRE		To query the present setting frequency.
?SCUR		To query the present setting current limit.
?MVOL		To query the present measuring voltage.
?MFRE		To query the present measuring frequency.
?MCUR		To query the present measuring current limit.
?MPF		To query the present measuring power factor.
?MPOW		To query the present measuring power.

5.2.3 Complete Command Frame

1. Request Frame

Frame format: ID (1 byte) + function code (1 byte) + data (4 byte) + check code (1 byte)

Command			**Description**
Instrument ID	1-28		ID of the AC power source.
Command	ASCII	HEX	
	'R'	0x52	Read data
	'W'	0x57	Write data
	'X'	0x58	Reset software
Function code	Refer to details in the next table		The parameter for operation.
Data	High byte follows low byte.		Write data: write data to the AC power source.
			Read data: data reply to the PC.
			Reset command: ignored.
Check code			The accumulated sum of the first seven bytes.

Note: The AC power supply will not return any commands after receiving reset software command.

2. Function Code

Function Code	**Function Description**	**Data Description**		**Meaning of Read Data**	**Meaning of Written Data**
0x30	Output mode	0 byte	Over current or not	1: Over current 0: Normal	0: Remove over current mark
		1 byte	Malfunction alarm	1: Malfunction 0: Normal	1: Reset to remove alarm mark
		2 byte	In high range or low range	1: High range 0: Low range	Ignored
		3 byte	Output on or off	1: Output on 0: Output off	Ignored
0x31	Targeted frequency	Frequency value, 4 bytes, unit 0.1Hz, range 450-2500.		The present frequency	The updated frequency
0x32	Targeted voltage in high range	Voltage value, 4 bytes, unit 0.1V, range 0-3000.		The present voltage	The updated voltage. If the previous voltage e is in low range, it will be switched to high range.
0x33	Targeted voltage for auto range	Voltage value, 4 bytes, unit 0.1V, range 0-3000.		The present voltage	The updated voltage. Voltage range will be changes accordingly. Voltage above 1500, switch to high range.
0x34	Max. output current	Current in 4 bytes, unit 0.001A, range below 30000.		Current limit value.	Current limit value.
0x35	Output on/off	Output status, 4 bytes (only read status).		1: Output on 0: Output off.	Turn on output.
0x36	Output on/off	Output status, 4 bytes (only read status).		1: Output on 0: Output off.	Turn off output.
0x4A	Serial number	4 bytes		Serial number	Cannot write

0x60	Irms	RMS current, 4 bytes, unit 0.001A	RMS current value	Cannot write
0x61	Vrms	RMS voltage, 4 bytes, unit 0.1V	RMS voltage value	Cannot write
0x62	Ipeak	RMS peak current, 4 bytes, unit 0.001A	Peak current value	Cannot write
0x63	Vpeak	RMS peak voltage, 4 bytes, unit 0.1V	Peak voltage value	Cannot write
0x64	Pva	Apparent power, 4 bytes, unit 0.1VA	Apparent power value	Cannot write
0x65	Pw	Active power, 4 bytes, unit 0.1W	Active power value	Cannot write
0x66	Pf	Power factor, 4 bytes, unit 0.001	Power factor value	Cannot write
0x67	Freq	Frequency, 4 bytes, unit 0.1Hz	Frequency value	Cannot write

5.2.4 Examples of Command Frame

The following examples of command frames are given in HEX code, with instrument ID as 0x01.

1) Set voltage of auto range at 120V

   Request frame: 01 57 33 B0 04 00 00 3F

   Replay frame: 01 57 33 B0 04 00 00 3F

2) Set voltage of auto range at 240V

   Request frame: 01 57 33 60 09 00 00 F4

   Replay frame: 01 57 33 60 09 00 00 F4

3) Set voltage of high range at 120V

   Request frame: 01 57 32 B0 04 00 00 3E

   Reply frame: 01 57 32 B0 04 00 00 3E

4) Set voltage of high range at 240V

   Request frame: 01 57 32 60 09 00 00 F3

   Reply frame: 01 57 32 60 09 00 00 F3

5) Set frequency at 60Hz

   Request frame: 01 57 31 58 02 00 00 E3

   Reply frame: 01 57 31 58 02 00 00 E3

6) Set output ON

   Request frame: 01 57 35 00 00 00 00 8D

   Reply frame: 01 57 35 01 00 00 00 8E

7) Set output OFF

   Request frame: 01 57 36 00 00 00 00 8E

   Reply frame: 01 57 36 00 00 00 00 8D

8) Clear error

   Request frame: 01 57 30 00 01 00 00 89

   Reply frame: 01 57 30 00 00 00 00 88

Remarks:

1) The request frames of setting voltage and setting frequency shall be sent before sending request frame of setting output on. During output on, if a new request frame of setting voltage or frequency is sent, the AC power source will response immediately and makes new output.
2) The AC power source stops output immediately once the request frame of setting output off is sent.
3) If the output is short circuit or error occurs, send the request frame to clear error. The output will be turned off immediately.

6. MAINTENANCE

6.1 Inspection

- Inspect the AC power source at regular intervals so that it maintains its initial performance for a long time.
- Check the input power cord for damage of the vinyl cover and overheating of the plug and cord stopper. Check the terminal screws and binding posts for loosening.
- Remove dust from the inside of the casing and ventilation holes of the cover by using a compressed air of the exhaust air of a vacuum cleaner.
- If the AC power source has not been used for a long time, please power on the AC power source to warm up for two hours every three months.

6.2 Cleaning

- Before cleaning, disconnect the AC mains.
- To clean the AC power source, use a soft cloth dampened in a solution of mild detergent and water. Do not spray cleaner directly onto the AC power source, since it may leak into the cabinet and cause damage.
- Do not use chemicals containing benzene, benzene, toluene, xylene, acetone, or similar solvents.
- Do not use abrasive cleaners on any portion of the AC power source.

6.3 Modification

No any modifications to the circuit or the components can be made to the AC power source by the users. In case of any modifications by the users, the warranty will automatically expire with the AC power source. And we do not take any responsibility hereafter incurred. If the returned unit be found with any modifications, we will make the AC power source to the original status and charge for maintenance service.