

User Manual

MPS-3600LP/6000LP Series Programmable DC Power Supply

MATRIX TECHNOLOGY INC.

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Chapter 1 Product Introduction

MPS-3600LP/6000LP series is the high-quality programmable DC power supply of new generation, and this series of products can be equipped with communication interface. MPS-3600LP/6000LP series power supply has the characteristics of both desktop type and system type, and can be freely matched with other instruments to integrate into the test system with special functions so as to meet measurement demands on different occasions, and the program can be edited through panel keyboard to bring great convenience to users. It is an alternative product of the ordinary programmable power supply, and has advantage of high cost performance.

This series of power supply boasts of the following characteristics:

- Non-polar servo, intelligent fan system
- Multi-group data storage
- Standard instrument rack design
- Support RS232, communication

Chapter 2 Technical Specification

2.1 Main technical specifications

Technical specifications form of MPS-3600LP/6000LP series power supply:

Model number		MPS-3603LP (36V/3A)	MPS-3605LP (36V/5A)	MPS-3610LP (36V/10A)	MPS-6003LP (60V/3A)	MPS-6005LP (60V/5A)
Rated input voltage		AC 220V/110V±5%				
Rated output voltage		0.01V-36V			0.01V - 60V	
Rated output current		0.005A - 3.1A	0.005A - 5.1A	0.005A - 10.1A	0.005A - 3.1A	0.005A - 5.1A
Voltage changing mode		Linear power supply				
Load regulation rate	Voltage	0.05%+5mV	0.05%+8mV	0.05%+10mV	0.05%+5mV	0.05%+8mV
	Current	0.1%+5mA	0.1%+5mA	0.1%+8mA	0.1%+5mA	0.1%+5mA
Power supply regulation rate	Voltage	0.05%+5mV	0.05%+8mV	0.05%+10mV	0.05%+5mV	0.05%+8mV
	Current	0.1%+5mA	0.1%+5mA	0.1%+8mA	0.1%+5mA	0.1%+5mA
Resolution of setting value	Voltage	10mV				
	Current	1mA				
Accuracy of setting value	Voltage	≤0.1%+2 byte				
	Current	≤0.2%+3byte	≤0.2%+3byte	≤0.2%+6byte	≤0.2%+2byte	≤0.2%+3byte
Resolution of readback value	Voltage	10mV				
	Current	1mA				
Readback accuracy	Voltage	≤0.1%+2byte	≤0.1%+2byte	≤0.1%+2byte	≤0.1%+2byte	≤0.1%+2byte
	Current	≤0.2%+3byte	≤0.2%+3byte	≤0.2%+6byte	≤0.2%+3byte	≤0.2%+3byte
Temperature	Operating environment	0 to 40 °C ≤ 85 R.H.				
	Storage environment	-15 to 70 °C ≤ 85 R.H.				
Size (W*H*D(mm))		214*108*305		214*108*365		
Packing weight (net weight)		5.2Kg		6.2Kg		

2.2 Supplementary characteristics

Status memory capacity: 9 groups of operating status

Recommended calibration frequency: once a year

Cooling mode: forced air cooling

Temperature of operating environment: 0 to 40°C

Temperature of storage environment: -20 to 70°C

Using environment: indoor use design, pollution class: 2, maximum humidity: 90%

Chapter 3 Quick Start

This chapter will briefly introduce the appearance and basic functions of MPS-3600LP/6000LP series power supply, so that you can get quick understanding of MPS-3600LP/6000LP series power supply. At the same time, you are told of the basic inspection that you need to do after getting the power supply, so as to ensure the normal operation of this product.

3.1 Introduction to front and rear panels

Front panel of MPS-3600LP/6000LP series power supply is shown in the Figure below.



Figure 3.1

- ① The upper part of the front panel is a black LED display screen and knob.
- ② The lower part of the front panel (from left to right) is 0-9 numeric keys, ESC exit key, functional keys, up and down keys, Enter key, input and output terminals in turn.

The layout of rear panel of MPS-3600LP/6000LP series is shown in the Figure below.

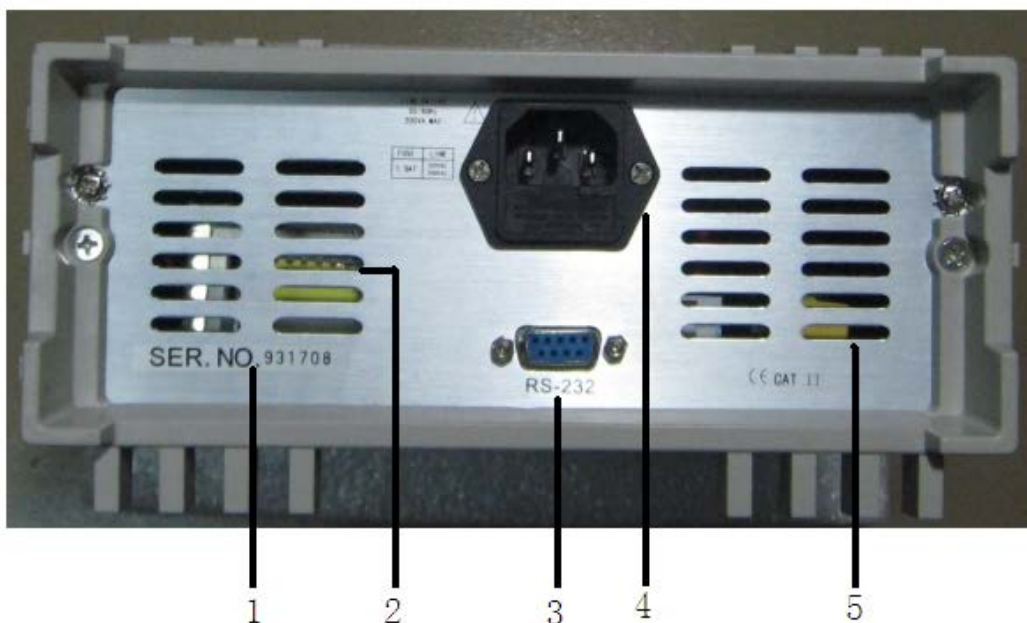


Figure 3.2 Rear Panel of MPS-3600LP/6000LP Series Power Supply

- ① Serial number
- ② Vent
- ③ 9-pin COM port
- ④ Power supply socket
- ⑤ Vent

3.2 Advance inspection

Please inspect the power supply according to the following steps so as to ensure the normal use of the power supply.

1. Goods inspection

Please inspect whether you receive the following accessories while receiving the power supply. If there is any shortage, please contact with the dealer who is the closest to you.

- A power supply cord (conform to the voltage standard used in this area)
- An Operation Manual (standard)
- A Qualified Certificate (standard)

2. Connect the power supply cord and turn on the power supply

After the power is on, the power supply will conduct self-inspection first, and then go into standby state.



Warning: A three-core power supply cord is provided when the power supply leaves the factory, and your power supply shall be connected to the three-core junction box. Before operating this power supply, you shall firstly make sure good grounding of the power supply.

3.3 Failure of power supply

Please solve the problems that may occur when you turn on the power supply in the following method.

1. Inspect whether the power supply cord is connected well

Model number	Fuse specification	
	230V	115V
IV3603	1.5A	3A
IV3610	5A	10A

2. Replacement method of fuse

Open the small plastic cover under the power supply input socket on the rear panel of the power supply by using a screwdriver, and then you can see the fuse. Please replace it with the fuse with specifications consistent with that of the original one.

Chapter 4 Panel Operation

This chapter will introduce the operation of front panel of power supply in details, which is divided into the following parts:

Keyboard arrangement

Introduction to operation of front and rear panels

Voltage setting operation

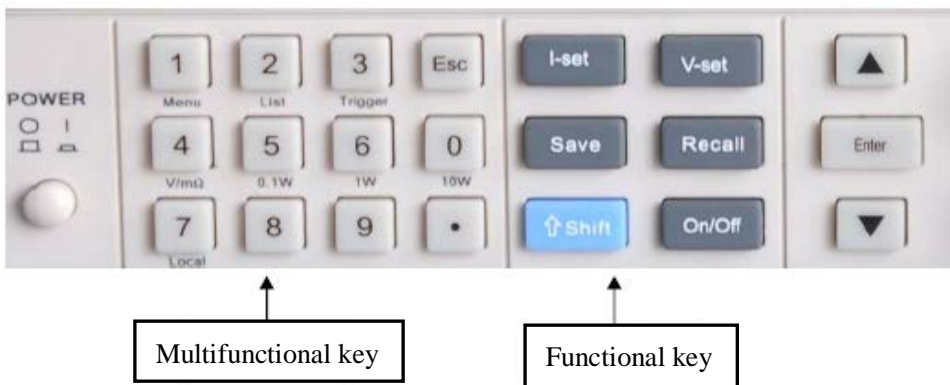
Current setting operation

Storage operation

Menu operation

On / off operation

4.1 Keyboard arrangement



Key description

Key position	Function description
0-9:	Numeric keys
Local (numeric key "7"):	Local operation (effective if pressed with shift at the same time, disconnected from the computer)
Battery (numeric key "8"):	Early warning function of battery charging, and setting of the higher and lower limits of current (effective if pressed with shift at the same time)
Ctrl (function key "Save"):	Clear key (to clear the error value when the setting is wrong,

	and it is effective if pressed with shift at the same time)
I-Set	Set the maximum output current of power supply
V-Set	Set the output voltage of power supply
Save	Store the current related parameters of power supply on the designated storage positions
Recall	Recall related setting parameters of power supply from the designated storage position
Shift	Composite key, used in combination with multifunctional key
On/off	Control the output state of power supply
▲	Page up key (select menu in operation, and increase output voltage at the interface)
▼	Page down key (select menu in menu operation, and decrease output voltage at the interface)
Enter	Confirmation key
knob	Used to change the setting of voltage and current of power supply

4.2 Introduction to operation of front and rear panels

Before using the power supply, please understand the following basic introduction to the key operation of front panel.

- After the power is on, the power supply shows panel operating mode automatically. Under the panel operating mode, all keys can be used.
- When the power supply is remote operating mode, the keys on panel do not work. The panel operating mode and remote operating mode only can be controlled for switch through PC machine. When the operating mode changes, the output parameters of power supply will not be affected.
- You can control the output On/Off of power supply by pressing the key on the front panel.
- LED can display the current operating state of power supply. When opening the power supply, LED will show two data, the first one shows voltage value, while the second one shows current value. When the instrument is in the output state, the current window shows an actual current, and while the instrument is closed, the current window shows a setting current.

4.3 Voltage setting operation

The range of voltage setting is between 0V and the maximum voltage setting value, and you can use the following three methods to set the output voltage value through the front panel.

Method 1: After power is on, you can directly press “▲” and “▼” to change the voltage setting value.

Method 2: Press “V-Set” + “0 to 9 numeric keys”, and then press “Enter” to set the voltage value.

Method 3: Change the voltage setting value through turning the knob left or right.

4.4 Current setting operation

The range of rated current setting is between 0V and the full rated output current,

Method 1: Operating steps

1. Press “I-Set”
2. Press “0 to 9 numeric keys” to input the current value you need
3. Press “Enter” for confirmation

Method 2: Change the voltage setting value through turning the knob left or right.

4.5 Access operation

The power supply can respectively store some commonly used parameters into 9 groups of non-volatile memory for users to recall for use quickly. You can use the keys of “Save” and “Recall” on the front panel to implement the access operation of (0~9) groups in storage area.

Storage contents include: 1. Voltage setting value 2. Current setting value

You can use “Save” + “0 to 9 numeric keys” and press “Enter” to store the parameters of power supply to the designated storage area.

You can use “Recall” + “0 to 9 numeric keys” and press “Enter” to recall the parameters from the designated storage area for use.

4.6 Early warning function of battery charging, and setting of higher and lower limits of current

Press “shift” and then press numeric key “8” to enter the early warning function of battery charging. As for the setting of higher and lower limits of current, the screen displays in turn as follows:

L X.XXX (lower limit of current)

H X.XXX (higher limit of current)

Use numeric keys to change setting value and press “Enter” for confirmation, and it will alarm when it is out of range!

Chapter 5 Remote Operating Mode

5.1 Communication between power supply and host

The power supply can be connected to the host interface by DB9 plug on the rear panel through the level conversion circuit, and the following contents can help you understand how to control the output of power supply through the host.

1. Communication setting

Before conducting the communication operation, you shall firstly match the power supply with the following parameters which control the host:

(1) Baud rate: 9600

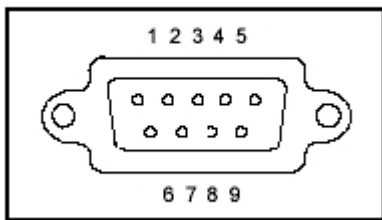
(2) Checkout: NONE (NONE,EVEN,ODD)

(3) Data bit: 8, stop bit: 1 (fixed value)

2. DB9 serial interface

The DB9 interface on the rear panel of power supply can be connected to the interface of the host.

3. Definition of interface pin



1	VCC (+3.6V)
2	RXD (receive)
3	TXD (send)
4	NC
5	GND (ground)
6	NC
7	NC
8	NC
9	NC

Chapter 6 SCPI Communication Protocol

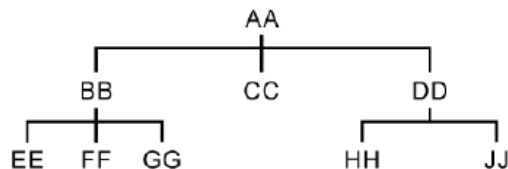
6.1 Overview of SCPI command

MPS-3600LP/6000LP series programmable DC power supply supports SCPI Communication Protocol. SCPI is a kind of standard command used for programmable instruments, which defines a set of command rules of communication. The command used for MPS-3600LP/6000LP

series power supply is divided into two big types: basic command (IEEE-488.2 common command sets) and the command sets designated by MPS-3600LP/6000LP series.

SCPI commands are arranged in way of hierarchical structure of command tree. Each command includes many alphabetic strings (mnemonic symbol), and levels are separated by colon (:). The command on the top of command tree is called "root command" or abbreviated as "root".

One path must be designated if visiting the next command. The structure of command tree is as follows:



In the Figure, AA means root path; BB, CC and DD are the direct sub-paths under the root path. EE, FF and GG means the sub-paths under BB, which HH and JJ are the sub-paths under DD.

Command instruction:

- 1) [:] AA:CC indicates that the current root path is AA, and CC under AA will be visited.
- 2) [:] AA:BB:FF indicates that the current root path is AA, and FF under the sub-path BB under the root path AA will be visited.
- 3) [:] AA:DD:HH indicates the current root path is AA, and HH under the sub-path DD under the root path AA will be visited.

As for this kind of command, many commands can be sent in a message at the same time and shall be separated with semicolon (;).

For example: [:] AA:BB:EE;FF;GG means visiting EE, FF and GG under BB.

[:] AA:BB:FF;:AA:DD:HH means visiting HH under FF and DD under BB.

The mnemonic symbols of SCPI language, namely key words, have two types including long format and short format. Short format is actually the abbreviation of long format. The use rules are as following:

- The mnemonic symbols of short format are made up of the first 4 alphabets of mnemonic symbol of long format; if the alphabet length of mnemonic symbol of long format is less than or equal to 4, then the mnemonic symbols of long format and short format are the same;

- If the length of long mnemonic symbol is larger than 4 and the fourth alphabet is vowel, the mnemonic symbols of short format will abandon the fourth alphabet vowel and become 3 alphabets. For example, the mnemonic symbols of short format of ERRor is ERR but not ERRO.

Some commands need parameters, such as the command of setting value. At this time, a blank is needed between the command and its first parameter (ASCII code is 32).

For example, the command of setting voltage value is [:]VOLT 12.000

There is a blank between the parameter 12.000 and VOLT command (ASCII code is 32).

The command sets of SCPI are insensitive to the upper case and lower case, that is to say, the commands do not distinguish upper case and lower case, and each command has an ending symbol EOI: command ends <LF> (it indicates the character "n" of ASCII code, namely the linefeed of ASCII code, the decimal system 10, and the hexadecimal 0A).

Notice: the ending symbol <LF> needs to be added behind all the following commands which are sent. If square bracket [] appears in the following instructions, it indicates that this alphabetic string can be written or not in the command.

6.2 Command sets of MPS-3600LP/6000LP power supply

6.2.1 Basic command (IEEE-488.2 common command sets)

This command includes the general functions defined in IEEE488.2 standard, and the functions are generally applicable to the measurement instruments which support IEEE488.2 standards.

This set of command starts with asterisk (*) and does not have hierarchical structure.

Command *IDN?

This command can read relevant information of power supply, such as the manufacturer, product model number, product serial number, firmware version number.

6.2.2 System command

The commands stated in this section are all the commands under [:]SYSTEM root path. The commands of the following example all adopt the mnemonic symbols of short format.

Command [:]SYSTEM:ERRor?

This command is used for reading the wrong code and wrong information of power supply.

Return command: wrong code, wrong information

For example: if the sending command is [:]

SYST:ERR?

<LF>

The return command of power supply is: "0, 'No Error' ", or "50, 'Error Para Count' ", or "70, 'Invalid Command' " and other forms.

Command [:]SYSTem:REM

This command is used for setting the power supply to be remote control model, namely PC control model.

Return command: N/A

For example: if the sending command is [:]

SYST:REM

<LF>

After it is successfully sent, the front panel of power supply is set as remote control model, at this time, the keys on the operation front panel are invalid. Only by pressing “Shift” + “numeric key 7”, or sending command [:]SYST:LOC, the power supply can be switched to be controlled by its front panel.

Command [:]SYSTem:LOC

This command is used for setting the power supply to be panel control model.

Return command: N/A

For example: If the power supply is under the remote control (PC) model, send command [:]

SYST:LOC

<LF>

After the command is successfully sent, the front panel of power supply has been set to be front panel control model.

6.2.3 Measurement command

The commands stated in this section are all the commands under [:]MEASure root path. The commands in the following example all adopt the mnemonic symbols of short format:

Command [:]MEASure:VOLTage?

This command is used for reading the output voltage value of power supply.

Return command: Numerical value

Return parameter unit: V

For example, if the sending command is [:]

```
MEAS:VOLT?
```

```
<LF>
```

The return command of power supply at this time is: 12.560, then it indicates that the current voltage value of power supply is 12.560V.

Command [:]MEASure:CURRent?

This command is used for reading the output current value of power supply.

Return command: Numerical value

Return parameter unit: A

For example: if the sending command is [:]

```
MEAS:CURR?
```

```
<LF>
```

The return command of power supply at this time is: 1.245, then it indicates that the current value of power supply at present is 1.245A.

Command [:]MEASure:VC?

This command is used for reading two measurement values for one-off time: output voltage value and output current value.

Return command: Numerical value list, use comma to separate them

Return parameter unit: V and A

For example: if the sending command is [:]

MEAS:VCM?

<LF>

The return command of power supply at this time is: 10.0000, 0.00000, namely, it indicates the output voltage value of current power supply is 10.0000V, and the output current value is 0.00000A.

6.2.4 Setting command

Command [:]OUTPut <bool>

1. This command is used for setting whether the output of power supply has been opened or not.

Return command: N/A

Parameter: parameter of bool type, therein 0-OFF, 1-ON

For example: if the sending command is [:]

OUTP 1

<LF>

After it is successfully sent, the output of power supply will be opened.

Command [:]VOLTagE <Value>

1. This command is used for setting the voltage value of power supply.

Unit: V

Return command: N/A

For example:

1) If the sending command is [:]

VOLT 30.000

<LF>

It indicates that the current voltage value of power supply is set to be 30V.

For example:

1) If needing to inquire the voltage setting value of power supply, then send command [:]

VOLT?

<LF>

Command [:]CURRent <Value>

1. This command is used for setting the current value of power supply.

Parameter: numerical value | MAX | MIN

Unit: A

Return command: N/A

For example:

1) If the sending command is [:]

CURR 3.000

<LF>

It indicates that the current value of power supply at present is set to be 3V.

2) If the sending command is [:]

CURR MAX2.000

<LF>

The maximum current value of the power supply is set as 2.0000A, which indicates that the current value of power supply at present is set as the maximum current value, 2.0000A.

3) If the sending command is [:]

CURR MIN0.000

<LF>

The minimum current value of the power supply is set as 0.0000A, which indicates the current value of power supply at present is set as the minimum current value, 0.0000A.

2. Relevant command: inquire the current setting value of power supply, the maximum value or minimum value command

[:]CURR? MAX | MIN

Parameter of return command: numerical value

For example:

1) If inquiring the setting current value of power supply, send command: [:]

CURR?

<LF>

If the return command of power supply is: 1.0000, it indicates the setting current value of this power supply is 1.0000A.

2) If inquiring the setting maximum current value of power supply, send command: [:]

CURR? MAX

<LF>

If the return command of power supply is: 2.0000, it indicates the setting maximum current value of the power supply with this model number is 2.0000A.

3) If inquiring the setting minimum current value of power supply, send command: [:]

CURR? MIN

<LF>

If the return command of power is: 0.0000, it indicates the setting minimum current value of the power supply with this model number is 0.0000A.

Safety

Please do not install the replacement parts on the instrument by yourself, or execute any unauthorized amendment. Please send the instrument to the maintenance department of the company for maintenance in order to ensure its safe use.

Please refer to the specified warning or notice in this Manual in order to avoid personal injury or instrument damage.

Safety Signs

Warning

It reminds users to pay attention to the certain operation procedures, methods, conditions and other items that may cause personal injury.

Notice

It reminds users of the operation procedures, methods, conditions and other items that may result in damages of instrument or permanent loss of data.



Grounding point



Danger!High voltage! (Opening only by the professionals).



Refer to the warnings and notices in relevant documents. (The voltage is relatively high,

please wear gloves in operation! To prevent electric shock, keep the machine from the place related to safety).

Certification and Quality Assurance

MPS-3600LP/6000LP series programmable DC power supply fully meets various technical standards stated in the Manual.

Quality Assurance

The company offers one-year quality assurance for the materials and production of this product since the day of delivery.

Maintenance service

For any repair, please send the product to the maintenance department designated by the company. The customer is obliged to undertake the single-route freight for sending the product for repair to the maintenance department of the company, and the company will take charge of the return freight. If the product is sent from other countries for maintenance in the factory, then all freights, customs duties and other taxes shall be undertaken by the customer.

Restriction of Quality Assurance

The above assurance is not applicable to the damages caused in the following circumstances:
The customer wrongly or improperly repairs the product;
The customer uses other software or interface;
The unauthorized amendment or wrong use;
Operate this product beyond the designated environment, or carry out configuration or maintenance in the non-designated maintenance shop;
The damage caused by the circuit installed by the customer.

Notice

No further notice will be given to the alteration of contents of the Manual, and the interpretation right thereof belongs to the company.