

# PROGRAMMABLE DC POWER SUPPLY **HA-PSA3515**



USER'S MANUAL



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# **User's Guide**

## **Programmable DC Power Supply**

## **Introduction of Programmable DC Power Supply**

Programmable power supply is a new generation of programmable DC power supplies of our factory. The power supply has RS232 programmable interface and optional USB interface, digital nixie tube, LED and indicator light to show working status, key light shows setting status. Double digital knobs and keypad are supplied to set parameters, while using of the adjusting knob, user can directly set the voltage and current and don't need to switch the key and knob. The built-in function module, controlled by 32 bits MPU, use CAN bus-mastering to supply the reliable output and over-load hardware protection, the step of over-load protection is adjustable and could be selected to be on or off. Except of this, power supply also protect itself by warning and cutting off output once fun controlling module gets fault, transistor over-heating, internal bus gets fault. It is of programmable CV/ CC adjustable step. The two working states, CV and CC, can be switched varying with the load. Meantime, the external voltage sampling terminal is supplied to output stable voltage for user load within the range of wire voltage drop.

Programmable power supplies are widely applied in national defense, institution, university and factory, especially in the areas of computer measuring and automatic control system as DC power supply.

### **Main function characteristics**

- All digital control, inside CAN bus controlling, low drift and high resolution
- Nixie tube + LED + Key Indicator to show working state, clarity and simple
- User-defined storage/recall function
- Adjust by digital knob roughly or finely. Convenient setting and direct output
- Keypad lock function, to avoid the misoperation
- Hardware of OVP (Over Voltage Protection), setting is adjustable and ON/OFF also could be selected.
- Distanced wire voltage drop compensate, ON/OFF available
- Temperature fan controlling, with warning of fan/over heat/fault of internal module
- Standard configuration: RS232 interface
- Optional configuration: USB device

**Packing List**

- Programmable Power Supply 1
- Power Cord 1
- CD (User's Guide) 1
- RS232 interface cable 1

**Optional**

- USB interface and cable 1

## Content

<b>Chapter 1 Prepare to use power supply</b> -----	4
1.1 Check the list of supplied items -----	4
1.2 Connect the power -----	4
<b>Chapter 2 Operation Instruction</b> -----	5
2.1 Front panel overview -----	5
2.2 keyboard instruction -----	5
2.3 Display screen overview -----	8
2.5 Connection of load and tips -----	8
2.6 Effect of load to power supply -----	10
2.7 Operation attention -----	11
2.8 Basic Operation -----	13
<b>Chapter 3 Programmable Interface</b> -----	16
3.1 To set series port-----	16
3.2 Programmable commands-----	16
<b>Chapter4 Maintenance</b> -----	17
<b>Chapter 5 Service and Support</b> -----	18
<b>Chapter 6 Specifications</b> -----	19

**Notice:** please excuse any modification of the contents without special notification. Besides, it is unavoidable for not-so-adequate description and wrong printing. The present document will not warrant in any form including, but not limited to, those for special aims.

## Chapter 1 Prepare to use

### 1.1 Check the list of supplied items

Check whether the meter and the accessories are complete and ready. If the package is badly damaged, please keep it until the meter passes the performance testing.

### 1.2 Connect the power

To guarantee the safe operation of the meter, the following conditions should be achieved.

Voltage: 115 (110~125)V

230(200~250)V

Frequency: 50 (45~60 )Hz

Working Environment: Indoor

Temperature: 0~40°C

Relative humidity: 20% ~ 90%RH (40°C)

Insert the power plug into the power socket with AC voltage 115V or 230V and earthing wire, then press the power switch on the panel to make the device connected to power source. Now the initialization of the power supply begins.

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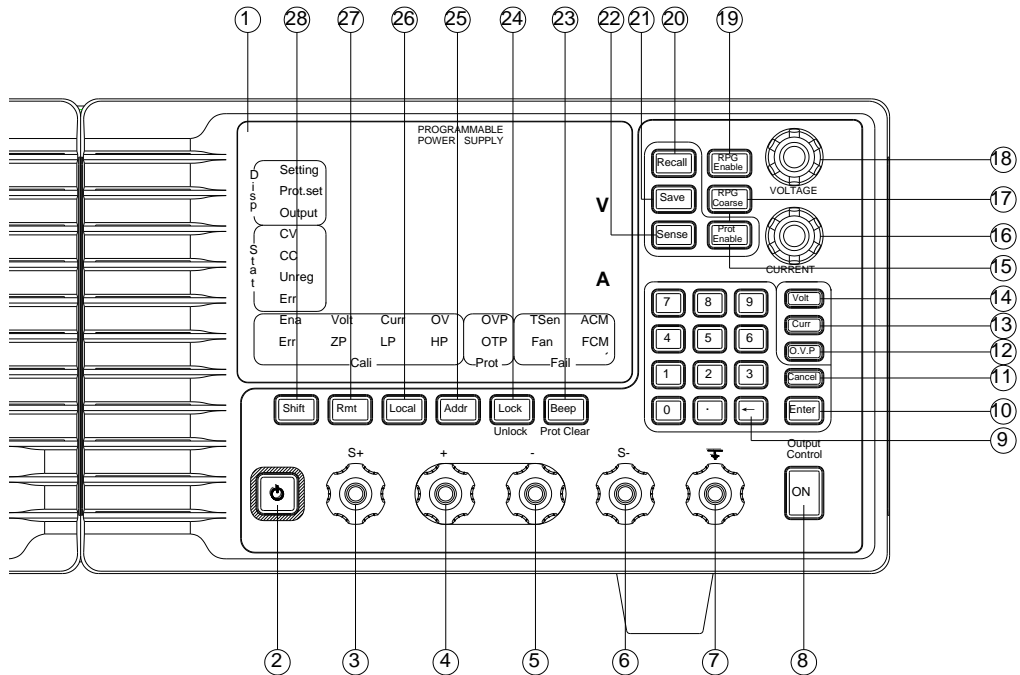
**Warning:** in order to ensure the security of the operator, triple-core socket outlet with the safe earthing wire must be used.

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## Chapter 2 Operation Instruction

User will get detail learning about functions and usage of the power supply through this chapter.

### 2.1 Front panel overview



### 2.2 Keyboard Instruction

- (1) LCD: Display the value of voltage/current, output the value of voltage/current and setting state, display the state.
- (2)【POWER】: Power switch, press it to connect AC power. Press again to select stand by.
- (3) S+: positive output terminal of external sampling, to compensate the voltage drop caused by wire resistance
- (4) +: Positive output terminal
- (5) -: Negative output terminal
- (6) S -: negative output terminal of external sampling, to compensate the voltage drop caused by wire resistance.
- (7)  $\perp$ : earthing.

- (8) Output Control: dc output switch, to control the output status of power supply, default is off. Press the key to enable the output and light on. Press again to disable the output and lighter off.
- (9) Numeric keys: to input data, **【←】** backspace key to delete the input data
- (10) **【ENTER】** : enter key. The light on indicates the key is available. Press the key to confirm the input and save, the light off.
- (11) **【Cancel】** : cancel key. The light on indicates the key is available. Press the key to cancel the input, the light off.
- (12) **【O.V. P】** : to set over voltage protection limitation. Press the key with light on, which indicates the present data input will be saved, the unit is V. when finish the data input, the light is off.
- (13) **【Curr】** : to set output current. Press the key with light on, which indicates the present data input will be saved, the unit is V. when finish the data input, the light is off.
- (14) **【Volt】**: to set output voltage. Press the key with light on, which indicates the present data input will be saved, the unit is V. when finish the data input, the light is off.
- (15) **【Pro Enable】** : to enable the OVP function. Press the key to enable the over voltage protection with light on. Press again to disable the function, the OVP function is disabled and light is off. The status of key was saved in memory and kept on next power on.
- (16) Current adjusting knob: to adjust the output current.
- (17) **【RPG Coarse】** : coarse adjusting knob enabled key, the step of which is 0.1V/0.1A. Press the key again to select fine adjusting, the step of which is 1mV/mA.
- (18) Voltage adjusting knob: to adjust the output voltage.
- (19) **【RPG Enable】**: knob enabled key, the step of which is controlled by **【RPG Coarse】** function key. Press again to disable the knob adjusting.
- (20) **【Recall】** : to recall the preset. Press the key to recall the saved data (series number), according parameter saved under the series number will be recalled after pressing of **【ENTER】** key. Or press **【Cancel】** key to return the former status.
- (21) **【Save】** : to save the preset. Press the key to show the series number of storage data, according parameter saved under the series number will be recalled after pressing of **【ENTER】** key. Or press **【Cancel】** key to return the former status. After data input, the



indicator lights off.

(22) **【Sense】** : remote compensation controlling key. Press the key to enable the remote compensation to control output voltage with light on. Press again to disable the mode. The status of key was saved in memory and kept on next power on.

(23) **【Beep】**(Prot Clear): beep on/off. Press the key to enable the beep function with light on. Press again to disable the beep function with light off. Second function: clear the over voltage protection.

(24) **【Lock】** (Unlock): to lock the keypad. Press the key to lock all the keys except of **【Shift】** key. Second function: press **【Shift】** and **【Lock】** keys to unlock the keys.

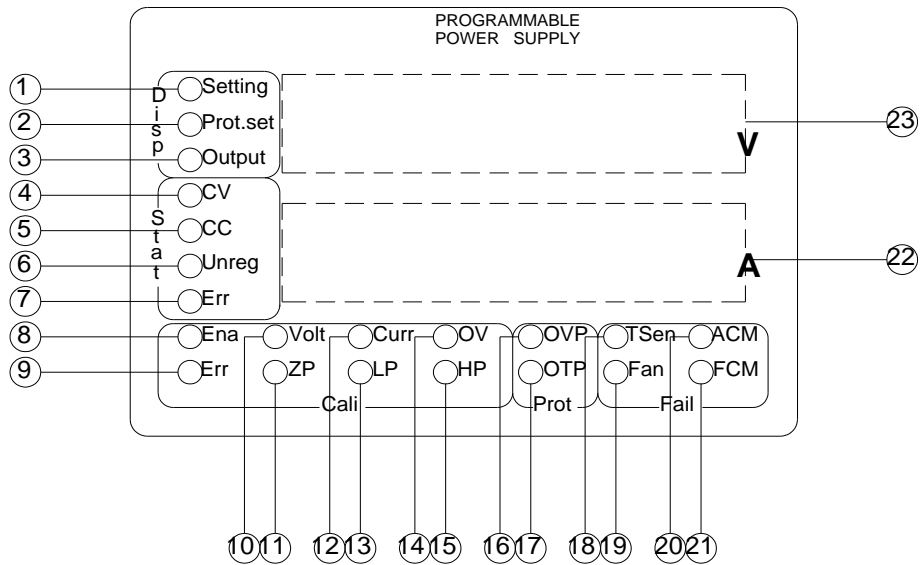
(25) **【Addr】** : Idle.

(26) **【Local】** : to select local controlling.

(27) **【Rmt】** : to select remote controlling, the key setting will be saved in memory, and kept when next power on.

(28) **【Shift】** : to select second function of keys. Press this key to enable the second function with light on, which should be preferred together with the multifunctional keys. Press other key to exit this shift key and the indicator light off.

### 2.3 Display screen overview



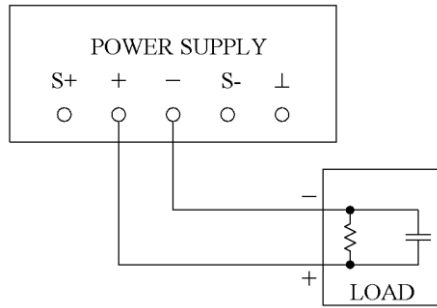
### 2.4 Display screen instruction

- (1) Indicator of output settings, when it's on, the data displayed is the setting of output voltage and current.
- (2) Indicator of protection settings, when it's on, the data displayed is the over voltage protection setting.
- (3) Indicator of monitoring data, when it's on, the data displayed is the real-time output voltage and current.
- (4) Indicator of CV mode selected for working with light on
- (5) Indicator of CC mode selected for working with light on
- (6) Alarm indicator of failure to output as preset, which indicates that the real output voltage/current available up to requirements, that maybe caused by over-low input voltage, or wire load, or damaged power unit inside, and the power supply have to be repaired.
- (7) Alarm indicator of failure to CC/CV controlling circuit, which indicates that the power supply getting fault and the output voltage/current out of preset range, or damage to logic controlling circuit and have to be repaired.
- (8) Indicator of calibration, the procedure only processed in factory.
- (9) Alarm indicator of error in calibration, the procedure only processed in factory.
- (10) Indicator of voltage calibration, the procedure only processed in factory.

- (11) Indicator of zero calibration, the procedure only processed in factory.
- (12) Indicator of current calibration, the procedure only processed in factory.
- (13) indicator of low point calibration, the procedure only processed in factory.
- (14) Indicator of OVP calibration, the procedure only processed in factory.
- (15) Indicator of high point calibration, the procedure only processed in factory.
- (16) Indicator of VOP protection, which indicates that the OVP protection is working and output is shut off. The output key is disabled until press the cancel key to cancel the OVP protection.
- (17) Alarm indicator of over-heat protection, which indicates the power over-heat event happened and output is shut off. user need to restart the power supply and turn on the output. If the temperature normal when power on again, the power supply go on working, otherwise the output will be shut off again.
- (18) Error indicator of temperature sensor, the power supply goes into protection with output disabled, and need to be repaired.
- (19) Failure indicator of fan, which indicates that the fan does not work as required speed. The output is disabled and has to be repaired.
- (20) Failure indicator of analog controlling system, which indicates that the bus cannot communicate with analog controlling module, it fail to receive the commands and need to be repaired.
- (21) Failure indicator of fan controlling module, which indicates that the bus cannot communicate with fan controlling module, it fail to receive the commands and need to be repaired.
- (22) Data display area 2, where show current settings when using knob and saved preset when using numeric keys.
- (23) Data display area 1, where show voltage settings when using knob and present settings when using numeric keys.

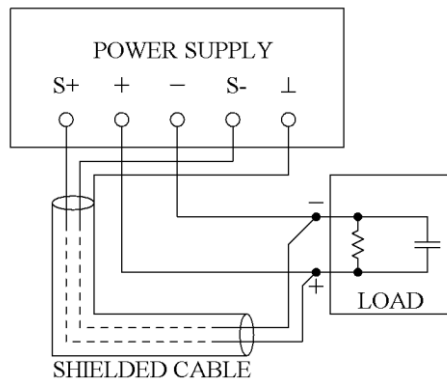
## **2.5 Load connection and attention**

### **2.5.1 Common connection of load without sense function**



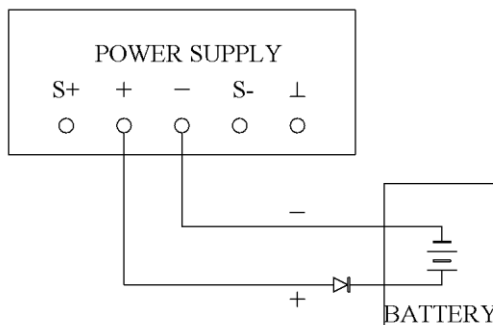
When sense function not preferred, terminal S+ and S- should be idle, cannot be connected with any other component and wire, or else cause the output voltage error to power supply.

**2.5.2 Common connection of load with sense function**



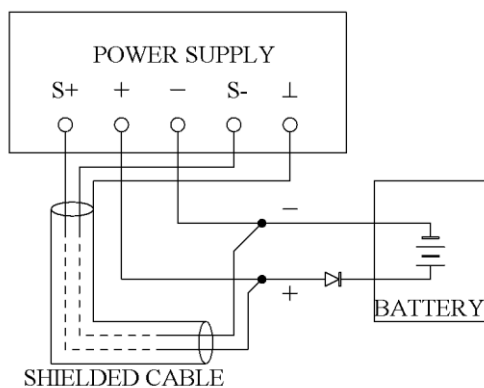
When sense function preferred, terminal S+ and S- are required to be right connected with load +/- polarity accordingly. If make wrong connection, the power supply output wrong voltage and probably to burn up the load. There is less current between the wire of S+ and S-, but maybe some interruption, which will increase the ripple voltage on load. To get best ripple voltage result, user is suggested to twist the S+ and S- wires for shielding.

**2.5.3 Common connection of load (Battery) without sense function**



When storage battery is used as load, user must connect a diode to avoid current contra flow in circuit, the support current of diode is required to match with the output current of power supply at normal working, or else it will be burn out. And do not make the wrong connection to battery polarity, or else the power supply will be burn out.

### 2.5.4 Common connection of load (Battery) with sense function



When storage battery is used as load, for long output cable, user can relieve the voltage drop with sense function, the connection of which is shown as figure. And user must connect a diode to avoid current contra flow in circuit, the support current of diode is required to match with the output current of power supply at normal working, or else it will be burn out. And do not make the wrong connection to battery polarity, or else the power supply will be burn out.

## 2.6 The influence of load

### 2.6.1 Maximum capacitance of load

Once OVP function disabled, load capacitance will lead to phase lag to power supply due

to its closed circle system. When capacitance is large enough, the phase lag is easy to cause the shock to power supply itself, to avoid this, the capacitance should be limited within 22000 $\mu$ F.

Once the OVP function enabled, the one-way thyristor serves as discharge component in over voltage protection circuit, the triggering of OVP will cause the thyristor breakover and release the stored energy in load capacitor. Once the total capacitance released from load and power supply internal over the support ability of thyristor, the component probably be damaged, to avoid this, the maximum capacitance should be limited within 10000 $\mu$ F.

For operator using of over capacitance load and cause the damage to thyristor, the maintenance is chargeable according to actual condition.

### **2.6.2 When load is storage battery**

The diode connected in anti-parallel at output terminal of power supply could support 15A current at most. Also the one-way thyristor serves as the discharge component in over voltage protection circuit at output terminal. If the voltage of OVP set lower than battery and OVP is enabled, the thyristor is probably to breakover and cause the huge short current to burn out the mainboard. So to protect the power supply and battery, user should connect one diode to prevent the contra flow current when you select storage battery as load. The capacitance of diode should match with the max output current, or else it will cause the diode over heat and burn out. Also do not make the reverse connection to battery to avoid the damage to diode and current sampling resistance.

For the damage of power supply caused by user wrong operation, the maintenance is chargeable.

## **2.7 Attention to operation**

### **2.7.1 The using of OVP function**

The function can be enabled or disabled as user demand, the value of which is also can be set. The wrong setting may cause the protection not work and output not normal. So user should set over voltage protection parameter according to actual condition.

OVP circuit makes the direct measurement to the voltage of output terminals internally without S+ and S- terminals, if user make mistake to connect them, the monitoring voltage probably get wrong, which is not so accurate (a little higher). So considering the

accuracy of OVP setting impossible reach to output voltage, please make a allowance during operation. Incorrect setting of OVP will lead to error action to power supply, or the OVP does not work when voltage of power supply over the bearable voltage of load.

### **2.7.2 The using of sense function**

S+ and S- terminals are used for sample the load voltage and stabilize it according to sampled voltage parameters, to lower the voltage drop to minimum and ensure the load voltage stability. Wire resistance is required less than 100mΩ, if too high, the wire resistance and load capacitance make up a low-pass RC filter, taking phase lag to output and lead to instability, also bring in interference.

When S+ and S- terminals connected to circuit (enable the sense function), please turn on the sense function, otherwise the output voltage will get lower.

When S+ and S- terminals are idle (disable the sense function), please turn off the sense function, otherwise the output voltage will get higher.

### **2.7.3 The requirement to AC power supply**

For the high power of this unit, the transformer at power-on will get a short saturation and periodic shock current, using the lighting air switch (C type release characteristic) may cause switch trip at power-on. A dynamic air switch (D type release characteristic) is advised for offer the AC power source, the capacitance of which should not less than 16A.

## **2.8 Basic Operation**

### **2.8.1 Setting of output voltage**

**Method 1:** Use the number keys to set. Press **【Volt】** key, then enter voltage value by the number keys on the front panel. Press the key of **【ENTER】** to save the setting. So the voltage value in the interface is the entered value.

For example: Set the voltage value to be 32.00V.

Press the keys of **【Volt】【3】【2】【.】【0】【0】【0】【ENTER】** in turn.

**Method 2:** Use the knob to set. Pressing the key of **【RPG Enable】**, and the voltage value will be varied with the rotating of the knob. Press **【RPG Coarse】** key to change step.

### **2.8.2 Setting of output current**

**Method 1:** Use the number keys to set. Press **【Curr】** key, then enter current value by the number keys on the front panel. Press the key of **【ENTER】** to save the setting. So the

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current value in the interface is the entered value.

For example: Set the current value to be 11.000A.

Press the keys of **【Curr】【1】【1】【.】【0】【0】【0】【ENTER】** in turn.

**Method 2:** Use the knob to set. Pressing the key of **【RPG Enable】**, and the current value will be varied with the rotating of the knob. Press **【RPG Coarse】** key to change step.

### 2.8.3 Setting of OVP

**Method 1:** Use the numeric keys to set. Press **【O.V. P】** key and then numeric keys to set the OVP value, finally press **【ENTER】** key to save the settings.

For example: set the OVP to 32.000V.

Press **【O.V.P】【3】【2】【.】【0】【0】【0】【ENTER】**.

**Method 2:** Use the knob to set. Pressing the key of **【RPG Enable】**, and the OVP value will be varied with the rotating of the knob. Press **【RPG Coarse】** key to change step.

### 2.8.4 Setting of output voltage

While press the **【OUTPUT】** key under presetting, the output is enabled, the current output voltage and current are displayed on screen. If press the key again, then back to preset status, the output is disabled, the current settings are displayed.

### 2.8.5 To set the remote control mode

Press **【RMT】** key to select remote control mode for device through the RS232 or USB interface.

### 2.8.6 To set local mode

Press **【Local】** key again to select local mode for device, which is controlled by keypad operation.

### 2.8.7 To lock the keypad

Press **【Lock】** (Ulock)key to enable the lock function. Press **【SHIFT】 + 【Lock】** key to disable the lock function and all keys come back to its function.

### 2.8.8 Beeper On/Off

Press **【Beep】** (Prot Clear) to enable the beeper. Press the key again to close the beeper.

### 2.8.9 To clear the OVP

While the device enter into the OVP function, press **【SHIFT】 + 【Beep】** (Prot Clear)



key to clear the OVP function, the indicator lights off.

#### **2.8.10 To enable the OVP function**

Press **【Prot Enable】** to enable the protection. Press the key again to disable the protection.

#### **2.8.11 To enable/disable the knob adjusting**

While press the **【RPG Enable】**, user select adjusting knob to set the value, the step of which is decided by **【RPG Coarse】** key. Press **【RPG Enable】** key again to exit the knob setting.

#### **2.8.12 To set the adjusting knob**

Press **【RPG Coarse】** to select 0.1V/0.1A as step for knob adjusting. Press the key again to select 1mA/1mA as step for adjusting knob.

#### **2.8.13 To recall the presetting**

Press **【Recall】** key to enter the storage address 1 to 6, then recall the saved settings by pressing of **【ENTER】** key.

#### **2.8.14 To save the presetting**

Press **【Save】** key to enter the storage address 1 to 6, then save the present settings to desired address by pressing of **【ENTER】** key.

#### **2.8.15 To set the sense function**

Press **【Sense】** key to control the output voltage by remote compensation mode. Press the key again to exit the sense function and device return to normal output mode.

## Chapter 3 Programmable Interface

Press **【RMT】** to enter remote control mode.

### 3.1 To set the series port

Baud Rate: 9600, Check: No parity, Word Length: 8, Stop bit: 1

### 3.2 Programmable Commands

<i>SCPI Commands</i>	<i>Description</i>
*IDN?	Query the device identification Return HA-PSA3515,BJA5.297.556, firmware version
SYSTem:VERSion?	Query the device firmware version, Return the version number
:LOCal	To set local control mode, return 1
VOLTage <NRf>	To set output voltage
MINimum	To output minimum voltage
MAXimum	To output maximum voltage
:PROTection <NRf>	To set OVP
:CLEar	To clear the OVP
CURRent <NRf>	To set output current
MINimum	To output minimum current
MAXimum	To output maximum current
OUTPut OFF	Turn off the output
ON	Turn on the output
OUTPut?	Query output status, Return 1, 0
MEASure?	Query all voltage/current
MEASure:CURRent?	Query current
:MINimum?	Query minimum current
:MAXimum?	Query maximum current
:VOLTage?	Query voltage
MINimum?	Query minimum voltage
:MAXimum?	Query maximum voltage
:PROTection?	Query OVP value

## Chapter 4 Maintenance

### 4.1 Cleaning

In the case of disconnecting of power, the apparatus can be cleaned by soft cloth with neutral washing liquid and clear water. It is forbidden to spray the washing liquid directly on the apparatus in case that the apparatus is damaged resulted from the leaking.

### 4.2 Daily maintenance

For safety, the following instructions are only for professional technicians.

#### 4.2.1 Replacing of fuse

If the apparatus cannot work properly because that the fuse is burnt out, first find the reason and correct, and then replace the fuse according to the original model. It is forbidden to use a temporary one or to short meeting the fuse block.

#### 4.2.2 As the apparatus is in malfunction and needs to repair, disconnect the power.

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**Warning:** To insure the effective protection, only specific model fuse with the rating of 250V can be replaced. The power must be disconnected before replacing. And the power wire must also be taken off.

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## **Chapter 5 Service and support**

### **5.1 Warranty**

We will give one year's warranty to maintaining or replacing since consignment for the verified quality problem of the product.

Except for this explanation and the description in the warranty card, the company has no other warranty, in proclamation or in implication. Under no circumstances, the company will responsible for the direct, indirect or other secondary loss.

## Chapter 6 Specifications

**6.1 Control range of adjusting:** 0~35V step: 1mV

0~15A step: 1mA

**6.2 Source effect:**  $CV \leq 1 \times 10^{-5} + 1\text{mV}$

$CC \leq 1 \times 10^{-5} + 3\text{mA}$

**6.3 Load effect:**  $CV \leq 1 \times 10^{-4} + 3\text{mV}$  (Sense on)

$CV \leq 1 \times 10^{-4} + 40\text{mV}$  (Sense off)

$CC \leq 1 \times 10^{-4} + 3\text{mA}$

**6.4 Period and random deflection (PARD)(rms):**

$CV \leq 1\text{mV}$

$CC \leq 6\text{mA}$

**6.5 Display resolution:** Voltage 1mV

Current 1mA

**6.6 Voltage setting accuracy:**  $\leq \pm (0.1\% + 10\text{mV})$

**Voltage reading accuracy:**  $\leq \pm (0.1\% + 10\text{mV})$

**Current setting accuracy:**  $\leq \pm (0.2\% + 25\text{mA})$

**Current reading accuracy:**  $\leq \pm (0.2\% + 25\text{mA})$

**OVP setting accuracy:**  $\leq \pm (0.5\% + 0.5\text{V})$

Note: if output less than rated 5%, 10 digits added to accuracy

### 6.7 General parameters

Voltage: 115(100-125)V

230(198-250)V

Rated Power: 0.8kW, 1.1kVA

Frequency: 50(45-60)Hz

Working Environment: Indoor

Surrounding temperature: 0~40°C

Relative humidity: 20 ~90%RH (40°C)

Warm-up time:  $\leq 15\text{min}$

### 6.8 Programmable Interface

RS232 (standard); USB (optional)

**6.9 Dimensions and Weight:** 425×150×465mm<sup>3</sup>, Approx. 20kg



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