

Instructions for Power Supply Maintenance

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Content of this Volume: It mainly describes the troubleshooting of various faults of the power supply APW9, and how to use the test tool for accurate troubleshooting.

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I. Requirements on the Maintenance Platform

* The constant temperature soldering iron above 80W (soldering temperature: 300-350 °C). The tip soldering iron head is used for soldering chip resistors and capacitors. The blade type soldering iron head is used for soldering and replacement of plug-in components (soldering temperature: 380-420 °C)

2. The thermal chimney is used for chip disassembly and soldering, be careful not to heat for a long time to avoid PCB foaming (soldering temperature: $260 \ C \pm 2 \ C$).

3. The AC controllable power supply voltage regulator (output 200-250V, can limit 0-20A current) is used for APW8 power-on inspection. If there is no such condition, a 100W ordinary light bulb can also be strung on the AC fire line with mains. Be careful.

4. For electronic load (power 3.6KW, meet the voltage 0-50V), if there is no such condition, a resistive load that matches the APW9 can also be made.

5. The multimeter, suction gun, tweezers, V9-1.2 test jig and special power test card firmware (if there is condition, an oscilloscope can be configured).

6. Flux, lead-free tin wire, water for cleaning panel with anhydrous alcohol; water for cleaning panel is used to clean flux residue and appearance after maintenance.

7. Thermally conductive silicone grease (2500) is used to repair the thermal conduction between the MOS and the cooling fin, thermal conductive silicone (704 silica gel) is used for fixing and covering the glue damage at the original after the repair of the PCBA components

II. Requirements on Maintenance Operations

 The maintenance personnel must have certain electronic knowledge, more than one year of maintenance experience, and a certain understanding of the working principle of switching power supply, and well master the soldering technology.





2. Before the product is opened and the PCBA panel is repaired, the large capacitor must be discharged, and the voltage must be measured with a multimeter (less than 5V discharge), and then the soldering operation can be performed! Be sure to confirm to avoid electric shock.

3. Pay attention to the working method when judging the circuit components. After replacing any device, the PCB panel has no obvious deformation, the soldering of bonding pad is reliable, and the replacement parts and the surrounding area have no problem such as insufficient parts, open circuit or short circuit.

4. After replacing the key components, the main circuit shall have no short circuit and other obvious abnormalities before the AC voltage test, otherwise there is a hidden danger of explosion.

5. It needs AC220V voltage to judge the circuit signal; pay attention to operational protection. The following: Notes, key slogans:

- Maintenance personnel qualifications must meet the specified requirements;
- Instruments and equipment used for maintenance must meet the specified requirements;

• The instruments and equipment for maintenance must be effectively grounded, and the maintenance environment must comply with anti-static requirements;

• Materials used for maintenance must meet the specified requirements; in order to guarantee the accuracy and traceability of the materials used for maintenance, the materials used for maintenance must be the production materials for the corresponding models, and the material replacement must be confirmed;

1. In order to prevent possible electric shock hazard, non-professionals should not disassemble the enclosure:

2. The maintenance personnel shall use a special enclosure opener to open the enclosure of power adapter and repair, to avoid damage to the internal components of the product:

- 3. After the product is opened, it is required to discharge the high voltage capacitor;
- 4. E-waste waste generated during product maintenance cannot be arbitrarily dropped:

5. Bad products must have a repair process card and indicate the cause of the failure, and placed separately;

6. The repaired products must be well marked to distinguish.

7. The repaired products must be placed in the repaired area and shall be systematically tested before they can be stored.

III. The Principle and Structure of the Power Supply

1. Principle overview

1. APW9 is composed of 1 large board, 3 fans and the upper and lower shell. The normal two input channels are connected with AC220V and have two output voltages of DC, which are respectively SB 12V. The main output voltage is 14.5v-21v, which is controlled by PIC port and communication with the miner.

1.2 Performance characteristics and range of use are described below:



APW9 power supply is a high-efficiency DC power supply designed and manufactured by our company. It has single-phase AC input and two DC outputs:

- 1>. 14.5V-21V voltage adjustable output, the maximum current can reach 170A;
- 2>. 12V voltage fixed output, the current can reach 12A.

he adjustable output part of voltage can meet the common DC load use within 170A current of the adjustable voltage range, especially suitable for circumstances with strict requirements for power supply of servers and mining machines; the 12V voltage's fixed output part can meet the use of control panel and cooling fin.

1.21 The are following characteristics:

The characteristics are as follows:

- 200-240V voltage input
- There is protection for undervoltage, short circuit, overload, over temperature, with automatic recovery after fault removal
 - The use of high-quality devices ensures stable and reliable products through reasonable design, and can work at full load for a long time in a high temperature environment at 50 °C or lower.

ΛΝΤ ΤRΛΙΝΙΝG ΛCΛDEMY

• Small size, high power density

1.3 Appearance of APW9 Power Supply





Note: If you need to turn on the default voltage 21.32V test, you can use the adapter cable to short connect the voltage Pin EN to GND.



• Distribution on the front panel of the power supply: two triangle-shape AC input interface

three size-4028 high speed fans

•Distribution on the left side of the power supply: four PCB-33 copper soldering terminals with adjustable voltage output

one 4Pin signal terminal

one 12V fixed voltage output PCIE terminal

•Distribution on the rear panel of the power supply: cooling vent, it forms the outlet of the high-speed fan.

• The model of the AC input terminal on the power supply front panel is C14, and the AC input cable of the C13 interface is required.

• The 4Pin signal terminal is the interface between the external control panel and the power supply. The SDA/SCL is the I2C protocol, and can adjust the output voltage of the power supply through I2C. EN is the enable signal of the power supply, and the control panel can enable the power supply through EN, which is effective in low level.

• The output part of the adjustable voltage adopts four PCB-33 copper soldering terminals, 90-degree side foot binding posts, M4 high current horizontal fixed seat; the 2 terminals close to the air outlet are output positive poles, and 2 near signal terminals are output negative poles, the output line or output copper bar can be fixed on terminal by M4 screw, which is convenient and flexible to use.

• The output part of the 12V fixed voltage uses the PCIE output terminal. The PCIE output terminal diagram is as follows:



The PCIE output line consists of two color lines, the 12V positive line is yellow, and the negative line is black.

Definition of 6PIN PCIE terminal positive and negative poles: Positive pole: yellow 1, yellow 2, yellow 3

Negative pole: black 4, black 5, black 6

1.4 Parameters of APW9 Power Supply:

	DC voltage	14.5V-21V
	Rated current (at	170A
OUT1	220V input)	
	Rated power (at	3600W
	220V input)	
	Ripple and noise	<1%
	Source	<1%
	regulation rate	



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	Load regulation	<1%
rate		
	Startup, rise	<2\$
	time	
	Power down	>10mS
	holding time	
	DC voltage	12.3V
	Rated current (at	12A
	220V input)	
	Ripple and noise	<1%
	Voltage	12.2V12.4V
	accuracy	
OUT?	Source	<1%
0012	regulation rate	
	Load regulation	<1%
	rate	
	Startup, rise	<28
	time	
	Power down	>10mS
	holding time	
	Voltage range	200-240V AC (two
		channels)
Input	Frequency range	47-63Hz
	Power factor	>0.99(full load)
	Leakage current	<1.5mA (220V 50Hz)
	Input	80-89V AC
	undervoltage	
	protection value	
	Output short	Yes
protection	circuit	
	Output	95-130A
	overcurrent	
	protection value	
	Over	Yes S



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	temperature	
	protection	
Environment	Operating	-20-60°C
	temperature	
	Working	20%-90%RH(no
	humidity	condensation)
	Altitude	Lower than 2000m
structure	Size	204.8SSS*157*42.5mm
	Net weight	About 3.2Kg
	Cooling method	Forced air cooling
	Noise	67dBA

2. Maintenance ideas and cases of common faults

2.1. Block diagram for power basic principle



AC input 200V- 240V: AC input of 200V-240V

EMIcircuit: EMI circuit

rectifying circuit: Rectifier circuit

PFC circuit: PFC circuit

VBUS filtering circuit:

12V main control /VCC circuit:

12V, FAN power supply and feedback circuit:

PWM main switch MOS circuit:

Isolation drive: Isolation drive



VCC-PWM main control chip driver circuit:

LLC--- main transformer buck DC conversion circuit:

Synchronous rectifying filter main output 14.5v-21v circuit port:

Sample feedback voltage stabilization:

PWM main switch MOS circuit:

Parallel output 12V circuit port:

PIC recording and communication control circuit:

2.2 Power PCBA board layout



Layout description: 1A-- first AC input and EMI circuit, 1B- PFC and main shunt MOS circuit, 1C-- 12V auxiliary and VCC circuit.



2A-- second AC input and EMI circuit, 2B-- PFC and main shunt MOS circuit, 2C-- 12V auxiliary and VCC circuit, 2D- 12V output port and PIC communication port



Physical picture, there will be small differences in product versions, but the principle is similar.

2.21 Two AC input EMI to PFC circuit schematic diagram, such as AC 1 key measure F1 insurance, U2 rectifier bridge, whether there is any damage in Q4, D7, D5, D6 (the other check method is the same). Note that if MOS is damaged, the drive resistance and circuit may be damaged synchronously and need to be replaced. During normal operation, it can be judged that the DC voltage at both ends of the large capacitor is 410-420v.





2.22 Two 12V auxiliary circuit and fan power supply principle, such as 12V 1 channel first to measure whether voltage detection starting resistor R33, 47K and HV connected to D1, D2 are interlinked, and whether there is any damage in F3, Q5, D8, D9, T1 (the same way as the other way). 12V output, the following circuit is converted from front-end two-way 12V series final control to output +12V ore feeder control board



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Main PWM chip U9 VCC power supply control, attention, the front two PFC should work normally.



2.23 The main control PWM drive circuit, PIC control voltage regulation schematic diagram, focus on the main IC VCC power supply and drive transformer.





2.24 LLC circuit two-way main switch MOS and transformer conversion step-down synchronous rectifier DC filter output circuit, focus on testing the main switch MOS Q14;Q15.Q31.Q32, check if there is short circuit in output rectifier end patch MOS positive and negative pole, and check over current protection circuit transformer, etc.



2.25 PIC control circuit, J15 communication and recording port





2.26 Location of A side of SMD patch and B side of plug-in



Figure 1 SMD patch side location



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Figure 2 Plug-in side location

2.3 Maintenance steps TRAINING ACADEMY

2.31. Check whether the appearance of the power supply is seriously damaged or deformed, and whether the DC fan and the AC socket are damaged.

2.32. Power on AC220V, check whether the fan is rotating normally, and use the multimeter to measure whether the output J6 terminal's voltage is 12V (12.1V-12.50) to eliminate measuring error

2.33. Open the shell, check the components and solder surface to see whether there is any charring by ignition (The key point is whether D1,D2,D21, D22 are broken, and whether the SMT capacitor of 12V circuit is flaring), use multimeter to detect F1 fuse at AC input terminal, open or not, U2 rectifier bridge; Check PFC MOS Q4;D7.D5.D6, whether there is a short circuit (in addition, the inspection method of one way is the same), Measure PWM circuit main switch MOS Q31;Q32;Q15.Q16 and output patch MOS Q17;Q18.Q19.Q20 to see whether there is a short circuit, if there is a short circuit, please check and replace the component position, and pay attention to the circuit resistance around the MOS tube. Audion may be damaged and need to be replaced.



2.34. Detect auxiliary 12V circuit F3,U5;T1;Q5.and check whether other components of D8 and D9 are short circuit or open circuit and the surrounding components are burnt out, etc. If any, it needs to be replaced.

2.35. If the above locations have no abnormity, the circuit of F1 or F2 fuse is normal, the DC fan turns when the two AC lines are switched on (If there is no rotating momentum to measure whether the fan socket has 12V, such as the normal replacement of fan), J6 has 12 v voltage output end, measure two way large capacitor PFC TEST20 - TEST30 or TEST2 - TEST7 gauge point to see both ends are DC410V - 420 - v, otherwise check PFC chip U21 or U1, 7 feet VCC power supply with 12 v or make sure if there is any material damage change, If there is no abnormality, the PWM circuit U9, U10, U24 should be detected.; Power supply VCC has 12V voltage or make sure whether the material is damaged or replaced, and whether the T5 or T7 drive transformer is damaged.

2.36. Other defects shall be further analyzed and judged according to the skills of maintenance personnel.

After the above inspection, the DC output of a single power supply test main circuit should be short-connected to the 4-5 PIN of J15 PIN to output about dc21.3v, as shown in the figure EN-GND PIN. Note that the short connection error may damage the chip. After the replacement of defective components and the inspection of welding, the AC220V test can be carried out. Note: if other circuits check that the large capacitance is 420V, if there is no output after short connection, it can also be considered that PIC chip U12 firmware can be re-recorded or IC can be replaced during recording (generally there are fewer defects here).



2.4. Test diagram of connection between conditionally available control board V1.2 and APW9 power supply PIC port, Mark 1 is the special card test firmware, 2 is the DC voltage debugging high and low conversion button, 3 is the PIC communication port, 4 is the control board letter socket, 5 is the power supply of 12V; Notice yellow plus black minus. Note: after the repair of general defective power supply products, the power on the PIC communication J15 port EN-GND pin is only short connection, there is a voltage



output of 21V or so is normal, it can be tested separately without the following control board (when the PIC microcontroller is broken, or firmware is abnormal, small board test is required after re-burning), and it can directly install the corresponding miner test.

After the maintenance of the power supply machine, 12V is with 12A load, and the main voltage DC21V with load 170A shall be tested as qualified



2.5 Simple judgment and maintenance of common faults of mine power supply

No	Fault symptom	Cause	Solution
1	The fan does not run, there is no 12V output	The power supply on the AC side is abnormal	 Check if the AC input line of the power supply is normal and the plugs at both ends are not loose. Check if the grid is powered and the voltage is normal.
2	The fan runs normally, there is no 12V output	 Low grid voltage Power protection 	 Use a multimeter to confirm that the current voltage is above 205V, so that the power can be turned on. Detect whether the power supply has an output short circuit or overload. This situation will cause the power supply to enter the lock protection state. It needs to be re-powered after the fault is removed to recover.
3	After the power supply stops output for a few seconds, it resumes normal operation. After a few minutes of continuous operation, it stops outputting again.	The power supply has entered the over temperature protection	 Check if the fan is running normally Check if the cooling air duct of the power supply is blocked. Check if the power supply has accumulated excessive dust inside for a long time. Check if the power used by the power supply or the ambient temperature exceeds the value of the power supply limit curve.



4	Output is normal, the fan does not work	The fan is faulty	 Check if the fan is blocked by debris The fan is faulty
5	The normally working power supply suddenly has no output and will not start again	Overcurrent protection of the power supply	Check whether the current of the load exceeds the upper limit of the overcurrent protection of the power supply. The power supply sets the overcurrent protection to the locked state, to prevent the power supply from continuing to output when the load is abnormal, causing a dangerous situation such as a fire.

2.6 After the power supply maintenance test is normal, it is required to operate normally for 2 hours with the rated load of 80% (140A) or more before it can be used by the client.

