Analysis of the voltage jump fault of the reinforced computer program-controlled power supply

Chao Li1*
1Department of Computer, Jiangsu Automation Research Institute, 222061, China
*Corresponding author’s e-mail: sansking@163.com

Abstract. During the process of hardening the computer, it was found that the voltage of the program-controlled power supply that was originally set to a voltage value would suddenly jump when the machine was turned on and off. According to this problem, locate the fault. The cause of the final positioning fault is that the software of the program-controlled power supply processor has not set up a signal verification process, which causes the program-controlled power supply to mistakenly consider the changes generated by the RS232 signal when the power is turned on and off as voltage control signals, resulting in voltage jumps. Modify the software of the program-controlled power processor to increase the signal verification when the program-controlled power processor receives the RS232 signal of the main board, which can effectively solve the fault phenomenon.

1. Introduction
Hardened computers are widely used in aerospace, shipbuilding and other fields. As a core device for computing and control, it plays a very important role. Once the hardened computer fails, some functions will be lost or even the entire system will be paralyzed, so it is necessary to analyze all kinds of hardened computer failures. Many universities and research institutes in our country have conducted research on reinforced computers [1-5].

During the debugging of the hardened computer, it was found that the voltage of the program-controlled power supply [6-10] that had previously set the voltage value would suddenly jump when the power was turned on and off, and the set value would jump to a fixed value. The voltage value of the programmable power supply should have a memory function. After the power is restarted, the previously set voltage value can be restored.

2. Fault location
The program-controlled power supply communicates with the main board through the RS232 serial port, and the processor of the program-controlled power supply receives the 5-byte character string (with frame header) sent by the host computer software through the serial port communication interface, thereby changing the voltage output value. The principle of program-controlled power supply is shown in Figure 1.
In order to further locate the fault, the fault tree of program-controlled power supply voltage jump is listed, as shown in Figure 2:

![Fault tree of program-controlled power supply voltage jump](image)

**Figure 1** Block diagram of program-controlled power supply

**Figure 2** Fault tree of program-controlled power supply voltage jump

For the program-controlled power supply voltage jump fault, the fault is deeply located according to the fault tree. Through the test of the programmable power supply processor, it is found that the output signals of the programmable power supply are normal, and no abnormality is found. Therefore, the failure of the programmable power supply processor is eliminated to cause the voltage jump failure of the programmable power supply. Through testing the DC / DC module of the programmable power supply, it is found that the voltage conversion of the DC / DC module of the programmable power supply is normal. Therefore, the fault of the DC / DC module is eliminated to cause the program-controlled power supply voltage jump failure. Since the voltage regulation of the program-controlled power supply is completed through the RS232 communication interface, a fault in the communication interface may cause a voltage jump failure of the program-controlled power supply. Through the oscilloscope to test the communication interface, it is found that the communication interface can receive and send RS232 signals normally. Therefore, the program-controlled power supply voltage jump failure caused by the communication interface failure is eliminated. Through the analysis of the RS232 signal in the process of switching on and off, it is found that the RS232 signal on the main board has a jump process (normal jump) compared with the normal operation when the machine is switched on and off. It is preliminarily inferred that the program-controlled power supply mishandles the RS232 signal transition generated when the power is turned on and off as a voltage...
regulation signal.

After further verification, by analyzing the software of the programmable power processor, it was found that the software of the programmable power processor did not set the signal verification, that is, there was no verification of the signal sent from the main board RS232, which would cause the main board RS232 signal to change once. The program-controlled power supply will be misjudged to respond to the command, causing the output voltage to change.

The program-controlled power processor software is modified. When the program-controlled power processor receives the RS232 signal of the main board, a signal verification process is added, that is, a frame header verification is added. Through this verification, the fault of voltage jump disappears when the program-controlled power is turned on and off.

In summary, the failure of the voltage jump when the programmable power supply is turned on and off is because the software of the programmable power supply processor does not set the signal verification process, which causes the programmable power supply to mistakenly consider the change generated by the RS232 signal when the power is turned on and off as a voltage control signal, which There is a jump.

3. Conclusion

Through the fault location process, the voltage jump when the program-controlled power supply is turned on and off is because the software of the program-controlled power supply processor does not verify the received RS232 signal, and the change caused by the RS232 signal when the machine is turned on is mistakenly regarded as a voltage control signal, which causes the voltage to appear. Jump.

Through the above analysis, the software of the program-controlled power processor is modified so that when the program-controlled power processor receives the RS232 signal of the main board, a signal verification process is added to solve the failure phenomenon.

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