Analysis of display whitish problem on a certain reinforced integrated computer

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Abstract: Aiming at the problem that the color of the display screen of a certain type of rugged integrated computer is white, the analysis and location are carried out first. By assuming a method to eliminate the problems of the main board, wiring harness and the display itself, the positioning fault exists with the LCD panel. After the test, it was found that the faulty plate was caused by the high contrast of the display control board. After a detailed analysis, the results showed that the connection of low-resistance media caused a short circuit between pins 1 and 3 in interface CN603, which had the same effect as pressing the contrast adjustment shortcut button S1. The contrast of the display control board is continuously increased, so that the display becomes white. The research in this paper enriches the cases of solving practical problems in engineering applications, and provides theoretical support and reference basis for the subsequent solving of similar problems.

1. Introduction
Rugged computers are widely used in aerospace, shipbuilding and other fields, and play a very important role as the core equipment for computing and control. 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]. The display screen is an important part of the rugged all-in-one computer, and it is also a part that is more prone to failure. Some scholars have analyzed and studied the display screen [6-11], which provides theoretical support and reference basis for the application and failure analysis of the display screen.

According to user feedback, after undergoing a high and low temperature cycle test, a certain type of rugged integrated computer is booted into the Windows desktop, the display screen color is white, and the font is not clear. When the resolution is adjusted to 800 * 600 or 1024 * 768 on site, the display is still white.

2. Problem analysis and location
The LCD display on the front panel of a certain rugged integrated computer is connected to the ruggedized computer main module via the VGA display signal via the display main control board. The display control board is located on the back of the display and is used to convert the VGA signal output from the motherboard to the LVDS signal Screen screen glass is installed in front of the display to protect the LCD display and improve electromagnetic compatibility. The working principle of the integrated computer is shown in Figure 1.
Perform fault analysis according to the design principle of the display link and establish the fault tree shown in Figure 2. Replace the normal motherboard module, it shows no abnormal, no bad area, but there is still the problem of whitish display. Exclude this factor. On site inspection, the related wiring harnesses of the display control board of the problematic products are all in sets. Exclude this factor. Replacing the normal LCD screen shows that there are no abnormalities or bad areas, but there is still the problem of whitish display. Exclude this factor.

Fig. 2 Fault tree of the whitening display screen of a certain type of rugged integrated computer

Replace the normal control board, the problem of whitish display disappears, and the problem of positioning the control board. The faulty display control board is tested, and the actual photos are shown in Figure 3 and Figure 4.
After the test, it was found that the faulty plate was caused by the high contrast of the display control board. When the technician adjusted the contrast to 50, the display returned to normal. As the font is unclear, the resolution is adjusted to 800 * 600 or 1024 * 768 in the field. The display effect is the same. When the contrast setting is changed to 50 or the factory value is restored, the font display returns to normal.

This display control board is not connected to the OSD button board in this product. The parameter values of brightness and contrast are controlled by buttons. Under normal circumstances, the parameter value will not automatically change. The contrast was restored to 50. After repeated startup and long-term aging verification, there was no automatic change in the contrast brightness value and other parameters.

Further analysis, the control panel contrast adjustment has a shortcut key, located in the third pin of the interface CN603, the schematic diagram shown in Figure 5. When S1 is pressed (S1 is grounded), the contrast will increase until it reaches 100. Therefore, it is speculated that the 3-pin grounding may cause the contrast to be automatically adjusted to 100 during the test. The cause of the grounding of pin 3 may be the damage of capacitor C1 or the short circuit between pin 1 (signal GND) and pin 3. If the capacitor C1 is damaged, it will cause pin 3 to be grounded all the time, and the contrast cannot be adjusted to 50 again, which is inconsistent with the actual situation and excludes this factor. The interface CN603 is not designed to be used for subsequent debugging and use. There is no three-proof treatment. The pins 1 and 3 are close to each other and the 2 pins are empty pins. Although the device is not connected to the OSD button board, it is very easy to cause if there are foreign objects. Pin 1 and pin 3 are short-circuited, so it is speculated that this time the low-resistance medium (such as water droplets) overlapped and short-circuited, which caused the contrast setting to increase. After the short circuit occurs, the main control chip has a storage function to save the changed contrast information, so that even after the low-resistance medium disappears, the contrast cannot be restored.

3. Mechanism analysis
Pin 1 of the interface CN603 is the signal GND, and pin 3 is the contrast adjustment control signal. The connection of the low-resistance medium causes the pins 1 and 3 of the interface CN603 to be short-circuited, which has the same effect as the contrast adjustment shortcut button S1 and makes the display control board contrast continue to increase, resulting in a whitish display. After the short circuit occurs, the main control chip has a storage function to save the changed contrast information, so that even after the low-resistance medium disappears, the contrast cannot be restored, and the display whitish phenomenon will always exist.

4. Measures and verification
At present, the three protection measures (anti-moisture, anti-salt fog, anti-fungal) for a certain type of integrated computer include material protection, process protection and structural protection. In terms of material protection, the chassis and module cover of a certain reinforced all-in-one computer are made of rust-proof aluminum, and the locking device is protected by materials such as stainless steel that are resistant to harsh environments; in terms of structural protection, sealing measures are taken for local components; On the aspect, the structural parts of the chassis are electroplated, the outer surface of the chassis is protected by paint, and the chassis ground and the signal ground are insulated by insulating materials. Three anti-paints are sprayed on the modules designed with functional circuits in the chassis, but for debugging and connection needs, the three functional interfaces of the functional
modules are not protected. In order to prevent similar problems during the test, first of all, water droplets should be avoided as much as possible. It is recommended not to open the box for a long time and try to keep the thermostat sealed.

The contrast value of the control panel of the faulty display is restored to the initial value of 50, and Aging verification is performed. At present, this board has been aging verified for 10 days, and after subsequent multiple boot and long-term aging verification, there has been no automatic change in contrast brightness value and other parameters. In the future, in order to avoid the same problem, adopt reliability optimization and improvement measures: dispense protection on the CN601 ~ CN606 interface on the display control board, and revise the design files, process cards, and set up inspection points.

5. Conclusion
To solve the problem that the color of the display screen of a certain type of rugged integrated computer is white, the analysis and location are carried out. By assuming the method to eliminate the problems of the main board, wiring harness and the display itself, the positioning fault exists with the LCD panel.

After testing, it was found that the fault of the display control board was caused by the high contrast of the display control board. After a detailed analysis, the results showed that the connection of low-resistance media caused a short circuit between pins 1 and 3 in interface CN603, which had the same effect as pressing the contrast adjustment shortcut button S1.

To avoid the same problem, adopt reliability optimization and improvement measures: dispense protection on the CN601 ~ CN606 interface on the display control board, and revise the design files, process cards, and set up inspection points.

The research in this paper enriches the cases of solving practical problems in engineering applications, and provides theoretical support and reference basis for the subsequent solving of similar problems.

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