A Movable Test Device for Main Board Voltage

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Abstract. Systematic thinking and mechanical physics methods are used to reform professional testing equipment and then to improve the working environment and conditions of professionals, which provides a design idea of movable test device for main board voltage. It is used to improve the efficiency of product quality test and maintenance. The device consists of two parts: the core component bearing system and the stability support system. The core component bearing system consists of a base, a test table, a voltage test device, a voltage test probe, and other components. The stability support system mainly provides functions such as component connection, core equipment fixing and equipment overall movement, including fixing columns, connecting rods, first baffles, first limiting plates, elastic parts, second baffles, lifting components, movable components and other components.

1. Introduction
The main board is the core component of the computer system [1]. The stability of main board operation determines the reliability of computer itself and its peripheral equipment. There are many types of typical faults related to the operation stability of the main board, such as the open welding or hard damage of chips such as the north-south bridge [2], poor contact of memory chips caused by poor performance of components [3], etc. These may cause frequent crashes, blue screens and other problems. People have formulated fault test methods such as main board diagnosis card method measurement, resistance voltage measurement method, observation method, software and hardware combination diagnosis method, menu method and plug-in exchange method [4]. However, in the actual test operation, the main board needs to be placed on a stable and difficult-to-shake test table [5], which would lead to new problems such as inconvenient movement and high requirements on the use environment [6].

In order to solve the problems of the complicated test processes, high test accuracy requirements and low efficiency of conventional test methods, we designed a movable computer main board voltage test device. The voltage test device consists of a core component bearing system and a stability support system. The core component bearing system consists of a base, a test table for placing the computer main board, a voltage test device and a voltage test probe for detecting the voltage of the computer main board. The connecting accessories comprise a fixed column, a connecting rod, a first baffle, a first limiting plate, an elastic member, a second baffle, a lifting assembly and a movable assembly. It is not only convenient for workers to carry all the devices, improves the efficiency of the equipment test, but also can effectively avoid the problem of test accuracy decline caused by shaking or collision.

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See Figure 1 to Figure 4. Figure 1 is a top view of a test device for main board voltage; Figure 2 is a left view; Figure 3 is a schematic diagram of a first baffle; Figure 4 is a schematic diagram of the second baffle.

Legend Marking Description: 1-Base, 2-Test Table, 201-Placing Slot, 3-Fixing Column, 301-Connection Rod, 302-Cylinder, 303-Lifting Connection Rod, 304-Voltage Test device, 305-Voltage Test Probe, 401-Motor, 402-Rotating Shaft, 403-Sliding Block, 404-Third Limiting Plate, 5-First Limiting Plate, 501-First Limiting Plate Holes, 502-First Limiting Plate, 503-Elastic Member, 6-Second Limiting Plate, 601-Second Limiting Plate Holes, 602-Second Limiting Plate, 603-Second Limiting Plate Holes, 7-Elastic Pad.

2. About Core Component Loading System

The so-called core component bearing system is to centralize the most basic and core functions in the device and distinguish them from auxiliary functions. Therefore, we describe these core components as a base, a test table (2) for placing the computer main board, a voltage test device (304) for detecting the voltage of the computer main board, a voltage test probe (305) and the like.

The base is mainly used for placing and fixing the testing tools of the device (see Figure 1). The design of the base refers to the design principle and casting materials of the sliding block of the rolling linear guide rail pair, as that present design is a movable portable device, it is not suitable to use overweight bed materials, such as bulky natural marble meter [8] for the bed material of rolling linear guide pair slider. According to the characteristics required by the design, ABS material with easy processing, low creep performance, excellent dimensional stability and high impact strength, namely acrylonitrile-butadiene-styrene plastic [9], is selected in this design. According to the compression resistance and bearing degree of the base support plate material, we have designed a fixing column (3) and a test table above the base to enhance the safety and reliability of the core components and provide a more stable operation support structure for professionals.

The test table is mainly used to place the main board to be tested (see Figures 1 and 2). We have designed a placement groove (201), a second baffle (6), a first baffle (5) and a first limit plate (501) inside the test table. Wherein the second baffle is fixedly installed at one end of the test table. The first
baffle is located at the position of the test table away from the second baffle. The first baffle is provided with two first baffle holes. The number of the first limit plates is two and is in a right-angle shape. A long side of that first limit plate penetrates through the hole of the first baffle plate and is fixedly mounted on the test table. The short side of the first limit plate is located near the second baffle plate, the short side of the first limit plate is connected with the first baffle plate through an elastic member (503), the movable assembly is located at the side of the first baffle plate far away from the second baffle plate, and the computer main board is placed on a placement slot between the first baffle plate and the second baffle plate.

The voltage test device and the voltage test probe are the test media of test resistance and voltage (see Figure 2). The voltage test probe is fixedly installed at the lower end of the voltage test device, and the upper end of the voltage test device is fixedly installed with a lifting assembly. The fixing column is fixedly installed on the base, and the lifting assembly is fixedly connected with the fixing column through a connecting rod.

3. About Stability Support System

To maintain the integrity and stability of the structure, we have designed a stable support system, including fixing column (3), connecting rod (301), first baffle (5), first limiting plate, elastic member (503), second baffle (6), lifting assembly, movable assembly and other accessories.

Fixed columns are used to connect the base and the voltage test device to ensure stability during voltage test. The test table is fixedly installed with a second limiting plate (601), the second baffle plate is provided with a second baffle plate hole (602) and a fixed hole (603), the second limiting plate penetrates through the second baffle plate hole, and the second baffle plate is connected with the test table through the fixed hole. The second baffle is fixedly connected with the test table through screws penetrating through the fixing holes. Elastic pads (7) are arranged on the opposite sides of the first baffle plate and the second baffle plate to protect the main board in the groove. The elastic pad material can be ordinary oil-resistant rubber, polyurethane, polytetrafluoroethylene, special synthetic rubber, etc. Considering the comprehensive cost, we suggest to choose ordinary rubber with low price and good elasticity as the material for making elastic cushion. The elastic member (503) is a spring. This design supports spiral type, scroll type, plate projectile type, special type and other types of springs. The coil spring has stronger applicability. This type of spring has good buffering, reset and tightening properties, and is conducive to reducing the influence of shaking generated during movement on test accuracy when fixing the main board [10].

The movable assembly is mainly used to support various components to maintain relative stability when movable on a given track. It comprises a motor (401), a rotating shaft (402) and a sliding block (403). A motor is fixedly mount on that test table. The motor is coaxially connected with the rotating shaft, the outer wall of the rotating shaft is provided with external threads, and the sliding block is provided with an inner cavity and the inner cavity is provided with internal threads. The sliding block is connected with the rotating shaft through thread matching, the cross-section of the sliding block is square, and the front and rear positions of the sliding block are provided with a third limiting plate (404). The third limiting plate is fixedly installed on the test table. The lifting assembly mainly comprises a cylinder (302) and a lifting connecting rod (303). The lifting assembly is located between the fixed column and the voltage test device, and the operator can flexibly adjust the specific position of the voltage test probe.

4. Examples

In order to test the practicability and reliability of this design, we have designed two examples. Example 1 takes the conventional ATX main board as the test object, and carries out TEST on the voltage test accuracy and stability of the device. In example 2, some parts of the test device are improved on the basis of the former to adapt to different computer main board sizes, such as Mini-ITX (mini), Micro ATX (compact), etc.

4.1 Examples of testing applications for conventional main board

In this example, the voltage test probe is fixedly installed at the lower end of the voltage test device,
the upper end of the voltage test device is fixedly installed with a lifting assembly, and the fixing column is fixedly installed on the base. The lifting assembly and the fixing column are fixedly connected through a connecting rod; The movable component is located at the side of the first baffle plate far away from the second baffle plate, and a computer main board is placed between the first baffle plate and the second baffle plate. When the lifting assembly moves up and down, the voltage test device installed with the voltage test probe is driven to move up and down to detect the voltage of the main board. The movable assembly moves to the left so that the first baffle moves to the left. The first baffle compresses the elastic member, and the computer main board is clamped and fixed through the cooperation of the first baffle and the second baffle. When the movable assembly moves to the right, the pressed elastic member returns to the initial state, so that the first baffle moves to the right.

As the sliding block and the rotating shaft are connected through thread matching, the sliding block moves in the left and right directions, thus driving the first baffle to move left and right. The lifting assembly comprises a cylinder and a lifting connecting rod, wherein the cylinder drives the lifting connecting rod to move up and down, and further drives the voltage test device installed with a voltage test probe to move up and down. The test table is provided with a placement slot, and the placement slot enables the computer main board to move along the slot without position deviation.

4.2 Examples of test and application of miniature main board

In order to enable the voltage test device of the computer main board to detect computer main boards of different sizes, this embodiment is improved on the basis of Example 1. The test table is fixedly installed with a second limiting plate, the second baffle plate is provided with a second baffle plate hole and a fixed hole, and the second limiting plate penetrates through the second baffle plate hole, and the second baffle plate is connected with the test table through the fixed hole. The second baffle can move left and right on the test table by opening holes in the second baffle, so that the distance between the first baffle and the second baffle becomes larger. The connection mode between the second baffle plate and the test table is not limited. In this embodiment, it is preferred that the second baffle plate is fixedly connected with the test table through screws penetrating through fixing holes. The advantage of this is that the second baffle plate is provided with a second baffle hole, and the second limiting plate is fixedly installed on the test table, so that the second baffle moves left and right along the second limiting plate on the test table through the second baffle hole, and the distance between the first baffle and the second baffle becomes larger.

5. Conclusion

Compared with the prior art, the beneficial effects of this design are: The motor rotates in the forward direction to drive the rotating shaft to rotate in the forward direction. As that slide block and the rotating shaft are connected through thread fit, the slide block moves left and right to the left, so that the first baffle plate moves to the left, and the first baffle plate compresses the elastic piece. The main board is clamped and fixed through the matching of the first baffle plate and the second baffle plate. The voltage test device installed with the voltage test probe is driven to move up and down through the up and down movement of the lifting component to detect the voltage of main board. As a result, the voltage of the main board is more scientific and efficient. Although we have described examples for reference, the design fully considers the generality and scalability of the platform [11], which is not limited to main board testing. I believe other professionals in the field can carry out further optimization design and make better examples based on the design idea. It should still be pointed out that our device does not consider the combination with 5G, artificial intelligence, virtual reality technology and other modern information technologies. Therefore, this design will develop towards automation and intelligence in the future [12].

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