Advances in Computer Science Research (ACSR), volume 76
7th International Conference on Education, Management, Information and Mechanical Engineering (EMIM 2017)

Secondary Power Supply Automatic Test System Design

Min Ji [1, a] and Pengfei Ji[2, b]

[1]Xijing University, Shaanxi Xi'an, 710123, China

[2] China Railway 21 Bureau Group Second Engineering Co. Ltd.,
Shaanxi, xi 'an 710065, China

[a] 995010771@qq.com, [b] 573825625@qq.com,

Keywords: Secondary power; Automatic test; Design

Abstract. In order to achieve the secondary power supply test, automatic test system for reasonable overall planning and design, to guarantee the output of the secondary power supply standard, for the extension to provide stable power supply. The overall design of the secondary power test system includes hardware design, software design, and test cabinet design.

Design of a Hardware Solution

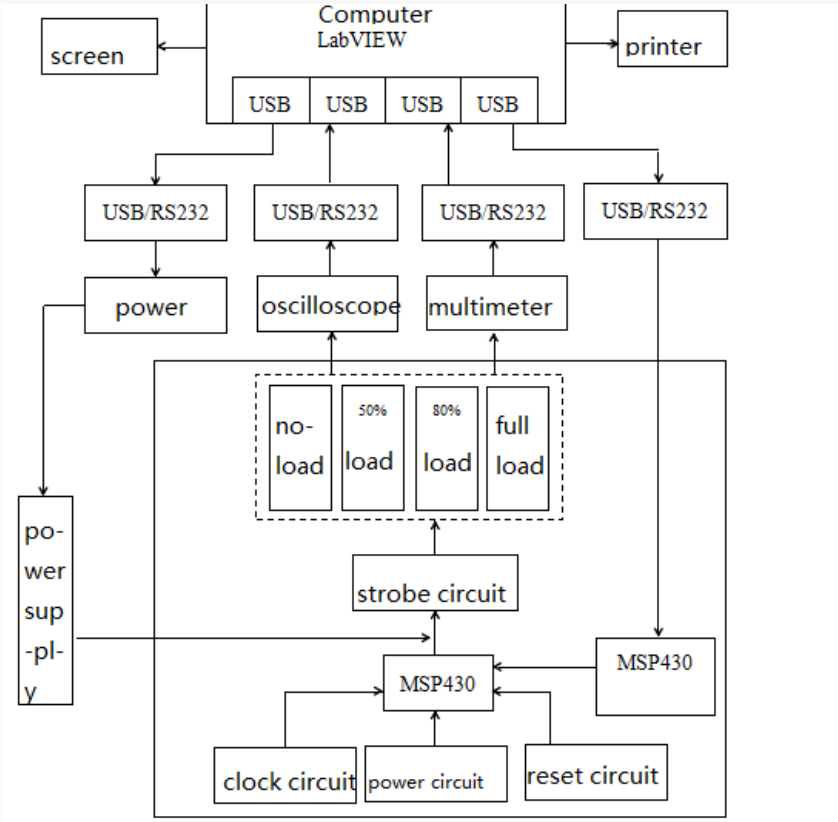

Figure 1 hardware overall design solution block diagram

Hardware design of automatic test system overall scheme is based on computers as PC hardware development platform, MSP430 MCU as the next bit machine, digital multimeter, digital oscilloscope, power supply, and to develop design load cases of complete hardware configuration. The computer is the control center of the entire test system, and the MSP430 is the operating system of the whole system. The overall hardware design scheme is shown in Fig.1.

In terms of design, a clear division of responsibilities between SCM and PC, a computer is a complete set of testing system of control center, based on the graphical interface of Windows as operation platform, through the USB serial port and USB/RS232 interface circuit and digital multimeter, digital oscilloscope, and respectively under the MSP430 SCM and PC RS232 serial port

for communication. PC through LabVIEW graphical programming language control the operation of the microprocessor MSP430, and control various load at the input relay switch, at the same time, with various load output terminal connected to a digital multimeter and digital oscilloscope will collected measured signal transmitted to the PC via a serial port communication, LabVIEW will get data for processing, preservation, then complete the automatic test of secondary power source.

The secondary power supply hardware of automatic test system is divided into chosen finished and designed two kinds of market, chooses the market mature products include: digital multimeter 1, and a digital oscilloscope, and a power supply, USB/RS232 serial interface converter 4 ,1 machine, computer, cable and connector several; The design of the hardware is not included: the load box 1, the machine cabinet 1.

Software Solution Design

After determining the hardware solution of the automated test system, the software solution of the system is designed with the functional characteristics of these devices. The software design requirements of the system can be summarized as: more system equipment, more easy to adopt modular thought, unified scheduling; The test data is so varied that you need to save the measured data and save it in Excel format after the test is complete. The project is multifarious, and the interface design is simple and elegant.

MSP430 is introduced

The next machine adopts TI company's MSP430. MSP430 series SCM is a 16-bit single chip, using currently popular in the industry, has reduced instruction set (RISCA), an instruction cycle can execute one instruction, MSP430 series MCU with 8 MHZ work, up to 8 MIPS instruction speed.

The previous machine, LabVIEW, is introduced

Upper machine adopt the NI company LabVIEW, which is a typical graphical editor language, has the industrial standard graphical development environment, widely accepted by the industry, academia and research laboratory, is regarded as a standard data acquisition and instrument control software.

Combined with hardware module, using LabVIEW as the design of efficient platform, using the modular thought, design the corresponding software solutions, software mainly includes the following functions: PC monitoring software, software of the monitoring and control software of singlechip processor and MSP430. In addition, the MSP430 is adopted as the controller of the load box, controlling the relay of the relay, which is the hybrid data acquisition system combined with the lower plane.

The Design of the Cabinet

Design of the Load Box Panel

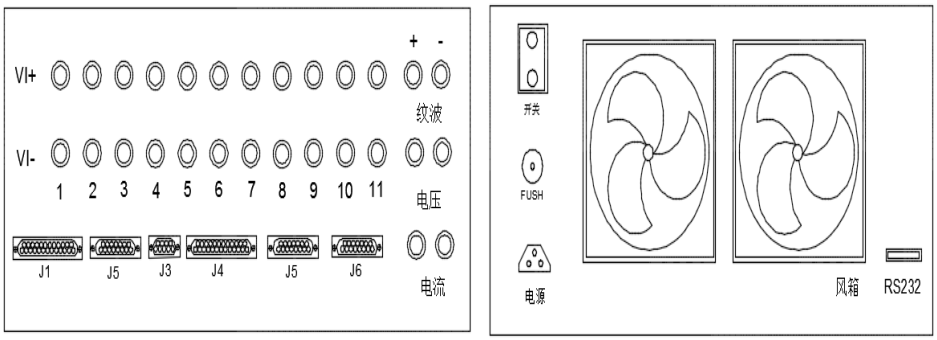

Figure 2 load box panel diagram

According to the actual test requirement, the load box of the automatic test system is designed. The load box panel diagram is shown in Fig.2. In order to be able to use the first panel, each

connector is inserted into the front panel. On the upper side of the front panel, from left to right are the terminal terminals of the second power supply from the first to the 11th. In the lower right corner of the front panel is the outlet of the ripple, voltage, and current, and the front panel is shown in Fig.2 . The back panel of the load box, as shown in Fig.2 is the RS232 bus communication interface in the lower right corner; The left side of the load box switches, insurance, and power outlets from top to bottom. The main part of the rear panel has two bellows.

Panel below a row of XD01 ~ XD06, followed by J30J - 25 ZKP, J30J - 25 ZKP, J30J - 25 ZKP, J30J - 9 ZKP, J30J - 15 ZKP, J30J - 25 TJL six different types of switches, the six connector with six of secondary power supply interface one-to-one correspondence, communication;

Panel for the above two rows of circular terminal, said power supply under test is at the top, the lower power supply under test negative, from left to right in turn for A + 7 28 V/A, D + 5 V (I) / 4 A, D + 5 V (II) / 1 A, A + 5 V (I) / 2 A, (II) A + 5 V / 6 A, A + 5 V (Ш) / 0.6 (I) A, A - 5 V / 0.6 A, (II) A - 5 V / 0.1 A, A + 24 V / 2 A, (I) + 28.5 V / 4.2 A, (II) + 28.5 V / 0.04 A;

On the right side of the panel, the left-hand column is positive, and the right side is negative, from top to bottom, to measure the ripple, voltage and current.

The payload box is shown in Fig.3.

Figure 3 load box object map

Special test cabinet panel design

According to the actual needs of the production activities, the special test cabinet of the secondary power supply test system is shown in the front panel of the automatic testing system, referring to appendix B.

Computer monitors located at the top of the test cabinet as the operation of the PC interface, through the display can be directly observed test power supply data, to facilitate in the actual production of the product performance parameters were observed. Down to the bottom of the display of digital oscilloscope, digital multimeter, respectively according to voltage and current ripple, these data, the three devices have been introduced in front. At the bottom of the test case is the front panel of the load box, which can be directly connected to a secondary power source for the reception.

Summary

This paper is divided into three sections, which describe the hardware design, software design and the design of the automatic test system. The design of the hardware design, including the overall structure design, equipment selection and load box design, was introduced. Then it describes the design of the software system; finally, the panel of the load box and the special test cabinet were designed.

References

[1] D. Wang, C. Mao, J. Lu, J. He, and H. Liu, "Auto-balancing transformer based on power electronics," Electric Power Systems Research, vol. 80, pp. 28-36, 2010.

[2] D. Wang, C.X. Mao, J.M. Lu, S. Fan, and F. Peng, "Theory and application of distribution electronic power transformer," Electric Power Systems Research, vol. 77, no. 3, pp. 219-226, 2007.
[3] Jamal Darusalam Giu, Ontoseno Penangsang. Implementation and Validation of Different Reconfiguration Strategies between HSA and PSO for Loss Reduction. International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering, Vol. 1, Issue 2, May 2013.
[4] H. Iman-Eini, Sh. Farhangi, J.L. Schanen, and M. Khakbazan-Fard, "A modular power electronic transformer based on a cascaded H-bridge multilevel converter," Electric Power Systems Research, vol. 79, pp. 1625-1637, 2009.
[5] J. Martin-Arnedo, F. Gonzalez, J. Martinez, and S. Alepuz, "Development and testing of a distribution electronic power transformer model," in Power and Energy Society General Meeting, 2012 IEEE, 2012, pp. 1-7.
[6] N. Mohan, T. M. Undeland, and W. P. Robbins."Power electronics: converters, applications, and design," 1989.
[7] Wang Pinglian, Yuan Sumin. Automated Measurement System for Wireless Transmitters. ICEMI 8th Electronic Measurement and Instruments International Conference, 2007.