

ENDURANCE TESTER FOR DETECTION OF FAULTY POINT IN SWITCHES AND SOCKETS

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ABSTRACT

This paper describes the design of system that detects the faulty point of the switch/socket of the endurance tester. This endurance machine is used to test switches/sockets for their endurance about 15000 or 20000 times by switching the switches on and off. The endurance machine also helps to identify the lifespan of switches for household and similar fixed electrical installations. Besides, it is also applied in the test of breaking volume of plug and socket, and mechanical action of normal operation lifespan. It uses a dolly counter, which is designed to on/off switches automatically until it reaches to given number of counts. The main drawback is that the machine cannot record the count which is having highest probability to break the switch. After operating the given number of counts, a visual inspection is needed to check the faults and defects in the tested switches and sockets. The main problem in the existing endurance machine is that it is not capable of find the exact point where the failure occurs. This study proposes a new method to solve this problem and find the lifespan of a switches and sockets, which is very important for quality control of the production line.

Keywords: Switch, Socket, Endurance, Defective Count

1. INTRODUCTION

The endurance machine for switch/socket endurance testing is a customized machine built with necessary requirements for standard testing (IEC standard-60669). It is used to check whether the switches or the plugs and sockets can endurance the mechanical damage or electric fatigue failure during the normal operation. Whether the contact adhesion occurs or there is a phenomena of being the on (off) station for a long time, which is the criterion of judging the sample is over damage or not. Therefore study about this special tester is performed initially. Overall process of current controlling, pneumatic mechanism of the

endurance tester is inspected thoroughly. Apart from this new technologies are used in various switch socket tester. Some of the existing systems are explained below.

Switch and Plug-Socket Endurance Tester SLT-3⁷

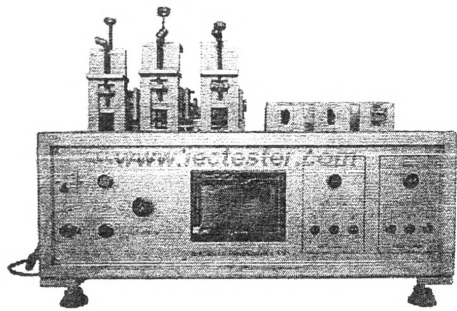


Figure 1: Switch and Plug-Socket Endurance Tester SLT-3

The test machine is designed and manufactured according to IEC60669-1 standards. It can do endurance testing for button switches, toggle switches, rocker switches, push switches, rotary switches, plug and sockets. Coupled with the load (resistive, inductive, capacitive) can process loading test, it has a corresponding PLC control system.

It is applicable for household and similar fixed electrical installations' breaking capacity and normal operating life test, also suitable for household and similar uses plug/ socket's breaking capacity and normal operating life test. The purpose is assessing whether the switch is able to withstand the normal use of mechanical damage and electrical fatigue damage, and whether the contacts has adhesion phenomenon, long-term closed or disconnected phenomena, to examine whether the test samples excessive worn and have other harmful consequences. It is a special test equipment for switches and plug-sockets electrical endurance test.

Switch Endurance Test machine⁶

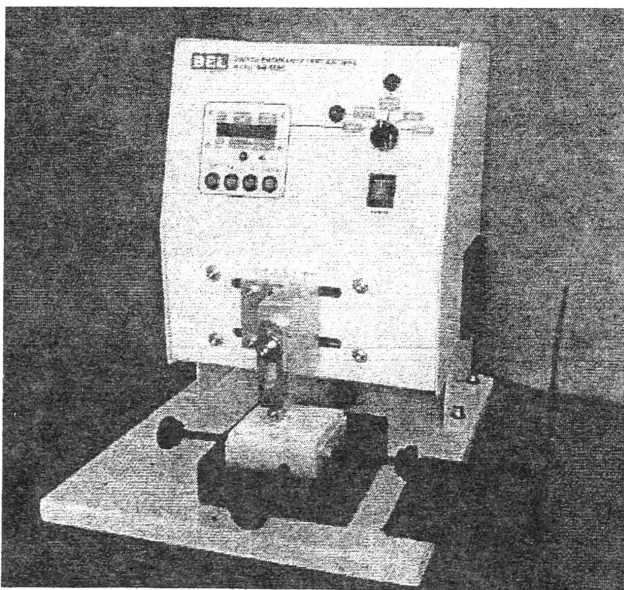
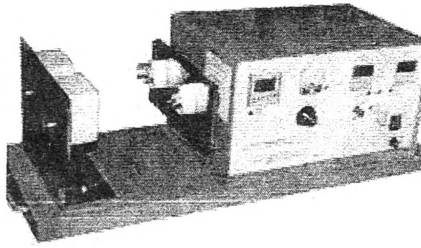


Figure 2: Switch Endurance Test machine

Switch tester model SW-800D is equipment for switch testing in durability of a switch under a simulation. Providing various test equipment for reducing the product operation failure and maintaining the quality are our main objectives. Switch Tester is suitable for test Rocker Switch, Wall Switch, Push Button Switch, Slide Switch, Micro Switch, Limit Switch, Vibration Switch...etc. Multi-functions of the Switch Endurance Tester are absolutely value added and able to connect with personal computer for viewing the test reports and data.

Switch Endurance Tester has been widely adopted by many international well know test laboratories and enterprises around the world.

Plug Socket Insertion Endurance Machine⁸



In order to ensure that the quality of plug and socket is in accordance to meet the EN60335 standard, several inspection test machine are provided to help client to minimize the risk of getting defective and control the quality of production. Plug Socket Insertion Endurance Machine was designed for determine the life test of plug and socket

Figure 3: Plug Socket Insertion Endurance Machine

by moving backwards and forwards as simulate actual use. The information resulting from this quality test can be used to determine the exact source of imperfection. Several famous laboratories around the world have used this model.

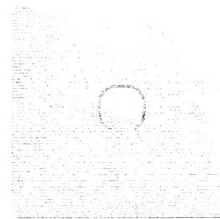
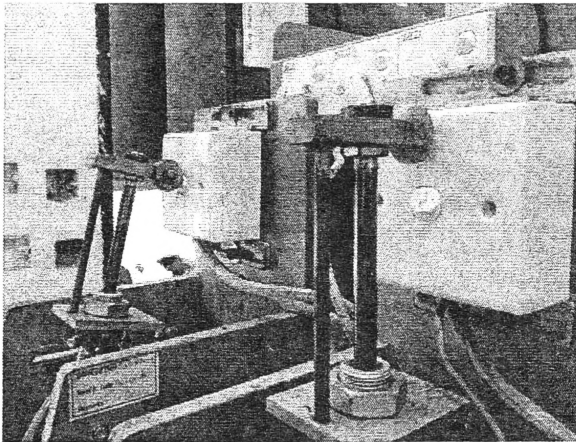


Figure 4: X5 switch TEST IN THE tester

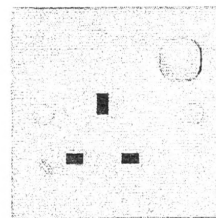
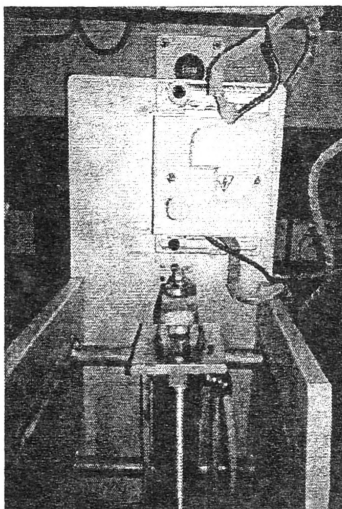


Figure 5: 13A socket test in the tester

2. EXPERIMENTAL

Before designing the main modification circuit, the existing control circuit of the tester is inspected. After that, various circuits are analyzed to sense such devices and their functionality. LDR, Atmega328P microcontroller and Buzzer are used as major components in designing. Initially, current line from the endurance tester is taken for the analysis in our system. It's fed to the LED to identify whether the signal is approached to the system. When the LED light up, LDR³ sensor circuit is utilized to detect the variation in light. Detected variation in the signal is stored in the microcontroller¹ memory. When the switch socket tester is in activated mode the counting process in continuously running and in that case corresponding variations of signal is stored as we mention earlier. There were two reasons to store those data's such as.

- To maintain the counting process continuously when a power failure occurred.
- To run the machine continuously without blocking the pneumatic dolly.

Stored data are compared with incoming data and analyzed to detect the error point of the counting process.

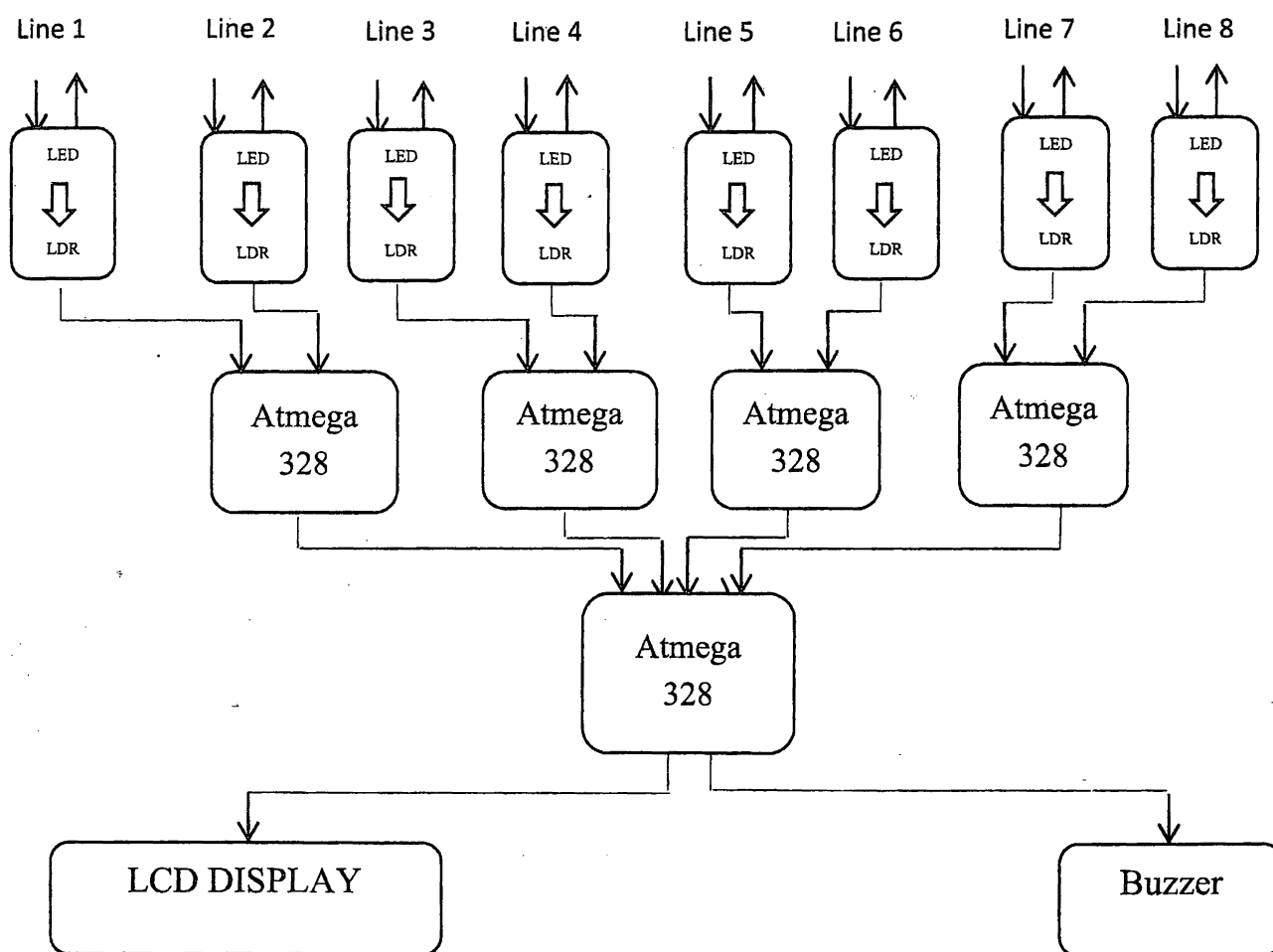


Figure 6: Schematic of the Circuit Diagram

X7, X5 & Bit Rocker series of switches in various brand names (Kevilton, Chint, Orange, Schenider) were tested in the newly designed faulty detection system.

Table 1: Result Details

| Brand Name | Type of the Switch/socket | Completed cycles Pass/Fail |
|------------|---------------------------|-------------------------------|
| Kevilton | X5- 2gang , 3gang | 15000 – pass, pass |
| | X7- 2gang , 3gang | 15000,9700 – pass, fail |
| | 45A appliance switch | 1900 – fail |
| Chint | X5- 2gang , 3gang | 15000 – pass, pass |
| | X7- 2gang , 3gang | 1700, 1850 – fail, fail |
| | 45A appliance switch | 15000 – pass |
| Orange | X5- 2gang , 3gang | 15000 – pass, pass |
| | X7- 2gang , 3gang | 15000 – pass, pass |
| | 45A appliance switch | 1950 – Fail |
| Schenider | X5- 2gang , 3gang | 15000 – pass, pass |
| | X7- 2gang , 3gang | 15000 – pass, pass |
| | 45A appliance switch | 15000 – pass |

Chint-2gang, 3gang and Orange 45A appliance switches are failed in 1700-2500 count range from 15000 counts. Further Kevilton X7 series 3 gang failed in 9770 counts. Our systems showed the exact point on the LCD screen where the failure occurred. The results show that the system works accurately to capture the point where the switch or a socket fails to operate. When comparing the system with the previous system, not only visual inspecting the defected of the switches and sockets, but also the new system can detected the error counting point using this sensor circuit. The cost for the system is around 5000/= Sri Lankan Rupees.

4. CONCLUSION

We have designed a system using an ATmega microcontroller to find the faulty point of endurance testing of switch/sockets. This system adds extra features to the existing endurance machine and it provides valuable information for quality control division to produce reliable products to the market. This study can be extended to find the faulty point due to different current flows through the switches and sockets using current sensors, which provides full-featured endurance testing capability.

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