

A Manual Adjustable Current Rated Circuit Breaker

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Abstract: *The current Circuit breakers have a fixed current rating from the manufacturer and whoever buys it must evaluate the current rating of the loads. However, it is inevitable to maintain the same loads for years. For every appreciable change in the load, another circuit breaker is needed to support the installed loads. This result into high cost of circuit breaker purchase and its installation, if the circuit breaker is not changed, it means undesired tripping. This paper aim to design an adjustable rated current circuit breaker based on Microcontroller which automates the reset of the adjusted current rating. If the set current is more than the current rating of the load, then the Circuit breaker does not trip and the load gets power after the refresh button pressed however, if it's below, the Circuit breaker trips instantly and its red LED goes off too.*

Keywords—Over-current, load, adjustable, power, Circuit, fault

1. INTRODUCTION

Over-current is any current in excess of the rated current of equipment of the ampacity of a conductor. An over-current is the result of an overload, short circuit, arc or ground fault. Effects of over-current include fires, conductor insulation damage and equipment damage. Over-current protection is the protection of electrical equipment or circuit against excess current and this is done by the installation of devices such as circuit breakers, fuses and relays. Over-current protection devices are meant to protect against the potentially dangerous effects of over currents, such as an overload current or a short-circuit current, which creates a fault current. An over-current protection device (OCPD) is a piece of electrical equipment used to protect service, feeder, and branch circuits and equipment from excess current by interrupting the flow of current. An over-current protection device protects the circuit by opening the device when the current reaches a value that will cause an excessive or dangerous temperature rise in conductors. Most over-current protection devices respond to both, short-circuit or ground-fault current values as well as overload conditions. All over-current protection devices are rated in amperes and they are manufactured to handle only a specific amount of current which is fixed.

Types of current protectors

Fuses

The principle of a fuse is based on the heating effect of the electric current. A simple fuse consists of a small conductive material with low resistance and it is placed in series with the circuit. When the current in the circuit exceeds the permitted value, it will cause melting of the conductive element in the fuse and open the circuit.

Circuit breakers

A circuit breaker is an automatic operated electrical switch designed to protect electrical circuit against over-current; they are not like fuses which are only used once and need to be replaced after. A Circuit breaker is a device that interrupts the abnormal or fault current. It is a mechanical device that disturbs the flow of high magnitude (fault) current and in additions performs the function of a switch.

In this paper an adjustable rated current with a range from 0A to 11A is designed and implemented. With this design one does not have to buy new circuit breaker in case there's an increase in the load, it displays both the set current and the load current which enables the user to adjust accordingly.

2. DESIGN OF THE PROJECT

The design of the load current rating machine consists of current controller, 12v Centre tap transformer, solid state module, micro-controller, socket, rheostat, connector.

BLOCK DIAGRAM

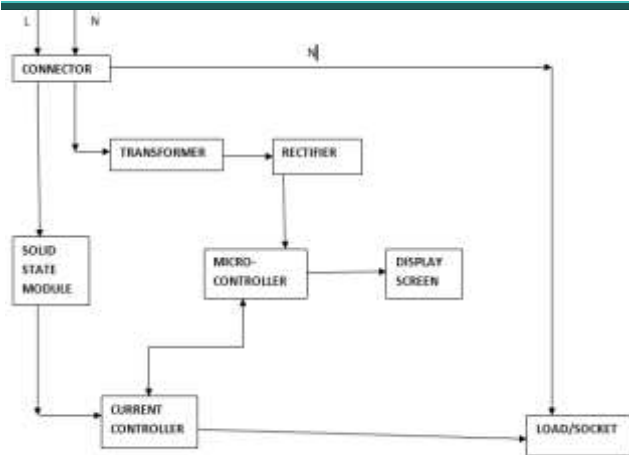


Figure 1: Block diagram of the project

240/12V Centre tapped transformer

It is for stepping down the 240V to 12v which will be center tapped to get 6V which is rectified to power the DC circuit components.

Micro-controller at mega 328p

It is an integrated circuit which is programmed using in ISIS8.6 software.

Current sensor

It is used to sense the current being drawn by the load and then gives a feedback to the micro-controller.

Solid state module

It is a tripping device used to protect the load against short circuit faults or power surges.

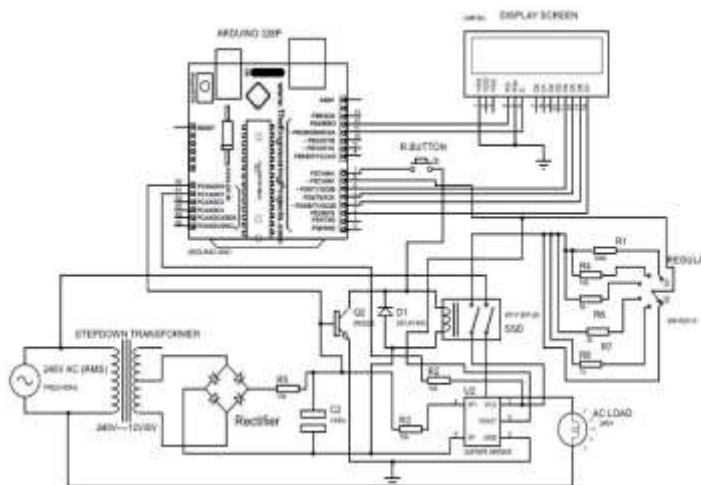


Fig. 2: Schematic diagram of the project.

3. OPERATION OF THE SYSTEM

The 240VAC from the source passes through the 240/12V transformer center tapped to get 6v. The neutral is connected to the socket directly and the live wire passes through the solid state module, then through the current sensor to sense the

current being drawn by the load for rating. The 12V from the secondary of the transformer is passed through Centre tapped transformer to get 6V. This voltage is rectified through the rectifier circuit then its supplied to the microcontroller for control and also used to power the LED screen where the values are displayed.

4. RESULTS AND CONCLUSION

When the turner is set to maximum antilock wise point, the current set is 0A and no load can receive power to operate. when the refresh button is pressed with the load connected, the solid state module lamp just flashes the red light and then it goes off since the Circuit breaker tends to trip instantly.

When the turner is turned clockwise, the current increase from 0A which is the minimum to 11A which is the maximum current for the circuit designed. Each time the turner is adjusted, the refresh button is pressed to execute the command and if not, then the set current is not activated at all but instead the previous command still stands. To identify the current needed by the load, the turner is adjusted to high current values like 8A, 9A, 10A or even 11A to avoid unnecessary Circuit breaker tripping during testing. If the set current is more than the current rating of the load, then the Circuit breaker does not trip and the load gets power after the refresh button pressed however, if it's below, the Circuit breaker trips instantly and its red LED goes off too.

When the load has a short-circuit, the Circuit breaker just trips instantly to protect the other components, equipment and human life.

During the tripping of the Circuit breaker, no sound is produced but it's only the red LED to go off.

Tripping of the Circuit breaker only occurs under two conditions;

- When the current rating of the load is more than the set current.
- When there is short-circuit in the system of the load circuit.

Therefore, the constructed circuit breaker plays all the necessary duties of an excellent protection system and with an allowance of adjustment if need be.

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