

# Development of a Simple Automatic Water-Heating Unit

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## Abstract

*The paper presents the design, construction and testing of a simple automatic water-heating unit. The principle of operation of this water-heating unit is simple. The device is designed to switch OFF automatically the heating of water whenever the temperature is close to the preset boiling point temperature and switches ON when it gets below a particular setting. An alarm is incorporated to define the state of the process. The design is quite flexible for numerous water heating operations.*

**Keywords:** Temperature, heating, alarm, automatic, sensor, electromagnetic relay, control, oscillator, latch, clock, switching.

## Introduction

The subject of automatic controls is enormous, covering the control of variables such as temperature, pressure, flow, level, voltage, speed, etc. Water heating is part of energy utilization and is a process that is as old as man, with the mode of heating water changing from the use of sun to the modern day electricity. That is why over time people have heated water in many ways. Even as recently as the turn of the century, running hot water was a luxury. It was available only to those who were well-off. In Nigeria today, a personal supply of hot water is thought of as a necessity, which is as important as food and shelter. Because of the importance of hot water to mankind, water-heating units are therefore indispensable and are found in homes, offices, factories, cafeterias, manufacturing processes, laundries, etc. In addition, heating elements are often the cause of many electrical fire outbreaks due to negligence. Hence there is a need to automate heating processes. In this paper, a simple automatic water-heating unit was designed and constructed. The unit is a simple system which could be used for various heating processes at home, offices, etc. The system is an automatic temperature switch that controls a powerful heater in a hot water storage vessel. It has two-fixed temperature settings, one to switch the water heater ON and

another to switch it OFF. Whenever the temperature of the water reaches the boiling temperature (above 95°C) the device automatically switches OFF the electrical power supply to the water-heating element. As the hot water is being drawn from the vessel for use and replaced with cold water or as the water temperature drops below a particular setting (below 85°C), the heating element is activated, i.e., turned ON to continue the heating. The switching involves the use of an electromechanical relay.

An alarm was incorporated to define the state of the process and it creates awareness when the heated water reaches its maximum preset temperature. It produces an audible sound with the aid of SR latch, an oscillator, and a speaker, which informs the user that the water has reached its optimum boiling. A precision temperature sensor was used in the design for better performance. The design is quite flexible for numerous water heating operations. The device holds an industrial importance.

The approach used in this design is the modular one where the overall design is first broken into seven functional blocks, where each block represents a section of the circuit that carries out a specific function. The functional block diagram of Fig. 1 shows the interconnections between these blocks. Each section of the block is analyzed below.