Introduction to Programmable Logic Controllers Ex8_serial

DTU 31343

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Part 1

The Arduino was connected and configured as described. The program in Figure 1 shows how the version number was received from the Arduino and stored.

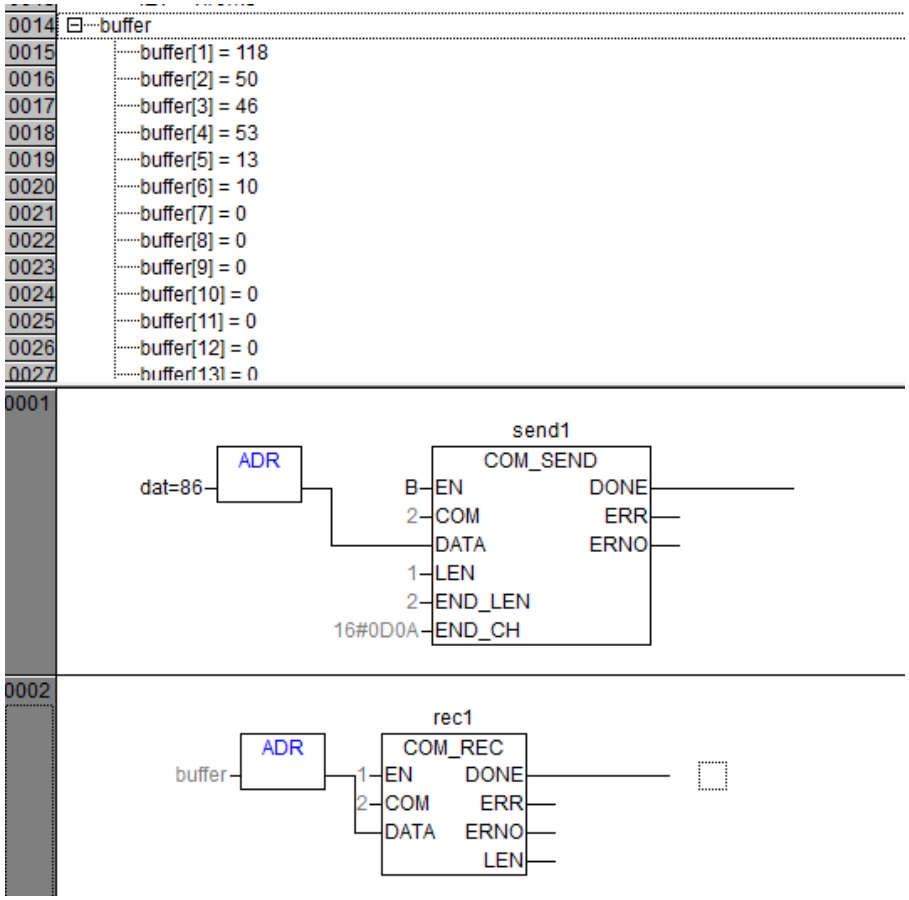

Figure 1: Program used to receive a response from the Arduino.

The received ASCII code in the buffer corresponded to the expected response from the given table.

Part 2

The program made to control the light in the room, and to poll the state of the light is shown in Figures 2 & 3.

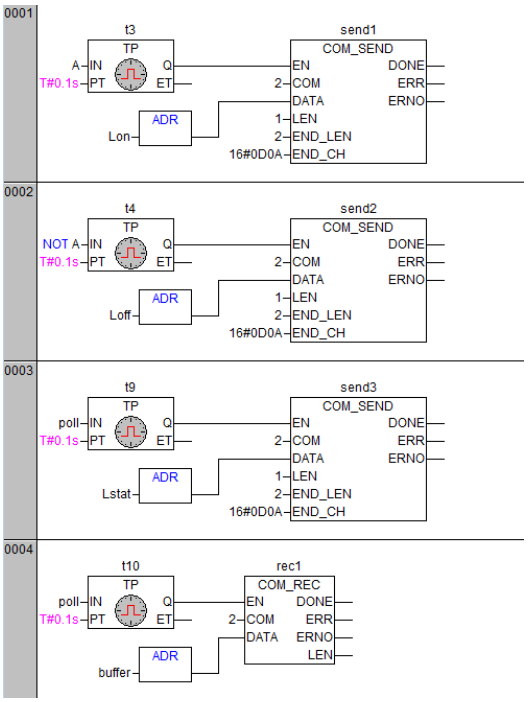

Figure 2: Sending the state of the switch and asking for the state of the light every second.

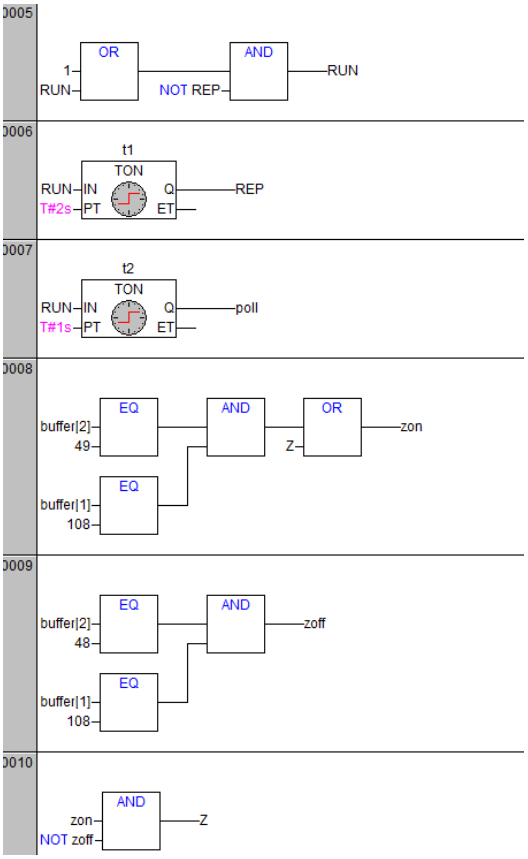

Figure 3: Creating a pulse for the polling rate, and filtering the response in the buffer to display the state of the light on the physical light.

To display the state of the light, the response in the buffer had to be filtered based on the ASCII code 108, and was either on when 49 was detected or turned off when 48 was detected. Therefore, based on the detected on or off, a latch was created that would reset if 48 was detected and set when 49 was detected. The result of this latch was fed to the physical light.

Part 3

To keep the room temperature between 20 °C and 22 °C, the heater was turned on when below 20 °C and turned off when above 22 °C. The program to achieve this is shown in Figures 4, 5, & 6.

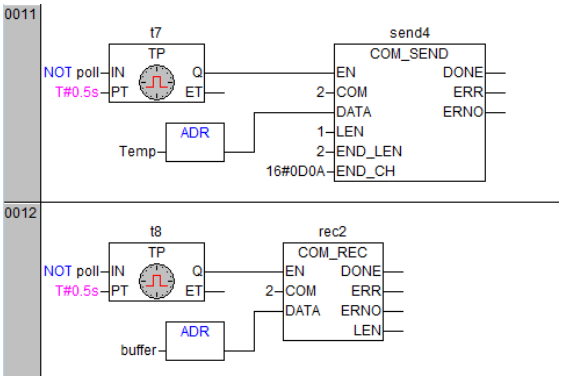

Figure 4: Polling the temperature of the room based on the same polling rate used for the light.

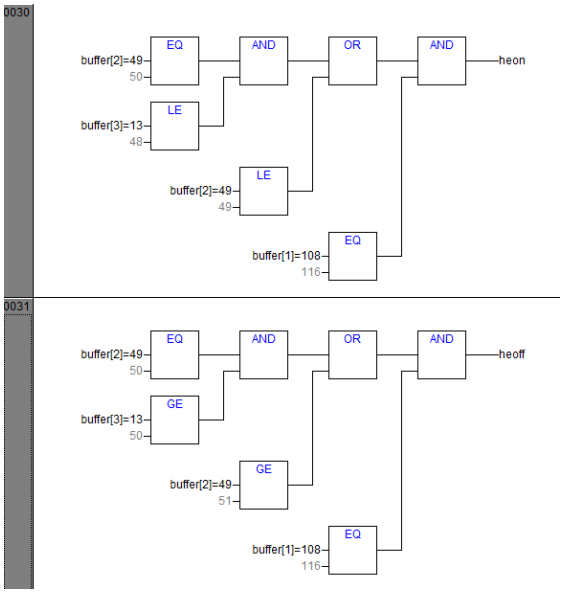

Figure 5: Filtering and decision making based on the read temperature to keep the temperature between 20 °C and 22 °C.

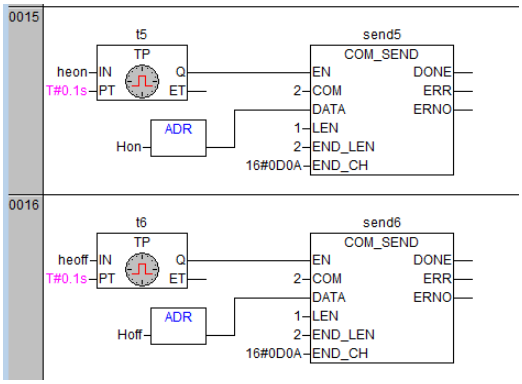

Figure 6: Turning the heater on or off based on the decision made.

The filtering worked similarly to how the light was displayed, only conditions were imposed based on the received temperature. The resulting program allowed the heater to be controlled such that the read temperature remained between 20 °C and 22 °C.

Part 4

To store the current temperature, the program in Figures 7 & 8 was implemented.

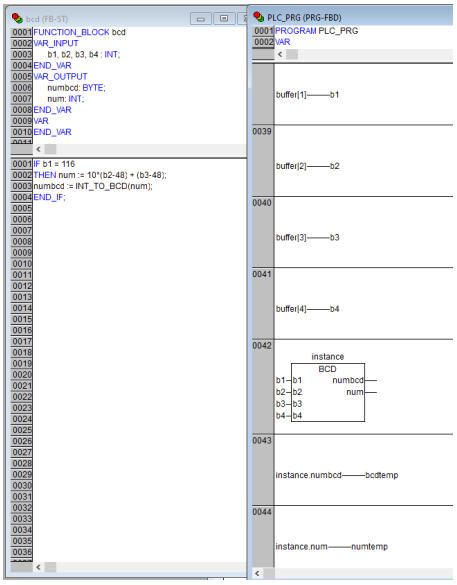

Figure 7: Program recording the current temperature in binary coded decimal.

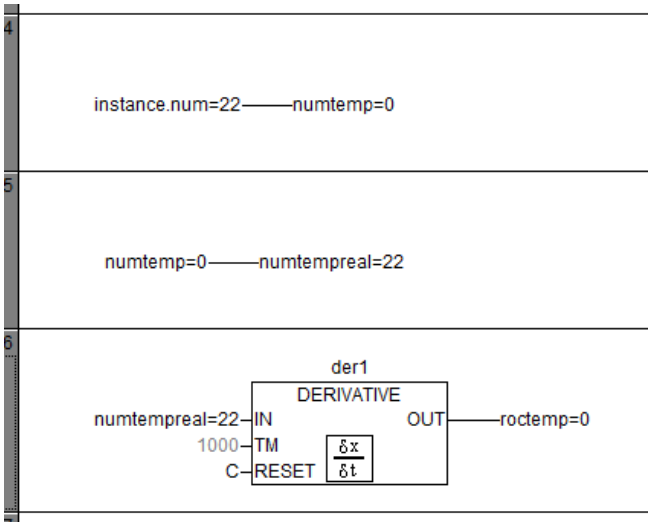

Figure 8: Calculating the rate of change in the temperature.

Using the derivative function block, allowed the rate of change to be calculated. The temperature, however, only changed by 1 °C at a time which made it difficult to detect. This was seen when displaying the result as a trace, where the samples used to make the trace, had to coincide with when the derivative function block was making its calculations.

Part 5

A trace was set up and the result over a 1 minute period is shown in Figures 9 & 10.

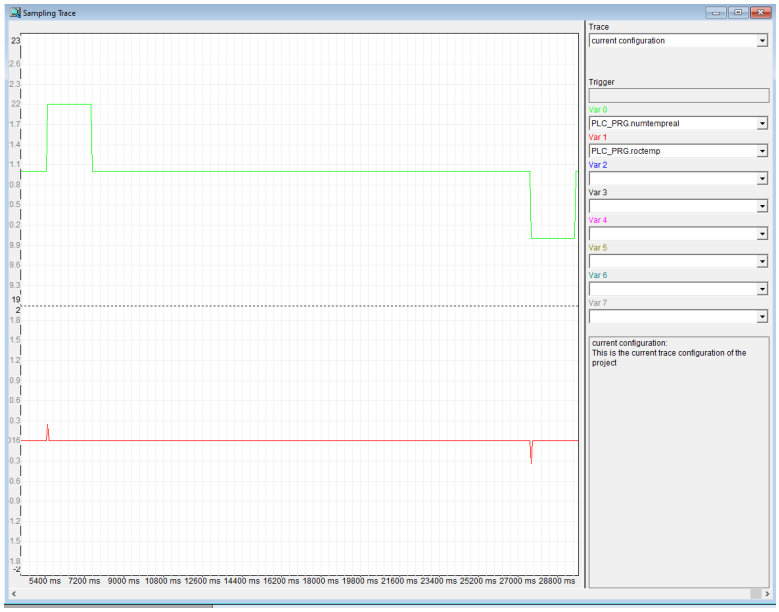

Figure 9: Trace of the temperature over a 30 s period.

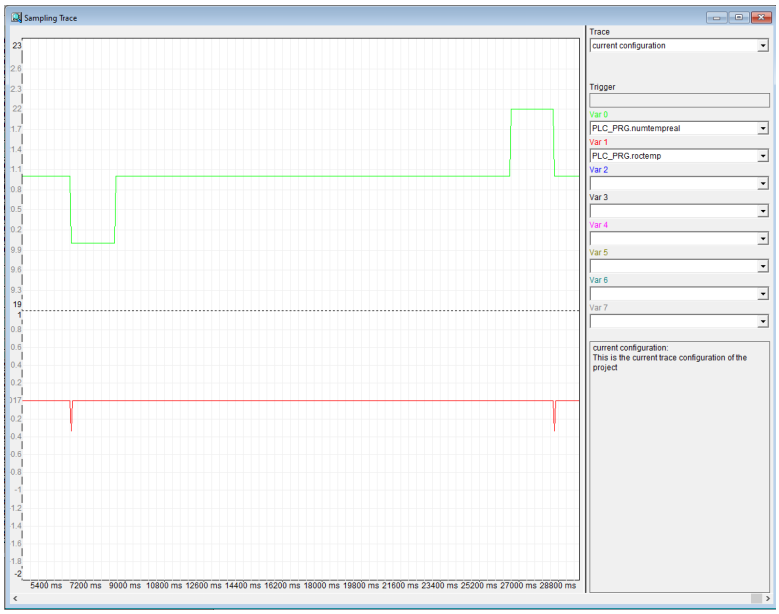

Figure 10: Trace of the temperature over a 30 s period.

It can be seen, that the temperature remains between 20 °C and 22 °C, and reacted accordingly by turning the heater on when it was falling below the bound, and on when it was rising above the bound. The rate of change is also shown and a reaction occured at most changes in temperature. Displaying the derivative trace consistently was difficult, as the reading had to coincide with the samples being taken over the time period period (limit on number of samples within a given time period).

Part 6

To keep the temperature as close to 21 °C as much as possible, the bounds in the decision making were tightened to keep the temperature between 20.9 °C and 21.1 °C as seen in Figure 11.

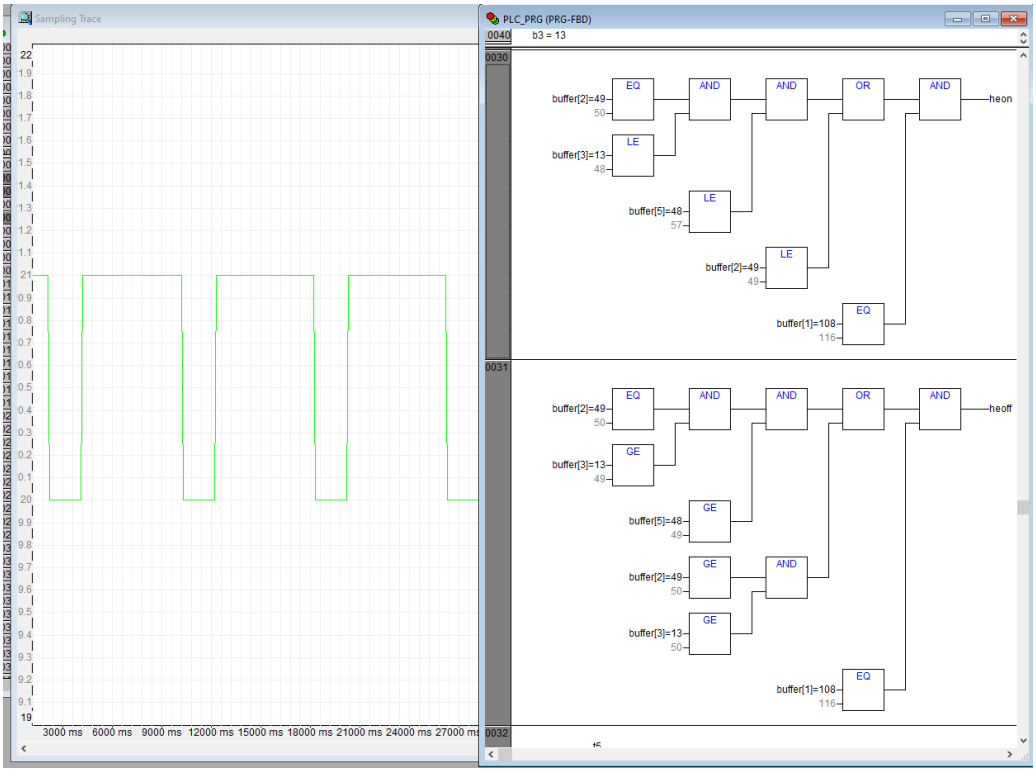

Figure 11: Program that keeps the temperature at 21.0 °C as best as possible.

The trace shows that the temperature fluctuated between 20 °C and 21 °C, however, this is partly due to the truncation in the variable, as an integer was being used. In reality, the temperature was hovering around 21.0 °C quite closely.

The temperature control system can't really be optimised to raise the temperature much faster, as the heater is either on or off. To improve this, the heater would have to have different intensity settings that could be selected based on the difference between the given temperature and the desired one. Additionally, if it were critical to keep the temperature to a desired setting, the polling rate would have to be increased such that larger fluctuations in temperature could be avoided.