Part 4

Status of light and temperature

When timer t9.Q is high the light status "lightStatus" is sent and "buffer" array is recieved . When the r11_en is high the temperature status "tempStatus" is sent and "buffer" array is recieved.'

Turn on/off light

"Turn light on" and "turn light off" is sent when r2_en is high and switch "in0" is either turned on or off. For some reason i have set it so that when "in0" is high, the light is off, and vice versa.

Turn on/off temperature

For controlling the "turn on/off heater" i have used greater/less than to control the temperature combined with r3_en.

To display the light by the current state of the light i used EQ operators combined with boolean variables to check if the light was on or off.

Store BCD values

To store the current value in BCD i first converted buffer[1],buffer[2] and buffer[4] from ASCII numbers to decimal by subtracting by 48. I then used a shift register to shift the position of buffer[1] four positions to the left, and then added buffer[2], and did the same with the fraction portion. I could also have used "int_to_BCD".

Decimal numbers in "REAL"

To get the decimal numbers in "REAL"i used the previus calculated INTs temp[1..3], converted them into strings and combined them using the concatenate operator. I the used the string_to_int operator. Defining the variable as a "REAL" and diving with 10, i got the decimal temperature "tempreal".

Rate of change

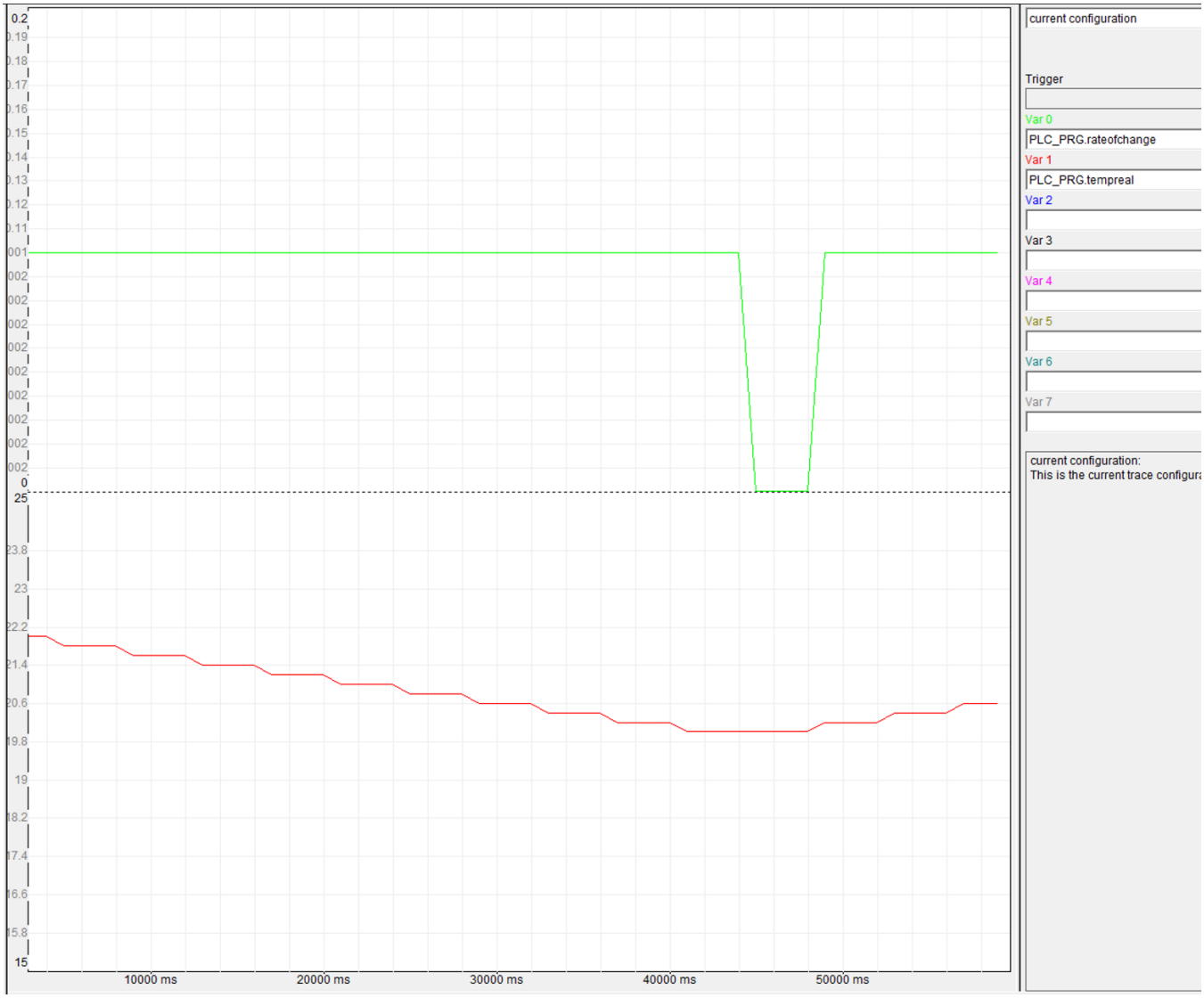
To calculate the rate of change in degrees/second i used a MOVE operater combined with a timer to make a two second delay in the values from temp[1..3] to temp1[1..3]. I then subtracted the current and previous INTs to get the difference. Like this:

$$ABS((temp[1]-temp1[1])\cdot 10 + (temp[2]-temp1[2]\cdot 1) + (temp[3]-temp1[3]\cdot 0.1)).$$

This could also have been done using "tempreal" instead of "temp", but i discovered CONCAT after i already made all of these calculations.

Part 5

The rate of change mostly stayed constant at 0.1degrees/second over the 60s period. At 44-47s it dived down to 0degrees/second.
The temperature goes from 22 degrees downto 20 degress and up again to 20.6 degrees when 60 seconds have passed.



ex8 part5 trace 2.0 - Notepad

File Edit Format View Help

```
19000 0.1 21.2
20000 0.1 21
21000 0.1 21
22000 0.1 21
23000 0.1 21
24000 1.e-001 20.8
25000 1.e-001 20.8
26000 1.e-001 20.8
27000 1.e-001 20.8
28000 0.1 20.6
29000 0.1 20.6
30000 0.1 20.6
31000 0.1 20.6
32000 0.1 20.4
33000 0.1 20.4
34000 0.1 20.4
35000 0.1 20.4
36000 0.1 20.2
37000 0.1 20.2
38000 0.1 20.2
39000 0.1 20.2
40000 0.1 20
41000 0.1 20
42000 0.1 20
43000 0.1 20
44000 0 20
45000 0 20
46000 0 20
47000 0 20
48000 0.1 20.2
49000 0.1 20.2
50000 0.1 20.2
51000 0.1 20.2
52000 0.1 20.4
53000 0.1 20.4
54000 0.1 20.4
55000 0.1 20.4
56000 0.1 20.6
57000 0.1 20.6
58000 0.1 20.6
59000 0.1 20.6
```

Part 6

To try to keep the temperature at exactly 21 degrees celcius i sped the timers up by 3x, but i couldn't get it to stay at exactly 21. It deviated by 0.1degrees.
Even though the rate of change isn't affected when i changed the timers, (i.e the rate of change is still 0.1degrees/s), the changes in steps are smaller.

One way of improving the temperature control with respect to speed would be to use a PID function block. Where the P and D ensure the speed.