

LABORATOR Y

Microcontroller

Temperature Data Logger

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SE5PC11

The main purpose of this experiment is to understand basic knowledge of Data Logger. Basically it is a device which is mainly used to record data. In this particular lab we will create temperature data logger which will measure real time temperature. Thus, we need following instructions to be done which is parts inside the MyAVR set to build a temperature data logger; measure the temperature, know the current time/date (Real Time Clock), write the measured value to a memory, together with the time/date, react on buttons to clear the memory and restart the data logging, output the logged values: – to a display – with an interface to a Personal Computer.

Atmel Mega88pa has internal hardware as a part of ADC to measure temperature. The temperature can be measured with an internal temperature sensor. The ADC has a resolution of 10 Bit only. This is very bad for the temperature sensor. To have a better resolution use oversampling. Use 128 measurement cycles for the oversampling and try to get two more bits for the resolution. Corresponding code provided by supervisor:

```
uint16_t adc_temperature_oversample(void){
    uint8_t i;
    uint32_t sum = 0;

    for (i = 0; i < 128; i++){
        ADCSRA |= (1 << ADSC) | (1 << ADEN); // Start ADC
        while( ADCSRA & (1 << ADSC) ) // wait for ADC complete
            ;
        sum += ADCW;}
    sum /= 32;
    // subtract offset
    sum -= TEMPSENSOR_OFFSET;
    // 0.27 deg. Celsius per step
    sum *= 27;
    sum /= 10;
    return sum;
}
```

Data Storage

To store the data we have just one small EEPROM with 256 Byte (24C02). So it is not a good idea to store every temperature value together with the whole time/date. This would use too much memory. Better is to store just the starting point (time/date), the number of recorded temperatures and after that the temperature values itself. So we need a fixed memory of: Number of values, 1 Byte, Year, 1 Byte, Month, 1 Byte, Day, 1 Byte, Hour, 1 Byte, Minute, 1 Byte, Sum: 6 Byte

To operate, the device should have two buttons. These buttons are for read and write. After the

device is powered it should be in standby. The LCD shows: the current time, the current temperature. If the button write is pressed in standby mode the device should start to record the temperature. The recording should not start, if there is already data in the memory! Please record one value every minute. While recording the LCD shows:

- Recording data
- How many temperature values are recorded
- The current temperature

If the button read is pressed in the standby mode, the device should show if there is no data in the memory or how many data-sets are stored and the associated time

Description of the Hardware:

- EEPROM add-on module for memory
- DS1307 add-on module for RTC
- LCD Interface

Description of the circuitry:

Pin PB0 to key 1(read button)

Pin PB1 to key 2(write button)