**Add Temperature measurement to ANENG 8008 (flashing EEPROM using Arduino Nano)**

Temperature measurement can be enabled by changing some values in the EEPROM 24C02. Following changes need to be made[5]:

- Cell AD -> 13 enables Celcius Temperature
- Cell BD -> 15 enables Fahrenheit Temperature

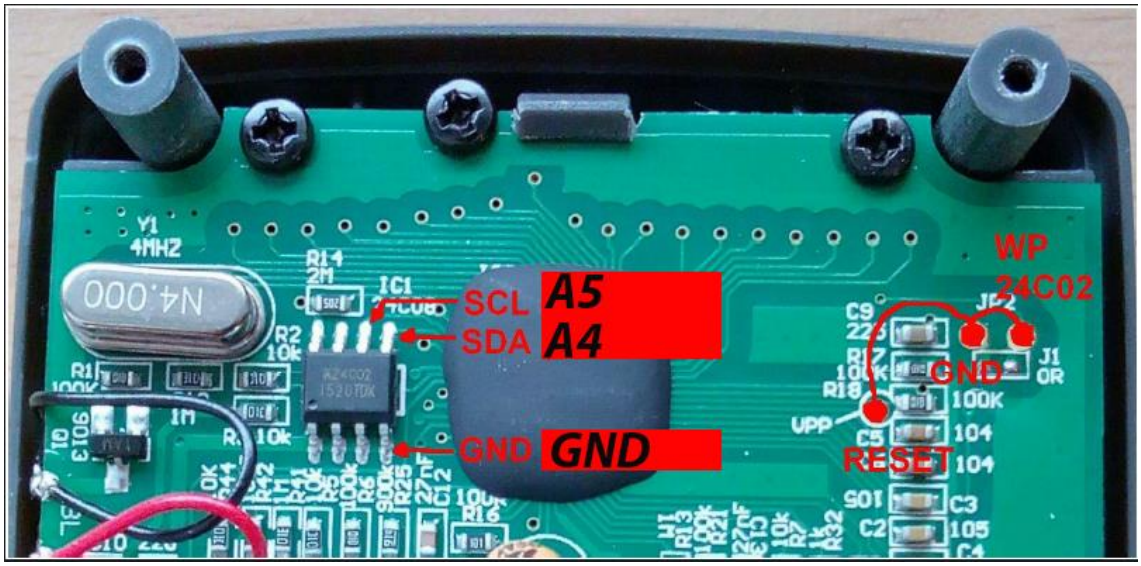
The temperature is then be measured in the "mV" selector position by pressing the yellow button "SEL/HOLD" a few times and cycling through the measurement options.

**NOTE**: Some found resources call for modifying cells AF and BF[3] or AC and BC[6], but the first values added the temperature functions on the "V" selector position and the temperature measurement did not work while the second values did not change anything (that was seen on the display).

**Flashing Procedure**

First, download the Arduino script from Resource 1.

1. Then set jumper between VPP and contacts JP2. Turns the processor into reset state (stops interference with 24C02) and enables writing to EEPROM.
2. Upload the script **WITHOUT** uncommenting the lines for //writeByte!!!
3. Connect Analog Pin 4 (A4) on the Arduino Nano to SDA on the EEPROM, Analog Pin 5 (A5) to SCL on the EEPROM and GND on the Arduino to GND on the EEPROM (see attached pictures)




http://kazus.ru/forums/attachment.php?attachmentid=115139&d=1496663215

4. Turn the power of the multimeter on (any selector position). It will not beep, nor show anything on screen.
5. Connect the Arduino Nano to the PC and open the Serial Monitor. On opening of the Serial Monitor it will show the EEPROM Dump. ***Save it!!!***
   Then uncomment the lines for enabling Temperature measurement in the Arduino Software. Change //writeByte to writeByte without the // in front and to our addresses and values.
   So it looks like this:

   writeByte(I2C_ADDR, 0xAD, (byte) 0x13);
   writeByte(I2C_ADDR, 0xBD, (byte) 0x15);

   **NOTE:** (In my case it only wrote one value to the EEPROM so I uncommented the lines one by one). Upload the modified sketch.

6. After every change check with the EEPROM Dump if the value was changed (close and open Serial Monitor again). If all the changes were made, also save this EEPROM Dump separately. The changed values should be in the same position as shown in the table below (background color green)

| | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **A** | **B** | **C** | **D** | **E** | **F** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | FF | FF | FF | FF | FF | FF | FF | FF | FF | 52 | 0 | FA | 0 | 0 | BE | 3 |
| **10** | 10 | 17 | F | 27 | 52 | 3 | 6E | 50 | 64 | 4B | 3C | 3C | A | FF | 40 | FF |
| **20** | 58 | 98 | AD | 82 | 64 | 0 | 96 | 0 | 0 | 80 | 72 | 80 | 0 | 80 | EE | 6E |
| **30** | 4E | 2 | 9 | AD | FB | 9 | 7D | 1 | A | C6 | 0 | A | A2 | FD | 9 | 0 |
| **40** | 0 | 1 | 0 | 1 | 0 | 7 | 98 | 0 | 64 | 0 | 64 | 0 | 64 | 0 | 0 | 0 |
| **50** | 0 | 80 | 0 | 80 | 0 | 80 | 0 | 80 | 0 | 80 | 0 | 80 | 0 | 80 | 0 | 80 |
| **60** | DD | 7E | E | 80 | A | 0 | 99 | 2A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **70** | C0 | 81 | 0 | 80 | 5B | 81 | E0 | 7C | 18 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| **80** | 0 | 0 | 0 | 0 | 0 | 16 | 0 | 10 | 0 | C | 0 | 7 | 13 | 1 | 12 | 3 |
| **90** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | D | 0 | 9 | 15 | 2 | 0 | 4 |
| **A0** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | A | 0 | 13 | 0 | 0 |
| **B0** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | B | 0 | 15 | 0 | 0 |
| **C0** | D | 0 | 2 | 10 | D | 0 | 3 | 20 | 20 | 0 | 3 | 20 | 20 | 0 | 3 | 10 |
| **D0** | D4 | 7F | 0 | 80 | 0 | 80 | 0 | 80 | 41 | 0 | 3 | 5 | D | 0 | 2 | 20 |
| **E0** | 0 | 80 | 0 | 80 | 0 | 80 | 0 | 80 | 0 | 80 | 0 | 80 | 0 | 80 | 0 | 80 |
| **F0** | 0 | 80 | FF | FF | FF | FF | FF | FF | 5A | C7 | CC | F | 78 | A2 | 0 | 0 |

7. Turn off the power on the multimeter and disconnect the Arduino Nano from the PC. Remove the jumper from VPP and contacts JP2 and remove the Arduino Nano from the EEPROM.
8. Turn the selector switch to the “mV” position and cycle through the measurement modes by pressing the yellow button “SEL/HOLD”. It should show °C and F.

**Resources**

1. General stuff on hacking multimeter EEPROMs and arduino script used for the modifications

   http://www.kerrywong.com/2016/03/19/hacking-dtm0660l-based-multimeters/

2. Convert Decimal to HEX

   https://www.binaryhexconverter.com/decimal-to-hex-converter

3. Nice page but pretty much almost nothing worked… (at least for the ANENG 8008)

   http://kazus.ru/forums/showthread.php?t=112135

   Picture above was taken and modified from the post in this PDF.

   http://kazus.ru/forums/showpost.php?p=1083503&postcount=1101

4. Multimeter IC Datasheet (DTM0660) and supplemental info

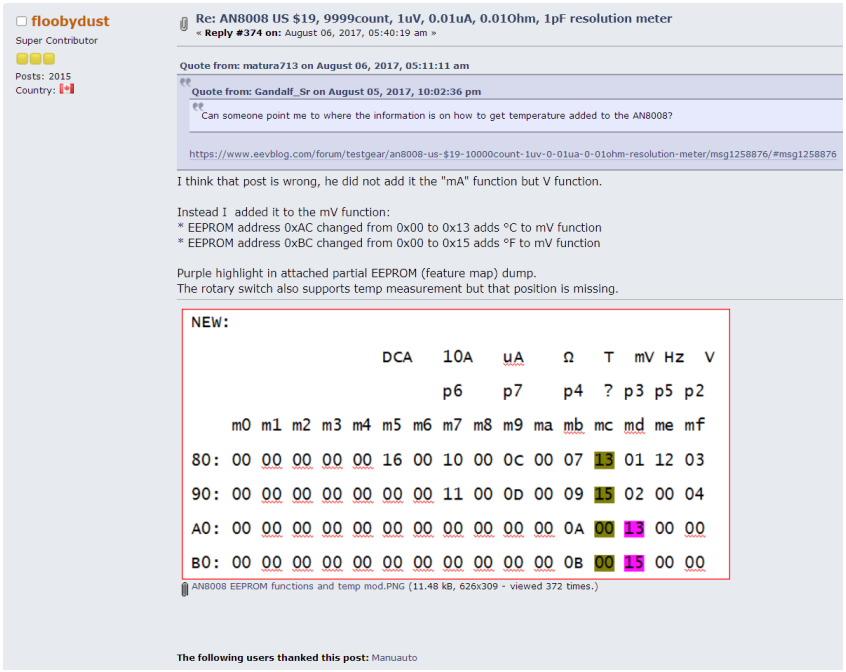
   http://www.kerrywong.com/blog/wp-content/uploads/2016/04/DTM0660DataSheet.pdf

   https://sigrok.org/wiki/Multimeter_ICs

5. The (in my case) CORRECT addresses to change


http://www.eevblog.com/forum/testgear/an8008-us-$19-10000count-1uv-0-01ua-0-01ohm-resolution-meter/msg1312471/#msg1312471

6. In the post is the wrong address but in the picture the correct one is shown… well guess which one I tested…




https://www.eevblog.com/forum/testgear/an8008-us-$19-10000count-1uv-0-01ua-0-01ohm-resolution-meter/350/?PHPSESSID=sha4eq16ebrf72jguu6n0v9sl5

7. Basic info on EEPROMs and using them

   https://www.youtube.com/watch?v=DQQJGCixgvU