

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 made⁵:

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

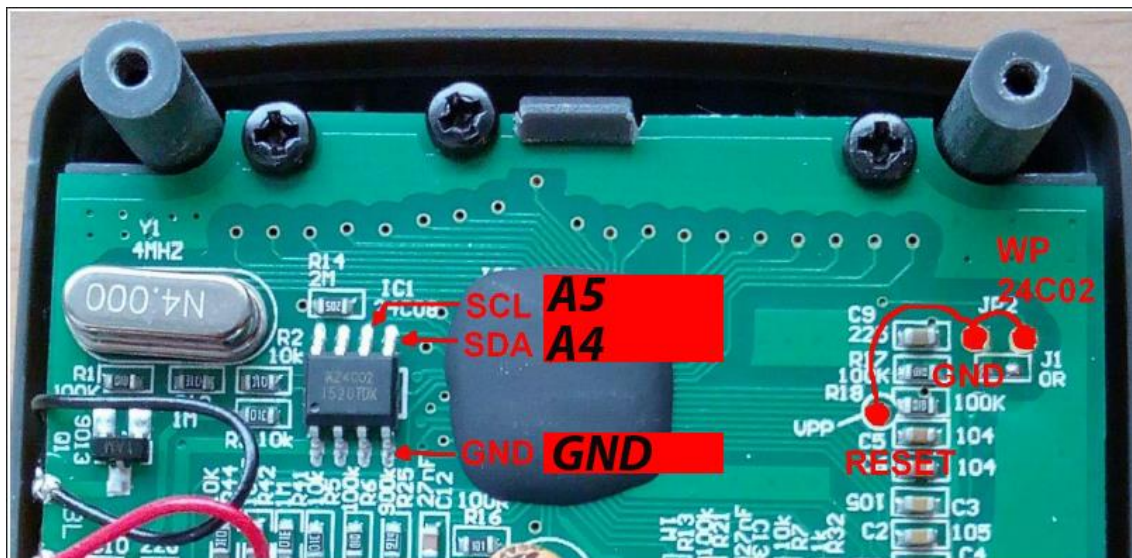
The temperature is then be measured in the “mV” selector position by pressing the yellow button “SEL/HOLD” a few times and cycling through the measurement options.

NOTE: Some found resources call for modifying cells AF and BF³ or AC and BC⁶, 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

Neytron
Newbie
Posts: 2
Country: 

Re: AN8008 US \$19, 9999count, 1uV, 0.01uA, 0.01Ohm, 1pF resolution meter
« Reply #659 on: September 29, 2017, 06:27:55 am »


Hi, I just bought both models an8008 and an8002 I think both are a good complement. Modify the an8008 eeprom to add the temperature measurement function.
Direction 0xAD = 0x13 and 0xBD = 0x15 to add the functions °C and °F respectively in the mV position.
Copy calibration data from an8002 to an8008, addresses from 0x0B to 0x0F
Both measure the same temperature now



20170928_123241.jpg (229.27 kB, 1063x598 - viewed 342 times.)

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

floobydust
Super Contributor
Posts: 2015
Country: 

Re: AN8008 US \$19, 9999count, 1uV, 0.01uA, 0.01Ohm, 1pF resolution meter
« Reply #374 on: August 06, 2017, 05:40:19 am »

Quote from: matura713 on August 06, 2017, 05:11:11 am

Quote from: Gandalf_Sr on August 05, 2017, 10:02:36 pm

Can someone point me to where the information is on how to get temperature added to the AN8008?

[https://www.eevblog.com/forum/testgear/an8008-us-\\$19-10000count-1uv-0-01ua-0-01ohm-resolution-meter/msg1258876/#msg1258876](https://www.eevblog.com/forum/testgear/an8008-us-$19-10000count-1uv-0-01ua-0-01ohm-resolution-meter/msg1258876/#msg1258876)

I think that post is wrong, he did not add it the "mA" function but V function.

Instead I added it to the mV function:
* EEPROM address 0xAC changed from 0x00 to 0x13 adds °C to mV function
* EEPROM address 0xBC changed from 0x00 to 0x15 adds °F to mV function

Purple highlight in attached partial EEPROM (feature map) dump.
The rotary switch also supports temp measurement but that position is missing.

NEW:

	DCA	10A	uA	Ω	T	mV	Hz	V
		p6	p7	p4	?	p3	p5	p2
m0	m1	m2	m3	m4	m5	m6	m7	m8
ma	mb	mc	md	me	mf			
80:	00	00	00	00	00	16	00	10
90:	00	00	00	00	00	00	11	00
A0:	00	00	00	00	00	00	00	00
B0:	00	00	00	00	00	00	00	00

AN8008 EEPROM functions and temp mod.PNG (11.48 kB, 626x309 - viewed 372 times.)

The following users thanked this post: Manuauto

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