

Test Specifications and Results of ADC components

Spec-00000058. pdf

$$v_i = (a_i \times \text{ADC_vdd}) / 2^{\text{ADC_bit}}$$

$$y = (v_i - x_offset) / \text{gain} + y_offset \quad \text{range min to max}$$

$$\text{SMA calculation method} \quad \text{phy} = (y_n + y_{n-1} + y_{n-2}) / n$$

$$\text{EMA calculation method} \quad \text{phy} = (y \times k) + (\text{phy}_{n-1} \times (1 - k))$$

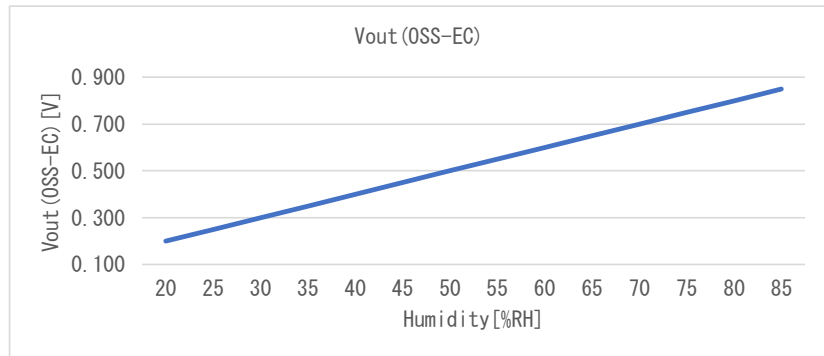
$$\text{WMA calculation method} \quad \text{phy} = (y_n \times n) + (y_{n-1} \times (n-1)) + \dots + (y_1 \times 1) / (n + (n-1) + \dots + 1)$$

$$\text{Non-MA calculation method} \quad \text{phy} = y$$

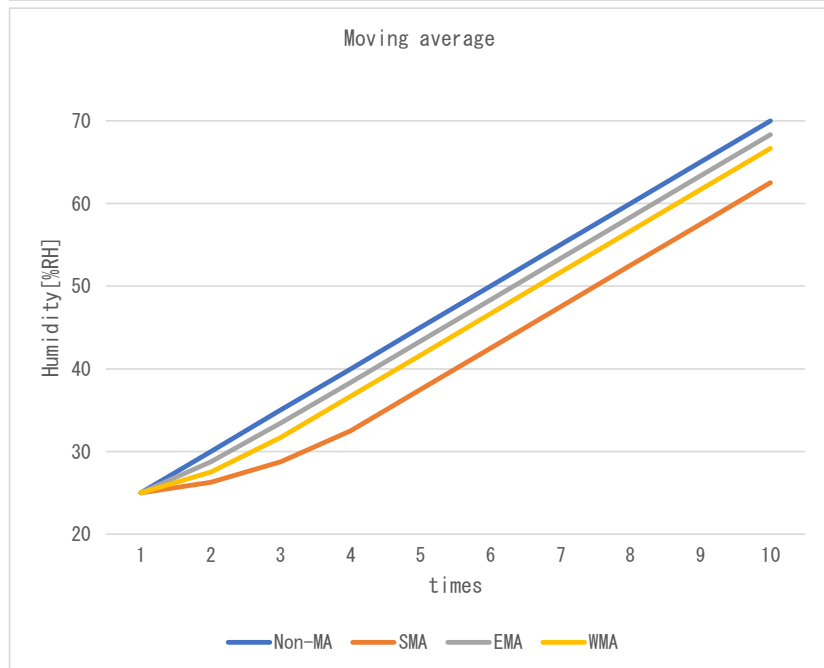
Date	28-Oct-22
Verifier	Red Dragon

Spec-CHS-MSS. pdf

component data		
x_offset	0.0000	[V]
gain	0.01	[V/%RH]
y_offset	0.0	[%RH]
max	85.0	[%RH]
min	20.0	[%RH]



Coefficient		
SMA	n	4
EMA	k	0.75
WMA	m	3

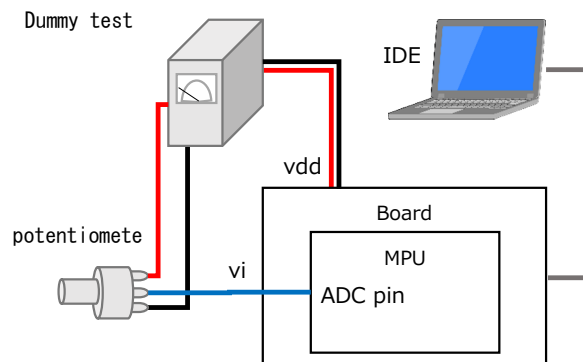


Test environment

Board	NUCLEO-F401RE
MPU	STM32F401RE
CompilerVer	Arm Compiler 6.16
IDE	Mbed Studio 1.4.4
Vdd	3.3 [V]
ADC bit	16 [bit]
ADC pin	A0 -
Component	Dummy

Normal operating voltage

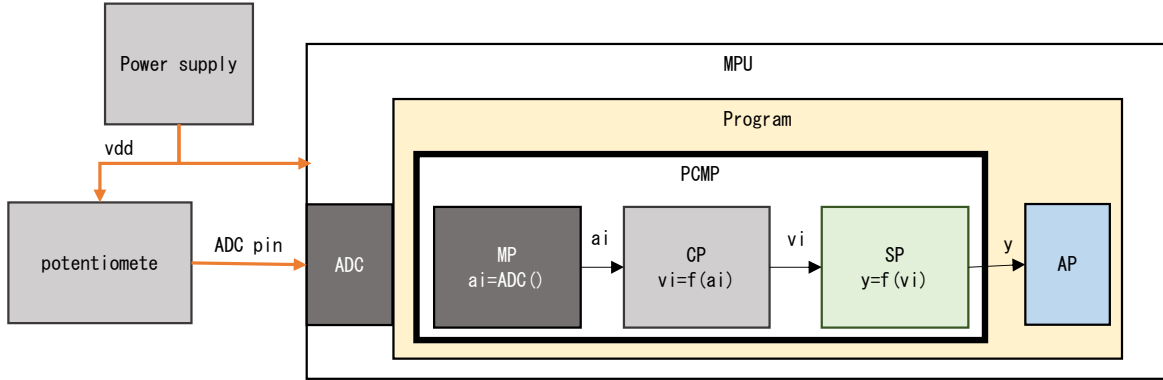
Vdd	5.0 [V]
-----	---------



Test Method

1. Coupling test with variable resistors

As shown in the figure below, the voltage is varied by a variable resistor to check if the temperature calculation results match the specifications. Non-MA mode:



※Use a 3.3V board instead of a 5V board because we do not have a board with 5V Vdd, although it is a 5V product

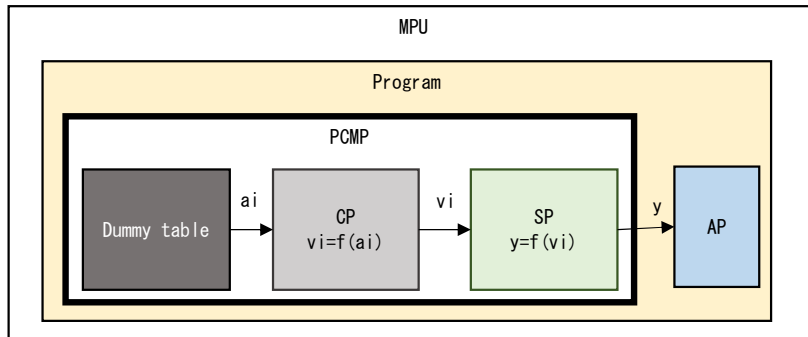
Data with 3.3V board	
x_offset	0.0000 [V]
gain	0.01 [V/%RH]
y_offset	0.0 [%RH]

No.	ADC pin	ai	vi	p	res. phy	res. sts	Judgment
1	Expected	0	0.000	0.000	20.000	4,002	OK
	Measured	32	0.002	0.161	20.000	4,002	
	Difference	-32	-0.002	-0.161	0.000	0	
2	Expected	29,789	1.500	150.000	85.000	4,001	OK
	Measured	29,783	1.500	149.969	85.000	4,001	
	Difference	6	0.000	0.030	0.000	0	
3	Expected	39,719	2.000	200.001	85.000	4,001	OK
	Measured	39,737	2.001	200.092	85.000	4,001	
	Difference	-18	-0.001	-0.091	0.000	0	
4	Expected	65,536	3.300	330.000	85.000	4,001	OK
	Measured	65,535	3.300	329.995	85.000	4,001	
	Difference	1	0.000	0.005	0.000	0	

res. sts 4,000 Normal
 4,001 Max Limiter NG
 4,002 Min Limiter NG

2. Detail of replacing ADC value test

As shown in the figure below, change the MP layer to the value read from the Dummy table as shown in the test, and perform the following detailed test.



2-1. Max/Min range test

Vary a_i according to Dummy table as shown in the table below, and check Max/Min limiters and diagnostic results. Non-MA mode.

No.		Dummy a_i	v_i	p	res. phy	res. sts	Judgment
1	Expected	2, 623	0. 200	20. 012	20. 012	4, 000	OK
	Measured	2, 623	0. 200	20. 012	20. 012	4, 000	
	Difference	0	0. 000	0. 000	0. 000	0	
2	Expected	2, 622	0. 200	20. 004	20. 004	4, 000	OK
	Measured	2, 622	0. 200	20. 004	20. 004	4, 000	
	Difference	0	0. 000	0. 000	0. 000	0	
3	Expected	2, 621	0. 200	19. 997	20. 000	4, 002	OK
	Measured	2, 621	0. 200	19. 997	20. 000	4, 002	
	Difference	0	0. 000	0. 000	0. 000	0	
4	Expected	2, 622	0. 200	20. 004	20. 004	4, 000	OK
	Measured	2, 622	0. 200	20. 004	20. 004	4, 000	
	Difference	0	0. 000	0. 000	0. 000	0	
5	Expected	11, 141	0. 850	84. 999	84. 999	4, 000	OK
	Measured	11, 141	0. 850	84. 999	84. 999	4, 000	
	Difference	0	0. 000	0. 000	0. 000	0	
6	Expected	11, 142	0. 850	85. 007	85. 000	4, 001	OK
	Measured	11, 142	0. 850	85. 007	85. 000	4, 001	
	Difference	0	0. 000	0. 000	0. 000	0	
7	Expected	11, 141	0. 850	84. 999	84. 999	4, 000	OK
	Measured	11, 141	0. 850	84. 999	84. 999	4, 000	
	Difference	0	0. 000	0. 000	0. 000	0	

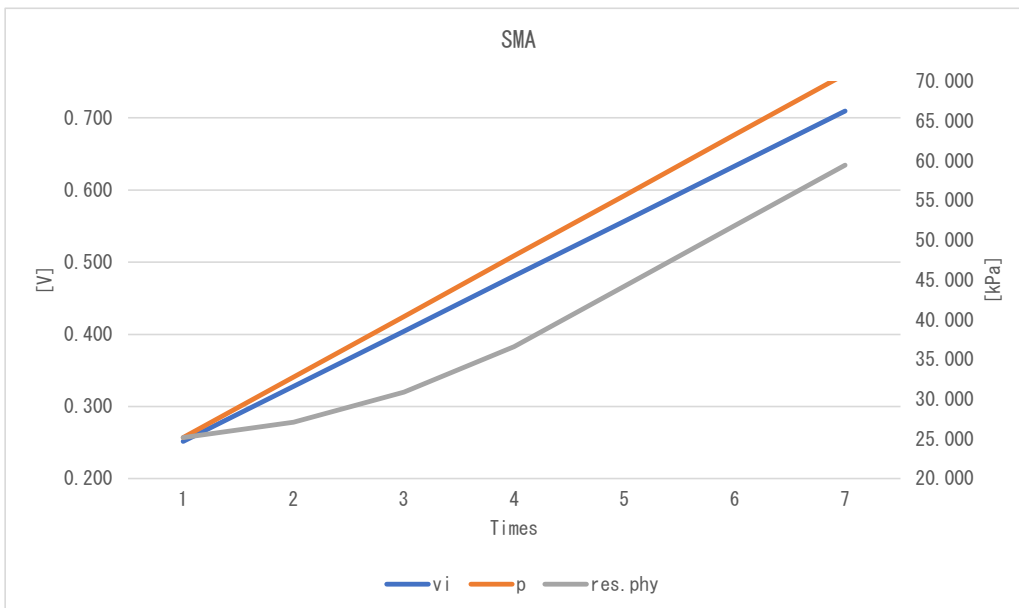
res. sts 4000 Normal
 4001 Max Limiter NG
 4002 Min Limiter NG

2-2. Moving average test

Check each Filter by changing a_i according to the Dummy table as shown in the table below.

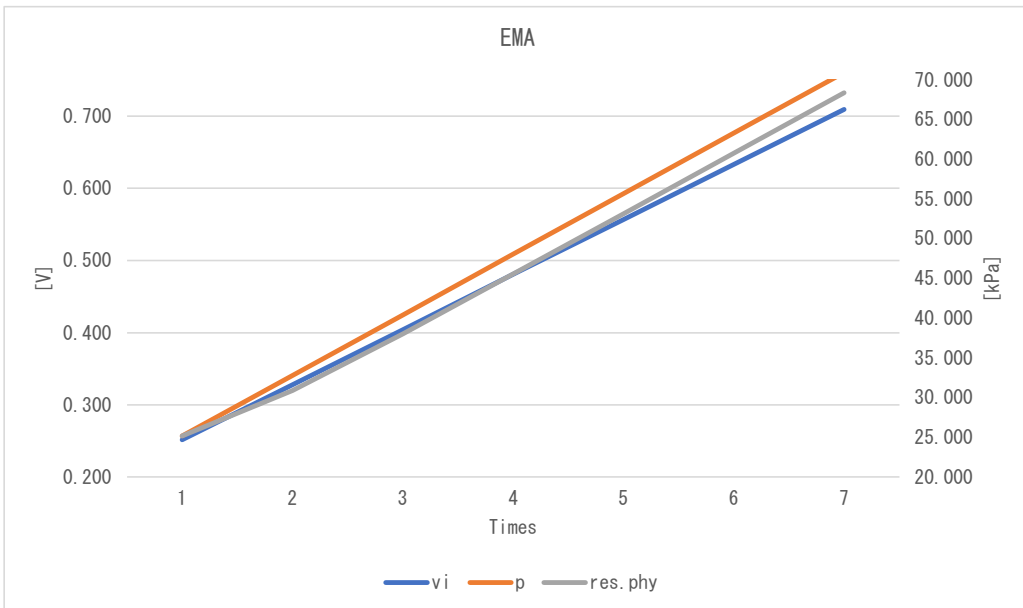
SMA

No.	Dummy a_i	v_i	p	res. phy	res. sts	Judgment
1	Expected	3,300	0.252	25.177	25.177	OK
	Measured	3,300	0.252	25.177	25.177	
	Difference	0	0.000	0.000	0.000	
2	Expected	4,300	0.328	32.806	27.084	OK
	Measured	4,300	0.328	32.806	27.084	
	Difference	0	0.000	0.000	0.000	
3	Expected	5,300	0.404	40.436	30.899	OK
	Measured	5,300	0.404	40.436	30.899	
	Difference	0	0.000	0.000	0.000	
4	Expected	6,300	0.481	48.065	36.621	OK
	Measured	6,300	0.481	48.065	36.621	
	Difference	0	0.000	0.000	0.000	
5	Expected	7,300	0.557	55.695	44.250	OK
	Measured	7,300	0.557	55.695	44.250	
	Difference	0	0.000	0.000	0.000	
6	Expected	8,300	0.633	63.324	51.880	OK
	Measured	8,300	0.633	63.324	51.880	
	Difference	0	0.000	0.000	0.000	
7	Expected	9,300	0.710	70.953	59.509	OK
	Measured	9,300	0.710	70.953	59.509	
	Difference	0	0.000	0.000	0.000	



EMA

No.		Dummy ai	vi	p	res. phy	res. sts	Judgment
1	Expected	3,300	0.252	25.177	25.177	4,000	OK
	Measured	3,300	0.252	25.177	25.177	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	4,300	0.328	32.806	30.899	4,000	OK
	Measured	4,300	0.328	32.806	30.899	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	5,300	0.404	40.436	38.052	4,000	OK
	Measured	5,300	0.404	40.436	38.052	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	6,300	0.481	48.065	45.562	4,000	OK
	Measured	6,300	0.481	48.065	45.562	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	7,300	0.557	55.695	53.161	4,000	OK
	Measured	7,300	0.557	55.695	53.161	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	8,300	0.633	63.324	60.783	4,000	OK
	Measured	8,300	0.633	63.324	60.783	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	9,300	0.710	70.953	68.411	4,000	OK
	Measured	9,300	0.710	70.953	68.411	4,000	
	Difference	0	0.000	0.000	0.000	0	



WMA

No.		Dummy ai	vi	p	res. phy	res. sts	Judgment
1	Expected	3,300	0.252	25.177	25.177	4,000	OK
	Measured	3,300	0.252	25.177	25.177	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	4,300	0.328	32.806	28.992	4,000	OK
	Measured	4,300	0.328	32.806	28.992	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	5,300	0.404	40.436	35.350	4,000	OK
	Measured	5,300	0.404	40.436	35.350	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	6,300	0.481	48.065	42.979	4,000	OK
	Measured	6,300	0.481	48.065	42.979	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	7,300	0.557	55.695	50.608	4,000	OK
	Measured	7,300	0.557	55.695	50.608	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	8,300	0.633	63.324	58.238	4,000	OK
	Measured	8,300	0.633	63.324	58.238	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	9,300	0.710	70.953	65.867	4,000	OK
	Measured	9,300	0.710	70.953	65.867	4,000	
	Difference	0	0.000	0.000	0.000	0	

