

Test Specifications and Results of ADC components

Spec-00000058. pdf

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

$$y = (v_i - x_{\text{offset}}) / \text{gain} + y_{\text{offset}}$$

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

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

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

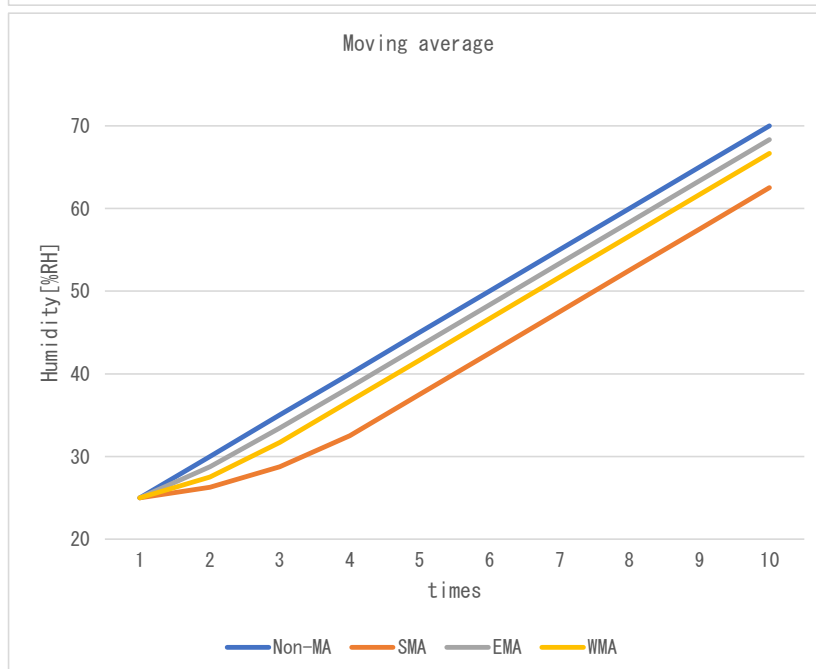
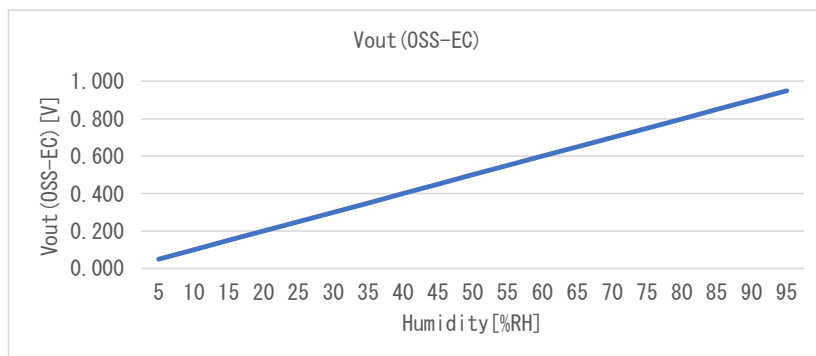
$$\text{Non-MA calculation method} \quad \text{phy} = y$$

Date	28-Oct-22
Verifier	Red Dragon

Spec-CHS-UPS_UPR_UGS_UGR. pdf

component data		
x_offset	0.0000	[V]
gain	0.01	[V/%RH]
y_offset	0.0	[%RH]
max	95.0	[%RH]
min	5.0	[%RH]

Coefficient		
SMA	n	4
EMA	k	0.75
WMA	m	3

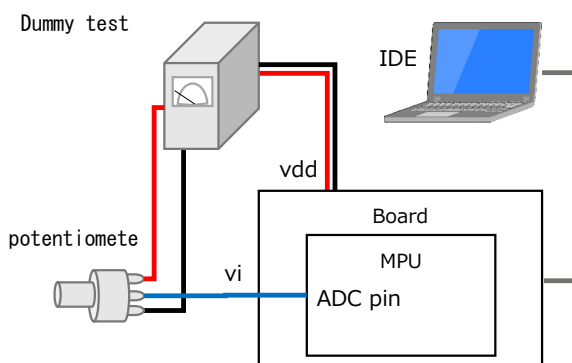


Test environment

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

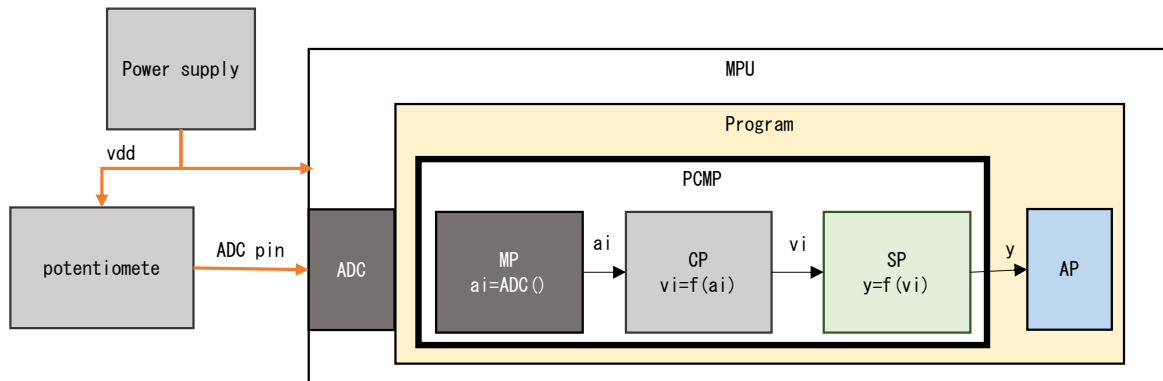
Vdd	5.0 [V]
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Test Method

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

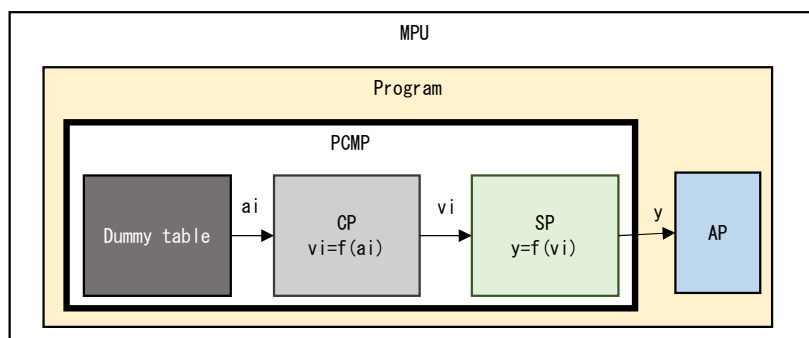
x_offset	0.0000 [V]
gain	0.01 [V/%RH]
y_offset	0.0 [%RH]

No.	ADC pin	ai	vi	p	res.phy	res.sts	Judgment
1	0.000	0	0.000	0.000	5.000	4,002	OK
		32	0.002	0.000	5.000	4,002	
		-32	-0.002	0.000	0.000	0	
2	1.500	29,789	1.500	150.000	95.000	4,001	OK
		29,799	1.500	150.050	95.000	4,001	
		-10	0.000	-0.050	0.000	0	
3	2.000	39,719	2.000	200.001	95.000	4,001	OK
		39,897	2.009	200.897	95.000	4,001	
		-178	-0.009	-0.896	0.000	0	
4	3.300	65,536	3.300	330.000	95.000	4,001	OK
		65,535	3.300	329.995	95.000	4,001	
		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	657	0.050	5.013	5.013	4,000	OK
	Measured	657	0.050	5.013	5.013	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	656	0.050	5.005	5.005	4,000	OK
	Measured	656	0.050	5.005	5.005	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	655	0.050	4.997	5.000	4,002	OK
	Measured	655	0.050	4.997	5.000	4,002	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	656	0.050	5.005	5.005	4,000	OK
	Measured	656	0.050	5.005	5.005	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	12,451	0.950	94.994	94.994	4,000	OK
	Measured	12,451	0.950	94.994	94.994	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	12,452	0.950	95.001	95.000	4,001	OK
	Measured	12,452	0.950	95.001	95.000	4,001	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	12,451	0.950	94.994	94.994	4,000	OK
	Measured	12,451	0.950	94.994	94.994	4,000	
	Difference	0	0.000	0.000	0.000	0	

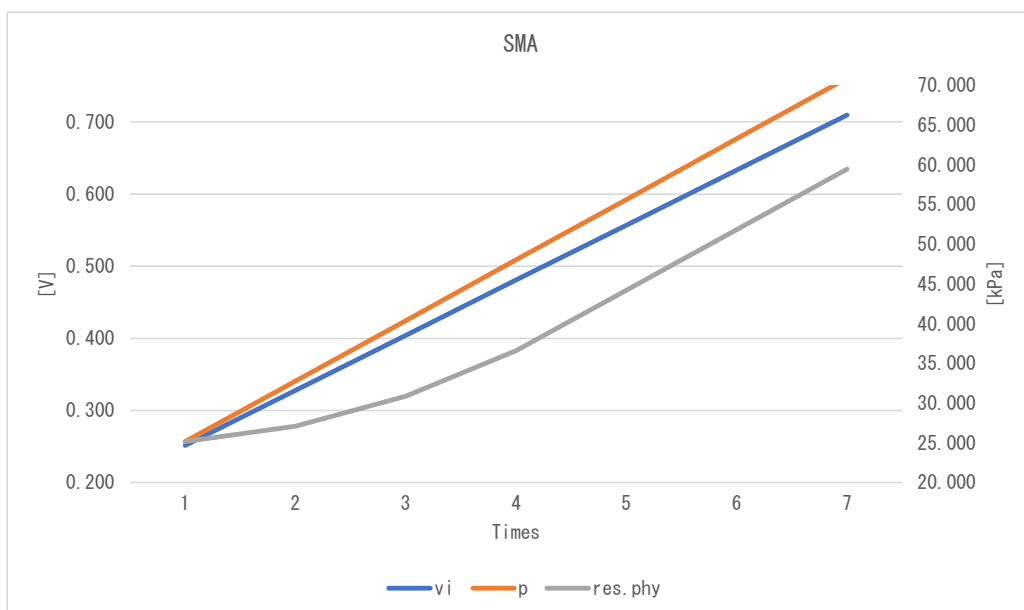
res. sts 4000 Normal
 4001 Max Limiter NG
 4002 Min Limiter NG

2-2. Moving average test

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

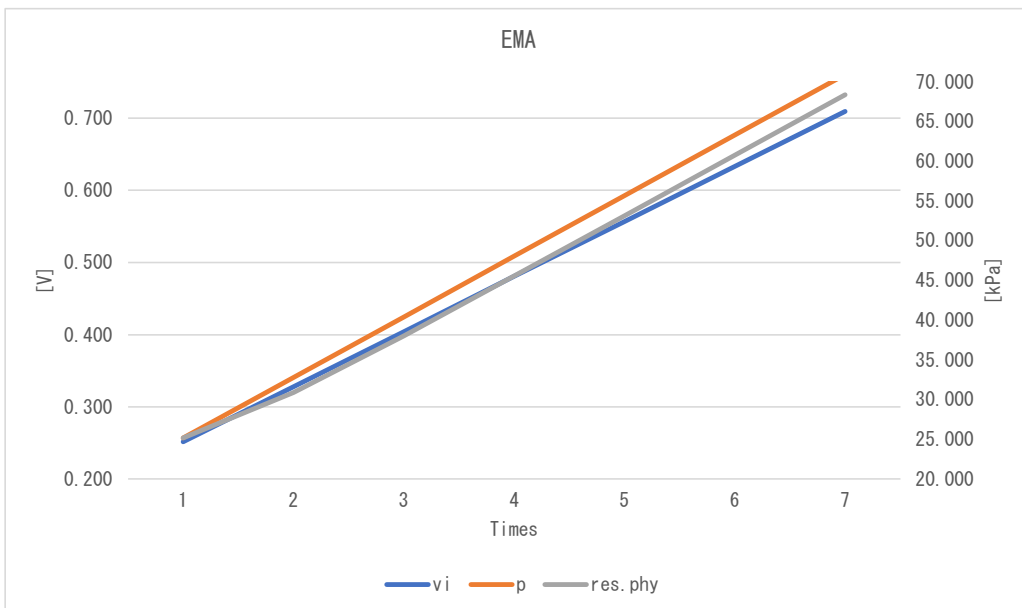
SMA

No.		Dummy a_i	v_i	p	res. phy	res. sts	Judgment
1	Expected	3,300	0.252	25.177	25.177	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	27.084	4,000	OK
	Measured	4,300	0.328	32.806	27.084	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	5,300	0.404	40.436	30.899	4,000	OK
	Measured	5,300	0.404	40.436	30.899	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	6,300	0.481	48.065	36.621	4,000	OK
	Measured	6,300	0.481	48.065	36.621	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	7,300	0.557	55.695	44.250	4,000	OK
	Measured	7,300	0.557	55.695	44.250	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	8,300	0.633	63.324	51.880	4,000	OK
	Measured	8,300	0.633	63.324	51.880	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	9,300	0.710	70.953	59.509	4,000	OK
	Measured	9,300	0.710	70.953	59.509	4,000	
	Difference	0	0.000	0.000	0.000	0	



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	

