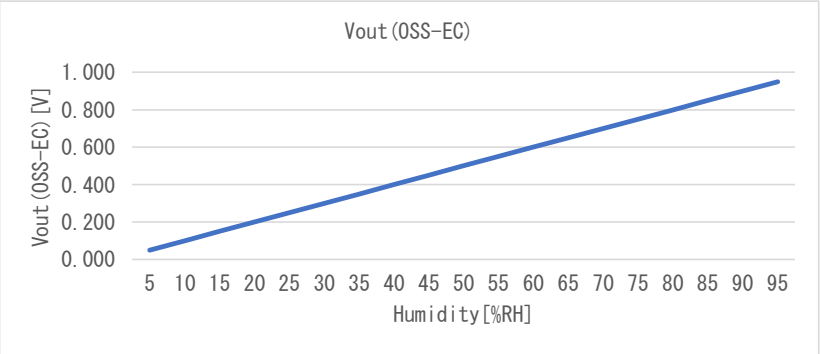
Test Specifications and Results of ADC components

Spec-00000058.pdf

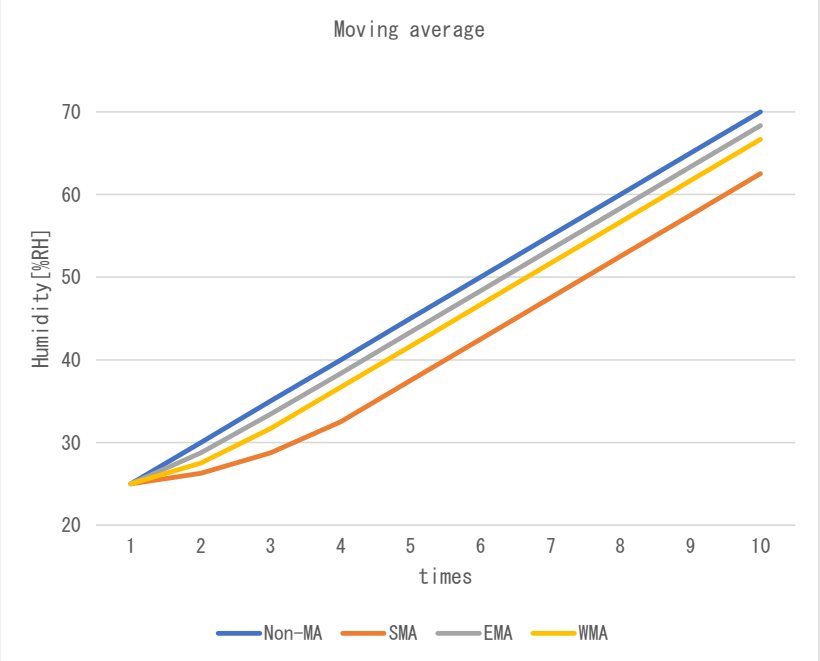
Date	28-Oct-22
Verifier	Red Dragon

vi = (ai × ADC_vdd) / 2^{ADC_bit}
y = (vi - x_offset) / gain + y_offset range min to max
SMA calculation method phy = ($y_n + y_{n-1} + y_{n-2}$) / n
EMA calculation method phy = (y × k) + (phy_{n-1} × (1 - k))
WMA calculation method phy = ((yn × n) + (yn-1 × (n-1)) + … + (y1 × 1)) / (n + (n-1) +…+ 1)
Non-MA calculation method phy = y

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]

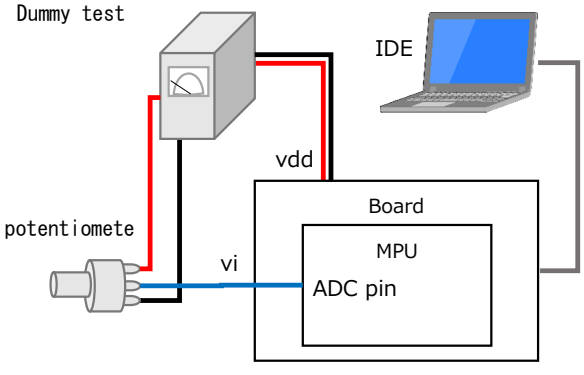


Coefficient		
SMA	n	4
EMA	k	0.75
WMA	m	3



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

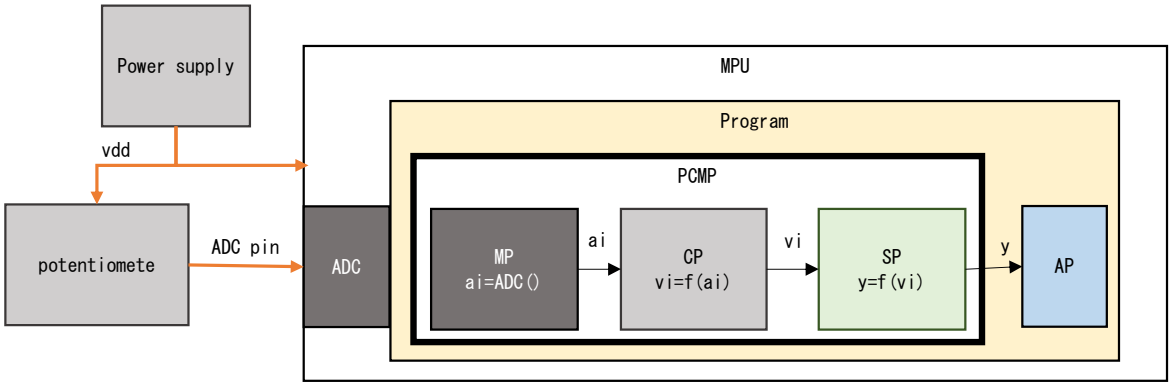
Normal operating voltage		
Vdd	5.0	[V]



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

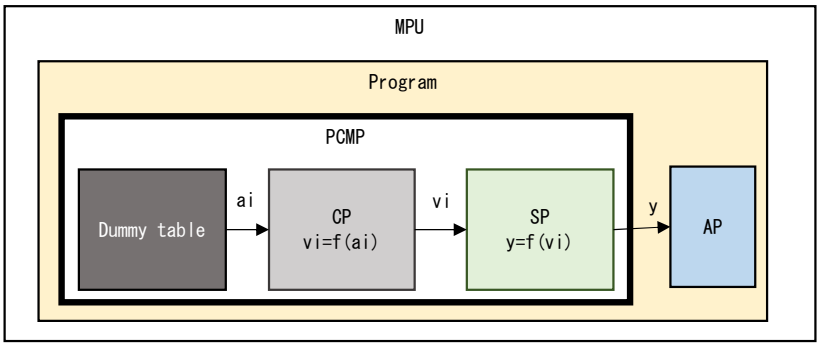
Data with 3.3V board		
x_offset	0.0000	[V]
gain	0.01	[V/%RH]
y_offset	0.0	[%RH]

No.		ADC pin	ai	vi	p	res.phy	res.sts	Judgment
1	Expected	0.000	0	0.000	0.000	5.000	4,002	OK
	Measured		32	0.002	0.000	5.000	4,002	
	Difference		-32	-0.002	0.000	0.000	0	
2	Expected	1.500	29,789	1.500	150.000	95.000	4,001	OK
	Measured		29,799	1.500	150.050	95.000	4,001	
	Difference		-10	0.000	-0.050	0.000	0	
3	Expected	2.000	39,719	2.000	200.001	95.000	4,001	OK
	Measured		39,897	2.009	200.897	95.000	4,001	
	Difference		-178	-0.009	-0.896	0.000	0	
4	Expected	3.300	65,536	3.300	330.000	95.000	4,001	OK
	Measured		65,535	3.300	329.995	95.000	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 ai according to Dummy table as shown in the table below, and check Max/Min limiters and diagnostic results. Non-MA mode.

No.		Dummy ai	vi	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	

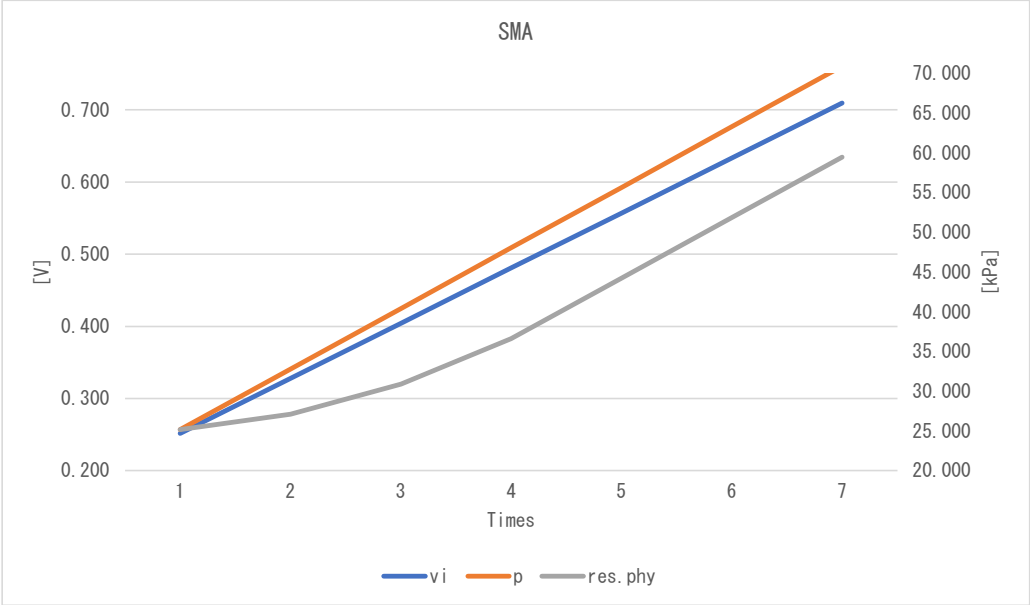
res.sts	4000	Normal
	4001	Max Limiter NG
	4002	Min Limiter NG

2-2. Moving average test

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

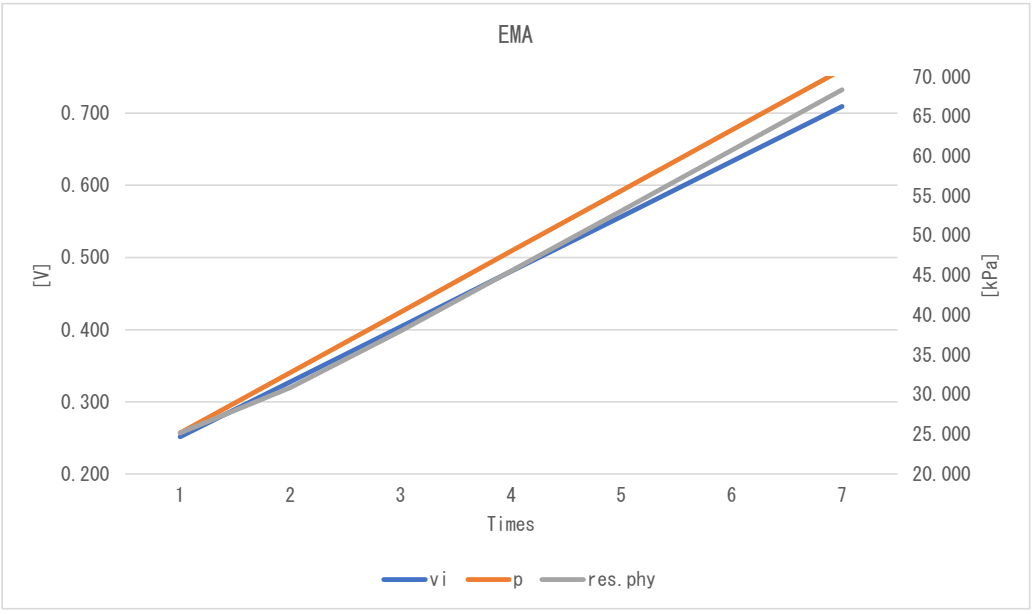
SMA

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	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