Test Specifications and Results of ADC components

Date	25-Oct-22
Verifier	Red Dragon

Spec-00000058.pdf

$vi = (ai \times ADC\_vdd) / 2^{ADC\_bit}$

$y = (vi - x\_offset) / gain + y\_offset$ range min to max

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

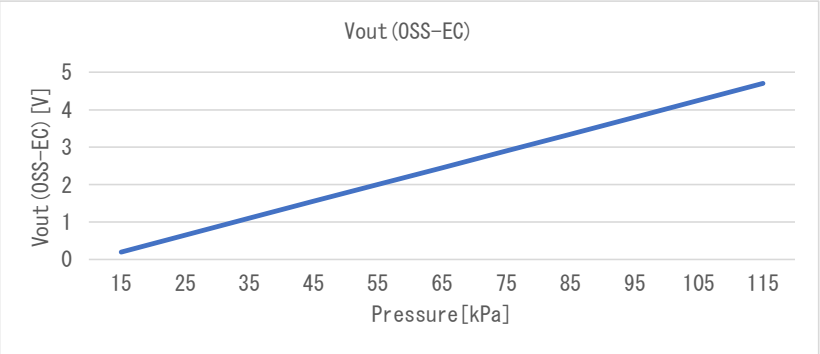
EMA calculation method $phy = (y \times k) + (phy_{n-1} \times (1 - k))$

WMA calculation method $phy = ((yn \times n) + (yn-1 \times (n-1)) + \cdots + (y1 \times 1)) / (n + (n-1) + \cdots + 1)$

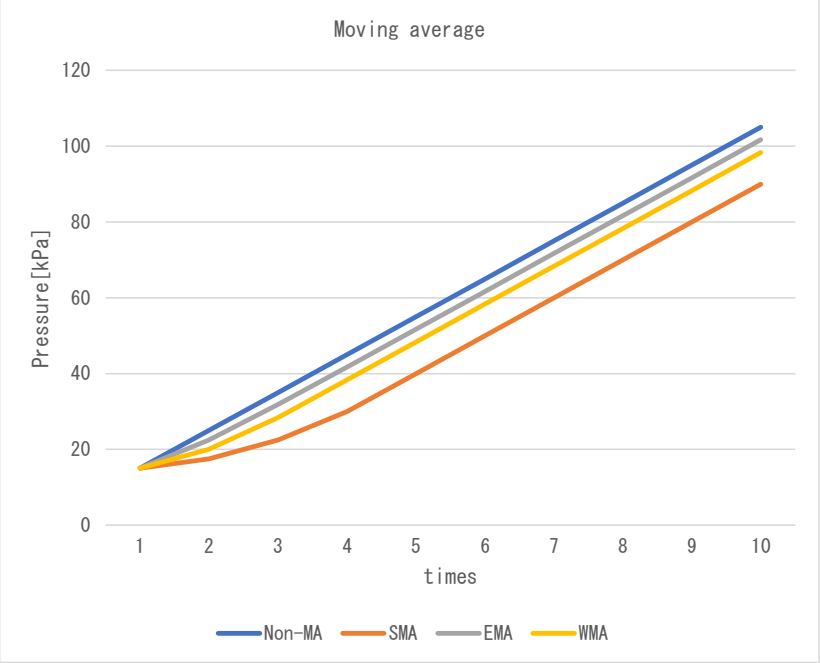
Non-MA calculation method $phy = y$

Spec-MPXH6115A.pdf

component data		
x_offset	-0.4750	[V]
gain	0.045	[V/kPa]
y_offset	0.0	[kPa]
max	115.0	[kPa]
min	15.0	[kPa]

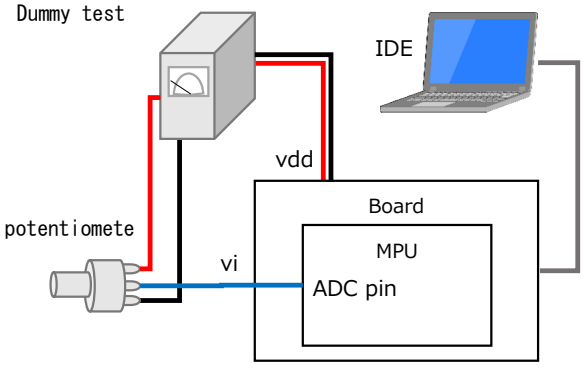


Coefficient		
SMA	n	4
EMA	k	0.75
WMA	m	3



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	

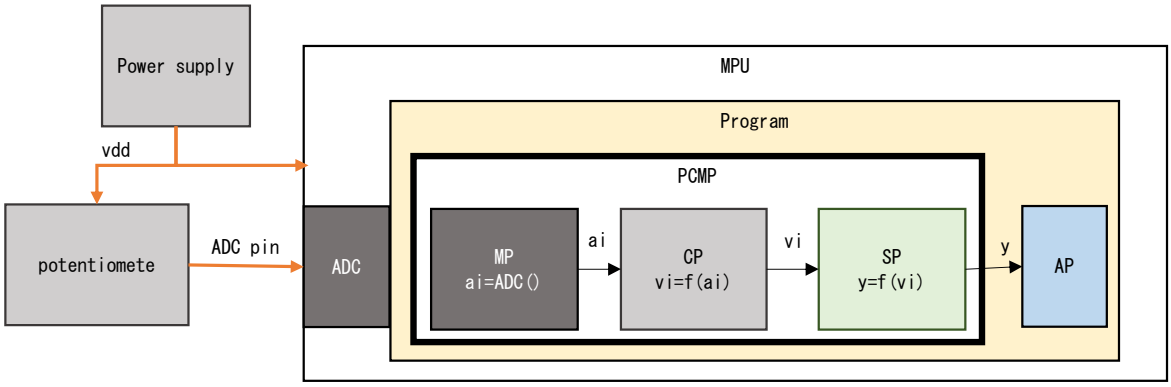
Normal operating voltage		
Vdd	5.0	[V]



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

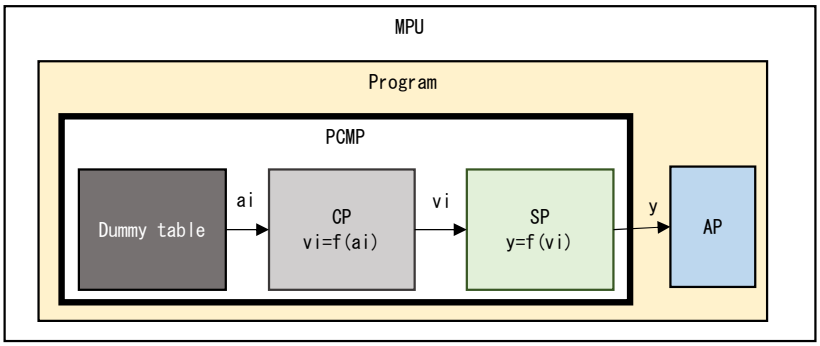
Data with 3.3V board		
x_offset	-0.3135	[V]
gain	0.0297	[V/kPa]
y_offset	0.0	[kPa]

No.		ADC pin	ai	vi	p	res.phy	res.sts	Judgment
1	Expected	0.000	0	0.000	10.556	15.000	4,002	OK
	Measured		32	0.002	10.610	15.000	4,002	
	Difference		-32	-0.002	-0.054	0.000	0	
2	Expected	1.500	29,789	1.500	61.060	61.060	4,000	OK
	Measured		29,831	1.502	61.132	61.132	4,000	
	Difference		-42	-0.002	-0.071	-0.071	0	
3	Expected	2.000	39,719	2.000	77.896	77.896	4,000	OK
	Measured		39,721	2.000	77.899	77.899	4,000	
	Difference		-2	0.000	-0.003	-0.003	0	
4	Expected	3.300	65,536	3.300	121.667	115.000	4,001	OK
	Measured		65,535	3.300	121.665	115.000	4,001	
	Difference		1	0.000	0.002	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	2,623	0.200	15.003	15.003	4,000	OK
	Measured	2,623	0.200	15.003	15.003	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	2,622	0.200	15.001	15.001	4,000	OK
	Measured	2,622	0.200	15.001	15.001	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	2,621	0.200	14.999	15.000	4,002	OK
	Measured	2,621	0.200	14.999	15.000	4,002	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	2,622	0.200	15.001	15.001	4,000	OK
	Measured	2,622	0.200	15.001	15.001	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	61,603	4.700	114.999	114.999	4,000	OK
	Measured	61,603	4.700	114.999	114.999	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	61,604	4.700	115.000	115.000	4,001	OK
	Measured	61,604	4.700	115.000	115.000	4,001	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	61,603	4.700	114.999	114.999	4,000	OK
	Measured	61,603	4.700	114.999	114.999	4,000	
	Difference	0	0.000	0.000	0.000	0	

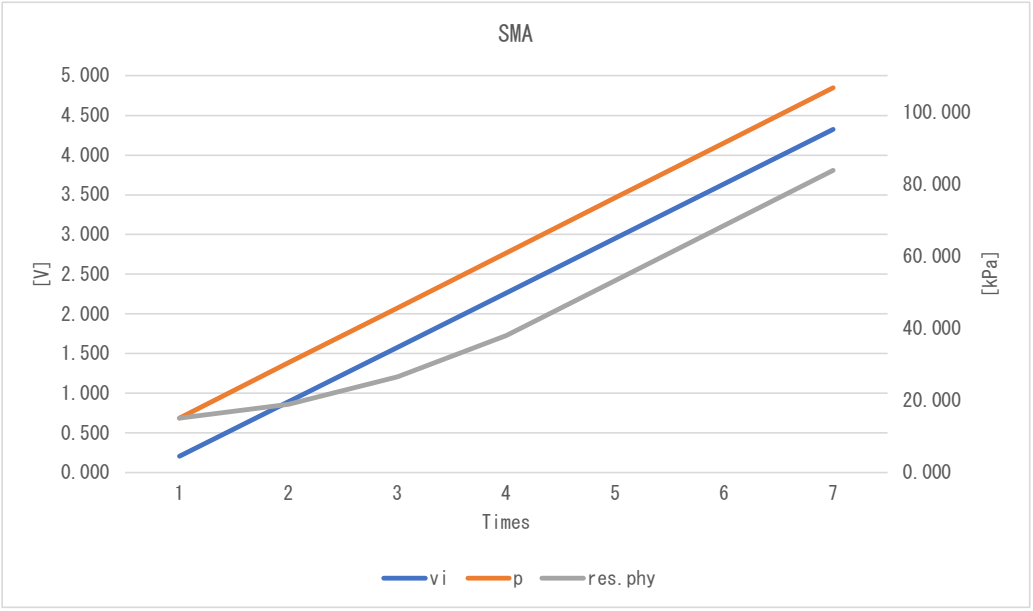
res.sts	4000	Normal
	4001	Max Limiter NG
	4002	Min Limiter NG

2-2. Moving average test

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

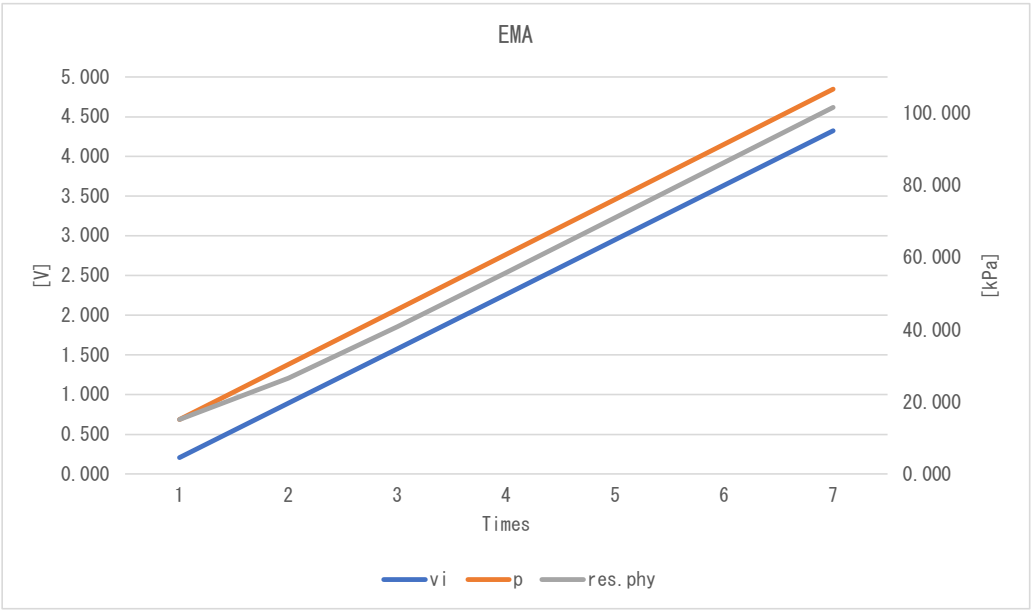
SMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	2,700	0.206	15.133	15.133	4,000	OK
	Measured	2,700	0.206	15.133	15.133	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	11,700	0.893	30.392	18.948	4,000	OK
	Measured	11,700	0.893	30.392	18.948	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	20,700	1.579	45.651	26.577	4,000	OK
	Measured	20,700	1.579	45.651	26.577	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	29,700	2.266	60.910	38.021	4,000	OK
	Measured	29,700	2.266	60.910	38.021	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	38,700	2.953	76.168	53.280	4,000	OK
	Measured	38,700	2.953	76.168	53.280	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	47,700	3.639	91.427	68.539	4,000	OK
	Measured	47,700	3.639	91.427	68.539	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	56,700	4.326	106.686	83.798	4,000	OK
	Measured	56,700	4.326	106.686	83.798	4,000	
	Difference	0	0.000	0.000	0.000	0	



EMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	2,700	0.206	15.133	15.133	4,000	OK
	Measured	2,700	0.206	15.133	15.133	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	11,700	0.893	30.392	26.577	4,000	OK
	Measured	11,700	0.893	30.392	26.577	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	20,700	1.579	45.651	40.882	4,000	OK
	Measured	20,700	1.579	45.651	40.882	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	29,700	2.266	60.910	55.903	4,000	OK
	Measured	29,700	2.266	60.910	55.903	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	38,700	2.953	76.168	71.102	4,000	OK
	Measured	38,700	2.953	76.168	71.102	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	47,700	3.639	91.427	86.346	4,000	OK
	Measured	47,700	3.639	91.427	86.346	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	56,700	4.326	106.686	101.601	4,000	OK
	Measured	56,700	4.326	106.686	101.601	4,000	
	Difference	0	0.000	0.000	0.000	0	



WMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	2,700	0.206	15.133	15.133	4,000	OK
	Measured	2,700	0.206	15.133	15.133	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	11,700	0.893	30.392	22.763	4,000	OK
	Measured	11,700	0.893	30.392	22.763	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	20,700	1.579	45.651	35.478	4,000	OK
	Measured	20,700	1.579	45.651	35.478	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	29,700	2.266	60.910	50.737	4,000	OK
	Measured	29,700	2.266	60.910	50.737	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	38,700	2.953	76.168	65.996	4,000	OK
	Measured	38,700	2.953	76.168	65.996	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	47,700	3.639	91.427	81.255	4,000	OK
	Measured	47,700	3.639	91.427	81.255	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	56,700	4.326	106.686	96.513	4,000	OK
	Measured	56,700	4.326	106.686	96.513	4,000	
	Difference	0	0.000	0.000	0.000	0