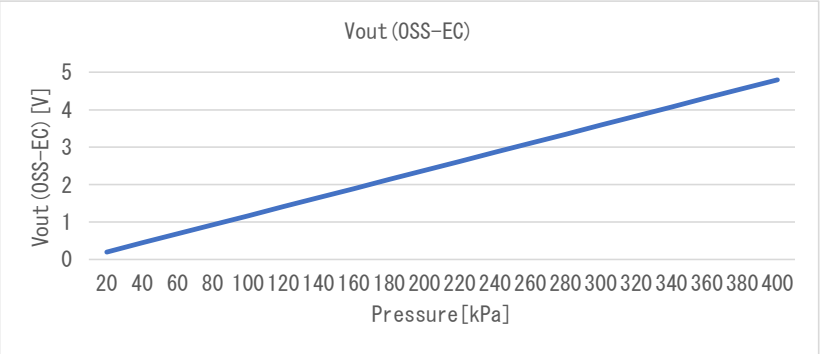
Test Specifications and Results of ADC components

Spec-00000058.pdf

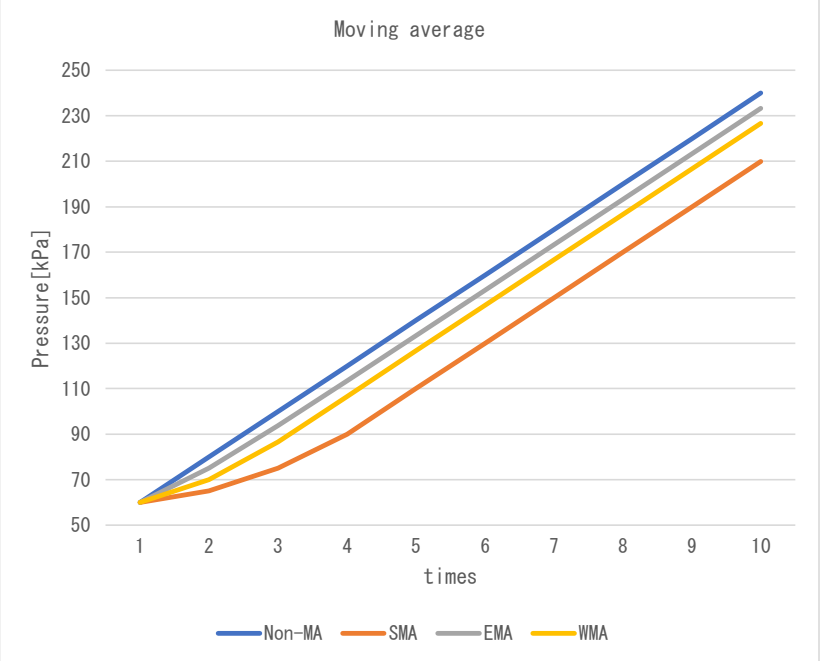
Date	25-Oct-22
Verifier	Red Dragon

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-MPXH6400A.pdf		
component data		
x_offset	-0.0421	[V]
gain	0.012105	[V/kPa]
y_offset	0.0	[kPa]
max	400.0	[kPa]
min	20.0	[kPa]

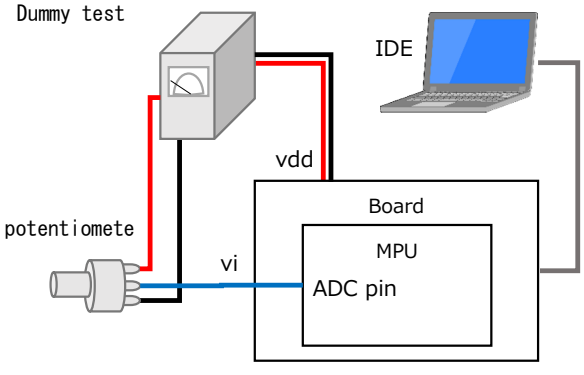


Coefficient		
SMA	n	4
EMA	k	0.75
WMA	m	3



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	

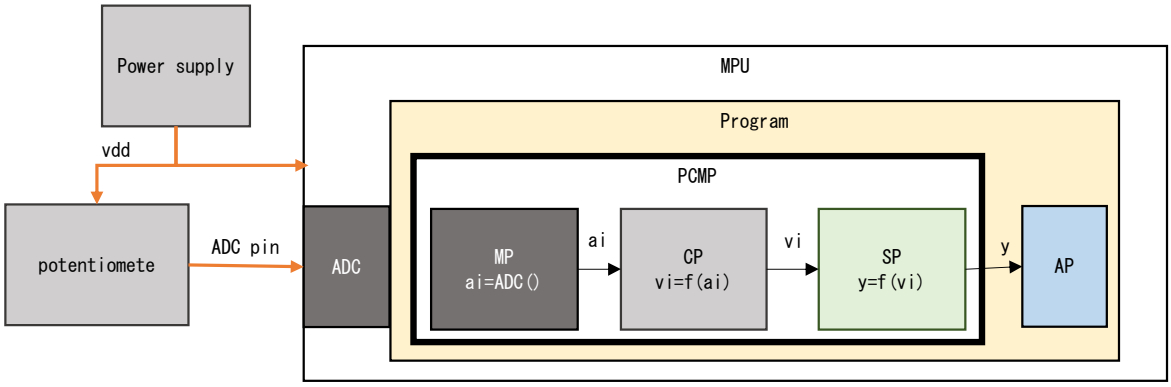
Normal operating voltage		
Vdd	5.0	[V]



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

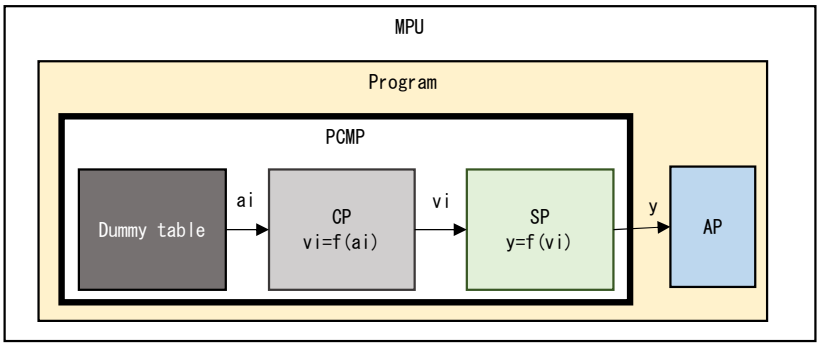
Data with 3.3V board		
x_offset	-0.0278	[V]
gain	0.007989	[V/kPa]
y_offset	0.0	[kPa]

No.		ADC pin	ai	vi	p	res.phy	res.sts	Judgment
1	Expected	0.000	0	0.000	3.478	20.000	4,002	OK
	Measured		32	0.002	3.680	20.000	4,002	
	Difference		-32	-0.002	-0.202	0.000	0	
2	Expected	1.500	29,789	1.500	191.228	191.228	4,000	OK
	Measured		29,799	1.500	191.291	191.291	4,000	
	Difference		-10	0.000	-0.063	-0.063	0	
3	Expected	2.000	39,719	2.000	253.814	253.814	4,000	OK
	Measured		39,561	1.992	252.818	252.818	4,000	
	Difference		158	0.008	0.996	0.996	0	
4	Expected	3.300	65,536	3.300	416.530	400.000	4,001	OK
	Measured		65,535	3.300	416.524	400.000	4,001	
	Difference		1	0.000	0.006	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	20.010	20.010	4,000	OK
	Measured	2,623	0.200	20.010	20.010	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	62,913	4.800	399.998	399.998	4,000	OK
	Measured	62,913	4.800	399.998	399.998	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	62,914	4.800	400.005	400.000	4,001	OK
	Measured	62,914	4.800	400.005	400.000	4,001	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	62,913	4.800	399.998	399.998	4,000	OK
	Measured	62,913	4.800	399.998	399.998	4,000	
	Difference	0	0.000	0.000	0.000	0	

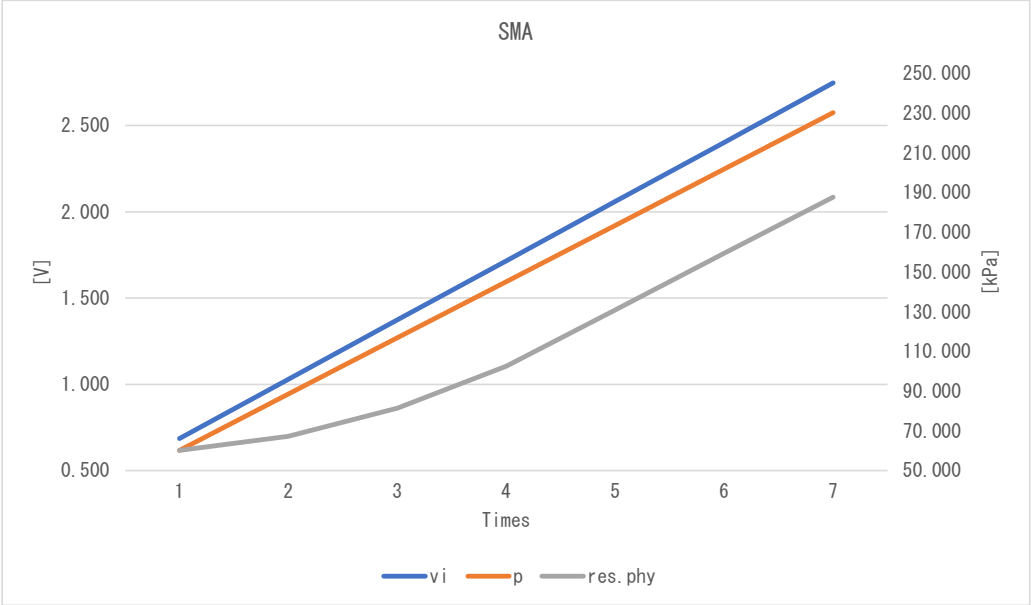
res.sts	4000	Normal
	4001	Max Limiter NG
	4002	Min Limiter NG

2-2. Moving average test

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

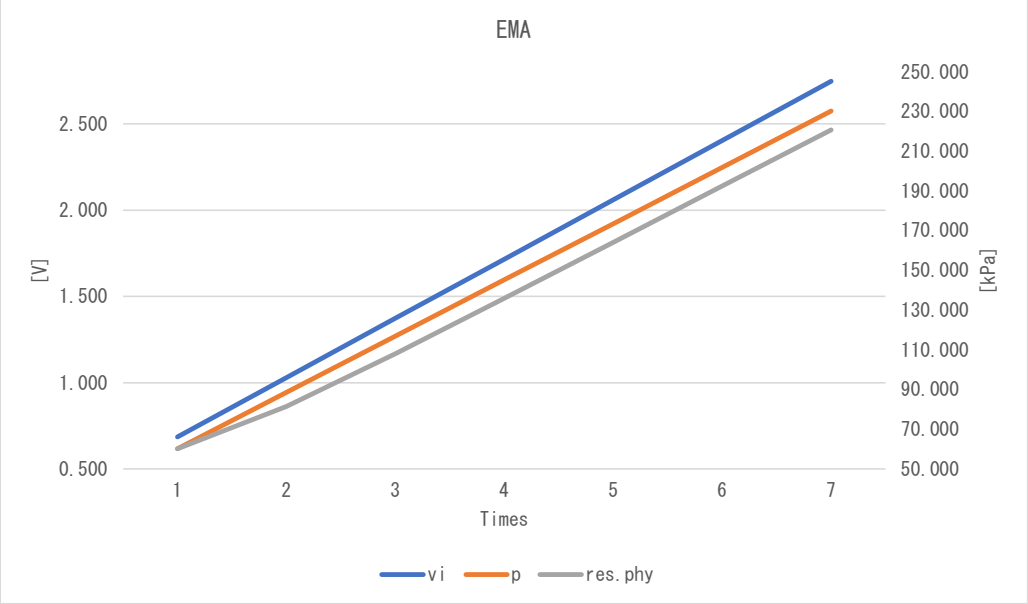
SMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	9,000	0.687	60.202	60.202	4,000	OK
	Measured	9,000	0.687	60.202	60.202	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	13,500	1.030	88.564	67.293	4,000	OK
	Measured	13,500	1.030	88.564	67.293	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	18,000	1.373	116.926	81.474	4,000	OK
	Measured	18,000	1.373	116.926	81.474	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	22,500	1.717	145.288	102.745	4,000	OK
	Measured	22,500	1.717	145.288	102.745	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	27,000	2.060	173.650	131.107	4,000	OK
	Measured	27,000	2.060	173.650	131.107	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	31,500	2.403	202.012	159.469	4,000	OK
	Measured	31,500	2.403	202.012	159.469	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	36,000	2.747	230.374	187.831	4,000	OK
	Measured	36,000	2.747	230.374	187.831	4,000	
	Difference	0	0.000	0.000	0.000	0	



EMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	9,000	0.687	60.202	60.202	4,000	OK
	Measured	9,000	0.687	60.202	60.202	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	13,500	1.030	88.564	81.474	4,000	OK
	Measured	13,500	1.030	88.564	81.474	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	18,000	1.373	116.926	108.063	4,000	OK
	Measured	18,000	1.373	116.926	108.063	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	22,500	1.717	145.288	135.982	4,000	OK
	Measured	22,500	1.717	145.288	135.982	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	27,000	2.060	173.650	164.233	4,000	OK
	Measured	27,000	2.060	173.650	164.233	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	31,500	2.403	202.012	192.568	4,000	OK
	Measured	31,500	2.403	202.012	192.568	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	36,000	2.747	230.374	220.923	4,000	OK
	Measured	36,000	2.747	230.374	220.923	4,000	
	Difference	0	0.000	0.000	0.000	0	



WMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	9,000	0.687	60.202	60.202	4,000	OK
	Measured	9,000	0.687	60.202	60.202	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	13,500	1.030	88.564	74.383	4,000	OK
	Measured	13,500	1.030	88.564	74.383	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	18,000	1.373	116.926	98.018	4,000	OK
	Measured	18,000	1.373	116.926	98.018	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	22,500	1.717	145.288	126.380	4,000	OK
	Measured	22,500	1.717	145.288	126.380	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	27,000	2.060	173.650	154.742	4,000	OK
	Measured	27,000	2.060	173.650	154.742	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	31,500	2.403	202.012	183.104	4,000	OK
	Measured	31,500	2.403	202.012	183.104	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	36,000	2.747	230.374	211.466	4,000	OK
	Measured	36,000	2.747	230.374	211.466	4,000	
	Difference	0	0.000	0.000	0.000	0