Test Specifications and Results of ADC components

Spec-00000057.pdf

Date	20-Oct-22
Verifier	Red Dragon

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

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

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

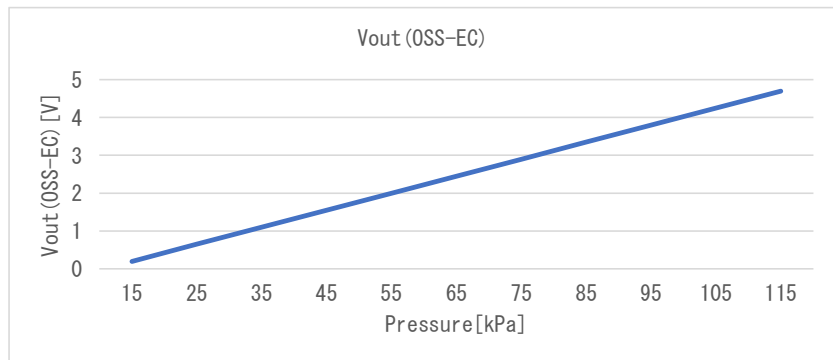EMA calculation method $phy = (y \times k) + (phy_{n-1} \times (1 - k))$

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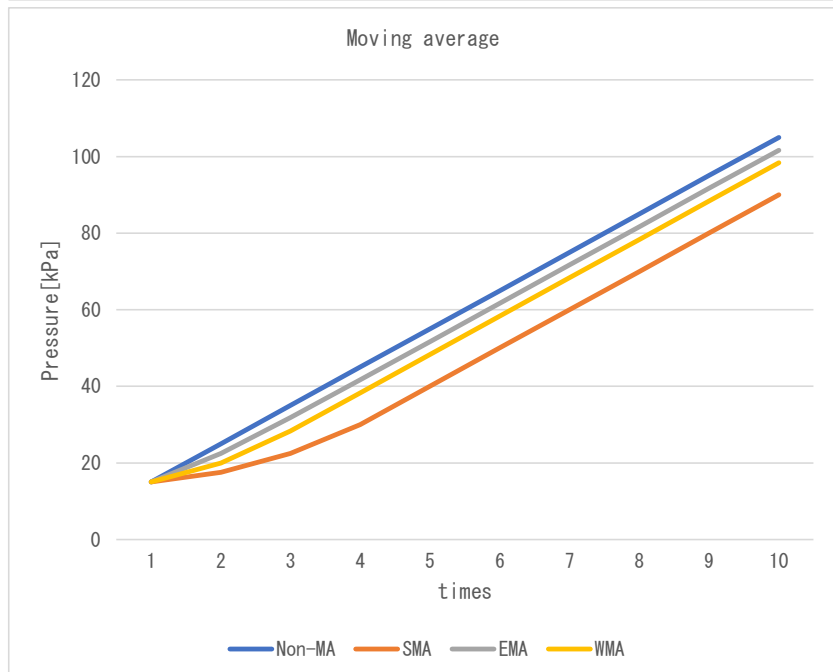
Non-MA calculation method $phy = y$

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	Mega 2560 Rev3
MPU	ATmega2560
ComplierVer	avr-gcc 7.3.0
IDE	Arduino IDE 1.8.19
Vdd	5.0 [V]
ADC bit	10 [bit]
ADC pin	A0 -
Component	Dummy
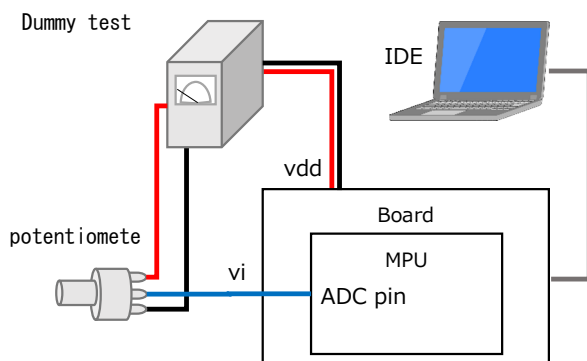
Test Method

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:
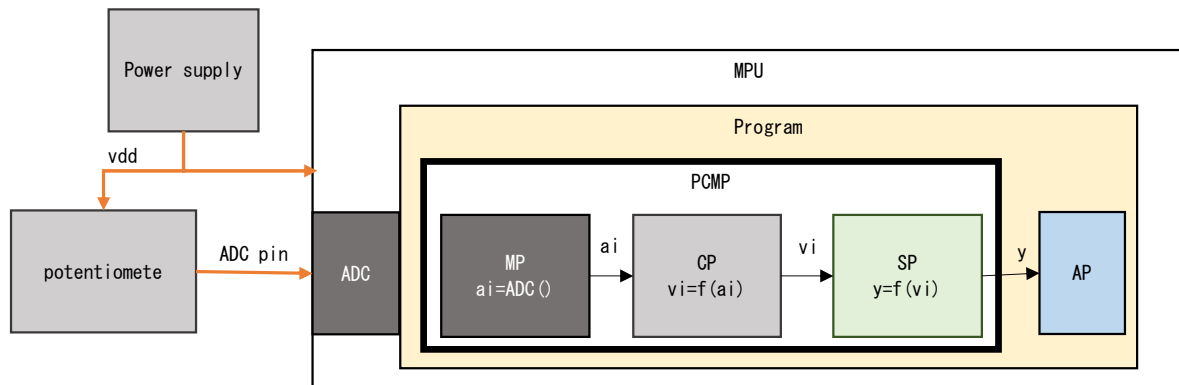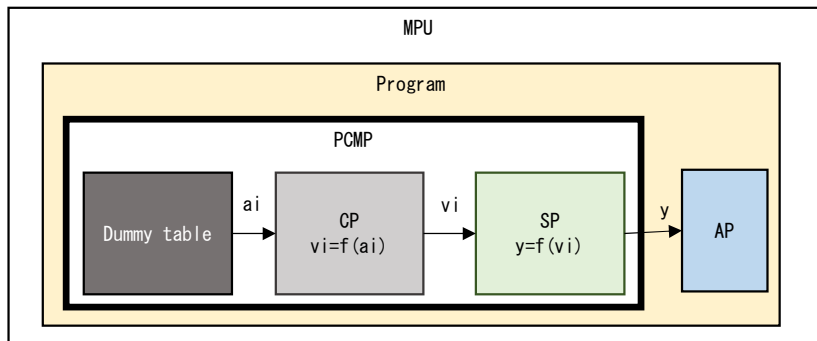

	No.	ADC pin	ai	vi	p	res. phy	res. sts	Judgment
1	Expected		0	0.000	10.556	15.000	4,002	
	Measured	0.000	0	0.000	10.556	15.000	4,002	OK
	Difference		0	0.000	0.000	0.000	0	
2	Expected		307	1.499	43.867	43.867	4,000	
	Measured	1.500	307	1.499	43.867	43.867	4,000	OK
	Difference		0	0.000	0.000	0.000	0	
3	Expected		410	2.002	55.043	55.043	4,000	
	Measured	2.000	410	2.002	55.043	55.043	4,000	OK
	Difference		0	0.000	0.000	0.000	0	
4	Expected		1,024	5.000	121.667	115.000	4,001	
	Measured	5.000	1,023	4.995	121.558	115.000	4,001	OK
	Difference		1	0.005	0.108	0.000	0	

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

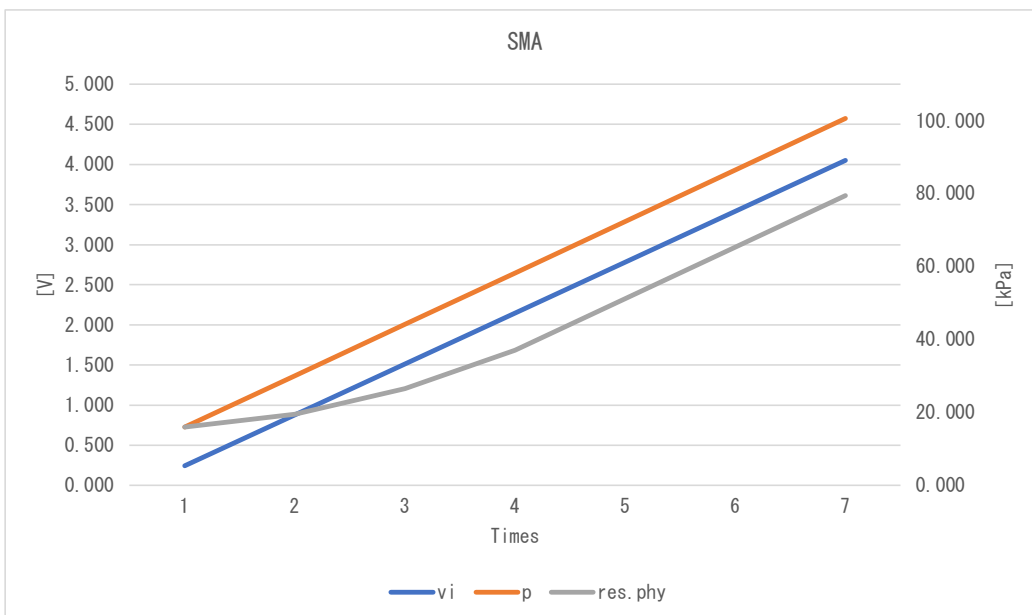| No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	42	0.205	15.113	15.113	4,000	
	Measured	42	0.205	15.113	15.113	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
2	Expected	41	0.200	15.004	15.004	4,000	
	Measured	41	0.200	15.004	15.004	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
3	Expected	40	0.195	14.896	15.000	4,002	
	Measured	40	0.195	14.896	15.000	4,002	OK
	Difference	0	0.000	0.000	0.000	0	
4	Expected	41	0.200	15.004	15.004	4,000	
	Measured	41	0.200	15.004	15.004	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
5	Expected	962	4.697	114.939	114.939	4,000	
	Measured	962	4.697	114.939	114.939	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
6	Expected	963	4.702	115.048	115.000	4,001	
	Measured	963	4.702	115.048	115.000	4,001	OK
	Difference	0	0.000	0.000	0.000	0	
7	Expected	962	4.697	114.939	114.939	4,000	
	Measured	962	4.697	114.939	114.939	4,000	OK
	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.
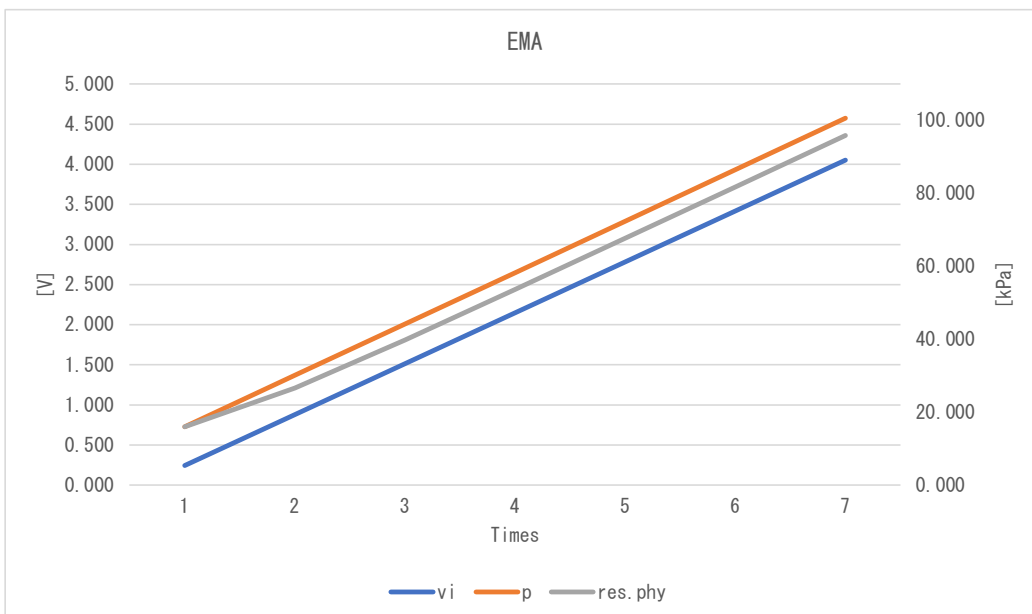
SMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	50	0.244	15.981	15.981	4,000	OK
	Measured	50	0.244	15.981	15.981	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	180	0.879	30.087	19.507	4,000	OK
	Measured	180	0.879	30.087	19.507	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	310	1.514	44.193	26.560	4,000	OK
	Measured	310	1.514	44.193	26.560	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	440	2.148	58.299	37.140	4,000	OK
	Measured	440	2.148	58.299	37.140	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	570	2.783	72.405	51.246	4,000	OK
	Measured	570	2.783	72.405	51.246	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	700	3.418	86.510	65.352	4,000	OK
	Measured	700	3.418	86.510	65.352	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	830	4.053	100.616	79.457	4,000	OK
	Measured	830	4.053	100.616	79.458	4,000	
	Difference	0	0.000	0.000	0.000	0	

SMA

EMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	50	0.244	15.981	15.981	4,000	OK
	Measured	50	0.244	15.981	15.981	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	180	0.879	30.087	26.560	4,000	OK
	Measured	180	0.879	30.087	26.560	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	310	1.514	44.193	39.785	4,000	OK
	Measured	310	1.514	44.193	39.785	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	440	2.148	58.299	53.670	4,000	OK
	Measured	440	2.148	58.299	53.670	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	570	2.783	72.405	67.721	4,000	OK
	Measured	570	2.783	72.405	67.721	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	700	3.418	86.510	81.813	4,000	OK
	Measured	700	3.418	86.510	81.813	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	830	4.053	100.616	95.915	4,000	OK
	Measured	830	4.053	100.616	95.916	4,000	
	Difference	0	0.000	0.000	0.000	0	

EMA

WMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	50	0.244	15.981	15.981	4,000	OK
	Measured	50	0.244	15.981	15.981	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	180	0.879	30.087	23.034	4,000	OK
	Measured	180	0.879	30.087	23.034	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	310	1.514	44.193	34.789	4,000	OK
	Measured	310	1.514	44.193	34.789	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	440	2.148	58.299	48.895	4,000	OK
	Measured	440	2.148	58.299	48.895	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	570	2.783	72.405	63.001	4,000	OK
	Measured	570	2.783	72.405	63.001	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	700	3.418	86.510	77.106	4,000	OK
	Measured	700	3.418	86.510	77.107	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	830	4.053	100.616	91.212	4,000	OK
	Measured	830	4.053	100.616	91.212	4,000	
	Difference	0	0.000	0.000	0.000	0	

WMA