Test Specifications and Results of ADC components

Date	11-Oct-22
Verifier	Red Dragon

Spec-00000057.pdf

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

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

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

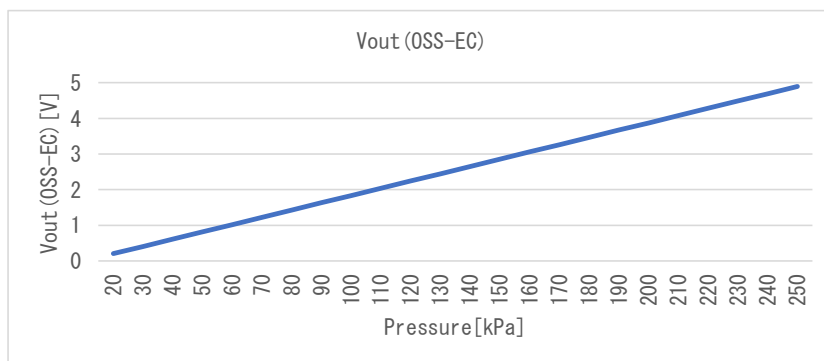EMA calculation method $phy = (y \times k) + (phy_{n-1} \times (1 - k))$

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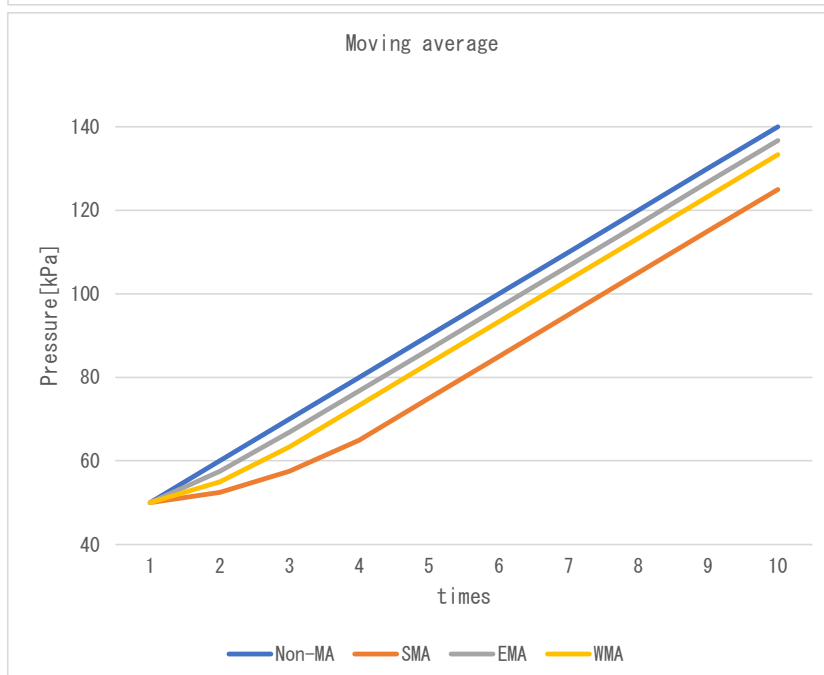
Non-MA calculation method $phy = y$

Spec-MPXA4250A.pdf

component data		
x_offset	-0.2000	[V]
gain	0.02	[V/kPa]
y_offset	0.0	[kPa]
max	250.0	[kPa]
min	20.0	[kPa]

Coefficient		
SMA	n	4
EMA	k	0.75
WMA	m	3

Vout(OSS-EC)

Moving average

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
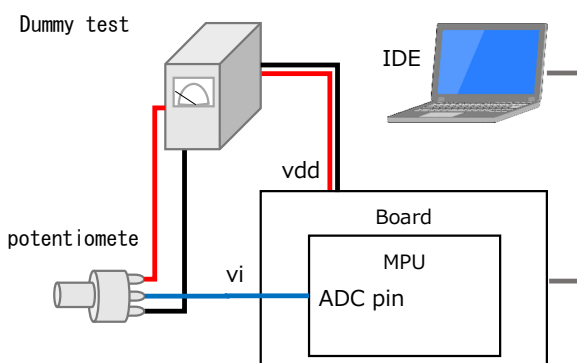
Test Method

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:
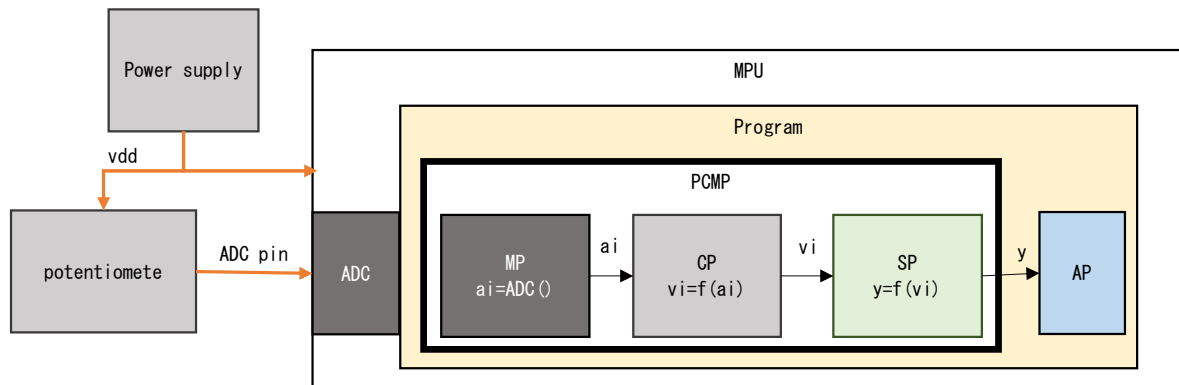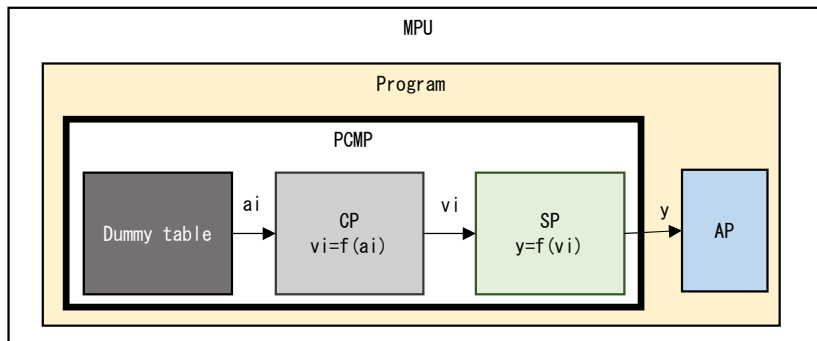

No.		ADC pin	ai	vi	p	res.phy	res.sts	Judgment
1	Expected		0	0.000	10.000	20.000	4,002	
	Measured	0.000	0	0.000	10.000	20.000	4,002	OK
	Difference		0	0.000	0.000	0.000	0	
2	Expected		307	1.499	84.951	84.951	4,000	
	Measured	1.500	308	1.504	85.195	85.195	4,000	OK
	Difference		−1	−0.005	−0.244	−0.244	0	
3	Expected		410	2.002	110.098	110.098	4,000	
	Measured	2.000	411	2.007	110.586	110.586	4,000	OK
	Difference		−1	−0.005	−0.488	−0.488	0	
4	Expected		1,024	5.000	260.000	250.000	4,001	
	Measured	5.000	1,023	4.995	259.756	250.000	4,001	OK
	Difference		1	0.005	0.244	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	42	0.205	20.254	20.254	4,000	
	Measured	42	0.205	20.254	20.254	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
2	Expected	41	0.200	20.010	20.010	4,000	
	Measured	41	0.200	20.010	20.010	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
3	Expected	40	0.195	19.766	20.000	4,002	
	Measured	40	0.195	19.766	20.000	4,002	OK
	Difference	0	0.000	0.000	0.000	0	
4	Expected	41	0.200	20.010	20.010	4,000	
	Measured	41	0.200	20.010	20.010	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
5	Expected	983	4.800	249.990	249.990	4,000	
	Measured	983	4.800	249.990	249.990	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
6	Expected	984	4.805	250.234	250.000	4,001	
	Measured	984	4.805	250.234	250.000	4,001	OK
	Difference	0	0.000	0.000	0.000	0	
7	Expected	983	4.800	249.990	249.990	4,000	
	Measured	983	4.800	249.990	249.990	4,000	OK
	Difference	0	0.000	0.000	0.000	0	

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res.sts    4000    Normal
           4001    Max Limiter NG
           4002    Min Limiter NG
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2-2. Moving average test
Check each Filter by changing ai according to the Dummy table as shown in the table below.
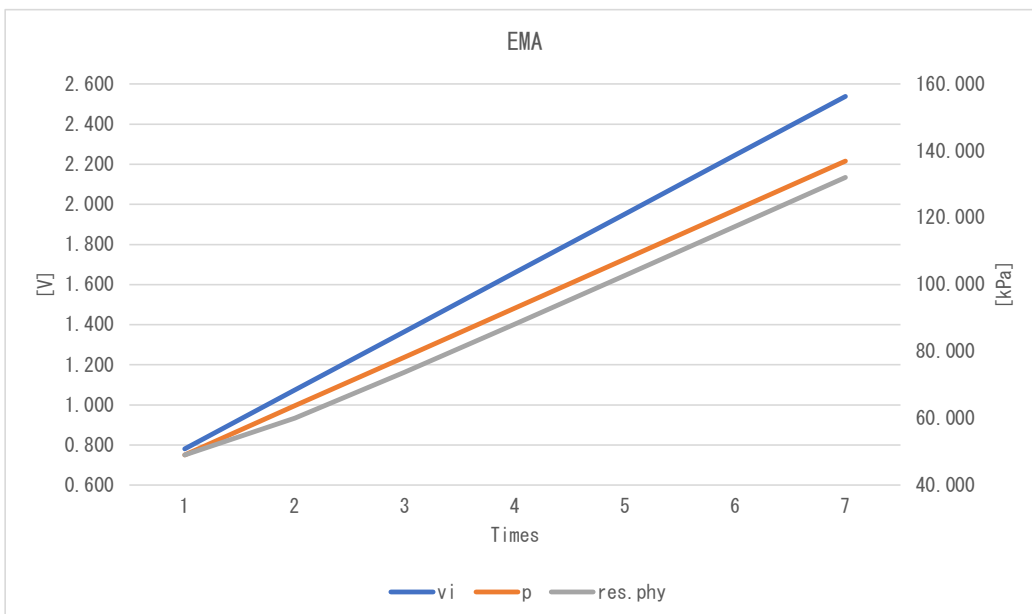
SMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	160	0.781	49.063	49.063	4,000	OK
	Measured	160	0.781	49.063	49.063	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	220	1.074	63.711	52.725	4,000	OK
	Measured	220	1.074	63.711	52.725	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	280	1.367	78.359	60.049	4,000	OK
	Measured	280	1.367	78.359	60.049	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	340	1.660	93.008	71.035	4,000	OK
	Measured	340	1.660	93.008	71.035	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	400	1.953	107.656	85.684	4,000	OK
	Measured	400	1.953	107.656	85.684	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	460	2.246	122.305	100.332	4,000	OK
	Measured	460	2.246	122.305	100.332	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	520	2.539	136.953	114.980	4,000	OK
	Measured	520	2.539	136.953	114.980	4,000	
	Difference	0	0.000	0.000	0.000	0	

SMA
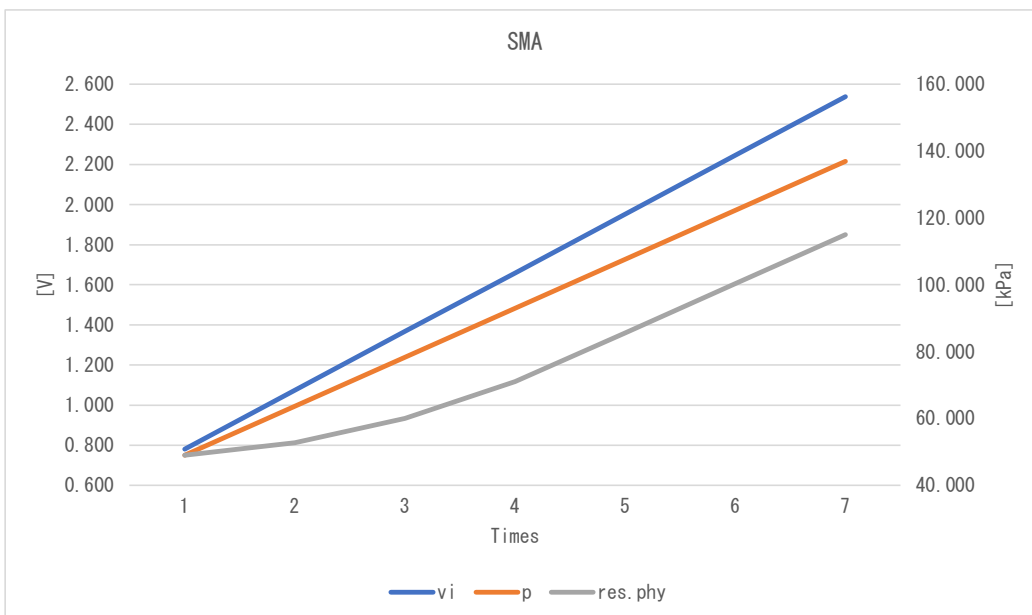
EMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	160	0.781	49.063	49.063	4,000	OK
	Measured	160	0.781	49.063	49.063	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	220	1.074	63.711	60.049	4,000	OK
	Measured	220	1.074	63.711	60.049	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	280	1.367	78.359	73.782	4,000	OK
	Measured	280	1.367	78.359	73.782	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	340	1.660	93.008	88.201	4,000	OK
	Measured	340	1.660	93.008	88.201	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	400	1.953	107.656	102.793	4,000	OK
	Measured	400	1.953	107.656	102.793	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	460	2.246	122.305	117.427	4,000	OK
	Measured	460	2.246	122.305	117.427	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	520	2.539	136.953	132.072	4,000	OK
	Measured	520	2.539	136.953	132.072		
	Difference	0	0.000	0.000	0.000	4,000	

EMA

WMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	160	0.781	49.063	49.063	4,000	
	Measured	160	0.781	49.063	49.063	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
2	Expected	220	1.074	63.711	56.387	4,000	
	Measured	220	1.074	63.711	56.387	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
3	Expected	280	1.367	78.359	68.594	4,000	
	Measured	280	1.367	78.359	68.594	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
4	Expected	340	1.660	93.008	83.242	4,000	
	Measured	340	1.660	93.008	83.242	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
5	Expected	400	1.953	107.656	97.891	4,000	
	Measured	400	1.953	107.656			OK
	Difference	0	0.000	0.000	97.891	4,000	
6	Expected	460	2.246	122.305	112.539	4,000	
	Measured	460	2.246	122.305	112.539	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
7	Expected	520	2.539	136.953	127.188	4,000	
	Measured	520	2.539	136.953	127.188	4,000	OK
	Difference	0	0.000	0.000	0.000	0	

WMA