

Test Specifications and Results of ADC components

Spec-00000057. pdf

$$v_i = (a_i \times \text{ADC_vdd}) / 2^{\text{ADC_bit}}$$

$$y = (v_i - x_{\text{offset}}) / \text{gain} + y_{\text{offset}} \quad \text{range min to max}$$

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

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

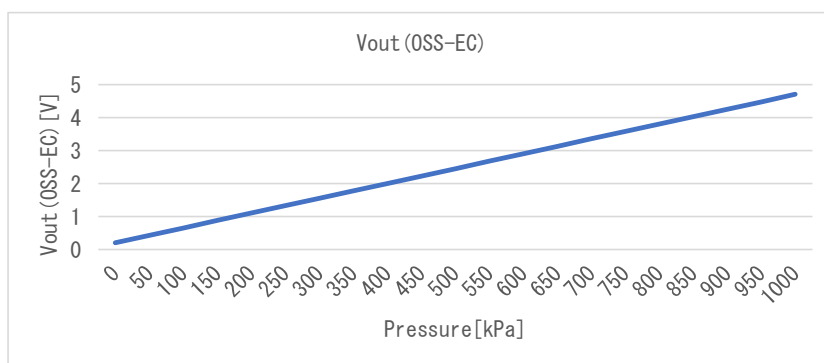
$$\text{WMA calculation method} \quad \text{phy} = ((y_n \times n) + (y_{n-1} \times (n-1)) + \dots + (y_1 \times 1)) / (n + (n-1) + \dots + 1)$$

$$\text{Non-MA calculation method} \quad \text{phy} = y$$

Date	20-Oct-22
Verifier	Red Dragon

Spec-MPX5999D. pdf

component data	
x_offset	0.2000 [V]
gain	0.004505 [V/kPa]
y_offset	0.0 [kPa]
max	1000.0 [kPa]
min	0.0 [kPa]

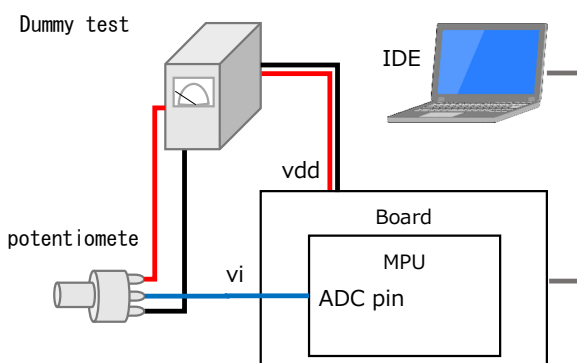


Coefficient		
SMA	n	4
EMA	k	0.75
WMA	m	3



Test environment

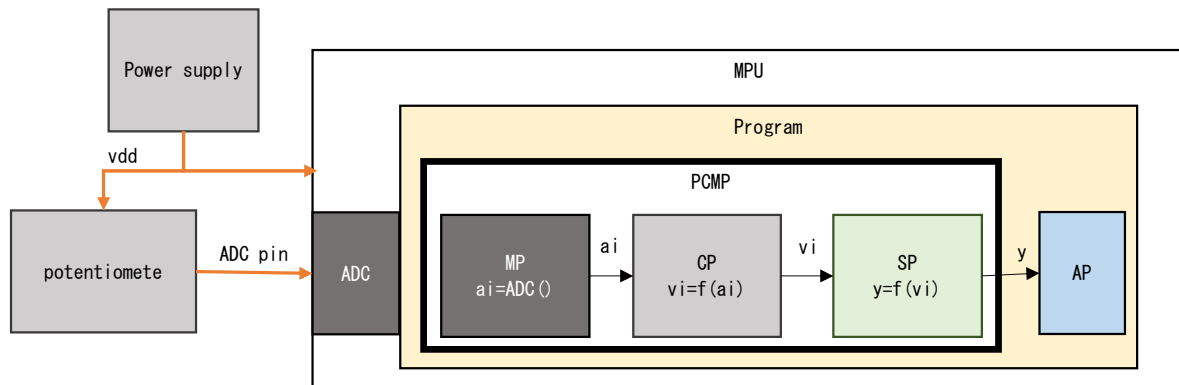
Board	Mega 2560 Rev3
MPU	ATmega2560
CompilerVer	avr-gcc 7.3.0
IDE	Arduino IDE 1.8.19
Vdd	5.0 [V]
ADC bit	10 [bit]
ADC pin	A0 -
Component	Dummy



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:

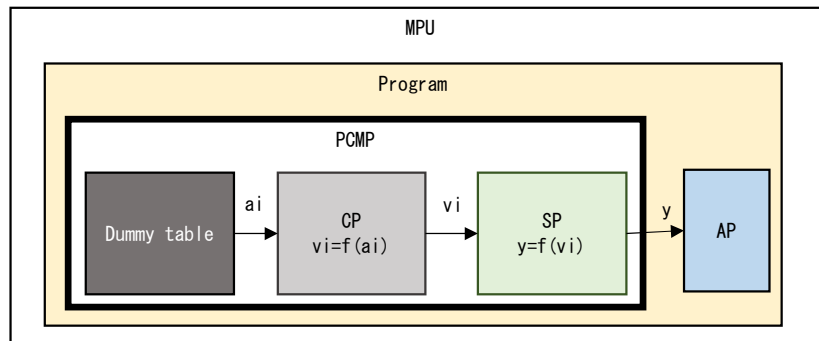


No.		ADC pin	ai	vi	p	res. phy	res. sts	Judgment
1	Expected	0.000	0	0.000	-44.395	0.000	4,002	OK
	Measured		0	0.000	-44.395	0.000	4,002	
	Difference		0	0.000	0.000	0.000	0	
2	Expected	1.500	307	1.499	288.351	288.351	4,000	OK
	Measured		307	1.499	288.352	288.352	4,000	
	Difference		0	0.000	0.000	0.000	0	
3	Expected	2.000	410	2.002	399.990	399.990	4,000	OK
	Measured		411	2.007	401.074	401.074	4,000	
	Difference		-1	-0.005	-1.084	-1.084	0	
4	Expected	5.000	1,024	5.000	1065.483	1000.000	4,001	OK
	Measured		1,023	4.995	1064.399	1000.000	4,001	
	Difference		1	0.005	1.084	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 a_i according to Dummy table as shown in the table below, and check Max/Min limiters and diagnostic results. Non-MA mode.

No.		Dummy a_i	v_i	p	res. phy	res. sts	Judgment
1	Expected	42	0.205	1.127	1.127	4,000	OK
	Measured	42	0.205	1.127	1.127	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	41	0.200	0.043	0.043	4,000	OK
	Measured	41	0.200	0.043	0.043	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	40	0.195	-1.041	0.000	4,002	OK
	Measured	40	0.195	-1.041	0.000	4,002	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	41	0.200	0.043	0.043	4,000	OK
	Measured	41	0.200	0.043	0.043	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	963	4.702	999.367	999.367	4,000	OK
	Measured	963	4.702	999.367	999.367	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	964	4.707	1000.451	1000.000	4,001	OK
	Measured	964	4.707	1000.451	1000.000	4,001	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	963	4.702	999.367	999.367	4,000	OK
	Measured	963	4.702	999.367	999.367	4,000	
	Difference	0	0.000	0.000	0.000	0	

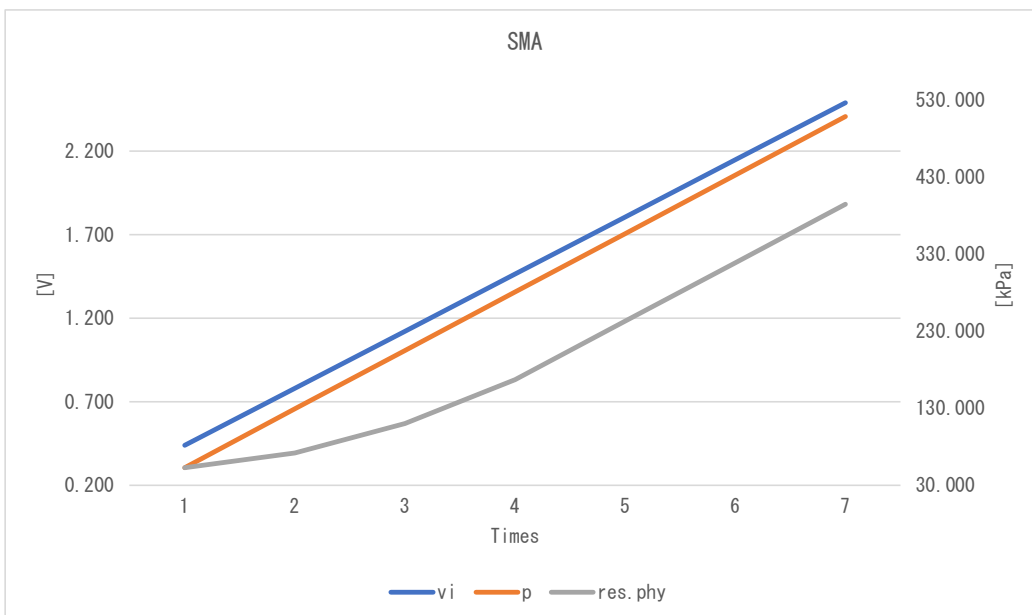
res. sts 4000 Normal
 4001 Max Limiter NG
 4002 Min Limiter NG

2-2. Moving average test

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

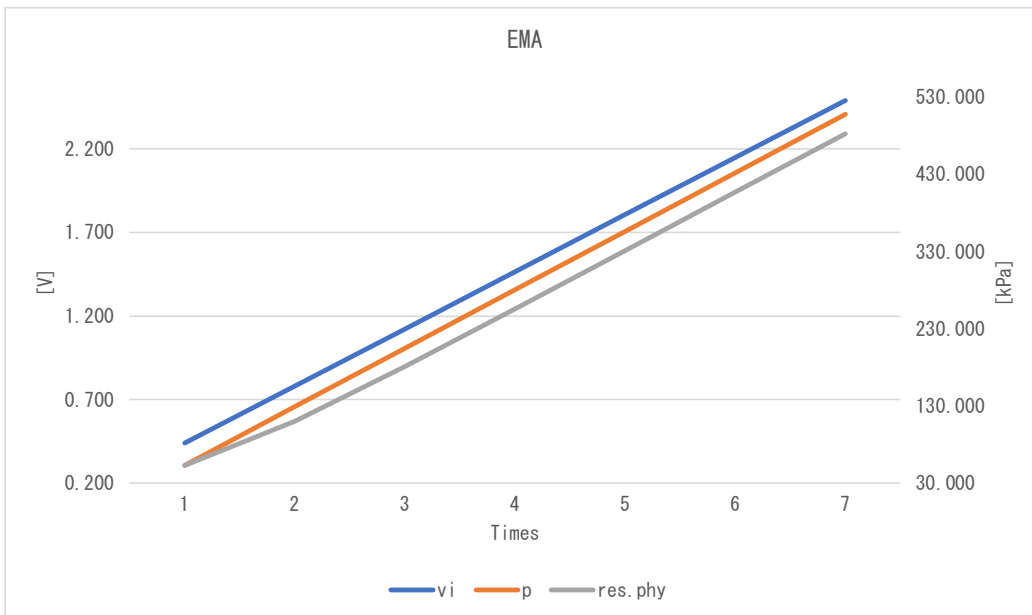
SMA

	No.	Dummy a_i	v_i	p	res. phy	res. sts	Judgment
1	Expected	90	0.439	53.153	53.153	4.000	OK
	Measured	90	0.440	53.153	53.153	4.000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	160	0.781	129.023	72.120	4.000	OK
	Measured	160	0.781	129.023	72.120	4.000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	230	1.123	204.894	110.056	4.000	OK
	Measured	230	1.123	204.894	110.056	4.000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	300	1.465	280.764	166.959	4.000	OK
	Measured	300	1.465	280.764	166.959	4.000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	370	1.807	356.635	242.829	4.000	OK
	Measured	370	1.807	356.635	242.829	4.000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	440	2.148	432.506	318.700	4.000	OK
	Measured	440	2.148	432.506	318.700	4.000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	510	2.490	508.376	394.570	4.000	OK
	Measured	510	2.490	508.376	384.570	4.000	
	Difference	0	0.000	0.000	10.000	0	



EMA

	No.	Dummy ai	vi	p	res. phy	res. sts	Judgment
1	Expected	90	0.439	53.153	53.153	4.000	OK
	Measured	90	0.440	53.153	53.153	4.000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	160	0.781	129.023	110.056	4.000	OK
	Measured	160	0.781	129.023	110.056	4.000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	230	1.123	204.894	181.184	4.000	OK
	Measured	230	1.123	204.894	181.184	4.000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	300	1.465	280.764	255.869	4.000	OK
	Measured	300	1.465	280.764	255.869	4.000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	370	1.807	356.635	331.444	4.000	OK
	Measured	370	1.807	356.635	331.444	4.000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	440	2.148	432.506	407.240	4.000	OK
	Measured	440	2.148	432.506	407.240	4.000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	510	2.490	508.376	483.092	4.000	OK
	Measured	510	2.490	508.376	483.092	4.000	
	Difference	0	0.000	0.000	0.000	0	



WMA

	No.	Dummy ai	vi	p	res. phy	res. sts	Judgment
1	Expected	90	0.439	53.153	53.153	4,000	OK
	Measured	90	0.440	53.153	53.153	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	160	0.781	129.023	91.088	4,000	OK
	Measured	160	0.781	129.023	91.088	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	230	1.123	204.894	154.313	4,000	OK
	Measured	230	1.123	204.894	154.314	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	300	1.465	280.764	230.184	4,000	OK
	Measured	300	1.465	280.764	230.184	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	370	1.807	356.635	306.055	4,000	OK
	Measured	370	1.807	356.635	306.055	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	440	2.148	432.506	381.925	4,000	OK
	Measured	440	2.148	432.506	381.925	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	510	2.490	508.376	457.796	4,000	OK
	Measured	510	2.490	508.376	457.796	4,000	
	Difference	0	0.000	0.000	0.000	0	

