

## Test Specifications and Results of ADC components

Spec-00000057. pdf

$$v_i = (a_i \times \text{ADC\_vdd}) / 2^{\text{ADC\_bit}}$$

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

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

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

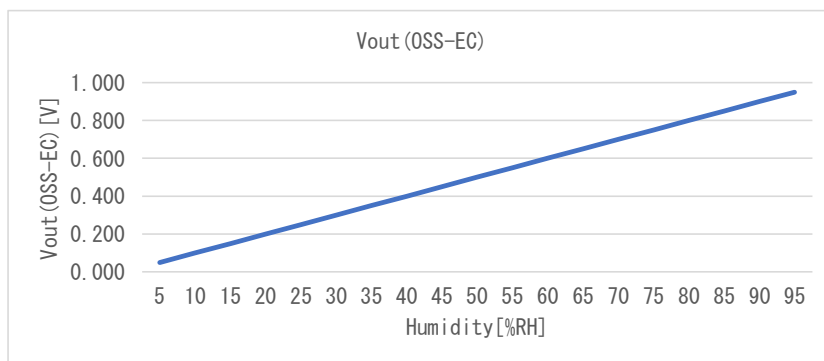
$$\text{WMA calculation method} \quad \text{phy} = ((y_n \times n) + (y_{n-1} \times (n-1)) + \dots + (y_1 \times 1)) / (n + (n-1) + \dots + 1)$$

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

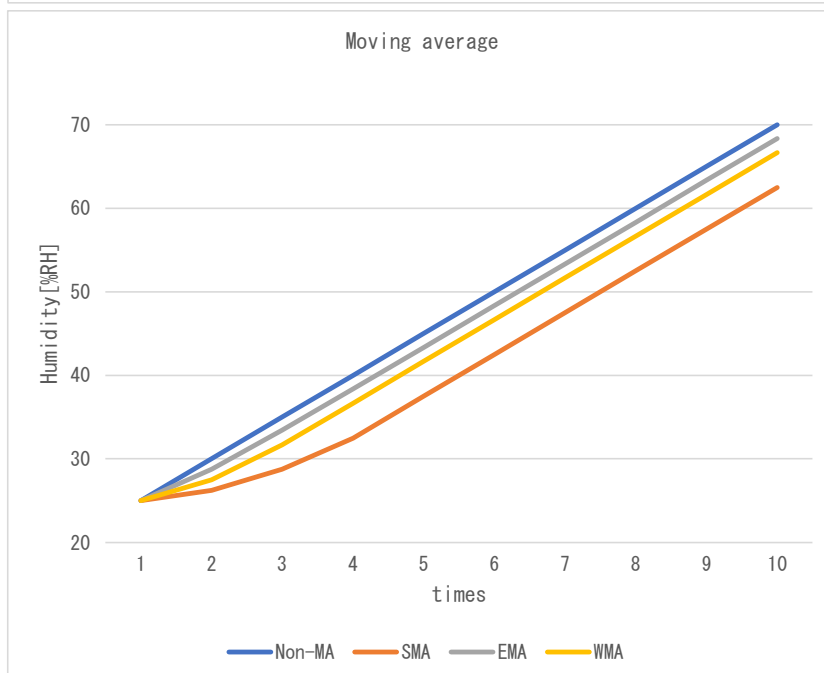
Date	28-Oct-22
Verifier	Red Dragon

Spec-CHS-UPS\_UPR\_UGS\_UGR. pdf

component data	
x_offset	0.0000 [V]
gain	0.01 [V/%RH]
y_offset	0.0 [%RH]
max	95.0 [%RH]
min	5.0 [%RH]

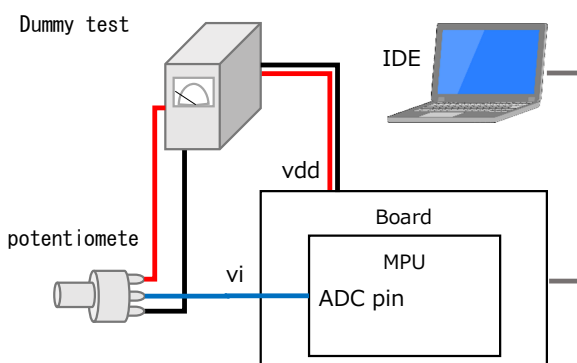


Coefficient		
SMA	n	4
EMA	k	0.75
WMA	m	3



### 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:

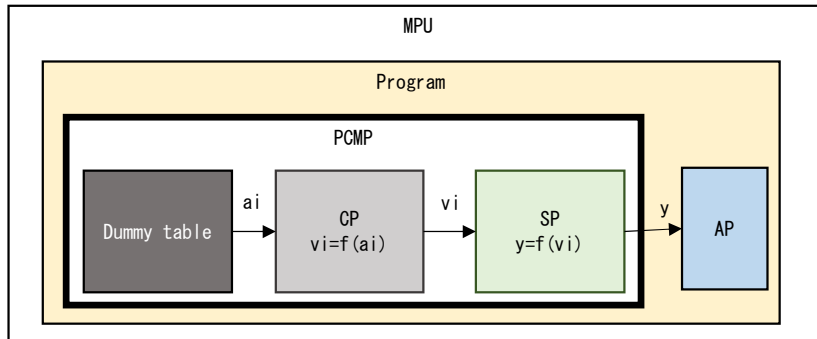


No.		ADC pin	ai	vi	p	res. phy	res. sts	Judgment
1	Expected	0.000	0	0.000	0.000	5.000	4,002	OK
	Measured		0	0.000	0.000	5.000	4,002	
	Difference		0	0.000	0.000	0.000	0	
2	Expected	1.500	307	1.499	149.902	95.000	4,001	OK
	Measured		307	1.499	149.902	95.000	4,001	
	Difference		0	0.000	0.000	0.000	0	
3	Expected	2.000	410	2.002	200.195	95.000	4,001	OK
	Measured		410	2.002	200.195	95.000	4,001	
	Difference		0	0.000	0.000	0.000	0	
4	Expected	5.000	1,024	5.000	500.000	95.000	4,001	OK
	Measured		1,023	4.995	499.512	95.000	4,001	
	Difference		1	0.005	0.488	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	12	0.059	5.859	5.859	4,000	OK
	Measured	12	0.059	5.859	5.859	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	11	0.054	5.371	5.371	4,000	OK
	Measured	11	0.054	5.371	5.371	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	10	0.049	4.883	5.000	4,002	OK
	Measured	10	0.049	4.883	5.000	4,002	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	11	0.054	5.371	5.371	4,000	OK
	Measured	11	0.054	5.371	5.371	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	194	0.947	94.727	94.727	4,000	OK
	Measured	194	0.947	94.723	94.727	4,000	
	Difference	0	0.000	0.004	0.000	0	
6	Expected	195	0.952	95.215	95.000	4,001	OK
	Measured	195	0.952	95.215	95.000	4,001	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	194	0.947	94.727	94.727	4,000	OK
	Measured	194	0.947	94.723	94.727	4,000	
	Difference	0	0.000	0.004	0.000	0	

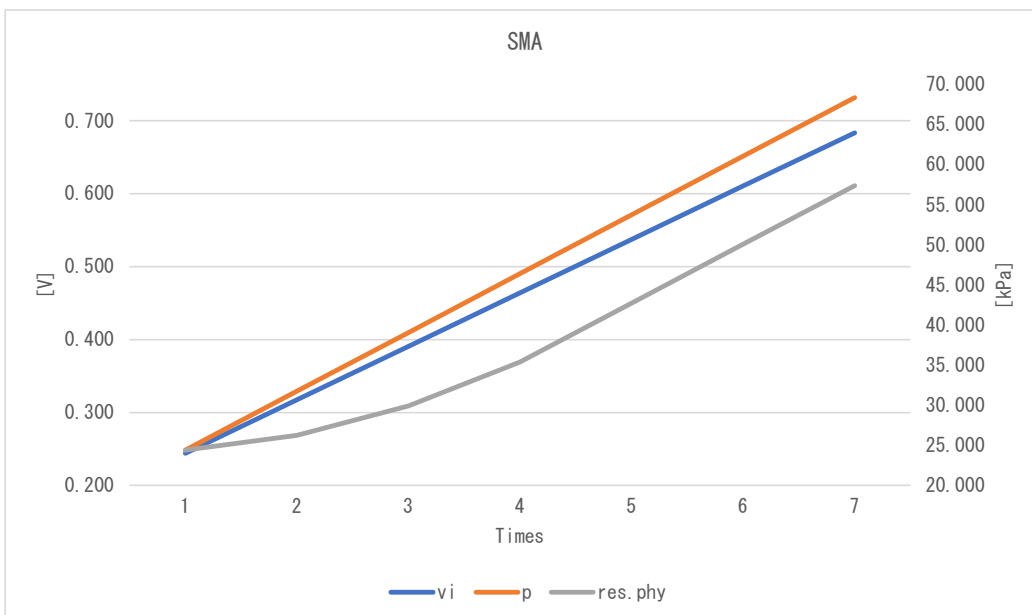
res. sts      4000    Normal  
                  4001    Max Limiter NG  
                  4002    Min Limiter NG

## 2-2. Moving average test

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

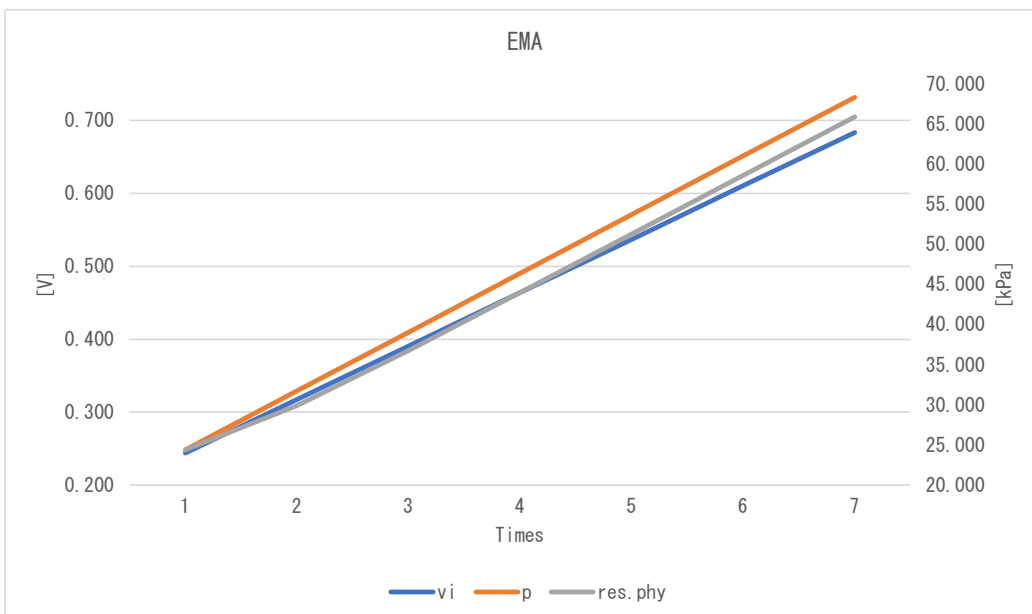
### SMA

	No.	Dummy $a_i$	$v_i$	$p$	res. phy	res. sts	Judgment
1	Expected	50	0.244	24.414	24.414	4.000	OK
	Measured	50	0.244	24.414	24.414	4.000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	65	0.317	31.738	26.245	4.000	OK
	Measured	65	0.317	31.738	26.245	4.000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	80	0.391	39.063	29.907	4.000	OK
	Measured	80	0.391	39.063	29.907	4.000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	95	0.464	46.387	35.400	4.000	OK
	Measured	95	0.464	46.387	35.400	4.000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	110	0.537	53.711	42.725	4.000	OK
	Measured	110	0.537	53.711	42.725	4.000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	125	0.610	61.035	50.049	4.000	OK
	Measured	125	0.610	61.035	50.049	4.000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	140	0.684	68.359	57.373	4.000	OK
	Measured	140	0.684	68.359	57.373	4.000	
	Difference	0	0.000	0.000	0.000	0	



# EMA

	No.	Dummy ai	vi	p	res. phy	res. sts	Judgment
1	Expected	50	0.244	24.414	24.414	4.000	OK
	Measured	50	0.244	24.414	24.414	4.000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	65	0.317	31.738	29.907	4.000	OK
	Measured	65	0.317	31.738	29.907	4.000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	80	0.391	39.063	36.774	4.000	OK
	Measured	80	0.391	39.063	36.774	4.000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	95	0.464	46.387	43.983	4.000	OK
	Measured	95	0.464	46.387	43.984	4.000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	110	0.537	53.711	51.279	4.000	OK
	Measured	110	0.537	53.711	51.279	4.000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	125	0.610	61.035	58.596	4.000	OK
	Measured	125	0.610	61.035	58.596	4.000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	140	0.684	68.359	65.919	4.000	OK
	Measured	140	0.684	68.359	65.919	4.000	
	Difference	0	0.000	0.000	0.000	0	



# WMA

No.		Dummy ai	vi	p	res. phy	res. sts	Judgment
1	Expected	50	0.244	24.414	24.414	4,000	OK
	Measured	50	0.244	24.414	24.414	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	65	0.317	31.738	28.076	4,000	OK
	Measured	65	0.317	31.738	28.076	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	80	0.391	39.063	34.180	4,000	OK
	Measured	80	0.391	39.063	34.180	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	95	0.464	46.387	41.504	4,000	OK
	Measured	95	0.464	46.387	41.504	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	110	0.537	53.711	48.828	4,000	OK
	Measured	110	0.537	53.711	48.828	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	125	0.610	61.035	56.152	4,000	OK
	Measured	125	0.610	61.035	56.152	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	140	0.684	68.359	63.477	4,000	OK
	Measured	140	0.684	68.359	63.477	4,000	
	Difference	0	0.000	0.000	0.000	0	

