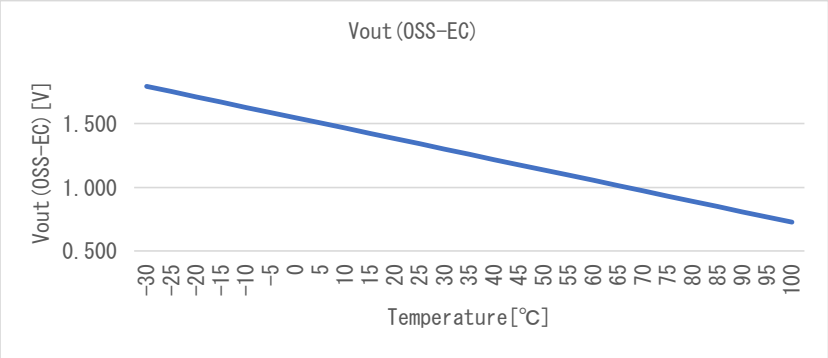
Test Specifications and Results of ADC components

Spec-00000058.pdf

Date	26-Oct-22
Verifier	Red Dragon

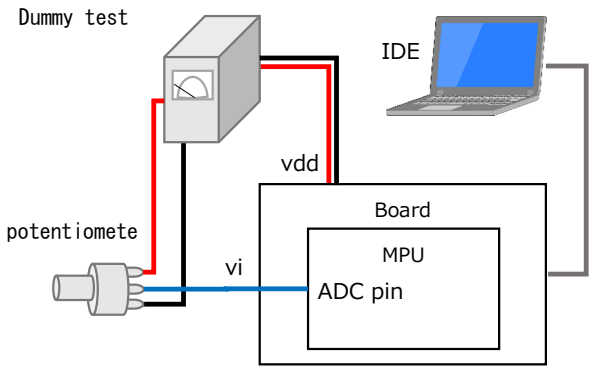
vi = (ai × ADC_vdd) / 2^{ADC_bit}
y = (vi - x_offset) / gain + y_offset　　range min to max
SMA calculation method　　phy = (y_n + y_{n-1} + y_{n-2}) / n
EMA calculation method　　phy = (y × k) + (phy_{n-1} × (1 - k))
WMA calculation method　　phy = ((yn × n) + (yn-1 × (n-1)) + ⋯ + (y 1 × 1)) / (n + (n-1) +⋯+ 1)
Non-MA calculation method　　phy = y

Spec-BD1020HFV.pdf		
component data		
x_offset	1.3000	[V]
gain	-0.0082	[V/℃]
y_offset	30.0	[℃]
max	100.0	[℃]
min	-30.0	[℃]



Coefficient		
SMA	n	4
EMA	k	0.75
WMA	m	3

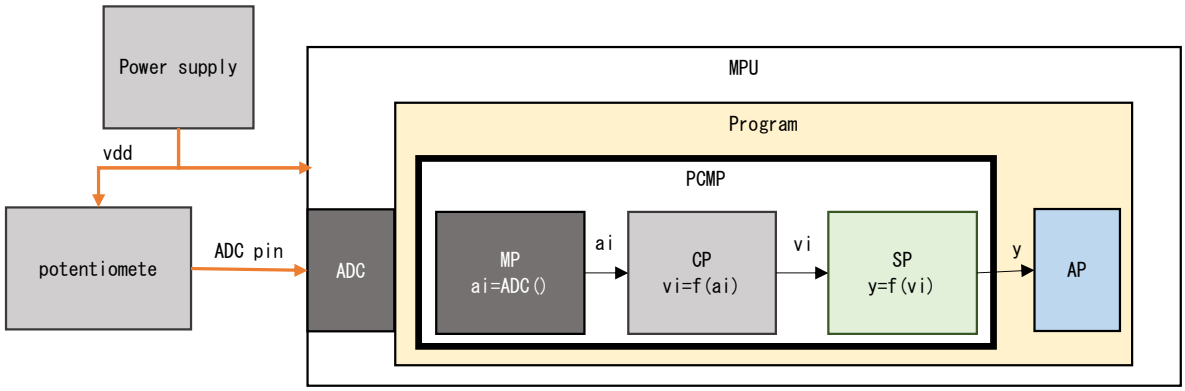
Test environment	
Board	NUCLEO-F401RE
MPU	STM32F401RE
ComplierVer	Arm Compiler 6.16
IDE	Mbed Studio 1.4.4
Vdd	3.3 [V]
ADC bit	16 [bit]
ADC pin	A0 -
Component	Dummy



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:

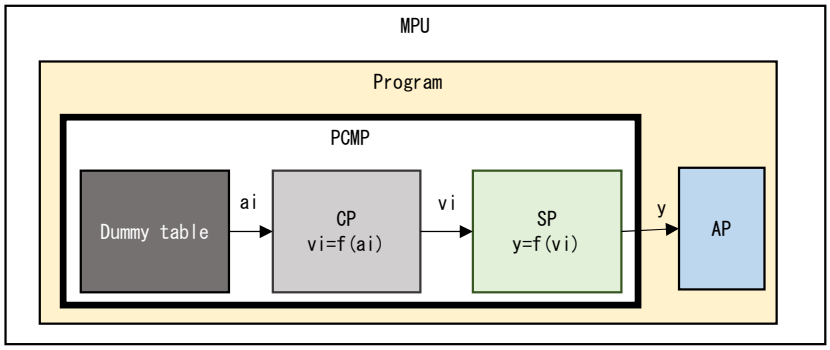


No.		ADC pin	ai	vi	p	res.phy	res.sts	Judgment
1	Expected	0.000	0	0.000	188.537	100.000	4,001	OK
	Measured		32	0.002	188.340	100.000	4,001	
	Difference		-32	-0.002	0.197	0.000	0	
2	Expected	1.300	25,817	1.300	30.001	30.001	4,000	OK
	Measured		25,670	1.293	30.904	30.904	4,000	
	Difference		147	0.007	-0.903	-0.903	0	
3	Expected	1.500	29,789	1.500	5.610	5.610	4,000	OK
	Measured		29,831	1.502	5.352	5.352	4,000	
	Difference		-42	-0.002	0.258	0.258	0	
4	Expected	3.300	65,536	3.300	-213.902	-30.000	4,002	OK
	Measured		65,535	3.300	-213.896	-30.000	4,002	
	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	35,587	1.792	-29.994	-29.994	4,000	OK
	Measured	35,587	1.792	-29.994	-29.994	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	35,588	1.792	-30.000	-30.000	4,000	OK
	Measured	35,588	1.792	-30.000	-30.000	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	35,589	1.792	-30.006	-30.000	4,002	OK
	Measured	35,589	1.792	-30.006	-30.000	4,002	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	35,588	1.792	-30.000	-30.000	4,000	OK
	Measured	35,588	1.792	-30.000	-30.000	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	14,418	0.726	100.000	100.000	4,000	OK
	Measured	14,418	0.726	100.000	100.000	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	14,417	0.726	100.006	100.000	4,001	OK
	Measured	14,417	0.726	100.006	100.000	4,001	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	14,418	0.726	100.000	100.000	4,000	OK
	Measured	14,418	0.726	100.000	100.000	4,000	
	Difference	0	0.000	0.000	0.000	0	

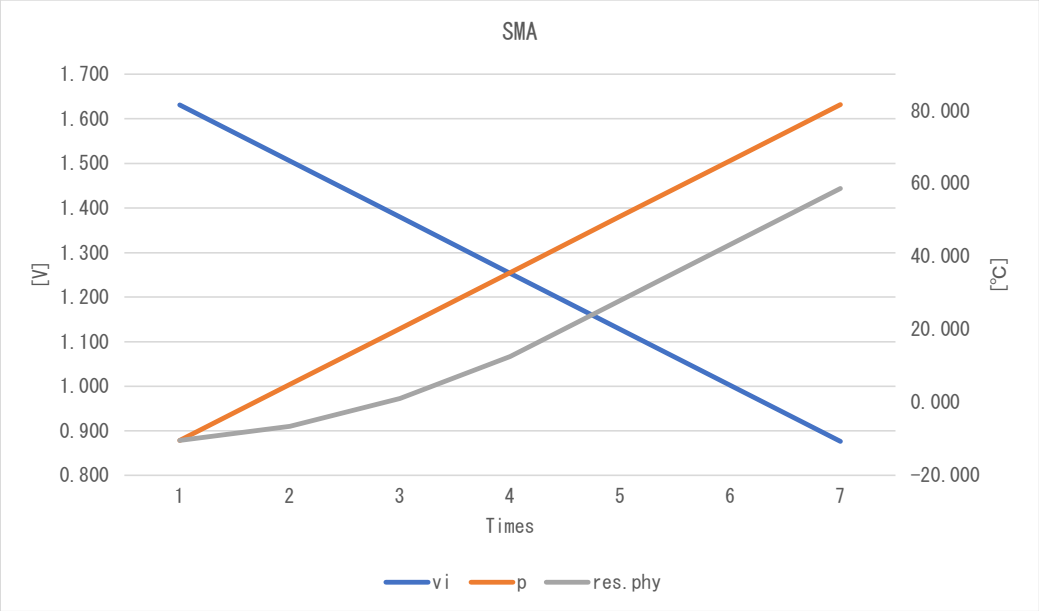
res.sts 4000 Normal
4001 Max Limiter NG
4002 Min Limiter NG

2-2. Moving average test

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

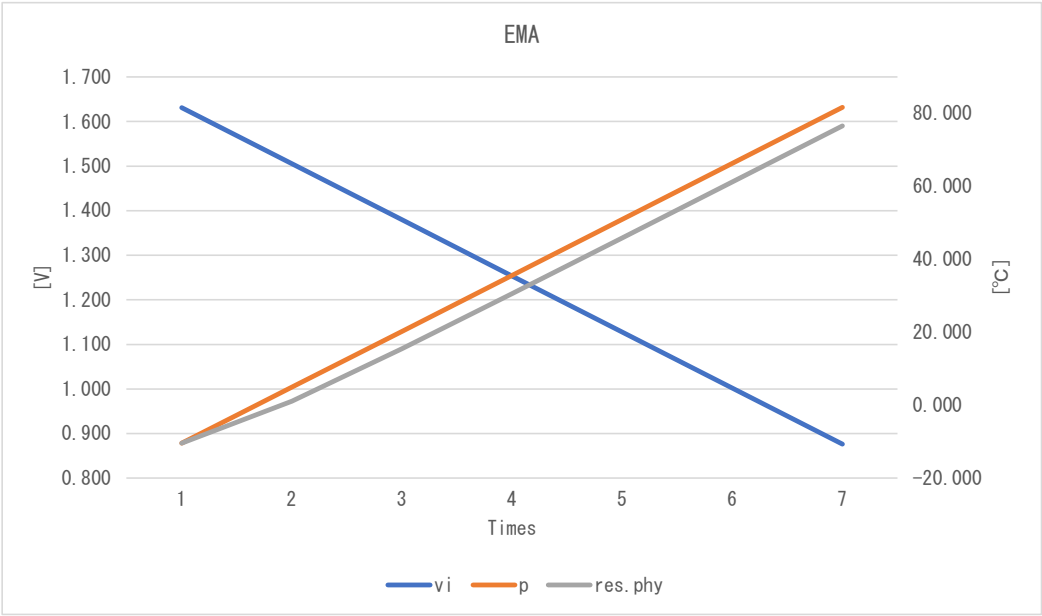
SMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	32,400	1.631	-10.423	-10.423	4,000	OK
	Measured	32,400	1.631	-10.423	-10.423	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	29,900	1.506	4.929	-6.585	4,000	OK
	Measured	29,900	1.506	4.929	-6.585	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	27,400	1.380	20.281	1.091	4,000	OK
	Measured	27,400	1.380	20.281	1.091	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	24,900	1.254	35.632	12.605	4,000	OK
	Measured	24,900	1.254	35.632	12.605	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	22,400	1.128	50.984	27.956	4,000	OK
	Measured	22,400	1.128	50.984	27.956	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	19,900	1.002	66.336	43.308	4,000	OK
	Measured	19,900	1.002	66.336	43.308	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	17,400	0.876	81.688	58.660	4,000	OK
	Measured	17,400	0.876	81.688	58.660	4,000	
	Difference	0	0.000	0.000	0.000	0	



EMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	32,400	1.631	-10.423	-10.423	4,000	OK
	Measured	32,400	1.631	-10.423	-10.423	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	29,900	1.506	4.929	1.091	4,000	OK
	Measured	29,900	1.506	4.929	1.091	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	27,400	1.380	20.281	15.483	4,000	OK
	Measured	27,400	1.380	20.281	15.483	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	24,900	1.254	35.632	30.595	4,000	OK
	Measured	24,900	1.254	35.632	30.595	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	22,400	1.128	50.984	45.887	4,000	OK
	Measured	22,400	1.128	50.984	45.887	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	19,900	1.002	66.336	61.224	4,000	OK
	Measured	19,900	1.002	66.336	61.224	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	17,400	0.876	81.688	76.572	4,000	OK
	Measured	17,400	0.876	81.688	76.572	4,000	
	Difference	0	0.000	0.000	0.000	0	



WMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	32,400	1.631	-10.423	-10.423	4,000	OK
	Measured	32,400	1.631	-10.423	-10.423	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	29,900	1.506	4.929	-2.747	4,000	OK
	Measured	29,900	1.506	4.929	-2.747	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	27,400	1.380	20.281	10.046	4,000	OK
	Measured	27,400	1.380	20.281	10.046	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	24,900	1.254	35.632	25.398	4,000	OK
	Measured	24,900	1.254	35.632	25.398	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	22,400	1.128	50.984	40.750	4,000	OK
	Measured	22,400	1.128	50.984	40.750	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	19,900	1.002	66.336	56.101	4,000	OK
	Measured	19,900	1.002	66.336	56.101	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	17,400	0.876	81.688	71.453	4,000	OK
	Measured	17,400	0.876	81.688	71.453	4,000	
	Difference	0	0.000	0.000	0.000	0