User Manual

ACC-28EP ADC Board

Analog to Digital Converting Board

JUL 20, 2015 (REV 1.0.2)

DELTA TAU
Data Systems, Inc.
NEW IDEAS IN MOTION ....

REVISION HISTORY			
VERSION	**DESCRIPTION**	**DATE**	**APPVD**
1.0.0	Manual 초본작성	2013.11.26	이명성
1.0.1	Converting Value 수정 Example 수정	2015.01.23	이명성
1.0.2	18 bit 기준 설명을 16bit로 변경	2015.07.20	이명성

※ 본 매뉴얼은 필요에 따라 수시로 업데이트 될 수 있으며, 본사 홈페이지에서 최신항목을 다운 받아 사용하시기 바랍니다. 매뉴얼에 관련된 문의사항이나 요청사항은 델타타우 코리아로 연락바랍니다.

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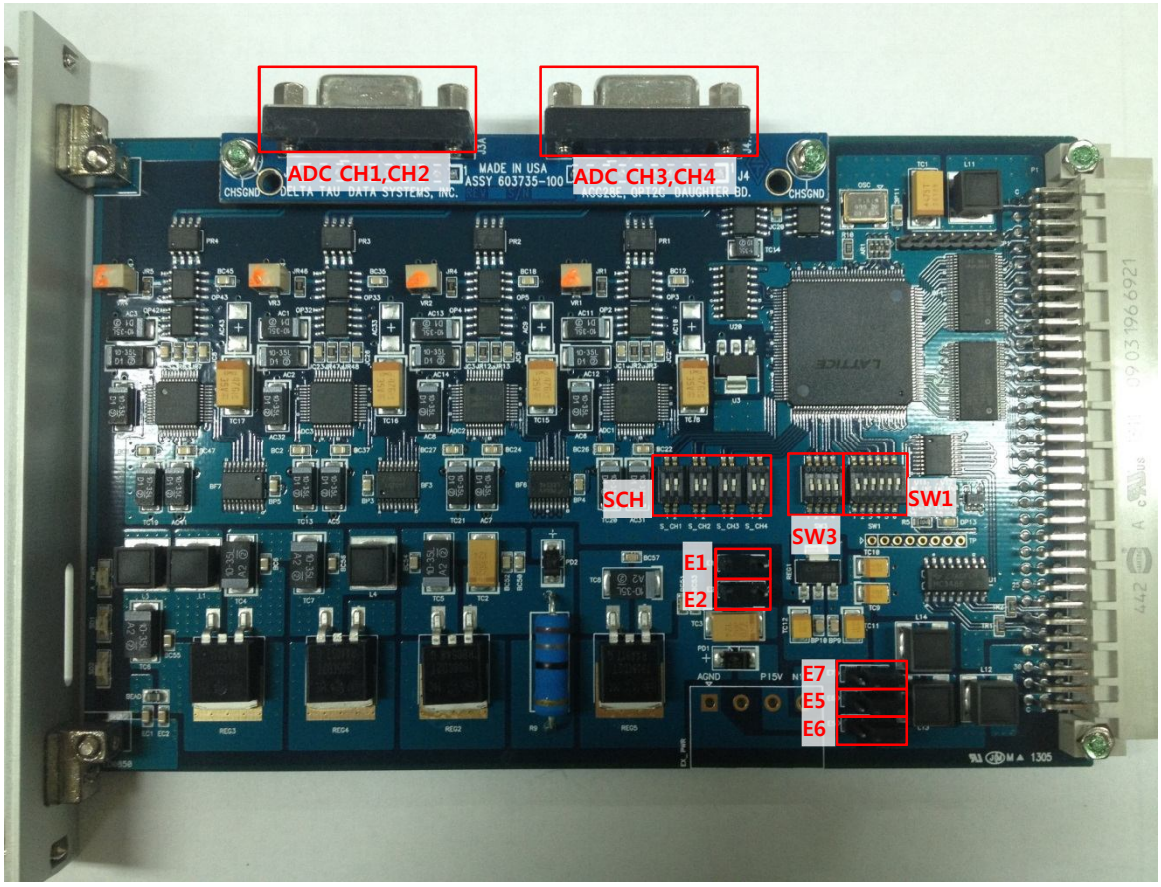
Table of Contents

1. INTRODUCTION

본 매뉴얼은 "ACC-28EP" 보드를 사용하는데 필요한 내용을 포함하고 있습니다. ACC-28EP 보드는 당사의 본사의 모션 컨트롤러인 UMAC 과 함께 사용되며, ±10[V] 범위(Differential Input)의 Analog 전압을 16bit Digital 신호로 변환하여 UMAC 에 전달합니다.

2. HARDWARE SETUP



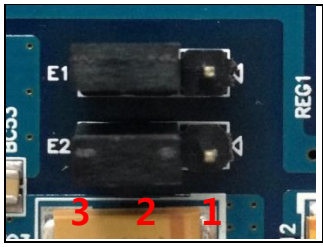
2.1. Electronic Specification

ADC 입력 범위 : Differential DC -10[V] ~ +10[V]

➔ ADC(-) to ADC(+) : -20[V] ~ +20[V]

2.2. Jumper

- **E1: CH1, CH2 OP AMP BIAS 전압 선택**
- **E2: CH3, CH4 OP AMP BIAS 전압 선택**

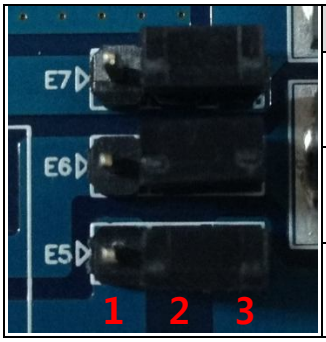


JUMPER	DESCRIPTION	DEFAULT
E1	1-2 Short: -10[V] ~ +10[V]	2-3 Short
	2-3 Short: -5[V] ~ +5[V]	
E2	1-2 Short: -10[V] ~ +10[V]	2-3 Short
	2-3 Short: -5[V] ~ +5[V]	

※ 위 전압 범위는 Differential Input 일 경우 기준입니다.

※ 반드시 "3.2. SW Setup for Extern Input"을 참고하시기 바랍니다.

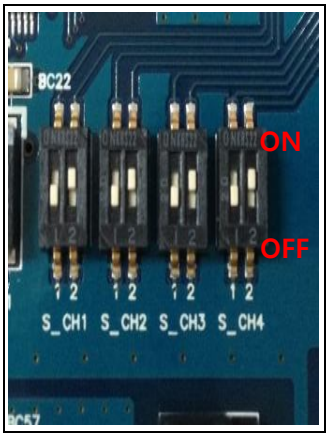
- **E5: Analog Ground 연결 선택**
- **E6: +15[V] 전원 소스 선택**
- **E7: -15[V] 전원 소스 선택**



JUMPER	DESCRIPTION	DEFAULT
E5	1-2 Short : 외부입력 AGND 연결	2-3 Short
	2-3 Short : UMAC AGND 연결	
E6	1-2 Short : 외부입력 +15[V] 사용	2-3 Short
	2-3 Short : UMAC +15[V] 사용	
E7	1-2 Short : 외부입력 -15[V] 사용	2-3 Short
	2-3 Short : UMAC -15[V] 사용	

2.3. Switch

- **S_CH1~4 Bit1: 각 채널의 ADC방식 선택**
- **S_CH1~4 Bit2: 각 채널의 입력범위 선택**

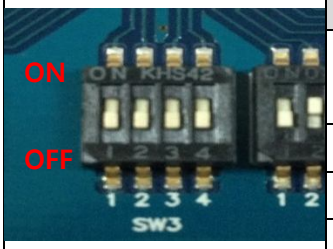


SWITCH	DESCRIPTION	DEFAULT
S_CH1	Bit1: OFF➔Bipolar, ON➔Unipolar	OFF
	Bit2: ON➔±5[V], OFF➔±10[V]	ON
S_CH2	Bit1: OFF➔Bipolar, ON➔Unipolar	OFF
	Bit2: ON➔±5[V], OFF➔±10[V]	ON
S_CH3	Bit1: OFF➔Bipolar, ON➔Unipolar	OFF
	Bit2: ON➔±5[V], OFF➔±10[V]	ON
S_CH4	Bit1: OFF➔Bipolar, ON➔Unipolar	OFF
	Bit2: ON➔±5[V], OFF➔±10[V]	ON

※ 위 전압 범위는 Differential Input 일 경우 기준입니다.

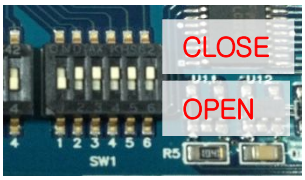
※ 반드시 "3.2. SW Setup for Extern Input"을 참고하시기 바랍니다.

- **SW3 : 28EP Input Clock 설정**



SWITCH	DESCRIPTION		DEFAULT
SW3-1	OFF	Use Phase Frequency	OFF
	ON	Use Servo Frequency	
SW3-2	미사용		OFF
SW3-3	미사용		OFF
SW3-4	미사용		OFF

- **SW1 : ACC-28EP Base Address 설정**



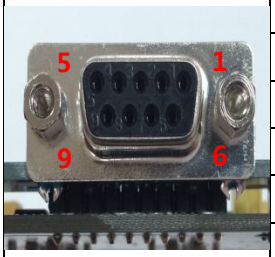
SW1의 설정에 따라 UMAC에서 ADC Data를 읽기 위해 할당해야 하는 M변수의 주소가 바뀝니다.

반드시 스위치 설정을 확인하여 현재 상태에 맞는 주소를 지정해야만 합니다.

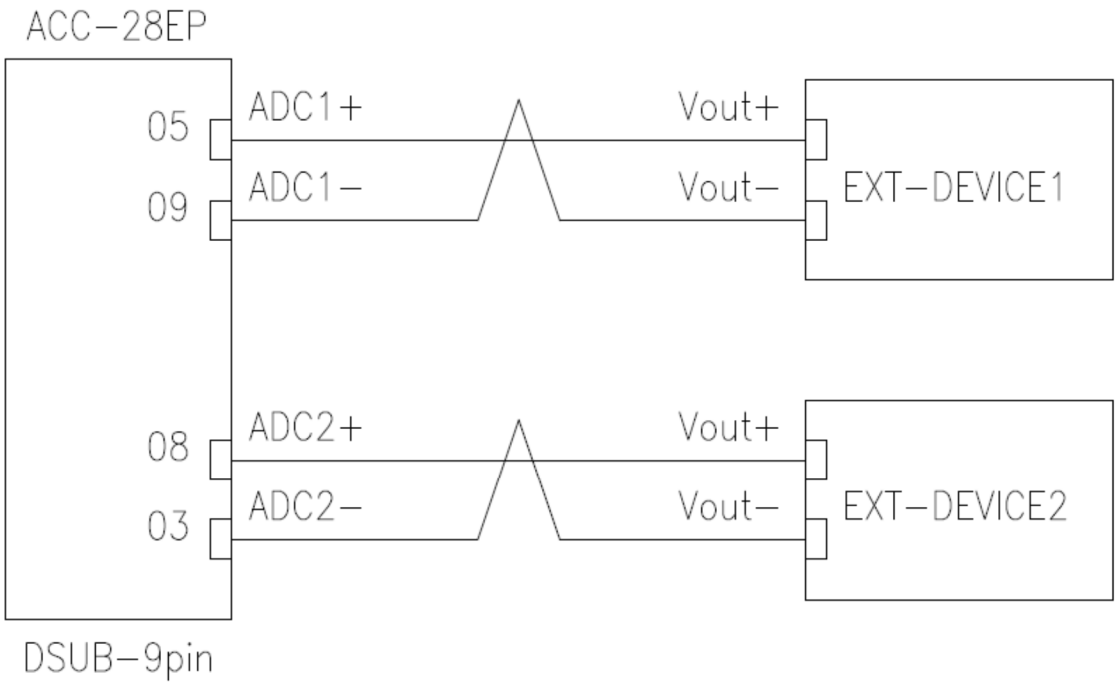
UMAC ADC DATA ADDRESS	DIP Switch1 Position					
	6	5	4	3	2	1
Y:$78C00-03	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
Y:$79C00-03	CLOSE	CLOSE	CLOSE	OPEN	CLOSE	CLOSE
Y:$7AC00-03	CLOSE	CLOSE	OPEN	CLOSE	CLOSE	CLOSE
Y:$7BC00-03	CLOSE	CLOSE	OPEN	OPEN	CLOSE	CLOSE
Y:$78D00-03	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	OPEN
Y:$79D00-03	CLOSE	CLOSE	CLOSE	OPEN	CLOSE	OPEN
Y:$7AD00-03	CLOSE	CLOSE	OPEN	CLOSE	CLOSE	OPEN
Y:$7BD00-03	CLOSE	CLOSE	OPEN	OPEN	CLOSE	OPEN
Y:$78E00-03	CLOSE	CLOSE	CLOSE	CLOSE	OPEN	CLOSE
Y:$79E00-03	CLOSE	CLOSE	CLOSE	OPEN	OPEN	CLOSE
Y:$7AE00-03	CLOSE	CLOSE	OPEN	CLOSE	OPEN	CLOSE
Y:$7BE00-03	CLOSE	CLOSE	OPEN	OPEN	OPEN	CLOSE
Y:$78F00-03	CLOSE	CLOSE	CLOSE	CLOSE	OPEN	OPEN
Y:$79F00-03	CLOSE	CLOSE	CLOSE	OPEN	OPEN	OPEN
Y:$7AF00-03	CLOSE	CLOSE	OPEN	CLOSE	OPEN	OPEN
Y:$7BF00-03	CLOSE	CLOSE	OPEN	OPEN	OPEN	OPEN

3. CONNECTION

3.1. Pin Connection



PIN	SYMBOL	FUNCTION	Description
1	-5Vdc	Output	-5V reference output
2	VREF	Output	5Vdc precision reference
3	ADC2-	Input	A-D Conv. Channel 2-
4	AGND	GND	Analog ref GND
5	ADC1+	Input	A-D Conv. Channel 1+
6	+5Vdc	Output	+5V reference output
7	AGND	GND	Analog ref GND
8	ADC2+	Input	A-D Conv. Channel 2+
9	ADC1-	Input	A-D Conv. Channel 1-

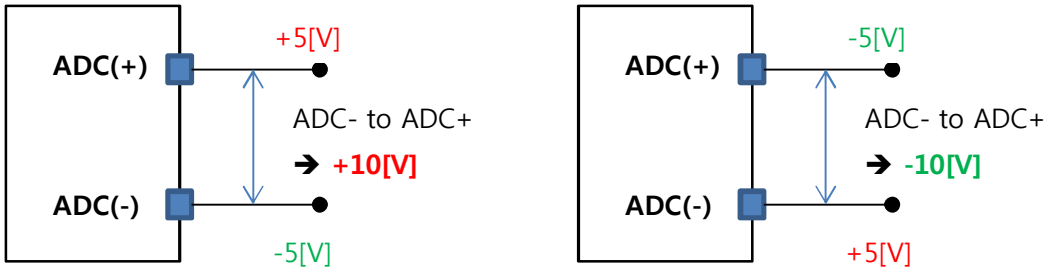


※ Single Ended Input일 경우 외부 장치의 GND (0[V])를 AxisLink-AI4의 ADC-(Pin09 or Pin03)에 결선하시면 됩니다.

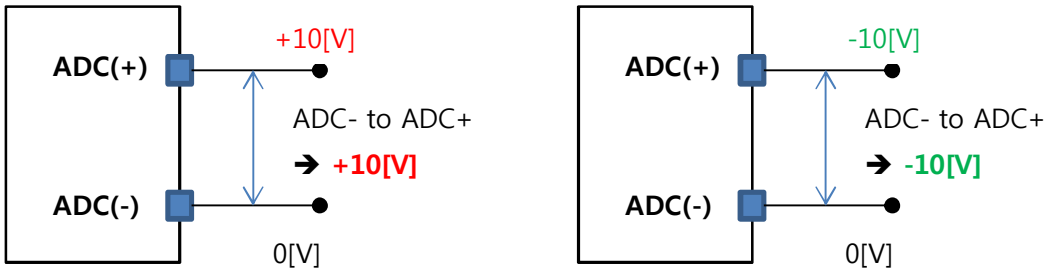
3.2. SW Setup for Extern Input

A. -5~+5[V] Bipolar Input

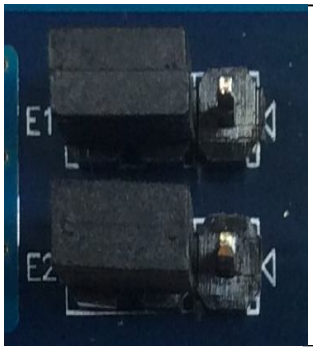
Range : ±5[V], Pole : Bipolar
➔ **ADC(-) to ADC(+) Input Range**
= -10[V] ~ +10[V]



<Differential Ended Input>



<Single Ended Input>



E1(for CH1,2)
E2(for CH3,4)
➔**2-3 Short(±5[V])**

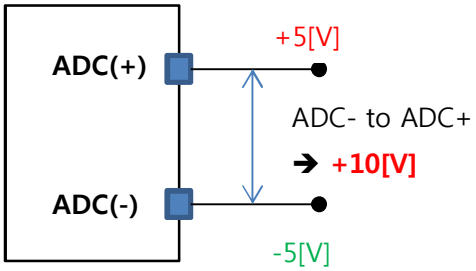
S_CHn-1
➔ **OFF(Bipolar)**
S_CHn-2
➔ **ON(±5[V])**

B. -5~+5[V] Unipolar Input

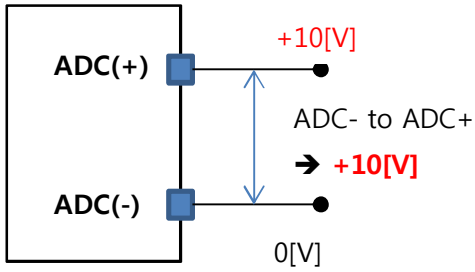
Range : ±5[V], Pole : unipolar

➔ **ADC(-) to ADC(+) Input Range**

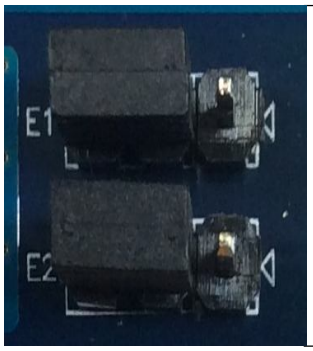
= 0[V] ~ +10[V]



<Differential Ended Input>



<Single Ended Input>



E1(for CH1,2)

E2(for CH3,4)

➔**2-3 Short(±5[V])**

S_CHn-1

➔ **ON(Unipolar)**

S_CHn-2

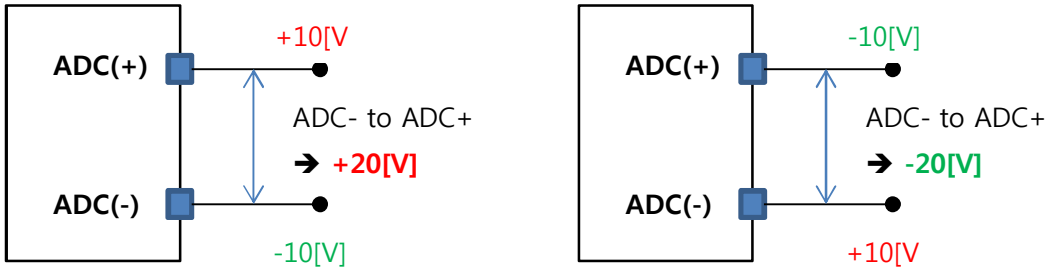
➔ **ON(±5[V])**

C. -10~+10[V] Bipolar Input

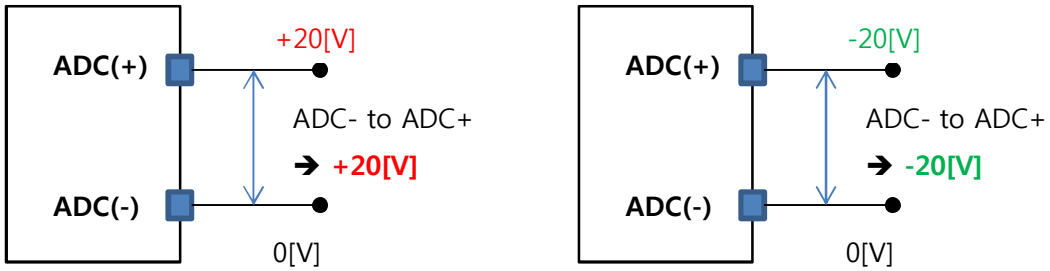
Range : ±10[V], Pole : Bipolar

➔ **ADC(-) to ADC(+) Input Range**

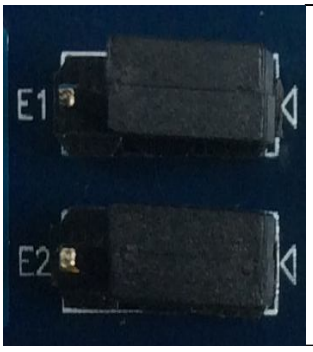
= -20[V] ~ +20[V]



<Differential Ended Input>



<Single Ended Input>



E1(for CH1,2)

E2(for CH3,4)

➔**1-2 Short(±10[V])**

S_CHn-1

➔ **OFF(Bipolar)**

S_CHn-2

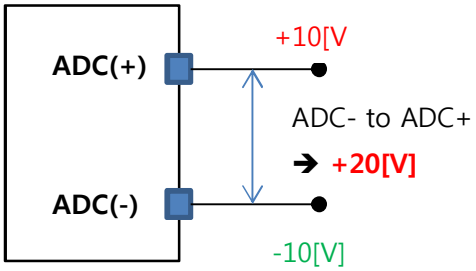
➔ **OFF(±10[V])**

D. -10[V] ~ +10[V] Unipolar Input

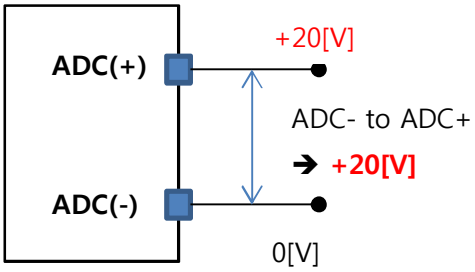
Range : ±10[V], Pole : unipolar

➔ **ADC(-) to ADC(+) Input Range**

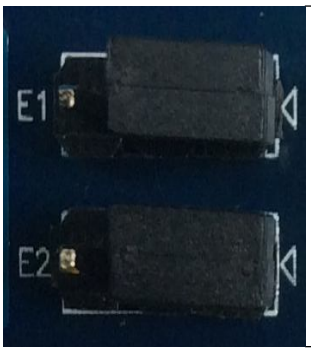
= 0[V] ~ +20[V]



<Differential Ended Input>



<Single Ended Input>



E1(for CH1,2)

E2(for CH3,4)

➔**1-2 Short(±10[V])**

S_CHn-1

➔ **ON(Unipolar)**

S_CHn-2

➔ **OFF(±10[V])**

4. CONVERTING VALUE

4.1. E1/E2 : 2-3 Short, S_CH-1 : OFF, S_CH-2 : ON

- **Bipolar Convert**
- **±5[V] Range : ADC- to ADC+ ➔ -10[V] ~ +10[V]**

A. Differential Ended Input

$$\textbf{Input ADC Value} = \frac{(\textbf{input voltage} + 5)[\textbf{v}]}{10[\textbf{v}]} \times (2^{16} - 1)$$

Input Voltage	Calculation	ADC Value
-5[V](Differential)	0/10*65535	0
0[V](Differential)	5/10*65535	32767
5[V](Differential)	10/10*65535	65535

$$\textbf{Input Voltage} = \textbf{Input ADC Value} \div (2^{16} - 1) \times 10 - 5$$

```
//Ex) Base Add : $78C00, CH1 Input Voltage
#define 28EP_ADC_CH1            M4000
#define INPUT_VOLTAGE           P100

28EP_ADC_CH1->Y:$78C00,8,16,U
INPUT_VOLTAGE = 28EP_ADC_CH1/$FFFF*10-5
```

B. Single Ended Input

$$\textbf{Input ADC Value} = \frac{(\textbf{input voltage} + 10)[\textbf{v}]}{20[\textbf{v}]} \times (2^{16} - 1)$$

Input Voltage	Calculation	ADC Value
-10[V](Single)	0/20*65535	0
0[V](Single)	10/20*65535	32767
10[V](Single)	20/20*65535	65535

$$\textbf{Input Voltage} = \textbf{Input ADC Value} \div (2^{16} - 1) \times 20 - 10$$

```
//Ex) Base Add : $78C00, CH1 Input Voltage
#define 28EP_ADC_CH1            M4000
#define INPUT_VOLTAGE           P100

28EP_ADC_CH1->Y:$78C00,8,16,U
INPUT_VOLTAGE = 28EP_ADC_CH1/$FFFF*20-10
```

4.2. E1/E2 : 2-3 Short, S_CH-1 : ON, S_CH-2 : ON

- **Unipolar Convert**
- **±5[V] Range : ADC- to ADC+ ➔ 0[V] ~ +10[V]**

A. Differential Ended Input

$$\textbf{Input Value} = \frac{\textbf{input votage[v]}}{\textbf{5[v]}} \times (2^{16} - 1)$$

Input Voltage	Calculation	ADC Value
0[V](Differential)	0/5*65535	0
2.5[V](Differential)	2.5/5*65535	32767
5[V](Differential)	5/5*65535	65535

$$\textbf{Input Voltage} = \textbf{Input ADC Value} \div (2^{16} - 1) \times 5$$

```
//Ex) Base Add : $78C00, CH1 Input Voltage
#define 28EP_ADC_CH1            M4000
#define INPUT_VOLTAGE           P100

28EP_ADC_CH1->Y:$78C00,8,16,U
INPUT_VOLTAGE = 28EP_ADC_CH1/$FFFF*5
```

B. Single Ended Input

$$\textbf{Input Value} = \frac{\textbf{input votage[v]}}{\textbf{10[v]}} \times (2^{16} - 1)$$

Input Voltage	Calculation	ADC Value
0[V](Single)	0/10*65535	0
5[V](Single)	5/10*65535	32767
10[V](Single)	10/10*65535	65535

$$\textbf{Input Voltage} = \textbf{Input ADC Value} \div (2^{16} - 1) \times 10$$

```
//Ex) Base Add : $78C00, CH1 Input Voltage
#define 28EP_ADC_CH1            M4000
#define INPUT_VOLTAGE           P100

28EP_ADC_CH1->Y:$78C00,8,16,U
INPUT_VOLTAGE = 28EP_ADC_CH1/$FFFF*10
```

4.3. E1/E2 : 1-2 Short, S_CH-1 : OFF, S_CH-2 : OFF

- **Bipolar Convert**
- **±10[V] Range : ADC- to ADC+ ➔ -20[V] ~ +20[V]**

A. Differential Ended Input

$$\textbf{Input ADC Value} = \frac{(\textbf{input voltage} + \textbf{10})[\textbf{v}]}{\textbf{20}[\textbf{v}]} \times (2^{16} - 1)$$

Input Voltage	Calculation	ADC Value
-10[V](Differential)	0/20*65535	0
0[V](Differential)	10/20*65535	32767
10[V](Differential)	20/20*65535	65535

$$\textbf{Input Voltage} = \textbf{Input ADC Value} \div (2^{16} - 1) \times \textbf{20} - \textbf{10}$$

```
//Ex) Base Add : $78C00, CH1 Input Voltage
#define 28EP_ADC_CH1            M4000
#define INPUT_VOLTAGE           P100

28EP_ADC_CH1->Y:$78C00,8,16,U
INPUT_VOLTAGE = 28EP_ADC_CH1/$FFFF*20-10
```

B. Single Ended Input

$$\textbf{Input ADC Value} = \frac{(\textbf{input voltage} + \textbf{20})[\textbf{v}]}{\textbf{40}[\textbf{v}]} \times (2^{16} - 1)$$

Input Voltage	Calculation	ADC Value
-20[V](Single)	0/40*65535	0
0[V](Single)	20/40*65535	32767
20[V](Single)	40/40*65535	65535

$$\textbf{Input Voltage} = \textbf{Input ADC Value} \div (2^{16} - 1) \times \textbf{40} - \textbf{20}$$

```
//Ex) Base Add : $78C00, CH1 Input Voltage
#define 28EP_ADC_CH1            M4000
#define INPUT_VOLTAGE           P100

28EP_ADC_CH1->Y:$78C00,8,16,U
INPUT_VOLTAGE = 28EP_ADC_CH1/$FFFF*40-20
```

4.4. E1/E2 : 1-2 Short, S_CH-1 : ON, S_CH-2 : OFF

- **Unipolar Convert**
- **±10[V] Range : ADC- to ADC+ ➔ 0[V] ~ +20[V]**

A. Differential Ended Input

$$\textbf{Input Value} = \frac{\textbf{input votage[v]}}{\textbf{10[v]}} \times (2^{16} - 1)$$

Input Voltage	Calculation	ADC Value
0[V](Differential)	0/10*65535	0
5[V](Differential)	5/10*65535	32767
10[V](Differential)	10/10*65535	65535

$$\textbf{Input Voltage} = \textbf{Input ADC Value} \div (2^{16} - 1) \times \textbf{10}$$

```
//Ex) Base Add : $78C00, CH1 Input Voltage
#define 28EP_ADC_CH1            M4000
#define INPUT_VOLTAGE           P100

28EP_ADC_CH1->Y:$78C00,8,16,U
INPUT_VOLTAGE = 28EP_ADC_CH1/$FFFF*10
```

B. Single Ended Input

$$\textbf{Input Value} = \frac{\textbf{input votage[v]}}{\textbf{20[v]}} \times (2^{16} - 1)$$

Input Voltage	Calculation	ADC Value
0[V](Single)	0/20*65535	0
10[V](Single)	10/20*65535	32767
20[V](Single)	20/20*65535	65535

$$\textbf{Input Voltage} = \textbf{Input ADC Value} \div (2^{16} - 1) \times \textbf{20}$$

```
Ex) Base Add : $78C00, CH1 Input Voltage
#define 28EP_ADC_CH1            M4000
#define INPUT_VOLTAGE           P100

28EP_ADC_CH1->Y:$78C00,8,16,U
INPUT_VOLTAGE = 28EP_ADC_CH1/$FFFF*20
```

5. EXAMPLE

```
////////////////////////////////////////////////////////////////////////////////
// 아래 항목은 E1, E2 점퍼 및 S-ch 설정에 따라 값을 변경해 주십시오.
////////////////////////////////////////////////////////////////////////////////

// A. INPUT_TYPE
//        1 : Single Ended Input
//        2 : Differential Ended Input
#define CH1_TYPE                1       // CH1의 입력 방식선택
#define CH2_TYPE                1       // CH2의 입력 방식선택
#define CH3_TYPE                1       // CH3의 입력 방식선택.
#define CH4_TYPE                1       // CH4의 입력 방식선택
////////////////////////////////////////////////////////////////////////////////
// B. INPUT_POLE
//        1 : Bipolar
//        2 : Unipolar
#define CH1_POLE                1       // CH1의 컨버팅 방식선택
#define CH2_POLE                1       // CH2의 컨버팅 방식선택
#define CH3_POLE                1       // CH3의 컨버팅 방식선택
#define CH4_POLE                1       // CH4의 컨버팅 방식선택
////////////////////////////////////////////////////////////////////////////////
// C. INPUT_RANGE
//        1 : ±[V](ADC(-) to ADC(+) -> -10[V] ~ +10[V])
//        2 : ±[V](ADC(-) to ADC(+) -> -20[V] ~ +20[V])
#define CH1_RANGE               1       // CH1의 전압 범위 선택
#define CH2_RANGE               1       // CH1의 전압 범위 선택
#define CH3_RANGE               1       // CH1의 전압 범위 선택
#define CH4_RANGE               1       // CH1의 전압 범위 선택
////////////////////////////////////////////////////////////////////////////////
```

```
////////////////////////////////////////////////////////////////////////////////
// 입력 받은 16Bit ADC data를 Voltage 단위로 변환하는 PLC 예제 입니다.
////////////////////////////////////////////////////////////////////////////////

#define INPUT_TEMP_1            P1000
#define INPUT_TEMP_2            P1001
#define INPUT_TEMP_3            P1002
#define INPUT_TEMP_4            P1003

#define INPUT_VOLT_1            P2000
#define INPUT_VOLT_2            P2001
#define INPUT_VOLT_3            P2002
#define INPUT_VOLT_4            P2003

#define ADC_DATA1               M7000
#define ADC_DATA2               M7001
#define ADC_DATA3               M7002
#define ADC_DATA4               M7003

ADC_DATA1->Y:$78C00,8,16,U          // 28EP CH1 ADC INPUT Base Add $78C00
ADC_DATA2->Y:$78C01,8,16,U          // 28EP CH2 ADC INPUT Base Add $78C00
ADC_DATA3->Y:$78C02,8,16,U          // 28EP CH3 ADC INPUT Base Add $78C00
ADC_DATA4->Y:$78C03,8,16,U          // 28EP CH4 ADC INPUT Base Add $78C00

Open PLC 3 clear
        INPUT_TEMP_1 = (ADC_DATA1/$FFFF*(20/CH1_POLE)-(2-CH1_POLE)*10)
        INPUT_TEMP_2 = (ADC_DATA2/$FFFF*(20/CH2_POLE)-(2-CH2_POLE)*10)
        INPUT_TEMP_3 = (ADC_DATA3/$FFFF*(20/CH3_POLE)-(2-CH3_POLE)*10)
        INPUT_TEMP_4 = (ADC_DATA4/$FFFF*(20/CH4_POLE)-(2-CH4_POLE)*10)

        INPUT_VOLT_1 = INPUT_TEMP_1/CH1_TYPE*CH1_RANGE
        INPUT_VOLT_2 = INPUT_TEMP_2/CH2_TYPE*CH2_RANGE
        INPUT_VOLT_3 = INPUT_TEMP_3/CH3_TYPE*CH3_RANGE
        INPUT_VOLT_4 = INPUT_TEMP_4/CH4_TYPE*CH4_RANGE
Close
```