

Chapter 21 Analog Input and Temperature Measurement Combination

Module

In response to actual needs of user applications, FBs-PLC provides an economical combination of temperature and analog input module measurement. In short, it is to integrate single temperature module and the characteristics of analog input module. Therefore, the setup and operation methods for single temperature module and analog input module are exactly the same, except the number of channels can be measured is different. Both 2A4TC and 2A4RTD modules have offered 2 channels analog input and 4 channels temperature measurement capability. The difference is that 2A4TC is using thermocouple to measure temperature, while the 2ARTD4 is using RTD sensor to measure temperature. There are 8 types of thermocouple to choose: J、K、T、E、N、B、R、S; And there are only two types of RTD sensor: PT-100 and PT-1000.

This combination measurement module occupied 4 numerical input registers and 8 points digital output. The maximum measureable temperature point of a PLC main unit is 32 points. The update rate for temperature reading value can be set as normal (the resolution is 0.1°) or fast (the resolution is 1°).

The WinProLadder provides the very user friendly table editing operation interface to configure the temperature measurement, for example, selecting the temperature module, type of sensor, and assign the registers to store the reading values. As to the temperature control, it has the convenient instruction FUN86 (TPCTL) to perform the PID operation to control the heating or cooling of the temperature process. Please refer to Chapter 18 for analog input operations and analog input modules setup.

21.1 Specifications of Temperature and Analog Input Measuring Modules

21.1.1 Specifications of Temperature Measurement

Items Specifications	Module	
	FBs-2A4TC	
Number of input points	4 points	
Thermocouple type and temperature measurement range	J(-200~900°C) K(-190~1300°C) R(0~1800°C) S(0~1700°C)	E(-190~1000°C) T(-190~380°C) B(350~1800°C) N(-200~1000°C)
I/O Points Occupied	2 IR(Input Register) 、 8 DO(Discrete Output)	
Software Filter	Moving Average	
Average Sample	NO 1、2、4、8Configurable	
Compensation	Built-in cold junction compensation	
Resolution	0.1°C	
Conversion Time	2 or 4 seconds	
Overall Precision	±(1%+1°C)	
Isolation	Transformer (Power) and photocouple (Signal) isolation (per-channel isolation)	

Item Specifications	Module
	FBs-2A4RTD
RTD input points	4 points
RTD type and temperature measurement range	3-wire RTD sensor JIS($\alpha=0.00392$) or DIN($\alpha=0.00385$) Pt-100($-200\sim 850^{\circ}\text{C}$) Pt-1000($-200\sim 600^{\circ}\text{C}$)
I/O Points Occupied	2 IR(Input Register) 、 8 DO(Discrete Output)
Software Filter	Moving Average
Average Samples	No 1 、 2 、 4 、 8 Configurable
Resolution	0.1 $^{\circ}\text{C}$
Conversion Time	1 or 2 seconds
Overall Precision	$\pm 1\%$
Isolation	Transformer(Power) and photocouple (Signal) isolation (pre-channel isolation)

21.1.2 Specifications of Analog Input Measurement

Item Specifications	Module
	FBs-2A4TC/FBs-2A4RTD
Input Channel	2 Channel
Digital input reading	$-8192\sim +8191$ or $0\sim 16383$ (14-bit) $-2048\sim +2047$ or $0\sim 4095$ (12-bit)
Input signal types	Voltage: $-10\sim +10\text{V}$, $-5\sim +5\text{V}$, $0\sim 5\text{V}$, $0\sim 10\text{V}$ Current: $-20\sim +20\text{mA}$, $-10\sim +10\text{mA}$, $0\sim 10\text{mA}$, $0\sim 20\text{mA}$
Resolution	14 or 12 bits
Finest resolution	Voltage : 0.3mV Current : 0.61 μA
I/O Points Occupied	2 IR(Input Register)
Accuracy	Within $\pm 1\%$ of full scale
Conversion Time	Updated each scan
Maximum absolute input signal	Voltage : $\pm 15\text{V}$ (max) Current : $\pm 30\text{mA}$ (max)
Input resistance	63.2K Ω (Voltage Input) 、 250 Ω (Current Input)
Isolation	Transformer (Power) and photocouple (Signal)

21.1.3 Common Specifications

Item Specifications	Module	
	FBs-2A4TC	FBs-2A4RTD
Internal Current Consumption	5V, 50mA	5V, 50mA
External Current Consumption	24V, 39mA	24V, 39mA
Indicator(s)	5V PWR LED	
Operating Temperature	0 ~ 60 °C	
Storage Temperature	-20 ~ 80 °C	
Dimensions	40(W)x90(H)x80(D) mm	

21.2 The Procedures of Using Temperature Measurement

Please refer this part to section 20.2

21.3 The Procedures to Configure the Temperature Measurement

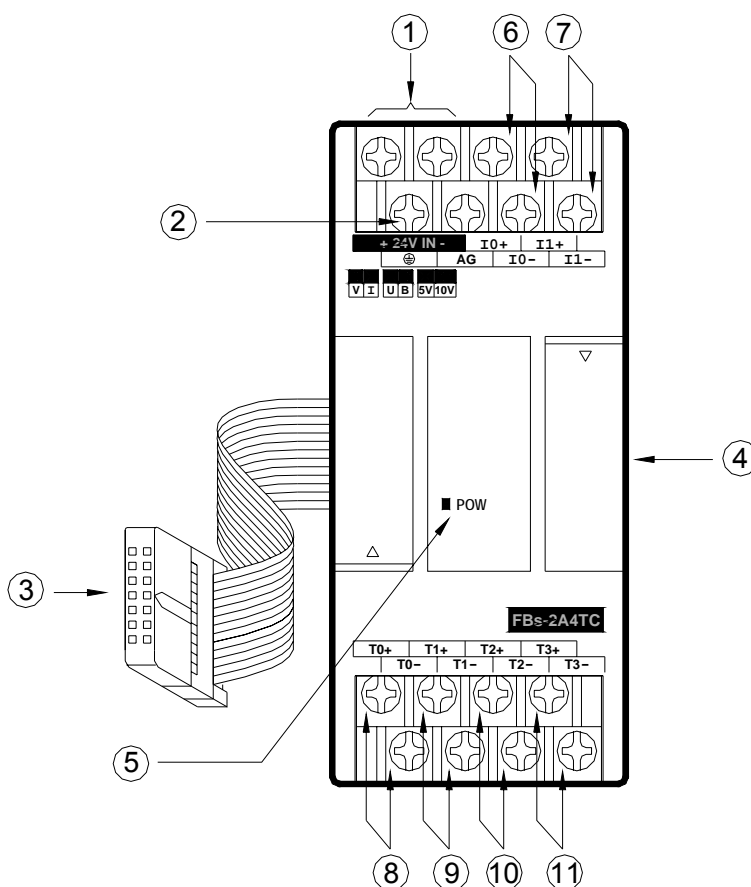
Please refer this part to section 20.3

21.4 Hardware Descriptions of Modules

FBs-2A4TC and FBs-2A4RTD is composed by three circuit boards. The lowest layer is the power board (provides isolated power supply module), the medium is the I/O board (terminal blocks in this layer), the top layer is the control board (control and expand input and output connections). The description is as follows:

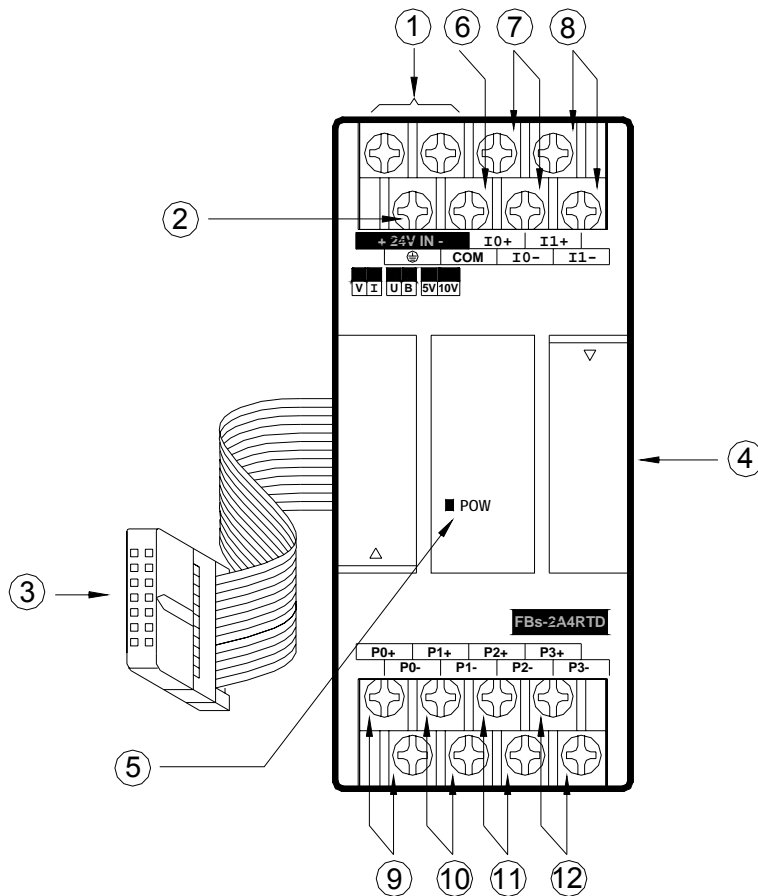
21.4.1 FBs-2A4TC/FBs-2A4RTD Outlook of Top View

2A4TC outlook of top view



- ① External power input terminal : Power supply of analog circuit for this module, the voltage can be $24\text{VDC} \pm 20\%$.
- ② Protecting ground terminal : Connect to the shielding of signal cable.
- ③ Expansion input cable : It should be connected to the front expansion unit, or the expansion output of main unit.
- ④ Expansion output connector : Provides the connection for next expansion unit.
- ⑤ Power Indicator : It indicates whether the power supply of the analog circuit and external input power source of this module are normal.
- ⑥ Analog input terminal of CH0 : The analog signal input of channel 0(I0+ 、 I0-).
- ⑦ Analog input terminal of CH1 : The analog signal input of channel 1(I1+ 、 I1-).
- ⑧ ~ ⑪ Thermocouple input terminal of CH0 ~ CH3 : The thermocouple input of channel 0 ~ channel 3(T0+,T0~T3+,T3-).

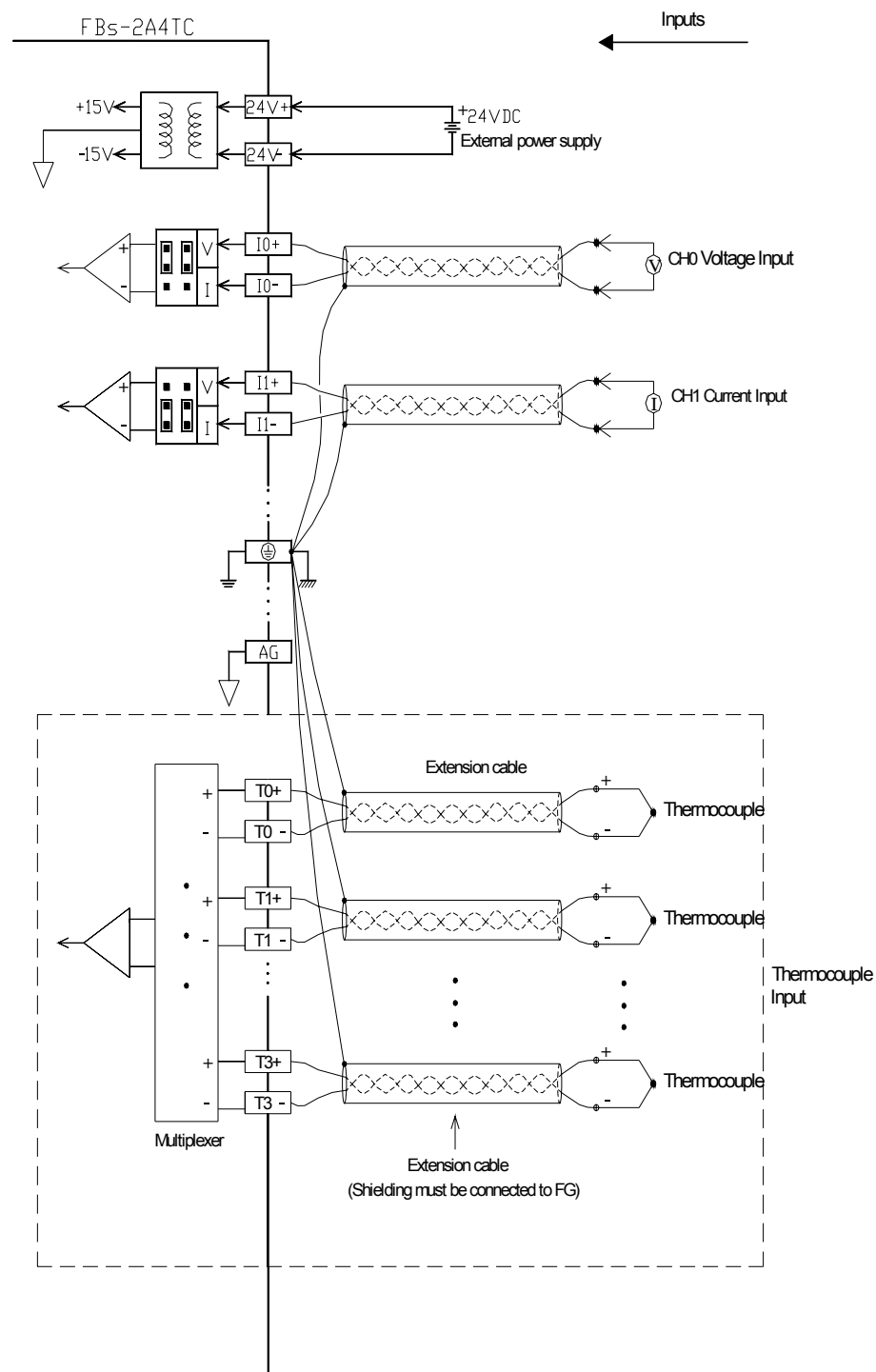
2A4RTD outlook of top view



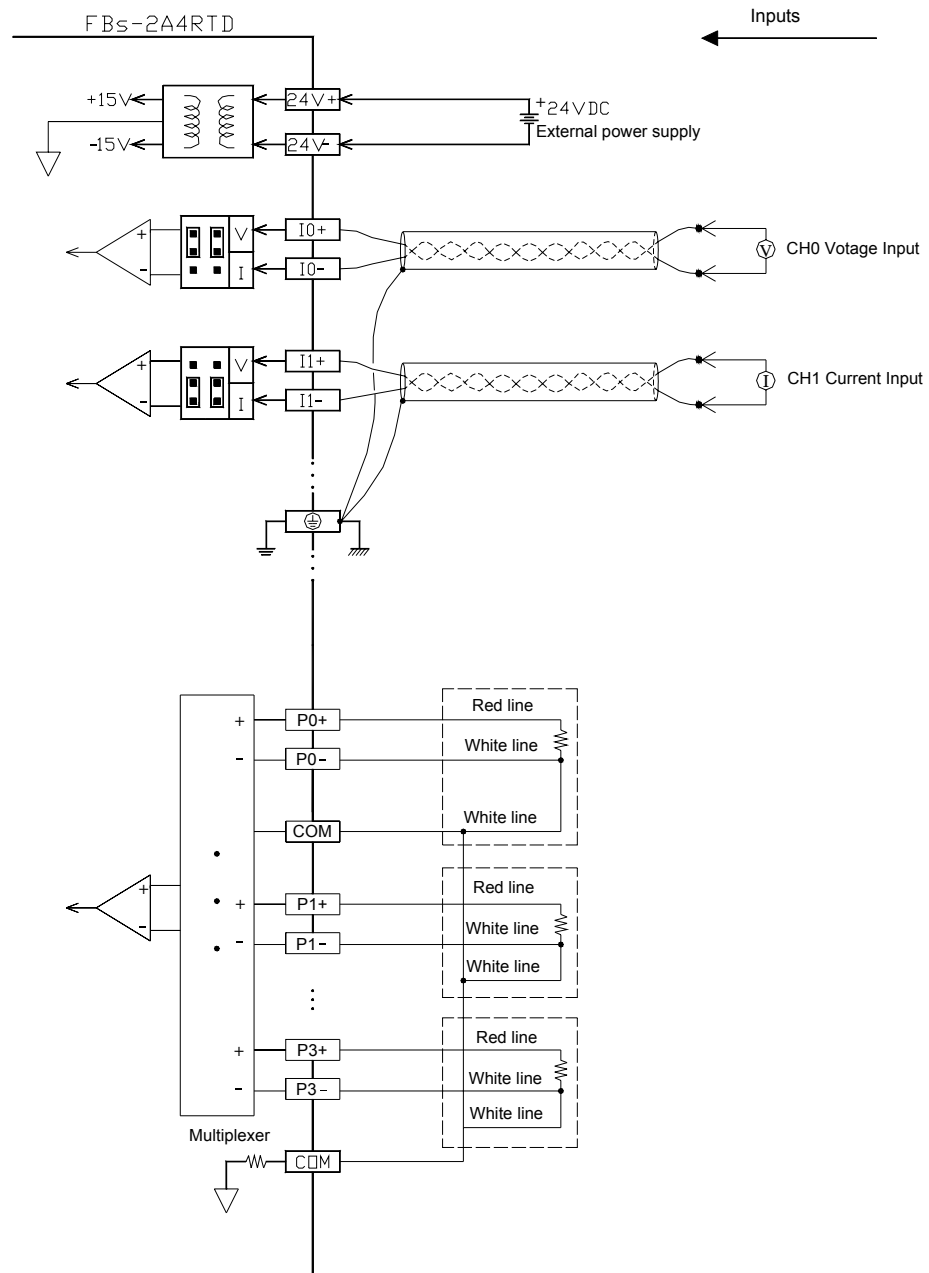
- ① External power input terminal : Power supply of analog circuit for this module, the voltage can be $24\text{VDC} \pm 20\%$.
- ② Protecting ground terminal : Connect to the shielding of signal cable.
- ③ Expansion input cable : It should be connected to the front expansion unit, or the expansion output of main unit.
- ④ Expansion output connector : Provides the connection for next expansion unit.
- ⑤ Power indicator : It indicates whether the power supply of the analog circuit and external input power source of this module are normal.
- ⑥ Common terminals of RTD : To connect to the common wire of each 3-wires RTD input.
- ⑦ Analog input terminal of CH0 : The analog signal input of channel 0 (I0+ 、 I0-).
- ⑧ Analog input terminal of CH1 : The analog signal input of channel 1 (I1+ 、 I1-).
- ⑨～⑫ Input terminal for CH0～CH3 RTD : The RTD input of channel 0～channel 3 (P0+,P0-~P3+,P3-).

21.5 Wiring of Modules

21.5.1 Wiring of 2A4TC Module



21.5.2 Wiring of 2A4RTD Module

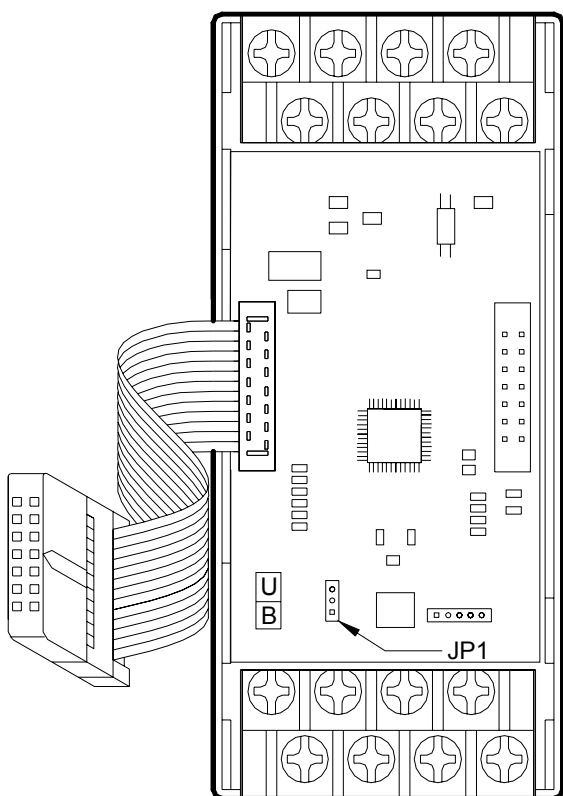


21.6 The Jumper Setup of 2A4RTD/2A4TC

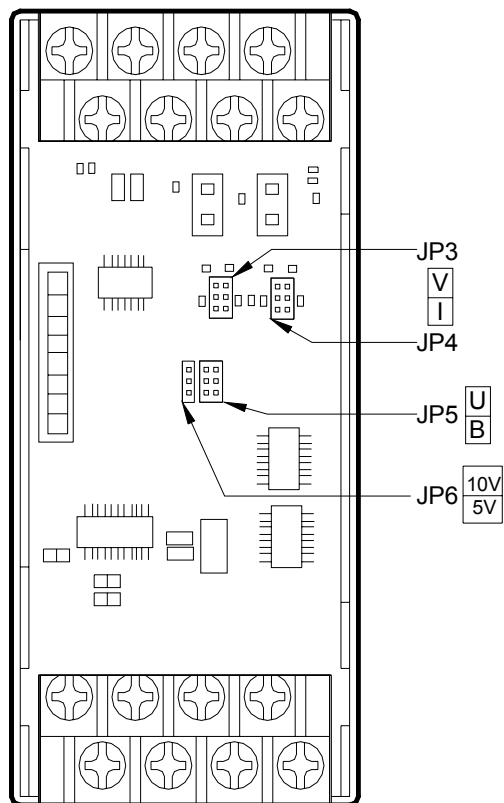
The analog input measurements of measurement signal and measurement range of these two modules are selected and set by the jumper's connection

21.6.1 Position Jumper

21.6.1.1 The Position Jumper of 2A4TC

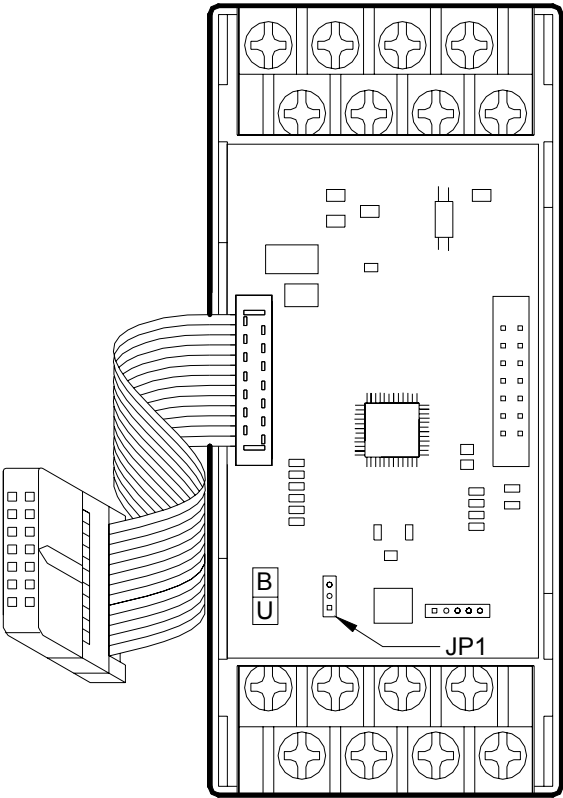


Pin layout in control board(open top cover)

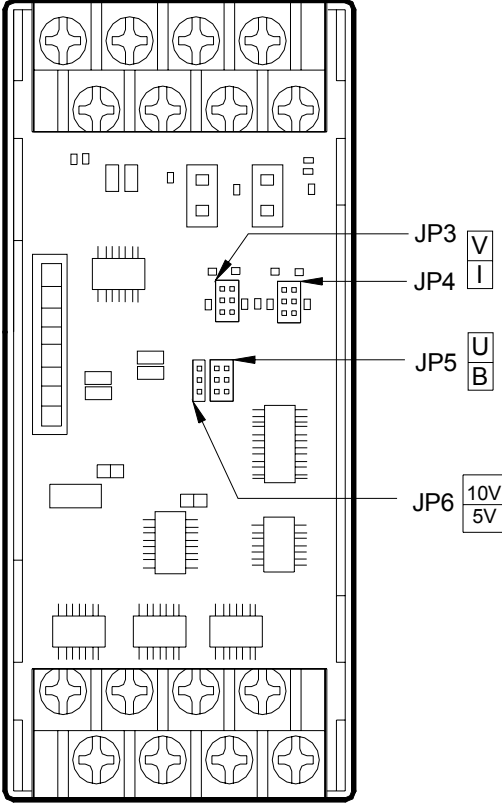


Pin layout on I/O board (remove control board)

21.6.1.2 The Position Jumper of 2A4RTD



Pin layout in control board(open top cover)



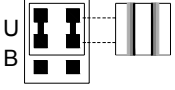
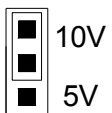

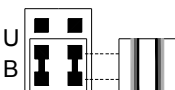
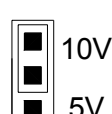
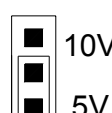
Pin layout on I/O board (remove control board)

21.6.2 Input Code Format Selection of Jumper Setting

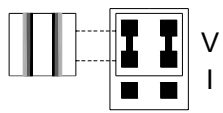
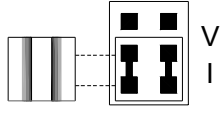
Input Code Format	JP1 Setting	Input Value Range	Corresponding Input Signals
Bipolar	<div>JP1</div> <div><div>■</div> U</div> <div><div>■</div> B</div>	-8192~8191	-10V~10V(-20mA~20mA) -5V~5V(-20mA~20mA)
Unipolar	<div>JP1</div> <div><div>■</div> U</div> <div><div>■</div> B</div>	0~16383	0V~10V(0mA~20mA) 0V~5V(0mA~10mA)

Regarding the explanations of choosing input code format, please refer to section 18.1.4.1.

21.6.3 Input Signal Form of Jumper Setup

Signal Form	JP5 Setting	JP6 Setting
0~10V or 0~20mA		
0~5V or 0~10mA		
-10~+10V or -20~+20mA		
-5~+5V or -10mA~+10mA		

21.6.4 Input Signal Type of Jumper Setup

Signal Form	JP3(CH0) , JP4(CH1) Setting
Voltage	
Current	

The default factory settings of FBs-2A4TC/FBs-2A4RTD are:

Input code format → Bipolar

Input signal type → -10V~+10V

For those applications that require the setting differ than the above default setting should make some modifications of jumper position according to above tables. While application, besides the setting of jumper should be conducted, the AI module configurations of Winproladder also need to be performed. (Refer to section 18.1.7 for explanation)