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LX5V-2PT2ADV-BD BD Module Manual

1 Installation

▪ Before installation, it must be ensured that the PLC host and the related device of the BD module terminal wiring are powered off reliably. The module shell is inserted into the BD module slot of PLC host, and then locked with two standard screws for fixation.

▪ Two standard terminal heads are equipped with this BD module. After connecting the wiring, insert them into its terminal. After confirming that the host, BD module, wiring, etc. are installed correctly, it can be powered on for use.

▪ ✎Note:
  ● The ADV input voltage cannot exceed the absolute maximum (-15V/+15V), otherwise the BD module will be damaged.
  ● Please install the BD module firmly and fix it on PLC. Poor contact may lead to failure.
  ● Tightening torque for fixing BD module or PLC top cover is 0.3N.m to0.6N.m. Please tighten it firmly to avoid malfunction.
  ● You can only use one LX5V-2PT2ADV-BD on the PLC main unit of LX5 series.

▪ **Warning: Cut off the power before installing, removing or wiring the BD module to avoid electric shock or product damage.**
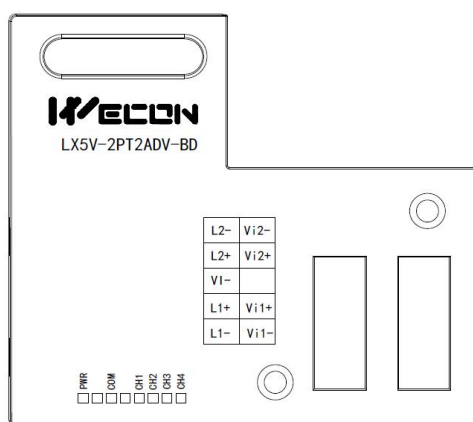
2 Appearance and terminal

Table1 Terminal distribution

IN_2PT part 2-wire/3-wire PT100 thermal resistance		IN_2ADV part Voltage output range: -10Vto10V	
L2-	Channel 2 sensor Signal input negative	Vi2-	Channel 2 Voltage input negative
L2+	Channel 2 sensor signal input positive	Vi2+	Channel 2 Channel 1 voltage input positive
VI-	Sensor common pole		NC
L1+	Channel 1 sensor signal input positive	Vi1+	Channel 1 Channel 1 voltage input positive
L1-	Channel 1 sensor Signal input negative	Vi1-	Channel 1 Voltage input negative

Table2 LED lamp function description

Indicator lamp	Description
PWR	ON when power-on (when the program is running, it will be ON).
COM	It flashes when communicating with PLC normally, and it is OFF when timeout.
CH1	Channel 1 lamp: Always on in range; Flashing outside the range of -100℃to600℃; Off when the channel is closed.
CH2	Channel 2 lamp: Always on in range; Flashing outside the range of -100℃to600℃; Off when the channel is closed.
CH3	Channel 3 lamp: Always on in range; flashing outside the range of (-10V to 10V); Off when the channel is closed.
CH4	Channel 4 lamp: Always on in range; flashing outside the range of (-10V to 10V); Off when the channel is closed.

3 Specification

(1) General specification: Same as PLC main unit. (Please refer to the accompanying manual of the PLC main unit.)
(2) Power supply specification: The power supply is provided internally by PLC.
(3) Performance specifications:

Project	Description
Power supply	5VDC±10%, 70mA (The power supply is provided internally by host)
PT part	
Analog input signal	Platinum thermal resistance PT100 sensor (100Ω), 3-wire, 2-channel input (CH1, CH2)
Sensor current	1mA sensor: 100 Ω (PT100)
Compensation range	-100 ℃ to 600 ℃ (recommended range)　　Over range display: 32767
Digital output	-1000 to 6000 (unit 0.1 ℃) 12-bit conversion to 11 data bits + 1 sign bit
Measurement accuracy	0.2℃ to 0.3℃
Total accuracy	Full range ±0.5% (compensation range)
Conversion speed	2 channels 50ms
Conversion features	
ADV section	
Analog input range	DC-10V to 10V (input resistor 160KΩ). Note: If the input voltage exceeds ± 15V, it will be damaged.
Rated range	(-10V to10V: -2000 to 2000)
Maximum display range	-2048 to 2048
Resolution	5mV [10V default range 1/2000]
Comprehensive precision	±0.5% of full scale
A/D conversion time	1 scan cycle (A/D conversion after ladder diagram END instruction is executed, and BD channel mapping value is updated)
Input features	
Insulation	There is no insulation between the channels of the module

4 Wiring

Wiring instructions:

(1) 2-wire PT100: When using channel 1, L1- and VI- are shorted with wires, and the two leads of the sensor are connected to L1+ and LI- respectively. Similarly, when using channel 2, L2- and VI- are shorted with wires, and the two leads of the sensor are connected to L2+ and L2- respectively.

(2) 3-wire PT100: When using channel 1, two leads of the same color are connected to L1- and VI- respectively, and the other lead of different color is connected to L1+. Channel 2 is connected in the same way.

⚠️ Warning

Cut off the power before installing, removing or wiring the BD module to avoid electric shock or product damage.

✎**Note:**

● Do not place signal cables near high voltage power cables or in the same trunk line. Otherwise, it may be disturbed or surged. Keep a safe distance between signal cable and power cable, at least 100mm.

● Ground the shielding of shielded wire or shielded cable. But the ground point and high voltage line cannot be the same.

● Do not connect cables of impermissible size to avoid poor contact or product damage.

● Fix the cable so that no force directly acts on the terminal line or cable connection area.

● The tightening torque of terminal is 0.5Nm to 0.6N.m. Please tighten it to prevent malfunction.

● Do not use empty terminals.

4.1 Applicable cables

(1) AWG25-16 is used for connection with output device.

(2) Maximum terminal tightening torque is 0.5N.m to 0.6N.m.

(3) Using different types of cables may cause poor contact with terminals. Please use pressfit terminals for good contact.

Line number and cross-sectional area

Line number	Cross-sectional area (mm²)	End processing
AWG26	0.1288	Stranded cable: Strip off the sheath, rub the core wire, and then connect the cable.
...	...	
AWG16	1.309	Single-core cable: Strip off the sheath and connect the cable.
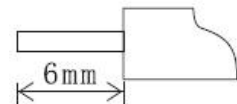
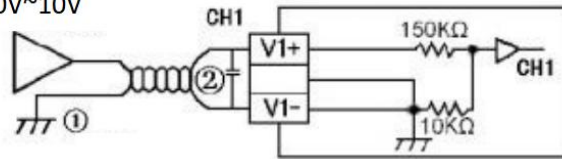## 4.2 I/O Mode

Thermal resistance PT100 input mode
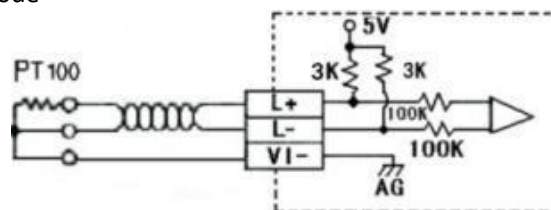
Voltage input mode

(1) Analog input is received through twisted pair shielded cable. Cables should be kept away from power lines or other wires that may cause electrical interference.

(2) If there is voltage fluctuation in the input or electrical interference in the external wiring, a smoothing capacitor can be connected (0.1uF to 0.47uF, 25V).

5 Description of PLC device

(1) When connected to LX3 series PLC, please refer to LX3 series BD module manual.

(2) When connected to LX5 series PLC, if the firmware version of PLC is lower than 2.051 (excluding 2.051), or BD module is not configured by host computer, it can be controlled by the following system devices:

Table3Device allocation

PLC model	BD Model	Device	Description		Device	Description
LX5V	2PT2ADV	SM2010	CH1 thermal resistance input channel open flag	OFF: Open ON: Close	SD2010	The temperature of CH1 at 0.1°C (-100℃ to 600℃: -1000 to 6000)
		SM2011	CH2 thermal resistance input channel open flag		SD2011	The temperature of CH2 at 0.1°C (-100℃ to 600℃: -1000 to 6000)
		SM2012	CH3 voltage input channel open flag		SD2012	CH3 digital value (-10V to10V: -2000 to 2000)
		SM2013	CH4 voltage input channel open flag		SD2013	CH4 digital value (-10V to10V: -2000 to 2000)

(3) User can select device through I/O mapping to use the configuration function of new BD module. For details, please refer to "6.1 Parameter configuration".

6 Instructions

6.1 Parameter configuration

① Open the host computer software and create a new project, in "Project Manager" → "Extended Function" , double-click "BD Module Configuration" **Note**to enter "BD settings" interface;

② Configure the currently connected PLC (take the LX5V-2416 model as an example) and BD module model on the BD module configuration interface: Select "LX5V-2PT2ADV" in the device bar on the right side of the BD module configuration interface and double-click to add it to the corresponding slot position of PLC (slot number 1 or 2, the software will select slot 1 by default, and right-click to move down to slot 2);

③ After adding the BD module to the slot, double-click or right-click to select configuration parameters to enter LX5V-2PT2ADV-BD configuration parameters interface, as shown in the following figure. Configure related parameters on this interface.
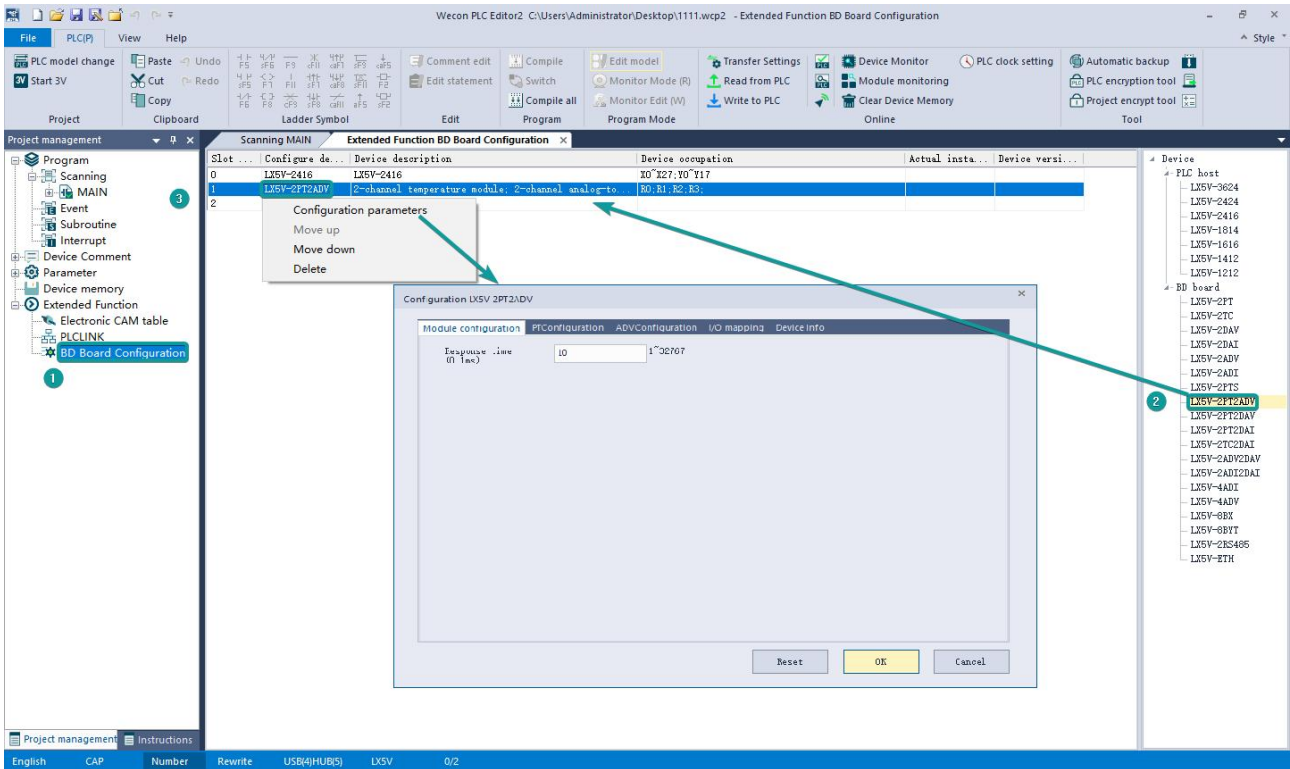
Note: This function is only supported in the following versions of host computer, slave computer and BD module:

(1) Supported host computer software versions: Wecon PLC Editor2 2.1.204 and above, as shown in the following figure:
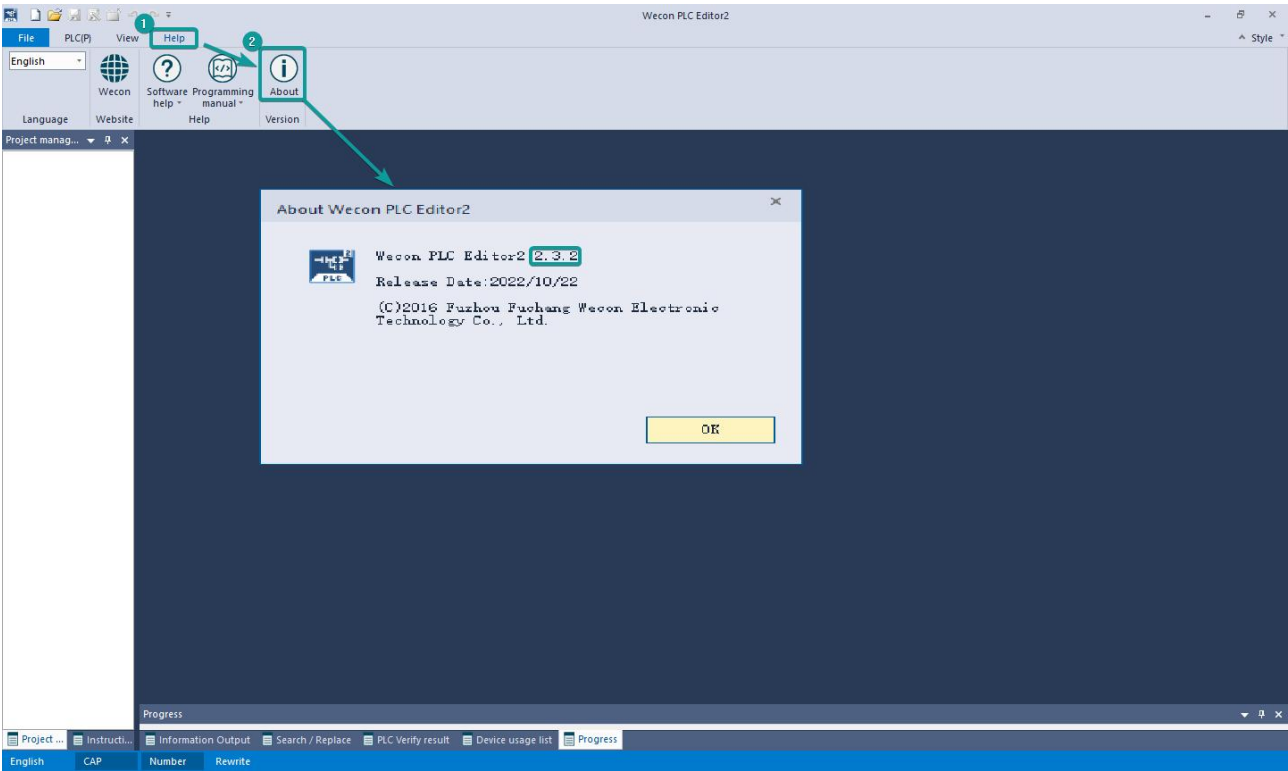
(2) Supported   PLC firmware: 2.051 and above, as shown in the following figure:
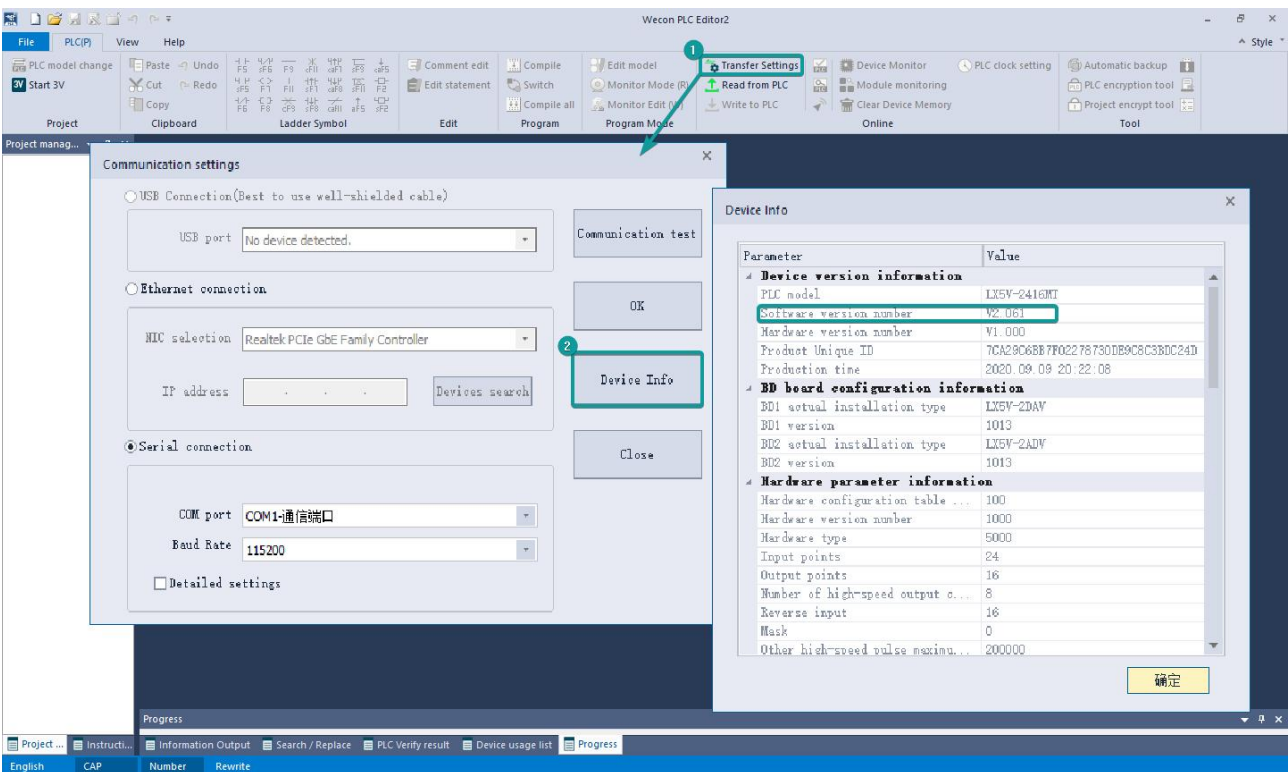
(3) Supported BD module version number: 1013 and above, as shown in the following figure:

Slot ...	Configure de...	Device description	Device occupation	Actual insta...	Device versi...
0	LX5V-2416	LX5V-2416	X0~X27;Y0~Y17	LX5V-2416MT	V2.061
1	LX5V-2PT2ADV	2-channel temperature module; 2-channel analog-to...	R0;R1;R2;R3;	LX5V-2PT2ADV	1013
2					

The parameter configuration interface is as below:

1、Module setting: Set response time (The response time is the interval time between PLC acquisition of BD module data. Range: 0.1ms to 3276.7ms).
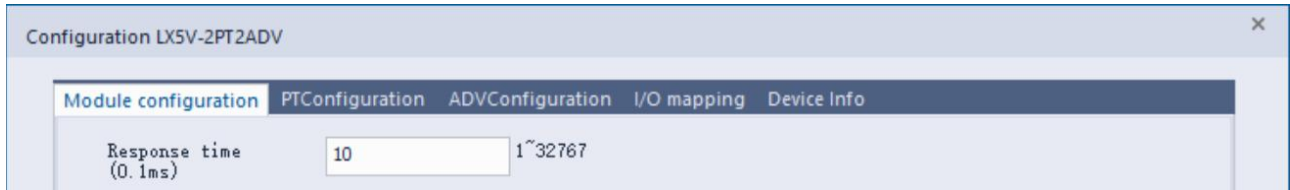
2、PT configuration:
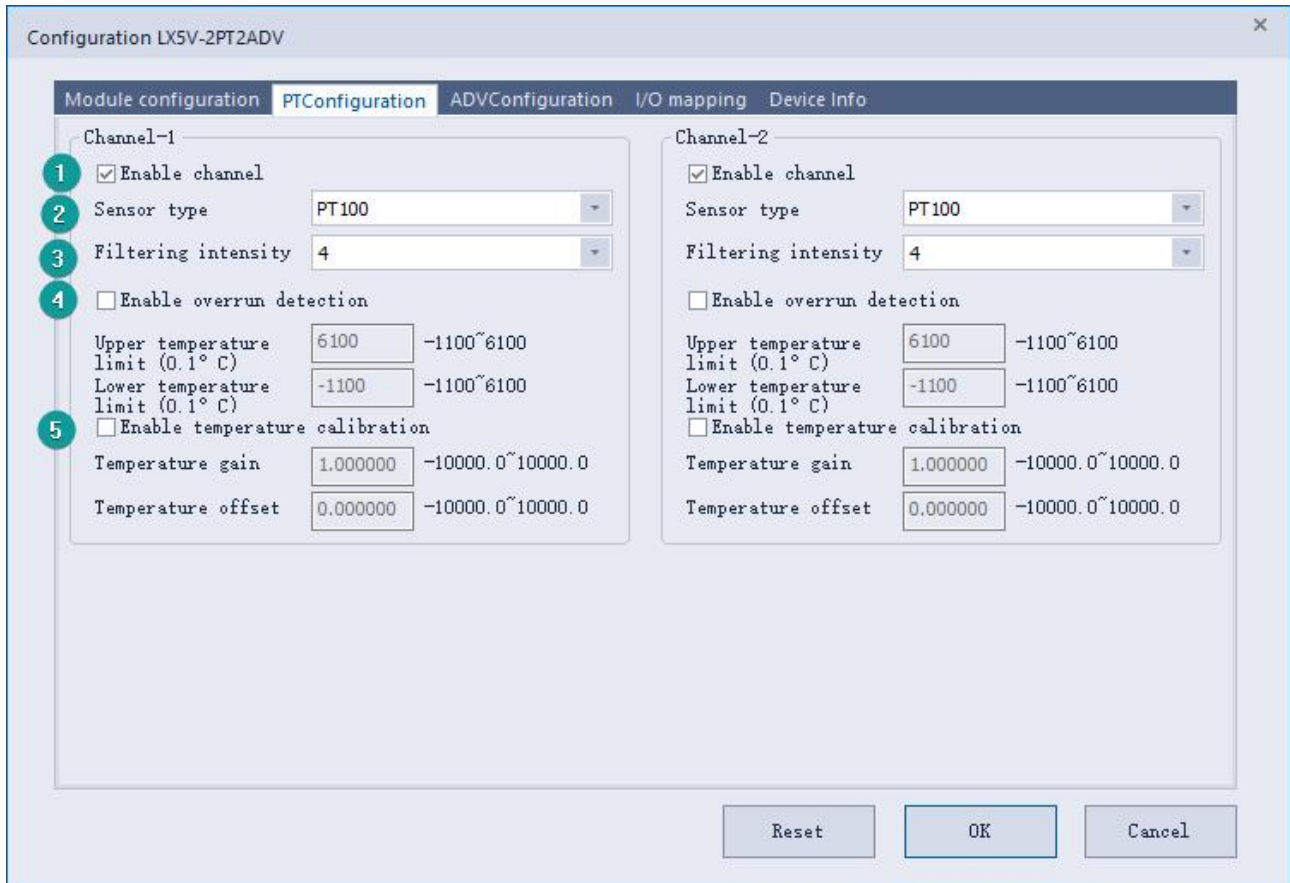
① Check enable channel to set whether to enable the current BD module channel.

② Sensor type: PT100 by default.

③ Setting the filtering intensity can reduce the jitter of BD channel value. The default configuration of filter intensity is 4. Level 0 is the lowest and level 9 is the highest. The filter intensity can be adjusted according to actual use.

④ Check enable overrun detection to judge that when the upper and lower limits of temperature exceed the current setting temperature, the host computer will prompt an error.

⑤ Check enable calibration, you could calculate the gain offset according to the following formula to convert the corresponding channel value:

Channel value = actual temperature value × gain value + offset value

When the channel value deviates from the actual temperature value, the channel can be calibrated by setting the gain offset, for example:

▪ The input temperature of control channel is 0℃, the value of acquisition channel is 30 (unit: 0.1℃), and the actual channel value should be 0 (unit: 0.1℃).

▪ The input temperature of control channel is 500℃, the value of acquisition channel is 5200 (unit: 0.1℃), and the actual channel value should be 5000 (unit: 0.1℃).

Suppose the gain is a, and the offset is b, then $\begin{cases} 0 = 30 * a + b \\ 5000 = 5200 * a + b \end{cases}$,

Solve and get $\begin{cases} a = 0.967118 \\ b = -29.0135 \end{cases}$ The calibration can be completed by setting the corresponding gain offset to the current channel.

Note: Using gain and offset calibration can only reduce the linear error. Since the PT100 resistance and temperature curve are nonlinear, there is still a certain error in partial temperature after the calibration is successful.

3、ADV configuration:

① Check enable channel to set whether to enable the current BD module channel.

② The conversion mode is set to ADV conversion mode by default. The measurement range is -10V to 10V (-2000 to 2000).

③ Setting the filtering intensity can reduce the jitter of BD channel value. The default configuration of filter intensity is 4. Level 0 is the lowest and level 9 is the highest. The filter intensity can be adjusted according to actual use.

④ Check enable calibration, you could calculate the gain offset according to the following formula to convert the corresponding channel value:

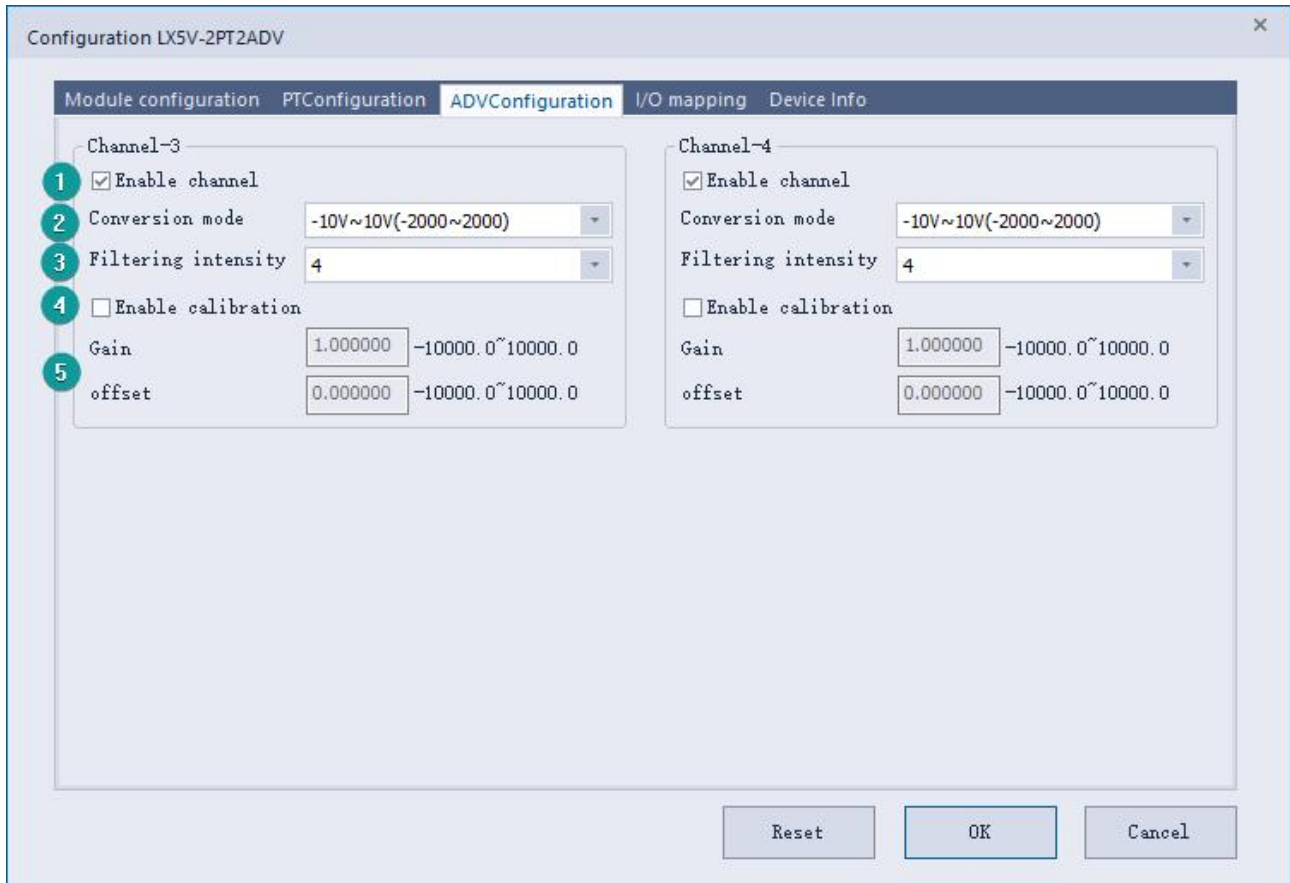Channel value = digital value * gain value + offset value

⑤ When the channel value deviates, you could also set the gain offset to calibrate the channel. For example:

▪ When the channel input analog is 10V, the digital quantity of BD module acquisition channel value is 1970, and the actual digital value should be 2000.

▪ When the channel input analog quantity is 0V, the digital quantity of BD module acquisition channel value is 30, and the actual digital value should be 0.

Suppose the gain is a, and the offset is b, then $\begin{cases} 2000 = 1970 * a + b \\ 0 = 30 * a + b \end{cases}$,

Solve and get $\begin{cases} a = 1.030928 \\ b = -30.92784 \end{cases}$ The calibration can be completed by setting the corresponding gain

offset to the current channel.

4、Set I/O mapping. The channels are mapped to R device according to the current number of BD module channels by default. As shown in the following figure, BD module CH1 to CH4 is mapped to device R0 to R3.
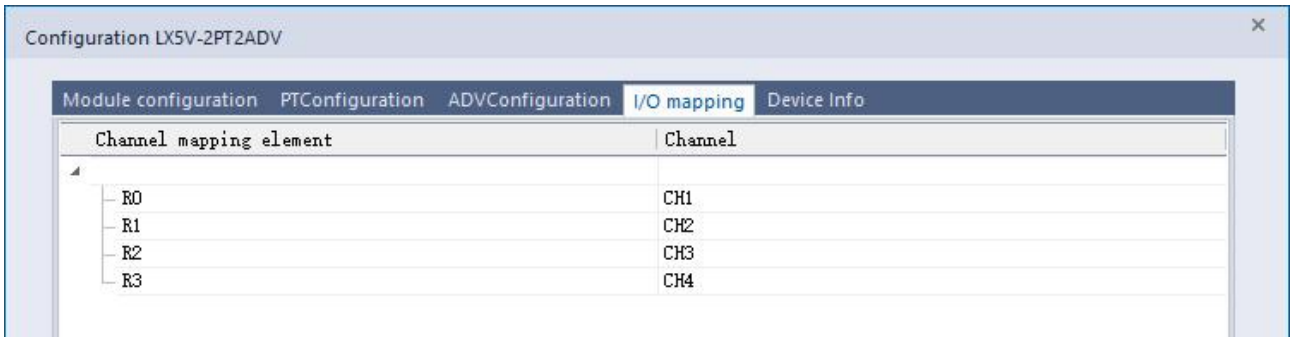
5、After the above configuration is completed, check the program, download the configuration to PLC, and STOP→RUN configuration takes effect.
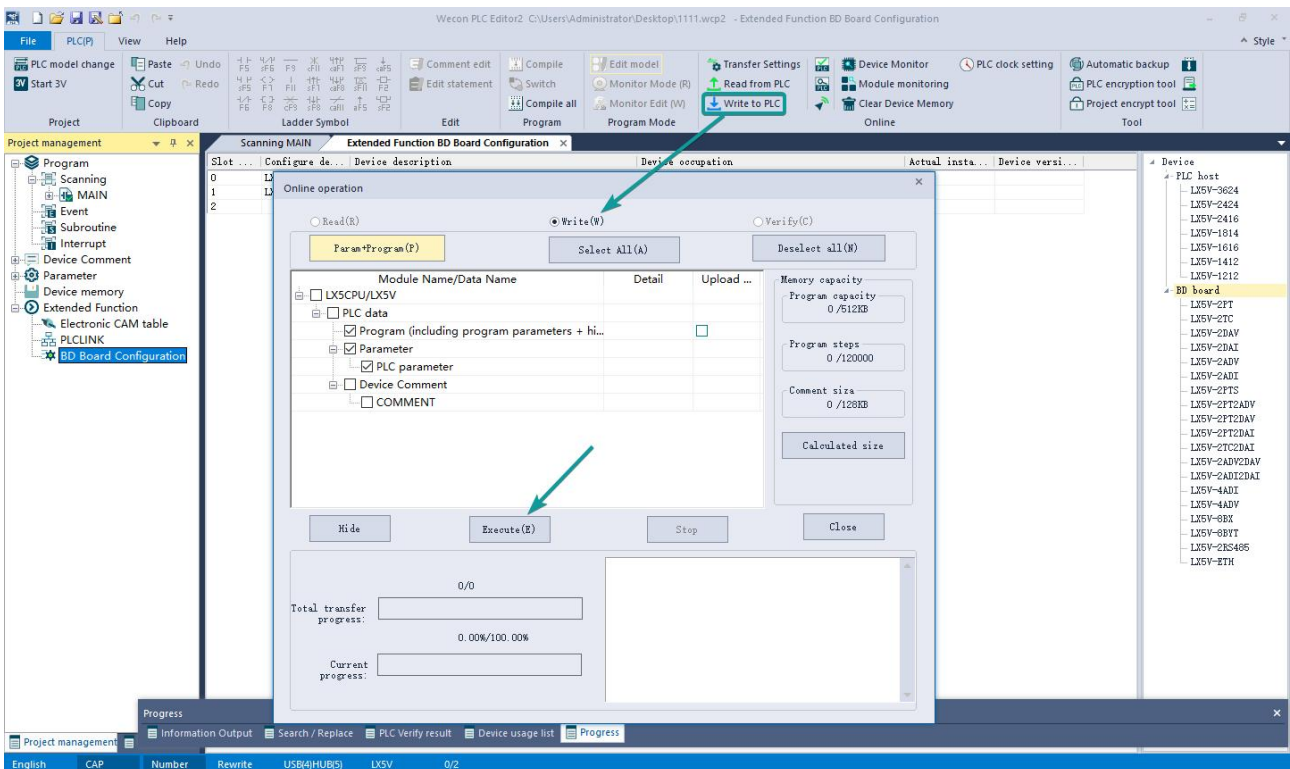
6.2 Ladder Diagram

1、Programming example that does not use the host computer software "BD module configuration" function. For device allocation, please refer to "5 PLC device description".

```
/*
 * Open bd board 4 channels
 */
      SM102
0   ─┤ ├─                                              [RST    SM2010   ]  Open CH1 thermal resistance input
      The firs                                                 BD1 the f
      t cycl..                                                 irst wa..

                                                       [RST    SM2011   ]  Open CH2 thermal resistance input
                                                               BD1 the s
                                                               econd w..

                                                       [RST    SM2012   ]  Turn on the CH3 voltage input channel
                                                               BD1 the t
                                                               hird wa..

                                                       [RST    SM2013   ]  Turn on the CH4 voltage input channel
                                                               BD1 the f
                                                               ourth w..

    /*
     * Channel values are mapped to D0~D3
     */
       SM100
10  ─┤ ├─                                          [MOV    SD2010   D0   ] Write the temperature value of CH1 to
      Always O                                             BD1 the f
      N afte..                                             irst wa..

                                                   [MOV    SD2011   D1   ] Write the temperature value of CH2 to
                                                          BD1 the s
                                                          econd w..

                                                   [MOV    SD2012   D2   ] Write the digital value of CH3 to register
                                                          BD1 the t
                                                          hird wa..

                                                   [MOV    SD2013   D3   ] Write the digital value of CH4 to register
                                                          BD1 the f
                                                          ourth w..
```

2.Programming example using "BD module configuration" function of host computer software:

```
/*
 * BD board channel values are mapped to R0~R3 via I/O
 */
       SM100
40  ─┤ ├─                                              [MOV    D0    R0      ] Map CH1 into R0 device
      Always O                                                      The first
      N afte..                                                       channel

                                                       [MOV    D1    R1      ] Map CH2 into R1 device
                                                                     The secon
                                                                     d channel

                                                       [MOV    D2    R2      ] Map CH3 into R2 device
                                                                     The third
                                                                      channel

                                                       [MOV    D3    R3      ] Map CH4 into R3 device
                                                                     The fourt
                                                                     h channel
```

6.3 BD monitoring interface and buffer memory

Open the module monitoring interface, select BD module module, select LX5V-2PT2ADV from the list of BD modules on the right to monitor it online, and check the current BD module communication status and error information in time.
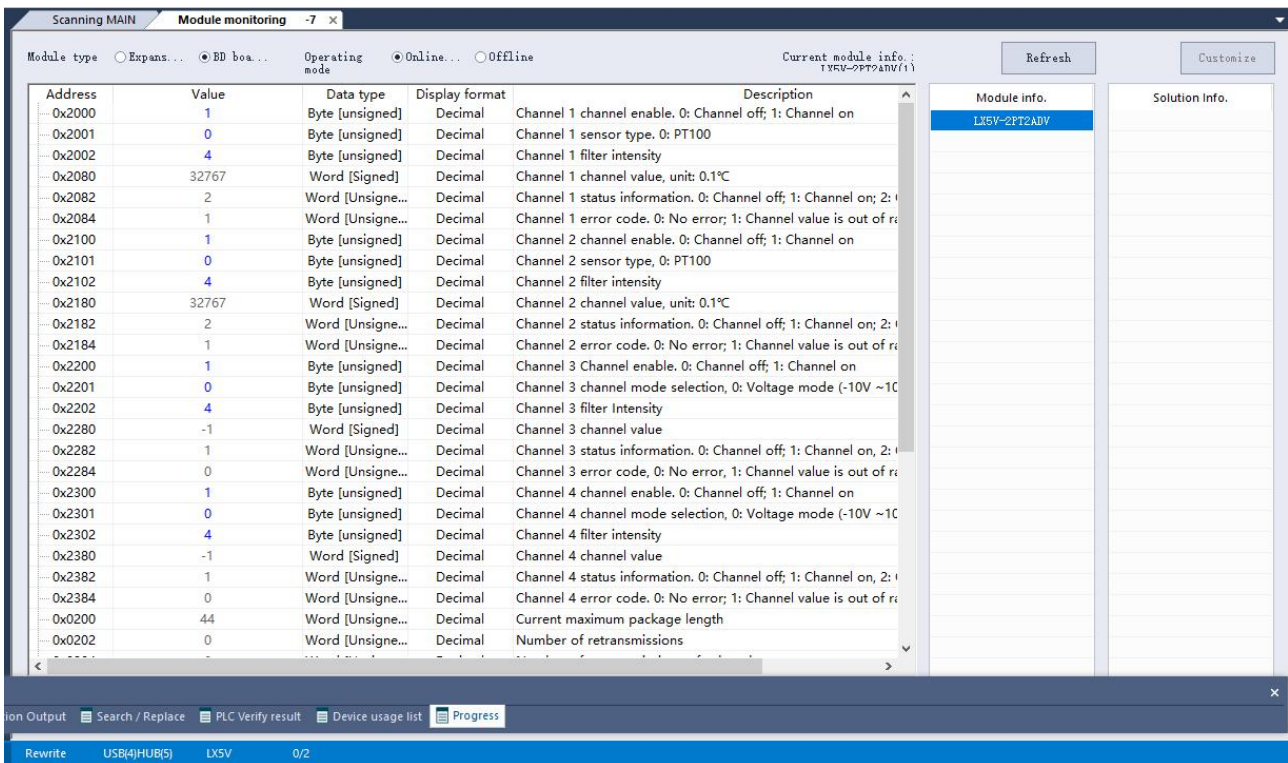
① PT buffer memory (BFM): used for BD module status monitoring.

BFM address	Power-off hold	Read/write	Memory name	Default	Range	Description
0x2000	×	R/W	Channel 1 channel enable	1	0 to 1	0: Channel closed 1: Channel open
0x2001	×	R/W	Channel 1 sensor type	0	0	0: PT100
0x2002	×	R/W	Channel 1 filter intensity	4	0 to 9	0: Minimum filter strength; 9: Maximum filter strength
0x2080	×	R	Channel 1 channel value	32767	-32768 to 32767	Unit: 0.1℃
0x2082	×	R	Channel 1 status information	1	0 to 2	0: Channel closed 1: Channel opened 2: Channel value exceeds the range
0x2084	×	R	Channel 1 error code	0	0 to 1	0: No error; 1: Channel value exceeds the range
0x2100	×	R/W	Channel 2 channel enable	1	0 to 1	0: Channel closed 1: Channel open
0x2101	×	R/W	Channel 2 sensor type	0	0	0: PT100
0x2102	×	R/W	Channel 2 filter intensity	4	0 to 9	0: Minimum filter strength; 9: Maximum filter strength
0x2180	×	R	Channel 2 channel value	32767	-32768 to 32767	Unit: 0.1℃
0x2182	×	R	Channel 2 status information	1	0 to 2	0: Channel closed 1: Channel opened 2: Channel value exceeds the range
0x2184	×	R	Channel 2 error code	0	0 to 1	0: No error; 1: Channel value exceeds the range

① ADV buffer memory (BFM): used for BD module status monitoring.

BFM address	Power off hold	Read-write Function	Memory name	Default	Range	Description
0x2200	×	R/W	Channel 3 channel enable	1	0 to 1	0: Channel closed 1: Channel open
0x2201	×	R/W	Channel 3 channel mode selection	0	0	0: Voltage mode (-10V to 10V)
0x2202	×	R/W	Channel 3 filter intensity	4	0 to 9	0: Minimum filter strength; 9: Maximum filter strength
0x2280	×	R	Channel 3 channel value	0	-2000 to 2000	
0x2282	×	R	Channel 3 status information	0	0 to 2	0: Channel closed 1: Channel opened 2: Channel value exceeds the range
0x2284	×	R	Channel 3 error code	0	0 to 1	0: No error; 1: Channel value exceeds the range
0x2300	×	R/W	Channel 4 channel enable	1	0 to 1	0: Channel closed 1: Channel open
0x2301	×	R/W	Channel 4 channel mode selection	0	0	0: Voltage mode (-10V to 10V)
0x2302	×	R/W	Channel 4 filter intensity	4	0 to 9	0: Minimum filter strength; 9: Maximum filter strength
0x2380	×	R	Channel 4 channel value	0	-2000 to 2000	
0x2382	×	R	Channel 4 status information	0	0 to 2	0: Channel closed 1: Channel opened 2: Channel value exceeds the range
0x2384	×	R	Channel 4 error code	0	0 to 1	0: No error; 1: Channel value exceeds the range

② Universal buffer memory (BFM): used to diagnose the communication status of the currently connected BD module.

BFM address	Power-off hold	Read-write Function	Memory name	Default	Range	Description
0x200	×	R	Current maximum package length	0	0 to0xFFFF	The maximum length of the currently sent package
0x202	×	R	Number of retransmissions	0	0 to0xFFFF	Number of retransmissions
0x204	×	R	Number of retransmissions of subpackages	0	0 to0xFFFF	Number of retransmissions of subpackages
0x206	×	R	Received times of sync frame	0	0 to0xFFFF	Received times of sync frame
0x208	×	R	Sent times of sync frame	0	0 to0xFFFF	Sent times of sync frame
0x20A	×	R	Control the number of transmissions	0	0 to0xFFFF	Control the number of transmissions
0x20C	×	R	Control the number of receptions	0	0 to0xFFFF	Control the number of receptions
0x20E	×	R	Number of subscriptions sent	0	0 to0xFFFF	Number of subscriptions sent
0x210	×	R	Number of subscriptions received	0	0 to0xFFFF	Number of subscriptions received
0x212	√	R/W	Latest error code	0	Only 0 can be written.	Protocol internal error code, write 0 to clear
0x214	×	R	Number of bytes sent	0	0 to 0xFFFFFFFF	Number of bytes sent
0x218	×	R	Number of valid bytes sent	0	0 to 0xFFFFFFFF	Number of valid bytes sent
0x21C	×	R	Number of bytes received	0	0 to 0xFFFFFFFF	Number of bytes received
0x220	×	R	Number of valid bytes	0	0 to	Number of valid bytes received

			received		0xFFFFFFFF	
0x224	×	R	Communication time (unit s)	0	0 to 0xFFFFFFFF	Normal communication time since the BD module is powered on