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LX5V-2TC2DAI-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 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:
  ● When DAI current is output, ensure that the external load resistance is less than 500Ω. If the external load resistance is greater than 500Ω, the output current will be lower than normal value.
  ● 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 a LX5V-2TC2DAI-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.**
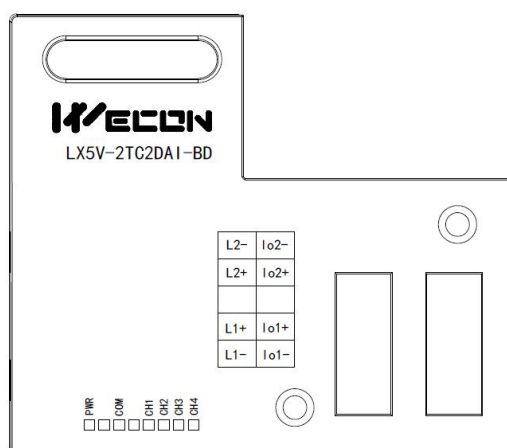
2 Appearance and terminal

Table1 Terminal distribution

IN_2TC part Application sensor: 2-wire type K/J thermocouple		OUT_2DAI part Current output range: 4mA to 20mA	
L2-	Channel 2 sensor signal input negative	Io2-	Channel 2 sensor signal output negative
L2+	Channel 2 sensor signal input positive	Io2+	Channel 2 sensor signal output positive
	NC		NC
L1+	Channel 1 sensor signal input positive	Io1+	Channel 1 sensor signal output positive
L1-	Channel 1 sensor signal input negative	Io1-	Channel 1 sensor signal output 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	Input channel 1 lamp: Always on in range; Flashing outside the range (type K: -100℃ to 1200 ℃; type J: -100 ℃ to 600 ℃); Off when the channel is closed.
CH2	Input channel 2 lamp: Always on in range; Flashing outside the range (type K: -100℃ to 1200 ℃; type J: -100 ℃ to 600 ℃); Off when the channel is closed.
CH3	Channel 3 lamp: Set the digital value 0to 2000 (4mA) to 20mA) to be always on; Flashes outside the digital value 0 to2000 (4mA to 20mA). When the channel is open, the light is on, and the current is output; When the channel is closed, the light is off, and the current is not output (approaching 0).

| CH4	Channel 4 lamp: Set the digital value 0to 2000 (4mA) to 20mA) to be always on; Flashes outside the digital value 0 to2000 (4mA to 20mA). When the channel is open, the light is on, and the current is output; When the channel is closed, the light is off, and the current is not output (approaching 0).

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	24VDC±10%, 50mA; 5VDC±10%, 70mA (The power supply is provided internally by host)	
TC Part		
Input signal	Thermocouple: Type K or J (both types can be used per channel)	
Rated range	Type K: -100℃ to 1200℃	Type J: -100℃ to 600℃
Digital output	Type K: -1000 to 12000	Type J: -1000 to 6000
	12-bit conversion, stored in 16-bit complement	
Over range display	32767	
Measurement accuracy	Type K: 0.4℃	Type J: 0.3℃
Total accuracy	± (0.5% full range + 1℃) pure water condensation point: 0℃/32℉	
Conversion speed	50ms*2 channels (channels that are not used are not converted)	
Conversion features The readings given at the calibration reference point 0 ℃ (0), respectively. (Limited by overall accuracy)		
DAI section		
Rated range	0 to 2000: 4mA to 20mA	
Analog output range	DC 4mA to 20mA (external load resistance ≤ 500 Ω)	
Digital output	12-bit binary	
Resolution	8uA [4mA to20mA/2000]	
Comprehensive precision	±0.5% of full scale (4mA to 20mA: ±0.08 mA)	
D/A conversion time	One scan cycle (D/A conversion after ladder diagram END instruction is executed, and BD channel output value is updated)	
Output features	External load is 250Ω. 0 to 2000 was converted to 4mA to 20mA. 	
Points occupied	0 point (2DAI is not affected by the standard maximum control points of the main PLC because it is operated through the data register)	

Note: Grounded thermocouples are not suitable for use with this unit!

4 Wiring
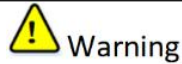
| ⚠ Warning |
|---|
| Cut off the power before installing, removing or wiring the BD module to avoid electric shock or product damage. |

✎**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

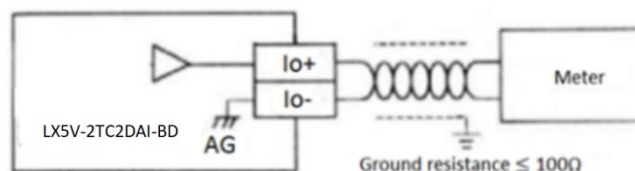| Line number	Cross-sectional area (mm²)	End processing
AWG26	0.1288	Stranded cable: Strip off the sheath, rub the core wire, and then connect the cable.
...	...	
AWG16	1.309	Single-core cable: Strip off the sheath and connect the cable.
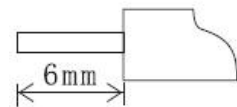
4.2 I/O Mode

Thermocouple input mode
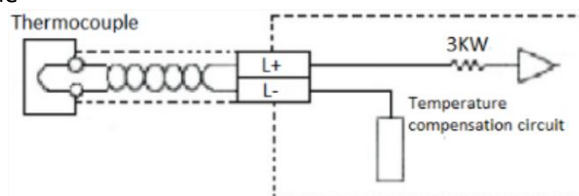
Current output mode

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	2TC2DAI	SM2010	CH1 thermocouple switch flag	OFF: Type K thermocouple ON: Type J thermocouple	SD2010	The temperature of CH1 at 0.1°C (Type K: -100℃ to 1200℃: -1000 to 12000; Type J: -100℃ to 600℃: -1000 to 6000)
		SM2011	CH2 thermocouple switch flag		SD2011	The temperature of CH2 at 0.1°C (Type K: -100℃ to 1200℃: -1000 to 12000; Type J: -100℃ to 600℃: -1000 to 6000)
		SM2012	CH3 current output channel open flag	OFF: Open ON: Close	SD2012	CH3 digital value (0 to 2000: 4mA to 20mA)
		SM2013	CH4 current output channel open flag		SD2013	CH4 digital value (0 to 2000: 4mA to 20mA)

(3) You 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, double-click "Project Manager" → "Extended Function" → "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-2TC2DAI" 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-2TC2DAI-BD configuration parameters interface, as shown in the following figure. Configure related parameters on this interface.
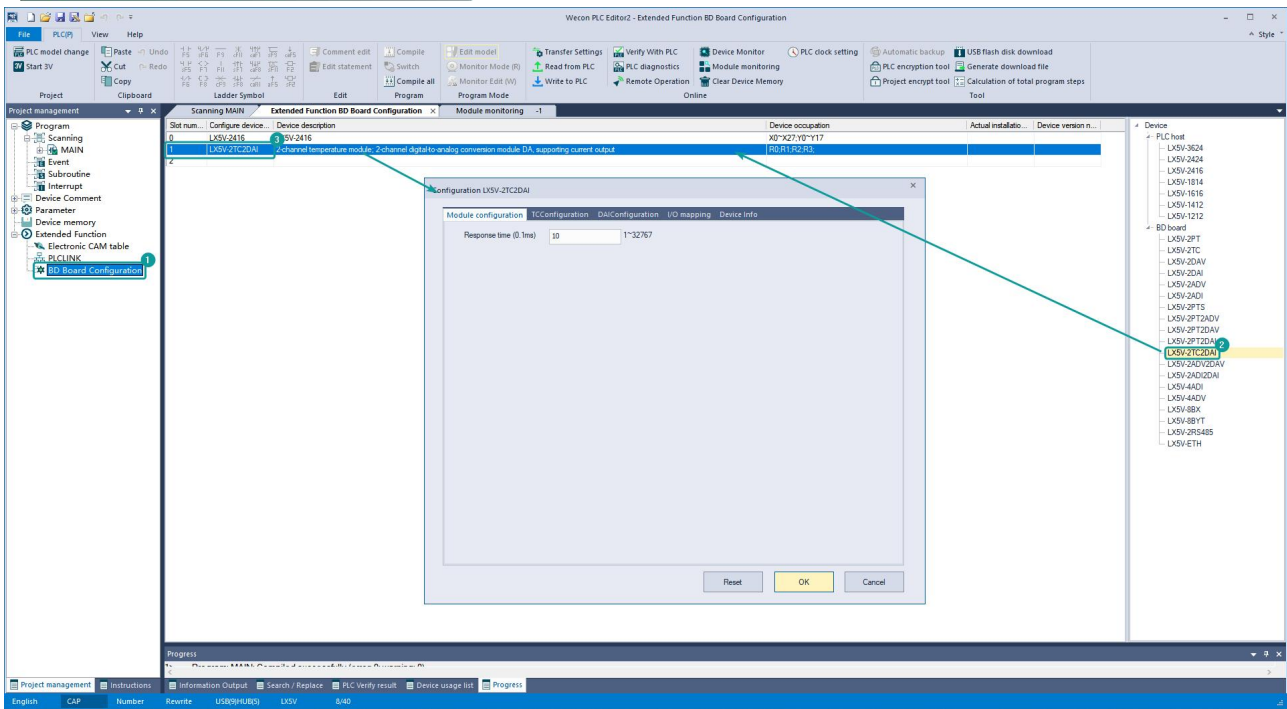
Note: This function is only supported in the following versions of host computer, slave computer and BD module:

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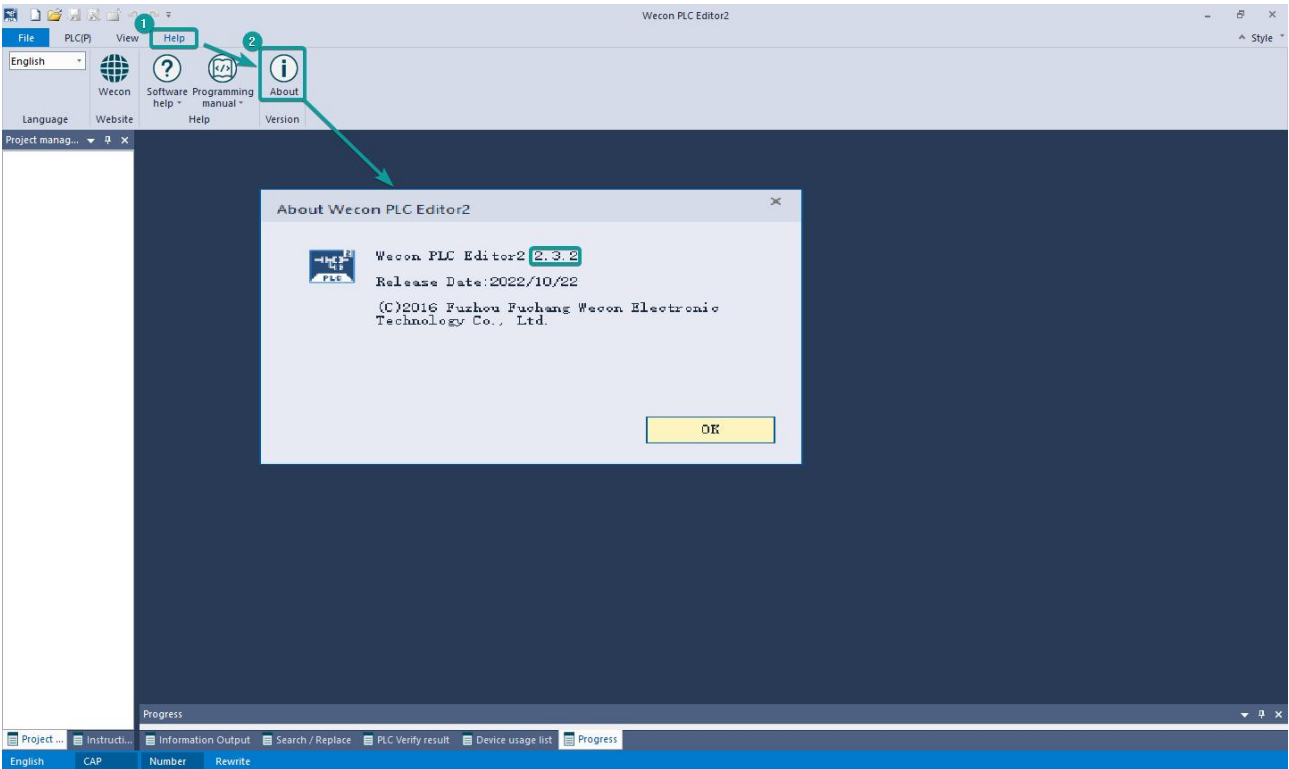
(2) Supported slave computer versions: 2.051 and above, as shown in the following figure:
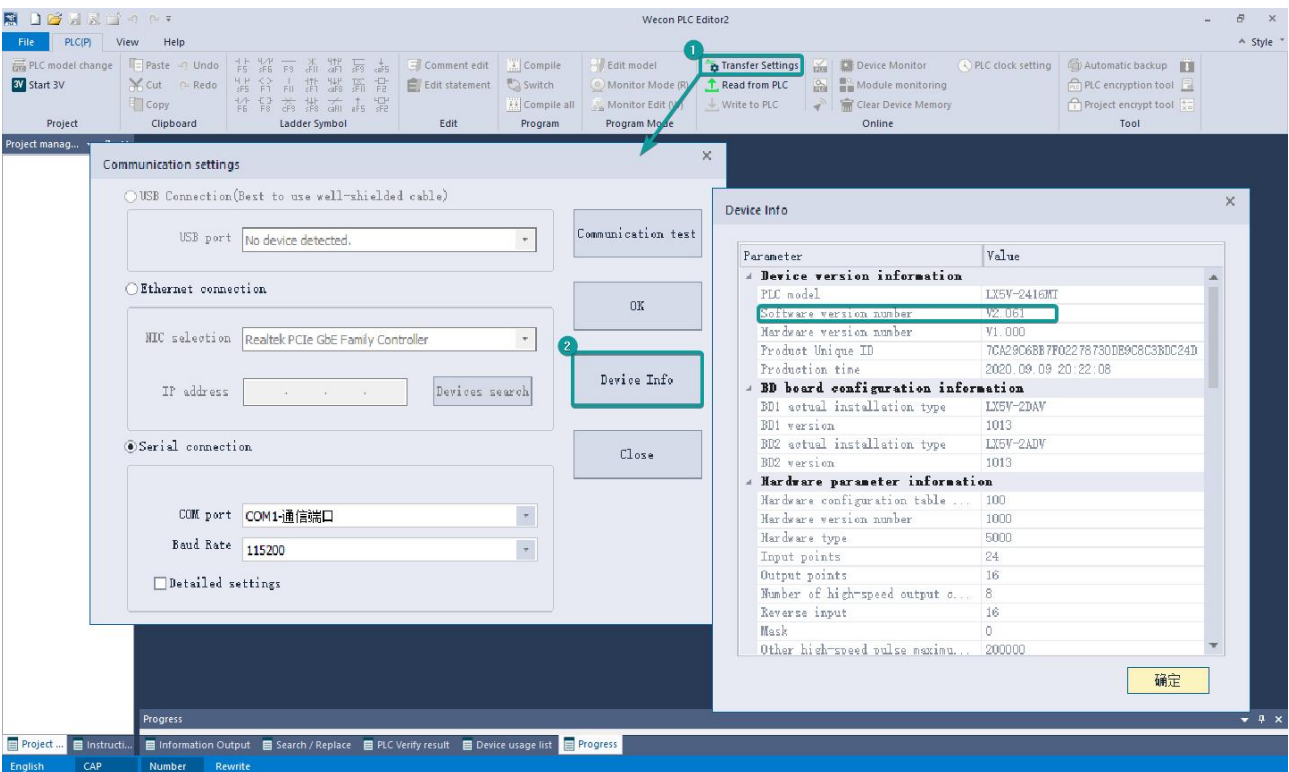
(3) Supported BD module version number: 1013 and above, as shown in the following figure:

Slot num...	Configure device...	Device description	Device occupation	Actual installatio...	Device version n...
0	LX5V-2416	LX5V-2416	X0~X27;Y0~Y17	LX5V-2416MT	V2.061
1	LX5V-2TC2DAI	2-channel temperature module; 2-channel digital-to-analog conversion module DA, supporting current output	R0;R1;R2;R3;	LX5V-2TC2DAI	1014
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).
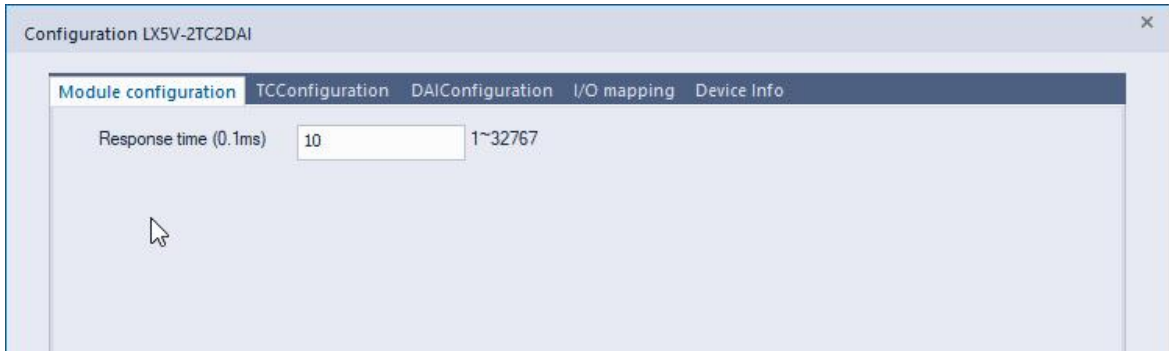
2、TC configuration:
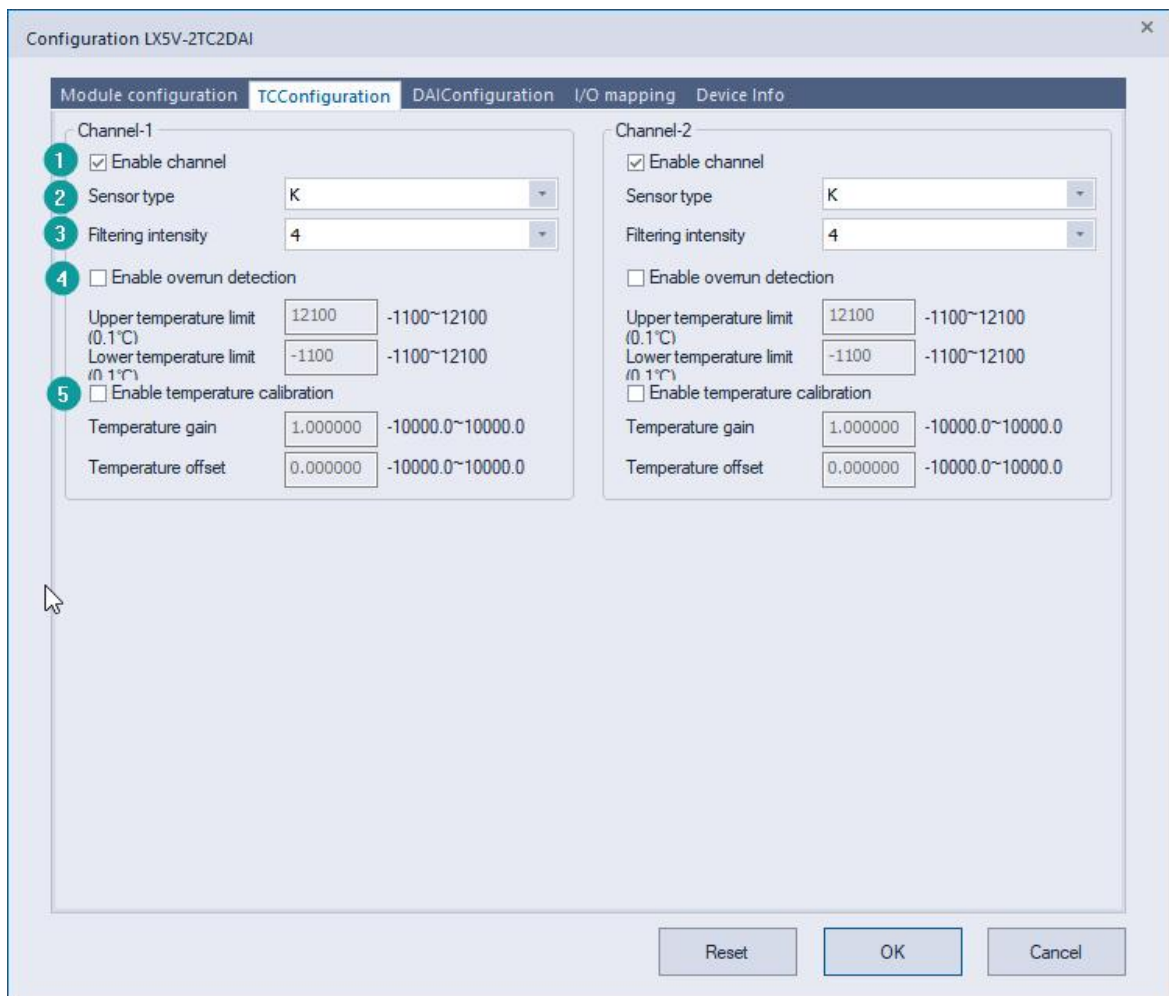
① Check enable channel to set whether to enable the current BD module channel.

② Sensor type: The default sensor type is K thermocouple (Type K and J are optional, and you can set through the drop-down box).

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.

✎Note: Different types of thermocouples can measure different temperature ranges.

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:

If the type of thermocouple connected to the current channel is K:

▪ The input temperature of control channel is 0℃, the value of acquisition channel is 50 (unit: 0.1℃), and the actual channel value should be 0 (unit: 0.1℃).

▪ The input temperature of control channel is 1100℃, the value of acquisition channel is 11100 (unit: 0.1℃), and the actual channel value should be 11000 (unit: 0.1℃)

Suppose the gain is a, and the offset is b, then $\begin{cases} 0 = 50*a+b \\ 11000 = 11100*a+b \end{cases}$,

Solve and get $\begin{cases} a = 0.995475 \\ b = -49.7738 \end{cases}$ The calibration can be completed by setting the corresponding gain offset to the current channel.

3、DAI configuration:
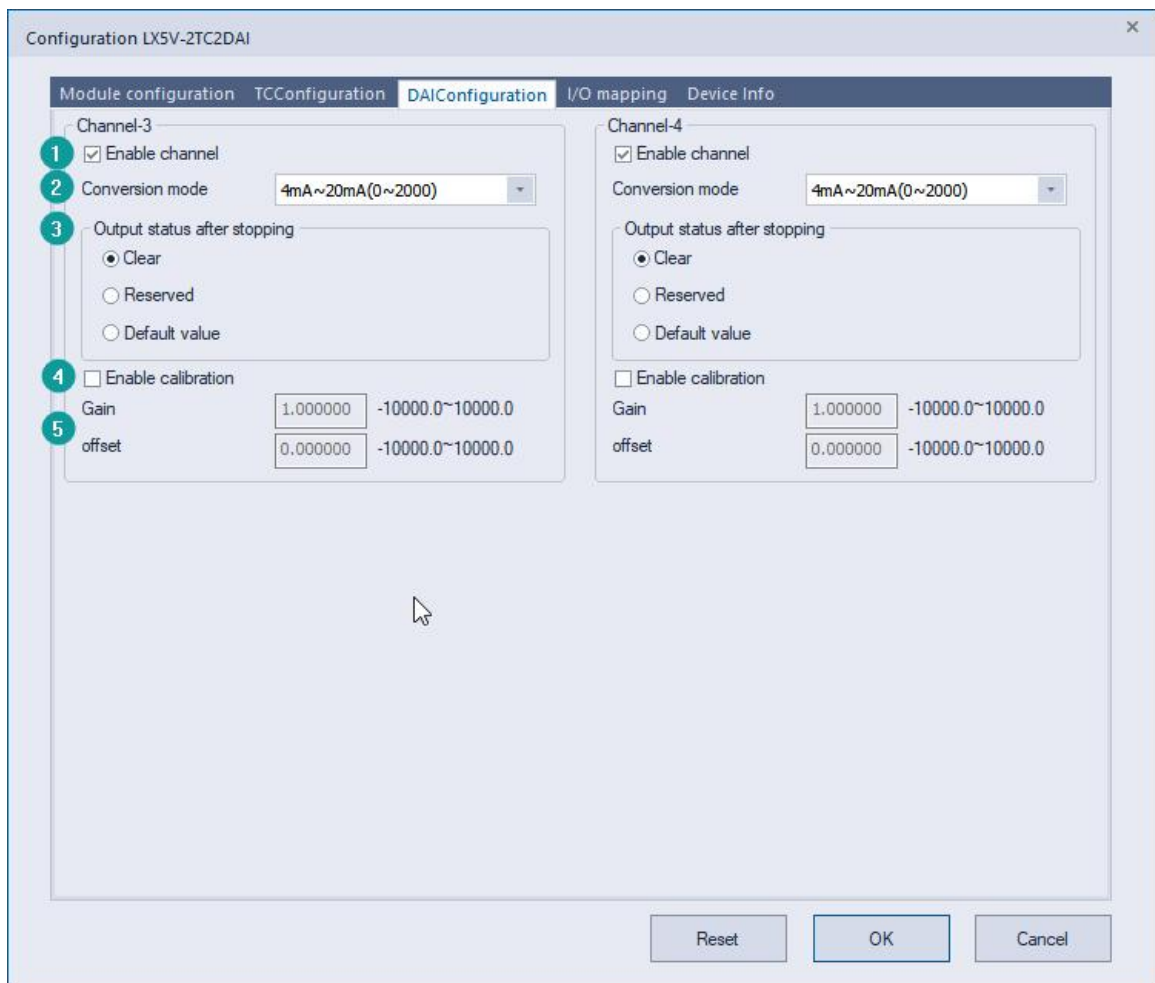
① Check enable channel to set whether to enable the current BD module channel.

② The conversion mode is set to DAI conversion mode by default, and the measurement range is 4mA~20mA (0~2000).

③ Output state after stop: When PLC stops, the output state of BD module channel mainly includes the

following three types:

Output clear: When PLC stops, the output current of BD module channel is 4mA

Output hold: When PLC stops, the channel output of the BD module maintains the digital current value set by the corresponding channel in the current I/O mapping device.

Output preset value: When PLC stops, BD module channel outputs preset digital value or preset analog quantity corresponding to the current value.

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

Channel input digital value = actual output current corresponds to 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 digital value is 0, the multimeter measures the output current of BD module channel to be 5mA (corresponding digital value is 125).

▪ When the channel input digital value is 2000, the multimeter measures the output current of BD module channel to be 5mA (corresponding digital value is 1875).

Suppose the gain is a, and the offset is b, then $\begin{cases} 0 = 125 * a + b \\ 2000 = 1875 * a + b \end{cases}$,

Solve and get $\begin{cases} a = 1.142857 \\ b = -142.857 \end{cases}$ 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.
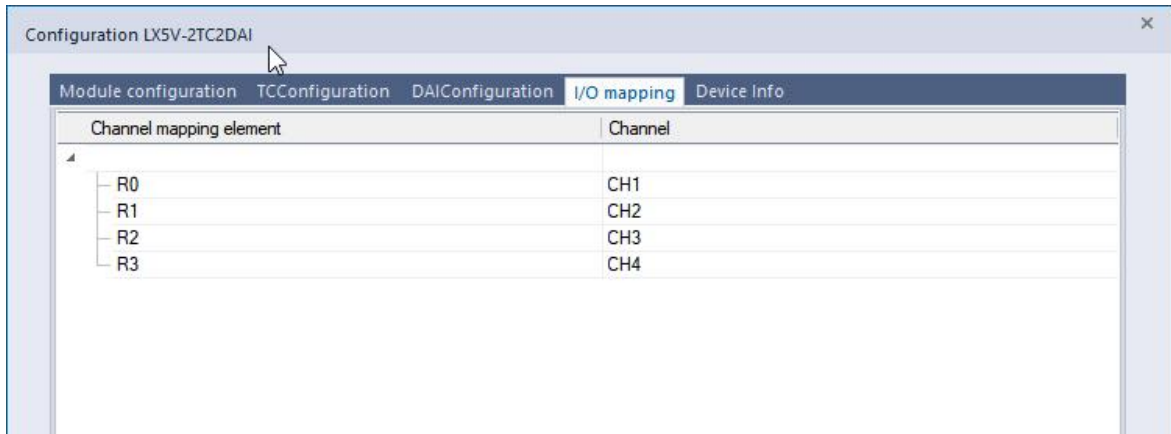
5、After the above configuration is completed, check the program, download the configuration to PLC, and STOP→RUN configuration takes effect.
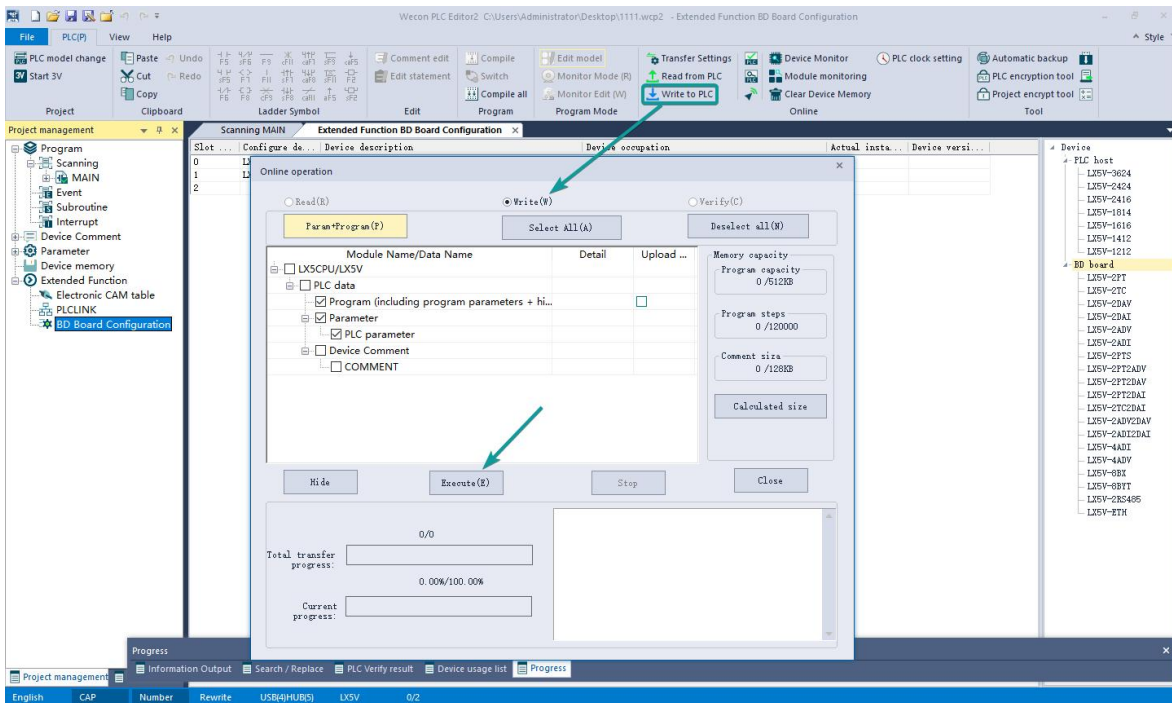
6.2 Ladder Diagram

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".

```
[Write]    1    2    3    4    5    6    7    8    9    10   11   12
/*
* Open four channels of BD board
*/
        SM102
0       ┤├                                              [RST   SM2010  ]    Switch CH1 to type K thermocouple
      The first cyc                                           BD1 the first
      le after R..                                            way switch
                                                        [RST   SM2011  ]    Switch CH2 to type K thermocouple
                                                              BD1 the sec
                                                              ond way s..
                                                        [RST   SM2012  ]    Turn on the CH3 current output channel
                                                              BD1 the thir
                                                              d way swi..
                                                        [RST   SM2013  ]    Turn on the CH4 current output channel
                                                              BD1 the fou
                                                              rth way sw..
/*
* Mapping channel values to D0~D3
*/
        SM100
10      ┤├                                        [MOV   SD2010    D0  ]    Write the temperature value of CH1 to
      Always ON                                         BD1 the first
      after RUN                                         way value
                                                  [MOV   SD2011    D1  ]    Write the temperature value of CH2 to
                                                        BD1 the sec
                                                        ond way v..
                                                  [MOV   D2       SD2012]    Write the value in D2 to CH3
                                                        3rd channel BD1 the thir
                                                        value      d way value
                                                  [MOV   D3       SD2013]    Write the value in D3 to CH4
                                                        4th channel BD1 the fou
                                                        value      rth way va..
```
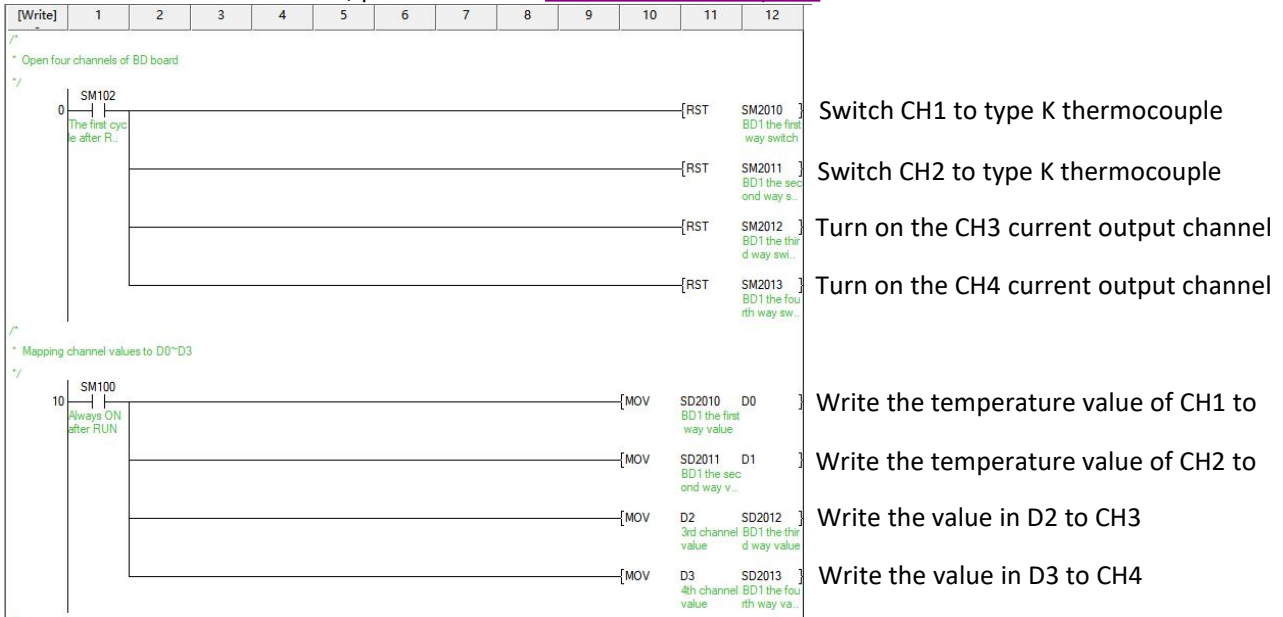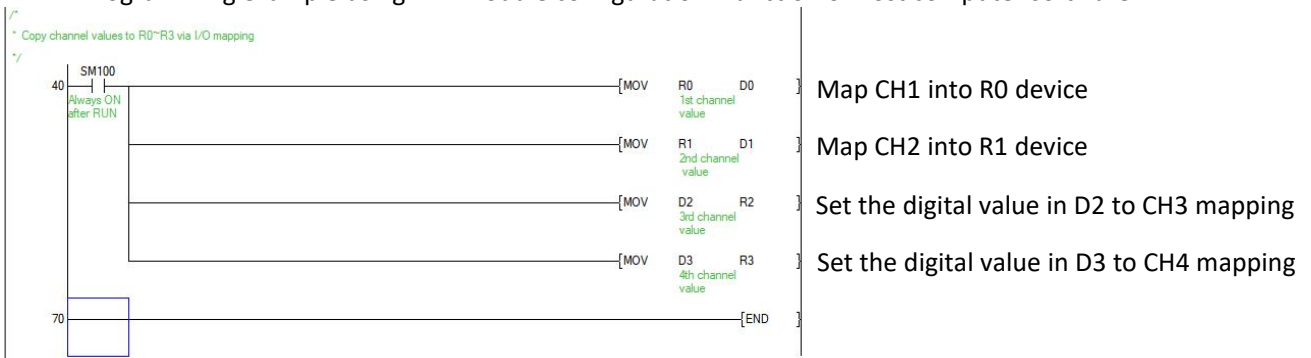
2.Programming example using "BD module configuration" function of host computer software:

```
/*
* Copy channel values to R0~R3 via I/O mapping
*/
        SM100
40      ┤├                                        [MOV   R0       D0  ]    Map CH1 into R0 device
      Always ON                                         1st channel
      after RUN                                         value
                                                  [MOV   R1       D1  ]    Map CH2 into R1 device
                                                        2nd channel
                                                        value
                                                  [MOV   D2       R2  ]    Set the digital value in D2 to CH3 mapping
                                                        3rd channel
                                                        value
                                                  [MOV   D3       R3  ]    Set the digital value in D3 to CH4 mapping
                                                        4th channel
                                                        value
70                                                               [END ]
```

6.3 BD monitoring interface and buffer memory

Open the module monitoring interface, select BD module module, select LX5V-2TC2DAI 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.
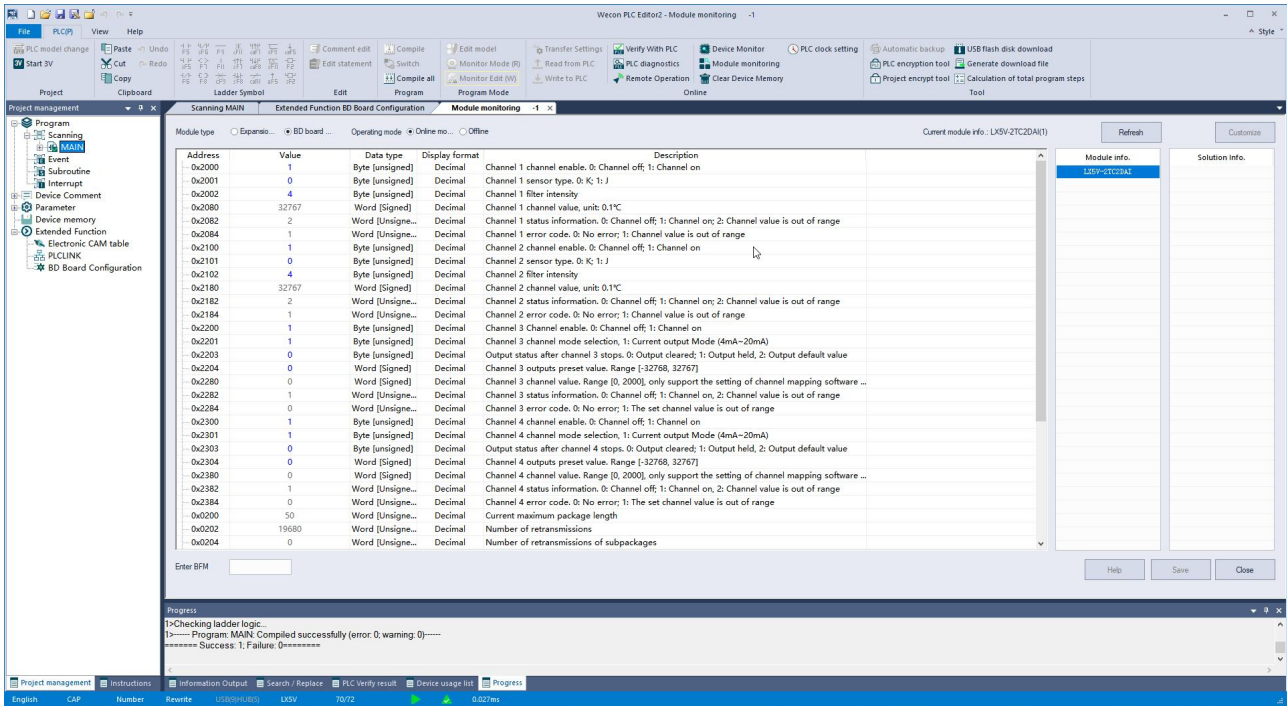
① TC buffer memory (BFM): used for BD module status monitoring.

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 to 1	0: Type K thermocouple; 1: Type J thermocouple
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 to 1	0: Type K thermocouple; 1: Type J thermocouple
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 DAI buffer memory (BFM): used for BD module status monitoring.

BFM address	Power-off hold	Read-write	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	1	1	1: Current output mode (4mA to 20mA)
0x2203	×	R/W	Output status after channel 3 stops	0	0 to 2	0: Output cleared; 1: Output held; 2: Output preset value
0x2204	×	R/W	Channel 3 output preset value	0	-32768 to 32767	
0x2280	×	R	Channel 3 channel value	0	0 to 2000	Only supported in channel mapping device setting
0x2282	×	R	Channel 3 status information	1	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	1	1	1: Current output mode (4mA to 20mA)
0x2303	×	R/W	Output status after channel 4 stops	0	0 to 2	0: Output cleared; 1: Output held; 2: Output preset value
0x2304	×	R/W	Channel 4 output preset value	0	-32768 to 32767	
0x2380	×	R	Channel 4 channel value	0	0 to 2000	Only supported in channel mapping device setting
0x2382	×	R	Channel 4 status information	1	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 to 0xFFFF	The maximum length of the currently sent package
0x202	×	R	Number of retransmissions	0	0 to 0xFFFF	Number of retransmissions
0x204	×	R	Number of retransmissions of subpackages	0	0 to 0xFFFF	Number of retransmissions of subpackages
0x206	×	R	Received times of sync frames	0	0 to 0xFFFF	Received times of sync frames
0x208	×	R	Sent times of sync frames	0	0 to 0xFFFF	Sent times of sync frames
0x20A	×	R	Control the number of transmissions	0	0 to 0xFFFF	Control the number of transmissions
0x20C	×	R	Control the number of receptions	0	0 to 0xFFFF	Control the number of receptions
0x20E	×	R	Number of subscriptions sent	0	0 to 0xFFFF	Number of subscriptions sent
0x210	×	R	Number of subscriptions received	0	0 to 0xFFFF	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 received | 0 | 0 to 0xFFFFFFFF | Number of valid bytes received |
| 0x224 | × | R | Communication time (unit s) | 0 | 0 to 0xFFFFFFFF | Normal communication time since the BD module is powered on |