XC series BD board for special functions

Operate Manual

Xinje Electronic Co., Ltd.

Catalog

1. CONFIGURE METHOD OF BD BOARD 1

2. ANALOG INPUT AND TEMPERATURE SAMPLING BOARD XC-2AD2PT-BD 2

3. ANALOG I/O EXPANSION BD BOARD XC-2AD2DA-BD 9

4. COMMUNICATION EXTEND CARD XC-COM-BD 13

5. XC-SD-BD FOR SD CARD 15

6. ETHERNET EXPANSION BOARD XC-TBOX-BD 27

1. Configure method of BD board

Configure method of BD board:

1） Install BD board correctly to the main unit;

2） Then, online with XCP edit tool, in “Window” menu, chose “Configure BD Board” (see graph 1)

3） Then, in “BD Board Configure”, choose “Other BD” (see graph 2), download user program.

Graph1

Graph2

2. Analog input and temperature sampling board XC-2AD2PT-BD

1、Characteristic:

- 14 bits high precise analog input.
- 2 channels voltage 0~10V、0~5V selective, 2 channels temperature analog input.
- Platinum temperature testing resistor (Pt100 two-line format), temperature sensor using analog input.

2、General Specification

Item	Voltage input	Temperature input
Analog input signal	DC0~5V、0~10V（Input resistor 300kΩ）	Platinum resistor Pt100（2-line format）
Temperature testing bound	-	-100~350℃
Distinguish ratio	0.15mV（10/16383）	0.1℃
Digital output bound	0~16383	-1000~3500
Colligate precision	±0.8% of the full-scale	
Convert time	15ms×4 channels	
PID output value	0~K4095	
No-load defaulted value	0	3500
Input characteristic		
Insulation	No insulation between each channel of PLC	
I/O engross	0 I/O (Since it is operated via data register, so it is not limited by main PLC's standard max. control points)	

3、External installation and connection

1） Installation method of expansion board:

Open the cover in the left of PLC (see the following dashed line), then insert the board to the PLC according to the pins, fix with the screws, close the PLC cover to finish.

2）Connection method：See the following graph

4、Distribution of input define ID

This BD board doesn't engross any I/O unit, the converted value will be sent to PLC register directly, the channel's correspond PLC register ID is：

Channel's ID	AD signal/te-mperature	PID output value	The set data/temp-erature	Kp	Ki	Kd	Diff	Death	start/sto-p
0CH	ID1000	ID1004	QD1000	QD1004	QD1005	QD1006	QD1007	QD1008	Y1000
1CH	ID1001	ID1005	QD1001						Y1001
2CH	ID1002	ID1006	QD1002	QD1009	QD1010	QD1011	QD1012	-	Y1002
3CH	ID1003	ID1007	QD1003						Y1003

Description：

1）0CH、1CH are AD input channels; 2CH、3CH are Pt input channels.

2）Kp: proportion parameters; Ki: integral parameter; Kd: differential parameters; Diff: control bound

Control bound Diff：in the assigned bound, carry on PID control, beyond that bound, don't carry on that control

Start signal (Y): if Y is 0, close PID control, if Y is 1, start PID control.

Death bound Death: it means the current PID control value compares with the preceding PID control value, if the difference between them is less than the set bound of death, the module will abandon the current PID control value, send the preceding PID control value to the PLC main unit.

3. Setting of working mode

1）For expansion's input/output, they both have option of voltage 0~5V、0~10V, current 0~20mA、4~20mA modes and sieve format. Setting via special FLASH data register FD. See the left graph:

2）Each channel's working mode is assigned by 4 bits in the correspond register. Each bit's definition is shown below：

Register FD8306：

<table>
<tr><th colspan="4">Channel 1</th><th colspan="4">Channel 0</th></tr>
<tr><th>Bit7</th><th>Bit6</th><th>Bit5</th><th>Bit4</th><th>Bit3</th><th>Bit2</th><th>Bit1</th><th>Bit0</th></tr>
<tr><td colspan="2">00：1/2 sieve
01： not sieve
10：1/3 sieve
11：1/4 sieve</td><td rowspan="2">-</td><td>0:0~10V
1:0~5V</td><td colspan="2">00：1/2 sieve
01：not sieve
10：1/3 sieve
11：1/4 sieve</td><td rowspan="2">-</td><td>0:0~10V
1:0~5V</td></tr>
<tr><td>-</td><td>-</td></tr>
<tr><th colspan="4">Channel 3</th><th colspan="4">Channel 2</th></tr>
<tr><th>Bit15</th><th>Bit14</th><th>Bit13</th><th>Bit12</th><th>Bit11</th><th>Bit10</th><th>Bit9</th><th>Bit8</th></tr>
<tr><td colspan="2">00：1/2 sieve
01：not sieve
10：1/3 sieve
11：1/4 sieve</td><td>-</td><td>-</td><td colspan="2">00：1/2 sieve
01：not sieve
10：1/3 sieve
11：1/4 sieve</td><td>-</td><td>-</td></tr>
</table>

5、Control specification

1）Usage of the four parameters: proportion parameter（Kp）、integral parameter（Ki）、differential parameter（Kd）、control proportion band（Diff）.

a.) Parameter P is proportion parameter, mainly reflect system's difference, as soon as the difference occurs, carry on control to decrease the difference.

b.) Parameter I is integral parameter, mainly used to remove the whisht difference, improve the system's no difference degree.

c.) Parameter D is differential parameter, mainly used to control signal's changing trend, decrease the shake of system.

Temperature control bound means: in the assigned bound, carry on PID control, beyond this bound, don't go on PID control.

2） Control specification

The PID regulate bound is（QD-Diff，QD+Diff），when the temperaure is below QD-Diff,the controller heat up ,when the temperature is higher than QD+Diff，the controller stop heating.

Temperature-control curve of PID：

3） Each parameter's reference value：Kp=20~100；Ki=5~20；Kd=200~800；DIFF=100~200；These reference values are only used for normal condition's reference, according to the field's detailed condition, each parameter's value could be set beyond the set bound.

6、Application of PID output value

When carry on temperature PID regulation, the module will output a PID control value every 2 seconds. So, in the PLC program, we could carry on heat control with the duty ratio formed by PID output vale and K4095 in 2 seconds! Assume PID output value is X（0≤X≤4095）,in the cycle of 2 seconds, carry on duty ratio control, 2X/4095 seconds heater output, (2－2X/4095) seconds heater close output.

7、Program

E.g.1、real time read data of channel 0, and carry on PID adjustment of channel 0.

E.g.2、example of PID temperature control

3. Analog I/O expansion BD board XC-2AD2DA-BD

1. Characteristics

- 14 bits high precision analog input
- 10 bits high precision analog output
- 2 channels 0-10V, 0-5V voltage input choices
- 2 channels 0-20mA, 4-20mA current output choices

2. General specifications

Item	Voltage input	Current output
Analog input range	DC0~5V, 0~10V(input resistor 300kΩ)	-
Analog output range	-	DC0~20mA、4~20mA (external load resistor is less than 500Ω)
Resolution	1/16383(14Bit); the transformed data is saved as hex in the PLC	1/1023(10Bit); the transformed data is saved as hex in the PLC
Digital output range	14 bits binary data (0~16383)	-
Digital input range	-	10 bits binary data (0~1023)
Integrated precision	±0.8% of the full scale	
Transformation time	15ms×2 channel	3ms/1 channel
PID output value	0~K1023	-
Insulation	There is no insulation among each PLC channel	
I/O occupy	0 point (the module operate the data via PLC registers, it will not be limited by PLC max I/O points)	

3. Connection and Installation

(1) Installation:

Open the cover on the left side of PLC, insert the expansion BD board into the pins, then fix it with the screw, then close the cover.

(2) Connection:

4. I/O address assignment

The BD board will not occupy I/O space, the transformed data will be saved in PLC registers. The PLC registers are as the following:

Channel	AD signal	PID output	PID control bit	Set value	PID parameters: Kp, Ki, Kd, Diff, Death
0CH	ID1000	ID1002	Y1000	QD1002	Kp-----QD1004；Ki-----QD1005；Kd-----QD1006；Diff---QD1007；Death--QD1008
1CH	ID1001	ID1003	Y1001	QD1003	
Channel	DA signal	-	-	-	-
0CH	QD1000	-	-	-	
1CH	QD1001	-	-	-	

Notes:

1) 0CH, 1CH are AD input channels; 2CH, 3CH are DA output channels.

2) Kp: proportion, Ki: integral, Kd: differential, Diff: control range

Diff: to do PID control in appointed area.

PID control bit (Y): Y=0, PID control is unable; Y= 1, PID control is able.

Death: to compare the former and the current PID control value, if the difference is less than death area, the module will abandon the current PID control value and send the former value into the PLC.

5. Working mode

1) The expansion BD board has 0-5V and 0-10V voltage input choices; 0-20mA, 4-20mA current output choices. They can be set by FLASH register in the PLC. As the right diagram showing, each register can decide the modes of 4 channels. Every 4 bits of the register can decide one channel's mode.

2) One register has 16 bits, every 4 bits can decide one channel's working mode.
Register FD8306:

Channel 1				Channel 0			
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
00：1/2 filter 01：no filter 10：1/3 filter 11：1/4 filter		-	0：0~10V 1：0~5V -	00：1/2 filter 01：no filter 10：1/3 filter 11：1/4 filter		-	0：0~10V 1：0~5V -
Channel 3				Channel 2			
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
-		-	0：0~20mA 1：4~20mA	-		-	0：0~20mA 1：4~20mA

6. AD transformation diagram

The relationship between input analog and transformed digital data:

0~5V analog input	0~10V analog input

The relationship between input digital and transformed analog data:

0~20mA analog output	4~20mA analog output

Note: If the output data is more than K1023, D/A result will be 20mA.

7. Example

Read the real time data of 2 channels; write the data in 2 channels.

Explanation:

M8000 is always ON when PLC is running.

When PLC is running, it writes the channel 0 data of model 1to register D0 of PLC.

4. Communication extend card XC-COM-BD

1、 Characteristic

- RS485 communication port
- RS232 communication port
- RS485 and RS232 can not be used at the same time

2、Installation and connection

1) Installation:

Open the PLC cover on the left, insert the card into the pins, fix it with screw and close the cover.

2) Connection:

Notes:

(1) TXD, RXD, GND are RS232 communication port.

(2) A, B are RS485 communication port.

(3) RS232 and RS485 can not be used at the same time.

3、XC software setting

When using the BD board, please select the BD serial port in the XCPpro software:

5. XC-SD-BD for SD card

1. Characteristic

- To install SD card and expand the XC memory
- PLC can read and write the data of SD card
- Support 4 data formats (single word, double word, float, character)
- XC hardware version V3.2 and above is required

2. Explanation

1) SD card

- XC-SD-BD has not been installed the SD card when out of factory, user needs to prepare MicroSD (TF card), the card memory should be not more than 2GB.
- Before install the SD card in the XC-SD-BD, please use card reader to format the SD to FAT16 in the PC.
- SD card supports hot plug, but please wait for at least 5 second after hot plug.

2) The file standard in SD card

- SD card supports .csv file, these file should be saved in the root directory.
- All the .csv files must be named as dataxxx.csv, xxx is the file index number, the range is 001~999, when xxx is less than 100, add 0 from the left side. For example, if file index number is 1, the file name will be data001.csv.

3) Data format and type in SD card

- SD card supports 4 kinds of data type: single word (W), double word (DW), float(Fm.n), character (Sx).
- The data range and space:

Data type	W	DW	Fm.n(m<=15,n<=15)	Sx(x<=16)
Data range	-32768～32767	-2147483648～2147483647	-18446742974197923840～18446742974197923840	\
Character occupied in SD card	6	11	m+1+n	2*x
WORD number	1	2	2	x

NOTE:

(1) When the real data length is less than the character length in SD card, add space from the left side. For example, single word data 454, data type is W, character length is 6, so add 6-3 = 3 spaces. The real number is ∟∟∟454. (∟ is space).

(2) When Fm.n is negative number, the sign bit occupies one character. For example, F5.3, after writing the number -12345.123 in SD card, the lowest valid bit will be deleted; the number will become -12345.12.

(3) The x of character Sx means word length, but not character length.

3. Operation for the SD

XC series PLC can connect SD card, write and read the data from the SD card.

1) Read the SD card

After installing the SD card successfully, PLC can read the SD card data. Use FROM instruction to read the appointed data block in .csv file of SD card.

- Read the data from SD card to PLC, unit is word.
- S1: K7 means the object is XC-SD-BD.
- S2~S2+2: appoint .csv file index number, the column head address of data block, the row head address of data block. Operand is D.

In the example, D200 is the .csv file index number

D201 is the column head address of the data block

D202 is the row head address of the data block

- S3: the word numbers you want to read out. Operand is D.
- D1: save the data in PLC register. Operand is D.

In this example, if D200=2, D201=1, D202=3, D210=3. The instruction will do like this: read 3 numbers start from column 1, row 2 of the file "data002.csv" in SD card, and save it in D220 of PLC.

If the data002.csv is shown as the following, then the numbers in the red color line will be read.

w,	dw,	s8,	f4.15,	dw,	w,	dw
2980,	178605,	HFASDFNQWEJFN,	769.467894,	-1321240,	-330,	780240
2471,	-191280,	JKSAHDKFHAKLS,	830.26683,	-2515275,	-23782,	-665320
9628,	39984,	jakjfkdakl,	387.56305,	458388,	-7728,	-884013
9045,	-251190,	testh,	949.899791,	-417510,	39600,	195264
1824,	141351,	hellbaby,	408.248854,	2644828,	-1836,	558904
22300,	70153,	testh,	570.088499,	-583542,	-6534,	1095926
-1742,	271975,	HSDKLJDF,	162.57849,	-1238233,	-25761,	-125260
1636,	207536,	JSKDJFDSALF,	735.422261,	293940,	2400,	345495
9962,	37107,	HDJNFCJDSNC,	860.864485,	538920,	24660,	827472

Explanation:

(1) In the data002.csv file, the first line is data type definition; this line is not included in the row address.

(2) The number "2471" is W type, "-191280" is DW type, so totally 3 words, the same as the read out word numbers.

2) Write SD card

By TO instruction, PLC can write the data into appointed location in .csv file of SD card. Please note that user must build a .csv file in the SD card at first, and define the write in data type in the .csv file. If not, the ERROR LED of XC-SD-BD will be always ON.

- Write the appointed data block of PLC in the SD card .csv file. Unit is word.
- S1: K7 means the object is XC-SD-BD.
- S2~S2+2: appoint the .csv file index number, the column and row address of data block. Operand is D.

  In the instruction, D100 is the index number of the .csv file

  D101 is the column head address of the data block

  D102 is the row head address of the data block
- S3: the word numbers need to write in the SD card. Operand is D.
- S4: the PLC register head address need to write into the SD card. Operand is D.

In the instruction, if D100=1, D101=1, D102=1, D110=5, D120=365, D121=10235465, D123=26456. So the data will be written in data001.csv is in the red color range:

```
w, dw, dw, f4.15,
  365,    10235465,       26456,          769.467894,
 2471,     -191280,       70153,           830.26683,
```

NOTE: the write in data type should be the same as the .csv file data type. If not, the ID1000 will be error.

3) Notice

- Character type Sx

A. Sx supports visible character such as letter, number, the same as ASCII code [32,126], but not support comma ",".

B. Invisible character, Sx supports end character.

- Reading and writing word number limitation

A. Limited by the RAM capacity of PLC, the reading and writing word number can not be more than 50 each time.

B. Can not read part of the data. For example, define the data format to be "W, DW, S8", if set the reading word number to 10 and read from the first column W, the S8 will not be read totally, ID1000 will return error value. When the program found that the parameters were wrong, it will not read and write the SD card.

C. When reading or writing data, if one row is over, it will jump to the first column of the next row.

D. ".csv" file can not have space between data. When writing data into SD card, the address must be continuous, if not the ID1000 will have error code 20.

E. When reading the data, the address can not over the last data address, if not the ID1000 will produce error code.

- Default operation file

To save the time, after installing the SD card, it will read the data001.csv file, if there is no this file in the SD card, ID1000 will return code 2. But this will not affect the following operation for other files.

4. SD card state information ID1000

The SD card state information will show in ID1000. Especially when SD card has error, it can check the error code in ID1000 to find the solution.

ID1000	Meaning	Reasons
0	Successful	
1	Initialization failure	SD card is not installed well or is damaged
2	Reading or writing file does not exist	The operation file does not exist
3	Reserved	
4	Reserved	
5	Reserved	
6	Reserved	
7	Reserved	

8	Reading or writing error	Uninstall the SD card when reading or writing
9	Reserved	
10	Reserved	
11	FAT16 error	SD card has not been formatted to FAT16
12	Reserved	
13	Reserved	
14	Reserved	
15	Reserved	
16	Reserved	
17	Reserved	
18	Reserved	
19	SD card is not inserted	SD card is not inserted
20	Reading or writing parameter error	Please check the file index number, column, row and word number
21	The reading or writing data are not fit for format definition	There are illegal characters when data type is character
22	The file data type is wrong	There are data type definition exclusive of “w, dw, Sx, Fm.n”
23	Data type is not matching when reading the file	There are illegal characters when data type is character
24	Illegal file name	Index number >999
25	Illegal column index	Column index > file column numbers
26	Illegal row index	Row index number is 0 or 1
27	Illegal reading and writing word numbers	Word numbers >50

5. The type definition in “.csv” file

Before writing data into .csv file, you need to define the data type in the Excel table.

A. Build a new Excel file, define the data type in the first row.

	A	B	C	D	E
1	w	dw	f3. 2	s5	dw
2					
3					

B. Save the file and named as dataxxx.csv. For example, data003.csv.

C. After saving the file, open it in txt file, you will see the following things: each data type is divided by “,” automatically. In that way PLC can recognize it easily.

6. Install and set the BD board

1) Install the BD board

Open the PLC cover on the right, insert the BD board with the pins then fix it with screw, then put the cover back.

2) Install SD card

There are three LED lights on the XC-SD-BD, they are Power, Run and Error.

Power: always ON after power on;

Run: blinking when PLC and BD communication is normal

Always ON when PLC and BD communication is abnormal

Error: Off when there is no error

Always ON when there is no SD card, SD card broken or SD card is not formatted.

Blinking when there are other errors.

3) Set the BD board

Open XCPpro V3.2, click “configure/BD setting, then select other BD/BD SD, then click OK.

7. Format changing tool

When there are data in the Excel, please use format changing tool to transform the Excel format to .csv. The tool will be attached with this manual. Please see the operation steps:

Open Excel, click Tool/Add-Ins/Browse…, then select the format changing tool, click ok.

A. In the tool menu, there is a format changing tool item. That means the tool installation is finished.

B. When finished the data inputting, click "format changing tool".

C. At last, save the file as .csv format.

	A	B	C	D	E	F	G	H
1	w	dw	s8	f4.15	dw	w	dw	
2	2980	1786	HFASDF		-13212	-330	780240	
3	2471	-1912	JKSAHI		-25152	-23782	-665320	
4	9628	399	jak		4583	-7728	-884013	
5	9045	-2511			-4175	39600	195264	
6	1824	1413	H		26448	-1836	558904	
7	22300	701			-5835	-6534	1095926	
8	-1742	2719	H		-12382	-25761	-125260	
9	1636	2075	JSKI		2939	2400	345495	
10	9962	371	HDJN		5389	24660	827472	

8. Example

Write data in data001.csv in SD card, read data from data002.csv.

Process: format the SD card→build a csv file→make the program→install SD card and BD board→configure the BD board, download the program and the data→debug the program, monitor the running result

Step:

1. Transform the SD card format to FAT16 by card reader

(1) Use card reader to connect SD card with PC. (SD card capacity should be less than 2GB).

(2) Right click the SD card disk, choose format.

(3) File system please select FAT.

(4) Click start to format the SD card until finish the process.

2. Build a empty file "data001.csv" and a file with data "data002.csv" in the root directory of SD card.

(1) Open the SD card, build two new Excel files.

(2) Open one of the file, input the following data types:

1	w	dw	f5.3	s7	w
2					

(3) Save the file as “data001.csv”. Then open it in txt, make sure it is correct.

data001.csv - 记事本

文件(F) 编辑(E) 格式(O) 查看(V) 帮助(H)

```
w,dw,f5.3,s7,w
```

(4) Open another Excel file, input the data type in the first line, and input data in each row, the data in each row should be accord with the data type.

	A	B	C	D
1	w	s8	dw	f6.2
2	245	hfiw	1234567890	543631.32
3	415	sdlgjeoa	-534007321	464.1
4	14456	8gskhd	77182	7654.65
5	26654	nd903jlp	8945	3563
6	12356	48djlj=j	9054873	-13251.98
7	97	ey67	326483894	-645.8
8	-27658	e21	89490	15.54
9	4579	k*nlw	737328923	3165.3
10				

(5) Transform the data via format changing tool.

	A	B	C	D
1	w	s8	dw	f6.2
2	245	hfiw	1234567890	543631.32
3	415	sdlgjeoa	-534007321	464.1
4	14456	8gskhd	77182	7654.65
5	26654	nd903jlp	8945	3563
6	12356	48djlj=j	9054873	-13251.98
7	97	ey67	326483894	-645.8
8	-27658	e21	89490	15.54
9	4579	k*nlw	737328923	3165.3

(6) Save as “data002.csv”. Then open it via txt file:

data002.csv - 记事本

文件(F) 编辑(E) 格式(O) 查看(V) 帮助(H)

```
w, s8, dw, f6.2
   245,          hfiw, 1234567890, 543631.32
   415,      sdlgjeoa, -534007321,     464.1
 14456,         8gskhd,     77182,   7654.65
 26654,       nd903jlp,      8945,      3563
 12356,       48djlj=j,   9054873, -13251.98
    97,           ey67,  326483894,    -645.8
-27658,            e21,     89490,     15.54
  4579,         k*nlw,  737328923,    3165.3
```

data002.csv - 记事本

文件(F) 编辑(E) 格式(O) 查看(V) 帮助(H)

```
w, s8, dw, f6.2
24                          .32
41                          4.1
14
26
12                          251.98
97
-27658, e21, 89490, 15.54
4579, k*nlw, 737328923, 3165.3
```

After format changing

Add space from the left side of the numbers

Attention: after format changing, if the data length is not enough, it will add space from the left side of the numbers. Before format changing, the data are out of order.

(7) File "data001" and "data002" are finished. Please delete the disk and pull out the SD card from the PC.

3. Make program in XCPpro software.

Before format changing

The data are out of order

(1) Purpose:

A. write 16 words from D200 to row 1, line 2 of data(

B. read 25 words from row 2, line 3 of data002.csv to D400.

(2) Process:

D0=1, writing file index no.

D1=1, the row no. of the writing file

D2=2, the line no. of the writing file

D100=16, write in 16 words

D10=2, reading file index no.

D11=2, row no. of the reading file

D12=3, line no. of the reading file

D300=25, read 25 words

Write 16 words from D200 to data001.csv

Read 25 words from data002.csv to D400

4. Insert the SD card on the XC-SD-BD, install the BD on the PLC.

(1) Power on the PLC, check the LED situation. POWER LED is ON, communication LED is flickering, ERROR LED is OFF.

(2) Connect the PLC with PC to configure the BD board.

(3) Click “Online --- download program & data”, select “BD config” in the window:

(4) Click the BD details in the project bar; you can see the BD board information.

5. Run the program to see the result.

A. Write data into data001.csv

a) The data in D200~D215 of PLC are shown as the following:

PLC1- Free Monitor

Monitor | Add Edit Del | Upward Downward

Reg	Monitor value	Word length	Num Format
D200	12335	Word	Dec
D211	-444711130	DWord	Dec
D203	78545.23	Float	Dec
D205	gh	Word	ASCII
D206	45	Word	ASCII
D207	9j	Word	ASCII
D208	3#	Word	ASCII
D209	+<	Word	ASCII
D210	5v	Word	ASCII
D211	?&	Word	ASCII
D212	-6786	Word	Dec
D213	-23412	Word	Dec
D214	-474327809	DWord	Dec

b) When M1 is from OFF→ON, write the data from D200~D215 to data001.csv.

The result of data001.csv is as the following:

```
w, dw, f5.3, s7, w
 12335,   555881125, 78545.227, gh459j3#+<5v?&,  -6786
-23412,  -474327809,
```

B. Read data002.csv

a) The data will be read in data002.csv:

```
w, s8, dw, f6.2
   245,          hfiw,  1234567890, 543631.32
   415,       sdlgjeoa,  -534007321,     464.1
 14456,         8gskhd,      77182,   7654.65
 26654,       nd903jlp,       8945,      3563
 12356,       48djlj=j,    9054873, -13251.98
    97,           ey67,  326483894,    -645.8
-27658,            e21,      89490,     15.54
  4579,          k*nlw,  737328923,    3165.3
```

b) when M2 is from OFF→ON, read the data from data002.csv to D400~D424 of PLC:

D400		Word	ASCII
D401		Word	ASCII
D402		Word	ASCII
D403		Word	ASCII
D404	sd	Word	ASCII
D405	lg	Word	ASCII
D406	je	Word	ASCII
D407	oa	Word	ASCII
D408	-534007321	DWord	Dec
D410	464.1	Float	Dec
D412	14456	Word	Dec
D413		Word	ASCII
D414		Word	ASCII
D415		Word	ASCII
D416		Word	ASCII
D417		Word	ASCII
D418	8g	Word	ASCII
D419	sk	Word	ASCII
D420	hd	Word	ASCII
D421	77182	DWord	Dec
D423	7654.65	Float	Dec

C. the process of reading the data from SD card to PLC registers:

6. Ethernet expansion board XC-TBOX-BD

1. Summarization

- Ethernet extension BD board special for XC series PLC, support MODBUS-RTU
- Support remote monitoring, program download/upload
- XCPpro software version requirements:
  Hardware v2.10: XCPpro v3.3
  Hardware v2.0: XCPpro v3.0f

2. Characteristics

- Flexible distributed automation structure, simplify the system management
- Standard RJ45 interface, TCP/IP protocol
- To realize remote monitoring, checking and programming, save time and cost
- To store and deal with the data via Ethernet, simplify the data processing and filing
- Connect PLC with Ethernet to realize intercommunication with other devices
- High cost performance, easy to maintain, support simple user's friendly diagnose function

3. System construction

The industrial Ethernet system contains XC-TBOX-BD, PC (connect to network), XC series PLC, XCPpro software, HMI, network connector (hub, router, switch), twisted-pair cable, etc.

4. Suitable field

Industrial Ethernet is an electrical network which based on shielded coaxial cable, twisted-pair cable or optical fiber which based on optical network. It is accord with IEEE802.3 by using ISO and TCP/IP protocol. As the expansion of Modbus/RTU protocol, Modbus/TCP protocol defines the standard of TCP/IP network transmission and application. XC-TBOX-BD meets the requirements for industrial network automation control. It provides complete solution and reliable control method.

The application based on XC-TBOX-BD:

- Remote monitor, maintain and debug the PLC program of the IP device
- Traditional Modbus communication is one-master-multi-slaver mode, the speed is very slow.
  By using XC-TBOX-BD, master station can communicate with other branch stations.

In the following picture, XC-TBOX-BD and TBOX support devices with Modbus/RTU interface connecting to Ethernet. It can realize multi-master-multi-slaver system; make the devices suitable for complicated system.

5. Interface for Ethernet

- Ethernet interface is RJ45, please see the photo on the right:
- The pin definition of RJ45:

Pin	Wire color	Signal	Direction
S1	Orange white	TXD+	Output
S2	Orange	TXD-	Output
S3	Green white	RXD+	Input
S4	Blue	-	-
S5	Blue white	-	-
S6	Green	RXD-	Input
S7	Brown white	-	-
S8	Brown	-	-

6. Install the BD board

Open the cover on the left of PLC, insert the board on the pins, fix it with the screw.

Location for install the BD board

7. Configure the BD board

- Install the BD board on the PLC
- Connect PLC with PC, use XCPpro software to configure the BD board
- Select configure/BD setting, then click BD serial port:

8. DIP switch

XC-TBOX-BD has four DIP switches:

ON

1	2	3	4

OFF

The function of DIP switch:

Switch	Status	Function
S1	ON	SLAVE mode
	OFF	MASTER mode
S2	ON	Close log on server
	OFF	Open log on server
S3	ON	Use set IP
	OFF	Use static IP (192.168.0.111)
S4	ON	Undefined
	OFF	Undefined

- There are 2 modes for TBOX IP configurations:

A. use static IP

B. use the IP set by users

The priority is A > B.

A. use static IP (DIP switch S3 is OFF)

If users don't know the IP of TBOX or for initial use, please select default IP for TBOX.

IP address: 192.168.0.111

Mask code: 255.255.255.0

Gateway: 192.168.0.1

DNS: 192.168.0.1

B. use the user's IP (DIP switch S3 is ON)

Set IP address, mask code, gateway and DNS (same as default gateway)

9. LED display

LED	Indication	Function
REMOTE	Remote log on	Always ON: log on remote server
COM	Serial port	Shining: has connection
IP	IP checking	Shining: IP address conflict
LINK	Ethernet connection	Always ON: network connection is normal
ACT	Ethernet data	Shining: received data

10. Using steps

If you want to connect the PLC in the Ethernet, you have to set the XC-TBOX-BD first. Please see the steps:

(1) Hardware connection and setting

A Install the XC-TBOX-BD on the PLC.

B Make sure the XCPpro version according to the XC-TBOX-BD hardware version.

C Set the DIP switch according to the requirements.

D Make sure XC-TBOX-BD is connected with Ethernet. Electrify the PLC.

Notes: when you use it at the first time, make sure DIP switch S3 is OFF for the network to recognize XC-TBOX-BD, set it to static IP address 192.168.0.111, and then connect it with the Ethernet. The IP of PC must be in the same gateway of the XC-TBOX-BD (192.168.0.xxx, but cannot conflict with other devices). XC-TBOX-BD has the same IP when out of the factory, so cannot configure them together. You have to configure them one by one. Otherwise the IP address will conflict with each other.

E Make sure PC with XCPpro software are in the network.

(2) Set the parameters

A Open the software XCPpro, click option/Ethernet module settings.

B It shows the TCP_IP device window, click Refresh List:

C double click the target TBOX, it shows the Edit TBOX device window:

Parameters explanation:

- **Communication**

Log in

Name: defined by user

Device ID: no need set, use default value

Remote log in

The aim of this part is to connect XC-TBOX-BD and its device to the WAN. It can remote maintenance the

machine by remote server of XC-TBOX-BD.

IP, Port, Server 2 name: If user uses XINJE company server, no need to set these parameters. If user can build his own server, input these parameters according to his server.

Config network:

When the DIP switch 3 is OFF, users can set parameters of the IP device including IP address, mask code, gateway, DNS (the same as default gateway). Then turn ON DIP switch 3, the network will recognize this XC-TBOX-BD.

Serial port:

Baud rate, databits, stopbits, parity, protocol can be modified. Please note the baud rate must be the same as the connected device.

- **Master/client**

The Edit TBOX device window will show the device type and version. When XC-TBOX-BD is in master mode, it will show TBOX_Master, the master mode parameters are effective. The client mode parameters will be ineffective. When XC-TBOX-BD is in slave mode, it will show TBOX_Slave, the client mode parameters are effective, the master mode parameters will be ineffective.

TBOX_Master parameters:

Protocol: UDP: effective, fast

TCP: receiving/sending data is stable, occupy more sources

Station IP table: station num: the station numbers controlled by master device in the Ethernet (slave station)

IP: slave IP address

TBOX_Slave parameters:

Send delay: XC-TBOX-BD will send the next command when received the answer from the slave station. Add delay between the answer and command to decrease the possibility of losing the command pack.

Station table: the slave station in the Ethernet, support direct access.

- **TBOX comment**

It includes device name and content. They can be modified according to user's demands, then click "OK".

D Click "Write to TBOX", the click "OK". All the parameters are effective. The existed device will be listed in the TCP_IP device window. Close this window.

	Name	IP	Mask	DNS	Port	Comment	....
1	TBOX1	192.168.0.20	255.255.255.0	192.168.0.1	65535		

E Click option /comm. Mode settings, it shows "select communication mode" window, please select "UDP" for communication mode, network type can be "outer network" or "inner network". If there are many XC-TBOX-BD, only the target station works. Now, you can monitor and upload, download program of PLC via Ethernet.

F Click "OK" to finish the XC-TBOX-BD parameters setting.

11. XC-TBOX-BD connects to SCADA

When use WAN, XC-TBOX-BD can connect with Touchwin SCADA (version 2.c.5 and higher).

The steps are as below:

(1) Open Touchwin software, build a new file

(2) Select PC HMI software/Win800*600 or Win 1024*768 (according to your PC screen size).

(3) Click “Next” , then PLC port device select “Thinget XC series”

(4) Download port device select “unused download port” then click “Next”

(5) The parameters in below window:

- Name: XC-TBOX-BD log in name
- User ID: XC-TBOX-BD log in device ID. Please delete the “-“ when input the ID. For example: ID 01-10-02-21-00-01-00-00 will be 0110012100010000.
- Device: select the device in the drop-down list, then click “Add”.
- Server IP and port:XC- TBOX-BD remote log in IP and port.

Click “Next” to finish the configuration.

(6) Make the project in below window:

Please note: for all the objects in the project, please change the “PLC port” to network device. For example: the lamp button, change “PLC port” to “thinget XC series”.

(7) After finishing the editing of project, click online simulation button to monitor the remote device.

12. Example

The following is a Ethernet consisted of three PLC and one HMI.

In this system, there are 3 XC-TBOX-BD and 1 T-BOX. T-BOX is master mode, others are slave mode. HMI is master device, PLC1, PLC2, PLC3 are slave devices.

This system's purpose is to control multi slave devices by multi master devices. Make the industrial network being used widely.

The steps are as shown as below:

1) Set 3 PLC station NO. to 1, 2, 3 individually via XCPpro software.

2) Connect the TBOX and XC-TBOX-BD which are in Master mode and Slave mode with corresponding control devices. If it is the first time to use T-BOX and XC-TBOX-BD, it can't be recognized. Please turn the DIP switch S3 off, use the static IP address and connect the TBOX and XC-TBOX-BD into the Industrial Ethernet in turn. After setting one in the XCPpro software, turn the DIP switch S3 on so as to set next one.

3) select "BD serial port" in the XCPpro software for XC-TBOX-BD

4) In this example, set the IP address of T-BOX and XC-TBOX-BD, the IP address are 192.168.0.10, 192.168.0.20, 192.168.0.30, 192.168.0.40.

In the "edit TBOX device", please see the following detailed configuration:

T-BOX1 parameters setting: (Turn off DIP switch 1)

T-BOX2 parameters setting: (Turn on DIP switch 1)

T-BOX3 parameters setting: (turn on DIP switch 1)

T-BOX4 parameters setting: (turn on DIP switch 1)

After setting, click “write to T-BOX”. The following steps please refer to “Operating step”. Now, the parameters settings have been finished.

Xinje Electronic Co., Ltd.

4th Floor Building 7,Orignality Industry park, Liyuan Development Zone, Wuxi City, Jiangsu Province 214072

Tel: (510)85134136

Fax: (510)85111290

www.xinje.com