XP-BD Manual

Operating Manual

Xinje Electronic Co.,Ltd.

Catalog

1. Configure method of BD board

Configure Method of BD Board:

1) Install BD correctly on the main unit;
2) Then connect the model online via XCP edit tool, in the “Window” menu, choose “Config. BD Board(C)” as shown in the following graph1.
3) Click it, in the “Config. BD Board(C)” dialog box, choose “Other BD” (Just as showed in the graph 2), click “OK” to download the program.

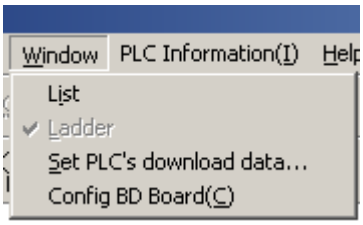
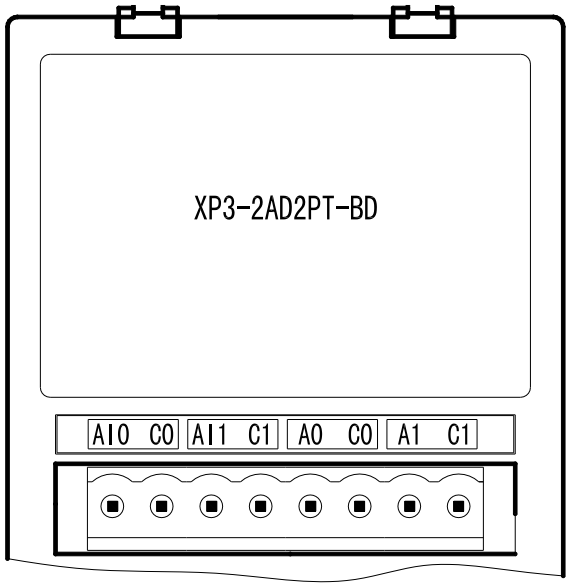


Figure 1

Figure 2

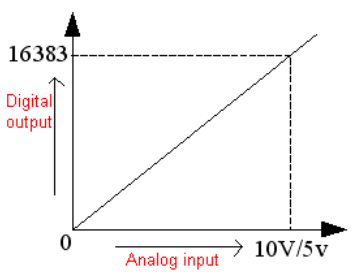
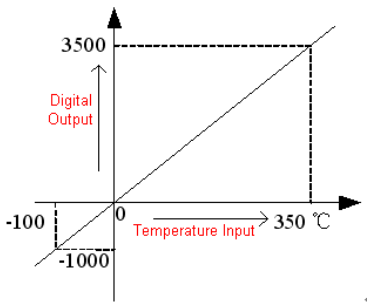
2. Analog Input and Temperature Sampling Board XP3-2AD2PT-BD

2.1 Specifications



- 14 bits high precision analog input
- 2 channels voltage 0~10V, 0~5V (selectable) analog input
- 2 channels PT temperature testing resistor (PT100 two-line form) temperature sensor

2.2 General Specification

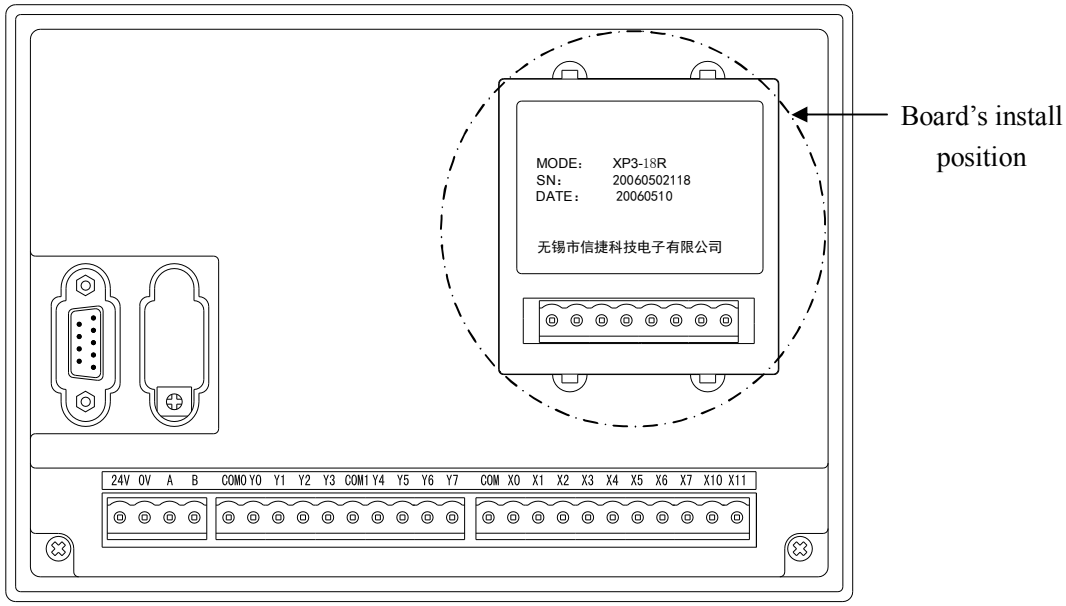
Item	Voltage Input	Temperature Input
Analog Input Signal	DC0~5V, 0~10V (Input resistor 300kΩ)	Platinum Resistor PT100 (2 lines format)
Temperature Testing Bound	-	-100~350℃
Distinguish Ratio	0.15mV（10/16383）	0.1℃
Digital Output Bound	0~16383	-1000~3500
Integrate Precision	±0.8% of full scale	
Convert Time	15ms×4 channels	
PID Output Value	0~K4095	
Vacant Defaulted Value	0	3500
Input Specialty		

Insulation	No insulation among each channel of PLC
Engrossed points	0 point (As operated via data register, so the engrossed points are not limited by PLC's max control points)

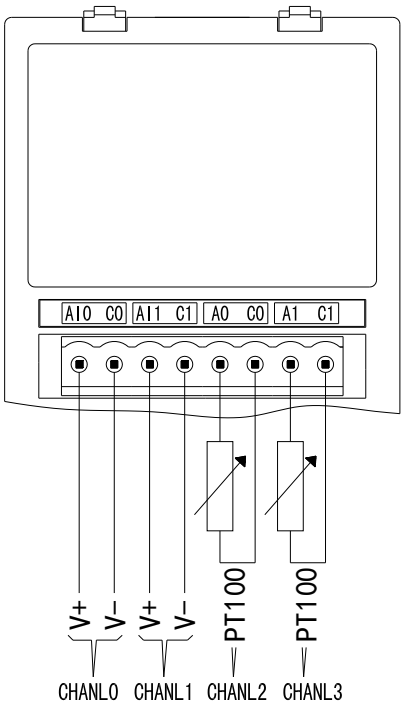
2.3 External Installation and Connection

1) The Installation Method of Board:

Open the board's cover at the back of XP3 (As shown in the following graph), install it according to the pin arrangement. Then fix it with screws, close the cover.



2) Connection: See the following graph



2.4 Assignment of Input ID

This BD board does not engross I/O units, the converted data will directly send into PLC register. The channel corresponding PLC register ID is:

Channel	0CH	1CH	2CH	3CH
AD signal/Temperature value	ID1000	ID1001	ID1002	ID1003
PID output value	ID1004	ID1005	ID1006	ID1007
Set the target value	QD1000	QD1001	QD1002	QD1003
Kp	QD1004		QD1009	
Ki	QD1005		QD1010	
-Kd	QD1006		QD1011	
Diff	QD1007		QD1012	
Death	QD1008		-	
Start/Stop	Y1000	Y1001	Y1002	Y1003

Note：

1）Kp：proportion parameter; Ki：Integral parameter; Kd：Differential parameter; Diff：Control proportion band;

PID value：PID output value（0~4095）

2）Control coil's status（Y1000/Y1001）：0：means close PID control；1：means start PID control

Description:

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

2) Kp：proportion parameter; Ki：Integral parameter; Kd：Differential parameter; Diff：Control band;

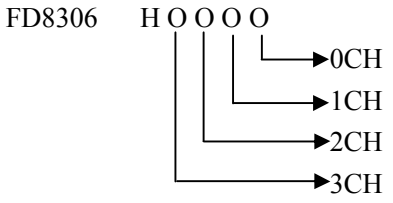
Control Band Diff: Carry on PID control in the assigned bound, beyond the bound, don't carry on PID control

Start Signal (Y): PID control is closed when Y is 0, open PID control when Y is 1

Death Bound "Death": Compare the current PID output value with the preceding PID output value. If their difference is less than the set death bound, the module will abandon the current PID output value, still transfer the preceding PID output value to PLC main unit

2.5 Setting of Working Mode

1) Expansion's input has voltage 0~5V、0~10V these two modes and filter form to select. Set via special FLASH data register FD8306 in PLC. Refer to the graph by the right, each register set the 4 channels' mode, each register has 16 bits. From low bit to high bit, each 4 bits set one channel's mode



2) Each channel's working mode is assigned by the four bits of the corresponding register, each bit's definition is shown below:

Register FD8306:

CH1				CH 0			
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
00：1/2 filter 01：not filter 10：1/3 filter 11：1/4 filter		-	0:0~10V 1:0~5V	00：1/2 filter 01：not filter 10：1/3 filter 11：1/4 filter		-	0:0~10V 1:0~5V
CH3				CH 2			
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
00：1/2 filter 01：not filter 10：1/3 filter 11：1/4 filter		-	-	00：1/2 filter 01：not filter 10：1/3 filter 11：1/4 filter		-	-

3) Usage of four parameters: Proportion parameter（Kp）, integral parameter (Ki), differential parameter (Kd), control proportion band（Diff）.

Parameter P is proportion parameter，mainly reflect system's wrap, when system wrap appears, carry on control immediately to decrease the wrap.

Parameter I is integral parameter, mainly used to remove net difference, improve the system's

no-difference degree

Parameter D is differential parameter, mainly used to control signal's change trend, decrease system's shake.

Temperature control proportion band means: in the assigned bound, carry on PID control，beyond the bound, do not carry on PID control.

2.6 Control Specialties

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

Parameter P is proportion parameter，mainly reflect system's wrap, when system wrap appears, carry on control immediately to decrease the wrap.

Parameter I is integral parameter, mainly used to remove net difference, improve the system's no-difference degree

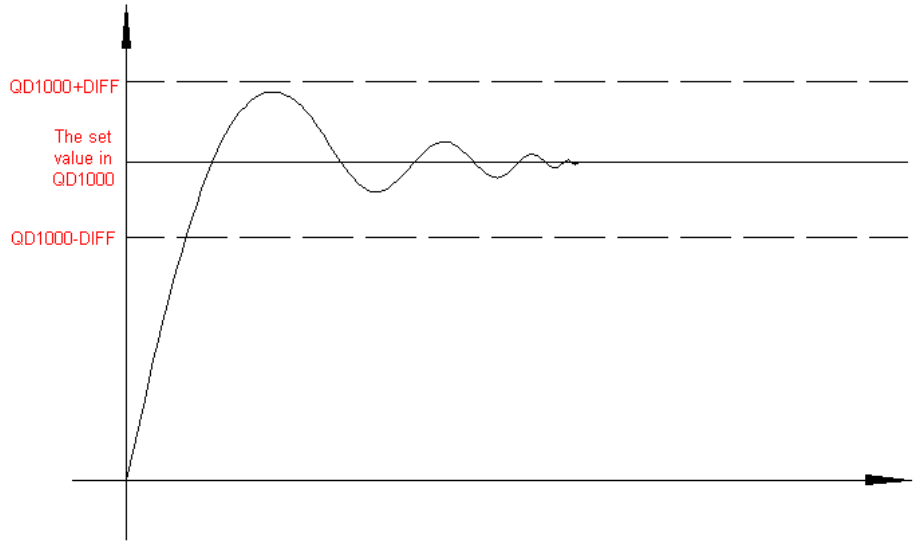
Parameter D is differential parameter, mainly used to control signal's change trend, decrease system's shake.

Temperature Control Band Means: in the assigned bound, carry on PID control，beyond the bound, do not carry on PID control.

2) Control Specialties

The bound of carry on PID adjustment is: (QD-Diff，QD+Diff), when temperature is low than QD-Diff, controller go on heating, when temperature is higher than QD+Diff, controller stop heating.

PID Temperature Control Curve is Shown Below:



Each parameter's reference value：Kp=20~100；Ki=5~20；Kd=200~500；DIFF=100~200；

This reference value only for normal condition，according to the locale detail condition, each

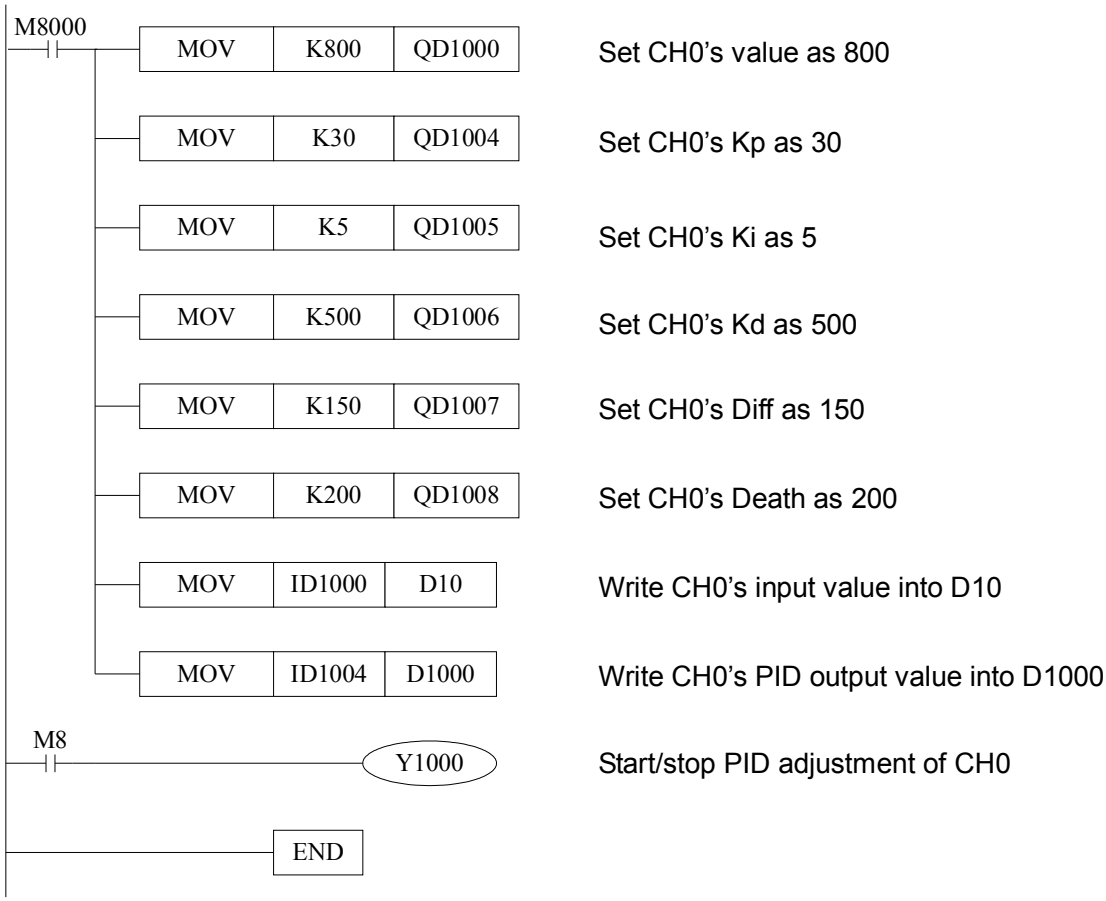
reference value could be beyond the bound.

2.7 Application of PID Output Value

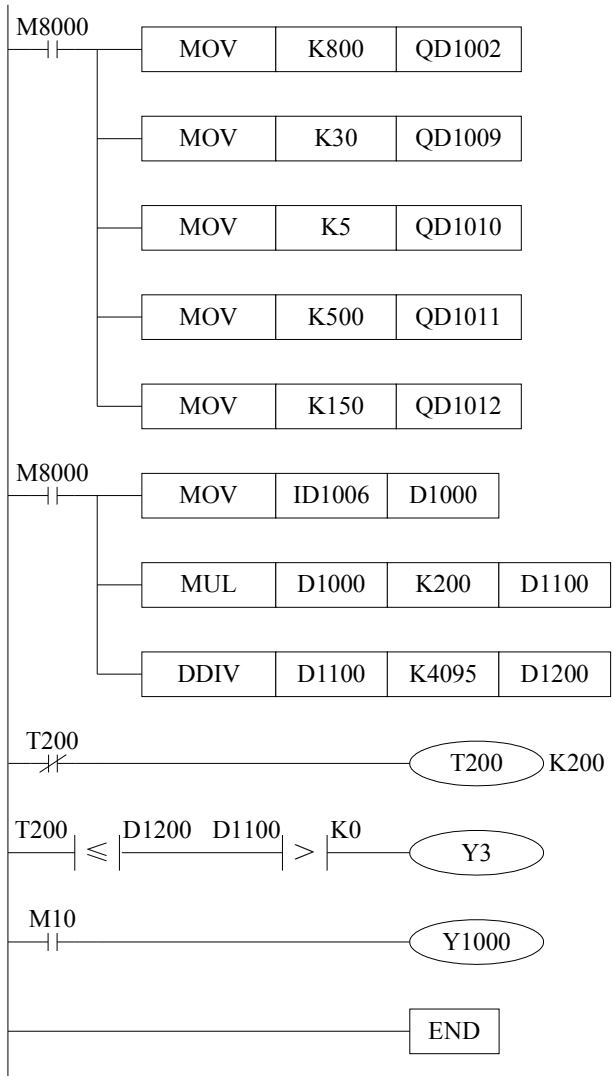
When carry on PID adjustment, this BD board heat with the cycle of 2 second. According to the comparison of PID output value (Channel 1 ID1004、channel 2 ID1005) and 4095, open and cut of heating form different high-low level ratio. Assume the output value of PID is X (0≤X≤4095). In the heating cycle of 2s, heat at 2X/4095 second. Stop heat at (2 - 2X/4095) second.

2.8 Program

E.g.1) Real time read the AD value of CH0, then carry on PID parameters setting with CH0, then read the PID output value.



E.g.2) PID temperature control example



Set CH2's value as 800 (80 degrees)

Set CH2's Kp as 30

Set CH2's Ki as 5

Set CH2's Kd as 500

Set CH2's Diff as 150

Convert PID output value (0~4095) to be value of 0~200

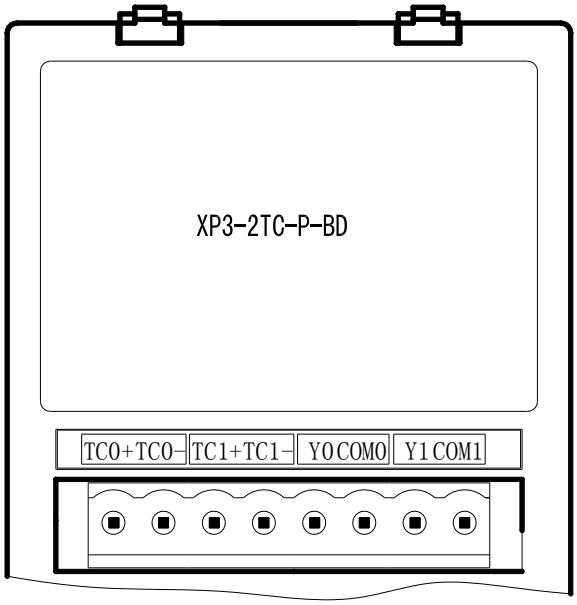
T200 is 10ms timer

Via ON/OFF of Y3, carry on PID temperature adjustment

Stop/start CH2

3. K type thermocouple temperature PID control board XP3-2TC-P-BD

3.1 Specifications



- Analog input used by thermocouple (K type) temperature sensor
- 2 channels input, 2 channels output
- 2 groups PID parameters
- Hide cold terminal compensate circuit inside
- Distinguish ratio precision is 0.1℃

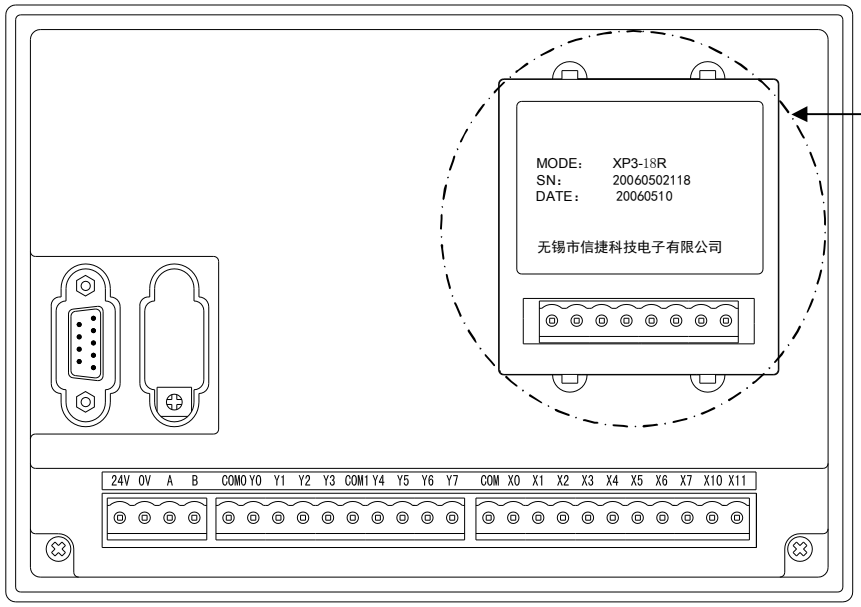
3.2 General Specification

Item	Content
Analog Input Signal	Thermocouple K type
Input Points	2 points
Temperature Testing Bound	0℃~970℃
Digital Output Bound	0~9700, 16 bits binary
Output Points	2 points
Output Format	NPN collector open circuit transistor output
Control Precision	0.4℃
Distinguish Ratio	0.1℃
Synthesis Precision	±0.8%（Relative max value）
Convert Speed	45ms×2 routes
Analog Power	DC24V±10%,50mA

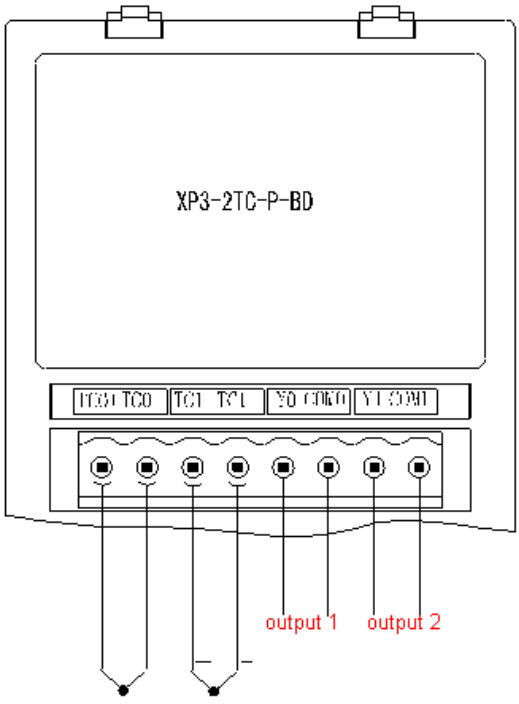
3.3 External Installation and Connection

1）Install Method of Expand Board:

Open the expand cover behind XP3 (See the following graph), then install according to the pin and fix with screws. Close the cover to finish.



2) Connection Method



- Output terminals

  Transistor output terminals, please choose DC5V~30V smooth power.

- Circuit insulation

Between programmable controller's interior circuit and output transistor, use optical coupling device to insulate. Each public module is divided separately

- Response time

  The time from PLC drive optical coupling device to transistor ON/OFF is not more than 0.2ms.

- Output current

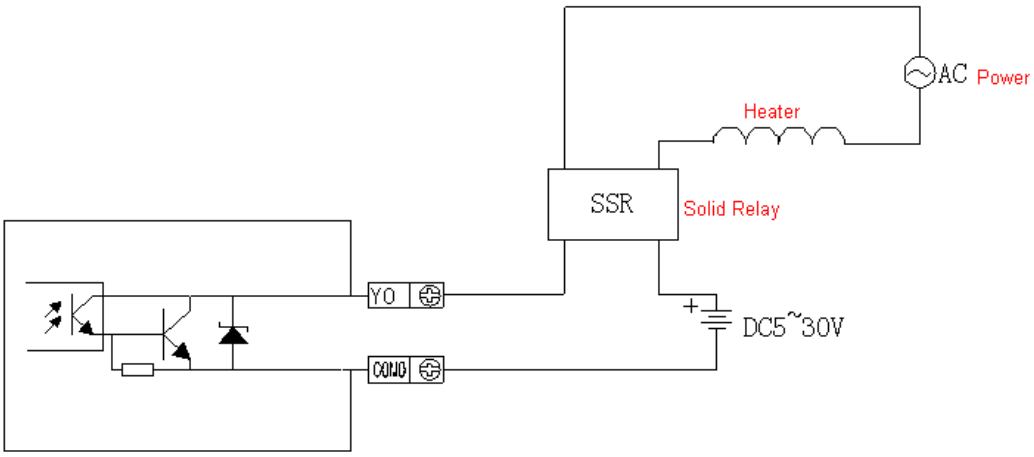
  Each point's current could be 0.8A, but to restrict temperature increasing, please use as 1.2A per 4 points or 2.0A per 8 points.

- Open circuit leak current

  Below 0.1mA.

The output current is the following:

The Output Current is Shown Below:



3.4 The Assignment of I/O ID

This BD expansion does not engross I/O unit, the converted data is directly sent into PLC register, also add two extra output points. Extra outputs do not conclude normal system's I/O output. Channel's correspond PLC register ID is:

Channel	Current Temperature	Set Temperature	Kp	Ki	Kd	Diff	Start/stop
0CH	ID1000	QD1000	QD1001	QD1002	QD1003	QD1004	Y1000
1CH	ID1001	QD1005	QD1006	QD1007	QD1008	QD1009	Y1001

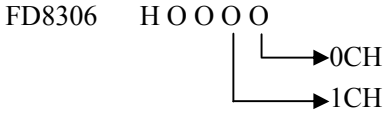
Note:

1) Kp: proportion parameter；Ki: integral parameter; Kd：differential parameter; Diff：control proportion band.
2) Control coil's status (Y1000/Y1001): 0：means close PID control；1：means start PID control.

3) Expansion input has voltage 0~5V/0~10V these two modes and filter form to select. Set via set the 4 channels' mode, each register has 16 bits. From low bit to high bit, each 4 bits set one channel's mode

3.5 Setting of the Working Mode

1) Set the expansion's working mode via special FLASH data register FD8306 in PLC. Refer to the graph by the right, each register has 16 bits, from low bit to high bit, every 4 bits confirm 1 channel's mode



2) Temperature Control Cycle

Temperature Control Cycle: When carry on PID adjustment, the output terminals carry on heating according to the duty cycle got by PID output value, this period is called Temperature Control Cycle

CH1				CH0			
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
-	-	-	0:2 Sec.	-	-	-	0:2 Sec.
			1:20 Sec.				1:20 Sec.

3) Control Specialty

Usage of Four Parameters: Proportion parameter (Kp)、integral parameter (Ki)、differential parameter (Kd)、control proportion band (Diff)

Parameter P is proportion parameter，mainly reflect system's wrap, when system wrap appears, carry on control immediately to decrease the wrap.

Parameter I is integral parameter, mainly used to remove net difference, improve the system's no-difference degree

Parameter D is differential parameter, mainly used to control signal's change trend, decrease system's shake.

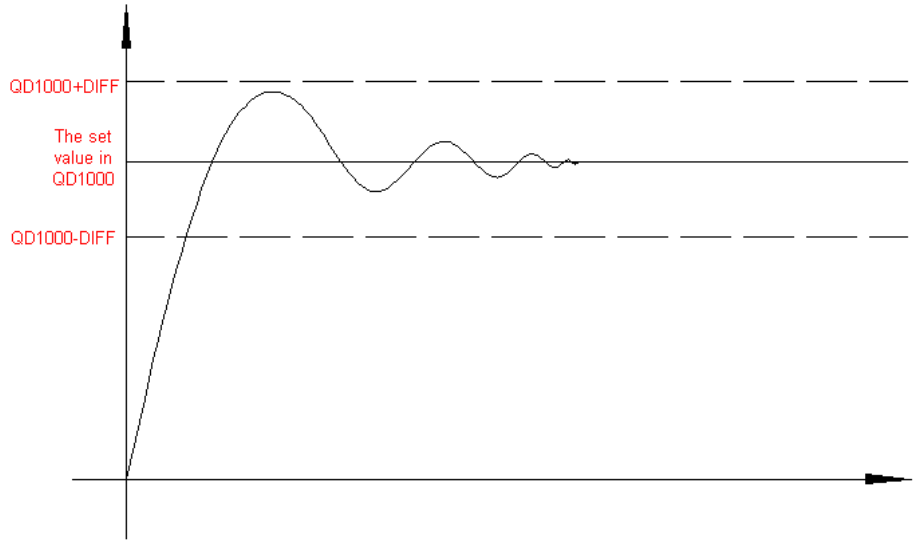
Temperature Control Band Means: in the assigned bound, carry on PID control，beyond the bound, do not carry on PID control.

Temperature Control Cycle: When carry on PID adjustment, the output terminals carry on heating according to the duty cycle got by PID output value, this period is called Temperature Control Cycle

4) Control Specialties

The bound of carry on PID adjustment is: (QD-Diff，QD+Diff), when temperature is low than QD-Diff, controller go on heating, when temperature is higher than QD+Diff, controller stop heating.

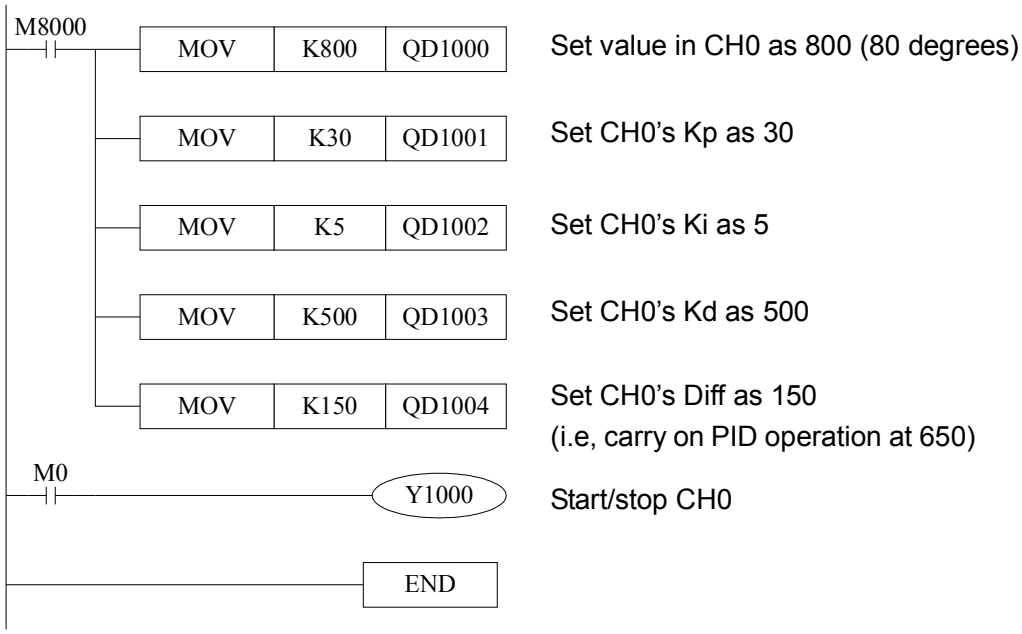
The Control Curve of PID is Shown Below:



Each parameter's reference value：Kp=20~100；Ki=5~20；Kd=200~500；DIFF=100~200；
This reference value only for normal condition，according to the locale detail condition, each reference value could be beyond the bound.

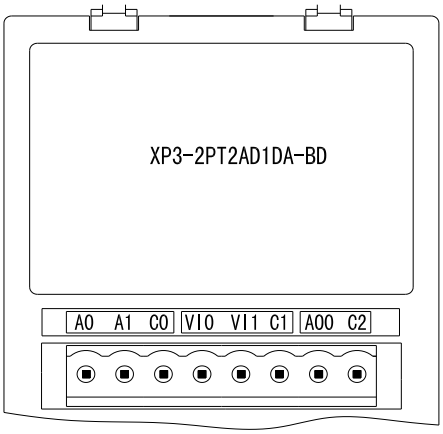
3.6 Program

Program with CH0



4. Analog and Temperature Sampling Board XP3-2PT2AD1DA-BD

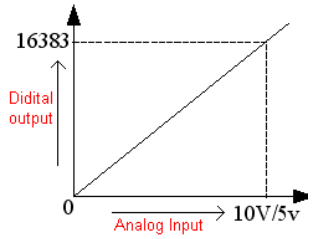
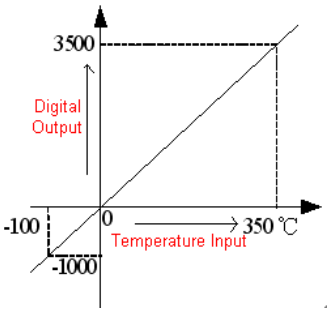
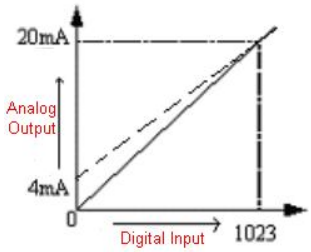
4.1 Specifications



- 14 bits high precision analog input
- 10 bits high precision analog output
- 2 channels voltage 0~10V、0~5V (selectable) analog input
- 2 channels PT temperature testing resistor (Pt100 2-line format) temperature sensor

4.2 General Specification

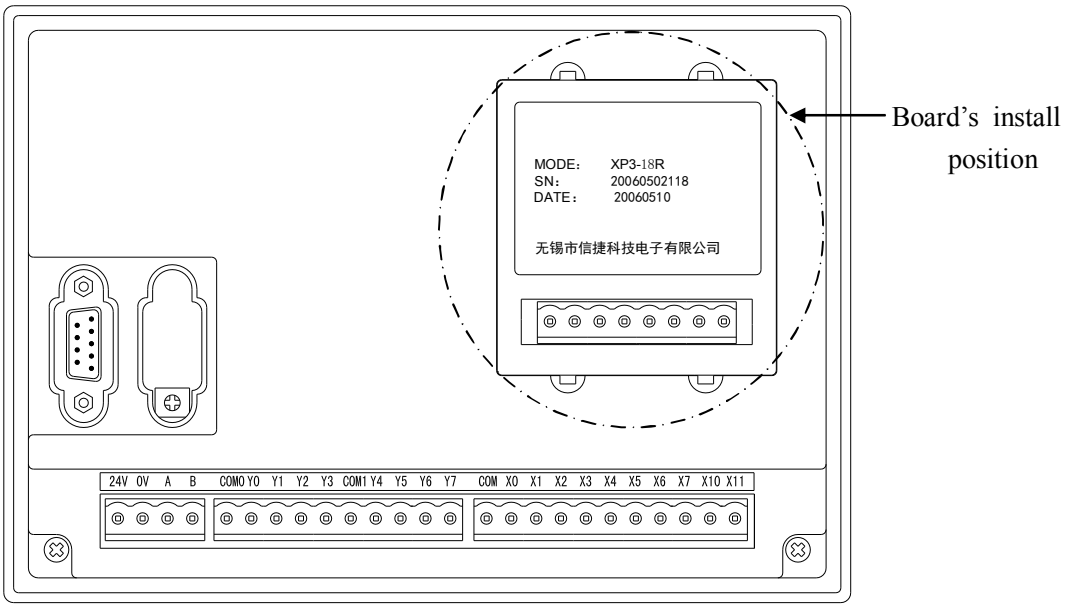
Item	Voltage Input	Temperature Input	D/A output
Analog Input Signal	DC0~5V、0~10V (Input Resistor 300kΩ)	Platinum resistor Pt100 (2 line from)	—
Digital Input Bound	—	—	10 bits Binary (0～1023)
Analog Output Bound	—	—	0～20mA、4～20mA
Temperature Testing Bound	—	-100~350℃	—
Distinguish Ratio	0.15mV（10/16383）	0.1℃	1/1023
Digital Output Bound	0~16383	-1000~3500	—
Integrate Precision	±0.8% of the full scale		
Convert Time	15ms×4 channels		
PID output value	0~K4095		

Vacant defaulted value	0	3500	—
Input/Output Specialty			
Insulation	No insulation among PLC's each channel		
Engrossed I/O	0 point (because it is operated via data register, so it is not limited by master PLC's standard I/O control points)		

4.3 External Installation and Connection

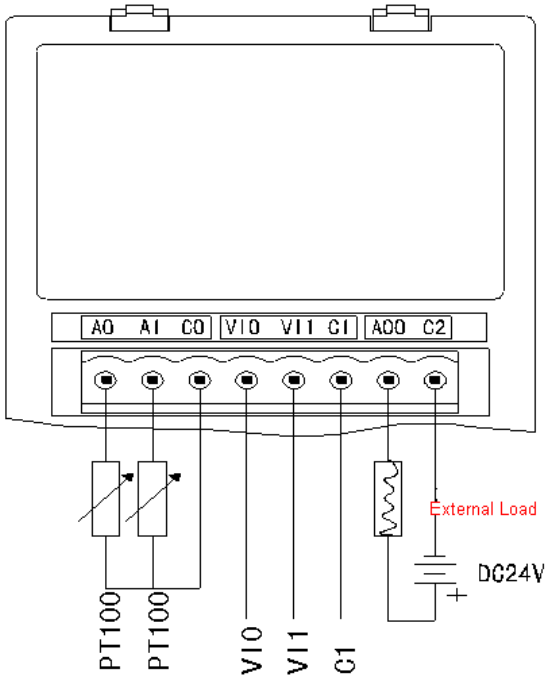
1) Installation method of the expansion board:

Open the board's cover at the back of XP3 (As shown in the following graph), then install it according to the pin arrangement. Then fix it with screws, close the cover.



2) Connection format：As showed in the following graph:

Note: Module's 0~20mA or 4~20mA output need 24V power supplier from outside. According to the QD value, the module adjusts the signal's current. However, the model itself doesn't generate current.



4.4 Assignment of input ID

This BD board does not engross I/O units, the converted data will directly send into PLC register. The channel's correspond PLC register ID is:

Channel	0CH	1CH	2CH	3CH
AD signal/Temperature value	ID1000	ID1001	ID1002	ID1003
PID output value	ID1004	ID1005	ID1006	ID1007
Set the target value	QD1001	QD1002	QD1003	QD1004
D/A Output Value	QD1000			
Kp	QD1005		QD1009	
Ki	QD1006		QD1010	
-Kd	QD1007		QD1011	
Diff	QD1008		QD1012	
Death	--		QD1013	
Start/Stop	Y1000	Y1001	Y1002	Y1003

Note:

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

2) Kp: proportion parameter; Ki: Integral parameter; Kd: Differential parameter; Diff: Control bound

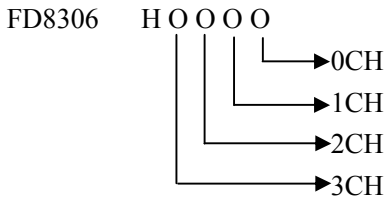
Control bound (Diff): carry on PID control in the assigned bound; beyond the bound, don't carry on PID control

Start Signal (Y): Close PID control when Y is 0, open PID control when Y is 1

Death Bound (Death)：Compare the current PID output value with the preceding PID output value. If their difference is less than the set death bound, the module will abandon the current PID output value, still transfer the preceding PID output value to PLC main unit.

4.5 Setting of Working Mode

1) Expansion's input has voltage 0~5V、0~10V these two modes and filter form to select. Set via special FLASH data register FD8306 in PLC. Refer to the graph by the right, each register set the 4 channels' mode, each register has 16 bits. From low bit to high bit, each 4 bits set one channel's mode



Register FD8306:

CH 1				CH 0			
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
00：1/2 filter 01：not filter 10：1/3 filter 11：1/4 filter		-	-	00：1/2 filter 01：not filter 10：1/3 filter 11：1/4 filter		-	-
CH 3				CH 2			
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
00：1/2 filter 01：not filter 10：1/3 filter 11：1/4 filter		-	0:0~10V 1:0~5V	00：1/2 filter 01：not filter 10：1/3 filter 11：1/4 filter		-	0:0~10V 1:0~5V

2) Output channel's mode setting value is stored in register FD8307 (Low bit), it's definition is shown below:
Register FD8307：

-				D/A channel			
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
00：1/2 filter 01：not filter 10：1/3 filter 11：1/4 filter		-	-	00：1/2 filter 01：not filter 10：1/3 filter 11：1/4 filter		-	0：0~20mA 1：4~20mA
-				-			
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
-		-	-	-		-	-

Parameter D is differential parameter, mainly used to control signal's change trend, decrease system's shake.
Temperature control proportion band means: in the assigned bound, carry on PID control，beyond the bound, do not carry on PID control.

3) Control features
The bound of carry on PID adjustment is:（QD-Diff，QD+Diff），when temperature is low than QD-Diff, controller go on heating, when temperature is higher than QD+Diff，controller stop heating.

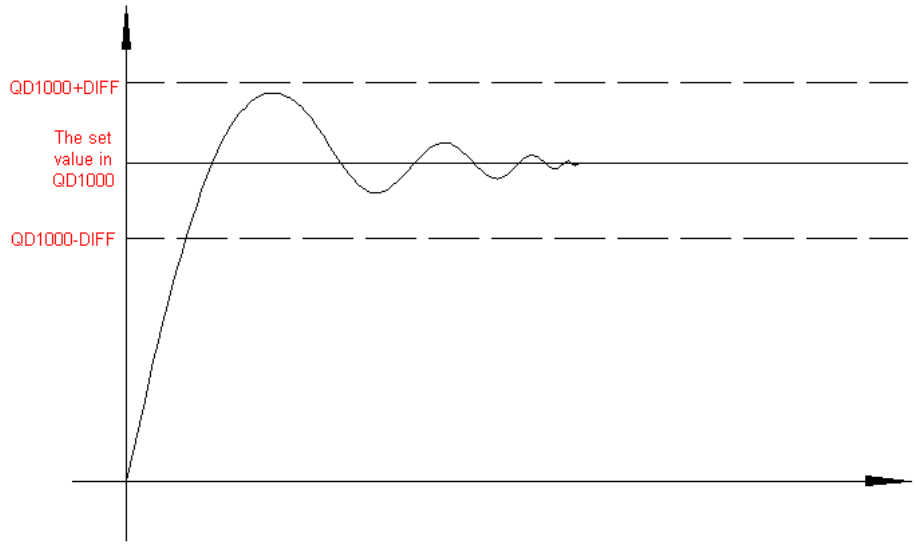
4.6 Control Specialties

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

Parameter P is proportion parameter，mainly reflect system's wrap, when system wrap appears, carry on control immediately to decrease the wrap.
Parameter I is integral parameter, mainly used to remove net difference, improve the system's no-difference degree
Parameter D is differential parameter, mainly used to control signal's change trend, decrease system's shake.
Temperature control band means: in the assigned bound, carry on PID control，beyond the bound, do not carry on PID control.

2) Control Specialties
The bound of carry on PID adjustment is: (QD-Diff，QD+Diff), when temperature is low than QD-Diff, controller go on heating, when temperature is higher than QD+Diff, controller stop heating.

PID temperature control curve is shown below:

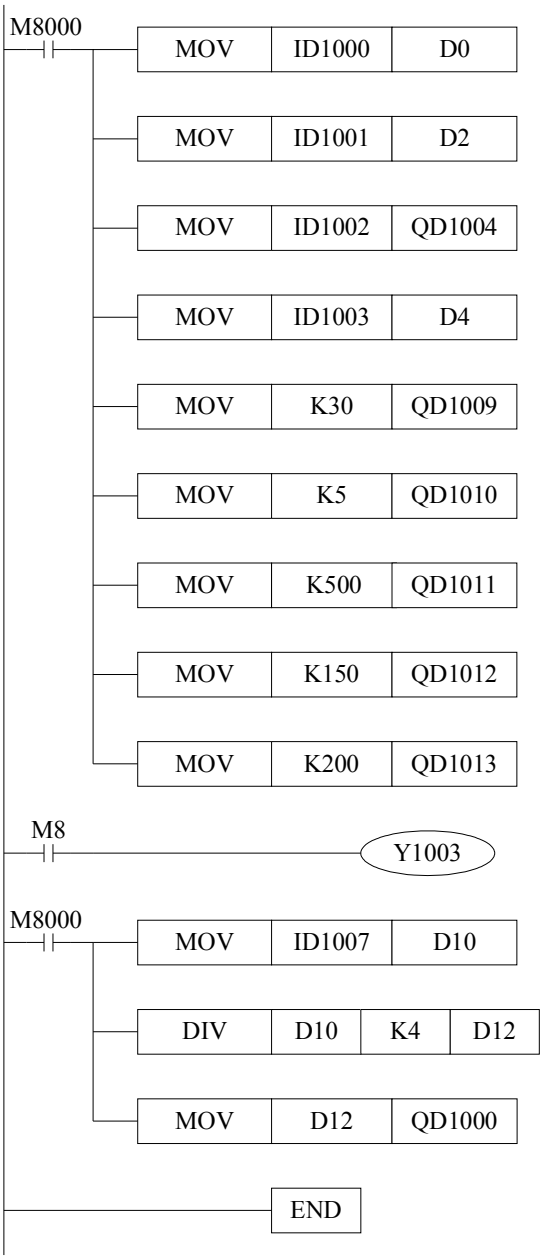


Each parameter's reference value：Kp=20~100；Ki=5~20；Kd=200~500；DIFF=100~200；This reference value only for normal condition，according to the locale detail condition, each reference value could be beyond the bound.

4.7 Program

E.G.: Use the water pump's rotation speed to control the pipe's water pressure. 2 channels temperature input (ID1000、ID1001). Via a potentiometer, set a pressure value (ID1002). From the pipe, test a pressure feedback value (ID1003). According to the pressure setting value and the pipe's feedback pressure value, via PID operation, output an analog signal (QD1000). Use this analog signal to control the inverter's speed, then realize controlling the pipe's pressure. In this way, it will form a closed loop of control system.

Program& correspond description:



Write channel 0 (input temperature) into D0

Write channel 1 (output temperature) into D2

Treat CH2 (Pressure setting 0~10V) as the set value in

Write CH3 (Pressure Feedback) into D4

Set AD Channel's Kp as 30

Set AD Channel's Ki as 5

Set AD Channel's Kd as 500

Set AD Channel's Diff as 150

Set AD Channel's Death as 200

Start/stop PID adjustment of CH3

Write PID output value of CH3 into D10

Change PID output bound from 0~4095 as

Convert PID output to be 0~10V output, to control inverter's rotation speed

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