XP3-BD series HARDWARE MANUAL

XP3-2AD2PT-BD	14 bits input, 2 channel voltage 0/10-0/15 2 channel T temprature testing
XP3-2TC-P-BD	2 channel input, 2 channel output 2 groups of PID parameter
XP3-2PTAD1DA-BD	14 bits high precision analog input 10 bits high precision analog output 2 channel voltage 0/10V or 0/5V

XP3-BD User Manual

Index

Page

Chapter 1 **Configuration of the BD-Board**
1-1 Configuration 3

Chapter 2 **AI and temperature sampling board XP3-2AD2PT-BD**
2-1 General 5
2-2 Specs 6
2-3 External installations and connections 7
3-4 Assignment of input ID 8
2-5 Working Mode settings 9
2-6 Control settings 10
2-7 Application of PID output value 10
2-8 Programs 11

Chapter 3 **K type thermo coupling temperature PID board XP3-2TC-P-3D**
3-1 General 13
3-2 Specs 14
3-3 External installations and connections 15
3-4 Assignment of input ID 17
3-5 Working Mode settings 18
3-6 Control Speciality 19
3-7 Programs 20

Chapter 4 **Analogue AI/AO temperature sampling board XP3-2PT2ADIDA-BD**
4-1 General 21
4-2 Specs 22
4-3 External installations and connections 23
4-4 Assignment of input ID 24
4-5 Working Mode settings 25
4-6 Control Speciality 26
4-7 Programs 27

1 Configuration of the BD-Board

1-1. Configuration

1-1 Configuration

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)” (Image 1).
3. Click it, in the “Config BD Board(C)” dialog box, choose “Other BD” (Just as shown in graph and click “OK” to download the program.

Image 1

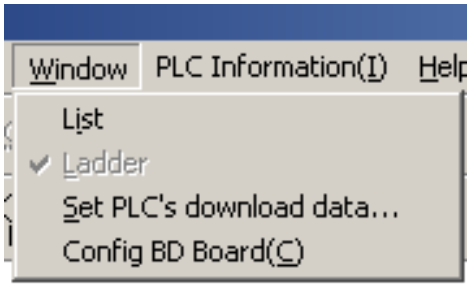
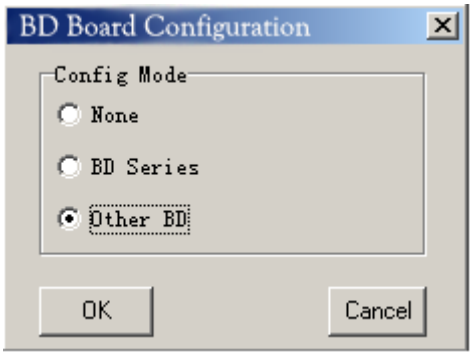


Image 2



2 AI and temperature sampling board XP3-2AD2PT-BD

2-1. General

2-2. Specs

2-3. External installations and connections

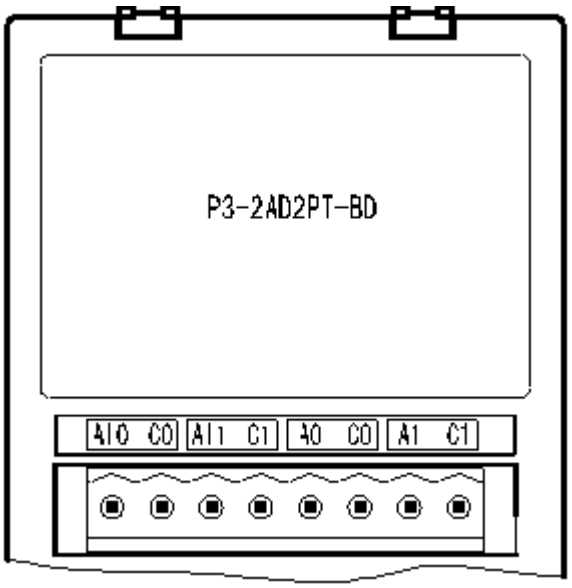
2-4. Assignment of input ID

2-5. Working Mode settings

2-6. Control settings

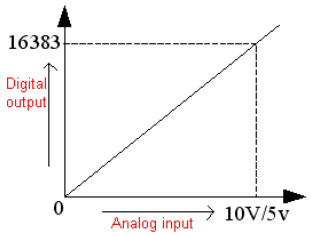
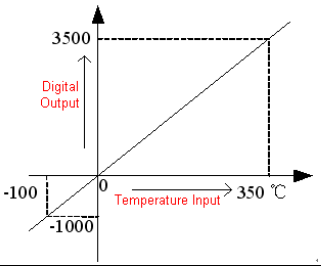
2-7. Application of PID output value

2-1 General



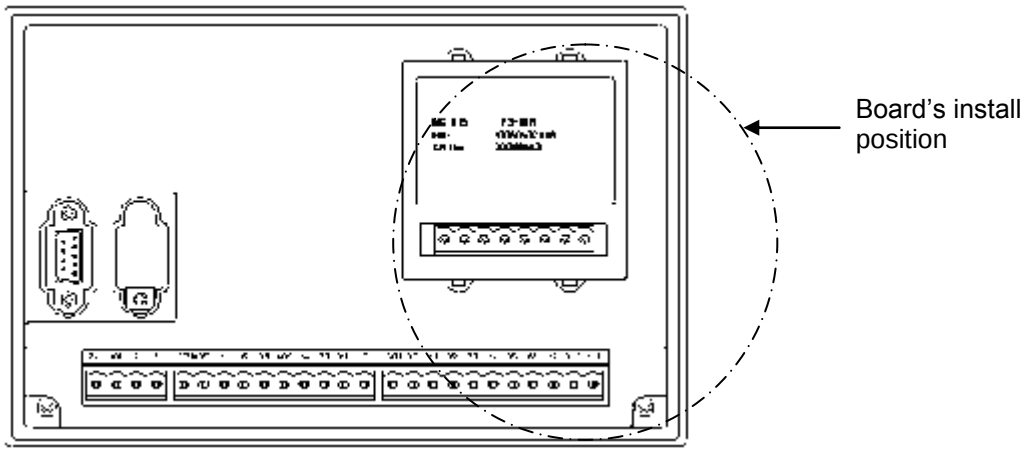
- 14 bits high precision analogue input.
- 2 Channel voltage 0/10V, 0/5V (selectable) analogue input.
- 2 channels PT temperature testing.
- resistor (PT100 two-wire format) temperature sensor analogue input.

2-2 Specs

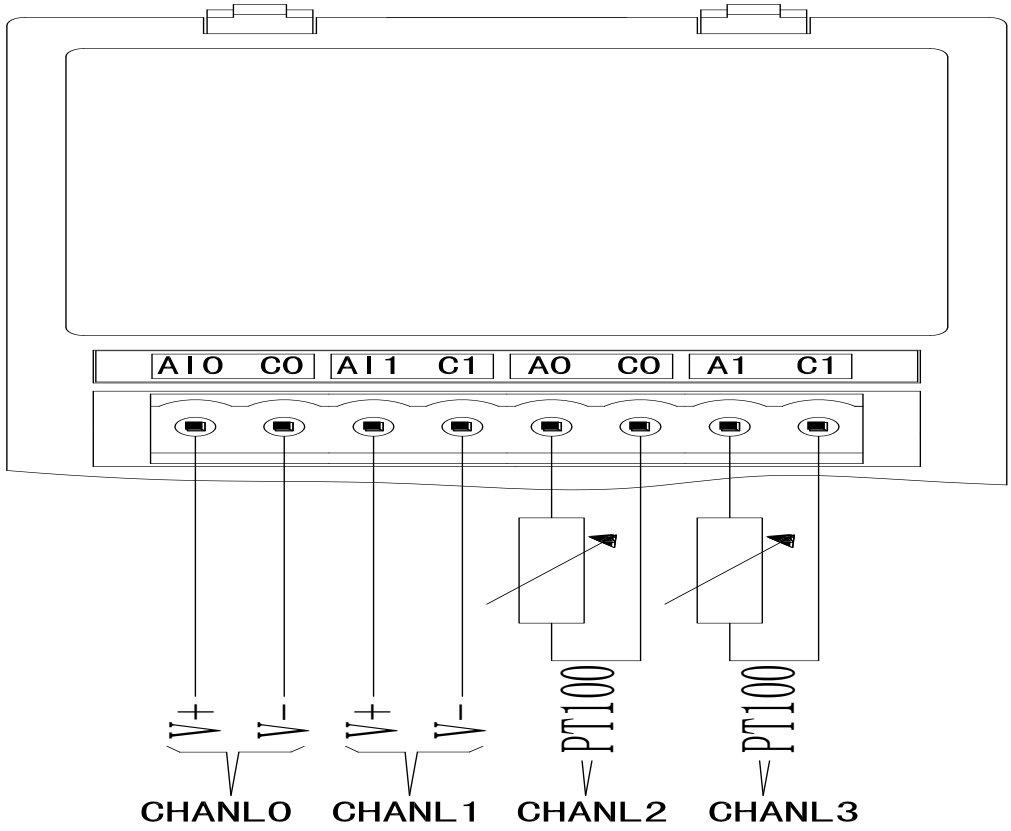
Item	Voltage Input	Temperature Input
Analogue Input Signal	DC: 0 to 5V, 0 to 10V (Input resistor 300kΩ)	Platinum Resistor PT100 (2-wire format)
Temperature Testing band	-	-100 to 350 degrees C
Resolution	0.15mV 10/16383	0.1
Digital Output band	0 to 16383	-1000 to 3500
Integrate Precision	±0.8% of full scale	
Convert Time	15ms × 4 channels	
PID Output Value	0 to K4095	
Vacant Defaulted Value	0	3500
Input Specialty		
Isolation	No isolation between each channel of PLC	
Used points	0 point (As operated via data register, so the used points are not limited by PLC's max control points)	

2-3 External installations and connections

1) The Installation of Board:
Open the board's cover at the back of XP3 (As shown in the following image); install it according to the pin arrangement. Then fix it with screws, close the cover.



2) Connection: See the following diagram



2-4 Assignment of input ID

This BD board does not use standard I/O units memory addresses, the converted data will be directly sent into PLC register. The channels correspond to the PLC register ID:

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	
Dead Band	QD1008		-	
Start/Stop	Y1000	Y1001	Y1002	Y1003

Note:

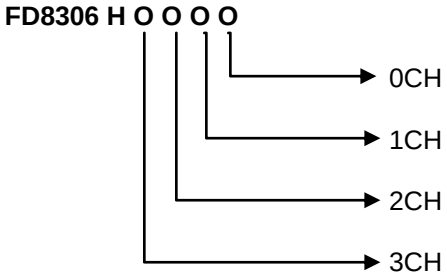
1. **PID value:** PID output value:0 to 4095.
2. **Kp:** proportion parameter
3. **Ki:** Integral parameter.
4. **Kd:** Differential parameter.
5. **Diff:** Control proportion band.
6. **Control coil's status:** Y1000/Y1001 (0 = means stop PID control, 1 = means run PID control

Description:

- 0CH and 1CH are AD input channels.
- 2CH and 3CH are PT100 input channels.
- Kp: proportion parameter.
- Ki: Integral parameter.
- Kd: Differential parameter.
- Diff: Control band.
- Control Band Diff: Carry on PID control in the assigned band, beyond the band, don't carry
- on PID control
- Start Signal (Y): PID control is closed when Y is 0, open PID control when Y is 1.
- Dead Band "Dead Band": Compare the current PID output value with the preceding PID
- output value. If their difference is less than the set Dead Band, the module will abandon the
- current PID output value; still transferring the preceding PID output value to PLC main unit.

2-5 Working Mode settings

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



2) Each channel's working mode is assigned by the four bits of the corresponding register, each bits 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		-	-

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

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

3. Parameter I is integral parameter, mainly used to remove net difference, improve the systems no-difference degree

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

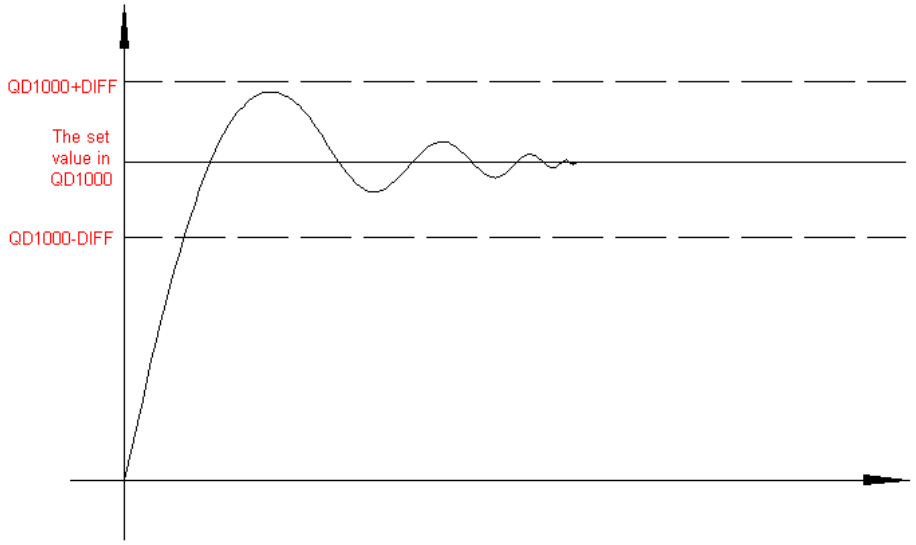
5. Temperature control proportion band means: in the assigned band, carry on PID control, beyond the band, do not carry on PID control.

2-6 Control settings

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

- **Parameter P** is the proportion parameter.
- **Parameter I** is the integral parameter.
- **Parameter D** is differential parameter
- **Temperature Control Band Means:** in the assigned band, to carry out PID control.

PID Temperature Control Curve is Shown Below:



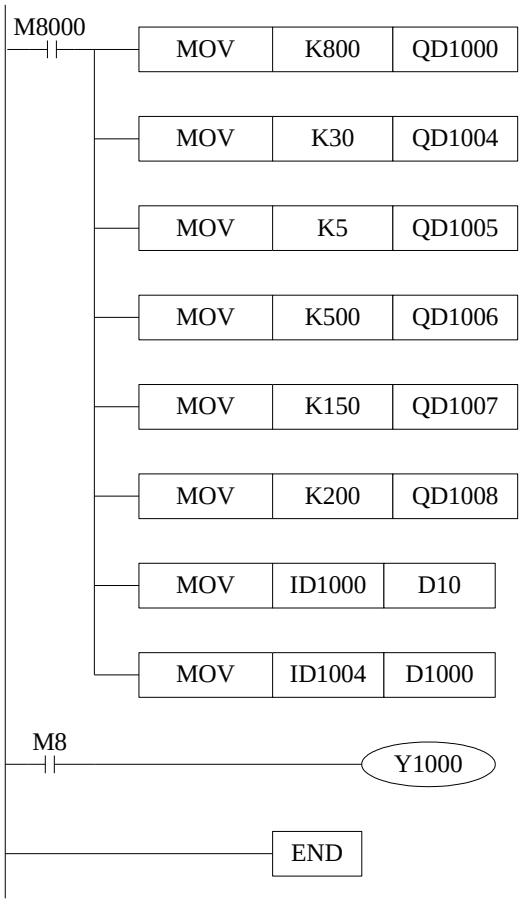
Note:
Each parameter's reference value: Kp=20/100, Ki=5/20, Kd=200~500, DIFF=100/200.
This reference value only for normal condition, according to the locale detail condition, each reference value could be beyond the band.

2-7 Application of PID output values

When using PID, the BD board will perform heating control with a cycle of 2 Seconds.
This modifies the output value based on the PID control.

2-8 Programs

E.g.1: Real time readings of the AD value of CH0, and then carries on PID parameters setting with CH0, then read the PID output value.



Set CH0's value as 800

Set CH0's Kp as 30

Set CH0's Ki as 5

Set CH0's Kd as 500

Set CH0's Diff as 150

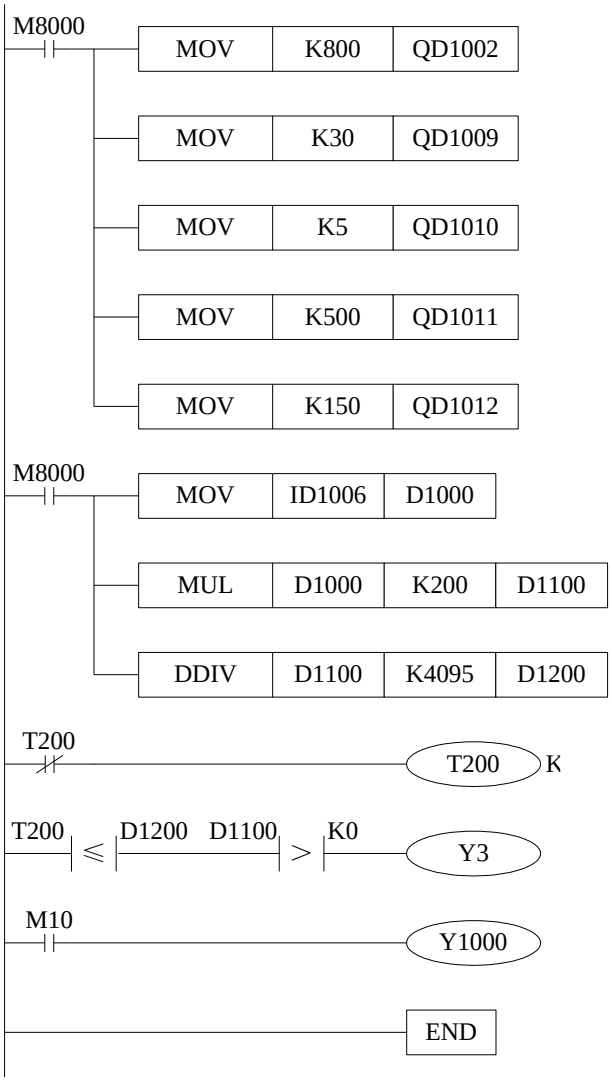
Set CH0's Death as 200

Write CH0's input value into D10

Write CH0's PID output value into D1000

Start/stop PID adjustment of CH0

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 thermo coupling temperature PID board XP3-2TC-P-3D

3-1. General

3-2. Specs

3-3. External installations and connections

3-4. Assign input/output ID

3-5. Working Mode settings

3-6. Control speciality

3-7. Programs

3-1 General

- Analogue input used by thermocouple (K type) temperature sensor
- 2 channels input, 2 channels output
- 2 groups PID parameters
- Cold terminal compensate circuit inside
- Resolution is 0.1

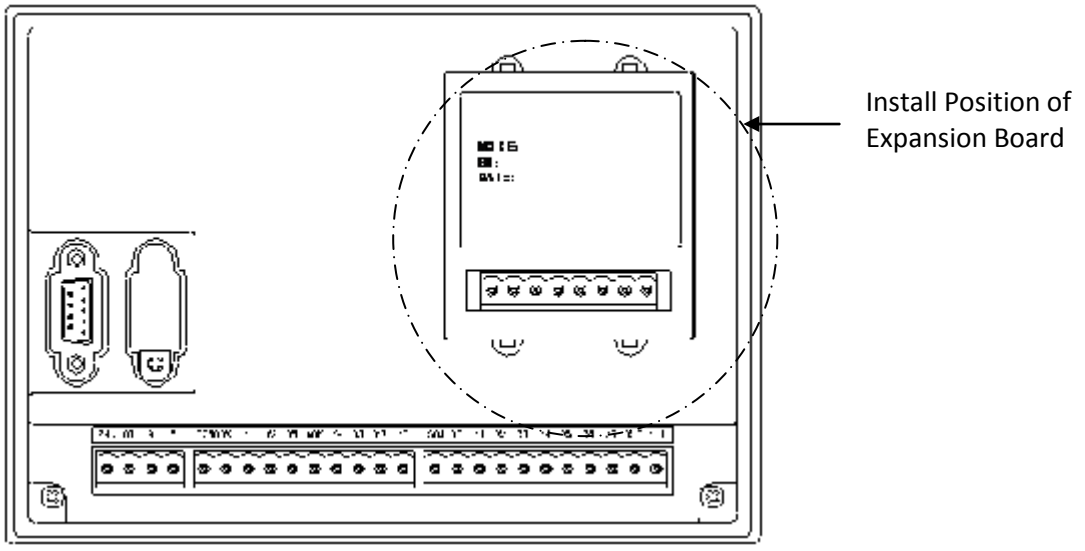
3-2 Specs

Item	Content
Analogue Input Signal	Thermocouple K type
Input Points	2 points
Temperature Testing Band	0 to 970°C
Digital Output Band	0~9700, 16 bits binary
Output Points	2 points
Output Format	NPN collector open circuit transistor output
Control Precision	0.4°C
Resolution	0.1°C
Synthesis Precision	±0.8% (Relative max value)
Conversion Speed	45ms × 2 channels
Analogue Power	DC24V±10%, 50mA

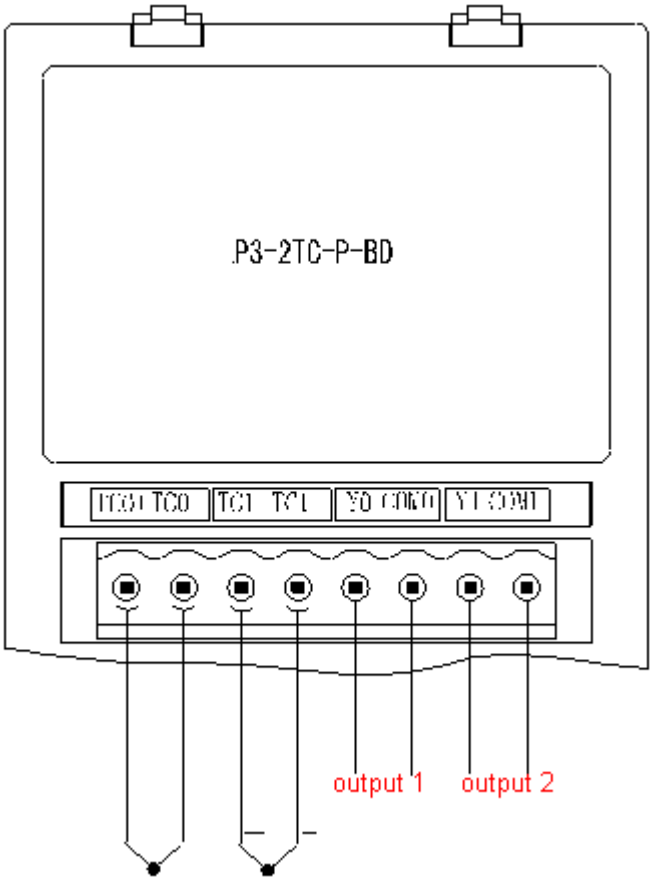
3-3 External installations and connections

Installation Method of Expand Board:

1. Open the expansion cover behind XP3 (See the following diagram), then install according to the pin and fix with screws.



2. Connection Method

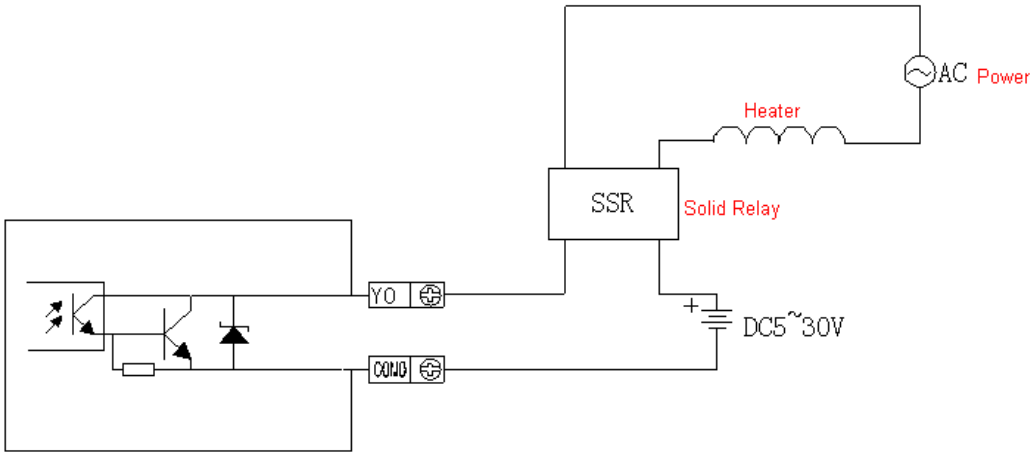


- Output terminals:
  Transistor output terminals - please choose DC5V to 30V-regulated power.

- 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
- Open circuit leakage current:
  Below 0.1mA
  The Output Current is Shown Below:



3-4 Assign input/output ID

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

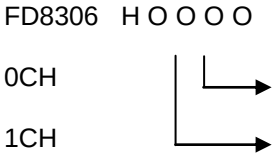
Channel	Current Temperature	Set Temperature	Kp	Ki	Kd	Diff	Start/stop
0CH	ID1000	QD1000	QD1001	QD1002	QD1003	QD1004	Y1000
1CH	ID1001	QD1005	QD1006	QD1007	QD1008	QD1009	Y1001

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's input has voltage 0/5V or 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 Working Mode settings

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.

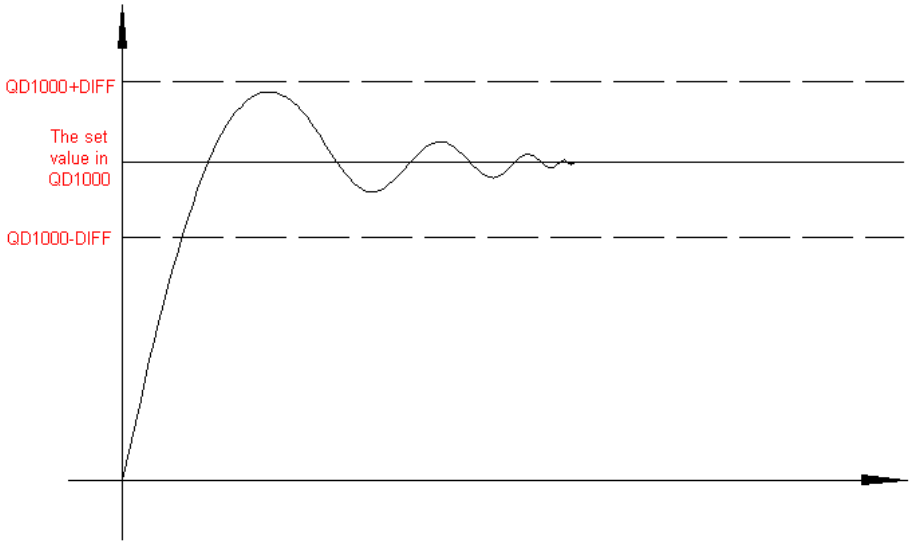
3-6 Control specialities

1. Usage of Four Parameters:
Proportion parameter (Kp), integral parameter (Ki), differential parameter (Kd), control proportion band (Diff)
Parameter P is the proportion parameter:
Parameter I is the integral parameter, mainly used to remove net difference.
Parameter D is the differential parameter, mainly used to control signal's change trend.
Temperature Control Band Means: in the assigned band, to carry out PID control, beyond the band does not carry out PID control.

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

3. Control Specialties:
The band of the PID adjustment is: (QD-Diff QD + Diff), when the temperature is lower than QD-Diff, controller goes on heating, when temperature is higher than QD + Diff, the controller will stop heating.

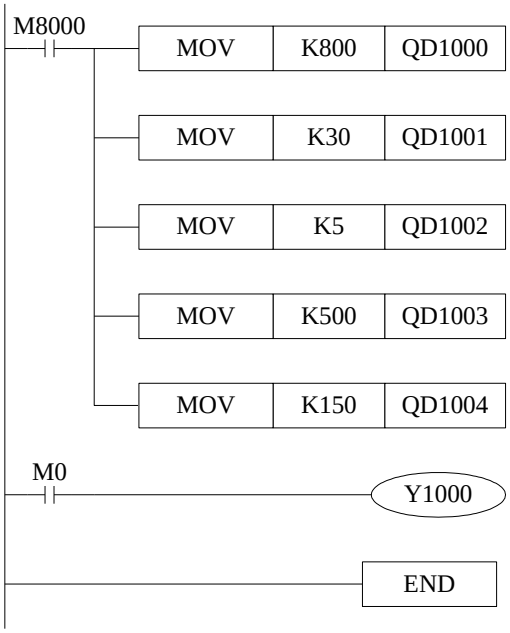
The Control Curve of PID is Shown Below:



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 band.

3-7 Programs

Program with CH0



Set value in CH0 as 800 (80 degrees)

Set CH0's Kp as 30

Set CH0's Ki as 5

Set CH0's Kd as 500

Set CH0's Diff as 150
(i.e., carry on PID operation at 650)

Start/stop CH0

4 Analogue AI/AO temperature sampling board XP3-2PT2ADIDA-BD

4-1. General

4-2. Specs

4-3. External installations and connections

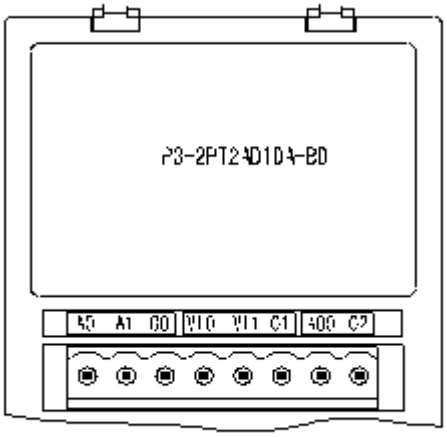
4-4. Assignment of input ID

4-5. Working Mode settings

4-6. Control settings

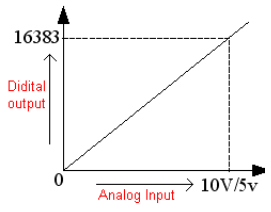
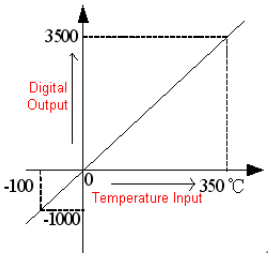
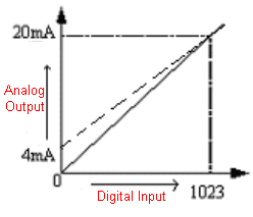
4-7. Programs

4-1 General



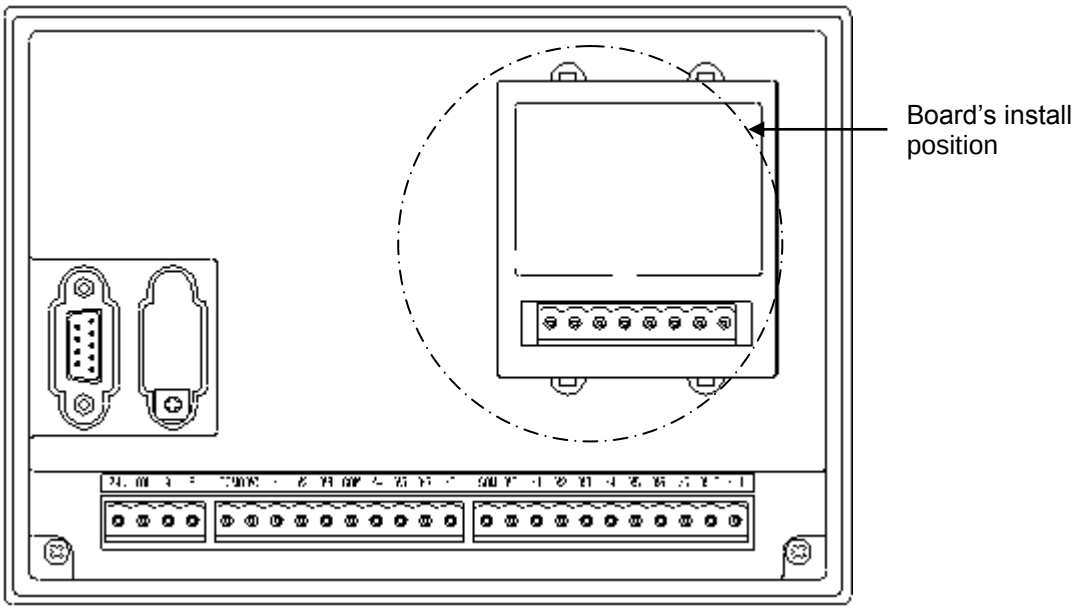
- 14 bits high precision analog input
- 10 bits high precision analog output
- 2 channels voltage 0/10V or 0/5V (selectable) analog input
- 2 channels PT temperature testing resistor (PT100 2-wire format) temperature sensor analog input

4-2 Specs

Item	Voltage Input	Temperature Input	D/A output
Analogue Input Signal	DC: 0to 5V, 0 to 10V (Input Resistance 300kΩ)	Platinum resistor PT100 (2-wire format)	
Digital Input band			10 bits Binary (0/1023)
Analogue Output band			0/20mA, 4/20mA
Temperature Testing band		-100 to 350°C	
Distinguish Ratio	0.15mV 10/16383	0.1ºC	1/1023
Digital Output band	0 to 16383	-1000 to 3500	
Integrate Precision	±0.8% of the full scale		
Conversion Time	15ms × 4 channels		
PID output value	0 to K4095		
Vacant defaulted value	0	3500	—
Input/output Specialty			
Isolation	No isolation among PLC's each channel		
Used 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)		

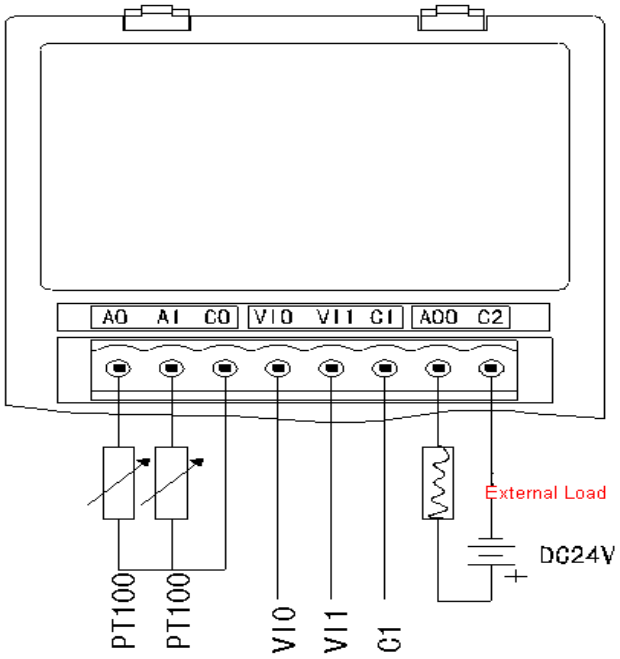
4-3 Extension installations and connections

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



2. Connection format: As shown in the following graph:

Note:
Module's 0/20mA or 4/20mA output needs 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 use I/O units, the converted data will be sent directly into the PLC register. The channel's 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	QD1001	QD1002	QD1003	QD1004
D/A Output Value	QD1000			
Kp	QD1005		QD1009	
Ki	QD1006		QD1010	
Kd	QD1007		QD1011	
Diff	QD1008		QD1012	
Dead Band	--		QD1013	
Start/Stop	Y1000	Y1001	Y1002	Y1003

Note:

1. Both 0CH and 1CH are PT input channels; 2CH and 3CH are AD input channels
2. **Kp:** proportion parameter
3. **Ki:** Integral parameter
4. **Kd:** Differential parameter
5. **Diff:** Control band

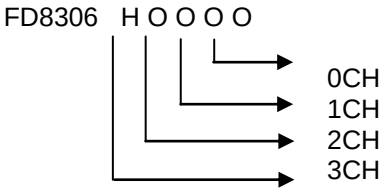
Control band

6. **(Diff):** Carry on PID control in the assigned band;
7. **Start Signal** (Y): Close PID control when Y is 0, open PID control when Y is 1
8. **Dead Band (Dead Band):** Compare the current PID output value with the preceding PID output value. If their difference is less than the set Dead Band, the module will not use the current

PID output value and will transfer the preceding PID output.

4-5 Working mode settings

1) Expansion's input cards have 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' modes, 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); its definition is

shown below:
Register FD8307:

-				D/A channel			
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
meter 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 the differential parameter.

Temperature control proportion band: in the assigned band, and will carry on PID control.

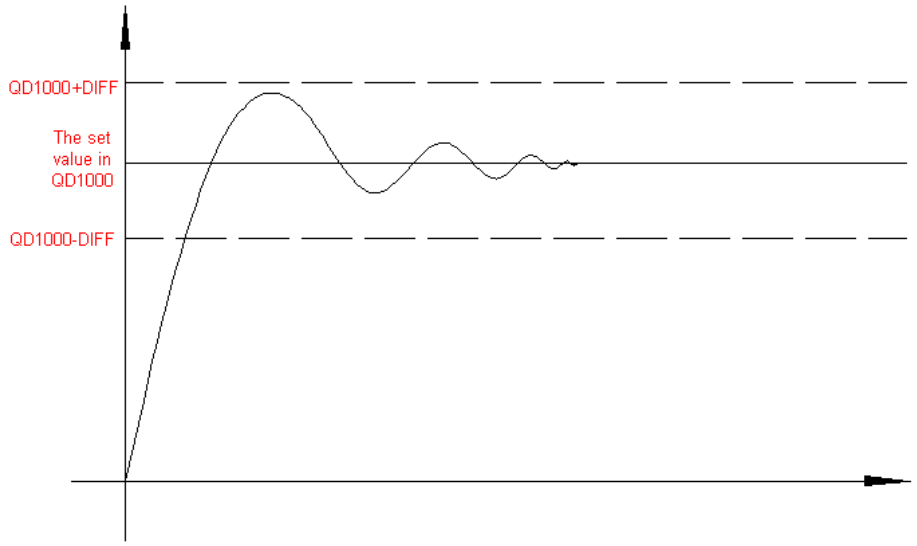
4-6 Control specialities

1. **Usage of Four Parameters:** Proportion parameter (Kp), integral parameter (Ki), differential parameter (Kd), control proportion band (Diff).
Parameter P is the proportion parameter.
Parameter I is the integral parameter, mainly used to remove net difference.
Parameter D is the differential parameter, mainly used to control signal's change trend.
Temperature Control Band Means: in the assigned band, to carry out PID control, beyond the band does not carry out PID control.

2. **Temperature Control Cycle:** When carrying out PID adjustment, the output will carry on heating according to the duty cycle got by PID output value, this period is called *Temperature Control Cycle*

3**. Control Specialties:** The band of the PID adjustment is: (QD-Diff QD + Diff), when the temperature is lower than QD-Diff, controller goes on heating, when temperature is higher than QD + Diff, the controller will stop heating.

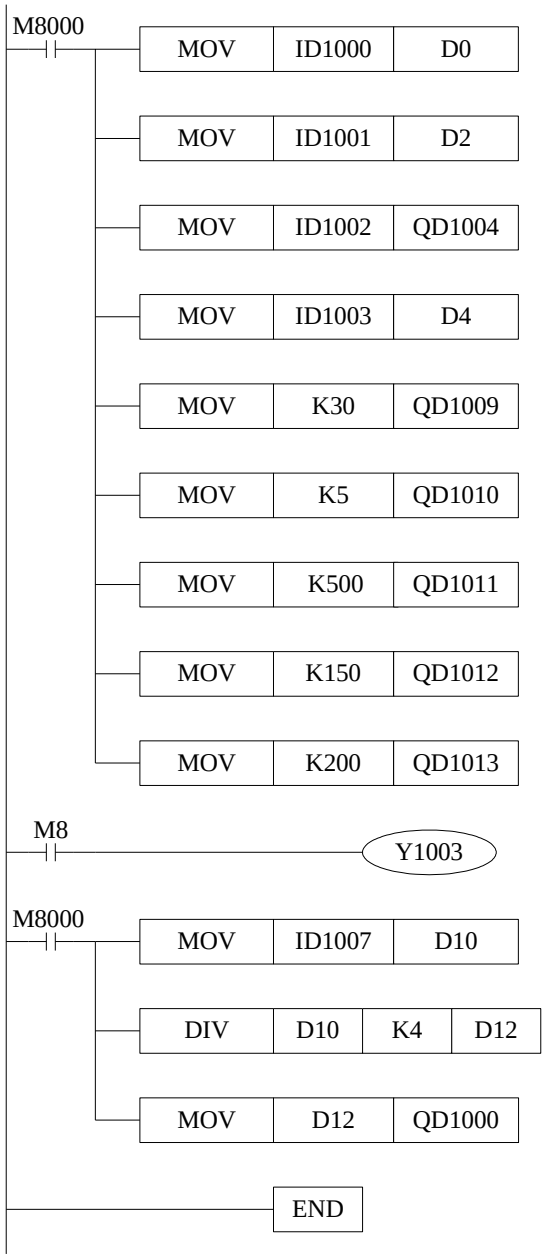
The Control Curve of PID is Shown Below:



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 band.

4-7 Programs

The following example is a sample Program & corresponding 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 CH3

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 Dead band as 200

Start/stop PID adjustment of CH3

Write PID output value of CH3 into D10

Change PID output range from 0/4095 as 0/1023

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

Documentation Reference				
Document Number				Revision Date
MANU	L008	R2	V1	05/07/2011
XINJE IS A REGISTERED TRADEMARK OF XINJE ELECTRICAL CO.LTD. REPLICATION OF THE INFORMATION CONTAINED WITHIN THIS DOCUMENT WITHOUT PRIOR NOTIFICATION AND AGREEMENT IS PROHIBITED.				

Engineered and supplied by:

International partners with:

Web: www.listo-ltd.com
www.xinje-support-centre-listo.com

E-mail: support@listo-ltd.com

Please consider the environment before printing this document