

# Rockhood Automation

**XC** series expansions with special functions

**Operate Manual**



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## I、Module's information

### 1、Basic Characteristic

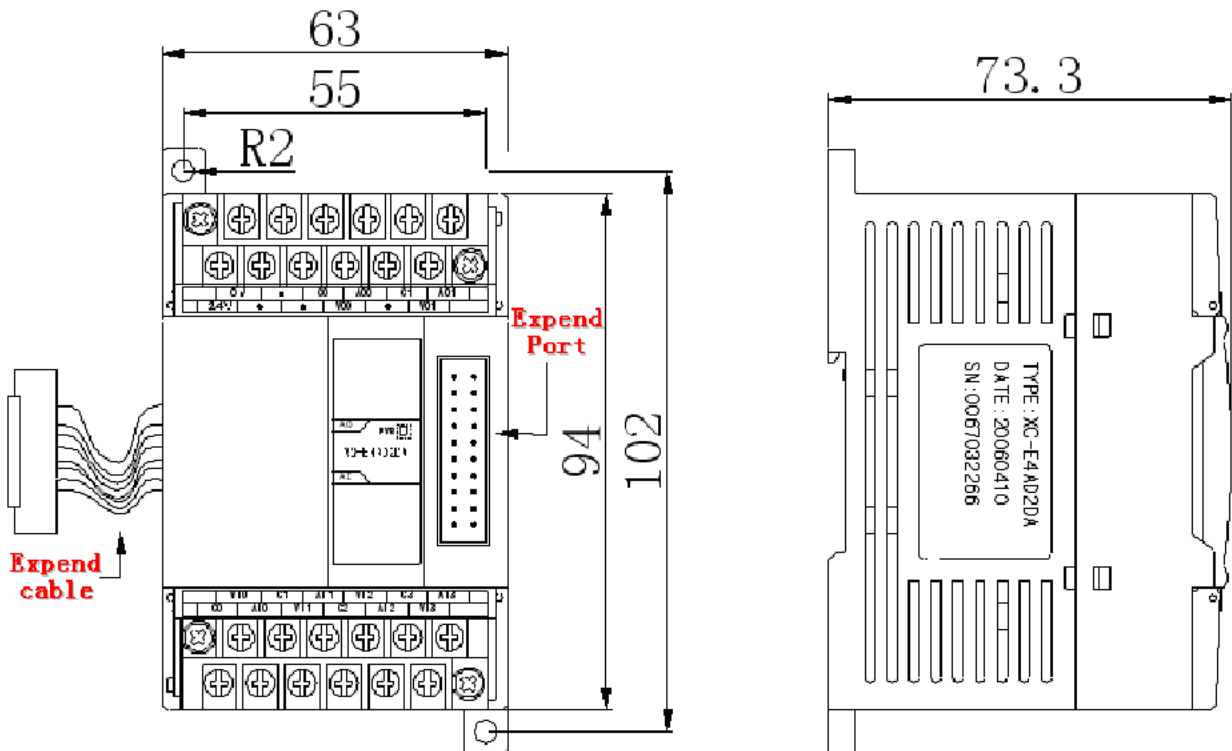
XC series PLC have not only strong functions of logic dispose、data operation、high speed disposing etc. but also functions of A/D、D/A convert、PID adjustment; With using expansions of analog input module、analog output module、temperature control module etc, XC series PLC are widely used in the control system of temperature、flow、liquid level、pressure.

### 2、Module's Name

The detailed information is the following:

Model	Function
XC-E8AD	8 channels analog input (14bit); 4 channels current input, 4 channels voltage input
XC-E4AD2DA	4 channels analog input (14bit); 2 channels analog output (12bit); current、voltage selectable
XC-E4DA	4 channels analog output (12bit); current、voltage selectable
XC-E6PT-P	-150°C~350°C, 6 channels Pt100 temperature sampling, 0.1 degree precision, include PID operation
XC-E6TC-P	0°C~1000°C, 6 channels K type thermocouple temperature sampling module, 0.1 degree precision, include PID operation

### 3、Exterior Size



#### 4、General Specification

Operating Environment	No Canker gas
Ambient Temperature	0°C~60°C
Store Temperature	-20~70°C
Ambient Humidity	5~95%
Store Humidity	5~95%
Installation	Can be fixed with M3 screws or directly installed on orbit of DIN46277 (width: 35mm)
Size	63mm×102mm×73.3mm

#### 5、Items to note when using

- Please confirm the specification, choose suitable module
- When carry on processing the screws or layout project, please protect the scraps falling into the modules
- Before connecting, please confirm again module's specification and connected device
- When connecting, please check if the connection is fastness, cable breaking off will cause data incorrect, short circuit and other fault! Installation, layout should only be carried after cutting all power.

## II、PID Function

### 1、Brief introduction of PID function

Among XC series PLC special modules, digital input module (A/D module) and temperature control modules both have PID control function. It is widely used and flexible. When using, only four parameters ( $K_p$ 、 $K_i$ 、 $K_d$  and Diff) should be set.

### 2、Parameter's usage

Usage of four parameters: Proportion parameter ( $K_p$ )、Integral parameter ( $K_i$ )、Differential parameter ( $K_d$ )、Control proportion band (Diff)

$K_p$ —parameter P is proportion parameter, mainly reflect system's wrap. When wrap occurs, carry on control to decrease this wrap.

$K_i$ —parameter I is integral parameter, mainly used to eliminate whisht difference, improving system's no difference degree.

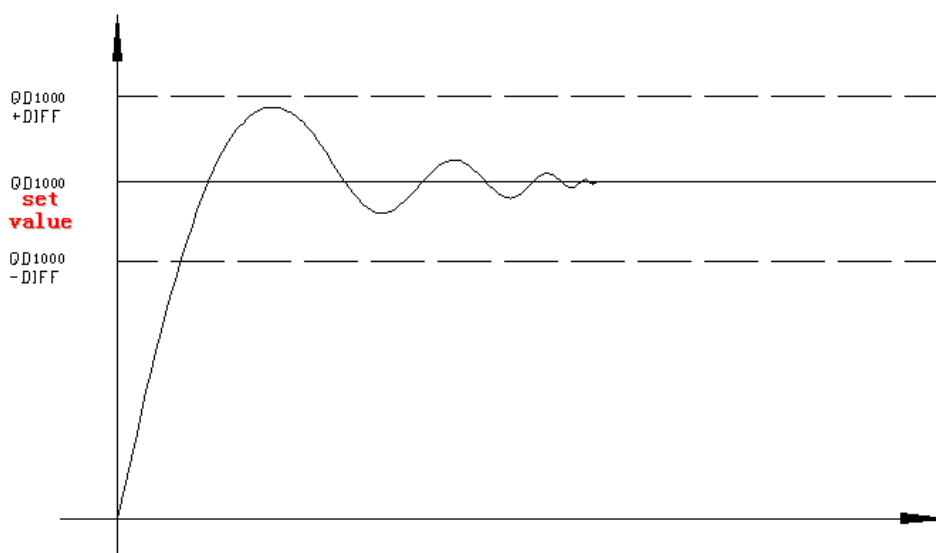
$K_d$ — parameter D is differential parameter, mainly used to control signal's changing trend, decrease system's shake.

Diff—Control bound means in the assigned bound, carry on PID control, out the bound, do not carry on PID control.

### 3、Control characteristic

The bound of PID adjustment is, when the testing value is low than QD-Diff, controller output with the full scale; when the testing value is larger than QD+Diff, the controller stop output; in the bound of ( $QD-Diff$ ,  $QD+Diff$ ) , carry on PID adjustment.

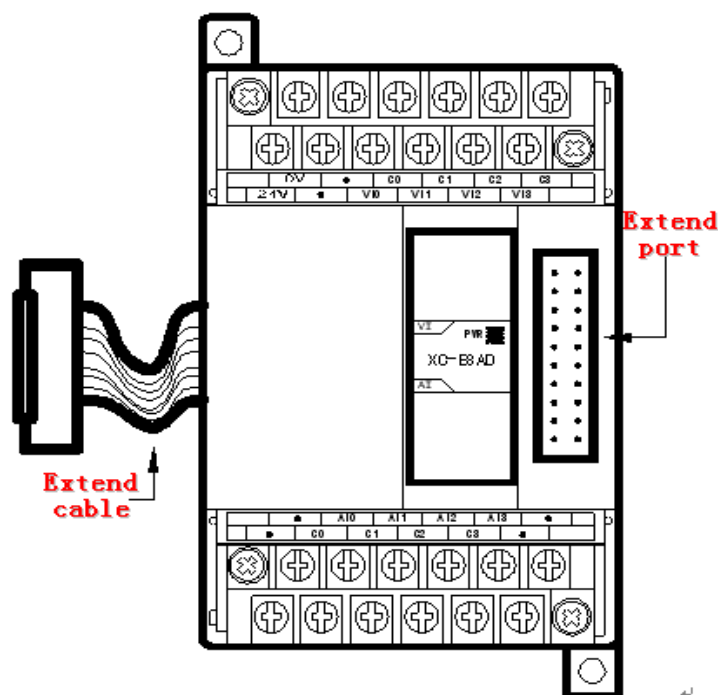
The control curve of PID is the following:



Each parameter's reference value:  $K_p=20\sim 100$ ;  $K_i=5\sim 20$ ;  $K_d=200\sim 700$ ;  $DIFF=100\sim 200$ 。

### III、Analog input module (XC-E8AD)

#### 1. Specification



#### Specialty:

- 14 bits high precision analog input
- 8 channels analog input: The first four channels current input (0~20mA、4~20 mA two kinds); The left 4 channels voltage input (0~5V、0~10V two kinds)
- As special function module of XC, 7 models could be connected at most.
- With PID adjustment function

Items	Current input (0CH~3CH)	Voltage input (4CH~7CH)
Analog input bound	DC0~20mA、4~20mA	DC0~5V、0~10V
Max input bound	0~40mA	±18V
Digital output bound	14 bits binary data	
PID control value	0~4095	
Distinguish Ratio	1/16383(14Bit)	
Integrate Precision	0.8%	
Convert speed	15ms per channel	
Power used by analog	DC24V ± 10%,100mA	
Install format	Can be fixed with M3 screws or directly installed on orbit of DIN46277 (width: 35mm)	
Size	63mm×102mm×73.3mm	

## 2. Input ID assignment

XC series analog module doesn't engross I/O units, the converted data is directly transferred into PLC register. Channels' correspond PLC register ID is:

### Input、 output ID list

Register's ID of expansion 1:

Channel	AD signal	PID output value	PID start/stop control bit	The set value	PID parameters: Kp、Ki、Kd、control bound Diff、dead bound "Death"
0CH	ID100	ID108	Y100	QD100	Kp: QD108 Ki: QD109 Kd: QD110 Diff: QD111 Death: QD112
1CH	ID101	ID109	Y101	QD101	
2CH	ID102	ID110	Y102	QD102	
3CH	ID103	ID111	Y103	QD103	
4CH	ID104	ID112	Y104	QD104	
5CH	ID105	ID113	Y105	QD105	
6CH	ID106	ID114	Y106	QD106	
7CH	ID107	ID115	Y107	QD107	

Register's ID of expansion 2:

Channel	AD signal	PID output value	PID start/stop control bit	The set value	PID parameters: Kp、Ki、Kd、control bound Diff、dead bound "Death"
0CH	ID200	ID208	Y200	QD200	Kp: QD208 Ki: QD209 Kd: QD210 Diff: QD211 Death: QD212
1CH	ID201	ID209	Y201	QD201	
2CH	ID202	ID210	Y202	QD202	
3CH	ID203	ID211	Y203	QD203	
4CH	ID204	ID212	Y204	QD204	
5CH	ID205	ID213	Y205	QD205	
6CH	ID206	ID214	Y206	QD206	
7CH	ID207	ID215	Y207	QD207	

Register's ID of expansion 3:

Channel	AD signal	PID output value	PID start/stop control bit	The set value	PID parameters: Kp、Ki、Kd、control bound Diff、dead bound "Death"
0CH	ID300	ID308	Y300	QD300	Kp: QD308 Ki: QD309 Kd: QD310 Diff: QD311 Death: QD312
1CH	ID301	ID309	Y301	QD301	
2CH	ID302	ID310	Y302	QD302	
3CH	ID303	ID311	Y303	QD303	
4CH	ID304	ID312	Y304	QD304	

5CH	ID305	ID313	Y305	QD305	
6CH	ID306	ID314	Y306	QD306	
7CH	ID307	ID315	Y307	QD307	

Register's ID of expansion 4:

Channel	AD signal	PID output value	PID start/stop control bit	The set value	PID parameters: Kp, Ki, Kd, control bound Diff, dead bound "Death"
0CH	ID400	ID408	Y400	QD400	Kp: QD408 Ki: QD409 Kd: QD410 Diff: QD411 Death: QD412
1CH	ID401	ID409	Y401	QD401	
2CH	ID402	ID410	Y402	QD402	
3CH	ID403	ID411	Y403	QD403	
4CH	ID404	ID412	Y404	QD404	
5CH	ID405	ID413	Y405	QD405	
6CH	ID406	ID414	Y406	QD406	
7CH	ID407	ID415	Y407	QD407	

Register's ID of expansion 5:

Channel	AD signal	PID output value	PID start/stop control bit	The set value	PID parameters: Kp, Ki, Kd, control bound Diff, dead bound "Death"
0CH	ID500	ID508	Y500	QD500	Kp: QD508 Ki: QD509 Kd: QD510 Diff: QD511 Death: QD512
1CH	ID501	ID509	Y501	QD501	
2CH	ID502	ID510	Y502	QD502	
3CH	ID503	ID511	Y503	QD503	
4CH	ID504	ID512	Y504	QD504	
5CH	ID505	ID513	Y505	QD505	
6CH	ID506	ID514	Y506	QD506	
7CH	ID507	ID515	Y507	QD507	

Register's ID of expansion 6:

Channel	AD signal	PID output value	PID start/stop control bit	The set value	PID parameters: Kp, Ki, Kd, control bound Diff, dead bound "Death"
0CH	ID600	ID608	Y600	QD600	Kp: QD608 Ki: QD609 Kd: QD510 Diff: QD611 Death: QD512
1CH	ID601	ID609	Y601	QD601	
2CH	ID602	ID610	Y602	QD602	
3CH	ID603	ID611	Y603	QD603	
4CH	ID604	ID612	Y604	QD604	

5CH	ID605	ID613	Y605	QD605	
6CH	ID606	ID614	Y606	QD606	
7CH	ID607	ID615	Y607	QD607	

Register's ID of expansion 7:

Channel	AD signal	PID output value	PID start/stop control bit	The set value	PID parameters: Kp, Ki, Kd, control bound Diff, dead bound "Death"
0CH	ID700	ID708	Y700	QD700	Kp: QD708 Ki: QD709 Kd: QD710 Diff: QD711 Death: QD712
1CH	ID701	ID709	Y701	QD701	
2CH	ID702	ID710	Y702	QD702	
3CH	ID703	ID711	Y703	QD703	
4CH	ID704	ID712	Y704	QD704	
5CH	ID705	ID713	Y705	QD705	
6CH	ID706	ID714	Y706	QD706	
7CH	ID707	ID715	Y707	QD707	

**Description:**

Start signal (Y) : when Y is 0, close PID control, when be 1, start PID control

Parameter P: Proportion parameter, mainly reflex system's difference, carry on control as soon as difference occurs to improve the system's no difference degree.

Parameter I: Integral parameter. Mainly used to remove whisht, improve the system's no difference degree.

Parameter D: Differential parameter, mainly used to control signal's changing trend,minish system's shake.

Control bound Diff: In the assigned bound, carry on PID control. Beyond the bound, no PID control.

Dead area Death: When the current PID control value compares with the preceding PID control value. If the difference between them is less than the set dead bound's value, the module will abnegate the current PID control value, send the preceding PID control value to the PLC main unit.

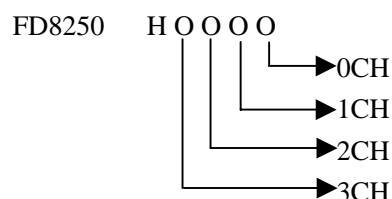
Each parameter's reference value: Kp=20~100; Ki=5~20; Kd=200~700; DIFF=100~200

**3. Setting of working mode**

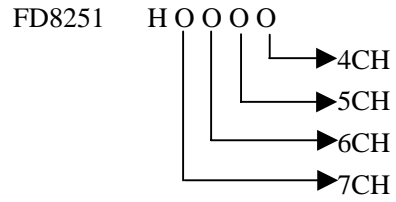
1) Expansion's 0CH~3CH channels have two modes to select: current 0~20mA、4~20mA, 4CH~7CH channels have two modes to select, voltage 0~5V、0~10V. Set via special FLASH data register FC inside PLC. See the following table:

Module	Channel's ID	
	0CH~3CH	4CH~7CH
1# module	FD8250	FD8251
2# module	FD8258	FD8259

Take 1# module as example:



3# module	FD8266	FD8267
4# module	FD8274	FD8275
5# module	FD8282	FD8283
6# module	FD8290	FD8291
7# module	FD8298	FD8299



Note: As showed in the preceding table, each register set 4 channels' mode, each register has 16 bits. From low bit to high bit, every 4 bits separately set 4 channels' mode.

Each bit's definition is showed in the following table:

The following, we take module 1 as example to describe the setting format:

Register FD8250:

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

Register FD8251:

Channel 5				Channel 4			
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
00: 1/2 filter		-	0: 0~10V	00: 1/2 filter		-	0: 0~10V
01: not filter				01: not filter			
10: 1/3 filter		-	1: 0~5V	10: 1/3 filter		-	1: 0~5V
11: 1/4 filter				11: 1/4 filter			
Channel 7				Channel 6			
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
00: 1/2 filter		-	0: 0~10V	00: 1/2 filter		-	0: 0~10V
01: not filter				01: not filter			
10: 1/3 filter		-	1: 0~5V	10: 1/3 filter		-	1: 0~5V
11: 1/4 filter				11: 1/4 filter			

**E.g.:** 1) Set module 1's No. 3、No.2、No.1、No.0 channel's working mode separately as 0~20mA、4~20mA、0~20mA、4~20mA, filters are all 1/2 filter, data in FD8250 is 0101H

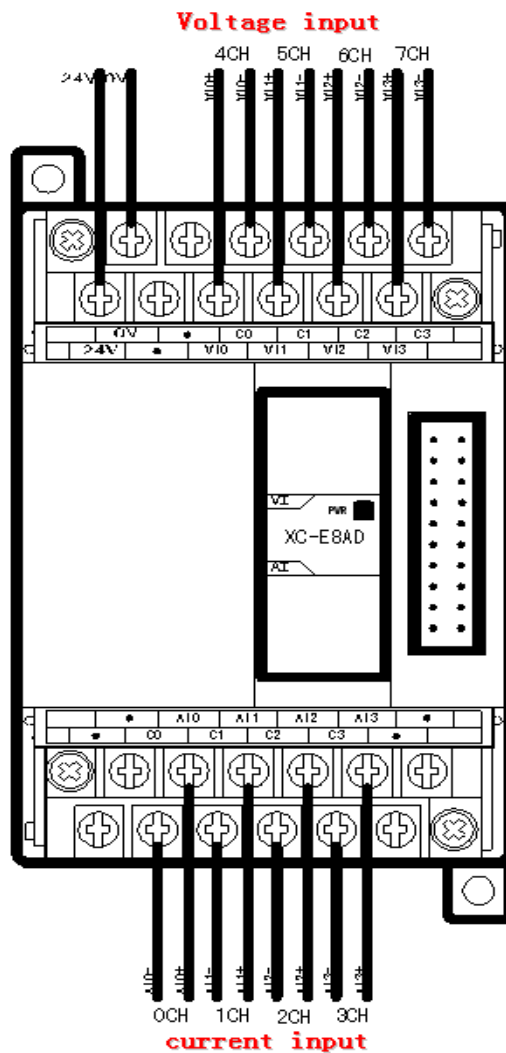
2) Set module 1's No. 7、No.6、No.5、No.4 channel's working mode separately as 0~10V、0~5V、0~10V、0~5V, all the four channels don't filter, data in FD8251 is 4545H

#### 4. Exterior connection

About exterior connection, you should note the following two items:

- When connect +24V power outside, please use the 24V power on PLC main unit to avoid interfere.
- To avoid interfere, please use the shield cable and single point grounding with the shield layer.

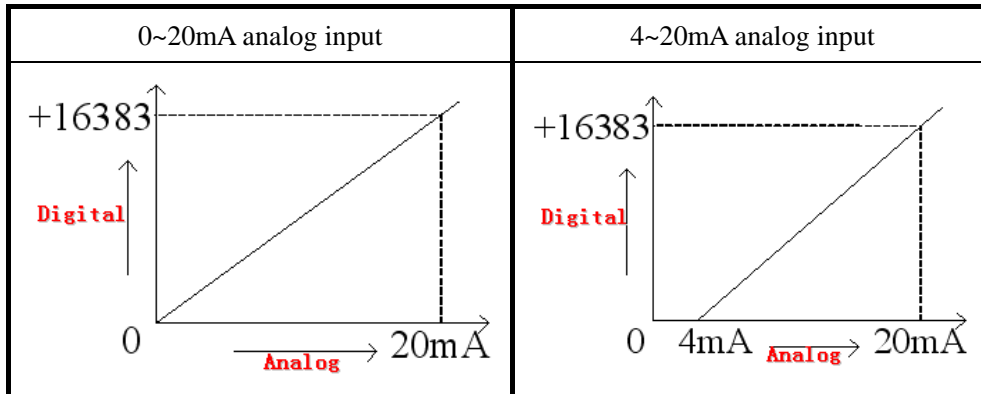
Layout chart:



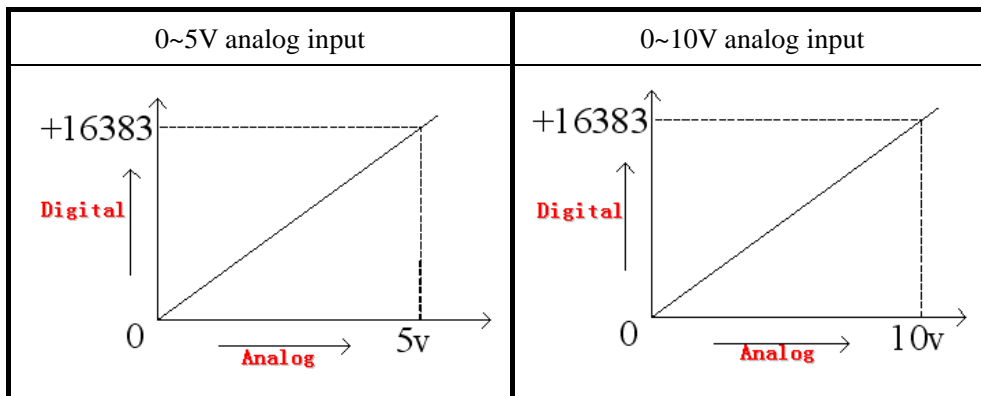
## 5. Analog/digital convert chart

The relationship between input analog and converted digital quantity is showed in the following chart:

### Current mode of Channel 0~Channel 3:

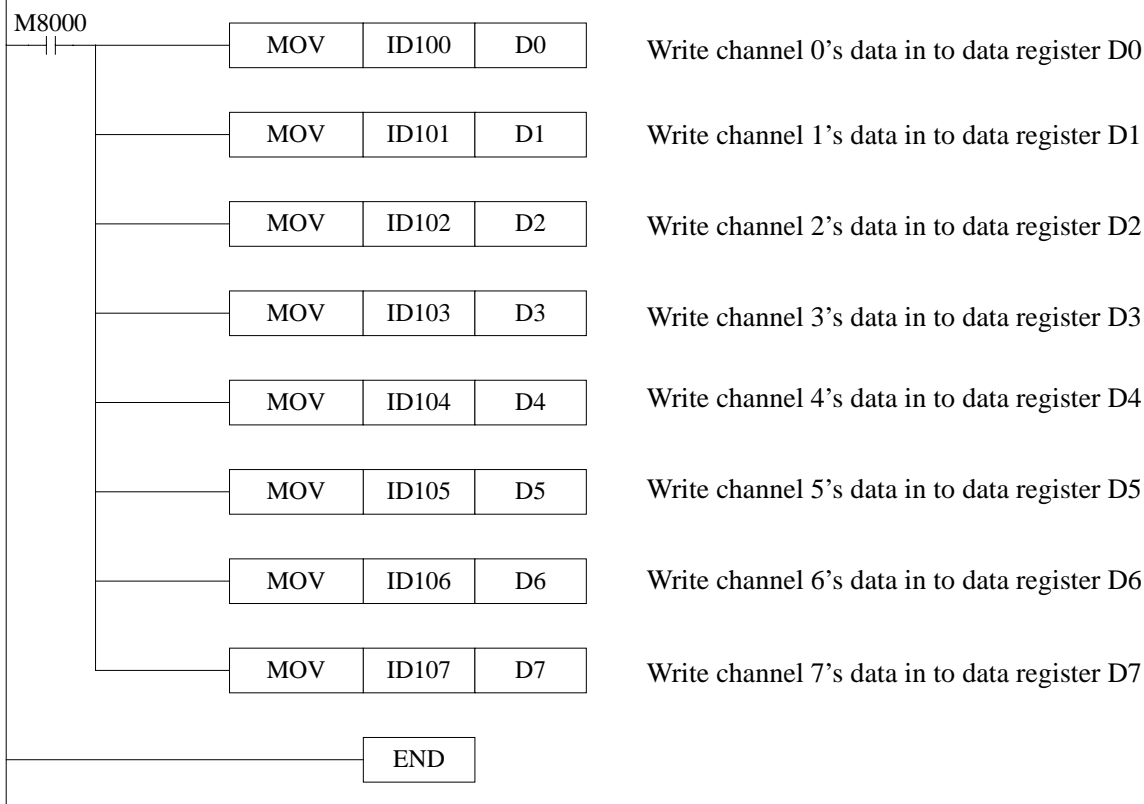


### Voltage mode of Channel 4~Channel 7:



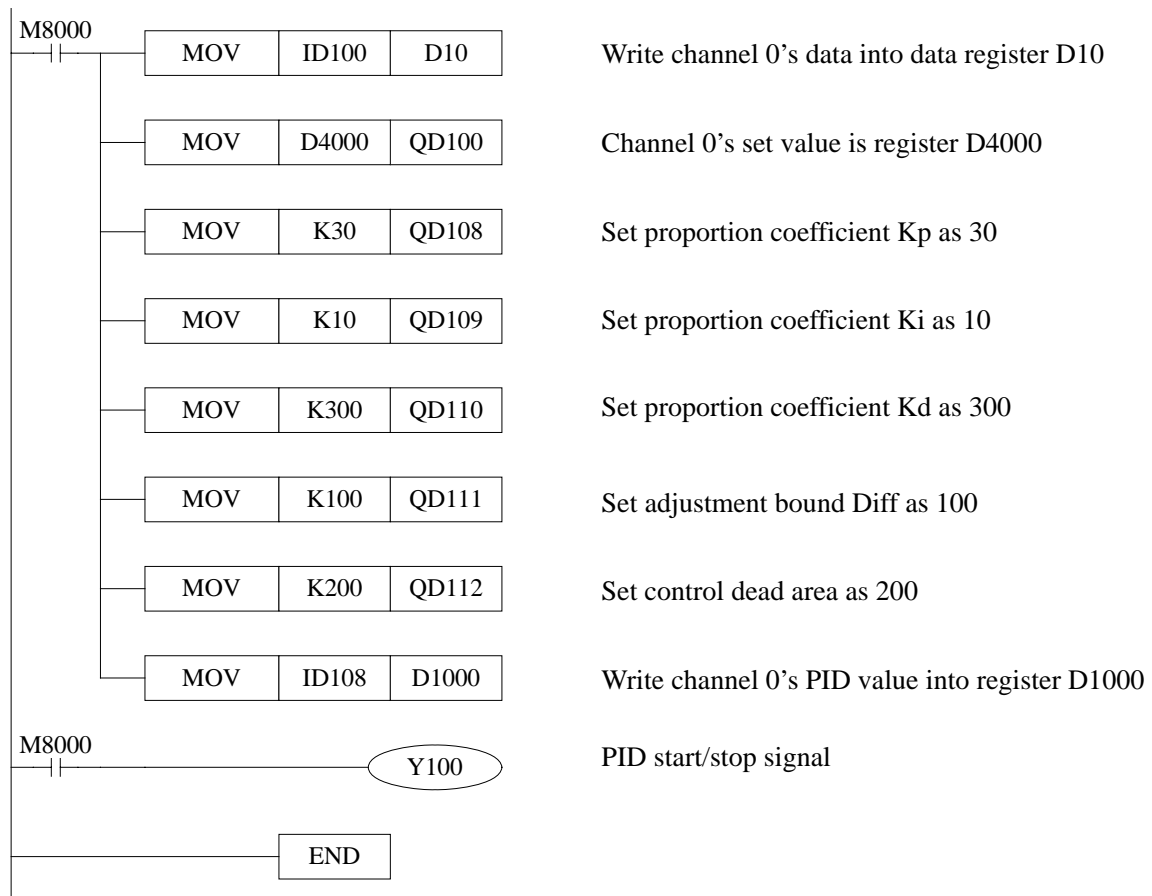
## 6. Programming

E.g. 1) Real time read unit 1 XC-E8AD module's 8 channels' data



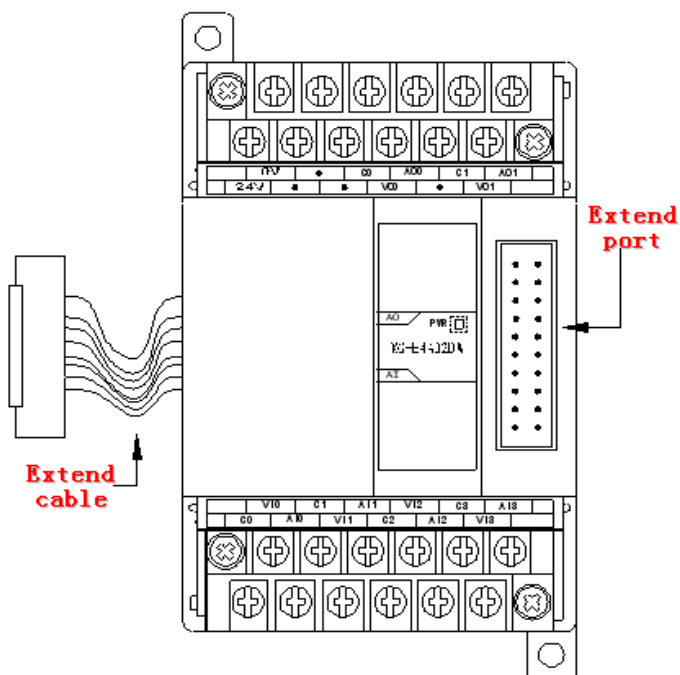
E.g.2) Application of PID control in AD modules

The following, we take channel 0 of XC-E8AD as the example:



## IV、 Analog input/output module XC-E4AD2DA

### 1. Specification



### Characteristic:

- 4 channels 14 bits analog input and 2 channels 12 bits analog output
- 4 channels selectable voltage 0~5V、0~10V, current 0~20mA、4~20mA input and 2 channels selectable voltage 0~5V、0~10V, current 0~20mA、4~20mA output. Set via host machine.
- As special function module of XC, 7 modules could be connected at most
- 4 channels A/D have PID adjustment function

Items	Analog input (AD)		Analog output (DA)	
	Voltage input	Current input	Voltage output	Current output
Analog input bound	DC0~5V、0~10V	DC0~20mA、4~20mA	-	
Max input bound	DC±18V	DC0~40mA	-	
Analog output bound	-		DC0~5V、0~10V (Exterior load resistance 2K Ω ~1M Ω)	DC0~20mA、4~20mA (Exterior load resistance is less than 500 Ω)
Digital input bound	-		12 bits binary data (0~4095)	
Digital output bound	14 bits binary data (0~16383)		-	
Distinguish ratio	1/16383(14Bit); the converted data is stored into PLC in the format of HEX format (14Bit)		1/4095(12Bit); the converted data is stored into PLC with the format of HEX. (12Bit)	
PID control value	0~4095		-	
Integrate precision	0.8%			
Convert speed	15ms per channel		2ms per channel	
Power used by analog	DC24V ± 10%, 100mA			
Install format	Fixed with M3 screws or directly installed on orbit of DIN46277 (Width: 35mm)			
Exterior size	63mm×102mm×73.3mm			

[Extend cable]: Realize data transfer via the connection of extend cable and PLC extend port

[Extend port]: Connect with other expansions

## 2. The assignment of input/output ID

XC series analog modules do not engross I/O units, the converted data is directly transferred into PLC register, analog output is also directly offered by PLC register.

Register's ID of expansion 1:

Channel	AD signal	PID output value	PID start/stop control bit	The set value	PID parameter: Kp, Ki, Kd, control bound Diff, dead bound Death
0CH	ID100	ID104	Y100	QD102	Kp: QD106 Ki: QD107 Kd: QD108 Diff: QD109 Death: QD110
1CH	ID101	ID105	Y101	QD103	
2CH	ID102	ID106	Y102	QD104	
3CH	ID103	ID107	Y103	QD105	
Channel	DA signal	-	-	-	-
4CH	QD100	-	-	-	
5CH	QD101	-	-	-	

Register's ID of expansion 2:

Channel	AD	PID output value	PID start/stop control bit	The set value	PID parameter: Kp, Ki, Kd, control bound Diff, dead bound Death
0CH	ID200	ID204	Y200	QD202	Kp: QD206 Ki: QD207 Kd: QD208 Diff: QD209 Death: QD210
1CH	ID201	ID205	Y201	QD203	
2CH	ID202	ID206	Y202	QD204	
3CH	ID203	ID207	Y203	QD205	
Channel	DA signal	-	-	-	-
4CH	QD200	-	-	-	
5CH	QD201	-	-	-	

Register's ID of expansion 3:

Channel	AD signal	PID output value	PID start/stop control bit	The set value	PID parameter: Kp, Ki, Kd, control bound Diff, dead bound Death
0CH	ID300	ID304	Y300	QD302	Kp: QD306 Ki: QD307 Kd: QD308 Diff: QD309 Death: QD310
1CH	ID301	ID305	Y301	QD303	
2CH	ID302	ID306	Y302	QD304	
3CH	ID303	ID307	Y303	QD305	
Channel	DA signal	-	-	-	-

4CH	QD300	-	-	-	
5CH	QD301	-	-	-	

Register's ID of expansion 4:

Channel	AD signal	PID output value	PID start/stop control bit	The set value	PID parameter: Kp, Ki, Kd, control bound Diff, dead bound Death
0CH	ID400	ID404	Y400	QD402	Kp: QD406 Ki: QD407 Kd: QD408 Diff: QD409 Death: QD410
1CH	ID401	ID405	Y401	QD403	
2CH	ID402	ID406	Y402	QD404	
3CH	ID403	ID407	Y403	QD405	
Channel	DA signal	-	-	-	-
4CH	QD400	-	-	-	
5CH	QD401	-	-	-	

Register's ID of expansion 5:

Channel	AD signal	PID output value	PID start/stop control bit	The set value	PID parameter: Kp, Ki, Kd, control bound Diff, dead bound Death
0CH	ID500	ID504	Y500	QD502	Kp: QD506 Ki: QD507 Kd: QD508 Diff: QD509 Death: QD510
1CH	ID501	ID505	Y501	QD503	
2CH	ID502	ID506	Y502	QD504	
3CH	ID503	ID507	Y503	QD505	
Channel	DA signal	-	-	-	-
4CH	QD500	-	-	-	
5CH	QD501	-	-	-	

Register's ID of expansion 6:

Channel	AD signal	PID output value	PID start/stop control bit	The set value	PID parameter: Kp, Ki, Kd, control bound Diff, dead bound Death
0CH	ID600	ID604	Y600	QD602	Kp: QD606 Ki: QD607 Kd: QD608 Diff: QD609 Death: QD610
1CH	ID601	ID605	Y601	QD603	
2CH	ID602	ID606	Y602	QD604	
3CH	ID603	ID607	Y603	QD605	
Channel	DA signal	-	-	-	-

4CH	QD600	-	-	-	
5CH	QD601	-	-	-	

Register's ID of expansion 7:

Channel	AD signal	PID output value	PID start/stop control bit	The set value	PID parameter: Kp, Ki, Kd, control bound Diff, dead bound Death
0CH	ID700	ID704	Y700	QD702	Kp: QD706 Ki: QD707 Kd: QD708 Diff: QD709 Death: QD710
1CH	ID701	ID705	Y701	QD703	
2CH	ID702	ID706	Y702	QD704	
3CH	ID703	ID707	Y703	QD705	
Channel	DA signal	-	-	-	-
4CH	QD700	-	-	-	
5CH	QD701	-	-	-	

**Description:**

Start signal (Y) : When Y is 0, close PID control; when being 1, start PID control

Parameter P: proportion parameter, mainly reflect system's difference, control as soon as difference occurs to decrease this difference.

Parameter I: Integral parameter, mainly used to remove the whisht and improve the system's no difference degree

Parameter D: differential parameter, mainly control signal's changing trend and decrease the system's shake.

Temp. control bound Diff: in the assigned bound, carry on PID control, beyond that bound, no PID control

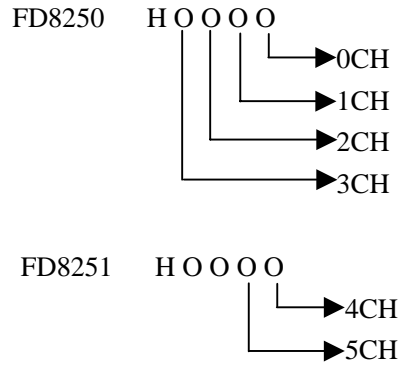
Each parameter's reference value: Kp=20~100; Ki=5~20; Kd=200~700; DIFF=100~200

### 3. Setting of working mode

1) Expansion's input/output all have options of voltage 0~5V、0~10V, current 0~20mA、4~20mA modes. Via setting of special FLASH data register FD in PLC. See the following table:

Module	Channel's ID	
	0CH~3CH	4CH~5CH
1# expansion	FD8250	FD8251 low byte
2# expansion	FD8258	FD8259 low byte
3# expansion	FD8266	FD8267 low byte
4# expansion	FD8274	FD8275 low byte
5# expansion	FD8282	FD8283 low byte
6# expansion	FD8290	FD8291 low byte
7# expansion	FD8298	FD8299 low byte

Take 1# expansion as example:



Note: As shown in the preceding table, every register set 4 channels mode, each register has 16 bits, from low to high, every 4 bits set separately 4 channels mode.

Each channel's working mode is assigned by correspond register's 4 bits. Each bit's definition is showed in the following table:

The following, we take module 1 as example to show how to set:

Register FD8250:

Channel 1				Channel 0			
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
00: 1/2 filter		0: voltage input	0:0~10V	00: 1/2 filter		0: voltage input	0:0~10V
01: not filter			1:0~5V	01: not filter			1:0~5V
10: 1/3 filter		1: current input	0:0~20mA	10: 1/3 filter		1: current input	0:0~20mA
11: 1/4 filter			1:4~20mA	11: 1/4 filter			1:4~20mA
Channel 3				Channel 2			
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
00: 1/2 filter		0: voltage input	0:0~10V	00: 1/2 filter		0: voltage input	0:0~10V
01: not filter			1:0~5V	01: not filter			1:0~5V
10: 1/3 filter		1: current input	0:0~20mA	10: 1/3 filter		1: current input	0:0~20mA
11: 1/4 filter			1:4~20mA	11: 1/4 filter			1:4~20mA

Register FD8251 low byte:

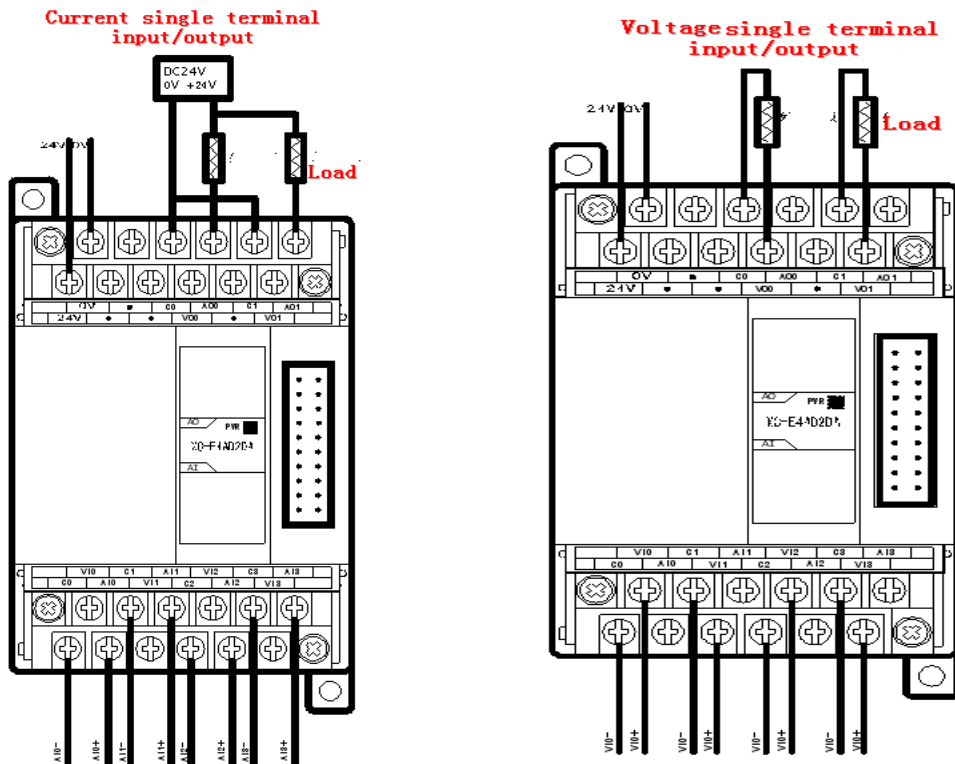
Channel 5				Channel 4			
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
00: 1/2 filter		0: voltage input	0:0~10V 1:0~5V	00: 1/2 filter		0: voltage input	0:0~10V 1:0~5V
01: not filter		1: current input	0:0~20mA 1:4~20mA	01: not filter		1: current input	0:0~20mA 1:4~20mA
10: 1/3 filter				10: 1/3 filter			
11: 1/4 filter				11: 1/4 filter			

**E.g.:** 1) If set working mode 0~20mA、4~20mA、0~10V、0~5V of module 1's channel 3、channel 2、channel 1、channel 0, filters are all 1/2 filter, value in FD8250 is 2301H

#### 4. Exterior connection

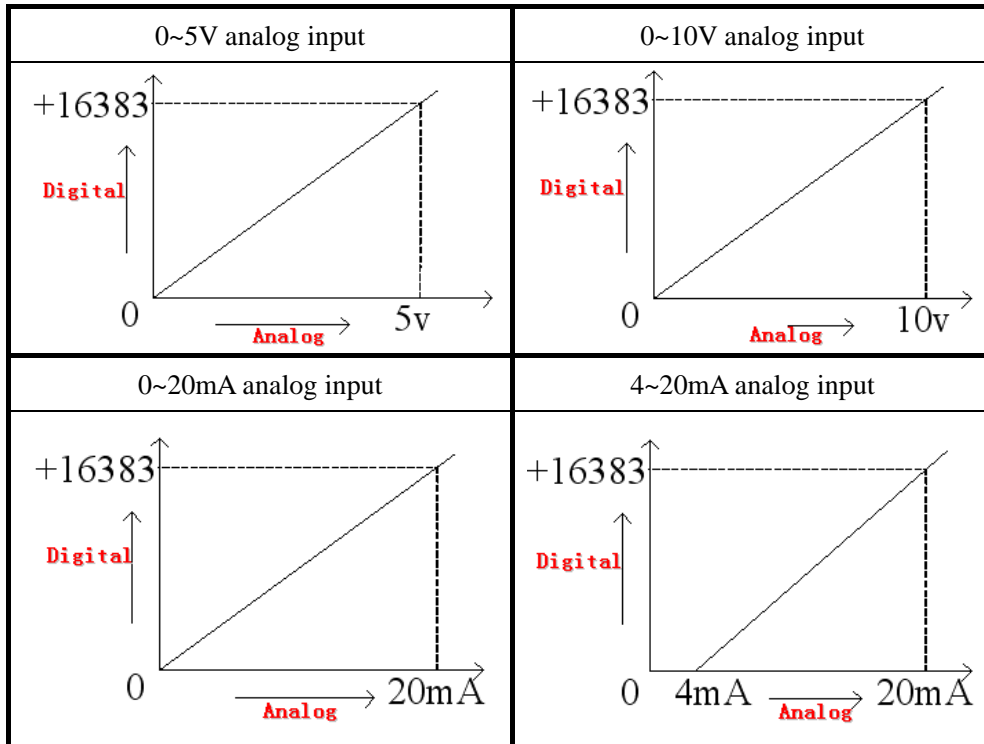
When carry on exterior connection, please note the following two items:

- When connect +24V power outside, please choose 24V power on PLC main unit to avoid interfere.
- To avoid interfere, please use shield cable and single point grounding with the shield layer.
- Module's 0~20mA or 4~20mA output need 24V power from outside, according to the analog output register QD's value, the module adjusts the loop circuit's current, but the module itself doesn't produce current.

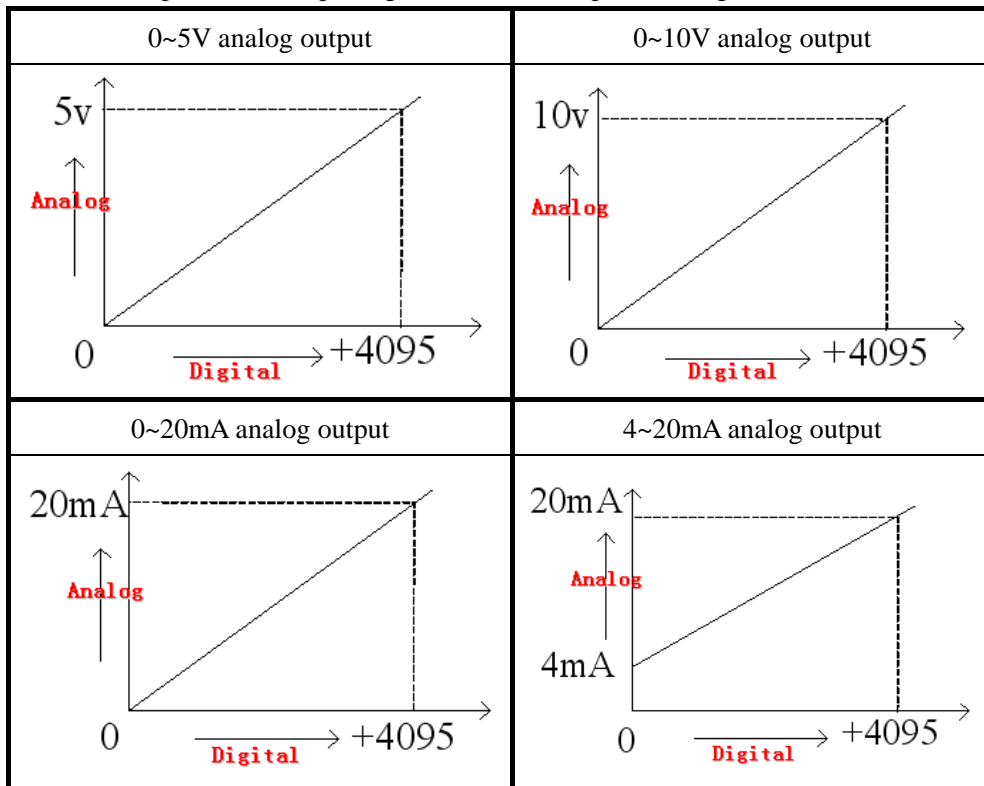


## 5. Analog digital convert chart

The relationship between input analog and converted digital is showed in the following chart:



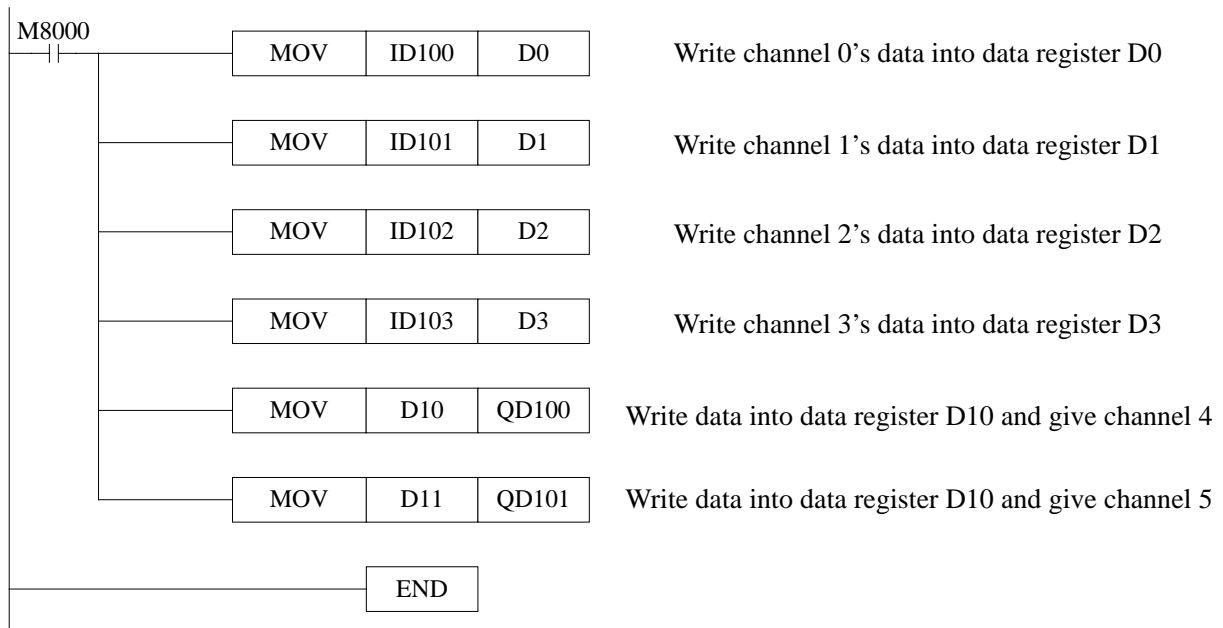
The relationship between output digital and its correspond analog data is showed in the following chart:



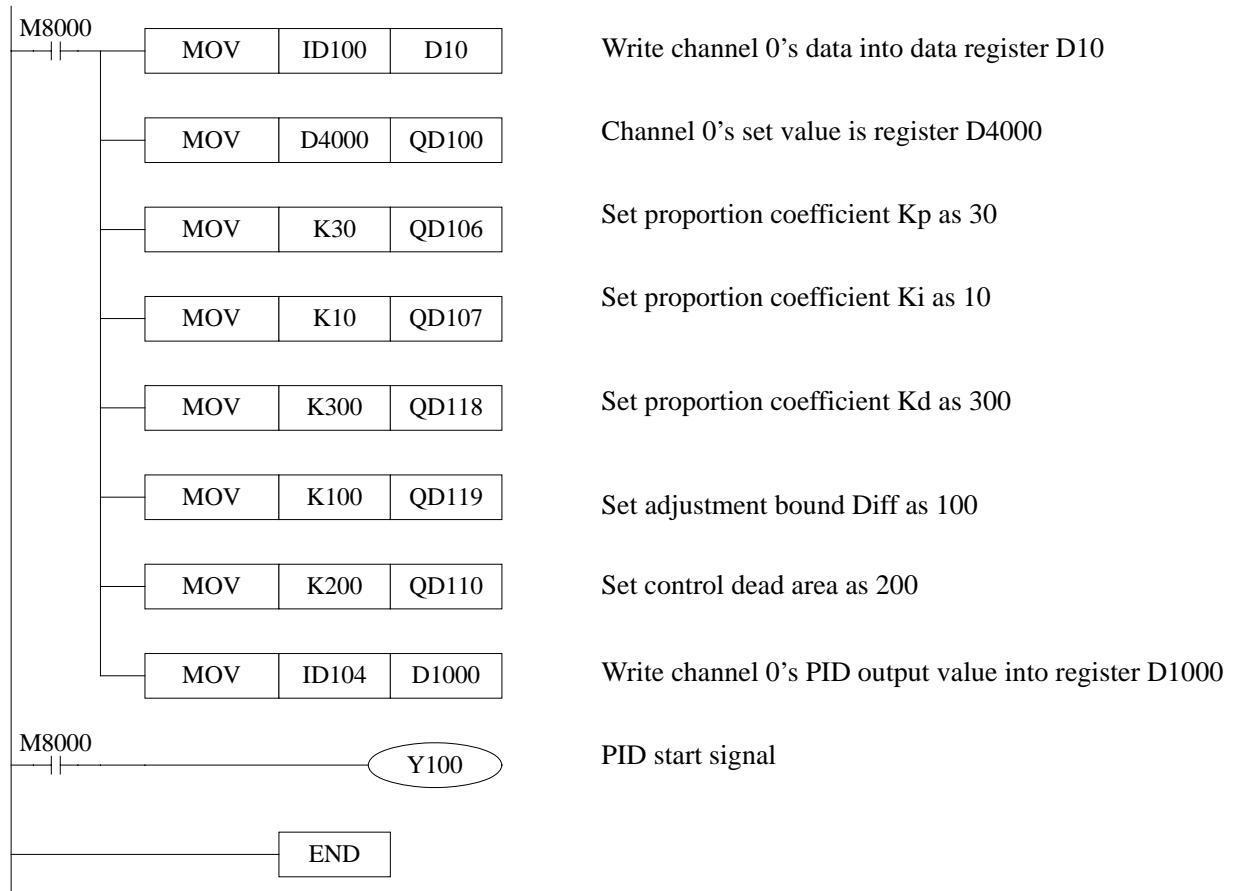
When input data exceed K4095, D/A converted output analog data keep 5V、10V or 20mA.

## 6. Programming

E.g.1) Real time read 4 channels data, write 2 channels data (take expansion 1 as example)

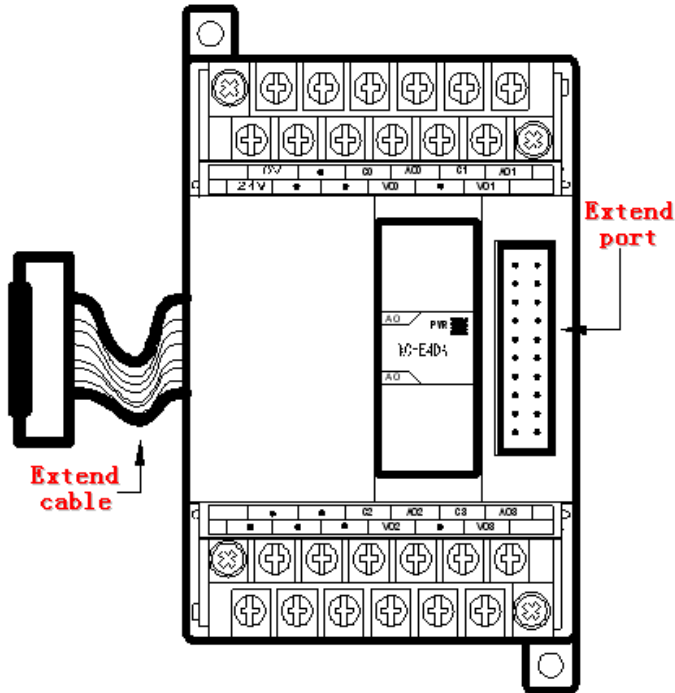


E.g.2) Applied method of PID (take expansion 1's channel 0 as example)



## V、Analog output module XC-E4DA

### 1、Specification



#### Characteristic:

- 12 bits high precision analog output
- 4 channels selectable voltage 0~5V、0~10V, current 0~20mA、4~20mA output
- As special function module of XC, 7 modules could be connected

Items	Voltage output	Current output
Analog output bound	DC0~5V、0~10V	DC0~20mA、4~20mA
Digital output bound	12 bits binary data	
Distinguish Ratio	1/4096(12Bit); the converted data is stored into PLC with the format of HEX	
Integrate precision	0.8%	
Convert speed	2ms per channel	
Insulate format	DC/DC convert, optical coupling insulation	
Power for analog using	DC24V $\pm$ 10%,100mA	
Install format	Can be fixed with M3 screws or directly installed on orbit of DIN46277 (width: 35mm)	
Exterior size	63mm $\times$ 102mm $\times$ 73.3mm	

**[Extend cable]:** Realize data transfer via connecting of extend cable and PLC extend port

**[Extend port]:** Connect with other expansions

## 2. Assignment of Output ID

XC series analog module does not engross I/O units, the converted data is directly transferred into PLC register. The output channel's correspond PLC register ID is:

Output ID list

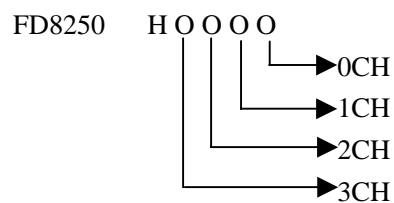
Channel	No.1 unit	No.2 unit	No.3 unit	No.4 unit	No.5 unit	No.6 unit	No.7 unit
0CH	QD100	QD200	QD300	QD400	QD500	QD600	QD700
1CH	QD101	QD201	QD301	QD401	QD501	QD601	QD701
2CH	QD102	QD202	QD302	QD402	QD502	QD602	QD702
3CH	QD103	QD203	QD303	QD403	QD503	QD603	QD703

## 3. Setting of working mode

1) Each expansions' input/output have the choice of voltage 0~5V、0~10V, current 0~20mA、4~20mA modes. Via the setting of special FLASH data register FD inside PLC, see the following table:

Module	Channel's ID	
	0CH~3CH	
1# module	D8250	
2# module	D8258	
3# module	D8266	
4# module	D8274	
5# module	D8282	
6# module	D8290	
7# module	D8298	

Take expansion1 as the example:



Each channel's working mode is assigned by the correspond register's 4 bits. Each bit's definition is listed in the following table:

Take module 1 as the example:

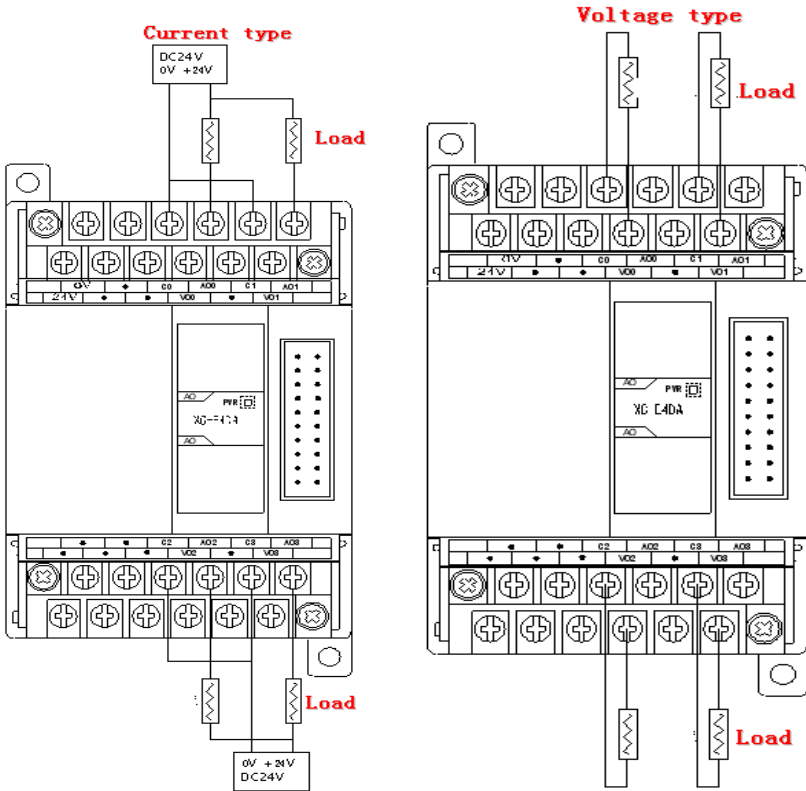
Register FD8250:

Channel 1				Channel 0			
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
-		0: Voltage input	0:0~10V 1:0~5V	-		0: Voltage input	0:0~10V 1:0~5V
		1: current input	0:0~20mA 1:4~20mA			1: Current input	0:0~20mA 1:4~20mA
Channel 3				Channel 2			
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
-		0: Voltage input	0:0~10V 1:0~5V	-		0: Voltage input	0:0~10V 1:0~5V
		1: current input	0:0~20mA 1:4~20mA			1: current input	0:0~20mA 1:4~20mA

### 4. Exterior connection

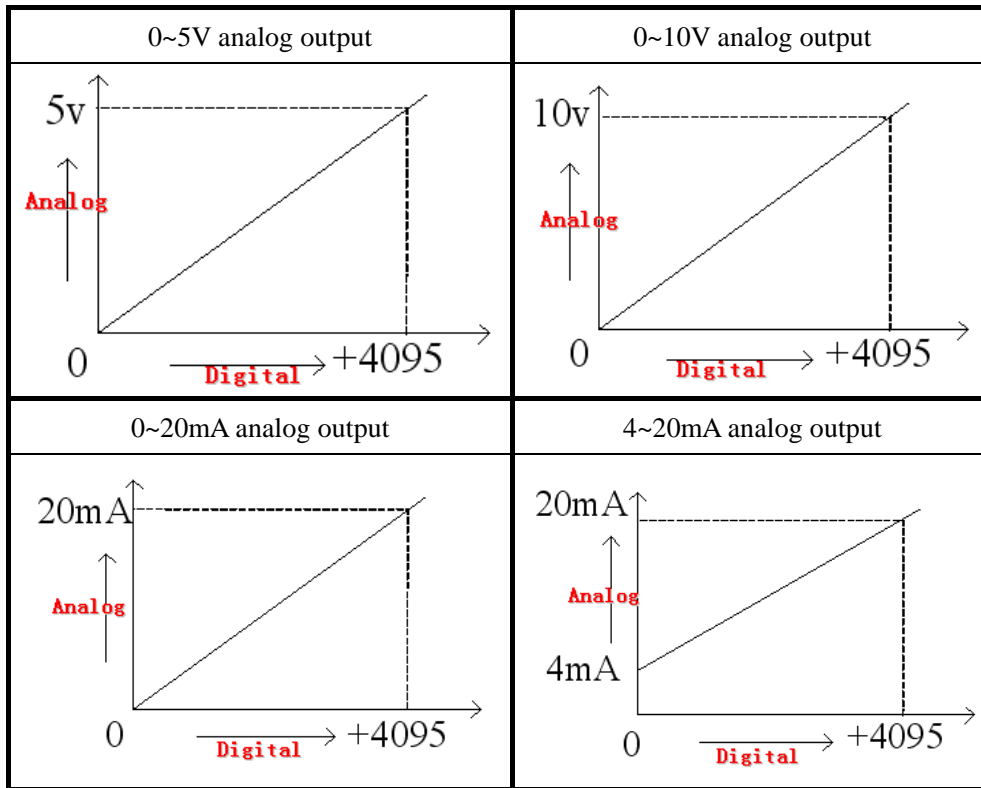
When carry on exterior connection, please note the following two items:

- When connect +24V power outside, please choose 24V power on PLC main unit to avoid interfere.
- To avoid interfere, please use shield cable and single point grounding with the shield layer.
- Module's 0~20mA or 4~20mA output need 24V power from outside, according to the analog output register QD's value, the module adjusts the loop circuit's current, but the module itself doesn't produce current.



## 5. Analog digital convert chart

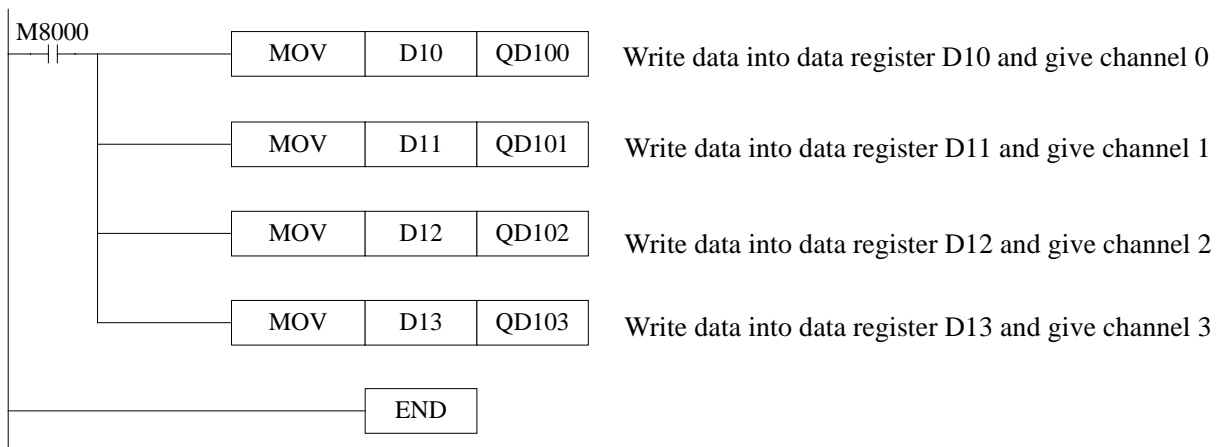
The relationship between PLC's output digital and its correspond analog data is showed in the following chart:



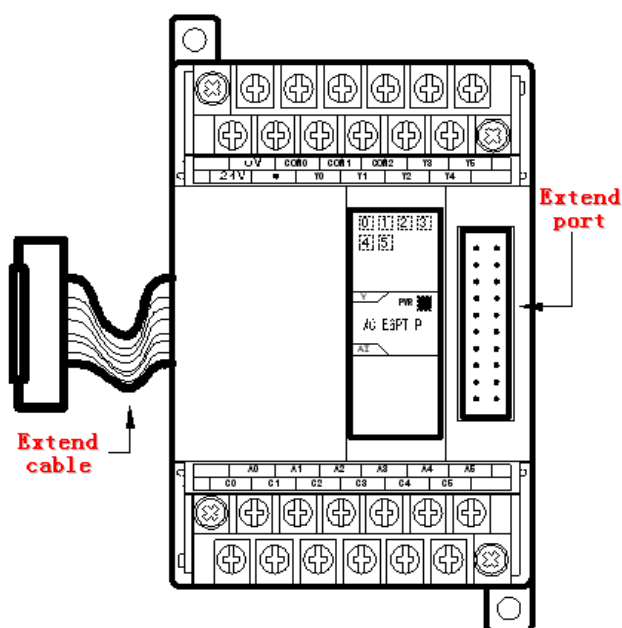
When the output data exceed K4095, D/A converted output analog data keep 5V、10V or 20mA

## 6. Programming

Real time write data into 4 channels



## 1. Specification



### Characteristic:

- Platinum thermo-resistance input, Pt100
- 6 channels input, 6 channels output
- 2 groups PID parameters (every 3 channels has a group of PID parameter)
- 1mA lasting current output, not affected by the exterior environment
- Distinguish ratio is 0.1℃
- As special function module of XC, 7 modules could be connected

Item	Content
Analog input signal	Pt100 platinum thermo-resistance
Temperature testing bound	-100℃~350℃
Digital output bound	-1000~3500, 16 bits with sign bit, binary
Control precision	±0.5℃
Distinguish ratio	0.1℃
Integrate precision	±0.8% (relative to the max value)
Convert speed	100ms×6 channels
Analog using power	DC24V±10%, 50mA
Install format	Fixed with M3 screws or directly installed on orbit of DIN46277 (Width: 35mm)
Exterior size	63mm×102mm×73.3mm

**[Extend cable]:** Realize data transfer via the connection of extend cable and PLC extend port.

**[Extend port]:** Connect with other expansions

**Note:** 1、 Without signal input, the channel's data is 3500

2、 According to the actual requirement, connect with Pt100 platinum thermo-resistance

## 2. Assignment of input definition ID

XC series analog modules don't engross I/O units, the converted data is directly transferred into PLC register, channel's correspond PLC register's ID is:

Table of input definition ID:

Channel	1#module	2#module	3#module	4#module	5#module	6#module	7#module
0CH	ID100	ID200	ID300	ID400	ID500	ID600	ID700
1CH	ID101	ID201	ID301	ID401	ID501	ID601	ID701
2CH	ID102	ID202	ID302	ID402	ID502	ID602	ID702
3CH	ID103	ID203	ID303	ID403	ID503	ID603	ID703
4CH	ID104	ID204	ID304	ID404	ID504	ID604	ID704
5CH	ID105	ID205	ID305	ID405	ID505	ID605	ID705

Table of output definition ID:

Channel	1#module	2#module	3#module	4#module	5#module	6#module	7#module
0CH set temperature	QD100	QD200	QD300	QD400	QD500	QD600	QD700
1CH set temperature	QD101	QD201	QD301	QD401	QD501	QD601	QD701
2CH set temperature	QD102	QD202	QD302	QD402	QD502	QD602	QD702
3CH set temperature	QD103	QD203	QD303	QD403	QD503	QD603	QD703
4CH set temperature	QD104	QD204	QD304	QD404	QD504	QD604	QD704
5CH set temperature	QD105	QD205	QD305	QD405	QD505	QD605	QD705
First 3 channels P parameter	QD106	QD206	QD306	QD406	QD506	QD606	QD706
First 3 channels I parameter	QD107	QD207	QD307	QD407	QD507	QD607	QD707
First 3 channels D parameter	QD108	QD208	QD308	QD408	QD508	QD608	QD708
First 3 channels temperature control bound	QD109	QD209	QD309	QD409	QD509	QD609	QD709
Last 3 channels P parameter	QD110	QD210	QD310	QD410	QD510	QD610	QD710
Last 3	QD111	QD211	QD311	QD411	QD511	QD611	QD711

channels I parameter							
Last 3 channels D parameter	QD112	QD212	QD312	QD412	QD512	QD612	QD712
Last 3 channels temperature control bound	QD113	QD213	QD313	QD413	QD513	QD613	QD713

**Description:**

Start signal (Y) : When Y is 0, close PID control; when being 1, start PID control

Parameter P: proportion parameter, mainly reflect system's difference, control as soon as difference occurs to decrease this difference.

Parameter I: Integral parameter, mainly used to remove the whisht and improve the system's no difference degree

Parameter D: differential parameter, mainly control signal's changing trend and decrease the system's shake.

Temp. control bound Diff: in the assigned bound, carry on PID control, beyond that bound, no PID control

Each parameter's reference value: Kp=20~100; Ki=5~20; Kd=200~700; DIFF=100~200

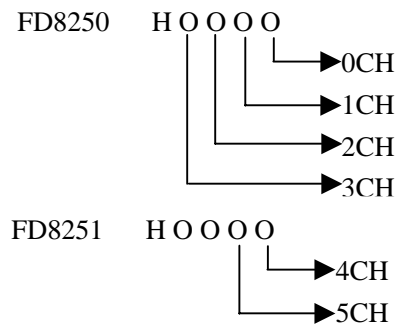
**3. Setting of input filter**

1) Every input of expansion has option of filter, set via special FLASH data register FD in PLC.

Seethe following chart:

Module	channel's ID	
	0CH~3CH	4CH~5CH
1#module	FD8250	FD8251 low byte
2# module	FD8258	FD8259 low byte
3# module	FD8266	FD8267 low byte
4# module	FD8274	FD8275 low byte
5# module	FD8282	FD8283 low byte
6# module	FD8290	FD8291 low byte
7# module	FD8298	FD8299 low byte

Take 1# module as example:



Each channel's filter mode is assigned via correspond register's 4 bits! Each bit's definition is showed in the following table:

Take module 1 as the example:

Register FD8250:

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

Register FD8251:

Channel 5				Channel 4			
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
00: 1/4 filter		-	-	00: 1/4 filter		-	-
01: 不 filter				01: 不 filter			
10: 1/2 filter		-	-	10: 1/2 filter		-	-
11: 1/3 filter				11: 1/3 filter			

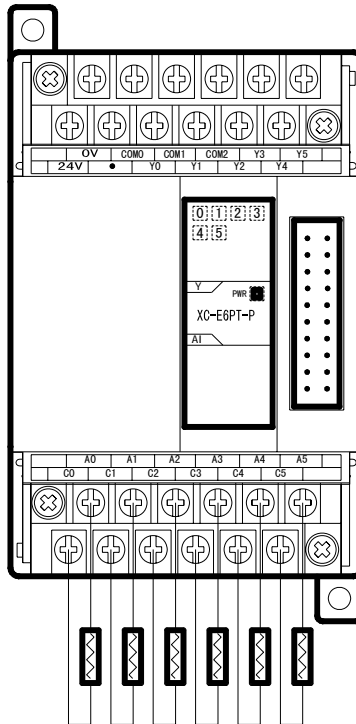
When leave the factory, the defaulted value is 0, the initial filter format is 1/2 filter.

#### 4. Exterior connection

About outside layout, you should note the following two items:

- When carry on +24V power, please use 24V power on PLC main unit to avoid interfere.
- To avoid interfere, please take shield measure with the signal cable.

**Input connection:**

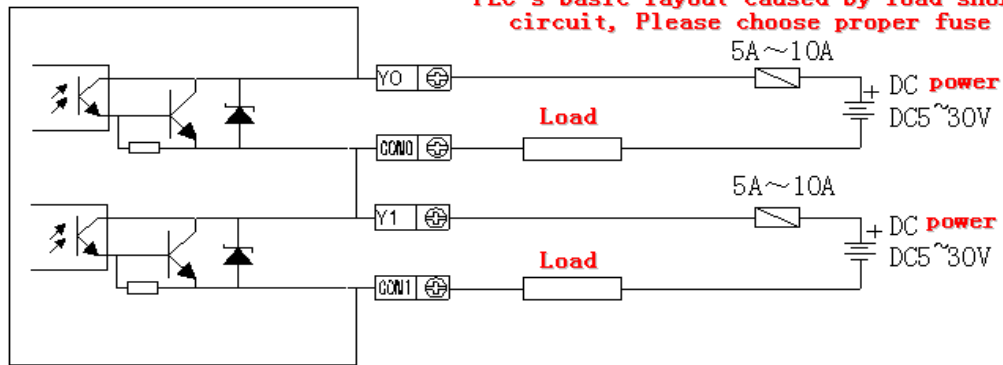


- Output terminals  
Transistor output terminals, please choose DC5V~30V flat power.
- Circuit insulation  
Between PLC's interior circuit and output transistor, use optical insulation. Each public module is also separate.
- Response time  
The time from PLC drive (or cut) optical coupling device to transistor ON/OFF, no more than 0.2ms.
- Output current  
Each point has electricity 0.8A, but to avoid temperature rising, please use as every 4 points 1.2A or every 8 points 2.0A
- Open circuit leak current  
Below 0.1mA

The output circuit is the following:

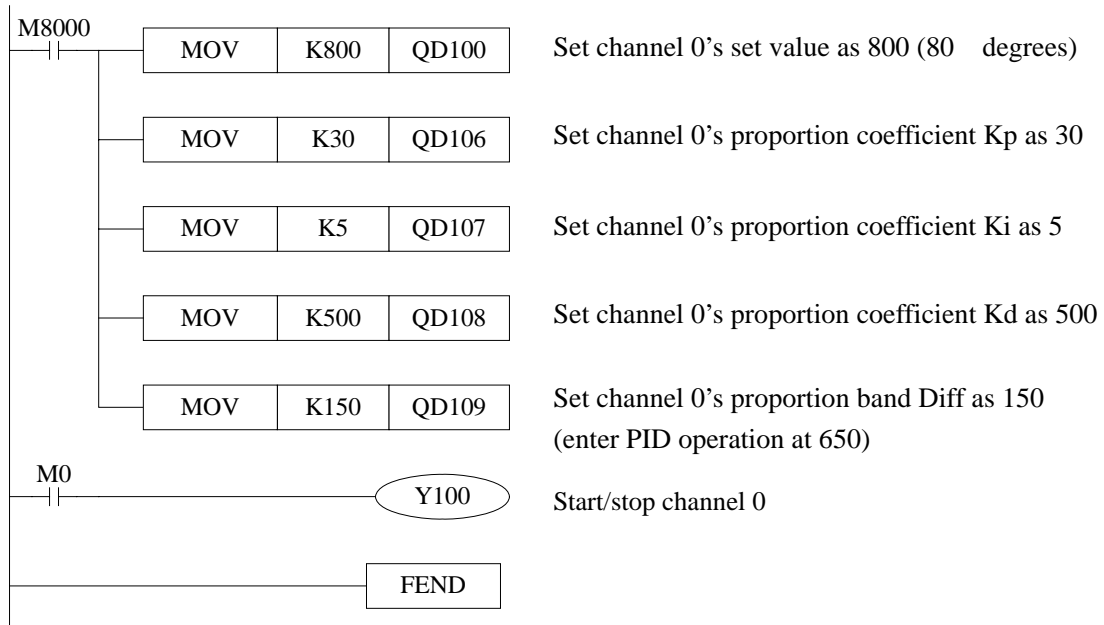
Take channel 0 and channel 1 as the example:

To avoid burning the output unit and PLC's basic layout caused by load short circuit, Please choose proper fuse



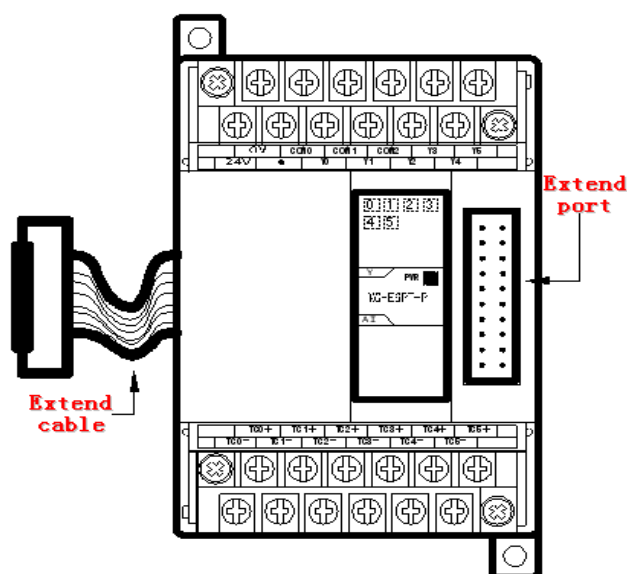
## 6. Programming

### Program with the first channel



## VII、 K type thermocouple temperature PID control module XC-E6TC-P

### 1. Specification



#### Characteristic:

- Thermocouple K type analog input used by temperature sensor
- 6 channels input, 6 channels output
- 2 groups PID parameters (one group PID parameters every 3 channels)
- Hide cold-terminal compensate circuit inside
- Distinguish precision is 0.1℃
- As special function module of XC , 7 modules could be connected at most

Items	Content
Analog input signal	K type thermocouple
Temperature testing bound	0℃~1000℃
Digital output bound	0~10000, 16 bits with sign bit, binary
Control precision	±0.5℃
Distinguish ratio	0.1℃
Integrate precision	±0.8% (compare with the max value)
Convert speed	100ms×6 channels
Power for analog using	DC24V±10%, 50mA
Install format	Fixed with M3 screws or directly installed on orbit of DIN46277 (Width: 35mm)
Exterior size	63mm×102mm×73.3mm

**[Extend cable]:** Realize data transfer via the connection of extend cable and PLC extend port

**[Extend port]:** Connect with other expansion

Note: 1、 If no signal input, the channel's data is 0

2、 According to the actual requirement, connect with K type thermocouple

## 2. Assignment of input ID

XC series analog modules don't engross I/O units, the converted data is directly transferred into PLC register, channel's correspond PLC register's ID is:

Input ID list

Channel	1# Expansion	2# Expansion	3# Expansion	4# Expansion	5# Expansion	6# Expansion	7# Expansion
0CH	ID100	ID200	ID300	ID400	ID500	ID600	ID700
1CH	ID101	ID201	ID301	ID401	ID501	ID601	ID701
2CH	ID102	ID202	ID302	ID402	ID502	ID602	ID702
3CH	ID103	ID203	ID303	ID403	ID503	ID603	ID703
4CH	ID104	ID204	ID304	ID404	ID504	ID604	ID704
5CH	ID105	ID205	ID305	ID405	ID505	ID605	ID705

Output ID list

Channel's ID and parameter	1# Expansion	2# Expansion	3# Expansion	4# Expansion	5# Expansion	6# Expansion	7# Expansion
0CH set temperature	QD100	QD200	QD300	QD400	QD500	QD600	QD700
1CH set temperature	QD101	QD201	QD301	QD401	QD501	QD601	QD701
2CH set temperature	QD102	QD202	QD302	QD402	QD502	QD602	QD702
3CH set temperature	QD103	QD203	QD303	QD403	QD503	QD603	QD703
4CH set temperature	QD104	QD204	QD304	QD404	QD504	QD604	QD704
5CH set temperature	QD105	QD205	QD305	QD405	QD505	QD605	QD705
First 3 channels P para.	QD106	QD206	QD306	QD406	QD506	QD606	QD706
First 3 channels I para.	QD107	QD207	QD307	QD407	QD507	QD607	QD707
First 3 channels D para.	QD108	QD208	QD308	QD408	QD508	QD608	QD708
First 3 channels temp. control bound	QD109	QD209	QD309	QD409	QD509	QD609	QD709
Last 3 channels P	QD110	QD210	QD310	QD410	QD510	QD610	QD710



Take module 1 as example

Register FD8250:

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

Register FD8251:

Channel 5				Channel 4			
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
00: 1/4 filter		-	-	00: 1/4 filter		-	-
01: not filter				01: not filter			
10: 1/2 filter		-	-	10: 1/2 filter		-	-
11: 1/3 filter				11: 1/3 filter			

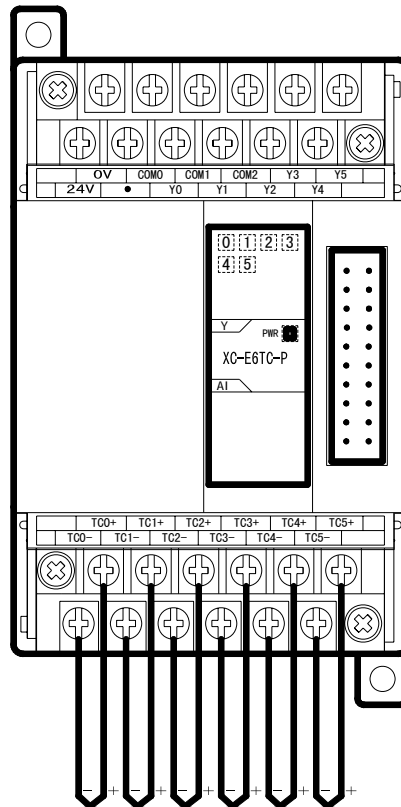
When leave the factory, their defaulted value is 0, i.e. the initial filter format is 1/4 filter

#### 4. Exterior connection

**About the exterior connection, you should pay attention to the following two items:**

- When connect with +24V power outside, please use the 24V power on PLC main unit to avoid interfere
- To avoid interfere, shield measure is necessary for the signal cables

**Input method:**

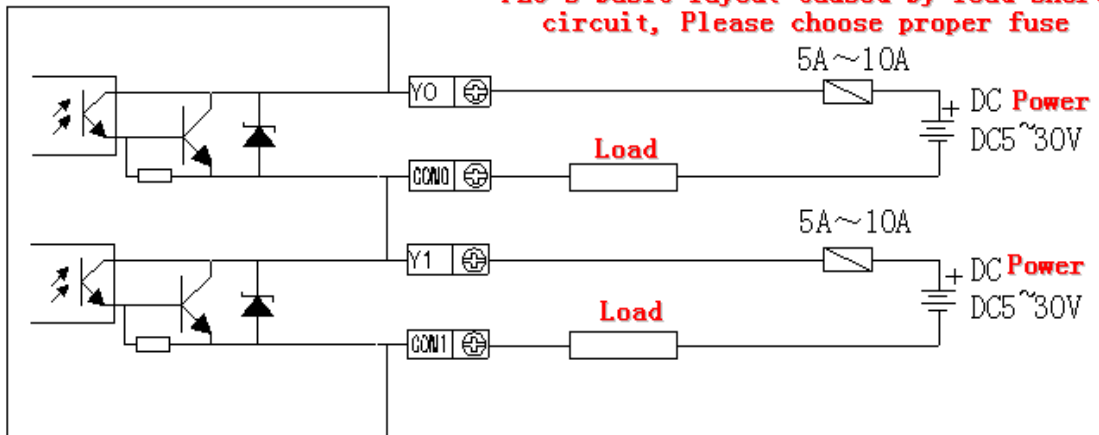


- Output terminal  
For transistor output terminals, flat please use power of DC5V~30V.
- Circuit insulation  
Between PLC interior circuit and output transistor, carry on optical insulation with optical coupling device. Each public modules are separate.
- Response time  
The time form PLC drive (or cut) optical coupling circuit to transistor's ON/OFF, no more than 0.2ms
- Output circuit  
Each point's current 0.8A. But to restrict the increase of temperature,, please use in the condition of every 4 points 1.2A or every 8 points 2.0A
- Open circuit leak current  
Below 0.1mA.

The output circuit is the following:

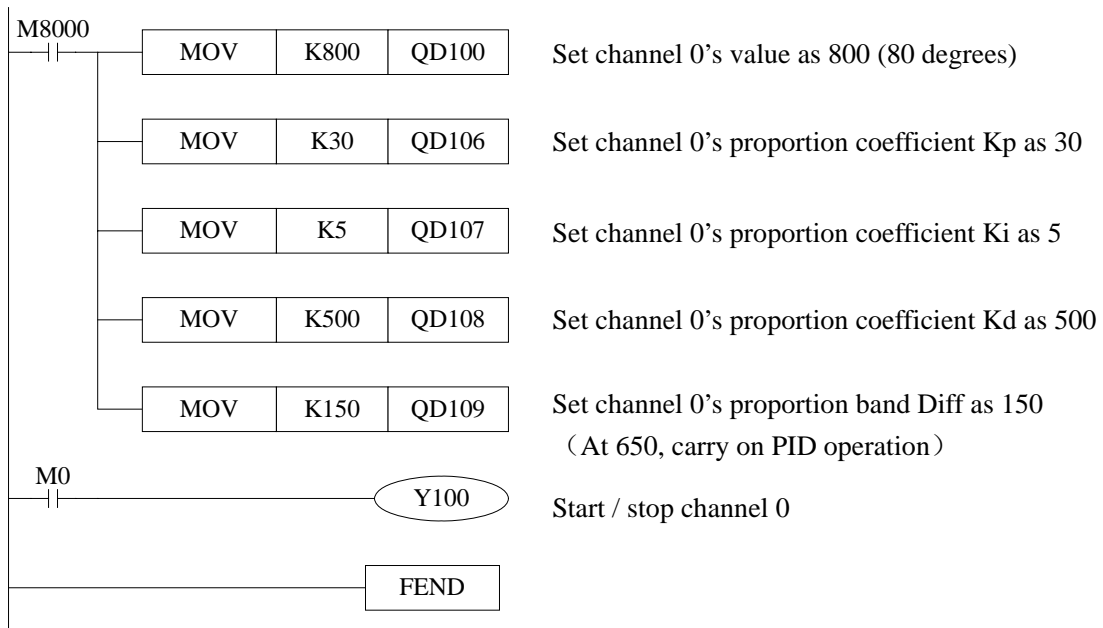
Take channel 0 and channel 1 as the example:

To avoid burning the output unit and PLC's basic layout caused by load short circuit, Please choose proper fuse



## 6. Program

### Program with the first channel



**Any confusion, please contact with:**

**Rockhood Automation Co.,Ltd**

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[robin@rockhood.com](mailto:robin@rockhood.com)

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