



MA series module

Operation manual

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1. Summary

1.1 Introduction

Xinje MA series modules are extension of the PLC which are based on Modbus communication protocol and RS-485 communication port. MA series modules include expansion I/O modules, analog input or output modules etc. MA module enlarges the application field of the XC series PLC, TP series touch screen, PLC&HMI integrator and other devices which support Modbus protocol in temperature, flow, liquid level, pressure and other process control systems. It also meets the requests of industry control better.

1.2 Module type

Type	Function
MA-8X8YR	8 channels digital input (NPN input), 8 channels relay output
MA-8PX8YR	8 channels digital input (PNP input), 8 channels relay output
MA-8X8YT	8 channels digital input (NPN input), 8 channels transistor output
MA-8PX8YT	8 channels digital input (PNP input), 8 channels transistor output
MA-16X	16 channels digital input(NPN input)
MA-16PX	16 channels digital input(PNP input)
MA-16YR	16 channels digital output, relay output
MA-16YT	16 channels digital output, transistor output
MA-4DA	4 channels analog output
MA-8AD-A/V	8 channels analog input
MA-4AD2DA	4 channels analog input, 2 channels analog output
MA-4AD	4 channels analog input
MA-2DA	2 channels analog output
MA-6TCA-P	6 channels type K thermocouple temperature control
MA-6PT-P	6 channels PT100 temperature control

1.3 Configuration

MA series modules can connect with PLC, HMI, PLC&HMI integrator and other devices via RS-485 com port, one device can expand 16 MA modules at most. MA series modules are in Modbus slave station mode in the system.

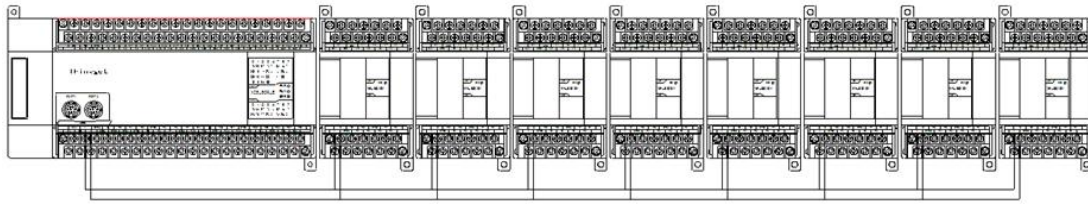
The devices which can be connected with MA are shown as below:

Xinje XD, XC series PLC

Xinje TG,TH,TP series touch screen

Xinje OP series display screen

Any devices can be seemed as Modbus master station.



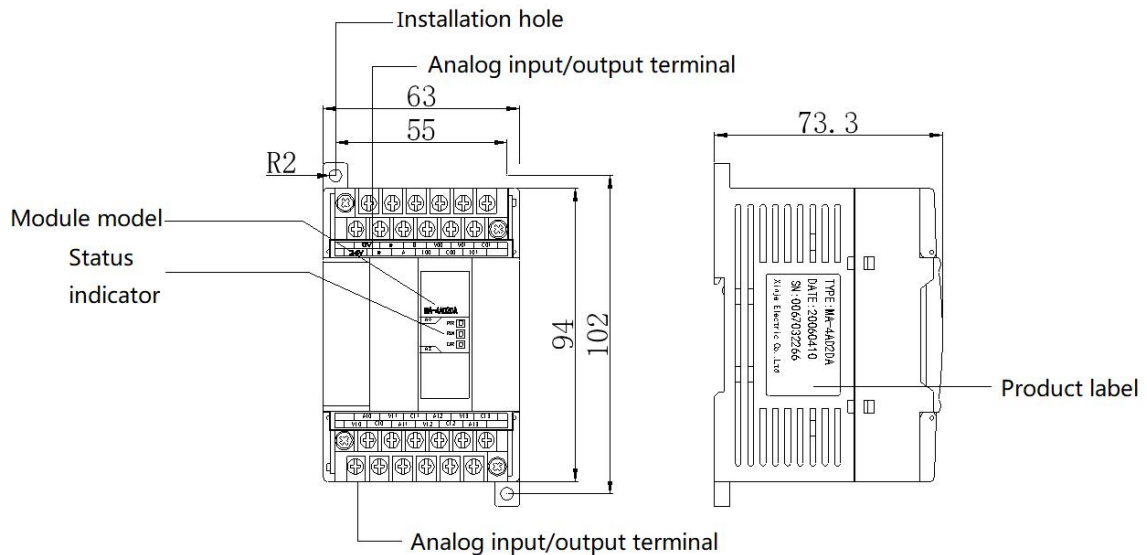
RS-485 communication

- Use 2 bits DIP switch to set communication baud rate.
- Use 4 bits DIP switch to set module station number.

1.4 Specs and dimension

The external dimension of MA series:

Unit: mm



The module function of each parts:

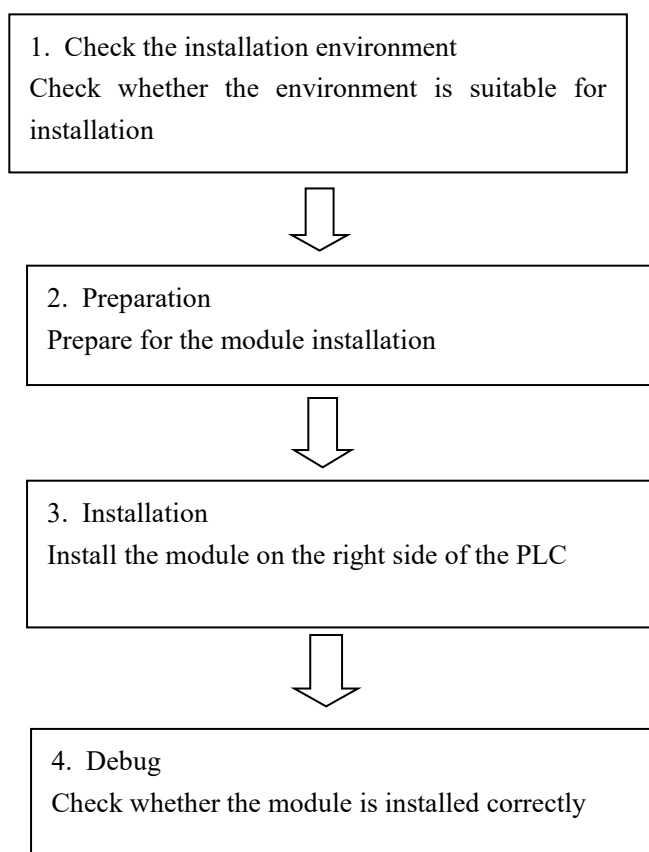
Name	Description
Status indicator	PWR light is on after power-on; RUN light is on during data interaction; ERR light is on when error
Module model	The model of modules
I/O terminal	Terminals for connecting analog input, output and external equipment
Product label	Model, serial number and other information
Installation hole	Spin the screw(M3) in the hole to install the modules

General specifications of the modules:










Item	Specifications
Power supply	DC24V \pm 10%
Using environment	No corrosive gas
Ambient temperature	0°C~60°C
Ambient humidity	5~95%
Installation	Fix the modules with M3 screw or install on DIN46277 (width 35mm) rail
Profile dimension	63mm \times 102mm \times 73.3mm

1.5 Installation

1.5.1 Steps of installation



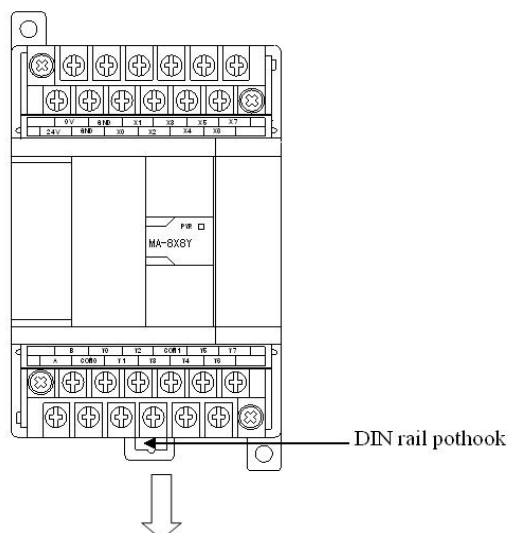
Do not install the module under below environment:

<p>sunshine</p> 	<p>temperature more than 0-50°C</p> 	<p>humidity more than 35-85% RH</p> 
<p>dew</p> 	<p>causticity and inflammability gas</p> 	<p>dust, salt, iron bits and lampblack</p> 
<p>oscillation and crash</p> 	<p>splash water, oil and medicine</p> 	<p>strong electric or magnetic field</p> 

1.5.2 Installation requirement

Use DIN46277 rail (width 35mm) or M3 screw to install the MA module.

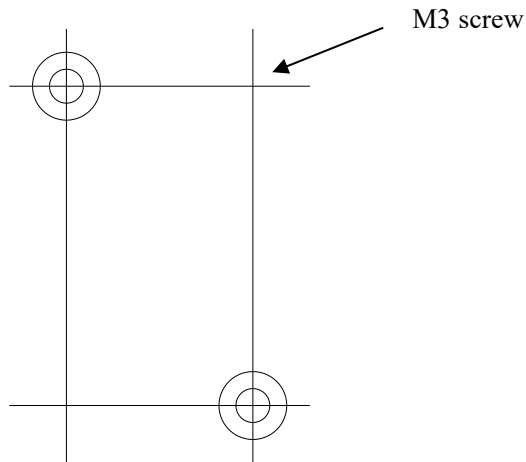
- Use DIN46277 rail



The MA modules can be installed on the DIN46277 rail (width 35mm). When uninstalling, pull down the pothook of the DIN rail.

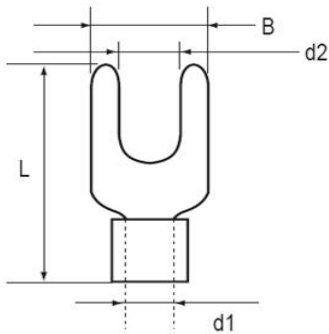
- Installation directly

Screwing into the mounting hole with the M3 screw.



1.5.3 Layout of the I/O points

- "Y" point



"Y" point dimension:

B: below 6mm

L: below 13mm

d2: below 3.2mm

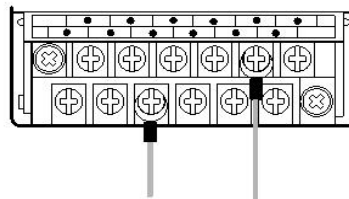
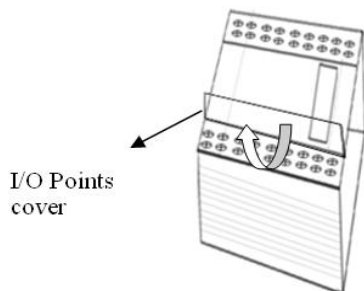
- Layout method

A. Cut off the power supply

B. Open the cover of the I/O points

C. Install the "Y" point onto the I/O points, screwing out the points screw, insert the "Y" point then screw in the points screw

D. Close the I/O terminal cover



1.5.4 Notice items

- Confirm the specs and select the suitable module.
- Do not let the wire and cutting bits falling into the module when operating and layout.
- Confirm the specs of the module and device make sure everything is normal.
- Make sure the connection is steady, if it is loose the data will be incorrect or cause short.



Installation, layout operation should be carried out after cutting down all the power supply!

2. Communication parameter setting

MA series modules are based on MODBUS protocol, it can realize the communication between module and related devices by setting the parameters (including baud rate, data bit, stop bit, check bit and communication station numbers).

In the MA series module, the baud rate and station number can be set by DIP switch. (The DIP switch is located on the right side of the module)

2.1 Baud rate setting

DIP switch				
Baud rate	19200 bps	4800bps	9600bps	57600bps

2.2 Station number setting

DIP switch				
Station number	No.1	No.2	No.3	No.4
DIP switch				
Station number	No.5	No.6	No.7	No.8
DIP switch				
Station number	No.9	No.10	No.11	No.12

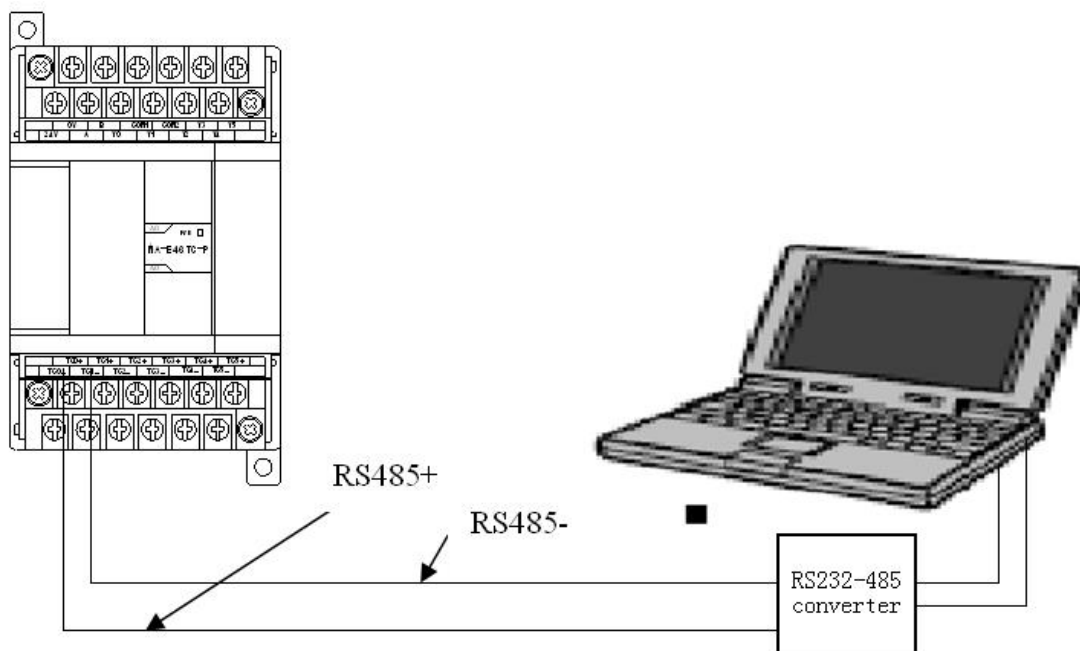
DIP switch	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
	ON OFF	ON OFF	ON OFF	ON OFF
Station number	No.13	No.14	No.15	No.16

3. Module configuration tool config

Analog I/O range of MA-4DA, MA-8AD, MA-4AD2DA can be set by MODBUS communication instruction or tool Config. The former is related with address and communication instruction, will be stated in following chapter. Next we will introduce the tool Config.

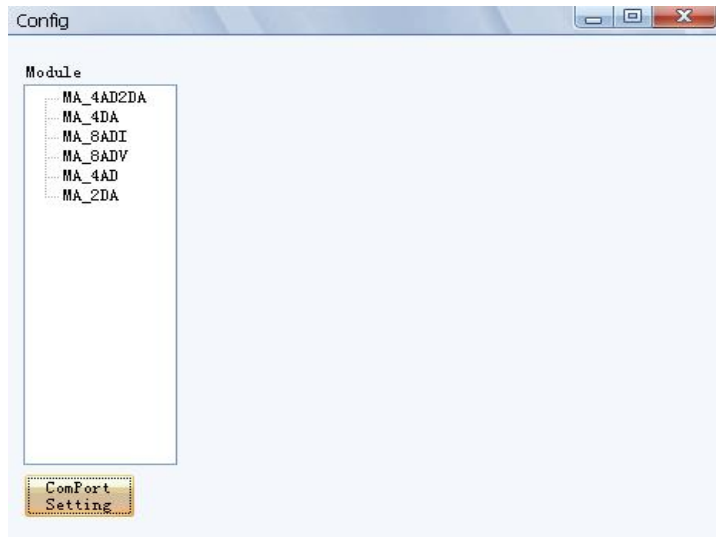
3.1 Hardware connection

As the com port of the module is RS485 while the com port of the computer is RS232, so please use a RS232-485 converter to communicate with the computer.

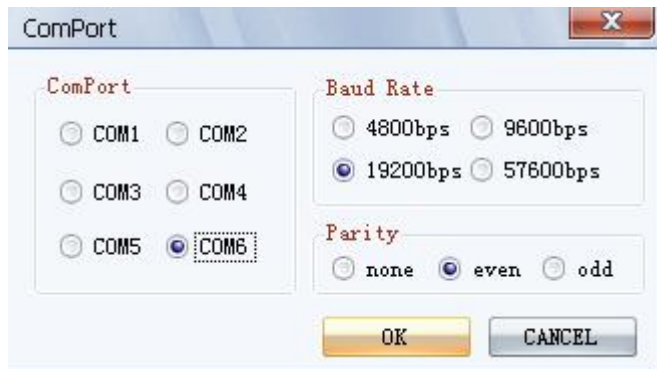


3.2 Software setting

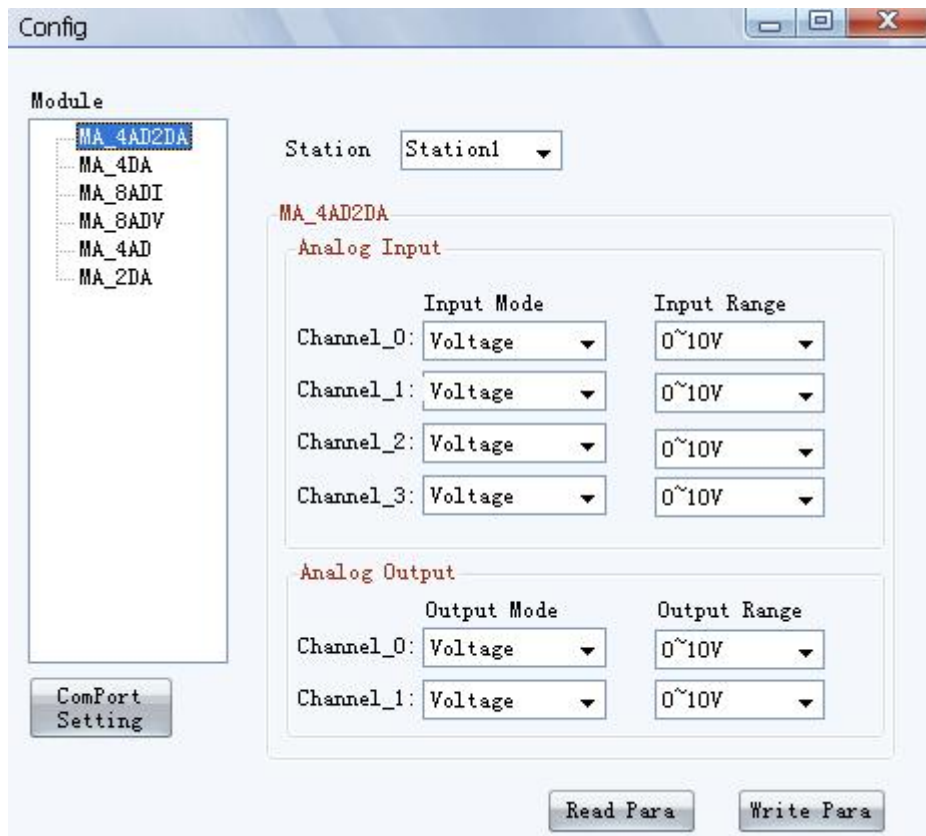
1. First, open the software Config:



2. Click com port config, set the communication parameters between computer and module:



3. Choose the module type, e.g MA-4AD2DA:

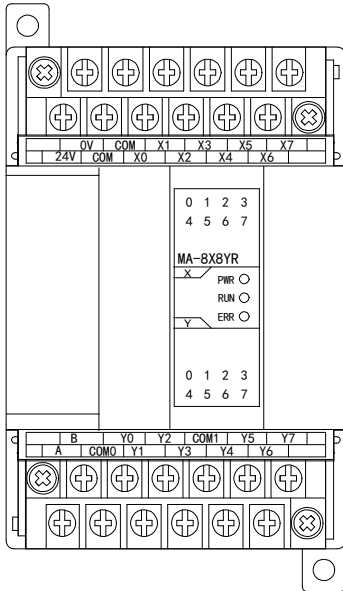


- (1) Station number selection: choose the module station number, the number is set via DIP switch
 - (2) Analog input: configure the input mode and output range.
 - (3) Analog output: configure the output mode and output range.
- Click the "write para" to make the parameters effective, the parameters are memoried when the power is cut off.

4. MA-nXnY I/O modules

4.1 Module features and specifications

MA-nXnY I/O modules are based on MODBUS communication protocol which provide more I/O points and satisfy the production requirements.



Module types:

Type	Description
MA-8X8YR	8 channels digital input,8 channels digital relay output
MA-8X8YT	8 channels digital input,8 channels digital transistor output
MA-16X	16 channels digital input
MA-16YR	16 channels digital relay output
MA-16YT	16 channels digital transistor output

Item	Specifications
Power supply	DC24V ± 10%
Using environment	No corrosive gas
Ambient temperature	0℃~60℃
Ambient humidity	5~95%
Installation	Use M3 screw or fix on the DIN46277 rail (width 35mm)
Dimension	63mm × 102mm × 73.3mm

4.2 Terminal explanation

- (1). MA-8X8YR terminal arrangement

	0V	COM	X1	X3	X5	X7
24V	COM	X0	X2	X4	X6	

	B	Y0	Y2	COM2	Y5	Y7
A	COM0	Y1	Y3	Y4	Y6	

(2). MA-16X terminal arrangement

	0V	B	COM	X1	X3	X5
24V	A	COM	X0	X2	X4	

□

	COM	X7	X11	X13	X15	X17
COM	X6	X10	X12	X14	X16	

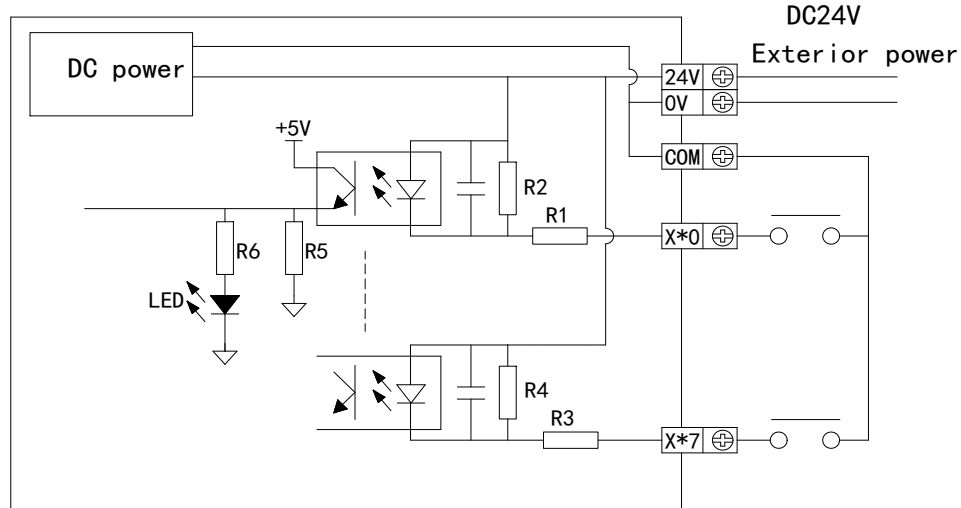
(3). MA-16YR/T terminal arrangement

	0V	B	Y0	Y2	Y3	Y5
24V	A	COM0	Y1	COM1	Y4	

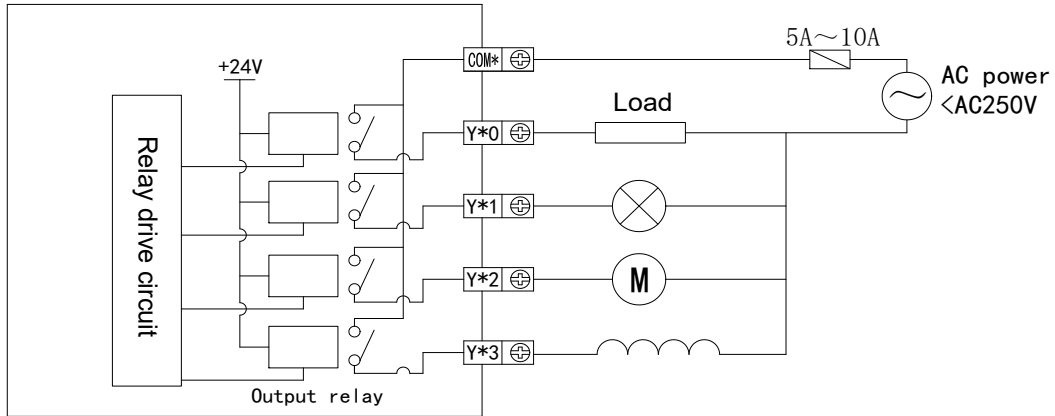
	Y6	Y10	Y12	Y13	Y15	Y17
COM2	Y7	Y11	COM3	Y14	Y16	

4.3 External connection

(1) For MA-8X8YR, MA-8X8YT the input points connection is as below:

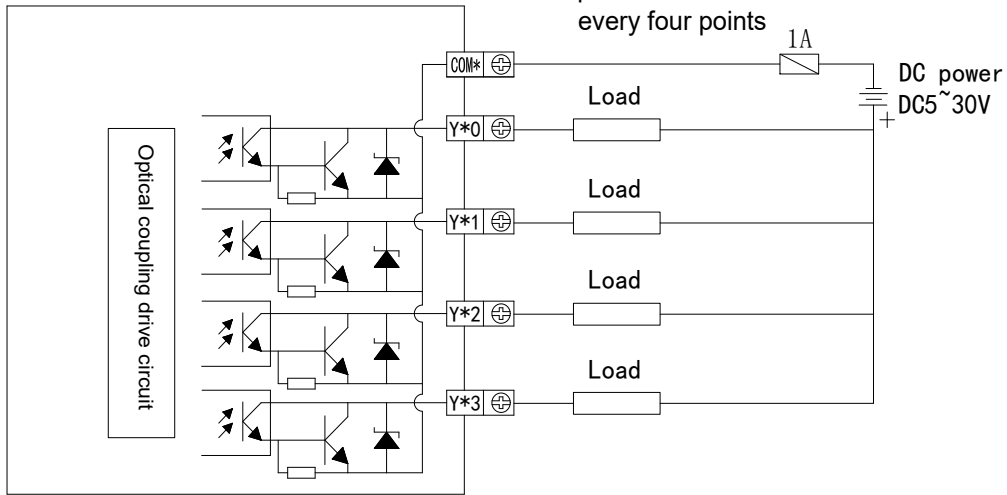


The output terminal wiring mode of MA-8X8YR is shown in the following figure:

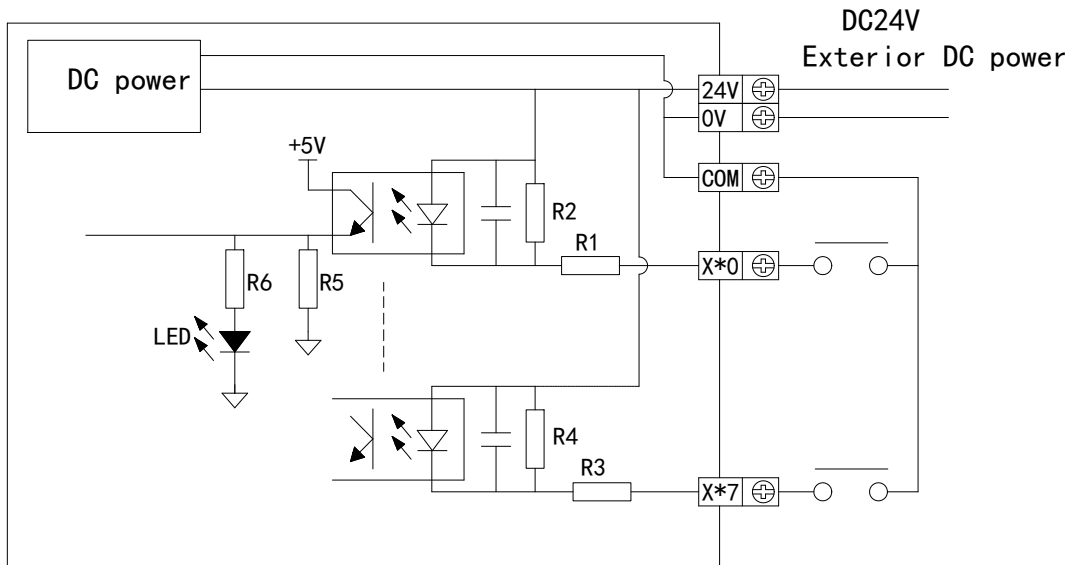


The output terminal wiring mode of MA-8X8YT is shown in the following figure:

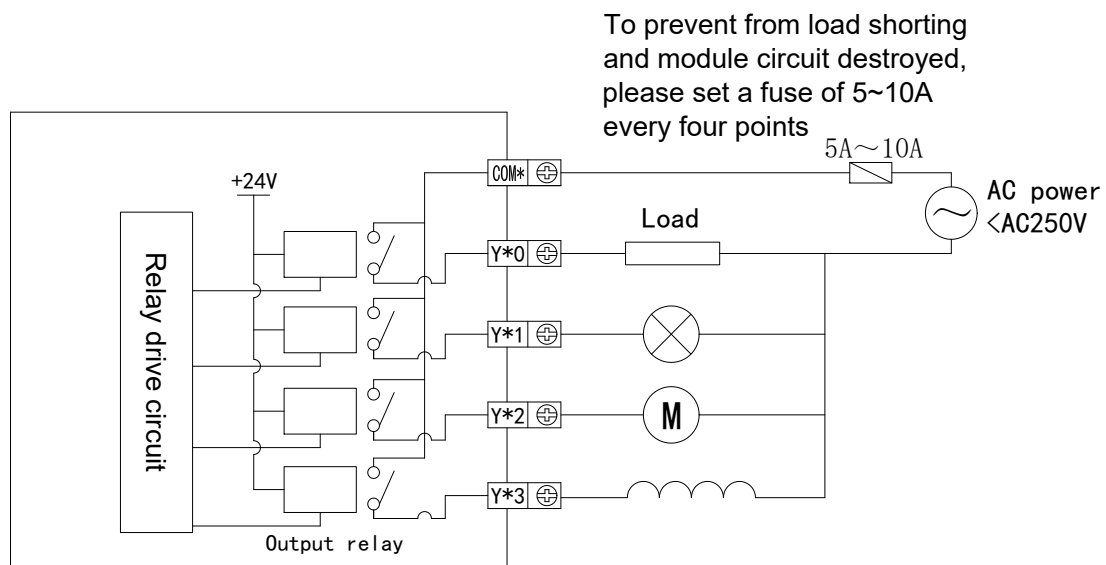
To prevent from load shorting and module circuit destroyed, please set a fuse of 5~10A every four points



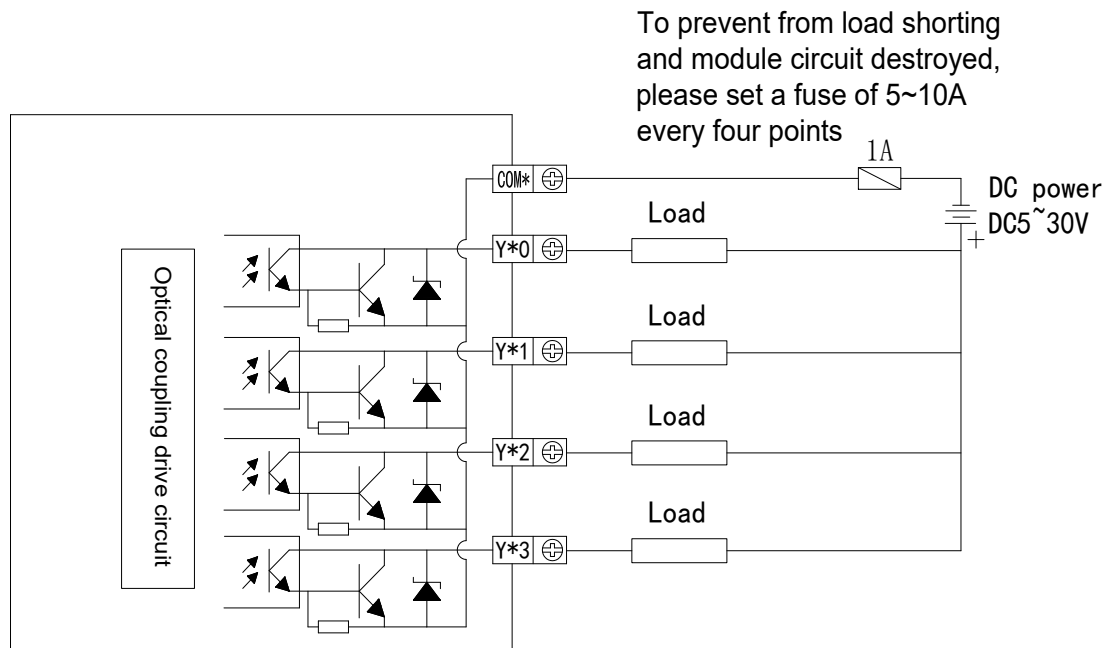
(2) For MA-16X, the input points connection is as below:



(4) For MA-16YR, the output points connection is as below:



For MA-16YT, the output points connection is as below:



4.4 Modbus communication address

(1) Module read bit address

Modbus address (Decimal:K)	Description	Note
0x00	X0 Input point	8X8YR , 16X
0x01	X1 Input point	8X8YR , 16X
0x02	X2 Input point	8X8YR , 16X
0x03	X3 Input point	8X8YR , 16X
0x04	X4 Input point	8X8YR , 16X
0x05	X5 Input point	8X8YR , 16X

0x06	X6 Input point	8X8YR , 16X
0x07	X7 Input point	8X8YR , 16X
0x08	X10 Input point	16X
0x09	X11 Input point	16X
0x10	X12 Input point	16X
0x11	X13 Input point	16X
0x12	X14 Input point	16X
0x13	X15 Input point	16X
0x14	X16 Input point	16X
0x15	X17 Input point	16X

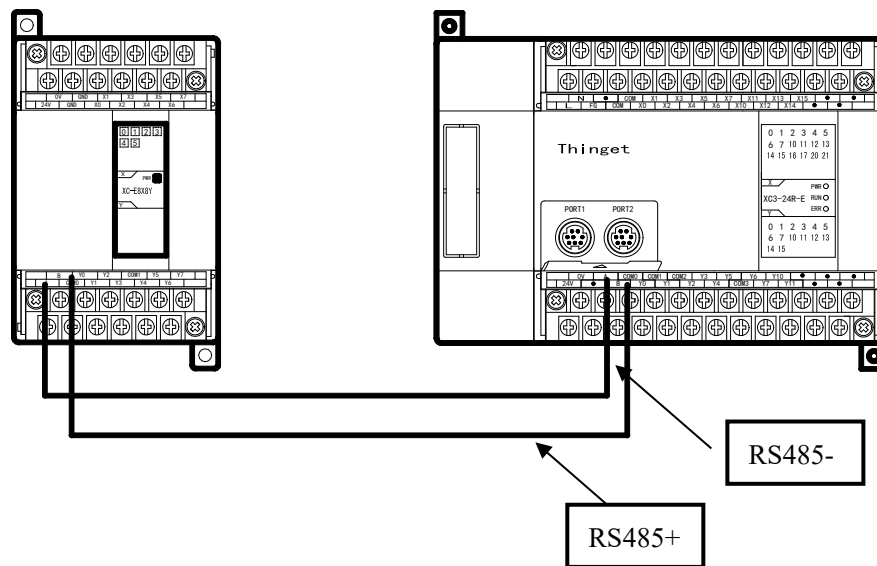
(2) Module write bit address

Modbus address (Decimal:K)	Description	Remark
0x128	Y0 Output point	8X8YR/T , 16YR/T
0x129	Y1 Output point	8X8YR/T , 16YR/T
0x130	Y2 Output point	8X8YR/T , 16YR/T
0x131	Y3 Output point	8X8YR/T , 16YR/T
0x132	Y4 Output point	8X8YR/T , 16YR/T
0x133	Y5 Output point	8X8YR/T , 16YR/T
0x134	Y6 Output point	8X8YR/T , 16YR/T
0x135	Y7 Output point	8X8YR/T , 16YR/T
0x136	Y10 Output point	16YR/T
0x137	Y11 Output point	16YR/T
0x138	Y12 Output point	16YR/T
0x139	Y13 Output point	16YR/T
0x140	Y14 Output point	16YR/T
0x141	Y15 Output point	16YR/T
0x142	Y16 Output point	16YR/T
0x143	Y17 Output point	16YR/T

4.5 Application example

In this chapter, there are two examples: communicate with Xinje XC series PLC and Xinje HMI.

4.5.1 MA-8X8YR communicate with Xinje XC series PLC XC-32T-E



For this example, write the value of PLC coil into MA I/O points, read the value of MA I/O points to PLC coil.

(1) Hardware connection: connect the MA-8X8YR com port A,B with XC-32T-E com port A,B.

Communication parameters setting: baud rate 57600bps, station number No.2.

For MA-8X8YR: baud rate 57600bps, set DIP switch 1-ON, 2-ON;

Station No.2, set DIP switch 1-ON, 2-ON, 3-OFF, 4-OFF.

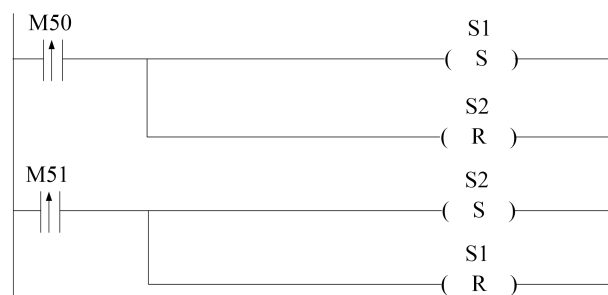
For PLC XC-32T-E: set the COM2 baud rate to be 57600bps then write into PLC and restart.

(2) Corresponding Modbus address

The address corresponding relationship between MA and PLC:

PLC coil	MA I/O points	MA Modbus address
M1	Y1	K129
Y0	Y0	K128

(3) Ladder chart

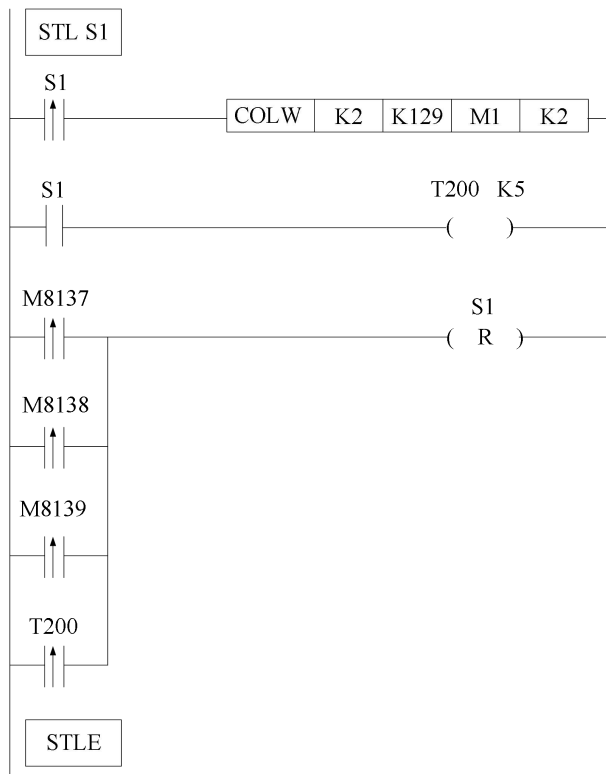


Open the process coil status and write it into control process S1;

Reset the read coil status control flow S2;

Open the process coil status and read the process control S2;

Reset the write coil status control flow S1;

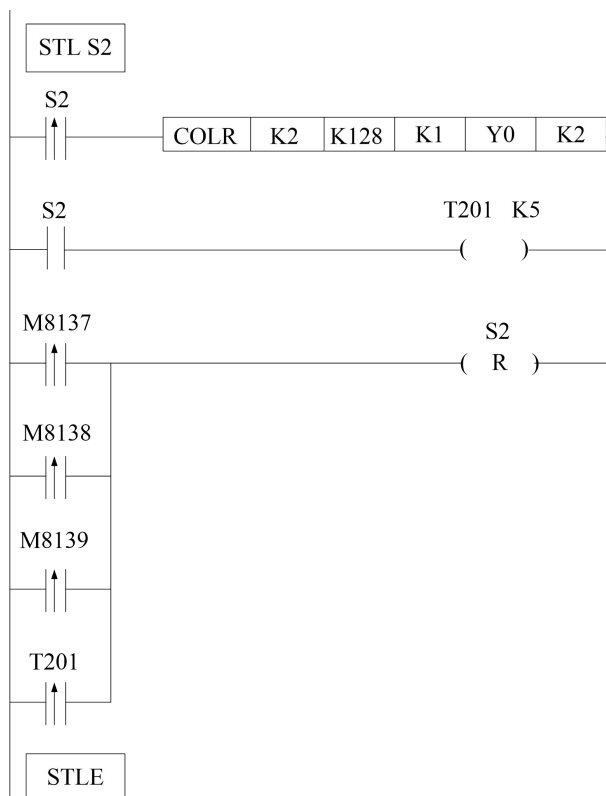


Start process S1

At the beginning of the process, write the local coil M1 status to the module address K129, that is, the module output point Y1;

Delay for 50ms

Reset process S1.



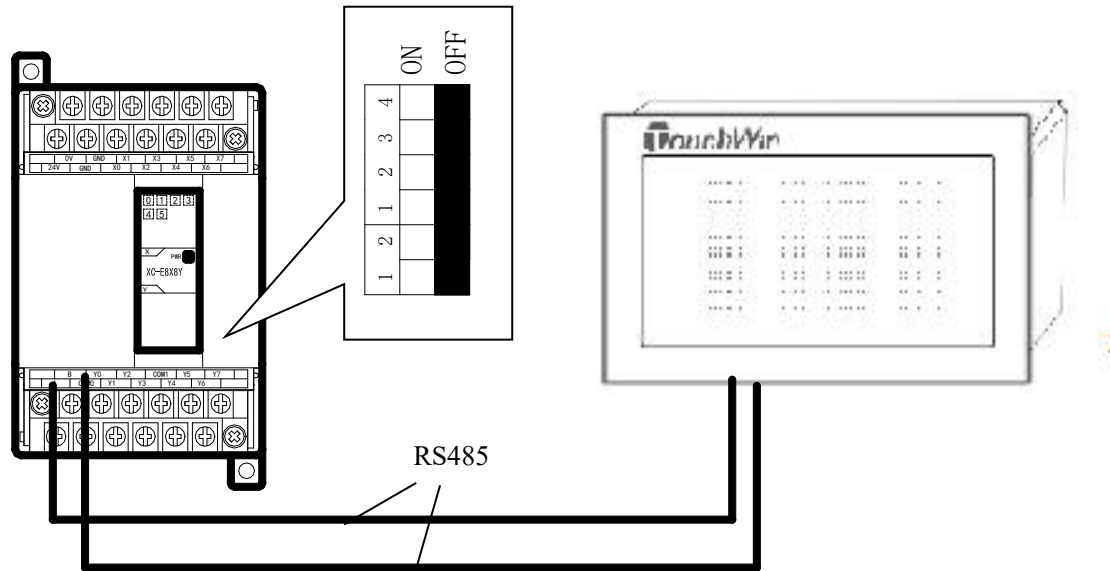
Read the module address K128 to the local output point Y0, that is, the module output point Y1 status;

Delay for 50ms

Reset process S2.

4.5.2 MA-8X8YR communicate with Xinje TP series touch screen TP460-L

(1) Hardware connection: connect the MA-8X8YR terminal A,B with TP460-L PLC port pin4-A and pin7-B.



(2) Communication parameters setting: baud rate 19200bps, station number 1.

For MA-8X8YR:

Baud rate 19200bps, set DIP switch: 1-OFF, 2-OFF

Station number: 1, set DIP switch 1-OFF, 2-OFF, 3-OFF, 4-OFF.

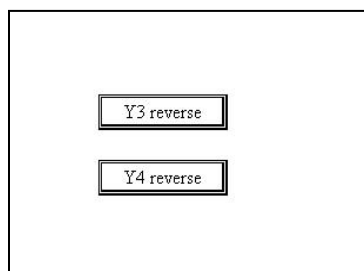
For TP460: PLC choose " Modbus RTU (panel is Master)", communication parameters set to be 19200, 8, Even, 1; when editing the TP screen, set PLC station number to be 1.

(3) Edit the screen

For example, edit the screen in TP, make the output point Y3 and Y4 of MA to do reverse operation, the Modbus address are as below:

MA output point	Corresponding Modbus address
Y3	K131
Y4	K132

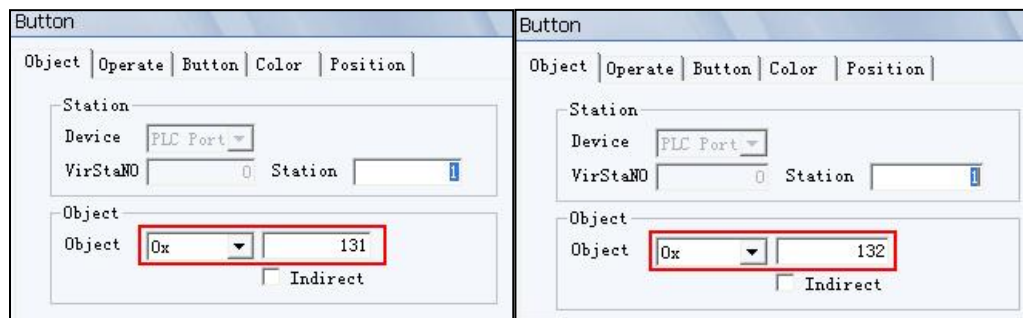
Edit the screen in TP as below:



For "Y3 reverse" button , the object choose 0x131;

For "Y4 reverse" button, the object choose 0x132.

Please see below picture:

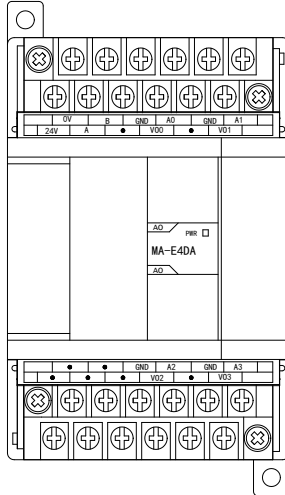


After connecting with touch screen, the user can realize reverse function for Y3 and Y4 on touch screen.

5. MA-4DA analog quantity output module

5.1 Module features and specifications

MA-4DA transforms the 10 bits digital value into analog value (current or voltage value).



Module features :

- 4 channels analog quantity output, two modes:
Voltage output mode: 0~5V, 0~10V.
Current output mode: 0~20mA, 4~20mA.
- 10 bits high precision analog output.

Item	Voltage output	Current output
Analog output range	DC 0~5V, 0~10V	DC 0~20mA, 4~20mA
	(Exterior load resistance less than 2KΩ~1MΩ)	(Exterior load resistance less than 500Ω)
Digital input range	10 bits binary data	
Resolution ratio	1/1023 (10Bit)	
Integrated precision	0.8%	
Conversion speed	3ms/1 channel	
Module Power supply	DC24V ± 10%, 100mA	
Installation	Use M3 screw or fix on DIN46277 rail (width 35mm)	
Dimension	63mm × 102mm × 73.3mm	

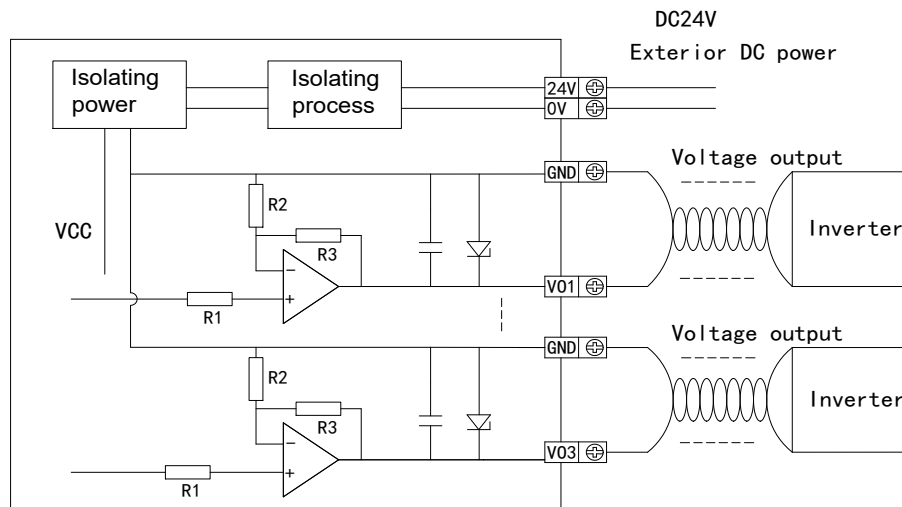
5.2 Terminal explanation

The terminal arrangement of MA-4DA:

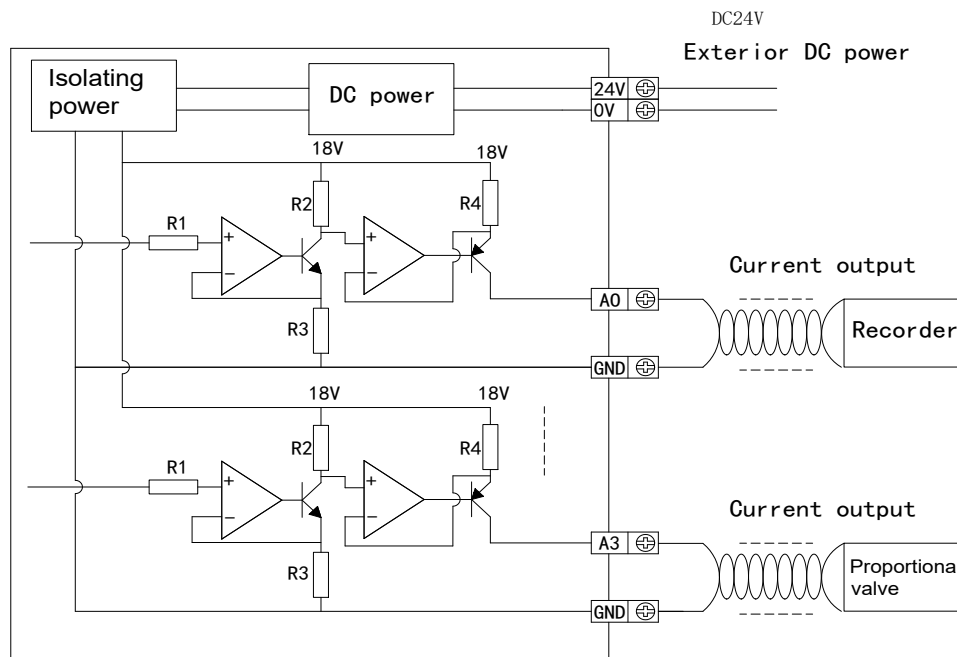
	0V	B	C00	I00	C01	I01	
	24V	A	•	V00	•	V01	
	•	•	C02	I02	C03	I03	
	•	•	•	V02	•	V03	

5.3 External connection

(1) For MA-4DA, voltage output connection is as below:



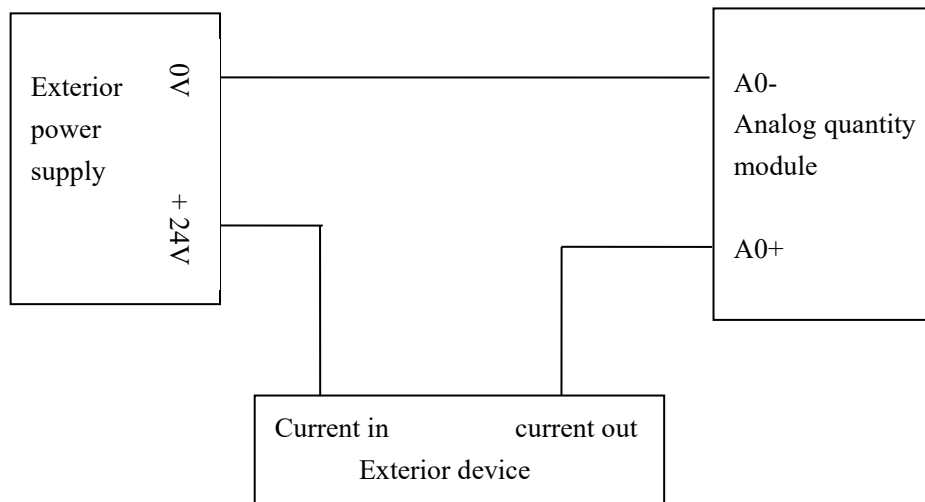
(2) For MA-4DA, current output connection is as below:



Notice for exterior connection:

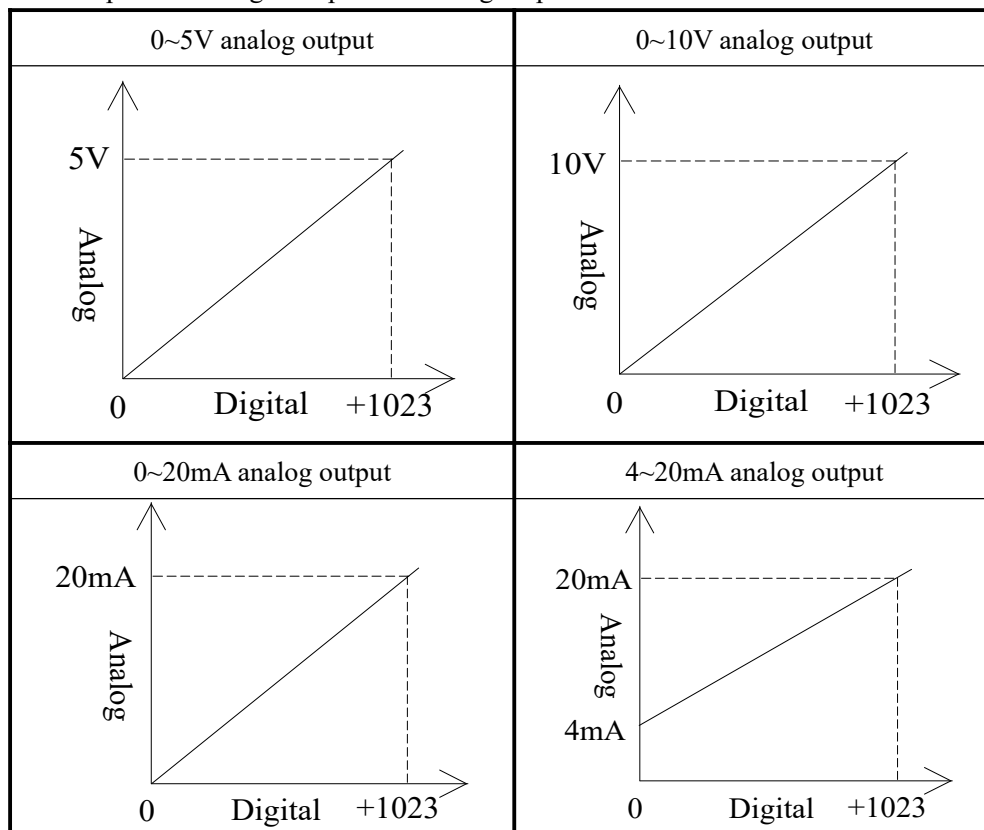
- When connecting the +24V power supply, use the DC power on the connected devices to prevent from interference.
- Use shielding cable and single-point ground for shielding layer.
- 0~20mA or 4~20mA output of the module need a exterior power supply of +24V, then the module adjust the circuit current according to the analog, but the module do not produce current.

Attention: current output need +24V power supply providing from outside, see below picture



5.4 DA conversion diagram

The relationship between digital input and analog output of the module is as below:



5.5 MA-4DA analog output address

(1) Modbus write in bit address

Modbus address (Decimal)	Description	Note
0x128	Channel 0 output mode configure bit	0 : voltage 1: current
0x129	Channel 1 output mode configure bit	0 : voltage 1: current
0x130	Channel 2 output mode configure bit	0 : voltage 1: current
0x131	Channel 3 output mode configure bit	0 : voltage 1: current
0x136	Channel 0 output range configure bit	voltage 0: 0~10v 1: 0~5v
		current 0: 0~20mA 1: 4~20mA
0x137	Channel 1 output range configure bit	voltage 0: 0~10v 1: 0~5v
		current 0: 0~20mA 1: 4~20mA
0x144	Channel 2 output range configure bit	voltage 0: 0~10v 1: 0~5v
		current 0: 0~20mA 1: 4~20mA
0x145	Channel 3 output range configure bit	voltage 0: 0~10v 1: 0~5v
		current 0: 0~20mA 1: 4~20mA

(2) Modbus write in word address

Modbus address (Decimal)	Description	Remark
4x128	DA Channel 0 output value	10 bits
4x129	DA Channel 1 output value	10 bits
4x130	DA Channel 2 output value	10 bits
4x131	DA Channel 3 output value	10 bits

5.6 Application

Connect the MA-4DA with XC-32T-E, set channel 1 to be "current 4~20mA", transform the value in D100 into analog.

(1) Hardware connection: connect the RS485 com port A, B of MA-4DA and PLC.

(2) Communication parameters setting: baud rate: 19200bps, station number: 1.

For MA-4DA: Baud rate 19200bps, set DIP switch 1-OFF, 2-OFF;

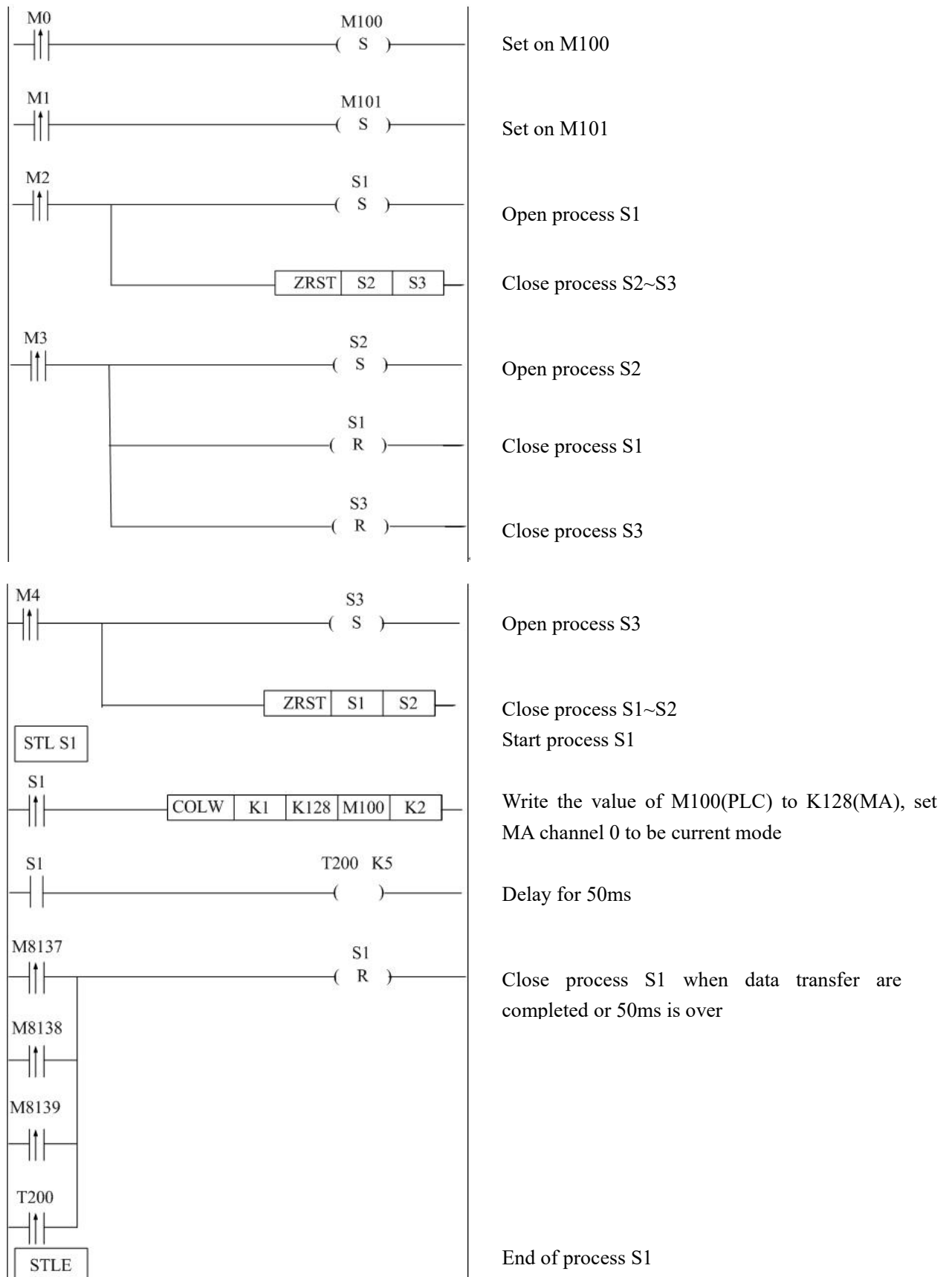
Station number 1, set DIP switch 1-OFF, 2-OFF, 3-OFF, 4-OFF.

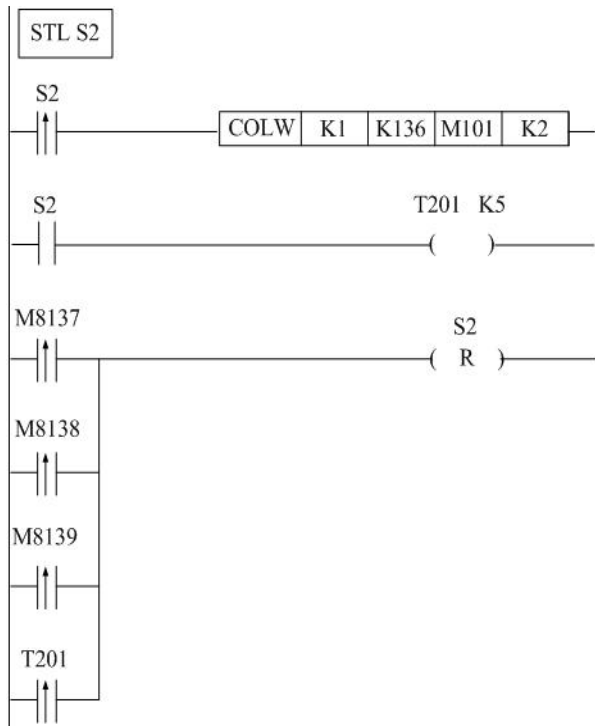
For PLC: set the baud rate of COM 2 to 19200bps, which is valid after writing to PLC and powering on again.

(3) Address corresponding relationship:

PLC coil address	MA Modbus address	Description
M100	K128	Channel 0 output mode configuration address bit
M101	K136	Channel 0 output range configuration address bit
D100	K128	Channel 0 output value address

(4) ladder chart



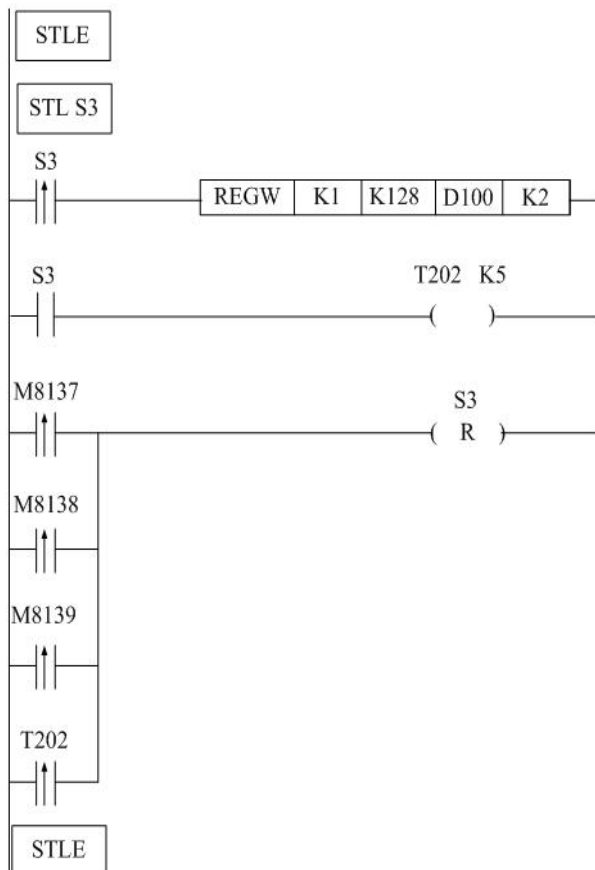


Start process S2

Write the value of M101(PLC) to K136(MA), set channel 0 output range to be 4~20mA

Delay for 50ms

Close process S2 when data transfer are completed or 50ms is over



End of process S2

Start process S3

Write the value of D100(PLC) to K128(MA), output the DA converted value

Delay for 50ms

Close process S3 when data sending are completed or 50ms is over

End of process S3

6. MA-8AD analog output module

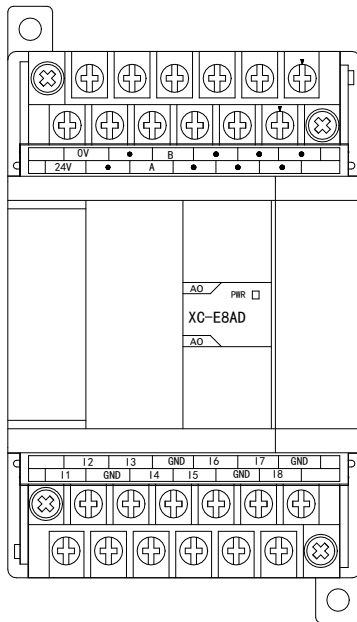
6.1 Module features and specifications

MA-8AD analog input module includes two types:

MA-8AD-V voltage input type

MA-8AD-A current input type.

The module transform the analog input value (voltage or current) into digital value, then send them to related devices.



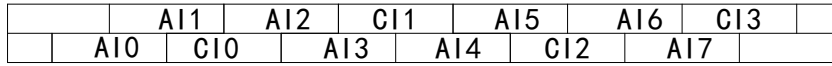
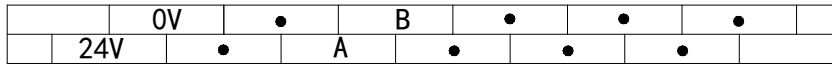
Module features:

- 8 channels 12 bits high precision analog input
- Two modes:
Voltage input : 0~5V, 0~10V
Current input : 0~20mA, 4~20mA
- PID auto-tune function inside

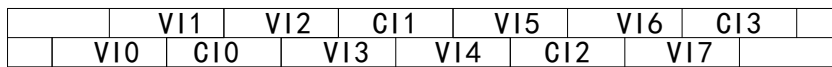
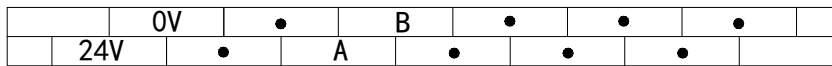
Item	Voltage	Current
Analog input range	DC 0~5V, 0~10V	DC 0~20mA, 4~20mA
	(Exterior load resistor 2KΩ~1MΩ)	(Exterior load resistor less than 500Ω)
Maximum input range	±18V	0~40mA
Digital output range	12 bits binary data	
Resolution	1/4095 (12Bit)	
Integrated precision	0.8%	
Conversion speed	20ms per channel	
Module Power supply	DC24V ± 10%, 100mA	
Installation	Use M3 screw or fix on DIN46277 rail (width 35mm)	
Dimension	63mm × 102mm × 73.3mm	

6.2 Terminal explanation

For MA-8AD-A current input type, the arrangement of the points are as below:

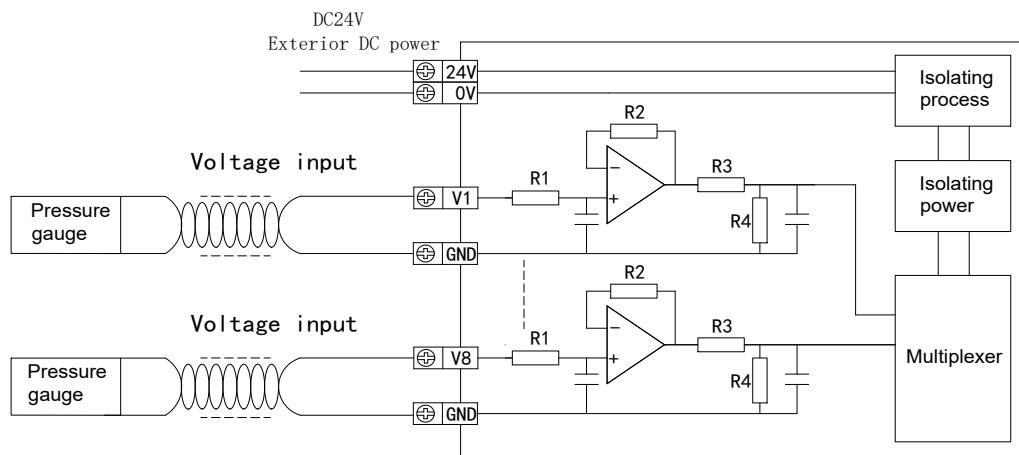


For MA-8AD-V voltage input type, the arrangement of the points are as below:

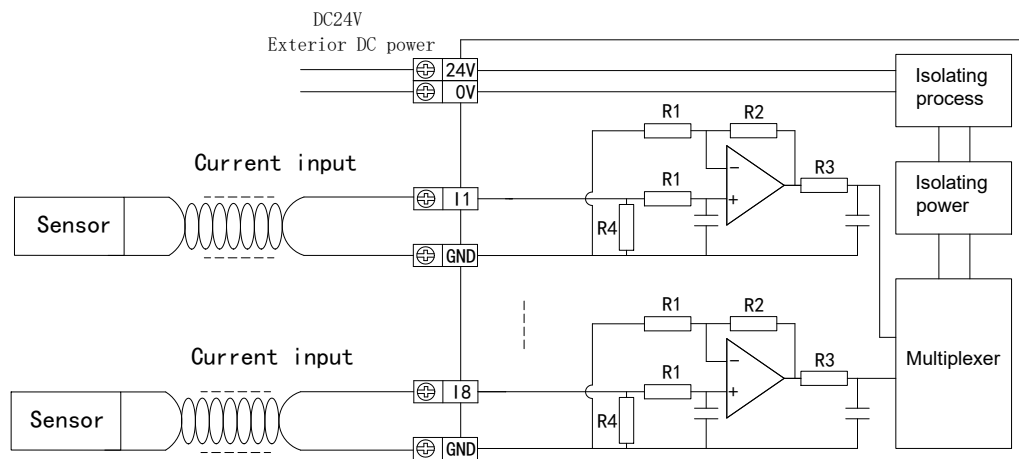


6.3 External connection

(1) For MA-8AD-V voltage input type, the voltage input connection is as below:



(2) For MA-8AD-A current input type, the current input connection is as below:

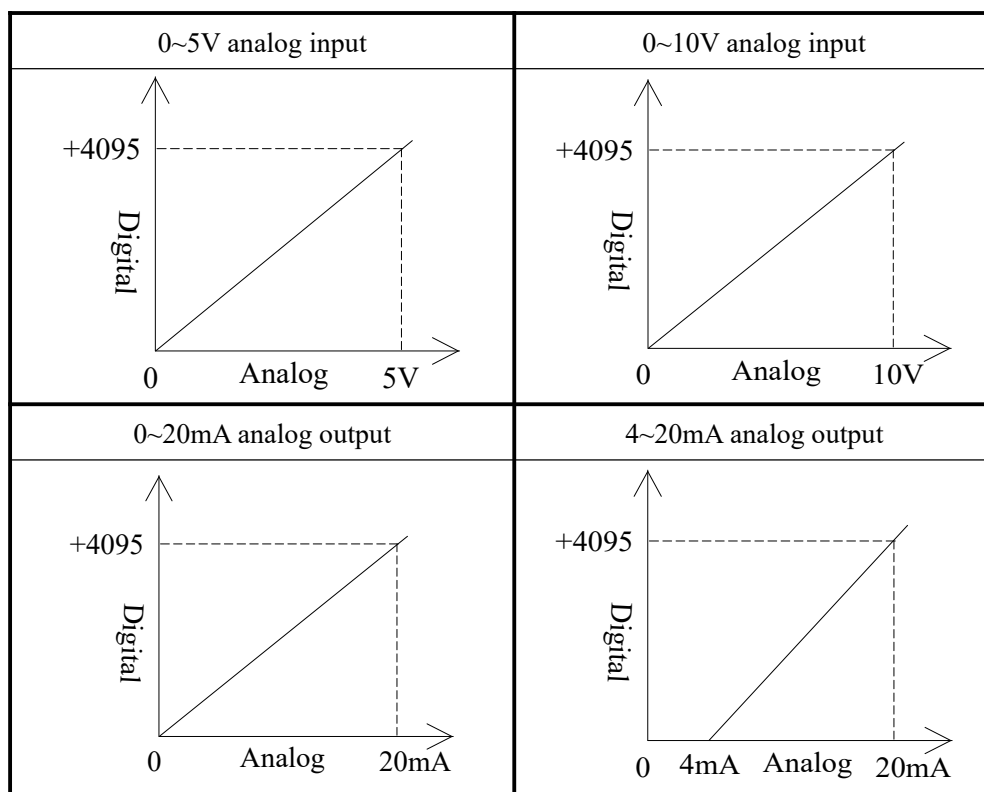


Notes for external connection:

- When connecting the +24V power supply, use the DC power on the connected devices to prevent from interference.
- Use shielding cable and single-point ground for shielding layer.
- 0~20mA or 4~20mA output of the module need a exterior power supply of +24V, then the module adjust the circuit current according to the analog quantity, but the module do not produce current.

6.4 AD conversion diagram

The relationship between analog and digital are as below:



6.5 MA-8AD analog quantity input module address

For this module, the address assignment of voltage type and current type are the same.

(1) Modbus read bit address

Modbus address (decimal)	Description	Note	
		0	1
0x00	Channel 0 PID control result	Close	Output
0x01	Channel 1 PID control result	Close	Output
0x02	Channel 2 PID control result	Close	Output

0x03	Channel 3 PID control result	Close	Output
0x04	Channel 4 PID control result	Close	Output
0x05	Channel 5 PID control result	Close	Output
0x06	Channel 6 PID control result	Close	Output
0x07	Channel 7 PID control result	Close	Output
0x08	Channel 0 Open circuit check	Normal	Open
0x09	Channel 1 Open circuit check	Normal	Open
0x10	Channel 2 Open circuit check	Normal	Open
0x11	Channel 3 Open circuit check	Normal	Open
0x12	Channel 4 Open circuit check	Normal	Open
0x13	Channel 5 Open circuit check	Normal	Open
0x14	Channel 6 Open circuit check	Normal	Open
0x15	Channel 7 Open circuit check	Normal	Open
0x16	Channel 0 Auto-tune error check	Normal	Error
0x17	Channel 1 Auto-tune error check	Normal	Error
0x18	Channel 2 Auto-tune error check	Normal	Error
0x19	Channel 3 Auto-tune error check	Normal	Error
0x20	Channel 4 Auto-tune error check	Normal	Error
0x21	Channel 5 Auto-tune error check	Normal	Error
0x22	Channel 6 Auto-tune error check	Normal	Error
0x23	Channel 7 Auto-tune error check	Normal	Error

(2) Modbus write bit address

Modbus address (Decimal)	Description	Note	
		0	1
0x128	Channel 0 Input range configure bit	0~5V	0~10V
		0~20mA	4~20 mA
0x129	Channel 1 Input range configure bit	0~5V	0~10V
		0~20mA	4~20 mA
0x130	Channel 2 Input range configure bit	0~5V	0~10V
		0~20mA	4~20 mA
0x131	Channel 3 Input range configure bit	0~5V	0~10V
		0~20mA	4~20 mA
0x132	Channel 4 Input range configure bit	0~5V	0~10V
		0~20mA	4~20 mA
0x133	Channel 5 Input range configure bit	0~5V	0~10V
		0~20mA	4~20 mA
0x134	Channel 6 Input range configure bit	0~5V	0~10V
		0~20mA	4~20 mA
0x135	Channel 7 Input range configure bit	0~5V	0~10V
		0~20mA	4~20 mA
0x136	Channel 0 PID enable bit	Close	Enable

0x137	Channel 1 PID enable bit	Close	Enable
0x138	Channel 2 PID enable bit	Close	Enable
0x139	Channel 3 PID enable bit	Close	Enable
0x140	Channel 4 PID enable bit	Close	Enable
0x141	Channel 5 PID enable bit	Close	Enable
0x142	Channel 6 PID enable bit	Close	Enable
0x143	Channel 7 PID enable bit	Close	Enable
0x144	Channel 0 Auto-tune enable bit	Close	Enable
0x145	Channel 1 Auto-tune enable bit	Close	Enable
0x146	Channel 2 Auto-tune enable bit	Close	Enable
0x147	Channel 3 Auto-tune enable bit	Close	Enable
0x148	Channel 4 Auto-tune enable bit	Close	Enable
0x149	Channel 5 Auto-tune enable bit	Close	Enable
0x150	Channel 6 Auto-tune enable bit	Close	Enable
0x151	Channel 7 Auto-tune enable bit	Close	Enable
0x152	Channel 0 Positive/negative action selection bit	Negative action	Positive action
0x153	Channel 1 Positive/negative action selection bit	Negative action	Positive action
0x154	Channel 2 Positive/negative action selection bit	Negative action	Positive action
0x155	Channel 3 Positive/negative action selection bit	Negative action	Positive action
0x156	Channel 4 Positive/negative action selection bit	Negative action	Positive action
0x157	Channel 5 Positive/negative action selection bit	Negative action	Positive action
0x158	Channel 6 Positive/negative action selection bit	Negative action	Positive action
0x159	Channel 7 Positive/negative action selection bit	Negative action	Positive action

(3) Modbus read word address

Modbus address (Decimal)	Description
4x00	Channel 0 Current value
4x01	Channel 1 Current value
4x02	Channel 2 Current value
4x03	Channel 3 Current value
4x04	Channel 4 Current value
4x05	Channel 5 Current value
4x06	Channel 6 Current value
4x07	Channel 7 Current value

4x08	Channel 0 PID digital output
4x09	Channel 1 PID digital output
4x10	Channel 2 PID digital output
4x11	Channel 3 PID digital output
4x12	Channel 4 PID digital output
4x13	Channel 5 PID digital output
4x14	Channel 6 PID digital output
4x15	Channel 7 PID digital output

(4) Modbus write word address

Modbus address (Decimal)	Description	Note
4x128	Channel 0 Setting value	
4x129	Channel 1 Setting value	
4x130	Channel 2 Setting value	
4x131	Channel 3 Setting value	
4x132	Channel 4 Setting value	
4x133	Channel 5 Setting value	
4x134	Channel 6 Setting value	
4x135	Channel 7 Setting value	
4x136	Channel 0 Parameter P	
4x137	Channel 0 Parameter I	
4x138	Channel 0 Parameter D	
4x139	Channel 0 Parameter DIFF	
4x140	Channel 1 Parameter P	
4x141	Channel 1 Parameter I	
4x142	Channel 1 Parameter D	
4x143	Channel 1 Parameter DIFF	
4x144	Channel 2 Parameter P	
4x145	Channel 2 Parameter I	
4x146	Channel 2 Parameter D	
4x147	Channel 2 Parameter DIFF	
4x148	Channel 3 Parameter P	
4x149	Channel 3 Parameter I	
4x150	Channel 3 Parameter D	
4x151	Channel 3 Parameter DIFF	
4x152	Channel 4 Parameter P	
4x153	Channel 4 Parameter I	
4x154	Channel 4 Parameter D	
4x155	Channel 4 Parameter DIFF	
4x156	Channel 5 Parameter P	
4x157	Channel 5 Parameter I	
4x158	Channel 5 Parameter D	

4x159	Channel 5 Parameter DIFF	
4x160	Channel 6 Parameter P	
4x161	Channel 6 Parameter I	
4x162	Channel 6 Parameter D	
4x163	Channel 6 Parameter DIFF	
4x164	Channel 7 Parameter P	
4x165	Channel 7 Parameter I	
4x166	Channel 7 Parameter D	
4x167	Channel 7 Parameter DIFF	
4x168	Channel 0 Control period	Min 0.5s, max 200s
4x169	Channel 1 Control period	Min 0.5s, max 200s
4x170	Channel 2 Control period	Min 0.5s, max 200s
4x171	Channel 3 Control period	Min 0.5s, max 200s
4x172	Channel 4 Control period	Min 0.5s, max 200s
4x173	Channel 5 Control period	Min 0.5s, max 200s
4x174	Channel 6 Control period	Min 0.5s, max 200s
4x175	Channel 7 Control period	Min 0.5s, max 200s
4x176	Channel 0 Correct current value	Change current value
4x177	Channel 1 Correct current value	Change current value
4x178	Channel 2 Correct current value	Change current value
4x179	Channel 3 Correct current value	Change current value
4x180	Channel 4 Correct current value	Change current value
4x181	Channel 5 Correct current value	Change current value
4x182	Channel 6 Correct current value	Change current value
4x183	Channel 7 Correct current value	Change current value
4x184	Channel 0 Auto-tune output range	0%~100%
4x185	Channel 1 Auto-tune output range	0%~100%
4x186	Channel 2 Auto-tune output range	0%~100%
4x187	Channel 3 Auto-tune output range	0%~100%
4x188	Channel 4 Auto-tune output range	0%~100%
4x189	Channel 5 Auto-tune output range	0%~100%
4x190	Channel 6 Auto-tune output range	0%~100%
4x191	Channel 7 Auto-tune output range	0%~100%
4x192	Channel 0 Deviation value setting	
4x193	Channel 1 Deviation value setting	
4x194	Channel 2 Deviation value setting	
4x195	Channel 3 Deviation value setting	
4x196	Channel 4 Deviation value setting	
4x197	Channel 5 Deviation value setting	
4x198	Channel 6 Deviation value setting	
4x199	Channel 7 Deviation value setting	

6.6 Application example

This example realizes the PID control of set value and control the object with digital quantity on the foundation of communication between PLC and MA-8AD. The operation process are as below:

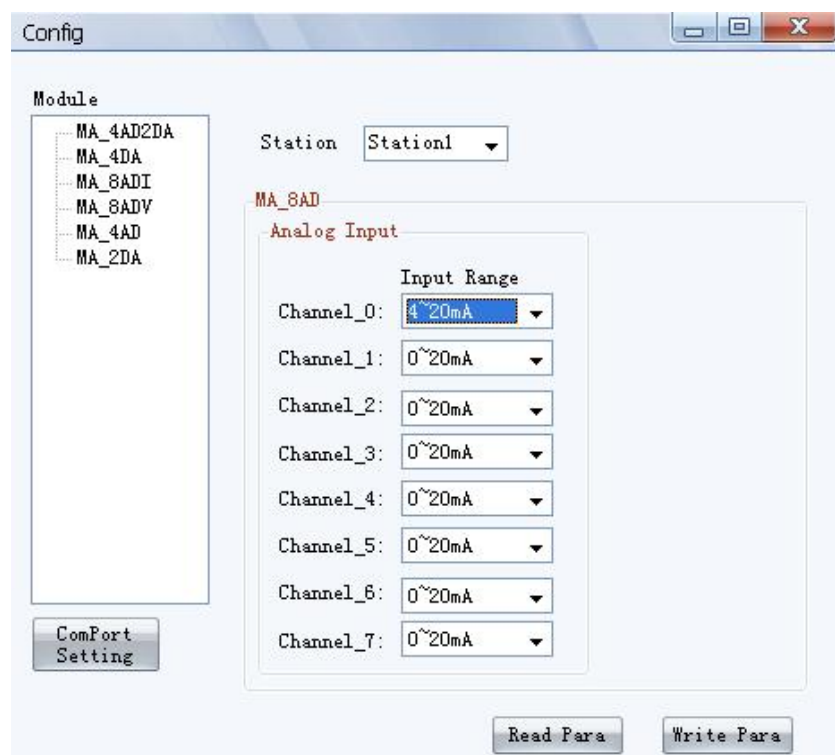
- (1) Hardware connection: connect the RS485 com port A, B of MA-8AD and the PLC
- (2) Communication parameters setting: baud rate 19200bps, station number 1.

For MA-8AD: baud rate 19200bps, set DIP switch 1-OFF, 2-OFF;

Station number 1, set DIP switch 1-OFF, 2-OFF, 3-OFF, 4-OFF.

For PLC: set the com2 port baud rate to be 19200bps, write into the PLC and restart.

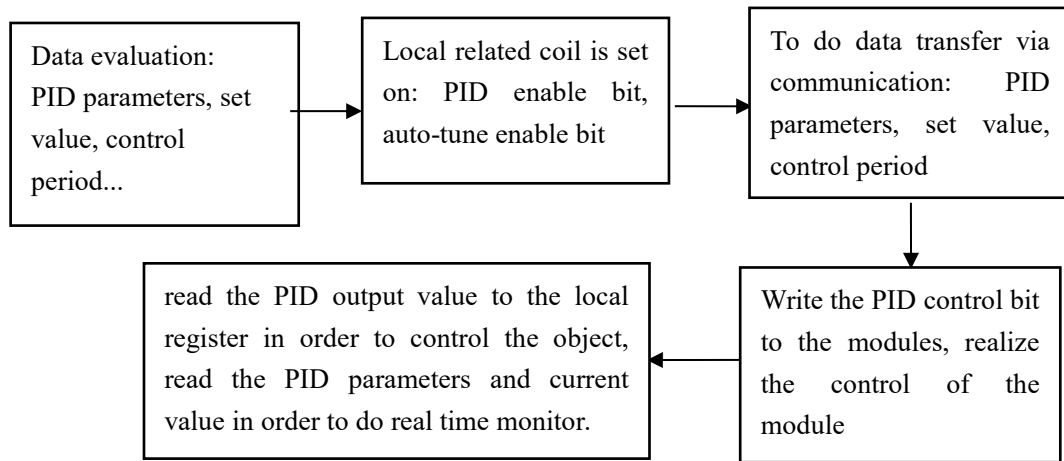
- (3) Input range configure: via configure tool Config:



Set the current range of channel 0 to be 4~20mA, click "Write Para" to make them effective.

At the beginning of the program, write the PID parameters, set value, control period into the register. It needs to configure the related parameters of the control object including PID enable bit, auto-tune enable bit in order to do Modbus communication. When the local trigger condition is satisfied, PLC send the set value, channel control period, PID parameters to the corresponding address of the module via write instruction. At this time, all the preparations for PID auto-tune have been done. When PID enable bit is on, the module starts to do PID control with the defaulted state of negative action and reads the current value with the period of 100ms. When auto-tune enable bit is on, the module starts to do auto-tune. Among up two processes, read the PID output value to the local register to realize object control.

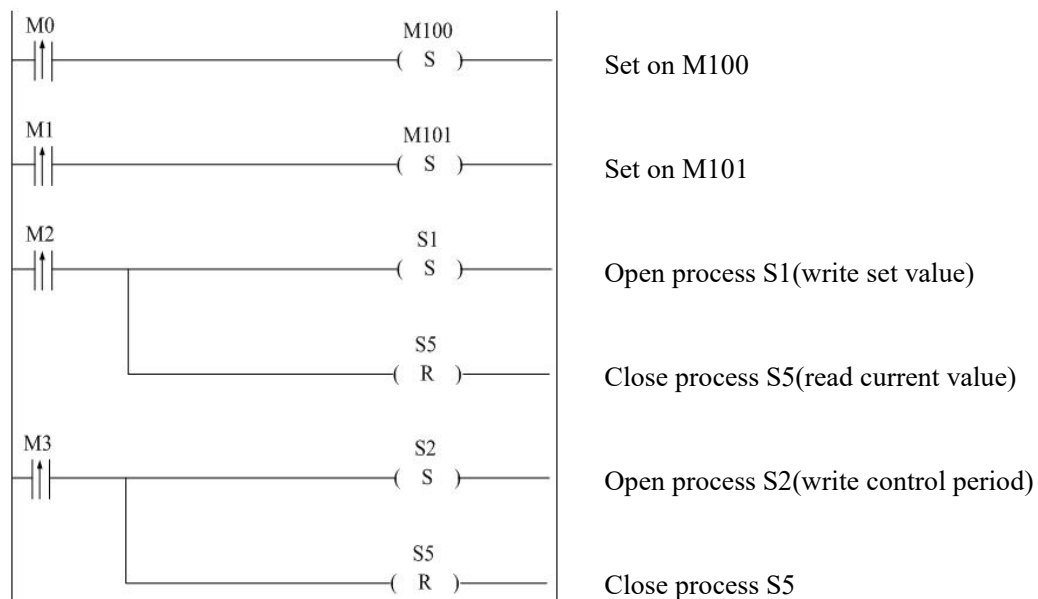
The whole process are as below:

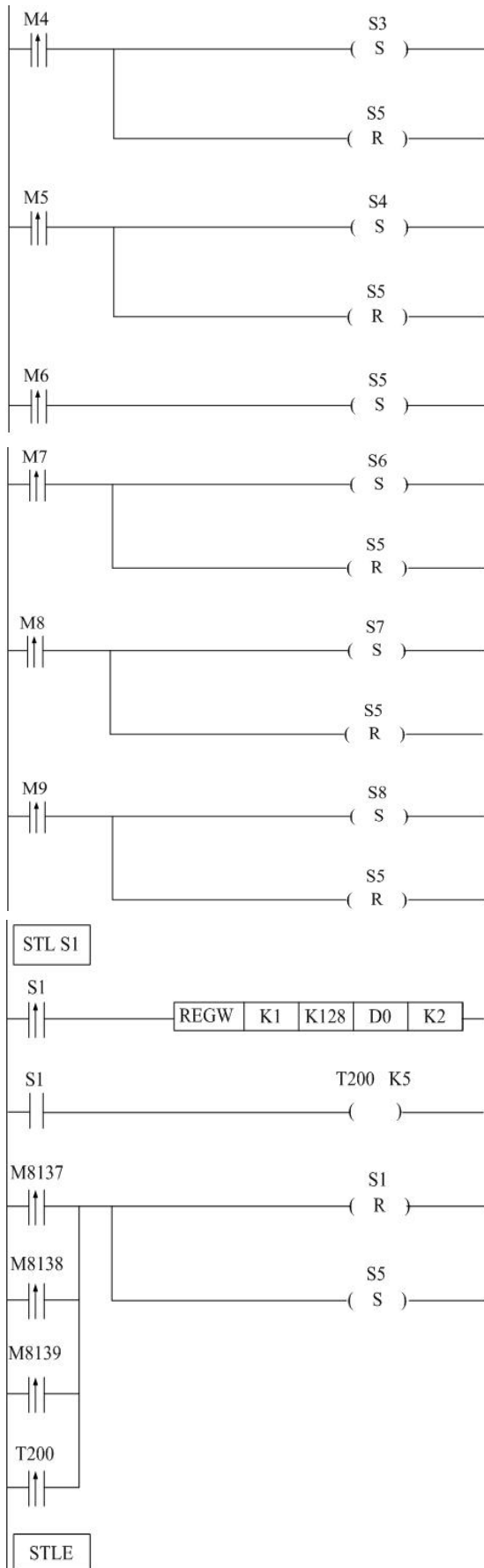


(4) The corresponding address relationship between MA module and the PLC are as below:

PLC address	MA Modbus address	Note
D0	K128	Channel 0 set value
D1	K168	Channel 0 control period
D2	K136	Channel 0 parameter P
D3	K137	Channel 0 parameter I
D4	K138	Channel 0 parameter D
D5	K139	Channel 0 parameter Diff
D6	K0	Channel 0 current value
D7	K8	Channel 0 PID output value
M100	K136	Channel 0 PID enable bit
M101	K144	Channel 0 auto-tune enable bit

(5) Ladder chart:





Open process S3(write PID parameters)

Close process S5

Open process S4(open manual PID control)

Close process S5

Open process S5

Open process S6(auto-tune control)

Close process S5

Open process S7(read auto-tune state)

Close process S5

Open process S8(read PID control results)

Close process S5

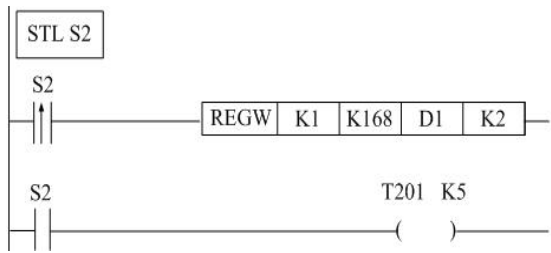
Start process S1

Write the value of D0(PLC) to K128(MA), i.e. channel 0 set value

Delay for 50ms

Close process S1 and open process S5 when data transfer are completed or 50ms is over

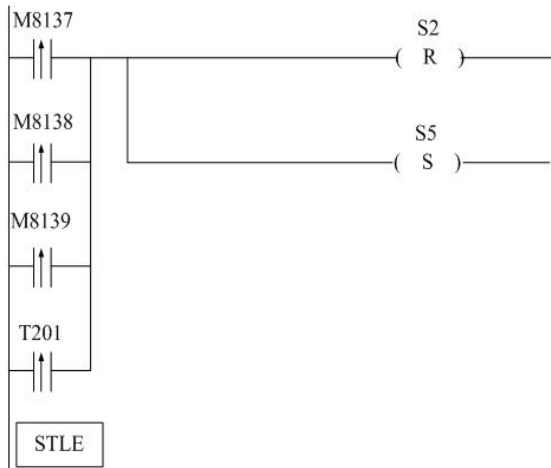
End of process S1



Start process S2

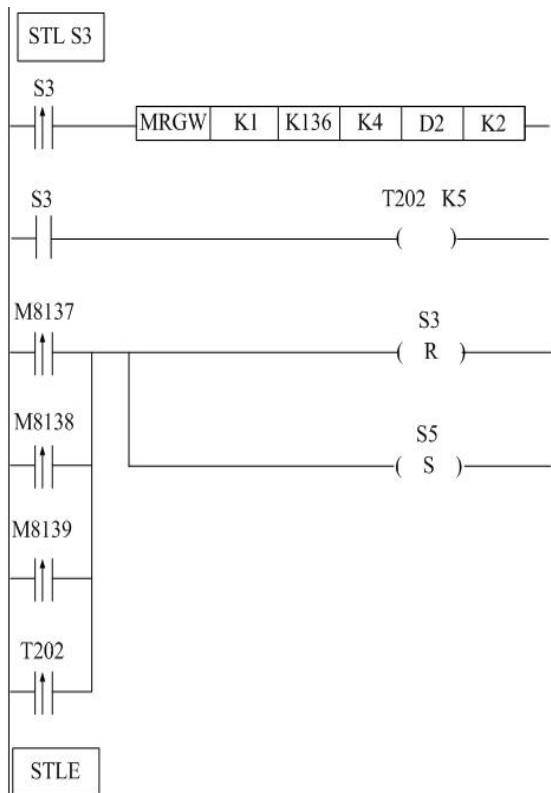
Write the value of D1(PLC) to K168(MA),
i.e. channel 0 control period

Delay for 50ms



Close process S2 and open process S5 when
data transfer are completed or 50ms is over

End of process S2



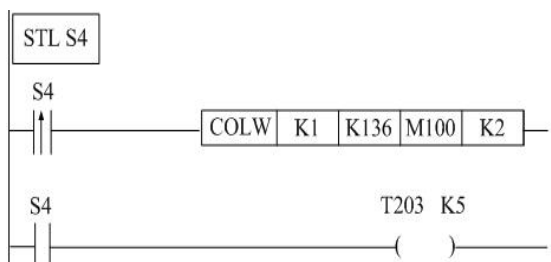
Start process S3

Write the value of D2~D5(PLC) to
K136~K139(MA), i.e. the PID parameters

Delay for 50ms

Close process S3 and open process S5 when
data transfer are completed or 50ms is over

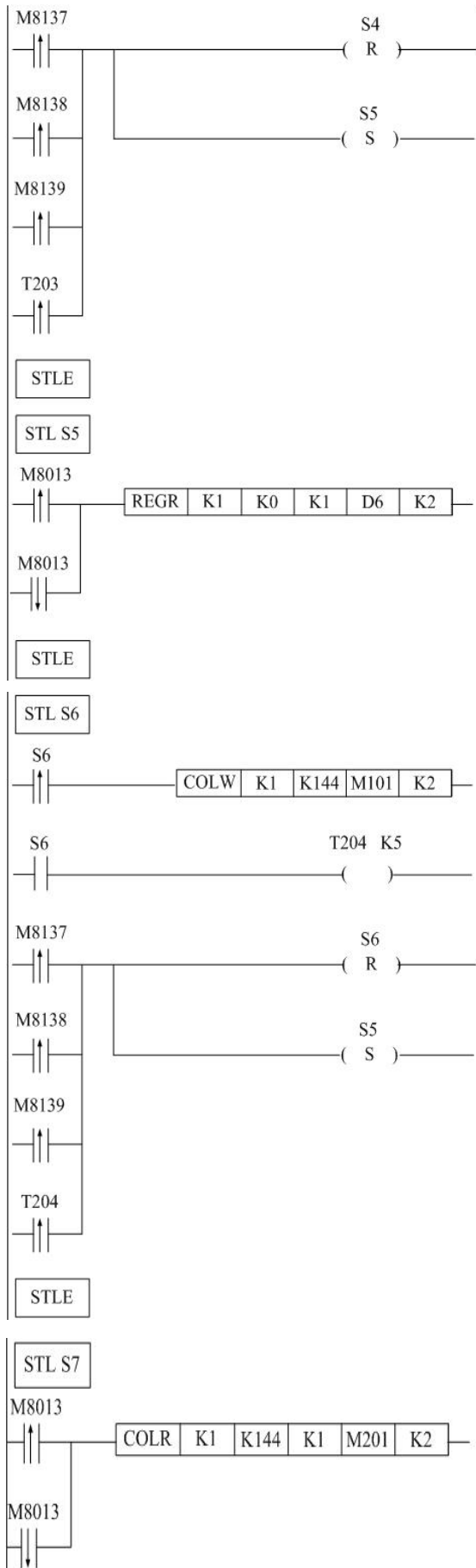
End of process S3



Start process S4

Write the value of M100(PLC) to K136(MA), open
channel 0 PID enable bit

Delay for 50ms



Close process S4 and open process S5 when data transfer are completed or 50ms is over

End of process S4

Start process S5

Read the value of K0(MA) to D6(PLC) every 500ms, i.e. channel 0 current value

End of process S5

Start process S6

Write the value of M102(PLC) to K144(MA), open channel 0 auto-tune control bit

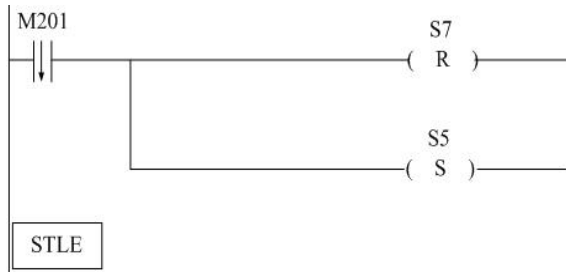
Delay 50ms

Close process S6 and open process S5 when data transfer are completed or 50ms is over

End of process S6

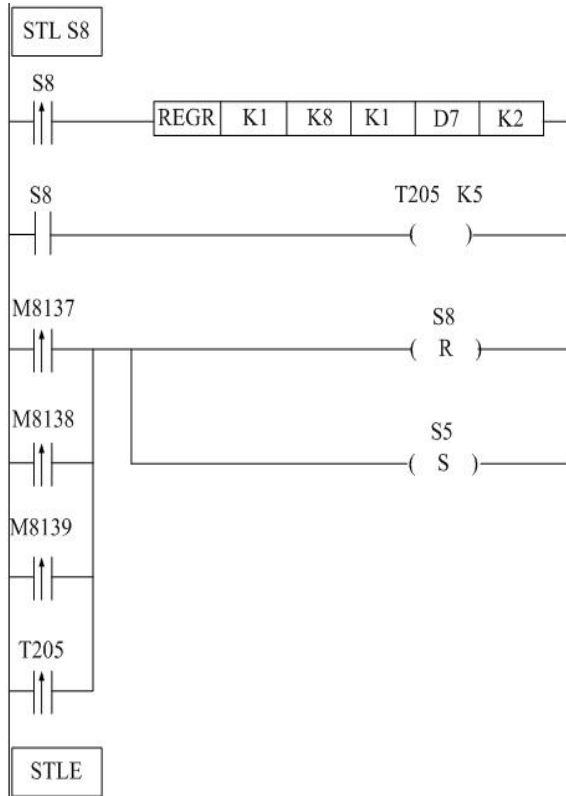
Start process S7

Read the value of K136(MA) to M201(PLC) every 500ms, i.e. channel 0 auto-tune state bit



Close process S7 and open process S5 when data transfer are completed or 50ms is over

End of process S7



Start process S8

Read the value of K8(MA) to D7(PLC), i.e. channel 0 PID output value

Delay for 50ms

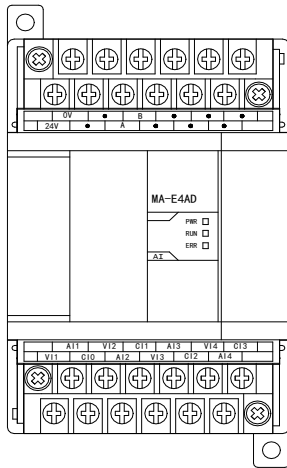
Close process S8 and open process S5 when data transfer are completed or 50ms is over

End of process S8

7. MA-4AD analog input module

7.1 Module features and specifications

MA-4AD analog input module transforms the 4 channels analog input values into digital values, connect with other devices via Modbus communication protocol.

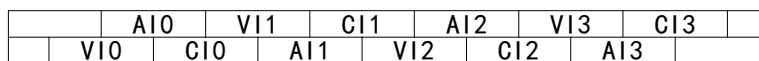
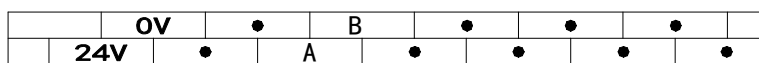


Module features:

- 4 channels analog input:
Voltage input 0~5V, 0~10V
Current input 0~20mA, 4~20mA
- 12 bits high precision analog input
- 4 channels PID control function

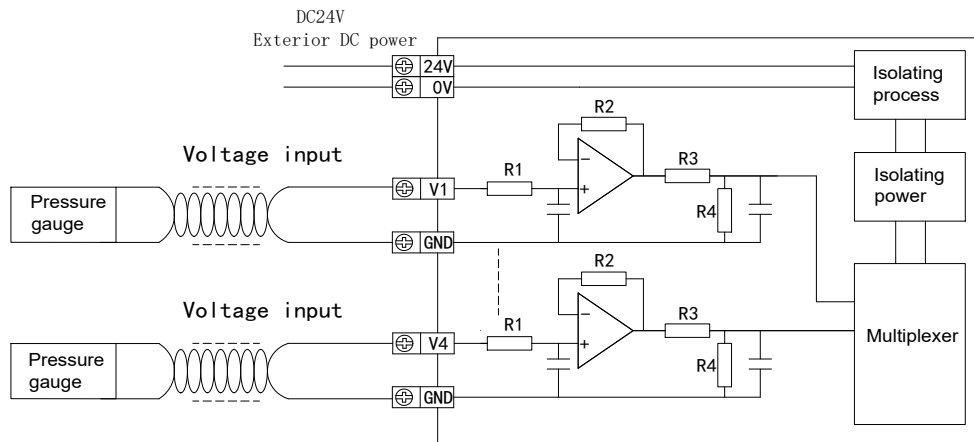
Item	Analog input (4AD)	
Analog input type	Voltage input	Current input
Analog input range	0~5V,0~10V	0~20mA,4~20mA
Maximum input range	DC ± 18V	0~40mA
Digital output range	12 bits binary data(0~4095)	
Resolution	1/4095(12Bit)	
PID output range	0~K4095	
Integrated precision	0.8%	
Converting speed	20ms per channel	
Module Power supply	DC24V±10%, 100mA	
Installation	Fix up the module with M3 screw or put on DIN46277 rail (width 35mm)	
Dimension	63mm×102mm×73.3mm	

7.2 Terminal explanation

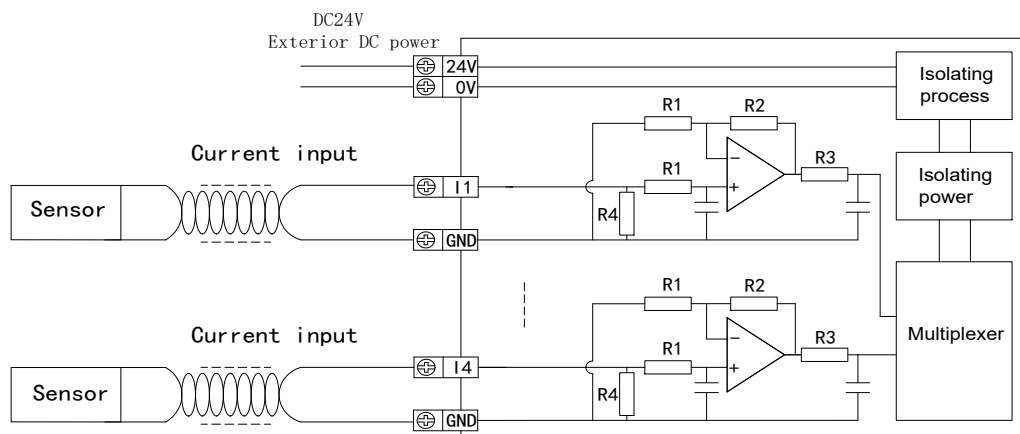


7.3 External connection

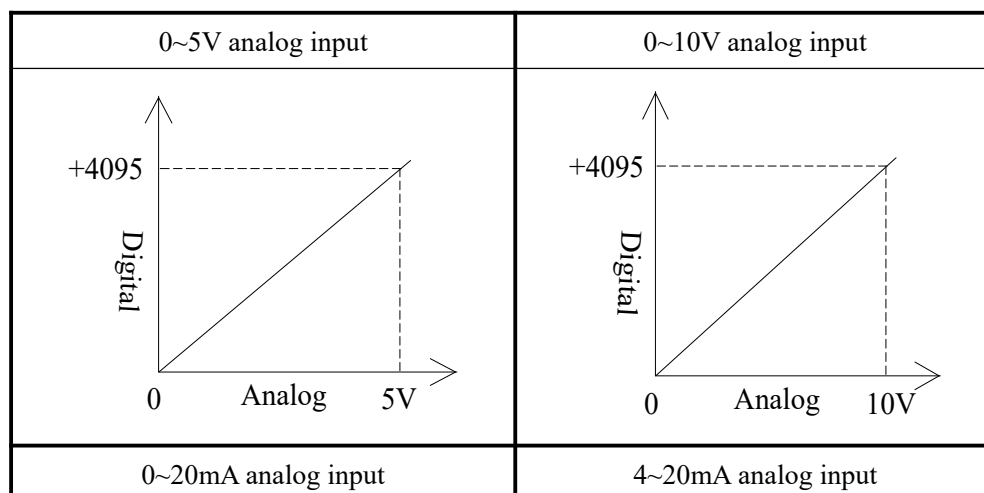
(1) For MA-4AD voltage input points connection is as below:

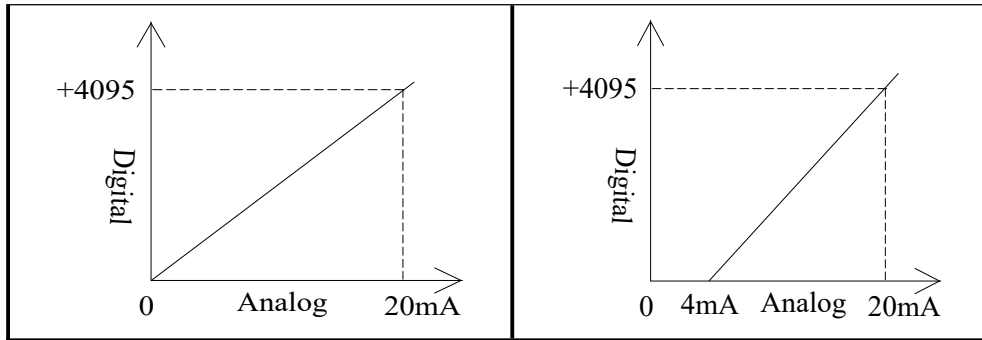


(2) For MA-4AD current input points connection is as below:



7.4 AD conversion diagram





7.5 I/O address assignment

(1) Modbus read bit address

Modbus address (Decimal)	Function	Note	
		0	1
0x00	AD channel 0 PID control result	Close	Output
0x01	AD channel 1 PID control result	Close	Output
0x02	AD channel 2 PID control result	Close	Output
0x03	AD channel 3 PID control result	Close	Output
0x08	AD channel 0 circuit opening check	Normal	Open
0x09	AD channel 1 circuit opening check	Normal	Open
0x10	AD channel 2 circuit opening check	Normal	Open
0x11	AD channel 3 circuit opening check	Normal	Open
0x12	AD channel 0 auto-tune error check	Normal	Error
0x13	AD channel 1 auto-tune error check	Normal	Error
0x14	AD channel 2 auto-tune error check	Normal	Error
0x15	AD channel 3 auto-tune error check	Normal	Error

(2) Modbus write bit address

Modbus address (Decimal)	Function	Note
0x128	AD channel 0 input mode configure bit	0: voltage 1: current
0x129	AD channel 1 input mode configure bit	0: voltage 1: current
0x130	AD channel 2 input mode configure bit	0: voltage 1: current
0x131	AD channel 3 input mode configure bit	0: voltage 1: current
0x136	AD channel 0 input range configure bit	Voltage 0: 0~10V 1: 0~5V
		Current 0: 0~20mA 1: 4~20mA
0x137	AD channel 1 input range configure bit	Voltage 0: 0~10V 1: 0~5V
		Current 0: 0~20mA 1: 4~20mA
0x138	AD channel 2 input range configure bit	Voltage 0: 0~10V 1: 0~5V
		Current 0: 0~20mA 1: 4~20mA
0x139	AD channel 3 input range configure bit	Voltage 0: 0~10V 1: 0~5V
		Current 0: 0~20mA 1: 4~20mA
0x160	AD channel 0 PID enable bit	0: close 1: enable
0x161	AD channel 1 PID enable bit	0: close 1: enable
0x162	AD channel 2 PID enable bit	0: close 1: enable
0x163	AD channel 3 PID enable bit	0: close 1: enable
0x168	AD channel 0 auto-tune enable bit	0: close 1: enable
0x169	AD channel 1 auto-tune enable bit	0: close 1: enable
0x170	AD channel 2 auto-tune enable bit	0: close 1: enable

0x171	AD channel 3 auto-tune enable bit	0: close 1: enable
0x176	AD channel 0 action selection bit	0: negative 1: positive
0x177	AD channel 1 action selection bit	0: negative 1: positive
0x178	AD channel 2 action selection bit	0: negative 1: positive
0x179	AD channel 3 action selection bit	0: negative 1: positive

(3) Modbus read word address

Modbus address (Decimal)	Function	Remark
4x00	AD channel 0 current value	
4x01	AD channel 1 current value	
4x02	AD channel 2 current value	
4x03	AD channel 3 current value	
4x08	AD channel 0 PID digital output	
4x09	AD channel 1 PID digital output	
4x10	AD channel 2 PID digital output	
4x11	AD channel 3 PID digital output	

(4) Modbus write word address

Modbus address(Decimal)	Function	Remark
4x130	AD channel 0 set value	
4x131	AD channel 1 set value	
4x132	AD channel 2 set value	
4x133	AD channel 3 set value	

4x134	AD channel 0 parameter P	
4x135	AD channel 0 parameter I	
4x136	AD channel 0 parameter D	
4x137	AD channel 0 parameter DIFF	
4x138	AD channel 1 parameter P	
4x139	AD channel 1 parameter I	
4x140	AD channel 1 parameter D	
4x141	AD channel 1 parameter DIFF	
4x142	AD channel 2 parameter P	
4x143	AD channel 2 parameter I	
4x144	AD channel 2 parameter D	
4x145	AD channel 2 parameter DIFF	
4x146	AD channel 3 parameter P	
4x147	AD channel 3 parameter I	
4x148	AD channel 3 parameter D	
4x149	AD channel 3 parameter DIFF	
4x150	AD channel 0 control period	Min 0.5s, max 200s
4x151	AD channel 1 control period	Min 0.5s, max 200s
4x152	AD channel 2 control period	Min 0.5s, max 200s
4x153	AD channel 3 control period	Min 0.5s, max 200s
4x154	AD channel 0 modify current value	To change current value
4x155	AD channel 1 modify current value	To change current value

4x156	AD channel 2 modify current value	To change current value
4x157	AD channel 3 modify current value	To change current value
4x158	AD channel 0 auto-tune output range	0%~100%
4x159	AD channel 1 auto-tune output range	0%~100%
4x160	AD channel 2 auto-tune output range	0%~100%
4x161	AD channel 3 auto-tune output range	0%~100%
4x162	AD channel 0 deviation value setting	
4x163	AD channel 1 deviation value setting	
4x164	AD channel 2 deviation value setting	
4x165	AD channel 3 deviation value setting	

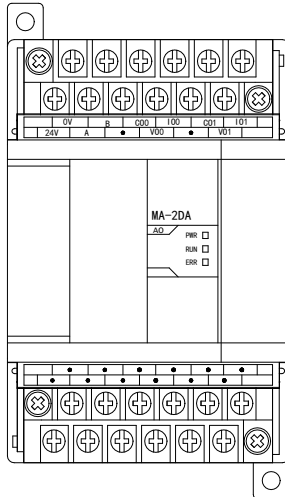
7.6 Application example

Please refer to the application example of MA-8AD.

8. MA-2DA analog output module

8.1 Module features and specifications

MA-2DA analog output module transforms 2 channels digital quantities into analog value, then connects with other devices via Modbus protocol.



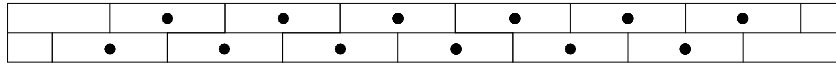
Module features:

- 2 channels analog output
- 10 bits high precision analog output

Item	Analog output (2DA)	
Output type	Voltage output	Current output
Analog output range	0~5V, 0~10V, (Exterior load resistor 2K Ω ~1M Ω)	0~20mA, 4~20mA (Exterior load resistor less than 500 Ω)
Digital input range	10 bits (0~1023)	
Resolution	1/1023(10Bit)	
Integrated precision	0.8%	
Convert speed	3ms/1 channel	
Module power supply	DC24V \pm 10%, 100mA	
Installation	Use M3 screw or fix on the DIN46277 (width 35mm) rail	
Profile dimension	63mm \times 102mm \times 73.3mm	

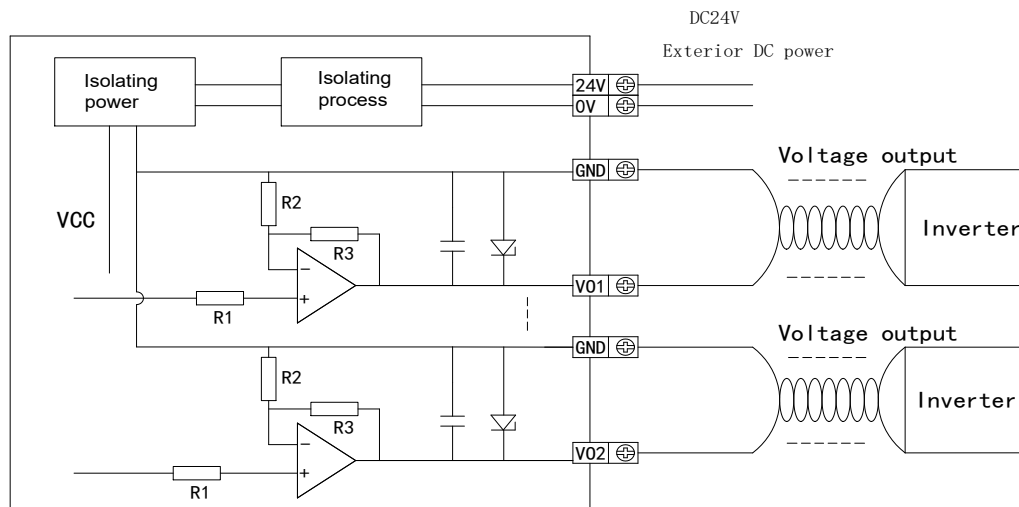
8.2 Terminal explanation

	OV	B	C00	I00	C01	I01
24V	A	•	V00	•	V01	

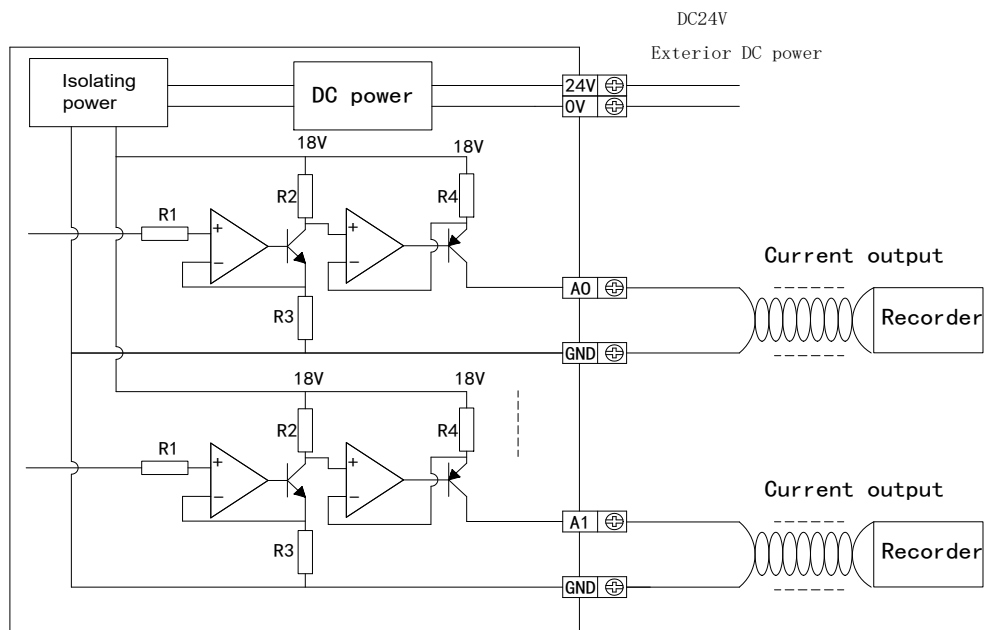


8.3 External connection

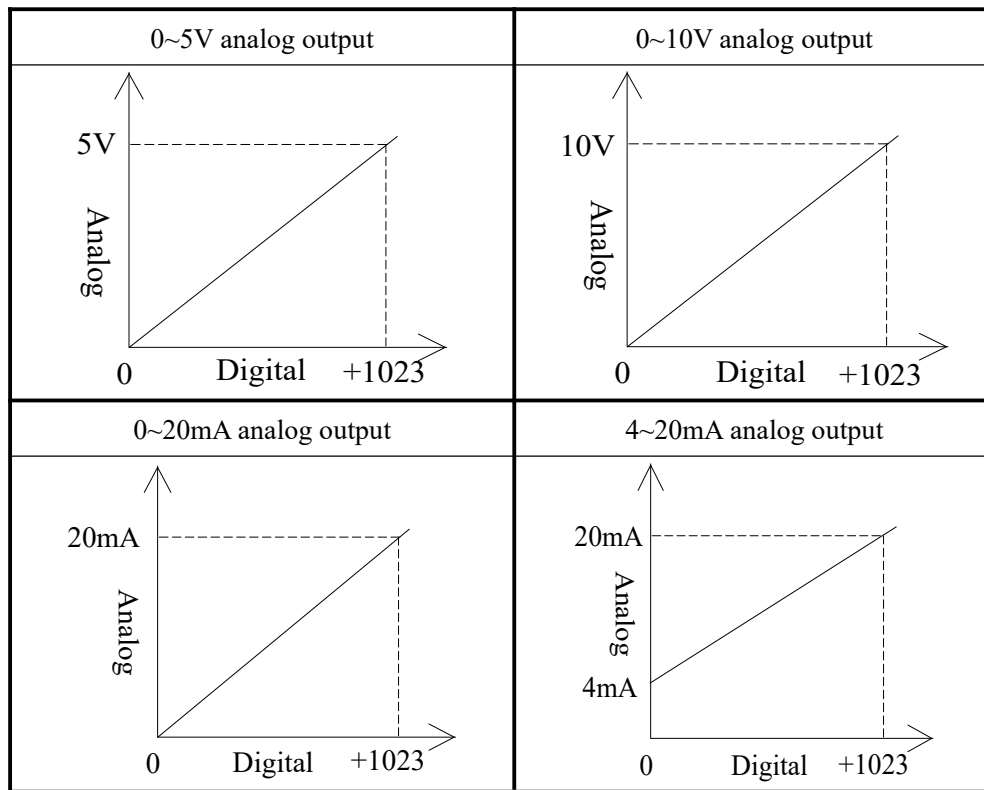
(1) For MA-2DA voltage output connection is as below:



(2) For MA-2DA current output connection is as below:



8.4 DA conversion diagram



8.5 MA-2DA address assignment

(1) Modbus write bit address:

Modbus address (Decimal)	Function	Note	
0x144	DA channel 0 output mode configure bit	0 : voltage 1: current	
0x145	DA channel 1 output mode configure bit	0 : voltage 1: current	
0x152	DA channel 0 output range configure bit	voltage	0: 0~10v 1: 0~5v
		current	0: 0~20mA 1: 4~20mA
0x153	DA channel 1 output range configure bit	voltage	0: 0~10v 1: 0~5v
		current	0: 0~20mA 1: 4~20mA

(2)Modbus write word address:

Modbus address (decimal)	Function	Note
4x128	DA channel 0 output value	10 bits
4x129	DA channel 1 output value	10 bits

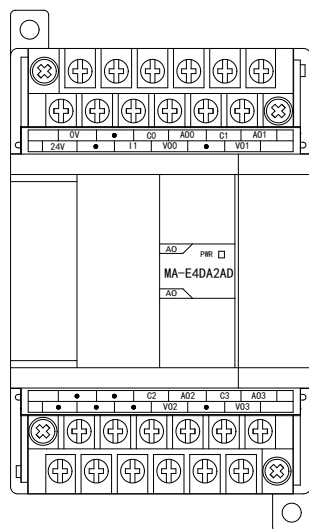
8.6 Application example

Please refer to the example of MA-4DA.

9. MA-4AD2DA analog I/O module

9.1 Module features and specifications

MA-4AD2DA analog I/O module transforms 4 channels analog input value into digital value and 2 channels digital value into analog value, then connects with other devices via Modbus protocol.



Module features:

- 4 channels analog input.
- Voltage input: 0~5V, 0~10V
- Current input: 0~20mA, 4~20mA
- 2 channels analog output
- 12 bits high precision analog input and 10 bits high precision analog output
- 4 AD channels have PID function

Item	Analog input (4AD)		Analog output (2DA)	
	Voltage input	Current input	Voltage output	Current output
Analog input range	0~5V, 0~10V	0~20mA, 4~20mA	-	
Max input range	DC ± 18V	0~40mA	-	
Analog output range	-		0~5V, 0~10V, (Exterior load resistor 2KΩ~1MΩ)	0~20mA, 4~20mA (Exterior load resistor less than 500Ω)

Digital input range	-	10 bits binary number (0~1023)
Digital output range	12 bits binary data(0~4095)	-
Resolution	1/4095(12Bit)	1/1023(10Bit)
PID output value	0~K4095	
Integrated precision	0.8%	
Conversion speed	20ms/1 channel	3ms/1 channel
Module Power supply	DC24V±10%, 100mA	
Installation	Use M3 screw or fix on the DIN46277 (width 35mm) rail	
Profile dimension	63mm×102mm×73.3mm	

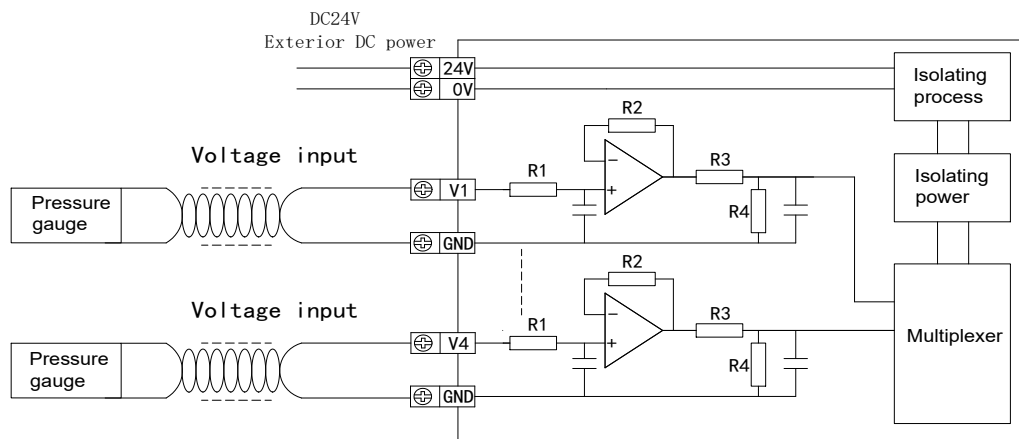
9.2 Terminal explanation

	OV	•	B	V00	V01	C01	
	24V	•	A	I00	C00	I01	

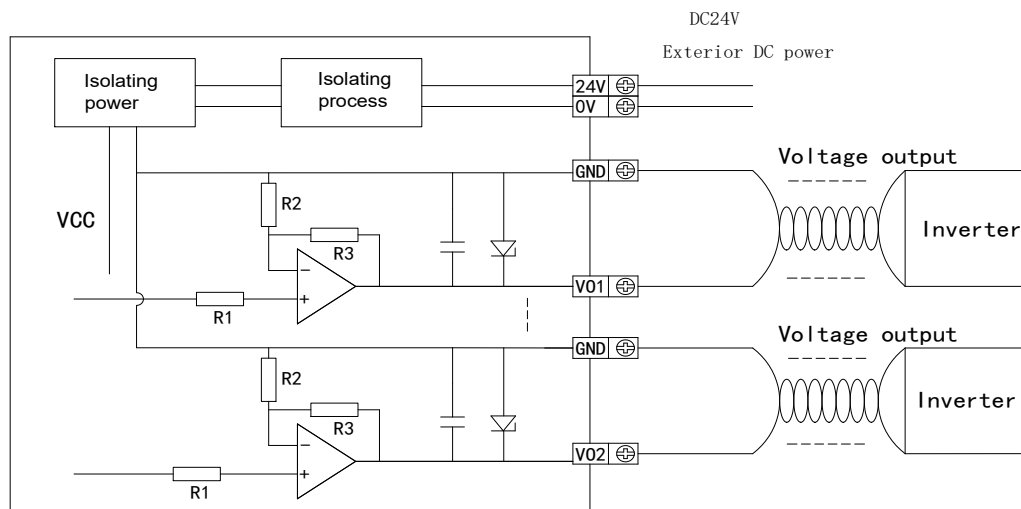
	A10	VI1	CI1	A12	VI3	CI3	
	VI0	CI0	A11	VI2	CI2	A13	

9.3 External connection

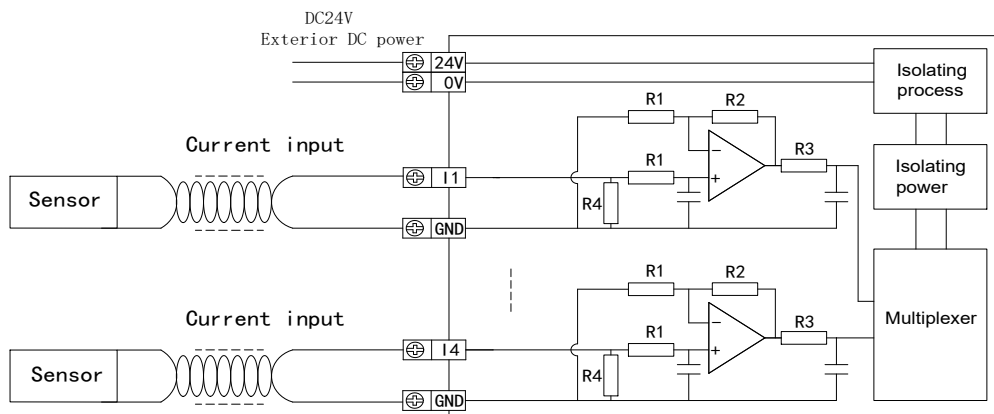
(1) For MA-4AD2DA voltage analog input points connection is as below:



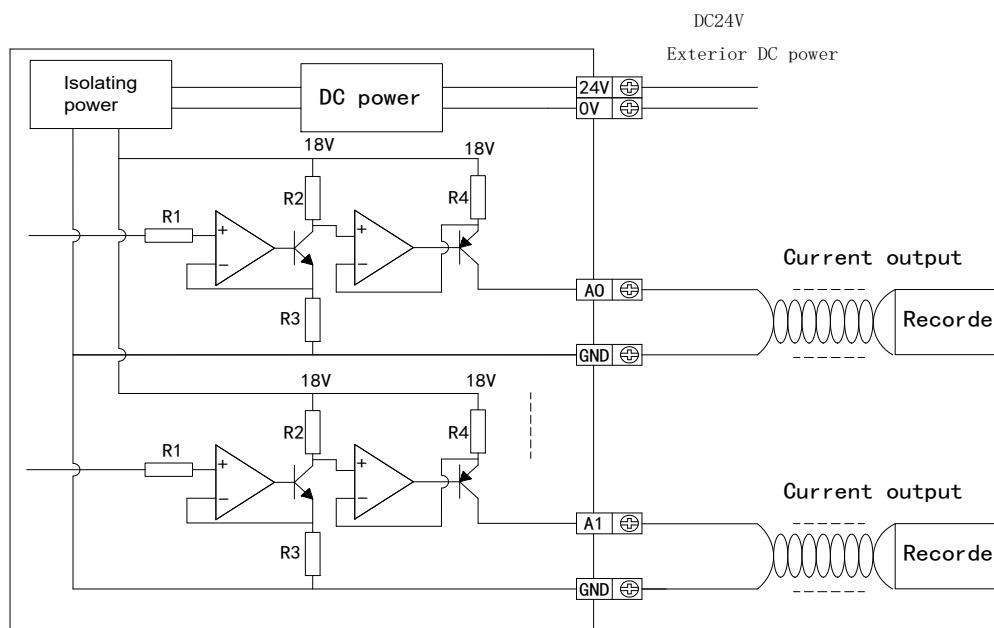
(2) For MA-4AD2DA voltage analog output points connection is as below:



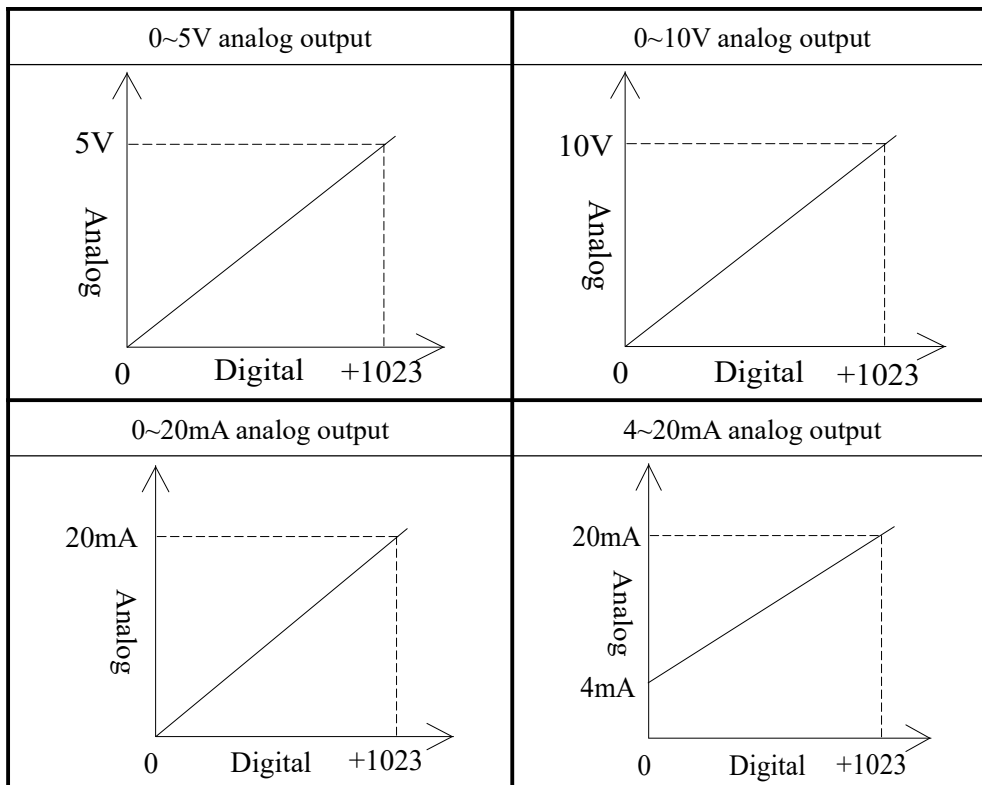
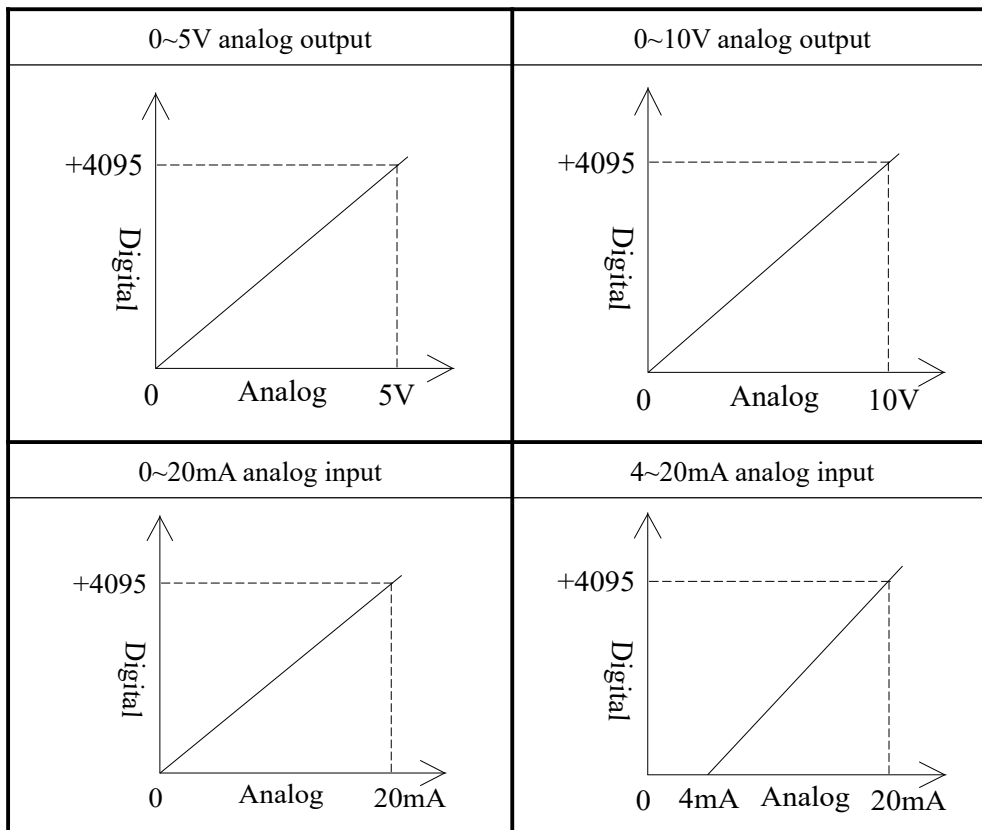
(3) For MA-4AD2DA current analog input points connection is as below:



(4) For MA-4AD2DA current analog output points connection is as below:



9.4 AD and DA conversion diagram



9.5 MA-4AD2DA address assignment

(1) Modbus read bit address

Modbus address (Decimal)	Description	Note	
		0	1
0x00	AD channel 0 PID control result	Close	Output
0x01	AD channel 1 PID control result	Close	Output
0x02	AD channel 2 PID control result	Close	Output
0x03	AD channel 3 PID control result	Close	Output
0x08	AD channel 0 Open circuit check	Normal	Open
0x09	AD channel 1 Open circuit check	Normal	Open
0x10	AD channel 2 Open circuit check	Normal	Open
0x11	AD channel 3 Open circuit check	Normal	Open
0x12	AD channel 0 Auto-tune error check	Normal	Error
0x13	AD channel 1 Auto-tune error check	Normal	Error
0x14	AD channel 2 Auto-tune error check	Normal	Error
0x15	AD channel 3 Auto-tune error check	Normal	Error

(2) Modbus write bit address

Modbus address (decimal)	Description	Note	
0x128	AD channel 0 Input mode configure bit	0: voltage 1: current	
0x129	AD channel 1 Input mode configure bit	0: voltage 1: current	
0x130	AD channel 2 Input mode configure bit	0: voltage 1: current	
0x131	AD channel 3 Input mode configure bit	0: voltage 1: current	
0x136	AD channel 0 Input mode configure bit	voltage	0: 0~10v 1: 0~5v
		current	0: 10~20mA 1: 4~20mA
0x137	AD channel 1 Input mode configure bit	voltage	0: 0~10 1: v0~5v
		current	0: 0~20mA 1: 4~20mA
0x138	AD channel 2 Input mode configure bit	voltage	0: 0~10v 1: 0~5v
		current	0: 0~20mA 1: 4~20mA
0x139	AD channel 3 Input mode configure bit	voltage	0: 0~10v 1: 0~5v
		current	0: 0~20mA 1: 4~20mA
0x144	DA channel 0 Output mode configure bit	0: voltage 1: current	
0x145	DA channel 1 Output mode configure bit	0: voltage 1: current	
0x152	DA channel 0 Input range configure bit	voltage	0: 20mA 1: 4~20mA
		current	0: 0~10 1: 0~5v
0x153	DA channel 1 Input range configure bit	voltage	0: 20mA 1: 4~20mA
		current	0: 0~10v 1: 0~5v
0x160	AD channel 0 PID enable bit	0: close 1: enable	

0x161	AD channel 1 PID enable bit	0: close 1: enable
0x162	AD channel 2 PID enable bit	0: close 1: enable
0x163	AD channel 3 PID enable bit	0: close 1: enable
0x168	AD channel 0 Auto-tune enable bit	0: close 1: enable
0x169	AD channel 1 Auto-tune enable bit	0: close 1: enable
0x170	AD channel 2 Auto-tune enable bit	0: close 1: enable
0x171	AD channel 3 Auto-tune enable bit	0: close 1: enable
0x176	AD channel 0 Action selection bit	0: negative action 1: positive action
0x177	AD channel 1 Action selection bit	0: negative action 1: positive action
0x178	AD channel 2 Action selection bit	0: negative action 1: positive action
0x179	AD channel 3 Action selection bit	0: negative action 1: positive action

(3) Modbus read word address

Modbus address (decimal)	Description	Note
4x00	AD channel 0 Current value	
4x01	AD channel 1 Current value	
4x02	AD channel 2 Current value	
4x03	AD channel 3 Current value	
4x08	AD channel 0 PID digital output	
4x09	AD channel 1 PID digital output	
4x10	AD channel 2 PID digital output	
4x11	AD channel 3 PID digital output	

(4) Modbus write word address

Modbus address (decimal)	Description	Note
4x128	DA channel 0 Output value	10 bits
4x129	DA channel 1 Output value	10 bits
4x130	AD channel 0 Setting value	
4x131	AD channel 1 Setting value	
4x132	AD channel 2 Setting value	
4x133	AD channel 3 Setting value	
4x134	AD channel 0 Parameter P	
4x135	AD channel 0 Parameter I	
4x136	AD channel 0 Parameter D	
4x137	AD channel 0 Parameter DIFF	
4x138	AD channel 1 Parameter P	
4x139	AD channel 1 Parameter I	
4x140	AD channel 1 Parameter D	
4x141	AD channel 1 Parameter DIFF	
4x142	AD channel 2 Parameter P	

4x143	AD channel 2 Parameter I	
4x144	AD channel 2 Parameter D	
4x145	AD channel 2 Parameter DIFF	
4x146	AD channel 3 Parameter P	
4x147	AD channel 3 Parameter I	
4x148	AD channel 3 Parameter D	
4x149	AD channel 3 Parameter DIFF	
4x150	AD channel 0 Control period	Min 0.5s max 200s
4x151	AD channel 1 Control period	Min 0.5s max 200s
4x152	AD channel 2 Control period	Min 0.5s max 200s
4x153	AD channel 3 Control period	Min 0.5s max 200s
4x154	AD channel 0 Modify current value	Change the current value
4x155	AD channel 1 Modify current value	Change the current value
4x156	AD channel 2 Modify current value	Change the current value
4x157	AD channel 3 Modify current value	Change the current value
4x158	AD channel 0 Auto-tune output range	0%~100%
4x159	AD channel 1 Auto-tune output range	0%~100%
4x160	AD channel 2 Auto-tune output range	0%~100%
4x161	AD channel 3 Auto-tune output range	0%~100%
4x162	AD channel 0 deviation value setting	
4x163	AD channel 1 deviation value setting	
4x164	AD channel 2 deviation value setting	
4x165	AD channel 3 deviation value setting	

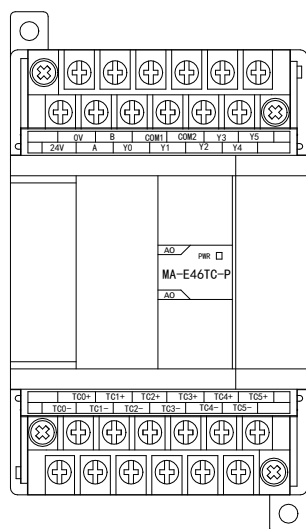
9.6 Application example

MA-4AD2DA module has 4 channels analog input (with PID function) and 2 channels analog output. For practical application, please see the application of MA-8AD and MA-4DA.

10. Temperature control module MA-6TCA-P

10.1 Module features and specifications

MA-6TCA-P temperature PID control module has 6 thermocouple sensor input channels, supports multi-type of thermocouples. Each channel has PID control function. The module can connect to the industry control system via Modbus protocol.



Module features:

- Support multi-type thermocouple sensor input
- DC-DC power supply insulation, enhance the noise immunity ability
- 6 channels input, 6 channels output, 6 channels PID auto-tune function
- PID real-time auto-tune function

Item	Specs
Using environment	0°C ~ 60°C
Measure temperature range	0°C ~ 1000°C
Digital output range	0 ~ 4095, 12 bits with sign, binary
Precision	0.1°C
Integrated precision	0.8% (relative max value)
Conversion speed	20ms/1 channel
Module Power supply	DC24V ± 10%, 50mA
Installation	Use M3 screw or fix on DIN46277 (width 35mm) rail
Dimension	63mm×102mm×73.3mm

Notice:

- (1) The channel data is 0 when no signal input
- (2) Connect thermocouple according to practical needs
- (3) The device installed with thermocouple should be grounded

10.2 Terminal explanation

The points arrangement of MA-6TCA-P are as below:

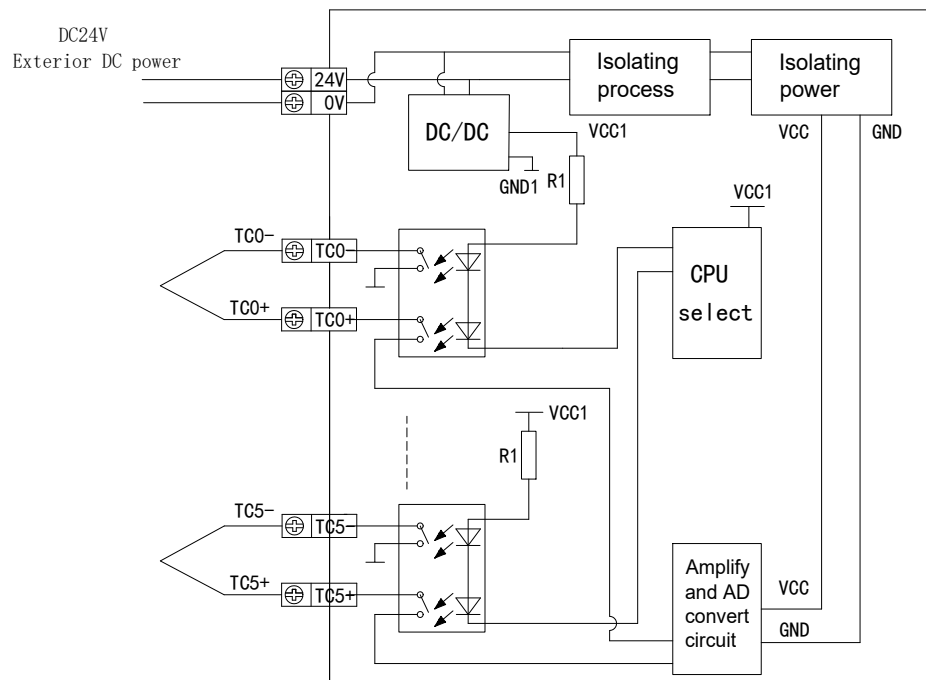
	0V	B	COM0	COM1	Y3	Y5	
	24V	A	Y0	Y1	Y2	Y4	

	T0+	T1+	T2+	T3+	T4+	T5+	
	T0-	T1-	T2-	T3-	T4-	T5-	

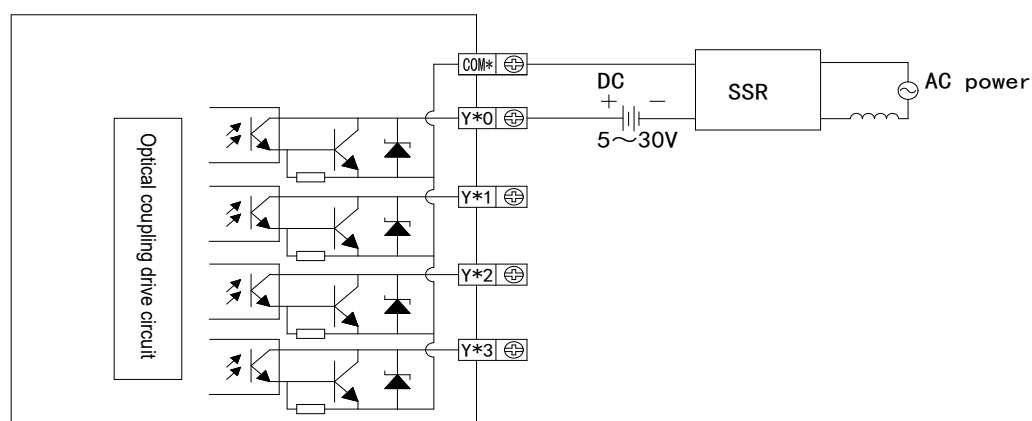
Terminal	Explanation	
Thermocouple sensor input (TC0+,TC0-,...,TC5+,TC5-)	6 channels	Analog input: 0°C ~ 1000°C
PID output (Y0~Y5)	6 channels	Digital output range: 0~4095 Duty cycle mode, Y output in ON period
Communication (A,B)	A: RS485+ B: RS485-	RS485 port, based on Modbus-RTU protocol

10.3 External connection

(1) For MA-6TCA-P, input connection is as below:



(2) For MA-6TCA-P, the output connection is as below:



10.4 I/O address assignment

10.4.1 Modbus read address

(1) bit address

Modbus address (Decimal)	Description	Note
0x00	Channel 0 PID control result	Switch quantity, corresponding to the ON/OFF state of channel's exterior relay
0x01	Channel 1 PID control result	
0x02	Channel 2 PID control result	
0x03	Channel 3 PID control result	
0x04	Channel 4 PID control result	
0x05	Channel 5 PID control result	
0x06	-	
0x07	-	
0x08	Channel 0 open circuit check bit	If one of the 6 channels is open or short, its channel state bit is 1, if normal the state is 0.
0x09	Channel 1 open circuit check bit	
0x10	Channel 2 open circuit check bit	
0x11	Channel 3 open circuit check bit	
0x12	Channel 4 open circuit check bit	
0x13	Channel 5 open circuit check bit	
0x14	-	
0x15	-	
0x16	Channel 0 Auto-tune error check	0: normal 1: error
0x17	Channel 1 Auto-tune error check	0: normal 1: error
0x18	Channel 2 Auto-tune error check	0: normal 1: error
0x19	Channel 3 Auto-tune error check	0: normal 1: error
0x20	Channel 4 Auto-tune error check	0: normal 1: error
0x21	Channel 5 Auto-tune error check	0: normal 1: error

(2) word address

Modbus address (Decimal)	Description	Note
4x00	Channel 0 Current temperature	Display current temperature, unit 0.1°C
4x01	Channel 1 Current temperature	
4x02	Channel 2 Current temperature	
4x03	Channel 3 Current temperature	
4x04	Channel 4 Current temperature	
4x05	Channel 5 Current temperature	
4x06	Channel 0 Output value	Digital quantity: 0~4095 Display current PID output range
4x07	Channel 1 Output value	
4x08	Channel 2 Output value	
4x09	Channel 3 Output value	
4x10	Channel 4 Output value	
4x11	Channel 5 Output value	

10.4.2 Modbus write bit address

(1) bit address

Modbus address (Decimal)	Description	Note
0x128	Channel 0 PID Control enable signal	When this signal is set on, the PID control enable bit of this channel are opened; the PID control process is closed when reset these bits. All channels are closed when the power is on.
0x129	Channel 1 PID Control enable signal	
0x130	Channel 2 PID Control enable signal	
0x131	Channel 3 PID Control enable signal	
0x132	Channel 4 PID Control enable signal	
0x133	Channel 5 PID Control enable signal	
0x134	-	
0x135	-	
0x136	Channel 0 Auto-tune enable signal	Under the condition of the channel enable bit is set on, set on the auto-tune bit to start auto-tune; when the auto-tune bit is 0, it means the auto-tune process end or close.
0x137	Channel 1 Auto-tune enable signal	
0x138	Channel 2 Auto-tune enable signal	
0x139	Channel 3 Auto-tune enable signal	
0x140	Channel 4 Auto-tune enable signal	
0x141	Channel 5 Auto-tune enable signal	

(2) word address:

Modbus address (Decimal)	Description	Note
4x128	Channel 0 Setting temperature	Control the target temperature value. Adjust range is 0~1000°C.
4x129	Channel 1 Setting temperature	

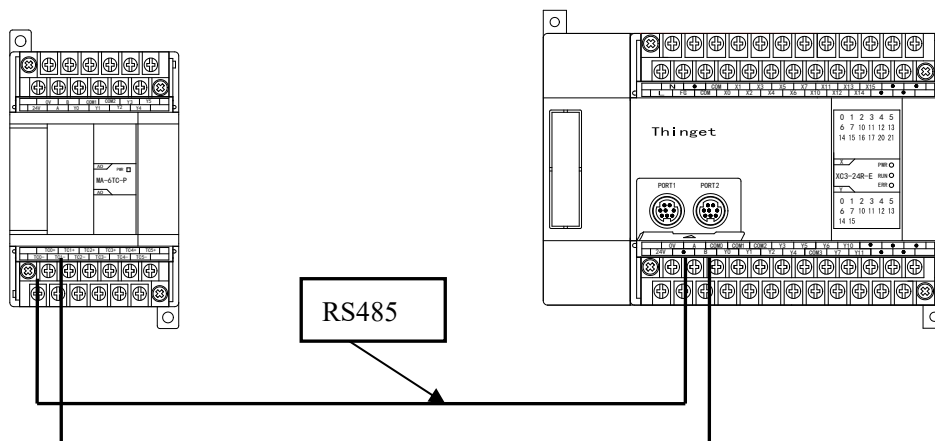
4x130	Channel 2 Setting temperature	resolution is 0.1 °C.
4x131	Channel 3 Setting temperature	
4x132	Channel 4 Setting temperature	
4x133	Channel 5 Setting temperature	
4x134	Channel 0 PID parameter P	The module PID parameters are modified after auto-tune process is completed; if users are not satisfied with the PID parameters, they can modify them directly. Parameter Diff means PID control is functional in the area of set temperature±Diff, the unit is 0.1°C, the defaulted value is 100; if the temperature is less than set temperature-Diff (positive action), PID output is the maximum value; if the temperature is more than set temperature+Diff, the PID output is the minimum value.
4x135	Channel 0 PID parameter I	
4x136	Channel 0 PID parameter D	
4x137	Channel 0 PID parameter Diff	
4x138	Channel 1 PID parameter P	
4x139	Channel 1 PID parameter I	
4x140	Channel 1 PID parameter D	
4x141	Channel 1 PID parameter Diff	
4x142	Channel 2 PID parameter P	
4x143	Channel 2 PID parameter I	
4x144	Channel 2 PID parameter D	
4x145	Channel 2 PID parameter Diff	
4x146	Channel 3 PID parameter P	
4x147	Channel 3 PID parameter I	
4x148	Channel 3 PID parameter D	
4x149	Channel 3 PID parameter Diff	
4x150	Channel 4 PID parameter P	
4x151	Channel 4 PID parameter I	
4x152	Channel 4 PID parameter D	
4x153	Channel 4 PID parameter Diff	
4x154	Channel 5 PID parameter P	
4x155	Channel 5 PID parameter I	
4x156	Channel 5 PID parameter D	
4x157	Channel 5 PID parameter Diff	
4x158	Channel 0 Temperature control period	Control period adjust range is 0.5~200s, minimum precision is 0.1s. The unit is 0.1s, it means you need to write 5 while the actual period is 0.5s.
4x159	Channel 1 Temperature control period	
4x160	Channel 2 Temperature control period	
4x161	Channel 3 Temperature control period	
4x162	Channel 4 Temperature control period	
4x163	Channel 5 Temperature control period	
4x164	Channel 0 Actual temperature	Actual temperature: the users can set the actual temperature when they found the actual temperature is different from the displayed temperature, the unit is 0.1°C (the write method is the same as "the set temperature"). When the module is written into this value, temperature difference value $\delta = \text{actual temperature} - \text{sampling}$
4x165	Channel 1 Actual temperature	
4x166	Channel 2 Actual temperature	
4x167	Channel 3 Actual temperature	
4x168	Channel 4 Actual temperature	
4x169	Channel 5 Actual temperature	

		temperature.
4x170	Channel 0 Auto-tune output range	Auto-tune output range: the output quantity of auto-tune, the unit is %, 100 means the mark-space ratio is 100% of the full-scale output, 80 means 80% of the full-scale output.
4x171	Channel 1 Auto-tune output range	
4x172	Channel 2 Auto-tune output range	
4x173	Channel 3 Auto-tune output range	
4x174	Channel 4 Auto-tune output range	
4x175	Channel 5 Auto-tune output range	
4x176	Channel 0 Temperature difference	Unit: 0.1°C
4x177	Channel 1 Temperature difference	Unit: 0.1°C
4x178	Channel 2 Temperature difference	Unit: 0.1°C
4x179	Channel 3 Temperature difference	Unit: 0.1°C
4x180	Channel 4 Temperature difference	Unit: 0.1°C
4x181	Channel 5 Temperature difference	Unit: 0.1°C
4x182	Channel 0 thermocouple sensor type	0: K-type 1: S-type 2: E-type 3: N-type 4: J-type 5: T-type 6: R-type
4x183	Channel 1 thermocouple sensor type	
4x184	Channel 2 thermocouple sensor type	
4x185	Channel 3 thermocouple sensor type	
4x186	Channel 4 thermocouple sensor type	
4x187	Channel 5 thermocouple sensor type	

10.5 Application example

This example is based on the communication between the PLC and MA-6TCA-P to do the PID auto-tune process.

(1) Hardware connection: connect the RS485 com port A, B of MA-6TCA-P and the PLC.



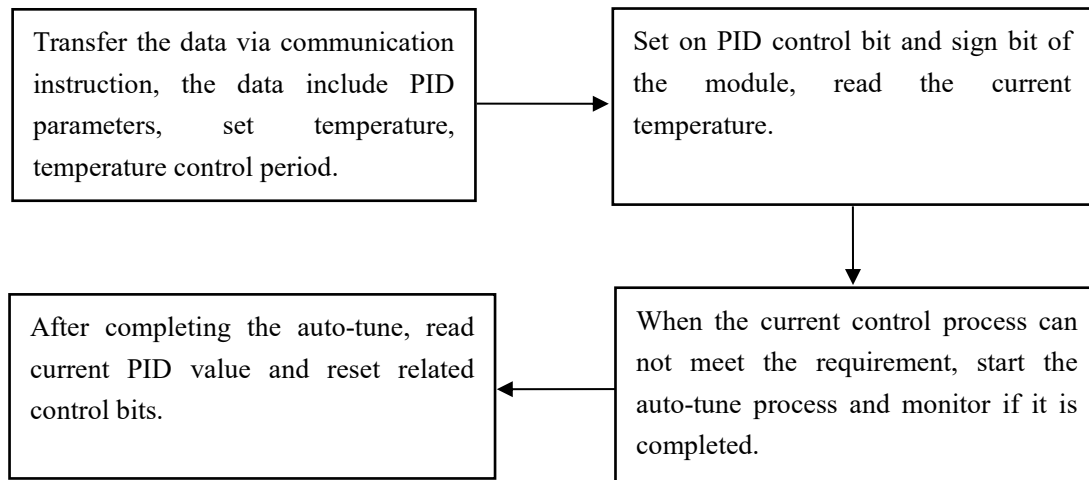
(2) Communication parameter setting: baud rate is 19200bps, station number is 1.

For MA-6TCA-P: baud rate 19200bps, set switch 1-OFF, 2-OFF;

Station number 1, set switch 1-OFF, 2-OFF, 3-OFF, 4-OFF.

For PLC, set the baud rate of COM 2 to 19200bps, which is valid after writing to PLC and powering on again.

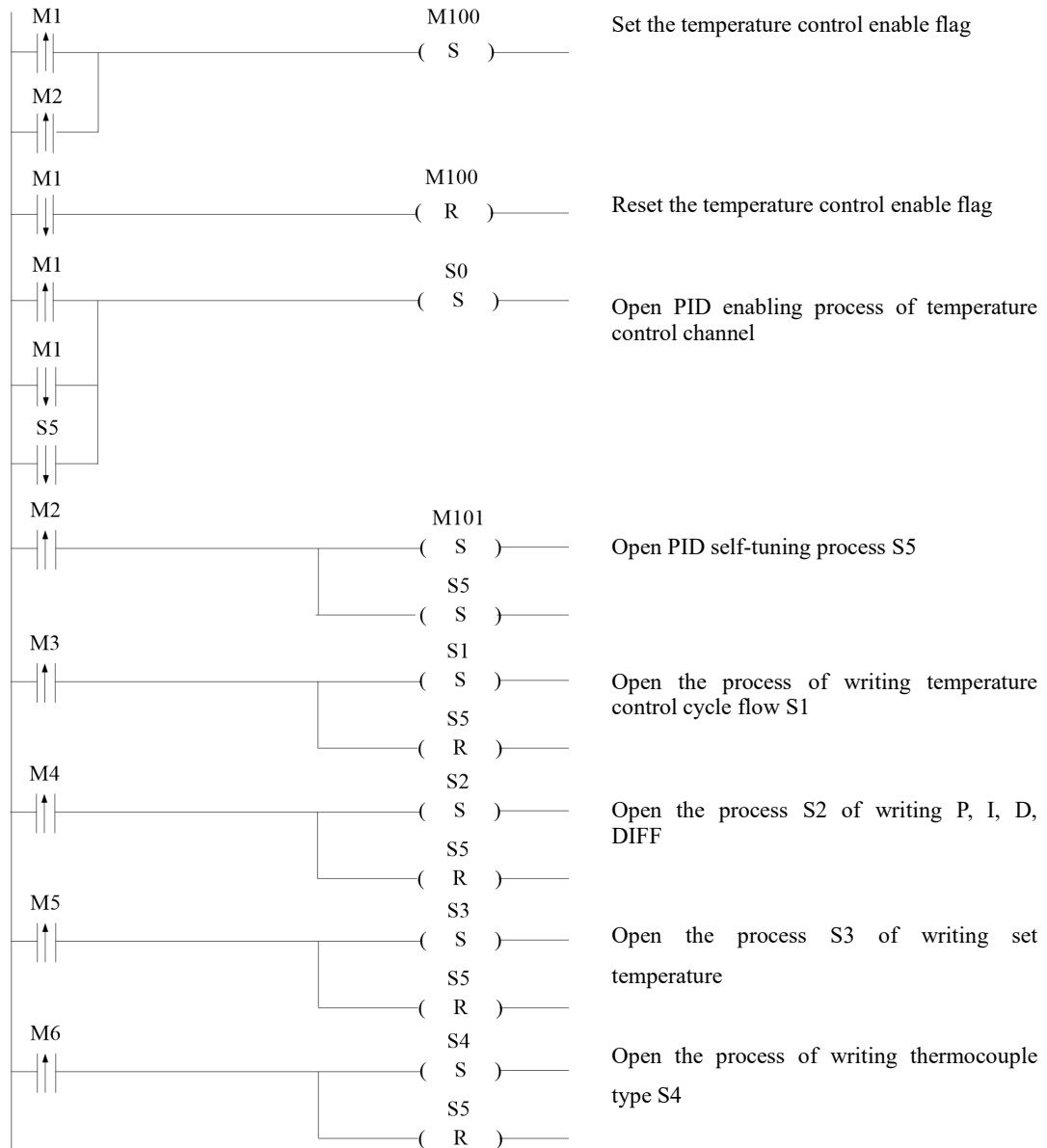
(3) The whole process:

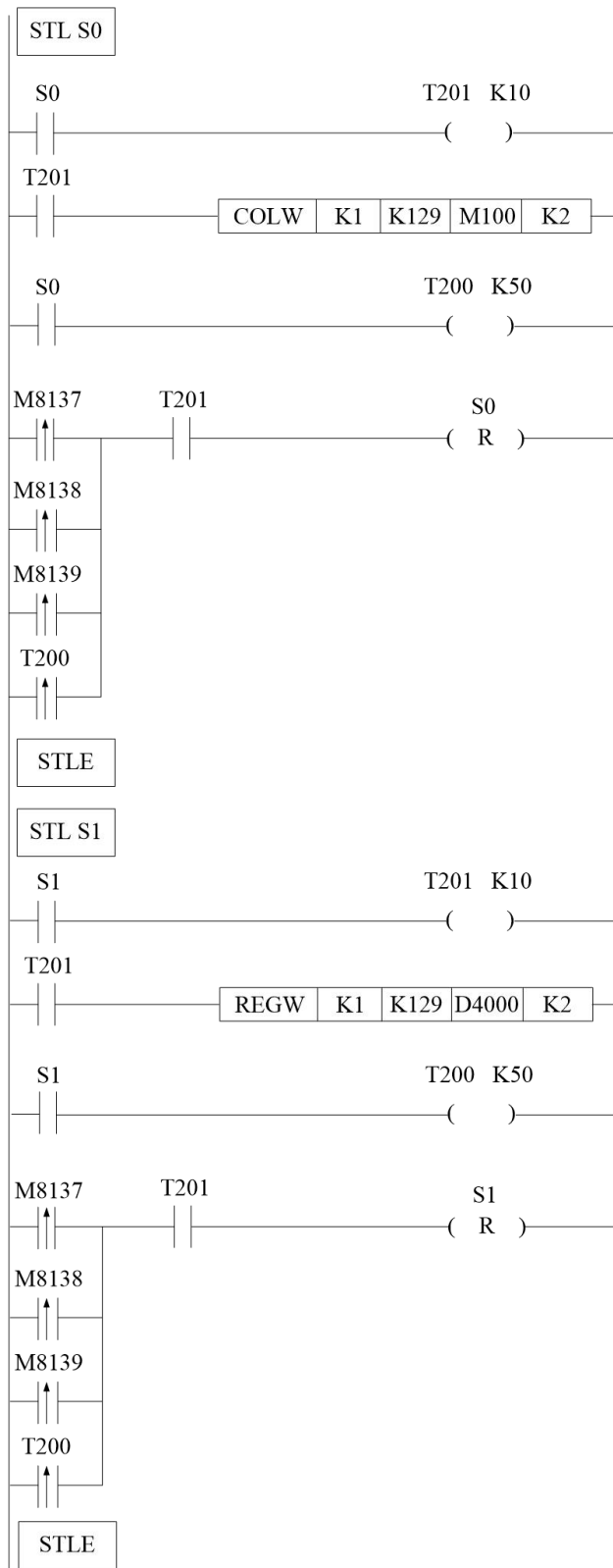


(4) Corresponding address

PLC coil address	MODBUS address	Note
D4002	K138	Channel 1 parameter P Setting vaule
D4003	K139	Channel 1 parameter I Setting vaule
D4004	K140	Channel 1 parameter D Setting vaule
D4005	K141	Channel 1 parameter Diff Setting vaule
D4008	K159	Channel 1 temperature control cycle value
D4000	K129	Channel 1 temperature setting value
D5000	K1	Channel 1 current temperature value
D4010	K183	Channel 1 thermocouple type value
M100	K129	Channel 1 PID enable bit
M101	K137	Channel 1 auto-tune enable bit

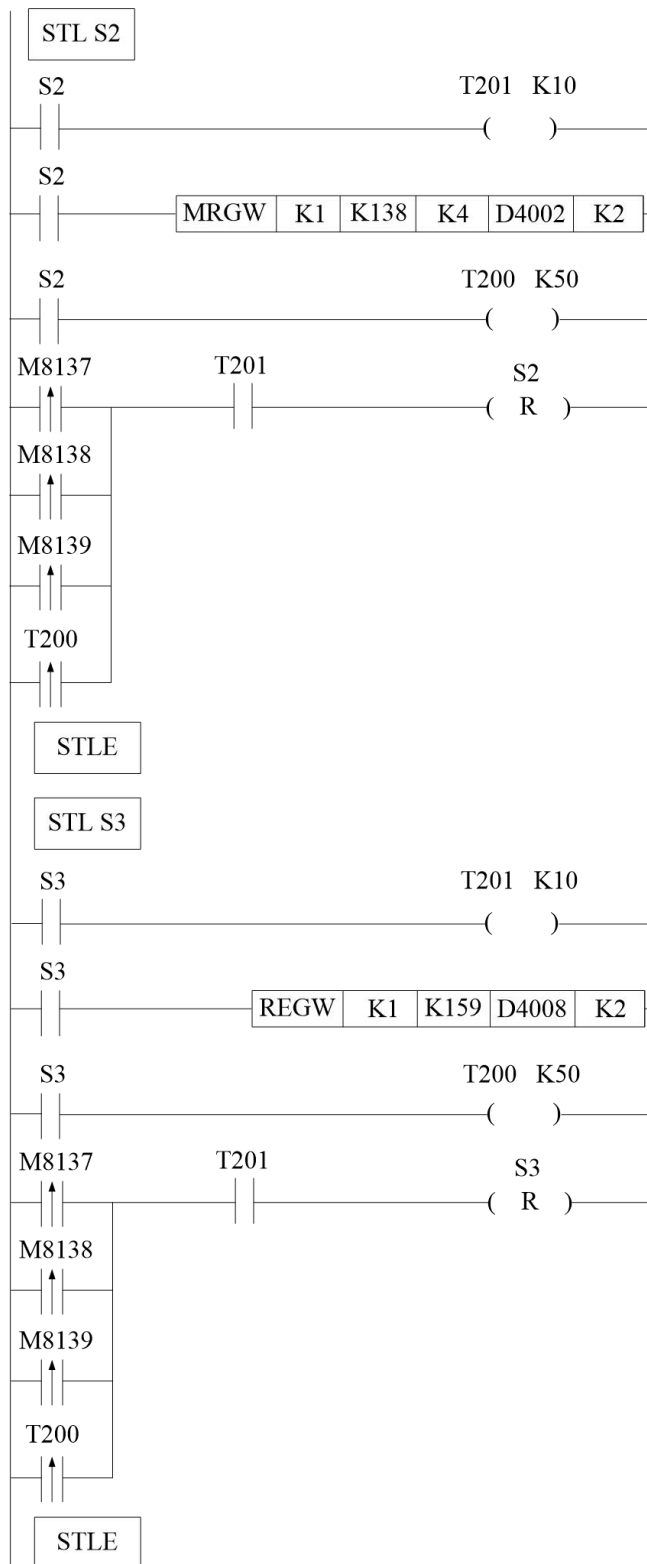
(5) ladder chart





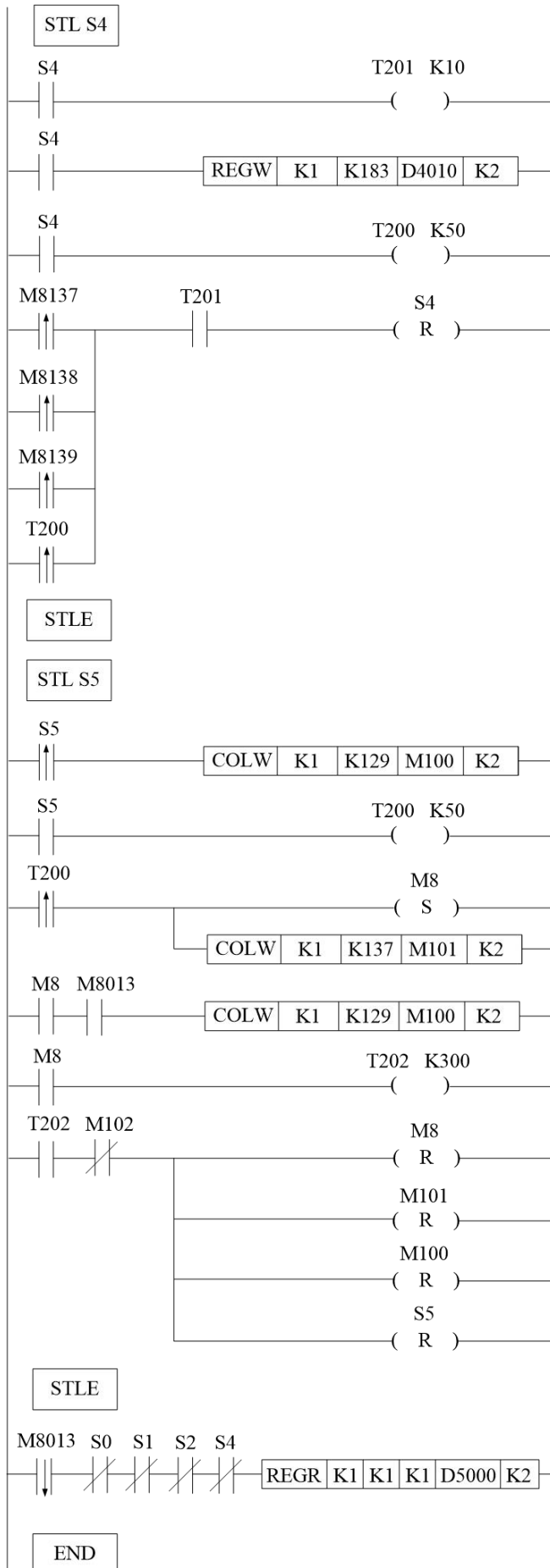
Start the process S0, write the M100 coil status to the module address K129, that is, open the first channel PID enable bit;

At the beginning of process S1, write the set temperature value D4000 to the module address K129, that is, the set temperature of channel 1 is D4000.



Process S2 starts. Write the values of D4002, D4003, D4004 and D4005 into the module addresses K138, K139, K140 and K141 respectively. That is, 1 channel PID parameter value.

Starting from process S3, write the value of temperature control cycle D4008 to module address K159, that is, the temperature control cycle to 1 is D4008.



Open process S4, write the type of thermocouple sensor into channel 1, that is, the value in D4010 is the parameter value corresponding to the set sensor type.

S5 process is PID self-tuning process.

Enable channel 1.

Open the PID self-tuning flag bit.

Read the current PID self-tuning flag bit in a period of 1s

When the PID self-tuning flag is automatically reset, it means the self-tuning is over, and the self-tuning process is closed at this time.

Read the current actual temperature value at the frequency of 1S without writing the set channel parameters.

Functions of all software components:

M1: The input of M100 position is executed, and the temperature control enabling process is opened;

M2: The input of M101 setting is executed, and the self-tuning process is opened;

M3: open the input execution of temperature control cycle writing process S1;

M4: Open the input execution of PID and DIFF writing process S2;

M5: Open the input execution of the set temperature value writing process S3;

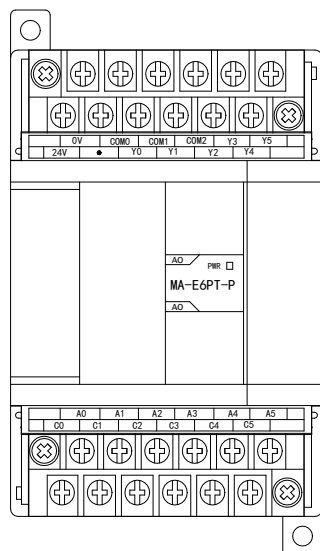
M6: open the input execution of the process S4 of writing thermocouple type;

M8: mark bit being adjusted.

11. PT100 temperature control module MA-6PT-P

11.1 Module features and specifications

MA-6PT-P can deal with 6 channels' PT100 temperature signals, construct the industry control system with other devices based on Modbus protocol.



Module features:

- Pt hot resistance input, degree number is PT100
- 6 channels input, 6 channels output, 6 channels individual PID auto-tune function
- 1mA constant current output, will not be interfered by outside environment
- Resolution precision is 0.1°C

Item	Description
Analog input signal	Pt100 Pt hot resistance
Measure temperature range	-100°C ~ 350°C
Digital output range	Full-scale 4095, 12 bits with sign, binary
Control precision	±0.1°C
Resolution	0.1°C
Integrated precision	0.8% (related maximum)
Conversion speed	20ms/1 channel
Module Power supply	DC24V ± 10%, 50mA
Installation	Use M3 screw or fix on DIN46277 rail (width 35mm)
Profile dimension	63mm×102mm×73.3mm

- Notice: (1) The channel data is 0 when no signal input
 (2) Connect Pt100 Pt hot resistance according to actual needs

11.2 Terminal explanation

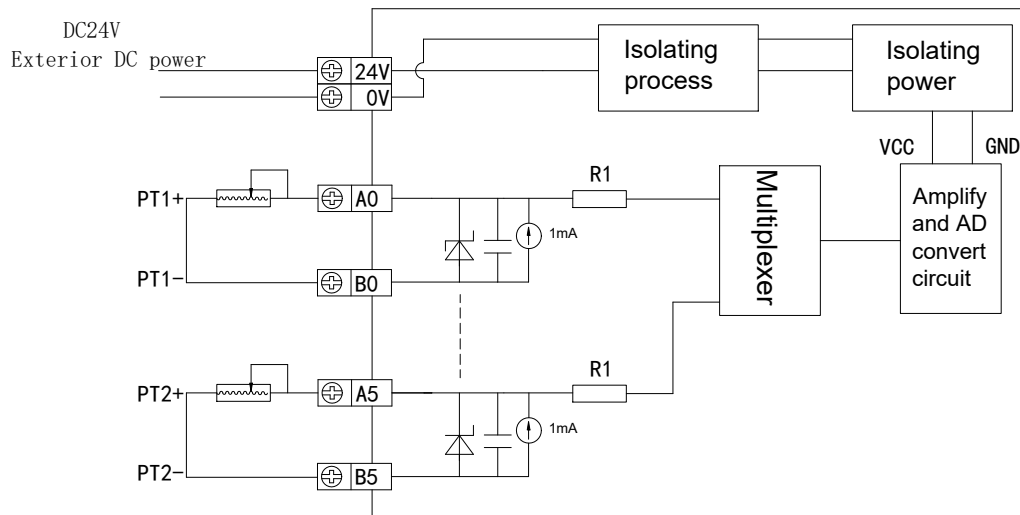
The points arrangement of MA-6PT-P are as below:

	OV	B	Y0	Y2	Y3	Y5
24V	A	COMO	Y1	COM1	Y4	

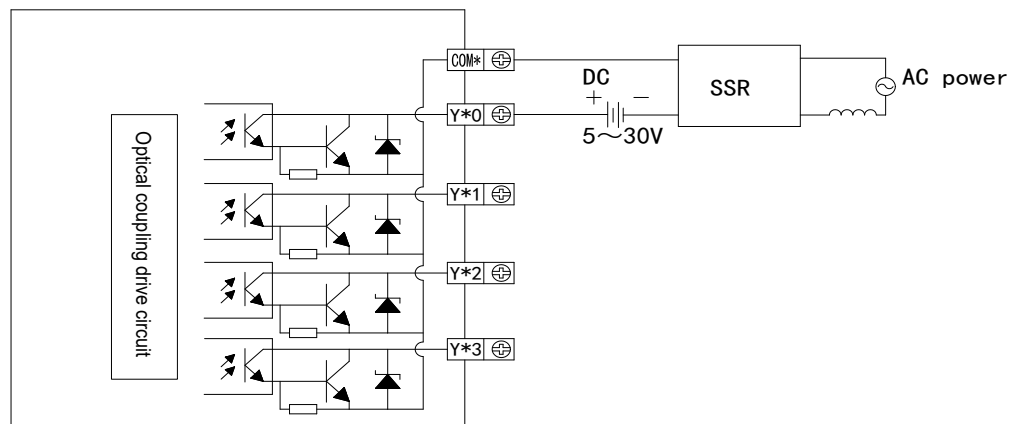
	B0	B1	B2	B3	B4	B5
A0	A1	A2	A3	A4	A5	

11.3 External connection

(1) For MA-6PT-P, the input points connection is as below:



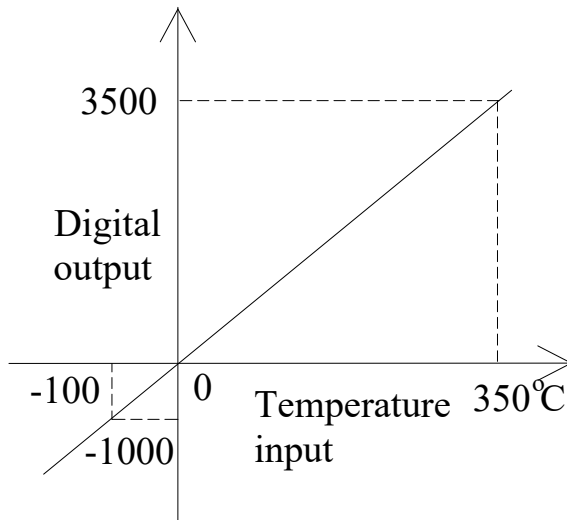
(2) For MA-6PT-P, the output points connection is as below:



Please pay attention to below notes when connecting PT100:

- When connecting +24 power supply, please use the power on PLC to prevent from interference.
- Shielding the signal wire to prevent from interference.

11.4 Pt input characteristic curve



11.5 I/O module address

11.5.1 Modbus read address

(1) bit address:

Modbus bit address (Decimal)	Description	Note
0x00	Channel 0 PID control result	Switch quantity, corresponding to the ON/OFF state of the channel's exterior connected relay
0x01	Channel 1 PID control result	
0x02	Channel 2 PID control result	
0x03	Channel 3 PID control result	
0x04	Channel 4 PID control result	
0x05	Channel 5 PID control result	
0x08	Channel 0 open circuit check bit	If one of the 6 channels is open circuit or short, the bit is 1, if normal it is 0.
0x09	Channel 1 open circuit check bit	
0x10	Channel 2 open circuit check bit	
0x11	Channel 3 open circuit check bit	
0x12	Channel 4 open circuit check bit	

0x13	Channel 5 open circuit check bit	
0x14	Channel 0 Auto-tune error check	0: normal 1: error
0x15	Channel 1 Auto-tune error check	0: normal 1: error
0x16	Channel 2 Auto-tune error check	0: normal 1: error
0x17	Channel 3 Auto-tune error check	0: normal 1: error
0x18	Channel 4 Auto-tune error check	0: normal 1: error
0x19	Channel 5 Auto-tune error check	0: normal 1: error

(2) word address:

Modbus bit address (Decimal)	Description	Note
4x00	Channel 0 Current temperature	Display current temperature, the unit is 0.1°C. e.g. 2000 means the current temperature is 200.0°C.
4x01	Channel 1 Current temperature	
4x02	Channel 2 Current temperature	
4x03	Channel 3 Current temperature	
4x04	Channel 4 Current temperature	
4x05	Channel 5 Current temperature	
4x06	Channel 0 Output value(Operation result)	Display the current PID output range, digital quantity, full-scale is 4095.
4x07	Channel 1 Output value(Operation result)	
4x08	Channel 2 Output value(Operation result)	
4x09	Channel 3 Output value(Operation result)	
4x10	Channel 4 Output value(Operation result)	
4x11	Channel 5 Output value(Operation result)	

11.5.2 Modbus write in address

(1) bit address:

Modbus bit address (decimal)	Description	Note
0x128	Channel 0 PID enable signal	Set on this signal to open PID control enable bit of the channel; close the PID control process when resetting. All of the channels are closed when the power is on.
0x129	Channel 1 PID enable signal	
0x130	Channel 2 PID enable signal	
0x131	Channel 3 PID enable signal	
0x132	Channel 4 PID enable signal	
0x133	Channel 5 PID enable signal	
0x136	Channel 0 Auto-tune enable signal	After the enable bit of the channel is set on, set on the auto-tune bit to enter into auto-tune process; when this bit is 0, it means the auto-tune process is closed or completed.
0x137	Channel 1 Auto-tune enable signal	
0x138	Channel 2 Auto-tune enable signal	
0x139	Channel 3 Auto-tune enable signal	
0x140	Channel 4 Auto-tune enable signal	
0x141	Channel 5 Auto-tune enable signal	

0x144	Channel 0 heating/cooling selection bit	0- heating action; 1-cooling action. All channels are defaulted as heating action when the power is on.
0x145	Channel 1 heating/cooling selection bit	
0x146	Channel 2 heating/cooling selection bit	
0x147	Channel 3 heating/cooling selection bit	
0x148	Channel 4 heating/cooling selection bit	
0x149	Channel 5 heating/cooling selection bit	

(2) output word address:

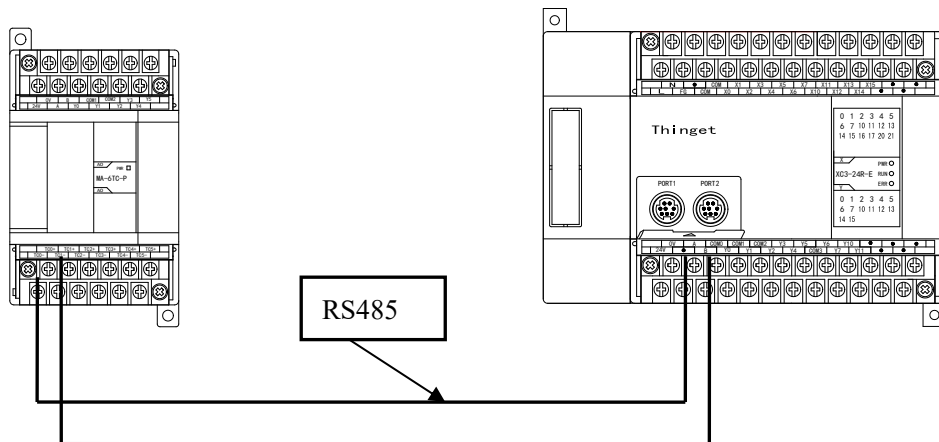
Modbus bit address (Decimal)	Description	Note
4x128	Channel 0 Setting temperature	Set temperature: the target temperature. Adjust range is $-100.0\sim+350.0$ °C, the precision is 0.1°C. Do not write radix point when writing the temperature, e.g. Write into 500 when temperature is 50.0°C.
4x129	Channel 1 Setting temperature	
4x130	Channel 2 Setting temperature	
4x131	Channel 3 Setting temperature	
4x132	Channel 4 Setting temperature	
4x133	Channel 5 Setting temperature	
4x134	Channel 0 PID Parameter P	The module PID parameters are modified after auto-tune process is completed; if users are not satisfied with the PID parameters, they can modify them directly. Parameter Diff means PID control is functional in the area of set temperature \pm Diff, the unit is 0.1°C, the defaulted value is 100; if the temperature is less than set temperature-Diff (heating action), PID output is the maximum value; if the temperature is more than set temperature+Diff, the PID output is the minimum value.
4x135	Channel 0 PID Parameter I	
4x136	Channel 0 PID Parameter D	
4x137	Channel 0 PID Parameter Diff	
4x138	Channel 1 PID Parameter P	
4x139	Channel 1 PID Parameter I	
4x140	Channel 1 PID Parameter D	
4x141	Channel 1 PID Parameter Diff	
4x142	Channel 2 PID Parameter P	
4x143	Channel 2 PID Parameter I	
4x144	Channel 2 PID Parameter D	
4x145	Channel 2 PID Parameter Diff	
4x146	Channel 3 PID Parameter P	
4x147	Channel 3 PID Parameter I	
4x148	Channel 3 PID Parameter D	
4x149	Channel 3 PID Parameter Diff	
4x150	Channel 4 PID Parameter P	
4x151	Channel 4 PID Parameter I	
4x152	Channel 4 PID Parameter D	
4x153	Channel 4 PID Parameter Diff	
4x154	Channel 5 PID Parameter P	
4x155	Channel 5 PID Parameter I	
4x156	Channel 5 PID Parameter D	
4x157	Channel 5 PID Parameter Diff	
4x158	Channel 0 Temperature control period	Control period adjust range is 0.5~200s, minimum precision is 0.1s. The unit is 0.1s, it means you need to write 5 while the actual
4x159	Channel 1 Temperature control period	
4x160	Channel 2 Temperature control period	

4x161	Channel 3 Temperature control period	period is 0.5s.
4x162	Channel 4 Temperature control period	
4x163	Channel 5 Temperature control period	
4x164	Channel 0 Actual temperature	Actual temperature: the users can set the actual temperature when they found the actual temperature is different from the displayed temperature, the unit is 0.1°C (the write method is the same as "the set temperature"). When the module is written into this value, temperature difference value δ = actual temperature – sampling temperature.
4x165	Channel 1 Actual temperature	
4x166	Channel 2 Actual temperature	
4x167	Channel 3 Actual temperature	
4x168	Channel 4 Actual temperature	
4x169	Channel 5 Actual temperature	
4x170	Channel 0 Auto-tune output range	Auto-tune output range: the output quantity of auto-tune, the unit is %, 100 means the mark-space ratio is 100% of the full-scale output, 80 means 80% of the full-scale output.
4x171	Channel 1 Auto-tune output range	
4x172	Channel 2 Auto-tune output range	
4x173	Channel 3 Auto-tune output range	
4x174	Channel 4 Auto-tune output range	
4x175	Channel 5 Auto-tune output range	
4x176	Channel 0 Temperature difference value	(sampling temperature + temperature difference δ)/10= display temperature. Then the display temperature will be equal or close to actual temperature. This parameter is signed number, the unit is 0.1°C, it can keep the data if the power is cut, the defaulted value is 0.
4x177	Channel 1 Temperature difference value	
4x178	Channel 2 Temperature difference value	
4x179	Channel 3 Temperature difference value	
4x180	Channel 4 Temperature difference value	
4x181	Channel 5 Temperature difference value	

11.6 Application example

This example is based on the communication between the PLC and MA-6PT-P to do the PID auto-tune process.

(1) Hardware connection: connect the RS485 com port A, B of MA-6PT-P and the PLC.



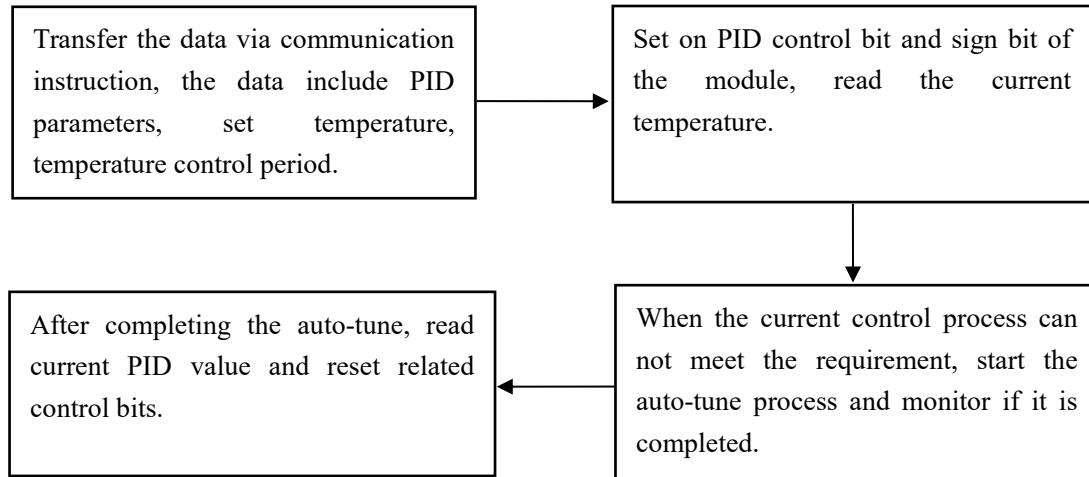
(2) Communication parameter setting: baud rate is 19200bps, station number is 1.

For MA-6PT-P: baud rate 19200bps, set switch 1-OFF, 2-OFF;

Station number 1, set switch 1-OFF, 2-OFF, 3-OFF, 4-OFF.

For PLC, set the baud rate of COM 2 to 19200bps, which is valid after writing to PLC and powering on again.

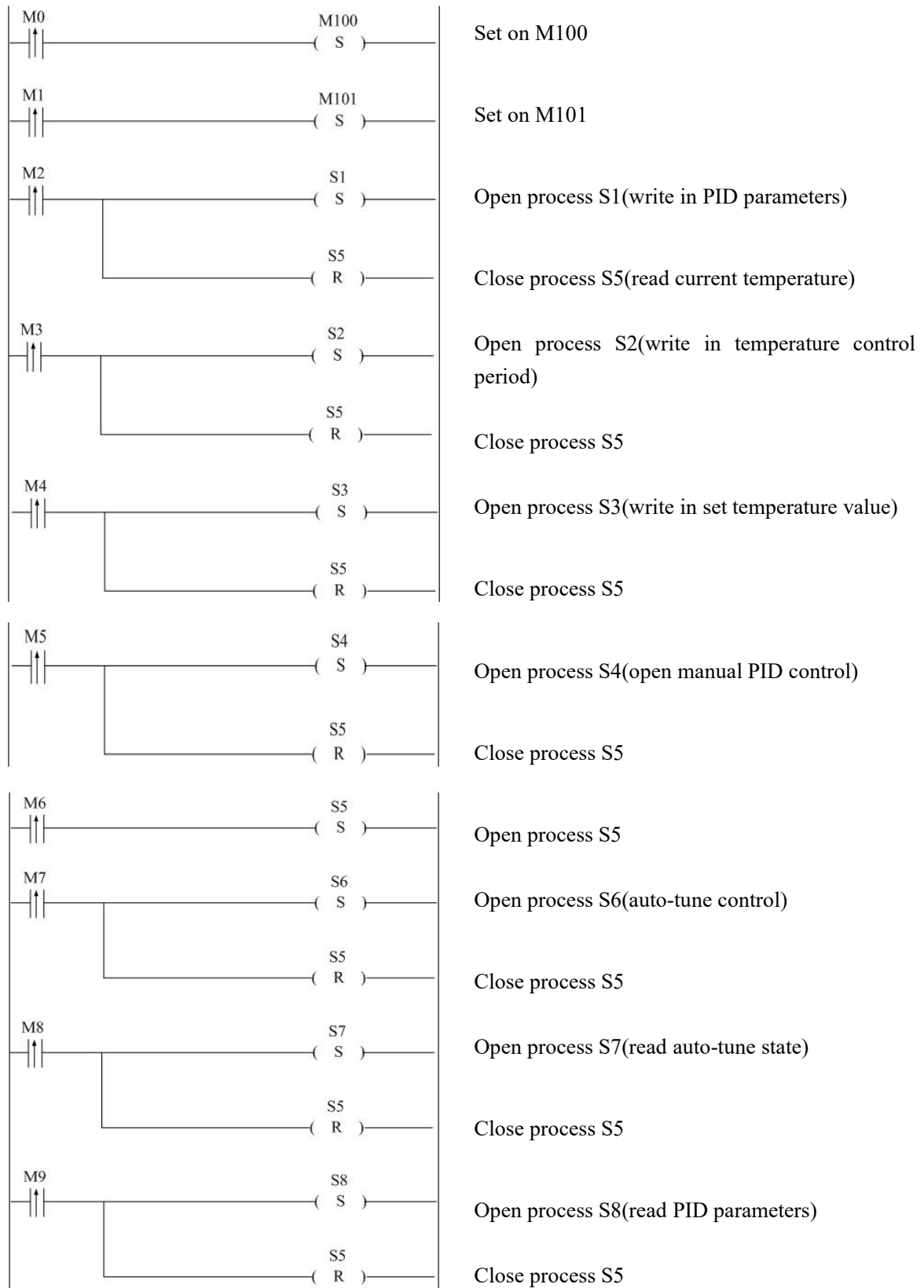
(3) The whole process:

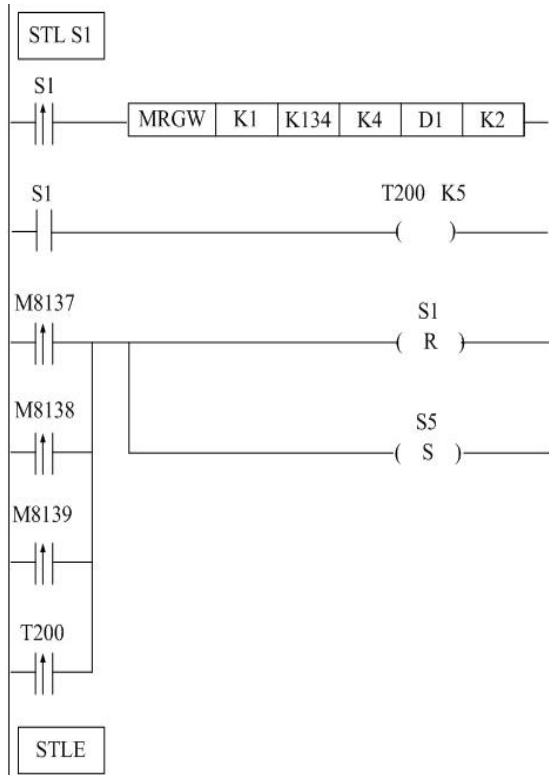


(4) Corresponding address

PLC address	MA Modbus address	Note
D1	K134	Channel 0 parameter P setting
D2	K135	Channel 0 parameter I setting
D3	K136	Channel 0 parameter D setting
D4	K137	Channel 0 parameter Diff setting
D5	K128	Channel 0 temperature set value
D6	K158	Channel 0 temperature control period
D7	K0	Channel 0 current temperature
D10	K134	Channel 0 parameter P display
D11	K135	Channel 0 parameter I display
D12	K136	Channel 0 parameter D display
D13	K137	Channel 0 parameter Diff display
M100	K128	Channel 0 PID enable bit
M101	K134	Channel 0 auto-tune enable bit

(5) ladder chart





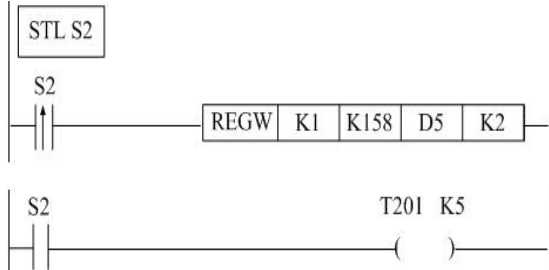
Start process S1

Write the value of D1~D4(PLC) to K134~K137(MA), i.e. channel 0 PID parameters

Delay for 50ms

Close process S1 and open process S5 when data transfer are completed or 50ms is over

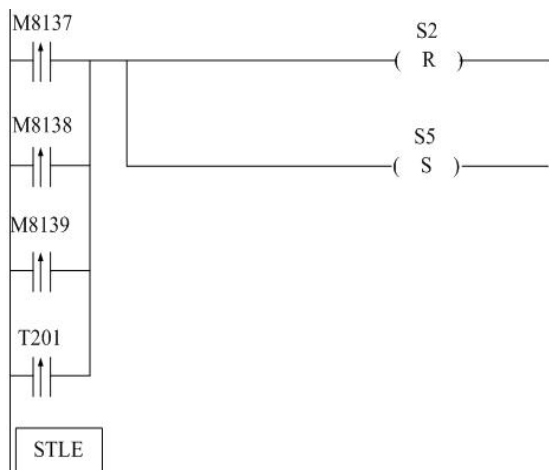
End of process S1



Start process S2

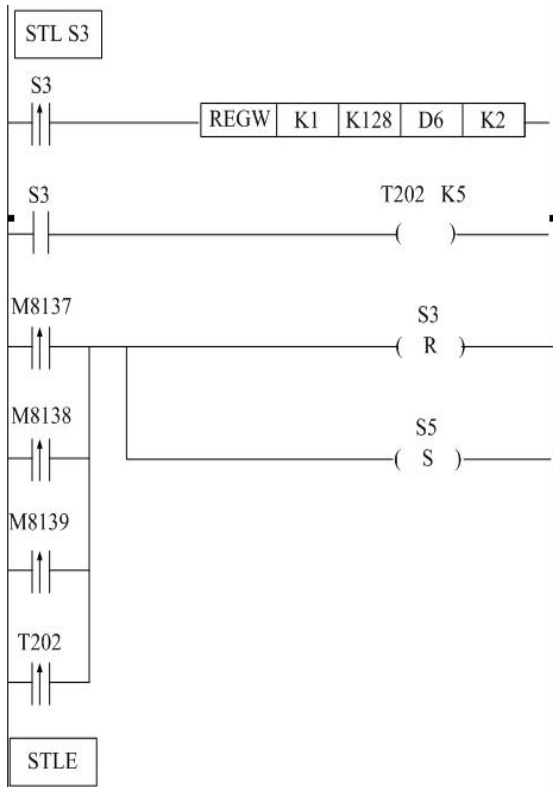
Write the value of D5(PLC) to K158(MA), i.e. channel 0 temperature control period

Delay for 50ms



Close process S2 and open process S5 when data transfer are completed or 50ms is over

End of process S2



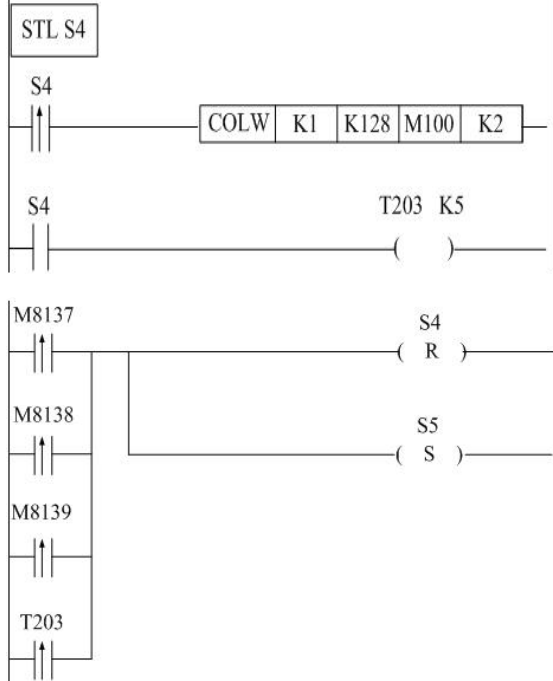
Start process S3

Write the value of D6(PLC) to K128(MA), i.e. channel 0 set temperature value

Delay for 50ms

Close process S3 and open process S5 when data transfer are completed or 50ms is over

End of process S3



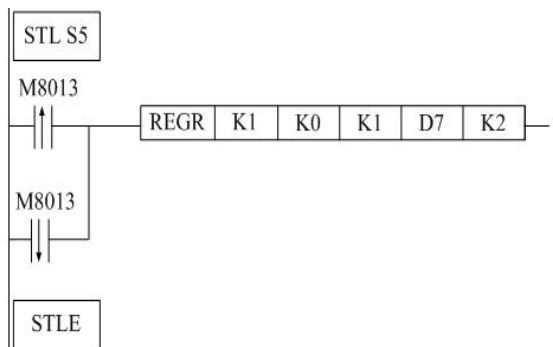
Start process S4

Write the value of M100(PLC) to K128(MA), i.e. open channel 0 PID enable bit

Delay for 50ms

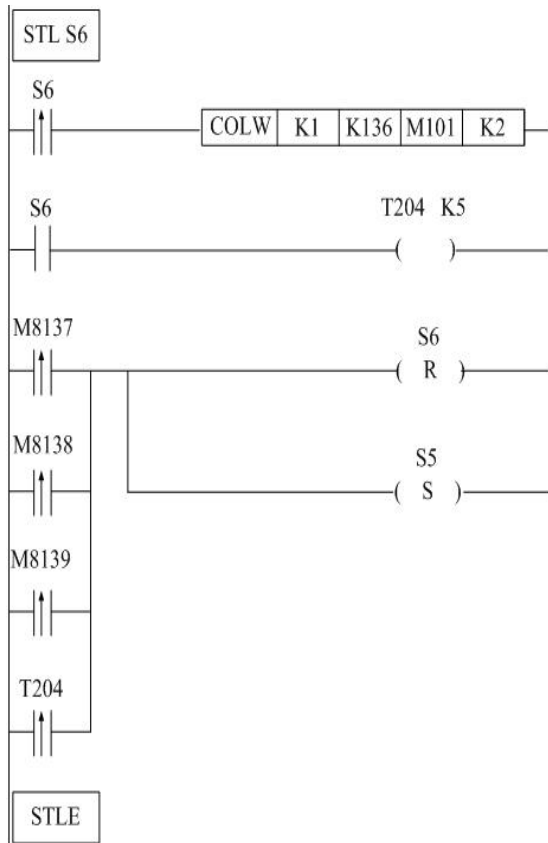
Close process S2 and open process S5 when data transfer are completed or 50ms is over

End of process S4



Read the value of K0(MA) to D7(PLC) every 500ms, i.e. channel 0 current temperature

End of process S5



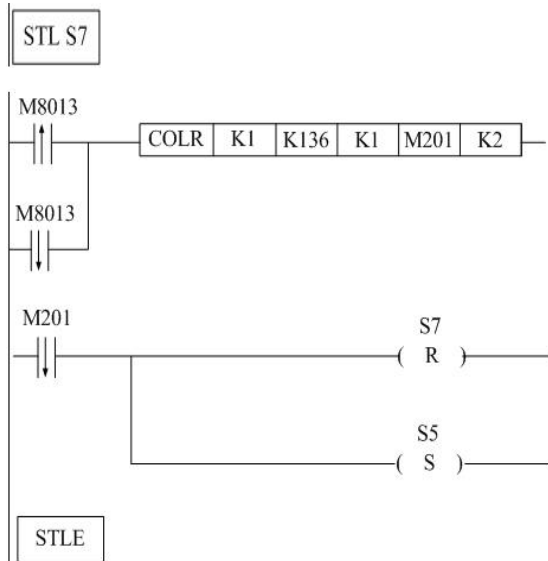
Start process S6

Write the value of M101(PLC) to K136(MA), open channel 0 auto-tune enable bit

Delay for 50ms

Close process S6 and open process S5 when data transfer are completed or 50ms is over

End of process S6

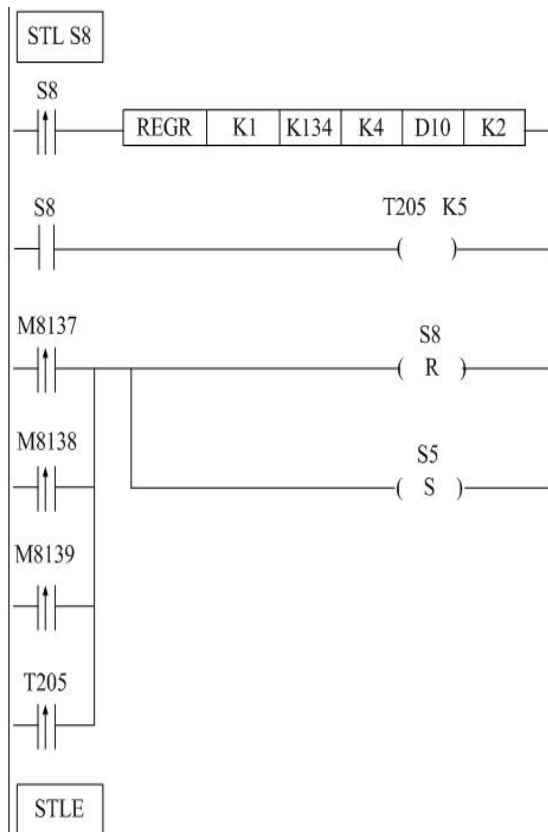


Start process S7

Read the value of K136(MA) to M201(PLC) every 500ms, i.e. channel 0 auto-tune state bit

Close process S7 and open process S5

End of process S7



Start process S8

Read the value of K134~K137(MA) to D10~D13(PLC), i.e. channel 0 PID parameters

Delay for 50ms

Close process S8 and open process S5 when data transfer are completed or 50ms is over

End of process S8

M0: Input execution of M100 setting;

M1: Input execution of M101 setting;

M2: open the input execution of PID parameter writing process S1;

M3: open the input execution of temperature control cycle value writing process S2;

M4: Open the input execution of the set temperature value writing process S3;

M5: Open the input execution of PID control process S4;

M6: open the input execution of the current temperature value reading process S5;

M7: Open the input execution of self-tuning control flow S6;

M8: open the input execution of reading the self-tuning status flag bit flow S7;

M9: Open the input execution of the process S8 for reading PID parameter values;

M201: Self-setting status local flag bit.

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