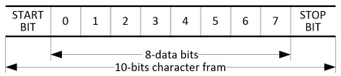
TX-800 series multi-loop independent self-tuning PID controller

Operation Manual [Software Edition](TX2...TX8)

1、Character structure

1.1. 10-bit character frame per frame (RTU mode)

Format：1. 8. N. 1：



Among them: 1 start bit, 8 data bits, and no check bit (or parity bit)

1 stop bit (or 2 stop bits)

1.1. Baud Rate (Unit: bps)

1200、2400、4800、9600、14400、19200、28800、38400

2、Communication format

Agreement: The controller is the slave machine or the lower-level machine, while the touch screen controller or computer, etc. is the master machine or the upper-level machine.

2.1. RTU Format

Starting mark	START	Maintain no input signal (at least 3.5 bytes idle), generally ≥ 20ms
Slave address	Adress	Communication bit address: 8-bit binary bit address. Note: 00H is the broadcast address.
Function code	Function	Function code: 8-bit binary address.
The highest byte of the data link	DATA(n-1)	Data content: N8-bits data content (N ≤ 40).
The middle byte of the data chain	.....	
The lowest byte of the data link	DATA 0	
CRC Low byte	CRC Check Low	CRC Check code
CRC High byte	CRC Check High	The 16-bit CRC check code consists of two 8-bit binary codes.
End sign	END	Maintain no input signal (at least 3.5 bytes idle), generally ≥20ms.

Note: 1) The "Start flag" for message sending must begin with at least a 3.5-byte pause interval. After the high byte of the CRC is transmitted, a pause of at least 3.5 bytes marks the "end flag", and a new message can resume after this pause.

2) A complete frame data must be transmitted as a continuous data stream. If there is a pause of more than 1.5 bytes between any two bits before the completion of a frame transmission, it is considered a frame error, the reception is stopped, the value in the buffer is cleared, and the error flag is cleared in the main communication loop until the message reception is restarted.

3) It is necessary to ensure that the time interval between two frames is at least 3.5 bytes. The 3.5 bytes of time is related to the specific communication baud rate. The calculation method is as follows: If the communication baud rate is 19200, then the 1.5 bytes of time length =1/19200*11*1.5*1000=0.86ms; 3.5 bytes of time length =1/19200*11*3.5*1000=2ms; The values calculated here are theoretical. In actual use, the time here should be as much as possible greater than or equal to 20ms, which can effectively avoid read and write frame errors as well as timeout errors in communication.

2.2. Slave address(Address)

00H: All controller Broadcast addresses (Broadcast)

01H: Communicate with the controller at the 01st bit address of the slave machine;

02H: Communicate with the controller at the 02nd address of the slave machine;

.....

FEH: Communicate with the controller at the 254th address of the slave machine;

2.3. Function code(Function)

03H: The host reads the content in the controller register.

06H: The host writes a WORD data to the controller's register.

10H: The host writes one or more data to the controller's registers.

08H: Loop detection.

All data is represented by two bytes, in binary complement. When there is a decimal point, it is also represented by two integers. For example, 100.0 is represented by 03E8H, and the decimal point is automatically added when displayed.

2.3.1. Function Code 03H, the host reads the content in the controller register

For example 1: The master reads the data from a character or integer parameter from the slave at the slave bit address 01H.

The host (such as a PC) performs a data read operation on the slave (such as a controller) at bit address 01H: It reads the data from an address space at the slave's starting register address 0008H. The representation method is as follows:

The host asks the slave machine for the format:

Slave address	Address	01H
Function code	Function	03H
Starting from the machine Register address	Data AddrHight	00H
	Data Addr Low	08H
The total number of read addresses (one Word is two bytes)	Number of data (count by word)	00H
		01H
CRC low byte	CRC Check Low	05H
CRC high byte	CRC Check Hight	C8H

The format of the slave machine responding to the host:

Slave address	Address	01H
Function code	Function	03H
Return the total number of bytes (one Word is two bytes)	Number of data (count by byte)	02H
Return two bytes of data at the first address of the register	Content of data （Address 0000）	00H
		64H
CRC low byte	CRC Check Low	B9H
CRC high byte	CRC Check Hight	AFH

Description: Read out the parameter value of the first channel setting value of the controller =100.

For example 2: The slave at the slave bit address 01H reads the data from two consecutive character or integer parameters.

The host (such as PC) performs a data read operation on the slave (such as controller) at bit address 01H: It reads the data from the two consecutive address Spaces at the slave's starting register address 0077H. The representation method is as follows:

The host asks the slave machine for the format:

Slave address	Address	01H
Function code	Function	03H
Starting from the machine Register address	Data AddrHight	00H
	Data Addr Low	77H
The total number of read addresses (one Word is two bytes)	Number of data (count by word)	00H
		02H
CRC low byte	CRC Check Low	74H

The format of the slave machine responding to the host:

Slave address	Address	01H
Function code	Function	03H
Return the total number of bytes (one Word is two bytes)	Number of data (count by byte)	04H
Return two bytes of data at the first address of the register	Content of data （Address 0000）	00H
		32H
Return two bytes of data at the	Content of data	00H
CRC high byte	CRC Check Hight	11H

second address of the register	（Address 0001）	04H
CRC low byte	CRC Check Low	5AH
CRC high byte	CRC Check Hight	3FH

Note: Read out the parameter values where the upper limit value of the eighth alarm channel 1 of the controller is 50 and the switching difference of the first alarm channel 1 is 4.

2.3.2. Function Code 06H: The host writes a WORD data to the controller's register

For example 1: The host writes a character or integer data to a parameter with the slave bit address of 01H.

The host (such as PC) performs a data write operation on the slave (such as controller) at bit address 01H: The host writes the first channel proportional band parameter value = 100 = 0064H to the slave register address 0028H, and the representation method is as follows:

The host asks the slave machine for the format:

Slave address	Address	01H
Function code	Function	06H
Starting from the machine Register address	Data AddrHight	00H
	Data Addr Low	28H
The written data (one Word is two bytes)	Data Content Hight	00H
	Data Content Low	64H
CRC low byte	CRC Check Low	08H
CRC high byte	CRC Check Hight	29H

The format of the slave machine responding to the host:

Slave address	Address	01H
Function code	Function	06H
Return what was written Slave register address	Data AddrHight	00H
	Data Addr Low	28H
Return the written data content (one Word is two bytes)	Data Content Hight	00H
	Data Content Low	64H
CRC low byte	CRC Check Low	08H
CRC high byte	CRC Check Hight	29H

Note: Set the value of the proportional band parameter of the first channel of the controller to 100.

For example 2: The host writes two consecutive character or integer data into two consecutive parameters from the slave bit address 01H.

Here, the 10H function code is used to write the eighth integration time = 150 = 0096H and the first differential time = 160 = 00A0H at one time into the two addresses 0037H and 0038H of the slave registers. At this point, only the address of the 0037H register is needed, and the representation method is as follows:

The host asks the slave machine for the format:

Slave address	Address	01H
Function code	Function	10H
Starting from the machine Register address	Data AddrHight	00H
	Data Addr Low	37H
The total number of addresses to be written (one Word is two bytes)	Number of data (count by word)	00H
		02H
Total number of written bytes	Count By Byte	04H
The written data (one single precision is 2 words, one word is 2 bytes, that is, a total of 4 bytes are occupied here)	Data Content Sub-Low	00H
	Data Content Low	96H
	Data Content Hight	00H
	Data Content Sub-High	A0 H
CRC low byte	CRC Check Low	51H
CRC high byte	CRC Check Hight	09H

The format of the slave machine responding to the host:

Slave address	Address	01H
Function code	Function	10H
Return what was written Slave register address	Data AddrHight	00H
	Data Addr Low	37H
Return the total number of addresses written (one Word is two bytes)	Number of data (count by word)	00H
		02H
CRC low byte	CRC Check Low	F0H
CRC high byte	CRC Check Hight	06H

Note: Set the value of the integral time parameter of the eighth channel of the controller to 150 and the value of the differential time parameter of the first channel to 160.

2.3.3. Function Code 08H: Loop detection

For example: The host (such as a PC) performs a data loop detection operation on the slave (such as a controller) at bit address 01H: The host writes data 1234H to the slave register address 0000H. This is not a real write operation but merely for loop detection testing. The value of the main switch parameter remains unchanged. The representation method is as follows:

The host asks the slave machine for the format:

Slave address	Address	01H
Function code	Function	08H
Slave register Address	Data AddrHight	00H (Arbitrary)
	Data Addr Low	00H (Arbitrary)
The written data A Word is two bytes.	Data Content Hight	12H Arbitrary)
	Data Content Low	34H Arbitrary)
CRC low byte	CRC Check Low	EDH
CRC high byte	CRC Check Hight	7CH

The format of the slave machine responding to the host:

Slave address	Address	01H
Function code	Function	08H
Return what was written Slave register address	Data AddrHight	00H
	Data Addr Low	00H
Return the content of the written data A Word is two bytes.	Data Content Hight	12H
	Data Content Low	34H
CRC low byte	CRC Check Low	EDH
CRC high byte	CRC Check Hight	7CH

2.4. Additional Responses in case of incorrect communication

When the slave machine (such as the controller) makes a communication connection AND an error occurs, at this time, the slave machine (such as the controller) will respond with an error code and send the Function code AND 80H or 90H to the host machine (such as the PC), so that the host machine (such as the PC) knows that an error has occurred.

For the specific meaning of error codes during incorrect communication, please refer to the "Meaning of Error Codes" table:

When the function code is 03H/06H/08H

The format of the slave machine responding to the host:

Slave address	Address	01H
Function code	Function	86H
Error code	Except code	02H
CRC low byte	CRC Check Low	C3H
CRC high byte	CRC Check Hight	A1H

When the function code is 10H

The format of the slave machine responding to the host:

Slave address	Address	01H
Function code	Function	90H
Error code	Except code	02H
CRC low byte	CRC Check Low	C3H
CRC high byte	CRC Check Hight	A1H

Note: When the function code is 03H/06H/08H, return the original function code after 80H; when the function code is 10H, directly return 90H AND return the error code in the Except code (see the table below).

The meaning of error codes

Error code	Explanation
01	**Function code error: The controller can recognize the function codes 03H, 06H, 10H, and 08H.**
02	**Register address error: The controller from the machine (ground) address cannot recognize this register address.**
03	**Parameter data value error: The parameter data value is too large or too small, and is not a data value that the controller can recognize.**
04	**The controller cannot handle: The controller cannot execute this command.**
06	**The controller is busy: The controller is processing data. Please widen the interval between the instruction strings or send the inquiry later. For example: The controller is initializing the relevant parameters; Note: This error code controller is not in use yet.**
09	**Check code error: CRC check code error in the instruction string.**
10	**Parity error Note: This error code is not in use for the controller.**
12	**Error: The length of the data received by the controller is shorter than the specified length.**
13	**Error: The length of the data received by the controller exceeds the specified length.**

2.5. CRC Check in RTU Mode

The check code calculation Data starts from Address and ends at Data content. Its operation rules are as follows:

Step 1: Let the 16-bit register (CRC register) = FFFFH;

Step 2: Bitwise the first 8-bit /Byte message instruction to the data in the 16-bit /CRC register

Perform Exclusive OR (XOR), and store the result after XOR in a 16-bit /CRC register. An 8-bit/Byte message instruction is 8 bits. When participating in the operation, the high 8 bits are supplemented to 00H, and the message instruction Data is from Address to Data content;

Step 3: Move the data in the CRC register one bit to the right to free up the highest bit of the CRC register, and fill in 0 to the highest bit of the CRC register.

Step 4: Check the value moved to the right from the CRC register: If it is 0, store the new value after the operation in Step 3 into the CRC register. If it is 1, the new value obtained after operation in step 3 will perform an Exclusive OR (XOR) operation bit by bit with A001H, and the result after XOR will be stored in the CRC register.

Step 5: Repeat steps 3 to 4 above to complete the operation of all 8-bits.

Step 6: Repeat steps 2 to 5 to retrieve an 8-bit message instruction until all message instructions have been fully processed. The final value of the CRC register obtained is the check code of the CRC. It is worth noting that the CRC check code must be placed in the CRC check code register of the message instruction, with the low eight bits and the high eight bits respectively. The low eight bits =CRC check code %256, and the high eight bits =CRC check code /256.

Note: The Exclusive OR (XOR) operation is a kind of operation that realizes the logical relationship of "different is 1, the same is 0". Its logical operator is "⊕", which is a bit operator, and its operation rules are as follows: In C language, there is a "bitwise XOR" operation called "^". 0⊕0 = 0, 0⊕1 = 1, 1⊕0 = 1, 1⊕1 = 0.

The following program is an example of CRC check code operation written in C language

```
unsignedintcrc_chk(unsigned char *data,unsigned char length)
// Define a pointer 'data' variable to store the starting address of the message instruction
// Define a length variable, Length, to store the length of the message instruction, that is, the byte length
{
unsigned char j;// Define a variable j to store which bit each message instruction moves to the right
    unsignedintreg_crc = 0xffff;// Assign an initial value to the CRC register 0xffff
        while(length--)//Each time the length value of the message instruction is reduced by one, that is, after each message instruction is operated, the total number of message instructions is reduced by one
        {
                reg_crc ^ = *data++;
                //Perform a bitwise XOR operation on the message instruction data in the pointer variable data and the data in the CRC register. Store the result of the operation in the reg_crc register. After the operation, the pointer variable data points to the address of the next message instruction
                for(j = 0; j < 8; j++)//The current extracted message command is operated bit by bit in a loop
                {
                if(reg_crc& 0x01)// If the least significant bit of the data in the CRC register is 1, then move the data in the CRC register one bit to the right and perform a bitwise XOR operation with 0xa001, and store the final operation result in the CRC register
                {
                        reg_crc = (reg_crc>> 1) ^ 0xa001;
                }
                else//If the least significant bit of the data in the CRC register is 0, the result of moving the data in the CRC register one bit to the right will be stored in the CRC register
                {
                        reg_crc = reg_crc>> 1;
                }
        }
}
return reg_crc; //Return the data in the CRC register after the operation
}
```

3、Register address (control parameter) definition

Serial number	Parameter name	Parameter symbol	Attribute	Control loop number (channel number) CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
1	Measured value	PV-X	R	0000H (1000H)	0001H (1020H)	0002H (1040H)	0003H (1060H)	0004H (1080H)	0005H (10A0H)	0006H (10C0H)	0007H (10E0H)
2	Set value	SV-X	R/W	0008H (1001H)	0009H (1021H)	000AH (1041H)	000BH (1061H)	000CH (1081H)	000DH (10A1H)	000EH (10C1H)	000FH (10E1H)
3	Control output indication (OUT on the controller）	OUT-X	R	0010H (1002H)	0011H (1022H)	0012H (1042H)	0013H (1062H)	0014H (1082H)	0015H (10A2H)	0016H (10C2H)	0017H (10E2H)
4	Alarm 1 indication (ALM on the controller）	ALM1-X	R	0018H (1003H)	0019H (1023H)	001AH (1043H)	001BH (1063H)	001CH (1083H)	001DH (10A3H)	001EH (10C3H)	001FH (10E3H)
5	Control output switch	SST-X	R/W	0020H (1004H)	0021H (1024H)	0022H (1044H)	0023H (1064H)	0024H (1084H)	0025H (10A4H)	0026H (10C4H)	0027H (10E4H)
6	Proportional band	P-X	R/W	0028H (1005H)	0029H (1025H)	002AH (1045H)	002BH (1065H)	002CH (1085H)	002DH (10A5H)	002EH (10C5H)	002FH (10E5H)
7	Integral time	I-X	R/W	0030H (1006H)	0031H (1026H)	0032H (1046H)	0033H (1066H)	0034H (1086H)	0035H (10A6H)	0036H (10C6H)	0037H (10E6H)
8	Differential time	D-X	R/W	0038H (1007H)	0039H (1027H)	003AH (1047H)	003BH (1067H)	003CH (1087H)	003DH (10A7H)	003EH (10C7H)	003FH (10E7H)
9	Positional hysteresis	HY-X	R/W	0040H (1008H)	0041H (1028H)	0042H (1048H)	0043H (1068H)	0044H (1088H)	0045H (10A8H)	0046H (10C8H)	0047H (10E8H)
10	Integral suppression	AR-X	R/W	0048H (1009H)	0049H (1029H)	004AH (1049H)	004BH (1069H)	004CH (1089H)	004DH (10A9H)	004EH (10C9H)	004FH (10E9H)
11	Self-tuning limit	ATU-X	R/W	0050H (100AH)	0051H (102AH)	0052H (104AH)	0053H (106AH)	0054H (108AH)	0055H (10AAH)	0056H (10CAH)	0057H (10EAH)
12	Self-tuning	AT-X	R/W	0058H (100BH)	0059H (102BH)	005AH (104BH)	005BH (106BH)	005CH (108BH)	005DH (10ABH)	005EH (10CBH)	005FH (10EBH)
13	Alarm type	SA-X	R/W	0060H (100CH)	0061H (102CH)	0062H (104CH)	0063H (106CH)	0064H (108CH)	0065H (10ACH)	0066H (10CCH)	0067H (10ECH)
14	Lower limit of alarm 1	AL1-X	R/W	0068H (100DH)	0069H (102DH)	006AH (104DH)	006BH (106DH)	006CH (108DH)	006DH (10ADH)	006EH (10CDH)	006FH (10EDH)
15	Alarm 1 upper limit	AH1-X	R/W	0070H (100EH)	0071H (102EH)	0072H (104EH)	0073H (106EH)	0074H (108EH)	0075H (10AEH)	0076H (10CEH)	0077H (10EEH)
16	Alarm 1: Poor switching	FH1-X	R/W	0078H (100FH)	0079H (102FH)	007AH (104FH)	007BH (106FH)	007CH (108FH)	007DH (10AFH)	007EH (10CFH)	007FH (10EFH)
17	Alarm 2 indication There is no output on the controller.	ALM2-X	R	0080H (1010H)	0081H (1030H)	0082H (1050H)	0083H (1070H)	0084H (1090H)	0085H (10B0H)	0086H (10D0H)	0087H (10F0H)
18	Lower limit of alarm 2	AL2-X	R/W	0088H (1011H)	0089H (1031H)	008AH (1051H)	008BH (1071H)	008CH (1091H)	008DH (10B1H)	008EH (10D1H)	008FH (10F1H)
19	Alarm 2 upper limit	AH2-X	R/W	0090H (1012H)	0091H (1032H)	0092H (1052H)	0093H (1072H)	0094H (1092H)	0095H (10B2H)	0096H (10D2H)	0097H (10F2H)
20	Alarm 2: Poor switching	FH2-X	R/W	0098H (1013H)	0099H (1033H)	009AH (1053H)	009BH (1073H)	009CH (1093H)	009DH (10B3H)	009EH (10D3H)	009FH (10F3H)
21	Forward and reverse action control and the first power-on alarm enable	EA-X	R/W	00A0H (1014H)	00A1H (1034H)	00A2H (1054H)	00A3H (1074H)	00A4H (1094H)	00A5H (10B4H)	00A6H (10D4H)	00A7H (10F4H)
22	Measurement value filtering	FILT-X	R/W	00A8H (1015H)	00A9H (1035H)	00AAH (1055H)	00ABH (1075H)	00ACH (1095H)	00ADH (10B5H)	00AEH (10D5H)	00AFH (10F5H)
23	Sensor correction	PB-X	R/W	00B0H (1016H)	00B1H (1036H)	00B2H (1056H)	00B3H (1076H)	00B4H (1096H)	00B5H (10B6H)	00B6H (10D6H)	00B7H (10F6H)
24	Upper limit of the temperature control setting value	SUH-X	R/W	00B8H	00B9H	00BAH	00BBH	00BCH	00BDH	00BEH	00BFH

				(1017H)	(1037H)	(1057H)	(1077H)	(1097H)	(10B7H)	(10D7H)	(10F7H)
25	Lower limit of the temperature control setting value	SUL-X	R/W	00C0H (1018H)	00C1H (1038H)	00C2H (1058H)	00C3H (1078H)	00C4H (1098H)	00C5H (10B8H)	00C6H (10D8H)	00C7H (10F8H)
26	Upper limit of the measured value	RH-X	R/W	00C8H (1019H)	00C9H (1039H)	00CAH (1059H)	00CBH (1079H)	00CCH (1099H)	00CDH (10B9H)	00CEH (10D9H)	00CFH (10F9H)
27	Lower limit of measurement value	RL-X	R/W	00D0H (101AH)	00D1H (103AH)	00D2H (105AH)	00D3H (107AH)	00D4H (109AH)	00D5H (10BAH)	00D6H (10DAH)	00D7H (10FAH)
28	Upper limit of heating output percentage	OPH-X	R/W	00D8H (101BH)	00D9H (103BH)	00DAH (105BH)	00DBH (107BH)	00DCH (109BH)	00DDH (10BBH)	00DEH (10DBH)	00DFH (10FBH)
29	Lower limit of heating output percentage	OPL-X	R/W	00E0H (101CH)	00E1H (103CH)	00E2H (105CH)	00E3H (107CH)	00E4H (109CH)	00E5H (10BCH)	00E6H (10DCH)	00E7H (10FCH)
30	Soft start percentage	BUF-X	R/W	00E8H (101DH)	00E9H (103DH)	00EAH (105DH)	00EBH (107DH)	00ECH (109DH)	00EDH (10BDH)	00EEH (10DDH)	00EFH (10FDH)
31	Soft start time	BUT-X	R/W	00F0H (101EH)	00F1H (103EH)	00F2H (105EH)	00F3H (107EH)	00F4H (109EH)	00F5H (10BEH)	00F6H (10DEH)	00F7H (10FEH)
32	Slope warming	SPR-X	R/W	00F8H (101FH)	00F9H (103FH)	00FAH (105FH)	00FBH (107FH)	00FCH (109FH)	00FDH (10BFH)	00FEH (10DFH)	00FFH (10FFH)

The definition of the register address (control parameter) is shown in the following table:

Note: 1) All data types in the above table are: signed int - signed integer, represented by binary complement;

2) The X in the parameter symbol represents channels 1 to 8, indicating corresponding temperature control parameters for channels 1 to 8. For example, PV-5 represents the temperature measurement value of the fifth channel, and D-7 represents the differential time of the seventh channel.

3.2 Simplify the communication address, and the parameter address starts from 4000H

3.2.1 Simplified address for Route 8：

Control loop number (channel number)											
Serial number	Parameter name	Parameter symbol	Attribute	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
1	Measured value	PV-X	R	4000H	4001H	4002H	4003H	4004H	4005H	4006H	4007H
2	Indicate the status. Note A	LED-X	R	4008H	4009H	400AH	400BH	400CH	400DH	400EH	400FH
3	Set value	SV-X	R/W	4010H	4011H	4012H	4013H	4014H	4015H	4016H	4017H
4	Lower limit of alarm 1	AL1-X	R/W	4018H	4019H	401AH	401BH	401CH	401DH	401EH	401FH
5	Alarm 1 upper limit	AH1-X	R/W	4020H	4021H	4022H	4023H	4024H	4025H	4026H	4027H
6	Lower limit of alarm 2	AL2-X	R/W	4028H	4029H	402AH	402BH	402CH	402DH	402EH	402FH
7	Alarm 2 upper limit	AH2-X	R/W	4030H	4031H	4032H	4033H	4034H	4035H	4036H	4037H
8	Proportional band	P-X	R/W	4038H	4039H	403AH	403BH	403CH	403DH	403EH	403FH
9	Integral time	I-X	R/W	4040H	4041H	4042H	4043H	4044H	4045H	4046H	4047H
10	Differential time	D-X	R/W	4048H	4049H	404AH	404BH	404CH	404DH	404EH	404FH
11	Sensor correction	PB-X	R/W	4050H	4051H	4052H	4053H	4054H	4055H	4056H	4057H
12	Alarm 1: Poor switching	FH1-X	R/W	4058H	4059H	405AH	405BH	405CH	405DH	405EH	405FH
13	Alarm 2: Poor switching	FH2-X	R/W	4060H	4061H	4062H	4063H	4064H	4065H	4066H	4067H
14	Alarm type	SA-X	R/W	4068H	4069H	406AH	406BH	406CH	406DH	406EH	406FH
15	The alarm is enabled for the first power-on	EA-X	R/W	4070H	4071H	4072H	4073H	4074H	4075H	4076H	4077H
16	Control output switch	SST-X	R/W	4078H	4079H	407AH	407BH	407CH	407DH	407EH	407FH
17	Self-tuning limit	ATU-X	R/W	4080H	4081H	4082H	4083H	4084H	4085H	4086H	4087H
18	Self-tuning	AT-X	R/W	4088H	4089H	408AH	408BH	408CH	408DH	408EH	408FH
19	Positional switching difference	HY-X	R/W	4090H	4091H	4092H	4093H	4094H	4095H	4096H	4097H
20	Integral suppression	AR-X	R/W	4098H	4099H	409AH	409BH	409CH	409DH	409EH	409FH
21	Upper limit output percentage	OPH-X	R/W	40A0H	40A1H	40A2H	40A3H	40A4H	40A5H	40A6H	40A7H
22	Lower limit output percentage	OPL-X	R/W	40A8H	40A9H	40AAH	40ABH	40ACH	40ADH	40AEH	40AFH
23	Measurement value filtering	FILT-X	R/W	40B0H	40B1H	40B2H	40B3H	40B4H	40B5H	40B6H	40B7H
24	Upper limit of the set value	SVH-X	R/W	40B8H	40B9H	40BAH	40BBH	40BCH	40BDH	40BEH	40BFH
25	Lower limit of the set value	SVL-X	R/W	40C0H	40C1H	40C2H	40C3H	40C4H	40C5H	40C6H	40C7H
26	Upper limit of the measured value	RH-X	R/W	40C8H	40C9H	40CAH	40CBH	40CCH	40CDH	40CEH	40CFH
27	Lower limit of measurement value	RL-X	R/W	40D0H	40D1H	40D2H	40D3H	40D4H	40D5H	40D6H	40D7H
28	Soft start percentage	BUF-X	R/W	40D8H	40D9H	40DAH	40DBH	40DCH	40DDH	40DEH	40DFH
29	Soft start time	BUT-X	R/W	40E0H	40E1H	40E2H	40E3H	40E4H	40E5H	40E6H	40E7H
30	Slope warming	SPR-X	R/W	40E8H	40E9H	40EAH	40EBH	40ECH	40EDH	40EEH	40EFH
31	Heating cycle	T	R/W	40F0H							
32	Enter the graduation number	SN	R/W	40F1H							
33	Temperature unit setting	UINT	R/W	40F2H							
34	Measurement decimal point Settings	DP	R/W	40F3H							
35	Display stable value	STDT	R/W	40F4H							
36	Turn off the heating deviation	PHOF	R/W	40F5H							

3.2.2 Simplified address for Route 6

Control loop number (channel number)									
Serial number	Parameter name	Parameter symbol	Attribute	CH1	CH2	CH3	CH4	CH5	CH6
1	Measured value	PV-X	R	4000H	4001H	4002H	4003H	4004H	4005H
2	Indicate the status. Note A	LED-X	R	4006H	4007H	4008H	4009H	400AH	400BH
3	Set value	SV-X	R/W	400CH	400DH	400EH	400FH	4010H	4011H
4	Lower limit of alarm 1	AL1-X	R/W	4012H	4013H	4014H	4015H	4016H	4017H
5	Alarm 1 upper limit	AH1-X	R/W	4018H	4019H	401AH	401BH	401CH	401DH
6	Lower limit of alarm 2	AL2-X	R/W	401EH	401FH	4020H	4021H	4022H	4023H
7	Alarm 2 upper limit	AH2-X	R/W	4024H	4025H	4026H	4027H	4028H	4029H
8	Proportional band	P-X	R/W	402AH	402BH	402CH	402DH	402EH	402FH
9	Integral time	I-X	R/W	4030H	4031H	4032H	4033H	4034H	4035H
10	Differential time	D-X	R/W	4036H	4037H	4038H	4039H	403AH	403BH
11	Sensor correction	PB-X	R/W	403CH	403DH	403EH	403FH	4040H	4041H
12	Alarm 1: Poor switching	FH1-X	R/W	4042H	4043H	4044H	4045H	4046H	4047H
13	Alarm 2: Poor switching	FH2-X	R/W	4048H	4049H	404AH	404BH	404CH	404DH
14	Alarm type	SA-X	R/W	404EH	404FH	4050H	4051H	4052H	4053H
15	The alarm is enabled for the first power-on	EA-X	R/W	4054H	4055H	4056H	4057H	4058H	4059H
16	Control output switch	SST-X	R/W	405AH	405BH	405CH	405DH	405EH	405FH
17	Self-tuning limit	ATU-X	R/W	4060H	4061H	4062H	4063H	4064H	4065H
18	Self-tuning	AT-X	R/W	4066H	4067H	4068H	4069H	406AH	406BH
19	Positional switching difference	HY-X	R/W	406CH	406DH	406EH	406FH	4070H	4071H
20	Integral suppression	AR-X	R/W	4072H	4073H	4074H	4075H	4076H	4077H

21	Upper limit output percentage	OPH-X	R/W	4078H	4079H	407AH	407BH	407CH	407DH
22	Lower limit output percentage	OPL-X	R/W	407EH	407FH	4080H	4081H	4082H	4083H
23	Measurement value filtering	FILT-X	R/W	4084H	4085H	4086H	4087H	4088H	4089H
24	Upper limit of the set value	SVH-X	R/W	408AH	408BH	408CH	408DH	408EH	408FH
25	Lower limit of the set value	SVL-X	R/W	4090H	4091H	4092H	4093H	4094H	4095H
26	Upper limit of the measured value	RH-X	R/W	4096H	4097H	4098H	4099H	409AH	409BH
27	Lower limit of measurement value	RL-X	R/W	409CH	409DH	409EH	409FH	40A0H	40A1H
28	Soft start percentage	BUF-X	R/W	40A2H	40A3H	40A4H	40A5H	40A6H	40A7H
29	Soft start time	BUT-X	R/W	40A8H	40A9H	40AAH	40ABH	40ACH	40ADH
30	Slope warming	SPR-X	R/W	40AEH	40AFH	40B0H	40B1H	40B2H	40B3H
31	Heating cycle	T	R/W	40B4H					
32	Enter the graduation number	SN	R/W	40B5H					
33	Temperature unit setting	UINT	R/W	40B6H					
34	Measurement decimal point Settings	DP	R/W	40B7H					
35	Display stable value	STDT	R/W	40B8H					
36	Turn off the heating deviation	PHOF	R/W	40B9H					

3.2.3 Simplified address for Route 4

Control loop number (channel number)							
Serial number	Parameter name	Parameter symbol	Attribute	CH1	CH2	CH3	CH4
1	Measured value	PV-X	R	4000H	4001H	4002H	4003H
2	Indicate the status. Note A	LED-X	R	4004H	4005H	4006H	4007H
3	Set value	SV-X	R/W	4008H	4009H	400AH	400BH
4	Lower limit of alarm 1	AL1-X	R/W	400CH	400DH	400EH	400FH
5	Alarm 1 upper limit	AH1-X	R/W	4010H	4011H	4012H	4013H
6	Lower limit of alarm 2	AL2-X	R/W	4014H	4015H	4016H	4017H
7	Alarm 2 upper limit	AH2-X	R/W	4018H	4019H	401AH	401BH
8	Proportional band	P-X	R/W	401CH	401DH	401EH	401FH
9	Integral time	I-X	R/W	4020H	4021H	4022H	4023H
10	Differential time	D-X	R/W	4024H	4025H	4026H	4027H
11	Sensor correction	PB-X	R/W	4028H	4029H	402AH	402BH
12	Alarm 1: Poor switching	FH1-X	R/W	402CH	402DH	402EH	402FH
13	Alarm 2: Poor switching	FH2-X	R/W	4030H	4031H	4032H	4033H
14	Alarm type	SA-X	R/W	4034H	4035H	4036H	4037H
15	The alarm is enabled for the first power-on	EA-X	R/W	4038H	4039H	403AH	403BH
16	Control output switch	SST-X	R/W	403CH	403DH	403EH	403FH
17	Self-tuning limit	ATU-X	R/W	4040H	4041H	4042H	4043H
18	Self-tuning	AT-X	R/W	4044H	4045H	4046H	4047H
19	Positional switching difference	HY-X	R/W	4048H	4049H	404AH	404BH
20	Integral suppression	AR-X	R/W	404CH	404DH	404EH	404FH
21	Upper limit output percentage	OPH-X	R/W	4050H	4051H	4052H	4053H
22	Lower limit output percentage	OPL-X	R/W	4054H	4055H	4056H	4057H
23	Measurement value filtering	FILT-X	R/W	4058H	4059H	405AH	405BH
24	Upper limit of the set value	SVH-X	R/W	405CH	405DH	405EH	405FH
25	Lower limit of the set value	SVL-X	R/W	4060H	4061H	4062H	4063H
26	Upper limit of the measured value	RH-X	R/W	4064H	4065H	4066H	4067H
27	Lower limit of measurement value	RL-X	R/W	4068H	4069H	406AH	406BH
28	Soft start percentage	BUF-X	R/W	406CH	406DH	406EH	406FH
29	Soft start time	BUT-X	R/W	4070H	4071H	4072H	4073H
30	Slope warming	SPR-X	R/W	4074H	4075H	4076H	4077H
31	Heating cycle	T	R/W	4078H			
32	Enter the graduation number	SN	R/W	4079H			
33	Temperature unit setting	UINT	R/W	407AH			
34	Measurement decimal point Settings	DP	R/W	407BH			
35	Display stable value	STDT	R/W	407CH			
36	Turn off the heating deviation	PHOF	R/W	407DH			

3.2.4 Simplified address for the second route：

Serial number	Parameter name	Parameter symbol	Attribute	CH1	CH2
1	Measured value	PV-X	R	4000H	4001H
2	Indicate the status. Note A	LED-X	R	4002H	4003H
3	Set value	SV-X	R/W	4004H	4005H
4	Lower limit of alarm 1	AL1-X	R/W	4006H	4007H
5	Alarm 1 upper limit	AH1-X	R/W	4008H	4009H
6	Lower limit of alarm 2	AL2-X	R/W	400AH	400BH
7	Alarm 2 upper limit	AH2-X	R/W	400CH	400DH
8	Proportional band	P-X	R/W	400EH	400FH
9	Integral time	I-X	R/W	4010H	4011H
10	Differential time	D-X	R/W	4012H	4013H
11	Sensor correction	PB-X	R/W	4014H	4015H
12	Alarm 1: Poor switching	FH1-X	R/W	4016H	4017H
13	Alarm 2: Poor switching	FH2-X	R/W	4018H	4019H
14	Alarm type	SA-X	R/W	401AH	401BH
15	The alarm is enabled for the first power-on	EA-X	R/W	401CH	401DH
16	Control output switch	SST-X	R/W	401EH	401FH
17	Self-tuning limit	ATU-X	R/W	4020H	4021H
18	Self-tuning	AT-X	R/W	4022H	4023H
19	Positional switching difference	HY-X	R/W	4024H	4025H
20	Integral suppression	AR-X	R/W	4026H	4027H
21	Upper limit output percentage	OPH-X	R/W	4028H	4029H
22	Lower limit output percentage	OPL-X	R/W	402AH	402BH
23	Measurement value filtering	FILT-X	R/W	402CH	402DH
24	Upper limit of the set value	SVH-X	R/W	402EH	402FH
25	Lower limit of the set value	SVL-X	R/W	4030H	4031H

26	Upper limit of the measured value	RH-X	R/W	4032H	4033H
27	Lower limit of measurement value	RL-X	R/W	4034H	4035H
28	Soft start percentage	BUF-X	R/W	4036H	4037H
29	Soft start time	BUT-X	R/W	4038H	4039H
30	Slope warming	SPR-X	R/W	403AH	403BH
31	Heating cycle	T	R/W	403CH	
32	Enter the graduation number	SN	R/W	403DH	
33	Temperature unit setting	UINT	R/W	403EH	
34	Measurement decimal point Settings	DP	R/W	403FH	
35	Display stable value	STDT	R/W	4040H	
36	Turn off the heating deviation	PHOF	R/W	4041H	

Note: 1) All data types in the above table are: signed int - signed integer, represented by binary complement;

2) The X in the parameter symbol represents channels 1 to 8, indicating corresponding temperature control parameters for channels 1 to 8. For example, PV-5 represents the temperature measurement value of the fifth channel, and D-7 represents the differential time of the seventh channel.

Note A: The working status of each channel: LED-1 indicates the status of the first channel, and LED-8 indicates the status of the eighth channel. It is divided into high and low bytes. The high byte indicates the heating percentage, and the low byte indicates the heating alarm status, etc

High byte: 0-100 indicates the current heating percentage

Low byte: From high to low bits, 7 is in place to 0, and bit7 - bit0 is 1 valid or output

Bit0 heating status, OUT is 0, no heating is 1, heating. Bit1/bit2 alarm AL1 alarm AL2 status 0 No alarm 1 Alarm Bit3 heating switch SST is 0, off is 1, on is open.

The Bit4 self-tuning AT status is set to 1 during tuning. The unit of Bit5 temperature is 0 degrees Celsius, which is 1 degree Fahrenheit. Bit6 displays a decimal point of 1 with one decimal point.

3.3. Description of each parameter

Serial number	Parameter name	Parameter symbol	Measurement range	Unit	Explanation	initial value
1	Measured value	PV-X	SVL～SVH	℃	This circuit actually measures the temperature. -16666 indicates a lower overflow, 18888 indicates an upper overflow, and 15555 indicates an input error.	——
2	Set value	SV-X	SVL～SVH	℃	Set the target value of the controller for this loop.	100
3	Control output indication (OUT on the controller）	OUT-X	0 or 1	—	0: The controller has no control output for this circuit and the indicator does not light up. 1:The controller has a control output for this circuit and the indicator light is on	——
4	Alarm 1 indication (ALM on the controller）	ALM1-X	0 or 1	—	0: The controller has no alarm output for this circuit and the indicator does not light up. 1:The controller has an alarm output for this circuit and the indicator light is on	——
5	Control output switch	SST-X	0 or 1	—	0: The controller turns off the output of this loop control. 1: The controller turns on the output of this circuit control.	1
6	Proportional band	P-X	0～9999	℃	Proportional effect regulation: The larger the P, the smaller the proportional effect, and the lower the system gain. 0: Switch to on-off control mode. At this point, the integral time I becomes 0.1 times the upper limit of the insensitive region, and the differential time D becomes 0.1 times the lower limit of the insensitive region.	30
7	Integral time	I-X	0～9999	S	The integral action time constant: The larger I, the weaker the integral action. It is mainly used to eliminate static aberration. 0: Switch to PD control mode. At this point, the integral suppression Ar is RESET, and Ar is set to zero, with the unit being ℃, to eliminate static error. When the proportional band P=0, see the explanation of the proportional band P.	240
8	Differential time	D-X	0～9999	S	Differential action time constant: The larger the D, the stronger the differential action, mainly used to suppress overshoot of the measured value. When the proportional band P=0, see the explanation of the proportional band P.	60
9	Control cycle	T-X	1～100	S	Thyristor or solid-state relay output: 2 to 3 seconds; Relay output: 20 to 30 seconds.	3
10	Integral suppression	AR-X	0～100	%	Integral suppression ratio: The larger the Ar, the greater the possible overshoot; if the Ar is too small, static tolerance may occur. When the integration time I=0, see the description of the integration time I.	100
11	Self-tuning limit	ATU-X	0～100	%	To overcome the overshoot phenomenon during self-tuning, the self-tuning control point can be lowered to SV×ATU.	100
12	Self-tuning	AT-X	0 or 1	—	1: Start self-tuning. After self-tuning is completed, return to 0. If self-tuning is not completed within 4 hours, it is considered a failure and the original P, I, and D values are still used for control.	0
13	Alarm type	SA-X	00～66	—	The units digit of XX represents the selection of alarm type 1, and the tens digit represents the selection of alarm type 2: X= 0: No alarm; 1: Upper limit deviation value alarm; 2: Lower limit deviation value alarm; 3: Alarm when the upper and lower limit deviation values are exceeded; 4: Alarm within the upper and lower limit deviation values; 5: Upper limit absolute value alarm; 6: Lower limit absolute value alarm.	01
14	Lower limit of alarm 1	AL1-X	-500～4000	℃	For details, please refer to the "Hardware Section" 4.5 Alarm Output Description.	50
15	Alarm 1 upper limit	AH1-X	-500～4000	℃	For details, please refer to the "Hardware Section" 4.5 Alarm Output Description.	50
16	Alarm 1: Poor switching	FH1-X	-500～4000	℃	The switching difference is 0.1 times that of FH1.	4
17	Alarm 2 indication (The controller has no output.）	ALM2-X	0 或 1	—	There is no indication or output on the controller, so a human-machine interface and PLC need to be borrowed 0: There is no alarm phenomenon in this circuit. There is an alarm phenomenon in this circuit.	——
18	Lower limit of alarm 2	AL2-X	-500～4000	℃	For details, please refer to the "Hardware Section" 4.5 Alarm Output Description. (The output needs to borrow the PLC port.	50
19	Alarm 2 upper limit	AH2-X	-500～4000	℃	For details, please refer to the "Hardware Section" 4.5 Alarm Output Description. (The output needs to borrow the PLC port.	50
20	Alarm 2: Poor switching	FH2-X	-500～4000	℃	The switching difference is 0.1 times that of FH1.	4
21	Positive and negative action control And enable the alarm for the first power-on	EA-X	000～111	—	The hundreds digit of XXX is selected for both forward and reverse action control: X=0: Reaction control (heating type); Positive action control (cooling type). The tens digit of XXX represents the first alarm enable selection of alarm 2, and the units digit of XXX represents the first alarm enable selection of alarm 1: X=0: After power-on, if the alarm conditions are met, no alarm will be triggered; thereafter, if the alarm conditions are met, an alarm will be triggered. All conditions that meet the alarm requirements will trigger an alarm.	011
22	Decimal point	DP-X	0～1	—	0: The resolution of the measured value PV is 1℃. 1：The resolution of the measured value PV is 0.1℃	0
23	Sensor correction	PB-X	-500～4000	℃	It is used to correct the measurement errors caused by sensors and thermocouple compensating wires.	0.0
24	Display suppression	DT-X	0～250	℃	It is used to suppress the change sensitivity of the display value, with a suppression range of 0.1 times the display suppression dt.	15
25	Measurement value filtering	FILT-X	0～250	—	The smaller this value is, the faster the response speed of the measurement value will be, but there may be fluctuations. The larger this value is, the slower the response speed of the measured value will be, and the more stable the display will be.	125
26	℃/℉ Switch	CTR-X	0 或 1	—	0：℃；1：℉。	0
27	Graduation number	SN-X	0～18	—	For details, please refer to the next page 3.4. List of Common Input Types and Measurement Ranges.	3
28	Upper limit of the measured value	SVH-X	-500～4000	℃	The highest measured value is the SVH value.	300
29	Lower limit of measurement value	SVL-X	-500～4000	℃	The lowest measured value is the SVL value. When the ambient temperature is too low, the value of this parameter should be reduced.	0
30	Upper limit of heating output	OPH-X	30～100%		Generally, when heating at 4- 20mA, set and adjust the maximum heating percentage. For example, if set to 50, then the maximum heating percentage of 50 means the maximum output is 12mA.	100
31	Lower limit of heating output	OPL-X	0～30%		Generally, when heating from 4 to 20mA, set and adjust the minimum heating percentage. For example, if set to 5, the minimum heating will be 5%, that is, the minimum output will be 4.8mA.	0
32	Soft start percentage	BUF-X	0--30%		After power-on, heat the BUF percentage for the BUT time and then enter the normal control temperature.	20
33	Soft start time	BUT-X	0---9999	S	There is no soft start function when BUT=0.	0
34	Slope warming	SPR-X	0---9999	Degree/minute	=0 no-slope heating, heating at full power, how many degrees change per minute. This parameter is temporarily invalid!	0