AN708 Series Intelligent Temperature Controller/ Adjustor User's Manual

Features:

⊙ TC / RTD / Analog signal universal input,

⊙ With display, alarm and adjusting function

⊙ Four optional control modes: ON-OFF control , PID heating , PID cooling , PID heating and cooling.

⊙ Advanced Fuzzy algorithm & Two Degrees of Freedom PID Arithmetic.

⊙ Optional control output, modularization design.

⊙ Good anti-interference

⊙ Power supply 100-240V AC/DC

⊙ Applied to system temperature control application.

For your safe, please read the below content carefully before you use the temperature controller!

■ Safty Caution

| |
|---|
| ※ Please read the manual carefully before you use the temperature controller. |
| ※ Please comply with the below important points. ⚠ Warning   An accident may happen if the operation does not comply with the instruction. ⚠ Notice   An operation that does not comply with the instruction may lead to product damage. |
| ※ The instruction of the symbol in the manual is as below. ⚠ An accident danger may happen in a special condition. |

⚠ Warning

1. A safty protection equipment must be installed or please contact with us for the relative information if the product is used under the circumstance such as nuclear control, medical treatment equipment, automobile, train, airplane, aviation and equipment etc. Otherwise, it may cause serious loss, fire or person injury.
2. A panel must be installed, otherwise it may cause creepage (leakage).
3. Do not touch wire connectors when the power is on, otherwise you may get an electric shock.
4. Do not dismantle or modify the product. If you have to do so, please contact with us first. Otherwise it may cause electric shock and fire.
5. Please check the connection number while you connect the power supply wire or input signal, otherwise it may cause fire.

⚠ Caution

1. This product cannot be used outdoors. Otherwise the working life of the product will become shorter, or an electric shock accident may happen.
2. When you connect wire to the power input connectors or signal input connectors, the moment of the No.20 AWG (0.50 mm2) screw tweaked to the connector is 0.74n.m - 0.9n.m. Otherwise the connectors may be damaged or get fire.
3. Please comply with the rated specification. Otherwise it may cause electric shock or fire, and damage the product.
4. Do not use water or oil base cleaner to clean the product. Otherwise it may cause electric shock or fire and damage the product.
5. This product should be avoid working under the circumstance that is flammable, explosive, moist, under sunshine, heat radiation and vibration. Otherwise it may cause explosion.
6. In this unit it must not have dust or deposit, otherwise it may cause fire or mechanical malfunction.
7. Do not use gasoline, chemical solvent to clean the cover of the product because such solvent can damage it. Please use some soft cloth with water or alcohol to clean the plastic cover.

1. Code Illustration

AN708 - ☐ - ☐ ☐ ☐ —— Input and communication: 0: 1 loop input without communication
8: 1 loop input with RS485 communication(please indicate when order)

Alarm: 3: Two alarm outputs   2: One alarm output   1: No alarm output
(One more alarm will be added when not using heating or cooling control)

Output function: R:Relay output C:4～20mA current output Q:SSR output

Dimension(mm)：4:48W×48H 6:48W×96H 7:72W×72H 8:96W×48H 9:96W×96H
16:80W×160H 80:160W×80H

AN708 Series intelligent temperature controller/adjustor

2. Model Illustration

Model		OUT 1(Note 1)	OUT 2(Note 2)	Alarm No.(Note 3)	Communication
Size 48*48	AN708-4-R20	Relay output	Relay output	1	No
	AN708-4-C20	4-20mA current output	Relay output	1	No
	AN708-4-Q20	SSR output	Relay output	1	No
	AN708-4-R18(to be ordered)	Relay output	Relay output	No	RS485
	AN708-4-C18(to be ordered)	4-20mA current output	Relay output	No	RS485
	AN708-4-Q18(to be ordered)	SSR output	Relay output	No	RS485
Other size	AN708-☐-R30	Relay output	Relay output	2	No
	AN708-☐-C30	4-20mA current output	Relay output	2	No
	AN708-☐-Q30	SSR output	Relay output	2	No
	AN708-☐-R38	Relay output	Relay output	2	RS485
	AN708-☐-C38	4-20mA current output	Relay output	2	RS485
	AN708-☐-Q38	SSR output	Relay output	2	RS485

Note 1：OUT 1: 4-20mA current output, load resistance 600Ω max. Can be set as main control output or as analog output through the software；
Relay output load capacity: 3A/250Vac；
SSR output load capacity: 30mA/24Vdc;

Note 2：OUT 2: Work as OUT2 only when the control mode is heating-cooling control(OT=3);
under other control mode, it works as Alarm3(size 48*48 without communication,
it works as Alarm2; size 48*48 with communication, it works as Alarm1);
relay output load capacity: 1A/250Vac;

Note 3：Alarm: Relay output load capacity: 1A/250Vac；

3. Main Technical Parameters

3. 1 Whole controller parameters

Power supply	100-240VAC
Total current	＜30mA（220VAC）
Ambient temperature	0-50℃
Ambient humidity	45-85%RH
Measurement accuracy	0.3%FS±3digits 25℃
Control mode	ON/OFF control，PID heating control，PID cooling control，PID heating & cooling control
Communication function	RS485 communication interface, MODBUS RTU protocol
Panel protection level	IP65
Temperature excursion	≤0.01%FS/℃
Dielectric strength	Between the connectors of power supply to relay output, power supply to signal input, relay output to signal input ≥2000VDC; Between the low voltage signal isolated with each other ≥ 600VDC.

3.2. Input signal table

No.	Symbol	Input signal	Measuring range	Resolution	Input impedance
0	ʁ	K type thermocouple	−50～1300℃	1℃	＞100KΩ
1	⅃	J type thermocouple	−50～1200℃	1℃	＞100KΩ
2	E	E type thermocouple	−50～1000℃	1℃	＞100KΩ
3	ʇ	T type thermocouple	−50～400℃	1℃	＞100KΩ
4	ƅ	B type thermocouple	600～1800℃	1℃	＞100KΩ
5	ſ	R type thermocouple	−10～1700℃	1℃	＞100KΩ
6	5	S type thermocouple	−10～1600	1℃	＞100KΩ
7	n	N type thermocouple	−50～1200℃	1℃	＞100KΩ
8	000	Reserved			
9	Pt	PT100	−199.9～850.0℃	0.1℃	（0.2mA）
10	JPt	JPT100	−199.9～500.0℃	0.1℃	（0.2mA）
11	Cu50	CU50	−50.0～150.0℃	0.1℃	（0.2mA）
12	Cu00	CU100	−50.0～150.0℃	0.1℃	（0.2mA）
13	oʋ	Linear voltage	0～50mV	0.01%FS	＞100KΩ
14	oA	Linear current	4～20mA	0.01%FS	＜110Ω
15	ʋ	Linear voltage	0～10V	0.01%FS	＞100KΩ
16	rt	Linear resistance	0～400Ω	0.01%FS	＞100KΩ

4. Panel Indication

OUT1 Indication Lamp
OUT2 Indication Lamp
AL1 Indication Lamp
AL2 Indication Lamp
AL3 Indication Lamp
AT:Auto-tuning Indication Lamp

OUT1 ○
OUT2 ○
AL1 ○
AL2 ○
AL3 ○
AT ○

SET function key
Shift function key
Increase Key
Decrease key

PV Value

SV set value   PV measuring display window
                SV SET value display window
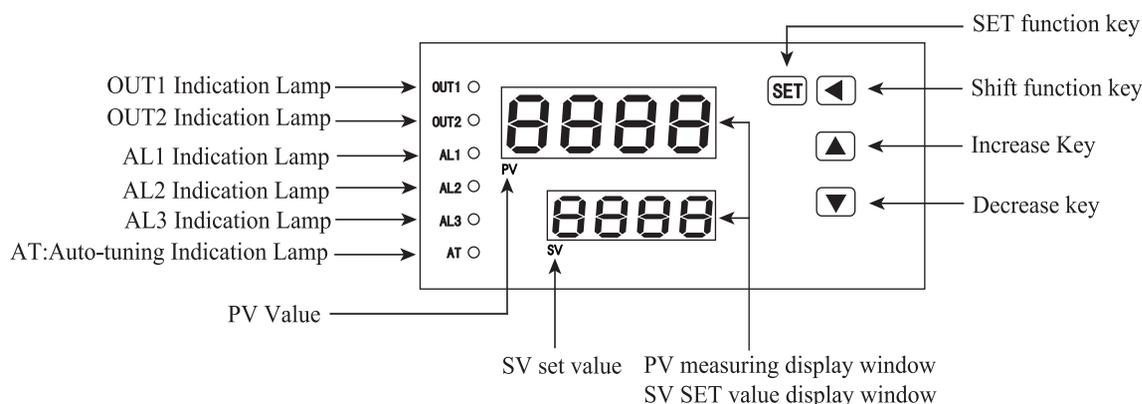
5.Panel Key Operation

（1）SET key：In normal display status, press SET key to show setting menu, press SET key for a few seconds to show advanced setting menu.

（2）◄ key：press ◄ key to make the parameters to flicker，the parameters can be changed.

（3）▲,▼ key：to change parameters in setting status.

（4）In advanced setting menu, press SET key for a few seconds to quit the menu and back to normal display status.

（5）In normal display status, press ◄ key for 3 second to start Auto-tuning function，at this moment AT indicating lamp turns on.

6. Operation Sequence

Power on & Reset

Press SET key for a few seconds

```
┌─────────┐
│   30    │
│  300    │  Measuring status
└─────────┘
```

| SET

```
┌─────────────┐
│Setting menu │  ──Press SET──→  Output function setting menu  ──Press SET key for a few seconds──→  Input function setting menu  ──Press SET key for a few seconds──→  Communication setting menu
└─────────────┘  for a few second
```

Setting menu column:

```
┌─────────┐
│  RL1    │
│  200    │  Alarm 1
└─────────┘
   │ SET
┌─────────┐
│  RL2    │
│  600    │  Alarm 2
└─────────┘
   │ SET
┌─────────┐
│  RL3    │
│ 1000    │  Alarm 3
└─────────┘
   │ SET
┌─────────┐
│  PS     │
│   0     │  PV bias value
└─────────┘
   │ SET
┌─────────┐
│  A-n    │
│   0     │  Manual / auto shift menu
└─────────┘
   │ SET
┌─────────┐
│  LCP    │
│   0     │  Password lock
└─────────┘
SET
```

Output function setting menu column:

```
┌─────────┐
│  ot     │
│   1     │  Control mode
└─────────┘
   │ SET
┌─────────┐
│  P      │
│  10     │  Proportional coefficient
└─────────┘
   │ SET
┌─────────┐
│  1      │
│  240    │  Integral time
└─────────┘
   │ SET
┌─────────┐
│  d      │
│  60     │  Derivative time
└─────────┘
   │ SET
┌─────────┐
│  HY     │
│   2     │  On/Off control hysteresis (effective when OT=0)
└─────────┘
   │ SET
┌─────────┐
│  Ct     │
│  20     │  OUT1 control cycle
└─────────┘
   │ SET
┌─────────┐
│  C-P    │
│  100    │  Cooling prportional coefficient (effective when OT=3)
└─────────┘
   │ SET
┌─────────┐
│  C-Ct   │
│  20     │  OUT2 control cycle (effective when OT=3)
└─────────┘
   │ SET
┌─────────┐
│  db     │
│   5     │  Heating cooling control dead area (effective when OT=3)
└─────────┘
SET
```

Alarm/output column:

```
┌─────────┐
│  HY1    │
│   1     │  Alarm 1 hysteresis
└─────────┘
   │ SET
┌─────────┐
│  Ad1    │
│   0     │  Alarm 1 mode
└─────────┘
   │ SET
┌─────────┐
│  HY2    │
│   1     │  Alarm 2 hysteresis
└─────────┘
   │ SET
┌─────────┐
│  Ad2    │
│   1     │  Alarm 2 mode
└─────────┘
   │ SET
┌─────────┐
│  HY3    │
│   1     │  Alarm 3 hysteresis
└─────────┘
   │ SET
┌─────────┐
│  Ad3    │
│   0     │  Alarm 3 mode
└─────────┘
   │ SET
┌─────────┐
│  oLL    │
│   0     │  Lower limit of control output
└─────────┘
   │ SET
┌─────────┐
│  oLH    │
│  100    │  Upper limit of control output
└─────────┘
SET
```

Input function setting menu column:

```
┌─────────┐
│  1nP    │
│   t     │  Input signal mode
└─────────┘
   │ SET
┌─────────┐
│  FL     │
│   0     │  Lower limit of input signal
└─────────┘
   │ SET
┌─────────┐
│  FH     │
│ 1300    │  Upper limit of input signal
└─────────┘
   │ SET
┌─────────┐
│  dP     │
│   0     │  Decimal point (Not effective for TC / RTD input)
└─────────┘
   │ SET
┌─────────┐
│  Ft     │
│   4     │  Fliter constant
└─────────┘
   │ SET
┌─────────┐
│  C-F    │
│   0     │  Temperature unit switch
└─────────┘
   │ SET
┌─────────┐
│  brL    │
│   0     │  Lower limit of transmit current output
└─────────┘
   │ SET
┌─────────┐
│  brH    │
│ 1300    │  Upper limit of transmit current output
└─────────┘
SET
```

Communication setting menu column:

```
┌─────────┐
│  bAd    │
│  9.6t   │  Baud rate
└─────────┘
   │ SET
┌─────────┐
│  Add    │
│   1     │  Meter communication address
└─────────┘
SET
```

7. Menu

Parameter name	Indication	Setting range	Ex-factory setting
Setting menu			
RL1	Alarm 1 setting value	FL～FH	200
RL2	Alarm 2 setting value	FL～FH	600
RL3	Alarm 3 setting value	FL～FH	1000
PS	Measured value amendment	-100～100	0
A_n	Manual / auto setting: 0: Manual；1: half-auto（Start Auto-tuning manually）2: auto（Start Auto-tuning automatically after power on）	0～2	1
LCP	If the units digit (4th digit from left to right) is 1，SV is prohibited to changed；if the tens digit (3rd digit) is 1，menu parameters are prohibited to changed.	0～9999	0
Output function setting menu			
Ot	Control mode. 0: ON/OFF control；1: Heating control；2: Cooling control；3: Heating & cooling control	0～3	1
P	Proportional coefficient	0～9999	10
1	Integral time	0～3600	240
d	Derivative time	0～3600	60
HY	ON/OFF control hysteresis	0～1000	2
Ct	OUT1 control cycle. Current output set as 0 . SSR output set as 1 . Relay output set as 4-20	0～250	20
C_P	Cooling proportional coefficient	1～200	100
C_Ct	OUT2 control cycle	1～250	20
db	Dead area for heating & cooling control	-100～100	5
HY1	Alarm hysteresis 1	0～1000	1
Ad1	Alarm mode 1	0～3	0
HY2	Alarm hysteresis 2	0～1000	1
Ad2	Alarm mode 2	0～3	1
HY3	Alarm hysteresis 3	0～1000	1
Ad3	Alarm mode 3	0～3	0
oLL	Lower limit of control output	0～99	0
oLH	Upper limit of control output	1～100	100

Input function setting menu			
InP	Input signal type	Please refer to input signal table	K
FL	Lower display limit of input signal	Please refer to input signal table	-50
FH	Upper display limit of input signal	Please refer to input signal table	1300
dP	Decimal point setting. Only effective for analog signal input	0~3	0
Ft	Filter constant	1~250	60
C-F	0: unit of celsius 1：unit of fahrenheit	0/1	0
brL	Display for 4mA transmit current output	FL~FH	0
brH	Display for 20mA transmit current output	FL~FH	1300
Communication setting menu			
bAd	Baud rate	4.8K, 9.6K	9.6K
Add	Meter communication address	0~250	1

Alarm function table

Alarm code	Alarm mode	Alarm output (AL1, AL2 is independent with each other）	Formula
0	High limit absolute value alarm	AL Temperature rises	Alarm:PV>AL Cancel:PV≤AL-HY
1	Low limit absolute value alarm	Temperature drops down AL	Alarm:PV<AL Cancel:PV≥AL-HY
2	High limit deviation value alarm	SV SV+AL Temperature rises	Alarm:PV>AL +SV Cancel:PV≤SV+AL-HY
3	Low limit deviation value alarm	Temperature drops down SV-AL SV	Alarm:PV<SV-AL Cancel:PV≥SV-AL+HY

8. Apperance & Mounting Dimension

Panel size   Side face size   Mounting size
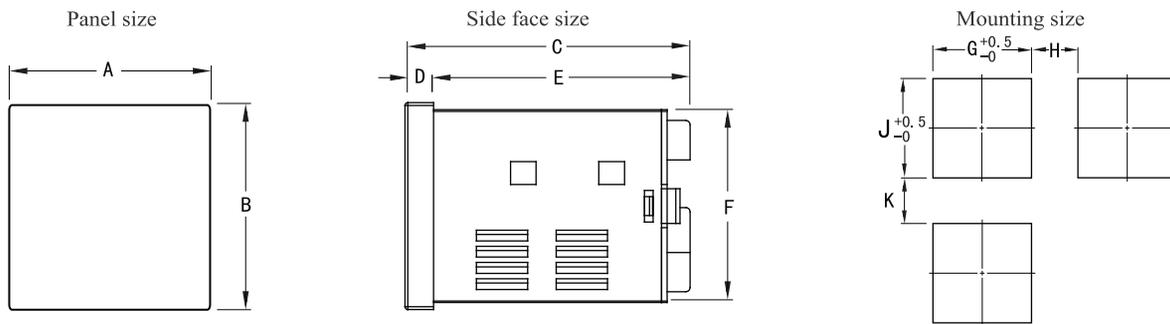
Code	A	B	C	D	E	F	G	H(Minimun)	J	K(Minimun)
4:(48*48)	48	48	101	10	91	45	45.5	25	45.5	25
6:(96*48)	48	96	100	6	94	91	45.5	25	91.5	25
7:(72*72)	72	72	100	10	90	67.5	68	25	68	25
8:(48*96)	96	48	100	6	94	45	91.5	25	45.5	25
9:(96*96)	96	96	101	10	91	90.5	91	25	91	25
80:(80*160)	160	80	102	10	92	76	154	30	76.5	30
16:(160*80)	80	160	102	10	92	153.5	76.5	30	154	30
Note	unit: (mm) tolerance+0.5%									

9. Connection Drawing

Model: AN708-4
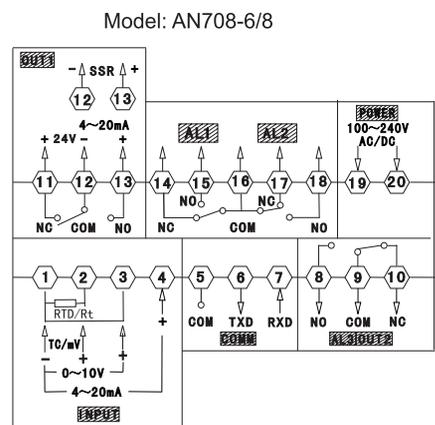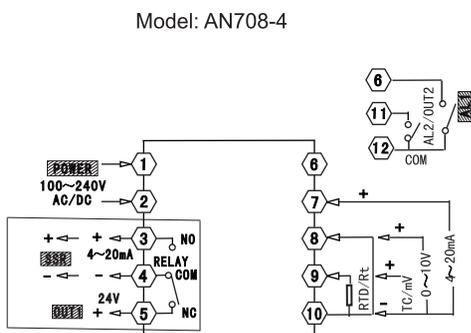
Model: AN708-6/8

Model: AN708-7 Model: AN708-9 AN708-16/80
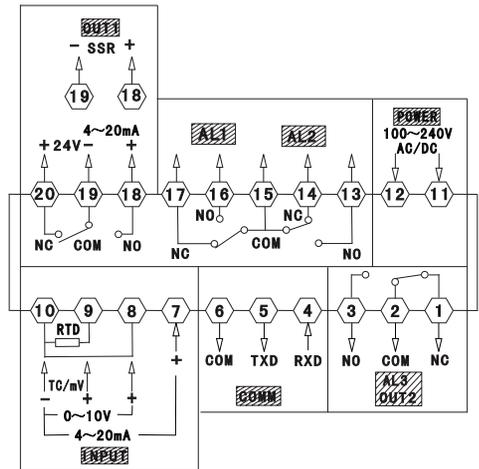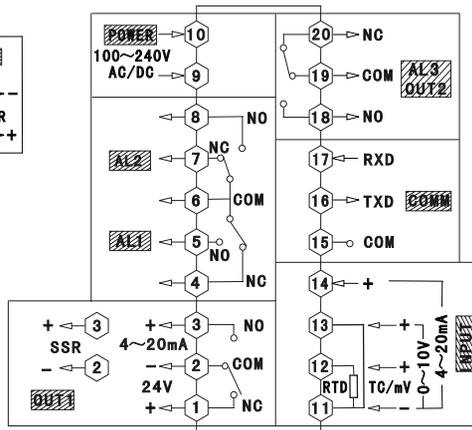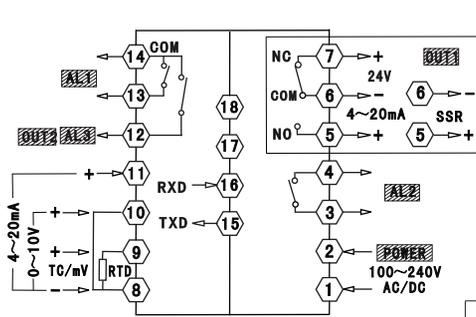
10. Simple Problem Shooting

Dispaly Message	Reasons & Solving Methods
Display HHHH	Input disconnect or over upper limit. Please check input signal, FH value and ambient working temperature.
Display LLLL	Input disconnect or under lower limit. Please check input signal, FL value and ambient working temperature.

11.Communication

AN708 series adjustor follow Modbus RTU communication protocol, and it can run RS485 half-duplex communication.Read function code is 0x03, write function code is 0x10, 16-bit CRC checking is applied. The meter can not return error message.

Data frame format

Start bit	Data bit	Stop bit	Check bit
1	8	2	None

11.1. Read Multiple Registers

For example: The host computer read the float number AL1 (The value of Alarm 1 is 15.4).The address code of AL1 is 0x0002 , for AL1 is float number (4bits), it will occupy 2 data register. Reference IEEE-754 standard the hexadecimal 16 result of the decimal float number is 0x41766666.

Request from the master unit (Read Multiple Registers)							
1	2	3	4	5	6	7	8
Meter address	Function code	High bit of start address	Low bit of start address	High bit of data length	Low bit of data length	Low bit of CRC code	High bit of CRC code
0x01	0x03	0x00	0x02	0x00	0x04	0xE5	0XC9

.

Correct answer from slave unit(Read Multiple Registers)								
1	2	3	4	5	6	7	8	9
Meter address	Function code	Data byte length	Data 1 high byte	Data 1 low bit	Data 2 high bit	Data 2 low bit	Low bit of CRC code	High bit of CRC code
0x01	0x03	0x04	0x41	0x76	0x66	0x66	0xE2	0xF4

11.2. Write Multiple Registers

For example: The host computer write the float number SV（setting value 600），

The address code for SV is 0x0000, for SV is float number (4bits), it will occupy 2 data register. Referring to IEEE-754 standard the hexadecimal 16 result of the decimal float number is 0x44160000.

Request from the master unit （Write Multiple Registers)												
1	2	3	4	5	6	7	8	9	10	11	12	13
Unit address	Function Code	High bit of start address	Low bit of start address	High bit of data length	Low bit of data length	Data Length	High bit of data 1	Low bit of data 1	High bit of data 2	Low bit of data 2	Low bit of CRC	High bit of CRC
0x01	0x10	0x00	0x00	0x00	0x02	0x04	0x44	0x16	0x00	0x00	0xFD	0xFC

Correct answer from slave unit (Write Multiple Registers)							
1	2	3	4	5	6	7	8
Meter address	Function Code	Start address of high 8 bit	Start address of low 8 bit	Data length high bit	Data length low bit	Low bit of CRC	High bit of CRC
0x01	0x10	0x00	0x00	0x00	0x02	0x41	0xC8

AN708 Series table reference address

Code	Reference address	Number of Variable	Data Length	Read & Write allow	Remark
0	0x0000	Setting Value SV	2	R/W	
1	0x0002	Alarm value AL1	2	R/W	
2	0x0004	Alarm value AL2	2	R/W	
3	0x0006	Alarm value AL3	2	R/W	
4	0x0008	Correct value PS	2	R/W	
5	0x000A	Proportion rate P	2	R/W	
6	0x000C	Integral time I	2	R/W	
7	0x000E	Differentia lD	2	R/W	
8	0x0010	ON/OFF Control Hysteresis HY	2	R/W	
9	0x0012	Heating & cooling dead district DB	2	R/W	
10	0x0014	Alarm 1 Hysteresis HY1	2	R/W	
11	0x0016	Alarm 2 Hysteresis HY2	2	R/W	
12	0x0018	Alarm 2 Hysteresis HY3	2	R/W	
13	0x001A	Control output Lo OLL	2	R/W	
14	0x001C	Control output Hi OLH	2	R/W	
15	0x001E	Display Low limit FL	2	R/W	
16	0x0020	Display High limit FH	2	R/W	
17	0x0022	Low limit value of analog	2	R/W	
18	0x0024	High limit value of analog	2	R/W	
19	0x0026	Measuring value	2	R	

Code	Reference address	Number of Variable	Data Length	Read & Write allow	Remark
20	0x0028	Manualswitch MAN	1	R	
21	0x002A	Lock LCK	1	R	
22	0x002C	Control output OT	1	R/W	
23	0x002E	Heating control Turn CT	1	R/W	
24	0x0030	Cooling proportion C_P	1	R/W	
25	0x0032	Cooling control Turn C_CT	1	R/W	
26	0x0034	Alarm 1 mode AD1	1	R/W	Note1
27	0x0036	Alarm 2 mode AD2	1	R/W	Note1
28	0x0038	Alarm 2 mode AD2	1	R/W	Note1
29	0x003A	Input signal select INP	1	R/W	Note2
30	0x003C	Decimal DP	1	R	
31	0x003E	Filter FT	1	R	
32	0x0040	Baud rate BAD	1	R	Note3
33	0x0042	Address ADD	1	R	

R：Read only；   R/W：Read/Write
For Parameter Setting Range , please refer to user's manual

Note 1：Please refer to alarm parameter form
Note 2：Please refer to input Parameter form
Note 3：Please refer to below table

Baud rate BAD	4.8K	9.6K
Data value	0	1

16 digit CRC verify program

```
unsigned int Get_CRC(uchar *pBuf, uchar num)
{
    unsigned i,j;
    unsigned int wCrc = 0xFFFF;
    for(i=0; i<num; i++)
    {
        wCrc ^= (unsigned int)(pBuf[i]);
        for(j=0; j<8; j++)
        {
            if(wCrc & 1){wCrc >>= 1; wCrc ^= 0xA001; }
            else
                wCrc >>= 1;
        }
    }
    return wCrc;
}
```