Digital PID Temperature Controller
User manual

MTD-02-E2

- ● Relay +SSR Drive output field selectable
- ● 3%F.S measuring accuracy
- ● Maximum 2 alarms
- ● C or F display field selectable
- ● Various size available
- ● Universal input
- ● Bar graphic display
- ● Program run/stop function
- ● Parameter reset function
- ● Loop break alarm

MTD Series Temperature Controller
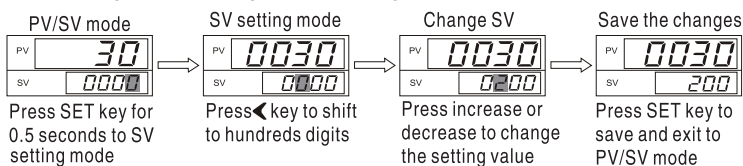## Instruction Manual

MTD-02-E2

Thank you for choosing our products, Please read this manual carefully and keep it in a safe place for further reference

General Information

- MTD has 4 digits dual LED display, 0.3% measuring accuracy with bar graphic display, 0.1 resolution for TC and RTD sensors
- Please make sure the power supply and the outputs both correctly configured before using, always refer to connection stickers on the side of the controller
- This controller supports various TC and RTD, analog signals, you can switch between TC and RTD via key pad. analog signals needs to be pre-determined before order. Please check "6.3" parameter INP1 for more information
- OUT was configured as reverse action(heating) as factory default, user can change it to direct(cooling) action, refer to "6.3" parameter Oud for more information
- This controller is a PID controller with auto-tuning function
- ON/OFF control, change P=0 to active ON/OFF control mode, the hysteresis for the ON/OFF controller is HYS.For heating,OUT off when PV>SV, OUT on when PV<SV-HYS, For cooling, OUT on when PV>SV+HYS, OUT off when PV<SV "Refer to 6.1 for details"
- Time proportional control, when I=0, d=0 P≠0, control mode change to time proportional control, rest windup is rSt, control cycle time is Cyt, output gets smaller when rSt gets smaller at heating mode, outputs increase when rSt decrease at cooling mode
- Please always perform auto-tuning to have a better control result at PID mode, refer to "7 auto-tuning"
- Output selectable between Relay, SSR Drive, standard SSR trigger, random SSR trigger, phase angled trigger, refer to "6.3" parameter OUT for more details
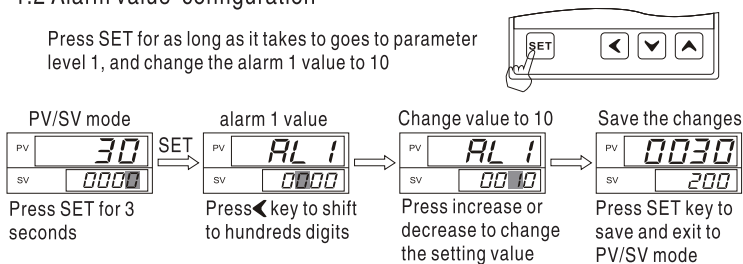
1. Quick Start Guide

1.1 Setting Value Configuration(change SV from 0 to 200)

PV/SV mode	SV setting mode	Change SV	Save the changes
PV **30** SV **0000**	PV **0030** SV **0000**	PV **0030** SV **0200**	PV **0030** SV **200**
Press SET key for 0.5 seconds to SV setting mode	Press ◄ key to shift to hundreds digits	Press increase or decrease to change the setting value	Press SET key to save and exit to PV/SV mode

Press increase or decrease once, the value will increase or decrease by 1 unit at each time, Press decrease or increase and hold it to fast decreasing or increasing the numbers. controller goes back to PV/SV mode and SV configuration saved if no input within 3 seconds Press ◄ for as long as it takes to goes back to previous parameters
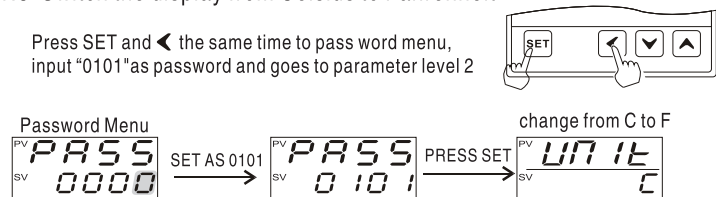
1.2 Alarm value configuration

Press SET for as long as it takes to goes to parameter level 1, and change the alarm 1 value to 10

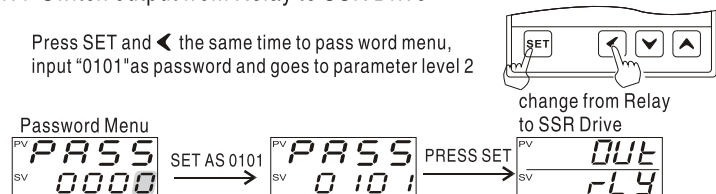| PV/SV mode	alarm 1 value	Change value to 10	Save the changes
PV **30** SV **0000**	PV **AL 1** SV **0000**	PV **AL 1** SV **0010**	PV **0030** SV **200**
Press SET for 3 seconds	Press ◄ key to shift to hundreds digits	Press increase or decrease to change the setting value	Press SET key to save and exit to PV/SV mode

1.3 Switch the display from Celsius to Fahrenheit

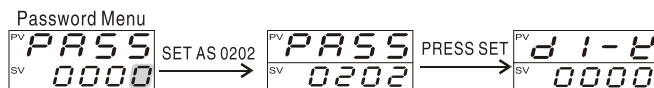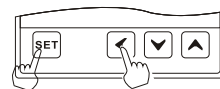Press SET and ◄ the same time to pass word menu, input "0101"as password and goes to parameter level 2

Password Menu
PV **PASS** SV **0000** →SET AS 0101→ PV **PASS** SV **0101** →PRESS SET→ change from C to F PV **UNIT** SV **C**

1.4 Switch output from Relay to SSR Drive

Press SET and ◄ the same time to pass word menu, input "0101"as password and goes to parameter level 2

Password Menu
PV **PASS** SV **0000** →SET AS 0101→ PV **PASS** SV **0101** →PRESS SET→ change from Relay to SSR Drive PV **OUT** SV **rLY**

1.5 Configuration for RUN/STOP function

Press SET and ◄ at the same time to password menu, input "0202" as password and press SET key

Password Menu
PV **PASS** SV **0000** →SET AS 0202→ PV **PASS** SV **0202** →PRESS SET→ PV **d1-k** SV **0000**

This is the parameter defines the RUN/STOP function for the controller, when d1-K=0, the Run/Stop function will be disabled. when d1-K=1, the Run/Stop function will be activated, press ▼ for 3 seconds , the controller will enter into STOP status, the output will be terminated,Press ▲ for 3 seconds ,the controller will enter into normal control status, and the program will run again.

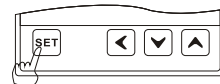## 1.6 Configuration for parameter Reset function

Press SET and ◄ at the same time to password menu, input "0202" as password and press SET key

Password Menu
PV **PASS** SV **0000** →SET AS 0202→ PV **PASS** SV **0202** →PRESS SET→ PV **rESt** SV **0000**

This is the parameter defines the RESET function, when you set Reset=0. the parameter Reset function disabled, when you set Reset=1, the parameter reset function activated, press ◄ ▲ left arrow and increase key at the same time for as long as it takes, all the parameters goes back to factory setting. this function is very useful for first-timer users when they are still learning the function, and messing with the controller. all parameter goes back to factory setting when they get lost during the process.
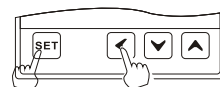
1.7 Active auto-tuning function

Press SET for as long as it takes to goes to parameter level 1, first parameter you will see is AT, this is the parameter used to active the auto-tuning function
Put the value as "Yes" if you want to active the auto-tuning
Put the value as "No" if you want to abort the auto-tuning in the process
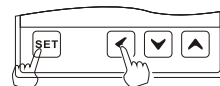

1.8 Change the input sensor type

Press SET and ◄ at the same time to pass word menu, input "0101"as password and goes to parameter level 2

Password Menu
PV **PASS** SV **0000** →SET AS 0101→ PV **PASS** SV **0101** →PRESS SET→ PV **INP 1** SV **k**

The first parameter you will see is the "Inp1", this is the parameter where you can configure the input sensors, the default code is for type "K" sensor, you can change to Pt100, type J etc.

1.9 Change the upper limit and lower limit of Setting value

Press SET and ◄ at the same time to pass word menu, input "0101"as password and goes to parameter level 2

Password Menu
PV **PASS** SV **0000** →SET AS 0101→ PV **PASS** SV **0101** →PRESS SET→ PV **LSPL** SV **0**
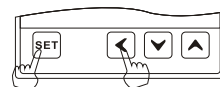
Locate the parameter "LSPL", this parameter defines the lower limit of the setting value, you can change them to other values as per your application

Password Menu
PV **PASS** SV **0000** →SET AS 0101→ PV **PASS** SV **0101** →PRESS SET→ PV **USPL** SV **400**

Locate the parameter "USPL", this parameter defines the higher limit of the setting value, the default upper limit of the setting value is 400C, you can change to other value if you want.

1.10 Change the alarm output mode

Press SET and ◄ at the same time to pass word menu, input "0101"as password and goes to parameter level 2

Password Menu
PV **PASS** SV **0000** →SET AS 0101→ PV **PASS** SV **0101** →PRESS SET→ PV **ALd 1** SV **11**

Locate the parameter "ALd1", this parameter defines the alarm output mode for alarm 1, the alarm mode has various options such as deviation high alarm, absolute high alarm, band alarm etc, the default mode is no alarm function ALD1=10, you can change it based on your application
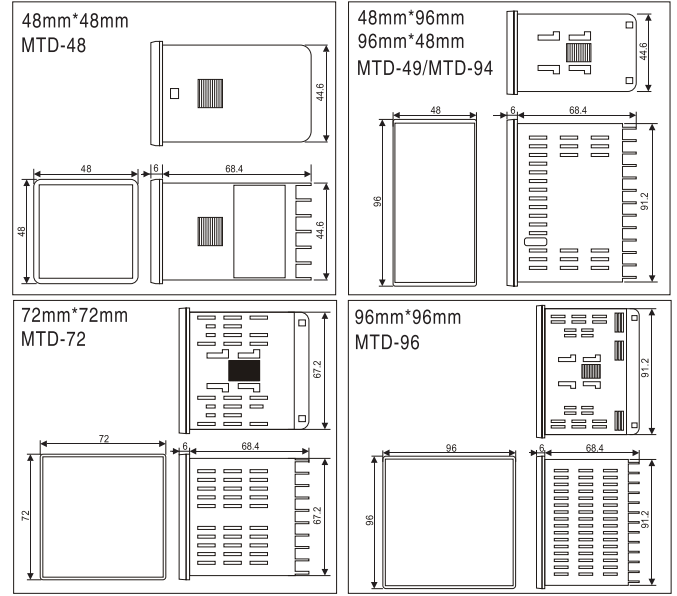
1.11 Alarm mode details
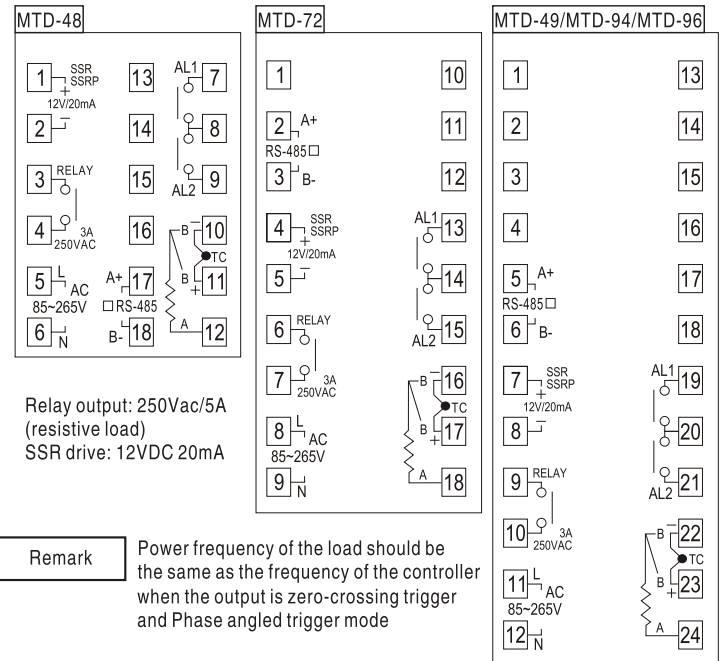
ALARM TYPE TABLE (ALd_=00~16)

10: No alarm output	00: No alarm output	09: Loop break alarm
11: Deviation high alarm	01: Deviation high alarm with hold action	
12: Deviation low alarm	02: Deviation low alarm with hold action	
13: Deviation high/low alarm	03: Deviation high/low alarm with hold action	
14: Deviation band alarm	04: Deviation band alarm with hold action	
15: Process high alarm	05: Process high alarm with hold action	
16: Process low alarm	06: Process low alarm with hold action	

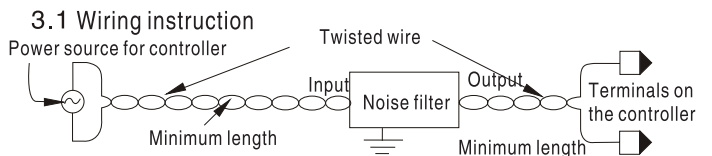| Code	ALD	□	Specification(Example for alarm 1)
N	10 or 00		No alarm
A	11		Deviation high alarm (AL1 ≥0); Deviation high alarm (AL1<0)
B	12		Deviation low alarm (AL1 ≥0); Deviation low alarm (AL1<0)
C	13		Deviation high/low alarm
D	14		Deviation band alarm
H	15		Process high alarm
J	16		Process low alarm
E	01		Deviation high alarm with hold action (AL1 ≥0); Deviation high alarm with hold action (AL1<0)
F	02		Deviation low alarm with hold action (AL1 ≥0); Deviation low alarm with hold action (AL1<0)
G	03		Deviation high/low alarm with hold action
M	04		Deviation band alarm with hold action
K	05		Process high alarm with hold action
L	06		Process low alarm with hold action
09			LBA alarm will be triggered if the temperature did not increase more than the LbAb value within the time duration defined under LbAt, this applys for reverse(heating) control mode when output is 100%. LBA alarm will be triggered if the temperature did not decrease more than the LbAb value witnin the time durantion defined under LbAt, this applys for direct(cooling) control mode when ouptut is 100%

2. Mounting and Dimensions

48mm*48mm MTD-48

48mm*96mm / 96mm*48mm MTD-49/MTD-94

72mm*72mm MTD-72

96mm*96mm MTD-96

3. Wiring Diagram

MTD-48

1 SSR SSRP + 12V/20mA
2
3 RELAY
4 3A 250VAC
5 AC 85~265V
6 N
13, 14, 15, 16, 17 RS-485, 18 B-
7 AL1
8
9 AL2
10 B TC
11 B +
12 A
A+ RS-485 B-

Relay output: 250Vac/5A (resistive load)
SSR drive: 12VDC 20mA

MTD-72

1
2 A+ RS-485
3 B-
4 SSR SSRP + 12V/20mA
5
6 RELAY
7 3A 250VAC
8 L AC 85~265V
9 N
10, 11, 12
AL1 13
14
AL2 15
16 B TC
17 B
18 A

MTD-49/MTD-94/MTD-96

1
2
3
4
5 A+ RS-485
6 B-
7 SSR SSRP + 12V/20mA
8
9 RELAY
10 3A 250VAC
11 L AC 85~265V
12 N
13, 14, 15, 16, 17, 18
AL1 19
20
AL2 21
22 B TC
23 +
24 A

Remark: Power frequency of the load should be the same as the frequency of the controller when the output is zero-crossing trigger and Phase angled trigger mode

3.1 Wiring instruction

Power source for controller — Twisted wire — Input — Noise filter — Output — Terminals on the controller
Minimum length — Minimum length

4. Panel Discription

1 PV PV display window, display PV
2 SV SV display window, display SV
3 OP1 : OUT indication
  AT : Auto-tuning indication
  AL1 : Alarm 1 indication
  AL2 : Alarm 2 indication
  COM : Communication indication
  °C : Celcius indication
  °F : Fahrenheit indication
4 Bar graphic, output percentage indication
5 SET Function key
6 ◄ Shift key, exit key
7 ▼ Value decrease
8 ▲ Value increase

OP1 OP2 AT
AL1 AL2 COM
°C °F PRG
OP1 %
SET ◄ ▼ ▲

5. Setting and Configuration

5.1 Setting flow chart

Power on → Self-checking → Display changes automatically → PV/SV mode

Display goes back to PV/SV mode if there is no input on the keypads within 1 minutes

Press SET or ◄ once → SV setting mode → "SET"
Press SET for 3 seconds → Parameter Level 1 → "SET"
Press SET and ◄ at the same time → Password menu → "SET"

PV	SV	Description
8.8.8.8	8.8.8.8	Power on
560	2.2.0 1	Series code / Version code
INP 1	C - - t	Input notation / Unit and sensor type
400.0	0.0	SV higher limit / SV lower limit

PV/SV

5.2 Compatible input sensors and Range

This controller will display factory default sensors and range as well as display unit during the power up process, below is a table you can use to check if the controller has been configured with the correct sensor and display unit, you may switch to other sensor type and display unit if you want.

Refer to table at right for compatible sensors and their range

Notation	Ʋ	E	J	Π	ῡ
Sensor type	K	E	J	N	Wu3_Re25
Range	1300 ℃	600 ℃	800 ℃	1300 ℃	2000 ℃
Notation	5	t	r	b	Pt
Sensor type	S	T	R	B	Pt100
Range	1600 ℃	400 ℃	1700 ℃	1800 ℃	800 ℃

5.3 Parameter configuration(except SV)

Use increase and decrease to change the parameter value and press SET to save the configuration after locate the parameters

6. Parameter Level

6.1 Parameter level 1

Press SET key for 3 seconds to parameter level 1

6.1.1 Parameter list

Below parameter will be displayed one by one, press SET key can shuffle among each parameters Press SET key for 3 seconds to save the configuration and exit to PV/SV mode

1# factory default

Notation	Name	Range	1#	Description
At	Autotune	NO or YES	NO	AT=YES, Autotune activated, AT=NO, Autotune off
AL 1	Alarm 1	-1999 to 9999	10	Value for alarm 1, HYS for alarm1=AH1
AL2	Alarm 2	-1999 to 9999	10	Value for alarm 2, HYS for alarm2=AH2
SC	Input offset	-199 to 199	0.0	to compensate the error caused by sensor
P	Proportional band	0.0 to 200.0	20.0	Proportional band for PID, Set P=0 for ON/OFF mode
HYS	Hysteresis for ON/OFF	0 to 999	1.0	HYS for ON/OFF mode Heating:Out off when PV>SV, Out on when PV<SV-HYS cooling:Out on when PV>SV+HYS, Out off when PV<SV
I	Integral time	0 to 3600 Sec	210	Integral off when I=0. I gets smaller integral gets stronger , but oscillation can be expected
d	Derivative time	0 to 3600 Sec	30	Derivative off when d=0 Counter balance the overshoot if increase d a little bit
CYt	Cycle time	0 to 999 Sec	20	Cycle time, Set as 20 for Relay output and 2 for SSR drive output
rSt	Rest Windup	-199 to 200	-5.0	overshoot supression after power on(rst>-P/2) recommend to calculate by autotune process
LCt	Protection lock	0-2	0	LCK=0：Be able to modify all parameters LCK=1：Only access to SV and auto-tune LCK=2：Only access to SV

6.2 Password

Press SET and left arrow key at the same time

Password Menu

PV	SV		PV	SV		Parameter level 2
PASS	0000	SET AS 0101	PASS	0101	PRESS SET	INP 1 / - - - t

6.3 Parameter level 2

Refer to "6.2" and Set PASS=0101 to go to parameter level 2
Below parameter will be displayed one by one, press SET key can shuffle among each parameters Press SET key for 3 seconds to save the configuration and exit to PV/SV mode

1# stands for factory default

Notation	Description	Range	1#	Description
INP 1	Input signal selection			

Notation	Ʋ	E	J	Π	ῡ	5	t	r	b
Description	K	E	J	N	Wu3_Re25	S	T	R	B
Range	1300 ℃	600 ℃	800 ℃	1300 ℃	2000 ℃	1600 ℃	400 ℃	1700 ℃	1800 ℃

Notation	AN4	AN3	AN2	AN1	Pt
Description	Backup	Backup	0-50mV	0-20mV	Pt100
Range					800 ℃

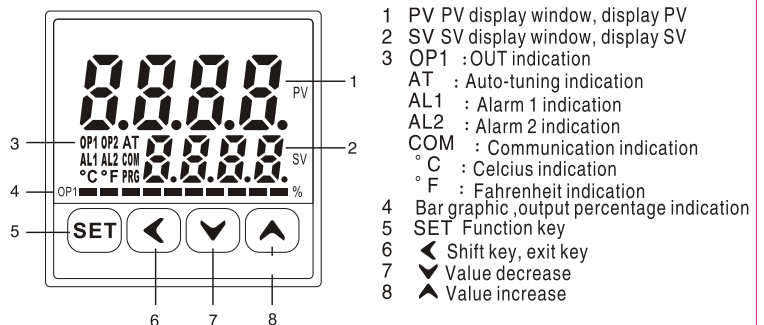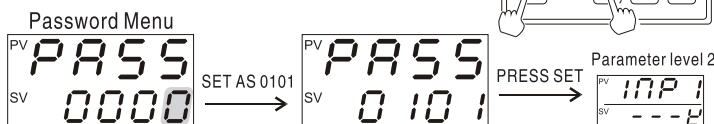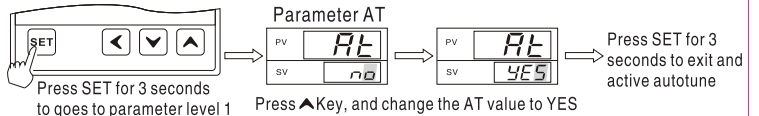| Notation	Description	Range	1#	Description
dP	Decimal Points	0 to 1	0	0: without decimal point 1: One decial point, for all input signals 2: two decimal points 3: three decimal points, for analog input signal only
LSPL	Lower limit for SV	-1999 to 9999	0	Lower limit for SV, or lower limit for Re-transmitted value
USPL	Higher limit for SV	-1999 to 9999	400	Higher limit for SV, or higher limit for Re-transmitted value
UN lt	Display Unit	C or F	C	C: Celsius F: Fahrenheit
PUFt	PV input filter	0 to 60	55	1-30 For general filter effects，31-60 For enhanced filter effects
ANL 1	Lower limit display for analog input	-199~9999	0	0-50mV input, display at ANL1 value when input is 0
ANH 1	Higher limit display for analog input	-1999~9999	2000	0-50mV input, display at ANH1 value when input is 50mV
ALd 1	Alarm 1 mode	00 to 16	10	To SET the alarm mode for alarm 1
AH 1	alarm 1 hysteresis	0.0to 100.0	0.4	To SET the hysteresis for alarm 1
ALd2	Alarm 2 mode	00 to 16	10	To SET the alarm mode for alarm 2
AH2	Alarm 2 hysteresis	0.0to 100.0	0.4	To SET the hysteresis for alarm 2
OUd	Control mode	Heat or cool	HEAT	HEAt :Reverse action(heating) CooL :Direct action(cooling)
OUt	Output mode	rLY or Ssr	RLY	Relay or SSR Drive rLY ⟷ SSr
SSrn	SSRP ouptut mode	Stnd or CYCL or PHAS	Stnd	Standard SSR or zero-crossing trigger or phase angled trigger Stnd ⟷ CYCL ⟷ PHAS *only available for configuration when Out=ssr
H=	Power frequency selection	50HZ or 60HZ	60HZ	50H= ⟷ 60H= 50HZ or 60HZ
LbAt	Loop break alarm time duration condition	0-9999 S	80	LBA alarm will be triggered if the temperature did not increase more than the LbAb value within the time duration defined under LbAt, this applys for reverse(heating) control mode when output is 100%
LbAb	Loop break alarm temperature variables	0-9999 Degrees	2	LBA alarm will be triggered if the temperature did not decrease more than the LbAt value within the time duration defined under LbAt, this applys for direct(cooling) control mode when ouput is 100% *LbAt and LbAb only available for configuration when Ald=09 or Ald2=09

ALARM TYPE TABLE (ALd_=00~16)

10: No alarm output	00: No alarm output
11: Deviation high alarm	01: Deviation high alarm with hold action
12: Deviation low alarm	02: Deviation low alarm with hold action
13: Deviation high/low alarm	03: Deviation high/low alarm with hold action
14: Deviation band alarm	04: Deviation band alarm with hold action
15: Process high alarm	05: Process high alarm with hold action
16: Process low alarm	06: Process low alarm with hold action
	09: Loop break alarm

7. Auto-tuning

Please active auto-tuning right after power on when Process value still far away from Setting value

Parameter AT

Press SET for 3 seconds to goes to parameter level 1

Press ▲Key, and change the AT value to YES

Press SET for 3 seconds to exit and active autotune

Goes to parameter AT and change the AT value to NO if you want to turn off the auto-tuning.AT indicator flashing after auto-tuning initiated. Auto-tuning is an ON/OFF control mode, significant temperature oscillation is expected and the time duration for the auto-tuning could be extra long then expected depends on different system AT indicator stop flashing after autotune finished, P, I,D, rSt value was calculated automatically during the autotune process.controller goes back to PV/SV mode and with all the mentioned parameter saved with a new value. Controller starts to control the system with new parameter

8. Sensor type and Range

Sensor type			Code
K	0 to 400 ℃	K	A4
	0 to 600 ℃	K	A6
	0 to 1300 ℃	K	B3
E	0 to 200 ℃	E	A2
	0 to 400 ℃	E	A4
	0 to 600 ℃	E	A6
J	0 to 400 ℃	J	A4
	0 to 600 ℃	J	A6
	0 to 800 ℃	J	A8
T	0 to 200 ℃	T	A2
	0 to 300 ℃	T	A3
	0 to 400 ℃	T	A4
S	0 to 1600℃	S	B6
R	0 to 1700℃	R	B7
B	200 to 1800℃	B	B8
N	0 to 1300℃	N	B3
Wu3_Re25	600 to 2000℃	W	B0

Sensor type			Code
Pt100	0 to 400 ℃	D	A4
	0 to 600 ℃	D	A6
	0 to 800 ℃	D	A8
	-100 to +200 ℃	D	C2
	-200 to +800 ℃	D	C8
	-100.0 to +200.0℃	D	F2
	-50.0 to +200.0℃	D	G2

Input type		Code
0 to 20mV		V	01
0 to 50mV	-1999 to 9999	V	02
0 to 5VDC	-199.9 to 999.9	V	03
0 to 10VDC		V	04
1 to 5VDC	-19.99 to 99.99	V	08
2 to 10VDC		V	09
4 to 20mA	-1.999 to 9.999	A	03
0 to 20mA		A	02

Remark: The accuracy is not guaranteed for S type sensor at 0-100C