PID-SSR Temperature Controller Instruction Manual

1. Features:

1.1 Input Sensor Types

Can be connect the following sensors and signals to the universal input.

Thermocouple (temperature input): K, J, T, E, S,R,B

Resistance thermometer (temperature input): Pt100, CU50

1.2 Control Outputs

A control output can be a relay output, voltage output (for driving SSR), or linear current output, depending on the model.

1.3 Adjusting PID Constants

Can be easily set the optimum PID constants by performing AT (auto-tuning) with the limit cycle method.

1.4 Standard Alarms

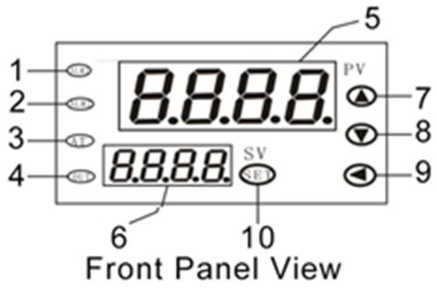
Can be output an alarm when the deviation, process value, set point, or manipulated value reaches a specified value.

1.5 Use this controller within the following allowable range:

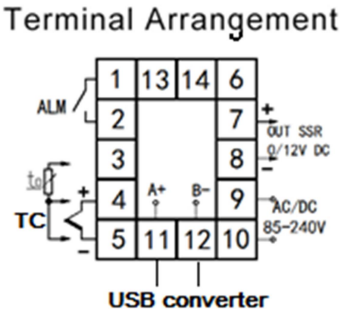
Allowable ambient temperature: −0 to +55 °C

Allowable ambient humidity: 5 to 85 % RH.

2. Parts Description:



Front Panel View



1 ALM1: lamp Lights when Event occurs

2 ALM2 lamp: Lights when Event occurs

3 AT lamp: Flashes during Auto-tuning (AT)

4 Output lamp: Lights when output is turned on

5 PV display: Displays Measured value (PV) or various Parameter symbols

6 SV display: Displays segment level, Set value (SV), Manipulated output value (MV) or various Parameter set values.

7 Up key:

−Increase numerals.

8 Down key:

−Decrease numerals

− To scroll through numbers faster, press and hold the Up key.

9Shift key: Shift digits when settings are changed.

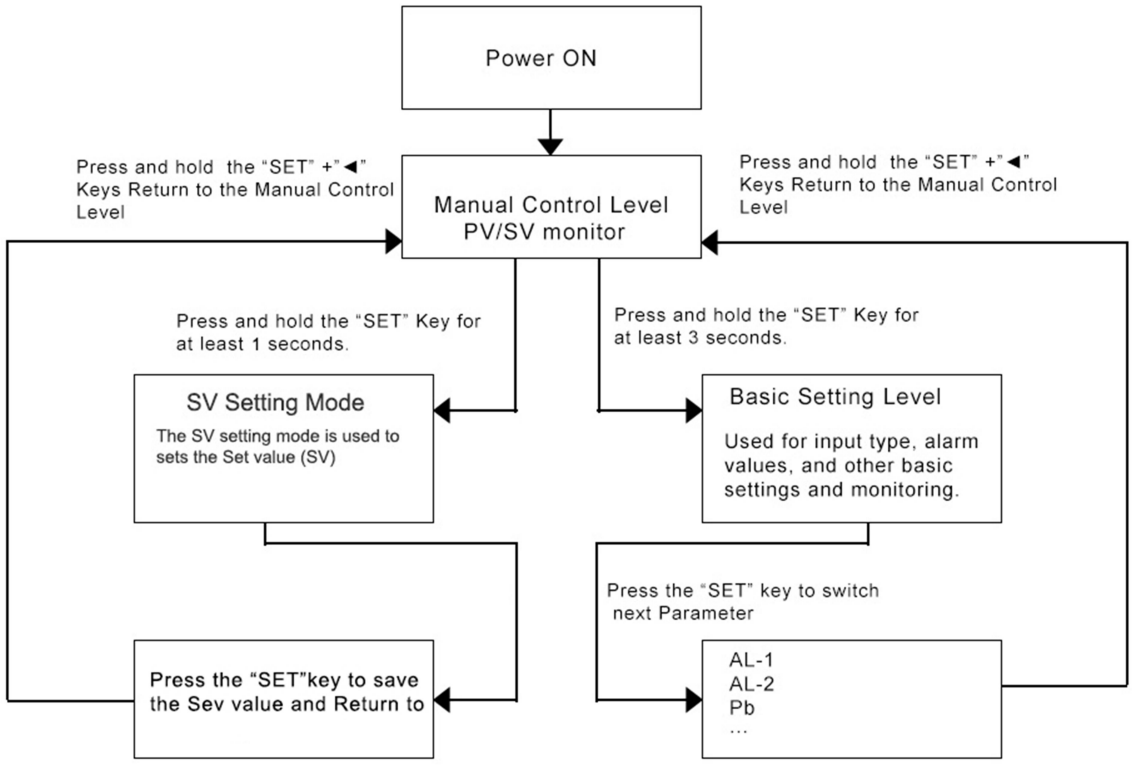
10 Set (SET) key: Used for Parameter calling up and set value registration.

3. Parameters

ID	Code	Name	Manual	Setting range	Ex-Factory
0	SP	Setting value	Set the temperature set value (SV) which is the target value for control	Determined by P-SL P-SH	100
1	AL-1	Alarm 1	Refer to ALP for the alarm mode suitable.	Determined by P-SL, P-SH	300
2	AL-2	Alarm 2			100
3	Pb	PV Bias	The value set in the PV bias is added to the actual input value to correct the input value.	±20.0	0.0
4	kP	Proportional Band	Set when PI or PID control is performance. For heating / cooling PID action. **When P=0,the controller is ON/OFF control**	1～9999	100
5	kI	Calculus time	Eliminates offset occurring in proportional control.	0～3000	500
6	kd	Differential time	Prevents overshoot and/or undershoot caused by integral action effect..	0～2000S	100S
7	kt	PID control cycle.	Control response time	2～120	20S
8	FILT	Digital Filter	This is a 1st-order lay filter by software prepared in order to reduce fluctuations of measured value (PV) by noise.	0～99	20
9	Hy	Differential gap	When the control is ON/OFF control（P=0） Relay contact may repeat its turning ON and OFF due to input fluctuation if measured value (PV) is near the alarm set value. the differential gap setting can prevent the relay contact from ON or OFF repetition.	0.1～50.0	0.5
10	dp	Decimal point position selection	Set the position of the decimal point for the measured value to be displayed.	0～3	0
11	outH	Output limiter high	The min value and max value of output current.	outL～200	200
12	outL	Output limiter low		0～outH	0
13	AT	Auto tuning	1: Auto tuning (AT) with learning start 0: Auto tuning (AT) with learning stop Turns OFF automatically when the AT with learning function is completed.	0～1	0
14	LocK	Set data lock	LOCK=0, Set value (SV) and Parameter can be set. LOCK=1,Only set value (SV) can be set. LOCK＞1, Set value (SV) and Parameter cannot be set.	0～50	0
15	TS	Input type	Cu50(Cu50)–50.0～150.0°C; Pt100(Pt1) –199.9～200.0°C; Pt100 (Pt2)–199.9～600.0°C; K(K) -30.0～1300°C; E(E) -30.0～700.0°C; J (J)-30.0～900.0°C; T(T) -199.9～400.0°C; S(S) -30～1600°C;	____	P
16	OP-A	Main output Opt. (Depends on your order)	0:no output 1:Relay output 2:Voltage output (for driving SSR) 3:Zero-cross output(for driving Triac) 4:PID linear current output(4-20mA /0-10v) (A single functional)	0～7	READ ONLY
17	C F	Measured value (PV) unit select	C: Celsius F: Fahrenheit If the value is changed, the controller needs to execute Auto-tuning again. Refer to 6.Auto-tuning	C	C
			0: Alarm function OFF;	0～10	1

18	ALP	Alarm output Opt.	1: Process high alarm; 2:Process low alarm; 3:Process high and low alarm.(H1 and L2) 4: Deviation High alarm ; 5: Deviation low alarm; 6:Deviation High and Low alarm.(H1 and L2) 7: Deviation high/low alarm; 8: Band alarm.		
19	COOL	System function Opt.	'0':reverse control(heating) '1':positive control(cooling)	0～1	0
20	P-SH	Range high	The control is displayed after the Input type and Input range.	P-SL～9999	1300
21	P-SL	Range low		-1999～P-SH	0
22	Addr	Address	Communication address can be set from 0 to 255	0～63	1
23	bAud	Communication speed	1200; 2400; 4800; 9600;	____	9600
24	HY-1	Alarm1 Differential gap	Relay contact may repeat its turning ON and OFF due to input fluctuation if measured value (PV) is near the alarm set value. the differential gap setting can prevent the relay contact from ON or OFF repetition.	0.1～50.0	0.5
25	HY-2	Alarm2 Differential gap		0.1～50.0	0.5

4. Operation



4.1 Basic Setting Level:

Press the key SET 3 seconds to enter into the main Parameters, the controller will display the Parameter code(1～25)in the window at the upper tube, and display the Parameter data at the lower tube. Press Key ▲、▼ or ◄ to adjust the Parameters, and then press the Key SET to preserve.

It will be preserved of the data and withdrawal of the setting with no any operations automatically within 10 seconds.

Electronics Lock. All the Parameter can be revised when Lock=0; Only the "SP" can be revised when Lock=1.

4.2Setting value Level:

Press the key SET 1 seconds to enter into the SV Setting Mode. When the operation mode is the Auto-tuning mode, the Set value (SV) can be set.

4.3Manual Control Operation:

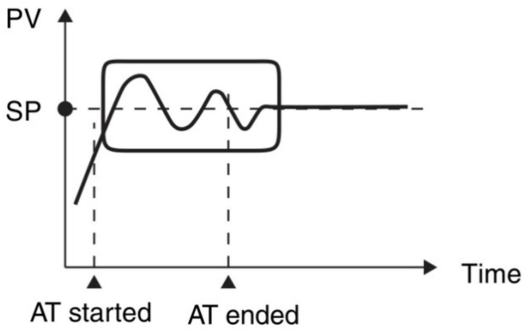
Press the ◀ key about 3S enter into the manual regulation, it will display "H" at the lower row, in this time can set the output power; press the ◀ key about 3S again it will withdraw the manual regulation.

4.4 Reset function operation:

Press and hold the ▼ key, then switch on the power of the controller. Wait until the display flashes three times , the controller will come back to default setting.

Tip: Main output Opt(OP-A) can be set only if lock=18

5. Determining PID Constants(Auto-tuning)



When AT is executed, the optimum PID constants for the set point at that time are set automatically. A method (called the limit cycle method) for forcibly changing the manipulated variable and finding the characteristics of the control object is employed.

Set the HY is 0.5～1℃, if the output is relay set the t=10S, then set the AT=1, the lamp of AT will be flashed, in this time the controller enter into **Auto-tuning**. now meter's control way is on-off mode, after 3 times vibrating(3 control period) automatically save P, I, D parameter, the self-adjusting procession finished.

Operation will be as shown in the following diagram:

Attentions：

-When **Auto-tuning**, the controller should not change the set value.

-When the power off during **Auto-tuning**, it will restart **Auto-tuning** next time.

-When it need artificially exit during **Auto-tuning**, set the Parameter(AT) to 0 so that can exit，but the setting result will not be valid.

6. Alarm (ALM) function：

Alarm (ALM) function	Alarm status[ON]	Alarm status[OFF]
Process high alarm	Measured value>Alarm set value	Measured value<Alarm set value
Process low alarm	Measured value<Alarm set value	Measured value>Alarm set value
Deviation high alarm	Measured value>Alarm set value + Set value	Measured value>Alarm set value + Set value
Deviation low alarm	Measured value<Alarm set value - Set value	Measured value>Alarm set value - Set value
Band alarm	Measured value<Alarm set value + Set value And Measured value>Alarm set value - Set value	Measured value>Alarm set value + Set value Or Measured value<Alarm set value - Set value
Out of band alarm	Measured value>Alarm set value + Set value Or Measured value<Alarm set value - Set value	Measured value<Alarm set value + Set value And Measured value>Alarm set value - Set value

Character Symbols：This manual indicates 9-segment display characters as shown below.

A	B	C	D	E	F	G	H	I	J	K	L	M
A	b	C	d	E	F	G	H	I	J	K	L	M
N	**O**	**P**	**Q**	**R**	**S**	**t**	**U**	**Y**	**T**			
n	o	P	q	r	S	t	u	y	T			

7. Host communication based on MODBUS-RTU protocol [OPTIONAL]

The master controls communication between master and slave. A typical message consists of a request (query message) sent from the master followed by an answer (response message) from the slave. When master begins data transmission, a set of data is sent to the slave in a fixed sequence. When it is received, the slave decodes it, takes the necessary action, and returns data to the master.

7.1 Communication Mode:

Data bit length	Stop bits	Parity bit	Communication time interval
8-bit (Binary)	1,2	NONE	300ms

7.2 Message length of each function (Unit: byte):

Function code (Hexadecimal)	Function	Query message		Response message	
		Min	Max	Min	Max
03H	Read holding registers	8	8	7	7
06H	Preset single register	8	8	8	8

7.3 Message format

Slave address	The slave address is a number from 1 to 255 manually set at the front key panel of the controller.
Function code	Refer to **7.2. Message length of each function**
Data	The data to execute the function specified by the function code is sent to the slave and corresponding data returned to the master from the slave.
CRC-16	CRC-16: Cyclic Redundancy Check

7.4 Read holding registers [03H]

The query message specifies the starting register address and quantity of registers to be read.

Slave address	Function code 03H	Register address	Quantity The setting must be 1	CRC16
Example: The contents of the holding register 1001H are the read out from slave address 1. Query message: 01 03 10 01 00 01 D1 0A Response message: 01 03 02 **00 FD** 79 C5 Explain：00FD=253,is processed as 25.3				

7.5 Preset single register [06H]

The query message specifies data to be written into the designated holding register. Only R/W holding registers can be specified. The controller EEPROM had a life span of data written to the EEPROM less than 1000,000 times

Slave address	Function code	Register address	Write data	CRC16
Example: Data is written into the holding register 0001H(AL-1) of slave address 1. Query message: 01 06 00 02 FF 38 68 28 Response message: 01 06 00 02 FF 38 68 28 When input ALM1 set value is -20.0,-20.0 is processed as -200,-200=0000H-00C8H=FF38H				

7.6 No response

The slave ignores the query message and does not respond when:

• The slave address in the query message does not coincide with any slave address settings.

• The CRC code of the master does not coincide with that of the slave.

• Transmission error such as overrun, framing, parity and etc., is found in the query message.

• The Communication time interval less than 300ms.

7.7 Register address list:

Symbol	Decimal point	Real Register	Holding Register
Messured value(PV)	YES	1001H	44098
Manipulated output (MV):	NO	1101H	44354
Alarm output	NO	1200H	44609
Controller parameters *(Refer to 3. Parameters)*			
SP	YES	0000H	40001
AL-1	YES	0001H	40002
AL-2	YES	0002H	40003
Pb	NO	0003H	40004
... And so on			
HY-2	YES	0019H	40026

Wiring Diagram