KCM- 7 PID temperature controller instruction manual

1.Features:

1.1 Input Type:

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

Resistance thermometer (temperature input): Pt100, CU50

Current input (analog input): 4 ~ 20 mA DC, 0 ~ 10 mA DC

NTC :KTY84-130, NTC100K ,NTC 10K, NTC 5K …

Tip:The input signal is single fixed by factory. For example the controller input signal is Current (4-20mA) so the controller only can work with 4-20mA sensor. As another example, the controller input signal is Pt100 so the controller only can work with Pt00 sensor, so it can't work with another sensor such as Cu50.

1.2.Control Output:

a. Relay output: relay contact: 250 V AC, 3 A (Resistive load)

b. SSR output: DC 0/10v voltage output (for driving SSR)

c. Current output : 4-20mA or 0-10v

depending on the controller 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 (OPTIONAL)

Relay contact:250 V AC, 3 A (Resistive load).

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

1.5 Sampling Time: 1 sec

1.6.Use this controller within the following allowable range:

Allowable ambient temperature: −0 to +55 °C

Allowable ambient humidity: 5 to 85 % RH.

2. Dimensions:

M:160×80mm panel cutout :152×76mm(horizontal)

MA:96×96mm panel cutout :92×92mm

MD: 72×72mm panel cutout :68×68mm

MF:96×48mm panel cutout :92×45mm(horizontal)

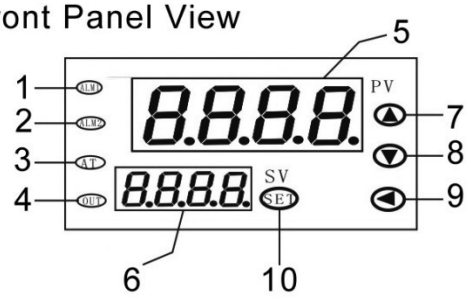
ME:48×96mm panel cutout :45×92mm(vertical)

MG: 48×48mm panel cutout :45×45mm

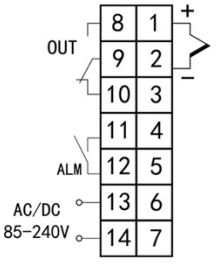
MR:88×72×59mm DIN 35 rail mounting socket

3.Parts Description:

Front Panel View



Terminal Arrangement



This wiring diagram is offered for example purposes only.

Tip: Correct terminal arrangement depending on the actual model.

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

9Shift key: Shift digits when settings are changed.

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

4.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 Input range	100
1	AL-1	Alarm Setting value	refer to ALP for the alarm mode suitable.		300
2	AL-2	Alarm Setting value	When alp=5 or =6, the parameter will be display		0.5
	HY-1	Alarm 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
3	SC	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	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
5	P	Proportional Band	Set when PI or PID control is performance. For heating / cooling PID action. **When P=0,the controller is ON/OFF control**	1～100.0	8
6	I	Calculus time	Eliminates offset occurring in proportional control.	0～9999	500
7	d	Differential time	Prevents overshoot and/or undershoot caused by integral action effect..	0～250S	100S
8	t	Control period	Proportional cycle time	2～120	20S
9	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
10	CooL	Hot/Cold	0:reverse control(heating) 1:positive control(cooling)	0～1	0
11	ALP	Alarm type	0: Alarm function OFF; 1: Process high alarm; 2:Process low alarm; 3: Deviation High alarm ; 4: Deviation low alarm; 5: Deviation high/low alarm; 6: Band alarm.	0～10	—

12	PF	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
13	PS-H	Input range high	These two parameters will take effect when the controller's input type is analog signals such as 4-20mA or 0-10V	PS-L～9999	9999
14	PS-L	Input range low		-1999～PS-H	0
15	dP	Decimal point position	Set the position of the decimal point for the measured value to be displayed.	0～3	0
16	LoCK	Set data lock	LOCK=18, all the parameter can be set. Otherwise, all the parameter can't be set	0～50	0
17	Uo	Initial output	Output initial value		
18	Addr	Address	Communication address can be set from 0 to 255	0～63	1
19	bAud	Baud rate	1200; 2400; 4800; 9600;		9600
18	Pb-H	Transmission output high	These two parameters will take effect when the controller with transmission output	Pb-L~PS-H	9999
19	Pb-L	Transmission output low		PS-L~Pb-H	0
20	outH	Output limiter high	Current output : The max value of output	outL～200	200
21	outL	Output limiter low	Current output : The min value of output	0～outH	0
22	C-F	Measured value (PV) unit select	C: Celsius F: Fahrenheit	C F	C

4.2. OUT Relay contact On/Off mode

set the parameter of p(Proportional Band)=0, When P=0,the controller is ON/OFF control.

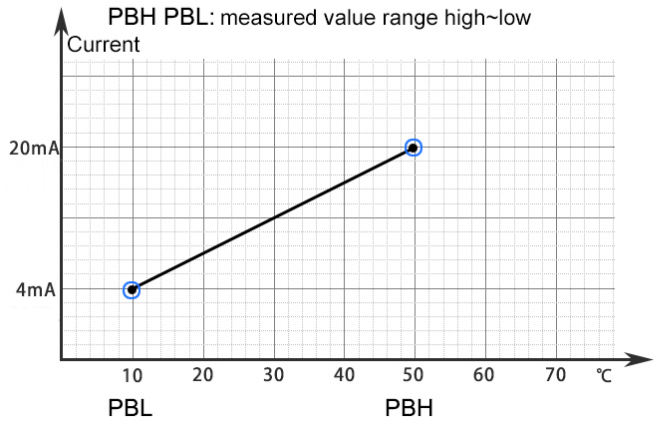
Table 4.2

OUT function	OUT relay status[ON]	OUT relay status[OFF]
CooL=1, P =0	PV ≥ SP	PV < SP − HY
CooL=0, P =0	PV ≤ SP	PV > SP + HY

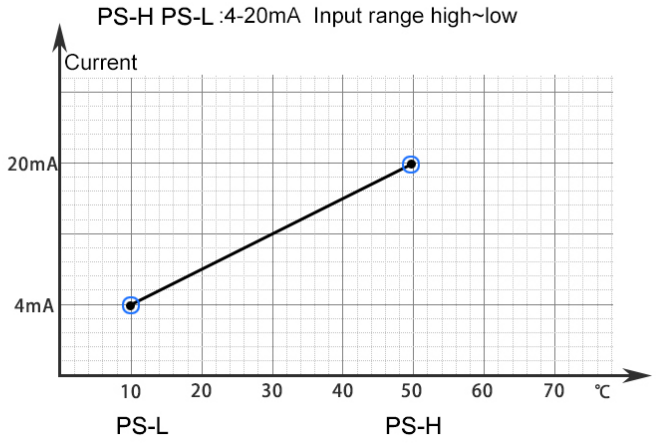
The parameters of SP , P , CooL, HY refer to 4. Parameters

4.3. About transmission output and analogue input(OPTIONAL)：

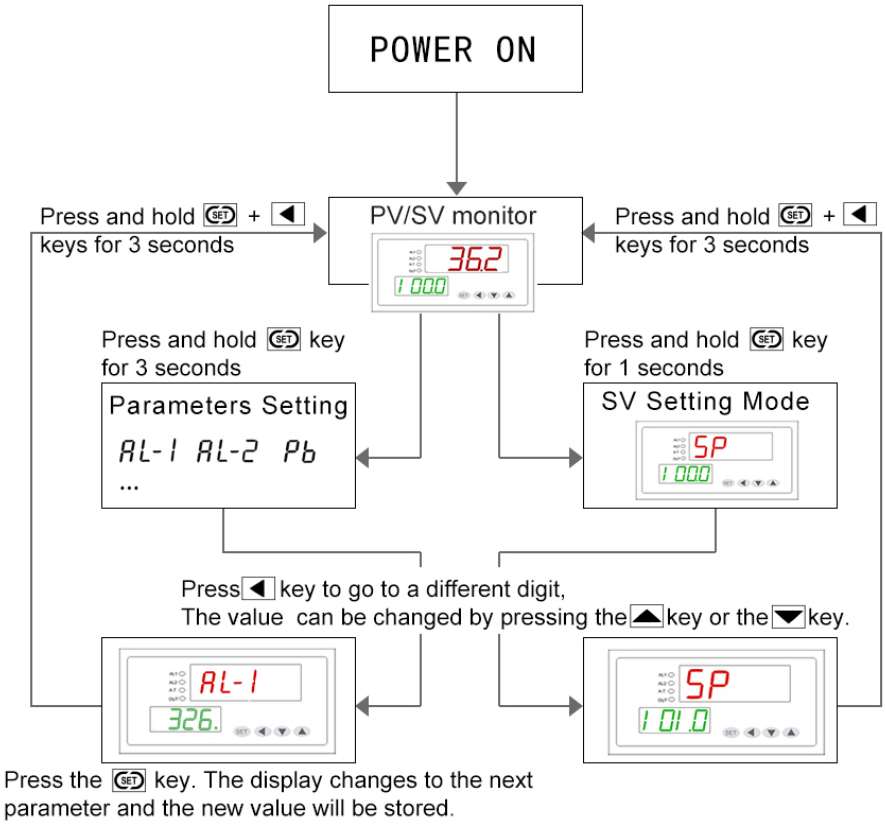
Transmission output



4-20mA input



5. Operation



5.1 Parameters Setting Level:

Press the SET key for 3 seconds to enter into the Parameters Setting mode, the controller will display the Parameter symbols (1～25) on the first LED display, and display the Parameter value on the second LED display.

Press ◀ key to go to a different digit.

Parameters value can be changed by pressing the ▼ key or the ▲ key.

Press the SET key. The display changes to the next parameter and the new value will be stored.

All the Parameters can be revised when LocK=0; Only the “SP” can be revised when LocK=1.

Display returns to the PV/SV monitor if no key operation is performed within 10 seconds , and the set value will be saved.

5.2 Setting value Level:

Press the SET key for 1 second to enter into the SV Setting Mode. During the Auto-tuning mode, the Set value (SV) can’t be changed.

5.3 Manual Control Operation:

Press the ◀ key while pressing the SET key for 3 seconds enter into the manual regulation, it will display “H” at the lower LED display, in this time can set the output value; Press the ◀ key while pressing the SET key for 3 seconds it will exit the manual regulation.

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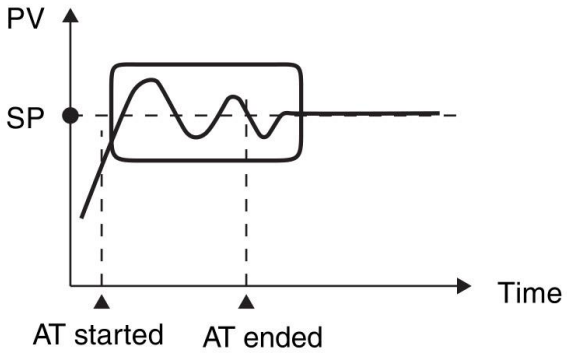
6.Determining PID Constants(Auto-tuning)

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=2S, 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) automatic 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.

7. Alarm function(OPTIONAL)

Alarm (ALM) function sets up the alarm status when the measured value (PV) or the deviation reaches the alarm set values. In the alarm status, the alarm output is output from the digital output terminals, and the alarms are used to drive the equipment danger signals or the safety equipment.

Alarm function	Alarm status[ON]	Alarm status[OFF]
1 high alarm	PV ≥ AL-1	PV < AL-1 − HY-1
2 low alarm	PV ≤ AL-1	PV > AL-1 + HY-1
3Deviation High	PV ≥ SP + AL-1	PV < SP + AL-1 − HY-1
4Deviation Low	PV ≤ SP − AL-1	PV > SP − AL-1 + HY-1
5 Band out	PV ≤ AL-2 OR PV≥ AL-1	AL-2 + HY < PV < AL-1 − HY
6 Band alarm	AL-2 ≤ PV ≤ AL-1	PV < AL-2 − HY OR PV > AL-1 + HY

8. 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.

8.1 Communication Mode:

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

8.2 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

8.3 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

8.4 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				

8.5 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				

8.6 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.

• Set the Response Timeout >200ms and Delay between polls>200ms.

8.7 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	1201H	44610
Controller parameters *(Refer to 4. Parameters)*			
SP	YES	0000H	40001
AL-1	YES	0001H	40002

Hy-1	YES	0002H	40003
Sc	NO	0003H	40004
... And so on			
Outl	YES	0015H	40022
C F	NO	0016H	40023

Refer to this link for more information on MODBUS-RTU Communication Protocol:

http://www.kcmeter.com/servicesread.asp?id=4

Or scan QR code for more information:

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			

Model and Suffix Code:

Specifications	Model and Suffix Code							
Model	KC	☐	☐	☐	☐	☐	☐	☐
SIZE	160×80mm panel cutout :152×76mm (horizontal)	M						
	96×96mm panel cutout :92×92mm	MA						
	96×48mm panel cutout :92×44mm(horizontal)	MF						
	48×96mm panel cutout :44×92mm(vertical)	ME						
	72×72mm panel cutout :68×68mm	MD						
	48×48mm panel cutout :44×44mm	MG						
	88×107×59mm DIN 35 rail mounting socket	MR						
Control method	PID control		7					
Number of alarm	NONE			☐				
	1 Alarm relay out			1				
Input Type	Thermocouple: K, E,J, R, S, T,WR25,N,RTD : Pt100, Cu50				PT			
	DC voltage : 0 -5V, 1-5V , Current 0-10 mA, 4-20 Ma				K			
	NTC 10K3950 3435 ,KTY 84-130 150				A			
	Specify a input type when ordering				NTC			
Control output	Relay output					☐		
	Voltage pulse(for driving SSR)					G		
	Analog output (DC current:4-20mA,0-10mA or Voltage 0-10 V DC)					A		
Power supply voltage	100 to 240V AC						☐	
	24V DC						1	
Communications	NONE							☐
	RS-485(2-wire system: MODBUS-RTU)							RS
	RS-232(3-wire system: MODBUS-RTU)							RX
	Measured value Transmission output							BS
	Measured value Data logger							LG