Intelligent Temperature Controller
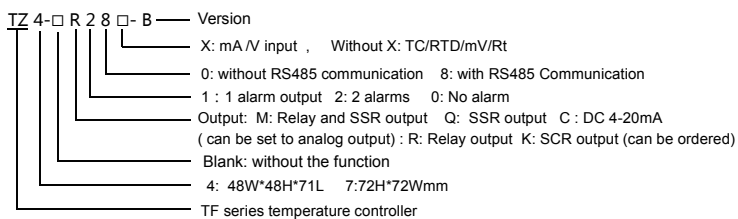
Operation Manual

I. Features:

⊙Optional input signal types and models

⊙With functions of measured display,control output,alarm output,analog output,RS485 communication,etc.

⊙ Diffferent types of PID arithmetic and with auto-tuning function.

⊙Used for industrial machinery, machine tools,measuring instruments.

⊙Economical and easy operation.

KKTZ-B01C-20180313

The instruction explain instrument settings, connections,name and etc,please read carefully before you use the temperature controller. Please keep it properly for necessary reference.

1.Safety Caution

⚠ Warning

1）When the failure or abnormal of products lead to a system of major accidents,please set proper protection circuit in the external.

2）Please don`t plug in before completing all the wire.Otherwise it may lead to electric shock, fire, fault.

3）Not allow to use outside the scope of product specification,otherwise it may lead to fire,fault.

4）Not allow to use in the place where is inflammable and explosive gas.

5）Do not touch power terminal and other high voltage part when the power on,otherwise you may get an electric-shock.

⚠ Caution

1）The product should not be used in a nuclear facility and human life associated medical equipment.

2）The product may occur radio interference when it used at home.You should take adequate countermeasures.

3）The product get an electric shock protection through reinforced Insulation. when the product is embedded in the devices and wiring,please subject to the specification of embedded devices.

4）In order to prevent surge occurs,when using this product in the place of over 30m indoor wiring and wiring in outdoor, you need to set the proper surge suppression circuitry.

5）The product is for panel mounting.In order to avoid to touch the wire connectors,please take necessary method.

6）Be sure to observe the precautions in this manual, otherwise there is a risk of a major injury or accident.

7）When wiring, please observe the local regulation.

8）To prevent to damage the machine and prevent to machine failure, the product is connected with power lines or large capacity input &output lines and other methods please install proper capacity fuse or other methods for protection.

9）Please don't put metal and wire clastic mixed with this product,otherwise it may lead to electric shock, fire, fault.

10）Please tighten screw torque according to the rules.If not,it may lead to electric shock and fire.

11）In order not to interfere with the product to dissipate heat, don't plug casing around the cooling vent hole and equipment.

12）Please don`t connect any unused terminal.

13）Please do the cleaning after power off, and use the dry cleaning cloth to wipe away the dirt. Please don`t use desiccant, otherwise, it may casue the deformation or discoloration of the product.

14）The readers of this manual should have basic knowledge of electrical,control, computer and communications.

15）In order to use this product with safety for long-term,regular maintenance is necessary. The life of some parts of the equipments are by some restrictions, but the performance of some will change for using many years.

16）Without prior notice, the contents of this manual will be change. We hope these is no any loopholes, if you have questions or objections, please contact us.

⚠ Caution of Install & Connection：

1. Installation：

1）This product is used in the following environmental standards（IEC61010-1）[Overvoltage categoryⅡclass of pollution 2]

2）This product is used in the following scope:surrounding environment, temperature, humidity and environmental conditions. Temperature：0～50℃；Humidity：45～85%RH;Environment condition：Indoor warranty,The altitude is less than 2000m.

3）Please avoid using in the following places:

The place will be dew for changing temperature;with corrosive gases and flammable gas;with vibration and impact; with water, oil, chemicals, smoke and steam facilities with Dust, salt, metal powder;and with clutter interference, static electric and magnetic fields, noise;where has air conditioning or heating of air blowing directly to the site; where will be illuminated directly by sunlight; where accumulation of heat will happen caused by radiation.

4）On the occasion of the installation, please consider the following before installation.

In order to protect heat saturated, please ensure adequate ventilation space.

Please consider connections and environment,and ensure that the products below for more than 50mm space.

Please avoid to installed over the machine of the calorific value(Such as heaters, transformer, semiconductor operations, the bulk resistance).When the surrounding is more than 50℃, please using the force fan or cooling fans.But don't let cold air blowing directly to the product.

In order to improve the anti - interference performance and security, please stay away from high pressure machines to install. Don`t install on the same plate with high pressure machine and the product.

The distance should be more than 200mm between the product and power line.

2.Cable caution：
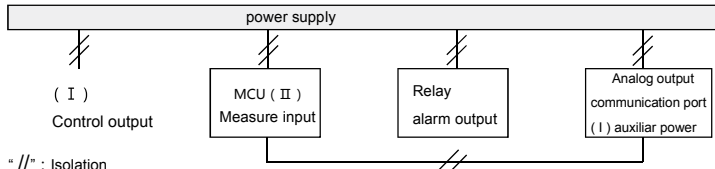
1）Please use specified compensation wire for TC input;Please use insulated TC if measured device is heated metal.

2）Please use the cable of lesser resistance in the place of RTD input,and the cable(3 wire) must be no resistance difference,but the total length is within 5m.

3）In order to avoid the effect of noise,please put input signal away from meter cable,power cable,load cable to wire.

4）In order to reduce power cables and the load power cables on the effect of this product,please use noise filter in the place where easy to effect.You must install it on the grounding of the disk if you use the noise filter,and make the wiring to be shortest between noise filter output side and power connectors.Don`t install fuse and switch on the wiring of noice filter output side,otherwise it will reduce the effect of noise filter.

5）It takes 5s from input power to output.If there is a place with interlocking actions circuit signal, use timer relay.

6）Please use twisted pair with a shield for analog output line,to ensure the reliabilty of signal, if necessary.

7）Please use twisted pair with a shield for remote RS485 communication cable,and deal with the shield on the host side earth, to ensure the reliabilty of signal.

8）This product don`t have the fuse; please set according to rated voltage 250V,rated current 1A if you need; fuse type:relay fuse.

9）Please use the suitable screw force and crimp terminal.

The screw terminal size：M3X8（with 7.0X7.0 square base）

Recommended tightening torque：0.4N.m

Proper cables：0.25～1.65mm single cable/multiple core cable

10）Please don`t put the Crimp terminal or bare wire part contact with adjacent connector.

II.Model Illustration

TZ 4-□ R 2 8 □- B ———— Version

X: mA /V input，   Without X: TC/RTD/mV/Rt

0: without RS485 communication   8: with RS485 Communication

1：1 alarm output 2: 2 alarms   0: No alarm

Output: M: Relay and SSR output   Q: SSR output C：DC 4-20mA (can be set to analog output)：R: Relay output K: SCR output (can be ordered)

Blank: without the function

4: 48W*48H*71L   7:72H*72Wmm

TF series temperature controller

Please note the input signal type when you choose the model. 1st type:TC/RTD/mV/Rt；2nd type: mA/V.

III. Common Models

Model	Control output	Alarm	Analog 4～20mA	RS485
TZ□-C28	4～20mA	2	multi-use with main control	Yes
TZ□-C2	4～20mA	2	multi-use with main control	No
TZ□-R28	relay	2	No	Yes
TZ□-Q28	SSR	2	No	Yes
TZ□-M1	relay&SSR	1	No	No
TZ□-M2	relay&SSR	2	No	No

IV. Specifications

1. Technical Parameters

Sample rate	2 times/per second
Relay capacity	AC 250V /3A Life of rated load>100,000 times
Power supply	AC/DC 100～240V（85-265V）
Power consumption	< 6VA
Environment	Temperature：0～50℃ no condensation，Humidity < 85%RH，altitude<2000m
Storage environment	-10～60℃, no condensation
SSR output	DC 24V pulse voltage，load<30mA
Current output	DC 4～20mA load<500Ω
Communication port	RS485 port Modbus-RTU procotol
Insulation impedance	Input, output, power VS meter cover > 20MΩ
ESD	IEC/EN61000-4-2 Contact ±4KV /Air ±8KV perf.Criteria B
Pulse traip anti-interference	IEC/EN61000-4-4 ±2KV perf.Criteria B
Surge immunity	IEC/EN61000-4-5 ±2KV perf.Criteria B
Voltage drop & short interruption immunity	IEC/EN61000-4-29 0%～70% perf.Criteria B
Dielectric strength	Signal input /output /power 1500VAC 1min，between lower than 60V circuits, DC 500V 1min
Total weight	About 400g
Shell material	The shell and panel frame PC/ABS (Flame Class UL94V-0)
Panel material	PC
Power failure memory	10 years，times of writing: 1 million times
Safety Standard	IEC61010-1 Overvoltage categoryⅡ，pollution level 2，levelⅡ(Enhanced insulation)

### 2. Measured signal specifications：

Input type	Symbol	Measure range	Resolution	Accuracy	Input impedance /auxiliary current	communication parameter code
K	ᵲ	-50～1200	1℃	0.5%F.S±3digits	> 500kΩ	0
J	J	0～1200	1℃	0.5%F.S±3digits	> 500kΩ	1
E	E	0～850	1℃	0.5%F.S±3digits	> 500kΩ	2
T	ᵗ	-50～400	1℃	0.5%F.S±2℃	> 500kΩ	3
B	ᵬ	250～1800	2℃	1%F.S±2℃	> 500kΩ	4
R	ᵣ	-10～1700	1℃	1%F.S±2℃	> 500kΩ	5
S	S	-10～1600	1℃	1%F.S±2℃	> 500kΩ	6
N	�	-50～1200	1℃	0.5%F.S±1℃	> 500kΩ	7
PT100	Pᵗ	-200～600	0.2℃	0.5%F.S±0.3℃	0.2mA	8
JPT100	JPᵗ	-200～500	0.2℃	0.5%F.S±0.3℃	0.2mA	9
CU50	CUSO	-50～150	0.2℃	0.5%F.S±3℃	0.2mA	10
CU100	CU00	-50～150	0.2℃	0.5%F.S±1℃	0.2mA	11
0～50mV	ᵲᵛ	-1999～9999	12bit	0.5%F.S±3digits	> 500kΩ	12
0～400Ω	rᵗ	-1999～9999	12bit	0.5%F.S±3digits	0.2mA	13
* 4～20mA	ᵲᴬ	-1999～9999	12bit	0.5%F.S±3digits	100Ω	14
* 0～10V	ᵛ	-1999～9999	12bit	0.5%F.S±3digits	>1MΩ	15

3. Isolation diagram

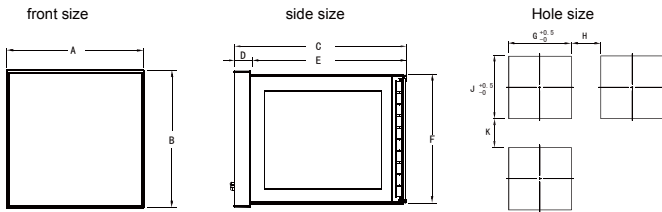| power supply			
（Ⅰ） Control output	MCU（Ⅱ） Measure input	Relay alarm output	Analog output communication port （Ⅰ）auxiliar power

" // " : Isolation

Note：When the auxiliary power supply between（Ⅰ）&（Ⅱ）is used as the power supply of external sensor, if the sensor is non-isolated, it does not isolate.

V. Universal Panel Name

TEMPERATURE CONTROLLER

PV ← ❶
SV ← ❷

AT   R/S
SET 《 ∧ ∨   ❸
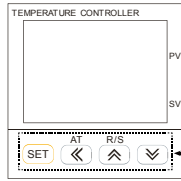
No.	symbol	Name	Function
1	PV	display window(green)	Setting value/parameters display window,display "STP" =stop control
2	SV	Display window (red)	measured value/parameters code display window
3	SET	SET function key	Menu key/confirm key, to enter or exit modified mode or confirm modifed parameters
	《AT	Shift/AT key	Activation/shift key/AT auto-tuning key,long press to enter/exit auto-tuning under measure control mode
	∧R/S	Increase key/R/S	Increase key, long press it to shift RUN/STOP mode under measure control mode
	∨	Decrease key	Decrease key

VI. Dimension and installation size

front size   side size   Hole size

A   D C   G +0.5 -0   H
                   E
B   F   J +0.5 -0
                                      K

Model	A	B	C	D	E	F	G	H(Min)	J	K(Min)
4:(48*48)	48	48	70.5	6.5	64.5	44.5	46	25	46	25
6:(96*48)	48	96	70.5	6.5	64.5	91.5	46	25	93	25
7:(72*72)	72	72	70.5	6.5	64.5	67.5	69	25	69	25
9:(96*96)	96	96	70.5	6.5	64.5	91.5	93	25	93	25

VII. Operation & menu

1. Operation process & method

measure control mode

PV 200
SV 200

Press SET > 3s

Press SET > 3s

PV AL1 SV 10   1st alarm
PV HY1 SV 1   1st alarm hystersis
PV Ad1 SV 3   1st alarm type
PV PS SV 0   amend
PV InP SV 8   input signal
PV ot SV   Control mode
(common menu)

PV LCK SV 0   LCK=33时 SET password
PV CP SV 20   control cycle
PV oVS SV 5   Overshoot limit
PV db SV 30   Differential time
PV I SV 120   Integral time
PV P SV 30   Proportional band

PV ACt SV 0   Control output mode
PV St SV 0   power on auto-tuning
PV SPd SV   control speed
PV PdC SV Fuz   PID type setting
PV AE1 SV 0   1st alarm extend
PV FL SV -50   Range low limit
(advanced menu)

PV VEr SV 120   Software version
PV dtr SV 10   Display fuzzy tracking value
PV dP SV   Decimal point setting
PV Ut SV ℃   Temperature unit setting
PV Ft SV 10   Digital filter coefficient
PV FH SV 200   Range high limit

VIII. Menu Illustration

☐ : Parameters will keep displaying all the time for all the model and all the setting
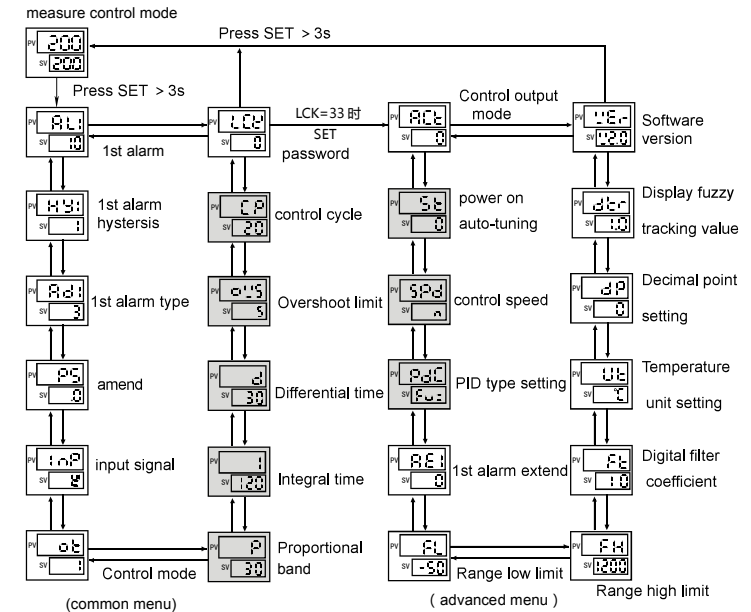▨ : Parameters will be hided based on model and menu setting

1. Normal menu illustration

No.	symbol	Name	Description	Set range	Default set
1	AL1	AL1	1st alarm value,note:the minus is dealed as absolute value when it is as a deviation value .	FL ~ FH	10
2	HY1	HY1	1st alarm backlash value	0 ~ 1000	1
3	Ad1	AD1	1st alarm type,note: set the AD1=0 , when 1st alarm is used as out2 (cooling output).when AD1> 6, alarm 2 will not act.	0 ~ 12	3
4	AL2	AL2	2nd alarm value,note:the minus is dealed as absolute value when it is as a deviation value .	FL ~ FH	5
5	HY2	HY2	2nd alarm backlash value	0 ~ 1000	1
6	Ad2	AD2	2nd alarm mode	0 ~ 6	4
7	PS	PS	Amend value, display value = actual measured value+ amend value	FL ~ FH	0
8	InP	INP	Optional input measured signal type:refer to input signal parameters table. Note: it need to change the relevant parameters after changing. SV , AL1 , HY1 , AL2 , HY2 , P , OVS , DB	refer to input signal table (page 3)	K
9	ot	OT	Control type : 0:ON/OFF control; related parrmeter: DB 1: PID heating control, related parameter: P , I , D, OVS, CP, ST, SPD,PDC 2: ON-OFF cooling control , related parameter DB , when used for compressor cooling control , set parameter: PT 3:PID heating & cooling control, (cooling control OUT2 make output by AL1 relay. related parameters: P, I, D, OVS, CP, CP1, PC, DB, ST , SPD, PDC 4. Over-temperature cooling output , related parameter : DB 5, PID cooling ,related parameters: P , I , D, OVS, CP, ST, SPD, PDC	0 ~ 5	1
10	A-n	A-M	Auto-manual control switch : AUTO(0) : auto control output , MAN(1): manual control output , AM(2): manual&auto shift	AUTO~AM	AUTO
11	P	P	Proportional band, the less setting value ,the faster system response. conversely , system response slower . P=0 , PID control is not valid	0 ~ 9999	30
12	I	I	Integral time , the less value,the stronger integral action. integral action is lower , I=0, no integral action	0 ~ 9999	120
13	d	D	Differential time . The bigger value,the stronger differential function. Conversely, lower differential function. D=0, no differential function. Set D=0, no control pressure, speed, other quick response system.	0 ~ 9999	30
14	oVS	OVS	Overshoot limit,in PID control process,when PV>SV+OVS,it force off output; The lower value,the lower PID adjusted range,the worse control stability; please set a proper value according actual state.	0 ~ 9999	5
15	CP	CP	OUT1 control cycle, 1:SSR control output, 4-200:relay ontrol output. Unit:second	1 ~ 200	20
16	CP1	CP1	OUT2 control cycle,cooling relay output cycle.Unit:second	4 ~ 200	20
17	PC	PC	OUT2 cooling proportionality coefficient,the higher value,the stronger cooling	1 ~ 100	10
18	db	DB	On-off control backlash(positive&negative value has same function). OT=3, as cooling control dead zone.(postive value& negative value is different). please modify the value according to decimal position,after change input .	-1000~1000	5
19	LCK	LCK	Lock function; 0001:SV value can not be modified, 0010:menu setting value only can be checked ,cannot modified . 0033: can enter to advanced menu. 0123: menu reset to factory setting.	0~9999	0

2. Advanced Menu Illustration

20	ACt	ACT	Control output mode, 0:relay output; 1: SSR output control 2 : 4 ~ 20mA control outpuy, please note that for TZ4,TZ7 you need to set ACT as 3 to change to 4-20mA analog output.	0~2 (0~3)	0
21	AE1	AE1	1st alarm extensions (refer to alarm extend function table page 8)	0~5	0
22	AE2	AE2	2nd alarm extensions (refer to alarm extend function table page 8)	0~5	0
23	dP	DP	decimal point set , TC/RTD iput , only can set 1 decimal point	0~3	0
24	dtr	DTR	PV fuzzy tracking value,it can get stable control display value in some status. Note:when alarm set value is equal with SV set value after set the DTR value,operation of alarm output is subject to actual measured value.Setting 0 to close the function.	0.0 ~ 2.0 (0~20)	1.0 (10)
25	Ft	FT	filter coefficient , the higher of value,the stronger of filter function	0 ~ 255	10
26	Ut	UT	Temperature unit: ℃: degrees Celsius F: Fahrenheit , _:no unit	℃、F、_	℃
27	FL	FL	Measure range low limit, set value must be less than range high limit	Refer input signal table	-50
28	FH	FH	Measure range high limit, set value must be bigger than range low limit.	Refer input signal table	1200
29	brL	BRL	Analog range low limit . Note: it also support reserse analog output	FL~FH	-50
30	brH	BRH	Analog range high limit. Note: it also support reserse analog output	FL~FH	1200
31	oLL	OLL	current output low limit amplitude, limit current output low limit amplitude	-5.0~100.0	0
32	oLH	OLH	current output high limit amplitude, limit current output high limit amplitude	0.0 ~ 105.0	100.0
33	St	ST	power on auto-tuning switch . 0: normal control after power on 1: enter to PID auto-tuning status after power on . Long press AT key to exit the auto-tuning	0~1	0
34	SPd	SPD	PID control speed adjustment, optional 0(N)no function, 1 (S) slow, 2(ss)medium slow, 3 (SSS) very slow , 4 (F) fast , 5 (FF)medium fast , 6 (FFF) express	0~6	N
35	PdC	PDC	Optional PID type : 0(FUZ) : Advanced fuzzy PID arithmetic, 1(STD) : normal PID arithmetic	0~1	FUZ
36	Pt	PT	Starting delay time of compressor, unit:second	0~9999	0
37	bAd	BAD	communication baud rate 0 (4.8) : 4.8K ; 1 (9.6) : 9.6K	0 (4.8K)、 1 (9.6K)	9.6K
38	Add	ADD	Communication Address	0~255	1
39	dtC	DTC	Sequenced transport of communication data and set 000 of response delay;1st is function reserve, 2nd is byte sequenced exchange, 3rd is response delay, it can set 0~9 to 10~100ms	refer to communciation procotol ②	0
40	CAE	CAE	User auto-calibrating enable function, the parameter is only for use of input signal except TC/RTD; Y: use auto-calibrate parameters; N: don`t use enable auto-calibrating parameters	0 (N), 1 (Y)	N
41	CAL	CAL	Operation of user auto-calibrating low limit input,when input low limit signal, flash YES . After confirmation , it will display OK , then finish low limit calibration.	YES/OK	YES
42	CAH	CAH	Operation of user auto-calibrating high limit input,when input low limit signal, flash YES . After confirmation , it will display OK , then finish high limit calibration.	YES/OK	YES
43	VEr	VER	software version	———	———

（1）Alarm parameters and output logic diagram:
Symbol description : "☆" means alarm hystersis ,"▲" means alarm value , "△" means SV value

No.	Alarm type	Alarm output (AL1, AL2 is independent of each other) Image : the hatched section means the alarm action
1	High limit absolute value alarm	AL
2	Low limit absolute value alarm	AL
3	※High limit deviation value alarm	SV+AL / SV
4	※Low limit deviation value alarm	SV-AL SV
5	※High/low limit deviation value alarm	SV-AL SV SV+AL
6	※High/low limit interval value alarm	SV-AL SV+AL

No.	Alarm type	The following two group of alarm parameters(AL1、AL2) used in combination,AL1 alarm output , AD2 must set to 0
7	High/low limit absolute value alarm	AL1 SV AL2
8	※High/low limit deviation value alarm	SV-AL1 SV+AL2 / SV
9	※Alarm between high limit absolute value and low limit deviation value .	SV-AL1 / SV AL2
10	※Alarm between high limit deviation value and low limit absolute value.	AL1 SV SV+AL2
11	High/low absolute value alarm	AL1 SV AL2
12	※High/low limit deviation alarm	SV-AL1 SV SV+AL2

※When the alarm value with deviation alarm set to a negative value, it deal with as an absolute value.
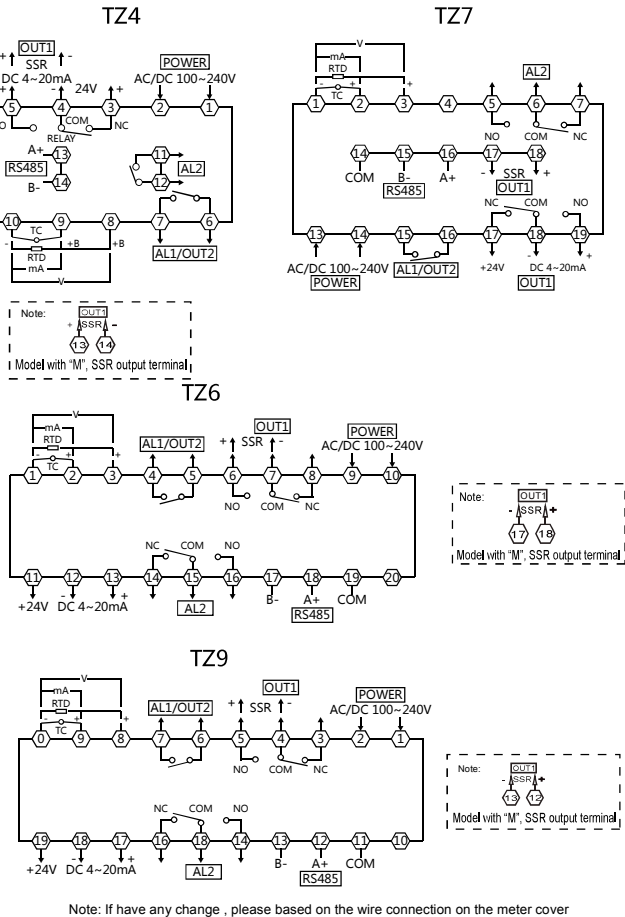
（2）Alarm extension function table

AE1/AE2 value	Alarm act mode when show HHHH/LLLL	Remark
0	keep the original alarm status	Power on alarm, alarm does not inhibit (As long as meet the requirement of alarm , make alarm output)
1	Forced alarm output	
2	Forced alarm close	
3	keep the original alarm status	Power on alarm , alarm inhibits. (Before PV value reach the set value at the first time ,the alarm does not output)
4	Forced alarm output	
5	Forced alarm close	

IX. Key function operation

1. Stop mode operation
1) Under measure mode, press ⚙ for several seconds to enter stop mode; SV window display "STOP" , main control output will stop or keep at minimum output.
2) under stop mode , short press ⚙ to exit stop mode , short press 《AT to modify SV value.
3) Under stop mode , alarm output and analog output can work normally.
2. PID Parameter auto-tuning operation:
1) Before auto-tuning, switch off power supply of control output load at temporary or set meter as stop mode.
2) Before auto-tuning PV value should meet the requirement: PID heating control , PV value is much lower than SV value ,PID cooling control, PV value is much larger than SV value.
3) Before auto-tuning, set proper alarm value,or remove the alarm effect to avoid the effect of alarm output,
4) Set PID type and SV value;the factory default is PID with fuzzy.
5) Set PID control,please set current output to proper range if it has OLL & OLH output limit; default set :OLL=0%,OLH=100%
6) Exit stop mode or connect load power supply, long press 《AT to enter auto-tuning mode, AT indicator flash.
7) Auto-tuning need a period, to ensure auto-tuning result, don`t modify parameter or power-off during auto tuning.
8) When AT light is off , it will exit auto-tuning. PID will update automatcially, and can get good control result.
9) During auto-tuning, long press 《AT key, measure beyond the range,display abnormally, shift to "STOP" status , power-off ect will stop the auto-tuning.
10) In the place with current output amplitude limit , it may not get best PID parameters even after auto-tuning.
11) Experienced users can set a proper PID parameter according to their experience.

3. PID heating & Cooling control operation
1) Set the control mode OT to 3.
2) PID heating control act on OUT1；Cooling control act on OUT2.
3) Cooling control OUT2 will make output by AL1 alarm relay.
4) Please set cooling start offset DB as a value bigger than 5, to ensure the cooling not affect PID heating result.
5) Please set cooling control cycle CP1 to a proper value,and change the cooling scaling factor to proper value.
6) When PV > SV+DB ,the cooling control start to effect;the bigger PV value ,the longer OUT2 output time.
4. Manual control and automatic control mode switch
1) Enter the normal menu and set the A-M as AM
2) Back to measure and control status , press SET key to switch manual control or automatic control
3) Set as manual control mode , the lower line display shows the output scale : M0~M100 according to (0%~100%), press increase and decrease key to adjust the output scale
4) Before switch manual control to auto-control, can press left key to modify SV value to get better control result.
5) If set it as AM status , meter will work as manual control mode after power on and output 0%.
5. Fixed manual control output mode
1) Set A-M menu as MAN
2) Back to measure and control interface , can adjust the output scale by manual.
3) It will reset to manual output scale after power on again.
6.Signal linear auto-tuning control operation
1）Set the INP type,and ensure one of inputs(0～50mV、RT(0～400Ω)、4～20mA and 0～10V).
2）Add the input signal to a proper input channel.
3) Enter menu low-limit to calibrate CAL,press " 《AT " to flash "YES" ;and set input signal to mininum value and input to meter.
4)When "YES" flashing, input Min value of signal to meter, and press "SET" to confirm&save calibrated value.
5）After calibrating low-limit,enter the high limit to calibrate CAH in menu,and flash "YES" .
6)Set input to max value to meter,and press "SET" to confirm& save calibrated value when "YES" flashing.
7)After calibrating, can enter CAE,and change "N" to "Y" then it can use calibrate value or factory default value.
8) The linear signal value of high-limit input should not great than the inout standard value range ±10%.
9）If you`re not satisfied with the calibrating result,you can reset.

X. Wire Connections

TZ4

TZ7

TZ6

TZ9

Note: If have any change , please based on the wire connection on the meter cover

XI. Methods of simple fault

Display	Methods
LLLL/HHHH	Checks whether the input disconnection and whether normal of FH value,FL value, working environment temperature and whether input signal is selected correctly.

XII.Communication procotol

Meter adopt RS485 Modbus RTU communication protocol, RS485 half duplex communication.Read function code:0x03,write function code 0x10/0x06.Adopts 16 digit CRC check, meter does not return for error check.
Data frame format:

Start bit	Data bit	Stop bit	Check bit
1	8	1	No

Abnormal communication processing :
When abnormal response , put 1 on the highest bit of function code.For example:Host request function code 0x03,and slave response function code should be 0x83.
Error code:
0x01---Illegal function: the function code sent from host is not supported by meter.
0x02---Illegal address: the register address designated by host beyond the address range of meter.
0x03---Illegal data: Date value sent from host exceeds the corresponding data range of meter.
Communication cycle :
Communication cycle is the time from host request to slave response data . ie: communication cycle= time of request data sending +slave preparation time + response delay time + response return time
Eg:9600 Baud rate:communication cycle of single measured data ≥250ms.

1. Read register
For example:Host reads integer SV(set value 200)
The address code of SV is 0x2000, since SV is integer(2 dyte),seizes 1data register.The memory code of 200 is0x00C8
Note:It should read DP value or confirm DP menu value first to ensure decimal point postion when reading data,and converse reading the data to get actual value. On the contrary, it should converse the data to corresponding ratio first before writing the data into meter.

Host request (Read multi-register)							
1	2	3	4	5	6	7	8
Meter Add.	Function code	Start Add. High bit	Start Add. Low bit	Data byte length high bit	Data byte length low bit	※CRC code low bit	※CRC code high bit
0x01	0x03	0x20	0x00	0x00	0x01	0x8F	0xCA

Slave normal answer(Read multi-register)						
1	2	3	4	5	6	7
Meter Add.	Function code	Data byte number	Data high bit	Data low bit	※CRC code low bit	※CRC code high bit
0x01	0x03	0x02	0x00	0xC8	0xB9	0xD2

Function code abnormal answer: (For example:host request ADD is 0x2011)

slave abnormal answer(Read multi-register)				
1	2	3	8	9
Meter ADD	Function ID	Error code	※CRC code low bit	※CRC code high bit
x01	0x83	0x02	0xC0	0xF1

2. Write multi-register

For example:Host use 0x10 function code write SV (setting value 150)

SV Add. code is 0x2000, since SV is integer(2 byte),seizes 1 data register.The hexadecimal code of 150 is 0x0096.

Host request (write multi-register)										
1	2	3	4	5	6	7	8	9	10	11
Meter Add	Function code	Start Add. High bit	Start Add. Low bit	Data byte Length/ high bit	Data byte Length/ low bit	Data byte length	Data high bit	Data low bit	※CRC code low bit	※CRC code high bit
0x01	0x10	0x20	0x00	0x00	0x01	0x02	0x00	0x96	0x07	0xFC

Slave normal answer (write multi-register)							
1	2	3	4	5	6	7	8
Meter Add	Function code	Start Add. High bit	Start Add. Low bit	Data byte Length/ high bit	Data byte Length/ low bit	※CRC code low bit	※CRC code high bit
0x01	0x10	0x20	0x00	0x00	0x01	0x0A	0x09

Host write SV with 0x06 function (setting value 150)

Host request (write single-register)							
1	2	3	4	5	6	7	8
Meter Add	Function code	Add. High bit	Add. Low bit	Data high bit	Data low bit	※CRC code low bit	※CRC code high bit
0x01	0x06	0x20	0x00	0x00	0x96	0x02	0x64

Slave normal answer (write single-register)							
1	2	3	4	5	6	7	8
Meter Add	Function code	Add. High bit	Add. Low bit	Data high bit	Data low bit	※CRC code low bit	※CRC code high bit
0x01	0x06	0x20	0x00	0x00	0x96	0x02	0x64

Slave abnormal answer (write single-register)				
1	2	3	8	9
Meter Add	Function code	Error code	※CRC code low bit	※CRC code high bit
0x01	0x86	0x02	0xC3	0xA1

Parameters reflection address

No.	Add reflection	Variable name	Register	Read/write	Remark
1	0x2000	Set value SV	1	R/W	
2	0x2001	1st alarm value AL1	1	R/W	
3	0x2002	1st alarm backlash HY1	1	R/W	
4	0x2003	2nd loop alarm AL2	1	R/W	
5	0x2004	2nd alarm backlash HY2	1	R/W	
6	0x2005	Display low limit FL	1	R/W	
7	0x2006	Display high limit FH	1	R/W	
8	0x2007	Analog output low limit BRL	1	R/W	
9	0x2008	Analog output high limit BRH	1	R/W	
10	0x2009	Control output low limit OLL	1	R/W	
11	0x200A	Control output high limit OLH	1	R/W	
12	0x200B	Overshoot limit OVS	1	R/W	
13	0x200C	Heat & Cool control dead zone DB	1	R/W	Default with 1 decimal point
14	0x200D	Colling Proportional coefficient PC	1	R/W	Default with 1 decimal point
15	0x200E	Amend	1	R/W	
16	0x200F	Dispaly fuzzy tracking value DTR	1	R	Engineering work without decimal point
17	0x2010	Measure value PV	1	R	
18	0x2011	output scale MV	1	R/W	0~100
19	0x2012	manual-auto control switch A-M	1	R/W	0: auto 1: manual
		Reserve			
20	0x2100	1st alarm mode AD1	1	R/W	
21	0x2101	2nd alarm mode AD2	1	R/W	
22	0x2102	1st alarm extended mode AE1	1	R/W	
23	0x2103	2nd alarm extended mode AE2	1	R/W	
24	0x2104	Control mode OT	1	R/W	
25	0x2105	Control output mode ACT	1	R/W	
26	0x2106	RUN STOP operation	1	R/W	1:RUN 2:STOP 3: Run auto-tuning 4:Stop auto-tuning

27	0x2107	Decimal point DP	1	R/W	
28	0x2108	Unit display UT	1	R/W	25 (℃) 26 (℉) 27 (_)
29	0x2109	Filter constants FT	1	R/W	
30	0x210A	Proportional coefficient P	1	R/W	No decimal point
31	0x210B	Integral time I	1	R/W	No decimal point
32	0x210C	Differential time D	1	R/W	No decimal point
33	0x210D	Control speed fine-tune SPD	1	R/W	
34	0x210E	Heating control cycle CP	1	R/W	No decimal point
35	0x210F	Cooling control cycle CP1	1	R/W	No decimal point
36	0x2110	Cooling relay time PT	1	R/W	No decimal point
37	0x2111	Optional input signal INP	1	R/W	Refer to input signal table
38	0x2112	Meter address ADD	1	R/W	
39	0x2113	Communication baud rate BAD	1	R	
40	0x2114	Communication delay setting DTC	1	R	Note ②
41	0x2115	PID arithmetic type PDC	1	R	
42	0x2116	Lock key LCK	1	R	
43	0x2117	Meter name	1	R	
44	0x2118	Output status	1	R	Note ①

R：Read ； R/W：Read/write

Note①:Measure status indication,it means operation when data position is 1. It means no opertion when it is 0.

D7	D6	D5	D4	D3	D2	D1	D0
STOP	HHHH	LLLL	AT	AL2	AL1	OUT2	OUT1

Note②:Sequenced transport and response delay of DTC communication data

DTC : □ □ □ —— Response delay : 0 ~ 9 means 10 ~ 100ms
—— Sequenced transport of byte : 0 = 1 , 2 , 2 = 2 , 1
—— Reserve

※16 digits CRC check code get C 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;
}
```