ITC-100 PID Temperature Controller

User Manual

Contents

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■Safety warning

●It's a must to use this product within its specification and using scope.

●When power on, do not connect, disassemble and touch terminals, as those may cause damage due to spark, malfunction or electric shock.

●No metal fragment, wire thread or metal dusts produced during installation are allowed to be inside the device, otherwise, there will be risk of electric shock, fire or malfunction.

●Please do not use this product in flammable and explosive locations, otherwise, there will be risk of damage caused by explosion.

●Never disassemble, refit and repair this product, or touch the inner components by yourself, otherwise, there will be risk of electric shock, spark or malfunction.

●If the replay was serving beyond its estimated lifetime, there will be risk of contact fusion and burning. It's a must to always pay attention to the using environment of relay, and using the relay within its rated load and estimated lifetime. The estimated lifetime of the relay varies according to the output load and switching condition.

■ Product features

●Panel size: DIN(48×48mm)

●Compatible with various temperature sensors (K, S, Wre, T, E, J, B, N, CU50, PT100)

●Wide control temperature range: -50 - 1300ºC (type K thermocouple)

●Display and control accuracy: 0.1 ºC, high measuring precision: ±0.2%FS

●PID control mode with high-performance self-tuning function

●User-defined output and alarm modes

●Adjustable digital filtering for reducing external interference

●Self-calibration available for ensuring long term stability of the instrument

●high luminance LED screen with height 0.39" characters, anti-dazzle panel, well visibility

● Inbuilt switching power supply applicable for wide voltage range with low power consumption

1.Technical parameters

Rated Voltage	AC 100-240V 50/60Hz
	AC/DC 12-24V 50/60Hz
	DC 12-24V
Working voltage	85 to 100% of the rated voltage
Power	About 5VA (100V - 240VAC)
	About 4VA (12V - 24VAC)
	About 3W (12V - 24VDC)
Characters	PV: high luminance LED screen with 4 digits of height 9.9mm displayed in red
	SV: high luminance LED screen with 4 digits of height 8.0mm displayed in green
Display accuracy	±0.2%FS 0.1ºC(＜1000ºC); 1ºC(≥1000ºC)
Sampling period	0.5 seconds
Temperature compensation	0-50ºC
Control output	Relay output: AC 250V 3A (resistive load)
	Voltage output (for driving SSR): 12VDC, 30mA DC
	Maximum load: 600Ω
	Electrical endurance of relay: 100,000 times
Alarm output	Relay output: AC 250V 3A (resistive load)
	Relay output: AC 250V 3A (resistive load)
Weight	About 140g
Working temperature	-10 - 55ºC (No ice or moisture condensation)
Working humidity	RH 35-85%
Storing temperature	-25 - 65ºC (No ice or moisture condensation)

2.Models and specifications

Table 1: Product models and specifications

Model	Control output	Voltage
ITC-100VH	SSR control output	AC 100-240V
ITC-100RH	Relay control output	AC 100-240V
ITC-100VL	SSR control output	AC/DC 12-24V
ITC-100RL	Relay control output	AC/DC 12-24V

3.Diagram and installing size (unit: mm)
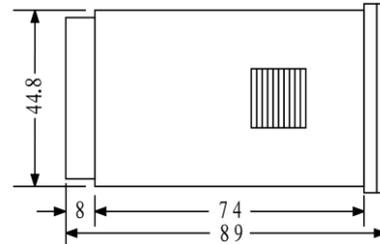
Figure 1: Shell Size
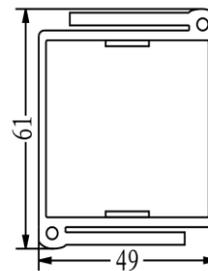
Figure 2: Mounting Bracket
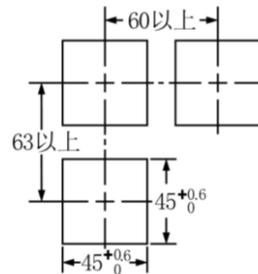
Figure 3: Panel Cutout

3.1 Insert temperature controller into the mounting hole in the panel, then put on the fixer from the rear and hold it temporarily, make sure there is no gap among temperature controller, panel and fixer. After that, fix the temperature controller with attached two bolts of the fixer under torque of 0.29N to 0.39N.

3.2 Make sure the surrounding temperature is within the stipulated temperature range, especially when there are two or more temperature controllers.

4.Wiring diagram
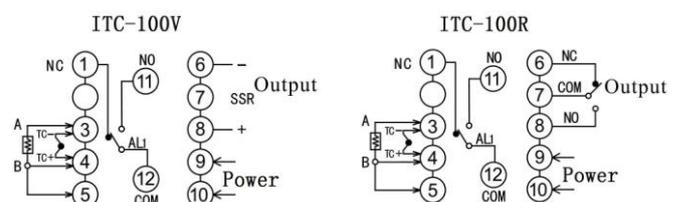
Figure 4:Wiring diagram

4.1 Connecting sensors

Please refer to the input sensor reference table to select sensor type and set the code. The default setting of sensor type is type K thermocouple. If other type sensor was adopted, it's a must to reset the configuration.

If error occurred when some thermocouples are used in different environments, press SC to calibrate as per the detailed stipulation in this manual.

4.1.1 Thermocouple

#3 and #4 terminals are for connecting thermocouple. No inverse connection of positive pole and negative pole are allowed. For common thermocouples, positive pole is red, while negative pole is blue or green. If the poles were connected inversely, the measured value will be displayed inversely on the screen.

4.1.2 Dual lines PT100 sensor

#3 and #4 terminals are the input ports for dual lines PT100 sensor, at the same time #4 and #5 terminals should be connected together.

4.1.3 RTD sensor

When connecting three lines RTD sensor, #3 terminal is for red wire, #4 and #5 are for other two blue lines. For some sensors, #4 and #5 terminals should be connected together.

4.2 Power supply connection

#9 and #10 terminals are for connecting power supply, polarity is indifferent when connecting. Before installation, it's a must to confirm the compliance of the input voltage to product specification, otherwise, there will be risks of abnormal usage, electric shock and fire.

4.3 Connection for control signal output

4.3.1 The output driving voltage and current of Model ITC-100V are 12VDC and 30mA respectively, while #6 output terminal is for negative pole, and #8 terminal is for positive pole. It can drive SSR (Solid-state replay). Please note that the positive pole and negative pole shouldn't be connected inversely.

4.3.2 Model ITC-100R output relay control signals. COM7 is public port, COM6(NC) is normally closed, COM8 (NO) is normally opened. It could directly control load of AC250V, <3A; for controlling load of AC250V, >3A, external high capacity controller is needed.

4.4 Connection for alarm control

Alarm is controlled by relay signals. COM12 (COM) is public port, COM1 is normally closed, COM11 is normally opened, maximum load is AC250/3A (resistive load).
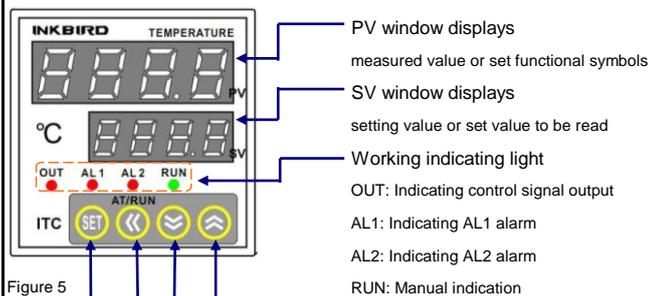
5. Panel instruction

Figure 5

PV window displays
measured value or set functional symbols

SV window displays
setting value or set value to be read

Working indicating light
OUT: Indicating control signal output
AL1: Indicating AL1 alarm
AL2: Indicating AL2 alarm
RUN: Manual indication

"INCREASE" key: when setting value, press "≲" key to increase value, keeping this key to be pressed can increase value quickly.

"DECREASE"key: when setting value, press "≲" key to decrease value, keeping this key to be pressed can decrease value quickly.

"MOVE" key: when setting temperature value or parameters, use this key to move cursor to required numerical position.

"SELF-TUNING" key: when in normal display mode, long press this key for over 2 seconds to start or stop self-tuning.

"SWITCHING" key: when in normal display mode, press this key for less than 1 second to switch automatic and manual mode.

"SET" key: when in normal display mode, press this key to view setting value for control signal output; long press for over 2 seconds to enter parameters setting mode.

6. Operation instruction

6.1 Display status

After power on, the instrument will conduct self-tuning, then enter measuring and monitoring status automatically. PV window displays current measured value, while SV window displays setting value; If "orAL" was displayed alternately between PV and SV windows, it means input value exceeded measuring range (or sensors in open loop), or input setting is incorrect. When there was alarm output, SV window will alternately display characters related to the alarms:

HiAL(alarm for high limit),LoAL(Alarm for low limit),

dHAL(alarm for plus deviation),dLAL(alarm for minus deviation).

6.2 View output value

Press "SET" key (no longer than 1 second), if SV window displays character "A"(for instance), it indicates automatic control mode, while if the displayed character is "M" (for instance:), it indicates the manual control mode.

6.3 Automatic/Manual control switch

Press "«" key (no longer than 1 second), the temperature controller can switch between automatic and manual control mode without interference to the operation. Under automatic control mode, RUN indicating light will off; and under manual control mode, RUN indicating light will on.

(remarks: if the running status of the function setting is "2: forbid manual mode", above operation is invalid).

6.4 Value setting

When SV window displays setting value, press "≲" key ("≲" key) to increase (decrease) setting value. Press "«" key to move cursor to required numerical position. Keeping "≲" key or "≲" key to be pressed could increase or decrease the value quickly.

6.5 Launch self-tuning function

When use the instrument for the first time, it's a must to use the self-tuning function of the instrument to determine control parameters (M50, P and t) for an ideal control effect. Press "«" key for over 2 seconds, then the SV window will display characters "A" and "T" alternately, and the system will enter self-tuning mode. When self-tuning, the temperature controller will conduct digital adjustment. After oscillation for 2 to 5 times, the instrument will automatically set the PID control parameters (parameters M50, P and T). After self-tuning, the system will return to PID automatic control mode. During self-tuning, press "«" key for over 2 seconds to cancel self-tuning, then the characters "AT" displayed in SV window will disappear.

Attentions: for temperature controller which had run self-tuning before, it's a must to set parameter CtrL as "2" before launching another self-tuning (please refer to section "parameters setting and definition" in this manual for detailed operation). The control parameter value will vary according to setting temperature, therefore, it's a must to run self-tuning with the most frequently used setting value of the system. If the setting value often changes, run self-tuning with the middle value of setting values.

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6.7 Parameters setting

Table 2: parameters setting and definition

Parameter	Definition	Value range	Unit	Default	Remarks
HIAL	Upper alarm limit	-1999~+9999	1℃	9999	See 6.8.1
LoAL	Lower alarm limit	-1999~+9999	1℃	-9999	See 6.8.1
dHAL	Deviation high alarm	0~9999	1℃	9999	See 6.8.1
dLAL	Deviation low alarm	0~9999	1℃	9999	See 6.8.1
dF	Hysteresis band	0~200.0	0.1℃	0.3	See 6.8.3
CtrL	Control mode	0: On/OFF 1,3: PID 2: Sel-turning		3	See 6.10.2
M50	Integral Time	0~9999	0.1℃	**1000**	See 6.11.3
P	Differential	0~9999	0.01S/℃	500	See 6.11.2
t	Hysteresis time	1~9999	second	120	See 6.11.3
Ctl	Control period	1~120	second	4	See 6.11.4
Sn	Input sensor	0~42		0	See 6.9.1
diP	decimal point position	0~3		1	See 6.9.2
diL	Displayed value for low limit	-1999~+9999	1 Digital	0	See 6.9.3
diH	Displayed value for high limit	-1999~+9999	1 Digital	1000	See 6.9.3
SC	Sensor Calibration	-199~+999		0	See 6.9.5
oP1	Output mode	0/2: time proportion 1：0-10mA		0	See 6.10.1
Opl	Low limit of output	0~220	1%	0	See 6.10.1
Oph	High limit of output	0~220	1%	100	See 6.10.1
ALP	Alarm definition	0~31		0	See 6.8.2
CF	System functions selection	2:Heater 3:Cooler		2	See 6.8.4
Addr	Communication address	0~63		1	See 6.12.1
Baud	Communication baud rate	0~4800		9600	See 6.12.2
dl	Digital filtering	0~20		0	See 6.9.4
run	Automatic/Manual status	0: manual 1: automatic 2: No manual		2	
LOC	Permission of revising parameter	0~999		40	See 6.14
EP1～EP8	8 definitions for field parameter	Select Any Parameters from it		none	See 6.13

6.6 Workflow for setting

After instrument powered on and run self-inspection, press "SET" key for over 2 seconds to enter parameters setting mode. User can press "≼" key(or "≽" key) to set the value. After value set, press "SET" key to confirm and go for setting for another function. Then repeat above operation, till all the functions are configured OK.Quit setting mode, and enter PV/SV monitoring mode.

Attentions: if parameters were changed during parameters setting mode, the temperature controller will save the change if there is no further operation for over 10 seconds, and return to PV/SV monitoring mode.

Press SET 3S to enter Setting Mode

HIAL 9999 → **HIAL**:Alarm value for high limit

LoAL -1999 → **LOAL**:Alarm value for low limit

dHAL 9999 → **dHAL**:Deviation high alarm

dLAL 9999 → **dLAL**:Deviation high alarm

dF 0.3 → **dF**:Return difference

CtrL 3 → **CtrL**:Control mode

ii 50 1000 → **M50**:Integral Time

P 500 → **P**:Rate

t 120 → **t**:Hysteresis time

Ctl 4 → **Ctl**:Control period

Sn 0 → **Sn**:Input sensor

diP 1 → **diP**:decimal place

diL 0 → **diL**:Displayed value for low limit

diH 1000 → **diH**:Displayed value for low limit

SC 0 → **SC**:Revise displayed value

oP1 0 → **oP1**: Output mode

oPL 0 → **Opl**:Low limit of output

oPH 100 → **Oph**:High limit of output

ALP 0 → **ALP**:Alarm definition

CF 2 → **CF**:System functions selection

Addr 1 → **Addr**:Communication address

bAud 9600 → **Baud**:Communication baud rate

dL 0 → **dl**:Digital filtering

run 2 → **run**:Running status

Loc 40 → **LOC**:Permission of revising parameter

EP1 nonE → EP8 nonE

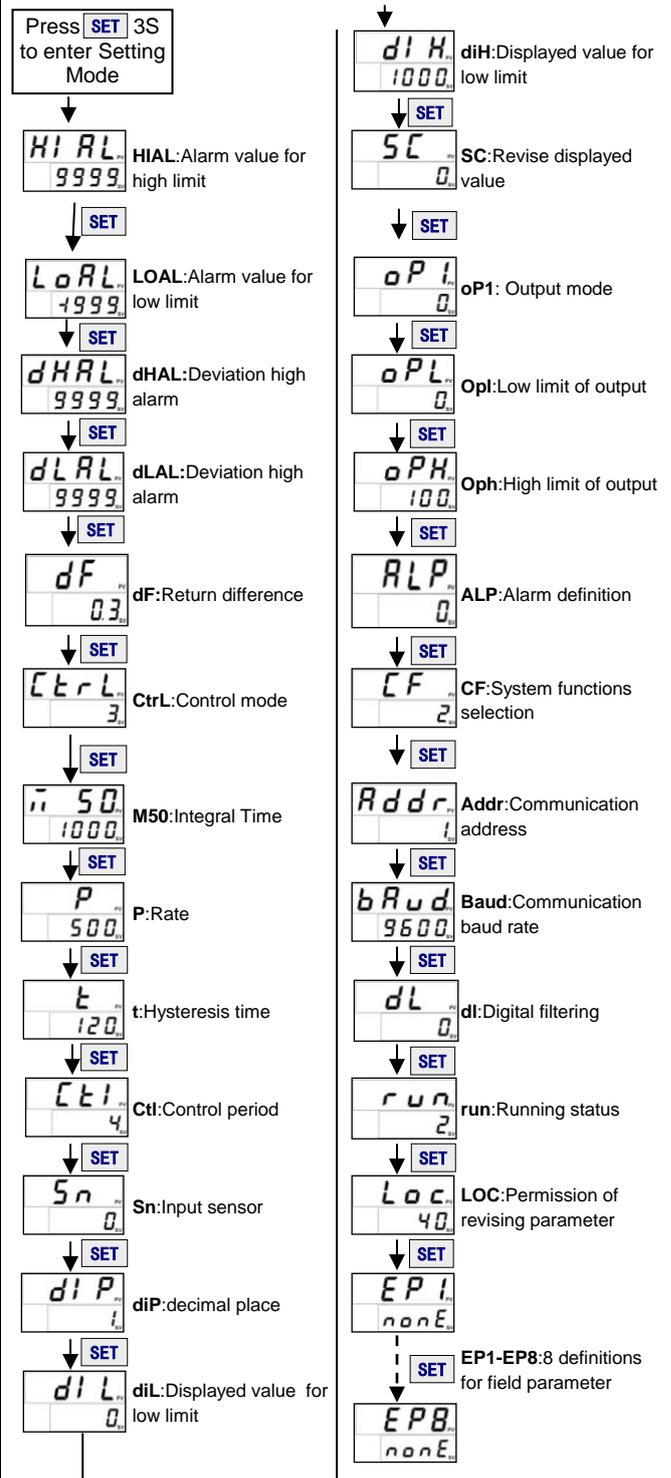**EP1-EP8**:8 definitions for field parameter

Figure 6:Workflow for setting

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6.8 Parameters related to alarm output: "HiAL, LoAL, dHAL, dLAL、 dF, ALP, CF"

6.8.1 Alarm parameters: "HiAL、LoAL、dHAL、dLAL". These parameters are for setting the alarm function of the instrument. When there is alarm condition, the system will output alarm signals to drive alarm relay to act (normally opened contact close/normally closed contact open), and alternately display the alarm reasons in the bottom screen. The alarm will be dismissed once the fault is fixed. Alarm conditions are as following:

HiAL: alarm when measured value is larger than HiAL (PV>HiAL).

LoAL: alarm when measured value is smaller than LoAL (PV＜LoAL).

dHAL: alarm when plus deviation is larger than dHAL (PV>SV+dHAL).

dLAL: alarm when minus deviation is smaller than dLAL (PV<SV-dLAL).

Generally, user don't need 4 alarms in effect at the same time. For any alarm not required, set it to the maximum value to avoid triggering it. For example, set HiAL=9999, LoAL=-1999, dHAL=9999, or dLAL=9999.

6.8.2 Defining parameter for alarm"ALP"

Table 3: defining alarm function

Alarm output	Alarm type	ALP
AL1	Upper alarm limit	0
	Lower alarm limit	0
	Deviation high alarm	0
	Deviation low alarm	0
AL2	Upper alarm limit	1
	Lower alarm limit	2
	Deviation high alarm	4
	Deviation low alarm	8

Above are part of common ALP setting. The setting range is 0 - 31.

It defines the output position of 4 alarms -- HiAL、LoAL、dHAL、dHAL. It's defined by following formula:

$ALP=A\times1+B\times2+C\times4+D\times8+E\times16$

When A=0, HiAL alarm is output by AL1;

When A=2, HiAL alarm is output by AL2;

When B=0, LoAL alarm is output by AL1;

When B=2, LoAL alarm is output by AL2;

When C=0, dHAL alarm is output by AL1;

When C=1, dHAL alarm is output by AL2;

When D=0, dHAL alarm is output by AL1;

When D=1, dHAL alarm is output by AL2;

When E=0, SV screen will display alternately the alarm symbols, enabling user to know the reasons for alarm quickly;

When E=1, SV screen won't display alternately the alarm symbols (except orAL)

Alarm for input exceed measurable range (orAL) could occur when there are improper sensor specification setting, input disconnected or short circuit. If such alarm occurred, the instrument will stop control, and keep the output value as stipulated by parameter oPL. No setting is needed for orAL.

6.8.3 Hysteresis Band (Dead Band) parameter "dF"

For avoiding alarm signals caused by input value fluctuation, and consequently malfunction, the instrument has return difference parameter dF (also called as non-sensitive zone, dead zone, or hysteresis). For example, the influence of dF parameter: assume HiAL value is 800 ℃, dF value is 2.0℃, then only when the measured temperature is larger than 802℃(HiAL+dF), the instrument enters HiAL alarm status. And only when the measured temperature is lesser than 798℃(HiAL-dF), the alarm will be dismissed.

6.8.4 Function parameter "CF"

Parameter CF is for selecting some system functions: when CF=2, it's heating control; when CF=3, it's refrigeration control.

6.9 Parameters related to input " Sn, diP, diL, diH, DL, Sc"

6.9.1 Sensor type input "Sn"

Table 4: sensor input code and measuring range

Sensor type	Input	Code	Measuring range
thermocouple	K	0	-50～1300ºC
	S	1	-50～1700ºC
	WRe	2	-0～2300ºC
	E	3	-2000～350ºC
	J	4	0～1000ºC
	T	5	0～1000ºC
	B	6	0～1800ºC
	N	7	0～1300ºC
Copper resistor	Cu50	20	-50～150ºC
Platinum resistor	Pt100	21	-200～600ºC

6.9.2 Decimal point position "diP"

Decimal position "diP" is for selecting displaying accuracy. This setting is only for display. The internal measuring accuracy is fixed to be 0.1℃.

When diP=0, it means the temperature display accuracy is 1℃.

When diP=1, 2 or 3, it means the temperature display accuracy is 0.1℃.

When the temperature display accuracy is set to be 0.1℃, while the measured temperature is lower than 1,000℃, the temperature will be displayed with accuracy 0.1℃; when the measured temperature is higher than 1,000℃, the temperature will be displayed with accuracy 1℃.

Changing diP parameter can only influence the display, there is no influence to the measuring accuracy.

6.9.3 Definition parameters "diH" and "diL" for linear input range

Linear input includes signals such as current: 0-20mV, 0-60mV; voltage: 0-1V, 0-5V; resistance: 0-80Ω, 0-400Ω. The displaying value range for the signals is -1999 - 9999 (decimal position could be set by diP). Parameters diH and diL are used to define the display range of linear input.

6.9.4 Filtering parameter "dL"

ITC-100 has in-built digital filtering system. When the displayed value is not stable due to input interference, use digital filtering to smooth it. dL=0-20, the larger the dL value, the measured value will be more stable, but respond will be more dull. When the instrument is interfered at field, gradually increase the dL value till the instant variation of measured value is within 2-5 unit. When verifying the instrument, it's a must to set dL as 0 to improve responding speed.

6.9.5 Amendment parameter "Sc"

Parameter "Sc" is for offset amendment for input to compensate the deviation of sensor or input signal. For thermocouples, if there is deviation at the cold compensation, use parameter "Sc" to amend.

For example, assume input signal is constant (500℃), and Sc value is 0.0℃, then the measured temperature is 500.0℃; while Sc value is 10.0℃, the measured temperature is 510.0℃. The default value of Sc is 0.

This parameter shouldn't be amended unless there is need to calibrate the measurement.

6.10 Parameters related to control output "oPI、oPL、oPH、CtrL"

6.10.1 Output mode parameters "oPI", "oPL" and "oPH" are used for limiting output

oPI is the mode of main output signal; oPL and oPH are the output low limit and high limit respectively.

When oPI=0, main output mode is time proportioning output (professional PID adjustment) or digital adjustment. Models with SSR, relay, and zero-crossing triggering silicon should set oPI=0.

When oPI=1, output mode is continuous output (for models with linear

current output). Output current are 0-10mA and 2-40mA.

When oPI=2, output mode is time proportioning output, and AL1 act as output synchronizing with main output. Under this mode, the AL1 of the instrument can't be used to output alarm signals as it's used as output. Only AL2 is available for alarm signals (refer to 6.8).

oPL and oPH are the output low limit and high limit. Attentions: the setting of oPI should be in accordance with the module of main output.

When oPI=1 (current output), oPL and oPH are as following:

0-10mA output: oPL=0, oPH=100

4-20mA output: oPL=40, oPH=200

Example for nonstandard output current: 2-8mA output: oPL=20, oPH=80.

oPI=0,2 (time proportioning output). Time proportioning output controls the ratio of open and close of relay (or ratio of high and low voltage output of SSR) in a fixed period to realize output variation. Time proportioning output could be regarded as a square wave, its period is equal to control period Ctl. Output value is proportional to the duty ratio of square wave, varying from 0% to 100%. Users can use oPL and oPH to limit the output range of time proportioning output. For example, to limit the output within range 20%-60%, set oPL=20, oPH=60. Generally, the default setting of time proportioning output is oPL=0, oPH=100, that is, no output limitation.
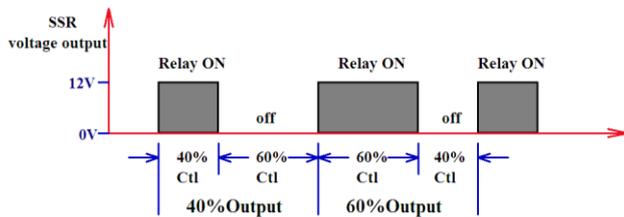
(wave when output is 40% and 60%)

Figure 7 diagram of time proportioning output

6.10.2 Adjustment mode parameter "CtrL"

ITC-100 allows digital adjustment or professional PID adjustment. Select it by CtrL parameter.

When CtrL=0, adopt digital adjustment (ON-OFF). It's only for applications where the requirements are not strict.

When CtrL=1, adopt professional PID adjustment. It's an improvement based on PID adjustment and fuzzy adjustment, suitable for various objects, and well control on fast changing objects and hysteresis. It's the default setting when product leaving factory. Under this setting, self-tuning could be launched by panel operation.

When CtrL=2, launch self-tuning. It's same operation as launching self-tuning by panel operation. If another self-tuning is needed after self-tuning, set CtrL as 2 to re-launch self-tuning.

When CtrL=3, adopt professional PID adjustment. After self-tuning, the instrument will apply such setting. Under this setting, no self-tuning is allowed from panel operation, thus to avoid maloperation to launch self-tuning.

6.11 PID control parameters related to self-tuning "M50, P, t" and functional parameter "CtL"

PID control parameters M50, P and t are the control parameters for professional PID adjusting algorithm. M50, P, and t are determined by self-tuning. This instrument adopted the latest professional PID adjustment which is a new algorithm enhanced with fuzzy logic. Following are the definition of each parameter.

6.11.1 Holding parameter "M50"

M50 defines the deviation for measured value when the object is stable, and the output value is 50% (when oPI=1, the current is 5.0mA). For example, for finding the best M50 value of a electric furnace, assume the output is keeping at 50%, the temperature of the electric furnace in stable stage is 700℃, while when the output is 0%, the temperature of electric furnace is room temperature 25℃, then M50 (optimal value) is 700-25=675℃.

M50 is mainly for adjusting the integral action of adjusting algorithm. The smaller the M50, the strong the integral action. The larger the M50, the weak the integral action (integral time will increase). But when M50=0, system will cancel integral action.

6.11.2 Rate parameter "P"

P is inversely proportional to the measurement variation when the output is 100%. It's definition is as following.

P= 100÷increased measuring value per second, the unit is ℃ or 10 defined units (when linear input). For example, when the output is 100%, no heat dissipation, and the temperature of the electric furnace increases 1℃ per second, then:

$$P=100÷1=100$$

P has influence to adjusting proportion and differential. When the P value increased, the adjusting proportion and differential action will increase proportionally; while when the P value decreased, the adjusting proportion and differential action will decrease proportionally. P has no influence to integral action. Set P=0 is equal to set P=0.5.

6.11.3 Hysteresis time "t"

For industrial control, the hysteresis effect of object system is the main factor which influences control effect. The larger the system hysteresis time, more difficult to achieve ideal control effect. Hysteresis time t is a new important parameter introduced into professional PID algorithm in comparing with PID algorithm. The instrument can conduct fuzzy logic operation according to parameter t to perfectly solve overshoot and oscillation, as well as achieve fastest respond speed. t is defined as the time needed for the electric furnace reaching 63.5% of its maximum heating rate when heating with a fixed power.

6.11.4 Function parameter "CtL"

CtL value can be set between 0.5-120 seconds (CtL value 0 is equal to 0.5 seconds). It reflects the operation speed of instrument control. For time proportioning output (triggering by SSR voltage/relay/control silicon), it represents the control period of the instrument; for linear current output, it controls the output fluctuation (time constant for digital filter to output value). If CtL is far lesser than hysteresis time t (lesser than 1/5 - 1/10), there is no difference if changing CtL. For example, when hysteresis time t is 100 seconds, then the control effect will be same no matter CtL=0.5 seconds or CtL=10 seconds.

Principle for determining CtL:

a. When under time proportioning output, and using SSR or controlled silicon as output actuator, the control period could be short (generally 4 seconds) to improve control accuracy. When using relay open and close to control output, short control period will be harm to the lifetime of mechanical switch, so the control period is generally 20 seconds.

b. When the output is linear current, small CtL value can speed up the respond against intelligent adjustment, and improve control accuracy. But the large differential action may cause frequent change of output current. If the actuator is regulating valve, and there are frequent valve actions, enlarge CtL properly to slow down the valve action till it meet the requirement.

6.12 communication parameter "Addr, bAud"

6.12.1 Parameter Addr defines the communication address of the instrument, its effective range is 0 - 63. Instruments in a same communication line should be set with different Addr to distinguish from each other.

6.12.2 Parameter bAud defines the communication baud rate, its effective range is 300 - 4800 bit/s

6.13 Field parameter "EP1 - EP8"

After setting the instrument, most parameters don't need to be amended at field. Besides, operators generally don't understand many parameters, and there is risk of fault caused by wrong setting by operators.

Generally, intelligent instrument has parameter lock (Loc) function. Common parameter lock will lock all the parameters. Sometimes, certain parameters need to be amended or adjusted at field by the operators. For example, parameters such as alarm high limit or alarm low limit. In parameter table, EP1 - EP 8 are 8 field parameters for operators. The value of parameter EP is other parameters, such as HiAL and LoAL. When Loc=0 or 1, selected parameters will be displayed, other parameters won't be displayed and amended. This function can speed up the amendment, and avoid important parameters (such as input and output parameters) been amended incorrectly.

There are maximum 8 field parameters available for parameter EP1- EP2. If field parameters are less than 8 (sometime none), they should be defined orderly from EP1 to EP8. Vacant field parameters are defined as nonE.

6.14 Permission for parameters "Loc"

Protection function Loc: when Loc is set as value except 2, 40, 808, the instrument only display the filed parameters (EP1 - EP8) and Loc. Only if set Loc as 2, 40 or 808, all the parameters can be amended.

When Loc=0, field parameters (EP1 - EP8)and temperature setting value can be amended.

When Loc=1, field parameters can't be amended (except Loc).

When Loc=2, 40 or 808, all the parameters and temperature setting value can be amended.

6.15 Common faults and handling methods

Table 5:Error and handling

Faults	Reasons	Handling methods
PV and SV screen not work	Wrong input voltage	Check whether the input voltage is in accordance with the specification of the instrument
	Power cable is not well connected	Check whether the power cable is bad or wrongly connected
	Instrument fault	Contact manufacturer or dealer
orAL displayed on the instrument	Sensor fault	Check whether sensor is connected correctly
	Wrong graduation mark selected	Select correct graduation mark in accordance with input signal
	Wrong connection for sensors	Connect signal cable correctly
Wrong measured value	Wrong graduation mark selected	Select correct graduation mark in accordance with input signal
	Wrong connection for sensors	Connect signal cable correctly
Malfunction of relay	Wrong setting for control output	Refer to the alarm instruction in the user manual to selected required alarm mode
No control output	Wrong wiring for control output	Connect control output cable correctly

7. Wiring instruction

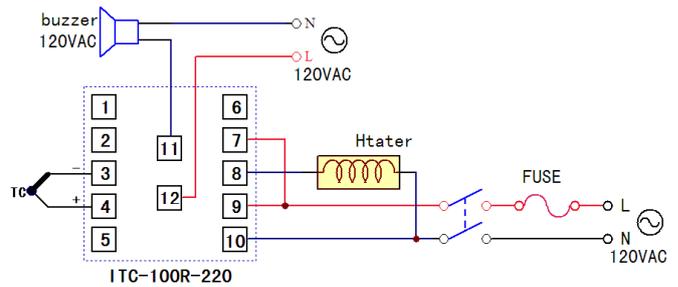### 7.1 Directly control load by the internal relay of the instrument.

Figure 8:ITC-100RH Wiring diagram

Control the heater by the internal relay of the instrument, no external control circuit is needed. This mode is only applicable for heater whose maximum load is 250V/3A or 120V/6A.

The internal control of alarm is relay output control which controls the power supply of the speaker. User can use bulb to replace with the speaker as alarm.

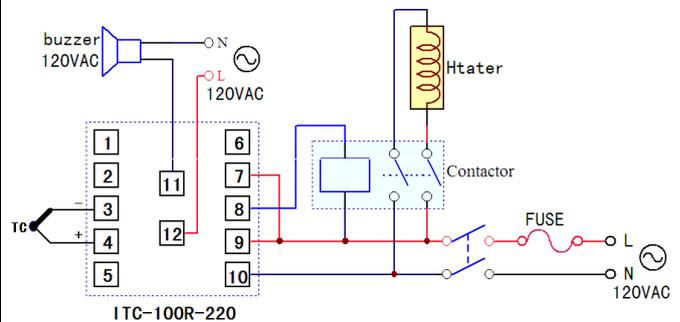### 7.2 Control the load via external contactor

Figure 9:ITC-100RH Wiring diagram

Instrument control output via external relay or contactor. With this method, the user can select external relay or contactor based on the power of heater, avoid output limitation of the internal relay of the instrument, and improve the lifetime of the instrument.

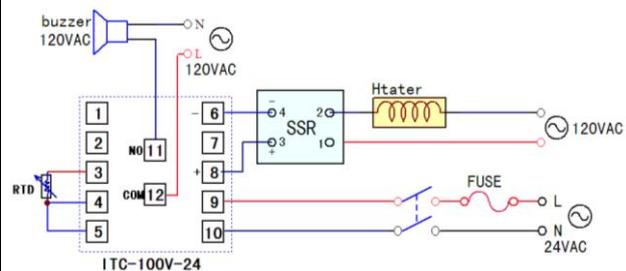### 7.3 SSR control

Figure 10:ITC-100VH Wiring diagram

ITC-100VH's output control signal is DC12V voltage for controlling external SSR to control the heater. User can select SSR based on the power of the heater. SSR is a kind of electronic switch without contactor, which can be used for higher frequency control than relay, featuring more stable temperature control for heater and long lifetime.
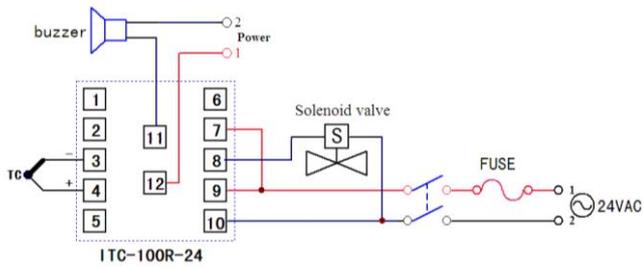
7.4 Solenoid valve or relay control

Figure 11:ITC-100RL Wiring diagram

ITC-100RL is generally used for low voltage devices. It's a must to pay attention to whether the power supply voltage and alarm voltage is within the stipulated range when wiring.

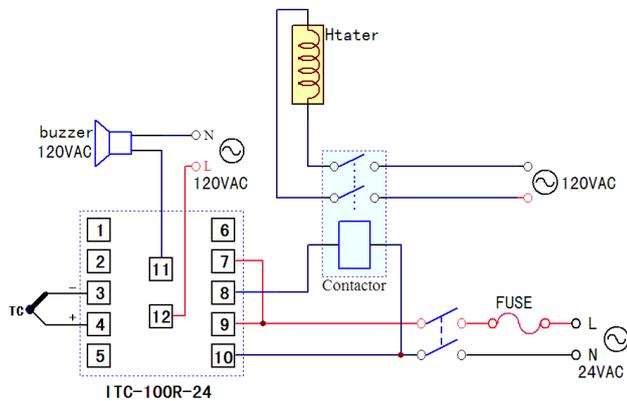## 7.5 Control load via external contactor (24V)

Figure 12:ITC-100RL Wiring diagram

ITC-100RL's control mode is the same as figure 9. Please note that the power supply for heater is high voltage(120VAC), the power supply for instrument is 24VAC (low voltage).

8. Field application example

For example, the application of instrument for oven. Following example is based on ITC-100RH and ITC-100VH, the required temperature is 150 ºC, and the high limit is 160ºC.
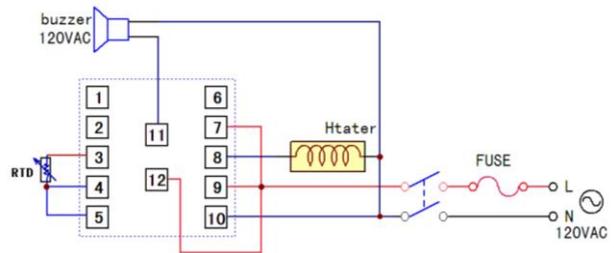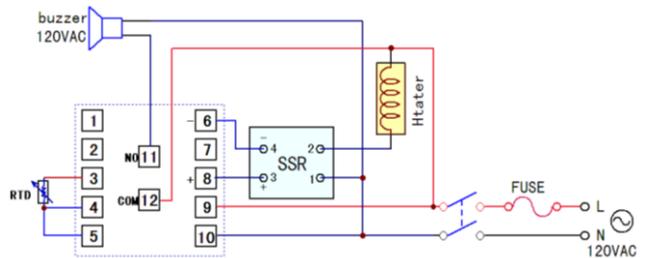

Figure 13:ITC-100RH Wiring diagram

Figure 14:ITC-100VH Wiring diagram

Wiring steps:

1. Connect sensor: the sensor in figure 13 and 14 are both three lines RTD sensors. Their connection method are the same. Red wire is for COM3, other two blue wires are for COM4 and COM5 (two blue wires can exchange COM port with each other).

2. Connect alarm: ITC-100RH and ITC-100VH's alarm control output are the same. COM12 is the power input port for alarm, which should connect with phase line (L). COM11 is alarm control output port, which should connect with alarm. The other line of the alarm should connect with the null line.

3. Connect heating tube: ITC-100RH controls heating tube by its internal relay. COM7 of the instrument connect with the power input port, which should connect with phase line (L). COM8 is the control output port, which should connect directly with the heating tube. The other wire of the heating tube should connect with null line (N); TC-100VH output DC12V voltage as control signal, driving SSR to control heating tube. COM8 of the instrument output positive voltage, which should connect with SSR's positive pole; COM6 of the instrument output negative voltage, which should connect with SSR's negative pole. The polarity should not be inversely connected.

4. Connect power supply: the power supply port of the instrument are COM9 and COM10, which are for the phase line and null line respectively. A dual linked switch should be connected in front of power supply, and connect fuse in phase line(L). The wire used must be able to bear the load current, otherwise, there will be risk of accidents such as fire

For simple users, no need to master all instructions, as long as the parameters of the following parameters in the process to set up to get the ideal control effect, set up flow chart as below:

INKBIRD

Power On

Initial display — 1312 ℃ orAL ⟫ 25.8 ℃ 150.0 — Setting target temperature SV=150

SET

Setting Alarm value for high limit — HI AL 9999 — Setting HIRL=160, more setting of alarms, please check 6.8.1

SET — *if don't need to set this parameter, press SET key to run into next setting.

Setting Control mode — CtrL 3 — Keep the Default value

SET

Setting Input sensor value — Sn 0 — Sn=20 (CU=20, more detail please check 6.9.1)

SET

Setting Revise displayed value — SC 0 — Keep the Default value

SET

Setting Alarm definition — ALP 0 — Keep the Default value

SET

Setting System functions selection — CF 2 — Keep the Default value. 2:Heater, 3:Cooler

SET

Setting Permission of revising parameter — Loc 40 — Keep the Default value
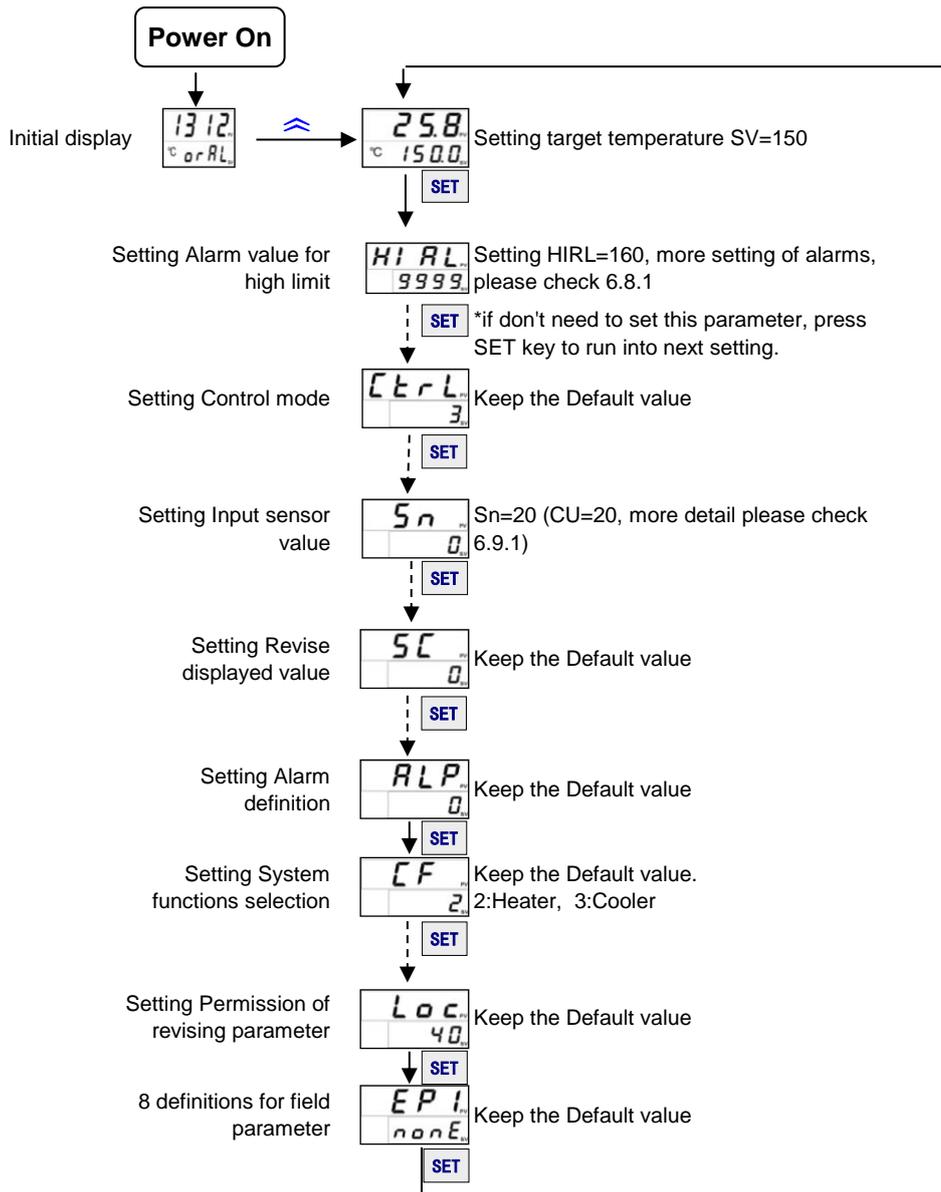
SET

8 definitions for field parameter — EP1 nonE — Keep the Default value

SET

Figure 15:Workflow of sample