Digital Display PID Temperature Controller

TC4/TC5 Series

Manual Instructions

Pls read the following safety considerations before use

Safety Considerations

※Please observe all safety considerations for safe and proper product operations to avoid hazards.

※Safety considerations are categorized as follows.

⚠Warning Failure to follow these instructions may result in serious injury or death.

⚠Caution Failure to follow these instructions may result in personal injury or product damage.

⚠Warning

1. **Fail-safe device must be installed when using the unit with machinery that may cause serious injury or substantial economic loss.(e.g.nuclear power control, medical equipment,ships,vehicles,railways, aircraft,combustion apparatus,safety equipment,crime/disaster prevention devices,etc.)**
   Failure to follow this instruction may result in personal injury,fire,or economic loss.
2. **The unit must be installed on a device panel before use.**
   Failure to follow this instruction may result in electric shock.
3. **Do not connect,repair,or inspect the unit while connected to a power source.**
   Failure to follow this instruction may result in electric shock.
4. **Check the terminal numbers before connecting the power source.**
   Failure to follow this instruction may result in fire.
5. **Do not disassemble or modify the unit.Please contact us if necessary.**
   Failure to follow this instruction may result in electric shock or fire.

⚠Caution

1. **Do not use the unit outdoore**
   Failure to follow this instruction may result in shorten the life cycle of the unit,or electric shock.
2. **When connecting the power input and relay output cables,use AWG20(0,50mm²)cables and make sure to tighten the terminal screw bolt above 0.74N.m to 0.90N.m.**
   Failure to follow this instruction may result in fire due to contact failure.
3. **Use the unit within the rated specifications.**
   Failure to follow this instruction may result in shorten the life cycle of the unit or fire.
4. **Do not use loads beyond the rated switching capacity of the relay contact.**
   Failure to follow this instruction may result in insulation failure,contact melt,contact failure,relay broken or fire.
5. **Do not use water or oil-based detergent when cleaning the unit.Use dry cloth to clean the unit.**
   Failure to follow this instruction may result in electric shock or fire.
6. **Do not use the unit where flammable or explosive gas,humidity,direct sunlight,radiant heat, vibrationorimpact may be present.**
   Failure to follow this instruction may result in fire or explosion.
7. **Keep dust and wire residue from flowing into the unit.**
   Failure to follow this instruction may result in fire or product damage.
8. **Check the polarity of the measurement input contact before wiring the temperature sensor.**
   Failure to follow this instruction may result in fire or explosion.
9. **For installing the unit with reinforced insulation,use the power supply unit which basic level is ensured.**

Model composition

TC □-□-□ □ □-□-□

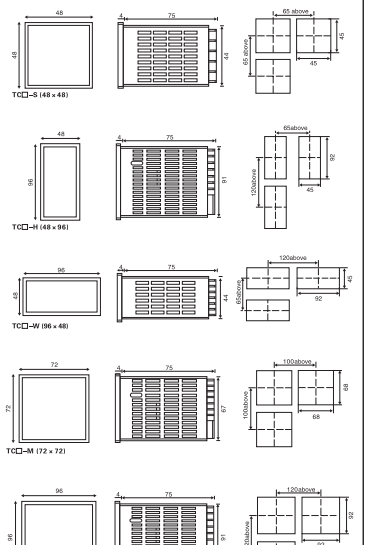
Item		
Product type	4	4-digit dual row LED display (red+green)
	5	4-digit dual row LED display (white+green)
Size	W	W48XH48mm
	H	W48XH96mm
	W	W96XH48mm
	M	W72XH72mm
	L	W96xH96mm
Output specification	S	W48XH48mm
	1U	Voltage controlled outputut
	2U	Temperature variable voltage output
	1A	Current controlled output
	2A	Temperature variable current output
	T	SCR zero-crossing output
	P	SCR phase shift output
Alarm output	0	No alarm
	1	One alarm
	2	Two alarms
Input specification	G	TC(K E J N T S R B) RTD(Pt100 Cu50) mA(0-20mA 4-20mA) V(0-5V 1-5V)
Power supply	2	100-240VAC
	4	24VDC
com. output	Blank	NO Communication
	C	RS485 Communication output(Modbus RTU method)
Item	TC	Temperature controllers

Specifications

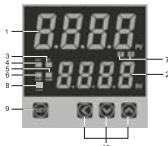
Power supply		①:100-240VAC ②:24VDC
Allowable voltage range		90-110% of rated voltage
Power consumption		Max.8VA
Input specification	TC	K E J N T S R B
	RTD	Pt100 Cu50
	Linear current	0-20mA 4-20mA
	Linear voltage	0-5V 1-5V
Display accuracy		±0.5%
Output specification		Relay contact output 250VAC 5A 1NO1NC
		SSR 12VDC ±2V below 20mA
		Voltage output(control output / variable output)
		Current output(control output / variable output)
		Output (zero-crossing output / phase shift output)
Option output	Alarm output	Relay 250VAC 5A Max,two sets of alarm outputs
	Com. output	RS485 Communication output(Modbus RTU method)
Control method		ON/OFF position control、PID control
Sampling period		100ms
Relay life cycle		Mechanical above 2.5 million times, Electrical above 100000 times
Dielectric strength		2000VAC 50/60Hz for 1min,(between all terminals and case)
Vibration		0.75mm amplitude at frequency 5 to 55HZ(for1min,) in each X,Y,Z direction for 2 hours
Insulation resistance		100MΩ 以上 (500VDC) MEGA
Noise resistance		Square shaped noise by noise simulator(pulse width 1 u s) 2kV R-phase,S-phase
Memory retention		Approx.10years(non-volatile semiconductor memory type)
Environment	Ambient temp.	-5~40C storage:-10~60C
	Ambient humi.	35%~85%RH storage:35~85%RH

Dimensions

Unit:mm



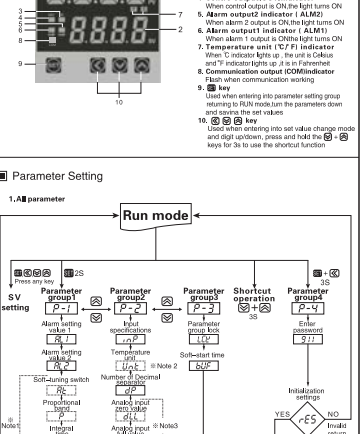
Parts description



1. **Present value (PV) display**
   1) RUN mode: Present value(PV) display
   2) Parameter setting mode:Parameter display
2. **Set value(SV) display**
   1) RUN mode: Set value (SV) display
   2) Parameter setting mode:Parameter setting value display
3. **Auto tuning(AT) indicator**
   Flash when the auto-tuning function working
4. **Control output(OUT)indicator**
   When control output is ON,the light turns ON
5. **Alarm output2 indicator (ALM2)**
   When alarm 2 output is ON,the light turns ON
6. **Alarm output1 indicator (ALM1)**
   When alarm 1 output is ON the light turns ON
7. **Temperature unit (℃/ F) indicator**
   When ℃ indicator lights up , the unit is Celsius and ℉ indicator lights up ,it is in Fahrenheit
8. **Communication output (COM)indicator**
   Flash when communication working
9. **SET key**
   Used when entering into parameter setting group returning to RUN mode,turn the parameters down and saving the set values
10. **◁ ▷ ▽ △ key**
    Used when entering into set value change mode and digit up/down, press and hold the ▽ - △ keys for 3s to use the shortcut function

Parameter Setting

1.All parameter



※ In the parameter setting mode, if no key is pressed within 30s, it wil automatically return to the RUN mode and the changed parameters will not be saved.

※ In each parameter group, press ▽ once to save the set value and go to the next parameter.

※ In each parameter group, press SET for 3s to save the set value and return to the RUN mode. (In SV setting, press ▽ only once)

※ The parameters marked by [ ] may not be displayed depending on the model or other parameter settings

※ When the[ιnP][U_nit], and [dP]parameters are changed,[SLL][SLH][$RH1$][$RH2$]in "Parameter group 2" ,[$AL1$][$AL2$][EC] in "Parameter group 1" and the "SVsetting value" parameter all will be initialized.

※ Set parameter as "parameter group 2" → "parameter group 1" → "SV setting" order considering parameter relation of each setting group.

※ After Factory reset: **1.All** parameters will be restored to factory defaults (except for [bUF] in"Parameter Group 3" and [oUt] in "Parameter Group 2"). 2. The default input specification is "Ordering"Requirement Value". 3. Restore the SV setting to "100".

2.Parameter group2[$P-2$]

Setting item	Parameter	Range	Factory default	Description
Input specification	ιnP	See table ofinput specifications and using range		
Temperature unit	U_nit	℃ or ℉	℃	Set temperature units (℃ or ℉)
Decimal places	dP	0 ~ 1	0	Decimal places
Analog input zero value	dLL	-999 ~ 9999	40	For example, when the input is 4~20mA,show display value of 4mA
Analog input full value	dLH	-999 ~ 9999	200	For example, when the input is 4~20mA,show display value of 20mA
Lower limit of SV	SLL	The minimum lower limit of the corresponding sensor type		Limit the lower limit of SV
Stipper limit of SV	SLH	The maximum upper limit of the corresponding sensor type		Limit the upper limit of SV
Output Specification	oUt	RLY or SSR	RLY	Output specification selection,RLY for relay output, SSR for SSR output
Control Method	Pcd	ON or OFF	ON	Control method selection,ON is PID control,OFF is ON/ OFF position control.
Alarm Type1	$Rt1$	00 ~ 16	01	12 kinds of alarm types selection,see the alarm type for details.
Alarm Return Difference 1	$RH1$	0~100	1	The difference required to return to the non-alarm state in the first set of alarm states
Alarm Type2	$Rt2$	00~16	00	12 kinds of alarm types selection,see the alarm type for details.
Alarm Return Difference 2	$RH2$	0~100	1	The difference required to return to the non-alarm state in the second set of alarm states
Heating/cooling Selection	HC	HET or COL	HET	HET is heating mode,COL is cooling mode.
Digital Filter	FiL	0~200	200	Unit is second, input sampling value filtering period

※Input specifications and usage range table

Input Specification	Display	Decimalplaces	Range of use (℃)	Range of use (℉)
Therm-ocouple K	K	0	-30 ~ 1300	-22 ~ 2372
		1	-30.0 ~ 999.9	-22.0 ~ 999.9
Therm-ocouple E	E	0	-30 ~ 700	-22 ~ 1292
		1	-30.0 ~ 700.0	-22.0 ~ 999.9
Therm-ocouple J	J	0	-30 ~ 900	-22 ~ 1652
		1	-30.0 ~ 900.0	-22.0 ~ 999.9
Therm-ocouple N	n	0	-30 ~ 1000	-22 ~ 1832
		1	-30.0 ~ 999.0	-22.0 ~ 999.9
Therm-ocouple T	t	0	-30 ~ 400	-22 ~ 752
		1	-30.0 ~ 400.0	-22.0 ~ 752.0
Therm-ocouple S	S	0	0 ~ 1760	32 ~ 3200
		1	0 ~ 999.0	32.0 ~ 999.9
Therm-ocouple R	r	0	0 ~ 1750	32 ~ 3182
		1	0 ~ 999.0	32.0 ~ 999.9
Therm-ocouple B	b	0	200 ~ 1800	392 ~ 3272
		1	200.0 ~ 999.0	392.0 ~ 999.9
Thermal resistance Pt100	Pt	0	-200 ~ 650	-328 ~ 1202
		1	-99.0 ~ 650.0	-99.9 ~ 999.9
Thermal resistance Cu50	Cu	0	-50 ~ 150	-58 ~ 302
		1	-50.0 ~ 150.0	-58.0 ~ 302.0

3.Parameter group 1[$P-1$]

Setting item	Parameter	Range	Factory default	Description
Alarm setting value1	$AL1$	The whole range	10	Set alarm1 data.
Alarm setting value2	$AL2$	The whole range	10	Set alarm2 data.
Auto-tuning switch	At	ON or OFF	OFF	ON open auto- tuning OFF close auto- tuning.
Proportional band	P	0.1 ~ 999.9	30.0	Proportional band of PID control, the unit is Celsiusmeaning no auto- tuning.
Integral time	I	0 ~ 9999	240	Integral time of PID control,the unit is second, recommended by auto- tuning.
Derivative time	d	0 ~ 9999	60	Derivative time of PID control,the unit is second, recommended by auto- tuning.
Control cycle	t	1 ~ 100	3 or 20	PID output control cycle , the recommend relay outputis 20 seconds and the SSR outpu is 2 seconds
Suppression of the overshoot	Ar	1 ~ 100	100	Used to suppress PID control overshoot,auxiliary control, recommered by auto- tuning
Bit return control	oH	1 ~ 999	2	Set the interval between on and off for control(this parameter is displayed only in bit control)
Bit return control	oFH	1 ~ 999	0	Overtime:PV<SV-OH opens output PV>SV-OHF Turn off output
Error correction	EC	-99~999	0	Error correction of display temperature

4.,Parameter group 3[$P-3$]

Setting item	Parameter	Range	Factory default	Description
Parameter group lock	LCk	0 1 2 3 4	0	0 Unlok 1 Lock parameter group3 2 Lock parameter group3,parameter group2 3 Lock parameter group3,parameter group2, parameter group1 4 Lock parameter group3,parameter group2, parameter group1,SV setting
Soft-start perchtage	bUF	0~100%	100	
Soft-star ttime	bUt			

5.SV setting

You can set the temperature to control with ▷, ▽, △, ◁ key.
Ex) In case of changing set temperature from 240Cto 250C

Press any key among ▷, ▽, △, ◁ keyin RUN mode, the right digit as SV display flashes and it enters to SV setting group.

Press ▷ key to move the desired digit.

Press ▽ or △ key to move the desired number.

Press ◁ key to save the value and it controls with this set value.

6.Shortcut operation

Press and hold the ▽+△ work for 3s to work the shortcut function.

※The specific function depends on the shortcut function type [USb]in"Parameter group 3".

※Factory default : RELAY/SSR switching.

※This function is not affected by the parameter group lock [LCk].

Shortcut Key Parameters	Display		Description
OFF	/		No shortcut function.
AT	At on	At oFF	For auto-tuning work/stop, same function as Auto-tuning[At]in"Parameter group 1"ON for work,OFF for stop.
AL	AL on	AL oFF	The user can force the alarm to be released when it is alarm.ON is not released,OFF is released, When the alarm range is exceeded, this function is reset.
OUT	oUt rLY	oUt SSr	For changing output specifications, same function as output specification [oUt]in"Parameter group 2".RLY for relay output,SSR for SSR output

7.Restore factory settings

Press and hold SET ◁ at the same time for 3s and then enter into "Parameter group 4" and enter the password 911, which will enter into the parameter reset [rES]. Select"no"and previous settings are maintained. Select"yES"and all parameters resume to default setting.

※[bUF] in "parameter group 3" and [oUt] in "parameter group 2" will not be restored.

Functions

1.Auto tuning[At]

PID auto- tuning measures the control subject's thermal characteristics and thermal response rate, and then determines the necessary PID time constant.And through this function,automic setting of parameters can be realized to achieve high-speed and stable control.

※During auto tuning, the heating system should be in working condition, the measured value PV is lower than the set value SV.

※When the control mode [Pcd] parameter is in the"on"state, the Self-tuning switch [At] will be displayed.

※Set the auto- tuning switch[At]in state of"on". AT indicator light starts flashing to indicate that it has entered the auto- tuning state.

※During auto tuning process,all parameter groups and SV settings will be locked. if manual interruption of auto- tuning , the auto- tuning switch[At]should be set to"oFF".

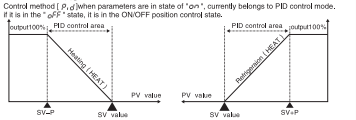
※During auto- tuning process, it will be automatically interrupted if there are failures code "$HHHH$" or "LLLL".

※When finish auto tuning , AT indicator light stop flashing, the resulting parameters P、I、d、Ar are automatically saved, then return to new control state as new parameters P、I、d、Ar and other parameters continue to run.

※Any interruption of auto tuning, the parameters P、I、d、Ar and other parameters will not be modified.

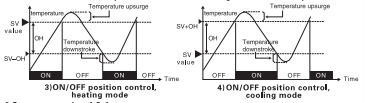
2.Control method[Pcd]

Control method [Pcd]when parameters are in state of "on ", currently belongs to PID control mode. If it is in the "oFF " state, it is in the ON/OFF position control state.



1)PID control The larger the measured value of the heating mode, the smaller the OUT output

2) PID control The larger the measured value of the control refrigeration mode, the greater the OUT output



3)ON/OFF position control, heating mode

4) ON/OFF position control, cooling mode

3.Suppress overshoot[Ar]

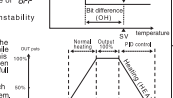
When used for PID control, overshoot suppression is adjusted. The larger the set value, the faster the heating, and it is easy to overshoot. The smaller the set value, the slower the heating and less prone to overshoot. The factory default is 60. It is recommended that the set value be obtained by PID Self-tuning.

4.Position controlreturn difference[bH]

Set the interval between ON and OFF for controlling output in ON/OFF position control.

※Control method [Pcd]when parameters are in state of "oFF " , bit difference [oH] will be displayed.

※If the hysteresis is too small, control output instability may occur due to externalinterference,etc.



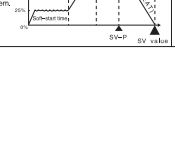
5.Soft-start time[bUF]

When a heating system is first put into operation, the present value (PV) is well below the set value (SV) while the OUT output reaches 100%.In some industries this can seriously threaten the life of the heating system when the system often goes from a low temperature state to full power instantaneously.

The Soft-start time range limits the output to 25%, which acts as a buffer and extends the life of the heating system.

※The time unit is s.

※Acts only on analog outputs or phase shifted outputs



6.Error correction [EC]

Controller itself does not have errors but there may be error by external input temperature sensor. This function is for correcting this error. if actual temperature is 80℃ but controller displays 78C.set input correction value [EC] as "002"and controller displays 80℃.

※Setting range-99~999C

※As the result of error correction, if current temperature value(PV) is over the limit range ,it displays "$HHHH$" or " LLLL ".

7.Digital filtering[FiL]

The present value (PV) may change repeatedly due to unstable input signal or external interference. which may present accurate control. in this case, the dicital filtering function can be used to stabilize the present value (PV) and achieve accurate control.

※When using this function, it is normal that the present value (PV) may deviate from the actual input value

8.Alarm type1[$Rt1$]

Set value	Alarm	Positive alarm value(AL1)	Negative alarm value(-AL1)	Deviation alarm/ absolute value alarm
0	No alarm function	No output		
1	Upper limit Deviation	AL1 ON SV	AL1 ON ON SV	Deviation alarm
2	Lower limit Deviation	AL1 ON SV	AL1 ON ON SV	Deviation alarm
3	interval alarm	AL1 AL1 ON ON SV		Always OFF
4	Off-range alarm	AL1 AL1 ON ON SV		Always ON
5	Absolute upper limit	AL1 ON ON 0		Absolute value alarm
6	Absolute lower limit	AL1 ON ON 0	AL1 ON ON 0	Absolute value alarm
10	No alarm function	No output		
11	Upper limit deviation of standby	AL1 ON SV	AL1 ON ON SV	Deviation alarm
12	Lower limit deviation of standby	AL1 ON SV	AL1 ON ON SV	Deviation alarm
13	Alarm within standby	AL1 AL1 ON ON SV		Always OFF
14	Alarm outside standby	AL1 AL1 ON ON SV		Always ON
15	Absolute upper limit of standby	AL1 ON ON 0	AL1 ON ON 0	Absolute value alarm
16	Absolute lower limit of standby	AL1 ON ON 0	AL1 ON ON 0	Absolute value alarm

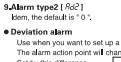
9.Alarm type2[$Rt2$]

Idem, the default is " 0 ".

● **Deviation alarm**

Use when you want to set up a temperature to produce a linkage.
The alarm action point will change with the change of setting temperature

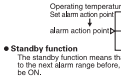
Set by this difference



● **Absolute value alarm**

No need to use linkage with setting temperature

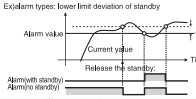
Operating temperature(absolute value)
Set alarm action point



● **Standby function**

The standby function means that start from the present value is out of the alarm range, and to the next alarm range before, even if the alarm ON condition is reached, the alarm will not be ON.

Ex)alarm types: lower limit deviation of standby



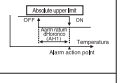
10.Alarm return difference[$RH1$]

It is used to return to the difference of non-alarm state under the alarm state.

For example, the alarm action is 120℃ in total, and set the alarm. return difference is 20℃,it is the alarm state when the temperature reaches above 120 C, and it is the non-alarm state when the temperature falls below 100 C.

※ Set range0~100C.

※ The factory default:1℃



11.Alarm return difference[$RH2$]

Idem, the default is"1"

Error

Display	Description	Troubleshooting
HHHH	Input broken or out of input range	Pls check if the input signal is wrong
LLLL	Input broken or out of input range	Pls check if the input signal is wrong

Precautions

1.To eliminate inductive interference, please separate the wiring of this product from the high-voltage and power lines.
2.When powering on or off the product, please use a power switch or circuit breaker.
3.Try to stay away from high-frequency equipment (high-frequencywelding machines,high -frequency sewing machines, large capacity SCR controllers) as much as possible.
4.This product is used in the following environments.
①Indoor ②Pollution level③Altitude below2000m ④Installation Classification Ⅱ
※If the above precautions are violated, it may cause product malfunction, please be sure to comply.

V23.7