

DUAL INDICATOR TEMPERATURE CONTROLLER

TS4 SERIES

INSTRUCTION MANUAL



Thank you for choosing our product.
Please read the following safety considerations before use.

Safety Considerations

- ⚠ Please observe all safety considerations for safe and proper product operation 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.
- ⚠ The symbols used on the product and instruction manual represent the following
- ⚠ symbol represents caution due to special circumstances in which hazards may occur.

Warning

- 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 fire, personal injury, or economic loss.
- Install on a device panel to use.**
Failure to follow this instruction may result in electric shock or fire.
- Do not connect, repair, or inspect the unit while connected to a power source.**
Failure to follow this instruction may result in electric shock or fire.
- Check 'Connections' before wiring.**
Failure to follow this instruction may result in fire.
- Do not disassemble or modify the unit.**
Failure to follow this instruction may result in electric shock or fire.

Caution

- When connecting the power input and relay output, use AWG 20(0.50mm²) cable or over and tighten the terminal screw with a tightening torque of 0.74-0.90N·m.**
When connecting the sensor input and communication cable without dedicated cable, use AWG 28-16 cable and tighten the terminal screw with a tightening torque of 0.74-0.90N·m.
Failure to follow this instruction may result in fire or malfunction due to contact failure.
- Use the unit within the rated specifications**
Failure to follow this instruction may result in fire or product damage.
- Use dry cloth to clean the unit, and do not use water or organic solvent.**
Failure to follow this instruction may result in electric shock or fire.
- Do not use the unit in the place where flammable/explosive/corrosive gas, humid, direct sunlight, radiant heat, vibration, impact, or salinity may be present.**
Failure to follow this instruction may result in fire or explosion.
- Keep metal chip, dust, and wire residue from flowing into the unit**
Failure to follow this instruction may result in fire or product damage.

Ordering Information

T	S	4	M	-2	4	R	-P
Wiring method							
Control output							
Power supply							
Sub output							
Size							
Digit							
Setting type							
Item							
No-mark	Bolt wiring method						
P	Connector plug connection method ^{※1}						
R	Relay contact + SSR drive output ^{※2}						
2	24VAC 50/60Hz, 24-48VDC						
4	100-240VAC 50/60Hz						
M	DIN W48 × H48mm						
C	DIN W72 × H72mm						
H	DIN W48 × H96mm						
B	DIN W96 × H96mm						
4	9999 (4 digit)						
S	Dual display type, set by touch switch						
T	Temperature controller						

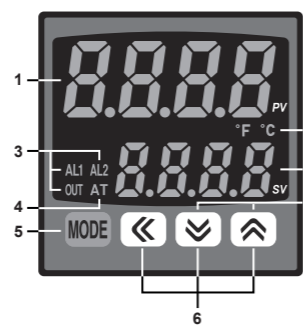
- ※1: Only for TS4-M model.
 ※2: In case of the AC voltage model, SSR drive output method (standard ON/OFF control, cycle control, phase control) is available to select.
 ※The above specifications are subject to change and some models may be discontinued without notice.
 ※Be sure to follow cautions written in the instruction manual and the technical descriptions (catalog, homepage).

Specificatio

Series	TS4-M	TS4-C	TS4-H	TS4-B
Power supply	AC Power 100-240VAC~ 50/60Hz	AC/DC Power 24VAC~ 50/60Hz, 24-48VDC=		
Allowable voltage range	90 to 110% of rated voltage			
Power consumption	AC Power Max. 5VA(100-240VAC 50/60Hz)	AC/DC Power Max. 5V(24VAC 50/60Hz), Max. 3W(24-48VDC)		
Display method	7 segment (PV: red, SV: green), other display part(green, red) LED method			
Character size	PV(W×H) 7.0×15.0mm	9.5×20.0mm	7.0×14.6mm	11.0×22.0mm
Input type	RTD	DIN Pt100Ω, Cu50Ω (Allowable line resistance max.5Ω per a wire)		
Display accuracy	TC	K(CA), J(IC), L(IC), T(CC), R(PR), S(PR)		
Control output	Relay 250VAC~ 3A 1a	SSR 12VDC±2V 20mA Max.		
Alarm output	AL1, AL2 Relay: 250VAC~ 1A 1a			
Control method	ON/OFF control, P, PI, PD, PID control			
Hysteresis	1 to 100°C/°F (0.1 to 50.0°C/°F)			
Proportional band(P)	0.1 to 999.9°C/°F			
Integral time(I)	0 to 9999 sec.			
Derivative time(D)	0 to 9999 sec.			
Control period(T)	0.5 to 120.0 sec.			
Manual reset	0.0 to 100.0%			
Sampling period	100ms			
Dielectric strength	AC power 2000VAC 50/60Hz 1min.(between input terminal and power terminal)	AC/DC power 1000VAC 50/60Hz 1min.(between input terminal and power terminal)		
Vibration	0.75mm amplitude at frequency of 5 to 55Hz in each X, Y, Z direction for 2 hours			
Relay life cycle	Mechanical	OUT: Over 5,000,000 times, AL1/2: Over 5,000,000 times		
Insulation resistance	Electrical	OUT: Over 200,000 times(250VAC 3A resistive load) AL1/2: Over 300,000 times(250VAC 1A resistive load)		
Noise	Square-wave noise by noise simulator(pulse width 1μs) ±2KV R-phase and S-phase			
Memory retention	Approx. 10 years (when using non-volatile semiconductor memory type)			
Environ-ment	Ambient temp.	-10 to 50°C, Storage: -20 to 60°C		
Ambient humi.	35 to 85%RH, Storage: 35 to 85%RH			
Insulation type	Double insulation or reinforced insulation (mark: □, dielectric strength between the measuring input part and the power part : AC power 2kV, AC/DC power 1kV)			
Approval	CE			
Weight	Approx. 147g (approx. 100g)	Approx. 203g (approx. 133g)	Approx. 194g (approx. 124g)	Approx. 275g (approx. 179g)

- ※1: ○ At room temperature(23°C±5°C)
 - Below 200°C of thermocouple R(PR), S(PR) is (PV ±0.5% or ±1°C, select the higher one) ±1 digit
 - Over 200°C of thermocouple R(PR), S(PR) is (PV ±0.5% or ±2°C, select the higher one) ±1 digit
 - Thermocouple L (IC), RTD Cu50Ω is (PV ±0.5% or ±2°C, select the higher one) ±1 digit
 ○ Out of room temperature range
 - Below 200°C of thermocouple R(PR), S(PR) is (PV ±1.0% or ±6°C, select the higher one) ±1 digit
 - Over 200°C of thermocouple R(PR), S(PR) is (PV ±0.5% or ±5°C, select the higher one) ±1 digit
 - Thermocouple L(IC), RTD Cu50Ω is (PV ±0.5% or ±3°C, select the higher one) ±1 digit
 For TS4M-□-P, add ±1°C by accuracy standard.
 ※2: The weight includes packaging. The weight in parentheses is for unit only.
 ※ Environment resistance is rated at no freezing or condensation.

Unit Description



- Present temperature (PV) display (Red)**
1) RUN mode: Present temperature (PV) display
2) Parameter setting mode: Parameter display
- Set temperature (SV) display (Green)**
1) RUN mode: Set temperature (SV) display
2) Parameter setting mode : Parameter setting value display
- Control/Alarm output display indicator**
1) OUT: It turns ON when the control output is ON.
During SSR drive output type in CYCLE/ PHASE control, this indicator turns ON when MV is over 3.0%.
2) AL1/AL2: It turns ON when the alarm output is ON.
- Auto tuning indicator**
AT indicator flashes by every 1 sec during operating auto tuning.
- MODE key**
Used when entering into parameter groups, returning to RUN mode, moving parameter, and saving setting values.

Adjustment

Used when entering into set value change mode, digit moving and digit up/down.

Digital input key

Press \leftarrow and \rightarrow keys for 3 sec. to operate the set function (RUN/STOP, alarm output reset, auto tuning) in digital input key [di - t].

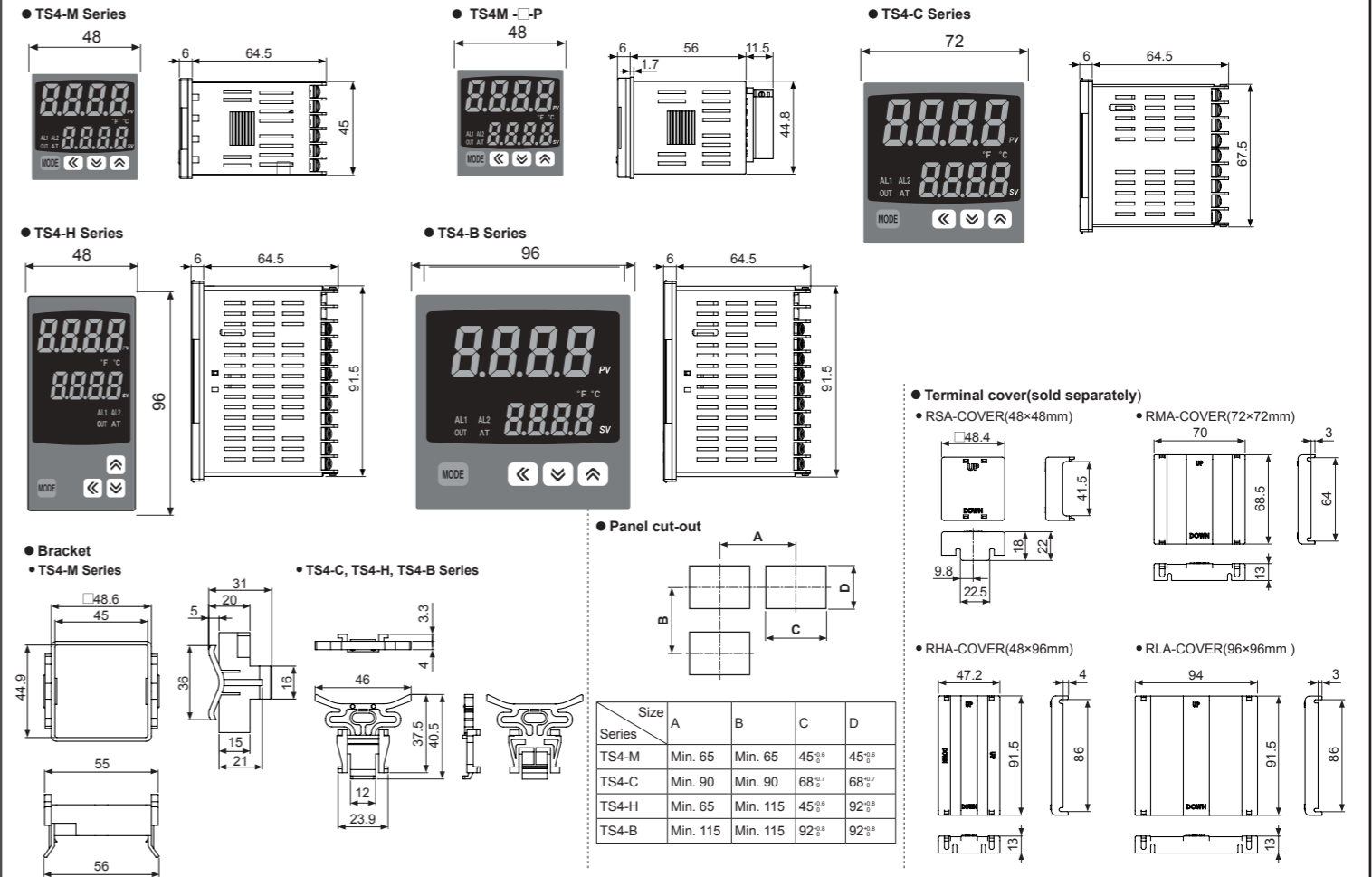
Temperature unit (°C/°F) indicator

It shows current temperature unit.

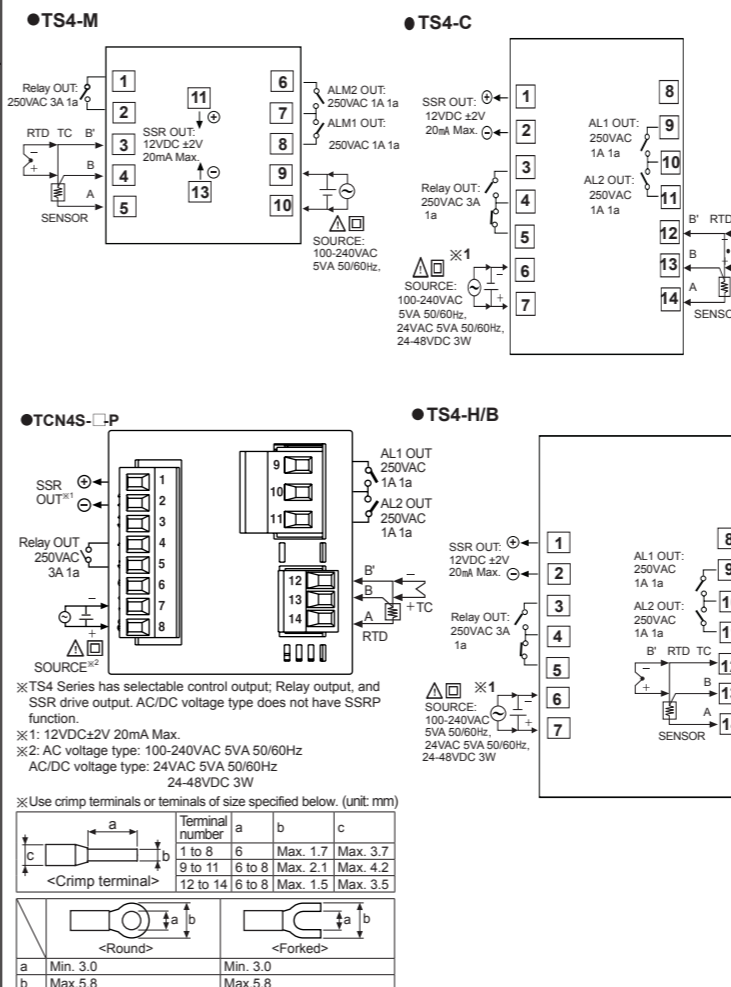
Input Sensor and Temperature Range

Input sensor	Display	Temperature range(°C)	Temperature range(°F)
Thermocouple	K(CA)	tcRH	-50 to 1200
		tcRL	-50.0 to 999.9
		tcLH	-30 to 800
		tcLH	-30.0 to 800.0
		tcLH	-40 to 800
		tcLH	-40.0 to 800.0
	J(IC)	tcRH	-50 to 400
		tcRH	-50 to 400
		tcRH	-50.0 to 400.0
		tcRH	-50 to 400
		tcRH	-50 to 400
		tcRH	-50 to 400
L(IC)	tcRH	-40 to 800	
	tcRH	-40 to 800	
	tcRH	-40.0 to 800.0	
	tcRH	-40 to 800	
	tcRH	-40 to 800	
	tcRH	-40 to 800	
T(CC)	tcRH	0 to 1700	
	tcRH	0 to 1700	
	tcRH	0 to 1700	
	tcRH	0 to 1700	
	tcRH	0 to 1700	
	tcRH	0 to 1700	
R(PR)	tcRH	0 to 1700	
	tcRH	0 to 1700	
	tcRH	0 to 1700	
	tcRH	0 to 1700	
	tcRH	0 to 1700	
	tcRH	0 to 1700	
S(PR)	tcRH	0 to 1700	
	tcRH	0 to 1700	
	tcRH	0 to 1700	
	tcRH	0 to 1700	
	tcRH	0 to 1700	
	tcRH	0 to 1700	
DPt100Ω	tcRH	-100 to 400	
	tcRH	-100 to 400	
	tcRH	-100.0 to 400.0	
	tcRH	-100 to 400	
	tcRH	-100 to 400	
	tcRH	-100 to 400	
RTD	Cu50Ω	tcRH	-50 to 200
		tcRH	-50 to 200
		tcRH	-50.0 to 200.0
	Pt100Ω	tcRH	-100 to 400
		tcRH	-100 to 400
		tcRH	-100.0 to 400.0

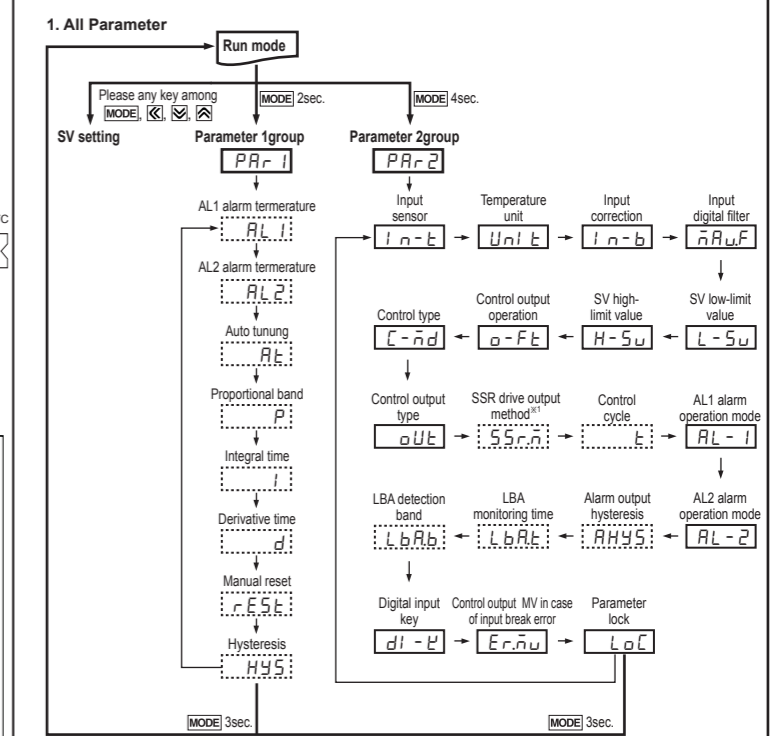
Dimensions



Connections



Parameter Groups



- ※ Press **MODE** key over 3 sec in any parameter group, it saves the set value and returns to RUN mode. (Exception: Press **MODE** key once in SV setting group, it returns to RUN mode).
- ※ If no key entered for 30 sec., it returns to RUN mode automatically and the set value of parameter is not be saved.
- ※ Press **MODE** key again within 1 sec. after returning to RUN mode, it advances of the first parameter of previous parameter group.
- ※ Press **MODE** key to move next parameter.
- ※ Parameter marked in [] might not be displayed depending on other parameter settings.
- ※ Set parameter as "Parameter 2 group → Parameter 1 group → Setting group of set value" order considering parameter relation of each setting group.
- ※1: It is not displayed for AC/DC power model (TS4 □ -22R).

2. Parameter 2group

MODE key: Moves parameter and saves the set.
or key: Changes the set

Table with 4 columns: Parameter, Display, Description. Contains settings for input sensor, temperature unit, input correction, input digital filter, SV low-limit value, SV high-limit value, control output operation, control type, control output type, SSR drive output method, control cycle, AL1 alarm operation mode, AL2 alarm operation mode, alarm output hysteresis, LBA monitoring time, LBA monitoring range, digital input key, control output MV in case of input break error, and parameter lock.

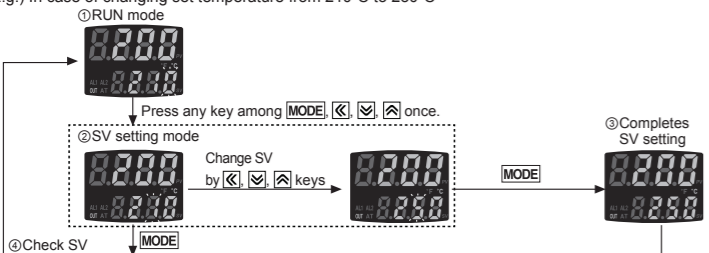
3. Parameter 1 group

MODE key: Moves parameter and saves the set.
or key: Moves digit, or key: Changes the set

Table with 4 columns: Parameter, Display, Description. Contains settings for AL1 alarm temp, AL2 alarm temp, auto tuning, proportional band, integral time, derivative time, manual reset, and hysteresis.

4. SV setting

You can set the temperature to control with MODE, or keys.
Setting range is within SV lower limit value [L-5U] to SV higher limit value [H-5U].
E.g.) In case of changing set temperature from 210°C to 250°C



5. Parameter reset

Reset all parameters as factory default. Hold the front MODE, or, or keys for 5 sec., to enter parameter reset [n-t] parameter. Select 'E5' and all parameters are reset as factory default.

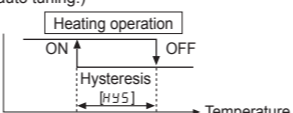
Functions

1. Auto tuning [Rt]

Auto tuning measures the control subject's thermal characteristics and thermal response rate, and then determines the necessary PID time constant. Application of the PID time constant realizes fast response and high precision temperature control.

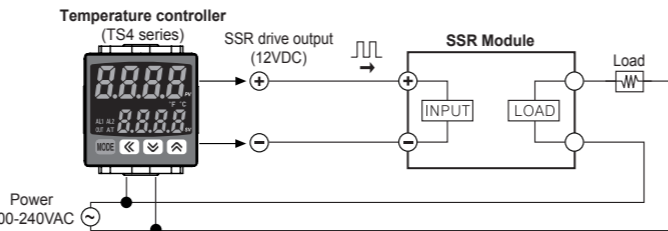
2. Hysteresis [HY5]

In case of ON/OFF control, set between ON and OFF intervals as hysteresis. (When control type [c-d] is set as onof, it is displayed.)



3. SSR drive output selection (SSRP function) [55r-n]

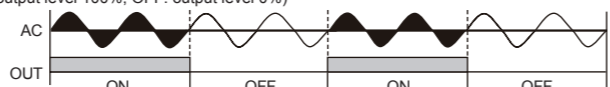
SSRP function is selectable one of standard ON/OFF control, cycle control, phase control by utilizing standard SSR drive output. Realizing high accuracy and cost effective temperature control as linear output (cycle control and phase control).



When selecting phase or cycle control mode, the power supply for load and temperature controller must be the same. In case of selecting PID control type and phase [PHAS] / cycle [PHAS] control output modes, control cycle [t] is not allowed to set.

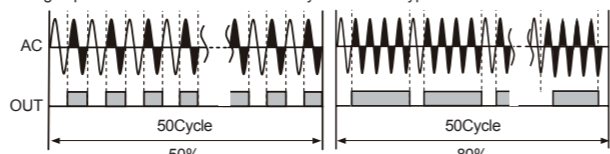
1) Standard ON/OFF control mode [5tnd]

A mode to control the load in the same way as Relay output type. (ON: output level 100%, OFF: output level 0%)



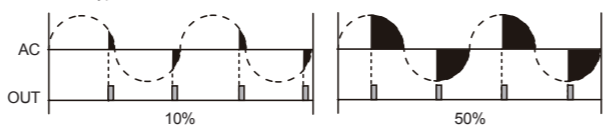
2) Cycle control mode [CYCL]

A mode to control the load by repeating output ON / OFF according to the rate of output within setting cycle. Having improved ON / OFF noise feature by Zero Cross type.



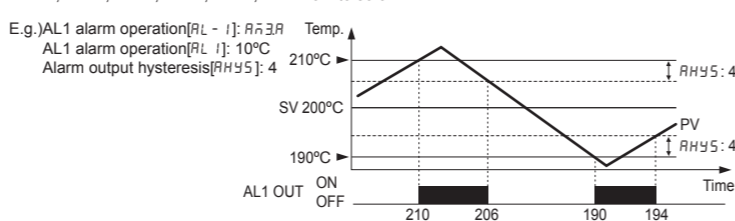
3) Phase control mode [PHAS]

A mode to control the load by controlling the phase within AC half cycle. Serial control is available. RANDOM Turn-on type SSR must be used for this mode.



4. Alarm output hysteresis [PHYS]

It displays alarm output ON and OFF interval and hysteresis is applied to both AL1 OUT and AL2 OUT. E.g.) AL1 alarm operation [AL-1]: A33RA



5. Digital input key [d-e] 3sec. [d-e]

Table showing digital input key operations: OFF (no function), RUN/STOP (pauses control output), Clear alarm (clears alarm output by force), and Auto-tuning (starts/stops auto-tuning).

6. Alarm

Set both alarm operation and alarm option by combining. Alarm outputs are two and each one operates individually. When the current temperature is out of alarm range, alarm clears automatically.

1) Alarm operation

Table with 4 columns: Mode, Name, Alarm operation, Description. Lists various alarm modes like Deviation high-limit, low-limit, high/low-limit, absolute value high/low limit, and sensor/loop break alarms.

※ H: Alarm output hysteresis [PHYS]

2) Alarm option

Table with 4 columns: Option, Name, Description. Lists alarm options like Standard alarm, Alarm latch, Standby sequence 1, Alarm latch and standby sequence 1, Standby sequence 2, Alarm latch and standby sequence 2.

※ Condition of re-applied standby sequence for standby sequence 1, alarm latch and standby sequence 1: Power ON. Condition of re-applied standby sequence for standby sequence 2, alarm latch and standby sequence 2: Power ON, changing set temperature, alarm temperature [AL-1, AL-2] or alarm operation [AL-1, AL-2], switching STOP mode to RUN mode.

3) Sensor break alarm

The function that alarm output will be ON when sensor is not connected or when sensor's disconnection is detected during temperature controlling. You can check whether the sensor is connected with buzzer or other units using alarm output contact.

4) Loop break alarm (LBA)

It checks control loop and outputs alarm by temperature change of the subject. For heating control (cooling control), when control output MV is 100% (0% for cooling control) and PV is not increased over than LBA detection band [LbRb].

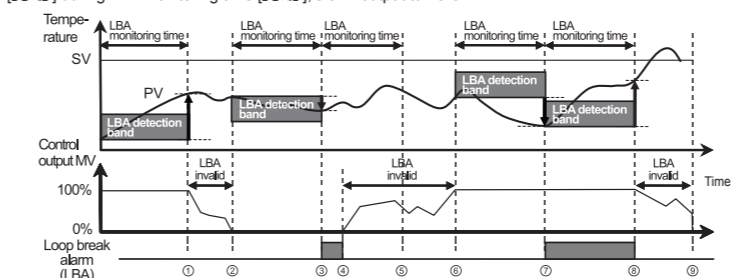
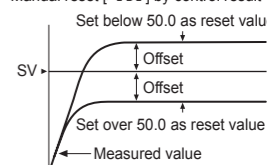


Table showing LBA monitoring times for different alarm options (1 through 8).

※ When executing auto-tuning, LBA detection band [LbRb] and LBA monitoring time are automatically set based on auto tuning value. When alarm operation mode [AL-1, AL-2] is set as loop break alarm (LBA) [LbR], LBA detection band [LbRb] and LBA monitoring time [LbRt] parameter is displayed.

7. Manual reset [-E5t]

When selecting P/PD control mode, certain temperature difference exists even after PV reaches stable status because heater's rising and falling time is inconsistent due to thermal characteristics of controlled objects, such as heat capacity, heater capacity. This temperature difference is called offset and manual reset [-E5t] function is to set/correct offset.



8. Input correction [n-b]

Controller itself does not have errors but there may be error by external input temperature sensor. This function is for correcting this error. E.g.) If actual temperature is 80°C but controller displays 78°C, set input correction value [n-b] as '002' and controller displays 80°C.

9. Input digital filter [nRUF]

If current temperature (PV) is fluctuating repeatedly by rapid change of input signal, it reflects to MV and stable control is impossible. Therefore, digital filter function stabilizes current temperature value.

10. Error

Table with 3 columns: Display, Description, Troubleshooting. Lists error codes like PEn, HHHH, LLLL and their corresponding descriptions and actions.

Factory Default

1. SV setting

Table with 2 columns: Parameter, Default. Shows SV setting parameters and their default values.

2. Parameter 1 group

Table with 8 columns: Parameter, Default, Parameter, Default, Parameter, Default, Parameter, Default. Shows factory default values for parameter group 1.

3. Parameter 2 group

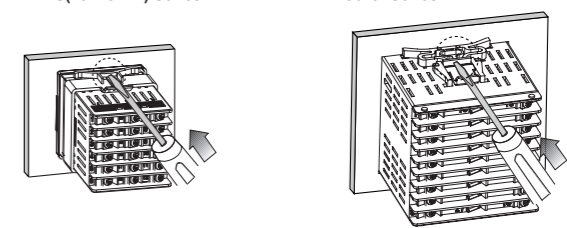
Table with 8 columns: Parameter, Default, Parameter, Default, Parameter, Default, Parameter, Default. Shows factory default values for parameter group 2.

※ The AC/DC voltage models do not have SSR drive output method [55r-n]. In case of control output [oUt], if set as 55r, it supports only ON/OFF output.

Installation

TCN45(48x48mm) Series

Other Series



Insert product into a panel, fasten bracket by pushing with tools as shown above.

Cautions during Use

- 1. Follow instructions in 'Cautions during Use'. Otherwise, it may cause unexpected accidents.
2. Check the polarity of the terminals before wiring the temperature sensor.
3. Keep away from high voltage lines or power lines to prevent inductive noise.
4. Install a power switch or circuit breaker in the easily accessible place for supplying or disconnecting the power.
5. Do not use the unit for other purpose (e.g. voltmeter, ammeter), but temperature controller.
6. When changing the input sensor, turn off the power first before changing.
7. 24VAC, 24-48VDC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
8. Make a required space around the unit for radiation of heat.
9. Make sure that power supply voltage reaches to the rated voltage within 2 sec after supplying power.
10. Do not wire to terminals which are not used.
11. This unit may be used in the following environments.

Major Products

- Photoelectric Sensors
Fiber Optic Sensors
Door Sensors
Door Side Sensors
Area Sensors
Proximity Sensors
Pressure Sensors
Rotary Encoders
Connector/Sockets
Switching Mode Power Supplies
Control Switches/Lamps/Buzzers
I/O Terminal Blocks & Cables
Stepper Motors/Drivers/Motion Controllers
Graphic/Logic Panels
Field Network Devices
Laser Marking System (Fiber, Co2, Nd: YAG)
Laser Welding/Cutting System
Temperature Controllers
Temperature/Humidity Transducers
SSRs/Power Controllers
Counters
Timers
Panel Meters
Tachometer/Pulse (Rate) Meters
Display Units
Sensor Controllers