

# TC Series

## Economical PID control

### ■ Features

NEW

- Realizes ideal temp. controlling with newly developed PID control algorithm and 100ms high speed sampling
- **Relay output and SSRP output embodied together**  
: SSRP output makes phase control and cycle control possible.(AC power)
- Dramatically increased visibility using wide display part
- Mounting space saving with compact design  
: Approx. 38% reduced size compared with existing model(depth-based)
- SV/PV deviation indicatable



**⚠ Please read "Caution for your safety" in operation manual before using.**



### ■ Ordering information

<b>T</b>	<b>C</b>	<b>4</b>	<b>S</b>	<b>—</b>	<b>1</b>	<b>4</b>	<b>R</b>														
		Setting type		Digit		Size															
				Alarm output		Power supply															
						Control output															
						<table border="1"> <tr> <td><b>N</b></td> <td>Indicator – Without control output</td> </tr> <tr> <td><b>R</b></td> <td>Relay output+SSRP output(AC power) Relay output+SSR output(AC/DC power)</td> </tr> </table>		<b>N</b>	Indicator – Without control output	<b>R</b>	Relay output+SSRP output(AC power) Relay output+SSR output(AC/DC power)										
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(※1) It is unavailable for TC4SP, TC4Y.

(※2) 11 pin socket(PG-11, PS-11) for TC4SP : sold separately.

### ■ Specifications

Series	TC4S	TC4SP	TC4Y	TC4M	TC4H	TC4W	TC4L
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, 24VAC 50/60Hz)					
	AC/DC power	Max. 3W(24–48VDC)					
Display method	7Segment (Red), Other display (Green, Yellow, Red) LED						
Character size	W7×H15mm		W7.4×H15mm	W9.5×H20mm	W7×H14.6mm	W9.5×H20mm	W11×H22mm
Input type	RTD	DPt100Ω (Allowable line resistance max. 5Ω per a wire)					
	TC	K (CA), J (IC), L (IC)					
Display method	RTD, TC	(PV ±0.5% or ±1℃ higher one) rdg ±1Digit(※1) ※TC4SP (Plug type) is (PV ±0.5% or ±2℃ higher one) rdg ±1Digit(※2) ☞ Based on room temperature (23℃ ±5℃)					

(※1) In case of out of room temperature range: (PV ±0.5% or ±2℃ higher one)rdg ±1 Digit

L(IC) and RTD CU50: (PV ±0.5% or ±3℃ higher one)rdg ±1 Digit

(※2) In case of out of room temperature range for TC4SP: (PV ±0.5% or ±3℃ higher one)rdg ±1 Digit

L(IC) and RTD CU50: (PV ±0.5% or ±4℃ higher one)rdg ±1 Digit

# Economical PID Control

## Specifications

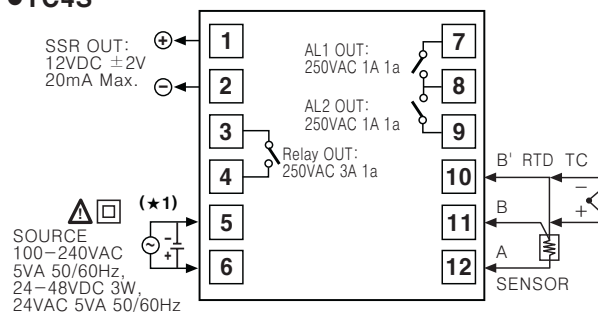
Series	TC4S	TC4SP	TC4Y	TC4M	TC4H	TC4W	TC4L
Control output	Relay	250VAC 3A 1a					
	SSR	12VDC $\pm$ 2V 20mA Max.					
Sub output	AL1, AL2 relay output : 250VAC 1A 1a(*TC4SP, TC4Y have AL1 only.)						
Control method	ON/OFF and P, PI, PD, PID control						
Hysteresis	1 to 100°C/°F [P.E.R, J1 E, L1 E, dP.E.H, EUS.H] / 0.1 to 50.0°C/°F [dP.E.L, EUS.L]						
Proportional band	0.1 to 999.9°C/°F						
Integral time(I)	9999sec.						
Derivative time(D)	9999sec.						
Control period	0.5 to 120.0sec.						
Manual reset	0.0 to 100.0%						
Sampling period	100ms						
Dielectric strength	AC power	2000VAC 50/60Hz for 1min.(Between input terminal and power terminal)					
	AC/DC power	1000VAC 50/60Hz for 1min.(Between input terminal and power terminal)					
Vibration	0.75mm amplitude at frequency of 5 to 55Hz in each X, Y, Z directions for 2 hours						
Relay life cycle	Control output	Mechanical: Min. 5,000,000 operations, Electrical: Min. 200,000 operations (250VAC 3A resistive load)					
	Alarm output	Mechanical: Min. 5,000,000 operations, Electrical: Min. 300,000 operations (250VAC 1A resistive load)					
Insulation resistance	Min. 100M $\Omega$ (at 500VDC megger)						
Noise	Square shaped noise by noise simulator(pulse width 1 $\mu$ s) $\pm$ 2kV R-phase and S-phase						
Memory retention	Approx. 10 years (When using non-volatile semiconductor memory type)						
Ambient temperature	-10 to 50°C (at non-freezing status)						
Storage temperature	-20 to 60°C (at non-freezing status)						
Ambient humidity	35 to 85%RH						
Insulation type	(*3)						
Approval	CE   (Except for AC/DC power type)						
Unit weight	Approx. 97g	Approx. 84g	Approx. 127g	Approx. 127g	Approx. 118g	Approx. 118g	Approx. 172g

(\*3) "□" Mark indicates that equipment protected throughout by double insulation or reinforced insulation.

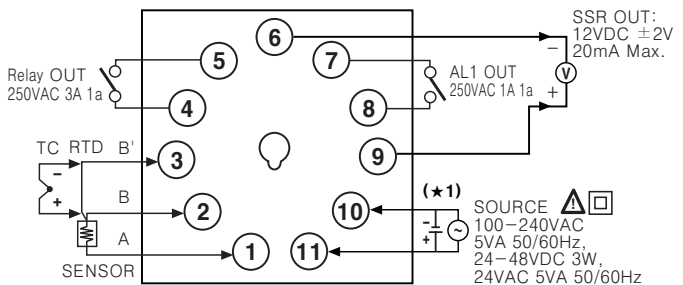
## Connections

\*TC4 series has selectable control output; Relay output, and SSRP output. AC/DC voltage type has Relay output and SSR output and it is selectable.

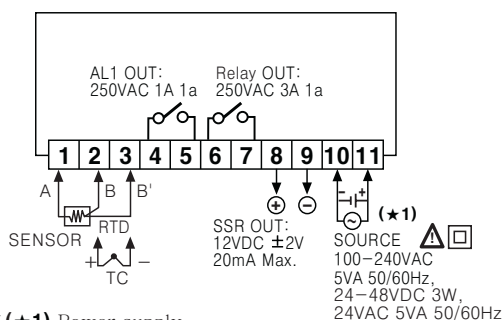
### TC4S



### TC4SP

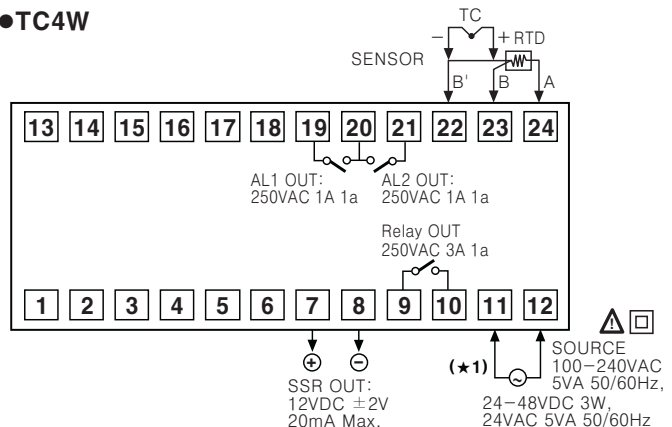


### TC4Y



(\*1) Power supply  
 -AC power : 100-240VAC 50/60Hz  
 -Low voltage : 24-48VDC, 24VAC 50/60Hz

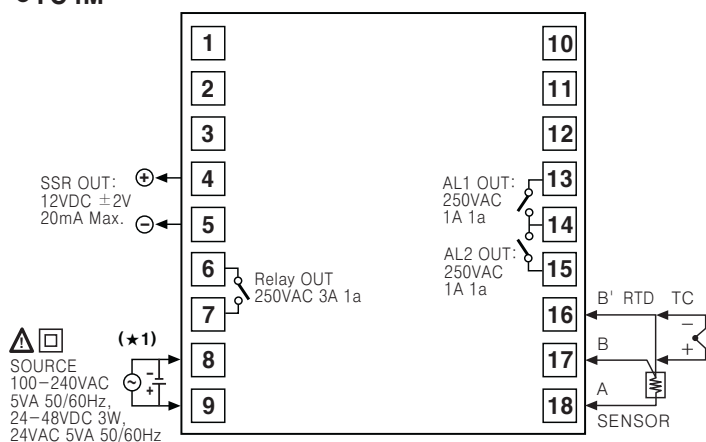
### TC4W



- (A) Photo electric sensor
- (B) Fiber optic sensor
- (C) Door/Area sensor
- (D) Proximity sensor
- (E) Pressure sensor
- (F) Rotary encoder
- (G) Connector/Socket
- (H) Temp. controller
- (I) SSR/Power controller
- (J) Counter
- (K) Timer
- (L) Panel meter
- (M) Tacho/Speed/Pulse meter
- (N) Display unit
- (O) Sensor controller
- (P) Switching power supply
- (Q) Stepping motor & Driver & Controller
- (R) Graphic/Logic panel
- (S) Field network device
- (T) Production stoppage models & replacement

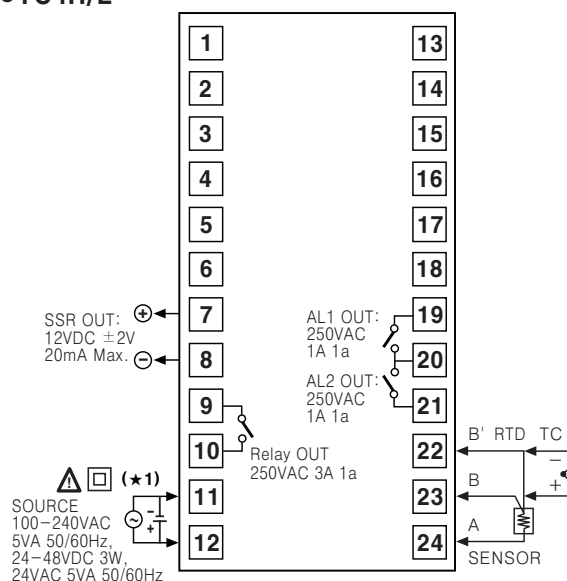
# TC Series

## ●TC4M



※(★1) Power supply  
 -AC power : 100-240VAC 50/60Hz  
 -AC/DC power : 24-48VDC 3W, 24VAC 50/60Hz

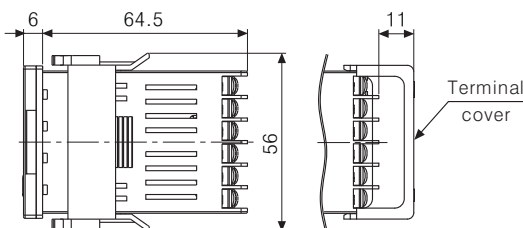
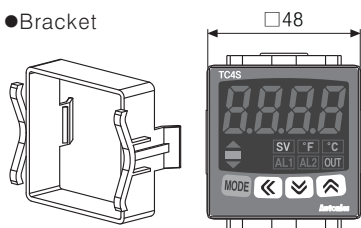
## ●TC4H/L



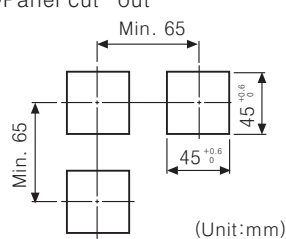
## ■Dimensions

### ●TC4S

#### ●Bracket

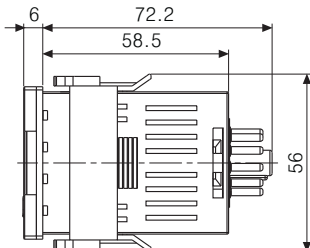
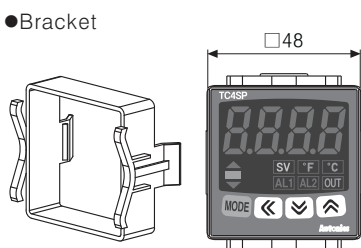


#### ●Panel cut-out

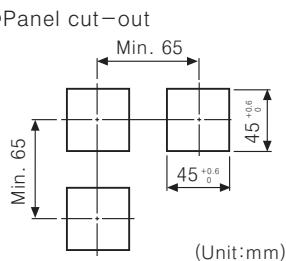


### ●TC4SP

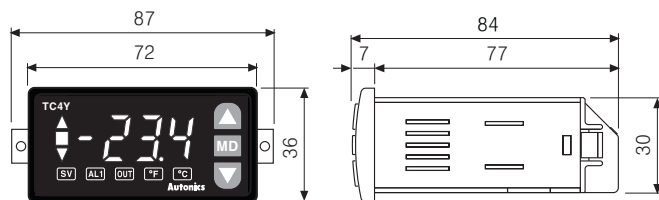
#### ●Bracket



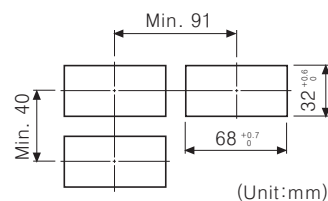
#### ●Panel cut-out



### ●TC4Y

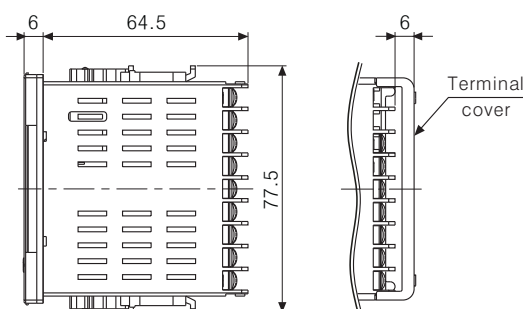
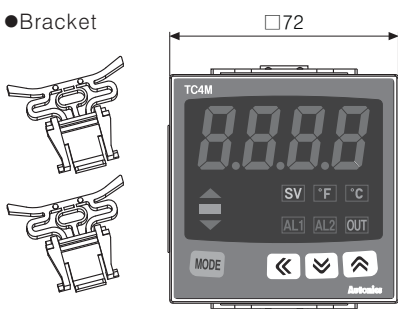


#### ●Panel cut-out

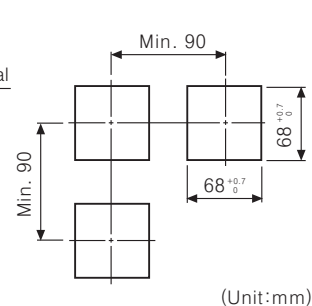


### ●TC4M

#### ●Bracket



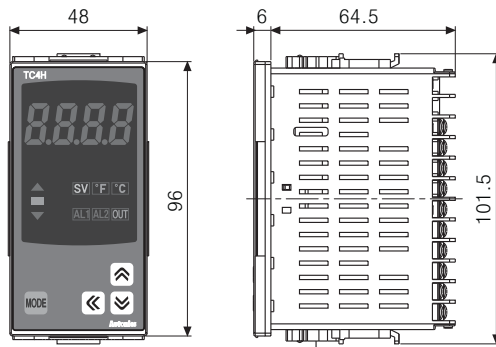
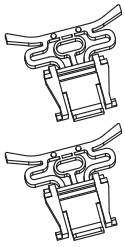
#### ●Panel cut-out



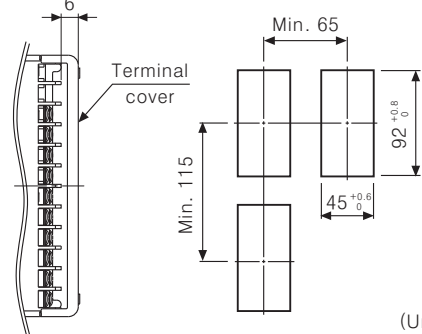
# Economical PID Control

## ●TC4H

### ●Bracket



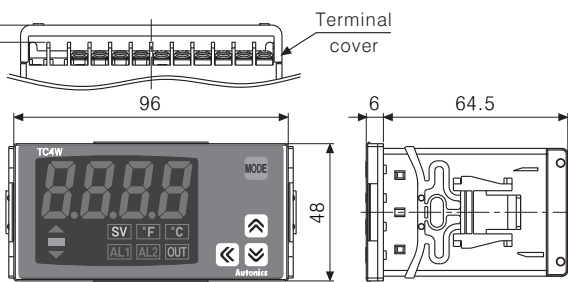
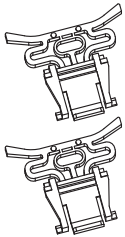
### ●Panel cut-out



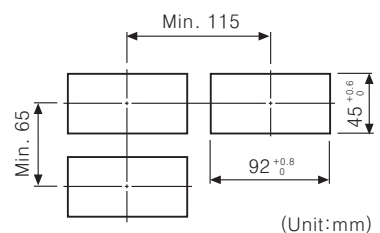
(Unit:mm)

## ●TC4W

### ●Bracket



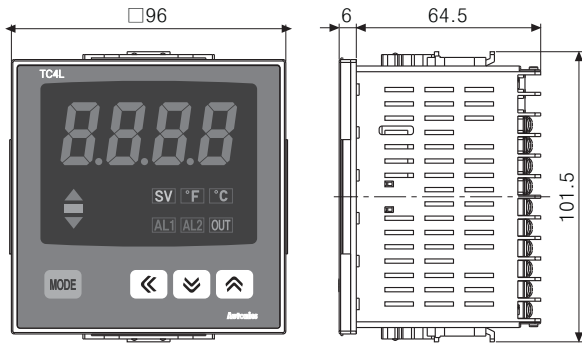
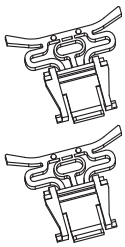
### ●Panel cut-out



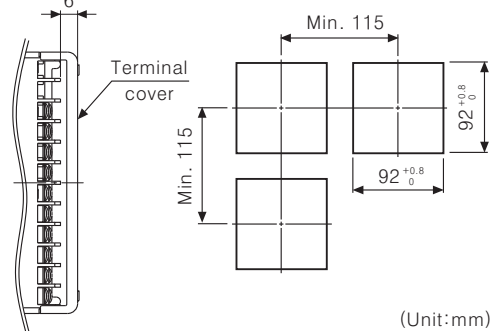
(Unit:mm)

## ●TC4L

### ●Bracket



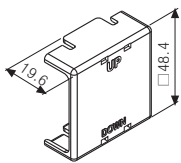
### ●Panel cut-out



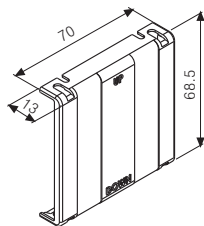
(Unit:mm)

## ●Terminal cover(Sold separately)

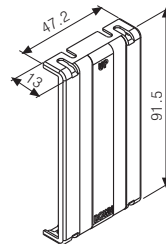
### ●RSA-Cover (48×48mm size)



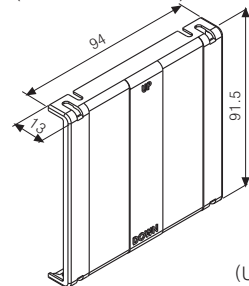
### ●RMA-Cover (72×72mm size)



### ●RHA-Cover (48×96mm, 96×48mm size)



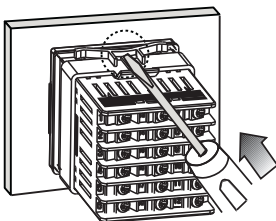
### ●RLA-Cover (96×96mm size)



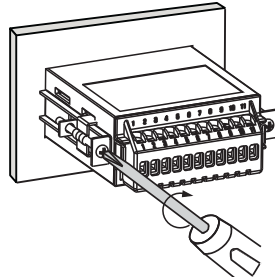
(Unit:mm)

## ■Product mounting

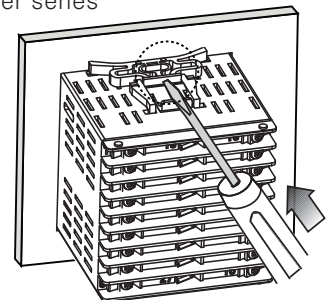
### ●TC4S/SP(48×48mm) series



### ●TC4Y(72×36mm) series



### ●Other series



※ Insert product into a panel, fasten bracket by pushing with tools as shown above.  
(In case of TC4Y, fasten bolts for bracket.)

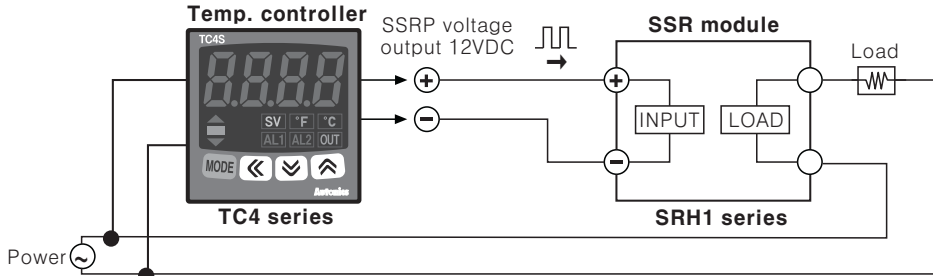
(A)	Photo electric sensor
(B)	Fiber optic sensor
(C)	Door/Area sensor
(D)	Proximity sensor
(E)	Pressure sensor
(F)	Rotary encoder
(G)	Connector/Socket
(H)	Temp. controller
(I)	SSR/Power controller
(J)	Counter
(K)	Timer
(L)	Panel meter
(M)	Tacho/Speed/Pulse meter
(N)	Display unit
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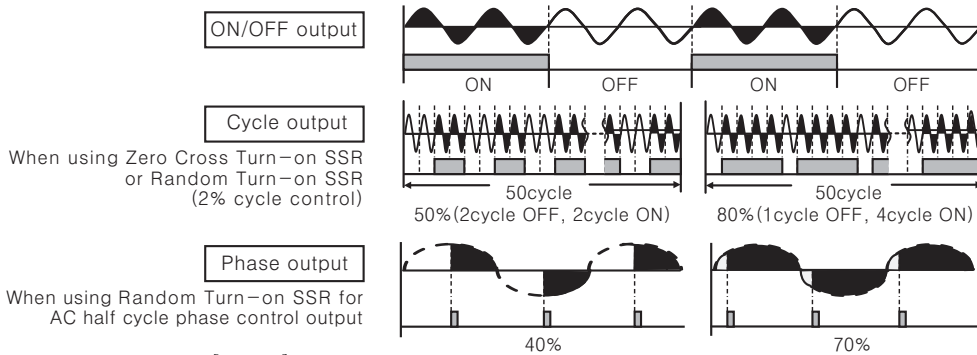
## ■SSRP(Solid State Relay Phase Output) output function[55r.ñ ]

※AC/DC power type supports ON/OFF output only when selecting control output [55r.ñ].  
(Not support to select SSRP output method function. [55r.ñ])

- SSRP is a user selectable output type which phase control and cycle control are added to standard SSR drive output.
- Standard SSR output is still available by internal parameter setting [55r.ñ]; in addition, "cycle control" with connecting Zero cross turn-on type SSR or Random turn-on type SSR and "phase control" with connecting Random turn-on type SSR are also available.
- Realizing high accuracy and cost effective temperature control with both current output (4-20mA) and linear output(cycle control and phase control).



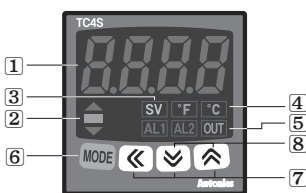
※You can select the functions with parameter settings.



- Standard 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%)
- Cycle control mode[εγεε ]  
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 (ZERO CROSS type)
- Phase control mode[PH#5 ]  
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.

※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 / cycle control output modes, control cycle (ε) is not allowed to set.

## ■Parts description

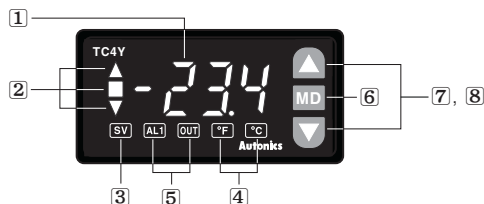


- Temperature display  
It shows current temperature (PV) in RUN mode and parameter and set value for each setting group in parameter change mode.
- Deviation indicator, Auto-tuning indicator  
-It shows current temperature (PV) deviation based on set temperature (SV) by LED.

No	PV deviation temp.	Deviation display
1	Over 2°C	▲ lamp on
2	Below ±2°C	■ lamp on
3	Under -2°C	▼ lamp on

-Deviation indicator (▲, ■, ▼) is flashed by every 1sec when operating auto tuning.

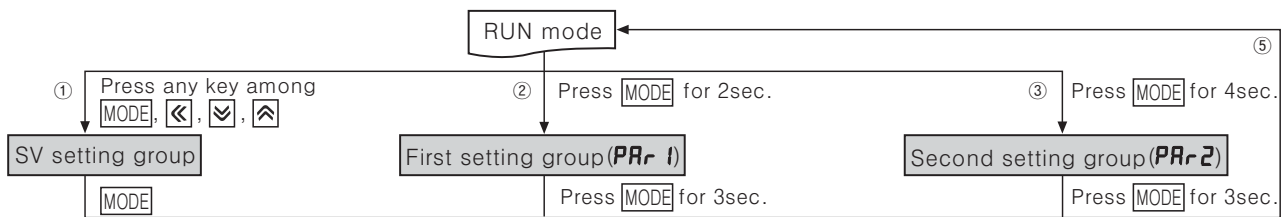
- Set temperature (SV) indicator  
Press any front key once to check or change current set temperature (SV), set temperature (SV) indicator is on and preset set value is flashed.



- Temperature unit (°C/°F) indicator: It shows current temperature unit.
- Control/alarm output indicator  
-OUT : It will light up when control output (Main Control Output) is on.  
※In case of CYCLE/PHASE control, it will light up when MV is over 3.0%. (Except for AC/DC power type)  
-AL1/AL2 : It will light up when alarm output AL1/AL2 are on.
- MODE Key : Used when entering into parameter setting group, 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.
- FUNCTION key : Press (MD)+(▲) keys for 3 sec. to operate function (RUN/STOP, alarm output cancel) set in inner parameter [dl -ε].  
※Press (MD)+(▲) keys once in set value operation to move digit.

# Economical PID Control

## Flow chart for setting group



(※1): It is not displayed for AC/DC power type.  
 ※If no key touched for 30sec., it will return to RUN mode automatically and the set value of parameter will not be changed.

AL1	Alarm1 setting value
AL2	Alarm1 setting value
At	Auto-tuning execute
P	Proportional band
I	Integral time
d	Derivation time
r-ES	Manual reset
HYS	Hysteresis

In-t	Input sensor
Unit	Temperature unit
In-b	Input correction
nARF	Input digital filter
L-Su	SV low-limit value
H-Su	SV high-limit value
o-Ft	Control output operation
C-n	Control type
oUt	Control output type
SSr-n	SSRP output method (※1)
t	Control cycle
AL-1	AL1 alarm operation mode
AL-2	AL2 alarm operation mode
AHYS	Alarm output hysteresis
LbAt	LBA monitoring time
LbAb	LBA detection range
dl-k	Digital key operation
Er-nu	Control output MV in case of input break error
LoC	Lock setting

※Parameter marked in [ ] might not be displayed depending on other parameter settings.

- Press any key once in RUN mode, it advances to set value setting group.
- Press **MODE** key over 2sec. in RUN mode, it advances to setting group 1.
- Press **MODE** key over 4sec. in RUN mode, it advances to setting group 2.
- First parameter will be displayed on viewer when it advances to the setting group.
- Press **MODE** key over 3sec. in the setting group, it returns to RUN mode.  
 [※Exception : Press **MODE** key once in SV setting group it returns to RUN mode.]

※Press **MODE** key again within a sec after return to RUN mode by press **MODE** key over 3sec., it advances to the first parameter of previous setting group.

※Parameter setup

Setting group 2 → Setting group 1 → Setting group of set value

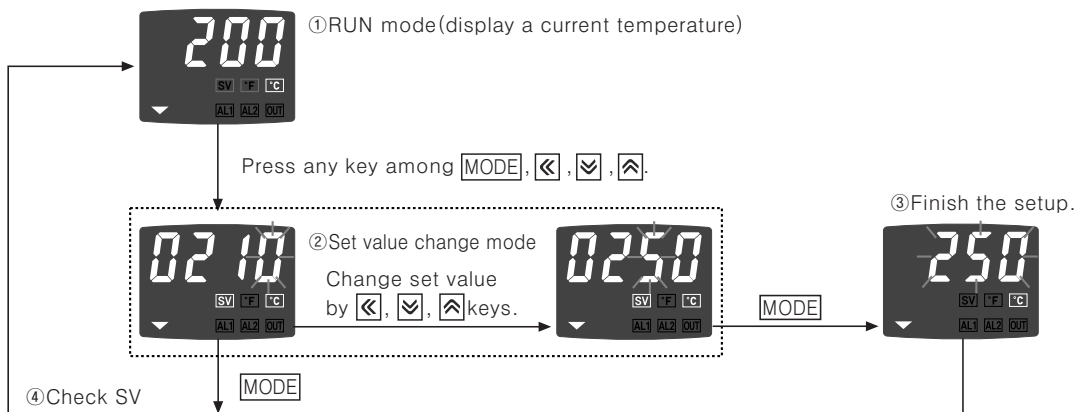
- Set parameter as the above considering parameter relation of each setting group.
- Check parameter set value after change parameter of setting group 2.

※Indicator type displays shaded parameter of setting group 2.

※Alarm operation mode (AL-1, AL-2) of setting group2 is decided whether to display according by alarm output type.

※If alarm operation mode (AL-1, AL-2) of setting group2 is set to [AnL / SbA. / LbAL], [AHYS] parameter is not displayed.

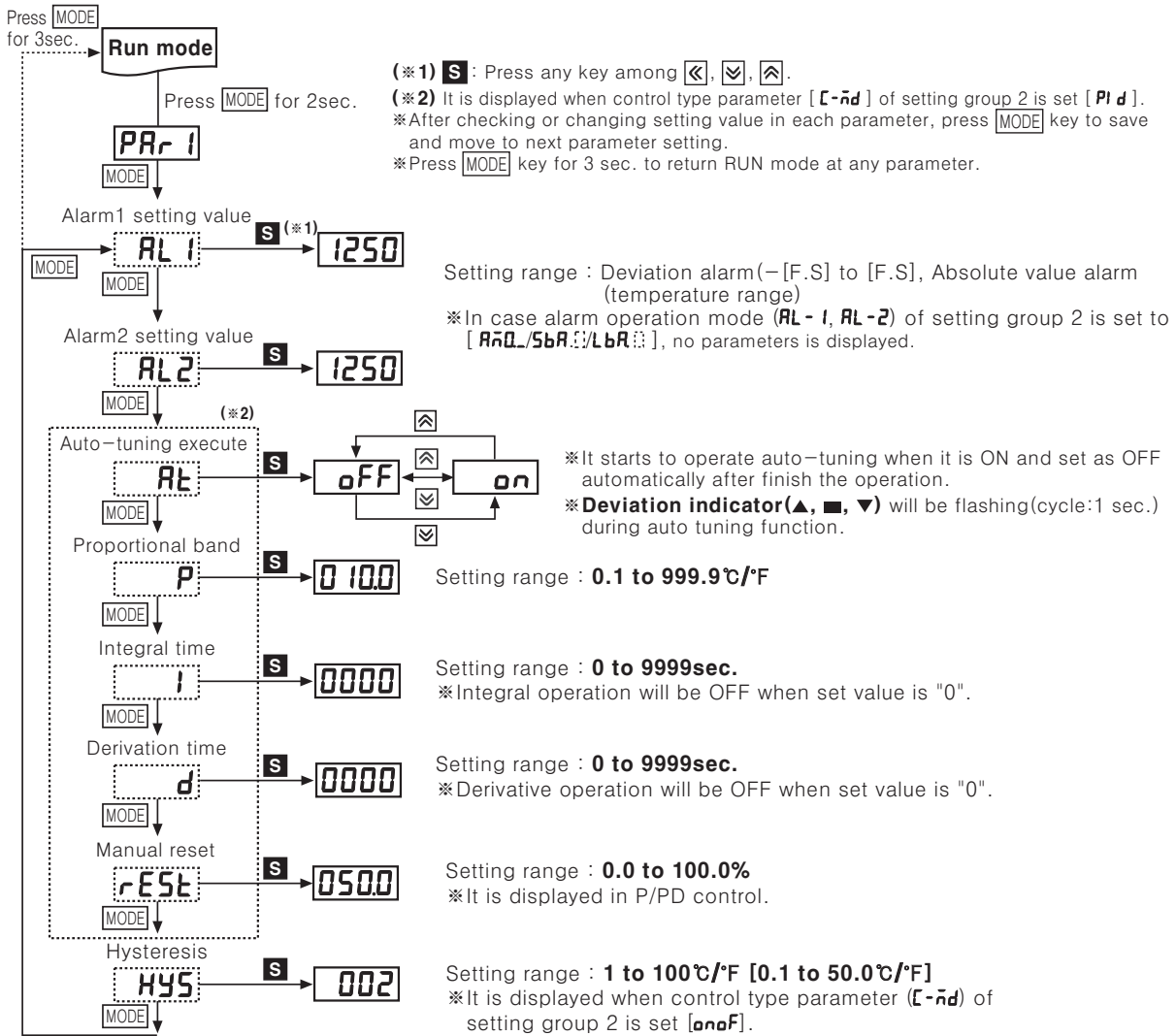
## Flow chart for SV setting group (※In case of changing set temperature from 210°C to 250°C.)



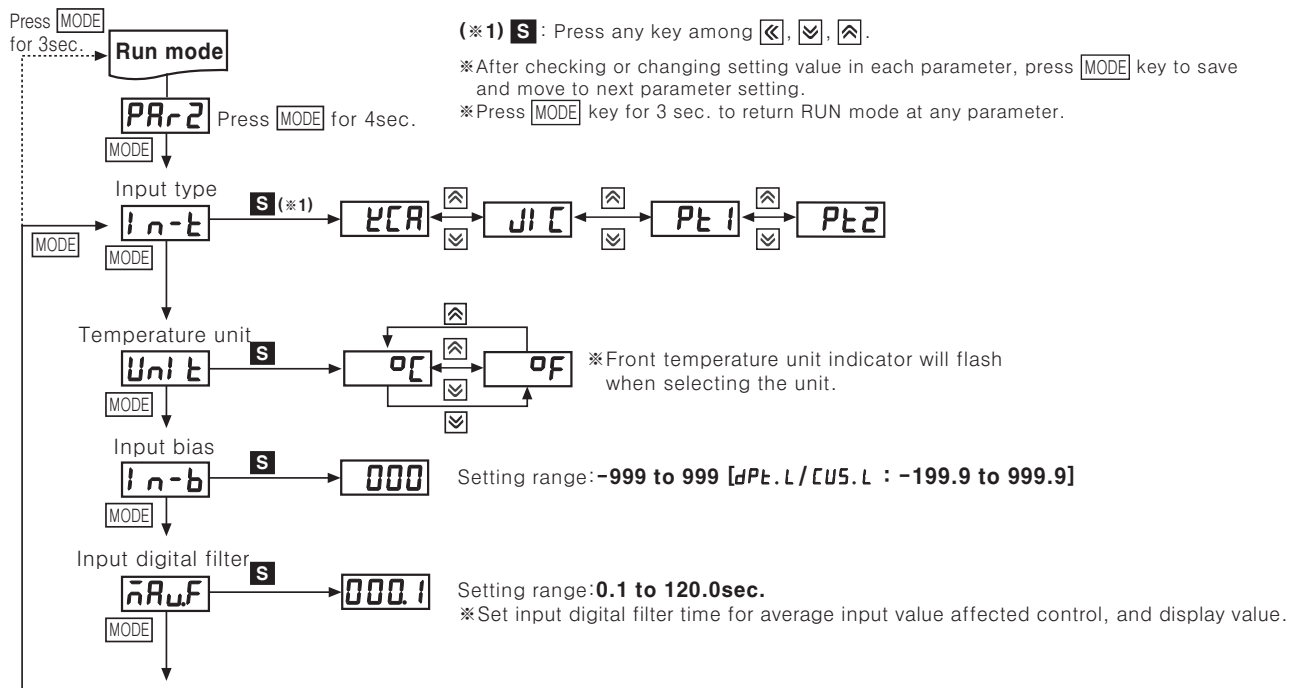
- (A) Photo electric sensor
- (B) Fiber optic sensor
- (C) Door/Area sensor
- (D) Proximity sensor
- (E) Pressure sensor
- (F) Rotary encoder
- (G) Connector/Socket
- (H) Temp. controller
- (I) SSR/Power controller
- (J) Counter
- (K) Timer
- (L) Panel meter
- (M) Tacho/Speed/Pulse meter
- (N) Display unit
- (O) Sensor controller
- (P) Switching power supply
- (Q) Stepping motor & Driver & Controller
- (R) Graphic/Logic panel
- (S) Field network device
- (T) Production stoppage models & replacement

# TC Series

## Flow chart for setting group 1



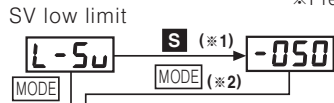
## Flow chart for setting group 2



# Economical PID Control

(※1) **S** : Press any key among  $\leftarrow$ ,  $\rightarrow$ ,  $\uparrow$ ,  $\downarrow$ .

(※2) After checking or changing setting value in each parameter, press **MODE** key to save setting value. Saved setting value will flash twice and then moves to next parameter setting automatically.  
 ※Press **MODE** key for 3 sec. to return RUN mode at any parameter.

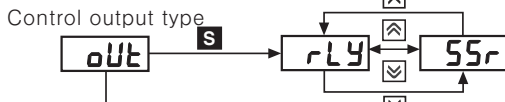
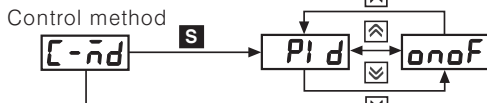
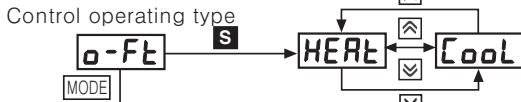


Setting range : Within using range of each sensor  
 ※It enables to set ranged [ L-Su ≤ H-Su ] - 1

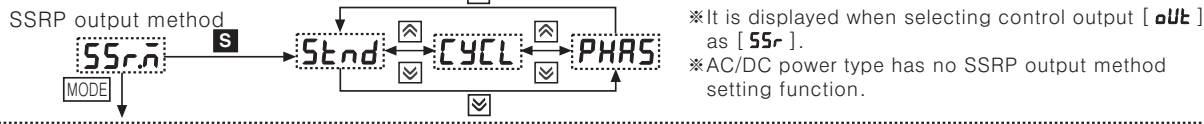
※In case of [ P n - E ] input sensor type, low/high-limit setting temperature (SV is also set as max./min. temperature range of input sensor).



Setting range : Within using range of each sensor  
 ※It enables to set ranged [ H-Su ≥ L-Su ] + 1



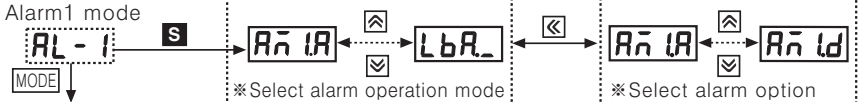
※Operates only selected output between Relay or SSR.



※It is displayed when selecting control output [ out ] as [ SSR ].  
 ※AC/DC power type has no SSRP output method setting function.



Setting range: 0.5 to 120.0sec.  
 ※In case of [ rLY ] output mode default value is 20.0 sec. (2.0sec. in case of [ SSR ] mode)  
 ※It will not be displayed when [ SSRn ] is set as [ CYCL/PHAS ].



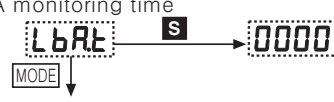
※Press  $\leftarrow$  key to convert alarm operation mode into alarm option.  
 ※Refer to H-56 page.



※Same with the above [ AL - 1 ].



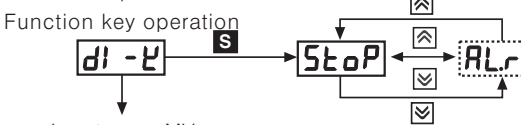
Setting range : 1 to 999℃/°F (dPt.L / CU5.L : 0.1 to 50.0℃)  
 ※If alarm operation mode (AL - 1, AL - 2) of setting group 2 is set to [ AnQ./SbA./LbA. ], [ AHYS ] parameter is not displayed.



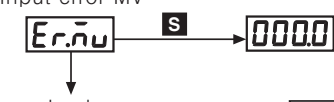
Setting range : 0 to 9999sec. (Automatically setting with auto-tuning)  
 ※ [ LbAt ] parameter is displayed when alarm operation mode (AL - 1, AL - 2) of setting group 2 is set as [ LbA. ].



Setting range : 1 to 999℃/°F (dPt.L / CU5.L : 0.0 to 999.9℃/°F)  
 (Automatically setting with auto-tuning)  
 ※When alarm operation mode (AL - 1, AL - 2) of setting group 2 is set as loop break alarm (LBA) [ LbA. ], and [ LbAt ] parameter does not set as 0, [ LbAb ] parameter is displayed.



※ [ ALrE ] is not displayed in case of indicator model. (TC4□-N□N)



Setting range : 0.0 to 100.0%  
 ※0.0/100.0% is displayed when control type parameter (C-nd) of setting group 2 is set [ onof ].



※For indicator model (TC4□-N□N), [ off, LoC 1 ] is available only.

(A)	Photo electric sensor
(B)	Fiber optic sensor
(C)	Door/Area sensor
(D)	Proximity sensor
(E)	Pressure sensor
(F)	Rotary encoder
(G)	Connector/Socket
(H)	Temp. controller
(I)	SSR/Power controller
(J)	Counter
(K)	Timer
(L)	Panel meter
(M)	Tacho/Speed/Pulse meter
(N)	Display unit
(O)	Sensor controller
(P)	Switching power supply
(Q)	Stepping motor & Driver & Controller
(R)	Graphic/Logic panel
(S)	Field network device
(T)	Production stoppage models & replacement



# TC Series

## ■ Factory default

### ●SV setting group

Parameter	Factory default
-	0

### ●Setting group 1

Parameter	Factory default
AL1	1250
AL2	
ALt	oFF
P	0100
I	0000
d	
rEST	0500
HYS	002

### ●Setting group 2

Parameter	Factory default	Parameter	Factory default
In-t	TCR	t	0200
Unit	°C	AL-1	Rn1R
In-b	0000	AL-2	Rn2R
nRμF	000.1	RYHS	000.1
L-Su	-050	LbAt	0000
H-Su	1200	LbAS	008
a-Ft	HEAt	LbAb	002
C-nd	PI d	dl-t	StoP
oUt	rLY	Er.nu	0000
SSr.n	Stnd	LoC	oFF

※AC/DC power type has no SSRP output method setting function and supports only ON/OFF output when selecting [55r] in control output setting function [oUt].

## ■ Input sensor and range [In-t]

- Select proper input sensor type by user application.

Input sensor		Display	Input range (°C)	Input range (°F)
Thermocouple	K(CA)	TCR	-50 to 1200	-58 to 2192
	J(IC)	JIC	-30 to 500	-22 to 932
	L(IC)	LIC	-40 to 800	-40 to 1472
RTD	DPT00Ω	PE1	-100 to 400	-148 to 752
		PE2	-100.0 to 400.0	-148.0 to 752.0
	CU50Ω	CU5.H	-50 to 200	-58 to 392
		CU5.L	-50.0 to 200.0	-58.0 to 392.0

## ■ Functions

See H-56 to 59 page for TC / TD common features.

### ◎Lock setting [LoC]

- A function to prevent changing SV and parameters of each setting group.
- Parameter setting values are still possible to check while Lock mode is ON.

Display	Description
oFF	Lock off
LoC1	Lock setting group 2
LoC2	Lock setting group 1, 2
LoC3	Lock setting group 1, 2, SV setting group

※ [oFF], [LoC1] are available only for indicator (TC4 □-N□N).

### ◎Error

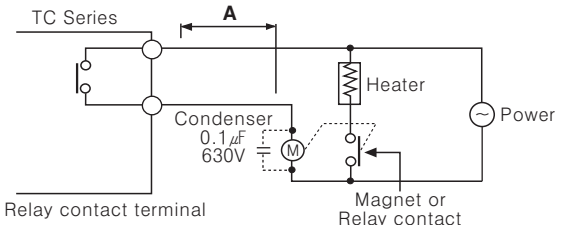
- Error mark will flash (every 1sec.) in PV viewer when error is occurred during the control operation.

Display	Description
oPE n	If input sensor is disconnected or sensor is not connected.
HHHH	If measured sensor input is higher than temperature range.
LLLL	If measured sensor input is lower than temperature range.

- It will operate normally, if input sensor is connected or returned to normal range under error oPE n / HHHH / LLLL status.

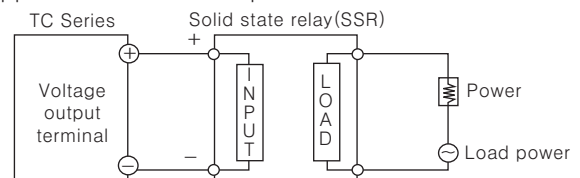
### ◎Output connections

- Application of relay output type



Keep power relay as far away as possible from temperature controller. If wires length of **A** is short, electromotive force occurred from a coil of magnet switch & power relay may flow in power line of the unit, it may cause malfunction. If wires length of **A** is short, please connect a mylar condenser 104 (630V) across coil of the power relay "M" to protect electromotive force.

- Application of SSRP output method



- ※SSR should be selected by the capacity of load, otherwise, it may short-circuit and result in a fire. Indirect heated should be used with SSR for efficient working.
- ※Please use a cooling plate or it may cause the capability deterioration, breakdown of SSR for a long usage.
- ※Refer to H-43 page for phase / cycle control connections.