

**Autonics**

**TEMPERATURE CONTROLLER  
TC4 Series**

**M A N U A L**



Thank you very much for selecting Autonics products.  
For your safety, please read the following before using.

**Caution for your safety**

- ※Please keep these instructions and review them before using this unit.
- ※Please observe the cautions that follow;
- Warning** Serious injury may result if instructions are not followed.
- Caution** Product may be damaged, or injury may result if instructions are not followed.
- ※The following is an explanation of the symbols used in the operation manual.
- Caution:** Injury or danger may occur under special conditions.

**Warning**

- In case of using this unit with machinery (Ex: nuclear power control, medical equipment, ship, vehicle, train, airplane, combustion apparatus, safety device, crime/disaster prevention equipment, etc) which may cause damages to human life or property, it is required to install fail-safe device. It may cause a fire, human injury or damage to property.
- Install the unit on a panel. It may cause electric shock.
- Do not connect, inspect or repair this unit when power is on. It may cause electric shock.
- Wire properly after checking terminal number.
- Do not disassemble the case. Please contact us if it is required. It may cause electric shock or a fire.

**Caution**

- This unit shall not be used outdoors. It may shorten the life cycle of the product or cause electric shock.
- When connect wire, AWG 20(0.50mm<sup>2</sup>) should be used and screw bolt on terminal block with 0.74N·m to 0.90N·m strength. It may cause a malfunction or fire due to contact failure.
- Please observe the rated specifications. It may shorten the life cycle of the product and cause a fire.
- Do not use beyond of the rated switching capacity of relay contact. It may cause insulation failure, contact melt, contact failure, relay broken and fire etc.
- In cleaning unit, do not use water or organic solvent. And use dry cloth. It may cause electric shock or a fire.
- Do not use this unit in place where there are flammable or explosive gas, humidity, direct ray of the light, radiant heat, vibration and impact etc. It may cause a fire or an explosion.
- Do not inflow dust or wire dregs into the unit. It may cause a fire or a malfunction.
- Please wire properly after checking the terminal polarity when connecting temperature sensor. It may cause a fire or an explosion.
- In order to install the units with reinforced insulation, use the power supply unit which basic insulation level is ensured. (TC4SP is basic insulation only.)

**Ordering information**

T	C	4	S	-	1	4	R	
Control output	Indicator - Without control output	N	Indicator - Without control output	R	Relay output+SSR drive output <sup>*1</sup>	2	24VAC 50/60Hz, 24-48VDC	
Power supply	4	100-240VAC 50/60Hz	Sub output	N	No alarm output	1	Alarm1 output	
Size	M	DIN W72 × H36mm	M	DIN W72 × H72mm	H	DIN W48 × H96mm	W	DIN W96 × H48mm
Setting type	4	9999(4 Digit)	C	Set by touch switch	T	Temperature controller		

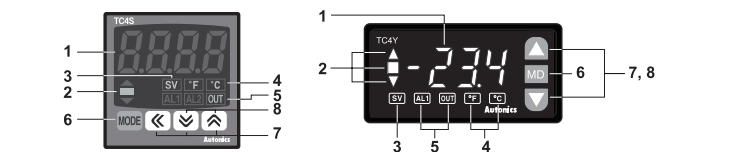
※1: In case of the AC voltage model, SSR drive output method (standard ON/OFF control, cycle control, phase control) is available to select.  
 ※2: It is unavailable for TC4SP, TC4Y.  
 ※3: Socket for TC4SP (PG-11, PS-11) is sold separately.  
 ※The above specifications are subject to change and some models may be discontinued without notice.

**Specifications**

Series	TC4S	TC4SP	TC4Y	TC4M	TC4W	TC4H	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)	AC/DC Power Max. 5VA (24VAC 50/60Hz), Max. 3W(24-48VDC)					
Display method	7Segment(RED), Other display(Green, Yellow, Red LED)						
Character size(W×H)	7.0×15.0mm	7.4×15.0mm	9.5×20.0mm	9.5×20.0mm	7.0×14.6mm	11.0×22.0mm	
Input type	RTD DP1100Ω, Cu50Ω (Allowable line resistance max.5Ω per a wire)	TC K(CA), J(IC), L(IC)					
Display accuracy <sup>*1</sup>	RTD • At room temperature(23°C±5°C): (PV ±0.5% or ±1°C, select the higher one) ±1digit TC • Out of room temperature range: (PV ±0.5% or ±2°C, select the higher one) ±1digit ※ For TC4SP, add ±1°C by accuracy standard.						
Control output	Relay 250VAC 3A 1a	SSR 12VDC ± 2V 20mA Max.					
Alarm output	AL1, AL2 Relay: 250VAC 1A 1a(※TC4SP, TC4Y have AL1 only.)						
Control method	ON/OFF and P, PI, PD, PID control						
Hysteresis	1 to 100°C/°F(0.1 to 50.0°C/°F) variable						
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 2,000VAC 50/60Hz for 1min.(Between input terminal and power terminal)	AC/DC Power 1,000VAC 50/60Hz for 1min.(Between input terminal and power terminal)					
Vibration	0.75mm amplitude at frequency of 5 to 55Hz in each of X, Y, Z directions for 2 hours						
Relay life cycle	Mechanical OUT: Min. 5,000,000 operations, AL1/2: Min. 5,000,000 operations	Electrical OUT: Min. 200,000 operations(250VAC 3A resistive load), AL1/2: Min. 300,000 operations (250VAC 1A resistive load)					
Insulation resistance	Min. 100MΩ(at 500VDC megger)						
Noise immunity	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)						
Environment	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, UL, etc.						
Weight <sup>*2</sup>	Approx. 141g (approx. 94g)	Approx. 123g (approx. 76g)	Approx. 174g (approx. 85g)	Approx. 204g (approx. 133g)	Approx. 194g (approx. 122g)	Approx. 194g (approx. 122g)	Approx. 254g (approx. 155g)

※1: Thermocouple L(IC) type, RTD Cu50Ω  
 • At room temperature (23°C ±5°C): (PV ±0.5% or ±2°C, select the higher one) ±1digit  
 • Out of room temperature range: (PV ±0.5% or ±3°C, select the higher one) ±1digit  
 In case of TC4SP Series, ±1°C will be added.  
 ※2: The weight with packaging and the weight in parentheses is only unit weight.  
 ※Environment resistance is rated at no freezing or condensation.

**Parts description**



- Present temperature (PV) display**  
 • RUN mode: Present temperature (PV) display.  
 • Parameter setting mode: Parameter or parameter setting values display.
- Deviation indicator, Auto-tuning indicator**  
 It shows current temperature(PV) deviation based on set temperature(SV) by LED.  

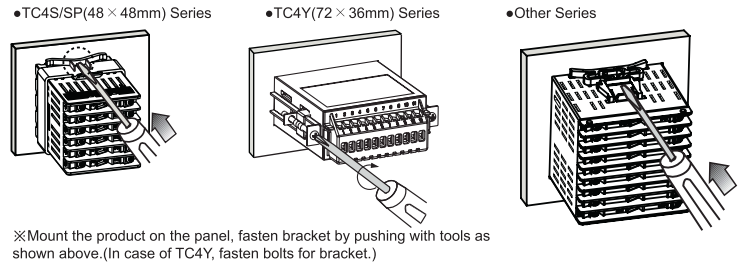
No.	PV deviation temp.	Deviation display
1	Over 2°C	▲ indicator ON
2	Below ±2°C	■ indicator ON
3	Under -2°C	▼ indicator ON

 The deviation indicators (▲, ■, ▼) flash by every 1 sec. when operating auto tuning.
- Set temperature(SV) indicator**  
 Press any front key once to check or change current set temperature(SV), the 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 turn ON when control output(Main Control Output) is ON.  
 • In case of CYCLE/PHASE control of SSR drive output, it will turn ON when MV is over 3.0% (only for AC power type)  
 • AL1/AL2: It will light up when alarm output Alarm1/Alarm2 are on.
- MODE key**  
 Used when entering into parameter 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 [FUNCTION] keys for 3 sec. to operate function(RUN/STOP, alarm output cancel, auto-tuning) set in inner parameter [J - L].  
 ※Press [FUNCTION] keys at the same time in set value operation to move digit.

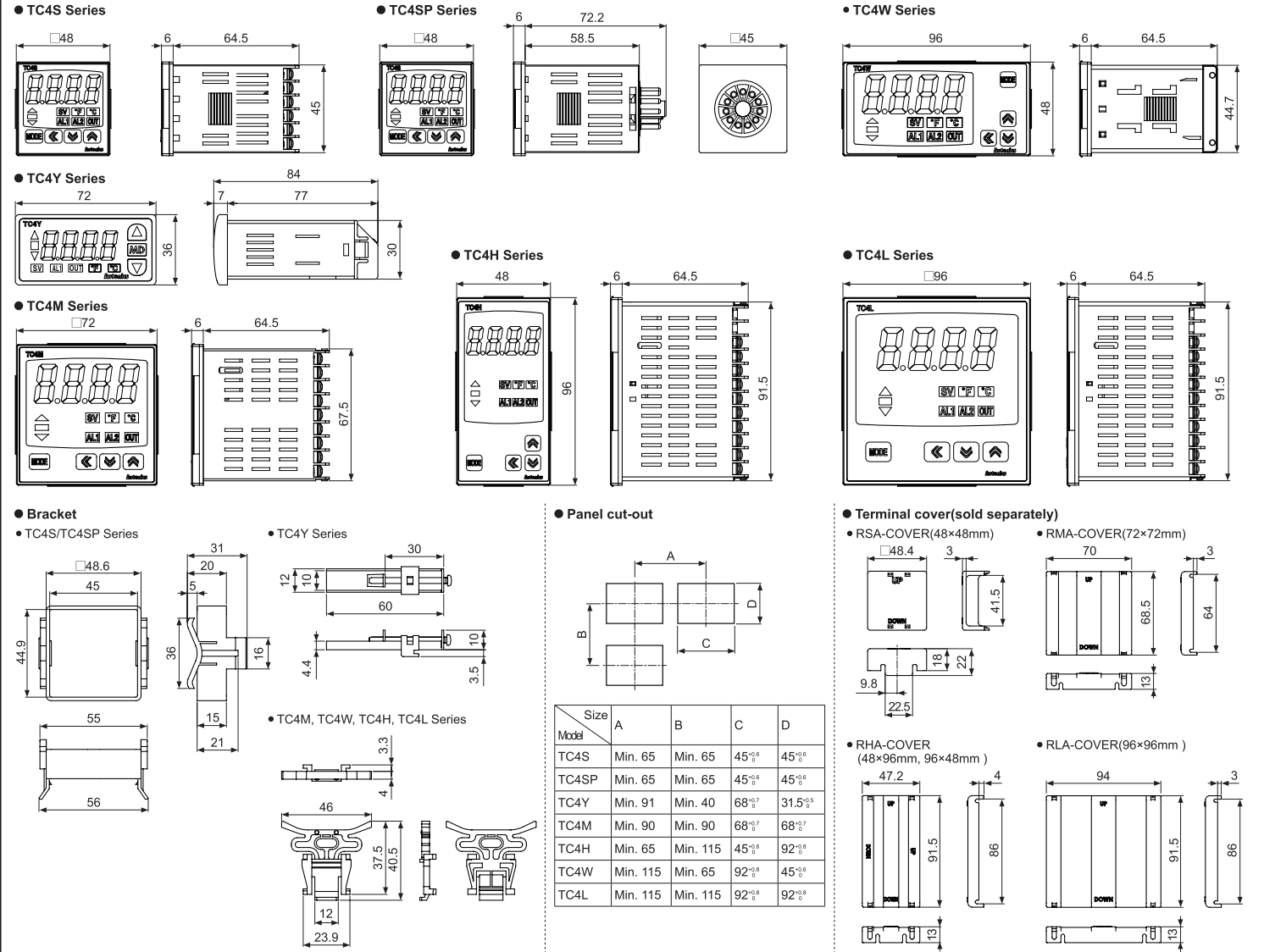
**Input sensor and temperature range [ i n t ]**

Input sensor	Display	Input range (°C)	Input range (°F)
Thermocouple	K(CA)	εCR	-50 to 1200
	J(IC)	JIC	-30 to 500
	L(IC)	LIC	-40 to 800
RTD	DP1100Ω	dPEH	-100 to 400
	Cu50Ω	εUSL	-50.0 to 200.0

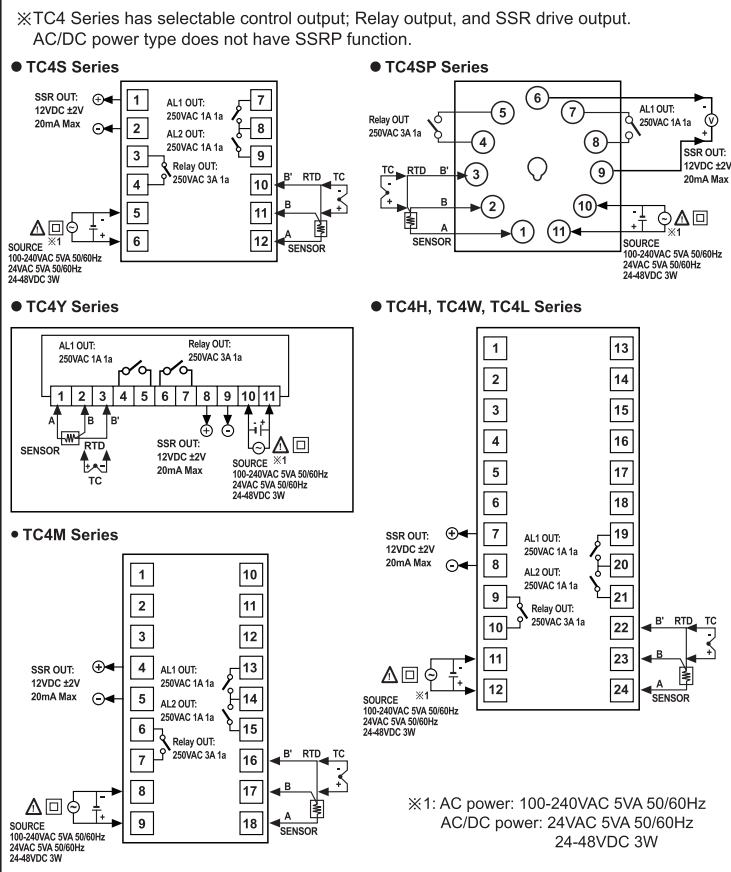
**Installation**



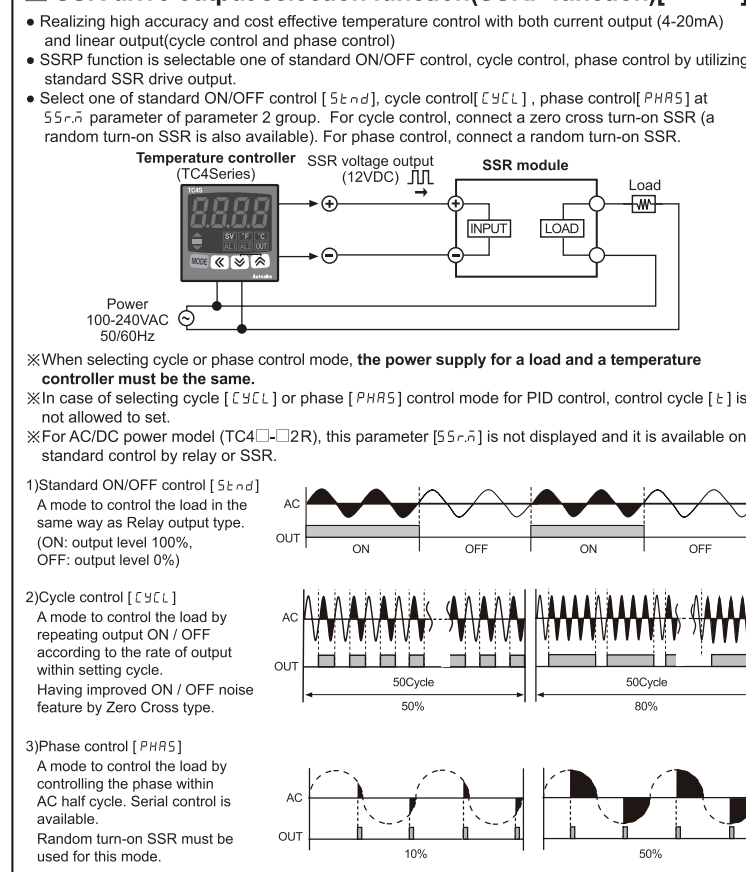
**Dimensions**



**Connections**

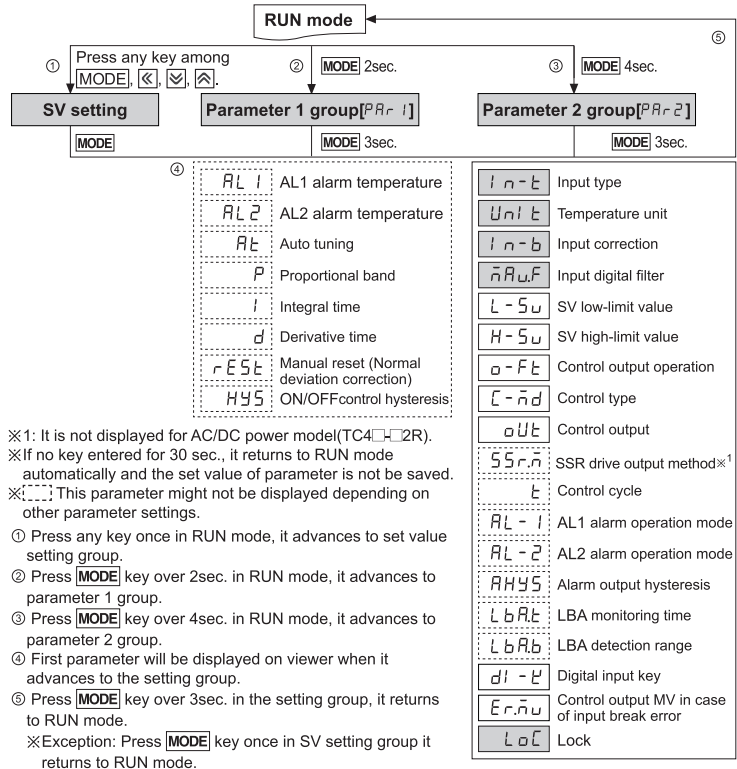


**SSR drive output selection function(SSRP function)[ 5 5 r n ]**



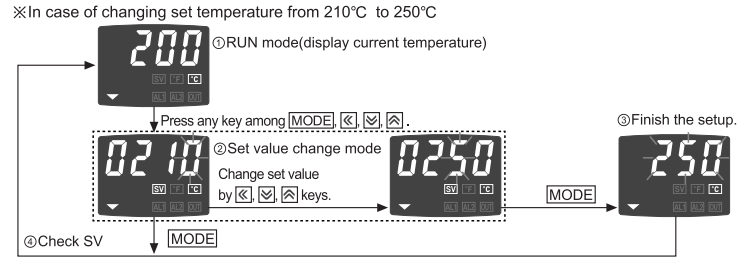


### Flow chart for setting group

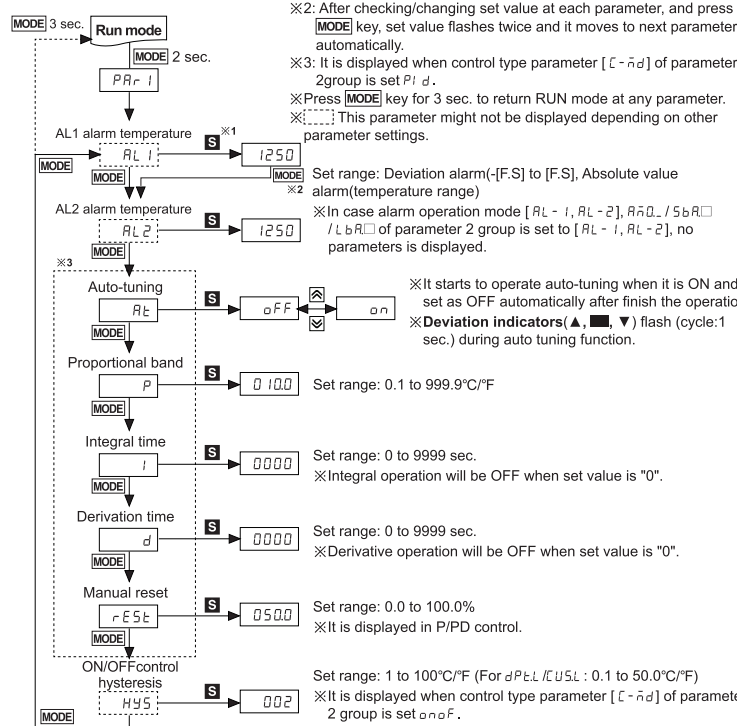


※1: It is not displayed for AC/DC power mode(TC4□-2R).  
 ※If no key entered for 30 sec., it returns to RUN mode automatically and the set value of parameter is not saved.  
 ※: This parameter might not be displayed depending on other parameter settings.  
 ① Press any key once in RUN mode, it advances to set value setting group.  
 ② Press **MODE** key over 2sec. in RUN mode, it advances to parameter 1 group.  
 ③ Press **MODE** key over 4sec. in RUN mode, it advances to parameter 2 group.  
 ④ First parameter will be displayed on viewer when it advances to the setting group.  
 ⑤ 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 **Parameter 2 group** → **Parameter 1 group** → **SV setting**  
 • Set parameter as the above considering parameter relation of each setting group.  
 • Check parameter set value after change parameter of parameter 2 group.  
 ※Indicator model (TC4□-N□) displays shaded parameter( ) of parameter 2 group.  
 ※AL-1, AL-2 parameters of parameter 2 group is decided whether to display according by alarm output type.  
 ※If alarm operation mode [AL-1, AL-2] of parameter 2 group is set to  $\overline{A}\overline{N}\overline{1}$  /  $\overline{S}\overline{b}\overline{R}\overline{1}$  /  $\overline{L}\overline{b}\overline{R}\overline{1}$ ,  $\overline{A}\overline{H}\overline{Y}\overline{5}$  parameter is not displayed.

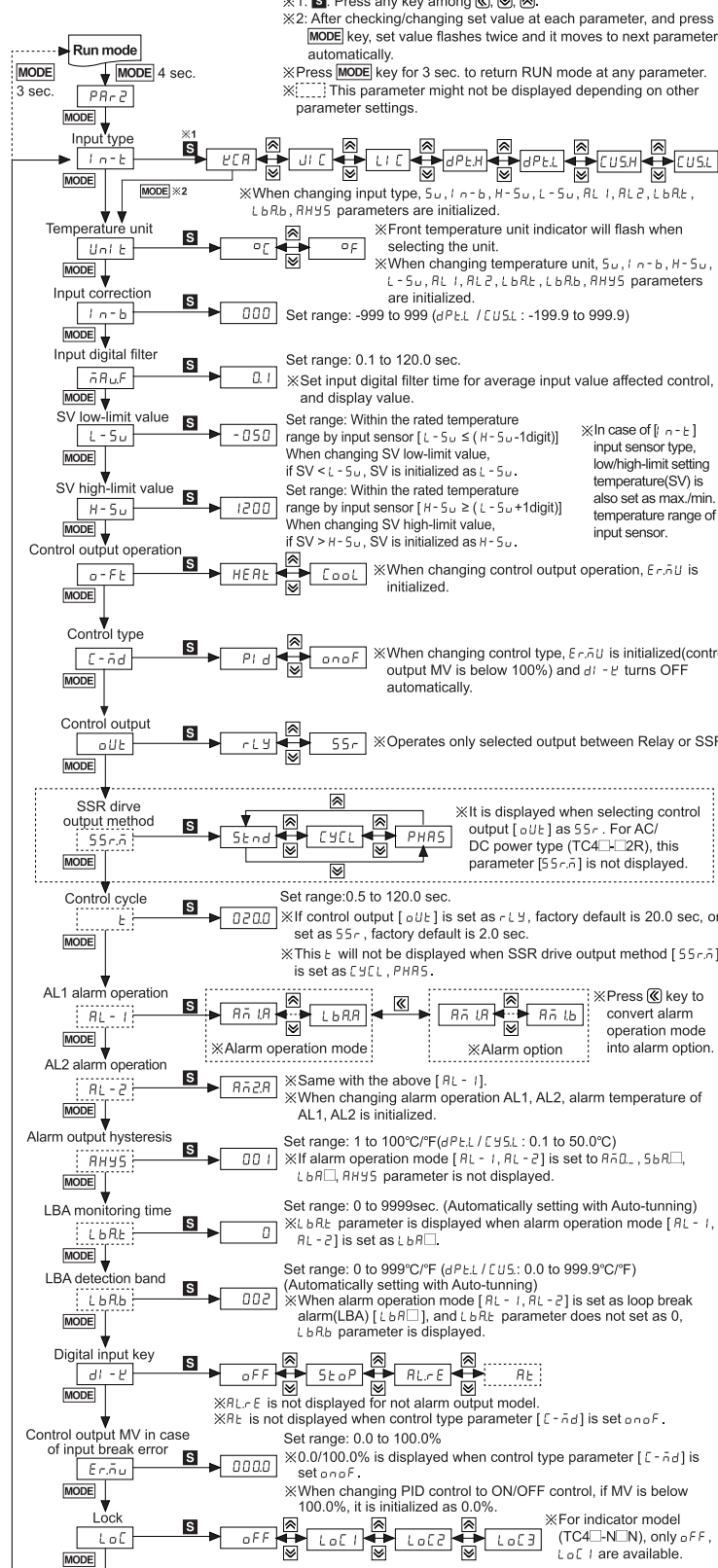
### Flow chart for SV setting group



### Parameter 1 group



### Parameter 2 group



### Factory default

Parameter	Factory default	Parameter	Factory default
Input type	TCR	Temperature unit	C
Input correction	0000	Input digital filter	0.1
SV low-limit value	-050	SV high-limit value	1200
Control output operation	HERt	Control type	PID
Control output	oUt	SSR drive output method	Stnd
Control cycle	0200	AL1 alarm operation mode	AN1
AL2 alarm operation mode	AN2	Alarm output hysteresis	001
LBA monitoring time	0	LBA detection range	002
Digital input key	oFF	Control output MV in case of input break error	0000
Lock	LoC		

### Alarm [AL-1/AL-2]

There are two alarms which operate individually. You can set combined alarm operation and alarm option.  
 Use digital input key (set as  $\overline{A}\overline{L}\overline{1}$ ) or turn OFF power and re-start this unit to release alarm operation.

**1) Alarm operation**

Mode	Name	Alarm operation	Description
$\overline{A}\overline{N}\overline{1}$	Deviation high-limit alarm	OFF $\overline{H}\overline{1}$ ON $\overline{H}\overline{1}$ High deviation: Set as 10°C	If deviation between PV and SV as high-limit is higher than set value of deviation temperature, the alarm output will be ON.
$\overline{A}\overline{N}\overline{2}$	Deviation low-limit alarm	ON $\overline{H}\overline{1}$ OFF $\overline{H}\overline{1}$ Lower deviation: Set as 10°C	If deviation between PV and SV as low-limit is higher than set value of deviation temperature, the alarm output will be ON.
$\overline{A}\overline{N}\overline{3}$	Deviation high/low-limit alarm	ON $\overline{H}\overline{1}$ OFF $\overline{H}\overline{1}$ / OFF $\overline{H}\overline{2}$ ON $\overline{H}\overline{2}$ High/Lower deviation: Set as 10°C	If deviation between PV and SV as high/low-limit is higher than set value of deviation temperature, the alarm output will be ON.
$\overline{A}\overline{N}\overline{4}$	Deviation high/low-limit reserve alarm	OFF $\overline{H}\overline{1}$ ON $\overline{H}\overline{1}$ / OFF $\overline{H}\overline{2}$ ON $\overline{H}\overline{2}$ High/Lower deviation: Set as 10°C	If deviation between PV and SV as high/low-limit is higher than set value of deviation temperature, the alarm output will be OFF.
$\overline{A}\overline{N}\overline{5}$	Absolute value high limit alarm	OFF $\overline{H}\overline{1}$ ON $\overline{H}\overline{1}$ / OFF $\overline{H}\overline{2}$ ON $\overline{H}\overline{2}$ Absolute-value Alarm: Set as 90°C	If PV is higher than the absolute value, the output will be ON.
$\overline{A}\overline{N}\overline{6}$	Absolute value low limit alarm	ON $\overline{H}\overline{1}$ OFF $\overline{H}\overline{1}$ / ON $\overline{H}\overline{2}$ OFF $\overline{H}\overline{2}$ Absolute-value Alarm: Set as 110°C	If PV is lower than the absolute value, the output will be ON.
$\overline{S}\overline{b}\overline{R}\overline{1}$	Sensor break alarm	—	It will be ON when it detects sensor disconnection.
$\overline{L}\overline{b}\overline{R}\overline{1}$	Loop break alarm	—	It will be ON when it detects loop break.

※ H: Alarm output hysteresis [HY5]

**2) Alarm option**

Option	Name	Description
$\overline{A}\overline{N}\overline{1}$	Standard alarm	If it is an alarm condition, alarm output is ON. If it is a clear alarm condition, alarm output is OFF.
$\overline{A}\overline{N}\overline{b}$	Alarm latch	If it is an alarm condition, alarm output is ON and maintains ON status. (Alarm output HOLD)
$\overline{A}\overline{N}\overline{c}$	Standby sequence 1	First alarm condition is ignored and from second alarm condition, standard alarm operates. When power is supplied and it is an alarm condition, this first alarm condition is ignored and from the second alarm condition, standard alarm operates.
$\overline{A}\overline{N}\overline{d}$	Alarm latch and standby sequence 1	If it is an alarm condition, it operates both alarm latch and standby sequence. When power is supplied and it is an alarm condition, this first alarm condition is ignored and from the second alarm condition, alarm latch operates.
$\overline{A}\overline{N}\overline{e}$	Standby sequence 2	First alarm condition is ignored and from second alarm condition, standard alarm operates. When re-applied standby sequence and if it is alarm condition, alarm output does not turn ON. After clearing alarm condition, standard alarm operates.
$\overline{A}\overline{N}\overline{f}$	Alarm latch and standby sequence 2	Basic operation is same as alarm latch and standby sequence 1. It operates not only by power ON/OFF, but also alarm setting value, or alarm option changing. When re-applied standby sequence and if it is alarm condition, alarm output does not turn ON. After clearing alarm condition, alarm latch operates.

※ 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. It is selectable between standard alarm [ $\overline{S}\overline{b}\overline{R}\overline{1}$ ] or alarm latch [ $\overline{S}\overline{b}\overline{R}\overline{1}$ ].

**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 [ $\overline{L}\overline{b}\overline{R}\overline{1}$ ] during LBA monitoring time [ $\overline{L}\overline{b}\overline{R}\overline{1}$ ], or when control output MV is 0%/100% for cooling control and PV is not decreased below than LBA detection band [ $\overline{L}\overline{b}\overline{R}\overline{1}$ ] during LBA monitoring time [ $\overline{L}\overline{b}\overline{R}\overline{1}$ ], alarm output turns ON.

**Start control** (1) When control output MV is 100%, PV is increased over than LBA detection band [ $\overline{L}\overline{b}\overline{R}\overline{1}$ ] during LBA monitoring time [ $\overline{L}\overline{b}\overline{R}\overline{1}$ ].  
 (2) The status of changing control output MV (LBA monitoring time is reset.)  
 (3) When control output MV is 0% and PV is not decreased below than LBA detection band [ $\overline{L}\overline{b}\overline{R}\overline{1}$ ] during LBA monitoring time [ $\overline{L}\overline{b}\overline{R}\overline{1}$ ], loop break alarm (LBA) turns ON after LBA monitoring time.  
 (4) Control output MV is 0% and loop break alarm (LBA) turns ON and maintains ON.  
 (5) The status of changing control output MV (LBA monitoring time is reset.)  
 (6) When control output MV is 100% and PV is not increased over than LBA detection band [ $\overline{L}\overline{b}\overline{R}\overline{1}$ ] during LBA monitoring time [ $\overline{L}\overline{b}\overline{R}\overline{1}$ ], loop break alarm (LBA) turns ON after LBA monitoring time.  
 (7) When control output MV is 100% and PV is increased over than LBA detection band [ $\overline{L}\overline{b}\overline{R}\overline{1}$ ] during LBA monitoring time [ $\overline{L}\overline{b}\overline{R}\overline{1}$ ], loop break alarm (LBA) turns OFF after LBA monitoring time.  
 (8) The status of changing control output MV (LBA monitoring time is reset.)  
 ※When executing auto-tuning, LBA detection band [ $\overline{L}\overline{b}\overline{R}\overline{1}$ ] 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) [ $\overline{L}\overline{b}\overline{R}\overline{1}$ ], LBA detection band [ $\overline{L}\overline{b}\overline{R}\overline{1}$ ] and LBA monitoring time [ $\overline{L}\overline{b}\overline{R}\overline{1}$ ] parameter is displayed.

### Input correction [i-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.  
 Ex) If actual temperature is 80°C but controller displays 78°C, set input correction value [i-n-b] as 002 and controller displays 80°C.  
 ※As the result of input correction, if current temperature value (PV) is over each temperature range of input sensor, it displays HHHH or LLLL.

### 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.  
 For example, set input digital filter value as 0.4 sec, and it applies digital filter to input values during 0.4 sec and displays this values. Current temperature may be different by actual input value.

### Hysteresis [HY5]

• If Hysteresis is too narrow, hunting (oscillation, chattering) could occur due to external noise.  
 • In case of ON / OFF control mode, even if PV reaches stable status, there still occurs hunting. It could be due to Hysteresis [HY5] SV, load's response characteristics or sensor's location. In order to reduce hunting to a minimum, it is required to take into following factors consideration when designing temp. controlling: proper Hysteresis [HY5], heater's capacity, thermal characteristics, sensor's response and location.

### Manual reset [rESt]

When selecting PID 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 [rESt] function is to set/correct offset.  
 When PV and SV are equal, reset value is 50.0%. After control is stable, PV is lower than SV, reset value is over 50.0% or PV is higher than SV, reset value is below 50.0%.

### Digital input key (MODE + MODE) 3sec. [dI-t]

Parameter	Operation
OFF	oFF It does not use digital input key function.
RUN/STOP	5toP It is available to pause on control output and auxiliary output (except loop break alarm, sensor break alarm) except control output operates normally as set. Press digital input key for 3sec to re-start the operation.
Clear alarm	ALrE It is available to clear alarm output by force. (It is only when alarm option is alarm latch, standby sequence.) Clear alarm is able to only for out of alarm operation range. Alarm operates normally right after clear alarm.
Auto tuning	Rt Auto tuning function, it is same as auto tuning function [Rt] of parameter 1 group. (You can execute auto tuning from parameter 1 group, and finish it by digital input key.) ※ When control type [rESt] is set as PID, Rt is displayed. When it is set as oFF, digital input key [dI-t] is changed as oFF.

### Control output MV when input sensor line is broken [Ernu]

The function to set control output MV in case of open error. Users are able to set by ON/OFF setting or MV setting. It executes control output by set MV regardless of ON/OFF or PID control output.

### Lock setting [LoC]

Display	Description	Troubleshooting
oFF	Lock off	Check input sensor state.
LoC1	Lock parameter group 2	When input is within the rated temperature range, this display disappears.
LoC2	Lock parameter group 1, 2	
LoC3	Lock parameter group 1, 2, SV setting	

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

### Error

Display	Description	Troubleshooting
oPEr	Flashes if input sensor is disconnected or sensor is not connected.	Check input sensor state.
HHHH	Flashes if measured sensor input is higher than temperature range.	When input is within the rated temperature range, this display disappears.
LLLL	Flashes if measured sensor input is lower than temperature range.	

### Caution for using

- The connection wire of this unit should be separated from the power line and high voltage line in order to prevent from inductive noise.
  - For crimp terminal, select following shaped terminal (M3).
  - Please install power switch or circuit-breaker in order to cut power supply off.
  - Switch or circuit-breaker should be installed near by users for convenient control.
  - Do not use this product as Volt-meter or Ampere-meter, this is a temperature controller.
  - In case of using RTD sensor, 3 wire type must be used. If you need to extend the line, 3 wires must be used with the same thickness as the line. It might cause the deviation of temperature if the resistance of line is different.
  - In case of making power line and input signal line closely, line filter for noise protection should be installed at power line and input signal line should be shielded.
  - Keep away from the high frequency instruments. (High frequency welding machine & sewing machine, large capacity SCR controller)
  - When supplying measuring input, if HHHH or LLLL is displayed, measuring input may have problem. Turn off the power and check the line.
  - Installation environment  
 ① It shall be used indoor.  
 ② Altitude Max. 2000m.  
 ③ Pollution Degree 2.  
 ④ Installation Category II.
- ※ It may cause malfunction if above instructions are not followed.

### Major product

- 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, CO<sub>2</sub>, Nd:YAG
- Laser welding/soldering system
- Temperature controllers
- Temperature/Humidity transducers
- SSR/Power controllers
- Counters
- Timers
- Panel meters
- Tachometer/Pulse(Rate) meters
- Display units
- Sensor controllers

