

# Autonics

## TEMPERATURE CONTROLLER

### TC4 SERIES



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 machineries(Nuclear power control, medical equipment, vehicle, train, airplane, combustion apparatus, entertainment or safety device etc), it is required to install fail-safe device, or contact us.**  
It may cause fire, human injury or property loss.
- Install the unit on a panel.**  
It may cause an electric shock.
- Do not connect, inspect or repair when power is on.**  
It may cause an electric shock.
- Wire properly after check terminal number.**  
It may cause a fire.
- Do not disassemble the case. Please contact us if it is required.**  
It may cause an electric shock or a fire.

#### Caution

- This unit shall not be used outdoors.**  
It might shorten the life cycle of the product or give an electric shock.
- When connect wire, no.20AWG(0.50mm) 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.
- For crimped terminal, select following shaped terminal.**
- Please observe the rated specifications.**  
It might 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 an oil-based detergent and use dry towels.**  
It may cause an 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 check the terminal polarity when connect 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

TC4S-14R	Control output	N	Indicator - Without control output
		R	Relay output+SSRP output(AC power) Relay output+SSRP output(DC power)
	Power supply	1	12-24VDC(DC power)
		4	100-240VAC 50/60Hz
	Alarm output	N	No alarm output
		1	Alarm1 output
		2	Alarm1 + Alarm2 output (*1)
	Size	S	DIN W48×H48mm(Terminal block type)
		SP	DIN W48×H48mm(Plug type) (*2)
		Y	DIN W72×H36mm(*3)
		M	DIN W72×H72mm
		H	DIN W48×H96mm
		W	DIN W96×H48mm
		L	DIN W96×H96mm
	Digit	4	9999(4 Digit Type)
	Setting type	C	Set by touch switch
	Item	T	Temperature controller

\*1: It is unavailable for TC4SP, TC4Y.  
\*2: 11 Pin Socket(PG-11, PS-11): Sold separately  
\*3: It is unavailable for DC power type.

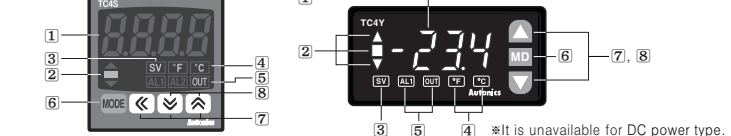
\*The above specifications are subject to change without notice.

#### Specifications

Series	TC4S	TC4SP	TC4 series				TC4L
			TC4Y	TC4M	TC4H	TC4W	
Power supply	AC power 100-240VAC 50/60Hz DC Power 12-24VDC(Except for TC4Y)						
Allowable voltage range	90 ~ 110% of rated voltage						
Power consumption	AC power Max. 5VA(100-240VAC 50/60Hz) DC Power Max. 12W(12-24VDC)						
Display method	7Segment(Red), Other display(Green, Yellow, Red LED)						
Character size	H	15.0mm	15.0mm	20.0mm	14.6mm	20.0mm	22.0mm
Input type	RTD	DIN Pt100Ω, Cu50Ω (Allowable line resistance max.5Ω per a wire) K(CA), J(IC), L(IC)					
Display accuracy	TC	(*1) (PV ±0.5% or ±1°C higher one) rdg ±1Digit (*2) *TC4SP(Plug type) is (PV ±0.5% or ±2°C higher one) rdg ±1Digit *Based on normal temperature(23°C ±5°C)					
Output	Relay	250VAC 3A 1a					
	SSR	12VDC ±2V 20mA Max.					
	Alarm	AL1, AL2 Relay: 250VAC 1A 1a(*TC4SP, TC4Y have AL1 only.)					
Control method	ON/OFF and P, PI, PD, PID control						
Hysteresis	1 ~ 100°C [P, I, L, C, dP, L, CU5.L] / 0.1 ~ 50.0°C [dP, L, CU5.L]						
Proportional band	0.1 ~ 999.9°C						
Integral time(I)	9999 sec.						
Derivative time(D)	9999 sec.						
Control period	0.5 ~ 120.0 sec.						
Sampling period	0.0 ~ 100.0%						
Manual reset	100ms						
Dielectric strength	AC power	2000VAC 50/60Hz for 1min. (Between input terminal and power terminal)					
	DC Power	1000VAC 50/60Hz for 1min. (Between input terminal and power terminal)					
Vibration	0.75mm amplitude at frequency of 5-55Hz in each X, Y, Z directions for 2 hours						
Relay life cycle	Mechanical	Min. 10,000,000 operations					
	Electrical	Min. 100,000 operations (at 250VAC 3A resistive load)					
Insulation resistance	Min. 100MΩ (500VDC megger)						
Noise immunity	AC power	Square-wave noise by noise simulator(pulse width 1μs) ±2KV R-phase and S-phase					
	DC Power	Square-wave noise by noise simulator(pulse width 1μs) ±0.5KV R-phase and S-phase					
Memory retention	Approx. 10 years (When using non-volatile semiconductor memory type)						
Ambient temperature	-10 ~ 50°C (at non-freezing status)						
Storage temperature	-20 ~ 60°C (at non-freezing status)						
Ambient humidity	35 ~ 85%RH						
Insulation type(*3)	□						
Approval	CE, UL (Except for DC power type)						
Unit weight	Approx. 97g	Approx. 84g	Approx. 127g	Approx. 127g	Approx. 118g	Approx. 118g	Approx. 172g

\*1: (PV ±0.5% or ±2°C higher one) rdg ±1Digit, in case, out of normal temperature range.  
\*2: TC4SP is (PV ±0.5% or ±3°C higher one) rdg ±1Digit, in case, out of normal temperature range.  
\*3: "□" Mark indicates that equipment protected throughout by double insulation or reinforced insulation.  
\* DC power type is unavailable for TC4Y series and doesn't received approvals.

#### 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 and Auto tuning indicator: It shows current temperature(PV) based on set temperature(SV) by LED. Deviation indicators (▲, ■, ▼) are 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). SV indicator will be ON and preset SV value will be flickering.
  - Temperature unit indicator(°C/°F): It shows current temperature unit.
  - Control/sub 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 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 [ ] + [ ] keys for 3 sec to operate function(RUN/STOP, alarm output cancel) set in inner parameter [ d1 - 2 ].
- \*Press [ ] + [ ] keys once in set value operation to move digit.

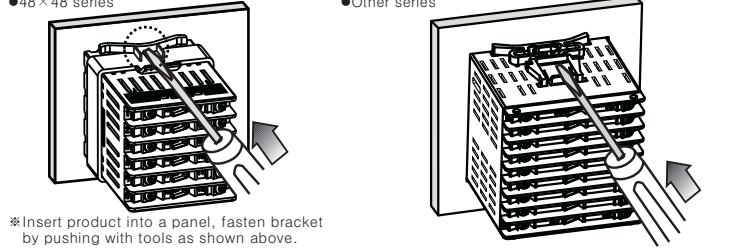
#### Input sensor and range [ I n - t ]

Select proper input sensor type by user application.

Input sensor	Display	Input range (°C)	Input range (°F)	
ThermoCouple	K(CA)	℄C	-50 ~ 1200	-58 ~ 2192
	J(IC)	J I C	-30 ~ 500	-22 ~ 932
	L(IC)	L I C	-40 ~ 800	-40 ~ 1472
RTD	DIN Pt100Ω	dP℄.H	-100 ~ 400	-148 ~ 752
	dP℄.L	-100.0 ~ 400.0	-148.0 ~ 752.0	
	CU50Ω	CU5.H	-50 ~ 200	-58 ~ 392
		CU5.L	-50.0 ~ 200.0	-58.0 ~ 392.0

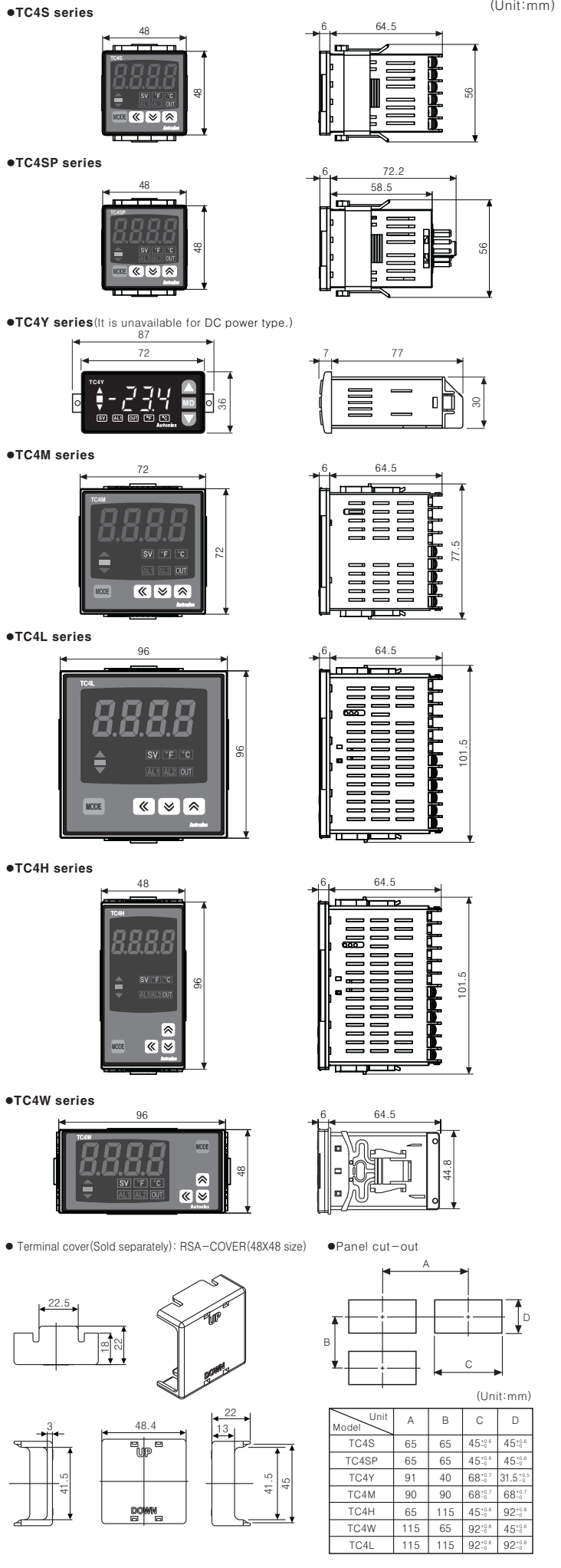
Setting range : [ ℄C / J I C / L I C / dP℄.H / dP℄.L / CU5.H / CU5.L ] (Default : [ ℄C ])

#### Product mounting



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

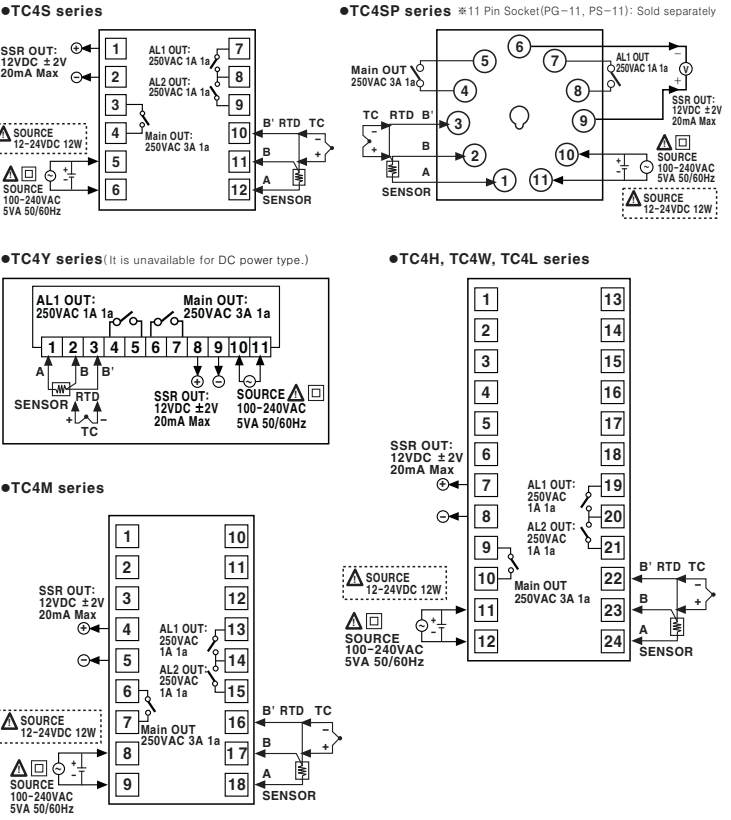
#### Dimensions



#### Connections

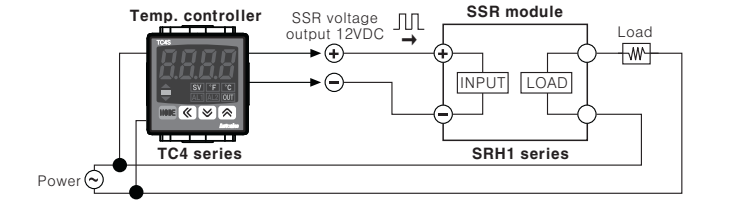
\*TC4 series has both Main Out and SSR Out. You may select the model as your needs.

\*DC power type specifications are seen in dotted line and when selecting SSR OUT, it supports ON/OFF output only.

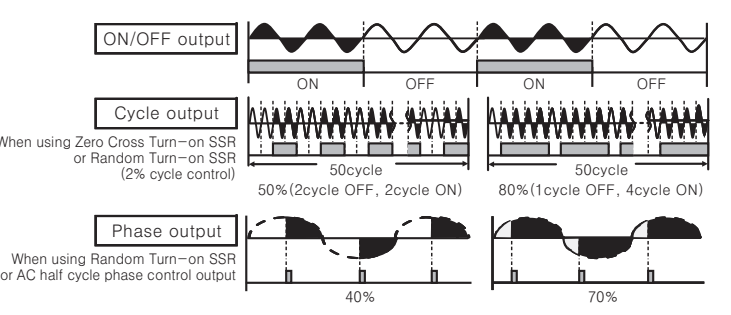


#### SSRP voltage output function

- DC power type supports ON/OFF output only when selecting control output [ 55r - 5 ]. (Not support to select SSRP output method function. [ 55r - 5 ])
- 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 - 5 ]; 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)

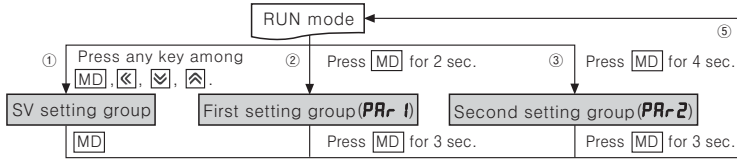


\*You can select the functions with parameter settings.



- Standard control mode [ 55r d ]**  
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 [ 55r C ]**  
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 [ 55r P ]**  
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 [ 55r P ] / cycle [ 55r C ] control output modes, control cycle [ t ] is not allowed to set.

### Flow chart for setting group



<b>AL1</b> : AL1 alarm temperature (Deviation/absolute value) setting	<b>Ln-b</b> : Input sensor
<b>AL2</b> : AL2 alarm temperature (Deviation/absolute value) setting	<b>Unl-t</b> : Temperature unit
<b>ALt</b> : Auto tuning ON/OFF	<b>Ln-b</b> : Input correction
<b>P</b> : Proportional band	<b>nRwF</b> : Input digital filter
<b>I</b> : Integral time setting	<b>L-Su</b> : SV low-limit value
<b>d</b> : Derivative time setting	<b>H-Su</b> : SV high-limit value
<b>rESt</b> : Manual reset(Normal deviation correction) setting	<b>o-Ft</b> : Control output operation(Cool/heat)
<b>HYS</b> : ON/OFF control hysteresis setting	<b>C-nd</b> : Control type
	<b>oUt</b> : Control output type
	<b>SSr</b> : SSR output method
	<b>t</b> : Control cycle
	<b>AL-1</b> : AL1 alarm operation mode
	<b>AL-2</b> : AL2 alarm operation mode
	<b>AHYS</b> : Alarm output hysteresis
	<b>LbARt</b> : LBA monitoring time
	<b>LbAR5</b> : LBA value
	<b>LbARb</b> : LBA detection range
	<b>dl-yl</b> : Function key operation
	<b>Ernu</b> : Control output MV in case of input break error
	<b>LoC</b> : 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 MD key over 2 sec in RUN mode, it advances to setting group 1.
- Press MD key over 4 sec in RUN mode, it advances to setting group 2.
- First parameter will be displayed on viewer when it advances to the setting group.
- Press MD key over 3 sec in the setting group, it returns to RUN mode.

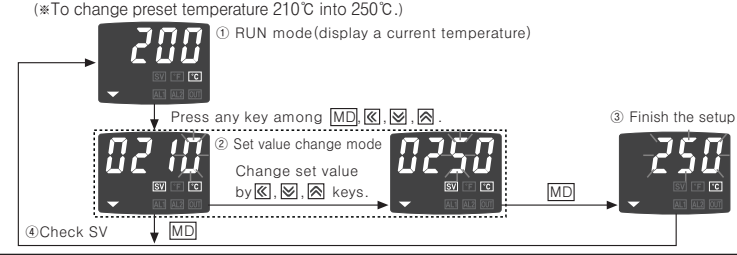
[\*Exception : Press MD key once in setting group of set value, it returns to RUN mode.]

- If no key touched for 30 sec, it will return to RUN mode automatically and the set value of parameter will not be changed.
- Press MD key again within a sec after return to RUN mode by press MD key over 3 sec, it advances to the first parameter of previous setting group.
- Indicator type displays colored parameter of setting group2.
- Parameter setup

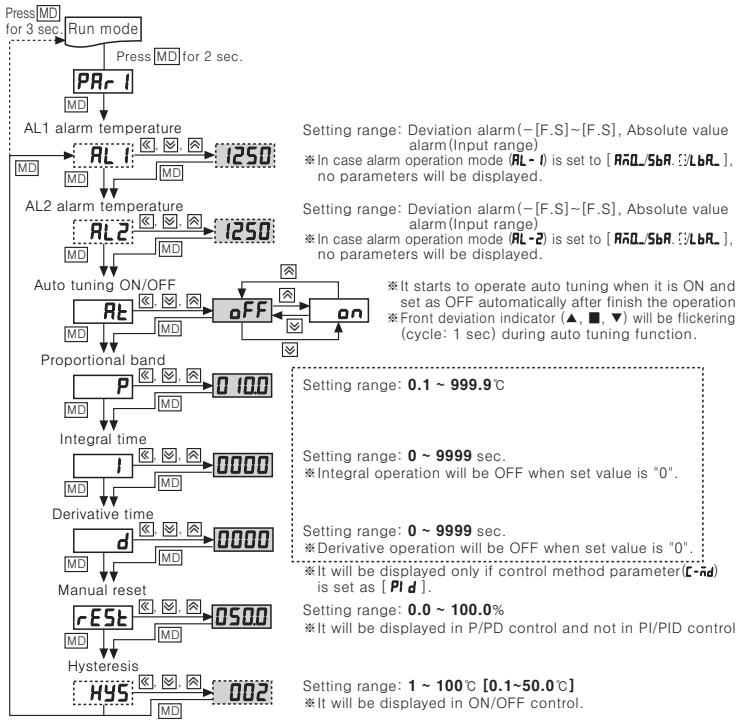
Setting group2 → Setting group1 → Setting group of set value

- Set parameter as the above considering parameter relation of each setting group.
- Check parameter set value after change parameter of setting group2.
- Parameter marked in [ ] would not be displayed by another parameter setting.
- Indicator type displays colored parameter of setting group2.

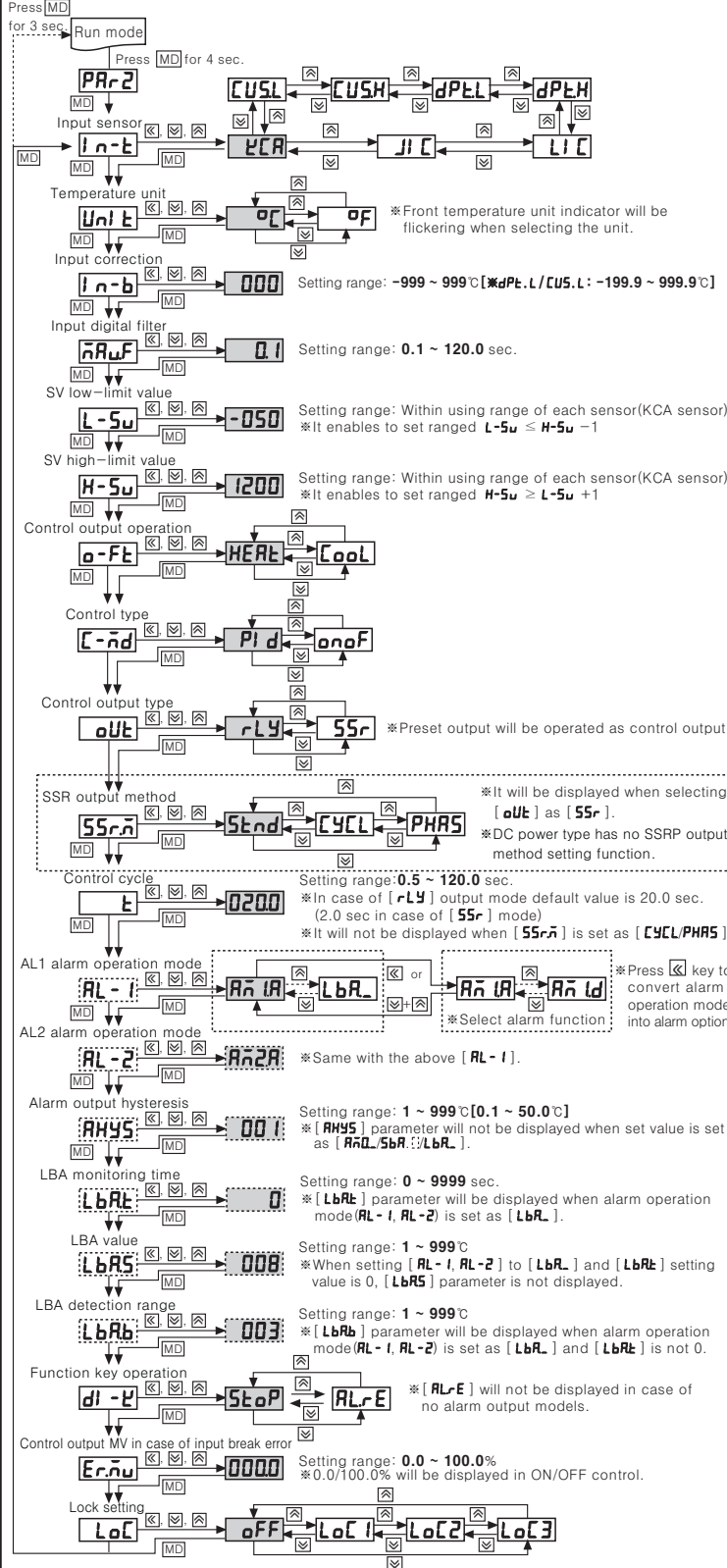
### Flow chart for SV setting group



### Flow chart for first setting group



### Flow chart for second setting group



### Factory default

First setting group		Second setting group	
Parameter	Factory default	Parameter	Factory default
AL1	1250	Ln-b	t
AL2	1250	Unl-t	AL-1
ALt	oFF	Ln-b	AL-2
P	100	nRwF	AHYS
I	0	L-Su	LbARt
d	0	H-Su	LbAR5
rESt	500	o-Ft	LbARb
HYS	2	C-nd	dl-yl
		Ernu	Ernu
		LoC	LoC
		SSr	LoC
		t	LoC

\* DC power type has no SSR output method setting function and supports only ON/OFF output when selecting [SSr] in control output setting function[aut].

### Current temperature(PV) deviation display

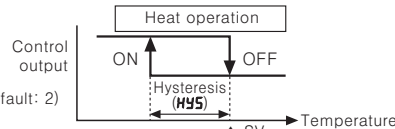
- A function to display SV / PV deviation on front lamp.
- When PV > SV + 2°C, ▲(RED) lamp is ON.
- When SV - 2°C ≤ PV ≤ SV + 2°C, ■(GREEN) lamp is ON.
- When PV < SV - 2°C, ▼(RED) lamp is ON.

### Auto tuning[ALt]

- Front deviation display lamp (▲, ■, ▼) will be flickering (cycle:1 sec) during auto tuning function. (When [ALt] parameter is set to ON.) After completing auto tuning, deviation display lamp (▲, ■, ▼) returns to normal operation and [ALt] parameter automatically becomes OFF.
- Set [oFF] to stop auto tuning function.
- When [oPEn] error occurs, stop the function.
- In case of [HHHH], [LLLL] error, auto tuning keeps operating and finishes normally as long as certain conditions are met.
- Setting range: [oFF/on] (Default: [oFF])

### Hysteresis[HYS]

- In case of selecting ON/OFF control, it is required to set hysteresis.
- Setting range: [tCR, dl C, L1 C, dPE H, CUS H] : 1 ~ 100(Default: 2) [dPE L, CUS L] : 0.1 ~ 50.0



### Digital filter[nRwF]

- A function to filter input signals for more stable PV display in order to provide stable control output. If noise occurs on input signals or PV value keeps changing, it gets difficult to perform high accuracy control since PV has a direct effect on output level.
- Setting range: 0.1 ~ 120.0(Default: 0.1 sec.)

### SV High / Low Limit Setting[L-Su / H-Su]

- A function to set high / low limit for SV(\*[L-Su > H-Su] cannot be set.)
- Users can set / change SV within the range of [H-Su]~[L-Su].
- When changing input sensors[Ln-b], [H-Su] and [L-Su] are automatically reset to Max / Min. of input sensor temperature range.

### Control type selection[C-nd]

- It is selectable PID, ON/OFF control.
- Setting range: [PI d, onoF]

### Control output selection[oUt]

- It is selectable output type between relay and SSR voltage output.
- Setting range: [rLY, SSr]

### Alarm output operation mode[AL-1 / AL-2]

Mode	Alarm output operation	Description(The initial value of AL1/AL2 is KCA.)
Rn0	---	No alarm output.
Rn1	OFF   ON   ON   OFF	Deviation high-limit alarm If deviation between PV and SV is occurring higher than set value of deviation temperature, the output will be ON. The deviation temperature is set in AL1/AL2. (Default of AL1, AL2: 1250)
Rn2	ON   OFF   OFF   ON	Deviation low-limit alarm If deviation between PV and SV is occurring lower than set value of deviation temperature, the output will be ON. The deviation temperature is set in AL1/AL2. (Default of AL1, AL2: 1250)
Rn3	ON   OFF   OFF   ON	Deviation high/low-limit alarm If deviation between PV and SV is occurring higher or lower than set value of deviation temperature, the output will be ON. The deviation temperature is set in AL1/AL2. *It is ON if AL value<0(Default of AL1, AL2:1250)
Rn4	OFF   ON   ON   OFF	Deviation high/low-limit reverse alarm If deviation between PV and SV is occurring higher or lower than set value of deviation temperature, the output will be OFF. The deviation temperature is set in AL1/AL2. *It is OFF if AL value<0(Default of AL1, AL2:0)
Rn5	OFF   ON   ON   OFF	Absolute value high-limit alarm If PV is equal to or higher than the absolute value of alarm temperature, the output will be ON. The absolute temperature is set in AL1/AL2. (Default of AL1, AL2: 1200)
Rn6	ON   OFF   ON   OFF	Absolute value low-limit alarm If PV is equal to or lower than the absolute value of alarm temperature, the output will be ON. The absolute temperature is set in AL1/AL2. (Default of AL1, AL2: -50)
SbAR	It will be ON when it detects sensor disconnection.	Sensor Break Alarm
LbAR	It will be ON when it detects loop break.	Loop Break Alarm

- Alarm output hysteresis[AHYS]
  - Above alarm output operation mode, "H" is alarm output hysteresis which displays alarm output's on/off interval. User settable.
  - When setting alarm operation mode as [Rn0...], [LbAR...], parameter will not be displayed.
  - Setting range [tCR, dl C, L1 C, dPE H, CUS H] : 1 ~ 100 (Default: 1) / [dPE L, CUS L] : 0.1 ~ 50.0

### Additional alarm output operation

Display	Operation	Description
[R]	General alarm	If it reaches to alarm temperature(deviation), sub output will be ON and OFF when it is out of the range.
[b]	Latch function	If it reaches to alarm temperature(deviation), sub output will be ON and it keeps ON status. (HOLD alarm output)
[c]	Standby sequence function	If it reaches to alarm temperature(deviation), sub output will not be ON and it works as general alarm operation from second reach to alarm temperature(deviation).
[d]	Latch & Standby sequence function	It operates latch and standby sequence mode simultaneously.

### Sensor Break Alarm(SBA)[SbAR]

- 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 sensor is connected with buzzers or other units using output contact.
- When setting alarm operation mode parameter[AL-1, AL-2] as [SbAR], it executes sensor break alarm.
- It is selectable between general alarm[SbAR] and latch[SbRb].
- The alarm output will be OFF when alarm output OFF or power OFF and ON again.

### Loop Break Alarm(LBA)[LbAR]

- If control deviation is not lowered under LBA detection values within LBA monitoring time at the section that control deviation | SV-PV | is out of LBA detection range during normal operation, it is considered control loop error and alarm output becomes ON.
- It does not detect LBA during auto tuning and LBA monitoring start will be initialized when entering alarm reset.
- LBA monitoring time setting range [LbARt] : 0 ~ 9999 (Default : 0, Unit: sec.)
- LBA detecting value setting range [LbAR5] : 1 ~ 999[0.1 ~ 100.0] (Default: 8, Unit: °C)
- LBA detecting width setting range [LbARb] : 1 ~ 999[0.1 ~ 100.0] (Default: 3, Unit: °C)

### FUNCTION KEY Selection Function[dl-yl]

- Press front key (MD) for 3 sec at the same time to perform RUN/STOP function [StoP] and Alarm output OFF function [ALt].
- In case of no alarm output model, it is fixed to [StoP].
  - RUN/STOP function [StoP] is to make control output stop in RUN mode by force.
    - Auxiliary output is normally provided regardless of RUN/STOP function.
    - In case power is off while [StoP] mode, [StoP] mode will be kept after Power is supplied again.
  - Press FUNC key (MD) for 3 sec to return to RUN mode.
  - Alarm output OFF function [ALt] is to make alarm (AL-1, AL-2) output off by force.
    - (Applicable to only to Latch [AL-1] and Latch / Standby [AL-2] mode)
    - (Available only if PV is out of alarm output setting range)

### Control output MV for open error (sensor break) (oPEn) [Ernu]

- A function to set control output MV in case of open error. User settable by ON/OFF setting or MV setting.
- It executes control output by set MV regardless of ON/OFF or PID control output.
- ON/OFF control setting range: 0.0(OFF)/100.0(ON) / PID control setting range: 0.0 ~ 100.0
- Default: 0.0 (Unit: %)

### 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                                  |
| LoC 1   | Lock setting group 2                      |
| LoC 2   | Lock setting group 1, 2                   |
| LoC 3   | Lock setting group 1, 2, SV setting group |

- Setting range: [oFF / LoC 1 / LoC 2 / LoC 3] (Default: [oFF])
- [oFF], [LoC 1] are available only for indicator(TC4□-N□).

### Error

- Error mark will flash(every 1 sec.) in PV viewer when error is occurred during the control operation.
- | Display | Description   |
|---------|---|
| oPEn    | 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.   |
- As soon as error causing factors get solved (by connecting input sensors / by making sensor input within the rated range), error mark [oPEn / HHHH / LLLL] will be disappeared and returning to normal operation mode.

### Caution for using

- Installation environment
    - It shall be used indoor.
    - Altitude Max. 2000m.
    - Pollution Degree 2.
    - Installation Category II.
  - Please install power switch or circuit-breaker in order to cut power supply off.
  - The switch or circuit-breaker should be installed near by users.
  - Do not use this product as Volt-meter or Ampere-meter, this is a temperature controller.
  - Be sure to use compensating wire when extends wire from controller to thermocouple, otherwise the temperature deviation will be occurred at the part where wires are connected to each other.
  - 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)
- It may cause malfunction if above instructions are not followed.**

### Major products

- Proximity sensors
- Area sensors
- Door/Door side sensors
- Counters
- Rotary encoders
- Power controllers
- Panel meters
- Graphic/Logic panels
- Temperature controllers
- Tachometer/Pulse(Rate) meters
- Temperature/Humidity transducers
- Stepping motors/drivers/motion controllers
- Laser marking system(CO2, Nd:YAG)
- Laser welding/soldering system
- Photoelectric sensors
- Fiber optic sensors
- Pressure sensors
- Timers
- Display units
- Sensor controllers

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