

# Autonics

## TEMPERATURE CONTROLLER

### TC4 Series

#### INSTRUCTION MANUAL



Thank you for choosing our Autonics 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(0.50mm<sup>2</sup>) 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, humidity, 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	C	4	S	-	1	4	R
Control output	N	Indicator - Without control output					
Power supply	R	Relay output+SSR drive output <sup>※1</sup>					
Sub output	2	24VAC 50/60Hz, 24-48VDC					
	4	100-240VAC 50/60Hz					
	N	No alarm output					
	1	Alarm1 output					
	2	Alarm1 + Alarm2 output <sup>※2</sup>					
	S	DIN W48 × H48mm (terminal block type)					
	SP	DIN W48 × H48mm (11pin plug type) <sup>※3</sup>					
	Y	DIN W72 × H36mm					
	M	DIN W72 × H72mm					
	H	DIN W48 × H96mm					
	W	DIN W96 × H48mm					
	L	DIN W96 × H96mm					
Digit	4	9999 (4 Digit)					
Setting type	C	Set by touch switch					
Item	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: Sockets for TC4SP (PG-11, PS-11(N)) are sold separately.

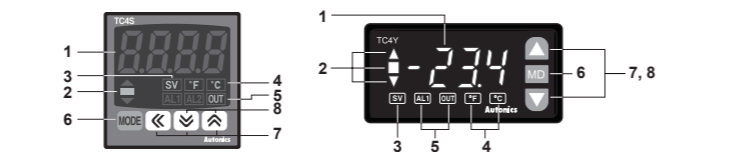
※The above specifications are subject to change and some models may be discontinued without notice.  
 ※Be sure to follow cautions written in the instruction manual and the technical descriptions (catalog, homepage).

### Specifications

Series	TC4 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	AC power	90 to 110% of rated voltage	AC/DC Power	Max. 5VA (100-240VAC 50/60Hz)				
Power consumption	AC power	Max. 5VA (24VAC 50/60Hz), Max. 3W (24-48VDC)	AC/DC Power	Max. 5VA (100-240VAC 50/60Hz)				
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		7.0×14.6mm	11.0×22.0mm
Input type	RTD	DPT100Ω, 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						
	TC	※ For TC4SP, add ±1°C by accuracy standard.						
Control	Relay	250VAC ~ 3A 1a						
output	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 X, Y, Z direction 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 50VDC 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)							
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, RU, US							
Weight <sup>※2</sup>	AC power	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)
	AC/DC Power	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) ± 1 digit
- Out of room temperature range: (PV ± 0.5% or ± 3°C, select the higher one) ± 1 digit
- In case of TC4SP Series, ± 1°C will be added.
- ※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**
  - 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**

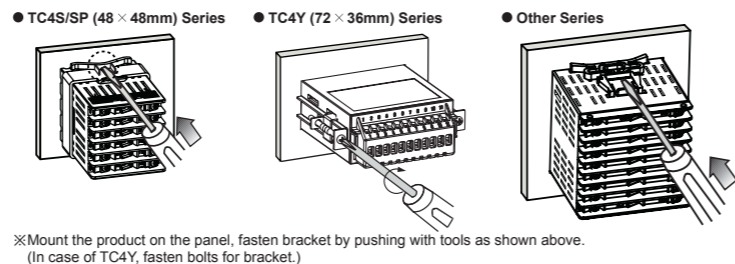
Press  $\left[ \text{FUNCTION} \right]$  keys for 3 sec. to operate function (RUN/STOP, alarm output cancel, auto-tuning) set in inner parameter [j - 2].

※ Press  $\left[ \text{FUNCTION} \right]$  keys at the same time in set value operation to move digit.

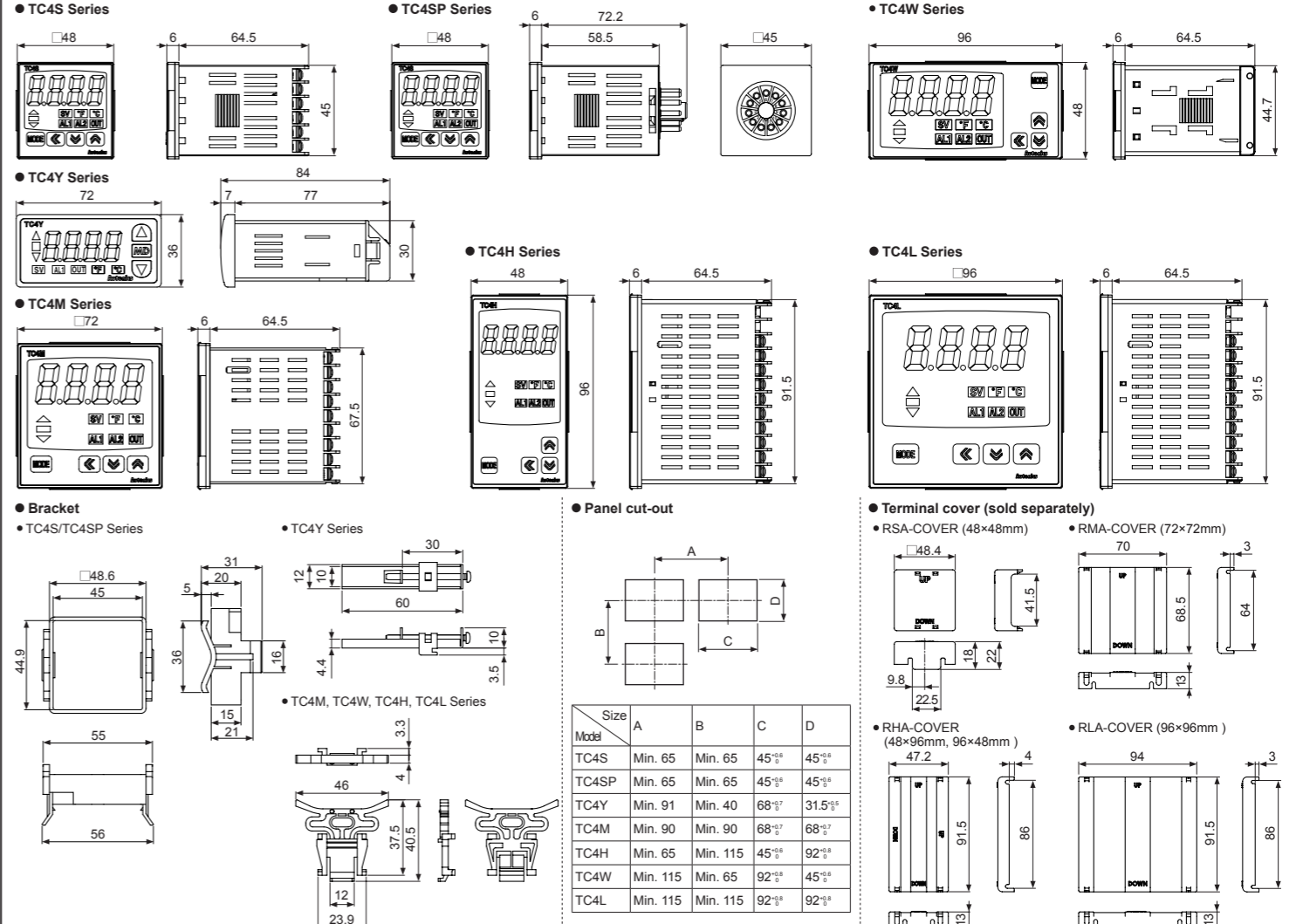
### Input Sensor and Temperature Range [i n - t ]

Input sensor	Display	Temperature range (°C)	Temperature range (°F)
Thermocouple	K (CA)	-50 to 1200	-58 to 2192
	J (IC)	-30 to 500	-22 to 932
	L (IC)	-40 to 800	-40 to 1472
RTD	dPt100	-100 to 400	-148 to 752
	dPt100	-100.0 to 400.0	-148.0 to 752.0
	Cu50	-50 to 200	-58 to 392
	Cu50L	-50.0 to 200.0	-58.0 to 392.0

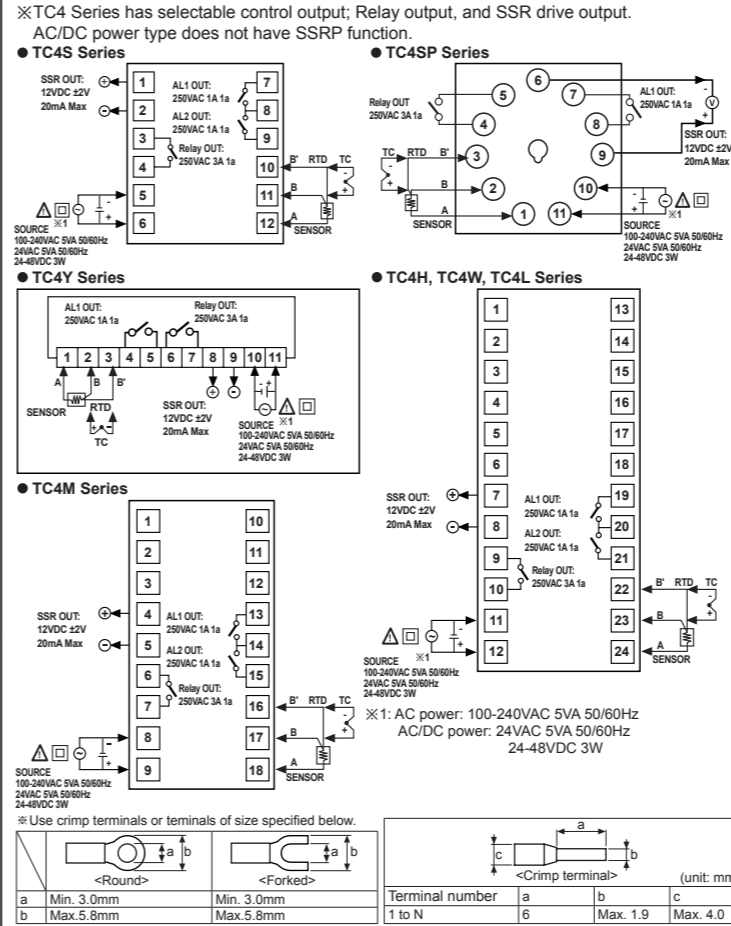
### Installation



### Dimensions

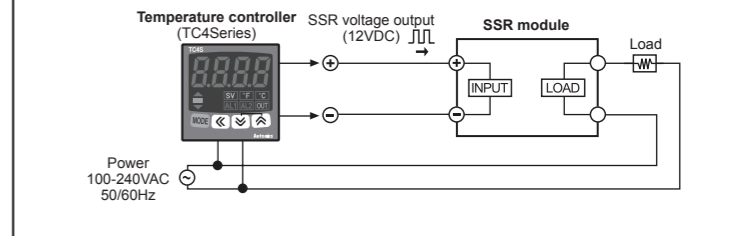


### Connections

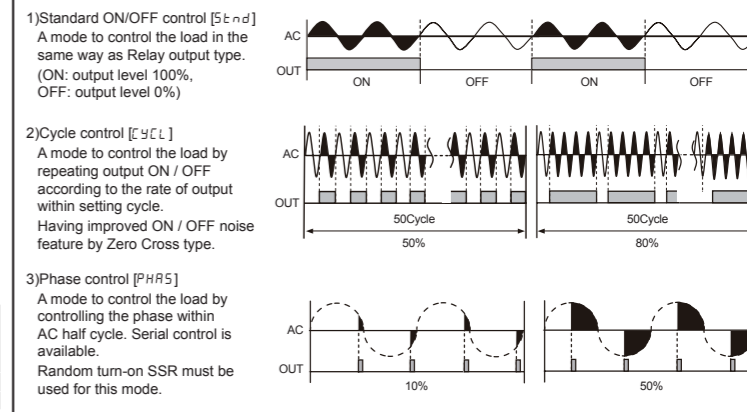


### SSR Drive Output Selection Function (SSRP Function) [5 5 r n]

- 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).
- Select one of standard ON/OFF control [5 t n d], cycle control [C Y C L], phase control [P H A S] at [5 5 r n] parameter of Parameter group 2. For cycle control, connect zero cross turn-on SSR or random turn-on SSR. For phase control, connect random turn-on SSR.



※ When selecting cycle or phase control mode, the power supply for a load and a temperature controller must be same.  
 ※ In case of selecting cycle [C Y C L] or phase [P H A S] control mode for PID control, control cycle [t] is not allowed to set.  
 ※ For AC/DC power model (TC4□-□2R), this parameter [5 5 r n] is not displayed and it is available only standard control by relay or SSR.



### Parameter Groups

**RUN mode**

① Press any key among [MODE], [←], [→], [△], [▽] → **SV setting**

② Press [MODE] key over 2sec. → **Parameter group 1 [PAr-1]**

③ Press [MODE] key over 4sec. → **Parameter group 2 [PAr-2]**

④ Press [MODE] key over 3sec. → **Parameter group 1 [PAr-1]**

⑤ Press [MODE] key over 3sec. → **Parameter group 2 [PAr-2]**

⑥ Press [MODE] key over 3sec. → **SV setting**

AL1	AL1 alarm temperature	[AL1]	Input type
AL2	AL2 alarm temperature	[AL2]	Temperature unit
At	Auto tuning	[Un1t]	Input correction
P	Proportional band	[In-b]	Input digital filter
i	Integral time	[nRwF]	SV low-limit value
d	Derivative time	[L-5u]	SV high-limit value
rESt	Manual reset (Normal deviation correction)	[H-5u]	Control output operation
H55	ON/OFF control hysteresis	[o-Ft]	Control type
		[c-nd]	Control output
		[oUt]	SSR drive output method
		[55r-n]	Control cycle
		[t]	AL1 alarm operation mode
		[AL-1]	AL2 alarm operation mode
		[AL-2]	Alarm output hysteresis
		[RH55]	LBA monitoring time
		[LbRt]	LBA detection range
		[LbRb]	Control type
		[d1-lt]	Control output
		[Er-nu]	Control output MV in case of input break error
		[LoC]	Parameter lock

※1: It is not displayed for AC/DC power model (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 group 1.  
 ③ Press [MODE] key over 4sec. in RUN mode, it advances to parameter group 2.  
 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 group 2] → [Parameter group 1] → [SV setting]

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

※Indicator model (TC4□□□N□) displays shaded parameter (□□□□) of Parameter group 2.  
 ※AL-1, AL-2 parameters of Parameter group 2 is decided whether to display according by alarm output type.  
 ※If alarm operation mode [AL-1, AL-2] of Parameter group 2 is set to RA□□ / SbR□ / LbR□, RH55 parameter is not displayed.

### Flow Chart For SV Setting Group

※In case of changing set temperature from 210°C to 250°C

### Parameter Reset

Reset all parameters as factory default. Hold the front [←] [→] keys for 5 sec., to enter parameter reset [rESt] parameter. Select 'YES' and all parameters are reset as factory default. Select 'no' and previous settings are maintained. If setting parameter lock [LoC] or processing auto-tuning, parameter reset is unavailable.

### Parameter Group 1

※1: Press any key among [←], [→], [△], [▽].  
 ※2: After checking/changing set value at each parameter, and press [MODE] key, set value flashes twice and it moves to next parameter automatically.  
 ※3: It is displayed when control type parameter [c-nd] of parameter group 2 is set PId.

※Press [MODE] key for 3 sec. to return RUN mode at any parameter.  
 ※This parameter might not be displayed depending on other parameter settings.

Setting range: Deviation alarm [-F.S.] to [F.S.], Absolute value alarm (temperature range)

AL1 alarm temperature [AL1] 1250  
 AL2 alarm temperature [AL2] 1250

Auto-tuning [At] oFF

Proportional band [P] 0.100 Setting range: 0.1 to 999.9°C/F

Integral time [i] 0000 Setting range: 0 to 9999 sec.  
 ※Integral operation will be OFF when set value is "0".

Derivation time [d] 0000 Setting range: 0 to 9999 sec.  
 ※Derivative operation will be OFF when set value is "0".

Manual reset [rESt] 0500 Setting range: 0.0 to 100.0%  
 ※It is displayed in P/PD control.

ON/OFF control hysteresis [H55] 002 Setting range: 1 to 100°C/F (For dPtL / cUSL : 0.1 to 50.0°C/F)  
 ※It is displayed when control type parameter [c-nd] of Parameter group 2 is set oNoF.

### Parameter Group 2

Run mode

① Input type [In-t] 0000 Setting range: 0 to 999.9°C/F  
 ※When changing input type, SV, [In-b], [H-5u], [L-5u], [AL-1], [AL-2], [LbRt], [LbRb], [RH55] parameters are initialized.

② Temperature unit [Un1t] 0000 Setting range: 0 to 999.9°C/F  
 ※Front temperature unit indicator will flash when selecting the unit.  
 ※When changing temperature unit, SV, [In-b], [H-5u], [L-5u], [AL-1], [AL-2], [LbRt], [LbRb], [RH55] parameters are initialized.

③ Input correction [In-b] 000 Setting range: -999 to 999 (dPtL / cUSL : -199.9 to 999.9)

④ Input digital filter [nRwF] 0.1 Setting range: 0.1 to 120.0 sec.  
 ※Set input digital filter time for average input value affected control, and display value.

⑤ SV low-limit value [L-5u] -050 Setting range: Within the rated temperature range by input sensor [L-5u ≤ (H-5u-1digit)]  
 When changing SV low-limit value, if SV < L-5u, SV is initialized as L-5u.

⑥ SV high-limit value [H-5u] 1200 Setting range: Within the rated temperature range by input sensor [H-5u ≥ (L-5u+1digit)]  
 When changing SV high-limit value, if SV > H-5u, SV is initialized as H-5u.

⑦ Control output operation [o-Ft] HErEt Control output operation, Er-nu is initialized.

⑧ Control type [c-nd] PId Control type, Er-nu is initialized (when control MV is below 100%) and d1-lt turns OFF automatically.

⑨ Control output [oUt] rLY SSR drive output method, 55r Operates only selected output between Relay or SSR.

⑩ SSR drive output method [55r-n] Stnd Control cycle, t Setting range: 0.5 to 120.0 sec.  
 ※If control output [oUt] is set as rLY, factory default is 20.0 sec, or set as 55r, factory default is 2.0 sec.  
 ※This t will not be displayed when SSR drive output method [55r-n] is set as CyCL, PHAS.

⑪ AL1 alarm operation [AL-1] RA1A Alarm operation mode, RA1b Alarm option.

⑫ AL2 alarm operation [AL-2] RA2A Same with the above [AL-1].

⑬ Alarm output hysteresis [RH55] 001 Setting range: 1 to 100°C/F (dPtL / cUSL : 0.1 to 50.0°C)  
 ※If alarm operation mode [AL-1, AL-2] is set to RA□□, SbR□, LbR□, RH55 parameter is not displayed.

⑭ LBA monitoring time [LbRt] 0 Setting range: 0 to 9999sec. (Automatically setting with Auto-tuning)  
 ※LbRt parameter is displayed when alarm operation mode [AL-1, AL-2] is set as LbR□.

⑮ LBA detection band [LbRb] 002 Setting range: 0 to 999°C/F (dPtL / cUSL : 0.0 to 999.9°C/F)  
 (Automatically setting with Auto-tuning)  
 ※When alarm operation mode [AL-1, AL-2] is set as loop break alarm (LBA) [LbR□], and LbRt parameter does not set as 0, LbRb parameter is displayed.

⑯ Digital input key [d1-lt] oFF Digital input key, StOp, AL-1, AL-2, RA-1, RA-2.

⑰ Control output MV in case of input break error [Er-nu] 0000 Setting range: 0.0 to 100.0%  
 ※0.0/100.0% is displayed when control type parameter [c-nd] is set oNoF.  
 ※When changing PID control to ON/OFF control, if MV is below 100.0%, it is initialized as 0.0%.

⑱ Parameter lock [LoC] oFF Parameter lock, LoC1, LoC2, LoC3.

### Factory Default

Parameter	Factory default
SV setting	0

Parameter	Factory default
Parameter Group 1	
AL1	1250
AL2	1250
At	oFF
P	0.100
i	0000
d	0000
rESt	0500
H55	002

Parameter	Factory default
Parameter Group 2	
In-t	0000
Un1t	00
In-b	0000
nRwF	000.1
L-5u	-050
H-5u	1200
o-Ft	HErEt
c-nd	PId
oUt	rLY
55r-n	Stnd
t	002
AL-1	RA1A
AL-2	RA2A
RH55	001
LbRt	0
LbRb	002
d1-lt	oFF
Er-nu	0000
LoC	oFF

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

Set both alarm operation and alarm option by combining. Each alarm operates individually in two alarm output models. When the current temperature is out of alarm range, alarm clears automatically. If alarm option is alarm latch or alarm latch and standby sequence 1/2, press digital input key [d1-lt] 3 sec., digital input key [d1-lt] of Parameter group 2 set as AL-1, or turn OFF the power and turn ON to clear alarm.

Mode	Name	Alarm operation	Description
RA□□	—	—	No alarm output
RA1□	Deviation high-limit alarm	OFF → ON (SV 100°C / PV 110°C) 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.
RA2□	Deviation low-limit alarm	ON → OFF (PV 90°C / SV 100°C) 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.
RA3□	Deviation high/low-limit alarm	ON → OFF (SV 90°C / PV 100°C) 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.
RA4□	Deviation high/low-limit reserve alarm	OFF → ON (PV 90°C / SV 100°C) 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.
RA5□	Absolute value high limit alarm	OFF → ON (SV 90°C / PV 100°C) Absolute-value Alarm: Set as 90°C	If PV is higher than the absolute value, the output will be ON.
RA6□	Absolute value low limit alarm	ON → OFF (PV 90°C / SV 100°C) Absolute-value Alarm: Set as 110°C	If PV is lower than the absolute value, the output will be ON.
SbR□	Sensor break alarm	—	It will be ON when it detects sensor disconnection.
LbR□	Loop break alarm	—	It will be ON when it detects loop break.

※ H: Alarm output hysteresis [RH55]

### 2) Alarm operation

Option	Name	Description
RA□□	Standard alarm	If it is an alarm condition, alarm output is ON. If it is a clear alarm condition, alarm output is OFF.
RA□b	Alarm latch	If it is an alarm condition, alarm output is ON and maintains ON status. (Alarm output HOLD)
RA□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.
RA□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.
RA□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.
RA□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 [SbR□] or alarm latch [SbRb].

### 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] during LBA monitoring time [LbRt], or when control output MV is 0% (100% for cooling control) and PV is not decreased below than LBA detection band [LbRb] during LBA monitoring time [LbRt], alarm output turns ON.

Start control to ① When control output MV is 100%, PV is increased over than LBA detection band [LbRb] during LBA monitoring time [LbRt].  
 ① to ② The status of changing control output MV (LBA monitoring time is reset.)  
 ② to ③ When control output MV is 0% and PV is not decreased below than LBA detection band [LbRb] during LBA monitoring time [LbRt], loop break alarm (LBA) turns ON after LBA monitoring time.  
 ③ to ④ Control output MV is 0% and loop break alarm (LBA) turns and maintains ON.  
 ④ to ⑥ The status of changing control output MV (LBA monitoring time is reset.)  
 ⑥ to ⑦ When control output MV is 100% and PV is not increased over than LBA detection band [LbRb] during LBA monitoring time [LbRt], loop break alarm (LBA) turns ON after LBA monitoring time.  
 ⑦ to ⑧ When control output MV is 100% and PV is increased over than LBA detection band [LbRb] during LBA monitoring time [LbRt], loop break alarm (LBA) turns OFF after LBA monitoring time.  
 ⑧ to ⑨ The status of changing control output MV (LBA monitoring time is reset.)

※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.

### Input Correction [In-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 [In-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 [nRwF]

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 [RH55]

• 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 [RH55] 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 [RH55], heater's capacity, thermal characteristics, sensor's response and location.

### Manual Reset [rESt]

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 [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 ([d1-lt] + [d1-lt] 3sec.) [d1-lt]

Parameter	Operation
OFF	oFF It does not use digital input key function.
StOp	Pauses control output. Auxiliary output (except loop break alarm, sensor break alarm) except Control output operates as setting. Hold the digital input keys for 3 sec. to restart. Digital input key (t over 3 sec.)
RA□□	Clears alarm output by force. (only when alarm option is alarm latch, or alarm latch and standby sequence 1/2.) This function is applied when present value is out of alarm operation range but alarm output is ON. Alarm operates normally right after clearing alarm.
At	Starts/Stops auto-tuning. This function is same as auto-tuning [At] of parameter group 1. (You can start auto-tuning [At] of parameter group 1 and stop it by digital input key.) ※This parameter At appears only when control method [c-nd] of Parameter group 2 is set as PId. When control method [c-nd] of Parameter group 2 is set as oNoF, this parameter is changed as oFF.

### Control Output MV When Input Sensor Line Is Broken [Er-nu]

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.

### Parameter Lock [LoC]

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

A function to prevent changing SV and parameters of each setting group. Parameter setting values are still possible to check when parameter lock is set.  
 ※oFF, LoC1 are available only for indicator (TC4□□□N□).

### Error

Display	Description	Troubleshooting
oPE□	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.	

### Cautions during Use

- Follow instructions in 'Cautions during Use'. Otherwise, it may cause unexpected accidents.
- Check the polarity of the terminals before wiring the temperature sensor.  
 For RTD temperature sensor, wire it as 3-wire type, using cables in same thickness and length.  
 For thermocouple (CT) temperature sensor, use the designated compensation wire for extending wire.
- Keep away from high voltage lines or power lines to prevent inductive noise.  
 In case installing power line and input signal line closely, use line filter or varistor at power line and shielded wire at input signal line.  
 Do not use near the equipment which generates strong magnetic force or high frequency noise.
- Install a power switch or circuit breaker in the easily accessible place for supplying or disconnecting the power.
- Do not use the unit for other purpose (e.g. voltmeter, ammeter), but temperature controller.
- When changing the input sensor, turn off the power first before changing.  
 After changing the input sensor, modify the value of the corresponding parameter.
- 24VAC, 24-48VDC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
- Make a required space around the unit for radiation of heat.  
 For accurate temperature measurement, warm up the unit over 20 min after turning on the power.
- Make sure that power supply voltage reaches to the rated voltage within 2 sec after supplying power.
- Do not wire to terminals which are not used.
- This unit may be used in the following environments.  
 ①Indoors (in the environment condition rated in 'Specifications')  
 ②Altitude max. 2,000m  
 ③Pollution degree 2  
 ④Installation category II

### Major Products

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- Door Side Sensors
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- I/O Terminal Blocks & Cables
- Stepper Motors/Drivers/Motion Controllers
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- Laser Marking System (Fiber, Co., Nd: YAG)
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- Temperature/Humidity Transducers
- SSRs/Power Controllers
- Counters
- Timers
- Panel Meters
- Tachometer/Pulse (Rate) Meters
- Display Units
- Sensor Controllers

HEADQUARTERS:  
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 TEL: 82-51-519-3232  
 E-mail: sales@autonics.com

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

Set both alarm operation and alarm option by combining. Each alarm operates individually in two alarm output models. When the current temperature is out of alarm range, alarm clears automatically. If alarm option is alarm latch or alarm latch and standby sequence 1/2, press digital input key [d1-lt] 3 sec., digital input key [d1-lt] of Parameter group 2 set as AL-1, or turn OFF the power and turn ON to clear alarm.

Mode	Name	Alarm operation	Description
RA□□	—	—	No alarm output
RA1□	Deviation high-limit alarm	OFF → ON (SV 100°C / PV 110°C) 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.
RA2□	Deviation low-limit alarm	ON → OFF (PV 90°C / SV 100°C) 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.
RA3□	Deviation high/low-limit alarm	ON → OFF (SV 90°C / PV 100°C) 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.
RA4□	Deviation high/low-limit reserve alarm	OFF → ON (PV 90°C / SV 100°C) 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.
RA5□	Absolute value high limit alarm	OFF → ON (SV 90°C / PV 100°C) Absolute-value Alarm: Set as 90°C	If PV is higher than the absolute value, the output will be ON.
RA6□	Absolute value low limit alarm	ON → OFF (PV 90°C / SV 100°C) Absolute-value Alarm: Set as 110°C	If PV is lower than the absolute value, the output will be ON.
SbR□	Sensor break alarm	—	It will be ON when it detects sensor disconnection.
LbR□	Loop break alarm	—	It will be ON when it detects loop break.

※ H: Alarm output hysteresis [RH55]

### 2) Alarm operation

Option	Name	Description
RA□□	Standard alarm	If it is an alarm condition, alarm output is ON. If it is a clear alarm condition, alarm output is OFF.
RA□b	Alarm latch	If it is an alarm condition, alarm output is ON and maintains ON status. (Alarm output HOLD)
RA□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.
RA□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.
RA□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.
RA□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 [SbR□] or alarm latch [SbRb].

### 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] during LBA monitoring time [LbRt], or when control output MV is 0% (100% for cooling control) and PV is not decreased below than LBA detection band [LbRb] during LBA monitoring time [LbRt], alarm output turns ON.

Start control to ① When control output MV is 100%, PV is increased over than LBA detection band [LbRb] during LBA monitoring time [LbRt].  
 ① to ② The status of changing control output MV (LBA monitoring time is reset.)  
 ② to ③ When control output MV is 0% and PV is not decreased below than LBA detection band [LbRb] during LBA monitoring time [LbRt], loop break alarm (LBA) turns ON after LBA monitoring time.  
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