

# 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	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
								Size	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

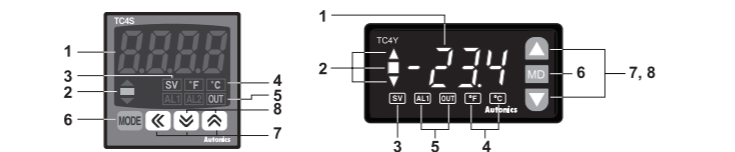
※1: In case of the AC voltage model, SSR drive output method (standard ON/OFF control, cycle control, phase control) is available to select.  
 ※2: It is unavailable for TC4SP, TC4Y.  
 ※3: Socket for TC4SP (PG-11, PS-11) is sold separately.  
 ※The above specifications are subject to change and some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

#### Specifications

Series	TC4 Series						
	TC4S	TC4SP	TC4Y	TC4M	TC4W	TC4H	TC4L
Power supply	AC power	100-240VAC 50/60Hz					
Allowable voltage range	AC/DC Power	24VAC 50/60Hz, 24-48VDC					
Power consumption	AC power	90 to 110% of rated voltage					
Display method	AC/DC Power	Max. 5VA(100-240VAC 50/60Hz), Max. 3W(24-48VDC)					
Character size(W×H)	7Segment(Red), Other display(Green, Yellow, Red LED)	7.0×15.0mm					
Input type	RTD	DP1100Ω, Cu50Ω (Allowable line resistance max.5Ω per a wire)	TC				
Display accuracy <sup>*1</sup>	TC	• At room temperature(23°C±5°C): (PV ±0.5% or ±1°C, select the higher one) ±1digit • 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				
Alarm output	SSR	12VDC ± 2V 20mA Max.	AL1, AL2 Relay: 250VAC 1A 1a(※TC4SP, TC4Y have AL1 only.)				
Control method	ON/OFF and P, PI, PD, PID control	1 to 100°C/°F(0.1 to 50.0°C/°F) variable					
Hysteresis	Proportional band(P)	0.1 to 999.9°C/°F					
Integral time(I)	Derivative time(D)	0 to 9999 sec.					
Control period(T)	Manual reset	0.5 to 120.0 sec.					
Sampling period	Diode	100ms					
Dielectric strength	AC power	2,000VAC 50/60Hz for 1min.(Between input terminal and power terminal)					
Vibration	AC/DC Power	1,000VAC 50/60Hz for 1min.(Between input terminal and power terminal)					
Relay life cycle	Mechanical	0.75mm amplitude at frequency of 5 to 55Hz in each of X, Y, Z directions for 2 hours					
Electrical	OUT: Min. 5,000,000 operations, AL1/2: Min. 5,000,000 operations	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)	Square-wave noise by noise simulator(pulse width 1μs) ± 2kV R-phase and S-phase					
Noise immunity	Approx. 10 years (When using non-volatile semiconductor memory type)	Approx. 10 years (When using non-volatile semiconductor memory type)					
Memory retention	Approx. 10 years (When using non-volatile semiconductor memory type)	Approx. 10 years (When using non-volatile semiconductor memory type)					
Environment	Ambient temp.	-10 to 50°C, Storage: -20 to 60°C					
Insulation type	Ambient humi.	35 to 85%RH, Storage: 35 to 85%RH					
Approval	CE, c, UL, US	Double insulation or reinforced insulation (mark: □), Dielectric strength between the measuring input part and the power part: AC power 2kV, AC/DC Power 1kV					
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 value display.
- Deviation indicator, Auto-tuning indicator**  
 It shows current temperature(PV) deviation based on set temperature(SV) by LED.  

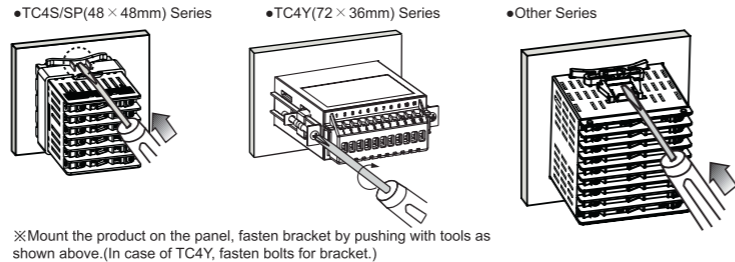
No.	PV deviation temp.	Deviation display
1	Over 2°C	▲ indicator ON
2	Below ±2°C	■ indicator ON
3	Under -2°C	▼ indicator ON

 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.

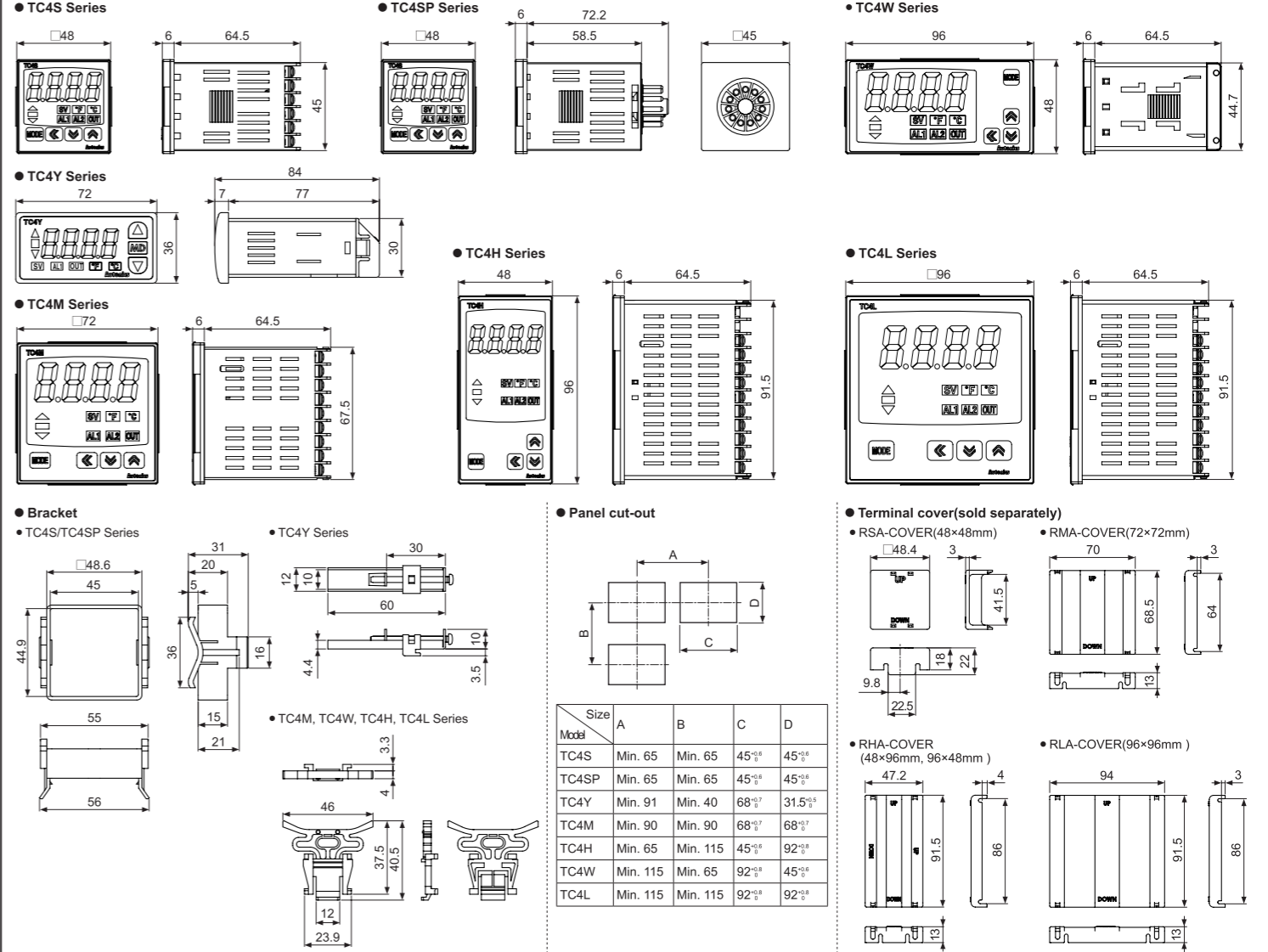
#### Input sensor and temperature range [ i n t ]

Input sensor	Display	Input range (°C)		
		Input range (°C)	Input range (°F)	
Thermocouple	K(CA)	[-] C R	-50 to 1200	-58 to 2192
	J(IC)	J I C	-30 to 500	-22 to 932
	L(IC)	L I C	-40 to 800	-40 to 1472
RTD	DP1100Ω	d P E H	-100 to 400	-148 to 752
	Cu50Ω	C U S L	-50 to 200.0	-58 to 392.0

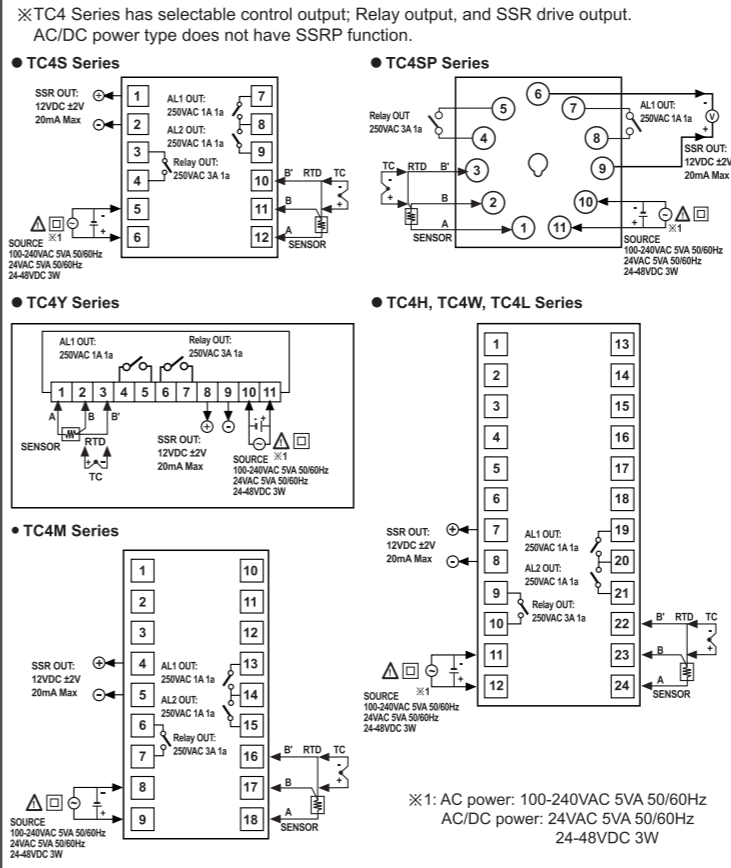
#### Installation



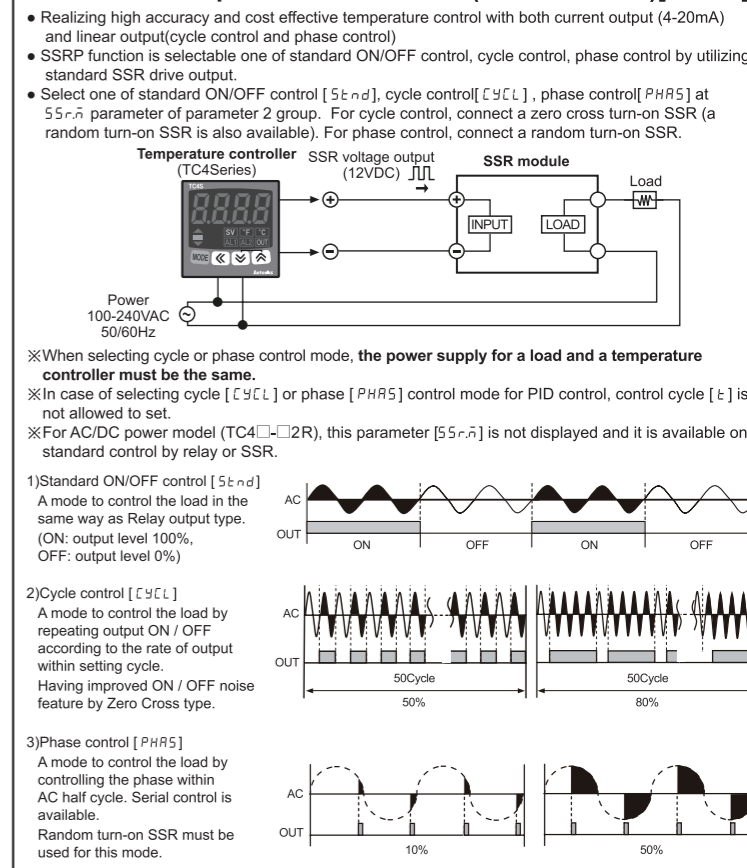
#### Dimensions



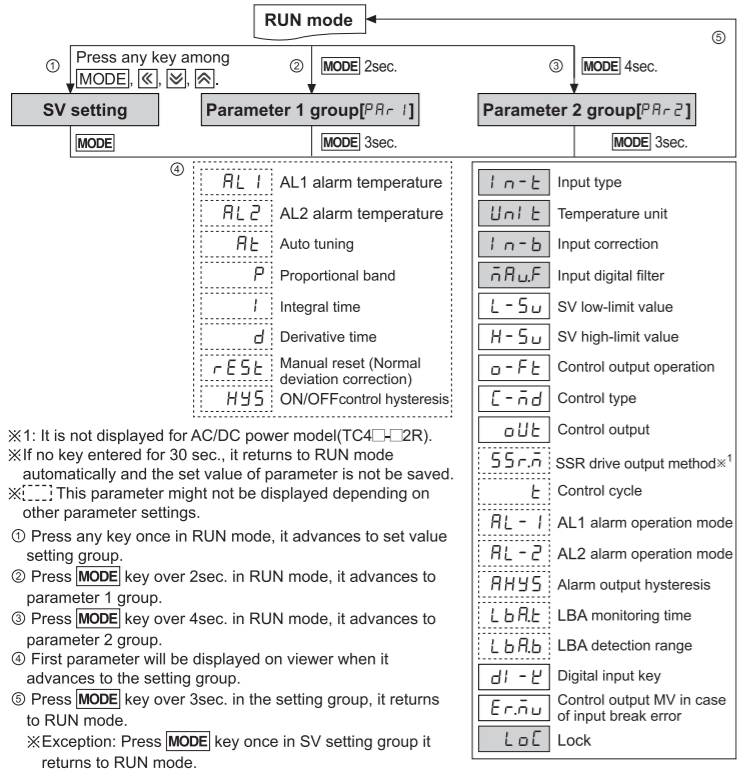
#### Connections



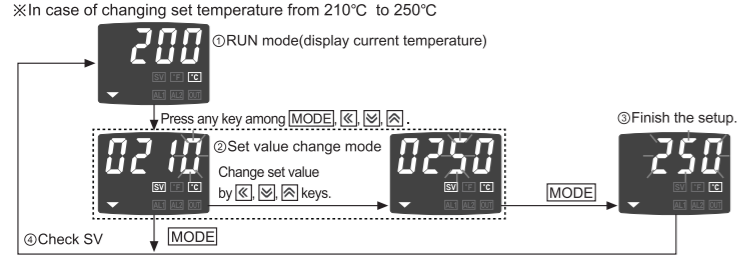
#### SSR drive output selection function(SSRP function)[ 5 5 r n ]



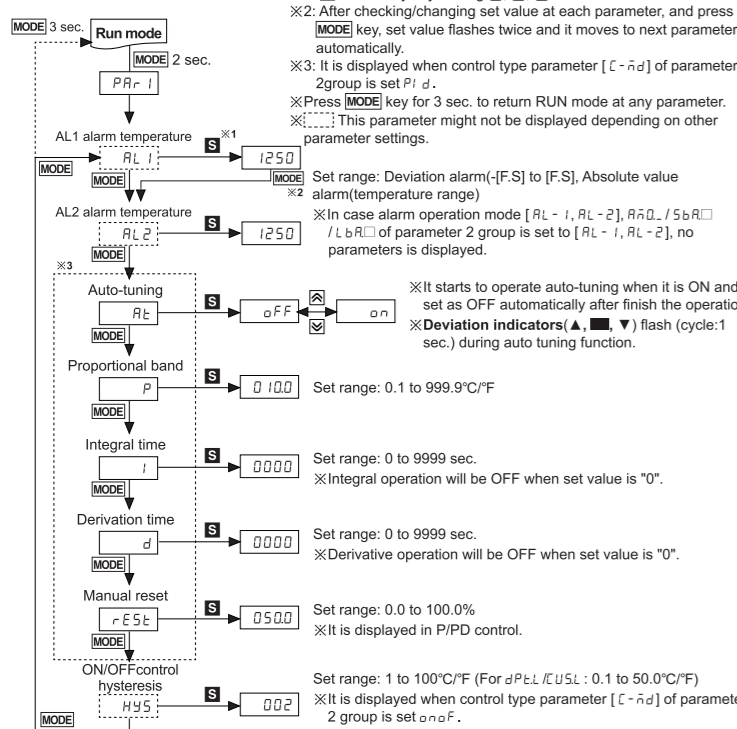
### Flow chart for setting group



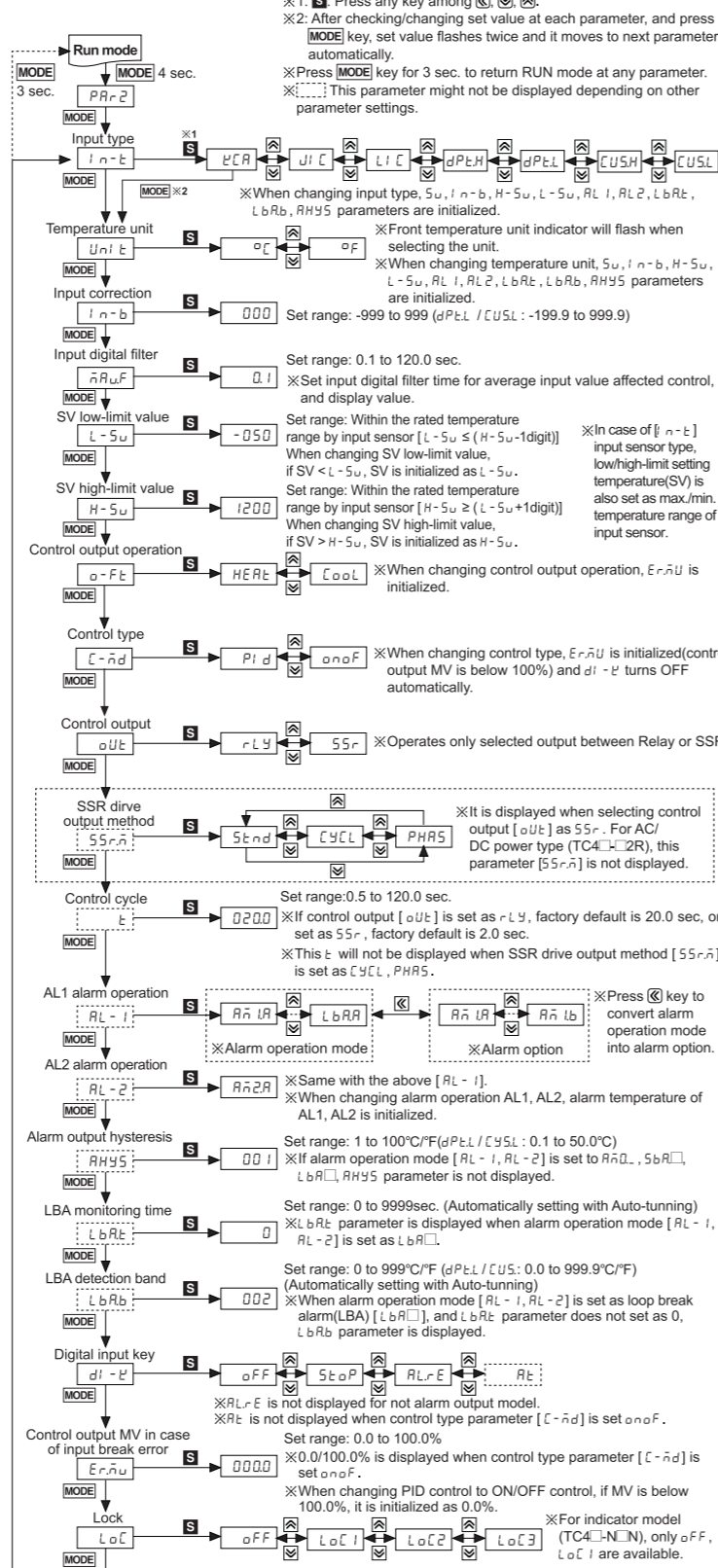
### Flow chart for SV setting group



### Parameter 1 group



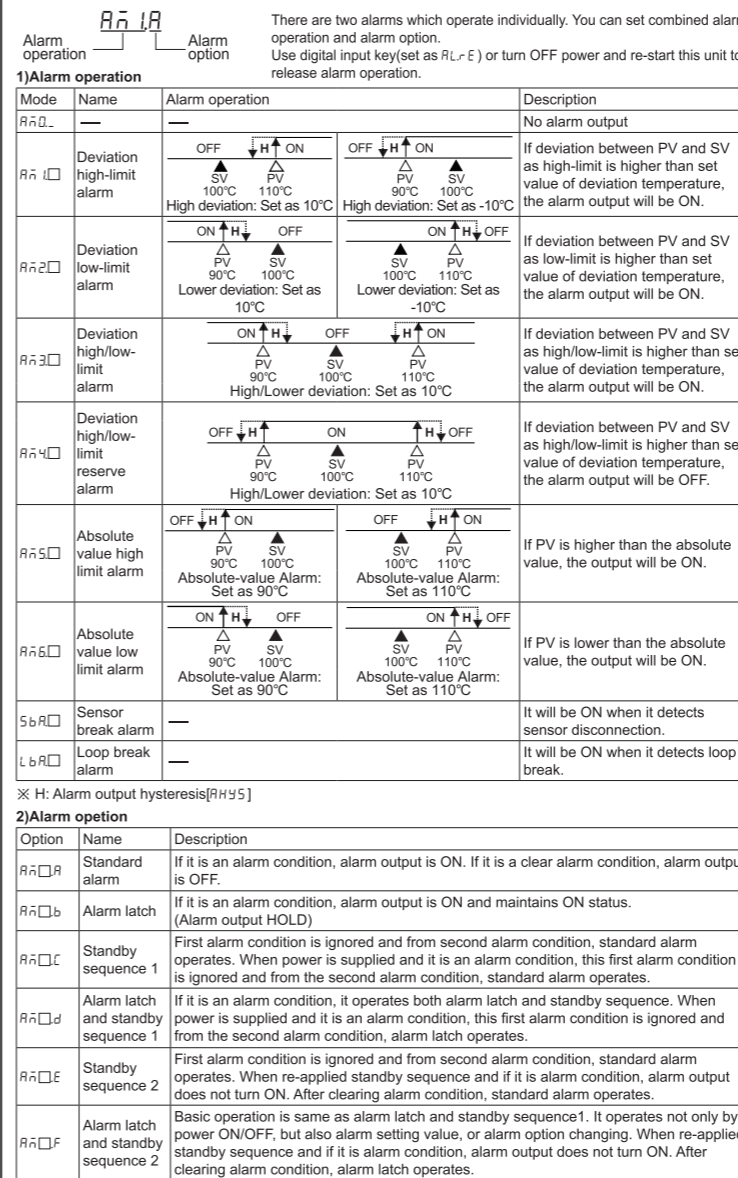
### Parameter 2 group



### Factory default

Parameter	Factory default	Parameter	Factory default
Input type	UCR	Unit	C
Input correction	000	Input digital filter	0.1
SV low-limit value	-050	SV high-limit value	1200
Control output operation	HERt	Control type	PID
Control output	SSr	Control cycle	0200
AL1 alarm operation mode	AL-1	AL2 alarm operation mode	AL-2
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	off
ON/OFF control hysteresis	002	Control output	SSr

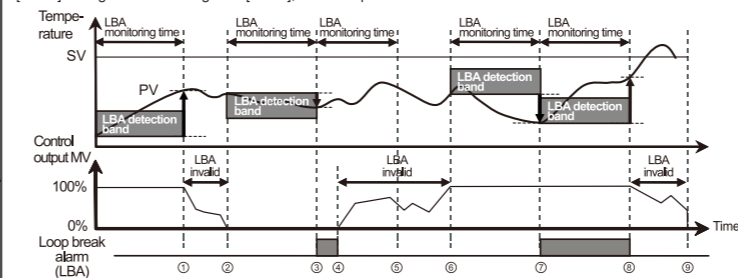
### Alarm [AL-1/AL-2]



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

**3) Sensor break alarm**  
The function that alarm output will be ON when sensor is not connected or when sensor's disconnection is detected during temperature controlling. You can check whether the sensor is connected with buzzer or other units using alarm output contact. It is selectable between standard alarm [5bAR] or alarm latch [5bARb].

**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 [LbARb] during LBA monitoring time [LbAR], or when control output MV is 0%/100% for cooling control and PV is not decreased below than LBA detection band [LbARb] during LBA monitoring time [LbAR], alarm output turns ON.



**Start control** (1) When control output MV is 100%, PV is increased over than LBA detection band [LbARb] during LBA monitoring time [LbAR].

(2) (3) The status of changing control output MV (LBA monitoring time is reset.)

(4) (5) When control output MV is 0% and PV is not decreased below than LBA detection band [LbARb] during LBA monitoring time [LbAR], loop break alarm (LBA) turns ON after LBA monitoring time.

(6) (7) When control output MV is 100% and PV is not increased over than LBA detection band [LbARb] during LBA monitoring time [LbAR], loop break alarm (LBA) turns ON after LBA monitoring time.

(8) (9) The status of changing control output MV (LBA monitoring time is reset.)

### 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 [nARuF]

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 [HYS]

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

### Manual reset [rES]

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

### Digital input key [di-E] 3sec. [d1-E]

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	AL It is available to auto tuning function, it is same as auto tuning function [AL] of parameter 1 group. (You can execute auto tuning from parameter 1 group, and finish it by digital input key.) *When control type [C-nd] is set as PID, AL is displayed. When it is set as ON/OFF, digital input key [di-E] 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.

### 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	

### 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.	

### 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
  - It shall be used indoor.
  - Altitude Max. 2000m.
  - Pollution Degree 2.
  - Installation Category II.

\*It may cause malfunction if above instructions are not followed.

### Major product

**Autonics Corporation**  
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**Major products:**

- Photoelectric sensors
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- Connector/Sockets
- Switching mode power supplies
- Control switches/Lamps/Buzzers
- I/O Terminal Blocks & Cables
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- Field network devices
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- Laser welding/soldering system