

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.

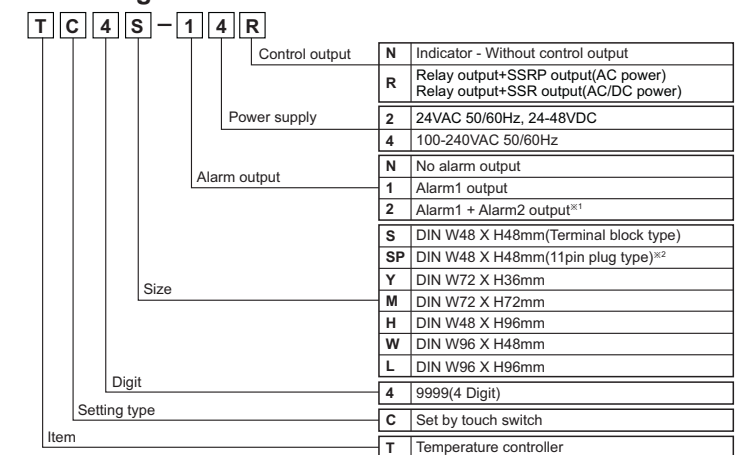
Warning

- 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. It may cause a fire.
- 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(0.50mm²) 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 crimp terminal, select following shaped terminal(M3).
- 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



※1: It is unavailable for TC4SP, TC4Y.
※2: Socket for TC4SP (PG-11, PS-11) is sold separately.

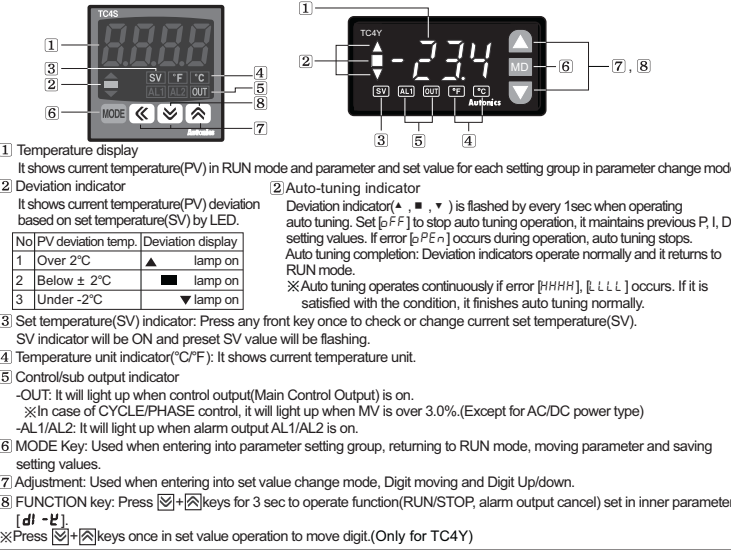
※The above specifications are subject to change without notice.

Specifications

Series	TC4 series						
	TC4S	TC4SP	TC4Y	TC4M	TC4H	TC4W	TC4L
Power supply	AC power	100-240VAC 50/60Hz	24VAC 50/60Hz, 24-48VDC				
Allowable voltage range	AC/DC Power	90 to 110% of rated voltage					
Power consumption		Max. 5VA(100-240VAC 50/60Hz, 24VAC 50/60Hz)	Max. 3W(24-48VDC)				
Display method		7Segment(Red), Other display(Green, Yellow, Red LED)					
Character size	Height	15.0mm	15.0mm	20.0mm	14.6mm	20.0mm	22.0mm
	Width	7.0mm	7.4mm	9.5mm	7.0mm	9.5mm	11.0mm
Input type	RTD	DPT100Ω, Cu50Ω (Allowable line resistance max.5Ω per a wire)					
	TC	K(CA), J(IC), L(IC)					
Display accuracy	RTD	(PV ± 0.5% or ± 1°C higher one) rdg ± 1Digit ^{※1} ※TC4SP(Plug type) is (PV ± 0.5% or ± 2°C higher one) rdg ± 1Digit ^{※2} - Based on room temperature(23°C ± 5°C)					
	TC						
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 [KCA, JIC, LIC, DPT.H, CU5.H] / 0.1 to 50.0°C/°F [dPt.L, CU5.L]						
Proportional band(P)	0.1 to 999.9°C/°F						
Integral time(I)	9999 sec.						
Derivative time(D)	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 directions for 2 hours						
Relay life	Control output	Mechanical: Min. 5,000,000 operations, Electrical: Min. 200,000 operations (250VAC 3A resistive load)					
	Alarm output	Mechanical: Min. 5,000,000 operations, Electrical: Min. 300,000 operations (250VAC 1A resistive load)					
Insulation resistance	Min. 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 temperature	-10 to 50°C, Storage: -20 to 60°C					
	Ambient humidity	35 to 85%RH, Storage: 35 to 85%RH					
Insulation type ^{※3}	□						
Approval	CE, UL (Except for AC/DC power type)						
Unit weight	Approx. 97g	Approx. 84g	Approx. 127g	Approx. 128g	Approx. 118g	Approx. 118g	Approx. 172g

- ※1: In case of out of room temperature range: (PV ± 0.5% or ± 2°C higher one)rdg ± 1 Digit L(IC) and RTD CU50: (PV ± 0.5% or ± 3°C higher one)rdg ± 1 Digit
- ※2: In case of out of room temperature range for TC4SP: (PV ± 0.5% or ± 3°C higher one)rdg ± 1 Digit L(IC) and RTD CU50: (PV ± 0.5% or ± 4°C higher one)rdg ± 1 Digit
- ※3: "□" Mark indicates that equipment protected throughout by double insulation or reinforced insulation.
- ※Environment resistance is rated at no freezing or condensation.

Parts description

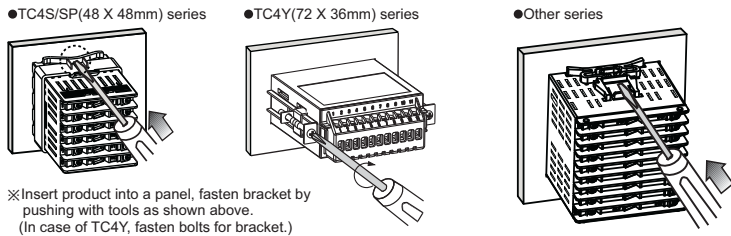


Input sensor and temperature range [I n - t]

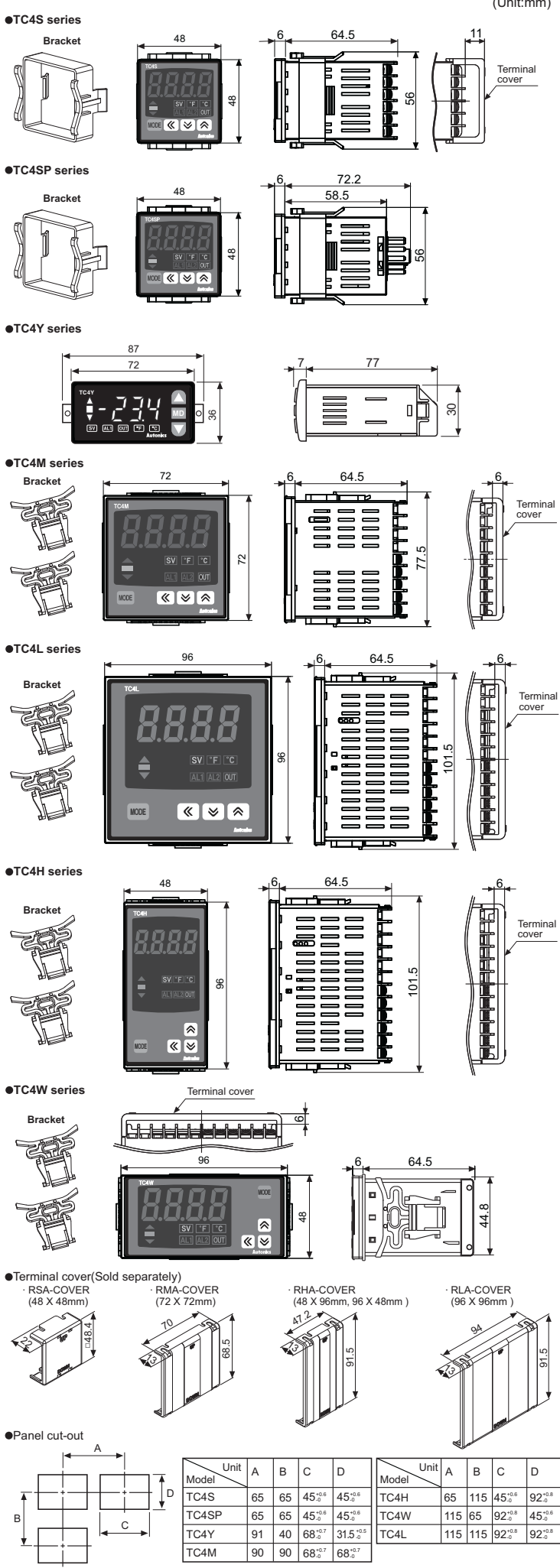
Input sensor	Display	Temperature range(°C)	Temperature range(°F)	
Thermo Couple	K(CA)	-50 to 1200	-58 to 2192	
	J(IC)	-30 to 500	-22 to 932	
	L(IC)	-40 to 800	-40 to 1472	
RTD	DPT100Ω	dPt.L	-100 to 400	-148 to 752
		dPt.L	-100.0 to 400.0	-148.0 to 752.0
	CU50Ω	CU5.H	-50 to 200	-58 to 392
	CU5.L	-50.0 to 200.0	-58.0 to 392.0	

Factory default : [L C R]

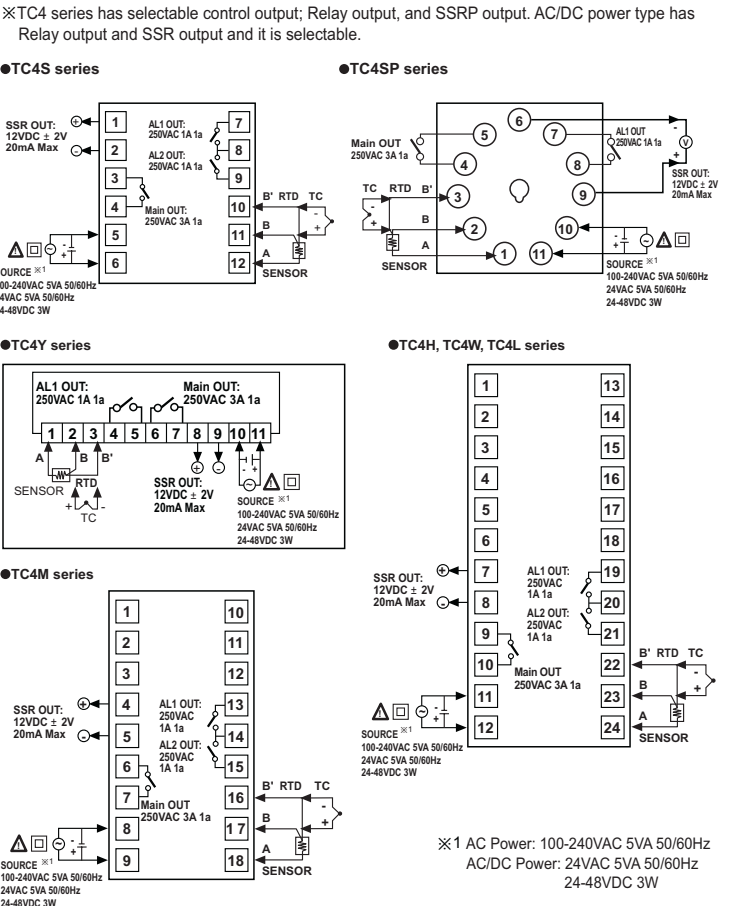
Installation



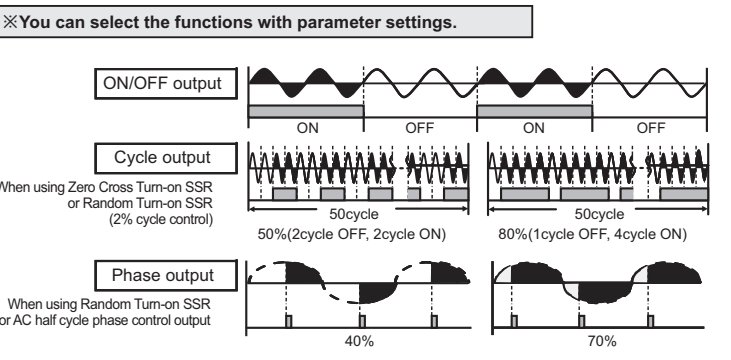
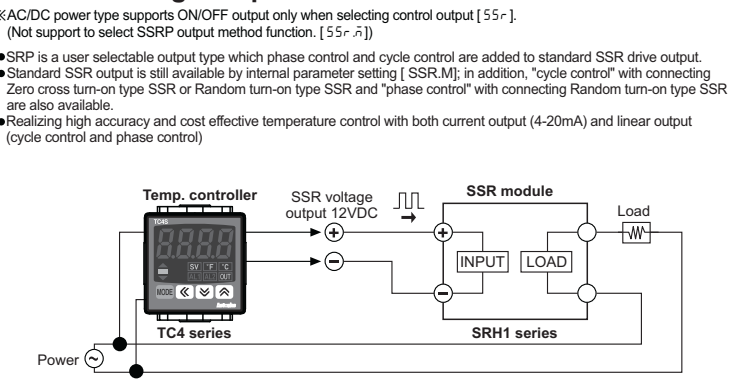
Dimensions



Connections

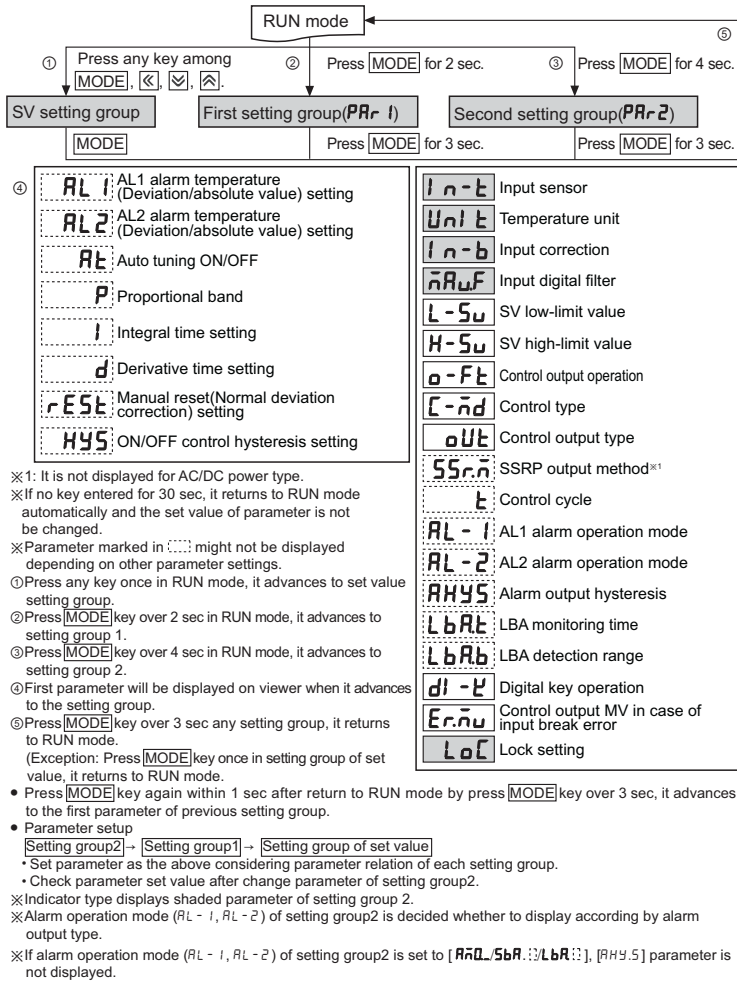


SSRP voltage output function

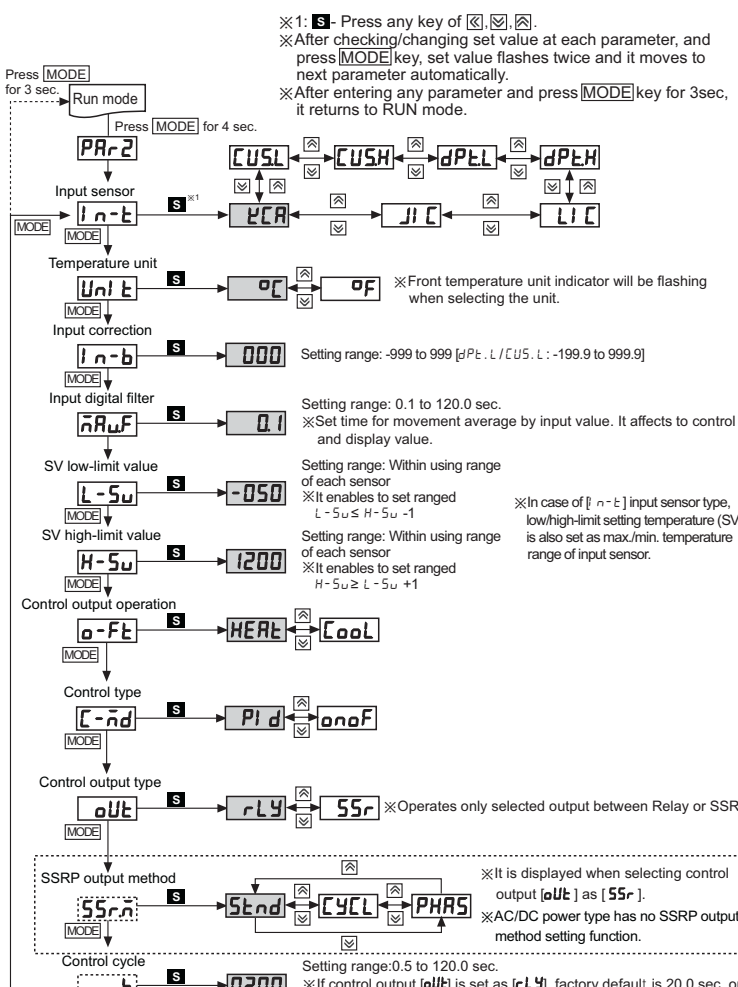


- Standard control mode [S t n d]
A mode to control the load in the same way as Relay output type. (ON: output level 100%, OFF: output level 0%)
 - Cycle control mode [C y c l]
A mode to control the load by repeating output ON / OFF according to the rate of output within setting cycle. Having improved ON / OFF noise feature(Zero Cross type).
 - Phase control mode [P h a s]
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 [P h a s] / cycle [C y c l] control output modes, control cycle [t] is not allowed to set.

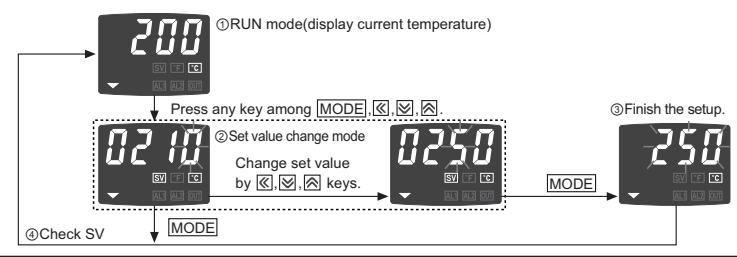
Flow chart for setting group



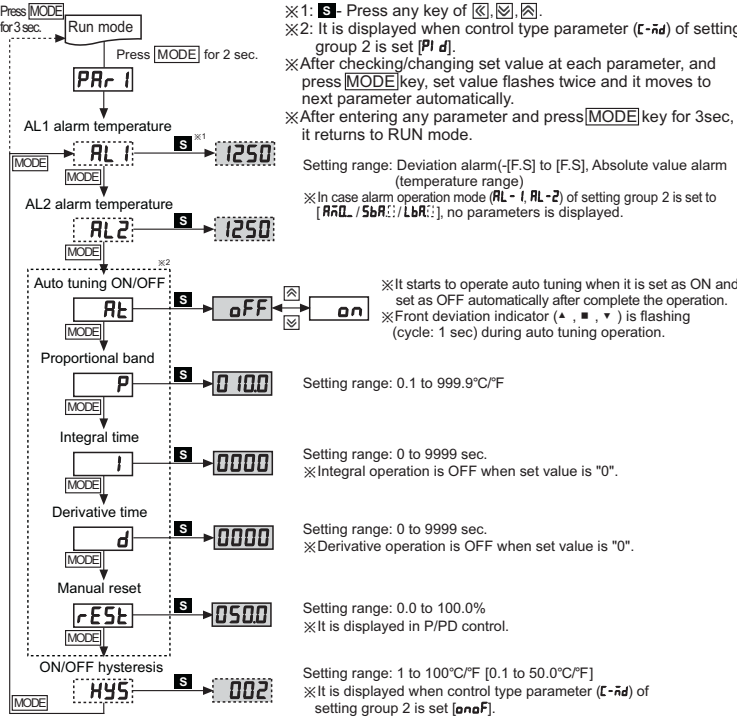
Flow chart for second setting group



Flow chart for SV setting group



Flow chart for first setting group



Factory default

Parameter	Factory default	Parameter	Factory default	Parameter	Factory default
-	0	In-t	ℓCR	t	0200
		Un-t	°C	AL-1	Rn1R
		I n-b	0000	AL-2	Rn2R
		nRwF	0001	RHYS	0001
		L-Su	-050	LbAr	0000
		H-Su	1200	LbAb	002
		o-Ft	HERt	dl-ℓ	StoP
		C-nd	PI d	Er-nu	StoP
		oUt	rLy	LoC	oFF
		SSr:n	Stnd	LoC1	LoC2
		t	CYCL	LoC3	LoC3
		AL-1	PHAS		

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

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 AL-1) or turn OFF power and re-start this unit to release alarm operation.

Operation	Name	Alarm operation	Description
Rn0	-	-	No alarm output
Rn1	□	OFF → ON (H) / ON → OFF (H) Alarm (Deviation) temperature: 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.
Rn2	□	ON → OFF (H) / OFF → ON (H) Alarm (Deviation) temperature: 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.
Rn3	□	ON → OFF (H) / OFF → ON (H) Alarm (Deviation) temperature: 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.
Rn4	□	OFF → ON (H) / ON → OFF (H) Alarm (Deviation) temperature: 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.
Rn5	□	OFF → ON (H) / ON → OFF (H) Alarm temperature (Absolute): 90°C	If PV is equal to or higher than the absolute value of alarm temperature, the output will be ON.
Rn6	□	ON → OFF (H) / OFF → ON (H) Alarm temperature (Absolute): 110°C	If PV is equal to or lower than the absolute value of alarm temperature, the output will be ON.
SbR	□	-	It will be ON when it detects sensor disconnection.
LbR	□	-	It will be ON when it detects loop break.

Alarm option

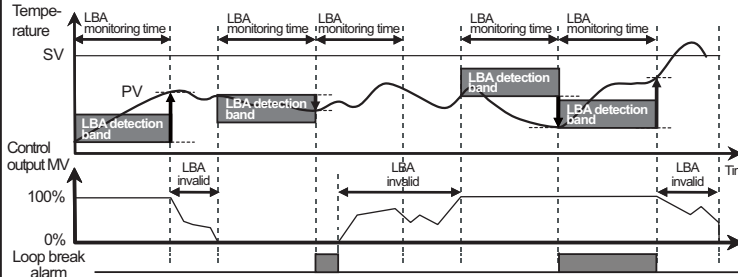
Option	Name	Description
Rn0A	Standard alarm	If it is an alarm condition, alarm output is ON. If it is a clear alarm condition, alarm output is OFF.
Rn0b	Alarm latch	If it is an alarm condition, alarm output is ON and maintains ON status.
Rn0c	Standby sequence 1	First alarm condition is ignored and from second alarm condition, standard alarm operates.
Rn0d	Alarm latch and standby sequence 1	If it is an alarm condition, it operates both alarm latch and standby sequence 1. 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.
Rn0e	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.
Rn0f	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.

Sensor break alarm (SbR)

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.

Loop break alarm (LbR)

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



Start control	Description
① to ①	When control output MV is 100%, PV is increased over than LBA detection band [LbR.b] during LBA monitoring time [LbR.t].
① to ②	The status of changing control output MV (LBA monitoring time is reset.)
② to ②	When control output MV is 0% and PV is not decreased below than LBA detection band [LbR.b] during LBA monitoring time [LbR.t], loop break alarm (LBA) turns ON after LBA monitoring time.
② to ③	Control output MV is 0% and loop break alarm (LBA) turns and maintains ON.
③ to ③	The status of changing control output MV (LBA monitoring time is reset.)
③ to ④	When control output MV is 100% and PV is not increased over than LBA detection band [LbR.b] during LBA monitoring time [LbR.t], loop break alarm (LBA) turns ON after LBA monitoring time.
④ to ④	When control output MV is 100% and PV is increased over than LBA detection band [LbR.b] during LBA monitoring time [LbR.t], loop break alarm (LBA) turns OFF after LBA monitoring time.
④ to ⑤	The status of changing control output MV (LBA monitoring time is reset.)

※When executing auto-tuning, LBA detection band [LbR.b] 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 [LbR.b] and LBA monitoring time [LbR.t] 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.

Ex) 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'.

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.

ON/OFF control hysteresis [HYS]

In case of ON/OFF control, set between ON and OFF intervals as hysteresis.

If hysteresis is too small, it may cause control output hunting (takeoff, chattering) by external noise, etc.

Manual reset [rEST]

When selecting P/PD control mode, certain temperature difference exists even after PV reaches stable status 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 [di-ℓ] function [di-ℓ]

●RUN/STOP function [StoP]

Digital input key (t: over 3 sec.)

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 output function [AL-E]

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.

Control output MV for open error [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]

A function to prevent changing SV and parameters of each setting group.

Parameter setting values are still possible to check while Lock mode is ON.

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

Setting range: [oFF / LoC1 / LoC2 / LoC3] (Default: [oFF])

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

- Please install power switch or circuit-breaker in order to cut power supply off.
 - Install power switch or circuit-breaker to supply or cut off the power.
 - 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)
 - Installation environment
 - ① It shall be used indoor.
 - ② Altitude Max. 2000m.
 - ③ Pollution Degree 2.
- ※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
- Temperature controllers
- Switching power supplies
- Temperature/Humidity transducers
- Tachometer/Pulse(Rtd) meters
- 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
- Fieldnet Logic panels
- Graphic input devices

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