### **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.

Marning 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

- 1. 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 personal injury, fire or economic loss
- Do not use the unit in the place where flammable/explosive/cradiant heat, vibration, impact, or salinity may be present. Failure to follow this instruction may result in explosion or fire.
- 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.
- 5. 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

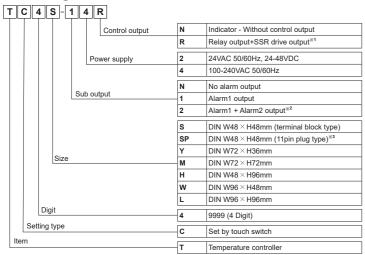
### **⚠** Caution

- When connecting the power input and relay output, use AWG 20(0.50mm²) 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.

  2. Use the unit within the rated specifications.
- Failure to follow this instruction may result in fire or product damage
- 3. 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.
- 4. 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



- X1: In case of the AC voltage model, SSR drive output method (standard ON/OFF control, cycle control, phase control) is available to select
- X2: It is unavailable for TC4SP, TC4Y.X3: Sockets for TC4SP (PG-11, PS-11(N)) are sold separately.
- \*The above specifications are subject to change and some models may be discontinued
- Be sure to follow cautions written in the instruction manual and the technical descriptions (catalog, homepage).

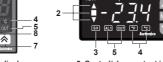
### Specifications

Series		TC4 Series						
		TC4S	TC4SP	TC4Y	TC4M	TC4W	TC4H	TC4L
Power	AC power	100-240VAC∼ 50/60Hz						
supply	AC/DC Power	24VAC~ 5	0/60Hz, 24-4	48VDC=				
Allowable	voltage range	90 to 110%	of rated vol	tage				
Power	AC power	Max. 5VA (	100-240VAC	50/60Hz)				
consumptio	on AC/DC Power	Max. 5VA (2	24VAC 50/6	0Hz), Max. 3	W (24-48V	DC)		
Display m	ethod	7Segment	(Red), Other	display (Gre	een, Yellow	, Red LED)		
Character	size (W×H)	7.0×15.0mr	n	7.4×15.0mm	9.5×20.0mi	m 9.5×20.0m	m 7.0×14.6m	nm 11.0×22.0m
Input	RTD	DPt100Ω, 0	Cu50Ω (Allo	wable line re	sistance m	ax.5Ω per a	wire)	
type	TC	K (CA), J (I	C), L (IC)					
D: 1	RTD	• At room to	emperature (	(23°C±5°C): (	(PV ±0.5%	or ±1°C, sele	ect the high	er one) ±1dio
Display ×1	KID	Out of roc	m temperat	ure range: (F	V ±0.5% o	or ±2°C, sele	ct the highe	r one) ±1digit
accuracy*1	TC	<ul> <li>Out of room temperature range: (PV ±0.5% or ±2°C, select the higher one) ±1digit</li> <li>※ For TC4SP, add ±1°C by accuracy standard.</li> </ul>						
Control	Relay	250VAC~	3A 1a					
output	SSR	12VDC== ±	2V 20mA N	lax.				
Alarm out	put	AL1, AL2 R	elay: 250VA	C∼ 1A 1a (	XTC4SP, 1	TC4Y have A	L1 only.)	
Control m	ethod	ON/OFF ar	nd P, PI, PD,	PID control				
Hysteresis	8	1 to100°C/°F (0.1 to 50.0°C/°F) variable						
Proportion	nal band (P)	0.1 to 999.9°C/°F						
Integral time (I)		0 to 9999 sec.						
Derivative time (D)		0 to 9999 s	ec.					
Control pe	eriod (T)	0.5 to 120.0 sec.						
Manual re	set	0.0 to 100.0%						
Sampling	period	100ms						
Dielectric	AC power	2,000VAC	50/60Hz for	1min. (betwe	en input te	rminal and p	ower termin	nal)
strength	AC/DC Power	1,000VAC	50/60Hz for	1min. (betwe	en input te	rminal and	ower termin	nal)
Vibration		0.75mm amplitude at frequency of 5 to 55Hz in each X, Y, Z direction for 2 hours						
5.	Mechanical	OUT: Min. 5.000.000 operations, AL1/2: Min. 5.000.000 operations						
Relay	F	OUT: Min. 2	200,000 ope	rations (250)	VAC 3A res	sistive load),		
life cycle	Electrical	AL1/2: Min. 300,000 operations (250VAC 1A resistive load)						
Insulation resistance		Min. 100MΩ (at 500VDC megger)						
Noise immunity		Square-wave noise by noise simulator (pulse width 1μs) ± 2KV R-phase and S-phase						
Memory retention		Approx. 10 years (When using non-volatile semiconductor memory type)						
Environ Ambient temp.		10 to 50°C, Storage: -20 to 60°C						
-ment	Ambient humi.	35 to 85%F	RH, Storage:	35 to 85%R	:H			
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		( <b>F</b> . <b>S</b> )		ia allo powor	ран. 110 р	J. 2. 2. 10, 70	0,5010110	,
Weight <sup>*2</sup>								

- 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 includes packaging. The weight in parentheses is for unit only vironment resistance is rated at no freezing or condensation

### Unit Description





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

bacca circon tomporatare (cr) by LLB.					
No. PV deviation temp.		Deviation display			
1	Over 2°C	▲ indicator Of			
2	Below ±2°C	indicator Of			
3	Under -2°C	▼ indicator Of			
The deviation indicators ( A V) flack 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
- nperature (SV) indicator is ON and preset set value is flashed. 4. Temperature unit (°C/°F) indicator

### 5. 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.

### 6. MODE key

Used when entering into parameter group, returning to RUN mode, moving parameter, and saving setting values.

Used when entering into set value change mode, digit moving and digit up/down.

### 8. FUNCTION key

Press → keys for 3 sec. to operate function (RUN/ STOP, alarm output cancel, auto-tunning) set in inner

※Press → keys at the same time in set value

## ■ Input Sensor and Temperature Range [ n- b]

Input sensor		Display	Temperature range (°C)	Temperature range (°F)
	K (CA)	FEB	-50 to 1200	-58 to 2192
Thermocouple	J (IC)	JI E	-30 to 500	-22 to 932
	L (IC)	LIE	-40 to 800	-40 to 1472
	DPt100Ω	dPt.H	-100 to 400	-148 to 752
RTD		dPt.L	-100.0 to 400.0	-148.0 to 752.0
KID		E U 5.H	-50 to 200	-58 to 392
	Cu30Ω	EU5.L	-50.0 to 200.0	-58.0 to 392.0

### Installation

● TC4S/SP (48 × 48mm) Series ● TC4Y (72 × 36mm) Series







\*Mount the product on the panel, fasten bracket by pushing with tools as shown above.

# TC4Y Series

Dimensions

TC4S Series

TC4M Series

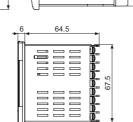
Bracket

• TC4S/TC4SP Series

SV F C ALI ALE OUT

**(()** 

72



• TC4Y Series

TC4SP Series

• TC4M, TC4W, TC4H, TC4L Series

 TC4H Series 48 ALI ALZ OU

Size

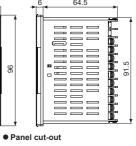
TC4SP

TC4Y

TC4M

72.2

58.5



Min. 65 Min. 65 45<sup>+0.6</sup>

Min. 65 Min. 65 45\*%

TC4H Min. 65 Min. 115 45\*08 92\*08

TC4L Min. 115 Min. 115 92\*08 92\*08

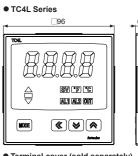
TC4W Min. 115 Min. 65 92\*08

Min. 91 Min. 40 68% 31.5%

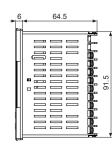
Min. 90 Min. 90 68<sup>-0.7</sup> 68<sup>-0.7</sup>

45\*0.6

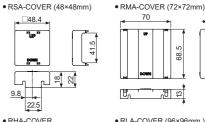
45\*0.6



• TC4W Series

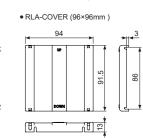


### • Terminal cover (sold separately)





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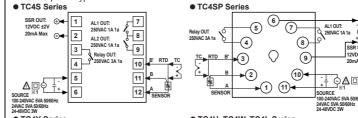


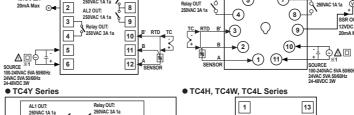
### Connections

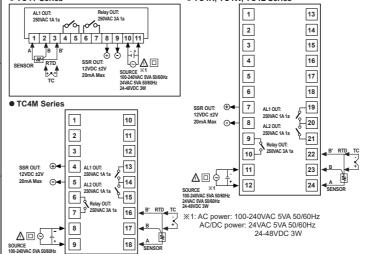
XTC4 Series has selectable control output; Relay output, and SSR drive output AC/DC power type does not have SSRP function.

12

23.9





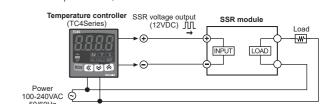


used for this mode

# ■ SSR Drive Output Selection Function (SSRP Function)[55-ñ]

- standard SSR drive output. Realizing high accuracy and cost effective temperature control as linear output(cycle control and
- Select one of standard ON/OFF control [5End], cycle control [EBEL], phase control [PHR5] at [55c.5] parameter of Parameter group 2. For cycle control, connect zero cross turn-on SSR or rand turn-on SSR. For phase control, connect random turn-on SSR.

• SSRP function is selectable one of standard ON/OFF control, cycle control, phase control by utilizing



\*When selecting cycle or phase control mode, the power supply for a load and a temperature controller must be the same

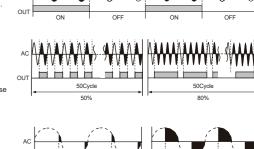
\*In case of selecting cycle [LYLL] or phase [PHR5] control mode for PID control, control cycle [E] is not allowed to set

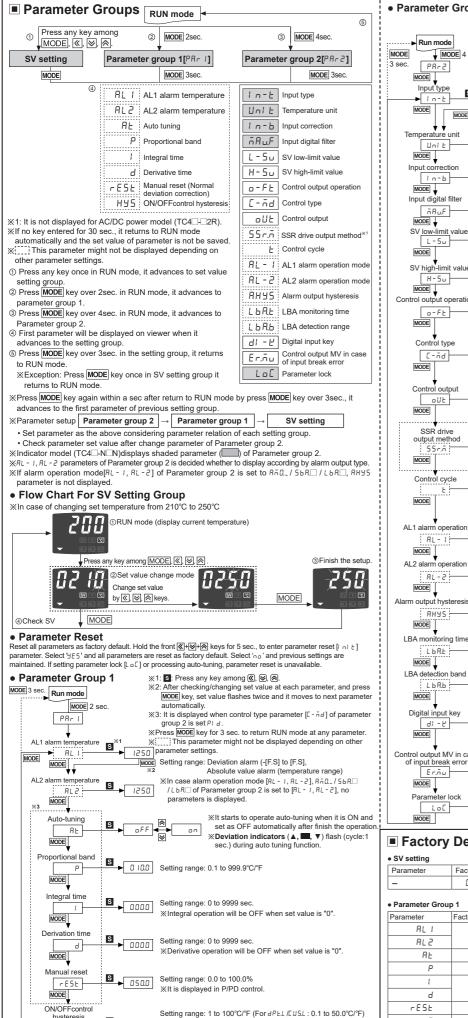
※For AC/DC power model (TC4□-□2R), this parameter [55r.ñ] is not displayed and it is available only standard control by relay or SSR

1)Standard ON/OFF control [5 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%)

2)Cycle control [[ 4[ 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 by Zero Cross type.

3)Phase control [PHR5] A mode to control the load by controlling the phase within AC half cycle. Serial control is Random turn-on SSR must be

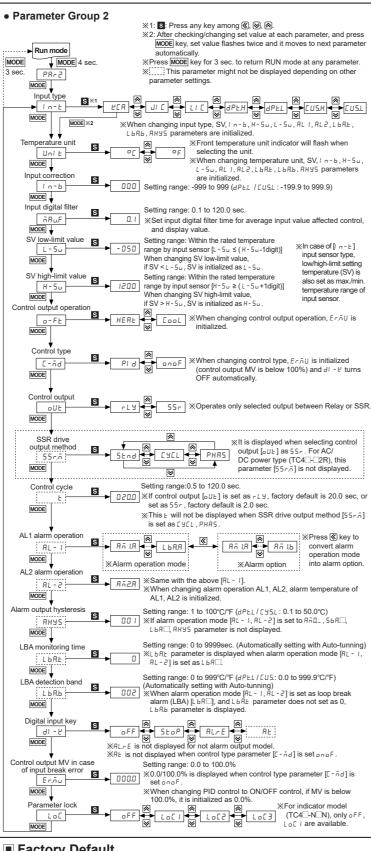




XIt is displayed when control type parameter [E - nd] of Parame group 2 is set and F.

002

H95



### ■ Factory Default

	<ul> <li>Parameter Gro</li> </ul>	oup 2		
Factory default	Parameter	Factory default	Parameter	Factory default
0	In-E	FCB	E	0.00
. 4	Uni E	٥٢	01 - 1	Rō LR
	In-b	0000	nL-1	חחנח
Factory default	ñ R u.F	000.1	AL-5	R.S.A.R
1250	L-5u	-050	RHY5	0001
	H-5u	1500	LbRE	0000
	n-Ft	HERL	LhBh	002
0 10.0				StoP
nnnn				0000
0000				
050.0	55r.ñ	5End	LoC	oFF
002	XAC/DC power type has no SSR drive output method [5]			
	0 1 Factory default 1250 oFF 0 100 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Factory default	In-E   LER     In-E	Parameter   Factory default   Parameter

# ■ Alarm [AL - 1/AL - 2]

1)Alarm operation

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(☑+♠ 3 sec. digital input key[4: - ½] of Parameter group 2 set as AL, E), or turn OFF the power and turn ON to clear alarm.

ı jAlai il	орегиноп	tur	n OFF the power and turn C	N to clear alarm.
Mode	Name	Alarm operation		Description
AñO		_		No alarm output
Aŭ (□	Deviation high-limit alarm	OFF H ON  SV PV  100°C 110°C  High deviation: Set as 10°C	OFF H ON  A  PV  SV  90°C 100°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.
9ñ2.□	Deviation low-limit alarm	ON H OFF  A SV 90°C 100°C  Lower deviation: Set as 10°C	ON THE OFF  SV PV 100°C 110°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.
Rñ∃□	Deviation high/low- limit alarm	ON H OI PV S 90°C 100 High/Lower devia	If deviation between PV and SV as high/low-limit is higher than set value of deviation temperature, the alarm output will be ON.	
Aŭ 4.□	Deviation high/low- limit reserve alarm	OFF H ON H OFF  PV SV PV  90°C 100°C 110°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.
Rā 5.□	Absolute value high limit alarm	OFF H ON  PV SV 90°C 100°C  Absolute-value Alarm: Set as 90°C	OFF H ON  SV PV  100°C 110°C  Absolute-value Alarm: Set as 110°C	If PV is higher than the absolute value, the output will be ON.
A ē.□	Absolute value low limit alarm	ON H OFF  A PV SV 90°C 100°C Absolute-value Alarm: Set as 90°C	ON H OFF  SV PV 100°C 110°C  Absolute-value Alarm: Set as 110°C	If PV is lower than the absolute value, the output will be ON.
56R□	Sensor break alarm	_		It will be ON when it detects sensor disconnection.
LBRD	Loop break	_		It will be ON when it detects loop break.

2)Alarm opetion Option Name Description Standard If it is an alarm condition, alarm output is ON. If it is a clear alarm condition, alarm output R⊼□A is OFF. If it is an alarm condition, alarm output is ON and maintains ON status Яй□ь Alarm latch (Alarm output HOLD) 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. Aŭ □E Alarm latch If it is an alarm condition, it operates both alarm latch and standby sequence. When Bā□d and standby power is supplied and it is an alarm condition, this first alarm condition is ignored and

sequence 1 from the second alarm condition, alarm latch operates. 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 Rā□E sequence 2 does not turn ON. After clearing alarm condition, standard alarm operates. Basic operation is same as alarm latch and standby sequence1. It operates not only by power ON/OFF, but also alarm setting value, or alarm option changing. When re-ap standby sequence and if it is alarm condition, alarm output does not turn ON. After sequence 2 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 [RL 1, RL 2] or alarm operation [RL - 1, RL - 2], switching STOP mode

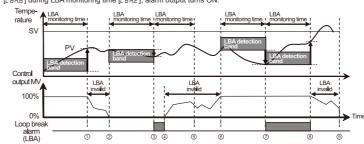
### 3)Sensor break alarm

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 inits using alarm output contact. It is selectable between standard alarm [56RA] or alarm latch [56Rb].

### 4)I oon break alarm (I BA)

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 [L bAb] during LBA monitoring time [L bAb], or when control output MV is 0% (100% for cooling

control) and PV is not decreased below than LBA detection band [ԼԵԶԵ] during LBA monitoring time [ԼԵԶԵ], alarm output turns ON



Start control to ①	When control output MV is 100%, PV is increased over than LBA detection band [L bRb] during LBA monitoring time [L bRb].		
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 [L bAb] during LBA monitoring time [L bAb], 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 [L bRb] during LBA monitoring time [L bRb], loop break alarm (LBA) turns ON after LBA monitoring time.		
⑦ to ®	When control output MV is 100% and PV is increased over than LBA detection band [Ł bRb] during LBA monitoring time [Ł bRŁ], 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[Ł ሁ유ե] and LBA monitoring time are automatically set ba on auto tuning value. When alarm operation mode [RL - 1, RL - 2] is set as loop break alarm (LBA)[LbR...]. LBA detection band [L b R b] and LBA monitoring time [L b R b] parameter is displayed

### Input Correction [ 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

E.g.) 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.

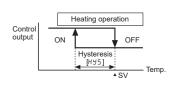
ЖAs the result of input correction, if current temperature value (PV) is over each temperature range of input sensor, it displays 'нннн' or 'L L L L '.

### Input Digital Filter [ñ fl u.F ]

If current temperature (PV) is fluctuating repeatedly by rapid change of input signal, it refl ects 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 [H95]

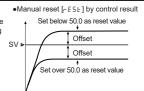
- If Hysteresis is too narrow, hunting (oscillation)
- chattering) could occur due to external noise. In case of ON / OFF control mode, even if PV reaches stable status, there still occurs hunting. It could be due to Hysteresis [H95] SV, load's response characteristics or sensor's location. In order to reduce hunting to a minimum, it is required to take into following factors consideration when designing temp. controlling; proper Hysteresis [HY5], heater's capacity, thermal characteristics, sensor's response and location.



### ■ Manual Reset [r E 5 b ]

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 [-E5b] 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 (🔝 + 🔊 3sec.) [d/ -년]

Parameter		Operation				
OFF	oFF	It does not use digital input key function.				
RUN/STOP	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.  It				
Clear alarm	ALE	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.				
Auto-tuning	ЯĿ	Starts/Stops auto-tuning. This function is same as auto-tuning[RE] of parameter group 1. (You can start auto-tuning [RE] of parameter group 1 and stop it by digital input key.) %This parameter RE appears only when control method [C-ād] Parameter group 2 is set as PId. When control method [C-ād] Parameter group 2 is set as and F, this parameter is changed as aFF.				

### ■ Control Output MV When Input Sensor Line Is Broken [☐ r.n.u]

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 [L □ []

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. 

Dis	splay	Description
	oFF	Unlock
L		Lock parameter group 2
L	0[5	Lock parameter group 1, 2
L	o [ 3	Lock parameter group 1, 2, SV setting

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

### 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
- Do not use near the equipment which generates strong magnetic force or high frequency noise
- 4. Install a power switch or circuit breaker in the easily accessible place for supplying or disconnecting the power
- 5. 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
- B. 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. 9. Make sure that power supply voltage reaches to the rated voltage within 2 sec after supplying power.

10. Do not wire to terminals which are not used.

11. This unit may be used in the following environments.

①Indoors (in the environment condition rated in 'Specifications')

②Altitude max. 2,000m

③Pollution degree 2

4 Installation category II

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