

Autonics High Accuracy PID Temperature Controller TK4 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. 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. 1. Fail-safe device must be installed when using the unit with machinery... 2. Install on a device panel to use. 3. Do not connect, repair, or inspect the unit while connected to a power source. 4. Check 'Connections' before wiring. 5. Do not disassemble or modify the unit.

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 0.74-0.90Nm. When connecting the sensor input and communication cable without dedicated cable, use AWG 28-26 cable or over and tighten the terminal screw with a tightening torque of 0.74-0.90Nm. 2. Use the unit within the rated specifications. 3. Use dry cloth to clean the unit, and do not use water or organic solvent. 4. 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. 5. Keep metal chip, dust, and wire residue from flowing into the unit.

Ordering Information

TK 4 N - 1 4 R N. Table detailing options for OUT2 control, OUT1 control, Power supply, Input/Output option, and Size.

- 1. In case of TK4N/SP Series, option control selection and digital input will be limited due to number of terminals. 2. 'S' represents SSR drive output support models which SSR function (standard ON/OFF, cycle, phase) control are available. 3. Select 'R' or 'C' type in case of using heating/cooling control and 'N' type in case of using standard control. 4. Does not support in AC/DC voltage type model. 5. Does not support in TK4N. 6. The CT input model of TK4N is selectable only for standard model which has alarm output 1. 7. The heating/cooling model of TK4N-1 has only alarm output 2. 8. Only for TK4S-□□□, OUT2 output terminal is used as DI-2 input terminal. 9. 11Pin socket (PG-11, PS-11(N)) for TK4SP: sold separately.

Shaded descriptions are upgraded or added functions from the before TK Series. 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, user manual and the technical descriptions (catalog, homepage).

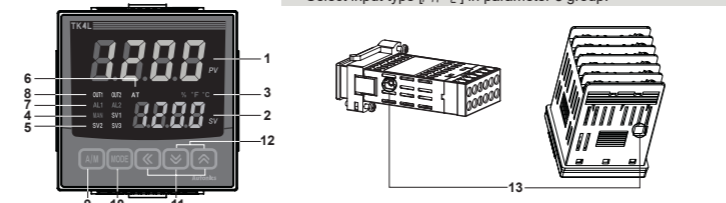
Specifications

Table with 7 columns (Series: TK4N, TK4SP, TK4S, TK4M, TK4W, TK4H, TK4L) and rows for Series, Power supply, Allowable voltage range, Power consumption, Display method, Character size, Input type, Display accuracy, Control output, Alarm output, Option output, Option input, Control method, Hysteresis, Proportional band, Integral time, Derivative time, Control period, Manual reset value, Sampling period, Dielectric strength, Vibration, Relay life cycle, Insulation resistance, Noise immunity, Memory retention, Environ -ment, Protection, Insulation type, Approval, and Weight.

- At room temperature range (23°C±5°C): Thermocouple K, J, T, N, E type, below -100°C / Thermocouple L, U, PLII, Cu50Ω, DPT 50Ω; (PV ±0.3% or ±2°C, select the higher one) ±1-digit; Thermocouple C, G, R, S type, below 200°C: (PV ±0.3% or ±3°C, select the higher one) ±1-digit; Thermocouple B type, below 400°C: there is no accuracy standards. Out of room temperature range: RTD Cu50Ω, DPT50Ω: (PV ±0.5% or ±3°C, select the higher one) ±1-digit; Thermocouple R, S, B, C, G type: (PV ±0.5% or ±5°C, select the higher one) ±1-digit; Others, below -100°C: within ±5°C; In case of TK4SP Series, ±1°C will be added to the degree standard. The weight includes packaging. The weight in parenthesis is for unit only. Environment resistance is rated at no freezing or condensation.

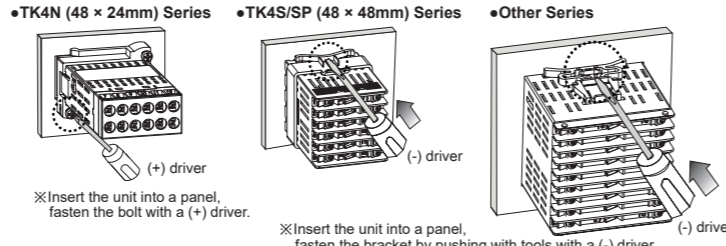
Unit Description

The input selection switch (TC, RTD/mV, V, mA) disappeared. Select input type [a-z] in parameter 3 group.



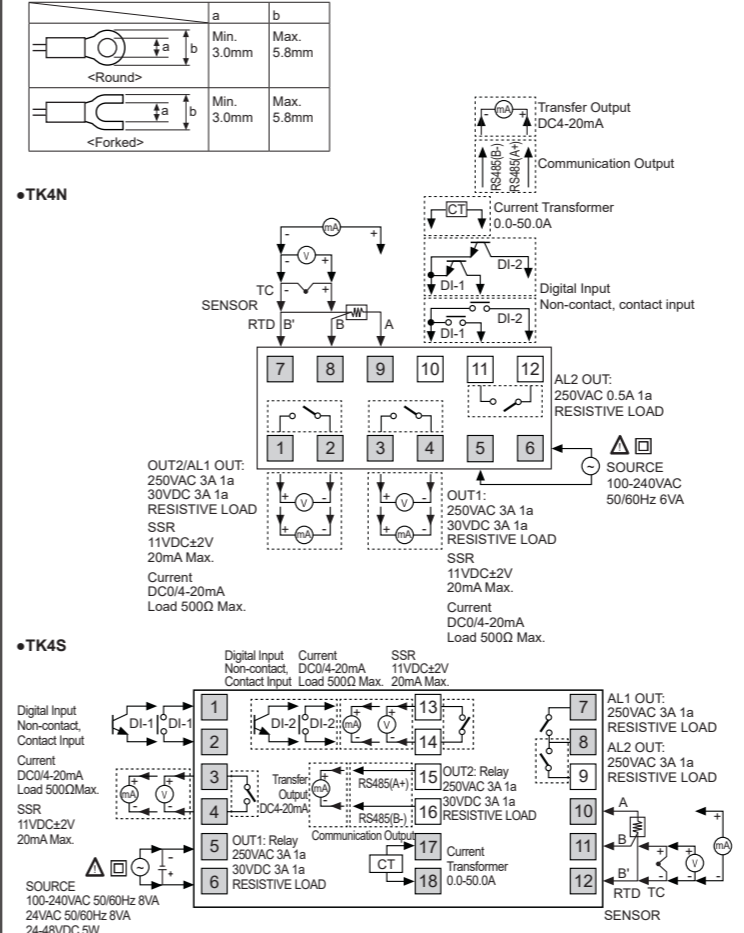
- 1. Measured value (PV) display part: RUN mode: It displays currently measured value (PV). Setting mode: It displays the parameter. 2. Set value (SV) display part: RUN mode: It displays the set value (SV). Setting mode: It displays the set value of the parameter. 3. Manual (%C/F%) indicator: It displays the unit set at display unit [u/n] in parameter 3 group. (In case of TK4N, % is not supported). 4. Unit control indicator: It turns ON during manual controlling. 5. Multi SV indicator: One of SV1 to 3 lamps will be ON in case of selecting multi SV function. 6. Auto tuning indicator: It flashes by 1 sec. when executing auto tuning. 7. Alarm output (AL1, AL2) indicator: It turns ON when the alarm output is ON. 8. Control output (OUT1, OUT2) indicator: It turns ON when the control output is ON. \*During cycle/phase controlling in SSRP function model (TK4-□4S□), when MV is over 5.0%, it turns ON. \*To use current output, when MV is 0.0% in manual control, it turns OFF. Otherwise, it always turns ON. When MV is over 3.0% in auto control, it turns ON and when MV is below 2.0%, it turns OFF. 9. key: It is used when switching auto control to manual control. \*TK4N/SP do not have the key. The key operates switching simultaneously. 10. key: It is used when entering parameter groups, returning to RUN mode, moving parameter, saving the set value. 11. keys: It is used when entering the set value changing mode and moving or changing up/down digit. 12. Digital input key: When pressing + keys for 3 sec. at the same time, it operates the function (RUN/STOP, alarm clear, auto tuning) set at digital input key [d1 - d] in parameter 5 group. 13. PC loader port: It is the PC loader port for serial communication to set parameter with DAQMaster installed in PC. Use this for connecting SCM-US (USB/Serial converter, sold separately).

Installation

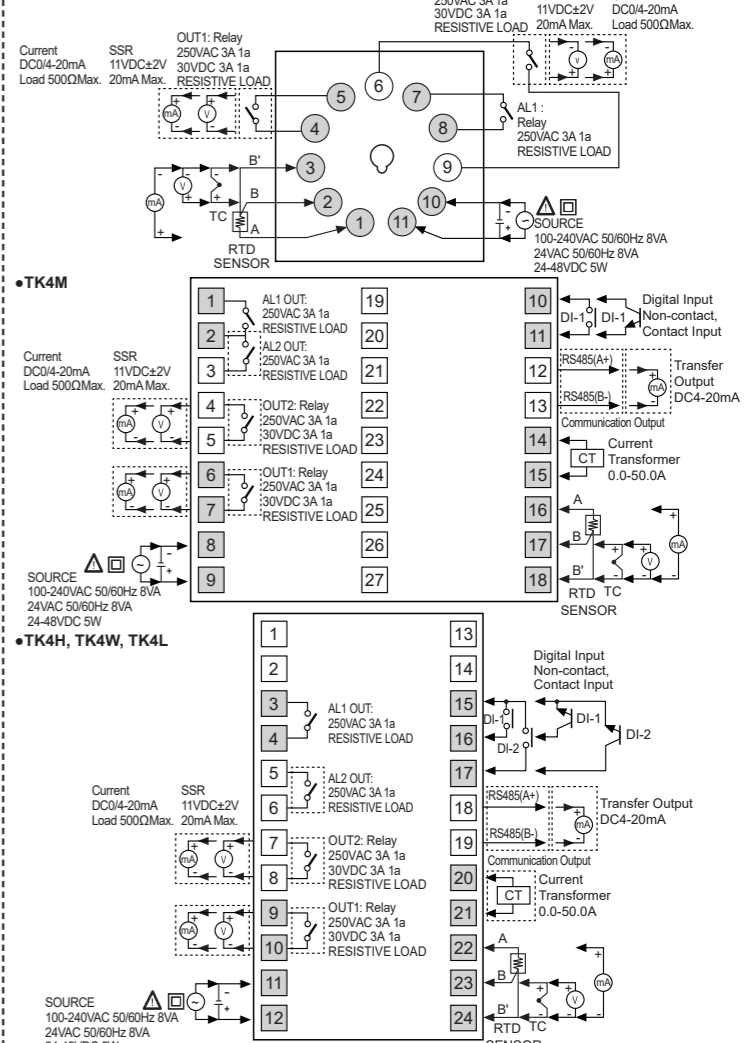


Connections

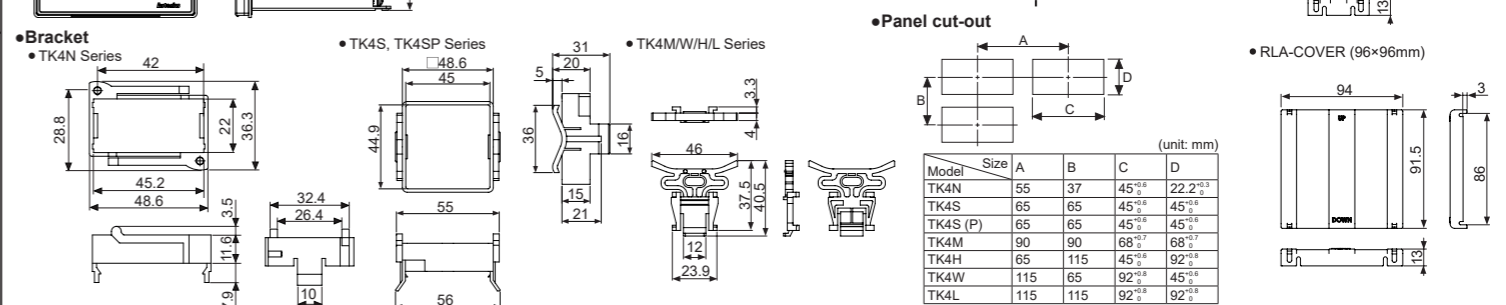
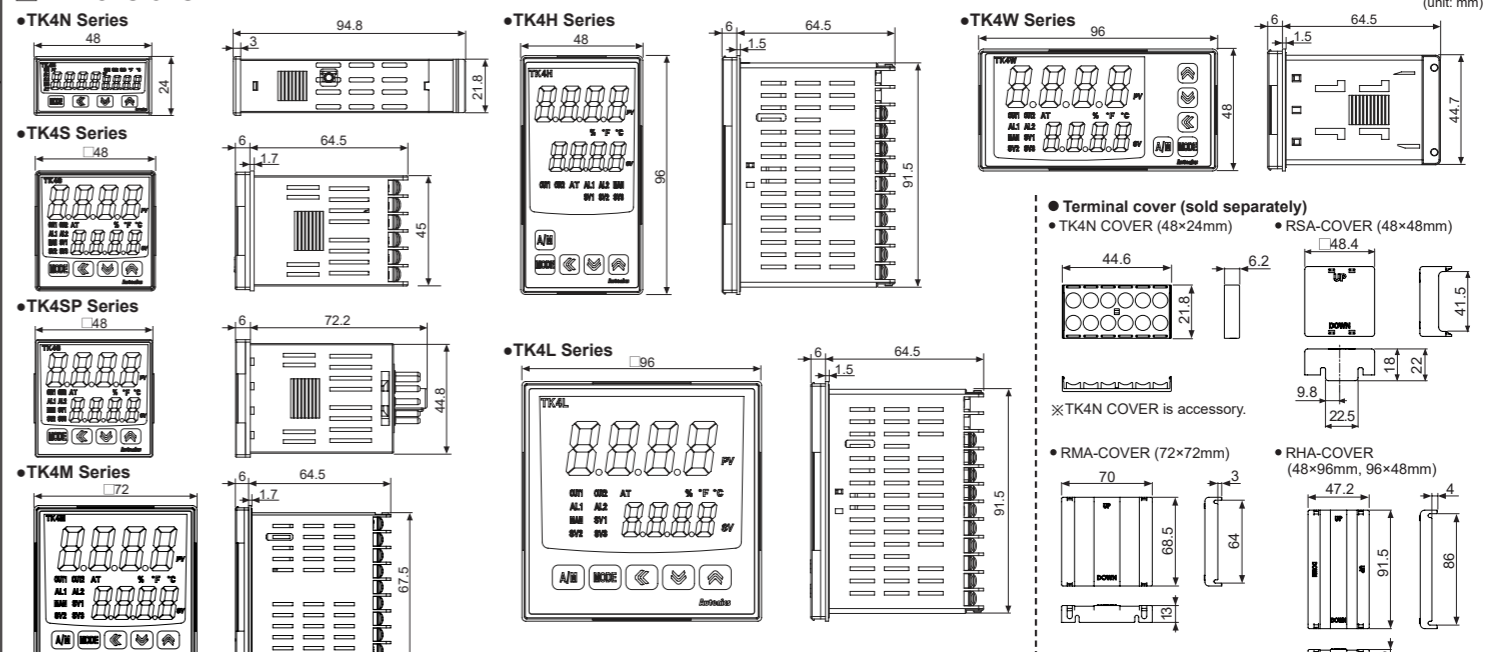
Standard model has shaded terminals only. When the operation mode of heating/cooling OUT2 relay output model is heating or cooling control, the OUT2 is usable as alarm output 3 (except TK4N Series). When the operation mode of heating/cooling OUT2 current output model is heating or cooling control, the OUT2 is usable as transmission output 2. Use terminals of size specified below.



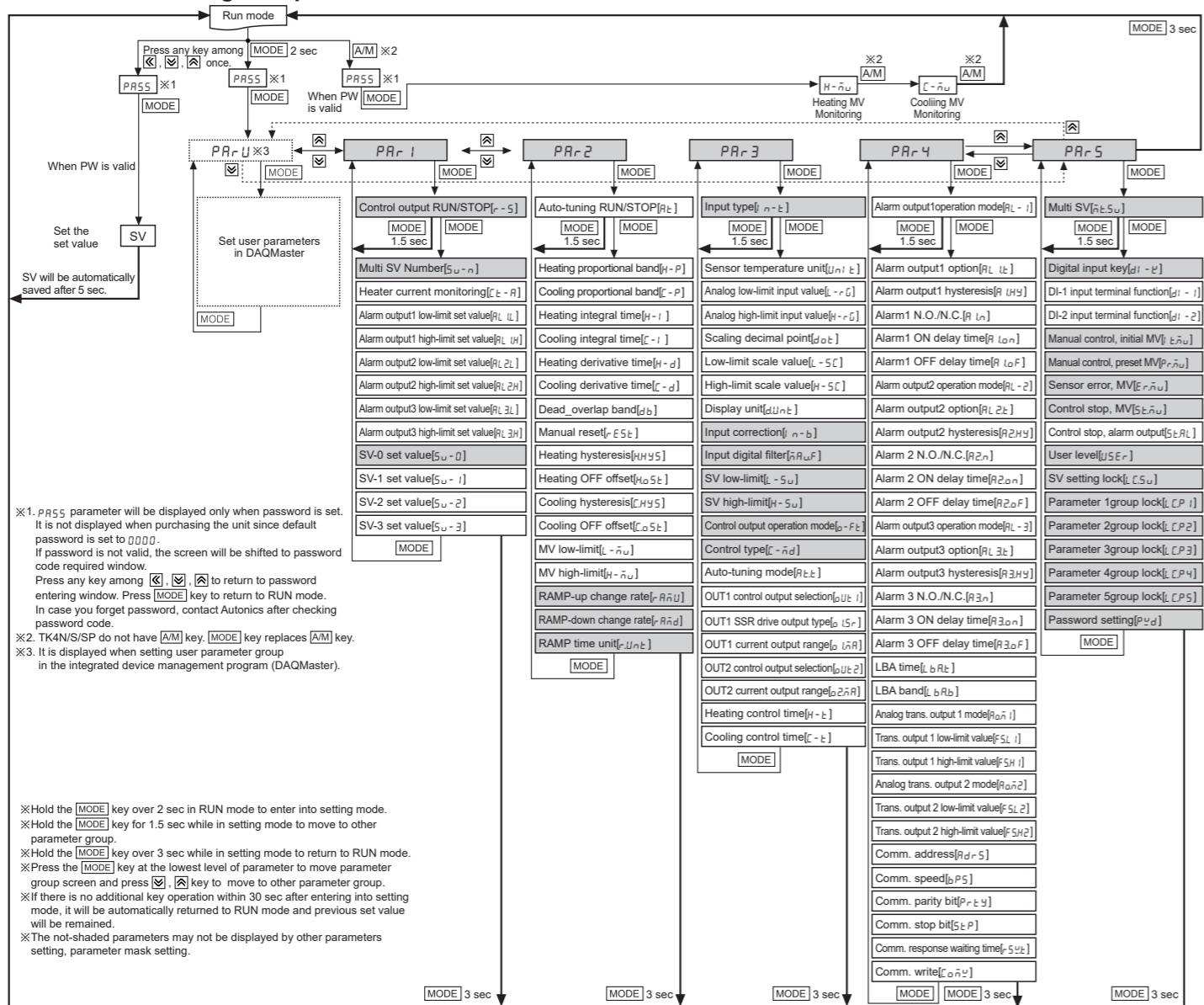
Connections (continued)



Dimensions



### Flow Chart for Setting Group



※1. PR55 parameter will be displayed only when password is set. It is not displayed when purchasing the unit since default password is set to 0000. If password is not valid, the screen will be shifted to password code required window. Press any key among [OK], [MODE], [AM] to return to password entering window. Press [MODE] key to return to RUN mode. In case you forget password, contact Autonics after checking password code.

※2. TK4N/S/SP do not have [AM] key. [MODE] key replaces [AM] key.

※3. It is displayed when setting user parameter group in the integrated device management program (DAQMaster).

※Hold the [MODE] key over 2 sec in RUN mode to enter into setting mode.

※Hold the [MODE] key for 1.5 sec while in setting mode to move to other parameter group.

※Hold the [MODE] key over 3 sec while in setting mode to return to RUN mode.

※Press the [MODE] key at the lowest level of parameter to move parameter group screen and press [OK], [AM] key to move to other parameter group.

※If there is no additional key operation within 30 sec after entering into setting mode, it will be automatically returned to RUN mode and previous set value will be remained.

※The not-shaded parameters may not be displayed by other parameters setting, parameter mask setting.

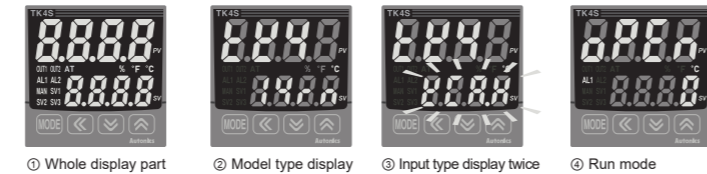
### Input Types and Range

Input type	Decimal point	Display	Input range (°C)	Input range (°F)
Thermocouple	K (CA)	1	-200 to 1350	-328 to 2463
	J (IC)	0.1	-199.9 to 999.9	-328 to 1472
	E (CR)	0.1	-199.9 to 800.0	-199.9 to 999.9
	T (CC)	1	-200 to 400	-328 to 752
	B (PR)	1	-199.9 to 400.0	-199.9 to 752.0
	R (PR)	1	0 to 1800	32 to 3272
	S (PR)	1	0 to 1750	32 to 3182
	N (NN)	1	0 to 1750	32 to 3182
	C (TT) <sup>※1</sup>	1	-200 to 1300	-328 to 2372
	G (TT) <sup>※2</sup>	1	0 to 2300	32 to 4172
RTD	L (IC)	0.1	-200 to 900	-328 to 1652
	U (CC)	0.1	-199.9 to 900.0	-199.9 to 999.9
	Platinel II	1	-200 to 400	-328 to 752
	Cu 50Ω	0.1	-199.9 to 200.0	-199.9 to 392.0
	Cu 100Ω	0.1	-199.9 to 200.0	-199.9 to 392.0
	JPt 100Ω	1	-200 to 650	-328 to 1202
	DPT 50Ω	0.1	-199.9 to 600.0	-199.9 to 999.9
	DPT 100Ω	1	-200 to 650	-328 to 1202
	Nickel 120Ω	0.1	-199.9 to 650.0	-199.9 to 999.9
	Analog	Voltage	0-10V	RA1
0-5V		RA2	(Display point will be changed according to decimal point position.)	
1-5V		RA3		
0-100mV		RA4		
Current	0-20mA	RA5		
4-20mA	RA6			

※1: C (TT): Same temperature sensor as former W5 (TT)  
 ※2: G (TT): Same temperature sensor as former W (TT)

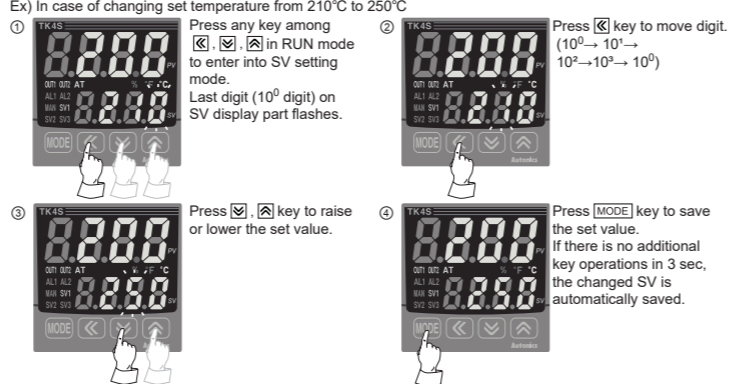
### Initial Display When Power ON

When power is supplied, whole display parts flash for 1 sec. Afterwards, model name and input sensor type will be flash twice and then it enters into RUN mode.



### Set Value (SV) Setting

You can set the temperature to control with [OK], [MODE], [AM] keys. Set range is within SV low-limit value [L - 5u] to SV high-limit value [H - 5u].

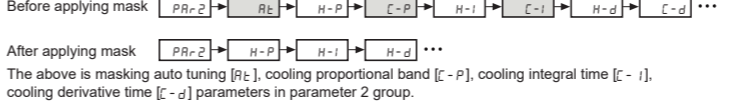


### Parameter Reset

Press [OK] + [MODE] + [AM] to reset all parameters in memory to default value. Set [n1] parameter to '4E5' to reset all parameters. In case password function is on, it is required to enter valid password to reset parameters. Password is also reset.

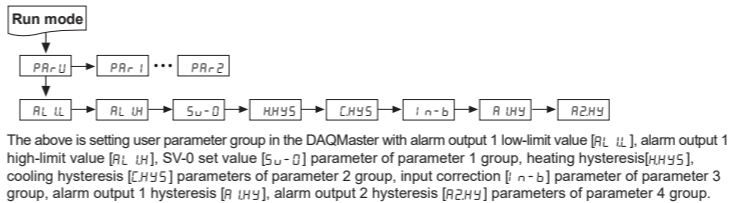
### Parameter Mask

This function is able to hide unnecessary parameters to user environment or less frequently used parameters in parameter group. You can set this in the integrated device management program (DAQMaster). Masked parameters are not only displayed. The set value of masked parameters are applied. For more information, refer to the DAQMaster user manual. Visit our website (www.autonics.com) to download the DAQMaster program and the user manual.



### User Parameter Group [PR-U] Setting

This function is able to set the frequently used parameters to the user parameter group. You can quickly and easily set parameter settings. User parameter group can have up to 30 parameters in the integrated device management program (DAQMaster). For more information, refer to the DAQMaster user manual. Visit our website (www.autonics.com) to download the DAQMaster program and the user manual.



### Auto-tuning

Auto-tuning measures the control subject's thermal characteristics and thermal response rate, and then determines the necessary PID time constant. Application of the PID time constant realizes fast response and high precision temperature control. (When setting control type [C - d] is set as P, it is displayed.) Set [n1] parameter to [on] in parameter 2 group to start auto-tuning. To stop auto-tuning, change the set as [off]. (It maintains P, I, D values of before auto-tuning.) If sensor break error [bPE] occurs during auto-tuning, it stops this operation. If the measured temperature is over or below the input range, it operates continuously. During auto-tuning operation, whole parameters are only available to check.

### Alarm

Mode	Name	Alarm operation	Description
off	—	—	No alarm output
dUCC	Deviation high-limit alarm	OFF   H   ON SV PV 100°C 110°C High deviation: Set as 10°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.
JJdU	Deviation low-limit alarm	ON   H   OFF PV SV 90°C 100°C Low deviation: Set as 10°C Low 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.
JdUc	Deviation high/low-limit alarm	ON   H   OFF   H   ON PV SV PV SV 90°C 100°C 120°C Low deviation: Set as 10°C, High deviation: Set as 20°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.
CdUJ	Deviation high/low-limit alarm	OFF   H   ON   H   OFF PV SV PV SV 90°C 100°C 120°C Low deviation: Set as 10°C, High deviation: Set as 20°C	If deviation between PV and SV as high/low-limit is lower than set value of deviation temperature, the alarm output will be OFF.
PuCC	Absolute value high-limit alarm	OFF   H   ON   H   ON PV SV PV SV 90°C 100°C 110°C Absolute-value: Set as 90°C Absolute-value: Set as 110°C	If PV is higher than the absolute value, the output will be ON.
JJPu	Absolute value low-limit alarm	ON   H   OFF   H   OFF PV SV PV SV 90°C 100°C 110°C Absolute-value: Set as 90°C Absolute-value: Set as 110°C	If PV is lower than the absolute value, the output will be ON.
LbR	Loop break alarm	—	It will be ON when it detects loop break.
5bR	Sensor break alarm	—	It will be ON when it detects sensor disconnection.
HbR	Heater break alarm	—	It will be ON when CT detects heater break.

※H: Alarm output [hysteresis] [H] [HY]

※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 to RUN mode.

### Factory Default

SV setting group [5u]				Password input parameter			
Parameter	Factory default	Parameter	Factory default	Parameter	Factory default	Parameter	Factory default
5u	0	PR55	0001				

### Parameter 1 group [PR-1]

Parameter	Factory default	Parameter	Factory default	Parameter	Factory default	Parameter	Factory default
r-5	rUn	RL LH	1550	RL 3H	1550	5u-3	0000
5u-n	5u-0	RL 2L	1550	5u-0	0000		
Ct-A	00	RL 2H	1550	5u-1	0000		
RL 1L	1550	RL 3L	1550	5u-2	0000		

### Parameter 2 group [PR-2]

Parameter	Factory default	Parameter	Factory default	Parameter	Factory default	Parameter	Factory default
ALt	oFF	H-d	0000	Ho5t	000	rARU	000
H-P	0 100	C-d	0000	CHY5	002	rARd	000
C-P	0 100	db	0000	Co5t	000	rARt	n1 n
H-1	0000	rE5t	0500	L-nu	-1000		
C-1	0000	HHY5	002	H-nu	1000		

### Parameter 3 group [PR-3]

Parameter	Factory default	Parameter	Factory default	Parameter	Factory default	Parameter	Factory default
i n-t	ECRH	H-5C	1000	o-Ft	HEAt	o 15r	5tnd
Un1t	oC	dUn1t	o'0		H-C	o 1AR	4-20
L-rG	0000	i n-b	0000	C-n'd	P1 d	oUt2	CUr
H-rG	1000	nARuF	0001		PP	o2nA	4-20
d-oE	00	L-5u	-200	ALt	tUn1	H-t	0200 (Relay)
L-5C	0000	H-5u	1350	oUt1	CUr	C-t	0020 (SSR)

### Parameter 4 group [PR-4]

Parameter	Factory default	Parameter	Factory default	Parameter	Factory default	Parameter	Factory default
RL-1	dUCC	RL2n	no	LbRt	0000	bP5	95
RL 1H	AL-A	RL2on	0000	LbRb	002	Pr-y	noE
RL 1U	001	RL2oF	0000	RoAn	Pu	5tP	2
RLn	no	RL-3	oFF	F5L1	-200	r54t	20
RLon	0000	RL3t	AL-A	F5H1	1350	Co5t	EnA
RLoF	0000	RL3Y	001	RoAn2	Pu		
RL-2	JJdU	RL3n	no	F5L2	-200		
RL2t	AL-A	RL3on	0000	F5H2	1350		
RL2Hy	001	RL3oF	0000	Rd-r5	01		

### Parameter 5 group [PR-5]

Parameter	Factory default	Parameter	Factory default	Parameter	Factory default	Parameter	Factory default
nE5u	1	Pr-nu	0000	LCP5	oFF	LCPS	oFF
dl-y	5toP	Er-nu	0000	LCP1	oFF	Pyd	0000
dl-1	oFF	5tAn	0000	LCP2	oFF		
dl-2	oFF	5tAL	Co5t	LCP3	oFF		
LtAn	RUto	U5Er	5tnd	LCP4	oFF		

### User Manual

For the detail information and instructions, please refer to user manual and user manual for communication, and be sure to follow cautions written in the technical descriptions (catalog, homepage). Visit our homepage (www.autonics.com) to download manuals.

### Comprehensive Device Management Program[DAQMaster]

DAQMaster is a comprehensive device management software for setting parameters and monitoring processes. DAQMaster can be downloaded from our website at www.autonics.com.

Item	Minimum specifications
System	IBM PC compatible computer with Pentium III or above
Operations	Windows 98/NT/XP/Vista/7/8/10
Memory	256MB+
Hard disk	1GB+ of available hard disk space
VGA	Resolution: 1024x768 or higher
Others	RS232C serial port (9-pin), USB port

### 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.
- Do not apply excessive power when connecting or disconnecting the connectors of the product.
- 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.
- Do not overlapping communication line and power line.
- Use twisted pair wire for communication line and connect ferrite bead at each end of line to reduce the effect of external noise.
- 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.
  - Indoors (in the environment condition rated in 'Specifications')
  - Pollution degree 2
  - Altitude max. 2,000m
  - Installation category II

### Major Products

- Photodiode Sensors
  - Fiber Optic Sensors
  - Door Sensors
  - Door Side Sensors
  - Area Sensors
  - Proximity Sensors
  - Pressure Sensors
  - Rotary Encoders
  - Connector/Sockets
  - Switching Mode Power Supplies
  - Control Switches/Lamps/Buttons
  - I/O Terminal Blocks & Cables
  - Stepper Motors/Drivers/Motion Controllers
  - Graphic/Logic Panels
  - Field Network Devices
  - Laser Marking System (Fiber, CO<sub>2</sub>, Nd:YAG)
  - Laser Welding/Cutting System
  - Temperature Controllers
  - Temperature/Humidity Transducers
  - SSRs/Power Controllers
  - Counters
  - Timers
  - Panel Meters
  - Tachometer/Pulse (Rate) Meters
  - Display Units
  - Sensor Controllers
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