

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 symbol represents caution due to special circumstances in which hazards may occur.

- 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.

Warning

- 1. Fail-safe device must be installed when using the unit with machinery that may cause serious injury or substantial economic loss. 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

- 1. 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. 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

Ordering information table showing TK4N-14RN, TK4S, TK4M, TK4H, TK4L models with options for output, power supply, input/output, 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-D, OUT2 output terminal is used as DI-2 input terminal. 9. 11Pin socket (PG-11, PS-11(N)) for TK4SP: sold separately.

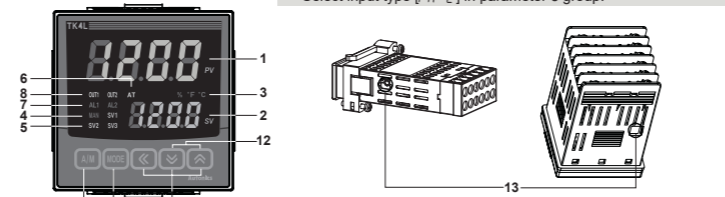
Shaded descriptions are upgraded or added functions from the before TK Series. The above specifications are subject to change and some models may be discontinued without notice. Be sure to follow cautions written in the instruction manual, user manual and the technical descriptions (catalog, homepage).

Specifications

Specifications table with columns for 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, 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, Environment, Protection, Insulation type, Approval, and Weight.

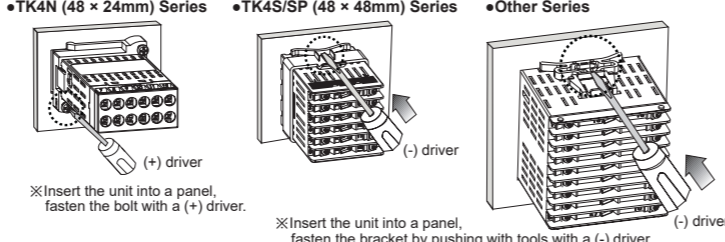
At room temperature range (23°C±5°C): Thermocouple K, J, T, N, E type, below -100°C / Thermocouple L, U, Pt100, Cu50Ω, DPT 50Ω; Thermocouple R, S, B, C, G type: (PV ±0.5% or ±5°C, select the higher one) ±1-digit; Others, below -100°C: within ±5°C. In case of TK4SP Series, ±1°C will be added to the degree standard. 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.

Unit Description



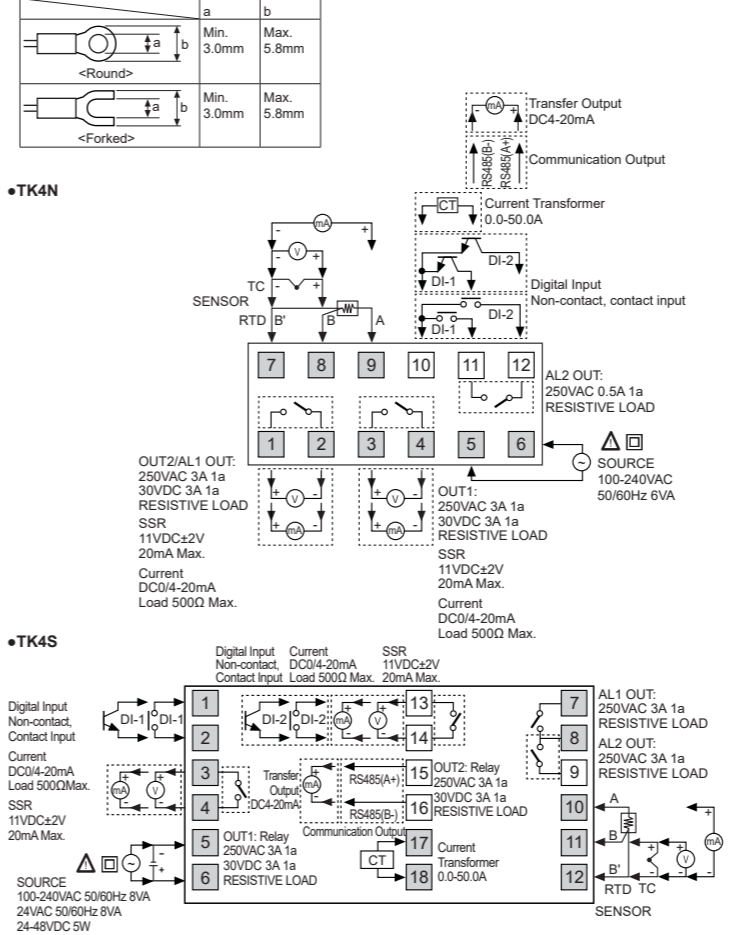
- 1. Measured value (PV) display part: RUN mode: It displays currently measured value (PV). Setting mode: It displays the parameter. 2. Set value (SV) display part: RUN mode: It displays the set value (SV). Setting mode: It displays the set value of the parameter. 3. Manual control indicator: It displays the unit set at display unit [u, n, e] 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. 9. Key: It is used when switching auto control to manual control. 10. Key: It is used when entering parameter groups, returning to RUN mode, moving parameter, saving the set value. 11. Key: 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 - v] 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

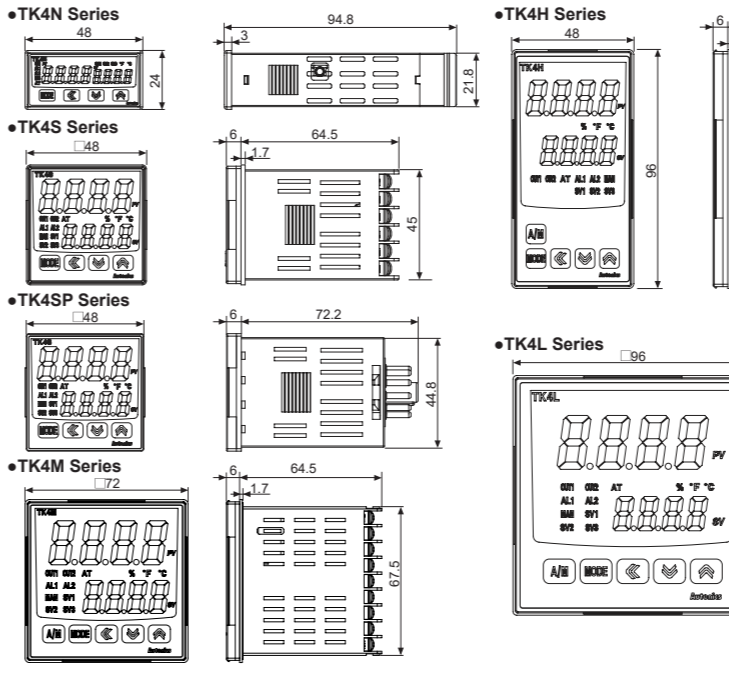


Connections

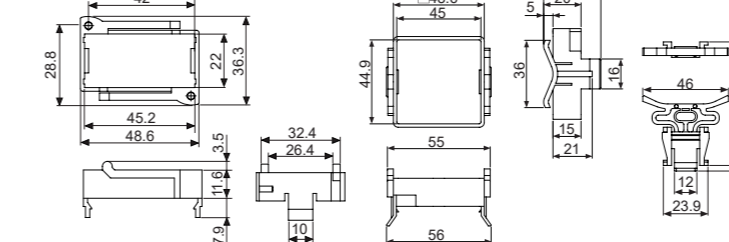
Standard model has shaded terminals only. When the operation mode of heating/cooling OUT2 relay output model is heating or cooling control, the OUT2 is usable as alarm output 3 (except TK4N Series). When the operation mode of heating/cooling OUT2 current output model is heating or cooling control, the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



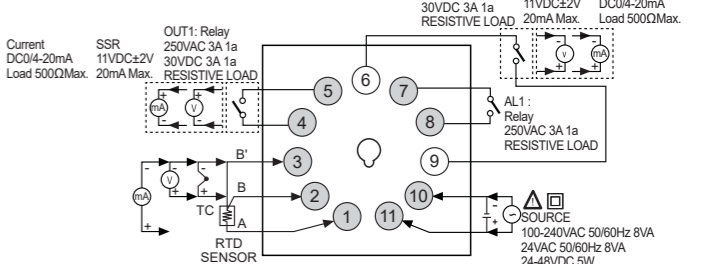
Dimensions



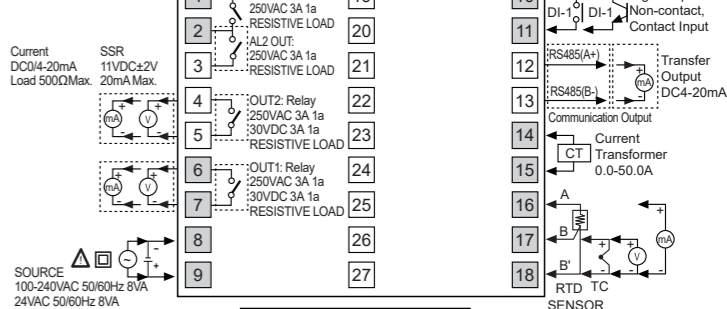
Bracket



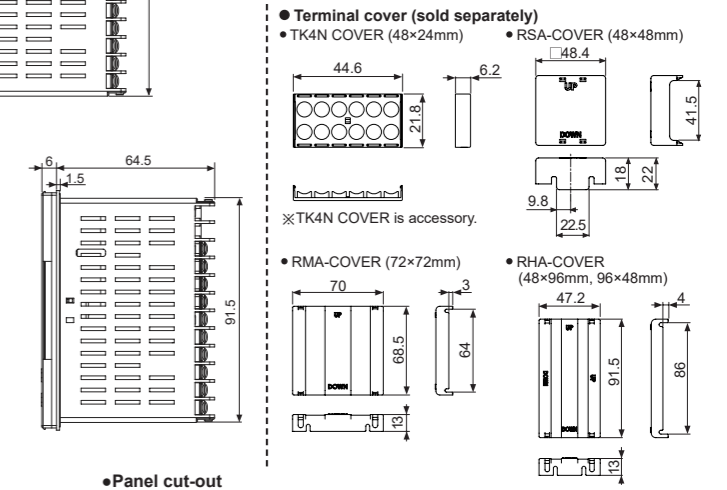
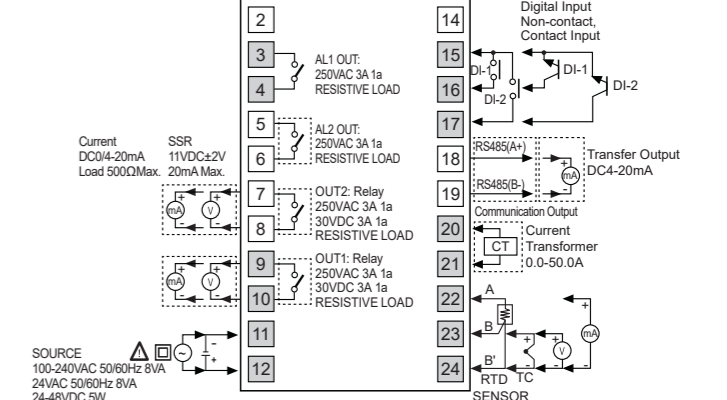
TK4SP



TK4M

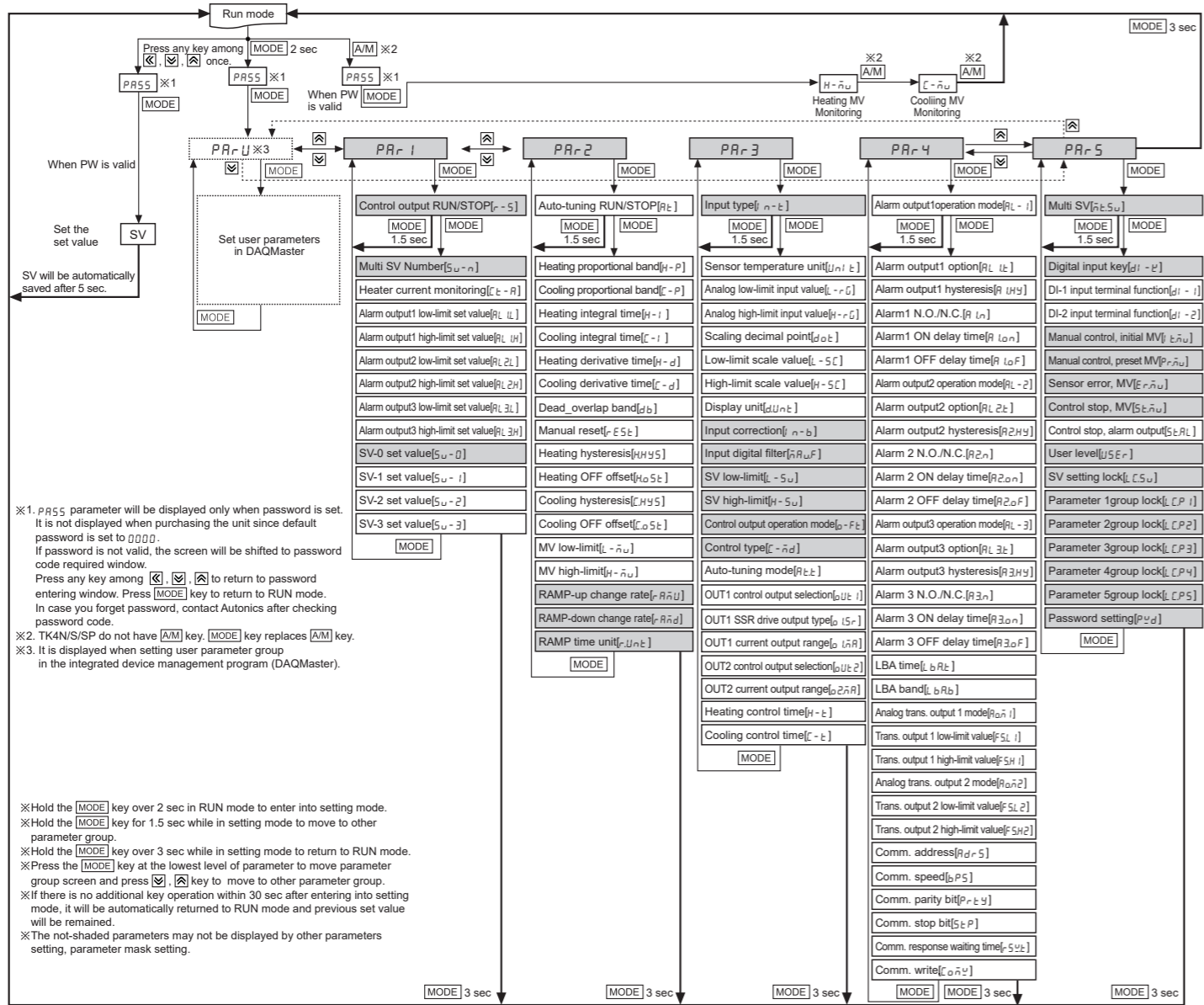


TK4H, TK4W, TK4L



Panel cut-out table showing dimensions (A, B, C, D) for models TK4N, TK4S, TK4S (P), TK4M, TK4H, TK4W, and TK4L.

Flow Chart for Setting Group

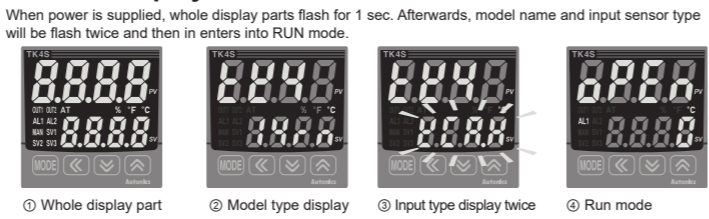


Input Types and Range

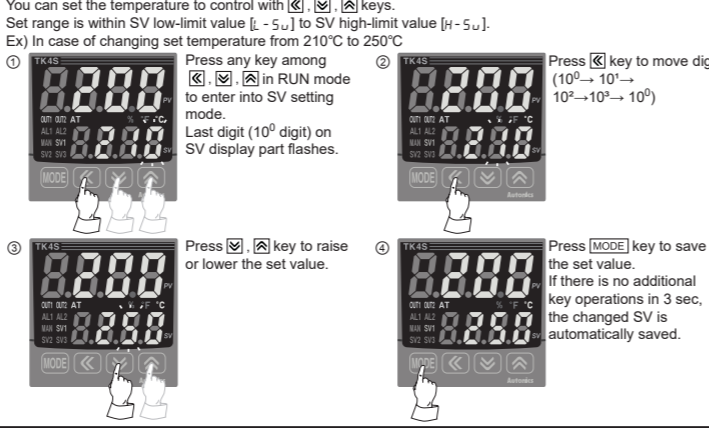
Input type	Decimal point	Display	Input range (°C)	Input range (°F)
Thermocouple	K (CA)	1	-200 to 1350	-328 to 2463
	J (IC)	0.1	-199.9 to 999.9	-328 to 1472
	E (CR)	0.1	-199.9 to 800.0	-328 to 1472
	T (CC)	1	-200 to 400	-328 to 752
	B (PR)	1	-199.9 to 999.9	-328 to 1652
	R (PR)	1	-199.9 to 999.9	-328 to 1652
	S (PR)	1	-199.9 to 999.9	-328 to 1652
	N (NN)	1	-200 to 1300	-328 to 2372
	C (TT) ^{*1}	1	0 to 2300	32 to 4172
	G (TT) ^{*2}	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	-328 to 1652
	Platine II	1	-199.9 to 400.0	-328 to 752.0
	Cu 50Ω	0.1	-199.9 to 200.0	-328 to 392.0
	Cu 100Ω	0.1	-199.9 to 200.0	-328 to 392.0
	JPT 100Ω	0.1	-199.9 to 650.0	-328 to 1202
	DPT 50Ω	0.1	-199.9 to 650.0	-328 to 1202
	DPT 100Ω	0.1	-199.9 to 650.0	-328 to 1202
	Nickel 120Ω	0.1	-199.9 to 650.0	-328 to 1202
	Analog	Voltage	0-10V	-1999 to 9999
Current		0-20mA	-1999 to 9999	(Display point will be changed according to decimal point position.)
0-5V		-1999 to 9999		
0-20mA		-1999 to 9999		

*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



Set Value (SV) Setting



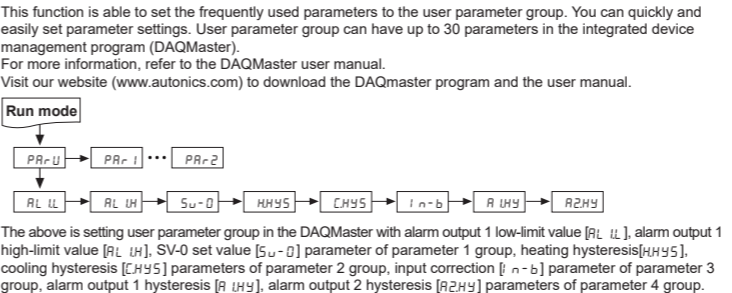
Parameter Reset

Press [MODE] + [PR55] + [MODE] to reset all parameters in memory to default value. Set [n1] parameter to '5E5' 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. Before applying mask: PR-2 → RL → H-P → C-P → H-I → C-I → H-d → C-d. After applying mask: PR-2 → H-P → H-I → H-d.

User Parameter Group [PR-U] Setting



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 [n] 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 n] 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
d u C C	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.
J J d u	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.
J d u C	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.
C d u J	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.
P u C C	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.
J J P u	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.
L b R	Loop break alarm	—	It will be ON when it detects loop break.
5 b R	Sensor break alarm	—	It will be ON when it detects sensor disconnection.
H b R	Heater break alarm	—	It will be ON when CT detects heater break.

Factory Default

SV setting group [S_u]				Password input parameter			
Parameter	Factory default	Parameter	Factory default	Parameter	Factory default	Parameter	Factory default
S_u	0	PR55	0001				
Parameter 1 group [PR-1]				Parameter 2 group [PR-2]			
Parameter	Factory default	Parameter	Factory default	Parameter	Factory default	Parameter	Factory default
r-5	rUn	RL LH	1550	RL 3H	1550	S_u-3	0000
S_u-n	S_u-0	RL 2L	1550	S_u-0	0000		
Ct-A	00	RL 2H	1550	S_u-1	0000		
RL LL	1550	RL 3L	1550	S_u-2	0000		
Parameter 3 group [PR-3]				Parameter 4 group [PR-4]			
Parameter	Factory default	Parameter	Factory default	Parameter	Factory default	Parameter	Factory default
i n-t	ECRH	H-S C	1000	a-Ft	HEAt	a l5r	5tnd
Un1-t	0C	dUn-t	0'o	H-C	H-C	a lAR	4-20
L-r G	0000	i n-b	0000	C-n d	Pi d	oUt 2	CUr r
H-r G	1000	nARuF	000.1	PP	PP	o2nA	4-20
d o t	00	L-S u	-200	RL-t	tUn I	H-t	0200 (Relay)
L-S C	0000	H-S u	1350	oUt 1	CUr r	C-t	0020 (SSR)
Parameter 5 group [PR-5]				Parameter 6 group [PR-6]			
Parameter	Factory default	Parameter	Factory default	Parameter	Factory default	Parameter	Factory default
RL-1	d u C C	R2n	no	L b R t	0000	b P5	95
RL LH	RL-A	R2on	0000	L b R b	002	P r y	no n E
RL U t	001	R2oF	0000	R o n i	P u	5 t P	2
R ln	no	RL-3	oFF	F5L 1	-200	r5Y t	20
R lo n	0000	RL 3t	RL-A	F5H 1	1350	C o n y	E n R
R lo F	0000	R3HY	001	R o n 2	P u		
RL-2	J J d u	R3n	no	F5L 2	-200		
RL 2t	RL-A	R3on	0000	F5H 2	1350		
R2HY	001	R3oF	0000	R d r 5	01		

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: 1024×768 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')
 - Altitude max. 2,000m
 - Pollution degree 2
 - 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/Buzzers
 - I/O Terminal Blocks & Cables
 - Stepper Motors/Drivers/Motion Controllers
 - Graphic/Logic Panels
 - Field Network Devices
 - Laser Marking System (Fiber, CO₂, 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
- Autonics corporation**
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