

KX Series

Digital temperature controller

- Multi input
- Position of the decimal point selection
- 2 stage step function by the external contact (KX4S)
- Select the output action : reverse action/direct action
- PID auto tuning
- Control Loop Break Alarm (LBA)
- Absolute / deviation alarm (high, low, within range)
- Input compensation setting



●● Suffix code

Model	Code	Description		
KX	<input type="checkbox"/> - <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Digital Temperature Controller		
Dimension	2N	48(W) X 96(H) mm		
	3N	96(W) X 48(H) mm		
	4N	48(W) X 48(H) mm		
	7N	72(W) X 72(H) mm		
	9N	96(W) X 96(H) mm		
	4S	48(W) X 48(H) mm	for 11 pin socket	
Control output	M	Relay		
	S	SSR (voltage pulse 12 V DC)		
	C	SCR (Current 4 – 20 mA DC)		
Alarm output	C	※ KX4N, KX4S selection only	ALH, ALL, LBA (1a common output)	
		※ KX4S selection inhibited		
	E	KX2N, KX3N, KX9N	ALH (1c), ALL(1a)	
		KX7N, KX4N (optional)	ALH (1a), ALL(1a)	
		K	※ KX4N, KX4S selection inhibited	
			KX2N, KX3N, KX9N (optional)	ALH (1c), ALL(1a), LBA(1a)
	KX7N (optional)	ALH (1a), ALL(1a), LBA(1a)		
Retransmission output (Optional)	A	※ Only selectable with models given in the below KX4N-□C KX2N-□E, KX3N-□E, KX9N-□E KX2N-□K, KX3N-□K, KX9N-□K	Retransmission output(RET) 4 – 20 mA DC	
	N	None		
Power Supply Voltage	A	100 – 240 V AC, 50 – 60 Hz		
	D	24 V DC (KX4S selection inhibited)		

* When using 4–20 mA input, attach 0.1 % of 250 Ω resistance to the input terminal of 1 – 5 V DC

Specification

Input

Thermocouple	K, J, E, T, R, B, S, L, N, U, W, PL2
RTD input	Pt 100 Ω , KPt 100 Ω
DC rated voltage	1 – 5 V DC (4 – 20 mA DC), 0 – 10 V DC
Input display resolution	Usually less than the decimal points of range
Input sampling time	250 ms
Allowable signal source resistance	Max. 250 Ω (Thermocouple input), max. 2 K Ω (DC voltage input)
Allowable wiring resistance	RTD : max 10 Ω /1 wire, however resistance among 3 wires must be same
Allowable input voltage	Within ± 20 V for 1 min
Scaling	0.0 % ~ 100.0 % of FS
Cold junction compensation error	± 3.5 $^{\circ}\text{C}$ (0 ~ 50 $^{\circ}\text{C}$)
Input break function	With the input break, up-scale and output become OFF

Performance

Display accuracy	± 0.5 % of FS but, range 0 ~ 400 of B thermocouple are excluded from the guaranteed range.
Insulation resistance	Min 20 M Ω , 500 V DC, for 1 min (between the 1st and 2nd terminal)
Dielectric strength	2,300 V AC, 50 / 60 Hz, for 1 min (between the 1st and 2nd terminal)

Control function and output

Range setting	Please refer to the range and input code
Control type	PID control, ON/OFF control
Proportional band(P)	Within the input range
Integral time	0 ~ 3600 sec
Differential time	0 ~ 3600 sec
Anti reset wind up (A.R.W)	Within the input range
Control loop break alarm (LBA)	0 ~ 7200 sec
Proportional cycle	0 ~ 100 sec
Control output hysteresis	0 ~ 10 % of FS
ON/OFF control	Set the proportional band to "0" (0.0)
Alarm type	Absolute alarm, deviation alarm (high alarm, low alarm, within range alarm)
Indication when range exceeded	Exceeding max range "0000" flickers, exceeding min range "UUUU" flickers
Decimal point function	With DC rated voltage, select the position of decimal point which caused by parameter
Position of decimal point selection	DC voltage, select the decimal point with current input (0~3 digits)
Input compensation value setting	-100.0 ~ 100.0 of FS
High or low alarm hysteresis	0 ~ 10 % of FS
High/Low range limitation	Within the input range
Output action	Direct action/reverse action (selected by parameter)
Scaling setting	-199 ~ 9999 (high and low scaling setting when inputting DC voltage)



● Output

Control output	Relay	NO : 5 A 250 V AC, 5 A 30 V DC (resistive load) NC : 3 A 250 V AC, 1 A 30 V DC (resistive load)
	SSR	12 V DC min, pulse voltage (load resistance min 600 Ω)
	SCR	4 – 20 mA DC (load resistance max 600 Ω), accuracy : ±0.2 mA
Alarm output	Relay	250 V AC 3 A (load resistance) ※please refer to the connection diagram (contact) just, KX4N : 1a contact, 250 V AC 1 A (load resistance)
Retransmission output	Current	4 – 20 mA DC (load resistance max 600 Ω), accuracy : ±0.2 mA

General specification

Model	KX2N	KX3N	KX4N	KX4S	KX7N	KX9N
Power Supply Voltage	100 – 240 V AC, 50 – 60 Hz, 24 V DC (KX4S selection inhibited)					
Voltage fluctuation	±10 % of the Power Supply Voltage					
Power consumption	11 VA max.		7 VA max.		11 VA max.	
Ambient Temperature	0 ~ 50 °C					
Ambient humidity	35 ~ 85 % RH (without dew condensation)					
Vibration Resistance	10 – 55 Hz, 0.76 mm, 2 hrs each in X, Y and Z direction					
Shock Resistance	300 m/s ² to the direction 6 each 3 times					
Weight (Included the weight of box)	approx. 320 g	approx. 320 g	approx. 180 g	approx. 180 g	approx. 300 g	approx. 400 g

Range and input code

Classification	code (SL1)	Input signal	Range(°C)	
			1 °C (SL2 : X1XX)	0.1 °C (SL2 : X0XX)
Thermocouple	0001	K	-50 ~ 1300	-50.0 ~ 999.9
	0101	J *2	-50 ~ 600	-50.0 ~ 600.0
	1100	E	-199 ~ 999	-199.9 ~ 999.9
	1101	T	-50 ~ 400	-50.0 ~ 400.0
	0100	R	0 ~ 1700	0.0 ~ 999.9
	0110	B *1	0 ~ 1800	0.0 ~ 999.9
	0111	S	0 ~ 1700	0.0 ~ 999.9
	1000	L *2	-199 ~ 900	-199.9 ~ 900.0
	1001	N *2	-199 ~ 1300	-199.9 ~ 999.9
	1010	U	-50 ~ 400	-50.0 ~ 400.0
	1011	W (Re5-Re25)	0 ~ 2300	0.0 ~ 999.9
	1110	PL2	0 ~ 1300	0.0 ~ 999.9
RTD	0010	KPt100 Ω (old model)	-199 ~ 500	-199.9 ~ 500.0
	0011	Pt100 Ω (IEC)	-199 ~ 640	-199.9 ~ 640.0
DC Voltage Voltage Current	0000	1 – 5 V DC *3	-199 ~ 9999	Decimal point selection by SL4
	1111	0 – 10 V DC *3		

※ When using 4-20 mA input, attach 0.1 % of 250 Ω shunt resistance at the both ends of the input terminal within 1 – 5 V DC input mode

※ Accuracy : ±0.5 % of FS

*1 : range 0 ~ 400 °C are excluded from the guaranteed range

*2 : range with less than 0 °C, ±1 % of FS *3 : ±1 % of FS

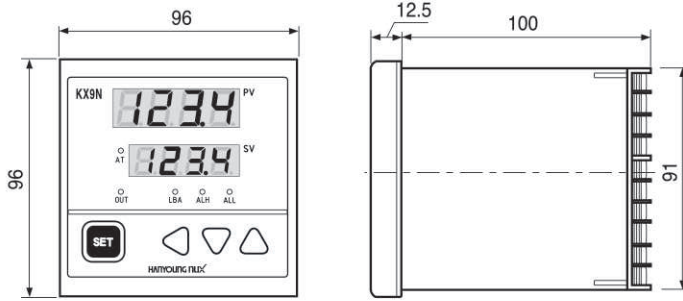
A

Temperature
Controller

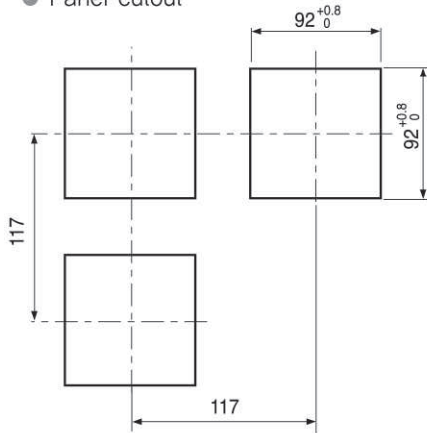
Dimension and panel cutout (unit : mm)

KX9N

● Dimension

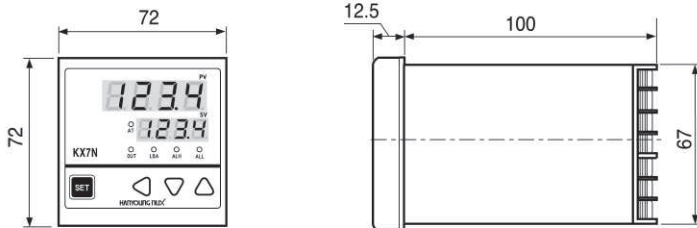


● Panel cutout

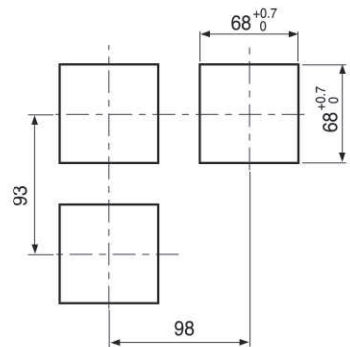


KX7N

● Dimension

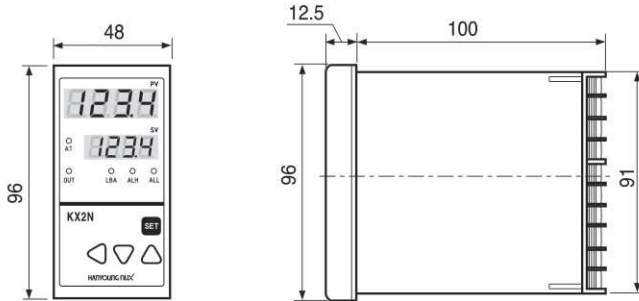


● Panel cutout

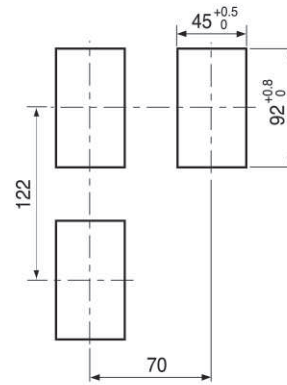


KX2N

● Dimension

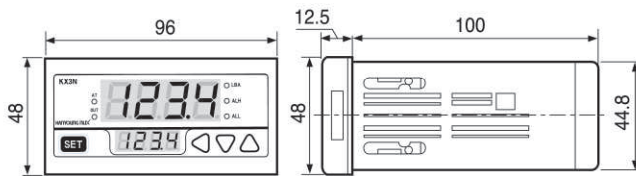


● Panel cutout

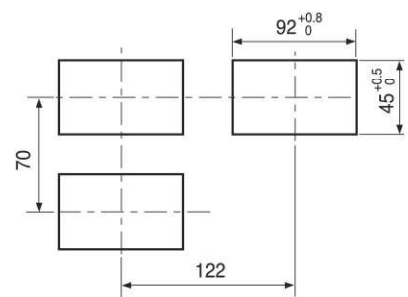


KX3N

● Dimension

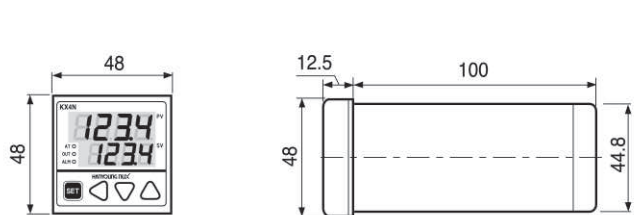


● Panel cutout

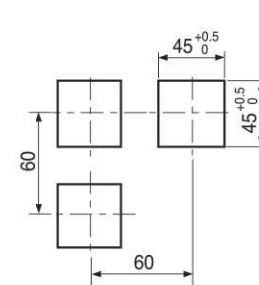


KX4N

● Dimension

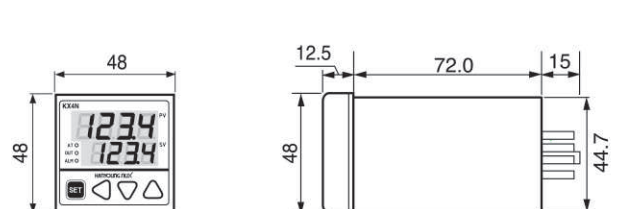


● Panel cutout

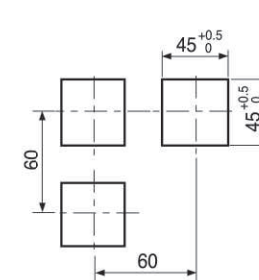


KX4S

● Dimension

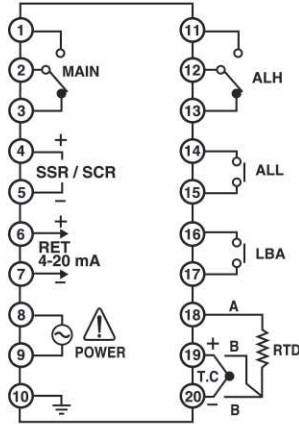


● Panel cutout

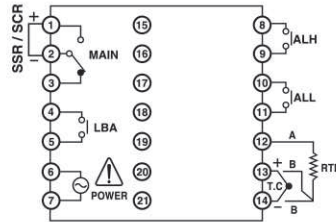


Connection diagram

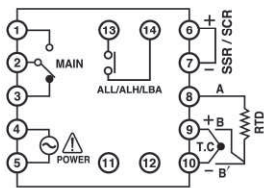
● KX 2N / 3N / 9N



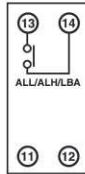
● KX 7N



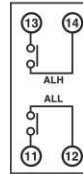
● KX 4N



• Standard(C)

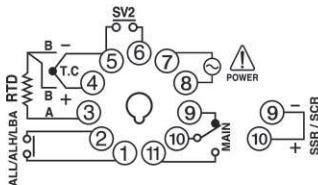


• alarm 2 contact (E)



• Standard(C) + Retransmission output(A)

● KX 4S



Main function explanation

■ Auto tuning (AT)function

Auto tuning function measures, computes and sets the optimum PID or ARW constant to the temperature control automatically. After supplying power in and while temperature is increasing, press the **SET** key and **△** key synchronously to begin the auto tuning. When auto tuning is finished, tuning operation will be ended automatically.

■ LBA : Control Loop Break Alarm

LBA function starts to measure time from the moment when the PID computed value becomes 0 % or 100 %. Also, from this point, this function detects heater break, sensor break manipulator malfunction and etc by comparing the changed amount of measured value in each set time. Also, it can set the LBA dead band in order to prevent any malfunction to happen in the normal control loop.

- ① When control output value which obtained by PID operation is 100 %, LBA will be ON only when process value does not rise more than 2 °C in the LBA setting time
- ② When control output value which obtained by PID operation is 0 %, LBA will be ON only when process value does not drop more than 2 °C in the LBA setting time

■ Heating/Cooling output action selection

Able to select reverse action (heating control) or direct action (cooling control) output by the internal parameter

- ① Reverse action: ON with measurement value < Setting value
- ② Direct action: ON with measurement > Setting value

■ ON/OFF control setting method

Usually temperature controller performs the temperature control by "PID control method" which is by the PID auto-tuning. However, ON/OFF control method is used when controlling refrigerator, fan, solenoid valve and etc. When users want to set the temperature controller as ON/OFF control mode, set the set value of proportional band as 0 in the "general setting parameter". Here, HYS (hysteresis) parameter will be displayed. Prevent such actions by setting the desired ON/OFF action range.

Parameter symbol	Name	Set range	Default value
P	Proportional band	0 ~ 100 %	20 °C
	Set the proportional band as "0" when using ON/OFF control. However, performing PID auto-tuning when using the ON/OFF control, it will be changed to PID control		

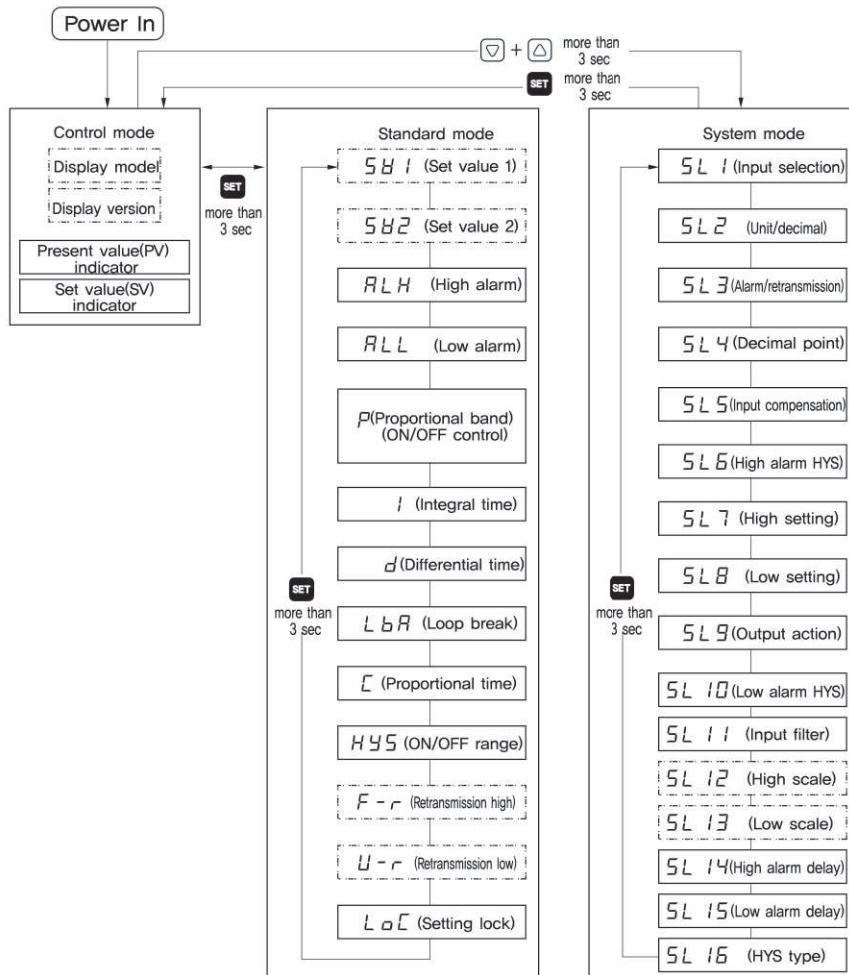
■ 2 stage step function by external contact (Only with model KX4S)

It can select 2 types of control target value that has been set in advance by external contact input ON/OFF so it can be applied to the step control and etc easily. (SV1 selection = #5 - #6 OFF)

■ Max range and min range exceeded indication

- ① If the present value increases due to the input break (sensor break) or etc and exceeds the maximum temperature range then **0000** (indication of exceeding the max range) will flicker in the measured value displaying unit.
- ② If present value decreases and exceeds the minimum temperature range then **UUUU** (indication of exceeding the min range) will flicker in the measured value displaying unit.

Parameter composition



Parameter setting

■ Control temperature setting

Supplying the power in after completes the wiring, it will display the model and version of temperature controller for a while and display measured temperature and set temperature.

This state is called as control mode.

Pressing the **SET** key in the control mode state will flicker the set value in the indicator.

■ General mode setting

General mode is the setting mode which sets alarm set value, ON/OFF action, hysteresis (HYS) and etc which are required to change the set value frequently. It sets each parameter when necessary.

But, performing the PID auto-tuning will automatically set *P* (proportional band), *I* (integral time), *d* (differential time), *R* (anti reset wind up), *LbA* (control loop break alarm) and etc

*(Press the **SET** key for 3 seconds continuously.)

Present value display unit	Name	Default value	Setting range	Explanation	
*1	SV1	Set value 1	-50 °C	within input range	Set value 1 (SV 1)
*1	SV2	Set value2	-50 °C		Set value 2 (SV 2)
	ALH	High alarm	1,300 °C		display the set value of high alarm.
	ALL	Low alarm	-50 °C		display the set value of low alarm.
	P	Proportional band	20 °C	0~100% of FS	set when performing the proportional control. Setting to '0' will be as ON/OFF control.
	R	Anti reset wind up	20 °C	0~100% of FS	prevents overshoot and undershoot caused by integral effectiveness. Automatically operates with setting '0'.
	I	Integral time	240sec	0~3600sec	Eliminates offset occurring in proportional control, and reach faster Integral action will be turned OFF with setting '0'.
	d	Differential time	60sec	0~3600sec	prevents ripples by predicting output change thereby improving control stability. Differential action will be turned OFF with setting '0'.
	LbA	Control loop break alarm	0sec	0~7200sec	Indicates control loop break alarm setting. Not operated with [0]setting
	C	Proportional cycle	*3	1~100sec	Displays control output cycle (sec).
	HYS	Hysteresis	1 °C	0~10 % of FS	set the control sensitivity of control output (main output)(with ON/OFF)
*2	F-r	High Retransmission output	1,300 °C	within input range	limits the max value of Retransmission output
*2	U-r	Low Retransmission output	-50 °C		limits the min value of Retransmission output.
	LoL	Set data lock	0000	0000~0003	Set the set data lock level

* 1 is exclusive for KX4S specification (Not displayed with other specifications)

* 2 is optional (If the model does not have retransmission output then not displayed)

* 3 varies the default value depending on the control input

(20 sec with relay output, SSR output : 2 sec)

System mode setting

The system mode sets the specification of temperature controller in the first installation by engineer

In the control mode press Δ and ∇ keys at the same time for 3 seconds to enter in to the initial setting mode

Press the **SET** key or 3 seconds to return to the operation mode (PV/SV)



Symbol (PV display screen)	List	Description	Default value (SV display screen)
SL1	Input selection	Multi input, "Please refer to the range and input code"	0001 (K Thermocouple)
SL2 	① Output selection	0 : Current output 1 : Relay, voltage output	1111
	② Decimal point function selection	0 : Without decimal point 1 : With decimal point	
	③ Temperature unit selection	0 : None 1 : Celsius(°C)	
	④ Indicator/controller selection	0 : Temperature indicator 1 : Temperature controller	
SL3 	① Alarm standby action selection	0 : With standby operation 1 : NONE	1111
	② Retransmission output (optional):	0 : With the Retransmission output 1 : NONE	
	③ Alarm type selection	0 : Alarm within the range 1 : High and low alarm	
	④ Deviation/ absolute alarm selection	0 : Deviation alarm 1 : Absolute alarm	
SL4	Position of decimal point selection	0 → 0000 (none) 1 → 000.0 (1 st) 2 → 00.00 (2 nd digit) 3 → 0.000 (3 rd digit)	0
SL5	Input compensation value setting	±100 % of FS	0
SL6	High alarm(ALH) hysteresis setting	± 10% of max range	1
SL7	Max temperature setting	Within temperature setting but, SL7 > SL8	1300
SL8	min temperature setting		-50
SL9	Control output action	0 : Reverse action (heating) 1 : Direct action (cooling)	0
SL10	Low alarm hysteresis setting	±10 % of max range	1 °C
SL11	Input filter	0 ~ 100 sec	0
SL12	Max input scale setting	9999	9999
SL13	Min input scale setting	-1999	-1999
SL14	High alarm (ALH) delay time setting	0 ~ 100sec	0 sec
SL15	Low alarm (ALL) delay time setting	0 ~ 100sec	0 sec
SL16	Control output hysteresis type selection	0: Hysteresis 1: Hysteresis X double action (left, right)	0

Press the **SET** key.)