LCD Digital Temperature Controller

KXN series

INSTRUCTION MANUAL

Thank you for purchasing Hanyoung Nux products. Please read the instruction manual carefully before using this product, and use the product correctly.
Also, please keep this instruction manual where you can view it any time.

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MA0308KE230105

Safety information

Please read the safety information carefully before the use, and use the product correctly.
The alerts declared in the manual are classified into **Danger**, **Warning** and **Caution** according to their importance

⚠ **DANGER**	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury
⚠ **WARNING**	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury
⚠ **CAUTION**	Indicates a potentially hazardous situation which, if not avoided, may result in minor injury or property damage

⚠ DANGER

Do not touch or contact the input/output terminals because it may cause electric shock.

⚠ WARNING

- If the product is used with methods other than specified by the manufacturer, then it may lead to injury or property damage.
- Please install an appropriate protective circuit on the outside if a malfunction or an incorrect operation may be a cause of leading to a serious accident.
- Since this product does not have the power switch or a fuse, please install those separately on the outside. (Fuse rating: 250V 0.5A)
- To prevent damage or failure of this product, please supply the rated power voltage.
- To prevent electric shock or equipment failure, please do not turn on the power until completing wiring.
- Since this is not explosion-proof structure, please do not use in a place where combustible or explosive gas is around.
- Never disassemble, modify, or repair the product. There is a possibility of a malfunction, an electric shock, or a risk of fire.
- Please turn off the power when mounting/dismounting of the product. This is a cause of an electric shock, a malfunction, or failure.
- Since there is a possibility of an electric shock, please use the product as mounted on a panel while the power is being supplied.

⚠ CAUTION

- Before using a temperature controller, there could be a temperature difference between PV of the temperature controller and the actual temperature so please operate the temperature controller after compensating the temperature difference appropriately.
- The contents of the instruction manual are subjective to change without prior notice.
- Please make sure that the specification is the same as what you have ordered.
- Please make sure that the product is not damaged during shipping.
- Please use this product in a place where the ambient operating temperature is 0 ~ 50 °C (40 °C max, closely installed) and the ambient operating humidity is 35 ~ 85 % R.H (without condensation).
- Please use this product in a place where corrosive gas (such as harmful gas, ammonia, etc.) and flammable gas do not occur.
- Please use this product in a place where there is no direct vibration and a large physical impact to the product.
- Please use this product in a place where there is no water, oil, chemicals, steam, dust, salt, iron or others.
- Please do not wipe this product with organic solvents such as alcohol, benzene and others. (Please use mild detergent)
- Please avoid places where excessive amounts of inductive interference and electrostatic and magnetic noise occur.
- Please avoid places where heat accumulation occurs due to direct sunlight or radiant heat.
- Please use this product in a place where the elevation is below 2,000 m.
- Please make sure to inspect the product if exposed to water since there is a possibility of an electric leakage or a risk of fire.
- For thermocouple (TC) input, please use a prescribed compensation lead wire. (There is a temperature error if a general lead is used.)
- For resistance temperature detector (RTD) input, please use a small resistance of lead wire and the 3 lead wires should have the same resistance. (There is a temperature error if the 3 lead wires do not have the same resistance.)
- Please put the input signal wire away from the power lines and load lines to avoid the effect of inductive noise.
- The input signal wires and output signal wires should be separated from each other. If it is not possible, please use shielded wires for the input signal wires.
- For thermocouple (TC), please use ungrounded sensors. (There is a possibility of a malfunction of product by an electric leakage if a grounded sensor is used.)
- If there is a lot of noise from the power line, installing an insulated transformer or a noise filter is recommended. The noise filter should be grounded on the panel and the lead wire between the output of the noise filter and the power terminal of the instrument should be as short as possible.
- It is effective against noise if making the power lines of the product the twisted pair wiring.
- Please make sure the operation of the product before using since the product may not operate as it intends if the alarm function is not properly set.
- When replacing the sensor, please turn off the power.
- In case of the high frequent operation such as proportional operation, please use an auxiliary relay since the life span of the output relay will be shortened if it connects to the load without the rated margin. In this case, SSR output is recommended.
  · Electromagnetic switch proportion cycle: set 20 sec min.
  · SSR: proportion cycle: set min.1 sec
- Contact output life expectancy: Mechanical - 1 million times min. (without load) Electrical – 100 thousand times min. (250 V a.c. 3A: with rated load)
- Please do not connect anything to the unused terminals.
- Please connect wires properly after making sure the polarity of terminal.
- Please use a switch or breaker (IEC60947-1 or IEC60947-3 approved) when the product is mounted on a panel.
- Please install a switch or break near the operator to facilitate its operation.
- If a switch or breaker is installed, please put a name plate that the power is off when the switch or breaker is activated.
- In order to use this product properly and safely, we recommend periodic maintenance.
- Some parts of this product have limited expected life span and aged deterioration.
- The warranty of this product (including accessories) is 1 year only when it is used for the purpose it was intended under normal condition.
- When the power is being supplied there should be a preparation time for the contact output. Please use a delay relay together when it is used as a signal on the outside of interlock circuit or others.
- When the user replaces with a spare unit due to product failure or other reason, please check the compatibility since the operation can be varied by the difference of setting parameters even though the model name and code are the same.

Suffix code

Model	Code							Description
KX	□ -	□	□	□	□	□		Digital Temperatrue Contoller
Dimension	2N							48(W) × 96(H) ㎜
	3N							96(W) × 48(H) ㎜
	4N							48(W) × 48(H) ㎜
	7N							72(W) × 72(H) ㎜
	9N							96(W) × 96(H) ㎜
	4S							48(W) × 48(H) ㎜ 11pin socket type
Control output		M						Relay
		S						Voltage pulse output (12 V d.c.)
		C						Current output (4 - 20 ㎃ d.c.)
Alarm output			C					✳ KX4N, KX4S only ALH, ALL, LBA(1a common output)
			E					✳ KX4S not selectable
								KX2N, KX3N, KX9N ALH(1c), ALL(1a)
								KX7N, KX4N (option) ALH(1a), ALL(1a)
			K					✳ KX4N, KX4S not selectable
								KX2N, KX3N, KX9N (option) ALH(1c), ALL(1a), LBA(1a)
								KX7N (option) ALH(1a), ALL(1a), LBA(1a)
Restransmission output (Option)				A				✳Only selectable with models given in the below Retransmission output(RET) 4 - 20 ㎃ d.c. KX4N - □ C KX2N - □ E, KX3N - □E, KX9N - □ E KX2N - □K, KX3N - □ K, KX9N - □ K
				N				None
Power supply voltage					A			100 - 240 V a.c., 50 - 60 Hz
					D			24 V d.c. (except KX4S)

※ When using 4 - 20 ㎃ input, connect 0.1 % 250 Ω resistor to the input terminal of 1-5 V d.c.

Input code for input type and range

Input type	SL1	Input type	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 ~ 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	- 199 ~ 400	- 199.9 ~ 400.0
	1011	W(Re5-Re25)	0 ~ 2300	0.0 ~ 999.9
	1110	PL2	0 ~ 1300	0.0 ~ 999.9
RTD	0010	KPt100 Ω	- 199 ~ 500	- 199.9 ~ 500.0
	0011	Pt100 Ω(IEC)	- 199 ~ 640	- 199.9 ~ 640.0
DCV	0000	1 - 5 V d.c. ✳3	- 199 ~ 9999	Decimal point: According to SL4
	1111	0 - 10 V d.c. ✳3		

※ K, J, E, T, R, B, S, N : IEC 584.
L, U : DIN 43710,
W(Re5-Re25) : Hoskins Mfg.Co.USA.
Pt100 Ω : IEC 751, KS C1603.
(Kpt100 Ω: Rt = 139.16 Ω ※ Rt: resistance at 100 °C)

※ When using 4 - 20 ㎃ input, connect 0.1 % 250 Ω shunt resistor to the input terminal when the input mode is 1 - 5 V d.c.

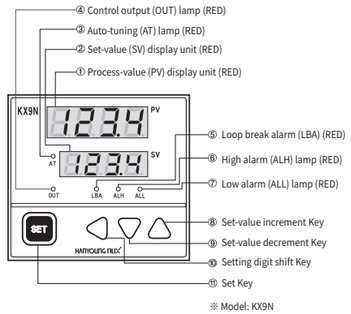
※ Accuracy : ± 0.5 % of F.S

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

✳2 : The accuracy of the range less than 0 °C is ±1 % of F.S

✳3 : ± 1 % of F.S

Part name and function



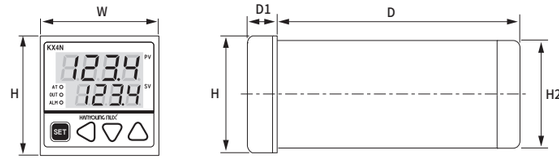
※ Model: KX9N

Specification

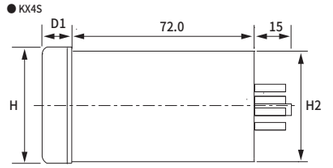
Power supply voltage		100 - 240 V a.c. (±10 %), 50 - 60 Hz, 24 V d.c. (±10 %) (Excluding KX4S)	
Power consumption		KX 2, 3, 7, 9 Below 11 VA max	KX4, KX4S Below 7 VA max
Input	Input type	Please refer to Input code	
	Sampling cycle	250 ㎳	
	Indication accuracy	±0.5 % (Please refer to Input type)	
	Allowable voltage	±20 V d.c. for 1 minute	
	Reference junction temperature	±3.5 °C, 0 ~ 50 °C	
	Operation after input break	Up scale after input break, output OFF	
Control output	Relay	NO : 5 A 250 V a.c., 5 A 30 V d.c.(Resistive load), NO : 3 A 250 V a.c., 1 A 30 V d.c.(Resistive load)	
	Voltage output	ON voltage : More than 12 V d.c. min, Load resistance: 600 Ω min	
	Current output	Range : 4 - 20 ㎃ d.c. (±5%), Accuracy : ±0.2 ㎃, Load resistance: 600 Ω max	
Retransmission output		Range : 4 - 20 ㎃ d.c. (±5 %), Accuracy : ±0.2 ㎃, Load resistance: 600 Ω max	
Alarm output		250 V a.c., 3 A (Resistive load), refer to connection diagram (contact) But, KX4N: 1a contact, 250 V a.c. 1A (load resistance)	
Control	Contact input	OFF resistance : 10 kΩ min, ON resistance : 1 kΩ max	
	Method	PID control, ON/OFF	
	Output operation	Reverse action, Direct action	
	Anti-reset wind-up	Auto (A=0), 0.1 ~ 100.0 %	
Insulation Resistance		20 MΩ min between 1st and 2nd terminals	
Dielectric strength		2,300 V a.c. between 1st and 2nd terminals, for 1 minute	
Operating environment	Temperature & Humidity	0 ~ 50 °C, 35 ~ 85 % R.H.(With no condensation)	
	Environment	Please refer to safety information	

Dimension & Panel cutout & Connections

● KX2N, KX3N, KX4N, KX7N, KX9N

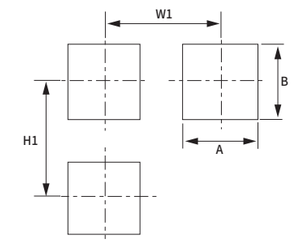


● KX4S



※ Remark: current : 4 - 20 mA d.c.,
SOLID STATE : 12 V d.c. min.

※ KX4N, KX4S, KX7N: These models do not have earth terminal



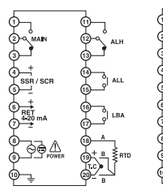
(Unit : ㎜)

Classification	Type	KX2N	KX3N	KX4N	KX4S	KX7N	KX9N
Product dimensions	W	48	96	48	48	72	96
	H	96	48	48	48	72	96
	H2	91	44.8	44.8	44.7	67	91
	D	100	100	100	✳2)	100	100
	D1	12.5	12.5	12.5	7.4	12.5	12.5
Panel cutout	W1 ✳1)	70	122	60		93	117
	H1 ✳1)	122	70	60	✳2)	93	117
	A	45	92	45		68	92
	B	92	45	45		68	92

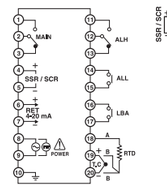
✳1) +0.5 mm tolerance applied
✳2) Socket type
✳3) Separately marked

■ Connections

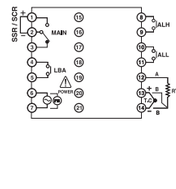
● KX2N



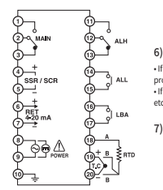
● KX3N



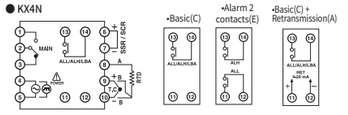
● KX7N



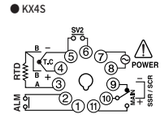
● KX9N



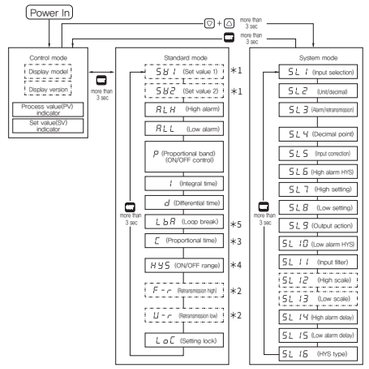
● KX4N



● KX4S



Parameter composition



Main functions

1) Main functions

LBA function starts to measure time from the moment when the control output obtained by P.I.D operation 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 obtained by P.I.D 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 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

2) Auto tuning(AT) function

Auto tuning function measures, computes and sets the optimum P.I.D 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.

3) 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 "standard mode". At this time, HYS (hysteresis) parameter will be displayed. It prevents frequent ON/OFF operation with setting a proper ON/OFF operating range.

Parameter symbol	Name	Setting range	Default value
P (ON/OFF)	Proportional band	0 ~ 100 % of F.S	20 °C
HYS	Hysteresis	0 ~ 10 % of F.S	1 °C

⚠ CAUTION
If you run Auto tuning in the ON/OFF control mode, the control mode will be changed to PID.

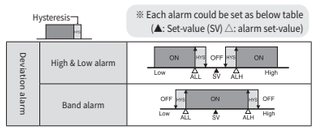
4) Set data lock function

The set data lock function is used to prevent the changing of each setvalue by the front key and the activation of the auto-tuning function, i.e., prevent misoperation after setting has ended. For set data lock, display LOC by pressing the SET key, then set the following value in accordance with setting procedure thereby enabling data lock ON or OFF.

0000 : No set data locked.
0001 : Only set-value (SV) can be changed with the set data locked.
0010/0011 : All set data locked.

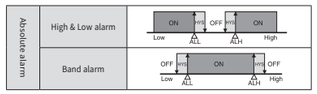
5) Alarm Funtion

(1) Deviation alarm



This alarm setting is that the alarm is activated if a few °C is higher or low than set-value. For example, if the set-value of the temperature is 200 °C and a system is designed to have that the high alarm (RLH) is activated when the process value is 205 °C and the low alarm is activated when the process value is 190 °C then set the high alarm (RLH) 5 °C, and set the low alarm (RLL) 10 °C. If the set-value is changed to 300 °C, the high alarm is activated at 305 °C and the low alarm is activated at 290 °C.

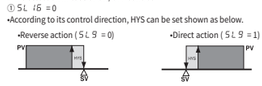
(2) Absolute alarm



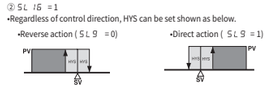
Note) Regardless of the set-value, the high or low alarm is activated at the alarm set- value.
※ For the band alarm, the relay of the low alarm (RLL) is not activated but the relay of the high alarm (RLH) is activated.

(3) HYS Selection

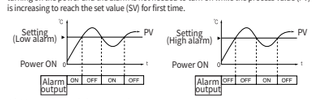
- HYS selection in case of ON/OFF control
① SL 16 = 0
•According to its control direction, HYS can be set shown as below.



② SL 16 = 1
•Regardless of control direction, HYS can be set shown as below.



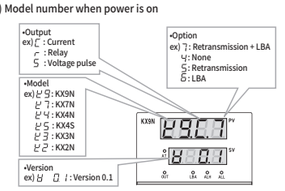
(4) Alarm hold operation on/off
When the power is being supplied and the process value (PV) is within the alarm range, this function is used to turn off the alarm output until the process value (PV) reaches the out of the alarm range. This is used for low alarm and other applicable alarms when turning on the power and the alarm is not needed to turn on while the process value (PV) is increasing to reach the set value (SV) for first time.



6) Up scale and down scale

• If the process value exceeds the upper limit of input range due to upscale, etc., the process value(PV) display unit flashes overscaledisplay [0000]
• If the process value becomes below the lower limit of input range due to downscale, etc., the process value(PV) display unit flashes underscale display [UUUU]

7) Model number when power is on



8) Control direction

Reverse action (heating) or direct action (cooling) can be selected in the internal parameter (SL 9).
① Reverse [0]: Control output ON when PV < SV
② Direct [1]: Control output ON when PV > SV

9) Input filter

Input filter time can select from SL 11. When PV value becomes unstable due to effects of noise, the filter helps to eliminate the unstable status
(If select [0], input filter is off)

10) Input scale

In case of DCV input, it's a setup range of input range
Example, SL 1 =0000 (1 - 5V DCV), SL 12 =100.0, SL 13 =0.0, Input scale is as follows.

Input voltage	1 V	3 V	5 V
Display	0.0	50.0	100.0

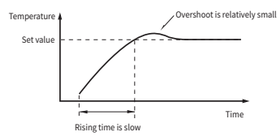
11) Alarm delay time

Delay time of High alarm and low alarm can set from SL 14 and SL 15.
If user set it, alarm will be ON after passing delay time.
(Turning off the alarm has nothing to do with delay time)

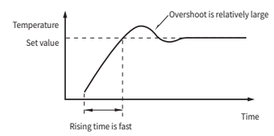
12) Anti-reset windup (ARW)

Set anti-reset windup from "A" parameter to prevent over - integral.

① A = Auto (0)



② A = set value



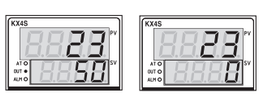
※ If ARW value is too small or too big, overshoot or undershoot will happen. Please use same value as P (Proportional band)

13) Select set value (only for KX4S)

- Select a set value (SV 1 or SV 2) by external contact input

① External contact input is OFF (SV 2 =OFF)
•Display SV 1, start control according to the [Picture 1].

② External contact input is ON (SV 2 =ON)
•Display SV 2, start control according to the [Picture 2].



[Picture 1] [Picture 2]

Parameter setting

■ Set value (S.V) setting

After completing the wiring setup and turning on the power, it shows the model and firmware version of the temperature controller for a moment then it displays the process value and the set value. This mode is called "control mode". In "control mode", if SET key is pressed then the set value in the SV display unit is blinking. The set value can be changed with using ▽ key and △ key and moving the placement of the digits by pressing ◁ key. After adjusting the desired value, press SET key to set the desired value to the set value. After setting the set value, please execute the auto-tuning by pressing SET key and △ key at the same time.

■ Standard mode setting

Standard mode is a setting mode that has frequently used functions by a user such as alarm parameters, ON/OFF operation, hysteresis (control operation range) and others. Each parameter can be set according to its application.

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

✳ press SET the key continuously for 3 sec.

Press SET key

Parameter symbol	Name	Setting range	Default value
✳1 SV1	Set value 1	within input range	-50 °C
✳1 SV2	Set value 2		-50 °C
ALH	High alarm	within input range (ALL < ALH)	1300 °C
ALL	Low alarm		-50 °C
P (ON/OFF)	Proportional band	0 ~ 100 % of F.S	20 °C
		ON - OFF "0"	(0 °C → ON/OFF)
A	Anti reset wind up	0 ~ 100 % of F.S	20 °C
I	Integral time	0 ~ 3600 sec	240 sec
d	Differential time	0 ~ 3600 sec	60 sec
✳5 LbA	Control loop break alarm	0 ~ 7200 sec	0 sec
C	Proportional cycle	1 ~ 100 sec	✳3
✳4 HYS	hysteresis	0 ~ 10 % of F.S	1 °C
✳2 F-r	High Retransmission output	within input range (F-r > U-r)	1300 °C
✳2 U-r	Low Retransmission output		-50 °C
LoC	Set data lock	0 ~ 3	0000

✳1 is only available in KX4S (not displayed in other models)

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

✳3 varies the default value depending on the control input (relay output: 20 sec, SSR output: 2 sec)

✳4 is displayed only when P (proportional band) is set to "0" and it is used to set the hysteresis of ON/OFF control operation

✳5 is LbA parameter that if it is set to "0", LbA function is OFF

■ System mode setting

System setting mode is a setting mode that a user (or an engineer) set its parameters for the first time to use it properly since KX series temperature controller has many functions.
(1) In the control mode press △ and ▽ keys at the same time for 3 seconds to enter into the system setting mode
(2) Press the SET key for 3 seconds to return to the control mode (PV/SV)

Press SET key

Symbol (PV display unit)	List	Information	Default value (SV display unit)
SL 1	Input selection	Multi input, Please refer to "input code" table	0001 (K Thermocouple)
SL 2	Output confirmation (※ operation impossible)	0 : Current output 1 : Relay, voltage output	1111
	Decimal point function selection	0 : Without decimal point 1 : With decimal point	
	Temperature unit selection	0 : None 1 : Celsius(°C)	
	Indicator/controller selection	0 : Temperature indicator 1 : Temperature controller	
SL 3	Alarm hold operation selection	0 : With hold operation 1 : None	1111
	Retransmission output (option)	0 : With retransmission output 1 : None	
	Alarm type selection	0 : Band alarm 1 : High and low alarm	
	Deviation/ absolute alarm selection	0 : Deviation alarm 1 : Absolute alarm	
SL 4	Decimal point position election	0 → 0000 1 → 000.0 2 → 00.00 3 → 0.000	0
SL 5	Input correction value	± 100 % of F.S	0
SL 6	Hysteresis of high alarm(ALH)	0 ~ 10 % of F.S	1
SL 7	Upper limit of temperature setting range	Within Input range (SL7 > SL8)	1300
SL 8	Lower limit of temperature setting range		-50
SL 9	Control direction	0 : Reverse action 1 : Direct action	0
SL 10	Hysteresis of Low alarm(ALL)	0 ~ 10 % of F.S	1 °C
SL 11	Input filter	0 ~ 100 sec	0
SL 12	Max. Input scale	9999	9999
SL 13	Min. Input scale	-1999	-1999
SL 14	Delay time of High alarm(ALH)	0 ~ 100 sec	0 sec
SL 15	Delay time of Low alarm (ALL)	0 ~ 100 sec	0 sec
SL 16	HYS Selection	0 : Hysteresis is applied under set value 1 : Hysteresis is applied over and under set value	0

⚠ CAUTION
When you select input type, please make sure that your sensor type and input selection setting are the same. Otherwise, it may be a cause of product malfunction or lead to a serious problem.

※ If the values of SL 1, SL 2 are changed, all parameters of temperature will be initialized. So SL 1 and SL 2 have to be set first.

※ In case of DCV input, if the values of SL 12, SL 13 are changed, SL 7 and SL 8 will be initialized.

※ If the alarm type is changed in SL 3, the value of alarm (ALH, ALL) will be changed.