

Digital Temperature Controller



HX series

INSTRUCTION MANUAL

Thank you for purchasing HANYOUNG product.
Please check whether the product is exactly the same as you ordered.
Before using the product, please read this instruction manual carefully.
Please keep this manual where you can view at any time.

HEAD OFFICE

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Safety information

Alerts declared in the manual are classified to Danger, Warning and Caution by their criticality.

⚠ DANGER	DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING	WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

⚠ Danger

Do not touch or connect any undesirable conductive part to input-output terminal, since there is a possibility of electric shock.

⚠ Warning

- Please install an appropriate protective circuit on the outside. 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 : 250 V 0.5 A)
- 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 malfunction, electric shock or a risk of fire.
- Please turn off the power when mounting/dismounting of the product. This is a cause of electric shock, malfunction, or failure.
- If the product is used with methods other than specified by the manufacturer, it may lead to injury or property damage.
- Since there is a possibility of electric shock, please use the product as mounted on a panel while the power is being supplied.
- If it is used with systems, machines and equipment that could lead to a risk of life or property damage, please implement safety devices and protections for both lives and the applications and plan for preventing accidents.

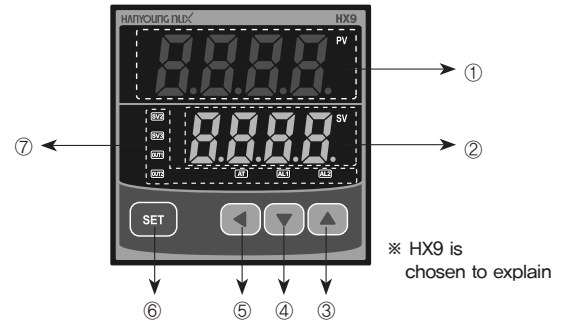
⚠ CAUTION

- The contents of the instruction manual are subjective to change without prior notice.
- Please make sure that the specification is the same as exactly 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 ℃ (40 ℃ 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 exist.
- 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 hazardous substances (Contamination class 1 or 2).
- Please do not wipe this product with organic solvents such as alcohol, benzene or others. (Please use mild detergent instead)
- Please avoid places where excessive amount of inductive interference and electrostatic or magnetic noise occurs.
- 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 electric leakage or a risk of fire.
- For thermocouple (TC) input, please use a prescribed compensation lead wire. (There will be 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 will be a temperature error if the 3 lead wires do not have the same resistance.)
- Please keep 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 malfunction of the product by 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 wire between the output of the noise filter and the power of the instrument should be as short as possible.
- It is effective against noise, if the power lines of the product are made twisted pair wiring.
- Please make sure the operation of the product before using, since the product may not operate as it intends to if the alarm function is not properly set.
- While 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.
 - * For Electromagnetic switch : set cycle time : minimum 20 sec.
 - * For SSR : set cycle time : minimum 1 sec.
- Please do not connect anything to the unused terminals.
- Please connect wires properly after making sure the polarity of the terminals.
- 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 to 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.
- 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 correcting the temperature difference appropriately.

Suffix code

Model	Code	Description
HX	<input type="checkbox"/> - <input type="checkbox"/> <input type="checkbox"/>	Multi-input and output digital temperature controller
Dimension	2	48(W) × 96(H) mm
	3	96(W) × 48(H) mm
	4	48(W) × 48(H) mm
	7	72(W) × 72(H) mm
	9	96(W) × 96(H) mm
Control output	0	Standard
	1	Heating / Cooling (simultaneous control)
HX2/3/9 option	0	None
	1	RS485 communication + Heater break alarm (H.B.A)
HX7 option	0	None
	1	RS485 communication + D.I 2 contacts (SV2, SV3)
	2	RS485 communication + Heater break alarm (H.B.A)
HX4 option	0	None
	1	RS485 communication + D.I 1 contact (SV2)
	2	RS485 communication + Heater break alarm (H.B.A)

Part name and function



Number	Name	Description
①	Process value (PV)	Displays the process value in the operation mode.
②	Set value (SV)	Displays the set value in the operation mode
③	▲ Up key	Increases the set value or used to move between groups and to change an option in a parameter in setting mode
④	▼ Down key	Decreases the set value or used to move between groups and to change an option in a parameter in setting mode
⑤	◀ Shift key	Used to move the position of the digit
⑥	SET	Sets (confirm) the set value, displays the output amount, or set an option in a parameter in setting mode and moves between the parameters in a group. By pressing for 3 seconds, it enters the display setting mode (setting mode) or returns to the operation mode
⑦	SV2	Lights when SV2 is displayed.
	SV3	Lights when SV3 is displayed.
	OUT1	OUT1 indicator.
	OUT2	OUT2 indicator.
	AT	Auto-tuning indicator (blink).
	AL1	Alarm 1 operation indicator.
	AL2	Alarm 2 operation indicator.
⑧	SET + ▲	Hot key(run/stop) Hot key is designated for AT or Manual MV configurable in the group of "G.CtL"
⑨	SET + ▼	Quick menu Sets the value: SV1, SV2, AL1, AL2

External Contact Input (D.I) Selection

3 predetermined set values (temperature values) could be changed with using ON/OFF of the external 2 contact inputs

External input contact selection (d.I.SL)	OFF (contact input is not used)		ON (contact input is used)	
	External contact input	SV2	SV3	
No display	Set value 1 display (SV1)	OFF	OFF	
	Set value 2 display (SV2)	ON	OFF	
	Set value 3 display (SV3)	OFF	ON	

Control Output Composition

HX series is a multi-control-output temperature controller. It can have relay ON/OFF,

SSR voltage pulse output, 4 - 20 mA current output as a control output by selecting an option in the parameter.

If the option is chosen like below in the output parameter (*OUT*) of the output group (*OUT*) in standard temperature controller

0 : Relay ON/OFF control is as a control output.

1 : SSR output is as a control output.

2 : 4 - 20 mA d.c current output is as a control output.

3 : Relay PID control is as a control output.

(1) Standard type

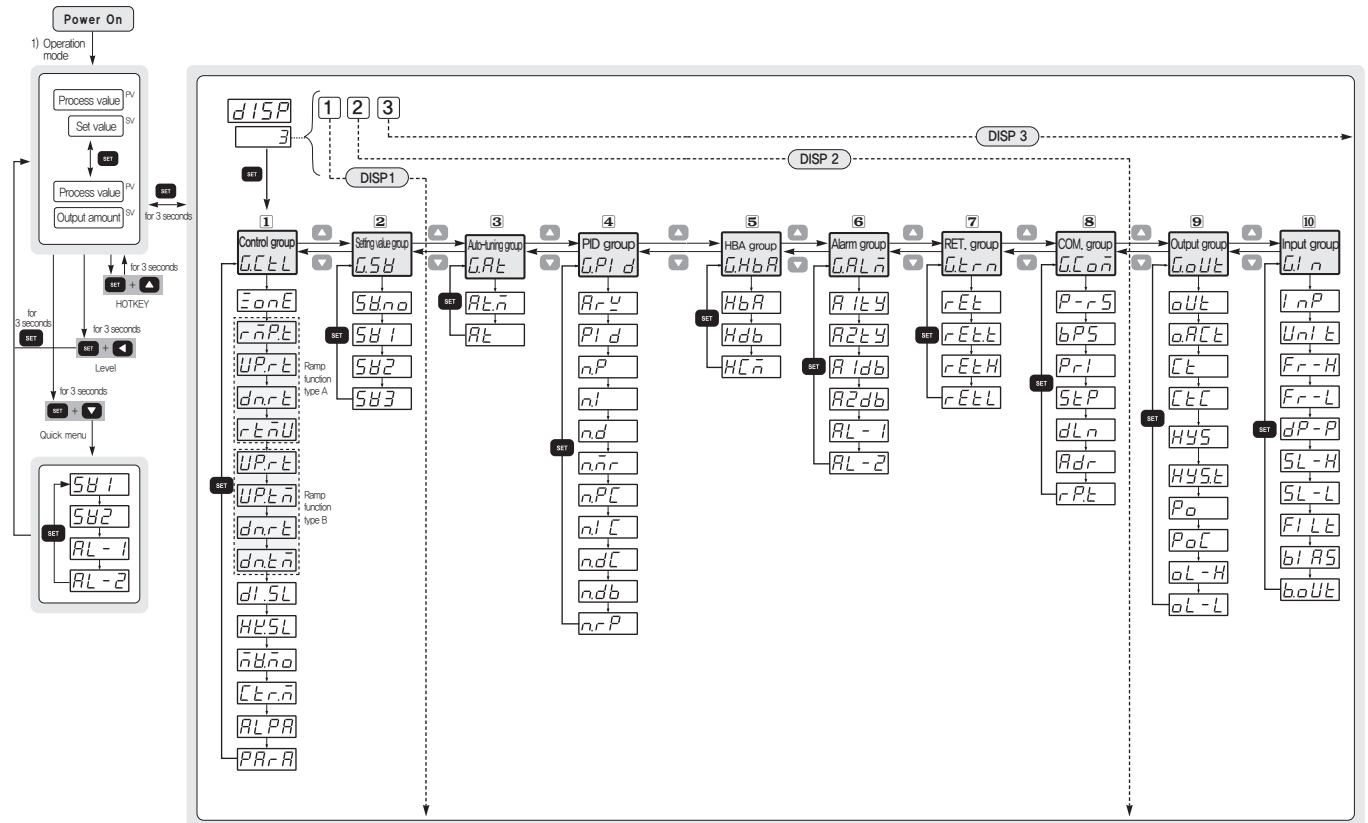
Type	Output code	OUT1(Heating)		OUT2		Default
		Relay	SSR/SCR/RET	Relay	SSR/SCR/RET	
Standard Type	0	Control output (ON/OFF)	-	AL2 (Alarm 2 output)	RET (retransmission output)	1
	1	-	SSR			
	2	-	SCR(4 - 20 mA)			
	3	Control output (PID)	-			

※ In standard type, retransmission is not selected to OUT1(Heating).

(2) Heating / Cooling Type (simultaneous control)

Type	Output code	OUT1(Heating)		OUT2		Default
		Relay	SSR/SCR/RET	Relay(AL2)	SSR/SCR/RET	
Heating / Cooling type	4		SSR	AL2 (Alarm 2 output)	SSR	4
	5		SCR(4 - 20 mA)			
	6	Control output (PID)	RET (retransmission output)			
	7		SSR			
	8		SCR(4 - 20 mA)	SCR (4 - 20 mA)		
	9	Control output (PID)	RET (retransmission output)			
	10		SSR	Control output (PID)	RET (Retransmission output)	
	11		SCR(4 - 20 mA)			
	12	Control output (PID)				

Setting Mode



Input code for input type and range

Input signal	Input signal	Input type	Range (°C)	Accuracy	Note	
Thermocouple (TC)	1	K *1	-200 ~ 1370	±0.5 % of FS ±1 Digit	• F.S is the measurable range from the maximum to the minimum for each range. • Digit is the minimum display value *1 below 0 °C : ±1.0 % of FS ± 1 digit *2 0 ~ 400°C range : ±10 % of FS ± 1 digit *3 20 → KPt100 Ω (C1603) 21, 22 → Pt100 Ω (IEC751)	
	2	K *1	-199.9 ~ 999.9			
	3	J *1	-100.0 ~ 999.9			
	4	E *1	-100.0 ~ 999.9			
	5	T *1	-199.9 ~ 400.0			
	6	R	0 ~ 1700			
	7	B *2	0 ~ 1800			
	8	S	0 ~ 1700			
	9	L *1	-100.0 ~ 900.0			
	10	N	-200 ~ 1300			±1.0 % of FS ±1 Digit
	11	U *1	-199.9 ~ 400.0			
	12	W	0 ~ 2300			±0.5 % of FS ±1 Digit
	13	Platinel II	0 ~ 1390			
Resistance temperature detector (RTD)	20	KPt100 Ω *3	-199.9 ~ 500.0	±0.5 % of FS ±1 Digit	*4 In case of using Current input, Resistor 250 Ω 0.1 % should be installed in the input terminal.	
	21	Pt100 Ω *3	-199.9 ~ 640.0			
	22	Pt100 Ω *3	-200 ~ 640			
DC voltage (VDC / mV DC)	30	1.000 - 5.000 V d.c.	-1999 ~ 9999 Scaling function(SL-H/SL-L) necessary	±0.5 % of FS ±1 Digit		
	31	0.0 - 100.0 mV d.c.				
DC current	30	4 - 20 mA d.c. *4				

Operation Method

■ When turn the power on after completing wiring

- (1) After the firmware version of the temperature controller appears for a short period of time, the operation mode is running like the number ① that process value (current temperature) and the set value are displayed.
- (2) In the number ①, if **SET** button is pressed for 3 seconds, it enters **di SP** display setting mode. It can be selected as DISP 1, DISP 2 and DISP 3 to limit displaying setting groups
- (3) In the operation mode, if **SET** button is pressed, the output amount is displayed like the picture ⑤ ~ ⑥ below.

• Switching between modes

How to set access levels [Level (LEVL)] and a group display [Display (diSP)]

- Setting group is displayed as shown in the configuration parameters according to the setting group is displayed [Display (diSP)].
- Setting group is editable depending on setting Access Level [Level (LEVL)].

Access level [Level (LEVL)]

LEVL 3 : parameter values can be changed for all setting groups with the key of controller in front.

LEVL 2 : parameter values can not be changed for output group and input group with the key of controller in front.

LEVL 1 : parameter values can not be changed for Auto-tuning group(G,At), PID group(G,PId), Alarm Group (G,ALM), retransmission group(G,Trn), communication group(G,CoM), output group(G,oUt), input group (G,iN) with the key of controller in front.

⚠ Caution

In the operation mode, if **SET** and **◀** button are pressed simultaneously for 3 seconds, it enters **LEVL** setting mode which prevents an operator to change parameter setting as limiting access to the group. The default is 3rd level. The level setting mode limits the display setting mode.

1 Control group

Symbol	Parameter	Option	Available condition	Default
G.C.L.L	Control group	Options for control mode	—	—
E.o.n.E	Zone setting	OFF / ON	Control output: PID	OFF
r.n.P.t	Ramp function type	A / B	Always on	A
U.P.r.t	Ramp rising temperature	OFF/ EUS (0 ~ 100%)	Ramp function type A	OFF
d.n.r.t	Ramp falling temperature	OFF/ EUS (0 ~ 100%)		OFF
r.t.u	Ramp time unit	HOUR / MIN		HOUR
U.P.r.t	Ramp rising temperature	OFF/ EUS (0 ~ 100%)	Ramp function type B	OFF
U.P.t.n	Ramp rising time	0.01 ~ 99.59(hh,mm)		0.01
d.n.r.t	Ramp falling temperature	OFF/ EUS (0 ~ 100%)		OFF
d.n.t.n	Ramp falling time	0.01 ~ 99.59(hh,mm)		0.01
d.i.S.L	External contact input	OFF / ON		OFF
H.P.S.L	Hot key setting	AT / A-M	Always on	AT
A.U.M.A	Auto/manual setting	AUTO / MAN ⁽¹⁾		AUTO
C.t.r.n	Control mode	TRAD / 2DOF		TRAD
A.L.P.A	2DOF Alpha coefficient	0 ~ 100 %	Control mode: 2DOF	50 %
P.A.R.R	Factory reset function	0/1 [PASSWORD: 1304] ⁽²⁾	Always on	0

- (1) When manual output function is selected with 'ON', 'AT indicator' lights on at the front panel. (When auto-tuning (AT) is running, 'AT indicator' flashes at the front panel)
- (2) If you select "1" in factory reset function, PASSWORD is displayed. If you input the PASSWORD [1304], controller power turns on and off for initializing parameter value.

2 Set value (SV) setting group

Symbol	Parameter	Option	Available condition	Default
G.S.H	Set value setting group	Options for set values	—	—
S.H.n.o	Set value Number setting	1~3 (the chosen set value is displayed and controlled)	Always on	1
S.H.1	Set value 1 (SV1) setting	EU (0 ~ 100 %)		EU(0 %)
S.H.2	Set value 2 (SV2) setting	EU (0 ~ 100 %)		EU(0 %)
S.H.3	Set value 3 (SV3) setting	EU (0 ~ 100 %)		EU(0 %)

3 Auto-tuning (AT) group

Symbol	Parameter	Option	Available condition	Default
G.A.T	Auto-tuning group	Options for auto-tuning (AT) group	—	—
A.T.n	Auto-tuning type setting	Standard (STD): S.t.d Low PV (LOW): L.o.w	Control output: PID	STD
A.T	Auto-tuning start setting	OFF / 1 ~ 3 / A.U.T.o (AUTO)		OFF

4 P.I.D group

Symbol	Parameter	Option	Available condition	Default
G.P.I.d	PID group	Options for PID mode	—	—
A.R.U	ANTI RESET WIND-UP setting	Auto / 50.0 ~ 200.0 %	PID control	100 %
P.I.d	PID group setting	0 / 1 ~ 3	Always on	0
n.P	n. Proportional band (P)	0.1(H/C TYPE : 0.0) ~ 999.9 %	Selecting one of PID groups	5.0 %
n.I	n. Integral time (I)	OFF / 1 ~ 6000 s	Always on	240 s
n.D	n. Derivative time (D)	OFF / 1 ~ 6000 s	Always on	60 s
n.n.r	n. Manual reset	-5.0 ~ 105.0 %	Integral time: OFF	50.0 %
n.P.C	n. Proportional band (PC) for cooling	0.0(ON/OFF) / 0.1 ~ 999.9 %	heating-cooling	5.0 %
n.I.C	n. Integral time (IC) for cooling	OFF / 1 ~ 6000 s		240 s
n.D.C	n. Derivative time (DC) for cooling	OFF / 1 ~ 6000 s		60 s
n.d.b	n. hysteresis (dead band)	-100.0 ~ 50.0 %		3.0 %
n.r.P	n. Zone position setting	EU(0) < 1.RP < 2.RP < EU(100 %)	PID group 1 or PID group 2	EU (100 %)

5 Heater Break Alarm (HBA) group

Symbol	Parameter	Option	Available condition	Default
G.H.b.A	Heater break alarm group	Options for HBA mode.	—	—
H.b.A	Current setting of HBA output	OFF / 1 ~ 50 A	HBA Option (Refer to "model name and code" table)	OFF
H.d.b	Hysteresis setting of HBA output	0 ~ 50		EUS (0.5 %)
H.C.n	Current measurement value of HBA output.	Only indicates current measurement value (0 ~ 50 A)		

6 Alarm group

Symbol	Parameter	Option	Available condition	Default
G.A.L.n	Alarm group	Options for alarm mode	—	—
A.1.t.y	Alarm 1 type setting	OFF / 1 ~ 21		1
A.2.t.y	Alarm 2 type setting	Refer to "Alarm type and code"		2
A.1.d.b	Hysteresis (dead band) of alarm 1	EUS(0 ~ 100 %)	Always on	EUS (0.5 %)
A.2.d.b	Hysteresis (dead band) of alarm 2			
A.L-1	Set value of alarm 1	Absolute alarm : EU(-100 ~ 100 %)		EU (100 %)
A.L-2	Set value of alarm 2	Deviation alarm : EUS(-100 ~ 100 %)		EU (0 %)

7 Retransmission (RET) group

Symbol	Parameter	Option	Available condition	초기값
G.R.T.n	RET. Group	Options for RET. Group.	—	—
R.E.t	Retransmission type or power for sensor	Process value(PV) / set value (SV) / output amount (MV) / power for sensor (SPS)	RET. option	PV
R.E.t.t	Retransmission value	4 ~ 20 mA / 0 ~ 20 mA (1)	—	4~20mA
R.E.t.H	High limit of retransmission	TC / RTD: FR-H ~ FR-L	PV / SV	EU(100 %)
R.E.t.L	Low limit of retransmission	DC voltage: SL-H ~ SL-L (Must be RET.H) RET.L.)		EU(0 %)

- (1) If you want retransmission 0~5V, a 250 Ω 0.1% resistor must be connected to retransmission output terminal. If you want retransmission 0~10V, a 500 Ω 0.1% resistor must be connected to retransmission output terminal.

8 Communication group

Symbol	Parameter	Option	Available condition	Default
	Communication group	Options for communication mode.	-	-
	RS485/RS422 Protocol	PC.LINK (code : 0) PC.LINK SUM (code : 1) MODBUS-ASCII (code : 2) MODBUS-RTU (code : 3)		0
	Communication speed (BPS)	2400(code : 2), 4800(code : 3), 9600(code : 4), 14400(code : 5), 19200(code : 6)		4
	Parity Bit	NONE(code : 0), EVEN(code : 1), ODD(code : 2)	Option	1
	Stop Bit	1bit (code : 1), 2bit (code : 2)		1
	Data length	7bit (code : 7), 8bit (code : 8) (code 8 is not available for PC LINK)		8
	Address	1 ~ 99 but, max 31 units		1
	Response time	0 ~ 10, Response time = processing time + (response time X 25 ms)		0

* Please note that frequent communicational data recording may exceed life of EEPROM and cause malfunction.

9 Output group



Please make sure to choose "input code" in "input code setting" of the input group first and then select "output code" in "output type setting" and other options in other groups. If "input code" is set later, the options in the other groups will be lost.

Symbol	Parameter	Option	Available condition	Default
	Output group	Options for output type and mode	-	-
	Output type setting	Refer to "control output composition"	Always on	Std : 1 * HC : 4
	Output operation	REV: reverse, DIR: direct	Output code	REV
	Cycle time	1 ~ 1000 s	Output code	0~3
	Cycle time for cooling	1 ~ 1000 s	Output code	4~12
	Hysteresis	Standard : EUS(0 ~ 100 %) Heating / Cooling: 0.0 ~ 10.0 %	ON/OFF control	EUS(0.5 %) 0.5%
	Hysteresis type	Cntr / EdGE	ON/OFF Control	Cntr
	Output amount of OUT1 when input break	Standard : -5.0 ~ 105.0 % Heating - Cooling : 0.0~105.0 %	Always on	0.0 %
	Output amount of OUT2 when input break	0.0 ~ 105.0 %	Heating / Cooling	0.0 %
	High limit of output amount	Standard : 0L-L + 1Digit ~ 105.0 % Heating - Cooling : 0.0 ~ 105.0 %	PID control	100.0 %
	Low limit of output amount	Standard : -0.5 % ~ 0L-H - 1Digit Heating - Cooling : 0.0 ~ 105.0 %		0.0 % 100.0 %

* Std : Standard, HC : Heating / Cooling

10 Input group

Symbol	Parameter	Option	Available condition	Default
	Input group	Options for input type and input mode	-	-
	Input code setting	Input signal and measurable range code	Always on	Code : 1
	Temperature unit setting	°C / °F	TC or RTD	°C
	High limit setting	Within range (refer to "input code for input type and range"), FR-H) FR-L	Always on	1370
	Low limit setting			-200
	Decimal point position (voltage input)	Fixed for T.C or RTD / DC voltage: 0~3 setting for decimal point position		1
	High limit of scale (voltage input)	-1999 ~ 9999 but, SL-H)	Voltage input (mV,V)	100.0
	Low limit of scale (voltage input)	SL-L decimal point according to DP-P		0.0
	Process value filter	OFF / 1 ~ 120 sec		OFF
	Process value bias (compensation)	EUS(-100 ~ 100 %)	Always on	EUS(0 %)
	Operation after input break (burn-out)	OFF / UP / DOWN		UP

Alarm type and code

Pay attention in selecting relay type. Using inverse relay (such as use normally closed instead of normally open) will not output anything even though the indicator is on.

Hysteresis (Δ : set value, -▲ : alarm set value, ▲ : alarm set value)

Code	Alarm type	Operation
1	High absolute value (NO)	
2	Low absolute value (NO)	
3	High deviation value (NO)	
4	Low deviation value (NO)	
5	High deviation value (NC)	
6	Low deviation value (NC)	
7	High-Low deviation value	
8	High-Low deviation range	
9	High absolute value (NC)	
10	Low absolute value (NC)	
11	High absolute (NO, Hold)	
12	Low absolute (NO, Hold)	
13	High deviation (NO, Hold)	
14	Low deviation (NO, Hold)	
15	High deviation (NC, Hold)	
16	Low deviation (NC, Hold)	
17	High-Low deviation value (Hold)	
18	High-Low deviation range (Hold)	
19	High absolute value (NC, Hold)	
20	Low absolute value (NC, Hold)	
21	Heater break alarm 1 (HBA1)	

Function

Function Description

Function 1 : Auto-tuning

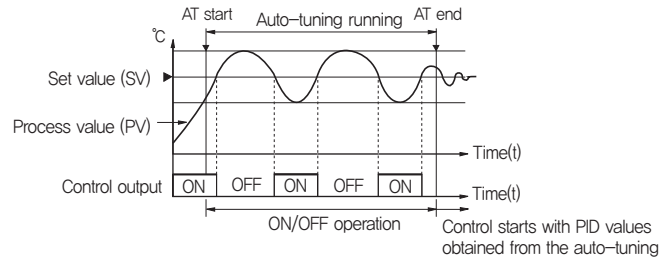
Auto-tuning is a function that the controller automatically measures the characteristics of the target system and calculates the optimal values for proportional band (P), integral time (I), and derivative time (D) and then set the optimal value for each PID parameters. During auto-tuning, the control output is changed to ON/OFF control to get response from the target system. From the response, the most appropriate PID values are obtained for the system. This is called "Limit Cycle".

HX series has two types of auto-tuning : standard type and low PV type.

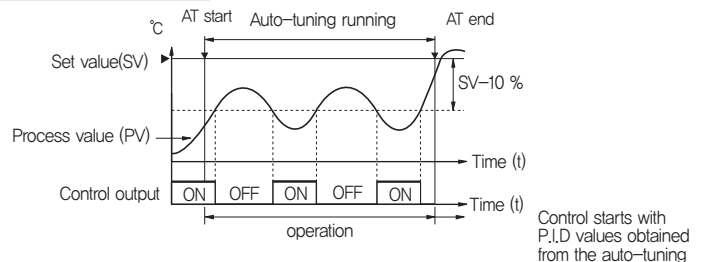
① Standard auto-tuning : This auto-tuning is based on the set value (SV).

② Low PV auto-tuning : This auto-tuning is based on the value 10 % lower than the set value (SV).

a) Standard auto-tuning Select auto-tuning type (At,M) with standard (Std) in auto-tuning group (G,At)



b) Low PV auto-tuning Select auto-tuning type with PV(Low) in auto-tuning group (G,At)



Meaning of auto-tuning (AT) start in auto-tuning Group(G,At) is as follows:

- 1 is auto-tuning for SV1.
 - 2 is auto-tuning for SV2.
 - 3 is auto-tuning for SV3.
- AUTO proceed with the Auto-tuning in the order of the SV1, SV2, SV3.

If you want to use the auto-tuning, there are 2 ways:

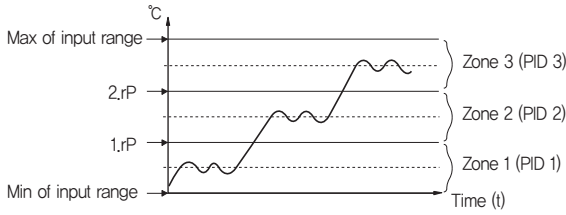
1. When you select the number for set value (SV) you want to start auto-tuning (AT) of auto-tuning Group (G,At), auto-tuning will start.
2. After selecting auto-tuning (At) in hot-key (Hk,SL) of control group (G,At), auto-tuning will start with pressing hot-key (SET + UP) in the operation mode of controller for 3 seconds and auto-tuning will stop with pressing hot-key (SET + UP) for 3 seconds.

Note: When auto-tuning (AT) runs, 'AT indicator' flashes at the front panel. (When manual output is 'ON', 'AT indicator' lights on at the front panel.)

Function 2 : PID auto-tuning in Zone

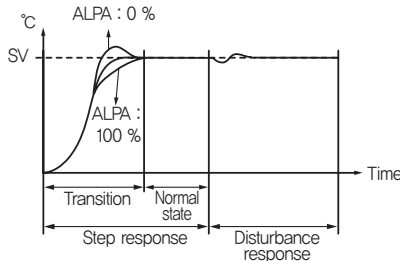
Within the input range, 3 different PID groups can be applied to each of the 3 zones. Since some systems have a wide range of temperature to control and the optimal P.I.D values are different for their temperature ranges, this function can be used to apply different optimal PID values to their temperature ranges.

When select ON in Zone of control group(G.Ctl) and set the location of temperature in n,rP of PID group(G.PID), that distinguishes Zone 1, Zone 2, Zone 3.



Function 3 : 2 degrees of freedom PID

In order to get better response against disturbance in the steady state, there is usually a large overshoot in the transient state. To reduce this overshoot in the transient state, 2 degrees of freedom PID control is used while obtaining good disturbance response in the steady state. The parameter "ALPA" is used to control the amount of overshoot.

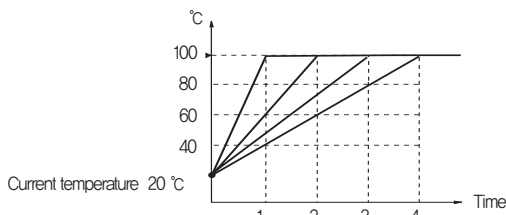


Select 2-DOF in control mode(ctr,M) of control group(G.Ctl)
 If ALPA = 0%, it's same with previous PID control.
 If ALPA = 100%, it may takes long to reach normal state.

Function 4 : Ramp function

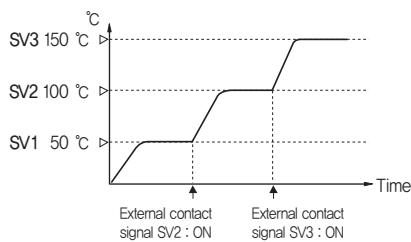
Ramp function Type: A
 Select A in Ramp function type(rMP,t) of control group(G.Ctl)
 Ramp function is a gradient of the set value to reach setting value(SV).
 Setting method is as shown below,
 1. Set ramp rising temperature value or falling temperature value
 2. Set ramp time unit and (Hour/Min.)

Ramp function Type: B
 Select B in Ramp function type(rMP,t) of control group(G.Ctl)
 This is similar function with Ramp function type A, except that type B sets time in detail, 0.01~99.59(hh,mm).



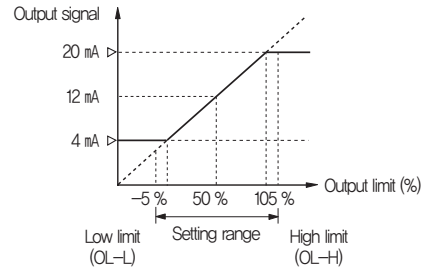
Function 5 : External contact input

This function is used to select one of the set values (SV1, SV2, SV3) by the external contact input signal and it is used as the step control.
 External contact input should be "ON" to use this function.



Function 6 : Output limit

This function is used to set the high limit and low limit as the operating range of the control output. The output limit (the high limit and low limit) can be set -5 ~ 105 % of the output amount.



Function 7 : Heater break alarm

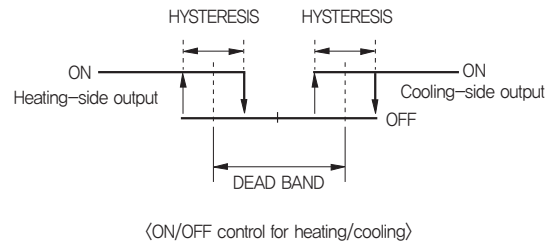
- ① This function detects heater break and immediately turns the alarm on.
- ② Please use the current transformer (CT) designed by Hanyoung NUX.
- ③ The electric current value and alarm operating point (hysteresis) are set in "HBA group".
- ④ This function cannot be used if phase control method (SCR output) is used by thyristor.

Note: If you want to use HBA, please set parameter in HBA group(G.HbA) referring to alarm type and codes.

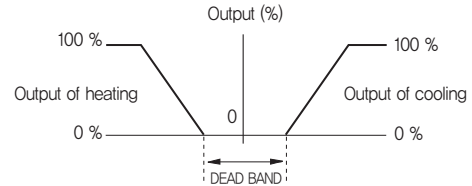
Function 8 : Heating / Cooling control

In Heating / Cooling control, it divides the PID computation result into two control signals and outputs to heating and cooling output terminal. The control method for each heating and cooling can be selected either PID control or ON/OFF control. Also, it is possible to choose one of the control outputs: relay output, SSR, and current output as the heating output and cooling output.

If both heating and cooling are controlled by ON/OFF control, the dead band (hysteresis) is shown as below.

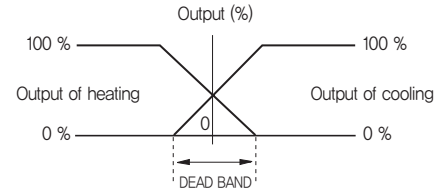


The dead band of PID control for Heating / Cooling is shown as below.



<PID control for Heating / Cooling: Dead band of "+" set value>

Also, the dead band of "-" set value and the dead band of PID control for both heating and cooling are shown as below. At this time, there is an overlapped output from the both.



<PID control for Heating / Cooling: Dead band of "-" set value>

Function 9 : Output during emergency

When there is A/D Error or input break (Burn-out), it stops the PID control and outputs the preset value. (P0 parameter in output group)

Function 10 : Alarm hold function

If alarm hold function is not set up, low alarm is active when temperature is rising with power on. If you select alarm hold function, there is no limit alarm ON during the temperature rise, until set-point.

Note: If you want to use the alarm hold function, please set proper parameter referring to alarm group(G.ALM).

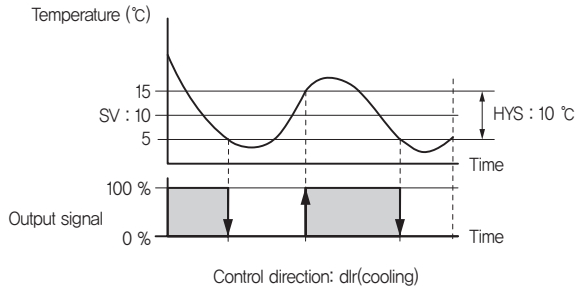
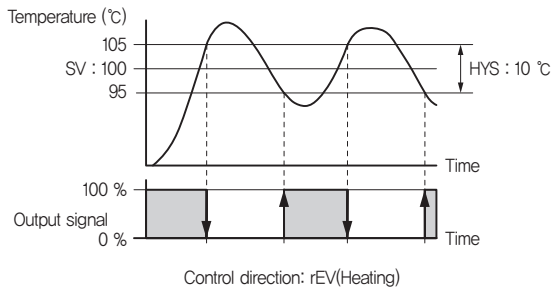
Function 11 : Hysteresis type

According to selection of Hysteresis type in ON/OFF control, ON/OFF turning point is as follows:

ex) HYS:t: Cntr(center)

- Hysteresis type sets center,

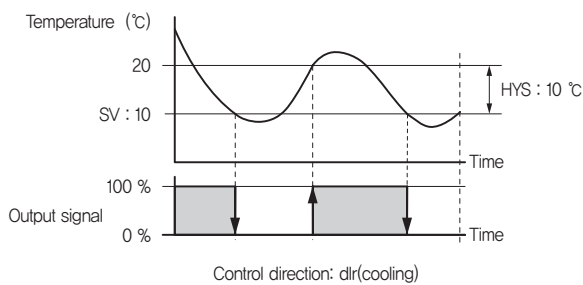
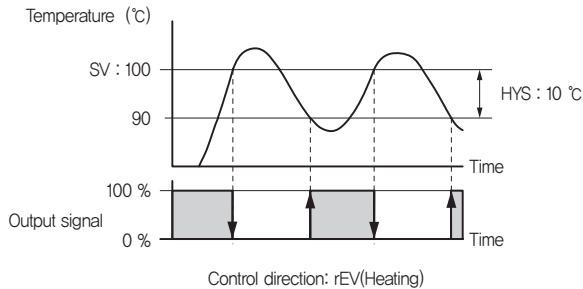
- In heating control, OFF point is $SV + HYS/2$ and ON point is $SV - HYS/2$.
- In cooling control, OFF point is $SV - HYS/2$ and ON point is $SV + HYS/2$.



ex) HYS:t: EdGE(edge)

- Hysteresis type sets with edge,

- In heating control, OFF point is SV and ON point is $SV - HYS$.
- In cooling control, OFF point is SV and ON point is $SV + HYS$.



Function 12 : Manual output function

If you want to use manual output function, there are 2 ways as follows.

1. Select ON in manual output(MV.Mo) of control group(G.CIL) and current control output amount converts manual output value. When choose OFF, manual output converts back to auto-output control.
2. Select manual output function in hot-key(Hk.SL) of control group(G.CIL) and press hot-key(SET+UP) for 3 seconds at the front panel for manual control output. When press hot-key(SET+UP) again, manual output converts back to auto-output control.

Note: When auto-tuning(AT) runs, 'AT indicator' flashes at the front panel.
(When manual output is 'ON', 'AT indicator' lights on at the front panel.)

Output amount for manual output is adjusted by UP and DOWN key in monitor MV screen.

Function 13 : Factory reset function

This function is used for parameter values to revert to initial setting values.

1. Select factory reset function (PArA) in control group (G.CIL).
2. If "*" is selected, input for password will be prompt.
3. Entering correct password [1304] will reset parameter values to initial setting values and controller will be restarted (power OFF and ON).
4. In case of input wrong password for 3 times, display will go back to operation screen.

Function 14 : Quick menu setting

This function is for selecting frequently used parameters quickly and easily.

1. Press SET+DOWN key for 3 sec. it will go to the quick menu setting.
2. SV1, SV2, AL-1, AL-2 values can be set from quick set menu.
3. Press SET key for 3 sec. to go back to operation screen.

Function 15 : HOT key

This function is for activating/deactivating most frequently used function on operation screen.

1. Press SET+UP key for 3 sec. to activate hot-key function.
2. Press SET+UP key for 3 sec. again to deactivate hot-key function.

One of the following two functions can be assigned as hot-key function from the hot-key select menu (HKSL) in control group (G.CIL).

1. AT (Auto-tuning) : ON / OFF
2. A-M : Automatic control / Manual control

Specification

Power supply	100 - 240 V ac ($\pm 10\%$), 50/60 Hz	
Power consumption	6 W max, 10 VA max	
Input	Type	Refer to input type and range
	Sampling cycle	62.5 ms
	Accuracy	$\pm 0.5\%$ of FS (Refer to input type and range)
	Allowable voltage	Within ± 20 V dc (VDC), within ± 10 V dc (TC, RTD)
	Reference junction compensation accuracy	$\pm 3.5\text{ }^\circ\text{C}$ ($0 \sim 50\text{ }^\circ\text{C}$)
Operation after input break	T.C: OFF, UP/DOWN RTD: UP	
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 (voltage pulse)	ON voltage : 12 V dc min, OFF voltage : 0.1 V dc max Load resistance 600 Ω min
	SCR (current)	range : 4 - 20 mA ($\pm 5\%$), accuracy : ± 0.2 mA Load resistance 600 Ω max
Retransmission output		range : 4 - 20 mA ($\pm 5\%$), accuracy : ± 0.2 mA Load resistance 600 Ω max
		range : 0 - 20 mA ($\pm 5\%$), accuracy : ± 0.2 mA Load resistance 600 Ω max
Alarm output	5 A 250 V a.c., 5 A 30 V d.c (resistive load)	
Contact input	OFF resistance : 10 k Ω min, ON resistance : 1 k Ω max	
Control	Method	ON/OFF, P.I.D control
	Output operation	Reverse operation, Direct operation
	Anti-reset windup	Auto(A=0), 0.1 ~ 100.0 %
Interface	Standard	EIA RS485
	Max connection unit	31 units (but, ADDRESS setting : 1 ~ 99)
	Communication method	2 wire half duplex
	Data transmission	asynchronous
	Communication sequence	None
	Communication distance	Within 1.2 km
	Communication Speed	2400, 4800, 9600, 14400, 19200 BPS (parameter selectable)
	Start bit	1 BIT
	Data length	7 or 8 BIT
	Parity bit	NONE, EVEN, ODD
	Stop bit	1 or 2 BIT
Protocol	PC-LINK, PC-LINK SUM, MODBUS-ASCII, MODBUS-RTU	
Response time	Processing time in receiving + (response time x 25 ms)	
Storage	Non-volatile memory(EEPROM) writing 1,000,000 times	
Insulation resistance	20 M Ω min (primary terminal - secondary terminal)	
Dielectric strength	2,300 V a.c. for 1 minute (primary terminal - secondary terminal)	
Operating ambient temperature	$0 \sim 50\text{ }^\circ\text{C}$, (without condensation)	
Operating ambient humidity	35 ~ 85 % R.H (without condensation)	

HX communication – instructions about the D register address

D-register address	Parameter name	Parameter meaning	Parameter setting	Parameter division
0001	NPV	Current present value (PV)	Read only *1	Process
0002	NSV	Current set value (SV)	Read only *1	Process
0004	SSV	Current set value (SV)	Read only *1	Process
0005	MVOUT	OUT1 control output value of standard type, Total control output value of heating/cooling type.	Read only *2	Process
0006	CH1OUT	OUT1 control output value of standard type, OUT1 control output value of heating/cooling type.	Read only *2	Process
0007	CH2OUT	OUT2 control output value of heating/cooling type.	Read only *2	Process
0008	PIDNO	When ZONE is OFF, currently applied set value (SV) and PID group number 0001: SV1, PID group 1 0002: SV2, PID group 2 0003: SV3, PID group 3 When ZONE is OFF, currently applied PID group number 0001: PID group 1 0002: PID group 2 0003: PID group 3	Read only	Process
0009	ALMSTS	Current state of Alarm 1 and Alarm 2: 0000: Alarm 1 OFF, Alarm 2 OFF 0001: Alarm 1 ON, Alarm 2 OFF 0002: Alarm 1 OFF, Alarm 2 ON 0003: Alarm 1 ON, Alarm 2 ON	Read only	Process
0013	OUT2_IND	When the OUT2 control output is SCR (4~20mA) in Heating / Cooling type, it shows the temperature controller "OUT2 indicator" status.	Read only	Process
0014	H1CM	Current measurement value of the heater break alarm output	Read only	Process
0016	ADESTS	Current situation of the AD error. 0001: AD conversion error	Read only	Process
0017	ERRSTS	Current situation of the input error. 0001: Input sensor Burn-out 0002: RJC error 0004: Input range exceeded 0008: Less than input range	Read only	Process
0018	AT_STS	Autotuning (AT) current state 0000: AT type 9999: AT in progress ("AT indicator" in the temperature controller front display blinking)	Read only	Process
0102	ZONE	Zone function set (For the zone position setting, set in RP parameter of each PID group)	0: OFF, 1: ON	Control Group
0104	ARW	ARW (Anti-reset windup) setting	0: AUTO, 50.0 ~ 200.0 % *2	Control Group
0106	DI_SL	External contact input (DI) function	0: OFF, 1: ON	Control Group
0107	ALPHA	Alpha factor of 2 DOF PID	0 ~ 100 %	Control Group
0108	UP_RT	Ramp-up temperature setting	0: OFF / EUS(0~100 %) *1	Control Group
0109	DN_RT	Ramp-down temperature setting	0: OFF / EUS(0~100 %) *1	Control Group
0110	RTMU	Ramp-time unit setting	0: Hour, 1: Min	Control Group
0111	UPTM	Ramp-up time setting	0.01 ~ 99.59 [hh,mm] *2	Control Group
0112	DNTM	Ramp-down time setting	0.01 ~ 99.59 [hh,mm] *2	Control Group
0113	RAMPT	Ramp type selection	0: A Type, 1: B Type	Control Group
0120	MVMOD	Manual output function (when selecting the manual output, the "AT indicator" in the temperature controller front display is steady)	0: AUTO , 1: MANUAL	Control Group
0121	MANMV	Manual output value (Manual MV) set	0 ~ 100 %	Control Group
0122	CTRM	Control mode selection	0: Traditional, 1: 2 DOF PID (2DOF)	Control Group
0124	HKSL	Hot-key selection	0: Auto-tuning (AT) function 1: Manual output function	Control Group
0300	SVNO	Set value (SV) number selection	1 ~ 3	Set value setting group
0301	SV1	Set value 1 (SV) setting	EU(0 ~ 100 %) *1	Set value setting group
0302	SV2	Set value 2 (SV) setting	EU(0 ~ 100 %) *1	Set value setting group
0303	SV3	Set value 3 (SV) setting	EU(0 ~ 100 %) *1	Set value setting group
0305	AT MODE	Auto-tuning (AT) type selection	0: Standard Automatic Operation 1: Low value (PV) type automatic operation	Auto-tuning Group
0306	AT	Auto-tuning (AT)	0: OFF, 1 ~ 4	Auto-tuning Group
0310	1,P	ID 1 proportional band	0.0 ~ 999.9 % *2	PID Group
0311	1,I	PID group 1 integral time	0 ~ 6000 sec	PID Group
0312	1,D	PID group 1 derivative time	0 ~ 6000 sec	PID Group
0313	1,MR	PID group 1 manual reset	-5.0 ~ 105.0 % *2	PID Group
0314	1,PC	PID group 1 cooling proportional band	0.0 ~ 999.9 % *2	PID Group
0315	1,IC	PID group 1 cooling integral time	0 ~ 6000 sec	PID Group
0316	1,DC	PID group 1 cooling derivative time	0 ~ 6000 sec	PID Group
0317	1,DB	PID group 1 Heating / Cooling dead band	-100.0 ~ 50.0 % *2	PID Group
0318	1,RP	PID group 1 zone position setting	EU(0 ~ 100 %), (1,RP) (2,RP) *1	PID Group
0320	2,P	PID 2 proportional band	0.0 ~ 999.9 % *2	PID Group
0321	2,I	PID group 2 integral time	0 ~ 6000 sec	PID Group
0322	2,D	PID group 2 derivative time	0 ~ 6000 sec	PID Group
0323	2,MR	PID group 2 manual reset	-5.0 ~ 105.0 % *2	PID Group
0324	2,Pc	PID group 2 cooling proportional band	0.0 ~ 999.9 % *2	PID Group
0325	2,Ic	PID group 2 cooling integral time	0 ~ 6000 sec	PID Group
0326	2,Dc	PID group 2 cooling derivative time	0 ~ 6000 sec	PID Group
0327	2,DB	PID group 2 Heating / Cooling dead band	-100.0 ~ 50.0 % *2	PID Group
0328	2,RP	PID group 2 zone position setting	EU(0 ~ 100 %), (1,RP) (2,RP) *1	PID Group
0330	3,P	PID 3 proportional band	0.0 ~ 999.9 % *2	PID Group
0331	3,I	PID group 3 integral time	0 ~ 6000 sec	PID Group
0332	3,D	PID group 3 derivative time	0 ~ 6000 sec	PID Group
0333	3,MR	PID group 3 manual reset	-5.0 ~ 105.0 % *2	PID Group

D-register address	Parameter name	Parameter meaning	Parameter setting	Parameter division
0334	3,Pc	PID group 3 cooling proportional band	0.0 ~ 999.9 % *2	PID Group
0335	3,Ic	PID group 3 cooling integral time	0 ~ 6000 sec	PID Group
0336	3,Dc	PID group 3 cooling derivative time	0 ~ 6000 sec	PID Group
0337	3,DB	PID group 3 Heating / Cooling dead band	-100.0 ~ 50.0 % *2	PID Group
0400	HBA	Heater break alarm (HBA) current set	0: OFF, 1 ~ 50 A	Heater break alarm group
0401	HDB	Heater break alarm (HBA) Hysteresis (deadband) set.	0 ~ 50	Heater break alarm group
0410	A1TY	Alarm 1 type setting	0: OFF, 1 ~ 21	Alarm Group
0411	A2TY	Alarm 2 type setting	0: OFF, 1 ~ 21	Alarm Group
0413	A1DB	Hysteresis (dead band) of alarm 1	EUS(0 ~ 100 %)	Alarm Group
0414	A2DB	Hysteresis (dead band) of alarm 2	EUS(0 ~ 100 %)	Alarm Group
0416	AL-1	Set value of alarm 1	PV alarm: EU (-100 ~ 100 %) *1	Alarm Group
0417	AL-2	Set value of alarm 2	Deviation alarm: EUS (-100 ~ 100 %)	Alarm Group
0500	RET	Retransmission output type selection	0: Indicated value 1: Set value (SV) 2: Control output value (MV) 3: Power SPS for the sensor	Retransmission group
0501	RET,H	Retransmission output upper limit setting	-1999 ~ 9999	Retransmission group
0502	RET,L	Retransmission output lower limit setting	-1999 ~ 9999	Retransmission group
0503	RET,T	Retransmission output form	0: 4 ~ 20 mA, 1: 0 ~ 20 mA	Retransmission group
0600	OUT	Output type selection	0~12 (refer to the number of control output type selection)	Output group
0601	o,ACT	Output operation selection	0: Reverse operation (heating), 1: Direct action (cooling)	Output group
0602	CT	Cycle type (Control cycle)	1 ~ 1000 sec	Output group
0603	CTC	Cooling cycle type (cooling control cycle)	1 ~ 1000 sec	Output group
0604	HYS	Heating / Cooling type, ON/OFF control hysteresis	Standard type,EUS(0~100%) *1 Heating / Cooling type 0 ~ 10.0%	Output group
0605	PO	Output1 setting when input breaks	-5.0~105.0% *2	Output group
0606	POC	Output2 setting when input breaks	0~105.0% *2	Output group
0607	OL-H	Output upper limit function	Standard type, OL-L +1 digit ~ 105.0 % Heating / Cooling type, 0.0 ~ 105.0 %	Output group
0608	OL-L	Output lower limit function	Standard type, -0.5 % ~ OL-H-1 digit Heating / Cooling type, 0.0 ~ 105.0 %	Output group
0610	INP	Input type selection	1~31	Input group
0611	UNIT	Temperature unit selection	0: °C, 1: °F	Input group
0612	FR-H	Upper range selection	EU(0 ~ 100 %) *1	Input group
0613	FR-L	Lower range selection	EU(0 ~ 100 %) *1	Input group
0614	DP-P	Decimal point position selection during the voltage input)	0: No decimal points 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places	Input group
0615	SL-H	Scale upper limit setting (during voltage input)	-1999 ~ 9999	Input group
0616	SL-L	Scale lower limit setting (during voltage input)	-1999 ~ 9999	Input group
0617	FILT	Measurement value filter selection	0: OFF, 1 ~ 120 sec	Input group
0618	BIAS	Measurement value correction setting	EUS(-100 ~ 100%) *1	Input group
0619	B,OUT	Operation selection when input breaks	0: OFF, 1: UP, 2: DOWN	Input group
0624	HYST	Hysteresis type	0: CENTER , 1: EDGE	Output group

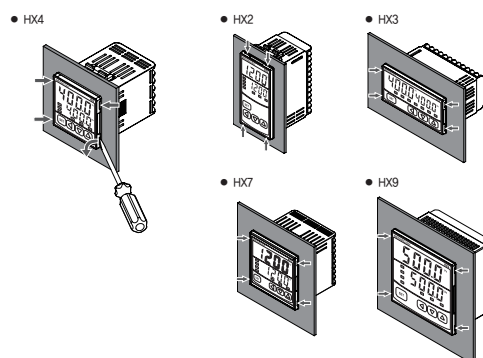
*1: Please check the presence or absence of the decimal points according to the input type and range settings

- Set value with decimal points : if you want to input an SV1 of 100.0°C through communication, transmit 03E8(100). (03E8 is the hex value of 1000)
- Set value without decimal points: if you want to input an SV1 of 100.0°C through communication, transmit 0064(100). (0064 is the hex value 100)

*2 : Set value with decimal places.

※ For the instructions of the protocol regarding the communication please refer to the Hanyoung protocol instruction manual on Hanyoung Nux homepage(www.hynux.com).

How to dismantle case

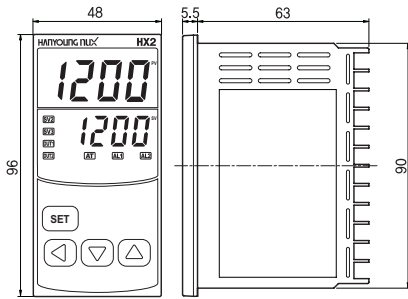


Appearance, Panel cutout and Connection Diagram

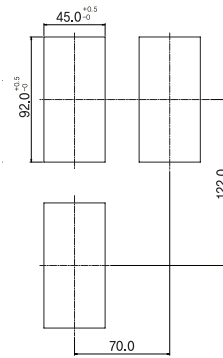
(Units : mm)

HX2

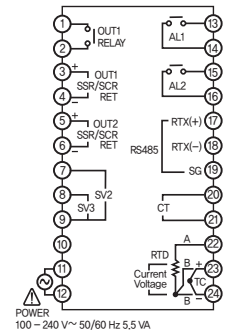
● Appearance



● Panel cutout

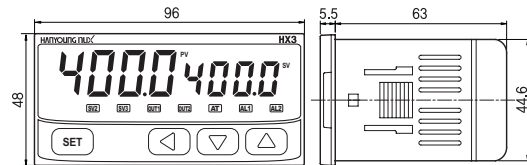


● Connection Diagram

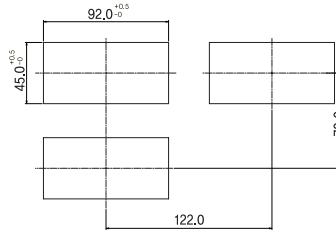


HX3

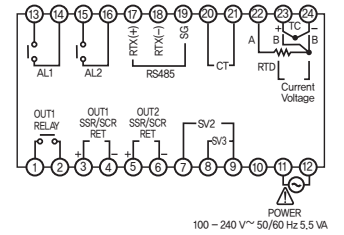
● Appearance



● Panel cutout

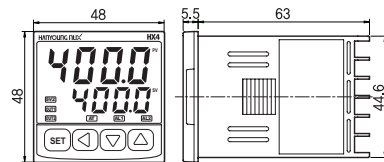


● Connection Diagram

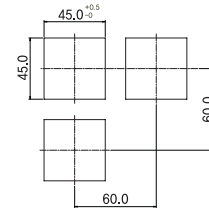


HX4

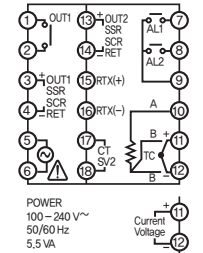
● Appearance



● Panel cutout

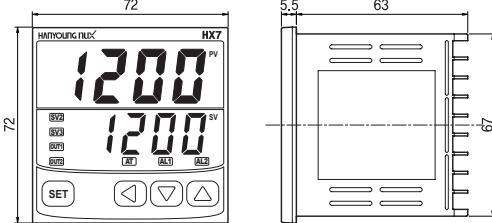


● Connection Diagram

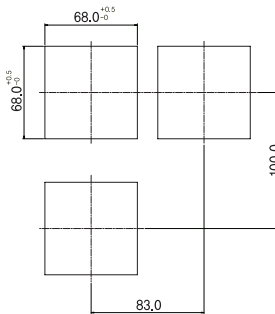


HX7

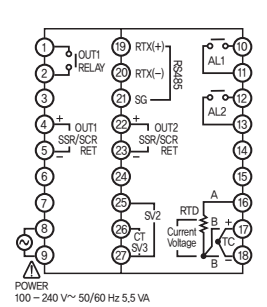
● Appearance



● Panel cutout

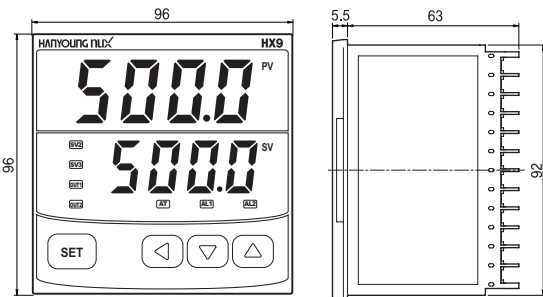


● Connection Diagram

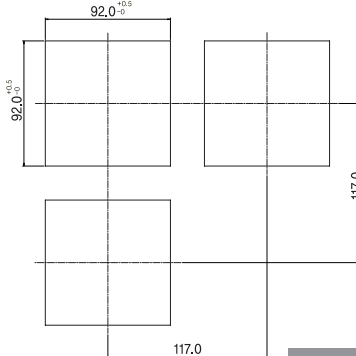


HX9

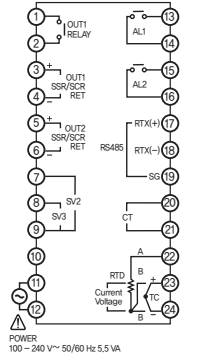
● Appearance



● Panel cutout

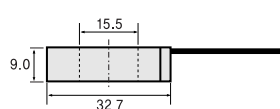
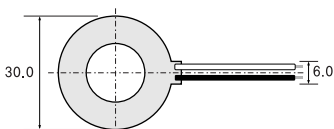


● Connection Diagram



CT-50N

● Appearance



Bracket

