

NX Series

Digital Temperature controllers-2nd Edition operation manual



HANYOUNG nux

INFORM

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HANYOUNG NUX CO.,LTD.

28, Gilpa-ro 71beon-gil, Michuhol-gu, Incheon, korea

Tel : +82-32-876-4697 Fax : +82-32-876-4696

E-mail : overseas@hynux.com

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Safety Precautions

Signal words are used in this manual and apply to hazards or unsafe practices which could result in injury or property damage. See the information below for definitions of the signal words.

 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 property damage or minor injury or both.

DANGER

- There is a risk of electric shock at the input/output terminals, so do not allow the body to come into contact with living things.

WARNING

- If there is a possibility of a serious accident due to malfunction or abnormality of this product, install an appropriate protection circuit on the outside.
- Since this product is not equipped with a power switch and fuse, install them separately on the outside (fuse rating: 250 V a.c. 0.5 A a.c.)
- To changing the usage input sensor (default: K Type), firstly set the input group (G.In), and set the output group (G.Out), then set the other groups. Change the data of the input group or output group after setting other group first, the data of other groups already set up will be initialized so be careful.
- Please supply the rated power voltage, in order to prevent product breakdowns or malfunctions.
- To prevent electric shocks and malfunctions, do not supply power until the wiring is completed.
- The product does not have an explosion-proof structure, so avoid using it in places with flammable or explosive gases.
- Never disassemble, modify, process, improve or repair this product, as it may cause abnormal operations, electric shocks or fires.
- Please disassemble the product after turning OFF the power. Failure to do so may result in electric shocks, product abnormal operations or malfunctions.
- Any use of the product other than those specified by the manufacturer may result in personal injury or property damage.
- Please use this product after installing it to a panel, because there is a risk of electric shock.

CAUTION

- The contents of this manual may be changed without prior notification.
- Please check it matches the specifications ordered.
- Please check there are no damages or product abnormalities occurred during shipment.
- Use the product within the temperature range from 0 to 50°C (max. 40° C for close installation)/ humidity range from 35 to 85% RH (without condensation)
- Use the product in places where corrosive gases (especially harmful gases, ammonia, etc.) and flammable gases are not generated.
- Use the product in places where vibrations and impacts are not applied directly to product body.
- Use the product in places without liquids, oils, chemicals, steam, dust, salt, iron, etc. (pollution degree 1 or 2).
- Do not wipe the product with organic solvents such as alcohol, benzene, etc. (wipe it with neutral detergents).
- Avoid places where large inductive interference, static electricity, magnetic noise are generated.
- Avoid places with heat accumulation caused by direct sunlight, radiant heat, etc.
- Use the product in places with elevation below 2000 m.
- When fixing the product to a panel, attach the two brackets on the fixing holes and tighten them with a screwdriver. The fixing torque is about 14.7 N · cm (1.5kg · cm).
- When water enters, short circuit or fire may occur, so please inspect the product carefully.
- For thermocouple input, use the predetermined compensating cable (temperature errors occur when using ordinary cable).

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- For RTD input, use a cable with small lead wire resistance and without resistance difference among 3 wires (temperature errors occur if the resistance value among 3 wires is different).
 - Use the input signal line away from power line and load line to avoid the influence of inductive noise.
 - Input signal line and output signal line should be separated from each other. If separation is not possible, use shield wires for input signal line.
 - Use a non-grounded sensor for thermocouple (using a grounded sensor may cause malfunctions to the device due to short circuits). When there is a lot of noise from the power, we recommend to use insulation transformer and noise filter. Please install the noise filter to a grounded panel or structure, etc. and make the wiring of noise filter output and product power supply terminal as short as possible.
 - Tightly twisting the power cables is effective against noise.
 - If the alarm function is not set correctly, it will not be output in case of abnormal operation, so please check it before operation.
 - When replacing the sensor, be sure to turn off the power.
 - Use an extra relay when the frequency of operation (such as proportional operation, etc.) is high, because connecting the load to the output relay rating without any room shortens the service life. In this case, SSR drive output type is recommended.
 - ※ When using electromagnetic switch: set the proportional cycle to at least 20 sec.
 - ※ When using SSR: set the proportional cycle to at least 1 sec.
 - ※ Contact output life: Mechanical life min. 10 million times (no load), electrical life min. 100,000 times (250 V a.c. 3 A at rated load)
 - Although the front part of this product has a IP65 degree of protection, waterproof packing between the product and the panel must be used, make sure the packing between the panel and the product does not collapse. (Except for NX1)
 - Do not wire unused terminals.
 - Wire correctly, after checking the polarity of the terminals.
 - When this device install to panel, please use the switches or circuit breaker acknowledged with IEC6947-1 or IEC947-3
 - Install switches or circuit breakers at close distance for user convenience.
 - Specify on the panel that, switches or circuit breakers are installed, if the switches or circuit breakers are activated, the power will be cut off.
 - Regular maintenance is recommended for the continuous safe use.
 - Some components of this product may have a lifespan or deteriorate over time.
 - The warranty period of this product, is 1 year, including its accessories, under normal conditions of use.
 - When using the heater break alarm, connect the heater power supply and the controller power supply to the same power line.
 - The preparation period of the contact output is required during power supply. If used as a signal to external interlock circuit, etc. please use a delay relay together.
 - The preparation period of the contact output is required during power supply. If used as a signal to external interlock circuit, etc. please use a delay relay together.
 - If the user changes the product in case of malfunctions, the operation may be different due to set parameters differences even if the model name is the same. So, please check the compatibility.
 - Before using the temperature controller, there may be a temperature deviation between the PV value of the temperature controller and the actual temperature, so please use the product after calibrating the temperature deviation.
 - The write life of non-volatile memory (EEPROM) is one million times. When configuring the system, please make sure that the number of times that data are written to non-volatile memory does not exceed one million times.

Outline

The front display of this digital temperature controller shows the 4-digit measured value (PV) and set value (SV) with 7-segment LEDs.

It is divided into general type and heating/cooling type, and each setting item is composed of 10 groups. Functions and features include group PID (3 types), multiple inputs (19 types), multiple outputs (Relay, SSR, 4 - 20 mA) and external contact signal input (there are three initial control target setting values) after setting the external contact signal function selected by), Ramp function, automatic calculation 2 types (standard, low PV type), transmission output, communication function (RS485, 422), sensor power, alarm function 21 types High precision multi-input sampling cycle 250 ms, measurement input Functional controller with accuracy $\pm 0.5\%FS$ (heater burnout alarm, upper limit, lower limit, etc.).

Modcode

■ NX1 Modcode

Model	Code		Content			
NX1 -	☐	☐	Multi Input/Output Temperature Controller. 48(W) X 24(H) mm			
Control type	0		Normal type			
	1		Heating/cooling control (simultaneous control)			
Normal type			Option	Terminal number ④, ⑤	Terminal number ⑥, ⑦	Default
	0		RET	RET	OUT1(RLY)	3
	1		-	OUT1(SSR/SCR)	-	1
	2		RS485/RET	RET	OUT1(RLY)	3
	3		RS485	OUT1(SSR/SCR)	-	1
	4		ALM	OUT1(SSR/SCR)	ALM	1
	5		RS485/ALM	OUT1(SSR/SCR)	ALM	1
Heating / cooling type	0		-	OUT2(SSR/SCR)	OUT1(RLY)	6
	1		-	OUT1(SSR/SCR)	OUT2(RLY)	10
	2		RS485	OUT2(SSR/SCR)	OUT1(RLY)	6
Power voltage			100 - 240 V a.c. 50/60 Hz			
		D	24 V d.c.			

※ OUT1: Heating output, OUT2: Cooling output

● NX1 control output configuration

Type	Output	Heating		Cooling	
		RELAY ⑥-⑦	SSR/SCR ④-⑤	RELAY ⑥-⑦	SSR/SCR ④-⑤
Normal type	0	RLY (ON/OFF)	RET	-	
	1	(ALARM)	SSR		
	2		SCR		
	3	RLY	RET		
Heating / Cooling type	6	RLY	-	-	SSR
	9		-	-	SCR
	10	-	SSR	RLY	-
	11	-	SCR		-

※ RLY (Relay output), SSR (Voltage pulse output), SCR (Current output, 4-20 mA d.c.), RET (Retransmission output)

■ NX2, 3, 7, 9 Model code

Model	Code				Content	Default
NX	☐ -	☐	☐	☐	Multiple input output thermostat	
Size	2				48(W) X 96(H) mm	
	3				96(W) X 48(H) mm	
	7				72(W) X 72(H) mm	
	9				96(W) X 96(H) mm	
Control method	0				Normal type (heating control)	1
	1				Heating/cooling (simultaneous) control	4
NX9 option		0			None	
		1			RS485, HBA	
NX7 option		0			None	
		1			RS485, HBA	
		2			SV2, SV3, HBA	
NX2, NX3 option		0			SV2, SV3	
		1			HBA	
		2			RS485	
Power voltage					100 - 240 V a.c. 50/60 Hz	
			D		24 V d.c.	

● NX2,3,7,9 control output configuration (if the control output is SCR, HBA cannot be used.)

① Normal type

Type	Output	Heating		Cooling	
		RELAY	SSR / SCR / RET	RELAY	SSR / SCR / RET
Normal type	0	RLY(ON/OFF)	-	AL2	RET
	1	-	SSR		
	2	-	SCR		
	3	RLY	-		

② Heating and cooling type

Type	Output	Heating		Cooling	
		RELAY	SSR / SCR / RET	RELAY	SSR / SCR / RET
Heating / Cooling type	4	-	SSR	AL2	SSR
	5		SCR		
	6	RLY	RET		SCR
	7	-	SSR		
	8		SCR		
	9	RLY	RET		
	10	-	SSR	RLY	RET
	11		SCR		
	12	RLY	-		

※ RLY (Relay output), SSR (Voltage pulse output), SCR (Current output, 4-20 mA d.c.), RET (Retransmission output)

CAUTION

● Control output wiring

When wiring or removing the control output, shut off the controller and external power supply, because there is a risk of electric shock. Use shielded wires for voltage pulse output (SSR) and current output (SCR) wiring.

NX4 model code

Model	Code		Content	Remarks
NX4	☐ -	☐	Multi Input/Output Temperature Controller 48(W) X 48(H) mm	
Control method	0		Normal type (heating control)	
	1		Heating/cooling control (simultaneous control)	Default = 1
	2		Heating/cooling control (NX4-20 only)	Default = 4
NX4-0 ☐	0		None	
	1		HBA, AL2	OUT1 (terminals ①-②-③) applied as AL1. (when selecting SSR / SCR control output)
	2		SV2, SV3	
	3		RET, RS485	
	4		RS485	
	5		AL1, AL2	
	6		AL1, AL2, SV2	OUT1 (terminals ⑥-⑦) applied as SV2 (when selecting RELAY control output)
NX-4-1 ☐	0		None	OUT2 (terminals ⑪-⑫) applied as SSR/SCR.
	4		RS485	
NX-4-2 ☐	0		AL1	OUT2 (terminals ⑪-⑫) applied as RLY.
Power voltage			100 - 240 V a.c. 50/60 Hz	
		D	24 V d.c.	

※ OUT1(①-②-③) can be used for AL1 when AL1 is not selected.

※ OUT1: Heating control, OUT2 : Cooling control

● **NX4 control output configuration (if the control output is SCR, the HBA can not be used)**

※ RLY(Relay output), SSR(Voltage pulse output), SCR(Current output, 4-20 mA d.c.), RET(Retransmission output)

① NX4-00

Type	Output	Heating side (OUT1)		-		Default
		RELAY ①-②-③	SSR / SCR ⑥-⑦	⑬-⑭	⑪-⑫	
Normal type (heating)	0	RLY (ON/OFF)	-	-	-	1
	1	AL1	SSR			
	2	AL1	SCR			
	3	RLY	-			

② NX4-01

Type	Output	Heating side (OUT1)		Alarms and transformers		Default
		RELAY ①-②-③	SSR / SCR ⑥-⑦	RELAY⑬-⑭	Transformer ⑪-⑫	
Normal type (heating)	0	RLY (ON/OFF)	-	AL2	-	1
	1	AL1	SSR		CT	
	2	AL1	SCR		-	
	3	RLY	-		CT	

※ NX4-01: HBA output is designated as 1-2-3 or 13-14 when selecting 21 for alarm type.

※ RLY(Relay output), SSR(Voltage pulse output), SCR(Current output, 4-20 mA d.c.), RET(Retransmission output)

③ NX4-02

Type	Output	Heating side (OUT1)		External input (DI)		Default
		RELAY ①-②-③	SSR / SCR ⑥-⑦	⑬-⑭	⑪-⑫	
Normal type (heating)	0	RLY (ON/OFF)	-	SV2	SV3	1
	1	AL1	SSR			
	2	AL1	SCR			
	3	RLY	-			

④ NX4-03

Type	Output	Heating side (OUT1)		Communication and retransmission		Default
		RELAY ①-②-③	SSR / SCR ⑥-⑦	⑬-⑭	⑪-⑫	
Normal type (heating)	0	RLY (ON/OFF)	-	RS485	RET	1
	1	AL1	SSR			
	2	AL1	SCR			
	3	RLY	-			

⑤ NX4-04

Type	Output	Heating side (OUT1)		Communication		Default
		RELAY ①-②-③	SSR / SCR ⑥-⑦	⑬-⑭	⑪-⑫	
Normal type (heating)	0	RLY (ON/OFF)	-	RS485	-	1
	1	AL1	SSR			
	2	AL1	SCR			
	3	RLY	-			

⑥ NX4-05

Type	Output	Heating side (OUT1)		Alarm 1 & 2		Default
		RELAY ①-②-③	SSR / SCR ⑥-⑦	⑬-⑭	⑪-⑫	
Normal type (heating)	0	RLY(ON/OFF)	-	AL1	AL2	1
	1	-	SSR			
	2	-	SCR			
	3	SSR	-			

⑦ NX4-06

Type	Output	Heating side (OUT1)		Alarm 1 & 2		Default
		RELAY ①-②-③	SSR / SCR ⑥-⑦	⑬-⑭	⑪-⑫	
Normal type (heating)	0	RLY(ON/OFF)	SV2	AL1	AL2	1
	1	-	-			
	2	-	-			
	3	RLY	SV2			

⑧ NX4-07

Type	Output	Heating side (OUT1)		Communication and transformers		Default
		RELAY ①-②-③	SSR / SCR ⑥-⑦	⑬-⑭	⑪-⑫	
Normal type (heating)	0	RLY (ON/OFF)	-	RS485	-	1
	1	AL1	SSR		CT	
	2	AL1	SCR		-	
	3	RLY	-		CT	

※ RLY(Relay output), SSR(Voltage pulse output), SCR(Current output, 4-20 mA d.c.), RET(Retransmission output)

⑨ NX4-10

Type	Output	Heating side (OUT1)		Cooling side (OUT2)		Default	
		RELAY ①-②-③	SSR / SCR ⑥-⑦	⑬-⑭	SSR / SCR ⑪-⑫		
Heating type	0	RLY(ON/OFF)	-	-	-	1	
	1	AL1	SSR				
	2	AL1	SCR				
	3	RLY	-				
Heating / Cooling type	4	AL1	SSR		-	SSR	4
	5	AL1	SCR				
	6	RLY	-				
	7	AL1	SSR			SCR	
	8	AL1	SCR				
	9	RLY	-				
	10	-	SSR			-	
	11	-	SCR				
	12	RLY	-				

⑨ NX4-14

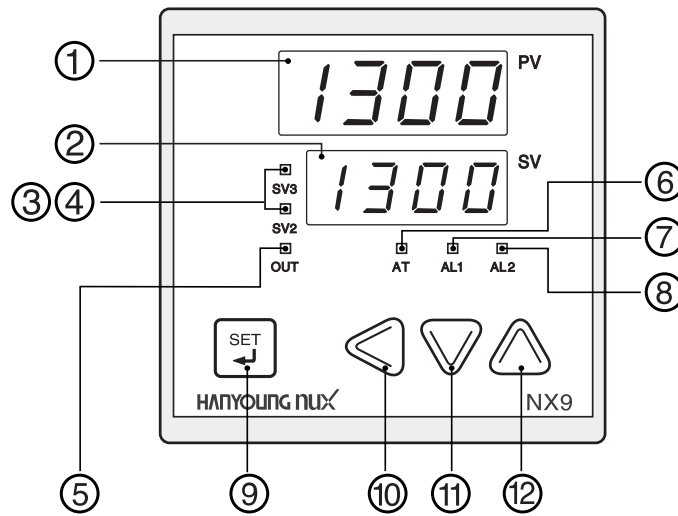
Type	Output	Heating side (OUT1)		Cooling side (OUT2)		Default
		RELAY ①-②-③	SSR / SCR ⑥-⑦	⑬-⑭	SSR / SCR ⑪-⑫	
Heating type	0	RLY(ON/OFF)	-	AL2	-	1
	1	AL1	SSR			
	2	AL1	SCR			
	3	RLY	-			
Heating / Cooling type	4	AL1	SSR	RS485	SSR	4
	5	AL1	SCR			
	6	RLY	-		SCR	
	7	AL1	SSR			
	8	AL1	SCR			
	9	RLY	-		-	
	10	-	SSR	-		
	11	-	SCR	-		
	12	RLY	-	-	-	

⑨ NX4-20

Type	Output	Heating side (OUT1)		Cooling side (OUT2)		Default
		RELAY ①-②-③	SSR / SCR ⑥-⑦	⑬-⑭	SSR / SCR ⑪-⑫	
Heating type	0	RLY(ON/OFF)	-	-	-	1
	1	AL1	SSR			
	2	AL1	SCR			
	3	RLY	-			
Heating / Cooling type	4	AL1	SSR	-	-	4
	5	AL1	SCR			
	6	RLY	-			
	7	AL1	SSR			
	8	AL1	SCR			
	9	RLY	-			
	10	-	SSR	AL1	RLY	
	11	-	SCR			
	12	RLY	-			

Part names and functions

Front part



Display part

Display part name	Function
① Present value (PV) display	Displays present value (PV)
② Set value (SV) / Parameter display	Displays set values, various setting parts, setting modes and codes
③ ④ Set value (SV) indicator	Turns on when set value 2 or 3 is displayed
⑤ Output (OUT) lamp	Turns on during output operation
⑥ Auto-tuning display lamp	Blinks during auto-tuning / lights up during manual output
⑦ Alarm 1 indicator	Turns on during alarm 1 operation
⑧ Alarm 2 indicator	Turns on during alarm 2 operation

Control part

No.	Name	Content
⑨	 Set Key	Move among parameters and data settings, select automatic output amount display. Press and hold for more than 3 sec. to enter simple menu
⑩	 Shift Key	Change the digit position to be set
⑪	 Down Key	Decrease set value, select data of each setting mode
⑫	 Up Key	Increase set value, select data of each setting mode

Specifications

Input specification

Input type	Thermocouple: K, J, E, T, R, B, S, L, N, U, W, PL2 (refer to input signal and measurement range) RTD : Pt 100 Ω , KPt 100 Ω DC voltage input : 1-5 V d.c., -10-20 mV, 0-100 mV d.c., 4-20 mA d.c.(250 Ω with external resistor)
Input sampling cycle	250 ms
Input display resolution	Basically, below the decimal point of the range
Input impedance	Thermocouple and DC voltage input (mV): min. 1 M Ω , DC voltage input (V): approx. 1 M Ω
Allowable signal source resistance	Thermocouple: max. 250 Ω , DC voltage: max. 2 k Ω
Allowable wiring resistance	RTD: max. 10 Ω /wire (conductor resistance among 3 wires should be same)
Allowable input voltage	Within ± 10 V (thermocouple, RTD, DC voltage: mV d.c.) Within ± 20 V (DC voltage: V d.c.)
Noise reduction rate	NMRR (normal mode): min. 40 dB (50/60 Hz ± 1 %) CMRR (common mode) : min. 120 dB (50/60 Hz ± 1 %)
Standard	Thermocouple / RTD (KS/IEC/DIN)
RJC error	± 1.5 $^{\circ}\text{C}$ (15 ~ 35 $^{\circ}\text{C}$), ± 2.0 $^{\circ}\text{C}$ (0 ~ 50 $^{\circ}\text{C}$)
Input break detection (BURN-OUT)	Thermocouple: OFF, UP/DOWN Scale selection RTD : UP Scale (detection current at thermocouple and RTD BURN-OUT: approx. 50 nA)
Measurement accuracy	± 0.5 % (FULL SCALE)
Input range	Refer to "Input Signal and Measurement Range" Thermocouple, RTD : can be changed within the range of input signal and measurement range table. DC voltage : min. and max. voltages can be changed within each range. Scaling possible within the range of the measurement range

Output specifications

① Alarm output (HBA common)

Relay contact output	Contact capacity : 240 V a.c. 1 A, 30 V d.c. 1 A (resistive load). Contact configuration : 1a Output contacts: different according to model specifications (refer to wiring diagram)
Heater break alarm	1 EA (NX2, NX3, NX4, NX7, NX9) Current measurement range: AC 1-50 A (resolution: 0.5 A, $\pm 5\%$ of maximum scale ± 1 digit). Alarm output: set and use alarm output Deadband: 0 ~ 100% of max. range setting Others: available for ON / OFF control or time proportional output (but not for current output and cooling output). When output is ON, the break can not be detected in less than 0.2 sec.

② Retransmission output

Current output	Current output range : 4-20 mA d.c. Load resistance : max. 600 Ω Accuracy : $\pm 0.5\%$ of max Resolution : approx. 3,000 Output ripple : max. 0.3% (P-P) of the max. scale (150 Hz) Output update cycle : 250 ms
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③ Control output (output type can be selected from relay, current, SSR, heating / cooling type can be set individually.

Relay contact output	Contact capacity: 240 V a.c. 3 A, 30 V d.c. 3 A (resistive load) Contact configuration: 1C Output operation: time proportion, ON / OFF Proportional period: 1 to 1000 s Output limit: high limit (OH) and low limit (OL) can be set in the range from 0.0 to 100.0%. Valid also for auto-tuning (AT). ON / OFF Hysteresis: 0 to 100% (full scale) Time resolution: smaller between 0.1% or 10 ms
SSR output (voltage pulse output)	ON voltage: NX2, 3, 4, 7, 9 approx. min. 12 V d.c. (load resistance min. 600 Ω, limited to 30 mA in short circuit) OFF Voltage: max. 0.1 V d.c. Proportional period: 1 ~ 1000 s Output operation: time proportional Output limit: high limit (OH) and low limit (OL) can be set in the range from 0.0 to 100.0%. Valid also for auto-tuning (AT). Time resolution: smaller between 0.1% or 10 ms
Current output (4 - 20 mA)	Current output range : 4-20 mA d.c. Load resistance : max. 600 Ω Accuracy : $\pm 0.5\%$ of max. scale (4-20 mA range), Resolution : approx. 3,000 Output ripple : 0.3% (P-P) or less of the maximum scale (150Hz) Output update cycle : 250 ms Output operation : continuous PID Output limit : high limit (OH) and low limit (OL) can be set in the range from -5.0 to 105.0%. Valid also for auto-tuning (AT).

■ Function specification

Measurement input	Input Correction (Bias): -100.0 to 100.0 % of instrument range (It can adjust the desired correction value for the measurement input value) Scaling: The measurement range can be scaled according to the setting of the maximum (SL-H) and minimum (SL-L) values of the measurement range. Input filter (Filter) : OFF, 1 ~ 120 s
Control	Number of PIDs per set value (SV): 3 set values (SV) can be set, and P.I.D constants can be selected for each set value. Auto-Tuning: Auto-Tuning is performed according to the specified set value (SV) number (standard type, low PV type) Proportional Band P (Proportional Band): 0.1 ~ 999.9 % (maximum range), 0.0 ~ 999.9 % (when heating/cooling control) Integral time I (integration time) : OFF, 1 ~ 6000 s Derivative time D (derivative time) : OFF, 1 ~ 6000 s ON/OFF control: Available by selecting the output selection number (OT) "0" PID selection: ZONE PID/auto 1, 2, 3 selectable Manual reset: -5.0 to 105.0 % of output (only when integral time is "OFF") Forward/reverse action selection: selection according to parameter change Emergency output value: In case of general type: -5.0 ~ 105.0 % of output value, in case of heating and cooling type: 0.0 ~ 105.0 % ON/OFF hysteresis (HYS): 0.0 to 100.0 % of device range (only when ON/OFF control is set) Heating/cooling side deadband: -100.0 to 50.0 % of output value A.R.W (Anti Reset Wind-up) : AUTO, 50.0 ~ 200.0 % Ramp function selection: It can set the rise and fall of temperature slope in hours or minutes when the power is turned on.
Transmission Output	Transmission signal: selected value (PV), set value (SV), output value (MV). Power supply for sensor (SPS) 12 V d.c continuous output. (However, when using transmission output, sensor power cannot be used.) Scaling: display value, set value.
Alarm Output	Set point: Depends on model-specific specifications (refer to wiring diagram) Alarm type: upper/lower limit, upper/lower limit deviation, standby upper/lower limit, heater burnout (refer to the alarm type and code table) Setting range: In case of display value alarm ... 0 to 100% of instrument range Deviation alarm ... -100 to 100% of instrument range Alarm hysteresis: 0.0 to 100.0% of instrument range

4) Operating environment

Installation environment	Continuous vibration (5 - 14 Hz): peak-to-peak max. 1.2 mm Continuous vibration (4 - 150 Hz): max. 4.9 m/s² Short time vibration: 14.7 m/s², max. 15 seconds (each 3 directions) Shock: 147 m/s², max. 11 ms (6 directions each 3 times) Panel cutout: refer to "panel cutout"
Normal operating conditions	Ambient temperature: 0 ~ 50 °C Ambient humidity: 35 ~ 85% RH (without condensation) Magnetic field effect: max. 400 AT / m Warm-up time: min. 30 minutes
Ambient temperature influence	Thermocouple, voltage input: ± 1 μV / °C or ± 0.01% / °C of max. range RTD input: max. ± 0.05 Ω / °C Analog output: max. ± 0.05% / °C of max. range (continuous output)

5) Transport and storage conditions

Storage temperature	-25 ~ 70 °C
Storage humidity	5 ~ 95 % RH (without condensation)
Shock	Max. 1 min packaging

6) structure

Model	WXHxD(mm)	Protection structure	Weight(g)	Texture
NX1	48(W) × 24(H) × 100(D) mm	-	94 g	Plastic case (ABS)
NX2	48(W) × 96(H) × 100(D) mm	IP65 (However, limited to the front)	342 g	
NX3	96(W) × 48(H) × 100(D) mm		340 g	
NX4	48(W) × 48(H) × 100(D) mm		342 g	
NX7	72(W) × 72(H) × 100(D) mm		344 g	
NX9	96(W) × 96(H) × 100(D) mm		472 g	

7) Power specifications

Power voltage	100-240 V a.c. (voltage fluctuation rate : ±10 %)	24 V a.c. / V d.c.
Power frequency	50 - 60 Hz	
Power consumption	Max. to 6.0 W, max. 10 VA, 8 VA (NX1)	
Insulation resistance	1st terminal - 2nd terminal : min. 500 V d.c. 20 MΩ 1st terminal - ground : min. 500 V d.c. 20 MΩ 2nd terminal - ground : min. 500 V d.c. 20 MΩ	
Dielectric strength	1st terminal - 2nd terminal : 2,300 V a.c. 50/60 Hz for 1 min. 1st terminal - ground : 2,300 V a.c. 50/60 Hz for 1 min. 2nd terminal - F•G : 1,500 V a.c. 50/60 Hz for 1 min.	
Sensor power supply	12 V d.c. (20 mA d.c., cannot be used with retransmission output)	

8) INTERFACE

Applicable standard	EIA RS485 compatibility
Maximum number of Connections	The 31 ADDRESS setting can be set from 1 to 99.
Communication method	2-wire half-duplex or 4-wire half-duplex (depending on wiring method)
Synchronous	Asynchronous
Communication sequence	None order
Communication distance	Within 1.2 km
Communication speed	2400, 4800, 9600, 14400, 19200 BPS (Communication speed is changed by parameter setting.) ※ NX1 DC products: 600, 1200, 2400, 4800, 9600 BPS
START BIT	1 BIT
DATA BIT	7 or 8 BIT
PARITY BIT	None (even) , (odd)
STOP BIT	1 or 2 BIT
PROTOCOL	PC LINK SUM none(0), PC LINK SUM existed (1), Modbus ASCII(2), Modbus RTU(3) ※ NX1 DC products : PC LINK SUM none(0), PC LINK SUM existed (1)
RESPONSE TIME	Receive processing time + (response time × 10 ms)

9) Input signal and Measuring range

CAUTION

● Measuring input wiring

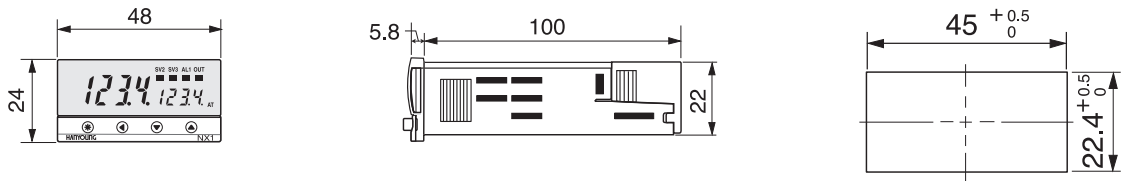
- When wiring the measuring input line, disconnect the controller body and external power supply to avoid a danger of electric shock.
- Pay attention to the polarity of the input before connecting. Wrong connection may result in malfunction.
- Use shielded wires for input wiring. The shield must be grounded at single-point.
- For measuring input signal, wire after leaving room between the power supply circuit and the ground circuit, if possible.

Input signal	Selection number	Input type		Range (°C)	Accuracy	Remarks
Thermocouple (T.C)	1	K	*2	-200 ~ 1370	±0.5 % of FS ±1 digit	• FS is from the minimum to the maximum value of each measurable range. • Digit is the minimum display value ※1 0 ~ 400° C range: ± 10.0% of FS ± 1 digit ※2 Below 0°C: ± 1.0% of FS ± 1 digit ※3 20 → KPt100 Ω (C1603) ※3 21, 22 → Pt100 Ω (IEC751) ※4 When current input is used, attach a 250 Ω 0.1% resistor to the input signal terminal.
	2	K	*2	-199.9 ~ 999.9		
	3	J	*2	-199.9 ~ 999.9		
	4	E	*2	-199.9 ~ 999.9		
	5	T	*2	-199.9 ~ 400.0		
	6	R		0 ~ 1700		
	7	B	*1	0 ~ 1800		
	8	S		0 ~ 1700		
	9	L	*2	-199.9 ~ 900.0		
	10	N		-200 ~ 1300	±1.0 % of FS ±1 digit	
	11	U	*2	-199.9 ~ 400.0	±0.5 % of FS ±1 digit	
	12	W		0 ~ 2300		
	13	Platinel II		0 ~ 1390		
RTD (RTD)	20	KSPt100 Ω	*3	-199.9 ~ 500.0	±0.5 % of FS ±1 digit	
	21	Pt100 Ω	*3	-199.9 ~ 640.0		
	22	Pt100 Ω	*3	-200 ~ 640		
DC voltage (V d.c./mV d.c.)	30	1 - 5 V d.c.		-1999 ~ 9999 (Using the scaling function (SL-H / SL-L))	±0.5 % of FS ±1 digit	
	31	0 - 10 V d.c.				
	32	-10 - 20 mV d.c.				
	33	0 - 100 mV d.c.				
Direct current	30	4 - 20 mA d.c.	*4			

Dimensions and panel cutout

1) NX1

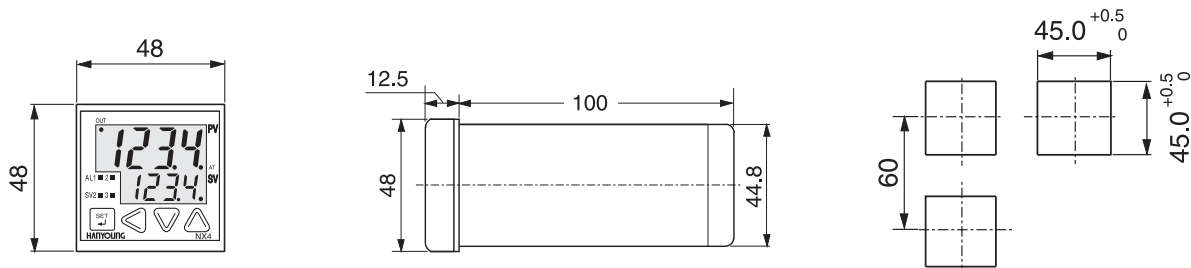
●Panel cutout



[Unit : mm]

2) NX4

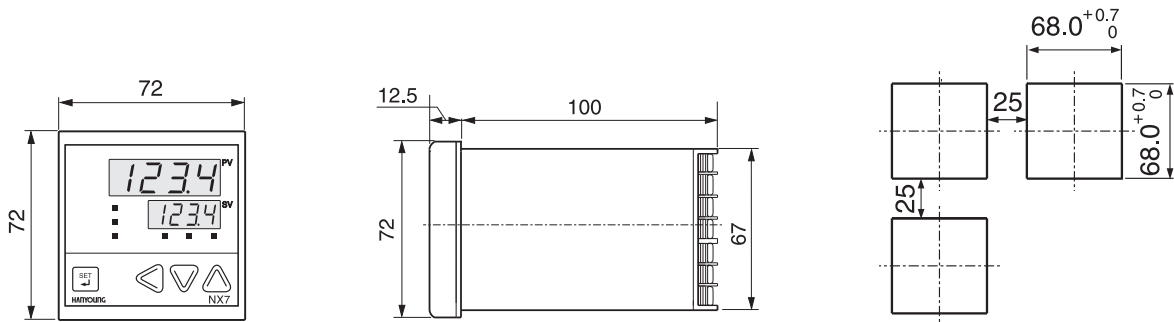
●Panel cutout



[Unit : mm]

3) NX7

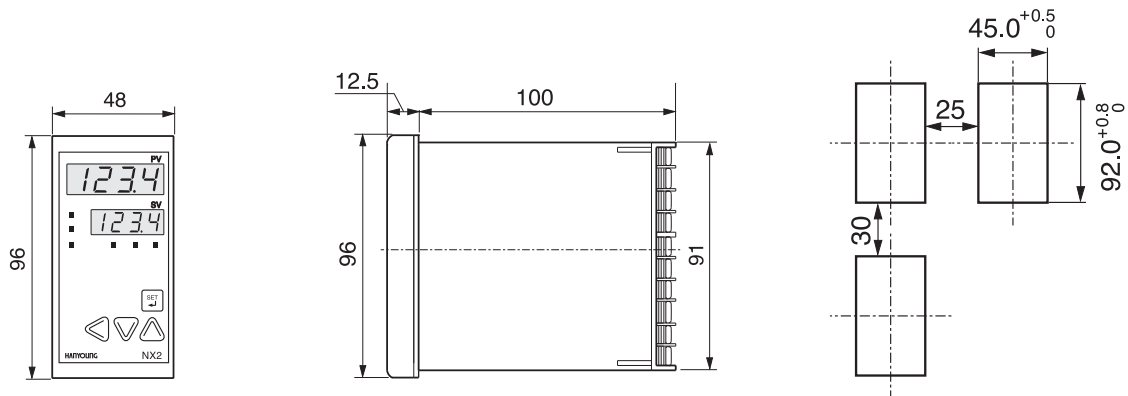
●Panel cutout



[Unit : mm]

4) NX2

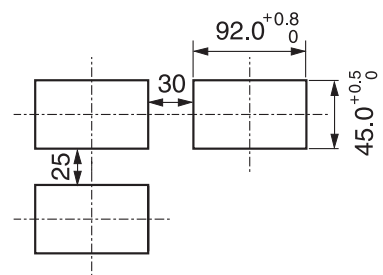
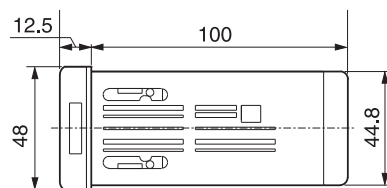
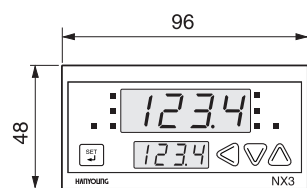
●Panel cutout



[Unit : mm]

5) NX3

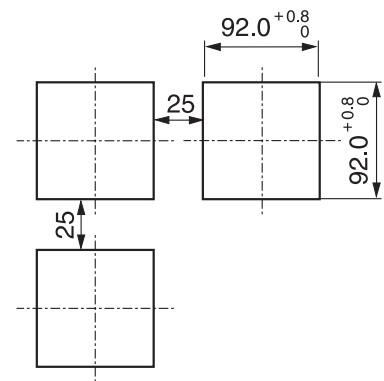
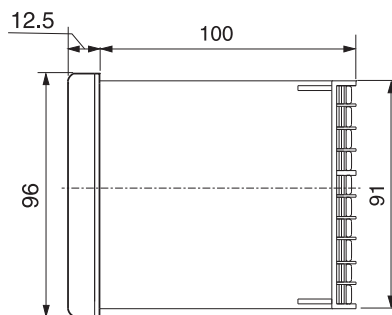
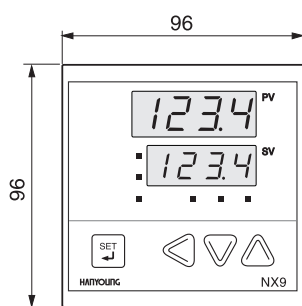
●Panel cutout



[Unit : mm]

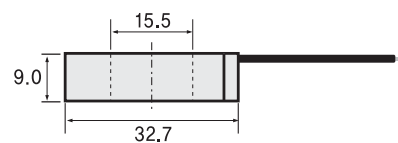
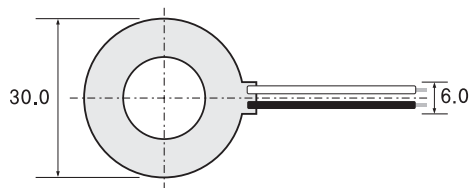
6) NX9

●Panel cutout



[Unit : mm]

7) Current detector (Model name: CT-50N)
※ Sold separately



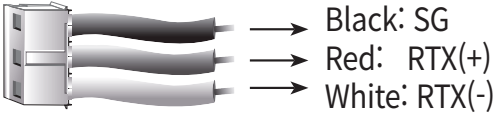
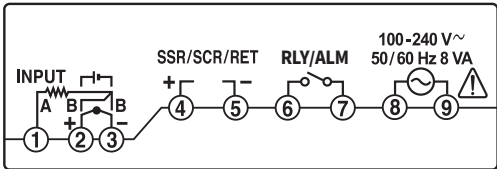
[Unit : mm]

Connection Diagrams

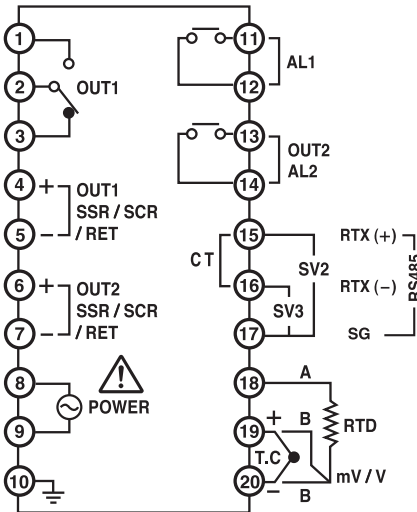
※ Terminal Description (Model NX2, NX3, NX9)

1) OUT1 (first control output)	Heating side output in case of heating/cooling type ● Relay output (terminal number ① ② ③) ● SSR / SCR output (terminal number ④ ⑤) However, when the SSR/SCR output is not used for the first control output, the transmission output (RET : 4 - 20 mA d.c.) can be used.
2) OUT2 (secondary control output)	In case of heating/cooling type, cooling side control output ● Relay output (terminal number ⑬ ⑭) ● SSR / SCR output (terminal number ⑥ ⑦) ● RET (Transmission output ⑥ ⑦) However, when SSR/SCR output is not used.
3) SV2 / SV3	2nd / 3rd set value selection terminal When the ⑮-⑰ terminal is ON, the second set value is selected, When the ⑯-⑰ terminal is turned on, the 3rd set value is selected.
4) POWER	100 - 240 V a.c. 50 - 60 Hz / 24 V d.c. (order specification)
5) input sensor (signal)	Since it is a multiple input, when selecting a thermocouple input, connect the positive polarity of the thermocouple to terminal ⑰ and the polarity thermocouple to terminal ⑳. For RTD input, connect A to terminal ⑱, B to terminal ⑰, and B to terminal ⑳.
6) AL1 / AL2 (Alarm 1 output / Alarm 2 output)	There are two types of alarm output, and if OUT2 is not used as a control output, it can be designated as a secondary alarm output.

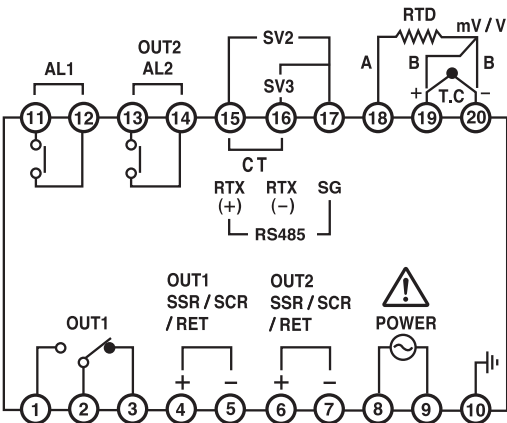
1) NX1 (48×24 mm)



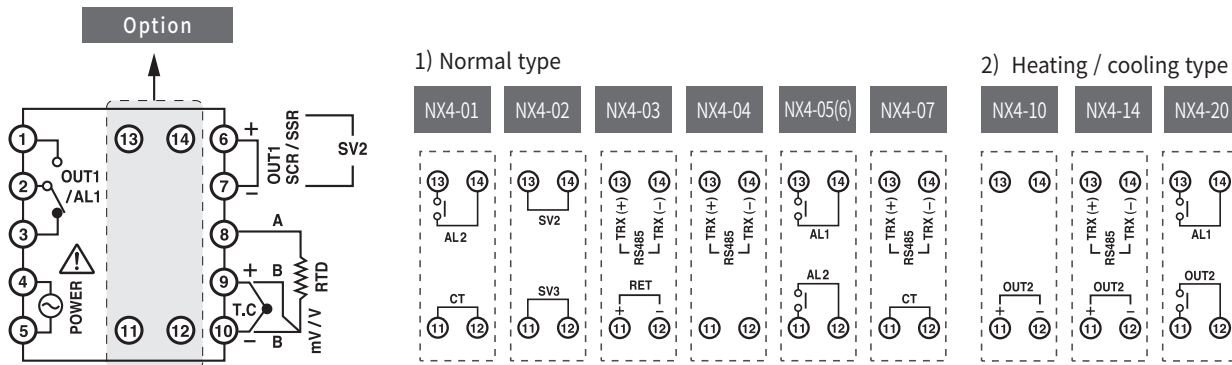
2) NX2 (48×96 mm)



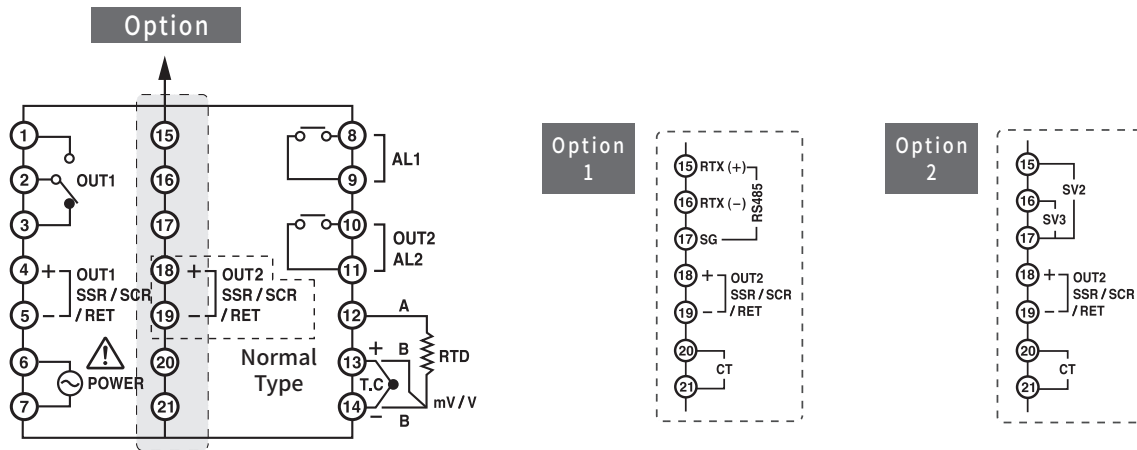
3) NX3 (96×48 mm)



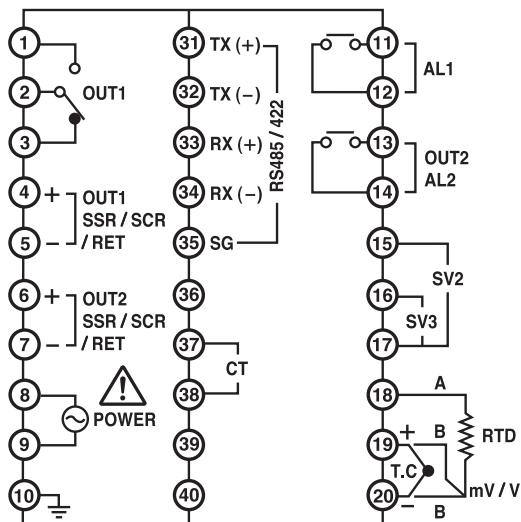
4) NX4 (48×48 mm)



5) NX7 (72×72 mm)



6) NX9 (96×96 mm)



⚠ CAUTION

● Ground wiring

- For grounding, use the wire with its thickness 2mm² or more and class III grounding or more (grounding resistance: max. 100 Ω).
- The length of the ground wire should be within 20 m
- Ground single-point from the ground terminal.
- Do not connect the wiring between ground terminals

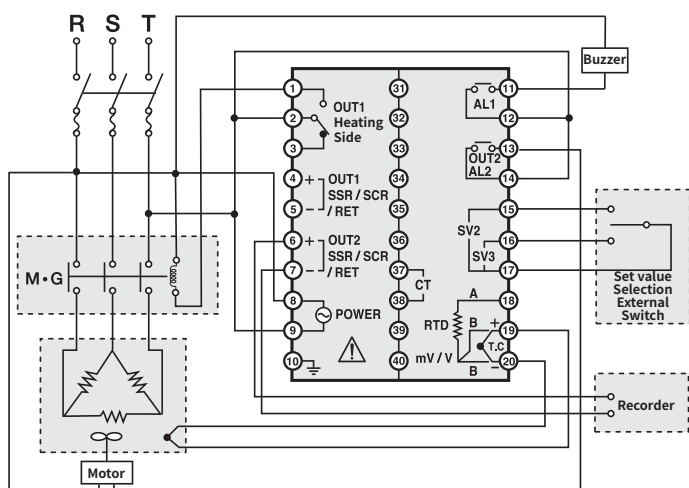
Connection example

※Model : NX9 Standard

Heating · Cooling Type

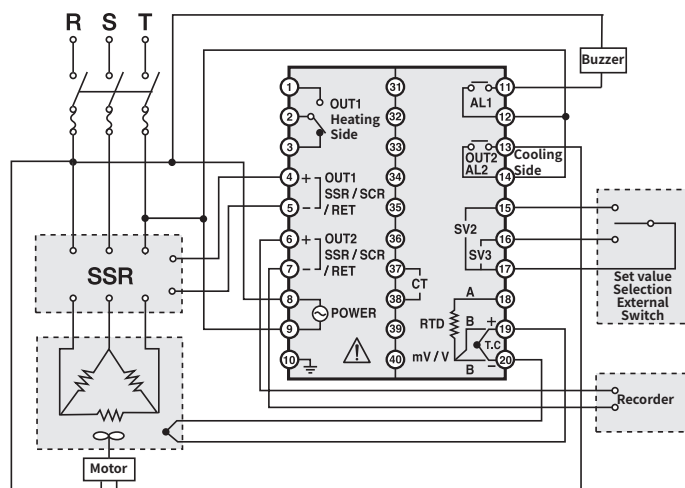
Heating Side
Relay Output

Cooling Side
Relay Output



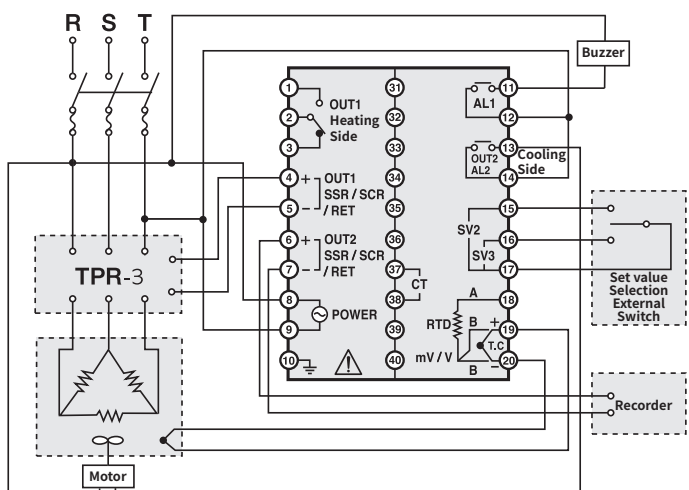
Heating Side
S.S.R Output

Cooling Side
Relay Output



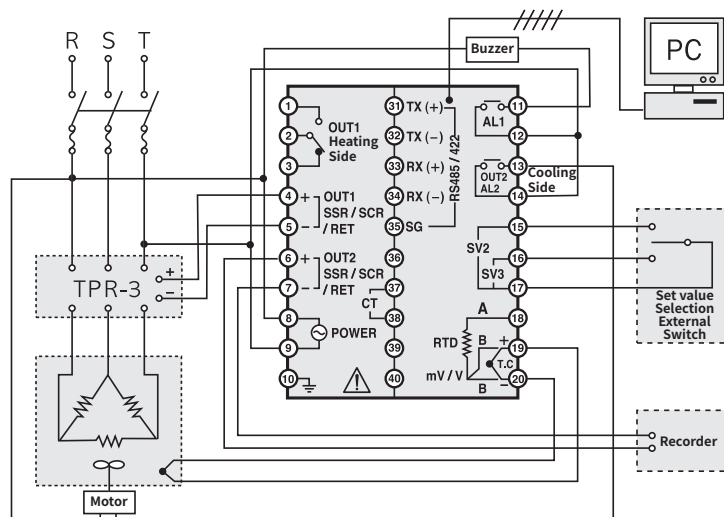
Heating Side
4-20 mA Output

Cooling Side
Relay Output



Heating Side
4-20 mA Output

Cooling Side
Relay Output

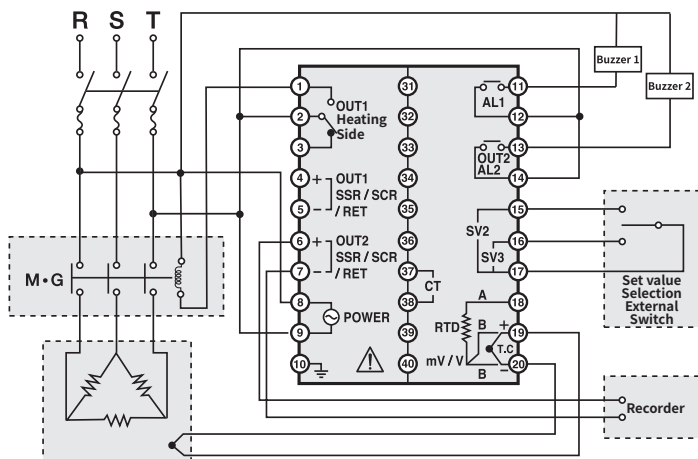


※ Option: Communication + Heater burnout alarm

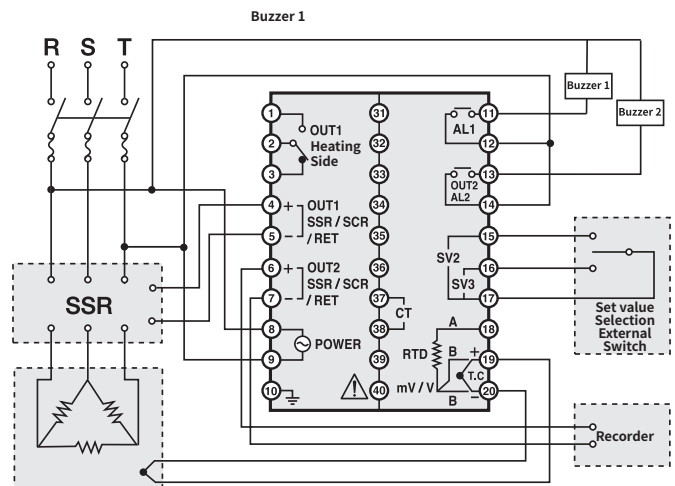
※Model : NX9 Standard

General type

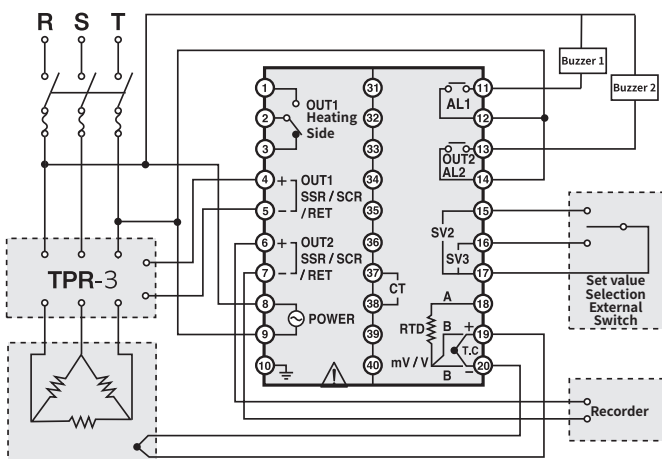
Heating Side Relay Output



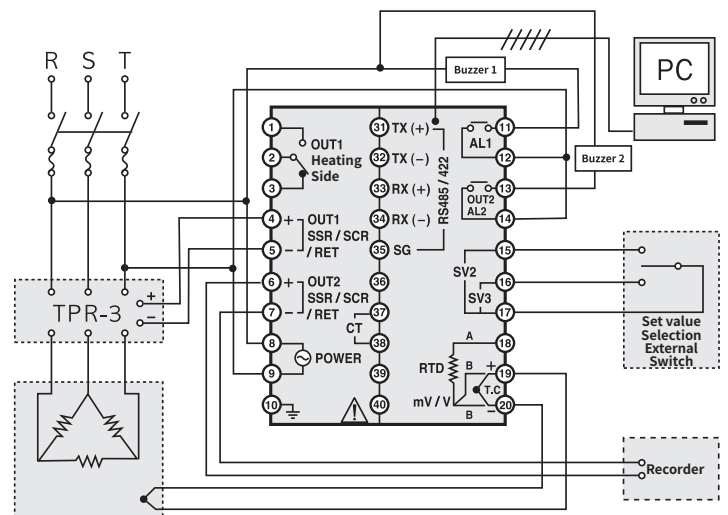
Heating Side S.S.R Output



Heating Side 4-20 mA Output

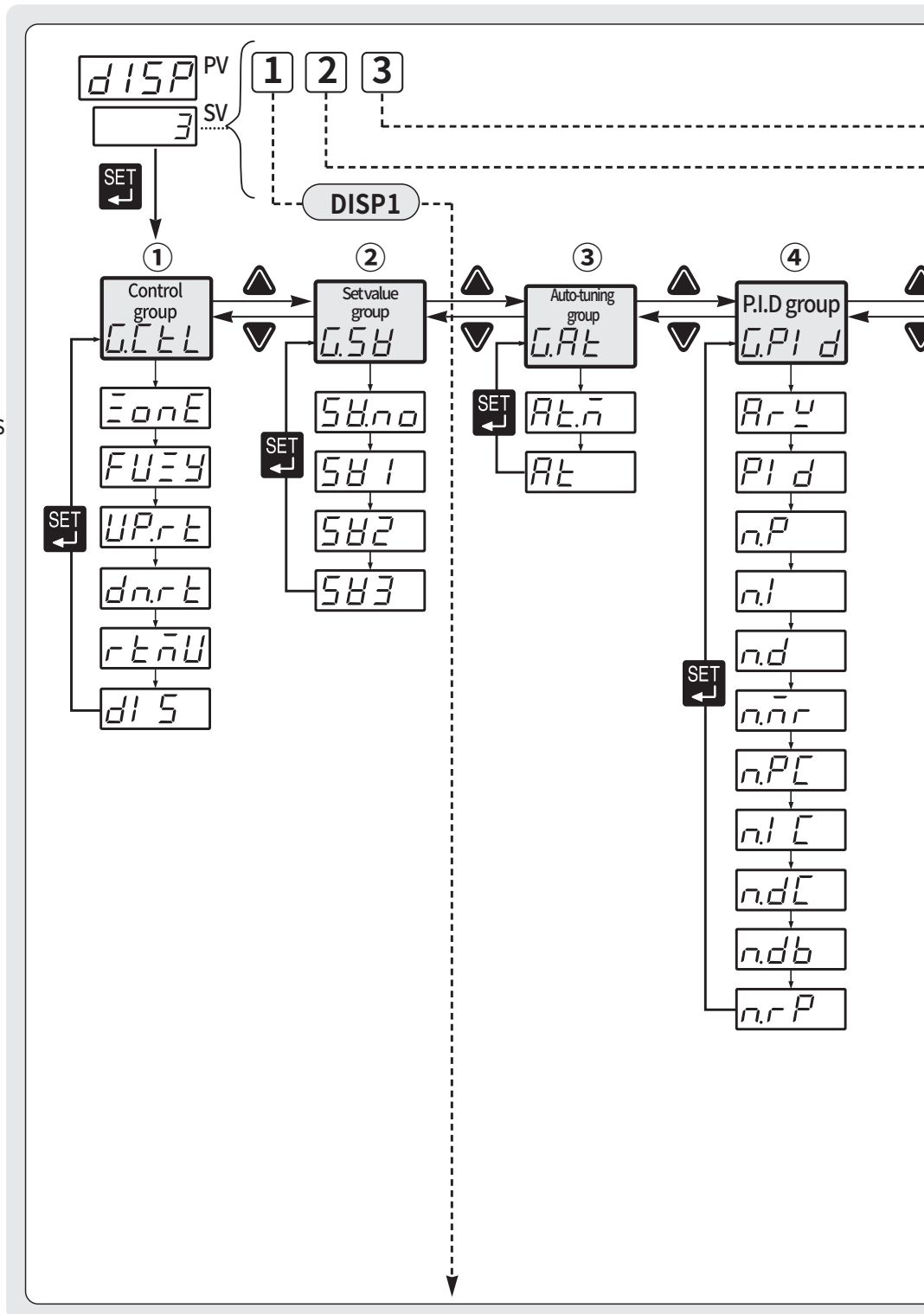
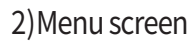
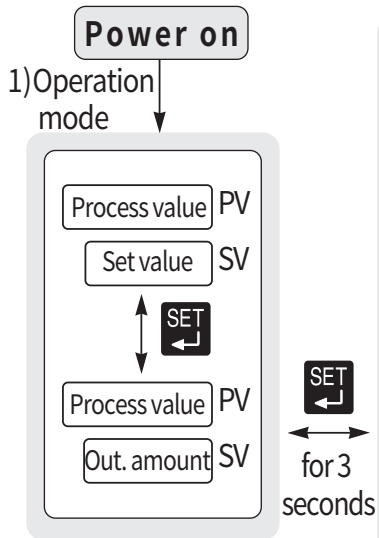


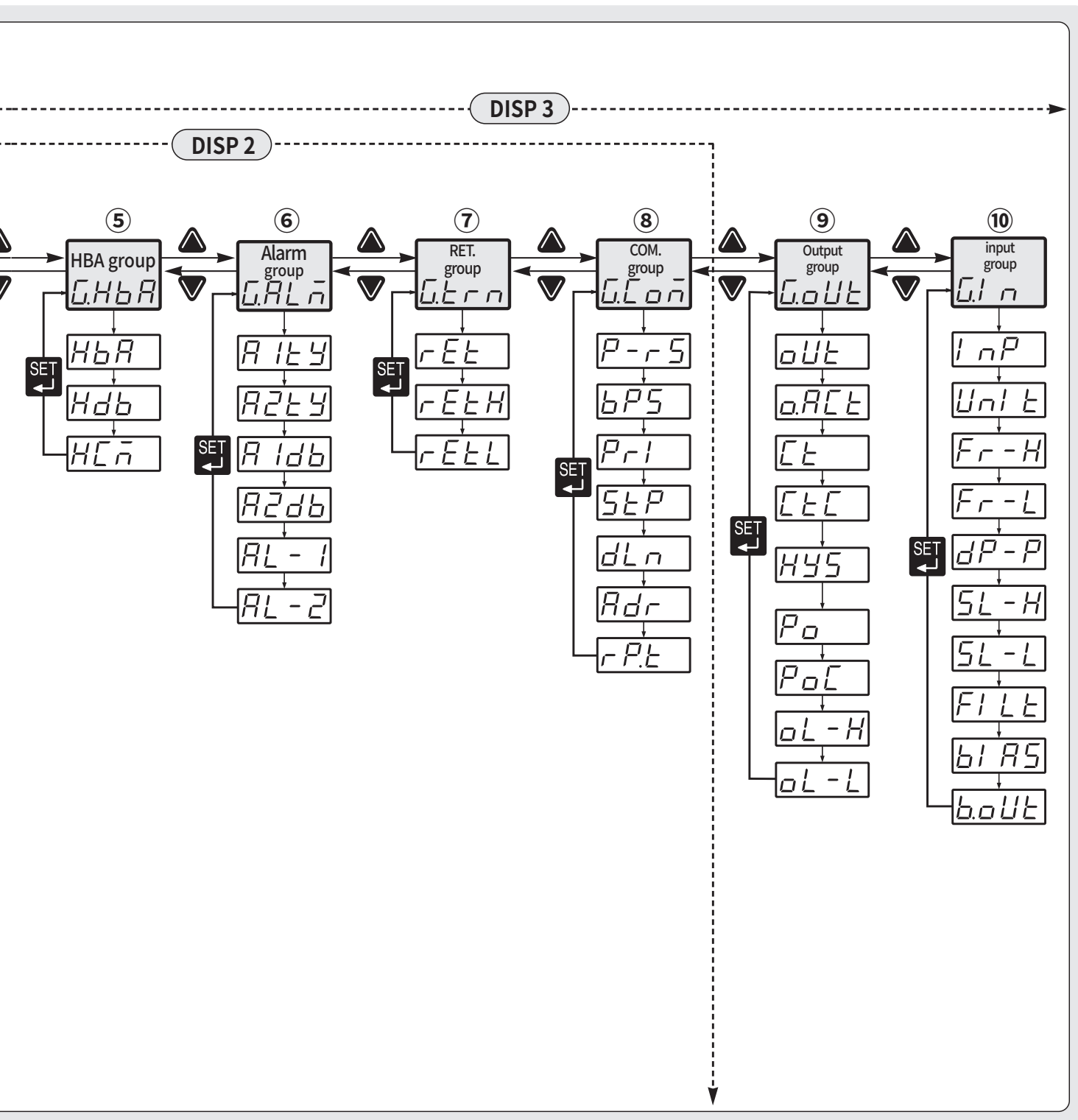
Heating Side 4-20 mA Output



※ Option: Communication + Heater burnout alarm

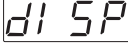
Parameter Configuration





Operation Method

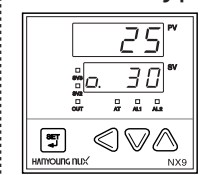
■ Turn On the power after finish the wiring

- (1) After displaying the management version of the temperature controller for a while, the operation mode showing the current measured value and set value is displayed as shown in ①.
- (2) Press the  button for more than 3 seconds as ① states, can be entered the  display selection mode, the parameter display range is limited to 1, 2, 3 setps.
- (3) When the  button is pressed in the operation mode displaying the measured value and the set value, the output amount is displayed as shown in the figure ⑤-⑥ below.

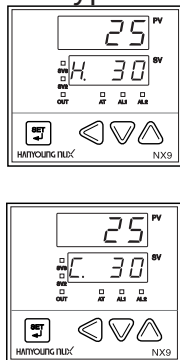
● How to move the screen

Output amount display

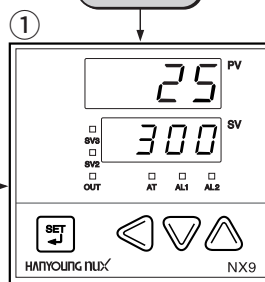
⑥ Normal type



⑤ Heating • Cooling type



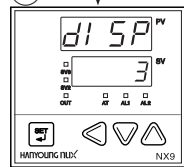
Power on



Operation mode

②

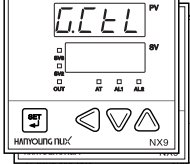
for 3 seconds



Display selection mode

③

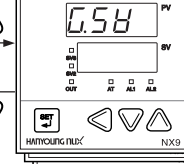
For 3 seconds



Setting group

④

For 3 seconds



Access setting of access level [Level(LEVL)] and display selection mode [Display(dISP)]

- According to the display selection mode [Display(dISP)] setting, a group of settings is displayed as parameter configuration.
- According to access level[Level(LEVEL)] setting, it can be edited a group of setting.

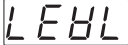
Access level[Level(LEVL)]

LEVL 3 : The key on the front display of the temperature controller can be changed the parameter values of all setting groups.

LEVL 2 : The key on the front display of the temperature controller can be changed the parameter values of output group (G.oUt) and input group (G.In)

LEVL 1 : The key on the front display (window) of the temperature controller cannot be changed the value of auto tuning group (G.At), PID group (G.PId), alarm group (G.ALM), transmission group (G.trn), communication group (G.CoM), output group (G.oUt), and input group (G.In).

⚠ CAUTION

In order to designate the level of the setting part in the state of operation screen ①, you can enter the setting mode by pressing  and the  for about 3 seconds at the same time  (LEVEL), and the 3rd level is set at the time of shipment. However, the display setting range can be set within the range of the level setting mode.

1 Control group

Control area and ramp function can be selected, and control area function, ramp function and external contact function can be turned on or off.

As shown in Table 1, by turning ON/OFF the two external contact inputs (SV2, SV3), three preset values can be arbitrarily selected and controlled.

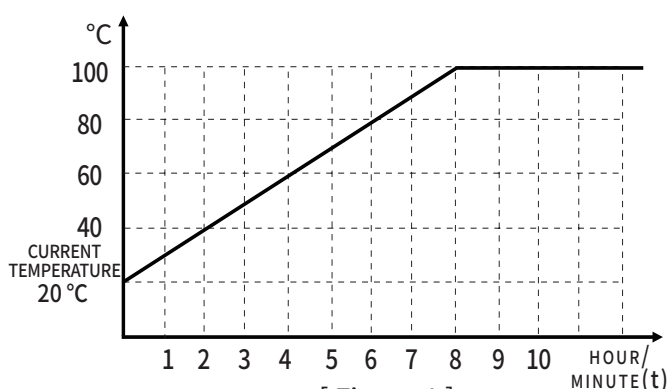
Sign	Item	Content	Display conditions	Default
	Control group	Set the control related mode	-	-
	Control Zone function	OFF / ON	Control output	OFF
	Fuzzy function selection	OFF / ON	PID control	OFF
	Lamp rise temperature setting	OFF/ EUS (0 ~ 100 %)	-	OFF
	Lamp down temperature setting	OFF/ EUS (0 ~ 100 %)		OFF
	Lamp time unit setting	hour / MIN		hour
	External contact input (DI) function	OFF / ON	Option	OFF

1) What is Control Zone Selection? In the process of controlling a wide temperature range, the optimum PID value depends on the temperature range, so the PID value is set within the range. This function is applied differently depending on the situation. It is divided into 3 Zones and each Zone has a different PID. The ability to apply groups.

2) What is the lamp function? It refers to the slope of the set value reaching the set value (SV). The setting method is to set the rising (falling) temperature according to the temperature value set in the ramp rising (falling) temperature setting mode and the time (minute) selected in the ramp time unit setting. As the slope of the value/ramp time unit setting, it has a slope to reach the changed setting value from the current setting value.

Ex) If the ramp rising temperature is set to 10°C, the ramp time unit is set to MIN, and the set value is changed from 20°C to 100°C, the slope of 10°C will change from 20°C to 100°C.

- 1) Ramp rising temperature setting value (UP.rt): 10°C
- 2) Select time unit: Minutes (MIN)
- 3) Set value: 20°C → 100°C



[Figure 1]

DIS select	Setting value (SV) selection mode by external contact signal		
OFF	External contact signal not selected		
ON	external signal display selection	SV2	SV3
	1st set value (SV1) display	OFF	OFF
	2st set value (SV2) display	ON	OFF
	3st set value (SV3) display	ON	ON

[Chart 1]

⚠ CAUTION (Figure 1 & Chart 1)

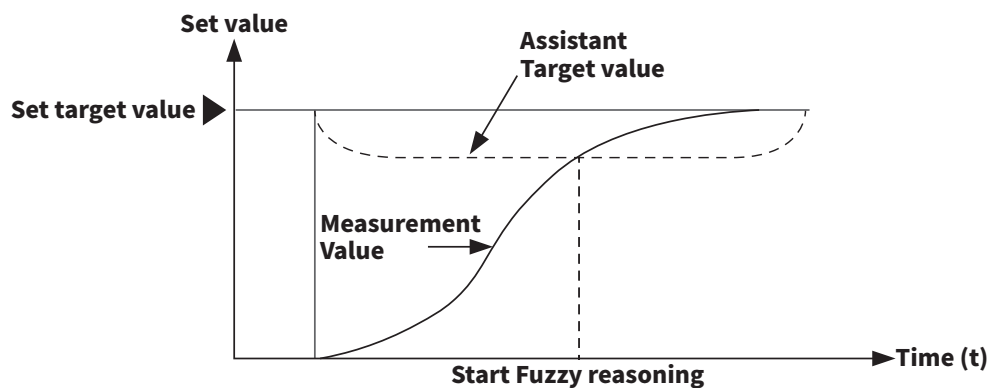
● External contact input wiring

- When connecting external contacts, be sure to cut off the controller body and external power.
There is a risk of electric shock.
- For external contacts, use non-voltage contacts (relay contacts, etc.).
- When the terminal voltage is OFF (approx. 5 V) and the current (approx. 1 mA) is ON, use a non-voltage contact with sufficient opening/closing capability.
- When using TRANSISTOR, the voltage at both ends when the contact is ON and the current when the contact is OFF should be less than 100 uA.

3) What is FUZZY function? The overshoot suppression function using fuzzy reasoning enables effective control in the following cases when used in combination with the automatic calculation function.

- ① When starting control at the position where the deviation between the target set value and the measured value is large at the operation start position.
- ② In case of to shorten the warming up time of operation.
- ③ Severe load fluctuations during normal operation.
- ④ If the setpoint changes frequently, turning on the purge function monitors the deviation and detects the risk of overshoot. Control continues by automatically changing the target setpoint to a slightly lower virtual secondary target value (SSP).

After that, when it enters the range where there is no risk of overshoot, it gradually returns to the original target setting value. However, the fuzzy function operates in PID operation.



2 Set value (SV) setting group

In the set value setting group, after setting three types of control set values (1st, 2nd, 3rd set value) in advance, an external contact signal (or key on the front of the device) It can be controlled each setting by selecting it.

When 1 is selected in the setpoint number selection mode, the first setpoint is displayed and is controlled by the setpoint.

Sign	Meaning	Setting contents	Display conditions	Default
	Set value group setting display	A group to set the settings to be controlled	-	-
	Select set value number	1~3 (Displays and controls the set value (SV) of the selected number among 3 set values.)	Always show	1
	1st setpoint setting mode	※ EU (0.0 ~ 100.0 %)		EU (0.0 %)
	2st setpoint setting mode	EU (0.0 ~ 100.0 %)		
	3st setpoint setting mode	EU (0.0 ~ 100.0 %)		

※ EU : A value in industry units that corresponds to the instrument range.

3 Auto Tuning (AT) group

CAUTION

● Auto Tuning start / stop

Do not use the Auto Tuning function in the following process.

- Fast response control processes such as flow control and pressure control.
- A process whose output must not be turned on/off, even temporarily.
- A process that prevents a large load from being applied to the control panel, etc.
- A process with a risk of adversely affecting product quality if setpoint fluctuations exceed acceptable ranges.

This digital temperature controller can select one of two automatic tuning methods: the standard value automatic tuning method (STD: target value) and the low limit set value (LOW: SV - 10 %) automatic tuning method of the automatic tuning method. The stabilization time is slightly longer. Even if overshoot (control that exceeds the target value) occurs, good results can be obtained if the purge function is used for the control that is a problem.

1) If the auto tuning start selection mode is set to OFF, automatic calculation is not performed.

Among the set values (SV1, SV2, SV3), the calculated PID value is automatically calculated based on the set value of the corresponding number and stored in the corresponding number.

2) Also, "AUTO" mode is applied when ZONE is set to ON in the control group.

It is divided into 1, 2, 3 groups, and when AT is executed in Auto mode, the calculation is automatically performed and stored in PID 1, 2, 3 groups.

Sign	Meaning	Setting contents	Display conditions	Default
	Auto tuning group display	Displays the Auto-tuning group.	-	-
	Auto tuning type selection	Standard : <i>Std</i> / LOW PV : <i>LOW</i>	ABS	STD
	Auto tuning start selection	OFF / 1 ~ 3 / <i>AUTO</i>	ABS	OFF

4 PID group

It is used to check the auto-tuned PID and ARW values in the PID group or to manually change the set value in the auto-tuning group.

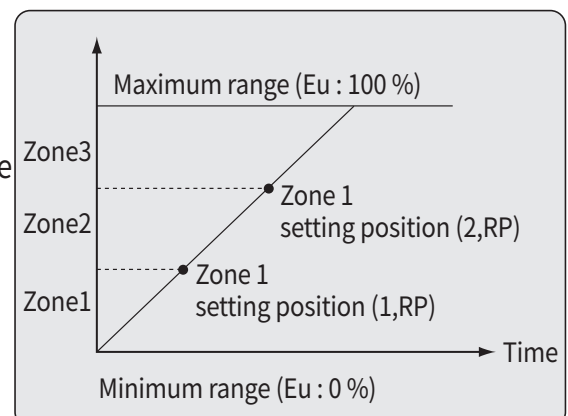
1) Press the key, ANIT RESET WIND-UP value can be set automatically or manually, press the key again, the PID mode is displayed, in this mode is to select for showing 3 types(0 to 3) of group PID value. For example, in PID mode, if "0" is set, the PID value is not displayed and "1" is set using the or key. If you do this and press , each PID value of group 1 is displayed in turn, and even if 2 or 3 is set, group 2, The third group value is displayed.

2) In addition, the manual reset mode display indicates that the integral value (I) In case of "0", manual reset mode is displayed and offset (offset: target value and A manual reset value can be set to remove any deviation from the measurement.

(Setting range: -5.0 % to 105.0 % of proportional band)

3) When the control group control zone selection mode is "ON", 2 zones can be set to form 3 zones.

※ The "n" mark in the Meaning column of the table below can be set from 1 to 3. In the case of heating/cooling type only, cooling side proportional band, cooling side integral time, The deadband modes of cooling-side differential time annealing and cooling are shown. And the figure on the right shows the Zone setting when controlling the PID group.



Sign	Item	Contents	Display conditions	Default
	PID group	Set the PID related mode.	-	-
	ANTI RESET WIND-UP Selection	Auto / 50.0 ~ 200.0 %	PID control	100 %
	PID Select group	0 / 1 ~ 3	Always show	0
	n.proportional band (P)	0.1(H/C TYPE : 0.0) ~ 999.9 %	When selecting a PID group	5.0 %
	n.integral time (I)	OFF / 1 ~ 6000 s	Always show	240 s
	n.differential time (D)	OFF / 1 ~ 6000 s	Always show	60 s
	n.manual reset	-5.0 ~ 105.0 %	Integral time : OFF	50.0 %
	n.Cooling side proportional band (P)	0.0(ON/OFF control) / 0.1 ~ 999.9 %	Heating/ Cooling type	5.0 %
	n.Integral time on the cooling side (I)	OFF / 1 ~ 6000 s		240 s
	n.Cooling side differential time (D)	OFF / 1 ~ 6000 s		60 s
	n.Blind spot for heating and cooling	-100.0 ~ 50.0 %		3.0 %
	n.Zone positioning	EU(0) < 1.RP < 2.RP < EU(100 %)	For PID group 1 or 2	EU (100 %)

5 Heater break alarm (HBA) group

In heater burnout alarm group setting mode, each alarm can detect and output current in one place, and it consists of output deadband setting mode and current detection display mode. (Exclusive current transformer: CT-50N, measuring range, 1 ~ 50 A)

Sign	Item	Contents	Display conditions	Default
	Heater break alarm group	Set the heater burnout alarm mode.	-	-
	Heater burnout alarm output current setting	OFF / 1 ~ 50 A	Option	OFF
	Heater burnout alarm output dead band setting	0 ~ 50		0
	Display of current measurement value of heater burnout alarm output	display only (0 ~ 50 A)		

6 Alarm group

⚠ CAUTION

● Alarm output wiring

- If the relay contact output exceeds the contact capacity (240V a.c. resistive load 1A, 30V d.c. resistive load 1A), use a relay to turn the load ON/OFF.
- When switching small currents, connect a bleeder resistor so that a current exceeding the switching capacity of the relay flows.
Relays have a lifespan (over 100,000 cycles [resistive load]).
Be sure to connect CR FILTER (when using AC) or DIODE to DC L load.

Alarm group has two alarm output type selection mode, alarm output deadband, and set value setting mode. In "Alarm type and code", it is possible to set the code number suitable for use during 21 types of operation, and to set the alarm output deadband and alarm set value.

* It is not displayed when output selection numbers 10, 11, 12 are selected in Heating/Cooling method.
(Refer to output type)

Sign	Item	Contents	Display conditions	Default
	Alarm group	Set the alarm related mode.	-	-
	Primary alarm output type selection	OFF / 1 ~ 21	Always show	1
	Secondary alarm output type selection	See "Alarm Types and Codes".		2
	Primary alarm output deadband setting	EUS(0 ~ 100 %)		EUS (0.5 %)
	Secondary alarm output deadband setting			
	Primary alarm setpoint setting	Absolute alarm : EU(-100 ~ 100 %) Deviation alarm : EUS(-100 ~ 100 %)		EU (100 %)
	Secondary alarm setpoint setting			EU (0 %)

※Note: If the reverse alarm type is selected in Alarm type and code, the indicator light turns off when the contact output is ON. Therefore, please be careful when using it.

7 Retransmission group

In the transmission output mode, one function can be selected from measured value (PV), set value (SV), output amount (MV), and sensor power (SPS), and the upper and lower limits of the transmission output are set.

※Note: (However, the transmission group display indicates that the transmission output exists in the output group output selection mode and the output selection number is 4, 5, 7, 8), the transport group is not shown.)

Sign	Item	Contents	Display conditions	Default
	Retransmission group	Set the transmission related mode.	-	-
	For Retransmission output type or sensor power selection	Display value PV / Set value SV / Output MV/sensor power SPS	Option	PV
	Retransmission output upper limit setting	Thermocouple / RTD : FR -H ~ FR- L DC voltage: SL -H to SL-L	PV / SV when selected	EU(100 %)
	Retransmission output lower limit setting	Only. RET. H > RET.L		EU(0 %)

(Note 1) If transmission output is desired, it should be connected to the transmission output terminal.

CAUTION

● Retransmission output wiring

- To avoid electric shock, be sure to cut off the controller body and external power when installing/removing the receiver.
- Retransmission output and SCR/SSR/SPS output use the same terminal, and the function of which terminal to use is selected by PARAMETER.
- Retransmission outputs 4 - 20 mA d.c.

● Power supply (SPS) output wiring for sensors

- To avoid the risk of electric shock, be sure to cut off the controller body and external power when installing removing the sensor.

● Retransmission output function

- When using the control side as a current output for heating/cooling control (transmission output and sensor power supply functions are not available).
- When using the sensor power supply function, the transmit output function cannot be used.

8 Communication group

The communication method of NX series is 2-wire or 4-wire half-duplex by RS485 / RS422, and up to 31 computers can be connected. The communication mode of the communication group is to set the communication conditions as follows.

⚠ CAUTION

NX-series products are not insulated.

If communication is transmitted/received with multiple devices at the same time, malfunction may occur.

Sign	Item	Contents	Display conditions	Default
	Communication group	Set the communication related mode.	-	-
	RS485 Protocol	PC-LINK (set value : 0) PC-LINK SUM (set value : 1) MODBUS-ASCII (set value : 2) MODBUS-RTU (set value : 3)	Option	0
	communication speed (BPS)	2400(set value : 2), 4800(set value : 3), 9600(set value : 4), 14400(set value : 5), 19200(set value : 6)		4
	Parity Bit	NONE(set value : 0), EVEN(set value : 1), ODD(set value : 2)		1
	Stop Bit	1Bit (set value : 1), 2Bit (set value : 2)		1
	data length	7Bit (set value : 7), 8Bit (set value : 8) (8-bit except MODBUS-ASCII)		8
	Address	1-99 steps, up to 31 units		1
	Response time	0 to 10. Actual response time = Processing time + (response time X 25 ms)		0

※ Please note that frequent data writing through communication may exceed the life of the EEPROM and cause malfunction.

● NX1 DC product

Sign	Item	Contents	Display conditions	Default
	Communication group	Set the communication related mode.	-	-
	RS485 Protocol	PC-LINK (set value : 0) PC-LINK SUM (set value : 1)	Option	0
	communication speed (BPS)	600 (set value : 0), 1200 (set value : 1), 2400 (set value : 2), 4800 (set value : 3), 9600 (set value : 4)		4
	Parity Bit	NONE(set value : 0), EVEN(set value : 1), ODD(set value : 2)		1
	Stop Bit	1Bit (set value : 1), 2Bit (set value : 2)		1
	data length	7Bit (set value : 7), 8Bit (set value : 8) (8-bit except MODBUS-ASCII)		8
	Address	1-99 steps, up to 31 units		1
	Response time	0 to 10. Actual response time = Processing time + (response time X 25 ms)		0

9 Output group

When ordering, this digital temperature controller is divided into general type and heating/cooling type, and not only input but also output is multi-type, so relay, SSR (voltage pulse), and current (4 - 20 mA dc) outputs are possible. Choose arbitrarily.

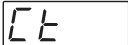
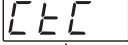
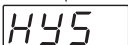
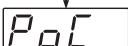
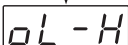
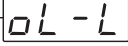
The range of output type selection (output selection number) is ① ~ ③ for general type and ④ ~ ⑫ for heating and cooling type depending on the purpose. Depending on the control output selection, transmission output and alarm output may not be applied.

For example, if the general type control output is selected as the current output, the output selection number (OT) becomes #2. In this case, transmit output and alarm 2 output are possible. However, in the case of heating/cooling control type, if the heating side output is a voltage pulse and the cooling side output is a relay (output selection number ⑩ ~ ⑫), only transmission output is available and alarm output 2 cannot be used.



When setting, be sure to select "Input type selection number" in the input group input type selection mode and "Output type selection number" in the output group output type selection mode, and then set another mode.

CAUTION Please be care full that the data of the other group that has already been set will be changed, if the input type selection number change after setting the mode of other group.

Sign	Item	Contents	Display conditions	Default
	Output group	Set the output type and output mode.	-	-
	Select output type	See Control Output Configuration	Always show	Normal: 1 Heating / Cooling Type: 4
	Select output action	REV : Reverse action DIR : Forward action	output selection numbers 0 to 3	REV
	Cycle time	1 ~ 1000 s	output selection Numbers 4 to 12	relay : 30 s / SSR: 2 s
	Cooling cycle time	1 ~ 1000 s		
	Hysteresis	Normal Type : EUS(0 ~ 100 %)	ON/OFF control	EUS(0.5 %)
		Heating • Cooling Type : 0.0 ~ 10.0 %	Heating • Cooling Type	0.5 %
	Output 1 when input is disconnected Output value setting	Normal Type : -5.0 ~ 105.0 % In case of Heating and Cooling Type : 0.0~105.0 %	Always show	0.0 %
	Output 2 when input is disconnected Output value setting	0.0 ~ 105.0 %	Heating • Cooling Type	0.0 %
	Output value upper limit function	Normal Type : OL-L + 1Digit~ 105.0 % Heating • Cooling Type : 0.0 ~ 105.0 %	PID control	100.0 %
	Output value lower limit function	Normal Type : -0.5 % ~ OL-H-1Digit Heating • Cooling Type : 0.0 ~ 105.0 %		0.0 % 100.0 %

10 Input group

1) Select input type

After turning on the power, if the  key is pressed for more than 3 seconds while the current temperature is displayed, 3 is displayed on the PV display and 3 on the SV display.

(However, if 3 is not displayed at this time, should be reseted it in level setting mode)

Press the  key again, the control group will be shown.

At this time, press the  key, the input group will be shown and press the  key again, the "input type and range" 's selection numbers will be shown on set value display(SV).

And use  or  key to select the input type and range selection number.

Then if the setting number is blinking, press the  key to memorize it



CAUTION

When setting, be sure to select "input type selection number" in the input group input type selection mode, select "output type selection number" in the output group output type selection mode, and set another mode. Please be care full that the data of the other group that has already been set will be initialized, if the input type selection number & output type selection number change after setting the mode of other group.

2) Unit (°C)

When the  key is pressed in the above condition, °C is displayed in the unit display mode.

3) Upper and lower limit range setting

After selecting the unit, press the  key to display the upper limit setting mode. Use the ,  and  keys to set the range value. In the same way as the upper limit setting method, press the  key to set the lower limit range.

4) Decimal point location selection

The decimal point position display is entered and the parameter does not appear in T.C.RTD.

However, in the "decimal point position selection" mode, the voltage input selection number (30, 31, 32, 33) is selected from the input type selection, and the setting range is 1 decimal place (selection one: 0.0), 2 decimal places. (2 choices: 0.00) Select the third digit (select 3: 0.000) with  or  key and memorize with  key.

5) Scale upper and lower limit settings

Scale is the same function as setting upper and lower limits when inputting a thermocouple or RTD. (30, 32, 33) Scale setting mode is displayed only when voltage input is selected in input type selection mode and is set with ,  and  keys.

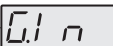
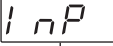
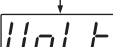
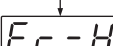
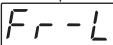
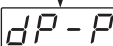
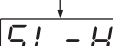
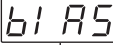
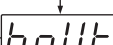
6) Select Metric Value Filters

The display value filter selection function removes the display value fluctuation by displaying the calculated value for the set time when the display value fluctuates due to the noise component included in the input signal. The setting range can be set to OFF or from 1 to 120 seconds, and the initial value is set to OFF.

7) Display value correction setting

Display value correction corrects the input value of the sensor. The measured value of sensor can be wrong when the sensor cannot be installed in the desired position.

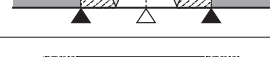
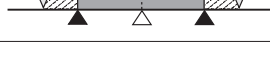
In addition, when controlling using multiple controllers, changing the measured value (input value) due to sensor accuracy and measuring instrument error even if the same set value is controlled is corrected for indication value (setting range: about span) -100.0 ~ 100.0 %, initial value: 0.0 %) For setting method, select with the , , and  keys in the display value setting correction mode and memorize it with the  key.

Sign	Item	Contents	Display conditions	Default
	Input group display	Select input type and set input mode.	-	-
	Select input type	Select input signal and measurement range number [P. 14]	Always show	selection number : 1
	Input range unit	°C, °F	When selecting thermocouple or RTD input	°C
	Upper limit range setting	within range (See Input Types and Ranges) only, FR-H > FR-L	Always show	1370
	Lower limit range setting			-200
	Decimal point location selection (when voltage is input)	Fixed thermocouple or RTD / DC voltage: set 0~3 to select position	When inputting voltage (mV, V)	1
	Scale upper limit setting (displayed when voltage is input)	-1999 to 9999 However, SL-H > SL-L Decimal point position is by DP-P		100.0
	Scale lower limit setting (Displayed when voltage is input)			0.0
	Select measure filter	OFF / 1 ~ 120 seconds	Always show	OFF
	Measurement value correction setting	EUS (-100.0 ~ 100.0 %)		EUS(0.0 %)
	Burn-out Select action	OFF / UP / DOWN		UP

Alarm types and codes

(Note): In cooling control, the output will be OFF when the indicator lamp is ON

Alarm deadband  ($\triangle$: Set value, $\triangleleft$: Minus alarm set value, $\blacktriangle$: Alarm set value)

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

Function

■ Feature details

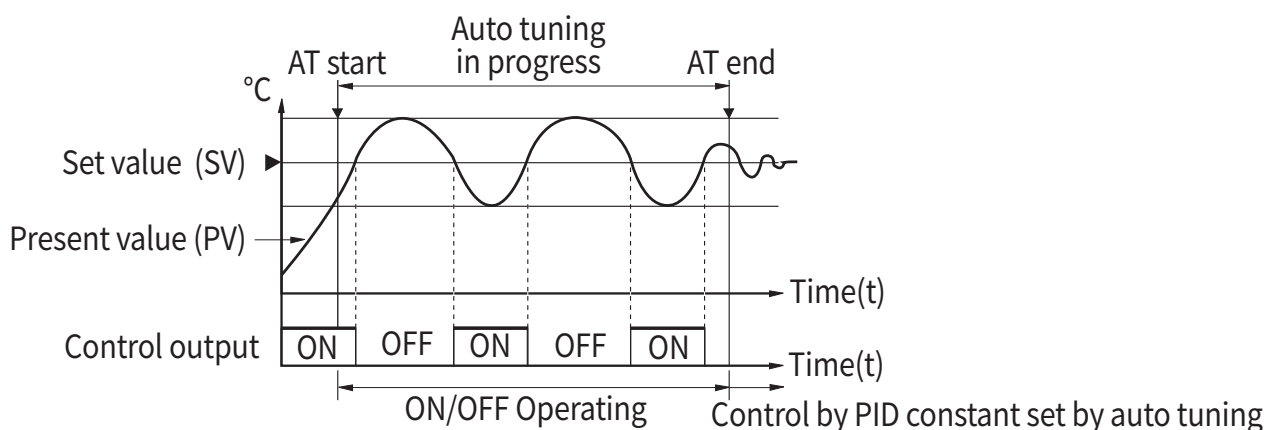
Function 1) Auto Tuning

Auto tuning is a function that automatically sets the optimal proportional (P), derivative (I), and integral (D) constants that the controller automatically measures and calculates the characteristics of the control system. When auto tuning starts, the control output is temporarily changed to ON/OFF control, and an appropriate PID constant is calculated and set from the response data. This method is called a limit cycle.

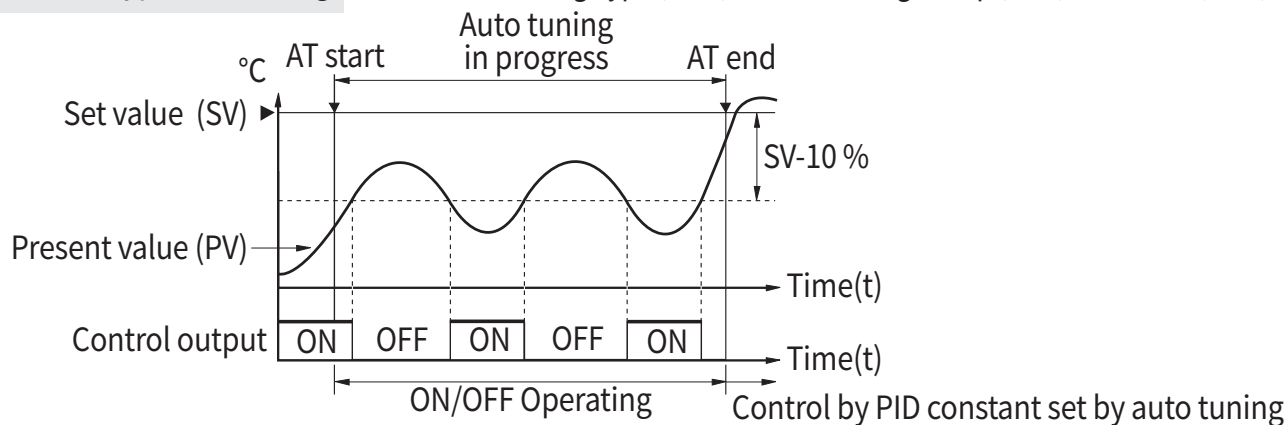
The NX series controller has two types of auto-tuning: standard type and low PV type.

- ① Standard auto tuning: Auto tuning according to the set value (SV)
- ② Low PV type auto tuning: Auto tuning based on a value 10% lower than the set value (SV)

a) Standard auto-tuning Select the auto-tuning type (At.M) of the auto-tuning group (G.At) as standard (Std)



b) Low PV type auto tuning Select Auto Tuning Type (At.M) of Auto Tuning Group (G.At) as Low PV (LoW)



The meaning of auto tuning start (At) of auto tuning group (G.At) is as follows.

- 1 performs auto-tuning for SV1.
- 2 performs auto-tuning for SV2.
- 3 performs auto-tuning for SV3.
- AUTO performs auto-tuning in the order of SV1, SV2, and SV3.

There are two (2) options to use auto tuning as follows.

1. Select the desired set value (SV) number in Auto Tuning Start (At) of Auto Tuning Group (G.At) to start Auto Tuning.
2. After selecting the auto-tuning function (At) from the hot key (Hk.SL) of the control group (G.CtL), press the hot key (SET + UP) for 3 seconds while the controller is operating to start auto-tuning. -After tuning, press the shortcut key (SET+UP). Press again for 3 seconds to stop auto-tuning.

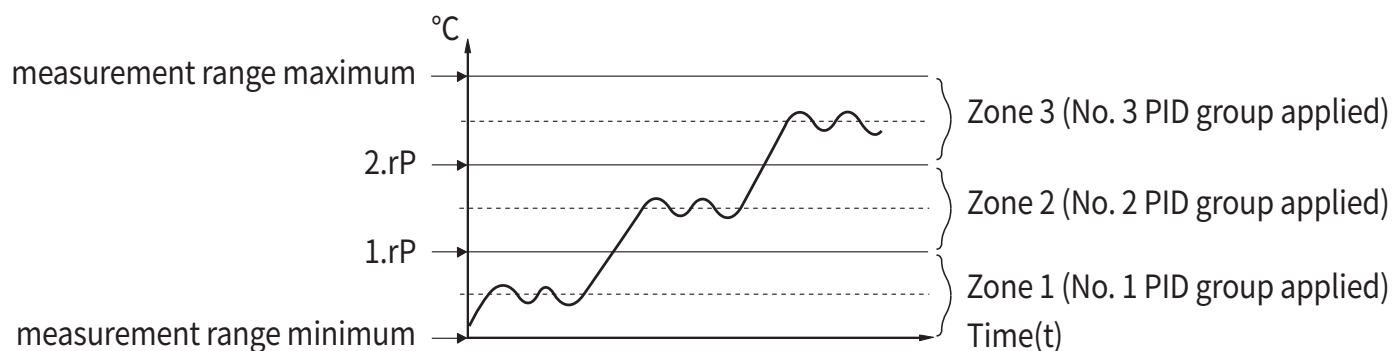
Note: When auto-tuning (AT) is executed, the 'AT lamp' on the front display window of the controller blinks.
(When manual output is ON, the 'AT lamp' on the front display window of the controller lights up.)

Function 2) Apply PID Groups in Zone Selection

Divide into 3 Zones within the input range and apply a different PID group to each Zone.

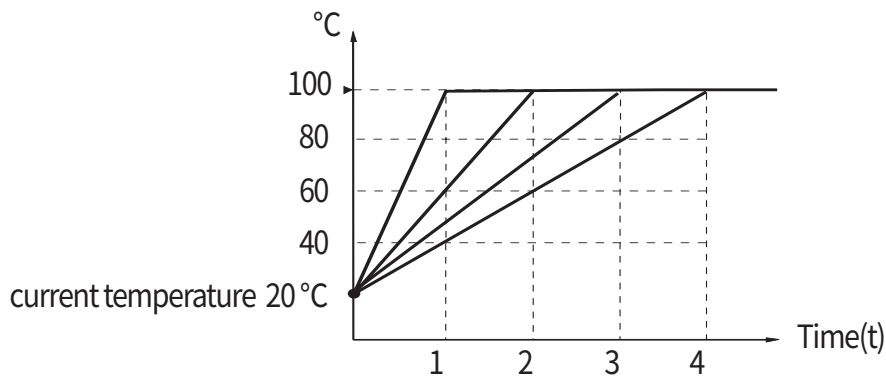
In the process of controlling a wide temperature range, the optimal PID value varies depending on the temperature range, so it is a function to apply PID data differently depending on the area.

By selecting ON in the control zone (ZONE) of the control group (G.CtL) and setting the temperature position in n.rP of the PID group (G.PID), it can be divided into zones 1, 2 and 3.



Function 3) Ramp Function

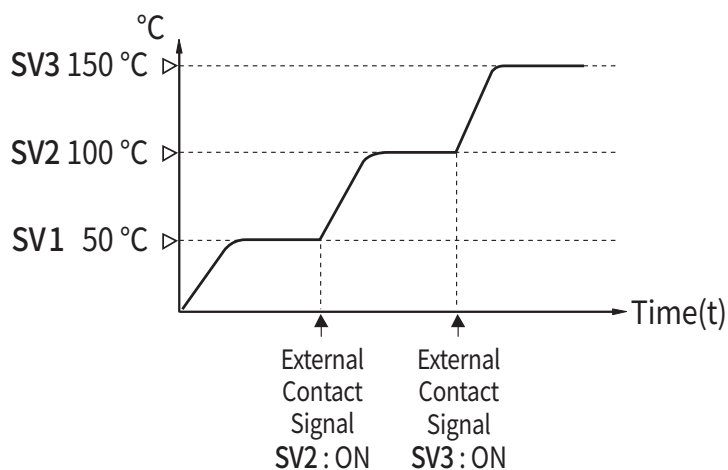
Refers to the slope at which the set value reaches the set value (SV.) The slope of the temperature set value/ramp time unit setting has a slope that reaches the set value (SV) from the current temperature.



Function 4) External contact input(DI) Function

This is a function that to select an arbitrary set value from three pre-set settings (SV1, SV2, SV3) by an external contact input signal, can be used for step control.

It can be used only when the external contact input (DI.SL) of the control group (G.Ctl) is set to ON.

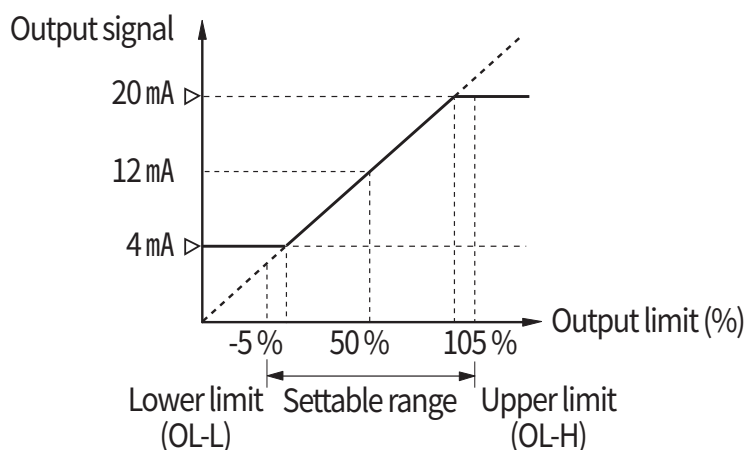


Function 5) Output Limit

The upper and lower limits can be set as the operation range of the control output.

Output limit can set the upper and lower limits within the range of -5 to 105 % of the output amount.

It can be set in the output amount upper limit (oL-H) and output amount lower limit (oL-L) of the output group (G.oUt).



Function 6) Heater Break Alarm (HBA)

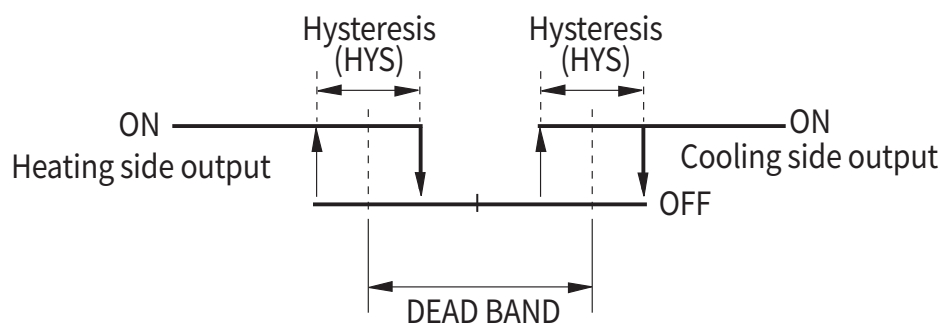
- ① It detects heater burnout and generates an alarm immediately.
- ② Use a current detector (CT) specified by our company.
- ③ Current and alarm operating point are set with the front key.
- ④ It cannot be used when controlling by the phase angle control method using a thyristor. (SCR output)

Note: To use the heater break alarm (HBA), set in the corresponding parameter of the alarm group (G.ALM) referring to the alarm type and code.

Function 7) Heating/Cooling Control

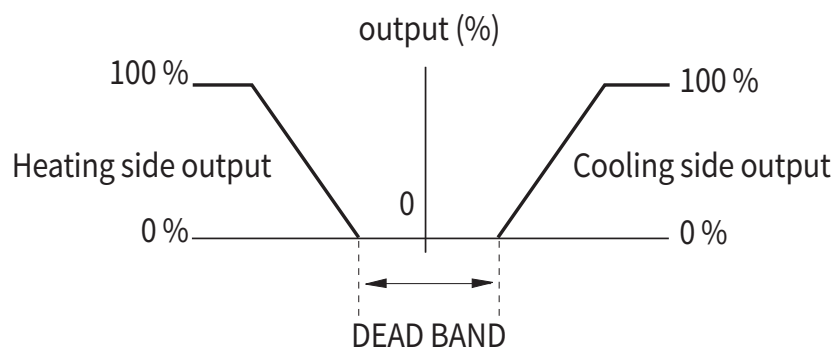
Heat/cool control divides the PID operation result into two signals, one for heating and one for cooling, and outputs it. PID control or ON/OFF control can select and output the heating side and cooling side respectively. In addition, it is possible to select and control one of the relay output, SSR (voltage pulse output), and current output (4 - 20 mA d.c.) for heating side output and cooling side output, respectively.

The dead zone during ON/OFF control for both heating and cooling sides is shown below.



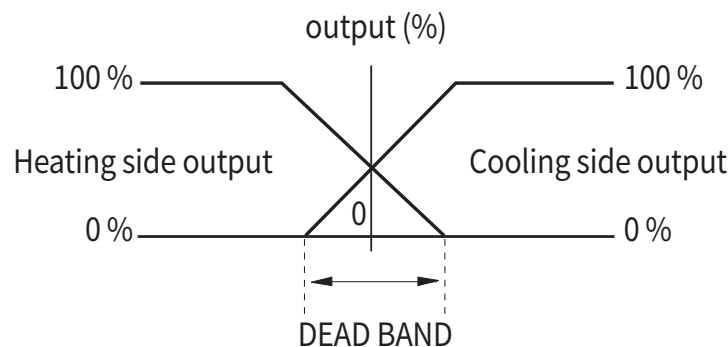
< In case of ON/OFF control of both heating side and cooling side >

For both heating side and cooling side, the dead band for PID control is as follows.



< Dead band of PID control “+” set value for both heating/cooling side >

Also, the dead band for the “—” set value and the dead band for both heating/cooling PID control are as follows. In this case, the outputs on both sides overlap.



< Dead band of PID control “—” set value for both heating/cooling side >

Function 8) Emergency Output

In automatic mode, in case of A/D error or input disconnection, output by PID operation is cut off and preset output value is output. ($P_{\square}$ output)

Function 9) Alarm Hold Function

If there is no alarm hold function, the lower limit alarm will be ON while the temperature is rising when the power is turned on and the temperature rises.

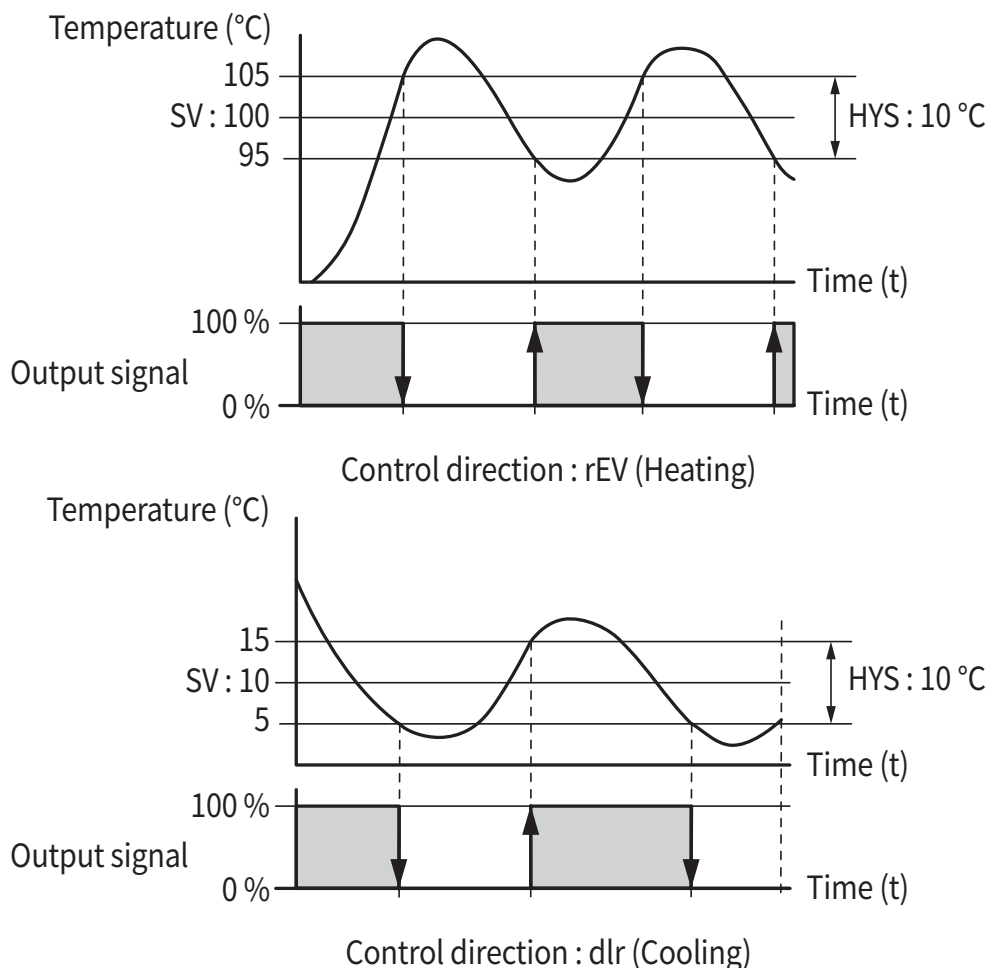
In order to prevent the lower limit alarm from turning on when the temperature rises, It can be selected the alarm hold function to turn on the power until the alarm set value is exceeded and then release the lower limit alarm.

Note: To use the alarm hold function, set it in the corresponding parameter of the alarm group referring to the alarm type and code.

Function 10) Hysteresis Type

The ON/OFF switching points according to the hysteresis type selection during ON/OFF control are as follows.

- In case of heating control, the OFF point becomes $SV + HYS/2$ and the ON point becomes $SV - HYS/2$.
- In 'cooling control', the OFF point becomes $SV - HYS/2$, and the ON point becomes $SV + HYS/2$.



Function 11) Easy Setup Menu

This is a function for easy entry of frequently changed parameters.

1. the controller presses the SET+DOWN key for 3 seconds in the operating screen state, it enters the simple setting menu.
2. press SET in the easy setting menu, it changes to SV1 → SV2 → AL1 → AL2.
3. Press SET for 3 seconds to return to the controller's operation screen from the easy setup menu.

NX Communication (D Register Address Description)

D register address	Parameter name	Parameter Meaning	Parameter setting	Parameter classification
0001	NPV	Current Progression (PV) Value	Read only *1	Process
0002	NSV	Current setting (SV) value	Read only *1	Process
0004	S SV	Current setting (SV) value	Read only *1	Process
0005	MVOUT	Control output value of general type OUT1, Heating/cooling type, total control output value	Read only *2	Process
0006	CH1OUT	Control output value of general type OUT1, Heating/cooling type, OUT1 control output value	Read only *2	Process
0007	CH2OUT	Heating/cooling type, OUT2 control output value	Read only *2	Process
0008	PIDNO	Set value (SV) and PID group number applied when current ZONE = OFF 0001: SV1, PID group 1 0002: SV2, PID group 2 0003: SV3, PID group 3 PID group number applied when current ZONE = ON 0001: PID group 1 0002: PID group 2 0003: PID group 3	Read only	Process
0009	ALMSTS	Current status of alarm 1 and alarm 2, 0000: Alarm1 OFF, Alarm2 OFF 0001: Alarm1 ON, Alarm2 OFF 0002: Alarm1 OFF, Alarm2 ON 0003: Alarm1 ON, Alarm2 ON	Read only	Process
0013	OUT2_IND	Heating/cooling type, OUT2 control When the output is SCR (4 - 20mA), Status of 'OUT2 lamp' of thermostat	Read only	Process
0014	H1CM	Heater burnout alarm output current measured value	Read only	Process
0016	ADESTS	Current status of AD errors 0001: AD conversion error	Read only	Process
0017	ERRSTS	Current state of input errors 0001: Input sensor Burn-out 0002: RJC error 0004: Input out of range 0008: Less than input range	Read only	Process
0018	AT_STS	Auto Tuning Status (AT) 0000: AT end, 9999: AT in progress (thermostat 'AT lamp' on the front display blinks)	Read only	Process
0102	ZONE	Zone function setting (Zone location setting is set in RP parameter of each PID group)	0: OFF, 1: ON	Control group
0103	FUZZY	Fuzzy feature selection	0: OFF, 1: ON	Control group
0104	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
0108	UP.RT	Lamp rising temperature setting	0: OFF / EUS(0~100 %) *1	Control group
0109	DN.RT	Lamp down temperature setting	0: OFF / EUS(0~100 %) *1	Control group
0110	RTMU	Lamp time unit setting	0: Hour, 1: Min	Control group
0121	MANMV	Manual output value setting	0 ~ 100 %	Control group
0300	SVNO	Select set value number	1 ~ 3	Setpoint setting group
0301	SV1	1st set value setting	EU(0 ~ 100 %) *1	Setpoint setting group
0302	SV2	2st set value setting	EU(0 ~ 100 %) *1	Setpoint setting group
0303	SV3	2st set value setting	EU(0 ~ 100 %) *1	Setpoint setting group
0305	AT MODE	Auto tuning type selection	0: standard automatic calculation, 1: Low measurement value (PV) type automatic calculation	Auto tuning group
0306	AT	Auto tuning	0: OFF, 1 ~ 4	Auto tuning group
0310	1.P	Proportional band of PID group 1	0.0 ~ 999.9 % *2	PID group
0311	1.I	Integral time of PID group 1	0 ~ 6000 sec	PID group
0312	1.D	Differential time of PID group 1	0 ~ 6000 sec	PID group
0313	1.MR	Manual reset of PID group 1	-5.0 ~ 105.0 % *2	PID group
0314	1.Pc	Cooling side proportional band of PID group 1	0.0 ~ 999.9 % *2	PID group
0315	1.Ic	Integral time of cooling side of PID group 1	0 ~ 6000 sec	PID group
0316	1.Dc	Cooling side differential time of PID group 1	0 ~ 6000 sec	PID group
0317	1.DB	PID group 1 heating/cooling dead zone	-100.0 ~ 50.0 % *2	PID group
0318	1.RP	Zone location setting of PID group 1	EU(0 ~ 100 %), (1.RP < 2.RP) *1	PID group
0320	2.P	Proportional band of PID group 2	0.0 ~ 999.9 % *2	PID group
0321	2.I	Integral time of PID group 2	0 ~ 6000 sec	PID group
0322	2.D	Differential time of PID group 2	0 ~ 6000 sec	PID group
0323	2.MR	Manual Reset of PID Group 2	-5.0 ~ 105.0 % *2	PID group
0324	2.Pc	Cooling side proportional band of PID group 2	0.0 ~ 999.9 % *2	PID group
0325	2.Ic	Integral time of cooling side of PID group 2	0 ~ 6000 sec	PID group
0326	2.Dc	Cooling-side derivative time of PID group 2	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	Zone location setting of PID group 2	EU(0 ~ 100 %), (1.RP < 2.RP) *1	PID group
0330	3.P	Proportional band of PID group 3	0.0 ~ 999.9 % *2	PID group
0331	3.I	Integral time of PID group 3	0 ~ 6000 sec	PID group
0332	3.D	Differential time of PID group 3	0 ~ 6000 sec	PID group
0333	3.MR	Manual reset of PID group 3	-5.0 ~ 105.0 % *2	PID group

D register address	Parameter name	Parameter Meaning	Parameter setting	Parameter classification
0334	3.Pc	Cooling side proportional band of PID group 3	0.0 ~ 999.9 % *2	PID group
0335	3.Ic	Integral time for cooling side of PID group 3	0 ~ 6000 sec	PID group
0336	3.Dc	Cooling-side derivative time of PID group 3	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 output current setting	0: OFF, 1 ~ 50 A	Heater break alarm group
0401	HDB	Heater break alarm output dead band setting	0 ~ 50	Heater break alarm group
0410	A1TY	1st alarm output type setting	0: OFF, 1 ~ 21	Alarm group
0411	A2TY	2st alarm output type setting	0: OFF, 1 ~ 21	Alarm group
0413	A1DB	1st alarm output deadband setting	EUS(0 ~ 100 %)	Alarm group
0414	A2DB	2st alarm output deadband setting	EUS(0 ~ 100 %)	Alarm group
0416	AL-1	1st alarm set value setting	Absolute alarm : EU(-100 ~ 100 %)	*1 Alarm group
0417	AL-2	2st alarm set value setting	Deviation alarm : EUS(-100 ~ 100 %)	Alarm group
0500	RET	Select Transmission Output Type	0: Display value (PV) 1: Set value (SV) 2: Control output value (MV) 3: Power SPS for sensor	Transmission group
0501	RET.H	Transmission output upper limit	-1999 ~ 9999	Transmission group
0502	RET.L	Transmission output low-limit setting	-1999 ~ 9999	Transmission group
0600	OUT	Select output type	0 ~ 12 (of the control output configuration See output type selection number)	Output group
0601	o.ACT	Select output action	0: Reverse action (heating), 1: Forward action (cooling)	Output group
0602	CT	Cycle time (control cycle)	1 ~ 1000 sec	Output group
0603	CTC	Cooling cycle time (cooling control cycle)	1 ~ 1000 sec	Output group
0604	HYS	Normal type, Hysteresis of ON/OFF control Heating/cooling type, Hysteresis of ON/OFF control	Normal type, EUS(0~100%) Heating/cooling type, 0 ~ 10.0%	*1 *2 Output group
0605	PO	Output 1 output amount setting in case of input disconnection	-5.0~105.0%	*2 Output group
0606	POC	Output 2 output amount setting in case of input disconnection	0~105.0%	*2 Output group
0607	OL-H	Output capacity upper limit function	Normal type, OL-L +1 digit ~ 105.0 % Heating/cooling type, 0.0 ~ 105.0 %	*2 Output group
0608	OL-L	Output low limit function	Normal type, -0.5 % ~ OL-H-1 digit Heating/cooling type, 0.0 ~ 105.0 %	*2 Output group
0610	INP	Select input type	1~31	Input group
0611	UNIT	Select temperature unit	0: °C, 1: °F	Input group
0612	FR-H	Select upper range	EU(0 ~ 100 %) *1	Input group
0613	FR-L	Select the lower limit range	EU(0 ~ 100 %) *1	Input group
0614	DP-P	Decimal point position selection (when inputting voltage)	0: no decimal point 1: 1st decimal place 2: 2nd decimal place 3: 3rd decimal place	Input group
0615	SL-H	Scale upper limit setting (when voltage is input)	-1999 ~ 9999	Input group
0616	SL-L	Scale lower limit setting (when voltage is input)	-1999 ~ 9999	Input group
0617	FILT	Select measure value filter	0: OFF, 1 ~ 120 sec	Input group
0618	BIAS	Measurement value correction setting	EUS(-100 ~ 100%) *1	Input group
0619	B.OUT	Selection of action when input is disconnected	0: OFF, 1: UP, 2: DOWN	Input group

*1: Make sure there is a decimal point according to the input type and range setting.

- **setpoint with decimal point** : to input 100.0°C to SV1 through communication, send 03E8(1000).
(03E8 is a hex value of 1000.)
- **Setpoint with out decimal point** : Send 0064(100) to input 100°C to SV1 through communication.
(0064 is the hex value of 100.)

*2: A setting value with a decimal point.

※ Communication-related protocol usage can be found on the Hanyoung Nux website (www.hynux.com).
Please refer to the Korean-English protocol manual.

TEL : +82-32-876-4697



HANYOUNG NUX
28, Gilpa-ro 71beon-gil, Michuhol-gu, Incheon, korea
HANYOUNGNUX CO.,LTD
