NX Series

Process Temperature Controller

INSTRUCTION MANUAL

Thank you for the purchase of **HANYOUNG** product.
Please read this manual carefully.

Interface RS-485/422

Universal In/Output

Fuzzy

Heat/Cool

SV2, SV3 Input

OUT

PV

AT

SV

AL1 2

SV2 3

SET

HANYOUNG   NX4

NX9   NX2   NX7   NX3

HANYOUNG
ELECTRONIC CO., LTD.

CONTENTS

HANYOUNG ELECTRONIC CO., LTD.

NX Series

◆ High Accuracy 0.5 class 250ms

Features

- Fuzzy
- Auto Tuning
- Alarm Output
- Retransmission Output
- Universal Input · Output
- Free Scale function (Voltage/Current Input)
- Ramp function
- Heating / Cooling
- Zone PID
- Group PID (1,2,3)
- Power supply for sensor (24VDC)
- Output Limits
- Interface (RS485 / 422)
- 3 Set points
- Heater break alarm
- IP65 front facia

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Before using, please read this (SAFETY INFORMATION) and then use this controller.
It is most important that the instructions in this manual are followed when using this instrument.
Please keep this manual for future reference.
Precautions are classified in **WARNING** and **CAUTION**.

⚠ WARNING	There is a possibility of death or heavy injury when handling in wrong way.
⚠ CAUTION	There is a possibility of injury or physical damage when handling in wrong way.

⚠ WARNING

① Caution on wiring
● Use an external protection circuit if a fault in the control loop could possibly lead to a serious problem.
● This instrument do not have a switch for power and a fuse, so please set them if it is needed.
  (Fuse rating 250V, 0.5A)

② Power supply
● Use a rated voltage to prevent damage or trouble.
● To avoid electrical shock or damage, do not turn ON the power until the wiring is completed.

③ Prohibit use in gas atmosphere
  Do not use it at a place exposed to combustible or explosive gas.

④ Handling of unit
● To avoid malfunction, electrical shock or fire, this unit must not be disassembled or repaired.
● Do not touch the terminals to avoid electrical shock or malfunction.

⑤ Caution on maintenance
● Turn OFF the power before mounting or removing the instrument.
● To ensure continuous and safe operation of the instrument, periodical maintenance is recommended. Some parts are limited in life.
● The warranty period is 1 year only if using in the correct way.

⚠ CAUTION

① Caution on handling
◎ Do not install the instrument under any of the following conditions.
● The ambient temperature exceeds 0 ~ 50℃
● The ambient humidity exceeds 20 ~ 90% RH.
● A place where temperature changes suddenly or icing occurs.
● A place exposed to corrosive gas or combustible gas.
● Vibration or shock is likely to be transmitted to the instrument.
● A place exposed to water, oil, chemicals, steam, sunlight.
● A place exposed to much dust, salt or iron.
● A place with much inductive disturbance, static electricity, magnetism noise.
● A place where heat such as radiant heat stays.

② Installation

● For NX9, 7, 3 and 2, attach the brackets (2 units) on the fixed halls and tighten with a screwdriver.
Fixing torque is about 14.7N. cm (1.5kg.cm). NX1 and NX4 has a plastic bracket.
(Care should be taken not to tighten forcedly.)

③ Caution on terminal connections

● Use a compensating cable with thermocouple.
● For R.T.D input use a cable which is a small lead wire resistance and without resistance difference to 3wires.
● To avoid inductive noise to input wires seperate from the power and output wires.
● Keep input wires away from output wires and use shielded wires to earth.
● If the wiring has noise, use the following step: connect a surge absorber to the conductor coil side if the conductors are connected to the load output, such as the relay contact output.
● Use an insulating transformer with a noise filter when the power suppy has much noise.
● Noise filter should be mounted on a panel which has been earthed and the wiring between the noise filter output and the instrument power terminals should be shorten.
● It is effective to use a twisted cable for power supply against noise.
● The heater power supply and the instrument power supply should be connected using the same power suppy when a heater break alarm.
● Time for preparation of contact output is required at power ON. When the output signal is used for an extenal interlock circuit, connect a delay relay.

④ For load circuit connection

● Use an extra relay when the frequency of operation is rather high. In thic case, SSR output type is Recommended.
  • Electromagnetic switch : Proportional cycle time is Min. 30sec
  • SSR : Proportional cycle time is Min. 1 sec
  • Contact output life : Mechanical : Min. 10 million times (no load)
                                                                  Electrical : Min. 100 thousand times (rated load)
  • SSR drive pulse voltage, DC 4~20mA are not insulated with internal circuit.
                          Use non-grounded sensor to R.T.D and thermocouple.

⑤ For waterproof (Waterproof type)

The instrument has IP65. Use rubber packing when installling the instrument to panel.
Please attach the rubber in correct way.

⑥ Caution on key operation / trouble

● If alarm function is not set correctly, alarm output can not be operated at a trouble.
Be sure to check the alarm operation.
● If the input cable is disconnected, the display shows " b.oUt ".
When replacing the sensor, please turn OFF the power supply.

⑦ Other

Do not use organic solvents such as alcohol, benzine when cleaning. (Use neutral detergent)

2 INSTRUCTION

This instrument has process-value (PV) and set-value (SV) each 4 digits with 7 segment FND. This instrument is divided universal type and heating-cooling type and each setting items has 10 groups. Function and feature : Group P.I.D, Universal-input (19 types), Universal-output (Relay, SSR, Current), Local input, Remote input, External contact input, Ramp function, Auto-tuning 2 types (standard type, low PV type), Retransmission, Communication (RS485 /422), Power supply for sensor, 21 types of alarm, Sampling cycle 250ms, 0.5% of FS high accuracy.

3 ORDERING INFORMATION

NX1 – ☐ ☐

Model NX1 : 48×24 mm
Process temperature controller

Control type 0 ☐ : Universal type

Number	Control output	Optional
00	Relay	None
01	SSR/SCR	None
02	Relay	RS485
03	SSR/SCR	RS485
04	SSR/SCR	ALM
05	SSR/SCR	ALM /RS485

Control type 1 ☐ : Heating / Cooling

Number	Control output(H)	Control output(C)	Optional
10	Relay	SSR/SCR	None
11	SSR/SCR	Relay	None
12	Relay	SSR/SCR	RS485

NX2 – ☐ ☐

Model NX2 : 48×96 mm
Process temperature controller
Control type   0 : Universal
                1 : Heating / Cooling
Optional   0 : None
                1 : HBA

NX3 – ☐ ☐

Model NX3 : 96×48 mm
Process temperature controller
Control type   0 : Universal
                1 : Heating / Cooling
Optional   0 : None
                1 : HBA

NX7 – ☐ ☐

Model NX7 : 72×72 mm
Process temperature controller
Control type   0 : Universal
                1 : Heating / Cooling
Optional   0 : None
                1 : RS485 / HBA
                2 : SV2, SV3 / HBA

NX9 – ☐ ☐

Model NX9 : 96×96 mm
Process temperature controller
Control type 0 : Universal
             1 : Heating / Cooling
Optional   0 : None
             1 : RS 485 / 422 / HBA

※ NOTE : The HBA is not available on SCR control output

① Universal type

Universal type	Output code (O T)	OUT1		OUT2	
		Relay	SSR /SCR(Current)	Relay	SSR /SCR(Current)
NX9-0□ NX7-0□ NX3-0□ NX2-0□	0	Relay(ON/OFF control)		AL2	Retransmission
	1		SSR	AL2	Retransmission
	2		SCR	AL2	Retransmission
	3	Relay		AL2	Retransmission

② Heating / Cooling type

Heating / Cooling type	Output code (O T)	Heating (OUT1)		Cooling (OUT2)	
		Relay	SSR / SCR	Relay	SSR / SCR / RET
NX9-1□ NX7-1□ NX3-1□ NX2-1□	4		SSR	(AL2)	SSR
	5		SCR	(AL2)	SSR
	6	Relay	RET	(AL2)	SSR
	7		SSR	(AL2)	SCR
	8		SCR	(AL2)	SCR
	9	Relay	RET	(AL2)	SCR
	10		SSR	Relay (AL2)	Retransmission
	11		SCR	Relay (AL2)	Retransmission
	12	Relay		Relay (AL2)	Retransmission

NX4 - □ □

- Model NX4 : 48×48 mm
  - Process temperature controller
- Control type 0 : Universal
  - 1 : Heating / Cooling (Output code 4~9)
  - 2 : Heating / Cooling (Output code 10~12)
- Optional 0 : None
  - 1 : HBA / ALM1 / ALM2
  - 2 : SV2, SV3
  - 3 : RET / RS485
  - 4 : RS485/SSR/SCR (Control output)

※ NOTE : The HBA is not available on SCR control output

① Control output (NX4-01)

Universal type	Output code (O T)	OUT1		OUT2	
		Relay	SSR /SCR(Current)	Relay	SSR /SCR / RET
NX4-01	0	Relay(ON/OFF control)		AL2	−
	1		SSR	AL2	−
	2		SCR	AL2	−
	3	Relay		AL2	−

② Control output (NX4-02/00)

Universal type	Output code (OT)	OUT1		OUT2	
		Relay	SSR /SCR(Current)	Relay	SSR /SCR / RET
NX4-02/00	0	Relay(ON/OFF control)		–	–
	1		SSR	–	–
	2		SCR	–	–
	3	Relay		–	–

③ Control output (NX4-03)

Universal type	Output code (OT)	OUT1		OUT2	
		Relay	SSR /SCR(Current)	Relay	SSR /SCR / RET
NX4-03	0	Relay(ON/OFF control)		–	Retransmission
	1		SSR	–	Retransmission
	2		SCR	–	Retransmission
	3	Relay		–	Retransmission

④ Control output (NX4-10/14)

Heating/Cooling type	Output code (OT)	Heating (OUT1)		Cooling (OUT2)	
		Relay	SSR /SCR(Current)	Relay	SSR /SCR / RET
NX4-10/14	4		SSR	–	SSR
	5		SCR	–	SSR
	6	Relay		–	SSR
	7		SSR	–	SCR
	8		SCR		SCR
	9	Relay			SCR

⑤ Control output (NX4-20)

Heating/Cooling type	Output code (OT)	Heating (OUT1)		Cooling (OUT2)	
		Relay	SSR /SCR(Current)	Relay	SSR /SCR / RET
NX4-20	10		SSR	Relay (AL2)	–
	11		SCR	Relay (AL2)	–
	12	Relay		Relay (AL2)	–

1) INPUT

Input	Thermocouple: K, J, E, T, R, S, B, L, N, U, WRe 5-26, PL-Ⅱ R.T.D: Pt 100Ω, KPt 100Ω Direct voltage: 1~5V, -10~20mV, 0~100mV(Programmable scale type)
Sampling time	250mS
Input resolution	Below decimal point of measurement range
Input impedance	T/C and mV input: 1MΩ min., DC V: 1MΩ
Lead wire tolerable resistance	R.T.D: 10Ω max. / wire
Input tolerable voltage	±10V (T/C, R.T.D, Voltage: mV DC) ±20V (Voltage: V DC)
Noise removal rate	NMRR(normal mode): 40dB min. CMRR(common mode): 120dB min. (50/60Hz ±1%)
Standard	T/C, R.T.D: KS, IEC, DIN
Standard junction temp. compensation tolerance	±1.5℃(15~35℃), ±2.0℃(0~50℃)
Burn-out	T/C: OFF, Up/Down selectable R.T.D: Up scale (Detection current: 50nA)
Accuracy	±0.5% (Full scale)
Input range	Refer to "Input signal and Measurement range" T/C and R.T.D are changeable within range of input signal and measurement range. Voltage: min. voltage and max. voltage are available within range of measurement. 　　　　　Scaling available.

2) OUTPUT

① ALARM (HBA OUTPUT)

Relay contact output	Contact capacity: 240VAC 1A, 30V DC 1A(resistive load) Contact: 1a Output points: Refer to "Terminal Arrangement"
Heater break alarm	Point: 1 point (NX2, NX3, NX4, NX7, NX9) Current measurement range: AC 1~50A (resolution: 0.5A, ±5% ±1digit of F.S) Alarm output: Selectable in Alarm types Deadband : 0~100% of max. range • HBA is available when On/Off control or proportional output 　(but, when current output or cooling control, HBA is not available) • Break detection is not possible in 0.2 sec. when output on.

② RETRANSMISSION OUTPUT

Current output	Current output range: 4~20mA DC Resistive load: 600Ω max. Accuracy: ±0.5% of max. scale (4~20mA range) Resolution: Approx. 3,000 Output ripple: 0.3% (P-P) max. of scale (150Hz) Sampling: 250mS

③ CONTROL OUTPUT

Relay contact output	Contact capacity: 240VAC 3A, 30VDC 3A (resistive load)
	Contact: 1C
	Output operation: P.I.D control, ON/OFF
	Proportional cycle: 1~1,000 sec.
	Output limit: 0.0~100.0% range, higher limit(OH) or lower limit(OL) selectable (valid when AT)
	ON/OFF hysteresis: 0~100%(Full scale)
	Time resolution: 0.1% or 10mS
SSR drive voltage output	ON voltage:24VDC min.(resistive load 600Ω min., 30mA limit when short)
	OFF voltage: 0.1VDC max.
	Proportional cycle: 1~1,000 sec.
	Output operation: P.I.D control
	Output limit: 0.0~100.0% range, higher limit(OH) or lower limit(OL) selectable (valid when AT)
	Time resolution: 0.1% or 10mS
Current output	Current output range: 4~20mA DC
	Resistive load: 600Ω max.
	Accuracy: ±0.5% of full scale (4~20mA range), Resolution: Approx. 3,000
	Output ripple: 0.3%(P-P) of max. scale (150Hz)
	Sampling time: 250mS
	Output operation: P.I.D control
	Output limit: -5.0~105.0% range, higher limit(OH) or lower limit(OL) selectable (valid when AT)

3) FUNCTION

Measurement input	Input correction (Bias): -100.0~100.0% for instrument range
	Scaling : According to SH, SL of measurement range
	Filter : OFF, 1~120 sec.
Control	3 settings (SV1, SV2 and SV3) and P.I.D setting each
	Auto tuning : According to set value (Standard type, Low PV type)
	Proportional Band : 0.1~999.9% (Max. range), 0.0~999.9% (When heating·cooling control)
	Integral Time : OFF, 1~6000 sec.
	Derivative Time : OFF, 1~6000 sec.
	ON/OFF control: By selecting output code (OT) " 0 "
	P.I.D selection : Zone PID/Segment PID selectable
	Manual Reset : -5.0~105.0% of output (valid when I=OFF)
	Direct / Reverse action : Changeable by parameter
	Preset output limit : -5.0~105.0% of output value, 0.0~105.0% when heating, cooling control
	ON/OFF hysteresis (HYS): 0.0~100.0% of instrument range (valid when ON/OFF control)
	Heating-Cooling hysteresis : -100.0~50.0% of output value
	A.R.W(Anti Reset Wind-up): AUTO, 50.0~200.0%
	Fuzzy : selection ON/OFF by parameter
Retransmission output	Signal : Process value(PV), Set value(SV), Output value(MV)
	Scaling : PV, SV
Alarm output	Set point : Refer to terminal arrangement
	Multi-alarm : High/Low process alarm, High/Low deviation alarm, Hold function of alarm, Heater break alarm (H.B.A)
	Setting range : Process alarm ······ 0~100% of instrument range Deviation alarm ······ -100~100% of instrument range
	Alarm hysteresis : 0.0~100.0% of instrument range

4) OPERATING ENVIRONMENT

Installation environment	Continuous vibration (5~14Hz): Forward width 1.2mm max. (4~150Hz): 4.9㎨ (0.5G) max. Vibration : 14.7㎨ (1.5G), 15 sec. max. (each 3 direction) Shock : 147㎨ (15G), 11msec max. (6 direction each 3 times) Panel cutout: Page 11, 12
Normal operation condition	Ambient temperature : 0~50℃ Ambient humidity : 20~90%RH (no condensation) Influence of magnetic : 400AT/m max. Warm-up time: 30 min. min.
Influence of ambient temperature	T/C, Voltage input : ±1μV/℃ or ±0.01%/℃ of max. range R.T.D input : ±0.05Ω/℃ max. Analog output : ±0.05%/℃ max. (continuous output)

5) STORAGE CONDITION

Storage temperature	-25~70℃
Storage humidity	5~95%RH (no condensation)
Shock	1m max. in packing condition

6) STRUCTURE

MODEL	EXTERNAL DIMENSION	PROTECTION	WEIGHT	MATERIAL
NX1	48(W)×24(H)×100(D)mm		94g	
NX2	48(W)×96(H)×100(D)mm		342g	
NX3	96(W)×48(H)×100(D)mm	IP 65 front facia	340g	Plastic case (ABS)
NX4	48(W)×48(H)×100(D)mm		342g	
NX7	72(W)×72(H)×100(D)mm		344g	
NX9	96(W)×96(H)×100(D)mm		472g	

7) POWER SUPPLY

Power supply	100~240VAC(90~264VAC)	
Frequency	50/60Hz	24V AC・DC(will be available in May,2000)
Power consumption	6.0W max., 10VA max.	
Insulation resistance	Between primary terminal and secondary terminal : DC 500V, 20MΩ min. Between primary terminal and ground : DC 500V, 20MΩ min. Between ground and secondary terminal : DC 500V, 20MΩ min.	
Dielectric strength	Between primary terminal and secondary terminal : 2,300VAC 50/60Hz for 1 min. Between primary terminal and ground : 2,300VAC 50/60Hz for 1 min. Between F・G and secondary terminal : 1,500VAC 50/60Hz for 1 min.	
Power supply for sensor	24VDC 20mA (But, it is not available in retransmission output)	

8) SAFETY AND EMC STANDARDS

Safety standards	IEC1010-1-1990 and EN61010-1-1992; CATⅡ (IEC1010-1); and UL508.
EMC Standards	EN55011 Class A, GroupⅠ, EN61000-3-2, EN61000-3-3 for emission(EMI) and EN50082-2-1995, for immunity(EMS). (The indicator continuously operates within a measuring accuracy of ±20% of the range.

9) INTERFACE

Standard	EIA RS485
Communication address	0~31, 1~99 setting available
Communication method	2 wire half duplex or 4 wire half duplex
Synchronization	Start-stop synchronous mode
Communication sequence	None
Communication distance	1.2Km max.
Communication speed	600, 1200, 2400, 4800, 9600 BPS (Speed is changeable by parameter)
Start bit	1 BIT
Data bit	7 or 8 BIT
Parity bit	None, even numbers, odd numbers
Stop bit	1 or 2 BIT
Communication protocol	PC LINK WITHOUT SUM(0), PC LINK WITH SUM(1)
Response time	Reception treatment time + (Response time × 10mS)

10) INPUT SIGNAL and MEASUREMENT RANGE

Input type (Input signal)		Input code	Range (℃)	Range(℉)	Accuracy	Remarks
Thermocouple (T.C)	K　＊2	1	-200~1370	-300~2500	±0.5% of F.S ±1digit	• F.S is maxium value ~ minimum value of each RANGE. • Digit is minimum value of display ＊1 0~400℃ : ±10% of F.S ±1digit ＊2 0℃ and below : ±1.0% of F.S ±1digit ＊3 -150.0~150.0℃ range : ±1.0% of F.S ±1digit ※ 20 → KPt100 ※ 21 → DPt100
	K　＊2	2	-199.9~999.9	0~2300		
	J　＊2	3	-199.9~999.9	-300~2300		
	E　＊2	4	-199.9~999.9	-300~1800		
	T　＊2	5	-199.9~400.0	-300~750		
	R　＊2	6	0~1700	32~3100		
	B　＊1	7	0~1800	32~3300	±0.5% of F.S ±1digit	
	S	8	0~1700	32~3100		
	L　＊2	9	-199.9~900.0	-300~1300	±0.5% of F.S ±1digit	
	N	10	-200~1300	-300~2400	±1.0% of F.S ±1digit	
	U　＊2	11	-199.9~400.0	-300~750	±0.5% of F.S ±1digit	
	W	12	0~2300	32~4200		
	Platinel II	13	0~1390	32~2500		
R.T.D	KSPt100 ＊3	※ 20	-199.9~500.0	-199.9~999.9	±0.5% of F.S ±1digit	
	Pt100 ＊3	※ 21	-199.9~640.0	-300~1180		
Direct voltage (VDC/mVDC)	1~5V	30	1~5V		±0.5% of F.S ±1digit	
	-10~20mV	32	-10~20mV			
	0~100mV	33	0~100mV			
Direct voltage (mV)	DC 4~20mA	※ 30	※ When using current input, use the resistor 250Ω 0.1% on input terminal.			

1) NX1 (48×24mm)

● Panel cutout
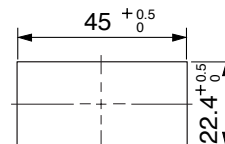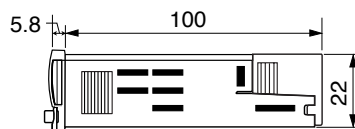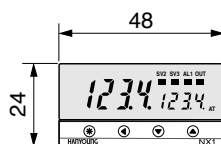
(Unit : mm)

2) NX4 (48×48mm)

● Panel cutout
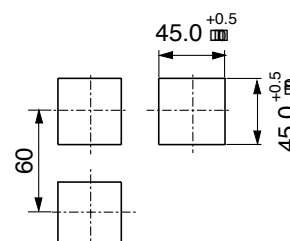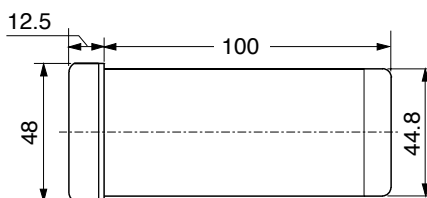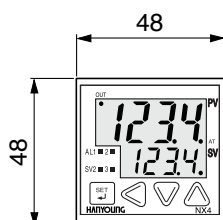
(Unit : mm)

3) NX7 (72×72mm)

● Panel cutout
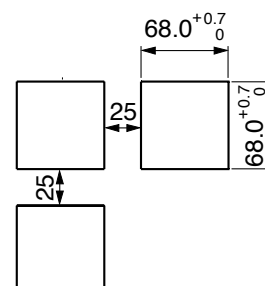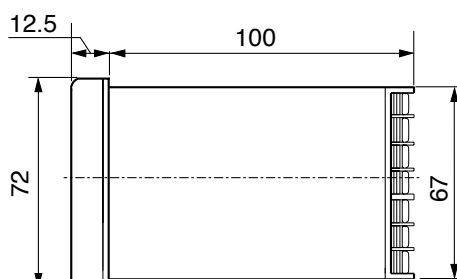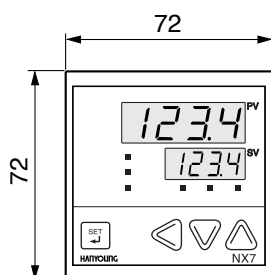
(Unit : mm)
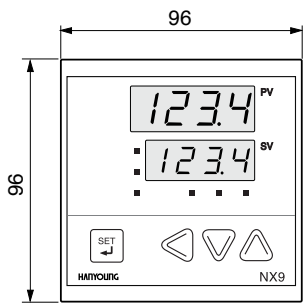
4) NX2 (48×96mm)

● Panel cutout
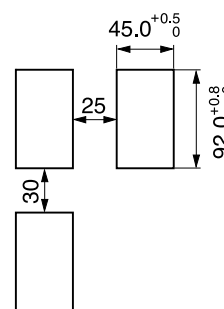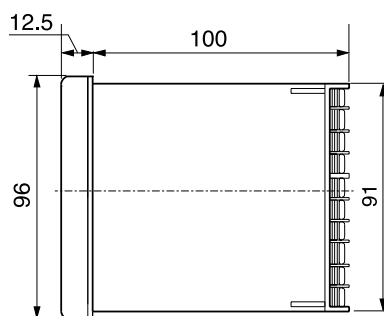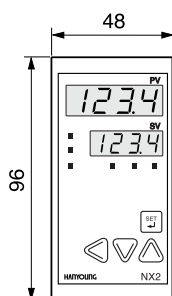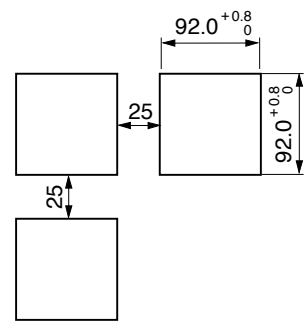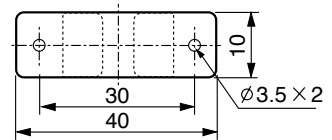

(Unit : mm)

5) NX3 (96×48mm)

● Panel cutout

96

12.5   100

48   48   44.8

92.0 $^{+0.8}_{0}$

30   45.0 $^{+0.5}_{0}$

25
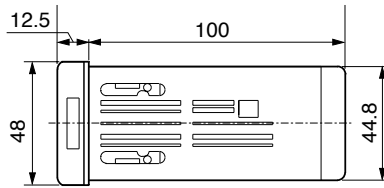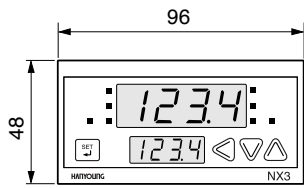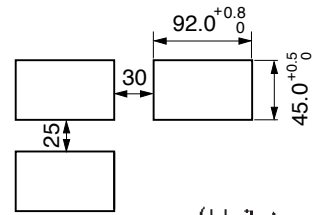
(Unit : mm)

6) NX9 (96×96mm)

● Panel cutout

96

12.5   100

96   96   91

PV
SV
SET
↵   NX9

92.0 $^{+0.8}_{0}$

25   92.0 $^{+0.8}_{0}$

25
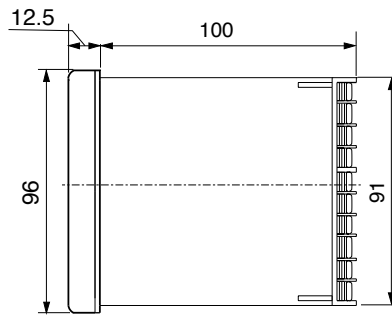
(Unit : mm)

7) CURRENT TRANSFORMER (Model: CTL-6-S)

● Panel cutout

15
l   k
0.5
Ø5.8
U-RD
CTL-6-S
21

2.8
7.0
K   L
25
10.5   3

10
30
40
Ø3.5×2
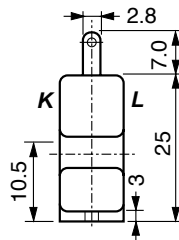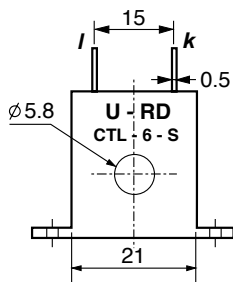
(Unit : mm)

※ Terminal (Model NX2, NX3, NX9)

1) OUT1 (Output 1)	Heating side output when Heating / Cooling type. ● Relay output (terminal no. ① ② ③) ● SSR / SCR output (terminal no. ④ ⑤) But, If you do not use SSR / SCR output as output 1, you could use it as retransmission output (4~20mA DC)
2) OUT2 (Output 2)	Cooling side output when Heating / Cooling type. ● Relay output (terminal no. ⑬ ⑭) ● SSR / SCR output (terminal no. ⑥ ⑦) ● RET (Retransmission output ⑥ ⑦) when SSR/SCR is not using.
3) SV2 / SV3	Terminals for SV2 or SV3 ⑮ - ⑰ : SV2 , ⑯ - ⑰ : SV3
4) POWER SUPPLY	100 - 240 VAC 50/60Hz
5) Input sensor (signal)	Thermo couple : ⑲ → + , ⑳ → − R.T.D : ⑱ → A , ⑲ ⑳ → B
6) AL1 / AL2 (Alarm output 1 / Alarm Output 2)	When you do not use output 2 as control output , you could use it as alarm 2.

1) NX1 (48×24mm)

POWER :
100 - 240VAC 50 / 60 Hz
CONTACT RATE : OUT1
1 A 240 VAC
(RESISTIVE LOAD)
CURRENT OUT1 :
4 - 20 mA DC
(Resistive load 600 Ω max.)
SOLID OUT : 24VDC
(Resistive load 600 Ω min.)

Black : SG
Red : Ry/TX —
White : RX/TX +
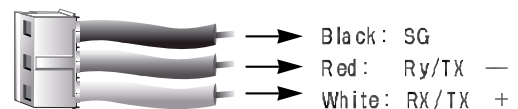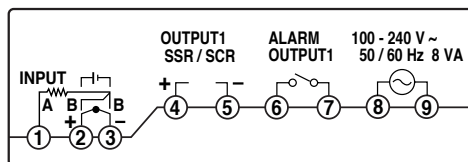
2) NX2 (48×96mm)

POWER :
100 - 240 VAC 50 / 60 Hz 6 W
CONTACT RATE : OUT1
3 A 240 VAC
(Resistive load)
AL1.2 : 1 A 240 VAC
CURRENT OUT 1.2 : 4-20 mADC
(Resistive load 600 Ω max.)
SOLID OUT 1.2 : 24 VDC
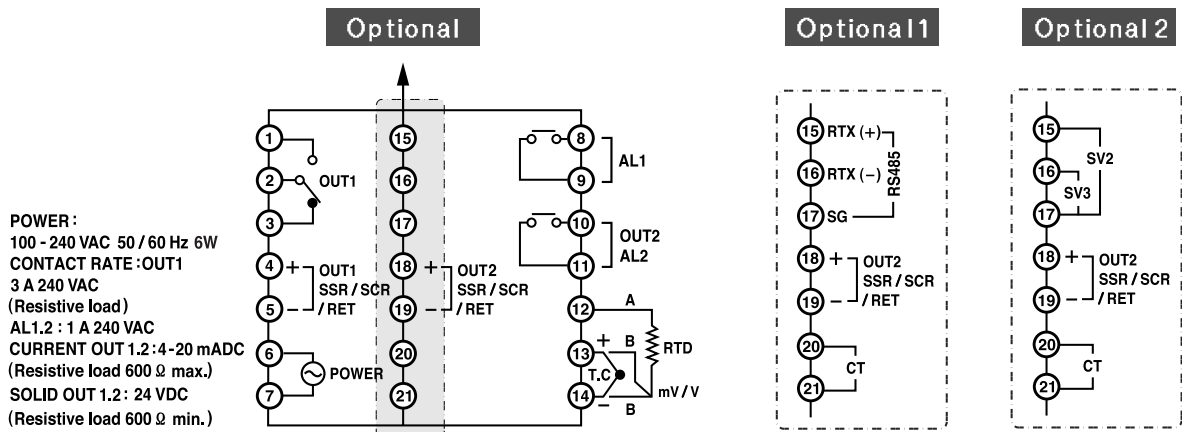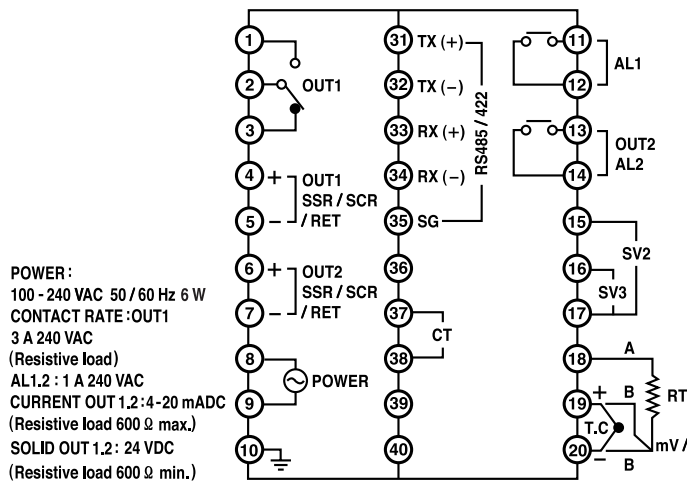(Resistive load 600 Ω min.)
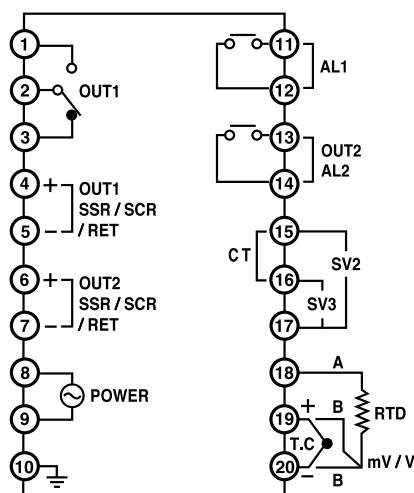
3) NX3 (96×48mm)

POWER :
100 - 240 VAC 50 / 60 Hz 6 W
CONTACT RATE : OUT1
3 A 240 VAC
(Resistive load)
AL1.2 : 1 A 240 VAC
CURRENT OUT 1.2 : 4-20 mADC
(Resistive load 600 Ω max.)
SOLID OUT 1.2 : 24 VDC
(Resistive load 600 Ω min.)

4) NX 4 (48×48mm)

Optional

POWER :
100 - 240 VAC 50 / 60 Hz 6 W
CONTACT RATE : OUT1
3 A 240 VAC
(Resistive load)
AL1.2 : 1 A 240 VAC
CURRENT OUT 1.2 : 4-20 mADC
(Resistive load 600 Ω max.)
SOLID OUT 1.2 : 24 VDC
(Resistive load 600 Ω min.)

Optional1 **Optional2** **Optional3**
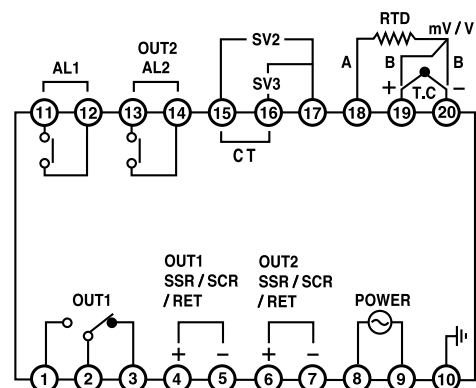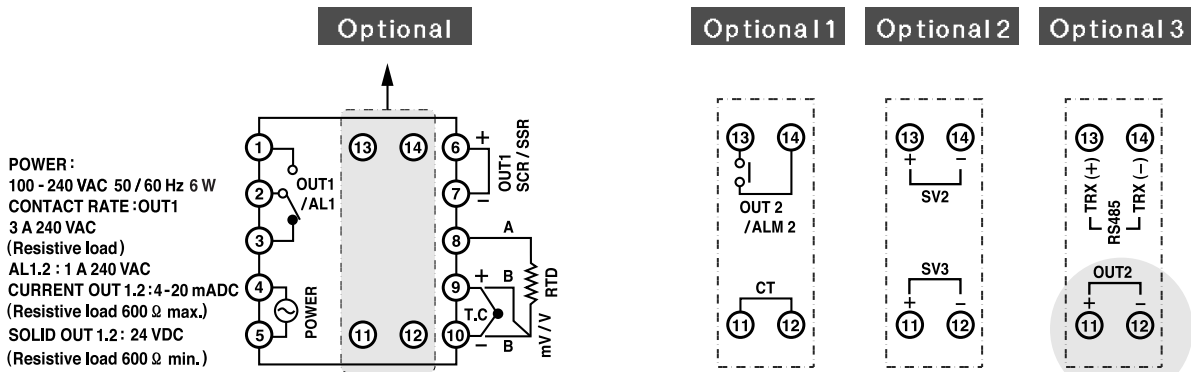
(Note)
Output 2 :
RET / SSR / SCR

5) NX 7 (72×72mm)

Optional

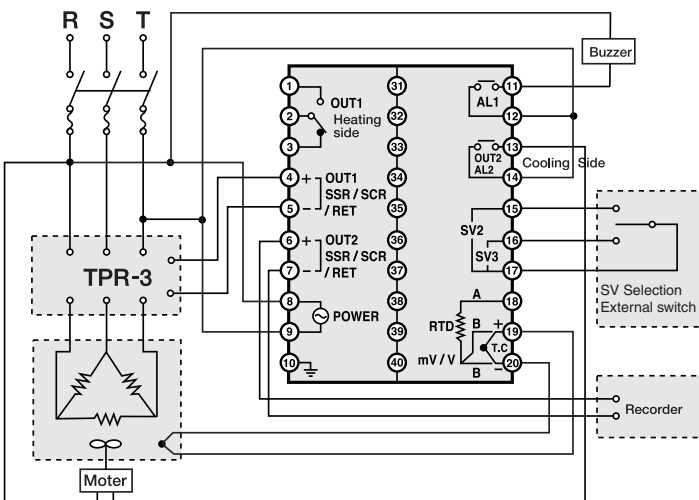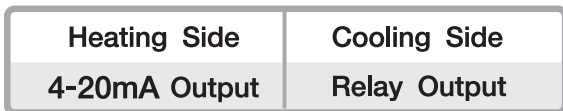POWER :
100 - 240 VAC 50 / 60 Hz 6 W
CONTACT RATE : OUT1
3 A 240 VAC
(Resistive load)
AL1.2 : 1 A 240 VAC
CURRENT OUT 1.2 : 4-20 mADC
(Resistive load 600 Ω max.)
SOLID OUT 1.2 : 24 VDC
(Resistive load 600 Ω min.)

Optional1 **Optional2**

6) NX 9 (96×96mm)

POWER :
100 - 240 VAC 50 / 60 Hz 6 W
CONTACT RATE : OUT1
3 A 240 VAC
(Resistive load)
AL1.2 : 1 A 240 VAC
CURRENT OUT 1.2 : 4-20 mADC
(Resistive load 600 Ω max.)
SOLID OUT 1.2 : 24 VDC
(Resistive load 600 Ω min.)

※Model: NX9

Heating・Cooling Type

Heating Side	Cooling Side
Relay Output	Relay Output

Heating Side	Cooling Side
SSR Output	Relay Output

Heating Side	Cooling Side
4-20mA Output	Relay Output

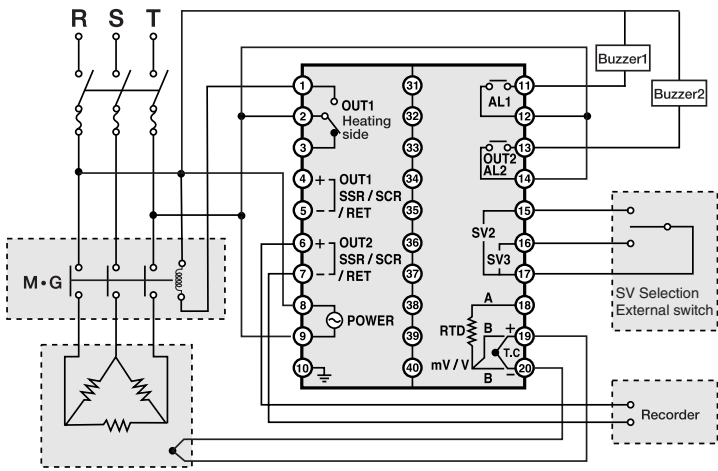| Heating Side	Cooling Side
4-20mA Output	Relay Output
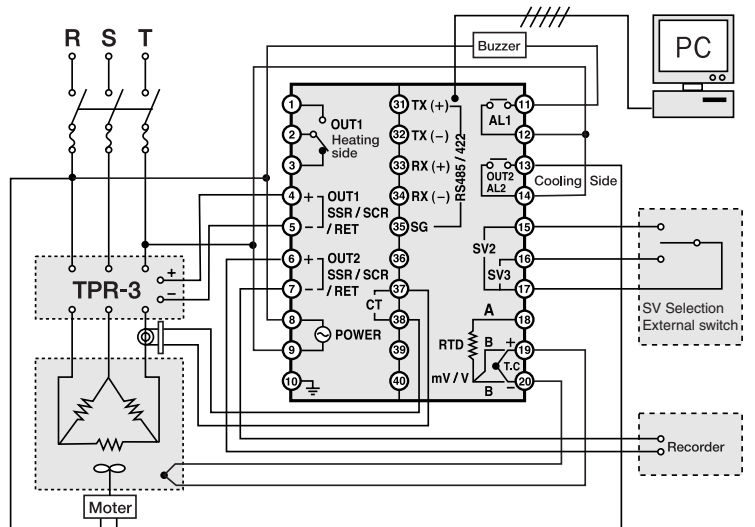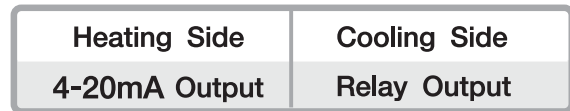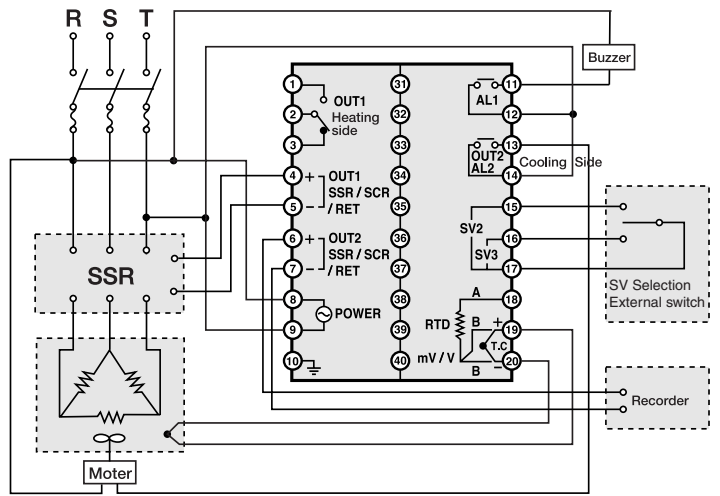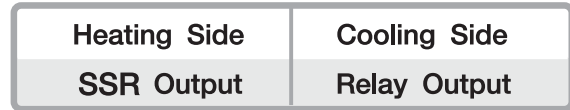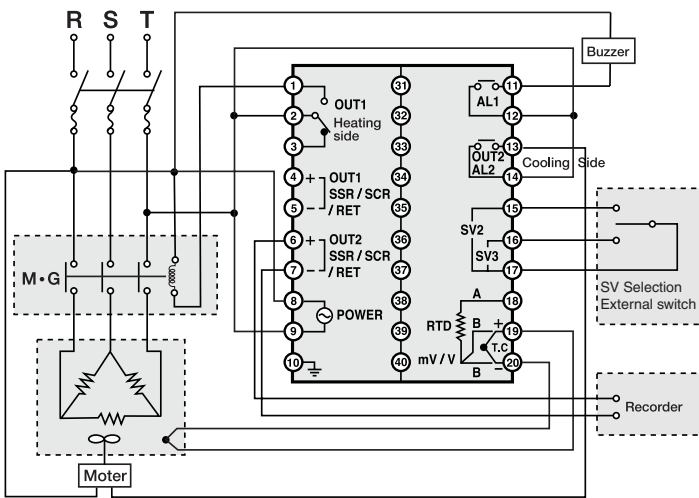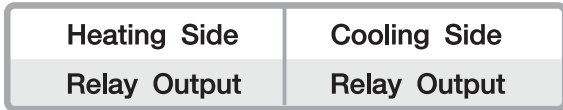
※ Optional: Communication + Heater break alarm

Universal Type

Heating Side
Relay Output
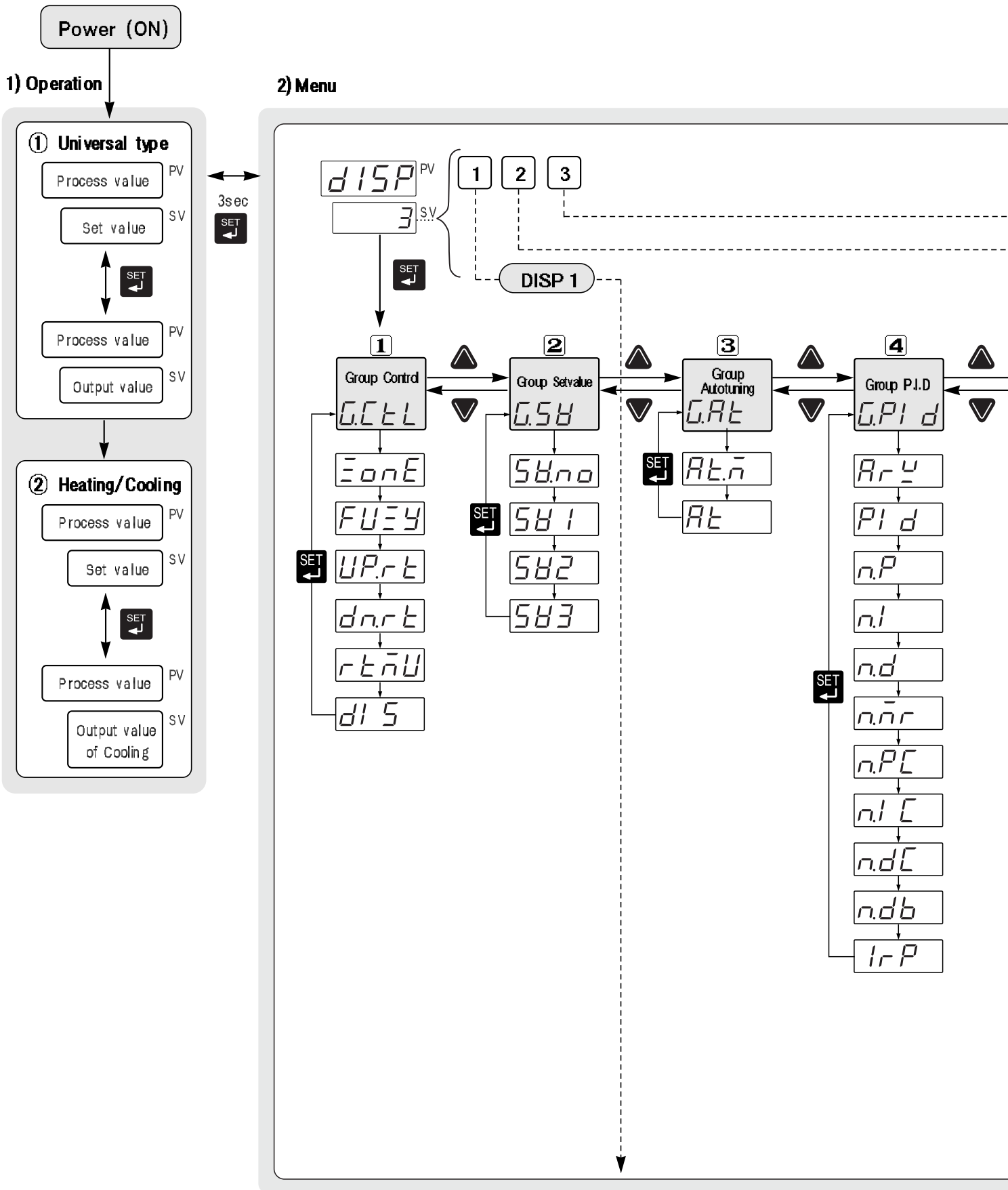

Heating Side
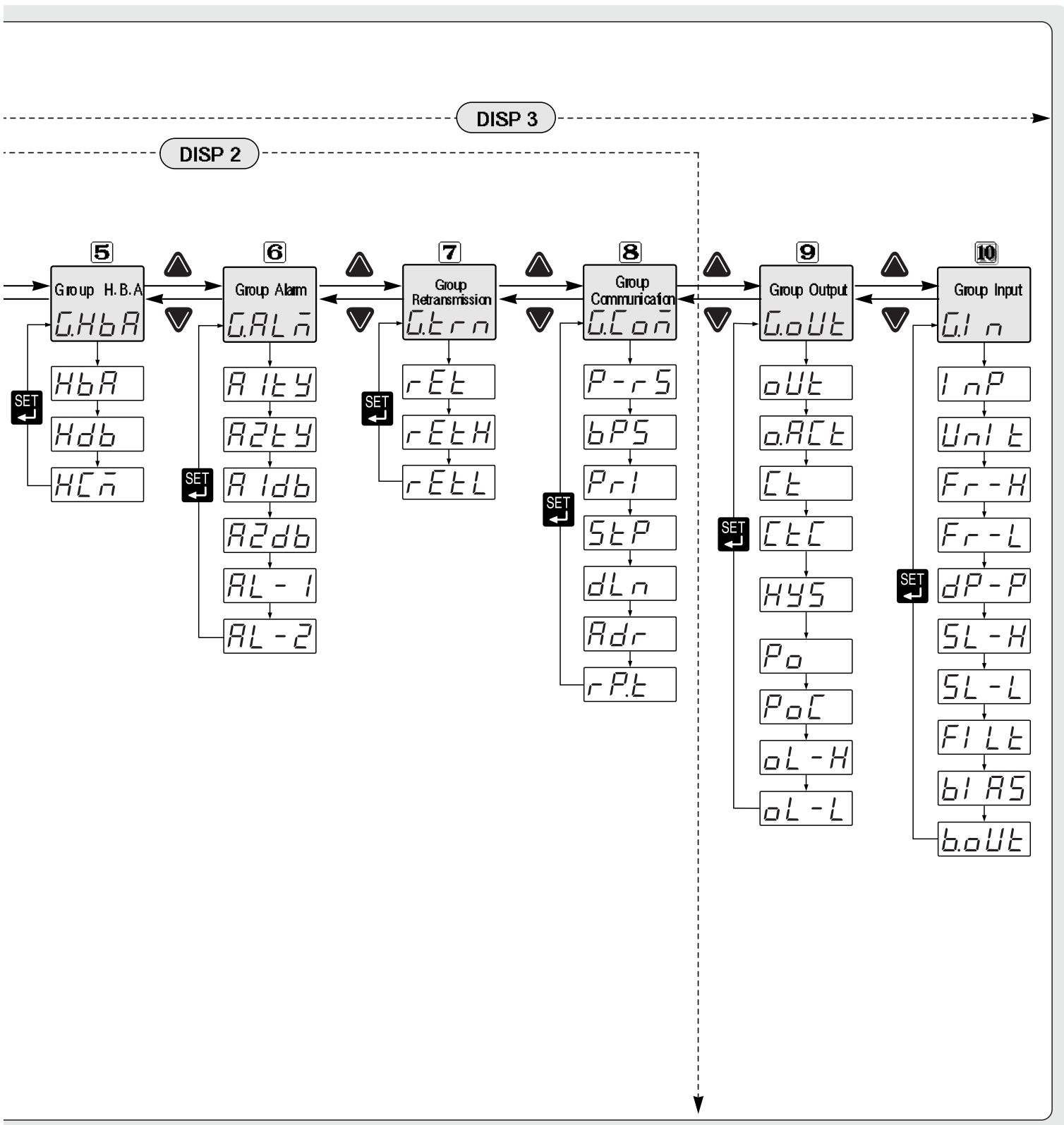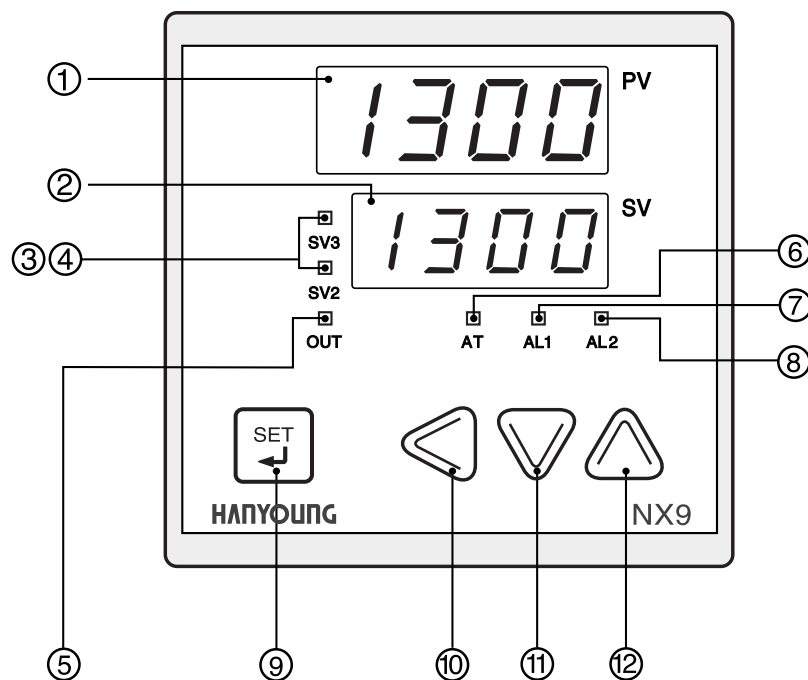### SSR Output
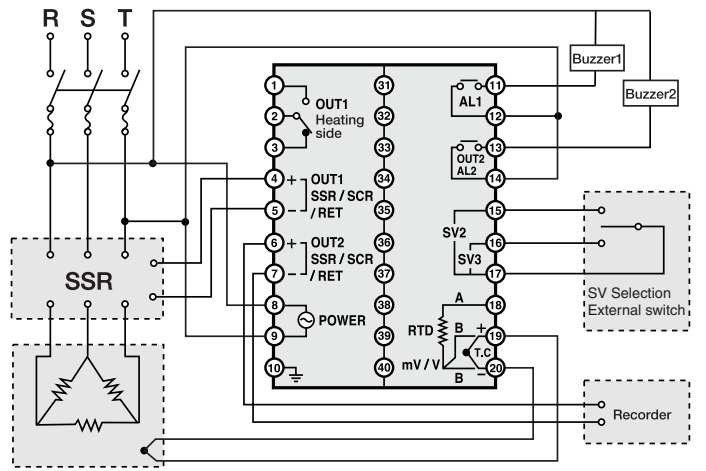
Heating Side
4-20mA Output
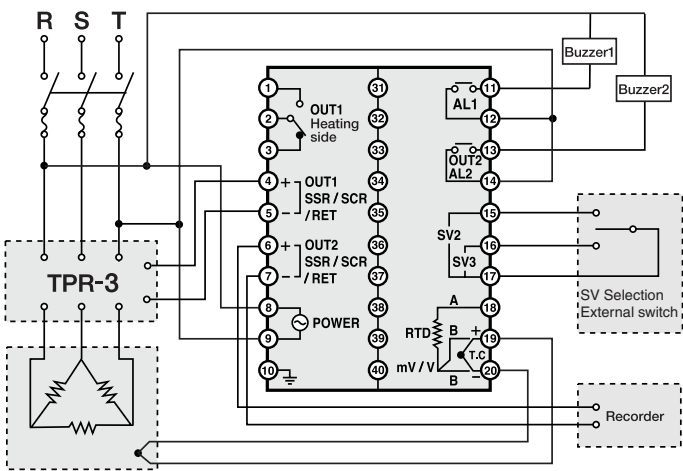
Heating Side
4-20mA Output

※ Optional: Communication + Heater break alarm

Power (ON)

1) Operation

① Universal type

| Process value | PV |
| Set value | SV |

⇅ SET ↵

| Process value | PV |
| Output value | SV |

② Heating/Cooling

| Process value | PV |
| Set value | SV |

⇅ SET ↵

| Process value | PV |
| Output value of Cooling | SV |

3sec SET ↵

2) Menu

| dISP | PV |
| 3 | SV |

[1] [2] [3]

SET ↵

DISP 1

① Group Control — G.CtL
- EonE
- FUzY
- UP.rt
- dn.rt
- rtnU
- dIS

SET ↵

② Group Setvalue — G.SU
- SU.no
- SU1
- SU2
- SU3

SET ↵

③ Group Autotuning — G.At
- At.m
- At

SET ↵

④ Group P.I.D — G.PId
- Ar.Y
- PId
- n.P
- n.I
- n.d
- n.mr
- n.PC
- n.IC
- n.dC
- n.db
- Ir.P

SET ↵

5	6	7	8	9	10
Group H.B.A	Group Alarm	Group Retransmission	Group Communication	Group Output	Group Input
$G.HbA$	$G.ALm$	$G.trn$	$G.Con$	$G.oUt$	$GI n$

HbA	$A1tY$	rEt	$P-rS$	oUt	$I nP$
Hdb	$A2tY$	$rEtH$	bPS	$o.ACt$	$Unl t$
HCm	$A1db$	$rEtL$	Prl	Ct	$Fr-H$
	$A2db$		StP	CtC	$Fr-L$
	$AL-1$		dLn	HYS	$dP-P$
	$AL-2$		Adr	Po	$SL-H$
			$rP.t$	PoC	$SL-L$
				$oL-H$	$FI Lt$
				$oL-L$	$bl AS$
					$b.oUt$

20

1) Functional Description

2) Displays

Name of respective parts	Functions
① Process-value (PV)	Displays the process temperature value.
② Set-value (SV)	Displays various set value, message, and parameter.
③④ Set-value display indicator	Lights when the SV2 or SV3 is displayed.
⑤ Output indicator	Lights when the control output is ON.
⑥ Auto tuning indicator	Flickers when the auto tuning operates.
⑦ Alarm 1 indicator	Lights when the alarm 1 Operates.
⑧ Alarm 2 indicator	Lights when the alarm 2 Operates.

3) Control key

Key		Functions
⑨	SET↵	Used to change from the operation mode to the setting mode, to select parameters, and to register set-value. Press this key for 3 sec to display setting mode, set-value, and process value.
⑩	◁	Used to select digit for changing.
⑪	▽	Used to decrease set-values and to select setting mode.
⑫	△	Used to increase set-values and to select setting mode.

● AFTER COMPLETION OF WIRING, APPLY POWER ON

(1) Management version is indicated as ① and then present PV and SV will be indicated as ②.

(2) For setting a level, press [SET] and [<] at a time for 3 sec. to enter $LEHL$ (LEVEL) setting mode. (Level 3 is set at the factory refer to page 19 table of setting items.)

(3) In the ② condition, press [SET] for 3 sec to enter $dISP$ (display) selection mode.
(This mode is limited by level setting mode ④)
(In condition of set value and process value display, press [SET] to indicate an auto output value as ⑥,⑦)

● Display shift

After checking wiring, power ON.

①
```
n939 PV
o 103 SV
```

● **Setting and Display level select**
This controller has 3 different levels of setting, thereby restricting operator access if so desired.
The following describes these levels :
• Level 1 select : Access available to setting and displaying only up Group #3 (Group set value)
• Level 2 select : Access available to setting and displaying only up Group #8 (Group communication)
• Level 3 select : Access available to setting and displaying of all Groups.

⑦ Universal
```
25 PV
o. 30 SV
```

Auto output value display [SET]

②
```
25 PV
300 SV
```

3 Sec [SET] [<]

④
```
LEHL PV
3 SV
```

[SET] 3 Sec

⑥ Heating/Cooling
```
25 PV
H. 30 SV
```
or
```
25 PV
C. 30 SV
```

③ [SET] 3 Sec
```
dISP PV
3 SV
```

[SET]

⑤
```
tESt PV
0 SV
```

Ban the use of this mode because this is special mode.

3sec [SET]

```
C.CtL PV
SV
```

Make display range to be same as level setting range so that not to be shown other display group which is not needed.

Control group setting display.
Press [V] or [<] key to shift to each group.

If press [SET] key in the control group, control mode will be shown.

- Control zone, fuzzy function, and ramp function are available.
- Fuzzy function is operating in the P.I.D control. (not operating in the ON/OFF control)
- Using two external contact input (SV2, SV3) as ON/OFF, it is possible to control 3 kinds setting values.

Signal	Name	Operation	Display condition	Initial Value
C.CtL	Control group display	Set a control mode	—	—
ZonE	Zone selection 1	OFF / ON	Always	OFF
FUZY	Fuzzy function selection	OFF / ON	P.I.D control	OFF
UP.rt	Initial increasing temperature	OFF / EUS (0~100%)	Always	OFF
dn.rt	Initial decreasing temperature	OFF / EUS (0~100%)	Always	OFF
rtnU	Time unit	HOUR / MIN	Always	HOUR
dIS	External contact input selection	OFF / ON (Refer to chart 1)	Always	OFF

1) **Control zone selection ?** This function is useful when controlling wide temperature range.

2) **Fuzzy function ?** When occuring big gap between SV and PV, automatically a set value will be changed to lower subsidary set value to eliminate overshoot.
After elimitating overshoot, the set value will be returned to origin.

3) **Ramp function ?** It is a rate of set value to arrive to initial set value (SV1, SV2, SV3) according to seting temperature and time.

exam.) Present temp. 20℃ , set value 100℃ , 20℃ per min. or hour. (Picture 1)
1) Initial uprising set value (up.rt) : 100℃
2) Unit time : Minute (min.)
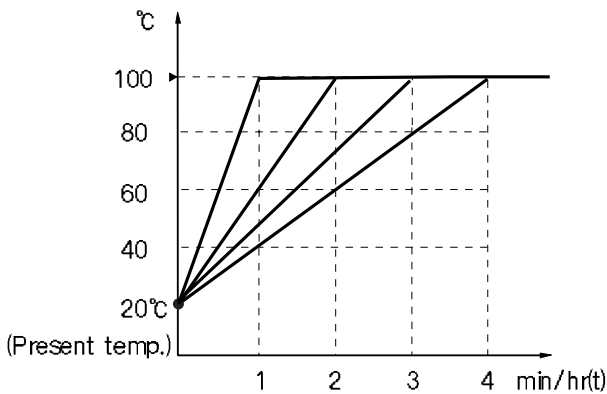
(Picture 1)

DIS selection	Set value selection by external contact signal		
OFF	No external contact signal		
ON	External signal / Display	SV2	SV3
	SV1 display	OFF	OFF
	SV2 display	ON	OFF
	SV3 display	ON	ON

(Chart 1)

● Input type selection

After power ON and when PV is indicating, press ⌘ key for 3 sec to be displayed $dl\ 5P$ at PV and 3 at SV. (If it is not indicated 3, set again in the level setting mode)
① Control group is indicated when press ⌘ key once more. At the time, ⑩ input group is indicated when press ⋁ key and then "Input type and range selection is shown at SV when press ⌘. At this time the input and range is selected by ⋁ or ⌘ key.

⚠ **CAUTION**

When setting, "**Input type selection number**" must be selected in the input type selection mode and also "**Output type selection number**" must be selected in the output type selection mode before moving to other mode.
If not, data of other group will be changed to prior value.

● Display unit (℃ / ℉)

After selecting input type and range, press ⌘ key to select display unit. Press ⋀ key to choose ℃ or ℉ and press ⌘ key when finishing selection.

● Maximum and Minimum range

After selecting display unit, press ⌘ key to set Maximum and Minimum range using ⋖ or ⋁ or ⋀ key. Press ⌘ key once more to finish.

● Decimal point

Parameter is not indicated in T.C and R.T.D input, but when selecting voltage input (code 30,32,33), "Decimal point" mode is indicated. (set 1 : 0.0, set 2 : 0.00, set 3 : 0.000)

● Maximum and Minimum on scale

It is the same function as Maximum and Minimum Range setting when R.T.D or thermocouple input This mode is indicated when voltage input (30, 32, 33)

● PV filter

When PV value becomes unstable due to effects of noise, the filter helps suppress the unstable status. (Range: OFF or 1~120sec. initial value: OFF)

● PV bias

Use this function to adjust PV value in cases where it is necessary for PV value to agree with another recorder or indicator, or when the sensor cannot be mounted in correct location.
(Range : -100.0~100.0% of SPAN, Initial value : 0.0%)
Setting a value using ⋖ or ⋁ or ⋀ key and press ⌘ key to finish.

Signal	Name	Description	Condition	Initial value
G.I n	Input group	Input type and mode selection	—	—
I nP	Input signal selection	Refer to input signal and range	Always	Selection NO.1
Uni t	Measurement range unit	℃ / ℉	Thermocouple or R.T.D	℃
Fr - H	High limit	Refer to input signal and range	Always	1370
Fr - L	Low limit	(Notice : FR-H > FR-L)	Always	-200
dP - P	Decimal point(on voltage input)	Thermocouple or R.T.D : decimal point of instrument / DC Voltage : 0~3	On voltage input (mV,V)	1
SL - H	Maximum on scale (on voltage input)	-1999~9999 Notice : SL-H > SL-L Deimal point : according to DP-P	On voltage input (mV,V)	100.0
SL - L	Minimum on scale (on voltage input)			0.0
FI L t	PV filter	OFF/1~120 sec	Always	OFF
bI AS	PV bias	EUS (-100.0~100.0%)	Always	EUS(0.0%)
b.oU t	Bum-out	OFF / UP / DOWN	Always	UP

SET

This Digital temperature controller is divided into 2 type: UNIVERSAL TYPE AND HEATING / COOLING TYPE Output is selectable from Relay, SSR and Current (4~20mA DC)
Output type range (output code) is ⓪~③ for universal type and ④~⑫ for Heating /Cooling type. Sometimes retransmission output and alarm output are not available according to control output (EX. when you choose output code (OT) 2, it is current output of Universal type. In this case, retransmission output and alarm output are available. But, In Heating / Cooling control type with SSR on Heating side and Relay output on Cooling side (output code ⑩), the retransmission output is avalable but alarm output 2 is not available.

⚠ CAUTION
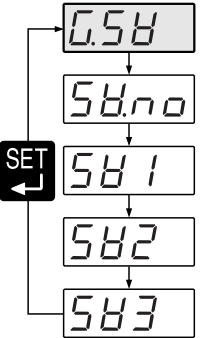
When setting, "Input type selection number" must be selected in the input type selection mode and also "Output type selection number" must be selected in the output type selection mode before moving to other mode.
If not, data of other group will be changed to prior value.

Signal	Name	Description	Conditi	Initial value
`G.oUt` Output group	Output group	Output type and mode selection	—	—
`oUt` Output signal	Output signal	Refor to type of control output	Always	(0 / 3)
`o.ACt` Output operation	Output operation	REV: Reverse DIR: Direct action	Output code 1~3	REV
`Ct` Cycle time	Cycle time	1~1000 sec	Relay / SSR	30 sec
`CtC` Cycle time of cooling output	Cycle time of cooling output	1~1000 sec	Output code 4~12	30 sec
`HYS`	Hysteresis of universal type	EUS(0.0~100.0%)	ON/OFF Control	EUS(0.5%)
	Hysterecis of Heating/Cooling type	0.0~10.0%	Heating/Cooling	0.5%
`Po`	Output volume when input disconnection Output 1 (Out1)	Universal : -5.0~105.0% Heating / Cooling : 0.0~105.0%	Always	0.0%
`PoC`	Output volume when input disconnection Output 2 (Out2)	0.0~105.0%	Heating / Cooling	0.0%
`oL-H`	Maximum value of output	Universal : OL-L + 1Digit~ 105.0% Heating / Cooling : 0.0~ 105.0%	PID Control	100.0%
`oL-L`	Minimum value of output	Universal : -0.5%~ OL-H-1Digit	PID Control	0.0 %
		Heating / Cooling : 0.0~ 105.0%		100.0%

14 SET VALUE GROUP SETTING

In this setting group, 3 type of set value are set as SV1. SV2 and SV3. After setting set value, selet each set value from external contact signal to control.

Signal	Name	Description	Condition	Initial value
$\overline{L.5H}$	Set value group	Set value setting	—	—
$5H.no$	Select number of set value	1~3(Display and control a set value which is selected in 3 types.)		1
SET $5H\ I$	Set SV 1	✳ EU(0.0~100.0%)	Always	EU(0.0%)
$5H2$	Set SV 2	EU(0.0~100.0%)		EU(0.0%)
$5H3$	Set SV 3	EU(0.0~100.0%)		EU(0.0%)

✳ EU : Value at an engineering unit in compliance with the range of an instrument.
✳ : It is not available in NX1.
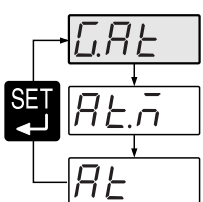
15 AUTO TUNING

This Digital temperature controller has two types of auto-tuning as STD (Standard type) and LOW(Low PV type : SV - 10%. Low PV type is the value 10% lower than the set value. Use this type where overshoot is to be suppressed.

※Auto-tuning: The Auto-tuning function automatically measures, computes and set the optimum P.I.D and ARW constants. The Auto-tuning function can be activated at any time during the process after power ON : while temperature is rising or when control has stabillzed.
Auto tuning is not operated when selecting "OFF" in selection mode of auto tuning start and when selecting 1 ~ 3, among 3 kinds set valu (SV1, SV2, SV3) selecting number will be auto tuned "Auto" mode will be operated when ZONE is ON. When setting a value on 1.rp 2.rp, it is separated in group 1, 2, 3.
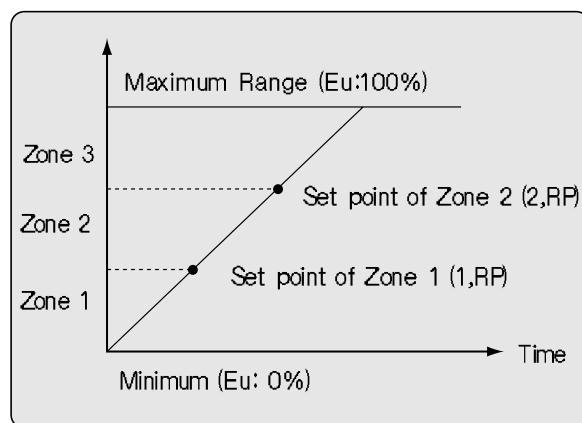
Signal	Name	Description	Condition	Initial value
$\overline{L.HL}$	Auto tuning group	Indicates Auto tuning	—	—
SET $HL.n$	Auto tuning type	Standard (STD) : $5Ld$ / Low PV (LOW) : Lo^{U}	ABS	STD
HL	Auto tuning start	OFF / 1~3 / $HULo$ (AUTO)	ABS	OFF
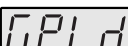
When checking P.I.D. values or setting SV in manual mode, this can be done in P.I.D. Group.
Press [⏎] key to get Anti Reset Wind value by auto or manual and then press [SET] once more to be indicated P.I.D mode which is selectable 3 types of P.I.D group (0~3). Example, "0" is no P.I.D mode and after seleting "1" using [∧] or [∨] and pressing [⏎] , it is available to change P.I.D value in zone "1". ("2"and "3"are same as "1")
When integral time is 0, manual reset mode is indicated and then you could set reset value to remove off set. (range: -5%~105.0% of proportional band). You could set 3 zones by selecting zone mode ON.

※ In diagram, "n" is available to set 1~3 and proportional band of cooling side, integral time of cooling side, hysteresis are indicated in Heating / Cooling type.
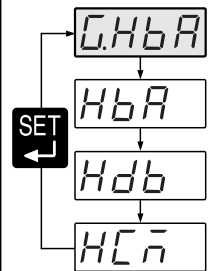

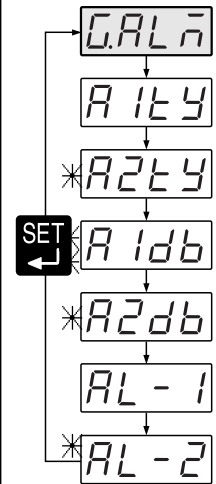| Signal	Name	Description	Condition	Initial value
`G.PI d`	P.I.D group	Set P.I.D mode	—	—
`Ar Y`	Anti Reset Wind-Up	Auto / 50.0~200.0%	P.I.D control	Auto
`PI d`	P.I.D group selection	0 / 1~3	Always	0
`n.P`	n. Proportional band(P)	0.1 (H/C TYPE:0.0)~999.9%	P.I.D group	5.0%
`n.I`	n. Integal time (I)	OFF / 1~6000 sec.	Always	240 sec.
`n.d`	n. Derivative time (D)	OFF / 1~6000sec.	Always	60 sec.
`n.n r`	n. Manual reset	-5.0~105.0%	Integral time: OFF	50.0%
`n.PC`	n. Proportional band of cooling side (P)	0.0(ON/OFF제어) / 0.1~999.9	Heating • Cooling type	5.0%
`n.I C`	n. Integral time of cooling side (I)	OFF / 1~6000 sec.	Heating • Cooling type	240 sec.
`n.dC`	n. Derivative time of cooling side (D)	OFF / 1~6000 sec.	Heating • Cooling type	60 sec.
`n.db`	n. Hysteresis	-100.0~50.0%	Heating • Cooling type	3.0%
`Ir P`	n. Zone point	EU (0) < 1.RP < 2.RP < EU (100.0%)	ZONE = ON	EU(100.0%)

17　HEATER BREAK ALARM GROUP

Heater break alarm group consist of output dead band and current detection display mode and detects 2 spots.
(to be ordered seperately: current transformer mode CTL-6-S, Measuring range: 1~50A)

Signal	Name	Description	Codition	Initial value
`G.HbA`	Heater break alarm group	Set HBA mode	—	—
`HbA`	Current setting mode of HBA	OFF / 1~50A	Optional	OFF
`Hdb`	Hysteresis setting mode HBA	EUS (0.0~100.0%)		EUS(0.5%)
`HCm`	Current measurement value of HBA	Only display (0~50A)		

18　ALARM GROUP SETTING

There are 2 alarm outputs available per conrtoller. In Alarm Group, setting are made for mode, dead band and value of each alarm. Refer to the next page for the 22 different types of alarm functions. In Heating・Cooling type of, ✳ is not indicated when selecting 10,11,12 (Refer to page 21.)

Signal	Name	Description	Condition	Initial value
`G.ALm`	Alarm group	Set alarm mode	—	—
`A1tY`	Type of Alarm 1	OFF / 1~22 Refer to "**Alarm type and code**"	Always	1
`A2tY`	Type of Alarm 2			2
`A1db`	Dead band of Alarm 1	EUS (0.0~100.0%)	Always	EUS(0.5%)
`A2db`	Dead band of Alarm 2			
`AL-1`	Set value of Alarm 1	PV alarm, Deviation alarm EU (-100.0~100.0%)	Always	EU(100.0%) EU(0.0%)
`AL-2`	Set value of Alarm 2			

※ Reference : Display lamp will be OFF when output ON in inverted type.

(Notice) : Display lamp will be ON when output OFF in inverted type.

Hysteresis ▭▭ (△ : Set point , -▲ : Minus Alarm set point , ▲ : Alarm set point)

Code NO.	Alarm type	Function
1	High absolute value	
2	Low absolute value	
3	High deviation value	
4	Low deviation value	
5	High deviation value (inverted)	
6	Low deviation value (inverted)	
7	High · Low deviation value	
8	High · Low band	
9	High absolute (inverted)	
10	Low absolute (inverted)	
11	High absolute with hold function	
12	Low absolute with hold function	
13	High deviation with hold function	
14	Low deviation with hold function	
15	High deviation with hold function (inverted)	
16	Low deviation with hold function (inverted)	
17	High · Low deviation with hold function	
18	High · Low band with hold function	
19	High absolute value with hold function (inverted)	
20	Low absolute value with hold function (inverted)	
21	Heater break alarm 1 (HBA 1)	

In retransmission output mode, process value (PV), set value (SV), output volume (MV) or power supply for sensor will be selected and set maximum value and minmum value of, retransmission output.

※**Reference** : Retransmission group will be indicated when selecting retransmisson in output group. If selecting code 4,5,7 or 8 in output group, retransmisson will not be indicated.

Signal	Name	Description	Condition	Initial value
`G.trn`	Retransmissin group	Set retransmission mode	※Reference	—
`rEt`	Retransmissin type or Power for sensor	PV / SV / Output volume (MV) / Power for sensor (SPS)	Optional	PV
`rEtH`	Hight limit of retransmission	Thermocouple / R.T.D : FR -H ~ FR- L DC voltage : SL -H ~ SL-L but, RET. H > RET.L	PV / SV	
`rEtL`	Low limit of retransmission			

NX series are equipped with 4 wire /2 wire half-duplex the RS485 / RS422 communication interfaces.
Using the interfaces, communications are available with maximum 31 devices.

| Signal	Name	Description	Condition	Initial value
`G.Con`	Communication group	Set communication mode	—	—
`P-rS`	RS 485 / RS 422 Protocol	PC.LINK(Set value:0) / PC.LINK SUM (Set value:1)		0
`bPS`	Communication rate (B.P.S)	600(SV:0) / 1200(SV:1) / 2400(SV:2) 4800(SV:3) / 9600(SV:4)		4
`Pri`	Parity check	NONE(SV:0)/EVEN(SV:1)/ODD(SV:2)		1
`StP`	Stop bit	1bit (SV:1) / 2bit (SV:2)	Optional	1
`dLn`	Data length	7bit (SV:7) / 8bit (SV:8) (Except PC LINK :8)		8
`Adr`	Address	1~99 , maximum 31 devices		1
`rP.t`	Response time	0~10. response time = (handling time + response time) X 10ms		0

1) AUTO TUNING

The Auto tuning function automatically measures, computes and sets the optimum Proportional band(P), Integral time(I), and Deri-vative time(D). When Auto-tuning, the controller performs ON/OFF

control and determine proper P.I and D. (Limit cycle type) NX series controller have two types of Auto-tuning as below.

① Standard type auto-tuning :

This type is based on set point value (SV)

② Low PV type auto-tuning :

This type is based on the value 10% lower than the set point value (SV)

a) STANDARD TYPE AUTO-TUNING
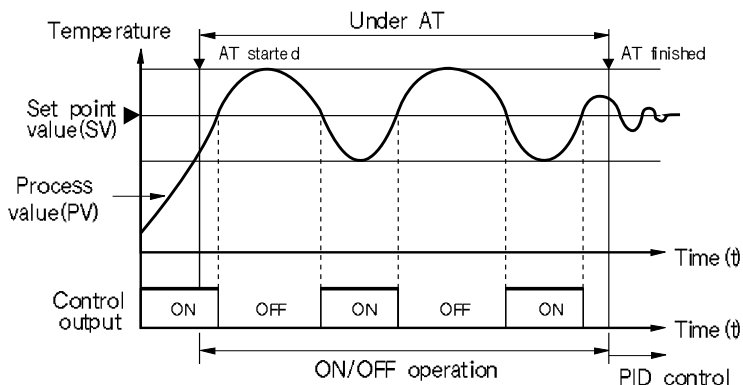

b) LOW PV TYPE AUTO-TUNING
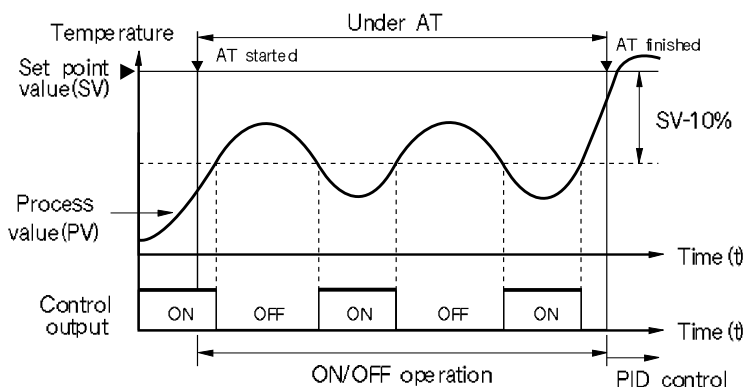
2) Auto-tuning in Zone PID

Zone PID automatically sets PID group in accordance with a measured value. In Zone PID, auto-tuning sets the proper PID value by recognizing a mid-value of reference point as set point value.
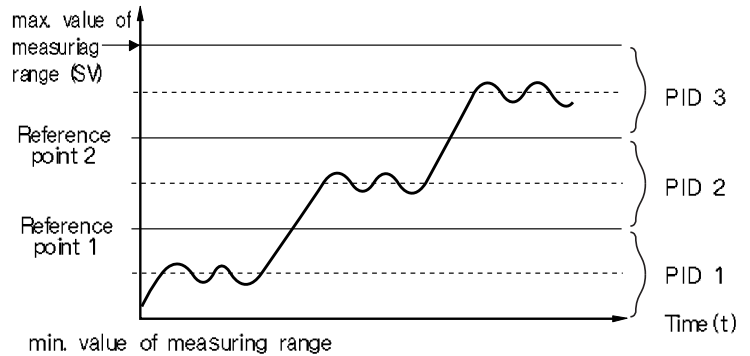

3) EXTERNAL CONTACT INPUT

Optional SV will be selected among SV1, SV2, and SV3 by external contact input.
It will be used as step control.
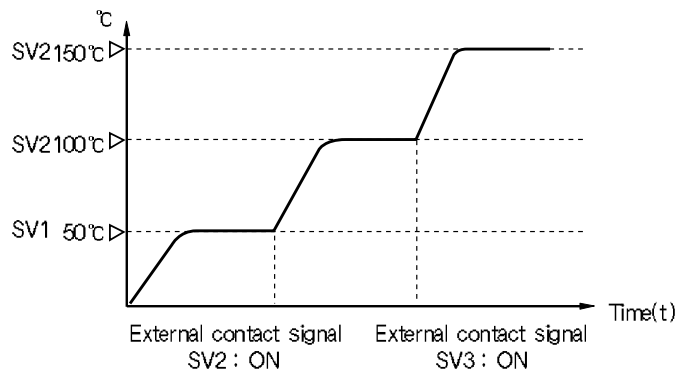
4) FUZZY CONTROL

Fuzzy control eliminates overshoot using Fuzzy Logic. Employing Fuzzy control and Auto-tuning, the controller effectively control as below.

① When the controller starts control at the position which has a big gap between SV and PV.
② When reducing warming up time
③ When the load is fluctuating extreamly
④ When changing a set point value frequently
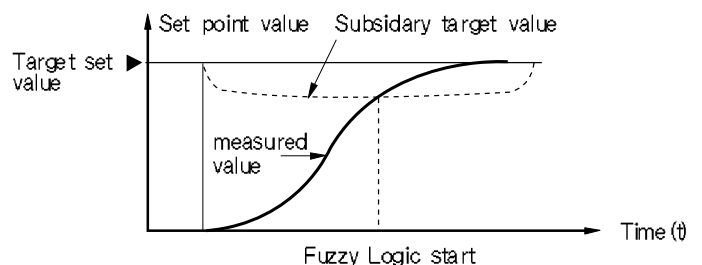
5) OUTPUT LIMIT

Control output is set in high and low limit as operating range. Output limit is -5~105% of output.

< Dead band of " + " SV >

< Dead band of " — " SV >
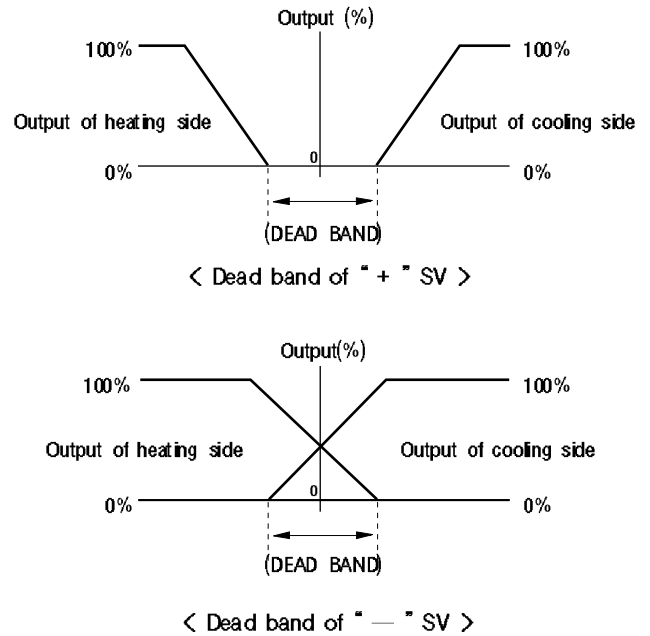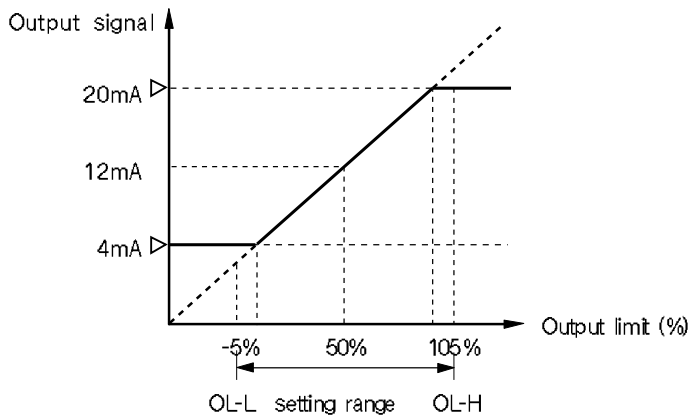
6) HEATER BREAK ALARM (HBA)

Set-value of HBA to be set about 85% to input of CT but the set-value should be less in case that the ratio of voltage variation is high. HBA detects an heater disconnection and makes an alarm operation.

① Using current transformer (CT) designated by HANYOUNG.
② Set using voltage and set-value of HBA by front keys.
③ Phase angle control type by thyristor could not use. (SCR Output)

7) HEATING / COOLING CONTROL

Heating / Cooling control output two signal devided for heating and cooling. It is available to output PID control or ON / OFF control in heating side and cooling side each, also could select a output among relay, SSR, or current output (4~20mA).

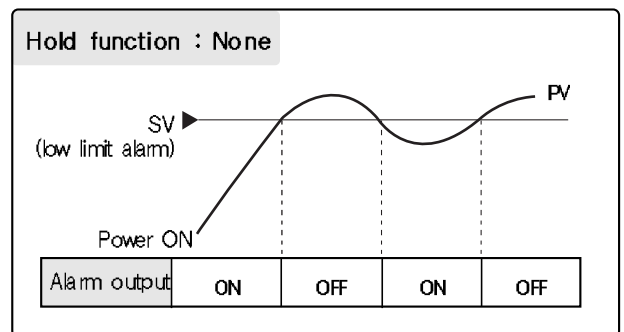When heating and cooling side are ON / OFF control, hysteresis will be shown as below.
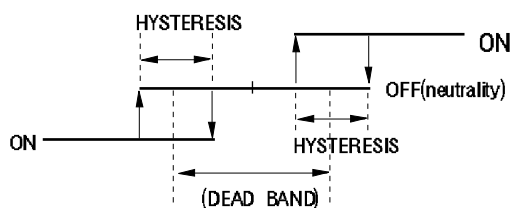
When heating and cooling side are PID control, hysteresis will be shown as below.
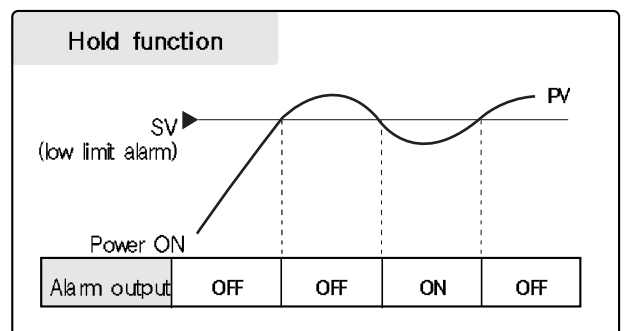
8) Emergency output

When A/D error or input disconnection occur in auto mode, PID output is cut and than Pre-set output is operated. (PO Output)

9) Hold function

Without hold function, Low limit alarm will be ON when increasing temperature. (Picture 1)
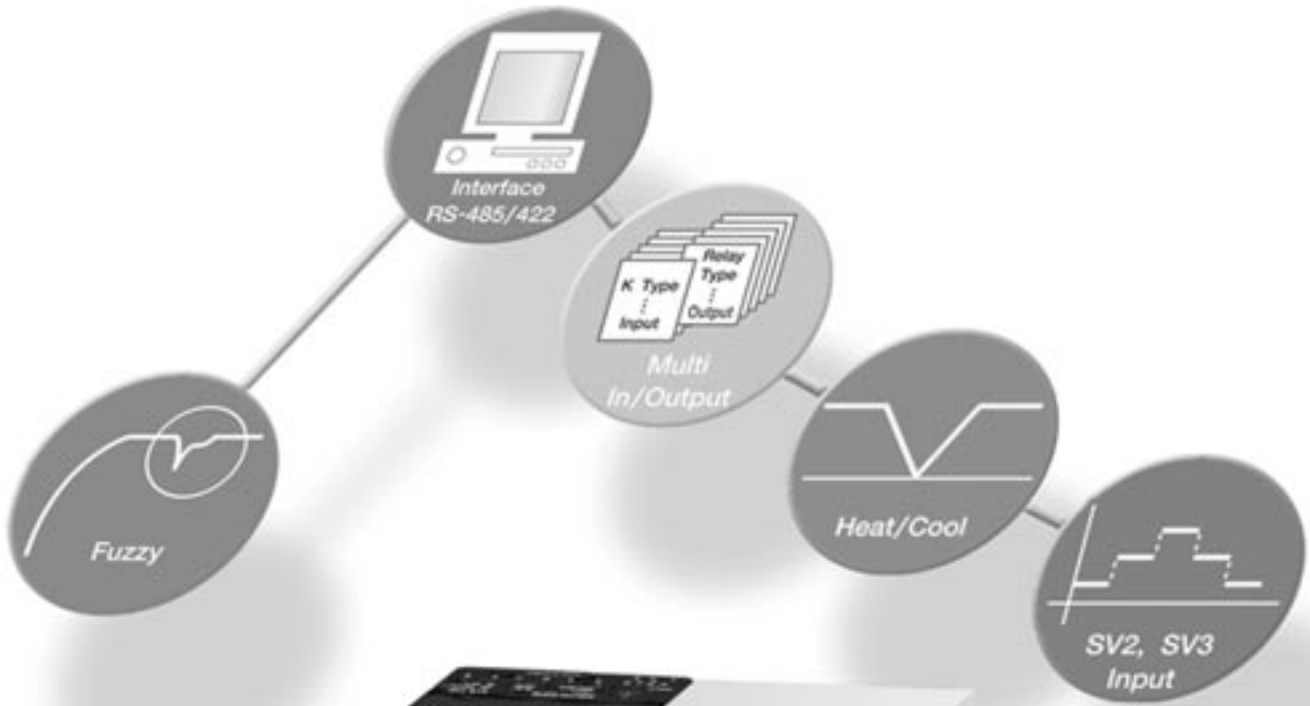

(Picture 1)

(Picture 2)

MEMO

Fuzzy

Small
Temperature Controller

Interface
RS-485/422

Multi
In/Output

K. Type
Input

Relay
Type
Output

Heat/Cool

SV2, SV3
Input

Fuzzy

HANYOUNG
ELECTRONIC CO., LTD.

High Accuracy: ± 0.1%

Fuzzy

Auto-Tuning PID

TEMPERATURE CONTROLLER

Fuzzy

TEMPERATURE CONTROLLER

Program

PV

U1
U2
U3
U4
U5   PRG
U6   RST
U7   FIX
U8   HLD
U9   OUT
U10   MAN/AT

1370.0

P01
S03
01

HANYOUNG NP200

| RUN/HOLD | RST | STEP | ▼ PTN ▲ |
| SET | FIX | DISP | ▼ ▲ |

HANYOUNG
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HANYOUNG

VERSION 2.1