SM-960NX User's Manual

1 Caution

Warning

This product is not manufactured as a safety device. Seperate safety device should be attached before using it, if you want to use it with the equipment that may cause loss of lives, property damage or cirtical damage on peripheral equipment.

Danger

▶ Electrical Shock : Please do not touch AC terminal during applying electic current.

▶ Make sure input power switch off when checking input power.

Caution

1. Do not use except the way that the manufacture indicates.
2. Prevent dust, water, grease and wiring dregs from coming into the product.
3. Check the load capacity and on-off times because the life cycle of relay shows difference depending on them.
   - Mecanical lifetime : Min 300,000 times
   - Electrical lifetime : Min 100,000 times at AC250VAC, 2A load
4. Seperate the product's wires from high-voltage wire, power cable and motor cable to avoid the inductive noise.
5. When connecting thermocouple and controller, use specified compensation wire.
6. When using RTD sensor, connection should be made in 3-wired way, In case of extension, the same thickness and length should be used.
   - If the circuit is getting longer (Default 3M), there will be temperature variation. In this case, use product after compensation by

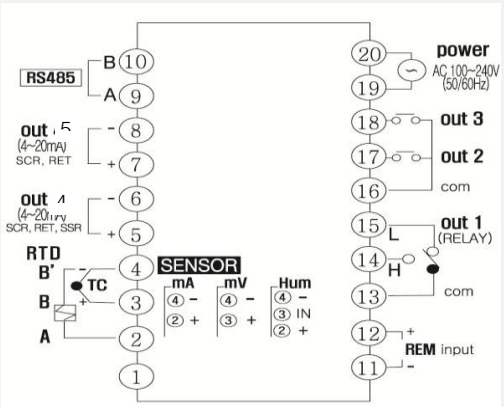
2 Product Specification

1. Size ▪ Outer Size (mm) : W 96 * H 96 * D 107 Panel Size(mm): W 92 * H 92
2. Model Construction ▪ OUT1: Relay, SSR .OUT2: Relay .OUT3: Relay .OUT4: Current .OUT5: Current
   ▪ Comunication : RS-485 Comm. .Program Control : 3 Pattern 20 Step .Remote Function
3. Sampling Period ▪ 250mS
4. Allowable Signal Source Resistance ▪ Thermocouple : 100Ω below Voltage :2KΩ below
5. Allowable Line Resistance ▪ RTD : 5Ω below
6. Allowable Input Voltage ▪ Within 10V
7. SSR Output ▪ OUT1~OUT3 Optional production SPEC : ON Voltage: approx. over 24 VDC(Load Resistance over 600Ω, Limited at 30mA current when shorted.) ▪ OUT4 Basic SPEC : OFF=0mA Output, ON=20mA Output (Below 600Ω)
8. Current Output ▪ Range : 4~20mA DC .Load Resistance : Below 600Ω
9. Normal Operation Condition ▪ Ambient themperature 0~50℃ , Ambient humidity : 20~85%
10. Influence of Ambient Temperature ▪ Thermocouple, Voltage Input : ±1μV/℃ or ±0.01% of maximum range .RTD Input : Below ± 0.05Ω/℃
11. Power Specification ▪ Power Supply : 100~240V AC(within ±10%), 50~60Hz .Power Consumption : 6.0W, Below MAX. 10VA

3 Input Sensor

Input Signal	Input type	Input Code	Range	Grade
Thermocouple	K	E	-200~1370	±0.3% of Total range
	K	E.dot	-199.9~600.0	
	J	J	-200~1200	
	T	t	-199.9~400.0	
	B	b	600~1800	
	S	S	0~1700	
	R	r	0~1700	
	C(W)	C	0~2300	
RTD	PT	Pt	-199.9~600.0	±0.3% of Total range
Humidity	HUM	HUn	0.0~100.0	±3% (Valid range 20~90%)
DC Voltage	1-5V	1-5	-1999~9999	
	0-10V	0-10	-1999~9999	
	4-20mA	4-20	-1999~9999	

4 Connection Diagram

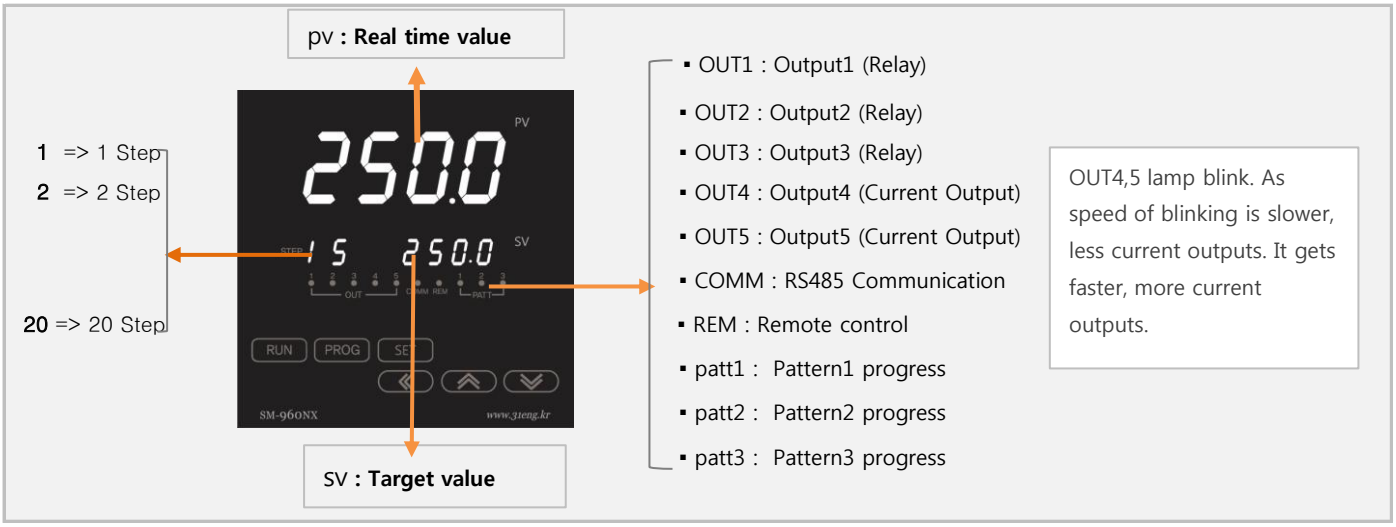


Caution! Please connect after main power OFF.

- Thermocouple : 3+ 4-
- RTD Sensor : Connect A with a single wire of other colors, Connect B & B' with two wires of the same color.
- Voltage Input : 3+ 4- ▪ Current Input : 2+ 4-
- Humidity Sensor : 2 with Black, 3 with White, 4 with Red (Refer to Website for Humidity Sensor types)
- Current Output 4 : 5+ 6-(Use 250Ω *1/4W resistance for voltage(1-5V) output)
- Current Output 5 : 7+ 8- (")
- OUT1 Relay Output : 13 input, 14 output
- RS485 Communication : 9 of A, 10 ▪ Remote input : 11-, 12+

5 Display (Programmable)

(It is initial screen of program control. Refer to next no.15 for FIX)



6 Function of Button

Button Type	Function
RUN	▪ Press it for 3 secs, it will operate program control with previous saved data. ▪ Press it for 3 secs during operation, ongoing program stops (Reset). ▪ If press it once shortly during operation, it pauses and runs (During Stop : Step screen blinks)
PROG	▪ If press it for 3 secs at initial screen, enter program group (Press once shortly after entering, move to next parameter). ▪ If press this button for 3 secs after entering program and altering each fuctions, it will save changed date & return to initial screen. ▪ If press it once shortly during progressing, pattern, step, left time and currnet on progress will be displayed. ▪ If there is no button controls for 60 secs, it will save changed data and return automatically.
SET	▪ Press for 3 secs, enter output group. ▪ Press once after entering output group, move to next parameter. ▪ If press for 3 secs after altering function, it will save changed date and return to initial screen.
《	▪ Move digit position.
∧ ∨	▪ Change each parameter value.

7 Setting Sequence

1. After entering input group, match connected sensor and sensor parameter.
2. Enter output group and prepare output type, alarm, autotuning, etc. for main operation.
3. Now it is ready to operate after entering program group, setting program and then returning to initial screen.

SET & UP button at the same time. 3 secs — **Initial Screen** — **PROG button, 3 secs**

SET button, 3

Input Group	
IN	Input sensor
FILT	Filtering
BIAS	compensation
SETH	Highest limit
SETL	Lowest limit
COMM	communication
C--F	℃ / ℉
LOC	Setting lock

Output Group	
OUT1	Relay ONOFF, PID
OUT2	Relay ONOFF, alarms, sub-output of timer etc.
OUT3	Relay alarm, program exit signal etc.
OUT4	Main current output (Control current, transmission, SSR)
OUT5	Current sub-output (Transmission, OUT4 COPY function)

Program Group	
ON OFF	program condition
PATT	Working pattern
STAP	Start pattern
TSET	Time type
POWE	Recover after power failure
WZ	Wait zone
STAC	Start condition
ENDC	End condition
ENDS	Total used step
SV01	1 Step temperature
TM01	1 Step time
≤	≤
SV20	20 Step temperature
TM20	20 Step time

8 Input Group

- Input sensor type and auxiliary functions can be set at input group.
- To enter Input Group : Press **SET** & **▲ button for 3 secs at the same time.**
- After entering input group, save the same sensor with connected to this equipment and then move to next parameter.
- Parameter shift among groups : Press "**SET" button once**
- Value(Function) change : **Press ▲ or ▼ button**
- Save and Return : Press "**SET" button for 3 secs.**
- " ·····► " : Parameter on the dotted arrow route is not displayed, if the related function is not selected.

Parameter	Function
In	▪ Available Input Sensor **: PT, K , K.dot, J, S. B. T, R, C, HUM** **V15, V10, MA20** PONT Decimal : Range 0~2 SCH "High" limits SCL "Low" limits Ex1) PONT: 0 SCH :100 SCL: 0 Display 0~100 Ex2) PONT:1 SCH :20.0 SCL:10.0 Display 10.0~20.0 Ex3) PONT:2 SCH :50.00 SCL:-10.00 Display -10.00~50.00 ▪ **If you select one of** V15, V10, MA20, you can set decimal, scale "High" and scale "Low".
FILt	▪ Measurement Value Filter (0~9) : Function to reduce fluctuation of display value tha might occur when it is installed at strong noise place, which is characteristics of digital device. (The higher the value, the less the fluctuation.)
bIAS	▪ Measurement Value Compensation (-50~50) : Compensate error due to too long or old wire for sensor. Ex1) Display 60 if you set BIAS at 10, when current measurement value is 50. Ex2) Display 40 if you set BIAS at -10, current measurement value is 50.
SEtH SEtL	▪ Set the Highest Limit : If you set SETH value, SV value cannot be set above the configured value. ▪ Set the Lowest Limit : SV value cannot be set below the configured value. Ex) If set at SETH:100 , SETL:-10, SV can be set only between -10~100
Conn	▪ Computer Remote Control : **OFF** (Computer communication not used) **: ON** (Communication used) { **Adr :** Communication ID number (assign 1~999 for each product) **bPS : communication Speed** (Select among 2,400, 4,800, 9,600, 19,200) * 255 units of porducts can be connected with one computer. * Refer to Website for protocol and monitoring program for demo.
C--F	C : Celcius (℃) F : Fahrenheit(°F)
LoC	▪ **OFF : Lock cancelled** ▪ **IN** : Lock only input group ▪ **ALL** : Lock Input, Output and Program group ▸ If set IN or ALL, it is possible to enter locked group but impossible to change the value. ▸ Under program OFF state, if press ▼ button 7 times continuously, InIt is dispayed. And if press "SET" button once, functions are reset.

■ **Output group is main function group of this equipment, and set control method, control range and alarm etc.**
■ **Press "SET" button for 3 secs to enter output gruop.**
■ Press "**SET" button** once to move into next parameters among group. Press ▲ or ▼ to change output types and fucntions.
■ Press "SET" button for 3 secs after altering values to save & return.

Main relay output

oUt1 (If entered data in no. 13 program group is relay control, signal goes out to OUT1.)

Select ONOF or PID by using ▲ or ▼

oUt1	OUT1 Output
onoF	ONOFF Control
tYP	Select Heat or COOL
HYS	Set Histeresis
dLt	Set Delay time

ON/OFF Control
Refer to 10.1

oUt1	
PId	PID Control
P	Proportional
I	Integral time
d	Differential
L	ON/OFF cycle

PID Control
Refer to 10.2

Main current output

oUt4 (If entered data in no.13 program group is current control, signal goes out to

Select among 4-20, PV, SV, SSR by using ▲ or ▼

oUt4	oUt4	oUt4
4-20	PV SV	SSr
P	FrH	P
I	FrL	I
d	CAL	d
nAH		L
nAL		
SLS		

Current control
Refer to 10.6

PV or SV Transmission
Refer to 10.8

SSr Output
Refer to 10.7

If press "SET" continuously, it moves from OUT1 to OUT2.

oUt2 (Sub Output for alarm)

oUt2	oUt2	oUt2	oUt2	oUt2
onoF	A1 A3	A2 A4	A5-A8	LbA
Sb2	AH	AL	AH	LtIn
tYP	AHYS	AHYS	AL	Lrn0
HYS	dAL	dAL	AHYS	
dLt			dAL	

ONOFF Control
Refer to 10.3

Refer to 11, Alarm

Loop break Alarm
Refer to 10.4

oUt5 (Sub Current Output)

oUt5	oUt5	oUt5
4-20	PV SV	CoPY
P	FrH	CAL
I	FrL	FrH
d	CAL	FrL
nAH		CAL
nAL		
SLS		

Current control
Refer to 10.6

PV Transmission
SV Transmission
Refer to 10.8

Copy control
Refer to 10.9

It moves from OUT2 to OUT3.

oUt3 (Sub Output for alarm)

oUt3	oUt3	oUt3	oUt3	oUt3
A1 A3	A2 A4	A5-A8	SbA	SCn
AH	AL	AH		SCn.A
AHYS	AHYS	AL	Sensor Break Alarm Refer to 10.5	SCn.b
dAL	dAL	AHYS		End.b
		dAL		

Same setting method as that of OUT 2, 3 for A1~A8.

Step alarm
Refer to 11. 1

10 Output Group Function Description

10.1 oUt1 / onoF

▪ If press "SET" button for 3 secs on initial screen, OUT1 at top and ONOF or PId at bottom screen will be displayed.

▪ **For ON / OFF control, press ▲ or ▼ and set ONOF.**

typ

▪ Set **OUT1 as** ONOF and press "SET" button once, **TYP at top and HEAT or COOL at bottom screen will be displayed.**

- For Heating or Cooling control, press ▲ or ▼ for set HEAT or COOL.

HYS

▪ If p**ress "SET" button once after setting TYP, HYS at top and** 1~99(0.1~99.9) at bottom screen will be displayed.

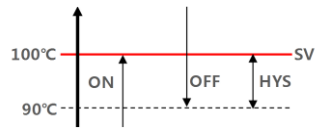
- **HYS represents thedeviation between relay ON and relay OFF.**

dLt

▪ If press "SET" once after setting **HYS, dlt at top and** 0~300 at bottom screen will be displayed.

▪ **dlt operates after setting time (sec) in dlt (Not works immediately at relay ON signal).**

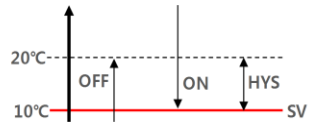
(Output lamp blinks during delayed time)



(Diagram 1)

oUt1 / onoF → typ / HEAT → HYS / 10.0 → dLt / 7

Diagram 1) Repeat ON below 90℃ and OFF over 100℃ (It operates after 7 secs delay at operating point)



(Diagram 2)

oUt1 / onoF → typ / COOL → HYS / 10.0 → dLt / 15

Diagram 2) Repeat ON over 20℃ and OFF under 10℃ (It operates after 15 secs delay at operating point.)

10.2 oUt1 / Pid

▪ If press "SET" button for 3 secs at initial screen, **OUT1 at top and ONOF or Pid at bottom will be displayed.**

For PId control (Heating PId), press ▲ or ▼ to set Pid and press "SET" once to move to next step.

<<After operating auto tuning, proper P.I.D value is saved automatically>> (Refer to 17-1)

P

▪ If time to reach target value is slow or excessive overshoot occurs after operating auto tuning, you can adjust "P.I.D" value manually.

▶ If **P** value is set higher : Speed gets slower while over-shotting decreases.

▶ If **P** value is set lower : Speed gets faster while over-shooting increases.

I / 0~9999

▪ Integral Value **(I)** : Slow period hunting is occurred, adjust it with I value.

- High I value makes hunting low.

d / 0~9999

▪ Differential Value **(d)** : When the small period hunting occurs, adjust it with D value (Lower value -> Less hunting)

- Adjust with **P, I, d value** for special case. But in general, it can be controlled properly by value of auto tuning.

L / 1~360

▪ Control Period Cycle : The duration of time of one cycle in a repeating event ON & OFF

- If you set cycle short, you can control precisely but relay life will be reduced (Recommend 10secs~30secs)

10.3 oUt2 / onoF

▪ OUT2 shows up after last parameter of OUT1.

- **OUT2 contains functions such as ONOF, A1~A8**(General alarm), **LbA**(Loop break alarm).

SV2

▪ If press "SET" once after setting **OUT2 as** ONOF, **SV2** at top and target temperature at bottom screen will be displayed.

- SV2 is target value of OUT 2, which is seperated from SV of OUT1 and it operates seperately with no regard to OUT1.

- **TYP,HYS,DLT** share same setting method as that of OUT1(Refer to 10-1).

10.4 oUt2 / LbA

▪ If set as LbA at OUT2 mode, OUT2 can be used as Loof break alarm function.

▪ If set as **LbA and press "SET" button once, L.TIM & L.rNG is displayed continuously.**

L.tIM - **L.tIM : Loop Break Monitoring Time**

L.rnG - **L.rNG : LBA Alarm Range**

▶**LBA** (Loop Break Alarm) : Function to check whether controlled device has problem or not.

Ex) Controlled device : Heater, **L.Tim** : 60, **L.rNG** : 2

LbA operates when there is no temperature change over 2℃ although heats for 60 secs continuously with full output.

▶ Major cause of LBA ① Disconnect of sensor wiring ② Errors of external device such as magnet, sub relay etc.

③ Errors of external load like heater, cooler etc. ④ Disconnection or wrong connection of external wiring.

▶LBA will be OFF when the problem is sloved and then make SV=PV or change LBA value.

10.5 oUt3 / SbA

▪ Sensor Break Alarm : After reach to OUT3 by pressing "SET" button, select SbA with ▲ or ▼

▪ If sensor is opened or disconnected, it will be displayed as "----" and Sensor Break Alarm output through OUT3.

10.6 oUt4 / 4-20

▪ **OUT4 & OUT5 are current-only output. (OUT4 : Main current control, OUT5 : Sub current)**

- It outputs when select "4-20" by pressing ▲ or ▼ in Output 4 or 5.

▪ If press "SET" button once after setting as "**4-20", P . I .D will be displayed in order.**

- During auto tuning, detect thermal characteristics of controlled device and save proper P.I.D value automatically.
- Setting method is same as relay PID (Refer to 10-2) of Out1's.

MAH

▪ Function to limit the maximum value

Ex) If you set **MAH as 15, the maximum current value will not be higher than** 15mA.

MAL

▪ Function to limit the minimum value

Ex) **If you set MAL as** 8, the minimum current value will not be lower than 8mA.

SLS / 0~360

▪ Slow Start Function - Used for the device which may be damaged by excessive current at the beginning of operation.

▪ **SLS is time to output until maximum** 20mA(Unit : Sec, Range : 0~3600 secs)

Ex) If set SLS as 60, it takes 60 secs to output 20mA.

But if you limit maximum current value, it is operated by limited value.

10.7 oUt4 / SSr

▪ **If set OUT4 as SSr, OUT4 turns to SSR output which repeats ON and OFF(**0mA & 20mA).

Sub parameter is same as Relay **PID**(Refer to 10-2).

10.8 oUt5 / Pv

▪ In case using **OUT4, 5** as transmission output**.**

- Select PV or SV by pressing ▲ or ▼ at OUT4, 5.

oUt5 / Sv

- **PV Transmission** : Change real time value at **PV screen** into **4-20mA** and output
- **SV Transmission** : Change setting value at **SV screen** into **4-20mA** and output

FrH – Transmission Output "High"

FrL – Transmission Output "Low"

• Setting - **FrH**: 100 **FrL**: 0
4mA current will output at 0℃ and 20mA current at 100℃
But if it is out of "High" & "Low" setting range, 3mA will output below 0℃
and 21mA over 100℃

CAL

▪ Function to compensate the current error when it occurs at transmission output (Range : −10.00~10.00)

(With 1.00 input, displayed current increases as much as 1mA. With −1.00 input, displayed current decreases as much as 1mA)

▶ SV Transmission Function Application tip : First, set as SV transmission & FRH: 20 , FRL:4 .
After returning to initial screen, if set SV as specific value, a constant current is output at specific set value
(Manual output is not necessary.)
Ex) If set SV as 8, 8mA is output continuously and set as 20, 20mA is output continuously.

10.9 oUt5 / CoPy

▪ **Current Copy Function** : If set OUT5 as COPY, OUT5 will make the same current as OUT4.

CAL

▪ If you set OUT5 as COPY and press "SET" button once, CAL at top and -10,00~10.00 at bottom screen is displayed

- It is a compensate function for difference errors of OUT4 and OUT5, because it is analog value (Range :-1.00~1.00mA).

11 Alarm

OUT2 . OUT3 Alarm (Common embedded alarm)

A1.	A2.	A3	A4	A5	A6	A7	A8
Absolute Alarm High	Absolute Alarm Low	Variation Alarm High	Variation Alarm Low	Absolute Alarm High & Low	Variation Alarm High & Low	Absolute Alarm within Range	Variation Alarm within Range
AH	AL	AH	AL	AH	AH	AH	AH
AHYS	AHYS	AHYS	AHYS	AL	AL	AL	AL
dAL	dAL	dAL	dAL	AHYS	AHYS	AHYS	AHYS
				dAL	dAL	dAL	dAL

Code	Alarm Type	Function
A1	Absolute Alarm High	▪ Alarm operates above the set value of **AH.** Ex) If you set AH **at** 120, alarm works above 120. AH value is fixed at 120 even though SV value is changed, which is called "Absolute Alarm".
A2	Alsolute Alarm Low	▪ Alarm operates below the set value of AL(Opposite concept with A1).
A3	Variation Alarm High	▪ Alarm operates above AH value with regard to changed SV value. Ex) If SV is set at 100 and **AH at** 5, alarm works above 105. When SV is changed into 200, alarm works above 205, which is called Variation Alarm.
A4	Variation Alarm Low	▪ Alarm operates below AL value with regard to changed SV value (Opposite concept with A3).
A5	Absolute Alarm High & Low	▪ Alarm operates both above and below the value of AH and AL alarm each (A1 Alarm + A2 Alarm). **AH** : Absolute Alarm High **AL** : Absolute Alarm Low Ex) If AH is set at 100 and AL 50, alarm works above 100 and below 50.
A6	Variation Alarm High & Low	▪ Alarm operates both above AH and below AL value with regard to changed SV value (A3 + A4). **AH** : Variation Alarm High **AL** : Variation Alarm Low Ex) If SV is set at 100, AH at 8 and AL at 10, alarm works above 108 and below 90. When SV value is changed, alarm works according to the changed value.
A7	Absolute Alarm within Range	▪ Alarm operates PV enter between AH value and AL value. Ex) If AH is set at 100 and AL at 50, alarm works between 100 and 50. Tip) AH value should be higher than AL value.
A8	Variation Alarm within Range	▪ Alarm operates between AH value and AL value with regard to changed SV value. Ex) If SV is set at 100, AH at 8 and Al at 10, alarm works between 108 and 90.

* AHYS (Alarm Hysteresis) : Set the range of 1-30 to prevent the relay vibration problem that results from the same start & finish point.

* dAL (Delaying Alarm) : Alarm signal doesn't work when the value is already within the set range of alarm output at the moment of turning on.

It works when the value accord with the set range of alarm output once again after detached from the range.

ON : DAL used **OFF** : DAL not used

11.1 Section Alarm

oUt3 / SCn

▪ If you select SCn in **OUT3** by ▲ or ▼ button, it is step alarm.
The alarm output is occured when this step runs in the middle of the progress. (If you set off, there is no step alarm.)

SCn.A

▪ If you set to SCn and press "SET" button once, SCn.A at top and off or 1~20 at bottom screen will be displayed.
If you select one of step among **1~20,** alarm outputs at the selected step.

SCn.b

▪ Setting method of SCn.b is same with SCn.A's. Also there is two step alarm, SCn.A & SCn.B.

End.b

If you set to SCn.b and press "SET" button one more time, **End.b at top and Time** (0 min.00sec) at bottom will be displayed.
-When the program is over, alarm is output as configured by the time set in this parameter (Max. 3 mins).

12 Program Group Setting

<<This device contains 3 patterns and 20 steps for each pattern.

PrOG / ON
- If press "**PROG" button for 3 secs, PROG at top and ON or OFF at bottom screen will be displayed.**
  And then select ON by press ▲ or ▼ and press "PROG" button to move next parameter.

PAtt / 1
- Select one of 3 patterns to start program work.
  1PT: Pattern1 2PT : Pattern2 3PT : Pattern3

StAP / 1
- Start pattern **1** : start from pattern1 **2** : start from pattern2 **3** : start from pattern3
  Insert relevant pattern, if you control by a single pattern.

tSEt / HH.MM
Time Type Setting
HH.MM : Hours. Minutes (99 hours 59 minutes) **MM.SS** : Minutes. Seconds (59 minutes 59 secs)

PoWE / rUn
- How to restart it at the time of power failure (Refer to 13-1)

WZ / 0
- Wait zone : Although setting time of the step is over, temperature increase(PV) is not followed by target value(SV) (Refer to 13-2).

StAC / PV
- Condition of device's operation start(Refer to 13-3)

EndC / STOP
- How to close all program operation and end the equipment (Refer to 13-4)

EndS / 20
- Register how many steps to use among 20 steps (Refer to 13-5)

SV01 / Target Temp. Set
- Step 1 Target Temperature

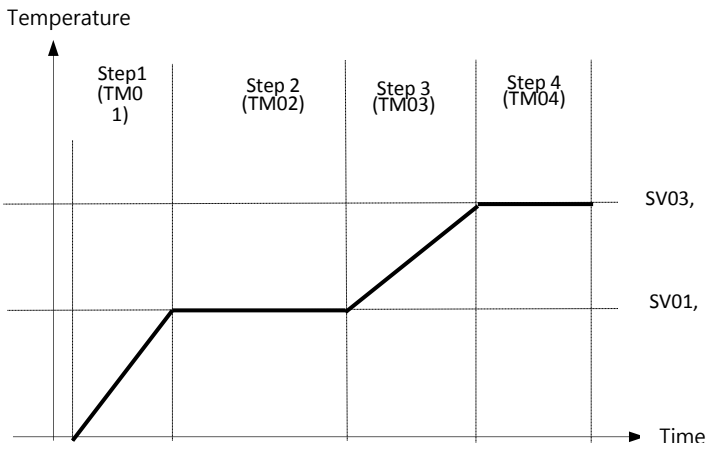
tM01 / Required time Set
- Step 1 Required time

SV02 / Target Temp.
- Step 2 Target Temperature

tM02 / Required time
- Step 2 Required time

SV20 / Target Temp.
- Step 20 Target Temperature

tM20
- Step 20 Required time



- If you press "PROG" button for 3 secs after finish program setting, it will save entered data and return to initial screen.
- If you press "**RUN**" button for 3 secs at initial screen, it will operate with saved data.
- If you press "**RUN**" button for 3 secs during operation, it will reset at initial state of pattern & segment. At this time, PV screen displays current temperature, SV screen shows STOP, none at step screen.
  All outputs stop except Communication and transmission output.

13 Program Function

13.1 **PoWE** POWER : Select how to restart after recovering from power failure during operation.

▶ **SEG** - Restart from the begginning fo progressing segment (The time of progressing segment is ignored)

▶ **rSt** - Stop of initial(STOP) and main output (OUT1, OUT4), Alarm works normally.

▶ **rUn** - Restart from stopping point of progressing segment (Operating the remaining time except for the progressed time of segment)

13.2 **WZ** ▪ WAIT ZONE : Wait setting range

WTIM ▪ WAIT TIME : Waiting time (00:00~99:59) But if set wait zone as 0, WTIM will not be displayed.

- Function to wait until PV value rached target value without moving to next segment, if PV value didn't reach to target value even though setting time of current segment is over.

Ex) **WZ:** 5 **WTIM** : 20
It waits for 20 minutes without moving to next step, if PV does not reach within the range of 5℃ of SV.
* When either WZ or WTIM is set at 0, wait function does not work.
(Corresponding step on step screen is flashing during wait in progress.)

13.3 **StAC** START CORD : Start Condition of the program

▶ **PV** : The first step time starts at the current temperature.

▶ **SSV** : The first step time starts at set temperature(The device is operated without regard to SSV. First step time starts when it reachs to SSV.)

- If select **SSV** and press "Set" button, SSTP at top and setting time at bottom screen is displayed.

Ex) If SSTP is set at 100℃ and current temperature is 50℃, step 1 time starts after it reached to 100℃.

13.4 **EndC** END CODE : End all setting program and select closing mode.

▶**StoP** : Main output (OUT1 & OUT4) stop

▶**ALSt** : Stop OUT1, 2, 3, 4, 5 all. But program end alarm and SV transmission output work.

▶**Hold** : Keep the temperature of the last segment (Hd is blinking at step screen).

▶**rPt** **: Repeat in the same pattern** **0** : Repeat infinitely **1** : Only once without repetition
2 : Repeat twice ~ ~ ~ 99 : Repeat 99 times

▶**LInK** : Link from one pattern to another

▪ One pattern consists of 20 steps and there are 3 patterns.
▪ You can link the next pattern, if you need more after using all 20 steps of pattern.
▪ **If select "LINK"** & press "**PROG" button, one of 1PT, 2PT, 3PT is displayed. And then press** ▲ or ▼ and choose pattern to link.
▪ **1PT : Link to pattern 1** **2 PT : Link to pattern 2** **3PT : Link to pattern 3** (Current pattern is not displayed.)
▪ Follow the setting condition of next pattern if linked to the next pattern.

13.5 **EndS** END STEP

▪ If you want to use 7 steps among 20 steps, insert 7 to make 7 step as the last segment.
- Insert the total number of segment to be used, if not error might occur.

14 Check Program Process

▪ If press "**PROG" button once shortly while program is working,**

SEG → **tEnP** → **tIME** → **CUrr** → **PAtt** → **rEPt** → **LInK**

It will return to initial screen if there is no PROG manipulation for over 60 secs.

▶ **SEG** : Step number of currently operating program

▶ **tEnP** : Target temperature fo currently progressing step

▶ **tIME** : Remaining time of currently progressing step

▶ **CUrr** : Display of OUT4 current output value

▶ **PAtt** : Pattern number of currently progressing program

▶ **rEPt** : Repeated number of pattern that is currently progressing (Include the current pattern)

▶ **LInK** : Number of next pattern, in case of link from a pattern to another (Nothing is displayed if there is no link)

<< If you want to skip the current progressing step and move to the next one,

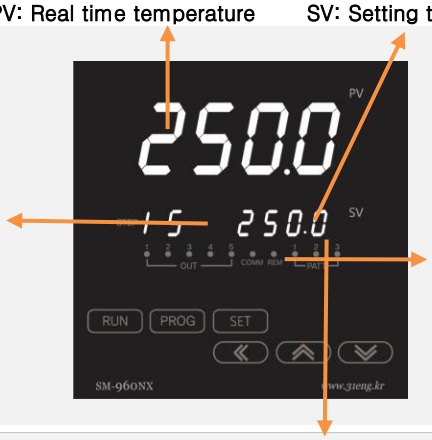
* Press both "SET" & ▲ button for 3 secs at the same time to move to the next step and press both "SET" & ▼ button for 3 times to move to the previous step.

15 Screen of FIX

PV: Real time temperature SV: Setting temperature (Target temperature)

STEPscreen setting at FIX

- **D1** : Display operation portion of OUT1
- **D4** : Display current amount of OUT4
- **D5** : Display current amount of OUT4
- **OF** : If OUT1 setting is forward PID - **P**
  reverse PID - **L**
  heating ONOF - **H**
  cooling ONOF - **C**
  (Refer to 16-1)



- OUT1 : Output 1 (Relay)
- OUT2 : Output 2 (Relay)
- OUT3 : Output 3 (Relay)
- OUT4 : Output 4 (only for current output)
- OUT5 : Output 5 (only for current output)
- COMM : RS485 Communication
- REM : Remote control

Chart 15-1

- SV Change : If you press "SET" button once, screen at bottom blinks. At this time, use ▲,▼ & ◀ button to change SV and press "SET" button once to save.

16 Function of Button in FIX

Button Type	Use & Function
SET	▪ If you press it once shortly, SV blinks. At this time, use **▲ or ▼ to change SV.** ▪ To enter output group, press it for 3secs. ▪ After entering output group and press once, move to next parameter. ▪ After entering output group, change the function & press it for 3 secs, and then it will save changed data and return to initial screen.
◀	▪Move dot position: For shift left of dot position, press SET button one time, and then press it once. ▪ Change on STEP screen contents : Refer to 16.1
▲ ▼	▪ Change functions and Up & Down for each setting value.
SET ▲	▪ To enter input group, press two buttons at the same time for 3 secs.
RUN	▪ Press for 3 secs to enter tuning group. ▪ After entering output group, if press it 3 secs at each output mode, auto tuning operates. ▪ If press 3 secs during tuning, it stops. * Refer to No. 17, tuning function
PROG	▪ To enter program group, press this for 3 secs. ▪ If press this 3 secs after entering program group, it saves setting data and returns to initial screen.

16.1 Display option of STEP screen (The belows are available under the state of FIX)

If you press ◀ once, Of is displayed on STEP screen. After that, select one of d1, d4, d5 function by pressing up, down button.

- **d1 : Display the duty value(the portion of operation time in combination with the operation time and the stop time of OUT1)**

Ex) Recent operation time - On : 90 secs, OFF : 10 secs, ON+OFF : 100 secs, So it runs 90 secs out of 100 secs, so portion of working is 90%.

- **d4 :** OUT4 current output value is displayed
- **d5 :** OUT5 current output value is displayed
- **OF :** Refer to Chart 15-1

17 Tuning Function

17-1 AUTO TUNING

A Purpose of Auto tuning

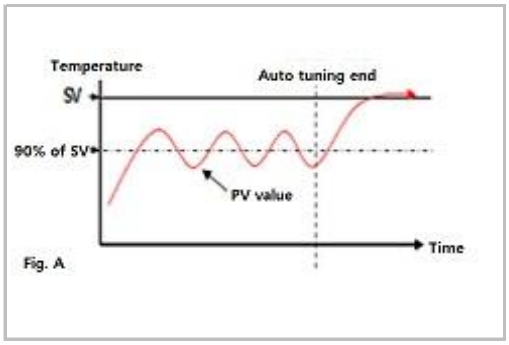
- **PID AUTO TUNING** is the control preparation that enables quick response and precise control. It is to calculate PID modification numbers for the optimal control and to set the value by measureing the thermal characteristics and thermal response speed of vairous controlled device.
- Auto tuning should be done at the first stage after attaching the controller.
- After tuning is finished, operation runs automatically.

B Auto Tuning Operation Method

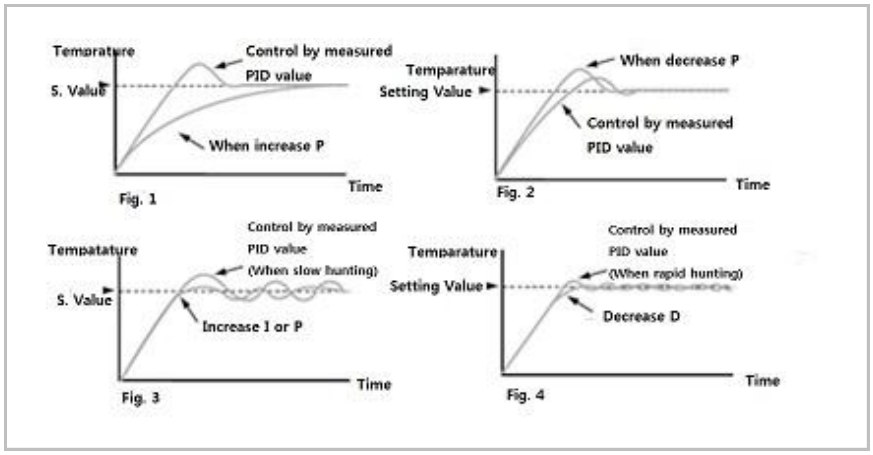
- If press "RUN" for 3 secs at FIX control initial screen, TUNG at top and one of AT or ST at bottom screen will be displayed.
  Set auto tuning as AT & self tuning as ST and then press "SET" for 3 secs to save & retrun.
- It operates by selecting one of PID, CPID, 4-20, 20-4 in output group OUT1 or OUT4, 5 and then pressing "RUN" button for 3 secs.
  After that, it returns to initial screen and auto tuning works at once.
- Auto tuning operates at 90% of SV and it ends after PV goes up & down 3 times. (Refer to Fig. A)

During auto tuning, AT lamp on front blinks. Blinking stops when tuning ends.

- **Press "RUN" button for 3 secs to stop tuning while auto tuning is in progress.**



(Auto tuning Graph)



(PID Graph)

17-2 Self tuning

A Advantage of Self tuning

- Self tuning is a function to change P.I.D value only changing SV unlike auto tuning.

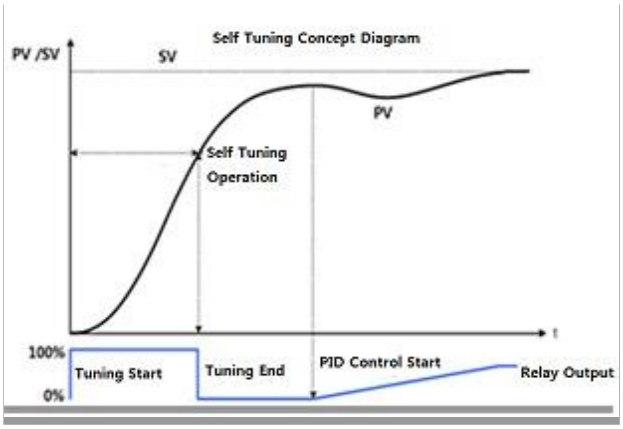
Auto tuning takes long time depending on output (Heater) as it is a function to get P.I.D value using output ON/OFF compulsorily several times by setting temperature.

But self tuning can save time to get P.I.D. value as it is a function to get P.I.D. value by change of SV or power on.

During self tuning ST lamp in front blinks & lamp turns off after tuning ends.

B Self tuning operation method

- **If press "RUN" for 3 secs on initial screen, enter to tUnG setting mode. After that, use ▲ or ▼ for set as "St" between AT & ST.**
- **Self tuning operation condition : It operates if there is a difference of over 30 degree with present PV when power on or change SV.**
- Press "RUN" for 3 secs to stop self tuning while it is in progress.



Special Function

S-a. Remote control (During remote operation, REM lamp truns on.)

If you press "SET" button once, SV is blinking to change target value. At this time press Up & Down button at the same time for 5 secs. If so, REM is displayed.

At this time, set OFF as ON by pressing "Up" button once and press "SET" button once to move into detailed function.

r.SCH > r.SCL > r.Bis > r.FIL is displayed in order.

- **r.SCH** (Range "High") : Match high value of input current from the outside to the device.
- **r.SCL** (Range "Low") : Match low value of input current from the outside to the device.
- **r.Bis** (Error compensation) : In the process of inputting a current, compensate the error caused by errors on the lines and the terminal etc.
- **r.FIL** (Prevention of fluctuation) : If it is installed where noise is generated, SV may be unstable.

(The higher the value, the less the fluctuation.)

* Remote cancellation : Remote on is displayed if you press "set" once. At this time, make remote "off" by Up & Down button.

S-b. **Special output function**

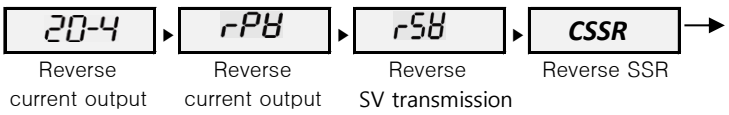
- How to enter : **If you press ▲+▼ button at a same time for 3 secs in one of output mode among OUT1, 4, 5, special function** parameter is displayed.

▪OUT Special function

CPId
Cooling PID

If this function is displayed, you can check the detailed specification like P, I, D, L etc. by pressing 'set" button (Detailed specification is same with 10.2 basic PID)

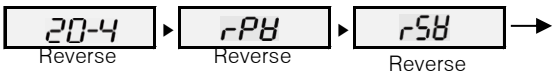
▪OUT4 Special function



Reverse current output | Reverse current output | Reverse SV transmission | Reverse SSR

If press Up button once, in 20-4, rPV, rSV and CSSR is displayed in order.
Press "SET" button for detailed specification change. Detailed specification of special function is same as general one.

▪OUT5 Special function



Reverse current output | Reverse current output | Reverse SV transmission

- Reverse output sub parameter is same as forward output sub parameter.

Ex) CPId=PId , 20-4=4-20 , rPV/rSV=PV/SV (Refer to general parameter in each group)

- To change to general function, select general function in special function mode by ▲ or ▼ button.

* Digital letters on the product's display are as belows.