SD Series Users' Manual

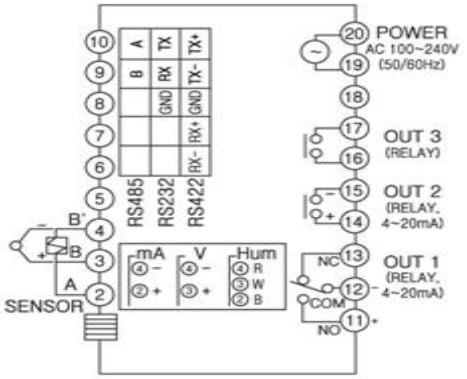
1 Model Types

①②③④⑤⑥

SD-96 M R R R N

①Dimension	②Input	③OUT1	④OUT2	⑤OUT3	⑥Comunication
96 : W96*H96	**M : Multi**	**R** : Relay Output	**R** : Relay	**R** : Relay	**N** : No Communication
94 : W96*H48	(Same for	**A** : Current Output	**A** : Current	**S** : SSR	**2** : 232Comm.
49 : W48*H96	all models)	**S** : SSR Output	**S** : SSR		**4** : 422Comm.
72 : W72*H72					**8** : 485Comm.
48 : W48*H48					

2 Dimension & Connection Diagram



(SD-96M Connection Diagram)

Caution! Please connect after turning power OFF

■Thermalcouple(K.J.R…) : Connect 3+, 4−

■RTD sensor(PT): Connect A with a single wire of other colors, Connect B and B' with two wires of the same color

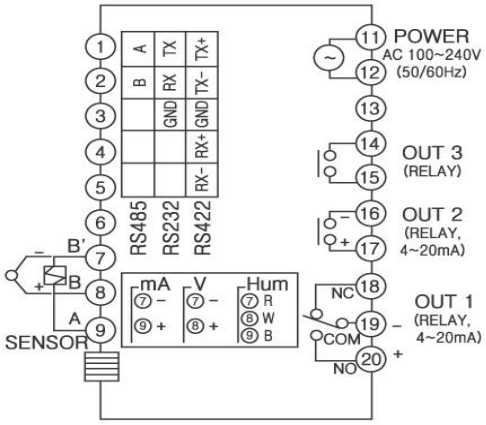
■Current Input: 2+, 4−

■Voltage Input: 3+, 4−

■Humidity Sensor Input: 2 with black, 3 with white, 4 with red
(Refer to website for types of Humidity Sensor)

■OUT1 Current Output : 11+, 12−

■OUT1 Relay Output: 11, 12



(SD-49M/94M Connection Diagram)

■Thermalcouple: 8+, 7−

■RTD Sensor: A with a single wire of other colors, B and B' with two wires of the same color

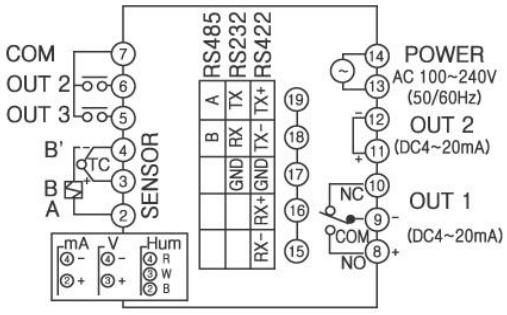
■Current Input: 9+, 7−

■Voltage Input: 8+, 7−

■Humidity Sensor Input: 9 with black, 8 with white, 7 with red

■OUT1 Current Output : 20+, 19−

■OUT1 Relay Output: 19, 20



(SD-72M Connection Diagram)

■Thermalcouple:: 4+, 3−

■RTD Sensor: A with a single wire of other colors, B and B' with two wires of the same color

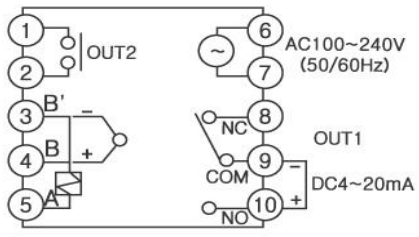
■Current Input: 5+, 3−

■Voltage Input: 4+, 3−

■Humidity Sensor Input: 5 with black, 4 with white, 3 with red

■OUT1 Current Output: 10+, 9−

■OUT1 Relay Output: 10, 9

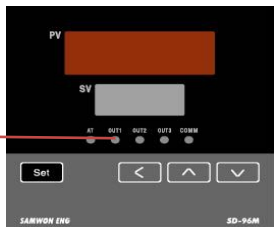


(SD-48M Connection Diagram)

3 Name & Function of Each Part

(LED Lamp's Usage)

AT : Auto Tuning
OUT1 : Output 1
OUT2 : Output 2
OUT3 : Output 3
COMM : Communication



*Current outputs, if OUT1, 2 Lamps blink
The slower the speed of blinking, The less the current
The faster the speed of blinking, The more the current

Button Type	Use & Function
Set	■If press it once, SV will flash. At that time, SV value changes by ▲▼ button ■If press it for 3 sec, enter output group ■Move among parameters in the group, if you press it once after entering output group ■Press it for 3 sec when returning from output group with altered data saved
◀	■Move among ciphers ■ Start or stop autotuning (refer to no.9 for details)
▲ ▼	■Change Each function value ■Change fast if you press it longer than 3 sec
Set + ▲	■Enter input group if you press both buttons for 3 sec at the same time ■Press only SET button for 3 sec when returning from input group

4 Input Type and Range

Input Signal	Input Type	Input Code	Range	Grade
Resistance Thermometer	PT	Pt	-199.9~600.0	±0.2% of total range
Thermocouple	K	K	-200~1370	±0.3% of total range
	K	K.dot	-199.9~600.0	
	J	J	-200~1200	
	T	t	-199.9~400.0	
	R	r	0~1700	
	C(W)	C	0~2300	
Humidity Sensor	HUM	HUn	0.0~100.0	±3% (Valid Range20~90%)
DC Voltage	1-5V	1-5	-1999~9999	
	0-10V	0-10	-1999~9999	
DC Current	4-20mA	4-20	-1999~9999	

*Digital Letters on the Product's Display are as belows.

A	B	C	D	E	F	G	H	I	J	K	L	M	N
A	b	C	d	E	F	G	H	I	J	K	L	n	n
O	P	Q	R	S	T	U	V	W	X	Y	Z		
o	P	q	r	S	t	U	V	y	없음	y	2		

5 Input Group

■Input group contains sensor type option and auxiliary functions not frequently used

■To enter Input Group: Press 'SET' button & ▲ button for 3 sec at the same time

■Parameter shift among groups: Press 'SET' button once

■Value(Function) Change: Press ▲ ▼ button

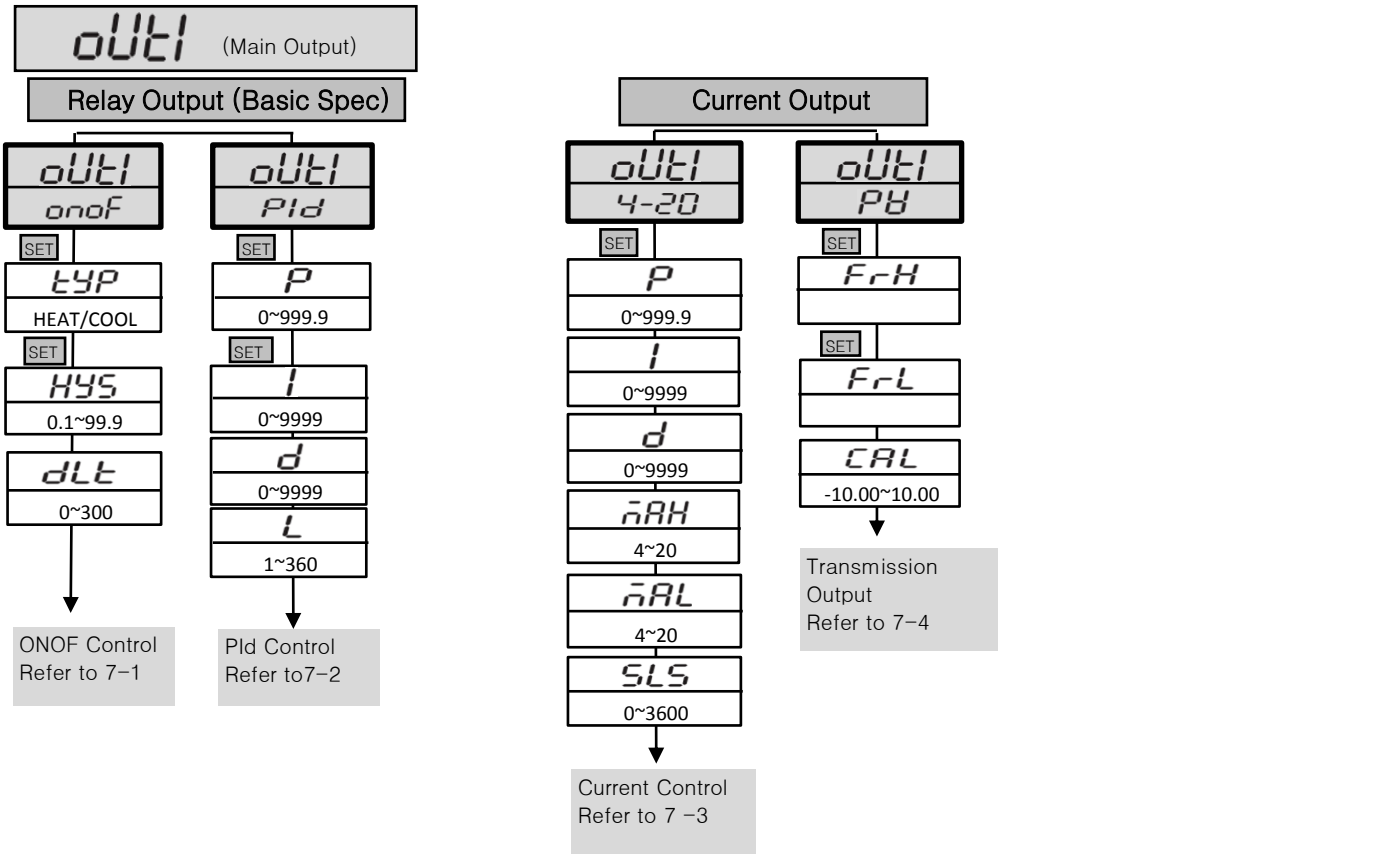
■Save and Return: Press 'SET' button for 3 sec

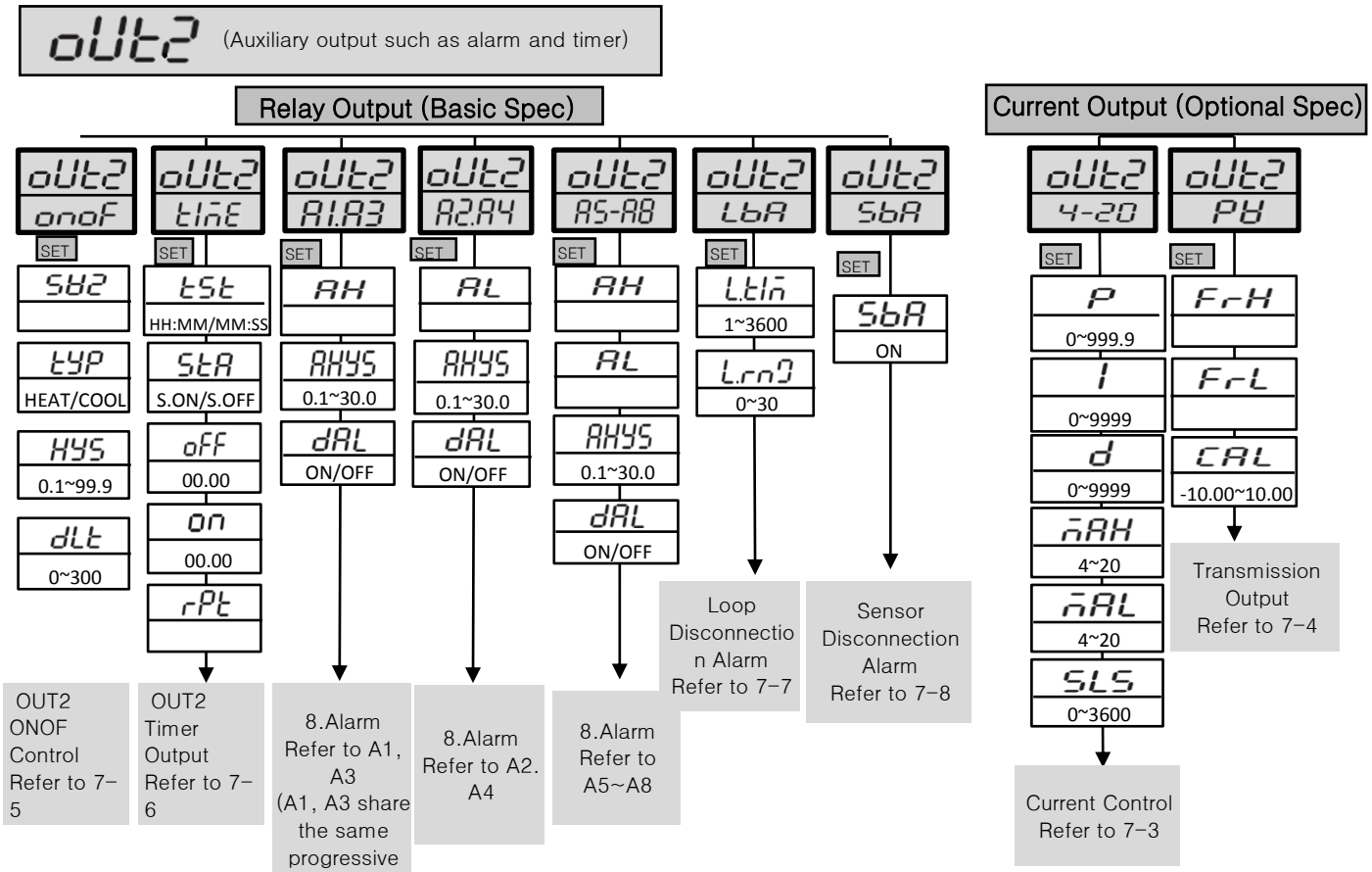
■ " - - →" : Parameter on the dotted arrow route is not displayed, if the related function is not selected

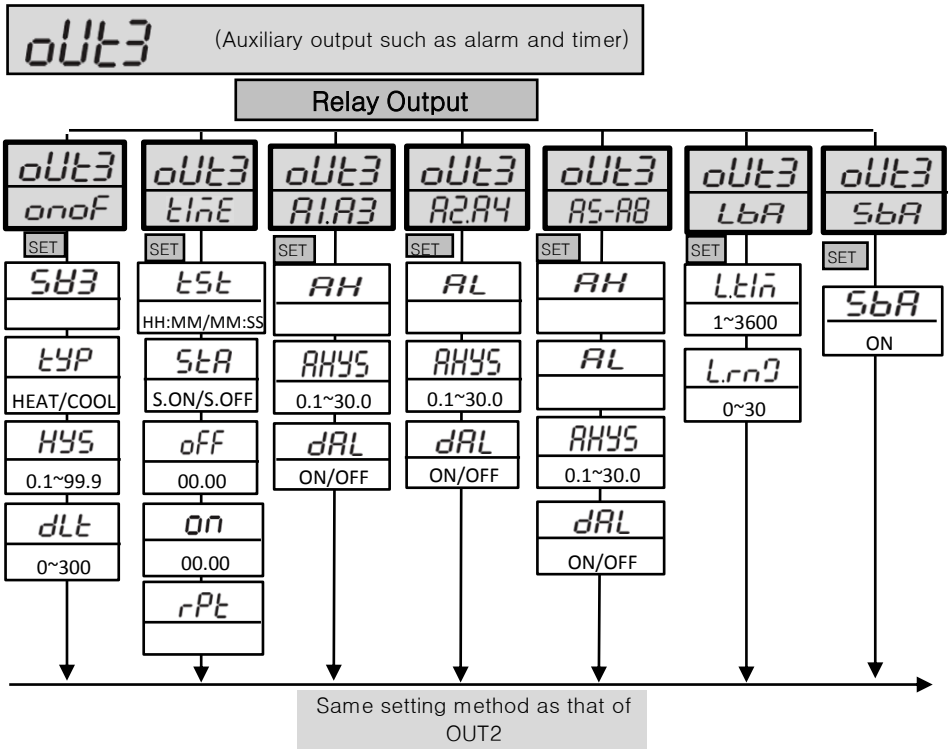
Parameter	Function
In Input Sensor	Available Input Sensor : PT, K, (K.dot), J, T, R, C, HUM V15, V10, MA20 PONT Decimal : Range 0~2 SCH Scale "High" SCL Scale "Low": Set Scale "High" or "Low", if you select V15(1-5V), V10(0-10V), MA20(4-20mA) ex1) PONT:0 SCH :100 SCL:0 display 0~100 ex2) PONT:1 SCH :200 SCL:0 display 0.0~20.0 ex3) PONT:2 SCH :5000 SCL:0 display 0.00~50.00
FILt	Measurement Value Filter(0~9) : Function to reduce the fluctuation of display value that might occur when it is installed at strong noise place, which is the characteristics of digital device. (The higher display value, the less fluctuation with display speed slowing down)
bIAS	Measurement Value Compensation(-50~50): Compensate the error due to too long or old sensor wire ex1)Display 60 if you set BIAS at 10, when the current measurement value is 50 ex2)Display 40 if you set BIAS at -10, when the current measurement value is 50
set 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 and 100
Conn	Computer Remote Control: OFF(computer communication not used) : ON(Communication used) 1) Adr: Communication ID Number (assign 1~999 for each product) 2) bPS: Communication Speed (select among 2400, 4800, and 9600) *255 units of products can be connected with one computer *Refer to the website for the protocol and monitoring program for demo
C--F	C: Celcius F: Fahrenheit
LoC	OFF: Lock cancelled IN: Lock only Input group ALL: Lock both Input & Output group *If set as In or All, it is possible to enter the locked group but impossible to change the value

6 Output Group

■Output group contains control system and alarm selection
■Press 'SET' button for 3 sec to enter output group
■Press ''SET' button once to move ino next parameters among group. Press ▲, ▼ buttom to change output types and functions
■Press 'SET' button for 3 sec after altering values to save and return







7 Output Group Function

7-1. Relay Output ON/OFF Control

oUt1 onoF

■If press 'SET' button for 3 sec, Out1 at top screen and either ONOF or PId at bottom screen will be displayed
■If you want ON/OFF control, select ONOF by pressing ▲, ▼ button

tyP HEAT/COOL

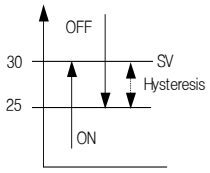
■If you press 'SET' button once after selecting ONOF in the previous stage, TYP at top screen and either HEAT or COOL at bottom screen will be displayed
■You can set HEAT for heating control or COOL for cooling control by pressing ▲, ▼ button

HYS 0.1~99.9

■If press 'SET' button once after setting TYP, HYS at top screen and numbers of 0.1~99.9 at bottom screen will be displayed , HYS means the range between relay ON and relay OFF

dLt 0~300

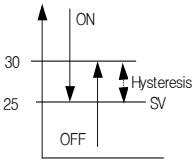
■If press 'SET' button once after setting HYS, dLt at top screen and numbers of 0~300 at bottom screen will be displayed, dLt will be working after delayed time(sec) set at DLT



*If SV is set at 30 and others as below

oUt1 onoF → tyP HEAT → HYS 5.0 → dLt 15 →

->It will operate at 25.0 after delaying for 15 sec as ON/OFF control heating type, and stop at 30.0



*If SV is set at 25 and others as below

oUt1 onoF → tyP COOL → HYS 5.0 → dLt 7 →

->It will operate at 30.0 after delaying for 7 sec as ON/OFF control cooling type, and stop at 25.0

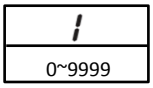
7-2. Relay Output PID Control

oUt1 PId

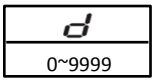
■If press 'SET' button for 3 sec, OUT1 at top screen and either ONOF or PId at bottom screen will be displayed
If you want heating PId control, set PId by pressing ▲, ▼ button and move to the next step by pressing 'SET' button once

P 0~999.9

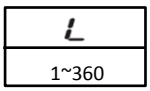
■If you operate Auto Tuning, appropriate PID value will be automatically saved after considering the current heating characteristics(refer to 9)
■If over-shooting occurs after executing Auto Tuning, Please manage PID value manually
▪If P value is set higher: the speed gets slower while over-shooting decreases
▪If P value is set lower: the speed gets faster while over-shooting increases
▪If P value is set '0', you can control ON/OFF



■Integral Value: adjust proportional width with P value, and then adjust the speed with I value
The less integral value, The faster the speed



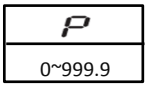
■Differential Value: When the small periodic hunting occurs, Please lower d value
* Set I or d value for special cases. In general, it can be controlled appropriately by the value of Auto Tuning



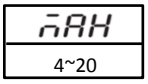
■Control Period Cycle: It represents time for repeating output On and OFF one by one
▪If you set the cycle short, you can control precisely but the relay life time will be reduced (10~30 sec is proper)

7-3. Current Output (Optional)

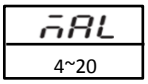
■If Output 1 is ordered as Current Output, either 4-20 or PV will be displayed when pressing 'SET' button for 3 sec▪Press ▲,▼ button to select 4-20 for current control
(If you want 1-5V Voltage control, connect 250Ω *1/4W resistance to both ends of output point)



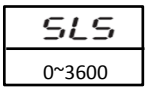
■If you press 'SET' button once after setting 4-20 in the previous step, P at top screen and the numbers of 0~999.9 at bottom screen will be displayed
■If you operate Auto Tuning, appropriate PID value will be automatically saved after considering the current heating characteristics(refer to 9)
■P: Proportional Value of Current Control ■I: Integral Value of Current Control
■D: Differential Value of Current Control



■Function to limit the maximum value of 4-20 current output
ex) If you set MAH as 15, the maximum current value will not be higher than 15mA

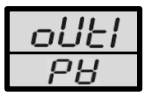


■Function to limit the minimum value of 4-20 current output
ex) If you set MAL as 8, the minimum current value will not be lower than 8mA

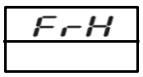


■It represents slow start time to take from the first current, which operates the controller, to reach maximum value
■Used for the device which can be damaged by excessive current when turning on
■If you input time, it means the time to take to reach maximum value(20mA) (Unit: sec, Range: 0~3600)
ex) If you set SLS at 60, It takes 60 sec for current value to reach 20mA
*If Out2 is ordered as Current Control, setting method is same as that of Out1 Current Control and target value is controlled by SV on main screen

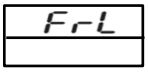
7-4. Transmission Output (Optional)



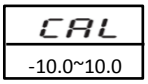
■If Out1 is ordered as Transmission Output, Out1 at top screen and either 4-20 or PV at bottom screen will be displayed Select PV for using transmission output



■Transmission Output "High"



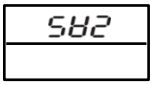
■Transmission Output "Low"
ex) When you set FrH: 100, FrL: 0, 4mA current will be transmitted at 0℃ and 20mA current at 100℃



■Function to compensate the current error when it occurs at the transmission output
■With 1.00 input, current increases as much as 1mA. With -1.00 input, current decrease as much as 1mA
■Setting method of OUT2 transmission output is same as that of OUT1

7-5. OUT2 ON/OFF Control

■Move into OUT2 after setting OUT1
■If OUT2 is relay output, one of ONOF, TIME, A1~A8, LbA, or SbA will be displayed
■Set ONOF in the case that OUT2 is used as ON/OFF



■If press 'SET' button once after setting ONOF in the previous step, SV2 at top screen and target value at bottom screen will be displayed
SV2 is the target value of OUT2, which is separate from SV, the target value of OUT1.
It operates separately with no regard to OUT1 TYP, HYS, dLt share the same setting method of OUT1's

7-6. OUT2 Timer Output

■In the case that OUT2 is used as timer, set one of ONOF, TIME, A1~A8, LbA, or SbA as 'TIME' by pressing ▲,▼ button

tSt / HH.MM/MM.SS	■Set hour, minute, second unit HH.MM(99Hours. 59Minutes), MM.SS(99Minutes. 59Seconds)

StA / S.ON/S.OFF	■Set start type S.ON: Start from On, S.OFF: Start from OFF
oFF / 00.00	■Stopping time of Timer Output
on / 00.00	■Operating time of Timer Output
rPt	■Repeating number of Operation & Stop 1: Repeat once , 100: Repeat 100 times, 0: Repeat indefinitely

Timer Operation Example
ex1) TST: HH.MM , STA:S.OFF , OFF:04.00, ON: 00.20, RPT: 0
From power on, 20 minutes operation after 4 hours stop repeating indefinitely

ex2) TST: MM.SS , STA:S.OFF, OFF:00.20, ON: 00.40, RPT: 5
From power on, 40 minutes operation after 20 minutes stop repeating 5 times

ex3) TST: HH.MM , STA:S.OFF , OFF:08.00, ON: 99.00, RPT: 1
From power on, 99 hours operation after 8 hours stop repeating once

7-7. OUT2 LBA Output

oUt2 / LbA	■Press ▲, ▼ to set LbA(Loop Break Alarm) in OUT2 group
L.tIm / 1~3600	■If press 'SET' button once after selecting LbA, L.TIM at top screen and time(1~3600) at bottom screen will be displayed ■ L.TIM : Loop Break Monitoring Time
L.rnG / 0~30	■If press 'SET' button once after setting L.TIM, L.rnG will be displayed at top screen ■L.rnG : Alarm range ex) L.TIM:120 L.rnG:2

■LBA operates, when there is no temperature change over 2'C after heating or cooling for 60 sec

LbA (Loop BreakAlarm) : Function to check whether the controlled device has problem or not
LbA output will be ON, when there is no temperature change durnig time set at LBA by monitoring the temperature through the temperature sensor after controller send the operationg signal

▶**Major cause of LbA ON**
①Disconnection or break of sensor wiring (*LbA will be immediately ON when "----" is displayed due to the break of sensor wiring)
②Errors of external device such as magnet and sub relay
③Abnormal load on heater and cooler ④Disconnection, wrong connection or damage of external wiring
▶LbA Output will be OFF, when the problem is solved and the device is properly operated

7-8. Sensor Break Alarm(SbA)

If select SbA(on) at OUT2,3, Sensor Break Alarm will be on

SbA (Sensor Break Alarm) :
"----" will be displayed at top screen(PV) and SbA signal is made, when the sensor is disconnected or incompatible sensor is connected. SbA output will stop, if sensor is properly connected.
*It can be recognized no sensor disconnection, if you connect the thermocouple sensor that share the same type as but different feature from one that you set at 'IN' of Input group

8 Alarm

Select & Use the appropriate alarm among A1-A8 at OUT2,3

Code	Alarm Type	Function
A1	Absolute Alarm High	■Alarm operates above the set value of AH alarm ex) If SV is set at 100 and 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	Absolute Alarm Low	■Alarm operates below the set value of AL alarm
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

A5	Absolute Alarm High & Low	■Alarm operates both above and below the set value of AH and AL alarm each AH: Absolute Alarm High AL: Absolute Alarm Low ex) If AH is set at 100 and AL at 50, alarm works above 100 and below 50 tip) AH value is higher than AL value.
Ab	Variation Alarm High & Low	■Alarm operates both above AH and below AL value with regard to changed SV value 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 between AH value and AL value (Setting method is same as A5) ex) If AH is set at 100 and AL at 50, alarm works between 100 and 50 tip) AH value is 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 Alarr Set the range of 1-30 to prevent the relay vibration problem that results from the same starting & finishing time

* dAL (delaying Alarm):

Alarm signal doesn't work when the value is 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

oFF: DAL not used ON: DAL used

9 AUTO TUNING

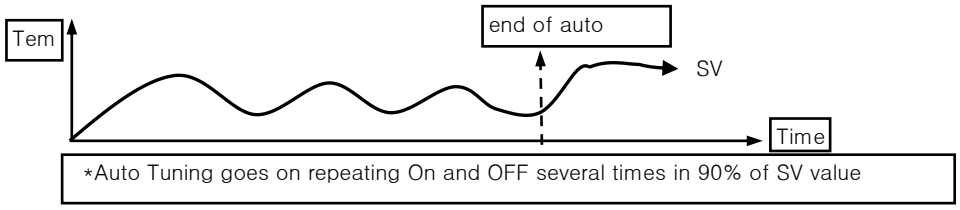
■PID AUTO TUNING is the control preparation that enables quick response and precise control. It is to calculate PID modification numbers for the optimal control and to set the value by measuring the thermal characteristics and thermal response speed of various controlled device.

■Auto tuning should be done at the first stage after attaching the controller

■It operates by pressing ◀ button for 3 sec after selecting one of PID, CPID, 4-20, or 20-4 in OUT1 or OUT2

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

■Press ◀ button for 3 sec to stop auto tuning while it is in progress



10 Special function

Used only for special cases, so that it is not displayed in general setting in order to avoid users' confusion

10-1 CPId Control (Cooling Pid Control) -Relay Output

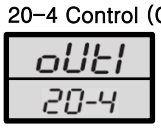
*How to enter CPId: Enter OUT1 and press both ▲, ▼ button at the same time for 3 sec

To convert it from special function into general function, press ▲ or ▼ button to set the other function

▪Sub parameters are same as that of heating PID

▪Press 'SET' button for 3 sec to return to main screen after setting up

10-2. 20-4 Control (Cooling Current Control) -Current Output



*How to enter 20-4: Enter OUT1 and press both ▲, ▼ button at the same time for 3 sec

To convert it from special function into general function, press ▲ or ▼ button to set the other function

▪Sub parameters are same as that of 4-20 Current Control

▪Cooling Current Control is available in OUT2. The way to enter is the same as in the case of OUT1

10-3. dEF (defrost control and task reservation)

*How to enter dEF: Enter OUT2 and Press both ▲,▼ button at the same time for 3 sec

To convert it from special function into general function, press ▲ or ▼ button to set the other function