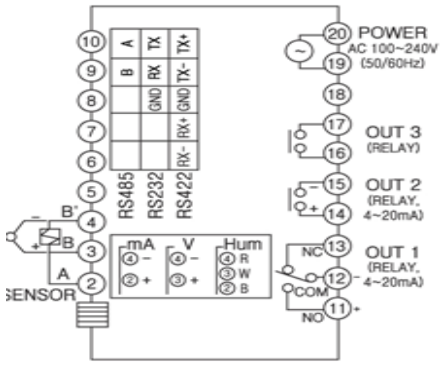
SD-96MX Users' Manual

1 Model Type

	①	②	③	④	⑤
SD-96MX		R	R	R	N

① SIZE(mm)	Cutting size(mm)	②OUT1	③OUT2	④OUT3	⑤Communication
SD96MX : W96*H96*D107	92*92(+0.5)	R : RELAY A : Current S : SSR	R : RELAY A : Current	R : RELAY S : SSR Output	**N** : No communication **2** : 232 comm. **4** : 422 comm. **8** : 485 comm.

2 Connection Diagram



Caution! Please connect after main power OFF.

- Thermocouple (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 (Option) : 11+ 12-
- OUT1 Relay Output : 11 (Output) 12 (Input)

3 Name & Function of each part

Setting of MV screen : After press and set with Up, Down button

- **OF** : NO setting (No display)
- **D1**
  - OUT1 Relay output : Display portion of operation
  - OUT1 Current output : Display current amount
- **D2** : If OUT2 is Current outputs, display current amount.
- **tP** : Display setting type of **OUT1**
  - ONOF (COOL) : **C**
  - ONOF (HEAT) : **H**
  - PID : **P**
  - CPID : **L**
  - 4-20 : **rE**
  - 20-4 : **dr**
  - PV transmission : **PV**

(Refer to page 8, 10-3)

Real time value (PV) Target value (SV)

This is the initial screen.
(Top screen : PV)
(Bottom screen : SV)

(LED lamp's Usage)

- OUT1 : Output 1
- OUT2 : Output 2
- OUT3 : Output 3
- COMM : Communication
- D1 : Display type of OUT1 on MV screen
- D2 : Display type of OUT2 on MV screen
- AT : Auto tuning
- ST : Self tuning

Button Type	Use & function
AT	▪ If press it for 3 secs after entering output group, it returns to initial screen and turns to auto tuning function. - If press it for 3 secs during auto tuning, tuning will stop.
SET	▪ **If press it once, SV will falsh. At that time, SV value change by ▲ or ▼ button.** ▪ If you press it for 3 secs, enter to output group. - Move among parameters in the group, if you press it once after entering output group.
	▪ Move digit position. (Press "SET" button and then this button to move digit position.**)** ▪ Move to MV screen (Move to MV screen if you press this button, without touching any other button.)
	▪ Setting value Up & change functions ▪ Setting value down & change functions -Change fast if you press longer than 3 secs.
SET + ▲	▪ Enter to input group, if you press both buttons for 3 secs at the same time.

4 Input type and Range

Input Signal	Input Type	Input Code	Range	Grade
stance Thermom	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	
	B	b	600~1800	
	S	S	0~1700	
	C(W)	C	0~2300	
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	
DC Current	4-20mA	4-20	-1999~9999	

5 Input Group

- Input group contains sensor type option and auxiliary functions. **(For main function setting, refer to output group No. 6)**
- To enter Input Group : Press "**SET" button & ▲ for 3 secs at the same time.**
- Parameter shift among groups : Press " SET" button one time.
- Value (Function) change : Press ▲ or ▼ button.
- Save and Return : Press "SET" button for 3 secs to save changed data and return.
- " ·····► " : Parameter on the dotted arrow route is not displayed, if the related function is not selected.

Parameter	Function
In	▪ Input Sensor **: PT, K, (K.dot), J, T, R, B. S, C, HUM, V15 , V10 , MA20** (Enter same type of sensors connected with this equipment's) PONT Decimal : Range 0~2 SCH Scale "High" SCL Scale "Low" Ex1) PONT:0 SCH :100 SCL:0 Display 0~100 Ex2) PONT:1 SCH :10.0 SCL:-10.0 Display -10.0~10.0 ▪ In case of selecting V15 , V10 and MA20, you can set Decimal, Scale "High" and Scale "Low".
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. Ex) Display 60 if you set BIAS at 10, when the current measurement value is 50. Display 40 if you set BIAS at -10, when the current measurement value is 50.
SEtH SEtL	▪ Set the Highest Limit : If you set SETH value, SV value cannot be set above SETH. ▪ Set the Lowest Limit : SV value cannot be set below SETL. Ex) If set at SETH:100 , SETL:-10, SV can be set only between -10~100.
Comm	▪ Remote Control **: OFF** (Computer communication is not used) **: ON**(Communication is used) **Adr :** Communication ID Number (Assign 1~999 for each product) **bPS : Communication Speed** (Select among 2400, 4800 and 9600) ▪ 255 units of products can be connected with one computer. * Refer to the website (www.31eng.co.kr) 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 group * If set In or All, it is possible to enter the locked group but cannot change the value. * **Initialization setting** : **If press DOWN Key 7 times continuously, INIt is displayed on PV screen.** At that time, press "SET" button to initialize.

6 Output Group

■ Output group is main operationg group and sets control method, control range and alarm.
■ Press **"SET" button** for 3 secs to enter output group,.
■ Press "**SET" button once to move into next parameters among group. Press ▲ or ▼ button to change output types and functions.**
■ Press **"SET" button** for 3 secs after altering functions. And then changed data is saved and it returns to initial screen.

Output 1 (Relay Output)

Select onof or PID by UP or Down button

oUt1 onoF	oUt1 PId
ONOFF Control	PID Control
tYP HEAT COOL	P 0~999 Proportional
HYS 0.1~99.9 Deviation between	I 0~9999 Integral
dLt 0~300초 Delay time	d 0~9999 Differential
	L 1~360 ON/OFF Cycle
ON/OFF Control Refer to 7-1	PID Control Refer to 7-2

Output 1 (Current Option)

Select 4-20 or PV by Up or Down

oUt1 4-20	oUt1 Pv
P Proportional	FrH Range "High"
I Integral	FrL Range "Low"
d Differential	CAL -1.00~1.00
nAH Current limit "High"	Transmission output
nAL Current limit "Low"	
SLS Slow Start	

Current control Refer to 7 -3

OUT2 can be set after last OUT1 parameter setting.

Output 2 (Relay output)

Auxiliary relay output (Select output type such as alarm, timer etc. by Up or Down button.

oUt2 onoF	oUt2 tiME	oUt2 AL ~ AB	oUt2 LbA	oUt2 SbA
Sb2	tSt		LtIn	
tYP	StA		Lrn0	
HYS	oFF		nAL	
dLt	On			
	rPt			
OUT2 ON/OFF Control Refer to 7-5	Timer output Refer to 7-6	Alarm Refer to 8	Loop break alarm Refer to 7-7	Sensor break alarm Refer to 7-7

Output 2 (Current Option)

Select 4-20 or PV by Up or Down button

oUt2 4-20	oUt2 Pv
P	FrH
I	FrL
d	CAL
nAH	
nAL	
SLS	Same as transmission output of out1 Refer to 7-4
Same as current control of out1	

OUT3 can be set after last OUT2 parameter setting.

Output 3 (Auxiliary output such as alarm, timer etc) Same function and setting as that of Out2.

oUt3 onoF	oUt3 tiME	oUt3 AL~ AB	oUt3 LbA	oUt3 SbA
Sb3	tSt		LtIn	
tYP	StA		Lrn0	
HYS	oFF			
dLt	On			
	rPt			

7 Description of Output Group

7-1. Relay output ON/OFF control

oUt1
onoF

▪ If press "SET" button for 3 secs on initial screen, OUT1 at top screen and ONOF or PId at bottom screen will be displayed.
▶When want to ON/OFF control, press ▲ or ▼ button to set ONOF.

tYP
HEAT COOL

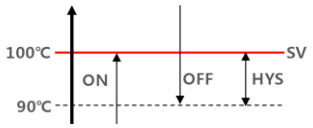
▪ Set as ONOF at the previous step.
And then if press "SET" button once, TYP at the top and HEAT or COOL at the bottom screen will be displayed.
▪ For Heating or Cooling control, press ▲ or ▼ button to set HEAT or COOL.

HYS
0.1~99.9

▪ If press "SET" once after setting TYP, HYS at top screen and numbers of 0.1~99.9 will be displayed.
HYS represents the deviation between relay ON and relay OFF.

dLt
0~300

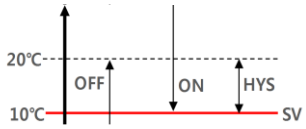
▪ If press "SET" once after setting HYS, dLt at top screen and unmber of 0~300 at bottom screen will be displayed.
dLt operates after delayed time (sec) set in dLt.



oUt1	→	tYP	→	HYS	→	dLt
onoF		HEAT		10.0		7

(Diagram 1)

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



oUt1	→	tYP	→	HYS	→	dLt
onoF		COOL		10.0		15

(Diagram 2)

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

7-2. Relay output PID control (After auto tuning, proper PID value is saved automatically. Refer to 9, Auto Tuning.)

oUt1
PId

▪ 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 ▼ button to set PId and press "SET" button once to move to next step.

P
0~999

<<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 : the speed gets slower while over-shooting decreases.
▶ If P value is set lower : the speed gets faster. But over-shooting may occur if it is extremely low (P=0, ONOFF control).

<<First, adjust proportional width with P value and then adjust details with I & d value. >>

I
0~9999

▪ Integral Value **(I)** : Long period slow hunting is occurred, adjust I value (High I value makes hunting low).

d
0~9999

▪ Differential Value : When the short period hunting occurs, please lower d value (Lower value -> Less hunting)
▶Set P, I or D value for special cases. In general, it can be controlled appropriately by the results of auto tuning.

L
1~3600

▪ Control Period Cycle : The duration of time of one cycle in a repeating event ON and OFF.
▶If you set the cycle short, you can control precisely but the relay life will be reduced. (Recommend 10~30 secs)

7-3. Current output (Option)

oUt1
4-20

▪ If OUT1 is ordered as Current Output, either 4-20 or PV will be displayed when pressing "SET" button for 3 secs at initial.
▶Select 4-20 pressing ▲ or ▼ button in case of using current control.

P
0~999

▪ If press "SET" once in 4-20, P at top screen and 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 heating characteristics.
▶ P : Proportional Value ▶ I : Integral Value ▶ d : Differencial Value(Same operating method with relay pid control of 7-2)

nAH
4~20

▪ Function to limit the maximum current value
Ex) If you set MAH as 15, the maximum currnet value will not be higher than 15mA.

nAL
4~20

▪ Function to limit the minimum current 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 can be damaged by excessive current when turning on**
▪ **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.

<<If OUT2 is type of current control, operating concept is same as OUT1 current control (7-3) and SV is controlled by SV of initial screen.>>

7-4. Transmission Output : Real time PV value on the equipment is switched and outputs 4~20mA.

oUt1
PV

▪ Press "SET" button for 3 secs at initial screen, OUT1 at top and 4-20 or PV at bottom will be displayed.
in case OUT1 is ordered as current output. Transmission output is set PV.

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

CAL
-1.00~1.00

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

7-5. **ON/OFF Control** (When you don't use out2, set until out1 and press "SET" button for 3 secs to return.)

oUt2
onoF

▪ If OUT2 is relay output, one of ONOF, TIME, A1~A8, LbA, SbA is displayed in output group OUT2.
▪ Set ONOF in case it is used as ON/OFF.

Sb2

▪ 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 seperated from SV of OUT1, the target value of OUT1.
It operates separately with no regard to OUT1. Set TYP,HYS and dLt same as OUT1(refer to 7-1).

7-6. Output 2 Timer Output

oUt2
tiME

▪ In case OUT2 is used as timer, press ▲ or ▼ button to set as TIME.

tSt

▪ Set HH.MM or MM.SS ┌HH.MM(99 Hours 59 Minutes),
└**MM.SS** (59 Minutes 59 Secs)

StA
oFF on

▪ **Set start type**
S.ON : Start from ON, **S.OFF** : Start from OFF

oFF Stopping Time of timer

on Operating time of timer

rPt Repeating number of Operation and Stop

1 : Repeat once , 100 : Repeat 100 times, 0 : Repeat infinitely

▪ Timer Operation Example
Ex1) **TST** : HH.MM , **STA :** S.OFF , **OFF:** 04.00, **ON:** 00.20**, RPT**: 0
20 minutes operation after 4 hours stop repeating infinitely

Ex2) **TST**: MM.SS , **STA**: S.OFF , **OFF**: 00.20, **ON**: 00.40, **RPT**: 5
40 seconds operation after 20 seconds stop repeating 5 times

Ex3**) TST**: HH.MM , **STA**: S.ON , **OFF**: 99.00, **ON**: 08.00 , **RPT**: 1
99 hours stop after 8 hours operation repeating once

7-7. OUT2 LBA Output

oUt2
LbA

▪ **Press ▲ or ▼ to set LbA (Loop Break Alarm) in OUT2 group when OUT2 is used as LbA.**

L.tIn **L.TIM :** Loop Break Monitoring Time

L.rnG **L.rnG :** Alarm Range

▶ LBA (Loop Break Alarm) : Function to check whether the controlled device has any 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 ect.
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 solved and then make SV value= PV value or change LBA setting value.

7-8. Sensor Break Alarm (SbA)

▪ **If select SbA (ON) at OUT2, 3, output mode becomes Sensor Break Alarm.**

"----" will be displayed and SbA signal is made when the sensor is disconnected or opened.

8 Alarm

Set alarm type with Up or Down button and press "SET" button to move into next parameter.

OUT2 , OUT3 Alarm (Common built-in 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	Absolute 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 set value of AH and AL alarm each (A1 Alarm + A2). **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 Alarm+ A4 Alarm). **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 if PV enter between AH value and AL value. Ex) If AH is set at 100 and AL at 50, alarm works when PV enter between 100 and 50. Tip) AH value should be higher than AL value.
A8	Variation Alarm within Range	▪ Alarm operates if PV enter 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 when PV enter between 108 and 90.

*** AHYS** (Alarm Hysteresis) : Set the range of 1-30 to prevent the realy vibration problem that results from the same starting & finishing time.

AHYS is applied to all alarm equally.

*** 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.

(All alarm equally applied)

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

9. Tuning Group

9-1 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, operation runs automatically.

B Auto Tuning Operation Method

▪ **If press "AT" for 3 secs at initial screen, TUNG at top and one of AT(Auto Tuning) or ST(Self Tuning) 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.

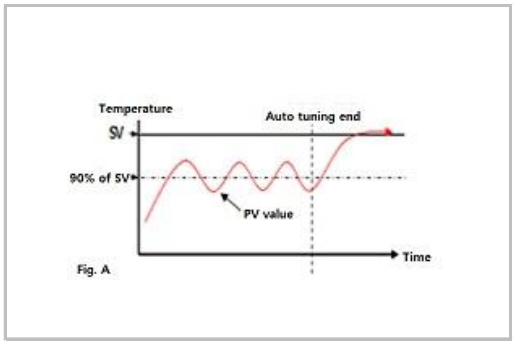
▪ **It operates by selecting one of PID, CPID, 4-20, 20-4 in OUT1 or OUT2 and then pressing "AT" for 3 secs.**

After that, it returns to initial screen and auto tuning works at once.

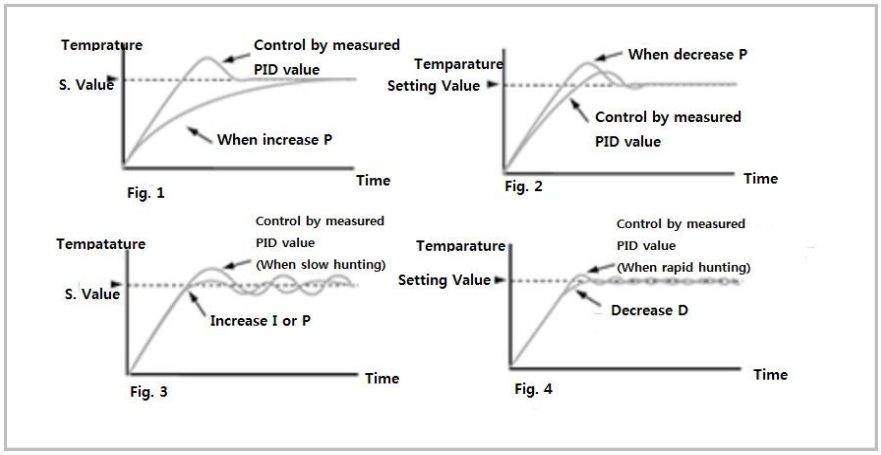
▪ Auto tuning operates at 90% of SV and it ends after PV value goes up & down 3 times. (Refer to Fig. A)

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

▪ Press "AT" button for 3 secs to stop tuning while auto tuning is in progress.



(Auto tuning Graph)



(PID Graph)

9-2 Self Tuning : Factory default settings is 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.

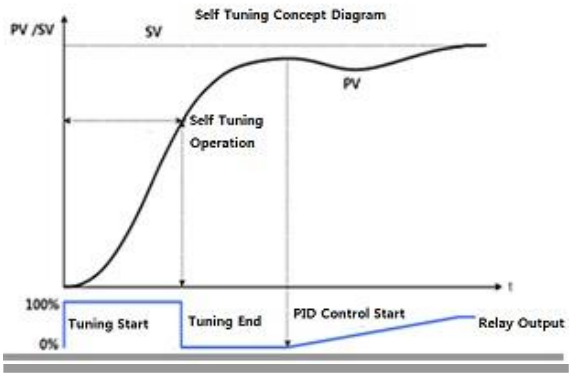
During self tuning ST lamp in front blinks & lamp turns off after tuning ends.

B Self tuning operation method

▪ **If press "AT" for 3 secs on initial screen, enter to tUnG setting mode. After that, use ▲ or ▼ & 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 "AT" for 3 secs to stop self tuning while it is in progress.



10 Special Function

10-1. CPId Control (Cooling Pid Control) - only Relay output

- **How to enter CPId : Enter output group and** press both ▲+▼ at the same time for 3 secs in OUT1 PID. If so, it will be switched to CPID.

  (To switch to PID or ONOFF from CPID, select it by pressing ▲ or ▼)

- Sub parameters of CPID & PID are same.
- Press "SET" for 3 secs to save & return to initial screen after setting up.

10-2. Cooling Current Control - only Current output

- How to enter 20-4 : Enter output group and press both ▲+▼ at the same time for 3 secs in OUT1 4-20. If so, it will be switched to 20-4.

  (To switch to 4-20 from 20-4, select 4-20 by pressing ▲ or ▼)

- Sub parameters of 20-4 & 4-20 are same.
- Press "SET" for 3 secs to save & return to main screen after setting up.

10-3. Setting of MV screen

- If you press "◀" button once, functions as below are displayed. At this time, you can change functions by Up or Down button.
  - As each parameter moves, LED lamp moves to match each function.
  - After finding function you want to use and press "SET" once, this function is saved and returned to initial screen.

▸ **OF :** No MV screen display

▸ **D1 : when out1 is relay output** - Display the duty value (The portion of operation time in combination with the operation time and the stop time of OUT1).

Ex) Recent relay 1 time operation time - ON: 60 secs OFF: 40 secs, On+Off=100 secs. So it operates 60 secs of 100 secs and operation portion is displayed as 60%.

▸ **D1 : when out1 is current output -** Real time current output of OUT1 is displayed.

(It is not displayed for the product current option is not applied.)

▸ **D2 :** OUT2 current output is displayed.

▸ **tp** : Setting type of OUT1 is displayed.

Display value is applied according to output type of output group OUT1 (Refer to 1Page, **tP** of no. 3 for display type).

11 Product Specification & Caution

Product Specification

Sampling Period 250ms

Relay contact point output Contact point capacity (Main) : 240 VAC 5A, 30V DC 5A(Resistive load)
Relay life : Over 1,000,000 times (Mechanical), Over 300,000 times (Electrical)

SSR Output ON Voltage : Approximately over 12 VDC(Load resistance over 300Ω, in cast of short circuit, it is limited to 30mA current.)

Current Output Current output range : 4~20mA DC Load resistance : Below 300Ω

Voltage output **Current output terminal : If you connect 250Ω on each + -, it switches to 1-5V.**

System requirements Continuous vibration (5~14Hz) : Peak to Peak below 1.2mm,
Normal operation condition : Ambient temperature 0~50℃ , Ambient humidity :20~85%

Power supply voltage : 100~240V AC(within ±10%) 50-60Hz Power consumption : Below 6.0W, MAX. 10VA

Panel cutting size W92 x H92

Digital letters of this equipment