SDMNPR1710E

- **Please keep these instructions and review before using this controller.**
- **This instruction manual uses WARNING and CAUTION as signal words for safety.**

WARNING WARNING indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.

1. In case of using this unit with machineries (warehouse, medical equipments, vehicle, train, airplane, nuclear power ot safety devices etc.) it requires installing fail-safe device.
   ▶**It may result in serious damage, fire or human injury.**
2. Use a rated voltage to prevent damage or trouble.
   ▶**It may result in fire.**
3. Check the number of terminal when connect each line and signal input.
   ▶**It may cause fire or trouble.**
4. Do not turn on the power until the wiring completed.
   ▶**It may cause electric shock.**
5. Do not repair, wiring or checkup when electric power on.
   ▶**It may cause electric shock.**
6. Installation the controller where there is no dust, corrosive or explosive gas, direct ray of the sun, mechanical vibration or shock present.
   ▶**It may cause fire or explosive.**
7. This controller must be mounted pannel.
   ▶**It may cause electric shock.**
8. Do not repair beyond of authorized technician.
   ▶**It may cause trouble.**

CAUTION CAUTION indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury and at other times or serious injury, I may also be used to alert against unsafe practice.

1. Ensure the surrounding ambient operating temperature is 0~50℃.
   ▶**It may cause fire or wrong operation.**
2. Ensure the power supply for the controller does not fluctuate. Main supply voltage fluctuation not exceed ±10% of the normal voltage.
   ▶**It may cause fire.**
3. This controller shall not be used outdoors.
   ▶**It might shorten the life cycle or given an electric shock.**
4. When wiring connection, #20AWG (0,5mm2) should be used and screw bolt on terminal block with 0,74N.m strength.
   ▶**It may result in malfunction or error.**
5. Keep the controller away from high current and voltage circuits. The controller and connection wires (esp., compensation conductors and RTD lead wires) should be kept approximately 30cm away from high electric circuit to limit the possible affect of noise.
   ▶**It may cause display fluctuation or error.**
6. Do not use a place where temperature fluctuate or icing occurs. It may cause fire, explosive or error.
7. In cleaning the controller, do not use water or an oil-based detergent.
   ▶**It might cause an electric shock or fire that will result in damage to the product.**
8. Do not inflow dust or dregs into inside of this controller.
   ▶**It may cause fire or trouble.**
9. Installation Category II, Pollution Degree 2, Altitude over 0~2000m use.

PROGRAMMABLE PID CONTROLLER

SDM Series

Thank you very much for selecting Sanup temperature controller. For your safety, please read the following before using.

SANUP ELECTRIC
• URL: http://www.sanup.com
• E-Mail: sanup@sanup.com

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1 Features

SDM is 2-pattern each 12-segment simple program controller. Very easy use, stabile control, Fuzzy Logic PID control algorithm and various functions are very useful for your factory.

- 2-Pattern 12-Segment Program Control — RUN/STOP
- Fuzzy Logic Algorithm — High Stable Control
- Universal Input — TC. RTD. Vdc. mAdc
- Universal Output — Relay. SSR. 4~20mAdc
- Manual control — Auto/Manual Control
- Heat-Cool Control — Programmable
- RS 485 Interface — MODBUS ASCII
- 4~20mA Ret. Output & 17Vdc TX Power — Standard Function
- Output Limit — High-Low Limit

2 Ordering Codes

MODEL	SIZE	-	CODE					SPECIFICATION
SDM	□	-	□	□	□	□	□	Programmable PID Controller
	4000							48(W)X48(H)X90(D) (mm)
	4900							48(W)X96(H)X100(D) (mm)
	9400							96(W)X48(H)X100(D) (mm)
	7000							72(W)X72(H)X100(D) (mm)
	8800							85(W)X100(H) (mm) *1
	9000							96(W)X96(H)X100(D) (mm)
Input			U					Universal Input
Range				0U				Full Range. See Input Table.
Control Output					U			Universal Control Output
Power						F		100~240V ac. 50-60Hz
Optional							N	None
							3	MODBUS RS 485 Interface

Note 1. Main board size of Board Type Controller.

3 Functional Description

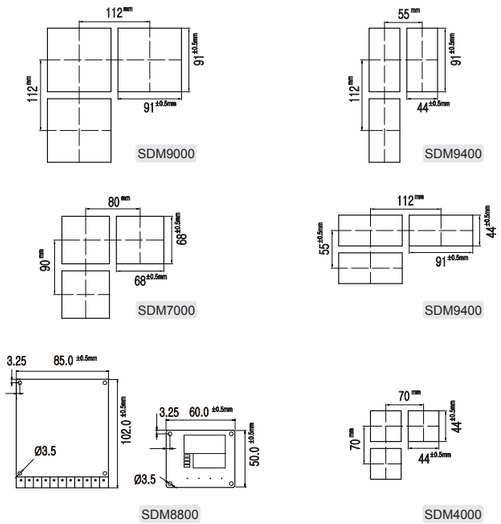
Status Indicator LED
Set Value Display
Set & Function Keys
Processing Value & Parameters Display

	KEY	FUNCTION
①	ENT	1. Enter Set Value 2. Start Program Control (keep 2 sec.)
②	↺	Call Parameters
③	∨ ∧	Decrement and Increment of Set Keep 2 sec. over, will be fast up/down.
④	MAN	1. Select Auto-Manual Control Mode 2. Start and Stop Auto-Tuning

4 Specification

Items		Specifications
Power	Power	100~240Vac (90~264Vac)
	Frequency	50/60Hz
	Power Consumption	5VA less
	Insulation	between primary & secondary terminal: 500Vdc 20MㅿΩ over
		between primary & ground terminal: 500Vdc 20MㅿΩ over
		between secondary & ground terminal: 500Vdc 20MㅿΩ over
	Dielectric Strength	between primary & secondary terminal: 2300Vdc 50/60Hz 1min.
		between primary & ground terminal: 2300Vdc 50/60Hz 1min.
		between secondary & ground terminal: 1500Vdc 50/60Hz 1min.
Input	Input	T.C: K.J.E.N.C.T.R.S.B RTD:Din Pt100/Pt100ㅿΩ Vdc: 1-5V.0-5Vdc 4-20mA(use Res.)
	Scan Time	140ms
	Impedance	T.C: 1MΩ
	Accuracy	T.C: † 0.3%+1digit or 3˚
		RTD/V. mAdc: † 0.2%+1digit
Output	Control	Relay Contact 250V 2A, R Load 4~20mAdc max. 600Ω SSR 20V 21mAdc
	Alarm	250Vac. 1A(R load)
	Retransmission	600 max. Programmable scale.
	TX Power	17V 30mAdc max.
	Interface	RS 485 MODBUS ASCII (optional)
Control	Auto Mode	PID with Auto-Tuning. P with MR. PI. PD. ON-OFF
	Manual Mode	Set Output Percent
Installation Condition	Continuous Vibration	5-14Hz: forward width 1.2m max. 4-150Hz: 4.9m/cm2
	Vibration	14.7m/cm2 15sec. max. each 3 direction
	Shock	147m/cm2 11msec. max. 6 direction 3 times
Operating Condition	Temperature	0~50˚
	Humidity	35~85%RH. No condensation
	Influence of Magnetic	400AT/m max.
	Warm-up Time	30min. min.
Operating Environment	Thermocouples	† 1BV/˚ or † 0.01%/˚ of F.S
	RTD	† 0.05Ω/˚
	Analog Output	† 0.05%/˚ of F.S
Storage	Temperature	-25~70˚
	Humidity	5~95%RH. No condensation

5 Demension & Panel Cut



Installation Guidelines

1. Ensure the operating temperature is 0~50˚ and humidity is 35~85%RH.
2. Ensure the supply electric power does not fluctuate greatly.
3. Install the controller where there is no dust, corrosive or explosive gas present.
4. Install the controller where there is no risk of mechanical vibration or shock.
5. Keep the controller away from high current and voltage. The controller and connection wires should be kept about 30cm (12") away from high current or high voltage line to limit the possible affects of noise.

Installation Procedure

1. Make a panel cutout of each size. When installing more than two controllers parallel to each other, keep enough distance between the panel cutouts. (refer to above drawing)
2. Insert the controller into the panel cutout.
3. Insert a mounting bracket into both side of the controller and tighteen the screws. (about 14.7Nm)

6 Set Parameters

When the power is turned on, the current value is displayed on the PV window and the selected program pattern P1 is displayed on the SV window. Press the ENTER key for more than 2 seconds to execute program operation by pattern 1 to start. Use the UP / DOWN keys to select Pattern 2 (P2) or pattern connection control (P1P2) can be selected and operating. When it is set to the fixed mode, displays the PV / SV, such as the controller.

Parameter Group 1 : Tuning Parameter Group ∩U1

Sign	Parameter	Operation
PASS	Password	Password for access other parameter group. PASS=5.
ConF.	Parameter Group	Select other parameter group. If wrong pass no., will be not display. ∩U1 : Tuning Group ∩U2 : Input-Output Group ∩U3 : Alarm & Ret. Out Group ∩U4 : Control Mode Group ∩U5 : Program Control Pattern 1 ∩U6 : Program Control Pattern 2 ∩U7 : RS485 Interface Group
P	Proportional Band	Set P band. (0.5~999.8%)
I	Integral Time	Set I time. (0~9998 sec.) If set to 0, control mode change to P control.
d	Derivative Time	Set D time. (0~2500 sec.) If set to 0, control mode change to PI control.
HYS	ON-OFF Hysteresis	On ON-OFF control mode, set to control dead-band.
AL-1	Alarm 1 Value	Set to Alarm 1 value. If set LBA or END, alarm is not operation.
AL-2	Alarm 2 Value	Set to Alarm 2 value. If set Heat-Cool control, alarm is not operation.
CP	Control Period	Set to control period. Generally set 20sec. for Relay and 1sec. for SSR output.
At	Auto-Tuning	Auto-Tuning srart. Disable when control mode set ON-OFF mode.
SH-H	Set Value Limit High	Set value limit high within range of use per input sensor limit.
SH-L	Set Value Limit Low	Set value limit low within range of use per input sensor limit.

Note Password for move group is fixed 5. If wrong number, display return to first parameter.

[Table1. Input Signal]

SIGN	INPUT	RANGE	
		˚	˜
K-tc	K-Type TC	-100~1370˚	-148~2498˜
J-tc	J-Type TC	-100~950˚	-148~1742˜
E-tc	E-Type TC	-100~750˚	-148~1382˜
n-tc	N-Type TC	-100~1300˚	-148~2372˜
C-tc	C-Type TC	0~2300˚	32~4172˜
t-tc	T-Type TC	-200~400˚	-328~752˜
K.ltc	K1-Type TC	-100.0~400.0˚	-148~752˜
r-tc	R-Type TC	-0~1760˚	32~3200˜
S-tc	S-Type TC	-0~1760˚	32~3200˜
b-tc	B-Type TC	-0~1800˚	32~3272˜
JPt	JIS Pt100Ω	-200~600˚	-328~1112˜
dPt	DIN Pt100Ω	-200~600˚	-328~1112˜
JPt1	JIS Pt100Ω	-200.0~600.0˚	-328~1112˜
dPt1	DIN Pt100Ω	-200.0~600.0˚	-328~1112˜
1-5	1~5Vdc		
0-5	0~5Vdc		

Parameter Group 2 : In/Output Group ∩U2

Sign	Parameter	Operation
InPt	Input	Set input sensor. See [Input-Table]
OUPt	Control Output	Set control output type. rELY : Relay output SSr : SSR output 4-20 : 4~20mA output
Un It	Display Unit	Set temperature unit ˚ or ˜
dP	Decimal Point Position	Set decimal point 0 / 0.0 / 0.00 / 0.000
SC-H	Scale High	Set high scale when use only V, mA input.
SC-L	Scale Low	Set low scale when use only V, mA input.
∩r	Manual Reset	Set manual reset when use only P control.
FILt	Filter	Set input filter time. 0~60sec.
InS	Insert	Set input offset adjustment.

Parameter Group 3 Alarm & Ret. Out Group ∩U3

Sign	Parameter	Operation
AL5.1	Alarm 1 Mode	Set alarm 1 mode. ---- : Alarm OFF -HI- : High Alarm -SH- : Standby High Alarm -LO- : Low Alarm -SL- : Standby Low Alarm -Hd- : Deviation High Alarm -Ld- : Deviation Low Alarm -dE- : Deviation Alarm LbA : LBA PEnd : Program Control End Crun : Short DI, AL is OFF Open DI, AL is ON (according to set DI)
HYS.1	Alarm 1 Hysteresis	Set alarm 1 dead-band.
AL5.2	Alarm 2 Mode	Set alarm 2 mode. Same as Alarm 1 except LBA and PEND.
HYS.2	Alarm 2 Hysteresis	Set alarm 2 dead-band.
LbA	Loop Break Alarm	In case of AL1 is set to LBA, set standby time of loop break. -If set to 0, function OFF. -Generally set to double of I time x 2 after Auto-Tuning.
rEt	Ret. Out Mode	Set retransmission output mode. Select PV: Retransmission PV Set SV: Retransmission SV Set MV: Retransmission contol output % -In case of set to 4-20mA output of 2'nd control output, retransmission is disable.
t-H	Ret. Out High Scale	Set retransmission output scale high.
t-L	Ret. Out Low Scale	Set retransmission output scale low.
d-tn	Output Delay Time	Set ramp control output time when first power on. -Set to 0, function is off. -Use only 4~20mA output.

Note Alarm 2 is disable when the cooling output is set to relay.

Parameter Group 4 : **Control Parameter Group** ∩U4

Sign	Parameter	Operation
SP-2	2'nd Set Value	Set 2'nd target point by DI selected
dI	Digital Input	DI Set digital input mode. SP2: Select 2'nd set point AM: Auto-Manual Control HOLd: Hold of program control segment rSOF: Program control run/stop MVOF: Control output OFF. 'OPEN' display on the front window -If set 'AM', disable front MANUAL key -If set 'rSOF', disable front ENT key for program control run/stop.
At-S	Auto-Tuning ON-OFF	OFF : Auto-Tuning disable. On : Auto-Tuning enable.
FUZY	Fuzzy Logic	Select FUZZY logic control
b.OUt	Burn-Out Output	Set output % when sensor broken
CACt	Control Mode	Set control mode. dOnF : Direct ON-OFF control dP Id : Direct PID control rP Id : Reverse PID control OnOF : Reverse ON-OFF control HECU : Heat-Cool control
∩H-H	Output High Limit	Set output high limit. (unit %) If set under 99.9%, disable Auto-Tuning. If set 99.9% under, disable LBA function.

oH-L	Output Low Limit	Set output low limit. (unit %) *If set to over 0, disable Auto-Tuning *If set to 0 or less is 0% recognition.
CGAP	Heat-Cool Dead-Band	When use only Heat-Cool control mode. Set dead-band. (1.0~50.0%)
CGAn	Heat-Cool Gain	When use only Heat-Cool control mode. Set gain. (0.1~10.0%)
CtYP	Cooling Output Type	Set cooling output. rELY: Relay output. Use alarm 2 output terminal. Disable AL 2. 4-20: 4~20mA output. Use RET. Out terminal. Disable RET. Out.
C-CY	Cooling Output Control Period (Unit: Sec.)	When use only Heat-Cool control mode. Set cooling output control period.(1~60s)

Parameter Group 5 : **Program Control Pattern 1 Group**

Sign	Parameter	Operation
r.5En	Program Control	Select program or fix control mode. PGn: Program Control Mode AUtO: Fix Control. Start Control First nAn: Fix Control. Standby Control First
W.Ait	Wait Time	Set wait time. Set 0 is disable.
P.Srt	Restart Mode	Set restart mode after electric power failure. rSEt : Reset StAt : Restart from segment 1
SGn0	Segment Number	Set segment no. (1~12 seg.)
SOrG	Start Value 1'st Seg.	Set start value of 1'st segment.
SnOd	Start Mode	Set start mode for program control SW : 1'st segment start from SORG value. PV : 1'st segment start from processing value.
SW 1	Segment 1 Set	Set segment 1 target value.
tn 1	Segment 1 Time Set	Set segment 1 time. (HH.MM)
SW 2	Segment 2 Set	Set segment 2 target value.
tn 2	Segment 2 Time Set	Set segment 2 time. (HH.MM)
:	:	:
SW A	Segment A Set	Set segment A target value.
tn A	Segment A Time Set	ASet segment A time. (HH.MM)
Endn	End Mode	Set program control end mode. HOLd : Hold at last set value rSEt : Reset. Program control end. rPt 1 : Repeat 1. Pattern repeat 1 time. rPt2 : Repeat 2. Pattern repeat 2 times. : rPt9 : Repeat 9. Pattern repeat 9 times.

Parameter Group 6 : **Program Control Pattern 2 Group**

Sign	Parameter	Operation
W.Ait	Wait Time	Set wait time. Set 0 is disable.
P.Srt	Restart Mode	Set restart mode after electric power failure. rSEt : Reset StAt : Restart from segment 1
SGn0	Segment Number	Set segment no. (1~12 seg.)
SOrG	Start Value 1'st Seg.	Set start value of 1'st segment.
SnOd	Start Mode	Set start mode. SW : 1'st segment start from SORG value. PV : 1'st segment start from processing value.
SW 1	Segment 1 Set	Set segment 1 target value.
tn 1	Segment 1 Time Set	Set segment 1 time. (HH.MM)
SW 2	Segment 2 Set	Set segment 2 target value.
tn 2	Segment 2 Time Set	Set segment 2 time. (HH.MM)
:	:	:
SW A	Segment A Set	Set segment A target value.
tn A	Segment A Time Set	Set segment A time. (HH.MM)
Endn	End Mode	Set program control end mode. HOLd : Hold at last set value rSEt : Reset. Program control end. rPt 1 : Repeat 1. Pattern repeat 1 time. rPt2 : Repeat 2. Pattern repeat 2 times. : rPt9 : Repeat 9. Pattern repeat 9 times.

Parameter Group 7 : **RS 485 Interface Group**

Sign	Parameter	Operation
Add5	Interface Address	Set address of RS485. 0~31.
SPEd	Interface Speed	Set interface speed. 2400: 2400bps 4800: 4800bps 9600: 9600bps
PAr Y	Parity	Set parity. None/Odd/Even nonE: None Odd : Odd EVEn: Even
CdLY	Response Delay Time	Set response delay time Set 1 is 4~54 msec. Set 2 is 54~104 msec. Set 3 is 104~154 msec.
LddF	Parameter Initialization	All parameters initialize to factory set. Run code is 123. Set 123 on SV window then controller will be run automatically.

Note 1. For related RS485, see the RS485 Interface User Manual.
2. Need to be careful consideration before run LddF. (Parameter Initialization)

7 Function Description

Select For Control Mode

The selection of the control mode can be selected from the manu group 5.

PGn : Program control mode
AUtO : Fix control. Control is immediately start when the power is turn on.
nAn : Fix control. Control is not start and it is in standby state when the power is on. You can use the ENTER key to run/stop the control.

Change Auto-Manual Control Mode

Changing between Auto-Manual control mode is by front MANUAL key or DI terminal.
The MAN LED will be ON during manual control.
When set to manual control mode, control output is indicated on the SV window.
Sign type as below.

' 88.8 — Sign of manual control mode on SV. Number mean is set value of output percent.

' 88.8 — Sign of auto control mode on SV. Number mean is present output percent.

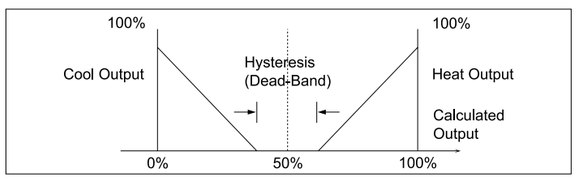
Limited Condition
-Disable Manual Control on ON-OFF control mode.
-Disable Manual Control on runing Delay Output time.
-In case of Heat-Cool control, over 50% is heat output and under 50% is cooling output.

Auto-Tuning

For optimal control, PID value is necessary. Auto-Tuning is auto set PID value after Auto-Tuning.
1. Auto-Tuning Procedure
a. Select the auto-tuning start parameter on parameter group 1, and enter STAT. Then will start tuning and blink on MAN lamp.
b. During tuning, controller will be run ON-OFF control mode.
c. For stop tuning, push MANUAL key on front. The MAN lamp will turn off and tuning stop enforcedly.
d. When Auto-Tuning nomally end, the controller calculates the optimum PID value and save it to controller parameters. The Loop Break Alarm value is auto set to twice the integral time.
2. Auto-Tuning Considerations
a. Disable on ON-OFF control mode or disable on Heat-Cool control mode.
b. Disable on limited control output set. (in case of high limit is under 99.0% or low limit is over 0.1%)

Heat-Cool Control

The Heat-Cool output is 50% of the control output obtained by PID calculation.
Each equations are
Heating Output=(Calculated output - 50% - Hysteresis/2) X 2
Cooling Output=(50% - Calculated output - Hysteresis/2) X 2 X Cooling Gain
1. Setting Procedure
a. Move to parameter group 4. On parameter CAct,set to HECU.
b. Set heat-cool hysteresis on CGAP.
Control output is turn off within this band.
c. Set cooling gain on CGAn.
Gain value is for cooling speed control. If gain is high, cooling speed also fast.
d. Set cooling output type on CtYP. Set one either rELY, 4-20.
e. If set Relay, set to cooling control period. C-CY
2. Heat-Cool Control Consideration
a. Disable Auto-Tuning
b. Cooling output set to Relay, disable Alarm 2. Cooling output 4~20mA, disable Ret. out.
c. If not special case, recommand to set 50% burn-out output.



8 Program Control Procedure

By configuring the program control variables in the manu groups 5 and 6, the two patterns each consist of 12 segments
Can use program control operation. If you use two patterns together a total of 24 segments are available.

If the program control allowable manu is set to PGM in the manu group 5, it is as follows. At this time, the pattern number can be specified and the output is OFF became.

Initial Display — Pattern 2 — Connection pattern 1 and 2

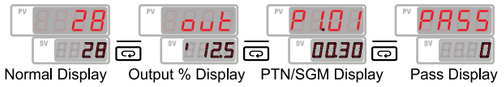
You can change pattern by using up/down keys. Press a ENTER key for confirms.

[1] Program Control Start-Stop

a. Set all related parameters.
b. Push ENTER key 2 sec. over then start program control with blink PGM LED.
c. If need to cancel runing program control, push ENTER key again.

[2] Operation Window During Program Control

When start program control, the PGM lamp flashes and see the following display.



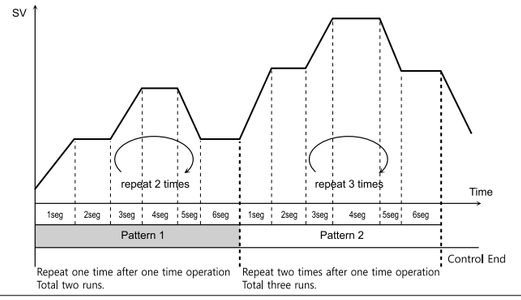
Normal Display — Output % Display — PTN/SGM Display — Pass Display

a. PATTERN/SEGMENT display P1 in the PV window means pattern 1 and 01 means segment 1.
b. PATTERN/SEGMENT display the numbers in the SV window show the remaining hours and minutes.
c. If PASS is set to 5, the manu group move window appears. The entry password is fixed 5, and the setting group selection screen does not appear unless 5 is entered.

[3] Program Control End mode

HOLd If set HOLD, countinuous control on last segment value.
rSEt If set rSEt, program control end and control output turn off.
rPt 1 If set rPt1, program will be return to first segment and operation one more time.
rPt2 If set rPt2, program will be return to first segment and operation two more time.
:
rPt9 Able to 9 times.

Repeat mode of pattern. Case of P1 = set rPt1 and P2 = set rPt 2 when P1P2 control mode.



[4] Pause Program Control (HOLD)

If need pause program control, push MANUAL key. Then PGM LED and SV display will be blink.
a. Enable set change Auto-Manual control mode.
b. Enable start Auto-Tuning.
Push ENTER key for control run again.

[5] WAIT Function (WAIT)

For a set time if the temperature does not reach the target value, controller standby till to close target value. Present set time is stop and waiting.
If not necessory, set to 0.

[6] Restart After Power Failure (PSrt)

In case of power failure when run program control,
a. If set to rSEt, program control stop.
b. If set to StAt, program control will be restart from first segment.

[7] Program Control Consideration

1. First parameter is pattern selection when power turn on.
2. Enable 99 hour 59 min. for each segment.
(HH:MM = Hour:Minute)
3. Disable related parameter setting during run program control.
If need, set after program control hold.
4. Disable Auto-Tuning during run program control.
If need, AT start after program control hold.
5. The range of each segment set value is limited by input type and scale.
6. Consideration up/down ability of the load when segment setting.

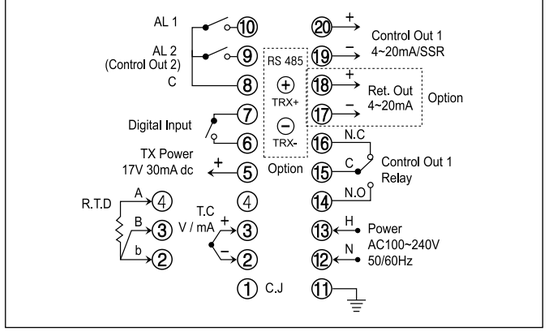
9 Parameter Initialization

Move to parameter group 7, set LddF to 123 and push ENTER
Then all parameters will be change set to factory init. value automatically.
Display LdOn after initializing ok.

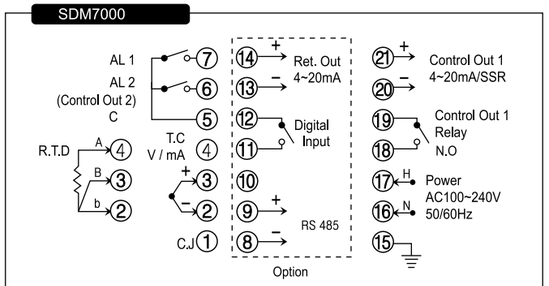
Note Past set values are not memory. Be careful use on working. Do not use if not permited supervizor.

10 Wiring Diagram

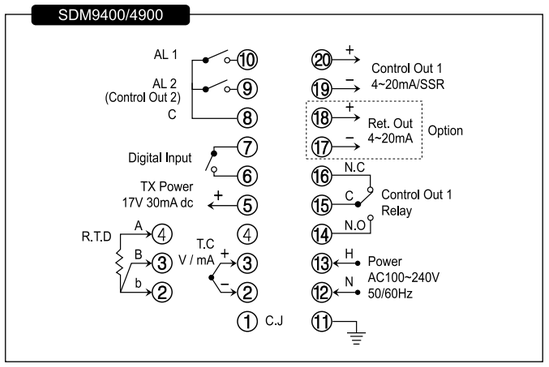
SDM9000



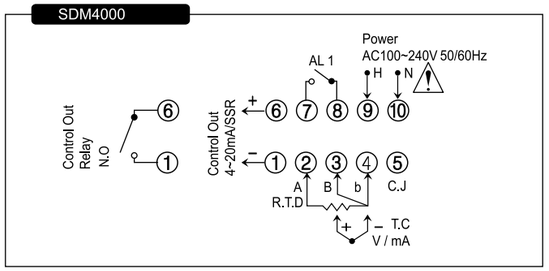
SDM7000



SDM9400/4900



SDM4000



Note 1. Use standard size terminal and wire.
2. When wiring, should be turn off electric power.
3. Recommand shield wire for input signal line.

Notice to Consumers
This manual will be able to modification without notice. If need more information, send email to sanup@sanup.com.