Sanup
Temperature Controller

SANUP ELECTRIC

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SDU series user manual

SDU Series

You have made a good choice in selecting a SDU series.
To get the best performance from your purchase, be sure to read this manual carefully before use.

SANUP ELECTRIC
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CONTENTS

Caution for Your Safety

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.

⚠ CAUTION

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

⚠ 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 or safety device 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 on panel.
   • 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 will result in death or serious injury. It may also be used to alert against unsafe practice.

Installation Guidelines

1. Ensure the surrounding ambient operating temperature is between 0~50℃ (32~122℉). • It may cause fire or wrong operation.
2. Altitude over 0~2000m use.
3. Ensure the power supply for the controller does not fluctuate greatly. Main supply voltage fluctuations not exceed ±10% of the normal voltage.
   • It may cause fire.
4. Install the controller where there is no dust, corrosive or explosive gas present. • It may cause fire.
5. Install the controller where there is no risk of mechanical vibration or shock.
   • It may cause trouble.
6. This controller shall not be used outdoors.
   • It might shorten the life cycle of the product or give an electric shock.
7. When wire connection, #20AWG (0.5mm2) should be used and screw bolt on terminal block with 0.74N.m strength.
   • It may result in malfunction or fire due to contact failure.
8. 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 (12") away form high current or voltage circuits to limit the possible affect of noise.
   • It may cause display fluctuation or error.
9. Do not use a place where temperature changes suddenly or icing occur.
   • It may cause fire, explosive or error.
10. mmmm
11. mmmm
12. 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.
13. Do not inflow dust or wire dregs into inside of this controller.
    • It may cause fire or trouble.
14. Check the number of terminal when connect signal input line.
    • It may cause fire or trouble.
15. Installation category II
16. Pollution degree 2

1. Feature

1-1. General

The SDU digital indicating controller is designed to accept almost kind of process transmitters. It is a new universal controller that handles all the common process control applications with simplicity, reliability, easy setting and low price.

1-2. Feature

- Universal input (K. J. E. N. C. T. R. S. B. Pt100Ω. JPt100Ω. 1~5Vdc 0~5Vdc)
- Various unit sizes (96x96. 48x96. 96x48. 72x72. 48x48(mm))
- Timer function (99 hour 59 minute)
- Delay timer for heater protect
- 2-wire dc power supply
- 2-point alarm output
- Free power voltage (100~240Vac, 50/60Hz)
- 4-20mA Retransmission
- RS 485 Interface

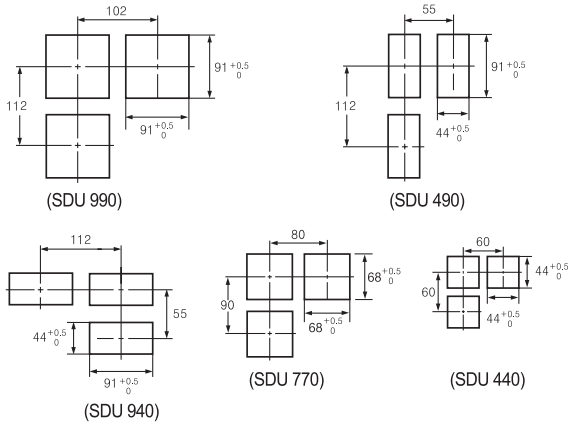
2. Installation

2-1. Installation Procedure

① Make a rectangular hole panel cutout. When installing more than two controllers parallel to each other, keep distance between the panel cutouts to allow room for the bezel of the controller.
② Insert the controller into the panel cutout.
③ Insert a mounting clip into both sides of the controller and tighten the screws. (around 14.7N.m)

2-2. Panel Cutouts

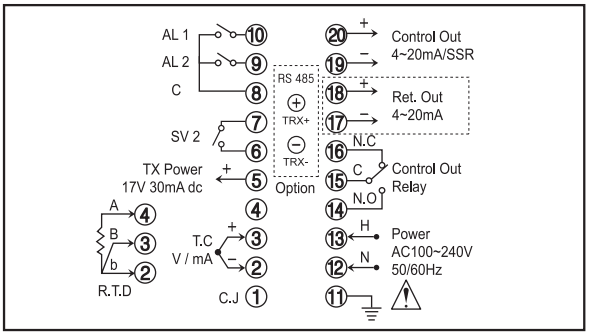
<Unit : mm>



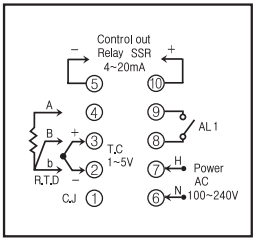
(Figure1) Panel Cut-Out

3. Wiring Diagram

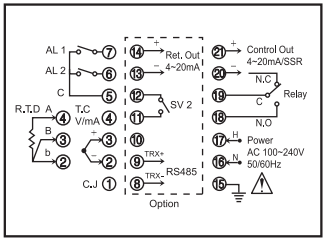
3-1. Wiring Diagram



(SDU 990, SDU 490, SDU 940)



(SDU 440)



(SDU 770)

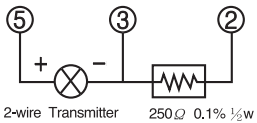
(Figure 2) Wiring Diagrams

3-2. Power Connection

Prior to applying power, ensure the supply voltage is connected to the correct terminals as marked on the electrical connection diagram. Connect the power supply voltage to power input terminals. If controlling a heater, prevent input surge voltage by making sure the power supply voltage and the heater magnetic switch drive voltage are isolated.

3-3. Input Signal Connection

① Thermocouple Input : Connect the positive lead of the thermocouple sensor.
② RTD Input : Connect lead A of the RTD sensor to terminal (A), and the other two leads to terminal (B) and terminal (b).
③ Voltage Input :
Connect the input signal positive lead to terminal + and the negative input signal lead to terminal. (SDU770 and SDU440 has no TX power function.)



(Figure 3) TX Power Connections

Note The maximum allowable resistance of the lead wire connected to the RTD is 15Ω. Each lead wire should be the same thickness.
Note For an input of 4~20mA install a 250Ω, ½W 0.1% resistor between terminals + and - as shown above.
Note Do not short between TX power terminal and signal input terminal.

3-4. Control Output Connection

① **Relay Output**
Relay output rated load is 250Vac 3A.
In case of using inductive load, connect a surge absorber or varistor for safety operating.

② **4~20mA**
Maximum driving impedence is 600 ohm.

③ **SSR Output**
Maximum driving current is 20mA.

3-5. Alarm Output

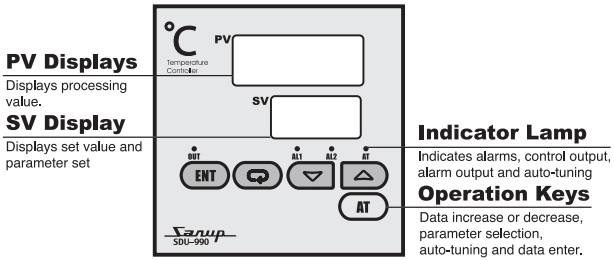
Supplied 2-point alarm normal open type.
Alarm relay output rated load is 250Vac 1A.

Note 1 In case of selecting time off mode, cannot use PV alarm

3-6. Ground

Connect the power supply ground terminal. If this connection is not made, the controller could be affected by noise, causing malfunction.

4-1. Front Description



(Figure 4) Front Description

	Keypads	Enter
①	ENT	① Accept displayed data. ② Timer ON/OFF
②		Select parameter to be displayed
③		Decrease parameter value Increase parameter value
④	AT	Start auto-tuning

Note SDU 440 and SDU 940 do not have (AT) key.
Execute on parameter group.

4-2. Parameter Groups

The parameters are divided into two groups. This includes group 1, the tuning parameter group, which is used frequently and extension group.

Note Group 1(Tuning parameter group) is accessible without any restrictions, but other parameter group is accessible only by entering a pass number. This number is entered at the end of group.

1. Tuning Parameter Group

These are frequently used parameters for tuning the controller.
This parameter group is accessible by connecting power to the controller and does not require a pass number. This parameter group controls every tuning parameter including target set value, PID coefficient, output period, hysteresis, alarm set value, and auto-tuning start.
This group is also used to get to the extension parameter group.

Table 1. Tuning Parameter Group

No.	Symbol	Setting Date	Operation
①	----	Set value	
②	P	Proportional Band	Proportional band value. (0.1~999.8%) If set to '0' ON-OFF control only
③	I	Integral time	Integral time value. (5~9998 sec.)
④	d	Derivative	Derivative time value. (0~2500 sec.) If set to '0' PI control only.
⑤	HYS	ON-OFF hysteresys	Set relay output on/off dead band. (0~200)
⑥	AL-1	Alarm 1Set	Alarm 1
⑦	AL-2	Alarm 2Set	Alarm 2
⑧	CP	Control period.	Sets control period. (1~60 sec.)
⑨	tIM	Timer	Set end timer (99 hour 59 minute). If set to '0' stop timer function.
⑩	AT	Auto-Tuning Start	If set to **ON** auto-tuning will start. If set to **OFF** auto-tuning will cancel. If display to **ting** timer operating. If display to **tEnd** timer end.
⑪	PASS	password	Enter password to access other parameter groups. **Password is '5'**

2. Extension Parameter Group

These define an input, control action, alarm set or high/ low limit.

Table 2. Extension Parameter Group

No.	Symbol	Setting Data	Operation
①	InPt	Input selection	Select input sensor signal type
②	Unit	Indicating Unit	Select celsius or fahrenheit
③	dP	Decimal point	When input is voltage or current use to set decimal point position. (Display 0.0, 0.00, 0.000)
④	SC-H	Display high limit	When input is voltage or current use to set high display limit.
⑤	SC-L	Display low limit	When input is voltage or current use to set low display limit.
⑥	AL5.1	Alarm 1 action	Select type of alarm 1
⑦	HYS.1	Alarm 1 hysteresys	Set alarm 1 dead band
⑧	AL5.2	Alarm 2 action	Selet type of alarm 2. Same as alarm 1 except LbA and P.End.
⑨	HYS.2	Alarm 2 hysteresys	Set alarm 2 dead band
⑩	CACt	Control action	Selet output action.
⑪	oH-H	Control output high limit	Set high control limit. (50.0~105.0%)
⑫	oH-L	Control output low limit	Set low control limit. (-5.0~30%)
⑬	d-to	Delay timer	Ramp output (0~30 min.) 4~20mA control output only. If set to '0' stop timer function.
⑭	b.Out	Burn out	Set control output % when sensor broken.
⑮	FILt	Input filter	Select input filter time 0~60 sec.
⑯	InS	Insert	Modification of input signal. (-100.0~100.0)

Table 3. Input Sensor and Range

	Symbol	Sensor	Range	
			°C	°F
①	K-tc	K-Type	-70~1370℃	-94~2498℉
②	J-tc	J-Type	-70~950℃	-94~1742℉
③	E-tc	E-Type	-70~750℃	-94~1382℉
④	n-tc	N-Type	-100~1300℃	-148~2372℉
⑤	C-tc	C-Type	0~2300℃	32~4172℉
⑥	t-tc	T-Type	-200~400℃	-328~752℉
⑦	K.1tc	K-Type	-100.0~400.0℃	-148~752℉
⑧	r-tc	R-Type	0~1760℃	32~3200℉
⑨	S-tc	S-Type	0~1760℃	32~3200℉
⑩	b-tc	B-Type	0~1800℃	32~3272℉
⑪	JPt	JIS Pt100 RTD	-200~600℃	-328~1112℉
⑫	dPt	DIN Pt100 RTD	-200~600℃	-328~1112℉
⑬	JPt1	JIS Pt100 RTD	-200.0~600.0℃	-328~1112℉
⑭	dPt1	DIN Pt100 RTD	-200.0~600.0℃	-328~1112℉
⑮	1-5	1-5VDC		
⑯	0-5	0-5VDC		

Table 4. Alarm type

	AL1	AL2
Alarm Off	----	----
High	-HI-	-HI-
Stand by High	-SH-	-SH-
Low	-LO-	-LO-
Stand by Low	-SL-	-SL-
Deviation High	-Hd-	-Hd-
Deviation Low	-Ld-	-Ld-
Deviation	-dE-	-dE-
Timer	-tn-	

Note The deviation alarm is 0 when the alarm set value is below 0.
Note The deviation alarm hysteresis is 1/2 of the alarm set value when it is below 1/2 of the alarm set value.

3. Optional Parameter Group

Parameter group for retransmission, interface and so on, **password is 15**.

Table 5. Optional Paramenter Group

	Symbol	Setting Data	Rem.
①	SP2	Set Point 2	
②	t-H	Retransmission High	
③	t-L	Retransmission Low	
④	Add5	Adress for interface	
⑤	SPEd	Speed 2400 : 2400bps 4800 : 4800bps 9600 : 9600bps	
⑥	PAr4	Check Parity nOnE Odd EvEn	
⑦	CdLY	Response Deiay 1 : 4~54 msec 2 : 54~104 msec 3 : 104~154 msec	
⑧	LddF	Parameter initializing setting code is 123 for initializing.	

4. Changing Parameters

① Pressing the key when the process value is displayed allows various parameter groups to be seen in the process value display.

② The indicated parameters can be changed by using the increase and decrease keys. Holding down these keys for more than 1.5 seconds will change the value rapidly.

③ After changing the value of a parameter, the right decimal point blinks, indicating the parameter has not been accepted. By pressing ENTER this value is accepted and entered into EEPROM (nonvolatile memory). When the value is accepted the decimal point disappears.

④ Once finished changing parameter values, pressing for more than 2 seconds returns the controller to normal operation and the process valu will be displayed. Waiting approximately 80 seconds without pressing the key will return the meter to normal operation as well.

5. Parameter Initializing

Parameter initializing find LddF at optional parameter group and set LdOP, press ENTER then processing initializing with blank FND. Display 123 is ok symbol.

⚠ Note

Parameter groups have a major affect on the operation of the controller. If possible, no changes in these parameter groups should be made during controller operation. All changes should be made by experienced personnel.

5-1. Operation Procedure

(1) Automatic operation

Upon connecting power the controller is in a state of automatic operation and the process value is indicated on the upper display (process value display) and the set value is indicated on the lower display (the set value / parameter display).
The set value can be changed by using ◁, ▷ and ENTER key.
Operation of the controller depends on the initial settings and alarm assignments. The controller will indicate a control output, an alarm state and an operation.
The controller can be tuned for the process being monitored by changing parameter group 1(tuning parameter group) as outlined in chapter 4.

(2) Temperature sensor condition

During operation if the temperature sensor is damaged or a wire to the sensor breaks contact, "burn" will flash in the process display.
Perform the following

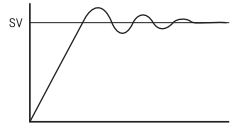
① Check the temperature sensor for damage.
② Check all connections to the sensor.

5-2. Auto-Tuning

Auto-tuning, using PID, automatically tunes the controller for the process being monitored so it will operate optimally. This saves time over tuning the controller manually.

(1) Auto-tuning procedure

① Find the AT key on the front and push during 2 second.
② When auto-tuning begins the controller is in ON-OFF control operation and the manual operation indicator (AT indicator) will be blink. (Figure 5)
③ To cancel autotuning press the AT key. The AT indicator will turn off and autotuning will stop.
④ When auto-tuning is stopped the controller calculates the optimum PID constant and applies it to the control function.



(Figure 5) Auto-tuning cycle

Note SDU 440 and SDU 940 has no AT key so find the auto-tuning parameter (parameter symbol : At) from parameter group 1 (tuning parameter group) and enable or disable auto-tuning by entering ON or OFF.

(2) Auto-tuning considerations

① Auto-tuning does not affect the output when the controller is in ON-OFF control mode.
② Auto-tuning does not affect the output when the controller is in delay time control mode.
③ Auto-tuning function does not operate when the high limit of the control output is below 99.9% or the low limit is above 0.1 %.
④ Auto-tuning does not affect the output when the controller is in timer control mode.
⑤ If operaring timer function during auto-tuning will be cancel.

5-3. ON-OFF Control

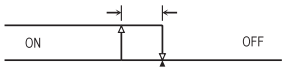
When the control operation is set to ON-OFF mode the controller performs the ON-OFF control operation and "hysteresis" can be adjusted.

(1) Programming procedure

① Find the proportional band parameter (parameter symbol : P) from parameter group 1.
② Enter "0" for positive (cooling operation) or negative (heating operation) operation of the ON-OFF control.
③ Find the hysteresis parameter (parameter symbol : HYS) from the tuning parameter group and set the hysteresis as required.
④ Find the control operation parameter (parameter symbol : CACt) from extension parameter group.

(2) Negative operation ON-OFF control

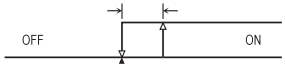
Performs as shown below including hysteresis (dead band)



(Figure 6) Negative operation

(3) Positive ON-OFF control

Performs as shown below including hysteresis (dead band)



(Figure 7) Positive operation

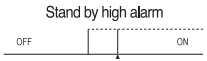
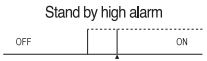
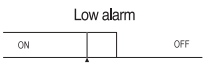
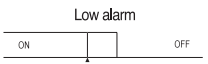
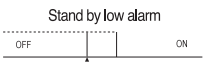
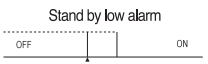
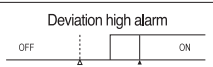
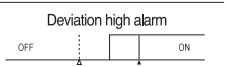
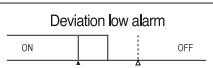
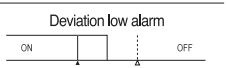
5-4. Alarm Operation

The alarms can be used as an output for two types of information. Alarm function based on the process value is disabled automatically when alarm 2 is used as a timer end output in the timer operating control.

(1) Alarm operation programming procedure

① Find the alarm operation parameter (parameter symbol : ALS) from extension parameter group and assign alarm operation.
② Find the hysteresis parameter (parameter symbol HYS) from extension parameter group and set the hysteresis.
③ Set the alarm activation point with the alarm parameter (parameter symbol : AL-1,AL-2) from parameter group 1.

(2) Assignment symbol and alarm operation.

Symbol	Alam 1 (AL−1)	Alam 2 (AL−2)
----	OFF	OFF
-HI-		
-SH-		
-LO-		
-SL-		
-Hd-		
-Ld-		
-dE-		
-tn-	Timer OFF	Timer OFF

Note SDU 440 has alarm 1 only

5-5. Timer Operation

(1) Programming Procedure

① Find the timer control output parameter (parameter symbol : tIm) from extension parameter group and set the required timer control output time in minutes. If set to "0" stop timer function. Segment maintenance time is expressed as XX.YY (XX : hour, YY minute) and can be set to a maximum of 99 hours 59minutes.

② The operation begins by pressing the (ENTER) key for 2 seconds. When the operation begins, the PV display last dot point blinks.

③ To stop control operating by set time
- control output is fix at output low limit value
- blink tEnd at set value indicating window
- AL-1 output contact ON if you set AL-1 is timer output.

④ When end of timer operation, press the (ENTER) key for two seconds. This resets to the normal control operation state.

(2) Timer Operating

① To cancel timer press the (ENTER) key. The tEnd indicator will turn off and AL-1 relay will stop.

② Restart from the first time repeat after a power failure.

③ During timer operation changing related parameter values is restricted. If change is required, it should be done after reseting to the normal control state.

④ Auto-tuning does not affect the output when the controller is in timer control mode.

⑤ If operaring timer function during auto-tuning will be cancel.

5-6. Ramp Output Control

Some heaters can be damaged if power is not supplied gradually. In this case the heater should be protected by using the ramp control function.

(1) Programming procedure

Find the ramp control output parameter (parameter symbol : SmV) from extension parameter group and set the required ramp control output time in minutes. The control output increases slowly after the power is on and resets to the original control output after the time set for the ramp control parameter SmV has been reached.
If set to "0" stop ramp output.

(2) Ramp control output

① Ramp control output is a 4-20 mA current control output.
② Ramp control output is disabled during ON/OFF control operation.
③ Auto-tuning is disabled when ramp control output is enabled.

7-1. Input

	Specification		Notice
Accuracy	T.C	±0.3% + 1DIGIT or ±3℃	Exception R,S,C,B, type less than 450℃
	RTD, Volt	±0.2% + 1 DIGIT	
Thermocouple & RTD Input	Type	Range	
	K-TYPE	-70~1370℃	
	J-TYPE	-70~950℃	
	E-TYPE	-70~750℃	
	N-TYPE	-100~1300℃	
	C-TYPE	0~2300℃	
	T-TYPE	-200~400℃	
	K1-TYPE	-100.0~400.0℃	
	R-TYPE	0~1760℃	
	S-TYPE	0~1760℃	
	B-TYPE	0~1800℃	
	JIS Pt100 RTD	-200~600℃	
	DIN Pt100 RTD	-200~600℃	
	JIS Pt100 RTD	-189.0~600.0℃	
	DIN Pt100 RTD	-189.0~600.0℃	
Voltage Input	1-5VDC	Scaling range with decimal point	
	0-5VDC		

7-2. Output

	Specification	Notice
Contact Output	250V AC, 2A R Load	Fixed by factory
Current Output	4-20mA dc, 600Ω max.	
SSR Output	20V, 20mA max.	
Alarm Output	2-Point 250V AC, 1A R Load	

7-3. Control Mode

	Specification	Notice
Control Mode	PID, PI, ON-OFF	Each normal and revers control mode
ARW	Operating with integral action	
Output Limit	Scaling output range	
Control Period	1~60 sec.	Application to contactor or SSR

7-4. Other

항목	사 양	비 고
Display Resolution	PV : 4 Digit 7-Segment SV : 4 Digit 7-Segment	
Scan Time	160m sec.	
Operating Environment	Temp. : 0~50℃, Humi. : 35~85%RH	
Power	100~240V ac, 50/60Hz, 0.1A max.	
Dimension	SDU990 : 96×96×110(mm) SDU490 : 48×96×110(mm) SDU940 : 96×48×110(mm) SDU770 : 72×72×110(mm) SDU440 : 48×48×100(mm)	

※ Caution should be used when installing this device. Misuse or incorrect installation may result in serious injury or damage to the controller.

※ This manual is subject to change without notice.