

Operation Instruction For Temperature Simulator

INDEX

1. Safety Information.....	1
2. Instrument Panel Layout and Function.....	3
3. Replacing the Battery.....	4
4. Power-on/off of Simulator.....	5
5. Output from Simulator.....	5
6. Other Features.....	10
7. Performance Capabilities.....	10
8. Calibration.....	13
9. Points for Attention to Use of Operation Instruction.....	17

1. Safety Information

To ensure the safety operation, the following signs are used only as specified in this operation instruction.

Warning

A warning shows that if the operation does not comply with the following correct instruction it is possible to bring hazards to the user or cause damage to the simulator in use. The warning also points out how to avoid the accidents.

Caution

A caution shows that if the operation does not comply with the following correct instruction, it is possible to cause damage to the simulator in use. The caution also points out how to avoid maloperation.

Note

A note serves as a sign to remind the user that he must understand the correct operation of the simulator and its characteristics.

To prevent the user and the simulator from any electric shock and other hazards, it is necessary to observe the following regulation:

Warning

- Do not operate the simulator at the working field where there exists flammable gas or explosive gas or vapor. It is very dangerous to operate the simulator in such surrounding.
- Never apply more than 30V between any two terminals, or between any terminal and earth ground.

Caution

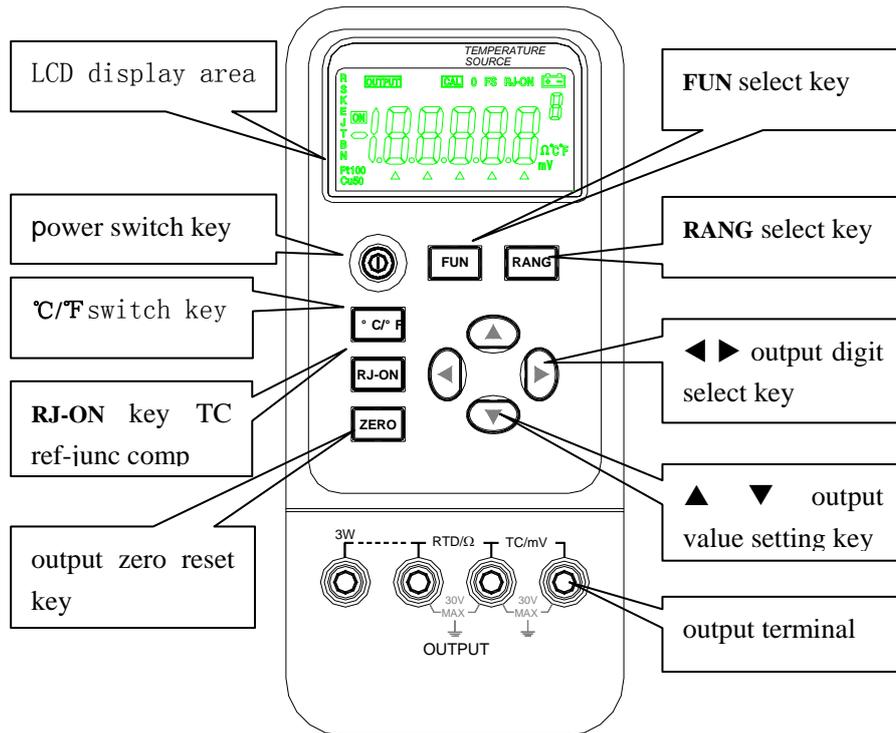
- **Disassembly:** No one is allowed to remove the split case (top & bottom) of the simulator except professionals.
- **Cleaning:** Periodically wipe the case with a damp cloth

and detergent; do not use any corrosive solvents.

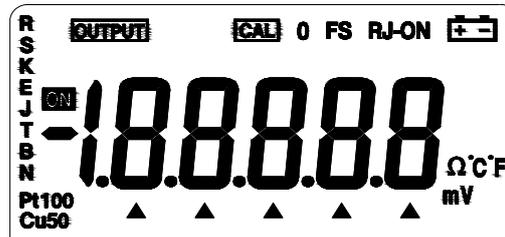
Note

- To keep the simulator in a designed accuracy, it needs warming up 5 minutes before it is put into operation.
- If any user requires a higher accuracy of the simulator, the user should make contact with the manufacturer.
- If the automatic reference-junction temperature compensation of the simulator deviates from its designed accuracy, the user should make contact with the manufacture.

2. Instrument Panel Layout and Function



Explanation of LCD Display Area



- a) **OUTPUT**: The display of this symbol denotes that the Simulator is in an output state.
- b) **CAL**: The display of this symbol denotes that

- the simulator is in a calibration state.
- c) 0 FS: This symbol appears in the display when the simulator is in a calibration state, denoting that the zero point or the full scale point is now in calibration.
- d) RJ-ON: The display of this symbol denotes that the simulator performs the operation of its reference-junction compensation. (Refer to subsection 5.2)
- e) : The display of this symbol denotes that the battery is nearly used up and needs replacing now. (Refer to subsection 3.1)
- f) ▲: The display of this symbol denotes that the output digits need setting now.
- g) mV, Ω, °C, °F: The display of this symbol denotes the unit of a present output value.
- h) : The display of this symbol denotes that the output signal is in turn on.
- i) R,S,K,E,J,T,B,N: Each of these individual symbols denotes the type of a thermocouple.
- j) 'Pt100, Cu50': The display of this symbol denotes the respective type of a RTD.

3. Replacing the Battery

Warning

- The test leads need removing and the power supply of the Simulator must be shut off prior to replacing the battery.

3.1 When the symbol  appears in the display, it denotes that the battery is nearly used up and needs replacing according to the following steps:

- 1) Remove the test leads and turn off the power supply of the Simulator.
- 2) Remove the holster from the simulator. Open the battery

cover at the back of the simulator by unlocking in the indicated direction.

- 3) Replace the used-up battery with a new one. Put the battery cover back and lock it in the indicated direction.

4. Power-on/off of Simulator

4.1 Power-key operation

Press the power key to turn on the power supply of the simulator. Now press the key again to hold it in one second and the power supply will be off.

When the power supply is turned on, the simulator will start to make self-diagnosis internally and the full screen is in display. After this, appropriate operation should be carried out.

Note

- **Power-on:** To ensure the correct operation of the simulator with power on, it is good practice to turn off the power supply pausing 5 seconds, and then restart the calibration.

4.2 Automatic power-off

By the shipping time, the simulator is set for the automatic power-off function in the factory like this: In case there is no key-operation of the simulator within 10 minutes after power-on, it will cut off the power supply automatically. However, users can decide whether they want to use this function or not. The setting can be done by themselves. (Refer to section 6.)

5. Output from Simulator

The output terminal of the simulator can produce DC voltage set by the user or simulating resistance.

! Caution

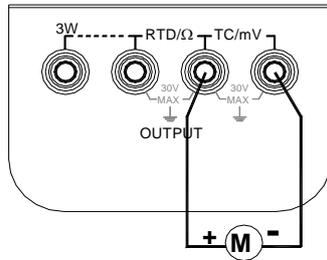
- Do not apply any voltage to the output terminal during the operation. If any improper voltage is applied to the output terminal, it will cause damage to the internal circuit.

Output Operation Procedure

Func. Operation	Range. Operation	Display	Set Range
DCV 1 V	1 V	0.0000 V	-0.1000 to 1.1000 V
	↓ 100mV	000.00 mV	-10.00 to 110.00 mV
OMH 400 Ω		000.0 Ω	000.0 to 400.0 Ω
↓ TC R	R	0000 °C	-40 to 1760 °C
↓	↓ S	0000 °C	-20 to 1760 °C
	↓ K	0000.0 °C	-200 to 1370 °C
	↓ E	0000.0 °C	-200 to 1000 °C
	↓ J	0000.0 °C	-200 to 1200 °C
	↓ T	0000.0 °C	-200 to 400 °C
	↓ B	400 °C	400 to 1800 °C
	↓ N	0000.0 °C	-200 to 1300 °C
↓ RTD Pt100	Pt100	000.0 °C	-200 to 850 °C
	↕ Cu50	000.0 °C	-50 to 150 °C

5.1 DC voltage output

- 1) Insert one end of the test lead into the output (TC/mV) jack of the simulator and connect the other end to the input of the user's instrument as shown in the following diagram:



- 2) Press the key (**FUN**) to select the V function when the unit 'V' appears in the display.
- 3) Press the key (**RANG**) to select the range of 1.0000V or 100.00mV when the display indicates the unit 'V' or 'mV'.
- 4) Press the key (◀) / (▶) to select set digits for output.
- 5) Press the key (▲) / (▼) to change the numerical value of the set digits. The value can do carry or number decrement automatically. Hold the pressed key in one second and the value will keep varying.
- 6) Press the key (**ZERO**) and the output will be directly set to 00.00mV or 0.0000V.

5.2 Simulating output from thermocouple (TC)

- 1) Insert one end of the test lead into the output (TC/mV) jack of the Simulator and connect the other end to the input of the user's instrument as shown in the above-illustrated diagram.
- 2) Press the key (**FUN**) to select the function of a thermocouple and the display will indicate the unit 'C' or the type of 'R' .
- 3) Press the key (**RANG**) to select an appropriate type.
- 4) Press the key (◀) / (▶) to select the set digits for output.
- 5) Press the key (▲) / (▼) to change the numerical value of the set digits. The value can do carry or number decrement automatically. Hold the pressed key in one second and the numerical value will keep varying.
- 6) Automatic compensation for reference-junction temperature. During the direct calibration of an instrument with reference-junction temperature compensation, it is common practice to press the key (**RJ-ON**) so that the Simulator can start the function of automatic reference-junction compensation, thus providing the required thermo-electromotive force for output

followed by displaying the symbol 'RJ-ON'. (Refer to section 7 concerning the reference-junction compensation accuracy of the simulator.) Where:

$$\text{output emf} = \text{emf corresponding to the set temperature} - \text{emf corresponding to the room temperature}$$

- ✧ It takes two seconds for the Simulator to start its internal reference-junction temperature. After this, each automatic compensation takes place at interval of 10 seconds.
 - ✧ If there is a change in the operating ambient temperature, do not start the operation until the built-in compensating sensor has become stable (ca.10 minutes).
 - ✧ If there is no need for the Simulator to perform the function of automatic reference-junction compensation, press the key (**RJ-ON**) and the symbol 'RJ-ON 'will no longer appear in the display.
- 7) Press the key (**ZERO**) and the output will be directly set to 0000°C (R or S type), 400°C(B type) or 0000.0°C(other type).
 - 8) Press the key (°C/°F) to select the unit '°C' or '°F'.

5.3 Simulating output from resistance or RTD

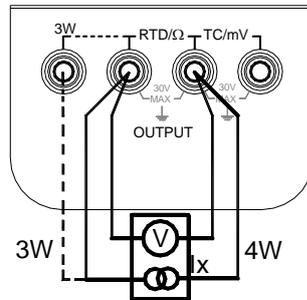
Note

- **Resistance-simulation:** The simulator produces the simulation resistance up to 400 Ω at its output terminal (RTD / Ω).The method of simulating resistance output is to send out an appropriate voltage 'VX' according to the exciting current 'IX' produced by the calibrated instrument. Because R (set resistance) = VX (output voltage) / IX (exciting current), the calibrated device must provide an exciting current to the simulator. The exciting current should range from 0.5mA to 2mA.

Note

- **Resistance-simulation:** A 4-wire system is designed for the resistance output during the calibration. If the user adopts a two-wire system, he or she should take into consideration the error (ca.0.1 Ω) arising from the lead resistance of the test leads. If the capacitance between the resistance output terminal of the simulator and the tested instrument is more than 0.1 μ f, the simulator will produce improper resistance.

- 1) Insert one end of the test lead into the output(RTD/ Ω) jack of the simulator and connect the other end to the input of the user's instrument as shown in the following diagram (The dedicated test leads supplied with the simulator can be made into a 3-wire or 4-wire system for testing output according to user's requirement.)



- 2) The display of the symbol 'OUTPUT' denotes the Simulator is in an output state.
- 3) Press the key (**FUN**) to select the function of resistance or RTD when the unit ' Ω ' or ' $^{\circ}$ C' and the type of the RTD 'Pt100' appear in the display.
- 4) During the use of the RTD function, press the key (**RANG**) to select a corresponding type.

- 5) Press the key (◀) / (▶) to select the set digits for output.
- 6) Press the key (▲) / (▼) to change the numerical value of the set digits. The value can do carry or number decrement automatically. Hold the pressed key in one second and the value will keep varying.
- 7) Press the key (ZERO) and the output will be directly set to 000.0°C
- 8) Press the key (°C/°F) to select the unit '°C' or '°F'.

6. Other Features

The following operation makes it possible for the simulator to change its automatic power-off function.

- 1) Cut off the power supply of the simulator.
- 2) Press the key (POWER) to make a full screen display, and then release the power key immediately followed by pressing the key (RANG) when the simulator gets into a maintenance state. The display indicates the symbol 'AP-XX'.
- 3) Press the key (▼) when the symbol 'AP-OF' appears in the display, denoting that there is no automatic power-off function available to the simulator, and when the symbol 'AP-ON' appears, denoting that the simulator has recovered the automatic power-off function.
- 4) Cut off the power supply again to exit the maintenance state.

7. Performance Capabilities

Output Function & Specification(applicable to temperature range from 18°C to 28°C, within one year after calibration)

Output	Range	Output Range	Resolution	Accuracy	Remark
DCV	100mV	-10.00mV to 110.00mV	0.01mV	±0.05% of set value ±30µV	Max. output current

	10000 mV	-100.00mV to 1100.00mV	0.1mV	$\pm 0.05\%$ of set value $\pm 0.3\text{mV}$	$\pm 2\text{mA}$
OHM	400 Ω	0.0 to 400.0 Ω	0.1 Ω	$\pm 0.05\%$ of set value $\pm 0.2\ \Omega$	$\pm 1\text{mA}$ excit. current Notes 1 & 2
TC	R	-40 $^{\circ}\text{C}$ to 1760 $^{\circ}\text{C}$	1 $^{\circ}\text{C}$	$\pm 0.05\%$ of set value $\pm 3^{\circ}\text{C}$ ($\leq 100^{\circ}\text{C}$)	By using ITS-90 temperature scale.
	S	-20 $^{\circ}\text{C}$ to 1760 $^{\circ}\text{C}$	1 $^{\circ}\text{C}$	$\pm 0.05\%$ of set value $\pm 2^{\circ}\text{C}$ ($> 100^{\circ}\text{C}$)	
	B	400 $^{\circ}\text{C}$ to 1800 $^{\circ}\text{C}$	1 $^{\circ}\text{C}$	$\pm 0.05\%$ of set value $\pm 3^{\circ}\text{C}$ (400 $^{\circ}\text{C}$ to 600 $^{\circ}\text{C}$) $\pm 0.05\%$ of set value $\pm 2^{\circ}\text{C}$ ($> 600^{\circ}\text{C}$)	
	E	-200.0 $^{\circ}\text{C}$ to 1000.0 $^{\circ}\text{C}$	0.1 $^{\circ}\text{C}$	$\pm 0.05\%$ of set value $\pm 2^{\circ}\text{C}$ ($\leq -100^{\circ}\text{C}$)	
	K	-200.0 $^{\circ}\text{C}$ to 1370.0 $^{\circ}\text{C}$	0.1 $^{\circ}\text{C}$		
	J	-200.0 $^{\circ}\text{C}$ to 1200.0 $^{\circ}\text{C}$	0.1 $^{\circ}\text{C}$		
	T	-200.0 $^{\circ}\text{C}$ to 400.0 $^{\circ}\text{C}$	0.1 $^{\circ}\text{C}$	$\pm 0.05\%$ of set value $\pm 1^{\circ}\text{C}$ ($> -100^{\circ}\text{C}$)	
	N	-200.0 $^{\circ}\text{C}$ to 1300.0 $^{\circ}\text{C}$	0.1 $^{\circ}\text{C}$		
RTD	Pt100	-200 $^{\circ}\text{C}$ to 850.0 $^{\circ}\text{C}$	0.1 $^{\circ}\text{C}$	$\pm 0.05\%$ of set value $\pm 0.6^{\circ}\text{C}$	By using Pt100-385 Notes 1 & 2
	C μ 50	-50.0 $^{\circ}\text{C}$ to 150 $^{\circ}\text{C}$	0.1 $^{\circ}\text{C}$		

Note 1: Without accessory lead resistance

Note 2: Range of exciting current: 0.5mA to 2mA;
max. output voltage: $\leq 2V$

Note 3: The accuracy does not include the error of internal temperature compensation caused by a sensor. The range of the internal temperature compensation sensor is from $-10^{\circ}C$ to $50^{\circ}C$ with its compensating error up to $0.5^{\circ}C$.

Note 4: Temperature coefficient: $\pm 0.005\%$ of range per $^{\circ}C$ for the temperature ranges from $0^{\circ}C$ to $18^{\circ}C$ and from $28^{\circ}C$ to $50^{\circ}C$.

General Specifications

- Power supply: single 9V battery (ANSI/NEDA 1604A or IEC6LR619V alkaline)
- Battery life: ca.25 hours
- Max. permitted voltage: 30V(between any two terminal or between any terminal and ground)
- Operating temperature: $0^{\circ}C$ to $50^{\circ}C$
- Operating relative humidity: $\leq 80\%$ RH
- Storage temperature: $\leq -10^{\circ}C$ to $55^{\circ}C$
- Storage humidity: $\leq 90\%$ RH
- Size: $200 \times 100 \times 40$ mm(with a holster)
- Weight: 550g(with a holster)
- Accessory: operation instruction, a set of CF-36 industrial test lead(with alligator clips)
- Option: AC power-supply adapter (VCPS) and a set of CF-31-A industrial test lead(with probe clips)
- Safety: certified as compliant to IEC1010 provisions (Safety

8. Calibration

Note

- To ensure the designed accuracy of the simulator, it is recommendable to calibrate your simulator once a year. The following recommended standard equipment is used to perform the calibration, which serves as an example.

! Caution

- During the operation, avoid any short circuit and never apply more than the max. permitted voltage to the output of the simulator and the co-working standard device, otherwise any maloperation will cause possible damage to their internal circuits.

8.1 Selecting Standard Equipment

Calib.Item	Standard Equipment	Output Range	Accuracy	Recommend
DCV 100mV	digital meter	max.110mV	$\pm(10\text{ppm}+1\mu\text{V})$	1281(FLUKE) 5520(FLUKE) or equiv.
1V		max.1.1V	$\pm(10\text{ppm}+5\mu\text{V})$	
OHM 400 Ω	digital meter standard equipment	max. 2V $\pm 1\text{mA excit.}$	$\pm(10\text{ppm}+5\mu\text{V})$ $\pm(80\text{ppm}+0.03\mu\text{A})$	

8.2 Ambient Condition for Calibration

Ambient temperature: $23^{\circ}\text{C} \pm 1^{\circ}\text{C}$

Relative humidity: 45 to 75% RH

Warming up:

- The standard equipment must be warmed up to the given time.
- Do not connect the simulator to the power supply until it has been

exposed to the calibrating ambient condition for 24 hours. Then set the simulator to a state of non-automatic shutdown followed by warming it up to 0.5 hour.

Note

- Power supply for calibration: During the calibration, the battery needs replacing with a new alkaline one.

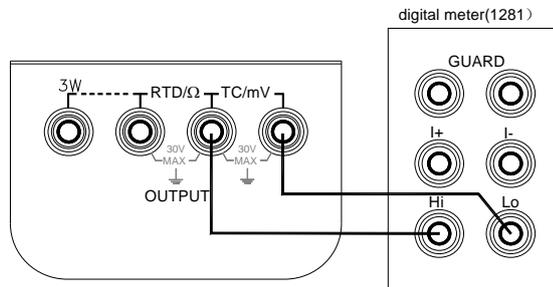
8.3 Operating output calibration

Operating output calibration in order of items and calibration points listed in the following table:

Item NO.	Output Range	Calib. Point
1	DCV/1V	0
		FS
		0 FS
2	DCV/100mV	0
		FS
3	OHM/400 Ω	0
		FS
		-0
		-FS

8.3.1 1V Range Calibration

- 1) The calibration wiring is shown in the following diagram:



- 2) Press the keys (**FUN**) & (**RANG**) first, and then press the key (**POWER**) to enter the simulator in a state of 1V output calibration when the symbols **OUTPUT**, **CAL 0**, **ON** and the unit 'V' appear in the display.
- 3) Set the digital meter to an appropriate range.
- 4) With the output stabilized, operate the keys (**◀**) / (**▶**) and (**▲**) / (**▼**) to set the indication of the simulator in identity with the reading of the digital meter.
- 5) Press the key (**ZERO**) and the display will flash, denoting that the calibrated point has been stored.
- 6) Press the key (**RANG**) to display the symbol **CAL FS**'. With the output stabilized, repeat the operation of steps 4 & 5.
- 7) Press the key (**RANG**) to display the symbol **CAL 0 FS**'. With the output stabilized, repeat the operation of steps 4 & 5.

Note

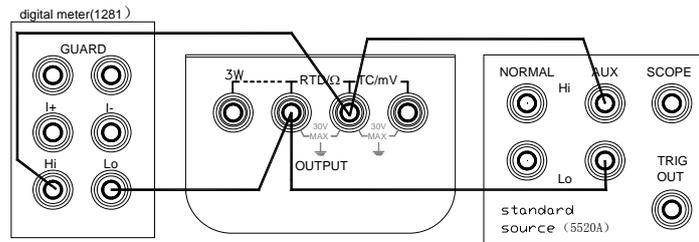
- **Calibration Storage:** Press the key (**ZERO**) to store the calibrated point when the display does not flash, denoting that the calibration storage is invalid.

8.3.2 100mV Range Calibration

- 1) The calibration wiring is shown in the above-illustrated diagram.
- 2) Press the key (**FUN**) to enter the simulator in a state of 100mV output calibration when the display indicates the symbols **OUTPUT**, **CAL 0**, **ON** and the unit 'mV'.
- 3) Repeat the operation of steps 3 to 6 in subsection 8.3.1.

8.3.3 Resistance Calibration

- 1) The calibration wiring is shown in the following diagram:



- 2) Press the key (**FUN**) to enter the simulator in a state of resistance output calibration when the display indicates the symbols **OUTPUT**, **CAL 0**, **ON** and the unit ' Ω '.
- 3) Set the digital meter and standard source to an appropriate range, and then set the standard source to +1mA output.
- 4) With the output stabilized, repeat the operation of steps 4 & 5 in subsection 8.3.1.
- 5) Press the key (**RANG**) to display the symbol '**CAL FS**'. With the output stabilized, repeat the operation of steps 4 & 5 in subsection 8.3.1.
- 6) Change the output of the standard source to -1mA output.
- 7) Press the key (**RANG**) to display the symbols '**CAL 0**' & '-'. With the output stabilized, repeat the operation of steps 4 & 5 in subsection 8.3.1.
- 8) Press the key (**RANG**) to display the symbols '**CAL FS**' & '-'. With the output stabilized, repeat the operation of steps 4 & 5 in subsection 8.3.1.

Note

- Exciting current: The flow direction of the exciting current must be in line with the calibration point, otherwise the display fails to flash, denoting that the calibration storage is invalid.

9. Points for Attention to Use of Operation

Instruction

- The present operation instruction is subject to change without notice.
- The content of the operation instruction is regarded as correct. Whenever any user finds its mistakes, omissions, etc., he is requested to contact the manufacturer.
- The present manufacturer is not liable for any accident and hazard arising from any maloperation.
- The functions described in this operation instruction should not be used as grounds to apply this product to a particular purpose.

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