# Instruction Manual
# For
# Model ~~1900-7 &~~ 1901-7
# Temperature Indicator

**SCIENTIFIC INSTRUMENTS, INC**

090-226 Rev. D

## TABLE OF CONTENTS

## SECTION I
## GENERAL DESCRIPTION

### 1.1 INTRODUCTION

The Model ~~1900~~ Microprocessor-Based Temperature Indicator is a 3-digit instrument designed to operate in conjunction with a ruthenium oxide sensor to furnish accurate temperature measurement over the range of 1.5 to 273K. Different Models of the ruthenium oxide sensor can be accommodated. These are:

a. Scientific Instruments, Inc. Model RO-105 (100K)
b. Scientific Instruments, Inc. Model RO-701GE (1K)
c. Scientific Instruments, Inc. Model RO-600 (1K)

Each Model has its own software that has been factory programmed at the time of order.

Typical voltage vs. temperature data for these specific sensors is stored in internal EPROMS to match the instrument to the actual sensor being used.

Model 1901 Indicator has the added features of two alarm set points, two associated alarm relay outputs, and an RS232C interface port. A 0 to 1 or 4 volt DC analog output is also available as an option.

Two front-panel switches enable the user to access a “Single Point Calibration” (SpCal) function and to set the temperature alarm points. The SpCal function is a selectable positive or negative offset, which is applied to the temperature reading.

### 1.2 SPECIFICATIONS

| | |
|---|---|
| Sensor Excitation | 10 Microamperes Constant Current |
| Display | 3-Digit LED |
| Temperature Range | 1.5 to 300K |
| Resolution | 0.1K from 1.5 to 99.9K<br>1.0K from 100 to 273K |
| Accuracy (SpCal)* | +/- 0.15K from 1.5 to 80K<br>+/- 0.15K to +/- 5.0%(80K to 273K) |
| Power Required | 9 VDC @ 500 ma., via a furnished 100-240 VAC/9VDC power converter. |
| Alarm Setpoints (1901 only) | Two, via front panel switches |
| Alarm Outputs (1901 only) | Two SPDT Relays (C, NO, NC)<br>28 VDC @ 0.25A |
| RS232 Interface (1901 only) | a) Output of Temperature<br>b) External Setting of Alarm Setpoints |
| Analog Output (1901 Option) | 0 to 1 or 4 volt DC, corresponding to 0 to 273K (2K ohm minimum load) |

* Single-Point Calibration (SpCal) is an integrated calibration function which enables the user to achieve the highest possible system accuracy at the most important temperature point.

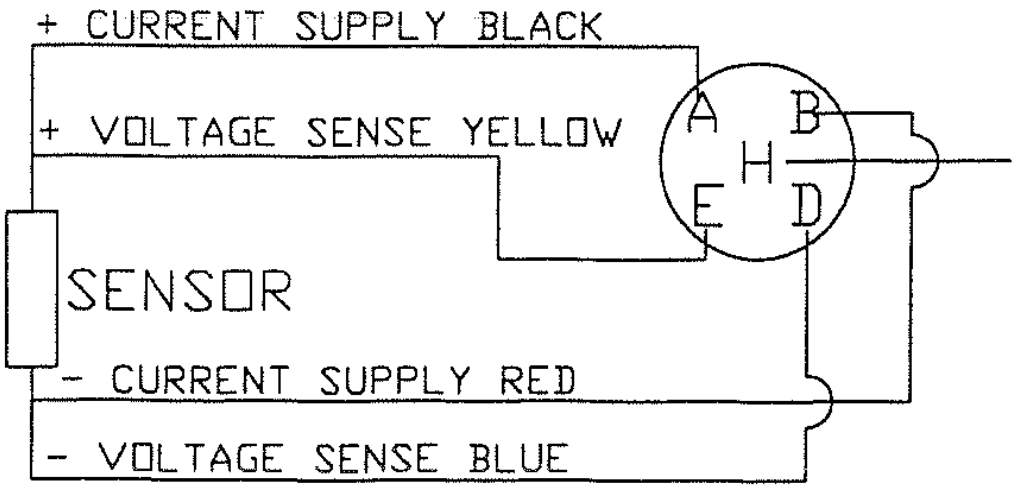
## SECTION II
## OPERATION

### 2.1 INPUT/OUTPUT CONNECTIONS

All input and output connections are made at the rear panel of the instrument:

a) Insert the plug from the power converter into the receptacle at the extreme right-hand side of the rear panel.

b) Wire the ruthenium oxide sensor to the furnished 5-pin plug as follows:




Insert this plug into its corresponding receptacle on the rear panel.

c) Connect the conductors of the RS232 modular IDC cable assembly (Model 1901 only), to the host computer or terminal as follows:

| | |
|---|---|
| BLK – Ground | GRN – Receive (In) |
| RED – Transmit (Out) | YEL – (No Connection) |

Insert the cable assembly receptacle into the RS232 port located at the extreme left-hand side of the rear panel.

d) The alarm relay outputs are available at the 6-pin terminal block (Model 1901 only). Pin assignments are as follows:

| | |
|---|---|
| 1 – Relay #1 NO | 4 – Relay #2 NO |
| 2 – Relay #1 C | 5 – Relay #2 C |
| 3 – Relay #1 NC | 6 – Relay #2 NC |

e) The analog output is available at the miniature double banana jack.

## 2.2 OPERATING PROCEDURES

Several moments after power is applied to the instruments, it will assume its principal mode of operation which is to display temperature as sensed by the associated ruthenium oxide sensor. If desired, the operator can:

a) Access the single point calibration mode,

b) change temperature set points (if the instrument is a Model 1901), and

c) access a special diagnostic subroutine to check operational readiness of the instrument.

The following paragraphs describe how all of these functions are accomplished.

### 2.2.1 Accessing Single Point Calibration Mode

a) Before applying power, press and hold the red “up” switch. Apply power and release the “up” switch. The temperature readout will not display the current single point calibration value.

b) To change this value, immediately press and hold both the “up” and “down” switches. When the readout begins to flash, release both switches and press the “up” switch to increase the calibration setting or the “down” switch to decrease the setting. When either switch is pressed once and released, the calibration value changes by one unit. If either switch is held for one second, the value changes rapidly.

c) Three seconds after either switch is released, the calibration value is stored (and displayed for an additional two seconds), and then temperature is displayed again.

### 2.2.2 Accessing Set Point Mode (Model 1901 only)

**NOTE:** The function of the set points is to control operation of the two internal alarm relays. If the temperature rises to, or above the set point established for a given relay (i.e., set point #1 for relay #1; set point #2 for relay #2), that relay will energize. If the temperature falls below the set point, that relay de-energizes.

a) With the instrument in its normal mode of operation (i.e. displaying temperature), press and release the “up” switch to display set point #1 or the “down” switch to display set point #2.

b) To change either set point, press and release the appropriate switch, then immediately press and hold both the “up” and “down” switches. When the readout begins to flash, increase the set point by pressing the “up” switch or decrease the set point by pressing the “down” switch. When either switch is pressed and released once, the set point changes by one unit. If either switch is held for one second, the value changes rapidly.

c) Three seconds after switch is released, the new set point is stored (and displayed for an additional two seconds), and then temperature is displayed again.

### 2.2.3 Accessing the Diagnostic Subroutine

a) Before applying power, press and hold the “down” switch. Apply power and release the “down” switch. The instrument will now enter the diagnostic subroutine and all eight segments of all readout decades will be displayed.

b) Press the “down” switch again. The instrument will display a legend designating which particular ruthenium oxide curve is being used in the temperature calculation software. Legends are as follows:

105 – Scientific Instruments, Inc. Model RO-105
701 – Scientific Instruments, Inc. Model RO-701GE
600 - Scientific Instrument's, Inc. Model RO-600

c) Press the “down” switch again. The instrument will display the version of software in the instrument.

d) Press the “down” switch again. The instrument will display a “d1” legend and output 0 volts at the analog output (assuming this option is installed).

e) Press the “down” switch again. The instrument will display a “d2” legend and output 1 or 4 +/- 0.010 volts at the analog output.

f) Press the “down” switch once more to return the instrument to its normal display of temperature.

### 2.2.4 Default Readouts

a) ‘000’ Indicates an open Sensor.

b) ‘555’ Indicates a possible shorted input or that the input is outside the range of the instrument.

## 2.3 CALIBRATION PROCEDURES

**CAUTION: THE FOLLOWING PROCEDURE IS PERFORMED BY SCIENTIFIC INSTRUMENTS, INC. AND IS USUALLY ONLY NECESSARY DURING INITIAL SET-UP OF THE INDICATOR AT THE TIME OF ORDER. IT HAS BEEN INCLUDED IN THIS MANUAL FOR INFORMATIONAL PURPOSES ONLY AND IS NOT NECESSARY FOR ROUTINE USE.**

By means of the front panel switches, the operator can access the sensor curve data stored in the internal EPROMs and select a different curve, if desired. In addition, through the use of a sensor simulator, the operator can reset an internal reference voltage. The following paragraphs describe how these functions are accomplished.

### 2.3.1 Accessing EPROM Sensor Curve Data

**CAUTION: SELECTING THE ALTERNATE SENSOR CURVE REQUIRES BOTH CHANGING THE SENSOR AND ALSO ADDITIONAL HARDWARE CHANGES WITHIN THE INDICATOR.**

a) Before applying power, press and hold both the “up” and “down” switches. Apply power. After two seconds, release both switches, then press and hold the “up” switch. After two seconds, release the “up” switch and then press and hold it again for two seconds.

b) When the “up” switch is released, the applicable legend will be displayed to signify which ruthenium oxide curve is being used. The display will flash for two seconds if neither switch is again pressed.

**NOTE:** The display will cycle through its programmed operations (briefly showing reference voltage) until the legend “CAL” is displayed. At that time, remove power unless a different curve is to be selected.

c) To select a different curve, press and release either the “up” or “down” switch while the display is flashing. At this time, the next sequential legend will be displayed. Subsequent pressing and releasing of either switch will cause the instrument to toggle through each curve legend. When the desired legend is displayed, do not press either switch; simply wait until the display cycles through its programmed operations until the legend “CAL” is displayed. At that time, remove power and the selected curve will be entered into memory.

**WARNING: DO NOT PRESS BOTH SWITCHES WHEN THE “CAL” LEGEND IS DISPLAYED, OTHERWISE THE INSTRUMENT WILL RECALIBRATE ITSELF AND ITS TEMPERATURE READINGS WILL NO LONGER BE VALID.**

### 2.3.2 Setting of Reference Voltage

a) Connect a 1 Megohm decade resistance box (General Radio Model 1433-B, or equivalent) to the sensor input receptacle in lieu of the 100K ruthenium oxide sensor. Use a 10K ohm decade resistance box (General Radio Model 1433-W, or equivalent for the 1K sensor.

b) Connect a digital voltmeter (Fluke Model 8840A, or equivalent) across the decade box terminals.

c) Perform steps “a” and “b” of paragraph 2.3.1.

d) When the legend “CAL” is displayed, set the simulated sensor input to 1.000 +/- 0.005 volts by means of the 1 Megohm decade box set to 100K ohms. This will calibrate the 100K Ruthenium Oxide Sensor..

e) Press both the “up” and “down” switches. The instrument will then accept this new reference voltage (1.2xxx)and return to the temperature display.

**WARNING: PERFORM THIS PROCEDURE ONLY WITH A 1.000 VOLT INPUT, OTHERWISE INACCURATE TEMPERATURES WILL BE DISPLAYED.**

f) To calibrate the 1K sensor, perform steps A through C and E using the 10K ohm decade box set at 1K ohms. The voltage across the box terminals should be .010 $\pm$ .0001 volts.

**WARNING: PERFORM THIS PROCEDURE ONLY WITH A 10 MV INPUT, OTHERWISE INACCURATE TEMPERATURES WILL BE DISPLAYED.**

## 2.4 RS232 OPERATIONAL (Model 1901 Only)

a) Connect the conductors of the RS232 modular IDC cable assembly to the computer as follows:

| | |
|---|---|
| BLK – Ground | GRN – Receive (In) |
| RED – Transmit (Out) | YEL – (No Connection) |

Insert the cable assembly receptacle into the RS 232 port located at the extreme left-hand side of the rear panel.

b) Set the computer to a baud rate of 9600, no parity, 8 data bits and 1 stop bit.

### 2.4.1 Temperature Data

a) The Model 1901 will transmit the current temperature reading to the host computer when a “T” and carriage return ..<CR>.. are received.

**NOTE: The instrument responds to both uppercase and lowercase letters.**

### 2.4.2 Setpoint Data

a) The Model 1901 will accept a new alarm setpoint value for the selected relay when the host computer transmits the following code:

S1, N, <CR>

in which:

S1 indicates that the setpoint is for relay #1. (S2 is used for relay #2).

N is the temperature setpoint in degrees Kelvin (to tenths of degree resolution), with the least significant digit being the tenth's digit.

<CR> is a carriage return.

EXAMPLE: A setpoint value of 12.3K for relay #2 should be transmitted as:

S2, 123, <CR>

Since the maximum range of the instrument is 273 Kelvin, the largest alarm setpoint value that will be interpreted correctly is 2730.

b) The Model 1901 will transmit the current setpoint value for the selected relay when the host computer transmits the follow code:

S1, <CR> or S2, <CR>

as applicable.