

UNIVERSAL RTD CALIBRATOR MODEL 311

- **CALIBRATE IN TEMPERATURE FOR YOUR RTD TYPE**
Select Platinum 100, 200, 500 and 1000 Ohm
Copper 10 Ohm
Nickel 110 and 120 Ohm
- **SIMULATE RTDS INTO PROCESS INSTRUMENTS**
Operates with devices that use pulsed excitation currents including Rosemount Smart Transmitters
- **CALIBRATE WITH LABORATORY ACCURACY**
 $\pm(0.01\% \text{ of Reading} + 0.075 \text{ Ohms})$
Accurate to $\pm 0.2^\circ\text{C}$ (0.4°F) for Pt 100 Ohm RTDs
- **RESOLUTION TO 0.1°C OR $^\circ\text{F}$**
- **DIGITAL ACCURACY WITH ANALOG SIMPLICITY**
Speed sensitive digital pot for fast output adjustment
- **USER SETTABLE "QUIK-CHEKS"**
Set any Span & Zero for instant recall
- **STANDARD "AA" ALKALINE BATTERIES**
50 hours of constant operation
- **THREE YEAR WARRANTY**
Toolbox tough
- **CUSTOM RANGES AVAILABLE**
Additional RTD types, base resistances or Alpha values

GENERAL INFORMATION

Simulate & Read RTDs

Altek's Model 311 RTD Calibrator lets you SIMULATE and READ RTD's over the entire industrial temperature range. Use with transmitters, recorders controllers, alarms, indicators, data acquisition and computer systems. Switch between four platinum 100 ranges, one platinum 200 range, one platinum 500 range and two platinum 1000 ranges. The Model 311 also has ranges for copper and Nickel and can be supplied with custom RTD ranges. When custom ranges are installed, one or more of the standard ranges is deleted. Call the factory for details.

Calibrate RTD Instruments

Simulate RTD resistances into all types of measuring instruments. The Altek Model 311 takes the place of bulky, expensive decade boxes and temperature tables. Output directly in $^\circ\text{C}$, $^\circ\text{F}$ or dial in the resistance value in ohms.

QUIK-CHEK Outputs

Save time with every calibration by instantly recalling three output settings with the handy QUIK-CHEK switch. All output settings are remembered, even with the power off.

Compatible With Modern Instruments

The Model 311 has been designed to calibrate a wide variety of RTD devices, supporting devices with excitation currents of as little as 0.090 mA and as high as 10.20 mA.

Some newer process control equipment use a pulsed excitation current to measure RTD sensors. This includes some smart transmitters, multi-channel recorders and inputs to computers and digital control systems.

The Model 311 is designed to work with these devices and accepts intermittent current pulses as short as 56 milliseconds.

Read RTD Sensors

The Model 311 display gives you fast, accurate temperature measurement with 0.1° and 1° or resistance measurement with 0.01Ω and 0.1Ω resolution. Two, three and four wire hookups assure accuracy in long cable runs. Open RTDs and leads are detected and indicated on the LCD display. Two readings per second track fast moving temperatures.

"MAX" and "MIN" memories are continuously updated from turn-on or whenever the "RESET" button is pressed. Model 311 gives you a handy tool to monitor temperatures for drift or control deviation. Just flip the QUIK-CHEK switch to display the MINimum and MAXimum temperature measured since reset.

OPERATING INSTRUCTIONS

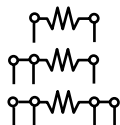
General

Connections

2, 3, 4
WIRE

The Model 311 accurately simulates and reads 2, 3, or 4 wire RTDs. Press the 2, 3, 4 WIRE push-button to match the instrument being calibrated. All connecting wires must be the same length and of the same material running along the same path to insure maximum accuracy.

Two, Three or Four Wire



Two wire RTD measurements are less accurate than other RTD measurements because of the errors introduced by the resistance of the lead wires. The third wire in a three wire hookup provides the instrumentation with a reference connection for the lead wires. The measuring instrumentation uses this reference to infer the actual resistance of the RTD element without the leads. Four wire RTD measurements take into account all wires other than the RTD sensing element. This makes four wire RTDs best suited for precision measurements.

Compatibility with Excitation Currents



RTD measuring instruments use different levels of excitation current to read RTDs. The 311 operates with excitation currents from 0.090 to 10.20 mA. As the excitation current increases the highest resistance that can be simulated decreases. With currents from 0.090 to 1.2 mA the 311 can simulate up to 2000Ω. At 5.00 mA of excitation the highest simulated resistance is 500Ω and at 10.20 mA the highest simulated resistance is 250Ω.

Some transmitters, recorders and other RTD input devices use intermittent, or pulsed, excitation currents to measure the resistance of the RTD. The Model 311 may be configured to operate with both fixed excitation currents (default operation) and with intermittent currents as fast as 56 milliseconds (see User Options below).

Changing RTD Types

Pt
Cu
Ni
Ω

SETUP

Eleven RTD types or ohms may be selected to match the sensors and instruments in your plant. The symbol Alpha (α) is used to identify the particular RTD curve. The value is derived by dividing the resistance of the sensor at 100°C by the resistance at 0°C ($\alpha = R_{100^\circ\text{C}}/R_{0^\circ\text{C}}$). For Pt 100 DIN/IEC/JIS this is $138.50/100.00 = 1.3850$. This value is sometimes represented as 0.00385 or simply as 385.

To change RTD types:

- 1) Turn the selector knob to the desired Metal (Pt, Cu, Ni or to Ohms. Note that for the most common RTD type, Pt 100Ω DIN/IEC/JIS $\alpha = 1.3850$, there is a dedicated position on the selector.
- 2) For Pt and Ni sensors there are a choice of several α values. Press the SETUP push-button to scroll through the available α curves.
Note: The Pt 200Ω, 500Ω & 1000Ω curves are not available when Intermittent Current Compatibility is enabled.

Changing Batteries

Low battery is indicated by BAT on the LCD display. Approximately 10 hours of operation remain before the LCD goes blank and the Model 311 shuts itself down. Turn the Model 311 off, loosen the screw on the battery compartment and lift off the battery compartment door. Replace the six "AA" batteries, replace the door and tighten the screw.



User Options

Auto-Off

The 311 can be set up to turn itself off after 30 minutes of inactivity. The internal timer is reset to 30 minutes each time the digital pot is turned or a push-button is pressed. This configuration is part of the DEFAULT SETTINGS.

Enabling Intermittent Excitation Current Compatibility

The 311 may be configured to operate with instruments that use only constant excitation currents or with a mix of instruments that use constant or intermittent excitation currents. This configuration is part of the DEFAULT SETTINGS.

Configuring Temperature Scales

The 311 may be configured for full time use of °C, full time use of °F or selectable °C and °F operation. This configuration is part of the DEFAULT SETTINGS.

Selecting Autoranging or 1° Resolution

The Model 311 may be configured to autorange or to constantly display with fixed resolution. When autoranging is selected, the Model 311 will display temperatures with 0.1° or 1° resolution. When fixed range is selected, the Model 311 will display temperatures with 1° resolution. This configuration is part of the DEFAULT SETTINGS.

Note: Some ranges are always displayed with 1° resolution.

DEFAULT SETTINGS - USER OPTIONS

The 311 may be restored to the factory settings. This will reset the HI, SET and LO "QUICK-CHEK" memories for all RTD types to 0 °C (32 °F) and the Ω range to 100Ω. Prompts also guide you for selection of Auto-Off, Intermittent Current Compatibility, temperature scale(s) and resolution.

- 1) Press and hold the STORE/RESET push-button while turning the 311 on.
- 2) Keep pressing the STORE/RESET push-button until the display flashes (about 5 seconds) then release. The revision number of the firmware will be displayed for a few seconds.
- 3) After five seconds the words SETUP, BAT and on will appear on the display indicating that AUTO-OFF is selected.
- 4) To toggle the AUTO-OFF function on and off press the SETUP push-button and the words on and OFF will display.
- 5) After five seconds the 311 will automatically store your choice and the words SETUP, OFF and a symbol for pulsed current (a waveform) will display indicating that Intermittent Current Compatibility is off.
- 6) To toggle Intermittent Current Compatibility on and off press the SETUP push-button and the words on and OFF will display.
- 7) After five seconds the 311 will automatically store your choice and the word SETUP, and the symbols °C & °F will display.
- 8) Press the SETUP push-button to make your selection. With °C flashing the unit will only display in °C, With °F flashing the unit will only display in °F and with both flashing you can select °C and °F for each T/C & RTD type. °C/°F is selected if no push-buttons are pressed.
- 9) After five seconds the 311 will automatically store your choice and the word SETUP and 0.1° will appear on the display.
- 10) To toggle the resolution press the SETUP push-button to switch between 0.1° and 1°.
- 11) After five seconds the 311 will automatically store your choice and the 311 will begin normal operation.

OPERATING INSTRUCTIONS

Source (Resistance Output or RTD Temperature Output)

SOURCE

SOURCE
READ

°C / °F

OUTPUT

2, 3, 4
WIRE

- 1) Set up the Model 311 for the correct RTD type and temperature scale (°C or °F).
- 2) Disconnect the input wires from the device to be calibrated or checked.
- 3) Connect the Model 311 to the device to be calibrated, being careful to observe proper connections for 2, 3 or 4-Wire hookups.
- 4) Turn the digital pot to the desired output value.

Whenever SOURCE is selected the word SOURCE will appear on the LCD. SOURCE will flash when the Model 311 is measuring the external excitation current and will be steady when accurately simulating a resistance. To change the output value, turn the speed sensitive digital pot. Turning the pot slowly will cause a gradual change in the output. A faster change will occur when the pot is turned faster. This function operates in all three output positions (HI, SET & LO).

NOTE: If SOURCE never stops flashing on the LCD the excitation current is out of range, too noisy or is intermittent. Check to see that the device being calibrated has operating power and that the 311 is properly connected. Also check the manual for the device to make sure that the excitation current is in the range of 0.090 to 10.20 milliamps.

Hint: Some "smart" transmitters and scanning recorders or indicators use intermittent currents to measure RTD's. The Model 311 can be configured to accept intermittent excitation with minimum 56 milliseconds fixed current (see Compatibility with Intermittent Excitation Currents).

STORE

HI
SET
LO
SOURCE

STORE
RESET

"QUIK-CHEK"

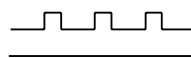
HI
SET
LO
SOURCE

- 1) Switch to HI (or LO).
- 2) Turn the digital pot to desired value.
- 3) Press STORE push button.

If a value is in the SET position and you want that value in HI or LO, press and hold the STORE button while moving the switch to HI or LO. Then release the STORE button. When there is no excitation current or the current is less than 90mA, the digits will flash on the LCD. "QUIK-CHEK" values may still be stored with the digits flashing.

Any time you need a stored value just throw the "QUIK-CHEK" switch. Any value in the RTD range may be stored in HI & LO. The Model 311 remembers the HI, LO and SET values for you with the power on or off. The resolution of the stored value will be based on the excitation from the receiver. When a new RTD type is selected, the resistance of the sensor at 0°C is stored in all "QUIK-CHEK" positions. When the ohms range is selected, 100Ω will be the initial setting for all "QUIK-CHEK" positions.

SELECTING FIXED/INTERMITTENT CURRENT



Operation with fixed or intermittent currents may be chosen immediately after the 311 is turned on.

If Intermittent Excitation Current Compatibility has been selected as a user option, the symbol for intermittent current (a waveform) and the word on or OFF will appear on the display each time the 311 is turned on. To toggle between on (Intermittent Compatibility) and OFF (fixed current) press the SETUP push-button. If the selection you want is already displayed wait 3 seconds and the 311 will begin operating.

Hint: Choose intermittent excitation *only* when device to be calibrated uses intermittent currents. Most devices require that fixed current operation is selected.

READ (Measure RTD Sensors or Resistors)

Read

SOURCE
READ

°C / °F

Input

2, 3, 4
WIRE

- 1) Set up the Model 311 for the correct RTD type and temperature scale (°C or °F).
- 2) Disconnect the wires from the resistance sensor to be read or checked.
- 3) Connect the Model 311 to the sensor to be measured, being careful to observe proper connections for 2, 3 or 4-Wire hookups.
- 4) Display present reading, Maximum or Minimum temperature.

Whenever READ mode is selected the word READ will appear on the LCD. The Model 311 can measure temperatures with resolution of 0.1° and 1° and resistance in two ranges with resolution of 0.01Ω and 0.1Ω. The display is updated twice per second to continuously track fast moving temperatures. Using three or 4-Wire hookups provides accurate readings in long cable runs.

Open RTDs



or

The Model 311 checks for open or high resistance connections. Open or burned out RTDS are indicated by - - - - on the display.

If the temperature is out of range the symbols or and ur will appear on the display.

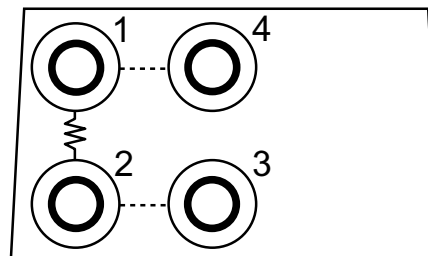
MIN/MAX

MAX
READ
MIN
READ

To read the Maximum or Minimum temperature since READ mode was entered, simply switch to MAX or MIN. The value will appear on the LCD along with the word MAX or MIN. The MAX/MIN values are automatically updated and may be viewed at any time without disturbing the other values. Pressing RESET will transfer the present temperature into both MAX and MIN and will update them as the measured temperature changes.

Connections

The Model 311 can be hooked up to instruments or sensors with two, three or four wire connections. Use the diagram on the connection panel (shown on the right) and match the resistor symbol to the diagram on the instrument, sensor or the manual for the instrument. For two wire connections, place a red lead in socket 1 and a black lead in socket 2. For three wire connections place a red lead in socket 1, and black leads in sockets 2 and 3. For four wire connections place red leads in sockets 1 and 4 and black leads in sockets 2 and 3.



SPECIFICATIONS

(Unless otherwise indicated, specifications are in % of Span in ohms with 1 mA fixed excitation current @ 23°C for 1 year)

General

General Accuracy: $\pm(0.01\%$ of reading + 0.075 Ohms)
Temperature Drift: $\pm 0.01\%$ / °C
Operating Temperature Range: -5 to 140 °F (-20 to 60 °C)
Storage Temperature Range: -22 to 170 °F (-30 to 80 °C)
Relative Humidity: 10 to 90%, non-condensing
Warm Up Time: 30 seconds to maximum accuracy
Battery Life: 6 "AA" Alkaline Batteries: Nominal 50 hours
Low Battery: "BAT" indication on LCD at 7 Volts nominal, approximately 10 hours left. Batteries should be removed when storing the unit for longer than three months.
Overall Size: 6.23 x 3.27 x 1.94 inches (158.1 x 83.1 x 49.3 mm)
Weight: 1lb, 2oz (0.5 kg)

New Product Information

This document contains information for a new product. Altek Industries Corp reserves the right to modify this product without notice.

SOURCE MODE (SIMULATION OF RESISTANCE)

Output Resistance Ranges:

0.00 to 409.99 and 410.0 to 2010.0 Ohms

Accuracy from 1 to 10 mA of External Excitation Current:
 $\pm(0.01\%$ of reading + 0.075 Ohms)

Accuracy Below 1 mA of External Excitation Current:

$\pm(0.01\%$ of reading + $\frac{0.025 \text{ mV}}{\text{mA Excitation Current}} + 0.05 \text{ Ohms}$)

Allowable External Excitation Current: 0.09 to 10.20mA

Intermittent Excitation Currents: Accepts intermittent excitation currents with minimum of 56 milliseconds fixed current at minimum repetition rate of 1/sec from 0.90 to 10 mA.

READ MODE (MEASUREMENT OF RTD SENSORS)

Input Resistance Ranges:

0.00 to 409.99 and 410.0 to 2010.0 Ohms

Accuracy: $\pm(0.01\%$ of reading + 0.075 Ohms)

Excitation Current Supplied: 1 mA, nominal

Normal Model Rejection: 50/60 Hz, 50 db

Common Mode Rejection: 50/60 Hz, 100 db

RANGES AND ACCURACIES

(Temperature Accuracies Converted From Resistance – Based On Ohms Accuracy of $\pm(0.01\%$ of Reading + 0.075Ω)

RTD TYPE	ALPHA	RANGE	ACCURACY	RANGE	ACCURACY
Pt 100Ω (DIN/IEC/JIS 1989)	1.3850	-200.0 to 200.0°C 200.0 to 600.0°C 600.0 to 850.0°C	$\pm 0.2^\circ\text{C}$ $\pm 0.3^\circ\text{C}$ $\pm 0.4^\circ\text{C}$	-328.0 to 392.0°F 392.0 to 1112.0°F 1112.0 to 1562.0°F	$\pm 0.4^\circ\text{F}$ $\pm 0.6^\circ\text{F}$ $\pm 0.7^\circ\text{F}$
Pt 100 (Burns)	1.3902	-195.6 to 200.0°C 200.0 to 648.8°C	$\pm 0.2^\circ\text{C}$ $\pm 0.3^\circ\text{C}$	-320.0 to 392.0°F 392.0 to 1200.0°F	$\pm 0.4^\circ\text{F}$ $\pm 0.6^\circ\text{F}$
Pt 100 (Old JIS 1981)	1.3916	-200.0 to 200.0°C 200.0 to 648.8°C	$\pm 0.2^\circ\text{C}$ $\pm 0.3^\circ\text{C}$	-328.0 to 392.0°F 392.0 to 1200.0°F	$\pm 0.4^\circ\text{F}$ $\pm 0.6^\circ\text{F}$
Pt 100 (US Lab)	1.3926	-200.0 to 100.0°C 100.0 to 700.0°C 700.0 to 862.2°C	$\pm 0.2^\circ\text{C}$ $\pm 0.3^\circ\text{C}$ $\pm 0.4^\circ\text{C}$	-328.0 to 212.0°F 212.0 to 1292.0°F 1262.0 to 1584.0°F	$\pm 0.4^\circ\text{F}$ $\pm 0.6^\circ\text{F}$ $\pm 0.7^\circ\text{F}$
Pt 200Ω (DIN/IEC/JIS 1989)	1.3850	-200.0 to 200.0°C 200.0 to 700.0°C 700.0 to 850.0°C	$\pm 0.1^\circ\text{C}$ $\pm 0.2^\circ\text{C}$ $\pm 0.3^\circ\text{C}$	-320.0 to 392.0°F 392.0 to 1292.0°F 1292.0 to 1562.0°F	$\pm 0.2^\circ\text{F}$ $\pm 0.4^\circ\text{F}$ $\pm 0.5^\circ\text{F}$
Pt 500Ω (DIN/IEC/JIS 1989)	1.3850	-200.0 to 600.0°C 600.0 to 850.0°C	$\pm 0.1^\circ\text{C}$ $\pm 0.2^\circ\text{C}$	-320.0 to 1112.0°F 1112.0 to 1562.0°F	$\pm 0.2^\circ\text{F}$ $\pm 0.3^\circ\text{F}$
Pt 1000Ω (Hy-Cal/HVAC)	1.3750	-184 to 275°C	$\pm 1^\circ\text{C}$	-300 to 527°F	$\pm 1^\circ\text{F}$
Pt 1000Ω (DIN/HVAC)	1.3850	-200 to 265°C	$\pm 1^\circ\text{C}$	-328 to 510°F	$\pm 1^\circ\text{F}$
Cu 10 (Minco)	1.4274	-200 to 260°C	$\pm 2^\circ\text{C}$	-328 to 500°F	$\pm 4^\circ\text{F}$
Ni 120 (Pure)	1.6720	-80.0 to 315.5°C	$\pm 0.1^\circ\text{C}$	-112.0 to 524.0°F	$\pm 0.2^\circ\text{F}$
Ni 110 (Bristol 7 NA)	1.5801	-106.7 to 315.6°C	$\pm 0.2^\circ\text{C}$	-160.0 to 600.0°F	$\pm 0.3^\circ\text{F}$
Ohms	0.00 to 409.99Ω 410.0 to 2000.0Ω	$\pm(0.01\%$ of Reading + 0.075Ω) $\pm(0.01\%$ of Reading + 0.075Ω)			

ADDITIONAL INFORMATION

Three Year Warranty

Our equipment is guaranteed against defective material and workmanship (excluding batteries) for a period of three years from date of shipment. Claims under guarantee can be made by returning the equipment prepaid to our factory. The equipment will be replaced, repaired or adjusted at our option. The liability of Altek is restricted to that given under our guarantee. No responsibility is accepted for damage, loss or other expense incurred through sale or use of our equipment. Under no condition shall Altek be held liable for any special, incidental or consequential damage.

Available From

Other Products

Altek designs and manufactures fast, accurate instruments for measurement, generation and simulation of virtually every process control signal. Consult our factory directly or contact your local stocking representative to order precise, low cost Milliamp Calibrators, Voltage Sources, Thermocouple Sources, RTD Simulators, Frequency Calibrators and Pressure Pumps, Indicators & Calibrators. Altek also produces calibrators for custom ranges and unique applications. New models are frequently added to the Altek family to meet all of your critical calibration requirements. Altek products are made in the USA.