

# UNIVERSAL RTD CALIBRATOR MODEL 311A

- **SIMULATE RTDS INTO SMART TRANSMITTERS**  
Works with a wide variety of models including Rosemount 3144 & Honeywell STT series
- **UNIVERSAL COMPATIBILITY WITH PROCESS INSTRUMENTS**  
Operates with devices that use pulsed excitation currents including PLCs, DCS and Multi-channel recorders
- **CALIBRATE IN TEMPERATURE FOR YOUR RTD TYPE**  
Platinum 100 $\Omega$ , Copper 10 $\Omega$  and 50 $\Omega$ , Nickel 110 and 120 $\Omega$   
Simulate from 0.00 to 500.00 Ohms
- **CALIBRATE WITH LABORATORY ACCURACY**  
 $\pm(0.01\%$  of Reading + 0.075 Ohms)  
Accurate to  $\pm 0.2$  °C (0.4 °F\*) for Pt 100 Ohm RTDs
- **RESOLUTION TO 0.1 °C OR °F AND TO 0.01 $\Omega$**
- **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



## GENERAL INFORMATION

### Compatible With More Instruments

The Model 311A has been designed to calibrate every type of RTD monitoring and measuring device. The enhanced circuitry of the 311A makes it compatible with a wider variety of instruments than other RTD calibrators.

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 Programmable Logic Controllers (PLCs), computers and digital control systems.

The Model 311A is designed to work with these devices and accepts intermittent current pulses as short as 10 milliseconds. It calibrates devices with excitation currents of as little as 0.090 mA and as high as 10.20 mA

### Simulate & Read RTDs

Altek's Model 311A RTD Calibrator lets you SIMULATE and READ RTDs over the entire industrial temperature range. Switch between four platinum 100 ranges and two ranges each for copper and Nickel. The Model 311A can also be supplied with custom RTD ranges. When custom ranges are installed, one or more of the standard ranges may be deleted. Call the factory for details.

### Calibrate RTD Instruments

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

### QUIK-CHEK Outputs

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

### Read RTD Sensors

The Model 311A display gives you fast, accurate temperature measurement with 0.1° and 1° or resistance measurement to 500.00 Ohms with 0.01 $\Omega$  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 311A 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.

ALTEK INDUSTRIES CORP  
A TRANSMATION COMPANY

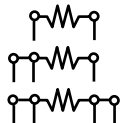
Distributed by: M&M Control Service, INC. 800-876-0036  
Http://www.mmcontrol.com Email: Sales@mmcontrol.com

### Connections



The Model 311A 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.

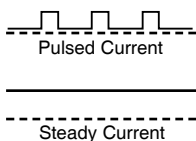
### Two, Three or Four Wire



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.

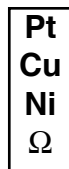
### Compatibility with Excitation Currents

RTD measuring instruments use different levels of excitation current to read RTDs. The 311A 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 5.0 mA the 311A can simulate up to 500.00Ω. 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 311A operates with both steady excitation currents and with intermittent currents as fast as 10 milliseconds.

### Changing RTD Types



Eight RTD types or ohms may be selected to match the sensors and instruments in your plant. The symbol Alpha ( $\alpha$ ) 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) There are a choice of several  $\alpha$  values for Pt, Ni & Cu. Press the SETUP push-button to scroll through the available  $\alpha$  curves.

### 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 311A shuts itself down. Turn the Model 311A 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 311A 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.

### Configuring Temperature Scales\*

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

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

### Operation With Noisy Excitation Currents

The Model 311A automatically adapts itself to work with steady and pulsed excitation currents. Sometimes, the 311A may not properly detect the excitation current, especially when the excitation current is disturbed by electrical noise generated by the device being calibrated. When Noisy Current Mode is on the 311A will operate as if all excitation currents are pulsed at less than 56 milliseconds.

### DEFAULT SETTINGS - USER OPTIONS

The 311A may be restored to the factory settings. This will reset the HI, SET and LO "QUIK-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, temperature scale(s) and resolution.

- 1) Press and hold the STORE/RESET push-button while turning the 311A on.
- 2) Keep holding the STORE/RESET push-button until the display flashes (about three seconds) then release. The revision number of the firmware will be displayed for a few seconds.
- 3) After three 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 three seconds the 311A will automatically store your choice and the word SETUP, and the symbols °C & °F will display\*.
- 6) 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.
- 7) After three seconds the 311A will automatically store your choice and the word SETUP and 0.1° will appear on the display.
- 8) To toggle the resolution press the SETUP push-button to switch between 0.1° and 1°.
- 9) After three 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 Noisy Current Compatibility is off.
- 10) To toggle Noisy Current Compatibility on and off press the SETUP push-button and the words on and OFF will display.
- 11) After three seconds the 311A will automatically store your choice and the 311A 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 311A for the correct RTD type (and temperature scale\*).
- 2) Disconnect the input wires from the device to be calibrated or checked.
- 3) Connect the Model 311A 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 311A 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).

Hint: Flashing digits on the display indicates that the excitation current produced by the device being calibrated is below 0.09 mA or that no excitation current is present. Excitation currents over 10.2 mA are indicated by - - - - on the display. Check to see that the device being calibrated has operating power and that the 311A 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.

### 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 0.09 mA, 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 311A remembers the HI, LO and SET values for you with the power on or off. When a new RTD type is selected, 0°C is stored in all “QUIK-CHEK” positions. When the ohms range is selected, 100.00Ω will be the initial setting for all “QUIK-CHEK” positions.

A  symbol indicates that intermittent currents faster than 56 milliseconds have been detected. With these fast excitation current pulses the 311A assumes that the excitation current is between 0.09 and 10.2 mA.

## READ (Measure RTD Sensors or Resistors)

### Read

SOURCE  
READ

°C / °F

### Input

2, 3, 4  
WIRE

- 1) Set up the Model 311A for the correct RTD type (and temperature scale\*).
- 2) Disconnect the wires from the resistance sensor to be read or checked.
- 3) Connect the Model 311A 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 311A can measure temperatures with resolution of 0.1° and 1° and resistance to 500.00Ω with resolution of 0.01Ω. 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 311A 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.

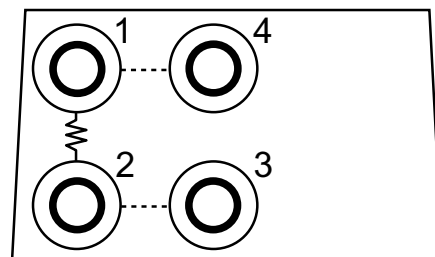
### MIN/MAX

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 311A 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)

*Altek Industries Corp reserves the right to modify this product without notice.*

### SOURCE MODE (SIMULATION OF RESISTANCE)

**Output Resistance Ranges:**  
0.00 to 500.00 Ohms  
**Accuracy from 1 to 10.2 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 10.20 mA  
**Intermittent Excitation Currents:** Accepts intermittent excitation currents with minimum of 10 milliseconds fixed current at minimum repetition rate of 1 every five seconds from 0.09 to 10.20 mA.

### READ MODE (MEASUREMENT OF RTD SENSORS)

**Input Resistance Ranges:**  
0.00 to 500.00 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) Based on ITS-90	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 648.9°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 648.9°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	$\pm 0.4^\circ\text{F}$ $\pm 0.6^\circ\text{F}$ $\pm 0.7^\circ\text{F}$
Cu 10 (Minco)	1.4274	-200 to 260°C	$\pm 2^\circ\text{C}$	-328 to 500°F	$\pm 4^\circ\text{F}$
Cu 50	1.4280	-50 to 150°C	$\pm 1^\circ\text{C}$	-58 to 302°F	$\pm 1^\circ\text{F}$
Ni 120 (Pure)	1.6720	-80.0 to 315.6°C	$\pm 0.1^\circ\text{C}$	-112.0 to 600.0°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 500.00 Ω	$\pm(0.01\%$ 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.

### \*SI

On SI labeled instruments, all non-SI engineering units have been disabled.

### 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.

### ORDERING INFORMATION

**Universal RTD Calibrator**  
 Included with each Model 311A are:  
 Two black and two red, 1 meter (3') test leads with banana plugs and spade lugs  
 Carrying Case 09-3786  
 Data Sheet  
 NIST Traceable Certificate and Three Year Warranty

### Part No.

**311A**

### OPTIONAL ACCESSORIES

**Replacement Leads**

### Part No.

**Kit-4**

### AVAILABLE FROM