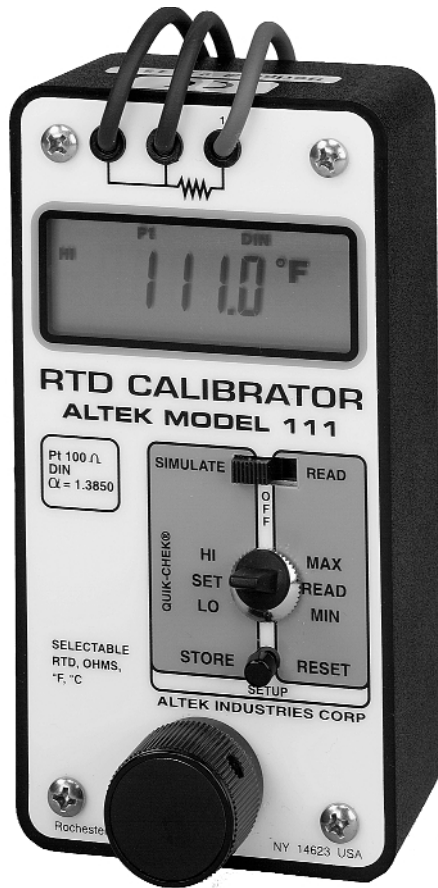


## RTD Calibrator

Model 111



- **World standard Platinum 100Ω RTD**  
DIN/IEC 751 curve  $\alpha=1.3850(0.00385)$
- **Simulate & read 2,3 wire RTDs & ohms**  
Temperatures from -200.0 to 850.0°C;  
-328.0 to 1562.0 °F  
Ohms from 0.00 to 410.00Ω
- **0.05% accuracy**  
Accurate to 1°F or 0.6°C
- **1° or 0.1° resolution**  
Field Selectable °F or °C
- **"Quik-Chek™" switch**  
Instantly recall three outputs; HI, LO & Set

## General description

Altek's Model 111 RTD Calibrator lets you simulate and read RTDs over the entire industrial temperature range. Use with transmitters, single & dual channel recorders, controllers, alarms and indicators.

Field customize the Model 111 to lock-in 0.1° or 1° resolution, fixed °C or °F or front selectable °F/°C operation. Read and simulate 2-wire and automatically compensate for 3-wire RTDs with built-in leads.

### Simulate an RTD sensor

Resolution is 0.1° C or F simulating the full range of Platinum 100 ohm RTDs into devices supplying a continuous excitation current of 0.09 to 1.1 mA. From 1.1 to 5.800 mA continuous excitation current the 111 resolution automatically adjusts to 1° C or F. Ohms range provides 0.01 ohm resolution from 0.00 to 410.00 ohms which automatically switches to 0.1 ohm resolution for continuous excitation currents above 1.1 mA.

### Instantly recall three output temperatures

"QUICK-CHEK" function stores three output temperatures for real convenience. The Model 111 simulates key temperatures for repetitive calibrations. Turn the knob to check trip points, controller action or hysteresis. The fast response 111 sets quickly without overshoot. Memory is retained even when power is off.

### Measure RTD sensors

The Model 111 display gives you fast, accurate temperature measurement with 0.1 and 1 degree or with 0.01 and 0.1 ohm resolution. Two and three wire hookups assure accuracy in short or long cable runs. Open RTDs and leads are detected and indicated on the LCD display. Two readings per second track fast moving temperatures.

### Recall maximum and minimum temperatures

"MAX" and "MIN" memories are continuously updated from turn-on or whenever the "RESET" button is pressed. Model 111 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.

### Calibrating additional instruments

For multichannel recorders, data acquisition, computer systems and smart transmitters Altek recommends using the Model 311A RTD Calibrator in place of the 111. The Model 311A is designed to operate with many devices that use pulsed or intermittent excitation currents to read an RTD. The 311A also operates with devices requiring 4 wire RTDs and has additional RTD types for other Platinum, Copper and Nickel sensors.

# General instructions



## Connections

The Model 111 accurately simulates and reads 2 and 3 wire RTDs. It has three leads permanently attached which are terminated with spade lugs. All connecting wires must be the same length and of the same material running along the same path to insure maximum accuracy.

### Two or three 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.

### Turn on

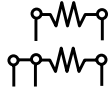
Each time the Model 111 is turned on, the LCD will display all segments for about 1 second. It then displays the currently selected RTD or Ohms mode for approximately 3 seconds. The currently selected temperature scale of °C or °F will then display for about 3 seconds. Depending on the configuration, RTD, Ohms, °C or °F may be selected during turn-on.

- 1) Move the power switch to SOURCE or READ
- 2) All segments on the LCD are turned on during self test
- 3) The display will indicate the selected RTD type for 3 seconds. Press the SETUP pushbutton to change between RTD and Ohms (based on configuration).
- 4) The display will indicate the selected temperature scale for 3 seconds. Press the SETUP pushbutton to switch between °C & °F (based on configuration).
- 5) The Model 111 will now Simulate or Read RTD or Ohms.

Depending on the configuration of the DIP switches the user prompts for RTD, Ohms, °C and °F may be skipped during turn-on.

The three "QUIK-CHEK" temperature values will be the same as previously stored. If a change is made between Ohms and RTD mode 100 Ohms will be stored for Ohms and 0°C (32°F) will be stored in all three "QUIK-CHEK" positions.

Note: The Model 111 will automatically convert the temperatures in memory between °F and °C. For example, if 212.0°F is stored in HI and the Model 111 is switched to °C, 100.0°C will be displayed.



## Pulsed excitation currents

Some distributed control systems, recorders, transmitters and other RTD input devices use intermittent, or pulsed, excitation currents to measure the resistance of the RTD. The Model 111 will not simulate correctly with these devices (see Calibrating Additional Instruments on page one).

## SELECTING °F OR °C

The Model 111 may be internally configured in one of three modes. The first two modes are for full-time use in °F or full-time use in °C. The third mode allows front panel selection of °F or °C each time the unit is turned on. If your facility is completely in °F or °C, set the internal DIP switches of the 111 to operate as a dedicated °F or °C instrument (see Setting Operating Mode below).

## Autoranging or fixed 1° resolution

The Model 111 may be internally configured to autorange or to constantly display with fixed resolution. When autoranging is selected, the Model 111 will display temperatures with 0.1° or 1° and ohms with 0.01 ohm or 0.1 ohm resolution. When fixed range is selected, the Model 211 will display temperatures with 1° and ohms with 0.1 ohm resolution. Note: Simulation of Pt 100 ohm RTD into devices with greater than 1.1 mA of excitation current (and some custom ranges) is displayed with 1° resolution.

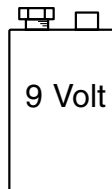
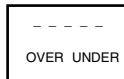
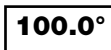
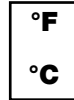
## Over range/under range

Out-of-range temperatures are indicated by - - - - and OVER or UNDER on the display during READ mode. If this occurs check for proper connections and RTD type selection. During simulate mode excitation currents below 0.090mA are indicated by the word SIM flashing on the display. Excitation currents above 5.8mA are indicated by - - - - and SIM flashing on the display. Check for proper connections.

## Changing the battery

Low battery is indicated by BAT on the LCD display. Approximately 10 hours of operation remain before the LCD goes blank and the Model 111 shuts itself down. Turn the Model 111 off. Remove the four corner screws and lift the unit out of the case. The battery is fastened to the bottom printed circuit board and is easily removed.

Note: If the new battery is installed within 30 seconds of removing the old battery the "Quik-Chek" values will remain in memory.



# Setting operating mode (DIP switches)

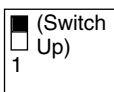


- 1) Turn the Model 111 OFF
- 2) Remove the 4 corner screws and lift faceplate assembly out of the case
- 3) Set the DIP switches for your options as diagrammed below

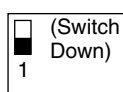
## Autoranging

Switches between autoranging 0.1°/1° (0.01 Ohm/0.1 Ohm) and fixed 1° (0.1 Ohm).

Fixed 1°



Fixed 0.1°\*



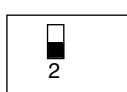
## Full time RTD or ohms

Switches between full time RTD or Ohms Mode (whichever is currently selected) and selectable modes at turn on.

Fixed RTD or Ohms



Selectable RTD/Ohms\*



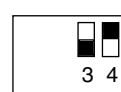
## TEMPERATURE SCALE

Switches between fixed °F, fixed °C or °C/°F selection at turn on.

Fixed °F



Fixed °C



°C/°F Switchable\*



\*Factory Settings (All switches down)

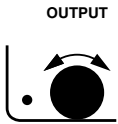
# Simulate RTD or resistance

## Simulate



- 1) Set up the Model 111 for RTD or Ohms and temperature scale (°C or °F).
- 2) Disconnect the input wires from the device to be calibrated or checked.
- 3) Connect the Model 111 to the device to be calibrated, being careful to observe proper connections for 2 or 3 Wire hookups.
- 4) Adjust the digital pot to the desired output value.

## Output



Whenever SIMULATE mode is selected the word SIM will appear on the LCD. SIM will flash when the Model 111 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. A filter circuit limits response when the pot is turned too fast. This function operates in all three output positions (HI, SET & LO).

## Store



- 1) Switch to HI (or LO).
- 2) Turn the digital pot to desired value.
- 3) Press STORE. The LCD will flash once indicating that the value has been stored

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. The LCD will flash once indicating that the value has been stored. Release the STORE button. When there is no excitation current or the current is less than 0.09 mA SIM will flash on the LCD. "QUIK-CHEK" values may be stored with SIM flashing.

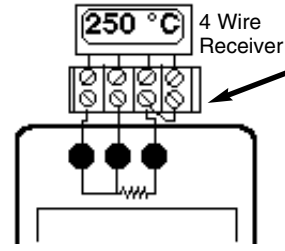
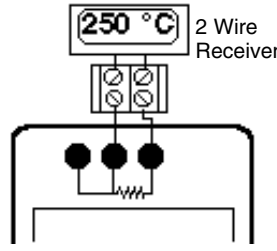
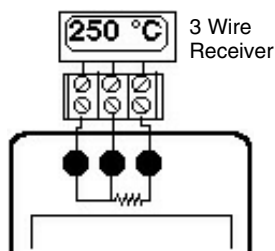
## Instantly recall temperatures



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 111 remembers the HI, LO and SET values for you with the power on or off. The resolution of the stored value is based on the excitation from the receiver. When RTD type is selected after Ohms was selected 0°C or 32°F is stored in all "QUIK-CHEK" positions. When the ohms range is selected, 100 will be the setting for all "QUIK-CHEK" positions.

**Note:** SIM constantly flashing on the LCD indicates that the excitation current is missing, out of range or is intermittent. Check to see that the device being calibrated has operating power and that the 111 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 5.800 milliamps. *The Model 111 will simulate only with instruments that use fixed excitation currents.* Some "smart" transmitters and scanning recorders or indicators use intermittent (pulsed) currents to measure RTD's. Try putting recorders into a calibrate mode or lock them into one channel. See Calibrating Additional Instruments on page one for more information.

## Hookup — Simulate an RTD or resistance



Add a jumper approximately the same gauge and length as the wires connected to the 111

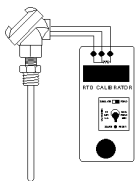
# Read an RTD sensor

## Read



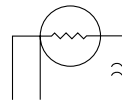
- 1) Set up the Model 111 for the RTD, Ohms and temperature scale (°C or °F).
- 2) Disconnect the wires from the resistance sensor to be read or checked.
- 3) Connect the Model 111 to the sensor to be measured, being careful to observe proper connections for 2 or 3 wire hookups.
- 4) Display present reading, Maximum or Minimum temperature.

## Input



Whenever READ mode is selected the word READ will appear on the LCD. The Model 111 can measure temperatures in two ranges with resolution of 0.1° and 1°. The display is updated twice per second to continuously track fast moving temperatures. Using three wire hookups provides accurate readings in long cable runs.

## Open RTDS



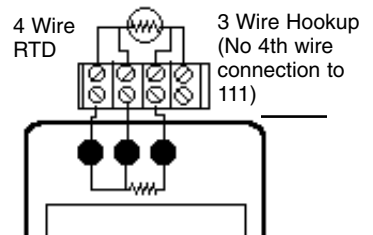
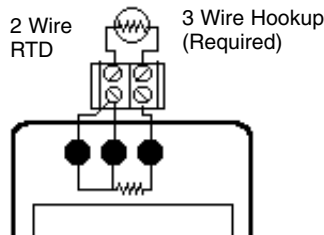
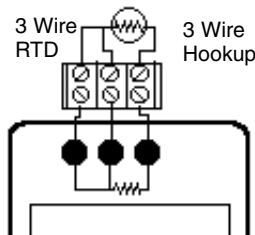
The Model 111 checks for open or high resistance connections. Open or burned out RTDS are indicated by - - - - on the display. Temperatures out of range for the RTD selected will be indicated by OVER and UNDER on the display.

## MIN/MAX



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. Press RESET and the Model 111 will flash the display once to indicate it has transferred the present temperature into both MAX and MIN and will update them as the measured temperature changes.

## Hookup — Read an RTD or resistor



# Specifications

(Unless otherwise Indicated, specifications are in % of 400 ohm span at 1.0 mA excitation current @ 23° C)

## General

Temperature drift:  $\pm 0.01$  %/°C  
Operating temperature range: -5 to +140° F (-20 to +60° C)  
Storage temperature range: -22 to +175° F (-30 to +80° C)  
Relative humidity: 10 to 90%, non-condensing  
Warm up time: 30 seconds to maximum accuracy  
Overload protection: Electronically protected to 40 VDC between leads 1 & 2, fuse protected to 125 VAC, 5A between leads 2 & 3  
Battery life: 9 Volt Alkaline: 50 hours  
Low battery: "BAT" indication on LCD at 7 Volts nominal, approximately 10 hours left  
Overall size: 2 1/2 x 2 5/8 x 5 1/8 inches (63.5 x 66.7 x 130 mm)  
Leads: Approximately 18" (0.46m) terminated with spade lugs  
Weight: 11.5 oz. (0.33 kg)  
Carrying case: Included, zippered with belt loop

## Simulate RTD or resistance

Accuracy:

$\pm 0.05\%$  from 1 mA to 5.8 mA of excitation current

$\pm(0.05\% + \frac{0.01 \text{ mV}}{\text{mA Excitation Current}})$  from 0.09 to 1 mA of excitation current

Output resistance range: 0.00 to 400.00 Ohms

Allowable excitation current: 0.090 to 5.800mA continuous DC (See Calibrating additional instruments on page one for calibrators compatible with pulsed or intermittent excitation currents)

## Measuring RTD sensors

Accuracy:  $\pm 0.05\%$

Excitation current supplied: 1 mA, nominal

Normal mode rejection: 50/60 Hz, 50 db

Common mode rejection: 50/60 Hz, 100 db

# Resolution and accuracy

RTD Type	Alpha	Range	Accuracy	Range	Accuracy
Pt 100 $\Omega$ (DIN/IEC/JIS 1989)	1.3850	-200.0 to 200.0°C	$\pm 0.5$ °C	-328.0 to 212.0°F	$\pm 0.9$ °F
		200.0 to 700.0°C	$\pm 0.6$ °C	212.0 to 750.0°F	$\pm 1.0$ °F
		700.0 to 850.0°C	$\pm 0.7$ °C	750.0 to 1200.0°F	$\pm 1.1$ °F
				1200.0 to 1562.0°F	$\pm 1.2$ °F
Ohms		0.00 to 410.00	$\pm 0.2$ $\Omega$		

**Note:** Above ranges are for READ mode in which the Model 111 provides a 1 mA excitation current and for SIMULATE mode into devices with less than 1.1 mA of excitation current. Simulating into devices with greater than 1.1 mA the Model 111 resolution changes automatically to 1°F, 1°C or 0.1 Ohm.

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  $138.50/100.00 = 1.3850$  (which is also shown as 0.00385 or simply 385).

# Warranty

Altek products are warranted to be free from defects in material and workmanship (excluding fuses, batteries and leads) for a period of three years from the date of shipment. Warranty repairs can be obtained by returning the equipment prepaid to our factory. Products will be replaced, repaired, or adjusted at our option. *Altek gives no other warranties, including any implied warranty of fitness for a particular purpose.* Also, Altek shall not be liable for any special, indirect, incidental or consequential damages or losses arising from the sale or use of its products.

## Altek Industries, Inc.

PO Box 1106, Everett, WA 98206

1520 75th Street SW, Everett, WA 98203

For more information:

U.S.A. (800) 322-5835

Fax (800) 265-6340

Service fax (425) 446-6331

E-mail: [sales@altekcalibrators.com](mailto:sales@altekcalibrators.com)

Web: [www.altekcalibrators.com](http://www.altekcalibrators.com)

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