Manual Supplement

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This supplement contains information necessary to ensure the accuracy of the above manual.

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FLUKE®
Calibration

Change #1, 546

On page 7, under the ***2.1 Specifications*** table, replace the **Computer Interface** with:

Computer Interface	RS-232

On page 9, under ***3.1 Unpacking***, remove the 5th bullet.

Change #2, 605

On page 7, under the ***2.1 Specifications*** table, replace the specifications for, Accuracy, Stability, and Target Emissivity with:

Accuracy:	0.5 °C + 0.3 % of reading (0.8 °F + 0.3 % of reading)
Stability:	±0.1 °C at 100 °C (±0.18 °F at 212 °F) ±0.3 °C at 500 °C (±0.54 °F at 932 °F)
Target Emissivity	Radiometrically calibrated to 0.95

Change #3, TP72

Starting on page 29, replace section ***8 Calibration Procedure*** with:

8 Calibration Procedure

Use this procedure to calibrate the Product with an effective infrared emissivity of 0.95.
Fluke Calibration recommends doing a radiometric calibration. A radiometric calibration uses a Radiation Thermometer (RT), with a selected emissivity of 0.95 to measure the temperature of the Product at each test point. This type of calibration resolves emissivity drift of the Product's target plate.

8.1 General Requirements

8.1.1 Environmental Conditions

- Temperature range: 23 °C ± 3 °C. Temperature needs to be stable during calibration. Avoid drafty areas.
- Ambient relative humidity: Below 70 % RH.

8.1.2 Equipment Requirements

CLASSIFICATION	MINIMUM USE SPECIFICATIONS	SUGGESTED EQUIPMENT
Radiation Thermometer	Spot Size: 90 % of energy within 9 mm diameter at a distance of at least 200 mm Accuracy: 0.25 °C + 0.15 % of reading Resolution: 0.1 °C Spectral Response: 8 µm to 14 µm	Fluke Thermalert 4.0 LT-50-CF2[1]
[1] Requires special transfer calibration with a flat-plate black body, such as a Fluke 4181		

8.2 Test Point Selection

9132 Range	Test Points
50 °C to 500 °C	50 °C, 100 °C, 200 °C, 300 °C, 400 °C, and 500 °C

8.3 Verification

8.3.1 Mounting and Alignment

Note

This section is not intended as a comprehensive instruction of radiometric measurements.

Follow these guidelines:

- Make sure the RT is centered on the target.
- Make sure the RT and the Product are level.
- Make sure the RT's line-of-sight is perpendicular to the Product target.
- Make sure there are no large sources of infrared near the test area (For example: incandescent bulbs, body heat, other black body sources.)
- If the emissivity value of the RT is selectable, set emissivity to 0.95. If the emissivity is not selectable, Make sure that the fixed emissivity value of the RT is 0.95.
- Ensure the spectral response of the RT is 8 µm to 14 µm.

8.3.2 Setup the Product

- Make sure there is no dust/dirt/debris on the surface of the Product target.
- Make sure there is no significant damage or scrapes on the target surface.
- Set the Product to display in degrees Celsius

8.3.3 Verification Procedure

For each test point:

1. Set the Product to the desired test point.
2. Wait for the Product to reach the desired test point within ±0.1 °C. Once the test point is reached, wait at least 10 minutes for the Product to stabilize.
3. Record 10 measurements with the reference RT evenly spaced over a time interval of 30 seconds to 1 minute.
4. Record the average of the 10 measurements as the final result.
5. Calculate the standard deviation of the 10 measurements. Verify that the calculated standard deviation is within 150 % of the limits defined in the stability specification of the Product.
6. Simultaneously push **SET** and **DOWN** to show the setpoint resistance value. Record the value shown on the Product. If adjustment is needed, use this value in the calculations as R_n (where n = 1, 2, 3).

8.4 Adjustment

If adjustment is needed, use this procedure to manually adjust the Product radiometrically. This procedure allows for recalculation of calibration coefficients α, R_0, and δ.

8.4.1 Adjustment Calculations

Calculate the new coefficients α, R_0, and δ from the measured resistances R_1, R_2, and R_3 and the radiometric temperature measurements RT_1, RT_2, and RT_3, respectively. The subscript on R_n and RT_n indicates the test point temperature from lowest to highest in order. For example, if 50 °C, 200 °C, and 500 °C are the selected test points, then R_1 and RT_1 correspond to the measurements at 50 °C. R_2 and RT_2 correspond to the measurements at 200 °C. R_3 and RT_3 correspond to the measurements at 500 °C. This relationship holds regardless of the order the test points were taken. To calculate new adjustment parameters α, R_0, and δ, the temperature points are typically 50 °C, 200 °C, and 500 °C but other temperature points can be used.

Compute δ

$$A = RT_3 - RT_2$$

$$B = RT_2 - RT_1$$

$$C = \left(\frac{RT_3}{100}\right) * \left(1 - \frac{RT_3}{100}\right) - \left(\frac{RT_2}{100}\right) * \left(1 - \frac{RT_2}{100}\right)$$

$$D = \left(\frac{RT_2}{100}\right) * \left(1 - \frac{RT_2}{100}\right) - \left(\frac{RT_1}{100}\right) * \left(1 - \frac{RT_1}{100}\right)$$

$$E = R_3 - R_2$$

$$F = R_2 - R_1$$

$$\delta = \frac{A * F - B * E}{D * E - C * F}$$

Compute R_0

$$a_1 = RT_1 + \delta * \left(\frac{RT_1}{100}\right) * \left(1 - \frac{RT_1}{100}\right)$$

$$a_3 = RT_3 + \delta * \left(\frac{RT_3}{100}\right) * \left(1 - \frac{RT_3}{100}\right)$$

$$R_0 = \frac{R_3 * a_1 - R_1 * a_3}{a_1 - a_3}$$

Compute α

$$\alpha = \frac{R_1 - R_3}{R_3 * a_1 - R_1 * a_3}$$

8.4.2 Updating the Coefficients on the Product

1. Simultaneously push **SET** and **EXIT** to enter the Secondary Menu.
2. Scroll through the Secondary Menu by repeatedly pushing **SET** (5 times) until CAL shows on the display.
3. Use the **UP** and **DOWN** buttons to select each parameter. Push **SET** to accept the value selected value for each parameter.