



WAVELENGTH ELECTRONICS

The **CAL100** is a calibration fixture for the LFI-3751 5 Amp Temperature Controller with Autotune. It is used with four external digital multi-meters and the LFI-3751 operated by Wavelength's Bench Link software.

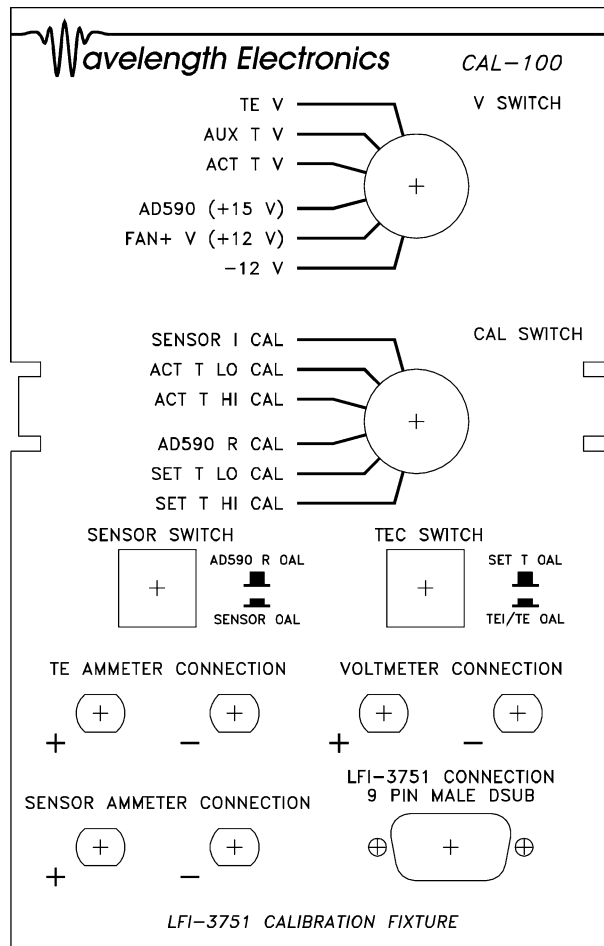
This operating guide includes all the instructions to insure proper calibration of the LFI-3751.

Calibrate the LFI-3751 with the CAL-100 Calibration Fixture

CAL100-00400-A



Front Panel at a Glance



1	TEC +	Positive TE Current Input	Connects to a TE for setpoint calibration or a 1ohm resistor for TE I and TE V calibration.
2	TEC -	Negative TE Current Input	Connects to a TE for setpoint calibration or a 1ohm resistor for TE I and TE V calibration.
3	AUX +	Auxiliary 100 mA Sensor Current	Connects to a 10 kohm resistor and pin 4 (SNS-) to produce a 1 Volt AUX T measurement
4	SNS -	Sensor Common	Sensor Common
5	SNS +	Sensor Bias Current Input	Connects to a series of fixed resistors for ACT T calibration
6	AD590	AD590 Bias Voltage	+15 V AD590 Bias Voltage.
7	FAN -	Fan Supply Common	Fan Common
8	FAN+	+12V Fan Supply Input	+12 V Fan Supply Connection
9	-12 V	-12 V Supply Input	-12 V Supply Connection

Equipment Requirements

PC

A PC with WIN 95 or higher, operating Wavelength's Bench Link software is required for calibration. The Bench Link software is provided with the LFI-3751 and communicates via RS-232.

Meters

Four external digital multi-meters are required to calibrate an LFI-3751 with the CAL-100 calibration fixture.

Each digital multi-meter is required to have a minimum resolution of 4 1/2 digits.

The TE Ammeter must be capable of sensing a current as high as 5.5 Amps.

Three of the external digital multi-meters plug into the CAL-100, while the fourth multi-meter is used to measure test points inside the LFI-3751 (+5 and -5 Volt references).

Cables

The CAT-221 cable is used to connect the 9-pin D-Sub OUTPUT Connector on the rear panel of the LFI-3751 to the 9-pin D-Sub connector on the front panel of the CAL-100. This cable is provided with the CAL-100.

The LFI-3751 must be connected to the PC via RS-232. This cable is not provided with the CAL-100.

Tools

Small flatblade screwdriver to secure the CAT-221 cable to the LFI-3751 and CAL-100.

Phillips screwdriver to remove LFI-3751 top cover.



Eleven Steps to Calibrate the LFI-3751

Once the hardware is set up, complete these calibration steps completed in the order specified.

Switch names are bolded. *Switch settings* are italicized. A ***field on the Bench Link calibration screen*** is both bold and italic. The status bar sometimes displays a message. This is at the bottom of the main Bench Link window.

1 Connect LFI-3751, voltmeter, and ammeters to CAL-100

With power to the LFI-3751 OFF, use the CAT-221 cable to connect the 9-pin D-sub Output Connector on the back of the LFI-3751 to the 9-pin D-sub on the front of the CAL-100 Calibration fixture. Failure to securely screw in the connectors can lead to damage to the D-Sub connector.

Use banana jacks to connect the voltmeter to the front panel of the CAL-100. Connect a high current ammeter (up to 5.5 Amps) to the TE Ammeter jacks. Connect another ammeter to the Sensor Ammeter jacks. If you do not set up the ammeters, the LFI-3751 will display a sensor error.

Reserve the last voltmeter to monitor the +5 and -5V reference test points inside the LFI-3751.

2 Connect LFI-3751 to PC

Connect the LFI-3751 to a PC via an RS-232 cable. Start Wavelength's Bench Link software and choose File -> New -> Temperature Controller. Turn on the main power switch on the LFI-3751. When communication is established, the fields will no longer blink. This might take a few seconds. For more information about operating under RS-232 control, refer to the LFI-3751 manual.

For optimum calibration, let the LFI-3751 warm up for one hour before calibration.

To start calibration, select Display -> Password Protected -> Calibration. Enter a two word user name (such as user 1), and the password **+273.15** to bring up the calibration screen. You can enter up to eight digits in the ***Serial Number*** field. This will be the title on the calibration window.



3 Calibrate Sensor Currents

Background: Four sensor currents are available to maximize the sensor sensitivity. Each current must be calibrated to assure accuracy of the actual temperature display.

Adjust **V Switch** to *ACT T V*.
Adjust **CAL Switch** to *SENSOR I CAL*.
Push **SENSOR Switch IN**.
Push **TEC Switch IN**.

Typical Values:

10 μ A, 100 μ A,
1 mA, 10 mA

In the Bench Link calibration screen, click on the **10 μ A current** field. The LFI-3751 will drive 10 μ A through the calibration circuitry. Enter the SENSOR AMMETER readings into the field. Press <ENTER> or use the mouse to click to the **100 μ A** field. Now, 100 μ A will flow. Again, enter the SENSOR AMMETER readings into the field. Repeat for the **1 mA** and **10 mA** fields. Note - if your meter range is low and causes an overload error, the LFI-3751 will display a sensor error. Correct the range and restart the calibration process.

4 Calibrate AD590 Resistance

Background: This calibrates the AD590 sense resistor.

Adjust **V Switch** to *ACT T V*.
Adjust **CAL Switch** to *AD590 R CAL*.
Push **SENSOR Switch OUT**.
Push **TEC Switch IN**.

Typical Values:

10 k ohm

The Sensor Error LED on the LFI-3751 will come on. Click on the **AD590** field and the system will start taking measurements and update in about 30 seconds. Completion of calibration is indicated by a check mark next to the **AD590** field and "10 kohm resistor calibrated" in the status bar.

5 Calibrate ACT T Voltage

Background: This calibrates the Actual Temperature display.

Adjust **V Switch** to *ACT T V*.
Adjust **CAL Switch** to *ACT T LO CAL*.
Push **SENSOR Switch IN**.
Push **TEC Switch IN**.

Typical Values:

ACT T V1: 1 V
ACT T V2: 4 V

Click the **ACT T V1** field. Wait until the A/D reading in the status bar settles. Enter the voltmeter reading into **ACT T V1**.
Adjust the **CAL Switch** to *ACT T HI CAL*. Click the **ACT T V2** field. Again, wait until the A/D reading displayed in the status bar settles. Enter the voltmeter reading into **ACT T V2**.



Eleven Steps to Calibrate the LFI-3751

6 Calibrate TE I Current

Background: This calibrates the thermoelectric current display.

Adjust **V Switch** to *TE V*.

Adjust **CAL Switch** to *ACT T LO CAL*.

Push **SENSOR Switch** *IN*.

Push **TEC Switch** *IN*.

Click on **TE I A1** and the LFI-3751 will drive positive 2.5 Amps. Enter the TEC Ammeter reading into **TE I A1**. Click on **TE I A2** field and the LFI-3751 will drive negative 2.5 Amps. Enter the TEC Ammeter reading into **TE I A2** (include the negative sign).

Typical Values:

TE I A1: 2.5 A

TE I A2: -2.5 A

7 Calibrate TE V Voltage

Background: This calibrates the thermoelectric voltage display.

Adjust **V Switch** to *TE V*.

Adjust **CAL Switch** to *ACT T LO CAL*.

Push **SENSOR Switch** *IN*.

Push **TEC Switch** *IN*.

Click on **TE V V1** and the LFI-3751 will drive positive 2.5 Amps. Enter the voltmeter reading in **TE V V1**. Click on **TE V V2** and the LFI-3751 will drive negative 2.5 Amps. Enter the voltmeter reading into **TE V V2** (include the negative sign).

Typical Values:

TE V V1: 3 V

TE V V2: -3 V

8 Calibrate +5 and -5 V References

Background: This is necessary to calibrate the setpoint values in the next two steps.

Remove the LFI-3751 top cover (4 screws). The test jacks are on the left side of the circuit board (when the front of the LFI-3751 is facing you). They are labeled on the circuit board. The black jack is ANALOG GROUND. The next jack is red and the +5V REFERENCE. The third jack is also red and the -5V REFERENCE.

Using the reserved voltmeter, measure the voltage across the +5V REFERENCE and ANALOG GROUND test jacks. Enter this reading in the **Ref+** field. Measure the voltage across the -5V REFERENCE and ANALOG GROUND test jacks. Enter this reading in the **Ref-** field (include the negative sign).

Reinstall the LFI-3751 top cover.

Typical Values:

Ref+ : 5 V

Ref- : -5 V



9 Calibrate LIM I Setpoint Currents

Background: This calibrates the limit current setting display.

The +5 and -5V reference voltages must be calibrated first. See step 8.

Adjust **V Switch** to *TE V*.

Adjust **CAL Switch** to *SET T LO CAL*.

Push **SENSOR Switch IN**.

Push **TEC Switch IN**.

Click on **POS LIM I** and wait while calculations are made. The calibration is complete when a check mark appears, and "Pos Lim Updated" appears on the status bar. Click on **NEG LIM I** and the process will repeat.

10 Calibrate SET T Setpoint Voltages

Background: This calibrates the set point display.

The +5 and -5V reference voltages must be calibrated first. See step 8.

Adjust **V Switch** to *ACT T V*.

Adjust **CAL Switch** to *SET T LO CAL*.

Push **SENSOR Switch IN**.

Push **TEC Switch OUT**.

Click on **Pos SET T Low** and wait while calculations are made. This can take several minutes. The unit is settling the test load to the setpoint temperatures. The calibration is complete when a check mark appears, and the output current is shut off.

Adjust **CAL Switch** to *SET T HI CAL*.

Click on **Pos SET T High** and the process will repeat

11 Confirm AUX T Voltage, AD590 (+15V), FAN + (+12V), -12V

Background: No calibration is done in this step. Standard operating voltages are verified.

Adjust **V Switch** to *AUX T V* and measure +1 V (+/- 5%).

Adjust **V Switch** to *AD590* and measure +14.8 V (+/- 5%).

Adjust **V Switch** to *FAN+* and measure +12 V (+/- 10%).

Adjust **V Switch** to *-12V* and measure -12 V (+/- 5%).



Block Diagram

