Thermal Cycler Temperature Verification System

For Applied Biosystems 9800 Fast Thermal Cycler

User Guide

Applied Biosystems

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Preface

How to Use This Guide

Purpose of This Guide

The *Thermal Cycler Temperature Verification System User Guide* provides step-by-step instructions for setting up and using the Thermal Cycler Temperature Verification System for the Applied Biosystems 9800 Fast Thermal Cycler.

Audience

This guide is intended for novice and experienced users of the Applied Biosystems 9800 Fast Thermal Cycler.

Text Conventions

This guide uses the following conventions:

- **Bold** indicates user action. For example:

  Type **0**, then press **Enter** for each of the remaining fields.
- *Italic* text indicates new or important words and is also used for emphasis. For example:

  Before analyzing, *always* prepare fresh matrix.
- A right arrow bracket (>) separates successive commands you select from a drop-down or shortcut menu. For example:

  Select **File > Open > Spot Set**.

  Right-click the sample row, then select **View Filter > View All Runs**.

User Attention Words

Two user attention words appear in Applied Biosystems user documentation. Each word implies a particular level of observation or action as described below:

Note: Provides information that may be of interest or help but is not critical to the use of the product.

IMPORTANT! Provides information that is necessary for proper instrument operation, accurate chemistry kit use, or safe use of a chemical.

Examples of the user attention words appear below:

Note: The size of the column affects the run time.

Note: The Calibrate function is also available in the Control Console.

IMPORTANT! To verify your client connection to the database, you need a valid Oracle user ID and password.

IMPORTANT! You must create a separate Sample Entry Spreadsheet for each 96-well plate.

Safety Alert Words

Safety alert words also appear in user documentation. For more information, see “Safety Alert Words” on page viii.

How to Obtain More Information

Related Documentation

The following related documents are shipped with the system:

- ***Applied Biosystems 9800 Fast Thermal Cycler with 96-Well Aluminum Sample Block Module User Guide* –** Describes the hardware and software and provides information on preparing, maintaining, and troubleshooting the system.
- ***Applied Biosystems 9800 Fast Thermal Cycler Base Module User Guide* –** Describes the hardware and software and provides information on preparing, maintaining, and troubleshooting the system.

Send Us Your Comments

Applied Biosystems welcomes your comments and suggestions for improving its user documents. You can e-mail your comments to:

techpubs@appliedbiosystems.com

How to Obtain Support

To contact Applied Biosystems Technical Support from North America by telephone, call **1.800.899.5858**.

For the latest services and support information for all locations, go to **http://www.appliedbiosystems.com**, then click the link for **Support**.

At the Support page, you can:

- Search through frequently asked questions (FAQs)
- Submit a question directly to Technical Support
- Order Applied Biosystems user documents, MSDSs, certificates of analysis, and other related documents
- Download PDF documents
- Obtain information about customer training
- Download software updates and patches

In addition, the Support page provides access to worldwide telephone and fax numbers to contact Applied Biosystems Technical Support and Sales facilities.

Safety and EMC Compliance Information

This section includes the following topics:

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General Instrument Safety xi
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Safety Conventions Used in This Document

Safety Alert Words

Four safety alert words appear in Applied Biosystems user documentation at points in the document where you need to be aware of relevant hazards. Each alert word–**IMPORTANT, CAUTION, WARNING, DANGER**–implies a particular level of observation or action, as defined below:

Definitions

IMPORTANT! – Indicates information that is necessary for proper instrument operation, accurate chemistry kit use, or safe use of a chemical.

– Indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

– Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.

– Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.

Except for IMPORTANTs, each safety alert word in an Applied Biosystems document appears with an open triangle figure that contains a hazard symbol. *These hazard symbols are identical to the hazard icons that are affixed to Applied Biosystems instruments* (see "Safety Symbols" on page ix).

Examples

The following examples show the use of safety alert words:

IMPORTANT! You must create a separate a Sample Entry Spreadsheet for each 96-well plate.

The lamp is extremely hot. Do not touch the lamp until it has cooled to room temperature.

CHEMICAL HAZARD. **Formamide**. Exposure causes eye, skin, and respiratory tract irritation. It is a possible developmental and birth defect hazard. Read the MSDS, and follow the handling instructions. Wear appropriate protective eyewear, clothing, and gloves.

ELECTRICAL HAZARD. Failure to ground the instrument properly can lead to an electrical shock. Ground the instrument according to the provided instructions.

Symbols on Instruments

Electrical Symbols on Instruments

The following table describes the electrical symbols that may be displayed on Applied Biosystems instruments.

Symbol	Description
	Indicates the **On** position of the main power switch.
	Indicates the **Off** position of the main power switch.
	Indicates the **On/Off** position of a push-push main power switch.
	Indicates a terminal that may be connected to the signal ground reference of another instrument. This is not a protected ground terminal.
	Indicates a protective grounding terminal that must be connected to earth ground before any other electrical connections are made to the instrument.
	Indicates a terminal that can receive or supply alternating current or voltage.
	Indicates a terminal that can receive or supply alternating or direct current or voltage.

Safety Symbols

The following table describes the safety *s*ymbols that may be displayed on Applied Biosystems instruments. Each symbol may appear by itself or in combination with text that explains the relevant hazard (see "Safety Labels on Instruments" on page x). These safety symbols may also appear next to DANGERS, WARNINGS, and CAUTIONS that occur in the text of this and other product-support documents.

Symbol	Description
	Indicates that you should consult the manual for further information and to proceed with appropriate caution.
	Indicates the presence of an electrical shock hazard and to proceed with appropriate caution.
	Indicates the presence of a hot surface or other high-temperature hazard and to proceed with appropriate caution.

Symbol	Description
	Indicates the presence of a laser inside the instrument and to proceed with appropriate caution.
	Indicates the presence of moving parts and to proceed with appropriate caution.

Safety Labels on Instruments

The following CAUTION, WARNING, and DANGER statements may be displayed on Applied Biosystems instruments in combination with the safety symbols described in the preceding section.

English	Francais
CAUTION Hazardous chemicals. Read the Material Safety Data Sheets (MSDSs) before handling.	**ATTENTION** Produits chimiques dangeureux. Lire les fiches techniques de sûreté de matériels avant la manipulation des produits.
CAUTION Hazardous waste.	**ATTENTION** Déchets dangereux.
CAUTION Hazardous waste. Refer to MSDS(s) and local regulations for handling and disposal.	**ATTENTION** Déchets dangereux. Lire les fiches techniques de sûreté de matériels et la régulation locale associées à la manipulation et l'élimination des déchets.
CAUTION Hot surface.	**ATTENTION** Surface brûlante.
DANGER High voltage.	**DANGER** Haute tension.
WARNING To reduce the chance of electrical shock, do not remove covers that require tool access. No user-serviceable parts are inside. Refer servicing to Applied Biosystems qualified service personnel.	**AVERTISSEMENT** Pour éviter les risques d'électrocution, ne pas retirer les capots dont l'ouverture nécessite l'utilisation d'outils. L’instrument ne contient aucune pièce réparable par l’utilisateur. Toute intervention doit être effectuée par le personnel de service qualifié de Applied Biosystems.

General Instrument Safety

Moving and Lifting Stand-Alone Computers and Monitors

WARNING Do not attempt to lift or move the computer or the monitor without the assistance of others. Depending on the weight of the computer and/or the monitor, moving them may require two or more people.

Things to consider before lifting the computer and/or the monitor:

- Make sure that you have a secure, comfortable grip on the computer or the monitor when lifting.
- Make sure that the path from where the object is to where it is being moved is clear of obstructions.
- Do not lift an object and twist your torso at the same time.
- Keep your spine in a good neutral position while lifting with your legs.
- Participants should coordinate lift and move intentions with each other before lifting and carrying.
- Instead of lifting the object from the packing box, carefully tilt the box on its side and hold it stationary while someone slides the contents out of the box.

Operating the Instrument

Ensure that anyone who operates the instrument has:

- Received instructions in both general safety practices for laboratories and specific safety practices for the instrument.
- Read and understood all applicable Material Safety Data Sheets (MSDSs). See “About MSDSs” on page xi.

WARNING **PHYSICAL INJURY HAZARD.** Use this instrument as specified by Applied Biosystems. Using this instrument in a manner not specified by Applied Biosystems may result in personal injury or damage to the instrument.

Chemical Safety

Chemical Hazard Warning

WARNING **CHEMICAL HAZARD.** Before handling any chemicals, refer to the Material Safety Data Sheet (MSDS) provided by the manufacturer, and observe all relevant precautions.

WARNING **CHEMICAL HAZARD.** All chemicals in the instrument, including liquid in the lines, are potentially hazardous. Always determine what chemicals have been used in the instrument before changing reagents or instrument components. Wear appropriate eyewear, protective clothing, and gloves when working on the instrument.

About MSDSs

Chemical manufacturers supply current Material Safety Data Sheets (MSDSs) with shipments of hazardous chemicals to *new* customers. They also provide MSDSs with the first shipment of a hazardous chemical to a customer after an MSDS has been updated. MSDSs provide the safety information you need to store, handle, transport, and dispose of the chemicals safely.

Each time you receive a new MSDS packaged with a hazardous chemical, be sure to replace the appropriate MSDS in your files.

Obtaining MSDSs

You can obtain from Applied Biosystems the MSDS for any chemical supplied by Applied Biosystems. This service is free and available 24 hours a day.

To obtain MSDSs:

1. Go to **https://docs.appliedbiosystems.com/msdssearch.html**
2. In the Search field, type in the chemical name, part number, or other information that appears in the MSDS of interest. Select the language of your choice, then click **Search**.
3. Find the document of interest, right-click the document title, then select any of the following:
   - **Open** – To view the document
   - **Print Target** – To print the document
   - **Save Target As** – To download a PDF version of the document to a destination that you choose
4. To have a copy of a document sent by fax or e-mail, select **Fax** or **Email** to the left of the document title in the Search Results page, then click **RETRIEVE DOCUMENTS** at the end of the document list.
5. After you enter the required information, click **View/Deliver Selected Documents Now**.

Chemical Safety Guidelines

To minimize the hazards of chemicals:

- Read and understand the Material Safety Data Sheets (MSDS) provided by the chemical manufacturer before you store, handle, or work with any chemicals or hazardous materials. (See “About MSDSs” on page xi.)
- Minimize contact with chemicals. Wear appropriate personal protective equipment when handling chemicals (for example, safety glasses, gloves, or protective clothing). For additional safety guidelines, consult the MSDS.
- Minimize the inhalation of chemicals. Do not leave chemical containers open. Use only with adequate ventilation (for example, fume hood). For additional safety guidelines, consult the MSDS.
- Check regularly for chemical leaks or spills. If a leak or spill occurs, follow the manufacturer’s cleanup procedures as recommended on the MSDS.
- Comply with all local, state/provincial, or national laws and regulations related to chemical storage, handling, and disposal.

Chemical Waste Safety

Chemical Waste Hazard

CAUTION **HAZARDOUS WASTE.** Refer to Material Safety Data Sheets and local regulations for handling and disposal.

Chemical Waste Safety Guidelines

To minimize the hazards of chemical waste:

- Read and understand the Material Safety Data Sheets (MSDSs) provided by the manufacturers of the chemicals in the waste container before you store, handle, or dispose of chemical waste.
- Provide primary and secondary waste containers. (A primary waste container holds the immediate waste. A secondary container contains spills or leaks from the primary container. Both containers must be compatible with the waste material and meet federal, state, and local requirements for container storage.)
- Minimize contact with chemicals. Wear appropriate personal protective equipment when handling chemicals (for example, safety glasses, gloves, or protective clothing). For additional safety guidelines, consult the MSDS.
- Minimize the inhalation of chemicals. Do not leave chemical containers open. Use only with adequate ventilation (for example, fume hood).For additional safety guidelines, consult the MSDS.
- Handle chemical wastes in a fume hood.
- After emptying the waste container, seal it with the cap provided.
- Dispose of the contents of the waste tray and waste bottle in accordance with good laboratory practices and local, state/provincial, or national environmental and health regulations.

Waste Disposal

If potentially hazardous waste is generated when you operate the instrument, you must:

- Characterize (by analysis if necessary) the waste generated by the particular applications, reagents, and substrates used in your laboratory.
- Ensure the health and safety of all personnel in your laboratory.
- Ensure that the instrument waste is stored, transferred, transported, and disposed of according to all local, state/provincial, and/or national regulations.

IMPORTANT! Radioactive or biohazardous materials may require special handling, and disposal limitations may apply.

Electrical Safety

DANGER **ELECTRICAL SHOCK HAZARD.** Severe electrical shock can result from operating the Applied Biosystems 9800 Fast Thermal Cycler without its instrument panels in place. Do not remove instrument panels. High-voltage contacts are exposed when instrument panels are removed from the instrument.

Fuses

ELECTRICAL SHOCK HAZARD. Improper fuses or high-voltage supply can damage the instrument wiring system and cause a fire. Before turning on the instrument, verify that the fuses are properly installed and that the instrument voltage matches the power supply in your laboratory.

FIRE HAZARD. For continued protection against the risk of fire, replace fuses only with fuses of the type and rating specified for the instrument.

Power

ELECTRICAL HAZARD. Grounding circuit continuity is vital for the safe operation of equipment. Never operate equipment with the grounding conductor disconnected.

ELECTRICAL HAZARD. Use properly configured and approved line cords for the voltage supply in your facility.

ELECTRICAL HAZARD. Plug the system into a properly grounded receptacle with adequate current capacity.

Overvoltage Rating

The Applied Biosystems 9800 Fast Thermal Cycler has an installation (overvoltage) category of II, and is classified as portable equipment

Physical Hazard Safety

Moving Parts

PHYSICAL INJURY HAZARD. Moving parts can crush and cut. Keep hands clear of moving parts while operating the instrument. Disconnect power before servicing the instrument.

Biological Hazard Safety

General Biohazard

BIOHAZARD. Biological samples such as tissues, body fluids, and blood of humans and other animals have the potential to transmit infectious diseases. Follow all applicable local, state/provincial, and/or national regulations. Wear appropriate protective eyewear, clothing, and gloves. Read and follow the guidelines in these publications:

- U.S. Department of Health and Human Services guidelines published in *Biosafety in Microbiological and Biomedical Laboratories* (stock no. 017-040-00547-4; **http://bmbl.od.nih.gov**)
- Occupational Safety and Health Standards, Bloodborne Pathogens (29 CFR§1910.1030; **http://www.access.gpo.gov/nara/cfr/waisidx_01/29cfr1910a_01.html**).

Additional information about biohazard guidelines is available at: **http://www.cdc.gov**

Workstation Safety

Correct ergonomic configuration of your workstation can reduce or prevent effects such as fatigue, pain, and strain. Minimize or eliminate these effects by configuring your workstation to promote neutral or relaxed working positions.

CAUTION MUSCULOSKELETAL AND REPETITIVE MOTION HAZARD. These hazards are caused by potential risk factors that include but are not limited to repetitive motion, awkward posture, forceful exertion, holding static unhealthy positions, contact pressure, and other workstation environmental factors.

To minimize musculoskeletal and repetitive motion risks:

- Use equipment that comfortably supports you in neutral working positions and allows adequate accessibility to the keyboard, monitor, and mouse.
- Position the keyboard, mouse, and monitor to promote relaxed body and head postures.

Safety and Electromagnetic Compatibility (EMC) Standards

This section provides information on:

- U.S. and Canadian Safety Standards
- Canadian EMC Standard
- European Safety and EMC Standards
- Australian EMC Standards

U.S. and Canadian Safety Standards

This instrument has been tested to and complies with standard UL 3101-1, "Safety Requirements for Electrical Equipment for Laboratory Use, Part 1: General Requirements."

This instrument has been tested to and complies with standard CSA 1010.1, "Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements."

Canadian EMC Standard

This instrument has been tested to and complies with ICES-001, Issue 3: Industrial, Scientific, and Medical Radio Frequency Generators.

European Safety and EMC Standards

Safety

This instrument meets European requirements for safety (Low Voltage Directive 73/23/EEC). This instrument has been tested to and complies with standards EN 61010-1:2001, "Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, Part 1: General Requirements" and EN 61010-2-010, "Particular Requirements for Laboratory Equipment for the Heating of Materials."

EMC

This instrument meets European requirements for emission and immunity (EMC Directive 89/336/EEC). This instrument has been tested to and complies with standard EN 61326 (Group 1, Class B), “Electrical Equipment for Measurement, Control and Laboratory Use – EMC Requirements.”

Australian EMC Standards

This instrument has been tested to and complies with standard AS/NZS 2064, “Limits and Methods Measurement of Electromagnetic Disturbance Characteristics of Industrial, Scientific, and Medical (ISM) Radio-frequency Equipment.”

Introduction to the Temperature Verification System

1

This chapter covers:

Probe Assembly 1-2
About the 0.1-mL Temperature Verification Probe Assembly 1-2
About the Digital Thermometer 1-3

Probe Assembly

Tests Performed

Use the Temperature Verification System to perform the following tests on your Applied Biosystems 9800 Fast Thermal Cycler:

- The Calibration Verification Test, which tests the sample block against temperature accuracy specifications
- The Temperature Non-Uniformity Test, which tests the temperature uniformity in the sample block

Unpacking the Kit

Carefully unpack the kit and check the parts included against the following list. If any part is damaged or missing, contact the shipping carrier and Applied Biosystems immediately.

Parts Included

- Digital Thermometer, Model 4500 with 9V battery installed
- Probe Kit, 0.1-mL Temperature Verification
- Probe Assembly, 0.1-mL Temperature Verification
- Cotton swabs
- Light mineral oil
- *Applied Biosystems Temperature Verification System For 9800 Fast Thermal Cycler User Guide*

Temperature Verification System Recalibration

Calibrate your Temperature Verification System once a year.

See “Recalibration Service for Model 4500 Temperature Verification Kit” on page A-1.

IMPORTANT! Do not try to recalibrate or perform any service on the digital thermometer. The only user-serviceable component in the unit is the battery.

About the 0.1-mL Temperature Verification Probe Assembly

The 0.1-mL probe assembly is used only with the 9800 system.

Measurement Method

The 0.1-mL probe assembly consists of one sample block probe that measures the temperature of the sample well.

The temperature is measured using a thermistor bead in the sample block probe tip.

About the Digital Thermometer

Use the handheld digital thermometer with a thermistor temperature device (thermistor) probe to verify that your thermal cycler is within calibration tolerance. You also use it to test the uniformity of the 9800 system sample block.

IMPORTANT! Do not try to recalibrate or perform any service on the digital thermometer. The only user-serviceable component in the unit is the battery.

Thermometer Temperature Range

The digital thermometer has a temperature range of –0 to 100 °C and is accurate to within ±0.1 °C.

Instructions for Use

Observe the following when using the digital thermometer:

- Make sure the thermistor probe is connected to the input connector located at the top of the digital thermometer.
- Turn on the digital thermometer by pressing the On/Off switch on the front of the meter.
- When completing the test, press the On/Off switch to turn off the meter.

Note: The temperature measured by the thermistor probe appears on the digital thermometer display in degrees Celsius.

Temperature Display Differences

The sample temperature display on the instrument is different than the display on the digital thermometer during heating or cooling transitions. The digital thermometer measures block temperature, whereas the thermal cycler measures sample temperature. Note that the instrument sample temperature display is a function of tube type and reaction volume.

Using the Probe While Running Programs

Applied Biosystems recommends that you use the thermistor probe and digital thermometer only for the temperature calibration verification test and the temperature uniformity test (see Chapter 2, Temperature Verification Tests).

Use of the thermistor probe and digital thermometer while running programs other than those used in the these tests results in a loss of accuracy of the thermistor probe due to the use of the heated sample block cover. The heated cover normally operates at 105 °C. The effect of the heated cover on the thermistor probe decreases as the temperature of the sample block approaches 99.9 °C.

2

Temperature Verification Tests

This chapter covers:

Calibration Verification Test 2-2
Temperature Non-Uniformity Test 2-7
Data Sheet: Calibration Verification Test 2-14
Data Sheet: Temperature Non-Uniformity Test. 2-15

Calibration Verification Test

Use the Calibration Verification Test to verify the temperature calibration of your Applied Biosystems 9800 Fast Thermal Cycler with 96-Well Aluminum Sample Block Module.

To complete the Calibration Verification Test, perform the following procedures:

- "Setting Up the 0.1-mL Probe Assembly" on page 2-2
- "Configuring the 9800 System" on page 2-3
- "Running the Test" on page 2-4
- "Evaluating the Results" on page 2-6

Equipment Required

This test requires the following items, included in your Temperature Verification kit:

- Digital Thermometer Model 4500 with 9V battery installed
- Cotton swabs
- Light mineral oil
- 0.1-mL Temperature Verification probe assembly

Setting Up the 0.1-mL Probe Assembly

To set up the 0.1-mL probe assembly:

1.	If the heated cover is in the forward position, lift the lever, then slide the heated cover back.
2.	With the instrument powered off and the sample block at room temperature, place the 0.1-mL Temperature Verification probe assembly on the sample blocks. **Note:** Make sure the undercut of the 0.1-mL Temperature Verification probe assembly is facing outwards.
3.	Use a cotton swab to coat well A6 with mineral oil.
4.	Place the 0.1-mL Temperature Verification probe assembly into well A6.
5.	Thread the probe wire through the undercut of the 0.1-mL Temperature Verification probe assembly to prevent damage to the probe and lead wires.
6.	Make sure the probe is connected to the digital thermometer.
7.	Slide the heated cover forward and pull the lever down. **IMPORTANT!** Seat the probe properly, and close the heated cover carefully. If the probe wire is crushed when the heated cover is closed, the probe may be damaged.
8.	Turn on the digital thermometer. Refer to the instructions included with your Temperature Verification Kit for a detailed description on operating the digital thermometer, Model 4500.

To set up the 0.1-mL probe assembly: ***(continued)***

9.	Continue with "Configuring the 9800 System" on page 2-3.

Configuring the 9800 System

To configure the 9800 system for the Calibration Verification Test:

1.	Complete the procedures in "Setting Up the 0.1-mL Probe Assembly" on page 2-2.
2.	Turn on the 9800 system.
3.	When the main menu opens, press **Util** to open the Utilities screen. **Note:** To press the menu items, use the corresponding F keys. For example, Util is F4 on this menu.
4.	Press **Diag** to open the Diagnostics screen. Diagnostics Hard - Hardware Diagnostics System - System Performance Tests TmpVer - Temperature Verification Upgrad - Firmware Upgrade Hard System TmpVer Upgrad Exit F1 F2 F3 F4 F5 (Screen display missing after F1 (Diag) is pressed)
5.	Press **TmpVer** to open the Temperature Verification screen. Temperature Verification Temp - Calibration Verification TNU - Temperature Non-Uniformity Temp TNU Exit F1 F2 F3 F4 F5
6.	Press **Temp**. This action opens the Calibration Verification screen and configures the 9800 system for the Calibration Verification Test. Calibration Verification Block temp = xx.x°C Cover temp = xxx°C Place probe in well A6 Press Run Run Cancel F1 F2 F3 F4 F5
7.	Continue with "Running the Test" on page 2-4.

Running the Test

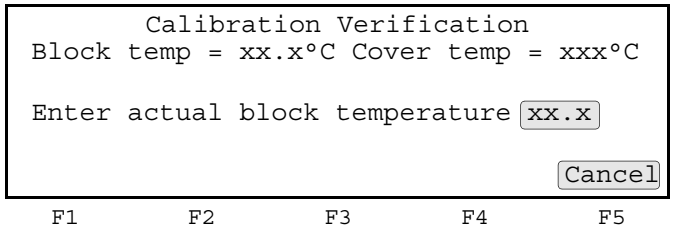
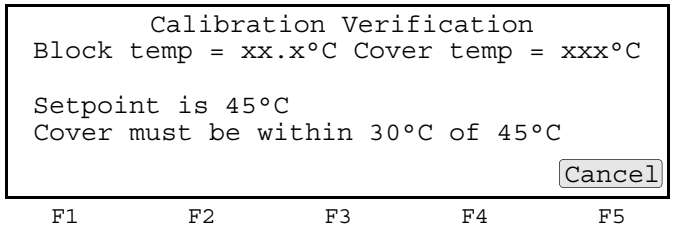
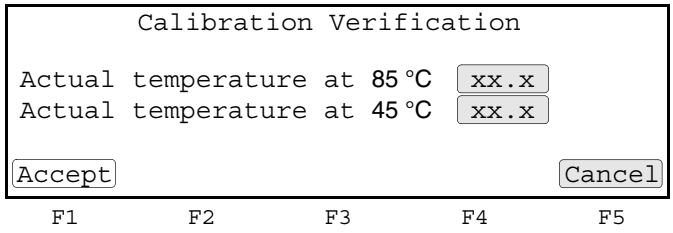
Use the digital thermometer to take temperature readings of the sample well connected to the 0.1-mL probe assembly. You take a reading at each of two setpoint temperatures.

Note: If necessary, press Cancel to exit the test.

To run the Calibration Verification Test:

1.	Complete the procedures in "Configuring the 9800 System" on page 2-3.
2.	Press **Run** to start the Calibration Verification Test. **Note:** To press the menu items, use the corresponding F keys. For example, Run is F1 on this menu. The **Calibration Verification** screen opens with the setpoint value displayed. Calibration Verification Block temp = xx.x°C Cover temp = xxx°C Setpoint is 85°C Cover must be within 10°C of 85°C Cancel F1 F2 F3 F4 F5 The Calibration Verification screen counts down the time until the setpoint is reached. Calibration Verification Block temp = xx.x°C Cover temp = xxx°C Stabilizing at setpoint... x:xx Cancel F1 F2 F3 F4 F5 **Note:** The cover must be within 10 °C of 85 °C. It may take several minutes for the 9800 system to ramp up.
3.	When the Stabilizing at setpoint value decrements to 0, read the digital thermometer. **Note:** Refer to the instructions included with your Temperature Verification Kit for a detailed description on operating the digital thermometer.

To run the Calibration Verification Test: ***(continued)***

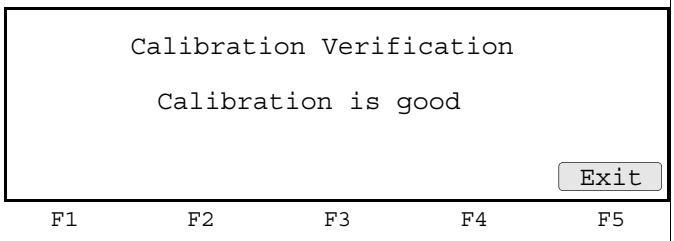
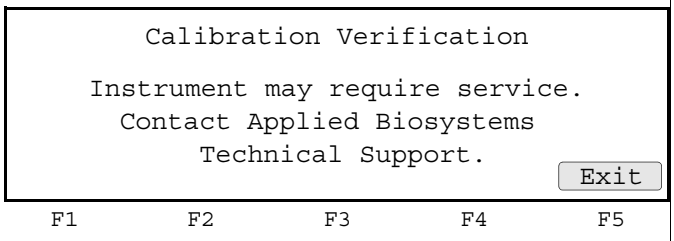
4.	Using the numeric keys, enter the value displayed on the digital thermometer into the Enter actual block temperature field.  **Note:** Round off the four-digit value on the digital thermometer to three digits before entering it into the Calibration Verification screen. **Note:** You may record this value on the Calibration Verification Test Data Sheet (page 2-14) to keep a permanent record of the test.
5.	Press **Enter**. The 9800 system begins the second reading (45 °C setpoint) and the Calibration Verification screen opens with the setpoint value displayed.  **Note:** The cover must be within 30 °C of 45 °C.
6.	Repeat steps 3 and 4 for the second reading. The 9800 system evaluates the calibration of the sample block temperature for the setpoint values you entered and displays the results. A summary screen appears at the conclusion of the test.  If you entered values on the Calibration Verification Test Data Sheet, compare those values with the actual test results.
7.	Press **Accept**. **Note:** To interpret the results, see “Evaluating the Results” on page 2-6.

To run the Calibration Verification Test: ***(continued)***

8.	When you have completed all measurements, be sure to: • Press **Exit**. • Remove the 0.1-mL probe assembly from the sample blocks. • Turn off the digital thermometer and clean off the oil. • See the warning below. • Remove the 0.1-mL Temperature Verification probe assembly from the sample blocks. **BURN HAZARD**. Make sure the sample blocks have cooled at least to room temperature (less than 25 °C) before removing the probe. The blocks and probes retain heat longer than expected.

Evaluating the Results

When the 9800 system completes the Calibration Verification Test, one of two screens opens. See the table below to evaluate the results.

If the sample block module...	Then the...
Is properly calibrated	**Calibration Verification** screen opens with the following message displayed: 
Does not pass the Calibration Verification Test	**Calibration Verification** screen opens with the following message displayed:  • If the test fails, repeat the procedure to make sure the meter was not misread or that errors were not made entering data. • If the test fails again, contact Applied Biosystems Technical Support. See “How to Obtain Support” on page vi.

Temperature Non-Uniformity Test

Use this test to verify the temperature uniformity of the Applied Biosystems 9800 Fast Thermal Cycler with 96-Well Aluminum Sample Block Module.

To complete the Temperature Non-Uniformity Test, perform the following procedures:

- "Setting Up the 0.1-mL Probe Assembly" on page 2-7
- "Running the Test" on page 2-9
- "Configuring the 9800 System" on page 2-8
- "Evaluating the Results" on page 2-13

Equipment Required

This test requires the following items, included in your Temperature Verification kit:

- Digital Thermometer Model 4500 with 9V battery installed
- Cotton swabs
- Light mineral oil
- 0.1-mL Temperature Verification probe assembly

Setting Up the 0.1-mL Probe Assembly

To set up the 0.1-mL probe assembly:

1.	If the heated cover is in the forward position, lift the lever, then slide the heated cover back.
2.	With the instrument powered off and the sample block at room temperature, place the 0.1-mL Temperature Verification probe assembly on the sample block.
3.	Use a cotton swab to coat wells A1, A12, C4, C9, F4, F9, H1, and H12 with mineral oil.
4.	Place the 0.1-mL probe assembly into well A1. **Note:** As the test progresses, move the 0.1-mL probe assembly to each of the test wells (A1, A12, C4, C9, F4, F9, H1, and H12).
5.	Thread the probe wire through the undercut of the 0.1-mL probe assembly to prevent damage to the probe and lead wires.
6.	Make sure the probe is connected to the digital thermometer.
7.	Slide the heated cover forward and pull the lever down. **IMPORTANT!** Seat the probe properly and close the heated cover carefully. If the probe wire is crushed when the heated cover is closed, the probe may be damaged.
8.	Turn on the digital thermometer. **Note:** Refer to the instructions included with your Temperature Verification Kit for a detailed description on operating the digital thermometer, Model 4500.

To set up the 0.1-mL probe assembly: ***(continued)***

9.	Continue with "Configuring the 9800 System" on page 2-8.

Configuring the 9800 System

To configure the 9800 system for the Temperature Non-Uniformity Test:

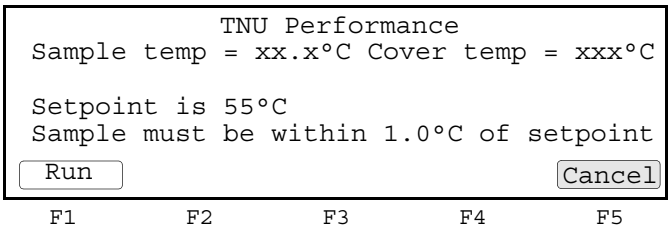
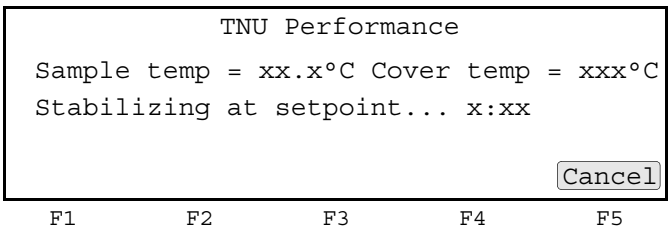
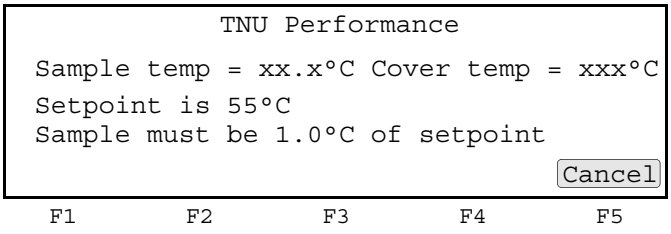
1.	Complete the procedures in "Setting Up the 0.1-mL Probe Assembly" on page 2-7.
2.	Turn on the 9800 system.
3.	In the main menu, press **Util** to open the Utilities screen. **Note:** To press the menu items, use the corresponding F keys. For example, Util is F4 on this menu.
4.	Press **Diag** to open the Diagnostics screen.
5.	Press **TmpVer** to open the Temperature Verification screen. Temperature Verification Temp - Calibration Verification TNU - Temperature Non-Uniformity Temp TNU Exit F1 F2 F3 F4 F5
6.	Press **TNU** to open the TNU Performance screen and configure the 9800 system for the Temperature Non-Uniformity Test. TNU Performance Sample temp = xx.x°C Cover temp = xxx°C Place Probe in well A1 Press Run Run Cancel F1 F2 F3 F4 F5 **Note:** If the cover temperature is not within 1 °C of the heated cover setpoint, the following screen opens: TNU Performance Sample temp = xx.x°C Cover temp = xxx°C Cover setpoint is 55C Cover must be within 1.0C of setpoint Cancel F1 F2 F3 F4 F5
7.	Continue with "Running the Test" on page 2-9.

Running the Test

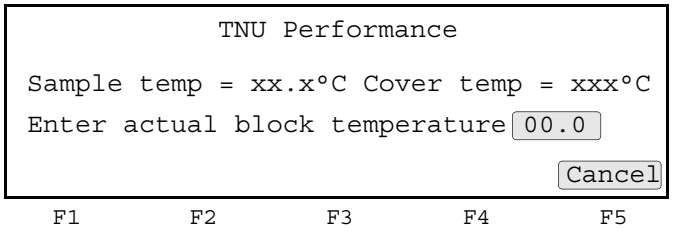
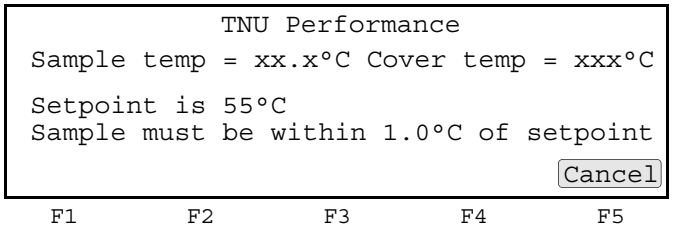
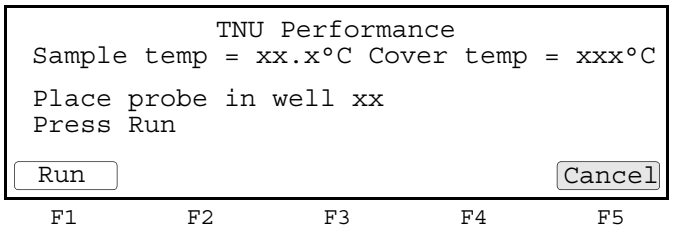
The Temperature Non-Uniformity Test uses the 0.1-mL probe assembly to test the temperature uniformity of six different wells in each sample block.

Note: If necessary, press **Cancel** to exit the test.

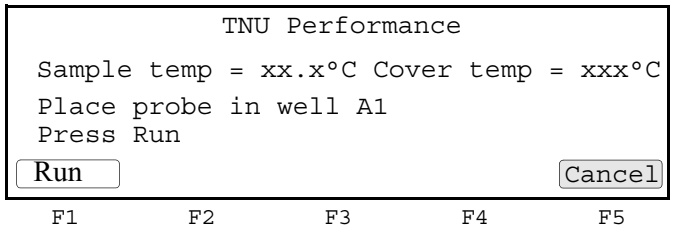
To run the Temperature Non-Uniformity Test:

1.	Complete the procedures in "Setting Up the 0.1-mL Probe Assembly" on page 2-7.
2.	Press **Run** to start the Temperature Non-Uniformity Test. **Note:** To press the menu items, use the corresponding F keys. For example, Run is F1 on this menu. The TNU Performance screen opens with the setpoint value displayed.  The TNU Performance screen counts down the time until the setpoint is stabilized.  **Note:** The sample blocks must be within 1.0 °C of the setpoint. In addition, the cover must be within 1 °C of 55 °C. It may take several minutes for the 9800 system to ramp up.
3.	When the TNU Performance screen opens giving the setpoint temperature, press **Cancel**. 
4.	When the Stabilizing at setpoint value decrements to zero, read the digital thermometer. **Note:** Refer to the instructions included with your Temperature Verification Kit for a detailed description on operating the digital thermometer, Model 4500.

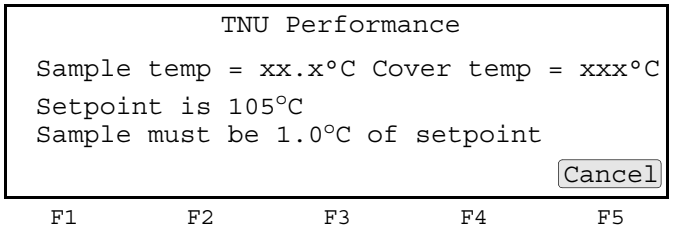
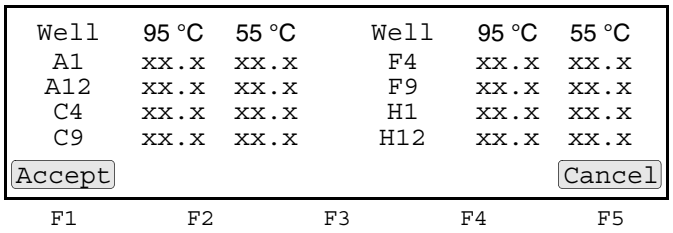
To run the Temperature Non-Uniformity Test: ***(continued)***

5.	Using the numeric keys, enter the value displayed on the digital thermometer into the Enter actual block temperature field.  **Note:** Round off the four-digit value on the digital thermometer to three digits before entering it in the **TNU Performance** screen. **Note:** You may record this value on the Temperature Non-Uniformity Test Data Sheet (page 2-15) to keep a permanent record of the test.
6.	Press **Enter** to open the **TNU Performance** screen with the setpoint value displayed.  **Note:** The sample blocks must be within 1.0 °C of the setpoint.
7.	Press **Enter**. The TNU Performance screen opens with the following prompt: 

To run the Temperature Non-Uniformity Test: ***(continued)***

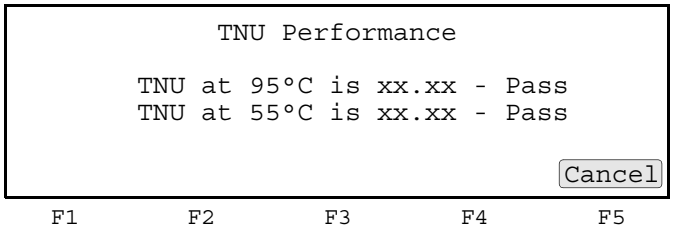
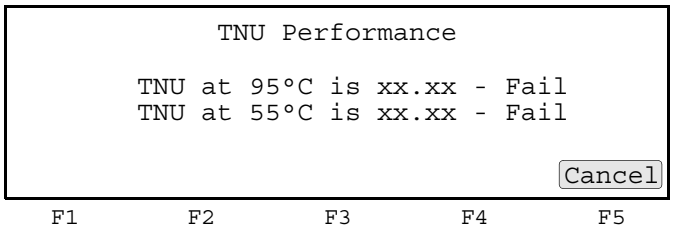
8.	Slide the heated cover back, and repeat steps 4–8 of "Setting Up the 0.1-mL Probe Assembly" on page 2-7 and steps 2–7 of this procedure. Complete these steps for all eight wells to be tested: • A1 • A12 • C4 • C9 • F4 • F9 • H1 • H12 The following screen opens:  The 9800 system then sets the heated cover setpoint to 105 °C.
9.	Slide the heated cover back, then repeat steps 4–8 of "Setting Up the 0.1-mL Probe Assembly" on page 2-7 and steps 2–7 of this procedure for all eight wells being tested: • A1 • A12 • C4 • C9 • F4 • F9 • H1 • H12

To run the Temperature Non-Uniformity Test: ***(continued)***

10.	When the TNU Performance screen opens giving the setpoint temperature, press **Cancel**.  The 9800 system evaluates the uniformity of the sample block temperature for the setpoint values you entered and displays the results. A summary screen opens at the conclusion of the test.  If you entered values on the Temperature Non-Uniformity Test Data Sheet, compare those values with the actual test results.
11.	Press **Accept**. **Note:** To interpret the results, see "Evaluating the Results" on page 2-13.
12.	When you have completed all measurements: a. Press **Cancel**. b. See the warning below. c. Remove the 0.1-mL probe assembly from the sample blocks. d. Turn off the digital thermometer and clean off the oil. **IMPORTANT!** Make sure the sample blocks are at room temperature (~25 °C) before removing the reaction plates.

Evaluating the Results

When the 9800 system completes the Temperature Non-Uniformity Test, the TNU Performance screen opens. Use the table below to evaluate the results.

If the...	Then...
Temperature of the sample block wells is uniform	"Pass" appears after each setpoint temperature. 
Temperature variation of the sample block wells exceeds performance specifications	"Fail" appears after the setpoint temperature(s) for which the test failed.  • If the test fails, repeat the procedure to make sure the meter was not misread or that errors were not made entering data. • If the test fails again, contact Applied Biosystems Technical Support. See "How to Obtain Support" on page vi.

Data Sheet: Calibration Verification Test

When running the Calibration Verification Test, record the setpoint values for well A6 on this data sheet. At the end of the Calibration Verification Test, check the values displayed on the 9800 system against the values recorded here to help you maintain accurate test records.

Date	Tested By	Probe Serial No.	Meter Serial No.	Setpoint Value: Well A6	
				85 °C	45 °C

Data Sheet: Temperature Non-Uniformity Test

When running the Temperature Non-Uniformity Test, record the setpoint values for wells A1, A12, C4, C9, F4, F9, H1, and H12 on this data sheet. At the end of the Temperature Non-Uniformity Test, check the values displayed on the 9800 system against the values recorded here to help you maintain accurate test records.

Date		
Tested By		
Probe Serial No.		
Meter Serial No.		
Setpoint Value	**95 °C**	**55 °C**
A1		
A12		
C4		
C9		
F4		
F9		
H1		
H12		

Recalibration A

Recalibration Service for Model 4500 Temperature Verification Kit

Applied Biosystems recommends that the Model 4500 Temperature Verification thermometer and probe be recalibrated on an annual basis.

Decontaminating the Temperature Probe

Decontaminate the temperature probe before shipping for recalibration.

Decontaminate the temperature probe by gently swabbing the probe cone with a cotton swab, using a 20% Clorox/80% water mixture.

Observe the following precautions when decontaminating your probe:

- Do not submerge the probe in bleach.
- Do not disassemble the probe assembly.

IMPORTANT! When shipping your Temperature Verification System, ship the meter and probe in the black case provided, and enclose a Decontamination Certificate.

Recalibration Service

To obtain recalibration for the Model 4500 thermometer and probe:

1.	Contact Alpha Technics prior to sending the thermometer an inform them of the order by either: • Sending the purchase order to: Alpha Technics 1560 Orangethorpe Way Anaheim, CA 92801 • Faxing the purchase order to: Alpha Technics 714-773-9327
2.	Send payment* with the thermometer for $135.00 plus $15.00 for shipping/handling, freight prepaid, to: Alpha Technics 1560 Orangethorpe Way Anaheim, CA 92801 *Payment may be made by purchase order, company letterhead with "verbal Purchase Order," or Visa/MasterCard credit card information. **Note:** If payment is not issued with the thermometer, Alpha Technics will bill you for the amount of $150.00 plus a 10% administrative fee.

To obtain recalibration for the Model 4500 thermometer and probe: ***(continued)***

3.	Include the following information in the shipment: • Your billing address • Your shipping address • The name and phone number of a contact person (someone most familiar with the thermometer)

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