

Thermal Cycler Temperature Verification System

**For GeneAmp® PCR System 2720, 9600, 9700, 9800, and
Veriti® Thermal Cyclers**

User Guide

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Preface

Safety information

Note: For general safety information, see this Preface and [Appendix D, “Safety” on page 137](#). When a hazard symbol and hazard type appear by a chemical name or instrument hazard, see the “Safety” Appendix for the complete alert on the chemical or instrument.

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:

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



CAUTION! – 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.



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



DANGER! – 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 **IMPORTANT**s, 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 symbols that are affixed to Applied Biosystems instruments* (see [“Safety symbols” on page 139](#)).

MSDSs

The MSDSs for any chemicals supplied by Applied Biosystems or Ambion are available to you free 24 hours a day. For instructions on obtaining MSDSs, see [“MSDSs” on page vii](#).

IMPORTANT! For the MSDSs of chemicals not distributed by Applied Biosystems or Ambion contact the chemical manufacturer.

How to use this guide

- Text conventions** This guide uses the following conventions:
- **Bold** text 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 symbol (▶) separates successive commands you select from a drop-down or shortcut menu. For example:
Select **File ▶ Open ▶ Spot Set**.

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.

How to obtain support

For the latest services and support information for all locations, go to:

www.appliedbiosystems.com

At the Applied Biosystems web site, you can:

- Access worldwide telephone and fax numbers to contact Applied Biosystems Technical Support and Sales facilities.
- 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.

For recalibration, please contact Alpha Technics (Formerly Alpha Sensors, Inc., Eutechnics Division) at:

www.alphatechnics.com

Calibration standards are traceable to NIST (U. S. National Institute of Standards and Technology).

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About this manual

This manual describes the Temperature Verification System and the tests for which it is used on the following thermal cyclers:

- 2720 Thermal Cycler
- GeneAmp® PCR System 9600
- GeneAmp® PCR System 9700, 0.5-mL Sample Block Module
- GeneAmp® PCR System 9700, 96-Well Sample Block Module
- GeneAmp® PCR System 9700, Dual 96-Well Sample Block Module
- GeneAmp® PCR System 9700, Dual 384-Well Sample Block Module
- GeneAmp® PCR System 9800
- Applied Biosystems Veriti® 96-Well Fast Thermal Cycler

This manual contains a separate chapter for each instrument. Each instrument chapter provides step-by-step instructions for performing two different tests, which are described in [“Temperature verification tests” on page 4](#).

About the Temperature Verification System

Description The Temperature Verification System is a kit consisting of a probe, a digital thermometer, frames to prevent ambient air from entering the sample block, light mineral oil, and cotton swabs. The system is used to verify temperatures of the sample block on your thermal cycler.

The table below indicates which Temperature Verification System kit you should order for your thermal cycler.

[Figure 1 on page 3](#) shows the major components of the 0.2-mL 96-Well Temperature Verification Kit.

Table 1 Thermal cycles and applicable kit types

Thermal cycler	Temperature Verification Kit	PN
<ul style="list-style-type: none"> • GeneAmp® 9700, 96-Well • GeneAmp® 9700, Dual 96-Well • 2720 • GeneAmp® 9600 	0.2-mL Single-Channel 96-Well Temperature Verification Kit	4317939
GeneAmp® 9700, Dual 384-Well	0.02-mL Single-Channel Dual 384-Well Temperature Verification Kit	4308354
<ul style="list-style-type: none"> • GeneAmp® 9700, 60-Well • Veriti® 	0.5-mL Single-Channel 60-Well Temperature Verification Kit	4309924
GeneAmp® 9800	0.1-mL Single-Channel 9800 Fast Thermal Cycler Temperature Verification Kit	4351630

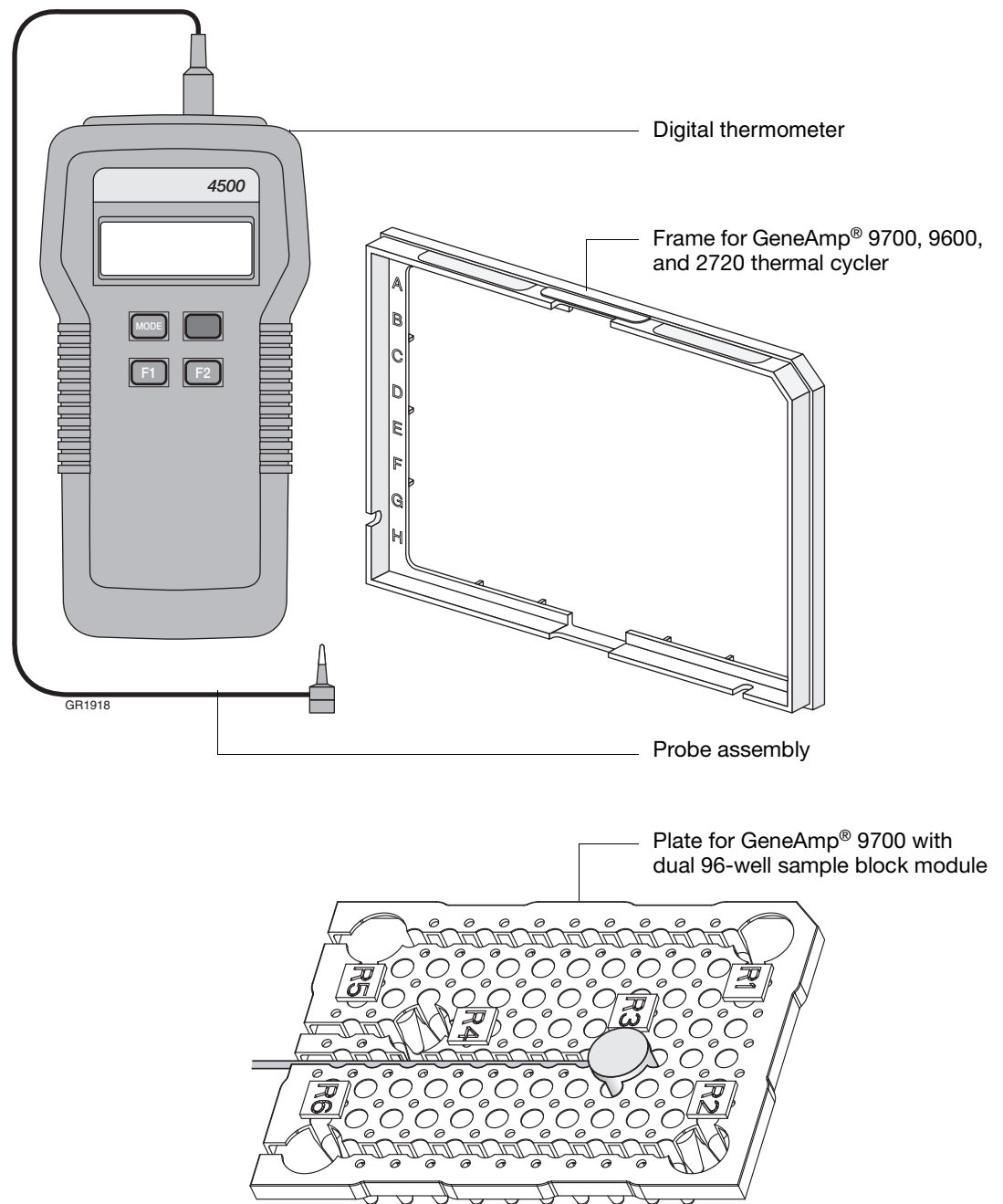


Figure 1 Components of the 0.2-mL 96-Well Temperature Verification Kit

Temperature verification tests

You use the Temperature Verification System to perform the following tests on your GeneAmp® PCR Systems, Veriti® Thermal Cycler, and 2720 Thermal Cycler:

- **Temperature calibration verification test** – Checks the temperature of the sample block against specifications for temperature accuracy
- **Temperature non-uniformity test** – Checks the uniformity of sample block temperature from well to well

You can perform these tests as frequently as necessary, depending on the type of work your laboratory performs. For example, a laboratory that does forensic typing may need to validate the instrument before or after running samples to have the test results considered valid in a court case. Another laboratory may want to validate a protocol.

Typically, the temperature calibration verification test should be performed at least once a year, and the temperature non-uniformity test should be run at the same time and frequency.

Running these tests verifies that the thermal cycler is operating to Applied Biosystems operating specifications.

Kit parts

The kit is supplied with a storage case (Figure 2) that includes:

- Model 4500 digital thermometer with a 9V battery installed
- Probe assembly
- Cotton swabs
- Light mineral oil
- Temperature verification frames



Figure 2 Temperature Verification Kit

Figures 1 and 2 show the major components of the kit.

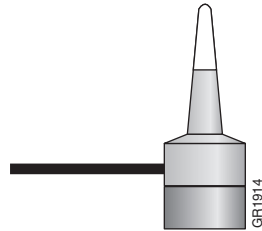
Note: If any part is damaged or missing, contact the shipping carrier and Applied Biosystems immediately. See [“Damages, claims, and returns”](#) on page 134.

Recalibration

Applied Biosystems recommends that your Temperature Verification System be recalibrated once a year. For instructions on having your system recalibrated by the manufacturer, refer to [Appendix A, “Recalibration.”](#)

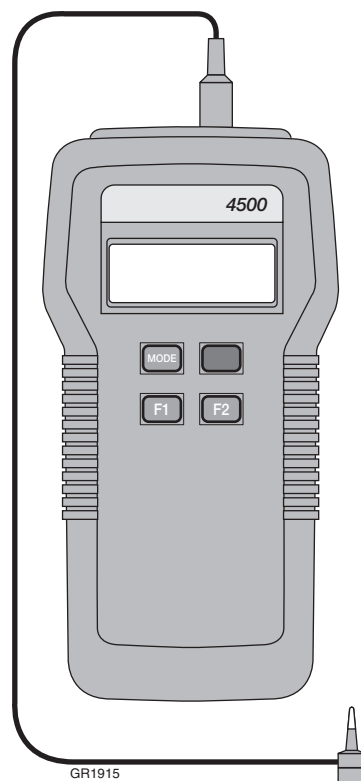
Probe assembly

The probe assembly, shown below, consists of a cone that measures the temperature of the sample well. The temperature is measured by a thermistor bead in the cone tip.



Digital thermometer

Overview The handheld digital thermometer, shown below, has a temperature range of 0 to 100 °C and is accurate to within ± 0.1 °C.



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.

- Precautions** When you use the digital thermometer:
- Make sure the probe assembly is connected to the input connector at the top of the digital thermometer. If a probe is *not* connected when the thermometer is powered on, the unit displays the error message “Error No Probe Found. Install Probe after Shut Down.”
 - To power on the digital thermometer, press the on/off switch on its front.
 - The temperature measured by the probe assembly appears on the digital thermometer display in degrees Celsius.
 - When you complete a test, press the on/off switch to power off the digital thermometer.

Temperature display differences The sample temperature that is displayed on the thermal cycler display screen differs from the temperature that is displayed on the digital thermometer during heating or cooling transitions. This is because the thermal cycler displays the *calculated sample* temperature, while the digital thermometer measures and displays the *sample block* temperature. The sample temperature that is displayed by the thermal cycler is calculated based on the ramp rate and reaction volume.

Using the probe while running programs Applied Biosystems recommends that you use the probe assembly and digital thermometer *only* for the temperature verification test and the temperature non-uniformity test, which are described in this manual.

If you use the probe assembly and digital thermometer while running programs other than those used in these two tests, be aware that the accuracy of the probe data reported by the assembly *decreases*. The decrease is due to the variability introduced into the test by placing the probe in alternate well locations and/or the selection of temperatures other than those recommended by Applied Biosystems.

Temperature Verification Tests for the 2720 Thermal Cycler

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Overview

Materials When you perform a temperature verification test on a 2720 thermal cycler, use the materials in the kit (PN 4317939).

Assembly [Figure 3](#) shows a properly assembled system. Note that the frame is positioned around the wells with the channel facing you. The location tab on the frame should align with the locator tab on the thermal cycler. The probe wire is threaded through the channel to prevent damaging the wire when you close the thermal cycler heated cover.

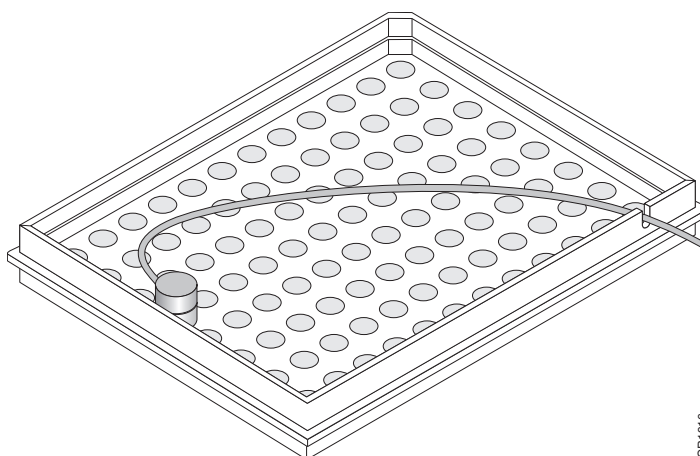


Figure 3 Proper assembly of the Temperature Verification System for 2720 thermal cycler



Figure 4 Temperature verification frame

Temperature calibration verification test

Use this test to verify the temperature calibration of your 2720 thermal cycler that has a 0.2-mL sample block module. The temperature calibration verification test consists of the following procedures, which you must perform in sequence:

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Configuring the 2720 thermal cycler	9
Running the test.	10
Evaluating the results	12
Ending the test.	12



WARNING PHYSICAL INJURY HAZARD. Hot Surface. Use care when working around the heated cover and sample block to avoid being burned by hot components.

Required equipment

This test requires the 0.2-mL Sample Block Module Temperature Verification Kit (PN 4317939), which includes:

- Cotton swabs
- Light mineral oil
- 2720 temperature verification frame
- 0.2-mL probe assembly
- Model 4500 digital thermometer with a 9V battery installed

Setting up the 0.2-mL probe assembly

1. Lift the lever and open the hinged heated cover.
2. Place the 2720 temperature verification frame on the sample block.
3. Using a cotton swab, coat well A6 with mineral oil.
4. Place the 0.2-mL probe assembly into well A6.
5. Thread the probe wire through the channel in the 2720 temperature verification frame to prevent damage to the probe and lead wires (see [Figure 3 on page 8](#)).
6. Make sure the probe is connected to the digital thermometer.
7. Pull the lever down to engage the heated cover and 2720 temperature verification frame.

IMPORTANT! Seat the probe properly and close the heated cover carefully. If the probe wire is crushed when you close the cover, the probe can be damaged.

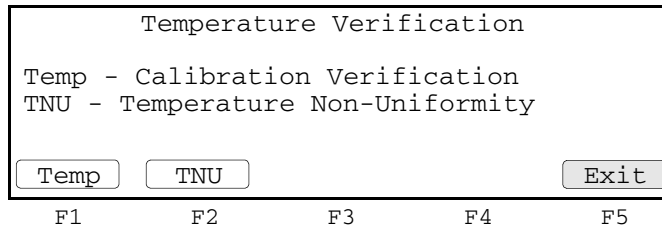
8. Power on the digital thermometer.

Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

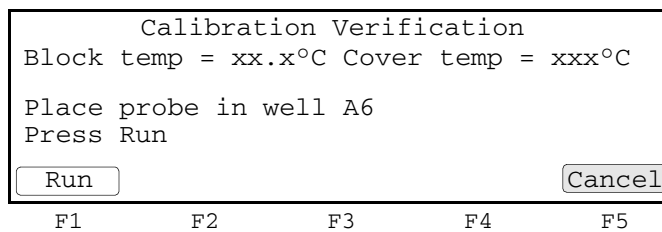
Configuring the 2720 thermal cycler

1. Power on the thermal cycler. The Main menu opens.
For best results, allow the thermal cycler 15 to 30 minutes to warm up to ambient temperature before performing the test.
2. Press **F4** (Util). The Utilities screen opens.

3. Press **F1** (Diag). The Diagnostics screen opens.
4. Press **F3** (TmpVer). The Temperature Verification screen opens.



5. Press **F1** (Temp). The thermal cycler is automatically configured for the calibration verification test and the Calibration Verification screen opens.



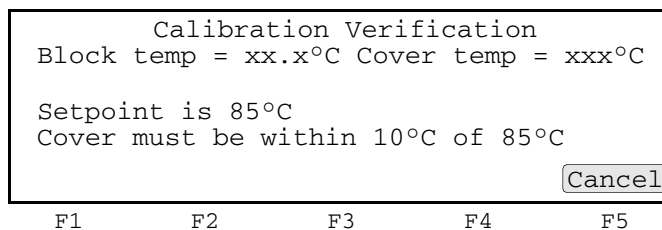
Running the test

In this test, you take temperature readings of the sample well at two different setpoint temperatures using the 0.2-mL probe assembly.

Note: Press **F5** (Cancel) if you want to end the test.

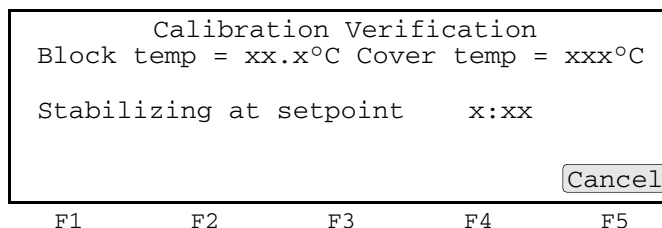
To run the calibration verification test:

1. Press **F1** (Run) to start the calibration verification test. The Calibration Verification screen opens with the setpoint value displayed.



Note: The cover must be at 85 °C ±10 °C. It may take several minutes for the system to ramp up.

Note: The Calibration Verification screen counts down the time until the setpoint is reached.



- When the “Stabilizing at setpoint” value decreases to 0, read the digital thermometer.

Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

- Using the numeric keys, enter the value that is displayed on the digital thermometer in the “Enter actual block temperature” field.

Calibration Verification

Block temp = xx.x°C Cover temp = xxx°C

Enter actual block temperature

F1 F2 F3 F4 F5

The digital thermometer displays a four-digit value. Round this off to three digits before typing it in the Calibration Verification screen.

Record this value on the Calibration Verification Test Data Sheet ([page 18](#)) to keep a permanent record of the test.

- Press **Enter**.

The thermal cycler automatically begins the second temperature reading (45 °C setpoint). The Calibration Verification screen displays the setpoint value.

Calibration Verification

Block temp = xx.x°C Cover temp = xxx°C

Setpoint is 45°C

Cover must be within 30°C of 45°C

F1 F2 F3 F4 F5

Note: The cover must be at 45 °C ± 30 °C. It may take several minutes for the system to ramp up.

- Repeat [steps 2 through 4](#) for the second temperature reading.

The thermal cycler evaluates the calibration of the sample block temperature for the setpoint values that you entered, then displays the results. A summary section opens when the test ends.

Calibration Verification

Actual temperature at 85 °C

Actual temperature at 45 °C

F1 F2 F3 F4 F5

- If you entered values on the Calibration Verification Test Data Sheet ([page 18](#)), compare those values with the actual test results.
- Press **F1** (Accept).

Evaluating the results

When the thermal cycler completes the calibration verification test, one of two screens opens, depending on the results. See the table below to evaluate the results.

If the sample block module...	Then the...
Is properly calibrated	Calibration Verification screen displays the following message: <div style="border: 1px solid black; padding: 10px; margin: 10px 0; text-align: center;"> Calibration Verification Calibration is good Exit </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> F1 F2 F3 F4 F5 </div>
Does not pass the calibration verification test	Calibration Verification screen displays the following message: <div style="border: 1px solid black; padding: 10px; margin: 10px 0; text-align: center;"> Calibration Verification Instrument may require service. Contact Applied Biosystems Technical Support. Exit </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> F1 F2 F3 F4 F5 </div> <ul style="list-style-type: none"> If the test fails, repeat the procedure to make sure that the thermometer was not misread or that data-entry errors were not made. If the test fails again, contact Applied Biosystems Technical Support. See “How to obtain support” on page viii.

Note: As a result of the Temperature Tolerance Stack, between the sample block, temperature probe and thermometer, the instrument firmware is programmed to accept a Pass/Fail result of ± 0.75 °C. Therefore, passing results may vary from 84.25 °C to 85.75 °C at the 85-degree setpoint and 44.25 °C and 45.75 °C at the 45-degree setpoint. Ranges greater than ± 0.75 degrees cause the test to fail.

Ending the test

1. Press **F5** (Exit).
2. Remove the 0.2-mL probe assembly from the sample block.
3. Power off the digital thermometer, then clean off the oil.

Wait for the sample block to reach room temperature (~25 °C), then remove the 2720 temperature verification frame from the sample block.



WARNING PHYSICAL INJURY HAZARD. Hot Surface. Use care when working around the heated cover and sample block to avoid being burned by hot components.

4. Clean the oil off the sample block.

Temperature non-uniformity test

Use this test to verify the temperature uniformity of the 2720 thermal cycler with a 0.2-mL sample block module. The temperature non-uniformity test consists of the following procedures, which you must perform in sequence:

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WARNING PHYSICAL INJURY HAZARD. Hot Surface. Use care when working around the heated cover and sample block to avoid being burned by hot components.

Required equipment

This test requires the 0.2-mL Sample Block Module Temperature Verification Kit (PN 4317939), which includes:

- Cotton swabs
- Light mineral oil
- 2720 temperature verification frame
- 0.2-mL probe assembly
- Model 4500 digital thermometer with a 9V battery installed

Setting up the 0.2-mL probe assembly

1. Lift the lever and open the hinged heated cover.
2. Place the 2720 temperature verification frame on the sample block.
3. Use a cotton swab to coat the following wells with mineral oil:
A1, A12, C4, C9, F4, F9, H1, H12
4. Place the 0.2-mL probe assembly into well A1, then as the test progresses, move the 0.2-mL probe assembly to each of the test wells.
5. Thread the probe wire through the channel in the 2720 temperature verification frame to prevent damage to the probe and lead wires (see [Figure 3 on page 8](#)).
6. Make sure the probe is connected to the digital thermometer.
7. Pull the lever down to engage the heated cover and 2720 temperature verification frame.

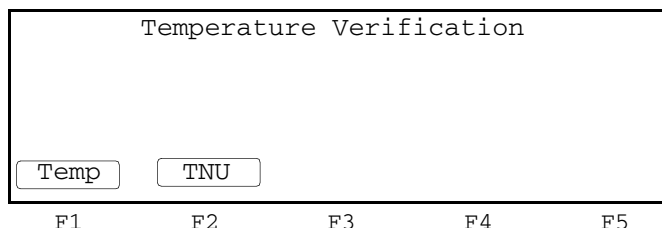
IMPORTANT! Seat the probe properly and close the heated cover carefully. If the probe wire is crushed when you close the heated cover, the probe can be damaged.

8. Power on the digital thermometer.

Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

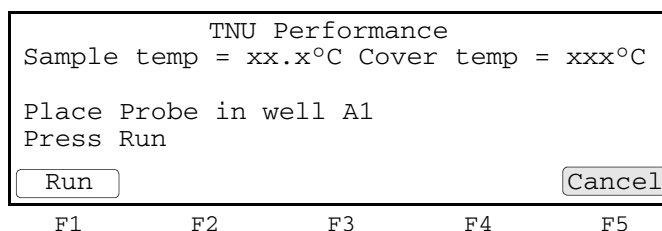
Configuring the 2720 thermal cycler

1. Power on the thermal cycler. The Main menu opens. For best results, allow the thermal cycler 15 to 30 minutes to warm up to ambient temperature before performing the test.
2. Press **F4** (Util). The Utilities screen opens.
3. Press **F1** (Diag). The Diagnostics screen opens.
4. Press **F3** (TmpVer). The Temperature Verification screen opens.



5. Press **F2** (TNU).

The thermal cycler automatically starts to configure the temperature non-uniformity test, with the cover setpoint of 35 °C and the sample starting with the setpoint of 37 °C. It may take several minutes for the system to stabilize at the cover and sample setpoint temperatures. After the system is configured, the TNU Performance screen opens.



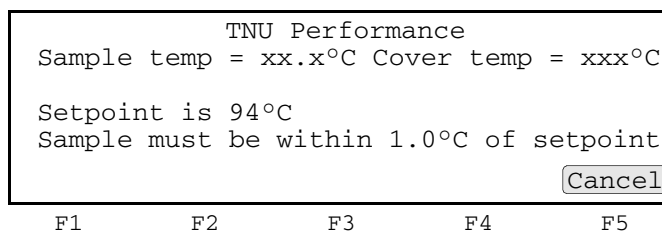
Running the test

The temperature non-uniformity test uses the 0.2-mL probe assembly to test the temperature uniformity of 8 different wells in the sample block.

Note: Press **F5** (Cancel) if you want to exit the test.

To run the temperature non-uniformity test:

1. Place the probe into the indicated well, then press **F1** (Run). The temperature non-uniformity test for the setpoint temperature of 94 °C starts, and the TNU Performance screen opens with the setpoint value displayed.



Note: The sample block increases from 37 °C to 94 °C. The sample block must be at 94 °C ±1.0 °C. It may take several minutes for the 2720 thermal cycler to stabilize at the setpoint temperature.

- When the sample block reaches 94 °C, the TNU Performance screen counts down the time until the setpoint is stable.

TNU Performance

Sample temp = xx.x°C Cover temp = xxx°C
 Stabilizing at setpoint x:xx

F1 F2 F3 F4 F5

- When the “Stabilizing at setpoint” value decreases to 0, read the digital thermometer.

Refer to the instructions in your Temperature Verification Kit for details on operating the Model 4500 digital thermometer.

- Using the numeric keys, enter the value that is displayed on the digital thermometer in the “Enter actual block temperature” field.

TNU Performance

Sample temp = xx.x°C Cover temp = xxx°C
 Enter actual block temperature

F1 F2 F3 F4 F5

The digital thermometer displays a four-digit value. Round off the value to three digits before you enter it in the TNU Performance screen.

Record the value on the Temperature Non-Uniformity Test Data Sheet ([page 19](#)) to keep a permanent record of the test.

- Press **Enter**. The following TNU Performance screen opens and the system automatically begins decreasing its setpoint temperature to 37 °C.

TNU Performance

Sample temp = xx.x°C Cover temp = xxx°C
 Setpoint is 37°C
 Sample must be within 1.0°C of setpoint

F1 F2 F3 F4 F5

- When the setpoint temperature reaches 37 °C, the TNU Performance screen opens with the following prompt:

TNU Performance

Sample temp = xx.x°C Cover temp = xxx°C
 Place probe in well xx
 Press Run

F1 F2 F3 F4 F5

7. Open the hinged heated cover. Repeat [steps 4 through 7](#) of the “[Setting up the 0.2-mL probe assembly](#)” on [page 13](#) and [steps 1 through 6](#) of this procedure. Complete these steps for all 8 wells to be tested: A1, A12, C4, C9, F4, F9, H1, H12.
8. The 2720 thermal cycler evaluates the uniformity of the sample block temperature for the setpoint values that you entered and displays the results. A summary screen opens at the end of the test.

Well	94°C	37°C	Well	94°C	37°C
A1	xx.x	xx.x	F4	xx.x	xx.x
A12	xx.x	xx.x	F9	xx.x	xx.x
C4	xx.x	xx.x	H1	xx.x	xx.x
C9	xx.x	xx.x	H12	xx.x	xx.x
<input type="button" value="Accept"/>			<input type="button" value="Cancel"/>		
F1	F2	F3	F4	F5	

If you entered values on the Temperature Non-Uniformity Test Data Sheet ([page 19](#)), compare those values with the actual test results.

9. Press **F1** (Accept).

Evaluating the results

When the thermal cycler completes the temperature non-uniformity test, the TNU Performance screen opens. See the table below to evaluate the results.

If the...	Then...
Temperature of the sample block wells is uniform	<p>“Pass” appears after each setpoint temperature.</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p style="text-align: center;">TNU Performance</p> <p style="text-align: center;">TNU at 94°C is xx.xx - Pass TNU at 37°C is xx.xx - Pass</p> <p style="text-align: right;"><input type="button" value="Cancel"/></p> </div> <p style="text-align: center;">F1 F2 F3 F4 F5</p>
Temperature variation of the sample block wells exceeds performance specifications	<p>“Fail” appears after the setpoint temperature(s) for which the test failed.</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p style="text-align: center;">TNU Performance</p> <p style="text-align: center;">TNU at 94°C is xx.xx - Fail TNU at 37°C is xx.xx - Fail</p> <p style="text-align: right;"><input type="button" value="Cancel"/></p> </div> <p style="text-align: center;">F1 F2 F3 F4 F5</p> <ul style="list-style-type: none"> If the test fails, repeat the procedure to make sure that the thermometer was not misread or that data-entry errors were not made. If the test fails again, contact Applied Biosystems Technical Support. See “How to obtain support” on page viii.

Ending the test

1. Press **F5** (Cancel).
2. Remove the 0.2-mL probe assembly from the sample block.
3. Power off the digital thermometer, then clean off the oil.
4. Wait for the sample block to reach room temperature (~ 25 °C), then remove the 2720 temperature verification frame from the sample block.



WARNING PHYSICAL INJURY HAZARD. Hot Surface. Use care when working around the heated cover and sample block to avoid being burned by hot components.

5. Clean the oil off the sample block.

Data Sheet: Temperature Non-Uniformity Test

When you run the temperature non-uniformity test, record the setpoint values for the wells that are listed on this data sheet. At the end of the test, compare the values that are displayed on the thermal cycler with the values that are recorded here.

Note: You can photocopy this page.

Date		
Tested by		
Probe serial no.		
Thermometer serial no.		
Setpoint value	94 °C	37 °C
A1		
A12		
C4		
C9		
F4		
F9		
H1		
H12		

Temperature Verification Tests for the GeneAmp® 9700 Thermal Cycler

3

This chapter covers:

Overview	22
Temperature calibration verification test.....	23
Temperature non-uniformity test.....	27
Data Sheet: Calibration Verification Test	32
Data Sheet: Temperature Non-Uniformity Test.....	33

Overview

Materials When you perform a temperature verification test on a GeneAmp® 9700 with a 96-Well Sample Block Module, use the materials in the kit (PN 4317939).

Assembly [Figure 5](#) shows a properly assembled system. Note that the frame is positioned around the wells with the channel facing you. The location tab on the frame should align with the locator tab on the thermal cycler. The probe wire is threaded through the channel to prevent damaging the wire when you close the thermal cycler heated cover.

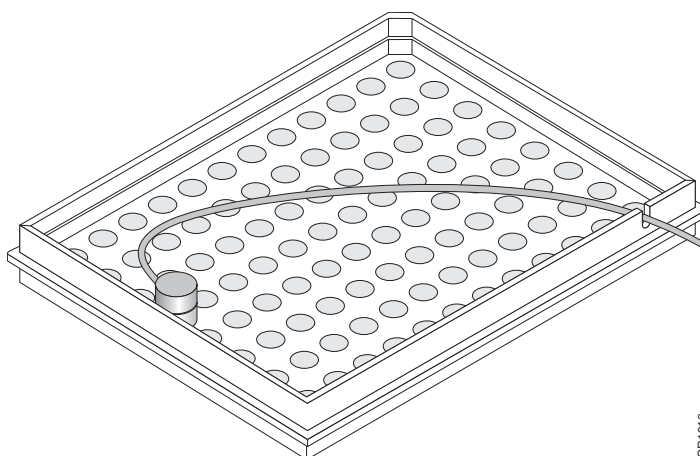


Figure 5 Proper assembly of the Temperature Verification System for GeneAmp® 9700 thermal cycler



Figure 6 Temperature verification frame

Temperature calibration verification test

Use this test to verify the temperature calibration of your GeneAmp® 9700 thermal cycler that has a 0.2-mL sample block module. The test consists of the following procedures, which you must perform in sequence:

Setting up the 0.2-mL probe assembly	23
Configuring the GeneAmp® 9700.....	23
Running the test.....	24
Evaluating the results	26
Ending the test.....	26



WARNING PHYSICAL INJURY HAZARD. Hot Surface. Use care when working around the heated cover and sample block to avoid being burned by hot components.

Required equipment

This test requires the 0.2-mL Sample Block Module Temperature Verification Kit (PN 4317939), which includes:

- Cotton swabs
- Light mineral oil
- 9700 temperature verification frame
- 0.2-mL probe assembly
- Model 4500 digital thermometer with a 9V battery installed

Setting up the 0.2-mL probe assembly

1. If the heated cover is in the forward position, lift the lever, then slide the heated cover back.
2. Place the 9700 temperature verification frame on the sample block.
3. Using a cotton swab, coat well A6 with mineral oil.
4. Place the 0.2-mL probe assembly into well A6.
5. Thread the probe wire through the channel in the 9700 temperature verification frame to prevent damage to the probe and lead wires (see [Figure 5 on page 22](#)).
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 wire is crushed when you close the heated cover, the probe can be damaged.

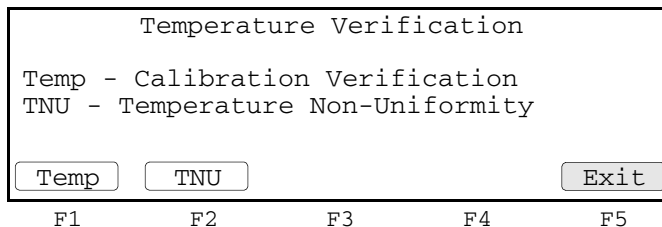
8. Power on the digital thermometer.

Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

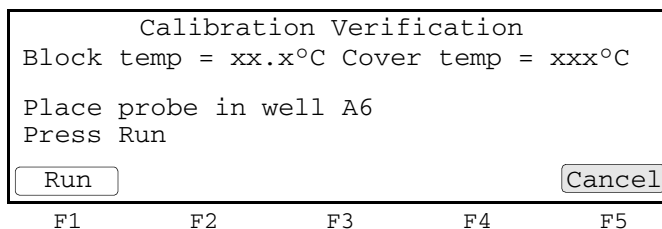
Configuring the GeneAmp® 9700

1. Power on the thermal cycler. The Main menu opens.
For best results, allow the thermal cycler 15 to 30 minutes to warm up to ambient temperature before performing the test.
2. Press **F4** (Util). The Utilities screen opens.

3. Press **F1** (Diag). The Diagnostics screen opens.
4. Press **F3** (TmpVer). The Temperature Verification screen opens.



5. Press **F1** (Temp). The thermal cycler is automatically configured for the calibration verification test and the Calibration Verification screen opens.



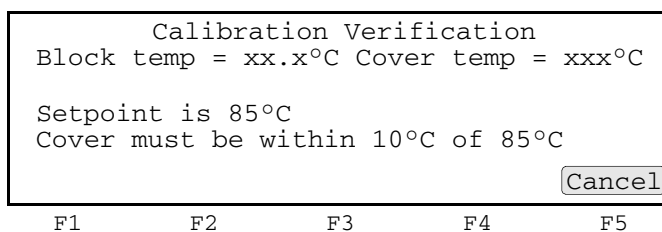
Running the test

In this test, you take temperature readings of the sample well at two different setpoint temperatures using the 0.2-mL probe assembly.

Note: Press **F5** (Cancel) if you want to end the test.

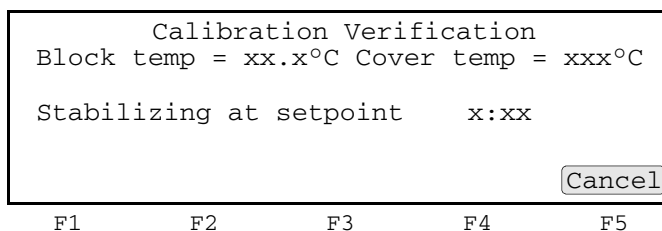
To run the calibration verification test:

1. Press **F1** (Run) to start the calibration verification test. The Calibration Verification screen opens with the setpoint value displayed.



Note: The cover must be at 85 °C ±10 °C. It may take several minutes for the system to ramp up.

The Calibration Verification screen counts down the time until the setpoint is reached.



- When the “Stabilizing at setpoint” value decreases to 0, read the digital thermometer.

Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

- Using the numeric keys, enter the value that is displayed on the digital thermometer in the “Enter actual block temperature” field.

Calibration Verification

Block temp = xx.x°C Cover temp = xxx°C

Enter actual block temperature

F1 F2 F3 F4 F5

The digital thermometer displays a four-digit value. Round this off to three digits before typing it in the Calibration Verification screen.

Record this value on the Calibration Verification Test Data Sheet ([page 32](#)) to keep a permanent record of the test.

- Press **Enter**.

The thermal cycler automatically begins the second temperature reading (45 °C setpoint). The Calibration Verification screen displays the setpoint value.

Calibration Verification

Block temp = xx.x°C Cover temp = xxx°C

Setpoint is 45°C

Cover must be within 30°C of 45°C

F1 F2 F3 F4 F5

Note: The cover must be at 45 °C ± 30 °C. It may take several minutes for the system to ramp up.

- Repeat [steps 2 through 4](#) for the second temperature reading.

The thermal cycler evaluates the calibration of the sample block temperature for the setpoint values that you entered, then displays the results. A summary section opens when the test ends.

Calibration Verification

Actual temperature at 85 °C

Actual temperature at 45 °C

F1 F2 F3 F4 F5

- If you entered values on the Calibration Verification Test Data Sheet ([page 32](#)), compare those values with the actual test results.
- Press **F1** (Accept).

Evaluating the results

When the thermal cycler completes the calibration verification test, one of two screens opens, depending on the test results. See the table below to evaluate the results.

If the sample block module...	Then the...
Is properly calibrated	Calibration Verification screen displays the following message: <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p style="text-align: center;">Calibration Verification</p> <p style="text-align: center;">Calibration is good</p> <p style="text-align: right;">Exit</p> </div> <p style="text-align: center;">F1 F2 F3 F4 F5</p>
Does not pass the calibration verification test	Calibration Verification screen displays the following message: <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p style="text-align: center;">Calibration Verification</p> <p style="text-align: center;">Instrument may require service. Contact Applied Biosystems Technical Support.</p> <p style="text-align: right;">Exit</p> </div> <p style="text-align: center;">F1 F2 F3 F4 F5</p> <ul style="list-style-type: none"> If the test fails, repeat the procedure to make sure that the thermometer was not misread or that data-entry errors were not made. If the test fails again, contact Applied Biosystems Technical Support. See “How to obtain support” on page viii.

Note: As a result of the Temperature Tolerance Stack, between the sample block, temperature probe and thermometer, the instrument firmware is programmed to accept a Pass/Fail result of ± 0.75 °C. Therefore, passing results may vary from 84.25 °C to 85.75 °C at the 85-degree setpoint and 44.25 °C and 45.75 °C at the 45-degree setpoint. Ranges greater than ± 0.75 degrees cause the test to fail.

Ending the test

1. Press **F5** (Exit).
2. Remove the 0.2-mL probe assembly from the sample block.
3. Power off the digital thermometer, then clean off the oil.

Wait for the sample block to reach room temperature (~25 °C), then remove the 9700 temperature verification frame from the sample block.



WARNING PHYSICAL INJURY HAZARD. Hot Surface. Use care when working around the heated cover and sample block to avoid being burned by hot components.

4. Clean the oil off the sample block.

Temperature non-uniformity test

Use this test to verify the temperature uniformity of the GeneAmp 9700 thermal cycler with a 0.2-mL sample block module. The test consists of the following procedures, which you must perform in sequence:

Setting up the 0.2-mL probe assembly	27
Configuring the GeneAmp® 9700.....	28
Running the test.....	28
Evaluating the results	30
Ending the test.....	31



WARNING PHYSICAL INJURY HAZARD. Hot Surface. Use care when working around the heated cover and sample block to avoid being burned by hot components.

Required equipment

This test requires the 0.2-mL Sample Block Module Temperature Verification Kit (PN 4317939), which includes:

- Cotton swabs
- Light mineral oil
- 9700 temperature verification frame
- 0.2-mL probe assembly
- Model 4500 digital thermometer with a 9V battery installed

Setting up the 0.2-mL probe assembly

1. If the heated cover is in the forward position, lift the lever, then slide the heated cover back.
2. Place the 9700 temperature verification frame on the sample block.
3. Use a cotton swab to coat the following wells with mineral oil:
A1, A12, C4, C9, F4, F9, H1, H12
4. Place the 0.2-mL probe assembly into well C4, then as the test progresses, move the 0.2-mL probe assembly to each of the test wells.
5. Thread the probe wire through the channel in the 9700 temperature verification frame to prevent damage to the probe and lead wires (see [Figure 5 on page 22](#)).
6. Make sure the probe is connected to the digital thermometer.
7. Slide the heated cover forward and pull the lever down.

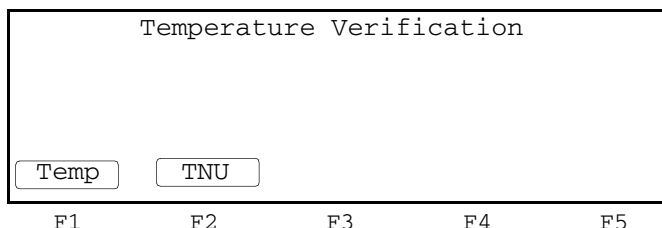
IMPORTANT! Seat the probe properly and close the heated cover carefully. If the probe wire is crushed when you close the heated cover, the probe can be damaged.

8. Power on the digital thermometer.

Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

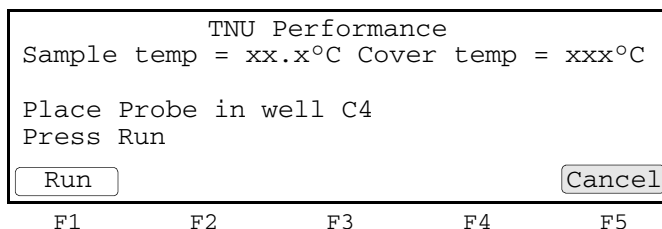
Configuring the GeneAmp® 9700

1. Power on the thermal cycler. The Main menu opens. For best results, allow the thermal cycler 15 to 30 minutes to warm up to ambient temperature before performing the test.
2. Press **F4** (Util). The Utilities screen opens.
3. Press **F1** (Diag). The Diagnostics screen opens.
4. Press **F3** (TmpVer). The Temperature Verification screen opens.



5. Press **F2** (TNU).

The thermal cycler automatically starts to configure the temperature non-uniformity test, with the cover setpoint of 35 °C and the sample starting with the setpoint of 37 °C. It may take several minutes for the system to stabilize at the cover and sample setpoint temperatures. After the system is configured, the TNU Performance screen opens.



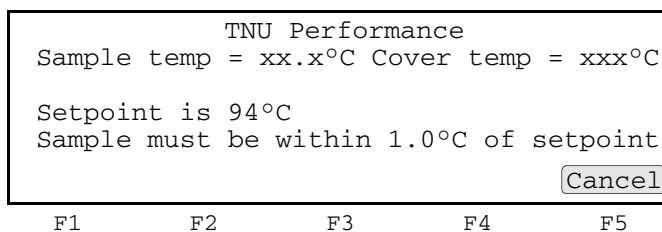
Running the test

The temperature non-uniformity test uses the 0.2-mL probe assembly to test the temperature uniformity of 8 different wells in the sample block.

Note: Press **F5** (Cancel) if you want to exit the test.

To run the temperature non-uniformity test:

1. Place the probe into the indicated well, then press **F1** (Run). The temperature non-uniformity test for the setpoint temperature of 94 °C starts, and the TNU Performance screen opens with the setpoint value displayed.



Note: The sample block increases from 37 °C to 94 °C. The sample block must be at 94 °C ±1.0 °C. It may take several minutes for the GeneAmp® 9700 thermal cycler to stabilize at the setpoint temperature.

- When the sample block reaches 94 °C, the TNU Performance screen counts down the time until the setpoint is stable.

TNU Performance

Sample temp = xx.x°C Cover temp = xxx°C
 Stabilizing at setpoint x:xx

F1 F2 F3 F4 F5

- When the “Stabilizing at setpoint” value decreases to 0, read the digital thermometer.

Refer to the instructions in your Temperature Verification Kit for details on operating the Model 4500 digital thermometer.

- Using the numeric keys, enter the value that is displayed on the digital thermometer in the “Enter actual block temperature” field.

TNU Performance

Sample temp = xx.x°C Cover temp = xxx°C
 Enter actual block temperature

F1 F2 F3 F4 F5

The digital thermometer displays a four-digit value. Round off the value to three digits before you enter it in the TNU Performance screen.

Record the value on the Temperature Non-Uniformity Test Data Sheet ([page 33](#)) to keep a permanent record of the test.

- Press **Enter**. The following TNU Performance screen opens and the system automatically begins decreasing its setpoint temperature to 37 °C.

TNU Performance

Sample temp = xx.x°C Cover temp = xxx°C
 Setpoint is 37°C
 Sample must be within 1.0°C of setpoint

F1 F2 F3 F4 F5

- When the setpoint temperature reaches 37 °C, the TNU Performance screen opens with the following prompt:

TNU Performance

Sample temp = xx.x°C Cover temp = xxx°C
 Place probe in well xx
 Press Run

F1 F2 F3 F4 F5

7. Slide the heated cover back. Repeat [steps 4 through 7](#) of the “[Setting up the 0.2-mL probe assembly](#)” on [page 27](#) and [steps 1 through 6](#) of this procedure. Complete these steps for all 8 wells to be tested: C4, C9, F4, F9, A1, A12, H1, H12.
8. The GeneAmp® 9700 thermal cycler evaluates the uniformity of the sample block temperature for the setpoint values that you entered and displays the results. A summary screen opens at the end of the test.

Well	94°C	37°C	Well	94°C	37°C
C4	xx.x	xx.x	A1	xx.x	xx.x
C9	xx.x	xx.x	A12	xx.x	xx.x
F4	xx.x	xx.x	H1	xx.x	xx.x
F9	xx.x	xx.x	H12	xx.x	xx.x
Accept			Cancel		
F1	F2	F3	F4	F5	

If you entered values on the Temperature Non-Uniformity Test Data Sheet ([page 33](#)), compare those values with the actual test results.

9. Press **F1** (Accept).

Evaluating the results

When the thermal cycler completes the temperature non-uniformity test, the TNU Performance screen opens. See the table below to evaluate the results.

If the...	Then...
Temperature of the sample block wells is uniform	<p>“Pass” appears after each setpoint temperature.</p> <div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>TNU Performance</p> <p>TNU at 94°C is xx.xx - Pass</p> <p>TNU at 37°C is xx.xx - Pass</p> <p>Cancel</p> </div> <p>F1 F2 F3 F4 F5</p>
Temperature variation of the sample block wells exceeds performance specifications	<p>“Fail” appears after the setpoint temperature(s) for which the test failed.</p> <div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>TNU Performance</p> <p>TNU at 94°C is xx.xx - Fail</p> <p>TNU at 37°C is xx.xx - Fail</p> <p>Cancel</p> </div> <p>F1 F2 F3 F4 F5</p> <ul style="list-style-type: none"> If the test fails, repeat the procedure to make sure that the thermometer was not misread or that data-entry errors were not made. If the test fails again, contact Applied Biosystems Technical Support. See “How to obtain support” on page viii.

Ending the test

1. Press **F5** (Cancel).
2. Remove the 0.2-mL probe assembly from the sample block.
3. Power off the digital thermometer, then clean off the oil.
4. Wait for the sample block to reach room temperature (~ 25 °C), then remove the 9700 temperature verification frame from the sample block.



WARNING PHYSICAL INJURY HAZARD. Hot Surface. Use care when working around the heated cover and sample block to avoid being burned by hot components.

5. Clean the oil off the sample block.

Data Sheet: Temperature Non-Uniformity Test

When you run the temperature non-uniformity test, record the setpoint values for the wells that are listed on this data sheet. At the end of the test, compare the values that are displayed on the thermal cycler with the values that are recorded here.

Note: You can photocopy this page.

Date		
Tested by		
Probe serial no.		
Thermometer serial no.		
Setpoint value	94 °C	37 °C
C4		
C9		
F4		
F9		
A1		
A12		
H1		
H12		

Temperature Verification Tests for the GeneAmp® 9700, Dual 96-Well Module

4

This chapter covers:

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Temperature non-uniformity test.....	42
Data Sheet: Calibration Verification Test	47
Data Sheet: Temperature Non-Uniformity Test.....	48

Overview

Materials When you perform the temperature verification test on a GeneAmp® 9700 with a dual 96-well sample block module, you use the materials in the kit (PN 4317939).

Assembly Figure 7 show the right frame of a properly assembled temperature verification system. Note that the probe wire is threaded through the channel to prevent damage to the wire when you close the thermal cycler heated cover.

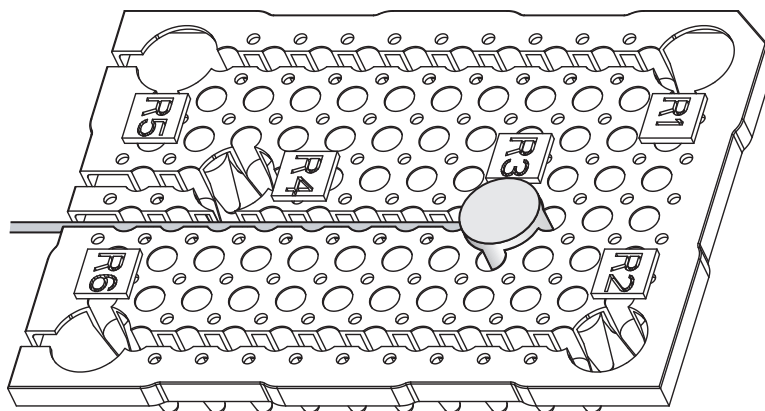


Figure 7 The temperature verification system for GeneAmp® 9700 with a dual 96-well sample block module (right frame shown)

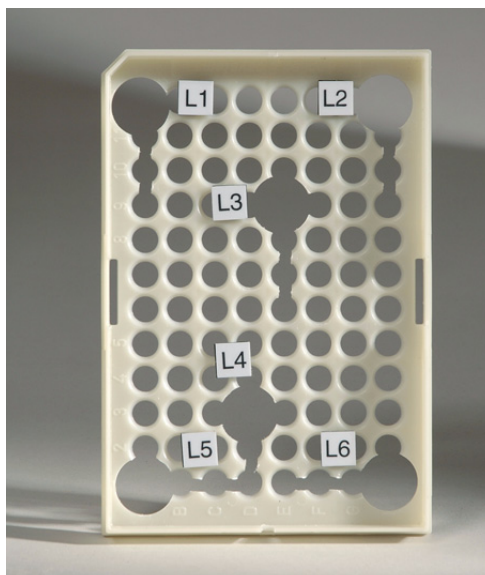


Figure 8 Left frame

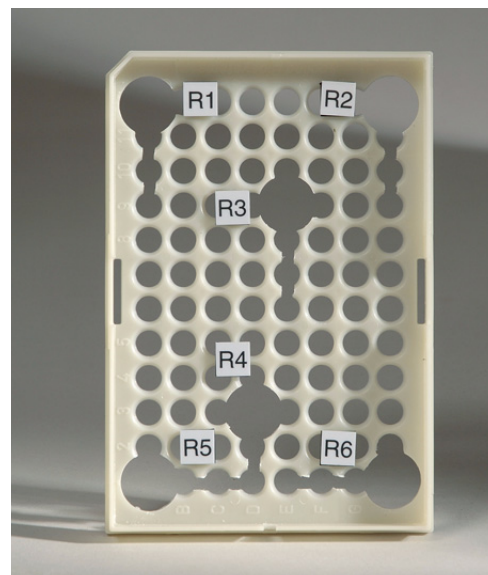


Figure 9 Right frame

Calibration verification test

Use this test to verify the temperature calibration of a GeneAmp® 9700 with a dual 96-well sample block module. The calibration verification test consists of the following procedures, which you must perform in sequence:

Setting up the 0.2-mL probe assembly	37
Configuring the GeneAmp® 9700.....	38
Running the test.....	39
Evaluating the results	41
Ending the test.....	41



WARNING PHYSICAL INJURY HAZARD. Hot Surface. Use care when working around the heated cover and sample block to avoid being burned by hot components.

Required equipment

This test requires the 0.2-mL Sample Block Module Temperature Verification Kit (PN 4317939), which includes:

- Cotton swabs
- Light mineral oil
- Left and right dual 96-well block temperature verification plates
- 0.2-mL probe assembly
- Model 4500 digital thermometer with a 9V battery installed

Setting up the 0.2-mL probe assembly

1. For GeneAmp® 9700 with Manual Dual 96-well Sample Block Module:
If the heated cover is in the forward position, lift the lever, then slide the heated cover back.

For GeneAmp® 9700 with Auto-Lid dual 96-Well Sample Block Module:
If the heated cover is in the forward position, lift the lever, then press the red button to slide the heated cover back.

2. Place both dual 96-well temperature verification plates on the sample block. The plate labeled with L1 to L6 is for the left sample block. The plate labeled with R1 to R6 is for the right sample block. Position the plates so the angled corners face away from you.

Note: The plates help you locate the probes within the sample blocks.

3. Using a cotton swab, coat well R3 with mineral oil.
4. Place the 0.2-mL probe assembly into well R3.
5. Thread the probe wire through the channel in the dual 96-well temperature verification plate to prevent damage to the probe and lead wires (see [Figure 7 on page 36](#)).
6. Make sure the probe is connected to the digital thermometer.

7. For GeneAmp® 9700 with Manual Dual 96-Well Sample Block Module:
Slide the heated cover forward then pull the lever down.

For GeneAmp® 9700 with Auto-Lid Dual 96-Well Sample Block Module:
Press the red button to slide and close the heated cover.

IMPORTANT! Seat the probe properly and close the heated cover carefully. If the probe wire is crushed when you close the heated cover, the probe can be damaged.

8. Power on the digital thermometer.

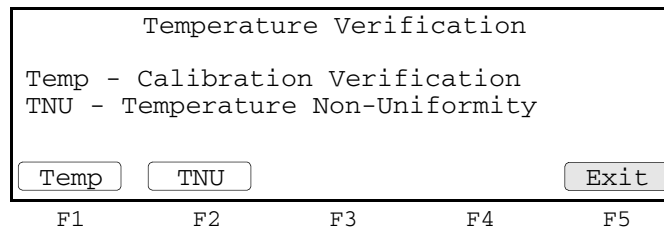
Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

Configuring the GeneAmp® 9700

1. Power on the thermal cycler. The Main menu opens.

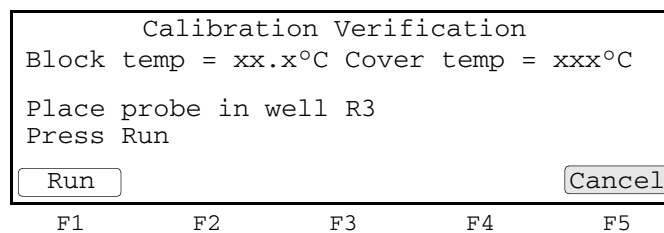
For best results, allow the thermal cycler 15 to 30 minutes to warm up to ambient temperature before performing the test.

2. Press **F4** (Util). The Utilities screen opens.
3. Press **F1** (Diag). The Diagnostics screen opens.
4. Press **F3** (TmpVer). The Temperature Verification screen opens.



5. Press **F1** (Temp).

The GeneAmp® 9700 is automatically configured for the calibration verification test, and the Calibration Verification screen opens.



Running the test In this test, you take temperature readings of the sample well at two different set points using the 0.2-mL probe assembly.

Note: Press **F5** (Cancel) if you want to exit the test.

To run the calibration verification test:

1. Press **F1** (Run). 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 1°C of 105°C

F1 F2 F3 F4 F5

Note: The cover must be at 105 °C ± 1 °C. It may take several minutes for the system to ramp up.

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

F1 F2 F3 F4 F5

2. When the “Stabilizing at setpoint” value decreases to 0, read the digital thermometer.

Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

3. Using the numeric keys, enter the value that is displayed on the digital thermometer in the “Enter actual block temperature” field.

Calibration Verification

Block temp = xx.x°C Cover temp = xxx°C

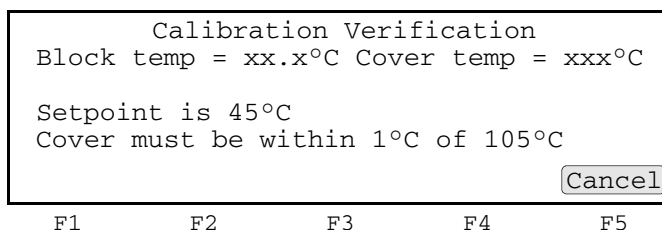
Enter actual block temperature

F1 F2 F3 F4 F5

Note: The digital thermometer displays a four-digit value; round this off to three digits before typing it in the Calibration Verification screen.

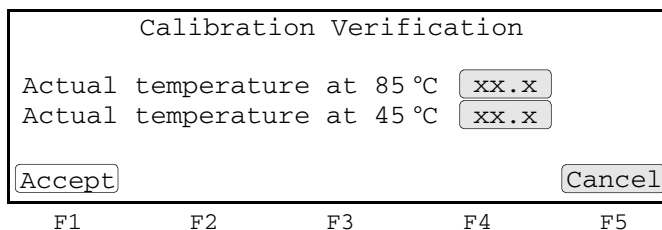
Note: Record this value on the Calibration Verification Test Data Sheet ([page 47](#)) to keep a permanent record of the test.

4. Press **Enter**. The GeneAmp® 9700 automatically begins the second reading (45 °C setpoint), and the Calibration Verification screen opens with the setpoint value displayed.



Note: The cover must be at 105 °C ± 1 °C. It may take several minutes for the system to ramp up.

5. Repeat [steps 2 through 4](#) for the second temperature reading.
The GeneAmp® 9700 evaluates the calibration of the sample block temperature for the setpoint values that you entered and displays the results. A summary screen opens at the end of the test.



6. If you entered values on the Calibration Verification Test Data Sheet ([page 47](#)), compare those values with the actual test results.
7. Press **F1** (Accept).

Evaluating the results

When the GeneAmp® 9700 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 displays the following message: <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p style="text-align: center;">Calibration Verification</p> <p style="text-align: center;">Calibration is good</p> <p style="text-align: right;"><input type="button" value="Exit"/></p> </div> <p style="text-align: center;">F1 F2 F3 F4 F5</p>
Does not pass the calibration verification test	Calibration Verification screen displays the following message: <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p style="text-align: center;">Calibration Verification</p> <p style="text-align: center;">Instrument may require service. Contact Applied Biosystems Technical Support.</p> <p style="text-align: right;"><input type="button" value="Exit"/></p> </div> <p style="text-align: center;">F1 F2 F3 F4 F5</p> <ul style="list-style-type: none"> • If the test fails, repeat the procedure to make sure that the thermometer was not misread or that data-entry errors were not made. • If the test fails again, contact Applied Biosystems Technical Support. See “How to obtain support” on page viii.

Ending the test

1. Press **F5** (Exit).
2. Remove the 0.2-mL probe assembly from the sample block.
3. Power off the digital thermometer, then clean off the oil.
4. Wait for the sample block to reach room temperature (~25 °C), then remove the dual 96-well temperature verification plates from the sample block.



WARNING PHYSICAL INJURY HAZARD. Hot Surface. Use care when working around the heated cover and sample block to avoid being burned by hot components.

5. Clean the oil off the sample block.

Temperature non-uniformity test

Use this test to verify the temperature uniformity of the GeneAmp® 9700 with Dual 96-Well Sample Block Module. The temperature non-uniformity test consists of the following procedures, which you must perform in sequence:

Setting up the 0.2-mL probe assembly	42
Configuring the GeneAmp® 9700	43
Running the test	44
Evaluating the results	46
Ending the test	46



WARNING PHYSICAL INJURY HAZARD. Hot Surface. Use care when working around the heated cover and sample block to avoid being burned by hot components.

Required equipment

This test requires the 0.2-mL Sample Block Module Temperature Verification Kit (PN 4317939), which includes:

- Cotton swabs
- Light mineral oil
- Left and right dual 96-well block temperature verification plates
- 0.2-mL probe assembly
- Model 4500 digital thermometer with a 9V battery installed

Setting up the 0.2-mL probe assembly

1. For the GeneAmp® 9700 with Manual Dual 96-Well Sample Block Module: If the heated cover is in the forward position, lift the lever, then slide the heated cover back.

For the GeneAmp® 9700 with Auto-Lid Dual 96-Well Sample Block Module: If the heated cover is in the forward position, lift the lever, then press the red button to slide the heated cover back.

2. Place both dual 96-well temperature verification plates on the sample block. The plate labeled with L1 to L6 is for the left sample block. The plate labeled with R1 to R6 is for the right sample block. Position the plates so the angled corners face away from you.

Note: The plates are used as guides to help you locate the probes within the sample blocks.

3. Use a cotton swab to coat wells L1 to L6 and R1 to R6 with mineral oil.
4. Place the 0.2-mL probe assembly into well L1. As the test progresses, move the 0.2-mL probe assembly to each of the test wells (L1 to L6 and R1 to R6).
5. Thread the probe wire through the channel in the dual 96-well temperature verification plate to prevent damage to the probe and lead wires (see [Figure 7 on page 36](#)).
6. Make sure the probe is connected to the digital thermometer.

- For the GeneAmp® 9700 with Manual Dual 96-Well Sample Block Module:
Slide the heated cover forward and pull the lever down.

For the GeneAmp® 9700 with Auto-Lid Dual 96-Well Sample Block Module:
Press the red button to slide and close the heated cover.

IMPORTANT! Seat the probe properly and then close the heated cover carefully. If the probe wire is crushed when you close the heated cover, the probe can be damaged.

- Power on the digital thermometer.

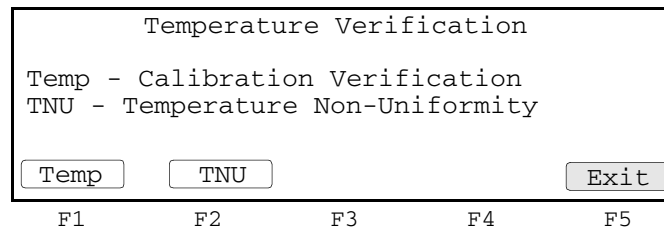
Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

Configuring the GeneAmp® 9700

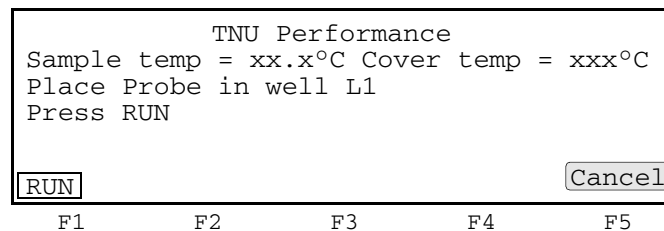
- Power on the thermal cycler. The Main menu opens.

For best results, allow the thermal cycler 15 to 30 minutes to warm up to ambient temperature before performing the test.

- Press **F4** (Util). The Utilities screen opens.
- Press **F1** (Diag). The Diagnostics screen opens.
- Press **F3** (TmpVer). The Temperature Verification screen opens.



- Press **F2** (TNU). The GeneAmp® 9700 is automatically configured for the temperature non-uniformity test, starting with the setpoint of 95 °C, and the TNU Performance screen opens. The following screen opens when the cover reaches the setpoint.



Running the test The temperature non-uniformity test uses the 0.2-mL probe assembly to test the temperature uniformity of 6 different wells in each sample block.

Note: Press **F5** (Cancel) if you want to exit the test.

To run the temperature non-uniformity test:

1. Press **F1** (Run). The temperature non-uniformity test starts, and the TNU Performance screen opens with the setpoint value displayed.

```

TNU Performance
Sample temp = xx.x°C Cover temp = xxx°C

Setpoint is 95°C
Sample must be within 1.0°C of setpoint
Cancel
F1      F2      F3      F4      F5

```

Note: The sample block must be at $95\text{ }^{\circ}\text{C} \pm 1.0\text{ }^{\circ}\text{C}$. In addition, the cover must be at $105\text{ }^{\circ}\text{C} \pm 1.0\text{ }^{\circ}\text{C}$. It may take several minutes for the GeneAmp[®] 9700 to stabilize at the setpoint temperature.

The TNU Performance screen counts down the time until the setpoint is stable.

```

TNU Performance
Sample temp = xx.x°C Cover temp = xxx°C
Stabilizing at setpoint   x:xx
Cancel
F1      F2      F3      F4      F5

```

2. When the “Stabilizing at setpoint” value decreases to 0, read the digital thermometer.

Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

3. Using the numeric keys, enter the value that is displayed on the digital thermometer in the “Enter actual block temperature” field.

```

TNU Performance
Sample temp = xx.x°C Cover temp = xxx°C
Enter actual block temperature 00.0
Cancel
F1      F2      F3      F4      F5

```

Note: The digital thermometer displays a four-digit value; round this off to three digits before typing it in the TNU Performance screen.

Note: Record this value on the Temperature Non-Uniformity Test Data Sheet (page 48) to keep a permanent record of the test.

4. Press **Enter**. The GeneAmp® 9700 automatically begins the second reading (55 °C setpoint), and the TNU Performance screen opens with the setpoint value displayed.

TNU Performance				
Sample temp = xx.x°C Cover temp = xxx°C				
Setpoint is 55°C				
Sample must be within 1.0°C of setpoint				
				<input type="button" value="Cancel"/>
F1	F2	F3	F4	F5

Note: The sample block must be at 55 °C ±1.0 °C. In addition, the cover must be at 105 °C ±1.0 °C. It may take several minutes for the GeneAmp® 9700 to stabilize at the setpoint temperature.

5. Repeat [steps 2 and 3](#) for the second reading.
6. Press **Enter**. The TNU Performance screen opens with the following prompt:

TNU Performance				
Sample temp = xx.x°C Cover temp = xxx°C				
Place probe in well xx				
Press Run				
<input type="button" value="Run"/>		<input type="button" value="Cancel"/>		
F1	F2	F3	F4	F5

7. For the GeneAmp® 9700 with Manual Dual 96-Well Sample Block Module:
Slide the heated cover forward and pull the lever down.
- For the GeneAmp® 9700 with Auto-Lid Dual 96-Well Sample Block Module:
Press the red button to slide and close the heated cover.
8. Repeat [steps 4 through 7](#) of “[Setting up the 0.2-mL probe assembly](#)” on [page 42](#) and [steps 1 through 7](#) of this procedure. Complete these steps for all the remaining 11 wells to be tested (L2 to L6 and R1 to R6).

The GeneAmp® 9700 evaluates the uniformity of the sample block temperature for the setpoint values that you entered and displays the results. A summary screen opens at the end of the test.

Well	95°C	55°C	Well	95°C	55°C
L1	xx.x	xx.x	L5	xx.x	xx.x
L2	xx.x	xx.x	L6	xx.x	xx.x
L3	xx.x	xx.x	R1	xx.x	xx.x
L4	xx.x	xx.x	R2	xx.x	xx.x
<input type="button" value="Accept"/>		<input type="button" value="More"/>		<input type="button" value="Cancel"/>	
F1	F2	F3	F4	F5	

9. If you entered values on the Temperature Non-Uniformity Test Data Sheet ([page 48](#)), compare those values with the actual test results.
10. Press **F1** (Accept).

Evaluating the results

After the GeneAmp® 9700 completes the temperature non-uniformity test, the TNU Performance screen opens. See the table below to evaluate the results.

If the...	Then...
Temperature of the sample block wells is uniform	<p>“Pass” appears after each setpoint temperature.</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p style="text-align: center;">TNU Performance</p> <p style="text-align: center;">TNU at 95°C is xx.xx - Pass TNU at 55°C is xx.xx - Pass</p> <p style="text-align: right;"><input type="button" value="Cancel"/></p> </div> <p style="text-align: center;">F1 F2 F3 F4 F5</p>
Temperature variation of the sample block wells exceeds performance specifications	<p>“Fail” appears after the setpoint temperature(s) for which the test failed.</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p style="text-align: center;">TNU Performance</p> <p style="text-align: center;">TNU at 95°C is xx.xx - Fail TNU at 55°C is xx.xx - Fail</p> <p style="text-align: right;"><input type="button" value="Cancel"/></p> </div> <p style="text-align: center;">F1 F2 F3 F4 F5</p> <ul style="list-style-type: none"> If the test fails, repeat the procedure to make sure that the thermometer was not misread or that data-entry errors were not made. If the test fails again, contact Applied Biosystems Technical Support. See “How to obtain support” on page viii.

Ending the test

1. Press **F5** (Cancel).
2. Remove the 0.2-mL probe assembly from the sample block.
3. Power off the digital thermometer, then clean off the oil.
4. Wait for the sample block to reach room temperature (~25 °C), then remove the dual 96-well temperature verification plates from the sample block.



WARNING PHYSICAL INJURY HAZARD. Hot Surface. Use care when working around the heated cover and sample block to avoid being burned by hot components.

5. Clean the oil off the sample block.

Data Sheet: Temperature Non-Uniformity Test

When you run the temperature non-uniformity test, record the setpoint values for the wells L1 to L6 and R1 to R6 listed on this data sheet. At the end of the test, compare the values that are displayed on the thermal cycler with the values that are recorded here.

Note: You can photocopy this page.

Date		
Tested by		
Probe serial no.		
Thermometer serial No.		
Setpoint value	95 °C	55 °C
L1		
L2		
L3		
L4		
L5		
L6		
R1		
R2		
R3		
R4		
R5		
R6		

Temperature Verification Tests for the GeneAmp® 9700, Dual 384-Well Sample Block Module

5

This chapter covers:

Calibration verification test.	50
Temperature non-uniformity test.	55
Data Sheet: Calibration Verification Test	60
Data Sheet: Temperature Non-Uniformity Test.	61

Calibration verification test

Use the calibration verification test to verify the temperature calibration of your GeneAmp® PCR System 9700, Dual 384-Well Sample Block Module. The calibration verification test consists of the following procedures, which you must perform in sequence:

Setting up the 0.02-mL probe assembly 50
 Configuring the GeneAmp® 9700 51
 Running the test 51
 Evaluating the results 54

Required equipment

This test requires the 0.02-mL Dual 384-Well Sample Block Module Temperature Verification Kit (PN 4308354), which includes:

- Light mineral oil
- Left and right 384-well temperature verification plates
- 0.02-mL probe assembly
- Digital thermometer Model 4500 with a 9V battery installed

Setting up the 0.02-mL probe assembly

1. If the heated cover is in the forward position, lift the lever, then slide the heated cover back.
2. Place both 384-well temperature verification plates on the sample blocks.

IMPORTANT! The temperature verification plates must be installed in both sample blocks throughout all temperature verification testing.

The plate labeled L1 to L6 is for the *left* sample block (Figure 10). The plate labeled R1 to R6 is for the *right* sample block (Figure 11). Position the plates so the angled corners face away from you.

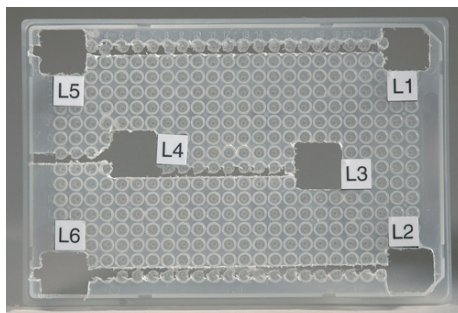


Figure 10 Left temperature verification plate

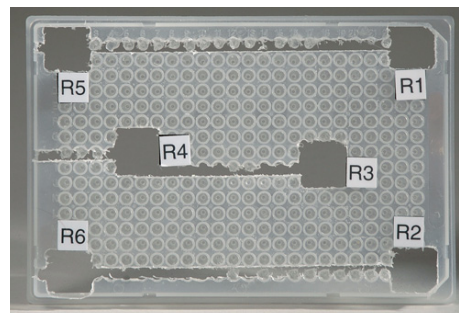


Figure 11 Right temperature verification plate

Note: The plates help you locate the probes within the sample blocks.

3. Use the stick-end of a cotton swab to coat well R3 with mineral oil; the wells are too small for the swab-end.
4. Place the 0.02-mL probe assembly into well R3.

5. Thread the probe wire through the channels in the 384-well temperature verification plate 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 you close the heated cover, the probe may be damaged.

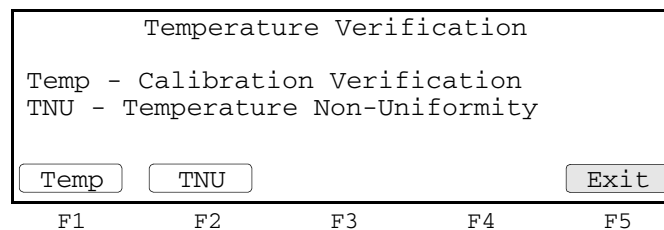
8. Power on the digital thermometer.

Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

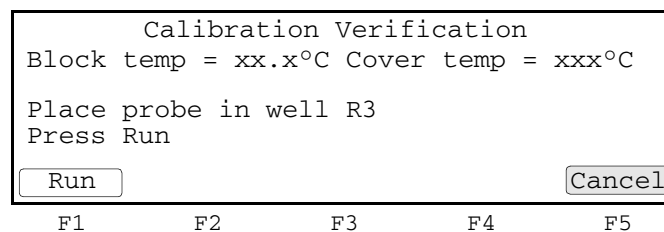
9. Continue with “Configuring the GeneAmp® 9700” below.

Configuring the GeneAmp® 9700

1. Complete the procedures in “Setting up the 0.02-mL probe assembly” above.
2. Power on the thermal cycler. The Main menu opens.
For best results, allow the thermal cycler 15 to 30 minutes to warm up to ambient temperature before performing the test.
3. Press **F4** (Util). The Utilities screen opens.
4. Press **F1** (Diag). The Diagnostics screen opens.
5. Press **F3** (TmpVer). The Temperature Verification screen opens.



6. Press **F1** (Temp) to automatically configure the GeneAmp® 9700 for the calibration verification test. The Calibration Verification screen opens.



7. Continue with “Running the test” below.

Running the test

Use the digital thermometer to take temperature readings of the sample well that is connected to the 0.02-mL probe assembly. You must take a reading at two different setpoint temperatures.

Note: If necessary, press **F5** (Cancel) to exit the test.

To run the calibration verification test:

1. Complete the procedures in “Configuring the GeneAmp® 9700” on page 51.
2. Press **F1** (Run) to start the calibration verification test. 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 1°C of 105°C				
				Cancel
F1	F2	F3	F4	F5

Note: The cover must be within ± 1 °C of 105 °C. It may take several minutes for the GeneAmp® 9700 to ramp up.

3. 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

When the “Stabilizing at setpoint” value decreases to 0, read the digital thermometer. Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

4. Using the numeric keys, enter the value that is displayed on the digital thermometer in the “Enter actual block temperature” field.

Calibration Verification				
Block temp = xx.x°C Cover temp = xxx°C				
Enter actual block temperature				xx.x
				Cancel
F1	F2	F3	F4	F5

Note: Round off the four-digit value on the digital thermometer to three digits before you enter it into the Calibration Verification screen.

Note: Record this value on the Calibration Verification Test Data Sheet (page 60) to keep a permanent record of the test.

5. Press **ENTER**. The GeneAmp® 9700 automatically begins the second reading (45 °C setpoint). The Calibration Verification screen opens with the setpoint value displayed.

Calibration Verification

Block temp = xx.x°C Cover temp = xxx°C

Setpoint is 45°C
Cover must be within 1°C of 105°C

F1 F2 F3 F4 F5

Note: The cover must be within ± 1 °C of 105 °C.

6. Repeat [steps 3](#) and [4](#) for the second reading.
7. The GeneAmp® 9700 evaluates the calibration of the sample block temperature for the setpoint values that you entered and displays the results. A summary screen opens at the end of the test.

Calibration Verification

Actual temperature at 85 °C

Actual temperature at 45 °C

F1 F2 F3 F4 F5

If you entered values on the Calibration Verification Test Data Sheet, compare those values with the actual test results.

8. Press **F1** (Accept). To interpret the results, see [“Evaluating the results” on page 54](#).
9. When you complete all measurements, be sure to:
- Press **Exit**.
 - Remove the 0.02-mL probe assembly from the sample blocks.
 - Power off the digital thermometer, then clean off the oil.
 - Remove the 384-well temperature verification plates from the sample blocks.



WARNING 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 GeneAmp® 9700 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	<p>Calibration Verification screen displays the following message:</p> <div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>Calibration Verification</p> <p>Calibration is good</p> <p style="text-align: right;"><input type="button" value="Exit"/></p> </div> <p style="text-align: center;">F1 F2 F3 F4 F5</p>
Does not pass the calibration verification test	<p>Calibration Verification screen displays the following message:</p> <div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>Calibration Verification</p> <p>Instrument may require service.</p> <p>Contact Applied Biosystems Technical Support.</p> <p style="text-align: right;"><input type="button" value="Exit"/></p> </div> <p style="text-align: center;">F1 F2 F3 F4 F5</p> <ul style="list-style-type: none"> • If the test fails, repeat the procedure to make sure that the thermometer was not misread or that data-entry errors were not made. • If the test fails again, contact Applied Biosystems Technical Support. See “How to obtain support” on page viii.

Temperature non-uniformity test

Use this test to verify the temperature uniformity of the GeneAmp® PCR System 9700, Dual 384-Well Sample Block Module. The temperature non-uniformity test consists of the following procedures, which you must perform in sequence:

Setting up the 0.02-mL probe assembly	55
Running the test	57
Evaluating the results	59

Required equipment

This test requires the Dual 384-Well Sample Block Module Temperature Verification Kit (PN 4308354), which includes:

- Light mineral oil
- Left and right 384-well temperature verification plates
- 0.02-mL probe assembly
- Digital thermometer Model 4500 with a 9V battery installed

Setting up the 0.02-mL probe assembly

1. If the heated cover is in the forward position, lift the lever, then slide the heated cover back.
2. Place both 384-well temperature verification plates on the sample blocks.

IMPORTANT! The temperature verification plates must be installed in both sample blocks throughout all temperature verification testing.

The plate labeled L1 to L6 is for the *left* sample block (Figure 12). The plate labeled R1 to R6 is for the *right* sample block (Figure 13). Position the plates so the angled corners face away from you.

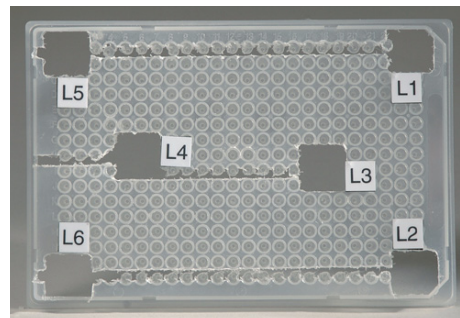


Figure 12 Left temperature verification plate

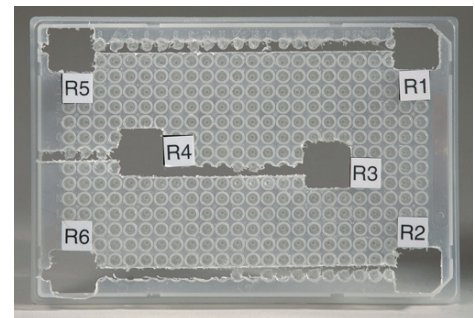


Figure 13 Right temperature verification plate

Note: The plates help you locate the probes within the sample blocks.

3. Use the stick-end of a cotton swab to coat wells L1 to L6 and R1 to R6 with mineral oil; the wells are too small for the swab-end.
4. Place the 0.02-mL probe assembly into well L1.

Note: As the test progresses, you move the 0.02-mL probe assembly to each of the test wells (L1 to L6 and R1 to R6).

5. Thread the probe wire through the channels in the 384-well temperature verification plate 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 you close the heated cover, the probe may be damaged.

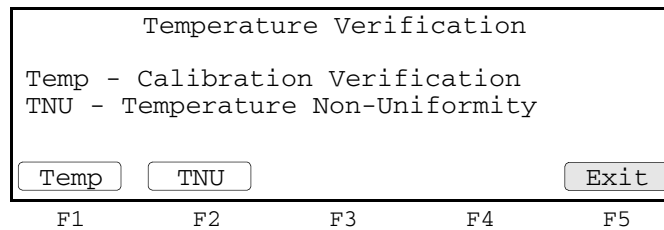
8. Power on the digital thermometer.

Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

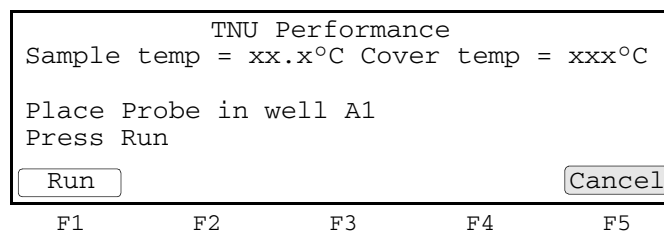
9. Continue with “[Configuring the GeneAmp® 9700](#)” below.

Configuring the GeneAmp® 9700

1. Complete the procedures in “[Setting up the 0.02-mL probe assembly](#)” above.
2. Power on the thermal cycler. The Main menu opens.
For best results, allow the thermal cycler 15 to 30 minutes to warm up to ambient temperature before performing the test.
3. Press **F4** (Util). The Utilities screen opens.
4. Press **F1** (Diag). The Diagnostics screen opens.
5. Press **F3** (TmpVer). The Temperature Verification screen opens.



6. Press **F2** (TNU). This automatically configures the GeneAmp® 9700 for the temperature non-uniformity test. The TNU Performance screen opens.



7. Continue with “[Running the test](#)” on page 57.

Running the test The temperature non-uniformity test uses the 0.02-mL probe assembly to test the temperature uniformity of six different wells in each sample block.

Note: If necessary, press **F5** (Cancel) to exit the test.

To run the temperature non-uniformity test:

1. Complete the procedures in “[Setting up the 0.02-mL probe assembly](#)” on [page 55](#).
2. Press **F1** (Run) to start the temperature non-uniformity test. The TNU Performance screen opens with the setpoint value displayed.

```

TNU Performance
Sample temp = xx.x°C Cover temp = xxx°C

Setpoint is 94°C
Sample must be within 1.0°C of setpoint
Cancel
  
```

F1 F2 F3 F4 F5

Note: The sample blocks must be within ± 1.0 °C of the setpoint. In addition, the cover must be within ± 1 °C of 105 °C. It may take several minutes for the GeneAmp® 9700 to ramp up.

3. The TNU Performance screen counts down the time until the setpoint is stable.

```

TNU Performance
Sample temp = xx.x°C Cover temp = xxx°C
Stabilizing at setpoint... x:xx
Cancel
  
```

F1 F2 F3 F4 F5

When the “Stabilizing at setpoint” value decreases to 0, read the digital thermometer. Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

4. Using the numeric keys, enter the value that is displayed on the digital thermometer in the “Enter actual block temperature” field.

```

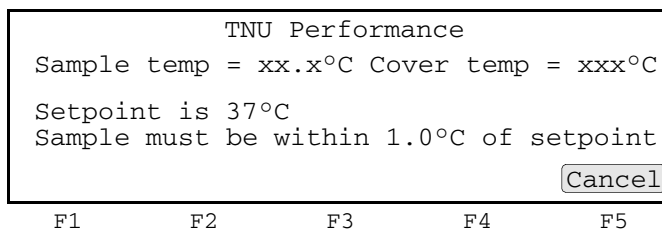
TNU Performance
Sample temp = xx.x°C Cover temp = xxx°C
Enter actual block temperature 00.0
Cancel
  
```

F1 F2 F3 F4 F5

Note: Round off the four-digit value on the digital thermometer to three digits before you enter it into the Calibration Verification screen.

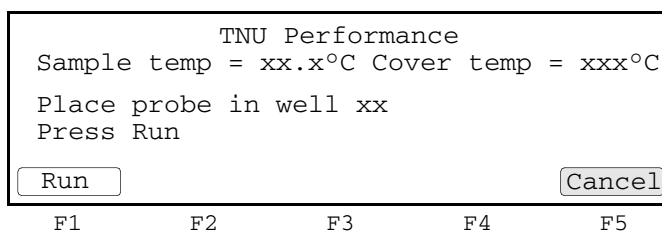
Note: Record this value on the Temperature Non-Uniformity Test Data Sheet ([page 61](#)) to keep a permanent record of the test.

- Press **ENTER**. The GeneAmp® 9700 automatically begins the second reading (37 °C setpoint). The TNU Performance screen opens with the setpoint value displayed.



Note: The sample blocks must be within ± 1.0 °C of the setpoint.

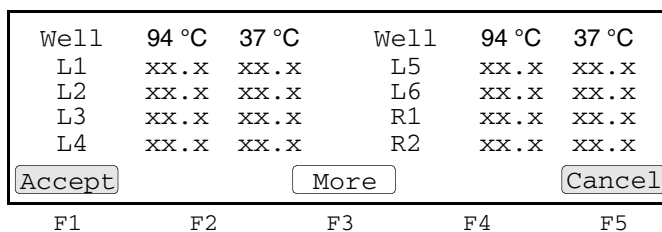
- Repeat [steps 3 and 4](#) for the second reading.
- Press **ENTER**. The TNU Performance screen opens with the following prompt:



- Slide the heated cover back, and repeat [steps 4 to 7](#) of “[Setting up the 0.02-mL probe assembly](#)” on [page 55](#) and [steps 2 through 7](#) of this procedure. Complete these steps for all 12 wells to be tested:

Left Sample Block	Right Sample Block
L1, L2, L3, L4, L5, and L6	R1, R2, R3, R4, R5, and R6

- The GeneAmp® 9700 evaluates the uniformity of the sample block temperature for the setpoint values that you entered and displays the results. A summary screen opens at the end of the test.



If you entered values on the Temperature Non-Uniformity Test Data Sheet, compare those values with the actual test results.

- Press **F1** (Accept). To interpret the results, see “[Evaluating the results](#)” on [page 59](#).

11. When you complete all measurements, be sure to:

- Press **Cancel**.
- Remove the 0.02-mL probe assembly from the sample blocks.
- Power off the digital thermometer, then clean off the oil.
- Remove the 384-well temperature verification plates from the sample blocks.

IMPORTANT! Make sure the sample blocks are at room temperature (~25 °C) before removing the reaction plates.

Evaluating the results

When the GeneAmp® 9700 completes the temperature non-uniformity test, the TNU Performance screen opens. See the table below to evaluate the results.

If the...	Then...
Temperature of the sample block wells is uniform	<p>“Pass” appears after each setpoint temperature.</p> <div data-bbox="797 751 1458 940" style="border: 1px solid black; padding: 5px; text-align: center;"> <p>TNU Performance</p> <p>TNU at 94°C is xx.xx - Pass TNU at 37°C is xx.xx - Pass</p> <p style="text-align: right;"><input type="button" value="Cancel"/></p> </div> <p style="text-align: center;">F1 F2 F3 F4 F5</p>
Temperature variation of the sample block wells exceeds performance specifications	<p>“Fail” appears after the setpoint temperature(s) for which the test failed.</p> <div data-bbox="797 1077 1458 1266" style="border: 1px solid black; padding: 5px; text-align: center;"> <p>TNU Performance</p> <p>TNU at 94°C is xx.xx - Fail TNU at 37°C is xx.xx - Fail</p> <p style="text-align: right;"><input type="button" value="Cancel"/></p> </div> <p style="text-align: center;">F1 F2 F3 F4 F5</p> <ul style="list-style-type: none"> • If the test fails, repeat the procedure to make sure that the thermometer was not misread or that data-entry errors were not made. • If the test fails again, contact Applied Biosystems Technical Support. See “How to obtain support” on page viii.

Data Sheet: Temperature Non-Uniformity Test

When running the temperature non-uniformity test, record the setpoint values for the wells listed on this data sheet. At the end of the test, compare the values that are displayed on the thermal cycler with the values that are recorded here.

Note: You can photocopy this page.

Date		
Tested by		
Probe serial no.		
Thermometer serial no.		
Setpoint value	94 °C	37 °C
L1		
L2		
L3		
L4		
L5		
L6		
R1		
R2		
R3		
R4		
R5		
R6		

Temperature Verification Tests for the GeneAmp[®] 9700, Auto-Lid Sample Block Module

6

This chapter covers:

Calibration verification test	64
Temperature non-uniformity test	69
Data Sheet: Calibration Verification Test.	74
Data Sheet: Temperature Non-Uniformity Test	75

Calibration verification test

Use the calibration verification test to verify the temperature calibration of your GeneAmp® PCR System 9700, Auto-Lid Sample Block Module. The verification test consists of the following procedures, which you must perform in sequence:

Setting up the 20-µL probe assembly 64
 Configuring the GeneAmp® 9700 65
 Running the test 66
 Evaluating the results 68

WARNING PHYSICAL INJURY HAZARD. Hot Surface. Use care when working around the heated cover and sample block to avoid being burned by hot components.

Required equipment

This test requires the Dual 384-Well Sample Block Module Temperature Verification Kit (PN 4308354), which includes:

- Light mineral oil
- Two 384-well temperature verification plates
- 20-µL probe assembly
- Digital thermometer with a 9V battery installed

Note: This kit is also used for the Auto-Lid sample block module.

Setting up the 20-µL probe assembly

1. Make sure the heated cover is in the rear position. If not, press and release the red button to automatically move the heated cover to the rear position
2. Place both 384-well temperature verification plates on the sample blocks.

IMPORTANT! The temperature verification plates must be installed in both sample blocks throughout all temperature verification testing.

The plate labeled L1 to L6 is for the *left* sample block (Figure 14). The plate labeled R1 to R6 is for the *right* sample block (Figure 15). Position the plates so the angled corners face away from you.

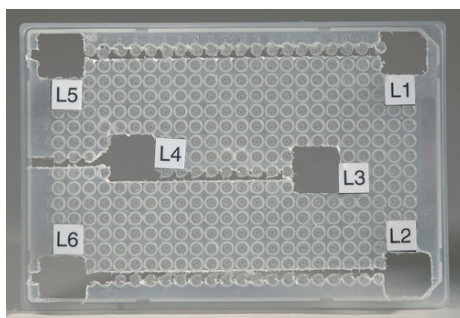


Figure 14 Left temperature verification plate

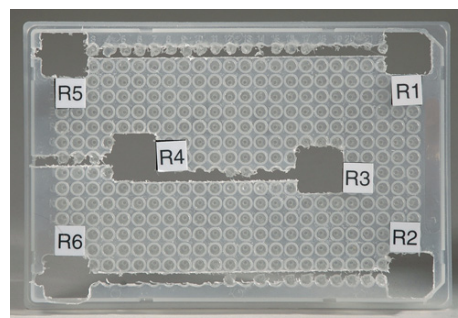


Figure 15 Right temperature verification plate

Note: The plates help you locate the probes within the sample blocks.

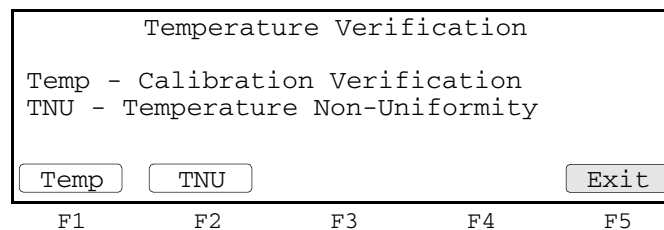
3. Use the stick end of a cotton swab to coat well R3 with mineral oil; The wells are too small for the swab end.
4. Place the 20- μ L probe assembly into well R3.
5. Thread the probe wire through the channels in the 384-well temperature verification plate to prevent damage to the probe and lead wires.
6. Make sure the probe is connected to the digital thermometer.
7. Press and release the red button to automatically close the heated cover.

IMPORTANT! Seat the probe properly. If the probe wire is crushed when the heated cover closes, the probe may be damaged

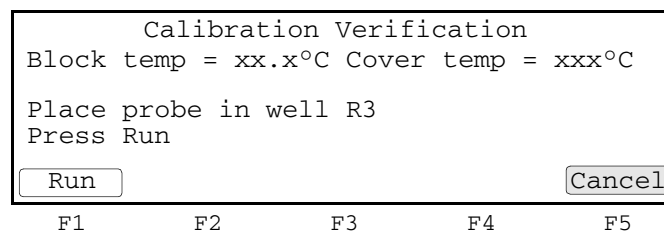
8. Power on the digital thermometer.
Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

Configuring the GeneAmp[®] 9700

1. Power on the thermal cycler. The Main menu opens.
For best results, allow the thermal cycler 15 to 30 minutes to warm up to ambient temperature before performing the test.
2. Press **F4** (Util). The Utilities screen opens.
3. Press **F1** (Diag). The Diagnostics screen opens.
4. Press **F3** (TmpVer). The Temperature Verification screen opens.



5. Press **F1** (Temp) to automatically configure the GeneAmp[®] 9700 for the calibration verification test. The Calibration Verification screen opens.



Running the test Use the thermometer to take temperature readings of the well that is connected to the 20- μ L probe assembly. You must take readings at two different setpoint temperatures.

Note: If necessary, press **F5** (Cancel) to exit the test.

To run the calibration verification test:

1. Press **F1** (Run) to start the calibration verification test. The Calibration Verification screen opens with a setpoint value displayed.

Calibration Verification

Block temp = xx.x°C Cover temp = xxx°C

Setpoint is 85°C

Cover must be within 1°C of 105°C

Cancel

F1 F2 F3 F4 F5

Note: The cover must be within ± 1 °C of 105 °C. It may take several minutes for the GeneAmp® 9700 to ramp up.

2. During the calibration:
 - a. 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

- a. When the “Stabilizing at setpoint” value decreases to 0, read the digital thermometer.

Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

3. Using the numeric keys, enter the value that is displayed on the digital thermometer in the “Enter actual block temperature” field.

Calibration Verification

Block temp = xx.x°C Cover temp = xxx°C

Enter actual block temperature

Cancel

F1 F2 F3 F4 F5

Note: The digital thermometer displays a four-digit value; round this off to three digits before typing it in the Calibration Verification screen.

Note: To keep a permanent record of the test, record this value on the Calibration Verification Test Data Sheet ([page 74](#)).

4. Press **Enter**. The GeneAmp® 9700 automatically begins the second reading (45 °C setpoint). The Calibration Verification screen opens with the setpoint value displayed.

Calibration Verification

Block temp = xx.x°C Cover temp = xxx°C

Setpoint is 45°C
Cover must be within 1°C of 105°C

F1 F2 F3 F4 F5

Note: The cover must be within ± 1 °C of 105 °C.

5. Repeat [steps 2](#) and [3](#) for the second reading.
6. The GeneAmp® 9700 evaluates the calibration of the sample block temperature for the setpoint values that you entered and displays the results. A summary screen opens at the end of the test.

Calibration Verification

Actual temperature at 85 °C

Actual temperature at 45 °C

F1 F2 F3 F4 F5

If you entered values on the Calibration Verification Test Data Sheet, compare those values with the actual test results.

7. Press **F1** (Accept). To interpret the results, see [“Evaluating the results” on page 68](#).
8. When you complete all measurements, be sure to:
- Press **F5** (Exit).
 - Remove the 20- μ L probe assembly from the sample blocks.
 - Power off the digital thermometer, then clean off the oil.
 - Remove the 384-well temperature verification plates from the sample blocks.

IMPORTANT! Make sure the sample blocks are at room temperature (~ 25 °C) before removing the reaction plates.

Evaluating the results

When the GeneAmp® 9700 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	<p>Calibration Verification screen displays the following message:</p> <div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>Calibration Verification</p> <p>Calibration is good</p> <p style="text-align: right;">Exit</p> </div> <p style="text-align: center;">F1 F2 F3 F4 F5</p>
Does not pass the calibration verification test	<p>Calibration Verification screen displays the following message:</p> <div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>Calibration Verification</p> <p>Instrument may require service.</p> <p>Contact Applied Biosystems Technical Support.</p> <p style="text-align: right;">Exit</p> </div> <p style="text-align: center;">F1 F2 F3 F4 F5</p> <ul style="list-style-type: none"> If the test fails, repeat the procedure to make sure that the thermometer was not misread or that data-entry errors were not made. If the test fails again, contact Applied Biosystems Technical Support. See “How to obtain support” on page viii.

Temperature non-uniformity test

Use this test to verify the temperature uniformity of the GeneAmp® PCR System 9700, Auto-Lid Sample Block Module. The temperature non-uniformity test consists of the following procedures, which you must perform in sequence:

Setting up the 20- μ L probe assembly	69
Configuring the GeneAmp® 9700.....	70
Running the test.....	70
Evaluating the results	73



WARNING PHYSICAL INJURY HAZARD. Hot Surface. Use care when working around the heated cover and sample block to avoid being burned by hot components.

Required equipment

This test requires the Dual 384-Well Sample Block Module Temperature Verification Kit (PN 4308354), which includes:

- Light mineral oil
- Two 384-well temperature verification plates
- 20- μ L probe assembly
- Digital thermometer with a 9V battery installed

Note: This kit is also used for the Auto-Lid sample block module.

Setting up the 20- μ L probe assembly

1. Make sure the heated cover is in the rear position. If not, press and release the red button to automatically move the heated cover to the rear position.
2. Place both 384-well temperature verification plates on the sample blocks.

IMPORTANT! The temperature verification plates must be installed in both sample blocks throughout all temperature verification testing.

The plate labeled L1 to L6 is for the *left* sample block (Fig 14). The plate labeled with R1 to R6 is for the *right* sample block (Fig 15). Position the plates so the angled corners face away from you.

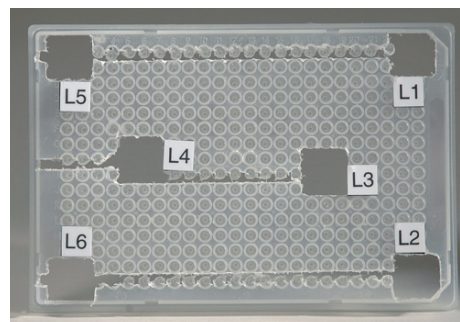


Figure 16 Left temperature verification plate

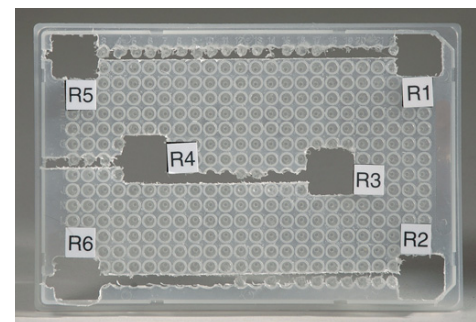


Figure 17 Right temperature verification plate

Note: The plates help you locate the probes within the sample blocks.

3. Use the stick end of a cotton swab to coat wells L1 to L6 and R1 to R6 with mineral oil; the wells are too small for the swab end.
4. Place the 20- μ L probe assembly into well L1.

Note: As the test progresses, move the 20- μ L probe assembly to each of the test wells (L1 to L6 and R1 to R6).

5. Thread the probe wire through the channels in the 384-well temperature verification plate to prevent damage to the probe and lead wires.
6. Make sure the probe is connected to the digital thermometer.
7. Press and release the red button to automatically close the heated cover.

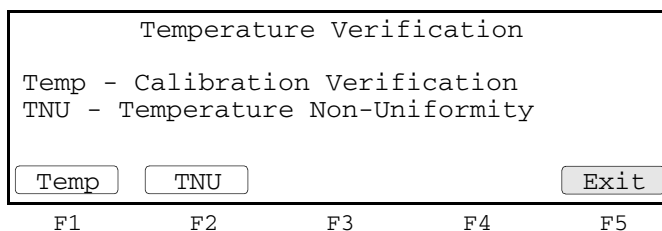
IMPORTANT! Seat the probe properly. If the probe wire is crushed when the heated cover closes, the probe may be damaged.

8. Power on the digital thermometer.

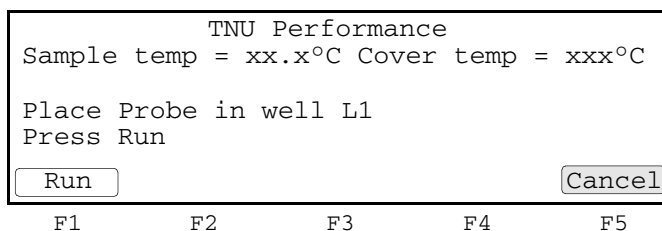
Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

Configuring the GeneAmp[®] 9700

1. Power on the thermal cycler. The Main menu opens.
For best results, allow the thermal cycler 15 to 30 minutes to warm up to ambient temperature before performing the test.
2. Press **F4** (Util). The Utilities screen opens.
3. Press **F1** (Diag). The Diagnostics screen opens.
4. Press **F3** (TmpVer). The Temperature Verification screen opens.



5. Press **F2** (TNU) to automatically configure the GeneAmp[®] 9700 for the temperature non-uniformity test. The TNU Performance screen opens.



Running the test

The temperature non-uniformity test uses the 20- μ L probe assembly to test the temperature uniformity of six different wells in each sample block.

Note: If necessary, press **F5** (Cancel) to exit the test.

To run the temperature non-uniformity test:

1. Press **F1** (Run) to start the temperature non-uniformity test. The TNU Performance screen opens with the setpoint value displayed.

TNU Performance				
Sample temp = xx.x°C Cover temp = xxx°C				
Setpoint is 94°C				
Sample must be within 1.0°C of setpoint				
				Cancel
F1	F2	F3	F4	F5

Note: The sample blocks must be within ± 1.0 °C of the setpoint. In addition, the cover must be within ± 1 °C of 105 °C. It may take several minutes for the GeneAmp® 9700 to ramp up.

2. Take a temperature reading.
 - a. The TNU Performance screen counts down the time until the setpoint is stable.

TNU Performance				
Sample temp = xx.x°C Cover temp = xxx°C				
Stabilizing at setpoint... x:xx				
				Cancel
F1	F2	F3	F4	F5

- b. When the “Stabilizing at setpoint” value decreases to 0, read the digital thermometer.

Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

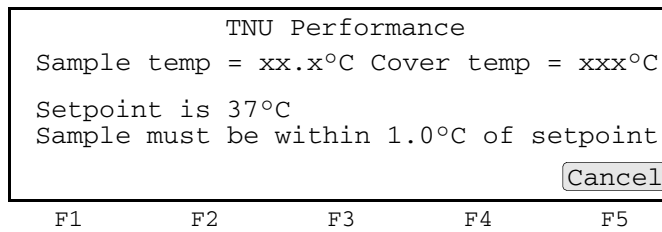
3. Using the numeric keys, enter the value that is displayed on the digital thermometer in the “Enter actual block temperature” field.

TNU Performance				
Sample temp = xx.x°C Cover temp = xxx°C				
Enter actual block temperature				00.0
				Cancel
F1	F2	F3	F4	F5

Note: The digital thermometer displays a four-digit value; round this off to three digits before typing it in the TNU Performance screen.

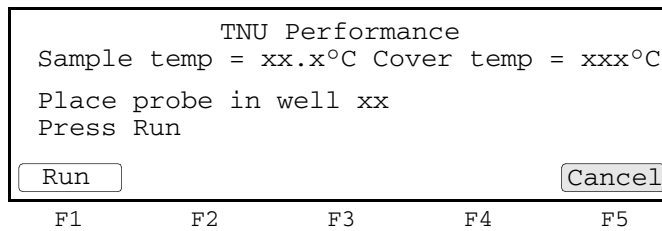
Note: To keep a permanent record of the test, record this value on the Temperature Non-Uniformity Test Data Sheet ([page 75](#)).

- Press **Enter**. The GeneAmp® 9700 automatically begins the second reading (37 °C setpoint). The TNU Performance screen opens with the setpoint value displayed.



Note: The sample blocks must be within ± 1.0 °C of the setpoint.

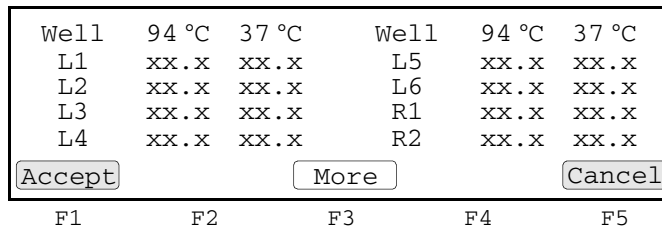
- Repeat [steps 2 and 3](#) and for the second reading.
- Press **Enter**. The TNU Performance screen opens with the following prompt:



- Press and release the red button to automatically open the heated cover. Repeat [steps 4 through 6](#) of “[Setting up the 20-µL probe assembly](#)” on [page 69](#) and [steps 1 through 6](#) of this procedure. Complete these steps for all 12 wells to be tested:

Left Sample Block	Right Sample Block
L1, L2, L3, L4, L5, and L6	R1, R2, R3, R4, R5, and R6

- The GeneAmp® 9700 evaluates the uniformity of the sample block temperature for the setpoint values that you entered and displays the results. A summary screen opens at the end of the test.



If you entered values on the Temperature Non-Uniformity Test Data Sheet, compare those values with the actual test results.

- Press **F1** (Accept). To interpret the results, see [“Evaluating the results”](#) on [page 73](#).

10. When you complete all measurements, be sure to:

- Press **F5** (Cancel).
- Remove the 20- μ L probe assembly from the sample blocks.
- Power off the digital thermometer, then clean off the oil.
- Remove the 384-well temperature verification plates from the sample blocks.

IMPORTANT! Make sure the sample blocks are at room temperature (~ 25 °C) before removing the reaction plates.

Evaluating the results

When the GeneAmp[®] 9700 completes the temperature non-uniformity test, the TNU Performance screen opens. See the table below to evaluate the results.

If the...	Then...
Temperature of the sample block wells is uniform	<p>“Pass” appears after each setpoint temperature.</p> <div data-bbox="797 751 1458 947" style="border: 1px solid black; padding: 5px; text-align: center;"> <p>TNU Performance</p> <p>TNU at 94°C is xx.xx - Pass TNU at 37°C is xx.xx - Pass</p> <p style="text-align: right;"><input type="button" value="Cancel"/></p> </div> <p style="text-align: center;">F1 F2 F3 F4 F5</p>
Temperature variation of the sample block wells exceeds performance specifications	<p>“Fail” appears after the setpoint temperature(s) for which the test failed.</p> <div data-bbox="797 1077 1458 1272" style="border: 1px solid black; padding: 5px; text-align: center;"> <p>TNU Performance</p> <p>TNU at 94°C is xx.xx - Fail TNU at 37°C is xx.xx - Fail</p> <p style="text-align: right;"><input type="button" value="Cancel"/></p> </div> <p style="text-align: center;">F1 F2 F3 F4 F5</p> <ul style="list-style-type: none"> • If the test fails, repeat the procedure to make sure that the thermometer was not misread or that data-entry errors were not made. • If the test fails again, contact Applied Biosystems Technical Support. See “How to obtain support” on page viii.

Data Sheet: Temperature Non-Uniformity Test

When running the temperature non-uniformity test, record the setpoint values for the wells listed on this data sheet. At the end of the test, compare the values that are displayed on the thermal cycler with the values that are recorded here.

Note: You can photocopy this page.

Date		
Tested by		
Probe serial no.		
Thermometer serial no.		
Setpoint value	94 °C	37 °C
L1		
L2		
L3		
L4		
L5		
L6		
R1		
R2		
R3		
R4		
R5		
R6		

Temperature Verification Tests for the GeneAmp® 9700, 0.5-mL Sample Block Module

7

This chapter covers:

Calibration verification test.	78
Temperature non-uniformity test.	83
Data Sheet: Calibration Verification Test	88
Data Sheet: Temperature Non-Uniformity Test.	89

Calibration verification test

Use the calibration verification test to verify the temperature calibration of your GeneAmp® PCR System 9700, 0.5-mL Sample Block Module. The calibration verification test consists of the following procedures, which you must perform in sequence:

Setting up the 0.5-mL probe assembly	78
Configuring the GeneAmp® 9700	79
Running the test	80
Evaluating the results	82

Required equipment

This test requires the 0.5-mL Sample Block Module Temperature Verification Kit (PN 4309924), which includes:

- Cotton swabs
- Light mineral oil
- GeneAmp® 0.5-mL temperature verification frame
- 0.5-mL probe assembly
- Digital thermometer Model 4500 with a 9V battery installed

Setting up the 0.5-mL probe assembly

1. If the heated cover is in the forward position, lift the lever, then slide the heated cover back.
2. Place the GeneAmp® 0.5-mL temperature verification frame on the sample block.
3. Use a cotton swab to coat well A6 with mineral oil.
4. Place the 0.5-mL probe assembly into well A6.
5. Thread the probe wire through the channel in the 0.5-mL temperature verification frame 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 you close the heated cover, the probe may be damaged.

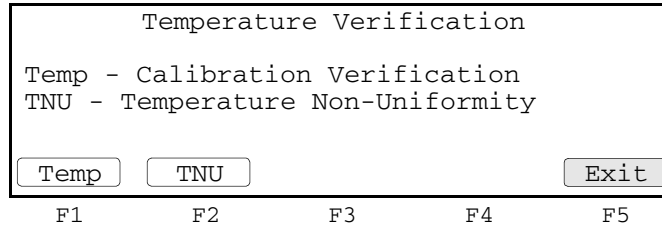
8. Power on the digital thermometer.

Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

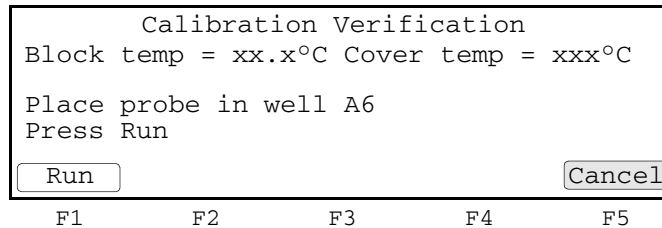
9. Continue with [“Configuring the GeneAmp® 9700” on page 79](#).

Configuring the GeneAmp® 9700

1. Complete the procedures in [“Setting up the 0.5-mL probe assembly” on page 78.](#)
2. Power on the thermal cycler. The Main menu opens.
For best results, allow the thermal cycler 15 to 30 minutes to warm up to ambient temperature before performing the test.
3. Press **F4** (Util). The Utilities screen opens.
4. Press **F1** (Diag). The Diagnostics screen opens.
5. Press **F3** (TmpVer). The Temperature Verification screen opens.



6. Press **F1** (Temp) to automatically configure the GeneAmp® 9700 for the calibration verification test. The Calibration Verification screen opens.



7. Continue with [“Running the test” on page 80.](#)

Running the test Use the digital thermometer to take temperature readings of the sample well that is connected to the 0.5-mL probe assembly. You must take readings at two different setpoint temperatures.

Note: If necessary, press **F5** (Cancel) to exit the test.

To run the calibration verification test:

1. Complete the procedures in “Configuring the GeneAmp® 9700” on page 79.
2. Press **F1** (Run) to start the calibration verification test. 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

F1 F2 F3 F4 F5

Note: The cover must be within ± 1 °C of 105 °C. It may take several minutes for the GeneAmp® 9700 to ramp up.

3. The Calibration Verification screen counts down the time until the setpoint is reached. When the “Stabilizing at setpoint” value decreases to 0, read the digital thermometer.

Calibration Verification

Block temp = xx.x°C Cover temp = xxx°C

Stabilizing at setpoint... x:xx

F1 F2 F3 F4 F5

Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

4. Using the numeric keys, enter the value that is displayed on the digital thermometer in the “Enter actual block temperature” field.

Calibration Verification

Block temp = xx.x°C Cover temp = xxx°C

Enter actual block temperature

F1 F2 F3 F4 F5

Note: The digital thermometer displays a four-digit value; round this off to three digits before typing it in the Calibration Verification screen.

Note: Record this value on the Calibration Verification Test Data Sheet (page 88) to keep a permanent record of the test.

- Press **ENTER**. The GeneAmp® 9700 automatically begins the second reading (45 °C setpoint). The Calibration Verification screen opens with the setpoint value displayed.

Calibration Verification

Block temp = xx.x°C Cover temp = xxx°C

Setpoint is 45°C
Cover must be within 30°C of 45°C

F1 F2 F3 F4 F5

Note: The cover must be within ± 1 °C of 105 °C.

- Repeat [steps 3](#) and [4](#) for the second reading.
- The GeneAmp® 9700 evaluates the calibration of the sample block temperature for the setpoint values that you entered and displays the results. A summary screen opens at the end of the test.

Calibration Verification

Actual temperature at 85 °C

Actual temperature at 45 °C

F1 F2 F3 F4 F5

If you entered values on the Calibration Verification Test Data Sheet, compare those values with the actual test results.

- Press **F1** (Accept). To interpret the results, see [“Evaluating the results” on page 82](#).
- When you complete all measurements, be sure to:
 - Press **Exit**.
 - Remove the 0.5-mL probe assembly from the sample block.
 - Power off the digital thermometer, then clean off the oil.
 - Remove the 0.5-mL temperature verification frame from the sample block.



WARNING 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 GeneAmp® 9700 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	<p>Calibration Verification screen displays the following message:</p> <div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>Calibration Verification</p> <p>Calibration is good</p> <p style="text-align: right;"><input type="button" value="Exit"/></p> </div> <p style="text-align: center;">F1 F2 F3 F4 F5</p>
Does not pass the calibration verification test	<p>Calibration Verification screen displays the following message:</p> <div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>Calibration Verification</p> <p>Instrument may require service. Contact Applied Biosystems Technical Support.</p> <p style="text-align: right;"><input type="button" value="Exit"/></p> </div> <p style="text-align: center;">F1 F2 F3 F4 F5</p> <ul style="list-style-type: none"> • If the test fails, repeat the procedure to make sure that the thermometer was not misread or that data-entry errors were not made. • If the test fails again, contact Applied Biosystems Technical Support. See "How to obtain support" on page viii.

Temperature non-uniformity test

Use this test to verify the temperature uniformity of the GeneAmp® PCR System 9700, 0.5-mL Sample Block Module. The temperature non-uniformity test consists of the following procedures, which you must perform in sequence:

Setting up the 0.5-mL probe assembly	83
Running the test.....	84
Evaluating the results	87

Required equipment

This test requires the 0.5-mL Sample Block Module Temperature Verification Kit (PN 4309924), which includes:

- Cotton swabs
- Light mineral oil
- GeneAmp® 0.5-mL temperature verification frame
- 0.5-mL probe assembly
- Digital thermometer Model 4500 with a 9V battery installed

Setting up the 0.5-mL probe assembly

1. If the heated cover is in the forward position, lift the lever, then slide the heated cover back.
2. Place the GeneAmp® 0.5-mL thermal insulation frame on the sample block.
3. Use a cotton swab to coat the following wells with mineral oil:
A1, A6, A10, B3, C5, C10, D1, D7, E8, F1, F5, F10
4. Place the 0.5-mL probe assembly into well A1.

Note: As the test progresses, you move the 0.5-mL probe assembly to each of the test wells.

5. Thread the probe wire through the channel in the 0.5-mL temperature verification frame 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 you close the heated cover, the probe may be damaged.

8. Power on the digital thermometer.

Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

9. Continue with “[Configuring the GeneAmp® 9700](#)” below.

Configuring the GeneAmp® 9700

1. Complete the procedures in “[Setting up the 0.5-mL probe assembly](#)” above.
2. Power on the thermal cycler. The Main menu opens.

For best results, allow the thermal cycler 15 to 30 minutes to warm up to ambient temperature before performing the test.

3. Press **F4** (Util). The Utilities screen opens.
4. Press **F1** (Diag). The Diagnostics screen opens.
5. Press **F3** (TmpVer). The Temperature Verification screen opens.

```

Temperature Verification
Temp - Calibration Verification
TNU - Temperature Non-Uniformity

Temp      TNU      Exit
F1        F2        F3        F4        F5

```

6. Press **F2** (TNU) to automatically configure the GeneAmp® 9700 for the temperature non-uniformity test. The TNU Performance screen opens.

```

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

```

7. Continue with [“Running the test”](#) below.

Running the test

The temperature non-uniformity test uses the 0.5-mL probe assembly to test the temperature uniformity of 12 different wells in the sample block.

Note: If necessary, press **F5** (Cancel) to exit the test.

To run the temperature non-uniformity test:

1. Complete the procedures in [“Setting up the 0.5-mL probe assembly”](#) above.
2. Press **F1** (Run) to start the temperature non-uniformity test. The TNU Performance screen opens with the setpoint value displayed.

```

TNU Performance
Sample temp = xx.x°C Cover temp = xxx°C

Setpoint is 94°C
Sample must be within 1.0°C of setpoint

Cancel
F1        F2        F3        F4        F5

```

Note: The sample block must be within ± 1.0 °C of the setpoint. In addition, the cover must be within ± 1 °C of 105 °C. It may take several minutes for the GeneAmp® 9700 to ramp up.

- The TNU Performance screen counts down the time until the setpoint is stable. When the “Stabilizing at setpoint” value decreases to 0, read the thermometer.

TNU Performance

Sample temp = xx.x°C Cover temp = xxx°C
Stabilizing at setpoint... x:xx

F1 F2 F3 F4 F5

Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

- Using the numeric keys, enter the value that is displayed on the digital thermometer in the “Enter actual block temperature” field.

TNU Performance

Sample temp = xx.x°C Cover temp = xxx°C
Enter actual block temperature

F1 F2 F3 F4 F5

Note: The digital thermometer displays a four-digit value; round this off to three digits before you enter it in the TNU Performance screen.

Note: Record this value on the Temperature Non-Uniformity Test Data Sheet (page 89) to keep a permanent record of the test.

- Press **ENTER**. The GeneAmp® 9700 automatically begins the second reading (37 °C setpoint). The TNU Performance screen opens with the setpoint value displayed.

TNU Performance

Sample temp = xx.x°C Cover temp = xxx°C
Setpoint is 37°C
Sample must be within 1.0°C of setpoint

F1 F2 F3 F4 F5

Note: The sample block must be within ± 1.0 °C of the setpoint.

- Repeat [steps 3](#) and [4](#) for the second reading.
- Press **ENTER**. The TNU Performance screen opens with the following prompt:

TNU Performance

Sample temp = xx.x°C Cover temp = xxx°C
Place probe in well xx
Press Run

F1 F2 F3 F4 F5

8. Slide the heated cover back, and repeat [steps 4 through 7](#) of “[Setting up the 0.5-mL probe assembly](#)” on [page 83](#) and [steps 2 through 7](#) of this procedure. Complete these steps for all 12 wells to be tested:
A1, A6, A10, B3, C5, C10, D1, D7, E8, F1, F5, and F10
9. The GeneAmp® 9700 evaluates the uniformity of the sample block temperature for the setpoint values that you entered and displays the results. A summary screen opens at the end of the test.

Well	94 °C	37 °C	Well	94 °C	37 °C
A1	xx.x	xx.x	C5	xx.x	xx.x
A6	xx.x	xx.x	C10	xx.x	xx.x
A10	xx.x	xx.x	D1	xx.x	xx.x
B3	xx.x	xx.x	D7	xx.x	xx.x

F1
F2
F3
F4
F5

If you entered values on the Temperature Non-Uniformity Test Data Sheet, compare those values with the actual test results.

10. Press **F1** (Accept). To interpret the results, see “[Evaluating the results](#)” on [page 87](#).
11. When you complete all measurements, be sure to:
 - Press **Cancel**.
 - Remove the 0.5-mL probe assembly from the sample block.
 - Power off the digital thermometer, then clean off the oil.
 - Remove the 0.5-mL temperature verification frame from the sample block.

IMPORTANT! Make sure the sample block is at room temperature (~25 °C) before removing the frame.

Evaluating the results

When the GeneAmp® 9700 completes the temperature non-uniformity test, the TNU Performance screen opens. See the table below to evaluate the results.

If the...	Then...
Temperature of the sample block wells is uniform	<p>“Pass” appears after each setpoint temperature.</p> <div data-bbox="802 411 1464 604" style="border: 1px solid black; padding: 5px; text-align: center;"> <p>TNU Performance</p> <p>TNU at 94°C is xx.xx - Pass</p> <p>TNU at 37°C is xx.xx - Pass</p> <p style="text-align: right;"><input type="button" value="Cancel"/></p> </div> <p style="text-align: center;">F1 F2 F3 F4 F5</p>
Temperature variation of the sample block wells exceeds performance specifications	<p>“Fail” appears after the setpoint temperature(s) for which the test failed.</p> <div data-bbox="802 735 1464 928" style="border: 1px solid black; padding: 5px; text-align: center;"> <p>TNU Performance</p> <p>TNU at 94°C is xx.xx - Fail</p> <p>TNU at 37°C is xx.xx - Fail</p> <p style="text-align: right;"><input type="button" value="Cancel"/></p> </div> <p style="text-align: center;">F1 F2 F3 F4 F5</p> <ul style="list-style-type: none"> • If the test fails, repeat the procedure to make sure that the thermometer was not misread or that data-entry errors were not made. • If the test fails again, contact Applied Biosystems Technical Support. See “How to obtain support” on page viii.

Data Sheet: Temperature Non-Uniformity Test

When running the temperature non-uniformity test, record the setpoint values for the wells listed on this data sheet. At the end of the test, compare the values that are displayed on the thermal cycler with the values that are recorded here.

Note: You can photocopy this page.

Date		
Tested by		
Probe serial no.		
Thermometer serial no.		
Setpoint value	94 °C	37 °C
A1		
A6		
A10		
B3		
C5		
C10		
D1		
D7		
E8		
F1		
F5		
F10		

Temperature Verification Tests for the GeneAmp[®] 9800

8

This chapter covers:

Calibration verification test.	92
Temperature non-uniformity test.	97
Data Sheet: Calibration Verification Test	103
Data Sheet: Temperature Non-Uniformity Test.	104

Calibration verification test

Use the calibration verification test to verify the temperature calibration of your Applied Biosystems GenAmp 9800 Fast Thermal Cycler with 96-Well Aluminum Sample Block Module. The calibration verification test consists of the following procedures, which you must perform in sequence:

Setting up the 0.1-mL probe assembly	92
Configuring the GeneAmp® 9800	93
Running the test	93
Evaluating the results	96

Required equipment

This test requires the following items in your Temperature Verification kit (PN 4351630):

- Digital thermometer Model 4500 with a 9V battery installed
- Cotton swabs
- Light mineral oil
- 0.1-mL temperature verification probe assembly

Setting 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. 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 you close the heated cover, the probe may be damaged.

8. Power on the digital thermometer.

Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

9. Continue with “Configuring the GeneAmp® 9800” on page 93.

Configuring the GeneAmp® 9800

1. Complete the procedures in “[Setting up the 0.1-mL probe assembly](#)” on page 92.
2. Power on the GeneAmp® 9800.
For best results, allow the thermal cycler 15 to 30 minutes to warm up to ambient temperature before performing the test.
3. When the main menu opens, press **Util** to open the Utilities screen.
4. Press **Diag** to open the Diagnostics screen.

```

Diagnostics
Hard   - Hardware Diagnostics
System - System Performance Test s
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 **F3** (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 **F1** (Temp). This action opens the Calibration Verification screen and configures the GeneAmp® 9800 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](#)” below.

Running the test

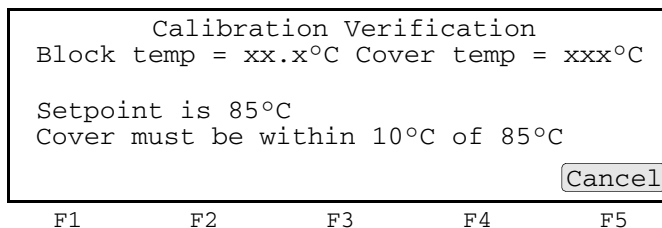
Use the digital thermometer to take temperature readings of the sample well that is connected to the 0.1-mL probe assembly. You take a reading at each of two setpoint temperatures.

Note: If necessary, press **F5** (Cancel) to exit the test.

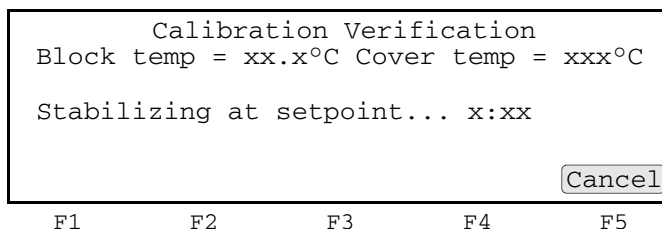
To run the calibration verification test:

1. Complete the procedures in “[Configuring the GeneAmp® 9800](#)” above.

- Press **F1** (Run) to start the calibration verification test. The Calibration Verification screen opens with the setpoint value displayed.



The Calibration Verification screen counts down the time until the setpoint is reached.

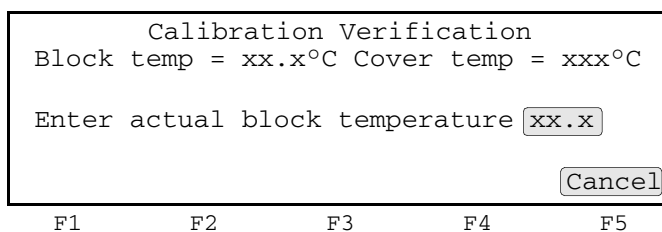


Note: The cover must be within ± 10 °C of 85 °C. It may take several minutes for the GeneAmp® 9800 to ramp up.

- When the “Stabilizing at setpoint” value decreases to 0, read the digital thermometer.

Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

- Using the numeric keys, enter the value that is displayed on the digital thermometer into the “Enter actual block temperature” field.



Note: Round the four-digit value on the digital thermometer to three digits before you enter it into the Calibration Verification screen.

Note: You can record this value on the Calibration Verification Test Data Sheet ([page 103](#)) to keep a permanent record of the test.

5. Press **Enter**. The GeneAmp® 9800 begins the second reading (45 °C setpoint), and the Calibration Verification screen opens with the setpoint value displayed.

Calibration Verification				
Block temp = xx.x°C Cover temp = xxx°C				
Setpoint is 45°C				
Cover must be within 30°C of 45°C				
				Cancel
F1	F2	F3	F4	F5

Note: The cover must be within ± 30 °C of 45 °C.

6. Repeat [steps 3](#) and [4](#) for the second reading.

The GeneAmp® 9800 evaluates the calibration of the sample block temperature for the setpoint values that you entered and displays the results. A summary screen opens at the end of the test.

Calibration Verification				
Actual temperature at 85 °C				
				xx.x
Actual temperature at 45 °C				
				xx.x
Accept		Cancel		
F1	F2	F3	F4	F5

If you entered values on the Calibration Verification Test Data Sheet, compare those values with the actual test results.

7. Press (**F1**) Accept. To interpret the results, see [“Evaluating the results” on page 96](#).
8. When you complete all measurements, be sure to:
- Press **Exit**.
 - Remove the 0.1-mL probe assembly from the sample blocks.
 - Power off the digital thermometer, then clean off the oil.
 - Remove the 0.1-mL temperature verification probe assembly from the sample blocks.



WARNING 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 GeneAmp® 9800 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	<p>Calibration Verification screen displays the following message:</p> <div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>Calibration Verification</p> <p>Calibration is good</p> <p style="text-align: right;"><input type="button" value="Exit"/></p> </div> <p style="text-align: center;">F1 F2 F3 F4 F5</p>
Does not pass the calibration verification test	<p>Calibration Verification screen displays the following message:</p> <div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>Calibration Verification</p> <p>Instrument may require service. Contact Applied Biosystems Technical Support.</p> <p style="text-align: right;"><input type="button" value="Exit"/></p> </div> <p style="text-align: center;">F1 F2 F3 F4 F5</p> <ul style="list-style-type: none"> • If the test fails, repeat the procedure to make sure that the thermometer was not misread or that data-entry errors were not made. • If the test fails again, contact Applied Biosystems Technical Support. See “How to obtain support” on page viii.

Temperature non-uniformity test

Use this test to verify the temperature uniformity of the Applied Biosystems GeneAmp® 9800 Fast Thermal Cycler with 96-Well Aluminum Sample Block Module. The temperature non-uniformity test consists of the following procedures, which you must perform in sequence:

Setting up the 0.1-mL probe assembly	97
Configuring the GeneAmp® 9800	98
Running the test	99
Evaluating the results	102

Required equipment

This test requires the following items in your Temperature Verification Kit:

- Digital thermometer Model 4500 with a 9V battery installed
- Cotton swabs
- Light mineral oil
- 0.1-mL temperature verification probe assembly

Setting 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.
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 you close the heated cover, the probe may be damaged.

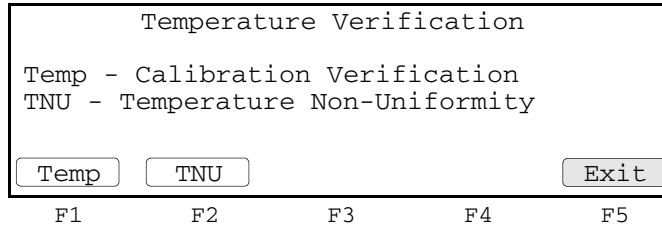
8. Power on the digital thermometer.

Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

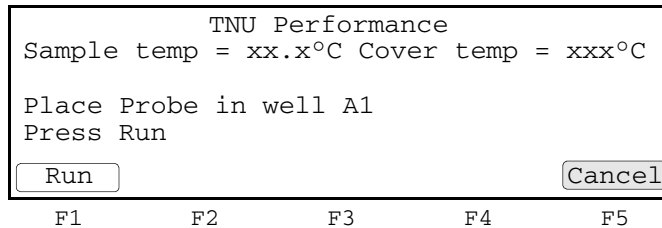
9. Continue with [“Configuring the GeneAmp® 9800” on page 98](#).

Configuring the GeneAmp® 9800

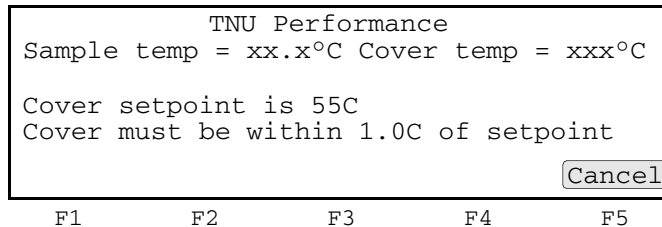
1. Complete the procedures in “[Setting up the 0.1-mL probe assembly](#)” on page 97.
2. Power on the GeneAmp® 9800.
For best results, allow the thermal cycler 15 to 30 minutes to warm up to ambient temperature before performing the test.
3. In the main menu, press **F4** (Util) to open the Utilities screen.
4. Press **F1** (Diag) to open the Diagnostics screen.
5. Press **F3** (TmpVer) to open the Temperature Verification screen.



6. Press **F2** (TNU) to open the TNU Performance screen and configure the 9800 for the temperature non-uniformity test.



Note: If the cover temperature is not within ± 1 °C of the heated cover setpoint, the following screen opens:



7. Continue with “[Running the test](#)” on page 99.

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 **F5** (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 97](#).
2. Press **F1** (Run) to start the temperature non-uniformity test. The TNU Performance screen opens with the setpoint value displayed.

TNU Performance				
Sample temp = xx.x°C Cover temp = xxx°C				
Setpoint is 55°C				
Sample must be within 1.0°C of setpoint				
Run				Cancel
F1	F2	F3	F4	F5

The TNU Performance screen counts down the time until the setpoint is stable.

TNU Performance				
Sample temp = xx.x°C Cover temp = xxx°C				
Stabilizing at setpoint... x:xx				
				Cancel
F1	F2	F3	F4	F5

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 GeneAmp® 9800 to ramp up.

3. When the TNU Performance screen opens to display the setpoint temperature, press **F5** (Cancel).

TNU Performance				
Sample temp = xx.x°C Cover temp = xxx°C				
Setpoint is 55°C				
Sample must be 1.0°C of setpoint				
				Cancel
F1	F2	F3	F4	F5

4. When the “Stabilizing at setpoint” value decreases to 0, read the digital thermometer.

Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

- Using the numeric keys, enter the value that is displayed on the digital thermometer into the “Enter actual block temperature” field.

TNU Performance

Sample temp = xx.x°C Cover temp = xxx°C

Enter actual block temperature

F1 F2 F3 F4 F5

Note: Round the four-digit value on the digital thermometer to three digits before you enter it in the TNU Performance screen.

Note: You can record this value on the Temperature Non-Uniformity Test Data Sheet ([page 104](#)) to keep a permanent record of the test.

- Press **Enter** to open the TNU Performance screen with the setpoint value displayed.

TNU Performance

Sample temp = xx.x°C Cover temp = xxx°C

Setpoint is 55°C

Sample must be within 1.0°C of setpoint

F1 F2 F3 F4 F5

Note: The sample blocks must be within ± 1.0 °C of the setpoint.

- Press **Enter**. The TNU Performance screen opens with the following prompt:

TNU Performance

Sample temp = xx.x°C Cover temp = xxx°C

Place probe in well xx

Press Run

F1 F2 F3 F4 F5

8. Slide the heated cover back, and repeat [steps 4 through 8](#) of “[Setting up the 0.1-mL probe assembly](#)” on page 97 and [steps 2 through 7](#) of this procedure at 50 °C. Complete these steps for all eight wells to be tested:

A1, A12, C4, C9, F4, F9, H1, and H12

The following screen opens:

TNU Performance				
Sample temp = xx.x°C Cover temp = xxx°C				
Place probe in well A1				
Press Run				
<input type="button" value="Run"/>				<input type="button" value="Cancel"/>
F1	F2	F3	F4	F5

The GeneAmp® 9800 then sets the heated cover setpoint to 105 °C.

9. Slide the heated cover back, then repeat [steps 4 through 8](#) of “[Setting up the 0.1-mL probe assembly](#)” on page 97 and [steps 2 through 7](#) of this procedure at 95 °C for all eight wells being tested:

A1, A12, C4, C9, F4, F9, H1, and H12

10. When the TNU Performance screen opens to display the setpoint temperature, press **F5** (Cancel).

TNU Performance				
Sample temp = xx.x°C Cover temp = xxx°C				
Setpoint is 105°C				
Sample must be 1.0°C of setpoint				
				<input type="button" value="Cancel"/>
F1	F2	F3	F4	F5

The GeneAmp® 9800 evaluates the uniformity of the sample block temperature for the setpoint values that you entered and displays the results. A summary screen opens at the end of the test.

Well	95 °C	55 °C	Well	95 °C	55 °C
A1	xx.x	xx.x	F4	xx.x	xx.x
A12	xx.x	xx.x	F9	xx.x	xx.x
C4	xx.x	xx.x	H1	xx.x	xx.x
C9	xx.x	xx.x	H12	xx.x	xx.x
<input type="button" value="Accept"/>			<input type="button" value="Cancel"/>		
F1	F2	F3	F4	F5	

If you entered values on the Temperature Non-Uniformity Test Data Sheet, compare those values with the actual test results.

11. Press **F1** (Accept). To interpret the results, see [“Evaluating the results”](#) on page 102.

12. When you complete all measurements:
 - a. Press **F5** (Cancel).
 - b. Remove the 0.1-mL probe assembly from the sample blocks.
 - c. Power off the digital thermometer, then 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 GeneAmp® 9800 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	<p>“Pass” appears after each setpoint temperature.</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p style="text-align: center;">TNU Performance</p> <p style="text-align: center;">TNU at 95°C is xx.xx - Pass TNU at 55°C is xx.xx - Pass</p> <p style="text-align: right;">Cancel</p> </div> <p style="text-align: center;">F1 F2 F3 F4 F5</p>
Temperature variation of the sample block wells exceeds performance specifications	<p>“Fail” appears after the setpoint temperature(s) for which the test failed.</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p style="text-align: center;">TNU Performance</p> <p style="text-align: center;">TNU at 95°C is xx.xx - Fail TNU at 55°C is xx.xx - Fail</p> <p style="text-align: right;">Cancel</p> </div> <p style="text-align: center;">F1 F2 F3 F4 F5</p> <ul style="list-style-type: none"> If the test fails, repeat the procedure to make sure that the thermometer was not misread or that data-entry errors were not made. If the test fails again, contact Applied Biosystems Technical Support. See “How to obtain support” on page viii.

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 test, compare the values that are displayed on the thermal cycler with the values that are recorded here.

Note: You can photocopy this page.

Date		
Tested by		
Probe serial no.		
Thermometer serial no.		
Setpoint value	95 °C	55 °C
A1		
A12		
C4		
C9		
F4		
F9		
H1		
H12		

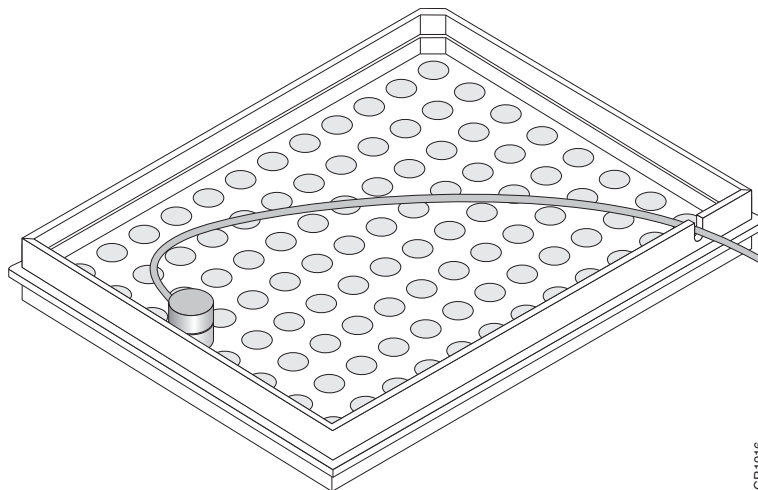
This chapter covers:

Overview	106
Calibration verification test.	107
Temperature non-uniformity test.	111
Data Sheet: Calibration Verification Test	114
Data Sheet: Temperature Non-Uniformity Test.	115

Overview

Materials When you perform temperature verification tests on the GeneAmp® 9600, you use the materials provided in your kit.

Assembly [Figure 18](#) shows a properly assembled system. The frame is positioned around the wells with the channel facing you, and the probe wire is threaded through the channel to prevent damaging the wire when the thermal cycler heated cover is closed.



GR1916

Figure 18 The Temperature Verification System for GeneAmp® 9600

Calibration verification test

Use this test to verify the temperature calibration of your GeneAmp® 9600. The calibration verification test consists of the following procedures, which you must perform in sequence:

Setting up the 0.2-mL probe assembly	107
Running the test.....	108
Calculating test results.....	109
Ending the test.....	110



WARNING PHYSICAL INJURY HAZARD. Hot Surface. Use care when working around the heated cover and sample block to avoid being burned by hot components.

Required equipment

This test requires the 0.2-mL Temperature Verification Kit (PN 4317939), which includes:

- Cotton swabs
- Light mineral oil
- 9600 temperature verification frame
- 0.2-mL probe assembly
- Model 4500 digital thermometer with a 9V battery installed

Setting up the 0.2-mL probe assembly

1. If the heated cover is in the forward position, turn the knob counterclockwise completely, then slide the heated cover back.
2. Place the 9600 temperature verification frame on the sample block.
3. Using a cotton swab, coat well E1 with mineral oil.
4. Place the 0.2-mL probe assembly into well E1.
5. Thread the probe wire through the channel in the 9600 temperature verification frame to prevent damage to the probe and lead wires (see [Figure 18 on page 106](#)).
6. Make sure the probe is connected to the digital thermometer.
7. Slide the heated cover forward, then turn the cover knob clockwise until the white mark on the knob is aligned with the white mark on the cover.

IMPORTANT! Seat the probe properly and then close the heated cover carefully. If the probe wire is crushed when you close the cover, the probe can be damaged.

8. Power on the digital thermometer.

Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

Running the test

1. Power on the GeneAmp® 9600. The Main menu opens.
For best results, allow the thermal cycler 15 to 30 minutes to warm up to ambient temperature before performing the test.
2. Press the **OPTION** key three times to move the pointer to **UTIL**, then press **ENTER**. The Utilities menu opens.

```
Select Function
DIR-CONFIG-DIAG-DEL
```

3. Press the **OPTION** key twice to move the pointer to **DIAG**, then press **ENTER**. The following menu opens:

```
Enter Diag Test #1
REVIEW History file
```

4. Press **5**, then press **ENTER** to run the Verify Calibration Diagnostic Test (Test #5).

Note: To ensure maximum accuracy, the temperatures of the heated cover and the sample block are the same in this test. This condition prevents the heated cover from affecting the accuracy of the probe assembly.

The temperature of the sample block and heated cover increases to 40 °C, and the following display opens:

```
Going to 40°C...
Cvr = xx°C Blk = xx.x°C
```

This display shows the current temperature of the block cover (Cvr = xx°C) and sample block (Blk = xx.x°C).

When the temperature of the block cover is within ± 10 °C of the sample block temperature, the following display opens:

```
Wait 3 minutes
Time=MM:SS Blk=40.0C
```

This display shows the current sample block temperature (“Blk=40.0C”) and a clock that counts up from 0 in minutes and seconds (“Time=MM:SS”).

When the clock reaches 3 minutes, the following display opens:

```
Record Temperature
Time=MM:SS Blk=95.0C
```

5. Measure the temperature of well E1 using the digital thermometer. Record this temperature as T(40).

6. Press **ENTER**.

The temperature of the sample block and heated cover go to 95 °C, and the following display opens:

```
Going to 95°C...
Cvr = xx°C Blk = xx.x°C
```

This display shows the current temperature of the block cover (Cvr = xx°C) and sample block (Blk = xx.x°C).

When the temperature of the block cover is within ± 10 °C of the sample block temperature, the following display opens:

```
Wait 3 Minutes
Time=MM:SS Blk=95.0°C
```

This display shows the current sample block temperature (“Blk=95.0°C”) and a clock that counts up from 0 in minutes and seconds (“Time=MM:SS”).

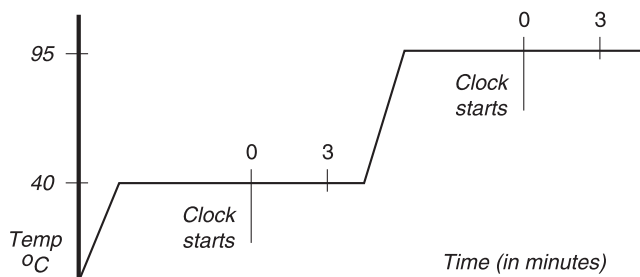
When the clock reaches 3 minutes, the following display opens:

```
Record Temperature
Time=MM:SS Blk=95.0°C
```

7. Measure the temperature of well E1 using the digital thermometer. Record this temperature as T(95).

IMPORTANT! To end the test at any time, press the **STOP** key. This returns you to the “Review History File” display. Press **5**, then press **ENTER** to return to the Verify Calibration Diagnostic test.

The figure below shows temperatures during the calibration verification test.



Calculating test results

Use the following information to calculate the results of the test. Refer to the calibration label in your user manual for the High and Low Offset values.

Note: If there is more than one GeneAmp® 9600 in your laboratory, verify that the serial number on the calibration label matches the serial number on the instrument that you are testing.

Average block temperature at the 95 °C hold

Use the following formula to calculate the average block temperature at the 95 °C hold:

$$\text{Block Average at 95 °C} = T(95) - \text{High Offset}$$

If the block average is more than 0.75 degrees Celsius above or below 95 °C, your GeneAmp® 9600 must be recalibrated.

For example:

If the measured temperature of well E1 is 95.2 °C, and the High Offset that is printed on your calibration label is -0.1, you would make the following calculation:

$$\text{Block Average at 95 °C} = 95.2 - (-0.1) = 95.3 \text{ °C}$$

In this example, because 95.3 °C does not differ by ± 0.75 degrees Celsius from the programmed target temperature, your instrument would not need to be recalibrated.

Note: The offset is the number of degrees Celsius that the temperature of well E1 differed from the average temperature of the block when the instrument was calibrated at the factory.

Average block temperature at the 40 °C hold

Use the following formula to calculate the average block temperature at the 40 °C hold:

$$\text{Block Average at 40 °C} = T(40) - \text{Low Offset}$$

If the block average is more than 0.75 degrees Celsius above or below 40 °C, your GeneAmp® 9600 must be recalibrated.

For example:

If the measured temperature of well E1 is 39.9 °C, and the Low Offset that is printed on your calibration label is +0.1, you would make the following calculation:

$$\text{Block Average at 40 °C} = 39.9 - (+0.1) = 39.8 \text{ °C}$$

In this example, because 39.8 °C does not differ by ± 0.75 degrees Celsius from the programmed target temperature, your instrument would not need to be recalibrated.

Ending the test

1. Remove the 0.2-mL probe assembly from the sample block.
2. Power off the digital thermometer, then clean off the oil.
3. Wait for the sample block to reach room temperature (~ 25 °C), then remove the 9600 temperature verification frame from the sample block.



WARNING PHYSICAL INJURY HAZARD. Hot Surface. Use care when working around the heated cover and sample block to avoid being burned by hot components.

4. Clean the oil off the sample block.

Temperature non-uniformity test

Use this test to verify the temperature uniformity of the GeneAmp® 9600. The temperature non-uniformity test consists of the following procedures, which you must perform in sequence:

Setting up the 0.2-mL probe assembly	111
Running the test.....	111
Calculating test results.....	113
Ending the test.....	113



WARNING PHYSICAL INJURY HAZARD. Hot Surface. Use care when working around the heated cover and sample block to avoid being burned by hot components.

Required equipment

This test requires the 0.2-mL Temperature Verification Kit (PN 4317939), which includes:

- Cotton swabs
- Light mineral oil
- 9600 temperature verification frame
- 0.2-mL probe assembly
- Model 4500 digital thermometer with a 9V battery installed

Setting up the 0.2-mL probe assembly

1. If the heated cover is in the forward position, turn the knob completely counterclockwise, then slide the heated cover back.
2. Using a cotton swab, coat the following wells with mineral oil:
A1, A4, A8, A12, C1, C4, C8, C12, E1, E4, E8, E12, H1, H4, H8, H12
3. Place the 9600 temperature verification frame on the sample block with the channel facing the front of the instrument.
4. Place the 0.2-mL probe assembly into well A1.
5. Thread the probe wire through the channel in the 9600 temperature verification frame to prevent damage to the probe and lead wires. Make sure the probe is connected to the digital thermometer (see [Figure 18 on page 106](#)).
6. Slide the heated cover forward, then turn the cover knob clockwise until the white mark on the knob is aligned with the white mark on the cover.

IMPORTANT! Seat the probe properly and close the heated cover carefully. If the probe wire is crushed when you close the heated cover, the probe can be damaged.

7. Power on the digital thermometer.

Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.

Running the test

1. Power on the GeneAmp® 9600.

For best results, allow the thermal cycler 15 to 30 minutes to warm up to ambient temperature before performing the test.

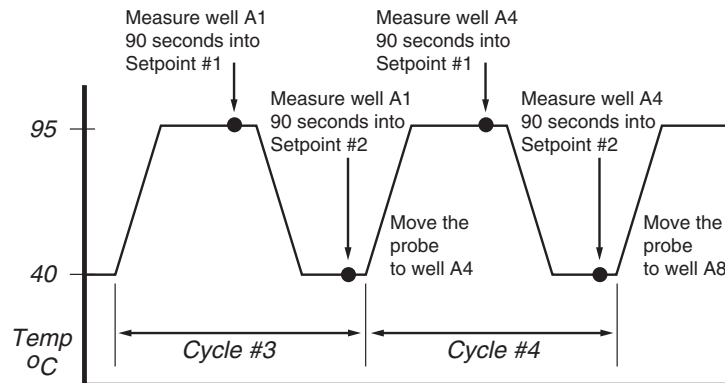
2. Set up a two-temperature CYCL program with the following parameters:
 - Setpoint #1 Temperature = **95 °C**
 - Hold Time = **2:00** minutes
 - Ramp Time = **0:00** minutes

 - Setpoint #2 Temperature = **40 °C**
 - Hold Time = **2:00** minutes
 - Ramp Time = **0:00** minutes
 - Cycles = **99**

Note: Refer to the *GeneAmp® PCR System 9600 User's Manual* (PN 0093-8660) for details on how to set up a CYCL program.

3. On the third cycle, measure the temperature of well A1 90 seconds into Setpoint #1 (95 °C setpoint temperature) using the digital thermometer. The time-remaining clock on the run-time display reads "0:30" (30 seconds). Record this temperature.
4. Again on the third cycle, measure the temperature of well A1 90 seconds into Setpoint #2 (40 °C setpoint temperature) using the digital thermometer. The time-remaining clock on the run-time display reads "0:30" (30 seconds). Record this temperature.

The figure below shows when to measure the temperatures.



5. After you measure the second temperature of well A1, turn the cover knob completely counterclockwise, then slide the heater cover back.
6. Move the probe assembly to the next well to be measured.
7. Slide the heater cover forward, then turn the cover knob clockwise until the white mark on the knob and the white mark on the cover are aligned.
8. Repeat the measurements on wells A4, A8, A12, C1, C4, C8, C12, E1, E4, E8, E12, H1, H4, H8, H12.

Note: The temperature display on the digital thermometer may not match the temperature display on the GeneAmp® 9600 because the heated sample block cover affects the probe temperature. If you suspect any temperature calibration problems, perform the calibration verification test that is described on [page 107](#).

Calculating test results

Use the following information to calculate the results of the test.

Note: If there is more than one GeneAmp® 9600 in your laboratory, verify that the serial number on the calibration label matches the serial number on the instrument that you are testing.

For the 16 Setpoint #1 measurements (95 °C hold), subtract the lowest measured temperature from the highest measured temperature.

For the 16 Setpoint #2 measurements (40 °C hold), subtract the lowest measured temperature from the highest measured temperature.

If *either* result is more than ± 1 °C from the setpoint, your GeneAmp® 9600 must be serviced by an Applied Biosystems service representative.

Ending the test

1. Remove the 0.2-mL probe assembly from the sample block.
2. Power off the digital thermometer, then clean off the oil.
3. Wait for the sample block to reach room temperature (~ 25 °C), then remove the 9600 temperature verification frame from the sample block.



WARNING PHYSICAL INJURY HAZARD. Hot Surface. Use care when working around the heated cover and sample block to avoid being burned by hot components.

4. Clean the oil off the sample block.

Data Sheet: Temperature Non-Uniformity Test

When you run the temperature non-uniformity test, record the setpoint values for the wells listed on this data sheet. At the end of the test, compare the values that are displayed on the thermal cycler with the values that are recorded here.

Note: You can photocopy this page.

Date		
Tested by		
Probe serial no.		
Thermometer serial no.		
Setpoint value	95 °C	40 °C
A1		
A4		
A8		
A12		
C1		
C4		
C8		
C12		
E1		
E4		
E8		
E12		
H1		
H4		
H8		
H12		

This chapter covers:

Overview	118
Calibration verification test.	119
Temperature non-uniformity test.	123
Data Sheet: Calibration Verification Test	127
Data Sheet: Temperature Non-Uniformity Test.	128

Overview

Materials When you perform temperature verification tests on the Veriti[®] Thermal Cycler, you use the materials provided in your kit.

Assembly [Figure 19](#) shows a properly assembled system. The frame is positioned around the wells with the channel facing you, and the probe wire is threaded through the channel to prevent damaging the wire when the thermal cycler heated cover is closed.

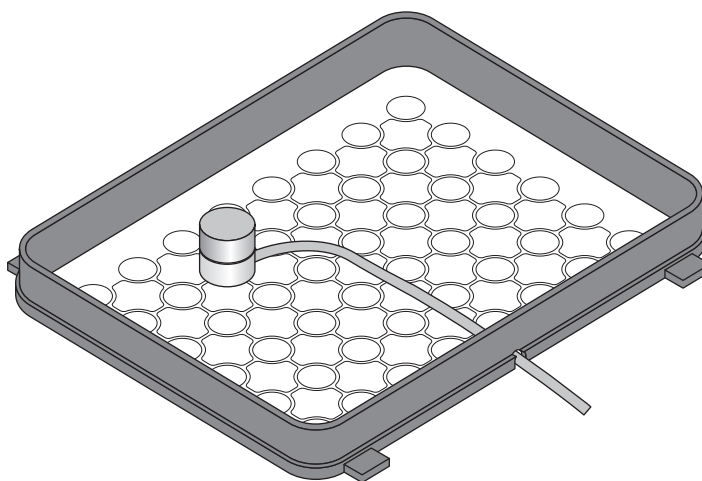


Figure 19 The Temperature Verification System for Veriti[®] Thermal Cycler

Calibration verification test

Use this test to verify the temperature calibration of your Veriti® Thermal Cycler. The calibration verification test consists of the following procedures, which you must perform in sequence:

Setting up the 0.5-mL probe assembly	119
Running the test.....	121
Ending the test.....	122



WARNING PHYSICAL INJURY HAZARD. Hot Surface. Use care when working around the heated cover and sample block to avoid being burned by hot components.

Required equipment

This test requires the 0.5-mL Temperature Verification Kit (PN 4309924), which includes:

- Cotton swabs
- Light mineral oil
- Temperature verification frame
- 0.5-mL probe assembly
- Model 4500 digital thermometer with a 9V battery installed
- Serial Communication Cable

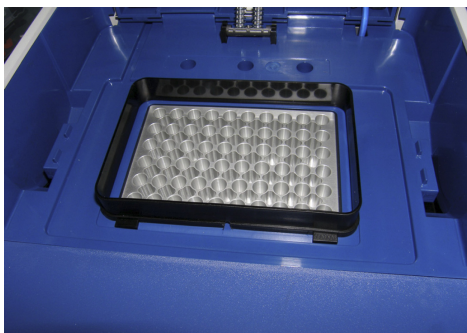
Setting up the 0.5-mL probe assembly

1. Power on the Veriti® Thermal Cycler.
For best results, allow the thermal cycler 15 to 30 minutes to warm to ambient temperature before performing the test.
2. In the Main Menu, select **Tools Menu**.
3. Connect the 4500 Digital Thermometer:
 - a. Attach the free end of cable (from the probe assembly) to the input connector port on the 4500 thermometer.
 - b. Attach the 9-pin DIN female end of the RS232 cable to the thermometer communication port, and the 9-pin DIN male end to the communication port of the instrument.

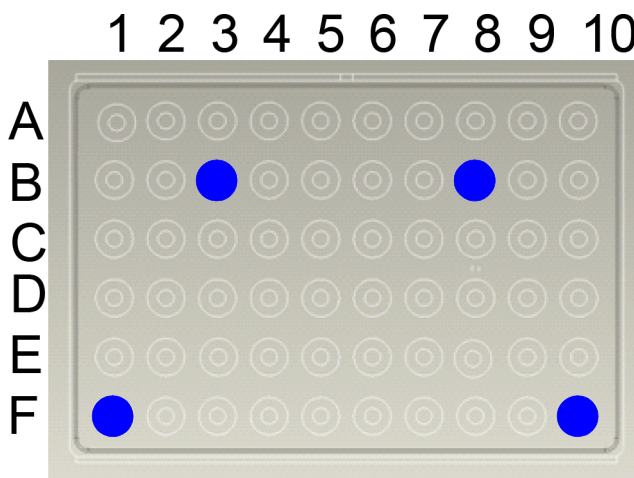


4. If the heated cover is closed, lift the lever and place the heated cover in the fully open position.

- Place the 0.5-mL Thermal Isolation Frame onto the sample block.



- Using a cotton swab, coat the following wells with mineral oil:
B3, B8, F1, F10



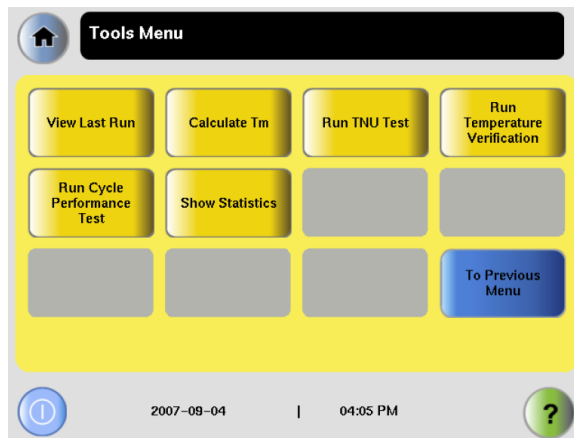
- Place the 0.5-mL probe assembly into well B3. Thread the probe assembly wire through the channel in the temperature verification frame to prevent damage to the probe assembly and lead wires (see [Figure 19 on page 118](#)).

IMPORTANT! Seat the probe properly and close the heated cover carefully. If the probe wire is crushed when you close the heated cover, the probe can be damaged.

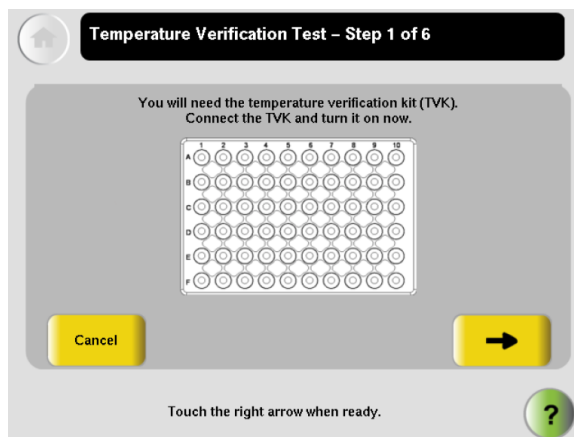
- Power on the digital thermometer.
Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.
- Make sure the probe assembly is connected to the digital thermometer and that the thermometer is powered on.
- Slide the heated cover forward and pull the lever down.

Running the test

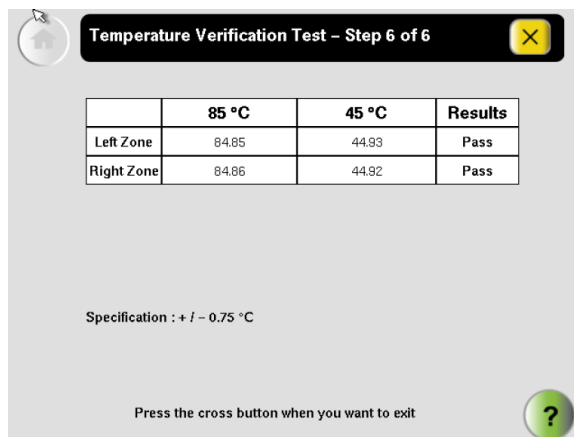
1. In the Tools Menu, select **Run Temperature Verification**.



2. Press → to begin the test. Perform the test as directed by the touchscreen. As the test progresses, move the 0.5-mL probe assembly to the remaining test wells: B8, F1, F10



3. When the test is complete, record zonal temperatures in the [“Data Sheet: Calibration Verification Test”](#) on page 127.



4. Press X to return to the Tools menu.

Ending the test

1. If the heated cover is closed, lift the lever and place the heated cover in the fully opened position.



WARNING PHYSICAL INJURY HAZARD. Hot Surface. Use care when working around the heated cover and sample block to avoid being burned by hot components.

2. Wait for the sample block to reach room temperature (~ 25 °C), then remove the the 0.5-mL probe assembly and thermal isolation frame from the sample block.
3. If you are performing a repeat measurement, clean the probe assembly and all wells of mineral oil, then perform the repeat measurement. Otherwise, power off the Veriti[®] Thermal Cycler and Model 4500 digital thermometer.
4. Clean the oil off the sample block.

Note: Follow the decontamination procedures in user guide for cleaning oiled wells.

Temperature non-uniformity test

Use this test to verify the temperature uniformity of the Veriti® Thermal Cycler. The temperature non-uniformity test consists of the following procedures, which you must perform in sequence:

Setting up the 0.5-mL probe assembly	123
Running the test.....	125
Ending the test.....	126



WARNING PHYSICAL INJURY HAZARD. Hot Surface. Use care when working around the heated cover and sample block to avoid being burned by hot components.

Required equipment

This test requires the 0.5-mL Temperature Verification Kit (PN 4309924), which includes:

- Cotton swabs
- Light mineral oil
- Temperature verification frame
- 0.5-mL probe assembly
- Model 4500 digital thermometer with a 9V battery installed
- Serial Communication Cable

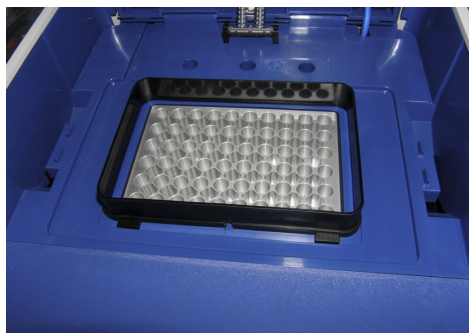
Setting up the 0.5-mL probe assembly

1. Power on the Veriti® Thermal Cycler. For best results, allow the thermal cycler 15 to 30 minutes to warm to ambient temperature before performing the test.
2. In the Main Menu, select **Tools Menu**.
3. Connect the 4500 Digital Thermometer:
 - a. Attach the free end of cable (from the probe assembly) to the input connector port on the 4500 thermometer.
 - b. Attach the 9-pin DIN female end of the RS232 cable to the thermometer communication port, and the 9-pin DIN male end to the communication port of the instrument.

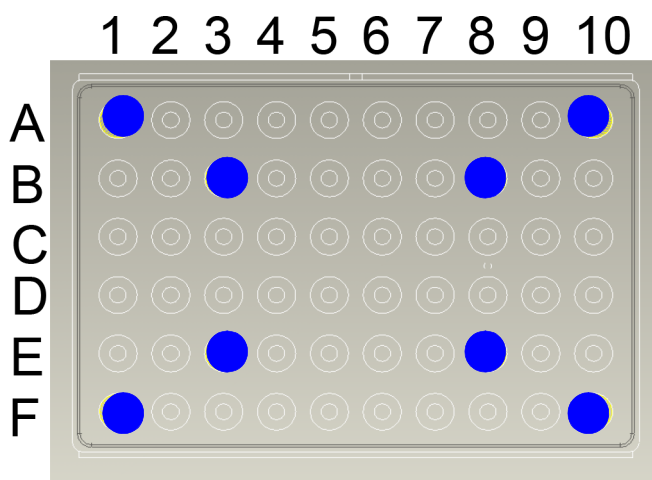


4. If the heated cover is closed, lift the lever and place the heated cover in the fully open position.

- Place the 0.5-mL Thermal Isolation Frame onto the sample block.



- Using a cotton swab, coat the following wells with mineral oil:
A1, A10, B3, B8, E3, E8, F1, F10



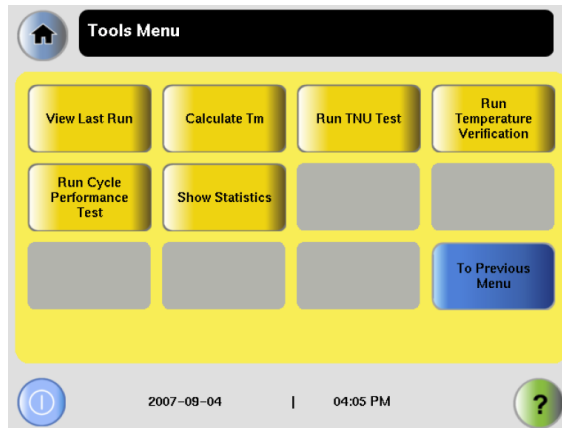
- Place the 0.5-mL probe assembly into well A1. Thread the probe wire through the channel in the temperature verification frame to prevent damage to the probe assembly and lead wires (see [Figure 19 on page 118](#)).

IMPORTANT! Seat the probe properly and then close the heated cover carefully. If the probe wire is crushed when you close the heated cover, the probe can be damaged.

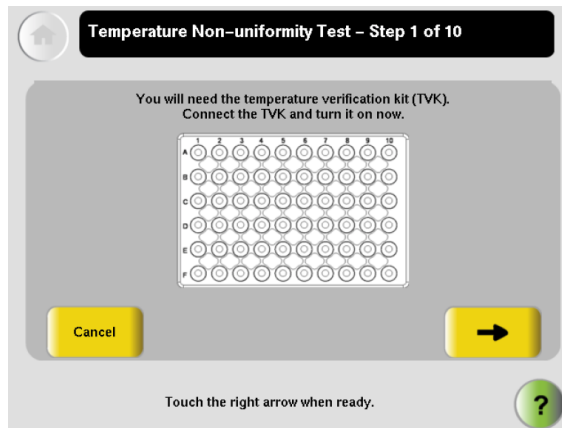
- Power on the digital thermometer.
Refer to the instructions in your Temperature Verification Kit for details on operating the digital thermometer, Model 4500.
- Make sure the probe assembly is connected to the digital thermometer and that the thermometer is powered on.
- Slide the heated cover forward and pull the lever down.

Running the test

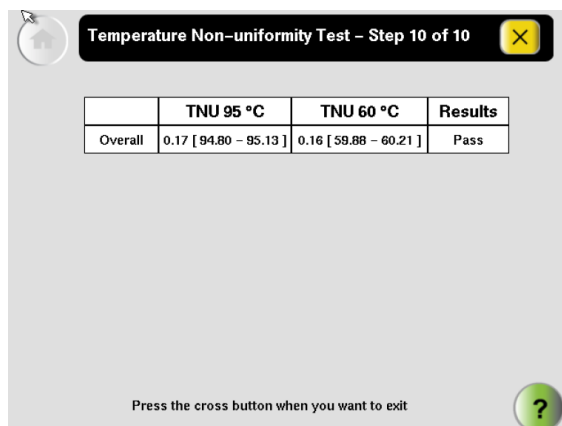
1. In the Tools menu, select **Run TNU Test**.



2. Press → to begin the test. Perform the test as directed by the touchscreen. As the test progresses, move the 0.5-mL probe assembly to the remaining test wells: A1, A10, B3, B8, E3, E8, F1, F10



3. When the test is complete, record the TNU in the [“Data Sheet: Temperature Non-Uniformity Test”](#) on page 128.



4. Press × to return to the Tools menu.

Ending the test

1. If the heated cover is closed, lift the lever and place the heated cover in the fully opened position.



WARNING PHYSICAL INJURY HAZARD. Hot Surface. Use care when working around the heated cover and sample block to avoid being burned by hot components.

2. Wait for the sample block to reach room temperature (~ 25 °C), then remove the the 0.5-mL probe assembly and thermal isolation frame from the sample block.
3. If you are performing a repeat measurement, clean the probe assembly and all wells of mineral oil, then perform the repeat measurement. Otherwise, power off the Veriti[®] Thermal Cycler and Model 4500 digital thermometer.
4. Clean the oil off the sample block.

Note: Follow the decontamination procedures in user guide for cleaning oiled wells.

Data Sheet: Temperature Non-Uniformity Test

When you run the temperature non-uniformity test, record the setpoint values for the wells listed on this data sheet. At the end of the test, compare the values that are displayed on the thermal cycler with the values that are recorded here.

Note: You can photocopy this page.

Date		
Tested by		
Probe serial no.		
Thermometer serial no.		
Measurement	Block TNU 1 at 95°C	Block TNU 2 at 60°C
1		
2		
3		
4		
5		

Recalibration

A

This appendix describes how to order a recalibration service for your Temperature Verification System.

Obtaining recalibration

Introduction Applied Biosystems recommends that the Model 4500 digital thermometer and Probe Assembly be recalibrated on an annual basis.

To have your thermometer and probe recalibrated:

1. Decontaminate the probe assembly (see below).
2. Send the equipment to the manufacturer (see below).

Decontaminating the probe assembly

Gently wipe the probe cone with a cotton swab that has been moistened with bleach solution (20% bleach, 80% water).

IMPORTANT! Do not submerge the probe in bleach solution. Do not disassemble the probe assembly.



WARNING CHEMICAL HAZARD. Sodium hypochlorite (bleach) is a liquid disinfectant that can be corrosive to the skin and can cause skin depigmentation. Read the MSDS, and follow the handling instructions. Wear appropriate protective eyewear, clothing, and gloves.

Sending equipment to Alpha Technics

1. Inform Alpha Technics of the recalibration order by visiting the Alpha Technics web site at <http://www.alphatechnicsonline.com> and following the online instructions.

Ship the Temperature Verification kits to:

Alpha Technics
17151 Gillette Avenue
Irvine, CA. 92614-5602

2. Ensure that the probe assembly is decontaminated.
3. Pack the Model 4500 digital thermometer and probe assembly in the black case.

4. Create a package that contains the:
 - Black case containing digital thermometer and probe assembly
 - Address and contact information:
 - Billing address
 - Shipping address
 - Name and phone number of a contact; preferably the person most familiar with the thermometer
5. Send the package freight prepaid to Alpha Technics at the address in [step 1](#).

Instrument Warranty Information

B

This chapter covers:

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Limited product warranty

Limited warranty Applied Biosystems warrants that all standard components of its Thermal Cycler Temperature Verification System for GeneAmp® PCR Systems will be free of defects in materials and workmanship for a period of ninety (90) days from the date the warranty period begins. Applied Biosystems will repair or replace, at its discretion, all defective components during this warranty period. After this warranty period, repairs and replacement components may be purchased from Applied Biosystems at its published rates. Applied Biosystems also provides service agreements for post-warranty coverage. Applied Biosystems reserves the right to use new, repaired, or refurbished instruments or components for warranty and post-warranty service agreement replacements. Repair or replacement of products or components that are under warranty does not extend the original warranty period.

Applied Biosystems warrants that all optional accessories supplied with its Thermal Cycler Temperature Verification System for GeneAmp® PCR Systems, such as peripherals, printers, and special monitors, will be free of defects in materials and workmanship for a period of ninety (90) days from the date the warranty begins. Applied Biosystems will repair or replace, at its discretion, defective accessories during this warranty period. After this warranty period, Applied Biosystems will pass on to the buyer, to the extent that it is permitted to do so, the warranty of the original manufacturer for such accessories.

With the exception of consumable and maintenance items, replaceable products or components used on or in the instrument are themselves warranted to be free of defects in materials and workmanship for a period of ninety (90) days.

Applied Biosystems warrants that chemicals and other consumable products will be free of defects in materials and workmanship when received by the buyer, but not thereafter, unless otherwise specified in documentation accompanying the product.

Applied Biosystems warrants that for a period of ninety (90) days from the date the warranty period begins, the tapes, diskettes, or other media bearing the operating software of the product, if any, will be free of defects in materials and workmanship under normal use. If there is a defect in the media covered by the above warranty and the media is returned to Applied Biosystems within the ninety (90) day warranty period, Applied Biosystems will replace the defective media.

Applied Biosystems does not warrant that the operation of the instrument or its operating software will be uninterrupted or error free.

Warranty period effective date Any applicable warranty period under these sections begins on the earlier of the date of installation or ninety (90) days from the date of shipment for hardware and software installed by Applied Biosystems personnel. For all hardware and software installed by the buyer or anyone other than Applied Biosystems, and for all other products, the applicable warranty period begins the date the product is delivered to the buyer.

Warranty claims Warranty claims must be made within the applicable warranty period, or, for chemicals or other consumable products, within thirty (30) days after receipt by the buyer.

Warranty exceptions

The above warranties do not apply to defects resulting from misuse, neglect, or accident, including without limitation: operation with incompatible solvents or samples in the system; operation outside of the environmental or use specifications or not in conformance with the instructions for the instrument system, software, or accessories; improper or inadequate maintenance by the user; installation of software or interfacing, or use in combination with software or products, not supplied or authorized by Applied Biosystems; and modification or repair of the product not authorized by Applied Biosystems.

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Some countries or jurisdictions limit the scope of or preclude limitations or exclusion of warranties, of liability, such as liability for gross negligence or wilful misconduct, or of remedies or damages, as or to the extent set forth above. In such countries and jurisdictions, the limitation or exclusion of warranties, liability, remedies or damages set forth above shall apply to the fullest extent permitted by law, and shall not apply to the extent prohibited by law.

Damages, claims, and returns

- Damages** If shipping damage to the product is discovered, contact the shipping carrier and request inspection by a local agent. Secure a written report of the findings to support any claim. Do not return damaged goods to Applied Biosystems without first securing an inspection report and contacting Applied Biosystems Technical Support for a Return Authorization (RA) number.
- Claims** After a damage inspection report is received by Applied Biosystems, Applied Biosystems will process the claim unless other instructions are provided.
- Returns** Do not return any material without prior notification and authorization. If for any reason it becomes necessary to return material to Applied Biosystems, contact Applied Biosystems Technical Support or your nearest Applied Biosystems subsidiary or distributor for a return authorization (RA) number and forwarding address. Place the RA number in a prominent location on the outside of the shipping container, and return the material to the address designated by the Applied Biosystems representative.

This appendix addresses apparent discrepancies between the published instrument specifications for accuracy and the pass/fail criterion used during the routine temperature verification.

Temperature Accuracy Verification Test

- In the System Specification Sheet, the thermal cycler accuracy specifications are published as ± 0.25 °C.
- The single-channel Temperature Verification Kit (TVK) consists of the hardware, thermometer and probe and an associated procedure.
- The TVK does *not* measure the original manufacturing specification of the thermal cycler. The purpose of the TVK test is to detect any system failure that may result in a shift in the original manufacturer's calibration. This kit should be used for temperature verification, *not* system calibration.
- For the GeneAmp[®] 9700, the system has an aggregate accuracy of ± 0.25 °C.
- The TVK has accuracy and discrepancy in addition to the original manufacturing specification.
- Temperature calibration of Applied Biosystems thermal cyclers is extremely stable, and no measurable change in the calibration accuracy is detectable *unless* a significant change occurs in the instrument characteristics after its manufacture.
- Temperature Tolerance stack-up between TVK and the original manufacturing specification is ± 0.75 degrees Celsius.

Note: As a result of the Temperature Tolerance Stack, the instrument firmware has been pre-programmed to accept a Pass/Fail result of ± 0.75 degrees Celsius; therefore passing results may vary from 84.25 °C up to 85.75 °C.

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Instrumentation safety

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 a standby switch by which the instrument is switched on to the Standby condition. Hazardous voltage may be present if this switch is on standby.
	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 symbols that may be displayed on Applied Biosystems instruments. Each symbol may appear by itself or with text that explains the relevant hazard. 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.
	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.
	Indicates the presence of a biological hazard and to proceed with appropriate caution.
	Indicates the presence of a radiological hazard and to proceed with appropriate caution.
	Indicates the presence of a slipping hazard and to proceed with appropriate caution.
	Indicates the presence of an ultraviolet light (in the instrument?) and to proceed with appropriate caution.

Environmental symbols on instruments

The following symbol applies to all Applied Biosystems electrical and electronic products placed on the European market after August 13, 2005.

Symbol	Description
	<p>Do not dispose of this product as unsorted municipal waste. Follow local municipal waste ordinances for proper disposal provisions to reduce the environmental impact of waste electrical and electronic equipment (WEEE).</p> <p>European Union customers: Call your local Applied Biosystems Customer Service office for equipment pick-up and recycling. See www.appliedbiosystems.com for a list of customer service offices in the European Union.</p>



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