C1000 Touch™ Thermal Cycler and CFX Real-Time PCR Detection Systems

Instrument Guide

BIO-RAD

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Bio-Rad Technical Support Department

The Bio-Rad Technical Support department in the U.S. is open Monday through Friday, 5:00 AM to 5:00 PM, Pacific time.

Phone: 1-800-424-6723, option 2

Email: Support@bio-rad.com.com (U.S./Canada Only)

For technical assistance outside the U.S. and Canada, contact your local technical support office or click the Contact us link at www.bio-rad.com.

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Bio-Rad's thermal cyclers and real-time thermal cyclers are covered by one or more of the following U.S. patents or their foreign counterparts owned by Eppendorf AG: US Patent Numbers 6,767,512 and 7,074,367.

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Table of Contents

Chapter 1 Introduction

The C1000 Touch™ is a modular thermal cycler instrument base. When combined with a standard thermal reaction module, the instrument functions as a traditional thermal cycler. When combined with an optical module (the CFX96™ optical module, for example), the instrument becomes a powerful real-time PCR detection system.

The C1000 Touch base can be used in the following configurations:

- C1000 Touch Thermal Cycler
- CFX96 Touch™ Real-Time PCR Detection System (when combined with CFX96 optical module)
- CFX96 Touch Deep-Well Real-Time PCR Detection System (when combined with CFX96 deep-well optical module)
- CFX384 Touch™ Real-Time PCR Detection System (when combined with CFX384™ optical module)

This guide explains how to set up and use the C1000 Touch base in a traditional thermal cycler configuration and, when combined with a CFX optical module, to perform sensitive quantitative PCR.

Main Features

The main features of the C1000 Touch thermal cycler include:

- Two programming options, including the Protocol AutoWriter, which automatically generates customized standard, fast, and ultrafast protocols
- A large color touch screen makes editing and running protocols easy
- Change throughput capability by linking as many as three S1000™ thermal cyclers or adding PC control for up to 32 cyclers
- USB flash drive compatibility allows universal protocol transfer and unlimited data storage
- Programmable temperature gradient to quickly and easily identify optimal annealing temperatures

Finding Out More

Note: Click the Bio-Rad logo in the upper right corner of any CFX Maestro software window to launch Bio-Rad's website. This site includes links to technical notes, manuals, product information, and technical support. This site also provides many technical resources on a wide variety of methods and applications related to PCR, real-time PCR, and gene expression.

Chapter 2 Setting Up the C1000 Touch Thermal Cycler

This chapter explains how to set up the C1000 Touch™ thermal cycler at your site.

Tip: Before setting up the thermal cycler, familiarize yourself with the thermal cycler and its reaction modules, ports, and accessories.

Site Requirements

The tables in this section list the room, environment, and power requirements necessary to successfully install and use the C1000 Touch thermal cycler.

Note: Install your C1000 Touch thermal cycler on a flat, dry surface with sufficient cool airflow for it to run properly.

Benchspace Requirements

Table 1. C1000 Touch benchspace requirements

Item	Specification
Input power	Up to 850 W, maximum
Frequency	50–60 Hz, single phase
USB ports	5 A, 1 B
Dimensions	W: 13 in; 33 cm D: 18 in; 46 cm H: 14 in; 36 cm
Weight	47 lb; 21 kg

Environment Requirements

Table 2. C1000 Touch environment requirements

Parameter	Range	Humidity Range
Operating conditions	15–31°C 59–87.8°F	0–80% RH, noncondensing
Storage conditions	15–31°C 59–87.8°F	0–80% RH, noncondensing

Power Requirements

Power to the C1000 Touch thermal cycler must be stable and within specifications to ensure proper operation. The power cable connected to the power inlet port must be rated for 7 amps or more.

Table 3. C1000 Touch power requirements

Item	Specification
Mains input voltage	100–240 VAC; 50–60 Hz, single phase
Maximum power usage	<850 watts
Number of power sockets	A minimum of 2 power sockets: ■ 1 socket for the thermal cycler ■ 1 socket for the computer running CFX Maestro™ software

System Overview

The illustrations in this section display the main components of the C1000 Touch thermal cycler base.

Front View

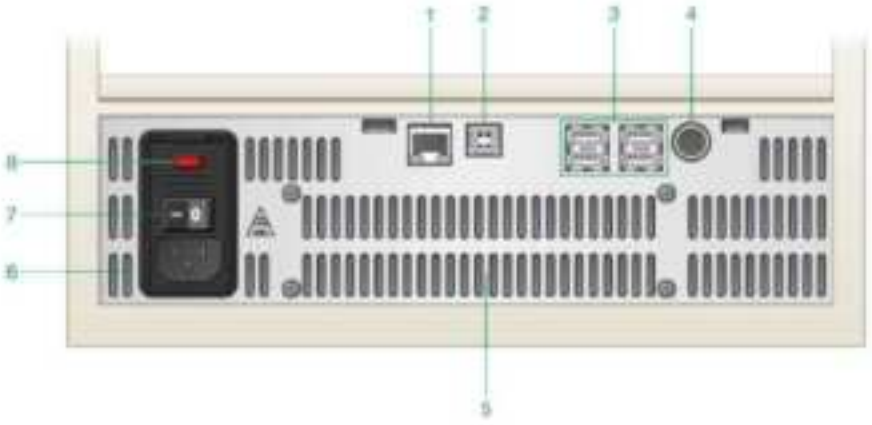
LEGEND

1. Reaction module bay	2. Reaction module locking bar
3. Touchscreen display	4. USB A port
5. Air intake vents	

Details

- **Reaction module bay** — holds the inserted reaction module.
- **Reaction module locking bar** — locks the reaction module in place.
- **Touch-screen display** — provides access to all the functions needed to create and run PCR protocols.
- **USB A port** — connects to a USB flash drive, mouse, or keyboard.
- **Air intake vents** — allow the thermal cycler to heat and cool quickly.

Back View



LEGEND

1. Ethernet port	2. USB Type B port
3. USB type A ports	4. Serial test port
5. Cooling vents	6. Power input
7. Power switch	8. Fuses

Details

- **Ethernet port** — connects the C1000 Touch thermal cycler to your network.
- **USB Type B port** — connects the C1000 Touch thermal cycler to a computer running CFX Maestro software.
- **USB Type A ports** — transfer data to and from a USB flash drive or to connect a USB mouse or keyboard.

  Tip: You can also use these ports to connect up to three S1000™ thermal cyclers to the C1000 Touch.
- **Serial test port** — this port is for service testing only.
- **Cooling vents** — cools thermal cycler.

  Caution: Do not block the cooling vents. For optimal operation, ensure that air can circulate behind the thermal cycler base.

Reaction Modules

The C1000 Touch thermal cycler is compatible with Bio-Rad's conventional reaction modules for standard PCR and its optical reaction modules for real-time PCR.

Conventional reaction modules

Bio-Rad's conventional reaction modules are available in four sizes:

- 96-well fast module
- 96-deep well module
- Dual 48/48-well fast module
- 384-well module

Optical reaction modules

Bio-Rad's optical reaction modules are available in three sizes:

- CFX96™ optical reaction module
- CFX96 deep well optical reaction module
- CFX384™ optical reaction module

Each reaction module includes a fully adjustable heated lid that is capable of running reliably with a broad range of reaction vessels. The reaction modules and the C1000 Touch thermal cycler are shipped separately.

Conventional Reaction Modules

Each reaction module contains cooling fins for fast heating and cooling and a fully adjustable heated lid. The top of a reaction module lid includes a lid lever, lid force knob, and status LED.

- **Heated inner lid** — maintains the lid temperature to prevent condensation and evaporation.
- **Sample/reaction block** — holds reaction vessels, including tubes and microplates.
- **Lid lever** — opens and closes the lid.
- **Lid force knob** — sets lid force and seals the reaction.
- **Status LED** — when on, indicates that the block is in use.

Optical Reaction Modules

Each reaction module contains cooling fins for fast heating and cooling and a fully adjustable, heated lid.

- **Heated inner lid** — maintains the lid temperature to prevent condensation and evaporation.
- **Sample/reaction block** — holds reaction vessels, including tubes and microplates.
- **Lid button** — opens and closes the lid and seals the reaction.
- **Status LED** — when on, indicates that the block is in use.

Recommended Sample Volumes

When using the C1000 Touch thermal cycler, the maximum sample volume is determined by the type of reaction module used. Table 4 lists the recommended volumes to use with each reaction module.

Table 4. Size and volume limit for C1000 Touch reaction modules

Number of Wells	Number of Blocks	Recommended Sample Volume, µl (Upper Limit)
96-well	1	10–50
96–deep well	1	10–125
Dual 48/48-well	2	10–50
384-well	1	3–30

Installing the C1000 Touch Thermal Cycler

The C1000 Touch thermal cycler base ships separately from the reaction module. The package includes:

- C1000 Touch thermal cycler base
- Power cord
- 1 USB cable

To install the C1000 Touch thermal cycler:

1. Unpack and set up the C1000 Touch thermal cycler base.
2. Attach the reaction module to the base.
3. (Optional) Connect up to three S1000 thermal cyclers to the C1000 Touch base.
4. Remove the shipping screw.

This section explains these tasks in detail.

Unpacking and Setting Up the C1000 Touch Thermal Cycler Base

Important: Before operating the thermal cycler, read the information in the sections Safety and Regulatory Compliance on page 83 and Instrument Safety Warning Labels on page 83.

Tip: If you plan to operate the thermal cycler with CFX Maestro software, ensure during setup that you have sufficient space near the thermal cycler for a computer.

To unpack and set up the thermal cycler base

1. Locate the package containing the thermal cycler base.
2. Remove the base from the packing material.

   Tip: Store the packing material for future use. If any item is missing or damaged, contact your local Bio-Rad office.
3. Place the thermal cycler base on a flat, dry surface with sufficient cool airflow to run properly.
4. Locate the power cord in the shipping package and insert one end into the power inlet port on back of the thermal cycler.

   Important: Do not power on the instrument at this time.
5. Attach the reaction module to the base. Proceed to Attaching Reaction Modules on page 18.

Attaching Reaction Modules

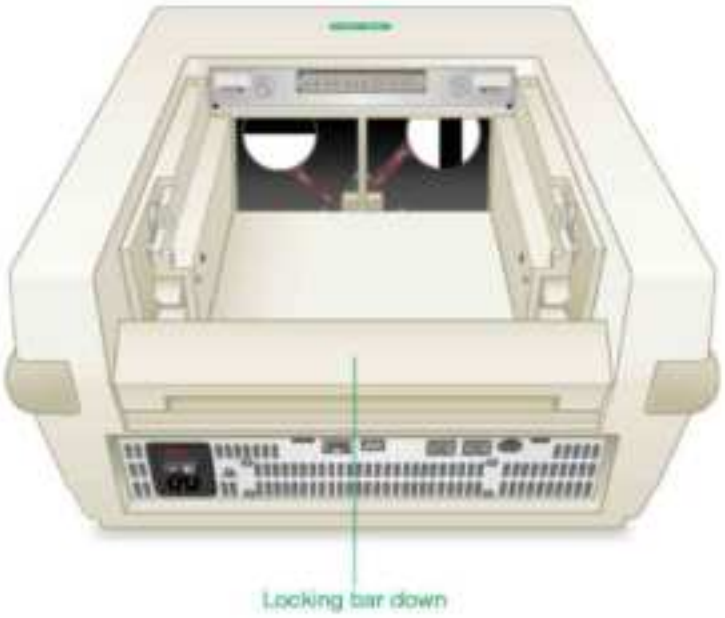
Note: Although the images in this section display the optical reaction blocks, the procedure for attaching optical and conventional reaction modules is the same. Follow the steps in this procedure to attach both optical and conventional reaction modules.

Bio-Rad reaction modules ship separately from the C1000 Touch thermal cycler base. Carefully unpack the reaction module and verify that the power and USB cables are included in the shipping container.

Note: Ensure that the C1000 Touch thermal cycler base rests on a flat, dry surface with sufficient cool airflow to run properly.

To attach a reaction module to the C1000 Touch thermal cycler base

1. Place the C1000 Touch thermal cycler in a suitable location.
2. Ensure that the locking bar, located on the back of the thermal cycler base, is pushed down.



3. Remove the reaction module from the packaging material.
4. Remove the instructions overlay from the thermal cycler's base.

   Tip: Store the packing material and instructions for future use. If any item is missing or damaged, contact your local Bio-Rad office.

5. Lift the reaction module using the handle indents above the air vents on each side.

6. With its lid lever pointing toward the front, insert the reaction module into the reaction module bay, leaving about 2 cm of space in front of the thermal cycler.

7. Pull the locking bar up to lock the reaction module in place.

   Important: There should be no space at the front of the module when it is locked into the C1000 Touch base.

8. If you have not done so, insert one end of the supplied power cable into the base of the thermal cycler and the other end into an appropriate electrical outlet.
9. Press the power switch on the back panel to start the thermal cycler.

Note: When the C1000 Touch starts, it runs a self-test to verify proper functions and then displays the Home screen. Use the Home screen to begin operating the thermal cycler.

Removing the Shipping Screw

Important: Bio-Rad's optical reaction modules ship with a red shipping screw inserted in the inner lid to stabilize the reaction module during shipping. You must remove the shipping screw before you can operate the reaction module.

To remove the shipping screw

1. The C1000 Touch thermal cycler recognizes that the shipping screw is inserted in the optical reaction module and displays a message on the touch screen instructing you to remove the screw.

   Touch **OK** to remove the shipping screw. The system's Properties dialog box appears displaying the Shipping Screw tab. Read the contents of the tab.

2. In the Shipping Screw tab, touch **Remove Shipping Screw**.
3. Open the optical module lid.
4. Remove the shipping screw from the hole that corresponds to well A-1 in the inner heated lid and store the screw in a safe place.

Note: You must reinsert the shipping screw should you need to return the reaction module for any reason. Save the screw in a safe and accessible place.

5. In the Shipping Screw tab, touch **OK** to confirm the screw status.
6. Close the Properties dialog box.

Loading Sample Plates

To ensure uniform heating and cooling of samples, plates must be in complete contact with the reaction block. To ensure adequate contact, do the following:

- Confirm that the block is clean before loading samples.
- Firmly press the individual tubes, tube strips, or microplates into the block wells.

When using one or a few tubes, use the tube frame (catalog #1849000 or #1849001) or load at least one empty tube in each corner of the block to ensure the lid exerts even pressure on individual tubes.

The process for loading plates differs depending on the type of block you are using:

- For conventional blocks, see Loading Plates in a Conventional Reaction Module on page 23.
- For optical reaction blocks, see Loading Plates into an Optical Reaction Module on page 26.

Loading Plates in a Conventional Reaction Module

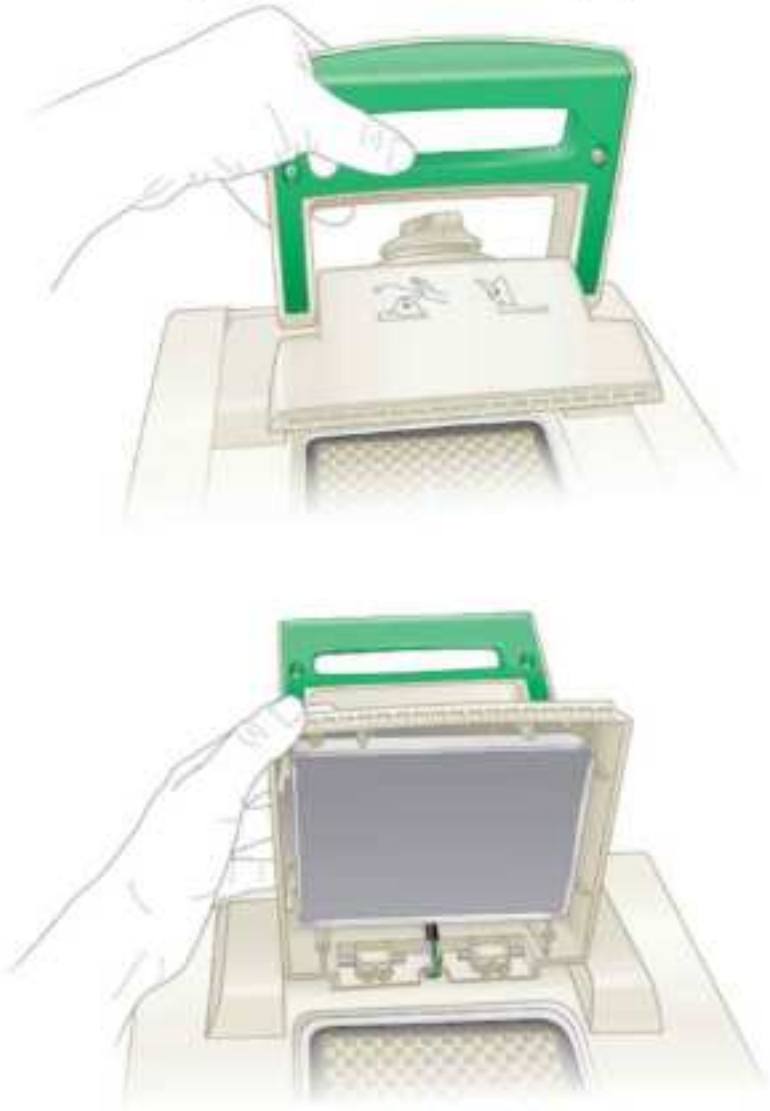
The inner lid of the conventional reaction module applies heat and force to the reaction vessel lids (caps or tape) to produce consistent and successful reactions. Heating the inner lid prevents condensation while applying force seals the reaction to prevent evaporation.

WARNING! After a run, the heated inner lid can remain hot. Use caution when opening and closing the lid.

To load plates in a conventional block

1. To open the lid, turn the lid force knob counterclockwise to release the inner lid.

2. Lift the lid lever completely until the reaction module stays open without assistance.



3. Place the microplate, individual tubes, or tube strips with sealed lids in the block.

   Important: Verify that the tubes are completely sealed to prevent leakage.

4. For accurate data analysis, verify that the orientation of reactions in the block is exactly the same as the orientation of the well contents in the Plate tab in the CFX Maestro software.

   Tip: You can edit the well contents using CFX Maestro software before, during, or after the run.

5. Close the lid:

   a. Push the lid lever down, making sure that the front of the lid is secured beneath the housing.

   b. Adjust the lid force by turning the lid force knob:

      - Turn the knob clockwise to increase the lid force.
      - Turn the knob counterclockwise to decrease the lid force.

   c. Increase the lid force until the heated lid touches the reaction vessel.

      Tip: The position marks on the lid indicate quarter turns.

      - If using tubes, increase the lid force by a quarter turn after the lid touches the tubes.
      - If using plates, increase the lid force by a half turn after the lid touches the plate.

   Note: If you tighten the lid past the recommended force, the knob slips and you hear a clicking sound. This is as designed. The lid force is beyond the recommended setting and further tightening can result in damage to the reaction vessels. If this happens, decrease the lid force by turning the lid force knob counterclockwise one full turn and then reapply the correct lid force.

Loading Plates into an Optical Reaction Module

WARNING! When running the CFX96 Touch™ or CFX96 Touch Deep Well system, always balance the tube strips or add tube caps to the corner wells to ensure the heated lid applies even pressure across the block.

To load plates into an optical reaction module

1. To open the motorized lid, do one of the following:
   - In the Detected Instruments pane in CFX Maestro software, click Open Lid.
   - On the Start Run tab in the software, click Open Lid.
   - Press the lid button on the front of the instrument.

2. Place the microplate, individual tubes, or tube strips with sealed lids in the block.

   Important: Verify that the tubes are completely sealed to prevent leakage.

   Tip: For optimal results, load sample volumes of 10–25 µl for the CFX96 Touch system, 10–125 µl for the CFX96 Touch Deep Well system, and 5–20 µl for the CFX384 Touch™ system.

3. For accurate data analysis, verify that the orientation of reactions in the block is exactly the same as the orientation of the well contents in the Plate tab in CFX Maestro software.

Tip: You can edit the well contents using CFX Maestro software before, during, or after the run.

4. To close the motorized lid, do one of the following:
   - Press the lid button on the instrument.
   - In the Detected Instruments pane in the software, click Close Lid.
   - On the Start Run tab in the software, click Close Lid.

   Important: Ensure that nothing blocks the lid when it closes. Although there is a safety mechanism to prevent the lid from closing if it senses an obstruction, do not place anything in the way of the lid before closing.

Connecting S1000 Thermal Cyclers to a C1000 Touch Thermal Cycler

You can connect up to three S1000 thermal cyclers to a C1000 Touch thermal cycler and run multiple protocols.

To connect an S1000 thermal cycler to the C1000 Touch thermal cycler

1. Insert a high-quality shielded USB cable (such as the Bio-Rad USB cable catalog #1848000) into the USB B port on the back of the S1000 thermal cycler.
2. Insert the other end of the USB cable into a USB A port on the back of the C1000 Touch thermal cycler.

   The thermal cycler detects the attached S1000 thermal cycler and displays the current status on its home screen. If the S1000 thermal cycler has a name, it appears on the status button instead of the serial number.

Detecting Connected Instruments

During installation, the CFX Maestro software installer automatically installs the instrument drivers onto the computer running the CFX Maestro software. CFX Maestro detects connected instruments when you start the software.

Important: You must disconnect the thermal cycler from the CFX Maestro computer before you install the software. You do not need to turn off the thermal cycler during the software installation.

To detect connected instruments

1. If you have not yet done so, insert the square (male) end of the supplied USB Type B cable into the USB Type B port located on the back of the C1000 Touch base.
2. Insert the other (port) end into a USB port on the CFX Maestro computer.
3. If the thermal cycler is not already running, press the power switch on the back of the instrument to turn it on.
4. Start CFX Maestro software.

The software automatically detects the connected instrument and displays its name in the Detected Instruments pane in the Home window.

Note: If the instrument does not appear in the Detected Instruments pane, verify that the USB cable is properly installed. To reinstall drivers, select Tools > Reinstall Instrument Drivers in the Home window in CFX Maestro software.

Detaching Reaction Modules

Important: Power off the thermal cycler before detaching a reaction module. Cooling fins within the reaction module might be hot immediately after running a protocol or incubation. Ensure that the fins are cool before detaching the reaction module.

Note: Although the image in this section displays an optical reaction module, the procedure for detaching optical and conventional reaction modules is the same. Follow the steps in this procedure to detach both optical and conventional reaction modules.

To detach the reaction module from the thermal cycler base

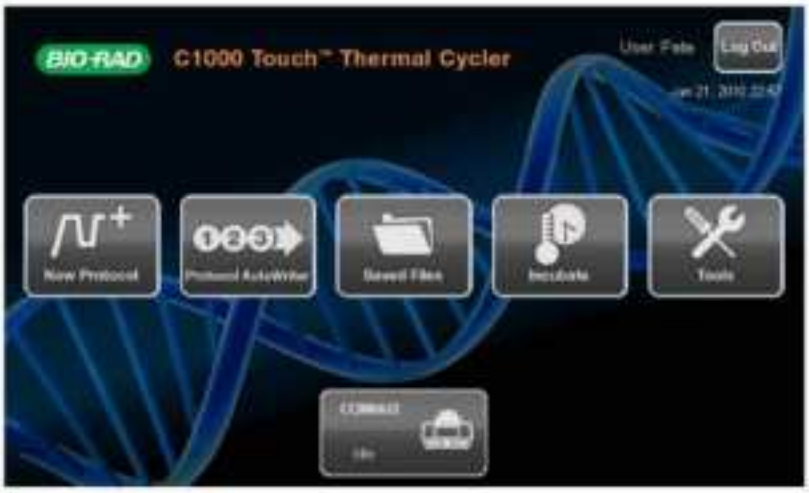
1. On the back of the thermal cycler base, push the locking bar down to unlock and release the reaction module.

2. Carefully lift the reaction module out of the bay using the handle indents on each side.
3. Set the reaction module on a clean, flat surface where it cannot get bumped, scraped, or dropped.

Chapter 3 The C1000 Touch Thermal Cycler Home Screen

The C1000 Touch™ thermal cycler Home screen provides access to all thermal cycler operations. It displays

- Date and time
- Name of logged-in user
- Instrument name
- Current status of the reaction module
- Name or serial number of any attached S1000™ thermal cycler



From the Home screen you can do the following:

- Create and edit protocols.
- Create protocols with the Protocol AutoWriter.
- View and manage files and folders.
- Incubate samples.

These tasks are explained in detail in the chapters that follow.

Tools Screen

From the Tools screen, users and administrators can access a variety of options. These options control the thermal cycler. All options available to users are also available to administrators. Only those who log in with an administrator account have access to the Admin options.

Note: You do not need to log in with a user account to access the User options.

To access the Tools menu as a user

1. (Optional) On the Home screen, tap **Log In** and select your user name.
2. On the Home screen, tap **Tools**.

   The Tools menu appears and displays the User options.

- **About** — displays the current firmware versions and serial numbers.
- **System Logs** — displays two types of logs:
  - **System Messages Log** lists messages that occur during each run.
  - **System Usage Log** lists all of the events that occur during each run.
- **Run Reports** — displays the run report each time a protocol is run.

  You can export the run report to a USB flash drive (for use when servicing the thermal cycler).
- **Gradient Calculator** — calculates a temperature gradient across a block.

To access the Tools menu as an administrator

1. On the Home screen, tap **Log In** and select **ADMIN** from the list of users.
2. Enter the administrator password if necessary.
3. Tap **Tools** on the Home screen.

   Tip: Alternatively, on the Home screen, tap **Tools**, and then tap **Admin** and enter the administrator password if necessary.

   The Tools menu appears and displays the User and Admin options.

- **System Settings** — from this screen, administrators can
  - Set user access levels to Open or Login required.
  - Set the date and time on the thermal cycler.
  - Enable or disable the screensaver and set its idle time.

  Tip: The screen saver appears after the system has been idle for a specified amount of time.
- **User Management** — add or remove users and clear passwords.
- **Email Settings** — set email server information.
- **Firmware Update** — update the firmware on the thermal cycler.
- **USB Thumb Key Test** — test USB thumb key compatibility.

- **Touchscreen Calibration** — calibrate the touch screen (for use when servicing the thermal cycler).
- **System Backup and Restore** — back up or restore system settings from a USB flash drive.
- **Diagnostic Test** — perform a series or subset of diagnostic self tests on the cycler (for use when servicing the thermal cycler).

Renaming the C1000 Touch Thermal Cycler

Initially, each C1000 Touch thermal cycler is given the name of the serial number on its base. You can rename a thermal cycler for easy identification.

To rename a C1000 Touch thermal cycler

1. On the Home screen, tap **Tools** to open the Tools menu.
2. Tap **About**, then tap **Name**.

   You see the System Details screen. The Name box is editable.

3. Type a new name using the alphanumeric keypad that appears.
4. Tap **OK** to accept the new name.
5. Tap **Back** to return to the Tools menu.

Creating User Accounts on the C1000 Touch Thermal Cycler

Tip: Creating user accounts on the C1000 Touch thermal cycler is optional.

Any user can create folders and protocols, edit protocol templates, and run protocols without logging in.

When logged in to the C1000 Touch thermal cycler, users can do the following:

- Run a protocol on the thermal cycler from their personal folder.
- Create and edit protocols in their folder.
- Copy any protocol and save it to their folder.
- Copy a protocol and save it with a new name to their folder.
- Delete protocols in their folder.

To create a new user

1. On the Home screen, tap **Log In** to open the user login screen.
2. Tap **New User**.
3. Tap **User Name** and enter a user name using the alphanumeric keypad that appears.
4. (Optional) Tap **Password** and enter a password for the user.

   The password can contain any combination of letters and numbers.
5. (Optional) Tap **Email Address** to enter the user's email address. The system emails messages to the user's email address upon run completion if the user is logged in when a run is started.
6. Tap **Create User**.

To log in to the C1000 Touch thermal cycler

1. On the Home screen, tap **Log In** and select your user name.
2. Enter your password using the alphanumeric keypad that appears, and then tap **OK**.

   Tip: The keypad does not appear if the user account does not have a password.

To log out of the C1000 Touch thermal cyler

▶ On the Home screen, tap **Log Out**.

Setting Up Email Notification

You can connect the C1000 Touch thermal cycler to your outgoing email server and have run notifications and reports emailed directly to a specified user account.

By default, the thermal cycler ships with Gmail server settings saved. You can create a Gmail account and have email sent to that account, or you can program the thermal cycler to send email to a specifc account on your site's email server.

This section explains how to connect the thermal cycler to a custom email server and how to send email to any user account.

Note: If you plan to set up a custom email server, consult your system administrator for site-specific email server requirements before continuing.

To connect the C1000 Touch thermal cycler to a custom email server

1. On the Home screen, tap **Log In** and log in to the thermal cycler as the administrator.

   Tip: The logged in user's name appears to the left of Log Out on the Home screen.

2. On the Home screen, tap **Tools** to open the Tools window.
3. In the Tools window, tap **Email Settings** to open the Outgoing Mail (SMTP) Server Settings dialog box.
4. Tap **New Server** at the bottom of the screen.

   An empty mail servers dialog box appears.

5. Tap the following fields and provide the information for your company:
   - **Mail Server Address** — the name of the outgoing email server at your company.
   - **Mail Server Port** — the port number for the SMTP server.
   - **Authentication Required** — if your site requires account authentication, select this checkbox.
   - **Use SSL** — if your site uses Secure Socket Layer (SSL), select this checkbox.
6. (Optional) Tap **Set As Default** to set this server as the default email server.
7. Tap **Save**. The new server appears in the **Mail Servers** dropdown list.
8. Tap **Back** to return to the Tools menu.

To add email recipients

1. In the Outgoing Mail (SMTP) Server Settings dialog box, select an email server from the **Mail Server** dropdown list.

   The server's address and port fields automatically populate.

2. (Optional) Select or clear the following checkboxes:
   - **Set As Default**
   - **Authentication Required**
   - **Use SSL**

3. Tap the **User Name** text box and type the email recipient's user name.
4. Tap the **Password** text box and type password for that user.
5. Tap **Save** to save the current server settings.
6. (Optional) To send a test email:
   a. Tap **Test Email** to open the Test Email dialog box.
   b. Tap **Test Email Address** and type an email address using the alphanumeric keypad.
   c. Tap **Attachment Size in MB** and enter an attachment size.

      The size limit for attachments is determined by your company's server. Bio-Rad recommends testing an attachment size between 0.5 and 5 MB.

      Note: Enter 0 to send a test email with no attachment.
   d. Tap **Send Email**.

      The system sends a test email to the email account.
   e. Tap **Cancel** to return to the Outgoing Mail (SMTP) Server Settings dialog box.
7. Tap **Back** to return to the Tools menu.

To remove an email server

1. In the Outgoing Mail (SMTP) Server Settings dialog box, select the server to be removed in the Mail Servers dropdown list.
2. Tap **Remove Server** at the bottom of the screen.
3. Tap **Yes** to confirm removal of selected server.
4. Tap **Back** to return to the Tools menu.

Chapter 4 Creating Protocols

Using the touch screen on the C1000 Touch™ thermal cycler, you can create and edit protocols, change step parameters, and set the sample volume and lid temperature.

For each protocol, you can add, edit, or remove any of the following parameters:

- Temperature gradients
- Temperature increments
- Ramp rate
- Extend time
- Alert beeps
- GOTO steps

The section Parameters and Ranges for Protocol Steps lists the options and ranges for protocol steps. Review the information in this section before creating your protocol.

Parameters and Ranges for Protocol Steps

Use the information in Table 5 on page 40 to modify the default settings for the steps in your protocol.

Temperature Steps

The target temperature is a value between 0.0 and 100.0 °C, set in tenths of a degree. The thermal cycler ramps up to this temperature and holds that value for a specified amount of time (the hold time).

Gradient Steps

The gradient range is between the lower and upper temperatures in a gradient step. The lower temperature is a value between 30.0 and 99.0°C, set in tenths of a degree. The maximum upper temperature is 100°C. The thermal cycler ramps up to the target temperature gradient across the block and holds that temperature for a specified hold time.

Important: Set the upper value of the gradient range within 24°C of the lower value.

Table 5. Parameters and ranges for protocol steps

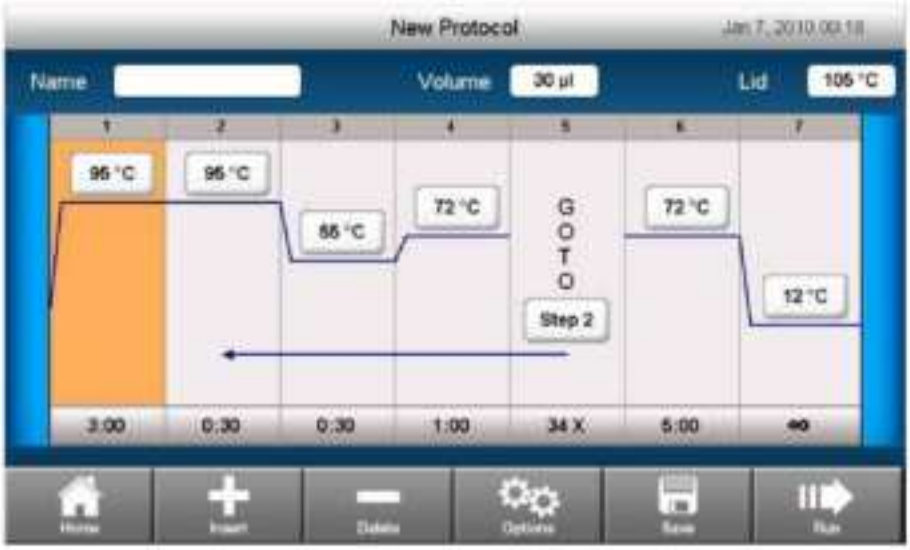
Parameter	Range	Description
Increment	A number from –10.0 to 10.0°C per cycle in tenths of a degree	Instructs the thermal cycler to change the target temperature of a step with each cycle, where a positive number increases the temperature and a negative number decreases the temperature. Available only to temperature steps.
Ramp rate	A number from 0.1 to 5°C per sec	Instructs the thermal cycler to ramp to the target temperature at the specified rate in that step. Available only to temperature steps.
Extend	A time from –60 to 60 sec per cycle	Instructs the thermal cycler to extend the hold time with each cycle. A positive number increases the hold time and a negative number decreases the hold time. Available to both temperature and gradient steps.
Beep	(No parameters)	Instructs the thermal cycler to beep to signal that the thermal cycler has reached the target temperature for that step. Available only to temperature steps.

Creating a Protocol

Important: While creating your protocol, take care setting the sample volume and lid temperature. If the lid temperature is too high, the sample temperature might rise above the target temperature. For more information about these settings, see Setting Sample Volume and Lid Temperature on page 48.

To create a protocol

1. On the Home screen, tap **New Protocol** to open the new protocol screen.



2. To set any of the following, tap its respective button and enter a value using the alphanumeric keypad that appears:

   - **Name** — the name of the protocol.

     The name can consist of up to 12 alphanumeric characters.

   - **Volume** — the sample/reaction volume in µl.
   - **Lid** — the temperature of the lid in °C.
   - **Temperature** — the target temperature of the step.
   - **Time** — the hold time of the step (between 1 sec and 18 hr) in the format of hr:min:sec.

     Tip: To set an infinite hold on a step, tap ∞.

3. (Optional) Insert a step if your protocol requires a new temperature, gradient, or GOTO step:
   a. Select the step in the protocol that will precede the new step and tap **Insert** at the bottom of the screen.

      The new step appears to the right of the selected step.

   b. Tap the type of step to insert.

      The default target temperature of a new step is 50°C and its default time is 30 sec (0:30). Tap time or temperature to edit the parameters in the new step.
4. (Optional) Tap **Run** to run the protocol.
5. Tap **Save** to open the Save As dialog box.

6. Tap **File Name** and type a name for the protocol.
7. Save the protocol:
   a. Do one of the following:
      - Select a folder from the dropdown list for the target location.
      - Click **New Folder** to create a new folder in the target location.

   b. Click **Save** to save the protocol or **Cancel** to return to the New Protocol dialog box.

After you create and save a protocol, you can modify the default settings for the following parameters:

- Target temperature
- Hold time
- Temperature gradient
- Ramp rate
- Temperature increment
- Extend time
- Beep alerts
- GOTO steps

These tasks are explained in the sections that follow.

Changing Target Temperature and Hold Time

To change the target temperature and hold time in a temperature step

▶ Tap **Temperature** or **Time** and enter a new value.

Adding or Removing a Temperature Gradient

To add a temperature gradient to a temperature step

1. In the Edit Protocol dialog box, tap a step in the protocol and tap **Options**.

   The Step Options dialog box appears.

2. In the Step Options dialog box, tap the **Gradient** checkbox. The gradient range appears to the right in the Step Options dialog box.

3. To change the gradient range, tap either the higher or lower value and enter a new value in the keypad that appears.

   Important: The upper value of the gradient range must be within 24°C of the lower value.

4. Tap **OK**.

   Note: You cannot include any other parameter to a gradient step.

5. In the Edit Protocol dialog box, tap **Save** to save your changes.

To remove the temperature gradient

1. Select the gradient step and then tap **Options**.

   The Step Options dialog box appears.

2. Clear the **Gradient** checkbox.
3. Tap **OK** to confirm.

Changing the Ramp Rate

The ramp rate option instructs the thermal cycler to ramp to the target temperature at a specified rate in that step.

To emulate a thermal cycler that runs at a slower ramp rate than the C1000 Touch, change the ramp rate of the appropriate protocol step.

To change the ramp rate

1. In the Edit Protocol dialog box, tap a step in the protocol and tap **Options**.

   The Step Options dialog box appears.

2. Tap **Ramp Rate** and enter a value using the keypad that appears.
3. Tap **OK** to confirm.

To remove a ramp rate

1. In the Edit Protocol dialog box, tap a step in the protocol and tap **Options**.
2. In the Step Options dialog box, tap **Ramp Rate** and use the back button on the keypad to clear the entry.
3. Tap **OK** to confirm.

Adding or Removing a Temperature Increment

An increment raises or lowers the target temperature for a step within each cycle.

To add a temperature increment

1. In the Edit Protocol dialog box, tap a step and tap **Options**.

   The Step Options dialog box appears.

2. Tap **Increment**.
3. Enter an increment value using the keypad that appears.

   Tip: A positive number increases the temperature, a negative number decreases the temperature

4. Tap **OK** to confirm.

To remove a temperature increment

1. In the Edit Protocol dialog box, tap a step in the protocol and tap **Options**.

2. In the Step Options dialog box, tap **Increment** and use the back button on the keypad to clear the entry.
3. Tap **OK** to confirm.

Adding or Removing an Extend Time Option

The Extend option instructs the thermal cycler to extend the hold time with each cycle.

To add or modify an Extend option

1. In the Edit Protocol dialog box, tap a step in the protocol and tap **Options**.

   The Step Options dialog box appears.
2. Tap **Extend** and type a value using the keypad that appears.
3. Tap **OK** to confirm.

To remove an Extend option

1. In the Edit Protocol dialog box, tap a step in the protocol and tap **Options**.
2. In the Step Options dialog box, tap **Extend** and use the back button on the keypad to clear the entry.
3. Tap **OK** to confirm.

Adding or Removing a Beep Alert

The C1000 Touch thermal cycler can emit a beep sound when it reaches the target temperature of a protocol step.

To add a beep alert

1. In the Edit Protocol dialog box, tap a step in the protocol and tap **Options**.

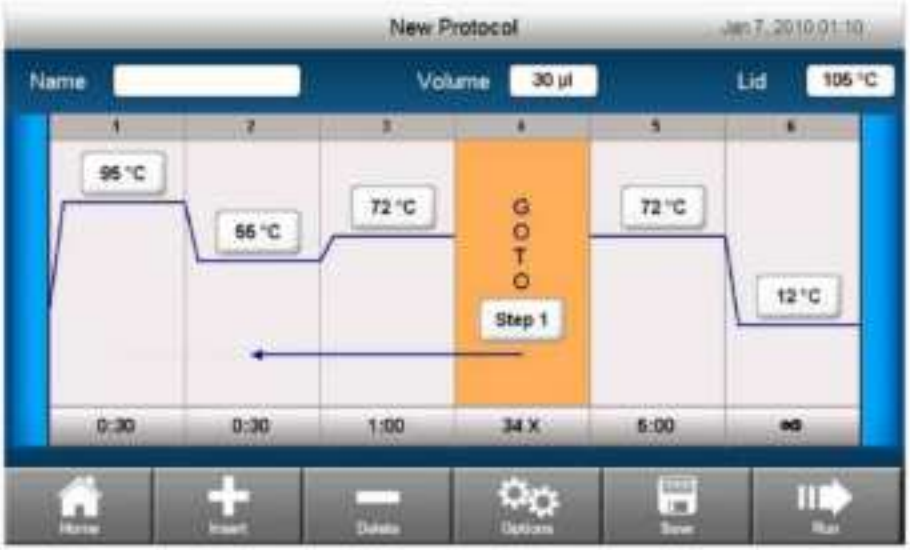
   The Step Options dialog box appears.
2. Tap the **Beep** checkbox to select it.
3. Tap **OK** to confirm.

To remove a beep alert

1. In the Edit Protocol dialog box, tap a step in the protocol and tap **Options**.
2. In the Step Options dialog box, tap **Beep** to clear the checkbox.
3. Tap **OK** to confirm.

Changing Parameters in a GOTO Step

The GOTO step instructs the thermal cycler to return to a specific step in the protocol and repeat the series of steps a specified number of times. This creates a cycle in the PCR experiment. The GOTO step in the following image instructs the thermal cycler to return to Step 2 and perform 34 additional repeats.



To change parameters in a GOTO step

1. To change the **GOTO** step number, tap **Step** in the protocol and type the new step number using the keypad that appears.
2. To change the number of repeats, tap the repeat **X** on the GOTO step and type a new value using the keypad that appears.
3. Tap **OK** to confirm.

Setting Sample Volume and Lid Temperature

Important: If the lid temperature is too high, the sample temperature might rise above the target temperature.

Sample Volume and Temperature Control Modes

The C1000 Touch uses one of two control modes to determine when the sample reaches the target temperature:

- **Calculated mode** — when a sample volume setting is greater than zero, the thermal cycler calculates the sample temperature based on the sample volume. Bio-Rad recommends using the calculated mode because it most accurately represents the actual sample temperature.
- **Block mode** — when a sample volume setting is zero (0) µl, the thermal cycler assumes that the sample temperature is the same as the measured block temperature.

To change the sample volume

1. In the Edit Protocol dialog box, tap **Volume** at the top of the screen and type a new value using keypad that appears.
2. Tap **OK** to confirm.

Lid Temperature

Note: When using a 96- or dual 48-well reaction block, Bio-Rad recommends a lid temperature of 105°C. When using a 384-well block, Bio-Rad recommends a lid temperature of 95°C.

The C1000 Touch's adjustable heated lid allows the user to control the lid temperature and force. Heating the lid prevents condensation from forming inside the reaction wells. When the C1000 Touch is running, the heated lid maintains the temperature specified for the protocol being run. Without a heated lid, water from the reagents can be lost to condensation, concentrating the reactants in the tube or plate.

The default lid temperature of the C1000 Touch is 105°C for 96- or dual 48-well reaction blocks and 95°C for 384-well blocks.

Note: When the block is running an infinite hold at a temperature below 30.0°C, the lid heater maintains 31.0°C.

To change the lid temperature

1. In the Edit Protocol dialog box, tap **Lid** at the top of the screen and type a new value using keypad that appears.
2. Tap **OK** to confirm.

Editing a Protocol

You can edit any parameter within an existing protocol. You can then save it with the same name into the same or a different folder, or you can rename the protocol and save it into any folder. A renamed protocol does not overwrite the original protocol.

Caution: Saving a protocol with the same name in the same folder overwrites the original protocol. You can have multiple protocols with the same name as long as they are saved in different folders.

To edit a protocol

1. On the Home screen, tap **Saved Files** to open the Saved Files screen.

2. Tap the location and folder in which the file resides, and then tap the file's name to select it.
3. Tap **Edit** to open the Edit Protocol screen. The protocol appears in a graphical format.

4. To change any of the following parameters, tap the respective button and enter a value using the alphanumeric keypad that appears.
   - Name
   - Volume
   - Lid
   - Temperature
   - Step time
5. (Optional) To add a new step, select a step in the protocol and tap **Insert** at the bottom of the screen.

   The new step appears to the right of the selected step.
6. Tap **Run** to run the protocol.
7. Tap **Save** to choose a new file name, location, and folder in which to save the protocol.

To add a protocol step

1. Tap the step in the protocol that will precede the new step and tap **Insert** at the bottom of the screen.

   The new step appears to the right of the selected step.
2. Tap the type of step to insert:
   - Temperature
   - Gradient
   - GOTO

   Tip: The default target temperature of a new step is 50°C and its default time is 30 sec (0:30). Tap time or temperature to edit the parameters in the new step.

   The new step appears to the right of the selected step.

To delete a protocol step

▶ In the protocol, select the target step and tap **Delete** at the bottom of the screen.

To rename a protocol

1. In the protocol, tap **Name** at the top of the screen.
2. Type a new name for the protocol using the alphanumeric keypad that appears.
3. Tap **OK** to accept the name.

To save an edited protocol

1. In the protocol, tap **Save** to open the Save As dialog box.

   Important: Saving the protocol with the same name in the same location overwrites the original protocol. Saving the protocol with a new name or in another location creates a new protocol. The original file remains unchanged.

2. To save the protocol with a new name, tap **File Name** and type a new name.
3. Do one of the following:
   - Select a folder from the dropdown list in which to save the protocol.
   - Tap **New Folder** to create a new folder in which to save the protocol.

4. Click **Save** to save the protocol or **Cancel** to return to the New Protocol dialog box.

Chapter 5 Protocol AutoWriter

This chapter explains how to create protocols on the C1000 Touch™ thermal cycler using the Protocol AutoWriter. The chapter also explains how to use the T_a calculator.

Overview of the Protocol AutoWriter

The Protocol AutoWriter (referred to in this document as the Protocol AutoWriter) uses standard PCR guidelines that automatically generate cycling protocols with initial template denaturation and enzyme activation, followed by cycles of denaturation, annealing, and extension, and then final extension steps. Protocols are based on user input parameters of target amplicon length, enzyme type, and annealing temperature or primer sequences.

Protocols generated by the Protocol AutoWriter at various speed settings (standard, fast,and ultrafast) can result in different product yields because the software can adjust the annealing temperature, reduce the total number of protocol steps or GOTO repeats, shorten hold times, or reduce the temperature differentials between steps to generate these protocols.

The Protocol AutoWriter uses established PCR standards that reference data tables to produce the final suggested protocols: either a standard two-step protocol or a three-step protocol with a final extension step.

The steps and value ranges that the Protocol AutoWriter generates are as follows:

1. **Initial hot start activation/denaturation step** — the range is 95–98°C for 30 or 180 sec, depending on the enzyme type and speed setting.
2. **Denaturation step** — the values are either 95 or 98°C for 5–30 sec, depending on the enzyme type and speed setting.
3. **Annealing step** — the Protocol AutoWriter uses either a value that you enter or the primer annealing temperature (T_a) at standard speed that is calculated by the T_a calculator.
   - **Length of annealing time** — the range is 10–30 sec depending on the speed setting. Two-step protocols combine annealing and extension steps.
   - **Annealing temperature (T_a)** — this temperature is calculated based on primer characteristics and the selected reaction speed. If the iProof enzyme is selected, 3°C are added to the T_a value.

4. **Extension step** (for three-step protocols only) — all extension steps are performed at 72°C with the duration based on a time calculated from set times per kbp (for example, 60 sec/kbp) of the largest amplicon in a size bin, often with some modifications at the smaller amplicon sizes.
5. **Number of repeats** — the steps are repeated 25–40 times depending on the speed selected.
6. **Final extension step** — this step is performed at 72°C for 1–5 min depending on speed settings.

The Protocol AutoWriter uses information about the reaction to automatically write a protocol. This feature enables you to enter the following information about the PCR experiment:

- **Primers** — the reaction T_a for the primers being used. If the T_a is not known, enter the primer sequence in the T_a calculator so that the Protocol AutoWriter calculates this value.

  Note: The T_a is adjusted from the primer melting temperature (T_m) information, which is based on the selected enzyme and the protocol speed selected.

- **Amplicon length** — the expected length of the PCR product.
- **Enzyme type** — the DNA polymerase enzyme (iTaq™, iProof™ DNA, or Other).

  If an enzyme other than iTaq or iProof DNA polymerase is used, enter additional information, including the hot-start activation time and the final extension time.

- **Desired run speed** — the reaction speed (standard, fast, or ultrafast). The Protocol AutoWriter optimizes the protocol depending on the selected speed setting.

The total run time is determined by the number of steps and cycles, the incubation time at each step, and the time it takes to reach uniformity at the target temperature.

To reduce the overall run time, the Protocol AutoWriter reduces one or more of the following:

- The total number of protocol steps (for primers with high T_m values, the annealing and extension steps can be combined into one step)
- The number of cycles
- The hold time in each temperature step
- The ramp time between steps (by reducing the temperature change from one step to the next)

For example, the Protocol AutoWriter can shorten a protocol by:

- Changing the initial template denaturation and enzyme activation step from 95°C for 3 min to 98°C for 30 sec hold time in each temperature step
- Changing the denaturation step in each cycle from 95°C for 30 sec to 92°C for 1 sec
- Combining the annealing and extension steps into a single step at 70°C for 20 sec

The T_a Calculator

The T_a calculator calculates the T_m value for each primer as well as the T_a value for the protocol at standard speed.

The T_a for the protocol is based on the average primer T_m values with the following applied:

- If the difference between the primer T_m values is >4°C, the T_a = (lower of the two primer T_m values + 2) – 4°C.
- If the difference between the T_m values is ≤4°C, the T_a = (average of the primer Tm values) – 4°C.

Base Pair Counting Method

For each primer, the T_a calculator uses the base pair counting method for sequences of 14 pairs or fewer.

$$T_m = ((w*A + x*T) * 2) + ((y*G + z*C) * 4)$$

where **w**, **x**, **y**, and **z** are the number of the bases **A**, **T**, **G**, and **C** in the sequence, respectively.

Nearest Neighborhood Method

For sequences longer than 14 bp, the nearest neighbor method is used. In the nearest neighbor method, the melting temperature calculations are based on the thermodynamic relationship between entropy (order or a measure of the randomness of the oligonucleotide), enthalpy (heat released or absorbed by the oligonucleotide), free energy, and temperature.

$$\Delta H = \Delta G + T^* \Delta S$$

where:

- ΔH = Enthalpy value, Cal/Mole*K
- T = temperature, Kelvin.
- ΔS = Entropy value, Cal/Mole*K
- ΔG = Gibbs free energy in Cal/Mole*K

The change in entropy and enthalpy is directly calculated by summing the values for nucleotide pairs shown in Table 6 on page 57 (Breslauer et al. 1986).

The relationship between the free energy and the concentration of reactants and products at equilibrium is given by:

$$\Delta G = R*T*\ln((DNA * Primer)/(DNA + Primer))$$

where R is the gas constant (1.986 Cal/Mole*K)

Substituting G in the two equations and solving for T gives

$$T = \Delta H/(\Delta S + R*Ln((DNA * Primer)/(DNA + Primer)))$$

assuming the concentration of DNA and the concentration of the DNA-primer complex are equal.

It has been determined empirically that there is a 5 kcal free energy (3.4 kcal) (Sugimoto et al. 1996) change during the transition from single-stranded to B-form DNA.

This is presumably a helix initiation energy. Finally, adding an adjustment for salt gives the equation that the T_a calculator uses:

$$T = (\Delta H - 5(KCal/K*Mole))/(\Delta S + (R * ln(1/(primer)))) + 16.6 \log_{10}(SaltMolarity)$$

No adjustment constant for salt concentration is needed, since the various parameters were determined at 1 M NaCl, and the $\log_{10}$ of 1 is zero.

The thermodynamic calculations assume that annealing occurs at pH 7.0. The T_m calculations assume that the sequences are not symmetrical and contain at least one **G** or **C**.

The oligonucleotide sequence should be at least 14 bases long to give reasonable T_m values. Less than 14 bases uses the base pair counting method (see Table 6 on page 57).

Table 6. Breslauer interaction constants

INTERACTION		Delta (H)	Delta (S)	Delta (G)
AA	TT	9.1	24	1.9
AT	TA	8.6	23.9	1.5
AC	TG	6.5	17.3	1.3
AG	TC	7.8	20.8	1.6
TA	AT	6	16.9	0.9
TT	AA	9.1	24	1.9
TC	AG	5.6	13.5	1.6
TG	AC	5.8	12.9	1.9
CA	GT	5.8	12.9	1.9
CT	GA	7.8	20.8	1.6
CC	GG	11	26.6	3.1
CG	GC	11.9	27.8	3.6
GA	CT	5.6	13.5	1.6
GT	CA	6.5	17.3	1.3
GC	CG	11.1	26.7	3.1
GG	CC	11	26.6	3.1

Creating a Protocol with the Protocol AutoWriter

To use the Protocol AutoWriter to create a new protocol

1. Tap **C1000 Touch Protocol AutoWriter** on the Home screen.
2. Select the enzyme to use for the reaction. The default selection is iTaq DNA polymerase.
   - If the protocol uses iProof DNA polymerase, tap **iProof**.

     Note: If you select iProof, the protocol automatically adds 3°C to the T_a value.
   - Tap **Other** to customize the enzyme options:
     - ☐ Gradient Range
     - ☐ Hot Start Activation
     - ☐ Final Extension

     In Target, tap the text box for each option and enter values using the keypad that appears.

3. In Target, tap **Amplicon Length** and enter the amplicon length in base pairs (bp).
4. In Target, tap **Annealing Temperature** and enter the T_a in °C.
5. In Speed, tap the appropriate reaction speed for the protocol.

Note: The annealing temperature and estimated total run time change as the speed changes:

- For **Standard** speed, the annealing temperature used in the protocol is 4°C below the primer average T_m.
- For **Fast** speed, the annealing temperature is 2°C below the primer T_m average.
- For **Ultrafast** speed, the unadjusted primer T_m average is used.

6. Tap **Next** to review the new protocol in the edit protocol screen.

   Tip: To edit the protocol, see Editing a Protocol on page 49.

7. Do one of the following:
   - Tap **Back** to return to the Protocol AutoWriter dialog box.
   - Tap **Save** to save the protocol.
   - Tap **Run** to run the protocol.

Creating a Protocol when the T_a Is Unknown

When the T_a is unknown, you can use the T_a calculator to calculate the value. Then you can return to the Protocol AutoWriter to create your protocol.

To use the T_a calculator

1. On the Home screen, tap **Protocol AutoWriter**.

   The Protocol AutoWriter dialog box appears.

2. Tap **T_a Calculator** at the bottom of the screen.
3. Tap **Forward Primer** and enter the forward primer sequence using the **A, T, G, C** keys.
4. Tap **OK** to confirm.
5. Tap **Reverse Primer** and enter the reverse primer sequence using the **A, T, G, C** keys.
6. Tap **OK** to confirm.
7. If necessary, perform either of the following:
   - To correct a wrong base entry in the sequence entry dialog box, press **BACK** and clear the previously added base.
   - To erase an entire primer sequence in the T_a Calculator dialog box, tap the corresponding clear button.

The Ta Calculator calculates and displays the T_m of each primer and the average T_m and T_a values, for example:

If the primer T_m values are greater than 4°C apart, the Protocol AutoWriter uses the lower primer T_m value + 2°C as a basis for calculating the T_a value, which can be further modified by the enzyme and reaction speed selections.

The T_a calculator generates an annealing temperature for standard speed with iTaq DNA polymerase. When using a different enzyme, the speed settings automatically adjust the T_a.

8. Tap **OK** to return to the Protocol AutoWriter. Refer to Creating a Protocol with the Protocol AutoWriter on page 58 for information about using the AutoWriter.

Chapter 6 Running Protocols

From the C1000 Touch™ thermal cycler you can do the following:

- Run a protocol.
- Monitor run.
- Pause and resume a run.
- Skip steps in a run.
- Cancel a run.
- Incubate samples.

This chapter explains how to perform these tasks using the thermal cycler's touch screen.

Running a Protocol

You can run standard and real-time protocols on the C1000 Touch thermal cycler. If your thermal cycler has a dual reaction block attached, you can run the same protocol on each block at the same time. You can also run multiple protocols at the same time if you have one or more S1000™ thermal cyclers connected to the C1000 Touch thermal cycler.

Important: You cannot run real-time protocols on an S1000 thermal cycler. You can run a real-time protocol on the C1000 Touch thermal cycler and a standard protocol on the S1000 at the same time.

This section explains how to prepare to run a protocol.

To run a standard protocol on a single reaction block

1. Do one of the following:
   - Select a protocol from the Saved Files library and then tap **Run**.
   - Edit a protocol from the Saved Files library and then tap **Run**.
   - Create a new protocol and then tap **Run**.

   The Run dialog box appears displaying the protocol and name of the thermal cycler at the top.

2. Review the sample volume and lid temperature settings. If necessary, tap the appropriate field to change the parameters for this run only.

   Note: The sample volume value determines the temperature control mode. If the value is greater than zero (0), the thermal cycler uses Calculated Temperature mode to calculate the target temperature. If the value is zero, the thermal cycler uses Block mode, in which case the thermal cycler assumes that the temperature of the sample is the same as that of the block.

3. (Optional) Tap **Additional Settings** and, using the alphanumermic keypad that appears, enter values for

   - User name
   - Email address (to send an email notification upon run completion)
   - Sample ID
   - Ramp rate for all steps of a protocol

   To run a protocol on the C1000 Touch at the same ramp speed as that of the DNA Engine® thermal cycler, tap the **DNA Engine Ramp** checkbox.

4. Tap **OK** to confirm and close the Additional Settings dialog box.
5. In the Run dialog box, tap **OK** to start the run.

To run a real-time protocol on a single reaction block

1. From the protocol screen tap **Run**.

   The Run dialog box appears displaying the protocol and name of the thermal cycler at the top.

2. Review the sample volume and lid temperature settings. If necessary, tap the appropriate field to change the parameters for this run only.

3. Select a scan mode for the run.
4. (Optional) Tap **Additional Settings** and, using the alphanumermic keypad that appears, enter values for
   - User name
   - Email address (to send an email notification upon run completion)
   - Sample ID
   - Ramp rate for all steps of a protocol

   To run a protocol on the C1000 Touch at the same ramp speed as that of the DNA Engine thermal cycler, tap the **DNA Engine Ramp** checkbox.
5. Tap **OK** to confirm and close the Additional Settings dialog box.
6. In the Run dialog box, tap **OK** to start the run.

To run multiple protocols at the same time

1. From the protocol screen tap **Run**.

   The Select block(s) to run on dialog box appears.

2. Tap the checkbox for each reaction module block on which you plan to run a protocol.

   Alternatively, tap **Select All** to select all available blocks.

3. Determine whether you want to start blocks individually or simultaneously:
   - Tap **Confirm all blocks individually** to start the runs at different times.
   - Clear (or leave clear) the checkbox to start the runs simultaneously.
4. Tap **OK** to confirm the settings.

   The Run dialog box appears
5. (Optional) Tap **Additional Settings** and, using the alphanumermic keypad that appears, enter values for
   - User name
   - Email address (to send an email notification upon run completion)
   - Sample ID
   - Ramp rate for all steps of a protocol

   To run a protocol on the C1000 Touch at the same ramp speed as that of the DNA Engine thermal cycler, tap the **DNA Engine Ramp** checkbox.
6. Tap **OK** to confirm and close the Additional Settings dialog box.
7. In the Run dialog box, tap **OK** to start the run.

Monitoring a Run

During a run, you can use the status buttons on the Home screen to monitor all blocks.

To monitor a running protocol

1. To see the detailed run status for a particular thermal cycler, tap its status button on the Home screen.

   If the thermal cycler has a dual 48/48 reaction module, tap the status button for one reaction block (labeled A or B) to see its detailed run status.

   To view the status of another reaction block, select it from the dropdown list.

2. To view the remaining time for the run, tap **View Clock**.
3. To return to the Status screen, tap **View Status**.

Pausing a Run

From its status screen, you can temporarily pause a running protocol. While the protocol is paused, the thermal cycler continues heating or cooling to the target temperature and maintains the lid temperature.

Tip: After a power failure, the C1000 Touch thermal cycler displays a warning message and automatically resumes running a protocol.

WARNING! Pausing a step can adversely change the outcome of the PCR reaction. If the protocol is paused during a temperature step, the PCR reaction stays at the target temperature for a longer hold time than the protocol step requires.

To pause or resume a running protocol

1. On the Home screen, tap the status button for the thermal cycler.

   Its Status dialog box appears.

2. In the Status dialog box, do one of the following:
   - To pause the running protocol, tap **Pause** .
   - To resume the protocol, tap **Resume**.

Skipping Steps in a Protocol

From its status screen, you can skip steps in a protocol while it is running if it is necessary to shorten the protocol.

Tip: By repeatedly skipping steps, it is possible to bypass several cycles of a GOTO loop and shorten a protocol.

To skip one or more steps in a running protocol

1. On the Home screen, tap the status button for the thermal cycler.

   Its Status dialog box appears.

2. Do one of the following:

   - To skip the current step, tap **Skip**.
   - To skip more than one step, tap **Skip** multiple times.

Canceling a Run

You can cancel a protocol while it is running. When the protocol is canceled, the block immediately stops changing temperature.

WARNING! Do not turn off the thermal cycler immediately after canceling a run. You must give the fans enough time to cool the block.

To cancel a protocol running on a single block

1. On the Home screen, tap the status button for the thermal cycler.

   Its Status dialog box appears.

2. Tap **Cancel** to cancel the run.

To cancel a protocol running on multiple blocks

1. On the Home screen, tap the status button for one thermal cycler.
2. In its Status dialog box, tap **Cancel**.
3. Select another block from the dropdown list and tap **Cancel**.
4. Continue until the protocol is canceled on all blocks.

Incubating Samples

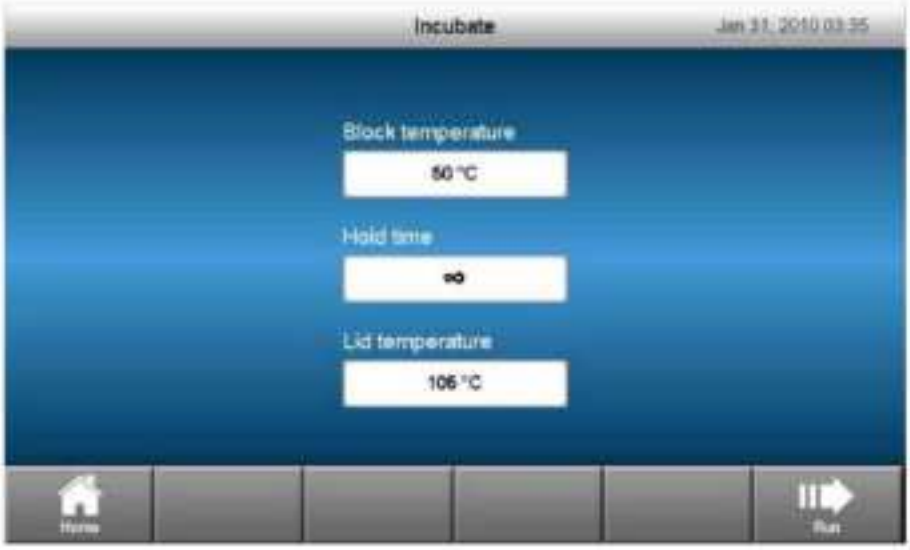
You can keep samples at a constant temperature for any amount of time.

WARNING! Incubating samples for extended periods of time at 4–10°C, particularly in areas of high humidity, can cause excessive moisture condensation around the block.

To incubate samples at a single temperature

1. On the Home screen, do one of the following:
   - If a single block is connected, tap **Incubate**.
   - If multiple blocks are connected, select the target block to incubate and tap **Incubate**.

   The Incubate screen appears:



   The values for block temperature, hold time, and lid temperature are the same as for the most recently run incubation.

   Note: When incubation occurs at temperatures below 30°C, the lid maintains a temperature of 31°C to prevent excessive condensation.

2. Tap each field to enter new incubation values using the keypad that appears.
3. Tap **Run** to start the incubation.
4. To end the incubation and view the final status screen, tap **Cancel**.

Chapter 7 Transferring Data Files

When the run is complete, CFX Maestro™ analyses the fluorescence data. If the run is performed in stand-alone mode and saved on the instrument itself, the data need to be transferred to the CFX Maestro computer for analysis.

The C1000 Touch™ thermal cycler can store up to 100 real-time PCR runs. After the run completes, you can transfer stored data files from the thermal cycler to the CFX Maestro computer through email, USB drive, or the software itself.

This chapter explains how to transfer stored data files to the CFX Maestro computer.

Transferring Data Using Email

To email a data file at the end of a run

1. Set up email notifications on the thermal cycler.

   See Setting Up Email Notification on page 36 to set up the email server and Creating User Accounts on the C1000 Touch Thermal Cycler on page 35 to assign email addresses.

2. On the User Settings screen, ensure that Attach Data File is selected.

   The run data are emailed as a .pcrd file.

Transferring Data Using a USB Drive

If you insert a USB drive into the USB port on the C1000 Touch thermal cycler, the data file (.zpcr file) is automatically saved to the root directory of the USB drive when the run completes. You can also locate previously saved data files on the thermal cycler and save them onto an attached USB drive.

To locate and save data files onto a USB drive

1. On the C1000 Touch Home screen, touch Saved Files to access the file folders.
2. On the Location column, touch Real-Time Data.
3. Select the file to export in the File column.

   Information about the selected file appears in the Preview pane.
4. To export the file, touch File Options.
5. On the message that appears, touch OK to save the file to the attached USB drive.

   The run data are saved onto the USB drive as separate .zpcr files.

To transfer the .zpcr file to the CFX Maestro computer

1. After saving the .zpcr file onto the USB drive, remove the USB drive from the C1000 Touch thermal cycler.
2. Insert the USB drive into a USB port on the CFX Maestro computer.
3. In Windows Explorer, locate and open the USB drive.
4. Select the .zpcr file and copy it into a folder on the computer.

Transferring Data Using CFX Maestro Software

To transfer data from CFX Maestro software

- In the Detected Instruments pane on the Home window of CFX Maestro software, right-click the target instrument and select Retrieve Data Files.

  The run data are saved into a folder labeled Real-Time Data as separate .zpcr files.

Chapter 8 Managing Files and Folders

You can save data files directly on the C1000 Touch™ thermal cycler. You can create folders on the thermal cycler in order to manage your stored data files. This chapter explains how to manage files and folders on the C1000 Touch thermal cycler.

The Saved Files Screen

On the C1000 Touch thermal cycler, you manage folders and files from the Saved Files screen. This screen is accessed by tapping **Saved Files** on the Home screen. On the Saved Files screen, you can access multiple locations and folders.

- **Recent** — contains a list of all previously run protocols.
- **<Name or serial number of thermal cycler>** — contains protocols stored on the thermal cycler, including the **Bio-Rad PCR** folder that stores the preinstalled PCR protocols.

  If a CFX96™ or CFX384™ optical reaction module is installed on the base, a **Bio-Rad qPCR** folder appears in the Folders column. This folder contains preinstalled qPCR protocols.
- **Real-time data** — contains the last 100 real-time PCR data files.

- **<User name>** — contains folders that the logged-in user creates in which to store personal protocols.

  All users can access the user folders. However, only a user who is logged in can edit, delete, or save into user folders.

- **<Attached devices>** (optional) — available when external devices such as USB flash drives or S1000™ cyclers are attached to the C1000 Touch thermal cycler.

Managing Files and Folders

To manage files and folders, tap **Saved Files** on the Home screen to open the Saved Files screen. The menu of functions provides options for managing files and folders; the menu changes depending on the selected option. Table 7 lists all the folder and file functions available in the Saved Files screen.

Note: Folder and file names have a 12 character limit on the C1000 Touch thermal cycler. Folder and file names have an 8 character limitation the S1000 thermal cycler.

Table 7. List of file and folder functions in the saved files screen

Options	Function
Folder options	
Copy	Copies an existing folder to another thermal cycler or a USB flash drive.
Delete	Deletes the folder and all of its contents.
Rename	Renames a folder.
File options	
Copy	Copies an existing file to another folder location.
Delete	Deletes a file.
Rename	Renames a file.
New Folder	Creates a new folder on the C1000 Touch thermal cycler, an attached S1000 thermal cycler, or a USB flash drive.
Home	Returns to the Home screen.

Managing Folders on the C1000 Touch Thermal Cyler

This section explains how to manage folders on the C1000 Touch thermal cycler.

Creating a New Folder

To create a new folder

1. On the Home screen, tap **Saved Files**.

   The Saved Files dialog box appears.

2. In the Saved Files dialog box, select a **Location** in which to create the new folder.

   You can select

   - The instrument (SC005016 in the image that follows)
   - Real-Time Data folder
   - User's folder
   - USB Drive (if one is attached)

3. Tap **New Folder** and enter a folder name using the keypad that appears.
4. Tap **OK** to confirm.

Copying a Folder

You can copy a folder in one location on the thermal cycler and save it into another location. You can also copy a folder and save it into the same location. In this case, you must rename the copied folder. You cannot have two or more folders with the same name in the same location.

To copy a folder

1. On the Home screen tap **Saved Files**.

   The Saved Files dialog box appears.

2. In the **Location** column, tap the location that contains the target folder.

   The folders within that location appear in the Folders column.

3. In the **Folders** column, select the target folder.

4. Tap **Folder Options** at the bottom of the dialog box.

   The Folder Options dialog box appears.

5. Tap **Copy**.

   The Save As dialog box appears.

6. (Optional) Tap **Folder Name** and enter a new name for copied folder using the keypad that appears.

7. Select location from the **Location** dropdown list.

8. Tap **Save** to save the changes.

Deleting a Folder

Important: When you delete a folder, its contents are also deleted. Take care when deleting folders from the C1000 Touch thermal cycler.

To delete a folder

1. On the Home screen, tap **Saved Files**.

   The Saved Files dialog box appears.

2. In the **Location** column, tap the location that contains the target folder.

   The folders within that location appear in the Folders column.

3. In the **Folders** column, select the target folder.
4. Tap **Folder Options** at the bottom of the dialog box.

   The Folder Options dialog box appears.

5. Tap **Delete**.
6. Tap **Yes** to confirm.

Renaming a Folder

To rename a folder

1. On the Home screen tap **Saved Files**.

   The Saved Files dialog box appears.

2. In the **Location** column, tap the location that contains the target folder.

   The folders within that location appear in the Folders column.

3. In the **Folders** column, select the target folder.
4. Tap **Folder Options** at the bottom of the dialog box.

   The Folder Options dialog box appears.

5. Tap **Rename** and type a new folder name using keypad that appears.
6. Tap **OK** to confirm the new name for the folder.

Managing Files on the C1000 Touch Thermal Cyler

This section explains how to manage files on the C1000 Touch thermal cycler.

Copying a File

To copy a file

1. On the Home screen tap **Saved Files**.

   The Saved Files dialog box appears.

2. In the **Location** column, tap the location that contains the folder in which the file is saved.

   The folders within that location appear in the Folders column.

3. In the **Folders** column, tap the folder in which the file is saved.

4. Tap **File Options** at the bottom of the dialog box.

   The File Options dialog box appears.

5. Tap **Copy**.

   The Save As dialog box appears.

6. (Optional) Tap **File Name** and enter a new name for copied file using the keypad that appears.

7. Select location from the **Location** dropdown list.

8. Select a folder in which to save the copied file from the **Folder** dropdown list.

   Alternatively, tap **New Folder** and create a new folder in which to save the copied file.

9. Tap **Save** to confirm.

Deleting a File

To delete a file

1. On the Home screen tap **Saved Files**.

   The Saved Files dialog box appears.

2. In the **Location** column, tap the location that contains the folder in which the file is saved.

   The folders within that location appear in the Folders column.

3. In the **Folders** column, tap the folder in which the file is saved.

4. Tap **File Options** at the bottom of the dialog box.

   The File Options dialog box appears.

5. Tap **Delete**.

6. Tap **Yes** to confirm.

Renaming a File

To rename a file

1. On the Home screen tap **Saved Files**.

   The Saved Files dialog box appears.

2. In the **Location** column, tap the location that contains the folder in which the file is saved.

   The folders within that location appear in the Folders column.

3. In the **Folders** column, tap the folder in which the file is saved.

4. Tap **File Options** at the bottom of the dialog box.

   The File Options dialog box appears.

5. Tap **Rename** and type a new name for the file using the keypad that appears.

6. Tap **OK** to confirm.

Appendix A Operating S1000 Thermal Cyclers Connected to the C1000 Touch Thermal Cyler

When an S1000™ thermal cyler is connected to a C1000 Touch™ thermal cycler, it is in semi-lockdown mode. In this mode, the S1000 thermal cycler does not respond when its control panel keys are pressed. However, the following keys on the control panel continue to respond:

- **SCREEN** — use this key to access the Running, Graphical, and Time Remaining screens.
- **PAUSE** — use this key to temporarily stop a protocol that is currently running on the S1000.

  This function is active when an individual protocol screen is displayed.
- **CANCEL** — use this key to cancel a protocol that is currently running on the S1000.

  This function is active when an individual protocol screen is displayed.
- **ENTER** — use this key to begin a run sent from the CFX Maestro™ software.
- **ENTER** — use this key to skip a step.

  This function is active when an individual protocol screen is displayed.

For more information about using the S1000 thermal cycler, refer to its documentation.

Appendix B Safety and Regulatory Compliance

The C1000 Touch™ thermal cycler heats and cools very quickly during operation. Bio-Rad strongly recommends that you follow the safety specifications listed in this appendix and throughout this manual.

Note: Use only Bio-Rad–supplied USB cables (catalog #1848000) when using the C1000 Touch thermal cycler.

Instrument Safety Warning Labels

The warning labels in Table 8 appear on the C1000 Touch thermal cycler and refer directly to the safe use of this instrument.

Table 8. Instrument safety warning labels

Icon	Meaning
	**CAUTION: Risk of danger!** This symbol identifies components that pose a risk of personal injury or damage to the instrument if improperly handled. Wherever this symbol appears, consult the manual for further information before proceeding. **Note:** Operating the C1000 Touch thermal cycler before reading this manual can constitute a personal injury hazard. Only qualified laboratory personnel should operate this instrument.
	**WARNING! Risk of electrical shock!** This symbol identifies components that pose a risk of electrical shock if improperly handled. Important: Never remove the outer case of a thermal cycler base. This may cause you to receive an electrical shock. This thermal cycler uses neutral fusing, which means that live power could still be exposed inside the instrument even when the fuse is blown or removed. Do not attempt to remove the outer case of this thermal cycler base, power supply, heat pump, or other accessories. If you open these instruments, you put yourself at risk for electrical shock and void your warranty. All repairs must be done by an authorized repair service.

Table 8. Instrument safety warning labels, continued

Icon	Meaning
	**WARNING! Hot surface!** This symbol identifies components that pose a risk of personal injury due to excessive heat if improperly handled. Important: The sample blocks can become hot enough during the course of normal operation to cause liquids to boil and explode. A thermal cycler generates enough heat to cause serious burns. Wear safety goggles or other eye protection at all times during operation. Always allow the sample block to return to idle temperature before opening the lid and removing samples. Always allow maximum clearance to avoid accidental skin burns.

Safety and Regulatory Compliance

This instrument has been designed to be safely operated under the environmental conditions listed in Table 9.

Table 9. Conditions for safe use

Usage Aspect	Conditions for Safe Use
Rated input power	100–240 VAC, 50–60 Hz, 850 W Max
Overvoltage category	II
Fuses	10 A, 250 V, 5 x 20 mm, fast blow (qty. 2)
Environment	Indoor use only
Temperature	15–31°C
Relative humidity	Up to 80% (noncondensing)
Altitude	Up to 2,000 meters above sea level
Pollution degree	2

Safety Compliance

This instrument has been tested and found to be in compliance with all applicable requirements of the following safety and electromagnetic standards:

- IEC 61010-1:2001 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements
- IEC 61010-2-010:2003 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 2-010: Particular Requirements for Laboratory Equipment for the Heating of Materials
- IEC 61010-2-081:2001+A1:2003 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 2-081: Particular Requirements for Automatic and Semi-Automatic Laboratory Equipment for Analysis and Other Purposes
- CAN/CSA-C22.2 NO. 61010-1-04 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements
- CAN/CSA-C22.2 NO. 61010-2-010-04 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 2-010: Particular Requirements for Laboratory Equipment for the Heating of Materials
- CAN/CSA-C22.2 NO. 61010-2-081-04 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 2-081: Particular Requirements for Automatic and Semi-Automatic Laboratory Equipment for Analysis and Other Purposes
- EN 61010-1:2001 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements
- EN 61010-2-010:2003 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory use, Part 2-010: Particular Requirements for Laboratory Equipment for the Heating of Materials
- EN 61010-2-081:2002+A1:2003 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory use, Part 2-081:Particular Requirements for Automatic and Semi-Automatic Laboratory Equipment for Analysis and Other Purposes
- UL 61010-1:2004 (R2008) Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements
- UL 6101A-2-010:2002 Standard for Electrical Equipment for Laboratory Use, Part 2: Particular Requirements for Laboratory Equipment for the Heating of Materials

Electromagnetic Compatibility (EMC)

- IEC 61326-1:2005 Electrical Equipment for Measurement, Control, and Laboratory Use - EMC Requirements, Class A
- EN 61326-1:2006 Electrical Equipment for Measurement, Control, and Laboratory Use - EMC Requirements, Class A
- FCC Part 15, Subpart B, Sections 15.107 and 15.109 as a Class A Digital Device

FCC Warnings and Notes

- **Warning:** Changes or modifications to this unit, not expressly approved by Bio-Rad, could void the user's authority to operate the equipment.
- **Note:** This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radiofrequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.
- **Note regarding FCC compliance:** Although this instrument has been tested and found to comply with Part 15, Subpart B of the FCC Rules for a Class A digital device, please note that this compliance is voluntary, for the instrument qualifies as an "exempted device" under 47 CFR 15.103(c), in regard to the cited FCC regulations in effect at the time of manufacture.
- **Note regarding Class A FCC limits:** Shielded cables must be used with this unit to ensure compliance with the Class A FCC limits.
- **Note regarding Canadian EMC compliance:** Le present appareil numerique n'emet pas de bruits radioelectrique depassant les limites applicables aux appareils numeriques de class A prescrites dans le reglement sur le brouillage radioelectrique edicte par le Ministere des Communications du Canada.
- **Note regarding cables:** Shielded cables must be used with this unit to ensure compliance with the Class A FCC limits.

Battery

The C1000 Touch thermal cycler uses a 3 V lithium-metal coin cell battery and a 4.8 V nickel-metal hydride rechargeable battery pack to maintain time settings and run data in the event of AC power loss. If the time and/or run data do not remain set after the unit is turned off, it may be an indication that the batteries are getting weak. If this occurs, contact Bio-Rad Technical Support for assistance.

WARNING! Do not attempt to change the batteries. Contact Bio-Rad Technical Support.

For the State of California, USA only

- Perchlorate material – special handling may apply, see www.dtsc.ca.gov/hazardouswaste/perchlorate
- Perchlorate material – lithium battery contains perchlorate

Warranty

The C1000 Touch thermal cycler and associated accessories are covered by a standard Bio-Rad warranty. Contact your local Bio-Rad office for the details of the warranty.

Appendix C CFX Instrument and CFX Maestro Software Catalog Numbers

This appendix lists the catalog numbers for Bio-Rad's CFX instruments and compatible optical and traditional reaction modules, and the CFX Maestro™ software.

Table 10. Catalog numbers for Bio-Rad's CFX instruments and modules, and CFX Maestro software

Catalog Number	Description
Instruments and Reaction Modules	
184-1100	C1000 Touch™ Thermal Cycler Chassis
184-2000	S1000™ Thermal Cycler Chassis
184-0148	Dual 48/48 Fast Reaction Module
184-0196	96-Well Fast Reaction Module
184-0197	96-Well Deep Well Reaction Module
184-0138	384-Well Reaction Module
185-1196	C1000 Touch Thermal Cycler With 96-Well Fast Reaction Module
185-1197	C1000 Touch Thermal Cycler With 96-Well Deep Well Reaction Module
185-1148	C1000 Touch Thermal Cycler With Dual 48/48 Fast Reaction Module
185-1138	C1000 Touch Thermal Cycler With 384-Well Reaction Module
185-2196	S1000 Thermal Cycler With 96-Well Fast Reaction Module
185-2197	S1000 Thermal Cycler With 96-Well Deep Well

Table 10. Catalog numbers for Bio-Rad's CFX instruments and modules, and CFX Maestro software, continued

Catalog Number	Description
	Reaction Module
185-2148	S1000 Thermal Cycler With Dual 48/48 Fast Reaction Module
185-2138	S1000 Thermal Cycler With 384-Well Reaction Module
184-5097	CFX96™ Optical Reaction Module
185-5195	CFX96 Touch™ Real-Time PCR Detection System
184-4095	CFX96 Deep Well Optical Reaction Module
185-4095	CFX96 Touch Deep Well Real-Time PCR Detection System
185-5201	CFX Connect™ Real-Time PCR Detection System
184-5385	CFX384™ Optical Reaction Module
185-5485	CFX384 Touch™ Real-Time PCR Detection System
CFX Maestro Software and Accessories	
12004110	CFX Maestro Software
12004128	CFX Maestro Software for Mac
184-5001	CFX Maestro Software, Security Edition, 1 user license
184-5005	CFX Maestro Software, Security Edition, 5 user licenses
184-5010	CFX Maestro Software, Security Edition, 10 user licenses
184-5008	CFX Maestro Software, Chinese Edition

Table 10. Catalog numbers for Bio-Rad's CFX instruments and modules, and CFX Maestro software, continued

Catalog Number	Description
184-5028	CFX Maestro Software, Russian Edition
184-5025	Precision Melt Analysis Software, with calibration kit
184-8000	USB Cable *

*To prevent interference or data loss, use a sufficiently shielded USB 2.0 cable (catalog # 184-8000) when connecting instruments to the computer or to another instrument.

Appendix D Recommended Plastic Consumables

Recommended Plastic Consumables for CFX384 Touch Systems

For optimal results, Bio-Rad recommends the following consumables for the CFX384 Touch™ systems:

- HSP3805 — Low-profile 384-well Hard-Shell® plates with clear shell and white wells
- HSP3865 — Low-profile 384-well Hard-Shell plates with black shell and white wells

Recommended Plastic Consumables for CFX96 Touch and CFX96 Touch Deep Well Systems

The CFX96 Touch™ and CFX96 Touch Deep Well systems accept low-profile 0.2 ml plates and tubes. Bio-Rad recommends the following consumables for optimal results:

- MLL9601 — Multiplate™ low-profile 96-well unskirted PCR plates with clear wells
- MLL9651 — Multiplate™ low-profile 96-well unskirted PCR plates with white wells
- HSP9601 — Hard-Shell® low-profile 96-well skirted PCR plates with white shell and clear wells
- HSP9655 — Hard-Shell low-profile 96-well skirted PCR plates with white shell and white wells
- TLS0801 — Low-profile 0.2 ml 8-tube PCR strips without caps, clear
- TLS0851 — Low-profile 0.2 ml 8-tube PCR strips without caps, white
- TCS0803 — Optical flat 8-cap strip, for 0.2 ml PCR tubes and plates

High-profile plates can also be used with the CFX96 Touch™ deep well real-time PCR detection system.

Plate Seals and Plate Sealer

For optimal results, Bio-Rad recommends the following plate seals:

- MSB1001 — Microseal® 'B' adhesive seals, optically clear (strong adhesive-based)
- MSC1001 — Microseal 'C' optical seals, optically clear (pressure-activated, adhesive-based)
- 1814000 — PX1™ PCR plate sealer

Appendix E Maintenance and Troubleshooting

This appendix explains how to clean and maintain the C1000 Touch™ thermal cycler and how to troubleshoot problems that you might have.

Cleaning and Maintaining the C1000 Touch Thermal Cycler

The C1000 Touch requires little maintenance for proper operation and precise thermal control. However, with long and constant use, the thermal cycler will require some cleaning and other maintenance including replacing the fuses.

The CFX96 Touch™, CFX96 Touch Deep Well, and CFX384 Touch™ systems include a sensitive optical shuttle system that moves quickly during data collection and a sample block that must heat and cool very fast. Contamination of these components can interfere with thermal cycling and data collection.

WARNING! Never allow a reaction to run with an open or leaking sample lid. The reagents could escape and coat the block, inner lid, and optical head in the shuttle system. Excessive dirt can dim the signal, and fluorescence contamination can create excessive background signal. The shuttle system cannot be cleaned except by trained Bio-Rad service engineers.

Avoid contaminating your CFX96 Touch, CFX96 Touch Deep Well, and CFX384 Touch system by following these suggestions:

- Always clean the outside of any containers before placing them in the block.
- Never run a reaction with a seal that is open, loose, punctured, or otherwise damaged because you could contaminate the block, inner lid, and optical system.
- Never run a PCR or real-time PCR reaction with volatile reagents that could explode and contaminate the block, inner lid, and optical system.
- Clean the block and inner lid periodically to prevent the buildup of dirt, biohazardous material, or fluorescent solutions.
- Never clean or otherwise touch the optical system behind the heater plate holes in the inner lid.
- Clean the outer lid and C1000 Touch base on a regular schedule.

Cleaning the C1000 Touch Thermal Cycler

Clean the C1000 Touch thermal cycler on a regular schedule to remove any debris or dirt that might interfere with proper function (see Table 11). Clean the base to prevent damage to the air intake or reaction module bay.

Important: For instructions on handling and cleaning radioactive or biohazardous materials, consult the guidelines for radiation safety and biosafety provided by your institution. These guidelines also include disposal methods of hazardous materials.

Table 11. C1000 Touch thermal cycler base maintenance

Component	Action
Air vents	Use a soft brush, damp cloth, or vacuum cleaner to remove light dust from the air vents. Remove any heavy dust that is deep in the vents with a vacuum cleaner. **Tip:** Cleaning the vents allows sufficient airflow for precise thermal control during a run.
Touch screen	Use any commercially available touchscreen cleaning agent and a soft cloth to clean the touch screen. **Caution:** Do not spray or pour cleaning agent directly onto the touch screen. **Caution:** Do not use abrasive detergents or rough material because they can scratch the touch screen.
Reaction module bay	Use a damp soft cloth to remove debris and spilled liquids. Cleaning the bay allows precise heating and cooling of the reaction block. **Caution:** Never use cleaning solutions that are corrosive to aluminium. Avoid scratching the surface of the bay; surface scratches can interfere with precise thermal control. **Caution:** Never pour water or other solutions in the reaction module bay. Wet components can cause electrical shock when the thermal cycler is plugged in.
Outside case of the thermal cycler base	Use a damp cloth or tissue to clean spills off the outside case. If needed, use a mild soap solution and remove the residue completely. **Tip:** Cleaning the outside case prevents corrosion.

Cleaning Reaction Modules

Clean the reaction modules on a regular schedule to prevent reagents from accumulating and interfering with the ability of the reaction block to change temperature quickly (see Table 12 on page 98).

WARNING! To prevent electrical shock, always remove the reaction module from the thermal cycler base before cleaning it.

Important: Never touch or allow solutions to touch the optical system that is located behind the lid plate holes in the inner lid:

Table 12. Reaction module maintenance

Component	Action
Cooling fins	Use a soft brush or damp cloth to remove light dust from the cooling fins. Remove any heavy dust that is deep in the fins with a vacuum cleaner. Use water and a soft cloth to remove debris that is stuck to the fins. **Tip:** Cleaning the fins improves precise sample heating and cooling. **Caution:** Avoid scratching the surface. Never use cleaning solutions that are corrosive to aluminum, such as bleach or abrasive cleansers. If needed, use a mild soap solution and rinse well to remove the residue completely.
Outside cover of the reaction block	Use a soft cloth and water to remove debris from the outer block. **Caution:** Never clean the block with strong alkaline solutions (strong soap, ammonia, or highly concentrated bleach). Never use corrosive or abrasive cleaning solutions. These cleaning agents can damage the block and prevent precise thermal control.
Block wells	Important: Clean spills immediately to prevent them from drying inside wells. Use disposable plastic pipets with water (recommended), 95% ethanol, or a 1:100 dilution of bleach in water. Always rinse the wells with water several times to remove all traces of ethanol, bleach, or soap. **Caution:** If left in the block wells, bleach, ethanol, or soap could corrode the block and/or destroy tubes and microplates during a run. Always rinse the block well after cleaning it with any solution other than water. **Caution:** Never heat the block after adding a cleaning solution. Heating the block with cleaning solution damages the block, lid, and thermal cycler base. If oil is used, the wells must be cleaned thoroughly and often. Use of oil in the wells is not recommended. Clean the oil when it is discolored or contains dirt. Use a solution of 95% ethanol to clean oil. Do not allow oil to build up in the block.
Inner lid of the reaction module	Use a soft cloth and water to remove debris and solutions from the inner lid surface.

Table 12. Reaction module maintenance, continued

Component	Action
	Tip: Cleaning the inner lid improves precise sample heating and cooling. **Caution:** Never use abrasive detergents or rough materials that scratch the surface.
Outer lid surface of the reaction module	Use a damp cloth or tissue to clean spills off the outside case. If needed, use a mild soap solution and rinse the surface with a damp cloth. **Tip:** Cleaning the cover prevents corrosion.

Maintaining Sufficient Airflow

The C1000 Touch thermal cycler requires sufficient airflow to heat and cool precisely to the correct target temperature. If the flow of air is blocked, the thermal cycler cannot ramp to the correct temperature in the specified time. This section explains how to test the airflow and how to fix low or warm airflow.

Testing for Sufficient Airflow

The airflow is sufficient when the thermal cycler heats and cools to the correct target temperatures promptly. Bio-Rad suggests that you test the airflow when you set up the C1000 Touch thermal cycler in a new location. You can also measure the air temperature at any time to ensure sufficient airflow.

To determine the presence of sufficient airflow

1. Set up and start the thermal cycler.
2. Adjust the local environment for typical conditions:
   - Turn on any nearby equipment, such as fans or other thermal cyclers.
   - Open any window blinds to reproduce typical conditions during a run.
3. Run a typical PCR protocol for 30 min.

   If more than one thermal cycler is in the area, run a protocol on all the thermal cyclers at the same time.

   Note: Samples are not required for the test runs. However, you must include an empty microplate or tubes. The lid does not heat correctly if it touches the hot block of the reaction module.
4. Measure the air temperature at the air intake vents of all the thermal cyclers.

   If the air intake temperature increases above 31°C, see Fixing Insufficient Airflow that follows.

Fixing Insufficient Airflow

If the air temperature near the thermal cycler is above 31°C, make one or more of the following changes to increase the flow of cooler air around the thermal cycler:

- Adjust air conditioning to lower the ambient air temperature.
- Move the thermal cycler to another location.

- Provide more space around the thermal cycler and between adjacent instruments. Arrange instruments so that the warm exhaust air from one instrument does not enter the air intake vents of another.
- Shield the thermal cycler from heat sources such as radiators, heat-producing instruments, and bright sunlight.

Replacing Fuses

Fuses on the C1000 Touch thermal cycler are designed to blow in case of severe power surges or other causes of electrical short. This protects both the user and the thermal cycler from excessive electric charge. Fuses on the thermal cycler rarely need to be replaced. However, some institutions prefer to replace fuses on a regular basis to maintain uninterrupted operation.

If the thermal cycler does not turn on, first verify that the power cord is plugged in to a functioning power source. Also, verify that the power cord and power source are within the specifications for this thermal cycler.

Important: Do not attempt to replace the power cord on the C1000 Touch thermal cycler. Instead, contact Bio-Rad Technical Support.

Finally, verify that the fuses are intact. If the fuses are broken or burned, replace the fuses. This section explains how to view and replace fuses on the C1000 Touch thermal cycler.

Tip: The thermal cycler has two 10 A, 250 V, 5 x 20 mm, fast blow fuses.

WARNING! To prevent electrical shock, always turn off and unplug the thermal cycler from the electrical outlet before checking the fuses.

To view and replace the fuses

1. Using a small coin, open the fuse drawer on the back of the thermal cycler.
2. Pull out the fuse drawer and remove each fuse.
3. Look at the condition of each fuse.

   A bad fuse shows a break or burned spot in the metal. A good fuse has intact metal.
4. Replace each damaged fuse.
5. Close the fuse drawer.

Appendix F References

1. Breslauer KJ et al. (1986). Predicting DNA duplex stability from the base sequence. Proc Natl Acad Sci USA 83, 3,746–3,750.
2. Sugimoto N et al. (1996). Improved thermodynamic parameters and helix initiation factor to predict stability of DNA duplexes. Nucleic Acids Res 24, 4,501–4,505.

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Web site bio-rad.com **USA** 1 800 424 6723 **Australia** 61 2 9914 2800 **Austria** 43 1 877 89 01 177 **Belgium** 32 (0)3 710 53 00 **Brazil** 55 11 3065 7550
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