



WHITE PAPER

The Opentrons Thermocycler Module

The World's Most Affordable Fully Automated Thermocycler

Written by
Opentrons



SECTION 1

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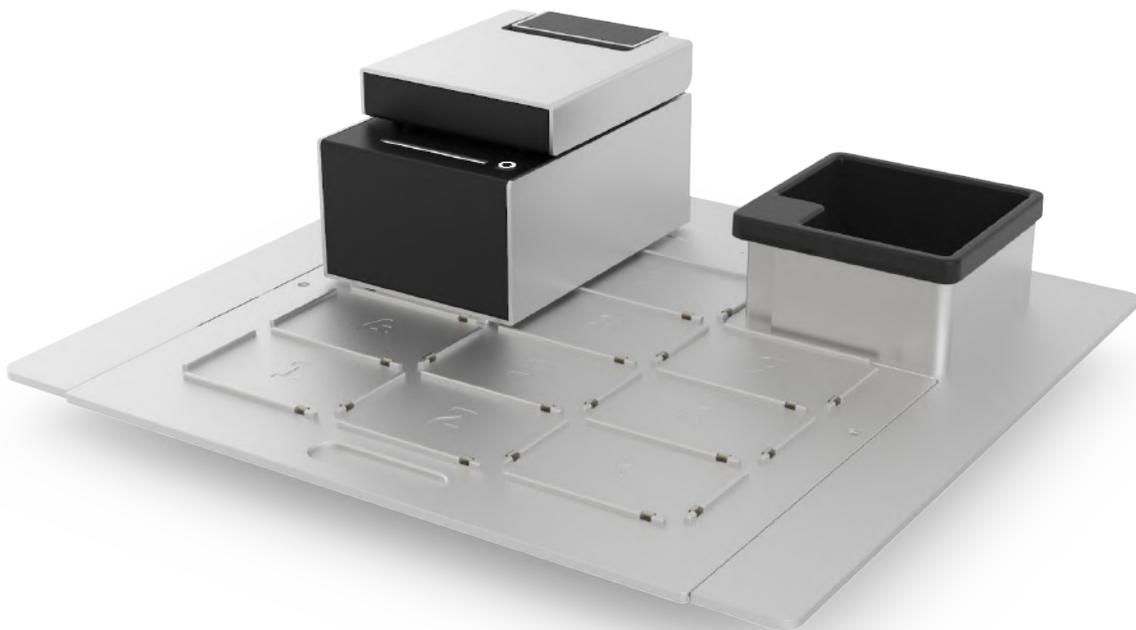
SECTION 2

Introduction

The Opentrons Thermocycler is the most affordable fully automated thermocycler ever made. Designed to fit perfectly onto the deck of the Opentrons OT-2 pipetting robot, the Opentrons Thermocycler boasts performance that has been tested to be comparable to machines five times its price.

The Opentrons Thermocycler enables automation of workflow steps both upstream and downstream for a smooth end-to-end process.

The Opentrons Thermocycler is also seamlessly integrated with the Opentrons platform to suit various applications.



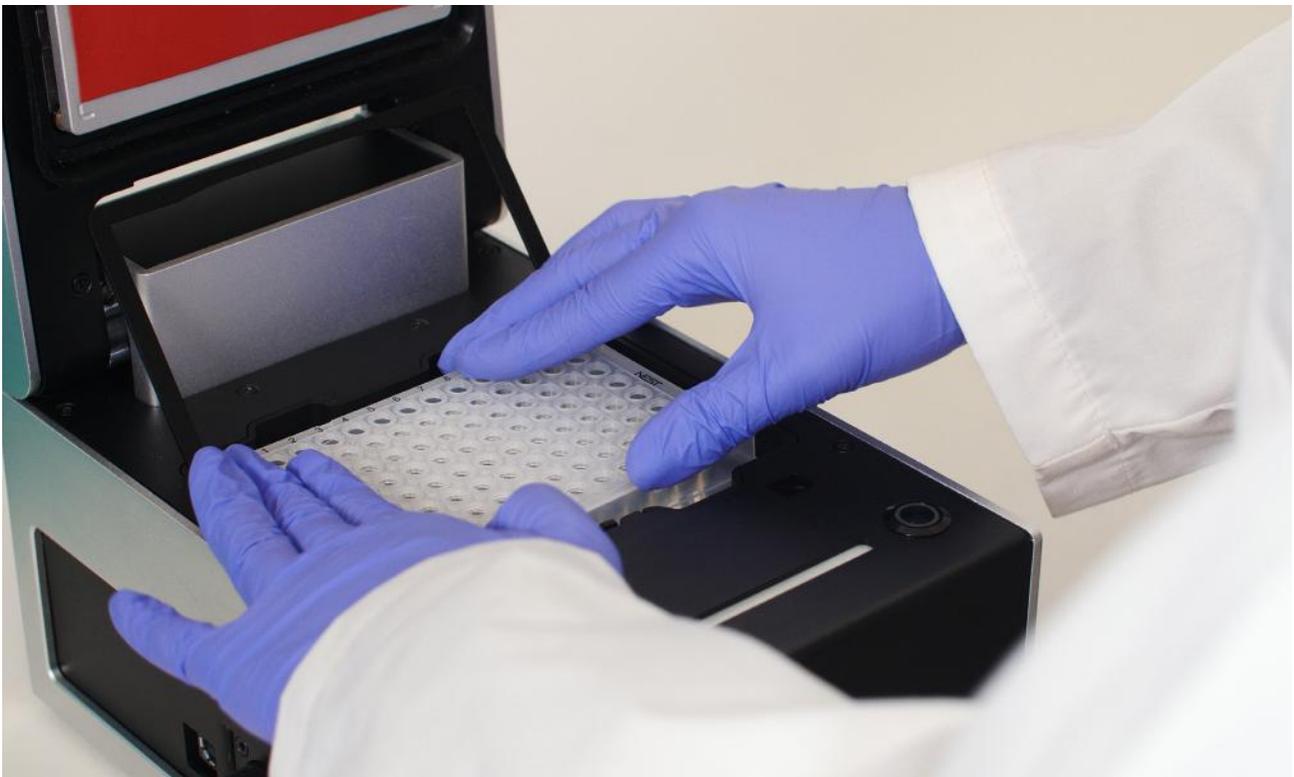
SECTION 3

Product Description

The Opentrons Thermocycler features an automated heated lid and disposable seal system for preventing sample loss.

This module demonstrates highly uniform and speedy ramp rates across all 96 wells that can generate highly uniform PCR products with minimal sample loss and cross-contamination (see: Thermocycler PCR Application note).

It is integrated with the OT-2 liquid handling robot and can be used seamlessly for end-to-end NGS library prep protocols, PCR, and many other thermocycler-based applications, all from a single software interface.



Figures 1 and 2 demonstrate the device's open lid and a closer look at the plate latching mechanism. The latch secures the plate on the module to ensure level and accurate plate placement for optimal results.

FIGURE 1

Thermocycler with Lid Open



It is recommended that you use the 0.1 mL full-skirted 96-well NEST plate. Color coded LEDs on the module indicate ramp status.

FIGURE 2

Thermocycler Latch Mechanism



SECTION 4

Product Specifications

TABLE 1

Thermocycler Specifications

OPENTRONS THERMOCYCLER SPECIFICATIONS	
Compatible Volumes/Format	0.1 mL full-skirted 96-well NEST plate
Working Volume	10 - 100 μ L
Temperature Range	4°C - 99°C
Uniformity	+/-0.5°C up to 95°C
Accuracy	+/-0.5°C up to 95°C
Settling Time	within 30 sec of arrival at target temperature
Ramp Rate (Block)	4°C/sec (MAX); 2.5°C/sec (AVG)
Cooling Rate	2.5°C/sec (MAX)
Lid Temp Range	37°C - 110°C
Lid Accuracy	+/-1°C at 105°C
Lid Uniformity	+/-1°C at 105°C
Voltage	120-240 V
VAC Current	8.5/5 A
Dimensions Closed (LxWxH)	316 mm x 172 mm x 154 mm
Dimensions Open (LxWxH)	316mm x 172mm x 312mm
Mass	7.6 kg

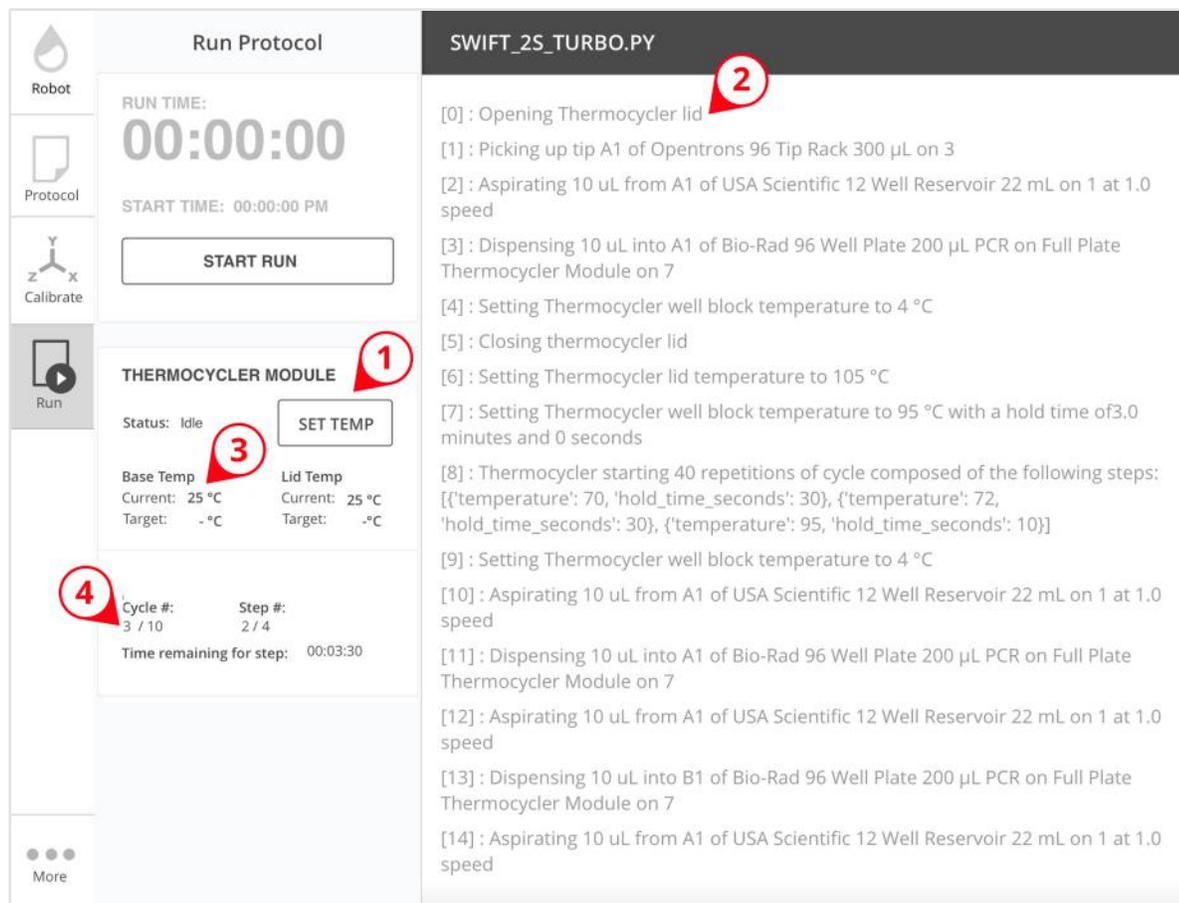
Environmental Test Conditions: Data shown was collected between 22°C - 24°C at 30-60% relative humidity. Different conditions may yield different results.

Opentrons Run App: Figure 3 demonstrates the Opentrons Thermocycler interface in the Opentrons App. Through the app, you can set the temperature of the thermocycler's base block prior to the start of a protocol run (1). In addition to allowing you to manage the temperature of your samples outside of a protocol run,

the app shows you the thermocycler's progress during a protocol in real time (2). While a protocol is running, you can monitor the thermocycler's temperature status (3) and progress in executing a given profile (4).

FIGURE 3

Easy-to-Use Thermocycler Interface in the Opentrons App

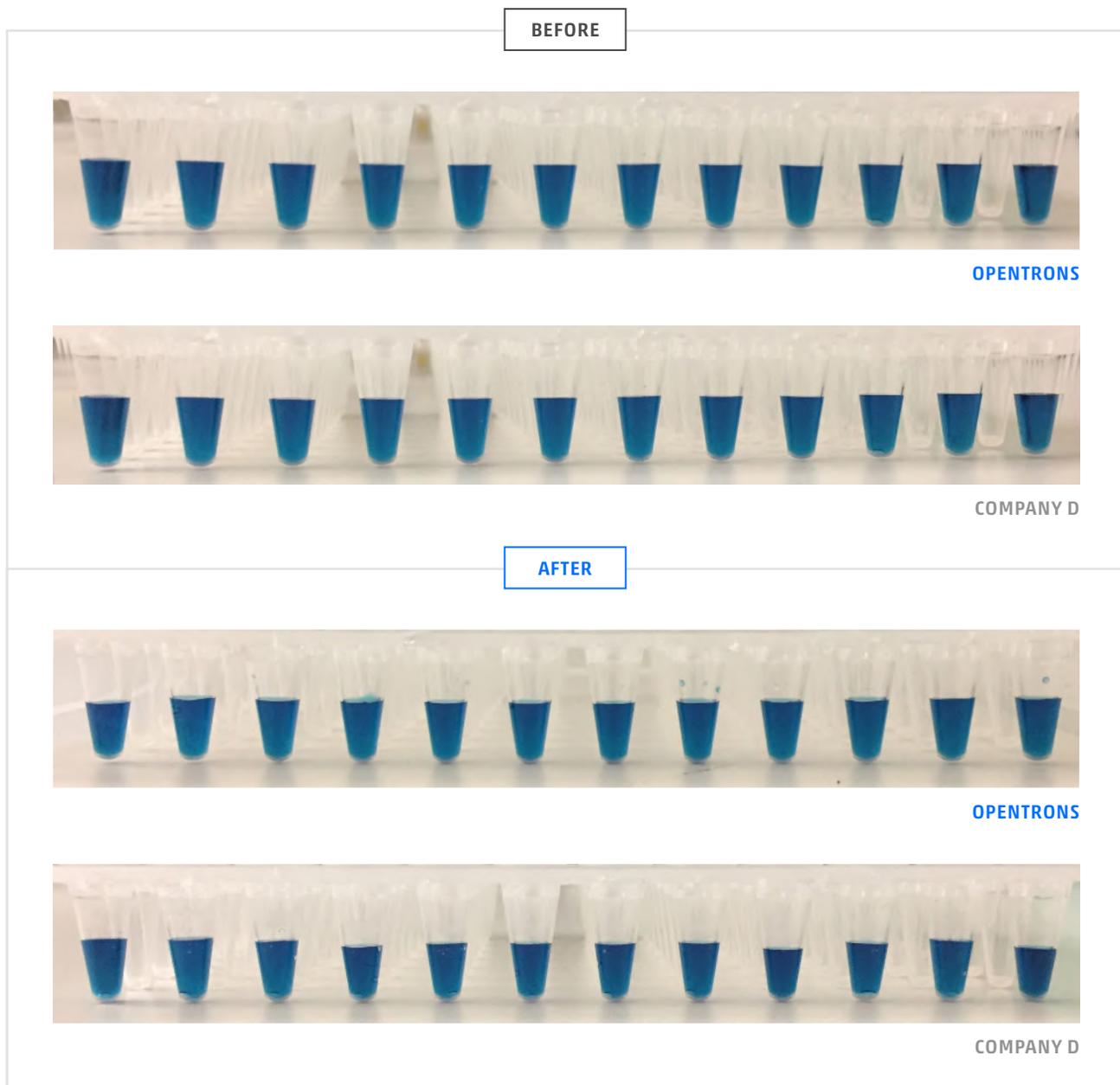


SECTION 5

Results and Discussion

FIGURE 4

Minimal Sample Loss Observed on the Opentrons Thermocycler



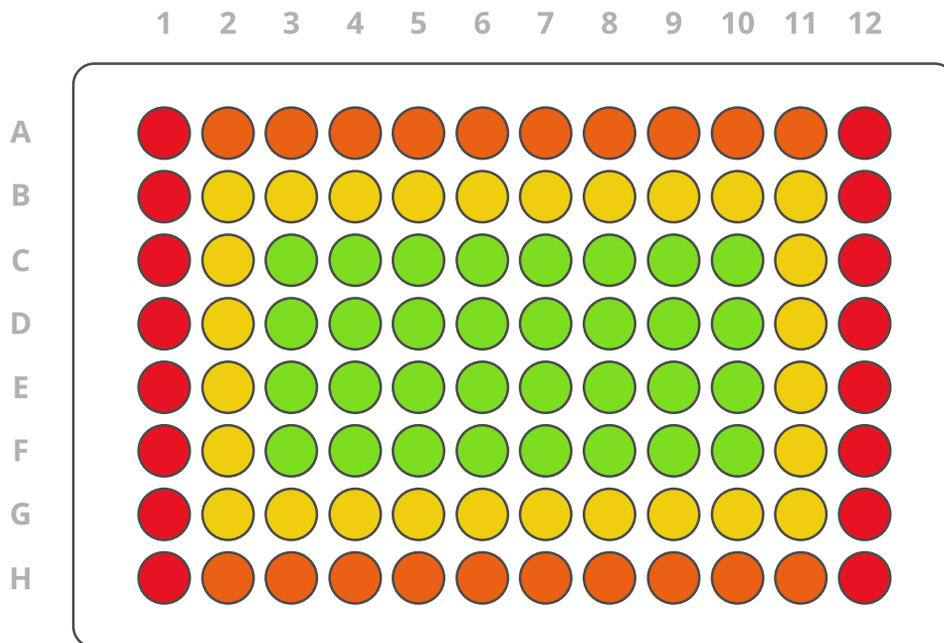
DISCUSSION

To visualize the extent of evaporation, blue dye was added to 50 μL of water in row H of the 96-well, full-skirted NEST PCR plate and imaged before and after running a 30 cycle PCR profile on both the Opentrons Thermocycler and a thermocycler from Company D. The wells from the plate

on the Opentrons Thermocycler show minimal evaporation in contrast to the variable volumes shown in the plate run on the thermocycler from Company D. A common protocol was performed using the Opentrons' lid seal for both experiments.

FIGURE 5

Optimal Well Locations for Minimal Evaporation



DISCUSSION

For minimal evaporation and optimal PCR results, it is recommended to use the wells located in the chart above. Green areas indicate the highest well to well uniformity with minimal sample loss. Dark red areas indicate the

wells with the highest risk of evaporation. Results may vary depending on your sample quantity, reaction temperatures and cycle longevity.

SECTION 6

Summary

The specifications described in this document highlight the high performance of the Opentrons thermocycler as compared to competitor products which are far more expensive. The high accuracy and uniformity enables reliable results from PCR based applications in automated workflows.

ADDITIONAL RESOURCES

For more information about the Opentrons Thermocycler please refer to the links below. These links are continually updated with additional data as it becomes available.

- [Thermocycler PCR Application Note](#)