VeritiPro Thermal Cycler—technical comparison to the Veriti Thermal Cycler

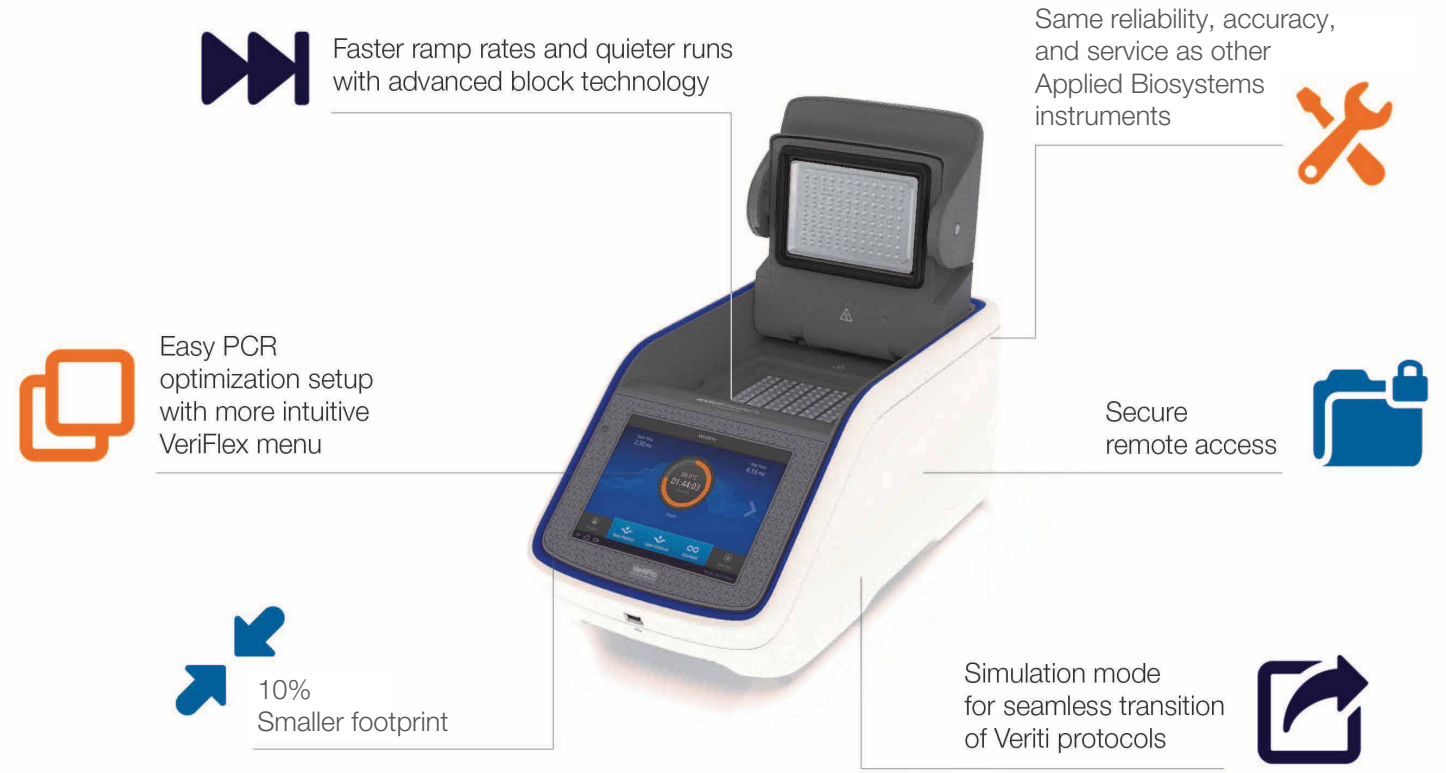


Figure 1. Features of the Applied Biosystems™ VeritiPro™ Thermal Cycler.

Introduction

The Applied Biosystems™ Veriti™ Thermal Cycler set a new standard for innovation when it launched in 2007. It was the first thermal cycler to contain an LCD touchscreen interface, multiple temperature zone block, and web-enabled remote control software. In 2020, the Veriti Thermal Cycler was upgraded to the VeritiPro Thermal Cycler and now features the latest block technology and connectivity options. These advancements provide higher ramp rates, quieter runs, and more intuitive Applied Biosystems™ VeriFlex™ temperature optimization setup while continuing to offer the same high-end performance (Figure 1). This study demonstrates that the VeritiPro Thermal Cycler delivers equivalent reliability, accuracy, and consistency in amplification uniformity as the Veriti Thermal Cycler by comparing coefficient of variation (CV) and robustness across a variety of PCR consumables.

VeritiPro Thermal Cycler highlights

The VeritiPro Thermal Cycler was designed with improved instrument vent technology to reduce the noise level, making it the quietest instrument in the Applied Biosystems™ thermal cycler portfolio. The expanded 8-inch touchscreen and improved user interface provide an intuitive, interactive system for easy programming. Protocol setup includes an option for simulation modes, allowing users to select from a list of instruments, including the Veriti Thermal Cycler, for easy instrument transition and consistency in experimental protocols. All of these updates are included in a more compact instrument that can easily fit in a small workspace (Table 1).

Materials and methods

To verify the performance of the VeritiPro Thermal Cycler, a variety of Applied Biosystems™ PCR plastics were used during testing. A complete list of Applied Biosystems™ MicroAmp™ consumables used in this study is shown in Table 2. All PCR plate consumables were tested using the Veriti 96-Well Thermal Cycler (Cat. No. 4375786), the VeritiPro 96-Well Thermal Cycler (Cat. No. A48141), and the VeritiPro 384-Well Thermal Cycler (Cat. No. A48140).

For amplification uniformity testing, a single bulk reaction was prepared using Applied Biosystems™ Power SYBR™ Green PCR Master Mix (Cat. No. 4367660) according to the standard protocol. Lambda DNA standard (Component C from the Invitrogen™ Quant-iT™ PicoGreen™ dsDNA Assay Kit, Cat. No. P7589) was used as a template at a final concentration of 0.01 ng/µL with lambda forward primer (5′-GATGAGTTCGTGTCCGTACAACT-3′) and lambda reverse primer (5′-ACGGCTGCACGGAGTTCAGTATG-3′) at 0.2 µM concentration. The bulk reaction was tested at 10 µL or 100 µL volume for 96-well reactions and 5 µL, 10 µL, or 20 µL for 384-well reactions using different PCR consumables on the Veriti and VeritiPro Thermal Cyclers. The following thermal profile was used: 95°C for 10 min, 25 cycles at 94°C for 15 sec and 70°C for 90 sec, and a final stage at 72°C for 7 min.

Upon completion of thermal cycling, the PCR reactions were transferred to an Applied Biosystems™ ViiA™ 7 Real-Time PCR System (Cat. No. 4453534) or an Applied Biosystems™ QuantStudio™ 5 Real-Time PCR System, 384-well (Cat. No. A28570), for fluorometric analysis. Amplification uniformity was calculated as CV using the following formula:

$$\text{CV (\%)} = \frac{\text{Standard deviation of SYBR Green signal for each run}}{\text{Average SYBR Green signal for each run}} \times 100\%$$

Table 1. Specification comparison.

	Veriti Thermal Cycler		VeritiPro Thermal Cycler	
Block format	96-well, 0.2 mL alloy block	384-well, 0.02 mL aluminum block	96-well, 0.2 mL alloy block	384-well, 0.02 mL alloy block
Max. block ramp rate	3.9°C/sec	3.7°C/sec	6.0°C/sec	5.0°C/sec
Max. sample ramp rate	3.9°C/sec	3.1°C/sec	4.4°C/sec	3.5°C/sec
Temperature accuracy	±0.25°C (35–99°C)		±0.25°C (35–99°C)	
Temperature range	0–100.0°C		0–100.0°C	
Temperature uniformity	<0.5°C (20 sec after reaching 95°C)		<0.5°C (30 sec after reaching 95°C)	
Dimensions (H x W x D)	24.5 x 23.7 x 48.5 cm		21.7 x 24.5 x 46.5 cm	
PCR volume range	10–100 µL	5–20 µL	10–100 µL	5–20 µL
VeriFlex Block range	25°C range across block, 6 temperature zones (up to 5°C per zone)	NA	30°C range across block, 6 temperature zones (up to 10°C per zone)	NA
Max. fan noise (dB)	<57.1 (idling); <61.3 (cycling)		Quiet idle; <48 (cycling)	

Table 2. PCR consumables used in amplification uniformity testing.

Manufacturer	Description	Cat. No.
Thermo Fisher Scientific	MicroAmp EnduraPlate Optical 384-Well Clear Reaction Plates with Barcode	4483285
	MicroAmp EnduraPlate Optical 96-Well Multicolor Reaction Plates with Barcode	4483355
	MicroAmp Optical 96-Well Reaction Plate with Barcode	4306737
	MicroAmp Reaction Tube without Cap, 0.2 mL	N8010533
	MicroAmp Clear Adhesive Film	4306311
	MicroAmp Optical Adhesive Film	4311971
	MicroAmp Optical 8-Tube Strip with Attached Optical Caps, 0.2 mL	A30588
	MicroAmp 8-Tube Strip with Attached Domed Caps, 0.2 mL	A30589
	MicroAmp 8-Tube Strip, 0.2 mL	N8010580
	MicroAmp 8-Cap Strip, clear	N8010535

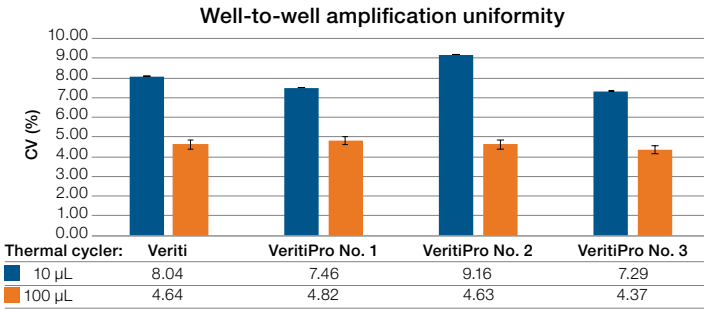
For robustness testing, short-amplicon reactions were prepared using Applied Biosystems™ AmpliTaq Gold™ 360 Master Mix (Cat. No. 4398886) and Applied Biosystems™ AmpliTaq Gold™ Fast PCR Master Mix (Cat. No. 4390941) according to the standard protocols with human genomic DNA (Roche, Cat. No. 11691112001).

Long-amplicon reactions were prepared using the Applied Biosystems™ SequalPrep™ Long PCR Kit with dNTPs (Cat. No. A10498) according to the standard protocol. Four-plex PCR reactions were prepared using Invitrogen™ Platinum™ SuperFi™ Green PCR Master Mix. Reactions were tested at 10 µL volume comparing different PCR consumables on the Veriti and VeritiPro Thermal Cyclers. Gel electrophoresis was performed after PCR with the Invitrogen™ E-Gel™ Power Snap Electrophoresis Device (Cat. No. G8100) to separate targets according to size. Gels were visualized using the Invitrogen™ iBright™ FL1500 Imaging System (Cat. No. A44241).

Results

Amplification uniformity

CV was calculated using fluorescence intensity data from one Veriti Thermal Cycler and three VeritiPro Thermal Cyclers. Figure 2 shows amplification uniformity across a 96-well plate, for two reaction volumes, 10 µL (low) and 100 µL (high); Figure 3 shows amplification uniformity across a 384-well plate, for 5 µL, 10 µL, and 20 µL reaction volumes. Figures 4 and 5 show thermal cycler uniformity on a 96-well and 384-well plate, respectively, evaluated across various combinations of PCR plates, adhesive film, tubes, tube strips, and cap strips by measuring the average fluorescence intensity of 10 µL (for 96-well) and 5 µL (for 384-well) PCR reactions. Run-to-run amplification uniformity on a 96-well and 384-well plate is demonstrated in Figures 6 and 7, respectively, showing the VeritiPro Thermal Cycler provides reproducible thermal performance across separate 10 µL (for 96-well) and 5 µL (for 384-well) PCR reactions. Overall, results show comparable well-to-well and run-to-run uniformity between thermal cyclers using different reaction volumes and PCR consumables. Results were reproducible across the three VeritiPro Thermal Cyclers.



Thermal cycler:	Veriti	VeritiPro No. 1	VeritiPro No. 2	VeritiPro No. 3
10 µL	8.04	7.46	9.16	7.29
100 µL	4.64	4.82	4.63	4.37

Figure 2. Comparison of well-to-well amplification uniformity between one Veriti 96-Well Thermal Cycler and three VeritiPro 96-Well Thermal Cyclers at low (10 µL) and high (100 µL) reaction volumes. The CV for each run was calculated using fluorescence intensity data after PCR in a MicroAmp Optical 96-Well Reaction Plate sealed with MicroAmp Clear Adhesive Film.

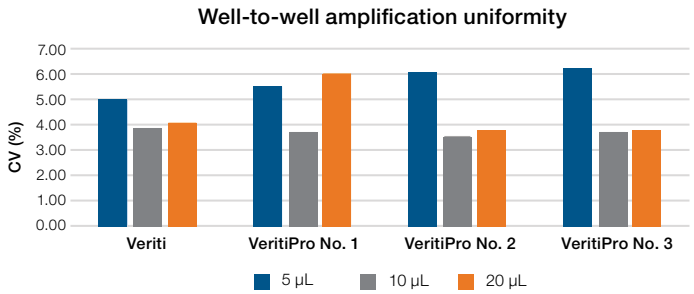


Figure 3. Comparison of well-to-well amplification uniformity between one Veriti 384-Well Thermal Cycler and three VeritiPro 384-Well Thermal Cyclers at low (5 µL), medium (10 µL), and high (20 µL) reaction volumes. The CV for each run was calculated using fluorescence intensity data after the PCR in a MicroAmp EnduraPlate Optical 384-Well Clear Reaction Plate sealed with MicroAmp Clear Adhesive Film.

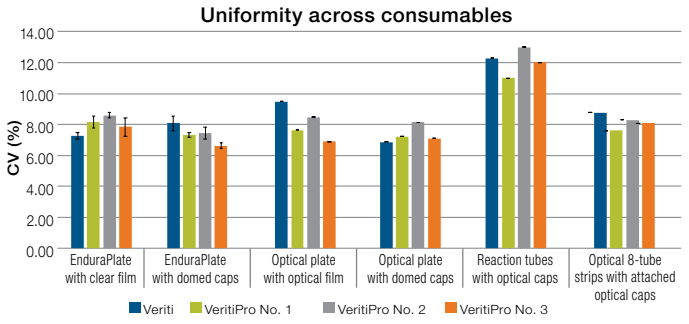


Figure 4. Comparison of well-to-well amplification uniformity between one Veriti 96-Well Thermal Cycler and three VeritiPro 96-Well Thermal Cyclers using various combinations of PCR consumables including MicroAmp EnduraPlate and Optical plates. The CV for each run was calculated using fluorescence intensity data from low-volume (10 µL) reactions.

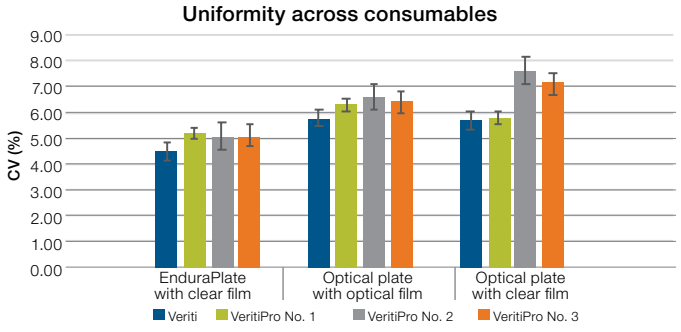


Figure 5. Comparison of well-to-well amplification uniformity between one Veriti 384-Well Thermal Cycler and three VeritiPro 384-Well Thermal Cyclers using various combinations of MicroAmp EnduraPlate and Optical plates with various films. The CV for each run was calculated using fluorescence intensity data from low-volume (5 µL) reactions.

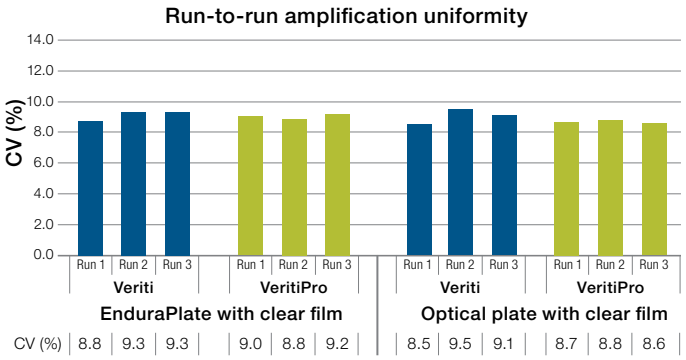


Figure 6. Comparison of run-to-run amplification uniformity between Veriti 96-Well and VeritiPro 96-Well Thermal Cyclers on MicroAmp EnduraPlate and Optical plates with clear film. The CV for each run was calculated using fluorescence intensity data after PCR in 10 µL reactions.

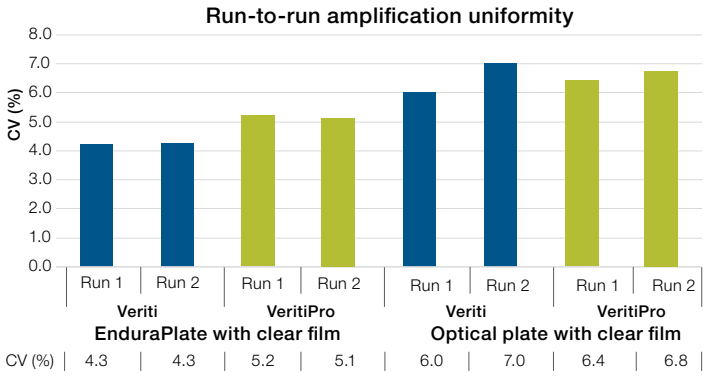


Figure 7. Comparison of run-to-run amplification uniformity between Veriti 384-Well and VeritiPro 384-Well Thermal Cyclers on MicroAmp EnduraPlate and Optical plates with clear film. The CV for each run was calculated using fluorescence intensity data after PCR in 5 µL reactions.

Robust thermal performance

To demonstrate robustness, the Veriti and VeritiPro Thermal Cyclers were tested by amplifying targets of different lengths and complexities, including standard DNA sequences, high AT- or GC-rich sequences, and amplicons likely to form primer-dimers. Four-plex PCR was carried out to verify the capability of the VeritiPro Thermal Cycler to amplify targets of different lengths simultaneously in a single reaction. Successful amplification of the targets was demonstrated by the presence of distinct bands of correct sizes after gel electrophoresis. Results in Figure 8 indicate that the VeritiPro Thermal Cycler provides thermal robustness equivalent to that of the Veriti Thermal Cycler without the need to reoptimize experiments.

Easy protocol transition

For users concerned about reoptimizing protocols to run on the VeritiPro Thermal Cycler, simulation modes eliminate the need to do this work. Simulation modes allow the user to run protocols under the same conditions as a different thermal cycler. The user selects from a list of instruments, including the Veriti Thermal Cycler, for easy instrument transition and consistency in experimental protocols.

Easy temperature optimization

VeriFlex Block technology, available on the VeritiPro 96-Well Thermal Cycler, utilizes multiple Peltier elements to optimize PCR temperature with precision (Figure 9). Easily set temperatures across the block based on minimum and maximum temperatures, set the midpoint, or provide more precise control using the 6 temperature zones (Figure 9). With 6-zone control, you can set up to a maximum difference of 10°C between zones with a 30°C maximum range across the VeriFlex Block.

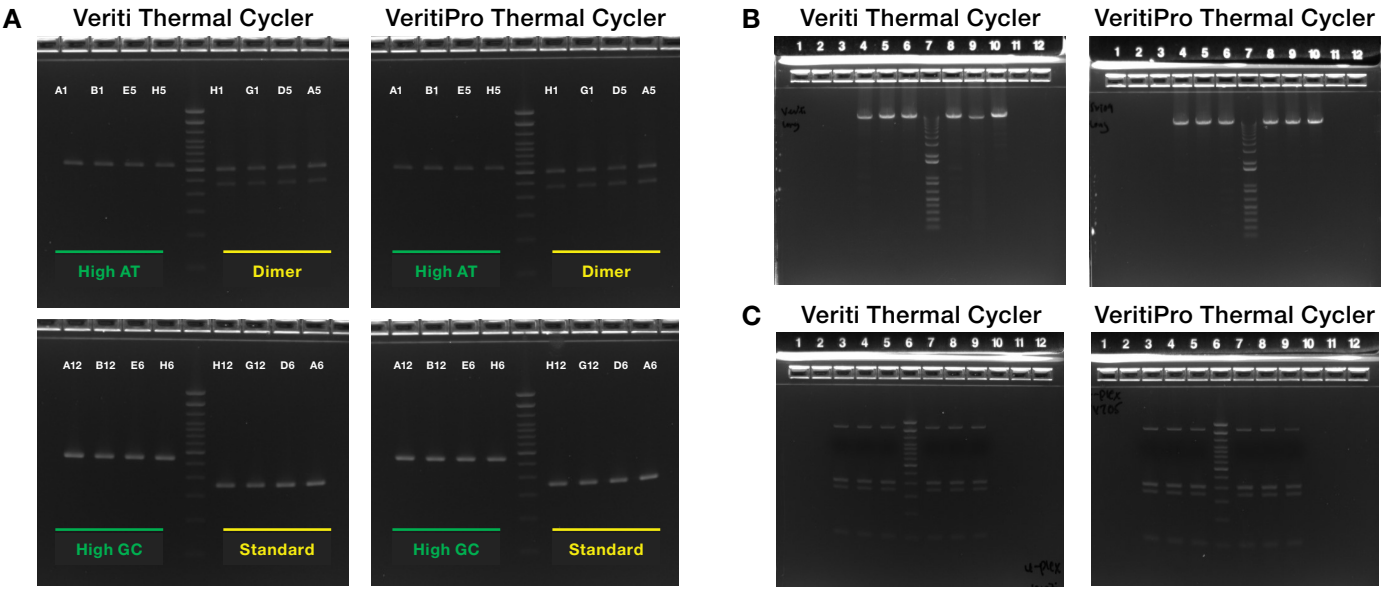


Figure 8. Comparison of robustness between Veriti and VeritiPro Thermal Cyclers. (A) AmpliTaq Gold 360 Master Mix was used to amplify single, short human genomic DNA fragments (313 bp, 499 bp, 556 bp, or 585 bp) of different complexities in MicroAmp 8-Tube Strips with Attached Domed Caps. **(B)** The SequalPrep Long PCR Kit was used to amplify a single, long human genomic DNA amplicon (12,342 bp) in MicroAmp 8-Tube Strips with MicroAmp 8-Cap Strips. **(C)** Platinum SuperFi Green PCR Master Mix was used to simultaneously amplify four DNA amplicons (99 bp, 345 bp, 403 bp, and 1,606 bp) in MicroAmp Optical 8-Tube Strips with Attached Optical Caps.

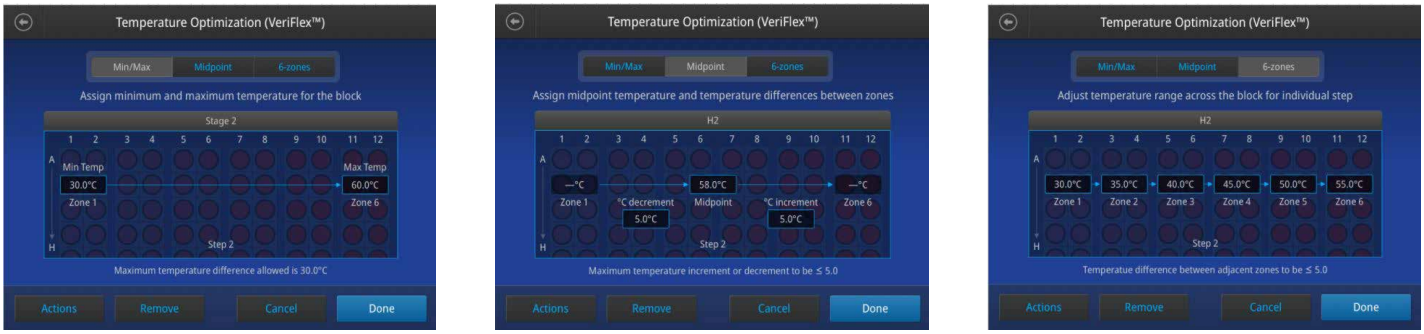


Figure 9. User interface of the VeritiPro 96-Well Thermal Cycler for temperature optimization.

Secure remote access

The VeritiPro Thermal Cycler is a cloud-enabled instrument, allowing users to connect anytime, anywhere with a mobile device or desktop computer to have access to the instrument while away from the lab. Access is secure and private with an account on the Thermo Fisher™ Connect Platform to design and share protocols, download experimental report files, schedule an instrument run, or check run status remotely.

Multi-instrument control

The VeritiPro Thermal Cycler has multi-instrument run options, enabling one VeritiPro instrument on the same network to run the same protocol on many instruments simultaneously. For users seeking to control access of technicians to instruments and protocols, Applied Biosystems™ Thermal Cycler Fleet Control Software (Cat. No. A40070) can be used with the VeritiPro Thermal Cycler to reduce errors and provide audit logs.

Reliability

Each VeritiPro Thermal Cycler comes with the proven reliability and quality associated with Applied Biosystems™ instruments. To ensure the highest reliability, components used to manufacture thermal cyclers must pass rigorous testing for repeated stress, environmental conditions, including low and high temperature and humidity, as well as shock and vibration testing according to ISTA standards. This testing ensures each VeritiPro unit will deliver high-quality performance.

applied
biosystems

Discussion

Consistent amplification uniformity and robust thermal performance during PCR are crucial to obtaining high-quality results. In this study, we have shown that the VeritiPro Thermal Cycler provides thermal capabilities equivalent to those of the Veriti Thermal Cycler in uniformity and robustness, with templates of differing lengths and complexities.

Results with the VeritiPro Thermal Cycler were consistent across multiple combinations of PCR plates, tubes, strip tubes, adhesive films, and cap strips. Both low (10 µL) and high (100 µL) reaction volumes were tested on the VeritiPro 96-Well Thermal Cycler, and low (5 µL), medium (10 µL), and high (20 µL) reaction volumes were tested on the VeritiPro 384-Well Thermal Cycler using the same experimental protocols that have been optimized and verified on the Veriti Thermal Cycler, without the need to reoptimize. Additionally, the VeritiPro Thermal Cycler offers higher ramp rates, allowing for faster time-to-results.

Ordering information

Product	Cat. No.
VeritiPro 96-Well Thermal Cycler	A48141
VeritiPro 96-Well Thermal Cycler + MicroAmp 8-Tube Strips Package	A47396
VeritiPro 96-Well Thermal Cycler + MicroAmp EnduraPlate 96-Well Plates Package	A47397
VeritiPro 96-Well Thermal Cycler + MicroAmp TriFlex 3 x 32-Well Plates Package	A47398
VeritiPro 96-Well Thermal Cycler + ABRC*	A48764
VeritiPro 96-Well Thermal Cycler + REX**	A48765
VeritiPro 96-Well Thermal Cycler + MicroAmp 8-Tube Strips Package + ABRC	A48766
VeritiPro 96-Well Thermal Cycler + MicroAmp 8-Tube Strips Package + REX	A48767
VeritiPro 96-Well Thermal Cycler + MicroAmp EnduraPlate 96-Well Plates Package + ABRC	A48768
VeritiPro 96-Well Thermal Cycler + MicroAmp EnduraPlate 96-Well Plates Package + REX	A48769
VeritiPro 96-Well Thermal Cycler + MicroAmp TriFlex 3 x 32-Well Plates Package + ABRC	A48770
VeritiPro 96-Well Thermal Cycler + MicroAmp TriFlex 3 x 32-Well Plates Package + REX	A48771
VeritiPro 384-Well Thermal Cycler	A48140
VeritiPro 384-Well Thermal Cycler + MicroAmp EnduraPlate 384-Well Plates Package	A47399
VeritiPro 384-Well Thermal Cycler + ABRC	A50325
VeritiPro 384-Well Thermal Cycler + REX	A50326
VeritiPro 384-Well Thermal Cycler + MicroAmp EnduraPlate 384-Well Plates Package + ABRC	A50327
VeritiPro 384-Well Thermal Cycler + MicroAmp EnduraPlate 384-Well Plates Package + REX	A50328

* ABRC: AB Repair Center extended warranty.

** REX: Rapid Exchange extended warranty.

Find out more at **thermofisher.com/veritipro**

ThermoFisher SCIENTIFIC