

Thermal Cycler

How to select the correct thermal cycler for your lab for effective clinical diagnostics

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Introduction

The demand for faster, shorter and more accurate polymerase chain reaction (PCR) protocols has resulted in many technological advances in thermal cycler instrumentation. Although thermal cyclers have become an essential tool for DNA amplification, and are considered by many as the workhorse of the laboratory, numerous challenges can still arise when choosing an instrument.

Temperature accuracy is a critical factor in the success or failure of a PCR reaction. Commercial laboratories

continue to be faced with increasing demands for more precise temperature control in a quicker time scale, without compromising data accuracy and quality. Additionally, laboratories also demand a system that is flexible, along with intuitive software that is easy to use. It is vital that the user has confidence that results are reliable, accurate and consistent time after time, and are achieved in a timely manner.

This article explores how the Alpha Cycler 4 from PCRmax addresses these challenges through the use of intuitive features, software and a smart monitoring app, ensuring increased confidence in the systems continued performance and throughput.

Responding to flexibility challenges

The Alpha Cycler 4 is the only truly fully independently controllable multi-block thermal cycler available on the market. The four bay-design means the system can be specified in any combination of 96 and 384 well formats. It is immediately clear that the versatile unit meets the need for high-throughput laboratories; however, the system could also prove invaluable in multi-user laboratories, including small academic groups and contract research organisations. A multi-block thermal cycler offers flexibility with the ability to perform multiple runs simultaneously, in addition to saving space and reducing service contract costs, which means high-throughput and multi-user laboratory requirements are addressed.

Addressing temperature control challenges

As mentioned, generating reproducible and meaningful PCR results is heavily reliant upon obtaining the correct temperature. For a reaction to work correctly, efficient and precise temperature changes are needed. Achieving accurate temperature changes is heavily dependent upon the material used for the heating block. In commercial laboratories where accurate temperature changes impact upon the choice of material used for the block construction, PCRmax, after careful consideration chose an alloy construction for the heating block ensuring uniformity is achieved quickly. In addition the Alpha Cycler block formats run gradients across 12 or 16 columns for 96 or 384 well plates respectively, allowing for finer optimisation of temperature and more specific PCR product amplification. Each block also contains 8 individual heat sources (peltier elements), which are monitored and controlled by the system that allows for establishment of fine gradients. With these features combined the Alpha Cycler 4 can provide thermal accuracy

of $\pm 0.20\text{C}$ (recorded at 550C). To further enhance temperature control active sample cooling (ASC) is an approach employed to reduce non-specific amplification in PCR reactions. Within PCR reactions, even the smallest number of primer dimers occurring early in a reaction will most often be preferentially amplified over your target. This is because PCR preferentially amplifies shorter fragments over the longer target amplicon, which wastes the components needed to generate your target, and therefore reducing yield. ASC works by chilling the block to 40C and holding it there until the heated lid reaches the correct temperature preventing sample pollution.



Achieving flexibility and improved confidence in results and system performance

In combination with instrumentation that is capable of improving thermal accuracy, accompanying software is also becoming increasingly important to the end-user. The updated Alpha Cyclers 4 software and app includes an abundance of advanced options to increase flexibility, save users time within the laboratory, improve confidence in the results obtained and the systems continued performance.

The use of apps has become increasingly common in the past five years, and their use is now being more heavily considered within scientific laboratories to enhance the results obtained, and provide a method of collecting information in real-time. In-line with the promise to provide continued improvements and quality, PCRmax has developed a monitoring app known as the Alpha Track. Alpha Track allows users to monitor the time until runs complete by scanning a QR code generated by the system. Once the QR code has been scanned, there is no need for Wi-Fi or an Ethernet connection. Users can then track their runs remotely, which ultimately saves unnecessary time spent in the lab, and allows other tasks to be completed simultaneously. Failed runs can cause ruined data and waste time and reagents, however the intuitive reporting features help to minimise such events. With the ability to communicate error messages, which are then

reported back to PCRmax, on the condition of the system and its health, PCRmax can successfully monitor each unit, and potentially spot errors and problems before they occur. Ultimately, this feature acts as a preventative maintenance visit, and with every run completed a health check of the system is also accomplished, giving end-users complete confidence that the system is performing perfectly.

Additionally, due to the android interface and simple clean design, little to no training is required to script any protocol, helping to save precious research time. Along with a specially designed program wizard, users can be assured that the Alpha Cyclers 4 will optimise reaction outcomes. By simply inputting the forward and reverse primer sequences, defining the amplicon length and source of the template, the wizard will create a bespoke protocol for your target with optimised cycling conditions. Users also have the ability to programme their own USB as a key, allowing them to unlock personalised protocols for only them to use and access, and coupled with protocol locking, allowing users to password protect protocols so that programs can not be stopped or interrupted during running, end-users are provided with complete peace of mind that their runs will not be ruined.

Conclusion

With a myriad of thermal cyclers available, and an abundance of challenges to overcome within the commercial laboratory, it can be difficult to select the most appropriate option. The Alpha Cyclers 4 combines exceptional thermal accuracy, with intuitive user friendly software to help save precious research time, and an app that find faults before they happen and allows the user to work remotely. Ultimately, the seamless integration of software and instrumentation ensures the Alpha Cyclers 4, can easily cater for modern laboratory needs, providing outstanding performance in a compact and user friendly design.

