Product Information Sheet

AmpXpress™

AmpXpress™ is a very rapid thermal cycler utilizing SuperConvection™ technology that make the instrument significantly faster than conventional thermal cyclers.

• 40 cycle PCR in 20 minutes • 24 samples per run • 20 - 100 µl range

Features & benefits of AmpXpress

- ✓ **Speed**
  - + *Saves time and enables more runs per day.*
  - + *Increased specificity due to rapid and precise temperature homogenization.*
- ✓ **Temperature uniformity**
  - + *No 'well-to-well' variation.*
- ✓ **Run 100 µl reactions for improved sensitivity**
  - + *Important when only a few target molecules are present.*
  - + *Dilutes the effect of inhibitors.*

Background

Several attempts have been made to speed up the PCR process, mostly by reducing reaction volumes and using specialized reaction vessels such as thin capillaries and cuvettes (Wittwer *et al* 1989). The major challenges, to enable fast PCR, is to rapidly achieve thermal uniformity within a given PCR reaction mixture to prevent over- and undershooting of temperature (Kim *et al* 2008) and to achieve efficient and fast energy transfer (Elenitoba-Johnson *et al* 2008). Heating and cooling of a reaction mixture creates density (temperature) variations within the fluid that will come to equilibrium through the force of normal gravity (1x*g*, in conventional thermal cyclers) if waiting long enough. Fast PCR, involving rapid PCR chemistries, typically employs short hold times, where *ramp* times make up the major part of the run - if the run is performed on a conventional thermal cycler. Fast PCR instruments should thus not only ramp at a high rate, but also achieve thermal equilibrium rapidly. It is important for the outcome of the

PCR process that the entire sample reaches thermal equilibrium, preferably as fast as possible, before moving to the next target temperature. If not, poor template denaturation, mispriming and other side-reactions will occur that have adverse effects on specificity and yield (Wittwer *et al* 1991).

To overcome these problems a novel, rapid and sensitive thermal cycler - AmpXpress - has been developed to enable fast temperature ramping. AmpXpress utilizes high-speed centrifugation to enable fast temperature ramping without over- and undershooting sample temperature. The increased g-force, resulting from centrifugation, induces rapid thermal homogenization of the reaction volume through a process called Super-Convection. More precisely, the increased g-force acts upon the colder (i.e. denser) subset of the fluid giving rise to an instant mass transport that in turn enables the samples to reach *set* temperatures much faster than previously possible, in volumes ranging from 20 to 100 µl (Mårtensson *et al* 2006). SuperConvection improves the performance of any amplification process based on thermal cycling, such as PCR (Gidlöf *et al* 2009) and cycle sequencing (AlphaHelix Application Note 2).

AmpXpress also features a sophisticated control system for in-tube temperature measurements of the reaction temperature. This allows for accurate monitoring of reaction temperature, including degree of thermal homogenization, in real time. **In-tube temperature measurement is a prerequisite for truly fast PCR.**

The instrument

The heart of the instrument is the centrifuge that operates at approximately 7000 rpm. A circular infrared (IR) heater encircles the centrifuge and the samples (Figure 1) to enable very fast temperature ramping rates by 'direct transfer' of infrared energy. Samples are efficiently cooled by high-speed centrifugation generating a potent 'wind-chill' effect while sample temperature is monitored in real time using the in-tube temperature measurement system.

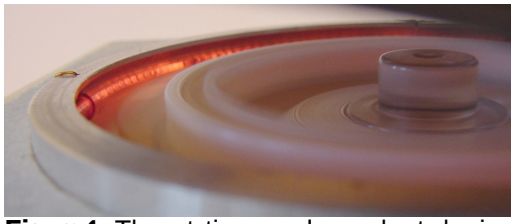

Figure 1. The rotating samples are heated using a circular high-energy IR source.

To secure uniform and reproducible performance AlphaHelix has developed 0.2 ml sample tubes specially manufactured to withstand the elevated g-force, thereby ensuring trouble-free operation in AmpXpress.

Software

AmpXpress is controlled via a user interface on the front panel, or, optionally, using and external netbook and the 'AmpX' software. The AmpX software is used to easily define run parameters and transfer them to the instrument.

Technical specifications

General data

Dimensions: 19 x 35 x 15,5 cm (WxDxH)
Weight: 7 kg
Power consumption: <600 W
Power supply options for mobile use are available upon request.
Operating ambient temp: 15° C to 25° C
Centrifugation: 6900 rpm (approx. 3000x*g*)

Sample capacity

Number of samples per run: 24
Sample volume: 20 µl, 50 µl and 100 µl.

Thermal performance

General
Temperature working range:

40° C to 98° C @ 20 µl and 50 µl
50° C to 98° C @ 100 µl

Typical cycle times

3-step protocol: Cyclic from 95° C hold for 0 s; to 58° C hold in 3 s; to 72° C hold for 3 s; back to 95° C.

@ 20 µl: 25 s
@ 50 µl: 37 s

A 40 cycle run according to the 3-step protocol takes ≤20 minutes @ 20 µl.

References

1. Wittwer CT et al (1989) "Automated polymerase chain reaction in capillary tubes with hot air". Nucleic Acid Res. 17:4353-4357
2. Kim YH et al (2008) "Performance evaluation of thermal cyclers for PCR in a rapid cycling condition". BioTechniques 44(4):495-6
3. Elenitoba-Johnson O et al (2008) "Plastic versus glass capillaries for rapid-cycle PCR". BioTechniques 44(4):487-492
4. Wittwer CT et al (1991) "Rapid cycle DNA amplification: time and temperature optimization". BioTechniques 10:76-83
5. Mårtensson G et al (2006) "Rapid PCR amplification of DNA utilizing Coriolis effects". Eur Biophys J 35:453-458
6. Gidlöf et al (2009) "Complete discrimination of six individuals based on high-resolution melting of hypervariable regions I and II of the mitochondrial genome". BioTechniques, 47(2):671–678

Ordering Information	
Item	Product Code
AmpXpress Gold	60-1001
AmpXpress Dark Blue	60-1002
AmpXpress Blue	60-1003
AmpXpress Red	60-1004
Item, accessories	
24-tube 0,2 ml rotor	60-1005
20 µl temperature probe (0,2 ml tube)	60-1006
50 µl temperature probe (0,2 ml tube)	60-1007
100 µl temperature probe (0,2 ml tube)	60-1008

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