

# TOptical Thermocycler®

## The Real-Time PCR System with maximum flexibility

- Customization with up to 6 colour filter modules for excitation and detection of commonly used fluorescent dyes
- Up to 6 fold multiplexing
- Excitation by three different coloured long living LEDs
- Excellent heating and cooling rates and temperature uniformity



**Biometra**

PRODUCT LINE

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# TOptical Thermocycler

## The Real-Time PCR System with maximum flexibility

The TOptical Real-Time PCR Thermocycler builds on the reliability and flexibility of the well known Biometra TProfessional series with quick exchange block system. Due to silver block technology the TOptical provides outstanding temperature uniformity and highest ramping rates for short PCR protocols and reproducible reaction conditions in each single well. In combination with the patented optical detection system, featuring maintenance free LED technology, accurate and reliable data acquisition is guaranteed.

Free customisation with up to six colour filter modules offers maximum flexibility for detection of versatile fluorescent dyes. Optionally available with gradient function the TOptical allows optimisation of new assays in a single run. By the yet intuitive PC software qPCRsoft the setup of Real-Time PCR experiments becomes very easy and the time to great results significantly shortened.



- Customization with up to 6 colour filter modules for excitation and detection of commonly used fluorescent dyes
- Up to 6 fold multiplexing
- Excitation by three different coloured long living LEDs
- Patented array of high performance optical fibers for loss-free excitation and detection of fluorescence
- Highly sensitive Channel Photo Multiplier (CPM) with efficient noise reduction
- Existing TProfessional Thermocycler retrofittable with TOptical module
- Block optionally with gradient function
- Excellent heating and cooling rates and temperature uniformity
- Small footprint
- Easy to use software for creating experiments, for analysis and data export
- MIQE-compliant sample documentation

**PCR**  
licensed and authorized

**TOptical**  
Thermocycler

### Modular block system

The TOptical Thermocycler is an open platform for all kinds of Real-Time PCR kits regardless if one-step or two-step kits or if SYBR Green or probes are used for detection. There is no restriction and no dependence on a specific supplier. It consists of the base unit of the TProfessional Thermocycler and the TOptical module. This modular system allows the upgrade of existing TProfessional Thermocyclers by the TOptical module to a complete Real-Time PCR Thermocycler. Simply insert the TOptical module that is automatically recognized by the base unit and within a few seconds you can begin your Real-Time PCR experiment. Or the TOptical module can be quickly exchanged for a standard PCR module and the instrument be used as conventional Thermocycler. For maximum flexibility five different modules in various block formats, ranging from 0.5 ml tubes up to 384 well microplates, are available.

### Air stream design and footprint

The footprint of the TOptical Thermocycler is kept to the minimum with 28 cm x 43 cm and features an optimized air stream design for maximum performance. Excessive heat is efficiently transferred away from the block to the heat sink and removed by the air stream.

This superior energy management guarantees little power consumption, high temperature uniformity for reproducible results and noise reduction in combination with low overall heat emission. Moreover by its small footprint the instrument saves valuable bench space.

### Superior block temperature uniformity

The block uniformity and speed are critical factors for successful and reliable Real-Time PCR results. To achieve ultimate performance the TOptical Thermocycler features silver block technology. Due to the excellent heat conductivity the block equilibrates extremely fast to temperature changes and provides maximum speed and temperature uniformity over the complete temperature range. This also serves for the broad dynamic range of 9 logs.

With average ramping rates of up to 5.0°C/sec (max. 6.0°C/sec) the TOptical overall run times are reduced and the specificity of PCR reactions becomes increased. Moreover due to the superior block temperature uniformity equal reaction conditions are provided in each single well what reduces the risk of PCR artefacts by mispriming. To protect the valuable silver against corrosion, the block surface is covered with a durable thin gold layer.



TOptical Module

### Gradient function

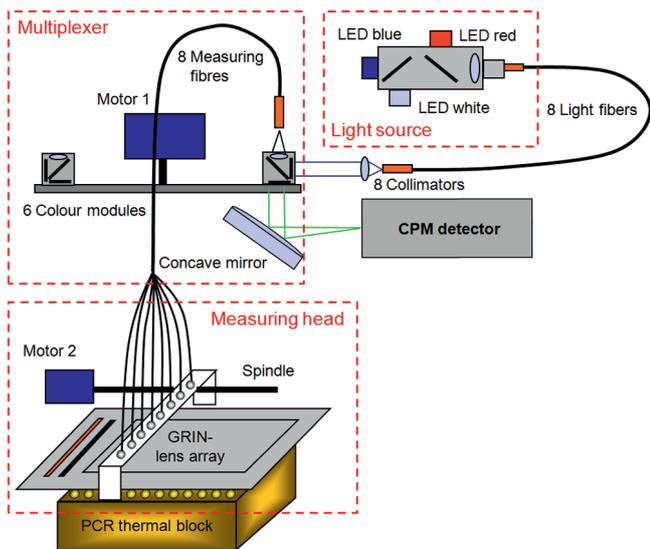
Finding the best annealing temperature is crucial, especially for Real-Time PCR experiments, to achieve optimal specificity and efficiency of assays. Often optimisation of experiments is conducted only limited which can lead to suboptimal results under routine conditions and the risk to waste valuable samples, reagents and time. For optimising new primer combinations in a single run, the TOptical module optionally can be equipped with gradient function. With a gradient span of 40 °C and the linear gradient tool for programming of equal temperature increments between the 12 columns of the block, the TOptical fulfils every wish for easy optimisation of Real-Time PCR assays.

New primer pairs with unknown annealing temperatures can be tested quickly and therefore new protocols optimized in a very short time. The gradient function can be used at any step of the PCR protocol and within the complete block temperature range between 3°C and 99°C. Additionally also during gradient steps time or temperature increments can be added. For easy identification of the optimal annealing temperature, the given temperature in each single column of the block can be viewed in the software and transferred to a non-gradient program without any changes.

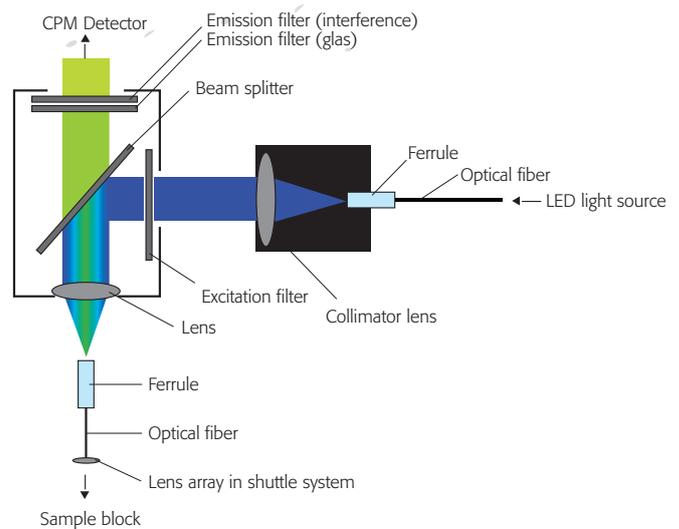
### Patented optical system with long-term guarantee

The TOptical Thermocycler features a patented, innovative optical system with 10 years long-term guarantee (Patent no. DE 2006 036 171 B4). The optical system consists of three LEDs for fluorescence excitation, high-performance optical fibers for light transmission, a rotating filter wheel with colour filter modules arranged in a multiplexer, a shuttle unit with lens array that scans the block and a Channel Photo Multiplier (CPM) for fluorescence detection.

The combination of all these components ensures precise excitation and detection of fluorescent signals at highest sensitivity. Thanks to the transmission of light by optical fibers no deviations in the illumination of single wells occur eliminating the need to use passive reference dyes for normalisation. Moreover by the rotating filter wheel the time to scan the block always stays the same regardless how many fluorescent colours are going to be detected.



- Schematic drawing of the patented optical system. In the light source three different coloured long lasting LEDs are arranged generating light for the excitation of fluorescent dyes. The multiplexer unit consists of a rotating wheel with up to 6 colour filter modules. By the rotation of the filter wheel the colour filter modules pass subsequently each of the eight light fibers that transmit fluorescent light from the source to the multiplexer. In the measuring head an array of optical fibers arranged in a shuttle system scans the sample block row-wise transmitting fluorescent light for the excitation of samples to each single well and collecting emitted light. Emitted light is detected by a highly sensitive Channel Photo Multiplier (CPM) after it has passed emission filters in the colour modules. The use of high performance optical fibers for the transmittance of light between the light source, multiplexer and measuring head minimizes losses in quantum efficiencies and therefore ensures highest sensitivity. By the scanning unit the beam of light is always positioned exactly above centre of each well to ensure optimal excitation of fluorescent dyes and collection of emitted light. Moreover due to the excitation of each single well the use of passive reference dyes for normalisation is not necessary.



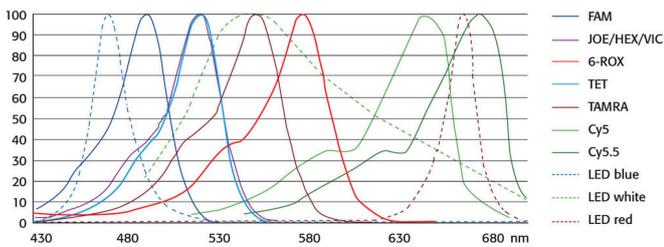
- Schematic drawing of the TOptical lightpath. Fluorescent light for the excitation of dyes is emitted by LEDs. The light is transmitted by high performance optical fibers to collimator lenses. The fluorescent light is bundled and transmitted to an excitation filter of a colour filter module located on a rotating filter wheel. The light is deflected by a beam splitter and transferred by optical fibers to a lens array in a shuttle that scans the sample block column by column. The light excites the fluorescent dyes in the reaction mix. The fluorescent dyes then emit light of a higher wavelength that is collected by the lenses in the shuttle system and transferred by optical fibers back to the filter colour module. In the colour module the light passes the beam splitter and two emission filters and is then further transferred to the channel photo multiplier for detection.

### LED technology

The fluorescent dyes are excited by three LEDs in the colours blue, white and red. The combination of these three LEDs allows optimal excitation of fluorescent dyes over a wide spectral range. Unlike with so-called „wide blue“ LEDs especially the short-wavelength blue spectral range and the long-wavelength red range are optimally covered.

In combination with the high-performance optical fibers and the highly-sensitive Channel Photo Multiplier intensity losses in the quantum efficiency are avoided to ensure maximum sensitivity. Due to the excitation of each single well the use of passive reference dyes is not necessary, allowing multiplexing of up to six dyes.

The longevity of the LEDs makes a regular exchange of the light source superfluous and thus helps avoid recurring costs.



Optical LED excitation. The excitation spectra of the blue, white and red TOptical LED (dotted lines) cover very well the absorption spectra of the commonly used fluorescent dyes FAM, JOE/HEX/VIC, 6-ROX, TET, TAMRA, CY5 and Cy 5.5 (solid lines). In combination with the beam transfer by high performance optical fibers superb sensitivity is achieved.

### Flexible configuration with optical filter modules

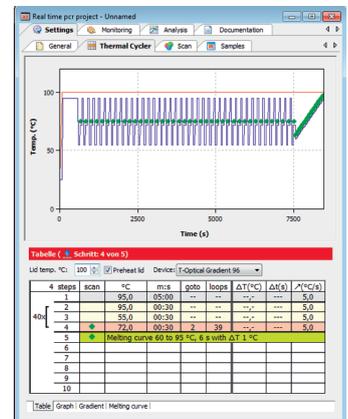
The unique TOptical multiplexer filter wheel can be equipped with up to 6 color filter modules of choice. Color filter modules covering the whole range of commonly used Real-Time PCR dyes, from the blue to the red absorption spectrum, and additionally special color filter modules optimized for versatile FRET applications are available. With the maximum of 6 color filter modules the TOptical Thermocycler allows accurate multiplexing of up to 6 targets in parallel. The filters sets are designed for optimal discrimination of fluorescence emitted from different dyes.

Since the TOptical Thermocycler is always equipped with 3 LEDs, the FRET modules can be used without any prior technical modifications of the system. The combination of LEDs allows different singleplex FRET experiments, providing further experimental options.

The customisation with color filter or FRET modules therefore offers the flexibility to upgrade the system at any time and to expand the spectrum of applications if desired.

### Software

The TOptical Thermocycler is controlled by the PC software qPCRsoft. The software is especially developed to provide easy programming and clear arrangement of functional elements. It includes the same easy spreadsheet table or graphical programming function as the TProfessional Thermocycler. Information on samples is entered in a well arranged plate scheme that provides a comprehensive overview at a glance and allows to group different experiments that are measured on one single plate. To accelerate the way to results the plate scheme can also be edited during or after the run. For monitoring of runs a progress bar visually indicates the actual performed step and results of experiments are continuously plotted as product accumulation curves. The graphical display of data can be customized for optimal visualisation. The software provides automatic baseline subtraction and threshold setting for data analysis and export of raw data to \*.csv-files. csv-files allow data import and analysis in Excel. Graphs can be copied for direct export and used e.g. for Powerpoint presentations. Typical evaluation methods for Real-Time PCR like  $\Delta\Delta Ct$  method, absolute quantification, relative quantification, allelic discrimination and efficiency calculation are already integrated in the software. Expression of genes can be normalized of using multiple reference genes and individual reaction efficiencies. In addition the software provides a MIQE-compliant documentation of experiments.



	1	2	3	4	5	6	7	
A	Cell culture FAM: BACT S JOE: GADPH TAMRA: dMYC	Cell culture FAM: BACT S JOE: GADPH TAMRA: dMYC	Cell culture FAM: BACT S JOE: GADPH TAMRA: dMYC	Cell culture FAM: BACT U JOE: GADPH TAMRA: dMYC				
B	Cell culture FAM: BACT S JOE: GADPH TAMRA: dMYC	Cell culture FAM: BACT S JOE: GADPH TAMRA: dMYC	Cell culture FAM: BACT S JOE: GADPH TAMRA: dMYC	Cell culture FAM: BACT U JOE: GADPH TAMRA: dMYC				
C	Cell culture FAM: BACT S JOE: GADPH TAMRA: dMYC	Cell culture FAM: BACT S JOE: GADPH TAMRA: dMYC	Cell culture FAM: BACT S JOE: GADPH TAMRA: dMYC	Cell culture FAM: BACT U JOE: GADPH TAMRA: dMYC				
D	Cell culture FAM: BACT S JOE: GADPH TAMRA: dMYC	Cell culture FAM: BACT S JOE: GADPH TAMRA: dMYC	Cell culture FAM: BACT S JOE: GADPH TAMRA: dMYC	Cell culture FAM: BACT U JOE: GADPH TAMRA: dMYC				
E	Cell culture FAM: BACT S JOE: GADPH TAMRA: dMYC	Cell culture FAM: BACT S JOE: GADPH TAMRA: dMYC	Cell culture FAM: BACT S JOE: GADPH TAMRA: dMYC	Cell culture FAM: BACT U JOE: GADPH TAMRA: dMYC				
F	Cell culture FAM: BACT S JOE: GADPH TAMRA: dMYC	Cell culture FAM: BACT S JOE: GADPH TAMRA: dMYC	Cell culture FAM: BACT S JOE: GADPH TAMRA: dMYC	Cell culture FAM: BACT U JOE: GADPH TAMRA: dMYC				
G	Cell culture FAM: BACT S JOE: GADPH TAMRA: dMYC	Cell culture FAM: BACT S JOE: GADPH TAMRA: dMYC	Cell culture FAM: BACT S JOE: GADPH TAMRA: dMYC	Cell culture FAM: BACT U JOE: GADPH TAMRA: dMYC				
H	Cell culture FAM: BACT S JOE: GADPH TAMRA: dMYC	Cell culture FAM: BACT S JOE: GADPH TAMRA: dMYC	Cell culture FAM: BACT S JOE: GADPH TAMRA: dMYC	Cell culture FAM: BACT U JOE: GADPH TAMRA: dMYC				

plate scheme



# TOptical Thermocycler

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## Order Information

Item	Order No.
TOptical Gradient 96 (without Filter)	846-070-500
TOptical 96 (without Filter)	846-070-501
TOptical Gradient 96 Module (without Filter)	846-070-510
TOptical Module 96 (without Filter)	846-070-511

Filter	Wavelengths	Dyes	Order No.
TOptical Filter Module 1	470nm/520nm	FAM™, SYBR® Green, Alexa488®	846-070-520
TOptical Filter Module 2	470nm/545nm	JOE™, VIC®, HEX™, Yakima Yellow®	846-070-521
TOptical Filter Module 3	535nm/580nm	TAMRA™, DFO™, Alexa 546®, NED™	846-070-522
TOptical Filter Module 4	565nm/605nm	ROX™, TexasRed®, Cy3.5®	846-070-523
TOptical Filter Module 5	630nm/670nm	Cy5®, Alexa 633®, Quasar 670™	846-070-524
TOptical Filter Module 6	660nm/705nm	LightCycler Red 705®, Alexa 680®	846-070-525
TOptical FRET Module 1	470nm/580nm	FAM™/TAMRA™	846-070-526
TOptical FRET Module 2	470nm/670nm	FAM™/Cy5®	846-070-527
TOptical FRET Module 3	470nm/705nm	FAM™/Cy5.5®	846-070-528
TOptical FRET Module 4	515nm/670nm	JOE™/Cy5®	846-070-529
TOptical FRET Module 5	470nm/605nm	FAM™/ROX™	846-070-530
TOptical Filter Module SYPRO	490nm/580nm	SYPRO Orange®	846-070-531

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## Technical Specifications

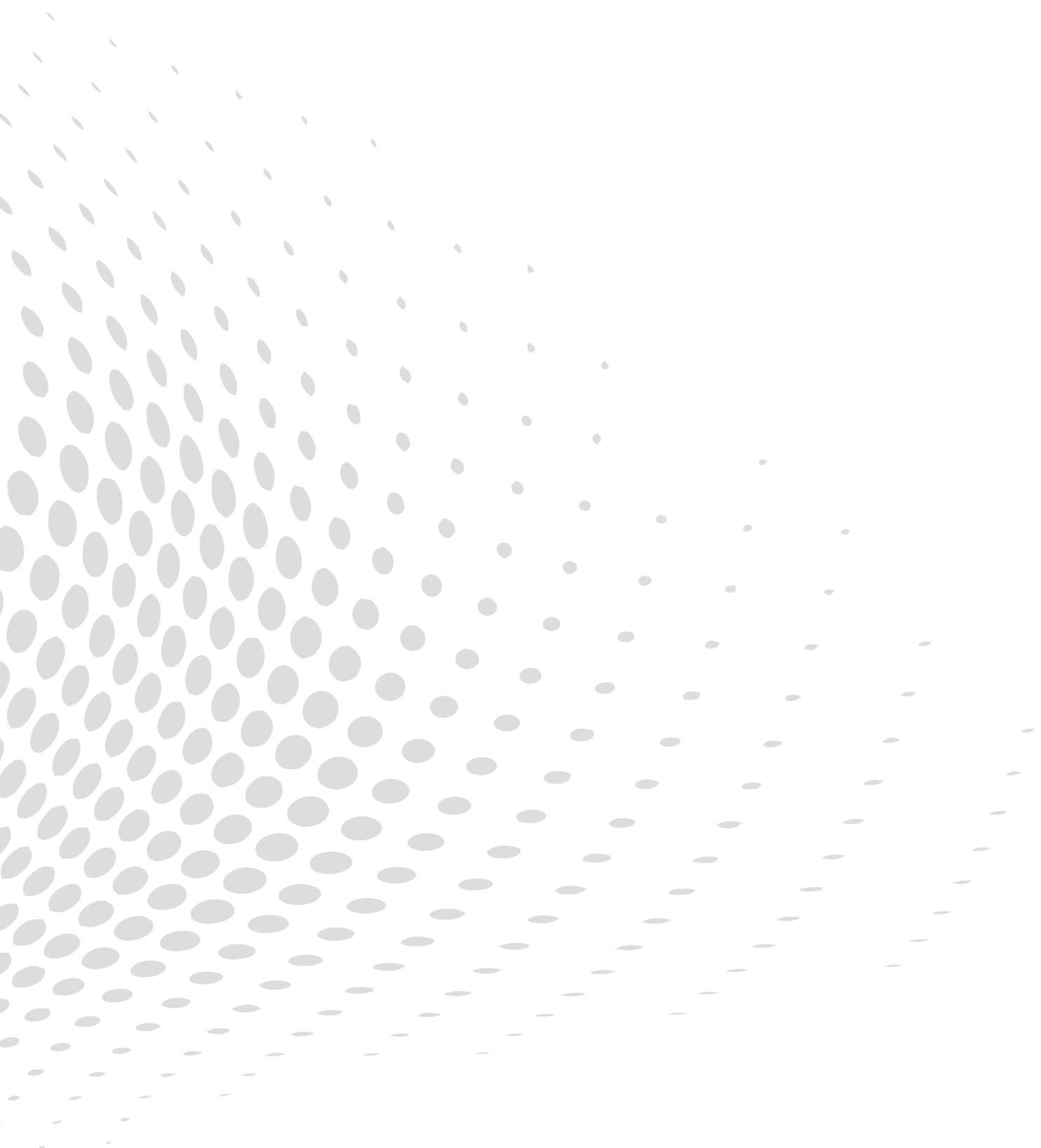
TOptical Thermocycler	
Block format	96 well
Lid temperature	30°C–110°C
Gradient span	40°C
Max. heating rate	6.0°C/sec
Avg. heating rate	5.0°C/sec
Max. cooling rate	4.5°C/sec
Avg. cooling rate	3.5°C/sec
Ramping rate	min. 0.1°C/sec, max. 5.0°C/sec
Block temperature uniformity (15 sec after clock starts)	± 0.15°C at 55°C ± 0.25°C at 72°C ± 0.50°C at 95°C



# TOptical Thermocycler

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Control accuracy	+/- 0,1°C
Temperature increments	min. 0.1°C/cycle
Time increments	min. 1 sec/cycle
Heated Lid	Manual opening mechanism, automatic pressure application
Contact pressure heated lid	10 kg, automated
Control mode	controlled by PC, remote control mode
No. of programs	unlimited on PC
Dimensions	28 cm x 38 cm x 43 cm 28 cm x 64 cm x 43 cm when opened
Power supply	100V, 110V, 230V
Operating conditions	15°C to 35°C, max. 70% humidity, max. 2000 m height
Supported plastic ware	96 well microplates with adhesive optical foil Strips of 8 0.2 ml with optical lids 0.2 ml single tubes with optical lids
Sensitivity	1 nmol/l FAM at 30µl sample volume in a 96 well PCR plate
Measuring time	96 well plate (single measurement, 6 colours) appr. 8 sec
Measuring range	+/- 130 000 (+/-17 bit)
Block capacity	96 well
Sample volume	10-80µl
Light source	Three long living high power LEDs (blue, white, red)
Filter	Filterwheel with stepping motor 6 colour modules for up to 6-fold multiplexing
Lightpath	An array of 8 high performance optical fibers in a shuttle system directs LED light bundled by lenses to samples. The fluorescent dyes in the reaction mix are excited through from above through the lid of the tubes. The reflected light is focused by lenses and directed through optical fibers to a photomultiplier
Detector	Highly sensitive channel photo multiplier (CPM) Optimal signal/noise ration by effective noise reduction (decreased SNR (signal/noise ratio)-technology)
Colour modules	6 colour modules for all commonly used real-time PCR dyes 5 FRET filter combinations 1 filter for protein stability measurements
<b>Software</b>	
qPCRsoft	License-free control and analysis software
Analysis methods	Absolute quantification Relative quantification ΔΔCt method Genotyping Efficiency calculation Multigene-/Multiplate-Analysis
Export functions	Excel, *.csv, GenEx, qBASE
Security	User administration, MIQE-compliant sample documentation



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Änderungen in Ausführungen und Lieferumfang sowie  
technische Weiterentwicklung vorbehalten!

