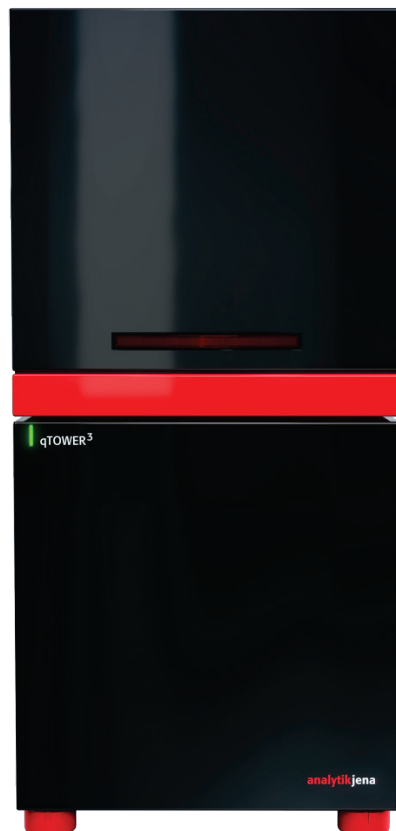


Operating manual

qTOWER³ / qTOWER³ G Real-Time PCR Thermal Cycler



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1 Basic Information

1.1 Notes on the manual

The user manual describes the following two models of the qTOWER³ series:

- ❑ qTOWER³
- ❑ qTOWER³ G

In the text below these devices are collectively called qTOWER³. Differences between the models are explained in the corresponding section.

The qTOWER³ is intended for operation by qualified specialist personnel observing this user manual.

The manual informs about the design and function of the unit and provides personnel familiar with PCR technology with the necessary know-how for the safe handling of the equipment. The manual also provides notes on the servicing and caring for the unit.

Conventions

Instructions for action which occur in chronological order are numbered and combined into action units and furnished with the corresponding results.

Lists which are not in chronological order are shown as itemized lists, sub-listings as bullet points.

Safety notes are indicated by pictographs and signal words. The type and source of the danger are stated together with notes on preventing the danger. The meaning of the pictographs and signal words used is explained in section "Symbols and signal words used" p. 6.

The elements of the control and analysis program are indicated as follows:

- ❑ Program terms are identified with SMALL CAPS e.g., Menu FILE.
- ❑ Menu items are separated by arrows (►), e.g. FILE ► NEW.
- ❑ Buttons are marked with square brackets, e.g. [ADD].

1.2 Intended use

qTOWER³ is a thermal cycler for amplifying DNA by way of the polymerase chain reaction (PCR) licensed for real-time PCR experiments. The license is limited to applications outside of vitro diagnostics (research use only).

The integrated detector enables the measurement of the sample fluorescence in up to six spectral channels during the PCR, with the filters used in the color or FRET modules being exactly matched to the properties of the most frequently used fluorescence dyes, thereby permitting a sensitive and selective detection of fluorescent PCR products.

Analytik Jena AG offers a number of color or FRET modules of which up to six can be installed simultaneously in the device. Replacement and retrofit of color or FRET modules can be easily accomplished.

qTOWER³ is an open platform for real-time PCR and supports both intercalating dyes as well as individual samples and kits of various manufacturers. qTOWER³ can be used in different applications, such as expression analyses, genotyping and the detection of pathogens.

qTOWER³ is fully controlled from the PC using the program qPCRsoft. qPCRsoft provides the following functions

- ☐ Device control and monitoring
- ☐ User administration
- ☐ Context-sensitive help functions
- ☐ Design of real-time PCR experiments and their evaluation
- ☐ Storage of methods (templates) and measuring results (projects)
- ☐ Planning and evaluation of
 - Absolute quantifications
 - Relative quantifications
 - $\Delta\Delta C_t$ – analyses
 - DNA melting curves
 - Genotyping
 - End point analyses
- ☐ Results printout
- ☐ Results export to MS EXCEL or as CSV file
- ☐ Results export to extended programs for the analysis of real-time PCR data (e.g. GenEx, qBASE)

A detailed description of the program qPCRsoft is available in the software manual.

We recommend the following scientific publication for an intensive introduction into the real-time PCR analysis techniques and applications:

Logan, Julie; Edwards, Kristin; Saunders, Nick (ed.): *Real-time PCR – Current Technology and Application*. Norfolk UK: Caister Academic Press, 2009

1.3 Warranty and liability

The warranty and liability periods comply with the legal requirements and the provisions in the General Terms and Conditions of Analytik Jena AG.

Deviations from the intended use described in this manual result in limitations of warranty and liability in the event of damage.

Warranty and liability claims are excluded for personal injury and property damage due to one or several of the following causes:

- ☐ use of the qTOWER³ other than intended
- ☐ improper commissioning, operation and servicing of the device
- ☐ modifications of the equipment without prior consultation with Analytik Jena AG
- ☐ unauthorized intervention in the equipment
- ☐ operation of the device with faulty safety equipment
- ☐ use of other than original spare parts, wearing parts or consumables
- ☐ improper repairs
- ☐ improper transport and storage of the device
- ☐ faults due to the non-observance of this manual

2 Safety instructions

2.1 Symbols and signal words used

This manual uses the following symbols and signal words to indicate hazards or instructions. The safety instructions are always placed before an action.



WARNING

Indicates a potentially hazardous situation.

If it is not prevented death or most serious injuries (incapacitation) can result.



CAUTION

Indicates a potentially hazardous situation.

Unless avoided light or minor injuries may result.



CAUTION! Hot surface!

Touching the hot surface can cause burns.



WARNING! Danger of electric shock if touched!

Electrical voltages present a danger of electrical shock.



BIOLOGICAL HAZARD

This symbol indicates that precautions must be taken when working with potentially infectious material.



NOTICE

Indicates a potentially hazardous situation which might cause material or environmental damage.

In this manual, on the product itself, and on the packaging, the following symbols are used to present important information to the customer, regardless of which language they speak.



CE marking



Manufacturer of the product, including address



Manufacturing date of the product



Order number of the product



Temperature limit



Serial number of the device



Observe operating instructions



Caution

In combination with the symbol above:

Attention! Note the accompanying documents






Symbol for waste disposal in accordance with WEEE directive:

Do not dispose of in household waste

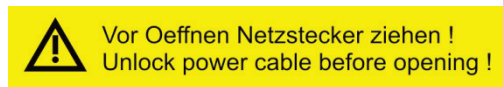
2.2 Safety symbols on the qTOWER³

The qTOWER³ is fitted with safety symbols, the content of which must always be observed. Damaged or missing safety symbols can cause incorrect actions leading to personal injury or material damage! The safety symbols must not be removed! Damaged safety symbols must be replaced without delay!

The following safety symbols are attached to the qTOWER³ and accessories:

Warning symbol (on heatable lid)		Mandatory action signs (on equipment backplate)
		
Warning against a hazard location	Warning against hot surface	Before opening the device always disconnect the mains plug

The following notice sign is attached to the rear of the qTOWER³:



2.3 Technical condition

The qTOWER³ corresponds in its design and construction to the current state of the art technology. Unauthorized modifications or changes, especially such that affect the safety of the staff and the environment, are generally not allowed.



Observe the following:

- ☐ Any manipulation of the safety equipment is prohibited! In case of an accident manipulations of the safety equipment will be interpreted as deliberate!
- ☐ The operator must only operate the device in a sound and operationally safe condition. The technical condition must always comply with the legal requirements and regulations.
- ☐ Prior to every use the device must be checked for damage and sound condition.
- ☐ Any changes in the device affecting its safety must be reported by the operating personnel to the operator without delay.

2.4 Requirements for the operating personnel

The qTOWER³ must only be operated by qualified specialist personnel instructed in the use of the device. The instructions also include imparting the contents of this manual. In addition to the safety at work instructions in this manual the generally applicable safety and accident prevention regulations of the respective country of operation must be observed and adhered to. The operator must ascertain the latest version of these regulations.

The operating and service personnel must have access to the manual at any time!



Observe the following:

- ☐ The device must only be commissioned, operated and serviced by trained personnel instructed in technical safety.
- ☐ The operation or servicing of the device by minors or individuals under the influence of alcohol, drugs or medication is not permitted.
- ☐ It must be ensured that only authorized personnel works at the device. The operating personnel must be familiar with the dangers arising from samples and excipients. Suitable personal protection equipment must be worn.
- ☐ Prior to pauses or at the end of the work appropriate skin cleaning and protection measures must be carried out.
- ☐ Eating, drinking and smoking at the location of the device is prohibited!



- ☐ The device must be handled with the appropriate care and kept clean in accordance with laboratory standards to prevent contamination of the device (e.g. on the heatable lid). Observance of these laboratory rules reduces the risk of being contaminated with potentially infectious material and the risk of cross-contamination of the samples. Wear protective gloves and/or take other safety measures if there is a chance that your skin may come into contact with infectious material when handling the device.
- ☐ The operator must decontaminate the device if the housing or the sample block were contaminated with hazardous substances. For suitable disinfection agents and procedures see "Disinfecting the device" p. 33. Other disinfection agents that are not included in the list shall only be used after consultation with Analytik Jena AG.

2.5 Safety instructions, transport and installation



Observe the following:

- ☐ Only transport the device in its original packaging and with the transport lock in place! Make sure that the device is empty and no sample vessels are in the sample block.
- ☐ Please verify that the delivery is complete on receipt of the qTOWER³ and check for possible transport damage. If the delivery is incomplete or the device was damaged during transport, please contact Analytik Jena AG.
- ☐ To prevent health damage the following must be observed when moving the device in the laboratory (lifting and carrying):
 - For reasons of safety 2 persons are required to transport the device and must position themselves on both sides of the equipment.
 - Since the device does not have handles, grip the device firmly with both hands at the lower end, lifting it simultaneously.The guide values and statutory limits for lifting and carrying loads without auxiliary equipment must be observed and adhered to.

The qTOWER³ can be installed by the Analytik Jena AG customer service or trained specialist personnel authorized by Analytik Jena AG.

2.6 Safety instructions - operation

2.6.1 General

The operator of the qTOWER³ must make sure before each commissioning that the condition of the device including the safety equipment is sound.



Observe the following:

- ☐ Free access to the power switch on the back of the enclosure has to be ensured during operation.
- ☐ The ventilation fittings at the rear of the device must be unobstructed and operational. Covered vents or ventilation slits etc. may cause the device to break down or may cause damage to it.
- ☐ Be careful to avoid crushing or pinching injuries when closing the device.

- ❑ The use of oil between the samples and the sample block is not necessary to achieve an improved heat exchange. However, if you still want to use oil, you should use mineral oil. Do not use silicone oil.



- ❑ The thermal block, the samples and the heated lid reach high temperatures. There is a risk of burns during contact.
- ❑ Ensure that the lid is securely closed before starting the program! Do not touch the heated lid!
- ❑ The rapid heating of the thermal block can cause liquids to boil explosively. Always wear safety goggles during operation!
- ❑ Do not touch hot sample vessels or plates and do not open them or boiling liquid may escape!
- ❑ Only use plates and vessels that are suitable for high temperatures (up to 100°C), fit well into the thermal block (no shaking) and whose lids seal tightly!

2.6.2 Safety instructions - Protection against explosion and fire



The qTOWER³ must not be operated in an explosive environment.

The operating personnel must be familiar with the location of the fire-fighting equipment in the operating room of the device.

The qTOWER³ must not be operated with flammable, explosive or volatile substances.

2.6.3 Safety instructions - electrical equipment

Work on electrical components of the qTOWER³ may only be carried out by a qualified electrician in accordance with the applicable electrical engineering rules. Life-threatening electrical voltages may occur in the interior of the qTOWER³!



Observe the following:

- ❑ Any work on the interior of the device may only be carried out by the customer service of Analytik Jena AG and specially authorized technicians.

- ❑ The electrical components must be checked regularly by a qualified electrician. Any defects, such as loose connections, faulty or damaged cables, must be repaired without delay.
- ❑ Do not replace the removable mains cable of the device by a mains cable that does not meet the specifications (without protective ground conductor).



- ❑ Before opening the device it must be switched off from the power switch and the mains connector must be disconnected from the mains outlet!
- ❑ The qTOWER³ must be switched off immediately using the power switch and the power supply disconnected from the mains if there is any interference with the electric components.
- ❑ The qTOWER³ fulfills the corresponding requirements for interference emission and resistance from the IEC 61326 series. Assess the electromagnetic environment of the device before operation.
- ❑ Do not operate the device near sources of strong electromagnetic radiation (e.g. unshielded, deliberately operated high frequency source) as these may affect proper operation of the device.

2.6.4 Handling of samples, auxiliary and operating materials

The operator is responsible for the selection of substances used in the process as well as for their safe handling. This is particularly important for radioactive, pathogenic, infectious, poisonous, corrosive or otherwise dangerous substances. For details contact the safety officer responsible for your location. When handling dangerous substances local safety codes and guidelines must be observed. The following general notes do not replace the specific local regulations or the regulations in the EC safety data sheets of the manufacturers for the auxiliary and operating materials.



Observe the following:

- ❑ The relevant regulations and the notes in the EC safety data sheets of the manufacturers have to be observed and complied with regards to storage, handling, use and disposal for all auxiliary and operation materials used during the operation of the device.
- ❑ Auxiliary and operation materials may never be placed in containers or vessels for food. The approved containers for the relevant material are to be used and

these have to be labeled accordingly. The notes on the labels have to be observed!

- ☐ Protective goggles and rubber gloves have to be worn when handling reagents.
- ☐ Auxiliary and operating materials as well as their containers may not be disposed in domestic waste or enter the sewage system or the soil. The applicable regulations for disposal of these materials must be meticulously observed.
- ☐ Ensure good room ventilation in working rooms.
- ☐ If only a few samples are treated, an (empty) vessel of the same height must additionally be placed at each corner position of the block. If the number of samples in the block is too low, there is a risk of the vessels being damaged and sample liquid leaking out.



- ☐ For your own safety, please observe the potential infectious qualities of the examined biological material.

2.6.5 Safety instructions - service and repair

On principle, maintenance of the qTOWER³ is performed by the customer service department of Analytik Jena AG or its authorized and trained specialist personnel. Unauthorized maintenance can damage the device. Therefore, the operator may generally only carry out the tasks listed in chapter "Maintenance and care" p. 32.



The following has to be observed:

- ☐ The exterior of the device may only be cleaned with a damp, not dripping, cloth after the device has been switched off.
- ☐ Do not use alcohol (e.g. methanol or ethanol), organic solvents or abrasives to clean the device.
- ☐ Any maintenance on the device may usually only be carried out in the switched-off condition (unless stated otherwise).

2.7 Behavior during emergencies

In case of danger or accidents, immediately switch off the qTOWER³ using the main switch on the equipment backplate. Disconnect the power plug from the power supply! Because a rapid response can save lives during an emergency, the following has to be ensured:



- ☐ The operating staff must be familiar with the location of safety equipment, accident and danger alarms as well as first aid and rescue equipment as well as their handling.
- ☐ The operator is responsible for the respective training of the operating staff.
- ☐ All equipment for first aid (first-aid kit, eyewash bottles, stretcher, etc.) as well as equipment for firefighting (fire extinguishers) must be within reach and easy to access. All equipment has to be in a sound condition and should be checked regularly.

2.8 Standards and directives

Safety class and safety type

The qTOWER³ features protection class I.

The casing features protection type IP 20.

Device safety

The qTOWER³ complies with the safety standards

- ☐ EN 61010-1:2010
- ☐ UL 61010-1:2012
- ☐ CAN/CSA-C22.2 No. 61010-1-12:2012

EMC compatibility

The qTOWER³ has been tested for radio interference suppression and interference resistance and meets the requirements of

- ☐ EN 61326-1:2013
- ☐ EN 61326-2-6:2006

The qTOWER³ complies with the applicable requirements of EMC directive 2014/30/EU and low voltage directive 2014/35/EU.

Environmental compatibility

The qTOWER³ has been tested for environmental compatibility and meets the requirements of

- ☐ DIN ISO 9022-2:2015-06
- ☐ DIN ISO 9022-3:2015-08
- ☐ DIN EN 60068-2-64:2009-04
- ☐ DIN EN 60068-2-27:2010-02
- ☐ DIN EN 60068-2-31:2009-04

EU directives

The qTOWER³ is designed and tested in accordance with standards meeting the requirements of EU directives 2014/35/EU and 2014/30/EU. The device leaves the manufacturer in a pristine and technically safe state.

Federal Communications Commission Advisory (U.S. only)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device doesn't cause harmful interference, and (2) accepts any interference (including interference that may cause undesired operation). This device complies with Part 18 of the FCC Rules.

Interference-causing Equipment Standards (Canada only)

This device complies with Canadian ICES-001 / NMB-001.

Guidelines for China

The qTOWER³ contains restricted substances (according to directive "Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products"). Analytik Jena guarantees, that those hazardous substances may not leak out during the next 25 years when the instrument is used in accordance with its intended purpose.

To ensure safe operation, the operator must strictly observe the safety and operating instructions contained in this manual. For accessories which have also been supplied, and system components from other manufacturers, their operating instructions should be referred to.

Besides the safety instructions in this manual and the local safety regulations that apply to the operation of the qTOWER³ the general applicable regulations regarding accident prevention, occupational health and safety and environmental protection have to be observed and complied with. References to potential dangers do not replace the work protection regulations which must be observed.

3 Technical data

Block format	96 wells
Sample volume	10 – 80 µL
Lid temperature	30 – 110 °C
Temperature gradient	40°C (qTOWER³ G only)
Max. heating rate*	max. 8°C/s, Ø 7°C/s (depending on consumables used)
Max. cooling rate*	max. 6 °C/s, Ø 5.5°C/s (depending on consumables used)
Heating rate adjustment	min. 0.1 °C/s
Temperature uniformity (15 s after starting the clock)	±0.15 °C at 55 °C ±0.25 °C at 72 °C ±0.50 °C at 95 °C
Temperature range	3 °C – 99 °C
Control accuracy	± 0.1 °C
Temperature increments	min. 0.1 °C/cycle
Time increments	min. 1 s/cycle
Heated lid	Manual opening mechanism, automatic contact pressure
Heated lid contact pressure	30 kg, automated
Dimensions (H x W x D)	59 cm x 27.5 cm x 27.5 cm 70 cm x 27.5 cm x 50 cm when opened
Mass	30 kg
Noise level	45 dB
Energy supply	
Operating voltage	100 V, 115 V, 230 V
Line frequency	50 – 60 Hz
Power consumption (max.)	max. 850 W
Instrument fuses	2 x 10 AT / 250 V
Safety circuits	Monitoring of the closing mechanism of the device (lock with handle), over-temperature protection in the heated lid
Operating conditions	Air pressure: 0.7 bar to 1.06 bar Max. permissible altitude: 2000 m Humidity: max. 70 % Operating temperature: +15 °C to +35 °C



Supported plastic products	96-well micro titer plates with optical film 8-well strips 0.2 ml with optical lids 0.2 ml individual vessels 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 colors) approx. 6 s
Measuring range	±130 000 (±17 bit)
Dynamic range	10 log stages
Light source	Four high-intensity LEDs (blue, green, white, red)
Detector	Photo Multiplier (PMT)
Color filter modules	Color modules for all frequently used real-time PCR dyes Color module 1 (470 nm/520 nm) Color module 2 (515 nm/545 nm) Color module 3 (535 nm/580 nm) Color module 4 (565 nm/605 nm) Color module 5 (630 nm/670 nm) Color module 6 (660 nm/705 nm) Protein color module 1 (490 nm/580 nm) FRET filter combinations: FRET module 1 (470 nm/580 nm) FRET module 2 (470 nm/670 nm) FRET module 3 (470 nm/705 nm) FRET module 4 (515 nm/670 nm) FRET module 5 (470 nm/605 nm)
Software and PC	
qPCRsoft	Control and analysis program
Analysis methods	Absolute quantification, relative quantification, $\Delta\Delta C_t$ method, allelic discrimination, efficiency calculation, DNA melting curves, POS/NEG analysis in the end point
Export functions	Excel, CSV, LIMS, GenEx, qBase
Data connection	USB
PC software requirements	Minimum Pentium IV, > 1 GHz
Operating system	Win 7 / Win 8 / Win 10

4 Installation conditions

4.1 Environmental conditions

The following requirements are placed on the climatic conditions in the operating room of the qTOWER³:



	Operation	Transport, Storage
Temperature range	+15 °C to +35 °C	+5 °C to +55 °C
Max. humidity:	70 %	10 % to 30 % Use drying agent!
Air pressure	0.7 bar to 1.06 bar	
Permissible altitude	max. 2000 m	

The laboratory atmosphere must be free of draft, corrosive vapors and vibration.

The following requirements are placed on the location of the qTOWER³:

- ☐ Do not locate the device directly near a door or window.
- ☐ Place the device on a heat-resistant and acid-resistant surface.
- ☐ Do not locate the device near sources of electromagnetic interference.
- ☐ Avoid direct sunlight and radiation from heaters onto the qTOWER³; if necessary ensure air conditioning.
- ☐ Never cover the air vents of the backplate of the device with other equipment or installations!

4.2 Energy supply



WARNING! Observe the mains connection!

The qTOWER³ may only be connected to a properly grounded mains outlet in accordance with the voltage specifications on the type plate.

The qTOWER³ is operated with single-phase alternating current. Prior to making the connection check that the voltage selection switch of the device is set to the correct value.

Switching-on conditions

Energy supply	
Operating voltage	100 V, 115 V, 230 V
Line frequency	50 – 60 Hz
Power consumption	max. 850 W

Instrument fuses

Mains voltage	Instrument fuses
100 V, 115 V, 230 V	2 x 10 AT / 250 V

4.3 Space requirement



NOTICE

When opening the qTOWER³ the upper device hood tilts back. Allow adequate space for this.

qTOWER ³	Height [cm]	Width [cm]	Depth [cm]
closed	59	27.5	27.5
open	70	27.5	50

The open device has a space requirement of 70 cm x 27.5 cm x 50 cm (H x W x D). Allow adequate space for placement of the device. In addition, keep a safety distance of at least 10 cm to other equipment or walls!

Additional space may be required next to the qTOWER³ for a PC, monitor and possibly a printer. The PC, monitor and printer may also be placed on a separate table.

5 Function and setup

The qTOWER³ combines a PCR thermocycler with a patented fluorescence photometer.

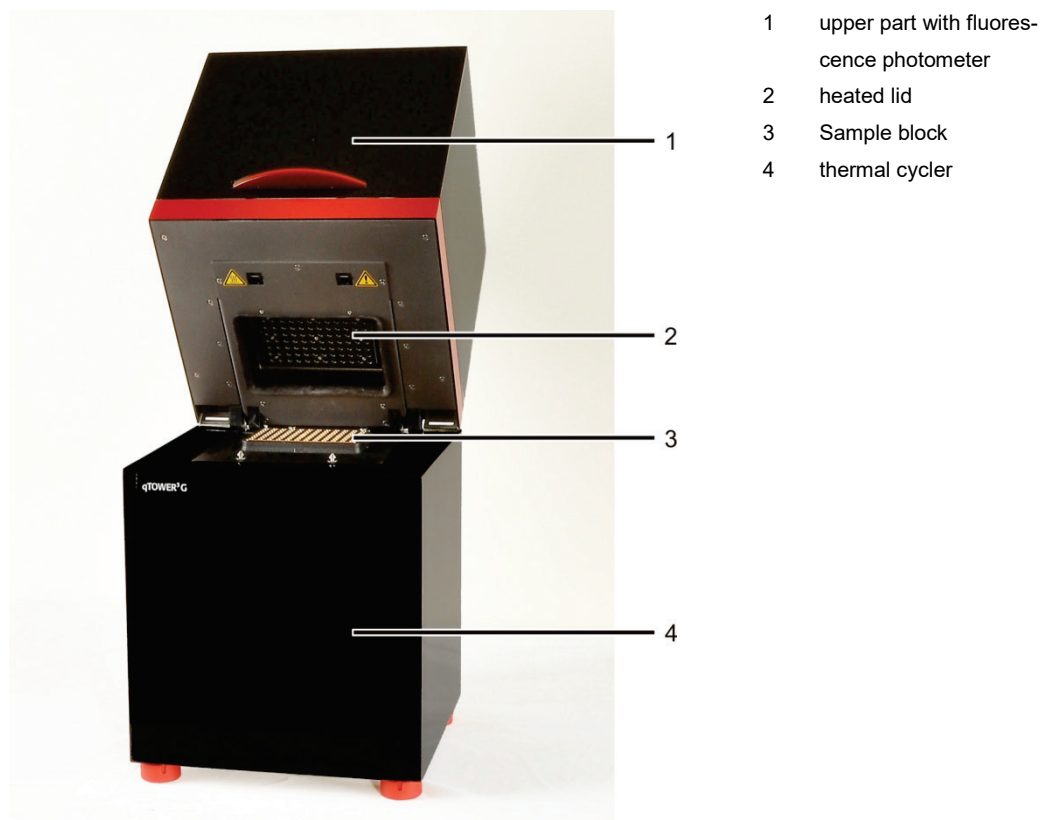


Fig. 1 Layout of the qTOWER³

5.1 Fluorescence spectrometer

An 8-channel Epi fluorescence photometer with fiber -multiplexer and mechanical scanning device is used as detector.

Light for exciting the dyes is emitted by four long-life LEDs in blue, green, white and red. The light is passed through optic fibers to collimator lenses, bundled and then transferred to the excitation filter of the color modules fitted to a rotating filter wheel. The light is deflected via a beam divider and passed through additional optic fibers to a lens array in a shuttle system scanning the sample block in columns. The light excites the fluorescence dyes in the reaction mix. The fluorescence dyes then emit a light of longer wavelength that is bundled through the lenses in the shuttle system and passed via the optic fibers back to the color modules. In the color modules the light passes the beam divider followed by two emission filters and is then transferred to the photomultiplier (CPM) for detection.

The filter wheel of the photometer can be populated freely with a choice of color filter modules. In addition, color filter modules can be retrofitted at any time, extending the application spectrum of the device. A total of 12 color filter modules are available. This also includes filter modules especially optimized for FRET applications. You can choose color modules from all absorption spectra of the standard fluorescent dyes, from the blue through the red excitation range.

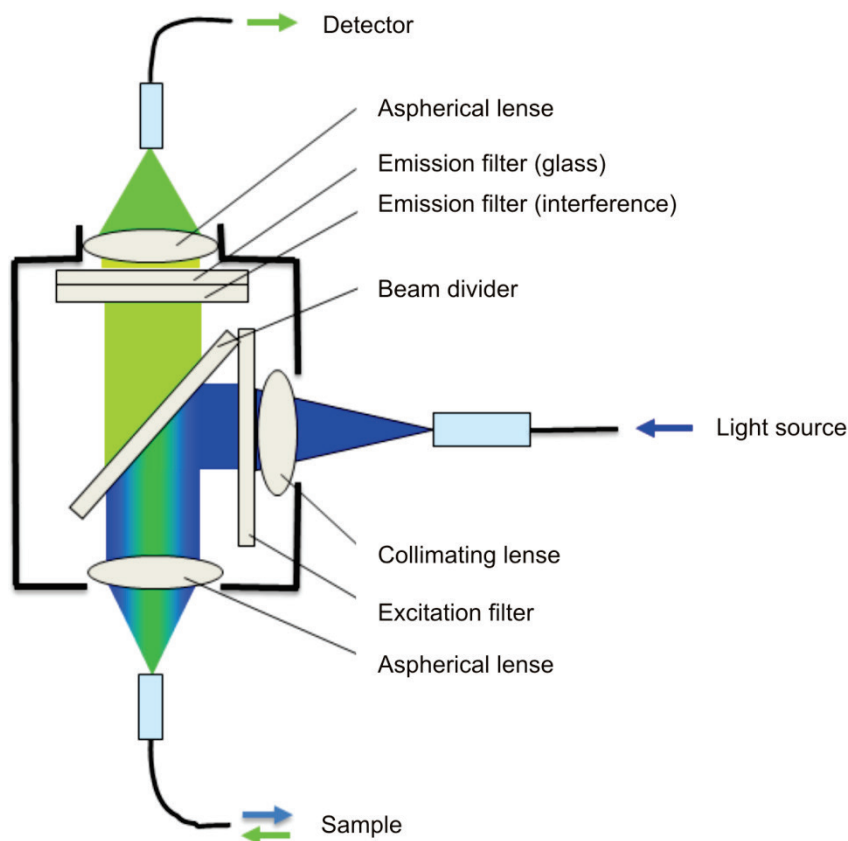


Fig. 2 Schematic structure of the Epi fluorescence photometer

5.2 PCR thermocycler

The qTOWER³ is equipped with a thermal block with 96 wells. To guarantee the best possible performance and heat exchange capability, the thermal block is made from gold-plated silver. This achieves a high temperature homogeneity and uniformity in combination with heating rates of up to 8 °C/s and cooling rates of up to 6 °C/s.

The **qTOWER³ G** also features a 96 well thermal block but is additionally equipped with a gradient function. The maximum temperature span of the gradient is 40 °C with 12 columns. This means that the device is particularly well prepared for establishing new primary pairs.

The qTOWER³ is not limited to specific detection reagents or the plastic products of a specific manufacturer. Optical plastic products in the formats 0.2 ml tubes, 8 well strips with optical lids or 96 well micro titer plates can be used.

To avoid condensation or potential sample loss, the qTOWER³ is equipped with a motorized heated lid. This can be adjusted up to 110 °C and guarantees an optimum contact pressure on the sample vessels during the entire real-time PCR run process irrespective of the consumables used.

6 Commissioning

Prior to commissioning, check that all requirements are fulfilled at the installation location (see section "Installation conditions" p. 19).

6.1 Connections and control elements

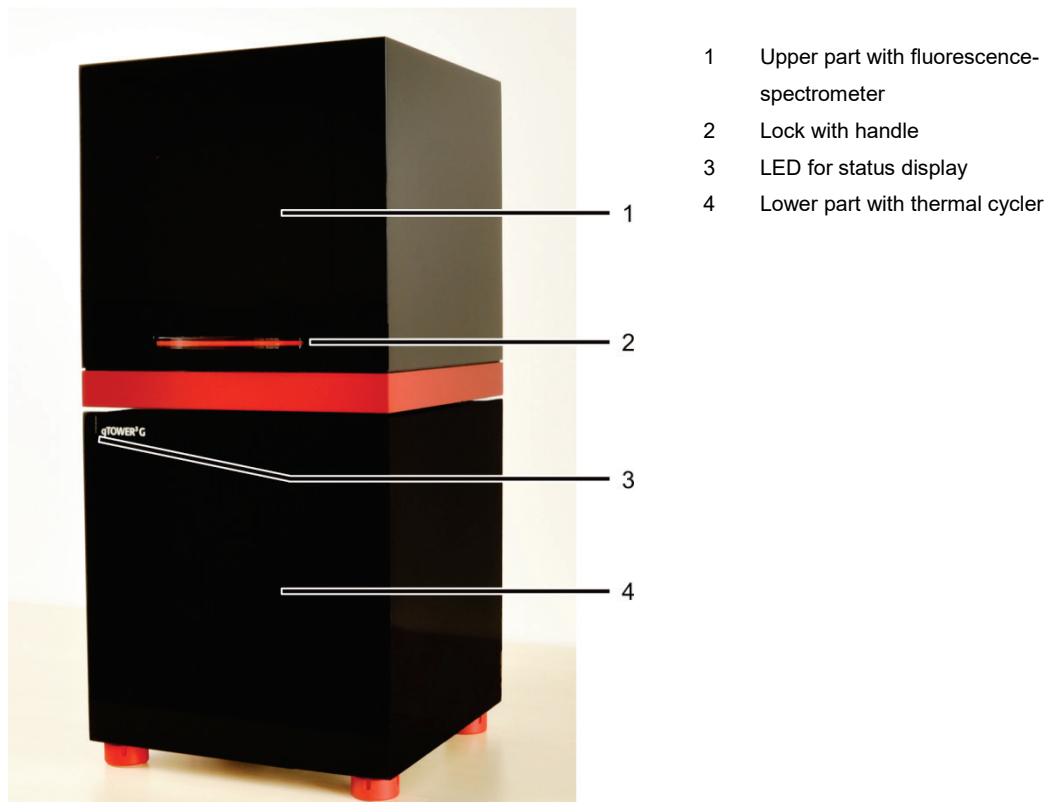


Fig. 3 qTOWER³ front view

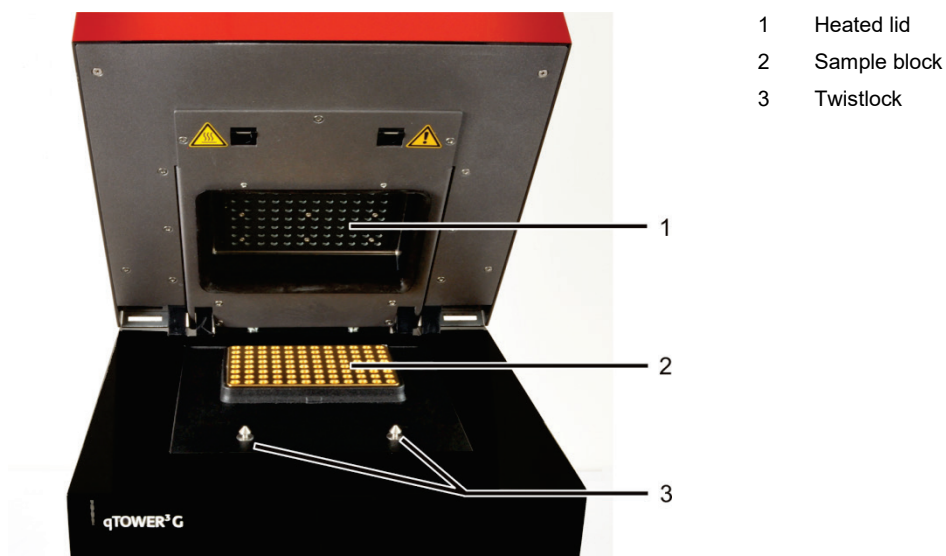


Fig. 4 qTOWER³, open

The qTOWER³ is opened by folding back the upper part and the cover for the sample block it contains and the fluorescence photometer. To this end press the handle in until the lock disengages with a click and the upper part gently snaps open. The upper part can then be folded back from the handle.

The mains connection, mains switch and USB interface for PC connection are on the rear of the device.

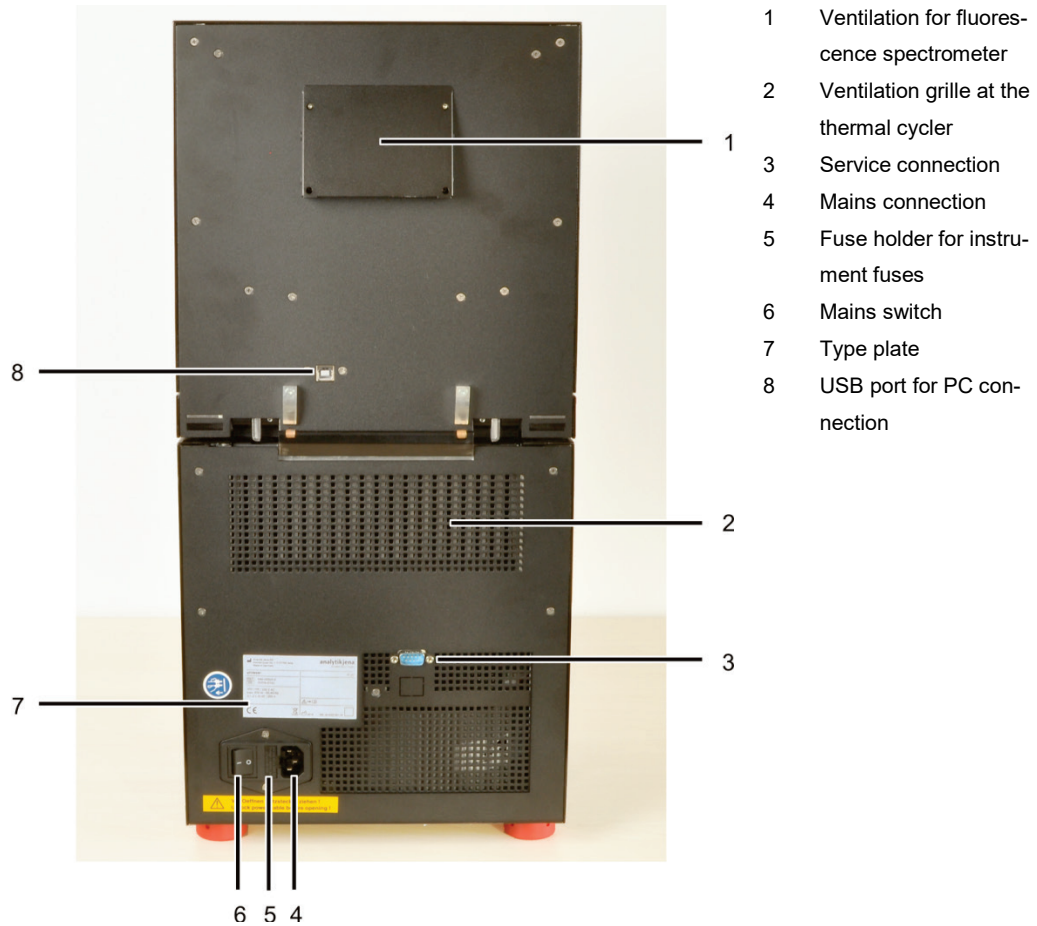


Fig. 5 qTOWER³ rear view

The type plate is also located on the rear of the device. The type plate shows the serial number of the device and the electrical connection data.

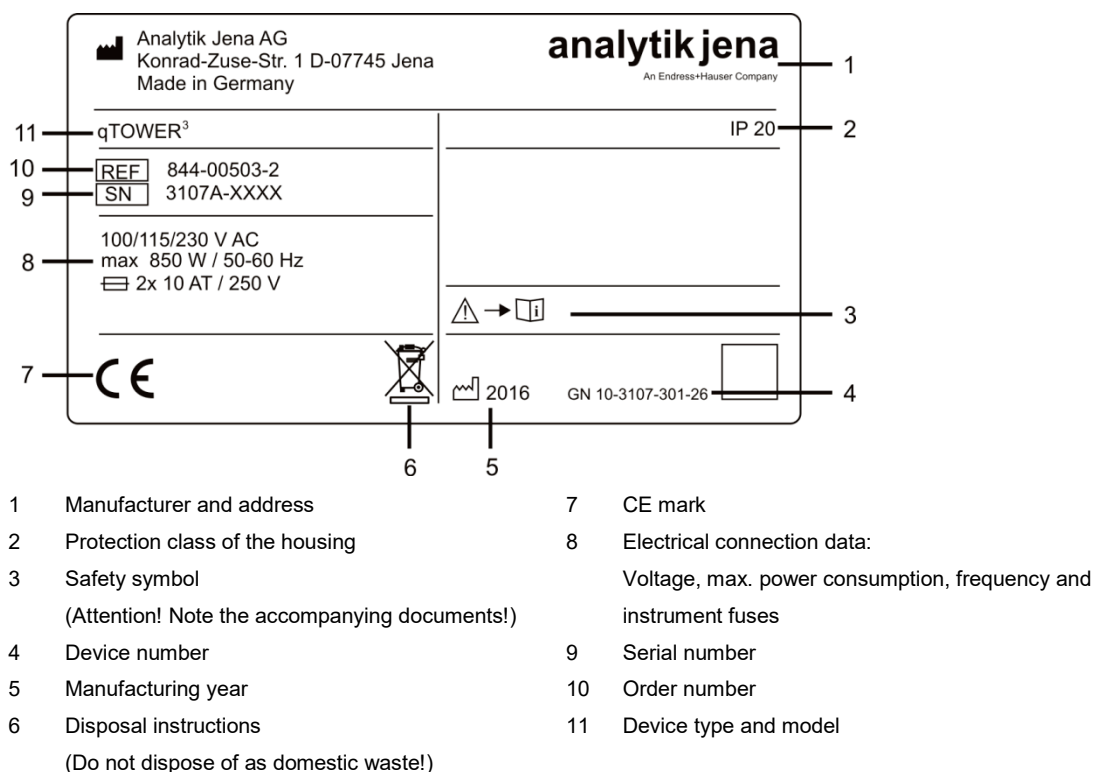


Fig. 6 Type plate

The voltage selector switch is located on the bottom of the device, behind a cover. It can be used to adjust the operating voltage to the mains voltage.

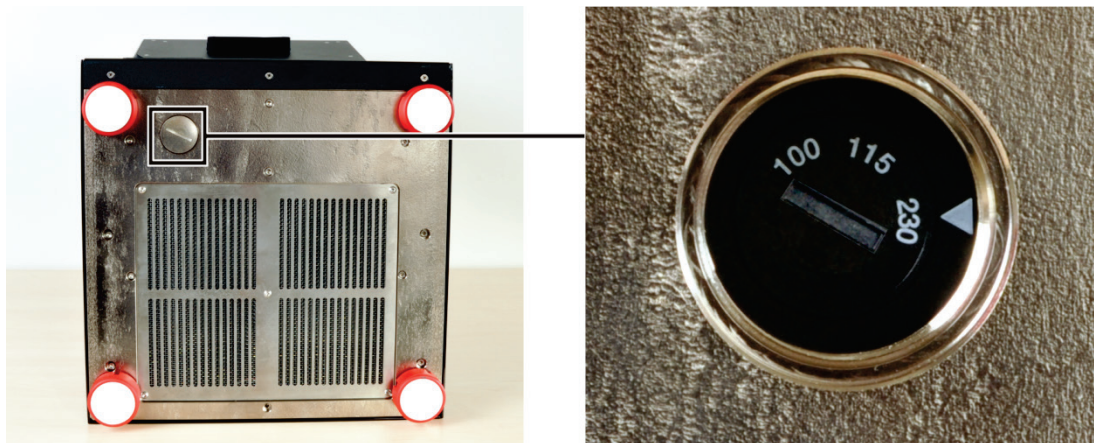
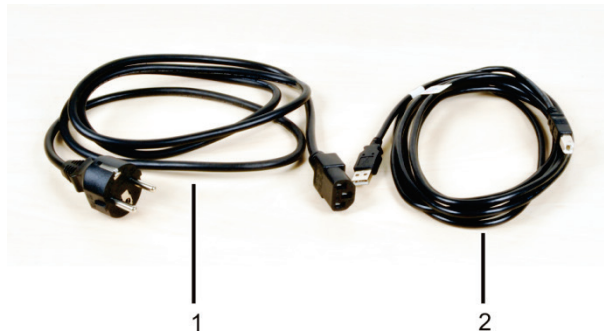


Fig. 7 Voltage selector switch on the bottom of the qTOWER³

The following accessories are part of the qTOWER³:

- ☐ Mains and connection cable
- ☐ CD or USB memory stick with qPCRsoft program, including manual for software and device
- ☐ Operating instructions and software manual
- ☐ Packaging and packaging instructions



- 1 Mains cable
- 2 USB cable for PC connection

Fig. 8 Mains and connection cable

Use only the supplied mains cable or a mains cable with the same specifications.

6.2 Setting up the qTOWER³



WARNING! Risk of electric shock! Do not touch!

Check that the mains connection conditions match those on the type label on the device backplate.

Before connecting the device to the mains network set the correct operating voltage at the voltage switch on the underside of the device.



NOTICE

Unsuitable packaging material may cause damage to the device! Keep the original packaging for subsequent transports.

The following steps are required during the installation of the qTOWER³:

- ☐ Assemble the color modules (unless installed)
- ☐ Connect the device to the mains and the PC
- ☐ Install the qPCRsoft program on the PC

1. Remove the qTOWER³, connection cable and operating manual with the installation CD or the USB memory stick from the transport packaging. Wait until the device has reached room temperature.
2. Verify that the delivery is complete. Check the device and accessories for transport damage.
3. If the color modules are not installed yet, assemble the color modules in accordance with section "Installing color modules" p. 34.



4. Place the device on its side. Check the set operating voltage.
5. Use the voltage selection switch (Fig. 7 S. 26) to adjust the operating voltage to the mains voltage.
Adjust the switch using a screwdriver or a coin so that the arrow points in the direction of the mains voltage available on site.

6. Connect the USB-cable to the USB interface of the qTOWER³ (8 in Fig. 5 p. 25) and to the PC.
 7. Connect the mains connection to the qTOWER³. Plug the plug into the mains socket.
 8. Switch on the PC. Install qPCRsoft on the PC. Pay Attention to the information in the software manual.
Note:
The qTOWER³ is only supported from qPCRsoft program version 3.2.
 9. Switch on the qTOWER³ with the mains switch.
During first startup the qTOWER³ will be detected as a USB device. After successful automatic driver installation the qTOWER³ is ready for operation. If the drivers are not installed automatically, you can complete the installation via the Windows routine.
The drivers are on the installation CD or on the USB memory stick.
 10. Start the qPCRsoft program.
 11. Open the lid. To do so, press in the red handle on the front until the lock opens with a click. Fold back the upper part of the device.
 12. Remove the red transport lock and put it aside for later transports.
 13. If you installed color modules, specify them in the qPCRsoft software (see section "Installing color modules" p. 34).
- ✓ **The qTOWER³ is ready for operation.**

Its operation is software-controlled using qPCRsoft. The settings for the measuring or temperature program can be found in the software manual.

7 Operation

7.1 Switching the qTOWER³ on

Observe the following sequence when switching on the device:

1. Switch on the qTOWER³ using the mains switch on the back of the device.
2. Start the qPCRsoft program.
 - ✓ **The qTOWER³ is ready for operation. The green status LED lights up.**

If you have started the qPCRsoft software before switching on the device, e.g. to first prepare a real-time PCR project, you must link the qTOWER³ to the PC.

1. Start the qPCRsoft program.
2. Switch on the qTOWER³ with the mains switch.
3. Call up the EXTRAS ► DEVICE IDENTIFICATION menu command.
 - ✓ **The qTOWER³ is ready for operation. The green status LED lights up.**

Status LED

The status LED is located on the front of the device next to the device name, (3 in Fig. 3 p. 24).

- ☐ During the device initialization the LED flashes red/green.
- ☐ As soon as the device is ready for operation, the LED switches to green.
- ☐ During a measurement, the LED flashes red/green.
- ☐ In case of a device error, the LED will turn red.

7.2 Switching off the qTOWER³



NOTICE

Do not switch off the qTOWER³ during a PCR run!

Keep the qTOWER³ closed even if switched off, to prevent the sample block from being contaminated. Dust or other contamination reaching the wells can distort the fluorescence measurements

1. Close the lid of the qTOWER³.
2. Switch off the power of the device using the mains switch on the back.
3. Exit the qPCRsoft program.
 - ✓ **The qTOWER³ is completely switched off.**

7.3 Inserting samples / Starting the PCR analysis



WARNING! Biological hazard!

Take great care when working with potentially infectious material. Wear suitable protective equipment, e.g. protective gloves.



WARNING

Risk of eye injury!

The rapid heating of the thermal block can cause liquids to boil explosively. Always wear safety goggles during operation.



CAUTION! Hot surface!

The thermal block, the samples and the heated lid reach high temperatures. There is a risk of burns during contact.

The qTOWER³ is equipped with a 96 well SBS sample block. This makes it suitable for the use of 0.2 ml individual tubes, 8 well strips and 96 well micro titer plates. These and other consumables can be ordered from Analytik Jena AG.

After pipetting the PCR samples into the wells these must be sealed with a transparent optical adhesive film (sealing film). The optical transparency of the films affects the fluorescence signal directly. Therefore, only use clear adhesive film as offered for real-time PCR.

The strength of the lid contact pressure has been designed for a fully populated block. If only a few samples are to be used in the block, place an additional two (empty) vessels of the same height in the four corner positions of the block. Otherwise the sample vessels or the heated lid may be damaged from excess contact pressure.

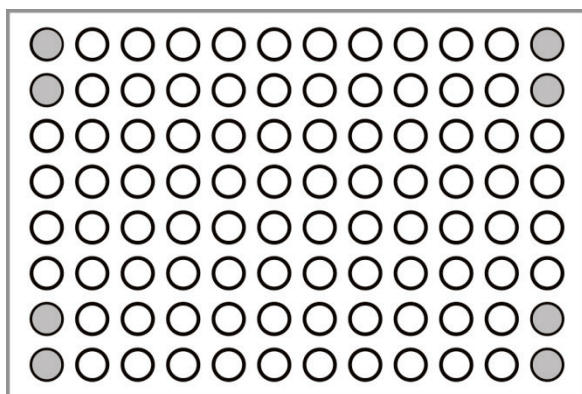


Fig. 9 Position of additional vessels for measurements with few samples

1. Prepare a real-time PCR project with complete details about the PCR run, fluorescence measurements and the sample layout of the PCR plate (see qPCRsoft manual).
2. Open the lid. To do so, press in the red handle on the front until the lock clicks open. Fold back the upper part of the device.

3. Place the PCR plates onto the thermal block in such a way that well A1 is on the left-hand side (arrow in the figure below). This position corresponds to the well allocation in the qPCRsoft program.



Fig. 10 **Position A1 on the sample block**

4. Close the lid. To do so, fold the lid forward and press it down from the handle until the lock engages with a click.
5. Start the PCR run in the qPCRsoft program.

8 Maintenance and care



WARNING! Risk of electric shock! Do not touch!

Prior to commencing any maintenance or cleaning work, switch off the device and pull the mains plug. Wait until the qTOWER³ is completely dry before recommissioning it.

The qTOWER³ is practically maintenance-free.

The following care and maintenance tasks can be performed by the customer:

- ☐ Cleaning and disinfection of the housing and sample block
- ☐ Replacing the fuses
- ☐ Installation or replacement of color modules

All maintenance work and repairs beyond this scope must only be performed by Analytik Jena AG customer service personnel or persons authorized by Analytik Jena AG. Any unauthorized interference limits warranty entitlements. If the device exhibits any faults or details, please contact the Analytik Jena AG customer service immediately. In order to guarantee sound and safe operation and to ensure laboratory certification, we recommend concluding a maintenance agreement with regular device validation.

8.1 Cleaning the housing



NOTICE

The use of alcohol, organic solvents or abrasives can damage the paintwork. When cleaning, please also pay Attention to the notes in chapter "Safety instructions - service and repair" p. 13.

Only wipe the housing of the qTOWER³ with a soft clean cloth which may be wetted with a commercial neutral detergent, if necessary.

8.2 Cleaning the sample block



WARNING

Risk of eye injury!

Wear safety goggles when blasting the sample block with compressed air.

Dust or reagent residue in the sample block can cause an increase in the background signal.

- ☐ Blow out the recesses in the sample block with compressed air.

- ❑ To remove reagent residue fill the affected wells with max. 20 µL distilled water or ethanol. Wait for approx. 1 min before you suck out the liquid again. Repeat the process until the background signal is in the normal range.

8.3 Disinfecting the device



WARNING! Biological hazard!

Clean the qTOWER³ with particular care after analyzing potentially infectious material. Wear suitable protective equipment, e.g. protective gloves.



NOTICE

The only suitable cleaning method for the housing is wipe disinfection.

When using spray disinfectants there is a risk that the liquid enters the sensitive electronic system through the air vents. If the disinfectant has a spray nozzle, apply disinfectant to a suitable cloth before using it on the device.

- ❑ Avoid contamination by handling sample substances with care.
- ❑ Wipe spilled samples or reagents immediately with an absorbent cloth or piece of paper.
- ❑ If the qTOWER³ is used for the analysis of infectious material, great care must be taken because the qTOWER³ cannot be decontaminated as a whole device.
- ❑ Immediately remove visible contamination by suitable means. Do not allow solvents to enter the device.
- ❑ The sample block is also suitable for wipe and spray disinfection. The only suitable cleaning method for the housing is wipe disinfection.

Device part	recommended disinfectants	Provider
Sample chamber	Descosept AF	Dr. Schuhmacher GmbH
	Meliseptol HBV (cloths)	B. Braun company
Housing	Descosept Spezial	Dr. Schuhmacher GmbH

Pay attention to the efficacy spectrum of the listed disinfectants with regard to your customer-specific decontamination requirements!

- ❑ Only the use of ethanol or isopropanol containing disinfection agents is approved for wipe disinfection. The use of disinfection agents with ingredients or concentrations that differ from the recommended disinfection agents invalidates all warranty claims regarding damage to the device or non-effectiveness.
- ❑ If the qTOWER³ has to be sent to Analytik Jena AG for service, a prior decontamination must be carried out and documented (see "Return" p. 41).

8.4 Exchanging fuses



WARNING! Risk of electric shock! Do not touch!

Before exchanging fuses, switch off the power switch and disconnect the device from the mains network.

Only use the specified fuses. If the wrong fuses are used, there is a risk of fire, injuries and device damage.

Mains voltage	Instrument fuses
100 V, 115 V, 230 V	2 x 10 AT / 250 V

1. Switch the qTOWER³ off. Unplug the power cord!
2. Carefully open the fuse holder on the rear of the device. Use a standard screwdriver to do so.
3. Remove the old fuses and replace them with new ones.

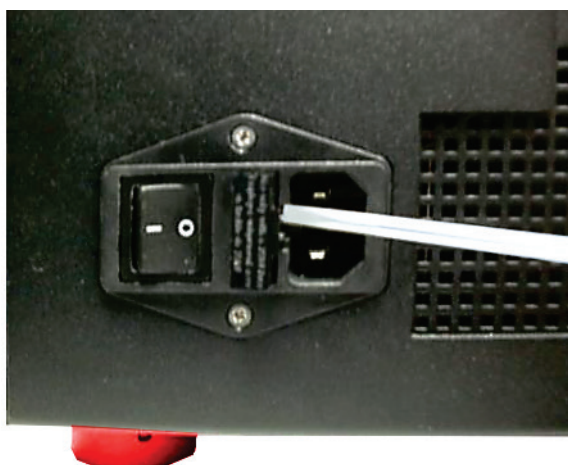


Fig. 11 Fuse holder on the rear of the device

If the fuses melt repetitively have the qTOWER³ checked by Analytik Jena AG customer service personnel or by persons authorized by Analytik Jena AG.

8.5 Installing color modules

Depending on the delivery state of the qTOWER³ or when purchasing additional color modules, it might be necessary to install the color modules in the device. The top device hood must be removed for this purpose.



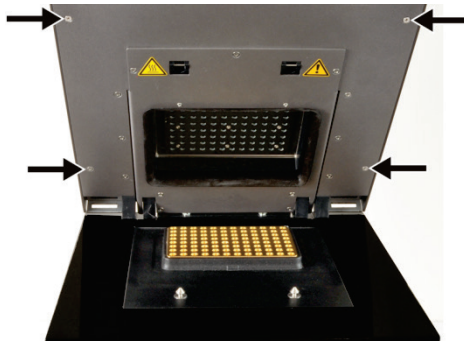
NOTICE

Sensitive optics!

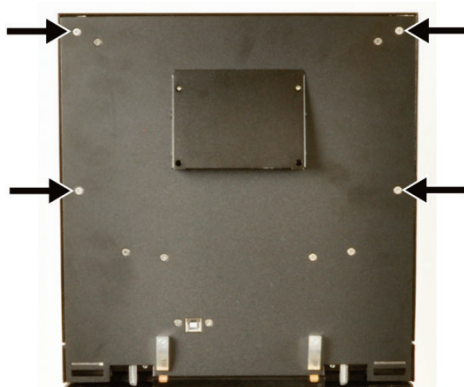
The optical components of the device are located below the top device hood. Be careful not to kink or excessively bend the optic fibers. They could break.

Proceed as follows:

1. Switch off the qTOWER³



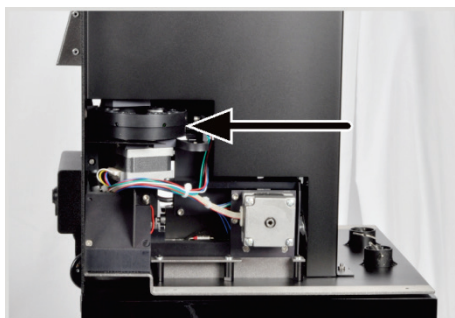
2. Open the lid. Remove the four external screws on the inside of the lid.
3. Close the lid.



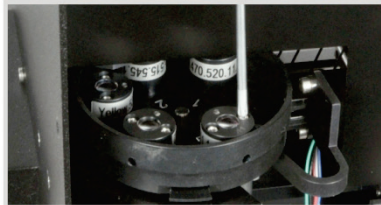
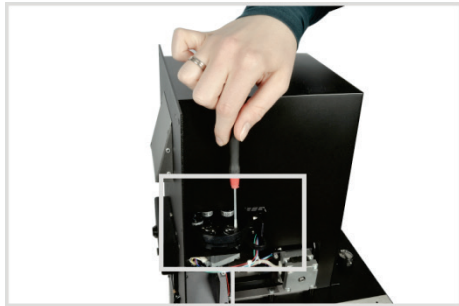
4. On the device backplate remove the four external screws at the upper part with which the hood is attached.



5. Pull the hood slightly forward and lift it off the device. Leave the hood in a secure place.



- ✓ The pivotable holder for the color modules is now accessible.



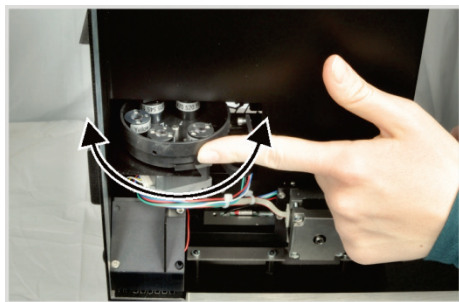
6. Note the code on the color module and the position in which the color module is to be installed.
7. Place the color module onto the free position with the pin pointing down. The silver pin points to the motor axis and must engage in the centering hole next to the large hole for the pin of the color module.

Note: The correct position of the color module is found quicker if you rotate the color module slightly around its own axis during insertion. Press the color module down until it rests flat on the rotor.

8. Screw on the color module with the M2 screws supplied.
9. Repeat this procedure for all color modules.
10. Close the remaining openings of the rotor with the color module dummy elements supplied.

Note:

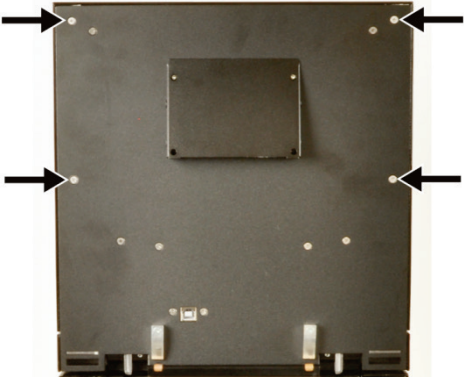

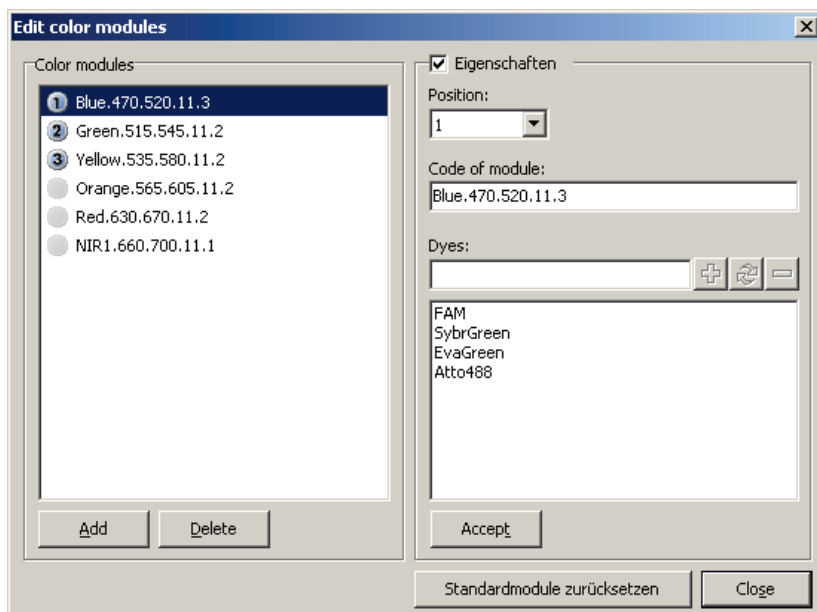
The dummy elements seal the openings light-proof. If you want to install additional color modules at a later time, unscrew a dummy element from the rotor and install the color module in its place.



11. Rotate the wheel with the installed color modules and check whether the color modules grind against the upper lid. If this is the case, loosen the screw connection of the color module, check its position and retighten the screws.

i NOTICE

Do not attempt to force a jammed color module into the correct position simply by tightening it further. The sensitive optics may be damaged.

	<p>12. Place the hood back onto the device.</p> <p>13. First tighten the four external screws at the upper part on the backplate of the qTOWER³.</p>
	<p>14. Open the lid and remove the four external screws on the inside of the lid.</p> <p>15. Close the lid again.</p>
<p>16. Switch on the qTOWER³ Start the qPCRsoft program.</p> <p>17. Select the command EXTRAS ► EDIT COLOR MODULES from the menu.</p> <p>The window with the same name opens.</p> <p>The available color modules are listed on the left-hand side of the window.</p> <div data-bbox="408 1182 1228 1792">  </div> <p>18. From the list, select the module installed in the device.</p> <p>Activate the PROPERTIES checkbox and select the position in which the module is installed in the device. If necessary, add dye names, if these have not yet been included in the list. Click on [ACCEPT].</p> <p>19. Follow the above instructions for every installed color module.</p>	

20. Use [CLOSE] to close the window.

✓ **The inserted color modules are ready for measurements.**

Define a new color module as follows:

- ☐ Click [Add] on the left of the window.

A new color module with the name COLOR.000.000.00.0 is created.

- ☐ Enter the name, position and properties of the color module on the right-hand side of the menu window.

Remove a color module as follows:

- ☐ Select the color module from the COLOR MODULES list. Click on [DELETE].

The properties of a color module can be changed as follows:

1. Activate the PROPERTIES checkbox.
2. In the POSITION list, select the position of the color module on the carrier in the fluorescence measuring head.
3. Enter the code of the color module into the CODE OF MODULE field.
4. Enter the dye to be detected with the color module into the DYES field. Click on [+].
The dye is added to the list.
To remove a dye, select it in the list and click on [-].
5. Click [ACCEPT] to assign the properties to the marked color module.

9 Troubleshooting

The following chapter describes possible errors of the qTOWER³. There are some error correction measures that can be performed by the customer. These are listed in the following chapter. All maintenance work and repairs beyond this scope must only be performed by Analytik Jena AG customer service personnel or by persons authorized by Analytik Jena AG. Any unauthorized interference limits warranty entitlements.

To prevent secondary damage, inform the Analytik Jena AG customer service immediately if the device exhibits any errors or defects.

If an error occurs, the qPCRsoft program outputs error codes that can be allocated to the following malfunctions:

Error code	Cause
$x \leq -100$	Device error in the optical unit of the fluorescence photometer
$-99 \leq x \leq -10$	Error in the qPCRsoft program (e.g. in the settings) or data communication error
$-9 \leq x \leq -2$	General device error, e.g. lid open
-1	No error
$x \geq 0$	Device error in the PCR thermocycler

The following errors can be fixed by the customer:

Error code	Cause	Remedy
–	Device cannot be activated	Check voltage supply Exchanging fuses Replace mains cable
–	Sample cups are damaged during measurements.	Check suitability of sample cups for use Insert samples properly (see section 7.3 p. 30)
$x = -8$	Lid not closed	Check that the sample are inserted correctly Close the lid, make sure it clicks into place
$x = -80$	USB not available	Replace USB cable Switch to a different USB port on the PC
$-99 \leq x \leq -10$	qPCRsoft or data communication error	Check configuration in the software

If the error still persists after performing these measures, please inform Analytik Jena AG.

10 Transport and storage

10.1 Transport



NOTICE

Use suitable packaging material and transport locks!

Unsuitable packaging material may cause damage to the device! Only transport the qTOWER³ in its original packaging and with the transport lock in place! Information on proper packaging is included with the device.

Observe the safety instructions in the section "Safety instructions, transport and installation" p. 10. Transport the qTOWER³ and its components very carefully to prevent damage from impact or vibration. The device should be transported in such a way that major temperature fluctuations are avoided and the formation of condensate is thus prevented.

10.2 Placing the transport lock

Before packing the qTOWER³, the transport lock for the upper part that contains the fluorescence photometer must be installed. If the transport lock is no longer available, you can place an empty PCR plate in the sample block. The qTOWER³ must be connected with the PC and the qPCRsoft program must be started for the installation process. The installation is software-controlled:

- ☐ Start qPCRsoft and select EXTRAS ► TRANSPORT LOCK from the menu. Follow the instructions on the monitor screen.



Fig. 12 Transport lock in the qTOWER³

10.3 Return



WARNING

Risk of damage to health due to improper decontamination!

Before returning the device to Analytik Jena AG perform a professional decontamination.



NOTICE

Analytik Jena AG must refuse acceptance of contaminated devices. The sender may be liable for any damage caused by inadequate decontamination of the device.

- ☐ Please clean all device components from biologically hazardous, chemical and radioactive contamination (see "Disinfecting the device" p. 33).
- ☐ The decontamination protocol is provided by the service when the return is registered. Complete the form and attach the signed decontamination declaration to the outside of the shipment.
- ☐ Only use the original packaging for the shipment and insert the transport lock. If the original packaging is no longer available, please contact Analytik Jena AG or your local distributor.
- ☐ Please attach the warning note "CAUTION! SENSITIVE ELECTRONIC DEVICE!" to the packaging.
- ☐ Please include a sheet containing the following data:
 - Name and address of the sender
 - Name and telephone number of a contact for inquiries
 - A detailed description of the fault, the precise conditions and situations under which the fault occurs.

10.4 Moving the qTOWER³ in the laboratory



CAUTION!

Risk of injury if the device falls!

Move the qTOWER³ with great care. 2 persons are required to lift and carry the device. They should position themselves on both sides of the equipment.

Since the device does not have handles, grip the device firmly with both hands at the lower end, lifting it simultaneously.

Observe the following when moving the device within the laboratory:

- ☐ Disconnect the mains connection and the PC from the device.
- ☐ Observe the guide values and adhere to the legally mandated limits for lifting and carrying without auxiliary means!

- ❑ For the setup at the new location observe the notes in section "Installation conditions" p. 19.

10.5 Storage



NOTICE

Possible device damage due to environmental conditions and condensation water.

The device must only be stored in air-conditioned rooms. The atmosphere must be low in dust and free from aggressive vapors.

If the device is not installed immediately after delivery or not required for prolonged periods, it should be stored in its original packaging. A suitable desiccant should be added to the equipment to prevent damage from moisture.

The following requirements are placed on the climatic conditions in the storage room of the qTOWER³:

- ❑ Temperature range: +5 °C to +55 °C
- ❑ Max. humidity: 10 % to 30 %

11 Disposal

The operator of the qTOWER³ must dispose the waste materials that occur during measurements (sample materials) in accordance with the statutory and local regulations.

At the end of its service life, the qTOWER³ and all its electronic components must be disposed of as electronic waste in accordance with valid regulations.

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