

Operating manual

qTOWER³ auto / qTOWER³ 84 auto

Real-time PCR thermal cycler



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1 Basic information

1.1 Notes on this operating manual

Contents	<p>These operating instructions describe the following thermal cycler models:</p> <ul style="list-style-type: none"> ▪ qTOWER³ auto ▪ qTOWER³ 84 auto <p>Note: In the text below, these devices are collectively called qTOWER³ auto. If differences between the models exist, they are explained in the corresponding sections.</p> <p>The automated real-time PCR thermal cyclers are only intended for use by qualified specialist personnel observing these operating instructions. In addition, these instructions include the description of the qTOWER³ auto power module, which supplies the thermal cycler with power.</p> <p>The operating manual contains information about the design and function of the device and provides operating personnel familiar with PCR technology with the necessary know-how for the safe handling of the equipment. The operating manual further contains notes on the maintenance and servicing of the device, as well as potential causes and remedies of any faults.</p>
Conventions	<p>Instructions in chronological sequence are numbered, grouped into blocks of instructions and the expected result is indicated.</p> <p>Safety instructions are indicated by pictographs and signal words. The type, source and consequences of the danger are stated together with notes on preventing the danger. The meaning of the pictograms and signal words used is explained in section 2 "Safety and warning instructions".</p>
Symbols and signal words used	<p>The operating manual uses the following symbols and signal words to indicate hazards or instructions. Safety instructions are always placed before an action.</p>
	<hr/> <p>WARNING</p> <p>Indicates a potentially hazardous situation which, if not prevented, can result in death or most serious injuries (incapacitation).</p> <hr/>
	<hr/> <p>CAUTION</p> <p>Indicates a potentially hazardous situation which, if not prevented, can result in light or minor injuries and material damage.</p> <hr/>
	<hr/> <p>ATTENTION</p> <p>Indicates a potentially hazardous situation which, if not avoided, can result in damage to the product or items in its vicinity.</p> <hr/>

1.2 Purpose

The qTOWER³ auto is a thermal cycler developed for real-time PCR experiments which amplify DNA by way of the polymerase chain reaction (PCR), while using fluorescence spectroscopy for the highly sensitive detection of target sequences. The signal from the fluorescent dyes excited by a light source correlates, in terms of quantity, with the PCR product and may be shown in real-time.

Thanks to a modular design that has been specially adapted to meet the requirements of automation technology, the device can be used for all relevant real-time PCR applications, for example for the detection of pathogens, gene expression analysis, SNP genotyping or mutation detection, as well as for experimental studies with increased sample throughput.

Optimized for the area of gene expression and genotyping, the real-time PCR cycler allows for multiplex analyses depending on the fluorescence properties of the dyes and sensors, as well as the available filter modules – proof of several target sequences in a single PCR reaction. Analytik Jena offers a number of color or FRET modules here, up to six of which can be installed simultaneously in the device.

In addition to the optical components for the detection of real-time signals, the amplification of the target sequences plays a central role. With Peltier technology and the use of high-quality block materials, the qTOWER³ auto boasts a superb thermal homogeneity, maximum speed and accuracy.

The qTOWER³ auto is fully controlled from the PC using the qPCRsoft auto application software. The control software is simple and intuitive, and guides the user on a step-by-step basis through the programming, data acquisition and analysis menu items. Furthermore, the software offers a wide spectrum of free analysis tools which allow for the quick and reliable evaluation of comprehensive analyses:

- Absolute and relative quantification
- $\Delta\Delta C_t$ – Analyses with/without PCR efficiency
- DNA melting curves
- SNP genotyping
- End point analyses

Further information on the various qPCRsoft auto software functions can be found in the software user 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

**ATTENTION**

The device is intended for **general laboratory use**. The license is limited to applications outside of vitro diagnostics (research use only).

The device may only be used for the applications described in these operating instructions.

The manufacturer does not accept liability for any other use.

1.3 Warranty and liability

The warranty duration and liability comply with the legal requirements and the provisions in the general terms and conditions of Analytik Jena.

Deviations from the intended use described in this operating manual result in limitations of warranty and liability during a damage event. Warranty and liability claims are excluded for personal injury and property damage due to one or several of the following causes:

- Improper use of the qTOWER³ auto.
- Improper commissioning, operation and maintenance of the device.
- Modifications of the equipment without prior consultation with Analytik Jena.
- Operation of the device with defective or faulty safety equipment.
- Use of parts other than the original spare parts, wearing parts, or consumables.
- Repairs that have not been carried out correctly.
- Improper transport and storage of the device.
- Errors due to the non-observance of this operating manual.

2 Safety and warning instructions

2.1 General notes






- For your own safety and to ensure error-free and safe operation, please read this section carefully before commissioning.
- Observe all safety instructions in these operating instructions.
- References to potential dangers do not replace the work protection regulations which must be observed.
- The device meets all EMC requirements for commercial and industrial use and for use in small businesses!

2.2 Safety markings

2.2.1 Safety symbols

Damaged or missing safety symbols can cause incorrect actions leading to personal injury or material damage. Do not remove safety symbols! Replace damaged safety symbols immediately!

The following safety symbols are attached to the front of the power supply unit or to the rear of the device:









Safety symbol	Meaning
	Risk of electric shock! Do not touch!
	General warning sign
	Warning about hot surface
	Disconnect the plug before opening the device
	Do NOT dispose of this device as municipal waste! To ensure optimum protection of the global environment and minimize pollution, valuable raw materials can be recovered. Please recycle this device. Alternatively, dispose of the electronic components as electronic waste in accordance with valid regulations.



The device contains substances subject to regulation (according to regulation SJ/T 11363-2011). Analytik Jena guarantees that the substances will not leak within the next 25 years and, therefore, will not cause any environmental danger or health risk within this period of time if the device is used as intended.

2.2.2 Symbols

The following symbols are used on the device and/or its packaging:

Symbol	Meaning
	CE marking
	Manufacturer and address
	Year of manufacture
	Order number
	Temperature limit
	Serial number
	Note Observe the operating manual!
	Caution In combination with the symbol above: Attention! Observe accompanying documents!

2.3 Requirements for the operating personnel

The qTOWER³ auto may only be operated by qualified specialist personnel instructed in the use of the device. The instruction also includes imparting the contents of this operating manual.

In addition to the work safety instructions in this operating 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 manual has to be accessible to the operating and maintenance personnel at all times! Operation or maintenance of the device by individuals under the influence of alcohol, drugs or medication is not permitted.
- It must be ensured that only authorized personnel work 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 installation 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. 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 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 has been contaminated with hazardous substances – suitable disinfectants and methods are described in the section “Disinfecting the device” on page 31.



ATTENTION

Disinfectants other than those specified may **only** be used following prior consultation with Analytik Jena.

2.4 Safety instructions - Transport and installation

The device may only be transported with the transport locks in place and in its original packaging. Always ensure that the device is empty and no sample vessels are in the sample block. Further information can be found in separate packing instructions.

The qTOWER³ auto can be installed by the Analytik Jena Customer Service or specialist personnel trained and authorized by Analytik Jena.

Observe the guide values and adhere to the legally mandated limits for lifting and carrying without auxiliary means!

- For safety reasons, 2 persons are required to transport the device.

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

2.5 Safety instructions: during operation

2.5.1 Summary of safety instructions

The operator of the qTOWER³ auto must make sure before each commissioning that the condition of the device including the safety equipment is sound. The technical condition must always comply with the legal requirements and regulations.

- Free access to the power switch on the back of the enclosure has to be ensured during operation.
- The ventilation fittings at the rear and the bottom of the device must be free and operational. Covered ventilation grilles or slots etc. may cause the device to break down or may cause damage to it.
- Risk of crushing when moving the drawer.
- The thermal block, the samples, and the heated lid reach high temperatures. There is a risk of burns during contact.
- Wear safety goggles during operation!
The rapid heating of the thermal block can cause liquids to evaporate explosively.
- Only use plates and tubes that are suitable for high temperatures (up to 110 °C)!
- Do not touch hot sample tubes or plates and do not open them or boiling liquid may escape!

2.5.2 Safety instructions – protection against explosion and fire

- Do not operate the qTOWER³ auto with flammable, explosive or volatile substances.
- Do not operate the qTOWER³ auto in a potentially explosive environment.
- The operating personnel must be familiar with the location of the fire-fighting equipment in the operating room of the device.

2.5.3 Safety instructions – electrical equipment

The qTOWER³ auto meets the requirements for interference emission and resistance defined in the corresponding standards series – for further information, see the “Standards and directives” section on page 42.

- Assess the electromagnetic environment before operating the device. Do not operate the device near sources of strong electromagnetic radiation (for example, an unshielded, deliberately operated high frequency source), as these may affect proper operation of the device.
- The device may only be connected to power sources whose nominal voltage is the same as that on the rating plate of the device.

- 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.
- The qTOWER³ auto must be switched off immediately using the power switch (on the equipment backplate) and the power supply disconnected from the mains if there is any interference with the electric components.
- Before opening, the device must be isolated from all circuits!
- Work on the electrical components of the qTOWER³ auto may only be performed by Analytik Jena Customer Service employees and specially authorized technicians according to the valid electrotechnical regulations. Life-threatening voltages may be applied within the device! There is a risk of electric shock if contact is made with live components, which may lead to serious injury or death.
- Make sure the correct fuses are used and replace these if necessary. To do this, separate the device from the mains supply.
- The device may only be used with the power cable supplied or a power cable with the same specification. The use of other power cables is not permitted.
- Wipe spilled samples or reagents immediately with an absorbent cloth or piece of paper. Do not allow any liquid to enter the device.
- Do not use the power supply unit in environments with extreme humidity (> 95%) or in locations in which condensation may occur.

2.5.4 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 hazardous substances. For details contact the safety officer responsible for your location.

- When handling hazardous 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.
- Protective goggles and rubber gloves have to be worn when handling reagents.
- For your own safety, please observe the potential infectious qualities of the examined biological material.
- Observe all notices on the cleaning and decontamination of the device. The use of other cleaning or decontamination procedures is only permitted following prior consultation with Analytik Jena.
- When using operating materials, always observe the appropriate regulations and the notes in the EC safety data sheets of the manufacturer with regard to their storage, use and disposal.
- Never place auxiliary and operating materials 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!

- Auxiliary and operating materials as well as their containers may not be disposed of as domestic waste or enter the sewage system or the soil. The applicable regulations for disposal of these materials must be observed.
- Ensure good room ventilation in working rooms.

2.6 Behavior during emergencies

- In case of danger or accidents, immediately switch off the qTOWER³ auto at the main switch.
- 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 personnel must be familiar with the locations of safety equipment, accident and danger alarms as well as first-aid and rescue equipment as well as its use.
- The operator is responsible for the respective training of the operating personnel.
- 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.

2.7 Safety instructions – maintenance and repair

On principle, maintenance of the qTOWER³ auto is performed by the customer service department of Analytik Jena or by specialist personnel that has been authorized and trained by Analytik Jena. Unauthorized maintenance can damage the device.

Therefore, the operator may generally only carry out the tasks listed in section "Maintenance and repair" p. 29.

3 Layout and function

3.1 Layout

The qTOWER³ auto boasts a modular design concept, comprising a block cycler unit with fluorescence spectrometer and a power module unit (controller). Depending on the block system used, 96 or 384 samples may be processed per run. The qTOWER³ auto is suitable for use in a robotic system, whereby up to 4 devices can be controlled simultaneously using a PC. A CyBio Composer or .dll can be used to integrate the devices.

The movable drawer provides maximum flexibility for system integrators. With easy access to the extended drawer, the sample carrier (microtiter plate) can be easily positioned on the drawer without any problems.

The patented high-performance optics, comprising a fiber-optic shuttle system and unique light source, guarantee a superb homogeneous excitation and illumination of all individual samples. The light source comprises 4 high-performance LEDs with a broad spectrum reaching deep into the red. In combination with specially optimized filter modules comprising one emission and one excitation filter, a broad spectrum of fluorophores can be specifically excited and detected. Depending on the application, up to 6 filter modules may be mounted in one device, whereby the simultaneous analysis of up to 6 target sequences may take place in a well.

A recalibration of the system after replacing the filter modules is not necessary here.



Fig. 1 Device components

- 1 qTOWER³ auto
- 2 qTOWER³ 84 auto
- 3 qTOWER³ auto power module

3.1.1 qTOWER³ auto

The qTOWER³ auto combines a PCR thermal cycler with a patented fluorescence photometer. The status LED on the front of the qTOWER³ auto informs the user about the current status of the device (active/inactive). Furthermore, the device has a movable drawer which can be moved in and out, depending on the operating state of the device.

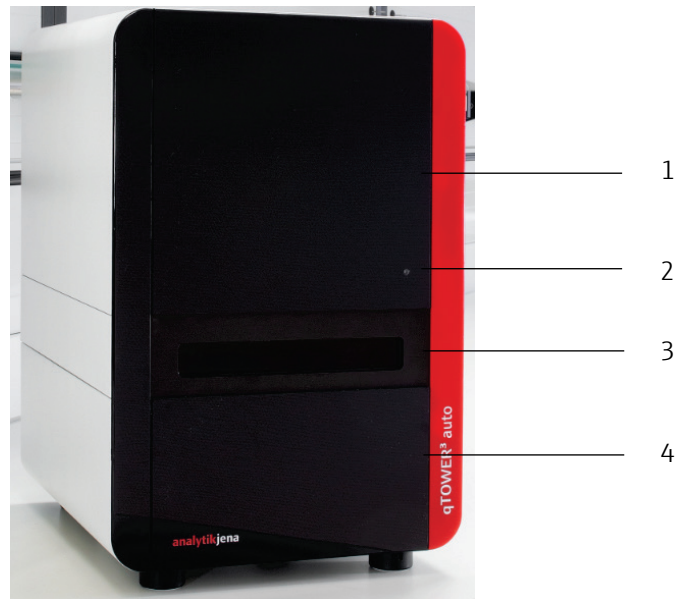


Fig. 2 qTOWER³ auto (front view)

- 1 Upper part with fluorescence photometer
- 2 Status LED (indicates whether the device is switched on or off)
- 3 Drawer
- 4 Block cycler unit

The drawer serves to hold the sample carrier (micro titer plate). Once a sample carrier has been positioned on the drawer and moved into the device, this is positioned above the thermal block and the front flap closes and locks automatically.



ATTENTION

Never attempt to pull the drawer out or push it in manually.

All movements of the drawer (moving in/out) are exclusively controlled by the software commands in the qPCRsoft auto program or using an external communication software.

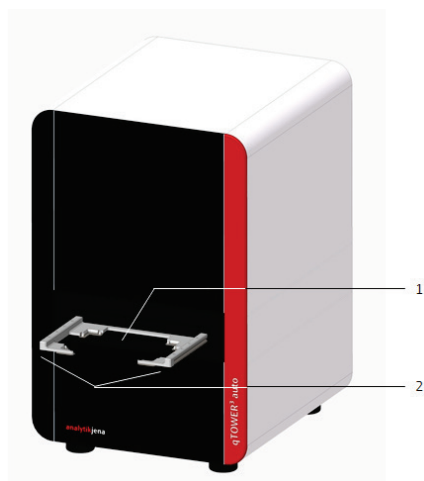


Fig. 3 qTOWER³ auto with extended drawer

- 1 Drawer
- 2 Guide tracks of the drawer

The connections described in Fig. 4 are attached to the rear side of the qTOWER³ auto, beside the fans.

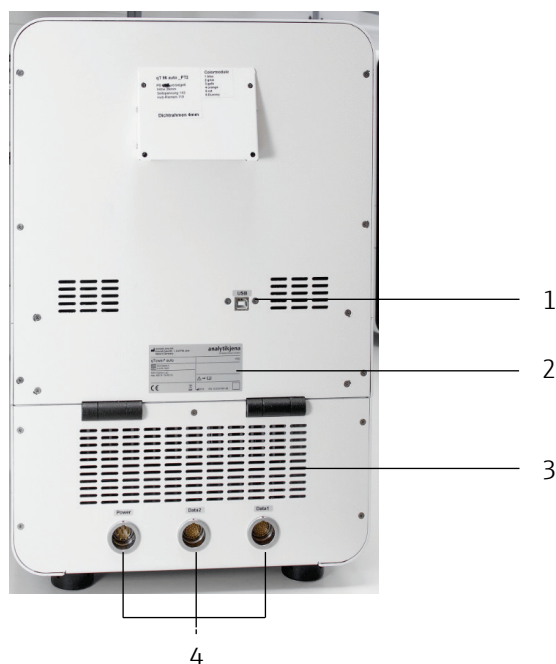


Fig. 4 qTOWER³ auto (rear view)

- 1 USB port for PC connection
- 2 Type plate
- 3 Fan grating
- 4 Electrical connections
 - Data 1 connection (lid heating – communication lines)
 - Data 2 connection (connection of thermal block sensors)
 - Power line connection (power)

3.1.2 qTOWER³ auto power module

The qTOWER³ auto power module is used to provide the automated real-time PCR qTOWER³ auto thermal cycler with power. The external solution allows for flexibility with regards to installation or integration in automation systems.

The operating status (on/off) is indicated by the status LED on the front of the device. The connections for Data 1, Data 2 and Power are also located here.



Fig. 5 Power module (front view)

- 1 Status LED (indicates whether the device is switched on or off)
- 2 Power connection
- 3 Data 1 connection (lid heating – communication lines)
- 4 Data 2 connection (for connecting the sensors of the thermal block)

A mains connection socket, the fuse compartment and the power switch are located at the back of the qTOWER³ auto, in addition to the service connection.

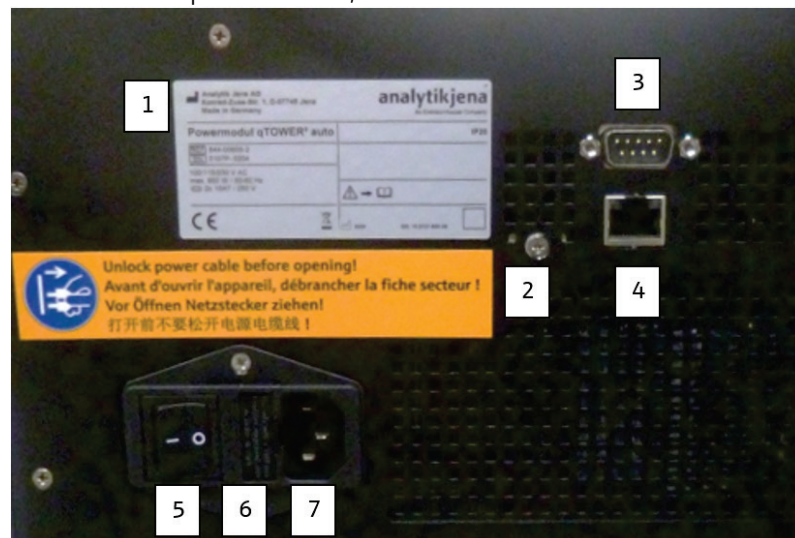


Fig. 6 Power module (rear view)

- 1 Type plate
- 2 Warning note
- 3 Service connection
- 4 Ethernet port
- 5 On/Off switch
- 6 Fuse compartment
- 7 Mains connection socket

3.2 Function

3.2.1 Fluorescence spectrometer

qTOWER³ auto

The detector unit is a patented **8-channel** epi-fluorescence photometer with fiber multiplexer and mechanical scanning device.

qTOWER³ 84 auto

The detector unit is a patented **16-channel** epi-fluorescence photometer with fiber multiplexer and mechanical scanning device.

The fluorescence spectrometer comprises the following components – see the following schematic representation:

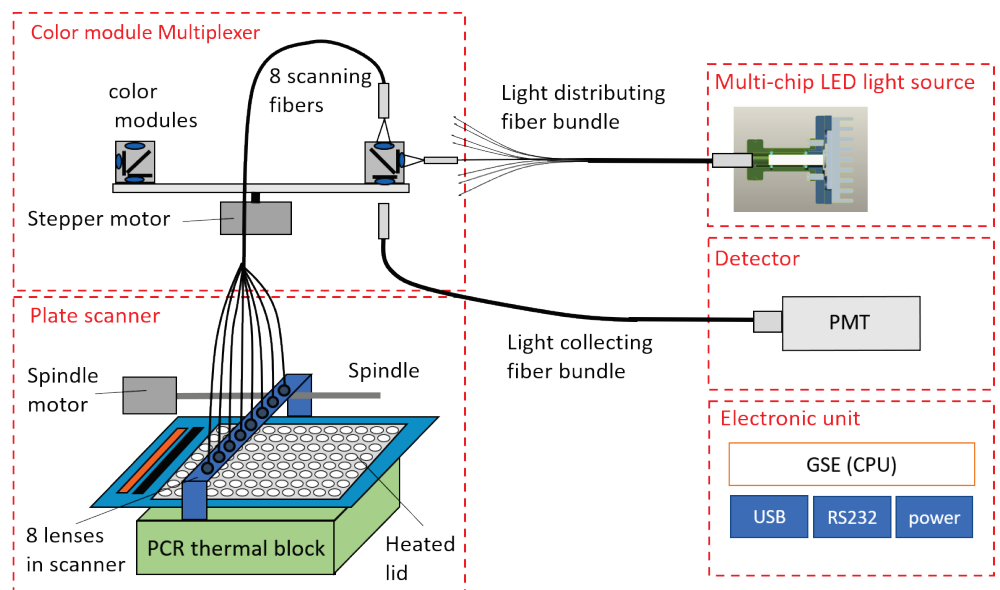


Fig. 7 Schematic representation: fluorescence spectrometer

Light source

A long-life, sturdy four-color LED (blue, green, white and red) in the qTOWER³ auto is used as an excitation light source for the emission of fluorescent dyes. The LEDs allow for a sensitive excitation of various dyes across a very broad wavelength spectrum that goes deep into red, whereby the light source does not require any warm-up period (Fig. 7).

Multiplexer

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 optical fibers to a lens array in a shuttle system scanning the sample block in columns (Fig. 7: Multiplexer).

Measuring head

The fluorescent dyes are specifically excited in the reaction mix thanks to the light and emit light of a longer wavelength. Using the lenses in the shuttle system, the emitted light is bundled and passed back to the color modules via the optical fibers (Fig. 7: Measuring head).

Photomultiplier (PMT)

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.

Starting from the light source, the light beam course is represented in the following diagram by the blue and green arrows.

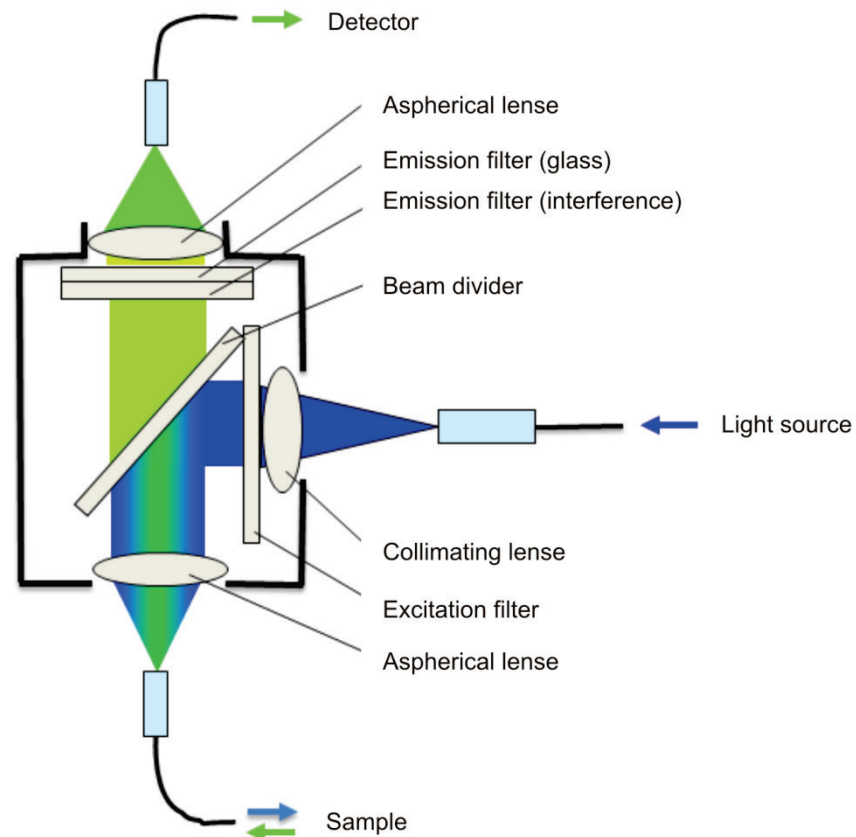


Fig. 8 Schematic representation: light beam course through filter color module

The filter wheel of the photometer can be populated freely with a choice of filter modules. In addition, filter modules can be retrofitted at any time, extending the application spectrum of the device. The product portfolio from Analytik Jena comprises a total of 12 different filter modules (6 color modules for the most frequently used fluorescent dyes, from the blue to the red excitation range; 5 filter modules specially optimized for FRET applications and 1 protein module for melting curve analysis). A retrofitting or replacement of the installed modules may be carried out by the Analytik Jena Service team at any time.



ATTENTION

If you intend to extend the application spectrum of the device with regard to using filter modules, always contact the service department because extensions – to be performed by the operator himself – are **not** intended by the manufacturer.

3.2.2 PCR thermal cycler

The real-time PCR qTOWER³ auto thermal cycler is available in 2 different block formats, which are characterized by the following features:

qTOWER³ auto

The qTOWER³ auto is equipped with a thermal block with **96** wells. To ensure the best possible performance and thermal conductivity, the thermal block is made of **gold-plated silver**.

Due to its excellent heat conductivity, silver equilibrates extremely quickly, thus providing maximum speed and temperature uniformity. Heating rates of up to 8 °C/s and cooling rates of up to 5.5 °C/s are thus possible.

To protect the valuable silver blocks against corrosion, the block surfaces are gold-plated.

qTOWER³ 84 auto

The qTOWER³ 84 auto is equipped with a thermal block with **384** wells, made from an **aluminum** with excellent heat conducting properties.

This achieves a high temperature homogeneity and uniformity in combination with heating rates of up to 4 °C/s and cooling rates of up to 2 °C/s.

All blocks are perfectly sealed to prevent condensed water from penetrating the Peltier elements underneath the sample block and other parts of the electronics. The sealing protects the Peltier elements and prolongs the lifetime of the device.

3.2.3 Lid heating

The qTOWER³ auto comes equipped with an automated heated lid. This can be adjusted to temperatures of up to 110 °C and prevents condensation forming in the area of the reaction tubes above the block surface level. Furthermore, the heated lid guarantees – regardless of the consumables used – a reliable contact between the reaction tubes and the thermal block during the entire real-time PCR run thanks to a constant contact pressure. This significantly improves temperature uniformity.

As the heated lid is mounted inside the device, there is no risk of injury from hot surfaces.

3.2.4 Plastic



ATTENTION

The qTOWER³ auto is only intended for use with micro titer plates made of special plastic materials that are verified for automation processes.

Micro titer plates that have been specifically verified for automated PCR and qPCR applications have gripper positions and are full-skirted. Furthermore, they should also be stackable.

For real-time PCR applications, it is important that the sample carriers are sealed with optical foil before the PCR run. Regardless of the sealing method used, thanks to the lid technology, the same pressure is always applied to the consumables for absolutely reproducible conditions.

3.3 Type plate

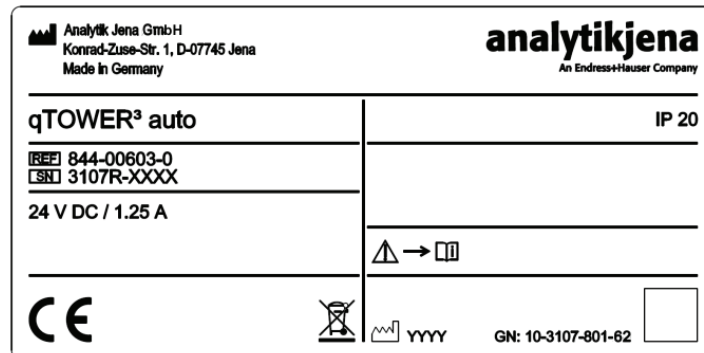


Fig. 9 qTOWER³ auto type plate

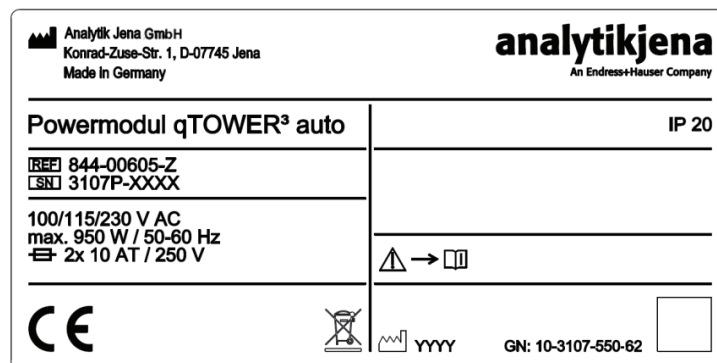


Fig. 10 qTOWER³ auto power module type plate

The type plate is located on the rear of the respective device unit and includes the following information:

- Manufacturer, address (incl. logo)
- Device designation (trade name)
- Information for device identification, such as serial number etc.
- Technical data (incl. electrical connection data)
- Safety symbols, such as CE marking etc.
- Disposal instructions (Do not dispose of as domestic waste!)

4 Installation and commissioning

Environmental conditions	The specific requirements regarding the ambient conditions of the installation site and the space requirements for the real-time PCR thermal cycler, as well as for the power module, can be found in "Technical data" on page 39 ff.
Requirements with regard to the installation location	<p>Consideration must be given to the following when installing the qTOWER³ auto:</p> <ul style="list-style-type: none">▪ Place the real-time PCR thermal cycler and the power module on a dry and sturdy surface. The surface must be heat-resistant and acid-proof.▪ The device should not be installed in the immediate vicinity of sources of electromagnetic interference.▪ Keep the device out of direct sunlight.▪ Protect the device against wet and damp conditions, as well as condensation.▪ Place the device at a minimum distance of 15 cm between the rear of the device and the wall or other objects. A minimum distance of 10 cm should be maintained on both sides. Ensure that the ventilation slits are clear. Insufficient ventilation may cause the device to overheat.▪ Take into consideration the space required for the control PC (also monitor and printer, where applicable)

4.1 Power supply



WARNING

Observe the mains connection!

Only connect the qTOWER³ auto to a properly grounded power outlet in accordance with the voltage specifications on the type plate.

The qTOWER³ auto is operated with single-phase alternating current.

Prior to commissioning, please make sure that the operating voltage is the same as the mains voltage.

The device may only be used with the power cable supplied or a power cable with the same specification. The use of other power cables is not permitted.

4.2 Unpacking and inspection

The qTOWER³ auto incl. power module will be carefully packed upon delivery. Please carefully check the device and the packaging material for any mechanical damage that may have occurred during transport and delivery. If transport damage is detected, document its type, amount and size! Do not attempt to operate the device if there is any visible damage.



ATTENTION

Severe damage to the cardboard box and/or the packaging material may indicate that damage has occurred to the real-time thermal cyclers or the power module and must be immediately reported to Analytik Jena.

1. Unpack the device by removing all protective film, fastenings, such as adhesive tape, etc.
2. Check the delivery for completeness (and ensure that it matches your order).

Standard scope of delivery:

Components	Amount
qTOWER ³ auto	1
Power module	1
Power cable	1
USB connection cable	1
Data cable (for data 1 and data 2 connections)	2
Power cable	1
qTOWER auto operating manual (EN)	1
Software CD	1
Ethernet cable	1

If the delivery is incomplete or the device is damaged, please immediately contact Analytik Jena or the dealer responsible.

Keep the original packaging for a possible return. If you have a complaint, the device must be returned in its original packaging. Transport damage caused by poor packaging is excluded from the warranty. For further information, see section "Device return information", p. 36.

4.3 Installing and connecting the device



WARNING

Risk of electric shock! Do not touch!

NEVER connect or separate the power cable from the power connector when the green status LED is lighting on the power module and the qTOWER³ auto. Pay attention to the warning notes in the section "Safety instructions: during operation" on page 11.

Place the qTOWER³ auto and the power module on a sturdy, even surface in a secure, dry place.

Leave the device switched off to allow it to acclimatize adequately (> 2 hours).

1. Make sure the power switch at the back of the power module is OFF before connecting the power cable to a grounded power outlet (100 V to 230 V). Take note of the voltage rating on the type plate beside the power cable on the back of the power module.

Note: Make sure that the power switch and the power cable are easily accessible. This is important in the event that the device needs to be separated from the supply voltage.

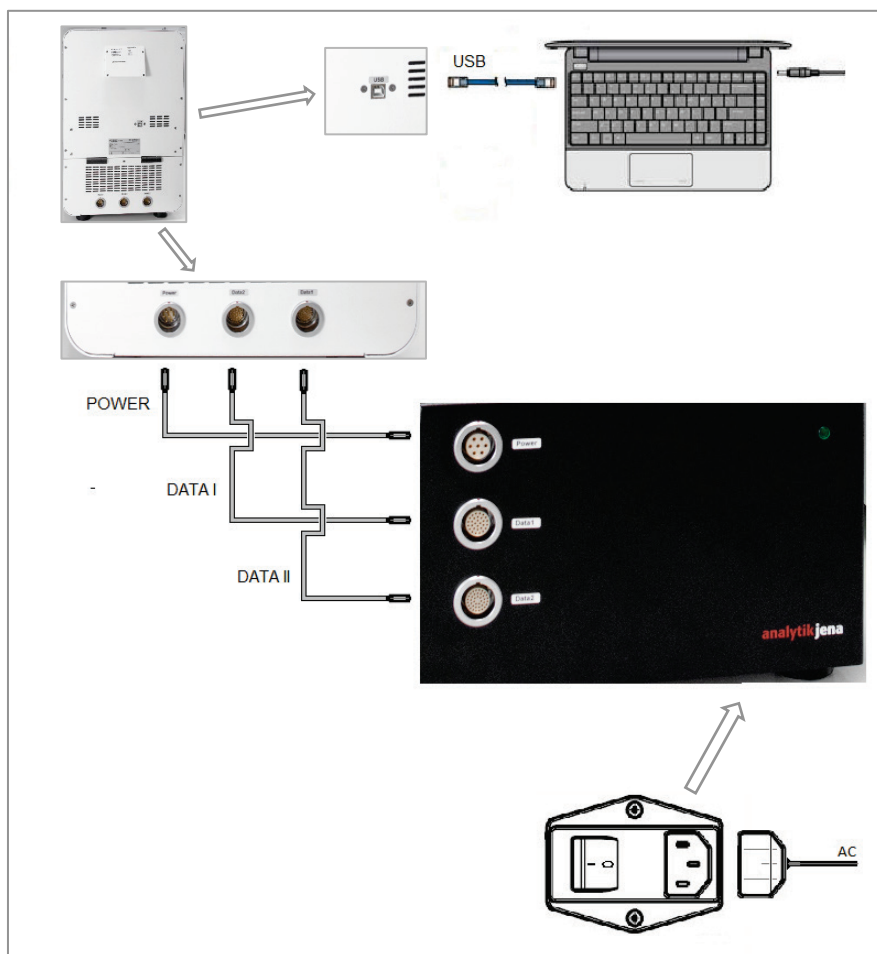


Fig. 11 Connecting the qTOWER³ auto

2. Connect the PC and the qTOWER³ auto using the USB cable included in the scope of delivery.

Alternatively, the qTOWER auto can be controlled via Ethernet. Establish the LAN connection to the power module for this purpose.



Fig. 12 Connections at rear

3. Connect the power cable and the two data connection cables both at the qTOWER³ auto and the power module (Fig. 11). The connection cables (circular connectors) are fitted with a push-pull locking mechanism for this purpose, i.e. the connector automatically locks into place; before removing it, first slide back the outer sleeve.



ATTENTION

Remove the transport lock during commissioning.

4. Switch on the qTOWER³ auto power module (see "Switching on the qTOWER³ auto" page 27).

5 Operation

5.1 Switching on the qTOWER³ auto

1. Switch the qTOWER³ auto on using the power module power switch. The status LED at the power module lights up green and the qTOWER auto starts with the automatic initialization, whereby the control electronics and all motorized components are checked.

Note: During initialization, the status LED at the front of the qTOWER³ auto flashes green.

2. After initialization the status LED is lit green. The device is operational.
3. Then start the qPCRsoft auto application software on your control PC. The device is automatically recognized by the control software and the connection to the device is shown in the status bar.

Note: If you already started the qPCRsoft auto application software before switching on the device, for example to prepare a real-time PCR project first, the software normally detects the qTOWER³ auto automatically.

4. If not, device identification with the qTOWER³ auto will need to be manually initiated. To do this, click on EXTRAS in the menu bar and activate the item DEVICE IDENTIFICATION.
5. A line of communication is created between the control software and the device.

Status LED

There is a status LED on the front of the qTOWER³ auto which gives information about the current operating status of the device:

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

5.2 Switching off the qTOWER³ auto



ATTENTION

The qTOWER³ auto may **not** be switched off during the PCR run!

Once the PCR run is finished, the qPCRsoft auto application software can be stopped and the device switched off by actuating the power switch.

5.3 Real-time PCR analysis

5.3.1 Safety instructions



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 evaporate explosively. Always wear safety goggles during operation.



WARNING

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

5.3.2 Preparing samples

1. After pipetting the PCR samples into the wells these must be sealed with a transparent optical adhesive foil (sealing foil).

Note: The optical transparency of the foils affects the fluorescence signal directly. Therefore, only use clear adhesive foil as offered for real-time PCR.

2. 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 auto manual).
 3. Move out the drawer and place the sample carrier on it. Make sure that Well A1 is on the left-hand side.
-



ATTENTION

Never attempt to pull the drawer out or push it in manually. This may damage the device.

4. Start the PCR run. The drawer with the sample carrier is automatically inserted into the qTOWER³ auto and the PCR program is processed step-by-step.

6 Maintenance and repair

The maintenance and repair work that may be carried out by the customer is restricted to the work described in this manual.



WARNING

Risk of electric shock! Do not touch!

Prior to commencing any maintenance or cleaning work, switch off the device and unplug the power plug.

We recommend regularly performing the following maintenance and repair work at the specified intervals, taking the following information into account:

Maintenance and repair work	Monthly	Every six months
Check the drawer of the qTOWER ³ auto (see page 30)	X	
Check electrical components and cables, test the grounding conductor (qualified electricians only!)		X

All maintenance and repair work beyond this scope may only be performed by Analytik Jena Service personnel or authorized and trained persons. Any unauthorized intervention limits warranty entitlements. If the device exhibits any faults or defects, please contact the Analytik Jena Customer Service immediately.

- Contamination and natural wear of assemblies lead to higher stress on the device and thus to a higher probability of device failure.
- All motor- or manually operated parts in the qTOWER³ auto are subject to natural wear. Pay attention to signs of wear on mechanically stressed assemblies and have them replaced if necessary.

6.1 Cleaning the housing



WARNING

Danger of short circuit!

Prior to commencing any maintenance or cleaning work, switch off the qTOWER³ auto power module and pull the power plug. Do not use any dripping wet cloths for cleaning. No liquids are allowed to ingress the device interior.

The power module and the automated real-time qTOWER³ auto thermal cyclers may only be operated again after cleaning once they are completely dry.



ATTENTION

The use of concentrated alcohol, organic solvents or abrasives for cleaning can damage the device housing.

If the devices become contaminated during daily use, cleaning with a damp cloth is sufficient.

Only wipe the device housing with a soft, clean cloth which may be wetted with a commercially available neutral cleaning agent, if necessary.

6.2 Checking the drawer

The guide tracks in the drawer of the qTOWER³ auto must be regularly checked for dents, burrs or deformations. If the device exhibits any defects, please contact Analytik Jena Customer Service immediately.

6.3 Disinfecting the device



WARNING

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



ATTENTION

The housing and the drawer of the real-time PCR housing is only suitable for wipe disinfection.

If using spray disinfectants there is a risk that the liquid may enter the sensitive electronic system through the ventilation slots. If the disinfectant has a spray nozzle, apply disinfectant to a suitable cloth before using it on the device.

- Avoid contamination by handling samples carefully.
- Wipe spilled samples or reagents immediately with an absorbent cloth or piece of paper.
- If the qTOWER³ auto is used for analyzing infectious material, great care must be taken because the qTOWER³ auto cannot be decontaminated as a complete device. Only the housing and the drawer of the device may be disinfected.
- Immediately remove visible contamination by suitable means. Do not allow solvents to enter the device.
- Recommended disinfectant (for the housing):
Incidin Pro – Supplier: Ecolab Deutschland GmbH
- Pay attention to the efficacy spectrum of the listed disinfectants with regard to your customer-specific decontamination requirements!
- 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.
- Disinfectants other than those specified may **only** be used following prior consultation with Analytik Jena.
- If the qTOWER³ auto and/or the qTOWER³ power module has to be sent to Analytik Jena for service, a prior decontamination must be carried out and documented.

6.4 Replacing the fuse



WARNING

Risk of electric shock! Do not touch!

Only replace the fuse if the device has been disconnected from the grid and the power cable has been unplugged!

1. Switch off the device at the mains switch and unplug the power cable.
2. Open the fuse compartment by inserting a small, flat screwdriver into the slot.
3. Turn the screwdriver carefully to open the fuse compartment.

Note: When a power cable is plugged into the power connector, opening the fuse compartment is not possible.

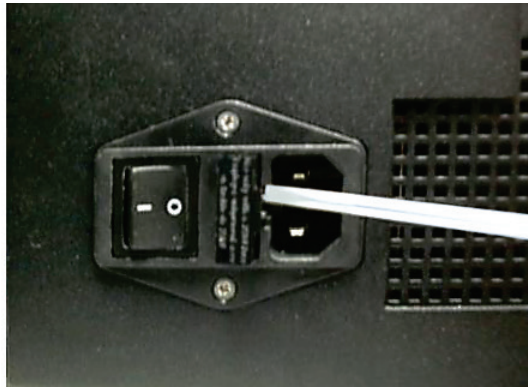


Fig. 13 Fuse compartment at the back of the qTOWER³ auto power module

4. Pull the fuse holder out of the compartment and check the fuse. If the fuse has blown or the fuse element shows signs of damage, replace the fuse with an identical fuse type (2 x 10 AT/250 V).

Note: Only use the specified fuses. Using incorrect fuses increases the risk of fire. There is a risk of personal injury or damage to the device.

5. Reinsert the fuse holder into the compartment and close the cover.

7 Error messages

7.1 General

The following section describes possible errors of the qTOWER³ auto.



ATTENTION

If you cannot eliminate errors yourself, please contact customer service.

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

Error code	Description/Causes
$x \leq -100$	Device error in the optical unit of the fluorescence spectrometer
$-99 \leq x \leq -10$	<ul style="list-style-type: none"> ▪ Error in the qPCRsoft auto program (e.g., in the settings) ▪ Data communication error
$-9 \leq x \leq -2$	General device error
-1	Does not indicate an error condition
$x \geq 0$	PCR thermal cycler: device error

Note: The error code overview (incl. the examples) documents the status at the time of printing; more current information may be available – please contact the manufacturer/service for more information!

There are some error correction measures that can be performed by the customer. These are listed in the following chapter.

7.2 Information on errors or malfunctions

Error/malfunction	Possible cause(s)	Suggested solution
Power supply interrupted		Check all connecting cables incl. connectors Note: Power supply via the power module is ensured if the LED is permanently lit green.
Power failure	No device-specific causes; failure caused by lack of power supply	The device is restarted when power has been re-established.
Fuse failure		Replace the fuse – see page 32.
Repeated fuse failure	Permanent electronics error	Contact service.
Status LED is lit red	Indicates a device error	Check the error message in the software. Contact service.

Error messages

Sample carrier jammed	Position error	If the sample carrier is already in the device, contact service!
Drawer does not move	Mechanical or electrical failure	Contact service.
Drawer makes strange noises when moving		Contact service.

8 Transport and storage

8.1 Transport



ATTENTION

Only transport the qTOWER³ auto in its original packaging and with the transport lock in place! Unsuitable packaging material may cause damage to the device!

Observe the safety instructions in the "Safety instructions - Transport" section on page 10.

Transport the qTOWER³ auto 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.

8.1.1 Inserting the transport lock

The transport locks must be inserted before the qTOWER³ auto is packaged.

Further information can be found in separate packaging instructions.

8.1.2 Moving the qTOWER³ auto in the laboratory



CAUTION

Risk of injury if the device falls!

- 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 installation at the new location, observe the information in the "Safety instructions - Transport and installation" section on page 10.

8.1.3 Device return information



WARNING

Risk of damage to health due to improper decontamination!

Perform a professional decontamination before returning the device.



ATTENTION

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

Return authorization number (RAN)

- Please contact our service department to receive a return authorization number (RAN). This number has to be attached to the outside of the box in a clearly visible manner. Returns without RAN will not be accepted!
- Please clean all device parts, removing any biologically hazardous, chemical or radioactive contamination (see also the section "Disinfecting the device", page 31.)
- Download the decontamination declaration as an editable PDF document in German and English from the Internet, see:
- https://www.analytik-jena.com/fileadmin/content/service/customer/Declaration_of_decontamination_en_01.pdf
- 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 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

8.2 Storage



ATTENTION

The device must be stored in an air-conditioned room in order to prevent any damage to the device from environmental conditions and condensed water!

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 packaging to prevent damage from moisture.

Further information on the air-conditioned storage requirements for the qTOWER³ auto can be found in the section "Environmental conditions" on page 41 .

9 Disposal

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

At the end of their service life, the qTOWER³ auto and the qTOWER³ auto power module with their electronic components must be disposed of as electronic waste in accordance with valid regulations.

10 Specification

10.1 Technical data

10.1.1 qTOWER³ auto

General data	Designation/type	qTOWER ³ auto	qTOWER ³ 84 auto
	Dimensions (width x height x depth)	310 x 479 x 365 mm (drawer moved in) 310 x 479 x 477 mm (drawer moved out)	
	Traveling distance of the drawer	112 mm	
	Weight	approx. 27 kg	
	Position tolerance of the sample carrier when the drawer is moved out	± 0.15 mm	
Thermal block Technical characteristics	Sample carrier	Verified for automatable processes, full-skirted	
	Sample block	Silver (gold-plated)	Aluminum (special alloy)
	Sample capacity	96	384
	Sample volume	10 – 100 µl	2 – 30 µl (5 – 20 µl recommended)
	Heating	max. 8 °C/s	max. 4 °C/s
	Cooling	max. 5.5 °C/s	max. 2 °C/s
	Temperature setting range	4 °C – 99 °C	
	Temperature uniformity	55 °C ± 0.15 °C after 15 s	
	Temperature control accuracy	± 0.1 °C	
	Heating rate adjustment	min. 0.1 °C/s	
	Temperature uniformity (after 15 seconds)	± 0.15 °C at 55 °C ± 0.25 °C at 72 °C ± 0.50 °C at 95 °C	
	Temperature increments	min. 0.1 °C/cycle	
	Time increments	min. 1 s/cycle	
Heated lid Technical characteristics	Lid temperature range	30 °C – 110 °C	
	Contact force	approx. 300 N, automated	

Specification

qPCR application	Sensitivity	1 nmol/l FAM at 30 µl Sample volume	1 nmol/l FAM at 10 µl Sample volume
	Measuring time	approx. 6 s for a simple measurement, 6 colors	
	Measurement range	± 130 000 (±17 bit)	
	Dynamic range	10 log stages	
Fluorescence spectrometer	Measuring principle	Fiber-optic shuttle system with 8 optical fibers	Fiber-optic shuttle system with 16 optical fibers
	Light source	Four-color high-performance LEDs (blue, green, white, red)	
	Detector	Highly-sensitive PMT (Photo Multiplier Tube) Optimum signal/noise characteristics due to efficient noise suppression	
	Filter modules	<ul style="list-style-type: none"> ■ 12 color-, FRET- and protein modules ■ 6 positions in the device 	
Other characteristics	Safety features	<ul style="list-style-type: none"> ■ Sample chamber is monitored by sensors ■ Overtemperature protection in the heated lid ■ Interlock switch (front flap) 	
	Noise emissions	< 45 dB	
	Regulations/certificates	See "Standards and directives" on page 42	

10.1.2 Power module

General data	Designation/type	qTOWER³ auto power module	
	Dimensions (width x height x depth)	290 x 186 x 335 mm	
	Mass	approx. 12 kg	
Electrical characteristics	Protection type	IP 20	
	Safety class	I	
	Voltage range*	100 / 115 / 230 V	
	Max. power	950 W	
	Frequency	50/60 Hz	
	Fuse	2x 10 AT / 250 V	
	Output ports	3 (Power, Data 1, Data 2)	
Other characteristics	Safety features	<ul style="list-style-type: none"> ■ Overload detection ■ Ground fault ■ Overheating detection ■ Sheathed connectors and sockets 	
	Regulations/certificates	See "Standards and directives" on page 42	

* Set to fixed values (as specified in the order) by the manufacturer; can only be changed by service if necessary.

10.2 Environmental conditions

	Operation	Transport, storage
Temperature range	+15 °C to +35 °C	-10 °C to +55 °C
Max. humidity	70 %	10 % to 30 % Use desiccant!
Max. permissible height	2000 m	
Air pressure	0.7 to 1.06 bar	
Work environment	Only suitable for operation in rooms	

10.3 Standards and directives

Device safety	<p>The qTOWER³ auto meets the requirements of the following safety standards:</p> <ul style="list-style-type: none"> ▪ EN 61010-1:2010 ▪ EN 61010-2-010:2014 <p>For the safety class and protection type of the device, see “Technical data” on page 17ff.</p>
EMC compatibility	<p>The qTOWER³ auto meets the applicable requirements of EMC directive 2014/30/EU.</p> <p>The device has been tested for radio interference elimination and interference immunity and meets the requirements of the following standards:</p> <ul style="list-style-type: none"> ▪ EN 61326-1:2013 Immunity ▪ EN 61326-1:2013 Emissions (Class A)
Environmental compatibility	<p>The qTOWER³ auto has been tested for environmental compatibility and meets the requirements of directive 2011/65/EU.</p> <p>The conditions of use and transport – in accordance with the requirements of EN 61010-1:2010 – refer to the following standards:</p> <ul style="list-style-type: none"> ▪ DIN EN 60068-2-1, Ab, 2008-01 ▪ DIN EN 60068-2-2, Bb, 2008-01 ▪ DIN EN 60068-2-78, Cab, 2014-02 ▪ DIN EN 60068-2-6, Fc, 2008-10 ▪ DIN EN 60068-2-64, Fh, 2009-04 ▪ DIN EN 60068-2-27, Ea, 2010-02 ▪ DIN EN 22248 ▪ DIN EN 22206
EU directives	<p>The qTOWER³ auto was built and tested in compliance with the standards given. The requirements of the EU directives 2014/35/EU and 2014/30/EU were also met. Customers receive devices that are in a sound condition with regard to technical safety. To maintain this condition and to ensure safe operation, the operator must observe the safety and operating instructions contained in this operating manual.</p>
Directives for the U.S.A.	<p>The device meets the requirements of Part 15 of the FCC regulations (Federal Communications Commission Advisory). The following two requirements pertain to operation:</p> <ul style="list-style-type: none"> ▪ The device does not cause interference. ▪ The device is resistant to interference, including such interference as is liable to cause malfunctions. <p>The device meets the requirements of Part 18 of the FCC regulations.</p>
Directives for Canada	<p>The device meets the requirements of Canadian industry standard ICES-001 (Interference-Causing Equipment Standard).</p> <p>For accessories delivered with the device and system components from other manufacturers, the information in the respective operating manuals have priority.</p>

Information regarding safety corresponds to the currently valid regulations of the European Union. In other countries the applicable laws and country specific regulations have to be complied with.

Besides the safety instructions in this operating manual and the local safety regulations that apply to the operation of the qTOWER³ auto, the generally applicable regulations regarding accident prevention, occupational health and safety and environmental protection must be observed and complied with.