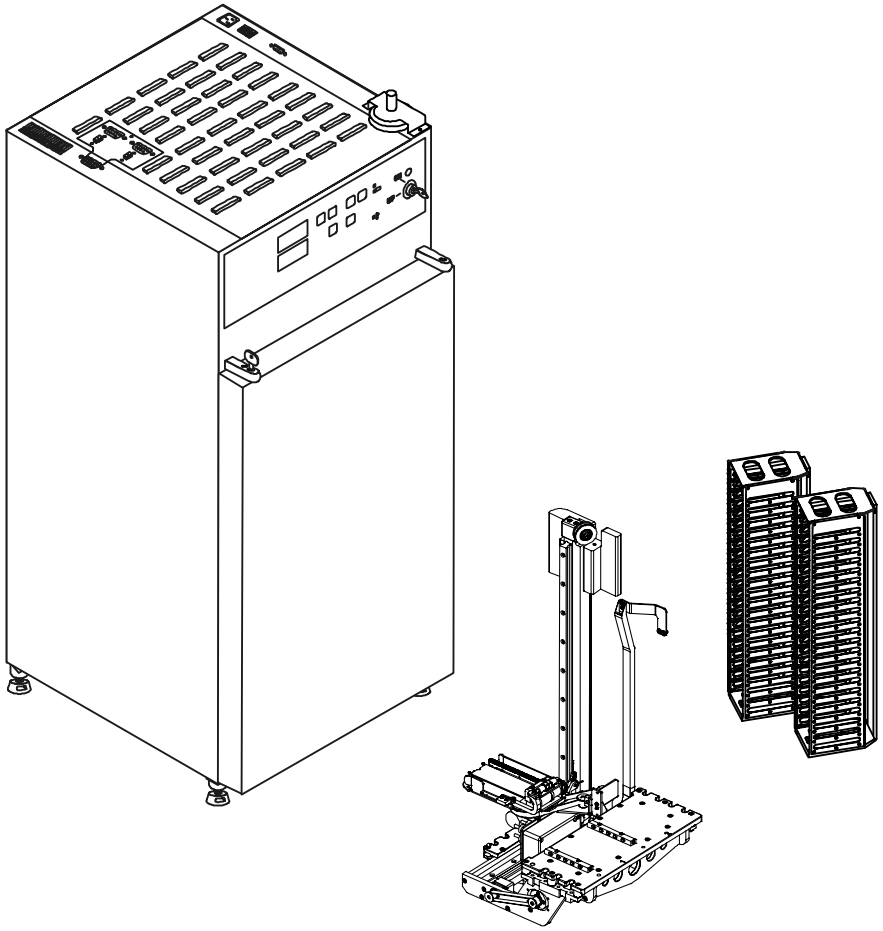
Operating Instructions

Automatic Incubator Cytomat® 2 C-Lin

Cytomat® 2



Valid: 01.2011 50114970

Thermo SCIENTIFIC

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- Translation of the original operating instructions -

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1. General notes

1.1 Identification of the device and of the documenmtation

Identification of the device
Device name:.....Automatic Incubator
Type designation:.....Cytomat® 2 C Lin
Serial No.:.....see nameplate

Allocation of product documentation
Documentation:.....50114970
Vaid:.....12.2010

Certifications and quality audit:
Certification: .....CE-Certification

1.2 Instruction of the operating personnel

These operating instructions describe the Automatic Incubator Cytomat® 2 C-Lin. The Automatic Incubator has been manufactured in keeping with the latest technological developments and is operationally safe. However, the device may present potential hazards, particularly if it is operated by inadequately trained personnel or if it is not used in accordance with the intended purpose. Therefore, the following must be observed to prevent accidents:

- The Automatic Incubator must be operated only by trained and authorized personnel.
- For any operation of this device, the operator must prepare clear and concise written instructions in the language of the operating and cleaning personnel based on these operating instructions, applicable safety data sheets, plant hygiene guidelines, and technical regulations, in particular:
  – which protective measures apply when specific agents are used,
  – which measures are to be taken in the case of an accident.
- It is necessary to provide personnel with adequate and individual pro tective equipment.
- Furthermore it is requireed to annually conduct a health and safety briefing in accordance with the regulations in "BetrSchV"

Repairs to the device must be carried out only by trained and authorized expert personnel.

1.3 Applicability of the instructions

- The content of these operations is subject to change at any time without prior notice.
- Concerning translations into foreign languages, the German version of these operating instructions is binding.
- Keep these service instructions close to the device so that safety instructions and important information are always accessible.

Should you encounter problems that are not detailed adequately in these service instructions, please contact Thermo Electron LED GmbH immediately for your own safety.

1. General notes

1.4 Warranty

Thermo Electron LED GmbH warrants the operational safety and functions of the Automatic Incubator only under the condition that:

- The device is operated and serviced exclusively in accordance with its intended purpose and as described in these operating instructions,
- the device is not modified,
- only original spare parts and accessories are used that have been ap proved by Thermo Electron LED GmbH,
- inspections and maintenance are performed at the specified intervals.

The warranty starts from the date of delivery of the device to the operator.

1.5 Standards and directives

The manufacturer declares that the product is in compliance with the essential requirements according to Machine Directive 2006/42/EC and documents this through the CE mark.

Manufacturer and distributor of the device:
Thermo Electron LED GmbH
Robert-Bosch-Straße 1
D - 63505 Langenselbold

The device complies with the following standards and guidelines:

- 2006/42/EC machine directive
- EMC Guideline 2004/108/EG
- DIN EN 12100 - 1-2:2003
- 2006/95/EC low voltage directive
- DIN EN 60204 - 1
- DIN EN 61010 - 1: 2002
- EN 61326:06-2008
- UVV BGV D4 Revised Version

The following safety regulations must be observed if the device is operated within the territory of the Federal Republic of Germany:

- BGR 104
- BGR 120
- BGI 629
- BGI 630
- EC Official Gazette, L 374
- Principles of good microbiological proceedings (see page 78).

For other countries, the applicable national regulations are binding.

1. General notes

1.6 Intended purpose of the device

The automatic incubator Cytomat® 2 C Lin is a laboratory device for preparing and cultivating cell and tissue cultures in microplates or similar containers. The device allows the simulation of the special physiological ambient conditions for these cultures due to:

- temperature,
- relative humidity,
- CO_2 content

1.6.1 Correct use

The automatic incubator has been designed for the integrated application in computer-aided systems, particularly for HTS (High Throughput Screening) procedures.
The Plate Shuttle™ System (PSS) in the device allows the automated, direct access to the sample containers (specifically microplates or similar containers). The transfer of the incubate to the integrator system or other transport systems is achieved at a fixed position. For this purpose, the Automatic Incubator must be integrated in a security system installed on-site that:

- effectively prevents a manual intervention of the automatic transfer or pickup area,
- is provided with an EMERGENCY OFF function of the device that is integrated logically into the overall system.

The automatic incubator is suited for installation and operation (also continuous operation) in the following fields:

- Laboratories for cellbiological and biotechnological experiments of safety levels L1, L2, and L3.
- Medical-microbiological laboratories in accordance with DIN 58956.

The CO_2 required for the optional gas supply of the incubator is supplied from an on-site gas supply system, either from CO_2 cylinders or from a central pressurized gas container. The gas supply system must be designed in a way that ensures that the operating pressure of the CO_2 supply line can be set to a range between 0.8 bar (min.) and 1 bar (max.) and that the pressure cannot be changed.

1.6.2 Incorrect use

Do not process cell or tissue cultures in the device that are not in accordance with the regulations of safety levels L1, L2, and L3. Do not use tissues, substances or liquids that:

- are easily combustible or explosive,
- release vapors that form combustible or explosive mixtures when exposed to air, release poisons.

1. General notes

1.7 Safety devices

The device is equipped with several safety installations for device and product protection as well as for reduction of gas supply and of the power consumption:

- Two separate door switches interrupt the two functional units when the outer door is opened:
  - Gas supply and heating of the incubator system and
  - the rotation of the Plate Shuttle™ System (PSS).
- An independent thermal protection protects samples from harmful overheating in case of a failure.
- A pressure compensation opening ensures pressure compensation within the device chamber.
- Audible and visual alarms indicate failures during operation.

1.8 Safety devices at the operator end

Prior to initial commissioning of the automatic incubator, a safety system must be installed at the operator end which includes both practical constructional safety installations and control functions. The safety devices to be installed must effectively prevent the following hazards:

- manual interventions into the automatic transfer or pickup/takeover area on the outside of the device,
- manual interventions into the operating range of the Plate Shuttle™ System (PSS), the automatic lifting system in the chamber of the device. The device control must be integrated into a safety system which:
- includes an EMERGENCY STOP function for the device,
- does not compromise the functioning of the protective devices installed on site.

1. General notes

1.9 Explanation of safety informations and symbols

The general safety instructions point out potenzial hazards during operation. Prior to the use of the device, read the safety instructions carefully.

1.9.1 Designation of safety information and symbols:

WARNING!

is used if non-observance may cause serious or even fatal injuries.

CAUTION!

is used if non-observance may cause medium to minor injuries or damage.

NOTE

is used for applicational hints and useful information.

RECYCLING

Valuable raw materials can be reused.

Wear safety gloves!

Wear safety goggles!

Harmful liquids!

Electric shock!

Hot surface!

1. General notes

Contaminaton hazard!

Fire hazard!

Explosion hazard!

Suffocation hazard!

Contusion hazard!

Entaglement!

1. General notes

1.9.2 Symbols on the device:

CE symbol

Observe operating instructions!

Unplug power plug before opening!

Contusion hazard!

Hot surface / Thermostat!

Laser class 2. Do not stare into beam.

Entaglement!

Entaglement!

1. General notes

1.10 Overview of safety notes

Safety notes on carbon dioxide (CO_2)
As CO_2 is rated as a harmful gas, certain safety instructions must be observed when the CO_2 incubator is set up and operated.

WARNING - Suffocation hazard!

CO_2 released in large amounts into the room atmosphere may cause suffocation.
If CO_2 is released immediately initiate safety measures !

- **Leave the room immediately and secure all access points so that nobody enters the room!**
- **Indicate danger resulting from escaping gas at entrances!**
- **Inform security service or fire department!**

NOTE – Personnel training

Personnel operating devices with gas supply must be trained on the particular handling of the used process gases before starting their work, particularly:

- **The correct operation of pressurized gas containers and gas supply systems,**
- **the duty to report damages and shortcomings in gas supply systems, pressurized gas containers and the supply lines,**
- **the particular measures to be taken in the event of accidents or failure.**

NOTE - Installations

Work on supply lines, compressed gas containers, cylinders or reservoirs that contain CO_2 for the incubator must only be carried out by expert personnel using the appropriate tools.

The trainings must be repeated in appropriate intervals. They must give regard to the specific operating instructions of the gas supplier.

Safety instructions for decontamination
During operation, for maintenance work or for a shut-down, observe the hygiene regulations of the operator!

1. General notes

WARNING - Contamination hazard!

The incubator can be used for the permanent or temporary storage of toxic or infectious substances or materials. Thereforeit could be that the device or device components are contaminated.

- **Infectious or toxic substances or residues must always be removed completely from the work space.**
- **Prior to starting any maintenance work, inquire about potential infection hazards.**
- **Prior to repairs, make sure that the device has been cleaned and disinfected to ex clude infection hazards!**
- **The operator must provide a declaration of decontamination.**

WARNING - Recycling!

All components of the device can be recycled. If toxic or infectious substances were used in the device, the components must be decontaminated as required before they are discarded or shipped.
For shipped components, a certificate of decontamination must be attached.

2. Delivery of the device

2.1 Packaging

The automatic incubator Cytomat® 2 C Lin is delivered in a stable packaging box. All packaging materials can be separated and are reusable.

Packaging materials

• Packaging carton	Recycled paper
• Foam elements	Styrofoam (CFC-free), Polyethylene
• Pallet	Untreated wood
• Packaging film	Polyethylene
• Packaging ribbons	Polypropylene

2.2 Checking the delivery

After unpacking the device, check the device components for possible transport damages and for completeness.
If damages are detected or if components are missing, please contact Thermo Electron LED GmbH.

2.3 Scope of delivery

Quantity of the delivered device components	**Cytomat® 2**
Cytomat® 2	1
Power supply cable	1
Plate Shuttle™ System PSS	1
Plug with silver mesh, preassembled in pressure compensation opening	1
Key for power switch	2
Key for outer door	2
Alarm contact connector	1
Cover plug PSS receptacle	1
Interface cable RS 232, 9-way	1
Cable clips	5

2. Delivery of the device

Quantity of the delivered device components	Cytomat® 2 C Lin
Optional equipment	
Transfer station with plate empty sensor	1
Stackers	2
CO_2 connecting hose set	1
CO_2 filter, preassembled	1
Tools	
Open-end wrench, 24 mm	1
Allen wrench, 2 mm, for blower wheel	1
Allen wrench, 3 mm, for blower wheel cover	1
socket wrench 7 mm	1
Instructions	
Operating instructions	1
Software documentation Plate Shuttle™ System PSS	1
Terminal- Software	1

3. Installation of the device

3.1 Ambient conditions

The device must only be operated at locations that meet the particular ambient conditions listed below.

Requirements:
- Draft-free and dry location.
- The minimum distance to adjacent surfaces must be observed on all sides (see Section 3.3.).
- Air inlet and outlet openings of the device must not be obstructed.
- The operating room must be equipped with an appropriate room ventilation (see Section 3.2.).
- Solid, level, fire-proof surface.
- Vibration-proof substructure (rack, lab table) capable of bearing the weight of the device and of accessories.
- To ensure constant temperature, the ambient temperature must be within a range of +18° C to +29° C.
- Relative humidity up to 80 % (max.).
- No direct exposure to sunlight.
- Devices that produce excessive heat are not allowed near the location of the automatic incubator Cytomat® 2 C Lin.
- The installation room must be adequately illuminated (> 300 lx).
- Altitude up to 2,000 metres above sea level.
- Mains supply voltage fluctuations up to 10 % of the nominal voltage.

3.2 Room ventilation

During continuous operation, the room climate may change due to energy and CO_2 released by the device.
- Therefore, operate the automatic incubator only in rooms with adequate ventilation (maximum air limit value for CO_2 : 5000 ml/m³).
- Do not install the device in room recesses without ventilation.
- The room ventilation should be a technical ventilation that is in accordance with the requirements of BGR 120 (guidelines for laboratories) or some other suited ventilation system of appropriate capacity.
- As the pressure compensation and any opening of the glass door during the operation of the device will release small quantities of CO_2 into the operating room, the room ventilation must be capable of carrying the released gas safely off into the open.

The gas consumption largely depends on the opening frequency of the automatic lift door and on the opening frequency of the service doors (outer door and glass door).

3. Installation of the device

3.3 Space requirements

When installing the device, make sure that the installation and supply connections are freely accessible.

Fig. 1: The side distances given are recommended minimum distances. To protect the CO_2 incubator against contamination, use a substructure even if the device is installed near the floor. The height of the substructure should not fall below 200 mm. The minimum distance to adjacent surfaces round the device must be 200 mm.

NOTE– Accessibility of the device:

To ensure the accessibility of the device for care and maintenance works, keep larger side and rear distances.

3.4 Locating points

Fig. 1: During positioning in the integrator, the centers of the stands are used as locating points. Additionally, the right front device stand is used for aligning the outer door hinge and may therefore be located with a tolerance of 1.5 mm to the front and to the rear.

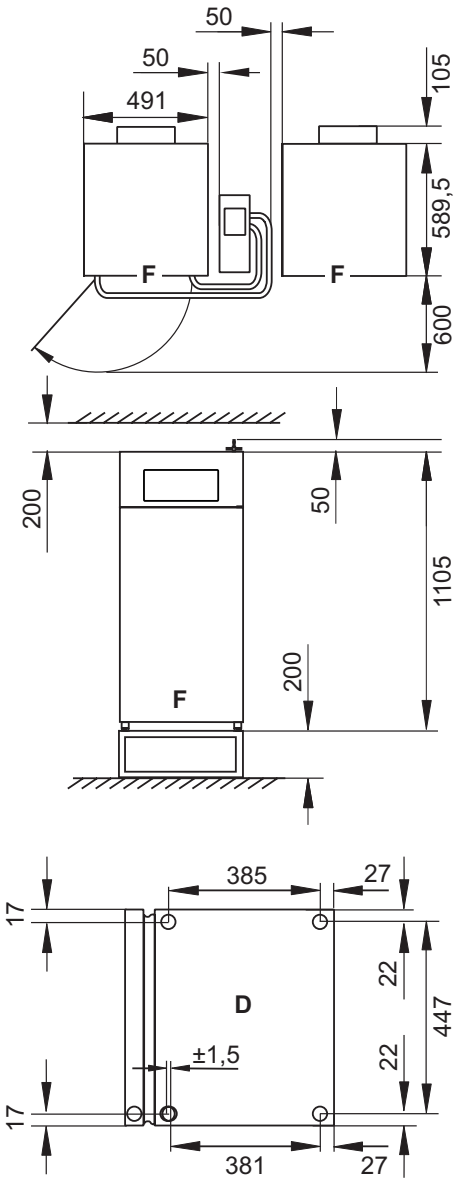


Fig. 1,
Device dimensions and minimal distances, values in mm, F = Front

3. Installation of the device

3.5 In-plant Transport

The device must be transported only in the upright position under the following transport conditions:

- The automatic lift door is closed,
- the Plate Shuttle™ System (PSS) is secured, the handler has been lowered to the lowest position,
- all stackers and culture containers have been removed from the device chamber,
- both doors (outer door and glass door) are closed.

NOTE – Lift points:

Lift the device only using the lift points shown in Fig. 2.
For transport, the doors or accessories of the device, e.g. the rear automatic lift door, must not be lifted.

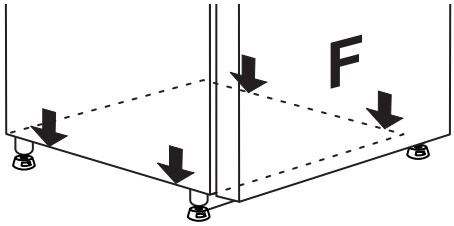


Fig. 2,
Lift points, F = Front

NOTE – Transport:

It may be necessary to use lifting equipment for lifting and transportation. If lifting manually please observe local manual handling regulations.

Fig. 3: Note the position of the center of gravity.

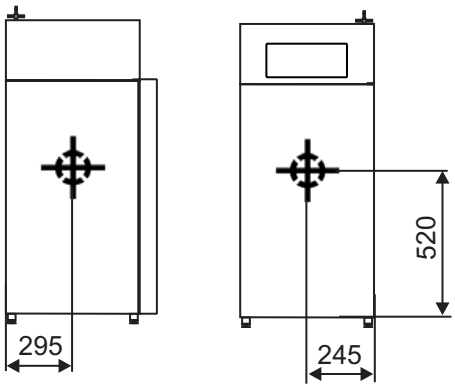


Fig. 3,
Center of gravity, values in mm

For longer transportation, particularly on uneven and rough surfaces, always use a transport pallet.

4. Description of the device

4.1 View of the service side

[1] Control box cover
[2] Power supply socket
[3] Socket for external alarm system
[5] CO_2 filter with connecting sleeve
[6] Power switch, lockable
[7] Energy chain thread plugs
[8] Glass door
[9] Protective film
[10] Measurement opening in glass door
[11] Outer door with magnetic seal
[12] Stacker
[13] Plate Shuttle™ System (PSS)
[14] Glass door latch
[15] Support rail for Plate Shuttle™ System (PSS)
[16] Nameplate
[17] Floorpan filling level indicator
[18] Glass door latch
[19] Device stand, height-adjustable
[20] Incubator door switch
[21] Door switch, Plate Shuttle™ System PSS
[22] Outer door latch, lockable
[23] Incubator operating panel
[24] RS 232 connection, Plate Shuttle™ System (PSS) / Incubator / Barcode
[25] Operating mode digital display

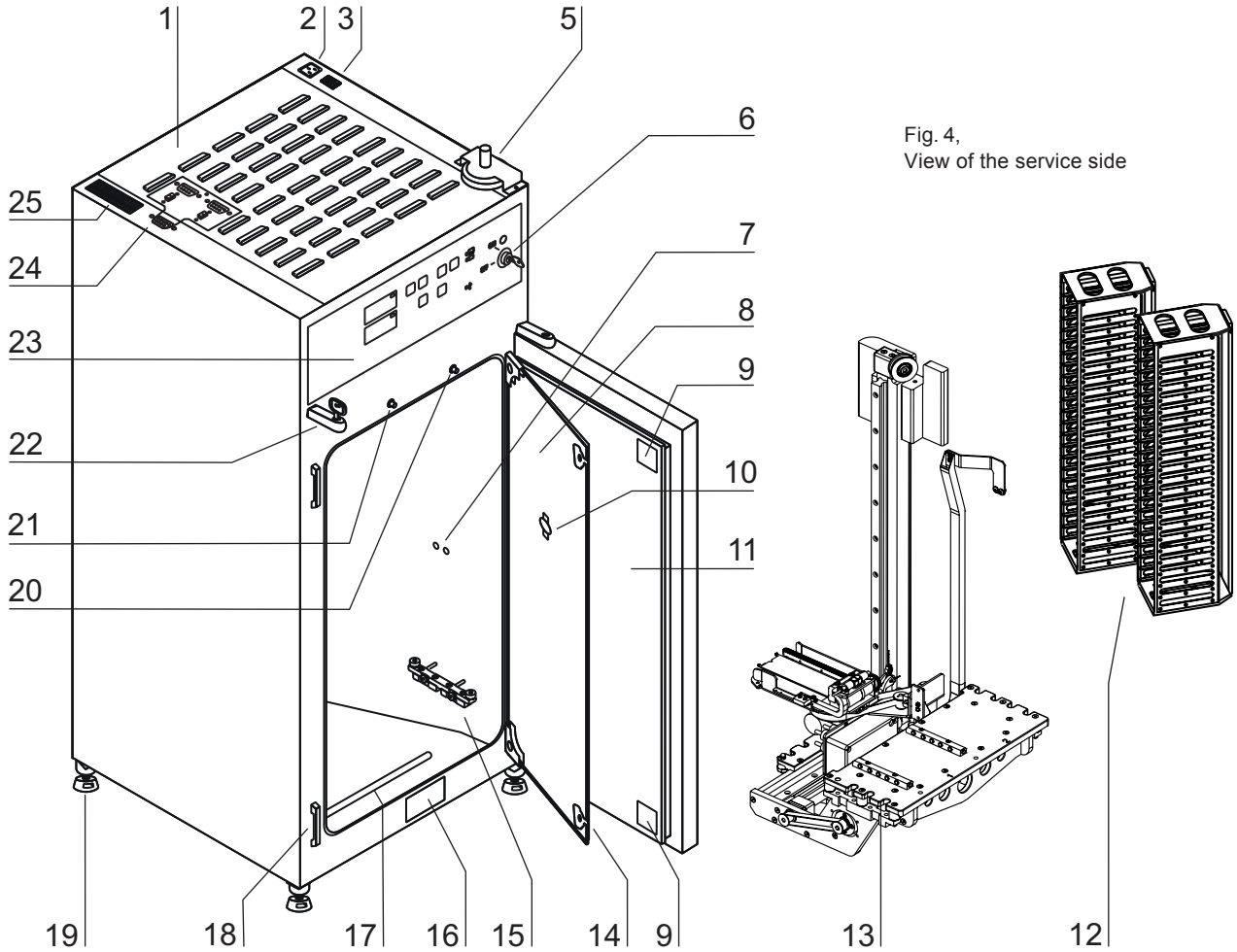


Fig. 4,
View of the service side

4. Description of the device

4.2 View of the robot side

[1] Control box blower with air cleaner
[2] Cable clip (for cable routing, as required)
[3] Automatic lift door
[4] Transfer station empty sensor
[5] Transfer station (optional)
[6] Transfer station mounting plate
[7] Pressure compensation opening / pipe channel and plug with silver mesh
[8] Automatic lift door opening with seal
[9] Plate Shuttle™ System (PSS) handler in loading / unloading position to transferstation
[10] Plate Shuttle™ System (PSS) mounting position in chamber

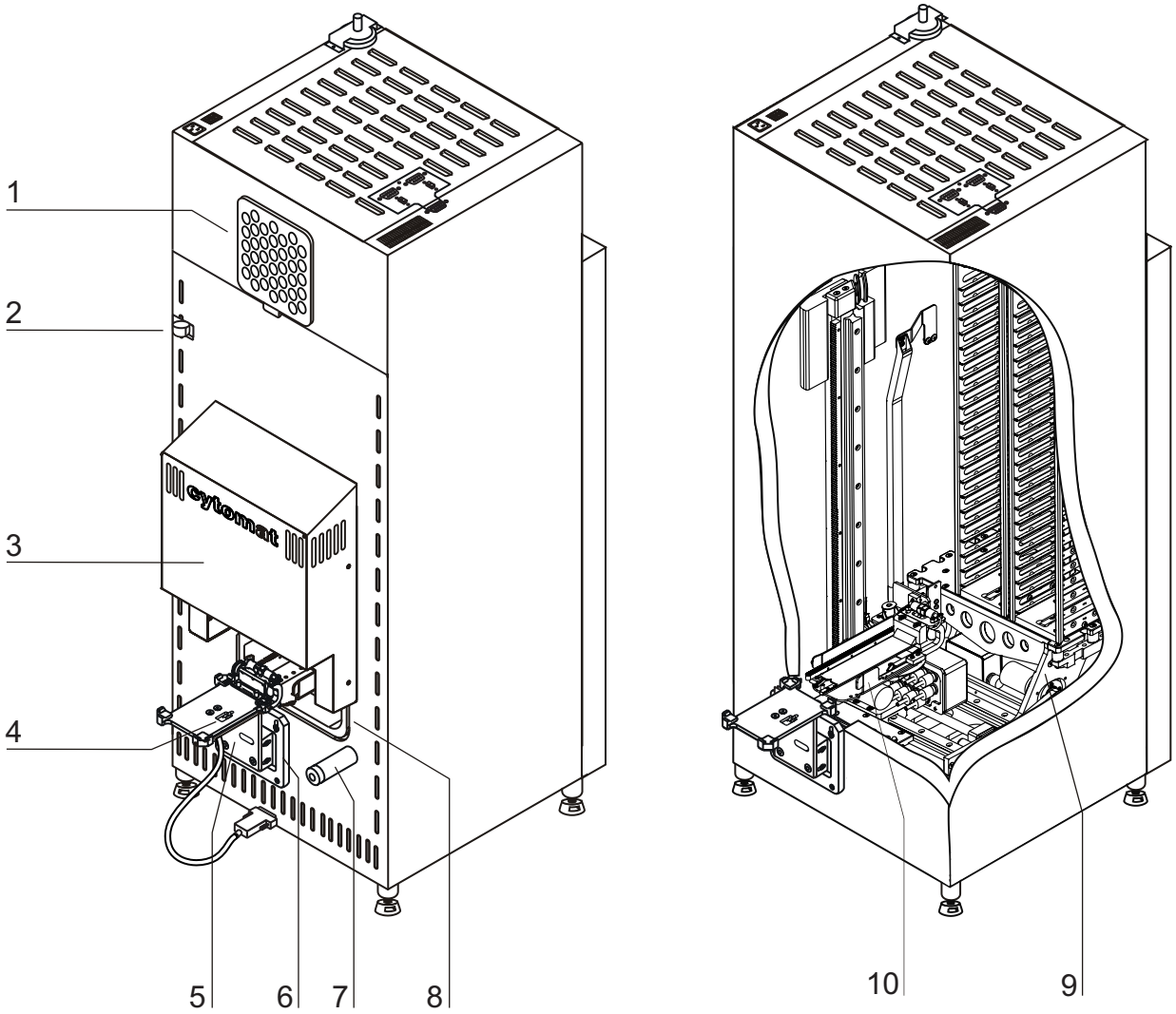


Fig. 5,
View of the robot side

4. Description of the device

4.3 Chamber atmosphere

In the chamber of the automatic incubator, the particular physiological ambient conditions for the preparation and cultivation of cell and tissue cultures are simulated. The chamber atmosphere is determined by three factors:

- Temperature,
- Relative humidity,
- CO_2 concentration.

Temperature:
To ensure undisturbed operation, the temperature in the operating room must be at least 18 °C and the incubation temperature must be at least 8 °C higher than the ambient temperature (T_A). Depending on the equipment of the device, this heating system controls the incubation temperature from this temperature threshold (T_A) in the following temperature ranges:

- T_A + 8 °C to 50 °C (max.)

Relative humidity:
The floorpan of the chamber can hold 0.8 liters of processed water. The heating of the chamber supports the condensation of the water, thereby ensuring a constant humidity within the chamber. Under normal operating conditions, the constant relative humidity in the chamber (depending on the incubation temperature) is:

- approx 95 % at 37° C

For humidification, processed water with following quality is required:

- distilled, demineralized and
- autoclaved, sterile

CO_2 supply (optional):
In order to ensure growth conditions for cell and tissue cultures, the chamber is supplied with CO_2. The pH of the bicarbonate-buffered culture media largely depends on the CO_2 content of the chamber atmosphere. The CO_2 content of the chamber atmosphere can be controlled within a range of 0-20 %.
The supplied CO_2 must have one of the following quality characteristics:

- Purity 99.5 % min.,
- Medical gas quality.

4. Description of the device

4.4 Sensor system

Fig. 6: The measuring cell is installed at the chamber ceiling. The blower wheel [4] and two sensor modules are integral to the baseplate [2] of the measuring cell:

- Sensor [1] for measuring and monitoring the chamber temperature,
- the CO_2 sensor [3] for acquiring the CO_2 content of the chamber atmosphere.

The blower wheel is protected by a removable grid. The grid must be installed during the operation of the device since otherwise moisture may penetrate the electronic components through the threaded holes for the retaining screws.

The sensor for measuring the chamber temperature and the CO_2 sensor are components of the control system of the device. The measured values transmitted by these sensors are compared with the set nominal values. Based on this data, the control system controls the heating, the thermostat inflow temperature, and the CO_2 supply.
The thermal protection has been preprogrammed at the factory and cannot be changed. It protects the stored samples from overheating. If the temperature is exceeded by more than 1° C, the thermal protection responds and the chamber temperature is automatically reduced to the set nominal value so that the incubation process can be continued even in case of a failure. Any response of the thermal protection will simultaneously trigger an audible and a visual alarm.

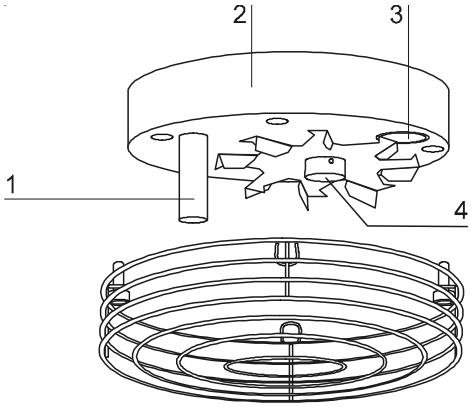


Fig. 6,
Measuring cell sensors

4.5 Door switches

Fig. 7: Two door switches are installed at the upper edge of the chamber opening.
If the door switch [1] is activated by opening the glass door, the traveling motion of the Plate Shuttle™ System (PSS) is cancelled. The momentary motion is finished and the Plate Shuttle™ System (PSS) is stopped.
If the incubator door switch [2] is activated by opening the glass door, the CO_2 supply (optional) and the heating of the chamber are interrupted. The operating panel shows a corresponding display (indicators flash).
If the door remains open for more than 30 seconds, a short acoustic alarm sounds. If the door remains open for more than 10 minutes, the acoustic alarm sounds continuously.
The outer door can only be closed after the glass door has been latched properly.

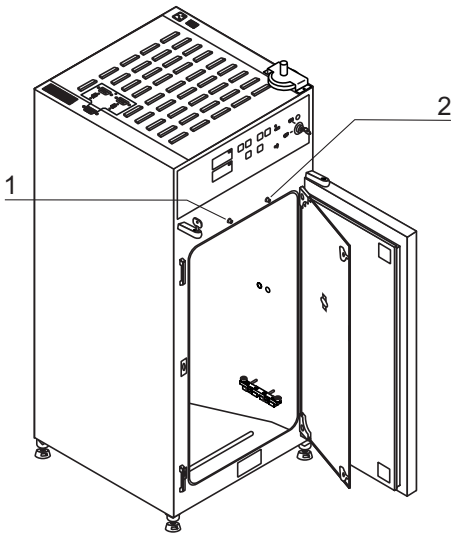


Fig. 7,
Door switch

4. Description of the device

4.6 Supply connections

Fig. 8: The supply connections are installed at the top and at the front of the device.

Power supply connection:
The power supply [1] of the device is achieved using a connector for non-heating appliances. The holder for the two device fuses is integral to the power supply socket for non-heating appliances of the power supply connection.

Alarm contact:
The device can be connected to an on-site, external alarm system (e.g. telephone system, building monitoring system, visual or audible alarm system). For this purpose, a potential-free alarm contact [2] is preinstalled in the device.

Incubator RS 232 interface:
Using the RS 232 interface [3], the automatic incubator can be connected to the serial interface of a PC (see Section 6.7). This connection allows the computer-aided acquisition and documentation of the major incubation parameters (temperature, CO_2 concentration, failure codes, etc.).

CO_2 gas connection (optional):
The gas supply line between the device and the gas supply system is connected using the supplied connecting hose. The device is supplied with CO_2 through the connecting sleeve at the sterile filter [4] with a preset, non-changeable pressure between 0.8 bar (min.) and 1.0 bar (max.).
Before the CO_2 is fed into the chamber, it flows through the sterile filter [3] with a separation rate of 99.998 % referred to a particle size of 0.3 µm (HEPA filter quality).

RS 232 interface for Plate Shuttle™ System (PSS):
The RS 232 interface [5] connects the automatic incubator to the serial interface of a PC (see Section 6.7). This connection is used for the control of the Plate Shuttle™ System (PSS). Via this interface, the integrator can also request data for documenting the major incubation parameters (temperature, CO_2 concentration, failure codes, etc.).
The software control of the PSS is described in a sperate instruction (ID No. 50113635).

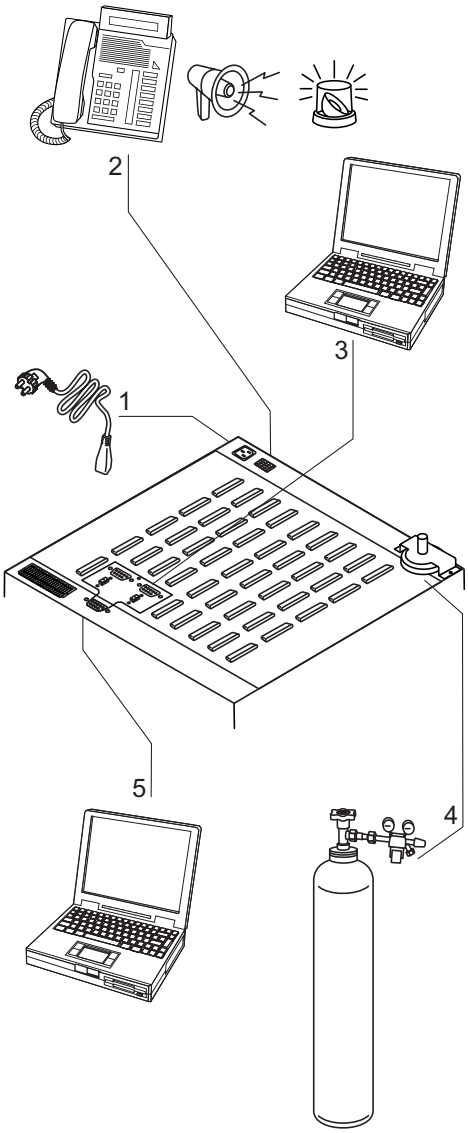


Fig. 8,
Supply connections

4. Description of the device

LED display:

Fig. 9: The LED display [6] informs the user about the operational state of the device:

DO	Plate Shuttle™ System (PSS) door switch
POT	Sensor „Transfer station loaded“
SE	Limit switch „Shovel extended”
POS	Limit switch “Shovel loaded“
GO	Limit switch “Automatic lift door open“
GC	Limit switch “Automatic lift door closed“

+ 42 V	Power supply	+ 42 V
+ 24 V	Power supply	+ 24 V
+ 12 V	Power supply	+ 12 V
+ 5 V	Power supply	+ 5 V

Supply connection labelling:
The supply connections [1] - [7] are labelled with quick references of the specifications.

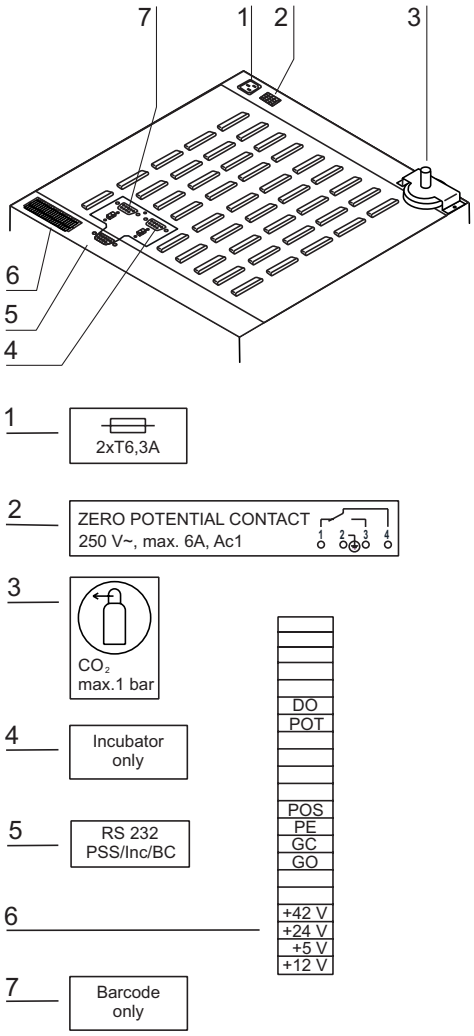


Fig. 9,
LED display

4. Description of the device

4.7 Chamber layout

The chamber of the automatic incubator has only a minimum of surface, thereby supporting both the prevention of contamination and the easy, effective decontamination. All components of the chamber are made of stainless steel and have a burnished, absolutely smooth and easy-to-clean surface. Any embossings have a large radius.

Plate Shuttle™ Systems (PSS) support rails:

Fig. 10: The Plate Shuttle™ System (PSS) is secured with screws to a total of three support rails [2] within the chamber. The lateral support rails are attached to rubber isolators, the backpanel support rail is attached to steel bolts.
For cleaning or disinfecting, the Plate Shuttle™ System (PSS) is removed from the support rails as a complete unit.
The simple screw connections allow the quick removal and exact reinstallation.

CAUTION - Reference position!

The mounting position of the support rails in the chamber is used as a reference for positioning the Plate Shuttle™ Systems (PSS) in the chamber.
If the position of the support rails is changed, the handler may collide with the chamber walls.
Do not remove the support rails!

Measuring cell, Plate Shuttle™ System (PSS) plug receptacle:

Fig. 10: The measuring cell with blower wheel [1] and the plug receptacle [3] of the Plate Shuttle™ System (PSS) are installed to the chamber ceiling. The blower wheel ensures the intermixture of the chamber atmosphere. The protective grid and the blower wheel of the measuring cell can be removed for cleaning and disinfection.

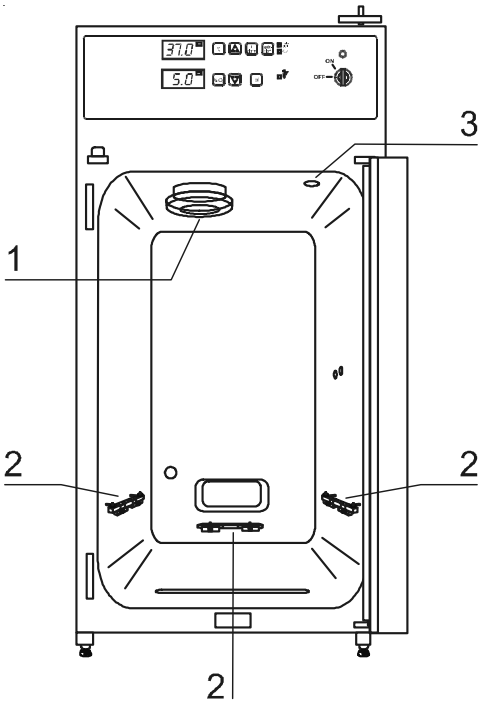


Fig. 10,
Chamber layout

4. Description of the device

Water reservoir:

Fig. 11: The water reservoir [3] is integral to the floor of the interior container and has an inclination toward the rear panel of the device. The water level is monitored by a level sensor [2] that controls an indicator at the display and triggers an audible alarm when the level falls below minimum. The embossing [4] in the floorpan is an indicator for the maximal level.

NOTE – Water reservoir

The chamber floorpan can hold up to 0.8 liters of processed water. During operation, a sufficient quantity of processed water of the following quality must be available:

- **destilled, sterile or**
- **demineralized, autoclaved**

Pressure compensation opening:

Fig. 11: A pressure compensation opening [2] with insert [1] at the rear panel of the device allows a compensation between the pressures in the chamber and operating room.

NOTE – Pressure compensation

During operation of the device, the pressure compensation opening must not be obstructed as otherwise overpressure may build up in the device chamber!

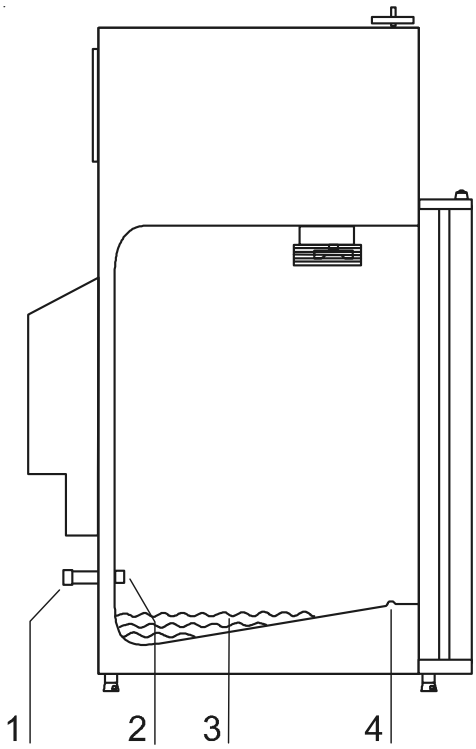


Fig. 11,
Water reservoir

4. Description of the device

4.8 Plate Shuttle™ System (PSS)

The Plate Shuttle™ System (PSS) is the transport and storage system of Cytomat® 2 Lin.

Fig. 12: A rotating handler [11] at the lift system [15] that moves vertically is used for transporting the microtest plates [3] from the stackers [4] to the transfer position (e.g. transfer station [13] or on-site transport system). The baseplate [5] is equipped with two lockable rails [6] that can each accomodate one stacker [4].

The horizontal movement of the Liftsystem [15] is effected via the spindle [9] which is driven by the motor [7] over the belt [8].

The microtest plates can be transported by using software commands to the addressed storage positions in one of the two stackers.
The handler shovel [12] deposits the microtest plate at the corresponding position in the stacker.

The plate empty sensor [10] is able to detect if the Plate Shuttle™ System (PSS) handler is occupied to prevent the double loading of the stacker, e.g. after a power reset.
The counterweight [1] nearly compensates the weight of the handler [11] so that almost only the weight of the microtest plates must be shifted.

The connection of the Plate Shuttle™ System (PSS) to the electronic control unit of the device is achieved by using the connecting cable in the cable chain [2].

The Plate Shuttle™ System (PSS) is made of stainless steel, corrosion-protected aluminum and high-quality plastics.

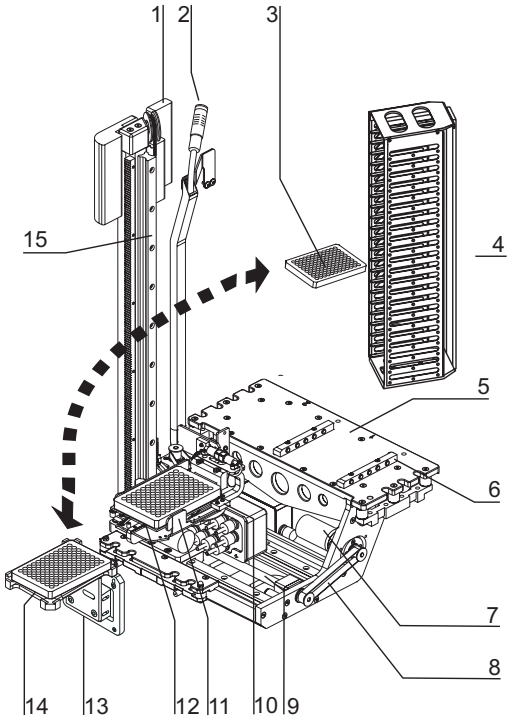


Fig. 12,
Plate Shuttle™ System (PSS), view with transfer station (optional)

NOTE – Microplate setting

Microplates with flattened corner [11] must be deposited on the transfer station so that the flattened corner does not face the device.

4. Description of the device

4.9 Stackers (storage system)

The stackers are used as the storage system of the Plate Shuttle™ Systems (PSS).

Fig. 13: The baseplate [6] can accomodate two stackers. Each stacker is equipped with several guide rails to accomodate microplates [2].
The vertical distance between two support rails, the so-called pitch [3], indicates the clear distance of the microplate bottoms in millimeters.

The support rails have locking tabs at the opening side of the stacker to prevent accidental shifting of the installed microplates. The stackers are positioned on and engaged in the locking rails [5] of the baseplate.

Stackers are available with various pitches for microplates of different heights (see section 12, spare parts and accessories).

NOTE – Pitch

When selecting stackers, please bear in mind that the selected pitch must exceed the height of the microplate with cover by at least 5 mm.

NOTE – Numeric designation

The loading or unloading position of the handler is adjusted exactly to the corresponding stacker. The invividual stacker slots on the baseplate are designated with numbers [4].

CAUTION – Handler collision!

The traveling motions of the handler are programmed for the individual pitch in the stacker. If stackers with a higher or lower pitch than originally provided are to be used, the traveling motion of the handler must be readjusted!

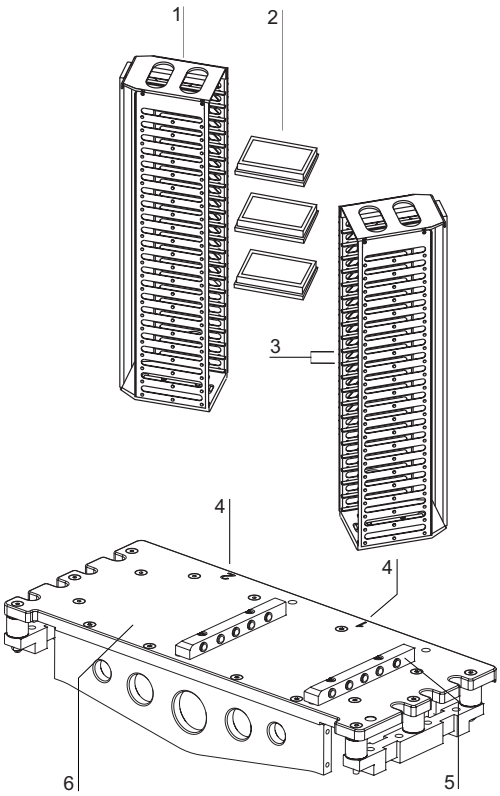


Fig. 13,
Stackers

4. Description of the device

4.10 Automatic lift door

Fig. 14: The automatic lift door with transfer station (optional) is the defined transfer position of the automatic incubator to the external on-site transport system.
The handler [2] of the Plate Shuttle™ Systems (PSS) picks up the microplate [5] from the addressed storage position in the stacker and transfers it to the on-site transport system at the opening [3]. For this purpose, the microplate is either deposited on the transfer station [5] or transferred immediately to the transport system. The plate empty sensor [4] at the transfer station is used for checking the load state of the plate (empty or not) and to see if the handler is allowed to load the plate.
The automatic lift door is used for the airtight sealing of the automatic incubator chamber. The latch plate of the lift door is heated to prevent condensation. The latch plate is located behind a cover [1].

CAUTION - Traveling motion intervention!

The automatic lift door is moved by electric motors. Any attempt to stop the traveling motion or to tamper with the motions manually bears the risk of crushing hands or fingers. Do not tamper with the traveling motion!

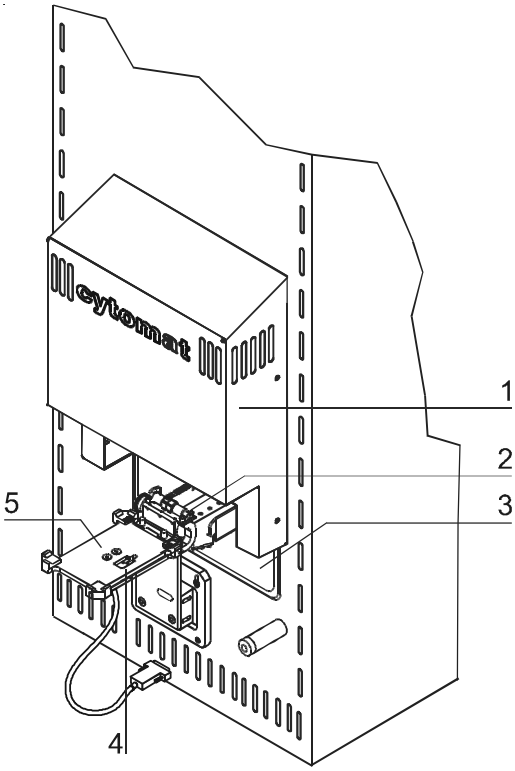


Fig. 14,
Automatic lift door

4. Description of the device

4.11 Safety equipment automatic lift door

Fig. 15: Prior to start up of the automatic incubator, a safety system [1] must be installed at the operator end in order to prevent interventions into the traveling movement of the Handler and the automatic lift door.

CAUTION– Safety equipment missing!

The automatic incubator has been designed for integration into an overall system. The device may only be placed into operation after the following safety equipment have been installed on the operator end:

- **Protection against manual interventions into the automatic transfer or takeover / pickup area on the outside of the device.**
- **Logical integration of the device control into the overall safety system with an EMERGENCY STOP function for the device.**
- **The proper functioning of the safety devices installed on site must not be compromised.**

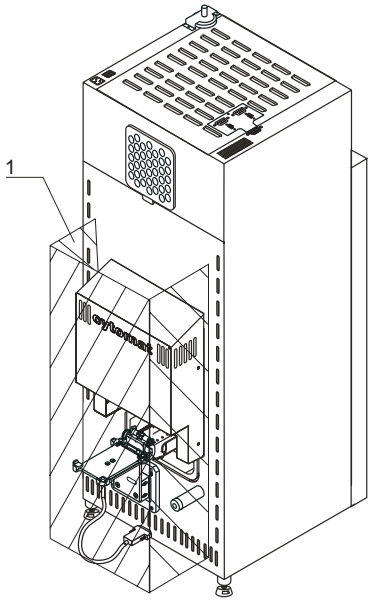


Fig. 15,
Safety equipment automatic lift door

5. Start-up

5.1 Preparing the device

On delivery the automatic incubator and the thermostat are provided in a clean but not sterile condition. Prior to the start-up, the device should be decontaminated for its intended purpose.

NOTE – Decontamination!

For detailed information on cleaning and disinfecting the device, see section 9.

5.2 Plate Shuttle™ System (PSS) removal

For the decontimation of the chamber, the Plate Shuttle™ System (PSS) is removed completely; then, the interior surfaces of the chamber and the complete Plate Shuttle™ System (PSS), including the stacker, are cleaned and disinfected.

NOTE – Moisture sensitivity

Do not allow mositure to enter the connecting plugs as otherwise the device pins may be affected due to resulting creepage currents. If the connecting cable plug is disconnected, the plug receptacle must always be sealed using the protective cap.

Removal:

1. Disconnect the handler / counterweight cable from the deflection pulley. Deposit handler and counterweight on the baseplate.
2. **Fig. 16:** Disconnect the connecting cable plug [3] from the plug receptacle [1] at the chamber ceiling.
3. Disconnect the connecting cable plug [8] from the plug receptacle [9] at the right wall of the chamber.
4. Install protective cap [2] to plug receptacle.
5. Remove the two retaining screws [5] of the energy chain [6].
6. Remove the retaining screw cap nuts [7] (size 7) from the support rails [4]. Carefully lift the Plate Shuttle™ System (PSS) from the screws and remove it from the chamber.
7. Do not deposit the Plate Shuttle™ System (PSS) on the floor but on a support that is suited for the cleaning and disinfection; support the Plate Shuttle™ System (PSS).

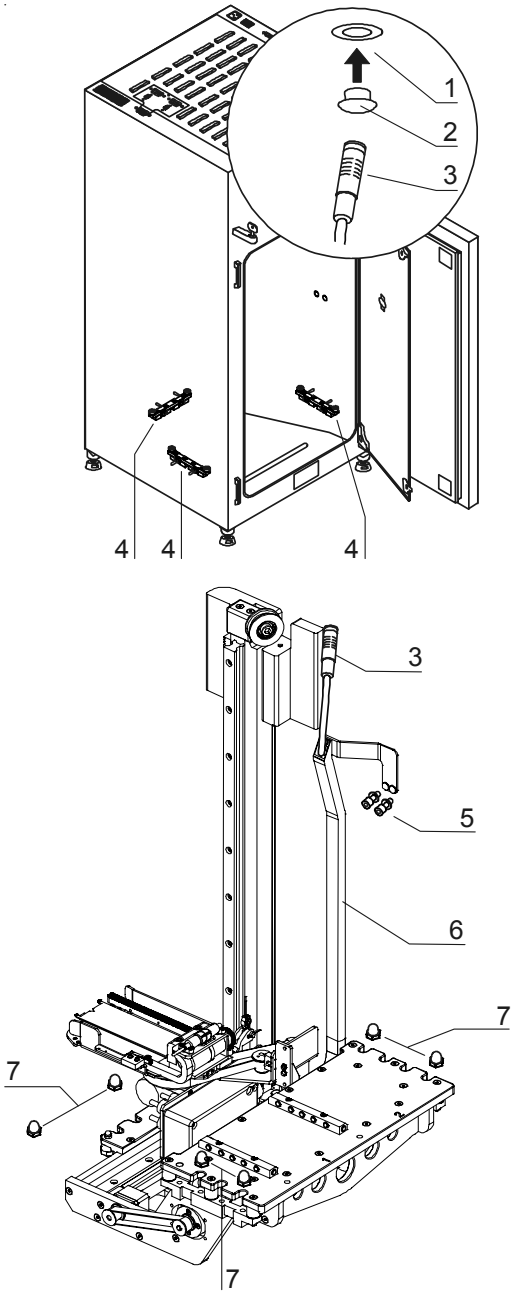


Fig. 16,
Plate Shuttle™ System (PSS) removal

5. Start-up

5.3 Plate Shuttle™ System (PSS) installation

Installation:
1. Position Plate Shuttle™ System (PSS) onto support rail retaining bolts.
2. Install and tighten all six cap nuts.
3. **Fig. 17:** Install the energy chain bracket [5] and secure it using the screws.

Connecting the counterweight cable:
For safety reasons and to avoid damaging the handler or the interior walls of the chamber during transport, the cable connection from the counterweight to the handler is disconnected from the deflection pulley. To reestablish the weight balance for the operation of the handler, the cable must be connected.
1. Remove transport straps.
2. Slightly raise the handler [4].
3. Insert the cable [1] into the deflection pulley [2].
4. Carefully lower the handler until the counterweight [3] tensions the cable.

Establishing electrical connections of the Plate Shuttle™ System (PSS):
1. Remove the protective cap [10] from the plug receptacle [8].
2. Align the red mark [7] of the plug with the red mark [9] of the plug receptacle.
3. Insert connecting cable plug [6] into plug receptacle [8] at the chamber ceiling and exert slight pressure until it is engaged.

Plate Shuttle™ System (PSS) leveling:
Before the stackers are positioned on the baseplate, the Plate Shuttle™ System (PSS) must be adjusted horizontally.
1. Position a air lever on the baseplate.
2. Rotate the adjustable device stands using the supplied wrench (24 mm) so that the Plate Shuttle™ System (PSS) is adjusted horizontally in all directions. Set the device stand height starting from left to right and from front to rear.

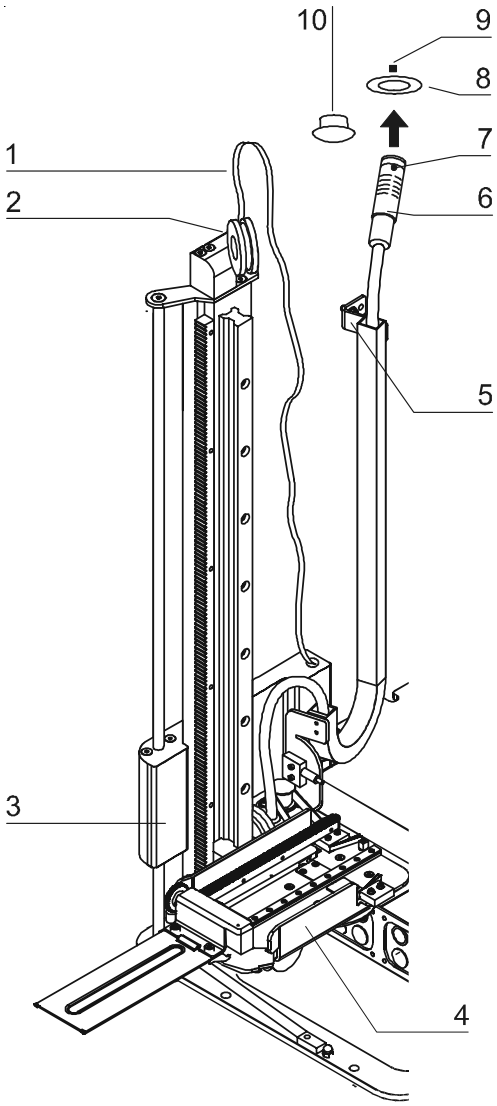


Fig. 17,
Plate Shuttle™ System (PSS) installation

5. Start-up

Stacker installation:

1. **Fig. 18:** Grab the stacker at the handle plate [1]. Slightly tilt the stacker toward the front of the device, position it above the locking rail [4] and exert slight pressure to the front until it is engaged.

   NOTE – Handling stackers

   The stackers are precision components whose form and orientation must remain unchamnged. Stackers must not be installed or removed using excessive force or tools.

2. To ensure an absolutely plane position, the locking plate [3] of the stacker and the baseplate [2] of the Plate Shuttle™ System (PSS) must be kept absolutely clean. Therefore, never deposit the stackers on the floor but only on the particle-free surfaces after they have been perfectly cleaned.

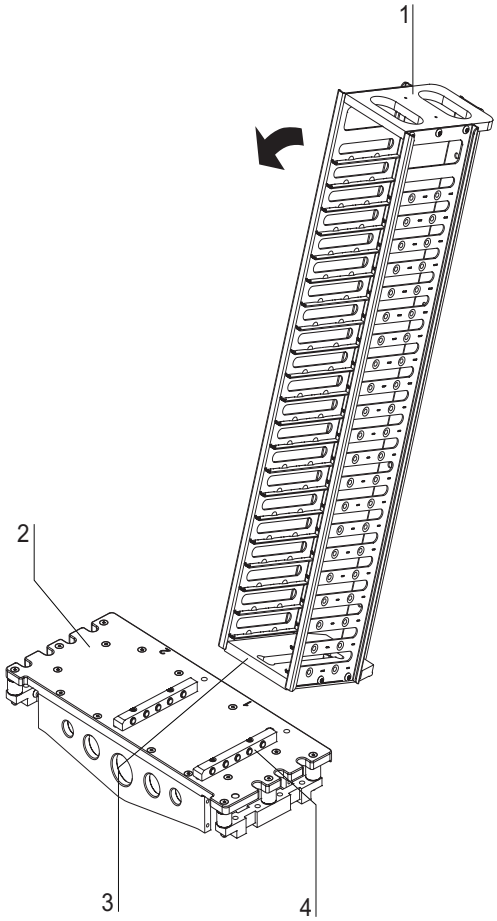


Fig. 18,
Stacker installation

5. Start-up

5.4 Transfer station installation / Direct transfer to on-site transport systems

Fig. 19: After the transfer station [1] has been adapted to the Plate Shuttle™ System (PSS) at the factory, it is removed for the transport from the mounting plate [7] at the backpanel of the device.

Transfer station installation:

1. Install the transfer station by installing the two screws [2] through the holes [3] into the threads [4] of the mounting plate [7].
2. Connect the plug [5] of the plate empty sensor connecting cable to the interface socket [6].

NOTE – Mounting plate

The position of the mounting plate has been adapted to the position of the Plate Shuttle™ Systems (PSS) in the chamber. The position and the settings at the mounting plate must remain unchanged.

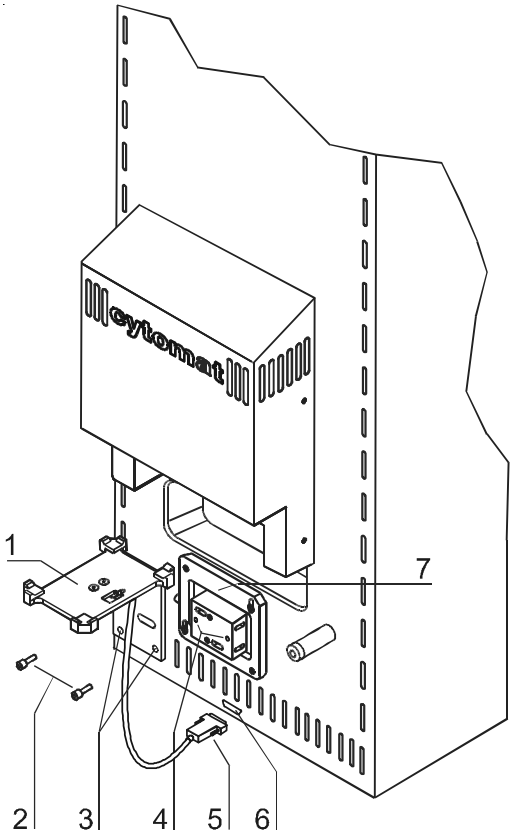


Fig. 19,
Transfer station installation

5. Start-up

5.5 Transfer station dimensions

Fig. 20: To protect the incubator against contamination, use a substructure even if the device is installed near the floor. The height of the substructure should not fall below 200 mm.
The minimum distance to adjacent surfaces above the device must be 200 mm.

NOTE – Extension width

The extension width of the handler shovel is the distance between the device backpanel and the center of the shovel when the shovel is fully extended. The extension width is 100 ± 5 mm and can be changed using the software.

Direct transfer to on-site transport systems:
If the microplates are to be transferred directly to an on-site transport system. the extended shovel must be aligned with this transport system by adjusting the device stands accordingly.

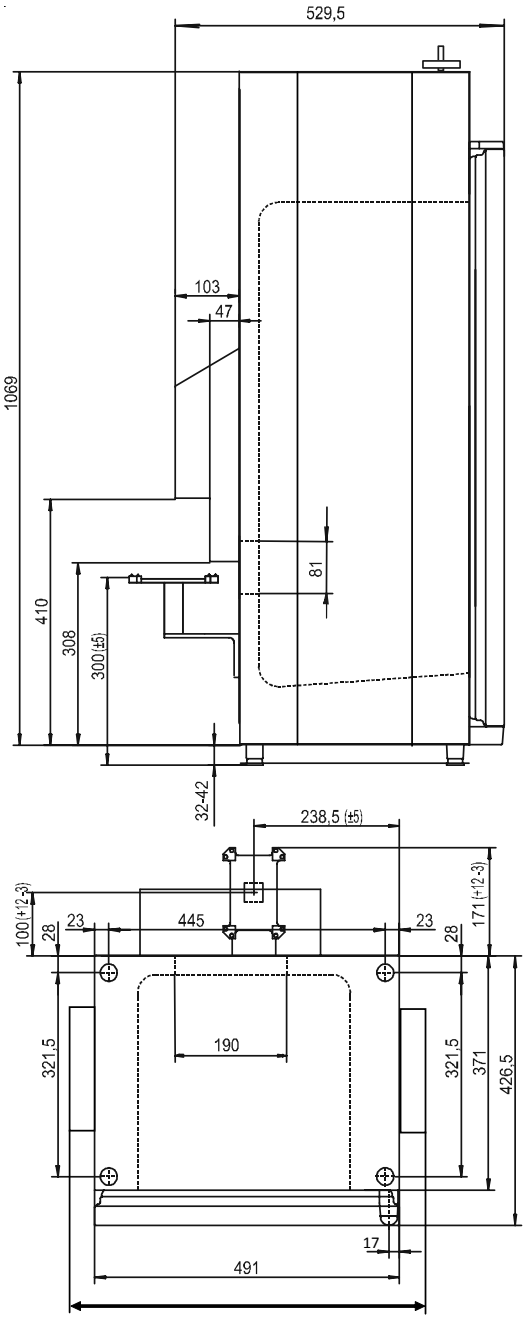


Fig. 20,
Transfer station dimensions, values in mm

5. Start-up

5.6 Power supply connection

WARNING - Electric shock!

Contact with current-carrying components may cause a lethal electric shock.
Before connecting the device to the power supply, check plug and connection line for damage.
Do not use damaged components for connecting the device to the power supply!
After the installation and before switching on the automatic incubator, make sure that the temperature of the device corresponds with the temperature in the operating room. This applies particularly if the packed device had been stored before at lower temperatures!

The device must be connected only to a correctly installed and grounded power supply source:
- Fusing: T 16 A
- Circuit breaker: G 16

Connection to the power supply system:
1. Before connecting the device to the power supply, check to see if the voltage of the power supply corresponds with the specifications on the nameplate at the front of the device below the glass door. If the ratings given for voltage (V) and current (A) are not correct, the device must not be connected to the power supply.
2. **Fig. 21:** Connect the connector for non-heating appliances [2] to the socket [3] of the device.
3. Connect the grounding plug [1] of the power supply cable to a properly grounded and fused socket.
4. Make sure the cables are not subjected to tensile or compressive force.

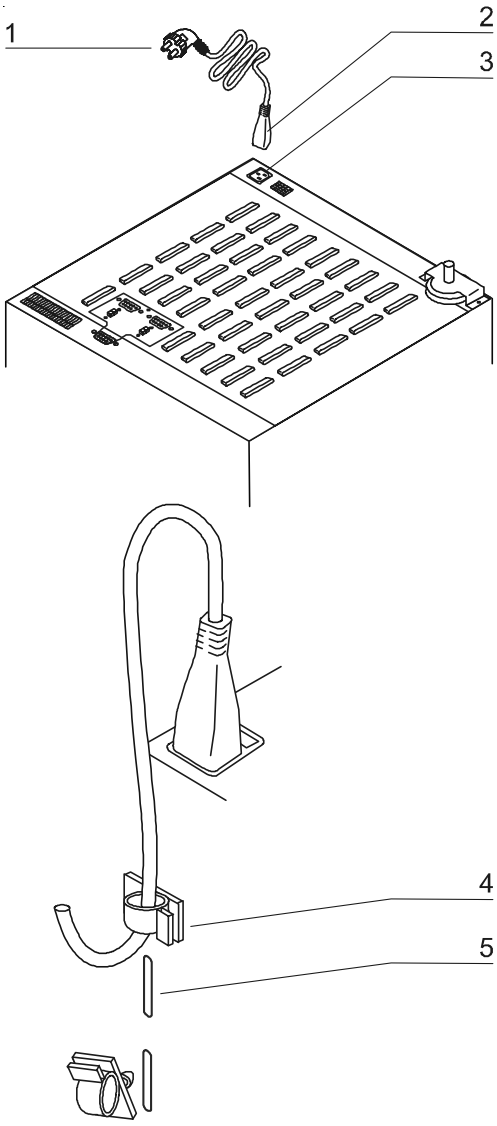


Fig. 21,
Power supply connection

5. Start-up

5.7 Connection to the CO_2 supply (optional)

For the CO_2 used, the following quality requirements apply:

- Purity 99.5 % min
- Medical gas quality

CAUTION - Overpressure!

The operating pressure of the CO_2 supplied to the device must not exceed 1 bar.
If the gas is supplied at a higher pressure, the valve integral to the device may not close correctly and the gas supply control may be impaired.
Set the gas supply to a range between 0.8 bar (min.) and 1.0 bar (max.) and make sure that this pressure setting cannot be changed!

The connection to the gas supply system is achieved by using the supplied flexible gas pressure hose.

1. **Fig. 22:** Slide the hose clamp [4] onto the gas pressure hose [1]. Connect the gas pressure hose [1] to the angular adapter [5].
2. Remove the protective cap [2] from the sleeve [3] of the sterile filter [7] and install the connector [6] to the sleeve using two hose clamps.
3. Install the angular adapter [5] into the connector [6]. Secure all hose connections using hose clamps.
4. Connect the gas pressure hose to the on-site gas supply system.

Gas consumption of the device at a CO_2 nominal value of 5 %:

- doors permanently closed: ~ 0.2 l/h
- per opening of automatic lift door, less than 30 s: 0.8 l
- for each opening of the service doors: ~ 4 l

The daily gas consumption (l/24h) with one opening of the service doors and one opening of the automatic lift door in 5 minute intervals (12 openings/h) can then be calculated as follows:

CO_2 = 24 h x 0.2 l/h + (24 x 12) x 0.8 l + 4 l
CO_2 = 4.8 l + 230 l + 4 l
CO_2 = ~ 240 l per day in continuous operation

This calculation applies only to application temperatures of 25° C to 35° C.

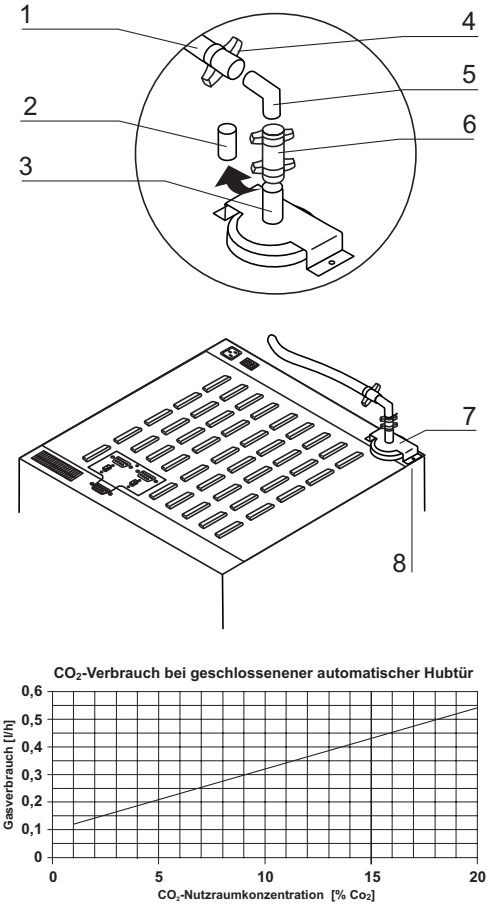


Fig. 22,
Gas supply hose connection

5. Start-up

5.8 RS 232 interface

The RS 232 interface has three connectors for data communication via separate logs according to the positions of the two slide switches.

The RS 232 interface for the incubator has been de signed for a cable connection with 9-way connectos and a contact assignment of 1:1; if can be used for the documentation of the incubatin parameters.

Connection of the device:
1. Turn PC or control system off.
2. Connect connector of the serial interface cable [1] (not com prised in the scope of delivery) to the receptacle [2] at the RS232 interface of the automatic incubator and secure it using the screws.
3. Connect interface cable to an unassigned slot COM 1/ COM 2 etc. at the PC.

Tranfer protocol:
The interface must be configured as follows: 9600 baud, 8 data bits, 1 stop bit, no parity.

Command sequences:
Data communiucation is achieved with a defined structure of command sequences (frames).

Frame structure:
<STX | command | data | BCC | ETX>

Command:
Bit 0-3 = data field length in byte
Bit 4-7 = command

Check sum:
BCC = 1 – complement
(command XOR data XOR … XOR data NXOR FF_H)

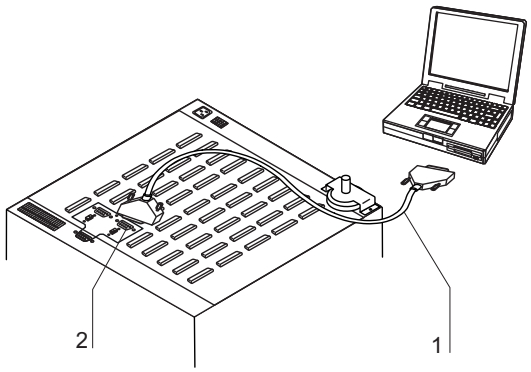


Fig. 23,
RS 232 interface for incubator

5. Start-up

Command list – Reading closed- loop data:
Command: 0110 0001 (61_H)
Data:
0001 0000 (10_H)
for temperature during incubation operation
0001 0001 (11_H) for CO_2

Device response for temperature and CO_2:
Data:
Nominal value x 10 (2 bytes, integer)
Nominal value (4 bytes, floating point number)
Internal use (5 bytes for CO_2 , otherwise 7 bytes)
(see example below)

Command list – Requesting failure codes:
Command: 1001 0000 (90_H)
Data: none

Response - Requesting failure codes:
The microprocessor returns a total of bytes (7 inte ger values). Each integer value represents an actual Failure code in the assigned control loop (0 = incubation temperature, 1 = CO_2 content, 6 = general).

The entry in index 6 belongs to a superior failure that is show simultaneously ijn all displays (e. g. failure code 99). The failure code for the incubation temperature is shown in the temperature display, the code for CO_2 is shown in the CO_2 display. Value 0 shows that there is no current failure.

Faulty response from control unit:
If a returned response incomplete or faulty, the CPU responds with an NAK (12_H, only 1 byte, without frame). Otherwise, the command code (with pertaining length information) and the data that may be required and transferred as a response.

Particularities during data communication:
For the data communication between PC and microcontroller, the following particularities must be observed: The microprocessor stores an int or unsigned int value with the sequence <Highbyte>, <Lowbyte> in the memory. For the PC, this sequence is reversed. The microcontroller transfers these values in its format, i. e. the PC must reverse the sequence of the bytes. For floats, there is no difference.

Example: Temperature data request and response

Request:
$02_H\ 61_H\ 10_H\ 8E_H\ 03_H$

Response:
$02_H\ \underline{6D_H}\ \underline{01_H}\ 72_H\ 38_H\ 91_H\ C7_H\ 41_H\ \underline{F5_H}\ \underline{6B_H}\ \underline{F4_H}\ \underline{43_H}\ \underline{9E_H}\ \underline{00_H}\ \underline{32_H}\ 4B_H\ 03_H$
integer *float* *intern*
(37.0) (24.946)

5. Start-up

5.8.1 Connection to the Plate Shuttle™ System (PSS) software

The RS 232 interface of the Plate Shuttle™ System (PSS) connects the automatic incubator to the internal control system of the integrator which may be a PC workstation for an individual installation or a server for an integrated network. The entire motion sequence of the Plate Shuttle™ System (PSS) for the automated loading and unloading of the stackers and for depositing or removing microplates, e.g. at the transfer station, is controlled by this external computer system.
After a power reset, the Plate Shuttle™ System (PSS) is initialized automatically. The system retracts the shovel to the end position, the stacker rotates sideways into the limit switch, then moves slowly down to the zero point limit switch for the vertical position. If the glass door is closed, the handler moves to a stand-by position in front of the automatic lift door after the initialization has been completed.
The Plate Shuttle™ System (PSS) is ready for operation.
If the glass door is opened during the initialization process, the handler moves to the stand-by position only after the glass door has been closed. If the automatic lift door was opened during the initialization process, it is closed after the completion of the initialization process; this may take up to one minute. After the initialization has been completed, the Plate Shuttle™ System (PSS) can be addressed by its RS 232 interface (see Plate Shuttle™ System (PSS) Software Control, ID No. 50113635).

NOTE – Test run

To complete the start-up, a test run must be performed to check if the Plate Shuttle™ System (PSS) can perform all the traveling motions exactly and without collisions.

NOTE – Holding position

If the device doors are opened during a running series of tests, the Plate Shuttle™ System (PSS) is stopped after the last command has been executed. In this holding position, neither the position of the handler nor the position of the loading shovel must be tampered with manually.

5. Start-up

5.8.2 Connection to the service software

The service software is used for adjusting the handler access in stacker 1 and stacker 2 and for adapting the handler to the transfer station or to the external transport system.
These adjustments are always neccessary after:
- the stacker configuration has been changed,
- the transfer station has been replaced,
- the connection of the Plate Shuttle™ System (PSS) to the external transport system has been changed.

NOTE – Software documentation

The operation of the Plate Shuttle™ System (PSS) software and of the service software is described in a separate software documentation and in service instructions.

5.8.3 Reading operating data

Additionally, the operating data of the incubator (temperature / CO_2 gassing) as well as the bar code reader data can be read via these interfaces.

5.8.4 Significance of the switch positions

Fig. 24:
I. Both switches (A and B) in left position:
- All logs are assigned to interface [1], Plate Shuttle™ System (PSS).

II. Switch A in right position, switch B in left position:
- The barcode reader data is assigned to interface [2],
- the connection to the software of the Plate Shuttle™ System (PSS) and the operating data of the incubator are assigned to interface [1].

III. Switch A in left position, switch B in right position:
- The operating data of the incubator is assigned to interface [3],
- the connection to the software of the Plate Shuttle™ System (PSS) and the barcode reader data are assigned to interface [1].

IV. Both switches (A and B) in right position:
- The connection to the software of the Plate Shuttle™ System (PSS) is assigned to interface [1],
- the barcode reader data is assigned to interface [2],
- the operating data of the incubator is assigned to interface [3].

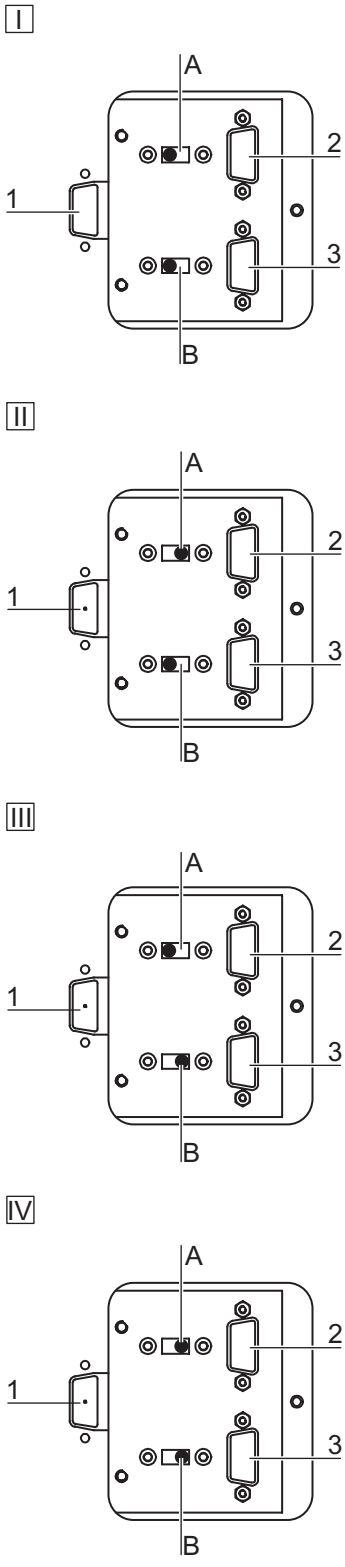


Fig 24,
Data log switch positions

5. Start-up

5.9 Alarm contact connection for incubator

NOTE - Expert work

Thermo Electron LED GmbH warrants the operational safety and the operability of the device only if installation and repairs are performed properly.
The connection of the device to an external alarm system must only be carried out by adequately trained and authorized expert electrical / telecommunication personnel!

Fig. 25: The connector [5] for the connecting cable is a standard component. The values for the operating voltage of the external circuits and the fusing of the alarm system are given in the table on the next page:

1. Connect the individual conductors [1] to [4] of the connecting cable as shown in the wiring diagram.
2. Connect the connector [5] of the alarm system connecting cable to the socket [6] of the supply connection.

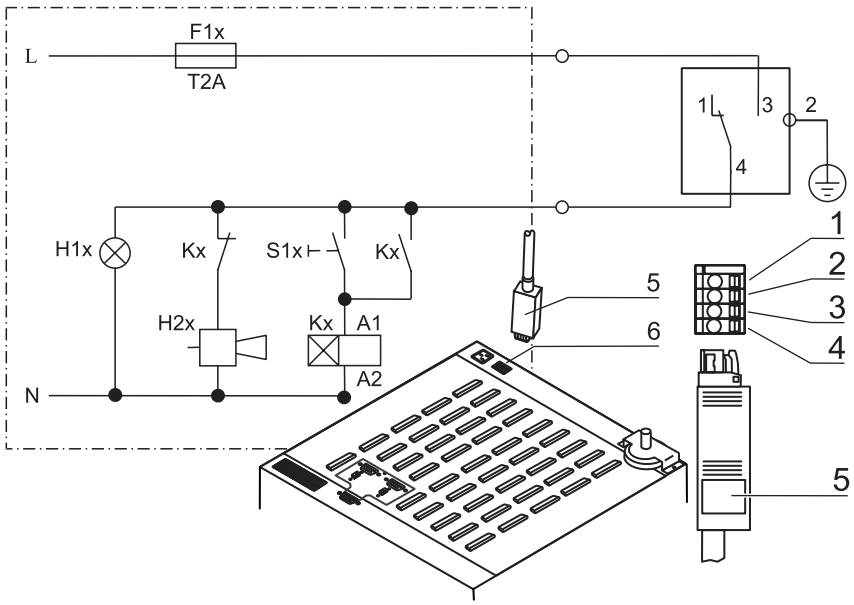


Fig. 25,
Example of a connection scheme for an external alarm system

5. Start-up

Circuit	Voltage	External fusing
Circuits with system voltage	250 V ~ max.	6 A max.
SELV circuits	25 V ~	2 A max.
(cf. VDE 0100, Part 410)	60 V =	1 A max.
SELV-E circuits	50 V ~	1 A max.
(cf. VDE 0100, Part 410)	120 V =	0.5 A max.

Cytomat® 2 alarm relais

Operating state	Contact 4 - 1	Contact 4 - 3
No failure, power off	X	0
No failure, power on	X	0
Failure	0	X
X: Contact closed / O: Contact open		

NOTE - Switching structure

For all failures reported by the device (sensor circuit open, deviation from the nominal value and door open for more than 10 minutes), the alarm relay switches over.

6. Handling and control

6.1 Power switch

To switch the device on:

Fig. 26:
The power switch of the automatic incubator is a key-operated switch, i.e. it can only be operated using the corresponding key.

To switch the device on:
Insert key [2] into key cylinder and rotate clockwise to position „**ON**"; the switch indicator [1] illuminates. For safety reasons, the key can be removed from the cylinder after the device has been turned on.

To switch the device off:
Rotate key [2] counterclockwise to position „**OFF**". The switch indicator goes off.

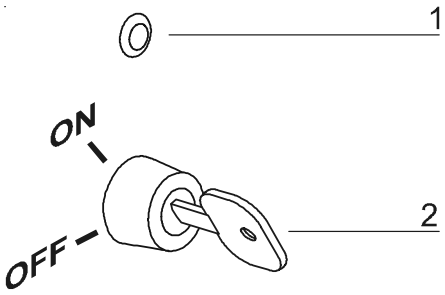


Fig. 26,
Switching the device on and off

6.2 Operating panel

Fig. 27:
The operating panel is divided into three functional areas:
- One display or two displays for the numeric values of temperature and CO_2 content (optional).
- Seven keys for selecting functions and for entering data.
- Six LEDs that show functions and operating states.

[1] Temperature display
[2] Heating LED
[3] Key for setting temperature nominal value
[4] Key for increasing value
[5] Key for requesting failure codes/silencing audible alarms
[6] Key for activating auto-start
[7] LED for indicating active auto-start
[8] LED for indicating open glass door
[9] LED for indicating activated thermal protection
[10] Key for starting cal function
[11] Key for decreasing value
[12] Key for setting CO_2 nominal value (optional)
[13] LED for gassing (optional)
[14] CO_2 display (optional)

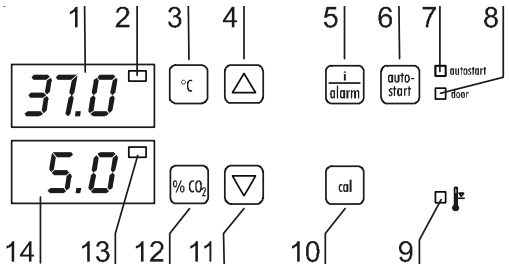


Fig. 27,
Operating panel

6. Handling and control

6.3 Control self-test

After the device has been turned on using the power switch, the control goes through a test routine.

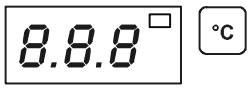
NOTE – Displays

For devices that are not equipped with CO_2 gas system (optional), the indicator at the display is disabled.

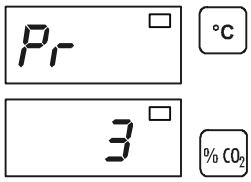
1. Turn device on

▶ Turn power switch to „ON“.

○ All operating panel indicators illuminate.

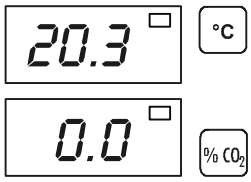


○ The software version is displayed at the temperature display and at the CO_2 display (optional).



2. Test routine ended

○ The temperature display shows the temperature actual value, the CO_2 display (optional) shows the CO_2 actual value.



NOTE – Factory presettings!

When the device is delivered, the following nominal values have been set:
- **Temperature: 37° C**
- **CO_2 content: 0.0 % (optional)**

6. Handling and control

6.4 Setting the temperature nominal value

1. Display nominal value

▶ Press [°C] key.

○ The current nominal value is displayed at the temperature display.

2. Enter nominal value
The nominal value can be inceased or decreased gradually. When the key is kept depressed, the UP-/DOWN function performs a quick browse; after approx 3 seconds, the browse speed increases even more.
To increase the nominal value:

▶ Press [°C] + [△] key

To reduce the nominal value:

▶ Press [°C] + [▽] key.

3. Accept and store nominal value

▶ Release the two keys.

○ The current **actual value** is displayed at the temperature display.

6.5 Setting the CO_2 nominal value

1. Display nominal value

▶ Press [% CO_2] key.

○ The current **actual value** is displayed at the CO_2 display.

2. Enter nominal value
The nominal value can be inceased or decreased gradually. When the key is kept depressed, the UP-/DOWN function performs a quick browse; after approx 3 seconds, the browse speed increases even more.
To increase the nominal value:

▶ Press [% CO_2] + [△] key.

To reduce the nominal value:

▶ Press [% CO_2] + [▽] key.

6. Handling and control

3. Accept and store nominal value

▶ Release the two keys.

○ The current **actual value** is displayed at the CO_2-Display.

6.6 Activating auto-start

The auto-start function is an automated routine for starting and adjusting the CO_2 measuring system. After the start, the device control unit adjusts the temperature to the nominal value; simultaneously, humidity is built up. When temperature and relative humidity have reached constant values, the CO_2 measuring system is automatically adjusted to these values, and the chamber is supplied with the preset quantity of CO_2.

NOTE – Application of the routine

To ensure that the specified accuracy of the CO_2 measuring system is maintained, the device should always be started using the auto-start routine after the nominal temperature setting has been changed by more than 1° C or after extended interruptions of the operation of the device. The auto-start routine should be run at least every three months on the occasion of cleaning and maintenance works.

Usually, the routine takes 5-8 hours. At low room temperatures and when the device is cold, it may take up to 10 hours.
If the glass door is opened or if the power supply of the device is interrupted while the routine is running, the routine is interrupted and rerun after the glass door has been closed or after the power supply has been reestablished.
The auto-start routine can be cancelled prematurely.
At the beginning of the auto-start routine, the chamber atmosphere must consist only of ambient air.

6. Handling and control

1. Open both doors until the audible alarm sounds after 30 seconds

- ○ All current **actual values** flash at the displays, the „door“ LED illuminates, after 30 seconds the audible alarm sounds.

2. Enter nominal value

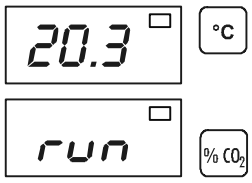
- ▶ Sections 6.4 – 6.5

3. Activate auto-start

- ▶ Press [auto-start] key for 5 seconds.
- ○ „auto-start“ LED flashes.

4. Close all device doors

- ○ The current value is shown at the temperature display „run“ is shown at the CO_2 display. The „door“ LED goes off.



5. Cancel auto-start

- ▶ Press [auto-start] key for 5 seconds.
- ○ Displays returns to normal operation (incubation operation).The „auto-start“ LED goes off. The device is ready for operation. The chamber is supplied with CO_2 (optional).

NOTE – Cancelling the routine

The auto-start routine can be cancelled prematurely.

6. Handling and control

6.7 Requesting failure codes

The automatic incubator is equipped with a failure diagnostic system. This system recognizes failures during the operation and allows the allocation of failure causes due to numeric codes. Failure recognition is indicated by an audible and visual alarm at the operating panel. The diagnostic system stores the last 10 failures in the sequence of their occurence. The failure chart can be requested and read. If the cause of a failure cannot be repaired, please provide the fault code and the serial number (nameplate) of the device available when contacting Technical Service.

NOTE – Response delay

To prevent short-time changes of the operating conditions from resulting in constant failure messages during the operation of the incubator, the diagnostic system has a response delay:

- **After changes of nominal values: max. 159 min**
- **After the glass door has been opened: for devices with nominal temperature of 37 ° C, max. 45 min**
- **Other failure causes: max. 1 min**

NOTE – Delay time reset

If the set nominal value is reached during the specified period, the delay time is reset to 1 min.

NOTE – Failure causes

Failure codes 101 and 102 must not necessarily be caused by a malfunction in the closed-loop circuit; they may also be caused by incorrectly entered values, if a nominal value entered is below the actual value.
When the temperature nominal value and/or the CO_2 nominal value is reduced, a failure message may be set due to the inertia of the atmosphere in the chamber. Therefore, the device doors should be opened for some time if the nominal values are reduced.

6. Handling and control

NOTE – Displays!

For devices that are not equipped with CO_2 gas system (optional), the indicator at the display is disabled.

1. The audible alarm sounds

○ The indicator for the faulty closed-loop circuit flashes.

2. Silence audible alarm

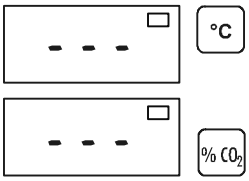
▶ Press any key.

○ The audible alarm goes off.

3. Request failure code

▶ Keep [i alarm] key depressed.

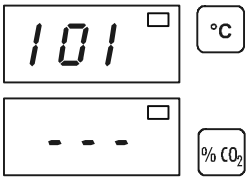
○ If no fault is registered, the display is blank.



4. Read failure code

▶ Press [i alarm] key.

○ Display of faulty closed-loop circuit (temperature display) shows failure code CO_2 display is blank (—).

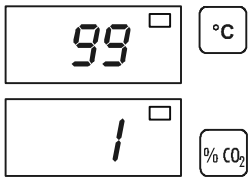


6. Handling and control

4. Select failure table

▶ Press i alarm + △ key.

○ The temperature display shows the failure codes of the failure registered last. The CO_2 display shows the rank within the stored failure table.



5. Exit failure table

▶ Release i alarm key.

○ The temperature display shows the actual value.The CO_2 display shows the actual value.

6. Erase failure table

▶ Press i alarm + cal key for 5 seconds.

○ The failure table is erased.

6. Handling and control

6.8 Failure code list

Code	Description	Cause	Repair
55	I^2C bus failure	Quality of measured values dropped below 50 %	Eliminate cause for interference, e.g. cellular phone
66	Deviation of temperature sensors	Plausibiliy of temperature signal not sure	Contact Technical Service
77	$C0_2$ cal range exceeded	Max. adjustment value exceeded	Contact Technical Service
88	Failure during auto-start	Total time elapsed or max. adjustment value exceeded	Repeat auto-start
99	Device doors open	Doors open for more than 10 minutes	Close device doors
100	Temperature below nominal value	Act. value < nom. value -2 °C (37 °C)	Contact Technical Service
		Act. value < nom. value -3 °C (50 °C)	
101	Temperature above nominal value	Actual value > nominal value +1 °C	Do not exceed permitted ambient temperature
104	Temperature sensor faulty	Sensor circuit open/shorted	Contact Technical Service
Failure codes for optional $C0_2$ closed-loop circuit			
200	$C0_2$ below nominal value	Actual value < nominal value -1 %	Check gas supply:
		• No $C0_2$	• Connect new gas cylinder
		• Prepressure low	• Raise prepressure to 1 bar
		• Supply line clogged	• Check supply line to device
201	$C0_2$ above nominal value	Actual value > nominal value +1 %	Check gas supply:
		• Prepressure high	• Reduce prepressure
204	$C0_2$ measuring cell faulty	Sensor circuit open/shorted	Contact Technical Service

6. Handling and control

6.9 Thermal protection reset (incubator)

1. „Thermal protection active“ LED flashes, audible alarm sounds.

2. Turn device off

- ▶ Rotate power switch to „OFF“.
- ▶ All indicators go off.

3. Turn device on again

- ▶ Rotate power switch to „ON“.
- ▶ All indicators at the operating panel illuminate.

NOTE – Thermal protection

When the cause of the failure (e.g. excessive temperature in the operating room) has been repaired, the device is set to normal incubation operation after it has been turned on again. If the cause of the failure cannot be repaired with simple measures (e.g. by ventilating the room or by reducing the temperature in the operating room), the thermal protection will respond again immediately; in this case, contact Technical Service. The thermal protection function responds only at temperatures above the temperature in the operating room.

7. Operation

7.1 Preparing the device

The device must only be released for operation after all major measures for the start-up, particularly decontamination and test run, have been taken (Section 5.1–5.9).

NOTE – Hygiene regulations

Prior to any operation, the user must clean and disinfect the chamber in accordance with the hygiene regulations set forth by the operator to protect the cultures.
The „Principles of good microbiological proceedings“ at the end of these instructions is to be used as safety information for personnel operating the device.

Before starting operation, the following device components must be checked for their correct function:

- The gas hose and the connector must be connected tightly to the angular adapter and to the sterile filter and secured with the hose clamps.
- Depending on the operating temperature, the floorpan must be filled with processed water.

NOTE – Water reservoir

The floorpan of the chamber can hold up to 0.8 litres of processed water. For the running operation, always keep a sufficient quantity of processed water of the following quality available:
- **destilled, sterile or**
- **demineralized, autoclaved**

Check water level on a daily basis and refill water as required. We recommend to refill the waterreservoir at 500 ml residal water volume.

- The pressure compensation opening must be permeable, its insert must be installed to the pipe from outside.
- The glass door measurment opening must be capped.
- Make sure that the counterweight cable is connected to the handler.
- The components of the Plate Shuttle™ System (PSS) and the on-site transport system must be adapted to each other, the traveling motions must be synchronized without risk of collisions.

7. Operation

7.2 Starting operation

Starting and loading the device:

NOTE – Devices without CO_2 supply

For starting devices without CO_2 supply, ignore the operating steps for CO_2 adjustment.

1. Switch on thermostat and Automatic Incubator and set incubator to the required operating temperaure. The thermostat temperature is set to the required inflow temperature using the interface.
2. Ventilate chamber by leaving both device doors open until audible alarm sounds.
3. Fill the floorpan with up to 0,8 litres of processed water. Do not exceed the top level mark. The water low alarm indicator goes off.
4. Make sure that the CO_2 supply system valve is open.
5. Set nominal values for temperature and CO_2 content at the operating panel.
6. Start device using auto-start routine.
7. Close device doors.
8. The Plate Shuttle™ System (PSS) is initialized, the handler moves to the stand-by position in front of the automatic lift door.
9. The temperature control adjusts the temperature to the set nominal value, humidity rises.
10. When temperature and relative humidity are constant, the ideal loading state is achieved. For devices with optional CO_2 supply, the CO_2 measuring system is adjusted automatically.
11. The „auto-start“ indicator goes off.
12. The CO_2 control supplies the set amount of CO_2.
13. The device is ready to be loaded.

NOTE – Duration of the auto-start routine

When the device is cold and when the ambient temperature is low, the auto-start routine or the adjustment of the CO_2 measuring system may take up to 8 hours.

HINWEIS – Change the nominal temperature

For the examination of the measuring accuracy of the internal equipment temperature sensor, a temperature alignment must be accomplished with each change of the operating temperature.

8. Shut-down

8.1 Shutting the device down

CAUTION! – Contamination hazard!

If the chamber surfaces are contaminated, germs my be transferred to the environment of the device.
In case of a shut-down, the device must be decontaminated!

1. Unload stacker completely. Make sure that all microplates have been removed from the chamber.
2. Switch incubator off, disconnect power plug and protect it from accidental reconnection.
3. Close CO_2 supply system lock valve.
4. Disconnect gas pressure hose from filter sleeve at top of device.
5. Drain water completely from floorpan (see Section 9).
6. Remove stacker and Plate Shuttle™ System (PSS).
7. Clean and disinfect device.
8. Install Plate Shuttle System™ (PSS) and connect power plug to socket in operating room.

NOTE – Ventilation

To ensure that the chamber is permanently ventilated during the shut-down period of the device, open the glass door and the outer door and secure them in this position.

9. Cleaning and disinfection

9.1 Preparations

The operator must prepare hygiene regulations for the decontamination of the device in relation to the application of the device.
Shut the automatic incubator down before starting with the cleaning and disinfection procedure (see chapter 8.1).

WARNING - Suffocation hazard!

Large amounts of CO_2 released into the room atmosphere may cause suffocation. Prior to cleaning and disinfection work, disconnect the device from the gas supply. Close CO_2 supply system shut-off valve.

WARNING - Electric shock!

Contact with current-carrying components may cause a lethal electric shock.
Prior to cleaning and disinfection work, disconnect the device from the power supply!

- **Turn the device off using the power switch.**
- **Unplug power connector and protect it against accidental reconnection.**
- **Check to see if the device is deenergized.**

CAUTION! – Health hazard!

The surfaces of the chamber may be contaminated. Contact with contaminated cleaning liquids may cause infections. Disinfectants may contain harmful substances.
When cleaning and disinfecting, always observe the safety instructions and hygiene regulations!

- **Wear safety gloves.**
- **Wear safety goggles.**
- **Wear mouth and respiratory system protection gear to protect the mucous membranes.**
- **Observe the safety instructions of the manufacturer of the disinfectant and of the hygiene experts.**

9. Cleaning and disinfection

The Plate Shuttle™ System (PSS) should be cleaned and disinfected separately after it has been removed from the device. This decontamination process requires a working surface that is suited for the treatment of these components with cleaning agents and disinfectants.
To prepare the cleaning and disinfection, proceed as follows:

- Unload both stackers completely.
- Remove stackers and Plate Shuttle™ System (PSS) (see Section 6: Start-up).

NOTE – Support rails!

Do not remove the support rails of the Plate Shuttle™ System (PSS) as otherwise the Plate Shuttle™ System (PSS) cannot be positioned correctly in the chamber!

- If required, remove the protective grid and the blower wheel from the measuring cell baseplate.
- Drain water completely from the floorpan.

The blower wheel and its cover can be removed and autoclaved for disinfection.

Blower wheel removal:

1. **Fig. 28:** Remove the two retaining screws [1] of the cover using the supplied Allen wrench (3 mm) and remove the cover.
2. The blower wheel [3] is secured to the axle by a set screw [2]. Remove set screw using the Allen wrench (2 mm) and pull blower wheel off.

NOTE – Functional test

After the installation, check to see if the blower wheel is securely attached to the axle and if it can rotate freely, then secure the cover using the screws.

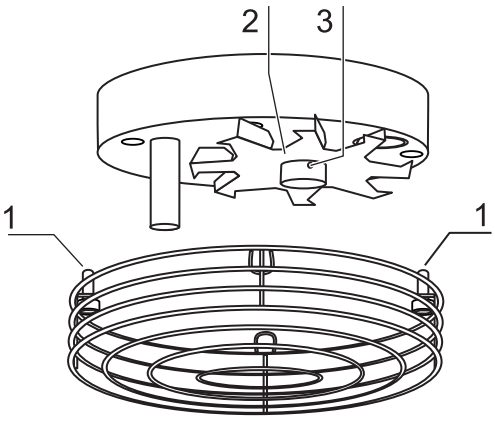


Fig. 28,
Blower wheel/cover removal

9. Cleaning and disinfection

9.2 Cleaning

The cleaning of the chamber and of the Plate Shuttle™ System (PSS) components is usually performed prior to a disinfection.
If cleaning is to be the only means of decontamination, the components must be lubricated after drying as described in Section 10.4.

CAUTION – Harmful liquids!

Some device components are made of plastic. Solvents may dissolve plastics. Powerful acids or lyes may cause embrittlement of the plastics. For cleaning the plastic components and surfaces, do not use hydrocarbon-containing solvents, cleaning agents with an alcohol content of more than 10 % or powerful acids and lyes!
The sensors of the transfer station and of the handler must not be allowed to come in contact with alcohol!

NOTE – Delicate electronic components

Do not allow liquid to enter the receptacle of the Plate Shuttle™ System (PSS) and the measuring cell sensor opening as otherwise the device control system may be damaged by resulting creepage currents.
Make sure that the receptacle of the Plate Shuttle™ Systems (PSS) is sealed with a cap when the plug is removed.

Cleaning the chamber, the Plate Shuttle™ Systems (PSS) and the stackers prior to disinfection:

1. Wipe chamber surfaces clean using a solution of lukewarm water and conventional dishwashing agent or a special cleaner (e.g. Liquinox). A solution of lukewarm water and dishwashing agent is also suited for removing stubborn deposits.
2. Rinse the cleaned surfaces with autoclaved water (3 to 5 cycles) to ensure that cleaning agent residues are removed completely.
3. Wipe the surfaces dry using a soft, sterile cloth.

9. Cleaning and disinfection

Cleaning the device exterior surfaces:

1. Wipe the outer surfaces clean using a solution of lukewarm water and conventional dishwashing agent.
2. Wipe the outer surfaces thoroughly dry.

Recommended cleaning agents:

Liquinox or conventional dishwashing agents based on soap suds.

9. Cleaning and disinfection

9.3 Disinfection

The basic decontamination procedure is the wipe/spray disinfection. Use this procedure to decontaminate the exterior surfaces of the device and all components of the Plate Shuttle™ System (PSS).

NOTE – Sterilization in the autoclave

The measuring cell blower wheel and its cover and only full-metal stackers can be autoclaved.

CAUTION – Alcoholic disinfectants!

Disinfectants with an alcohol content of more than 10 % may form, in combination with air, easily ignitible and explosive gas mixtures. When using such disinfectants, avoid open flames or exposure to excessive heat during the entire disinfection process!

- **Use such disinfectants only in adequately ventilated rooms.**
- **After the disinfectant has been allowed to react, wipe the cleaned device components thoroughly dry.**
- **Do not operate the device before it has dried completely.**
- **Observe safety regulations to avoid fire and/ or explosion hazard caused by alcohol-containing disinfectants.**

CAUTION – Aldehyde-/chloride-containing disinfectants

Aldehyde- and chloride-containing disinfectants may corrode noble metals.
Use only disinfectants that are neutral towards noble metals!

9. Cleaning and disinfection

Disinfecting the chamber, the Plate Shuttle™ System (PSS) and the stackers:

1. Wipe surfaces clean using disinfectant or spray disinfectant onto surfaces.
2. Allow disinfectant to react as recommended by manufacturer.
3. Rinse cleaned surfaces thoroughly with autoclaved water (3 to 5 cycles). Wipe the components of the Plate Shuttle™ Systems (PSS) clean using a sterile cloth moistened with autoclaved water. All disinfectant residues must be removed completely by rinsing.
4. Wipe surfaces dry using a sterile cloth.

Recommended disinfectant:

A surface disinfectant recommended by Thermo Electron LED GmbH can be ordered under following part numbers:

• Spray bottle, 250 ml Part No.: 50052425
• Refill bottle, 500 ml Part No.: 50051939

NOTE – Description disinfectant

Details for efficiency and approvals are available on request.

Rinsing agents:

Distilled, preferably autoclaved water, not demineralized. Isopropanol p. a. (solution of 70 % alcohol).

Auxiliaries:

Lint-free, sterile cloths or sheets.

9. Cleaning and disinfection

9.4 Lubrication

After each cleaning and disinfection, the moving components of the lift system must be lubricated using special grease.

NOTE – Lubrication of components!

Apply grease to clean cloth and apply sparesly (thin film) to the following lift system components:

- **Linear rail [2] below the shovel**
- **Counterweight guide rods [4] at the lift system**
- **Plastic gear [1] and pertaining aluminum toothed rack [3] of the handler**
- **Plastic gear [5] and pertaining aluminum toothed rack [6] of the lift system**
- **Spindle [7] for the horizontal drive of the lift system.**

Lubricant:
Kluebersynth UH 1 14 31 special grease is a special lubricant for sliding components.
Kluebersynth contains only substances that are in accordance with the purity requirements of FDA and is approved by USDA-H1 (United States Department of Agriculture). Part No.: 50 056 899 (maintenance set)

Auxiliaries:
Lint-free, sterile cloths or sheets.

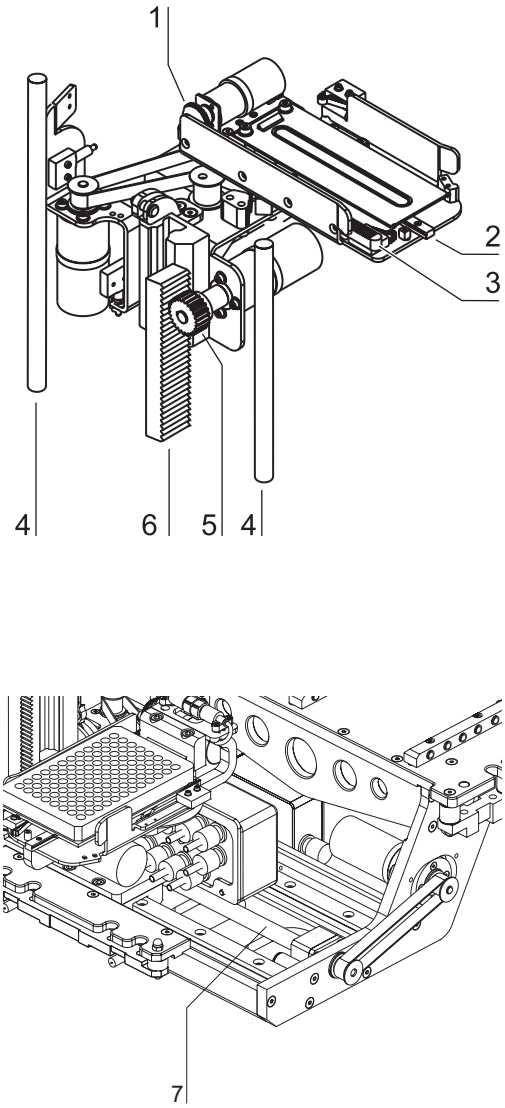


Fig. 29,
Component lubrication

10. Maintenance

10.1 Inspections and checks

To ensure the operativeness and the operational safety of the device, the functions and device components listed below must be checked at different intervals.

For the inspections and checks the appropriate personal protective equipment should be used.

Daily check:
- Water level in the chamber floorpan
- Gas supply of the CO_2 supply system.

Annual inspection:
- Tightness of the glass door seal.
- Automatic lift door seal.
- Permeability of the pressure compensation opening insert.
- Functional check of the operating panel and of the device control system.
- Belts tensions at Plate Shuttle™ System (PSS).
- Electrical safety check in accordance with the relevant national regulations (e.g. BGV A 2).
- Check the stability of the incubator.
- Check the existing and functionality of the safety devices.
- Check the presence and readability of all indicating labels on the incubator.

NOTE – Functional test

If safety devices were removed or disabled for inspections, the device must not be operated before the safety devices have been reinstalled and checked for their correct function.

10. Maintenance

10.2 Service intervals

During running operation, the following service works must be performed:

3-month service:
- Run auto-start routine.
- Perform CO_2 comparison measurement.
- Clean Plate Shuttle™ System (PSS) components.
- Check belt to handler and replace as required.
- Check belt of the horizontal drive system and replace as required.

Annual service:
- Replace sterile filter.
- Perform temperature comparison measurement.
- Replace electronic module air cleaner.

10 year service:
- Check the complete cytomat by trained and authorized expert personnel (e.g. Thermo service).

NOTE – Service contract

Thermo Electron LED GmbH offer a device-specific service contract that comprises all test and service works required.

10. Maintenance

10.3 Preparing temperature calibration

To determine the exact measured value of the device-internal temperature sensor, a temperature comparison measurement has to be performed on an annual basis.
If a temperature deviation of more than ± 0.1° C is found during this check, a temperature calibration is required.
During this process, the temperature control of the device is set to the value measured during the temperature comparison measurement.
Use a calibrated measuring instrument with an accuracy of ≤ ± 0.1° C for this test. To minimize temporary temperature fluctuations during the measurement, the measuring instrument is placed into the chamber in an isothermal container (e.g. a bowl filled with glycerol). The baseplate of the Plate Shuttle™ System (PSS) is the reference location for the comparison measurement.

NOTE – Isothermal container

Do not use a container filled with water as an isothermal container as the evaporation of water will result in a lower temperature reading.

Comparison measurement procedure:
Fig. 30:
1. Switch automatic incubator and thermostat on using power switch.
2. Set temperature nominal value and allow device to be heated. This may take up to several hours.
3. Place measuring instrument [2] centrally onto the baseplate of the Plate Shuttle™ System (PSS). Alternatively, a temperature sensor may be positioned in this location. Route the connecting line through the measurement opening [1] in the glass door.
4. Close doors.
5. Wait until the temperature value displayed at the measuring instrument has stabilized and read this value as reference value approx 2 hours after this stationary state has been established.
6. Calibrate temperature control as described in table 10.4.

Measurement example:
- Temperature nominal value: 37° C
- Comparison temperature: 36.4° C

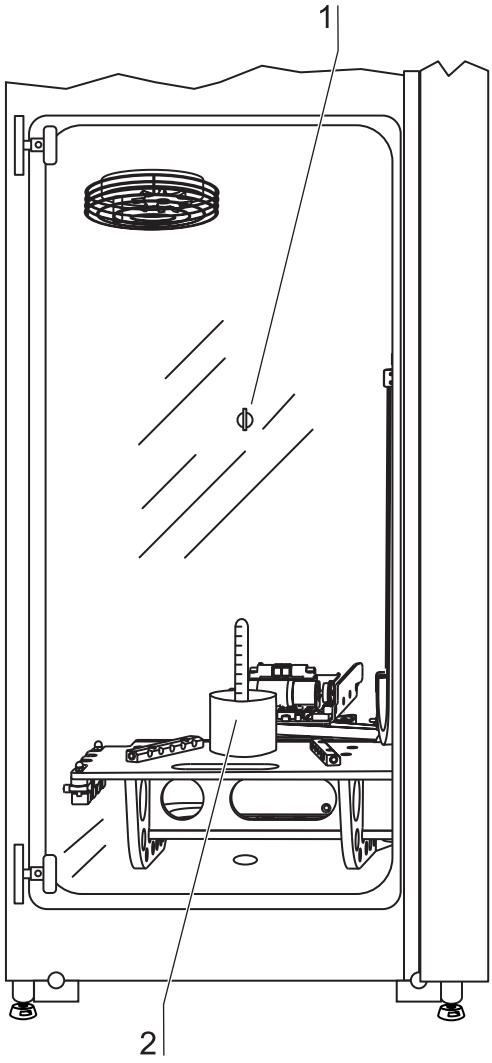


Fig. 30,
Temperature calibration

10. Maintenance

10.4 Temperature calibration procedure

1. Activate calibration

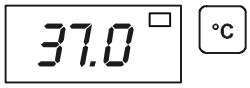
▶ Press [cal] for 5 seconds.

○ All operating panel indicators flash.

2. Display nominal value

▶ Press [°C] key.

○ Preset value: 37° C



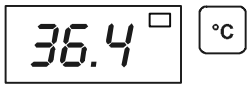
3. Enter measured value (destination value)

▶ Press [°C] + [△] key

or

▶ Press [°C] + [▽] key.

○ Destination value e.g. 36.4° C

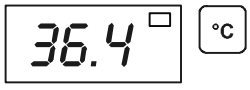


4. Accept destination value

▶ Press [cal] key.

○ The temperature display momentarily shows „CAL“,

then the corrected actual value (measured destination value 36.4° C) is displayed.



10. Maintenance

5. Cancel calibration

▶ Press any key.

○ The temperature display and the CO_2 display show the actual values.

NOTE – Excessive chamber temperature after temperature calibration

Excessive chamber temperature after the temperature calibration may be compensated by opening the doors for approx 30 seconds.

10.5 CO_2 calibration (optional)

To check the exact measured value of the device-internal CO_2 sensor, a CO_2 comparison measurement has to be performed every three months.
If a deviation above ± 0.5 % is found during this check, a CO_2 calibration is required.
During this process, the CO_2 control of the device is set to the value measured during the comparison measurement.
Use a calibrated measuring instrument with an accuracy of ≤ ± 0.5 % CO_2 for this test. Suitable instrument:
- Portable IR readout instrument.

The measuring sample is withdrawn through the sealable measurement opening of the glass door. The comparison measurement must be performed with the heated device during the operation or after an auto-start routine has been run.

Comparison measurement procedure:
Fig. 31:
1. Switch thermostat and automatic incubator on using power switch.
2. Run auto-start routine. Allow humidity to build up. This process may take several hours. Enter CO_2 nominal value and supply automatic incubator with gas.
3. Approx 2 hours after the stationary state has been established, route IR readout instrument through measurement opening [1] into chamber. Wait until the CO_2 value displayed by the instrument has stabilized and read this value to be used as reference value.
4. Remove measuring probe, plug measurement opening and close doors.
5. Calibrate CO_2 control as described in section 10.6.

Measurement example:
- Displayed CO_2 nominal value: 5.0 %
- Measured value: 5.6 %

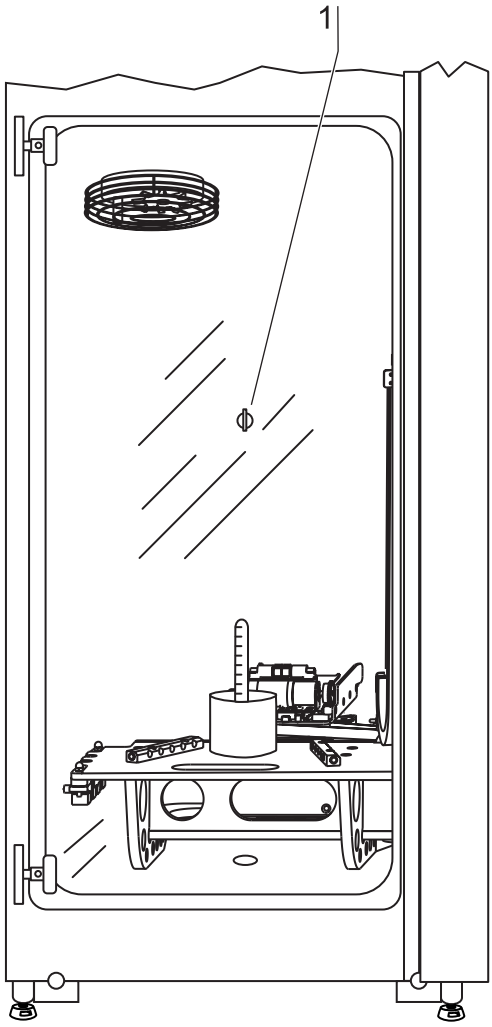


Fig. 31,
CO_2 calibration

10. Maintenance

10.6 Optional CO_2 calibration procedure

1. Activate calibration

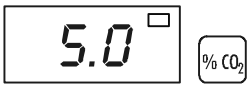
▶ Press [cal] key for 5 s.

○ All operating panel indicators flash.

2. Display nominal value

▶ Press [% CO_2] key.

○ Set nominal value: 5 %



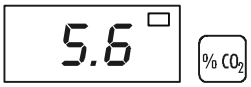
3. Enter measured value (destination value)

▶ Press [% CO_2] + [△] key

or

▶ Press [% CO_2] + [▽] key.

○ Destination value: e.g. 5.6 %

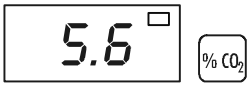


4. Accept destination value

▶ Press [cal] key.

○ The CO_2 display momentarily shows „CAL“,

then the corrected actual value (measured destination value 5.6 %) is displayed.



10. Maintenance

5. Cancel calibration

▶ Press any key.

○ The temperature display and the CO_2 display show the actual values.

NOTE – Excessive CO_2 content after CO_2 calibration

Excessive CO_2 content after the temperature calibration may be compensated by opening the doors for approx 30 seconds.

10.7 Sterile filter replacement

Fig. 32: The sterile filter has a plastic thread and is screwed by hand into the threaded hole of the valve block.

1. Make sure that the gas supply has been closed.
2. Remove connector [1] from sterile filter sleeve [4].
3. Remove two retaining screws [3] and remove retainer [2].
4. Unscrew sterile filter from threaded hole [5] in valve block.
5. When installing the new sterile filter, make sure that the plastic thread is not canted. Install filter using caution.
6. Install retainer [2].
7. Connect gas hose connector to filter sleeve and secure hose using hose clamp. Check to see if the hose is tight on the sleeve.

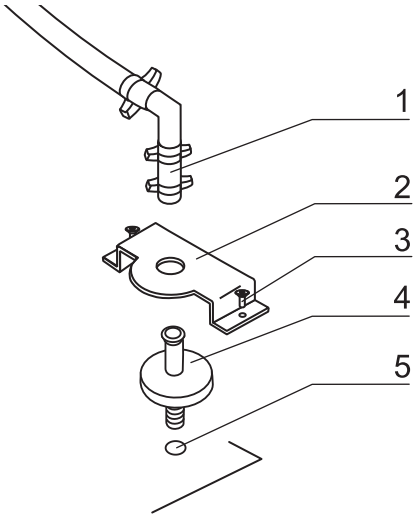


Fig. 32,
Sterile filter replacement

10.8 Replacing the door seal

Fig. 33: The door seal (magnetic seal) of the outer door is located in the retaining slot. No tools are required to replace the seal.

1. Pull the magnetic seal [3] out of the guide slot [2].
2. Position the new seal at a corner [1] and press the seal retaining rail [4] into the slot.
3. Make sure that the retaining rail taper is positioned correctly in the slot [2] and that the seal is flush with the door frame.

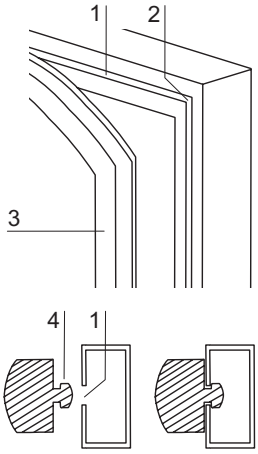


Fig. 33,
Replacing the door seal

10.9 Electronic module air cleaner replacement

Fig. 34: The air cleaner is installed loosely in the filter bezel which is attached to the robot side of the device.

1. Pry off filter bezel [3] using a screwdriver and remove bezel.
2. Remove filter mesh [2] and insert new filter mat into filter bezel.
3. Install filter bezel to filter opening [1].

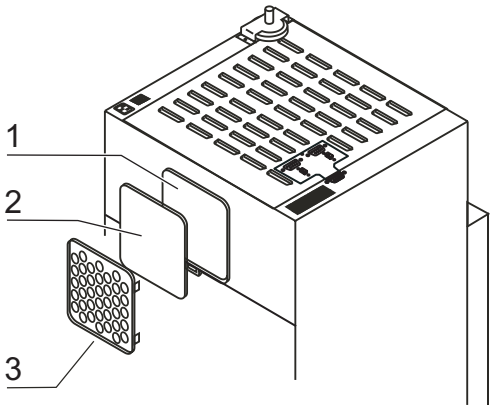


Fig. 34,
Air cleaner replacement

10. Maintenance

10.10 Device fuse replacement

Fig. 35: The two identical device fuses [3] are installed in the fuse compartment [4] next to the power supply cable socket of the device. The fusage ratings are given at the device nameplate.

1. The fuse holder is secured to the fuse compartment [4] using two locking tabs [1].
2. To remove the fuse holder, squeeze the two locking tabs and pull holder [2] out of fuse compartment.
3. Remove faulty fuse from holder and install new fuse.
4. Slide fuse holder into fuse compartment and press holder on until locking tabs are fully engaged.

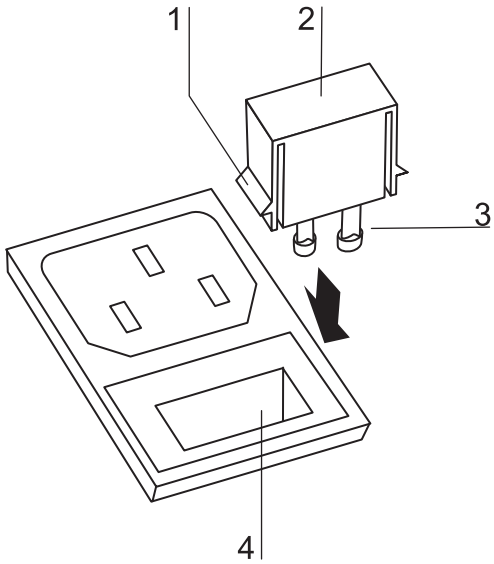


Fig. 35,
Device fuse replacement

11. Disposal

11.1 Disposal procedure

Discarded devices or worn device components contain reusable materials. All device components can be discarded properly after they have been decontaminated properly.

CAUTION – Contamination hazard!

As the device can be used for preparing and pro-cessing infectious substances, it may become contaminated.
Before device components are discarded, they must be decontaminated!

- **The device components must be cleaned thoroughly; after the cleaning, they must be disinfected or sterilized, as required by the application.**
- **Discarded devices or device components must be provided with an appropriate certificate showing the decontamination measures performed.**

Recyclable materials

Component	Material
Thermal insulation components	Polystyrene foam EPS/PPS compound
Printed circuit boards	Enclosed electrical components coated with various plastics, equipped on epoxy resin-bound boards.
Plastic components, general	Note material labelling
Exterior housing	Steel sheet, painted
Device rear panel	Steel sheet
Outer door	Steel sheet, painted
Outer door magnetic seal	EMPP-enclosed magnetic core
Door inner panel	Steel sheet, painted
Operating panel and indicator foil	Polyethylene
Glass screen	Soda-silicate glass
Glass door seal, Septum	Tempered silicone
Automatic lift door seal	Tempered silicone
Heatings	Silicone-sheathed resistance-type wires
Interior container	Stainless steel
Measuring cell baseplate	Stainless steel
Measuring cell blower wheel	Stainless steel
Measuring cell cover	Stainless steel

11. Disposal

Component	Material
Plate Shuttle™ System PSS	Aluminum (anodized), stainless steel, various plastic components
Stackers	Aluminum (anodized), stainless steel
Cables	Plastic-sheathed copper flexible
Packaging	Corrugated board, polyethylene film
Gas hose	Polyvinyl chloride (PVC), cloth-reinforced

12. Spare parts and accessories

12.1 List of spare parts and accessories

NOTE – Repairs!

Use only original spare parts that have been tested and approved by Thermo Electron LED GmbH. The use of other spare parts presents potential hazards and will make the warranty void.

Description	Type	Part No.
Operating instructions	*Cytomat® 2 C Lin*	50114970
Plate Shuttle™ System PSS software-documentation	*Cytomat® 2 C Lin*	50113635
Plate Shuttle™ System assy.	*PSS Cytomat® 2 C Lin*	50112748
Automatic lift door assy.	*Cytomat® 2 C*	50070746
Automatic lift door cover	*Cytomat® 2 C*	50066161
Device stand	heigt-adjustable	50049939
Blower wheel	stainless steel	50073826
Outer door magnetic seal	778 x 858	50061913
Glass door silicone seal	*Cytomat® 2 C*	50048705
Glass door	Complete	50061920
Device fuse 230 V	T 6.3 A (set of 2)	3002641
Device fuse 100/120 V	T 10 A (set of 2)	3700900
Power supply cable	EU	50043143
Power supply cable	GB	50047100
Power supply cable	CH	50047099
Power supply cable	USA	50043145
Power supply cable	I	50047101
Hose set for CO_2 gas connection		50062701
Sterile filter, gas inlet	with thread	50050737
Surface disinfectant, 500 ml, refill bottle		50051939
Surface disinfectant, 250 ml, refill bottle		50052425

12. Spare parts and accessories

Available Stackers:

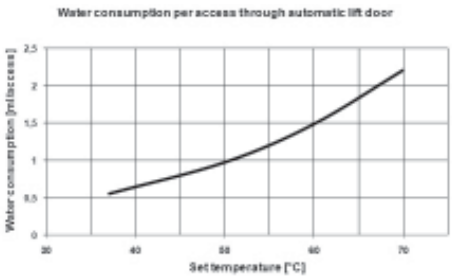
Pitch	Microtest plate type	Capacity / Stacker	Part No.:
17 mm	Well plates	28 microtest plates	50081736
23 mm	Well plates	21 microtest plates	50082829
28 mm	Well plates	17 microtest plates	50083259
29 mm	Well plates	16 microtest plates	50083263
33 mm	Well plates	15 microtest plates	50083260
50 mm	Deep-Well plates	10 microtest plates	50083261
69 mm	Deep-Well plates	7 microtest plates	50083262

13. Technical data

Description	Unit	Value
Mechanical		
Exterior dimensions (without transfer station) (W x H x D)	mm	491 x 1101 x 529,5
Interior dimensions (W x H x D)	mm	340 x 740 x 340
Chamber volume	l	85
Number of stackers (standard delivery)	Piece	2
Max. individual sample weight, incl. microtest plates	gr	300
Max. total load per stacker	kg	8
Plate Shuttle™ System PSS max. total load	kg	18
Weight , incl. Plate Shuttle™ System PSS	kg	80 (net weight)
Packaging exterior dimensions (W x H x D)	mm	720 x 1320 x 765
Device weight in packaging	kg	100
Thermal		
Ambient temperature range (T_A)	°C	+18°C to +28 °C
Temperature control range	°C	T_A + 8°C…50° C
Temporal temperature deviation, (DIN 12880, Part 2)	°C	± 0.1
Local temperature deviation, (DIN 12880, Part 2), measured in loaded 96 well microplates	°C	at 37 °C < ± 0.5
Temperature recovery time, automatic lift door open for 10 s	min	at 37 °C < 5
Heat dissipation to environment: at 37 °C, automatic lift door permanently closed	KWh/h	90
Cool-down time, with auto-start, to 37 °C Ambient temperature 20 °C	h	< 8
Humidity		
Constant humidity	% rH	at 37 °C > 95
Humidity in constant access, automatic lift door open for 10 s	% rH	at 37 °C > 93
Water quality		destilled and autoclaved
Capacity, incubation operation	l	0.8 max.
Water consumption	ml/access	At 37 °C ~ 0,6

Water consumption per access through automatic lift door (opening of the service door is not considered)

- How to calculate maximum number of accesses: Maximum number of accesses = 800 ml / water consumption per access (see diagram)
- Recomendation: Refill the waterreservoir at 500 ml residal water volume.



13. Technical data

Description	Unit	Data
CO_2 gas supply system		
Gas purity	%	99.5 min. or medical quality
Prepressure	bar	0.8–1.0
Measuring and control range	Vol - %	0... 20
Control deviation, temporal	Vol - %	± 0.1
Recovery time, at 5 % CO_2 in constant access (to 98 % of initial value)	min	< 1
Accuracy after auto-start routine	% CO_2	± 0.5
Measuring system drift	% CO_2/month	± 0.2 (± 0.5 max.)
Electrical system		
Mains voltage / frequency (EU)	V	I/PE AC, 230 V / 50 Hz
Mains voltage / frequency (USA,CAN)	V	I/PE AC, 120 V / 60 Hz
Mains voltage / frequency (JP)	V	I/PE AC, 100 V / 50/60 Hz
Rated voltage	V	I/PE AC, 230 V
Rated frequency	Hz	50/60
Interference suppression		Interference level N
Type of protection for entire device (DIN 40 050)		IP 20
Protection class		I
Overvoltage category (IEC 1010, EN 61010)		II
Pollution severity (IEC 1010, EN 61010)		2
Rated current	A	3
On-site fusing:		
Fuse		T 16 A
Circuit breaker		G 16
Rated input for entire device	kW	< 0.70
EMC class		B
SELV for Plate Shuttle™ System PSS	V	< 48
Rated current for Plate Shuttle™ System PSS	A	< 1
Protection class for Plate Shuttle™ System PSS		exceeds IP 67
Plate Shuttle™ System PSS		
Max. access time per microtest plate	s	< 20
Others		
Sound pressure level (DIN 45 635, Part 1)	dB(A)	< 50
Relative humidity of environment	% rH	80 max.

14. Principles of good microbiological proceedings[1]

General information:

- Keep windows and doors at the place of location closed while carrying out work.
- Do not eat, drink or smoke in the work area.
- Do not store food in the work area.
- Wear laboratory coats or other protective clothing in the work area.
- Always use auxiliaries when pipetting.
- Do not use syringes and hollow needles unless absolutely necessary.
- For all manipulators, try to avoid aerosol formation.
- After completion of the work and prior to leaving the work area, wash your hands thoroughly and disinfect and regrease them, as required.
- Keep the work area tidy and clean. The work tables should contain only the re quired devices and materials. Store stocks only in the designated containers and cabinets.
- Check the identity of the used agents at regular intervals as required for assessing the potential hazard. The intervals depend on the potential hazard.
- When handling agents, employees are subject to a verbal, job-related instruction prior to starting work and subsequently at least once a year.
- Employees with no or little experience in microbiology, virology or cellular biology must be carefully instructed, guided, and looked after.
- Vermin must be exterminated at regular intervals, as required.

The following additional principles apply to the handling of causatives:

- Disinfect all workplaces every day. If required, the growth of resistent germs must be prevented by using a different disinfectant.
- Do not wear protective clothing outside the work area.
- Autoclave or disinfect contaminated devices prior to cleaning.
- Germ-contaminated waste must be collected safely and destroyed by autoclaving or disinfecting.
- If infectious material is spilled, the contaminated area must be immediately blocked and disinfected.
- When handling humanopathogenic germs for which an effective vaccine is available, all employees must be vaccinated and immunity has to be checked at regular intervals using appropriate measures.
- The health conditions of the employees must be monitored using occupational medicine check-ups, i.e. initial examination prior to starting work and annual follow-ups. For the check-ups, particularly the guidelines G24, “Skin Diseases”, and G42, “Infection Diseases”, of the German trade associations apply; these guidelines are used as generally acknowledged occupational medicine guidelines by physicians to rate, evaluate, and acquire examination results based on identical criteria.
- For handling genetically manipulated organisms, viruses, and subviral agents with potential hazards, proceeding according to guideline G43, “Biotechnology”, of the German trade associations is required.
- First aid instructions for accidents with pathogenic microorganisms and viruses must always be freely accessible in the work area. All accidents must be reported immediately to the supervisor in charge.

14. Principles of good microbiological proceedings[1]

Further safety measures in dependence of the potential hazard:

- Usage of safety cabinets (airflow directed away from the experimentator) according to Class I, Class II (type-tested)[2] or Class III.
- Restriction and monitoring of the access to certain areas.
- Usage of special protective clothing and breathing equipment.
- Disinfection of all germ-contaminated materials before they are removed from the worktable.
- Constant vacuum in the work area.
- Reduction of the germ quantity in the exhaust air by suited measures, e.g. HEPA filters.

The following general directives apply to the handling of humanopathogenic and livestock-pathogenic biological agents:

- For handling humanopathogenic biological agents, a permission according to the German Federal Epidemic Act is required.
- For the handling of livestock epidemic germs, a permission in accordance with the German Livestock Epidemic Act and Livestock Epidemic Germ Directive is required.
- Pregnant women and breast-feeding mothers must not handle infectious huma nopathogenic biological agents or materials containing these agents.

[1]To be applied accordingly to cell cultures.

[2]Manufacturers' references are published in the information bulletins "Safe Chemical Working" of the German chemical industry's trade association and of the German trade association for health and welfare service and also on demand by the inspection office of the expert commission "Health and Welfare Service".

The commission can be contacted at the trade association for health and welfare service, Pappelallee 35-37, D-2000 Hamburg

Reference: Notice B003, Issue 1/92 – BG 630 of the trade association of the German chemical industry, published by Jedermann Verlag, Postfach 103140, D-69021 Heidelberg.

15. Device log

☞ **NOTE – Device log:**

Record nameplate information, work carried out, maintenance work, and repairs here.

Device type:		Part number:	
Serial number:		Service number:	
Location:		Operator's note:	

Work carried out	Notes	Date	Signature

16. Certificate of decontamination

Customer certificate of decontamination for the execution of a service order.

Invoice recipient / Customer no.:			Location / Forwarding address:		
Year of manufacturer:	KC:	ST:	Name of technician:		Appointed date:
order date:	Ordered by:	Order no.:			
Type of device:			ID no. / Order no.:		Operating hours:
Equipment no.:	Factory no.:	Service device no.:	Date of delivery:	Date of start-up:	Customer inventory no.:

Certficate of decontamination

Dear customer,

when using biological and chemical agents within and ouside of devices, hazards to the health of the operating personnel may be present and contamination of the surroundings of the device may occur when service or repair works are carried out.
Within the scope of national and international legal regulations, such as
- responsibility of a company for the protection of its employees,
- responsibility of the operator for the operational safety of devices,

all possible hazards must absolutely be prevented. Prior to any calibration, service, and repair works, prior to any relocation of a device, and prior to the shut-down of a device, the device must be decontaminated, disinfected, and cleaned as required by the work to be carried out.
Therefore, we ask you to fill in this certificate of decontamination before you start with the required work.

Yours sincerely

Thermo Electron Corporation

Works to be carried out (please mark where applicable)

Service	☐	Filter replacement	☐
Repair	☐	Relocation	☐
Calibration	☐	Transport	☐

Declaration of possible contamination (please mark where applicable)

The device is clear of biological material	☐	The device is clear of dangerous chemical substances	☐
The device is clear of radioactivity	☐	The device is clear of other dangerous substances	☐
The device is clear of cytostatic agents	☐		

Certification:

Prior to carrying out the required work, we have decontaminated, disinfected, and cleaned the device as described in the operating instructions of the device and in accordance with nationally applicable regulations.
The device does not present any hazards.

Note:

Date, legally binding signature, stamp

Internet: http://www.thermo.com