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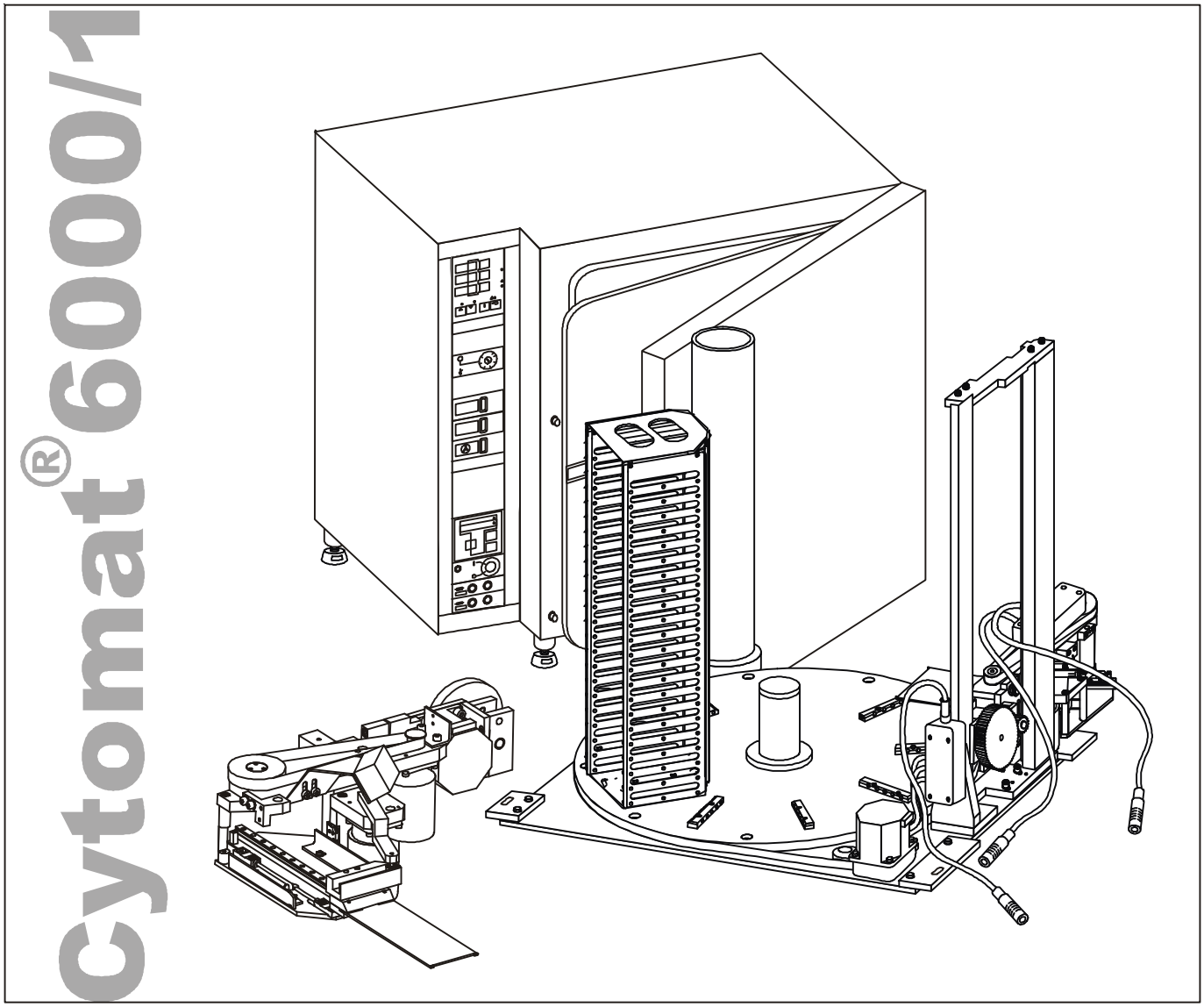
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Kendro®

Operating Instructions

Automatic Incubator Cytomat® 6000/6001



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Contents

1. General notes 6
1.1 General safety instructions 6
1.2 Warranty 7
1.3 Explanation of symbols 8
1.3.1 Symbols used in the operating instructions 8
1.3.2 Symbols on the device 9
1.4 Intended purpose of the device 10
1.4.1 Correct use 10
1.4.2 Incorrect use 10
1.5 Standards and safety regulations 11
1.7 Safety notes on gases 12

2. Delivery of the device 14
2.1 Packaging 14
2.2 Acceptance inspection 14
2.3 Standard equipment 15

3. Installation of the device 16
3.1 Ambient conditions 16
3.2 Room ventilation 16
3.3 Space requirements 17
3.4 In-plant transport 17

4. Description of the device 18
4.1 Front view 18
4.2 Rear view 19
4.3 Safety devices 20
4.4 Door switches 20
4.5 Thermal protector 20
4.6 Chamber atmosphere 21
4.7 Sensor system 22
4.8 Supply interfaces 24
4.9 Chamber layout 26
4.10 Plate Shuttle™ System (PSS) 28
4.11 Stackers (storage system) 30
4.12. Automatic gate/transfer station 31

5. Start-up 32
5.1 Hygiene preparations 32
5.2 Removing the Plate Shuttle™ System (PSS) 32
5.3 Connecting the microperlator (optional) 34
5.4 Installing the Plate Shuttle™ System (PSS) 34
5.5 Installing the transfer station 37
5.6 Installing the oxygen electrode 38
5.7 Connections for process gases 40
5.8 Connecting the cooling system/Cytomat® 6001 41
5.9 Power supply connection 42
5.10 RS 232 interface for process data 43
5.11 Connecting the alarm system 45
5.12 RS 232 interface for Plate Shuttle™ System (PSS) 47

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Contents

6. Handling and control 48
6.1 Operating panel 48
6.2 Power switch 48
6.3 Controls for temperature and CO_2/O_2 49
6.4 Thermal protector 50
6.5 Switches for additional functions 51
6.6 Controlling the stacker position 53
6.7 Failure detection during incubation operation 54
6.8 Troubleshooting 55
6.9 Special functions 57
6.10 CO_2 comparison measurement 58

7. Operation 59
7.1 Preparing the device 60
7.2 Starting operation 60

8. Shut-down 61
8.1 Shutting the unit down 61

9. Cleaning and decontamination 62
9.1 Preparations 62
9.2 Wipe/spray disinfection 64
9.3 Lubrication 66

10. Maintenance 67
10.1 Inspections and checks 67
10.2 Service intervals 67
10.3 Inspection intervals for Plate Shuttle™ System (PSS) 68
10.4 Replacing the device fuses 69

11. Disposal 70
12.1 Disposal procedures 70

12. Spare parts and accessories 71
12.1 List of spare parts and accessories 71

13. Technical data 72

14. Principles of good microbiological proceedings 77

15. Device log 79

16. Certificate of decontamination 80

17. Satement of conformity 81

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Figures

Fig. 1 Dimensions and minimal distances 17
Fig. 2 Lift points at bottom of device 17
Fig. 3 Front view 18
Fig. 4 Rear view 19
Fig. 5 Outer door switch and glass door switch 20
Fig. 6 Thermal protector 20
Fig. 7 Measuring cell sensors 22
Fig. 8 Oxygen electrode 23
Fig. 9 Supply interfaces I 24
Fig. 10 Supply interfaces II 25
Fig. 11 Chamber 26
Fig. 12 Magazine and lift system 29
Fig. 13 Stackers 30
Fig. 14 Automatic gate with transfer station 31
Fig. 15 Plate Shuttle™ System (PSS) removal 33
Fig. 16 Microperlator connection, Plate Shuttle™ System (PSS) installation 35
Fig. 17 Stacker installation 36
Fig. 18 Transfer station installation 37
Fig. 19 Preparations for oxygen electrode 38
Fig. 20 Oxygen electrode connection 39
Fig. 21 Gas supply connection 40
Fig. 22 Cooling system connection 41
Fig. 23 Power supply connection 42
Fig. 24 RS 232 interface connection for process data 43
Fig. 25 Example of a connection scheme for an external alarm system 46
Fig. 26 Plate Shuttle™ System (PSS) connection 47
Fig. 27 Operating panel 48
Fig. 28 Input field for temperature/CO_2/O_2 49
Fig. 29 Thermal protector adjustment 50
Fig. 30 Manual stacker position control 53
Fig. 31 Selecting special functions 57
Fig. 32 Selecting CO_2 comparison measurement 58
Fig. 33 Water removal 63
Fig. 34 Gas analyzer and O_2 electrode removal 63
Fig. 35 Lubricating the Plate Shuttle™ System (PSS) 66
Fig. 36 Device fuse replacement 69
Fig. 37 Gas consumption during operation 73
Fig. 38 pH in nutrient media 74
Fig. 39 Dimensions I 75
Fig. 40 Dimensions II 76

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1. General notes

1.1 General safety instructions

These operating instructions describe the Cytomat® 6000/6001. 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 only be operated by trained and authorized personnel.
- For personnel operating this device, the operator must prepare written instructions in a reasonable form based on these operating instructions, the safety data sheets, the hygiene regulations and the applicable Technical Guidelines.
- Any repairs to the device must only be performed by the Technical Sevice of Kendro Laboratory Products or by adequately trained and authorized expert personnel.
- If the automatic incubator is used in combination with devices or systems from third-party suppliers, these components must be described in a separate instruction supplied by the device manufacturer or supplier.
- Should you encounter problems that are not mentioned in these operating instructions, please contact Kendro Laboratory Products for the sake of your own safety.
- The contents of the operating instructions are subject to change without further notice.
- Concerning translations into foreign languages, the German version of these operating instructions is binding.
- Keep these operating instructions in the vicinity of the device so that safety instructions and important information are always accessible.

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1. General notes

1.2 Warranty

Kendro Laboratory Products warrant the operational safety and the operativeness of the automatic incubator Cytomat® 6000/6001 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 that have been approved by Kendro Laboratory Products are used,
- inspections and maintenance works are carried out at the specified intervals.

The warranty is valid from the date of delivery of the device to the operator.

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1. General notes

1.3 Explanation of symbols

1.3.1 Symbols used in the operating instructions:



WARNING!

is used if non-observance may cause serious or even lethal 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!

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1. General notes


Fire hazard!


Explosion hazard!


Suffocation hazard!


Contusion hazard!

1.3.2 Symbols on the device:


CE symbol


Observe operating instructions!


Unplug power plug before opening!


Contusion hazard!


Do not grab component!

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1. General notes

1.4 Intended purpose of the device

1.4.1 Correct use

The automatic incubator *Cytomat*® 6000/6001 is a laboratory device for preparing and cultivating cell and tissue cultures. The device allows the simulation of the special physiological ambient conditions for these cultures due to the exact control of:

- temperature,
- CO_2 content,
- O_2 content (optional).

When the incubator is operated with filled water bath, the chamber atmosphere has a relative humidity of ≥ 90 % in the compensated state.

The automatic incubator has been designed for the integrated application in computer-aided systems, particularly for HTS (High Throughput Random Screening) procedures. The Plate Shuttle System™ PSS in the device allows the automated, direct access to the culture containers (specifically microplates or similar containers). The transfer or pick-up of the incubate to or from 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 pick-up area,
- is provided with an EMERGENCY OFF function of the device that is integrated logically into the overall system.

The automatic incubator *Cytomat*® 6000/6001 is suited for installation and operation in laboratories and for permanent operation. The gases (CO_2, O_2 or N_2) required for the gas supply of the incubator are supplied from an on-site gas supply system, either from pressurized gas 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 gas supply line can be set to a range between 0.8 bar (min.) and 1 bar (max.) and that the pressure cannot be changed.

1.4.2 Incorrect use:

Do not treat 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.

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1. General notes

1.5 Standards and safety regulations

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

- ZH 1/10
- ZH 1/119
- ZH 1/342
- ZH 1/343
- ZH 1/598
- TRG 280
- EU Official Gazette, L 374
- Safety data sheets of the gas supplier relevant to the particular characteristics of CO_2, O_2 and N_2.
- Principles of good microbiological proceedings, notice of the trade association of the German chemical industry.

For other countries, the applicable national regulations are binding.

The device is in accordance with the following standards and safety requirements:

- EN 61010-1:1993
- EN 61010-1/A2:1995
- Low Voltage Guideline 73/23 EWG
- EMC Guideline 89/336 EWG
- DIN 12880 Part 1/11.78
- EN 61326 (EN 50081-1, EN 50082-2)

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1. General notes

1.7 Safety notes on gases

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 when the device is operated.

NOTE – Personnel instruction

Personnel operating devices with CO_2 supply must be instructed about the particular handling of CO_2 before starting their work:
- **Correct operation of pressurized gas containers and gas supply systems (e.g. TRG 280),**
- **obligation to report damages and shortcomings in CO_2 supply lines,**
- **measures to be taken in case of accidents or failures.**

These instructions must be repeated at appropriate intervals and must comprise the particular operating instructions of the gas supplier.

CAUTION - Suffocation hazard!



CO2 released in large amounts into the room atmosphere may cause suffocation.
If CO_2 is released, initiate safety measures immediately!
- **Leave the room immediately and do not allow others to enter the room!**
- **Inform security service or fire department!**

Oxygen (O_2):
O_2 is a gas that promotes combustion and may explode in combination with grease-containing materials.

WARNING - Oxygen explosion!



O_2 may explode in combination with oils, greases, and lubricants. If highly compressed oxygen comes in contact with grease- or oil-containing substances, the mixture may explode.
- **For cleaning these components, use only cleaners that do not contain oil or grease.**

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1. General notes



CAUTION - Fire hazard!



Keep all connections and components of the oxygen system free from substances that contain oil, grease, or lubricant!
Released oxygen promotes combustion.
Do not use open flames in the vicinity of oxygen-operated systems!

- **Do not smoke in the vicinity of oxygen systems.**
- **Do not expose the components of an oxygen system to excessive heat.**

Nitrogen (N_2):
Nitrogen mixes easily with air. High concentrations of nitrogen reduce the oxygen content in the air.



CAUTION - Suffocation hazard!



N2 released in large amounts into the room atmosphere may cause suffocation due to oxygen deficiency. If N_2 is released, initiate safety measures immediately!

- **Leave the room immediately and do not allow others to enter the room!**
- **Inform security service or fire department!**



NOTE – Installation work

Any work to supply lines and pressurized gas containers, cylinders or containers used for storing N_2, CO_2 or O_2 must only be performed by expert personnel using the appropriate tools.

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2. Delivery of the device

2.1 Packaging

The automatic incubator *Cytomat*® 6000/6001 is delivered in a stable packaging box.
The stackers and the transfer station are packed separately in the box.
The microperlator is installed in the device chamber (only versions with O_2 control).
The Cytomat 6001 has the heat exchanger plate installed in the floorpan.

All packaging materials can be separated and are reusable:

Packaging materials:

- Packaging carton Paper
- Foam elements Styrofoam (CFC-free)
- Packing box Wood
- Packaging film Polyethylene
- Packaging ribbons Polypropylene

2.2 Acceptance inspection

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 Kendro Laboratory Products.

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2. Delivery of the device

2.3 Standard equipment

Quantity of the delivered components	**Automatic Incubator Cytomat® 6000**	**Automatic Incubator Cytomat® 6001**
Automatic Incubator	1	1
Standard: Plate Shuttle™ System (PSS) with 9 stackers	1	1
Key for outer door	2	2
Siphon	1	1
Connecting hose set	1	1
Zero modem cable	1	1
1 digital and 1 analogue interface with 2 adapters	1	1
Angular connector for external alarm connection	1	1
Heat exchanger plate	–	1
Special grease Lubricant	1	1
CD for test operation	1	1
Fittings for retaining the incubator to the location	2	2
Optional equipment		
Transfer station, standard with plate empty sensor	1	1
Transfer station, turnable (90°) with plate empty sensor	1	1
Transfer station, Swap station (180°) with plate empty sensor	1	1
Bar code laser scanner	1	1
O_2 controller with microperlator and sensor	1	1
Instructions		
Operating instructions	1	1
Software documentation for Plate Shuttle™ System (PSS)	1	1

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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.

- Draught-free and dry location.
- The minimal 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 a constant incubation temperature of 37° C, the ambient temperature must be within a range of +18° C (min.) to maximum +30° C (max.).
- Relative humidity up to 60 % (max.).
- No direct exposure to sunlight.
- Devices that produce excessive heat are not allowed near the location of the automatic incubator *Cytomat*® 6000/6001.

3.2 Room ventilation

During continuous operation, the room climate may change due to energy released by the device.

- Therefore, operate the automatic incubator only in rooms with adequate ventilation.
- 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 ZH 1/119 (Guidelines for laboritories) or some other suited ventilation system with 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 threshold limit value (TLV) of the gases largely depends on the opening frequency of the automatic gate and on the opening frequency of the service doors (outer door and glass door).

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3. Installation of the device

3.3 Space requirements

Fig. 1: When installing the device, make sure that the installation and supply connections are freely accessible.
The side distances given are recommended minimal distances. To protect the automatic 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 minimal distance to adjacent surfaces at the sides and above the device must be 50 mm.

NOTE – Accessibility of the device

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

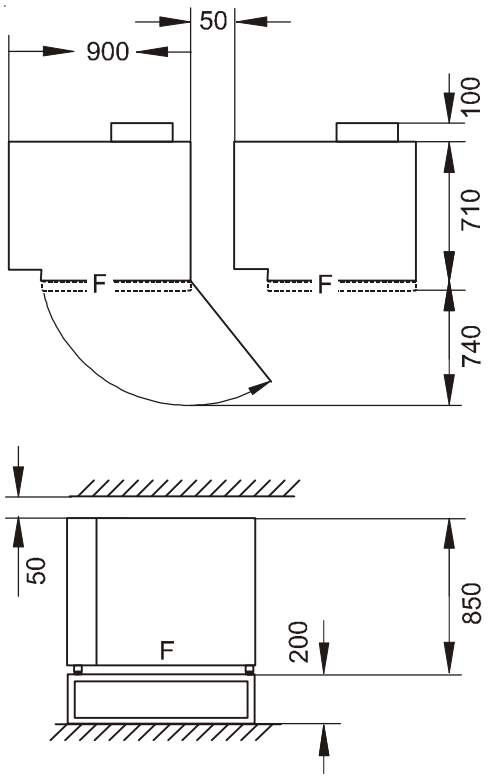


Fig. 1
Dimensions and minimal distances, values in mm, F = Front

3.4 In-plant transport

Fig. 2: Transport the device only in an upright position with the automatic gate closed, the Plate Shuttle System PSS secured (handler in lower position) without stacker and culture containers.

NOTE – Lift points

Do not transport the device using the doors or components attached to the device (e.g. rear automatic gate or transfer station) as lift points. Lift the device only using the lift points shown in Fig. 2.

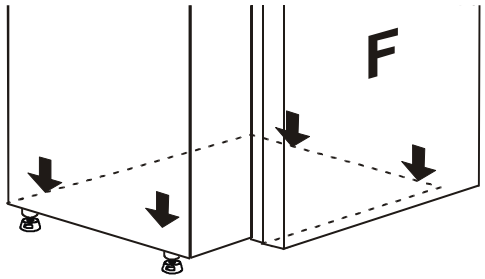


Fig. 2
Lift points at bottom of device, F = Front

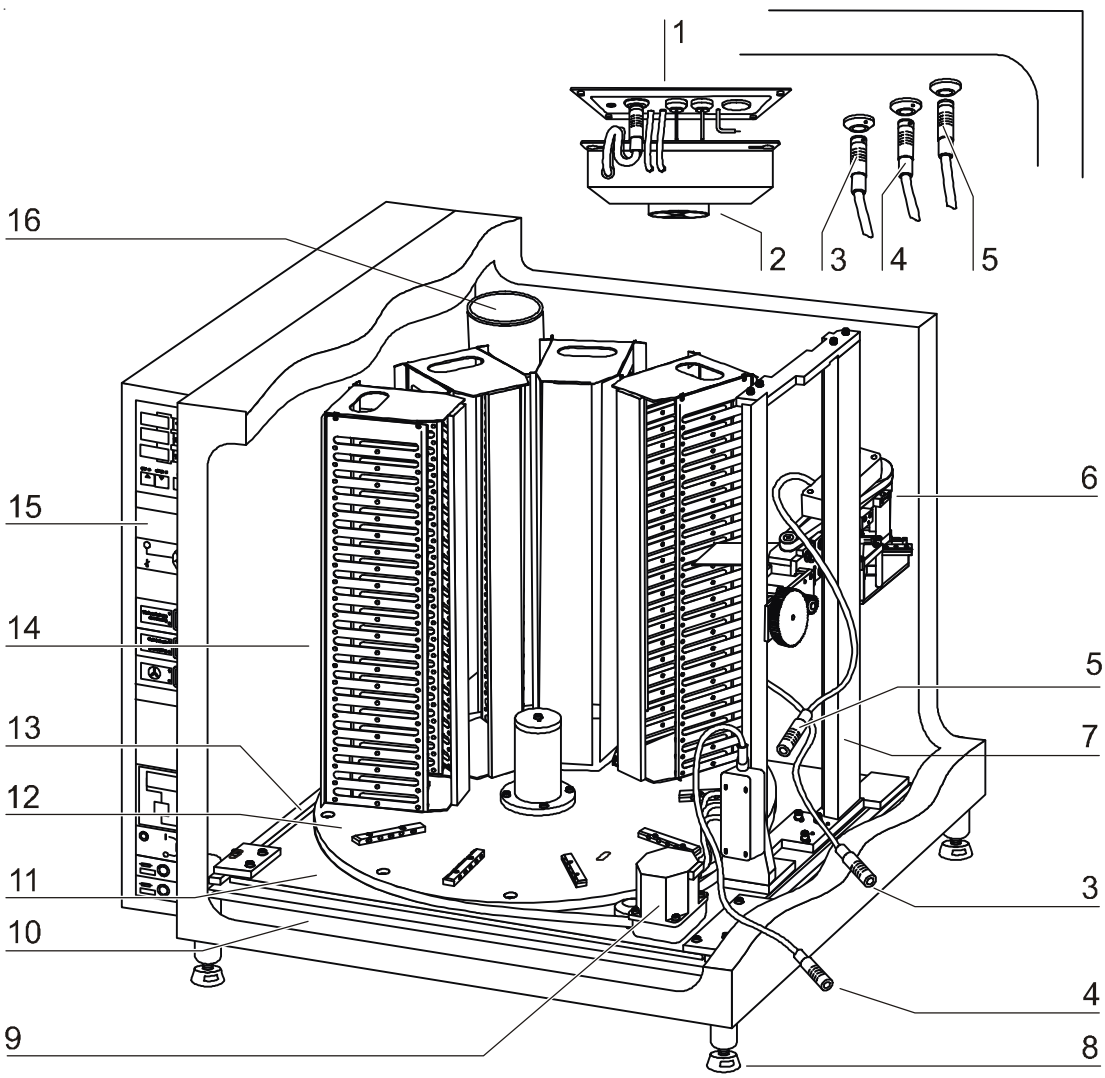
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4. Description of the device

4.1 Front view

[1] Sensors and supply connections (on chamber ceiling)
[2] Gas analyzer and blower (on chamber ceiling)
[3] Connection for optional bar code scanner (on chamber ceiling)
[4] Connection for lift system (on chamber ceiling)
[5] Connection for turntable (on chamber ceiling)
[6] Plate Shuttle™ System (PSS) handler
[7] Lift system linkage for Plate Shuttle™ System (PSS)
[8] Device stand, adjustable
[9] Turntable stepper motor for Plate Shuttle™ System (PSS)
[10] Water reservoir in floorpan
[11] Baseplate for Plate Shuttle™ System (PSS)
[12] Magazine turntable for Plate Shuttle™ System (PSS)
[13] Support rail for Plate Shuttle™ System (PSS)
[14] Stacker
[15] Operating panel
[16] Air pipe with blower (only Cytomat® 6001)

Fig. 3
Front view



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4. Description of the device

4.2 Rear view

[1] Outer door, heated
[2] Glass door
[3] Pressure compensation opening
[4] Connection for O_2/N_2 (optional)
[5] Connection for CO_2
[6] RS 232 interface, process data
[7] Analog interface, process data
[8] Control box vent
[9] Connection for external systems
[10] RS 232 interface for bar code scanner (optional)
[11] Power connection for uninterrupted power supply (UPS)
[12] Power connection for device heating
[13] RS 232 interface for Plate Shuttle™ System (PSS)
[14] Inflow/outflow connection for low-temperature thermostat (only Cytomat® 6001)
[15] Transfer station
[16] Automatic gate with cover

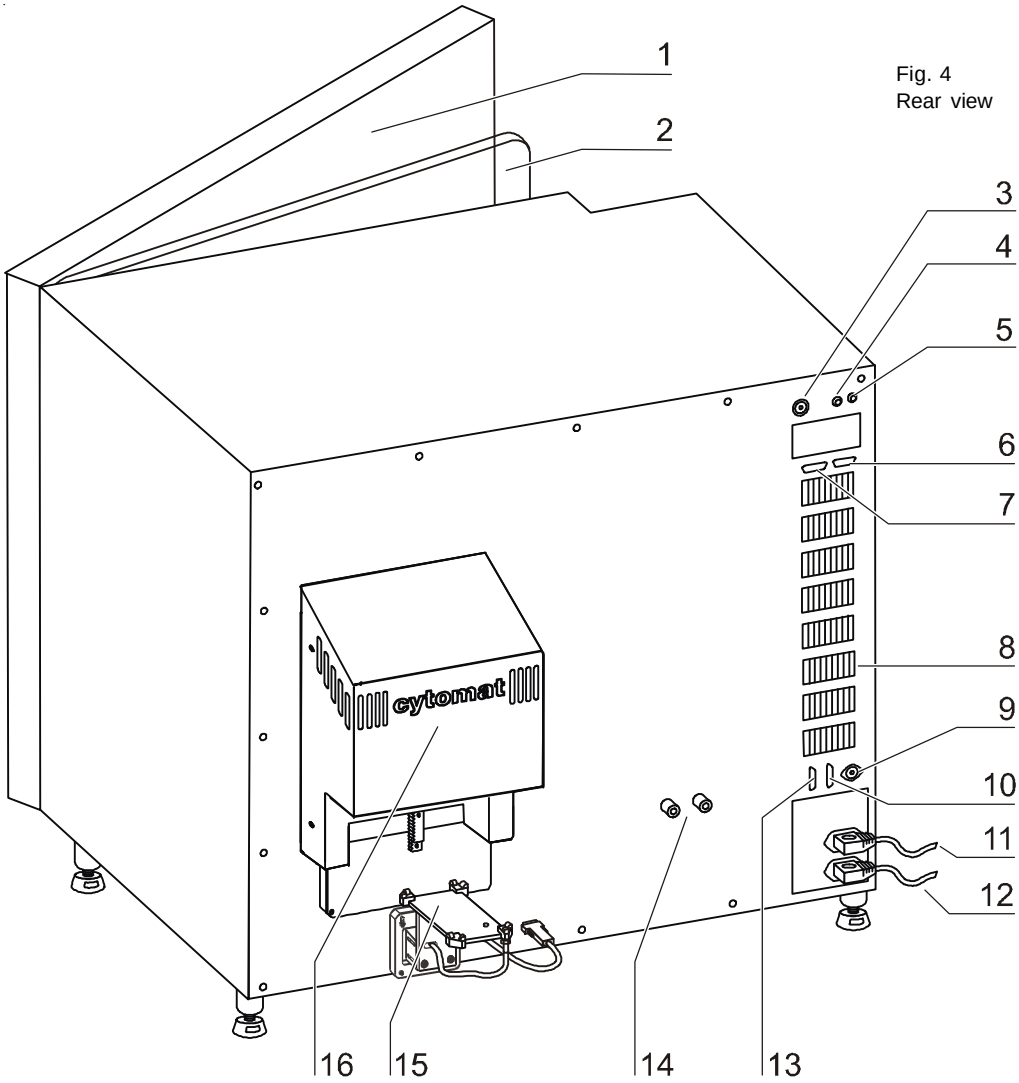


Fig. 4
Rear view

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4. Description of the device

4.3 Safety devices

The incubator is equipped with safety devices that protect the device and the operator; it is also equipped with means for reducing the consumption of the supplied gases and of the electrical energy:

- The outer door switch interrupts gas supply and heating when the door is opened.
- The glass door switch interrupts only the traveling motions of the Plate Shuttle System when the glass door is opened.
- A settable thermal protector protects (depending on the selected setting) the samples or the device from harmful overheating in case of a failure.
- A pressure compensation opening with non-return valve ensures pressure compensation within the device chamber.
- Audible and visual alarms indicate failures during operation.

4.4 Door switches

Fig. 5: Two door switches are installed at the left side of the chamber opening. If the outer door is opened, the door switch [2] interrupts the gas supply and the heating. If the door remains open for more than 10 minutes, an acoustic alarm sounds continuously. A second door switch [1] interrupts the traveling motion of the turntable when the glass door is opened.

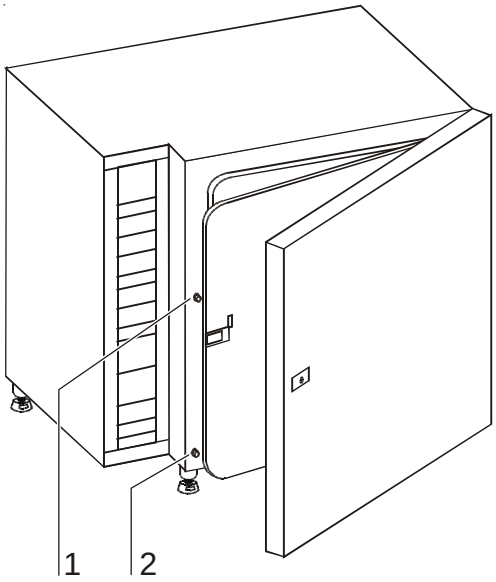


Fig. 5
Outer door switch and glass door switch

4.5 Thermal protector

Fig. 6: The automatic incubator is equipped with a thermal protector [1] (Temperature Safety Class 3.1) that protects, depending on its setting, either

- the samples (when a temperature nominal value is set) or
- the device (when the rotating knob is rotated all the way to the stop)

from harmful overheating.
The maximal temperature nominal value can be set steplessly using the rotary switch [2] in a range of 0-50° C. It should be set 1°-2° higher than the nominal value for the incubation temperature in the chamber.
As soon as the temperature in the chamber is exceeded by 1°, the thermal protector gains control of the heating system and issues a visual alarm (red indicator illuminates).
.

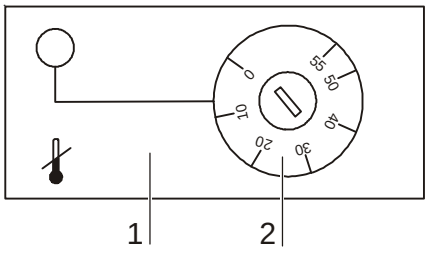


Fig. 6
Thermal protector

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4. Description of the device

4.6 Chamber atmosphere

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

- Temperature,
- relative humidity,
- CO_2 concentration,
- O_2 concentration (optional).

NOTE – Operating modes

Cytomat® 6000: The device can be operated with or without water bath.
Cytomat® 6001: The device can be operated with or without water bath.
Cytomat® 6001 with heat exchanger: The device can only be operated with water bath.

Temperature:
To ensure undisturbed operation, the temperature in the operating room (RT) should be at least 18° C.
Depending on the equipment of the device, the heating system controls the incubation temperature in the following temperature ranges:

- *Cytomat*® 6000: RT + 8° C up to 50° C max.
- *Cytomat*® 6001: +10° C up to 50° C max. ***

To achieve incubation temperatures below the existing room temperature, the automatic incubator *Cytomat*® 6001 is equipped with a heat exchanger that is connected to an external cooling system.

Relative humidity:
The floorpan of the chamber can hold up to 6.0 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 of the following quality is required:

- distilled, demineralized or
- autoclaved, sterile.

Temperature and humidity for *Cytomat*® 6001 with heat exchanger
To ensure an even cooling and temperature distribution within the chamber and good humidification, an additional recirculating air blower that is integral to the air pipe of the PSS aspirates air from the chamber ceiling and blows it through the air pipe over the cooled water bath.
The cooled air is then routed upward along the side walls and distributed evenly throughout the chamber.

***the lower temperature limit depends on the efficiency of the low-temperature thermostat.

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4. Description of the device

CO_2 supply:
To ensure the growth conditions for the cell and tissue cultures, the chamber is supplied with CO_2. The pH of the bicarbonate-buffered culture media largely depends of the CO_2 concentration. The CO_2 content of the chamber atmosphere can be controlled within a range of 0-20 %. Optionally, the device can be supplied with oxygen or nitrogen.

O_2 supply:
If the automatic incubator is to be operated with more than 21 % oxygen, the chamber is supplied with oxygen. The O_2 content of the chamber atmosphere can be controlled within a range of 21-80 %.

N_2 supply:
If the oxygen content during operation is to be lowered below 21 % (oxygen content in air), the chamber is supplied with nitrogen. The N_2 content of the chamber atmosphere can be controlled within a range of 3-21 %.

NOTE – Process gases

All process gases must have one of the following quality characteristics:
- **Purity 99.5 % min.,**
- **medical gas quality**

4.7 Sensor system

Fig. 7: The gas analyzer [7] mounted to the device ceiling contains the CO_2 measuring system. The gas analyzer connects electrically to the electronic unit via a gasproof and waterproof socket [1]. The required hose connections between connection panel and gas analyzer are marked with color rings. For cleaning or service, the gas analyzer can be removed from the device.
The baseplate [6] contains:
- the CO_2 outlet [1],
- the power supply connection [2] of the gas analyzer,
- the two temperature sensors [3] and [4] for monitoring the chamber temperature (for the temperature controller and the thermal protector),
- the connection [7] for the oxygen electrode,
- the electrical connection for the oxygen electrode [5] (option).

The sensor for chamber temperature monitoring and the CO_2 sensor are integral to the device control system. Their measured values are compared to the set nominal values. Based on this data, the control system controls the heating and the CO_2 supply.

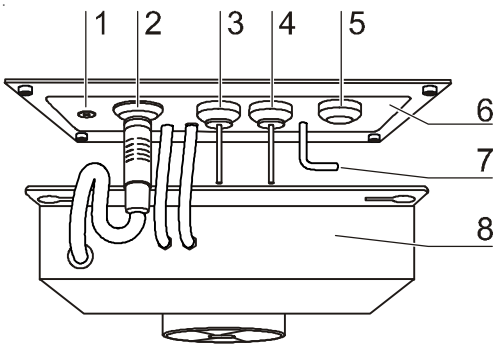


Fig. 7
Measuring cell sensors

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4. Description of the device

Measurement and control of the optional N_2/O_2 supply is performed by an oxygen electrode that works on Clarke's principle. The electrode interior consists of a platinum cathode and a chlorated silver anode. A 0.3 molar KCL solution is used as electrolyte.

Fig. 8: The oxygen electrode [2] is delivered as a separate kit to be retrofitted to the lift linkage [1].

NOTE – Oxygen electrode

If the oxygen control is not required, the electrode must be removed from the chamber, and the protective cap must be installed to the electrode plug.

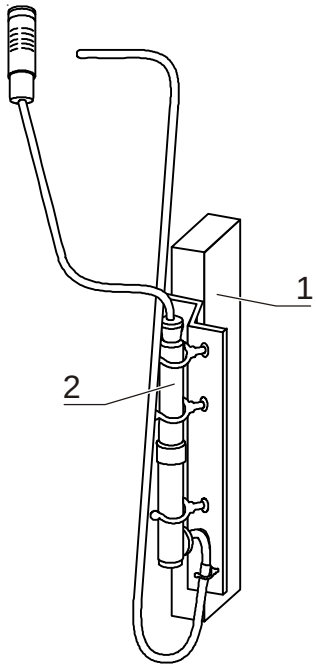


Fig. 8
Oxygen electrode

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4. Description of the device

4.8 Supply interfaces

Fig. 9 and Fig. 10: All supply interfaces are installed at the rear of the device.

Gas connections:
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 [1]. The N_2/O_2 supply is connected to the sleeve [2].
All process gases must be supplied at the device with a fixed preset, non-changeable pressure of between 0.8 (min.) and 1.0 bar (max.).
Before the gases are fed into the chamber, they flow through a sterile filter with a separation rate of 99.998 % referred to a particle size of 0.3 µm (HEPA filter quality).

RS 232 interface for bar code scanner (optional):
Using the RS 232 interface for bar code scanners [3], the bar code designations on the culture container faces can be read.

Alarm contact:
The device can be connected to an on-site, external alarm system (e.g. telephone system, building monitoring system, visual or acoustic alarm system). For this purpose, a potential-free alarm contact [4] is preinstalled in the device.

NOTE - Alarm contact

Failures are reported to the alarm contact only if they are caused by atmospheric conditions in the chamber (temperature or gas). Failures that occur in the PSS are not reported to the alarm contact.

RS 232 interface for Plate Shuttle System (PSS):
The PC interface [5] 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 software control of the PSS is described in a separate instruction.

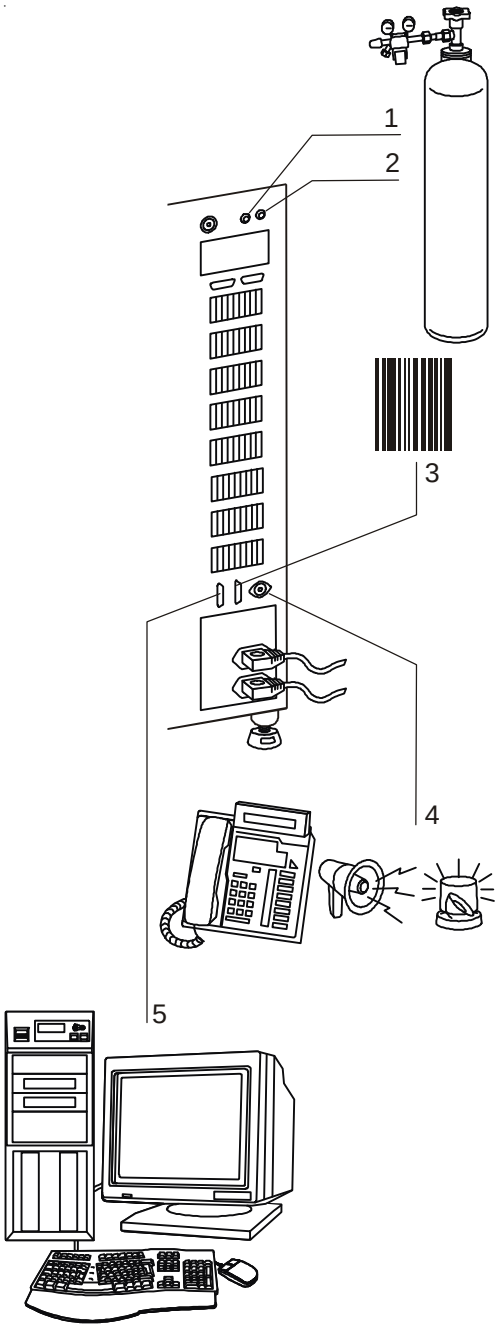


Fig.9
Supply interfaces I

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4. Description of the device

Pressure compensation opening:
A pressure compensation opening [5] with non-return valve at the rear panel of the device ensures the compensation between the pressures in the chamber and in the operating room. During the operation of the device, the pressure compensation opening must not be obstructed.

Communication interfaces:
The RS 232 interface [1] connects the automatic incubator to the serial interface of a PC. This connection allows the computer-aided acquisition and documentation of the major incubation parameters (temperature, CO_2 concentration, O_2 concentration).
Accordingly, using the analog interface [2], the incubation parameters can be read and documented (e.g. by a circular chart recorder).
For a detailed description of the interfaces, please refer to the software documentation.

Power connections:
Power connection for UPS [4]
The power supply connection for the UPS (uninterrupted power supply, upper power plug) supplies the entire automatic mode and control unit with power. To ensure that the magazine keeps moving on in case of a power loss, a separate UPS system should be available for the UPS connection. If a separate UPS system is not available, the UPS connection should be connected to the existing power supply system. The power supply connection circuit of the electronic unit is switched through the main switch of the automatic incubator. Therefore, the electronic unit is activated when the device is switched on. Power supply connection is achieved through a grounding plug at a properly fused socket.

Power connection for heating [3]
The power connection for the heating of the device supplies the entire heating system with current and is established by connecting a grounding plug to a properly fused socket.

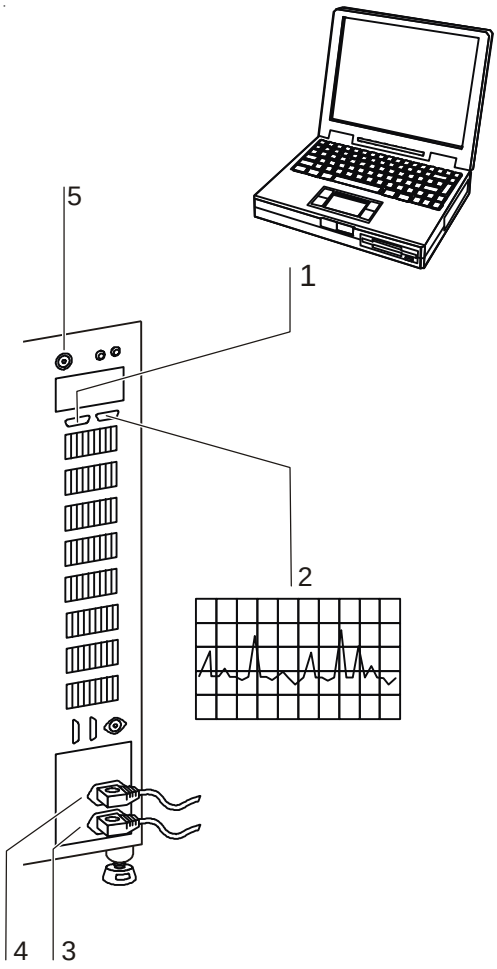


Fig.10
Supply interfaces II

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4. Description of the device

4.9 Chamber layout

Fig. 11: The components of the chamber are made of stainless steel and have a highly polished, perfectly smooth and easy-to-clean surface.

Heating system:
An air jacket heating system is used for heating the chamber. The heating elements are arranged in a way that prevents condensate from forming above the water reservoir in the chamber. The outer door of the device is also heated. The radiation of heat to the interior glass door prevents condensate from depositing. The chamber of the device is always clearly visible, even in case of high humidity. In some cases, when the incubator is operated at the recommended minimal temperature difference of 8° C (ambient temperature 29° C and incubation temperature 37° C), condensation may occur; this can usually be prevented by lowering the ambient temperature by 3° C to 4° C.

Gas analyzer (CO_2) and magazine sockets:
The gas analyzer [2] and the sockets [4] of the Plate Shuttle™ System (PSS) are installed at the chamber ceiling. A blower wheel behind the gas analyzer ensures that the supplied gases are thoroughly mixed and evenly distributed throughout the chamber atmosphere.

Water reservoir:
The water reservoir [6] is integral to the floor of the chamber and can hold up to 6.0 liters of water.

Heat exchanger, Cytomat® 6001:
The heat exchanger [11] in the Cytomat® 6001 is used for lowering the chamber temperature to allow incubation operation below the existing room temperature.
The heat exchanger plate with quick-connect adapter and Ø 12 mm connection for the low-temperature thermostat is connected to an external cooling system [10] using the connections at the rear of the device. During operation, the heat exchanger must always be immersed in water.

Plate Shuttle™ System (PSS) support rails:
The Plate Shuttle™ System (PSS) is secured with screws to two support rails [5] within the chamber. For cleaning and disinfecting, the Plate Shuttle™ System (PSS) is removed from the support rails as a complete unit. The simple screw connections allow the quick removal. The support rails must not be removed as their mounting points determine the alignment of the Plate Shuttle System™ (PSS) to the opening [3] of the automatic gate.

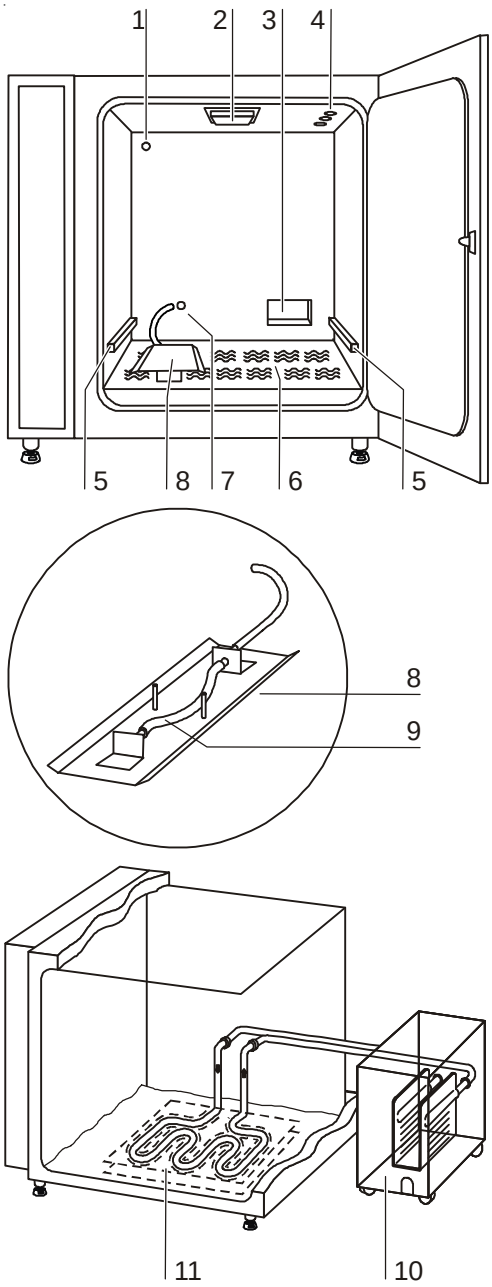


Fig. 11
Chamber

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4. Description of the device

Microperlator (only with O_2 control):
The microperlator [8] is installed to the floorpan of the device and connected to the oxygen or nitrogen supply line [7]. The oxygen or nitrogen is supplied to the heated water through the porous hose [9]. This ensures humidification of the gases as they enter the chamber so that an undesired lowering of the chamber humidity is prevented.

Socket for Cytomat® 6001 blower:
The Cytomat® 6001 has an additional blower that is installed into an air pipe. The blower can be switched on during operation to increase the humidity within the chamber. The socket [1] for the blower is located at the upper left area of the interior container rear panel.

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4. Description of the device

4.10 Plate Shuttle System (PSS)

Fig. 12: The Plate Shuttle System (PSS) is the transport and storage system of the *Cytomat*® 6000/6001. It consists of the following components:

- the baseplate [8] with turntable [6] to accomodate the stackers [7],
- an air pipe [1] with integral recirculating air blower (only Cytomat® 6001),
- the lift linkage [10] and
- the handler [11].

The baseplate [8] has screwed-on holders [2] for mounting the Plate Shuttle™ System (PSS) assembly to the support rails of the chamber.
The turntable [6] is supported on bearings centrally on the baseplate and driven by a stepper motor [3]. The power transfer from the stepper motor to the turntable is achieved by a flat belt [4]. The stepper motor drive has an integral belt tensioner that pretensions the flat belt and readjusts the belt tension automatically.
The turntable has lockable rails [5] to accomodate 9 stackers.
A rotating handler [11] at the lift linkage [10] that moves vertically is used for transferring the culture containers [9] from the stackers [7] to the transfer station where the containers are received by an integrator system or by some other transport system.
The handler is equipped with a stepper motor [14] for the vertical traveling motion at the lift linkage. Two gear motors [15] and [16] drive the horizontal rotating motions and the motion of the shovel to the stackers and to the transfer station.
The culture containers can be transferred to the addressed storage positions in the stackers by using software commands. The handler shovel [17] deposits the culture container at the corresponding position in the stacker.
As this happens, an optional bar code laser scanner [13] at the handler can read the description at the face of the culture containers.
The plate detection sensor [12] is capable of detecting if the handler is occupied to prevent the double loading of the stacker, e.g. after a power reset.

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4. Description of the device

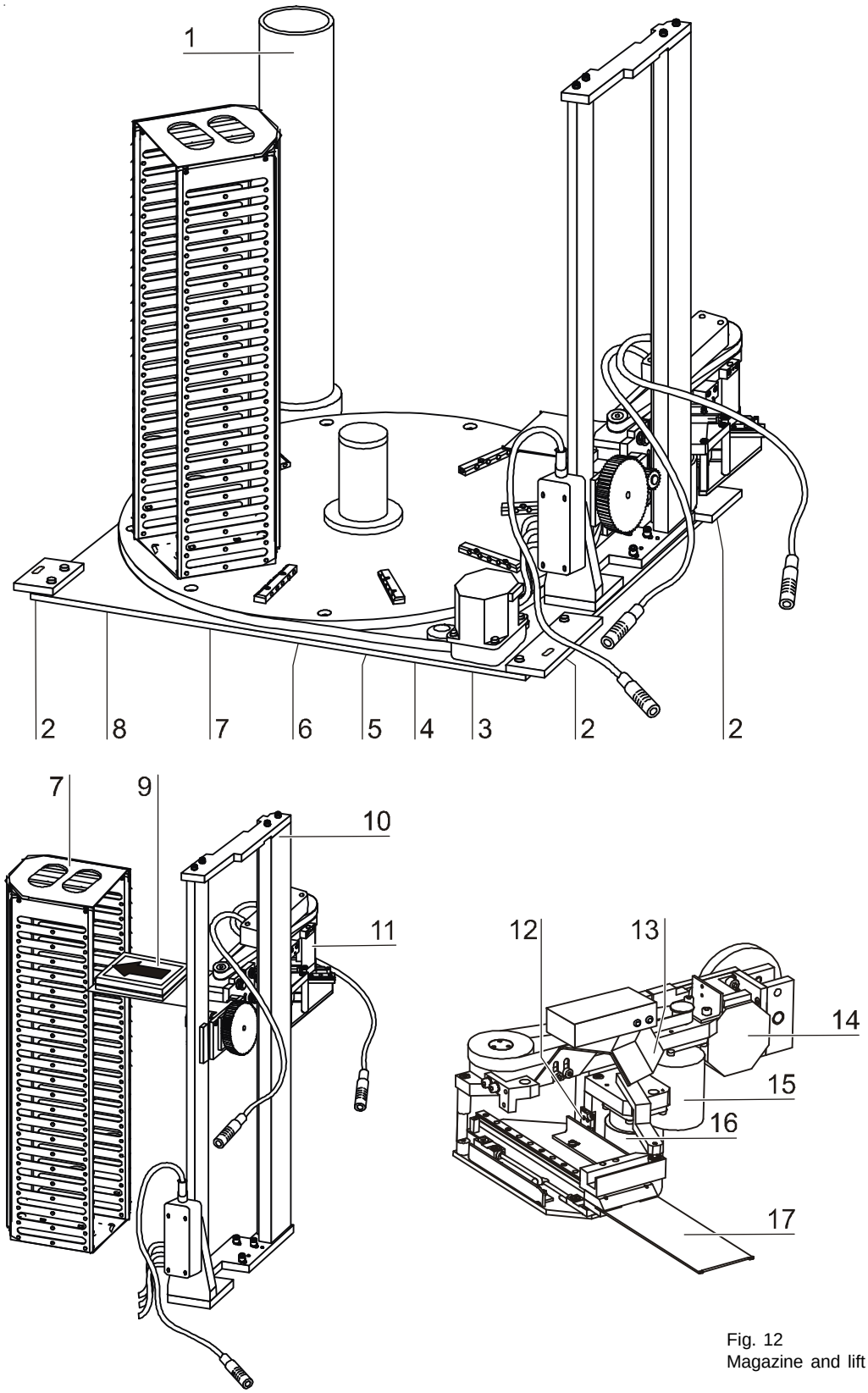


Fig. 12
Magazine and lift system

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4. Description of the device

4.11 Stackers (storage system)

Fig. 13: The stackers are used as the storage system of the Plate Shuttle™ System (PSS). The turntable [5] can accomodate 9 stackers. Each stacker is equipped with several support rails to accomodate culture containers [1]. The vertical distance between two support rails, the so-called pitch [3], indicates the number of levels in a stacker for storing culture containers. Stackers are available with various pitches for different culture containers.

For a list of available stackers and part numbers, please refer to Section 12.

Stacker for	Pitch	Levels	max. Height
1536 well plates	17 mm	28	12 mm
96 well plates	23 mm	21	18 mm
Microplates	28 mm	17	23 mm
Microplates	29 mm	16	24 mm
Transwell plates	33 mm	15	28 mm
Deepwell plates	50 mm	10	45 mm
Tippbox	69 mm	9	64 mm

The support rails have locking tabs at the opening side of the stacker to prevent the accidental shifting of the installed culture containers.
The stackers are positioned on and engaged in the locking rails [4] of the turntable.

CAUTION – Handler collision:

The traveling motions of the handler are programmed for the individual pitch in the stakker.
If stackers with higher or lower pitches than originally provided are to be used, the handler shovel will collide with the culture containers.
When using stackers with different pitches, the traveling motion of the handler must be readjusted!

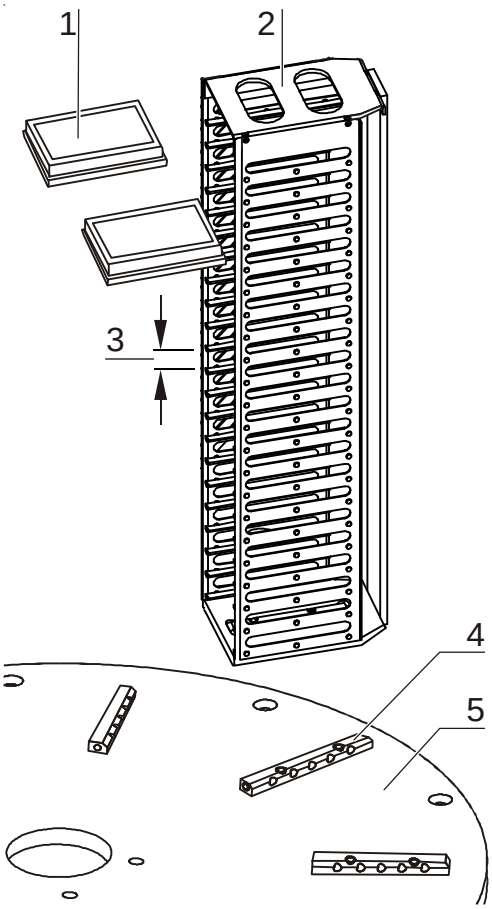


Fig. 13
Stackers

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4. Description of the device

4.12. Automatic gate / transfer station

Fig. 14: The automatic gate [2] with transfer station [4] is the transfer system of the automatic incubator to the external, on-site transport system.
For the Cytomat® 6000/6001, three transfer station versions are available:

- Standard transfer station [4],
- 90° rotatable transfer station [6],
- 180° rotatable SWAP station [5].

The handler of the Plate Shuttle™ System (PSS) picks up the culture container from the addressed storage position of the stacker and transfers it to the culture container at the on-site transport system. For this purpose, the culture container is deposited on the transfer station [4] where it is picked up by the transport system. The detection sensor [3] is used for checking the load state of the plate (empty or not) to see if the handler can load the transfer station.
The automatic gate [2] is used for the almost airtight sealing of the automatic incubator chamber. The latch plate of the lift door is heated to prevent condensate. The latch plate is located behind a cover [1].



CAUTION - Traveling motion intervention!



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



CAUTION – Hot surface!



**The components of the Plate Shuttle System (PSS) may be heated in the incubator.
Handle culture containers and surfaces of the PSS only using protective gloves!**

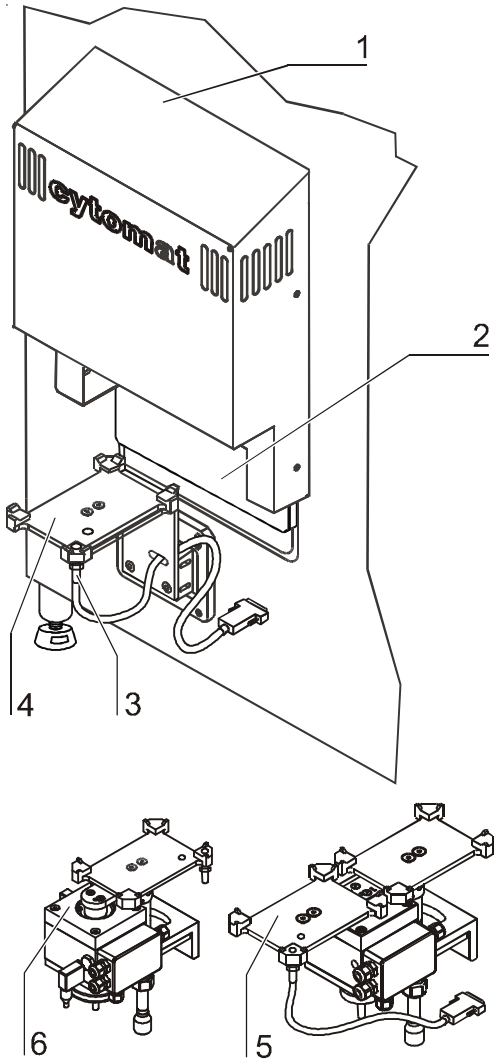


Fig. 14
Automatic gate with transfer station

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5. Start-up

5.1 Hygiene preparations

The automatic incubator is delivered in a clean, but not sterile state. Prior to the initial start-up, the device should be decontaminated for its intended purpose. For detailed information on cleaning and disinfecting the device, see Section 9.

5.2 Removing the Plate Shuttle™ System (PSS)

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

NOTE – Moisture sensitivity

Do not allow moisture to enter the connecting plugs as otherwise the function of the device control may be impaired due to resulting creepage currents. If the connecting cable plugs are disconnected, the sockets must always be sealed using the supplied protective caps.

Removal:

1. **Fig. 15:** Disconnect the connecting cable plugs [5], [6], and [7] (optional for bar code scanner) from the sockets at the chamber ceiling and remove all filler plugs. For Cytomat® 6001, the blower motor plug [3] must be disconnected from the socket in the chamber rear panel.
2. Pull off front floorpan gasket [12].
3. Mark the position of the front mounting plates [10] and [13] on the support rails [1] and [9].
3. Remove the mounting plate screws [2], [10], and [13] from the support rails. Grasp magazine tab [11], tilt magazine slightly forward and hold bottom of baseplate. Remove Plate Shuttle™ System (PSS) from chamber. Do not grasp Plate Shuttle™ System (PSS) at lift linkage [8] or at air pipe [4].

NOTE – Lift linkage

Do not grasp the Plate Shuttle™ System (PSS) at the air pipe or at the lift linkage.
If the linkage bends by tensile or compressive forces, the complete lift system may be damaged.

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5. Start-up

NOTE – Support rails

Do not remove the Plate Shuttle™ System (PSS) support rails as this will prevent the correct positioning in the chamber during reinstallation.

4. Do not deposit the Plate Shuttle™ System (PSS) on the floor but on a support that is suited for the cleaning and disinfection; secure the PSS.

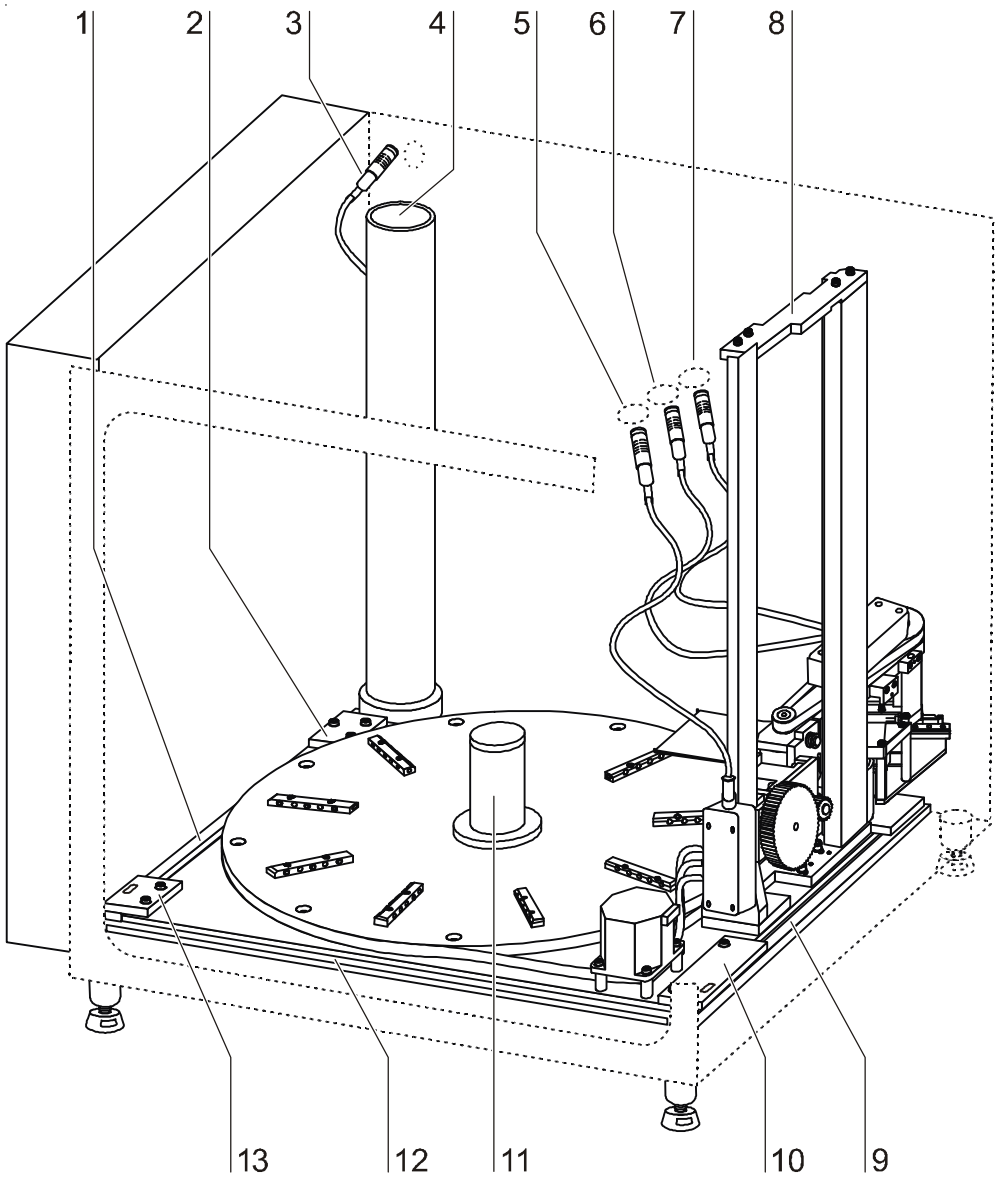


Fig. 15
Plate Shuttle™ System (PSS) removal

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5. Start-up

5.3 Connecting the microperlator (optional)

The microperlator [12] is an integral standard component of the optional O_2 equipment.

1. **Fig. 16:** The pressure hose [4] is installed to the sleeve [11] on the device rear panel and to the sleeve [3] at the microperlator.
2. Connect the porous hose [6] to the two sleeves [5] and [7] at the bottom of the microperlator.
3. Place the microperlator [12] parallel to the left side wall of the chamber into the floorpan.

5.4 Installing the Plate Shuttle™ System (PSS)

The Plate Shuttle™ System (PSS) is installed as a complete assembly:

1. **Fig. 16:** Place the baseplate [18] onto the two support rails [9] at the markings of the front mounting plates.

NOTE – Lift linkage

Do not grasp the Plate Shuttle™ System (PSS) at the air pipe or at the lift linkage.
If the linkage bends by tensile or compressive forces, the complete lift system may be damaged.

2. Install the three retaining screws [17] and tighten them by hand.
3. To prevent faulty connections, the plug [15] of the connecting line (from the splitbox at the handler) and the socket have a red mark. Connect the plug to the center socket at the chamber ceiling [2] and engage it by applying slight pressure.
4. Connect the plug [16] of the bar code scanner connecting line (optional) to the rear socket at the chamber ceiling [2] and engage it by applying slight pressure.
5. Connect the plug [14] of the turntable stepper motor connecting line (from splitbox at lift linkage) to the front socket at the chamber ceiling [2] and engage it by applying slight pressure.
6. Connect the plug [13] of the blower motor to the socket at the rear of the chamber [1] and engage it by applying slight pressure (only Cytomat® 6001).
7. Install the seal [8] to the floorpan sheet [10].

Levelling the device:
Before the initial start-up of the automatic incubator, the device housing must be levelled: Rotate the adjustable device stands using a 24 mm wrench so that the magazine turntable is adjusted horizontally in all directions. When levelling the device with the stands, proceed from left to right and from rear to front.

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5. Start-up

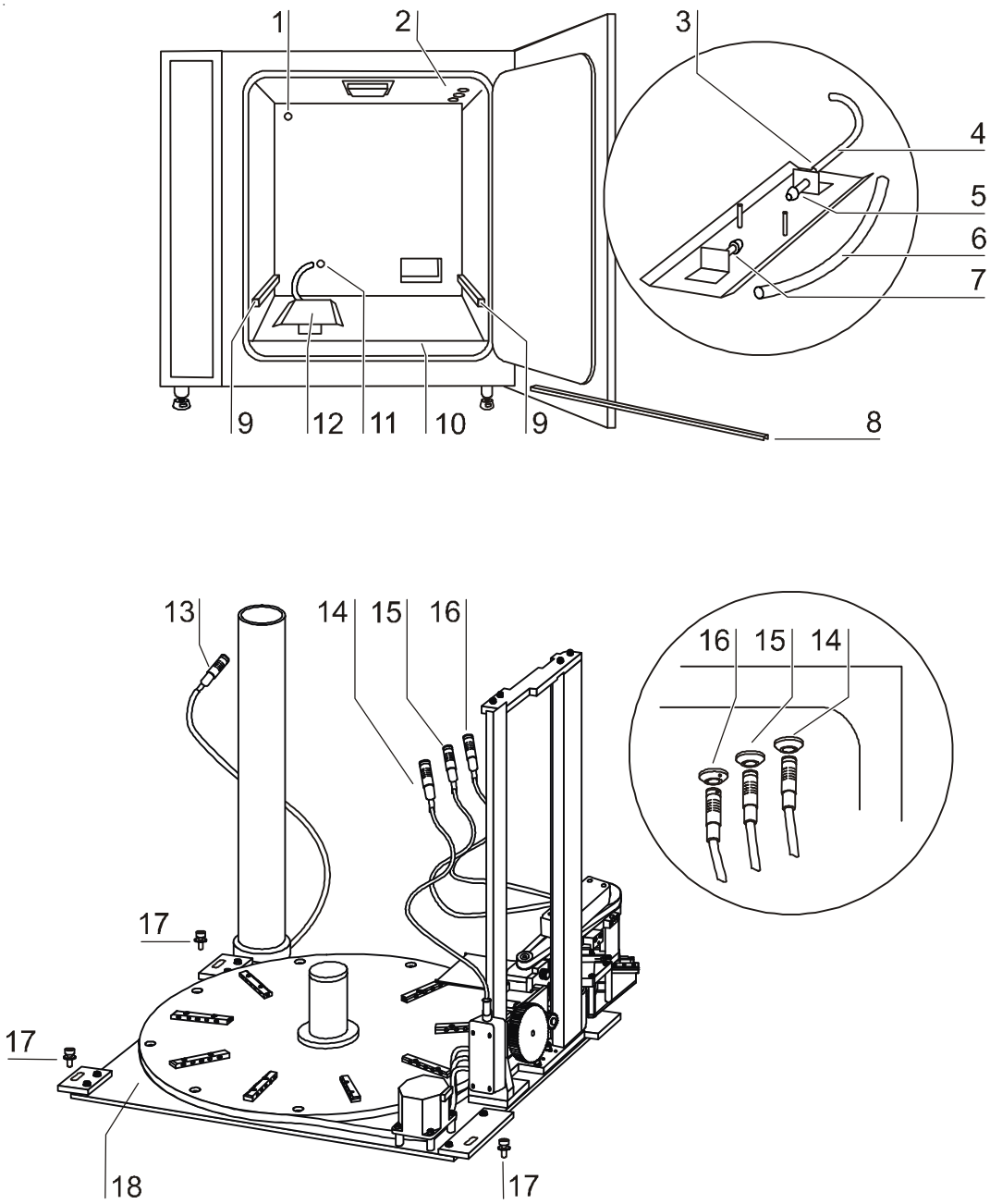


Fig. 16
Microperlator connection, Plate Shuttle™ System (PSS) installation

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6. Start-up

Installing the stacker:

1. **Fig. 17:** Grasp the stacker at the handle plate [1].
2. Slightly tilt the stacker toward the front of the device, position it above the locking rail [3] and apply slight pressure until it is engaged.

NOTE – Handling stackers

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

To ensure an absolutely plane position, the locking plate [2] of the stacker and the turntable [4] of the magazine 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.

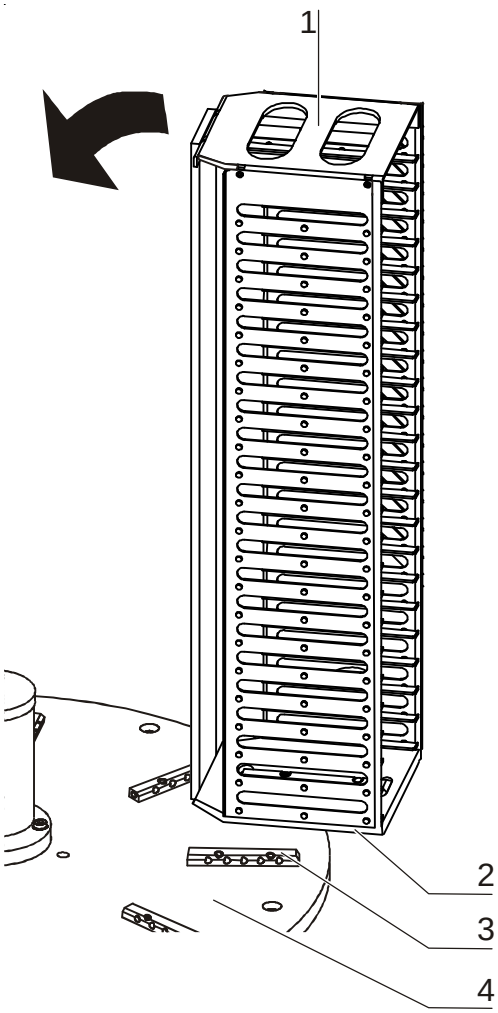


Fig. 17
Stacker installation

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5. Start-up

5.5 Installing the transfer station

Fig. 18: The Cytomat® 6000/6001 can be equipped with three different transfer stations:

- Standard transfer station [1],
- 90° rotatable transfer station [10] (optional),
- 180° rotatable Swap station [8] (optional).

The transfer station is matched to fit the position and the traveling motions of the Plate Shuttle™ System PSS at the factory and is then removed for the transport from the mounting plate [7] at the device rear panel.

NOTE – Table installation position

For the installation of the 90° rotatable transfer station [10] and of the Swap station [8], the transfer station tables must be rotated by 90° parallel to the device rear panel.

Installing the transfer station:
The transfer station is installed to the mounting plate [2].

1. Insert the screws [7] through the holes of the bracket into the two holes [5] at the mounting plate and tighten the screws by hand:
   - standard version through holes [6],
   - 90° rotatable transfer station through holes [11],
   - Swap station through holes [9].

2. Connect the plug [4] of the plate detection sensor connecting cable to the interface socket [3].

NOTE – Mounting plate

The position of the mounting plate has been matched exactly to fit the position of the Plate Shuttle™ System PSS in the chamber. The position and the settings at the mounting plates must remain unchanged.

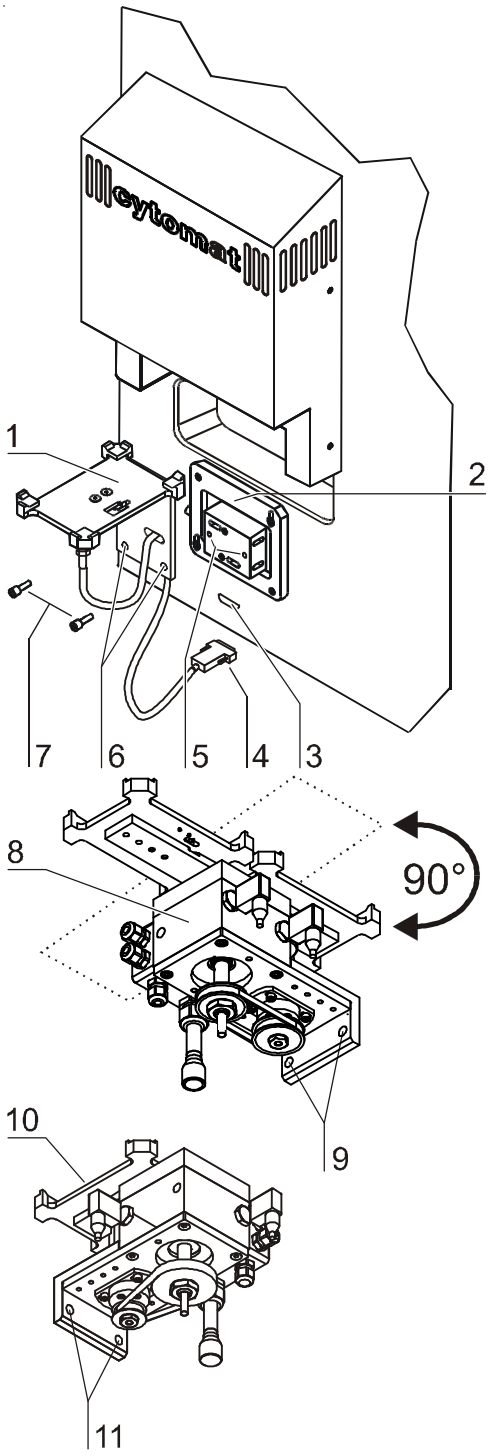


Fig. 18
Transfer station installation

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5. Start-up

5.6 Installing the oxygen electrode

The oxygen electrode is preinstalled. Before it is used with the device, it must be cleaned and disinfected. After this, the oxygen electrode is disassembled, prepared for the application, and installed.

NOTE – Hygiene regulations

When preparing the oxygen electrode, observe the hygiene regulations for cleaning and disinfection.

1. **Fig. 19:** Install electrode holder [1] to lift linkage [2] (right front).
2. Disassemble preinstalled electrode by removing two wire clamps [3].
3. Remove foil membrane [6] from bag and place it centrally onto onto clamp sleeve [7]. The letter “R” must be visible from above.
4. Place mounting ring [5] (rubber ring) onto foil and press electrode sleeve [4] into clamp sleeve. Cut off projecting foil as required.
5. Secure electrode sleeve [4] in clamp sleeve [7] and install lower wire clamp [12].
6. Using a syringe [10], fill electrode sleeve with approx 3.5 ml KCL solution [11].
7. Wipe platinum cathode [9] of electrode interior [8] using a clean cloth or filter sheet moistened with destilled water; after the cleaning, do not touch the cathode.
8. Slowly insert electrode interior [8] into electrode sleeve. The KCL solution should be approx 1-3 mm below the extension opening. Eliminate air bubbles in the electrode interior by slight tapping. The platinum cathode must be seated tightly on the foil membrane.
9. Secure electrode interior in clamp sleeve by installing upper wire clamp.

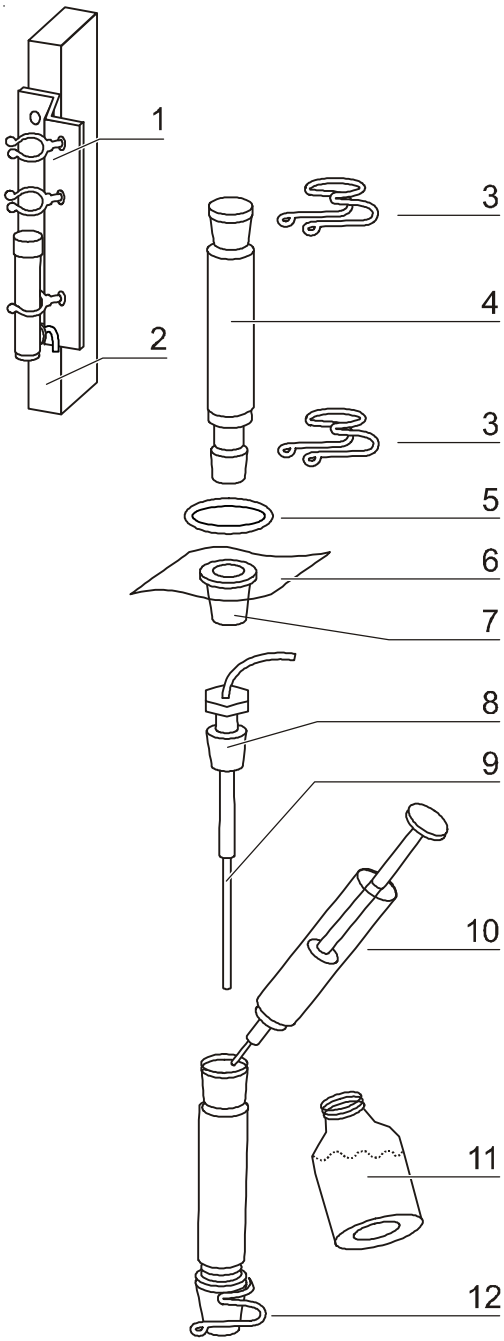


Fig. 19
Preparations for oxygen electrode

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5. Start-up

10. **Fig. 20:** Install electrode [5] to electrode holder [6] at lift linkage.
11. The hose [3] is used for the direct supply of ambient air to the oxygen electrode (required for calibrating the O_2 control system). Connect hose to angled sleeve [1] at baseplate and to sleeve [7] of O_2 electrode.
12. Connect oxygen electrode plug [4] to socket [2] at chamber ceiling.

NOTE – Hose routing

Route the hose so that it cannot be caught by the stackers when the turntable rotates.

NOTE – Oxygen electrode

If the O_2 electrode is installed to the device that is switched on and has reached operating temperature, the warm-up phase of the electrode is considered automatically to ensure optimal measurement accuracy. After 1.5 hours have elapsed, a calibration is performed, then gas supply is performed using the set nominal value.
If the O_2 electrode is removed from the device, the indicator in the O_2 display of the control unit goes off. In this case, the socket of the O_2 electrode must be sealed using the protective cap.

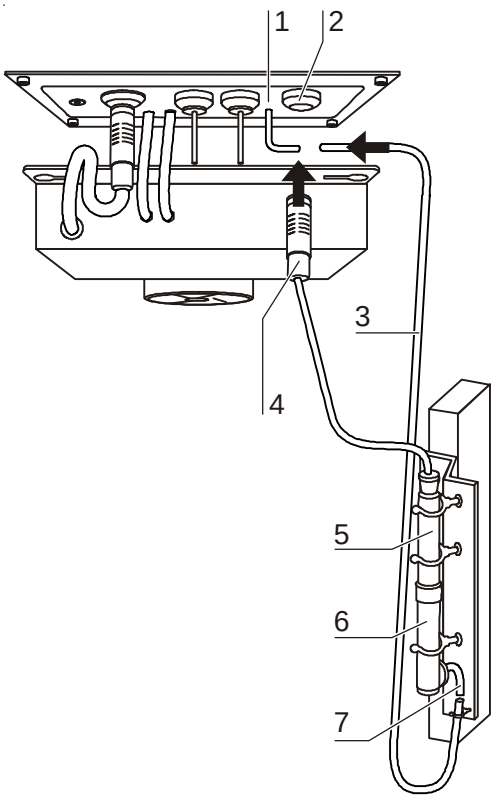


Fig. 20
Oxygen electrode connection

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5. Start-up

5.7 Connections for process gases

For the process gases, the following quality requirements apply:
- Purity 99.5 % min.,
- medical gas quality.

CAUTION - Overpressure!

The operating pressure of the gas supplied to the device must not exceed 1 bar.
If the gas is supplied at a higher pressure, the valves 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!

Fig. 21: The gas supply is connected using the supplied flexible gas pressure hoses.
- Connect CO_2 hose [3 to sleeve [2];
- connect O_2/N_2 hose [4] to sleeve[1].

1. Remove protective cap [5] from sleeve [7].
2. Slide union nut [5] onto gas pressure hose [7].
3. Connect gas pressure hose [6] to sleeve [7].
4. Connect gas pressure hose to on-site gas supply system.

NOTE – Check connections

Before gas is supplied to the device, check to see if the gas supply lines for O_2/N_2 and CO_2 are connected to the correct sleeves at the device.

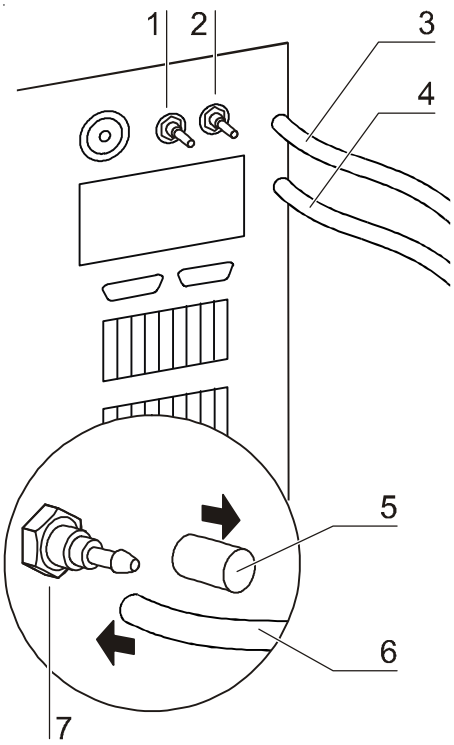


Fig. 21
Gas supply connection

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5. Start-up

5.8 Connecting the cooling system / Cytomat® 6001

The external cooling system is connected through the sleeve at the device rear panel. The heat exchanger plate is placed into the floorpan of the chamber and connected to the rear panel connections using quick-connect adapters.

1. **Fig. 22:** Place heat exchanger plate [5] into chamber floorpan. Place isolating blocks [3] and [4] onto inflow and outflow lines.
2. Connect two quick-connect adapters [1] and [2] to the corresponding receptacles at the device rear panel. To disconnect an adapter, depress the safety disk at the adapter receptacle and pull adapter off.
3. Connect low-temperature thermostat inflow and outflow line [7] to sleeves [6] (sleeve Ø 12 mm). The two sleeves are interchangeable.

NOTE – Heat exchanger plate

During operation, the heat exchanger plate must always be immersed in water.

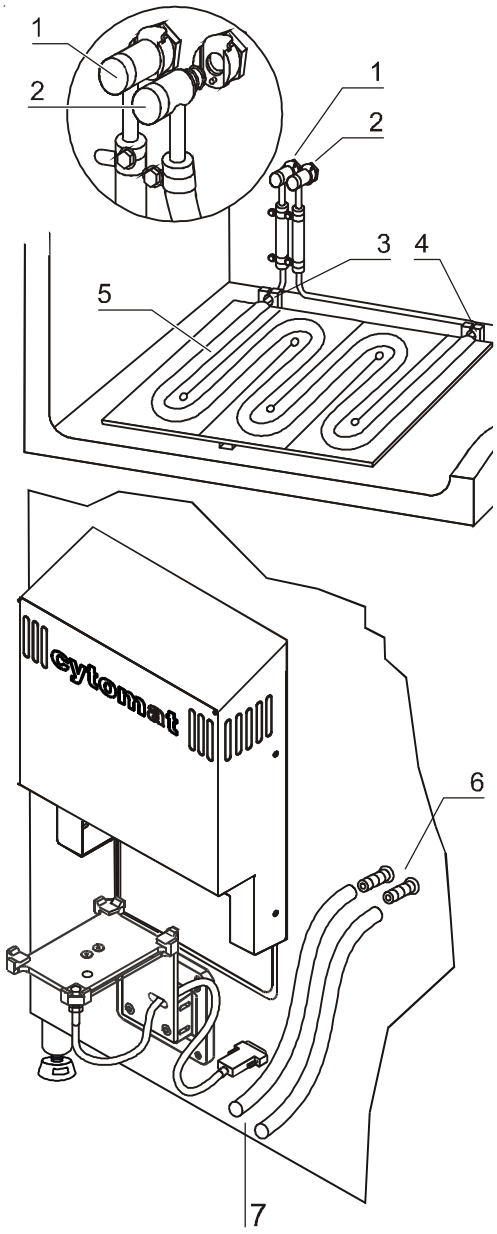


Fig. 22
Cooling system connection

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5. Start-up

5.9 Power supply connection

The device must be connected to a correctly installed and grounded power supply source:

- Fusing: T 16 A,
- Circuit breaker: G 16.



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!

1. Before connecting the device to the power supply, check to see if the voltage rating of the sockets corresponds with the specifications on the nameplate of the device. 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. 23:** Connect UPS: Connect grounding plug [1] of UPS cable to a properly grounded and fused socket or to a separate UPS system.
3. Connect device heating: Connect grounding plug [2] of device heating power cable to a properly grounded and fused socket.
4. Make sure the two power supply cables are not subjected to tensile or compressive force.

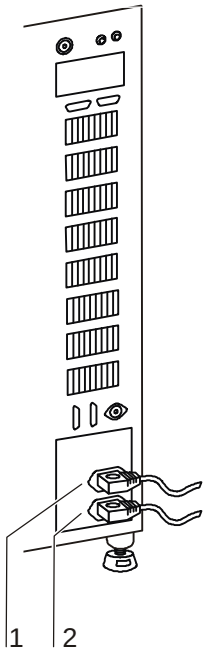


Fig. 23
Power supply connection

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5. Start-up

5.10 RS 232 interface for process data

Fig. 24: The process data during incubation operation (temperature, CO_2, and O_2) can be read with an analog recording device (e.g. circuit chart recorder) or with a connected PC.
The connection to the analog interface [1] is established using a 15-way female connector.
The RS 232 interface [2] has been designed for a cable connection with 9-way connectors and a contact assignment of 1:1 and is connected to a serial interface (COM 1/COM 2 etc.) at the PC (the interface cable is not comprised in the scope of delivery).

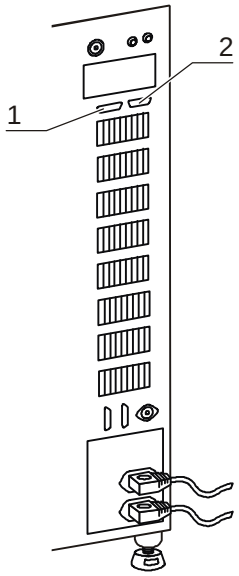


Fig. 24
RS 232 interface connection for process data

Analog connection
The analog interface converts the displayed digital values for temperature, CO_2, and oxygen (if installed) into analog signals by using a 4 channel A/D converter and a microprocessor. The resolution for D/A conversion is 10 bit for each channel, which means the total resolution is 1024 steps. The outputs are isolated from the power supply of the incubator and from the protective ground in order to avoid ground loops.
The analog outputs are connected to a female 15-way D-Sub connector at the rear of the incubator. External devices can be connected to the interface by using the standard RGB/S video cable which comes with this option. The anlog output signals are:

Red, ”R”, temperature 0...50° C = 0...0.5 VDC	10 mV/° C
Green, ”G”, CO_2 concentration 0...20% CO_2 = 0...1.0 VDC	50 mV/%
Grey, ”S”, O_2 concentration 0...100% O_2 = 0...1.0 VDC	10 mV/%
Blue, ”B”, not used	

External devices can be connected directly to a male 15-way D-Sub connector that fits the female output connector of the incubator:

Temperature,	Pin 1, (+)
CO_2	Pin 2, (+)
O_2	Pin 13, (+)
Ground (-)	Pins 6, 7, 8, and 10

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5. Start-up

Digital connection

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

Command sequences:
Data communication 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 data1 XOR ... XOR dataN
XOR FF_H)

Command list - Reading closed-loop data:
Command:
0110 0001 (61_H)
Data:
0001 0000 (10_H) for temperature
0001 0001 (11_H) for CO_2
0001 0010 (12_H) for O_2

Device response for temperature and CO_2/O_2:
Data:
Intern (2 bytes)
Nominal value (4 bytes, floating point number)
Internal use (5 bytes)
(see example below)

Example: Temperature data request and response

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

Response:
02_H $6B_H$ $\underline{00}_H$ $\underline{00}_H$ 42_H 14_H $4A_H$ $3D_H$ $\underline{00}_H$ $\underline{00}_H$ $\underline{00}_H$ $\underline{00}_H$ $\underline{00}_H$ $4A_H$ 03_H
inter (37.07) *intern*

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5. Start-up

5.11 Connecting the alarm system

NOTE - Expert work

Kendro Laboratory Products warrants the operational safety and the operativeness 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!

Function:
When failures occur in the temperature or gas control circuits, the connected alarm/monitoring system issues an alarm. The potential-free contacts (1 NO contact, 1 NC contact) have been dimensioned for the following circuits:

Circuits:

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

Cytomat® alarm relay:

Operating state	Contact 2 - 3	Contact 2 - 1
No failure, power off	X	O
No failure, power on	O	X
Failure	X	O
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 off.

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5. Start-up

Fig. 25: External alarm/monitoring systems (e.g. telephone system or building monitoring systems) are connected to the socket [1] using an angular connector [2].

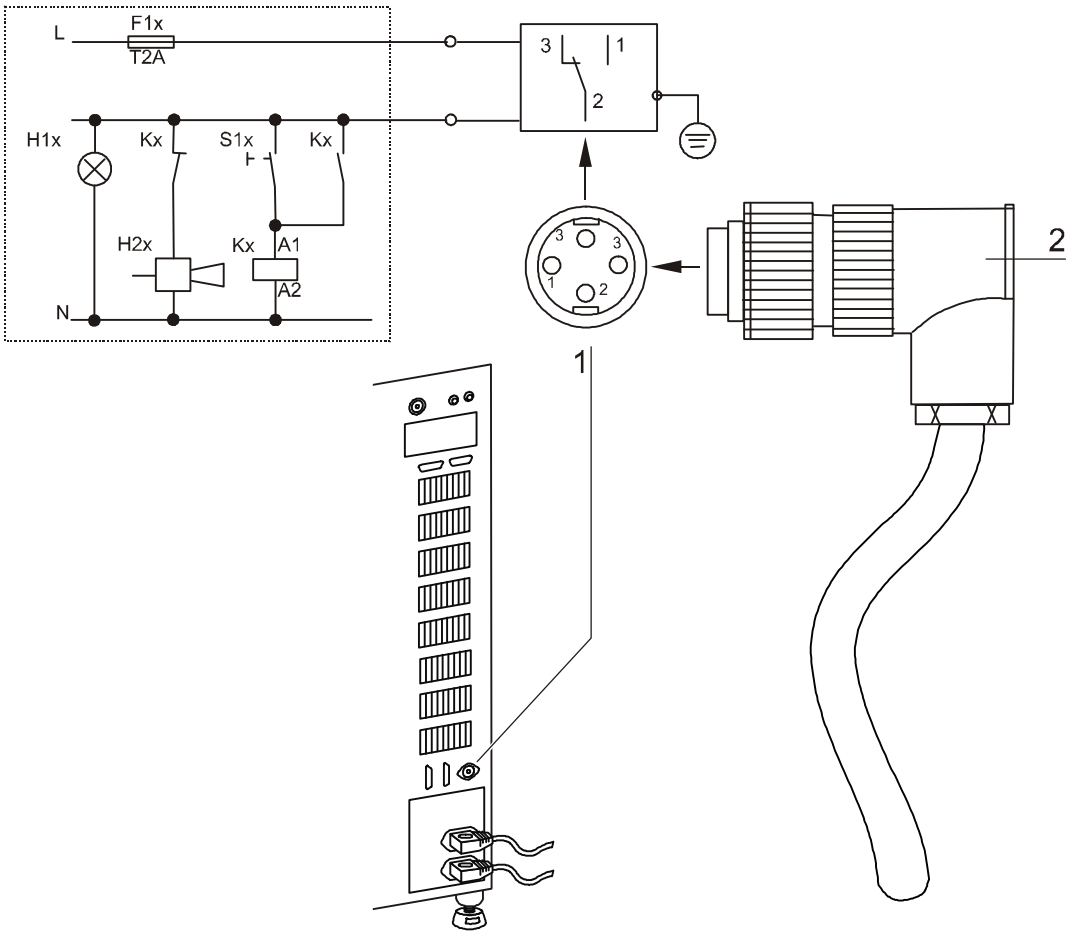


Fig. 25
Example of a connection scheme for an external alarm system

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5. Start-up

5.12 Interface for Plate Shuttle™ System (PSS)

The RS 232 interface for the PSS connects the automatic incubator to the external control system of the integrator. This may be a PC workstation for an individual installation or a server for an integrated network. The entire motional procedure of the Plate Shuttle™ System (PSS) for the automated loading and unloading of the stackers and for picking up or depositing the culture containers at the transfer station is controlled by using this external computer system.

Connecting the device:

1. **Fig. 26:** Turn computer system off.
2. Connect the serial interface cable to the RS 232 interface PSS [1] of the automatic incubator and to a serial interface (COM 1/COM 2 etc.) of the external computer system.

NOTE - Initial start-up

For the initial start-up of the automatic incubator, the magazine should be empty (no culture containers).
The function of the automatic check-in system is only available when the glass door is closed.
For testing the device functions, use only the test software supplied with the device. This software gives you a good overview of the incubator functions.

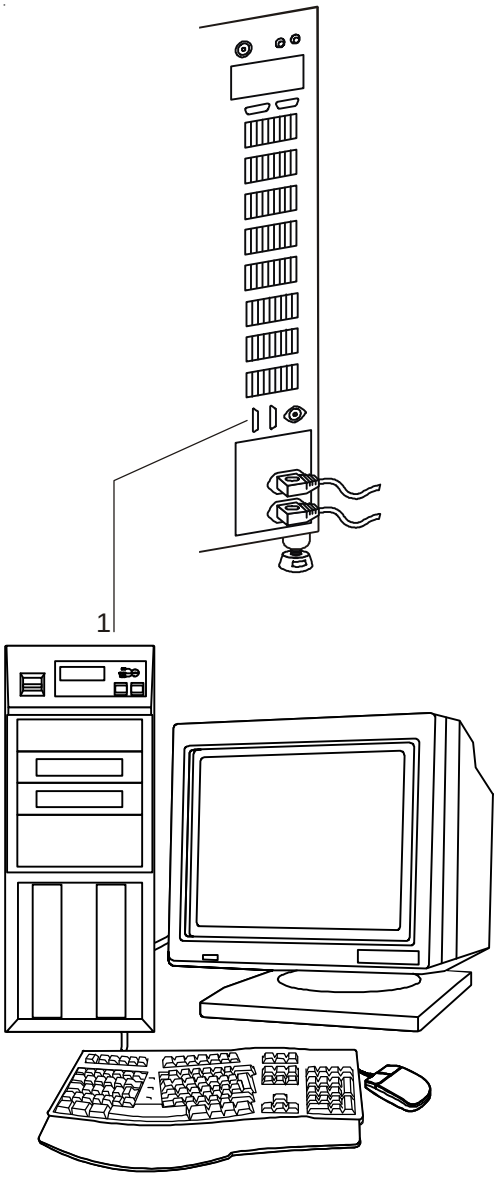


Fig. 26
Plate Shuttle™ System (PSS) connection

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6. Handling and control

6.1 Operating panel

Fig. 27: The two device versions have different operating functions. The Cytomat® 6000 does not have the two switches [4] and [5] for the manual switching of the automatic gate heating and for the blower.

[1] Operating panel for temperature and CO_2/O_2 control
[2] Thermal protector
[3] Switch for outer door heating
[4] Switch for automatic gate heating (only Cytomat® 6001)
[5] Switch for blower (only Cytomat® 6001)
[6] Operating panel for manual stacker position control
[7] Power switch
[8] Fuse T 2 A for UPS
[9] Line fuse T 10 A (230 V) or M 12 A (100 – 120 V)
[10] Power switch indicator

NOTE – Line fuse 100–120 V

Device versions for 100–120 V power supply systems have only one fuse holder for the device-integral fusing of the UPS connection [8] and of the power supply connection [9].

6.2 Power switch

Fig. 27: The power switch [7] is used for the interruption in all poles of the device and also serves as an emergency-off switch. When the device is switched on, the green indicator [10] is illuminated.

NOTE – Power supply

In case of a power failure during UPS operation, the green indicator [10] goes off.
The power supply connection of the electronic system is routed through the main switch of the incubator. Therefore, the electronic system is always activated when the automatic incubator is switched on.

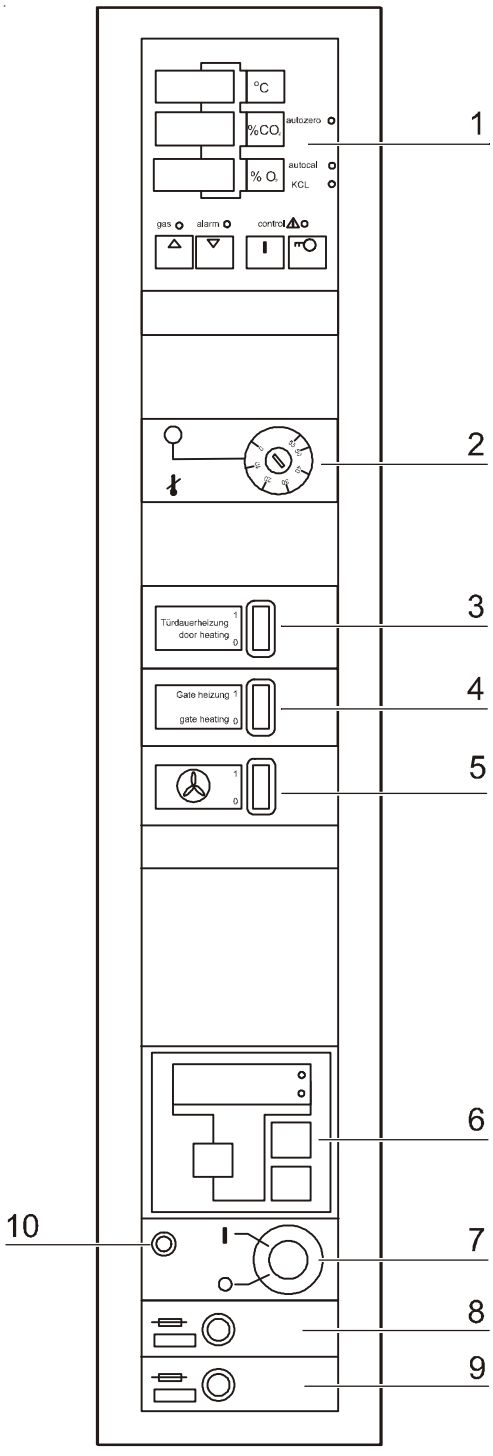


Fig. 27
Operating panel

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6. Handling and control

6.3 Controls for temperature and CO_2/O_2

Fig. 28: Input field for temperature and gas values

[1] Temperature display (° C). During normal operation, the actual value is displayed. The nominal value can be displayed by pressing the nominal value key.
[2] CO_2 concentration display (%). During normal operation, the actual value is displayed. The nominal value can be displayed by pressing the nominal value key.
[3] O_2 concentration display During normal operation, the actual value is displayed. The nominal value can be displayed by pressing the nominal value key.
[4] ALARM LED, flashes when a failure is detected.
[5] GAS LED, illuminates when gas supply is enabled.
[6] Increase key (UP)
[7] Decrease key (DOWN)
[8] I key. Press this key to display failure codes.
[9] KEY key. Press this key to display special functions.
[10] CONTROL LED, flashes while special functions are selected.
[11] O_2 nominal value key.
[12] KCL LED, flashes if the O_2 electrode must be serviced.
[13] AUTOCAL LED, blinkt, flashes while the O_2 measuring system is being calibrated automatically.
[14] CO_2 nominal value key.
[15] AUTOZERO LED, flashes while the CO_2 measuring system is being calibrated automatically.
[16] Temperature nominal value key.

Setting nominal values:

1. Keep nominal value key (temperature, CO_2, O_2) depressed.
2. Press increase key (UP) or decrease key (DOWN) repeatedly until the desired nominal value is shown at the corresponding display.
3. Release nominal value key; the entered value is stored, the current actual value is displayed.

NOTE – Factory settings

The following values have been set at the factory:

- **Temperature: 37.0° C,**
- **CO_2 concentration: 0.0 %,**
- **O_2 concentration: 21.0 %.**

To ensure optimal measurement accuracy, the device should be switched off and powered up again if the temperature nominal value is to be changed by more than 1° C.

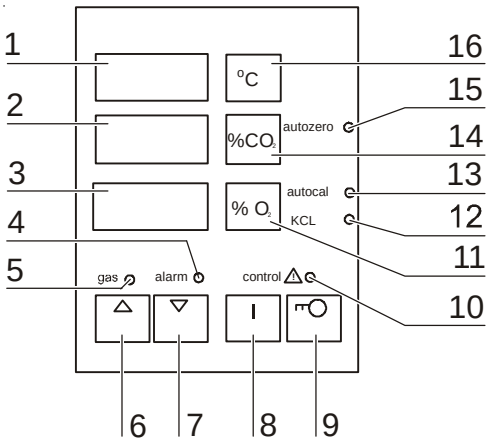


Fig. 28
Input field for temperature/CO_2/O_2

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6. Handling and control

6.4 Thermal protector

Depending on the setting used, the thermal protector prevents either the samples or the device from overheating:

- Sample protection when a temperature nominal value is set;
- device protection when the rotary switch is rotated all the way to the stop.

NOTE – Application of the thermal protector

The thermal protector can switch off the heating temporarily if required. It must only be used for protecting samples that are not damaged by a temperature drop (refer to Laboratory Guidelines ZH 1/119 or applicable national regulations).

To enable device protection:
Fig. 29: Set rotary switch [2] to stop position by rotating slot [3] all the way clockwise.

To enable sample protection:
Using the rotary switch [2], set the temperature nominal value of the thermal protector slightly higher than the temperature nominal value set with the temperature control.

1. **Fig. 29:** Locate response point to determine at which temperature the thermal protector responds. Start device up and rotate rotary switch [2] all the way clockwise to the stop (device protection).
2. After the preset temperature has been reached (temperature control nominal value), reset thermal protector to response point using the rotary switch [2]. The response point is reached when the red indicator [1] illuminates.
3. Adjust thermal protector. The optimal setting of the thermal protector is achieved by rotating the rotary switch [2] back by approx one division mark (1° C-2° C) until the red indicator goes off.

NOTE – Thermal protector functional test

The correct function of the thermal protector must be checked at appropriate intervals (1-2 months). This check should also be performed prior to extended working cycles.

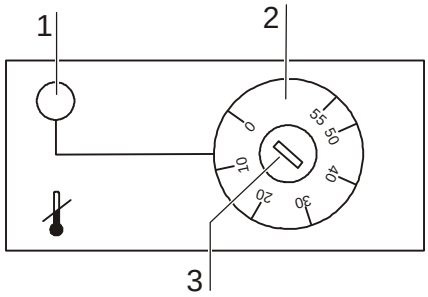


Fig. 29
Thermal protector adjustment

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6. Handling and control

6.5 Switches for additional functions

The additional functions
- outer door heating
- automatic gate heating
- blower

can be used for optimizing the relative humidity in the chamber at different operating modes.
The parameters conditioning the relative humidity during heat exchanger operation in the Cytomat® 6001 largely depend on the operating conditions of the device:
- ambient temperature,
- thermostat operation,
- length of the coolant inflow and outflow route.

Optimizing the relative humidity in the Cytomat® 6001 with heat exchanger:
The maximal relative humidity that can be achieved in the chamber depends on the dew point (minimal surface temperature) in the chamber. If the temperature in the operating room is between 20° C and 25° C and if the device is operated at a chamber temperature of 37° C, the “coldest“ surface zone of the chamber is at the rear panel of the device.
To determine a defined location for condensate formation in the chamber, the chamber is connected to the exterior container through a thermobridge (cold spot) where the liquid can flow back safely into the floorpan.
If, however, the device is to be operated with a chamber temperature of < 30° C, the water bath temperature must be cooled down using the heat exchanger so that the water surface becomes the coldest surface in the chamber.

Calculation examples:

Ambient temperature	22° C
Chamber temperature	37° C
Thermobridge (cold spot)	approx 36° C
Water bath	approx 37° C
Water volume at 36° C	41.75 g/m³
Water volume at 37° C	43.95 g/m³

$$\text{Relative humidity (rH)} = \frac{41.75\ g/m^3 * 100}{43.95\ g/m^3} = 95\ \%$$

Ambient temperature	22° C
Chamber temperature	25° C
Thermobridge (cold spot)	approx 25° C
Water bath	approx 20° C
Water volume at 25° C	23.07 g/m³
Water volume at 20° C	17.32 g/m³

$$\text{Relative humidity rH} = \frac{17.32\ g/m^3 * 100}{23.07\ g/m^3} = 75\ \%$$

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6. Handling and control

Therefore, to optimize the relative humidity, the temperature of the water bath must be as high as possible. This is achieved by reducing the heat energy supplied to the chamber and by increasing the heat transfer between the water surface and the air within the chamber.

Increasing the heat transfer
To increase the heat transfer from the water surface to the chamber air, the air circulation speed is increased by switching on an additional blower. At the same time, the evaporation rate increases with the higher air circulation which results in an additional improvement of the air humidity.

Reducing the heat energy
The operation of the Plate Shuttle™ System (PSS) automatically introduces uncontrolled energy (power dissipation from the electric motors) into the chamber; this energy cannot be reduced.
As condensate formation on the automatic gate is low due to the parameters, the heating of the automatic gate and of the outer door can be switched off. It must be considered when testing if or how much condensate forms on a door if this may present a hazard for the stored samples.

Water bath temperature
The optimal water temperature is determined by conducting a series of tests that increases the water temperature gradually. The temperature may remain increased as long as the temperature in the chamber remains stable. The water temperature must be measured in the center of the floorpan. Make sure that the heat exchanger is always completely immersed in the water.

NOTE – Settings for the additional functions

The following settings for the additional functions are the result of experiments with average operating conditions.

Settings for Cytomat® 6000:

Switch for outer door heating	on

Settings for Cytomat® 6001 with heat exchanger:

Switch for outer door heating	off
Switch for automatic gate heating	off
Switch for blower	on

Settings for Cytomat® 6001:

Switch for outer door heating	on
Switch for automatic gate heating	on
Switch for blower	off

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6. Handling and control

6.6 Controlling the stacker position

Fig. 30: The operating panel is used for the manual control of the rotary motions of the magazine. For the visual inspection with opened outer door, the magazine can be rotated gradually until the desired stacker (1-9) is positioned in the chamber opening and culture containers can be manually removed from or placed into the stacker.
The stacker position is controlled using the keys [2], [3], and [4] on the operating panel; the display [1] shows the corresponding operating state:

- "run" while the magazine is rotating,
- "door" as soon as the glass door is opened,
- "hold" when the magazine has moved to the selected stakker position,
- number of the stacker position that the magazine is currently in or that had just been selected.

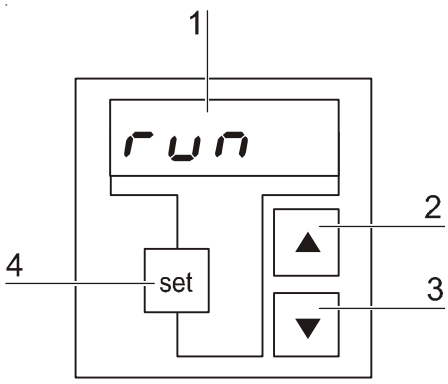


Fig. 30
Manualstacker position control

Selecting the stacker position:

1. Press the **set** key [4]; the display shows the current stakker position (e.g. **nr 5**).
2. Select stacker by pressing the increase key **UP** [2] or the decrease key **DOWN** [3]. The display shows the change of the value in increments.
3. Press the **set** key to start the traveling motion to the desired stacker position. The display shows **run**.
4. When the traveling motion is completed, the display shows **hold**. The glass door can be opened for access to the culture containers; the dsísplay shows **door**.

NOTE – Interrupting the rotating motion

When the glass door is opened, the rotating motion of the magazine is interrupted. As soon as the door is closed, the rotating motion to the selected position continues.

NOTE – Failure message

If the operation is cancelled due to a failure, the display shows the failure message ERR. The operation can be restarted. If it is cancelled again, the cause of the failure should be identified by a request through the PC interface (software control of the Plate Shuttle™ System (PSS)).

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6. Handling and control

6.7 Failure detection during incubation operation

A diagnostic system monitors all parameters of the chamber atmosphere and detects any failures that occur.
To prevent temporary changes of the operating conditions from resulting in failure messages during incubation operation, the diagnostic system has a response delay in the following tolerance range:

- Temperature: ± 0.5° C
- CO_2 content: ± 1.0 % CO_2
- O_2 content: ± 2.0 % O_2

Erasing failure messages:

- Change nominal value.
- Switch device off and back on.

Failure display:
If the diagnostic system detects a failure, the ALARM LED and the indicator of the affected control loop flash.
When the outer door is opened, the indicators of all control loops flash. Additionally, the acoustic alarm sounds when this function is enabled (special function).

Quitting failures:
Keep the I key depressed. The acoustic alarm is switched off (silenced), and the failure code is shown in the display that has been assigned to the faulty control loop.
If no failure is present, the displays show two dashes separated by a dot (-.-) when the I key is pressed.

Besides failures due to deviations from the set nominal value, the diagnostic system detects additional failures:

Temperature control loop:

- Open in temperature sensor circuit

CO_2 control loop:

- CO_2 gas analyzer faulty
- Gas analyzer disconnected

O_2 control loop:

- Electrolyte exhausted (refill KCL)
- O_2 electrode faulty

Identifying failures:
The failures detected by the diagnostic system are assigned to special failure codes which simplifies the identification of failure causes (see failure code list).

Storing failure codes:
For service purposes, the device has a failure code memory that can store up to 9 failure codes. This memory is maintained even in case of a power failure.

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6. Handling and control

6.8 Troubleshooting

To ensure fast failure repair, always observe the possible causes and the repair actions in the table below.

Failure code list:

Code	Description	Possible cause	Repair
99	Door open	Doors not closed	Close doors
100	Temperature below nominal value	Temperature set at thermal pro-tector low, observe indicator	Check thermal protector setting; see START-UP
101	Temperature above nominal value	Ambient temperatur high	Actuate door heating switch
104	Open in sensor circuit	Temperature sensor	Contact Service
200	CO_2 below nominal value	CO_2 gas not connected CO_2 gas cylinder empty CO_2 prepressure low	Connect gases, see INSTAL-LATION; replace CO_2 gas cylinder, set prepressure to 1 bar
201	CO_2 above nominal value	CO_2 prepressure high	Set prepressure to 1 bar
202	Gas analyzer calibration failure	Hose connection interchanged or plugged, blower at gas analyzer faulty	Check hose connections, observe color code rings, replace blower, contact Service
203	Gas analyzer	Gas analyzer disconnected	Connect gas analyzer, connect plug repeatedly
300	N_2 below nominal value	N_2 gas not connected N_2 gas cylinder empty N_2 prepressure low	Connect gases, see INSTALLATION; replace N_2 gas cylinder, set prepressure to 1 bar
301	N_2 above nominal value	N_2 prepressure high	Set prepressure to 1 bar
302	O_2 below nominal value	O_2 not connected O_2 gas cylinder empty O_2 prepressure low	Connect gases, see installation; replace O_2 gas cylinder, set prepressure to 1 bar
303	O_2 above nominal value	O_2 prepressure high	Set prepressure to 1 bar
304	Electrolyte failure	Electrolyte exhausted Electrolyte level low Foil membrane damaged Electrode not installed correctly	Refill electrolyte (see Annex) Install electrode correctly (see Annex)

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6. Handling and control

NOTE – Failure causes

If the failures cannot be repaired using the recommended repair actions, the device must be shut down.
Contact Technical Service to repair the failure.

Failure causes:
The possible failure causes below are not displayed by failure messages.

Failure	Repair
Device heating inoperative	Check nominal value, check to see if heating system plug is connected
Device gas supply inoperative	Observe GAS LED: Check to see if gas supply is enabled Check nominal value
Acoustic alarm system does not respond to failures	Check horn operating state (enabled/disabled), see Section "Special Functions"
Nominal values cannot be changed	Nominal values are locked, see Section "Special Functions"
Excessive condensation on glass screen	Check switching state of switch for continuous door heating or for blower (only cytomat® 6001)

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6. Handling and control

6.9 Special functions

Special functions can only be accessed and changed using the key-operated switch at the control unit.

Horn: Enabled/Disabled
Function level 1:
Simultaneously with the failure message, an acoustic alarm sounds when the horn is enabled.
- Horn OFF: „Muted“ alarm
- Factory setting: Horn ON

Gas supply: Enabled/Disabled
Function level 2:
When „Gas supply DISABLED“ is selected, the gas supply is permanently disabled. The green GAS LED goes off.
- Factory setting: Gas supply ENABLED. The green GAS LED is illuminated.

Nominal value: Locked/Unlocked:
Function level 4: To prevent tampering with set nominal values (temperature, CO_2, O_2), the nominal value keys can be locked on this level.
- Factory setting: Keys unlocked.

Operating mode:
Function level 7: Factory settings for operating mode.
- *Cytomat*® 6000 = U.1
- *Cytomat*® 6001 = U.0

These settings must remain unchanged!

Failure code list
Function level 10: On function level 10, the failure codes can be read.

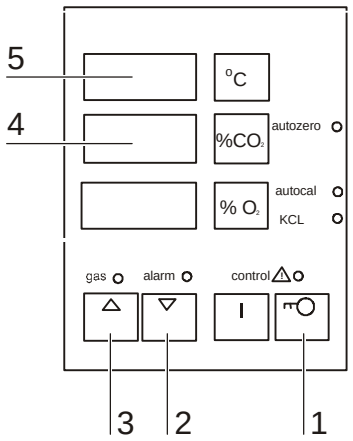


Fig. 31
Selecting special functions

Function level	Display: °C	Display: CO2	Function	Factory setting
1 Horn	[.1]	[A .1] [A .0]	Horn on Horn off	Horn on
2 Gas	[.2]	[G .1] [G .0]	Gas supply enabled Gas supply disabled	Gas supply enabled
4 Nominal values	[.4]	[S .0] [S .1]	Locked Unlocked	Unlocked
7 Operating mode	[.7]	[U .1] [U .0]		Setting must remain unchanged

Selecting special functions:
1. **Fig. 31:** Keep key [1] depressed and select function level by pressing UP [3] or DOWN [2] key. The temperature display [5] shows the level (e.g. 1).
2. Release the key [1], then press it again. The CO_2 display [4] shows blinking the operating state of the setting (e.g. A .1).
3. Change state by pressing the UP/DOWN key.
4. Release key [1]. Changed state is taken over and stored.

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6. Handling and control

6.10 CO_2 comparison measurement

If a precise CO_2 comparison measurement shows a concentration that deviates largely from the actual value, the CO_2 measuring system can be corrected manually during the operation of the device.
Example:

- CO_2 display: 7.0 % CO_2
- CO_2 measured value: 6.2 % CO_2

Go to function level 3:

1. **Fig. 32:** Keep KEY key [1] depressed and select function level 3 by pressing the UP key [4].
2. Release key [1].
3. Keep key [1] depressed again.
4. The temperature display (° C) shows the flashing value (.0), the CO_2 display shows (.1).
5. Enter the nominal value (the CO_2 concentration measured before) by pressing the UP key. The temperature display (° C) shows the value.
6. Release key [1].
7. Press I key [2] to start the internal calculation process.

NOTE – Failure causes

After completion of the calculation process, the CO_2 display shows the corrected concentration. If the displayed actual value exceeds the nominal value, open doors for approx 15 seconds to eliminate the excessive gas.

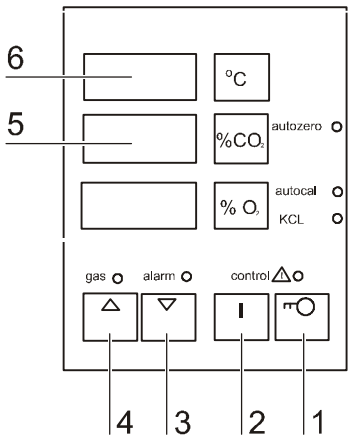


Fig. 32
Selecting CO_2 comparison measurement

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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.
Prior to starting operation, the following device components must be checked for their correct function:

- The gas hoses must be connected tightly to the connecting sleeves and secured with the hose clamps.
- The pressure compensation opening must be permeable, its insert must be installed to the pipe from outside.
- The components of the Plate Shuttle™ System (PSS) and the on-site transport system must be matched to fit each other, the traveling motions must be synchronized without collision hazard.



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 are to be used as safety information for personnel operating the device.



NOTE – Water supply

The floorpan of the chamber can hold up to 6 l of processed water. For the running operation, always keep a sufficient quantity of processed water of the following quality available:

- **distilled, demineralized, or**
- **autoclaved, sterile.**

Check water level daily.
Cytomat® 6001: For operation with heat exchanger, the heat exchanger plate must always be immersed in water.

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7. Operation

7.2 Starting operation

Starting and loading the device:

NOTE – Devices without gas supply

For starting devices without gas supply, ignore the operating steps for CO_2/O_2 adjustment.

1. Turn the device on using the power switch.
2. Ventilate chamber by leaving both device doors open for approx 5 minutes.
3. If the device is to be operated with water, fill the chamber floorpan with up to 6 l of processed water.
4. Make sure that the CO_2/O_2 supply system valve is open.
5 .Set nominal values for temperature and CO_2/O_2 content at the operating panel.
6. Start device using auto-start routine by keeping UP and DOWN keys simultaneously depressed for approx 5 seconds. The GAS LED goes off, the CO_2 display shows the value 0.0, the O_2 display shows the value 21.0 (with oxygen electrode installed).
7. Close device doors.
8. The temperature control adjusts the temperature to the set nominal value, humidity in the chamber increases.
9. When temperature and relative humidity are constant, the ideal loading state is achieved. For devices with optional CO_2/O_2 supply, the CO_2/O_2 measuring system is adjusted automatically. The AUTOZERO and AUTOCAL LEDs flash.
10. The actual values are displayed.
11. The CO_2/O_2 control supplies the set amount of gas.
12. **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 adjustment of the CO_2 measuring system may take up to 15 hours.

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8. Shut-down

8.1 Shutting the unit down

Temporary shut-down (e.g. to interrupt operation for one or two days):

1. Unload stacker completely. Make sure that all culture containers have been removed from the chamber.
2. Switch device off using the main switch. Disconnect power plug and protect it from accidental reconnection.
3. Close CO_2/O_2 supply system shut-off valve.
4. Clean and disinfect chamber.
5. While the unit is shut down, the chamber must be continuously ventilated: Leave glass door and outer door slightly open and secure them in this position.

Additional measures required for the extended storage or final shut-down of the device:

6. Disconnect gas pressure hoses from connecting sleeves.
7. Remove oxygen electrode and clean it using distilled water. Install protective cap to connecting sleeve.
8. Remove stacker and Plate Shuttle™ System (PSS).
9. Drain water completely from floorpan.
10. Clean and disinfect device.
11. Install Plate Shuttle™ System (PSS) and connect plugs to sockets in chamber.
12. Disconnect two power plugs from device and store them at a separate location.

NOTE – Handler malfunction

If the handler motion is blocked when the device is started up again, cancel operation immediately:

1. **Switch the device off and disconnect it from the power supply system.**
2. **Move all motor-driven handler components manually for a short while.**
3. **Reconnect device to the power supply system and switch it on. If the handler fails to move again, shut the device down. Do not repeatedly attempt to start the handler!**
4. **Contact Technical Service for repair.**

NOTE – Condensate formation

Water residues in the disconnected and closed device may cause harmful condensate formation. Remove water completely from the device.

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9. Cleaning and decontamination

9.1 Preparations

The operator must prepare hygiene regulations for the decontamination of the device in accordance with the application of the device.



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 de-energized.**



WARNING – Protective measures!

Contact with contaminated surfaces may cause infections. Disinfectants may contain harmful substances.
The operator must set cleaning and disinfection measures depending on the potential hazard of the experiments conducted with the device.

The disinfection is carried out in three stages:

- **Pre-disinfection,**
- **cleaning,**
- **final disinfection.**

For the pre-disinfection, the Plate Shuttle™ System (PSS) with installed stackers remains in the chamber.
The following preperations are required for cleaning and disinfection:

- **Remove stackers, then remove Plate Shuttle™ System (PSS), (see chapter 5.2).**
- **Remove gas analyzer, if installed.**
- **Completely remove water from the floorpan.**

This decontamination process requires a working surface that is suited for the treatment of these components with cleaning agents and disinfectants.

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9. Cleaning and decontamination

Water removal:
The water is removed using the supplied siphon.

1. **Fig. 33:** Press suction unit [1] onto floorpan recess.
2. Close valve [4] at bulb [3] (position tap at right angle to hose).
3. Draw in water by compressing bulb [3] repeatedly.
4. Open valve [4] and collect water in a suited container [5].
5. Empty bulb by removing suction unit from floorpan and lifting it so that all the water can flow from the hose and the bulb into the container.
6. Remove water residues in floorpan completely using a cloth.

Gas analyzer and O_2 electrode removal:
The gas analyzer can be removed for disinfection.

1. **Fig. 34:** Disconnect gas analyzer connections. Remove gas analyzer connecting plug [1] and oxygen electrode connecting plug [5] as well as connecting hoses [2], [3] and oxygen hose [10] from connecting sleeves [4] and [9].
2. Attach protective caps to connecting sleeves [1] and [5].
3. Remove oxygen electrode [8] from holder.
4. Loosen two retaining screws [6] and remove knurled screw [7] of gas analyzer.
5. Carefully remove gas analyzer with blower.
6. For installation, make sure that the two hose connections [2] and [3] are connected to the corresponding color-coded connecting sleeves.

NOTE – Functional test

After the installation, check to see if the gas analyzer is attached securely to the chamber ceiling.

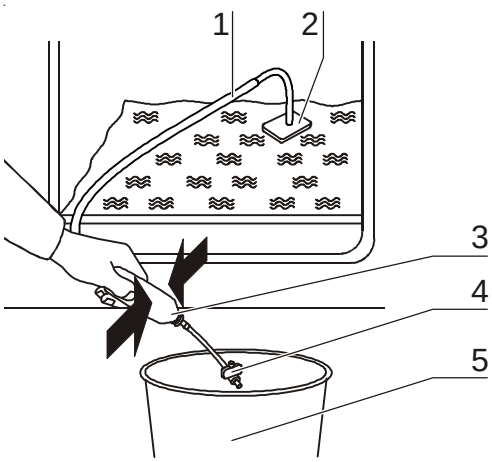


Fig. 33
Water removal

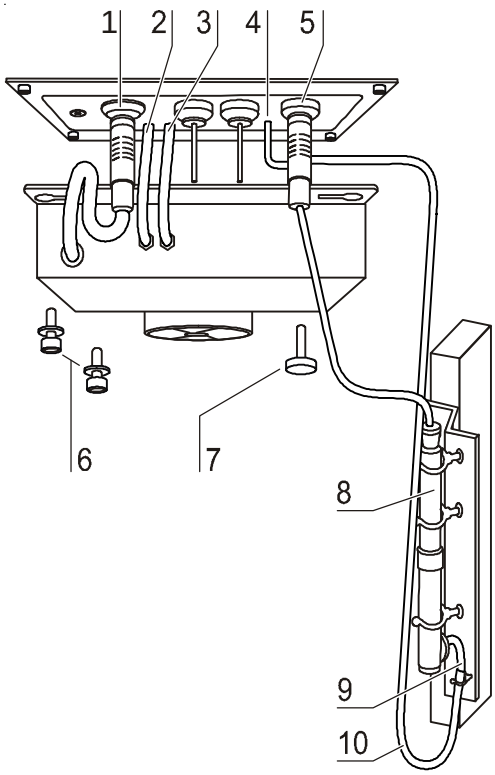


Fig. 34
Gas analyzer and O_2 electrode removal

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9. Cleaning and decontamination

9.2 Wipe/spray disinfection

The wipe/spray disinfection procedure is used for the decontamination of the chamber and of the Plate Shuttle™ System (PSS) components. Only stackers with metallic support rails can be autoclaved.



CAUTION – Fire hazard!



Disinfectants with an alcohol content of more than 10 % may form, in combination with air, easily combustible 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 all components are completely dry.**
- **Observe safety regulations to avoid fire and/ or explosion hazard caused by alcohol-containing disinfectants.**



CAUTION – Harmful chemicals!



Chloride-containing disinfectants may corrode noble metals. Therefore, use only disinfectants that do not contain choride or whose low content of chloride does not harm noble metals!

Alcohol dulls the protective foils of the photocells. The detection sensor of the transfer station, of the handler, and of the turntable must not be allowed to come into contact with alcohol!

Some exterior surfaces of the device are made of plastics. Solvents may dissolve plastics, and powerful acids or lyes may cause embrittlement of the plastics. Do not use hydrocarbon-containing solvents, detergents with an alcohol content of more than 10 % or powerful acids or lyes for cleaning plastic components!

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9. Cleaning and decontamination

Pre-disinfection:
1. Disconnect all connecting cables of the Plate Shuttle™ Systems (PSS) and of the gas analyzer and plug the sockets using the protective caps.
2. Spray disinfectant onto all surfaces and device components in the chamber or wipe surfaces and components clean using disinfectant.
3. Allow disinfectant to react as specified by manufacturer.

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

Final disinfection:
1. Wipe the chamber surfaces and the removed device components clean again using disinfectant.
2. Allow disinfectant to react as specified by manufacturer.
3. Install all removed components into the chamber.

Cleaning the device exterior surfaces:
1. Wipe the exterior surfaces clean again using a solution of tepid water and domestic dishwashing agent.
2. Then, wipe surfaces thoroughly dry.

Disinfectant:
Kendro Laboratory Products recommends the disinfectant Barrycidal 36.
When applied properly, Barrycidal 36 is a highly effective broad-range disinfectant. The effectiveness of the product is the result of its ammonium compounds. The broad-range disinfectant is effective against viruses, bacteriae, yeasts, funguses and AIDS causatives (HIV). Barrycidal 36 is DGHM-listed.
Part no. for Barrycidal 36: 50 052 425
Restriction:
In some European countries and in the U.S.A., Barrycidal 36 has not been approved as a disinfectant. In these areas, some other suited disinfectant that meets the aforementioned safety requirements must be used.
As an alternative for the U.S.A., Kendro Laboratory Products recommends Microcide SQ. Microcide SQ is EPA-listed. Direct order: www.globalbio.com.

Cleaning agents:
Liquinox or domestic dishwashing agents based on soap lye.

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

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9. Cleaning and decontamination

9.3 Lubrication

Fig. 35: 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 a clean, lint-free cloth and apply sparesly (thin film) to the following lift system components:

- **Plastic gear [2] of the handler and the related aluminum gear rack of the lift system. For the rack, lubricate the teeth [6] and the side surfaces [1].**
- **Guide rail [3] on both sides of the lift system.**
- **Teeth of the drive gear [4] and of the transfer gear [5] of the handler.**
- **Linear rail [7] below the shovel. If the rail is equipped with a lubricator nipple, lubricate it using a suited grease gun; otherwise the entire surface of the linear rail must be lubricated.**

Lubricant:
Heraeus special grease 3500 Lubricant is a special lubricant for sliding components.
Lubricant 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.: 76 003 500

Auxiliaries:
Lint-free, sterile cloths or sheets.

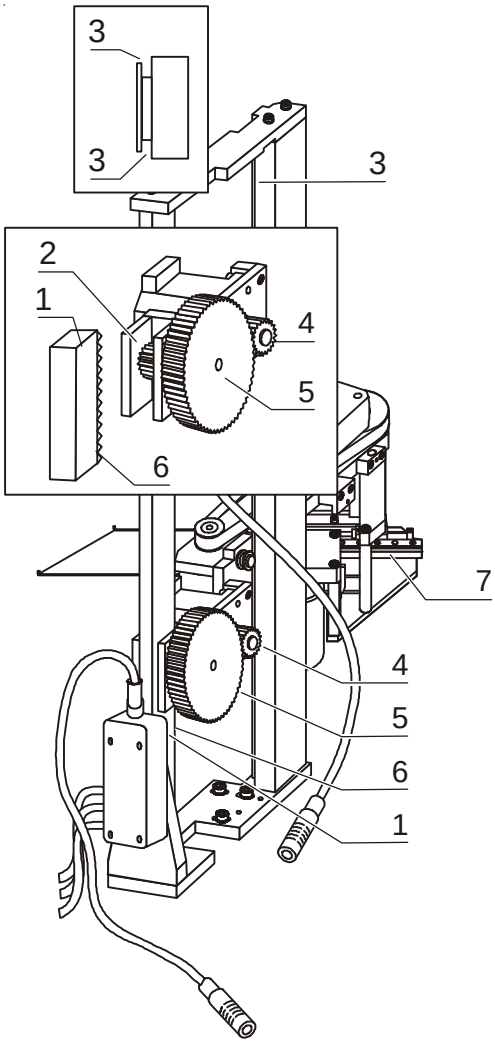


Fig. 35
Lubricating the Plate Shuttle™ System (PSS)

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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.

Daily check:
- Gas supply of the CO_2 supply system.
- Gas supply of the O_2 supply system.

Annual inspection:
- Tightness of the glass door seal.
- Automatic gate seal.
- Permeability of the pressure compensation opening insert.
- Functional check of the operating panel and of the device control system.
- Belt tension.
- Electrical safety check in accordance with the applicable national regulations (e.g. VBG 4).

NOTE – Functional check

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

10.2 Service intervals

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

3-month service:
- Perform CO_2 comparison measurement.
- Perform basic cleaning for Plate Shuttle System (PSS) components.

Annual service:
- Replace sterile filter.
- Perform temperature comparison measurement.

NOTE – Service contract

Kendro Laboratory Products offers a device-specific service contact that comprises all test and service works required.

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10. Maintenance

10.3 Inspection intervals for Plate Shuttle™ System (PSS)

		Inspect		Service		Replace	
		Months	Cycles	Months	Cycles	Months	Cycles
Lift system vertical guide	• Even grease film along entire guide length	2	2000	6	50000	--	--
	• No dust particles						
	• No signs of wear						
	• Remove old grease pack						
	• Apply new grease pack						
	• In case of excessive play, replace worn parts as required						
Shovel linear guide	• Check maximal vertical and lateral play	2	2000	6	50000	--	--
	• Even grease film along entire guide length						
	• No dust particles						
	• No signs of wear						
	• Remove old grease pack						
	• Apply new grease pack						
	• In case of excessive play, replace worn parts as required						
Turntable drive belt	• Check flat belt for signs of wear	2	2000	6	50000	12	100000
	• Belt edges must not be frayed						
	• Belt tissue must not be visible						
	• Tension belt as required						
Handler system toothed belt	• Check toothed belt for signs of wear	2	2000	6	50000	12	100000
	• Belt edges must not be frayed						
	• Belt tissue must not be visible						
	• Tension belt as required						

NOTE – Checking for corrosion

Water of insufficient quality may cause corrosion. Check the chamber components for signs of corrosion at regular intervals:
- **Aluminum corrosion: white**
- **Steel corrosion: brown**

Remove deposits immediately.

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10. Maintenance

10.4 Replacing the device fuses

Fig. 36: The two identical device fuses are installed in the fuse compartments [1] and [2] below the main switch. The fusage ratings are:

- **Voltage 230 V**
  Fuse for UPS [1] T 2 A
  Fuse for heating system [2] T 10 A
- **Voltage 100-120 V**
  Fuse for UPS [1] T 2 A
  Fuse for heating system [2] M 12 A

NOTE - Line fuse 100 - 120 V

For device versions for a line voltage of 100-120 V [5], the device-integral fusing of the UPS connection and of the power supply connection has only one fuse holder each.

1. Switch device off and disconnect both power plugs.
2. The fuse holders [4] are screwed into the fuse compartments. To replace a fuse, unscrew the holder [4] from the fuse compartment.
2. Remove faulty fuse [3] from holder and install new fuse to holder [4].
3. Screw fuse holder into fuse compartment.

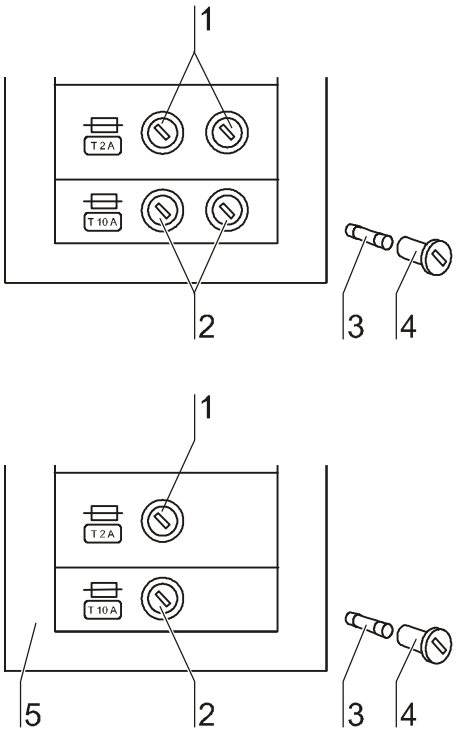


Fig. 36
Device fuse replacement

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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!

The device can be used for preparing and processing infectious substances so that 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	Stainless steel sheet, painted
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 gate seal	Tempered silicone
Heatings	Silicone-sheathed resistance-type wires
Interior container	Stainless steel
Gas analyzer	Stainless steel
Plate Shuttle System (PSS)	Aluminum (anodized), stainless steel, various plastic components
Stacker	Aluminum (anodized), stainless steel
Cables	Plastic-sheathed copper flexible
Packaging	Corrugated board, polyethylene film, wood

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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 Kendro Laboratory Products. The use of other spare parts presents potential hazards and will make the warranty void. When ordering spare parts, please have the device specifications of the nameplate available.

Description	Type	Part No.
Operating instructions	cytomat® 6000/1	50072911
Plate Shuttle System software documentation	cytomat® 6000/1	50072912
Device stand	height-adjustable	50029587
Outer door magnetic seal		50011356
Glass door silicone seal		50048705
Glass door	complete	50057651
Device fuse	T 2 A (set of 2)	50044261
Device fuse 230 V	T 10 A (set of 2)	3700897
Device fuse 100 V -120 V	T 12 A (set of 2)	50034779
Power supply cable	EU	50043143
Power supply cable	GB	50047100
Power supply cable	CH	50047099
Power supply cable	USA	50035414
Power supply cable	IT	50047101
Power supply cable	AUS	50068738
Power supply cable	DK	50072450
Hose set for gas connection		50062701
Surface disinfectant, 500 ml, refill bottle	Barrycidal 36	50051939
Surface disinfectant, 250 ml, spray bottle	Barrycidal 36	50052425
Stacker / Levels		
96 well plates P23	21	50066776
384 well plates P23	21	50066776
1536 well plates P17	28	50067450
Transwell plates P33	15	50067452
Deep well plates P50	10	50067453
Pitch P28	17	50067451
Pitch P29	16	50067740
Pitch P69 / Tippbox	9	50067454

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13. Technical data

Item	Component		Data
1	**Ambient temperature**		+18° C (min.) to +30° C (max.)
2	**Temperature range 6000** **Temperature range 6001**		approx 8 °C above room temp. up to 50 °C approx +10 °C* to 50 °C (*lower temperature limit depends on low-temperature thermostat efficiency)
3	**Spatial temperature differences** according to DIN 58945		'+/- 0.5 °C
4	**Temporal temperature fluctuations** according to DIN 58945		'+/- 0.1 °C
5	**Incubator dimensions** Exterior dimensions Interior dimensions	 - Width: - Height: - Depth: - Width: - Height: - Depth:	 900 mm 850 mm 810 mm 607 mm 669 mm 595 mm
6	**Chamber volume**		approx 240 l
7	**Weight**		approx 150 kg
8	**Power supply** Protection class Protection type Rated output Rated voltage/frequency UPS		 I IP 20 1.2 kW 230 V AC or 100 – 120 V AC, 50 / 60 Hz, see nameplate 230 V AC or 100 – 120 V AC, 50 / 60 Hz, see nameplate
9	**Idle consumption at 37 °C**		approx 90 W
10	**Fusing**	On-site Device UPS	T 16 A T 10 A, 230 V M 12 A, 100 – 120 V T 2 A
11	**Gast supply system** Filter in gas line Process gas purity Process gas prepressure Setting range Setting accuracy **O2 control (option)** N2 supply range O2 supply range	 Separation rate for particle size % CO2 % CO2 % O2 < % O2 >	 0,99998 > 0.3 µm 99.5 % min. 99.5 % min. 1 bar 0 - 20 0.1 3 - 21 21 - 80
12	**Relative humidity**	const. humidity	≥ 95 %
13	**Filling quantity:** Distilled water		6 l

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13. Technical data

Gas consumption during operation:

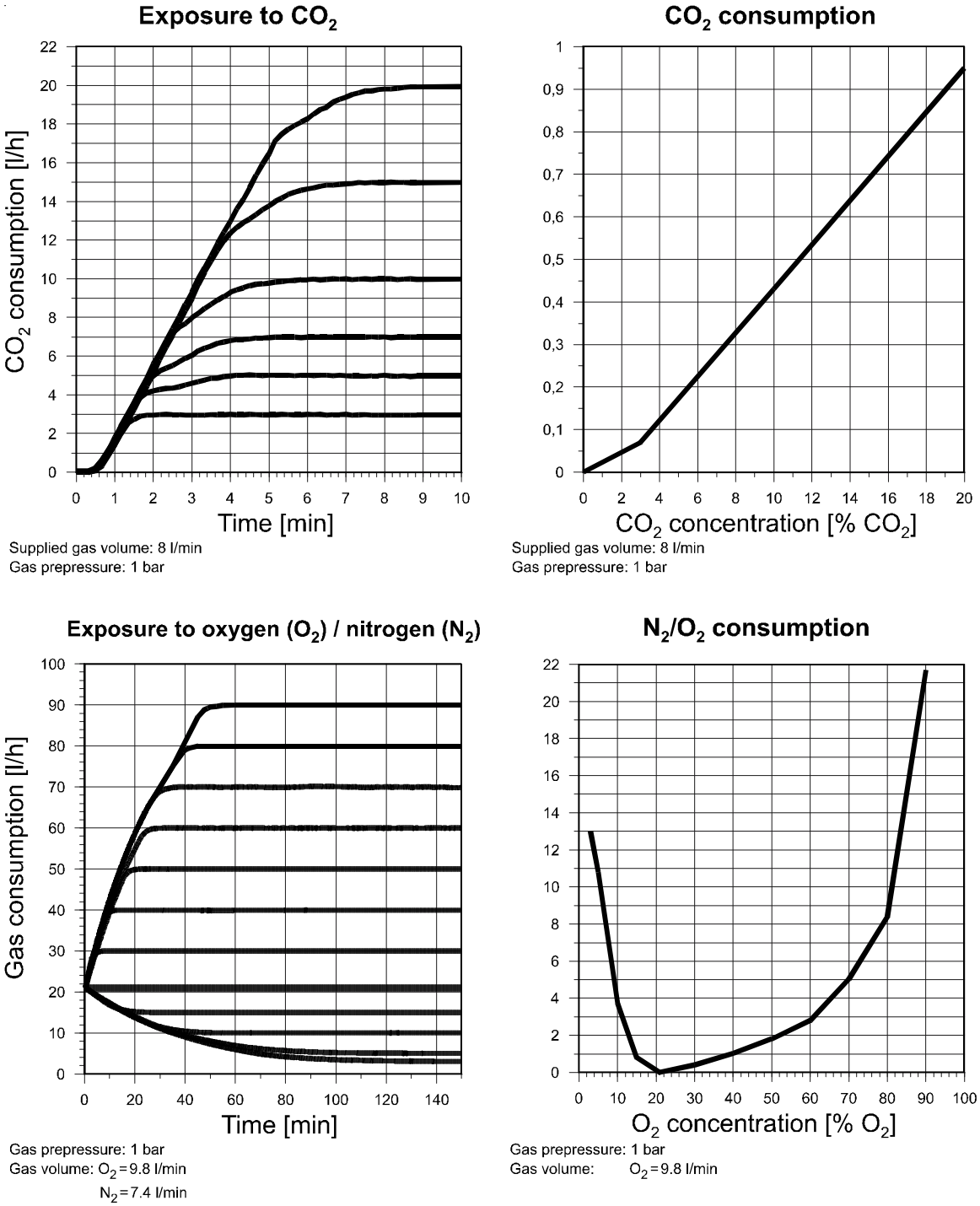


Fig. 37
Gas consumption during operation

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13. Technical data

pH in nutrient media:

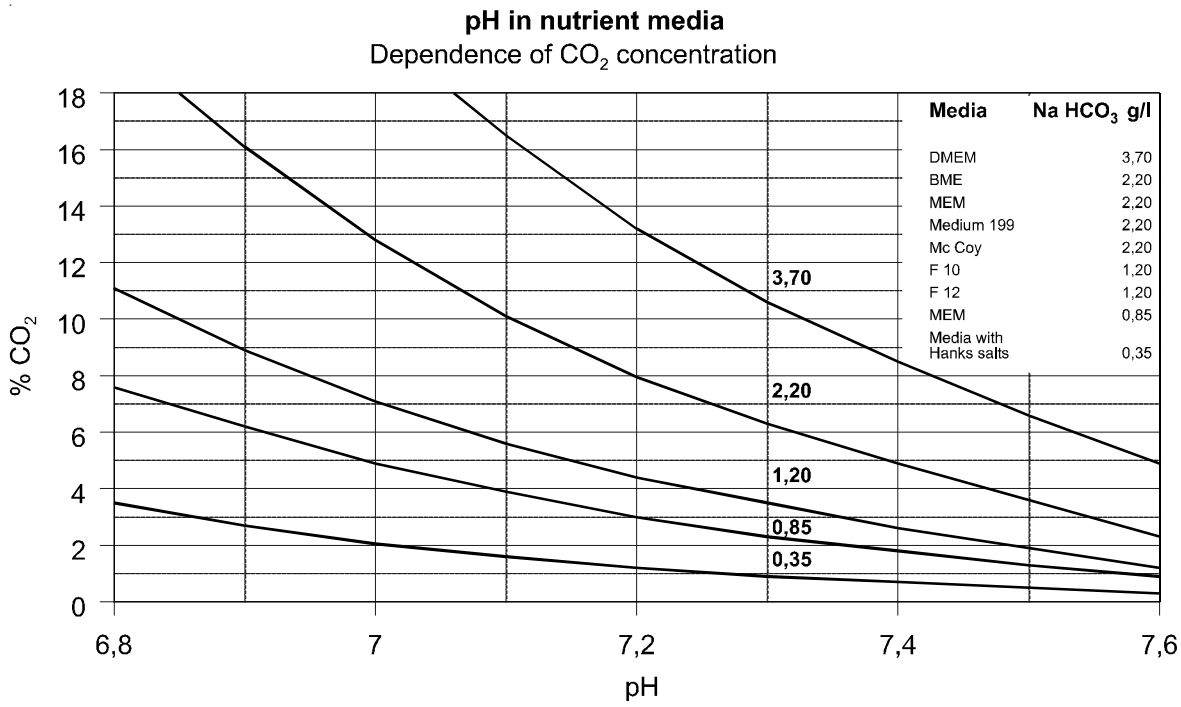


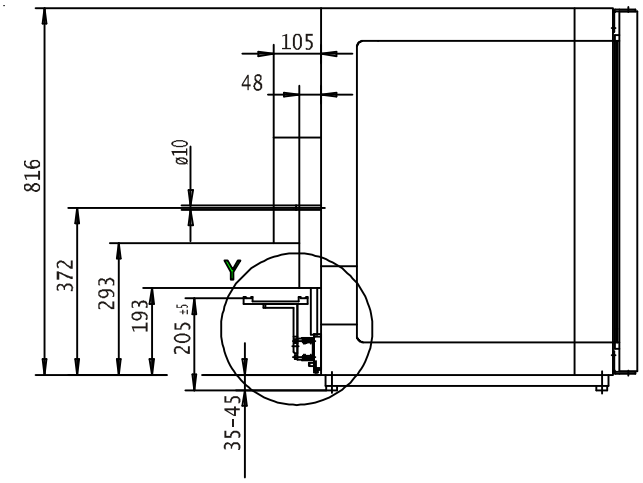
Fig. 38
pH in nutrient media

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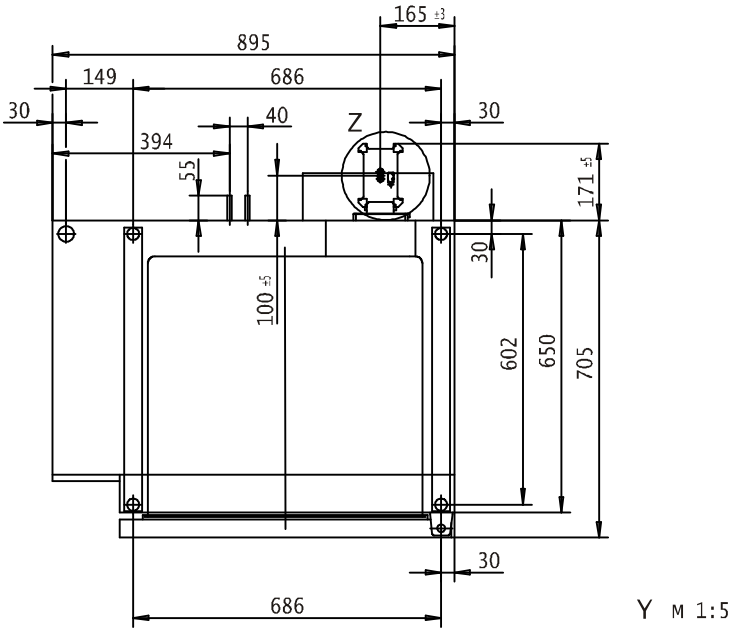
13. Technical data

Dimensioning I

Side view



Top view



Transfer station side view

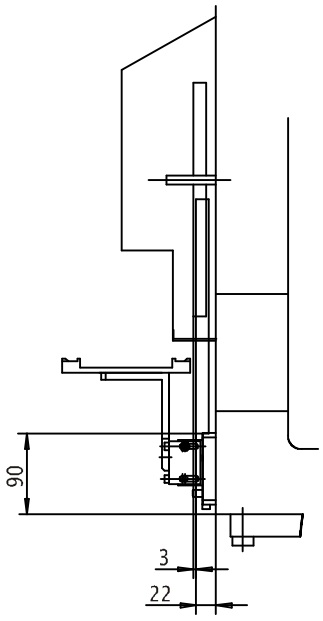


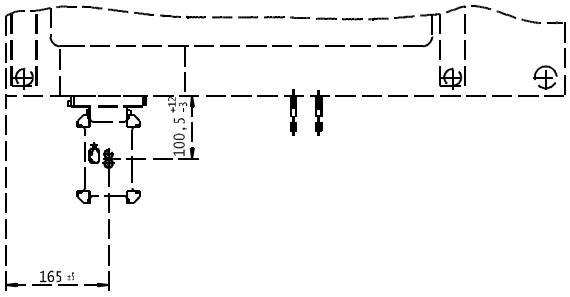
Fig. 39
Dimensions I

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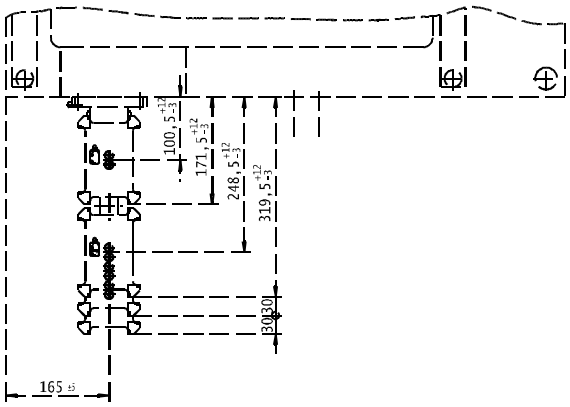
13. Technical data

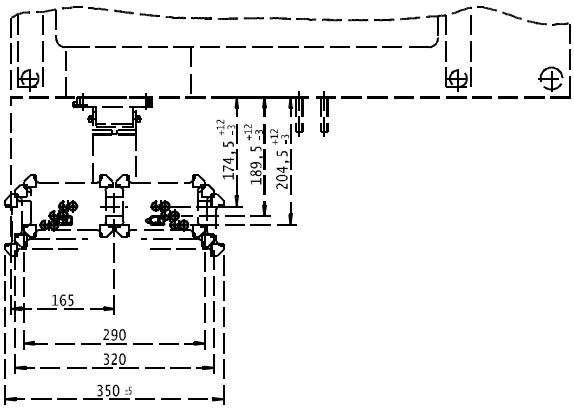
Dimensioning II

Standard transfer station

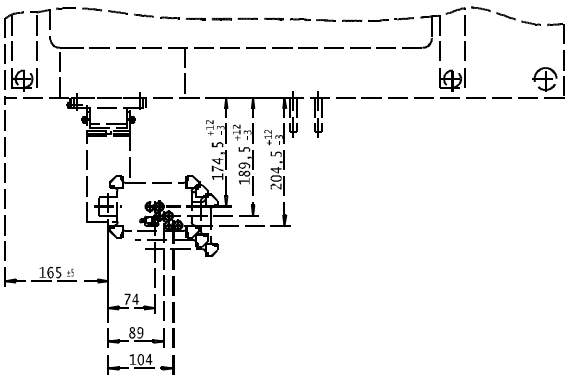


SWAP station 180° rotatable





Transfer station 90° rotatable



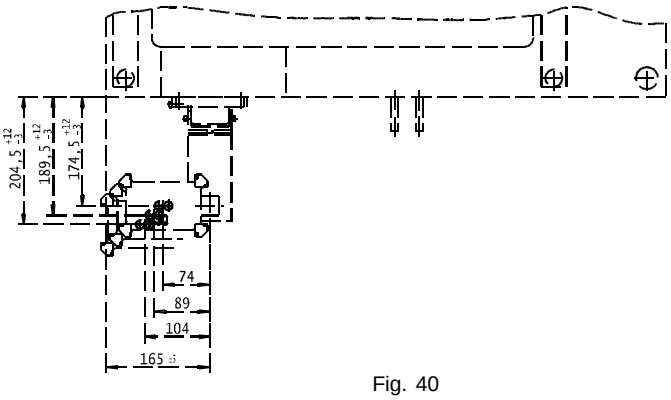


Fig. 40
Dimensions II

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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 required 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 chekked 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.

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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 humanopathogenic 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 – ZH 1/343 of the trade association of the German chemical industry, published by Jedermann Verlag, Postfach 103140, D-69021 Heidelberg.

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15. Device log

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

Work carried out	Notes	Date	Signature

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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

KENDRO Laboratory Products GmbH

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

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17. Statement of conformity

KONFORMITÄTSERKLÄRUNG
STATEMENT OF CONFORMITY
CERTIFICAT DE CONFORMITE

CE

Kendro®
Quality Products – Lifetime Care

Produkt:	Labor-Wärmeschrank, Begasungsbrutschrank
Product:	Laboratory Drying Oven, Gassed Incubator
Produit:	Etuve de laboratoire, Incubateur à CO_2

Modell(e):
Model (s): cytomat 6000, cytomat 6001
Modèle (s):

Die bezeichneten Erzeugnisse erfüllen die Bestimmungen der Richtlinie:
The designated products conform to the guideline:
Les produits désignés sont conformes aux dispositions de la directive:

73/23/EWG mit Änderungen / with revisions / avec les modifications
89/336/EWG

Die Übereinstimmung der Erzeugnisse mit den Bestimmungen der Richtlinie wird durch die vollständige Einhaltung folgender Normen nachgewiesen:
The conformity of the products with the requisites as set forth in the guideline is evidenced by the full compliance with the following standards:
La conformité des produits aux dispositions de la directive est attestée par le respect total des normes suivantes:

DIN 12880 Teil 1/11.78, EN 61010-1:1993, EN 61010-1A2:1995 (IEC 1010),
EN 61326 (EN 50081-1, EN 50082-2)

D-63450 Hanau, 13.05.2002

Kendro Laboratory Products GmbH
Leiter Quality Management

Kendro Laboratory Products GmbH
Heraeusstrasse 12 - 14
D-63450 Hanau

i.V. Hess

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