thermoscientific

Operating instructions

CO_2-Incubator

Heracell® 150i/240i



DOMINIQUE DUTSCHER SAS

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Thermo Fisher Scientific Inc.
168 3rd Avenue
Waltham, MA 02451
USA

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Caution
When used as a medical device:



Federal law restricts this device to sale by or on the order of a qualified scientist with studies of medicine, biology or chemistry.



Safety with regard to the protection of persons, the environment and the material under process largely depends on the conduct of the persons using the equipment.

This operating manual is important for your safety as well as for the setup, installation, use and maintenance of the equipment!

To avoid errors and any resulting damage, especially personal injuries, be sure to read this manual carefully before using the equipment and follow all instructions.

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1. General notes

1.1 Overview of the Thermo Fisher international sales organizations

Postal address Germany:

Thermo Electron LED GmbH
Robert-Bosch-Straße 1
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Enquiries from Germany:

Phone Sales	0800 1 536376
Phone Service	0800 1 112110
Fax Sales/Service	0800 1 112114
E-Mail	info.labequipment.de@thermofisher.com

Enquiries from Europe, Middle East, and Africa:

Phone	+ 49 (0) 6184 / 90-6940
Fax	+ 49 (0) 6184 / 90-7474
E-Mail	info.labequipment.de@thermofisher.com

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Enquiries from North America:

Phone	+1 800-879 7767
Fax	+1 828-658 0363
E-Mail	info.labequipment@thermofisher.com

Enquiries from Latin America:

Phone	+1 828-658 2711
Fax	+1 828-645 9466
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Enquiries from Asia Pacific:

Phone	+852-2711 3910
Fax	+852-2711 3858
E-Mail	info.labequipment@thermofisher.com

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1.2 Identification of the device and of the documentation

Identification of the device

Device name:	CO_2 incubator
Type designation:	***HERACELL® 150i***
	HERACELL® 240i
Serial No.:	40830469 or higher

Allocation of product documentation

User information:	Operating instructions 50115191
Valid:	01.2018

Certifications and quality audit:

Certification:	CE Certification
Test mark:	GS by VDE Germany
	CSA by VDE Germany

1.3 Instruction of the operating personnel

These operating instructions describe the CO_2 incubator ***HERACELL® 150i/240i***. The CO_2 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 CO_2 incubator must be operated only by trained and authorized personnel.
- For any operation of this device, the operator must prepare clear and concise written instructions in the language of the operating and cleaning personnel based on these operating instructions, applicable safety data sheets, plant hygiene guidelines, and technical regulations, in particular:
  - which decontamination measures are to be applied for the CO_2 incubator and accessories,
  - which protective measures apply when specific agents are used,
  - which measures are to be taken in the case of an accident.
- Repairs to the device must be carried out only by trained and authorized expert personnel.

1.4 Applicability of the instructions

- 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 close to the device so that safety instructions and important information are always accessible.

Should you encounter problems that are not detailed adequately in these operating instructions, please contact Thermo Scientific immediately for your own safety.

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1.5 Warranty

Thermo Scientific warrants the operational safety and functions of the CO_2 incubator only under the condition that:

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

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

1.6 Explanation of safety information and symbols

Safety information and symbols used in the operating instructions



WARNUNG
Indicates a hazardous situation which, if not avoided, could result in death or serious injury!



Caution
Indicates a hazardous situation which, if not avoided, could result in minor or moderate injuries.



ACHTUNG
Indicates a situation which, if not avoided, could result in property damage.

Hinweis
Is used for applicational hints and useful information.

Additional symbols for safety informations:



Wear safety gloves!



Wear safety goggles!



Harmful liquids!

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Electric shock!



Hot surfaces!



Fire hazard!



Explosion hazard!



Suffocation hazard!

Symbols on the device



CE conformity mark: confirms conformity according to EU Guidelines



VDE test mark



Mark of conformity USA/Canada



Observe operating instructions!



Mark of prescription devices!

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1.7 Intended purpose of the device

Correct use

Correct use related to a medical device (USA only)



Caution
When used as a medical device:



Federal law restricts this device to sale by or on the order of a qualified scientist with studies of medicine, biology or chemistry.

The intended use of this incubator is to provide an environment with

- controlled temperature,
- CO_2,
- elevated humidity,
- an automatic decontamination mode, and
- O_2 at suppressed levels,

for the development of ova or embryos at or near body temperature.

Correct use related to a laboratory device (Rest of the world)

The CO_2 incubator *HERACELL® 150i/240i* 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/N_2 content,
- and increased relative humidity.

Fields of Application

HERACELL® 150i/240i has been designed for installation and operation in the following fields of application:

- Laboratories for cytobiological and biotechnological experiments of safety levels L1, L2, and L3
- Medical-microbiological laboratories in accordance with DIN EN 12128
- Laboratories in the central area of clinics and hospitals

The gases required for the incubator (CO_2 and / or O_2/N_2) are supplied to the device from a separate gas supply system, either from gas cylinders or from a central pressurized gas container.

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The layout of the gas supply system must ensure that the operating pressure of the gas supply lines can be set to a range between 0.8 bar (min.) to 1 bar (max.) and that the pressure cannot be changed.

If the device is equipped with the optional gas monitoring system, up to four devices can be interconnected in line, independent of the of the gas supply system capacity.

The CO_2 incubator is suitable for continuous operation.

Incorrect use

Do not use 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 ignitable or explosive,
- release vapors that form combustible or explosive mixtures when exposed to air,
- release poisons,
- release dust,
- exhibit exothermic reactions,
- are pyrotechnical substances.

1.8 Standards and directives

The device complies with the following standards and guidelines:

- DIN EN 61010 - 1:2011, DIN EN 61010 - 2 - 010:2015
- Low Voltage Guideline 2014/35/EU
- EMC Guideline 2014/30/EU
- China EEP hazardous substance informations
http://www.thermofisher.com/us/en/home/technical-resources/rohs-certificates.html

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

- DGUV Guideline 100-500
- TRBS 3145/TRGS 725
- Safety data sheets of the gas suppliers with regard 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.

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1.9 Safety notes



- In the case of biological incubators, biological safety with regard to the protection of persons, its surroundings and the load is heavily dependent on the observance of the applicable regulations by the persons using the equipment.
- Even then, however, the possibility of hazards, especially health hazards, arising cannot be ruled out.
- The residual risk depends on the work performed in each individual case.
- To avoid errors and causing damage, especially personal injuries, be sure to carefully read this manual before putting the equipment into operation, and follow all instructions.
- Safe and reliable operation of the unit can only be guaranteed if the necessary inspections, maintenance and repair work are carried out by Thermo Electron LED GmbH Service Department personnel or by personnel authorized by our company.
- Gas is to be supplied to each unit by means of a pressure reducer with the inlet pressure set to between 0.8 and max. 1 bar. This setting must not be changed for safety reasons.
- The place of installation must be thoroughly ventilated in order to expel the gases escaping around the pressure relief valve to the outside.
- Only original replacement parts authorized by the manufacturer are to be used.
- Refer to the Appendix titled "BASIC RULES OF SOUND MICROBIOLOGICAL ENGINEERINGPRACTICE

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1.10 Safety notes on gases

Hinweis

Installation work:

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

Instruction of the personnel:

Personnel operating devices with CO_2 supply must be instructed about the particularities in the handling of CO_2 before starting their work:

- correct operation of pressurized gas containers and gas supply systems,
- 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.

Safety notes on carbon dioxide (CO_2)

Since CO_2 is rated as a harmful gas, certain safety instructions must be observed when the CO_2 incubator is started up and when the device is operated.



Suffocation hazard!

Large amounts of CO_2 released 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!

Safety notes on oxygen (O_2)

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



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 device components, use only oil- and grease-free lubricants.
- Keep all connections and components of the oxygen system free from substances that contain oil, grease, or lubricant!

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Fire hazard!

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.**

Safety notes on nitrogen (N_2)

Nitrogen mixes easily with air. High concentrations of nitrogen reduce the oxygen content in the air.



Suffocation hazard!

Large amounts of N_2 released into the room atmosphere may cause suffocation. 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!**

1.11 Operational Safety Rules

The following rules must be heeded when working with Heracell 150i/240i:

- Observe the sample weight limits specified for your Heracell-incubator as a whole and its shelving in particular (***Seite 161***).
- Arrange the samples evenly throughout the work space, making sure not to place them too closely to the interior walls to ensure a uniform temperature distribution.
- Do not load your CO_2-incubator with substances that exceed the capabilities of the available lab apparatus and Personal Protection Equipment to provide sufficient degrees of protection to users and third parties (***Seite 14***).
- Check the door seal once a month for proper sealing performance and possible damage.
- Do not process any samples containing hazardous chemical substances that may be released into the ambient air through defective seals or may cause corrosion or other defects on parts of the CO_2-incubator.
- The tempering of defined substances or materials with higher moisture content can result in increased condensation in the chamber. Measures on ***page 77*** must be observed.

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2. Delivery of the device

2.1 Packaging

The CO_2 incubator ***HERACELL® 150i/240i*** is delivered in a stable packaging box. All packaging materials can be separated and are reusable:

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

2.2 Acceptance inspection

After the device has been delivered, check the delivery immediately for:

- completeness
- possible damage

If components are missing or damage is found on the device or the packaging, esp. damages caused by humidity and water, please contact the line-hauler as well as the Technical Support of Thermo Scientific immediately.



Caution

Risk of injury

Should sharp edges have formed in damaged areas or elsewhere on the device, take all necessary precautions to protect personnel handling the incubator. For example, have them wear protective gloves and other personal protection equipment.

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2.3 Standard equipment components *HERACELL® 150i*

Quantity of the delivered components (in piece)	***HERACELL® 150i*** CO_2 incubator or CO_2 /O_2 incubator	
	Solid glass door and continuous shelves	3-door gas tight screen and continuous shelves
Shelf	3	3
Support rail for shelf	4	4
Shelf supports for shelf	6	6
Insert for pressure compensation opening	1	1
Plug for pipe channel	1	1
Power supply cable	1	1
Connector, potential-free contact	1	1
Spare caps, set	1	1
CO_2 connecting hose set	1	1
Open-end wrench, 24 mm	1	1
Allen wrench 2 mm for blower wheel	1	1
Allen wrench 3 mm for blower wheel cover	1	1
Operating instructions (CD)	1	1
Summarized safety instructions		
Water pump	1	1

2.4 Optional equipment components *HERACELL® 150i*

Quantity of the delivered components (in piece)	***HERACELL® 150i*** CO_2 incubator or CO_2 /O_2 incubator	
	Solid glass door and continuous shelves	3-door gas tight screen and continuous shelves
O_2 connecting hose set	1	1
O_2 sensor with set for gas humidification *1)	1	1
CO_2 connecting hose set, gas monitoring (optional)	1	1
O_2 / N_2 connecting hose set, gas monitoring (optional)	1	1

*1) O_2 sensor with gas humidification set is packed in a separate carton and placed into the work space during transport.

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2.5 Standard equipment components *HERACELL® 240i*

Quantity of the delivered components (in piece)	***HERACELL® 240i*** CO_2 incubator or CO_2 /O_2 incubator			
	Solid glass door and continuous shelves (standard version)	Solid glass door and split shelves (optional)	6-door gas tight screen and continuous shelves (standard version)	6-door gas tight screen and split shelves (optional)
Shelf	3	6	3	6
Support rail for shelf	4	6	4	6
Shelf supports for shelf	6	12	6	12
Insert for pressure compensation opening	1	1	1	1
Plug for pipe channel	1	1	1	1
Power supply cable	1	1	1	1
Connector, poten-tial-free contact	1	1	1	1
Spare caps, set	1	1	1	1
CO_2 connecting hose set	1	1	1	1
Open-end wrench, 24 mm	1	1	1	1
Allen wrench 2 mm for blower wheel	1	1	1	1
Allen wrench 3 mm for blower wheel cover	1	1	1	1
Operating instructions (CD)	1	1	1	1
Summarized safety instructions				
Water pump	1	1	1	1

2.6 Optional equipment components *HERACELL® 240i*

Quantity of the delivered components (in piece)	***HERACELL® 240i*** CO_2 incubator or CO_2 /O_2 incubator			
	Solid glass door and continuous shelves (standard version)	Solid glass door and split shelves (optional)	6-door gas tight screen and continuous shelves (standard version)	6-door gas tight screen and split shelves (optional)
O_2 connecting hose set	1	1	1	1

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O_2 gas humidification system connecting hose set *1)	1	1	1	1
Bottle turning device (motor with four rollers, optional) *2), *3)	1	-	1	-
CO_2 connecting hose set, gas monitoring (optional)	1	1	1	1
O_2/N_2 connecting hose set, gas monitoring (optional)	1	1	1	1

*1) O_2 sensor with gas humidification set is packed in a separate box that is placed into the work space during transport.
*2) For bottle turning devices, the version with split shelves is not available.
*3) Each level of a bottle turning device is packed in a separate box. The boxes (1 to 4) are delivered with the device.

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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:

- Draft-free and dry location.
- The minimal distance to adjacent surfaces must be observed on all sides (see ***„Space requirements“* on *page 24***).
- The operating room must be equipped with appropriate room ventilation.
- Solid, level, fire-proof surface.
- Vibration-proof substructure (floor stand, lab table) capable of bearing the weight of the device and of accessories (particularly if several devices are stacked).



Caution
Contamination hazard
Do not place the incubator directly on the lab floor, but mount it on the floor stand or on a lab work surface (option; to be ordered separately). Contaminants, such as bacteria, viruses, fungi, prions, and other biological substances may use the open door to migrate easily from the floor into the incubator's work space.

- The electrical system of the device has been designed for an operating height of up to 2000 m above sea level.
- To ensure a constant incubation temperature of 37 °C, the ambient temperature must be within a range of +18 °C to +33 °C.



Notice
To high or to low ambient temperatures

If the ambient temperatures are to high or to low, the properly functionality of the incubator could be faulty.The incubation temperature as well as the temperature distribution could be false or affected.

- Relative humidity up to 80 % (max.).
- No direct exposure to sunlight.
- Devices that produce excessive heat must not be placed near the location of the ***HERACELL® 150i/240i***.
- If excessive temperatures tend to occur in the operating room, be sure to provide a thermal protection means that cuts out the power supply to mitigate the impact of over-temperature scenarios.
- Power line voltage variations must not exceed ±10 % of the nominal voltage.
- Transient surges must lie within the range of levels that normally occur in the power supply

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system. The impulse withstand voltage based on surge category II of IEC 60364-4-444 shall be applied at the nominal voltage level

- Do not cover or obstruct the fresh air or exhaust vents in the unit housing.
- Avoid condensation, e.g. after transport or change of location. Should condensation exist, wait until the moisture has evaporated completely before connecting the CO_2-incubator to a power source and powering up.



Notice

Humidity

After transport or storing under humid conditions a drying-out process must be performed. During the drying-out process the equipment cannot be assumed to meet all the safety requirements of the IEC 61010-2-010 standard. The drying-out period is 2 hours.

- Consider installing a dedicated upstream circuit breaker per Incubator to avoid the failure of multiple devices in case of an electrical fault.

3.2 Room ventilation

When $CO_2/O_2/N_2$ is supplied, the work space of the incubator is slightly pressurized. The pressure is released through the pressure compensation opening into the operating room.

Pressure compensation and any opening of the glass door/gas-tight screen during the operation of the device will release very small quantities of $CO_2/O_2/N_2$ into the operating room; the room ventilation must be capable of carrying the released gas safely off into the open.

In addition, heat dissipating from the device during continuous operation may cause a change in the room climate.

- Therefore, the ***HERACELL® 150i/240i*** must only be installed in rooms with sufficient ventilation.
- When several devices are to be placed in the same room, additional ventilation may have to be provided as necessary.
- Do not install the device in room recesses without ventilation.
- The room ventilation should be a technical ventilation that complies with the requirements of DGVU information 213-850 (Guidelines for laboratories, Germany) or some other suited ventilation system with appropriate capacity.

3.3 Space requirements



Noteice

Make sure that power sockets remain freely accessible at all times!

To allow a rapid disconnection of power in case of an emergency, make sure that power outlets remain freely accessible at all times!

When installing the device, make sure that the installation and supply connections are freely accessible.
The control box on the rear panel of the device may serve as a spacer to adjacent objects. The

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side distances given are minimal distances.
To protect the CO_2 incubator against contamination, use a floor stand even if the device is installed near the floor. The height of the floor stand should not fall below 200 mm.

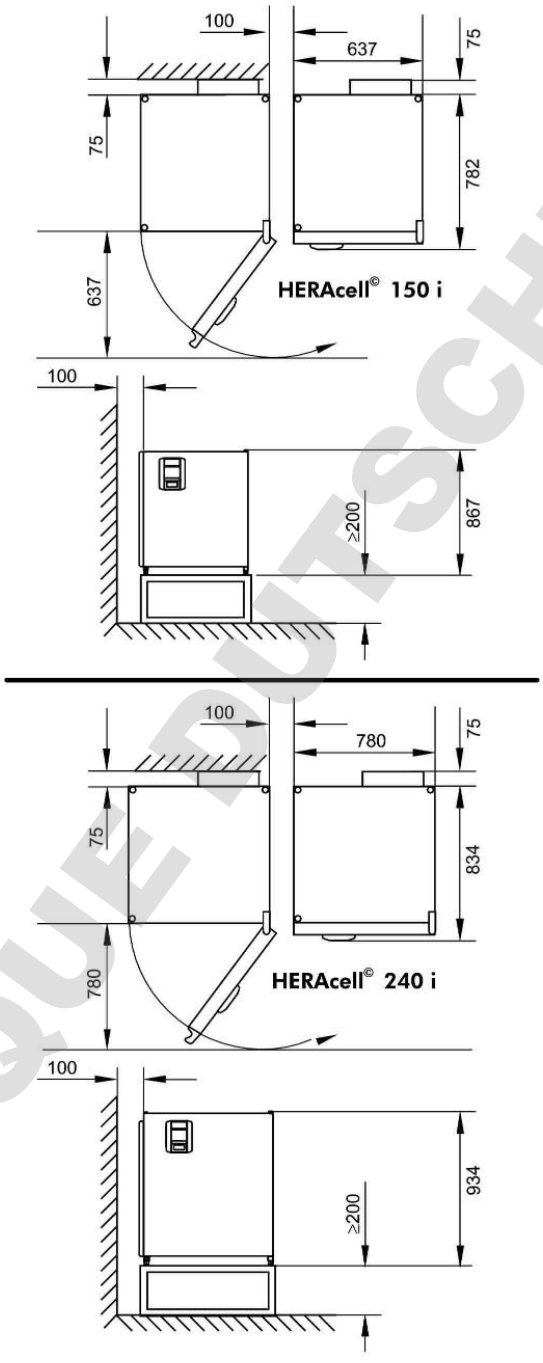


Figure. 1. Device dimensions

Note
Accessibility of the devices:
To ensure the accessibility for care and maintenance works, keep larger side and rear distances.

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3.4 Transport

For transport, do not lift the device using the doors or components attached to the device (e.g. control box on rear panel) as lift points.

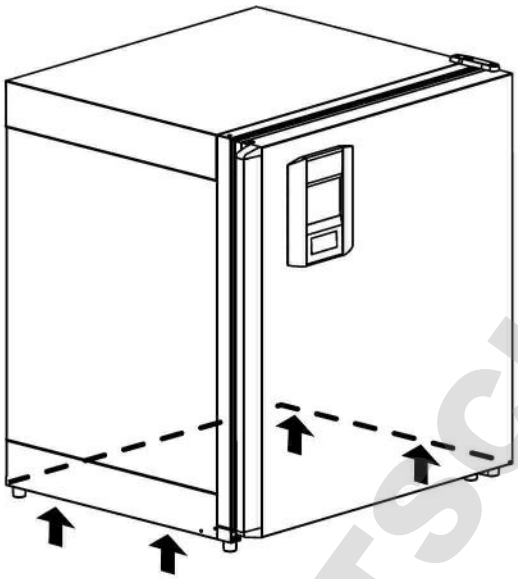


Figure. 2. Lift points

Caution

Heavy loads! Lift with care!

To avoid injury through physical strain, such as strain traumata and slipped discs, do not attempt to lift the incubator alone!

To avoid injury through dropped loads, be sure to wear Personal Protection Equipment, such as safety shoes, when lifting the incubator. To avoid crushing your fingers or hands (particularly in a closing door) or damaging the incubator, do not use any other lift points than those indicated in the illustration above.

Note
Lift points:
Lift the device only using the lift points.

Notice

Humidity

After transport or storing under humid conditions a drying-out process must be performed. During the drying-out process the equipment cannot be assumed to meet all the safety requirements of the IEC 61010-2-010 standard. The drying-out period is 2 hours.

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3.5 Stacking

HERACELL® 150i/240i is suited for stacking up to two devices of the same device type.

HERAcell 240i only: For thermal separation, an adapter plate [3] can be placed between the two devices.

HERACELL® 150i

- Place the device to be stacked plate with the device stands [1] onto the stacking elements [5] on top of the device. Make sure that the device stands are seated safely on the stacking elements.

HERACELL® 240i

- Place the adapter plate with the receptacle recesses [8] at the bottom onto the stacking elements [9] on top of the device. Make sure that the adapter plate is seated safely on the recesses.
- Place the device to be stacked with the device stands [6] onto the stacking elements [7] at the top of the adapter plate.

The devices are secured to one another by their own weight.

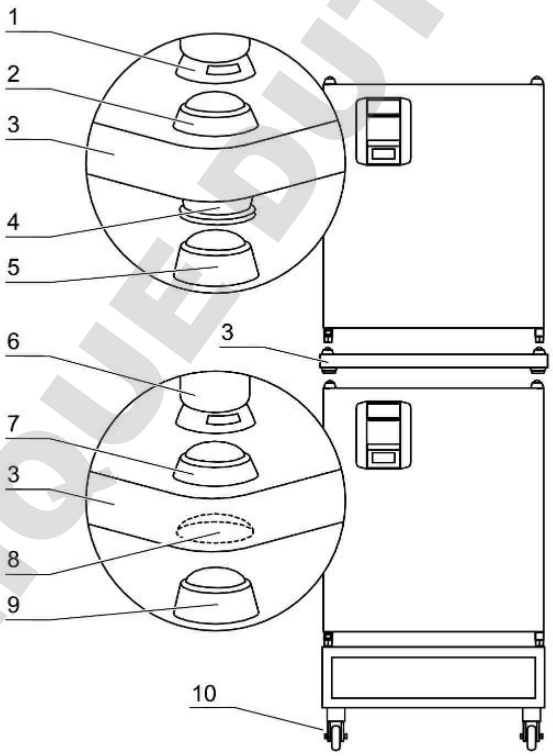


Figure. 3. Stacking

Notice
Transporting stacked devices!
The stacking elements are not locking elements. Therefore, it is not permitted to transport stacked devices.

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Note
Fastening on mobile racks:
If the devices are installed onto mobile racks, make sure that the rollers [10] are secured with a locking brake during the operation of the incubators and that the rollers are oriented toward the front for increased stability.

Condensate formation during the operation of stacked devices:
If stacked devices of type HERACELL® 150i are operated at an ambient temperature of more than 26 °C, condensate formation may occur on the upper device while the contra-con decontamination routine is run for the lower device.

3.6 Intermediate Storage

When the oven is placed in intermediate storage, which is permissible for a maximum of four weeks, make sure that the ambient temperature is between 20 °C to 60 °C (68 °F to 140 °F) and the maximum relative humidity does not exceed 90 %, non-condensing.

3.7 Retrofitting/Modifications

The following components can be retrofitted to the standard version:

HERACELL® 150i

- 3-segment gas-tight screen (the gas-tight screen is installed in place of the glass door)
- door hinge replacement on outer door and glass door (RH / LH door opening)
- lockable outer door
- split inserts
- infrared (IR) sensor
- PCB for USB interface

HERACELL® 240i

- 6-segment gas-tight screen (the gas-tight screen is installed in place of the glass door)
- door hinge replacement on outer door and glass door
- lockable outer door
- split inserts
- infrared (IR) sensor
- PCB for USB interface

Note
Modifications:
Retrofitting and modifications must only be performed by the Technical Service of Thermo Electron LED GmbH.

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4. Description of the device

4.1. Front view of *HERACELL® 150i*

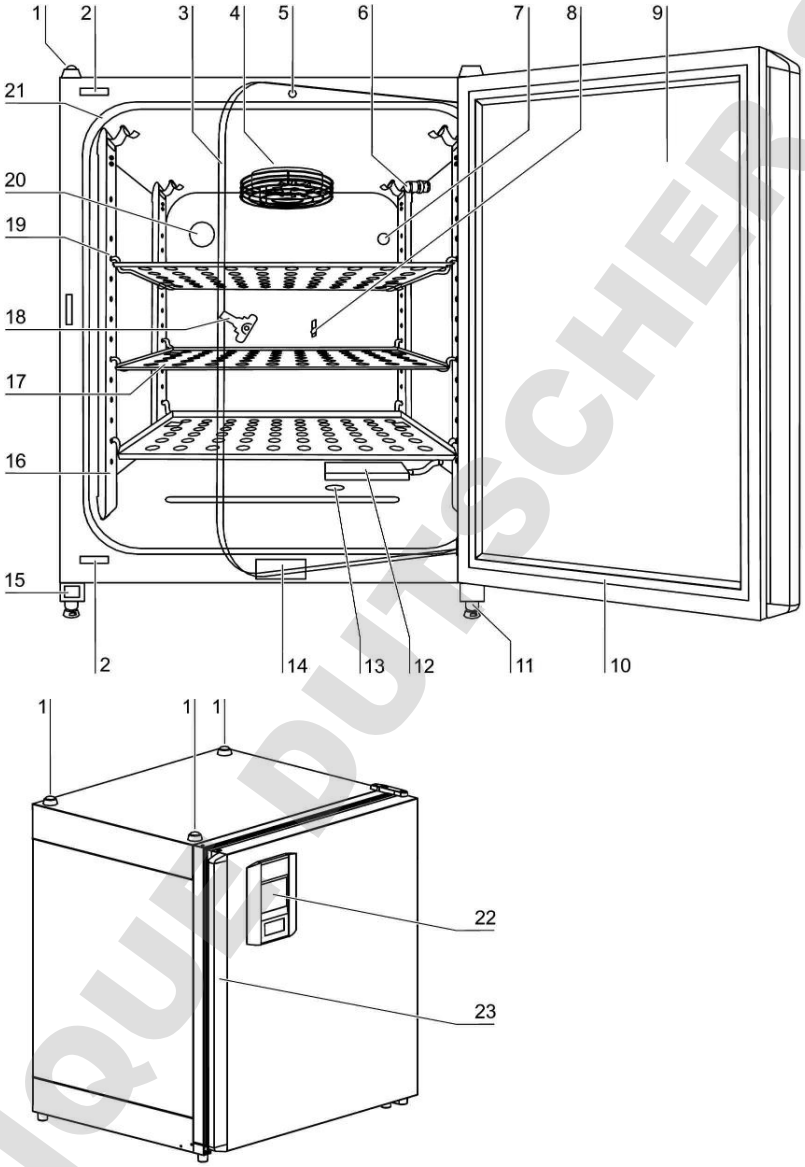


Figure. 4. Front view ***HERACELL® 150i***

1. Stacking elements
2. Plug caps
3. Glass door
4. Measuring cell with blower wheel and sensors
5. Door switch
6. Oxygen sensor (optional)
7. Pressure compensation opening with insert
8. Measuring opening

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9. Outer door
10. Outer door seal, replaceable
11. Stand, height-adjustable
12. Gas humidification (optional)
13. Water level sensor
14. Nameplate
15. Power switch
16. Support rail
17. Shelf
18. Latch, glass door
19. Support hook for shelf
20. Access port with plug
21. Glass door seal, replaceable
22. Operating panel (touchscreen)
23. Door handle

4.2. Rear view *HERACELL® 150i*

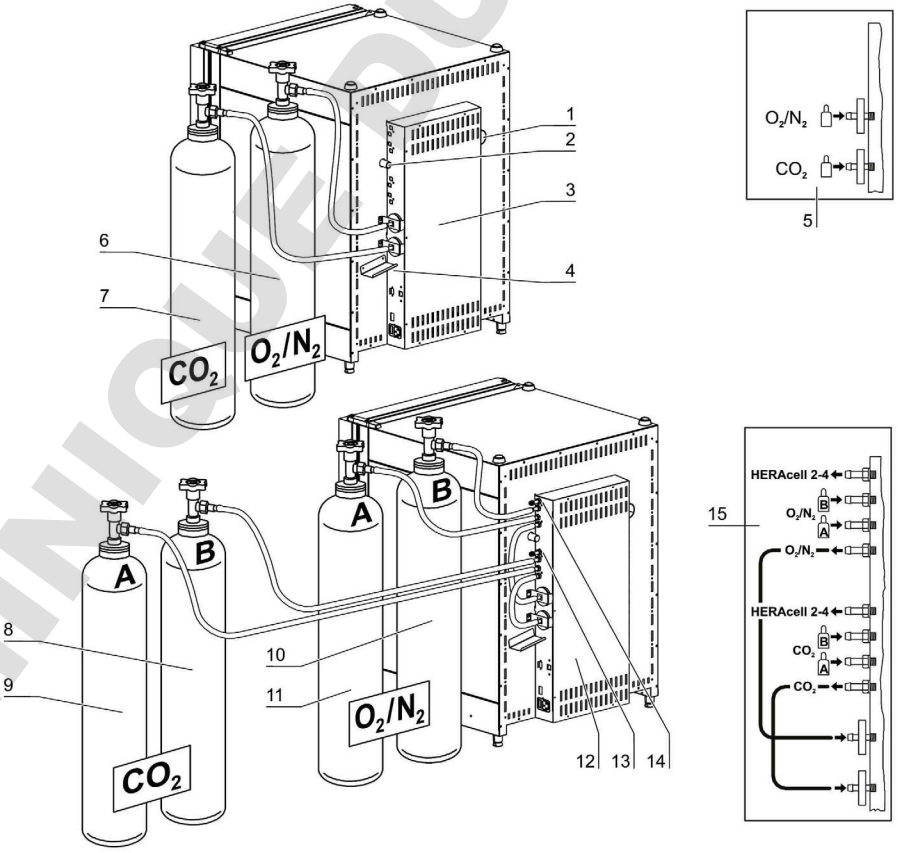


Figure. 5. Rear view ***HERACELL® 150i***

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1. Access port, Ø 42 mm
2. Pressure compensation opening
3. Control box with supply interface for combined gas connection (optional) CO_2 and O_2/N_2 without gas monitoring
4. Condensate drain gutter
5. Diagram: Gas connection CO_2 and O_2/N_2 without gas monitoring
6. O_2/N_2 gas cylinder
7. CO_2 gas cylinder
8. **Secondary** CO_2 gas supply **B** with optional gas monitoring
9. **Primary** CO_2 gas supply **A** with optional gas monitoring
10. **Secondary** O_2/N_2 gas supply **B** with optional gas monitoring
11. **Primary** O_2/N_2 gas supply **A** with optional gas monitoring
12. Control box with supply interface for combined gas connection (optional) CO_2 and O_2/N_2 with gas monitoring (optional)
13. Distributor connection for looping through the CO_2 gas supply for up to three additional devices (independent of device type)
14. Distributor connection for looping through the O_2/N_2 gas supply for up to 3 additional devices (independent of device type)
15. Diagram: Gas connection CO_2 and O_2/N_2 with optional gas monitoring

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Looped-through gas supply for *HERACELL® 150i*:

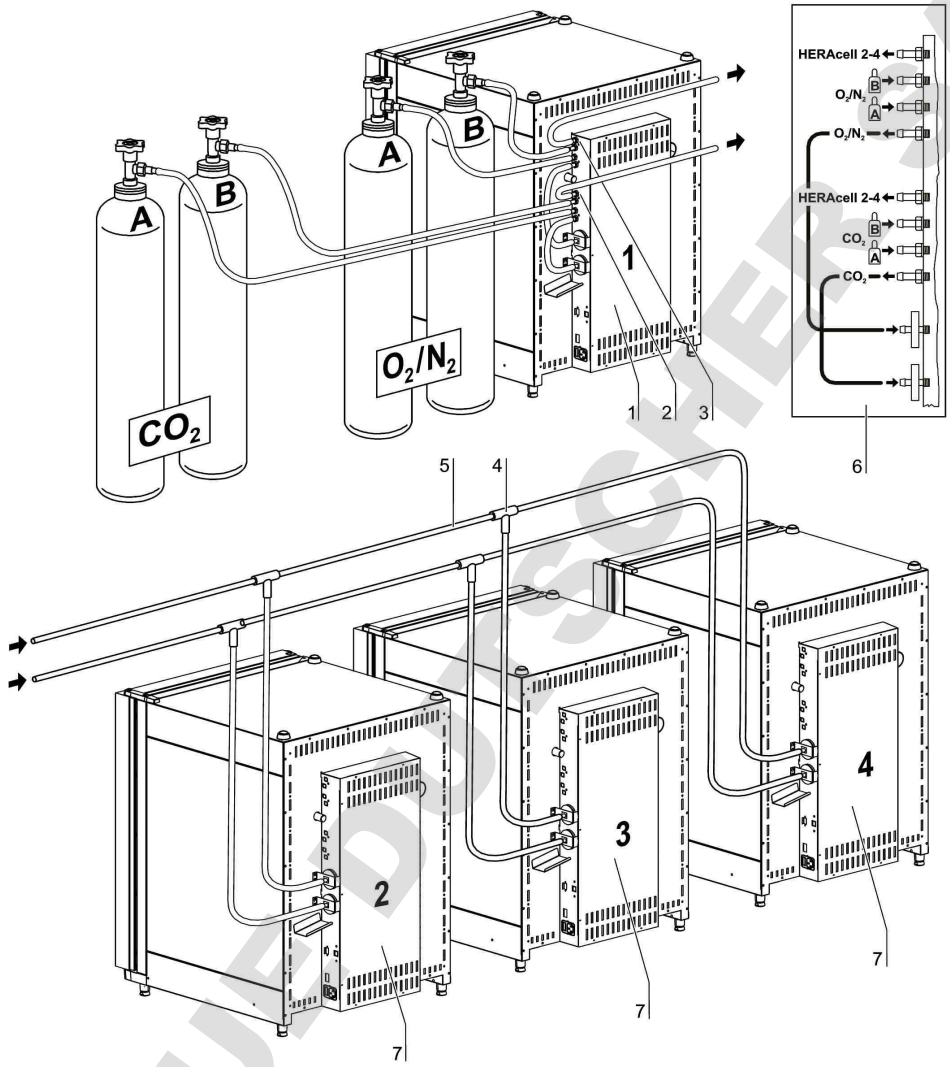


Figure. 6. Looped-through gas supply ***HERACELL® 150i***

1. Control box with supply interface for combined gas connection (optional) CO_2 and O_2/N_2 with gas monitoring (optional)
2. Distributor connection for looping through the CO_2 gas supply for up to three additional devices (independent of device type)
3. Distributor connection for looping through the O_2/N_2 gas supply for up to 3 additional devices (independent of device type)
4. Tee joint for fitting the gas pressure hoses together
5. Gas pressure hose for looping-through the gas supply
6. Diagram: Gas connection CO_2 and O_2/N_2 with optional gas monitoring
7. ***HERACELL® 150i*** with looped-through gas supply; therefore device must only be equipped with combined gas connection (optional) CO_2 and O_2/N_2

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4.3. Front view *HERACELL® 240i*

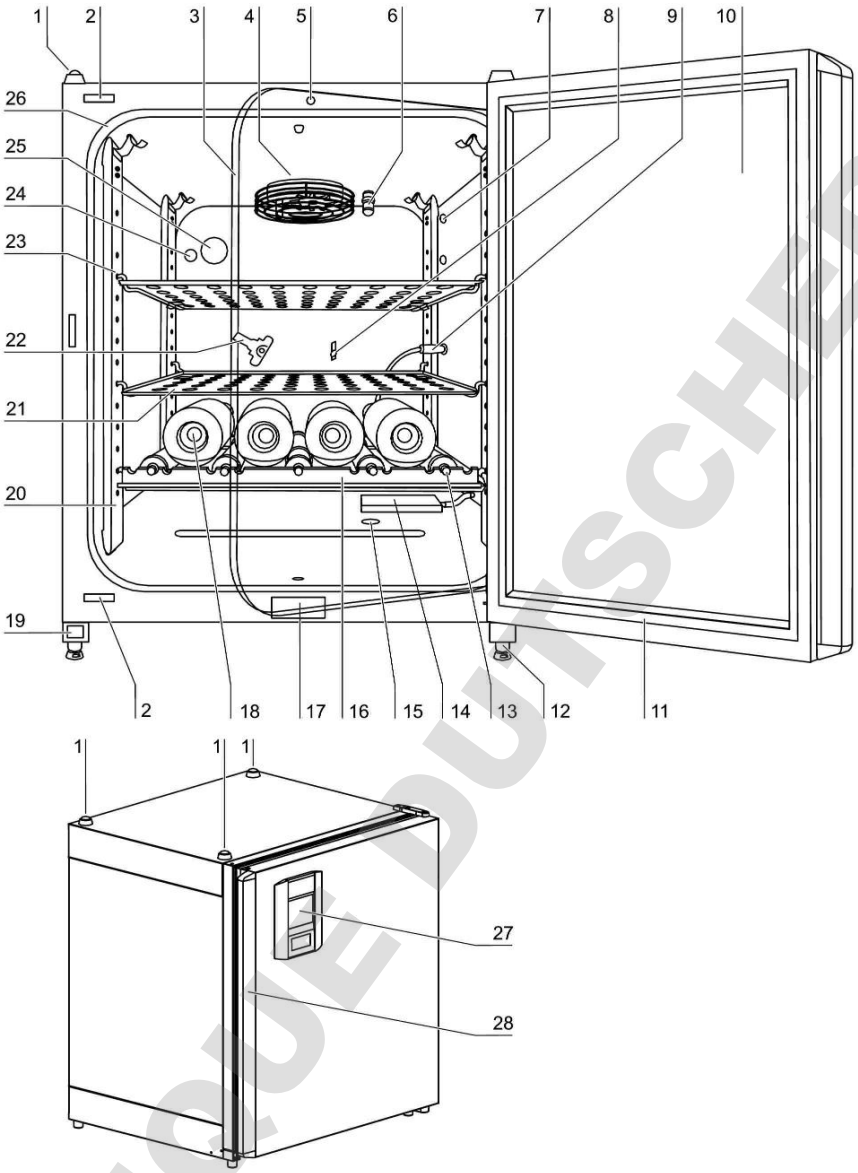


Figure. 7. Front view ***HERACELL® 240i***

1. Stacking elements
2. Plug caps
3. Glass door
4. Measuring cell with blower wheel and sensors
5. Door switch
6. Oxygen sensor (optional)
7. Receptacle for bottle turning device (optional)
8. Measuring opening
9. Plug for bottle turning device (optional)
10. Outer door

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11. Outer door seal, replaceable
12. Stand, height-adjustable
13. Drive roller for bottle turning device (optional)
14. Gas humidification (optional)
15. Water level sensor
16. Insert for bottle turning device (optional)
17. Nameplate
18. Cylinders (optional)
19. Power switch
20. Support rail
21. Shelf
22. Latch, glass door
23. Support hook for shelf
24. Pressure compensation opening with insert
25. Access port with plug
26. Glass door seal, replaceable
27. Operating panel (touchscreen)
28. Door handle

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4.4. Rear view *HERACELL® 240i*

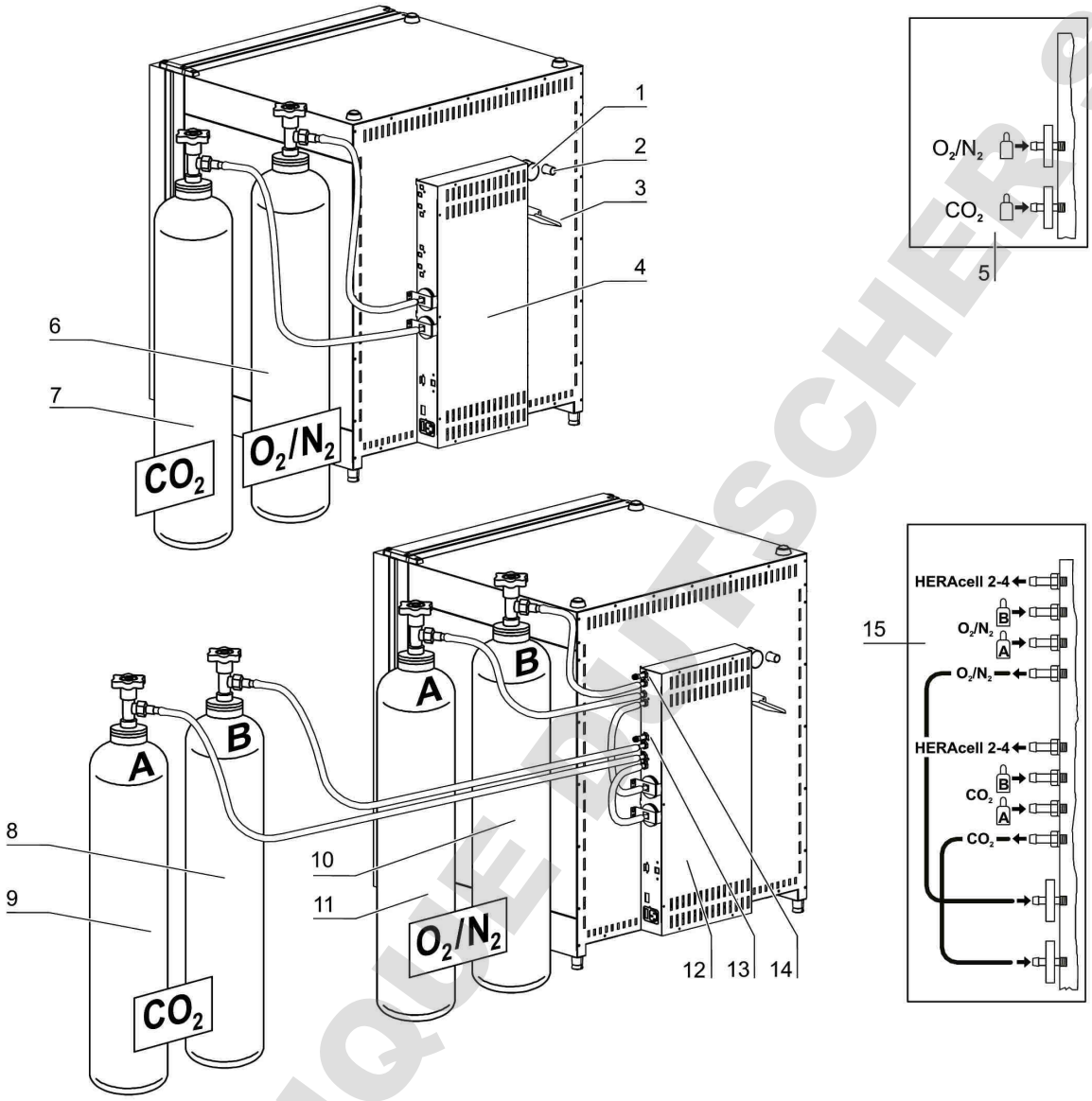


Figure. 8. Rear view ***HERACELL® 240i***

1. Pressure compensation opening
2. Access port, Ø 42 mm
3. Condensate drain gutter
4. Control box with supply interface for combined gas connection (optional) CO_2 and O_2/N_2 without gas monitoring
5. Diagram: Gas connection CO_2 and O_2/N_2 without gas monitoring
6. O_2/N_2 gas cylinder
7. CO_2 gas cylinder
8. **Secondary** CO_2 gas supply **B** with optional gas monitoring

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9. **Primary** CO_2 gas supply **A** with optional gas monitoring
10. **Secondary** O_2/N_2 gas supply **B** with optional gas monitoring
11. **Primary** O_2/N_2 gas supply **A** with optional gas monitoring
12. Control box with supply interface for combined gas connection (optional) CO_2 and O_2/N_2 with gas monitoring (optional)
13. Distributor connection for looping through the CO_2 gas supply for up to three additional devices (independent of device type)
14. Distributor connection for looping through the O_2/N_2 gas supply for up to 3 additional devices (independent of device type)
15. Diagram: Gas connection CO_2 and O_2/N_2 with optional gas monitoring

Looped-through gas supply for *HERACELL® 240i*:

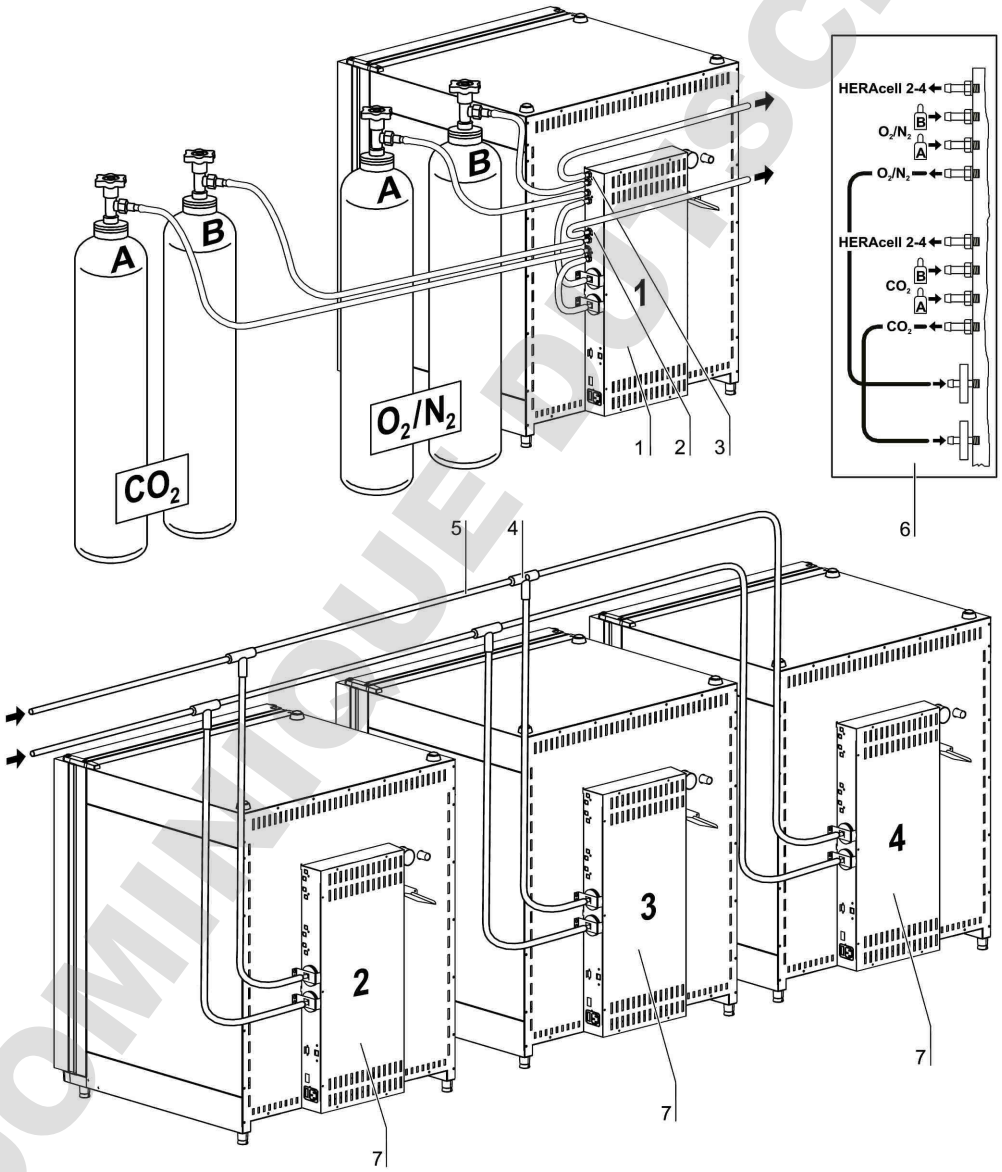


Figure. 9. Looped-through gas supply ***HERACELL® 240i***

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1. Control box with supply interface for combined gas connection (optional) CO_2 and O_2/N_2 with gas monitoring (optional)
2. Distributor connection for looping through the CO_2 gas supply for up to three additional devices (independent of device type)
3. Distributor connection for looping through the O_2/N_2 gas supply for up to 3 additional devices (independent of device type)
4. Tee joint for fitting the gas pressure hoses together
5. Gas pressure hose for looping-through the gas supply
6. Diagram: Gas connection CO_2 and O_2/N_2 with optional gas monitoring
7. ***HERACELL® 240i*** with looped-through gas supply; therefore device must only be equipped with combined gas connection (optional) CO_2 and O_2/N_2

4.5. Safety devices

The device is equipped with the following safety devices:

- A door switch interrupts the $CO_2/O_2/N_2$ supply and the work space heating when the glass door is opened.
- The optional gas detector switches the gas supply over to a full gas cylinder.
- An independent thermal protection protects the samples from harmful overheating in case of failures.
- A pressure compensation opening ensures pressure compensation in the device work space.
- The alarm relay circuit uses audible and visual alarms to indicate errors during operation.

4.6. Work space atmosphere

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

- Temperature
- Relative humidity
- CO_2 concentration
- O_2 concentration (optional)

Temperature:

To ensure undisturbed operation, the temperature in the operating room must be at least 18 °C and the incubation temperature must exceed this temperature by at least 3 °C.

The heating system controls the incubation temperature from this temperature threshold up to 55 °C. The principle of air jacket heating and the additional, separate heating of the outer door and glass door/gas-tight screen minimize the risk of condensate formation at the side walls, at the ceiling of the work space, and at the glass door/gas-tight screen.

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Relative humidity:

The heating of the work space promotes the condensation of the water, thereby ensuring a constant humidity within the work space. For the running operation, always keep a sufficient quantity of processed water of the following quality available:

- ***HERACELL® 240i***: quantity 4.5 l
- ***HERACELL® 150i***: quantity 3.0 l

Water quality recommendation:

For trouble-free operation of the equipment, fill the water reservoir with sterilized distilled water or equivalent. The acceptable conductivity should be within the range of 1 to 20 µS (resistivity within the range of 50 kΩ to 1 MΩ).



Notice

No tap or ultrapure water in humidity reservoir.

Sterile distilled water treated to an equivalent quality level is the recommendation for use in the integrated humidity reservoir. The acceptable conductivity should be within the range 0f 1 to 20 µS/cm (resistivity should be within the range of 50 kΩcm to 1 MΩcm). The pH should be in the range of 7-9. Ultrapure Type 1 water or deionized (DI) water with a resistivity approaching or equal to 18.2 MΩcm, contains very few ions and will actively pull ions from interior components, damaging stainless steel, copper and glass. If there is only access to DI or Type 1 water, one option is to add a sterile solution of weak sodium bicarbonate to raise the pH and add ions (recommended 84 mg/l (1mmol/l)).



Notice
Termination of warranty!

Using chlorinated tap water or additives that contain chlorine will void the manufacture warranty. Similarly, the use of ultrapure water whose conductivity is out of the range of 1 to 20 µS (and whose resistivity is out of the range of 50 kΩ to 1 MΩ) will void the manufacture warranty.
If you should have any questions, please contact Technical Support of Thermo Fisher Scientific.



Notice

No chloride containing disinfectants

While stainless steel is resistant to corrosion, it is not corrosion proof. Many chemicals have a negative effect on stainless steel, especially chlorine and derivatives with oxidizing activity. The addition of chloride-containing disinfectants or copper sulfate into the water as a constant disinfectant is not recommended because these can damage the connecting stainless steel/copper joint of the drain.
For cleaning the interior, the recommendation is mild soap solution in water then rinse to remove residues. Wipe the interior surfaces ans parts with a diluted quaternary ammonium disinfectant. Follow this by wiping with 70 % alcohol to remove any remaining traces of the disinfectant.

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Caution

Risk of an electric shock

Fill the water reservoir just up to the max. level. Overfilling could cause a hazard of the user or a malfunction of the device (short circuit).

Under normal operating conditions and at the usual incubation temperature of 37 °C, a constant relative humidity of approx 93 % is achieved in the work space.

If dew formation occurs on the culture containers due to elevated relative humidity, the humidity in the work space can be adapted to a lower value by enabling the Low Humidity feature. The relative humidity in the work space is lowered from approx. 93 % to approx. 90 %. The modification requires an extended adaption phase. To ensure that it effectively prevents dew formation on culture containers, it must be used as a permanent setting.

CO_2 supply:

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

- Purity 99.5 % min.
- medical gas quality

O_2 supply:

If the CO_2-incubator is to be operated with more than 21 % oxygen, the work space is supplied with oxygen. The O_2-content of the work space atmosphere can be controlled within a range of 0 to 21 %.

N_2 supply:

If the oxygen content during operation is to be lowered to less than 21 % (air oxygen content), the work space is supplied with nitrogen. The O_2-content of the work space atmosphere can be controlled depending on the configuration of the sensor within a range of 1 % to 21 % and 5 % to 90 %.

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4.7. Door switch

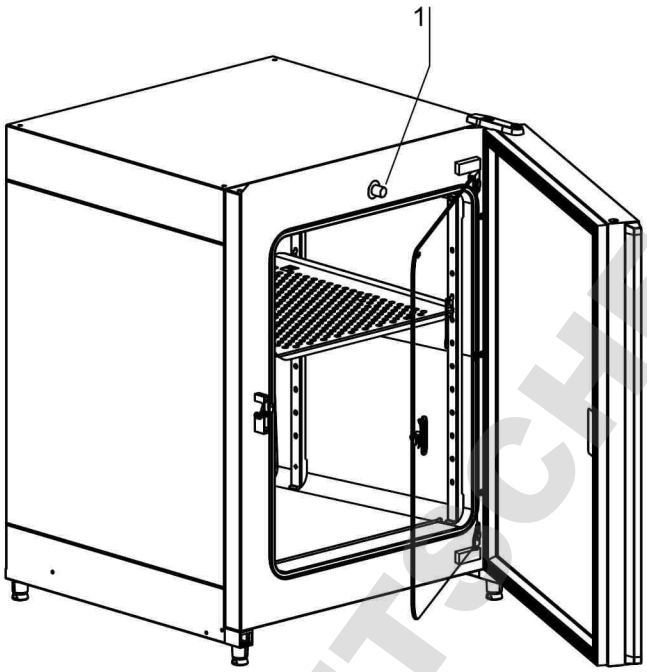


Figure. 10. Door switch

A door switch [1] is installed at the upper edge of the work space opening. If the door switch is activated by opening the glass door, the gas supply and the heating of the work space are interrupted and the display shows a corresponding message.
If the door remains open for more than 30 seconds, a short audible alarm sounds. If the door remains open for more than 10 minutes, an audible alarm sounds and the alarm relay responds.

The outer door can only be closed after the glass door has been latched properly.

Note
Versions with gas-tight screen:
For devices with the optional gas-tight screen, the door switch function described above is activated when the outer door is opened.

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4.8. Sensor system

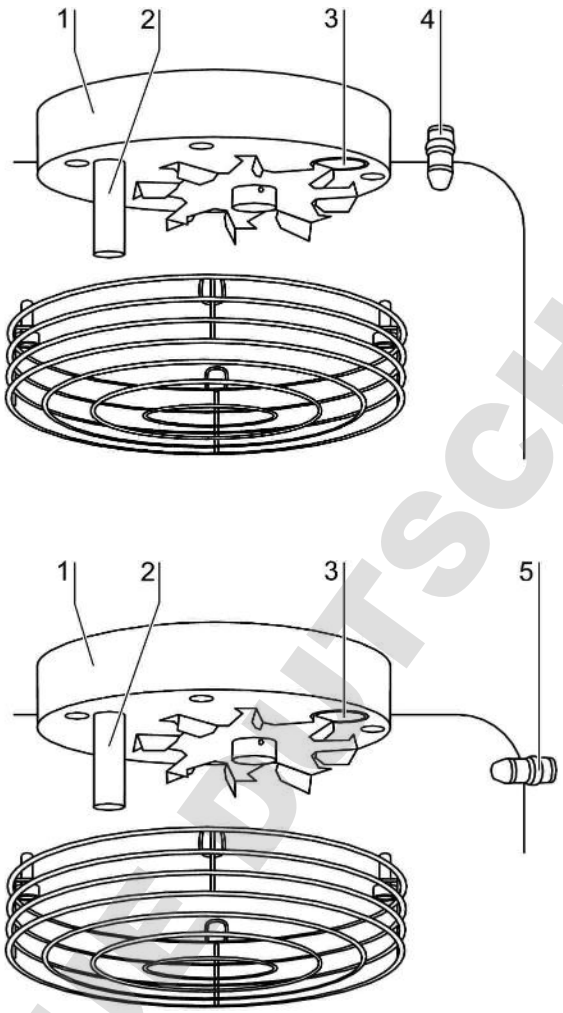


Figure. 11. Temperature, CO_2 and O_2 sensors

The blower wheel and two sensor modules are integral to the baseplate [1] of the measuring cell:

- Sensor [2] for the acquisition of the work space temperature and the thermal protection,
- CO_2 sensor [3] for the acquisition of the CO_2 content in the work space atmosphere.

The O_2 sensor (optional) [4] for the acquisition of the O_2 content in the work space atmosphere is installed at various locations next to the measuring cell:

- ***HERACELL® 150i*** in the sidewall in the upper area [5],
- ***HERACELL® 240i*** in the ceiling of the work space [4].

The sensor for the acquisition of the work space temperature as well as the CO_2 sensor and the O_2 sensor are integral to the control system of the device. Their measured values are compared to the selected set values. Based on this data, the control system controls heating and $CO_2/O_2/N_2$ supply.

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The blower intermixes the supplied gases and ensures an even temperature distribution within the work space.

The thermal protection has been preprogrammed at the factory and cannot be changed. It protects the stored cultures from overheating.

If the set temperature is exceeded by more than 1 °C, the thermal protection responds and the work space temperature is automatically reduced to the selected set value so that the incubation process can be continued even in case of a failure. Any response of the thermal protection will simultaneously trigger a visual alarm.

If the thermal protection is enabled:

- an error message is issued
- the alarm relay responds

If the error message is accepted, the display shows the Over temperature icon to indicate the response of the thermal protection, and the temperature display is highlighted in red.

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4.9. Supply interface

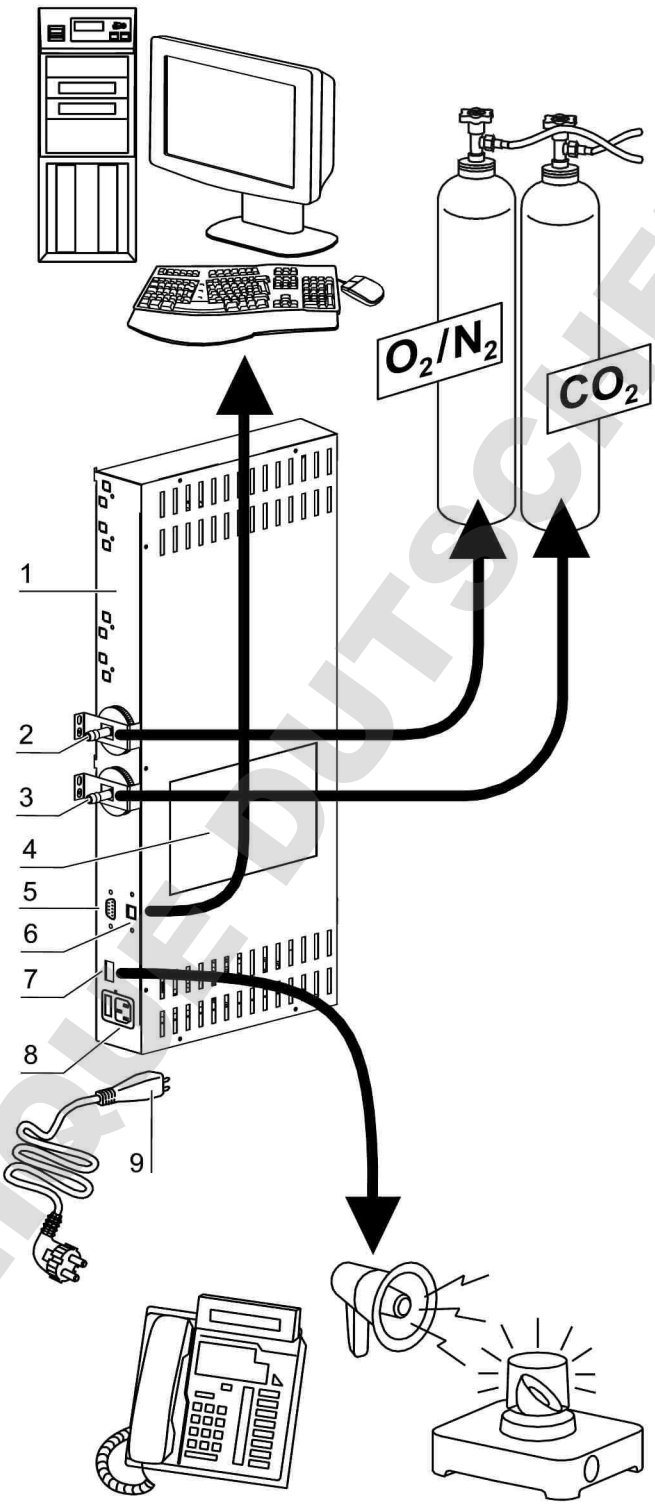


Figure. 12. Supply interface

All supply connections are installed in the supply interface (control box [1]) in the rear of the device.

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Gas connection:

The gas supply lines between the device and the gas supply system are connected using the supplied connecting hoses. O_2/N_2 is supplied to the device through connecting sleeve [2]. CO_2 is connected to sleeve [3].

All process gases must be supplied to the device at a fixed pressure that has been preset within a range of 0.8 to 1.0 bar and must remain unchanged.

Before the gases are fed into the work space, they flow through a gas inlet filter with a separation rate of 99.97 % for a particle size of 0.3 µm (HEPA filter quality).

The illustration shows the optional combined gas connection without the optional gas monitoring system.

Label:

The label [4] contains information about gas supply, an alarm contact terminal legend, and notes about the electrical fusing of the device.

RS 232 interface:

Via the RS 232 interface [5], the incubator can be connected to the serial interface of a PC. This connection allows the computer-aided acquisition and documentation of the major operating parameters (temperature, $CO_2/O_2/N_2$ concentration, error codes, etc.).

USB interface (optional):

As an alternative to the RS 232 interface [5], the incubator can be connected to a PC via the optional USB interface [6]. This connection - USB 1.1 /

USB 2.0 full speed compatible - allows the computer-aided acquisition and documentation of the major operating parameters (temperature, $CO_2/O_2/N_2$ concentration, error codes, etc.).

Alarm contact:

The device can be connected to an on-site, external alarm system (e.g. telephone system, building monitoring system, visual or audible alarm system).

For this purpose, a potential-free alarm contact [7] is preinstalled in the device.

Note
Alarm contact:
The alarm contact responds for all errors reported by the control loops (see *„Error messages“* on *page 124*).
Power supply connection:
The connection to the power supply system is established by connecting a cable with plug for IEC connector [9] to the socket [8]. The receptacle for the two device fuses is integral to the socket.

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4.10. Work space components

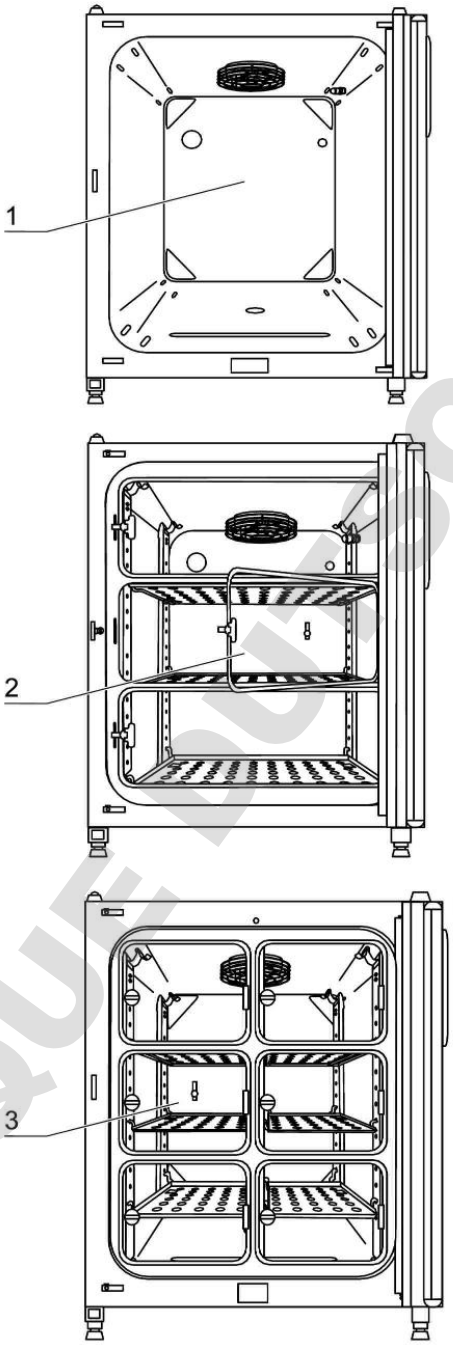


Figure. 13. Work space components

The work space of the incubator has only a minimum of surface, thereby supporting both the prevention of contamination and easy, effective decontamination.

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4.10.1. Interior container

All components of the work space are made of stainless steel and have a high-gloss polished, absolutely smooth and easy-to-clean surface. Any embossings have a large radius.

As an option, the interior container, the shelf system, and the blower wheel with its cover can be made of copper material.

Materials of the interior container

The standard version is equipped as follows:

- Interior container made from stainless steel.

Materials with increased contamination protection are optionally available:

- Interior container made from stainless steel, with transparent *i*ONGURAD™ silver ion coating,
- Interior container made from copper, combined with the following components also made from copper material: Shelf system and blower wheel with protective grid (cover).

Note
Oxidation of copper components:
When exposed to heat and humid air, the copper material of the interior container will oxidize. This results in a discoloration of the copper components during the test run for checking the device functions. Do not remove the oxide layer during routine cleaning as the antimicrobial effect of the copper material is based on it.

The components of the shelf system can be removed easily so that only the easily treatable, surface-reduced interior container [1] remains in the work space for cleaning and manual disinfection works.

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4.10.2. Optional split gas-tight screens

Equipment versions:

- ***HERACELL® 150i*** with 3-segment gas-tight screen [2]
- ***HERACELL® 240i*** with 6-segment gas-tight screen [3]

For devices that are equipped with the optional gas-tight screen, the contamination hazard is considerably lower and the recovery times of the incubation parameters are shorter for:

- work space temperature
- CO_2 concentration
- O_2/N_2 concentration
- relative humidity

Advantage of the gas-tight screen: The cross sections of the openings are smaller when samples are accessed.

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4.10.3. Water reservoir

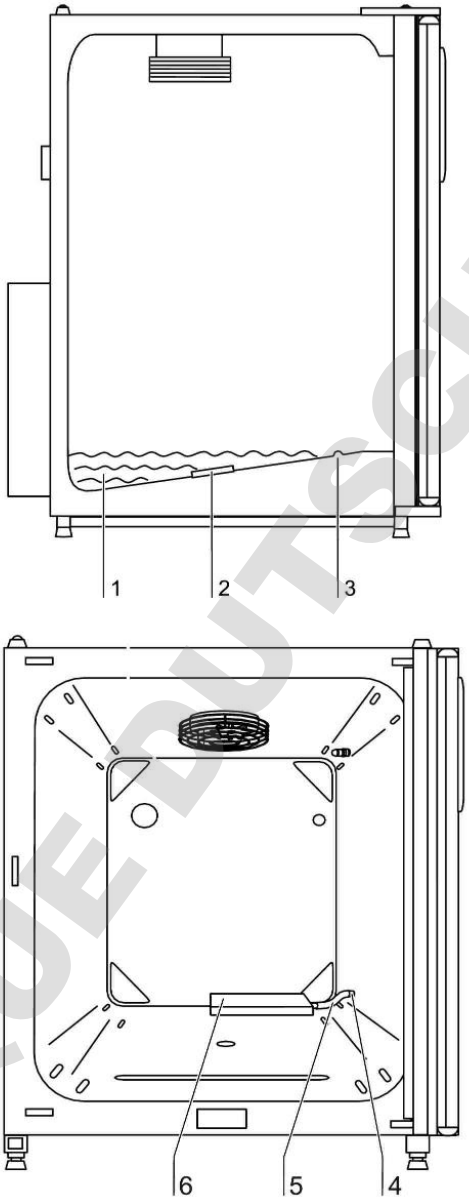


Figure. 14. Water reservoir

The water reservoir [1] is integral to the interior container floor and inclines toward the rear. The water level is monitored by a water level sensor [2] that issues an alarm message at the display and an audible signal when the water falls below the minimal level. The embossings [3] in the water tray are used as indicators for the maximal level.

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4.10.4. Gas humidification (optional, only for O_2 control)

A hose [5] connects the gas humidification [6] to the device-integral oxygen or nitrogen supply line [4]. The inflowing oxygen or nitrogen is fed to the heated water. This ensures humidification of the gases as they enter the work space and prevents an undesired drop of the work space humidity.

4.10.5. Heating system

An air jacket heating is used for heating the work space. The arrangement of the heating elements ensures that condensate formation above the water reservoir is prevented as far as possible.

The outer door of the device is also heated. The heat radiated onto the interior glass door/gas-tight screen prevents condensate formation. The work space of the device always remains visible, despite high humidity.

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4.10.6. Rear panel openings

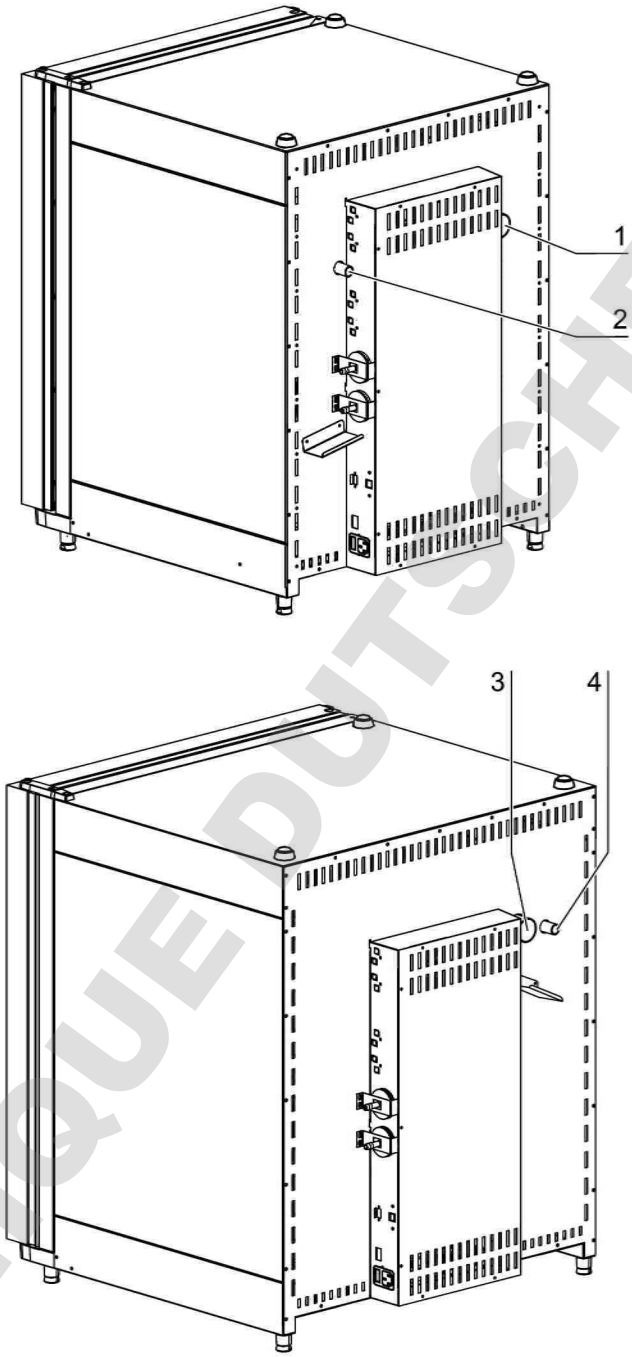


Figure. 15. Rear panel openings

A pressure compensation opening with insert in the rear panel of the device allows a compensation between the pressures in the work space and in the operating room.

A sealable access port allows cables, hoses or additional sensors to be routed into the work space of the device.

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HERACELL® 150i:

- access port, Ø 42 mm [1]
- pressure compensation opening [2]

HERACELL® 240i:

- access port, Ø 42 mm [3]
- pressure compensation opening [4]

Note
Operating conditions:
When accessories are to be operated in the work space of the CO2-incubator, the ambient condition requirements must be observed (see table below). The energy introduced into the work space affects the beginning of the temperature control range. When additional heating sources are introduced into the work space, condensation (e.g. at the glass door) may occur.

Introduced energy	Control ranges of the temperatures	
	General	Example: RT[1] = 21 °C
0 W	RT + 3 °C	24 °C
5 W	RT + 6,5 °C	27,5 °C
10 W	RT + 9,5 °C	30,5 °C
15 W	RT + 13 °C	34 °C
20 W	RT + 16 °C	37 °C

1 RT= Ambient temperature

4.10.7. Shelf system

The support rails [1] of the shelf system are perforated every 42 mm so that the support hooks [8] can be inserted variably for any culture container size required. The shelves [2] have an integrated tilt protection and withdrawal stop. For details of the shelf system, see Section „Start-up“.

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4.10.8. Bottle turning device for *HERACELL® 240i* (optional)

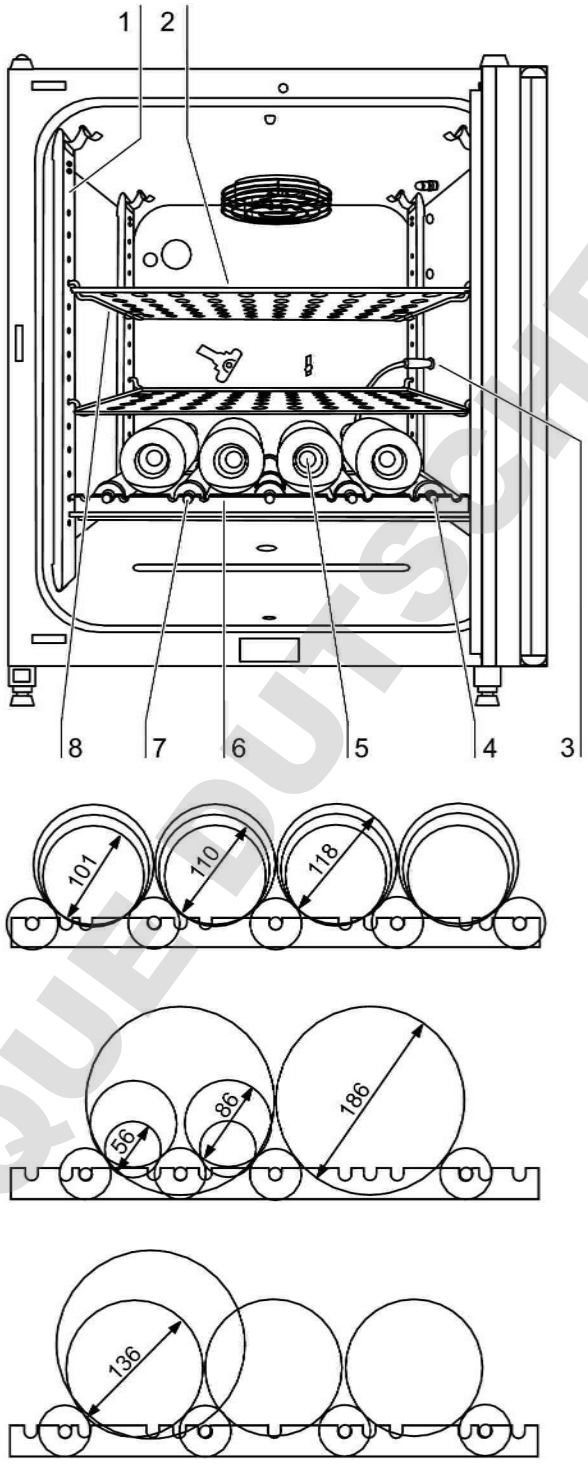


Figure. 16. Bottle turning device

HERACELL® 240i may be equipped with up to four separate bottle turning devices. Each unit consists of a roller insert [6] with a drive roller [4] and four idle rollers [7] that are also rotated due to the transmission function of the inserted cylinders [5].

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Each unit is controlled separately as the drive roller is connected to the device control unit by a connector [3] at the right side of the device.

This modular layout also allows the operation of only one bottle turning device in combination with several shelves.

The arrangement of the idle rollers in the roller insert frame depends on the configuration of the cylinders used. The drive roller is always inserted into the right roller guide. The position and the number of the idle rollers in the frame then depend on the cylinder diameter and on the number of cylinders. The figure shows three examples of different idle roller positions in dependence of the cylinder diameter.

The arrangement of the roller inserts in the work space is designed alphabetically as a, b, c, and d with a being the lowest and d being the uppermost roller insert.

The connections of the drive rollers are assigned correspondingly to the device control unit. The drive roller of the switching insert a must only be connected to the lower receptacle a of the corresponding control unit.

Note
Connection assignment:
If the drive roller is not properly connected to the control unit, the parameters cannot be set correctly on the operating panel of the device.
Receptacles:
To prevent corrosion due to moisture in the work space, unassigned receptacles of the bottle turning device must always be plugged with the protective cap.

The rotating speed of the bottle turning devices is set depending on two parameters:

- Diameter (of the cylinders used),
- drive roller set value.

The value is determined using a diagram (see ***„Installing the optional bottle turning devices HERACELL® 240i“* on *page 62***).

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4.10.9. Water pump

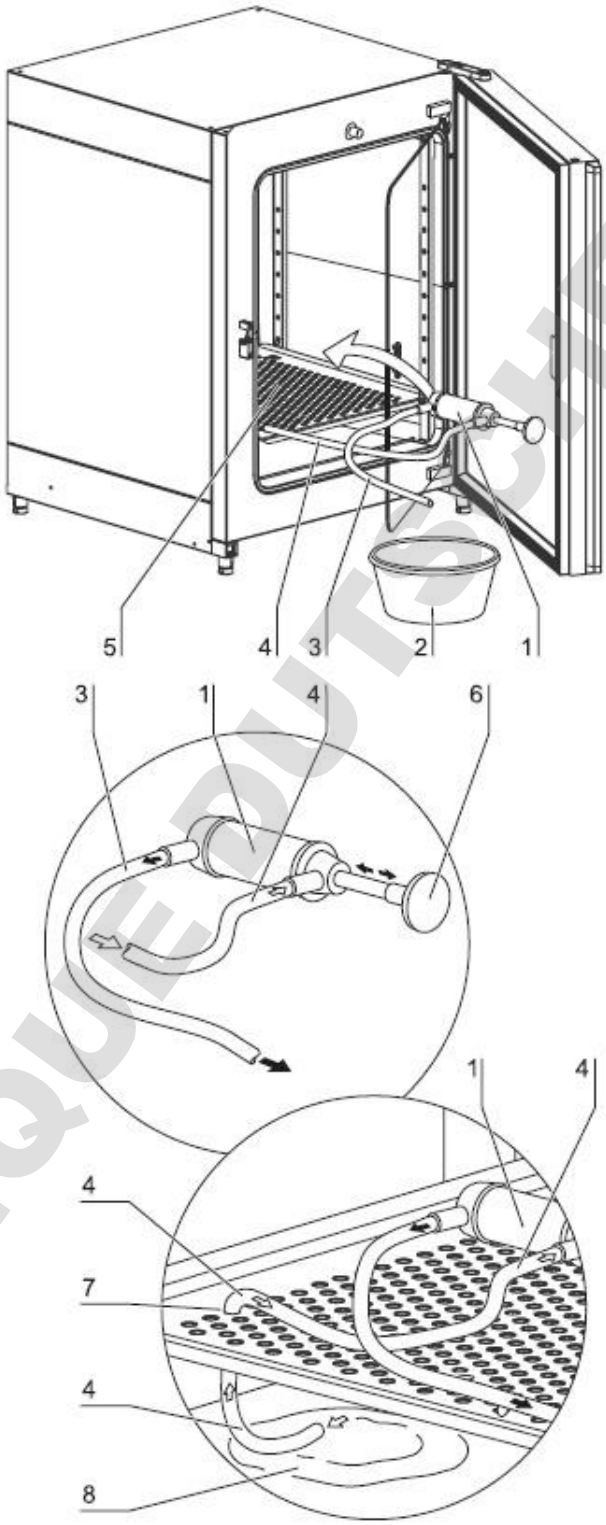


Figure. 17. Water pump

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The water pump serves for suction cleaning of the remaining water in the water reservoir. The water drain works through gravity.

1. Place the water pump [1] on lowest shelf [5].
2. Feed the inlet hose [4] through a whole [7] of the lowest the shelf to the water reservoir [8].
3. Prepare a bucket [2].
4. Suck the water, therefore pump the water pump using the hand grip [6] about four times until water flows in the outlet hose.
5. Let the water run into the bucket [2] through gravity.
6. Wipe out the rests of the water at the floor plate of the water reservoir.

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5. Start-up

5.1. Let the device adapt to the ambient conditions



Let the device adapt to the ambient conditions!
The device must adapt to ambient conditions prior to start-up.

- **Set up the device in the operating room and let it adapt to the expected operating room temperature.**
- **For a period of approx. 2 hours prior to switching it on.**
- **Open the device doors.**

5.2. Preparing the work space

Upon delivery, the CO_2 incubator is not in a sterile state. Before the initial start-up, the device must be decontaminated.

Before the decontamination is performed, the following work space components must be cleaned:

- Support rails,
- support hooks,
- shelves,
- bottle turning assembly (optional),
- gas humidification (optional),
- work space surfaces,
- work space seals and gaskets,
- glass door/gas-tight screen.

Note
Decontamination:
For details about the cleaning and disinfection of the device (see *„Cleaning and disinfection“* on *page 133*).

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5.3. Installing the shelf system



Caution

Risk of overloading!

Overloading may damage the shelves or cause the shelves and/or the CO2-incubator to tilt. When the shelves are being drawn out, ultimately destroying the samples.

To avoid overloading the incubator or its shelving be sure to observe the sample weight limits specified in chapter 12.

Tools are not required for the installation of the shelf system. The support rails are secured using spring pressure. After the support hooks have been inserted into the rail, the shelves are pushed onto the support hooks.

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5.3.1. Installation/removal of the support rail

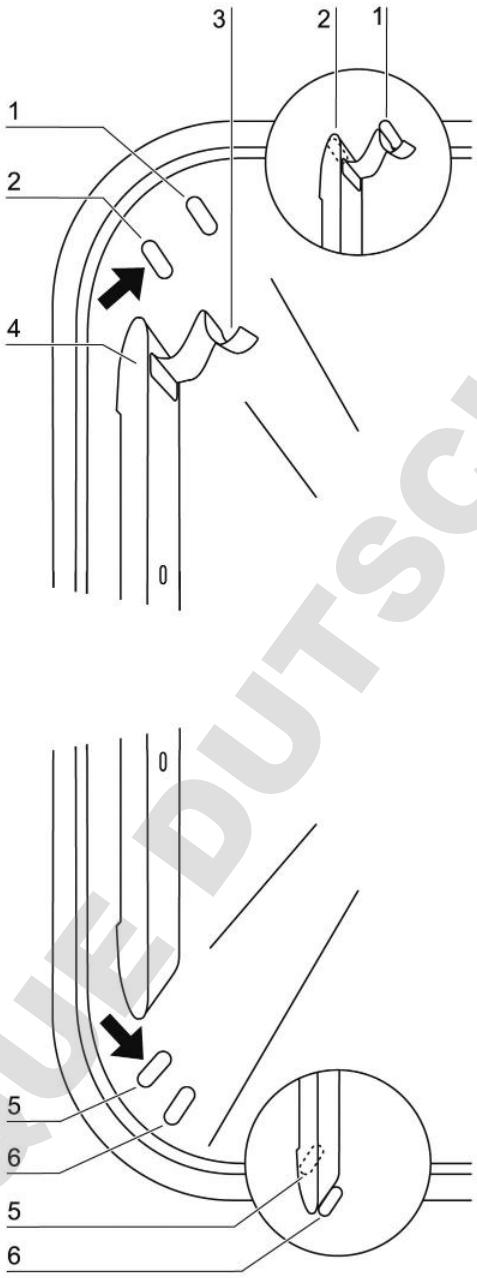


Figure. 18. Support rail installation/removal

The support rails are held at the sides by the embossings [2] and [5] and secured by the embossings [1] and [6]. The support rails marked with the diamond shape are inserted at the rear panel of the device with the locksprings [3] facing upward.

1. Position the support rail [4] onto the lower embossing [6] and tilt it toward the work space side wall so that the rail is positioned over the two embossings [5] and [2].
2. Clamp the lockspring [3] behind the upper embossing [1].
3. To remove the support rails, pull the lockspring tab down out of the embossing and remove the rail.

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5.3.2. Installing the shelf supports:

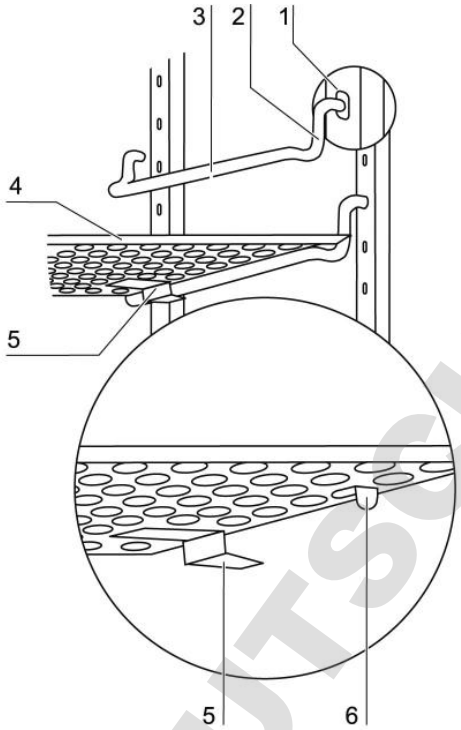


Figure. 19. Shelf support installation

1. Insert the shelf supports [3] into the perforations [1] of the support rail with the bar facing down.
2. Make sure that the two vertical elements [2] of the shelf support are flush with the support rail.

Installing the shelves:

1. Push the shelf [4] onto the shelf supports with the tilt protection [5] facing the rear panel of the device. The tilt protection [5] is also used as a guide for the shelf.
2. Slightly raise the shelf so that the withdrawal stop [6] can be routed over the shelf supports.
3. Make sure that the shelf support is positioned in the two tilt protections in a way that allows it to move freely.

5.3.3. Leveling the device

1. Position a bubble level onto the center shelf or onto the roller holder.
2. Rotate the adjustable device stands using the supplied 24 mm wrench until the shelf is positioned horizontally in all directions. Perform the adjustment of the device stands from left to right and from rear to front.

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5.4. Installing the gas humidification (optional, only for O_2/N_2-control)

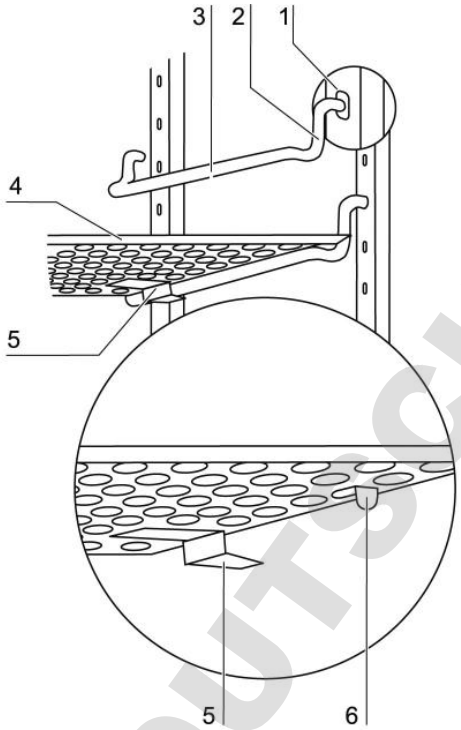


Figure. 20. Installing gas humidification

The gas humidification [1] is installed to the water tray parallel to the rear panel of the device. The position to the right side wall is predetermined by the hose length.

1. Install hose [2] to the sleeve of the gas humidification and then to the sleeve [3] of the device-integral oxygen or nitrogen supply line.
2. Place gas humidification immediately to the rear panel of the device and align it parallel to the rear panel.

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5.5. Installing the optional bottle turning devices *HERACELL® 240i*

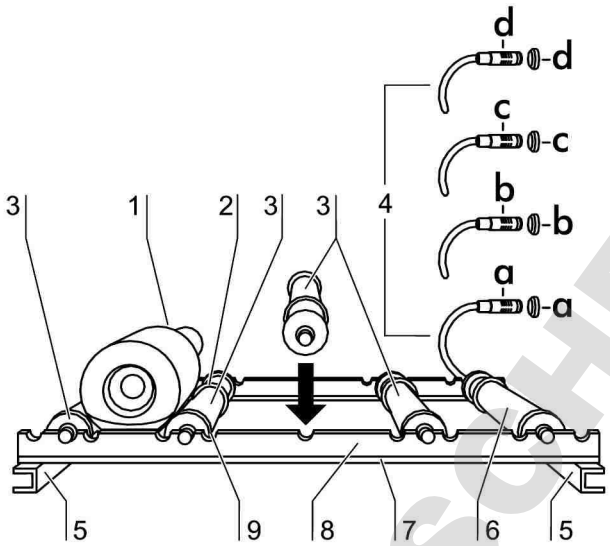


Figure. 21. Installing the bottle turning devices

1. Align the roller insert so that the roller holder [8] and the cross member [7] are flush and facing the work space opening.
2. Slide the roller insert with both guide rails [5] onto the shelf supports.
3. Slightly raise the roller insert so that the withdrawal stop can be routed over the shelf support.
4. Insert the drive roller [6] into the right receptacle and connect the cable [4] to the corresponding control unit a.
5. Insert the four idle rollers [3] the into receptacles and position the rollers in the receptacles in accordance with the bottle diameter.
6. Place the bottles onto the rollers. To ensure that the bottles will not be shifted against each other by the rotation, the bottoms of the bottles should contact the stop disks [2] of the rollers and the cylinder necks [1] should contact the rubber stop rings [8]. The stop ring can be positioned accordingly on the roller.

Set speed of the bottle turning device:

7. The rotating speed of the bottle turning devices is set depending on two parameters:

- Diameter (of the bottles used),
- drive roller set value.

Use of diagram:

8. The diagram shows the common bottle diameters as different graphs (ascending straight).

- Set the desired speed at the Y axis. Read the corresponding set value (in %) from the X axis at the point of intersection of the Y value with the specific graph.

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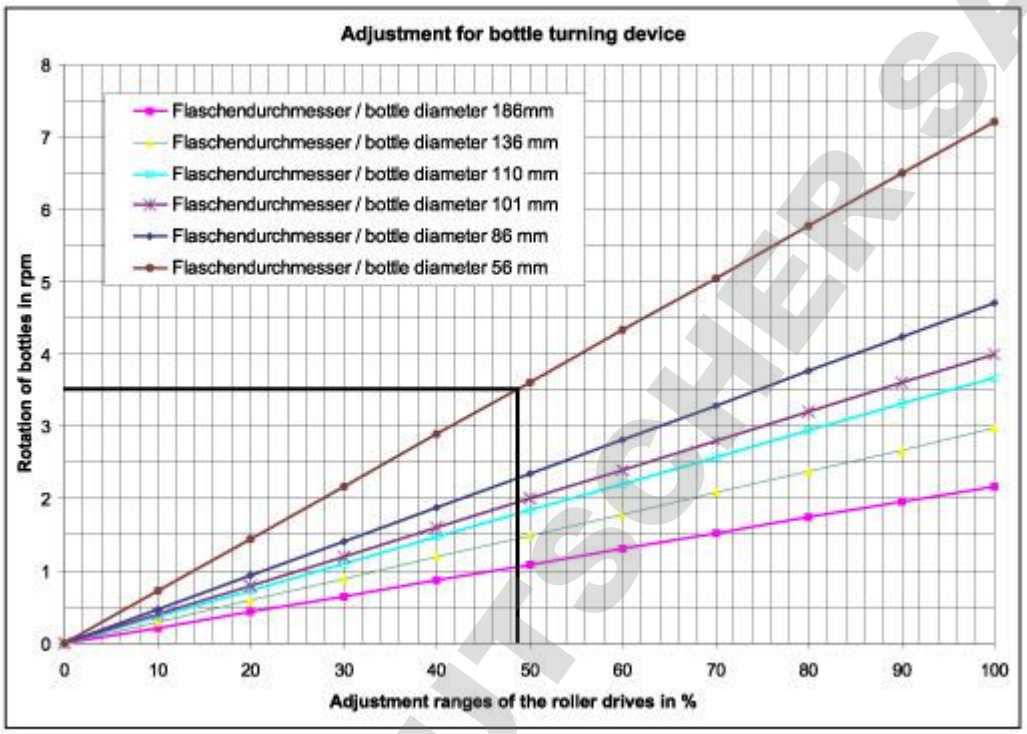


Figure. 22. Bottle turning speed

Example:

- Bottle diameter: 56 mm
- Desired speed: 3.5 rpm
- Determined set value: 48 %

In the dialog box SPEED BOTTLE TURN. DEVICE, the value 48 % is set (see ***„Options“* on *page 110***).

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5.6. Installing the optional center strut *HERACELL® 240i* for split inserts

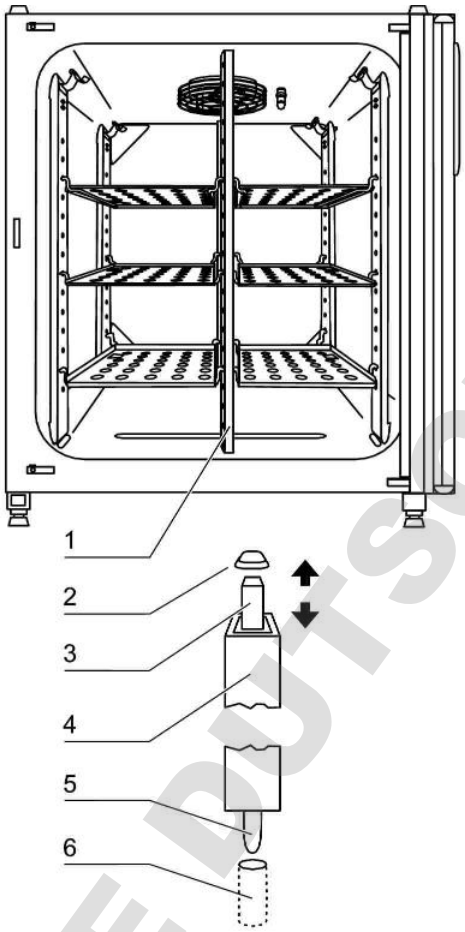


Figure. 23. Center strut installation

If ***HERACELL® 240i*** is equipped with the optional 6-segment insert, two center struts [1] with perforations at each side must be installed. In this case the shelf support rails must be installed to the support rails at the sides and at the left and right side of the strut.

The support rails marked with the diamond shape are installed at the rear panel of the device.

1. A pressure spring keeps the upper rectangular guide [3] of the center strut under tension. Insert this guide into the receptacle [2] in the work space ceiling and push it slightly upward so that it is pushed into the center strut.
2. Then, position the lower rod guide [5] of the center strut into the hole [6] in the work space floor and remove spring tension.
3. The center strut is stabilized by the spring pressure.

Note
Configuration with split inserts:
For versions with split inserts, bottle turning devices cannot be installed.

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5.7. Gas connection

Note
Gas quality:
The gases must have one of the following qualities:

- **Purity 99.5 % min,**
- **medical gas quality.**

Caution:
Overpressure!
The operating pressure of the gas applied 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!

5.7.1. Installing gas pressure hoses

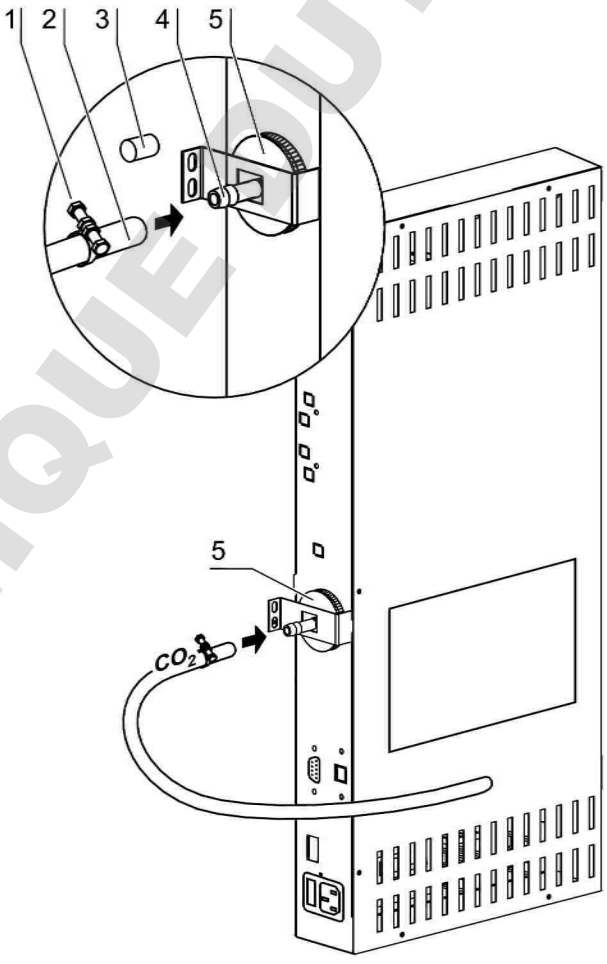


Figure. 24. Installing gas pressure hoses

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The gas supply from the gas supply system to the device is achieved using the supplied flexible gas pressure hoses:

1. Connect the gas pressure hose [2] to the sleeve of the gas supply system.
2. Remove the protective cap [3] from the sterile filter.
3. Slide the hose clamp [1] onto the gas pressure hose and connect hose to the sleeve [4] of the sterile filter [5].
4. Secure the gas pressure hose to the sleeve of the sterile filter using the hose clamp.

Note
Pressure compensation opening:
To ensure permanent pressure compensation, the pressure compensation opening must not be connected to an exhaust air system. The pipe of the pressure compensation opening must not be extended or redirected.

5.7.2. Installing devices without the optional gas monitoring system

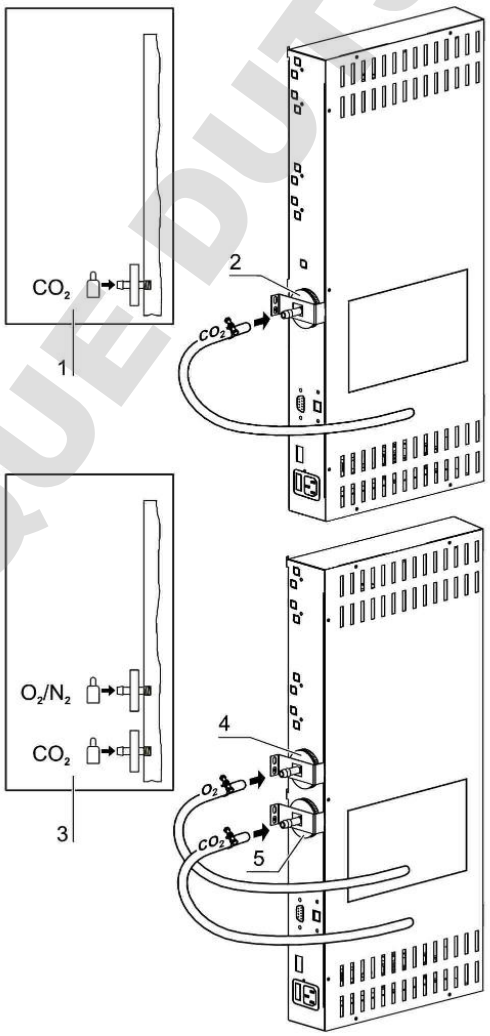


Figure. 25. Gas connection without gas monitoring system

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The gas supply from the gas supply system to the device is established using the supplied flexible gas pressure hoses (see ***„Installing gas pressure hoses“* on *page 65***):

CO_2 connection:

- For a device with CO_2 connection, connect the gas supply to the sterile filter [2] in accordance with the connection diagram [1].

Combined CO_2 and O_2/N_2 connection (optional):

For a combined $CO_2/O_2/N_2$ connection, proceed as follows in accordance with the connection diagram [3]:

- Connect the O_2/N_2 supply line to the upper gas inlet filter [4],
- connect the CO_2 supply line to the lower gas inlet filter [5].

Note
Manual gas monitoring:
On devices without the optional gas monitoring system, there is no automatic gas monitoring. Therefore, the filling level of the gas bottles must be checked every day.

5.7.3. CO_2 connection with gas monitoring system (optional)

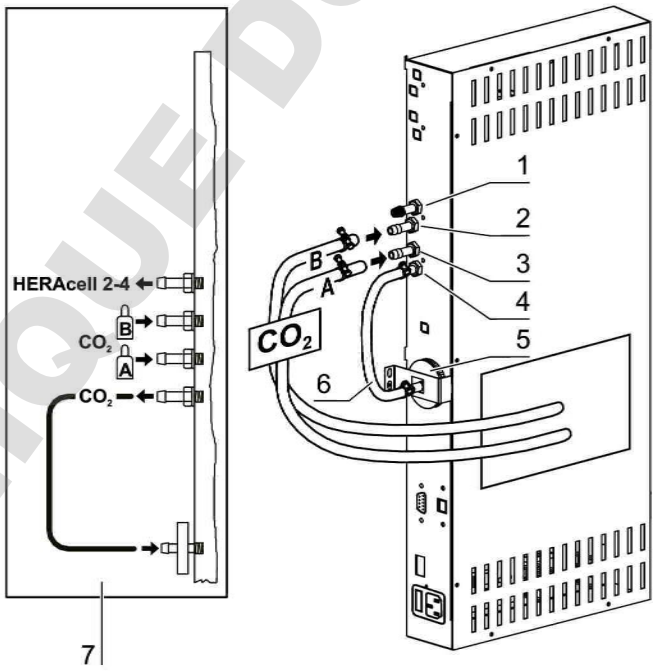


Figure. 26. Gas connection with gas monitoring system (optional)

The gas supply from the gas supply system to the device is established by the supplied flexible gas pressure hoses.

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Devices with CO_2 connections that are equipped with the optional gas monitoring system are connected according to the connection diagram [7].

CO_2 connection:

For a device that is operated with process gas CO_2 and equipped with the optional gas monitoring system, connect the gas supply lines as follows:

- Distributor connection [5] for the CO_2 gas supply for up to three additional devices. For looping the gas supply through, interconnect the devices with a gas pressure hose.
- Connect the gas container **B** to the upper connection [2] of the gas monitoring system.
- Connect the gas container **A** to the lower connection [3] of the gas monitoring system.
- The outlet of the gas monitoring system [4] is connected at the factory to the gas inlet filter [5] by a short gas pressure hose [6].

Note
Looping the gas supply through:
By looping the gas supply through, up to 4 devices can be supplied by a CO_2 gas supply.

5.7.4. Combined $CO_2/O_2/N_2$ connection with gas monitoring system (optional)

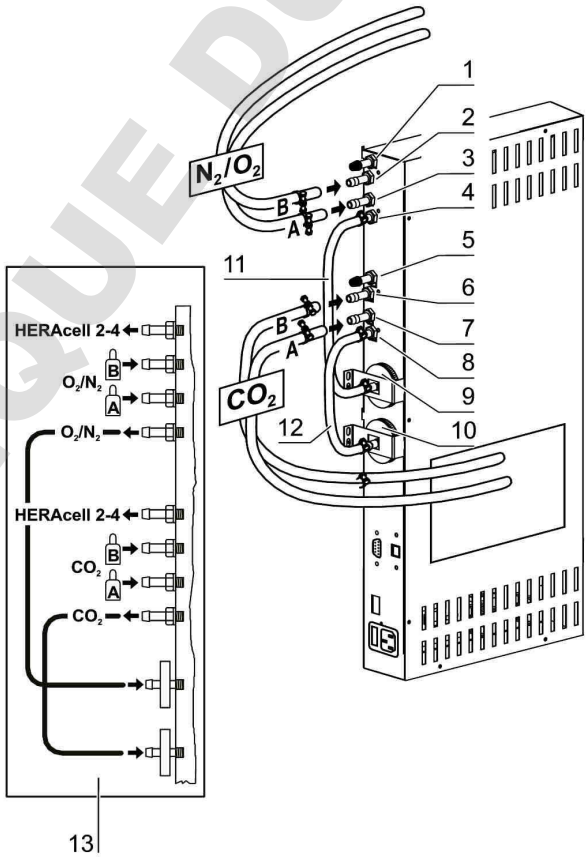


Figure. 27. Combined connection with gas monitoring system (optional)

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The gas supply from the gas supply system to the device is established by the supplied flexible gas pressure hoses.

Devices with the combined $CO_2/O_2/N_2$ connection that are equipped with the optional gas monitoring system are connected according to connection diagram [13] and have the following gas connections:

CO_2/N_2 supply:

- Distributor connection [1] for the O_2/N_2 gas supply for up to three additional devices. For looping the gas supply through, interconnect the devices with a gas pressure hose.
- Connect the gas container B [2] to the upper connection of the gas monitoring system.
- Connect the gas container A [3] to the lower connection of the gas monitoring system.
- The outlet of the gas monitoring system [4] is connected at the factory to the gas inlet filter [9] by a short gas pressure hose [11].

CO_2 supply:

- Distributor connection [5] for the CO_2 gas supply for up to three additional devices. For looping the gas supply through, interconnect the devices with a gas pressure hose.
- Connect the gas container B to the upper connection [6] of the gas monitoring system.
- Connect the gas container A to the lower connection [7] of the gas monitoring system.
- The outlet of the gas monitoring system [8] is connected at the factory to the gas inlet filter [10] by a short gas pressure hose [12].

Note
Looping the gas supply through:
By looping the gas supply through, up to 4 devices (see annex at the end of this section) can be supplied by a CO_2 gas supply or O_2/N_2 gas supply.

5.8. Power supply connection

Warning
Electric shock!
Contact with current-carrying components may cause a lethal electric shock.
Before connecting the device to the power supply, check plug and power supply cable for damage.
Do not use damaged components when connecting the device to the power supply!

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

- Fusing T 10 A
- Circuit breaker G 16

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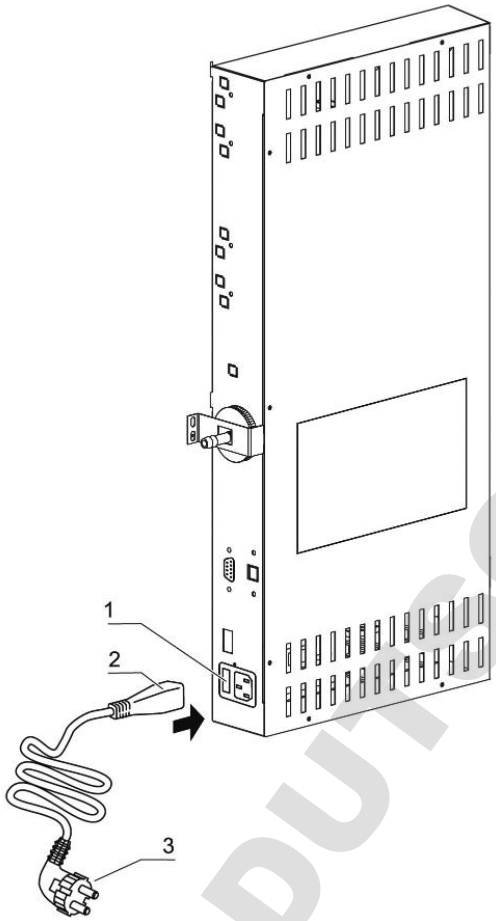


Figure. 28. Power supply connection

Connection to the power supply system:

1. Before connecting the device to the power supply, check to see if the voltage of the power supply corresponds with the specifications on the nameplate on the front 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. Connect the IEC connector [2] to the socket [1] of the control box of the device.
3. Route the power cord along a path that does not cross hot spots (e.g. drainpipes), tables, passageways and aisles. With stacked devices, keep the power cord away from hot spots on the other refrigerated incubator in the stack.
4. Connect the grounding plug [3] of the power supply cable to a correctly grounded and fused socket.
5. Make sure the power supply cable is not subjected to tensile or compressive force.

Note
Make sure that power sockets remain freely accessible at all times!

To allow a rapid disconnection of power in case of an emergency, make sure that power outlets remain freely accessible at all times!

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5.9. Connecting the RS 232 interface

Notice

Replacement should only be carried out by skilled and authorized qualified personnel of electrotechnology/signal engineering

The RS-232 data communication interface supports the querying of status information and temperature data from the CO_2-Incubator by entering basic commands in a standard terminal window provided by your computer's operating system. The interconnection requires a standard RS-232 cable with 9-pin connectors and a straight "1:1" pinout without any crossed wires, which is not supplied with the Incubator.

Notice

RS-232 interface compatibility

To avoid overloading and damaging the RS-232 interface check the interfacing parameters against the pin-out description given above and make sure that computer's interface port works with a signal level of ±5 V DC. The RS 232 data communication interface has been designed for a cable connection with 9-pin connector and a contact assignment of 1:1.

Data exchange is accomplished by a predefined structure of command sequences (see *„Data communication“* on *page 165*).

Note
Data communication diagram:
The command sequence syntax as well as the RS 232 interface data communication diagram are described in the annex at the end of this section.

Connecting the devices:

1. Turn the PC off.
2. Connect the serial interface cable connector (not included in the standard equipment) to the socket at the device supply interface at the rear of the device.
3. Connect the second connector to an unassigned serial port COM 1/COM 2 etc. at the PC.
4. Turn the PC on.

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5.10. Connecting the USB interface (optional)

As an alternative to data communication via RS 232 interface, the devices can be equipped with the optional USB interface. The USB interface complies with Standard USB 1.1 and is compatible with Standard USB 2.0 (full speed).

The interface stepping rate can be changed within the defined baud rates (9,600, 19,200, 38,400, 57,600 baud).

Data exchange is accomplished via a defined command sequence structure (frames). The command sequences correspond with the RS 232 interface installation diagram (see annex at the end of this section).

Using the USB interface for data communication between a PC and the device a driver must be installed first (see annex data communication).

5.11. Connecting the alarm contact

Note
Skilled work:
Thermo Scientific 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 system errors and failures occur in the temperature or gas control circuits, an alarm message is issued to the connected alarm/monitoring system. The potential-free contact (1 changeover contact) has been designed for the following circuits:

Alarm relay:

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

Operating states	Contact 4- 1	Contact 4 -3
Operating state power failure "off"	X	O
Operating state power failure "on"	O	X
Failure: power failure "off"	O	X
Failure: power failure "on"	X	O
X: Contact closed/O: Contact open		

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Note
Switching structure:
The alarm relay switches for all failures reported by the control loops (see *„Error messages“* **on** ***page 124***).



Caution
Alarm contact electrical compatibility considerations

To avoid overloading and damaging the alarm contact, check the electrical interfacing parameters of the alarm-receiving system for compatibility with the alarm-relay specifications given above.

Note
Blackout:
If the alarm relay reports a blackout, no display appears and the switches do not blink.

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Connection example:

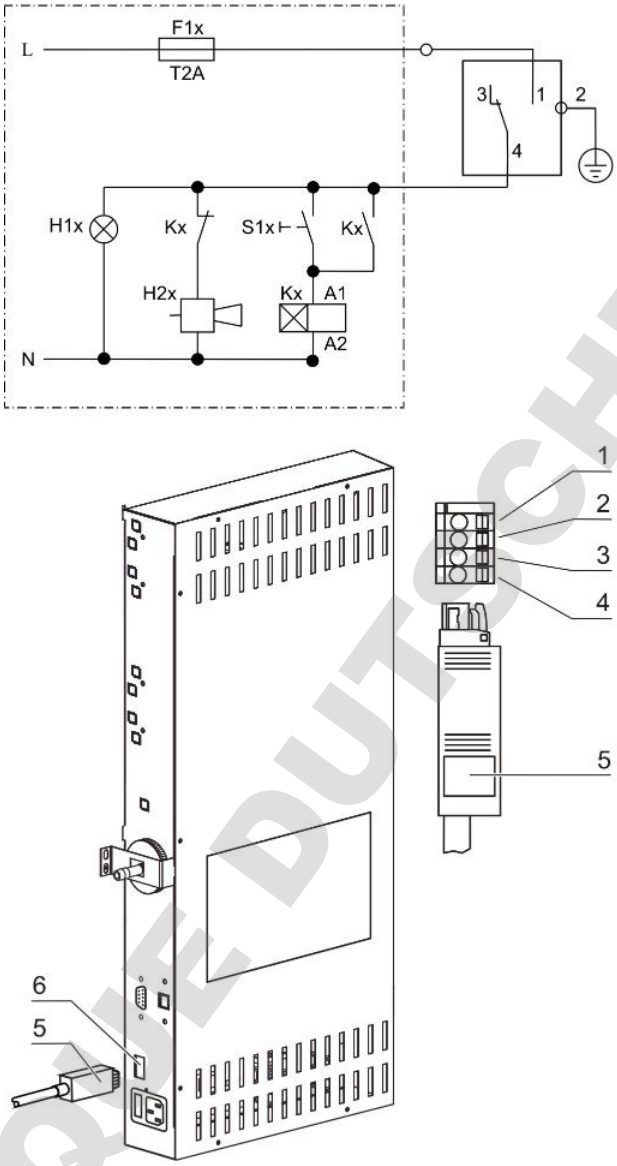


Figure. 29. Connection example

The connector [5] for the connecting cable is included in the standard equipment. The values for the operating voltage of the external circuits and of the fusing of the alarm system are given in the table on the previous page.

1. Connect the individual conductors [1] to [4] of the connecting cable as shown in the wiring diagram.
2. Route the alarm cable along a path that does not cross possible hot surfaces (e.g. exhaust air piping) tables, passageways and aisles. With stacked devices, keep the alarm cable away from hot spots on the other CO_2-incubator in the stack.
3. Connect the connector [5] of the alarm system connecting cable to the interface [6] at the control box at the rear panel of the device.

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6. Operation

Caution
The microbiological safety of the unit is largely dependent on the proper conduct of the persons using the unit. Refer to the Appendix "Basic rules of sound microbiological engineering practice".

6.1. Prior to starting operation

Apply the required individual protective equipment (e.g. for hands, face, body) and take off all jewelery.

6.2. Preparing the device

The device must only be released for operation after all major measures for the start-up have been taken (see Section 5).

Device check:

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

- Gas hoses must be seated tight on the connecting filter and must be secured using a hose clamp.
- The access port must be capped.
- The pressure compensation opening must be permeable, its insert must be installed in the work space.
- The glass door/gas-tight screen seal must not be damaged.
- The glass door measurement opening must be capped.
- The shelf system components must be installed safely.
- The gas humidification (optional) must be connected to the device-integral gas supply and aligned parallel to the rear panel.
- The drive rollers of the bottle turning device (optional) must be properly connected to the corresponding control unit.
- The idle rollers of the bottle turning device (optional) must be positioned in accordance with the cylinder diameters.
- The glass door must not be damaged.
- Disinfecting and cleaning the incubators work space with fuzz-free materials.
- Disinfect the work space according to the operator-specified hygiene guidelines.
- Don‘t use any explosive disinfectants. When using alcohol as a disinfectant, attend the national regulations.

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Decontaminating the device work space:

Run the contra-con decontamination routine (see ***„contra-con decontamination routine“*** **on** ***page 137***) or decontaminate the work space according to the hygiene regulations set forth by the operator.

Note
Hygiene regulations:
Prior to any operation, the user must clean and disinfect the work space in accordance with the hygiene regulations set forth by the operator to protect the cultures.
The “Principles of good microbiological proceedings” at the annex of these instructions can be used as safety information for personnel working with the device.
Water supply:
A sufficient quantity of treated water of the following quality must always be available for the running operation:

- **distilled, fully demineralized, and**
- **autoclaved, sterile.**

When the filling level drops below a minimum value, it must be possible to top up water during the work process.
Capacities:

- ***HERACELL® 150i*: 3.0 l**
- ***HERACELL® 240i*: 4.5 l**

6.3. Starting operation

1. Fill the water tray with a sufficient quantity of processed water. Do not exceed the upper level mark.
2. Make sure that the $CO_2/O_2/N_2$ supply system valves are open.
3. Turn the device on using the power switch.
4. Set the set values for temperature and CO_2/O_2 content on the operating panel.
5. Start contra-con.

Starting the device:

6. Start the device with the auto-start routine (see ***„Activating auto start“*** **on** ***page 94***).
7. The progress indicator auto-start appears on the display, and the automatic start routine is run.
8. The temperature control adjusts the temperature to the selected set value, humidity rises.
9. When temperature and relative humidity are constant, the automatic adjustment of the CO_2/O_2 measuring system is performed.
10. The CO_2/O_2 control supplies the set amount of CO_2/O_2.

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11. If the auto-start routine has been completed, the progress indicator is hidden, and the main menu is displayed. The device is operational.



Caution!

To avoid any risk of explosion and fire:



- **refrain from loading the CO_2-incubator with any of the substance listed in the section *„Incorrect use“* on *page 14*.**



- **make sure that the ambient air is free of any solvents!**
- **do not operate the CO_2-incubator in areas with an explosion hazard!**

Loading the device:

12. Load the work space with cultures or place bottles onto the bottle turning device rollers.

Note
Duration of the auto-start routine:
When the device is cold and when the ambient temperature is low, the auto-start routine may take up to 10 hours.
Loading:
To ensure sufficient air circulation and even heating of the samples, the loading surface within the work space should be used up to 70 % max. Voluminous objects in the work space that dissipate heat may impair heat distribution.

During tempering of defines substances or materials with higher moisture content, the access port is to be opened in order to reduce a possible condensation in the chamber. If necessary a modified door seal is available as an accessory.



Caution

Hot surfaces!

The screen of the glass door, the interior panel of the outer door as well as the surfaces of the shelving and the work space reach temperatures up to 55 °C while the CO_2-incubator is running through its heating cycles and need some time to cool down.

When removing samples from a running or recently completed heating cycle, always wear safety gloves and other appropriate personal protection equipment to avoid burns on hot surfaces.



Caution

Risk of overloading!

Overloading may damage the shelves or cause the shelves and/or the CO2-incubator to tilt. When the shelves are being drawn out, ultimately destroying the samples.

To avoid overloading the incubator or its shelving be sure to observe the sample weight limits specified in chapter 12.

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6.4. Interruption of operation

Make sure to prevent Contamination when operation is interrupted.

1. Remove all samples an brought in tools from the device, then clean and disinfect them.
2. Clean and disinfect the internal space.
3. Eliminate any debris.
4. Decontaminate the device.

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7. Handling and control (iCan™ touchscreen controller)

7.1. Power switch

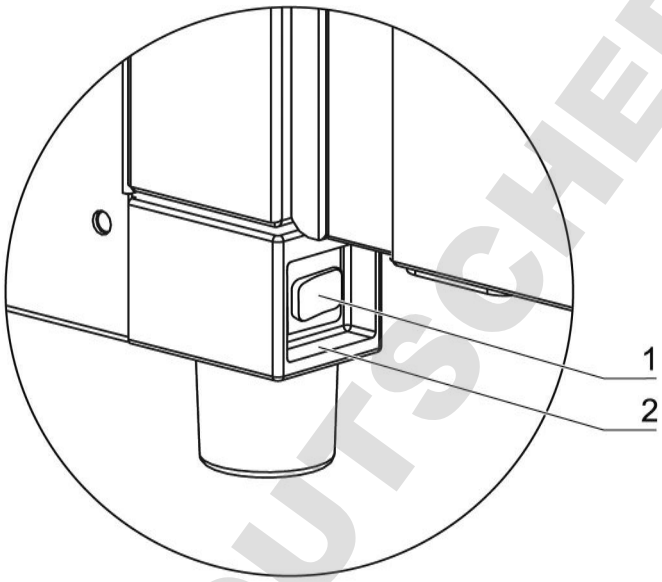


Figure. 30. Power switch

Depending on which side the door hinges are installed, the power switch [1] is integral to the front cover [2] of one of the front device stands.

- To turn the device on: Press the power switch [1]; the switch illumination comes on.
  - After a short audible signal and a short dark phase, the touchscreen display appears.
  - The control loop sensors pass the heat-up phase (see ***„Heat-up phase of the control loop sensors“*** **on** ***page 84***).
- To turn the device off: Press the power switch; the switch illumination goes off.

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7.2. Operating panel and operating structure

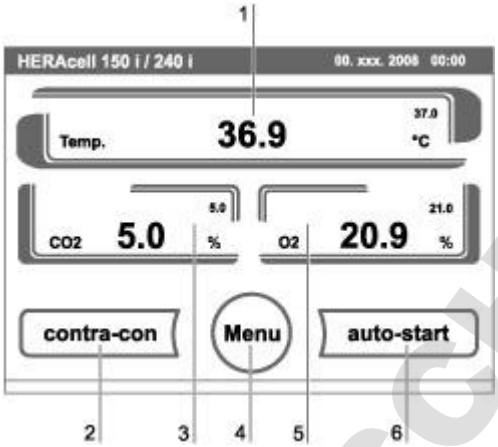


Figure. 31. Pressure-sensitive areas

The control panel works as a touchscreen and can be controlled performing light pressure on the pressure-sensitive areas of the screen using a finger or a blunt pin:

- Temperature display [1]
- CO_2 display [3]
- O_2 display [5] (optional)
- contra-con key [2]
- menu key [4]
- auto-start key [6]

Note
Extended pressure-sensitive area:
To accept a failure message, the entire touchscreen can be used as a pressure-sensitive area.

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7.3. Versions without O_2/N_2 control

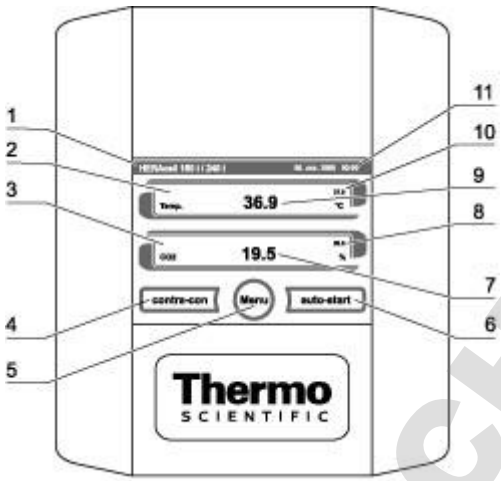


Figure. 32. iCan™ touchscreen without O_2/N_2 gas supply

Function keys and value displays of the operating panel for a device version without O_2/N_2 gas supply:

1. Type designation of the device
2. Temperature display
3. CO_2 display
4. Key for starting the contra-con decontamination routine
5. Key for opening the menu navigation
6. Key for starting the auto-start routine
7. Actual value CO_2
8. Set value CO_2
9. Temperature actual value
10. Temperature set value
11. Current date and time

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7.4. Version with combined $CO_2/O_2/N_2$ control (optional)

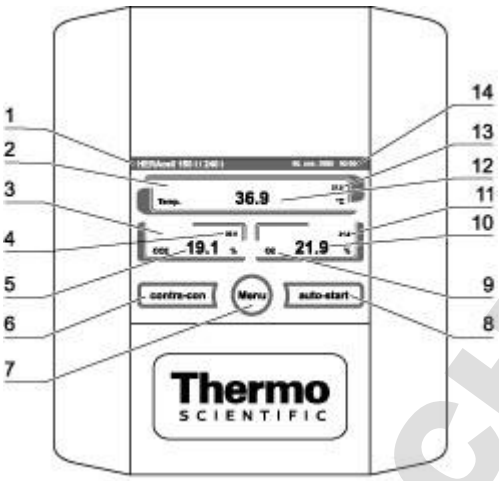


Figure. 33. iCan™ touchscreen with combined gas connection

Function keys and value displays of the operating panel of a device version with combined $CO_2/O_2/N_2$ gas supply:

1. Type designation of the device
2. Temperature display
3. CO_2 display
4. CO_2 set value
5. CO_2 actual value
6. Key for starting the contra-con decontamination routine
7. Key for opening the menu navigation
8. Key for starting the auto-start routine
9. O_2 display
10. O_2 actual value
11. O_2 set value
12. Temperature actual value
13. Temperature set value
14. Current date and time

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7.5. Structure of the operating levels

Operation is divided into three levels:

- **A:** Direct access to the control loop settings: Temperature, CO_2, O_2 set value and bottle turning device (optional),
- **B:** Start of the device routines contra-con or auto-start,
- **C:** Navigation through the submenus for device configuration.

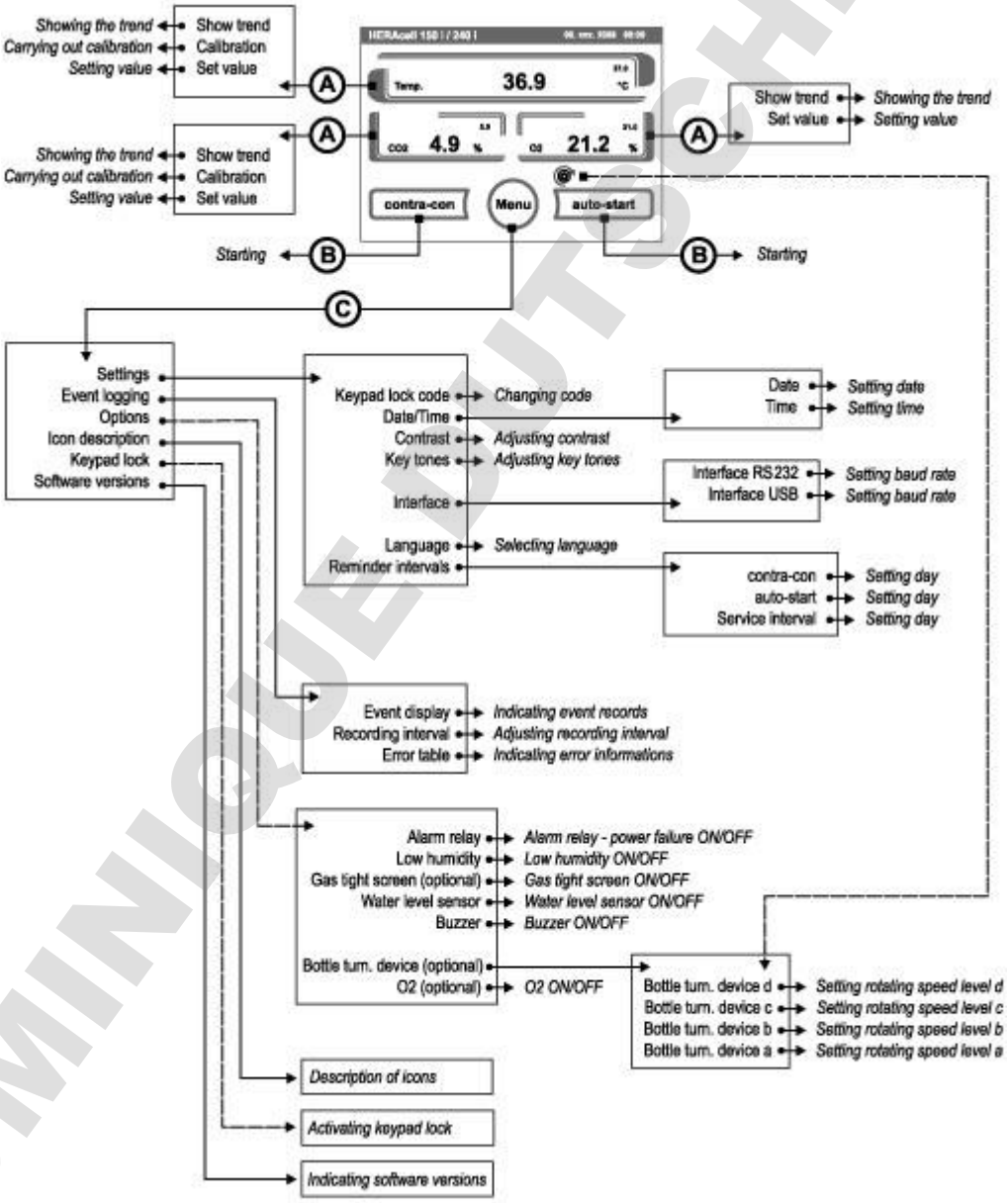


Figure. 34. Menu structure overview

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7.6. Factory presettings of the iCan™ touchscreen controls

Upon delivery of the device, the following set values have been preset:

- Temperature: 37 °C
- CO_2 content: 0.0 %
- O_2 content (optional): 21.0 %
- Optional bottle turning device speed a, b, c, and d: 0 %.

Note
CO_2/O_2 control:
Since the CO_2 concentration of the air is nearly 0 %, the CO_2 control and the control loop error monitoring system are disabled at a set value of 0 %.
Since the O_2 concentration of the air is nearly 21 %, the O_2 control and the control loop error monitoring system are disabled at a set value of 21 %.

7.7. Heat-up phase of the control loop sensors

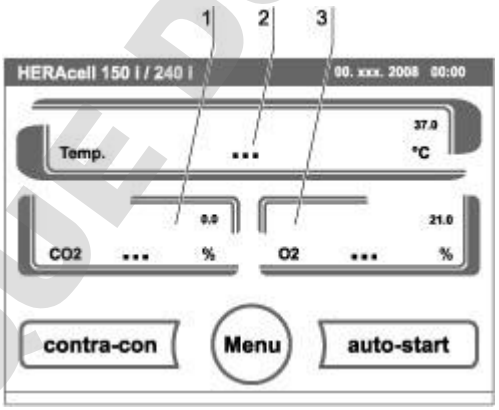


Figure. 35. Heat-up phase display

When the device has been switched on, the control loop sensors pass through a heat-up phase of varying duration during the start process:

Temperature control loop	10 s
CO_2 control loop	10 s
CO_2 control loop with IR measuring cell	3 min
O_2 control loop	5 min

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The start process is indicated by an audible signal. During the heat-up phase, the displays show dots (...) instead of values:

- Temperature display [2]
- CO_2 display [1]
- O_2 display [3]

After the heat-up phase has been completed, the control loop actual values are indicated.

Note
Exposure to CO_2 gas:
During the 5-minute heat-up phase of the O_2 control loop, the work space is not exposed to CO_2 gas and the CO_2 control and is disabled.

7.8. Event actions for settings

Key response:

Pressing a key can increase or reduce a value gradually:

- When the – key [4] or the + key [6] is kept depressed, the system switches to quick run,
- after the key has been kept depressed for more than 3 seconds, the quick run speed increases.

Note
Saving the settings:
To save changed values, press the Enter key.

Resetting the settings:
Unless a user action (contact with the pressure-sensitive areas and keys) occurs within 30 seconds, the system automatically exits the menu and the most recently confirmed setting defaults.

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7.9. Setting the temperature set value

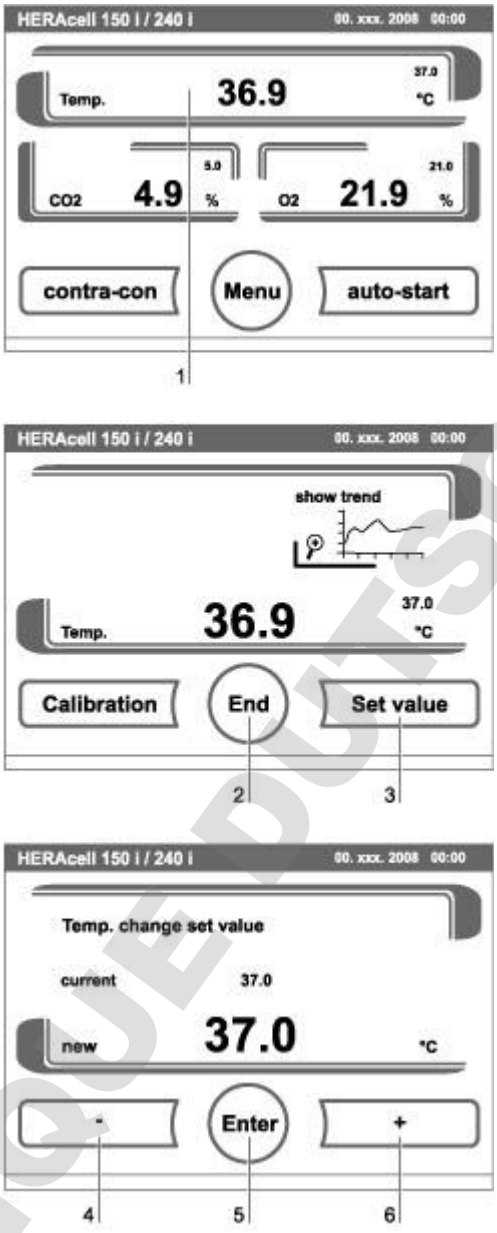


Figure. 36. Setting the temperature set value

1. Press the **TEMPERATURE DISPLAY** key [1].
   – The Temperature menu is displayed.
2. To exit the Temperature menu:
   – Press the **END** key [2].
3. To set the temperature set value:
   – Press the **SET VALUE** key [3].

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– To increase the set value:

– Press the + key [6].

To reduce the set value:

– Press the - key [4].

4. To accept and save the set value:

– Press the **ENTER** key [5].

– The system returns to the main menu. The temperature displays shows the actual value currently measured in the work space.

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7.10. Setting the CO_2 set value

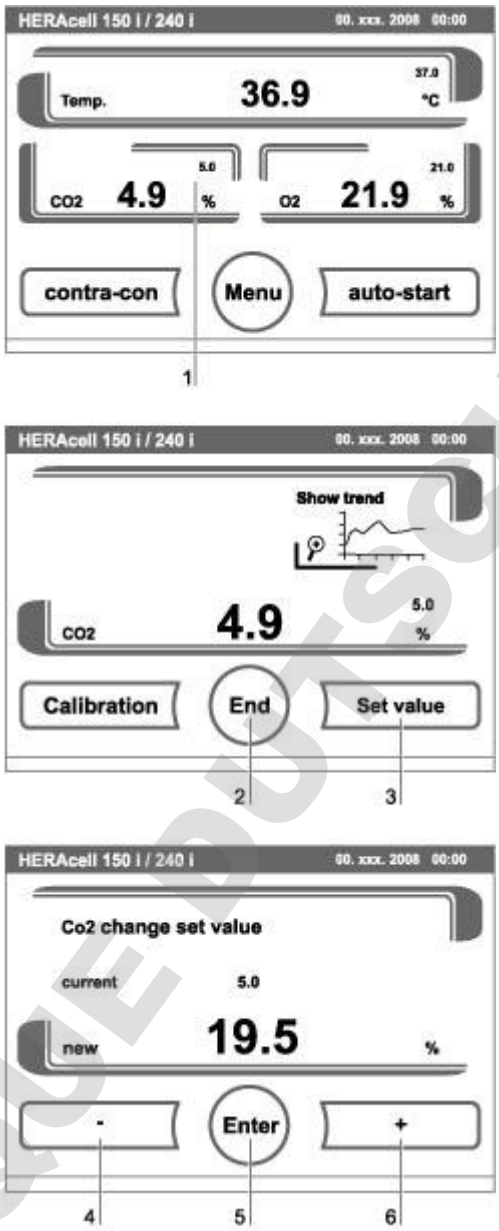


Figure. 37. Setting the CO_2 set value

1. Press the CO_2 **DISPLAY** key [1].
   – The CO_2 menu is displayed.
2. To exit the CO_2 menu:
   – Press the **END** key [2].
3. To set the CO_2 set value:
   – Press the **SET VALUE** key [3].

To increase the set value:

– Press the + key [6].

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To reduce the set value:

– Press the **-** key [4].

4. To accept and save the set value:

– Press the **ENTER** key [5].

– The system returns to the main menu. The CO_2 display shows the actual value currently measured in the work space.

Note
Deactivating the CO_2 control loop:
To deactivate the CO_2 control, the set value is set to 0 %.
If the control loop is deactivated, error monitoring is enabled as well.

Gas monitoring:
The switching state of the CO_2 control loop does not affect the function of the optional gas monitoring system. The gas monitoring system remains active even when the CO_2 control is switched off.
For set values of 21 % 02, the O_2 control is switched off and error monitoring is disabled as well.
The control loop error monitoring system (optional) is enabled.

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7.11. Setting the O_2 set value

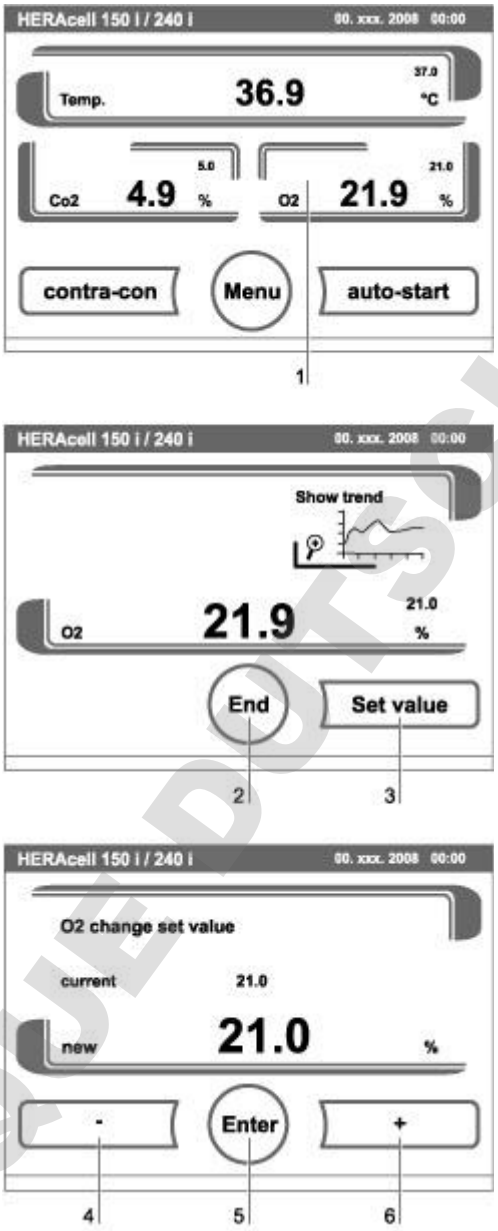


Figure. 38. Setting the O_2 set value

This setting is possible only on versions with the optional O_2/N_2 control.

1. Press the O_2 **DISPLAY** key [1].
   – The O_2 menu is displayed.
2. To exit the O_2 menu:
   – Press the **END** key [2].
3. To set the O_2 set value:
   – Press the **SET VALUE** key [3].

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To increase the set value:

– Press the + key [6].

To reduce the set value:

– Press the - key [4].

4. To accept and save the set value:
   – Press the **ENTER** key [5].
   – The system returns to the main menu. The O_2 displays shows the actual value currently measured in the work space.

Note
Factory settings:
Depending on the type of the O_2 sensor, one of the two O_2 control ranges has been preset at the factory:
Control range I: 1 % to 21 %
Control range II: 5 % to 90 %

Usage of the process gases:
For set values below 21 % O_2, the device must be connected to a nitrogen supply system.
For set values above 21 % O_2, the device must be connected to an oxygen supply system.
Since the O_2 concentration of the air is nearly 21 %, the O_2 control and the control loop error monitoring system are disabled at a set value of 21 %.
The control loop error monitoring system (optional) is enabled.

7.12. Auto-start routine

The auto-start function is an automated routine for the start and the subsequent adjustment of the CO_2 measuring system. After the start, the device control adjusts the temperature to the set value while humidity is generated. When temperature and relative humidity have reached constant values, the CO_2 measuring system is automatically adjusted to these values, and the work space is supplied with the preset quantity of CO_2.

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Note
Application of the auto-start routine:
To ensure that the specified accuracy of the CO_2 measuring system is maintained, the device should always be started using the auto-start routine if

- a difference of more than 1 °C is entered upon setting the temperature set value,
- the Low Humidity function is enabled/disabled,
- the device is restarted after an extended interruption of operation.

The auto-start routine should be run at least every three months on the occasion of cleaning and maintenance works.

Duration of the routine:
Running the routine usually takes 5 to 7 hours. At low room temperatures and when the device is cold, it may take up to 10 hours until the auto-start routine has been completed. If the glass door is opened or if the power supply of the device is interrupted while the routine is running, the routine is interrupted and rerun after the glass door has been closed or the power supply has been reestablished.

Start conditions for the auto-start routine:
Prior to running the auto-start routine, set the CO_2 and O_2 set values to the desired values and make sure that the atmosphere in the work space only consists of ambient air.
The floorpan of the device must be filled with a sufficient quantity of water.

Conditions that prevent the start of the auto-start routine:
The auto-start routine cannot be started if one of the following failure conditions exists.
Temperature control loop:

- Sensor breakage
- actual value above set value (excessive deviation)
- actual value below set value (excessive deviation)
- set value not plausible
- calibration values too high or too low
- sensor communication failure
- sensor parameter not plausible
- no communication with LM 75

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Note
Control loop for CO_2 gas supply:

- No communication with sensor.

In this case, the auto-start key is dimmed and its function is not available.

Faulty cancellation of the auto-start routine:

The auto-start is canceled if:

- an error is detected in the temperature control loop,
- an error is detected in the CO_2 control loop,
- the water filling level is insufficient.

auto-start-Dry execution of auto-start routine:
If the auto-start routine is to be run dry (without water in the floorpan of the work space), the water level sensor must be disabled prior to its start (see *„Options“* on *page 110*).

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7.12.1. Activating auto start

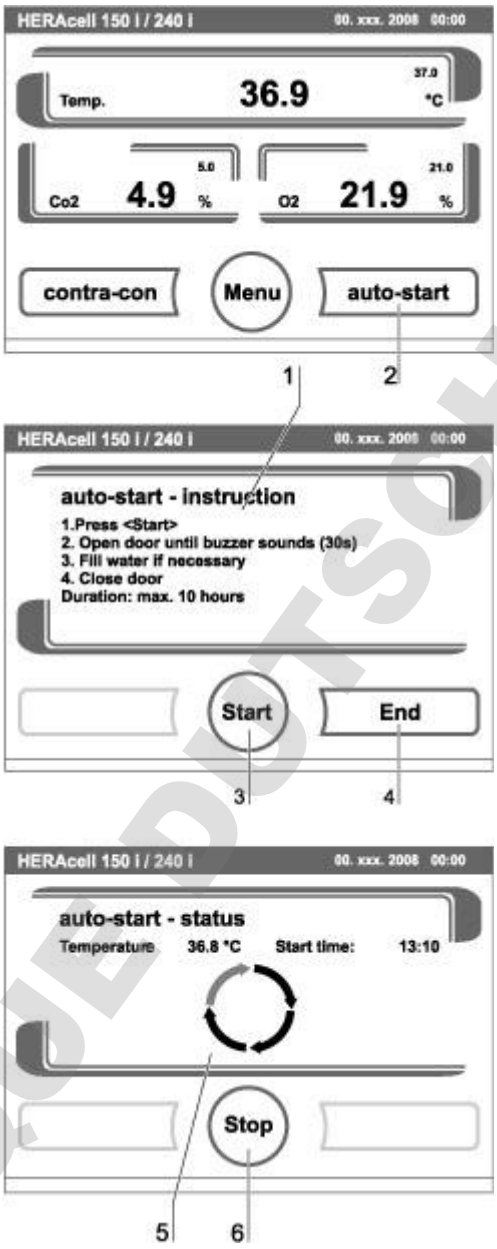


Figure. 39. Activating the auto-start routine

7.12.1.1. Preparations for the start:

1. Make sure that the CO_2-/O_2-/N_2 gas supply system valves are open.
2. Fill the floorpan of the work space with a sufficient quantity of water. The filling level must not exceed the upper filling level mark.
3. Set the set values for temperature, CO_2 and O_2 on the touchscreen.

7.12.1.2. auto-start routine activation:

1. Press the auto-start key [2].

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– The auto-start-instruction menu [1] is displayed.

2. To exit the auto-start-instruction menu and cancel auto-start:
   – Press the **END** key [4].
3. Activate the auto-start routine:
   – Press the **START** key [3].
4. To air the work space, open both device doors.
5. When the audible alarm sounds after 30 seconds, close both device doors.
   – The trend status indicator [5] is displayed.
6. During the progress, the status indicator displays the following information:
   – Temperature,
   – start time.

Note
Cancellation:
The auto-start routine can be canceled at any time!
Press the Stop key [6].

Automatic restart:
The auto-start routine is restarted automatically if the routine is canceled due to one of the following events:

- **The glass door is opened,**
- **the outer door is opened on a device with optional gas-tight screen,**
- **the power supply is interrupted.**

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7.12.2. Interrupting the auto-start routine

If the **STOP** key in the status display is depressed (see above), the auto-start routine is interrupted and the auto-start stop dialog box is displayed for a safety scan. The routine can now be permanently canceled or resumed.

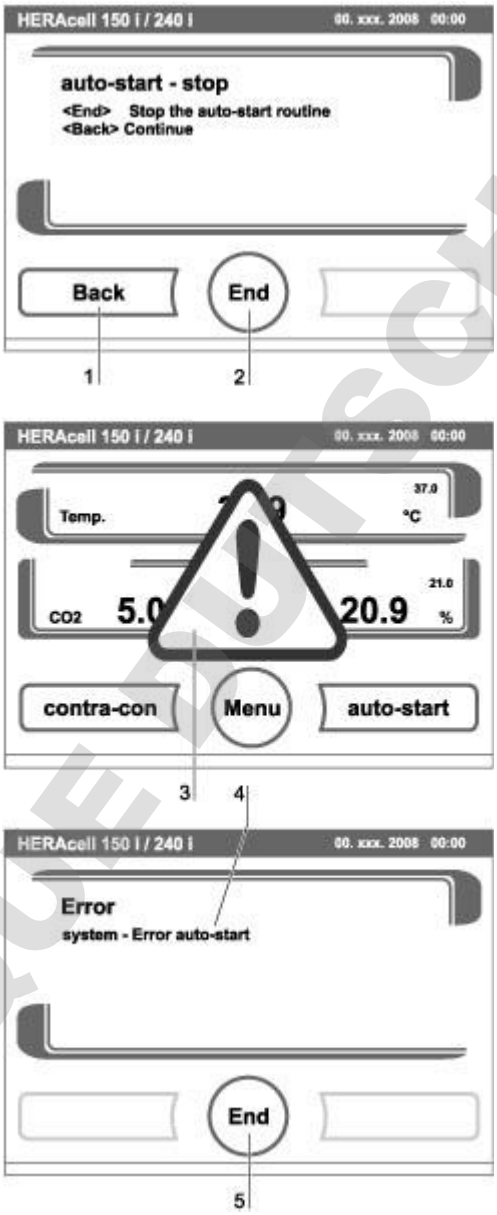


Figure. 40. Interrupting the auto-start routine

1. To resume the auto-start routine:
   – Press the **BACK** key [1].
   – The system returns to the status display, and the auto-start routine is resumed.
2. To cancel the auto-start routine:
   – Press the **END** key [2].

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– The warning triangle [3] is displayed as a failure message together with the audible signal.

3. To accept the failure message:
   – Press any position on the display.
   – The **ERROR** dialog box with the description of the error is displayed.
4. To end the auto-start routine:
   – Press the **END** key [4].
   – The system returns to the main menu.

7.13. Running the contra-con routine

contra-con is an automatic decontamination routine for disinfecting the device work space. For a detailed description of this device function (see ***„contra-con decontamination routine“* on *page 137***).

7.14. User configuration

The user configuration settings allow the user interface and the additional device functions to be adjusted to the requirements of everyday operation. The user configuration menu is split into six categories:

- Settings
- Event logging
- Options
- Icon description
- Keypad lock
- Software versions

To make a user-specific setting in a dialog box, navigate through the submenus listed in the illustrations and open the dialog box.

7.14.1. Settings

The input dialogs of the **SETTINGS** category comprise all settings for the individual configuration of the user display screen and the user interface:

- Keypad lock coding
- Date/time setting
- Contrast setting
- Key tone setting
- Interface configuration
- User display screen language setting
- Reminder interval setting

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7.14.1.1. Changing the keypad lock code:

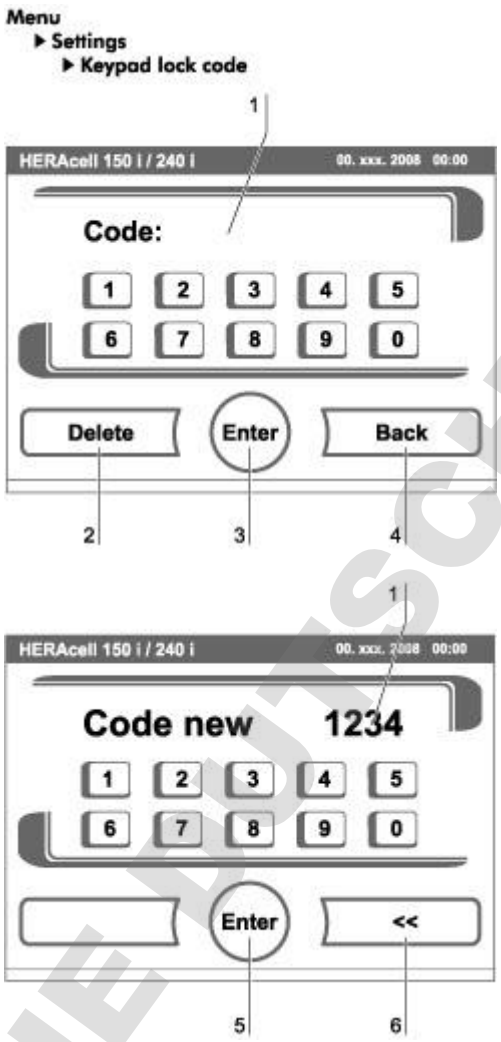


Figure. 41. Changing the code

The keypad lock prevents the unauthorized changing of the operational settings. Only those keys are locked where values can be entered.

The keypad is locked by entering four numbers.

- Upon delivery, the default code is: 0000.

This default can be changed into a user-defined code that is then enabled using the **KEYPAD LOCK** dialog box (see ***„Enabling/disabling the keypad lock“*** **on** ***page 121***).

1. To enter the default 0000:
   – Press the corresponding numeric keys.
   – The number combination is displayed hidden in the input box [1].
2. To delete the input numbers:
   – Press the **DELETE** key [2].
3. To exit the menu:

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– Press the **BACK** key [4].

4. To confirm the input:
   – Press the **ENTER** key [3].
   – The system changes to the **CODE NEW** menu.

Entering the new 4-digit code:

– Press the corresponding numeric keys.
– The number combination is displayed in the input box [1].

Fig.41: To set the cursor to the left to overwrite a value:

5. Press the **BACKSPACE** key (<<) [6].
6. To accept and save the input value:
   – Press the **ENTER** key [5].
   – The system returns to the Settings menu.

Note
Changing the user-defined code:
The user-defined code can be changed as often as required using the same procedure:

- **Activate the recoding function by entering the valid code.**
- **Enter the new code and confirm it.**

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7.14.1.2. Setting date/time:

The input dialog allows date and time to be set to the required time zone.

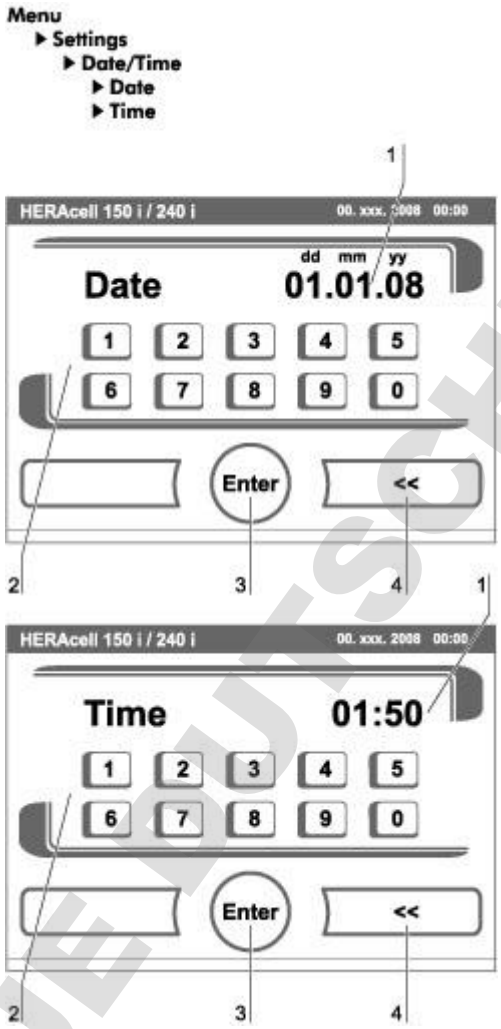


Figure. 42. Date / time setting

1. To enter the date:
   – Press the numeric key [2].
   – The input numbers are displayed in the input box [1].
2. To set the cursor to the left to overwrite a value:
   – Press the **BACKSPACE** key (<<) [4].
3. To accept and save the input value:
   – Press the **ENTER** key [3].
4. The system returns to the Date/Time menu.
5. Enter the time accordingly.
6. To accept and save the input value:
   – Press the **ENTER** key [3].
   – The system returns to the Date/Time menu.

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7.14.1.3. Setting the contrast:

The input dialog allows the color contrast of the operating panel to be set within the value range of 48 % to 80 %.

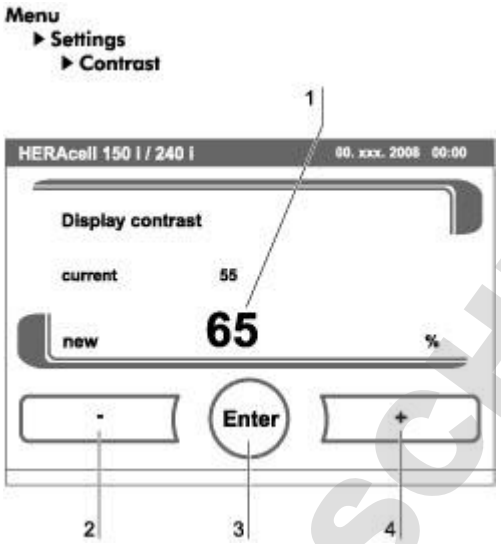


Figure. 43. Display contrast setting

1. To increase the value:
   – Press the + key [4].
2. To reduce the value:
   – Press the - key [2].
3. The value change appears in the display [1].
   – To accept and save the change:
   – Press the **ENTER** key [3].
   – The system returns to the Settings/Setup menu.

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7.14.1.4. Setting the key tone:

The input dialog allows the loudness of the key tone that sounds whenever a key is depressed to be set.

The value range is 0 to 100. The change occurs in increments of 5 %.

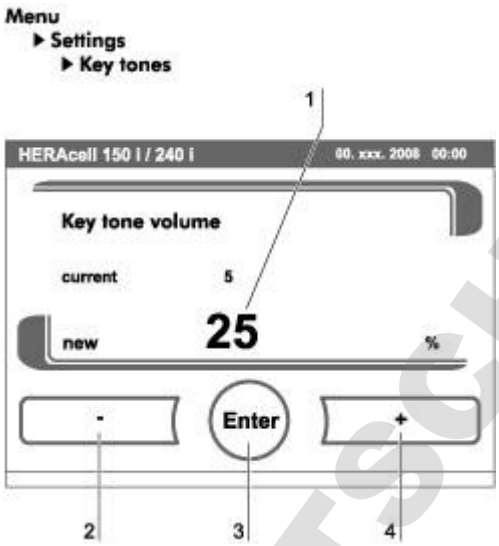


Figure. 44. Key tone setting

1. To increase the value:
   – Press the + key [4].
2. To reduce the value:
   – Press the - key [2].
3. The value change appears in the display [1].
4. To accept and save the change:
   – Press the **ENTER** key [3].
   – The system returns to the Settings/Setup menu.

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7.14.1.5. Setting the interface baud rate:

The input dialog allows the setting of the stepping rate for data communication of the:

- RS232 interface,
- USB interface (optional).

The stepping rate of both interfaces can be changed within the defined baud rates (9.600, 19.200, 38.400, 57.600 baud).

The standard stepping rate of both interfaces is 57.600 baud.

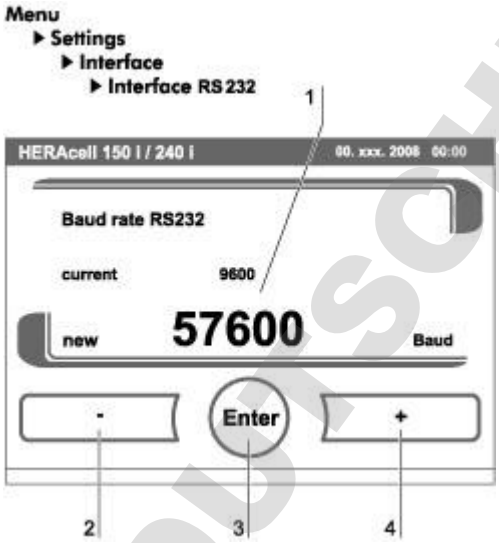


Figure. 45. RS 232 interface baud rate setting

Note
Use of HERAline:
If the devices are combined with the HERAline accessory, the baud rate must be set to 9,600 baud.

Figure. 46. USB interface baud rate setting

1. To increase the value:
   – Press the + key [4].
2. To reduce the value:
   – Press the - key [2].
3. The value change appears in the display [1].
4. To accept and save the change:
   – Press the **ENTER** key [3].
   – The system returns to the Interface menu.
5. To activate the new settings:
   – Browse back to the main menu.
   – Wait for approx. 10 seconds and perform a reset by switching the device off and on using the power switch.

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7.14.1.6. Setting the user display screen language:

The input dialog allows the language of the display screen to be set. Five languages are available:

- German
- English
- Spanish
- French
- Italian

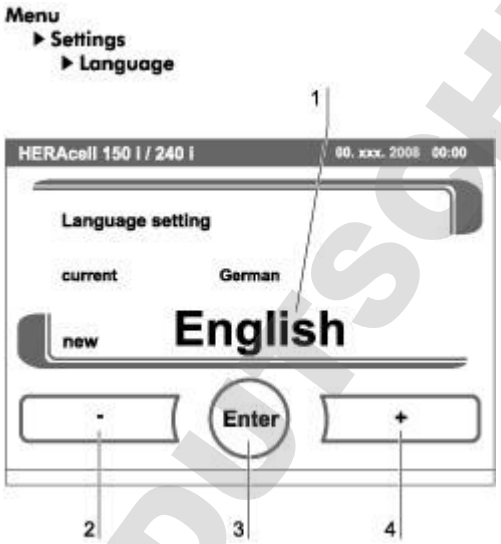


Figure. 47. Language setting

1. To browse upward in the selection:
   – Press the + key [4].
2. To browse downward in the selection:
   – Press the - key [2].
3. The new language appears in the display [1].
4. To accept and save the selection:
   – Press the **ENTER** key [3].
   – The system returns to the Settings menu.

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7.14.1.7. Setting the reminder intervals:

The reminder intervals are integral components of the alarm and monitoring system of the device control. For the two essential functions contra-con and auto-start as well as for routine service work, the user can set dates that trigger an alarm whenever they occur.

The counting begins at 00:00 hrs of the day on which the previously set reminder interval has elapsed.

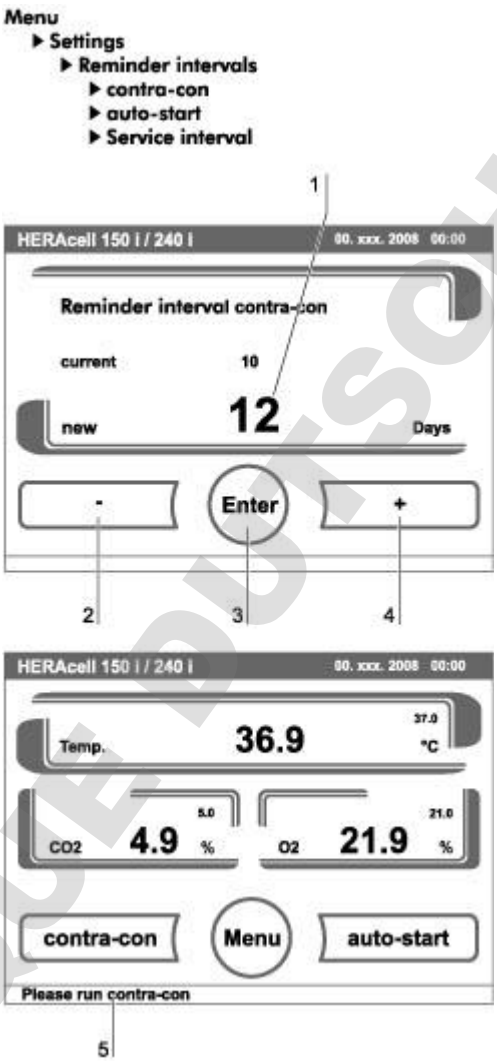


Figure. 48. Reminder interval setting

1. To increase the number of days:
   – Press the + key [4].
2. To reduce the number of days:
   – Press the - key [2].
3. The value change appears in the display [1].
4. To deactivate the reminder interval:
   – Set the value to **OFF**.
   – Press the - key [2].

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5. To accept and save the change:
   – Press the **ENTER** key [3].
   – The system returns to the Reminder Interval menu.

On the due date, the display shows a reminder message [5] for the activated reminder interval.

- **contra-con:** Please run contra-con.
- **auto-start:** Please run auto-start. Is displayed after the contra-con decontamination routine has been run successfully.
- **Service interval:** Request service. The service message can be confirmed. In this case, the Request Service icon is displayed.

After the routines have been run successfully, the reminder messages are hidden.

Factory settings:

contra-con decontamination routine	90 days
auto-start routine	Off
Service interval	365 days

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7.14.2. Event logging

The input dialogs of the category **EVENT LOGGING** comprise all settings for logging and outputting events during the operation of the device:

- Event display,
- time interval (of the logging cycle),
- error table.

7.14.2.1. Event display:

The event display [1] uses short, single-line entries specifying date and time to report the events that were logged during the operation of the device. The entries are listed in chronological order with the most recent event at the top position. The list can be displayed but not edited. If the event display consists of several pages, the user can browse through the list. The status indicator [2] indicates which page of the total number of pages is currently being displayed.

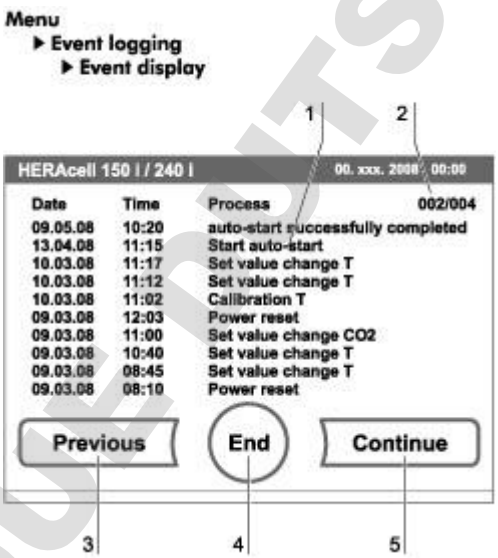


Figure. 49. Event display

1. To browse forward in the list:
   – Press the **CONTINUE** key [5].
2. To browse backward in the list:
   – Press the **PREVIOUS** key [3].
3. To exit the display:
   – Press the **END** key [4].
   – The system returns to the Event Logger menu.

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7.14.2.2. Changing the logging cycle time:
Due to limited memory resources, the oldest entries are deleted as new entries are logged. The period from which the displayed entries originate depends largely on the selected logging cycle time.

Logging cycle time	Minimal displayed period
10 s	22,5 hours
30 s	2,8 days
60 s	5,6 days
120 s	11,2 days
180 s	16,8 days

The setting controls the logging cycle in sections of seconds during which the control loop measured values are logged during the operation of the device and displayed by the trend display (see ***„Scaling the trend display“* on *page 123***).

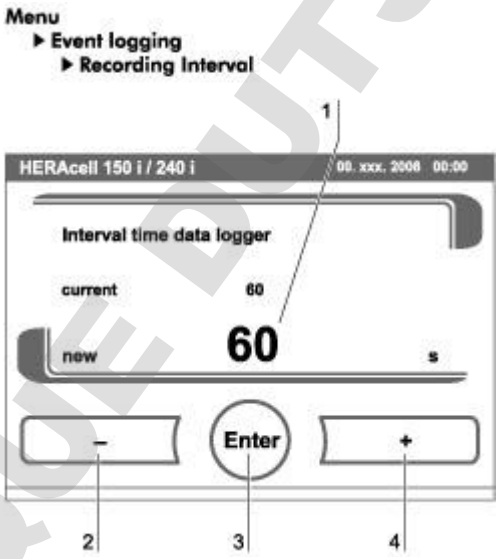


Figure. 50. Logging cycle setting

The settings can be made within the value range of 10 seconds to 3600 seconds.

1. To increase the value:
   – Press the + key [4].
2. To reduce the value:
   – Press the - key [2].
3. The value change appears in the display [1].
4. To accept and save the change:
   – Press the **ENTER** key [3].
   – The system returns to the Event Logger menu

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Note
Event logger interval time:
The logging cycle time does not affect the entries of the error table.

7.14.2.3. Displaying the error table:

The error table lists the errors detected by the device-integral monitoring system in descending chronological order. The most recently detected error is listed at the top position of 22 possible entries. An entry consists of the control loop in which the error occurred, the date, the time, and an error description. The error table can be displayed but not edited.

If the event display consists of two pages, the user can browse through the list. The status indicator [2] indicates which page of the two is currently being displayed.

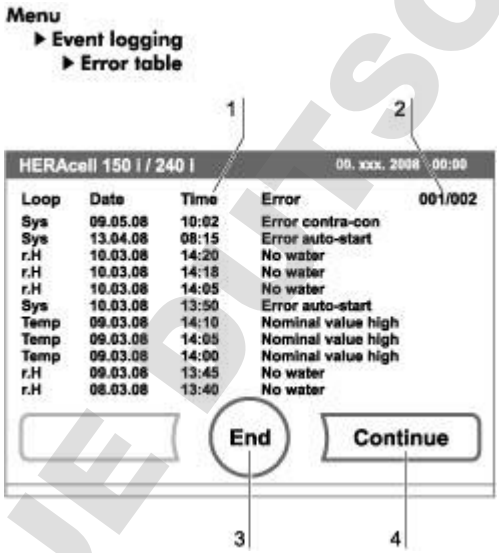


Figure. 51. Error table display

1. To browse forward in the error table:
   – Press the **CONTINUE** key [4].
2. To browse backward in the list:
   – Press the **PREVIOUS** key.
3. To exit the display:
   – Press the **END** key [3].
   – The system returns to the Event Logger menu.

Note
Troubleshooting:
For a detailed overview of causes for errors and their correction, please refer to the end of this chapter!

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7.14.3. Options

The input dialogs of the **OPTIONS** category comprise all settings of the functional device options:

- Alarm relay
- Low humidity
- Gas-tight screen
- Water level sensor
- Audible alarm
- Bottle turning device (optional)
- CO_2 (optional)

7.14.3.1. Setting the alarm relay:

The alarm relay is the interface for the connection of the device-integral monitoring system to an external monitoring system. Depending on the required input signal of the external monitoring system, network monitoring can be enabled or disabled. If network monitoring is enabled, a power failure is detected as an error. The relay cannot be switched off (see ***„Connecting the alarm contact“ on page 72***).

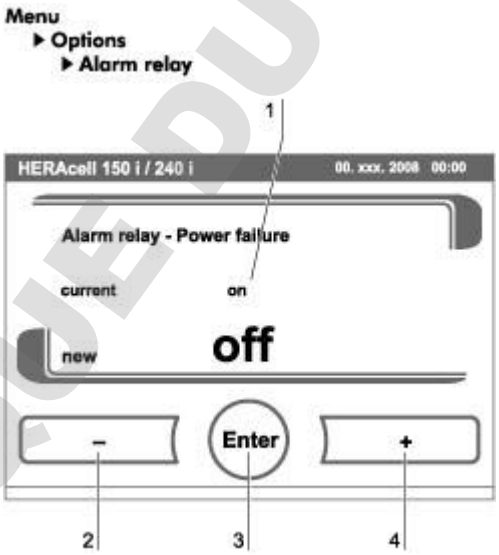


Figure. 52. Alarm relay setting

1. To toggle between two states [1]:
   – Press the + key [4].
   or
   – Press the - key [2].
2. To accept and save the change:
   – Press the **ENTER** key [3].
   – The system returns to the Options menu.

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7.14.3.2. Setting low humidity:

If condensation occurs on the culture containers due to high relative humidity, the humidity in the work space can be set to a lower level. At the factory, the device control is preset to high humidity (approx. 93 % relative humidity).

By enabling the Low Humidity feature, the relative humidity in the work space is lowered from approx. 93 % to approx. 90 %. The modification requires an extended adaption phase. To effectively prevent condensation on culture containers, it must be used as a permanent setting.

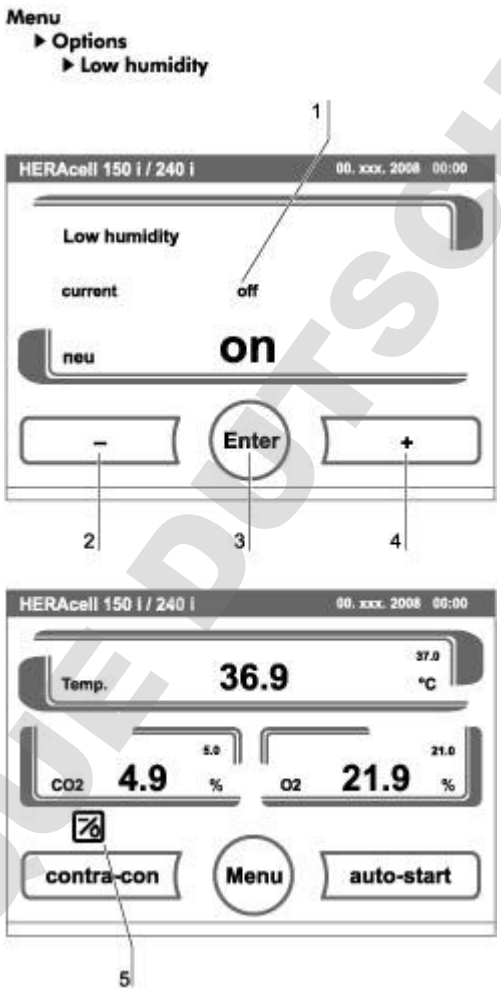


Figure. 53. Low humidity setting

1. To toggle between two states [1]:
   – Press the + key [4].

   or

   – Press the - key [2].
2. To accept and save the change:
   – Press the **ENTER** key [3].
   – The system returns to the Options menu.

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Note
Low humidity:
The enabling/disabling of the Low humidity function is entered into the event list.
If the Low humidity function is enabled, the corresponding icon [5] is displayed in the main menu.

7.14.3.3. Setting the gas-tight screen:

As the aperture cross-sections are smaller when accessing the samples, devices equipped with the optional gas-tight screen achieve shorter recovery times for the incubation parameters:

- Work space temperature,
- CO_2 concentration,
- O_2 concentration,
- relative humidity.

After conversion of the device, the device control system must be adjusted to the gas-tight screen option.

Note
Malfunction:
The conversion to gas-tight screen causes a change of the control parameters.
Failure to set the gas-tight screen function in accordance with the actually installed door version may impair the incubation performance.

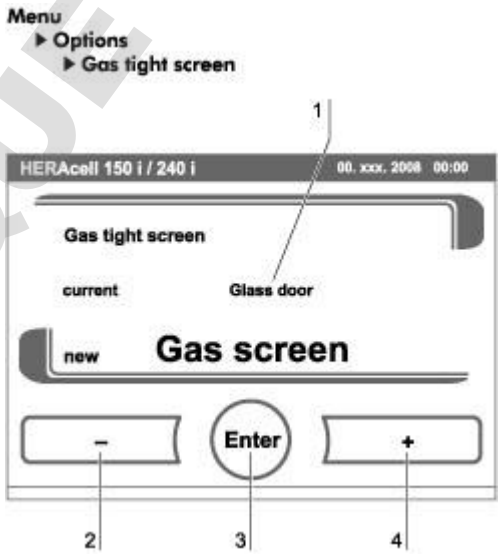


Figure. 54. Gas tight screen

1. To toggle between two options [1]:
   – Press the + key [4].

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or

– Press the **-** key [2].

2. To accept and save the change:

– Press the **ENTER** key [3].

– The system returns to the Options menu.

7.14.3.4. Switching the water level sensor on/off:

For incubation operation with ambient humidity or if the auto-start routine is to be run dry (without water), the water level sensor can be switched off.

This prevents alarm messages for the water level sensor by the device-integral monitoring system from being issued.

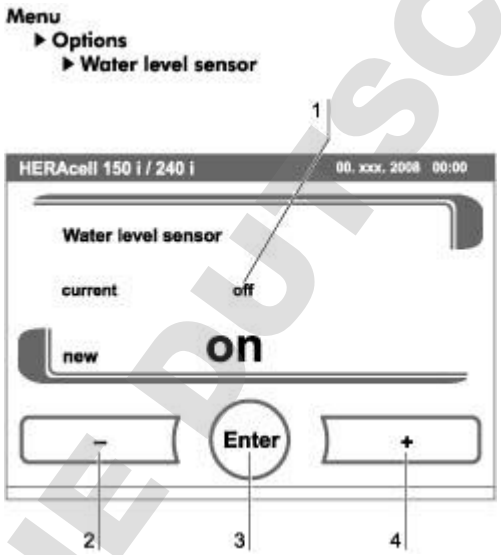


Figure. 55. Water level setting

1. To toggle between two states [1]:

– Press the **+** key [4].

or

– Press the **-** key [2].

2. To accept and save the change:

– Press the **ENTER** key [3].

– The system returns to the Options menu.

7.14.3.5. Switching the audible alarm on/off:

If the device-integral monitoring system detects an error:

- an audible alarm sounds
- in addition to the visual error message and the switching of the alarm relay.

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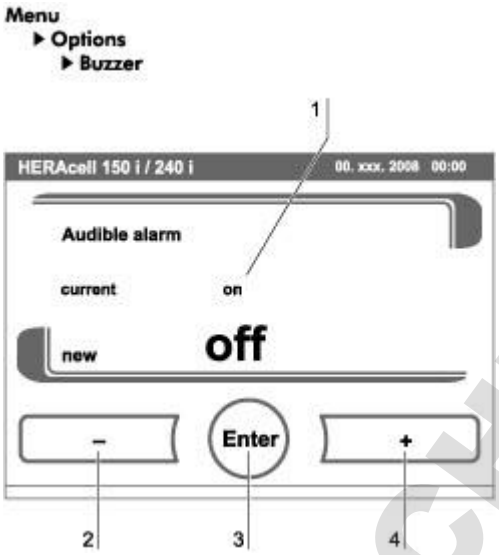


Figure. 56. Alarm relay setting

The audible alarm can be permanently disabled:

1. To toggle between two states [1]:
   – Press the + key [4].

   or

   – Press the - key [2].
2. To accept and save the change:
   – Press the **ENTER** key [3].
   – The system returns to the Options menu.

7.14.3.6. Setting the bottle turning device speed (option available only on *HERACELL® 240i*):

If the device has been configured at the factory for the bottle turning device function, the main menu displays the bottle turning device icon.

The speeds of the drive rollers can be set separately for each level within a value range of 0 % to 100 % (see ***„Bottle turning device for HERACELL® 240i (optional)“* on *page 52***).

The drive roller of a bottle turning insert is activated as soon as a value >0 for the speed has been entered and saved.

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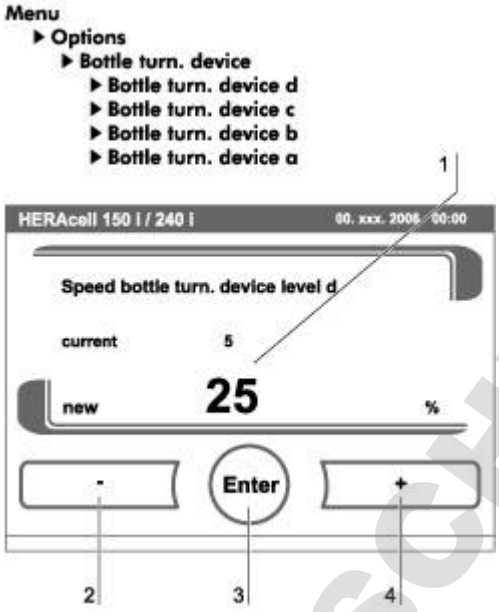


Figure. 57. Bottle turning device speed setting

1. To increase the value:
   – Press the + key [4].
2. To reduce the value:
   – Press the - key [2].
3. To switch the drive roller of one level off:
   – Set the value to 0 %.
4. The value change appears in the display [1].
5. To accept and save the change:
   – Press the **ENTER** key [3].
   – The system returns to the Bottle Turning Device menu.

Note
Quick access to bottle turning device levels:
To directly access the Bottle turning device submenu, touch the Bottle turning device icon in the main menu.

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7.14.3.7. Switching the O_2 control on and off:

Depending on the requirements to the work process, the O_2 control can be switched on and off. This setting is possible only on versions with the optional O_2/N_2 control.

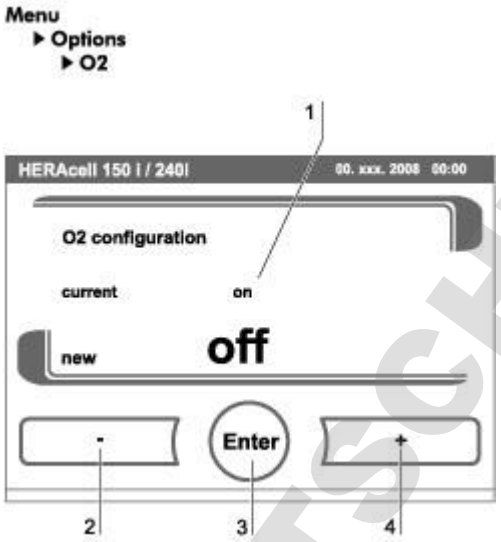


Figure. 58. Switching the O_2 control on and off

1. To toggle between two states of the O_2 control:
   – Press the + key [4].

   or

   – Press the - key [2].
2. The value change appears in the display [1].
3. To accept and save the setting:
   – Press the **ENTER** key [3].
   – The system returns to the Options menu.

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Note
O_2 value display:
If the O_2 control has been switched off, the O_2 display does not show an actual value (- - -).
This procedure provides protection for the O_2 sensor.
If the set value is set to 21 %, the O_2 control loop is not monitored. This applies to both O_2 control ranges:

- Control range I: 1 % to 21 %
- Control range II: 5 % to 90 %

In this case, the O_2 display shows the actual value.

Airing the work space:
If the device was operated with O_2 or N_2, the work space must be aired after the O_2 control has been switched off.

Gas monitoring:
The switching state of the O_2 control loop does not affect the function of the optional gas monitoring system. The gas monitoring system remains active even when the O_2 control is switched off or the O_2 sensor is disabled.

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7.14.4. Icon description

Essential operating states or error messages, e.g. keypad lock [3], low humidity [4] or bottle turning device [5] are displayed as icons in the touchscreen main menu in addition to the entries in the event or in the error table.

The Icon Description dialog box [1] explains the meaning of the individual icons.

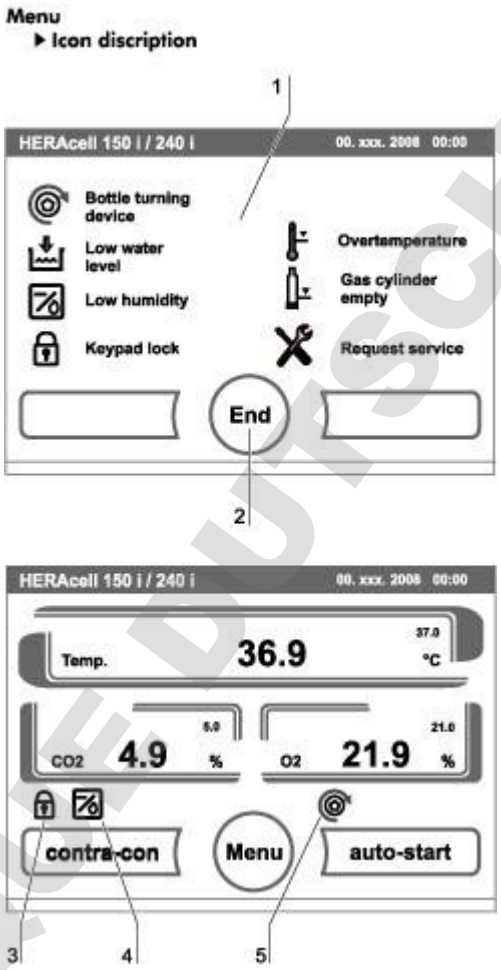


Figure. 59. Icon description overview

- To exit the display:
  - Press the **END** key [2].
  - The system returns to the Configuration menu.

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7.14.4.1. Function of the individual icons:

Bottle turning device:

This function indicator shows that the device has been configured for operation with the optional bottle turning device.

The Bottle Turning Device dialog box can also be accessed directly by touching the Bottle Turning Device icon in the main menu.

Low water level:

This error indicator shows that the water level sensor has detected a low water level.

Low humidity:

This function indicator shows that the relative humidity in the work space has been lowered from approx. 93 % to approx. 90 %.

Keypad lock:

This function indicator shows that the keypad lock has been activated so that currently the settings cannot be changed.

Overtemperature:

This error indicator shows that the device control has activated the overtemperature protection and has switched to backup control.

Gas cylinder empty:

Error message, indicating, that the filling level of one or of several gas cylinders is too low to ensure regular gas supply.

The monitoring function is available only for device versions with the optional gas monitoring system.

Request service:

This indicator shows that the routine service is due. The display of the icon is controlled by the time entry in the **REMINDER INTERVAL** dialog box and it appears after the reminder message has been confirmed.

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7.14.4.2. Gas cylinder filling level display (optional):

If the device is equipped with the optional gas monitoring system the icons [1] for gas cylinder A and gas cylinder B appear in the corresponding CO_2 display/O_2 display. The icons indicate the gas cylinder filling level (full / empty).

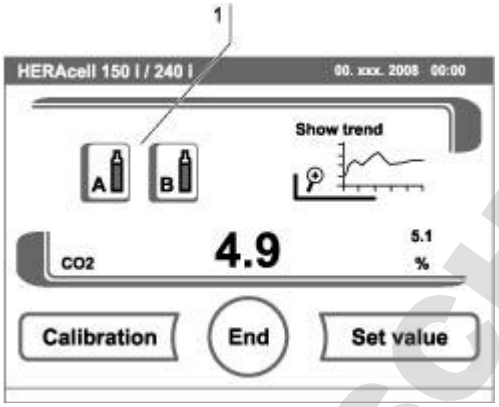


Figure. 60. Gas monitoring icons

The icon with the blue frame indicates the bottle not in use that will be switched over to continue the supply.

- Manual changeover to a full gas cylinder is possible.
  - Press the cylinder icon with the blue frame.

  or
- changeover can occur automatically, if:
  - the cylinder pressure drops below 0.6 bar.

After a manual or automatic changeover of the gas supply, another changeover is inhibited for 30 seconds. It takes approximately 2 minutes before the filling level of the new cylinder has been determined and can be displayed.

The gas monitoring system monitors the filling state of the two connected gas cylinders.

If one cylinder is empty:

- no audible alarm sounds but an error message is displayed,
- an entry is written into the event list.

If both bottles are empty:

- an audible alarm sounds and the alarm relay switches,
- an error message is displayed,
- an entry is written into the error table,
- an entry is written into the event list.

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Note
Cylinder changeover:
A manual or automatic changeover of a gas cylinder is entered into the event display.

7.14.5. Enabling/disabling the keypad lock

This input dialog box allows the keypad lock to be enabled or disabled. At the factory, the keypad lock is preset to the standard code 0000.

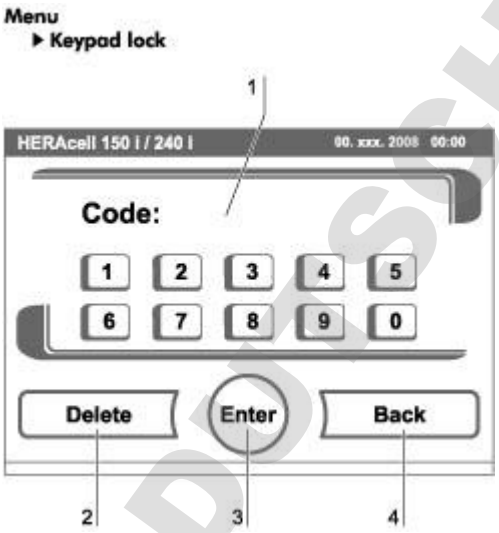


Figure. 61. Enabling/disabling the keypad lock

1. Enter the 4-digit code using the keypad. The input appears encrypted in the display [1].
2. To delete complete incorrect input:
   – Press the **DELETE** key [2].
3. To break off the input:
   – Press the **BACK** key[4].

The system returns to the Configuration menu.

4. To confirm the input:
   – Press the **ENTER** key [3].
   – The system returns to the Configuration menu.

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Note
Changing an existing code:
The currently valid code can be redefined in the Keypad Lock Code dialog box of the Settings/Setup menu (see *„Options“* on *page 110*).

Resetting the code:
If the keypad lock code is no longer available, the code must be reset to the standard code by the Technical Support of Thermo Fisher Scientific.

7.14.6. Software versions

This menu shows the unit software versions in the display [1].

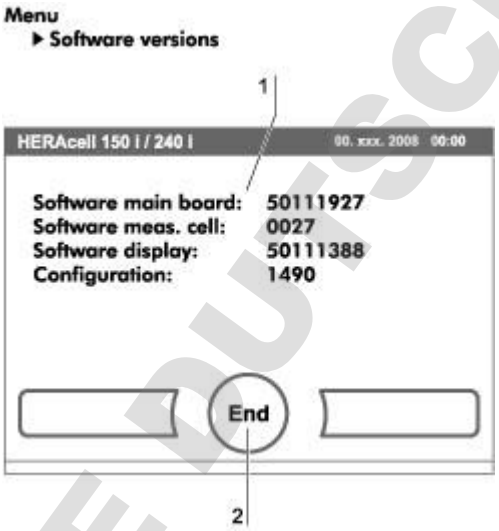


Figure. 62. Software versions

- To exit the display:
  - Press the **END** key [2].
  - The system returns to the Configuration menu.

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7.15. Scaling the trend display

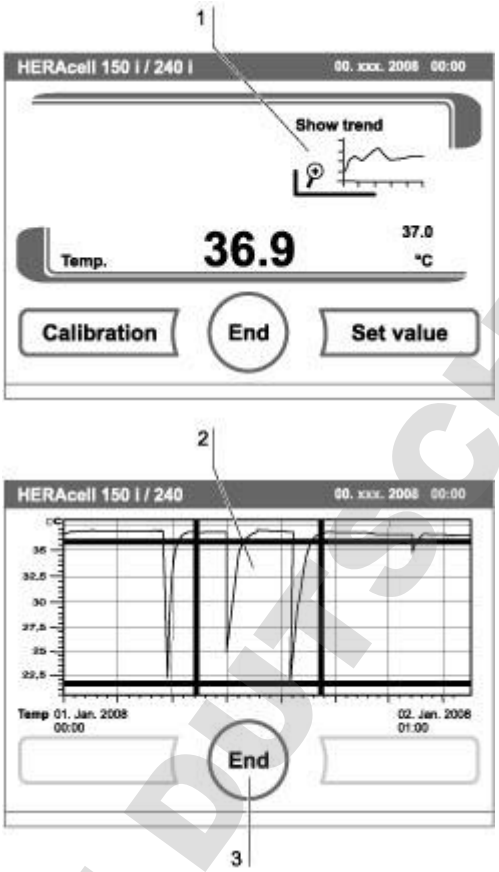


Figure. 63. Trend display scaling

The trend display of the three control loops:

- Temperature,
- CO_2,
- O_2,

can be scaled to two different versions.

1. Full screen display
   – Press the display, for the value required.
   – press the **SHOW TREND ICON** [1].
2. To display an enlarged section:
   – Open a rectangular section [2] in the desired area of the diagram using a finger or a pen. The size of the rectangle is determined by dragging a diagonal from the start (press onto screen at left of upper diagram frame) to the end (release at right of lower diagram frame).
   – Press any position **within** the marked rectangle area [2]. The section is now enlarged.

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– This process can be repeated any number of times until the section is displayed in the desired enlargement or until the maximal enlargement level (max. 30 event logger elements, i.e. 30 min. process at a logging cycle of 60 seconds).

– During zoom mode the trend display can be scrolled forward and back.

3. To return to the total trend:

– Open rectangle over a small diagram section and press any position **outside** the marked area.

4. To exit the trend display:

– Press the **END** key [3].

– The system returns to the main menu.

Note
Logging cycle:
The time interval of the data logging cycle can be redefined in the Interval Time Event Logger dialog box (see *„Event logging“* on *page 107*).

Resetting the code:
If the keypad lock code is no longer available, the code must be reset to the standard code by the Technical Support of Thermo Fisher Scientific.

7.16. Error messages

The error detection system is an integral element of the device-internal control system. It monitors the control loops and their sensors. If an error is detected in the system, the alarm relay switches and issues the following signals and messages:

- An audible alarm sounds,
- a flashing warning triangle [1] is displayed in the main menu; the value indicators are no longer updated,
- the detected error is listed in the error table,
- the event is entered into the event display.

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7.16.1. Response to an error message event

If the alarm relay was switched due to a user action, the switching state can be reset by accepting the error message (e.g. for the manual cancellation of the contra-con decontamination routine).

If the alarm relay was switched due to a technical defect, the switching state remains active until the defect has been corrected (e.g. low water level in work space).

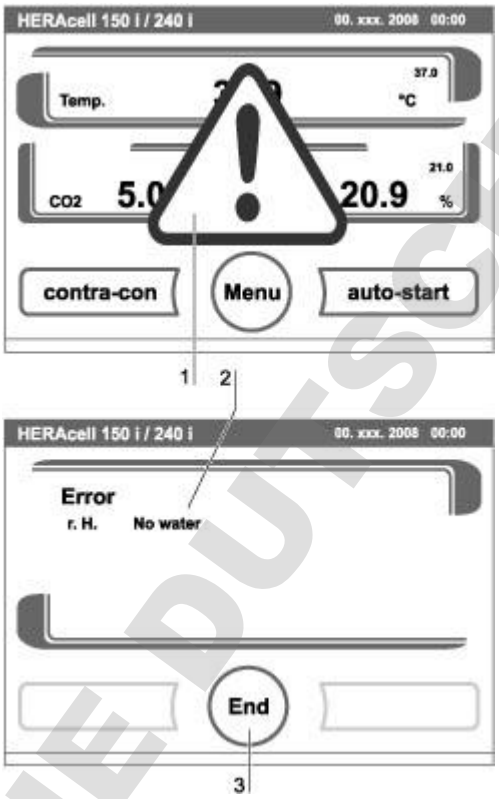


Figure. 64. Event error messages

1. To accept the failure message:

- Press any position on the touchscreen.
- The Error dialog box [2] appears and the detected error is displayed,
- the audible alarm is switched off.

2. To exit the error display:

- Press the **END** key [3].
- The error message disappears.

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7.16.2. Resetting the overtemperature protection mechanism

If the device control has activated the overtemperature protection mechanism and switched over to emergency control mode, a blinking warning triangle [2] and the icon [1] are displayed in the main menu.

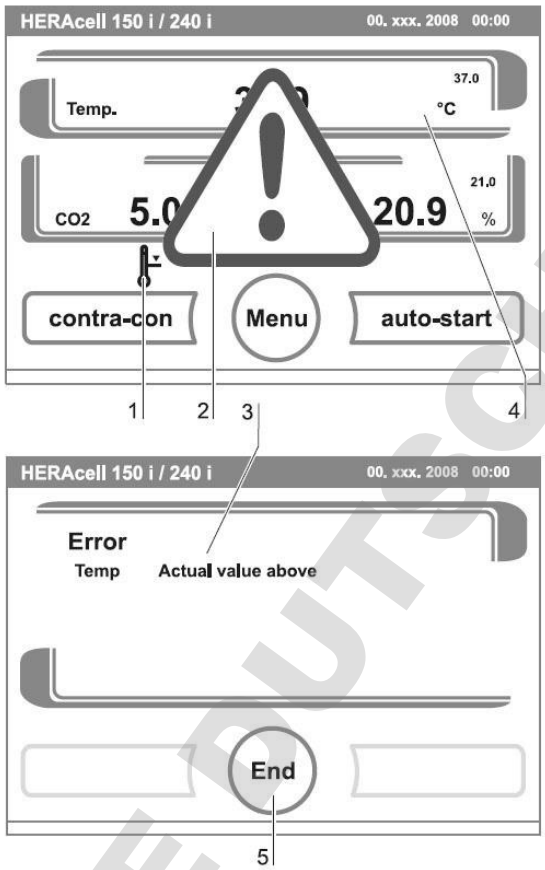


Figure. 65. Event error overtemperature

1. To display the fault cause:
   – Touch any position on the touch screen.
   – The Error dialog window [3] opens and the detected fault cause is shown;
   – the acoustic signal is switched off.
2. To close the error display:
   – Press the END [5] key.
   – The error message disappears.
   – The temperature display field [4] is surrounded by a red frame.
3. To reset the error message:
   – Switch off the device.
4. Open the doors and let the work space cool down.
5. Switch on the device.

If the overtemperature protection mechanism is re-activated although the potential fault causes (see error table) have been eliminated, take the device out of service and contact the technical service center.

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7.16.3. Troubleshooting

The error tables indicate source of error, cause of error, and possible corrections.

For any communication with the Technical Support of Thermo Fisher Scientific, please have the device data ready.

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Error message overview:

Control loop	Error message	Cause	Repair	Alarm relay	Buzzer
System	Device door open too long	Doors open for more than 10 minutes	Close device doors	x	x
	Failure display	Communication between display and main board faulty	Contact Service when failure is recuring	x	x
	Failure EEPROM main board	EEPROM on main board is faulty	Contact Service	x	x
	Failure communication mainboard	Communication between display and main board faulty[1]	Contact Service when failure is recuring		
	System - Failure data logger	Failure during recording data logger. Device is still working.	Reset device to cancel failure. When failure is recuring contact Service		x
	Failure contra-con	Failure in contra-con routine	Reset device to cancel failure. When failure is recuring contact Service	x	x
	System - Power down during contra-con	Power failure during contra-con routine	Reset device and start contra-con again.	x	x
	Failure upon auto-start	Failure during auto-start routine	Reset auto-start. When failure is recuring contact Service.	x	x
	System - Safety circuit active	Temperature signal plausibility doubtful[1]	Reset device. When failure is listed several times, contact Service.		
	Failure bottle turning device	Communication between bottle turning device and main board faulty	Contact Service	x	x
Temperature	Sensor breakage	Detected value is out of limit	Contact Service	x	x

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Control loop	Error message	Cause	Repair	Alarm relay	Buzzer
	Actual value above	Act. val. > nom. val. + 1 °C[2]	Do not exceed ambient temperature limit	x	x
	Actual value below	Act. val. < nom. val.- 1 °C[3]	Contact Service	x	x
	Calibration values too high/too low	Temperature max. adjustment value exceeded	Contact Service	x	x
	Actual value plausibility doubtful	Temperature signal plausibility doubtful	Contact Service	x	x
	Failure communication	Measuring cell cannot communicate with mainboard	Contact Service	x	x
	Failure LM75	LM75 sensor cannot communicate with mainboard	Contact Service	x	x
	Failure EEPROM sensor	NV-Ram sensor faulty	Contact Service	x	x
CO_2	Sensor breakage	Detected value is out of limit	Reset auto-start. When failure is recuring contact Service	x	x

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Control loop	Error message	Cause	Repair	Alarm relay	Buzzer
	Actual value above	Act. val. > nom. val + 1 %[3]	Check gas supply. Reduce prepressure to 1 bar max.	x	x
	Actual value below	Act. val. < nom. val. - 1 %[3]	Check gas supply. Change gas cylinder. Raise prepressure to 1 bar max. Check supply line to device.	x	x
	Calibration values too high/too low	Max. adjustment value exceeded for CO_2	Contact Service	x	x
	Failure communication	Measuring cell cannot communicate with mainboard	Contact Service	x	x
	Failure gas cylinder changeover switch	Gas cylinder changeover switch cannot communicate with mainboard	Contact Service	x	x
	No gas	Both CO_2 cylinders empty	Replace one or both CO_2 cylinders.	x	x
	Gas cylinder A empty	Gas cylinder A is empty	Replace gas cylinder A		
	Gas cylinder B empty	Gas cylinder B is empty	Replace gas cylinder B		
	Failure EEPROM sensor	NV-RAM sensor error	Contact Service	x	x
O_2	Sensor breakage	Detected value is out of limit	Contact Service	x	x

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Control loop	Error message	Cause	Repair	Alarm relay	Buzzer
	Actual value above	Act. val. > nom. val + 1 %[3]	Check gas supply. Reduce prepressure to 1 bar max.	x	x
	Actual value below	Act. val. < nom. val. - 1 %[3]	Check gas supply. Change gas cylinder. Raise prepressure to 1 bar max. Check supply line to device.	x	x
	Failure communication	O_2 sensor cannot communicate with mainboard	Contact Service	x	x
	Failure gas cylinder changeover switch	Gas cylinder changeover switch cannot communicate with mainboard	Contact Service	x	x
	No gas	Both O_2 cylinders are empty	Replace one or both O_2 cylinders.	x	x
	Gas cylinder A empty	Gas cylinder A is empty	Replace gas cylinder A		
	Gas cylinder B empty	Gas cylinder B is empty	Replace gas cylinder B		
rH	No water	Water level in the incubator under	Fill in water or if the auto-start routine is to be run dry (without water), the water level sensor can be switched off.	x	x

1 Error message will be displayed, but not entered in error table.

2 If failure is detectec, a special sample protection controlling will be enabled. To indicate the start of this routine, the icon overtemperature is displayed. The routine will be disabled after a power reset.

3 After changing the set value, error time will be set on 159min, after door opening on 45 min.(O_2 on 159 min.).

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8. Shut-down

8.1. Shutting the device down



CAUTION:
Contamination hazard!
If the work space surfaces are contaminated, germs can be transferred to the environment of the device.
In case of a shut-down, the device must be decontaminated!

1. Remove the culture containers and all accessories from the work space.
2. Pump the water out off the water reservoir (see chap. 9).
3. Fill in 350 ml water and start the contra- con decontamination routine.
4. Turn the device off using the power switch when the contra-con decontamination routine has been completed.
5. Unplug the power connector and protect it against accidental reconnection.
6. Close the CO_2/O_2/N_2 supply system shut-off valves.
7. Disconnect the gas pressure hoses from the sleeve at the rear of the device.
8. Clean the work space and wipe the device dry.
9. Until the device is shut down, the work space must be continuously ventilated. Leave the glass door and the outer door open and secure them in this state.

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9. Cleaning and disinfection

9.1. Cleaning



Notice
Incompatible cleaners!

Some device components are made of plastic. Solvents can dissolve plastics. Strong acids or caustic solutions can cause to become brittle of the plastic.
For cleaning plastic components and surfaces, do not use solvents that contain hydrocarbons, solvents with an alcohol content of more than 10 % or strong acids or caustic solutions.

Moisture-sensitive components!

Do not spray cleaning agent onto the touchscreen and the control box at the rear of the device. When wiping the device clean, always make sure that moisture does not enter into these components.

Cleaning exterior surfaces:

1. Remove dirt residues and depositions thoroughly using a solution of water and commercial detergent.
2. Wipe the surfaces clean using a clean cloth and clear water.
3. Then, wipe the surfaces dry using a clean cloth.

Cleaning display:



Notice
Moisture-sensitive display!
Do not spray or wipe the display with cleaner.

- Clean display using a dry cloth of 100 % micro fiber!

9.2. Decontamination procedures

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

The following disinfection procedures are compatible with the device:

Wipe/spray disinfection:

The wipe/spray disinfection is used as the standardized manual disinfection procedure for the device and for all accessories.

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contra-con decontamination routine:

The contra-con decontamination routine uses an automated program cycle to decontaminate the complete work space including the shelf system and the sensors.



Notice
The contra-con decontamination routine must be performed every 3 months.

9.3. Wipe/spray disinfection

The manual wipe/spray disinfection is carried out in three stages:

- Predisinfection
- cleaning
- final disinfection



CAUTION:

Alcoholic disinfectants!



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.**

Observe safety regulations to avoid fire and/or explosion hazard caused by alcohol-containing disinfectants (ZH 1/598).



Chloride-containing disinfectants!

Chloride-containing disinfectants can corrode stainless steel.

- **Use only disinfectants that do not affect stainless steel!**

Preparing the manual wipe/spray disinfection:



Warning

Electric shock!

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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 the power connector and protect it against accidental reconnection.**
- **Check to see if the device is deenergized.**



Health hazard!

The surfaces of the work space may be contaminated. Contact with contaminated cleaning liquids may cause infections.
Disinfectants may contain harmful substances.



When cleaning and disinfecting, always observe the safety instructions and hygiene regulations!

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

Predisinfection:

1. Remove all samples from the work space and store them in a safe place.
2. Pump the water off and remove water residues using a cloth.
3. Spray disinfectant onto the surfaces of the work space and of the accessories or wipe the surfaces clean using disinfectant.



Notice
Moisture-sensitive components!

Do not spray disinfectant onto the CO_2 sensor in the measuring cell baseplate or onto the O_2/N_2 sensor.

4. Allow the disinfectant to react as specified by the manufacturer.

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Removing accessories and shelf system:

1. Remove gas humidification, bottle turning device and/or shelves, then remove the entire shelf system from the work space.
   For removal and installation of the shelf system, please refer to chapter 5.
2. If required, remove the blower wheel and its cover from the baseplate of the measuring cell. The wheel and the cover can be autoclaved.

Removing blower wheel and cover:



Warning

Electric shock!

Contact with current-carrying components may cause a lethal electric shock.
Prior to removing the blower wheel, switch the device off and disconnect it from the power supply system.

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

Cleaning the work space and accessories:

1. Thoroughly remove dirt residues and deposits using a solution of tepid water and dishwashing agent.
2. Wipe the surfaces clean using a clean cloth and plenty of clear water.
3. Remove the cleaning liquid from the water tray and wipe all surfaces of the work space thoroughly dry.
4. Wipe accessories thoroughly dry.

Final disinfection:

1. Spray disinfectant again onto the work space, the shelf system, and the removed components and wipe them clean.
2. Allow the disinfectant to react as specified by the manufacturer.
3. Reinstall the shelf system and the removed components.

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

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9.4. contra-con decontamination routine

The entire program run of the decontamination routine takes approximately 25 hours.

During this routine, a hot and humid atmosphere at 90 °C with highly decontaminating effect is created in the work space. The effectiveness of the contra-con decontamination routine has been certified by independent institutes. Information on these tests is available from Thermo Scientific upon request.

After the run has been completed, the device must be started up again using the auto-start routine.

Note
Conditions that prevent the start of the contra-con decontamination routine:

The contra-con routine cannot be started if one of the following failure conditions exists.
Temperature control loop:

- **Sensor breakage,**
- **actual value above set value (excessive deviation),**
- **actual value below set value (excessive deviation),**
- **set value not plausible,**
- **calibration values too high or too low,**
- **sensor communication failure,**
- **sensor parameter not plausible,**
- **no communication with LM 75.**

Control loop for CO_2 gas supply:

- **No communication with sensor.**

In this case, the contra-con key is dimmed and its function is not available.

Overtemperature protection:

If the overtemperature protection was enabled on the device, the contra-con decontamination routine cannot be started before the fault hes been corrected or reset.

No gas is supplied during the contra-con decontamination routine on versions with the optional gas monitoring system:

If the error „no gas“ occurs during the contra-con decontamination routine, the audible alarm is triggered. The alarm can be confirmed by pressing on any position on the display. In this case, the contra-con decontamination routine is not canceled. The alarm relay remains switched until the gas monitoring system detects a full gas cylinder again.

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Note
Optional bottle turning device:

Before starting the contra-con decontamination routine, all rollers must be removed from the incubator. The electrical connection sockets must then be sealed with the protecting caps. The rack that supports the rollers may be left in place for the duration of the cycle.

Procedure of a contra-con decontamination routine:

1. After cleaning, reinstall the shelf system components into the work space.
2. Fill the floorpan with 350 ml processed water.
3. Turn the device on using the power switch.
4. Activate and start the decontamination routine.
5. After the decontamination routine has been completed, remove the remaining water using a sterile cloth.
6. Turn the device off or resume operation.



Caution:

Hot surfaces!



The handle and the screen of the glass door, the interior panel of the outer door as well as the surfaces of the shelf system and of the work space become extremely hot during the contra-con decontamination routine.
During the routine run or immediately after completion of the run, always wear safety gloves when touching these surfaces!



Notice
Damage to the samples!
During the contra-con decontamination routine, the work space is heated up to 90 °C.
Make sure that:

- **all samples are removed from the work space,**
- **all accessories are removed from the work space.**



Notice
The contra-con decontamination routine must be performed every 3 months.

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Operating phases of contra-con decontamination:

The remaining run time of the contra-con decontamination routine describes the time between the start or the current time status to the end of the drying phase. The indicated remaining run times are not measured values but merely used for orientation.

The routine is divided into five phases:

1. Heating phase
2. decontamination phase
3. condensation
4. cool-down
5. drying

Heating phase: Remaining run time approx. 25 hours.
The work space is heated to a temperature of 90 °C while an elevated relative humidity is created.

Decontamination phase: Remaining run time approx 23 hours.
After the decontamination atmosphere has been created, the decontamination phase of approx. 9 hours is started. The temperature is maintained at 90 °C.

Condensation: Remaining run time approx. 14 hours.
The floor heating is switched off, the temperature is maintained only by the sidewall heating. This function is activated to reduce the created moisture before the cool-down and to collect it at the work space floor.

Cool-down phase: Remaining run time approx. 8 hours.
The device cools down until the originally set temperature set value is reached.

Postheating phase: Remaining run time approx. 1 hour.
During the postheating phase, condensate within the device is eliminated as far as possible; remaining condensate accumulates at the bottom of the work space.

End of the decontamination routine: Remaining run time 0 hours.
When the remaining run time has elapsed to 0 hours, the device has reached the originally set working temperature again (e.g. 37 °C). The contra-con decontamination routine must then be stopped by pressing the appropriate key.

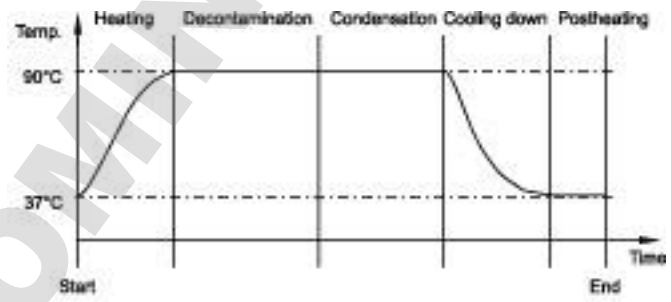


Figure. 66. Decontamination routine phases

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9.4.1. Activating the contra-con routine

The contra-con decontamination routine is used to decontaminate the complete work space.

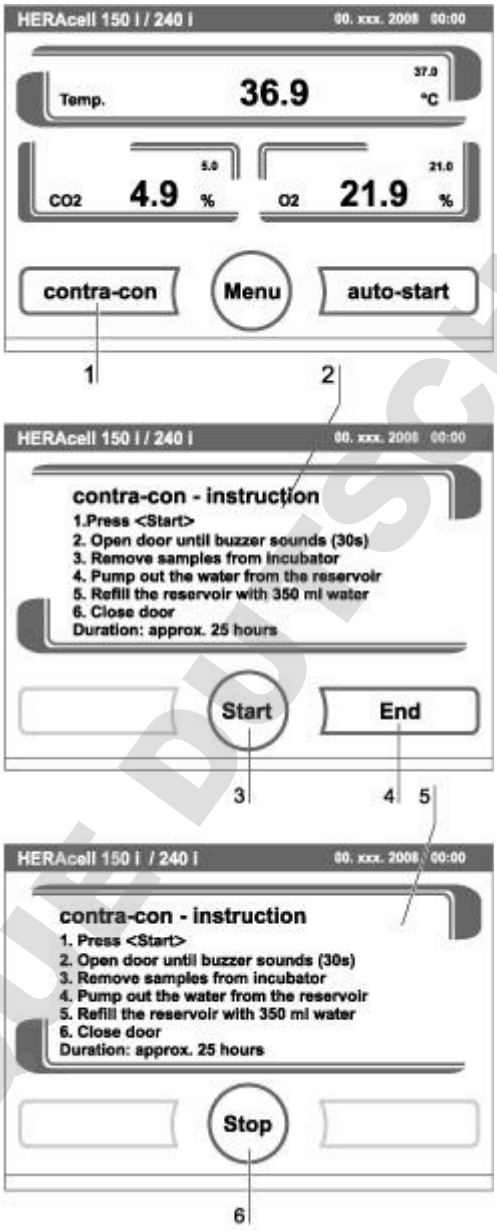


Figure. 67. Activating contra-con

1. Press the **CONTRA-CON** key [1].
   – The contra-con-instruction menu [2] is displayed.
2. To exit the contra-con-instruction menu and contra-con:
   – Press the **END** key [4].
   – The system returns to the main menu.
3. To activate contra-con:

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– Press the **START** key [3].
– The contra-con-instruction menu [2] is displayed.

4. To air the work space, open both device doors when the audible alarm sounds after 30 seconds.
5. Remove all samples from the work space.
6. Pump the water out of the floorpan and wipe off water residues.
7. Fill the floorpan of the work space with 350 ml processed water.
8. Close both device doors.

– The run of the contra-con decontamination routine starts.
– While the contra-con decontamination routine is running, the display shows the current status [5] and outputs the following information:
  - Temperature,
  - start time,
  - phase,
  - remaining run time.

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9.4.2. Interrupting contra-con

The contra-con decontamination routine can be interrupted at any time.

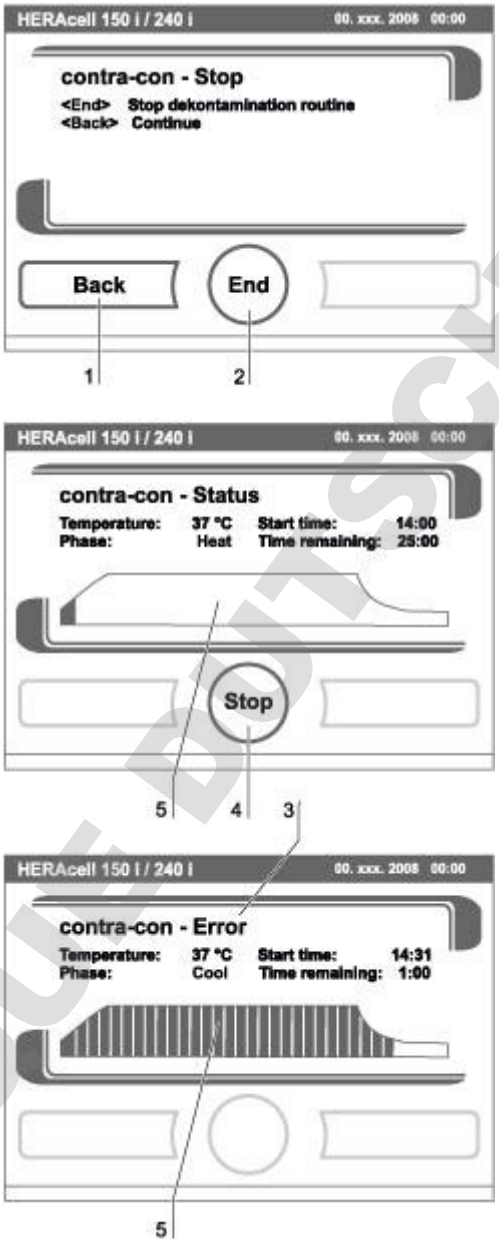


Figure. 68. Interrupting / canceling contra-con

1. To interrupt contra-con:
   – Press the **STOP** key [6].

If the **STOP** key is pressed, the routine is interrupted and the contra-con Stop dialog box is opened as a security request. The routine can now be ultimately canceled or resumed.

2. To cancel contra-con:
   – Press the **END** key [2].

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– The error message is displayed.

– If the error message is confirmed, the system returns to the main menu.

3. To resume contra-con:

– Press the **BACK** key [1].

– The system returns to the status display, and the decontamination routine is resumed.

4. To interrupt contra-con from the status display:

– Press the **STOP** key [4].

– The contra-con Stop dialog box is displayed as a security request (see above). Proceed with work step 2. (see section above).

9.4.3. contra-con interruption due to error

If an error occurs while the decontamination routine is run, an error message [3] is displayed and the following actions are initiated:

– The decontamination routine automatically changes to the cool-down phase,

– the audible alarm sounds.

1. To confirm the audible alarm:

– Press any position on the display.

– The audible alarm is switched off. The **END** key is displayed.

– If the decontamination routine is not canceled after this, cool-down to the set temperature occurs.

2. To cancel contra-con:

– Press the **END** key [2].

– The error message is displayed.

– If the error message is confirmed, the system returns to the main menu.

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9.4.4. Completing contra-con

After the five phases have been completed, the Stop **CONTRA-CON DECONTAMINATION ROUTINE** dialog box [1] is displayed.

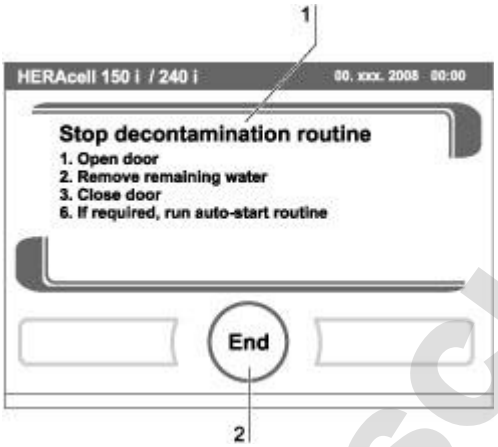


Figure. 69. contra-con completion

The decontamination routine must be stopped manually.

- To stop contra-con:
  - Press the **END** key [2].
  - The system returns to the main menu.

Note
Opening door during contra-con decontamination:
If the door will be opened and closed again whilst contra-con decontamination is running, the routine returns to a phase which will ensure a continuation without faults.

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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/N_2 supply system.

Annual inspection:

- Tightness of the glass door seal.
- Permeability of the pressure compensation opening with insert.
- Functional check of the operating panel and of the device control.
- Electrical safety check in accordance with the relevant national regulations (e.g. VBG 4).

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

10.2. Service intervals

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

3-month service:

- Run auto-start routine and contra-con decontamination routine,
- perform temperature and CO_2/O_2 comparison measurement.

Annual service:

- Replace gas inlet filter.
- Perform Technical Service inspection.

Note
Service contract:
Thermo Scientific offer a device-specific service contact that comprises all test and service works required.

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10.3. Equipment log book

We recommend you keep an equipment log book.

Keep a record of inspection and tests, calibration work and any major work carried out on the unit (e.g. maintenance work, agents loaded, etc.) in this log book.



Caution

Replacement of electrical parts

Work on electrical components of the unit may only be carried out by Thermo Electron LED GmbH service department personnel and when the unit is in a deenergized state (disconnected from the mains supply).

Only use original replacement parts approved by Thermo Electron Gmbh. The sensors may only be replaced by authorized personnel of the operator

10.4. Returns for Repair

Prior to returning any materials, please contact our Customer Service Department for a “Return Materials Authorization” number (RMA).

Material returned without a RMA number will be refused.



Warning

Contamination hazard

The Incubator may have been used for treating and processing infectious substances, which may have caused contamination of the incubator and its components. Prior to return shipment, it is therefore mandatory that all components of the O2-Incubator be properly decontaminated.

- **Clean the Incubator components thoroughly, then disinfect or decontaminate them (depending on application).**
- **Fill in and attach a safety declaration with details on decontamination activities performed to the items that are to be repaired.**

10.5. Preparing the temperature calibration

To determine the exact measured value of the device-integral temperature sensor, a temperature comparison measurement has to be performed every three months.

If a major temperature deviation is found during this check, a temperature calibration is required.

During this process, the temperature control of the device is set to the value measured during the temperature comparison measurement.

Use a calibrated measuring instrument with an accuracy of > ±0.1 °C for this test. To minimize temporary temperature fluctuations during the measurement, the measuring instrument is placed into the work space in an isothermal container (e.g. a bowl filled with glycerol). The center of the work space is the reference location for the comparison measurement.

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Note
Isothermal container:
Thermo Scientific offer a device-specific service contact that comprises all test and service works required.
Do not use a container filled with water as isothermal container as the evaporation of water will result in a lower temperature reading.

Excessive work space temperature:
Excessive work space temperature after the calibration can be reduced by leaving the doors open for approx. 30 seconds.

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Comparison measurement procedure:

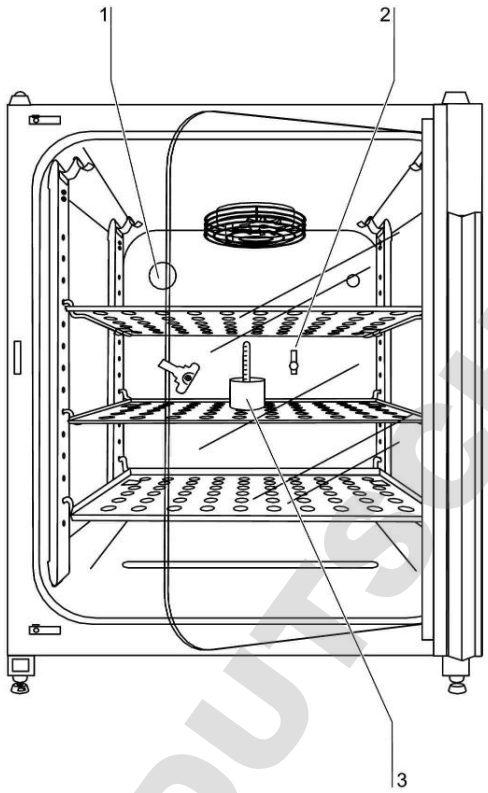


Figure. 70. Preparing the temperature calibration

1. Turn the device on using the power switch.
2. Set the temperature set value and allow the device to be heated. This may take up to several hours.
3. Place the measuring instrument [3] onto the center area of the work space.
4. Alternatively, a temperature sensor may be positioned in this location. Route the connecting cable either through the measurement opening [2] in the glass door or through the access port [1] in the rear panel of the device.
5. Close the doors.
6. Wait until the temperature value displayed on the measuring instrument has stabilized.
7. Calibrate the temperature control as described in ***„Temperature calibration procedure“* on *page 149***.

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10.6. Temperature calibration procedure

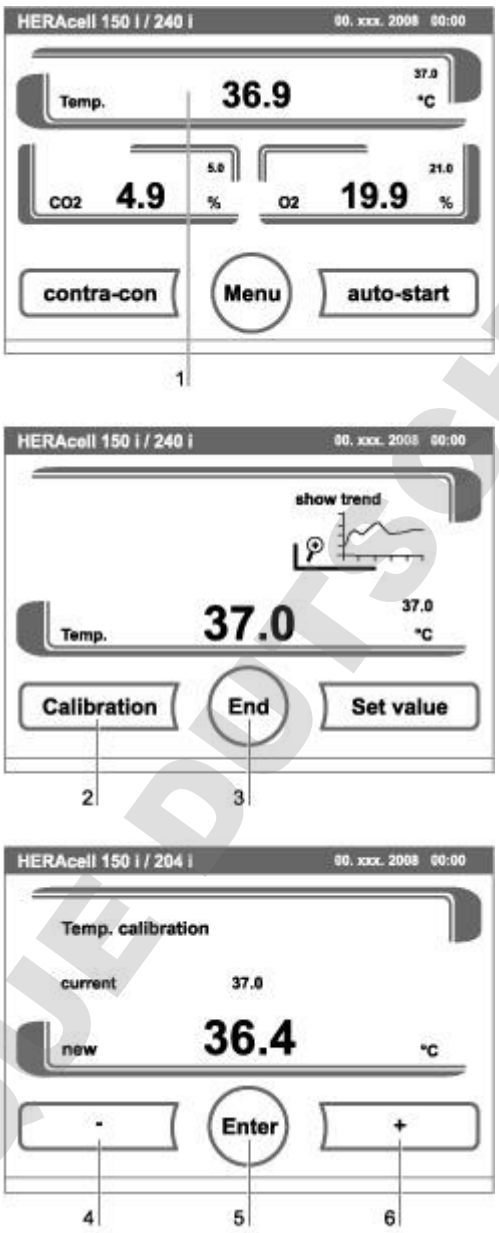


Figure. 71. Temperature calibration procedure

Measurement example:

- Temperature set value: 37 °C

Reference temperature: 36.4 °C

1. Press **TEMPERATURE DISPLAY** [1].
   – The temperature menu is displayed.
2. To exit the temperature menu:

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– Press the **END** key [2].

3. To enter the Calibration submenu:
   – Press the **CALIBRATION** key [2].
4. Enter the measured value (targeting value):

   The targeting value can be increased or reduced in increments; if you keep the + key [4] or the – key [6] depressed, the function switches to a rapid increase/reduction; after approx. 3 seconds, another increase/reduction occurs.

   To increase the targeting value:

   – Press the + key [6].

   To reduce the set value:

   – Press the – key [4].
5. To accept and store the targeting value:
   – Press the **ENTER** key [5].
   – The system returns to the main menu. The temperature display shows the current actual value measured in the work space.

Note
Excessive work space temperature:
Excessive work space temperature after the calibration can be reduced by leaving the doors open for approx. 30 seconds.

Value reset:
If the value isn't changed within the next 30 seconds, the system automatically exits the menu, and the most recently confirmed value is preserved.

10.7. Preparing the CO_2 calibration

To determine the exact measured value of the device-integral CO_2 sensor, a CO_2 comparison measurement has to be performed every three months.

If a major deviation is found during this check, a CO_2 calibration is required.

During this process, the CO_2 control of the device is set to the value measured during the comparison measurement.

Use a calibrated measuring instrument with an accuracy of ±0.3% CO_2 for this test.

Suitable instrument:

- Portable IR readout instrument.

The measuring sample is withdrawn through the sealable measurement opening of the glass door. The comparison measurement must be performed when the device is completely heated up.

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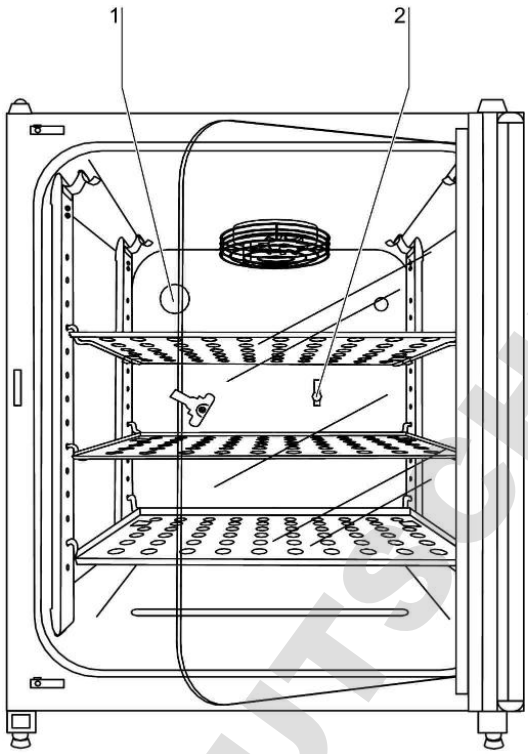


Figure. 72. Preparing CO_2 calibration

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Comparison measurement procedure:

1. Turn the device on using the power switch.
2. Set the CO_2 set value and start the device with auto-start.
3. Insert the measuring instrument probe through the measurement opening [1] into the work space. Wait until the CO_2 value displayed by the instrument has stabilized.

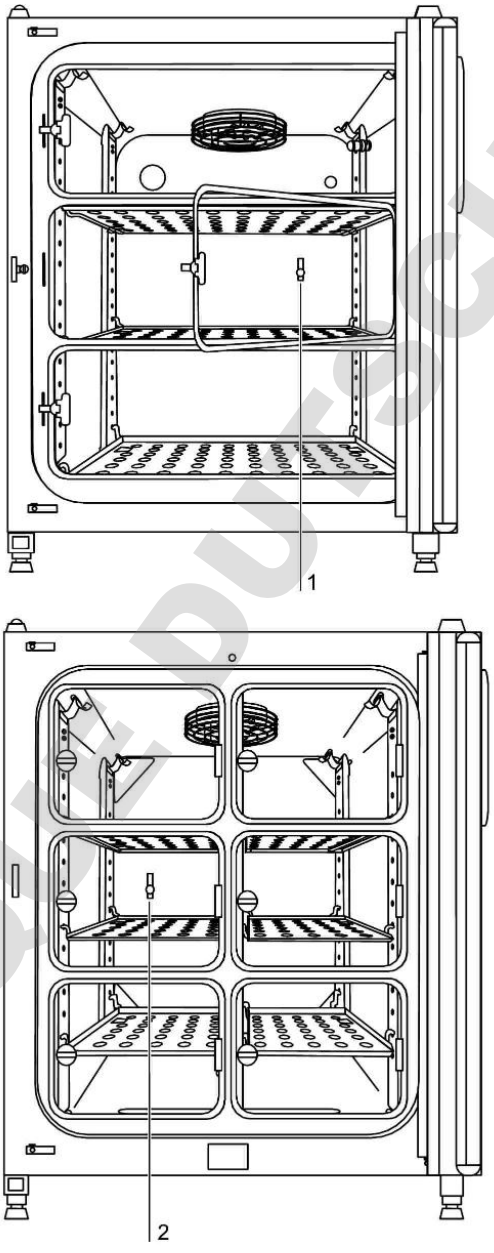


Figure. 73. Gas-tight screen measurement opening

4. For devices equipped with the optional gas-tight screen, the measurement opening is located:
   – on ***HERACELL® 150i*** [1] in the center gas-tight screen,
   – on ***HERACELL® 240i*** [2] in the left center gas-tight screen.

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5. Remove the measuring probe, plug the measurement opening and close the doors.
6. Calibrate the CO_2 control.

Note
IR measuring cell:
For devices with infrared (IR) measuring cells, the CO_2 calibration can only be performed when the CO_2 concentration has been set to 4.0 % or more.
Calibration should be performed with the CO_2 set value designated for the work process (prospective work process value).

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10.8. CO_2 calibration procedure

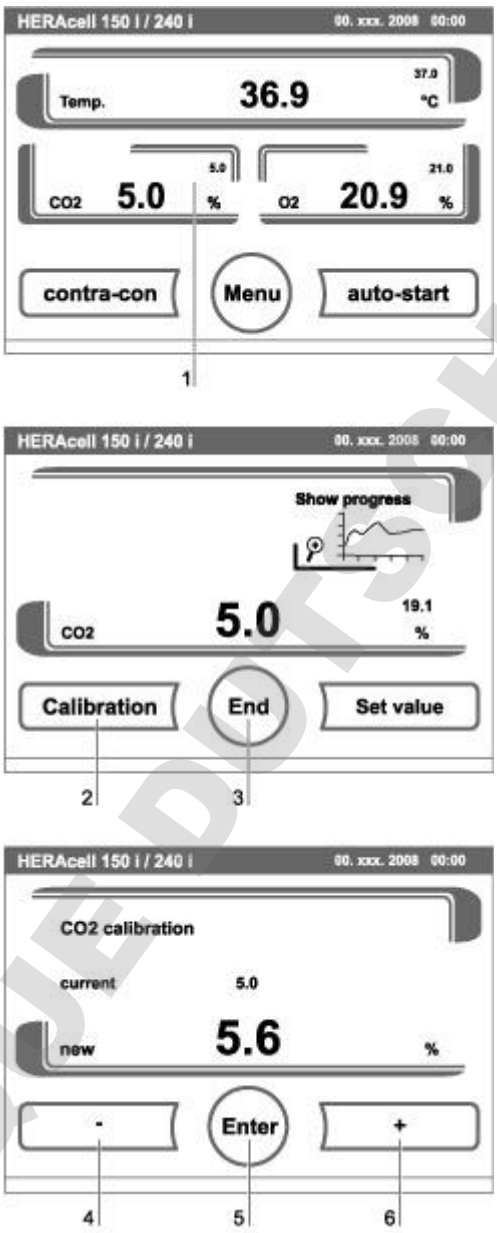


Figure. 74. CO_2 calibration procedure

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Measurement example:

- CO_2 set value: 5 %

Reference temperature: 5.6 %

1. Press the CO_2 **DISPLAY** key [1].
   – The CO_2 menu is displayed.
2. To exit the CO_2 menu:
   – Press the **END** key [3].
3. To enter the Calibration submenu:
   – Press the **CALIBRATION** key [2].
4. To enter the measured value (targeting value):
   The targeting value can be increased or reduced in increments; if you keep the + key [4] or the – key [6] depressed, the function switches to a rapid increase/reduction; after approx. 3 seconds, another increase/reduction occurs.

   To increase the targeting value:

   – Press the + key [6].

   To reduce the set value:

   – Press the – key [4].
5. To accept and store the targeting value:
   – Press the **ENTER** key [5].
   – The system returns to the main menu. The temperature display shows the current actual value measured in the CO_2 display.

Note
Excessive CO_2 content:
Excessive CO_2 content after the calibration can be reduced by leaving the device doors open for approx. 30 seconds.
Value reset:
If the value isn't changed within the next 30 seconds, the system automatically exits the menu, and the most recently confirmed value is preserved.

10.9. Replacing the gas inlet filter

The gas inlet filter (CO_2-/O_2-/N_2 supply) has plastic threads and is screwed by hand into the threaded hole at the control box.

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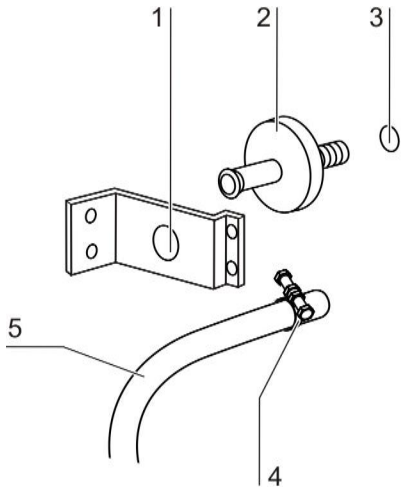


Figure. 75. Gas inlet filter installation

Procedure for gas supply gas inlet filter:

1. Make sure that the gas supply is shut off.
2. Loosen the hose clamp [4].
3. Remove the gas hose [5] from the sterile filter sleeve [2].

Procedure for all gas inlet filters:

4. Remove the retainer [1].
5. Unscrew the gas inlet filter [2] from the threaded hole [3].
6. When installing the new gas inlet filter, make sure that the plastic thread is not canted. Install the filter using caution.
7. Install the retainer [1].

Procedure for gas supply gas inlet filter:

8. Connect the gas hose to the gas inlet filter sleeve and secure it using the hose clamp. Check to see if the gas hose is securely seated on the sleeve.

10.10. Replacing the device fuses

The two identical device fuses [4] are installed in the fuse compartment [1] next to the power plug receptacle of the device:

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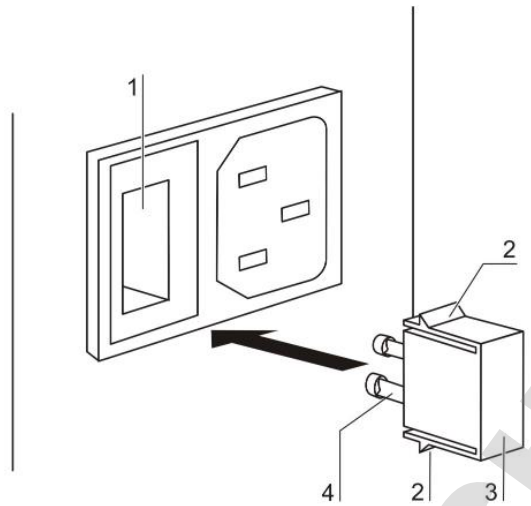


Figure. 76. Device fuse replacement

- Time delay fuses, 6.3 A (5x20 mm)

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

10.11. Replacing the door seal

The door seal (magnetic seal) [3] of the outer door is located in the retaining slot. No tools are required to replace the seal.

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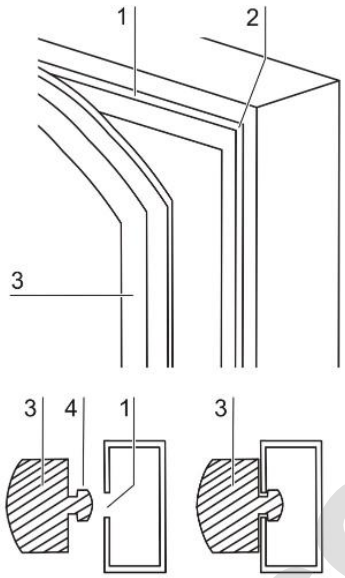


Figure. 77. Magnetic door seal replacement

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

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11. Disposal



Warning

Contamination hazard!

The device may have been used for treating and processing infectious substances. Therefore, the device and device components may have been contaminated.
Prior to disposal, all device components must be decontaminated.

- **Clean the device components thoroughly and either disinfect or decontaminate them (depending on application).**
- **Attach a declaration of non-objection with details of performed decontamination measures to the items that are to be disposed of.**

All device components can be disposed of after they have been decontaminated properly.

Note

Recycling Service

Thermo Fisher Scientific offer a recycling service for discarded components at the owner's expense.

Overview of the material used:

Component	Material
Thermal insulation components	Polystyrene foam EPS/PPS-Compound
Printed circuit boards	Enclosed electrical components coated with different plastics, equipped on epoxy resin-bound boards
Plastic components, general	Note material labeling
Exterior housing	Galvanized steel sheet, painted
Device rear panel	Galvanized steel sheet
Outer door	Galvanized steel sheet, painted
Door inner panel	Galvanized steel sheet, painted
Operating panel and indicator foil	Polyethylene
Magnetic door seal	Magnetic core sheated with EMPP
Heating	Silicone-sheated resistance-type wires

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Component	Material
Interior containers, installed components and shelves	Stainless steel 1.4301 or copper
Plug for pipe channel	Silicone
Pressure compensation opening insert	POM with brass sinter filter
Glass screen	Soda-silicate glass
Glass door seal, measurement opening	Tempered silicone
Sensor block	Stainless steel 1.4301
Blower wheel	Stainless steel 1.4305 or copper
Measuring cell base plate seal	Tempered silicone
Cables	Plastic-sheated copper flexible
Packaging	Corrugated board, polyethylene film and styro-foam

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12. Technical data

12.1. HERACELL® 150i

Description	Unit	Value
Mechanical		
External dimensions (W x H x T)	mm	637 x 867 x 782
Interior dimensions (W x H x T)	mm	470 x 607 x 530
Chamber volume	l	approx 151
Shelves (W x T)	mm	423 x 465
Standard quantity	Piece	3
Maximal quantity	Piece	10
Maximal surface load	kg	10/insertion shelf
Maximal device overall load	kg	30
Weight, without accessories	kg	70
Thermal		
Thermal safety devices according to DIN 12880:2007-5		Class 3.1 over temperature controller (TWW) with overt temperature detection function)
Ambient temperature range	°C	+18...33
Temperature control range	°C	RT +3...55
Temperature deviation, time (DIN 12880, Part 2)	°C	±0.1
Temperature deviation, spatial (DIN 12880, Part 2) at 37 °C[1]	°C	±0.5
Duration of the auto-start routine, to 37 °C ambient temperature20 °C	h	5...10
Heat transfer to environment: at 37 °C during contra-con decontamination	 kW/h kW/h	 0.06 0.112
Humidity		
Water quality		***see page 37***
Liquid quantity: Incubation operation contra-con disinfection operation	 l ml	 max. 3.0/min. 1.2 350
Constant humidity at 37 °C (high-humidity mode) Constant humidity at 37 °C (low-humidity mode)	% rH % rH	approx 93 approx 90
Others		
Sound pressure level (DIN 45 635, Part 1)	dB(A)	< 50
Relative humidity of environment	% rH	max. 80

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Location elevation	m ASL	max. 2000
CO_2 gas supply system		
Gas purity	%	min. 99.5 or medical quality
Prepressure	bar	min. 0.8 - max. 1
Measuring and control range	% Vol	0...20
Control deviation, temporal	% Vol	±0.1
CO_2 measuring cell		
Accuracy (absolute)	% CO_2	±0.3
O_2 gas supply system		
Gas purity	%	min. 99.5 or medical quality
Prepressure	bar	min. 0.8 - max. 1
Measuring and control range	% Vol	1...21 or 5...90
Control deviation, temporal	% Vol	±0.2
O_2 measuring cell		
Accuracy (absolute)	% O_2	±0.5 (Option: 1...21 % O_2)
Electrical system		
Rated voltage	V V V	1/N/PE 230 V, AC (±10 %) 1/N/PE 120 V, AC (±10 %) 1/N/PE 100 V, AC (±10 %)
Rated frequency	Hz	50/60
Interference suppression (DIN VDE 0875)		Interference level N
Type of protection (DIN 40 050)		IP 20
Protection class		I
Overvoltage category (EN 61010)		II
Pollution severity (EN 61010)		2
Rated current	A	2.5 (230 V, AC) 5.2 (120 V, AC) 4.3 (100 V, AC)
On-Site fusing: Fuse Circuit breaker		 T10 A G 16
Rated input	kW kW kW	0.58 (230 VAC) 0.62 (120 VAC) 0.43 (100 VAC)
EMC class		B

1 Determined on the basis of DIN 12880 for devices with standard equipment. See detailed information in calibration.

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12.2. HERACELL® 240i

Description	Unit	Value
Mechanical		
External dimensions (W x H x T)	mm	740 x 934 x 834
Interior dimensions (W x H x T)	mm	607 x 670 x 583
Chamber volume	l	approx 238
Shelves (W x T)	mm	560 x 500
Standard quantity	Piece	3
Maximal quantity	Piece	12
Maximal surface load	kg	10/insertion shelf
Maximal device overall load	kg	30
Weight, without accessories	kg	81
Thermal		
Thermal safety devices according to DIN 12880:2007-5		Class 3.1 over temperature controller (TWW) with over temperature detection function)
Ambient temperature range	°C	+18...33
Temperature control range	°C	RT +3...55
Temperature deviation, time (DIN 12880, Part 2)	°C	±0.1
Temperature deviation, spatial (DIN 12880, Part 2) at 37 °C[1]	°C	±0.5
Duration of the auto-start routine, to 37 °C ambient temperature 20 °C	h	5...10
Heat transfer to environment: at 37 °C during contra-con decontamination	 kW/h kW/h	 0.07 0.25
Humidity		
Water quality		***see page 37***
Liquid quantity: Incubation operation contra-con disinfection operation	 l ml	 max. 4.5/min. 1.8 350
Constant humidity at 37 °C (high-humidity mode) Constant humidity at 37 °C (low-humidity mode)	% rH % rH	approx 93 approx 90
Others		
Sound pressure level (DIN 45 635, Part 1)	dB(A)	< 50
Relative humidity of environment	% rH	max. 80
Location elevation	m ASL	max. 2000

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CO_2 gas supply system		
Gas purity	%	min. 99.5 or medical quality
Prepressure	bar	min. 0.8 - max. 1
Measuring and control range	% Vol	0...20
Control deviation, temporal	% Vol	±0.1
CO_2 measuring cell		
Accuracy (absolute)	% CO_2	±0.3
O_2 gas supply system		
Gas purity	%	min. 99.5 or medical quality
Prepressure	bar	min. 0.8 - max. 1
Measuring and control range	% Vol	1...21 or 5...90
Control deviation, temporal	% Vol	±0.2
O_2 measuring cell		
Accuracy (absolute)	% O_2	±0.5 (Option: 1...21 % O_2) ±2.0 (Option: 5...90 % O_2)
Electrical system		
Rated voltage	V V V	1/N/PE 230 V, AC (±10 %) 1/N/PE 120 V, AC (±10 %) 1/N/PE 100 V, AC (±10 %)
Rated frequency	Hz	50/60
Interference suppression (DIN VDE 0875)		Interference level N
Type of protection (DIN 40 050)		IP 20
Protection class		I
Overvoltage category (EN 61010)		II
Pollution severity (EN 61010)		2
Rated current	A	2.8 (230 V, AC) 5.4 (120 V, AC) 6.3 (100 V, AC)
On-Site fusing: Fuse Circuit breaker		 T10 A G 16
Rated input	kW kW kW	0.64 (230 VAC) 0.65 (120 VAC) 0.63 (100 VAC)
EMC class		B

1 Determined on the basis of DIN 12880 for devices with standard equipment. See detailed information in calibration.

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13. Data communication

13.1. Interfaces

13.1.1. RS 232 interface

The RS 232 data communication interface has been designed for a cable connection with 9-pin connector and a contact assignment of 1:1.

Setting the transmission speed:

- 9,600 – 57,600 baud,
- 8 data bits,
- 1 stop bit,
- no parity.

Data exchange is accomplished via a defined command sequence structure (see below).

13.1.2. USB port (optional)

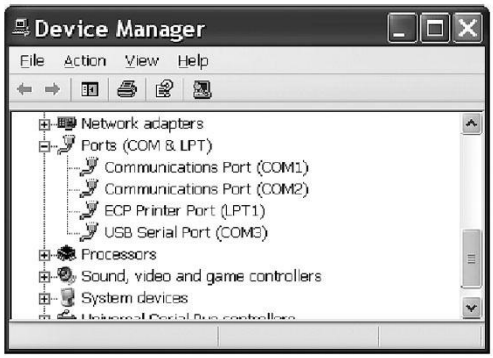
As an alternative to data communication via RS 232 interface, the devices can be equipped with the optional USB port. The USB port complies with Standard USB 1.1 and is compatible with Standard USB 2.0 (full speed).

The USB port is operated as a virtual COM port. Therefore, the port transmission speed can be changed within the defined baud rates (9,600, 19,200, 38,400, 57,600 baud).

Data exchange is accomplished via a defined command sequence structure. The command sequences comply with the design of the RS 232 interface.

Note
Installing the USB port with the virtual COM port:
If the USB port is to be used for data exchange between PC and incubator, the USB port is installed as virtual COM port (USB serial port) using the supplied driver.
The assigned COM port can be located in the Windows Device Manager/Ports dialog box, e.g. USB Serial Port (COM5), and is then defined as communication port in the HERACELL® 150i / 240i program (see *„Program HERACELL® 150i / 240i“* on *page 185*).

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The driver can be run under the following operating systems:

WIN 2000, WIN XP, WIN VISTA.

13.1.3. Installing the USB port driver

Connect the USB cable (optional) to the control box of the ***HERACELL® 150i/240i*** and to a PC.

As soon as the Windows Hardware Detector has identified the USB port, the **FIND NEW HARDWARE WIZARD** dialog box opens.

1. Select the **INSTALL FROM A LIST OR SPECIFIC LOCATION (ADVANCED)** option.

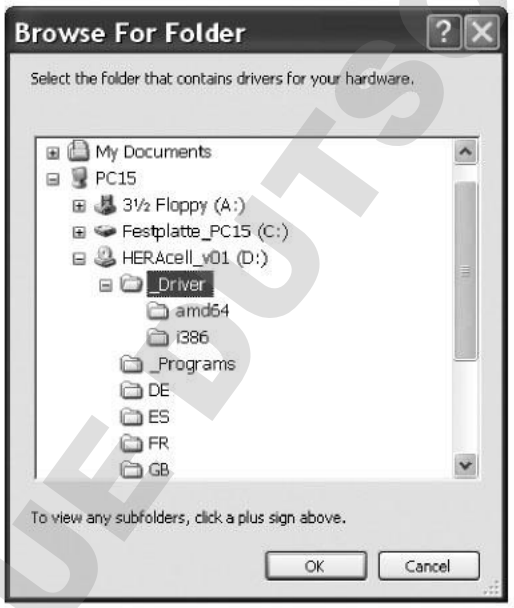


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2. Select the data CD as source.



3. On the data CD, select the **DRIVER** sub-directory.



4. The installation routine installs the driver: **EVAL22 Board USB**.

   After the installation has been completed successfully, the routine is completed with **FINISH**.

   The interface transmission speed can be selected within the defined baud rates (9,600, 19,200, 38,400, 57,600 Baud) at the touchscreen of the ***HERACELL® 150i/240i*** (see ***„Settings“*** **on** ***page 97***).

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13.2. Structure of the command sequences for data communication

All characters sent and received in the data exchange between a PC and the incubator ***HERACELL®*** ***150i/240i*** are ASCII characters that can be displayed on a conventional terminal.

This ensures that communication can be set up, controlled, and programmed easily.

13.2.1. Description of the protocol

Character coding

ASCII characters, capital letters are not allowed.

Reading parameters:

Query:	?:aaaa:bb::cc<CR>
or:	?:aaaa:bb:XXXX:cc<CR>
Response:	!:aaaa:bb:XXXXX:cc<CR>
where:	aaaa = parameter address
	bb = amount of payload in this telegram (00 – ff)
	cc = checksum: Inverted XOR of all bytes without checksum and <CR>
	XXXX = bb payload bytes

Description of the response elements:

aaaa	parameter address
bb	amount of payload in this telegram (00 – ff)
cc	checksum: Inverted XOR of all bytes without checksum and <CR>

Example of a software version query (50111927):

Query:	?:0001:00::cc<CR>
Response:	!:0001:08:50111927:cc<CR>

Writing parameters:

Command:	!:aaaa:bb:XXXXX:cc<CR>
Response:	!:aaaa:bb::cc<CR>
where:	aaaa = parameter address
	bb = amount of payload in this telegram (00 – ff)
	cc = checksum: Inverted XOR of all bytes without checksum and <CR>
	XXXX = bb payload bytes

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Response with an error message:

Response: !:aaaa:bb:XX:cc<CR>

Description of the response elements:

aaaa parameter address,
bb amount of payload (always 02)
cc checksum: Inverted XOR of all bytes without checksum and <CR>
XX = 2 bytes error message (see table below)

Example of an unknown command:

Query: ?:0005:00::cc<CR>
Response !:0005:02:?1:cc<CR>

Significance of the two bytes in the error message:

Error message	Description
?0	Error in telegram structure or checksum
?1	Unknown command or unknown parameter
?2	Internal memory error
?3	Data error (value not within its limits)

13.3. Overview of general parameters (addresses 0xxx)

General parameters are system values such as date, time, and motherboard version number.

13.3.1. Reading general parameters

Adress	Description	Note
001	Motherboard version number	8 digits
0010	Output date and time [hours:minutes:seconds], [day:month:year]	17 bytes/decimal value in format xx:xx:xx;xx:xx:xx
0011	Date [day:month:year]	8 bytes/decimal value in format xx:xx:xx
0012	Time [hours:minutes:seconds]	8 bytes/decimal value in format xx:xx:xx

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13.4 Overview of incubator parameters (addresses 2xxx)

Incubator parameters are divided into:

- the basic parameters of the three control loops temperature, CO_2 and O_2,
- the internal function parameters of operating functions and data logging.

13.4.1 Reading basic parameters

Address	Description	Note
2000	Device Status[1] (error) status of control loops for temperature, CO_2, O_2, rh, ref. temp.	33 bytes/hexadecimal value in format xxxxxxxx;xxxx;xxxx;xxxx;xxxx
2010	Set, actual and reference temperature[2]	23 bytes/decimal value in format +xxx.xx;+xxx.xx;+xxx.xx
2020	Set and actual CO_2 content[2]	15 bytes/decimal value in format +xxx.xx;+xxx.xx
2030	Set and actual O_2 content[2]	15 bytes/decimal value in format +xxx.xx;+xxx.xx
204a	Actual water level (100 % or 0 %)	7 bytes/decimal value in format xx
204b	Low humidity indicator (1 active, 0 inactive)	

1 Example of device status and (error) status of control loops (details see error message table).
2 All values have 2 decimal places.

13.4.2 Reading internal function parameters

Address	Description	Note
2100	Status of run[1] and remaining run time [hours:minutes] for disinfection, also date and time of last start	25 bytes/decimal value in format xx;+xxx:xx;xx.xx.xx;xx:xx
2105	Status of run[1], current CO_2 offset + waiting period [minutes:seconds] autostart, also date and time of last start	25 bytes/decimal value in format xx;xx.x;+xxx:xx;xx.xx.xx;xx:xx
2132	Read bottle turning device speed (all levels)[2]	8 bytes/hexadecimal value in format xxxxxxxx
2133	Read bottle turning device status (all levels) (1 active, 0 stopped)[2]	8 bytes/hexadecimal value in format xxxxxxxx
2140	Read status of gas cylinder changeover switch for CO_2[3]	2 bytes/hexadecimal value in format xx
2141	Read status of gas cylinder changeover switch for O_2[3]	2 bytes/hexadecimal value in format xx
2300	Read error memory (current errors)[4]	Up to 241 bytes/hexadecimal value, format see corresponding chapter
2301	Read error memory (prior errors)[4]	Up to 241 bytes/hexadecimal value, format see corresponding chapter

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Address	Description	Note
2400	Query (start) of the data stored in the data logger[5]	Up to 224 bytes/hexadecimal value, format see corresponding chapter
2401	Query (start) of the further data stored in the data logger[6]	224 bytes(hexadecimal value, format see corresponding chapter
2402	(Repeated) query of the most recent data logger querry[7]	224 bytes(hexadecimal value, format see corresponding chapter
2410	Read data logger write cycle in hours:minutes:seconds	8 bytes/decimal value in format xx:xx:xx

1 See table with notes on disinfection and autostart run status.
2 2 bytes per each level.
3 Bottle A active (0x01), bottle B active (0x02), bottle A pressure OK (0x10), bottle B pressure OK(0x20).
4 For more information on the error memory see this chapter
5 Set reading pointer to first entry, read up to 7 entries max.
6 Send the next 7 entries. Set reading pointer automaticilly to the next new entry, read up to 7 entries max.
7 Send entries of last telegram again. Can be used after communication error has occurred.

Note on *3) disinfection and autostart run status:

Bit	Disinfection	auto-start
0x00	contra-con not active	auto-start not active
0x01	Initialization	Initialization
0x02	Await door opening time	Await door opening time
0x03	Await door closing	Await door closing
0x04	Start	Start
0x05	Heat	Heat
0x06	Hold	Perform counter-voltage adjustment
0x07	Condensation	Waiting period 1
0x08	Cool-Down	Set tolerance band
0x09	Dry	Establish stable humidity
0x0A	Await release	Perform counter-voltage adjustment
0x0B	Stop	Waiting period 2
0x0C		Determine offset
0x0D		Read offset, check
0x0E		Release
0x0F		Stop

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13.5. Error memory structure

The error memory contains 22 error messages. A query is responded with 11 data sets with a colon as separator and can be queried using the following command:

Query: ?:2300:00::cc<CR>
Reading the **last** 11 error memory entries.

Query: ?:2301:00::cc<CR>
Reading the **first** 11 error memory entries.

These data sets consist of 11 byte and are encrypted in 21 ASCII characters prior to data transmission. Example: The byte 0x23 is converted into the ASCII characters 0x32 (‚2') and 0x33 (‚3').

- Byte 1 consists of 1 characters,
- Bytes 2 - 11 consist of 2 characters.

Therefore, a response consists of 1+(10 x 2) = 21 data bytes plus separator.

A data set always delivers the date, the time, the faulty control loop, the device status, and the error message.

Example of a response:

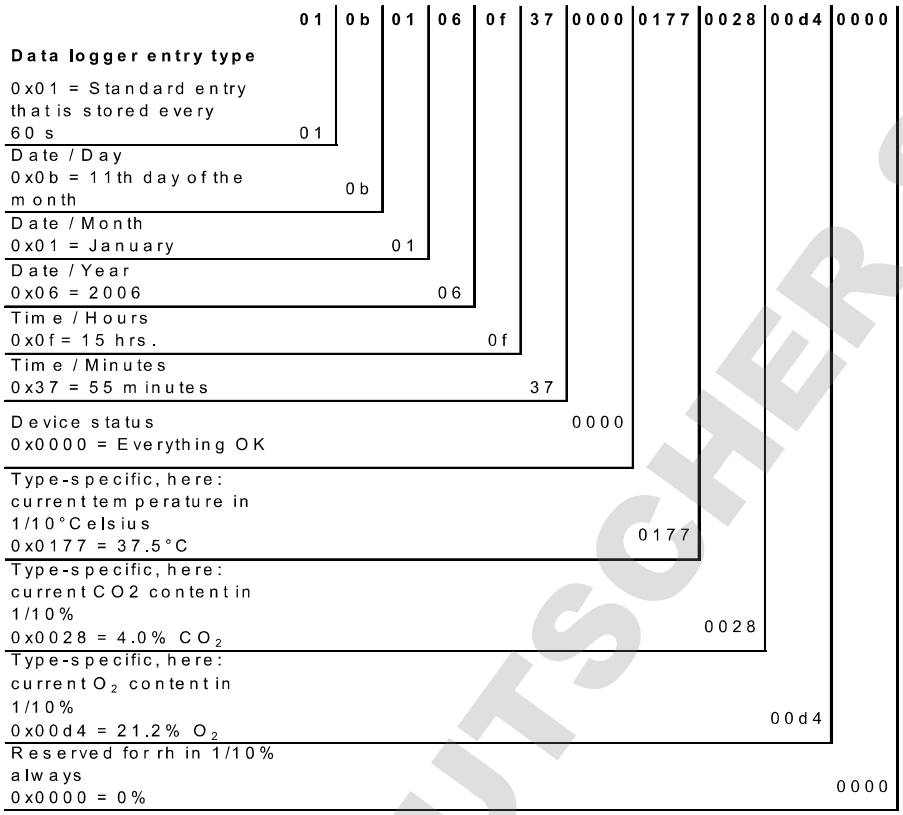


First data set: !:2300:fb:10b01060f372280000002:
(with 21 bytes)

Second data set:20b01060f38100001... ...:80
(beginning of the second data set after 21 bytes
of the first data set and of the separator [1 byte])

13.5.1. Error memory data set structure scheme:

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Therefore, the following information is transmitted in this data set:

- Created on 1 January 2006 at 15:55:34 hrs.
- A device error has occurred and the set temperature is too high.

13.5.2. Overview of the possible error messages in hex coding

Hex Code	Description/Type
0x00	Temperature control loop
0x01	CO_2 control loop
0x02	O_2 control loop
0x07	Water level
0x08	General device status

13.5.3. Overview of the possible error messages in bit coding

General device status, control loop for temperature and CO_2:

Bit	General device status
0x0002	Device Door open too long
0x0004	Display fails to communicate
0x0008	Mainboard parameter implausible (EPROM faulty)
0x0010	Data logger faulty (device remains operative)

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Bit	General device status
0x0020	Error in disinfection/contra-con
0x0040	No power supply during contra-con
0x0080	Error in auto-start
0x0100	Safety circuit activated
0x0200	Bottle turning device fails to communicate
0x2000	auto-start active (info)
0x4000	Disinfection active (info)
0x8000	Device error has occurred (info)

Bit	Temperature control loop error status
0x0001	Sensor breakage
0x0002	Value above set value upper limit
0x0004	Value below set value lower limit
0x0008	Set value implausible
0x0010	Calibration value too high/too low
0x0020	Communication error (to sensor)
0x0040	Communication error (to LM75)
0x0100	Measuring cell parameter implausible (EEPROM faulty)

Bit	CO_2 control loop error status
0x0001	Sensor breakage
0x0002	Value above set value upper limit
0x0004	Value below set value lower limit
0x0010	Calibration value too high/too low
0x0020	Communication error (to sensor)
0x0040	Communication error (to cylinder changeover switch)
0x0080	No gas, cylinders A and B empty
0x0100	Measuring cell parameters implausible (EEPROM faulty)
0x0200	Cylinder A empty
0x0400	Cylinder B empty

Bit	O_2 control loop error status
0x0001	Sensor breakage
0x0002	Value above set value upper limit
0x0004	Value below set value lower limit
0x0020	Communication error (to sensor)
0x0040	Gas cylinder changeover switch fails to communicate
0x0080	No gas, cylinders A and B empty
0x0200	Cylinder A empty
0x0400	Cylinder B empty

Bit	Water level error status
0x0001	No water

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13.6. Data logger structure

The data logger can store up to 10,000 events. Depending on the setting for the logging cycle (in sections of seconds), e.g. for a value of 60 s (default value), the events of about 5 days can be stored.

The data logger stores the following information:

- important user actions, system events, and error messages,
- measured data of the three control loops during incubation operation.

The data logger can be queried using the following commands:

Query: ?:2400:00::cc<CR>
Setting the data logger reading pointer to the oldest entry and output of the first data sets.

Query: ?:2401:00::cc<CR>
Output of the following data sets, the reading pointer automatically moves gradually from the older entries to the current entries.

Query: ?:2402:00::cc<CR>
Repeated output of the most recently read data, this command does not move the reading pointer. This command can be used to avoid data loss after a communication error has occurred.

Each query command is responded with up to 7 data sets that follow one another without a separator. These data sets consist of 16 bytes and are encrypted into 32 ASCII characters prior to transmission.

For example, the byte 0x23 is converted into the ASCII characters:

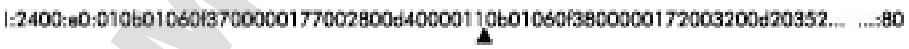
0x32 (‚2') and 0x33 (‚3').

Therefore, a response consists of up to 7 X 16 = 112 bytes, i.e. 224 ASCII characters.

A data set always delivers the date and the time (without seconds), the device status and the type of data logger entry (byte 0-7 or ASCII character 0-15).

Also, depending on the entry, the current actual values or set values of the control loops or other parameters can be entered (byte 8-15 or ASCII character 16-31).

Example of a response:

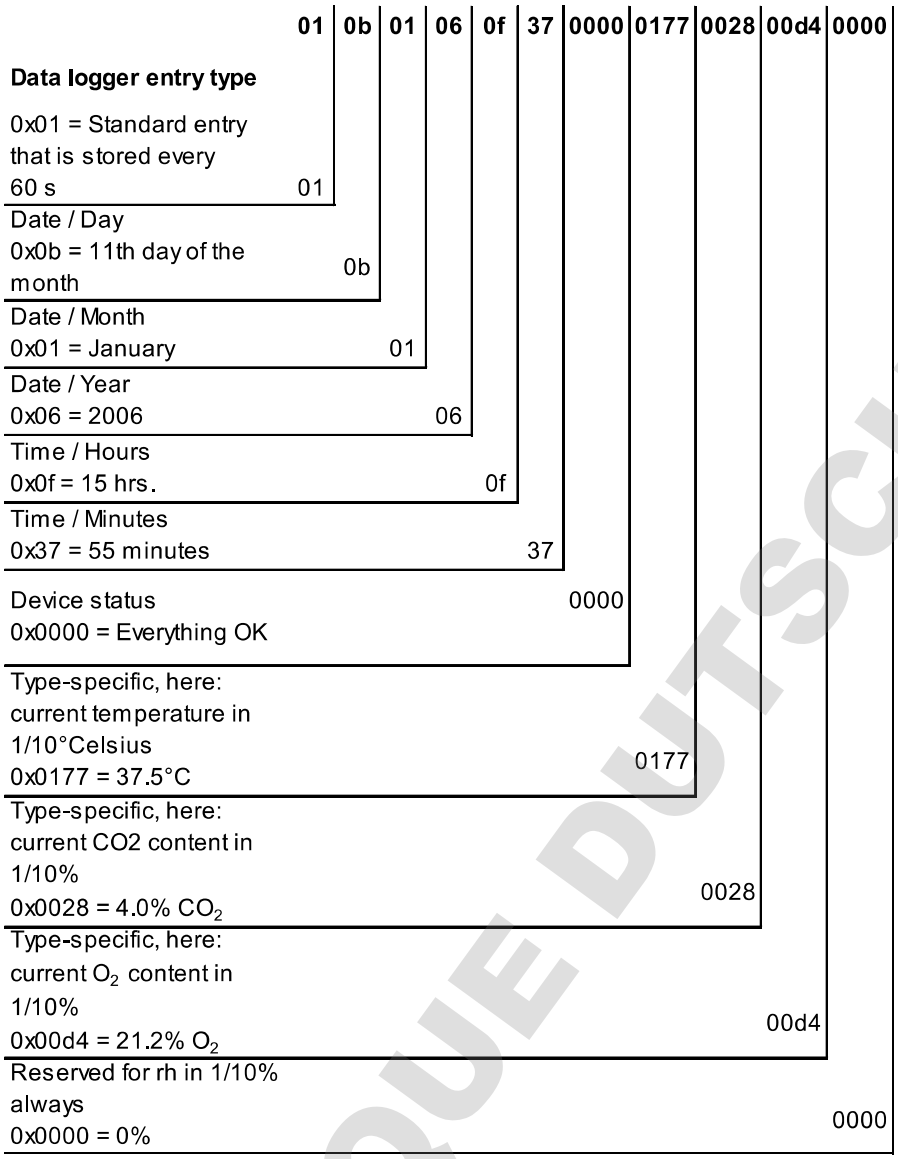


First data set !:2400:e0:010b01060f37000001770028004d4000011
(consisting of 32 byte ASCII characters)

Second data set0b01060f38000001720032004d20352... ...:80
(beginning of the second data set after 32 bytes of the first data set)

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13.6.1. Data logger data set structure scheme:



Therefore, the following information is transmitted in this data set:

- Created on 1 January 2006 at 15:55 hrs.
- The device status reports no particularities,
- the temperature is 37.5°C,
- gas concentration 4.0% CO_2, 21.2% O_2.

Note
Example of a code:
For an example of a code, please refer to the end of this chapter.

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13.6.2. Overview of possible event entries in bit coding

Code	Event	Special information (byte 8-15)
0x01	Set values from all control loops (periodically in minute cycles)	Current values for temperature, CO_2, O_2 and rh
0x02	Set value change (at beginning of new section)	Set value for temperature, CO_2, O_2 and rh
0x10	Change temperature set value	Set value for temperature, CO_2, O_2 and rh
0x11	Change CO_2 set value	Set value for temperature, CO_2, O_2 and rh
0x12	Change O_2 set value	Set value for temperature, CO_2, O_2 and rh
0x20	New temperature error	Status/error registration for temperature, CO_2, O_2 and rh
0x21	New CO_2 error	Status/error registration for temperature, CO_2, O_2 and rh
0x22	New O_2 error	Status/error registration for temperature, CO_2, O_2 and rh
0x2F	New system error	Status/error registration for temperature, CO_2, O_2 and rh
0x30	Power reset	Set value for temperature, CO_2, O_2 and rh
0x31	Door open	Current actual values for temperature, CO_2, O_2 and rh
0x32	Door closed	Current actual values for temperature, CO_2, O_2 and rh
0x40	Customer-specific temperature calibration	Calibration level (2 bytes), old temperature, new temperature (2 bytes each)
0x41	Customer specific CO_2 calibration	Calibration level (2 bytes), old temperature, new temperature (2 bytes each)
0x42	Customer specific O_2 calibration	Calibration level (2 bytes), old temperature, new temperature (2 bytes each)
0x50	Start auto-start	Status/error registration for temperature, CO_2, O_2 and rh
0x51	auto-start successfully completed	Current actual values for temperature, CO_2, O_2 and rh
0x52	auto-start completed with error	Status/error registration for temperature, CO_2, O_2 and rh
0x53	auto start stopped manually	Status/error registration for temperature, CO_2, O_2 and rh
0x60	Start contra-con	Status/error registration for temperature, CO_2, O_2 and rh
0x61	contra-con successfully completed	Current actual values for temperature, CO_2, O_2 and rh
0x62	contra-con completed with error	Status/error registration for temperature, CO_2, O_2 and rh
0x63	contra-con stopped manually	Status/error registration for temperature, CO_2, O_2 and rh

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Code	Event	Special information (byte 8-15)
0x70	Gas monitor cylinder A empty	Status/error registration for temperature, CO_2, O_2 and rh
0x71	Gas monitor cylinder B empty	Status/error registration for temperature, CO_2, O_2 and rh
0x72	Gas monitor manual changeover	Status/error registration for temperature, CO_2, O_2 and rh
0x90	Start low humidity	Current actual values for temperature, CO_2, O_2 and rh
0x91	Stop low humidity	Current actual values for temperature, CO_2, O_2 and rh
0x92	Start bottle turning device	Driver roller speed status (2 bytes each)
0x93	Stop bottle turning device	Driver roller speed status (2 bytes each)
0xe0	Delete data logger	Current actual values for temperature, CO_2, O_2 and rh
0xff	Last entry of data logger	No information, not even on date, time and status

13.7. Examples of data logger codes

An entry in the data logger is 16 bytes large and has the following structure:

1. byte: indicates the event (e.g. door open 0x31, measured value entry 0x01)
2. byte: day of entry
3. byte: month
4. byte: year
5. byte: hour
6. byte: minute
7. byte: device status
8. byte: device status
9. to 16. byte: various data on the event

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13.7.1. Functions for data logger queries

The following code example for reading the data logger uses six functions:

- **ahex**
  // converts the received ASCII character into a hexadecimal number,
- **send_telegramm**
  // sends a query to the data logger,
- **get_telegramm**
  // receives a response data the data logger,
- **time_2_str**
  // uses a hexadecimal value to create ASCII characters in time format,
- **num_2_string**
  // uses hexadecimal values to create ASCII characters to be entered into a file,
- **read_datalogger**
  // edits the received data and writes them into a file.

13.7.2. Example of a code for a a data logger query

char ahex (char a)

```
char ahex (char a)
    {
    char i;
    char hexa[16]="0123456789abcdef";

    for (i = 0; i < 16; i++)
        if (a == hexa[i])
        return (i);
    return 0;
    }
```

send_telegramm

```
void send_telegramm (char *p)
    {
    char string [15];
    unsigned char bcc = 0xFF;
    char i;

// copy telegram together
    strncpy (&string[0], "?:xxxx:00::00\r", 14);
// insert 4-digit address
    strncpy (&string[2], p, 4);
// calculate checksum: inverted XOR of all bytes
// without checksum and <CR>
    for (i = 0; i < 11; i ++)
        bcc = (bcc^string[i]);
// copy checksum
```

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```
    string[11] = hexa(bcc/16);
    string[12] = hexa(bcc%16);
// send telegram
    ComWrt (COM_NR, string, 14);
    return;
    }
```

get_telegramm

```
int get_telegramm (char *p)
    {
    int reading_count = 0;
// reading the telegram character by character
    do
        ComRd(COM_NR, &p[reading_count], 1);
// until reception of <CR>
    while ((p[reading_count++] != '\r'));
// return = number of received characters
    return (reading_count);
    }
```

time_2_str

```
char time_2_str (int z, char * b)
    {
        char i;
// output two numerals
        for (i = 1; i >= 0; i--){
// calculate value
        b[i] = z%10+0x30;
// reduce default value
        z = z/10;
        }
        return (2);
    }
```

num_2_string

```
char num_2_str (int z, char * b)
    {
// number with one decimal place
  char a[12];
  char i, l;
  int rest = 0;
  l = 0;
// Negative number?
  if (z < 0)  {
// set algebraic sign
        b[0] = '-';
        l = 1;
// convert value
```

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```
        z = 0xffffffff-z+1;
        }
// store decimal place
    rest = z % 10;
// cut off decimal place
    z = z / 10;
// calculate and copy number before decimal separator
    for (i = 0; i < 12; i++){
// calculate value
        a[i] = z%10+0x30;
// reduce default value
        z = z/10;
// Number copied completely?
        if (z == 0)    break;
    }
    for ( ; i >= 0; i--)b[l++] = a[i];
// calculate and copy number after decimal separator
    b[l++] = ',';
// calculate value
    b[l++] = rest%10+0x30;
    return (l);
    }
```

read_datalogger

```
int read_datalogger ( )
{
#define SIZE_DATA2  16
#define EVENT_STATUS 0x01
unsigned char buffer[300], string [300];
unsigned char zahlenstring [150],datestring ,timestring ;
unsigned char excelstring [150];
unsigned char len, h,i;
unsigned int  read_count,status;
#define EVENT_DATA.END 0xFF
char data;
int GetTele = 0
GetError = 0,
// writing the title line in the file
WriteFile (FileHandle, "Date;Time;Comment;Temp Act.;CO2 Act.;O2 Act.;rH Act.;Temp Set;CO2
Set;O2 Set;rH Set;\n", 85);
// infinite loop
while (1)
    {
// set data logger to beginning and read
    if (!GetTele){
        send_telegramm ("2400");
        }
    else{
```

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```
// read additional data sets
        send_telegramm ("2401");
        }
    len = get_telegramm (buffer);
// no telegram received
    if (!len) {
        GetError ++;
// requery
        send_telegramm ("2402");
        len = get_telegramm (buffer);
// again, no telegram received
        if (!len) return 1;
        }
// increase telegram counter
    GetTele ++;
// length of sent payload
    len = (ahex(buffer[7]) * 0x10 + ahex(buffer[8])) / 2;
// converting ASCII string into usable numeric string
    for (i = 0; i < (len); i++)
        zahlenstring [i] = (ahex(buffer[10 + (2*i)]) * 0x10 +
        ahex(buffer[11 + (2*i)]));
// calculation of the sent data packages
    data = ((len) / SIZE_DATA2);
// evaluation of all data packages
    for (i = 0; i < data; i++)9{
        len = 0;
    // write time and date into file
        len += time_2_str (zahlenstring[1+i*SIZE_DATA2],
        &excelstring[len]);
        excelstring[len ++] = '.';
        len += time_2_str (zahlenstring[2+i*SIZE_DATA2],
        &excelstring[len]);
        excelstring[len ++] = '.';
        len += time_2_str (zahlenstring[3+i*SIZE_DATA2],
        &excelstring[len]);
        excelstring[len ++] = ';';
        len += time_2_str (zahlenstring[4+i*SIZE_DATA2],
        &excelstring[len]);
        excelstring[len ++] = ':';
        len += time_2_str (zahlenstring[5+i*SIZE_DATA2],
        &excelstring[len]);
        excelstring[len ++] = ':';
        len += time_2_str (0, &excelstring[len]);
        excelstring[len ++] = ';';

        switch (zahlenstring[i*SIZE_DATA2]){
            case EVENT_STATUS:
// check cyclic entries for device errors
        status = zahlenstring[6+i*SIZE_DATA2]*0x100+
```

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```
        zahlenstring[7+i*SIZE_DATA2];
                if (status & INFO_ERROR){
                    str_cpy (&excelstring[len], "Error active;", 13);
                    len += 13;
                }
                else{
// query all device errors (see „Overview of possible event entries in bit coding“ on page 177)
                    if (status & DOOR_LONG){
                        str_cpy (&excelstring[len], "Door open too long;",
                        19);
                        len += 19;
                    else {
                        if (status & DOOR_OPEN){
                            str_cpy (&excelstring[len], "Door open;", 10);
                            len += 10;
                        }
                    }
// query remaining device errors now
//                  .
//                  .
//                  .
//                  .
//                  .
// and finally query cyclic nominal values entries without device // errors
                else{
                        str_cpy (&excelstring[len], "ok;", 3);
                        len += 3;
                    }
                }
// copy nominal values from numerical string to Excel string
                len += num_2_str ((zahlenstring[8+i*SIZE_DATA2]*0x100+
                zahlenstring[9+i*SIZE_DATA2]), &excelstring[len]);
                excelstring[len ++] = ';';
                len += num_2_str ((zahlenstring[10+i*SIZE_DATA2]*0x100+
                zahlenstring[11+i*SIZE_DATA2]), &excelstring[len]);
                excelstring[len ++] = ';';
                len += num_2_str ((zahlenstring[12+i*SIZE_DATA2]*0x100+
                zahlenstring[13+i*SIZE_DATA2]), &excelstring[len]);
                excelstring[len ++] = ';';
                len += num_2_str ((zahlenstring[14+i*SIZE_DATA2]*0x100+
                zahlenstring[15+i*SIZE_DATA2]), &excelstring[len]);
                excelstring[len ++] = ';';
// enter set values from here
                len += num_2_str (SollTemp, &excelstring[len]);
                excelstring[len ++] = ';';
                len += num_2_str (SollCO2, &excelstring[len]);
                excelstring[len ++] = ';';
                len += num_2_str (SollO2, &excelstring[len]);
                excelstring[len ++] = ';';
```

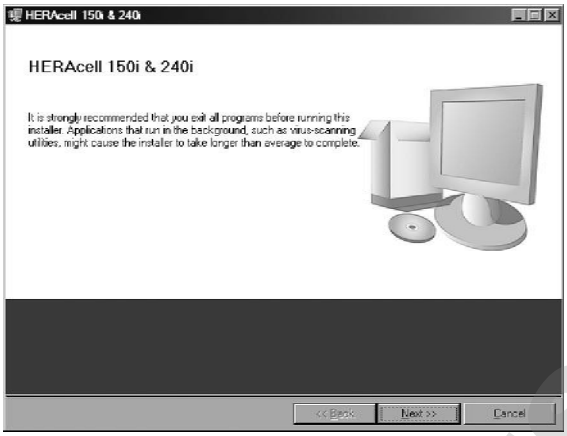
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```
            len += num_2_str (SollrH, &excelstring[len]);
            excelstring[len ++] = ';';
            excelstring[len] = '\n';
            len  += 1;
            WriteFile (FileHandle, excelstring, len);
            break;
// query the remaining events from here
            case EVENT_FORMAT_DATALOG:
                WriteFile (FileHandle, excelstring, len);
                WriteFile (FileHandle, "Data logger erased;\n",20);
                break;
            case EVENT_POWER_ON:
// update of set values
                SollTemp = zahlenstring[8+i*SIZE_DATA2]*0x100+
                zahlenstring[9+i*SIZE_DATA2];
                SollCO2 = zahlenstring[10+i*SIZE_DATA2]*0x100+
                zahlenstring[11+i*SIZE_DATA2];
                SollO2 = zahlenstring[12+i*SIZE_DATA2]*0x100+
                zahlenstring[13+i*SIZE_DATA2];
                SollrH = zahlenstring[14+i*SIZE_DATA2]*0x100+
                zahlenstring[15+i*SIZE_DATA2];
                WriteFile (FileHandle, excelstring, len);
                WriteFile (FileHandle, "Power on;\n", 10);
                break;
            case..
// query all events here (see „Overview of possible event entries in bit coding“ on page 177)
// cancel 0xFF indicates the end of the data logger
            case 0xFF:
            WriteFile (FileHandle, "End;\n",5);
        }
    }
return 0;
}
```

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13.8. Program *HERACELL® 150i / 240i*

The program provides a user surface (only with English menu designation) for handling the data communication between a device and a connected PC.

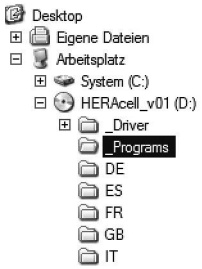


This program is used for:

- Reading and archiving error messages (error logger). The data sets are stored in the meta format *.CSV.
- Reading and archiving event entries (data logger). The data sets are stored in the meta format *.CSV.
- Creating a service file (servicefile) to be sent to the Technical Service of Thermo Fisher Scientific. The information of the service file is very useful for systematic troubleshooting. The data sets are stored in the proprietary format *.SRF.

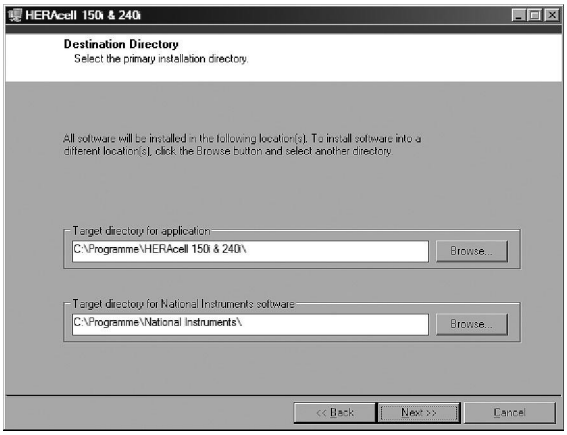
13.8.1. Installing the *HERACELL® 150i / 240i*

1. Starting the installation routine:
   – On the data CD in the subdirectory **PROGRAMS**, double-click on the file **SETUP.EXE** to open this file.



2. Locate the installation directory for the program.

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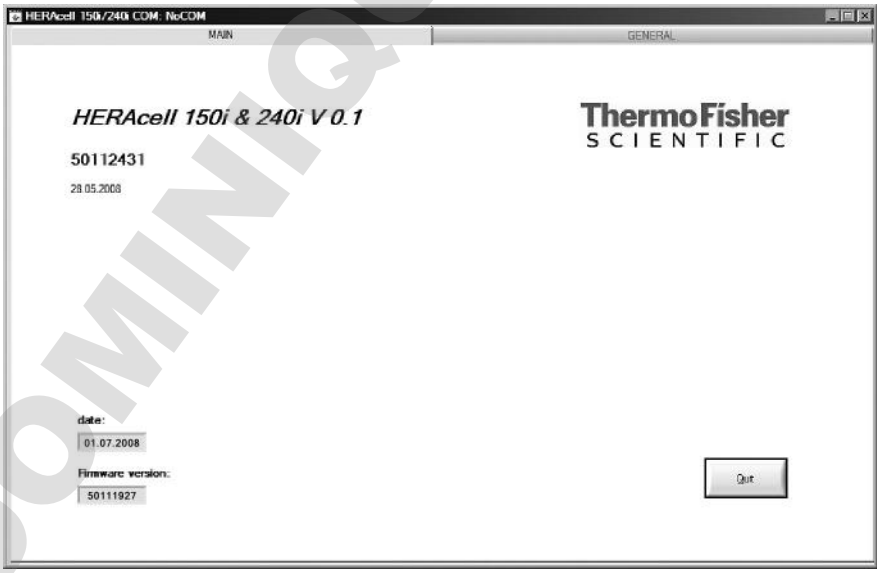
3. In the sequence of the given installation steps:
   – confirm the license agreement,
   – confirm the extent of installation,
   – after the message on the completeness of the installation has been displayed, close the installation surface and restart the computer.

13.8.2. Operating the *HERACELL® 150i / 240i*

User menu structure:

The user surface is divided into two main menus:

- MAIN with two functional elements:
  – Program version output **FIRMWARE VERSION**
  – Switch for exiting the program: **QUIT**



- GENERAL with the submenus:

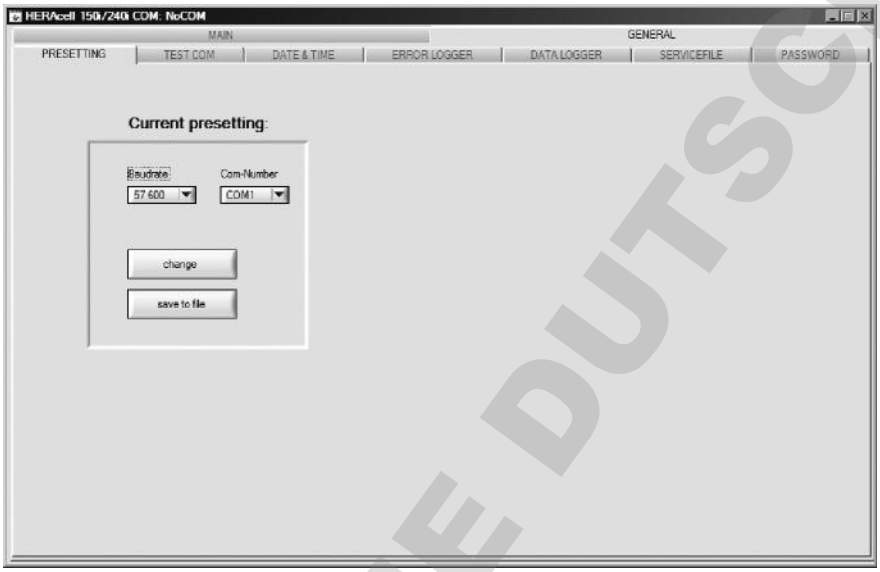
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– PRESETTING for setting the transmission speed and for selecting the serial port,
– TEST COM for testing the communication connection between PC and incubator,
– DATE & TIME for adjusting date and time to the desired time zone.
– ERROR LOGGER for reading the error messages,
– DATA LOGGER for reading the event entries,
– SERVICEFILE for reading error information and for creating a service file,
– PASSWORD to prevent access to the device parameters of the incubator.

Function of the user menu:

PRESETTING

The submenu PRESETTING is used to set the transmission speed and to select the serial port.



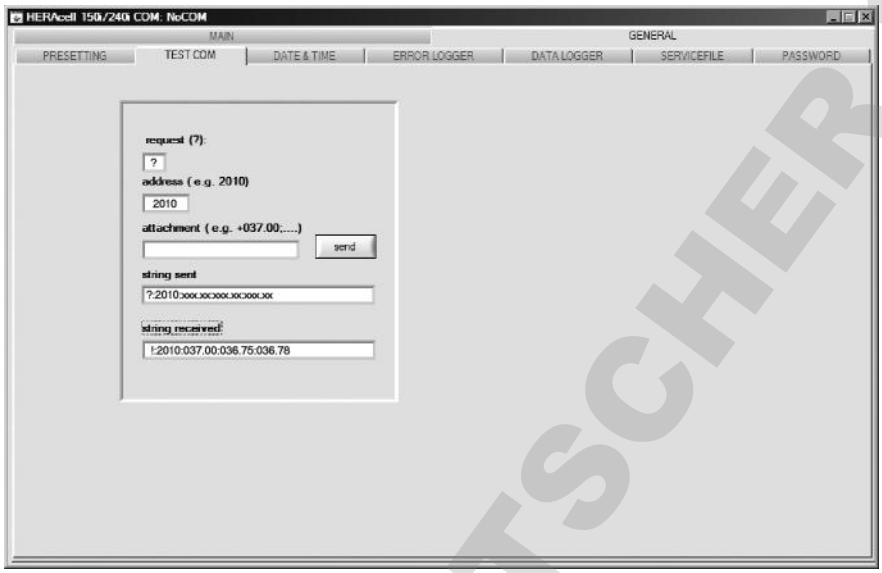
1. Select a transmission speed within the range of 9,600 to 115,200 baud.
2. Select the serial port of the PC. If the USB driver is installed, the (virtual) COM port assigned to the USB port can be selected (see ***„USB port (optional)“* on *page 165***).
3. Accept the settings:
4. Press the **CHANGE** button.
5. Save the settings (in an INI file):
6. Press the **SAVE TO FILE** button.

Note
Transmission speeds:
The transmission speed settings in the user menu PRESETTING and of the device must be identical!

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TEST COM

The submenu TEST COM is used for testing the communication connection with the settings defined in the submenu PRESETTING.



1. Example of a query for the currently measurable temperature values of the incubator:
   – Query: ? (default, not changeable)
   – Address: 2010 (temperature value address: Set value, actual value, reference value)
2. Send the query to the incubator:
3. Press the **SEND** button.
   – If the incubator returns a response string, the communication connection to the incubator has been established.
   – If a connection cannot be established, an error dialog is displayed:

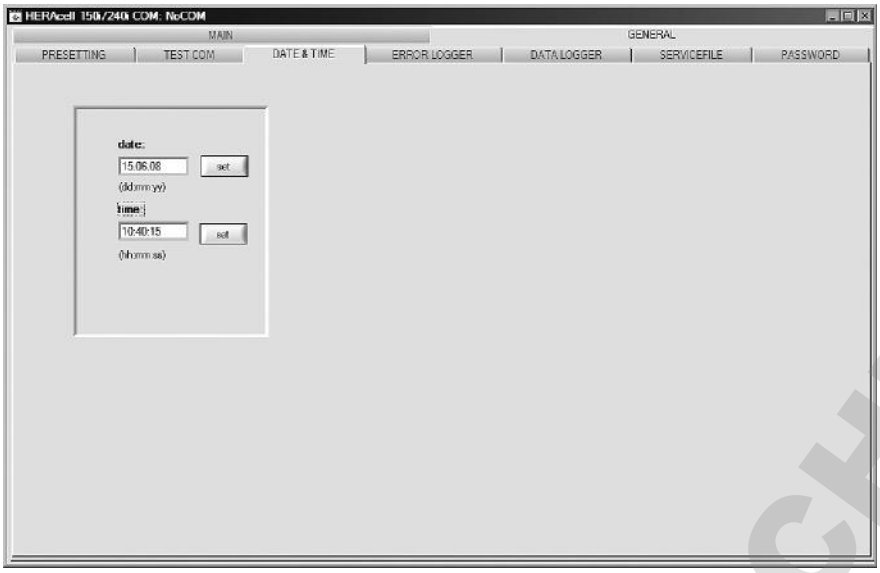


4. Exit the error dialog:
   – Press the **OK** button.

DATE & TIME

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The submenu DATE & TIME is used for adjusting date and time to the desired time zone.



1. Data in the two text boxes must be entered in the format DD.MM.YY (day, month, year).
2. Accept the input data:
   – Press the **SET** button.

ERROR LOGGER

The submenu ERROR LOGGER is used for reading the error messages into the text box of the user surface.



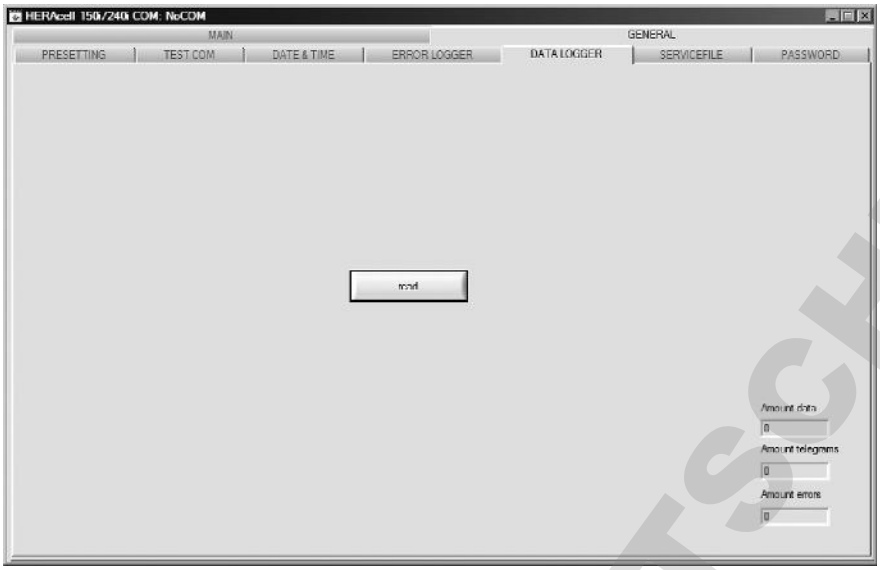
The data sets can be stored in the meta format *.CSV.

- Saving data sets as files:
  – Press the **SAVE TO FILE** button.

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DATA LOGGER

The submenu DATA LOGGER is used for reading the event entries into the text box of the user surface.



The data sets can be stored in the meta format *.CSV.

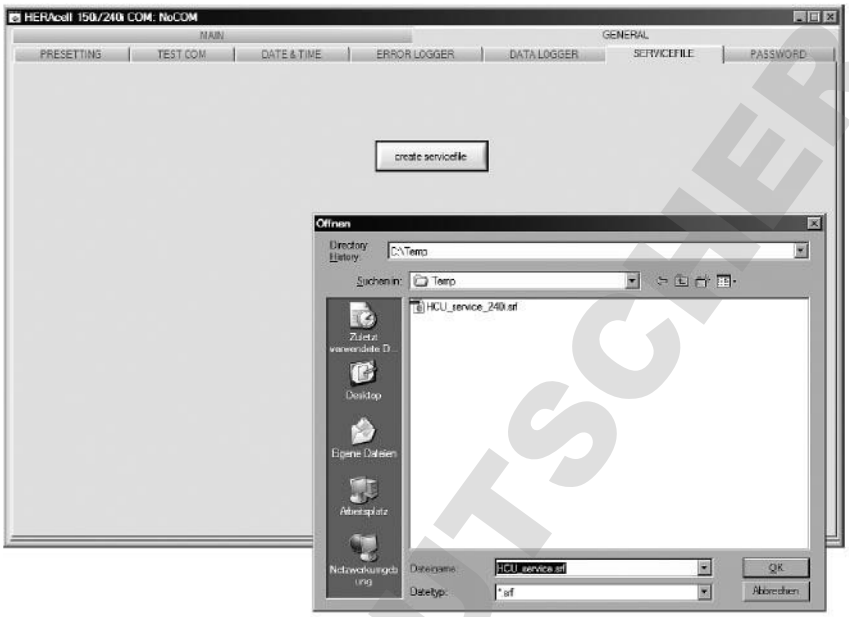
1. Read the data sets:
   – Press the **READ** button.
2. The progress of the data transmission is indicated in the three text boxes:
   – **AMOUNT DATA:** Total number of transmitted data sets.
   – **AMOUNT TELEGRAMS:** Therein the number of transmitted event entries.
   – **AMOUNT ERRORS:** Therein the number of transmitted error messages.

Note
Duration of the data transmission:
As the data logger can contain up to 10,000 data sets, the data transmission to a PC may take some time.

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SERVICEFILE

The submenu SERVICEFILE is used for reading error informations and for creating a service file from it, saved with the proprietary extension *srf. The service file is transmitted to the Technical Service of Thermo Fisher Scientific for fault analysis.



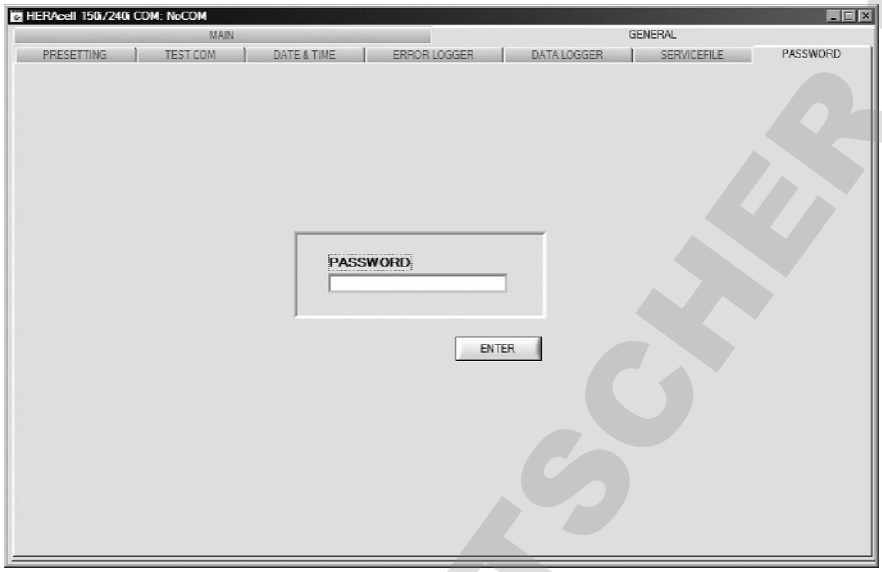
1. Create the service file:
   – Press the **CREATE SERVICEFILE** button.
   – Define file name and saving directory in the Windows dialog box.
2. Start saving process:
   – Press **OK** button.

Note
Duration of the procedure:
The compilation of device informations and the creation of the service file may take some time.

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PASSWORD

The submenu PASSWORD can only be accessed by the service personnel of Thermo Fisher Scientific.



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14. Device log

Please list carried out works here:

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

Work carried out	Notes	Date	Signature

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