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Cytoperm 2

Hot-Air Disinfectable Gassed Incubator

Operating Instructions

50048320 • Revision F • July 2023

ThermoFisher SCIENTIFIC

Preface

Postal address Germany

Thermo Electron LED GmbH
D - 63505 Langenselbold
Robert-Bosch-Straße 1

Enquiries from Germany

Phone

Sales 0800 1 536376
Service 0800 1 112110

Fax

Sales/Service 0800 1 112114

E-Mail
info.labequipment.de@thermo.com

Enquiries from Europe, Middle East and Africa

Tel. + 49(0) 6184 / 90-6940

Fax + 49(0) 6184 / 90-6772

E-Mail
info.labequipment.de@thermo.com

Postal address USA

Thermo Electron Corporation.
275 Aiken Road
Asheville, NC 28804
USA

Enquiries from North America

Phone + 1 800-879 7767
Fax + 1 828-658 0363

E-Mail
info.labequipment@thermo.com

Enquiries from Latin America

Phone + 1 828-658 2711

Fax + 1 828-645 9466

E-Mail
info.labequipment@thermo.com

Enquiries from Asia Pacific

Phone + 1 852-2711 391 0

Fax + 1 852-2711 3858

E-Mail
info.labequipment@thermo.com

Internet: www.thermofisher.com

As regards foreign-language translations, the German version of this instruction manual is binding.
This edition of the instruction manual applies to the Cytoperm 2 unit specified on the front page.

The safety concerning the protection of persons, environment and material to be treated mainly depends on the behaviour of the operating personnel of these units.

Please read and observe the following instructions carefully before starting the unit in order to avoid faults and resulting damage, especially adverse health effects.

Contents

General

Explanation of Icons in the Instruction Manual

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

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

Caution
Indicates a situation that could lead to property damage if it is not avoided.

In chapters of the instruction manual which deal with safety, this icon appears under the title of the chapter. Displayed on the equipment, this icon denotes that special attention must be paid to the information given in the instruction manual or accompanying documents.

Marks information in the instruction manual for optimizing use of the equipment.

“Water supply” vent/overflow

“Add/drain water” quick release coupling

Unit ON

Unit OFF

“Disinfection mode” key-operated switch

Marks information for higher surface temperature in the disinfection mode

Dangerous liquids

Risk of explosion

Explosion hazard

Suffocation

Hot surfaces!

Overtemperature protection, temperature limit controller

Selection of switching/interlocking functions

Error code enquiry / acknowledgment of “acoustic signal”

Control — “Change switching functions activated” display

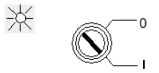
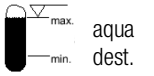
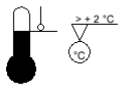
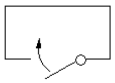
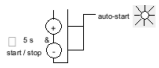
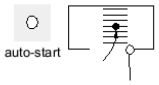
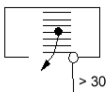
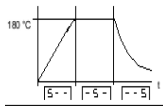
auto-start — Automatic startup of unit and calibration of measuring systems

auto-zero — “auto-zero” calibration active display

des — “Disinfection mode” display

Information on proper disposal / recovery of raw materials

Explanation of Icons to the Short Instructions

	Switch on unit (operate the main switch)
	Check the water level
	Set the temperature limit controller
	Close unit doors
	Read the operating instructions
	Start “disinfection routine”
auto-start 	automatical “auto-start”
	Open unit doors for at least 30 seconds
	Set the desired setpoints
	“activate” the auto-start
	End of the auto-start, bring in the samples
	Take out the samples, open unit doors for at least 30 seconds
	Flow chart of disinfection routine

General Instructions

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

Hot-air disinfectable fumigation incubators may only be operated by trained and authorized personnel.

Repairs to the fumigation incubator may only be carried out by trained and authorized specialist personnel.

For installation and operation, the respectively applicable national laws, regulations and guidelines must be observed.

When you have an enquiry, order replacement parts or file a complaint, please state the data on the nameplate and, if applicable, the fault code.

Equipment Log Book

We advise you to keep an equipment log book.

Keep a record of inspections and testing, calibration work and any major work carried out on the unit - such as maintenance, agents loaded, etc. - in this log book (refer to ***“Appendix”***).

Operating Instructions

The operator (employer) is expected to provide anyone who works on or with the equipment with written instructions, based on this instruction manual, for the tasks to be performed. These instructions should be easy to understand and in the language of the persons operating the equipment.

This also applies to disinfecting and cleaning the unit (also refer to ***“Maintenance”***).

For translations into foreign languages, the German version of these operating instructions is binding.

Store the operating instructions near the gassed incubator so that safety instructions and important operating information can always be consulted.

If you have any questions that you feel are not dealt with sufficient details in this manual, please contact Thermo Electron LED GmbH for your own safety.

Areas of Application

Intended Use

The Cytoperm 2 gassed incubator is an item of laboratory equipment for cell and tissue cultures and can be used to simulate the physiological environmental conditions of cells.

The unit is generally suitable for setup and operation in the following areas:

- In laboratories for microbiological and biotechnological work.
- Laboratories operating at safety levels L1, L2 and L3.

Only organisms which comply with the requirements for safety levels L1, L2 and L3 may be handled in the unit.

The unit must be set up and operated in accordance with all applicable regulations in your country.

It is not permitted to handle gases or agents whose vapours are combustible or can form a hazardous, potentially explosive atmosphere when mixed with air. Be sure to comply with the applicable regulations in your country.

Incorrect Use

To avoid the risk of explosion do not load the incubator with tissue, material, or liquids that:

- are easily flammable or explosive,
- release vapor or dust that forms combustible or explosive mixtures when exposed to air,
- release poisons,
- release dust,
- exhibit exothermic reactions,
- are pyrotechnical substances.

Refrain also from pouring any liquids onto the internal base plate or inserting bowls filled with liquids into the sample compartment.

Directives and Standards

The device complies with the following standards and directives:

- DIN EN 61010 - 1, DIN EN 61010 - 2 - 010
- EN 61326 -1
- EN 50581
- RoHS Directive 2011/65/EU
- Low Voltage Directive 2014/35/EU
- EMC Directive 2014/30/EU
- China EEP information about hazardous substances http://www.thermofisher.com/us/en/home/technical-resources/rohs-certificates.html

In addition, the vapor admission breeding cabinet complies with many other international standards, regulations and guidelines which are not listed here. If you have any questions regarding compliance with the national standards, regulations or guidelines for your country, please contact your nearest Thermo Fisher Scientific sales organization.

For other countries, the applicable regulations are binding.

Safety Instruction

- 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 Scientific 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.
- To maintain the temperature protection function, the functioning of the overtemperature protection device, temperature limit controller must be checked at reasonable intervals.
- Only original replacement parts authorized by the manufacturer are to be used.
- Refer to ***"Basic Rules of Sound Microbiological Engineering Practice*"***.

Safety Notes on Gases

Note

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)

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

Oxygen explosion!
Oxygen (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 the 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!

Fire hazard!
Released oxygen (O_2) 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!

Operational Safety Rules

The following instructions must be observed when working with the Cytoperm 2 hot-air disinfectable vapor admission breeding cabinet:

- Observe the sample weight limits specified for your device as a whole and its shelving in particular; refer to page 47).
- 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 hot-air disinfectable vapor admission breeding cabinets with substances which exceed the capabilities of the available laboratory apparatus and personal protective equipment to provide sufficient protection to users and third parties.
- Check the door seal every six months for proper sealing performance and possible damage.
- Do not process samples containing chemical substances hazardous to health which may be released to the ambient air through leaks in the device or which may cause corrosion or other types of damage to parts of the hot-air disinfectable vapor admission breeding cabinet.
- Tempering of defined substances or materials with a high moisture content may result in excessive formation of condensate in the chamber. The measures noted on page 24 must be taken.

Instruction of the Operating Personnel

These operating instructions describe the Cytoperm 2 hot-air disinfectable vapor admission breeding cabinet. The vapor admission breeding cabinet has been manufactured in line with the latest technological standards and has been tested for proper function prior to shipping. 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 for the sake of accident prevention:

- The CO_2 incubator must be operated only by trained and authorized personnel.
- The present operating instructions, applicable safety data sheets, plant hygiene guidelines and the corresponding technical rules issued by the operator shall be used to create written procedures targeted at personnel working with the subject matter device, detailing:
  - which protective measures apply when specific agents and pressurized gas containers are used,
  - the measures to be taken in case of accidents.
- Repairs to the device must be carried out only by trained and authorized expert personnel.

Warranty

Thermo Electron LED GmbH warrants the operational safety and function of Cytoperm 2 hot-air disinfectable vapor admission breeding cabinets 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 devices are not modified,
- only original spare parts and accessories that have been approved by Thermo Electron LED GmbH are used (third-party spares without Thermo Scientific approval void the limited warranty),
- inspections and maintenance are performed at the specified intervals,
- an operation verification test is performed after each repair activity.

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

Delivery

Packaging

Cytoperm 2 hot-air disinfectable vapor admission breeding cabinets are supplied in sturdy packaging. All packaging materials can be separated and are reusable:

Packaging materials

Packaging carton	Recycled paper
Foam elements	Styrofoam (CFC-free and HCFC-free)
Pallet	Chemically untreated wood
Packaging film	Polyethylene
Packaging ribbons	Polypropylene

Scope of Supply

Quantity of components supplied (pieces)	Cytoperm 2
Perforated shelves	2
Support rail for shelf	2
Shelf support	4
Power supply cable	1
Connector, potential-free contact	1
User Manual	1
Summarized Safety precautions	1

Acceptance Inspection

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

- for completeness,
- for 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.

Warning
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 device. For example, have them wear protective gloves and other personal protection equipment.

Setup and Installation

When setting up, installing and operating the unit, be sure to comply with all applicable regulations in your country.

Transport

water

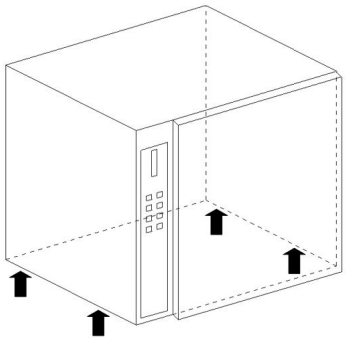


Fig. 1. Lifting points

Handle the unit with care during transport. Do not lift up the unit by its door. Refer to ***"Technical Specifications"*** for weights and dimensions.

Warning
Heavy loads!
Be careful when lifting!

To avoid overload-related injuries, For example, strains and disc damage, never try to lift the gassable incubator alone!
To avoid injury from falling loads, always wear personal protective equipment when lifting the humidification incubator. B. safety shoes. To avoid crushing the fingers or hands (especially by pinching when closing the door) or damaging the humidification incubator, only use the lifting points shown in the figure above.

Caution
Humidity

A drying procedure must be performed following transport or storage under damp conditions. During the drying procedure it cannot be assumed that the device will fulfill all of the safety requirements laid down in IEC 61010. The drying-out period is approx. 2 hours.

Place of Installation

To avoid or at least minimize deviations from the technical specifications, the temperature at the place of installation must be in the range +18 °C to +30 °C.

Attention

The place of installation must be dry and draught-free.

Ambient temperatures outside the specified range can interfere with the proper function of the vapor admission breeding cabinet. As a result the incubation temperature and temperature distribution may be incorrect or impaired.

- The installation location must be dry and free of drafts.
- Do not operate the device in room recesses without ventilation.
- Set up the device on a firm, non-flammable surface (laboratory bench, base frame). Ensure that no flammable materials are located at the rear wall of the device.
- Set up the device in such a manner as to ensure a level, secure stand. Do this by using a stable, vibration-free support (base frame, laboratory bench) which is capable of withstanding the weight of the device plus load.

Warning
Contamination hazard!

Never operate the vapor admission breeding cabinet directly on the laboratory floor; instead, set it down on a base frame (optional; must be ordered separately) or on an area of the laboratory bench.
Contaminants, such as bacteria, viruses, fungi, prion, and other biological substances may use the open door to migrate easily from the floor into the device`s work space.

- The vapor admission breeding cabinet is designed to operate at altitudes up to 2000 m above sea level.
- Do not cover or block the air intake and outlet openings of the device (observe minimum clearances, refer to ***"Clearances"***).
- CO_2, O_2 and/or N_2 are supplied to the vapor admission breeding cabinet. CO_2 gas is hazardous to health and O_2 gas promotes fire. For this reason the installation location must provide sufficient ventilation.
- A venting system must be provided to ensure safe evacuation to the outdoors of the gases which exit the pressure relief valve at the rear of the device.
- When several devices are to be placed in the same room, additional ventilation may have to be provided as necessary.
- To avoid any impact of the heat dissipated by the device on the ambient climate the room must be vented by means of a laboratory-grade ventilation system that complies with applicable local and national health and safety regulations and has sufficient capacity.
- 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.
- Information on gas flow rates during operation are given in the attachment.
- The device must not be exposed to direct sunlight.
- Devices that produce excessive amounts of heat must not be placed near the device.
- 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 system. The impulse withstand voltage based on surge category II of IEC 60364-4-443 shall be applied at the nominal voltage level.
- The maximum permissible relative humidity is 70 % (at an ambient temperature of 28 °C, non-condensing).
- Condensation must be avoided—for example, after moving or transporting the device. Should condensation exist, wait until the moisture has evaporated completely before connecting the device to a power source and powering up.

  Attention
  Humidity

  A drying procedure must be performed following transport or storage under damp conditions. During the drying procedure it cannot be assumed that the device will fulfill all of the safety requirements laid down in IEC 61010-2-010. The drying-out period is approx. 2 hours.

- In order to prevent multiple device failures in the event of a short circuit, consider installing a separate circuit breaker switch for each vapor admission breeding cabinet.

Intermediate Storage

If the vapor admission breeding cabinet is placed in intermediate storage (permissible for no more than four weeks) ensure that the ambient temperature remains between 20 °C and 60 °C (68 °F and 140 °F) and relative humidity does not exceed 90 %, non-condensing.

Warning
Contamination hazard!

Never operate the vapor admission breeding cabinet directly on the laboratory floor; instead, set it down on a base frame (optional; must be ordered separately) or on an area of the laboratory bench. Contaminants, such as bacteria, viruses, fungi, prion, and other biological substances may use the open door to migrate easily from the floor into the device`s work space.

Stacking

The unit is not suitable for stacking when operated in the manner intended.

Clearances

When setting up the unit, the minimum clearances between the unit and adjacent surfaces and other units must be maintained.

Larger clearances are recommended to facilitate accessibility for installation and the supply connections.

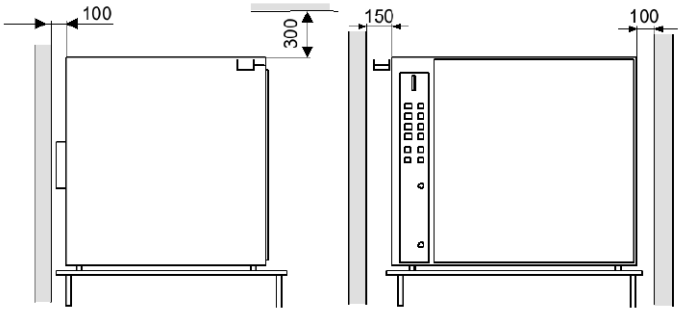


Fig. 2. Minimum clearances in mm

Supply Connections

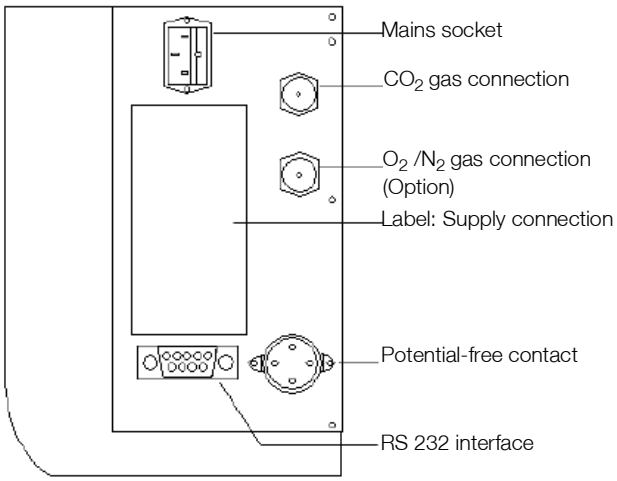


Fig. 3. Supply connections (rear panel of unit)

Mains connection

1. Prior to connecting the unit to the mains, make sure that the power supply ratings match those stated on the nameplate. If the voltage (V) and current (A) ratings given are not as required, do not connect the device to the power source!
2. Connect the IEC connector to the socket at the rear of the oven.
3. Route the power cable so as to avoid crossing hot surfaces (such as exhaust air piping), tables or passage ways.
4. Connect the protection-earthed plug of the power cord to a correctly protection-earthed and earth leakage circuit breaker fused power socket.
5. Make sure the power cord is not subjected to tensile or compressive force.

Fuse protection required:

- Use a type B 16 circuit-break switch or a type T 16 A fusible cutout.

Refer to the Chapter ***"Technical Specifications"*** for unit power consumption.

Keep the power outlet accessible!

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

Attention
It is not permissible to replace removable electric cables with cable of insufficient capacity.

Note: To ensure safe operation of the instrument, use the original power cord. For questions and requirements, contact your Thermo Fisher Service Organization.

Gas supply connection

The gas connections are located on the rear side of the device.

Gas must be supplied via a pressure regulator set to deliver a maximum inlet pressure of 0.8 to 1 bar. For safety reasons this setting must remain unchanged.

The gases must have at least 99.5 % purity. If several units are placed in the same room, special ventilation measures are required.

- CO_2-gassing
  Connect the gas cylinder to the gas nozzle on the unit.

- O_2/N_2-gassing (optional)
  If you intend to run the unit with an oxygen content above 21 %, connect an oxygen cylinder.
  If you intend to run the unit with an oxygen content less than 21 %, connect a nitrogen cylinder.
  To deactivate the oxygen control, set the nominal value to 21.0 % (average oxygen content of ambient atmosphere).

RS 232 interface

Connection of the vapor admission breeding cabinet to a computer via RS-232 may be performed only by trained and authorized specialist electrical or telecommunications personnel.

The RS-232 data communication interface supports the querying of operating status and temperature data from the vapor admission breeding cabinet by entering basic commands in a standard terminal window provided by your computer's operating system. The connection requires a standard RS-232 cable with 9-pin connectors and one-to-one contacts. This cable is not included in the scope of supply of the vapor admission breeding cabinet.

Users may employ the RS-232 command inventory listed in the table below for automating process data logging - for example, by embedding these commands in scripts that run on a remote computer.

Attention
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.

Connecting the vapor admission breeding cabinet to a computer

1. Turn the computer off.
2. Route the serial interface cable along a path that does not cross hot exhaust air piping, tables, aisles or passageways.
3. Plug one end of the serial interface cable (cable length 5 to max. 10 m, not included in the scope of supply) into the socket in the computer and alarm interface section on the rear side of the vapor admission breeding cabinet.
4. Connect the second connector to an unassigned serial port COM1/COM2 etc. at the PC.
5. Boot the computer.
6. Launch your standard terminal program and set up the connection with the following parameters:
   - 57600 bits per second
   - 8 Data bits
   - 1 Stop bit
   - No Parity
7. Once your terminal indicates that serial communication has been established successfully, enter any of the commands listed in the table below, depending on what type of information you want to query.
8. Use the following generic command syntax:

   ?:aaaa:bb::cc<CR>, where:
   - **?:** identifies the command line as a query;
   - **aaaa:** is the parameter address;
   - **bb::** is a query, that must be left at "00" for technical reasons;
   - **cc** is for a command - specific checksum listed in the table below;
   - **<CR>** is for carriage return.

You will receive a response of the following general format::

!:aaaa:bb:XXXXX:cc<CR>, where:

- **!:** identifies the line as a response to a query;
- **aaaa:** is the parameter address entered with the query;
- **bb:** is the number of payload bytes in hexadecimal code - for example, 1F for the decimal value 31;
- **XXXXX:** XXXXX: is the significant status information queried;
- **cc:** is a check sum (technically an inverted XOR of all bytes returned, excluding the check sum bytes and the <CR> character);
- **<CR>** is for carriage return.

Command Syntax	Response Example
Combined Date and Time	
?:0010:00::c1	**!:0010:11:31.07.10;01:02:23:e2** **Date Time**
Date only	
?:0011:00::c0	**!:0011:08:31.07.10:d2** **Date**
Time only	
?:0012:00::c3	**!:0012:08:01:02:23:dc** **Time**
Temperature Set Value (T1); Current Work Space Temperature (T2); Reference Temperature (T3); Temperature Sample Sensor (T4)	
?:3010:00::c2	**!:3010:1f:+125.00;+124.96;+000.000;+000.00:b0** **T1 T2 T3 T4**

“Potential - free contact” connection

Skilled Work

Thermo Scientific ensures the safety and functionality of the humidification incubator only if installation and repair work is performed properly. The connection of the humidification incubator to an external alarm system may only be carried out by trained and authorized specialist personnel in the electronics / telecommunications sector!

Function Description

When system errors and errors occur in the temperature control circuits, an alarm message is sent to the connected signaling / monitoring system. The potential-free contact (1 changeover contact) is dimensioned for the following specified circuits:

Switching behavior

The alarm relay switches on all errors reported by internal control circuits.

Circuit	Voltage	Fuse to be installed by customer
Mains-operated circuits	**max. 250 V AC**	**max. 6 A**
SELV / SELV - E - circuits	**25/50 V AC**	**max. 2/1 A**
(cf. VDE 0100 Part 410)	**60/120 V DC**	**max. 1/0.5 A**

Attention
Notes on the electrical connection values of the alarm contact.
To avoid overload conditions and damage to the alarm contact, the compatibility of the electrical connection values of the alarm monitoring system with the technical data of the alarm relay specified above must be checked!

Power failure

If the potential-free contact reports a power failure, no indication appears and the switch does not light up.

Connection example

The connector for connecting the connection cable is included in the scope of delivery of the gassable incubator. The values for the operating voltage and protection of the external circuits of the signaling system are described in the table.

1. Connect the individual wires [1] to [3] of the connection cable according to the assignments in the power connection diagram.
2. Lay the alarm cable so that it does not cross any possible hot surfaces (eg exhaust pipes), tables or passages.
3. Insert the plug of the alarm cable to the external alarm system into the interface on the back of the humidification incubator.

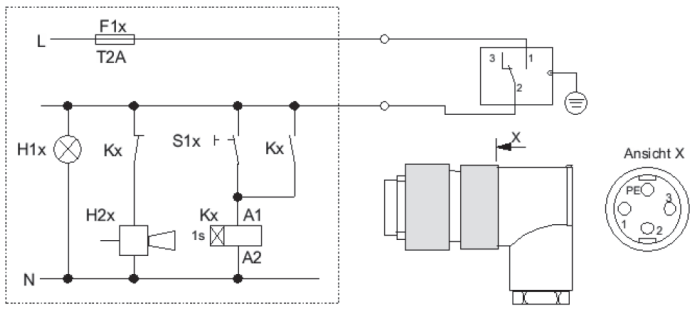


Fig. 4. Application example of “Potential - free contact” connection

The circuit diagram represents the normal operation. In the event of an error, the contacts 1-3 are closed. A power failure also represents an error.

Description of the Unit

Leveling the Shelves

The shelves can be aligned with the aid of a spirit level with height-adjustable feet.

Functional Principle

The atmosphere in the chamber can be regulated in relation to its temperature, CO_2 concentration, O_2 concentration (optional) and relative humidity.

Heating System

The temperature inside the unit can be regulated in the range of +7 °C to +50 °C, but must be at least +5 °C (approx. +7 °C for the O_2 version) above the ambient temperature of the unit. Condensation on the glass door is largely prevented by heating the unit door. If the unit door is left open for a long period of time, however, condensation cannot be ruled out.

The unit door heater can be switched off as required (refer to Chapter 9,“Operation”). This enables the unit to be operated at high ambient temperatures or when the operating temperature is only supposed to exceed the ambient temperature by approx. +4 °C (approx. +6 °C for the O_2 version).

Example:

Ambient temperature	Operating temp.	Heating of unit door
+25 °C	+37 °C	ON
+24 °C	+24 °C	OFF
+32 °C bis +33 °C	+37 °C	OFF

Gassing

Connection to the gas supplies (CO_2, O_2 or rather N_2) are located on the rear panel of the incubator.

The CO_2 content of the atmosphere in the chamber can be regulated in the range 0 % to 20 %.

- The O_2 concentration inside the unit can be regulated in the range 3 % to 90 % O_2 by admitting N_2 (< 21 % O_2) or O_2 (> 21 % O_2).
- The sum of the nominal values for CO_2 + O_2 must not exceed 90 %.

Example: 10 % CO_2 + 80 % O_2 = 90 % (possible)

20 % CO_2 + 80 % O_2 = 100 % (impossible)

Before entering the chamber, all gases pass through a filter where particles larger than 0.3 µm are retained. Filter efficiency is 99.998 %.

A fan integrated in the rear of the interior wall ensures that the gasses and the incubator atmosphere are thoroughly mixed.

The sensors for CO_2, O_2 (option) and relative humidity are also located on the rear panel of the interior wall. These sensors measure the parameters inside the unit and transmit corresponding signals to the closed-loop controller.

A pressure compensation vent on the rear panel of unit avoids undesirable pressure build-up inside the unit during the admission of gases.

Warning

The place of installation must be thoroughly ventilated in order to expel the gases escaping around pressure compensation vent.

Humidification

The atmosphere in the chamber is humidified through the admission of steam generated in a active humifier. Relative humidity (rH) can be regulated between 60 % and 95 %.

To ensure reliable operation of the steam generator, only fill the reservoir with fully desalinated or distilled water!

Attention! Do not put drinking water or ultrapure water into the moisture tank!

It is recommended that distilled water or treated water of comparable quality be used in the integrated moisture tank. The permissible conductivity should lie between 1 and 20 µS/cm (resistivity should lie between 50 kohm cm and 1 Mohm cm). The pH should range between 7 and 9. Type 1 ultrapure water or deionized water (DI) with a specific resistivity of 18.2 Mohm cm contains very few ions and actively draws ions out of internal components. This causes damage to stainless steel, copper and glass. If only DI or Type 1 water is available, one option is to add a weak, sterile sodium carbonate solution in order to increase pH and add ions (84 mg/l (1 mM)) is recommended).

Attention! Do not put drinking water or ultrapure water into the moisture tank!

Although stainless steel is corrosion resistant it is not corrosion-proof. Many chemicals have a negative effect on stainless steel, particularly chlorine and its oxidizing derivative. It is not recommended to add disinfectants containing chlorides or copper sulfate to the water for use as long-term disinfecting agent, as these may damage the drain joint connector, which is made of a steel/copper alloy. In cleaning the interior a mild water/soap solution is recommended to remove residues. Wipe the interior surfaces and parts with a dilute quaternary ammonium disinfecting agent. Then wipe with 70 % alcohol to remove all remaining traces of the disinfectant.

The capacity of the reservoir is approx. 4.7 L (difference between min. and max. levels: 2.2 L).

Attention

Electric Shock!

Fill the water tank only up to the maximum level. An overfilled water tank is a hazard to the user (electric shock) and can result in damage to the device (short circuit).

Door Switch

The heating system, gas supply and humidifier are switched off when the unit door is opened.

The unit door can only be closed when all glass doors are sealed properly. If the unit door is not properly closed while the unit is in operation, a visual alarm is given (all LEDs flashing). If the door is open for longer than 10 minutes, an acoustic alarm sounds when this monitoring function is activated by way of function level 1 (refer to ***"Switching Function: Acoustic Alarm ON/OFF"***).

Internal Fittings

Pull-out shelves, with support brackets to prevent tilting, are arranged inside the units. The support can be offset in the carrier racks at intervals of 46 mm.

Six-Piece Gas-Tight Glass Screen

By virtue of the small vent cross-section, unnecessary cooling and discharge of the atmosphere in the chamber is largely avoided when a glass door is opened of the six-piece gas-tight glass screen.

Lockable Outside Door

The outside door is lockable.

Disinfection Routine

This routine is for disinfecting the interior of the unit. In this process, the unit is heated to 180 °C and kept at the disinfection temperature for approx. 3 hours. The unit is then automatically cooled down again and the nominal values for temperature, gases and relative humidity are reset. The entire procedure lasts approx. 13 hours, after which the unit is ready for operation again.

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 workspace become extremely hot during the disinfection routine.
During the routine run or immediately after completion of the run, always wear safety gloves when touching these surfaces.

“Potential - Free Contact” Connection

Connection for the customer's own signaling system, e.g. telephone system, building services management systems. If the overtemperature-protection device trips or an error is detected by the diagnosis system, a fault message is sent to the customer's own signaling system.

Temperature Safety Device (Over Temperature Controller, OTC)

A class 3.1 overtemperature controller in accordance with DIN 12880 is installed as a temperature safety device. When ready for operation it assumes the control function when the preset temperature is exceeded.

Operate

Switch Panel

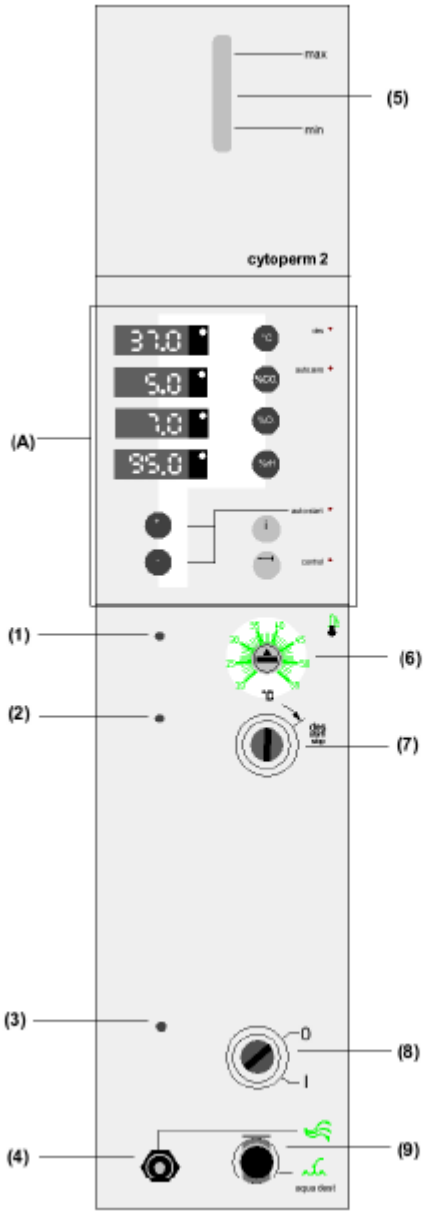


Fig. 5. Switch Panel

(A)	“Control and display panel” (refer ***Figure 10***)	
(1)	Indicator lamp	“Fault, overtemp. protection”
(2)	Indicator lamp	“Disinfection mode”
(3)	Indicator lamp	“Master Switch”
(4)	Vent/overflow	“Water Supply”
(5)	Level gauge	“Water Supply”
(6)	Setting knob	“Temperature protection device”
(7)	Key-op. switch	“Disinfection mode”
(8)	Master switch	(key-operated switch)
(9)	Quick-release coupling	“Add/drain water”

Water Supply

Level gauge (5)

- Indicates the water level.
- The water level should be in the range between “min and max”. This range is equivalent to a volume of 2.2 L. If the water supply falls below the “min.” level, a reserve of 0.5 L. is still available.

Filling the water reservoir

Caution

Electric shock

Fill the water tank only up to the maximum level. An overfilled water tank is a hazard to the user (electric shock) and can result in damage to the device (short circuit).

Attention
Refilling the water supply

Make certain that the water level in the water storage tank is checked and replenished at regular intervals. If the water tank contains too little water or is empty this impairs the incubation function.

For humidification of the incubator, water of the following quality must be used:

- Demineralised water that has been sterilized.

  or

- Sterile water that has been demineralised. Distilled or autoclaved water is suitable.

Attention! Do not use disinfectants containing chlorides!

Although stainless steel is corrosion resistant it is not corrosion-proof. Many chemicals have a negative effect on stainless steel, particularly chlorine and its oxidizing derivatives.
It is not recommended to add disinfectants containing chlorides or copper sulfate to the water for use as long-term disinfecting agent, as these may damage the drain joint connector, which is made of a steel/copper alloy.
In cleaning the interior a mild water/soap solution is recommended to remove residues. Wipe the interior surfaces and parts with a dilute quaternary ammonium disinfecting agent. Then wipe with 70 % alcohol to remove all remaining traces of the disinfectant.

Attention! Do not put drinking water or ultra-pure water into the moisture tank!

It is recommended that distilled water or treated water of comparable quality be used in the integrated moisture tank. The permissible conductivity should lie between 1 and 20 µS/cm (resistivity should lie between 50 kohm cm and 1 Mohm cm). The pH should range between 7 and 9. Type 1 ultrapure water or deionized water (DI) with a specific resistivity of 18.2 Mohm cm contains very few ions and actively draws ions out of internal components. This causes damage to stainless steel, copper and glass. If only DI or Type 1 water is available, one option is to add a weak, sterile sodium carbonate solution in order to increase pH and add ions (84 mg/l (1 mM)) is recommended).

Fill the canister with the water and leave the screw cap off. Hang the canister on the bracket located on the upper left of the incubator. (“**Figure 1**”) Connect the tubing connector (“**Figure 1**”) into the quick fit coupling, the water reservoir will be filled under the force of gravity. Should the water not flow, there may be an airlock in the tube, in which case press on the tube bulb to move the air through.

Attention!
If the reservoir is overfilled the excess water any will flow from the overflow pipe.

After filling place the filling canister on the floor and allow water in the filling tube to return to the canister before removing the quick fit connection. (“**Figure 2**”).

Attention!
After filling completely empty and dry the filling canister, store the canister dry to prevent the formation of contamination.

Fig. 6. Filled Cannister

Fig. 7. Run water back

As the outlet not only functions as an overflow but also as a vent, it must be unsealed while the unit is in operation.

Mains Switch

0 Unit OFF

I Unit ON (the green indicator lamp (3) indicates that unit is ready for operation).

Fig. 8. Mains Switch (8)

The power switch must not be used to disconnect the device from the electric power supply. Disconnection must be made by pulling out the power plug, which must be easily accessible at all times.

Temperature Protection Device (Temperature limit, Controller)

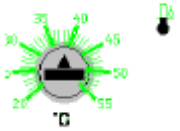


Fig. 9. Temperature limit controller (6)

A temperature protection device is built into the unit and acts as a temperature limit controller. It conforms to Thermal Safety Class 3.1 to DIN 12880 Part 1/11.78. In a functional state, the temperature limit controller assumes the control function if the set temperature is exceeded.

The red indicator lamp (1) “Fault” lights up as soon as the temperature limit controller responds.

The cutout temperature of the temperature limit controller can be adjusted in the range +20 °C to +55 °C using a coin or screwdriver.

Attention
Have your temperature protection device tested for proper operation at reasonable intervals. This applies in particular before prolonged work processes.

Operational Test

Condition: Nominal temperature (controller) reached/ constant.

To run this test, turn the dial on the Temperature Limit Controller so that it shows approx. +5 °C less than the temperature indicated on the temperature controller.

If the Temperature Limit Controller responds and the red indicator lamp (1) “Fault” comes on, the Temperature Limit Controller is operating properly.

Now set the Temperature Limit Controller to the required value depending on the max. cutout temperature.

- If the Temperature Limit Controller is set to the upper temperature limit, it assumes the function of unit protection (protection of unit and surroundings).
- If the Temperature Limit Controller is set to approx. +2 °C above the nominal temperature set at the temperature controller, it assumes the function of load protection of unit, its environment and loaded material).

The load protection function is only effective above room temperature.

If “Fault” is displayed during operation:

- Check the settings on the Temperature Limit Controller and the controller, and correct them if necessary. If the fault cannot be rectified, contact our service department.

Control and Display Panel (A)

Microprocessor-controlled controller with digital temperature, CO_2, O_2 (optional) and relative humidity displays.

The controller has the following functions:

- Temperature “set, display and control”
- CO_2 concentration “set, display and control”
- O_2- concentration “set, display and control” (OPTIONAL)
- Relative humidity “set, display and control”
- Error code “scan”
- Auto-start function “activate”
- Switching functions
  - Acoustic alarm “switch ON/OFF”
  - Humidification “switch ON/OFF”
  - Manual calibration of CO_2 measuring system “execute”
  - Setpoint lock-in “select ON/OFF”
  - Door heater “switch ON/OFF”

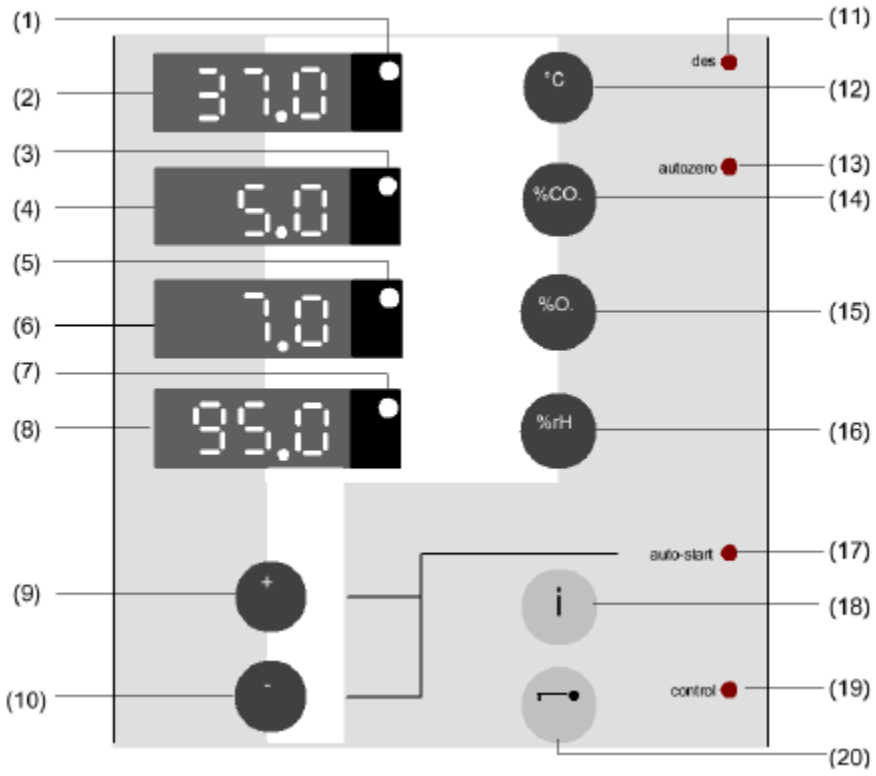


Fig. 10. Control and Display Panel (A)

(1)	Indicator lamp	"HEATING"	(11)	Indicator lamp	"Disinfection mode"
(2)	Display	"Temperature"	(12)	Key	"Temperature setpoint"
(3)	Indicator lamp	"CO_2 GASSING"	(13)	Indicator lamp	"auto-zero"
(4)	Display	"CO_2 concentration"	(14)	Key	"CO_2-setpoint"
(5)	Indicator lamp	"O_2/N_2 GASSING" (Optional)	(15)	Key	"O_2-setpoint" (Optional)
(6)	Display	"O_2 concentration" (Optional)	(16)	Key	"Relative humidity setpoint"
(7)	Indicator lamp	"HUMIDIFICATION"	(17)	Indicator lamp	"auto-start"
(8)	Display	"Relative humidity"	(18)	Key	"Error code inquiry" / Start calibration routines
(9)	Key	"Increase reading"	(19)		"Control"
(10)	Key	"Decrease reading"	(20)	Key	"Switching functions"

In its as-delivered condition, the unit is preset to the following values:

Temperature:	**37.0 °C**
CO_2-concentration:	**0.0 %**
O_2-concentration:	**21.0 % (option)**
Relative Humidity:	**60.0 %,** Humidity control activated via function level 2

Setting the Temperature Setpoint

Instruction	Entry / Keys / Remarks	Display / Remark/ Status
Switch on unit (master switch = "I")	VAll display elements come on for approx. 15 seconds. - Auto-test of controller -	Example: 
Display temperature setpoint	°C Press	Actual setpoint is displayed and decimal point flashes
Select temperature setpoint	°C & + Press	Setpoint increases
	°C & - Press	Setpoint decreases
Adopt NEW temperature setpoint	°C Release	Temperature inside unit is displayed

Setting the CO_2 Setpoint

Instruction	Entry / Keys / Remarks	Display / Remark / Status
Display CO_2 Setpoint	%CO_2 Press	Actual setpoint is displayed and decimal point flashes
Select CO_2 Setpoint	%CO_2 & + Press	Setpoint increases
Select temperature setpoint	%CO_2 & - Press	Setpoint decreases
Adopt NEW CO_2 setpoint	%CO_2 Release	CO_2- Concentration inside unit is displayed

Setting the O_2- Setpoint (Optional)

Instruction	Entry / Keys / Remarks	Display / Remark / Status
Display O_2 Setpoint	%O_2 Press	Actual setpoint is displayed and decimal point flashes
Select O_2 Setpoint	%O_2 & + Press	Setpoint increases
	%O_2 & - Press	Setpoint decreases
Adopt NEW O_2 setpoint	%O_2 Release	O_2- Concentration inside unit is displayed

The control is deactivated when the unit is set for 21 % O_2 since this corresponds to the O_2 content of air.

Setting the Relative Humidity Setpoint

Instruction	Entry / Keys / Remarks	Display / Remark / Status
Display the relative humidity setpoint	rH Press	Actual setpoint is displayed and decimal point flashes
Set the relative humidity setpoint	rH & + Press	Setpoint increases
	rH & - Press	Setpoint decreases
Adopt NEW the relative humidity setpoint	rH Release	Relative humidity concentration inside the unit is displayed

Disinfection Routine

The entire interior of the unit together with all sensors can be disinfected with hot air at 180 °C. The disinfection routine lasts approx. 13 hours.

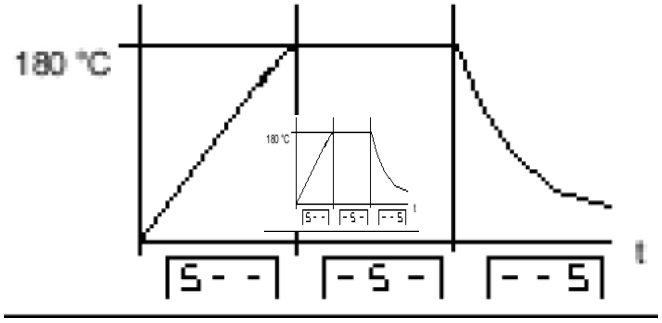
Start Disinfection Routine

Instruction	Entry / Keys / Remarks	Display / Remark / Status
Open the unit door for at least 30 seconds		All displays flash
Remove samples and vessels from the interior of the unit		
Activate the disinfection routine (turn key in direction of arrow)	 Press for approx. 1 second	Indicator Lamp (“(11)” on page 21) flashes and indicator lamp (“(3)” on page 21) comes on.
Close the door		Disinfection routine runs automatically. O_2 and relative humidity displays go out; Temperature Limit Controller is disabled. CO_2 display indicates the phases of the disinfection routine. “auto-start” routine begins on completion of the disinfection routine.

Attention

In the disinfection mode (appr. 13 h) occur slightly higher temperatures occur on the outer surface, the door area and the internal door grips. When LED “des” is flashing,

- proceed with particular caution-
Avoid touching the door areas during the disinfection routine.



Flow Chart of Disinfection Routine

Status display on CO_2-Display:

Heat

The chamber is heated to 180 °C; the disinfection temperature can be read off the temperature display.

Disinfect:

When the disinfection temperature of 180 °C is reached, a disinfection phase with a duration of approx. 3 hours is started. If the door is opened during the period and the temperature drops below 180 °C, the disinfection routine restarts automatically.

Cool:

On completion of the disinfection phase, the unit cools down to the originally set nominal temperature.

- The yellow indicator lamp “des” as soon as the unit reaches the set operating temperature (e.g. 37.0 °C) is reached. The sensors are automatically calibrated (auto-start) and the units readjusted to the set gas I rel. humidity setpoints. The disinfection routine is completed.
- If a temperature of 200 °C is exceeded during the disinfection routine, the latter is canceled and all poles of the heating system are disconnected. Error message 501 is displayed.

Cancelling the disinfection routine:

Instruction	Entry / Keys / Remarks	Display / Remark/ Status
Cancel disinfection	 Press for approx. 1 second	The CO_2 display indicates the cooling phase of the disinfection routine.

Auto-Start Routine / Auto-Zero Routine

An auto-start routine / auto-zero routine will have to be run when putting the unit into operation or if the temperature setpoint is altered by more than 1 °C.

Danger
Incorrect O_2 concentration.

Before the auto-start routine is initiated make certain the water storage tank contains enough water. Too little water in the tank leads to incorrect adjustment of the CO_2 measuring sensor, which in turn produces an incorrect CO_2 concentration result.

To ensure that there is only air, i.e. no CO_2 in the chamber before the auto-start routine is activated, ventilate the chamber by opening all doors.

The auto-start can only be activated if the doors are open for at least 30 s.

The indicator lamp “auto-start” (“(17)” on page 21) indicates when the auto-start routine is running. Calibration can take up to 5 hours, especially if the unit is cold.

If the unit door is opened during the auto-start, the auto-start routine / auto-zero routine restarts automatically after the unit door is closed.

On resumption of the power supply after a power failure, the auto-start routine / auto-zero routine is also restarted.

Instruction	Entry / Keys / Remarks	Display / Remark/ Status
Open unit doors for at least 30 seconds		All display segments flash
Adjust or check the setpoints	Refer to page 20 to page 23	
Activate auto-start	+ & - Press approx. for 5 seconds	Indicator lamp “(17)” on page 21 “autostart” flashes
Close all unit doors		Temperature reads “Actual value” CO_2 reads “0.0” O_2 reads “21.0” (optional) rel. humidity reads “Actual value”

The unit is set to the temperature and relative humidity setpoints. When temperature and relative humidity setpoints are achieved consistently, the CO_2 measuring system is automatically calibrated and the O_2 sensor (optional) is calibrated for 21 %.

- Indicator lamp (“(17)” on page 21) “auto-start” goes out.
- The auto-zero routine determines the reference value and O_2 sensor (optional) is calibrated.
- Gas is admitted until the CO_2 / O_2 setpoints are reached.

The auto-zero routine compensates for zero drift of the CO_2 measuring cell. The auto-zero routine runs automatically every 6 hours. When the indicator lamp (“(13)” on page 21) 'auto-zero' is flashing, the auto-zero routine is in progress. If the door is opened or closed during the auto-zero routine, auto-zero calibration is restarted.

If the auto-start has not been completed after 24 hours at the latest (“(17)” on page 21) “auto-start” is still flashing), the auto-start will have to be canceled manually and repeat.

Instruction	Entry / Keys / Remarks	Display / Remark/ Status
Cancel auto-start routine	+ & - Press approx. for 5 seconds	Indicator lamp (“(17)” on page 21) “auto-start” goes out and auto-zero calibration routine starts
		Indicator lamp “(13)” on page 21) “auto-zero” flashes
Cancel auto-Zero routine	+ & - Press approx. for 5 seconds	Indicator lamp (“(13)” on page 21) “auto-aero” goes out
		Unit displays the current actual values

If a repeat auto-start / auto-zero routine is unsuccessful, contact the service department of Thermo Scientific Instruments.

Error Code Request

The unit is equipped with an error diagnosis system.

This diagnosis system lets you detect and evaluate a fault during operation by means of specific codes.

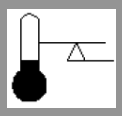
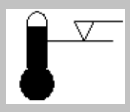
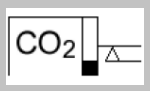
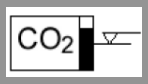
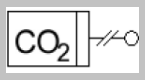
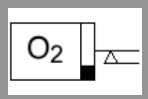
If an error occurs within a control loop, the relevant display flashes to indicate this.

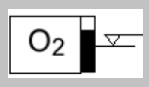
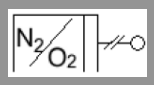
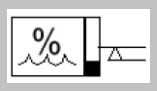
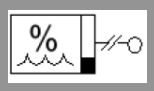
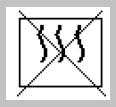
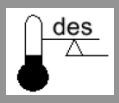
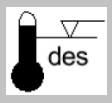
Press i -“(18)” on page 21) to display the error detected by the diagnosis system and to acknowledge the alarm. When the error is cleared, the error message is automatically closed and the display stops flashing.

Exception: Error 502

Instruction	Entry / Keys / Remarks	Display / Remark/ Status
Scan error code / Acknow-ledge acoustic alarm	i Hold down	Error code is displayed/acous-tic Acknowledge acoustic alarm is acknowledged. Display " - - - ": No error detec-ted

Errorcodes

CODE		CAUSE	ERROR CONDITION	POSSIBLE REMEDY
88		Error during auto-start	Measuring cell outside calibration ranges	Repeat the auto-start routine (refer to page 24)
99		Unit doors are open	Doors are open for more than 10 minutes	Close the unit doors or just acknowledge acoustic alarm
100		Temperature below setpoint	Actual value < setpoint -0.5 °C	Check the settings on the controller and Temperature Limit Controller (refer to page 19 and page 17)
101		Temperature above setpoint	Actual value > setpoint +1 °C	Ambient temperature could be too high: check the circuit status of the door heater (refer to page 31)
104		Temperature sensor faulty	Sensor broken/short-circuited	Contact the service department of Thermo Scientific Instruments
200		CO_2 below setpoint	Actual value < setpoint -1 %	Check the gas supply for - cylinder content - inlet pressure - supply line and connection to unit Refer to page 14
201		CO_2 above setpoint	Actual value > setpoint +1 %	Check the gas supply for - inlet pressure Refer to page 14
204		CO_2-measuring cell faulty	Sensor broken/short-circuited	Contact the service department of Thermo Scientific Instruments
300		N_2 below setpoint	Actual O_2 value < setpoint-2 % Gassing with N_2	Check the gas supply for -gas cylinder contents - inlet pressure - supply line and connection to unit Refer to page 14
301		N_2 above setpoint	Actual O_2 value > setpoint +2 % Gassing with N_2	Check the gas supply for - inlet pressure Refer to page 14
302		O_2 below setpoint	Actual O_2 value < setpoint +2 % Gassing with O_2	Check the gas supply for - gas cylinder contents - inlet pressure - supply line and connection to unit Refer to page 14

CODE		CAUSE	ERROR CONDITION	POSSIBLE REMEDY
303		O_2 above setpoint	Actual O_2 value > setpoint +2 % Gassing with O_2	Check the gas supply for - inlet pressure Refer to page 14
404		O_2 sensor faulty		Contact the service department of Thermo Scientific Instruments
400		Relative humidity below setpoint	Actual value < setpoint -5 %	Check the water reservoir Contact the service department of Thermo Scientific Instruments if necessary
404		Relative humidity sensor faulty	Sensor faulty/short-circuited	Contact the service department of Thermo Scientific Instruments
405		Evaporator faulty	95 °C > Actual value > 620 °C	Contact the service department of Thermo Scientific Instruments
500		“des” temperature below setpoint	Actual value < 180 °C -10 °C	Repeat the disinfection process Contact the service department of Thermo Scientific Instruments if necessary
501		“des” temperature above setpoint	Actual value > 180 °C +10 °C	Contact the service department of Thermo Scientific Instruments
502		Error during disinfection procedure	Power failure > 1 sec	Press the des switch (“(4)” on page 17) to reset the error and repeat the disinfection procedure; check voltage supply for power failure

A malfunction of the unit is not the only explanation for error codes 101, 201, 303. They can also be displayed after a setpoint is decreased.

Example:

When operating the unit with the setpoint entered for 10 % CO_2:

If the CO_2 setpoint is decreased to 5 % CO_2, the unit cannot reach this lower CO_2 concentration quickly enough due to its tightness. Error 201 is displayed.The designated error messages are displayed when:

- Setpoint < actual value.
- Setpoint temperature ≤ ambient temperature +7 °C

To avoid this, open the doors for a short time. This also applies to the reduced temperature and O_2 setpoints.

If these measures are unsuccessful or if errors with undefined codes occur, please notify our service department (refer to ***“Appendix”***).

When requesting our service, please state the scanned error code.

Switching Functions

Press  -(“(20)” on page 21) to select the individual switching functions as required.

The indicator lamp “control” (“(19)” on page 21) indicates when one of the switching functions specified below is selected:

- Acoustic alarm ON/OFF
- Humidification ON/OFF

- Manual zero calibration of CO_2 measuring system
- Setpoint lock-in ON/OFF
- Door heater ON/OFF

Switching Function: Humidification ON/OFF

Factory setting: Humidification switched on (set to 60 % rel. humidity).

Instruction	Entry / Keys / Remarks	Display / Remark / Status
Select function level 2	Hold down	Indicator lamp “control” flashes and current function level is indicated by the flashing display
	+ or - Press	 °C
Circuit status, Display and factory setting: Humidification ON	Release and press again	 °C CO_2
Change circuit status: Humidification OFF	- Press	 °C CO_2
Change circuit status: Humidification ON	+ Press	 °C CO_2
Exit function level	Release	Actual temperature, CO_2, O_2 and rel. humidity values are displayed again after 1 minute
	Press any setpoint key	Actual temperature, CO_2, O_2 and rel. humidity values are displayed again immediately

Switching Function: Manual Zero Calibration of CO_2 Measuring System

Recommendation: Check the CO_2 concentration, especially during long-term tests. If there is a large deviation (± 0.5 %) between the displayed actual value for CO_2 concentration and the nominal value, the measuring system can be re-calibrated during operation.
Example: Display: 5.0 % CO_2
Comparative measurement: 4.2 % CO_2

Instruction	Entry / Keys / Remarks	Display / Remark / Status
Select function level 3	Hold down	Indicator lamp “control” flashes and the current function level is indicated by the flashing display
	+ or - Press	 °C
Display zero point	Release and press again	 °C CO_2
Enter determined CO2 concentration	+ & - Press	 °C CO_2
Start calibration process/exit function level	Press	
Exit function level	i Press	“CAL” is briefly displayed. The corrected actual value is then displayed

Switching Function:Setpoint Lock-In ON/OFF

To prevent unintentional or unauthorized modification of the setpoints for temperature, CO_2, O_2 and rel. humidity, the setpoints can be “locked in”. The setpoints cannot be changed until the interlock has be canceled again.

Factory setting: setpoints unlocked.

Instruction	Entry / Keys / Remarks	Display / Remark / Status
Select function level 4	Hold down	Indicator lamp “control” flashes and current function level is indicated by the flashing display
	+ or - Press	 °C
Display circuit status, factory setting: setpoints released	Release and hold again	 °C CO_2
Change circuit status: locked setpoints	- Press	 °C CO_2
Change circuit status: Release setpoints	+ Press	 °C CO_2
Exit function level	Release Press any setpoint key	Actual temperature, CO_2, O_2 and rel humidity values are displayed again after 1 minute Actual temperature, CO_2, O_2 and rel humidity values are displayed again immediately

Switching Function: Door Heater ON/OFF

To adapt the unit to the ambient temperature in the place of installation, the door heater can be switched on or off (refer to page 31 for example).

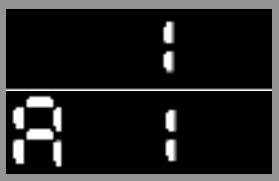
Condensation can occur inside the unit, especially on the glass door or glass screen, when the door heater is switched off.

Factory setting: door heater switched on.

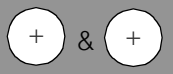
Instruction	Entry / Keys / Remarks	Display / Remark / Status
Select function level 5	Hold down	Indicator lamp “control” flashes and the current function level is indicated by the flashing display
	+ or - Press	 °C
Display circuit status, factory setting: Door heater ON	Release and hold down again	 °C CO_2
Change circuit status: Door heater OFF	- Press	 °C CO_2
Change circuit status: Door heater ON	+ Press	 °C CO_2
Exit function level	Release Press any setpoint key	Actual temperature, CO_2, O_2 and rel humidity values are displayed again after 1 minute Actual temperature, CO_2, O_2 and rel humidity values are displayed again immediately

Switching Function: Acoustic Alarm ON/OFF

Factory setting: acoustic alarm switched on.

Instruction	Entry / Keys / Remarks	Display / Remark / Status
Select function level 1	Press	Indicator lamp “control” flashes and current function level is indicated by a flashing display
	+ or - Press	 °C
Circuit status display and factory setting: Acoustic alarm ON	Release and press again	 °C CO_2
Change circuit status: acoustic alarm OFF	- Press	 °C CO_2
Change circuit status: acoustic alarm ON	+ Press	 °C CO_2
Exit function level 1	Release Press any setpoint key	Actual temperature, CO_2, O_2 and rel humidity values are displayed again after 1 minute Actual temperature, CO_2, O_2 and rel humidity values are displayed again immediately

Start-Up

Instruction	Entry / Keys / Remarks	Display / Remark / Status
Open unit doors		
Remove transit restraints and accessories from inside the unit		
Carry out basic cleaning		
Water reservoir	Fill unit with water	--observe max. level, use destilled or fully desalinated water
Switch on unit	Mains switch (8) = “I”	All display elements come on for approx. 15 seconds - auto-test of controller - O_2 version: The O_2 measuring system is started up automatically on completion of the auto-test. Duration: approx. 5 min. O_2 display reads “run”.
Adjust setpoints	Control and display panel (A)	Refer to page 17
Set temperature protection device	Adjust Temperature Limit Controller (6)	Refer to page 19
Select switching function(s) as required	On control and display panel (refer to page 17 and page 20 to page 27)	Refer to page 17
Activate auto-start	 Press Hold down for approx. 5 seconds	Indicator lamp “auto-start” flashes
Close all unit doors	Temperature displays “actual value” CO_2 displays “0.0”, O_2 displays “21.0” (optional) rel. humidity displays “actual value”	Unit is set to entered temperature and relative humidity setpoints Relative humidity is built up. When a constant temperature and relative humidity are reached, the CO_2 and O_2 measuring system is calibrated automatically. Indicator lamp “auto-start” goes out. “auto-zero” routine for determining reference values is executed. Gas is admitted until the entered CO_2 / O_2 setpoints are reached.

Operation

Operating Control

The microbiological safety of the unit is largely dependent on the proper conduct of the persons using the unit. Refer ***"Basic Rules of Sound Microbiological Engineering Practice*"***. Be sure to comply with the instructions contained in this manual as well as all applicable regulations and directives in your country.

Preparing the Device

The device must not be released for operation before all major start-up activities have been completed (refer ***"Start-Up"***).

Before beginning operation, check the condition of the following components of the vapor admission breeding cabinet:

- The door seal in the front frame must not be damaged.
- The glass door must not be damaged.
- The shelf system components must be installed safely.
- Clean and disinfect the interior and installed components. Use only lint-free cloths for wiping.
- Disinfect the work space according to the operator-specified hygiene guideline.
- Do not use explosive disinfecting agents. If using disinfectants which contain alcohol, comply with applicable national regulations.

Before Putting the Unit into Operation

- Put on all safety garments necessary to protect hands, face and body; remove jewelry.
- Disinfect and clean the chamber and fittings regularly. Only use lint-free materials to wipe surfaces clean.
- Do not use explosive disinfectants. When using alcoholic disinfectants, be sure they comply with all applicable regulations of your country (FRG: ZH 1/598).

During Operation

1. Turn the device on using the power switch.
2. Adjust the temperature set value on the control panel.
3. The temperature controller starts adjusting the work space to the user-specified temperature set value now. Temperature Setpoint.

Warning!

Risk of explosion or fire!

- Do not load the vapor admission breeding cabinet with any of the substances listed in the section **Incorrect Use**.
- Make sure that the ambient air is free of any solvents!

- Do not operate the vapor admission breeding cabinet in areas with a potentially explosive atmosphere.

4. Load the work space with samples.

Caution!
Hot surfaces!

During the heating cycles of the vapor admission breeding cabinet, the screen of the glass door, the interior surface of the outer door as well as the surfaces of the shelves and the chamber reach temperatures of up to 70 °C 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 overloading!

Overloading may damage the shelves or cause the shelves and/or the entire vapor admission breeding cabinet to tilt when the shelves are being drawn out, with the possible consequence that the samples are destroyed. To avoid overloading the vapor admission breeding cabinet or its shelving, make sure to observe the sample weight limits specified in ***"Technical Specifications"***.

Proper loading

When loading the unit, do not arrange articles too close to one another on the shelves (use only approx. 70 % of surface area) in order to avoid impairing air circulation and ensure constant heat flow. Do not impair temperature distribution.

When tempering defined substances or materials with a high moisture content, open the pipe penetration to reduce the possible formation of condensate in the chamber. A modified door seal is available as an accessory where needed.

Do not change the settings of the temperature safety device, otherwise sample protection is endangered.

Operating Interruptions

If operations are interrupted, make sure that no contamination hazards can occur.

- Remove, disinfect and clean any objects or auxiliaries put into the unit.
- Disinfect and clean the chamber.
- Disinfect and remove any residues.
- Disinfect the unit with hot air (disinfection routine).

Shutdown

The unit may only be shut down by qualified staff trained to operate this equipment.

The unit must not present any risk of contamination after shutdown.

- Shut off the gas supply.
- Remove, disinfect and clean any objects or auxiliaries put into the unit.
- Disinfect and clean the chamber. Leave the unit doors open until the chamber is dry.
- Disinfect the unit with hot air (disinfection routine).
- Set the main switch to “0” and disconnect the power plug.

Caution!
Contamination hazard!

If the surfaces of the chamber are contaminated, potentially hazardous biological substances may be transferred to the surroundings of the vapour admission breeding cabinet.

To rule out any risk for subsequent users, perform a complete cleaning, disinfection and decontamination cycle to the standards laid down in the section **Cleaning / Disinfection** if you suspect (or are certain) that hazardous biological substances have been processed with the vapor admission breeding cabinet.

Maintenance

Cleaning / Disinfection

Attention!
Be sure to disinfect the unit in compliance with the applicable regulations in your country.

The chamber and fittings are decontaminated through hot air disinfection at 180 °C. The sensors can be left inside the unit during the disinfection process. Do not spray the O_2 / rel humidity sensors (porous sintered material) with disinfectant.

Attention!
The operator is responsible for complete decontamination of the device at regular intervals.

Attention!
Chloride-containing disinfectants!

Chloride-containing disinfectants can corrode stainless steel. Use only disinfectants that do not affect stainless steel!

Attention!

Decontamination or cleaning agents

Contact Thermo Electron LED GmbH or its representative if you have any questions regarding which decontamination or cleaning agents can be used on parts of the device or in combination with the materials inside it.

Recommended disinfectant:

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

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

Attention! Description disinfectant: Details for efficiency and approvals are available on request.

Order Disinfection

- Remove samples, cultures, etc., from the unit.
- Switch off the unit.
- Remove shelves and carrier racks.
- Detach the rear panel of the inner vessel by lifting it up.
- Clean inner housing, shelves and carrier racks using a warm, skin-sensitive detergent (“Pril”) and allow them to dry completely. Do not wet sensors (4, 6, 8) with liquids and disinfectants.

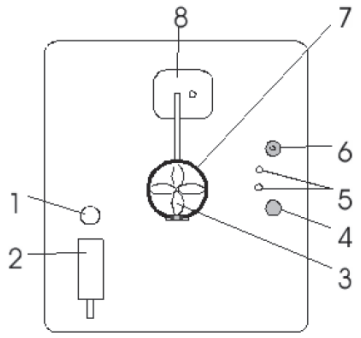


Fig. 11. Rear wall of inner vessel

Caution

To prevent injury to users, operate the device only when the rear wall of the internal tank is in place.

1. Lead-through and pressure compensation vent
2. Steam outlet: Do not fill unit with any liquids only clean the surface
3. Recirculated air blower
4. O_2 sensor (optional)
5. Pt 100 temperature sensors
6. Relative humidity sensor
7. Tubular radiator for disinfection
8. CO_2 - measuring cell

- Also clean glass door(s) and seal(s) with detergent and allow them to dry completely.

- Then spray surfaces and seals with disinfectant and allow it to react in accordance with the manufacturer's instructions for use.
- Then rinse surfaces with distilled water several times until all traces of disinfectant have been removed. Collect the washings.
- The surfaces of the unit can also be re-rinsed or sprayed with a 70 % by vol. alcohol solution (analytically pure isopropanol) if required.

Attention!

Alcoholic disinfectants

Be sure to comply with the safety instructions and applicable regulations in your country.
Alcohols or solutions with an alcohol content of greater than 10 % can ignite or form explosive gaseous mixtures when they come into contact with air and should therefore only be used in well-ventilated places. Do not expose to naked flame. Equipment and component parts cleaned using alcohol or alcoholic solutions must not be exposed to naked flames or other possible hazard sources. Wait until dry before use!

- Install the parts in the reverse order of removal as appropriate.
- Disinfect the unit with hot air at 180 °C (disinfection routine).

Caution

During the disinfection process (approx. 13 h) slightly elevated surface temperatures are generated on the housing surfaces, and particularly in the region of the doors and on the handles of the inner door. In this case the blinking indicator lamp “des” means

-Pay special attention-

As far as possible, avoid touching these areas during the “des” procedure.

- After disinfection, put the unit back into operation as described and always check that it is safe to operate prior to loading.

Testing

Attention!

The serviceability and safety of the unit are only guaranteed if the necessary testing, maintenance and repair work is carried out by the Thermo Scientific service department or by staff authorized by us.

The unit should be checked for safety, leak proofing and serviceability at least once a year.

Equipment Log Book

We recommend you keep an equipment log book (refer to ***“Appendix”***).

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.

Replacement of Electrical Parts

Attention!

Work on electrical components of the unit may only be carried out by Thermo Scientific 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 Scientific Instruments.

The sensors may only be replaced by authorized personnel of the operator.

Electric Shock!

Contact with live electrical components may cause a lethal electric shock. Before connecting the equipment to the power supply, check the power cord and the plug for damage. Do not use damaged cables for connecting the unit to the power supply!
Service is allowed only, if equipment is deenergized!

Prior to cleaning and disinfection work, disconnect the device from the power supply! Turn the device off using the power switch. There should be a lockout tagout of electricity prior to servicing the device. The alarm contact may be applied with 250 V AC, max. 6 A only.

Returns of Repair

Prior to returning any components, please contact our Technical Services Department for the necessary “Return Materials Authorization” number (RMA).

Material returned without an RGA number will be returned.

Caution!

Contamination hazard

The vapor admission breeding cabinet may have been used for treating and processing infectious substances. This may have caused contamination of the vapor admission breeding cabinet or its components.
Prior to return shipment, it is therefore mandatory that all vapor admission breeding cabinet components be properly decontaminated.

- It is therefore mandatory that all components of the vapor admission breeding cabinet be decontaminated prior to return shipment.
- Fill in and attach a safety declaration with details on decontamination activities performed to the items that are to be repaired.

Authorized Replacement Parts and Accessories

The safety and serviceability of the equipment are only guaranteed if the approved original replacement parts specified below are used.

Use of other parts presents unknown risks and is not approved under any circumstances.

Replacement Part	Type	Order No:
Instruction manual		50 042 724
Hose set for connecting unit to gas supply		50 062 701
Unit foot, upper part		50 044 921
Foot, height-adjustable, lower part		50 029 587
2 support brackets		50 011 380
Shelf, divided		50 069 921
Seal for inner cabin front		50 048 705
Glass door for gas-tight glass screen, left		50 030 020
Glass door for gas-tight glass screen with feedthrough, left		50 030 021
Glass door for gas-tight glass screen, right		50 030 022
Seal for glass door on gas-tight glass screen		50 041 536
Filler canister		50 029 126
Equipment fuse	T 6,3 A (2 pcs)	03 002 641
Sealing plug for feed-through (without hole)		03 669 008
Sealing plug for feed-through (with hole)		50 029 827
Subframe, 300 mm high		50 031 348
Subframe, 780 mm high		50 029 597
Pressure reducer for CO_2		03 429 937
Pressure reducer for N_2		03 429 942
Pressure reducer for O_2		03 429 943

Technical Specifications

TECHNICAL SPECIFICATIONS		
	UNITS:	**VALUE:**
MECHANICAL / OTHER		
Outer dimensions (W x H x D)	mm	920 X 855 X 775
Inner dimensions (W x H x D)	mm	607 X 669 X 585
Chamber volume	l	approx. 220
Divided Shelves (W x D) Quantity included in scope of supply Max. quantity Max. surface load Max. gross load of unit	mm pcs pcs kg kg	260 X 500 6 16 5 per shelf 30
Weight of unit excluding accessories	kg	107 (net)
THERMAL		
Ambient temperature range	°C	+18 ... +30
 Temperature CO_2-equipment Control range CO_2/O_2-equipment	 °C °C	Ambient Temperature +5 ... +50 +7 ... +50
Temperature deviation, temporal (DIN 12 880, Part 2)	K	< ±0.1
Temperature deviation, at: 37 °C spatial (DIN 12 880, Part 2) 50 °C	K K	< ± 0.5 < ± 0.7
Heating-up time with auto-start (ambient temperature 22 °C, unit empty) to: 37 °C	h	approx. 5
Cooling time (ambient temperature 22 °C unit empty) from: 37 °C to 25 °C	h	approx. 5
Heat release into surroundings at 37 °C / 95% rel. humidity Heat release into surroundings at 50 °C / 95% rel. humidity Heat release into surroundings during disinfection process	kWh/h kWh/h kWh/h	approx. 0.16 approx. 0.22 approx. 0.59
Recovery time at: 37 °C / 5 % C02 95 % rel. humidity / 7 % O_2 (closing the doors after they have been open for 30 s) Temperature CO_2 Humidity O_2	 min min min min	 ≤ 10 (98 % of the AW) ≤ 10 (98 % of the AW) ≤ 20 (95 % of the AW) ≤ 10 (98 % of the AW)
Humidification		
Water quality		resistivity 50 kΩ tos 1 MΩ, conductivity 1 to 20 µs
min. - max Value	l	2.2

TECHNICAL SPECIFICATIONS		
	UNITS:	**VALUE:**
Water demand to humidify: from 40 % rei. humidity to 95 % rei. humidity	ml	17
Water consumption	ml/h	10
Total capacity	l	4,7
Measuring range and Setting range *	% rH	60 ... 95
Control accuracy	% rH	± 1
GAS ENGINEERING		
Carbon dioxide (CO_2) Oxygen (O_2) Nitrogen (N_2) Purity Inlet pressure	 % bar	 99.5 0.8 up to max. 1
Measuring range and Setting range	% CO2	0 ... 20
Control accuracy	% CO2	± 0.1
Measuring range and Setting range	% O2	3 ... 90
Control accuracy	% O2	± 0.5
ELECTRICAL		
Rated voltage Rated frequency	v Hz	1/PE AC, 230 50/60
Radio interference suppression (DIN VDE 0875)		Interference suppression level N
Type of enclosure (DIN 40050)		IP 20
Protection class		I
Overvoltage category (IEC 1010)		II
Degree of soiling (IEC 1010)		2
Rated current	A	6.7
Fuse protection: Fuse Circuit-break switch		 T 16 A B 16
Rated power consumption during incubation/disinfection	kW	1.6 / 1.6
MISCELLANEOUS		
indoor or outdoor use		
Sound pressure level (DIN 45635 Part 1)	dB (A)	< 50
max. rH of the ambiance	% rH	80
max. altitude height	m NN	2.000

* Under some circumstances, eg. when working with culture vessels without covers, the control range will be restricted to 90-95 % since below this level evaporation of the medium will lead to an increase of the relative humidity in the chamber.

Materials Used / Disposal

Components	Material
Outer housing	Galvanized sheet steel, painted to RAL 9002
Inner vessel, shelves	Stainless steel, material No. 1.4301
Glass pane	Sodium silicate glass
Door seal of unit	Magnetic core sheathed in soft PVC
Glass door seal	Tempered silicon
Thermal insulation	PU foam sheet (CFC) incorporating non-woven needled glass fibre quilt (binder-free)
Control and display membrane	Polyethylene
Heating systems	Silicon-sheathed resistance heating conductor and tubular heater
Leads	Plastic-sheathed copper strands
Other components	Sheathed electrical components coated in various plastics partly mounted on printed circuit boards bonded with epoxy resin

Disposal

WEEE Compliance:

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2012/19/EU. It is marked with the following symbol:

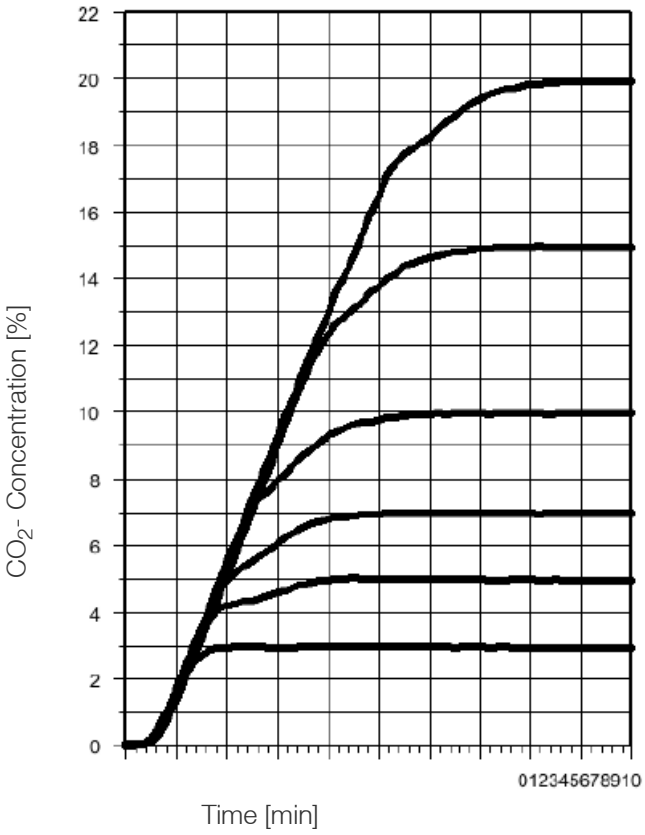
Thermo Electron LED GmbH has contracted with one or more recycling/disposal companies in each EU Member State, and this product should be disposed of or recycled through them. Further information on Thermo Electron's compliance with these Directives, the recyclers in your country, and information on Thermo Electron products which may assist the detection of substances subject to the RoHS Directive are available at www.thermofisher.com/WEEERoHS

Gas Consumption

Gas consumption during operation of “Cytoperm 2 gassed incubator”

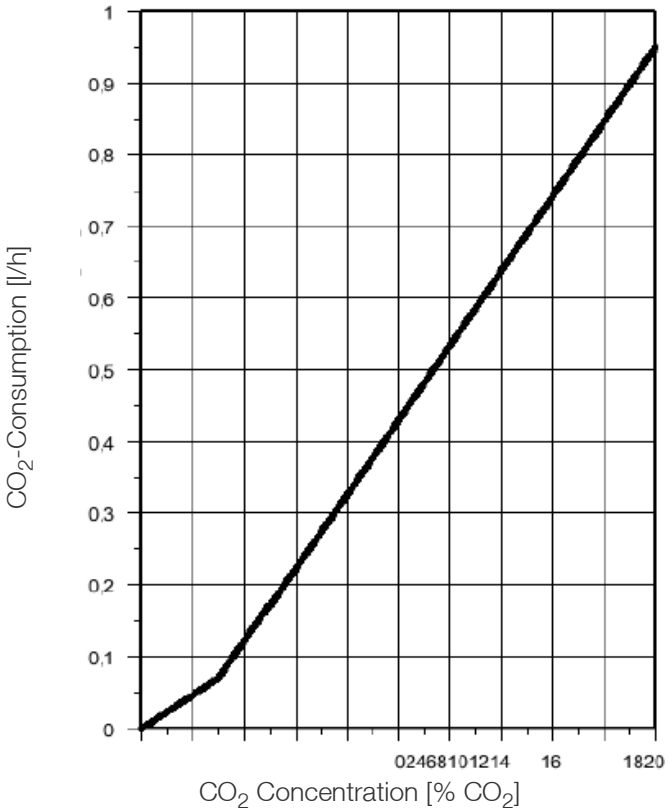
Gas consumption corresponds to the gas quantity released at the back of the unit which has to be discharged safely into the outside air by ventilating the placement area

Gasing with CO_2



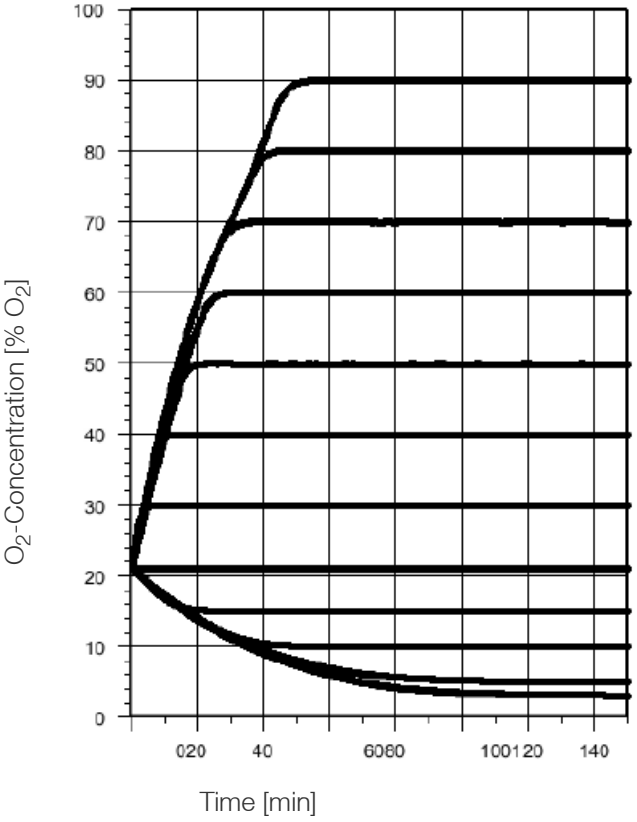
Amt of gas supplied: 8 l/min
Gas inlet pressure: 1 bar

Gas Consumption CO_2



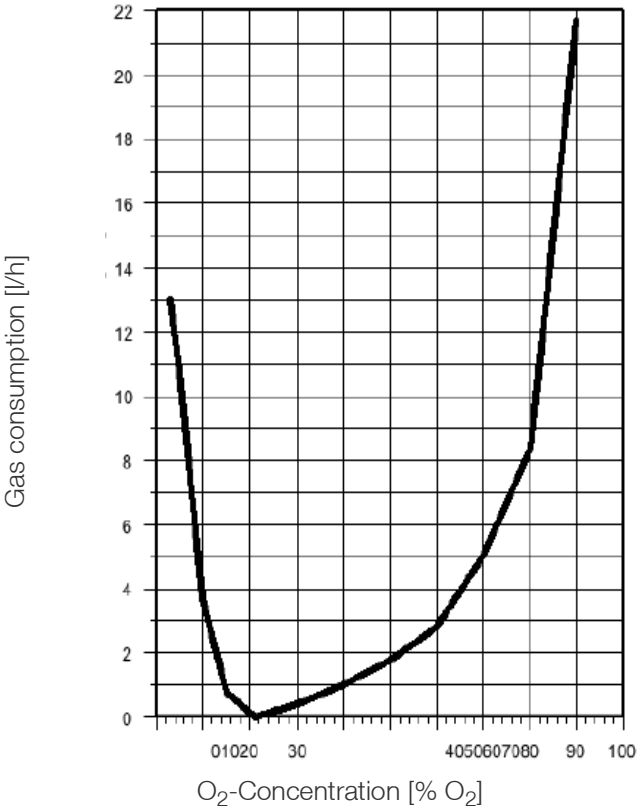
Amt of gas supplied: 8 l/h
Gas inlet pressure: 1 bar

Gas with Oxygen (O_2) / Nitrogen (N_2)



Gas inlet pressure: 1 bar
Amt of gas supplied: 0_2= 9.8 l/min
N_2= 7.4 l/min

Gas consumption N_2/O_2

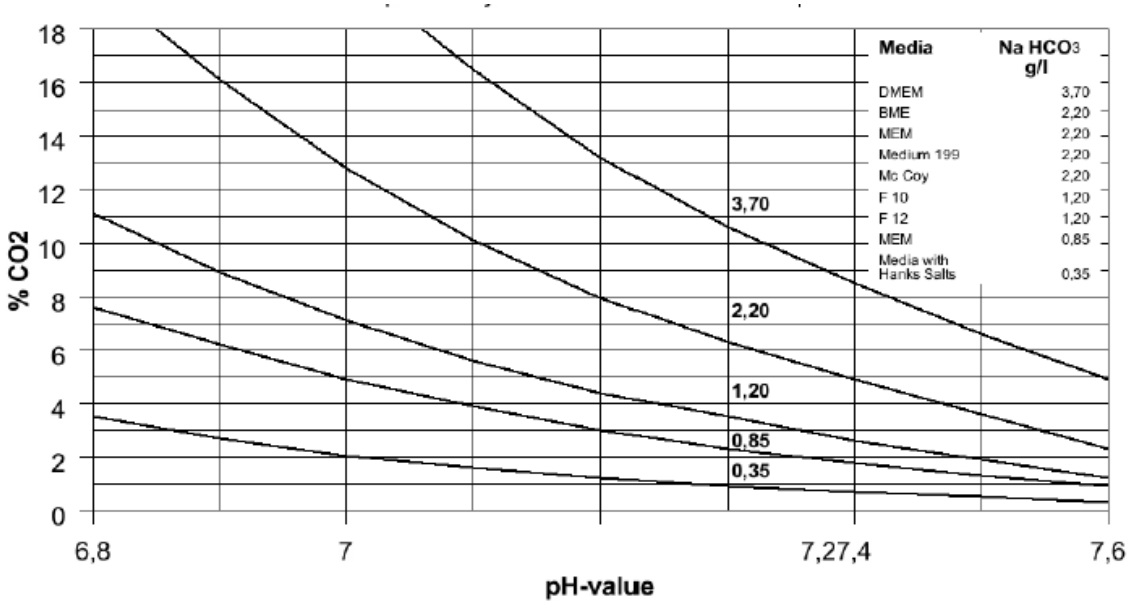


Gas inlet pressure: 1 bar
Amt of gas supplied: 0_2= 9.8 l/min
N_2= 7.4 l/min

pH-Value of Culture Media

pH-value of culture media

Dependency on the CO_2-concentration



Basic Rules of Sound Microbiological Engineering Practice*

General Rules

- Keep windows and doors in the working areas closed while work is in progress.
- Do not consume drinks, food or smoke in the working areas. Do not keep foodstuffs in the working areas.
- Lab coats or other protective garments must be worn in the working area.
- Oral pipetting is prohibited. Use pipetting aids.
- Only use needles and syringes if absolutely necessary.
- With all manipulators, be sure to avoid aerosol formation as far as possible.
- On completion of work and before leaving the working area, clean hands thoroughly. Disinfect and re moisturize hands if necessary.
- Keep working areas clean and tidy. Only equipment and materials actually required should be on the worktops. Keep stocks in the areas or cabinets provided for them only.
- Regularly check the identity of the biological agents used if this is a requirement for hazard potential assessment. The length of the interval between checks should be set according to hazard potential.
- With regard to the handling of biological agents, employees must be issued with verbal instructions relating to the workplace before commencing work. These instructions must be re-issued at least once annually thereafter.
- Employees inexperienced in the fields of microbiology, virology or cellular biology must be given thorough instructions and be supervised.
- Vermin and pests must be combatted regularly if necessary.

Handling of Pathogenes

Also heed the following basic rules regarding the handling of pathogenes:

- Disinfect all workplaces on a daily basis. It may be necessary to switch disinfectants as a precaution against resistant germs.
- Do not wear protective garments outside the working areas.
- Contaminated equipment must be autoclaved or disinfected prior to cleaning.
- Waste containing pathogenes must be collected safely and rendered harmless through autoclaving or disinfection.
- If infectious substances are spilt, the contaminated area must be closed off immediately and disinfected.
- If work is conducted using human pathogenes against which an effective antidote is available, all employees who are not yet immune must be vaccinated and checked regularly for immunity in the appropriate manner.
- The health of employees must be monitored by medical check-ups, i.e. employees must undergo an initial check-up before commencing work and subsequent annual check-ups. Medical check-ups should be conducted in accordance with the applicable employers' liability insurance association guidelines, in particular G 24, “Skin diseases”, and G 42, “Infectious diseases”. As generally recognized rules of industrial medicine, they enable the doctor to assess, evaluate and record the results of examinations according to the same criteria.

* Apply to cell cultures as appropriate.

Source: specification 8003, edition 1/92 - ZH 1/343 of the employer's liability insurance association for the chemicals industry, Jedermann Verlag, Dr. Otto Pfeffer OHG, PO box 103140, 69021 Heidelberg.

- Potentially hazardous, genetically engineered organisms, viruses and subviral agents must be handled in accordance with employers' liability insurance association guideline G 43 entitled “Biotechnology”.
- Instructions for administering first aid in the event of accidents involving pathogenic microorganisms and viruses must be immediately to hand in the working area. The person in charge must be notified of all accidents immediately.

Depending on hazard potential, it may be necessary to take further safety precautions:

- Use of class I, class II (type-approved)** or class III safety workbenches (air flow pointing away from experimenter).
- Restricting and supervising access to specific areas.
- Use of special protective garments and breathing apparatus.
- Disinfection of all materials containing pathogenes before they leave the worktop.
- Maintaining a partial vacuum in the working area.
- Reducing the germ count in the exhaust air by taking appropriate measures, such as using high performance suspended-matter filters.

Handling of Human-and Animal-Pathogenic Biological Agents

The following general rules also apply to the handling of human-and animal-pathogenic biological agents:

- Human-pathogenic biological agents may only be handled with approval under the terms of the Federal Epidemics Act.
- Approval under the terms of the Federal Animal Epidemics Act and the Ordinance concerning Agents of Animal Epidemics is required to handle agents of animal epidemics.
- Pregnant women or nursing mothers are not permitted to handle infectious and human-pathogenic biological agents or materials containing these agents.

They can also be obtained on request from the test center of the expert committee on “Health care and welfare” (Berufsgenossenschaft für Gesundheitsdienst und Wohlfahrtspflege, Prufstelle des Fachauschusses Gesundheitsdienst und Wohlfahrtspflege, Pappelallee 35-37, 22089 Hamburg, Germany).

Source: specification 8003, edition 1/92 - ZH 1/343 of the employer's liability insurance association for the chemicals industry, Jedermann Verlag, Dr. Otto Pfeffer OHG, PO box 103140, 69021 Heidelberg.

*Apply to cell cultures as appropriate.

**Manufacturers: certificates can be found in the memoranda of the employer's liability insurance association for chemicals entitled “Safe chemistry” and the employer's liability insurance association for health service and welfare.

Appendix

Log Book

Explanation of Confirmation of Safety

Information request form regarding maintenance and servicing contract

thermoscientific

Thermo Electron LED GmbH
Robert-Bosch-Straße 1
D - 63505 Langenselbold

Find out more at thermofisher.com

ThermoFisher SCIENTIFIC