BINDER
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Operating Manual

APT.line™ CB

CO_2 Incubators

CO_2 Incubators with O_2 control

with FPI-sensor system
and display controller MB1

BINDER GmbH

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CE

EG - KONFORMITÄTSERKLÄRUNG
EC - DECLARATION OF CONFORMITY
CE - DECLARATION DE CONFORMITE

Anbieter / Supplier / Fournisseur:	BINDER GmbH
Anschrift / Address / Adresse:	Im Mittleren Ösch 5, D-78532 Tuttlingen
Produkt / Product / Produit:	CO_2 Begasungsbrutschrank CO_2 Incubators Incubateurs à CO_2
Typenbezeichnung / Type / Type:	CB 150, CB 210

Die oben beschriebenen Produkte sind konform mit folgenden harmonisierten Normen:
The products described above are in conformity with the following harmonized standards:
Les produits décrits ci-dessus sont conformes aux normes harmonisées suivantes:

Sicherheit / safety / sécurité:

IEC/CEI 61010-1:2001	Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel- und Laborgeräte – Teil 1: Allgemeine Anforderungen Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements Règles de sécurité pour appareils électriques de mesurage, de régulation et de laboratoire – Partie 1 : Prescriptions générales
IEC/CEI 61010-2-010:2003	Sicherheitsbestimmungen für elektrische Meß-, Steuer-, Regel- und Laborgeräte – Teil 2-010: Besondere Anforderungen an Laborgeräte für das Erhitzen von Stoffen Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-010: Particular requirements for laboratory equipment for the heating of materials Règles de sécurité pour appareils électriques de mesurage, de régulation et de laboratoire. Partie 2-010 : Prescriptions particulières pour appareils de laboratoire utilisés pour l'échauffement des matières

EMV / EMC / CEM:

IEC/CEI 61326-1:2005	Elektrische Mess-, Steuer-, Regel- und Laborgeräte – EMV-Anforderungen. Teil 1: Allgemeine Anforderungen. Electrical equipment for measurement, control and laboratory use – EMC requirements. Part 1: General requirements. Matériel électrique de mesure, de commande et de laboratoire – Exigences relatives à la CEM. Partie 2-1 : Exigences générales.
IEC/CEI 61326-2-2:2005	Elektrische Mess-, Steuer-, Regel- und Laborgeräte – EMV-Anforderungen. Teil 2-2: Besondere Anforderungen - Prüfanordnung, Betriebsbedingungen und Leistungsmerkmale für ortsveränderliche Prüf-, Mess- und Überwachungsgeräte in Niederspannungs-Stromversorgungsnetzen. Electrical equipment for measurement, control and laboratory use – EMC requirements. Part 2-2: Particular requirements - Test configurations, operational conditions and performance criteria for portable test, measuring and monitoring equipment used in low-voltage distribution systems. Matériel électrique de mesure, de commande et de laboratoire – Exigences relatives à la CEM. Partie 2-1 : Exigences particulières - Configurations d'essai, conditions de fonctionnement et critères d'aptitude à la fonction des matériels portatifs d'essai, de mesure et de surveillance utilisés dans des systèmes de distribution basse tension.

Die oben beschriebenen Produkte sind konform mit folgenden EG-Richtlinien:
The products described above are in conformity with the following EC guidelines:
Les produits décrits ci-dessus sont conformes aux directives CE suivantes:

Niederspannungsrichtlinie 2006/95/EG Low voltage directive 2006/95/EC Directive basse tension 2006/95/CE	Richtlinie 2006/95/EG des Europäischen Parlaments und des Rates vom 12. Dezember 2006 zur Angleichung der Rechtsvorschriften der Mitgliedstaaten betreffend elektrische Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen Council Directive 2006/95/EC of 12 December 2006 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits Directive 2006/95/CE du Parlement Européen et du Conseil du 12 décembre 2006 concernant le rapprochement des législations des États membres relatives au matériel électrique destiné à être employé dans certaines limites de tension
EMV-Richtlinie 2004/108/EG EMC Directive 2004/108/EC Directive CEM 2004/108/CE	Richtlinie 2004/108/EG des Europäischen Parlaments und des Rates vom 15. Dezember 2004 zur Angleichung der Rechtsvorschriften der Mitgliedstaaten über die elektromagnetische Verträglichkeit und zur Aufhebung der Richtlinie 89/336/EWG. Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 98/336/EEC. Directive 2004/108/CE du Parlement Européen et du Conseil du 15 décembre 2004 relative au rapprochement des législations des États membres concernant la compatibilité électromagnétique et abrogeant le directive 98/336/CEE.

Die oben beschriebenen Produkte tragen entsprechend die Kennzeichnung CE.
The products described above, corresponding to this, bear the CE-mark
Les produits décrits ci-dessus, en correspondance, portent l'indication CE.

D-78532 Tuttlingen, 28.01.2008

BINDER GmbH

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Geschäftsführender Gesellschafter
Managing Director
Directeur général

V. Siegle

Leiter F & E
Head of R & D
Chef de service R&D

CONTENTS

Dear customer,

For the correct operation of the CO_2 incubator CB, it is imperative that you read this operating manual completely and carefully and observe the given instructions.

1. Safety

This operating manual is part of the scope of delivery. Always keep it at hand.

To avoid injuries and damage observe the safety instructions of the operating manual.

WARNING

Failure to observe the safety instructions.

Serious injuries and unit damage.

- Observe the safety instructions in this operating manual
- Carefully read the complete operating instructions of the CO_2 incubator CB.

1.1 Legal considerations

This operating manual contains information necessary for the intended use, correct installation, start-up and operation, and for the maintenance of the unit.

Understanding and observing the instructions in this operating manual are prerequisites for hazard-free use and safety during operation and maintenance.

This operating manual cannot cover all conceivable applications. If you would like additional information, or if special problems arise that you feel are not sufficiently addressed in this manual, please ask your dealer or contact us directly.

Furthermore, we emphasize that the contents of this operating manual are not part of an earlier or existing agreement, promise, or legal relationship, nor do they modify such a relationship. All obligations on the part of BINDER derive from the respective purchase contract, which also contains the entire and exclusively valid statement of warranty administration. The statements in this manual neither augment nor restrict the contractual warranty provisions.

1.2 Structure of the safety instructions

In this operating manual, the following harmonized denominations and symbols indicate dangerous situations following the harmonization of ISO 3864-2 and ANSI Z535.6.

Signal word panel

Depending on the seriousness and probability of the consequences, dangers are identified with a signal word, the corresponding safety color, and if appropriate, the safety alert symbol.

DANGER

Indicates an imminently hazardous situation that, if not avoided, will result in death or serious (irreversible) injury.

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious (irreversible) injury

CAUTION
Indicates a potentially hazardous situation which, if not avoided, may result in moderate or minor (reversible) injury

CAUTION
Indicates a potentially hazardous situation, which, if not avoided, may result in damage to the product and/or its functions or of a property in its proximity.

Safety alert symbol

Use of the safety alert symbol indicates **risk of injury**.

Observe all measures that are marked with the safety alert symbol in order to avoid death or injury.

Pictograms

Warning signs			
 Electrical hazard	 Hot surface	 Explosive substances	 Stability hazard
 Inhalation hazard.	 Gas cylinders	 Lifting hazard	 Pollution Hazard
 Harmful substances	 Biohazard		
Mandatory action signs			
 Mandatory regulation	 Read operating instructions	 Disconnect the power plug	 Lift with several persons
 Environment protection			
Prohibition signs			
 Do NOT touch	 Do NOT spray with water	 Do NOT climb	

	Information to be observed in order to ensure optimum function of the product.

Word message panel structure

Type / cause of hazard.

Possible consequences.

∅ Instruction how to avoid the hazard: prohibition

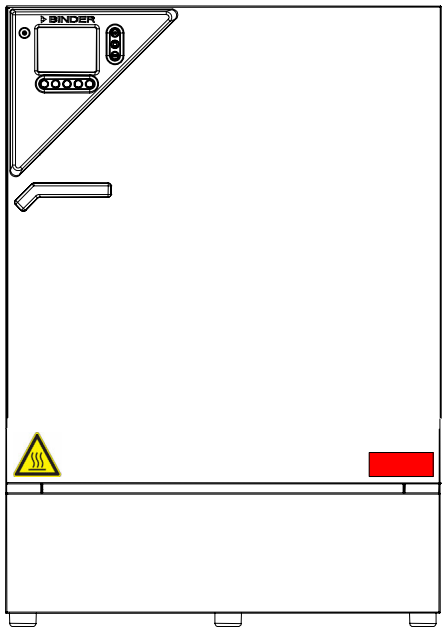
➢ Instruction how to avoid the hazard: mandatory action

Observe all other notes and information not necessarily emphasized in the same way, in order to avoid disruptions which could result in direct or indirect injury or property damage.

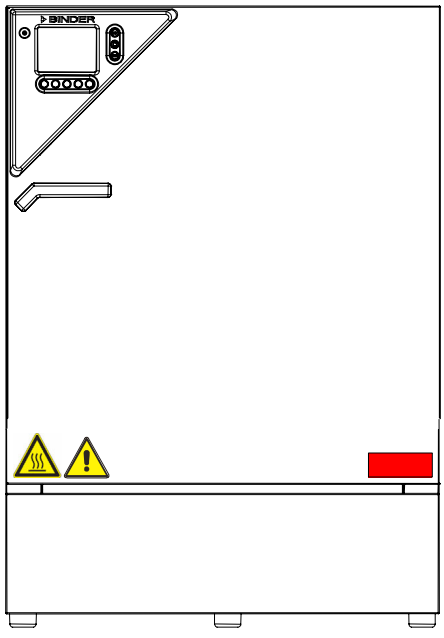
1.3 Localization / position of safety labels on the unit

The following labels are located on the unit:

Pictograms (Warning signs)	Service label
 Hot surface	
 Risk of injury • on the outer door: UL CB-UL only • above the access ports (option)	



CO_2 incubator CB



CO_2 incubator CB-UL

Figure 1: Position of labels on the CO_2 incubator

	Keep safety labels complete and legible.

Replace safety labels that are no longer legible. Contact BINDER Service.

1.4 Type plate

Position of type plate: left unit side (seen from front), at the bottom in the middle

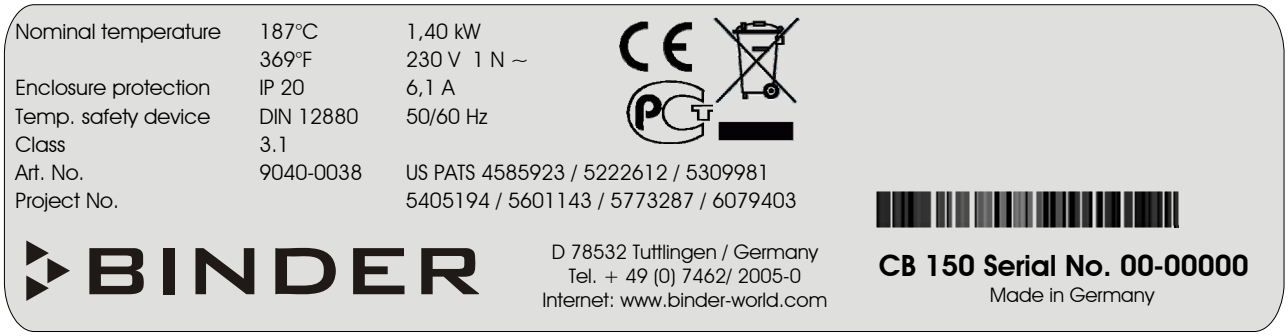


Figure 2: Type plate (example of CB 150 regular unit)

Indications of the type plate		Information
Nominal temperature	187°C 369°F	Nominal temperature
Enclosure protection	IP 20	IP type of protection 20 acc. to EN 60529
Temp. safety device	DIN 12880	Temperature safety device acc. to standard DIN 12880
Class	3.1	Temperature safety device, class 3.1
Art. No.	9040-0038	Art. No. 9040-0038
Project No.	---	(Special application acc. to project no.)
1,40 kW		Nominal power 1.40 kW
230 V 1 N ~		Nominal voltage 230 V ± 10 %, single-phase unit
6,1 A		Nominal current 6.1 Amp
50/60 Hz		Mains frequency 50/60 Hz
CB 150		Model CB 150
Serial No. 00-00000		Serial No. 00-00000

Symbol on the type plate	Information
CE	CE conformity marking
	Electrical and electronic equipment manufactured / placed on the market in the EC after 13 August 2005 and to be disposed of in separate collection according to directive 2002/96/EC on waste electrical and electronic equipment (WEEE).
	The equipment is certified in the GOST R certification system of GOSTSTANDARD Russia.
c UL us LISTED LABORATORY EQUIPMENT 43KM (CB-UL only)	The equipment is certified by Underwriters Laboratories Inc.® according to standards UL 61010A-1, UL 61010A-2-10, CSA C22.2 No. 1010.1-92, and CSA C22.2 No. 1010.2.010-94.

1.5 General safety instructions on installing and operating the CO_2 incubator

With regard to operating the CO_2 incubator CB and to the installation location, please observe regulations BGR 120 issued by the German professional association for the chemical industry (formerly ZH 1/119 laboratory guidelines issued by the employers' liability insurance association) (for Germany).

BINDER GmbH is only responsible for the safety features of the unit provided skilled electricians or qualified personnel authorized by BINDER perform all maintenance and repair, and if components relating to chamber safety are replaced in the event of failure with original spare parts.

To operate the unit, use only original BINDER accessories or accessories from third-party suppliers authorized by BINDER. The user is responsible for any risk caused by using unauthorized accessories.

CAUTION

Danger of overheating.

Damage to the unit.

∅ Do NOT install the unit in unventilated recesses.

➢ Ensure sufficient ventilation for dispersal of the heat.

Do not operate the CO_2 incubator CB in hazardous locations.

DANGER

Explosion hazard.

Danger of death.

∅ Do NOT operate the unit in potentially explosive areas.

➢ KEEP explosive dust or air-solvent mixtures AWAY from the unit.

The CO_2 incubator CB does not dispose of any measures of explosion protection.

DANGER

Explosion hazard.

Danger of death.

∅ Do NOT introduce any combustible or explosive substance at working temperature into the CO_2 incubator.

∅ NO explosive dust or air-solvent mixture in the inner chamber.

Any solvent contained in the charging material must not be explosive or inflammable. I.e., irrespective of the solvent concentration in the steam room, NO explosive mixture with air must form. The temperature inside the chamber must lie below the flash point or below the sublimation point of the charging material. Familiarize yourself with the physical and chemical properties of the charging material, as well as the contained moisture constituent and its behavior with the addition of heat energy and humidity.

Familiarize yourself with any potential health risks caused by the charging material, the contained moisture constituent or by reaction products that may arise during the temperature process. Take adequate measures to exclude such risks prior to putting the CO_2 incubator into operation.

DANGER

Electrical hazard.

Danger of death.

∅ The unit must NOT become wet during operation or maintenance.

The CO_2 incubators were produced in accordance with VDE regulations and were routinely tested in accordance to VDE 0411.

CAUTION

The glass doors and the inner chamber will become hot during operation.

Danger of burning.

∅ Do NOT touch the glass doors, the inner surfaces or the charging material during operation.

WARNING

Stability hazard.

Danger of injury.

Damage to the unit and the charging material.

Housing cover breakaway.

∅ Do NOT climb the lower housing cover.

∅ Do NOT load the lower housing cover with heavy objects while the unit door is open.

Vent out any gas that may escape via good room ventilation or a suitable exhaust system.

WARNING

High concentration of CO_2, O_2, und N_2.

Danger of poisoning.

∅ Do NOT set up units in non-ventilated recesses

➢ Ensure technical ventilation measures

➢ Observe the relevant regulations for handling these gases.

1.6 Intended use

Series CB incubators are suitable for the cultivation of mammal cells under typical conditions of approx. 37°C / *98.6°F*. The incubator permits setting defined pH conditions by common $NaHCO_3$ buffer systems of commercial cell media by keeping an exact CO_2 atmosphere inside. CB incubators guarantee high humidity inside to avoid osmolarity increasing caused by the evaporation of the cell media.

With the unit with O_2 control, a variable oxygen atmosphere can additionally influence the growth of the cells.

Observing the instructions in this operating manual and conducting regular maintenance work (chap. 13) is part of the intended use.

Other applications are not approved.

2. Unit description

The CO_2 incubators CB are equipped with a multifunctional microprocessor display controller with 4-channel technology for temperature, CO_2, and O_2 (unit with O_2 control) levels and a digital display accurate to one-tenth of a degree resp. 0.1 vol.-%

The inner chamber, the pre-heating chamber and the inside of the doors are all made of stainless steel (material no. 1.4301 (V2A) in Germany). The inner surfaces are smooth and therefore easy to clean. The inner chamber is deep-drawn from one piece, polished (suitable for pharmacy) and has no welds or inaccessible corners. The hinges and the seal of the inner glass door are glued from the outside to aid cleaning of the inner chamber. When operating the chamber at high temperatures (sterilization), the influence of the oxygen in the air may cause coloration of the metallic surfaces (yellowish-brown or blue) by natural oxidation processes. These colorations are harmless and will in no way impair the function or quality of the unit.

The perforated shelves and, for units with shelf holder, the complete shelf holder are made of stainless steel. The shelf holder offers 16 (CB 150) resp. 22 (CB 210) different positions for a maximum of 8 resp. 11 shelves. The shelf holder is demountable in three parts without any tool. In this way, you can clean it hygienically in every laboratory dishwasher before hot-air sterilization. For the unit with beads, you can insert a maximum of 6 (CB 150) resp. 8 (CB 210) shelves.

The housing is RAL 7035 powder-coated. All corners and edges are completely coated.

The heating system of the CO_2 incubator permits hot-air auto-sterilization at a set point of 187.5°C / *369.5°F.* Thus, a temperature of 180°C / *356°F* is obtained for at least 30 minutes on all internal surfaces, resulting in sterilization of the entire inner chamber. Therefore, this procedure meets all international guidelines regarding hot air sterilization, e.g. AAMI ST63, DIN 58947, European Pharmacopoeia.

Thanks to the standard safety device (class 3.1 according to DIN 12880), the set temperature is maintained in case of failure.

The gas enters the chamber via a fine filter (aseptic filter) with a high filtration efficiency, which also filters the smallest particles. This fine filter is easily accessible behind the lower housing cover (K), so you can change it easily if required.

A highly precise, drift-free CO_2 infrared measuring system in combination with the permanent mixture of CO_2 gas through a special gas mixing head developed by BINDER guarantees precise and constant CO_2 concentrations for long periods. This creates optimum growth conditions for cultures. The CO_2 measuring system can be removed from the inner chamber by hand and cleaned with suitable detergents.

The CO_2 incubator is also available with O_2 control in addition to CO_2 control.

For options, see chap. 16.5.

The CO_2 incubators CB are regularly equipped with a serial interface RS 422 for computer communication, e.g. with the communication software APT-COM™ 3 DataControlSystem (option, chap. 9.8)

The CO_2 incubator can be operated in a temperature range from 7 degrees above the ambient temperature up to +60°C / *140°F* and a CO_2 range of 0 vol.-% up to 20 vol.-%.

2.1 Unit overview

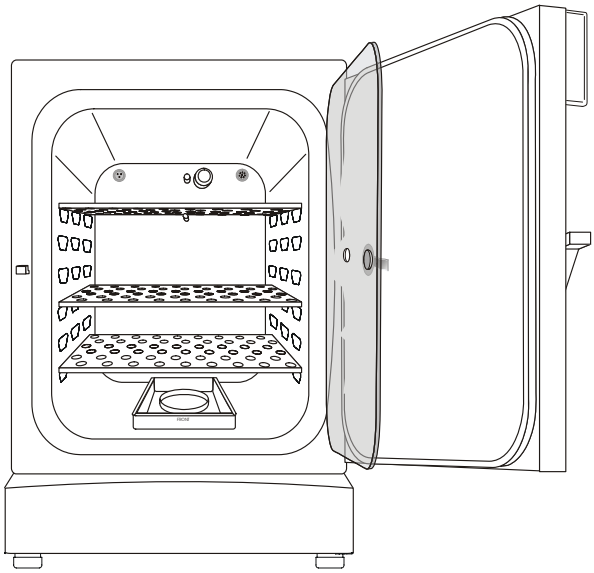


Figure 3: Unit with beads

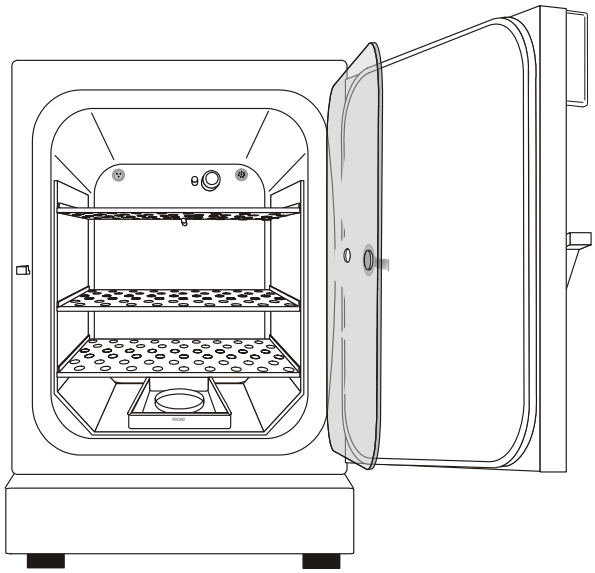


Figure 4: Unit with shelf holder

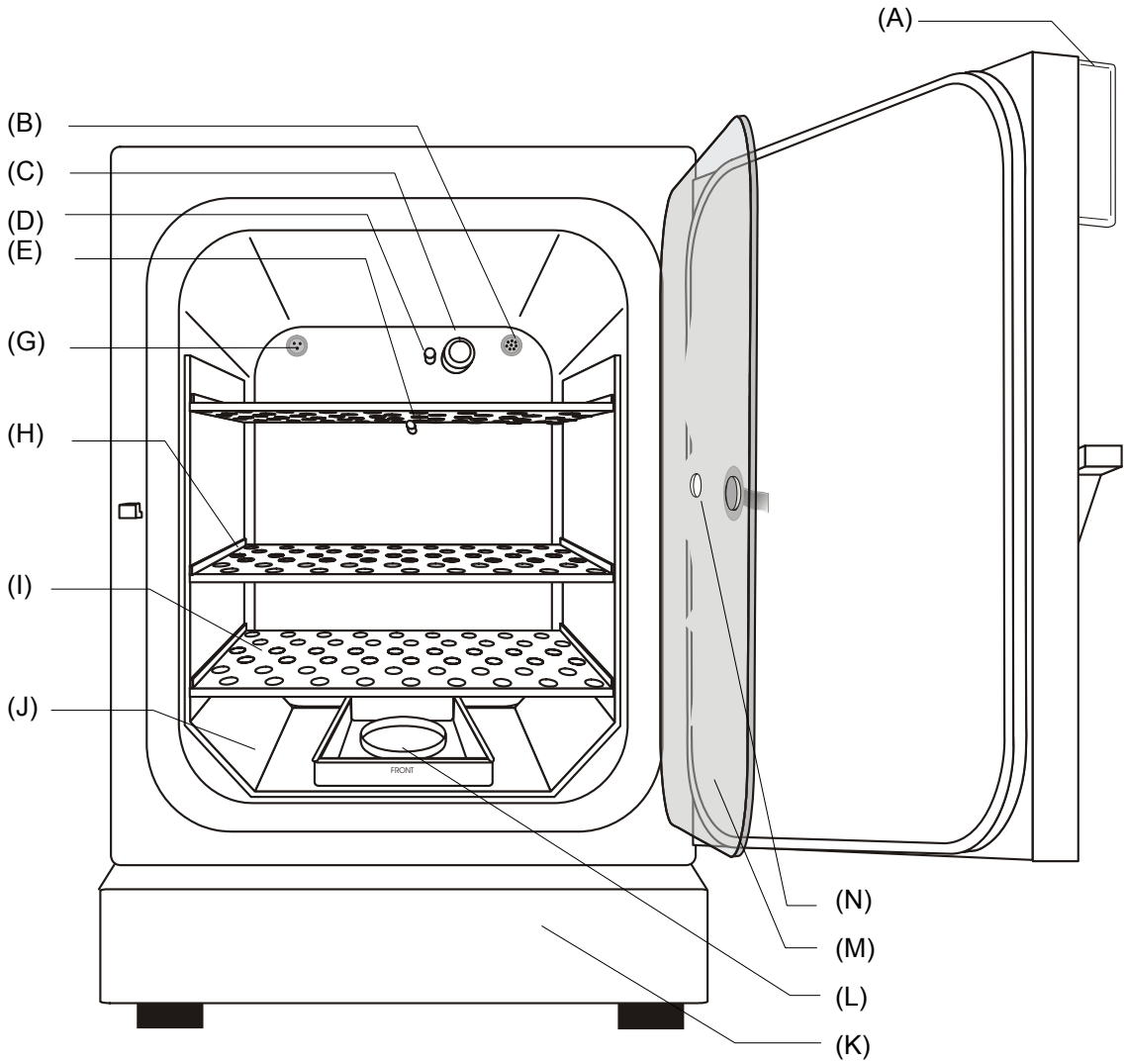


Figure 5: CB with shelf holder

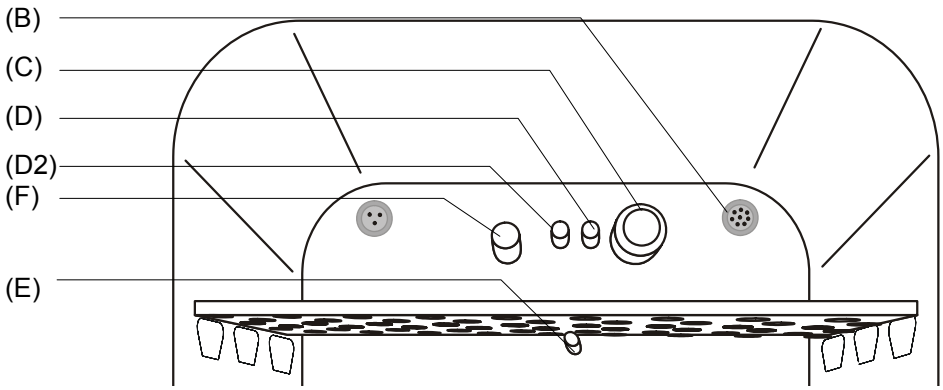


Figure 6: CB with O_2 control

(A) Display controller MB1 for temperature and CO_2 as well as O_2 (unit with O_2 control)
(B) Connection socket for low tension supply (option)
(C) CO_2 sensor
(D) Gas mixing head CO_2
(D2) Additional gas mixing head O_2/ N_2 (unit with O_2 control)
(E) Pt 100 temperature probe
(F) O_2 sensor (unit with O_2 control)
(G) Internal socket 230V (max. 3 A) (option)
(H) Shelf holder bar (only units with shelf holder)
(I) Shelves
(J) Shelf holder (only units with shelf holder)
(K) Lower housing cover
(L) Permadry™ water pans
(M) Inner glass doors
(N) Measuring access port

2.2 Instrument box CB

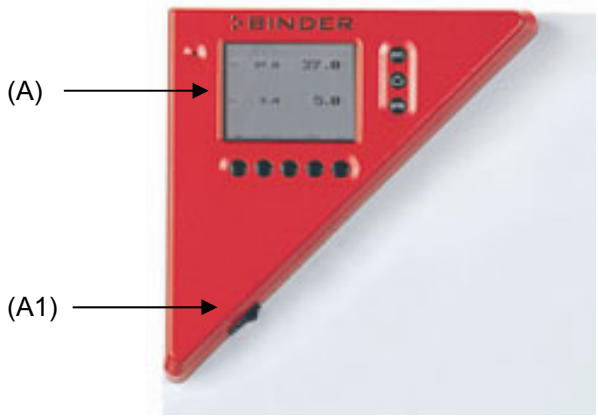


Figure 7: Triangle instrument box

(A) Microprocessor display controller MB1
(2) Main switch ON/OFF

2.3 Control panel at the rear of the unit

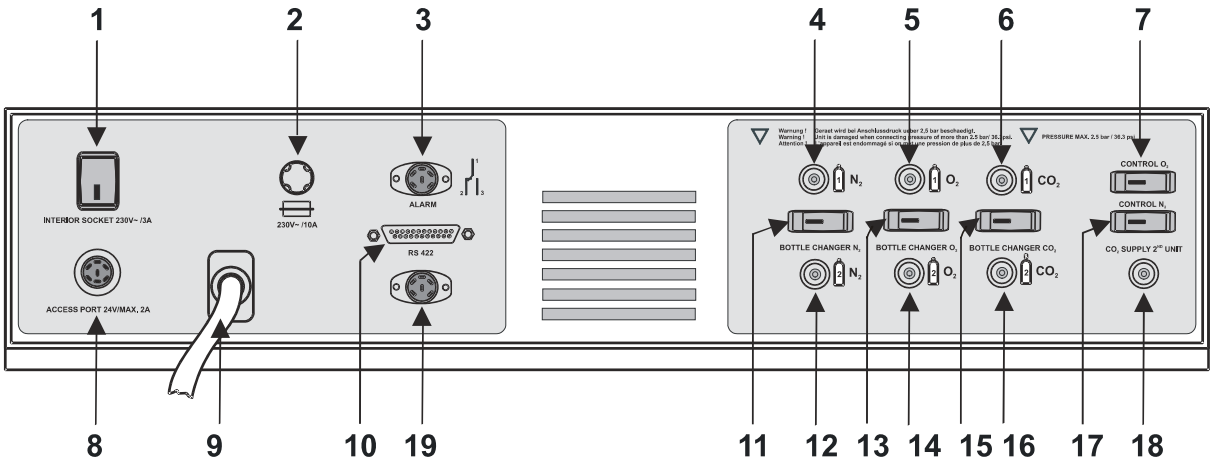


Figure 8: Rear control panel CB with O_2 control and several options

(1) Switch for internal socket 230 V / 115 V (option)

(2) Miniature fuse

(3) Connection socket for zero-voltage relay alarm output

(4) Quick acting closure socket for 1st N_2 bottle (unit with O_2 control)

(5) Quick acting closure socket for 1st O_2 bottle (unit with O_2 control)

(6) Quick acting closure socket for 1st CO_2 bottle

(7) Switch for pressure alarm O_2 ON/OFF (unit with O_2 control)
When switching off both switches (7) and (17) together: O_2 control OFF.

(8) Socket for low tension access port (option)

(9) Mains lead

(10) RS 422 interface

(11) Switch for N_2 bottle changer, ON/OFF (option for unit with O_2 control)

(12) Quick acting closure socket for 2nd N_2 bottle (option for unit with O_2 control)

(13) Switch for O_2 bottle changer, ON/OFF (option for unit with O_2 control)

(14) Quick acting closure socket for 2nd O_2 bottle (option for unit with O_2 control)

(15) Switch for CO_2 bottle changer, ON/OFF (option)

(16) Quick acting closure socket for 2nd CO_2 bottle (option)

(17) Switch for pressure alarm N_2 ON/OFF (unit with O_2 control)
When switching off both switches (7) and (17) together: O_2 control OFF.

(18) External gas connection for 2nd incubator (option)

(19) Connection socket for analog output 4-20 mA (option)

3. Scope of delivery, transportation, storage, and installation

3.1 Unpacking, and checking equipment and scope of delivery

After unpacking, please check the unit and its optional accessories, if any, based on the delivery note for completeness and for transportation damage. If transportation damage has occurred, inform the carrier immediately.

The final tests of the manufacturer may cause traces of the shelves on the inner surfaces. This has no impact on the function and performance of the unit.

Please remove any transportation protection devices and adhesives in/on the unit and on the doors and remove the operating manuals and accessory equipment.

	Remove any protective lamination sheet on the inner metal surfaces prior to commissioning.

	**CAUTION** **Sliding or tilting of the unit.** **Damage to the unit.** **Risk of injury by lifting heavy loads.** ∅ Do NOT lift or transport the unit using the door handle, the door or the lower housing. ➢ Lift the unit from the pallet at its four lower corners with the aid of four people.

If you need to return the unit, please use the original packing and observe the guidelines for safe lifting and transportation (chap. 3.2).

For disposal of the transport packing, see chap. 14.1.

Note on second-hand units (Ex-Demo-Units):

Second-hand units are units that were used for a short time for tests or exhibitions. They are thoroughly tested before resale. BINDER guarantees the technically flawless state of the chamber.

Second-hand units are marked as such with a sticker on the unit door. Please remove the sticker before commissioning the unit.

3.2 Guidelines for safe lifting and transportation

Following operation, observe the guidelines for temporary decommissioning (chap. 14.2).



CAUTION

Sliding or tilting the unit.

Damage to the unit.

Risk of injury by lifting heavy loads.

- ➢ Transport the unit in its original packaging only.
- ➢ Secure the CO_2 incubator with transport straps for transport.
- ∅ Do NOT lift or transport the unit using the door handle, the door or the lower housing.
- ➢ Lift the unit at its four lower corners with the aid of 4 people and place it on a rolling pallet.
- ➢ Move the unit to the desired location and lift it from the rolling pallet with the aid of four people.

- Permissible ambient temperature range for transport: -10°C / *14°F* to +60°C / *140°F*.

You can order transport packing and rolling pallets for transportation purposes from BINDER Service.

3.3 Storage

Intermediate storage of the unit is possible in a closed and dry room. Observe the guidelines for temporary decommissioning (chap. 14.2).

- Permissible ambient temperature range for storage: -10°C / *14°F* to +60°C / *140°F*.
- Permissible ambient humidity: max. 70 % r.H., non-condensing

If following storage in a cold location you transfer the unit to the installation site for start-up, condensation may form. Wait at least one hour until the CO_2 incubator has attained ambient temperature and is completely dry.

3.4 Location of installation and ambient conditions

Set up the CO_2 incubator on an even surface, free from vibration and in a well-ventilated, dry location.

CB incubators are suitable for freestanding installation on tables or freestanding installation on the optionally available stand (height 200 mm).The site of installation must be capable of supporting the unit's weight (see technical data, chap. 16.4).

Align the unit using a spirit level to ensure even covering of the cell-cultures with the medium. For this purpose, manually adjust the four incubator feet.

CO_2 incubators can be stacked on top of each other (maximally two units). For a safe stacking easy to maintain, use the original BINDER stacking stand (chap. 9.11.2) or the stacking adapter (chap. 9.11.3).

CAUTION

Sliding of stacked unit.

Damage to the units.

- ➢ When stacking, use rubber pads (Art. No. 8012-0376) for the feet of the upper incubator.

To completely separate the unit from the mains supply, you must pull the mains plug. Install the unit in a way that the mains plug is easily accessible and can be easily pulled in case of danger.

In order to avoid contamination, the unit should not be placed directly on the floor.

CAUTION

Danger of overheating.

Damage to the unit.

∅ Do NOT set up units in non-ventilated recesses.

➢ Ensure sufficient ventilation for dispersal of the heat.

- Permissible ambient temperature range for operation: +18°C / *64.4°F* to +30°C / *86°F*. At elevated ambient temperature values, fluctuations in temperature can occur.
- Ideal ambient temperature: at least 7°C below the intended working temperature. E.g., working temperature 37°C / *98.6°F* = ambient temperature 30°C / *86°F* and lower.

In the event of working temperatures of less than 7 degrees above the ambient temperature, the set point may be exceeded.

The ambient temperature should not be substantially higher than the indicated ambient temperature of +25°C / *77°F* to which the specified technical data relates. For other ambient conditions, deviations from the indicated data are possible.

Avoid direct solar radiation on the unit.

- Permissible ambient humidity: 70 % r.H. max., non-condensing.
- Installation height: max. 2000 m / *6561.7 ft* above sea level. After the incubator has been switched on for the first time, enter the altitude of the site above sea level into the controller (chap. 6.5).
- Wall distances: rear 100 mm / *3.94 in*, sides 50 mm / *1.97 in*.

To completely isolate the unit from the mains supply, you must disconnect the mains plug. Install the unit in a way that the mains plug is easily accessible and can be easily disconnected in case of danger.

Do not install or operate the CO_2 incubator CB in potentially explosive areas.

DANGER

Explosion hazard.

Danger of death.

∅ Do NOT operate the unit in potentially explosive areas.

∅ KEEP explosive dust or air-solvent mixtures AWAY from the vicinity of the unit.

CO_2, as well as O_2, and N_2 (unit with O_2 control) are harmful in high concentrations. Any gas that may escape has to be led out via good room ventilation or by connection to a suitable exhaust system.

WARNING

High concentration of CO_2, O_2, und N_2.

Danger of poisoning.

∅ Do NOT set up units in non-ventilated recesses

➢ Ensure technical ventilation measures

➢ Observe the relevant regulations for handling these gases.

Check compliance with the **maximum permitted workplace concentration for CO_2** when operating all units located in the room.

- Maximum permitted workplace concentration (for Germany): 5000 ppm = 0.5 vol.-%
- CO_2 lost with each opening the door: about 16.4 g, i.e. 0.0084 cubic meters / *0.296 cubic feet* (under normal pressure)
- CO_2 lost during 12h at 5 vol.-% without opening the door: approx. < 2 g, i.e. 0.001 cubic meter / *0.035 cubic feet* (under normal pressure 1013 mbar / *14.7 psi*)

Example to evaluate laboratory volume and air change rate:

Question: Is an air change rate of 1/h sufficient for a lab with a volume of 100 cubic meters / *3,531.5 cubic feet* with 10 incubators CB, opened 4 times per hour?

Calculation: CO_2 concentration = CO_2 lost by opening the door, multiplied by 10 units, multiplied by opening the door 4 times per hour, divided by lab volume

0.0084 cubic meters x 10 x 4 div. 100 cubic meters = 0.00336, i.e. 0.336 % or 3360 ppm.

0.296 cubic feet x 10 x 4 div. *3,531.5 cubic feet* = 0.00336, i.e. 0.336 % or 3360 ppm.

Result: The maximum permissible value of 5000 ppm is not exceeded under these operation conditions.

4. Installation and connections

4.1 CO_2 and O_2 sensors

4.1.1 The CO_2 measuring principle

Fast reaction times, as well as the highest accuracy and selectivity, characterize the CO_2 measuring procedure of the CB incubator series. The accuracy of the CO_2 measuring system is based on a single-beam infrared measuring cell, which measures in differential mode using the permanently alternating transmission feature of its semi-conductor filter.

Due to this highly developed single-beam principle with Fabry-Perot interferometer (FPI), disturbance variables and aging phenomena in the measuring system are almost completely eliminated, so that this measuring system, in contrast to other measuring procedures, remains practically drift-free between calibrations and is absolutely selective for CO_2.

The CO_2 measuring cell contains a measuring section inside in which the absorption of infrared light depends on the number of CO_2 molecules in the beam path. This number of CO_2 molecules changes with the ambient pressure in relation to a constant volume. The distances between the molecules are consequently pressure-dependent. The collision frequency of the IR-beam with CO_2 molecules increases therefore by increasing pressure. For this reason, the ambient pressure must be compensated in order to correct the display reading of the CO_2 concentration in vol.-%. This is achieved by entering the altitude of the site above the sea level (chap. 6.5).

4.1.2 General notes

Connect or remove the CO_2 sensor and O_2 sensor (unit with O_2 control) without rotating and only when the incubator is switched off.

Remove the CO_2 sensor before removing or replacing its filter cap.

The accuracy of the indicated values of CO_2 or O_2 (unit with O_2 control) depends on the ambient air pressure (approx. 0.08 vol.-% per 10 mbar / *0.15 psi*). In order to compensate this effect when measuring the CO_2 concentration, you can enter the altitude of the installation site above sea level to the controller (chap. 6.5).

The Teflon filter of the CO_2 sensor prevents dirt and humidity from intruding into the measuring cell. It is available as a spare part. Replace it whenever it is damaged or soiled.

The CO_2 sensor is temperature resistant up to a maximum temperature of 60°C / *140°F*.

	**CAUTION** **Excess temperature.** **Damage to the CO_2 sensor.** ∅ Do NOT autoclave the CO_2 Sensor. ∅ Do NOT expose the CO_2 sensor to hot-air sterilization.

The CO_2 sensor head was especially adjusted for the specific chamber. To avoid confusion, an adhesive label with a serial number sticks to the sensor head. When exchanging the sensor, you must repeat the CO_2 adjustment.

	**CAUTION** **Different CO_2 sensor.** **Invalid calibration.** ∅ Do NOT change the CO_2 sensor head. ➢ Note down the serial number of the CO_2 sensor.

4.1.3 Connecting the CO_2 sensor

Open the door of the inner chamber and plug in without rotating the CO_2 sensor (C) into the connection socket in the upper part of the rear of the inner chamber.

The sensor must click in correctly and sit tightly in the connection socket.

4.1.4 Connecting the O_2 sensor (unit with O_2 control)

Open the door of the inner chamber and plug in without rotating the O_2 sensor (F) into the appropriate connection socket in the upper part of the rear of the inner chamber.

The sensor must click in correctly and sit tightly in the connection socket.

4.2 Shelf holder and shelves (unit with shelf holder)

4.2.1 Demountable shelf holder

The shelf holder consists of a bottom part and two side parts. Hook both lateral parts in the bottom part.

	Perform assembly and disassembly of the shelf holder inside the chamber. It is not possible to take out the shelf holder entirely together with the shelves

For assembly and disassembly, fold both side parts towards the middle. In this position, you can insert them into the bottom part or take them out.

Hang in the shelf holder bars into the side parts.

Completely insert the shelf holder into the chamber until it hits the back wall.

4.2.2 Putting in the shelves

You can put the shelf holder bars (H) in different positions of the side parts of the shelf holder. Insert the shelves (I) straightly into the shelf holder bars (H).

Permitted shelf loads:
Pulled out condition: 10 kg / *22 lb*
Inserted condition: 20 kg / *44 lb*

4.3 Shelves (unit with beads)

You can put the shelves in different positions at the beads of the inner chamber. Insert the shelves straightly.

Permitted shelf loads:
Maximum load of one single shelf: 10 kg / *22 lb*
Maximum total load of all shelves: 30 kg / *66 lb*

4.4 Permadry™ water pan

The Permadry™ system developed by BINDER is an effective and easy to handle system to ensure high humidity inside the incubator but without any condensation forming on the inner surfaces. The Permadry™ water pan consists of two pans. The outer one is heated, the inner one cooled. With the slight difference of temperature caused by that cooling, the central pan is a specific point for condensation of the surplus humidity. Therefore, all other inner surfaces remain dry.

- Unit with shelf holder: Put the Permadry™ water pan on the bottom of the inner chamber within the free space of the ground part of the shelf holder. The front side of the water pan is marked “FRONT”.
- Unit with beads: Put the Permadry™ water pan on the bottom of the inner chamber in a way that both notches lock into place. The front side of the water pan is marked “FRONT”.
- Please make sure that the Permadry™ water pan has good contact to the inner chamber bottom and lie closely on it.
- Fill only the outer pan with distilled, sterilized water up to the filling level marking on the edge of the inner pan.

Figure 9: Permadry™ water pan

Maximum filling quantity of the outer pan (CB 150 and CB210): approx. 1.3 liters.

We recommend cleaning and refilling the pans 2 to 3 times a week. For evacuation, remove the Permadry™ water pan.

We recommend using distilled, sterile water to achieve optimum growth results. Any corrosive damage that may arise following use of water of different quality or by additives is excluded from liability.

If required, you can add microbiologically inhibiting substances such as copper chips, copper sulphate or ethylene diamine tetravinegar acid (EDTA) in a concentration of 1 to 5 mmol/l.

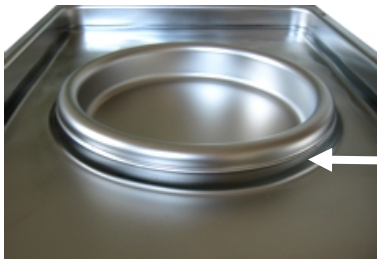


Figure 10: Filling height of the outer basin

Figure 11: Indication on the front of the water pan

4.4.1 With options “Inner chamber made of copper” and “Inner chamber made of copper combined with multiple divided glass door”:

You cannot use the usual Permadry™ water pan together with this option. Replace it by a Permadry™ pan system made of copper consisting of two parts.

Option	Permadry™ pan system Art. No.
Copper-made interior	8003-0064 + 4022-0057
Copper-made interior in combination with multiple divided glass door	8003-0067 + 4022-0057

Place the large-surface water pan on the bottom of the inner chamber within the free space of the ground part of the shelf holder. Put the small-surface water pan in the round empty space in the center of the large-surface water pan.

These impressions must be visible when the door is open. A texture on the rear wall of the pan marks the level.

For evacuation, remove the pans separately by hand.

4.5 Gas connections

4.5.1 Connection of the CO_2 gas bottle

A gas supply pressure above 2.5 bar / *36 psi* will result in unit damage. It is thus important to check the real output pressure of gas bottles, sets of gas bottles or central gas supplies **before** connecting the gas hose to the incubator.

CAUTION

Wrong sequence when connecting gas supply.

Damage to the unit.

∅ Do NOT connect the unit before setting the pressure.

➢ When connecting, observe the sequence:

1. Open the main tap of gas bottle or gas supply
2. Set the output pressure on the pressure scale
3. Connect the gas hose to the incubator

CAUTION

Output pressure higher than value indicated on the incubator.

Damage to the unit.

∅ Do NOT exceed the indicated output pressure of 2.5 bar / *36 psi* above the ambient pressure

➢ Before connection, check the output pressure on the pressure reducer of the bottle.

The gas connection values have been modified. If a maximum value of 2.0 bar / *29 psi* is indicated above the CO_2 socket of your incubator, this value remains valid.

The CO_2 gas necessary for operation must have a technical grade of 99.5 %.

Connect the CO_2 bottle with the supplied gas hose. Socket DN 6 for hose with internal diameter 6 mm / *0.24 inches*. For connection to the quick acting closure socket (6) on the rear of the unit see chap. 4.5.5.

For option bottle changer CO_2 an additional second CO_2 bottle is connected. Socket DN 6 for hose with internal diameter 6 mm / *0.24 inches*. For connection to the quick acting closure socket (16) on the rear of the unit see chap. 4.5.5.

Adjust the gas admission pressure at the CO_2 connection of the gas bottle to 2.0 bar / *29 psi* above the ambient pressure.

If a maximum value of 2.0 bar / *29 psi* is indicated at your incubator, set the gas admission pressure to 1 bar to 1.5 bar / *14 psi to 22 psi* above the ambient pressure.

Replacing gas bottles: Remove the hose connection to the incubator. Then open the main valve of the bottle pressure reducer. Check the output pressure on the second manometer; if appropriate, set it to 2.5 bar / *36 psi* maximum. Only then, establish the hose connection to the incubator.

	The recovery times of the gas concentrations inside the chamber following opening of the door, which are indicated in the technical data (chap. 16.4) refer to a connection pressure of 2.0 bar / *29 psi*. Decreasing supply pressure results in longer recovery times.

Conversion table for gas inlet pressures, bar – psi, see chap. 16.8.

	If you connect several units with different maximum values of gas admission pressure to a common supply net, use pressure reducers for units with a lower maximum gas admission pressure.

4.5.2 Connection of the CO_2 gas bottle with Fail Safe (option)

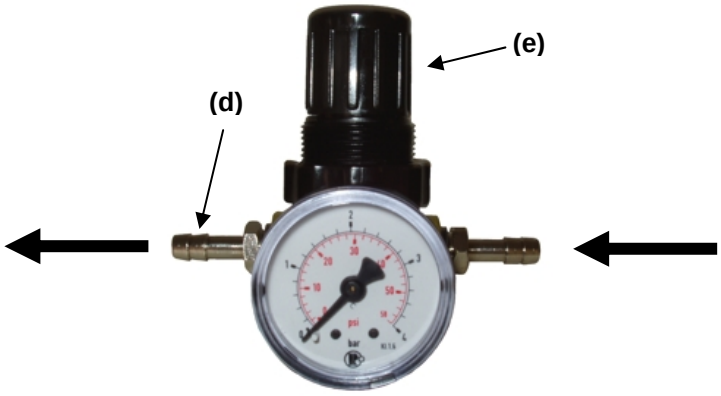


Figure 12: Pressure reducer with manometer for option Fail Safe

With the option Fail Safe, an adjustable pressure reducer with a manometer is delivered in order to ensure a constant supply pressure to the incubator. The pressure reducer unit is supplied ready for connection (with screwed-on hose nozzles and joint disks).

For installation, proceed in the following order:

1. By lifting the pressure adjusting knob (e) and turning it anticlockwise, close the pressure reducer valve
2. The secondary pressure of the gas supply must be between 2.5 bar and 28 bar / *36 psi and 406 psi* (recommended secondary pressure: 3 bar / *53.5 psi*).
3. Install the pressure reducer in the gas line between the CO_2 gas connection (6) and the gas supply. For this, put the gas hoses on the hose nozzles (d) and tighten them with the delivered hose clamps 8-12 mm. Respect the flow direction (arrow on the bottom side).
4. Then by lifting and turning, the pressure-adjusting knob (e) set the desired supply pressure to the incubator of 2.0 bar / *29 psi*.

For the function of the Fail Safe option, see chap. 9.9.

In case of option CO_2 bottle changer (connection chap. 4.5.7) and of option built-in bottle CO_2 changer with external gas connection for a second incubator (connection chap. 4.5.8), a second pressure reducer must be mounted in the gas line to connection (16). Set the same secondary pressure on both pressure reducers.

For the option Fail-Safe, set the pressure reducer mounted in between (one pressure reducer for each of both connections when combines with the option CO_2 bottle changer) to 2.0 bar / *29 psi* up to 2.5 bar / *36 psi* maximum. Set the secondary pressure of gas bottles, sets of gas bottles or central gas supplies by approx. 0.5 bar / *7 psi* higher, i.e., to 2.5 bar / *36 psi* up to 3 bar / *53.5 psi* maximum. Check the pressure setting **before** connecting the gas hose to the incubator.

Conversion table for gas inlet pressures, bar – psi, see chap. 16.8.

4.5.3 Connection of the O_2 bottle (unit with O_2 control)

A gas supply pressure above 2.5 bar / *36 psi* will result in unit damage. It is thus important to check the real output pressure of gas bottles, sets of gas bottles or central gas supplies **before** connecting the gas hose to the incubator.

	**CAUTION** **Wrong sequence when connecting gas supply.** **Damage to the unit.** ∅ Do NOT connect the unit before setting the pressure. ➢ When connecting, observe the sequence: 1. Open the main tap of gas bottle or gas supply 2. Set the output pressure on the pressure scale 3. Connect the gas hose to the incubator

	**CAUTION** **Output pressure higher than value indicated on the incubator.** **Damage to the unit.** ∅ Do NOT exceed the indicated output pressure of 2.5 bar / *36 psi* above the ambient pressure ➢ Before connection, check the output pressure on the pressure reducer of the bottle.

The gas connection values have been modified. If a maximum value of 2.0 bar / *29 psi* is indicated above the O_2 socket of your incubator, this value remains valid.

	The O_2 gas necessary for operation must have a technical grade of 99.5 %.

Connect the O_2 bottle with the supplied gas hose. Socket DN 6 for hose with internal diameter 6 mm / *0.24 inches*. For connection to the quick acting closure socket (5) on the rear of the unit see chap. 4.5.5.

For option bottle changer O_2/N_2 an additional second O_2 bottle is connected. Socket DN 6 for hose with internal diameter 6 mm / *0.24 inches*. For connection to the quick acting closure socket (14) on the rear of the unit see chap. 4.5.5.

	Adjust the gas admission pressure at the O_2 connection of the gas bottle to 2.0 bar / *29 psi* above the ambient pressure.

If a maximum value of 2.0 bar / *29 psi* is indicated at your incubator, set the gas admission pressure to 1 bar to 1.5 bar / *14 psi to 22 psi* above the ambient pressure.

Replacing gas bottles: Remove the hose connection to the incubator. Then open the main valve of the bottle pressure reducer. Check the output pressure on the second manometer; if appropriate, set it to 2.5 bar / *36 psi* maximum. Only then, establish the hose connection to the incubator.

	The recovery times of the gas concentrations inside the chamber following opening of the door, which are indicated in the technical data (chap. 16.4) refer to a connection pressure of 2.0 bar / *29 psi*. Decreasing supply pressure results in longer recovery times.

Conversion table for gas inlet pressures, bar – psi, see chap. 16.8.

4.5.4 Connection of the N_2 bottle (unit with O_2 control)

A gas supply pressure above 2.5 bar / *36 psi* will result in unit damage. It is thus important to check the real output pressure of gas bottles, sets of gas bottles or central gas supplies **before** connecting the gas hose to the incubator.

CAUTION

Wrong sequence when connecting gas supply.

Damage to the unit.

∅ Do NOT connect the unit before setting the pressure.

➢ When connecting, observe the sequence:

1. Open the main tap of gas bottle or gas supply
2. Set the output pressure on the pressure scale
3. Connect the gas hose to the incubator

CAUTION

Output pressure higher than value indicated on the incubator.

Damage to the unit.

∅ Do NOT exceed the indicated output pressure of 2.5 bar / *36 psi* above the ambient pressure

➢ Before connection, check the output pressure on the pressure reducer of the bottle.

The gas connection values have been modified. If a maximum value of 2.0 bar / *29 psi* is indicated above the N_2 socket of your incubator, this value remains valid.

The N_2 gas necessary for operation must have a technical grade of 99.5 %.

Connect the O_2 bottle with the supplied gas hose. Socket DN 6 for hose with internal diameter 6 mm / *0.24 inches*. For connection to the quick acting closure socket (4) on the rear of the unit see chap. 4.5.5.

For option bottle changer O_2/N_2 an additional second N_2 bottle is connected. Socket DN 6 for hose with internal diameter 6 mm / *0.24 inches*. For connection to the quick acting closure socket (12) on the rear of the unit, see chap. 4.5.5.

Adjust the gas admission pressure at the N_2 connection of the gas bottle to 2.0 bar / *29 psi* above the ambient pressure.

If a maximum value of 2.0 bar / *29 psi* is indicated at your incubator, set the gas admission pressure to 1 bar to 1.5 bar / *14 psi to 22 psi* above the ambient pressure.

Replacing gas bottles: Remove the hose connection to the incubator. Then open the main valve of the bottle pressure reducer. Check the output pressure on the second manometer; if appropriate, set it to 2.5 bar / *36 psi* maximum. Only then, establish the hose connection to the incubator.

The recovery times of the gas concentrations inside the chamber following opening of the door, which are indicated in the technical data (chap. 16.4) refer to a connection pressure of 2.0 bar / *29 psi.* Decreasing supply pressure results in longer recovery times.

Conversion table for gas inlet pressures, bar – psi, see chap. 16.8.

4.5.5 Connection of the hose lead to the gas bottle

The gas hose for connection to a gas bottle is already attached to the hose nozzle and secured by a hose clamp. Plug the hose nozzle into the corresponding quick acting closure socket (a) located at the rear of the unit. A rubber cover (b) closes this quick acting closure socket.

	Connect only the supplied hose nozzle to the quick acting closure socket. Otherwise, the quick acting closure socket may leak, and/or it may become impossible to connect the original hose nozzle. In this case, please contact BINDER Service.

Remove the rubber cover (b) by pulling it off.

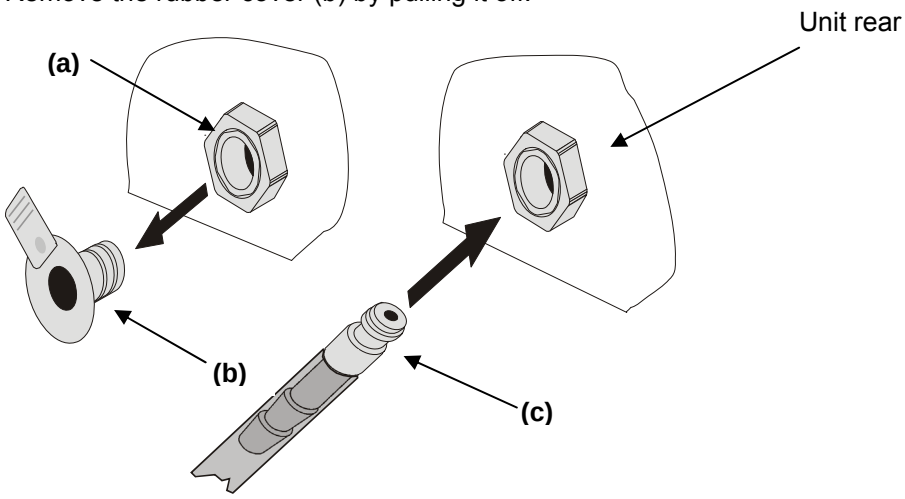
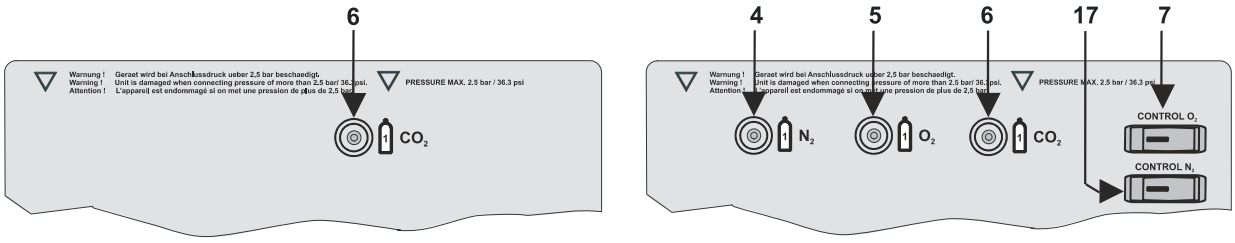


Figure 13: Connection of the hose lead to the gas bottle

Now fit the hose nozzle (c) in the quick acting closure socket. To remove the connection, pull the hose nozzle off the quick acting closure socket.



Unit without O_2 control

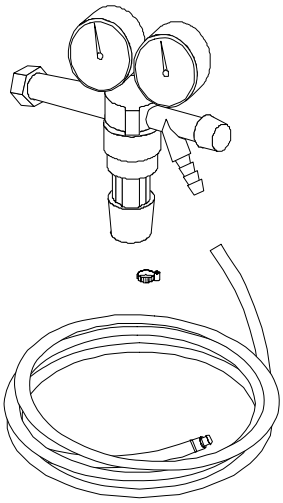
Unit with O_2 control

Figure 14: Standard gas connections at the rear control panel CB

This proceeding is the same for any gas connection. All quick acting closure sockets (CO_2, and N_2 and O_2 at unit with O_2 control) are degreased and supplied with a Viton gasket.

	Socket and hose nozzle for O_2 connection (unit with O_2 control) must be degreased.

4.5.6 Gas bottle connection kit (option)



Gas bottle connection kits are available for CO_2, N_2 and O_2 bottles.

The following parts for connecting one bottle with the input connectors of the incubator are included.

- Pressure reducer with manometers for bottle pressure and outlet pressure
- 5 m pressure hose with pre-assembled hose nozzle
- 1 hose clamp

Figure 15: Gas bottle connection kit

A gas supply pressure above 2.5 bar / *36 psi* will result in unit damage. It is thus important to check the real output pressure of gas bottles, sets of gas bottles or central gas supplies **before** connecting the gas hose to the incubator.

	CAUTION
	Wrong sequence when connecting gas supply. **Damage to the unit.** ∅ Do NOT connect the unit before setting the pressure. ➢ When connecting, observe the sequence: 1. Open the main tap of gas bottle or gas supply 2. Set the output pressure on the pressure scale 3. Connect the gas hose to the incubator

Replacing gas bottles: Remove the hose connection to the incubator. Then open the main valve of the bottle pressure reducer. Check the output pressure on the second manometer; if appropriate, set it to 2.5 bar / *36 psi* maximum. Only then, establish the hose connection to the incubator.

	The recovery times of the gas concentrations inside the chamber following opening the door, which are indicated in the technical data (chap. 16.4) refer to a connection pressure of 2.0 bar / *29 psi*. Decreasing supply pressure results in longer recovery times.

4.5.7 Connection of the built-in bottle changer for CO_2 (option)

Connect the two separate gas bottles to connectors (6) and (16).

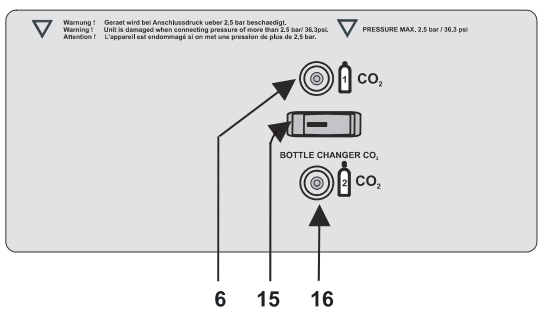


Figure 16: Gas connections for the built-in bottle changer at the rear control panel

	The CO_2 gas necessary for operation must have a technical grade of 99.5 %.

The outlet pressure of each of both gas bottles must be 2.0 bar / *29 psi* above the ambient pressure.

	CAUTION **Excessive output pressure > 2.5 bar / *36 psi*.** **Damage to the unit.** ∅ Do NOT exceed the output pressure of 2.5 bar / *36 psi* above the ambient pressure ➢ Before connection, check the output pressure on the pressure reducer of each bottle.

	With option CO_2 Fail Safe (chap. 9.9), install the optional additional pressure reducer (Art. No. 8009-0232) at **both** gas bottles (for installation chap. 4.5.2).

About the function, see chap. 9.10.1.

4.5.8 Connection of the built-in bottle CO_2 changer with external gas connection for a second incubator (option)

This option allows simultaneous CO_2 supply for two incubators using the built-in CO_2 bottle changer of the first incubator (chap. 9.10.1). Connect the second incubator to an external gas connection (18) at the rear of the first incubator.

For connection of the CO_2 bottle changer:

Connect the two separate gas bottles to connectors (6) and (16).

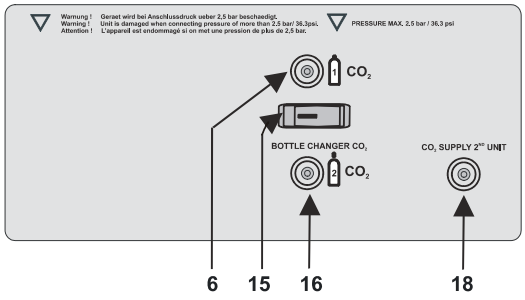


Figure 17: Gas connections for the built-in bottle CO_2 changer with external gas connection at the rear control panel

	The CO_2 gas necessary for operation must have a technical grade of 99.5 %.

The outlet pressure of each gas bottle must be 2.0 bar / *29 psi* above the ambient pressure.

	CAUTION **Excessive output pressure > 2.5 bar / *36 psi*.** **Damage to the unit.** ∅ Do NOT exceed the output pressure of 2.5 bar / *36 psi* above the ambient pressure ➢ Before connection, check the output pressure on the pressure reducer of each bottle.

	With option CO_2 Fail Safe (chap. 9.9), install the optional additional pressure reducer (Art. No. 8009-0232) at **both** gas bottles (for installation chap. 4.5.2).

As long as the hose nozzle (c) is plugged into the quick acting closure socket (a) (chap. 4.5.5), CO_2 gas keeps escaping permanently through the external gas connection (18). If you do not connect a second CB unit, the hose nozzle must not remain or become plugged in the quick acting closure socket.

	**WARNING** **High concentration of CO_2.** **Danger of poisoning.** ➢ If no second unit is connected: Remove the hose nozzle (c) from the quick acting closure socket (Figure 13).

About the function, see chap. 9.10.2.

4.5.9 Connection of the built-in bottle changers for N_2 and O_2 (option for unit with O_2 control)

Connect the two separate O_2 gas bottles to connectors (5) and (14).

Connect the two separate N_2 gas bottles to connectors (4) and (12).

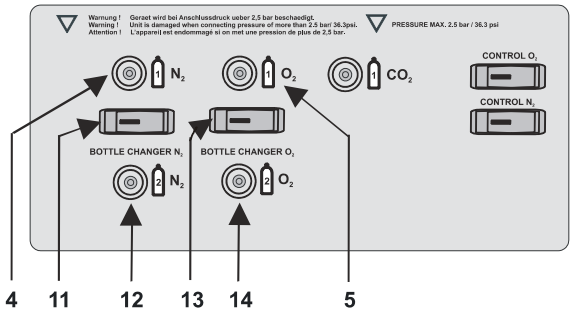


Figure 18: Gas connections for the built-in bottle changers for N_2 and O_2 at the rear control panel

	The O_2 and N_2 gas necessary for operation must have a technical grade of 99.5 %.

The outlet pressure of each gas bottle must be 2.0 bar / *29 psi* above the ambient pressure.

	**CAUTION** **Excessive output pressure > 2.5 bar / *36 psi*.** **Damage to the unit.** ∅ Do NOT exceed the output pressure of 2.5 bar / *36 psi* above the ambient pressure ➢ Before connection, check the output pressure on the pressure reducer of each bottle.

About the function, see chap. 9.10.3.

4.6 Electrical connection

- The CO_2 incubator has a fixed mains connection cable 1800 mm / *70.87 inches* in length
- CB 150, CB 210: Shock-proof plug, tension 230 V (1N~) +/- 10 %, 50/60 Hz
- CB 150 (100 V), CB 210 (100 V): NEMA plug 5-20P, tension 100 V (1N~) +/- 10 %, 50/60 Hz
- CB 150-UL, CB 210-UL: NEMA plug 5-20P, tension 115 V (1N~) +/- 10 %, 60 Hz
- Prior to connection and start-up, check the mains voltage. Compare the values to the data specified on the type plate of the unit (unit front behind the door, bottom left-hand, chap. 1.4)
- When connecting, please observe the regulations specified by the local electricity supply company and as well as the VDE directives (for Germany)
- Pollution degree (acc. to IEC 1010-1): 2
- Over-voltage category (acc. to IEC 1010-1): II

	CAUTION
	Danger of incorrect mains voltage. **Damage to the equipment.** ➢ Check the mains voltage before connection and start-up. ➢ Compare the mains voltage with the data indicated on the type plate.

See also electrical data (chap. 16.4).

	To completely isolate the unit from the mains supply, you must disconnect the mains plug. Install the unit in a way that the mains plug is easily accessible and can be easily disconnected in case of danger.

5. Start up

After connecting the supply lines (chap. 4), switch on the unit by the main switch (A1).

After switching on the incubator for the first time, enter the altitude of the site above sea level into the controller (chap. 6.5).

5.1 Function overview of display controller MB1

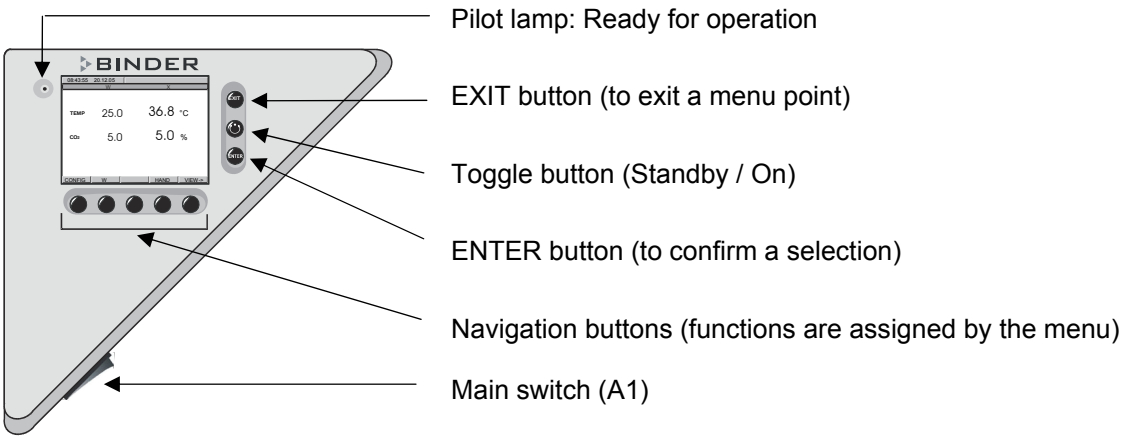


Figure 19: Display controller MB1

The display controller MB1 controls the following values inside the CO_2 incubator:

- Channel 1: Temperature in °C. Range 7 degrees above the ambient temperature up to 60°C / *140°F*)
- Channel 2: Carbon dioxide concentration in vol.-% (range 0 vol.-% up to 20 vol.-%)

Unit with O_2 control in addition:

- Channel 4: Oxygen concentration in vol.-% (range 0.2 vol.-% up to 95 vol.-%)

You can enter the desired set point values via a menu in the display controller.

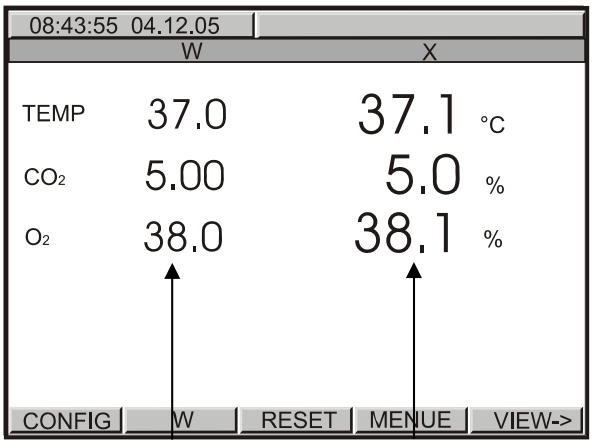


Figure 20: Normal display of the MB1 display controller with O_2 control

You can enter the set point values directly through the keypad of the controller or graphically through the software APT-COM™ 3 DataControlSystem (option, chap. 9.8) specially developed by BINDER.

These set points remain valid until the next manual change.

5.2 Factory presetting

The unit is supplied with the following basic parameters:

- Adjustment set temperature — 37°C / *98.6°F*
- CO_2 concentration — 5 vol.-%
- O_2 concentration (unit with O_2 control) — 20.7 vol.-%
- Safety device class 3.1 — 38.5°C / *101.3°F*
- Sterilization temperature — 187.5°C / *369.5°F*
- Acoustic alarm signal — switched on

The set temperature determines the desired working temperature in the inner chamber, i.e. set value 37°C / *98.6°F* = desired working temperature 37°C / *98.6°F*. The same is valid for the CO_2 and O_2 concentration (unit with O_2 control). For the hot-air sterilization, the set value is 187.5°C / *369.5°F* and cannot be changed.

	As long as there is no accordance between the actual and set value shown in the display, proper operation of the unit is not guaranteed.

5.3 Switching on the unit

Set the main switch (A1) to position I. The pilot lamp shows the unit is ready for operation.

	Observe a delay time of approx. 30s between switching Off and On again. Otherwise an initialization problem may occur (display showing e.g. “–1999”).

In case the main switch is already in position I and yet the controller display is dark, the chamber is in stand-by mode. Switch on the unit by pressing the Stand-by button. When switched on, the controller regulates temperature and CO_2 automatically to the factory default settings (chap. 5.2) or to the last entered set points.

Temperature: Equilibration time is approx. 1 hour.

CO_2: After approx. 5 minutes, the CO_2 concentration equilibrates automatically to the preset value of 5 vol.-% CO_2.

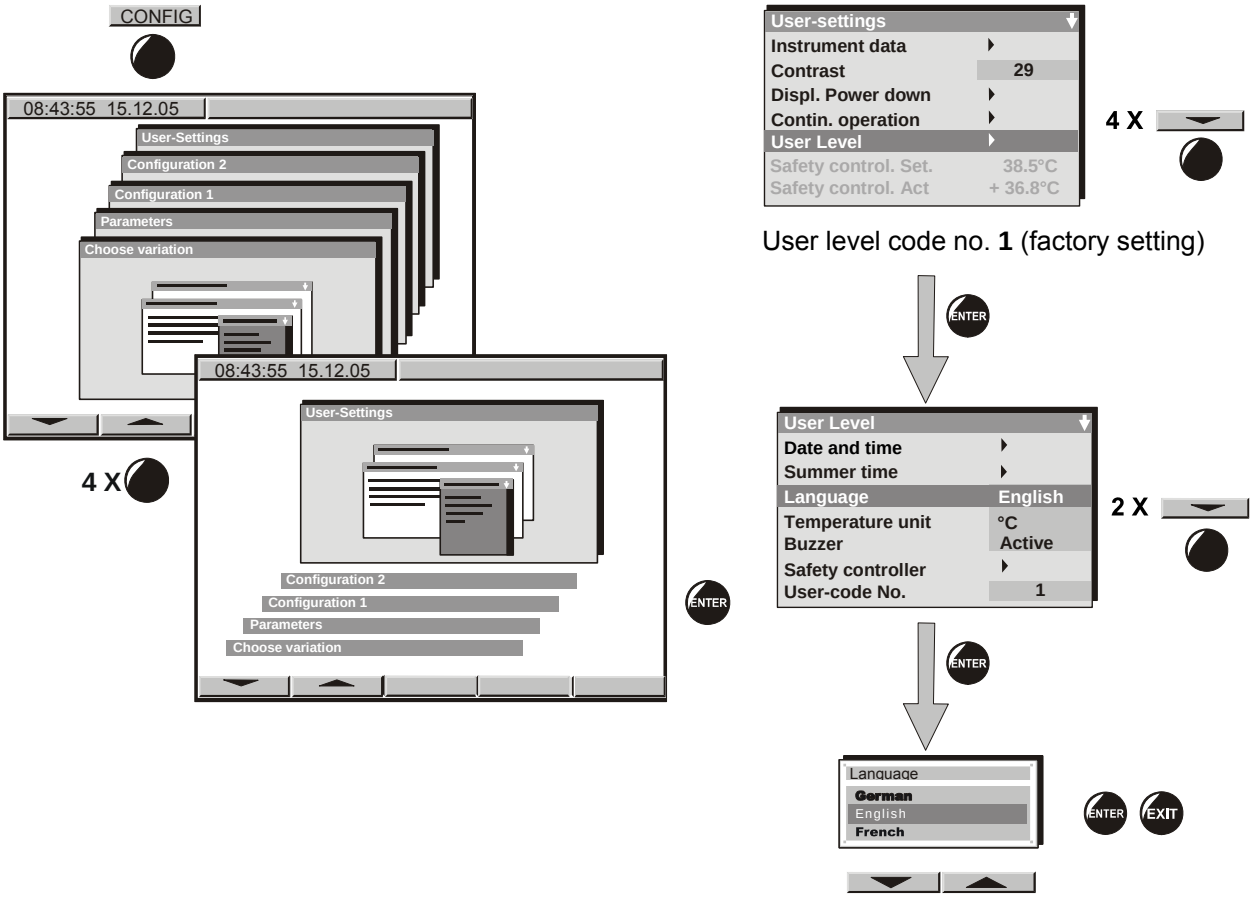
O_2 (unit with O_2 control): After a delay of 10 minutes, the ambient oxygen concentration of approx. 20.7 vol.-% is displayed. During the first 10 minutes, O_2 control is not defined. Then O_2 is regulated to the displayed set point value of 20.7 vol.-% .

6. Settings of the controller MB1

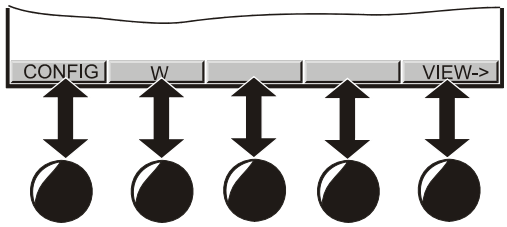
6.1 Selection of the menu language

The display controller MB1 controls temperature, concentration of carbon dioxide, and concentration of oxygen (unit with O_2 control) inside the CO_2 incubator. The controller communicates by a plain language menu guide in German, English and French.

The selection of the desired menu language is located in the sub-menu “User-Level” of the menu “User-Settings“. Select menu point “Language“.



The row of buttons below the display is context- sensitive. The inscription above the buttons on the display defines the button’s function.



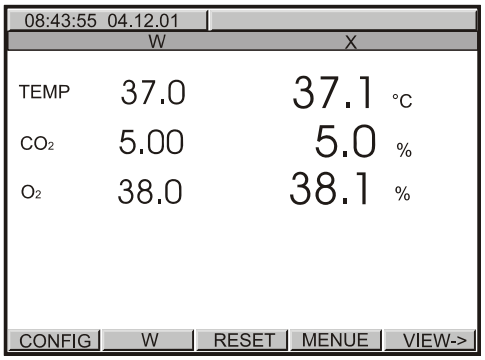
	Do NOT change the temperature unit from °C to °F.

6.2 Overview of controller MB1 displays

The highest operation level contains the following four different representations:

- **Normal display**
- **Event list**
- **Chart recorder function**
- **Contact page**.

Toggle between the displays by pressing button VIEW ->.



Normal display

Comparison of the current temperature and gas concentration (W) with the set point values (X)

Event List

Overview over the last 16 events or error conditions of the unit.

Chart recorder function

Graphical display of the temperature and gas concentration values and review of the last 43200 measurements of all parameters on a history display.

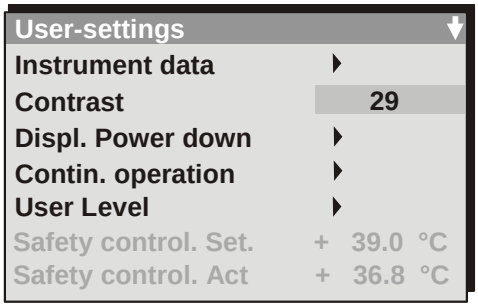
A memory interval of 5s corresponds to a supervision period of 2.5 days.

An enlarged line on the right indicates opening the door.

Contact page

Contact BINDER Service easily.

6.3 Settings in the menu “User-settings”



Instrument data

- **Instrument Name**

  Enter an individual name of the CO_2 incubator.

- **Address**

  Enter a controller address (1 to 30) for operation with the communication software APT-COM™.

All other entries are relevant only for service purposes.

Contrast:

Adjust the contrast of the display according to the ambient light situation to obtain maximum readability.

Displ. power down

- **Switch off event**

  Do not change the entry “Wait. Period”.

- **Waiting period**

  You can enter a delay time after which the display, following manual activation, will automatically be switched off again, on condition that the moment is outside the operation time defined in menu ”Contin. operation”.

Contin. operation

Enter an operation time to determine the period of display activity. Outside the defined period, the display is automatically switched off. Pressing down any key reactivates the display. After the time set in menu “Displ. power down“, the display is switched off again as far as the actual time is not within the operation time fixed in menu “Cont. operation“.

User Level

Toggle here to menu “User Level” (chap. 6.4) by entering a password. Factory default setting for this password is +00001. You can change the password (“user code”) in the menu “User Level”.

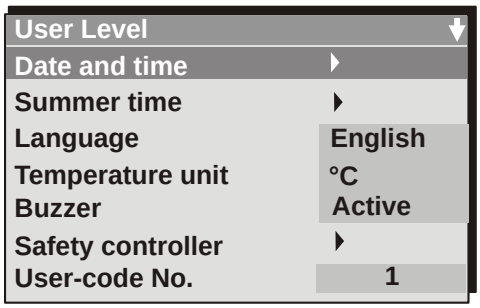
Safety control.Set

The setting of the tolerance limit of the safety controller (chap. 7.2) is displayed. You cannot change it here.

Safety control.Act

The measuring result of the safety controller is displayed. The safety controller compares the value measured by a second independent temperature sensor to the entered tolerance limit.

6.4 Settings in the menu “User Level”



Date and time

Enter the actual date and time to provide the measurement records with the correct relation of time. Data are displayed in the chart recorder function (chap. 6.6) of the controller and remain stored during power failure.

Summer time

Time is set one hour in advance during the summer time period.

- **Summer time switch**
  - **Off:** No change to summer time occurs
  - **User timed:** Beginning and end of summer time can be set individually
  - **Automatic:** The summer time arrangement for central Europe is enabled (summer time from last Sunday of March until last Sunday of October)

Language

Select the menu language as German, English, or French (chap. 6.1).

Temperature unit

	Do NOT change the temperature unit from °C to °F.

Buzzer

- **Inactive:** No acoustic alarm in case of alarm events (chap. 8).
- **Active:** Acoustic alarm in case of alarm events (chap. 8).

Safety controller

Enter a safety controller tolerance limit for temperature exceeding. For setting, see chap. 7.2.

User-Code No.

Change the password (“user code”) needed to access the menu “User settings”. Factory default setting: +00001.

	Keep in mind any change of the user password. There is no entrance to this menu without this password.

6.5 Entry of the sea level

After first switching on of the incubator, enter the altitude of the site over the sea level into the controller MB1.

This entry serves to correct the calculation of CO_2 concentration in vol.-% from the measurement of partial pressure.

The setting remains stored after power off.

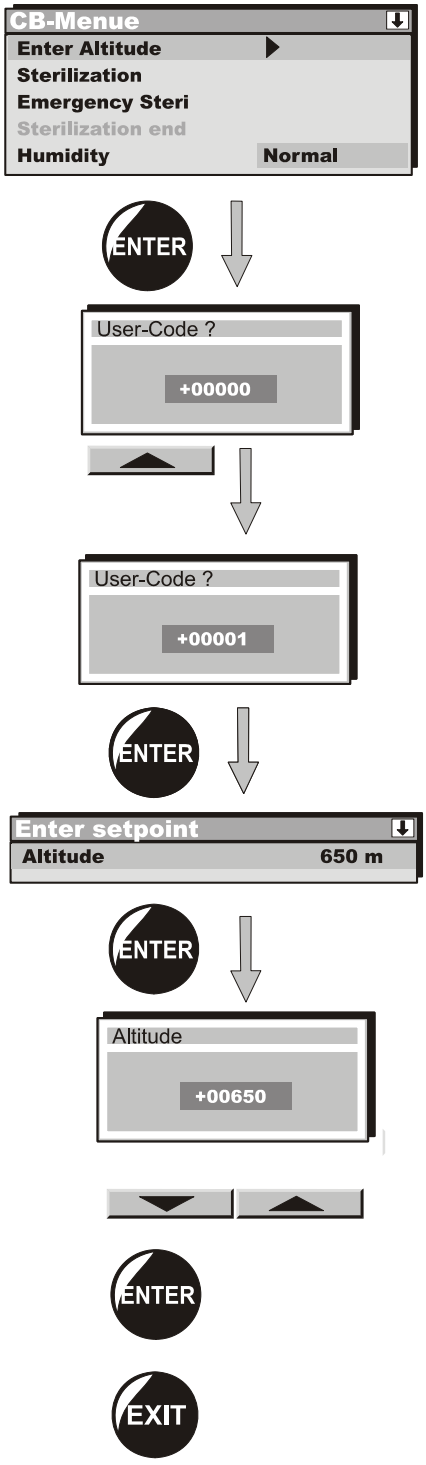
Proceeding:

In normal display, press the “menu” button to enter the CB-Menu.

Enter the user code
(factory setting: 00001)

Enter the altitude value in meters [m] into the field “Enter setpoint”. Confirm with ENTER and leave the menu with EXIT.

Correlation feet [ft] to meter [m]: **[m] = 0.305 * [ft]**
(see chap. 16.7).

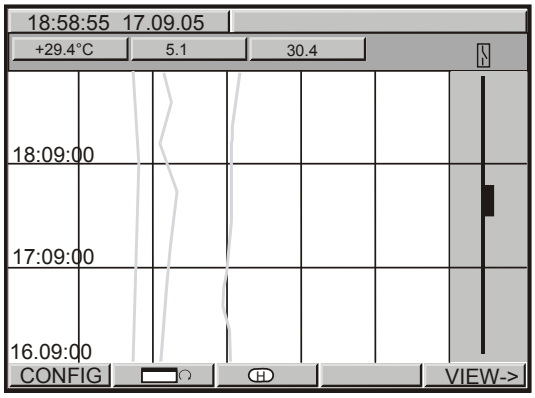


	Unlock the keyboard locking (option, chap. 9.7) via the key switch to enter the sea level.

6.6 Graphical representation of the measurement course (chart recorder function)

This way of data representation imitates a chart recorder and allows recalling any set of measured data of any point of time out of the recorded period.

Normal display of the chart recorder function:



Top left: The actual date and time are displayed.

Below: The current values of temperature [°C], CO_2 [%] and O_2 [%] (unit with O_2 control) are numerically and graphically displayed.

Scaling:

Temperature: 0°C / *32°F* up to 200°C / *392°F*

CO_2: 0 vol.-% up to 20 vol.-%

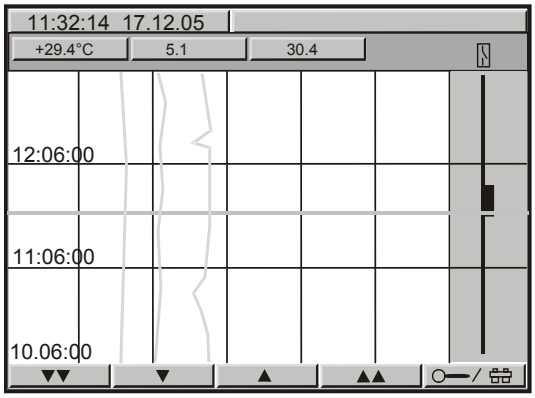
O_2 (unit with O_2 control): 0 vol.-% up to 100 vol.-%

Opening the door is displayed on the right side as an enlarged line.

Button allows toggling between different representations.

Depending on the selected kind of representation, button may not have been visible until now.

History display with cursor:



Select button = History. A pink line appears on the display marking as a cursor the selected instant. You can recall the recorded data of a certain instant.

Top left: Date and time of the selected cursor position are displayed.

Below: The corresponding values of temperature, CO_2, and O_2 (unit with O_2 control) of this instant are numerically and graphically displayed.

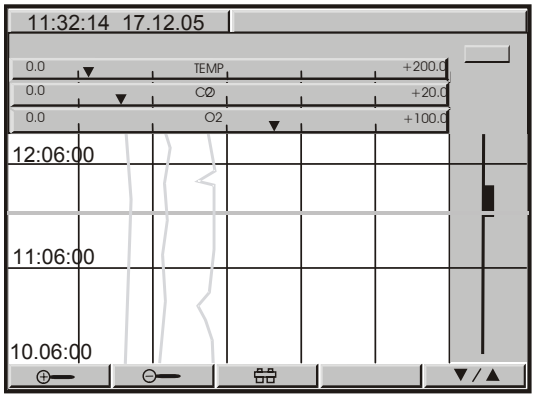
Scroll the cursor position using the arrow buttons.

Single arrow buttons: fine-tuning.

Double arrow buttons: page-up and page-down.

Switch to the zoom display by pressing button :

History - zoom function:

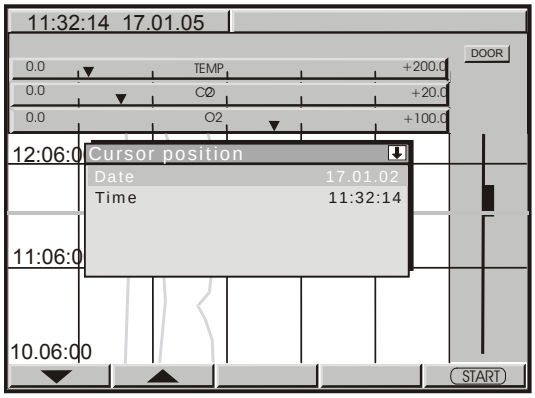


Magnifier buttons : Zoom and zoom back (i.e., shorten or extend the displayed period).

Toggle back to the former representation display using button .

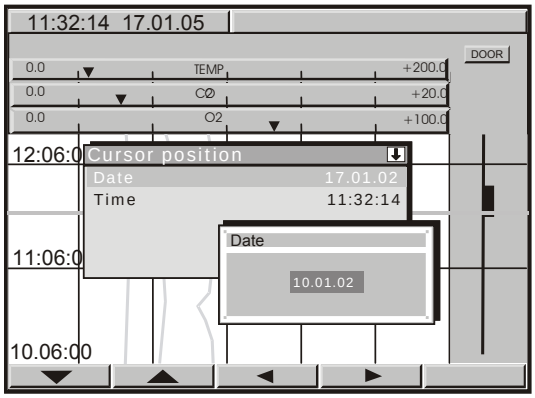
You can also directly enter any cursor position as a numerical input.

History representation: Toggling to any instant:



Press button . The window “Cursor position” opens to enter date and time.

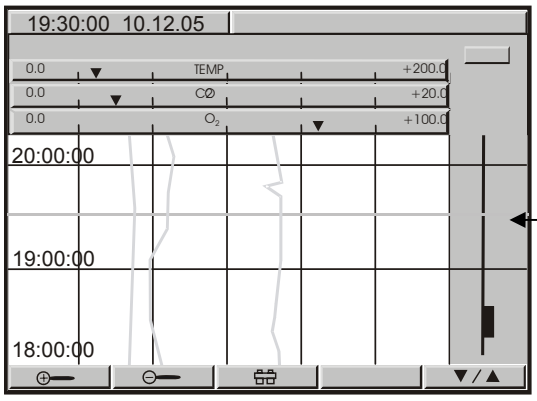
Select date or time with the arrow buttons and confirm with ENTER.



Now you can access any instant that you like to recall. Enter date and time with the arrow buttons and confirm with ENTER.

Press button START .

History display at the selected point of time:



Top left: Date and time of the selected cursor position are displayed.

Below: The corresponding values of temperature [°C], CO_2 [%] and O_2 [%] (unit with O_2 control) of this instant are numerically and graphically displayed.

The cursor line marks the corresponding instant.

The possible presentation depends on the pre-selected storage rate. This means the higher the storage rate, the more precisely but also shorter the data representation will be, see following table:

Storage rate	Storage duration	
	(hours)	(days)
5 sec	60	2.5
10 sec	120	5
1 min	720	30
5 min	3600	150
10 min	7200	300

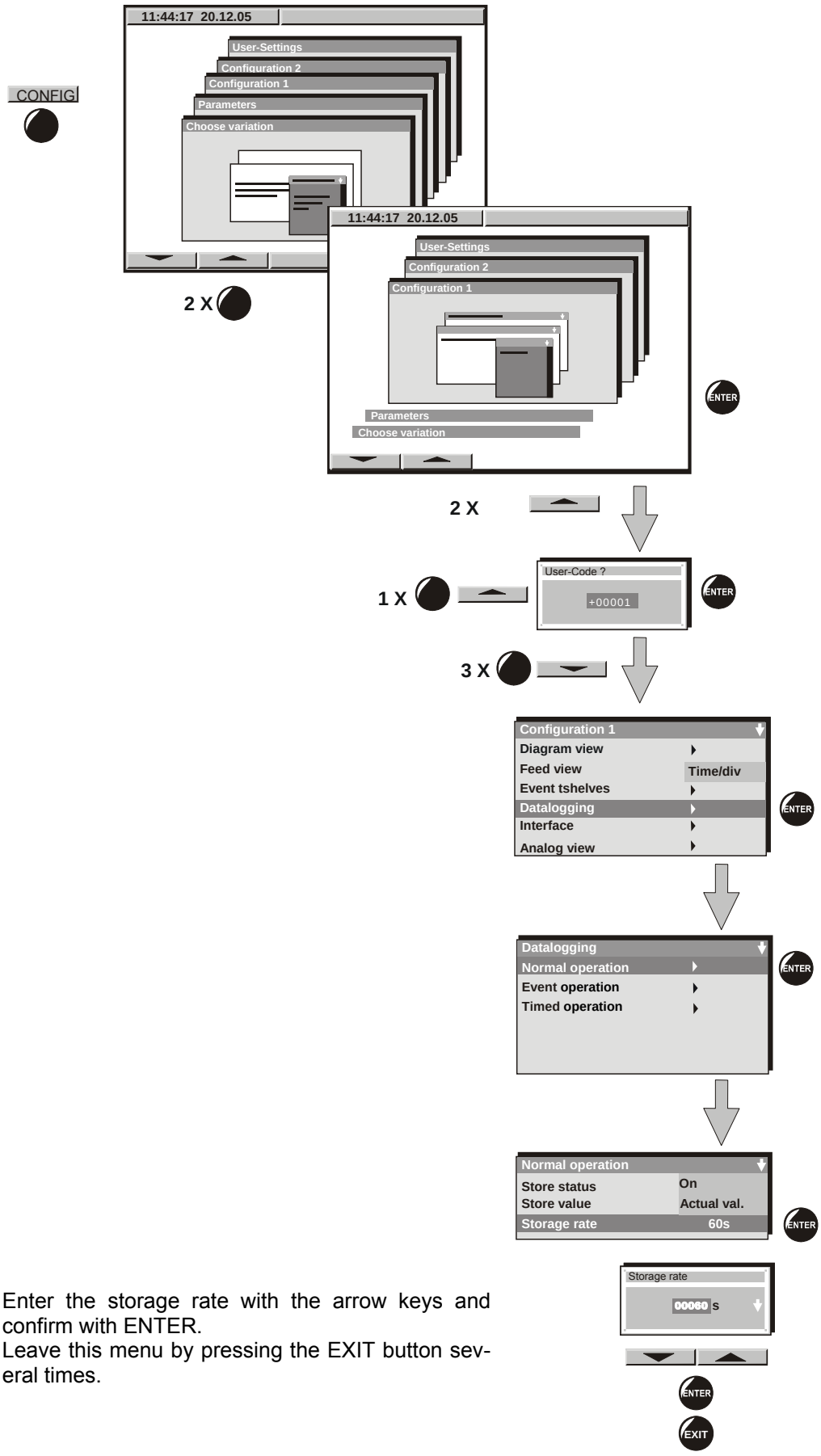
CAUTION

Setting the storage rate clears the measured-value memory.

Danger of information loss.

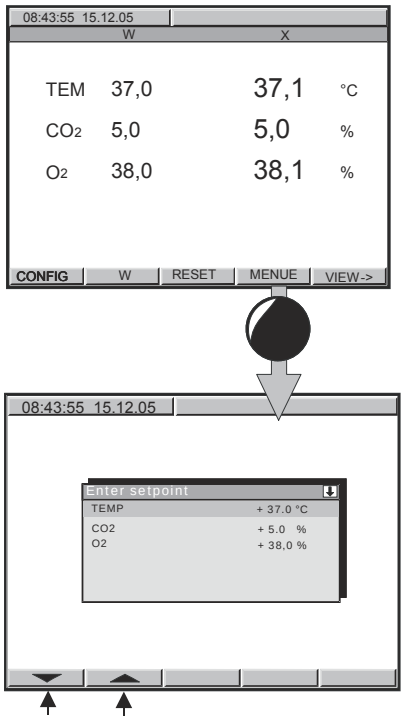
➢ Change the storage rate ONLY if the previously registered data are no more required.

6.6.1 Setting the storage rate

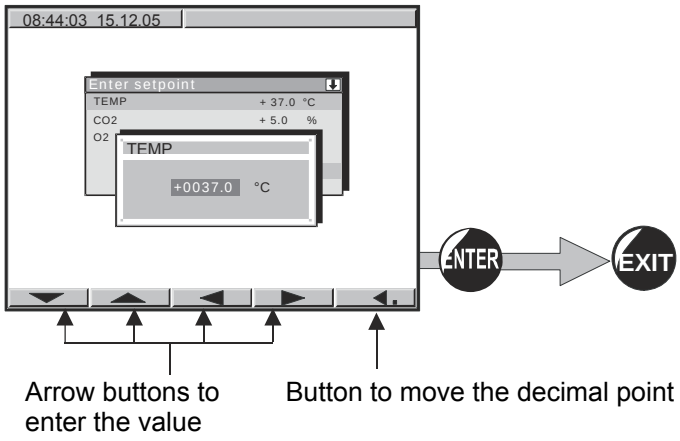


Enter the storage rate with the arrow keys and confirm with ENTER.
Leave this menu by pressing the EXIT button several times.

6.7 Entry of the set point values



Toggling between temperature set point, CO_2 set point, and O_2 set point (unit with O_2 control)



	Unlock the keyboard locking (option, chap. 9.7) via the key switch to enter the set point.

Setting ranges:

Temperature	7 degrees above the ambient temperature up to +60°C / *140°F*
Carbon dioxide	0 vol.-% up to 20 vol.-%
Oxygen (unit with O_2 control)	0.2 vol.-% up to 95 vol.-%

	With set point type "**Limit**", adapt the safety controller every time the set point for temperature is changed (chap. 7.2). Set the safety controller set point by approx. 2°C above the controller temperature set point. Recommended setting: Set point type "**Offset**" with safety controller set point 2°C. We recommend using the keyboard locking (option, chap. 9.7) during operation.

	When setting a lower temperature set point, in order to save time, we recommend cooling down the unit by switching it off and opening both doors of the unit.

	When setting a lower CO_2 set point, the CO_2 gas must be able to escape first. Open both doors of the unit for this purpose.

6.8 Deactivating O_2 control (unit with O_2 control)

If you do not want to use O_2 control, you can deactivate it by simultaneously switching off the two switches (7) for O_2 and (17) for N_2. Notifying or alarm messages for O_2 and N_2 are no more issued (pressure or concentration). The zero-voltage relay alarm output (chap.8.3) for messages of deviation of the O_2 concentration is also deactivated.

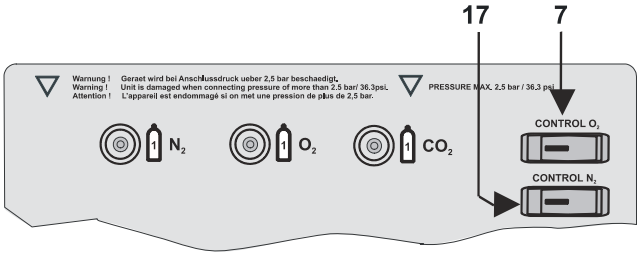


Figure 21: Switches for deactivating O_2 control, located at the rear control panel CB

If you switch off just one of the two switches (7) or (17), O_2 control remains functional. With switch (7) switched off, there is no more pressure alarm for O_2. With switch (17) switched off, there is no more pressure alarm for N_2. This is useful if you do not want to connect one of the two gas types O_2 or N_2.

	If you deactivate both pressure alarm messages with switches (7) and (17), O_2 control is deactivated automatically.

6.9 Humidity control of the Permadry™ system

The Permadry™ system with its 2-pan water system guarantees a maximum humidity of up to 95 % r.H. in the inner chamber, which remains condensation-free. This performance assumes an average ambient temperature of 25°C / *77°F* and a working temperature in the inner chamber of 37°C / *98.6°F*.

You can increase or decrease humidity slightly if required.

Proceeding:

- Unlock the keyboard locking (option, chap. 9.7).
- In normal display, press the “menu” button to enter the CB-Menu.
- Select setting “High”, “Normal” or “Low” in the field “Humidity”. Confirm with ENTER and leave the menu with EXIT.
- Lock afterwards the keyboard locking (option, chap. 9.7).

Factory default setting: “Normal”.

	If the ambient temperatures deviate by more than +/- 5°C from the values recommended by the manufacturer, the conditions for maximum air humidity with condensation-free inner chamber are no longer guaranteed. Contact BINDER Service for assistance.

6.10 Behavior during and after power failure and shut down

During power failure, all controller functions are out of operation. The gas inlet valves are closed so that no gas can escape into the ambient air. The zero-voltage relay alarm output (3) (chap. 8.3) is switched to alarm position indicating the alarm for the whole duration of the power failure.

After power return, the alarm message (red) “POWER ON” appears on the controller display. A buzzer sounds if you did not deactivate it in menu “User level” (chap. 6.4).

Power failure and power return appear in the event list.

After power return or after switching on by hand, the incubator regulates temperature, CO_2, und O_2 (unit with O_2 control) to the last entered set points.

If the unit had been in sterilization mode, the process is cancelled and the unit continues normal operation mode with the set points entered before. The set point values remain in memory. If the temperature or concentration of CO_2, and O_2 (unit with O_2 control) had dropped blow the alarm limits during power failure, press the RESET button as soon as the correct values are reached again to reset the state of alarm.

7. Temperature safety devices

7.1 Over temperature protective device (class 1)

The CO_2 incubator is equipped with an internal temperature safety device, class 1 acc. to DIN 12880. It serves to protect the unit and prevents danger caused by considerable defects.

If the actual temperature exceeds the nominal temperature by approx. 10°C, the over temperature protective device permanently switches off the unit. The user cannot take the device into operation again. The protective cut-off device is located internally. Only a service specialist can replace it. In this case, please contact an authorized service or BINDER Service.

7.2 Safety controller (temperature safety device class 3.1)

The CO_2 incubator is equipped with an over temperature safety device class 3.1 acc. to DIN 12880. It is called “safety controller”. This second, electrically independent temperature controller takes over control at a selectable set point in case of a faulty condition. It serves to protect the charging material against extensive high temperatures.

The message “TEMPERATURE LIMIT” on the controller display indicates safety controller activity. The safety controller controls the CO_2 incubator to the entered safety controller set point until the temperature inside the CO_2 incubator returns below this temperature and until you then reset it by button RESET.

	Regularly check the safety controller setting for set point type “Limit” or “Offset”. Set the safety controller set point by approx. 2°C above the desired temperature set point.

Safety controller set point types:

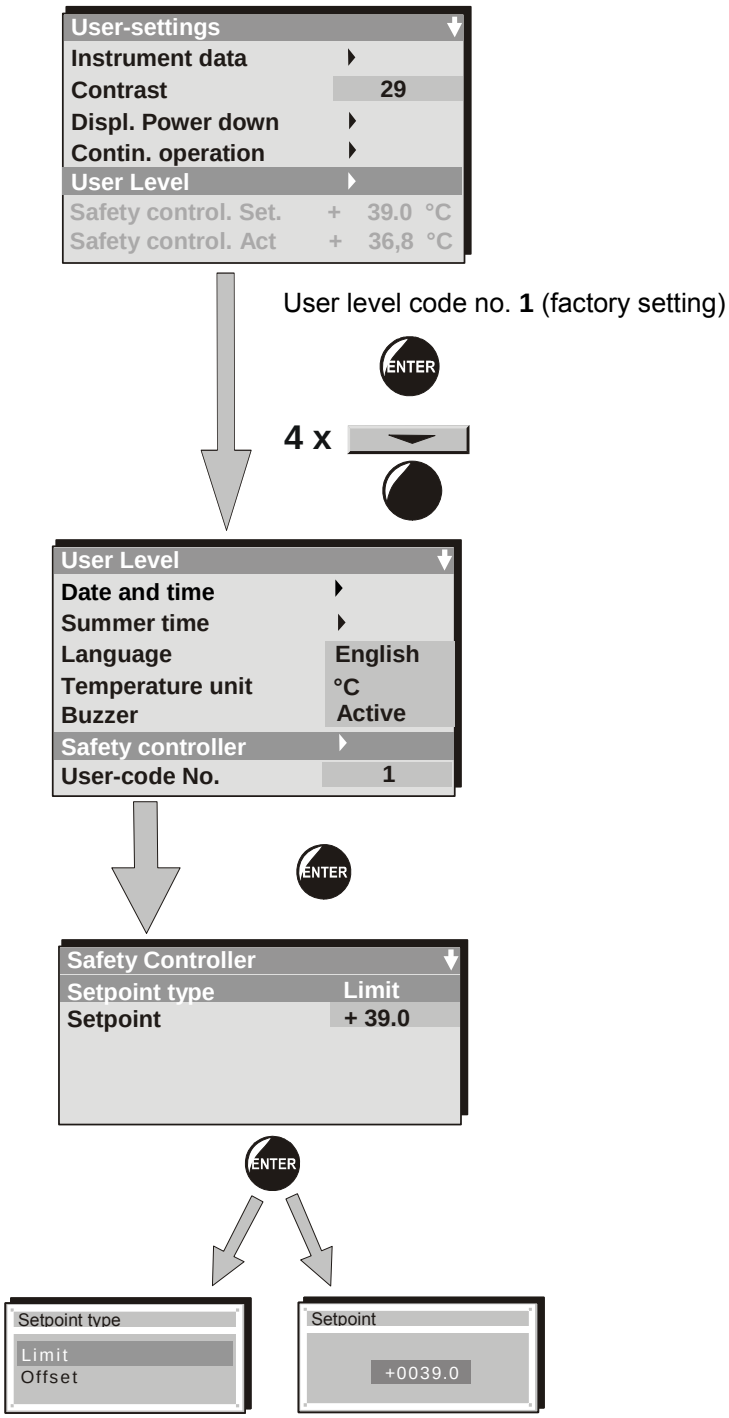
Limit	Absolute maximally permitted temperature value Example: temperature set point 37°C / *98.6°F*, safety controller set point 39°C / *102.2°F*
Offset	Maximum over temperature above any active temperature set point (e.g., 2°C). The maximum temperature internally and automatically changes with every set point change.

	Do NOT change the temperature unit from °C to °F.

	The setting of the safety controller set point remains valid during sterilization (chap. 12.5). Thus with safety controller set point type “Limit” set to a working set point, no sterilization is possible.

Checking and setting safety controller set point type and safety controller set point:

Unlock the keyboard locking (option, chap. 9.7).



In the menu “User Level”, select the submenu “Safety controller”.

- Select the safety controller set point type “Limit” or “Offset” in the field “Setpoint type”
- Enter the value for “Limit” or “Offset” in the field “Setpoint”.

Lock afterwards the keyboard locking (option, chap. 9.7).

Regarding temperature disturbances see alarm indications, chap. 8.

8. Notifying and alarm functions

8.1 Notifying and alarm system overview (auto diagnosis system)

The unit provides notification and alarm functions indicating messages in up to three steps:

1. Visual indication of notifying or error messages as blue notes on the display of the controller MB1.
2. Visual indication of alarm messages as red notes with an alarm bell symbol. After a delay time, some notes change their color from blue to red.

   Additionally there is an acoustic alert, if you did not deactivate the buzzer in menu “User level” (chap. 6.4).
3. Zero-voltage relay alarm outputs (3) (chap. 8.3) allow transmitting the alarm e.g., to a central monitoring system.

Notifying sequence	1	2	3
Event	**Note (blue field)**	**Alarm (red field)**	**Zero-voltage relay alarm outputs**
Door open	**DOOR OPEN** immediately	**DOOR OPEN** after 5 min.	after 15 min.
CO_2 gas supply pressure too low (< 0.3 bar / *4.4 psi*)	---	**LOW PRESSURE CO2** **LOW PRESSURE CO2** **LOW PRESSURE CO2** after 20 sec.	---
O_2 gas supply pressure too low (< 0.3 bar / *4.4 psi*) (unit with O_2 control) Switch (7) must be switched on (position I).	---	**LOW PRESSURE O2** **LOW PRESSURE O2** **LOW PRESSURE O2** after 20 sec.	---
N_2 gas supply pressure too low (< 0.3 bar / *4.4 psi*) (unit with O_2 control) Switch (17) must be switched on (position I).	---	**LOW PRESSURE N2** **LOW PRESSURE N2** **LOW PRESSURE N2** after 20 sec.	---
Temperature deviation of more than +/- 1°C of the entered set point	**TEMPERATURE** immediately	**TEMPERATURE** after 15 Min.	after 15 min.
CO_2 deviation of more than +/- 1 Vol.-% of the entered set point	**CO2** immediately	**CO2** after 15 min.	after 15 min.
O_2 deviation of more than +/- 1 Vol.-% of the entered set point (unit with O_2 control) Switch (7) AND / OR Switch (17) must be switched on (position I).	**O2** immediately	**O2** after 15 min.	after 15 min.
Exceeded temperature limit of the safety controller	---	**TEMPERATURE LIMIT** immediately	---
CO_2 sensor not plugged-in or faulty during operation	**!CO2-SENSOR!** immediately	**!CO2-SENSOR!** after 1 min.	---

Notifying sequence	1	2	3
Event	**Note (blue field)**	**Alarm (red field)**	**Zero-voltage relay alarm outputs**
During hot-air sterilization (no alarm)	**DO NOT OPEN THE DOOR**	---	---
End of automatic hot-air sterilization **The inner chamber and parts inside can still be hot. Do not touch.**	**STERI END** immediately	---	---
Power failure	---	---	immediately
Power return after power failure	---	**POWER ON** immediately	---
With option locking of the keyboard (chap. 9.7):			
Locked keyboard	**KEY LOCK** immediately	---	---
With option Fail Safe (chap. 9.9):			
Assessed deviation of the opening frequency of the CO_2 inlet valve	---	**FAIL SAFE** immediately	---

The indicated intervals refer to the time after occurrence of the error or indicated condition.

8.2 Resetting the notifying or alarm messages

The RESET button, which serves to acknowledge and reset the indication, appears automatically whenever a note or an alarm message comes up.

1. Remove the cause of the disturbance or wait that the unit compensates the reason of the error.
2. Hit the RESET button to reset the note or the alarm message.

CAUTION

In case the RESET button does not cancel the notifying or alarm indication, the nature of disturbance was not correctly removed.

➢ Contact BINDER Service.

The RESET button allows resetting notifying or alarm messages regarding temperature and CO_2 / O_2 only with in a tolerance sector of +/- 1°C resp. +/- 1 vol.-% .

➢ With values outside this range, contact BINDER Service.

8.3 Zero-voltage relay alarm output

The CO_2 incubator is equipped at the rear with a zero-voltage relay output for the temperature and CO_2, which permits the transmission of alarms (chap. 8) to a central monitoring system.

A DIN socket (3) serves to establish the connection.

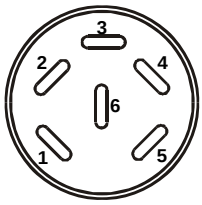
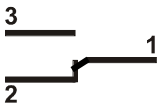


Figure 22: Pin configuration of the DIN socket (3)



Pin 1: Pole
Pin 2: Break relay
Pin 3: Make contact

In case of no alarm, contact 1 closes with contact 3.
Closing contact 1 with contact 2 switches the zero-voltage relay alarm output.

Maximum loading capacity of the switching contacts: 24V AC/DC – 2.5 A

DANGER

Electrical hazard.

Danger of death.

Damage to switching contacts and connection socket.

∅ Do NOT exceed the maximum switching load of 24V AC/DC – 2.5A.

∅ Do NOT connect any devices with a higher loading capacity.

The zero-voltage relay alarm output switches at following events:

Power failure	immediately
Deviation of temperature or CO_2 or O_2 (unit with O_2 control)	after 15 min from error
Door open	after 15 min from error

In case of a deviation of temperature or CO_2 or O_2 (unit with O_2 control), or of door open alarm, the alarm message on the controller display remains displayed during the alarm transmission via the zero-voltage relay outputs.

As soon as the cause of the alarm is rectified, you can reset the alarm transmission via the zero-voltage relay outputs together with the alarm message on the controller display hitting the RESET key.

In case of power failure, transmission of the alarm via zero-voltage relay outputs remains active for the duration of the power failure. Afterwards, both contacts close automatically.

The alert via the zero-voltage relay output exists for the whole duration of the power failure.

After power return, contact 1 closes automatically with contact 3. The alarm message (red) “POWER ON” appears on the controller display, and a buzzer sounds provided that it has not been deactivated in menu “User level” (chap. 6.4). Power failure and power return appear in the event list.

When using the communication software APT-COM™ 3 DataControlSystem (option, chap. 9.8) via the RS422 interface of the CO_2 incubator for data acquisition, the alarm is not automatically transmitted to the APT-COM™ protocol.

➢ Set the tolerance limits for recording limit value excesses separately in APT-COM™.

8.4 Door open

The open and closed condition of the unit door is controlled via the door contact switch. If the door is open, the temperature, CO_2, and O_2 (unit with O_2 control) controls switch off.

1. Door open:
   Notification (blue) “DOOR OPEN”.
2. Door open for more than 5 minutes:
   Alarm message (red) “DOOR OPEN”
   Acoustic alert (provided that it has not been deactivated in menu “User level” (chap. 6.4).
3. After further 10 minutes:
   The zero-voltage relay output is switched.

Close the door.

- The notification or alarm message is cancelled.
- The zero-voltage relay alarm output is switched off.

8.5 High and low temperature

1. Deviation of more than +/- 1°C from the temperature set point
   Notification (blue) “TEMPERATURE”.
2. Deviation for longer than 15 minutes
   Alarm message (red) “TEMPERATURE”
   Acoustic alert (if it has not been deactivated in menu “User level” (chap. 6.4)).
3. The zero-voltage relay alarm output switches.

In case of exceeding the temperature set point by approx. +1.5°C (adjustable, chap. 7.2), the safety controller (chap. 7.2) takes over temperature control.

In case of an **over temperature alarm**, proceed as follows:

- Switch off the unit
- Open both unit doors for approx. 5 minutes
- Switch on the unit again
- You can restart normal operation as soon as the requested values have equilibrated.

In case of an **under temperature alarm**, proceed as follows:

- Switch off the unit
- Wait approx. 5 minutes
- Switch on the unit again
- You can restart normal operation as soon as the requested values have equilibrated.

	If the same alarm indication arises again, please contact BINDER Service.

8.6 CO_2 over/under concentration

1. Deviation of +/- 1 vol.-% from the CO_2 set point
   Notification (blue) “CO2”.
2. Deviation longer than 15 minutes
   Alarm message (red) “CO2”
   Acoustic alert (if it has not been deactivated in menu “User level” (chap. 6.4).
3. The zero-voltage relay alarm output switches.

In case of a **CO_2 over concentration** alarm, proceed as follows:

- Switch off the unit.
- Open both unit doors for approx. 30 seconds.
- Switch on the unit again
- Normal operation can be restarted, as soon as the requested values have been readjusted

In case of a **CO_2 under concentration** alarm, proceed as follows:

- Switch off the unit.
- Switch on the unit again
- Normal operation can be restarted, as soon as the requested values have been readjusted

	If the same alarm indication arises again, please contact BINDER Service.

8.7 O_2 over / under concentration (unit with O_2 control)

1. Deviation of +/- 1 Vol.-% from the O_2 set point
   Notification (blue) “O2”.
2. Deviation longer than 15 minutes
   Alarm message (red) “O2”
   Acoustic alert (if it has not been deactivated in menu “User level” (chap. 6.4).
3. The zero-voltage relay alarm output switches.

In case of an **O_2 over concentration** alarm, proceed as follows:

- Switch off the unit.
- Open both unit doors for approx. 30 seconds.
- Switch on the unit again
- Normal operation can be restarted, as soon as the requested values have been readjusted

In case of an **O_2 under concentration** alarm, proceed as follows:

- Switch off the unit.
- Switch on the unit again
- Normal operation can be restarted, as soon as the requested values have been readjusted

	If the same alarm indication arises again, please contact BINDER Service.

8.8 Low pressure indication in case of empty gas bottles

The alarm indications show the pressure drop of the admissions of CO_2, O_2, and N_2 (unit with O_2 control) < 0.3 bar / *4.4 psi.*

If there is no bottle changer installed, you must change the gas bottle.

The alarm messages for O_2 and N_2 (unit with O_2 control) can be switched off by the switches (7) for O_2 and (17) for N_2. Position I = pressure alarm is active. If both alarms are switched inactive, the O_2 control switches off automatically.

Buzzer and visual indication on the display of the MB1 controller:

Decrease in CO_2 pressure	**Message "LOW PRESSURE CO2"**	
Decrease in O_2 pressure	**Message "LOW PRESSURE O2"**	(unit with O_2 control)
Decrease in N_2 pressure	**Message "LOW PRESSURE N_2"**	(unit with O_2 control)

	Prerequisite for pressure alarm messages for O_2 and N_2 (unit with O_2 control) is that both switches (7) and (17) are set to position ON (position I).

Proceeding in case of pressure alarm without gas bottle changer

- Change the gas bottle.
- Press the RESET button in order to cancel the error indication.

Proceeding in case of pressure alarm with gas bottle changer (option)

In case of an installed gas bottle changer the pressure drop is also indicated by a red alarm message. The bottle changer switches automatically to the second gas bottle. Despite a pressure drop indication (red alarm note), a continuous CO_2 / O_2 / N_2 admission is guaranteed in case the second gas bottle is opened.

- Make sure that the second gas bottle is open. Make sure that the bottle pressure is 2.0 bar / *29 psi* above the ambient pressure.
- Replace the empty bottle.
- Press the RESET button to cancel the alarm indication.

The outlet pressure of each of each gas bottle must be 2.0 bar / *29 psi* above the ambient pressure.

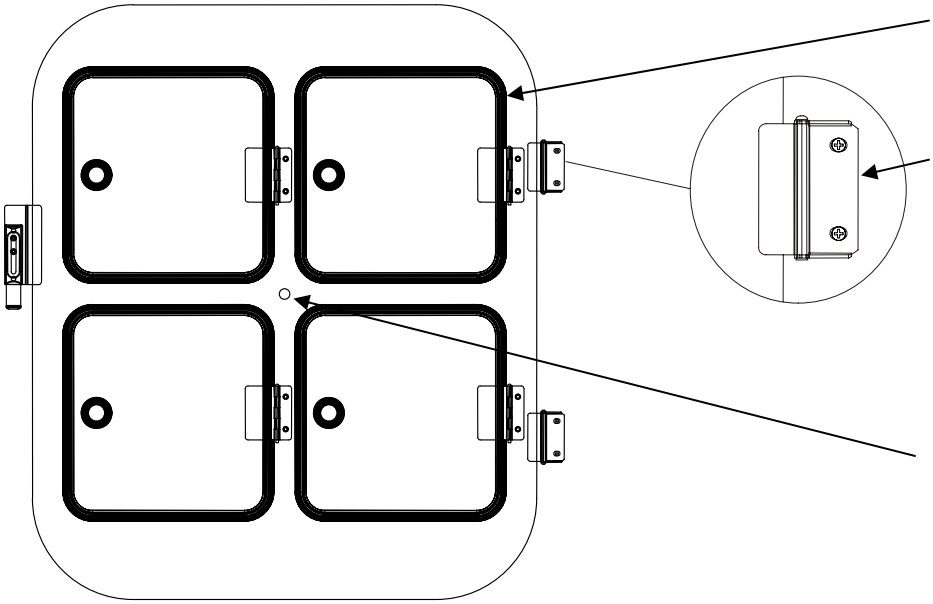
	**CAUTION**
	Excessive output pressure > 2.5 bar / *36 psi*. **Damage to the unit.** ∅ Do NOT exceed the output pressure of 2.5 bar / *36 psi* above the ambient pressure. ➢ Before connection, check the output pressure on the pressure reducer of each bottle.

The recovery times of the gas concentrations inside the chamber following the door being opened, which are indicated in the technical data (chap. 16.4) refer to a connection pressure of 2.0 bar / *29 psi*. Decreasing supply pressure down to the shift point (alarm point) of the built-in bottle changer of 0.3 bar / *4.4 psi* results in longer recovery times. Check the pressure displays of your gas supply. If very short recovery times are required or the door is opened frequently, replace the gas bottles promptly when the pressure decreases below 2.0 bar / *29 psi*.

9. Options

9.1 Multiple-divided inner glass door, gas proof (option)

For detailed subsequent installation instruction, see the “Installation Manual for Divided Inner Glass Door, gas proof” (Art. No. 7001-0064) included to each retrofit kit (Art. No. 8012-0406 for CB 150 with shelf holder, 8009-0315 for CB 150 with beads, Art. No. 8012-0349 for CB 210 with shelf holder).



Handling:

- Pull the door handles to open the individual glass doors. Do not press too strong while closing them in order to avoid pushing the doors through the gasket into the inner chamber.
- The rubber profile gaskets of the individual glass doors are easy to replace.
- If the divided inner glass door is not in straight position, fastening the hinge screws in the elongated holes of the hinge can align it. Set the door straight and operate the locking smoothly.

9.2 Multiple-divided glass door combined with copper-made interior (option)

The copper-made multiple-divided glass door (CB 150 with shelf holder: Art. No. 8012-0024, CB 210 with shelf holder: Art. No. 8012-0025) is not gas-proof and is different from the option described in chap. 9.1.

Adjusting the sealing force
According to his personal requirements, the user can adjust the sealing force of the spring on the glass door handle. To do this, loosen slightly the screw on the handle. The spring can then manually move the spring and thus vary the sealing force. After adjusting, tighten the screw again.

Demounting and mounting the glass doors
You can easily demount the glass doors for cleaning and handling purposes. Opened and then lift the relevant glass door. Mounting the glass doors is a reverse of the demounting procedure.

Demounting and mounting the lower cover
To remove the Permadry™ pans and for cleaning purposes the lower cover must be demounted. The two bottom glass doors must be opened approximately 90° or completely demounted. You can then easily lift the cover and demount it forwards. During this procedure, hold the cover at the two finger holes.

Option “Inner chamber made of copper” in combination with "multiple divided glass door:

With this option, you cannot use the double water pan. Replace it for a pan system made of copper consisting of two parts.

Replacement for multiple divided glass door in combination with multiple-divided glass door: Art. No. 8003-0067 + 4022-0057

Placing the pan system, see chap. 4.4.1.

9.3 Access ports

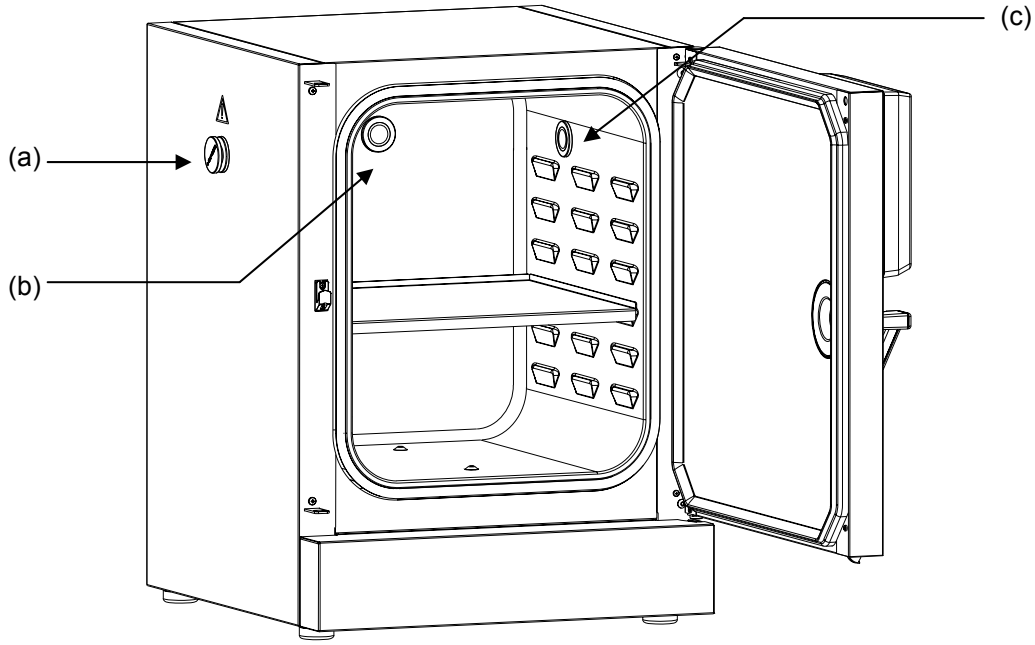


Figure 23: Positions of the optional silicon access ports left (a), rear (b), and right (c)

A warning sticker sticks above each access port.

When operating a CB with silicon access ports, both silicon plugs must tightly close the access ports. In case of not gastight or missing plugs, CO_2 gas may escape into the environment. The CO_2 control only switches off when opening the unit door.

WARNING

High concentration of CO_2.

Danger of poisoning.

➢ Tightly close each access port with two plugs during operation.

9.4 Interior socket 230V (option)

	This option is not available for CUL version.

The socket (G) is located at the upper left corner of the back wall of the inner chamber. It is suitable to supply electrical devices inside the incubator with 230V AC voltage.

The maximum head load must exceed a capacity of 70 W.

	CAUTION
	Exceeding the set point temperature. **Damage to the cultures.** ➢ Do NOT exceed the maximum head load of 70 W. ➢ Do NOT connect equipment with a nominal capacity > 70 W.

	Heat emission of electrical devices connected inside the CO_2 incubator may modify the temperature range.

The maximum load must not exceed 3 Amp.

	WARNING
	Overload of contacts. **Damage to contacts and connection socket.** **Electrical hazard.** **Danger of life.** ∅ Do NOT exceed the maximum load of 3 A. ∅ Do NOT connect any devices with a nominal current > 3 A.

You can switch off tension the interior socket with switch (1) at the unit rear (chap. 2.3) (position I = socket with tension).

Switching off the incubator at the main switch (A1) also switches off tension the interior socket.

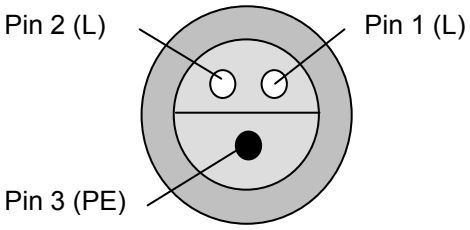


Figure 24: Interior socket (G) (front view)

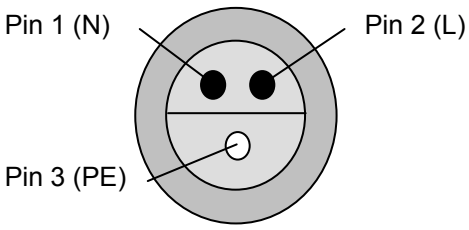


Figure 25: Delivered waterproof plug (front view)

Electrical data socket and plug: IP system of protection 65, 230 V 1N ~ 50-60 Hz

CAUTION

Risk of short circuit.

Damage to the unit.

- ➢ Use delivered plug only (IP protection type 65).
- ➢ If the socket is not used, close it with the waterproof lid.

When bringing in a heat load into the inner chamber by introducing electrical devices as shakers or rollers, the ambient temperature of the incubator must not exceed 25°C /. Otherwise, temperature control to 37°C / *98.6°F* cannot be guaranteed. When operating electrical devices inside the incubator, check the observation of the desired incubation temperature **before** bringing in the cells.

CAUTION

Excessive inner temperature > 37°C / *98.6°F* when operating electrical devices inside the incubator.

Damage to the cell cultures.

- ➢ When operating electrical devices inside the incubator: Ambient temperature ≤ 25°C / *77°F*.
- ➢ Check the temperature observation before bringing in the cells.

9.5 Low tension access port (option)

Application: This low voltage link is suitable to connect two electrical devices, one inside and one outside the incubator. E.g. for appliances divided in control part and working part like as for cell roller- and shaker systems.

Maximum load 24V AC/DC 2Amp.

WARNING

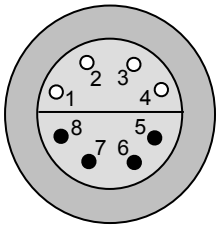
Overload of contacts.

Damage to contacts and connection socket.

Electrical hazard.

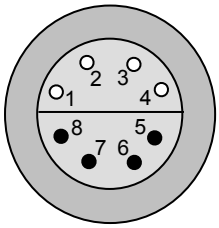
Danger of life.

- ∅ Do NOT exceed the maximum load of 24V AC/DC 2Amp.
- ∅ Do NOT connect any devices with a nominal current > 2 Amp.
- ∅ Do NOT connect any devices with a nominal voltage > 24 V DC.



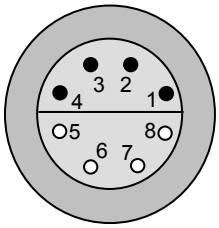
External side:

Exterior socket (8) at the rear of the unit (front view)



Internal side:

Interior socket (B) located at the upper right corner of the back wall of the inner chamber (front view)



Delivered plug:

on external and internal side (front view)

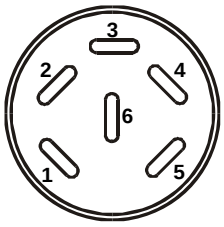
When bringing in a heat load into the inner chamber by introducing electrical devices as shakers or rollers, the ambient temperature of the incubator must not exceed 25°C / *77°F*. Otherwise, temperature control to 37°C / *98.6°F* cannot be guaranteed. When operating electrical devices inside the incubator, check the observation of the desired incubation temperature **before** bringing in the cells.

	CAUTION
	Excessive inner temperature > 37°C / *98.6°F* when operating electrical devices inside the incubator. **Damage to the cell cultures.** ➢ When operating electrical devices inside the incubator: Ambient temperature ≤ 25°C / *77°F*. ➢ Check the temperature observation before bringing in the cells.

9.6 Analogue outputs for temperature and CO_2 (option)

With this option, the CO_2 incubator is equipped with analogue outputs 4-20 mA for temperature and CO_2. These outputs allow transmitting data to external data registration systems or devices.

The connection (19) is realized as a DIN socket at the rear of the CO_2 incubator as following:



ANALOG OUTPUT 4-20 mA DC

PIN 1: Temperature –
PIN 2: Temperature +
PIN 3: CO_2 –
PIN 4: CO_2 +

CO_2 range: 0 vol.-% up to 100 vol.-%
Temperature range: 0°C / *32°F* up to +200°C / *392°F*

A suitable DIN plug is enclosed.

Figure 26: Pin allocation of DIN socket (19) for option analogue outputs

9.7 Keyboard locking (option)

The keyboard of the MB1 controller can be locked and unlocked via the key switch (option). In locked state, no entries to the controller are possible.

- Locked keyboard: Switch position vertical
- Unlocked keyboard: Switch position to the right

Only when the keyboard is locked, the key can be removed.

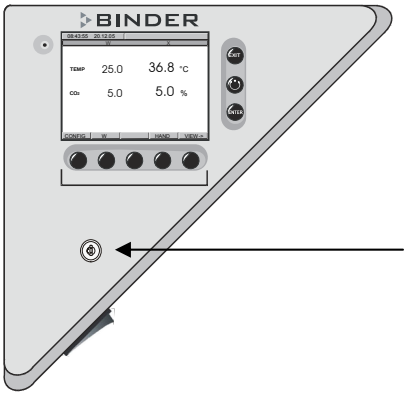


Figure 27: Keyboard locking (option)

If the keyboard is locked, the notification “KEY LOCK” is displayed on the controller MB1 display (chap. 8).

9.8 Communication software APT-COM™ 3 DataControlSystem (option)

The CO_2 incubator is regularly equipped with a serial interface RS 422 (10) to which you can connect the BINDER communication software APT-COM™ 3 DataControlSystem. The actual values of temperature, CO_2 and O_2 (unit with O_2 control) are given at adjustable intervals. Programming can be performed graphically via PC. Up to 30 chambers with RS 422 interface can be cross-linked. For further information, refer to the operating manual of the BINDER communication software APT-COM™.

Pin allocation of the RS 422 interface:

pin 2:	RxD (+)
pin 3:	TxD (+)
pin 4:	RxD (-)
pin 5:	TxD (-)
pin 7:	Ground

9.9 CO_2 Fail Safe (option)

9.9.1 Function overview

This safety function “Fail Safe” serves to avoid any unnoticed deviation of the CO_2 concentration inside the CO_2 incubator from the set point. Such deviations can be caused by failure of the CO_2 control, by failure of the CO_2 measuring system or by drift of the CO_2 measuring system. The monitoring system is independent of the controller and of the CO_2 sensor technology.

Advantage: This additional monitoring prevents that technical failures like sensor drift or sensor failure could cause a significantly modified CO_2 concentration inside the chamber which would not be reflected on the controller display and which could cause death of the incubated cells.

The opening frequency of the CO_2 inlet valve, which is necessary to maintain a defined CO_2 concentration, depends on the supply pressure at the unit and on the CO_2 set point.

Under constant operating conditions, the „Fail Safe“ monitoring system learns during undisturbed operation (no set point change, not opening the door, no pressure decrease in gas supply below 0.3 bar / *4.4 psi*, no sterilization) the opening frequency of the CO_2 inlet valve and memorizes the value. The system then continuously compares the actual opening frequency with the memorized reference value. In case of any significant deviations, it releases an alarm message and performs the CO_2 inlet with the learned opening frequency.

	The opening frequency of the CO_2 inlet valve also depends on the supply pressure at the incubator. Therefore, use the pressure reducer (chap. 4.5.2) delivered with this option. In case of option CO_2 bottle changer (connection chap. 4.5.7) and of option built-in bottle CO_2 changer with external gas connection for a second incubator (connection chap. 4.5.8), mount a pressure reducer (Art. No. 8009-0232) at each of both gas connections of the unit. Set the same secondary pressure 2.0 bar / *29 psi* up to maximally 2.5 bar / *36 psi* on both pressure reducers.

Observe the special hints regarding the CO_2 gas connection with option Fail-Safe in chap. 4.5.2.

9.9.2 Fail Safe alarm

The monitoring function is active during undisturbed operation. Alarms are emitted earliest after the following times:

- Monitoring of the upper limit of the opening frequency of the CO_2 inlet valve: after 19 hours.
- Monitoring of the lower limit of the opening frequency of the CO_2 inlet valve: after 35 hours.

If after these times the actual opening frequency of the CO_2 inlet valve deviates significantly from the learned value, the CO_2 control is permanently replaced by automatic control of the CO_2 inlet valve with the previously learned opening frequency. This is indicated by the alarm message “Fail Safe” (red) in the controller display. In addition to the alarm message, a buzzer sounds if it has not been muted previously in the “User Level” menu (chap. 6.4).

Following an alarm, the opening frequency of the CO_2 inlet valve is fixed to the previously learned value (fixed value control, no more adjustment/closed loop control). Thus in case of opening the door resulting in a decrease in CO_2, the set point will afterwards not be safely reached any more.

	Contact BINDER Service. Inform BINDER Service about the latest changes at the unit. Do not open the door in case of an alarm until arrival of the service, or transfer the cultures to another incubator.

9.9.3 Error detection at Fail Safe alarms

The following actions at the unit can cause modifications of the opening frequency of the CO_2 inlet valve and thus trigger a Fail Safe alarm:

- Change of the door gaskets
- Change of the CO_2 sensor
- Adjustment of the CO_2 control
- Change of the supply pressure CO_2 gas
- Connection of the unit to another CO_2 gas supply
- Change of the setting or replacement / removal of the delivered pressure reducer (one of both pressure reducers with option CO_2 bottle changer).

Following each of these measures, set the CO_2 concentration set point for approx. 1 minute to 0 in order to prevent an unjustified Fail Safe alarm. After resetting it to the desired CO_2 concentration for usual incubation operation, the monitoring system learns again the opening frequency under the modified conditions.

9.9.4 Detailed information on the time history of learning and comparison

Learning phase

After the first commissioning, with every change of the CO_2 set point, or following decommissioning for more than 1 week, the learned comparative values are automatically deleted.

Following an equilibration time of 3 hours, the learning phase consists of 4 periods of 4 hours each. In case of disturbance (set point change, opening the door, pressure decrease in gas supply below 0.3 bar / *4.4 psi*, sterilization), each period is individually repeated after another equilibration time of 3 hours.

	Each equilibration time must be undisturbed during 3 hours: no set point change, not opening the door, no pressure decrease in gas supply below 0.3 bar / *4.4 psi*, no sterilization.

	After each set point change, the new reference opening frequency of the CO_2 inlet valve is again determined.

If 4 learning phases have been successfully completed, the system concludes and memorizes a comparative value of the opening frequency of the CO_2 inlet valve.

Comparison phase

Having terminated the learning phase, each significant **increase** of the opening frequency of the CO_2 inlet valve is recognized and reported as a Fail Safe alarm. A light increase (caused by e.g. sensor drift) is recognized only after some hours or days, whereas a fast change (caused by e.g., almost complete failure of the CO_2 sensor) is rapidly recognized after a few minutes. Due to the four learning phases and to the equilibration phase before, this monitoring system is functional against an exceeding earliest 19 hours after start of learning opening frequency of the CO_2 inlet valve.

After further 4 undisturbed learning phases of 4 hours each (no set point change, not opening the door, no pressure decrease in gas supply below 0.3 bar / *4.4 psi*, no sterilization), a second comparative value is concluded. This value serves as a comparative value to recognize the lower alarm limit of the opening frequency of the CO_2 inlet valve. Earliest 35 hours after the start of learning, the alarm at **undershoots** of a minimum opening frequency is functional. The actual value of the opening frequency is then compared to a lower alarm limit every 4 hours.

The learned comparative value is maintained as long as a new learning phase is started, i.e., until change of the CO_2 set point or decommissioning the unit for more than one week.

9.10 Built in-bottle changers (option)

9.10.1 Built-in bottle changer for CO_2 (option)

Function:

Switch on (position I) switch (15) to activate the bottle changer. If the pressure of the bottle in use falls below 0.3 bar / *4.4 psi*, the internal bottle changer switches automatically to the other input connection of the two bottles:

When the first bottle is empty, the red alarm message “LOW PRESSURE CO2” (chap. 8.1) is displayed on the controller display with a 20 sec delay. 10 sec later, the bottle changer changes to the second full bottle.

Changing to the second bottle secures the gas supply. Now you can reset the alarm message using the RESET button. If not, the second bottle is empty as well.

The CO_2 supply is guaranteed as long as at least one of the gas bottles delivers an output pressure higher than 0.3 bar / *4.4 psi* above the ambient pressure.

The recovery times of the gas concentrations inside the chamber following opening the door, which are indicated in the technical data (chap. 16.4) refer to a connection pressure of 2.0 bar / *29 psi*. Decreasing supply pressure down to the shift point (alarm point) of the built-in bottle changer of 0.3 bar / *4.4 psi* results in longer recovery times. Check the pressure displays of your gas supply. If you are in need of very short recovery times or in case of opening the door very frequently, replace the gas bottles in time when the pressure decreases below 2.0 bar / *29 psi*.

Deactivation:

If you connect only one bottle to connectors either (6) or (16) or if you use a central CO_2 installation with an external bottle changer, the internal bottle changer can be deactivated by setting button (15) to position OFF. (Note: Position I = ON).

To operate the built-in bottle changer with only one supply it is essential to know which connection (6) or (16) is the active one.

Default setting is connection (6) when leaving the factory.

If after 20 seconds, the alarm message (red) “LOW PRESSURE CO2” appears on the display and cannot be reset by pressing the reset button, and yet the connected bottle provides a sufficient outlet pressure, the wrong inlet connection was used. In this case, put the pressure connection hose to the other connector (6) ↔ (16). You can reset the alarm afterwards by pressing the RESET button.

or

Activate the bottle changer for a few seconds by setting button (15) to position ON (position I). On this the bottle changer toggles to the other input (6) ↔ (16) automatically. You can reset the note afterwards by pressing the RESET button.

9.10.2 Built-in bottle CO_2 changer with external gas connection for a second incubator (option)

This option allows simultaneous CO_2 supply for two incubators CB using just the in-built CO_2 bottle changer of the first incubator (as described in chap. 9.10.1). The second incubator is connected to the external gas connection (18) at the rear of the first incubator.

For operation of the CO_2 bottle changer, follow the indications given in chap. 9.10.1.

As long as the hose nozzle (c) is plugged into the quick acting closure socket (a) (chap. 4.5.5), CO_2 gas keeps escaping permanently through the external gas connection (18). If you do not connect a second CB unit, the hose nozzle must not remain or become plugged in the quick acting closure socket.

WARNING

High concentration of CO_2.

Danger of poisoning.

- If no second unit is connected:
  Remove the hose nozzle (c) from the quick acting closure socket (Figure 13).

9.10.3 Built-in bottle changers for N_2 and O_2 (option for unit with O_2 control)

Function:

Switch on (position I) switches (13) and (11) to activate the bottle changers. If the pressure of one of the two connected bottle pairs falls below 0.3 bar / *4.4 psi*, the corresponding internal bottle changer switches automatically to the other input connection of the affected bottle pair.

When the first bottle is empty, the red alarm message “LOW PRESSURE O2” or “LOW PRESSURE N2” (chap. 8.1) is displayed on the controller display with a 20 sec delay. 10 sec later, the bottle changer changes to the second, full bottle.

Changing to the second bottle secures the gas supply. Now you can reset the alarm message using the RESET button. If not, the second bottle is empty as well.

The gas supply is guaranteed as long as at least one bottle of any bottle pair delivers an output pressure higher than 0.3 bar / *4.4 psi* above the ambient pressure.

The recovery times of the gas concentrations inside the chamber following opening the door, which are indicated in the technical data (chap. 16.4) refer to a connection pressure of 2.0 bar / *29 psi*. Decreasing supply pressure down to the shift point (alarm point) of the built-in bottle changer of 0.3 bar / *4.4 psi* results in longer recovery times. Check the pressure displays of your gas supply. If you are in need of very short recovery times or in case of opening the door very frequently, replace the gas bottles in time when the pressure decreases below 2.0 bar / *29 psi*.

Deactivation:

If only one bottle is connected to either connector (5) or (14) resp. (4) or (12) or if a central O_2 , or/and N_2 installation with an external bottle changer is used, the internal bottle changers can be deactivated by switching off switch (13) for O_2 bottle changer and/or switch (11) for N_2. (Note: Position I = ON)

To operate the built-in bottle changer with only one bottle, it is essential to know which of the connections (5) or (14) reps. (4) or (12) are the active ones.

Default setting is connection (5) for O_2 and (4) for N_2 when leaving the factory.

If after 20 seconds, the alarm message (red) “LOW PRESSURE O2” or “LOW PRESSURE N2” appears on the display and cannot be reset by pressing the reset button, and yet the connected bottle provides a sufficient outlet pressure, the wrong inlet connection of the corresponding gas was used. In this case, put the pressure connection hose of the corresponding gas to the other connector (5) ↔ (14) or (4) ↔ (12). You can reset the alarm afterwards by pressing the RESET button.

or

Activate the affected bottle changer for a few seconds by setting button (13) or (11) to position ON (position I). This causes the bottle changer to toggle to the other input (5) ↔ (14) or (4) ↔ (12) automatically. You can reset the alarm afterwards by pressing the RESET button.

The zero-voltage relay alarm output (chap. 8.1) becomes active only if both connectors of one bottle pair do not adduce a sufficient input pressure. Thereby the display shows with 5 minutes delay time the red alarm message “LOW PRESSURE O2” resp. “LOW PRESSURE N2” and the zero-voltage relay alarm output (3) switches.

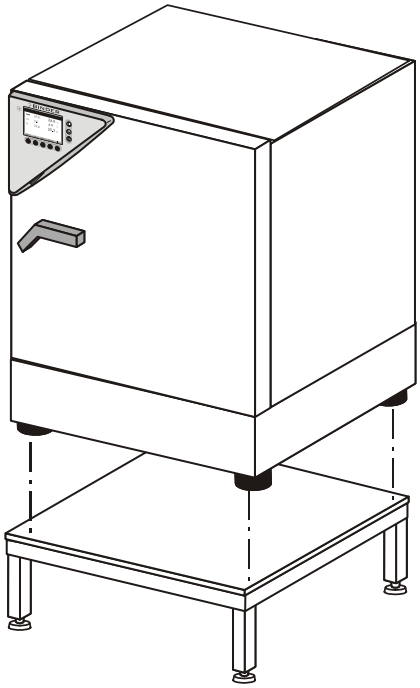
If you do not want to connect O_2 or N_2 bottles to the two bottle changers, the pressure alarm messages can be switched off. With switch (7) switched off, there is no more pressure alarm for O_2. With switch (17) switched off, there is no more pressure alarm for N_2.

	If you deactivate both pressure alarm messages with switches (7) and (17), O_2 control is deactivated automatically.

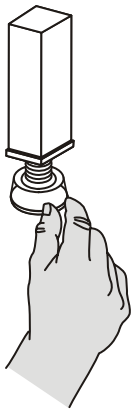
9.11 Stands

9.11.1 Stand 200 mm height (option)

In order to obtain easy access to the incubator and to avoid contamination of the incubator caused by soil pollution, BINDER recommends using stands.

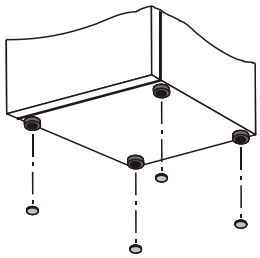


You can adjust the stand for straight standing with 4 adjustable feet by hand.



	Align the stand using a spirit level before lifting the incubator onto the stand.

Scope of delivery includes 4 rubber pads for the feet of the incubator. These rubber pads prevent sliding of the unit.



	**WARNING** **Sliding or tilting of the unit** **Risk of injury.** **Damage to the unit and of the charge.** ➢ Place the rubber pads under the unit feet when lifting the unit onto the stand.

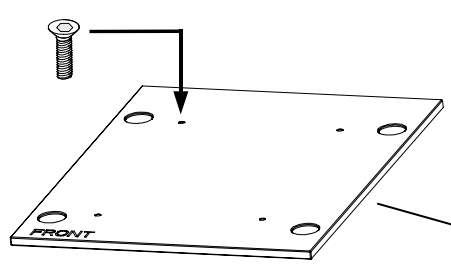
9.11.2 Stacking stand (option)

We recommend not stacking CB incubators directly on one another in order to avoid transmission of shocks and vibrations from one unit to the other, which could happen e.g. while opening or closing the door, cleaning, charging and discharging the unit. BINDER offers stable, vibration-free stands with castors (2 lockable by brakes) for safe stacking of two units.

The stacking stand ensures that the set incubation parameters are precisely maintained also during sterilization of the other unit in the same stacking stand (chap. 12.5) by thermal decoupling.

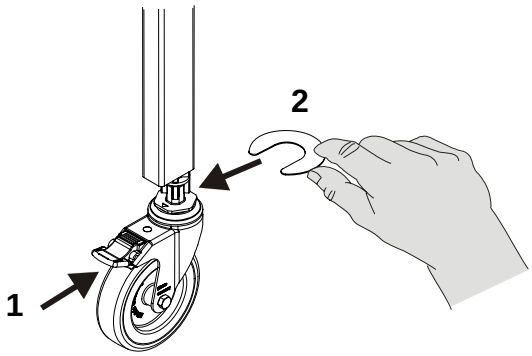
Using the stacking stand offers further advantages: You can pull forward the lower incubator separately (e.g., for access to the rear), and you do not need to place it directly on the floor (important for cleanness purpose).

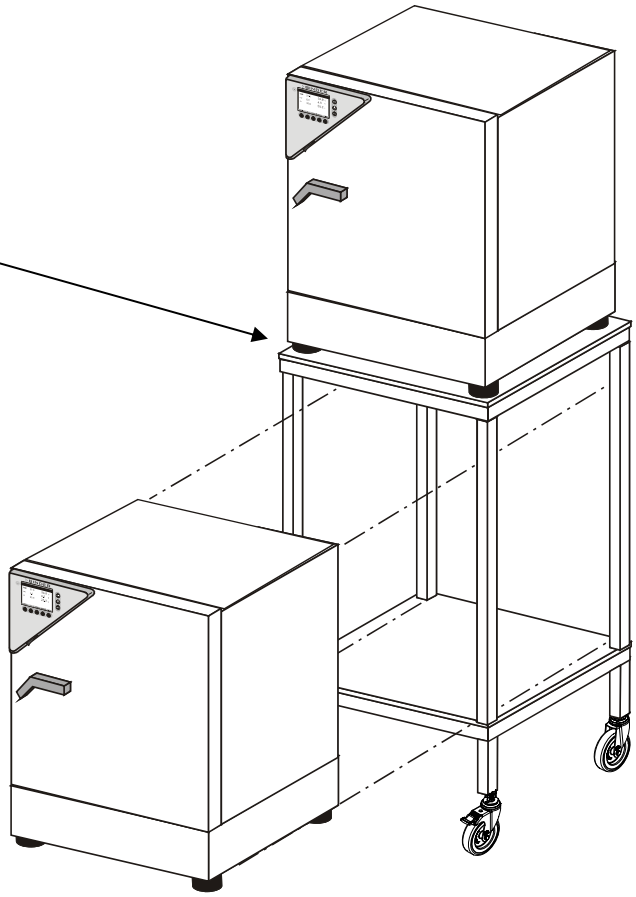
The lower board (metal) of the stacking stand is already built-in.
The enclosed upper board (plastic) needs fixing on the stacking stand. Put in the board with the side marked by “FRONT” pointing to the front. Screw on the board with the enclosed four screws (Art. No. 3001-0056).



Mounting the plastic board

Distance plate for height alignment
(scope of delivery including 5 pieces)





Adjusting the stacking stand for straight standing

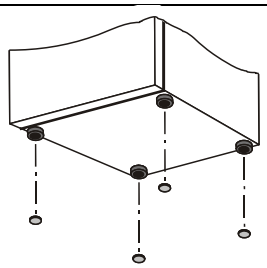
You can align the stand using the delivered distance plates:

1. Use an Allen screwdriver to loosen the hexagon socket screw at the lower side of the wheel holder.
2. Slightly pull forward the entire wheel from the stand foot. Push in the distance plate.

   Tighten the hexagon socket screw with the Allen screwdriver.

	Align the stand using a spirit level and the distance plates before lifting the incubator onto the stand.

Scope of delivery includes 4 rubber pads for the feet of the lower incubator to prevent sliding on the metal surface.



WARNING

Sliding or tilting of the unit

Risk of injury.

Damage to the unit and of the charge.

- Place the rubber pads under the feet of the lower unit when lifting the unit onto the metal plate of the stand.

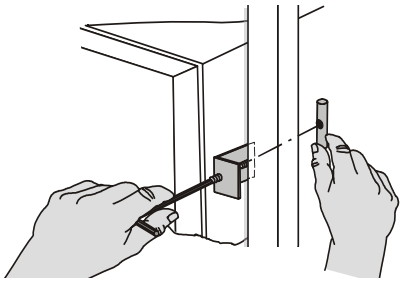


Figure 28: Spanning on the right side position

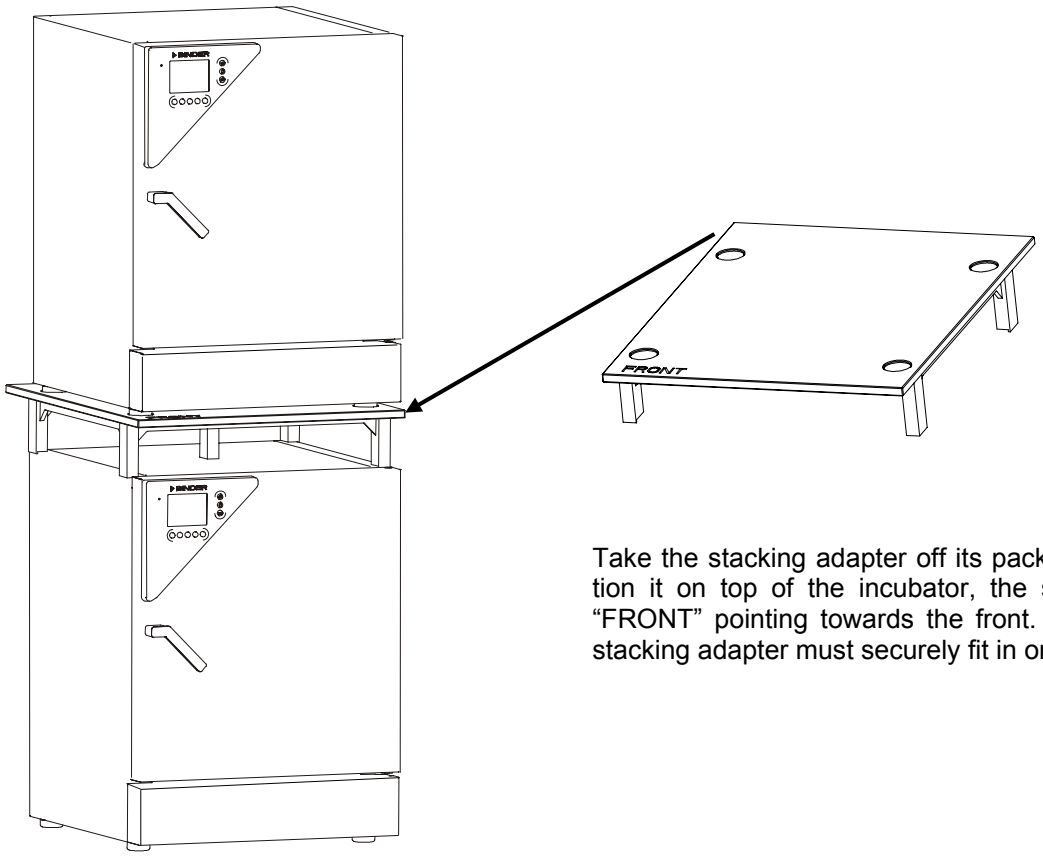
We recommend attaching the lower incubator inside the stand to improve its stability.

For this purpose, mount the two enclosed clamping devices between the right and left side of the lower incubator and the tetragonal strut in position as shown aside.

9.11.3 Stacking adapter for direct thermal decoupled stacking (option)

We recommend no to stack CB incubators directly on one another in order to avoid transmission of shocks and vibrations from one unit towards the other one, which could happen e.g. while opening or closing the door, cleaning, charging and discharging the unit. BINDER offers a stacking adapter for direct thermal decoupled stacking of two CB incubators.

The stacking adapter guarantees the exact maintenance of the set incubation parameters also during sterilization of the other unit in the same stacking stand (chap. 12.5).



Take the stacking adapter off its packaging and position it on top of the incubator, the side marked by “FRONT” pointing towards the front. The feet of the stacking adapter must securely fit in on the lower unit.

10. Reference measurements

Reference measurements of the temperature, CO_2, and O_2 (unit with O_2 control) can be performed via the silicone measuring port (N) on the inner glass door. Reference temperature measurements always take place under equilibrated conditions with both doors closed.

10.1 CO_2 reference measuring

It is a common wish of customers to perform test measurements between the calibrations implemented as a part of the recommended annual maintenance work. There are three possibilities to test the CO_2 concentration inside an incubator, see chapters 10.1.1 to 10.1.3.

10.1.1 Measuring CO_2 concentration indirectly via the pH of the cell medium

By use of the indirect determination of CO_2 concentration via the pH-value of the nutrient, it is possible to check the CO_2 concentration inside the chamber. This is a simple method to test the correct CO_2 concentration without any special CO_2 measuring equipment. You need only an accurate pH indicator or a pH-measuring electrode, which are standard equipment in cell culture laboratories.

	This method is not suitable for calibrating the BINDER FPI sensor system.

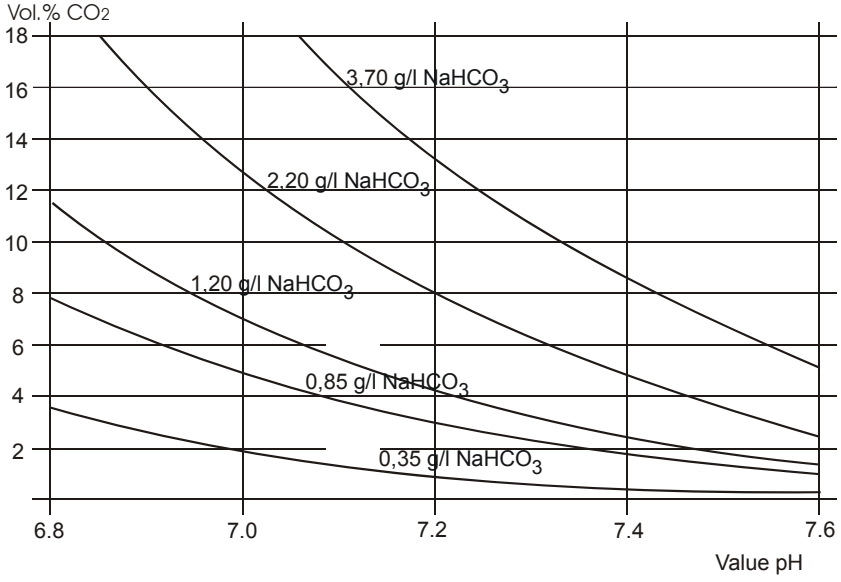
This method is based on the acid base equilibrium of the buffer system in the culture media.

$NaHCO_3$ buffers the common media. From the pH value of the medium, it is possible to conclude its CO_2 concentration. Figure 29 shows the relationship between CO_2 concentration in vol.-% and the pH of different $NaHCO_3$ buffered media.

Recommended procedure:

- Incubate an empty sample with medium for 1/2 day under the same conditions as the cells. You can perform the incubation in a cell culture bottle or in a 50 ml Falcon tube with open lid.
- After gassing, remove the empty sample from the incubator and within 5 minutes measure the pH-value with a glass electrode.

  During the measurement, the medium should have the least possible surface contact with the ambient air, so that the CO_2 can evaporate only slightly. A significant downward movement will happen only after 5 minutes, permitting sufficient time for measurement.
- In addition, you can of course use pH-test strips (pH range 6 to 8, not bleeding).



Trade names of common media:	$NaHCO_3$ [g/l]
DMEM	3.70
BME	2.20
MEM	2.20
Medium 199	2.20
Mc Coy	2.20
F10	1.20
F12	1.20

Figure 29: Value pH of $NaHCO_3$ buffered media as a function of the CO_2 concentration:

Example: If a pH of 7.2 is measured in a medium buffered with 2.20 g $NaHC0_3$ per liter, there must be 8 Vol.-% CO_2 surrounding this medium.

10.1.2 Measuring CO_2 directly via chemical indicator tubes

This is a common do-it-yourself test for many users. A chemical color reaction in a glass tube shows the CO_2 concentration. A standardized volume of air from the inside of the incubator has to be sucked through this glass tube to get a quantitative test result. Therefore, use a special hand pump with a standardized suction volume.

Procedure (example):

1) Break off both ends of the glass tube or remove the plugs.
2) Pin the end with the higher end of the scale to the adapter of the hand pump that belongs to that test system.
3) Pin the other end through the silicone access port of the inner chamber door of the CB incubator.
4) Take one sample volume out of the inner chamber volume by pressing the pump fully together and releasing it afterwards.
5) The standardized volume is sucked through the glass tube and the chemical indicator changes its color beginning from the side pinned into the chamber in the direction of the the hand pump.
6) The more CO_2 inside the chamber the further the chemical reaction will cause a color change of the chemical reactor.
7) You can read the CO_2 concentration by the scale directly printed on the glass tube or a delivered reference-reading rule.
8) The result must be corrected for the current ambient pressure. The required formula is printed on the instruction sheet of such systems.

All the necessary equipment must be supplied by one manufacturer only and one defined test system.

These test systems are not very accurate. A typical accuracy is around 10 % of the full-scale value.

	These test systems are not suitable for calibrating the BINDER FPI sensor system.

Figure 30: Example of chemical indicator tubes

Figure 31: Example of hand pump (foreground) and electrical pump (background)

10.1.3 Measuring CO_2 directly with an electronic infrared measuring device

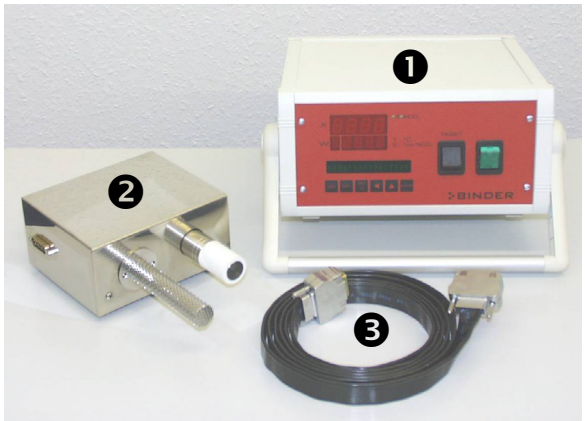
The easiest way of measuring the CO_2 concentration is by electronic sensor systems. BINDER offers the portable measuring device model CTM 01 which was especially designed to measure temperature and CO_2 concentration inside CO_2 incubators. You can use the CTM 01 both for reference measurements in certified laboratories, and for service purposes.

With its infrared measuring system, this measuring device bears the same measuring principle as the BINDER FPI sensor. If no test gases with defined concentration (recommended) are available, the CTM 01 is therefore also suitable for calibration.

	For detailed instructions regarding function and operating of the temperature and CO_2 measuring device, please see the Operating manual CTM 01 (Art. No. 8012-0021).

Device description:

- The measuring system consists of two parts: The measuring station, which remains outside the CO_2 incubator, and the sensor housing, which is put in the center of the usable volume of the incubator. A ribbon cable, which you can lay across the door gasket of the incubator without causing leakages, connects both parts.
- Place the measuring cell directly in the atmosphere to be measured. This means that there is no requirement for gas pumps, whose inconstant flow rates can cause inaccuracies. When converting the measured variable, partial pressure CO_2, to the display value, vol.-% CO_2, the respective altitude above sea level is entered and taken into account, so that the display value always corresponds immediately with the real concentration in vol.-% CO_2, irrespective of the place of use.
- The temperature is determined via a Pt100 temperature sensor and is displayed on the large LED display in 10 seconds alternation with the CO_2 concentration.
- The measured data of temperature and CO_2 -concentration are read to an RS 422 interface. Thus the measured data can be simply recorded, stored and graphically represented via PC using the APT-COM™ communication software (option, chap. 9.8) developed by BINDER.
- For monitoring, you van enter the set point values of the incubator into the mobile measuring system. If the measured values deviate from these nominal values by the pre-set tolerances, the unit reports this optically and acoustically, as well as via a zero-voltage relay output. The alarm function is active only if both measured values were previously lying within the tolerance limits.



❶ Measuring station

❷ Sensor housing

❸ Ribbon cable

Figure 32: BINDER temperature and CO_2 measuring device CTM 01

Figure 33: Measuring with CTM 01 (door is closed during measurement)

10.2 Temperature reference measurement

When performing a temperature reference measurement using an electronic measuring, and temperature display device, it is important to use a device traceable to an acknowledged standards/calibration institution (DKD, PTB for Germany) with valid calibration certificate.

The cable of the sensor must be thin enough to lay it over the door gasket of the incubator without causing any leakages.

11. Avoiding microbial contamination

The main types of microbial contaminants in cell and tissue culture are bacteria, fungi, yeast, mycoplasma, and viruses. This chapter gives an overview of potential sources of contamination and precautions and measures against them.

11.1 Cells and media

- Primary cultures from the original tissue
- Cells / cell lines from unknown sources or from cell banks: Use only cells of known and tested origin. Monitoring and routine screening of new cultures.
- Media and sera: Use only sera of known and tested origin (mycoplasma free. e.g., UV or γ radiated).
- Virus suspensions, antibody solutions etc. Use only reagents of known and tested origin.
- Laboratory instruments, media and reagents, which were exposed to possibly contaminated cultures must be sterilized / autoclaved / disposed.
- Antibiotics in the cell culture media may prevent bacteria detection: Use antibiotics selectively and economically.

11.2 Laboratory conditions / Equipment around the incubator

Sources of contamination in the cell culture lab are airborne germs, lab equipment, building features, and the lab personnel.

- Keep pipettes and instruments sterile after autoclaving.
- Bio safety cabinets (laminar air flow) (minimum of items apart from aspirator tube and burner, items positioned within easy reach and separate from each other, surface disinfected with an alcoholic disinfectant before and after use, cleaning the space underneath the bench, carry out regular sterility tests of the filters.
- Regular cleaning / disinfection of laboratory equipment such as centrifuge, microscope, water bath, refrigerator, and telephone.
- No equipment to be placed on the floor.
- Rough or humid walls are unsuitable.
- Make leaking doors and windows airtight.
- Supply air conditioning with special filters.
- Reduce the number of persons and their movements in the lab, by careful positioning of the relevant equipment. For practical reasons, install the CO_2 incubator close to the laminar air flow bench.
- Regular microbiological monitoring of the cell culture laboratory.

11.3 Working and behavior in the lab

Sources of contamination are the laboratory personnel themselves (surface germs, oral flora droplet transfer) and handling the equipment and cultures. We recommend staff training in aseptic techniques, laboratory safety and good laboratory practice (GLP).

Examples of general rules to reduce the contamination risks

- Reducing the hand germ count (wash hands with antimicrobial soap, dry with paper tissues, and rub dry hands with alcoholic solution).
- Wearing appropriate clothing (work coat, shoes, face mask)
- As few personnel as possible in the cell culture lab.

Examples of sterile working method

- Work "clean-to-dirty", i.e., handle confirmed uncontaminated cells first, unknown or untested cells next, and lastly, if necessary, cells suspected to be contaminated.
- Make daily microscopic observations of cultures and specific tests for the bacteria and fungi as part of a controlled routine. Test cultures for sterility before starting work.
- Keep working surfaces clean. Immediately wipe spilled liquids with alcohol solutions.
- No mouth pipettes.
- Never work above open sterile containers.

11.4 Chamber design and equipment of the CO_2 incubator

The design concepts behind the CO_2 incubator CB considerably reduce the risk of contamination.

- **Even surfaces for easy manual cleaning**

The inner surfaces are smooth and therefore easy to clean. The inner chamber is deep-drawn from a single piece, polished (suitable for pharmacy) and has no welds or inaccessible corners. The hinges and the seal of the inner glass door are glued from the outside, which also aids cleaning of the inner chamber.

- **Removable parts for cleaning and autoclaving**

The shelves and, for units with shelf holder, the complete shelf holder are removed easily without screws. The shelf holder is demountable in three parts without any tool. In this way, you can clean it hygienically in every laboratory dishwasher before hot-air sterilization. It is possible but not necessary to autoclave the shelves because they can remain inside the incubator during sterilization.

- **Door gasket**

The inner door gasket is removable and autoclaveable.

- **Gas fine filter**

The incoming gas used in the operation passes through a fine filter (aseptic filter, filtration efficiency 99.99 %, particle size 0.45 µm) with a high filtration efficiency, which also filters the smallest particles. This fine filter is easily accessible), so you can change it easily (chap. 13.4).

- **CO_2 measuring system in the inner chamber**

You can remove the CO_2 sensor from the inner chamber by hand and disinfect it (chap. 12.3).

- **Condensation prevention**

Condensation in the inner chamber represents a particular risk of contamination. The Permadry™ system developed by BINDER is an effective and easy to handle system to ensure high humidity (≥95 % r.H.) inside the incubator without any condensation forming on the inner surfaces.

- **Hot air sterilization at 180°C / *356°F***

The heating system of the CO_2 incubator permits hot-air auto-sterilization at a set point of 187.5°C / *369.5°F*. Thus, a temperature of 180°C / *356°F* is obtained for at least 30 minutes on all internal surfaces, resulting in sterilization of the entire inner chamber. Therefore, this procedure meets all international guidelines regarding hot air sterilization, e.g. AAMI ST63, DIN 58947, European Pharmacopoeia.

- **Option copper-made interior**

Surfaces out of copper reduce the risk of contamination by the bactericidal effect of copper ions released during oxidation.

11.5 Handling the CO_2 incubator

All manipulation of the CO_2 incubator involves some contamination risks, from installation to opening the doors and regular cleaning.

Install away from sources of contamination

- Do not place the CO_2 incubator on the floor or close to windows and doors. Use the optional stand, if appropriate.

Reduce the periods in which the door is open

- Do not open the door too frequently.
- Maintaining order inside the incubator results in shorter door opening times.

Water pan

- Fill the outer pan with distilled, sterilized water (chap. 4.4). Never use ion exchange water; ion exchangers are propagation sites for bacteria.
- Clean and refill the pans 2 to 3 times a week. For evacuation, remove the Permadry™ water pan. It is autoclaveable.
- If desired, you can add microbiologically inhibiting substances as copper chips, copper sulphate or ethylene diamine tetra-vinegar acid (EDTA) in a concentration of 1 to 5 mmol/l.

Avoiding condensation caused by ambient conditions

Ambient room conditions have an effect on condensation inside the incubator, which can be caused by insufficient wall clearances, preventing even dissipation of heat, air movement or direct sunlight. If the temperature distribution inside the chamber becomes uneven, condensation may form on the cooler surfaces.

- Observe the wall distances: rear 100 mm / *3.94 in*, sides 50 mm / *1.97 in*
- Do not place the unit in front of a window. No direct sunlight. No air movement.
- Permissible ambient temperature range for operation: +18°C / *64.4°F* to +30°C / *86°F*. Ideal ambient temperature: at least 7 degrees below the intended working temperature. E.g., working temperature 37°C / *98.6°F* = ambient temperature 30°C / *86°F* and less.
- The incubator should be precisely calibrated / adjusted.
- Adjustment of the door heating setting in response to critical ambient parameters by BINDER Service.

Regular cleaning, decontamination and sterilization

- Clean the shelves, glass door, gaskets and inner chamber weekly (for cleaning see chap. 12.1, for decontamination see chap. 12.2. You can clean the shelves in a laboratory dishwasher and, if needed, individually autoclave them.
- Regularly use the hot air sterilization function (chap. 12.5) following cleaning. Shelves, shelf support, and the emptied water pan, can remain in side the incubator during this operation.
- Replace CO_2 sterile filter (once or twice a year).

What to do in case of contamination

- Throw away / autoclave contaminated cultures.
- Inspect obviously uncontaminated cultures.
- Clean the incubator as described. Wipe the inner chamber and the doors with a disinfectant and and allow to dry. Autoclave the shelves. Empty the water pan and autoclave it.
- Perform hot air sterilization.

12. Cleaning, decontamination / disinfection, and sterilization

DANGER

Electrical hazard.

Danger of death.

∅ Do NOT spill water or cleaning agents over the inner and outer surfaces.

➢ Disconnect the unit before cleaning. Disconnect the power plug.

➢ Completely dry the appliance before switching it on again.

12.1 Cleaning

Disconnect the CO_2 incubator from the mains before cleaning. Disconnect the power plug.

Wipe the surfaces with a moistened towel. In addition, you can use the following cleaning agents:

Exterior surfaces, instrument panel:	Standard commercial cleaning detergents free from acid or halogenides. Alcoholic solutions. We recommend using the neutral cleaning agent Art. No. 1002-0016.
Inner chamber, shelf holders, shelf holder bars, shelves:	Standard commercial cleaning detergents free from acid or halogenides. Copper sulphate solutions or alcoholic solutions. We recommend using the neutral cleaning agent Art. No. 1002-0016.
CO_2 sensor:	Alcoholic solutions Do not immerse the CO_2 sensor into the solution. Disinfection with alcohol or alcoholic surface disinfectants without corrosive effect, free from acid or halogenides. We recommend using the disinfectant spray Art. No. 1002-0022.
Silicone door gasket:	Alcoholic solutions or neutral cleaning agent Art. No. 1002-0016.

	For surface protection, perform cleaning as quickly as possible. After cleaning completely remove cleaning agents from the surfaces with a moistened towel.

	**CAUTION** **Danger of corrosion.** **Damage to the unit.** ∅ Do NOT use acidic or chlorine cleaning detergents. ∅ Do NOT use a neutral cleaning agent on other kind of surfaces e.g., the zinc coated hinge parts or the rear unit wall.

	Observe the operating instructions and safety hints labeled on the bottles of the neutral cleaning agent and the disinfectant spray.

	Following use of the neutral cleaning agent and prior to hot-air sterilization, remove any agent residues, using a moistened towel in order to avoid formation of permanent residues.

	We recommend using the neutral cleaning agent Art. No. Art. Nr. 1002-0016 for a thorough and mild cleaning. For chemical disinfection, we recommend the disinfectant spray Art. No. 1002-0022. Any corrosive damage that may arise following use of other cleaning agents is excluded from liability by BINDER GmbH.

12.2 Decontamination / chemical disinfection

Disconnect the CO_2 incubator from the mains prior to decontamination / disinfection. Pull the power plug.

You can use the following disinfectants:

Inner chamber	Standard commercial surface disinfectants free from acid or halogenides. Alcoholic solutions. We recommend using disinfectant Art. No. 1002-0022.

In case of contamination of the interior by biologically or chemically hazardous goods, there are two possible procedures depending on the type of contamination and charging material.

(1) Spray the inner chamber with an appropriate disinfectant.

Before start-up, the unit must be absolutely dry and ventilated, as explosive gases may form during the decontamination process.

(2) Unit with shelf holder: You can sterilize the shelf holder parts in a sterilizer or autoclave.

	With every decontamination / disinfection method, always ensure adequate personal safety.

	Following frequent use of the disinfectant spray and prior to hot-air sterilization, remove any agent residues, by using the neutral cleaning agent and then a moistened towel in order to avoid formation of permanent residues.

	Having used the disinfectant spray, allow the incubator dry thoroughly, and aerate it sufficiently.

CAUTION

Danger of corrosion.

Damage to the unit.

∅ Do NOT use acidic or chlorine cleaning detergents.

∅ Do NOT use the neutral cleaning agent or the disinfectant spray on other kind of surfaces e.g., the zinc coated hinge parts or the rear unit wall.

Observe the operating instructions and safety hints labeled on the bottles of the neutral cleaning agent and the disinfectant spray.

We recommend using the neutral cleaning agent Art. No. Art. Nr. 1002-0016 for thorough and mild cleaning.

For chemical disinfection, we recommend the disinfectant spray Art. No. 1002-0022.

Any corrosive damage that may arise following use of other cleaning agents is excluded from liability by BINDER GmbH.

12.3 Disinfection of the CO_2 sensor

To ensure complete disinfection and correct function of the sensor, BINDER recommends a wipe disinfection of the sensor head with pure alcohol or non-corrosive alcoholic surface disinfectants. The disinfectant must be non-corrosive and free of chlorine or any acid. We recommend using the disinfectant Art. No. 1002-0022.

CAUTION

Excess temperature.

Immersion of sensor into liquids.

Damage to the CO_2 sensor.

∅ Do NOT immerse the CO_2 sensor into liquids.

∅ Do NOT expose the CO_2 sensor to autoclaving.

∅ Do NOT expose the CO_2 sensor to hot-air sterilization.

We recommend regular disinfection of the CO_2 sensor.

Recommended procedure:

1. Pull out the sensor
2. Spray the sensor head with alcohol or wipe it clean with a soaked cloth.
   The reaction time of the disinfectant used has to be respected
3. Before reinserting the CO_2 sensor, it must be completely dry.
4. The filter in the front of the sensor only needs replacing when damaged or dirty.

The CO_2 sensor head was especially adjusted for the specific chamber. To avoid confusion, an adhesive label with a serial number sticks to the sensor head. When exchanging the sensor, repeat CO_2 adjustment.

CAUTION

Different CO_2 sensor.

Invalid calibration.

∅ Do NOT change the CO_2 sensor head.

➢ Note down the serial number of the CO_2 sensor.

12.4 Sterilization of the O_2 sensor (unit with O_2 control)

The O_2 sensor can be hot air sterilized inside the chamber. To do this, remove the oxygen sensor and place it on the middle shelf. If the oxygen sensor is sterilized while plugged in, it is in danger of being destroyed.

CAUTION

O_2 sensor plugged in.

Damage to the O_2 sensor.

∅ Do NOT hot-air sterilize the O_2 sensor while it is plugged in.

12.5 Hot-air sterilization at 180°C / *356°F*

The incubator CB can perform an automatically controlled hot-air sterilization cycle. This procedure will take approx. 10 hours and consists of the following steps:

- Heating up phase: Heating up the inner chamber as fast as possible
- Sterilization phase: Holding the sterilization temperature for 4 hours which guarantees that 180°C / *356°F* is reached on all internal surfaces for at least 30 minutes (display “DO NOT OPEN THE DOOR”)
- Cooling down phase: Defined duration of 6 hours until 37°C / *98.6°F* is reached (display “STERI END”)
- Holding phase at 37°C / *98.6°F* of unlimited duration (display “STERI END”)

Activate hot-air sterilization in the CB Menu “Sterilization” of the display controller MB1. The manufacturer has set the sterilization temperature to 187.5°C / *369.5°F*.

The CO_2 sensor is temperature resistant up to a maximum temperature of 60°C / *140°F*.

CAUTION

Excess temperature.

Damage to the CO_2 sensor.

∅ Do NOT expose the CO_2 sensor to hot-air sterilization.

The CO_2 sensor head was especially adjusted for the specific chamber. To avoid confusion, an adhesive label with a serial number sticks to the sensor head. When exchanging the sensor, repeat CO_2 adjustment.

CAUTION

Different CO_2 sensor.

Invalid calibration.

∅ Do NOT change the CO_2 sensor head.

➢ Note down the serial number of the CO_2 sensor.

Check the safety controller settings to “Offset” 2°C or “Limit” 189.5°C, acc. to chap. 7.2.

Before carrying out the first hot-air sterilization, remove any protective lamination sheet from the inner metal surfaces.

Procedure of the hot-air sterilization:

- Switch off the unit.
- Pull out the CO_2 sensor without rotating from the connection socket in the upper part of the rear and remove it from the inner chamber.
- Remove the oxygen sensor (unit with O_2 control) without rotating from its connection socket and put it on the central shelf.
- Empty the Permadry™ water pan.

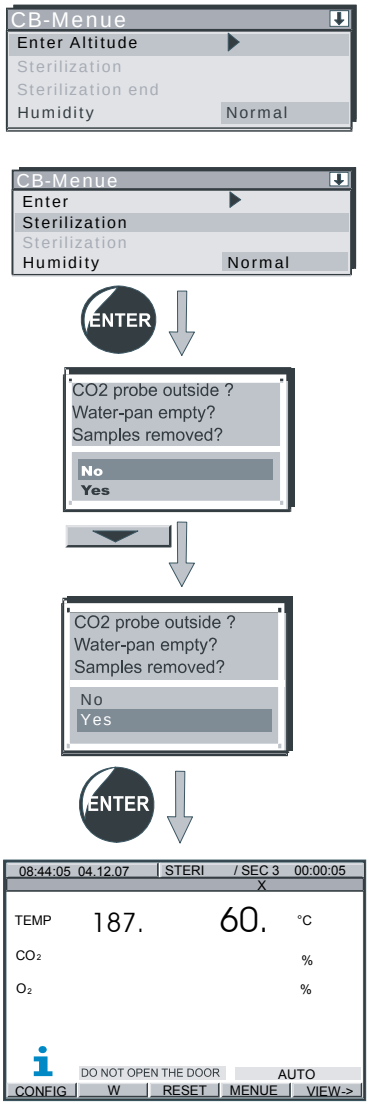
WARNING

Danger of implosion.

Destruction of the incubator.

➢ Empty the Permadry™ water pan before starting the hot-air sterilization.

- Water pans, shelf holder and shelves must be inside the incubator.
- Close the inner glass door and the outer unit door.
- Switch on the unit.
- Unlock the key switch (option, chap. 9.7).
- Activate the sterilization procedure in the CB menu “Sterilization”.



If the CO_2 sensor is still plugged, the menu point “sterilization” is inactive.

When the CO_2 sensor has been removed, you can select the menu point “sterilization”.

Confirm with “Yes”.

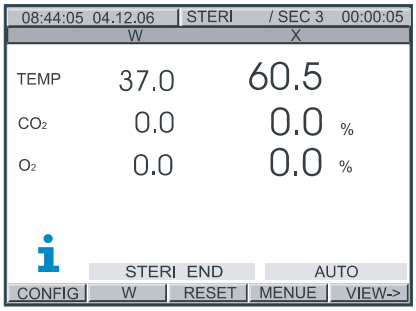
Display during the sterilization phase (example)

The message „DO NOT OPEN THE DOOR” implies that the sterilization is running.

	**CAUTION** **Glass door and inner chamber become hot during sterilization.** **Danger of burning.** ∅ Do NOT touch the glass door and inner surfaces during sterilization ➢ Wait 4 hours after sterilization before touching them.

	**CAUTION** **Interruption of temperature reaction time.** **Ineffective sterilization.** ∅ Do NOT open the unit doors during sterilization.

The sterilization phase is automatically finished after 4 hours. Indication “STERI END” is displayed.



Display after the sterilization phase (example)

The message “STERI END” implies that the sterilization phase is completed. The sterilization cycle is now in the cooling down phase or in the subsequent holding phase of 37°C / *98.6°F*.

You can now wait during the defined cooling down phase, which lasts 6 hours until reaching 37°C / *98.6°F* and is followed by a holding phase at 37°C / *98.6°F* of unlimited duration

If you prefer accelerating cooling- down, proceed as follows:

- Switch off the unit.
- If required, open the outer door.
- Cooling-down time:
  - Front door open: at least 1 hour
  - Front door closed: at least 4 hours

If required, open the glass door.

	**CAUTION** **The glass door handle reaches a temperature of approx. 150°C / *302°F*.** **Danger of burning.** ➢ Use gloves or a tool (e.g. pincers) to open the glass door.

- When the inner chamber has cooled down to a value below 60°C / *140°F*, plug in the CO_2 sensor and the O_2 sensor (unit with O_2 control).

	The CO_2 sensor is temperature resistant up to a maximum temperature of 60°C / *140°F*.

- Put the unit into operation (chap. 5.3).

Due to the sterilization, units in copper version change their color. This does not have any negative effect on the function and quality of the unit.

In case two units are directly stacked on top of each other **without** using the original BINDER stacking stand or the stacking adapter, the exact maintenance of the incubation set parameters in one of the units while carrying out sterilization in the other one cannot be guaranteed. Therefore, without using the stacking stand or the stacking adapter, no safe incubation is possible during sterilization of the other unit. We recommend using a stacking stand (chap. 9.11.2) or a stacking adapter (chap. 9.11.3).

13. Maintenance, and service

13.1 Maintenance intervals, service

DANGER

Electrical hazard.

Danger of death.

∅ The unit must NOT become wet during operation or maintenance work.

➢ Disconnect the unit before conducting maintenance work. Disconnect the power plug.

➢ Ensure all maintenance work is conducted by licensed electricians or experts authorized by BINDER.

Ensure regular maintenance work is carried out at least once a year.

	Replace the door gasket only when cold. Otherwise, the door gasket may become damaged.

We recommend taking out a maintenance agreement. Please consult BINDER Service.

BINDER telephone hotline:	+49 (0) 7462 2005 555
BINDER fax hotline:	+49 (0) 7462 2005 93555
BINDER e-mail hotline:	service@binder-world.com
BINDER Service hotline USA:	+1 866 816 8191 (toll-free in the USA)
BINDER Asia Pacific:	+ 603 6204 2855
BINDER Internet website	http://www.binder-world.com
BINDER address	BINDER GmbH, post office box 102, D-78502 Tuttlingen

International customers, please contact your local BINDER distributor.

13.2 Check of the air jacket heating fan

The user should regularly perform the following checks:

If the unit is in operation, you will be able to see the air jacket heating fan top center by looking through the ventilation slides at the rear of the unit. During operation, the fan must turn anti-clockwise continuously. The fan must move in left-hand rotation. For better monitoring, you can switch off the unit and wait until the fan has stopped.

13.3 Check of the humidity system fan

The user should regularly perform the following checks:

Hold a sheet of paper down in front of the ventilation silts at the rear of the unit. If the sheet of paper is sucked inwards, the fan is functioning correctly. When you open the door, the fan is switched off.

13.4 Gas inlet fine filter

The incoming gas used in operation passes through a fine gas filter (aseptic filter, filtration efficiency 99.99 %, particle size 0.45 µm).

The gas fine filter prevents dirt accumulating in the gas inlet valves and the tubes leading into the inner chamber, which could be in the gas bottle or in the supply tubes. A plastic hose clamp secures the connection.

The user should regularly visually check the gas fine filter for pollution.

	Regularly check the gas fine filter visually for pollution.

Replacing the gas fine filter

If gas with a technical grade of 99.5 % is used, we recommend changing the fine gas filter once a year. If gases with less pureness are used, the changing intervals could become shorter.

The fine gas filter is located behind the lower hosing cover (K) is easily accessible. Unscrew the two parker-screws left and right above the lower housing cover and push it downwards to remove the housing cover.

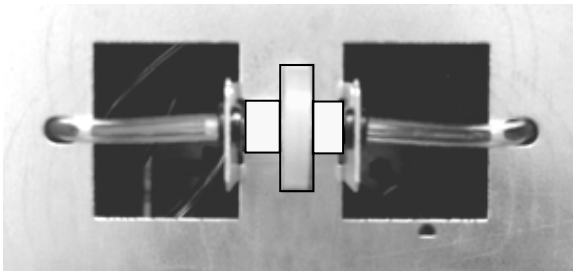


Figure 34: Gas fine filter

At the unit with O_2 control, both fine gas filters for CO_2 and for O_2/N_2 are located above each other. The tube ends for O_2/N_2 and the position of the O_2/N_2 fine gas filter are marked with yellow stickers.

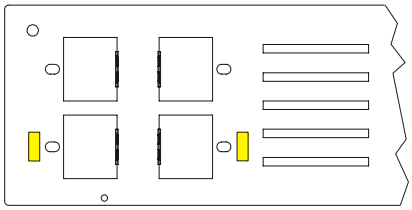


Figure 35: Fine gas filter positions behind the lower hosing cover

	Fix the fine filter correctly following replacement.

13.5 Sending back the unit to BINDER GmbH

If you send a BINDER product to us for repair or any other reason, we will only accept the product upon presentation of an authorization number that has previously been issued to you. We will issue an authorization number after receiving your complaint either in writing or by telephone prior to your sending the BINDER product back to us. The authorization number will be issued following receipt of the information mentioned below:

- BINDER product type and serial number
- Date of purchase
- Name and address of the dealer from which you bought the BINDER product
- Exact description of defect or fault
- Your full address; if possible contact person and availability of that person
- Exact location of the BINDER product
- Contamination clearance certificate (chap. 17) via fax in advance

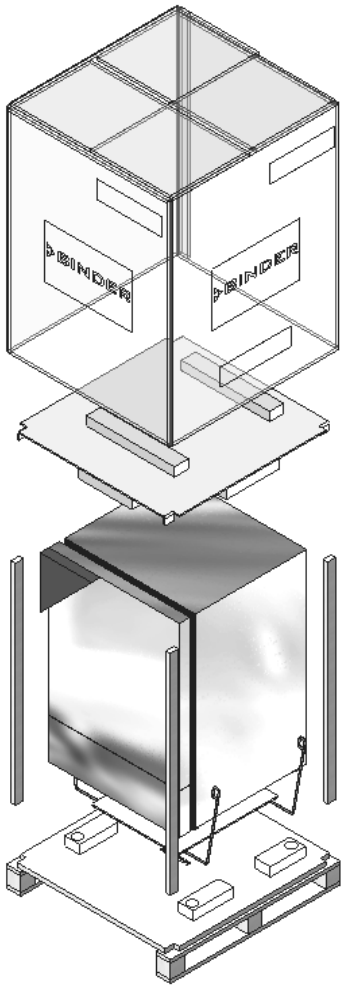
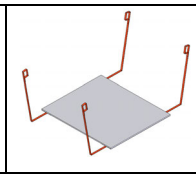
The authorization number needs to be applied to the packaging in such a way that it can be easily recognized or be recorded clearly in the delivery documents.

	For security reasons we cannot accept your delivery if it does not carry an authorization number.

14. Disposal

14.1 Disposal of the transport packing

14.1.1 Outer unit packing

Packing element		Material	Disposal
	Straps to fix packing on pallet (no image)	Plastic	Plastic recycling
	Transport box	Cardboard	Paper recycling
	Top cover with foamed plastic stuffing	Cardboard	Paper recycling
		PE foam	Plastic recycling
	Wooden sticks for stabilizing and for removal	Solid wood (IPPC standard)	Wood recycling
	Removal aid 	Cardboard	Paper recycling
		Plastic	Plastic recycling
	Pallet with foamed plastic stuffing	PE foam	Plastic recycling
		Solid wood (IPPC standard)	Wood recycling

14.1.2 Packing inside the unit, equipment

Packing element	Material	Disposal
Door protection	PE foam	Plastic recycling
Packing box equipment	Cardboard	Paper recycling
Insulating air cushion foil (CB 210 only)	PE foil	Plastic recycling
Paperboard (CB 150 only)	Cardboard	Paper recycling
Sensor packing	Cardboard	
	PE foam	Plastic recycling
Bag for operating manuals	PE foil	Plastic recycling

If recycling is impossible, all packing parts can also be disposed of with normal waste.

14.2 Decommissioning

- Switch off main switch (A1). Disconnect the unit from the mains.
- Turn off the CO_2 supply and the O_2 / N_2 supplies (unit with O_2 control). Remove the gas connections.
- Let the inner chamber sufficiently cool down before removing any parts.
- The Permadry™ water pan must not remain filled with water while the incubator is out of operation. Otherwise condensation on the inner surfaces may occur. In this case, clean and dry the incubator with open doors for at least one hour before taking it into operation again. BINDER recommends performing a hot air sterilization of the unit before commissioning.
- Disassembling the shelf holder takes place inside the chamber. Remove the shelves. Then fold both lateral parts to the middle and disconnect them from the bottom part.

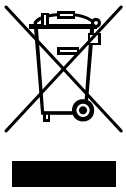
  You cannot take out the shelf holder of the incubator entirely together with the shelves.

- Temporal decommissioning: See indications for appropriate storage, chap. 3.3.
- Final decommissioning: Dispose of the unit as described in chap. 14.3 to 14.5.

When restarting the unit, please pay attention to the corresponding information chap. 5.3.

14.3 Disposal of the unit in the Federal Republic of Germany

According to directive 2002/96/EC of the European Parliament and of the Council on waste electrical and electronic equipment (WEEE), BINDER devices are classified as “monitoring and control instruments” (category 9) only intended for professional use“. They must not be disposed of at public collecting points.



The CO_2 incubator CB bears the symbol for the marking of electrical and electronic equipment manufactured / placed on the market in the EC after 13 August 2005 and be disposed of in separate collection according to the directive 2002/96/EC on waste electrical and electronic equipment (WEEE) and German national law for electrical and electronic equipment (Elektro- und Elektronikgerätegesetz, ElektroG). WEEE marking: crossed-out wheeled bin with solid bar under. A significant part of the materials must be recycled in order to protect the environment.

At the end of the device’s service life have the device disposed of according to the German national law for electrical and electronic equipment (Elektro- und Elektronikgerätegesetz, ElektroG) from 23 March 2005, BGBl. I p. 762 or contact BINDER Service who will organize taking back and disposal of the unit according to the German national law for electrical and electronic equipment (Elektro- und Elektronikgerätegesetz, ElektroG) from 23 March 2005, BGBl. I p. 762.

CAUTION

Violation against existing law.

∅ Do NOT dispose of BINDER devices at public collecting points.

➢ Have the device disposed of professionally at a recycling company, which is certified according to the German national law for electrical and electronic equipment (Elektro- und Elektronikgerätegesetz, ElektroG) from 23 March 2005, BGBl. I p. 762.

or

➢ Instruct BINDER Service to dispose of the device. The general terms of payment and delivery of BINDER GmbH apply, which were valid at the time of purchasing the unit.

Certified companies disassemble waste BINDER equipment in primary substances for recycling according to directive 2002/96/EC. In order to eliminate any health hazards to the employees of the recycling companies, the devices must be free from toxic, infectious or radioactive substances.

It is the user's responsibility that the unit is free from toxic, infectious or radioactive substances prior to handing it over to a recycling company.

– Prior to disposal, clean all introduced or residual toxic substances from the unit.

– Prior to disposal, disinfect the unit from all sources of infection. Be aware of the fact that sources of infection may also be located outside the inner chamber.

– If you cannot safely remove all toxic substances and sources of infection from the unit, dispose of it as special waste according to national law.

– Fill out the contamination clearance certificate (chap. 17) and enclose it with the unit.

WARNING

Contamination of the device with toxic, infectious or radioactive substances.

Danger of intoxication.

Danger of infection.

∅ NEVER take a unit contaminated with toxic substances or sources of infection for recycling according to directive 2002/96/EC.

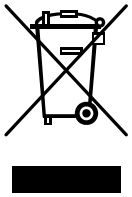
➢ Prior to disposal, remove all toxic substances and sources of infection from the unit.

➢ Dispose of a unit from which all all toxic substances or sources of infection cannot be safely removed as special waste according to national law.

14.4 Disposal of the unit in the member states of the EC except for the Federal Republic of Germany

According to directive 2002/96/EC of the European Parliament and of the Council on waste electrical and electronic equipment (WEEE), BINDER devices are classified as "monitoring and control instruments" (category 9) only intended for professional use". They must not be disposed of at public collecting points.

The CO_2 incubator CB bears the symbol for the marking of electrical and electronic equipment manufactured / placed on the market in the EC after 13 August 2005 and be disposed of in separate collection according to the directive 2002/96/EC on waste electrical and electronic equipment (WEEE). WEEE marking: crossed-out wheeled bin with solid bar under.



At the end of the device's service life, notify the distributor who sold you the device, who will take back and dispose of the unit according to the directive 2002/96/EC of 27 January 2003 on waste electrical and electronic equipment (WEEE).

CAUTION

Violation against existing law.

∅ Do NOT dispose of BINDER devices at public collecting points.

➢ Have the device disposed of professionally at a recycling company, which is certified according to conversion of the directive 2002/96/EC into national law.

or

➢ Instruct the distributor who sold you the device to dispose of it. The agreements apply that were reached with the distributor when purchasing the unit (e.g. his general terms of payment and delivery).

➢ If your distributor is not able to take back and dispose of the unit, please contact BINDER service.

Certified companies disassemble waste BINDER equipment in primary substances for recycling according to directive 2002/96/EC. In order to eliminate any health hazards to the employees of the recycling companies, the devices must be free from toxic, infectious or radioactive substances.

It is the user's responsibility that the unit is free from toxic, infectious or radioactive substances prior to handing it over to a recycling company.

– Prior to disposal, clean all introduced or residual toxic substances from the unit.

– Prior to disposal, disinfect the unit from all sources of infection. Be aware of the fact that sources of infection may also be located outside the inner chamber.

– If you cannot safely remove all sources of infection and toxic substances from the unit, dispose of it as special waste according to national law.

– Fill out the contamination clearance certificate (chap. 17) and enclose it with the unit.

WARNING

Contamination of the device with toxic, infectious or radioactive substances.

Danger of intoxication.

Danger of infection.

∅ NEVER take a unit contaminated with toxic substances or sources of infection for recycling according to directive 2002/96/EC.

➢ Prior to disposal, remove all toxic substances and sources of infection from the unit.

➢ Dispose of a unit from which all toxic substances or sources of infection cannot be safely removed as special waste according to national law.

14.5 Disposal of the unit in non-member states of the EC

CAUTION

Alteration of the environment.

➢ For final decommissioning and disposal of the CO_2 incubator, please contact BINDER Service.

➢ Observe the statutory regulations for appropriate, environmentally friendly disposal.

The main board of the CO_2 incubator includes a lithium cell. Please dispose of it according to national regulations.

15. Troubleshooting

Fault description	Possible fault cause	Required measures
Heating		
Temperature inside too high. Message “TEMPERATURE” displayed.	Difference between the set temperature and the ambient temperature too low.	Difference between the set temperature and the ambient temperature at least 7°.
Temperature inside too low. Message “TEMPERATURE” displayed.	Doors not closed.	Close door properly.
	Door gaskets defective.	Replace door gaskets.
	Controller defective.	Check the function of the temperature controller (Alarm indication acc. to chap. 8).
Chamber heating permanently, set point not held.	Controller defective.	Contact BINDER Service.
	Pt 100 sensor defective.	
	Semiconductor relay defective.	
	Controller not adjusted.	Calibrate and adjust controller.
Chamber does not heat up.	Heating element defective.	Contact BINDER Service.
	Semiconductor relay defective	
Chamber does not heat up when switching on the chamber. Safety controller responds.	Limit temperature reached. Safety controller (chap. 7.2) set too low.	Let the chamber cool down and hit RESET button of MB1 controller. If appropriate, select suitable limit value.
	Controller defective	Contact BINDER Service.
	Safety controller (chap. 7.2) defective.	
Unit permanently switched off (also when pressing the stand-by button, main switch (A1) is in position “I”).	Over temperature protective device (class 1) responds. Nominal temperature exceeded by 10° due to unit failure.	Contact BINDER Service.
	The miniature fuse has triggered (chap. 7.1).	Replace fuse with type 5x20mm, semi time-lag 10A (not CUL version). If the newly fitted fuse triggers again, there is a short circuit: contact BINDER Service.
Temperature inside too high. Message “TEMPERATURE LIMIT” is displayed.	Setting of the safety controller too high.	Check the setting of the safety controller. Choose a suitable limit value (chap. 7.2).
Safety controller responds. Message “TEMPERATURE LIMIT” is displayed.	Selected limit value has been reached.	Check temperature set point and setting of the safety controller. If appropriate, choose suitable limit value (chap. 7.2).
Gas		
Pressure alarm. Message “LOW PRESSURE CO2” is displayed.	CO_2 bottle is not connected correctly.	Correctly connect the gas bottle.
	Connected gas bottle is empty or not opened.	Open or replace gas bottle.
	Gas hose is dirty or obstructed.	Check the tube system for dirt accumulation or obstruction, clean or replace it.
	Defective function of the CO_2 controller (alarm indication, chap. 8).	Remove cause of fault, reset the alarm.
	Pressure sensor system defective.	Contact BINDER Service.

Fault description	Possible fault cause	Required measures
Gas (continued)		
Pressure alarm. Message “LOW PRESSURE O2” is displayed (unit with O_2 control).	O_2 bottle is not connected correctly.	Correctly connect the gas bottle.
	Connected gas bottle is empty or not opened.	Open or replace gas bottle.
	Gas hose is dirty or obstructed.	Check the tube system for dirt accumulation or obstruction, clean or replace it.
	Defective function of the O_2 controller (alarm indication, chap. 8).	Remove cause of fault, reset the alarm
	Pressure sensor system defective	Contact BINDER Service.
Pressure alarm. Message “LOW PRESSURE N2” is displayed (unit with O_2 control).	N_2 bottle is not connected correctly.	Correctly connect the gas bottle.
	Connected gas bottle is empty or not opened.	Open or replace gas bottle.
	Gas hose is dirty or obstructed	Check the tube system for dirt accumulation or obstruction, clean or replace it.
	Defective function of the controller (alarm indication, chap. 8).	Remove cause of fault, reset the alarm.
	Pressure sensor system defective	Contact BINDER Service.
CO_2 concentration inside too high. Message “CO2” is displayed.	Defective function of the CO_2 controller (alarm indication, chap. 8).	Remove cause of fault, reset the alarm.
	CO_2 sensor system defective	Contact BINDER Service.
CO_2 concentration inside too low. Message “CO2” is displayed.	Defective function of the CO_2 controller (alarm indication, chap. 8).	Remove cause of fault, reset the alarm.
	CO_2 sensor system defective.	Contact BINDER Service.
O_2 concentration inside too high. Message “O2” is displayed (unit with O_2 control).	Defective function of the O_2 controller (alarm indication, chap. 8).	Remove cause of fault, reset the alarm.
	O_2 sensor system defective	Contact BINDER Service.
O_2 concentration inside too low. Message “O2 LOW” is displayed (unit with O_2 control).	Defective function of the O_2 controller (alarm indication, chap. 8).	Remove cause of fault, reset the alarm.
	O_2 sensor system defective.	Contact BINDER Service.
Actual values of temperature, CO_2, O_2 (unit with O_2 control), or N_2 (unit with O_2 control) deviate a lot compared with a reference method. The pH indicator of the cell medium changes its normal color	Respective gas sensor system defective.	Transfer the cultures to another incubator and contact BINDER Service.
The concentration of CO_2 or O_2 (unit with O_2 control) does not reach the adjusted set value.	Door gaskets defective.	Replace door gaskets
	Doors not closed properly.	Close door properly.
	Connected gas bottle is empty or not opened.	Open or replace gas bottle.
	Gas bottle is not connected correctly.	Correctly connect the gas bottle.
	Gas hose is dirty or obstructed.	Check the tube system for dirt accumulation or obstruction, clean or replace it.
Recovery time (up to 5 vol.-% CO_2) after doors were open for 2 minutes is < 2 minutes.	CO_2 sensor system defective.	Contact BINDER Service.

Fault description	Possible fault cause	Required measures
Gas (continued)		
Recovery time (up to 5 vol.-% CO_2) after doors were open for 2 minutes is > 10 minutes.	Obstructed gas supply.	Check gas supply (bottle, connections, hose system).
	Insufficient CO_2 input pressure.	
Unusually high gas consumption.	Door gaskets defective.	Replace door gaskets
	Gas sensor not adjusted.	Calibrate sensor, contact BINDER Service
	Gas sensor defective.	Contact BINDER Service
	Gas fine filter not connected correctly.	Check hose connection of the gas fine filter (chap. 13.4).
Sterilization		
Message “DOOR OPEN” is displayed.	The outer unit door is not closed properly.	Close unit door properly.
Message “DO NOT OPEN THE DOOR” is displayed.	The sterilization is running.	Do not open the door.
Message “STERI END” is displayed.	The sterilization is completed	Let cool down the unit (chap. 12.5) and then take it into operation again (chap. 5).
Abortion of sterilization	Safety controller wrongly set.	Set safety controller to “Offset” or to “Limit” value 189.5°C (chap. 7.2).
Humidity		
No or too low humidity inside.	Permadry™ pan empty.	Fill the outer Permadry™ pan with water up to the marking on the inner pan with distilled, sterile water. The pan must have plain contact to the bottom of the inner chamber. Chap. 4.4.
	Humidity set too low.	Increase humidity (chap. 6.9).
Condensations inside the chamber.	Permadry™ pan filled with water when incubator is not operating.	Empty Permadry™ pan when incubator is not operating.
	Door gaskets defective.	Replace door gaskets
	Doors not closed properly.	Close door properly.
	Humidity set too high.	Reduce humidity (chap. 6.9).
Condensation on the door.	Unit placed on very cold floor.	Place the unit on a BINDER stand to increase the distance to the floor.
	Door gaskets defective.	Replace door gaskets
	Doors not closed properly.	Close door properly.
	Humidity set too high.	Reduce humidity (chap. 6.9).
Condensation on the divided inner glass door, gas-proof.	Unit placed on very cold floor.	Place the unit on a BINDER stand to increase the distance to the floor.
	Door gaskets defective.	Replace door gaskets
	Doors not closed properly.	Close door properly.
	Humidity set too high.	Reduce humidity (chap. 6.9).

Fault description	Possible fault cause	Required measures
Controller		
No entries to controller keypad possible. Notification “KEY LOCK” is displayed.	Keyboard locking (option) activated.	Unlock keyboard locking (chap. 9.7).
No access to menu “User settings”.	User code forgotten.	Contact BINDER Service.
Wrong temperature alarms, disturbance of temperature accuracy	Temperature unit changed to °F.	Set temperature unit to °C (chap. 6.4).
Chart recorder function: measured-value memory cleared, information loss.	New setting of storage rate.	Change the storage rate ONLY if the previously registered data are no more required (chap. 6.6).
Notifying or alarm message can not be reset with the RESET key.	Error cause not removed properly. Notifying or alarm messages for temperature and CO_2 / O_2 can be reset with the RESET key only within a range of +/- 1°C resp. +/- 1 Vol.-% .	Remove error cause. If the message still cannot be reset, contact BINDER Service.
Controller display too dark.	Contrast set too low.	Increase display contrast (chap. 6.3).
Display flashing: 1999 or -1999 or 9999.	Sensor rupture between sensor and controller	Contact BINDER Service.
	Short-circuit.	
	Initialization problem due to switching on the chamber too early.	Observe a delay time of approx. 30s between switching Off and On again the chamber.
RANGE ERROR CHAN. 1 RANGE ERROR CHAN. 2 RANGE ERROR CHAN. 3 RANGE ERROR CHAN. 4 RANGE ERROR CHAN. 5 is displayed.	Out of measuring range.	Switch off unit and open the doors. Then switch on unit by the main switch. If the error message persists, contact BINDER Service.
The usual display of temperature, O_2, and CO_2 is not displayed on the controller.	Wrong entry during set point modification.	Switch off unit by the main switch. Then switch on the unit again.
Miscellaneous		
Message „!CO2-SENSOR!“ is displayed	CO2 sensor not plugged in correctly.	Plug in CO_2 sensor correctly.
	Sensor rupture between sensor and controller.	Contact BINDER Service.

	Only qualified service personnel authorized by BINDER must perform repair. Repaired units must comply with the BINDER quality standards.

16. Technical description

16.1 Factory calibration and adjustment

This unit was calibrated and adjusted in factory. Calibration and adjustment were performed using standardized test instructions, according to the QM DIN EN ISO 9001 system applied by BINDER (certified since December 1996 by TÜV CERT). All test equipment used is subject to the administration of measurement and test equipment that is also a constituent part of the BINDER QM DIN EN ISO 9001 systems. They are controlled and calibrated to a DKD-Standard at regular intervals.

A record of this calibration and adjustment is part of the BINDER test certificate of the unit.

Adjustment in factory:

- **Temperature**: 37°C / *98.6°F* measured in the center of the usable volume
- **CO_2**: 0 vol.-% CO_2 (100 vol.-% N_2) and 5 vol.-% CO_2 (analyzed test gas directly exposed to the sensor head)
- **O_2** (unit with O_2 control): 0 vol.-% O_2 (100 vol.-% N_2) and 80 vol.-% O_2 (analyzed test gas directly exposed to the sensor head)

Suitable reference methods applicable for the user for comparison between reference measuring results and the display readings of the controller(s) are explained in chap. 10.

	An adjustment that may become necessary (adjustment of the controller display following a reference measurement) must only be performed by BINDER Service or by authorized services.

The service uses an electronic measuring and display device for temperature traceable to an acknowledged standards/calibration institution (DKD or PTB for Germany) with valid calibration certificate.

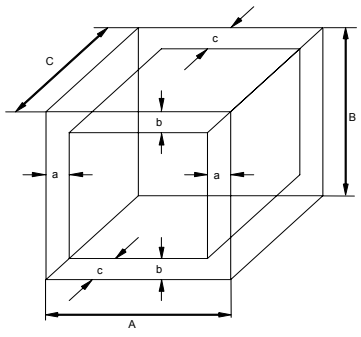
Test gases with an analyzed concentration serve to calibrate the sensor systems for CO_2 and O_2 (unit with O_2 control). The sensor heads are exposed directly to the test gas.

16.2 Over current protection

A miniature fuse accessible from the outside protects the device against over current. The miniature fuse is located at the rear of the chamber below the strain relief of the power cord. The fuse holder is equipped with a fuse clip 5mm x 20 mm. Replace the fuse only with a substitute of the same ratings. Refer to the technical data of the respective device type. If the fuse is blown, please inform an electronic engineer or BINDER Service.

16.3 Definition of usable space

The usable volume illustrated below is calculated as follows:



A, B, C = internal dimensions (W, H, D)
a, b, c = wall separation

a = 0.1*A
b = 0.1*B
c = 0.1*C

V_{USE} = (A - 2 * a) * (B - 2 * b) * (C - 2 * c)

Figure 36: Determination of the useable volume

The technical data refers to the so defined usable space.

	Do NOT place samples outside this usable volume. Do NOT load this volume by more than half to enable sufficient airflow inside the CO_2 incubator. Do NOT divide the usable volume into separate parts with large area samples. Do NOT place samples too close to each other in order to permit circulation between them and thus obtain a homogenous distribution of temperature, CO_2 and O_2 (unit with O_2 control).

16.4 Technical data CB

Unit size		**150**	**210**
Exterior dimensions			
Width	mm / *inch*	680 / *26.77*	740 / *29.13*
Height (incl. feet)	mm / *inch*	919 / *36.18*	1069 / *42.09*
Depth	mm / *inch*	715 / *28.15*	715 / *28.15*
plus door handle, I-triangle	mm / *inch*	54 / *2.13*	54 / *2.13*
plus mains connection and gas connection	mm / *inch*	60 / *2.36*	60 / *2.36*
Wall clearance rear	mm / *inch*	100 / *3.94*	100 / *3.94*
Wall clearance side	mm / *inch*	50 / *1.97*	50 / *1.97*
Number of doors		1	1
Number of inner glass doors		1	1
Interior dimensions			
Width	mm / *inch*	500 / *19.69*	560 / *22.05*
Height	mm / *inch*	600 / *23.62*	750 / *29.53*
Depth	mm / *inch*	500 / *19.69*	500 / *19.69*
Interior volume	l	150 / *5.4*	210 / *7.5*
Number of shelves (unit with shelf holder)	Series / max.	3/8	3/11
Number of shelves (unit with beads)	Series / max.	3/6	3/8
Size of shelf (unit with shelf holder) Width x Depth	mm x mm *inch x inch*	473 x 448 *18.62 x 17.64*	533 x 448 *20.98 x 7.64*
Size of shelf (unit with beads) Width x Depth	mm x mm *inch x inch*	495 x 444 *19.49 x 17.48*	555,5 x 444 *21.87 x 17.48*
Weight (empty)	kg	107 / 236	121 / 267
Temperature Data			
Temperature range, 7 degrees above ambient up to	°C / °F	60 / *140*	60 / *140*
Temperature variation at 37°C/ *98.6°F*	± °C	0.3	0.4
Temperature fluctuation	≤± °C	0.1	0.1
Recovery time 1) after door open for 30 sec at 37°C/ *98.6°F*	minutes	3	3
CO_2 Data			
CO_2 range	vol.-% CO_2	0 to 20	0 to 20
Setting accuracy	vol.-% CO_2	0.1	0.1
Recovery time 1) after door open for 30 sec at 5 vol.-% CO_2	minutes	3	3
CO_2 measurement		IR	IR
Connection hose nozzle DN6 for CO_2 for hose with internal diameter	mm / *inch*	6 / *0.24*	6 / *0.24*
Humidity Data			
Humidity (average value)	% r.H.	95	95
Recovery time 1) after door open for 30 sec	minutes	40	40

Unit size		150	210
O_2 Data			
O_2 range	vol.-% O_2	0.2 to 95	0.2 to 95
Setting accuracy with inlet pressure 2 bar	vol.-% O_2	0.1	0.1
Recovery time 1) from 21 vol.-% to 0.2 vol.-% O_2	minutes	33	***
from 21 vol.-% to 2 vol.-% O_2	minutes	19	***
from 21 vol.-% to 5 vol.-% O_2	minutes	11	***
from 21 vol.-% to 30 vol.-% O_2	minutes	4	***
O_2 measurement		ZrO_2	ZrO_2
Connection hose nozzle DN6 for O_2/N_2 for hose with internal diameter	mm / *inch*	6 / *0.24*	6 / *0.24*
Electrical Data			
IP system of protection acc. to EN 60529	IP	20	20
Nominal voltage (±10 %) 50/60 Hz	V	230 1N~	230 1N~
Nominal power (unit with shelf holder)	kW	1.40	1.60
Nominal power (unit with beads)	kW	1.30	1.50
Energy consumption 2) at 37°C/ *98.6°F*	W	140	140
Mains plug		Shock-proof plug	Shock-proof plug
Installation category acc. to IEC 1010-1		II	II
Pollution degree acc. to IEC 1010-1		2	2
Unit fuse	4x20mm / semi time-lag / 10 A		

Electrical Connection Data CB-UL (for the USA and Canada)

Unit size		150	210
Electrical Data			
Nominal voltage (±10 %) 60 Hz / 1N	V	115 1N~	115 1N~
Mains plug	NEMA	5-20P	5-20P
Nominal power	kW	1.30	1.50
Installation category acc. to IEC 1010-1		II	II
Pollution degree acc. to IEC 1010-1		2	2
Unit fuse	6.3 X 32 mm / 250V / super-time-lag TT / 16A		

Legend:

1) to 98 % of the set value
   The recovery times of the gas concentrations inside the chamber following the door being opened coincide with a connection pressure of 2.0 bar / *29 psi*. Decreasing supply pressure results in longer recovery times.
2) Use this value for dimensioning air condition systems.

*** Data not yet determined

All technical data is specified for units with standard equipment at an ambient temperature of +25°C / *77°F* and a mains voltage fluctuation of ±10. The temperature data is determined in accordance to factory standard following DIN 12880, observing the recommended wall clearances of 10 % of the height, width and depth of the inner chamber.

All indications are average values, typical for units produced in series. We reserve the right to alter technical specifications at all times.

	If the chamber is fully loaded, the specified heating up and cooling down times may vary according to the load.

16.5 Equipment and Options CB

	To operate the CO_2 incubator, use only original BINDER accessories or accessories from third-party suppliers authorized by BINDER. The user is responsible for any risk arising from using unauthorized accessories.

Regular equipment
Microprocessor display controller with 4-channel technology for temperature and CO_2 (and for O_2 with unit with O_2 control)
CO_2 infra-red absorption measuring system
Fan-assisted air jacket system
Hot-air auto sterilization at 187,5°C / *369.5°F*
Gas mixing head
Permadry™ system
Weldless deep-drawn inner chamber made of stainless steel 1.4301/V2A, polished
Electronic error auto-diagnosis system with zero-voltage relay output
Temperature safety device class 3.1 acc. to DIN 12880, part 1
Tightly closing inner glass door
3 perforated shelves, stainless steel 1.4301/V2A or copper
Communication interface RS 422
Test mark CUL, VDE

Options / accessories
Perforated shelf, stainless steel or copper
Glass door, multiply divided, gas-proof, stainless steel or copper, 4 times (CB 150), 6 times (CB 210)
Shelves for multiply divided Glass door, gas-proof, stainless steel or copper
Stand, height 200 mm, including rubber pads
Stacking adapter for direct, thermally decoupled stacking
Stacking stand with castors lockable by breaks
Silicone access ports closable with 2 silicone lids
Lockable door
Keyboard locking
Bottle changer CO_2/O_2/N_2 + connection kit
Built-in CO_2 bottle changer with external connection for 2nd incubator
Connection kit for CO_2 , O_2 or N_2 bottle
Internal socket 230 V (max. 3 A), with turn-off switch
Analog output temperature and CO_2 4-20mA with DIN socket
Cleaning kit (neutral cleaning agent, disinfection spray and lint-free disposable wipes)
Intelligent Fail-Safe CO_2 monitoring function
Calibration certificate for temperature and CO_2
Calibration certificate for O_2 (unit with O_2 control)
CELLROLL roller system + set of connection cables
Connection for low tension supply 24V AC/DC max. 2.5A
Qualification folder

16.6 Spare parts

BINDER GmbH is only responsible for the safety features of the unit provided skilled electricians or qualified personnel authorized by BINDER perform all maintenance and repair, and if components relating to chamber safety are replaced in the event of failure with original spare parts. The user is responsible for any risk arising from using unauthorized accessories.

Accessories and spare parts:

Unit size		**150**	**210**
Description		**Art. no.**	
Perforated shelf, stainless steel	unit with shelf holder	8012-0005	8012-0004
	unit with beads	6004-0080	6004-0082
Perforated shelf, copper	unit with shelf holder	8012-0007	8012-0006
Divided shelves (1 level) for Glass door, multiply divided, gas-proof, stainless steel	unit with shelf holder	8012-0363	8012-0364
	unit with beads	8012-0578	8012-0579
Divided shelves (1 level) for Glass door, multiply divided, copper	unit with shelf holder	8012-0028	8012-0029
Door gasket unit door		6005-0017	6005-0027
Door gasket glass door		6005-0077	6005-0080
Door gasket (slim) for Glass door, multiply divided, gas-proof		6005-0102	6005-0103
Door gasket for individual glass door for option Glass door, multiply divided, gas-proof		6005-0100	6005-0101
Individual glass door for option Glass door, multiply divided, gas-proof, complete		8010-0051	8010-0035
Glass door, multiply divided, gas-proof (retrofit kit), stainless steel	unit with shelf holder	8012-0406	8012-0407
	unit with beads	8009-0315	8009-0316
Stand, height 200 mm, including rubber pads		9051-0008	9051-0009
Stacking adapter for direct, thermally decoupled stacking		9051-0021	9051-0022
Stacking stand with castors lockable by breaks		9051-0020	9051-0023
CELLROLL roller system + set of connection cables and low tension access port		8012-0571	8012-0572
Rubber pads, 4 pieces		8012-0376	
Unit fuse 5x20mm 250V 10A semi time-lag (M)		5006-0012	
Unit fuse 6,3x32mm 250V 16A super-time (TT) for CUL version only		5006-0033	
Temperature fuse class 1		5006-0037	
Controller MB1, display		5014-0059	
Controller MB1, E/A board		5014-0060	
Temperature sensor Pt 100 straight (door heating)		5002-0021	
Temperature sensor Pt 100 bent off (air jacket)		5002-0022	
Temperature sensor 2 x Pt 100 straight (inner chamber + safety controller)		5002-0043	
CO_2 sensor		5002-0023	
O_2 sensor		5002-0015	
Gas fine filter		8009-0369	
Pressure reducer Fail Safe		8009-0232	
Permadry™ water pan		4022-0081	
Permadry™ cold water pan, copper		4022-0057	
Permadry™ humidity water pan, copper		8003-0064	
Permadry™ humidity water pan, copper, for multiply divided glass door		8003-0067	

Description	Art. no.
Calibration certificate for temperature and CO_2	8012-0228
Calibration certificate for O_2	8012-0229
Qualification folder	8012-0423
Cleaning kit (neutral cleaning agent, disinfection spray and lint-free disposable wipes)	8012-0503
Manual cell culture technology	7001-0079
Shelf for 36 Petri dishes, stainless steel	6006-0167
Petri dish incubation rack, rack for 6 x 6 Petri dishes, stainless steel	6006-0168
Petri dish incubation rack, rack for 6 x 6 Petri dishes, red	6006-0169
Petri dish incubation rack, rack for 6 x 6 Petri dishes, green	6006-0170
Petri dish incubation rack, rack for 6 x 6 Petri dishes, yellow	6006-0171
Petri dish incubation rack, rack for 6 x 6 Petri dishes, blue	6006-0172
Stainless steel tray for Petri dish incubation racks	6006-0173

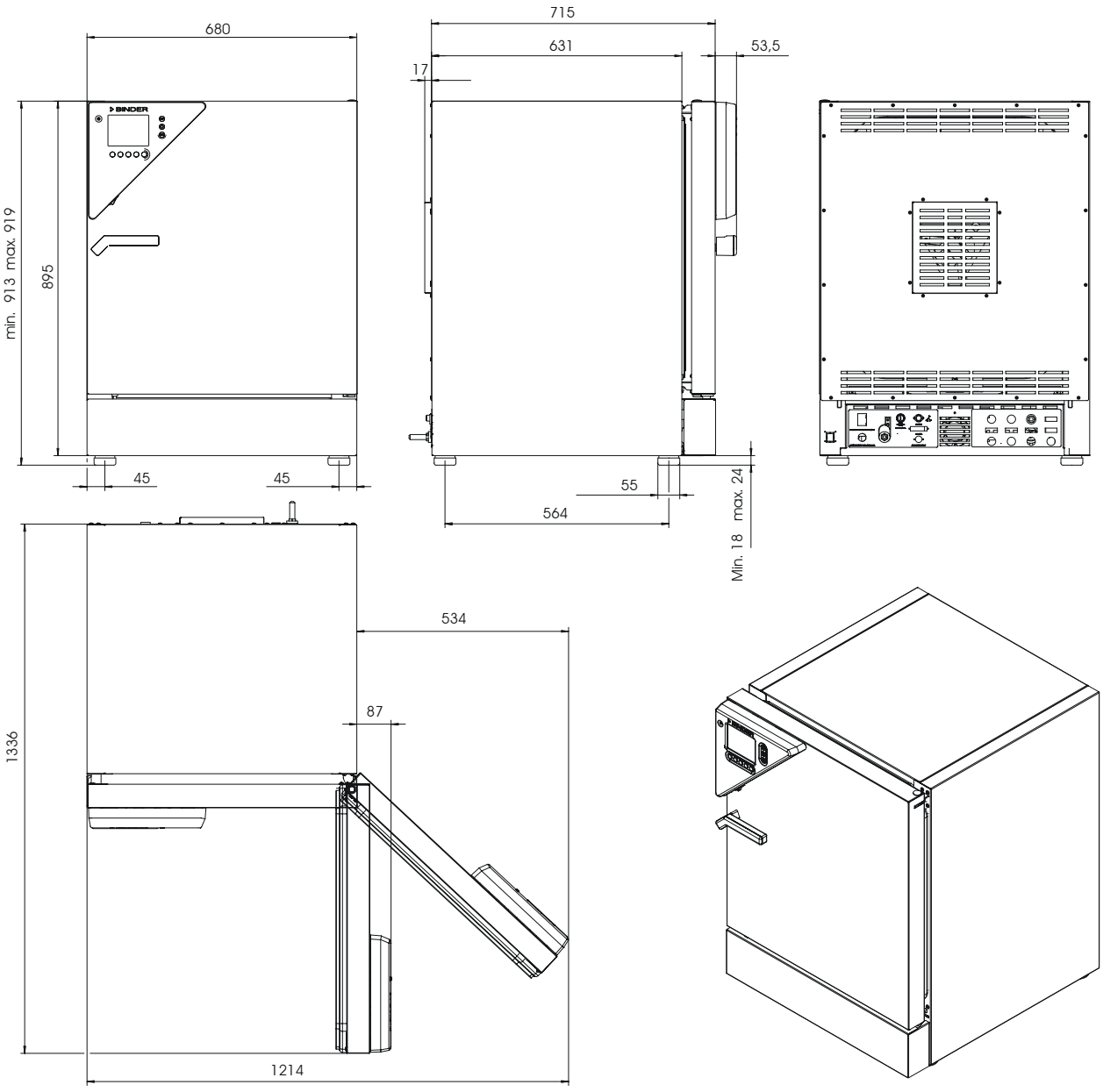
16.7 Important conversion data for non-SI units

1 ft = 0.305 m
1 m = 100 cm = 3.28 ft = 39.37 inch
1 mbar = 0.0145 psi

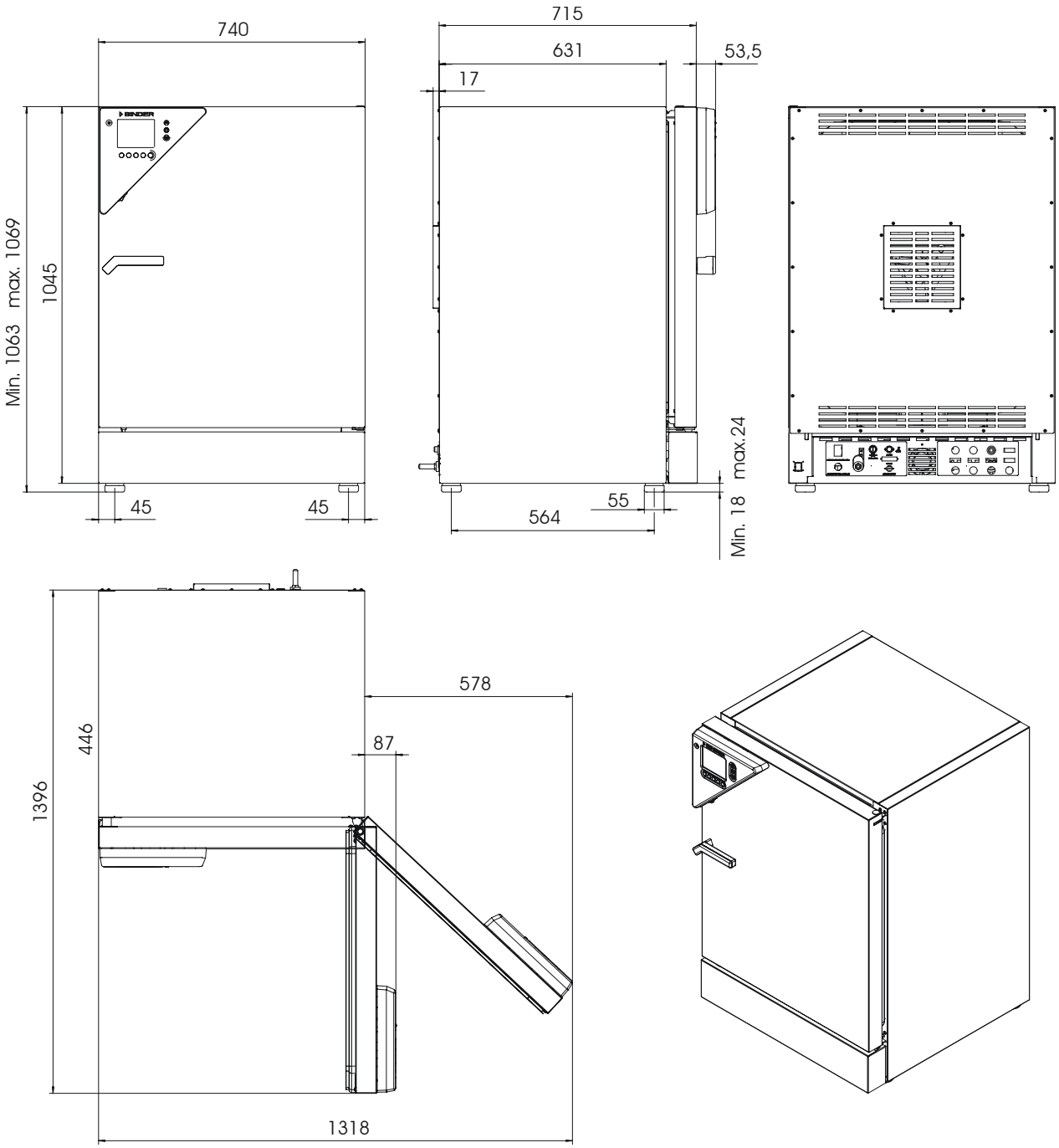
16.8 Conversion table for gas inlet pressures, bar – psi

bar	psi	bar	psi	bar	psi
1	14.5	3	43.5	5	72.5
1.5	21.7	3.5	50.7	5.5	79.7
2	29.0	4	58.0	6	87.0
2.5	36.3	4.5	65.2		

16.9 Dimensions CB 150



16.10 Dimensions CB 210



17. Contamination clearance certificate

Unbedenklichkeitsbescheinigung

Declaration of safeness with regard to safety and health
Erklärung zur Sicherheit and gesundheitlichen Unbedenklichkeit

The German Ordinance on Hazardous Substances (GefStofV), and the regulations regarding safety at the workplace require that this form be filled out for all products that are returned to us, so that the safety and health of our employees can be warranted.
Die Sicherheit und Gesundheit unserer Mitarbeiter, die Gefahrstoffverordnung GefStofV und die Vorschriften zur Sicherheit am Arbeitsplatz machen es erforderlich, dass dieses Formblatt für alle Produkte, die an uns zurückgeschickt wird.

	In the absence of a completely filled out form, a repair is not possible. Ohne Vorliegen des vollständig ausgefüllten Formblattes ist eine Reparatur nicht möglich.

- A completely filled out form should be transmitted by Fax (+49 (0) 7462 2005 93555) or by letter in advance to us, so that this information is available before the equipment/component part arrives. A second copy of this form should accompany the equipment/component part. Eventually the carrier should be informed.
  Eine vollständig ausgefüllte Kopie dieses Formblattes soll per Telefax (Nr. +49 (0) 7462 2005 93555) oder Brief vorab an uns gesandt werden, so dass die Information vorliegt, bevor das Gerät/Bauteil eintrifft. Eine weitere Kopie soll dem Gerät/Bauteil beigefügt sein. Ggf. ist auch die Spedition zu informieren.

- Incomplete information or non-conformity with this procedure will inevitably result in substantial delays in processing. We hope you will have understanding for this measure, which lies outside of our area of influence, and that you will help us to speed up this procedure.
  Unvollständige Angaben oder Nichteinhalten dieses Ablaufs führen zwangsläufig zu beträchtlichen Verzögerungen in der Abwicklung. Bitte haben Sie Verständnis für Maßnahmen, die außerhalb unserer Einflussmöglichkeiten liegen und helfen Sie mit, den Ablauf beschleunigen.

- **Please fill out this form completely.**
  Bitte unbedingt vollständig ausfüllen!

1.	**Unit/ component part / type:** / **Gerät / Bauteil / Typ:**
2.	**Serial No.**/ **Serien-Nr.:**
3.	**Details about utilized substances / biological substances** / **Einzelheiten über die eingesetzten Substanzen/biologische Materialien:**
3.1	**Designations** / **Bezeichnungen:**
a)	_____
b)	_____
c)	_____
3.2	**Safety measures required for handling these substances** / **Vorsichtsmaßnahmen beim Umgang mit diesen Stoffen:**
a)	_____
b)	_____
c)	_____

3.3 Measures to be taken in case of skin contact or release into the atmosphere / Maßnahmen bei Personenkontakt oder Freisetzung:

a) _____

b) _____

c) _____

d) _____

3.4 Other important information that must be taken into account / Weitere zu beachtende und wichtige Informationen:

a) _____

b) _____

c) _____

4. Declaration on the risk of these substances (please checkmark the applicable items) / Erklärung zur Gefährlichkeit der Stoffe (bitte Zutreffendes ankreuzen) :

❑ **4.1 For non toxic, non radioactive, biologically harmless materials / für nicht giftige, nicht radioaktive, biologisch ungefährliche Stoffe:**

We herewith guarantee that the above-mentioned unit / component part… / Wir versichern, dass o.g. Gerät/Bauteil...

❑ Has not been exposed to or contains any toxic or otherwise hazardous substances / weder giftige noch sonstige gefährliche Stoffe enthält oder solche anhaften.

❑ That eventually generated reaction products are non-toxic and also do not represent a hazard / auch evtl. entstandene Reaktionsprodukte weder giftig sind noch sonst eine Gefährdung darstellen.

❑ Eventual residues of hazardous substances have been removed / evtl. Rückstände von Gefahrstoffen entfernt wurden.

❑ **4.2 For toxic, radioactive, biologically harmful or hazardous substances, or any other hazardous materials / für giftige, radioaktive, biologisch bedenkliche bzw. gefährliche Stoffe oder anderweitig gefährliche Stoffe.**

We herewith guarantee that … / Wir versichern, dass ...

❑ The hazardous substances, which have come into contact with the above-mentioned equipment/component part, have been completely listed under item 3.1 and that all information in this regard is complete / die gefährlichen Stoffe, die mit dem o.g. Gerät/Bauteil in Kontakt kamen, in 3.1 aufgelistet sind und alle Angaben vollständig sind.

❑ That the unit /component part has not been in contact with radioactivity / das Gerät/Bauteil nicht mit Radioaktivität in Berührung kam

5. Kind of transport / transporter / Transportweg/Spediteur:

Transport by (means and name of transport company, etc.) Versendung durch (Name Spediteur o.ä.)

_____

Date of dispatch to BINDER GmbH / Tag der Absendung an BINDER GmbH:

_____

We herewith declare that the following measures have been taken / Wir erklären, dass folgende Maßnahmen getroffen wurden:

- ❑ Hazardous substances were removed from the unit / component part, so that no hazard exists for corresponding persons in the handling or repair of these items / das Gerät/Bauteil wurde von Gefahrstoffen befreit, so dass bei Handhabung/Reparaturen für die betreffenden Person keinerlei Gefährdung besteht
- ❑ The unit was securely packaged and properly identified / das Gerät wurde sicher verpackt und vollständig gekennzeichnet.
- ❑ Information about the hazardousness of the shipment (if required) has been provided to the transporter / der Spediteur wurde (falls vorgeschrieben) über die Gefährlichkeit der Sendung informiert.

We herewith commit ourselves and guarantee that we will indemnify BINDER GmbH for all damages that are a consequence of incomplete or incorrect information provided by us, and that we will exempt BINDER GmbH from eventual damage claims by third parties./ Wir versichern, dass wir gegenüber BINDER für jeden Schaden, der durch unvollständige und unrichtige Angaben entsteht, haften und BINDER gegen eventuell entstehende Schadenansprüche Dritter freistellen.

We are aware that, in accordance with Article 823 of the German Civil Code (BGB), we are directly liable with regard to third parties, in this instance especially the employees of BINDER GmbH, who have been entrusted with the handling / repair of the unit / component. / Es ist uns bekannt, dass wir gegenüber Dritten – hier insbesondere mit der Handhabung/Reparatur des Geräts/des Bauteils betraute Mitarbeiter der Firma BINDER - gemäß §823 BGB direkt haften

Name: _____

Position: _____

Date / Datum: _____

Signature / Unterschrift: _____

Company stamp / Firmenstempel:

Equipment that is returned to the factory for repair must be accompanied by a completely filled out contamination clearance certificate. For service and maintenance works on site, such a contamination clearance certificate must be submitted to the service technician before the start of the works. No repair or maintenance of the equipment is possible, without a properly filled out contamination clearance certificate.