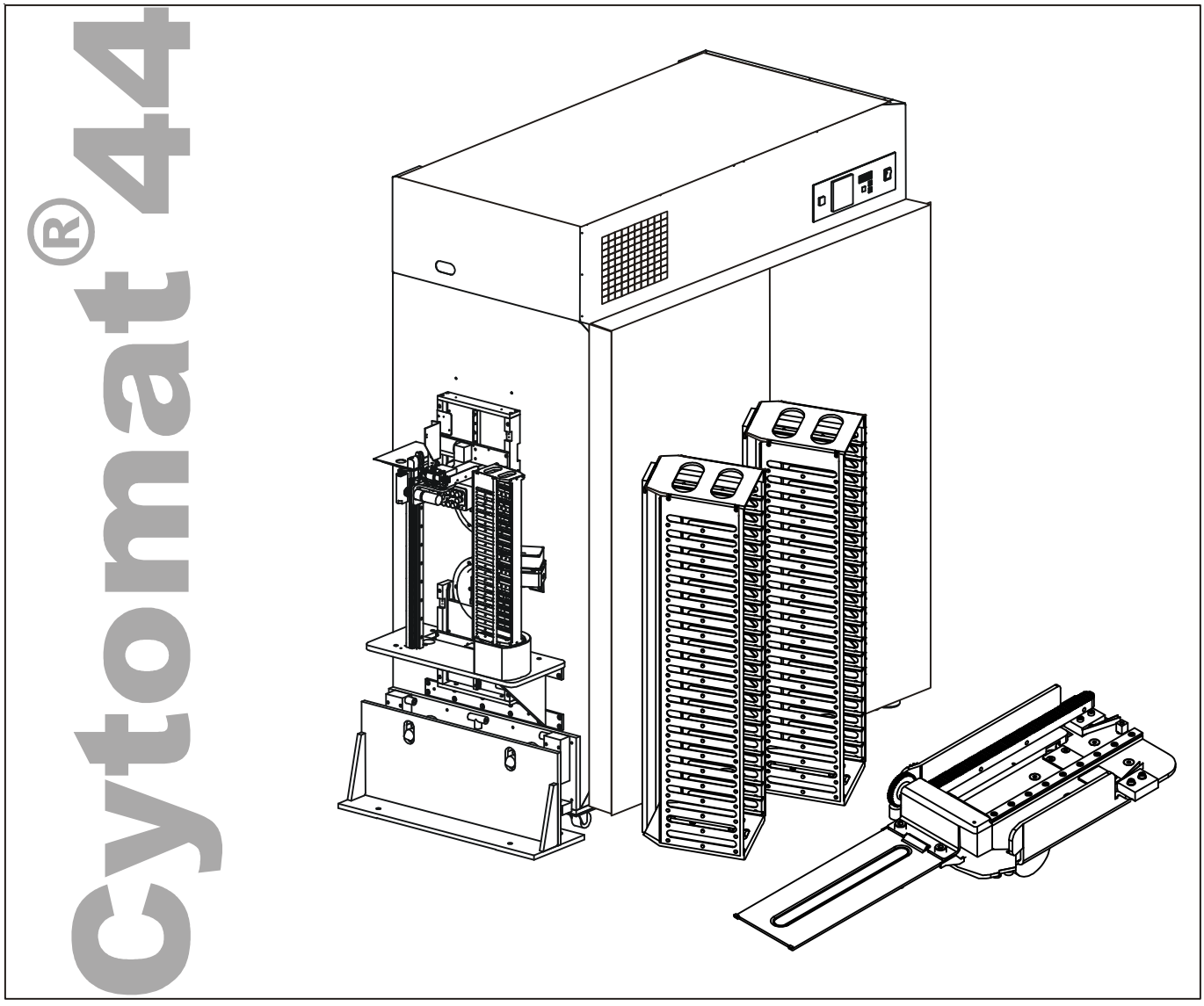
Operating Instructions

Storage Cabinet Cytomat® 44



Thermo
ELECTRON CORPORATION

Valid: 07.2005 50080109 B

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1. General notes

1.1 General notes for operation

These operating instructions describe the storage cabinet Cytomat® 44. The storage cabinet has been manufactured in keeping with the latest technological developments and is operationally safe. However, the device may present potential hazards, particularly if it is operated by inadequately trained personnel or if it is not used in accordance with the intended purpose. Therefore, the following must be observed to prevent accidents:

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

1.2 Warranty

Thermo Electron Corporation warrants the operational safety and the operativeness of the storage cabinet Cytomat® 44 only under the condition that:

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

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

1. General notes

Below is a list of the international Thermo marketing organizations.

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1. General notes

1.3 Explanation of symbols

1.3.1 Symbols used in the operating instructions:

WARNING!

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

CAUTION!

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

NOTE

is used for applicational hints and useful information.

RECYCLING

Valuable raw materials can be reused.

Wear safety gloves!

Wear safety goggles!

Harmful liquids!

Electric shock!

Crush hazard!

1. General notes

Crush hazard!

Suffocation hazard!

Hot surfaces!

1.3.2 Symbols on the device:

CE symbol

Observe operating instructions!

Unplug power plug before opening!

Crush hazard!

Do not touch component!

Hot surface / Thermostat!

1. General notes

1.4 Intended purpose of the device

1.4.1 Correct use

The storage cabinet Cytomat® 44 is a laboratory device for the automated long-term or intermediate storage of

- compounds or
- aqueous cell and tissue cultures

at a temperature range between -20°C bis +25°C at a dry and humid atmosphere. Three versions of the device are available; for each version, the refrigeration system controls a specific temperature / humidity atmosphere.

Cytomat® 44 dry refrigerator for storing compounds:

- Temperature range +4° C to +20° C for a dry sample chamber atmosphere at a relative humidity of < 10 %

Cytomat® 44 humidity refrigerator for storing aqueous samples or cell and tissue cultures:

- Temperature +4° C, humid sample chamber atmosphere > 75 %,
- Temperature +20° C, humid sample chamber atmosphere > 85 %.

Cytomat® 44 with controlled humidity for storing aqueous samples or cell and tissue cultures:

- Temperature range +4°C to +25°C at a relative humidity of 20% to 50%.

To reduce condensate formation and to improve the storage stability of the samples, the atmospheric oxygen content in the sample chamber can be reduced optionally by the controlled supply of nitrogen (N_2).

The device has been designed for the integrated application in computer-aided systems, particularly for HTS (High Throughput Screening) procedures. As it is equipped with rollers, it can also be used as a mobile storage system at various local docking stations or locations.

The Plate Shuttle™ System (PSS) in the device allows the automated, direct access to the culture containers (specifically microplates or similar containers). The transfer of the microplates to or from the integrator system or other transport systems is achieved at a fixed position. For this purpose, the Cytomat® 44 must be integrated in a security system to be installed on site that:

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

The Cytomat® 44 is suitable for installation and operation in laboratories and can also be used for continuous operation.

1.4.2 Incorrect use:

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

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

1. General notes

1.5 Standards and guidelines

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

- ZH 1 / 10
- ZH 1 / 119
- ZH 1 / 342
- ZH 1 / 343
- ZH 1 / 598
- TRG 280
- EU Official Gazette, L 374
- Principles of good microbiological proceedings, notice of the trade association of the German chemical industry.

For other countries, the applicable national regulations must be observed.

The device is in accordance with the following safety requirements:

- DIN EN 61010-1:1993
- DIN EN 61010-1A2:1995 (IEC 1010)
- DIN EN 61326 (EN 50081-1, EN 50082-2)
- Low Voltage Guideline 73 / 23 EWG
- EMC Guideline 89 / 336 EWG
- UVV VBG 20
- Machine Guideline 98 / 37 / EG

1. General notes

1.6 Safety devices

The device is equipped with several safety devices:

- When the service doors are opened, a door switch interrupts
- the traveling motions of the two Plate Shuttle™ Systems (PSS),
- the gas supply,
- the function of the refrigeration system.

- An independent thermal protection protects the samples from harmful overheating in case of a failure.
- Visual alarms indicate failures during operation.

1.7 Safety notes on gas

Nitrogen (N_2):
The gas is freely miscible with air. High concentrations of nitrogen reduce the oxygen content in the atmosphere.

CAUTION - Suffocation hazard!

Nitrogen released in large amounts into the room atmosphere may cause suffocation.
If N_2 is released, initiate the safety measures!

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

NOTE - Installations

Any work to supply lines, compressed gas containers, cylinders or reservoirs that contain N_2 must be carried out only by expert personnel using the appropriate tools.

2. Delivery of the device

2.1 Packaging

The storage cabinet Cytomat® 44 is delivered with the accessories in a stable packaging box. All packaging materials can be separated and are reusable.

Packaging materials

- Packaging carton — Recycled paper
- Foam elements — Rigid foam (CFC-free)
- Pallet — Untreated wood
- Packaging film — Polyethylene
- Packaging ribbons — Polypropylene

2.1.1 Opening the packaging box

Fig. 1: Position the packaging box so that an additional free space of at least 5 m is available at its face [1] for the further transport of the device.
The packaging box consists of a shipping pallet with a wooden frame construction to which the two side panels and the panels for the ends are secured with wood screws (hex head / M 10).
The end panel [1] is also used as a ramp over which the device is moved off the shipping pallet after the panel has been attached to the face [2] of the pallet.

To disassemble the packaging box, remove the retaining screws from the individual wooden panels:

1. Remove the top panel from the box.
2. Remove the side panels.
3. Remove the end panels.
4. Remove the filling materials.

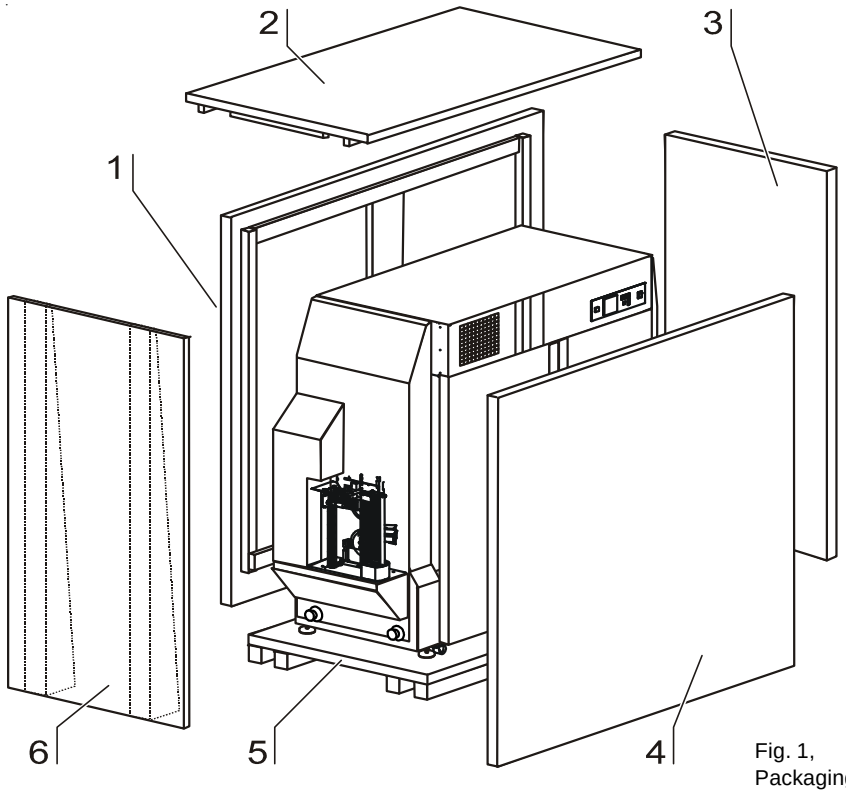


Fig. 1,
Packaging box

2. Delivery of the device

2.1.2 Moving the device off the shipping pallet

The device is equipped with 4 hydraulically adjustable stands and 4 transport rollers. During shipping, the device rests on 4 wooden beams.
To move the device off the shipping pallet, the 4 stands must be extended before the beams can be removed. Then, the hydraulic pressure is relieved so that the spring force retracts the stands, and the device rests on the transport rollers.

NOTE - Transport rollers

The transport rollers must be used only inside on level floor surfaces.

Fig. 2: The adjustable stands are moved using a manual hydraulic pump [3] at the right face of the device. To save space, the pump lever is detached for shipping.

1. Remove the pump lever [4] from the bracket at the left side panel of the device and and screw it onto the the hydraulic pump. Function of the hydraulic pump:
   - To hoist the device from the rollers [2] to the stands [1], pump within range **A**
   - To lower the device from the stands [1] to the rollers [2], move lever to position **B** (upper stop)
2. **Fig. 3:** Align the wedge-shaped end panel [1] flush with the pallet [2].
3. Move the device off the pallet.

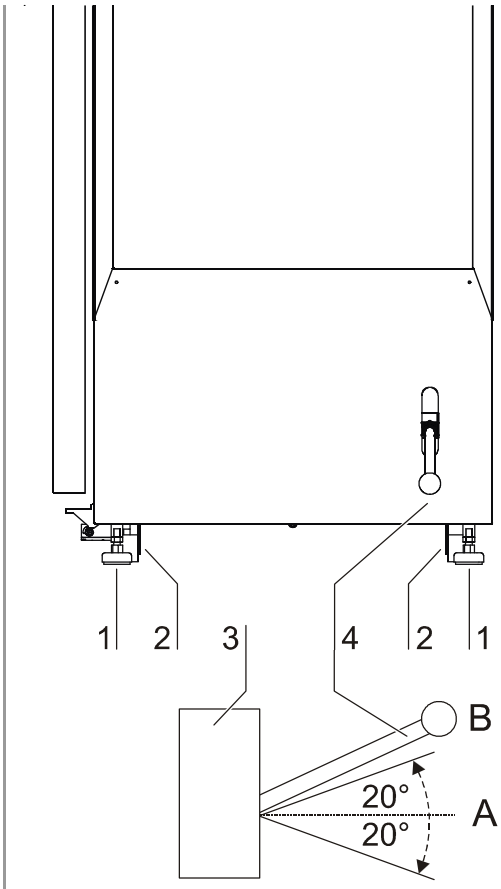


Fig. 2,
Function of the hydraulic pump

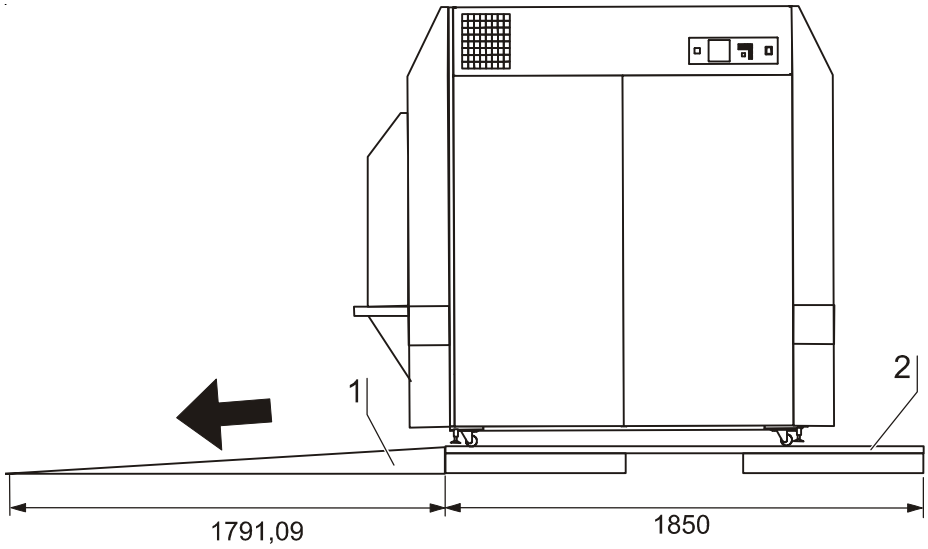


Fig. 3,
Shipping pallet with ramp

2. Delivery of the device

2.2 Checking the delivery

After unpacking the device, check the device components for possible transport damages and for completeness.
If damages are detected or if components are missing, please contact Kendro Laboratory Products GmbH.

2.3 Standard equipment

Description of the device components	**Quantity**
Cytomat® 44	1
Plate Shuttle™ System (PSS), internal subsystems with handler	2
Connecting cable for RS 232 interface	1
N2-connection hose set	1
Connector for alarm contact	1
Special grease Lubricant	1
CD for test operation	1
Optional equipment	
Plate Shuttle™ System (PSS), transfer system II	1
Stackers internal	44
Stackers external	1
Docking station	1
Barcode laser scanner	1
Instructions	
Operating instructions	1
Software documentation Plate Shuttle™ System (PSS)	1

3. Installation of the device

3.1 Ambient conditions

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

- Draft-free and dry location,
- The minimum distance to adjacent surfaces must be observed on all sides (see Section 3.3.).
- Air inlet and outlet openings of the refrigeration system must not be obstructed.
- The operating room must be equipped with an appropriate room ventilation (see Section 3.2.).
- Solid, level, fire-proof surface capable of withstanding the device weight (approx 880 kg) and additional loads.
- To ensure constant temperature, the ambient temperature must be within a range of +16° C to +28° C.
- Relative humidity of the device environment between 30 % and 70 %.
- No direct exposure to sunlight.
- Devices that produce excessive heat are not allowed near the location of the storage cabinet Cytomat® 44.

3.2 Room ventilation

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

- Therefore, operate the storage cabinet only in rooms with adequate ventilation.
- Do not install the device in room recesses without ventilation.
- The room ventilation should be a technical ventilation that is in accordance with the requirements of ZH 1 / 119 (Guidelines for laboratories) or some other suited ventilation system of appropriate capacity.

The gas consumption of a device with N_2 supply for optional O_2 regulation largely depends on the opening frequency of the automatic lift doors and on the opening frequency of the service doors (outer doors).
For devices without N_2 supply, the consumption of the N_2 required for defrosting averages 1.5 m^3 per week.

3.3 Stationary and mobile installation

The device has been designed for the integrated application in computer-aided systems, particularly for HTS (High Throughput Screening) procedures. It is equipped with rollers and can be used as a mobile storage system with or without a docking station at various locations. In combination with the optional docking station, the storage cabinet is equipped with a coupling system that allows the device to be quickly and safely connected to or disconnected from the docking station of a HTS-unit. For intermediate storage, the device can be moved completely with its load to a suitable storage location.

NOTE - Intermediate storage

To take the load off the transport rollers, the device should rest on the hydraulic stands even for intermediate storage.

3. Installation of the device

3.4 Space requirements

When installing the device, make sure that the installation and supply connections at the rear of the device are freely accessible.
Fig. 4: The distances for the front service doors and for the hydraulic pump on the right side are recommended minimum distances.
The distance to adjacent surfaces above the device must be at least 200 mm.

NOTE - Accessibility of the device

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

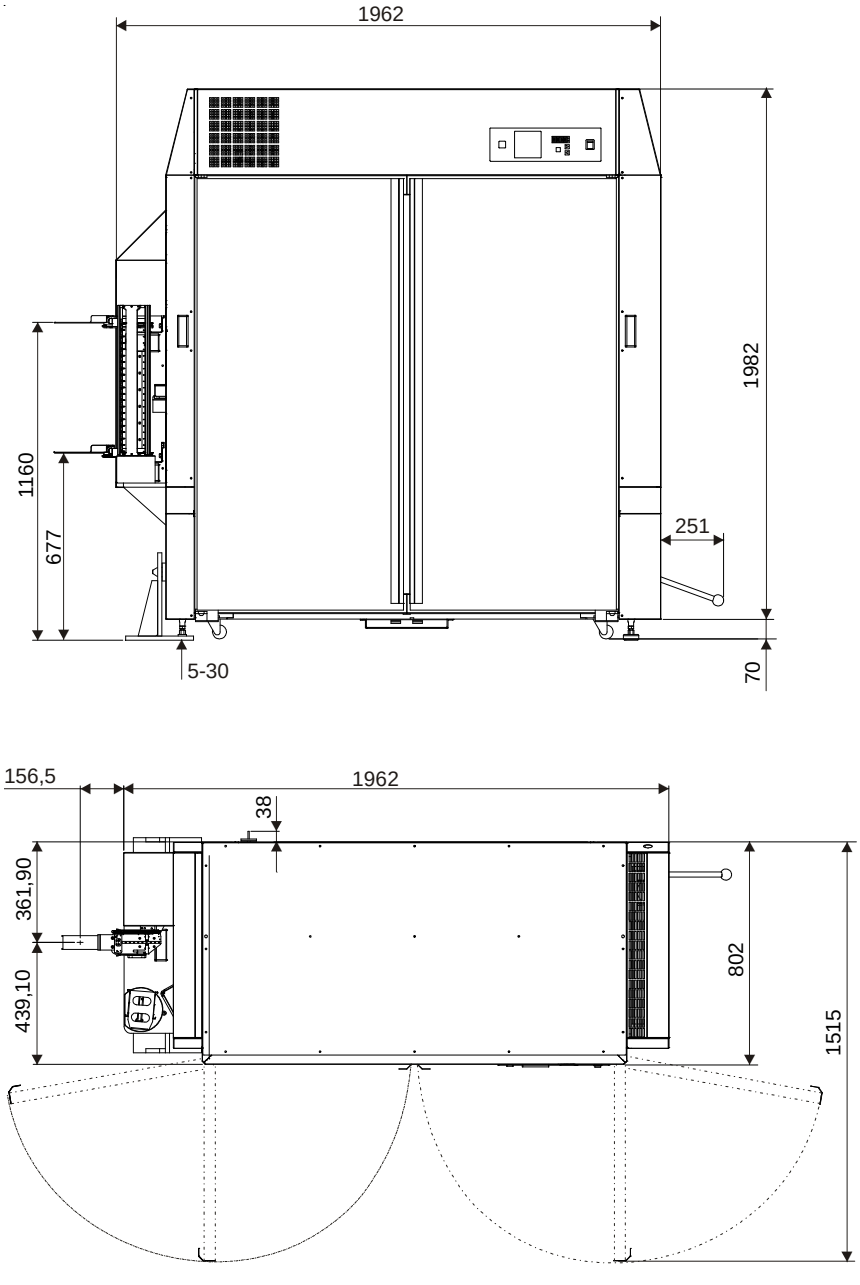


Fig. 4,
Dimensions and minimum distances

4. Description of the device

4.1 View of the service side

[1] Refrigeration system components
[2] Switchbox components
[3] Operating panel
[4] Drive side cover
[5] Drive for upper subsystem
[6] Drive for lower subsystem
[7] Hydraulic pump for stands
[8] Stands (4 pieces)
[9] Transport rollers (4 pieces)
[10] Handler subsystem B (lower)
[11] Electric door latch
[12] Stackers for lower subsystem B (22 units)
[13] Handler subsystem A (upper)
[14] Stackers for upper subsystem A (22 units)
[15] Docking station
[16] Internal lower transfer station (concealed by stacker retainers)
[17] Stacker for external intermediate storage
[18] Internal upper transfer station

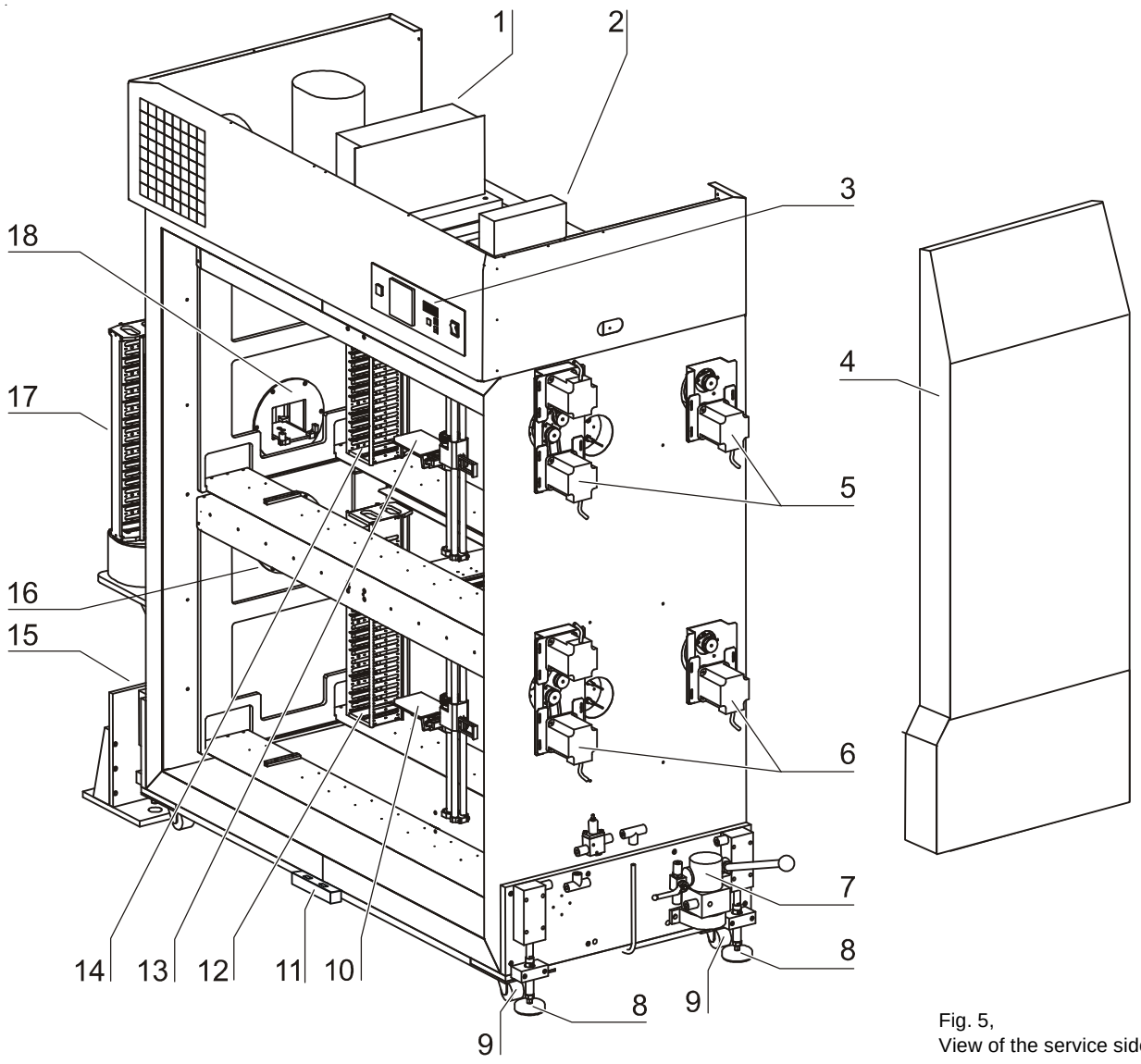


Fig. 5,
View of the service side

4. Description of the device

4.2 View of the internal subsystems

Upper subsystem **A**
- [1] Front stacker retainer for stackers No. 1 through 11
- [2] Rear stacker retainer for stackers No. 12 through 22
- [3] Handler with shovel

Lower subsystem **B**
- [4] Front stacker retainer for stackers No. 23 through 33
- [5] Rear stacker retainer for stackers No. 34 through 44
- [6] Handler with shovel

Direction of movement for both subsystems
- x axis, y axis, and z axis

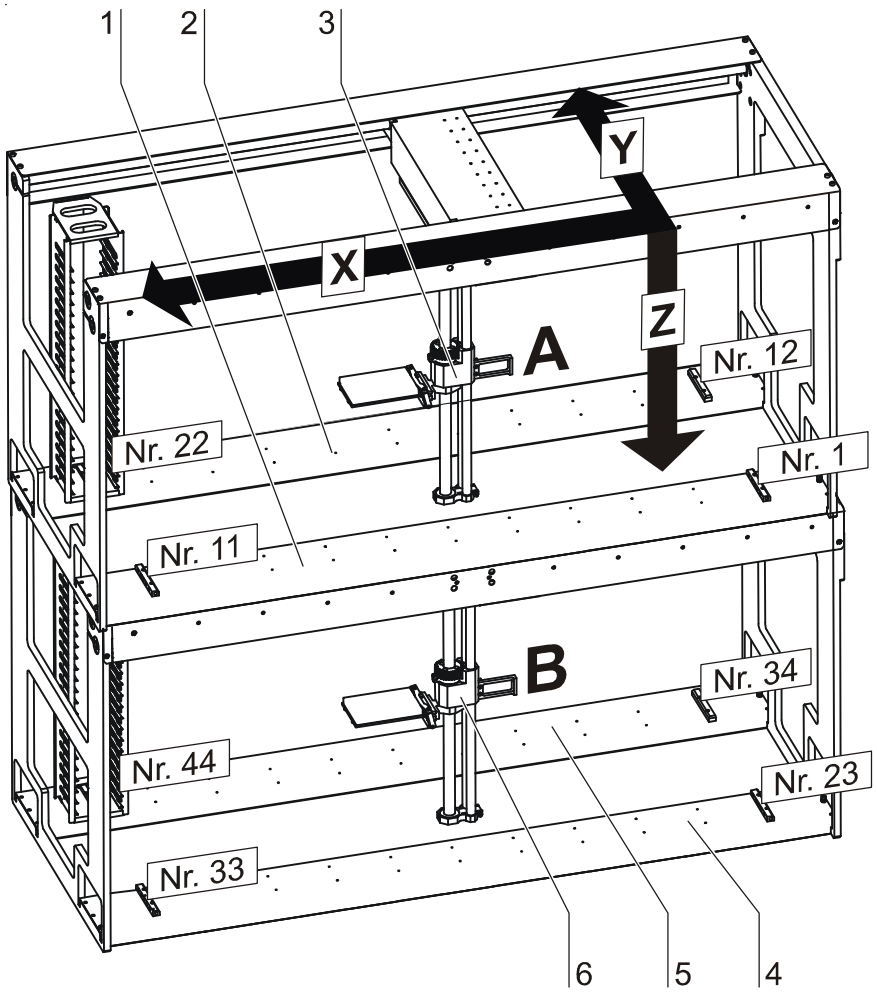


Fig. 6,
View of the subsystem

4. Description of the device

4.3 View of the integrator side

[1] External Plate Shuttle™ System (PSS)
[2] Docking station (optional equipment)
[3] Pins for docking station
[4] Stacker for intermediate storage
[5] Barcode reader on charging station (optional equipment)

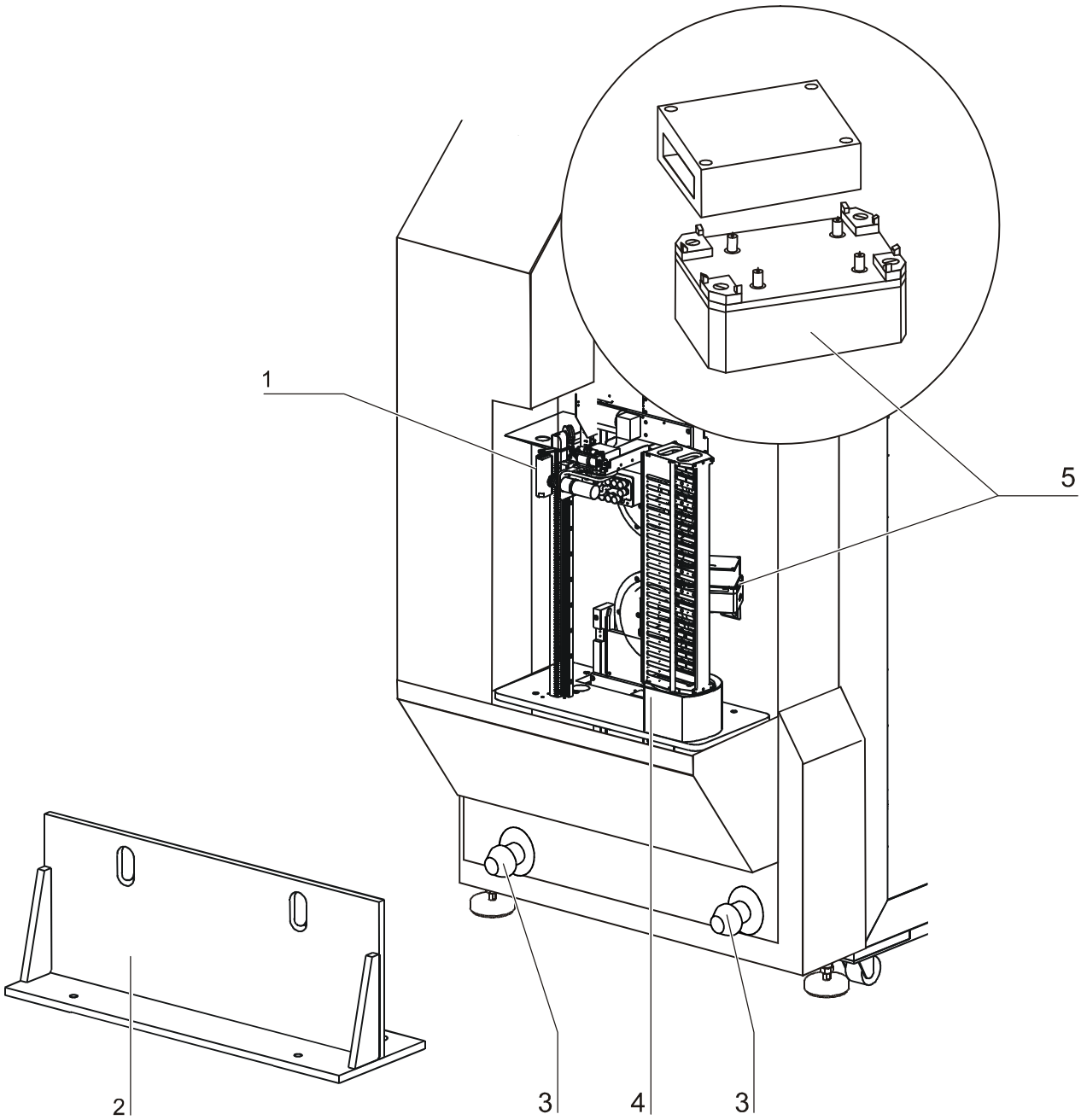


Fig. 7,
View of the integrator side

4. Description of the device

4.4 Operating panel

Fig. 8: The two functional units of the storage cabinet, the internal Plate Shuttle™ System (PSS) and the refrigeration system, are adjusted using two separate operating modules on the operating panel (see also Section 6, Handling and Control):

[1] Operating module for internal Plate Shuttle™ System (PSS) and

[2] Operating module for sample chamber refrigeration system

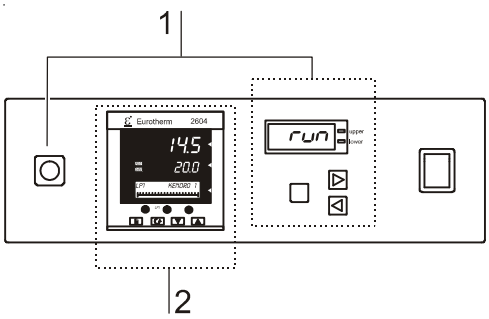


Fig. 8,
Operating modules

4.5 Door latch and door switches

Fig. 9: One door switch [2] per door wing is installed to the lower frame crossmember; the switches control the three functional units of the storage cabinet:

- electrical service door latch
- Plate Shuttle™ System (PSS)
- refrigeration system

These switches are actuated when both doors are closed and the service doors are locked electrically.
To open, the service door must be unlocked by entering a code on the operating module or by disconnecting the device from the power supply system and from the integral uninterruptible power system (UPS) using the key on the backpanel.

If unlocking of the service door is initiated on the operating module, the operation of the device is affected as follows:

- The traveling motions of the two subsystems of the Plate Shuttle™ System (PSS) are interrupted. The current motions are completed, then both subsystems are parked in a safe position. The handler shovels are extracted from the handlers, the handlers are rotated away from the stackers and aligned parallel to the sample chamber backpanel.
- The refrigeration system blower, the heating and the N_2 supply of the sample chamber are switched off.
- **Fig. 8:** The displays of operating module [1] and [2] indicate a visual alarm (door).

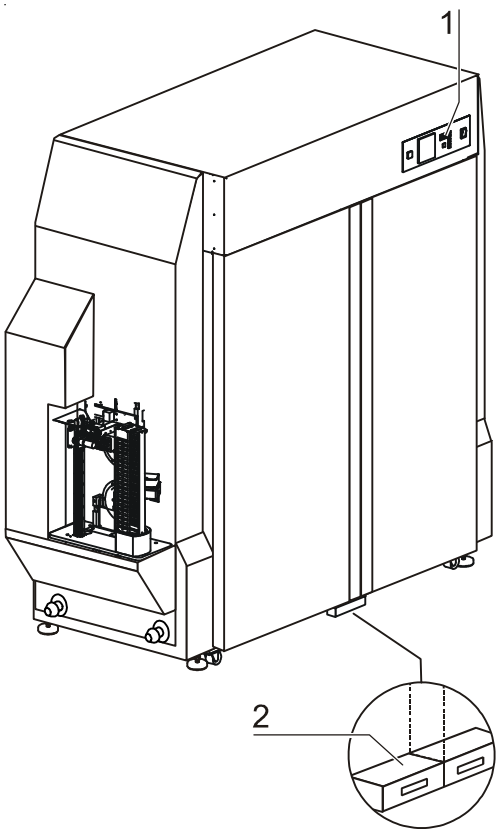


Fig. 9,
Door latch and door switches

4. Description of the device

4.6 Sample chamber layout

The sample chamber of the storage cabinet has only a minimum of surface, thereby supporting both the prevention of contamination and easy, effective decontamination.
All sample chamber wall panels are made of stainless steel and have a smooth easy-to-clean surface.

Recirculation system:
The refrigeration system is operated in a recirculation mode. The conditioned air enters the sample chamber through the ceiling and is withdrawn through the exhaust duct. The air ducts must be free from obstructions at all times.

Pressure compensation opening:
Fig. 10: A pressure compensation opening [allows compensation between the pressure in the chamber and in the operating room.

4.7 Sensor system

Fig. 10: The sensor modules are installed to the backpanel and to the sample chamber ceiling:

- The humidity sensor [2] for measuring the relative humidity in the sample chamber is located centrally in the upper area of the sample chamber backpanel.
- The sensors for air temperature (control system) [1] and for storage temperature (sample chamber temperature conditioning) [1] are installed in the left device ceiling.

The sensor for measuring the sample chamber temperature is a component of the control system for the device. The value measured by the temperature sensor is is compared to the set nominal value. Based on this data, the control system controls the refrigeration system.
If the nominal temperature is exceeded or falls below more than 2.0° C for a duration of 20 minutes (controled air temparature), the thermal protection system of the device automatically issues a temperature warning.
Also, if the storage temperature falls below or exceeds the nominal temperature by more than approx 2.5° C for the duration of more than 20 hours (heat-up / cool-down stage or change of nominal value), a temperature alarm is issued.

The integral humidity sensor measures the relative humidity in the sample chamber. The humidity sensor is part of the device control system only for the device version with controlled humidity.

If the actual value of the relative humidity exceeds or falls below the nominal value by more than 5 % for more than one hour, the device automatically issues a humidity alarm.

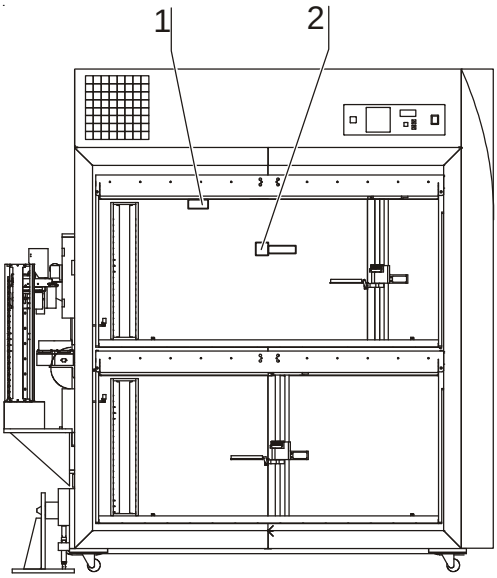


Fig. 10,
Sensor system

4. Description of the device

4.8 Sample chamber atmosphere

In the sample chamber of the storage cabinet, the particular physiological ambient conditions for storing samples are simulated:

- Compounds,
- aqueous samples,
- cell and tissue cultures.

The sample chamber atmosphere is determined by three factors:

- Temperature,
- relative humidity,
- residual dissolved oxygen content (optional function).

Temperature:
To ensure undisturbed operation, the temperature in the operating room should be between 16° C and 28° C.
The operating temperatures in the sample chamber of the device can be selected within a temperature range between +20° C and -20° C (for version with controlled humidity: from +4 °C to +25 °C only). Depending on the individual application, has the following temperature distribution the stacking units (stackers):

- at +25° C ± 2 K spatial / ± 0.5 K temporal
- at +4° C ± 2 K spatial / ± 1 K temporal
- at -20° C ± 2.5 K spatial / ± 1 K temporal

Relative humidity:
To create the humidity, no water bath is required. For the humidity control at temperatures of more than + 4 °C and at humidities of more than 20 %, a water bath is required only for the version with controlled humidity.
Under normal operating conditions, a constant relative humidity that depends on the refrigeration system of the device is established in the sample chamber.
Cytomat® 44 dry refrigeration:

- In the upper temperature range (+4° C to +25° C), a dry atmosphere with a relative humidity of < 10 % is created.

Cytomat® 44 humidity refrigeration:

- Temperature +4° C, humid sample chamber atmosphere > 75 %,
- Temperature +20° C, humid sample chamber atmosphere > 85 %.

Cytomat 44 with controlled humidity:

- Within the temperature range between +4 °C and +25 °C, an atmosphere with a relative humidity of 20 % to 50 % can be created.

Gas supply:
If the device is operated with dry refrigeration or controlled humidity, the introduction of nitrogen into the sample chamber has two functions:

- During defrosting, the introduction of nitrogen prevents moist air from entering the sample chamber which might result in undesired condensate formation.

For units with optional oxygen-control:

- To ensure improved stability conditions for the cell and tissue cultures, the atmospheric oxygen content (of the sample chamber atmosphere) can be lowered to below 21 % to reduce oxidation reactions.
  N_2 is supplied to the sample chamber at a constant value.

4. Description of the device

4.9 Refrigeration systems

4.9.1 Dry refrigeration system

The refrigeration system consists of two refrigeration cycles. The primary refrigeration system supplies the required refrigeration capacity for the conditioning of the sample chamber and for the initial dehumidification of the sample chamber atmosphere.
This refrigeration system is operated in combination with electrical heating.
The secondary refrigeration system is used for the residual dehumidification. The refrigeration coil in the airflow works with very low temperatures and freezes the residual water vapor in the sample chamber. Both refrigeration systems work with a constant capacity. An electrical heater adjusts the sample chamber atmosphere to the set nominal value. The recirculating blowers aspire the air from the ceiling to an aspiration duct and route it through the cold trap and a multiple-disk evaporator for dehumidification. Then, the dry and cold air flows over an electric heating so that it reaches the set nominal temperature.The conditioned air reenters the sample chamber through an air deflector in the ceiling. When the device is turned on using the power switch, the compressors and evaporators of both refrigeration cycles are energized immediately. The recirculation blowers and the electric heating are energized after a delay of 5 minutes; this is to ensure that the dehumidification of the sample chamber atmosphere starts simultaneously with the blower operation.

4.9.2 Cooling system controlled humidity

The cooling system consists of a controlled refrigeration system. The refrigeration system has two functions:

- It ensures the required refrigeration capacity for the conditioning of the sample chamber and is used for the initial dehumidification of the atmosphere.
- It introduces heat energy for humidity control via a refrigerant bypass circuit.

The recirculating blowers aspire the air from the ceiling to an aspiration duct and route it through a multiple-disk evaporator for humidification or dehumidification. Then, the air flows over an electric heating so that it reaches the set nominal temperature.
When the device is switched on using the power switch, the compressor and the condensor start operating immediately. The recirculating blowers start operating with a delay of 5 minutes.

4.9.3 Humid refrigeration system

The refrigeration system consists of a controlled refrigeration cycle. The control of the required refrigeration performance is achieved through a refrigerant bypass circuit. As with dry cooling, the recirculating blowers aspire the air from the sample chamber ceiling through an aspiration duct. The air is then routed through a multiple-disk evaporator so that it reaches the set nominal temperature. This conditioned air reenters the sample chamber through an air deflector at the ceiling. When the device is turned on using the power switch, the compressor and evaporator are energized immediately. The recirculation blowers are energized after a delay of 5 minutes.

4.9.4 Defrosting

When the humidity contained in the sample chamber air is frozen (dry refrigeration) or the automatic lift doors are opened to enrich the sample chamber atmosphere with humid air, ice formation occurs on the evaporator and at the cryotrap (dry refrigeration). To prevent the sample chamber atmosphere from being affected, the refrigeration systems are defrosted at regular intervals. For this purpose, the recirculation blowers and the heating (dry refrigeration) are switched off. For dry refrigeration only, the refrigeration system is flushed additionally with liquid N_2 for the duration of the defrosting process. The resulting condensate is accumulated in a tub and drained through a pipe bend into an evaporation tub where it is evaporated automatically.

4. Description of the device

4.10 Supply connections

Fig. 11: The supply connections are installed at the rear of the device: Electrical connections at the interface [1], gas connection through the filter with connecting sleeve [2].

RS 232 interface:
The RS 232 interface [3] connects the storage cabinet to the serial interface of a PC or to the interface of the integrator control. This connection is used for the control of the subsystems of the Plate Shuttle™ System (PSS). Via this interface, data can also be requested for documenting the major operating parameters (temperature, relative humidity, O_2 concentration, failure codes, etc.).
The software control of the Plate Shuttle™ System (PSS) is described in a separate instruction (ID No. 50053540).

Power supply connection:
The power supply connection [6] of the device is achieved using a cable with permanent connection and a grounding plug to a properly fused socket.

Power switch refrigeration system:
For tests and services the refrigeration system of the device can be separately disconnected from power supply. Activate / deactivate the refrigeration system using switch [7].

NOTE - Function temperature control

If the power supply of the refrigeration system is switched off, the temperature control also ist set out of function.

Uninterruptible power system (UPS):
During a power failure, the UPS supplies the Plate Shuttle™ Systems (PSS) and the door latch with power. The power supply of the Plate Shuttle™ Systems (PSS) electronic unit can be unterrupted using the key [4]. For this purpose, keep the key depressed for approx 3 seconds until the sound goes off.

NOTE - Power supply refrigeration system

The refrigeration system is not connected to the UPS and is switched off completely if a power failure occurs.

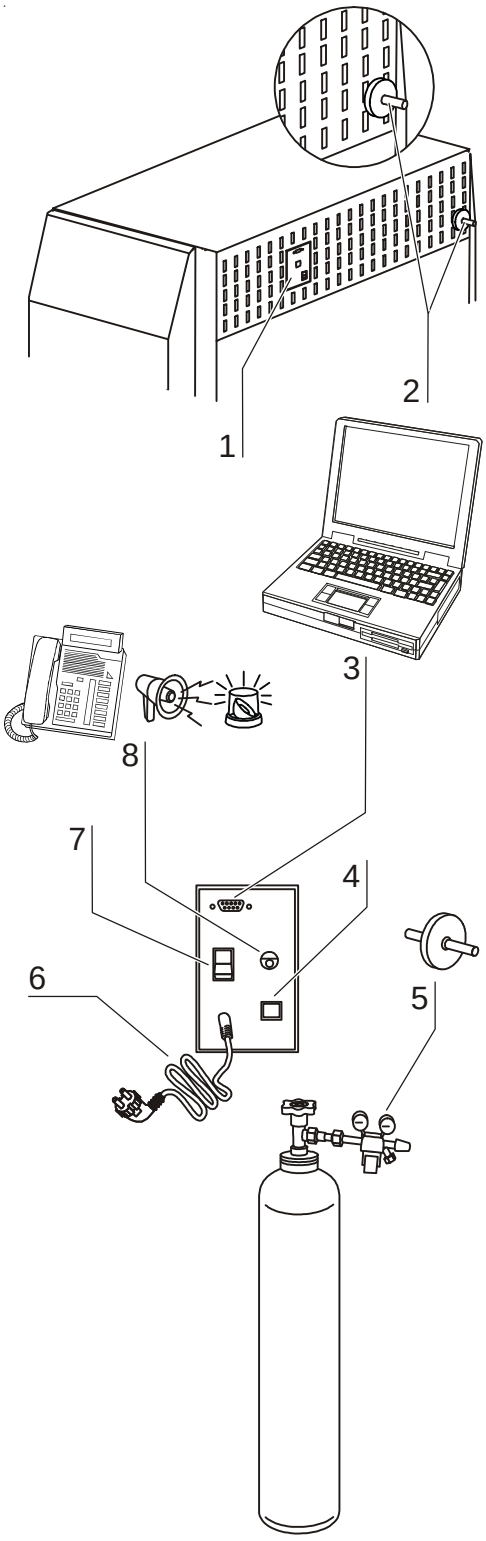


Fig. 11,
Supply connections

4. Description of the device

Gas connection:
The gas supply line between the device and the gas supply system is connected using the supplied connecting hose.

- **Fig. 11:** The common gas connection [2] for the refrigeration system of the dry refrigerator and the optional O_2 control at the gas supply system must be set to an operating pressure between 0.8 bar min. and 1.0 bar max.
- The N_2 flow rate for the unfreezing process is 6 l / min.

Alarm contact:
Fig. 11: The device can be connected to an on-site, external alarm system (e.g. telephone system, building monitoring system, visual or audible alarm system). For this purpose, a potential-free alarm contact [8] is preinstalled in the device.

4. Description of the device

4.11 Internal subsystems

Fig. 12: The internal subsystems transport the culture containers within the sample chamber of the storage cabinet from the stackers [8] to the relevant transfer station [4]. The plate sensor [6] detects if a location is empty or occupied.
At both transfer stations, an automatic lift door seals provides a gas tight seal to the sample chamber.
The handlers [2] and [4] of the two subsystems have separate drives that are mounted externally in the switchbox [1] at the right side of the device.
Each subsystem can accommodate 11 stackers per stacker retainer [3] and [5].
Stacker assignment is as follows:

- Upper subsystem **A** (numeration from right to left):
  front row, Stackers No. 1 through No. 11
  back row, Stackers No. 1 through No. 11
- Lower subsystem **B** (numeration from right to left):
  front row, Stackers No. 1 through No. 11
  back row, Stackers No. 1 through No. 11

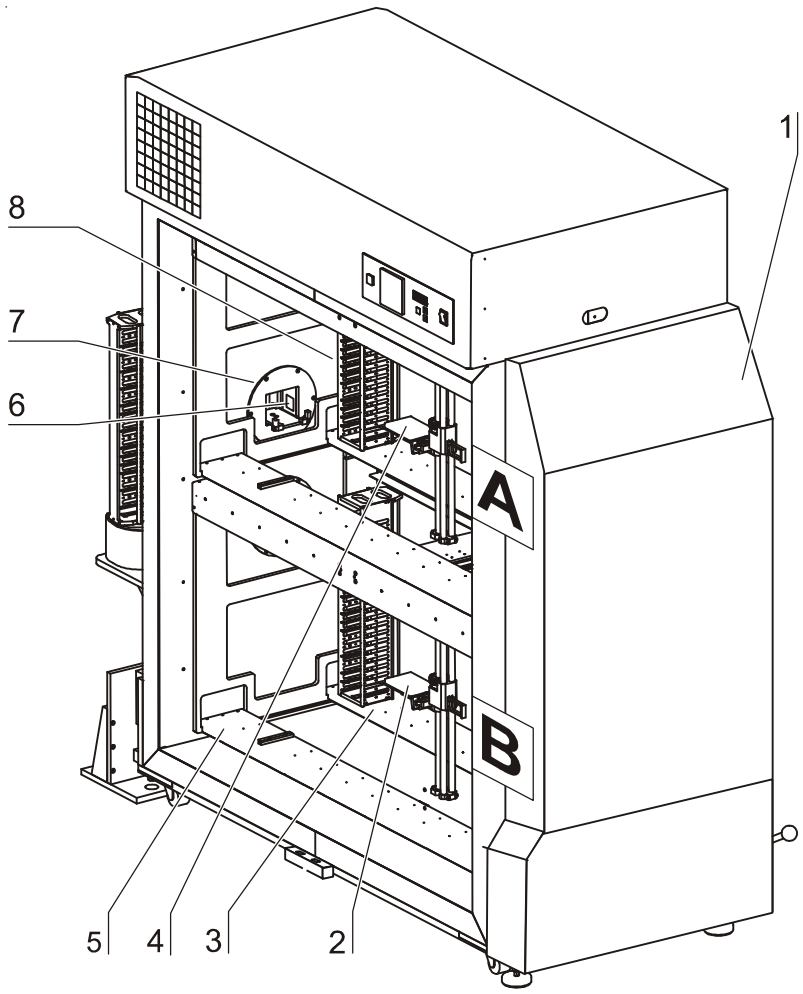


Fig. 12,
Internal Plate Shuttle™
System (PSS)

4. Description of the device

4.11 Stackers (storage system)

Fig. 13: The stackers [2] are used as the shelf system of the storage cabinet.
The storage capacity of the stackers is determined by the number of support rails for microplates [1].
The vertical distance between two support rails [3] of a stacker, is called the pitch and corresponds with the height of the microplate in millimeters.
Stackers are available with various pitches for microplates of different heights (see Section 12, Spare parts and accessories).

NOTE - Pitch

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

Stackers are positioned on and secured exactly to the locking rails [5] of each stacker retainers [4] .

NOTE - Numeric designation

The loading or unloading position of the handler is adjusted exactly to the corresponding stacker. The invividual stacker slots on the stacker retainers are marked with numbers.

CAUTION - Handler collision!

The traveling motions of the handler are programmed to the individual pitch in the stacker. If stackers with a higher or lower pitch than originally provided are to be used, the traveling motion of the handler must be reprogrammed!
The barcode reader is supplied with voltage by a battery which is charged through the contacts of the charging station.

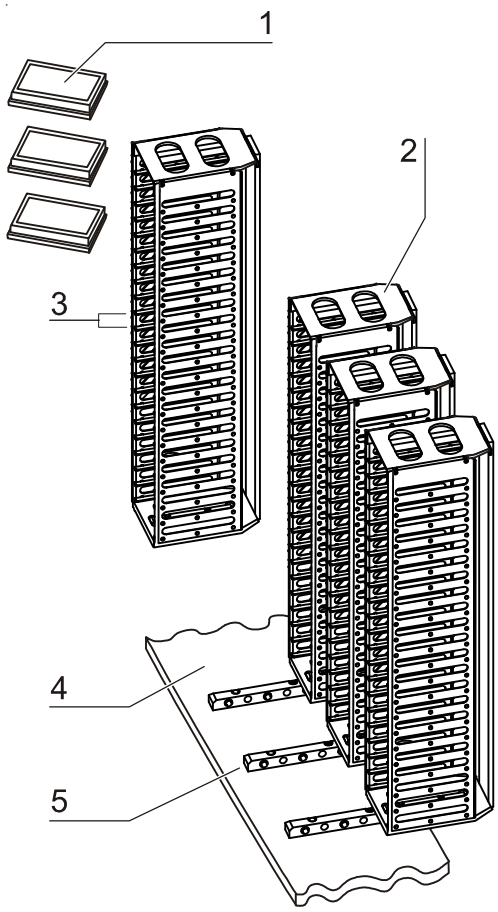


Fig. 13,
Stackers

4. Description of the device

4.12 External subsystem

Fig. 14: The external subsystem is the defined location for the transfer to the on-site transport system.
Two different procedures can be used for organizing the transfer of the culture containers:

- Intermediate storage in the stacker:
  Incoming and outgoing culture containers are stored intermediately in the stacker [3] of the transfer station.
  The handler [2] of the external Plate Shuttle™ System (PSS) transfers the culture containers from the stacker (intermediate storage) [3] to the on-site transport system or receives from it the samples to be stored intermediately.
- Direct transfer at a transfer station:
  The on-site transport system or the external Plate Shuttle™ System (PSS) deposits incoming and outgoing culture containers on a transfer station from where they are immediately forwarded.

To request the microplate status (empty or occupied), the plate empty sensor of the external Plate Shuttle™ System and the plate empty sensors of the two internal transfer stations communicate with each other.

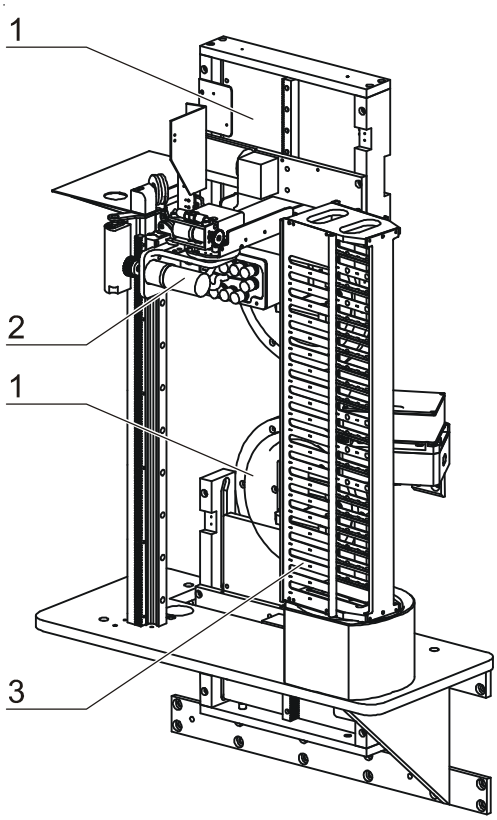


Fig. 14,
External subsystem

4. Description of the device

4.13 Barcode reader

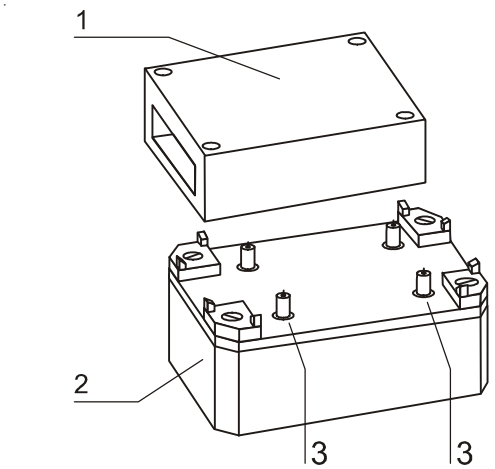
Fig. 14: The barcode reader [1] can be used as a stationary or mobile scanning unit:

- The stationary barcode reader is located on a charging station [2] at the external transfer station. Upon receipt of the culture containers from the integrator system, the handler approaches the barcode reader to read the sample label.
- The handler loads the mobile barcode reader like a microplate onto the shovel and transports it to the internal transfer station where the barcode reader is picked up by the internal Plate Shuttle™ System and moves along all stackers to read the barcode. The lower subsystem is read first, followed by the upper subsystem.

The service program is used to display or read out the stacker inventory.

NOTE - Battery-operated barcode reader

The the barcode reader unit is operated by a battery that is charged through the 4 contacts [3] of the charging station.



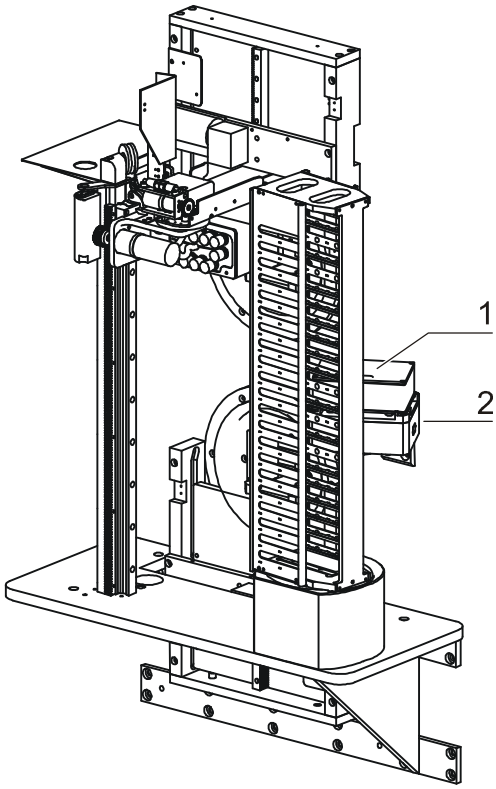


Fig. 15,
Barcode reader charging station

5. Start-up

5.1 Preparing the device

5.1.1 Shipping protection

All moving components of the internal and external Plate Shuttle™ System (PSS) are secured with pads and cable ties. Prior to the start-up, these components must be unpacked and the shipping protection devices must be removed.

NOTE - Shipping protection

Prior to connecting the device to the power supply system or switching on the device-integral uninterruptible power system (UPS) make sure that all shipping protection devices have been removed.

5.1.2 Temporary power supply

During a power failure, the device-integral UPS supplies the Plate Shuttle™ Systems (PSS) and the door latch of the device with voltage.
The electric door latch is disabled only when the device is disconnected from the power supply system and when the UPS is switched off.

5.1.3 Basic cleaning and decontamination

Upon delivery, the storage cabinet is clean but not sterile. Prior to the initial start-up, the sample chamber of the device should be decontaminated for future applications.

NOTE - Decontamination

For details about cleaning and disinfecing the device, refer to Section 9.

5. Start-up

5.2 Installing the (optional) docking station

The docking station secures the device to the integrator system or to some other transport system at a defined point of connection.

1. **Fig. 16:** Move the storage cabinet to the required position at the integrator / transport system and align it exactly with the transfer device.
2. Place the docking station [3] onto the floor and slide it onto the two tapered guide pins [1] at the face of the device until both guide pins are seated completely in the two slots [2] of the docking station. Make sure that the two front hydraulic stands [5] are exactly flush with the two tapered receptacles [4] in the baseplate of the docking station.
3. Lower the hydraulic stands [5] carafully until their tapered ends are engaged perfectly in the two receptacles [4] of the baseplate. For this purpose, raise the storage cabinet using the hydraulic pump.

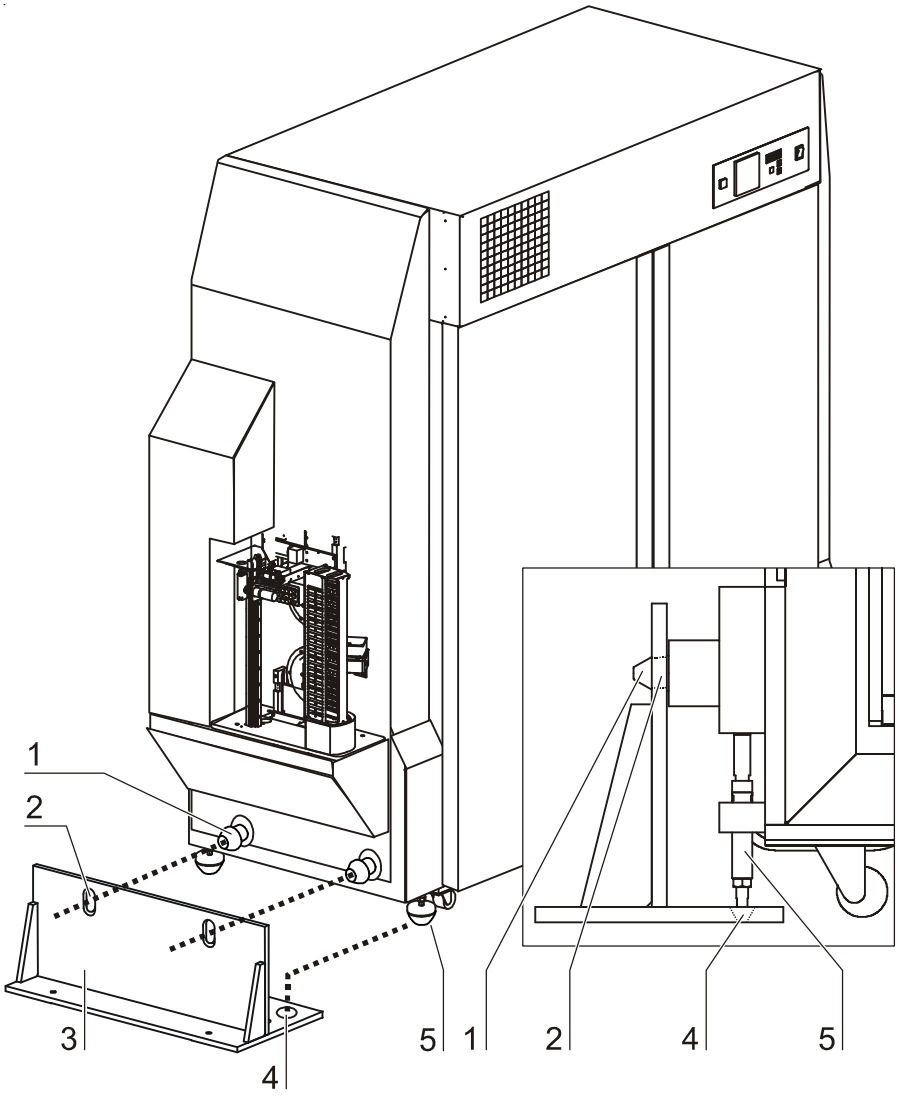


Fig. 16,
Docking station alignment

5. Start-up

4. **Fig. 17:** The docking station [1] is secured to the floor with 4 floor anchors. This requires a concrete foundation or screed of sufficient strength (see weights in Section 10, Technical Data).
   Mark the positions of the floor anchors through the 4 holes [3] in the baseplate. Lower the storage cabinet back onto the transport rollers and raise the pump lever up all the way to the stop.
5. Drill the holes (Ø 12 mm) for the 4 supplied floor anchors.
6. Attach the docking station to the floor (do not tighten bolts).
7. Move the storage cabinet back into the docking station, lower it onto the hydraulic stands and align the stands centrically to the receptacles in the baseplate.
8. Check the alignment of the storage cabinet to the integrator / transport system and correct alignment as necessary. Secure the docking station by tightening the supplied bolts [2] in the floor anchors to a max. torque of 55 Nm.
9. Place a bubble level onto the 4 stacker retainers of the two subsystems and level the device exactly horizontally in all directions.
10. Rotate the left and right device stands [5] and [6] as required using a 19 mm wrench at the hexagon [9]. Secure the stands by tightening the 19 mm locknut [8] while fixing the base [7] with a 19 mm wrench.
    Align the device stands from left to right and from front to rear.

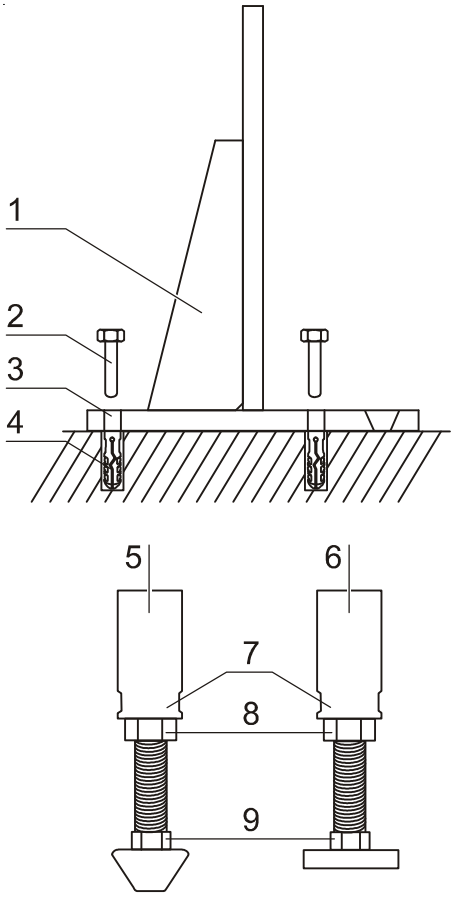


Fig. 17,
Docking station attachment

NOTE: Distance of the screw feet and transport rollers.

In order to avoid any collision with the docking station when moving into or out of the docking station, the screw feet of the device must be retracted so much as to allow for a minimum distance of 20 mm to the ground.
When in docked position, transport rollers must have a maximum distance of 20 mm to the ground.
The maximum lifting width of the screw feet is 40 mm.
The screw feet [5] are only available in combination with the docking station.

5. Start-up

5.3 Installing the stackers

When installing the stackers of the upper and lower subsystems, make sure that the open sides are always facing the Plate Shuttle™ System (PSS).

1. **Fig. 18:** Grasp the stacker by the handle plate [1] and position it slightly tilted above the locking rail [3], exert slight pressure to the front until it is engaged.
2. To ensure an absolutely plane position, the locking plate [2] of the stacker and the surface of the stacker retainers [4] must be kept absolutely clean. Therefore, never place the stackers on the floor but only on the particle-free surfaces after they have been cleaned.
3. To ensure unrestricted access to the storage locations (locking rails), the upper and lower internal Plate Shuttle™ Systems (PSS) can be moved manually along the X axis in both directions (see Section 6, Handling and Control). This requires that the handler [6] is aligned parallel to the stacker retainers. If necessary, correct the alignment of the handler manually:
   - Depress the locking pin [5] with a suitable tool, e.g. an angled allen wrench (4 mm) and rotate the handler as required.

NOTE - Handling stackers

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

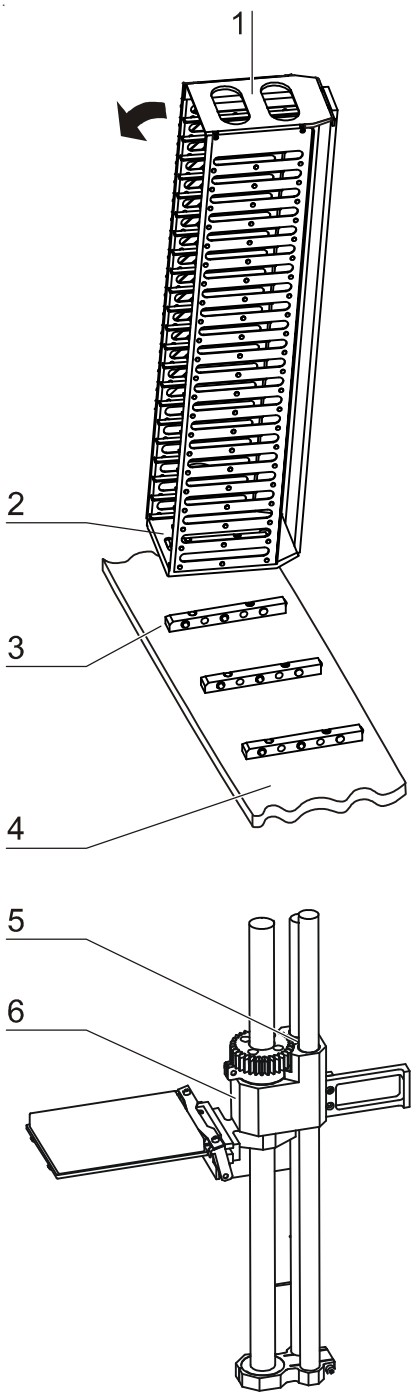


Fig. 18,
Stacker installation

5 Start-up

5.4 Setting up the external transfer station

Fig. 19: The external transfer station comprises the following functional units:

- External Plate Shuttle™ System (PSS),
- stackers for intermediate storage.

Optional equipment:

- Preinstalled charging station for the barcode reader.

For safety reasons, the cable between the counterweight and the handler is disengaged from the deflection roller to prevent the external Plate Shuttle™ Systems (PSS) from being damaged during transport. The cable connection must be engaged to reestablish the balance weight for the operation of the handler.

1. Remove the transport protection from the counterweight [3].
2. Slightly raise the handler [8].
3. Insert the cable [1] into the deflection roller [2].
4. Lower the handler carefully until the counterweight [3] tightens the cable.
5. Install the stacker [4] for intermediate storage to the locking rail on the base [5].
6. Place the reader [7] carefully onto the 4 contact pins of the charging station [6]. The read window must face the Plate Shuttle™ System (PSS).

NOTE - Charging the barcode reader battery

For the initial installation, the battery of the barcode reader must be charged. The charging process can only be started after the device has been connected to the power supply system.
For safety reasons and to prevent the barcode reader and the contact pins from being damaged, the barcode reader should only be installed after the storage cabinet has been coupled to the integrator and set up completely. The initial charging process takes approx 12 hours.

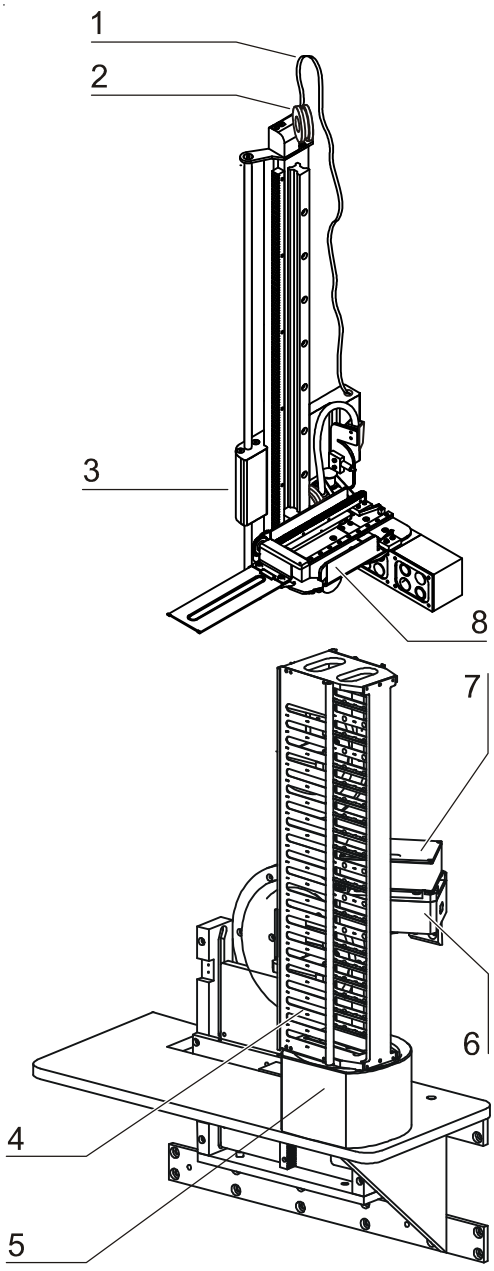


Fig. 19,
External transfer station setup

5. Start-up

5.5 Power supply connection

WARNING - Electric shock!

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

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

- Fusing: T 16 A
- Circuit breaker: B 16 A

Connection to the power supply system:

1. Before connecting the device to the power supply, check to see if the voltage of the power supply corresponds with the specifications on the nameplate at the rear of the device. If the ratings given for voltage (V) and current (A) are not correct, the device must not be connected to the power supply.
2. **Fig. 20:** Connect the grounding plug [3] of the power supply cable to a properly grounded and fused socket.
3. Make sure the cable is not subjected to tensile or compressive force.

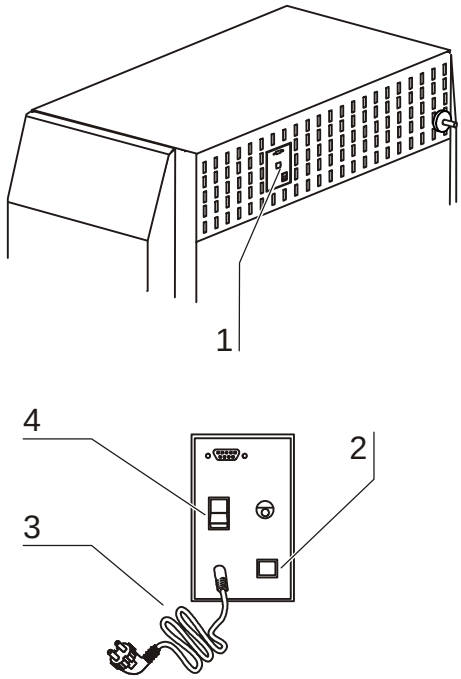


Fig. 20,
Power supply connection

NOTE - Function temperature control

If the power supply of the refrigeration system is switched off, the temperature control also ist set out of function. Activate the refrigeration system using switch [4].

5. Start-up

5.6 Connection to the gas (N_2) supply system

For the N_2 used, the following quality requirements apply:
- Purity 99.5 % min
- Medical gas quality

CAUTION - Overpressure!

The operating pressure of the N_2 supplied to the device must not exceed 1 bar.
If the gas is supplied at a higher pressure, the valve integral to the device may not close correctly and the gas supply control may be impaired.
- **The common gas connection for the refrigeration system of the dry refrigerator and the optional O_2 control at the gas supply system must be set to an operating pressure between 0.8 bar min. and 1.0 bar max.**
- **The N_2 flow rate for the unfreezing process is 6 l / min.**

1. **Fig. 21:** The gas supply is established through the sterile filter [1] at the rear of the device and the supplied flexible gas pressure hose.
2. Slide the hose clamp [5] onto the gas pressure hose [6]. Connect the gas pressure hose [6] to the angular adapter [4] and secure it using the clamp.
3. Remove the protective cap [7] from the sleeve [2] of the sterile filter and install the connector [3] to the sleeve using two hose clamps.
4. Install the angular adapter [5] into the connector [6]. Secure all hose connections using hose clamps.
5. Connect the gas pressure hose to the on-site gas supply system.

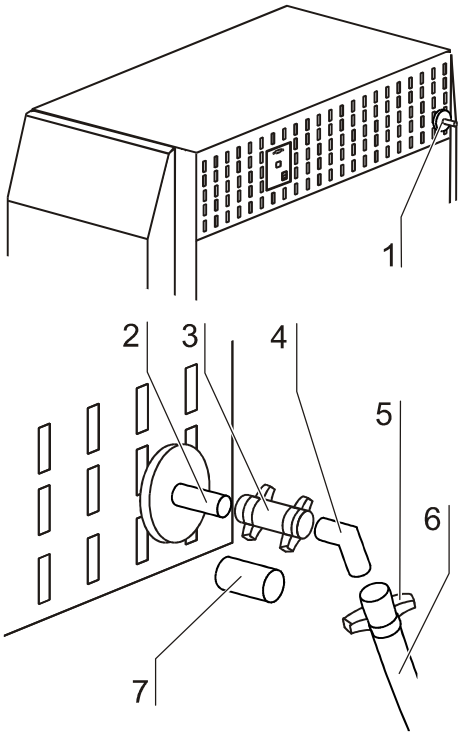


Fig. 21,
Gas supply connection

5. Start-up

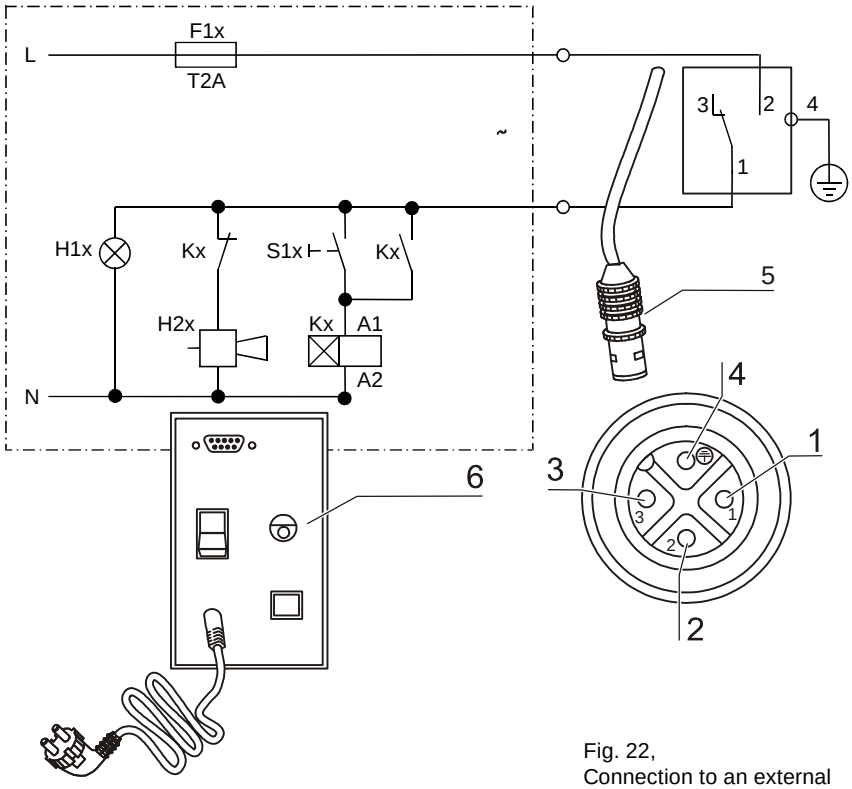
5.7 Connecting the alarm contact to the storage cabinet

NOTE - Expert work

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

Fig. 22: The connector [5] for the connecting cable is a standard component. The values for the operating voltage of the external circuits and the fusing of the alarm system are given in the table on the next page.

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



Cytomat® 44 alarm relay

Fig. 22,
Connection to an external alarm system

Operating state	Contact 1 - 3	Contact 1 - 2
No failure	X	O
Failure	O	X
X: Contact closed / O: Contact open		

5. Start-up

Circuits and fusing

Circuit	Voltage	External fusing
Circuits with system voltage	250 V ~ max.	6.0 A max.
SELV – circuits (cf. VDE 0100, Section 410)	25 V ~	2.0 A max.
	60 V =	1.0 A max.
SELV-E – circuits (cf. VDE 0100, Section 410)	50 V ~	1.0 A max.
	120 V =	0.5 A max.

NOTE - Switching structure

For all failures reported by the device (sensor circuit open, deviation from the nominal value, fault of the defrosting function, thermal protection), the alarm relay switches over.

5.8 RS 232 interface

The RS 232 interface of the Plate Shuttle™ System (PSS) connects the storage cabinet to the internal control system of the integrator which may be a PC workstation for an individual installation or a server for an integrated network. This interface is used to operate the software systems of the device.

5.8.1 Plate Shuttle™ System (PSS) software

The entire motion sequence of the Plate Shuttle™ System (PSS) for the automated loading and unloading of the stackers and for depositing or removing microplates, e.g. at the transfer station, is controlled by the Plate Shuttle™ System (PSS) software.
After a power reset, the Plate Shuttle™ System (PSS) performs an automatic initialization process in all three subsystems (external system and two internal subsystems). If one of the two automatic lift doors was opened during the initialization process, it is closed after the completion of the initialization process; this may take up to two minutes.
After the initialization has been completed, the Plate Shuttle™ System can be addressed.

5.8.2 Service software

The service software is used for setting and adapting the transport sequences:
- the handler access for the stackers of the two subsystems
- the adaptation of the external handler to the transfer station, to the external transport system or to the stacker for intermediate storage.

These adjustments are always neccessary after:
- the stacker configuration has been changed,
- the transfer station has been replaced,
- the connection of the Plate Shuttle™ System (PSS) to the external transport system has been changed.

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

5. Start-up

5.9 Handler test and test run

After start-up has been completed, a test run must be performed to see if the Plate Shuttle™ System (PSS) performs all traveling motion without the risk of collision.

NOTE - Handler alignment

Perform a visual inspection to check the handler alignment and the traveling motion in the direction of X.
The handlers of the both subsystems must be aligned exactly parallel to the guide rails of the relevant transfer station.
If required, the handlers can be rotated manually to the correct position.

Aligning the handler:

1. **Fig. 23:** Depress the locking pin [1] with a suitable tool, e.g. an angled allen wrench (4 mm) and and align the handler [2].
2. Release the pin.

Checking the microplate catch of the handler:
The microplate catch secures the microplates to the handler shovel during transport. The catch strap must be able to exert enough pressure onto the microplate to prevent it from being shifted by the acceleration of the taveling motion.

1. **Fig. 23:** Check to see if the strap [4] can move freely.
2. Check the clamping pressure that the strap exerts onto the microplate [3].

Then, install the stackers to the subsystems and test the traveling motion with the service door closed.

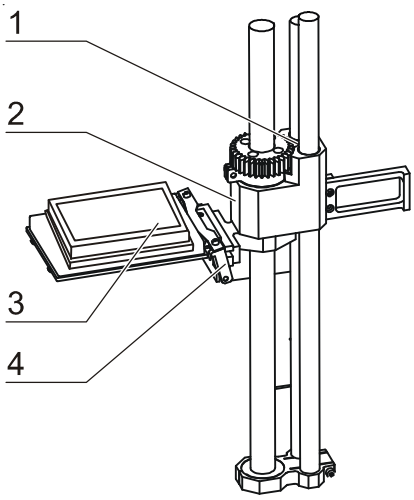


Fig. 23,
Microplate catch

6. Handling and control

6.1 Operating panel

Fig. 24: The operating panel is divided into two functional areas:

- Eurotherm control [2] for setting the working temperature in the interior chamber. Display of process values (e.g. temperature, relative humidity), error messages, and warnings.
- Control unit [3] of the Plate Shuttle™ System (PSS) with keys for requesting initialization, traveling functions and unlocking the service doors and with lock switch [1] for the protection of traveling functions.

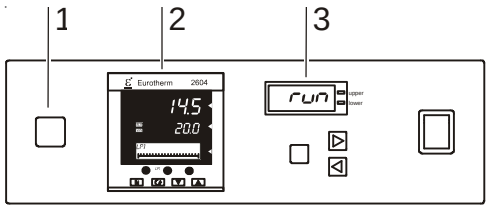


Fig. 24,
Operating panel

6.2 Power switch

6.2.1 Switching the device on:

1. **Fig. 25:** Switch the storage cabinet on using the power switch [1]. The switch is now in position **ON**.
2. Make sure that the power supply of the refrigeration system is activated.
3. When the display [3] goes off, enable the uninterrupted power supply (UPS) at the rear of the device using the switch [2].
4. The display of the Plate Shuttle™ Systems (PSS) shows the following message:
   - **run** if the Plate Shuttle™ System (PSS) recognizes its handler position,
   - **init** if the system does not recognize the position of one of its two handlers.
5. Upon switch-on, the Eurotherm control runs through a self-test during which all display segments illuminate.
   After a successful self-test, the message display (see Section 6.5.1) shows the device description for a duartion of approx 5 seconds:
   STORAGE CABINET
   CYTOMAT 44
   Then, the relative humidity value is given for the dry refrigeration device version.

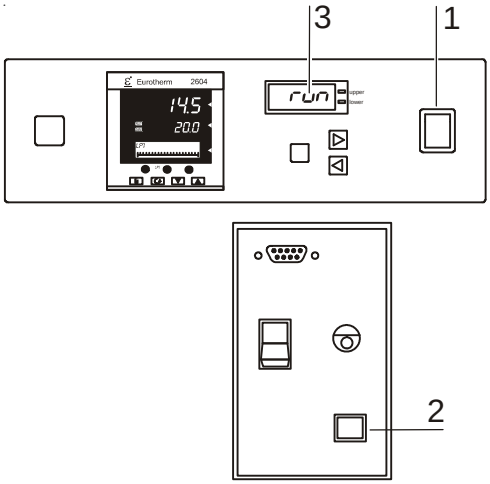


Fig. 25,
Power switch

NOTE - Warning

If the UPS responds upon a power failure, an audible alarm sounds and the right decimal point at the display of the Plate Shuttle™ System (PSS) illuminates.

6.2.2 Switching the device off:

1. Switch the storage cabinet off using the power switch. The switch is now in position **OFF**.
2. The power supply of the Plate Shuttle™ System (PSS) by the UPS must not be disabled separately.

6. Handling and control

6.3 Unlocking the service door

Fig. 26: The service door is locked electrically. The lock is connected to the UPS in combination with the Plate Shuttle™ System (PSS). Depending on the operating mode of the device, there are two ways to unlock the service door.

- De-energized device: The device is switched off using the power switch or disconnected from the power supply and the power supply for the Plate Shuttle™ System (PSS) by the UPS is disabled.
- Energized device: The Plate Shuttle™ System (PSS) is in the hold position and the display shows **hold**.

▶ Keep the upper lower key depressed for approx 5 seconds

When the display shows **open**, the service door is unlocked and can be opened.
The door remains unlocked for approx 30 seconds. If the service door is not opened during this period, the lock is reactivated, and the display shows **hold** again. The Plate Shuttle™ System (PSS) can execute further commands.

▶ Open the service door

If the service door is opened, the display shows **door**.

▶ Close the service door

If the service door is closed, the lock is reactivated automatically, and the display shows **hold**. The Plate Shuttle™ System (PSS) can execute further commands.

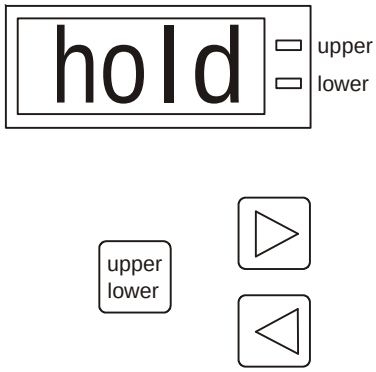


Fig. 26,
Unlocking the service door

NOTE - Read scan

After each opening of the door, a read scan should be performed for inventory and possible correction purposes (see software documentation).

NOTE - Frost formation in the sample chamber

If the service door is opened during operation at low temperatures (< +4° C), frost formation occurs in the sample chamber. The unit must not be opened for an interval exceeding 5 minutes, and must be operated for a period of at least 12 hours thereafter before the Plate Shuttle™ System (PSS) may be moved again.

6. Handling and control

6.4 Control Plate Shuttle™ System (PSS)

6.4.1 Display

Fig. 27: The display [1] shows the functional status of the Plate Shuttle™ System (PSS):

- **run** is displayed while the handlers are traveling; additionally, the two LEDs on the display illuminate. If only one handler is traveling, the corresponding upper or lower LED illuminates.
- **init** if an initialization is started after a restart or during an unsecure condition. To ensure faultless initialization, a visual inspection of the Plate Shuttle™ Systems (PSS) with open service door must be performed,
- **open** is displayed when the service door is unlocked,
- **door** is displayed when the service door is opened,
- **hold** is displayed when the handlers are in the hold position,
- **error** is displayed when a failure has occured. The failure code is read by the Plate Shuttle™ System (PSS) software via the RS 232 interface.

The two LEDs [2] and [3] indicate to which subsystem the functional status of the Plate Shuttle™ Systems (PSS) refers:

[2] upper subsystem **A**
[3] lower subsystem **B**

If both LEDs illuminate, the functional status refers to both subsystems.
The functional state (e.g. run) of the external subsystem is displayed without additonal LED indication.

6.4.2 Keypad

The keypad is used for the manual initialization of the Plate Shuttle™ System (PSS) and for the manual control of the traveling motion of the two internal subsystems when the service door is opened.

[4] Key for traveling motion right
[5] Key for traveling motion left
[6] Key for opening door
[7] Locking key for enabling the traveling motion

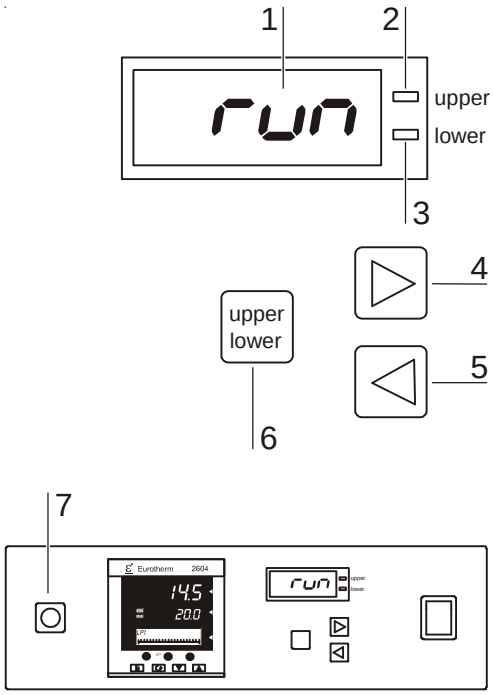


Fig. 27,
Control of the internal Plate Shuttle™ Systems (PSS)

6. Handling and control

6.4.3 Initialization

Fig. 28: The initialization of the control software for the Plate Shuttle™ System (PSS) starts automatically. While the initialization routine is running, display flashes **init.**
A reinitialization during running operation may be required if the system fails to recognize the position of the handler. In this case, the routine is started using a software command via the RS 232 interface (see Software Documentation).

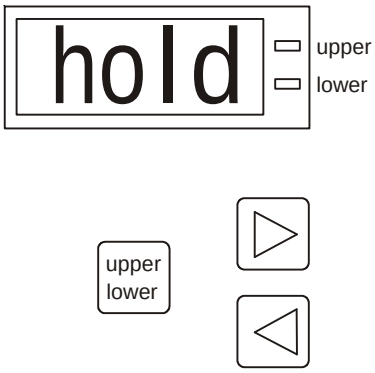


Fig. 28,
Initialization

The display flashes **init**. Wait until the device door is unlocked. For a visual inspection, the service door must be opened. During the visual inspection, note the alignment of the two shovels and the height of the two handlers.

When the display shows **open**,

- ▶ Open the service door

The shovels must be rotated toward the gate.

Check the height of the handler; the gearwheel must be positioned outside of the tooth rack.

2. Confirm the initialization:

- ▶ Press the ◁ + ▷ keys simultaneously

- ▶ Close the service door

While the initialization process is running, the display shows **run**.

After the initialization has been completed, the display shows **hold**.

6. Handling and control

6.4.4 Moving the handlers

Fig. 29: During a visual inspection with the service door opened, each subsystem handler can be moved along the direction of X. The traveling motion is controlled with the keys [3] and [4] and enabled with the locking key [5] on the operating panel. This key combination that requires both hands is to prevent accidental or uncontrolled handler motions.

1. Unlock the service door using the keypad.
2. Open the service door. The display shows **door**.
3. Each subsystem must be addressed separately. To select a subsystem:

   ▶ Press the [upper lower] key

   The LEDs [1] or [2] which indicate the selected subsystem illuminate alternately each time a key is pressed.
   - LED [1] indicates the upper subsystem
   - LED [2] indicates the lower subsystem

4. To move the handler to the left or to the right:

   ▶ Keep the lock switch [5] depressed and

   Press the [◁] key (to move the handler to the left)

   or

   Press the [▷] key (to move the handler to the right)

5. Close the service door. The lock is activated automatically. The handlers remain at the reached positions, the display shows **hold**.

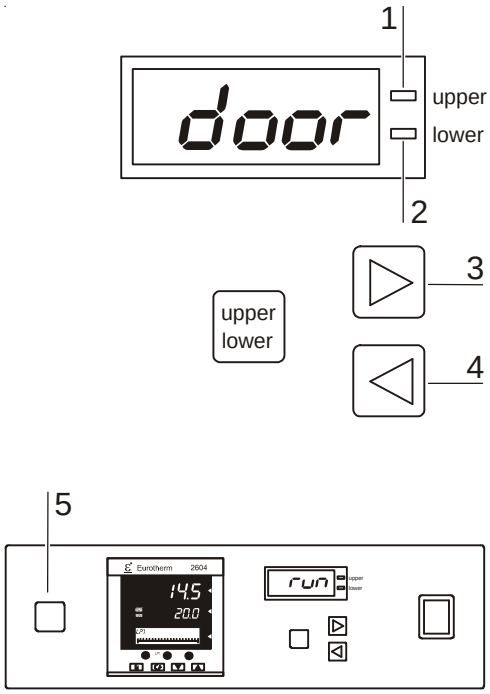


Fig. 29,
Moving the handlers

6. Handling and control

6.5 Temperature and humidity control

6.5.1 Display

Fig. 30: The display of the temperature control (Eurotherm control) is divided into five segments:

[1] ALM (Alarm indicator)
[2] SBY (Standby mode)
[10] Actual value display (indicates the currently measured process value)
[9] Nominal value display (indicates the set nominal value and is used for verification during value setting)
[3] Message display (for example humidity, set point, operating point, messages (alarms) about process sequence and informations for controller configuration.

6.5.2 Keypad

Fig. 30: The keypad for the operation of the control comprises:

[4] Function keys 1 - 3 (these functions are disabled)
[5] Selection key for the parameter menu
[6] Status key for function nominal value, indicated in display nominal value [9]
[5] Return key for selecting the nominal value in the nominal value indicator [8]
[7] Increment key for increasing the nominal value
[8] Decrement key for reducing the nominal value

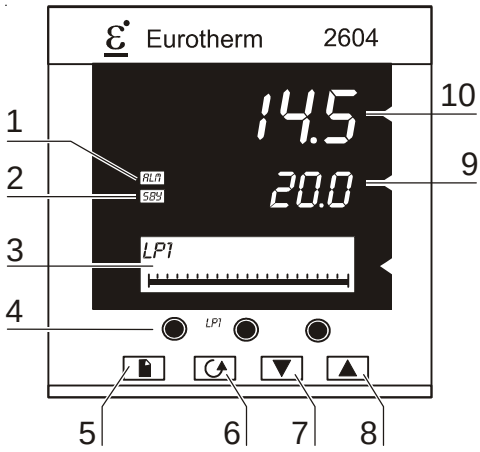


Fig. 30,
Temperature control

6.6 Function of the control

6.6.1 Setting the temperature nominal value

The temperature control is used for controlling the refrigeration system (dry refrigeration version) or the electric heating (humidity refrigeration version) The output is controlled automatically to adjust the process value to the nominal value. The menu parameter is the desired nominal value for the sample chamber temperature. The function of the controler is coupled to the power supply of the refrigeration system.

1. Select the temperature nominal value:

   ▶ Press the [↻] key

2. Enter the temperature nominal value:

   ▶ Press the [▲] key to increase the value

   ▶ Press the [▼] key to reduce the value

3. Store the value:

   ▶ Press the [↻] key

After a delay of approx 5 seconds, the control accepts the nominal value automatically. The display flashes momentarily whilst the nominal value changes.

6. Handling and control

6.6.2 Humidity controller

Only for device version with controlled humidity; for the versions with dry or moist cooling, the relative humidity is displayed only.
The humidity controller controls the refrigeration system via a range with upper limit during automatic operation. The output is controlled automatically to adapt the process value to the nominal value. The desired nominal value for the relative humidity is entered as menu parameter. The function of the controller depends on the power supply of the refrigeration system.

Fig. 30: The relative humidity is shown on the display [3]. The selection key [6] is used for switching over to humidity display. After one minute, the display automatically switches back to humidity if other parameters or messages were shown previously on the display.

1. Select the hunidity nominal value:

   ▶ Press the [↻] key

2. Enter the huimidity nominal value:

   ▶ Press the [▲] key 2 x to increase the value

   ▶ Press the [▼] key to reduce the value

3. Store the value:

   ▶ Press the [↻] key

After a delay of approx 5 seconds, the control accepts the nominal value automatically.

6.6.3 Defrosting

Fig. 31: Defrosting is performed in cyclic intervals of several hours during continuous operation. After the device has been switched on, the initial defrosting occurs already after approx 65 minutes. For the duration of a defrosting routine, the message section of the display [2] shows the message DEFROSTING ACTIVE. The defrosting routine is activated and controlled by the refrigeration system control. The defrosting routine cannot be cancelled or interrupted by an input via the control but only by:

- switching off the device or
- opening the service door. If the service door is opened while a defrosting routine is running, the defrosting process is restarted automatically as soon as the service door has been closed.

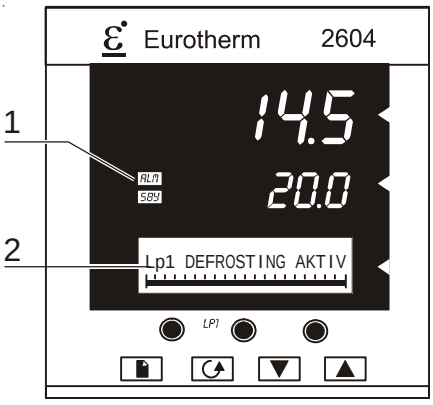


Abb. 31,
Indication defrosting

6. Handling and control

6.6.4 Alarm messages

Alarm display

Fig. 31: When an alarm occurs, the red indicator ALM [1] flashes. The message display [2] shows the failure source (e.g. temperature, humidity) and a description of the alarm.

Alarm contact

If an alarm is issued (ALM indicator), the control switches an alarm relay on the output and the alarm contact on the storage cabinet. The alarm contact remains switched until the ALM indicator goes off.

Alarm acknowledgement

The ALM indicator flashes until the alarm is acknowledged with the keypad.

- ▶ Press button and simultaneously

After the acknowledgement, the ALM indicator continues to flash until the failure cause has been repaired.
If another alarm is issued during this period, the indicator flashes again, and the message display [2] shows the new alarm message.

Temperature alarms

For the duration of heating or cooling down of the device to a new nominal value, the undertemperature or overtemperature alarm for the AIR TEMPERATURE is suppressed. Only after the process value (sample chamber temperature) has reached the nominal temperaure for the first time, the alarms are enabled and remain enabled until the device is switched off or RESET.
In this functional state, a deviation in temperature higher than 2,0° C is displayed as an alarm (see also table 6.6.4).
The alarms for the STORAGE TEMPERATURE remain enabled all the time.For the device version with controlled humidity, a temperature alarm causes an interruption of humidity control so that temperature control has priority over humidity control.

Humidity alarm

A change in the humidity nominal value results in the suppression of the alarm. If the process value (sample chamber humidity) reaches the nominal value for the first time, the alarm is issued. After this, a humidity deviation of more than 5.0 % is displayed as an alarm (see also Table 6.6.5).

Disabling the alarms for a change of the nominal value:

When the temperature nominal value is changed at the control, the AIR TEMPERATURE ALARMS must be disabled.

- ▶ Open the service door.

or

- ▶ Switch the device off and on again.

The AIR TEMPERATURE ALARMS are now disabled.
The alarm conditions are set again for the heating up or cooling down of the device.

NOTE - Disabling alarms during operation

An opening of the service door during the operation of the device also disables the AIR TEMPERATURE ALARMS.

6. Handling and control

6.6.5 Overview alarms and messages

Alarm	Process value	Description	Cause	Repair
HIGH TEMPERATURE	Air temp.	Actual value < Nominal value -2° C	• Faulty refrigeration system • No alarm system reset after change of nominal value	• Power on / off • Contact Service
LOW TEMPERATURE	Air temp.	Actual value > Nominal value +2° C	• Faulty refrigeration system (heating) • No alarm system reset after change of nominal value	• Power on / off • Contact Service
TEMP. TIMEOUT	Storage temp.	Actual value < Nominal value -2.5° C Actual value > Nominal value +2.5° C	• Refrigeration system frozen up or faulty	• Power on / off activated Start defrosting after 1 h • Check service door for leakage • Contact Service
S.br	Air temp.	Fault PT100	• Sensor broken	• Contact Service
S.br	Storage temp.	Fault PT100	• Sensor broken	• Contact Service
rH FAILURE	Humidity	Measuring range underflow	• Sensor failure	• Contact Service
rH FAILURE	Humidity	Measuring range overflow	• Sensor failure	• Contact Service
HIGH HUMIDITY (dry refrigerator only)	Humidity	rH > 60 %	• Automatic lift door doesn't close • Service door leakage	• Contact Service
HIGH/LOW Error (controlled humidity only)	Humidity	Actual value < nominal value - 5% Actual value > nominal value + 5 %	• Cooling system faulty or frozen • Water tub dry • Automatic lift door or service door leakage	• Switching the device on / off activates start defrosting after 1 hour • Refill water (humidity > 20%) • Check device for possible leakage • Contact service
AIR CONDIT. OFF	(Refrigeration system)	Overtemperature protection on	• Refrigeration system failure dry refrigeration	• Contact Service
DEFROST. TIMEOUT	(Refrigeration system)	Defrosting not completed after 13 min	• Refrigeration system control	• Power on / off • Contact Service

Indicator	Event	Duration
STORAGE CABINET CYTOMAT 44	• Device on • Control self-test successful • Control operative	5 s
DOOR	• Control operative	-
DEFROSTING	• Refrigeration system defrosts	11 min

7. Operation

7.1 Preparing the device

The device must only be released for operation after all major measures for the start-up, **particularly decontamination and test run**, have been taken (Section 5).

NOTE - Hygiene regulations

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

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

- The device must have been secured in the docking station or placed and levelled on the hydraulic stands.
- The components of the external Plate Shuttle System (PSS) and the on-site transport system must have been matched to one another, the traveling motions must be performed synchronously and without the risk of collisions.
- The stackers must be level on the locking rails.
- The gas hose and the connector must be connected tightly to the angular adapter and to the sterile filter and secured with the hose clamps.
- The pressure compensation opening must not be obstructed.

7.2 Starting operation

Starting and loading the device:

1. Open the gas supply system shut-off valve. Check to see if the operating pressure is set to a value range between 0.8 bar min and 1.0 bar max.
2. Close the service door.
3. Switch the storage cabinet on using the power switch.
4. The cytomat starts an initialization of the Plate Shuttle™ System (PSS), during which a visual inspection as described in Section 6.4.3 must be performed; then, the handler moves to the wait position in front of the automatic lift door.
5. Set the nominal temperature value at the operating panel of the temperature control.
6. When the temperature nominal value has been reached, the device is operative and can be loaded.

7. Operation

7.3 Precautions during operation

When the service doors are opened at low operating temperatures, dew point underflow may occur as a result of the temperature difference between the room where the device is located and the sample chamber. Depending on the air humidity in the room where the device is located, condensate formation may occur on sample chamber components; in case of extremely low application temperatures, even rime or ice formation may occur.

CAUTION - Damage caused by condensate!

Dew water can freeze at extremely low application temperatures.
Rime or ice formation affects the gliding characteristics of the moving components and may cause a complete failure of or damage to the Plate Shuttle™ System (PSS).
Dew water residues can intermix with the lubricant and therefore depreciate the lubricant quality. In the long run, this may corrode even the high-quality metal components used.

- **Do not open the service doors during operation at low application temperatures (below +4° C).**
- **If opening the doors is absolutely required, do not leave the doors open for more than 5 minutes.**
- **After closing the service doors, wait for a period of 12 hours before newly taking the Plate Shuttle™ System (PSS) into operation.**
- **To prevent moisture from depositing on the handler, the microplates to be loaded must be free from condensate and ice.**

Reestablishing the safe operating state
After opening the service doors (for an interval of less than 5 minutes), residues of perspiration water are absorbed by the cooling system and neutralized inside the heat exchanger after a period of at least 12 hours. After such a span the humidity inside the sample chamber has readjusted to the original humidity value, and the Plate Shuttle™ System (PSS) can be newly taken into operation.

8. Shut-down

8.1 Shutting the device down

CAUTION! - Contamination hazard!

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

CAUTION! - Danger of burns!

The stackers and the sample chamber surfaces freeze at low temperatures.
Contact with frozen metallic components may cause cold burns and frostbite.
- **Wear safety gloves.**
- **Wear mouth protection and safety goggles.**

1. Switch the device off using the power switch, disconnect the power plug and protect it from accidental reconnection.
2. Switch the device-integral UPS off.
3. Close the N_2 supply system shut-off valve.
4. Disconnect the gas pressure hose from the filter sleeve at the rear of the device.
5. Unload the stackers completely. Make sure that all microplates have been removed from the sample chamber.
6. Clean and disinfect the device.
7. Place the device onto its hydraulic stands at the storage location.

NOTE - Ventilation

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

CAUTION - Damage to the battery!

If the device is disconnected from the power supply for more than 3 months, the maintenance-free battery of the UPS may become damaged or even inoperative!
Connect the device to the power supply system for 6 hours at least every three months.

9. Cleaning and disinfection

9.1 Preparations

The operator must prepare hygiene regulations for the decontamination of the device in relation to the application of the device.

WARNING - Electric shock!

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

- **Turn the device off using the power switch.**
- **Unplug the power plug and protect it against accidental reconnection.**
- **Switch the device-integral UPS off.**
- **Check to see if the device is de-energized.**

CAUTION - Health hazard!

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

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

To prepare the cleaning and disinfection, proceed as follows:

- Remove the barcode reader from the charging station and store it at a suitable location.
- Unload all stackers completely.
- Remove the stackers from the sample chamber.
- Wipe condensate from the sample chamber walls and floor.

9. Cleaning and disinfection

9.2 Cleaning

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

CAUTION - Harmful liquids!

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

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

1. Wipe the chamber surfaces clean using a solution of tepid water and conventional dishwashing agent or a special cleaner (e.g. Liquinox). A solution of tepid water and dishwashing agent is also suited for removing stubborn deposits.
2. Rinse the cleaned surfaces with autoclaved water (3 to 5 cycles) to ensure that cleaning agent residues are removed completely.
3. Wipe the surfaces dry using a soft, sterile cloth.
4. Then, relubricate the components using a special grease (refer to Section 9.4, Lubrication, for working procedures and lubrication details).

NOTE - Lubricant

For lubricating the components, use only lubricants that have been approved by Thermo for this application.

Cleaning the device exterior surfaces:

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

Recommended cleaning agent:
Liquinox or conventional dishwashing agent based on soap suds.

Hilfsmittel Schmierung:
Special grease Spezialfett ISOFLEX LDS 18 Spezial A.

9. Cleaning and disinfection

9.3 Disinfection

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

NOTE - Sterilization in the autoclave

Full-metal stackers can be autoclaved.

CAUTION - Disinfectants!

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

- **Use such disinfectants only in adequately ventilated rooms.**
- **After the disinfectant has been allowed to react, wipe the cleaned device components thoroughly dry.**
- **Do not operate the device before it has dried completely.**
- **Observe safety regulations to avoid fire and / or esplosion hazard caused by alcohol-containing disinfectants (ZH 1 / 598).**

Aldehyde- / chloride-containing disinfectants:
Aldehyde- and chloride-containing disinfectants may corrode noble metals.
Use only disinfectants that are harmless to noble metals!

9. Cleaning and disinfection

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

1. Wipe surfaces clean using disinfectant or spray disinfectant onto surfaces.
2. Allow disinfectant to react as recommended by manufacturer.
3. Rinse cleaned surfaces thoroughly with autoclaved water (3 to 5 cycles). Wipe the components of the Plate Shuttle™ Systems (PSS) clean using a sterile cloth moistened with autoclaved water. All disinfectant residues must be removed completely by rinsing.
4. Wipe surfaces dry using a sterile cloth.
5. Then, relubricate the components using a special grease (refer to Section 9.4, Lubrication, for working procedures and lubrication details).

NOTE - Lubricant

For lubricating the components, use only lubricants that have been approved by Thermo for this application.

Disinfectants:
A surface disinfectant recommended by Thermo can be ordered under part number 50052425 (250 ml spray bottle) and 50051939 (500 ml refill bottle).
Details for efficiency and approvals are available on request.

As an alternative for the U.S.A., Kendro Laboratory Products recommends Microcide SQ. Microcide SQ is EPA-listed. Direct order: www.globalbio.com.

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

Auxiliaries:
Lint-free, sterile cloths or sheets.

Hilfsmittel Schmierung:
Special grease ISOFLEX LDS 18 Spezial A.

9. Cleaning and disinfection

9.5 Lubrication

Fig. 32: After each cleaning and disinfection, the moving components of the lift system of the external Plate Shuttle™ System (PSS) as well as the guide rods and the spindles of the internal Plate Shuttle™ Systems (PSS) must be lubricated using special lubricant.

NOTE - Lubrication of components

- **Apply lubricant to clean cloth and apply sparesly (thin film) to the following lift system components.**
- **Start a test run and test all motional sequences.**
- **Remove excess grease that has accumulated at the shaft ends and at the ends of the linear guides.**

External handler
- Linear rail [2] below the shovel
- Counterweight guide rods [4] at the lift system
- Plastic gear [1] and pertaining aluminum toothed rack [3] of the handler
- Plastic gear [5] and pertaining aluminum toothed rack [6] of the lift system
- Guide rails and spindles of the subsystems

Internal handlers (upper and lower subsystems)
- 3 Spindles [7] (below the protective cover)
- 3 linear guides, two in the direction of x and one in the direction of y [8].
- Vertical guide rail [9]

Lubricant:
Special grease ISOFLEX LDS 18 Spezial A.
Part No.: 50080979.

Auxiliaries:
Lint-free, sterile cloths or sheets.

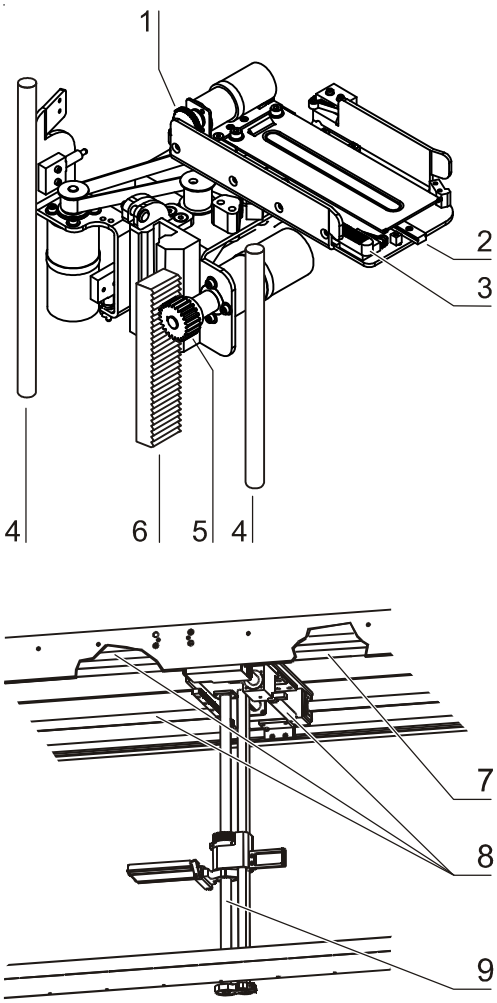


Fig. 32,
Component lubrication

10. Maintenance

10.1 Inspections and checks

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

Daily check:
- Gas level of the N_2 supply system.

Annual inspection:
- Tightness of the service door seal.
- Automatic lift door seals.
- Permeability of the pressure compensation opening insert.
- Functional check of the operating panel and of the device control system.
- Belt tension at the external handler.
- Electrical safety check in accordance with the applicable national regulations (e.g. BGV A 2).

NOTE - Functional test

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

10.2 Service intervals

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

3-month service:
- Visual inspection of the Plate Shuttle™ System (PSS).
- Check belt to handler and replace as required.
- Charge UPS battery. Connect the device to the power supply system for 6 hours at least every three months.
- Check the smooth running of the mechanics; carry out a lubrication status sight check (see chapter 9.4).

Annual service:
- Replace sterile filter.
- Perform temperature comparison measurement.
- Replace electronic module air cleaner.
- Check thermostat thermal protection.
- Clean refrigerant reservoir in thermostat.

NOTE - Service contract

Thermo offers a device-specific service contract that comprises all test and service works required.

10. Maintenance

10.3 Replacing the sterile filter

The sterile filter is installed at the rear of the device. The mounting sleeve with a plastic thread is screwed by hand into the threaded hole of the valve block.

1. Switch the device off using the power switch, disconnect the power plug and protect it from accidental reconnection.
2. Switch the device-integral UPS off.
3. Close the N_2 supply system shut-off valve and make sure that the gas supply remains shut off.
4. **Fig. 33:** Disconnect the gas pressure hose [4] from the filter sleeve. Remove the connector [3] from the sterile filter sleeve [2].
5. Unscrew the sterile filter [1] from the threaded hole in the valve block.
6. When installing the new sterile filter, make sure that the plastic thread is not canted. Install the filter using caution.
7. Connect the gas hose connector to the filter sleeve and secure the hose using the hose clamp. Check to see if the hose is tight on the sleeve.

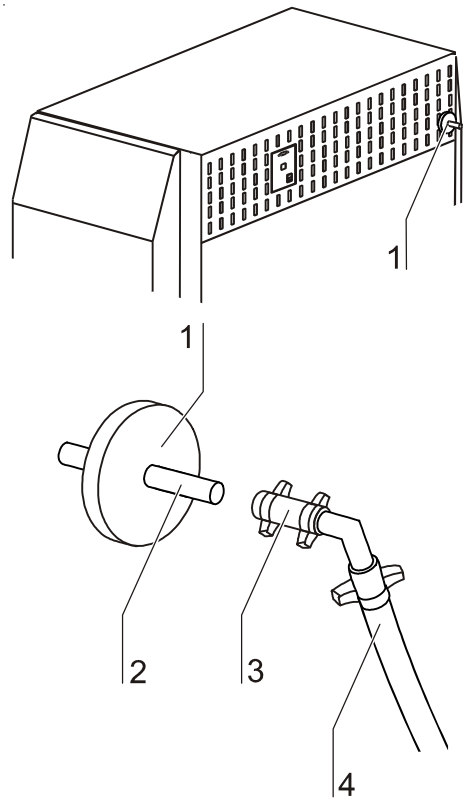


Fig. 33,
Sterile filter replacement

11. Disposal

11.1 Disposal procedure

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

CAUTION - Contamination hazard!

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

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

Recycable materials

NOTE-WEEE Compliance:

This product is required to comply with the European Union‘s Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with the following symbol:

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

12. Spare parts and accessories

Component	Material
Electronic boards	Enclosed electrical components with various plastics, equipped with epoxy resin-bound PCBs
Plastic components, general	Note material labelling
Exterior housing	Stainless steel
Device backpanel	Aluminum sheet-lined board
Outer door	Stainless steel
Outer door isulation	PU rigid foam
Outer door magnetic seal	PVC with magnetic core
Door inner panel	Stainless steel
Operaing panel and indicator foil	Polyethylene
Automatic lift door seal	Tempered silicone
Heatings	Silicone-sheathed resistance-type wires
Tubular heating elements (dry refrigeration)	Stainless steel
Interior container	Stainless steel
Sensor block	Nickle-plated brass
Plate Shuttle™ System (PSS)	Aluminum (anodized), stainless steel, various plastics
Stacker	Aluminum (anodized), stainless steel
Docking station	Aluminum (anodized), stainless steel
Drive side cover	Stainless steel
Uninterruptible power system (UPS)	Lead battery
Barcode reader power supply	Ni-MH battery pack
Switchbox cables	Plastic-coated copper flexible
Refrigeration system box cables	Silicone-coated copper flexible
Tubing	Copper
AC compressor and cold trap	Copper blades, copper tubes
Cold trap refrigerant	R 507
Refrigeration system refrigerant	R 507
Hydraulic system filling	HLP 32
Packaging / Shipping box	Polyethylene film, styrofoam, untreated wood
Gas hose	PVC, tissue-reinforced

12. Spare parts and accessories

12.1 List of spare parts and accessoris

NOTE - Repairs

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

When ordering spare parts, please have the device specifications of the nameplate available.

Description	Type	Part No.
Power supply cable	EU	50046005
Power supply cable	GB	50067126
Power supply cable	CH	50067124
Power supply cable	USA	50043220
Power supply cable	I	50067125
Power supply cable	AUS	50067177
Power supply cable	DK	50067127
Hose set for N2 gas connection (interior diameter 4 mm)		50062701
Sterile filter, gas inflow	with thread	50050737
Connector for alarm contact		50034772
Automatic lift door	Cytomat® 44	50078058
Device fuse 230 V	T 6.3 A (set of 2)	03002641
Device fuse 200 / 208 V	T 10 A (set of 2)	03700900
Circuit breaker for equipment	12A	50080405
Surface disinfectant, 500 ml, refill bottle	Barrycidal 36	50051939
Surface disinfectant, 250 ml, spray bottle	Barrycidal 36	50052425
Hydraulic oil	HLP 32	50079572
Special grease	Klüber Isoflex LDS 18 Spezial A.	50080979

Available Stackers:

Pitch	Microplate type	Capacity / Stacker	Part No.
17.0 mm	Well	28 microplates	50067450
23.0 mm	Well	21 microplates	50066776
28.0 mm	Well	17 microplates	50067451
29.0 mm	Well	16 microplates	50067740
33.0 mm	Well	15 microplates	50067452
35.0 mm	—	14 microplates	50079485
38.0 mm	—	13 microplates	50078255
43.0 mm	MD 384 tip box	11 microplates	50073846
45.5 mm	—	11 microplates	50078254
50.0 mm	Deep-Well	10 microplates	50067453
57.0 mm	Tube racks	9 microplates	50079718
60.0 mm	Tube racks	8 microplates	50079487
69.0 mm	Deep-Well	7 microplates	50067454

13. Technical data

Description	Unit	Value	
		Dry refrigeration	Humid refrigeration
Mechanical			
Exterior dimensions (W x H x D) (without transfer stations)	mm	1962 x 2052 x 801	1962 x 2052 x 801
Sample chamber volume (device empty)	l	1400	1400
Number of stackers (capacity)	Piece	44 (+1 at transfer system)	44 (+1 at transfer system)
Max. individual sample weight, incl. microplates	g	300	300
Max. total load per stacker	kg	8	8
Max. Plate Shuttle™ System (PSS), total load per subsystem	kg	176	176
Weight, incl. Plate Shuttle™ System (PSS) and stackers	kg	880	855
Packaging exterior dimensions (W x H x D)	mm	2140 x 2240 x 1010	2140 x 2240 x 1010
Weight, device in packaging	kg	872	847
Thermal			
Ambient temperature range	°C	+16° C bis +28° C	+16° C bis +28° C
Temperature control range	°C	-20° C to +25° C	-20° C to +25° C
Temporal temperature deviation at constant ambient temperature	°C	+20 / +-0,5 K +4 / +-1 K -20 / +-1 K	+20 / +-0,5 K +4 / +-1 K -20 / +-1 K
Local temperature deviation, measured in loaded 96 Well microplats	°C	+20 / +-2 K +4 / +-2 K -20 / +-2,5 K	+20 / +-2 K +4 / +-2 K -20 / +-2,5 K
Self-heat-up time from -20° C to +20° C in sample chamber at ambient temperature +32° C: (after power off)	h	7	
Self-heat-up time from -20° C to +20° C in sample chamber at ambient temperature +18° C: (after power off)	h	17	
Cool-down time, from +25° C to 4° C Ambient temperature +23° C	h	< 5	
Humidity			
Constant humidity (at ambient temperature +16° C to +28° C)	% rH	<10 % at 20° C <10 % at 4° C <35 % at -20° C	>75 % at +4° C >85 % at +20° C
Humidity increase in constant access, automatic lift door open for 10 s	% rH	Actual value +2 % at -20° C	-:-
Relative humidity of environment	% rH	max. 80	max. 80

13. Technical data

Description	Unit	Value
		Controlled humidity
Mechanical		
Exterior dimensions (W x H x D) (without transfer stations)	mm	1962 x 2052 x 801
Sample chamber volume (device empty)	l	1400
Number of stackers (capacity)	Piece	44 (+1 at transfer system)
Max. individual sample weight, incl. microplates	g	300
Max. total load per stacker	kg	8
Max. Plate Shuttle™ System (PSS), total load per subsystem	kg	176
Weight, incl. Plate Shuttle™ System (PSS) and stackers	kg	855
Packaging exterior dimensions (W x H x D)	mm	2140 x 2240 x 1010
Weight, device in packaging	kg	847
Thermal		
Ambient temperature range	°C	+16° C bis +28° C
Temperature control range	°C	+4° C to +25° C
Temporal temperature deviation at constant ambient temperature	°C	+20 / +-0,5 K +4 / +-1 K
Local temperature deviation, measured in loaded 96 Well microplats	°C	+20 / +-2 K +4 / +-2 K
Self-heat-up time from +4° C to +20° C in sample chamber at ambient temperature +32° C: (after power off)	h	5
Self-heat-up time from +4° C to +20° C in sample chamber at ambient temperature +18° C: (after power off)	h	14
Cool-down time, from +25° C to 4° C Ambient temperature +23° C and relative humidity of 20 %	h	< 5
Cool-down time, from +25° C to 4° C Ambient temperature +23° C and relative humidity of 50 %	h	< 6
Humidity		
Ambient temperature range	°C	+16° C to +28° C
Humidity temperature range	% rH	20 % to 50 %
Temporal humidity deviation at constant ambient temperature	% rH	20 °C / +- 2 % 4 ° C / +- 2 %
Humidity increase in constant access, automatic lift door open for 10 s	% rH	Actual value +2 % at +4° C
Relative humidity of environment	% rH	max. 80

13. Technical data

Description	Unit	Value	
		Dry refrigeration	**Humid refrigeration**
Gas supply			
Gas purity for nitrogen (N2)	%	99.5 min. or medical quality	99.5 min. or medical quality
Prepressure	bar	0.8 – 1.0	0.8 – 1.0
O_2 control range	Vol	10 % – 21 % at 10 l / min. N_2	10 % – 21 % at 10 l / min. N_2
Temporal control deviation	Vol %	± 1.0 (not during or after defrosting)	± 0.5 (not during or after defrosting)
Electrical			
Nominal voltage / Frequency **(EU)**	V / Hz	I/PE AC, 230 V / 50 Hz	I/PE AC, 230 V / 50 Hz
Nominal voltage / Frequency **(USA / CAN / J)**	V / Hz	I/PE AC, 200 - 208 V / 60 Hz	I/PE AC, 200 - 208 V / 60 Hz
Nominal voltage / Frequency **(JAPAN)**	V / Hz	I/PE AC, 200 / 50 Hz	I/PE AC, 200 / 50 Hz
Type of protection for entire device (DIN 40 050)		IP 20	IP 20
Protection class		I	I
Overvoltage category (IEC 1010, EN 61010)		II	II
Pollution severity (IEC 1010, EN 61010)		2	2
Rated current (230 V, 50 / 60 Hz)	A	8,7	5,7
Rated current (200 V - 208 V, 60 Hz)	A	10,5 - 10,1	7 - 6,7
Rated current (200 V, 50 Hz)	A	10	6,5
On-site protection: • Fuse • Circuit breaker		 T 16 A G 16	 T 16 A G 16
Power input 60 Hz	kW	2,1	1,4
Power input 50 Hz	kW	2,0	1,3
EMC class (EN 61326)		B	B
SELV for Plate Shuttle™ System (PSS)	V	< 48	< 48
Rated current for Plate Shuttle™ System (PSS)	A	< 1	< 1
Protection class for Plate Shuttle™ System (PSS)		exceeds IP 67	exceeds IP 67
Plate Shuttle™ System (PSS)			
Max. access time per microplate	s	60	60
Average access time per microplate at parallel operation of subsystems A and B	s	< 40	< 40
Others			
Sound pressure level (DIN 45 635, Part 1)	dB(A)	< 50	< 50

13. Technical data

Description	Unit	Value
		Controlled humidity
Gas supply		
Gas purity for nitrogen (N2)	%	99.5 min. or medical quality
Prepressure	bar	0.8 – 1.0
O_2 control range	Vol	10 % – 21 % at 10 l / min. N_2
Temporal control deviation	Vol %	± 1.0 (not during or after defrosting)
Electrical		
Nominal voltage / Frequency **(EU)**	V / Hz	l/PE AC, 230 V / 50 Hz
Nominal voltage / Frequency **(USA / CAN / J)**	V / Hz	l/PE AC, 200 - 208 V / 60 Hz
Nominal voltage / Frequency **(JAPAN)**	V / Hz	l/PE AC, 200 V / 50 Hz
Type of protection for entire device (DIN 40 050)		IP 20
Protection class		I
Overvoltage category (IEC 1010, EN 61010)		II
Pollution severity (IEC 1010, EN 61010)		2
Rated current (230 V, 50 / 60 Hz)	A	7,8 - 8,5
Rated current (200 V - 208 V, 60 Hz)	A	9,1 - 9,5
Rated current (200 V, 50)	A	9
On-site protection: • Fuse • Circuit breaker		 T 16 A G 16
Power input 60 Hz	kW	1,9
Power input 50 Hz	kW	1,8
EMC class (EN 61326)		B
SELV for Plate Shuttle™ System (PSS)	V	< 48
Rated current for Plate Shuttle™ System (PSS)	A	< 1
Protection class for Plate Shuttle™ System (PSS)		exceeds IP 67
Plate Shuttle™ System (PSS)		
Max. access time per microplate	s	60
Average access time per microplate at parallel operation of subsystems A and B	s	< 40
Others		
Sound pressure level (DIN 45 635, Part 1)	dB(A)	< 50

14. Principles of good microbiological proceedings[1]

General information:

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

The following additional principles apply to the handling of causatives:

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

14. Principles of good microbiological proceedings[1]

Further safety measures in dependence of the potential hazard:

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

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

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

[1]To be applied accordingly to cell cultures.

[2]Manufacturers' references are published in the information bulletins "Safe Chemical Working" of the German chemical industry's trade association and of the German trade association for health and welfare service and also on demand by the inspection office of the expert commission "Health and Welfare Service".
The commission can be contacted at the trade association for health and welfare service, Pappelallee 35-37, D-2000 Hamburg

Reference: Notice B003, Issue 1 / 92 – ZH 1 / 343 of the trade association of the German chemical industry, published by Jedermann Verlag, Postfach 103140, D-69021 Heidelberg.

15. Device log

NOTE - Device log

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

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

Work carried out	Notes	Date	Signature

Invoice recipient / Customer no.:	Location / Forwarding address:

Year of manufacturer:	KC:	ST:	Name of technician:	Appointed date:

order date:	Ordered by:	Order no.:

Type of device:	ID no. / Order no.:	Operating hours:

Equipment no.:	Factory no.:	Service device no.:	Date of delivery:	Date of start-up:	Customer inventory no.:

Certficate of decontamination

Dear customer,

when using biological and chemical agents within and ouside of devices, hazards to the health of the operating personnel may be present and contamination of the surroundings of the device may occur when service or repair works are carried out.
Within the scope of national and international legal regulations, such as
- responsibility of a company for the protection of its employees,
- responsibility of the operator for the operational safety of devices,
all possible hazards must absolutely be prevented. Prior to any calibration, service, and repair works, prior to any relocation of a device, and prior to the shut-down of a device, the device must be decontaminated, disinfected, and cleaned as required by the work to be carried out.
Therefore, we ask you to fill in this certificate of decontamination before you start with the required work.

Yours sincerely

Thermo Electron LED GmbH

Works to be carried out (please mark where applicable)

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

Declaration of possible contamination (please mark where applicable)

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

Certification:

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

Note:

Date, legally binding signature, stamp

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