Thermo Scientific

TS586e Freezers

Operating instructions

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Part of Thermo Fisher Scientific

Thermo SCIENTIFIC

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Dear Operator,
This unit has been manufactured in keeping with the latest technological developments and is operationally safe. However, the unit may present potential hazards, particularly if it is operated by inadequately trained personnel or if it is not used to the intended purpose:

For any operation of this unit, the operator must prepare written instructions in a reasonable form and in the language of the operating and cleaning personnel based on these operating instructions.

Use these operating instructions to familiarize the operating personnel with the functions, operation, and maintenance of the unit.

The contents of the operating instructions are subject to change without further notice.

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

For safety reasons, unauthorized modifications or reconditioning of the unit are prohibited and will make the warranty void.

Keep these operating instructions close to the unit so that safety instructions and important information are always accessible.

Trademarks:

Thermo Scientific TS Series is a registered trademark of Thermo Fisher Scientific and of its subsidiary companies. All other trademarks mentioned in the operating instructions are the exclusive property of the respective manufacturers.

Notes for the user

Dear User,
Prior to the initial operation of the unit, please read these operating instructions carefully to make sure that you can fully exploit the advantages of the unit and to prevent possible damages:

These operating instructions describe the freezers of the Thermo Scientific TS Series.

The freezers must be operated only by authorized and adequately trained personnel.

The installations described in the annexes must be carried out only by trained expert personnel.

Should you encounter problems that are not mentioned in these operating instructions, please contact your supplier immediately for your own safety.

Germany

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Explanation of symbols

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 hints and useful information.

RECYCLING
Valuable raw materials can be reused.

Wear safety gloves!

Wear safety goggles!

Corrosive substances!

Flammable!

Symbols on the unit:

CE symbol

Observe operating instructions!

General safety instructions

Correct usage:

The freezers are used to store specimen and preparations that are already frozen.
The units are generally suited for installation and usage in the following areas:

- Laboratories for microbiological and biotechnical experiments;
- Medical-microbiological laboratories according to DIN 58 956;
- Laboratories in the central area of clinics and hospitals;
- Laboratories of safety levels L1, L2, and L3.

Incorrect usage:

Do not operate the freezers in rooms that do not comply with the location requirements.
Do not store flammable tissues, substances or liquids in the freezers.
Do not store tissues, substances or liquids in the freezers that release toxic substances.

Safety requirements:

The unit is in accordance with the safety requirements of the following standards and directives:

- EN 61010-1: 2nd Edition with applicable clauses of EN 60335-2-89 ED. 1.2 and EN 378-2;
- Low Voltage Directive 2006/95/EC;
- EMC Directive 2004/1008/EC.

Safety devices:

The freezers are equipped with safety devices that protect the units as well as the stored materials against damage:

- Compressor protection

If more than five failures occur within 24 hours, a failure code will be displayed to prevent potential damage.

- Electronic monitoring system

The electronic monitoring system monitors the following unit functions and location requirements:

  - Compressor function,
  - Condenser function,
  - Closing state of door or lid,
  - Ambient temperature

- Power supply

The control system of the unit is equipped with a battery-supported power supply that supplies the monitoring system with energy in the case of a power failure.

- Optional backup cooling system

All models are available with an optional backup cooling system.

Reusable materials

Disposal:

The freezers and the packaging contain materials that can be reused.
Freezers contain refrigerant that must be discarded properly.
Discarded units must be immediately made unusable:

- Disconnect the unit from the mains supply.
- Cut the mains supply connection line
- Snap locks or bolt locks must be removed or made unusable to prevent playing children from being locked in the freezer which may cause suffocation.

Units used for microbiological experiments must be thoroughly cleaned and disinfected before disposal.
The discarded unit must be provided with an appropriate certificate showing the decontamination measures performed.
For materials used, please refer to section "Specifications."

Delivery, unit types and versions

Checking the delivery

Upon delivery, check the unit for completeness and for possible transport damages.
If damages are detected or if components are missing, please contact your forwarding agent and Thermo Electron LED GmbH or your supplier.

Scope of delivery

The standard equipment of the freezers comprises the following components:

Thermo Scientific TS Series, freezer upright:

Scope of delivery:
Freezer cabinet,
Key for locking the door,
4 shelves,
16 shelf supports,
Operating instructions.

Depending on the optional equipment, the scope of delivery may comprise further parts.

Unit and type designations

The freezers are available in two models:

Thermo Scientific TS Series freezer upright:

- TS586e, interior volume approx. 510 liters
- TS586ew, interior volume approx. 510 liters

Equipment versions

Features	TS 586e	TS 586ew
Cooling		
Air cooling	●	
Water cooling		●
CO_2 backup cooling system	☐	☐
Data acquisition		
Circular chart recorder	☐	☐
Ext. Pt100 connection	☐	☐
RS 232 interface	●	●
Potential-free alarm terminal	●	●
Adjustments for control functions		
Setpoint temperature	-50 °C to – 86 °C	-50 °C to – 86 °C
Hot alarm (excessive temperature)	+ 1 K to + 40 K, variable adjustment	+ 1 K to + 40 K, variable adjustment
Cold alarm (insufficient temperature)	- 1 K to - 40 K, variable adjustment	- 1 K to - 40 K, variable adjustment
Backup cooling temperature	-30 °C to – 70 °C	-30 °C to – 70 °C
Backup cooling	Selectable function on/off	Selectable function on/off
Battery supply disable	Selectable function off	Selectable function off
Delay for power failure signal	0 to 240 min.	-
Test operation	Selectable function on/off	Selectable function on/off
Keypad lock	Selectable function on/off	-
Monitoring functions for unit components		
Refrigeration systems	●	●
Condenser / filter	●	●
Closing state of door/ lid	●	●
Ambient temperature	●	●

● Standard equipment
☐ Optional equipment

Installation of the unit

Transport

CAUTION Unit orientation!
If the unit is tilted excessively, the compressor oil may flow from the compressor to the line system. An insufficient filling level may damage the compressor when the refrigeration system is started.
Transport the unit only in the vertical position!
When transporting, the unit must not tilt beyond 10° determined by IEC 61010-1, Fig. 3-1.
For the transport to the final location, the unit may be tilted temporarily to the left side (front view) to make it fit through doors.
The arrows in Fig. 3-1 point to the left side.

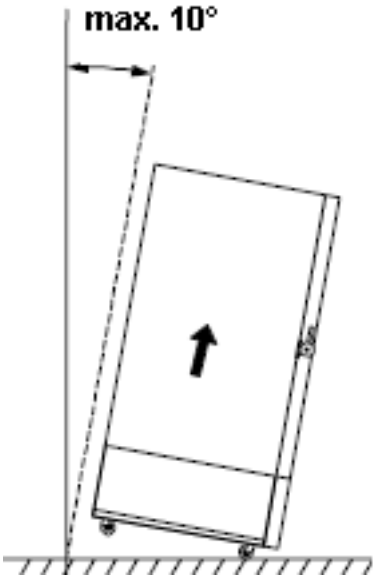


Fig. 3-1 Maximum tilt angle during transport

- Lift points!
When transporting the unit, do not use moving components of the unit. When lifting the unit, the load must be applied only at the lift points shown in Figures 3-2 and 3-3.

Lift points at Thermo Scientific TS Series models, Fig. 3-2:
The lower unit frame [1] at the positions marked in Fig. 3-2.

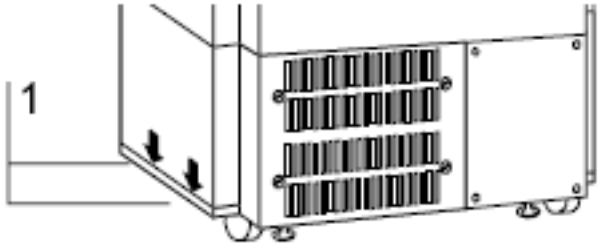


Fig. 3-2 Lift points atThermo Scientific TS Series models

Note - Stands!
To ensure secure and stable placement in the operating position, the front side of the unit is equipped with two stands [2]. To lock the stands in the operating position, tighten the locknut [1], **Fig. 3-4**.

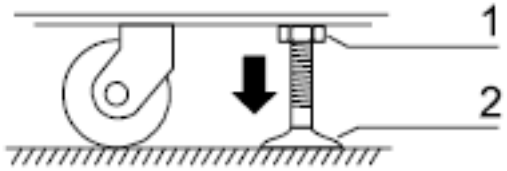


Fig. 3-3 Stand with locknut

Transport in buildings:

1. Make sure that the stands are in the transport position.
2. If the stands are in the operating position, loosen the stand locknuts and rotate the stands until the unit can be moved freely on the transport rollers.
3. Using the transport rollers, push the unit to the new location.

Transport outside of buildings:

> **Note** Transport rollers!
> The rollers are not suited for transporting the unit outside of buildings.
> For a transport of the unit outside of buildings, use suitable transport media such as lift-trucks or pallets.

1. Lift the unit onto the transport medium using only the lift points.
2. Transport the unit carefully so that it is not exposed to vibrations.

Unit placements:

1. Rotate the stands into the operating position to relieve the transport rollers of the load.
2. Align the unit by rotating the stands so that it is in a vertical position.
3. Check the secure placement of the unit.
4. Fix the stands using the locknuts.

Location

Requirements:

- The operational safety of the unit has been designed for locations with a height of up to 2000 m above sea level.
- For adequate room volume, see section “Room volume.”
- For adequate ventilation, see section “Room ventilation.”
- A surface capable of bearing the weight of the unit and of additional load (see section “Specifications.”)
- Level floor surface.
- Ambient temperature: +16 °C to +32 °C (Temperature Class N).
- Relative humidity: 80% max.
- No direct sunlight.
- Do not allow devices with excessive heat emission to be installed or placed in the vicinity of the freezer.
- A minimum distance must be kept to adjacent surfaces (see section “Specifications.”)

Room volume

Room volume requirements

:

CAUTION- Flammable refrigerant!
Depending on the unit type (see nameplate), the refrigerant system of the unit contains small quantities of the environmentally compatible, combustible refrigerant R 170 and R 290.

CAUTION **Refrigerant R 170 and R 290 in combination with a certain amount of oxygen forms a combustible gas/air mixture. As the Accident Prevention Regulations must assume an extreme case with regard to the explosion hazard, the content of R 170 and R 290 in the room air must not be allowed to reach the lower flamability limit. In this (theoretical) case it is assumed that the room where the unit is located is not ventilated, that there is no air exchange in that room, that the refrigerant is escaping immediately and completely and that an ignition source is present at that time!**
For the safe operation of the freezer, a free room volume detailed in the Specification section or an adequate room ventilation is sufficient.

Room ventilation

Note **- Room climate!**
During constant operation, the heat emitted by the refrigeration system results in permanent changes of the room climate.
In the room where the freezer is located, adequate room ventilation must be ensured in the first place to prevent the room temperature from rising over 32°C.
This excessive room temperature may impair the cooling performance of the unit!
Therefore, the freezers must be installed only in rooms with adequate ventilation or air-condition.

Views of the unit

Views of Thermo Scientific TS Series models

Front view, Fig. 4-1:

- Control panel [1] with display and function key for program control
- Lockable door handle [2]
- Air inlet [3] for supplying the refrigeration system components with air
- Transport rollers [4]
- Stands [5] for stable placement in the operating position
- Chart recorder [6] for acquisition of the interior temperature of the unit (optional equipment)

Interior view:

- Variable shelf [7]
- Sensor [8] for detecting the opening state of the door
- Inner door [9]

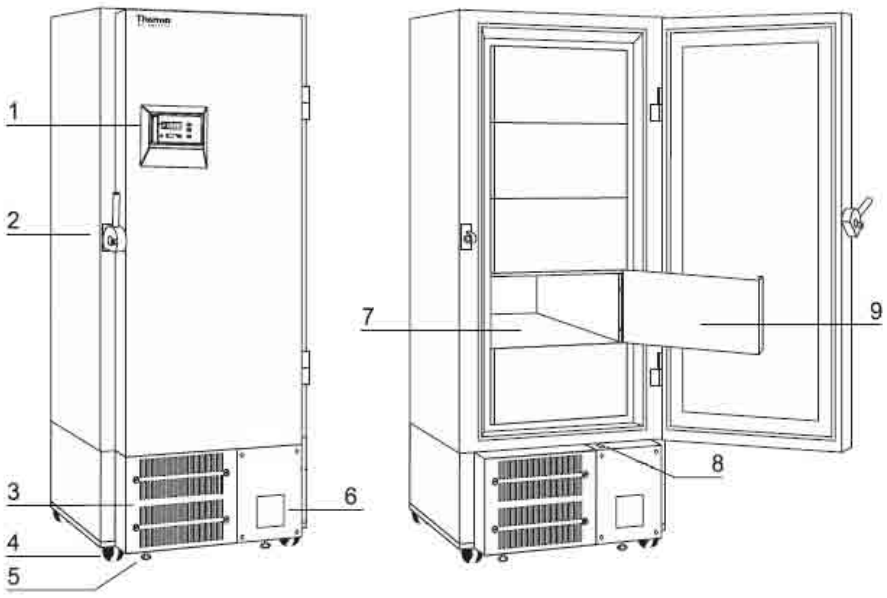


Fig. 4-1 Freezer upright front view and interior view

Rear view, Fig. 4-2:

- Optional Pt 100 terminal [1] for the external documentation of the interior temperature with external temperature recorder
- RS 232 PC interface [2] for the computer-aided documentation of the interior temperature
- Junction box [3] for connecting the unit to an external monitoring system
- Power cable [4] with plug

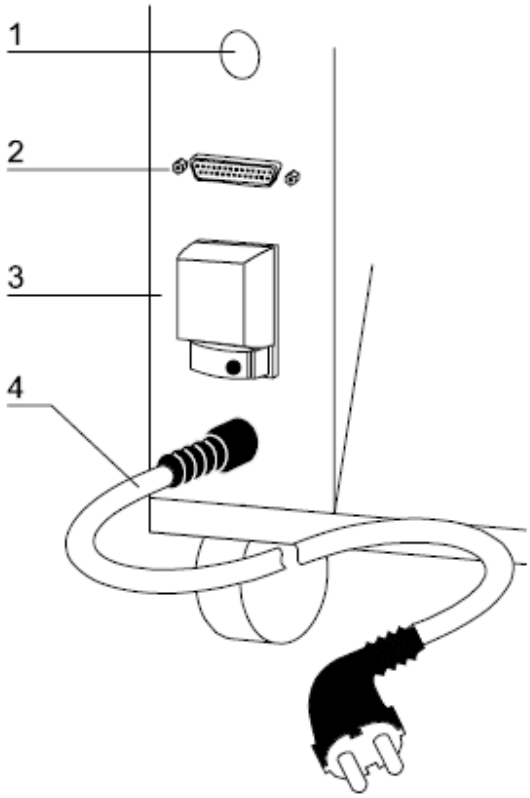


Fig. 4-2 Connections at the rear of Thermo Scientific TS Series models

Unit functions

Refrigeration system

The refrigeration system is operated according to the principles of single-stage cascade cooling. Two coupled refrigeration circuits are operated with one compressor for each cycle.
CFC- and HFC-free refrigerant is used exclusively within the closed refrigerant circle.

Door lock mechanism

Thermo Scientific TS Series

The freezer cabinet is equipped with a lockable latch that supports both the opening and the closing process.
Through the high temperature deviations between inner chamber and operating room result different pressures whose forces press the door during the closing process to the cabinet housing.
The latch supports the opening process [1] by pushing the door away from the housing.
Upon closing [2], the door is pulled tightly toward the housing.

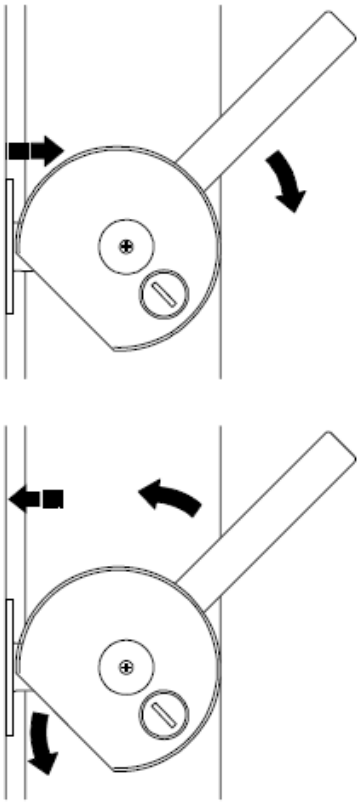


Fig. 5-1 Thermo Scientific TS Series door mechanism

Control system

The microprocessor-aided control system ensures that the setpoint temperature is always maintained. Simultaneously, the monitoring system monitors the safety of the unit and triggers a visual and an audible alarm in the case of a failure.
The safety chain of the unit comprises technical functions of the unit such as:

- Power supply failures,
- Excessive temperature,
- Insufficient temperature,
- Excessive or insufficient room temperature
- Closing state (Fig. 5-2) of the door

The opening sensor [1] registers the time during which the door or the lid of the freezer remains open. If the opening time exceeds two minutes, a short warning chime sounds, and the code oPEn is displayed. If the door remains open for more than four minutes, a steady warning chime sounds, and an additional failure code is displayed on the control panel.
The failure signal also activates the contact for an external monitoring system.

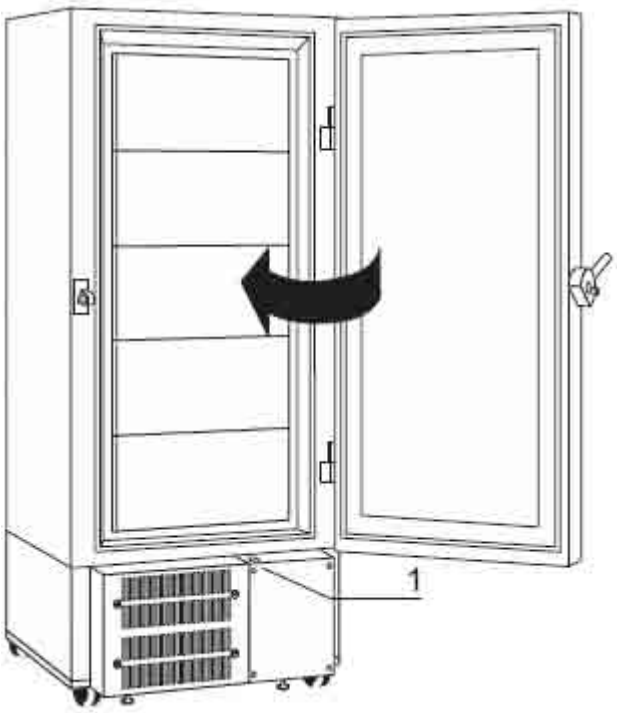


Fig. 5-2 Opening sensor

Unit inventory

To ensure the optimum utilization of the effective volume of the unit, a comprehensive inventory system is available for all models of both series.
The components of the individual inventory systems have been matched perfectly to the effective volumes to comply with all storage and accessability requirements:

Inventory system for Thermo Scientific TS Series models:

- Boxes
- Inserts
- Racks

Depending on the design of the boxes, the specimen containers are stored either in the dividers [1] of the box [2] or directly in the box itself. The boxes can be stored in drawers [3] with matching racks [4] or directly in the racks.

The separate inner doors prevent heat from entering the volume while the door is opened.

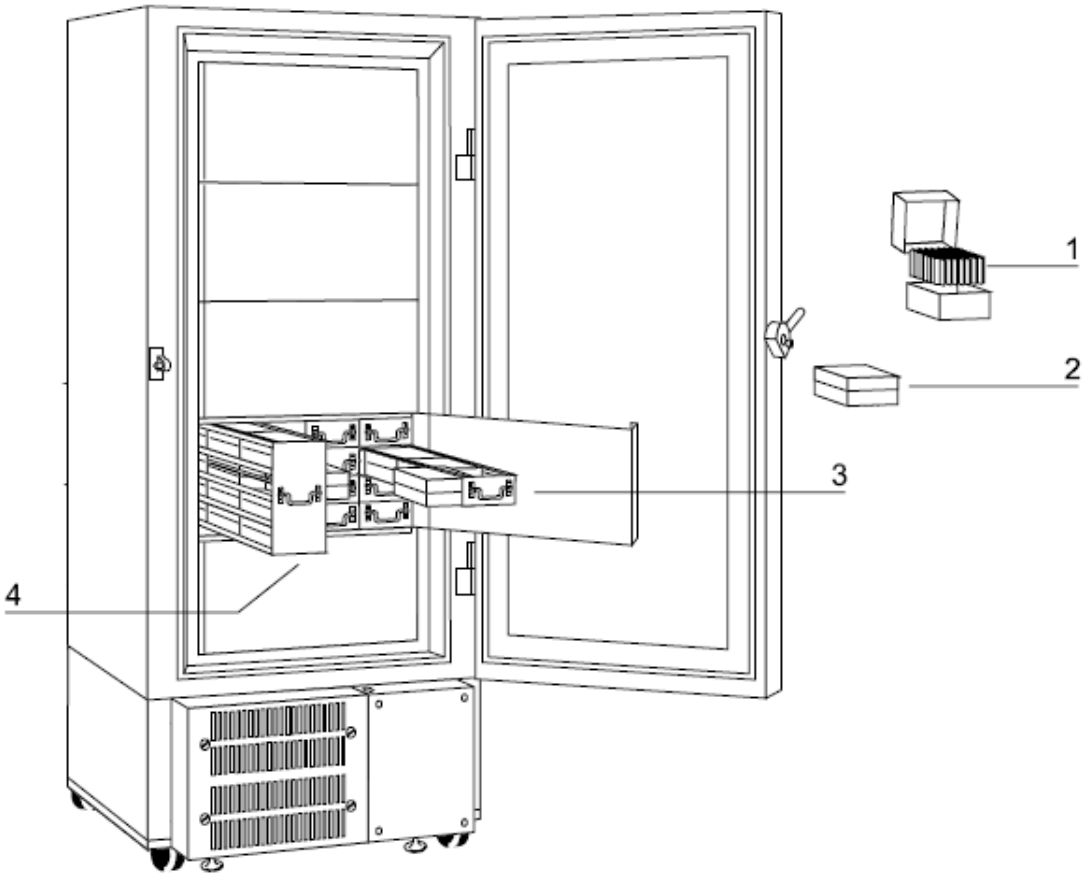


Fig. 5-3 Inventory for freezer upright

Start-up

Preparations

Note Observe the hygiene regulations!
When the unit is delivered, it is not sterile. If the unit is to be used for treating medical or safety-sensitive specimen or substances, it must be prepared accordingly. Prior to the initial operation, clean and disinfect the unit in accordance with the hygiene regulations!

The required preparations are described in section Reconditioning.

Preparing the effective volume

Preparing Thermo Scientific TS Series models:

The shelves in the freezer upright are variable and can be adjusted to match particular storage conditions.
If storage systems are used for storage, the shelves should be mounted in a manner that allows access to the entire shelf after opening the respective inner door.

Installation of the shelf supports, Fig. 6-1:

For each shelf, shelf supports must be installed to the four support rails at the interior walls of the freezer.

1. Open all inner doors until they reach the stop.
2. Insert the shelf support [2] with the bead facing upward into the slot [1].

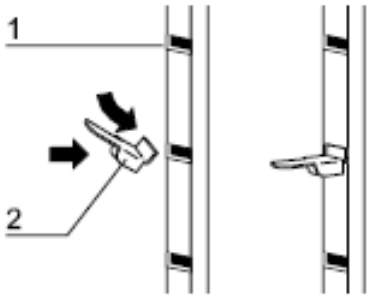


Fig. 6-1 Installation of the shelf supports

Installation of the shelf, Fig. 6-2:

1. Place the shelf [1] onto the four supports [2]. The low beads on the sides of the shelf must be facing upward.

2. Check to see if the shelf is in a stable position on all four supports.

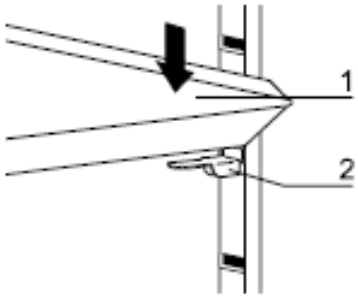
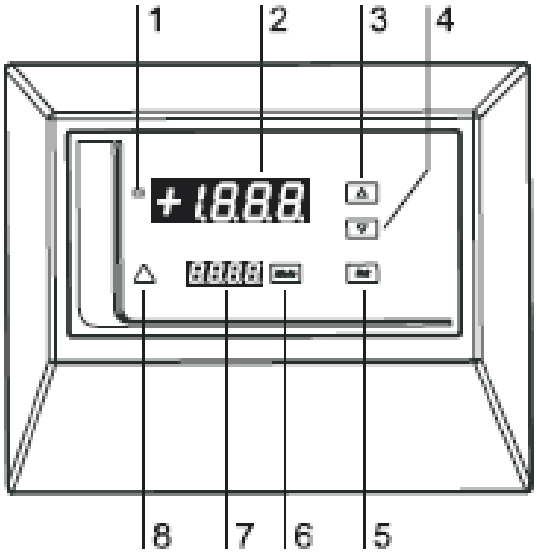


Fig. 6-2 Installation of the shelf

Description of the control panel

The control panel is used to control the functions of the unit.
The desired program modes are selected by pressing the corresponding keys and entering the appropriate values.
The two displays indicate the activated program functions, the corresponding values, and the alarm and failure codes.



[1] Refrigeration system on/off display

[2] Value display

[3] UP key

[4] DOWN key

[5] SET key

[6] MODE key

[7] Mode display

[8] Fault indicator

Fig. 6-3 Control panel

Function of the control panel:

The indicator [1] shows the operating state of the refrigeration system. If the indicator is on, the compressors are activated; otherwise, the compressors are deactivated.
During operation, the value display [2] shows the actual temperature. If a program function is activated, this display shows the setpoint value or the selected switching state.
The UP key [3] is used for increasing a value or for forward browsing of

- the selection of the available program modes or
- the stored failure codes.

The DOWN key [4] is used for decreasing a value or for backward browsing of

- the selection of the available program modes or
- the failure codes.

The SET key [5] is used for changing or storing a value. The function of this key depends on the program mode.
The MODE key [6] is used for activating the catalogue of available program modes.
The mode display [7] indicates the selected program mode.
The fault indicator [8] flashes if an alarm or a malfunction of the unit occurs. The corresponding failure code is shown in the mode display.

Quitting alarm or failure codes:

The key functions described below allow signals and failure codes to be quitted and turned off during operation.

Press any key:

- Quitting the audible alarm. As soon as the fault has been corrected, the alarm code will go off automatically (alarm codes).

Press the UP key [3] or the DOWN key [4]:

- Browse failure codes.

Press the SET key [5]:

- After the cause of the failure has been repaired (e.g. if the temperature is within the set alarm limits again), press the Set key to erase the failure code (or several failure codes).
  Keep the Set key depressed for 2 seconds.

Power connection with power plug

Note **Refrigeration system start-up:**
When the unit is connected to the mains supply, the refrigeration system is started up automatically, and the cooling phase is started!

WARNING **Electric shock:**
Contact with current-carrying components may cause a lethal electric shock.
Before connecting the unit to the mains supply, check plug and connection line for damage.
Do not use damaged components for connecting the unit to the mains supply!

The unit must be connected only to a correctly installed and grounded mains supply source.
The power connection is made with a grounding plug.
Each power outlet must be fused separately with a 16 A circuit breaker (Characteristic B).
Valid directives for Austria:

The unit must be connected only to an electrical system that complies with ÖVE – EN 1.
Valid directives for Switzerland:
The connection can be made with switches or outlets. Each power outlet must be fused separately with a 12 A circuit breaker.

> **Note Extension cord:**
> Do not use an extension cord for connecting the unit to the mains supply as this will result in line losses that may impair the start of the compressor.

Establishing the power connection:

1. Before connecting the unit to the mains supply, check to see if the voltage of the mains supply corresponds with the specifications on the nameplate of the unit.
2. If the ratings given for voltage (V) and current (A) are not correct, the unit must not be connected to the mains supply.
3. Connect the grounding plug of the unit to a correctly grounded and fused outlet.
4. Make sure the connection line is not subjected to tensile or compressive force.

Permanent power connection

> **Note Refrigeration system start-up:**
> **When the unit is connected to the mains supply, the refrigeration system is started up automatically and the cooling phase is started!**
> **Note Expert work:**
> **Permanent connections must be established only by adequately trained and authorized electrical expert personnel.**

If the unit is connected to the mains supply using a permanent connection, the following must be observed:

- To allow an all-pole disconnection of the unit, a main switch must be installed between the unit and the mains supply.
- This main switch may be an appliance switch according to IEC 947-1 or a circuit breaker according to IEC 947-3.
- The main switch must be installed within the direct vicinity of the unit and always be accessible.

> **Note Lockable main switch:**
> **To prevent the unit from being switched on or off accidentally, the switch must be lockable both in the on and in the off state.**

Connecting the unit to the mains supply:

1. Turn the main switch on.
2. Secure the main switch against being switched off accidentally.

Start process

The start is performed automatically in two phases.
Phase I is used for precooling the second stage of the refrigeration system. Phase II is used to initiate the second stage of the refrigeration system and to cool down the interior chamber.
During these phases the alarm code **A00** is displayed.
The duration of the start process depends on the temperature within the operating room and may take up to eight hours. When the setpoint temperature is reached or after eight hours, the start process is completed (**A00** goes out).

> **Note** **Start cancellation:**
> **If the refrigeration system can not be started due to technical faults, a failure code is displayed after five attempts.**

Operation

Notes for storing specimen

CAUTION Injury hazard!

The temperatures within the interior chamber of the unit are extremely low. Contact with frozen metallic parts or particles may cause serious injuries of the skin or of the eyes.

When handling the freezer, wear protective gear!

- **Wear safety gloves.**
- **Wear safety goggles.**
- **Wear protective clothing on arms and legs.**

Before the specimen can be stored in the freezer the unit should work at setpoint temperature for 24 hours.
The heat entering the interior chamber when new specimen are stored causes a rise of the temperature in the interior of the freezer. Therefore, do not fill the unit completely at once but only successively. Do not fill more than one rack at a time, even when storing precooled specimen.
When filling the freezers, the door should not remain open longer than necessary.

The more heat is allowed to enter the freezer, the longer it takes before the setpoint temperature is reached again.

CAUTION Load capacity limit!
The load capacity of the freezers is limited. Exceeding the upper load limit may impair the stability of the unit.
Do not exceed the upper load limit!

For the upper load limit, please refer to section "Specifications"

Program functions

The unit is controlled solely by control panel inputs. First, the desired program function is selected, then the corresponding values are input. This section describes the selectable program functions and lists the possible set values or setting options. The sequence reflects the structure of the program menu.

Setpoint temperature:

The setpoint temperature is the constant temperature at which the stored samples or substances are to be cooled.
Mode display: tSEt
Settable value range: -50 °C to -86 °C

Upper alarm temperature (warm alarm):

The upper alarm temperature is the upper limit value that the temperature within the interior chamber of the unit is allowed to reach before a failure signal is issued.
Mode display: tAh
Settable value range: 1 K to 40 K above setpoint temperature.

Lower alarm temperature (cold alarm):

The lower alarm temperature is the lower limit value that the temperature within the interior chamber of the unit is allowed to reach before a failure signal is issued.
Mode display: tALo
Settable value range: 1 K to 40 K below setpoint temperature.

Backup cooling system setpoint temperature (optional):

The setpoint temperature of the backup cooling system is the limit value that the temperature within the interior chamber of the unit is allowed to reach before the backup cooling system is activated. The difference to the setpoint temperature at least 20K.
Mode display: tbuP
Settable value range: -30 °C to -70 °C

Backup cooling system enable/disable (optional):

The automatic activation of the backup cooling system can be enabled or disabled.

Mode display: **buP**

Setting options: on or off

Battery operation disable:

Battery operation allows operation of the program control if a power failure occurs or if the unit is disconnected from the mains supply. If a power failure occurs, the control is automatically switched to battery operation. When the unit is reconnected to the mains supply, the backup supply is enabled again automatically.
Battery operation may be disabled during the power isolation phase to prevent battery discharge.
Mode display: Accu
Setting options: off

Alarm delay:

The alarm delay allows setting a delay time. In case of a power failure, the alarm is triggered when this time has elapsed. This function prevents that an alarm will be triggered when only a short power interruption occurs.
The interior temperature however always has priority.
Mode display: *AdEL*
Settable value range: 0 to 240 minutes

Test run:

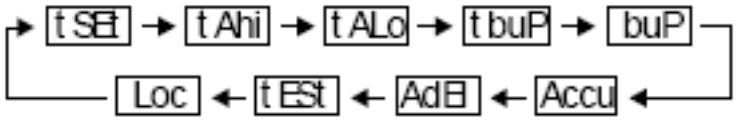
Use the test run to check the two displays (value display and mode display), the alarm indicator, the audible alarm sensors, the CO2 control and the battery for correct function.
When the test run is initiated, it performs the tests and is then completed automatically.
Mode display: *tESt*
Setting options: on

Keypad lock:

When the keypad is locked, values can not be changed at the display. The keypad lock prevents unauthorized persons from using the keypad for inputs.
Mode display: *Loc*
Setting options: on or off

Mode menu activation:

Pressing the MODE key activates the mode menu. By pressing the UP or DOWN key, you can browse through the mode menu.
tSEt is always the first mode displayed.



Default display: Value display

Per default, the value display shows the actual temperature within the interior chamber of the unit. While inputs are made or settings are changed, the current numerical value or the current setting option is displayed.

Alarm codes and failure codes:

Alarm codes and failure codes are indicated on the mode display.

Alarm codes:

Display: **A*****

All alarm codes have a specific numerical value. Each asterisk (*) represents an alarm code digit.

For a list of the alarm codes, please refer to section “Alarm codes” .

Failure codes:

Display: F**
All failure codes have a specific numerical value. Each asterisk (*) represents a failure code digit. For a list of the failure codes, please refer to section "Failure codes" .

Door or lid open:

Display: oPEn
The time elapsing after the opening of the door or of the lid is registered by the control system. After two minutes, a visual alarm (mode display oPEn) and an audible alarm (short signals) are triggered.
The oPEn display will go out as soon as door or lid is closed within the following two minutes. After four minutes, the chime sounds continuously, and the failure code F42 is displayed.

Condensor malfunction:

Mode display: cond
Excessive condensation temperature.

Limp-in mode:

Display: FAIL
If a failure occurs in the control or in the sensor system, the unit is switched to limp-in mode. In this case, the refrigeration system is switched from controlled operation to permanent refrigeration, and the interior temperature will cool down as far as possible.

Power failure:

Display: -
To save energy, only the short line is displayed. When the Set key is pressed, the actual temperature is displayed for three seconds.

CO_2 injection:

Mode display: inJ
If the backup cooling system is activated, the opening phase of the solenoid valve for injecting CO2 is displayed.

Program control

Automatic initialization of the program control on start (power connection)

No.	Proceedings	Operating steps	Typical display	Description
1.	Power connection		+ 1.8.8. 8. 8.8.8.8.	The program controls passes initialization. All indicators flash, the audible alarm chime sounds three times.
2.			3.13 d	The version number of the processor software is displayed. Display duration: 2 s.
3.			874 HF_	The parameter number of the parameter file is displayed. This number depends on the file version used. Display duration: 2 s.
4.			+25 A00	The actual temperature is displayed. A00 designates the state of the start process until the control phase is reached.

Setting the setpoint temperature - tSEt mode

No.	Instruction	Operating steps	Typical display	Description
1.	Activate mode	Press **Mode** key	-80 tSEt	The first mode (tSEt) is displayed. If no input occurs within 10 s, the actual temperature is displayed.
2.	Enable mode change	Press **Set** key	-80 tSEt	The value display flashes.
3.	Increase value	Press △ key	-84 tSEt	The value display stops flashing. The value is changed by one counter. Depressing the key for approx. 3 s will trigger a continuous, ascending counter sequence.
4.	Decrease value	Press ▽ key	-86 tSEt	The value display stops flashing. The value is changed by one counter. Depressing the key for approx. 3 s will trigger a continuous, descending counter sequence.
5.	Store mode change	Press **Set** key	-86 tSEt	The new value is stored. If the Set key is not pressed within 10 s, the original value is maintained.
6.	Exit menu	Press **Mode** key	+25	The actual temperature is displayed.

Setting the upper alarm temperature – tAHi mode (Top models only)

Note Interdependence of alarm temperature value and setpoint temperature:

The alarm temperature is input as an absolute value (Example below: -71 °C).
The value storage is relative to the setpoint temperature. If the setpoint temperature value is changed by one counter, the alarm temperature value will be changed accordingly by one counter.
The setting range of the alarm temperature value is limited by a difference of at least 1 K (Kelvin) to the setpoint temperature value.
If the setpoint temperature is set to -86 °C, the upper alarm temperature can be set to no more than -85 °C.

Factory setting: Setpoint temperature / tAHi +10 K

No.	Instruction	Operating steps	Typical display	Description
1.	Activate mode	Press Mode key	−86 tSEt	The first mode (tSEt) is displayed. If no input occurs within 10 s, the actual temperature is displayed.
2.	Select mode	Press △ key or Press ▽ key	−70 tAHi	The originally set value is displayed on the value display (upper). The selected mode is displayed on the mode display (lower).
3.	Enable mode change	Press Set key	−70 tAHi	The value display flashes.
4.	Increase value	Press △ key	−69 tAHi	The value display stops flashing. The value is changed by one counter. Depressing the key for approx. 3 s will trigger a continuous, ascending counter sequence.
5.	Decrease value	Press ▽ key	−71 tAHi	The value display stops flashing. The value is changed by one counter. Depressing the key for approx. 3 s will trigger a continuous, descending counter sequence.
6.	Store mode change	Press Set key	−71	The new value is displayed and stored. If the Set key is not pressed within 10 s, the original value is maintained, and the actual temperature is displayed.
7.	Exit menu	Press Mode key	+25	The actual temperature is displayed.

Setting the lower alarm temperature – tALo mode (Top models only)

Note Interdependence of alarm temperature value and setpoint temperature:

The alarm temperature is input as an absolute value (Example below: -96 °C). The value storage is relative to the setpoint temperature. If the setpoint temperature value is changed by one counter, the alarm temperature value will be changed accordingly by one counter. The setting range of the alarm temperature value is limited by a difference of at least 1 K (Kelvin) to the setpoint temperature value.
If the setpoint temperature is set to -86 °C, the upper alarm temperature can be set to no more than -87 °C.

Factory setting: Setpoint temperature/ tALo-5 K

No.	Instruction	Operating steps	Typical display	Description
1.	Activate mode	Press Mode key	−86 tSEt	The first mode (tSEt) is displayed. If no input occurs within 10 s, the actual temperature is displayed.
2.	Select mode	Press △ key or Press ▽ key	−95 tALo	The originally set value is displayed on the value display (upper). The selected mode is displayed on the mode display (lower).
3.	Enable mode change	Press Set key	−95 tALo	The value display flashes.
4.	Increase value	Press △ key	−94 tALo	The value display stops flashing. The value is changed by one counter. Depressing the key for approx. 3 s will trigger a continuous, ascending counter sequence.
5.	Decrease value	Press ▽ key	−96 tALo	The value display stops flashing. The value is changed by one counter. Depressing the key for approx. 3 s will trigger a continuous, descending counter sequence.
6.	Store mode change	Press Set key	−96	The new value is displayed and stored. If the Set key is not pressed within 10 s, the original value is maintained, and the actual temperature is displayed.
7.	Exit menu	Press Mode key	+25	The actual temperature is displayed.

Setting the backup cooling temperature – tbuP Mode (optional for Basic models)

Setting the backup cooling temperature determines the reference temperature that the backup cooling system uses.
Setting range: -30 °C to -70 °C, selectable in steps of 1 K.

Factory setting: - 60°C

No.	Instruction	Operating steps	Typical display	Description
1.	Activate mode	Press Mode key	-86 tSEt	The first mode (tSEt) is displayed. If no input occurs within 10 s, the actual temperature is displayed.
2.	Select mode	Press △ key or Press ▽ key	-65 tbuP	The originally set value is displayed on the value display (upper). The selected mode is displayed on the mode display (lower).
3.	Enable mode change	Press Set key	-65 tbuP	The value display flashes.
4.	Increase value	Press △ key	-60 tbuP	The value display stops flashing. The value is changed by one counter. Depressing the key for approx. 3 s will trigger a continuous, ascending counter sequence.
5.	Decrease value	Press ▽ key	-70 tbuP	The value display stops flashing. The value is changed by one counter. Depressing the key for approx. 3 s will trigger a continuous, descending counter sequence.
6.	Store mode change	Press Set key	-70	The new value is displayed and stored. If the Set key is not pressed within 10 s, the original value is maintained, and the actual temperature is displayed.
7.	Exit menu	Press Mode key	+25	The actual temperature is displayed.

Enabling/disabling the backup cooling system – bUP mode (optional for Basic models)

When this function is enabled, the backup cooling system will be activated as soon as the temperature within the interior chamber reaches the preset backup cooling temperature value.

No.	Instruction	Operating steps	Typical display	Description
1.	Activate mode	Press **Mode** key	−86 tSEt	The first mode (tSEt) is displayed. If no input occurs within 10 s, the actual temperature is displayed.
2.	Select mode	Press △ key or Press ▽ key	oFF bUP	The set switching state is displayed on the value display (upper). The selected mode is displayed on the mode display (lower).
3.	Enable mode change	Press **Set** key	oFF bUP	The value display flashes.
4.	Enable backup cooling	Press △ key	on bUP	The value display stops flashing as long as the key is depressed.
5.	Disable backup cooling	Press ▽ key	oFF bUP	The value display stops flashing as long as the key is depressed.
6.	Store mode change	Press **Set** key	oFF	The new setting is displayed and stored. If the SET key is not pressed within 10 s, the original value is maintained, and the actual temperature is displayed.
7.	Exit menu	Press **Mode** key	−86	The actual temperature is displayed.
Display while backup cooling is activated and during CO_2 / LN_2 injection				
			−65 , nJ	The injection solenoid is activated, the triggered mode is displayed in the mode display (lower).

Disabling battery operation – *Accu* mode

Battery operation allows the program control to remain operative while the power supply is interrupted. If the unit is to be shut down for an extended period of time (e.g. for service works), the battery operation should be disabled to prevent battery discharging. Battery operation can only be disabled in case of a power supply interruption. As soon as the power supply is reestablished, the battery operation will be enabled automatically.

No.	Instruction	Operating steps	Typical display	Description
1.	Disconnect unit from power supply, interrupt power supply	Remove power plug or turn unit off using the main switch	-	Display and chime issue the same alarm codes/signals as for a power failure.
2.	Activate mode	Press **Mode** key	-86 tSEt	The first mode (tSEt) is displayed. If no input occurs within 10 s, the actual temperature is displayed.
3.	Select mode	Press △ key or Press ▽ key	Accu	The set switching state is displayed on the value display (upper). The selected mode is displayed on the mode display (lower).
4.	Enable mode change	Press **Set** key	on Accu	The value display flashes.
5.	Disable battery operation	Press ▽ key	oFF Accu	The value display stops flashing as long as the key is depressed.
6.	Store mode change	Press **Set** key		Battery operation is disabled, and all indicators are off. If the Set key is not pressed within 10 s, the original value is maintained, and the actual temperature is displayed.

Setting the alarm delay – *AdEL* mode (Top models only)

The alarm delay allows the setting of a delay period after which the alarm is triggered in case of a power failure.
This function prevents alarms from being triggered if only a short power interruption occurs.
Setting range: 0 to 240 minutes, selectable in steps of 1 minute.

> **Note Usage of the alarm delay:**
> This function can also be used if a connected backup power supply is activated or deactivated.

No.	Instruction	Operating steps	Typical display	Description
1.	Activate mode	Press **Mode** key	−86 tSEt	The first mode (tSEt) is displayed. If no input occurs within 10 s, the actual temperature is displayed.
2.	Select mode	Press △ key or Press ▽ key	010 AdEL	The originally set value is displayed on the value display (upper). The selected mode is displayed on the mode display (lower).
3.	Enable mode change	Press **Set** key	010 AdEL	The value display flashes.
4.	Increase value	Press △ key	012 AdEL	The value display stops flashing. The value is changed by one counter. Depressing the key for approx. 3 s will trigger a continuous, ascending counter sequence.
5.	Decrease value	Press ▽ key	008 AdEL	The value display stops flashing. The value is changed by one counter. Depressing the key for approx. 3 s will trigger a continuous, descending counter sequence.
6.	Store mode change	Press **Set** key	008 AdEL	The new setting is displayed and stored. If the SET key is not pressed within 10 s, the original value is maintained, and the actual temperature is displayed.
7.	Exit menu	Press **Mode** key	−86	The actual temperature is displayed.

Activating a test run – tESt mode

The test run check the signals of the two displays, the alarm indicator, and the audible alarm system for normal operation.
When the backup cooling system is enabled, this function is tested by activating the backup cooling system once.

No.	Instruction	Operating steps	Typical display	Description
1.	Activate mode	Press Mode key	−86 tSEt	The first mode (tSEt) is displayed. If no input occurs within 10 s, the actual temperature is displayed.
2.	Select mode	Press △ key or Press ▽ key	oFF tESt	The switching state off is displayed on the value display (upper). The selected mode is displayed on the mode display (lower).
3.	Enable mode change	Press Set key	oFF tESt	The value display flashes.
4.	Activate test run	Press △ key	on tESt	The value display stops flashing as long as the key is depressed.
5.	Store mode change	Press Set key	+ 1.8.8 .8 tESt	The new setting is displayed and stored. The test run is started. If the Set key is not pressed within 10 s, the original value is maintained, and the actual temperature is displayed.
6.			+ 1.8.8 .8 tESt	During the test run, the following signals/codes are displayed: • The value display flashes twice • The mode display is on • The alarm indicator flashes twice • Audible chime on/off twice • Backup cooling is activated for 1 s if switched on, display inJ
7.			−86	After completion of the test run, the switching state of the test mode is automatically reset to oFF, and the actual temperature is displayed.

Locking the keypad – *Loc* mode (Top models only)

Locking the keypad will lock the entire control panel to protect it against unauthorized operation. If a person attempts to change values when the keypad is locked, the locking state is indicated by the display *Loc*.
Information are accessible even when the keypad is locked.

No.	Instruction	Operating steps	Typical display	Description
1.	Activate mode	Press **Mode** key	−86 *tSEt*	The first mode (*tSEt*) is displayed. If no input occurs within 10 s, the actual temperature is displayed.
2.	Select mode	Press △ key or Press ▽ key	*oFF* *Loc*	The switching state off is displayed on the value display (upper). The selected mode is displayed on the mode display (lower).
3.	Enable mode change	Press **Set** key	*oFF* *Loc*	The value display flashes.
4.	Lock keypad	Press △ key	*on* *Loc*	The value display stops flashing as long as the key is depressed.
5.	Store mode change	Press **Set** key	−86 *Loc*	The new setting is stored. The keypad is locked, values can no longer be changed. If alarm or failure codes are present, the status *Loc* will not be displayed. The keypad will also remain locked if the program control is reset. If the Set key is not pressed within 10 s, the original value is maintained, and the actual temperature is displayed.
Unlocking the keypad				
		Mode + ▽ depress simultaneously for 5 s	−86	An audible chime confirms the unlocking. Values can be changed again. The actual temperature is displayed.

Alarm codes

Alarm codes indicate a fault condition of the unit (malfunction from components of the cooling system or wrong operation, e.g. locking state of the door or of the lid). In addition to the alarm codes, the monitoring system performs a differentiated fault diagnosis. The results of this diagnosis are displayed as a failure code (see section “Failure codes I and II”). The alarm code in connection with failure codes ensures that faults can be easily located and repaired.
The alarm codes are displayed on the mode display.

> **Note Repairing faults!**
> If a fault can not be repaired using the measures described below, record the alarm code and contact Technical Service.

Alarm codes

Display	Description	Possible cause	Possible repairs / Notes
–	Battery supply activated	• Power supply interrupted	• Reestablish power supply
A00	Unit is started up		• Display goes off automatically after start-up has been completed (max. 8 h)
A04	Condenser temperature not within alarm limits	• Insufficient cooling • Excessive ambient temperature • Filter mat / condenser dirty	• Check wall clearance • Check ambient temperature and decrease as required • Clean filter mat/ condenser
A07	Intermediate cooler temperature not within alarm limits	• Unit is started up	• Display goes off automatically after start-up
A11	Compressor stage 1 overpressure	• Excessive ambient temperature on start-up	• Check ambient temperature
A15	Battery monitoring	• Battery voltage below lower limit	• Check power supply • Battery will be recharged after power supply has been reestablished
oPEn	Door/lid monitoring	• Door/lid open for more than 2 min	• Close door/lid

Failure codes

Failure codes are displayed as a result of the self diagnosis of the monitoring system. The program control microprocessor automatically monitors the selected configuration of the unit and the appropriate stored values. Any deviation from the values set by the operator or by the manufacturer are detected and indicated as failure codes.
The alarm codes are displayed on the mode display.

> **Note Repairing faults!**
> If a fault can not be repaired using the measures described below, record the alarm code and contact Technical Service.

Failure codes

Display	Description	Possible cause	Possible repairs / Notes
cond	Excessive condenser temperature	• Insufficient cooling • Excessive ambient temperature • Filter mat/condenser dirty	• Check wall clearance • Decrease ambient temperature • Clean filter mat/condenser
FAIL	Invalid measuring value	• Faulty temperature sensor	• Contact Technical Service
F00–F12	Program monitoring routines	• Control component malfunction	• Contact Technical Service
F13	Power failure	• Power failure occured	• Check power supply
F20	Actual temperature sensor fault	• Measuring circuit fault	• Contact Technical Service
F24	Condenser sensor fault	• Measuring circuit fault	• Contact Technical Service
F27	Intermediate cooler fault	• Measuring circuit fault	• Contact Technical Service
F29	Actual temperature not within alarm limits	• Newly stored specimen cause temperature rise • Door open too long • Faulty door seal • Excessive ambient temperature • Faulty refrigeration system	• Check alarm limit settings, allow device to cool down • Close door • Check seals • Decrease ambient temperature • Contact Technical Service
F36	Intermediate cooler temperature not within alarm limits	• Insufficient cooling • Excessive ambient temperature • Filter mat/condenser dirty • Insufficient cooling of stage 1	• Check wall clearance • Decrease ambient temperature • Clean filter mat/condenser • Contact Technical Service

Note – Repairing faults!
If a fault can not be repaired using the measures described below, record the alarm code and contact Technical Service.

Failure codes

Display	Description	Possible cause	Possible repairs / Notes
F39	Compressor 1 overpressure	• Alarm A11 occured five times within 24 h	• Check wall clearance • Decrease ambient temperature • Clean filter mat/condenser • Contact Technical Service
F42	Door/lid monitoring	• Door/lid open more than 4 min • Faulty switch	• Close door/lid • Contact Technical Service
F47	Backup cooling system supply	• Insufficient CO2 supply • Valve closed • Faulty pressure switch	• Connect full cylinder • Open valve • Contact Technical Service
F48	Backup cooling system activated	• Interior chamber temperature reached backup cooling temperature value • Newly stored specimen cause temperature rise (e.g too many specimen or specimen too warm) • Door/lid open too long • Power supply interrupted • Faulty refrigeration system	• Check backup cooling temperature setting • Check load, allow unit to cool down • Allow unit to cool down • Check power supply • Contact Technical Service

Shut-down

Unit shut-down

Remove all stored specimen and substances.

Units with power plug:

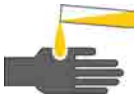
1. Remove the plug from the outlet.
2. Switch the battery off.
3. Remove the condensate from the interior chamber by using absorbent tissues.

Units with permanent connection:

1. Switch off the main switch.
2. Switch the battery off.
3. Collect the condensate in the interior chamber with absorbing tissues.

Reconditioning

Cleaning



CAUTION Solvent:

Several components of the unit are made of plastics that can be dissolved by solvents. Powerful acids and lyes can cause embrittlement of the plastic material.
For cleaning the unit, do not use solvents containing hydrocarbon, agents with an alcohol content of more than 10% and powerful acids or lyes!

- **Clean the unit using a solution of conventional dishwashing agent and water.**

Cleaning prior to the initial start-up and basic cleaning:

1. Turn the unit off and wait until the temperature of the interior chamber corresponds with the temperature of the operating room.
2. Clean the interior and the exterior of the unit using a solution of conventional dishwashing agent and lukewarm water.
3. Dry the unit thoroughly.

Note Encapsulated dirt

Dirt particles may become encapsulated which may result in unit components not being sterile after the disinfection.

- Remove stubborn deposits with dishwashing agent.
- Dry cleaned unit components immediately to prevent germ growth.

Cleaning during the operation of the unit:

1. Clean only the exterior of the unit using a damp cloth.
2. After the cleaning, dry the unit thoroughly.

Removing ice from the door seal:

Wear protective gloves!

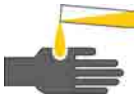
1. Carefully tap or scratch off ice from the door or lid seal using a blunt instrument.
2. Rub dry using a dry and absorbent tissue.

Disinfection

CAUTION Health hazard:

Disinfectants may contain harmful substances that may cause injuries when they come in contact with skin or eyes or that may harm the respiratory system when inhaled.
Observe the safety instructions!

- **Protect skin and eyes and observe the hygiene regulations when handling disinfectants.**
- **Observe the instructions of the disinfectant‘s manufacturer.**



CAUTION Plastic components:

Several components of the unit are made of plastics that can be dissolved by disinfectants with a high alcohol content.
For disinfection, do not use agents with an alcohol content of more than 10%!

1. Disinfection prior to the initial start-up and after the basic cleaning:
2. Before the disinfection, clean the unit thoroughly. Perform wipe disinfection only. Wipe the unit clean with disinfectant and allow the disinfectant to react according to the manufacturer’s instructions.
3. Dry moist residues on the unit with a clean cloth.

Maintenance

Warranty

Note Warranty:

The manufacturer warrants the operational safety and the proper functions of the unit only under the conditions that:

- the unit has not been modified,
- only original spare parts are used,
- all repairs are carried out by adequately trained and qualified personnel,
- inspections are performed at the specified intervals.

Note Service contract:

Thermo Fisher Scientific offer a service contract for the unit that comprises all the required inspections and maintenance works.

Annual inspection

To ensure the functionality and the operational safety of the unit, an annual inspection must be performed by Thermo Fisher Scientific Service or by authorized service personnel.

The annual inspection comprises the following test areas:

- Electrical safety according to the national regulations.
- Technical function test of the unit.
- Checking the unit seals
- Checking the components for damage.
- Cleaning of the condenser.

Note Function test:

If safety devices were removed or deactivated during service or repair works, the unit must not be started up before the safety devices have been reinstalled and checked for normal operation.

Periodic maintenance

During the operation of the unit, the following inspections and maintenance works have to be performed **periodically**:

- Cleaning of the filter mat. When the mat is visibly dirty, it must be cleaned.
- Cleaning of the fins on the condenser. When dust deposits are visible, the fins must be cleaned.
- Checking of the display functions of the control panel using the tESt mode.

Note **Cleaning works:**

When cleaning the filter mat and for maintenance works or when cleaning the condenser fins, it is not required to switch the unit off.

CAUTION **Cut hazards!**

The condenser fins have sharp edges that may cause cut wounds.
Always wear safety gloves!

Service of the air filtering system, Thermo Scientific TS Series models

1. The filter bezel [6] is retained with four bayonet locks [5]. Rotate the retaining screws so that the slots are in a horizontal position and remove the filter panel.
2. The filter mat [4] is retained in the bezel with pretensioned wire straps [3]. Remove the wire straps, then remove the filter mat.
3. Clean both sides of the filter mat using a vacuum cleaner or wash the mat. The filter mat must be replaced if it is extremely dirty.
4. Carefully clean the fins [2] of the condenser using a soft brush or a vacuum cleaner.
5. Insert the filter mat into the filter bezel and secure it using the wire straps.
6. Install the filter bezel, then push the retaining screws into the receptacles [1] and rotate them so that the slots are in a vertical position.
7. Check the filter bezel for secure installation.

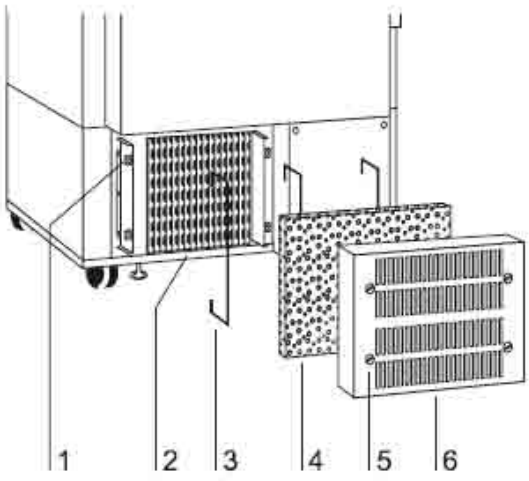


Fig. 10-1 Air filtering system, Thermo Scientific TS Series models

Repairs

CAUTION **Repairs:**
The operator is only allowed to replace parts that are listed in the spare parts list (page 11-1).
All other repairs must be carried out only by Thermo Electron LED GmbH or by authorized service personnel.

Replacement of the unit seals

1. Grab seal at one end and pull it out of the rail evenly using some force.
2. Press all four corners of the new seal into the rail, then tap them carefully into the rail using a plastic hammer.
3. Next, starting from the center, insert the two narrow edges of the seal. Press in manually first, then tap in carefully using the plastic hammer.
4. Then, starting from the center, insert the two longitudinal edges of the seal. Press in manually first, then tap in carefully using the plastic hammer.
5. Check seal for firm seating by trying to lift it slightly around the entire circumference.

Note **Replacement of the unit seal:**
To ensure correct sealing, the **cabinet** seals should always be replaced in pairs. For the replacement of the seals, it is **not** required to switch the unit off.

Spare parts

List of consumables and spare parts

Note **Repairs:**

Use only original spare parts tested and approved by Thermo Fisher Scientific Products. The use of other spare parts presents potential hazards and will make the warranty void. When ordering spare parts, please hold the unit specifications of the nameplate ready.

Spare parts Consumables	TS586e
Filter mat	50062116
Outer door seal (1 pc.)	50053887
Inner door seal (1 pc.)	50072834
Recording paper 1 day (100 pcs.)	50059202
Recording paper 7 days (100 pcs.)	50058997
Pen (5 pcs.)	50058998
Spare appliance key	50059977
Spare key for chart recorder (4 pcs.)	50059203
Operating instructions	50125800

Specifications

Dimensions and weights

		TS 586e	Units
Dimensions			
Outer:	Width	920	mm
	Height	1970	mm
	Depth (Top)	1035[1]	mm
	Depth (Basic)	1005[1]	mm
Inner:	Width	610	mm
	Height	1300	mm
	Depth	645	mm
	Volume	510	Liter
Inside door dimensions for moving [3]:	Width	845	mm
	Height	1970	mm
Minimum distance between unit and adjacent surfaces::	Left	200	mm
	Right	200	mm
	Top	100	mm
	Front	850	mm
	Rear	80	mm
Weights			
Freezer without load:		313/310	kg
Maximum load weight:		200	kg
Gross weight:		510	kg
Load capacity per shelf:		40	kg
Number of shelves:		4	piece

[1] including 80 mm spacer and 30 mm control panel
[3] Cabinet door, front trim panel, spacer can be removed by expert personnel.

Refrigeration system and ambient conditions

	TS 586e	Units
Refrigeration system		
Construction:	Single-stage cascade	
Operating temperature:	-50 to -86	°C
Temperature deviation, spatial:	-1,0 / + 3,0	K
Temperature stability in the specimen[1]	< ± 0,5K	K
Stage 1		
Refrigerant:	R 290	
Refrigerant quantity:	0,145	kg
Allowable operating overpressure:	23	bar
Stage 2		
Refrigerant:	R 170	
Refrigerant quantity:	0,077	kg
Idle pressure:	~7,6	bar
Allowable operating overpressure:	24	bar
Ambient conditions		
Required free room volume:	7,7	m^3
Temperature class (ISO 7371):	N	
Ambient temperature range:	+16 to +32	°C
Air humidity:	80 max.	% r.H.
Height of place of location:	2000 max.	m N.N.

[1] air-cooled, at setpoint temperature of -86 °C and room temperature of +25 °C

Electrical system

	TS 586 e	Units
Electrical system		
Rated voltage:	1/PE AC. 230 ± 10%	V
Rated frequency:	50 Hz	Hz
Power consumption[1]:	600/450	W
Power consumption nominal rated[2]:	1500	W
Current:	6,3	A
Energy consumption[1]:	14,4/10,7	kWh/24h
On-site individual protection:	Circuit breaker, 16 A – Characteristics B or fusible link T 16 A	
Electromagnetic compatibility:	according to EN 61326-1	
Type of protection (DIN 40 050):	IP 20	
Safety class:	I	
Protective measures:	Ground terminal	
Pollution severity (IEC 1010):	2	
Overvoltage category (IEC 1010):	II	
Noise level		
Sound pressure level (DIN 45 635 T.1)	< 49	dB (a)

[1] air-cooled, at setpoint temperature of -86 °C / -80°C and room temperature of +25 °C
[2] air-cooled, max. power consumption during cooling down phase and room temperature of +25°C

Materials used

Components	Materials
Exterior housing	Zinced steel, partially powder-coated
Interior housing, shelves, interior components	Stainless steel
Foam isolation	Polyurethane foam (PUR) CFC-, HCFC-, and HFC-free
Outer door seal	Polyvinylchloride (PVC) with magnetic insert
Inner door seal	Silicone
Pipes	Copper
Plastic components	Polyamide (PA) or Acrylnitrile-butadiene-styrene (ABS)
Electronic components	Electric components coated with various plastics, installed on boards with epoxy resin enclosure
Electric lines	Plastic-coated copper conductors
Control and indicator foil	Polyester
Compressor lubricant (Stage 1)	Alkylbenzene
Compressor lubricant (Stage 2)	Alkylbenzene
Refrigerant	R 290, R 170

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 Fisher Scientific 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 Fisher Scientific`s compliance with these Directives, the recyclers in your country, and information on Thermo Fisher Scientific products which may assist the detection of substances subject to the RoHS Directive are available at **www.thermo.com/WEEERoHS**.

Connection to an external monitoring system

Compatible circuits

Note Expert work:

Thermo Fisher Scientific warrants the operational safety and efficiency of the unit only if installations and repairs are carried out professionally. The unit must be connected to an external monitoring system only by trained and authorized expert electrical personnel!

The units are equipped with a potential-free alarm contact for the connection to an external monitoring system, e.g. phone system, building management system, etc.
The alarm contact is activated by the unit control when failure signals are issued.
The characteristic requirements of the external circuits are described in the table.

Circuit	Voltage	External protection
SELV circuits	33 V ~ max.	2 A max.
	70 V = max.	1 A max.

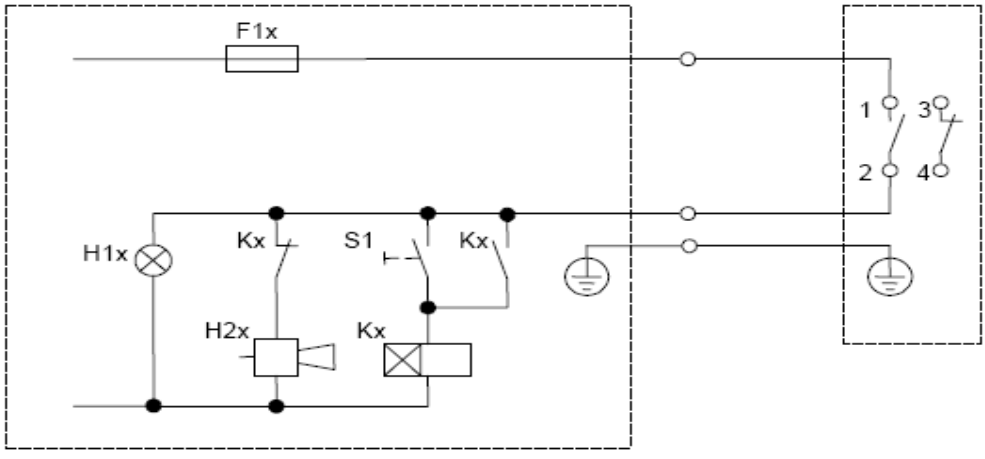


Fig. A-1 Typical wiring diagram for an external monitoring system

Connection to the unit

WARNING **Electric shock:**

Contact with current-carrying components may cause a lethal electric shock. Prior to the installations, isolate the monitoring system from the mains supply!

Installing the connection to the unit:

The junction box is located at the rear side of the unit.
The cover is clamped to the junction box.

1. Insert a screwdriver between the cover [1] and the strain relief [2] and slightly push the cover up to separate it from the junction box.
2. Tilt the cover up.
3. Remove the screw [4] and open the strain relief. Insert the connection line and connect the individual wires as shown in Fig. A1 (wiring diagram) to the terminals [3].
4. Secure the strain relief using the screw.
5. Install the cover and push it toward the junction box until it is properly engaged.

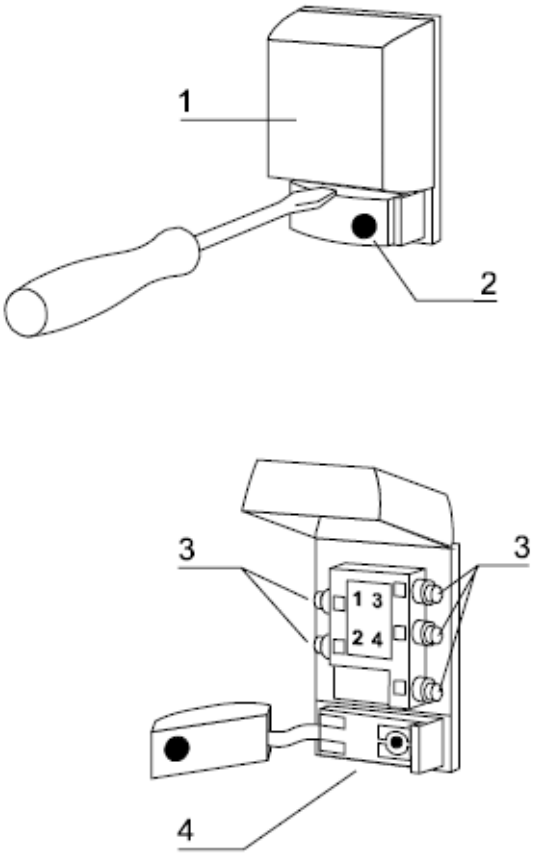


Fig. A-2 Connection to an external monitoring system

Optional circular chart recorder

The circular chart recorder is used to record the interior temperature of the freezers. The temperature conditions can be recorded and filed in daily or weekly intervals, depending on the configuration of the circular chart. Circular charts for daily intervals are available accessories.

Circular chart recorder configuration

1. **Fig. B-1:** Fold the pen carrier [1] up.

> **Note Plug-in connection!**
> **The drive is plugged into the support plate. No tools are required to remove the drive!**

2. Pull the drive [3] out of the chart recorder housing.
   To remove the support plate, grab the drive at the knurled screw [2] and carefully shake it loose.
3. Move the drive speed selector switch [6] into the desired position (24 h or 7 day interval).

A battery (IEC R 13, 1.5 V) supplies the circular chart recorder with power.

> **Note Battery characteristics!**
> **Use only leak-proof batteries.**
>
> - Insert the battery [5] into the holder [4]. Make sure the polarity is correct.
> - Install the drive to the support plate of the chart recorder housing.

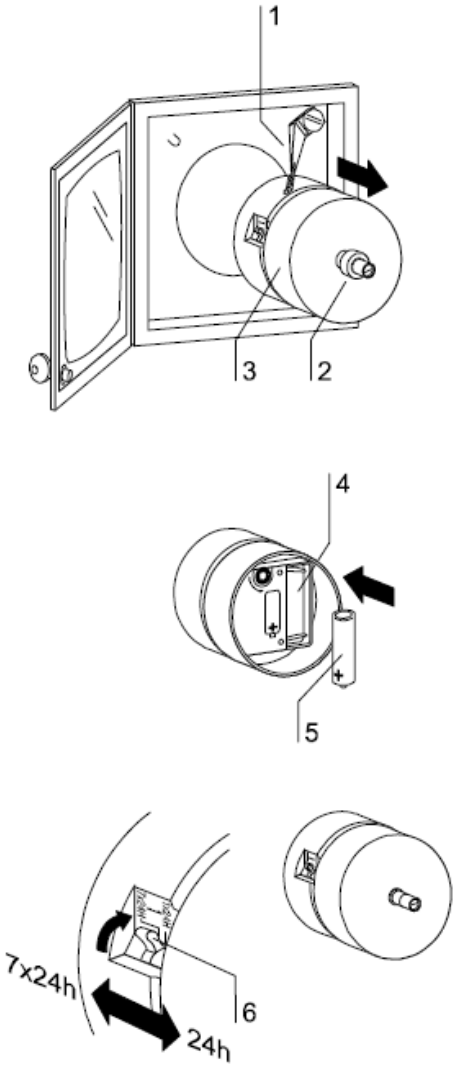


Fig. B-1 Removal of the drive

Recording the temperature

The circular chart recorder may be equipped with circuit charts for daily or for weekly intervals.

Installation of the circular chart

- Fold the pen carrier [6] up.
- Remove the knurled screw [4].
- Push the circular chart [3] onto the drive spindle [5] while making sure that the chart is located underneath the two diagonal guides [1].

> **Note Pen tip!**
> **Do not touch the pen tip!**

Installation of the pen

- Remove the protective cover [8] of the pen [7] by simultaneously rotating and pulling the cover.
- Carefully push the pen onto the support rail [9] of the pen carrier until it reaches the stop.
- Fold the pen carrier down onto the circular chart.

Adjustment of the pen carrier

- Read the actual temperature displayed on the control panel.
- Compare the temperature value with the recording position of the pen carrier on the circular chart.
- If there is only a slight difference between the recording position and the actual temperature (4-5%), the pen carrier can be adjusted; otherwise, the recorder must be readjusted by the manufacturer.
- Remove the pen carrier axle screw [2] using a screwdriver and rotate the pen carrier to the correct position.
- Retighten the axle screw.
- Rotate the circular chart until the pen is at the position for the current day and/or the current time.

- Secure the circular chart to the drive spindle and slightly tighten the knurled screw [4].

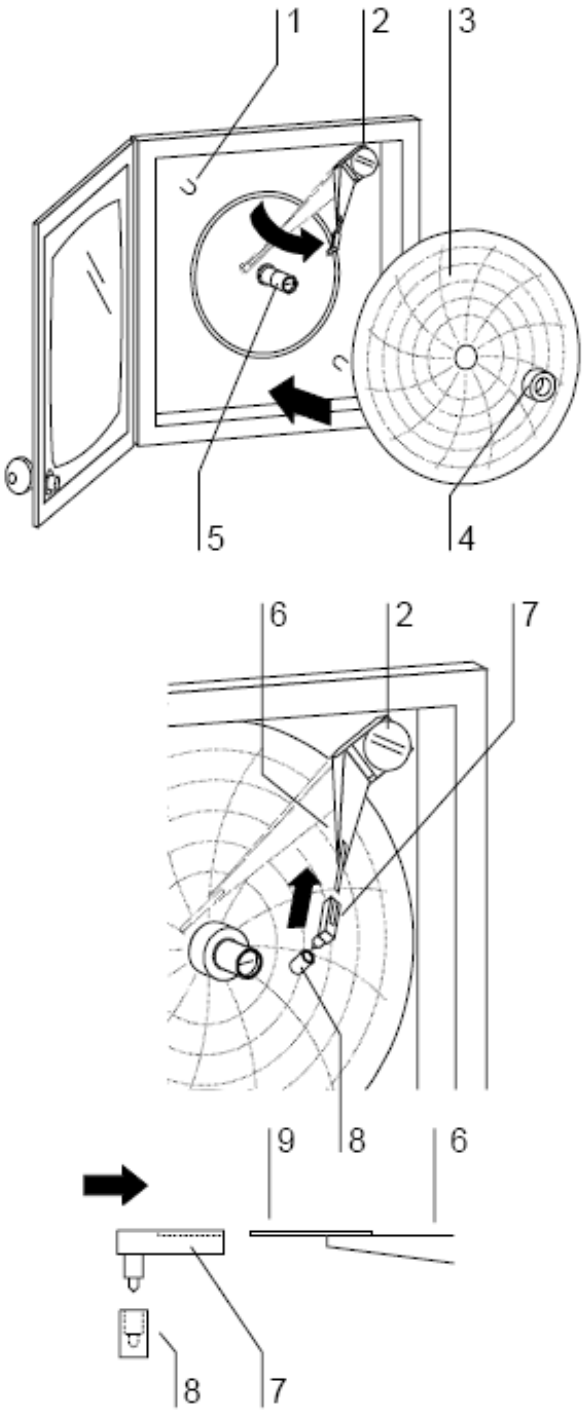


Fig. B-2 Installation of the circular chart

RS 232 interface protocol

General information

For connecting the unit to a PC, a RS 232 connection line with 1:1 contacts is required.

For the communication between the PC and the control unit of the freezer, the following settings are required:
9600 Baud, 8 data bits, 1 stop bit, no parity.

Telegram structure

Communication is carried out using a master/slave concept. The PC transfers a command, the control unit executes the command and responds immediately.

All telegrams are terminated with a carriage return.

The desired commands are requested by the PC using a telegram with the following structure:

?00 'Command' <CR>

The control unit responds using a telegram with the following structure:

!00q 'Status Data' <CR>

List of commands

Reading the interior temperature in real / float format:

Command:	TIL00
PC telegram:	?00TIL00 <CR>
Control unit telegram:	!00qsRxxxxxxxx <CR>
(Status s:	0 = Temperature is registered
	x = Temperature is not registered)

The data bytes xxxxxxxx correspond with the interior chamber temperature stored as a REAL number; for each byte of the REAL number, two ASCII characters are transferred.
Please note that for the further processing of the temperature, the microprocessor will process the bytes in reversed order as compared to the PC; therefore, the order of the 4 bytes must be reversed.

Example:
!00q0RC2A7E148 <CR>

INTEL format:	0xc2 0xa7 0xe1 0x48
Dos format:	0x48 0xe1 0xa7 0xc2

-83.94 °C

Pt 100-Connection

Connection requirements

The Pt 100 terminal is used for the connection of external instruments for documentation of the interior temperature.

> **CAUTION Electrical safety!**
> Connect only power sources / measuring amplifiers whose power supply results from a safety circuit!

Connect the external instrument according to the pin assignment as shown in Figure D 1.

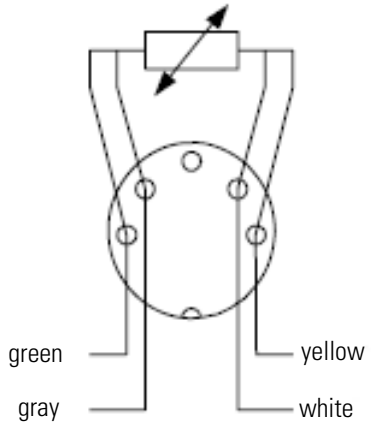


Fig. D-1 Connection line pin assignment

Water cooling

Unit function

Water cooling

The condenser of the refrigeration system is coupled with the cooling circle. The heat energy from the condenser is dissipated by the cooling water so that the heat release to the unit's surroundings is minimized; heat recovery is possible.

The units are equipped with a pressure-operated cooling water flow control so that cooling water only flows when required.

Coolant

Brines may be used as coolant if they are suited for this purpose.
The factory settings of the units and the specifications listed in these operating instructions apply if water is used as coolant.

Start-up

CAUTION Water damage!
Prior to the installation, make sure that the cooling water supply is disabled.
Check the installation for leak tightness.

On-site installation

Check to see if the installation is in accordance with the requirements listed in Specifications.
The lines for the cooling water outflow and inflow must be equipped with shut-off valves.

If the cooling water supply is achieved with recooling units, an overflow valve between outflow and inflow is required. The valve setting depends on the pump displacement; however, it should not exceed 3-4 bar.

As bacteria m ay grow at elevated inflow temperatures (> 25 °C), appropriate filters must be installed. For recooling units, growth inhibitors can be used. To prevent the growth of algae on exposure to light, do not use transparent hoses.

Filter

If a filter is installed in the cooling water supply line, the filter capacity must correspond with the required flow volume.
Brines used as coolant must not be contaminated.
Check the filter for contaminations at regular intervals.
Contaminated filters may impair the correct function of the refrigeration system and cause failures.

Connecting the unit

The connections for the cooling water supply are located at the rear of the unit.

The hose connections are common size G screw connections (3/4 in.) with 1/2 in. hose nozzle.

The hoses must be secured to the hoze nozzels using hose clamps.

The cooling water supply hoses must have a pressure resistance of at least 20 bar. Do not use PVC hoses with textile insert.

A hose set (2 meters) is an available accessory.

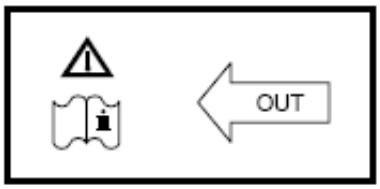


Fig. E-1 Cooling water outflow connection

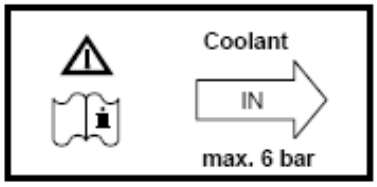


Fig. E-2 Cooling water inflow connection

Operation

Enabling the cooling water supply

Before operating the unit, the outflow and inflow shutoff valves must be opened.

Further settings at the unit are not required.

Shut-down

Disabling the cooling water supply

For shutting the unit down, proceed as described in the operating instructions of the unit.

In addition, the cooling water supply must be disabled

Spare parts an accessories

Repairs:

Use only original spare parts tested and approved by Thermo Scientific Products. The use of other spare parts presents potential hazards and will make the warranty void. When ordering spare parts and accessories, please hold the unit specifications of the nameplate ready.

Accessory	Order no.
Hose set: Hose (1/2 in.), 2 m each for cooling water outflow and inflow	50060770

Specifications

Dimensioning of the cooling water supply

	TS 586ew	Units
General		
Connections	G 3/4AG – G1/2 IG	inch
Inflow pressure	2 to 6	bar
Inflow temperature	6 to 25, ideal ca' 18	°C
Outflow temperature	ca +27	°C
Closed cooling water circles		
Pump flow volume	> 300	L/h
Differential pressure	min. 0.5	bar
Flow control pressure drop	0.1	bar
Condenser pressure drop	0.05	bar
Cooling water supply with ring line		
Overflow valve setting	max. 3 to 4	bar

Flow volumes

	TS 586ew	Units
Inflow temperature +12 °C, outflow temperature +27 °C, unit in control mode		
Setpoint temperature – 50 °C	10	L/h
Setpoint temperature – 86 °C	14	L/h
Inflow temperature +18 °C, outflow temperature +27 °C, unit in control mode		
Setpoint temperature – 50 °C	15	L/h
Setpoint temperature – 86 °C	20	L/h
Inflow temperature +25 °C, outflow temperature +27 °C, unit in control mode		
Setpoint temperature – 50 °C	75	L/h
Setpoint temperature – 86 °C	95	L/h

Refrigeration system

Specifications differing from the unit's operating instructions for units with water cooling:

	TS 586ew	Units
Refrigeration system		
Stage 1		
Coolant	R 290	
Coolant volume	0.135	kg

Principals of good microbiological proceedings[1]

General information

Keep windows and doors at the place of location closed while carrying out work.
Do not drink, eat or smoke in the working rooms.
Do not store food in the work area.
Wear laboratory frocks 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.
Vermins must be exterminated at regular intervals, as required.

For the handling of disease agents, the following principles apply additionally:
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 closed 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 means.

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 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 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.

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)[1] 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.

For the handling of humano- and livestock pathogenic biological agents, the following general directives apply:
For handling humanopathogenic biological agents, a permission according to the German Federal Epidemic Act or equivalent local legislation is required.

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

[1] Reference: BGI 630 of the trade association of the German chemical industry

Unit log

Note **Unit log**
Record nameplate information, work carried out, maintenance work, and repairs here.

Unit type:	Order number:
Serial number:	Service number:
Location:	Operator's notes:

Work carried out	Notes	Date	Signature