

-°cool expert MIC QKL mini 2



**For the benefit of the customer
In harmony with the environment**

Cooling system intelligence

Management Information Control (MIC)

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Installation and operating manual

Cooling controls from Cool Expert have the highest internationally recognized level of automation. The MIC QKL mini cooling control is the product of consistent further development of the KÜBATRON QKL 2B/T multifunction control, which also originated from the innovative genius of Cool Expert. The MIC QKL mini 2 is the ideal solution for all your needs in commercial refrigeration. The mini is particularly impressive in its easy operation and versatility of use in chest refrigerators and freezers as well as in cold rooms and freezer rooms. The MIC QKL mini 2 is a self-optimizing control with autoadaptive defrost detection at the best time in terms of energy. When the line for the temperature sensors is extended, compensation of the resistance is done automatically by means of the three-wire measurement technique even over longer distances. All setting and adjustment work can basically be dispensed with. A refrigeration system equipped with MIC QKL mini 2 is controlled and monitored by a knowledge-based algorithm around-the-clock without any interruption, detects changes in the operating state and manages the system at the operating point that is currently best in terms of energy. The potential savings in energy expenses using a MIC QKL mini 2 have been proven to be at 20% compared to state-of-the-art technology.

Room temperature control:

The MIC QKL mini 2 is suitable for control with one or two sensors, depending on the application. With only one temperature sensor in the cooler block as the sole reference variable, MIC QKL mini 2 performs the same tasks as its predecessor KÜBATRON QKL 2 B/T. Dual sensor control, in connection with the optional LON transceiver and a recorder, satisfies the hygiene directive for quality assurance of chilled goods according to HACCP (detection of room temperature using a proprietary sensor provided for that purpose). The dual sensor control is also indispensable in refrigerated cabinets and in the case of re-circulating air defrosting.

Air cooler fan management:

Prior to beginning the actual cooling process, the energy stored in the cooling block (from the formation of frost and ice) is supplied to the cold room by specifically advancing the fan. This air cooler fan control patented by Cool Expert also became known under the name latent heating. Frost and ice formation on the grille of the air cooler is reduced by the effect of sublimation. The defrosting processes are reduced considerably compared to state-of-the-art technology. Another benefit of the sublimation effect lies in the fact that the goods to be chilled lose less moisture. The relative air humidity is increased by at least 10%. In order

to prevent water drops from breaking away, the start of the cooler fan is time-delayed after each defrosting process.

Defrost detection:

- *Adaptive Dynamic Detection (ADD)* The defrost detection takes place at the best time in terms of energy according to the performance measurement principle. Two sensors (air inlet and cooler block temperature) are required for this. A defrost process is automatically initiated if the cooler experiences a reduction in performance of more than 5% due to frost and ice formation.
- *Load Integral Detection (LID)* Defrost detection takes place here similar to the ADD procedure described above; however, it takes into account the expected medium humidity level. Only LID defrost detection is possible in the case of the one-sensor control. This procedure can also be configured for the dual sensor control.

Defrost management:

A patented autoadaptive defrost management controls the electric defrost heating, the recirculating air defrosting and the hot gas defrosting. The defrost end temperature is calculated autoadaptively. The heat content of the given defrosting medium is the basis for calculating the defrost end temperature. Drain down time is mandatory after the defrost process has been completed. The defrost end temperature can also be set by hand for electric defrosting.

Fault management:

An autoadaptive early warning system monitors the performance of the coolers and constantly checks the availability of the refrigeration system. A message follows in the event of a fault. Up to 14 faults and two messages can be documented in a unique diagnostic system.

Two freely configurable digital inputs can be switched for various tasks:

Adjustable switch-off time and switch-on temperature of the cooling plant when opening the door, adjustable increase or decrease of the setpoint with or without defrost suppression, external defrost suppression or external defrost request, external standby in case of load shedding, cooling request or if the defrost locking mechanism is in effect, for example.

Communication:

Optional LON transceiver as the communication interface for data transmission in both directions.

Technical Specifications

Setpoint temperature adjusting range	-50 to 50 °C / -58 to 121 °F, in increments of 0.1 K/0.5 °R
Switching hysteresis	± 0.5 K / 0.9 °R adaptive from setpoint
Control accuracy	± 0.3 K / 0.7 °R from setpoint
Supply voltage	24 V ± 20 % AC/DC 3 VA
Ambient temperatures	in storage -50 to 70 °C / -58 to 158 °F during transport -50 to 70 °C / -58 to 158 °F in operation -20 to 55 °C / - 4 to 131 °F
LED display	7- segment display with 7 function messages
Measuring range	-60 °C / -76 °F to 60 °C / 140 °F
Resolution	0,1 K / 0,5 °R

Sensors	2 x MIC Sensor Pt1000 for three-wire measurement technique
EMV Specification	for industrial use according to EN50081-1 and EN50082-1
Software class	Class A
Outputs	4 relay outputs, 3 NO contact, 1 changeover switch, max. switching capacity 8(3) A 250 V AC
Inputs	2 digital inputs, contact current > 2 mA, shading only by means of floating contacts
Protection class II	When installed properly
Connecting terminals	terminal screws with lifting system 4 mm ²
Communication	optional plug-in LON transceiver FTT10A

Safety and work instructions

General safety instructions:

Cool Expert shall not under any circumstances assume liability or responsibility for damage resulting from improper installation or use of the control or accessories.

Functional warranty only in connection with sensors from Cool Expert (MIC Sensor Pt1000).

Appropriate safety devices are provided which switch off the system components connected to the control in the event of a fault.

Never attempt to open or repair the MIC QKL mini 2 control.

Observe the local and national standards and regulations when installing the MIC QKL mini 2 control.

The MIC QKL mini 2 is supplied with a protective low-voltage of 24 V AC/DC. The transformer required for this must comply with the EN 61558-2-6 or EN 61558-1.

Work instructions:

Electrical installation

Prior to beginning all work on the MIC QKL mini 2 control, disconnect the device from the mains and secure it from switching on again inadvertently!

As a matter of principle, electrical installations are to be carried out by authorized specialist companies only. The VDE 0100/0700 and DIN 8975 Part 7.33 as well as the provisions of the local electric power utility and all other safety and protection regulations, including the performance specifications of the components connected, must be observed.

A separator with a contact opening width of at least 3 mm / 0.12 in must be fitted at each pole (main and service switch).

Following the appropriate electrical installation or inspection work, the safety measures must be checked according to the applicable guidelines.

For use in potentially explosive rooms, the applicable guidelines for this must be observed. The MIC QKL mini 2 control must be installed outside potentially explosive areas.

For electric defrosting, a safety temperature limiter is provided for switching off the defrost heating in the irregular case.

General instructions and information on working with the MIC QKL mini 2

The MIC QKL mini 2 works as a self-optimizing multifunction control which saves and evaluates data by means of its sensors. All functions originating from the MIC QKL mini 2, such as cooling request, air cooler fan management and defrost, must be executed and ended by the control without any restrictions. The above-mentioned functions must neither be bridged nor interrupted by components from other manufacturers. Interruptions to the control functions listed above are assessed by the MIC QKL mini 2 as a fault.

The control is not limited to certain heat transfer media and can be used in direct expansion, CO₂, pump operation, NH₃ and dual-circuit refrigeration systems.

Emergency programs provided in the control protect valuable chilled goods in the event of a fault. Even in the case of total failure of both sensors, an emergency running function for the cooler fan and cooling request is maintained depending on the setpoint temperature.

One MIC QKL mini 2 control and a maximum of three air coolers

For smaller refrigeration systems with an overall refrigerating capacity of up to 6 kW, a maximum of three air coolers installed in one room can also be operated in parallel with one MIC QKL mini 2 multifunction control. In the case of electric defrosting, all the coolers are equipped with a safety temperature limiter.

Requirement for correct defrost detection

The MIC QKL mini 2 can only initiate a defrost process at the best time in terms of energy if the cooling process begins immediately after its cooling request and is also ended again by the MIC QKL mini 2. An incorrectly set vacuum or overpressure switch results in problems in defrost detection. The cooling process may be interrupted by the safety chain (vacuum or overpressure switch, etc.) only in the event of a fault.

Exceeding of the maximum defrost time

If the maximum defrost time of one hour is exceeded in the event of a fault and the calculated defrost end temperature is not reached, the control will switch to cooling request and reassume its control function.

Defrost suppression

It is possible to suppress the defrost processes via the digital inputs. After cancelling the defrost suppression, the next defrost process can be carried out after a minimum of 60 min. has elapsed.

Power supply and data memory

The data memory of the MIC QKL mini 2 is deleted every time there is a power failure. When power is restored, the control begins a restart with error diagnostics. Please make sure that there are no interruptions in the power supply and that the control is not switched off by external switches, e.g. manual control switches for stoppage. Frequent interruptions to the power supply result in ice build-up on the air cooler.

Important! Please observe!

Uncontrolled intrusion of warm air through openings in the wall, cover, floor or drains must be avoided in refrigerated units. Therefore, condensate drains must be equipped with a siphon and additionally heated when at sub-zero temperatures.

Positioning of the sensors S1 and S2

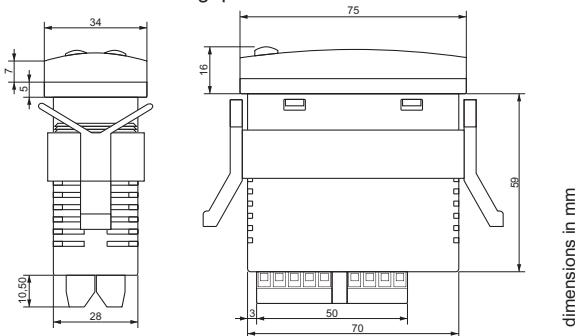
See installation manual "MIC Sensor Pt1000".

Installation and connection

Housing and dimensions:

Mounting
Cut-out size
Protection rating

Front panel installation with tension frame
71x29 mm 72.8x1.14 in (for front panel installation)
according to EN60529 : Front IP65 (fitted),
housing Ip20



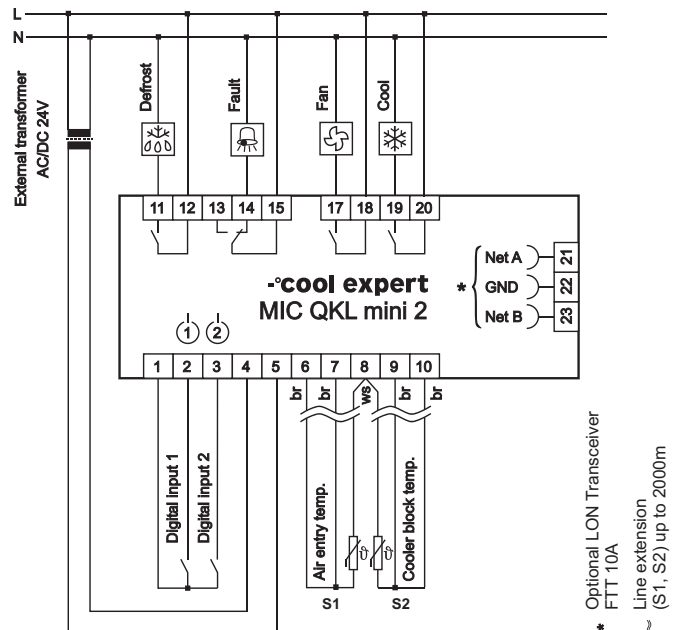
Installation instructions:

Protection rating IP65

The user interface of the control in the outside area of the door is designed to protection rating IP 65. The rest of the housing complies with the provisions of IP 20. To assure the protection rating of the control in the outside area of the door, the cut-out must be made to fit precisely for the purpose of fitting it into the control cabinet door. The cut-out must be fully deburred. The plastic housing must not be deformed from an incorrectly made cut-out. The door surface must be flat and have no unevenness. The wall thickness of the door should be at least 0.75 mm / 0.03 in. Prior to fitting the control, check that the seal between the installation frame and control cabinet door is inserted without any twisting. The tension frame pulls the control evenly from the inner side of the door against the outer side of the door with the necessary initial tension and fastens it.

When fitting the control, make sure that there is secure isolation from the other modules in the control cabinet (according to VDE 0106, Part 101).

Electrical connection:




The power supply of AC/DC 24 V may only be connected to the input terminals 4 and 5 provided for this purpose. Incorrect connection results in immediate destruction of the control.


The digital inputs 1 and 2 and the input terminals 1, 2 and 3, as illustrated here, may only be switched with floating contacts.


External voltage of any kind results in immediate destruction of the control and can lead to fatal injury if disregarded. This also applies to the Pt 1000 sensor inputs S1 and S2 terminals 6 to 10.


Display and control elements


LED operating status display


Fault display
 LED off: Fault relay "Off"
 LED flashes: Fault relay "On"
 LED illuminated: Fault confirmed but not cleared (fault relay "Off")


Cooling request
 LED off: Cooling relay "Off"
 LED illuminated: Cooling relay "On"

Cooler fan
 LED off: Fan relay "Off"
 LED illuminated: Fan relay "On"


Defrost request
 LED off: Defrost relay "Off"
 LED illuminated: Defrost relay "On"
 LED flashes: On hold (defrost relay "Off")


Entry status
 LED off: When moving through the menu
 LED illuminated: When a menu item is open and the setting is displayed
 LED flashes: When a menu item's setting is changed

Operating state for digital input 1
 LED illuminated: Floating contact at terminal 1 and 2 closed

Operating state for digital input 2
 LED illuminated: Floating contact at terminal 1 and 3 closed

Control buttons

Control button 1
 Move upwards in the menu or increase the value

Control button 2
 Move downwards in the menu or decrease the value

Handling and operation

The control is operated using two buttons. The control is set on three operating levels: the user level, the configuration level and the statistic level. Within the operating levels, the menu items are shown in the display using abbreviations. The menu items are selected by pressing the control buttons. A selected menu item will show its setting alternately after 5 sec. To change to the other operating level, set the appropriate menu item and press both buttons at the same time.

To make a setting or a change, the selected menu item must be opened by pressing both buttons at the same time. The "Entry Status" LED lights up and the current setting is displayed. Pressing the control buttons allows a setting or

change to be made within one of the opened menu items.



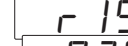

A deviation from the last saved setting is shown when the "Entry Status" LED flashes. Pressing both buttons at the same time closes and saves the changed menu item. The "Entry Status" LED is switched off, thus confirming that the setting has been correctly completed. After 5 sec. the new setting is shown alternately with its menu item. After changing from operating level "- 2-" or "- 3-" to operating level "- 1-", the room temperature "tL l" is automatically shown.

Note:


If an open menu item remains unedited, it will close automatically after 5 minutes. The last saved setting remains unchanged. You are automatically taken back to operating level "- 1-" to the display of the room temperature "tL l".

Starting operation


Initialization of the control:

 LED function test
 Device name
 Control version
 Software version

Display of the configured temperature scale

 Configured temperature scale is displayed for a short time ("°C" or "°F")

Normal operation after the initialization

 The room temperature is displayed after the initialization

Example

Note:


Alerts detected by the control also remain stored even in the event of power failure and are displayed again when power is restored (fault display LED, alert and buzzer). Alerts can only be deleted under the menu item "AL L" with "c L r".

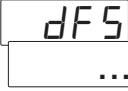
If the Power fail control "PFL" is set to "On", i.e. switched on, the alert "PFL" is displayed when power is restored.


Special functions of the control buttons

Defrost initiation (manual)

Press control button 1 permanently without interruption until "dFr" is displayed in the following routine.

 Keep button 1 pressed down permanently without interruption

 After approx. 3 seconds, the countdown shown opposite is counted to zero.

 The display "dFr" and the acoustic signal of the buzzer confirm the initiation of the manual defrost.

It is not possible to initiate a manual defrost under the conditions shown below: Standby by user ("ECL", "OFF"), standby by digital input, ("c 1 l" or "c 1 2", "5Lb").


The flashing fault display LED signals that the initiation of a manual defrost is not possible under the aforementioned conditions.

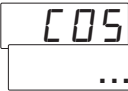
Note:


An active defrost can be cancelled with the procedure described previously.

Cooling request (manual)

Keep button 2 pressed down permanently until "cOr" is displayed in the following routine.

 Keep button 2 pressed down permanently without interruption.

 After approx. 3 seconds, the countdown shown opposite is counted to zero.

 The display "cOr" and the acoustic signal of the buzzer confirm the initiation of the cooling request.



It is not possible to initiate a manual cooling request under the conditions shown below:

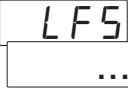
Standby of the control by user ("ECL", "OFF"), Standby by digital input, ("c 1 l" or "c 1 2", "5Lb"), room temperature "tL l" less than setpoint "tSp", defrost process active.


The flashing fault display LED signals that the initiation of a manual cooling request is not possible.

⚙️ Loading the factory setting

Disconnect control from the supply voltage and switch back on (starting operation). Keep control buttons 1 and 2 pressed down permanently without interruption until the following routine "LFP" appears in the display.

  During the starting operation of the control, keep both control buttons pressed down permanently without interruption.

 After completing the initiation, the countdown shown opposite is counted to zero.

 The display "LFP" and the acoustic signal of the buzzer confirm the loading of the factory setting.

Note:

This function can only be performed during the initiation phase after a restart. During normal operation, the procedure shown here has no effect. It is also possible to load the factory setting in the operating level 2 under the menu item "r 5L" "LFP".

Factory setting:

- Setpoint temperature "tSp" "00"
- Control On/Off "ECL" "On"
- Control mode "c 5" "d5C"
- Defrost load pre-selection "c 5L" "75"
- Defrost management "c d" "EL"
- Defrost end temperature "c dE" "100"
- Defrost duration "c dP", "5Ld"
- Air cooler fan management "c FR" "5Ld"
- Digital input 1 "c 1 l" "OFF"
- Setpoint shift "c 5S" "00"
- Door opening duration "c dd" "OFF"
- Safety temperature when opening door "c dE" "2"
- Time limit for ext. standby "c 5d", "OFF"
- System control "c EE" "On"
- Goods protection program "c 6P" "OFF"
- Temperature scale "c CF", "°C"
- Setpoint temperature lower bound "5Lb" "-500"
- Setpoint temperature upper bound "5Ub" "500"
- Acoustic alert "bUC" "On"
- Power fail control "PFL" "OFF"
- LON identification number "L Id" "0"
- LON Group number "LGr" "0"
- Password entry "P -" "- l"
- Correction factor of the ambient temperature "aL l", "00"
- Correction factor of the block temperature "aBl", "00"
- Show/ hide temperature display "dE", "On"

Operating level 2 The operating level



Display for room temperature (Temperature tL1)

Example: Display for room temperature (Standard display)

Display for room temperature measured by sensor S1. The room temperature can be hidden in operating level 2.1 under "dt". In this case, "-.-" is displayed. In the event of a sensor fault "E5 I", "-.-" is displayed alternately with "E5 I".

See note under "tBL"

Display for block temperature (Temperature Block)

Example: Display for cooler block temperature

Display for cooler block temperature measured by sensor S2. In the event of a sensor fault "E5 2", "-.-" is displayed alternately with "E5 2".

Information on temperature measurement "tL I" and "tBL":

The temperature is measured according to the principle of the three-wire measurement technique. In the case of an extension of the sensor wires, the resistances are compensated for by the three-wire measurement technique. If cable conductors are missing, the sensors S1 or S2 can also be connected according to the principle of the two-wire measurement technique. Resistances which inevitably distort the measurement result can be compensated for in the operating level "tL I" under "oL I" or under "oL 2" by the entry of a correction factor.

Display for current setpoint temperature (Temperature Setpoint Actual)

Example: Display for the current setpoint temperature

Note:

The setpoint value can be increased or decreased by connecting a correspondingly configured digital input. In this case, the current setpoint temperature is displayed here. After cancelling the connection, "tSA" and "tSr" display the same value.

Setpoint temperature setting (Temperature Setpoint Reference)

Example: Setting the setpoint temperature
Value: -50 °C / -58 °F to 50 °C / 121 °F

Note:

In the case of recirculating air defrost under "c d", "FAn" and a setpoint temperature lower than 0 °C / 32 °F, alert "EU5" is displayed

Alerts (Alerts)

Example: no alerts
or possible alerts
Alert current alert(s)
 Clearing the current alert by pressing the control button simultaneously

Note:

A detailed description of the MIC QKL mini 2 alerts is on the last page of this document

Control ON /OFF (Standby) (Enable Control)

Example: Controller in the operating mode "On"
 Controller in the operating mode "Off"

Operating mode "Off" (OFF):

All control functions are switched off (standby) The message "UCH" refers to the standby of the controller.

If no other entries are made, the current room temperature is displayed alternately with "UCH" after 5 minutes

To the configuration level (operating level 2)

Example: The first menu item after changing to the configuration level (if no password is provided)
or
 Request to enter password with a value from 0 to 999

Note:

If the display "- 2 -" flashes alternately with the display "- I" a password is possibly provided. The password is entered or cancelled in the operating level "- 2 -" under "P. -". When requested to enter a password, enter a numerical combination and then press both control buttons at the same time. If the wrong password is entered, the display changes immediately to the room temperature "tL I". The password can be entered as many times as needed.

To the Statistics Level (operating level 3)

Example: The first menu item after changing to the statistics level (operating level 3)



Control mode (Sensors & defrost detection) (Config Sensors)

Example: Dual sensor control load integral (Dual Sens Control LID)
Dual sensor control adaptive (Dual Sens Control)
Single sensor control (Single Sens Control)

Dual sensor control load integral (d5L)

Method for defrost detection by specifying a humidity level between 25 and 100%. (See setting under "c 5L" from 25 to 100%) In the control mode "d5L", both sensors S1 and S2 must be connected.

Dual sensor control adaptive (d5C)

The defrost detection is carried out adaptively here, at the best time in terms of energy. In the control mode "d5C", both sensors S1 and S2 must also be connected. Always observe the work instruction "Requirement for correct defrost detection".

Single sensor control (55C)

Single sensor control: The control of the room temperature as well as the defrost detection and defrosting control takes place solely by means of the cooler block sensor S2. The humidity level under "c 5L" must be predefined from 25 to 100% for defrost detection.

Note:

If residual ice is detected on the surface of the cooler block after a long period of operation time, this can be due to system-related causes. In this case, check to make sure that the expansion valve is set correctly for overheating, the system has sufficient refrigerant and the position of the cooler block sensor S2 (see installation manual MIC Sensor Pt1000). This list could be continued as required... The controller can be configured to the control mode "d5L" in order to increase the sensitivity of the defrost detection.

Defrost load pre-selection (Config Defrost Load)

Parameter is only valid in conjunction with "c 5", "d5L" or "c 5", "55C"

Example: Medium humidity level value: 25 to 100%

The expected humidity level has utmost priority for determining this value. The greater the value, the more sensitive the defrost detection.

Operating level 2 The configuration level

Defrost management (Config Defrost)

Example: Hot gas defrosting in multicompressor racks (Hot Gas extended)
Hot gas defrosting in refrigerating plants (Hot Gas Singleplants)
Recirculating air defrost (Fan Defrost)
Electric defrosting with adjustable defrost end temperature (Defro Power Pack)
Electric defrosting with adaptive defrost end temperature (Electric)

Hot gas defrosting in multicompressor racks (H6E)

The cooling process is interrupted, the defrost relay switched on, the fan is controlled as configured under "c FAn". At least two coolers of double output must be in cooling mode during the defrosting process regardless of the setpoint temperature in order to supply a cooler with hot gas for the purpose of defrosting. The task described above can be implemented individually by the corresponding configuration of the digital inputs "c I1" or "c I2", as shown under the menu item defrost communication "dL C".

Hot gas defrosting in refrigerating plants (H6S)

The hot gas defrosting is initiated as in the previous case of multicompressor racks. After an integration period for carrying out the pressure compensation, the compressor is switched on to supply the hot gas. After the defrost end temperature has been reached, the compressor is switched off. During the drain down time that follows now, the controller switches off the defrost relay by means of a time delay and switches the compressor on at the end of the drain down time.

Applicable to both hot gas defrosting methods (H6E) and (H6S)

The defrost end temperature is calculated adaptively depending on the heat content of the hot gas. Under the menu items "c dE" and "c dP", the defrost period as well as the defrost end temperature, if necessary, can be adjusted downwards. After reaching the defrost end temperature, the cooling process is initiated once again at the end of an adaptive drain down time. The start of the cooler fan is temperature and time-delayed, depending on the setpoint temperature, as described in the Standard Fan Management under "5L d".

Recirculating air defrosting (FAn)

The cooler fan is used exclusively for defrosting during the recirculating air defrosting. The defrost end is calculated adaptively. The expected defrosting duration is determined by the controller within the range of 12 to 45 minutes depending on the adjusted set point value. Two sensors are always required for the recirculating air defrosting (control mode "c 5", "d5L" or "d5C")! Setpoint values under 0 °C / 32 °F are not permissible (Attention: even during setpoint shift the setpoint value must not be less than 0 °C / 32 °F). Non-compliance results in the alert "EU5". The defrost relay is switched on during the recirculating air defrost if the goods protection program "c 6P" is configured to "OFF".

Electric defrosting with adjustable defrost end temperature (dPP)

The heating output required for the defrosting is supplied by an electric heater. A dynamic control process takes place above the melting point dependent on the cooler block temperature until the defrost end temperature is reached in order to minimise heat loss caused by convection and thermal radiation as well as from the heating output. The LED defrost request flashes while the defrost relay is switched off. The defrost end temperature and defrost period can be set under the menu items "cdE" and "cdP". Depending on the ice buildup of the cooler the defrost end temperature is increased by the controller by a maximum of 5 K / 9 °R.

Electric defrosting with adaptive defrost end temperature (EL)

The heating output required for the defrosting is supplied by an electric heater. The heating and control phase is identical to the process "Electric defrosting with adjustable defrost end temperature (dPP)" described previously. However, in this case, defrost end temperature and defrost period is calculated by the controller, depending on the setpoint temperature, ice buildup and heating output of the cooler.

Attention!

It is essential to ensure that the coolers during the defrosting process never hinder each other due to secondary air currents. Secondary air currents not only cause higher energy costs but also seriously impair the availability of a cooling plant. In the minus region, icing-up results in the area of the cooler.

Note:

Before starting the heat-up phase, the cooler-fan remains switched on for a maximum of 12 minutes for the use of a possible cold storage within the cooler block. During this time, the defrost request LED flashes. If the cooler block reaches the setpoint temperature within this time, the heat-up phase starts.

* **Drain down time:** After reaching the defrost end temperature, an adaptive drain down time follows for a period of approx. 5 to 8 minutes in order to ensure that the defrost water drains off. During the drain down time, the defrost request LED flashes. The cooling process starts when the drain down time has finished. The start of the fan is time delayed depending on the setpoint temperature as described in the standard fan management under "5t d".

Defrost end temperature (Config Defrost Endtemperature)

Parameter is only valid in conjunction with "cd", "H5E" or "cd", "H55" or "cd", "dPP"



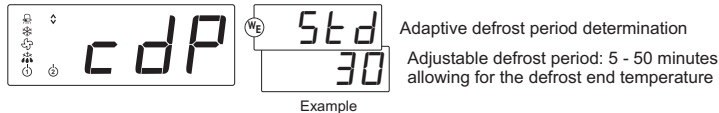
The menu item "cdE" has a dual function.

On the one hand, a defrost end temperature from 2 - 50 °C / 35.5 - 122 °C can be set under "cdE". The prerequisite for setting the defrost end temperature is the configuration of the electric defrost "dPP" under "cd".

On the other hand, the calculated defrost end temperature can be adjusted downwards under "cdE" if one of the two hot gas defrost modes "H5E" or "H55" is configured under "cd". The adjustment is made within the scale from 2 to 50 °C / 35.5 to 122 °F with the values from 2 to 10 °C / 35.5 to 50 °F. The cooler block temperature and the period of the defrosting process are used for calculating the defrost end temperature. This means: hot gas with high heat content = short defrosting process with high defrost end temperature max. = 30 °C / 86 °F. Hot gas with low heat content = long defrosting process with low defrost end temperature min. = 10 °C / 50 °F. The correction value 10 has the least influence on the adaptively calculated defrost end temperature. The value 2 has the greatest influence if the adaptively calculated defrost end temperature is to be adjusted downwards accordingly.

Defrost period (Config Defrost Periode)

Parameter is only valid in conjunction with "cd", "H5E" or "cd", "H55" or "cd", "dPP"



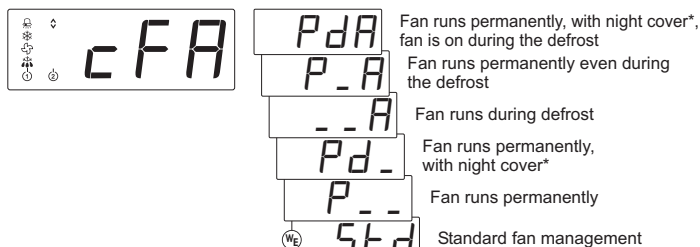
Adaptive defrost period determination (5t d)

The controller calculates the optimal defrost period adaptively from 10 to 45 minutes based on system parameters determined by the controller. The setpoint temperature and the evaluation of previous defrosts are essentially the basis for the calculation.

Adjustable defrost period

The defrost period can be set from 5 to 50 minutes. In contrast to timed defrosting procedures, the pre-defined defrost end temperature under "cdE" is included. The set value is a reference value. The actual defrost period is based upon the heating output and the ice buildup of the cooler. The controller adapts the defrost detection allowing for the defrost end temperature in order to reach the set target time. This process can require several defrost cycles. If the heating output is too low, the set value might not be reached or it might only be reached approximately.

Air cooler fan management (Config Fan)



Fan runs permanently, with night cover*, fan is on during the defrost (PdA)

Fan runs permanently with additional detection of a night cover*. The fan is switched on during the defrosting process.

Fan runs permanently even during the defrost (P_A)

Fan runs permanently even during the defrosting process.

Fan runs during the defrost (_ _ A)

Fan runs according to the standard fan management "5t d", even during a defrosting process.

Fan runs permanently with night cover* (Pd_)

Fan runs permanently with additional detection of a night cover*. The fan remains switched off during the defrosting process.

* **Night cover "PdA" and "Pd_":** During a load reduction within a refrigerated unit, due to a night cover, the controller switches from permanent operation to standard operation automatically. After cancelling a night cover, the controller switches back to permanent operation automatically. The detection of a night cover is not possible under control mode "c 5", "55E".

Fan runs permanently (P_ _)

Fan runs permanently but not during a defrosting process.

Standard fan management (5t d)

● **Fan pre-run:** If the room temperature increases 0.5 K / 0.9 °R above the setpoint value, the fan is first started (without the compressor running). The fan pre-run is controlled by means of temperature. The delay time can vary between 90 seconds and 20 minutes until the compressor start. The length of the lead time depends considerably on the course of the cooler block temperature and air intake temperature. In any case, the cooling process is initiated above the setpoint temperature at 1.5 K / 2.7 °R. During this time, residual energy of the cooler is transferred to the refrigerated unit. The formation of ice is reduced by the effect of sublimation, the relative air humidity increased and the next defrosting process is delayed considerably.

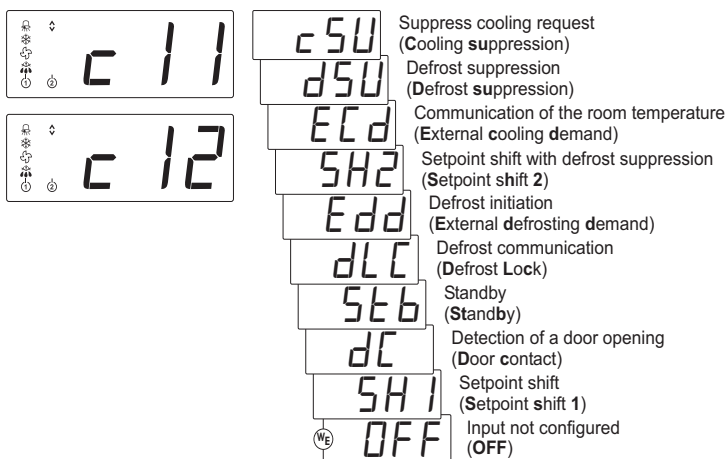
● **Cyclic air circulation:** In order to ensure even thermal stratification within the refrigerated unit, the fan runs for 5 minutes every 15 minutes, if the room temperature is below the setpoint temperature.

● **Adaptive fan start temperature:** After each defrosting process, the starting temperature of the fan is recalculated depending on the setpoint value and current room temperature in order to bind any possible residual heat within the cooler. The fan is controlled as described previously according to the principle of the time-delay switch, which is tracked adaptively in the event of setpoint changes and high loads.

Note:

For recirculating air defrost ("cd" "FRn"), the fan is switched on during the defrost phase regardless of the configuration given here.

Digital input 1 & Digital output 2 (Config Input 1, Config Input 2)



Cooling request suppression (c 5U)

The cooling request is suppressed or interrupted after the minimum running time has elapsed for the duration of the connection of the digital input or for a maximum of one hour. The fan management is not affected by this.

Defrost suppression (d5U)

External defrost suppression only takes place after connection of the corresponding configured digital input. After cancelling the defrost suppression, a defrost can be initiated 1 hour after the cooling request at the earliest. A defrost that has already been initiated is not interrupted.

Communication of the room temperature (E c d)

MIC QKL mini 2s are able to communicate with each other within one group or within several different groups. The communication takes place by connection of the correspondingly configured digital input. After a controller requests cooling within a group, an optimal comparison of the setpoint temperature takes place among the communicating controllers within this group. These controllers detect the specification of the new setpoint temperature and first start their cooler fans just like their cooling request in the event of increasing room temperature. If the other controllers detect the tentatively falling room temperature within a refrigerated unit, the other cooling capacities remain inactive but the cooler fans remain switched on. After reaching the setpoint temperature, all functions (cooler fans and cooling request) are deactivated allowing for the respective minimum runtime. The setpoint temperature originally set now has priority again. A deviation of the setpoint temperature within a group is limited to max. 8 K / 14.5 °R. In the case of setpoint temperatures above freezing point, the controller ensures that the room temperature does not exceed 0.5 °C.

The procedure described here enables room-temperature driven compressor capacity-control to be implemented easily.

You can obtain more information on communication of the room temperature with its various possible applications directly from Cool Expert on request.

Setpoint shift with defrost suppression (SH2)

For the duration of the connection the setpoint value is adjusted by the value configured under "c 55". During this time, no defrost can be initiated. A defrost that has already been initiated is not interrupted. The "new" setpoint value is displayed in operating level 1 under "5t R".

Defrost initiation (E d d)

Once all minimum runtimes have expired (cooling request, fan...), a defrosting process is initiated. A defrost is not permitted if the signal of the defrost suppression is on or the last defrost took place within less than one hour.

Defrost communication (d L C)

The controllers can work together as a group in one or in several refrigerated units after initiating a defrost in order to achieve an optimal defrost result. A defrosting controller blocks all other controllers of a group and thus prevents the occurrence of cost-intensive peak loads. The functions mentioned below are implemented for the duration of the connection of the configured digital input regardless of the defrosting procedure selected.

● **For electric defrosting if the configuration "EL" or "dPP" is selected under "cd".** The controller is switched to standby (a maximum of one hour) for the duration of the connection of the correspondingly configured digital input. After cancelling the signal, a defrost can be initiated 1 hour after the cooling request at the earliest.

● **For hot gas defrosting in interconnected and individual refrigeration systems if the configuration "H5E" or "H55" is selected under "cd".** The controller for generating hot gas is switched to the cooling request (a maximum of one hour) for the duration of the connection of the correspondingly configured digital input regardless of the room temperature. After cancelling the signal, a defrost can already be initiated after 5 minutes cooling request.

● **Circulating air defrosting if the configuration "FRn" is selected under "cd".** After the correspondingly configured digital input is connected, a defrosting process is also initiated. If the signal continues after finishing the defrost, the controller is switched to standby. The controller switches to normal operation after one hour at most. After cancelling the signal, a defrost can be reinitiated after a two-hour cooling request at the earliest.

You can obtain more information on defrost communication with its various possible applications

directly from Cool Expert on request.

Standby (5t b)

The standby mode is initiated immediately for the duration of the connection. The message "5t b" appears alternately with the room temperature "tL" in the display. Once the signal is cancelled, the controller remains blocked for a further eight minutes. A time safety margin can be configured under "c 5d". Even in the case of continuous connection of the digital input, the controller reassumes its control function after the time safety margin has expired.

Note:

An ongoing defrost is interrupted by the standby and resumed after cancelling the signal.

Detection of a door opening (dC)

The cooling request and fan run are suppressed or interrupted immediately (regardless of all minimum runtimes). The duration of the door opening in conjunction with "c c d" as well as a safety temperature under "c d t" can be configured in order to protect the goods against damage.

Setpoint shift (5H I)

The setpoint value is increased or decreased for the duration of the connection by the value configured under "c 55" and displayed in the operating level 1 under "t 5A".

Input not configured (OFF)

No function is performed during connection of the input.

Attention:

The functions of the digital inputs 1 and 2 described here may only be connected using potential-free contacts.

Setpoint shift (Config Setpoint Shift)

Parameter is only valid in conjunction with "c I I", "5H I" or "c I I", "5h2" or "c I 2", "5H I" or "c I 2", "5H2"

Correction of the setpoint temperature from -20 to +20 K / -36 to +35,5 °R

Correction of the setpoint temperature

If the digital input has been configured accordingly, the setpoint temperature can be increased or decreased from -20 to +20 K / -36 to +35,5 °R here

Note:

If defrosting with circulating air ("c d", "F n") the resulting setpoint value must not be set less than 0 °C / 32 °F! The alert "E U5" follows if this is disregarded.

Duration of door opening (Config Door Duration)

Parameter is only valid in conjunction with "c I I", "dC" or "c I 2", "dC"

Time controlled door opening "Off"
Adjustable value: 1 - 120 minutes

Example

Time controlled door opening "Off" (OFF)

The cooling and fan request are suppressed for the duration of the door opening.

Value 1 - 120 minutes

When opening the door, the cooling and fan request are suppressed for the duration of the set time from 1 to 120 minutes. The set switch-off time can also be activated by an impulse of the door contact.

Note:

If the door remains opened longer than 120 minutes without interruption, the alert "E E ." is displayed and the controller reassumes its control function. A safety temperature can be configured under "c d t".

Safety temperature during door opening (Config Door Temperature)

Parameter is only valid in conjunction with "c I I", "dC" or "c I 2", "dC"

Safety temperature "Off"
Adjustable value: 0,1 - 10 K / 0,5 - 17,5 °R

Safety temperature "Off" (OFF)

The room temperature is ignored for the duration of the door opening.

Value 0,1 - 10 K / 0,5 - 18 °R

Switch-on temperature after door opening 0,1 - 10 K / 0,5 - 18 °R greater than setpoint

Time limit in ext. standby (Config Standby Duration)

Parameter is only valid in conjunction with "c I I", "5t b" or "c I 2", "5t b"

No time safety margin configured
Adjustable value: 1 - 600 minutes

Example

No time safety margin configured (OFF)

All control functions remain switched off for an unlimited period of time for the duration of the external standby "5t b".

Value 1 - 600 minutes

After the time safety margin set from 1 to 600 minutes has expired, the standby is cancelled even if the signal is still on.

Goods protection program (Config Goods Protection)

Goods protection program "On", following setpoint value
Goods protection program "On"
Goods protection program "Off"

The goods protection program is only possible for the electric or circulating air defrosting! During electric defrosting, the cooler-fan and defrost heater are activated. In the case of the circulating air defrosting as previously using an additional heater.

Goods protection program "On", following setpoint value (FSP)

To protect goods against insufficient temperature, the goods protection program is initiated if the current respective setpoint value is under run even during setpoint shift. If the room temperature under runs the setpoint value by 0,5 K / 0,9 °R, the cooler fan is started after a maximum of 12 minutes.

If the controller still detects a falling room temperature within a maximum time period of 18 minutes after switching on the cooler fan, the heater is controlled by the defrost relay. Alternating operation between the cooler and heater is prevented by the controller. In the case of hot gas defrosting (under "c d", "HBE" or "HG5"), only the insufficient temperature is monitored but the heating relay is not switched. If the temperature is insufficient, the alert "E dF" is output in this case.

Goods protection program "On" (On)

In contrast to the procedure described above for protecting the goods against insufficient temperature, the lowest predefined setpoint value is always monitored here. The value in the case of configured setpoint shift must always be observed in this regard. The other process takes place as described above under "Goods protection program "On", following setpoint value (FSP)".

Goods protection program "Off" (OFF)

Room temperatures below the setpoint temperature are not monitored.

Note:

The setting "FSP" in conjunction with the setpoint shift "c 55" can also be used as defrost or heating program. In the case of the one-sensor control (under "c 5", "55C") the goods protection program is ignored.

System monitoring (Config ECO Enable)

Alert "E C D" "On"
Alert "E C D" "Off"

Note:

The system monitoring provides early warning of system faults before the malfunction occurs and protects goods against damage. By tracking the block temperature during the cooling process, performance reduction of the cooling plant is already detected to some extent and signalled by the alert "E C D".

Temperature scale (Config Celsius Fahrenheit)

Display of all temperature values in Celsius (°C)
Display of all temperature values in Fahrenheit (°F)

Setpoint temperature lower bound (Setpoint Lower Bound)

Setting -50°C / -58°F to ...
To limit the setpoint temperature

Setpoint temperature upper bound (Setpoint Upper Bound)

Setting ... bis 50°C / 121°F
To limit the setpoint temperature

Note:

By limiting the setpoint temperature to the current setpoint value in conjunction with the password "P - ." manipulation of the setpoint value (control level 1 under "t 5r") can be prevented.

Reset (Reset)

Loading of the factory settings (parameters and configuration are lost)
Restart of the controller (parameters and configuration are retained)
Reset of all values in the statistics level (control level 3)
Back to the user level without executing a function

Acoustic alert (Buzzer Control)

Acoustic alert "On"
Acoustic alert "Off"

Power fail control (Power Fail Control)

Alert in the event of power fail control "On" (in the event of power fail control, Alert "PFL")
Alert in the event of power fail control "Off"

Test program (Test-Program)

Alert relay "Off - On"
Cooling request relay "Off - On"
Fan relay "Off - On"
Defrost heating relay "Off - On"
Buzzer "Off - On"

Note:

The upper control button "O" is used to select the appropriate function. The selected function is switched on and off using the lower control button "O". The test program serves the purpose of checking the control function and system components. After 12 min. have elapsed without a button being pressed, the control will reassume its last configured functions and return to the user level.

LON service pin (only if LON module is available) (LON Service Pin)

LON service pin message is being sent
Back to the configuration level without executing a function

LON Identification number (LON Identifier)

Value 0 -255
In preparation!

LON Group number (LON-Group)

Value 0 -16
In preparation!

Version number (Ident Number)

Displays the device name
Displays the control version
Displays the software version

Entry of password (Password)

Password adjustable between 0 and 999
" - " = no password provided

To the expanded configuration level (operating level 2.1)

The first menu item after changing to the expanded configuration level (operating level 2.1)



Correction factor of the sensor data S1 and S2

Room temperature S1 (Offset tL1)

Correction factor: -10 bis 10 K / -18 bis 17,5 °R

Block temperature S2 (Offset tBL)

Correction factor: -10 bis 10 K / -18 bis 17,5 °R

Correction factor (oL 1), (obL)
The sensor values measured by the controller can be corrected in the range -10 to 10 K / -18 to 17.5 °R. The set correction value is added to or subtracted from the measured sensor values.

Note:
In some practical applications when the sensor lines S1 and S2 are extended in exceptional cases due to missing cable conductors, the three-wire measurement technique can be replaced by a two-wire measurement technique. The resistance resulting from this, which is normally compensated by the three-wire measurement technique, can be compensated by this parameter. If the two-wire measurement is absolutely essential, the sensors S1 and S2 are connected to terminals 7 and 8 as well as 8 and 9. A bridge must be inserted between terminals 6 and 7 as well as 9 and 10.



Display of max. & min. room temperature

Maximum room temperature "tL 1" (Temperature High)
Example

Minimum room temperature "tL 1" (Temperature Low)
Example

Note:
After start-up of the controller or after resetting the statistic values, it can last up to 15 minutes until a value is visible.
The maximum and minimum room temperature is evaluated by sensor S1 and is therefore only possible in the case of the two-sensor control.

Display the number of defrosts (Defrost Number)

The number of defrosting processes
Example

Display the number door openings (Door Contact Number)

Number of door openings
Example

Note:
Only in conjunction with configured door contact "dC" under "c 1" or "c 12"

Back to operating level (operating level 1)

The first menu item after changing to the operating level (operating level 1)

**Operating level 2.1
The expanded configuration level**

Display/hide temperature display (Display Temperature)

Temperature display "tL 1" switched on
Temperature display "tL 1" hidden

Temperature display "tL 1" switched on
Display of the room temperature in operating level 1 under "tL 1"
Temperature display "tL 1" hidden
Display of the room temperature is hidden after 5 minutes (Display in the display "...") The room temperature is displayed again by pressing a control button.

Back to the configuration level (operating level 2)

The first menu item after changing to the configuration level (operating level 2)

**Operating level 3
The Statistics Level**

Display number of alerts "ECO" (ECO Number)

Number of "ECO" alerts
Example

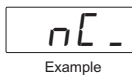
Note:
The number of "ECO" alerts is recorded even if system monitoring is deactivated (Operating level 2 "c EE", "OFF").

Number of power failures (Pfn Number)

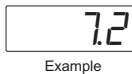
Number of power failures
Example

Note:
In the even of power failure and restoration of power the counter under "PFn" is increased by one.

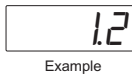
Diagnostic values (Cool Expert intern)



Possible values:
- n-, In I, LL-, nL-,
- L I, -L2, LL, dF, -dF



Value 0,0 bis 99,0



Value 0,0 bis 99,0



Value 0,0 bis 99,0

Example

Note

The values above are needed for diagnosis in the case of service by Cool Expert and are insignificant for the normal operation.

Back to operating level (operating level 1)



The first menu item after changing to the operating level (operating level 1)

Note:
All statistical values can be reset in operating level 2 (configuration level) under the menu item "r 5L, r L d".

Alerts



Sensor fault S1

Cause:
Temperature recording "EL I" not functioning.

Measures:
Check sensor S1 or supply cable, line break or line-to-line fault.



Sensor fault S2

Cause:
Temperature recording "EL L" not functioning.

Measures:
Check sensor S2 or supply cable, line break or line-to-line fault.



System monitoring

Cause:
● Controller detects no falling trend of the cooler block temperature during cooling request. The time-delayed alert takes place individually and is dependent on the speed of a constantly increasing block temperature. The alert takes place after 36 minutes at the earliest or after 6 hours at the latest.
● During cooling request the temperature difference between the sensors S1 and S2 is greater than 20 K/36 °R. The signal must last for at least 30 minutes without interruption.

Measures:
● Check system design (load of the refrigeration unit is too high in the case of storage).
● Check number of times door is opened (displayed in operating level 3 under "dLn").
● Check the function of the compressor (high pressure, low pressure, oil pressure difference, protective motor switch).
● Check expansion valve, adjust if necessary
● Check system for lack of refrigerant.
● Check condenser for dirt.
● Check that machinery room has sufficient ventilation.
● Check size and design of the liquid solenoid valve.
● Check the function of the cooler-fan.
● Check pressure-dependent speed control of the condenser fan (important at ambient temperatures: < 5 °C/41 °F).
● Check neutral zone pressure switch (compressor is switched off before reaching the setpoint temperature).

Note:
If the refrigerated unit is constantly overloaded, the system monitoring can be deactivated in the operating level 2 under "c EE". No messages are output.



Time-based system monitoring

Cause:
Setpoint temperature not reached within 48 hours, or 12 defrosts in succession without reaching the setpoint temperature.

Measures:
Check cooling plant for sufficient output.



Heating fault

Cause:
● Maximum defrost period exceeded by one hour.
● In the case of activated goods protection program (operating level 2 under "c 6P"); No increase of the room temperature within one hour or temperature in the cooler block is too high during the heating phase.

Measures:
Defrosting:
● Check output of the heater in the case of electric defrosting.
● Check setting of the safety temperature limiter.
● In the case of hot gas defrosting, check heat content of the hot gas.
● Check, if necessary, whether heat is escaping during the defrosting due to secondary air currents.

Goods protection program:

- Check the function and output of the connected heater.
- Check cooler fan.



Invalid configuration

Cause:
● A configuration entered by the user is invalid.
● The position of the sensors S1 and S2 is mixed up.

Measures:
Check the following configurations:
● Recirculating air defrosting (under "cd", "FRn") in conjunction with the one-sensor control (operating level 2 under "c 5", "55L") is invalid.
● Setpoint values (under "L 5r") less than 0 °C / 32 °F in the case of the recirculating air defrosting (operating level 2 under "c d",
● "FRn") are invalid. (In the case of the setpoint shift (operating level 2 under "c 55") the resulting setpoint value is less than 0 °C / 32 °F)

Notes:

The input of the last parameter in the configuration level was incorrect as a rule. The alert "EUS" cannot be acknowledged. The message is cancelled automatically as soon as the cause of the fault has been removed.



Power failure

Cause:
Interruption of the power supply.

Measures:
Check power supply, possibly power failure, wire breakage or loose contact.

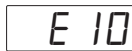
Note:
The monitoring of the power supply can be activated or deactivated in the operating level 2 under "PFL". The frequency of the voltage cut-off can be queried in the operating level 3 under "PF n".



Monitoring the door opening time

Cause:
Door opened for more than 2 hours without interruption.

Measures:
Close door. Check the function of the door contact if necessary.



Network module not recognized

Cause:
Network module cannot be recognized by the controller.

Measures:
Check network module and replace it if necessary.

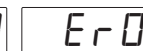


Maximum utilisation of the network module

Cause:
Network module is overloaded by the data traffic occurring in the network.

Measures:
Check network configuration

Internal control faults



Cause:
Internal fault of the control function

Measures:
Disconnect controller from the mains and restart. If one of the aforementioned alerts should occur repeatedly, the controller must be replaced.

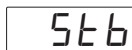
Messages



Standby by user

Controller was switched to standby by user in operating level 1 ("EL L" to "OFF"). The message "UCH" is displayed alternately with the room temperature for the duration of the standby.

Note:
Alerts detected by the controller remain stored even in the event of a power failure and are displayed again when power is restored (Fault display LED, alert and buzzer). Alerts can only be cleared under the menu item "AL L" with "c L r". If the Power fail control "PFL" is set to "On", i.e. switched on, the alert "PFL" is displayed when power is restored.



Standby by digital input

Controller was switched to standby by digital input. The message "5Lb" is displayed alternately with the room temperature for the duration of the standby.