

-°cool expert

MIC QKL e3

Temperature Control

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 e3 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 e3 is the ideal solution for all your needs in commercial refrigeration. The controller is particularly impressive in its easy operation and versatility for medium and low temperature applications such as display cabinets and cases as well as walk-in storage rooms. The MIC QKL e3 is a self-optimizing controller with autoadaptive defrost detection at the best time in terms of energy. If 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 e3 is permanently controlled and monitored by a knowledge-based algorithm without any interruption. The algorithm detects changes in the operating conditions and guides the system to the currently most efficient operating point. The potential energy savings using a MIC QKL e3 have been proven to be at least 20%, compared to state-of-the-art technology.

Room temperature control:

The MIC QKL e3 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 e3 performs the same tasks as its predecessor KÜBATRON QKL 2 B/T. Dual sensor control, combined with the optional network module and a recorder, complies with the hygiene regulation 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 essential in refrigerated cabinets and in the case of recirculating air defrosting.

Air cooler fan management:

Prior to beginning the actual cooling process, the energy stored in the cooler block (by the formation of frost and ice) is supplied to the cold room by specifically forerunning the air cooler fan. This air cooler fan control, patented by Cool Expert, also became known under the name latent heating. Frost and ice formation on the fins of the air cooler are reduced by the effect of sublimation. The defrosting processes are, compared to state-of-the-art technology, reduced considerably. Another benefit of the sublimation effect lies in the fact that the goods that are chilled lose less moisture. The relative air humidity is increased by at least 10%. In order to prevent unintentional throw of water droplets, the start of the air cooler fan occurs temperature- and 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 ADD. 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 average humidity level. In the case of the one-sensor control only LID defrost detection is possible. LID can also be used 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 connected for various tasks:

Adjustable switch-off time and switch-on temperature of the cooling plant when the door is open, 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 throw-off, cooling request or if the defrost locking mechanism is in effect, for example.

Communication:

Optional network module as a communication interface for data transmission in both directions. Using a MIC EEC Datalogger, it is possible to set up remote monitoring with alarm management. Quality assurance according to "Hazard Analysis and Critical Control Point" (HACCP) monitoring is furthermore possible.

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	≈ AC/DC 24 V +10 %/ -15 % 4,8 VA 50...60 Hz
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 50 °C / - 4 to 122 °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

General safety requirements	according to IEC 61010-1
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, connection of potential-free contacts only
Protection class II	when installed properly
Connecting terminals system	plug/connector with terminal screws with lifting 2,5 mm ²
Communication	optional plug-in network module

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 equipment must be provided (switches/fuses(B16)) for the power supply of the controller as well as the AC outputs of the relays to switch off the corresponding components in an incident. These facilities should be easily accessible to the user.

Disconnecting of the supply voltage does not prevent from the risk of electric shock in case external AC voltage is connected on the relay contacts.

Never attempt to open or repair the MIC QKL e3 control.

Observe the local and national standards and regulations when installing the MIC QKL e3 control.

The MIC QKL e3 is supplied with a protective low-voltage of 24 V AC/DC. The transformer required for this must comply with EN 61558-2-6 or EN 61558-1.

Work instructions:

Electrical installation

Prior to beginning all work on the MIC QKL e3 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 regulations of the local electricity supplier 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 e3 control must be installed outside potentially explosive areas.

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

General instructions and information on working with the MIC QKL e3
The MIC QKL e3 works as a self-optimizing multifunction control which saves and evaluates data gathered from its sensors. All functions originating from the MIC QKL e3, 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 e3 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 to 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 air cooler fan and cooling request is maintained depending on the setpoint temperature.

One MIC QKL e3 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 e3 multifunction control. In the case of electric defrosting, all the coolers have to be equipped with a safety temperature limiter.

Requirement for correct defrost detection

The MIC QKL e3 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 e3. 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 proceed with regular 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 e3 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!

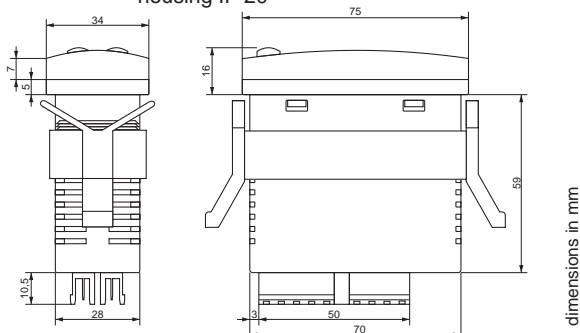
Uncontrolled intrusion of warm air through openings in the wall, ceiling, floor or drains must be avoided in refrigerated units. Therefore, condensate drains must be equipped with a siphon and additionally heated when operating at sub-zero temperatures.

Positioning of the sensors TL1 and TBL
See installation manual "MIC Sensor Pt1000".

Installation and connection

Housing and dimensions:

Mounting	Front panel installation with tension frame
Cut-out size	71x29 mm 72.8x1.14 in (for front panel installation) according to EN60529 : Front IP 65 (fitted), housing IP 20
Protection rating	



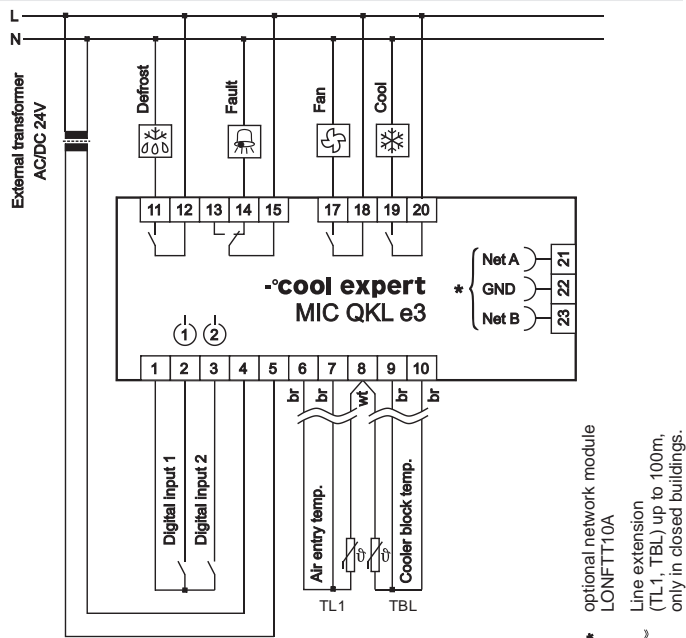
Installation instructions:

Protection rating IP 65

The user interface of the control in the outside area of the door is designed for 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 cutout 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 cutout. 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 TL1 and TBL, terminals 6 to 10.

Maintenance:

No maintenance required.

Display and control elements

LED operating status display

- Fault display (red)**
LED off: Fault relay "Off"
LED flashes: Fault relay "On"
LED illuminated: Fault confirmed but not cleared (fault relay "Off")
- Cooling request (green)**
LED off: Cooling relay "Off"
LED illuminated: Cooling relay "On"
- Air cooler fan (green)**
LED off: Fan relay "Off"
LED illuminated: Fan relay "On"
- Defrost request (yellow)**
LED off: Defrost relay "Off"
LED illuminated: Defrost relay "On"
LED flashes: On hold (defrost relay "Off")
- Entry status (red)**
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 (yellow)**
LED illuminated: Floating contact at terminal 1 and 2 closed
- Operating state for digital input 2 (yellow)**
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 main 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 1" is automatically shown.

Note:

If an open menu item remains unclosed, 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 1".

Starting operation

Initialization of the control:

- LED function test
- Device name
- Control version
- Control subversion
- Software version

Display of the configured temperature scale

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

Display of network module identification code

- The identification code of the network module is displayed temporarily. This message is only visible when a network module is installed.

Normal operation after initialization

- The room temperature is displayed after initialization

Note:


Alerts detected by the control also 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 deleted under the menu item "AL E" with "c L r".


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

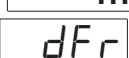
Special functions of the control buttons

Defrost initiation (manual)

Press 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 left is counted to zero.

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


It is not possible to initiate a manual defrost under the following conditions: Standby by user ("ECL", "OFF"), standby by digital input, ("c 1" or "c 12", "5Eb").


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 above.

Cooling request (manual)

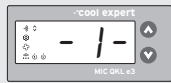
Keep button 2 pressed down permanently until "cDr" is displayed in the following routine.

 Keep button 2 pressed down permanently without interruption.


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

 The display "cDr" and an 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" or "c 12", "5Eb"), room temperature "tL 1" less than setpoint "tSA", defrost process active.



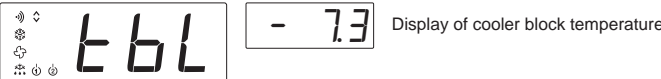
Display of room temperature (Temperature tL1)

 Display of room temperature (Standard display)

Display of the room temperature measured by sensor tL 1. 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 "E 5 I", " - - - - " is displayed alternately with "E 5 I".

See note under " t b L "

Display of block temperature (Temperature Block)

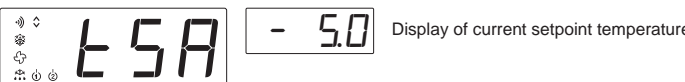
 Display of cooler block temperature

Display of the cooler block temperature measured by sensor t b L . In the event of a sensor fault "E 5 2" " - - - - " is displayed.

Information on temperature measurement " t L I " and " t b L ":

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 wire leads are missing, the sensors t L I or t b L can also be connected according to the principle of the two-wire measurement technique. Resistances which inevitably distort the measurement result can be compensated in the operating level " - 2 I - " under " o L I " or under " o L 2 " by the entry of a correction factor.

Display of current setpoint temperature (Temperature Setpoint Actual)

 Display of 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. After cancelling the connection, "tSA" and "tSr" display the same value.

Setpoint temperature setting (Temperature Setpoint Reference)



 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", "FRn" and a setpoint temperature lower than 0 °C / 32 °F, alert "EU5" is displayed.


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 it back on (initiation phase). 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 left is counted to zero.


 The display "LFP" and an 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 5 E " "LFP".

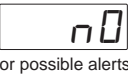
Operating level 1 The operating level

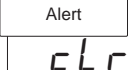
Alerts (Alerts)

Alerts (Alerts)

 Display of room temperature (Standard display)

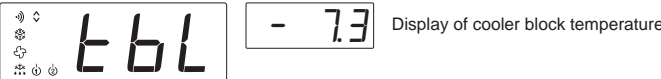
 no alerts
or possible alerts

 current alert(s)

 Clearing the current alert by pressing the control button simultaneously

Note:
A detailed description of the MIC QKL mini 2 alerts can be found on the last page of this document.

Display of block temperature (Temperature Block)

 Display of cooler block temperature

Control On / Off (Standby) (Enable Control)

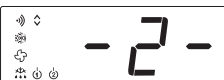
 Controller in the operating mode "On"

 Controller in the operating mode "Off"

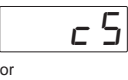
Operating mode "Off" (OFF):
All control functions are switched off (standby). The message "UCLH" refers to the standby of the controller.

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

To the configuration level (operating level 2)


 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 required.

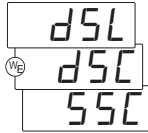
To the Statistics Level (operating level 3)

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



Control mode (Sensors & defrost detection)

(Config Sensors)



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 "c5L" from 25 to 100%) In the control mode "d5L", both sensors *EL* and *EL* must be connected.

Dual sensor control adaptive (d5C)

The defrost detection is carried out adaptively here, at the energetically optimum time. In the control mode "d5C", both sensors *EL* and *EL* 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 *EL*. The humidity level under "c5L" must be predefined from 25 to 100% for defrost detection.

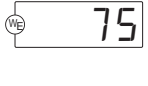
Note:

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 (evaporator superheat), the system has sufficient refrigerant and the cooler block sensor *EL* is positioned according to the installation manual MIC Sensor Pt1000. This list could be continued arbitrarily. 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 "c5", "d5L" or "c5", "55C"

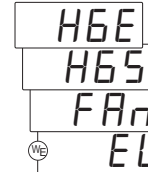


Medium humidity level value: 25 to 100%

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

Defrost management

(Config Defrost)



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 adaptive defrost end temperature (Electric)

Hot gas defrosting in multicompressor racks/central refrigeration plants (H6E)

The cooling process is interrupted, the defrost relay switched on, the air cooler fan is controlled as configured under "cFR". 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 "cI1" or "cI2", as shown under the menu item defrost communication "dLC".

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 following drain down time*, 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 "cdE" and "cdP", the defrost period as well as the defrost end temperature, can be adjusted downwards, if necessary. 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 air cooler fan is temperature and time-delayed, depending on the setpoint temperature, as described in the standard air cooler fan management under "5Ed".

Recirculating air defrosting (FRn)

The air 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 "c5", "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 "EUS.". The defrost relay is switched on during the recirculating air defrost if the goods protection program "cEP" is configured to "OFF". The connection of an electric heater is in this case not allowed.

Electric defrosting (EL)

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 5K/9°R.

Attention!

It is essential to ensure that the coolers during the defrosting process never interfere with each other due to secondary air currents. Secondary air currents do not only cause higher energy costs but also seriously impair the availability of a cooling plant. This results in icing-up in the area of the cooler, especially when operating at sub-zero temperatures.

Note:

Before starting the heat-up phase, the air 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 air cooler fan is time delayed depending on the setpoint temperature as described in the standard air cooler fan management under "5Ed".

Defrost end temperature

(Config Defrost Endtemperature)



Adjustable value: 0.1 - 50 °C / 0.5 - 121 °F

Adaptive calculation of defrost end temperature

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 precondition for setting the defrost end temperature is the configuration of the electric defrost "EL" 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 "H6S" or "H6E" 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 should be adjusted downwards.

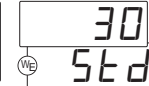
Adaptive calculation of defrost end temperature (5Ed)

The defrost end temperature is calculated adaptively by the controller itself. It is calculated depending on setpoint temperature, amount of frost/ice and the power of the defrost heating.

Defrost period

(Config Defrost Period)

Parameter is only valid in conjunction with "cd", "H6E" or "cd", "H6S" or "cd", "EL"



Adjustable defrost period: 5 - 50 minutes allowing for the defrost end temperature

Adaptive defrost period determination

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.

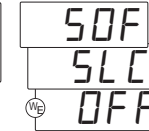
The controller adapts the defrost detection, taking the defrost end temperature into account, in order to reach the set target time. This process can require several defrost cycles. If the heating output is too low, the set value might not be reached or it might only be reached approximately.

Adaptive defrost period determination (5Ed)

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.

Cabinet mode

(Config Cabinet)



Cabinet mode "SOF"

Cabinet mode "SLC"

Cabinet mode "off"

Cabinet mode for open display cabinets (5LC)

When the parameter "5LC" is activated, the control variable is no longer the current air entry temperature but, according to "cL", the calculated mixing temperature of the block- and air entry temperature.

Cabinet mode for open display cabinets (50F)

When the parameter "50F" is activated, the control variable is no longer the current air entry temperature but the, according to the correction value "cLo" adapted, air entry temperature.

Note:

!Cool Expert Service can be asked for the optimum control-mode for a specific cabinet.

!The calculation of the air entry temperature with active cabinet mode "5LC" or "50F" is disabled upon detection of a night cover by the controller itself or after detection via a digital input parametrized with "nLD". The permanent operation of the air cooler fan is temporarily replaced by the energetically optimized air cooler fan management.

Cabinet Loading

(Config Cabinet Load)



Adjustable value: 10 - 100%

Value: 85 %

Value 10 - 100%

The value allows a weighted measurement of the block temperature and the actual process variable (air entry temperature). A high ratio setting thereby corresponds to a large fraction of the air cooler block temperature on the process variable.

Correction value air entry temperature

(Config Cabinet Offset)



Value: -10...10 K

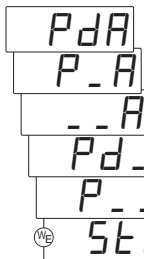
Value: 0 K

Value -10...10K

The value represents the influence of secondary air flows from the environment onto the actual process variable (air entry temperature). A positive value-setting corresponds to an increase of the air entry temperature, as a result the temperature in the cabinet is decreased by the setted value.

Air cooler fan management

(Config Fan)



- Fan runs permanently, with night cover*, fan is on during the defrost (PdA)
- Fan runs permanently even during the defrost (P.A)
- Fan runs during defrost (-.A)
- Fan runs permanently, with night cover* (Pd.)
- Fan runs permanently (P.)
- Standard air cooler fan management (Std)

Fan runs permanently, with night cover*, fan is on during the defrost (PdA)
Air cooler fan runs permanently with additional detection of a night cover*. The air cooler fan is switched on during the defrosting process.

Fan runs permanently even during the defrost (P.A)
Air cooler fan runs permanently even during the defrosting process.

Fan runs during the defrost (-.A)
Air cooler fan runs permanently during the defrosting process, in normal operation, however, the standard air cooler fan management (Std) is used.

Fan runs permanently with night cover* (Pd.)
Air cooler fan runs permanently with additional detection of a night cover*. The air cooler 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 "c5", "55L".

Note:
When cabinet mode is activated ("cL", "Dn"), the detection of a night cover disables the calculation of the mixing temperature (according to "cLL").

Fan runs permanently (P.)
Air cooler fan runs permanently but not during a defrosting process.

Standard air cooler fan management (Std)
Fan pre-run: If the room temperature increases 0.5 K / 0.9 °R above the setpoint value, the air cooler fan is first started (without the compressor running). The air cooler fan pre-run is controlled by means of temperature. The delay time can vary between 90 seconds and 20 minutes until the compressor starts. The length of the forerun 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.

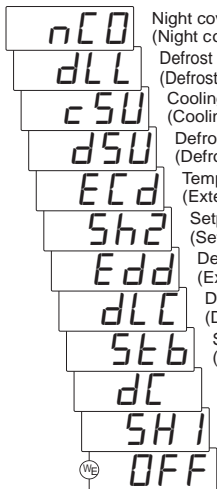
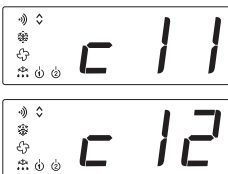
Cyclic air circulation: In order to ensure even thermal stratification within the refrigerated unit, the air cooler fan runs for 5 minutes every 15 minutes, if the room temperature is below the setpoint temperature.

Adaptive fan start temperature: After each defrosting process, the starting temperature of the air cooler fan is recalculated depending on the setpoint value and current room temperature in order to bind any possible residual heat within the air cooler. The air cooler 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 ("c d" "FRn"), the air cooler fan is switched on during the defrost phase regardless of the configuration given here.

Digital input 1 & Digital input 2

(Config Input 1, Config Input 2)



- Night cover on refrigerated cabinets (Night cover) (nCO)
- Defrost communication with linked defrost start (Defrost lock linked) (dLL)
- Cooling request suppression (Cooling suppression) (c5U)
- Defrost suppression (Defrost suppression) (d5U)
- Temperature communication (External cooling demand) (ECd)
- Setpoint shift with defrost suppression (Setpoint shift 2) (SH2)
- Defrost initiation (External defrosting demand) (Edd)
- Defrost communication (Defrost Lock) (dLL)
- Standby (Standby) (Stb)
- Detection of a door opening (Door contact) (dC)
- Setpoint shift (Setpoint shift 1) (SH1)
- Input not configured (OFF) (OFF)

Night cover (nCO)
For the duration of the connection the air cooler fan management is activated and a permanent fan operation is disabled. Calculation of the air entry temperature, if configured under "cL" respectively "cLc" or "cLL", is disabled. A possible configured, automatic recognition of a night cover remains active but is overridden by the activation of the digital input.

Defrost communication with linked defrost start (dLL)
Using electric defrost ("EL"), switching on the configured digital input results in a defrost phase after the expiration of all minimum runtimes (cooling demand, air cooler fan, ...). After finishing the defrost, air cooler fan and cooling demand are suppressed until the input signal is cancelled. 90 minutes after finishing the defrost the controller is starting his regular function even if the input signal is not released. A defrost is not allowed, if the signal for defrost suppression is switched on, or the last defrost happened less than 1 hour ago. However, the defrost request is saved and carried out after the removal of the internal lock.
Using recirculating air- or hot gas defrost ("FRn", "H5E" and "H55"), the "standard" defrost communication is carried out (see below).

Attention: When using defrost communication with the digital inputs 1 or 2, the goods protection program should not be configured. Nonobservance results in the alert "EUS".

Cooling request suppression (c5U)
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 air cooler 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.

Temperature communication (ECd)
Two MIC QKL mini 2's are also able to communicate with each other using their digital inputs without a network module. An adaptive setpoint correction of more than two controllers can only be established using optional network modules, as described under the operating level 2.2. Directly after a controller requests cooling, a temporarily adjustment of the setpoint temperature of the remaining controller takes place for the duration of the cooling request. The adapted setpoint temperature is displayed in the operating level 1 under "L5R". The controller perceives the new setpoint temperature and starts his air cooler fan first, followed by his cooling request in the event of a tendentially increasing room temperature. If the remaining controllers of the cooling position detect a tendentially falling room temperature, their cooling contactor remains inactive whereas the air cooler fans remain switched on. After the controller which initially requested cooling reaches his setpoint temperature, the cooling request and the air cooler fans are switched off under consideration of minimum runtimes. The air cooler fan management as configured under "cFA" is used again. The original setpoint temperature has now priority even for the former adapted controller.

Deviations in the setpoint temperatures of controllers belonging to the same group are limited to max. 8 K / 14.5 °R. If setpoint temperatures above freezing point are used it is ensured that the room temperature does not fall below 0.5 °C / 32.9 °R.

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

You can obtain more information on temperature communication 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 "c55". 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 "L5R".

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

Defrost communication (dLL)
Multiple controllers can work together as a group in one or in several refrigerated units after initiating a defrost in order to achieve an optimum 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" is selected under "c d". 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 "c d". The controller is switched to cooling request to generate hot gas (for 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 of cooling request.

Recirculating air defrosting if the configuration "FRn" is selected under "c d". 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 two-hours of cooling request at the earliest.

Attention:
When using defrost communication with the digital inputs 1 or 2, the goods protection program should not be configured. Nonobservance results in the alert "EUS".

You can obtain more information on defrost communication with its various possible applications directly from Cool Expert on request.

Standby (Stb)
The standby mode is initiated immediately for the duration of the connection. The message "5Lb" appears alternately with the room temperature "Ll" in the display. After cancelling the signal, the controller remains locked for 8 minutes more. This delay time can be adjusted in operating level 2.1, item "5d". A safety time can be configured under "c5d". Even in the case of continuous connection of the digital input, the controller reassumes its control function after the safety time 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 air cooler fan run are suppressed or interrupted immediately (regardless of all minimum runtimes). The message "-d-" is displayed alternately with the room temperature for the duration of door opening. The duration of the door opening in conjunction with "c d d" as well as a safety temperature under "c d L" can be configured in order to protect the goods against damage.

Setpoint shift (SH1)
The setpoint value is increased or decreased for the duration of the connection by the value configured under "c55" and displayed in the operating level 1 under "L5R".

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 t Shift (Config Setpoint Shift)

Parameter is only valid in conjunction with "c11", "5H1" or "c11", "5H2" or "c12", "5H1" or "c12", "5H2"



Correction of the setpoint temperature
If the digital input has been configured accordingly, the setpoint temperature can be increased or decreased from -30 to +30 K / -54 to +53.5 °R here.

Note:
If recirculating air defrosting is used ("c d", "FRn") the resulting setpoint value must not be set to less than 0 °C / 32 °F! The alert "EUS" follows if this is disregarded.

Duration of door opening (Config Door Duration)

Parameter is only valid in conjunction with "c l", "dC" or "c l2", "dC"

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

Value 1 - 120 minutes

When opening the door, cooling demand and air cooler fan 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.

Time controlled door opening "Off" (OFF)

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

Safety temperature during door opening (Config Door Temperature)

Parameter is only valid in conjunction with "c l", "dC" or "c l2", "dC"

Adjustable value: 0.1 - 10 K / 0.5 - 17.5 °R
Safety temperature "Off"

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.

Safety temperature "Off" (OFF)

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

Alarm time during door opening (Config Door Alarm)

Parameter is only valid in conjunction with "c l", "dC" or "c l2", "dC"

Adjustable value: 0 - 120 minutes
Standard

Value 0 - 120 Minuten

If the door remains open for longer than the configured time, a warning will be given by a periodic acoustic signal. After further 5 minutes the alert "Eda" is generated.

Standard (Std)

If the door remains open for longer than 120 minutes without interruption, the alert "Eda" is generated and the controller returns to its control function.

External standby safety time (Config Standby Duration)

Parameter is only valid in conjunction with "c l", "5Eb" or "c l2", "5Eb"

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

Value 1 - 600 minutes

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

No external safety time configured (OFF)

All control functions remain switched off for the duration of the external standby "5Eb" (no time limit).

Goods protection program (Config Goods Protection)

Goods protection program "on", following setpoint, with early low temperature warning
Goods protection program "on", with early low temperature warning
Goods protection program "on", following setpoint
Goods protection program "on"
Goods protection program "off"

Configuring the goods protection program is only possible in the case of electro- or recirculating air defrost. In the case of recirculating air defrost the heating is done by an additional heater.

Goods protection program on, following setpoint, with early low temperature warning (FSL)

To protect goods from low temperature (e.g. otherwise resulting in freezing), the goods protection program is initiated after the temperature has fallen below the actual setpoint, even if a setpoint correction is configured. If the room temperature falls more than 0.5 K/0.9 °R below the setpoint, after a maximum of 12 minutes the air cooler fan is started. If the controller detects an ongoing negative trend of the room temperature in a time window of 18 minutes, the heating is switched on additionally. At the same time the low temperature warning "E5P" is displayed by the controller. If using hot gas defrost (menu item "cd", "H5E" or "H55") only the temperature is monitored, the defrost relay remains unswitched.

Goods protection program on, with early low temperature warning (OnL)

In contrast to the previously described procedure for the goods protection against low temperature, now the lowest setpoint is relevant for the monitoring. Here the correction value must be paid attention to, when setpoint correction is used. The further procedure is the same as described in "Goods protection program on, following setpoint, with early low temperature warning (F5L)".

Goods protection program on, following setpoint (F5)

See ("c5P", "F5L"), however without early low temperature warning. The low temperature warning "E5P" is displayed, after the heating/heater remained on for at least 60 minutes without interruption.

Goods protection program on (On)

See ("c5P", "OnL"), however without early low temperature warning. The low temperature warning "E5P" is displayed, after the heating/heater remained on for at least 60 minutes without interruption.

Goods protection program off (OFF)

Room temperatures below the setpoint are not monitored.

Note:

The setting "F5" together with the setpoint correction "c55" could also be used as an unfreezing- or heating program. In the case of single sensor control ("c5", "c55") the goods protection program is not taken into account.

Attention: When using defrost communication with the digital inputs 1 or 2, the goods protection

program should not be configured. Nonobservance results in the alert "E55".

Temperature scale (Config Celsius Fahrenheit)

All temperature values are displayed in Celsius (°C)
All temperature values are displayed Fahrenheit (°F)

Setpoint temperature lower bound (Setpoint Lower Bound)

Setting -50°C / -58°F to ...
The setpoint temperature lowerbound

Setpoint temperature upper bound (Setpoint Upper Bound)

Setting ... to 50 °C / 121°F
The setpoint temperature upperbound

Note:

With "SLb" und "SUB" the adjustment range of the setpoint temperature under the item "E5r" can be limited. In conjunction with the password "P_" a manipulation of the setpoint value (control level 1 under "E5r") 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 configurationlevel without executing a function

Buzzer Control (Buzzer Control)

Buzzer Control "On" with repetition
Buzzer Control "On"
Buzzer Control "Off"

Buzzer Control "On" with repetition

The buzzer is switched "on" in the event of a fault. The buzzer becomes disabled by pressing one of the buttons. If the fault is not cleared within two hours, the buzzer recurs.

Buzzer Control "On"

The buzzer is switched "on" in the event of a fault. After pressing one of the buttons, the buzzer is disabled and remains disabled up to the next fault.

Buzzer Control "Off"

Buzzer remains disabled at all.

Power failure control (Power Fail Control)

Alert in the event of power failure "On"
Alert in the event of power failure "Off"

Alert in the event of power failure "On"

After a power failure, the alert "PFL" occurs.

Alert in the event of power failure "Off"

After a power failure, the alert remains disable.

Note:

Power failures are displayed in the statistics level "-3-", item "PFn", independently of the configuration above.

Test program (Test-Program)

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

Note:

The upper control button "⬆" is used to select the appropriate function. The selected function is switched on and off using the lower control button "⬇". The test program serves the purpose of checking the controller functions 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.

Entry of password (Password)

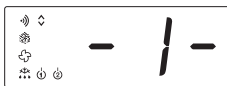
Password adjustable between 0 and 999
"- -" = no password provided

To the expanded configuration level (operating level 2.1)

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



The first menu item after changing to the network level (operating level 2.2)



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



Operating level 2.1

The expanded configuration level

Correction factors for sensor TL1 and TBL

Room temperature TL1 (Offset tL1)



Correction factor: -10 to 10 K / -18 bis 17.5 °R

Block temperature TBL (Offset tBL)



Correction factor: -10 to 10 K / -18 bis 17.5 °R

Correction factor (oL 1), (oBL)

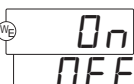
The sensor values measured by the controller can be corrected in the range -10 to 10 K / -18 to 17.5 °R. The set correction value is added to or subtracted from the measured sensor values.

Note:

In some practical applications, in exceptional cases, when the sensor lines TL1 and TBL are extended and cable conductors are missing, 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 TL1 and TBL 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/hide temperature display

(Display temperature)



Temperature display "EL" switched on

Temperature display "EL" hidden

Temperature display "EL" switched on

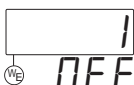
Display of the room temperature in operating level 1 under "EL"

Temperature display "EL" 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.

Internal heat control

(Internal heat control)



Heating control activated, value 1-15

No internal heat control

Heating control activated, value 1-15

Depending on this value the connected defrost heater will be checked in defined intervals. A value of 1 represents 6 month. Higher values will decrease the interval.

Attention:

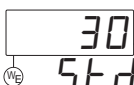
Values larger than 5 can possibly affect the control functions in a negative way and should only be used on behalf of the Cool Expert Service.

No internal heat control (OFF)

Interval checks of the defrost heater are disabled.

Internal standby delay

(Internal standby delay)



Value 1 - 900 seconds

Standard



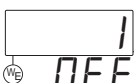
Operating level 2.2

The network level

Attention: Requirement for the usage of the network functions is that each controller is equipped with a network module. The multifunction Controller MIC QKL e3 has to be equipped with a network module release If3. For detailed compatibility information see MIC QKL LON Module Installation manual.

Network identification

(Network identification)



Adjustable value 1 - 16

Network based communication "off"

Adjustable value 1 - 16

The controllers in a network can be linked and separated in up to 16 communication groups. Controllers with the same identification number can communicate with each other. Precondition is that they are configured as described below. Up to 128 controllers can be linked in one network.

Network based Communication "Off" (OFF)

Network based communication disabled for this controller.

Temperature communication group

(Network temperature group)



Adjustable value 1 - 8

Temperature communication "off"

Value 1 - 900 seconds

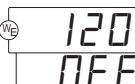
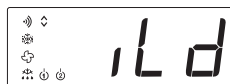
Once a standby signal is cancelled (by digital input or network module), the controller remains blocked for the programmed duration.

Default standby delay (5td)

The standby delay is set to 30 sec.

Safety time cooling demand suppression

(Internal Load Delay)



Adjustable value 1 - 120 minutes

Safety time "off"

Value 1 - 120 minutes

In conjunction with parametrizing "c 1" or "c 12" for "c 5U" the suppression of a cooling demand is reset after expiration of the set time.

Note:

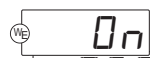
The cancellation of the suppressed cooling demand is carried out in order to limit the turn-off time.

System monitoring

(Error Cooling 0/1; Error Defrost)



System monitoring (Error Cooling 0)



Selected alert "On"



Time-based system monitoring (Error Cooling 1)



Selected alert "Off"



Defrost monitoring (Error Defrost)

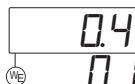
The alerts of the system monitoring (ECo, EC 1), as well as the alert for the defrost monitoring (EdF) can be enabled individually (On, OFF).

Note:

The system monitoring is used for the early detection of faults prior a breakdown of the system, thus prohibiting damage to the goods. Due to the monitoring of the cooler block temperature during the cooling process, capacity loss of the refrigeration plant is detected in the beginning and results in the alert "ECo" or "EC 1". Furthermore the heater is checked by monitoring the block temperature during the defrost process. For the case of insufficient heating capacity, the alert "EdF" is displayed.

Defrost Detection

(Defrost Parameter 4)



Adjustable value: -0.1 - 3 K

Factory setting

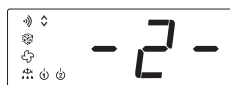
Value -0.1 - 3 Kelvin

This parameter allows the preselection or modification of the controller's tolerance for detecting a defrost. The further adaption of the controller then starts from the preselected value.

Note:

The Value for "dP4" is determined adaptively, based on the defrost time. Modifications of the value are only permitted after consultation with the Cool Expert Service.

Back to the configuration level (operating level 2)



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

Note:
The temperature communication using the digital inputs is disabled when a temperature communication group is set.

Defrost communication group (Network defrost group)

Adjustable value 1 - 8
Defrost Communication "Off"

Value 1 - 8
Up to 16 controllers can be linked together as a defrost communication group.
Precondition: The controllers belonging to the same defrost communication group have to be set to the same value of "nd6" and "nd1". Controllers of the same defrost communication group are working together and are coordinating their defrost processes in order to reach an optimum defrost result. A defrosting controller is locking the remaining controllers of the group (Cooling request- and defrost suppression). In this way the occurrence of cost intensive load peaks, as well as influences due to secondary air flows are avoided. The following processes are carried out, depending on the selected defrosting method.

For electric defrosting, if the configuration "EL" is selected under "cd". If the controllers detect that one controller of their defrost communication group has started a defrosting process, all the remaining controllers are switched to standby. In the irregular case, the cancelling of the standby state is done after the defrosting time exceeds 90 minutes. After cancelling the signal, the next defrosting process for the controllers that were switched to standby before is only allowed after one hour or if the setpoint temperature was reached.

For hot gas defrosting in interconnected and individual refrigeration systems if the configuration "HBE" or "HBS" is selected under "cd". Network defrost communication in combination with hot gas defrosting is not implemented in this software version.

Recirculating air defrosting if the configuration "FRN" is selected under "cd". If the controllers of a defrost communication group perceive that one controller of their group has started a defrosting process, all the remaining controllers initiate a defrosting process for themselves. The cooling process can only be initiated again after all controllers of the concerned defrosting group have finished their defrosting process or if a safety time of 90 minutes is exceeded. After resuming the cooling process the next defrosting can be initiated after a total of 2 hours cooling request (per controller) at the earliest.

You can obtain more information on defrost communication with its various possible applications directly from Cool Expert on request.

Defrost communication "Off" (OFF)
No network based defrost communication.

Note:
The defrost communication using the digital inputs is disabled when a defrost communication group is set.

Support group (Network support group)

Parameter only valid in combination with "nd1", "I" or higher, "nd6", "I" or higher and electrical defrost "-2-", "cd", "EL"

Adjustable value 1 - 8
No support group configured

Controllers belonging to the same network communication group "nd1" and the same defrost communication group "nd6", can be forced to defrost at the same time by the parameter "nUG" when using electric defrost. Controllers with the same values for "nd1", "nd6" and "nUG" are set to standby after the, by one controller of their group, commonly initiated defrost process. The standby-state of the controllers is ended after last controller in the group has finished defrosting. The cooling demand is started under consideration of the temperature communication, when configured.



Display max. & min. room temperature

Maximum room temperature "tH1" (Temperature High)

Minimum room temperature "tL1" (Temperature Low)

Note:
After the first start-up of the controller or after resetting the statistic values, it can last up to 30 minutes until a value is visible.
The maximum and minimum room temperature is evaluated by sensor TL1 and is therefore only possible in the case of the two-sensor control.

Display Defrost Percentage (Percentage of Defrost)

Percentage of Defrost Pod in %
$$Pod = \frac{\text{defrost heating time}}{\text{compressor running time}} \times 100\%$$

Note:
The Percentage of Defrost is a ratio consisting of the defrost heating time divided by the compressor running time. Typical values for state-of-the-art controllers range between 10 to 15 %. Due to the intelligent defrost detection and the implementation of a defrost management, the MIC QKL mini 2 achieves a much smaller percentage of defrost, typically less than 3 %. The required defrost energy is, especially in part-load operation, substantially reduced.

Display defrost count (Defrost Number)

The number of defrosting processes

Note:
All statistical values can be reset in operating level 2 (configuration level) under the menu item "r5L, rLd".

Note:
The defrost communication using the digital inputs is disabled when a support group is set.
Utilization of the parameter "nUG" leads to a slightly higher energy consumption for the defrost processes, as the number of defrosts is set by the air cooler with the highest frost rate. The total number of standby-states in a controller-group with same values for "nd1" and "nd6" is reduced by the parameter "nUG".

Hot gas power factor (Network support power)

Adjustable value 1 - 100

In preparation: this parameter has currently no function!

Network test (Network test)

- Show support group (5UG) (Show support group)
- Show defrost communication group (5d6) (Show defrost group)
- Show temperature communication group (5t6) (Show temperature group)
- Show network identification (5ld) (Show network identification)
- Network service message (nSP) (Network servicepin)

Show support group (5UG)
When pressing the lower button "⬇" all controllers within the same support group will signal their group membership by winking*.

Show defrost communication group (5d6)
When pressing the lower button "⬇" all controllers within the same defrost communication group will signal their group membership by winking*.

Show temperature communication group (5t6)
When pressing the lower button "⬇" all controllers within the same temperature communication group will signal their group membership by winking*.

Show network identification (5ld)
When pressing the lower button "⬇" all controllers within the same network identification will signal their group membership by winking*.

Network service message (nSP)
When pressing the lower button "⬇" a network service message is send.

Note:
"-R-" is shown if a message is sent successfully. The blinking Alarm-LED indicates an error when trying to send a message (e.g. no network module present, communication deactivated).

*winking: a winking controller shows a rotating "□" in the display for approx. 5 seconds and can therefore be easily identified in a group of controllers.

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 door openings (Door Opening Number)

Number of door openings

Note:
Only in conjunction with configured door contact "dE" under "c1I" or "c1E2"

Display number of alerts "Edo" (EDO Number)

Number of "Edo" alerts

Display number of alerts "ECO" (ECO Number)

Number of "ECO" alerts

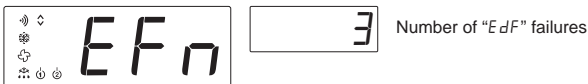
Note:
The number of "ECO" alerts is recorded even if system monitoring is deactivated (Operating level 2.1 "ECO", "OFF").

Display number of alerts "ECI" (EC1 Number)

Number of "ECI" alerts

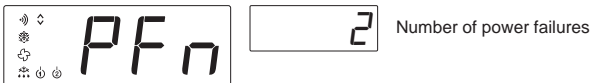
Note:
The number of "ECI" alerts is recorded even if system monitoring is deactivated (Operating level 2.1 "ECI", "OFF").

Number of "EdF" failures (EdF Number)



Note:
The number of "EdF" alerts is recorded even if system monitoring is deactivated (Operating level 2.1 "EdF", "DFF").

Number of power failures (Pfn Number)



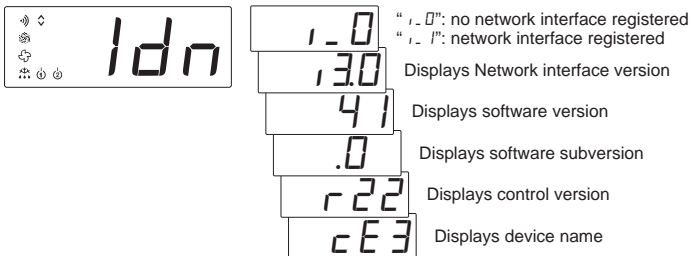
Note:
In the event of power failure and restoration of power the counter under "Pfn" is increased by one.

Diagnostic values (Cool Expert internal)



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

Version number (Ident Number)



Back to operating level (operating level 1)



Alerts

ES1 Sensor fault TL1

Cause:
Temperature sensor "EL 1" not functioning.

Measures:
Check sensor TL1 or supply cable, line break or line-to-line fault.

ES2 Sensor fault TBL

Cause:
Temperature sensor "EL 2" not functioning.

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

ECO 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 TL1 and TBL is greater than 20 K/36 °R, 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 air 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).

EC1 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.

EdF Defrost fault

Cause:
! Maximum defrost period of one hour exceeded.

Measures:
! Check output of the heater in the case of electric defrosting.
! Check setting of the safety temperature limiter.

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

EGP Early low temperature warning / Goods protection fault

Cause:
! Early low temperature warning (read under "cEP", "F5L" and "OnL")
! No increase of room temperature reached within a heating period of 60 minutes.
! During the heating period, the block temperature remains for at least 15 minutes 15K/27°R above the room temperature.

Measures:
! Check the function and output of the connected heater.

EUS Invalid configuration

Cause:
! A configuration entered by the user is invalid.
! The position of the sensors TL1 and TBL is mixed up.

Measures:
Check the following configurations:
! Recirculating air defrosting (item "c d", "FRn") in conjunction with the one-sensor control (operating level 2 under "c 5", "55L") is invalid.
! Setpoint values (under "E 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:
As a rule: When the alert occurs, the last parameter changed in the configuration level was incorrect. The alert "EUS" cannot be acknowledged. The message is cancelled automatically as soon as the

PFL 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 "Pfn".

Edo Monitoring the door opening time

Cause:
Door opened for more than the door alarm time (item "c dR" in combination with "c 1 l" or "c 12", "dc") without interruption.

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

E 10 Network module not recognized

Cause:
Network module cannot be recognized by the controller.

Measures:
Check network module and replace it if necessary.

E11 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

E34 **Er0** **EPc**

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

UCH Standby by user

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

5Eb Standby by digital input

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

IF3 Network module initialized

The message "IF3" appears after initialization or when a network module is installed.

IF_ Network module removed

The message "IF_" appears after removing a network module.

-d- Message at door opening

The message "-d-" is displayed alternately with the room temperature for the duration of door opening, when digital input (under "c 1" od "c 12", "dc") is configured accordingly.

Customer:	<input type="text"/>	Refrigeration specialist:	<input type="text"/>
Plant:	<input type="text"/>	Address:	<input type="text"/>
Controller No.:	<input type="text"/>	Phone:	<input type="text"/>
Serial No.:	<input type="text"/>	Contact:	<input type="text"/>

Marks:

The Operating level p. 4 (Operating level 1)

Parameter	Description	Factory setting	Setting
tL1	Display of room temperature	e.g. -05	Display only
tBL	Display of block temperature	e.g. -73	Display only
tSA	Display of current setpoint temperature	e.g. -50	Display only
tSr	Setpoint temperature setting	-00	
ALt	Alerts	n0	Display only
ECt	Control On / Off (Standby)	0n	
-2-	To the configuration level (operating level 2)	c5	Display only
-3-	To the statistics Level (operating level 3)	tH1	Display only

The expanded configuration level p. 8 (Operating level 2.1)

Parameter	Description	Factory setting	Setting
oL1	Correction factor for sensor TI1	00	
oBL	Correction factor for sensor TBL	00	
dt	Display/hide temperature display	0n	
iHC	Internal heat control	OFF	
iSd	Internal standby delay	5td	
iLd	Safety time cooling demand suppression	OFF	
ECO	System monitoring	0n	
EC1	Time-based system monitoring	0n	
EdF	Defrost monitoring	0n	
dP4	Defrost detection	e.g. 01	
-2-	Back to the configuration level (operating level 2)	c5	Display only

The configuration level p. 5-8 (Operating level 2)

Parameter	Description	Factory setting	Setting
c5	Control mode (Sensors & defrost detection)	d5C	
c5L	Defrost load pre-selection	75	
cd	Defrost management	EL	
cdE	Defrost end temperature	5td	
cdP	Defrost period	5td	
cC	Cabinet mode	OFF	
cCL	Cabinet loading	85	
cCo	Shift air entry temperature	00	
cFA	Air cooler fan management	5td	
c11	Digital input 1	OFF	
c12	Digital input 2	OFF	
c55	Setpoint shift	00	
ddd	Duration of door opening	OFF	
cdt	Safety temperature during door opening	2	
cdA	Alarm time during door opening	5td	
c5d	External standby safety time	OFF	
c6P	Goods protection program	OFF	
cCF	Temperature scale	°C	
SLb	Setpoint temperature lower bound	-500	
SUb	Setpoint temperature upper bound	500	
rSt	Reset	n0	Display only
bUC	Buzzer control	0n	
PFC	Power failure control	OFF	
tSt	Test program	A_0	Display only
P_	Entry of password	- 1	
-2.1-	To the expanded configuration level (operating level 2.1)	oL1	Display only
-2.2-	To the Network level (operating level 2.2)	LSP	Display only
-1-	Back to operating level (operating level 1)	tL1	Display only

The network level p. 8-9 (Operating level 2.2)

Parameter	Description	Factory setting	Setting
n1d	Network Identification	OFF	
nt6	Temperature communication group	OFF	
nd6	Defrost communication group	OFF	
nU6	Support group	OFF	
nUP	Hot gas power factor	1	
nt5	Network test	n5P	Display only
-2-	Back to the configuration level (operating level 2)	c5	Display only

The statistics level p. 9-10 (Operating level 3)

Parameter	Description	Display	Value
tH1	Display max. room temperature	e.g. -05	
tL0	Display min. room temperature	e.g. -73	
Pod	Display percentage of defrost	e.g. 150	
dFn	Display defrost count	e.g. 1	
dOn	Display number of door openings	e.g. 18	
Edn	Display number of alerts "Edo"	e.g. 2	
EO n	Display number of alerts "ECO"	e.g. 1	
E1 n	Display number of alerts "EC 1"	e.g. 0	
EF n	Display number of alerts "EdF"	e.g. 3	
PF n	Number of power failures	e.g. 2	
ldn	Version number	r22	
d_1	Diagnostic values (Cool Expert internal)	e.g. tL1	Display only
:		:	:
d10		e.g. 3	Display only
-1-	Back to operating level (operating level 1)	tL1	Display only