ENGINEERING
TOMORROW

User guide

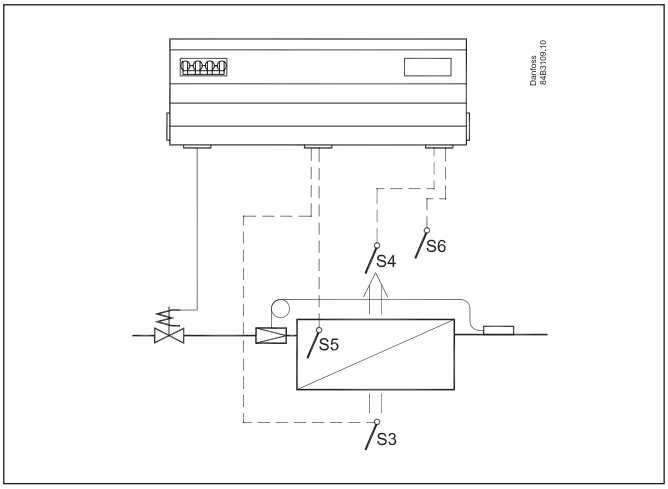
Controller tray for refrigeration appliance control with TEV AK-CT 200A + AK-CT 450A

ADAP-KOOL® Refrigeration control systems

Introduction

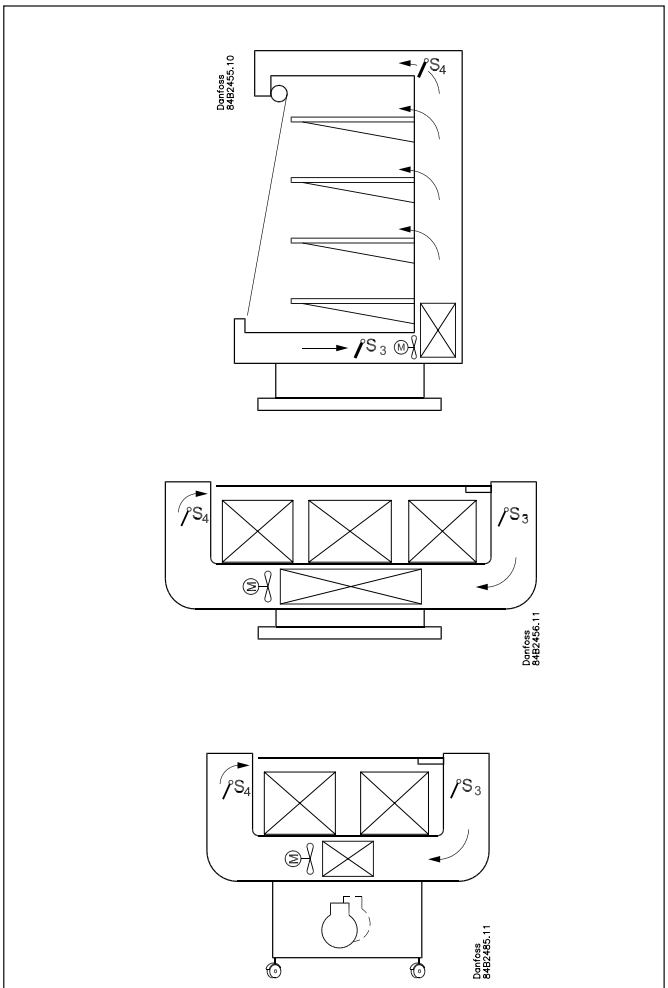
Application
Complete refrigeration appliance control with great flexibility to adapt to all types of refrigeration appliances and cold storage rooms.
- For refrigeration with brine
- For use with a thermostatic expansion valve (TEV)

Advantages
- Optimised for installation by manufacturer
- Electricity-controlled and voltage controlled relay connections
- Loads requiring electricity can be connected directly
- Overcurrent limitation
- Energy optimisation of the whole refrigeration appliance
- One controller for several different refrigeration appliances
- Quick set-up with predefined settings
- Built-in data communication
- Built-in clock function with power reserve



Principle
The temperature in the appliance is registered by one or two temperature sensors which are located in the air flow before the evaporator (S3) or after the evaporator (S4) respectively.
A setting for thermostat, alarm thermostat and display reading determines the influence the two sensor values should have for each individual function.
In addition product sensor S6, which can be optionally placed in the appliance, can be used to register the temperature near the required product in a certain place within the appliance.
The temperature of the evaporator is registered with the S5 sensor which can be used as a defrosting sensor.
In addition to the output for the solenoid valve type EVR the controller has 9 relay outputs which are defined by the use selected – the individual usage options are described in detail on page 12

Functions
- Day/night thermostat with ON/OFF or modulating principle
- Product sensor S6 with separate alarm limits
- Switch between thermostat settings via digital input
- Start of defrost via schedule, digital input or network
- Natural, electric, hot gas defrost or brine defrost
- Stop of defrost on time and/or temperature
- Coordination of defrosting among several controls
- Pulsing of fans when thermostat is satisfied
- Case cleaning function for documentation of HACCP procedure
- Rail heat control via day/night load or dew point
- Door function
- Control of two compressors
- Control of night blinds
- Light control
- Heat thermostat
- Integrated MODBUS communication with the option of mounting a LonWorks communication card



Appliance examples

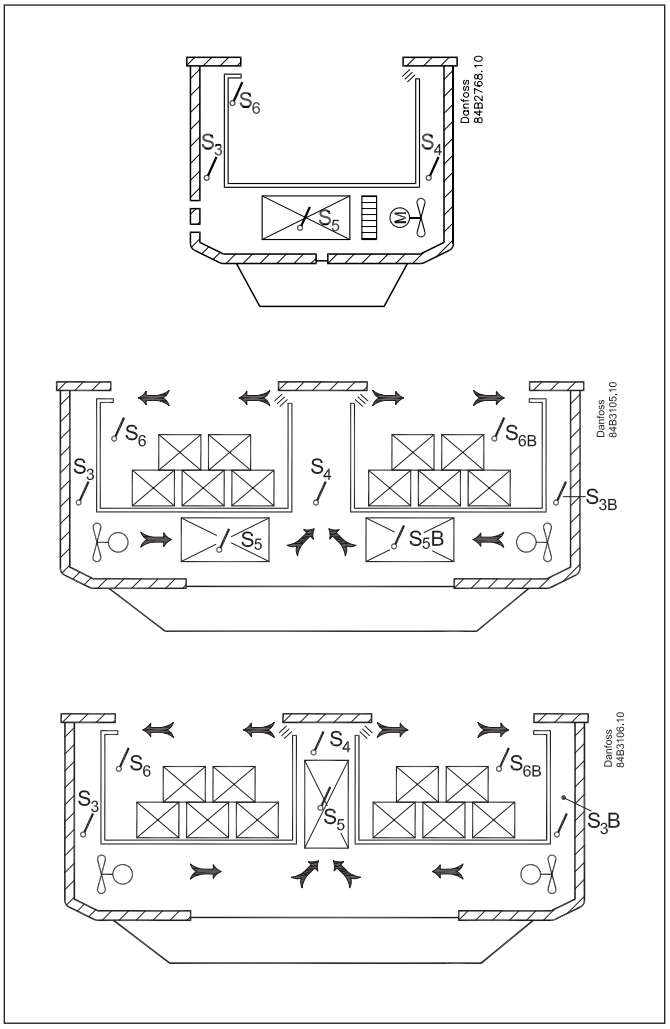
Contents

Applications

Here is an overview of the controller's usage options.

- Standard appliance or cooling room with one valve, one evaporator and one cooling section.
- Refrigeration appliance with one valve, two evaporators and two cooling sections (each with its own temperature-measuring function).
- Refrigeration device with one valve, one evaporator and two cooling sections.

A setting will configure input and outputs so that the controller's operation interface is directed at the selected application.
The current settings for the respective uses can be found on page 34.



Installation benefits

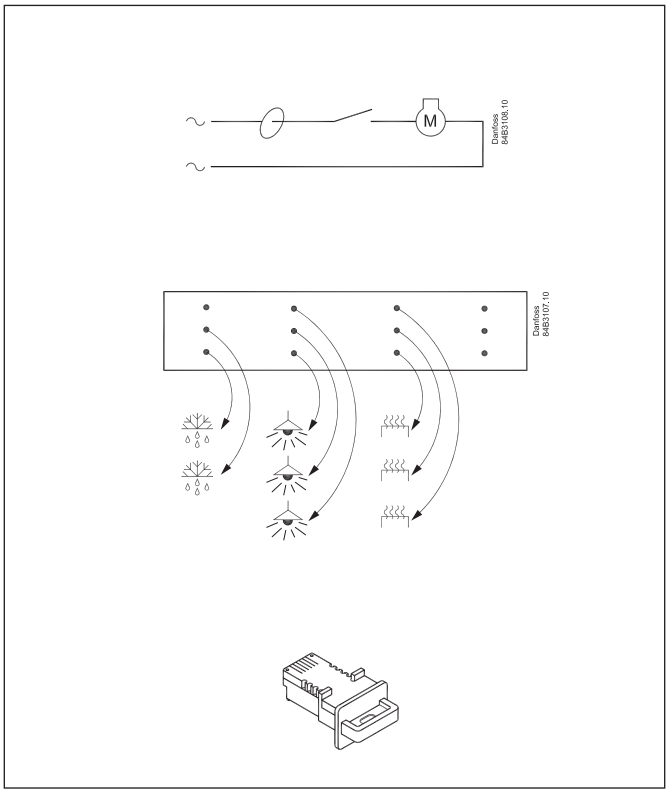
The controller is designed to provide a number of advantages when installed by the refrigeration appliance manufacturer, such as:

High relay load
Load connection/disconnection is controlled by a voltage measurement and a current measurement, so that the relay's switch function can operate under optimal conditions.
The controller can then connect loads of up to 16 A, without the use of auxiliary relays.

Spring clamps
All cable connections are made using plugs with spring switches. This allows for fast and easy installation.

Parallel power point
Several of the outlets have double or triple connections points, so the use of external loop clips is not usually necessary.

Structure of the controller
The controller consists of hardware type AK-CT 200A and a software identity code AK-CT 450A.
This software identity code is delivered in a separate plug and must be placed in an RJ45 plug in the hardware. It is first necessary to mount the plug when configuring the controller.

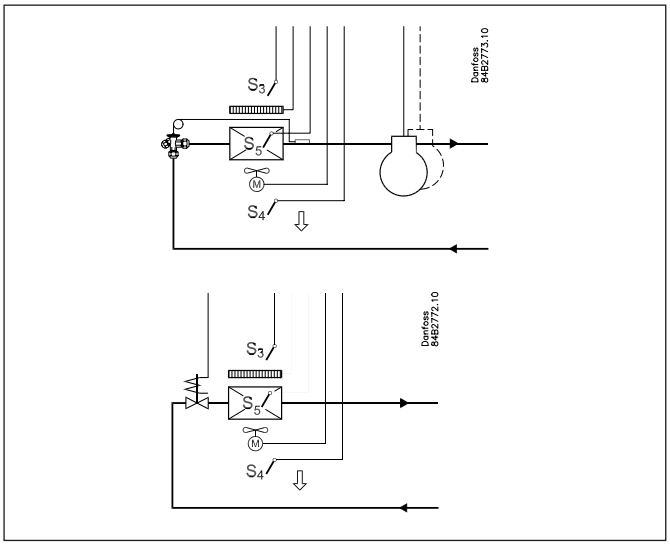


Operation

Cooling
Regulation can be performed on the basis of the following principles:

Direct expansion
The temperature is controlled either through the starting/stopping of a compressor or through the opening/closing of a solenoid valve in the liquid line.

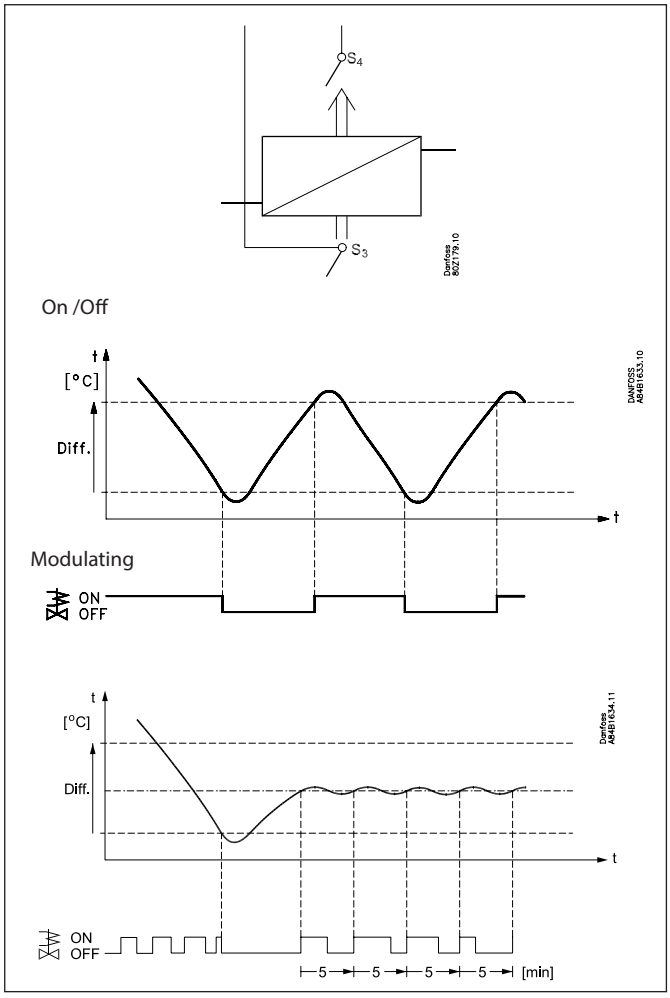
Brine
Here, the temperature is controlled by opening/closing a solenoid valve/motor valve in the brine supply.



Temperature control
The temperature in the appliance is registered by one or two temperature sensors which are located in the air flow before the evaporator (S3) or after the evaporator (S4) respectively. A setting for the thermostat, alarm thermostat and display reading determines how much the two sensor values should influence each individual function, e.g. 50% will produce an equal value from both sensors.
Various weightings can be set for day and night operation.

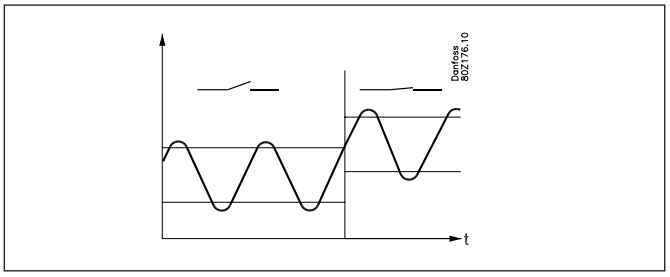
The actual temperature control can take place in two ways: as an ordinary ON/OFF regulation with a differential, or as a modulating control where the temperature variation will not be nearly as great as in ON/OFF control. There is however a limit to the use of a modulating control as it can only be used in DX central plant or brine system.

In principle, regulation in this system is the same as described above, but is now performed with a PI function. This results in reduced fluctuation of the regulated air temperature with stable loads, giving a more constant air humidity.
The function gives a constant temperature regulation with a temperature value, which lies half-way between the on and off values of the thermostat.
The operating parameters of the PI regulation are automatically optimised via the preset on and off values and the degree of opening of the valve.
The differential affects the amplification of the regulator and can therefore not be set to less than 2K in order to ensure regulation stability.
In a decentralised plant the thermostat function with ON/OFF control should be selected.
In a central plant the thermostat function may either be selected for ON/OFF control or modulating control.

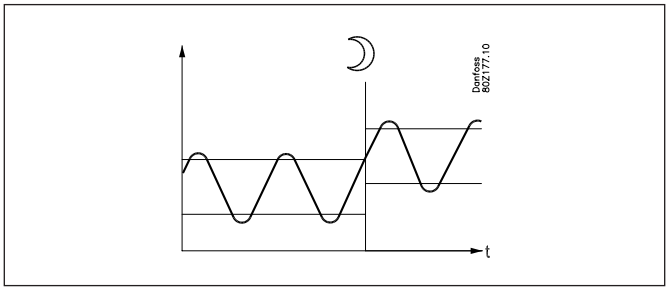


Temperature monitoring
Just as is possible for the thermostat, the alarm monitoring can be set with a weighting between S3 and S4 so that you can decide how much the two sensor values should influence the alarm monitoring. Minimum and maximum limits can be set for alarm temperature and time delays. A longer time delay can be set for high temperature alarms after defrosting, appliance cleaning or start-up.

Thermostat bands
Thermostat bands can be used beneficially for appliances where different product types are stored which require different temperature conditions. It is possible to change between the two different thermostat bands via a contact signal on a digital input. Separate thermostat and alarm limits can be set for each thermostat band – also for the product sensor.



Night setback of thermostat value
In refrigeration appliances there may be big load differences between the shop's opening and closing hours, especially if night lids/blinds are used. The thermostat reference may be raised here without it having any effect on the product temperature.
Change-over between day and night operation can take place, as follows:
• via an external switch signal.
• via a signal from the data communication system.



Product sensor
A separate product sensor S6, which may be placed in the appliance, can also be used and which can register and monitor the temperature in the warmest part of the appliance. There are separate alarm limits and time delays for the product sensor.

Appliance cleaning
This function makes it easy for the shop's staff to carry out a cleaning of the appliance according to a standard procedure. Appliance cleaning is activated via a signal – as a rule via a key switch placed on the appliance.
Appliance cleaning is carried out via three phases:
1 - at the first activation the refrigeration is stopped, but the fans keep on operating in order to defrost the evaporators. "Fan" is shown on the display.
2 - at the second activation the fans are also stopped and the appliance can now be cleaned. "OFF" is shown on the display.
3 - At the third activation refrigeration is recommenced. The display will show the actual appliance temperature, (o97 setting).

-	+	+	°C
1	÷	+	Fan
2	÷	÷	Off
3	+	+	°C

When appliance cleaning is activated a cleaning alarm is transmitted to the normal alarm recipient. A later processing of these alarms will document that the appliance has been cleaned as often as planned.

Alarm monitoring
There are no temperature alarms during appliance cleaning.

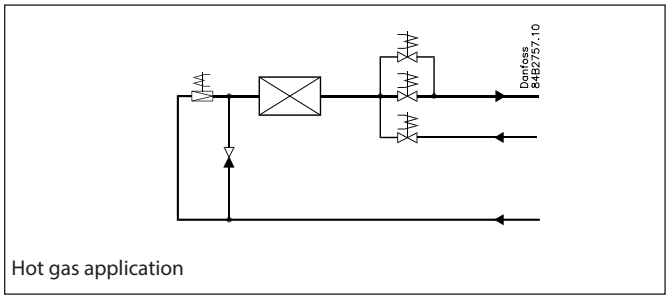
Appliance shut-down
The function closes the solenoid valve and all outputs are switched off.
The cooling appliance is stopped like the "Main switch", but this happens without an "A45 standby alarm".
The function can be enabled by a switch on the DI input or via a setting through data communication.

Defrost
Depending on the application you may choose between the following defrost methods:

Electric: The heating element is activated
Hotgas: Here the solenoid valves are controlled so that the hotgas can flow through the evaporator
Brine: Here, the solenoid/motor valve is opened on the supply pipe, so that hot brine can be fed through.
Natural: Here the fans are kept operating during the defrost

Defrost sequence
1) Pump down
2) Defrost
3) Waiting position after defrost
4) Draining (drain delay. Hotgas only)
5) Drip off
6) Delay of fan

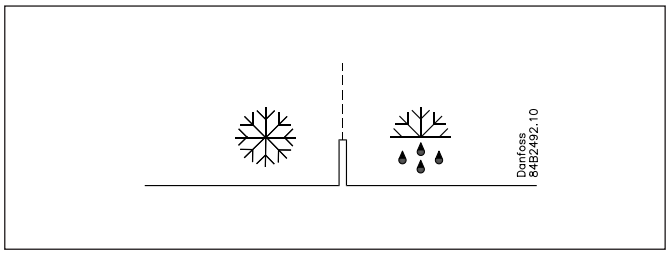
Hot gas defrost (application 7 only)
This type of connection can be used on systems with hotgas defrost, but only in small systems in, say, supermarkets – the functional content has **not** been adapted to systems with large charges.
Must not be used together with PMLX and GPLX valves, unless a time delay relay is installed, which ensures that the PMLX/GPLX valve is closed completely before the hotgas is turned on.



Hot gas application

Drip tray heating element
It is possible to control a heating element in the drip tray for hot gas defrosting. When defrosting is commenced, the heating element is activated. The heating element remains activated until a set time after defrosting has ended by time or temperature.

Start of defrost
A defrost can be started in different ways
Interval: Defrost is started at fixed time intervals, say, every eighth hour. An interval must ALWAYS be set to a "higher" value than the period set between two defrostings when a schedule or network signal is used.
Refrigeration time: Defrost is started at fixed refrigeration time intervals, in other words, a low need for refrigeration will "postpone" the defrost
Schedule: Here defrost can be started at fixed times of the day and night. However, max. 6 times
Contact: Defrost is started with a contact signal on a digital input
Network: The signal for defrost is received from a system unit via the data communication
Manual: An extra defrost can be activated from the controller's lower-most button
All the mentioned methods can be used at random – if just of them is activated a defrost will be started.

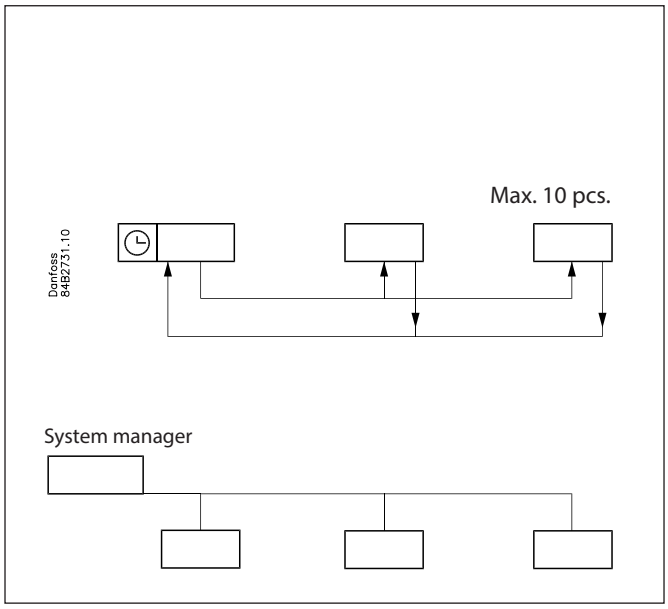


Stop of defrost
Defrosting can be stopped by either:
• Time
• Temperature (with time as safety).

Coordinated defrost
There are two ways in which coordinated defrost can be arranged. Either with wire connections between the controllers or via data communication

Wire connections
The digital input DI2 is connected between the current controllers. When one controller starts a defrost all the other controllers will follow suit and likewise start a defrost. After the defrost the individual controllers will move into waiting position. When all are in waiting position there will be a change-over to refrigeration.

Coordination via data communication
Here the system unit handles the coordination.
The controllers are gathered in defrosting groups and the system unit ensures that defrosting is started in the group according to a weekly schedule.
When a controller has completed defrosting, it sends a message to the system unit and then goes into a waiting position. When every controller in the group is in a waiting position, refrigeration is again permitted in all the individual controllers.



Defrost based on refrigeration time
When the aggregate refrigeration time has passed a fixed time, a defrost will be started.

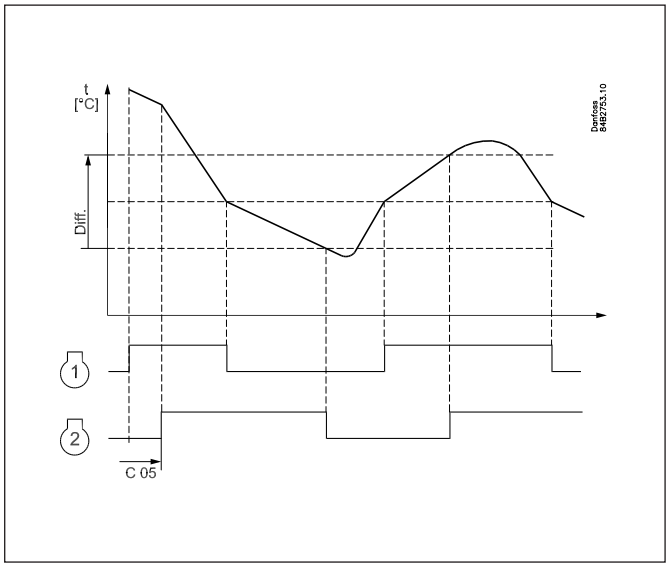
Min. time between defrosts
There is a 2 hours minimum time between defrosts.
This avoids that planned defrosts in accordance with the weekly schedule are carried out immediately after a defrost on demand has been carried out. The time applies from when a Defrost based on refrigeration time has been completed to when a planned defrost is again permitted. Defrost based on refrigeration time will not start defrosting with a shorter interval than the 2 hours either.

Melting function
This function will stop the air flow in the evaporator from being reduced by frost created by uninterrupted operation for a long time. The function is activated if the thermostat temperature has remained in the range between -5°C and +10°C for a longer period than the set melting interval. The refrigeration will then be stopped during the set melting period. The frost will be melted so that the air flow and hence the evaporator's capacity will be greatly improved.

Real-time clock
The controller has a built-in real-time clock which can be used to start defrosts. This clock has a power reserve of more than 24 hours.
If the controller is equipped with data communication, the clock will automatically be updated from the system unit.

Control of two compressors (application 8)
The two compressors must be of the same size.
When the controller demands refrigeration it will first cut in the compressor with the shortest operating time. After the time delay the second compressor will be cut in.

When the temperature has dropped to "the middle of the differential", the compressor with the longest operation time will be cut out.
The running compressor will continue until the temperature has reached the cutout value. Then it will cut out. When the temperature again reaches the middle of the differential, a compressor will again be started.
If one compressor cannot maintain the temperature within the differential, the second compressor will also be started.
If one of the compressors has run on its own for two hours, the compressors will be changed over so that operational time is balanced.

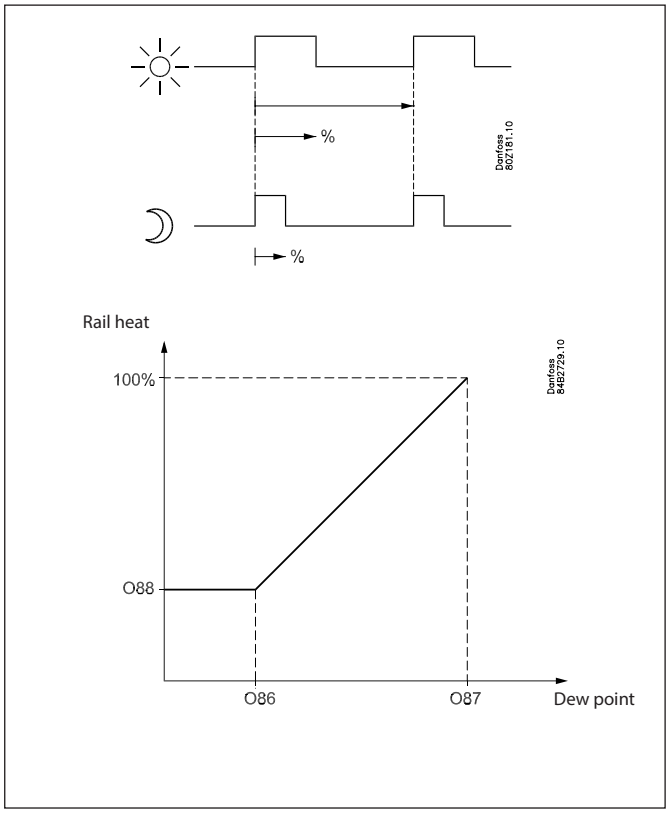


The two compressors must be of a type that can start up against a high pressure.
The compressors's settings for "Min On time" and "Min Off time" will always have top priority during normal regulation. But if one of the override functions is activated, the "Min On time" will be disregarded.

Railheat
It is possible to pulse-control the power to the rail heat in order to save energy. Pulse control can either be controlled according to day/night load or dew point.

Pulse control according to day and night
Various ON periods can be set for day and night operation.
A period time is set as well as the percentage part of the period in which the rail heat is ON.

Pulse control according to dew point
In order to use this function a system manager of the type AK-SM is required which can measure dew point and distribute the current dew point to the appliance controllers. For this the rail heat's ON period is controlled from the current dew point.
Two dew point values are set in the appliance control:
• One where the effect must be max. i.e.100%. (o87)
• One where the effect must be min. (o86).
At a dew point which is equal to or lower than the value in 086, the effect will be the value indicated in o88.
In the area between the two dew point values the controller will manage the power to be supplied to the rail heat.

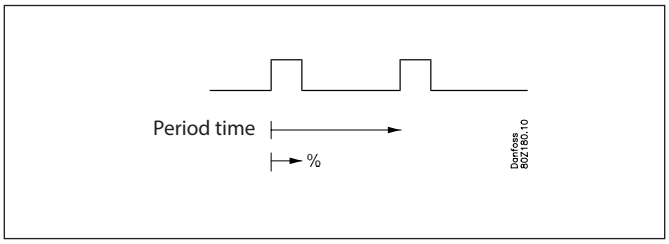


During defrosting
The rail heating will be active during defrosting (as selected in setting d27).

Fan

Pulse control
To obtain energy savings it is possible to pulse control the power supply to the fans at the evaporators.
Pulse control can be accomplished in one of the following ways:
- during the thermostat's cutout period (cold room)
- during night operation and during the thermostat's cutout period (appliance with night lid)

A period of time is set as well as the percentage of this period of time where the fans have to be operating.



Cutout of fans during plant breakdowns
If the refrigeration in a breakdown situation stops, the temperature in the cold room may rise quickly as a result of the power supply from large fans. In order to prevent this situation the controller can stop the fans if the temperature at S5 exceeds a set limit value.

Fan pause
When the setting P65 is set to a value greater than 0, the fans will stop while the night blind is rolling down.

Eco-mode
When the night blind is down, the fan speed can be reduced.
Eco-mode is not allowed if the heating function has been activated.
When Eco-mode is enabled, relay DO8 will be activated.

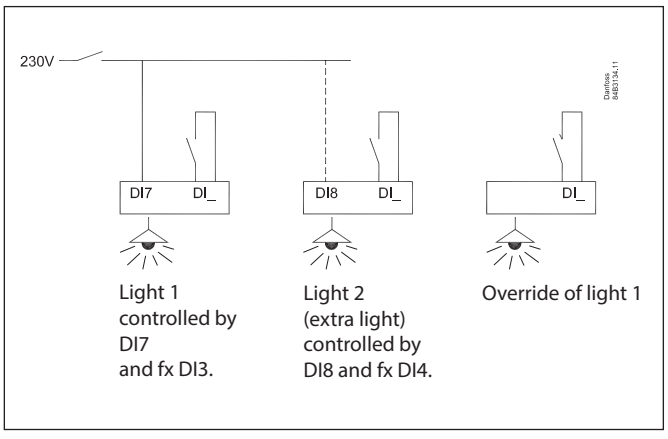
Light function
The function can be used for controlling the light in a refrigeration appliance or in a cold room. It can also be used for controlling a motorised night blind.

The light function can be defined in more than one way:
- The light is controlled via a signal from a door contact.
  The light will remain on for 2 minutes after the door has been shut.
- The light is controlled via the day/night function.
- The light is controlled via the data communication from a system unit.
  Here there are two operational options if data communication should fail:
  - The light can go ON.
  - The light can stay in its current mode.
- Two signals, **both** of which can be on before the light goes on.
  One can be a DI contact signal at the appliance (fx DI3) and the other can be via data communication or a voltage signal.
  Voltage signal **must** be activated on DI7.

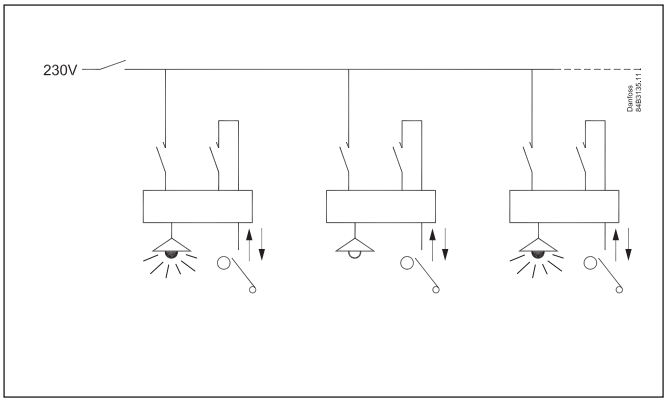
The light is switched off when "r12" (Main switch) is set to off (see o98).
The light is switched off when the appliance cleaning function is activated.

If an override of the light is desired, this can be done via pulse pressure on a DI input + setting = 19.

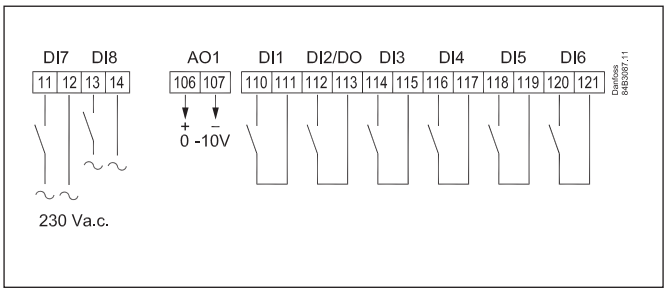
Extra light (light 2)
Light 2 can also be activated by one DI input, e.g. DI4.
It can also be controlled with two signals. For two signals, the second signal must be sent with a voltage signal on DI8.



Night blind
Motorised night blind can be controlled automatically from the controller. The night blinds will follow the status of the light function. When the light is switched on, the night blinds opens and when the light is switched off, the night blinds close again. When the night blinds are closed, it is possible to open them using a pulse signal on the digital input. If this input is activated, the night blinds will open and the refrigeration appliance can be filled with new products. If the input is activated again, the blinds close again.
If the activation is omitted, the blind will close automatically when the delay time expires. A setting is used to define whether the light is to be on or off when the night blind is up.
When the night blind function is used, the thermostat function can control with different weighting between the S3 and S4 sensors. A weighting during day operation and another when the blind is closed.
A night blind is open when the appliance cleaning function is activated.
A setting can define that the night blind is open when "r12" (Main switch) is set to off (see o98).



Digital inputs
There are six digital inputs with contact function and two digital inputs with high voltage signal.
They can be used for the following functions:
- Retransmission of contacts position via data communication
- Door contact function with alarm
- Starting or cancelling a defrost cycle
- Main switch - start/stop of cooling
- Night setback
- Thermostat bands switch
- General alarm monitoring
- Case cleaning
- Forced cooling
- Override of night blinds
- Coordinated defrost (DI2 only)
- Forced closing of valve
- Appliance shutdown
- Light, Extra light, Override light

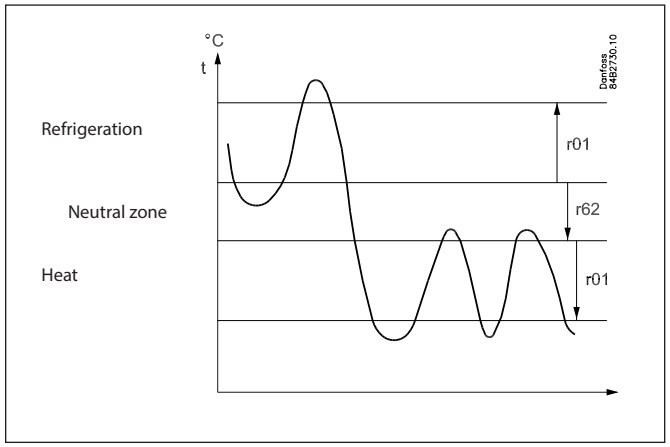


Forced closing
The solenoid valve can be closed with an external signal ("Forced closing").
If a defrost cycle is in progress, the forced closing status will not be re-established until the defrost is completed. Otherwise, the defrost cycle will be stopped immediately when the signal is received. The function can be defined in o90. The signal can be received from the DI3-input or via the data communication.
During a forced closing the fans can be defined to be stopped or in operation.

Door contact
The door contact function can via the digital inputs be defined for two different applications:
Alarm monitoring
The controller monitors the door contact and delivers an alarm message if the door has been opened for a longer period than the set alarm delay.
Alarm monitoring and stop of refrigeration
When the door is opened the refrigeration is stopped, i.e. the injection, the compressor and the fan are stopped and light switch on.
If the door remains open for a longer time than the set restart time, refrigeration will be resumed. This will ensure that refrigeration is maintained even if the door is left open or if the door contact should be defective. If the door remains open for a longer period than the set alarm delay an alarm will also be triggered.

Heating function

The heating function is used to prevent the temperature becoming too low, e.g. in a cutting room, etc. The limit for when the heating function cuts off is set as an offset value under the current cutout limit for the refrigeration thermostat. This ensures that refrigeration and heating do not occur simultaneously. The difference for the heating thermostat has the same value as for the refrigeration thermostat. To prevent that the heating thermostat cuts in during short-term drops in air temperature a time delay can be set for when to change from refrigeration to heating.

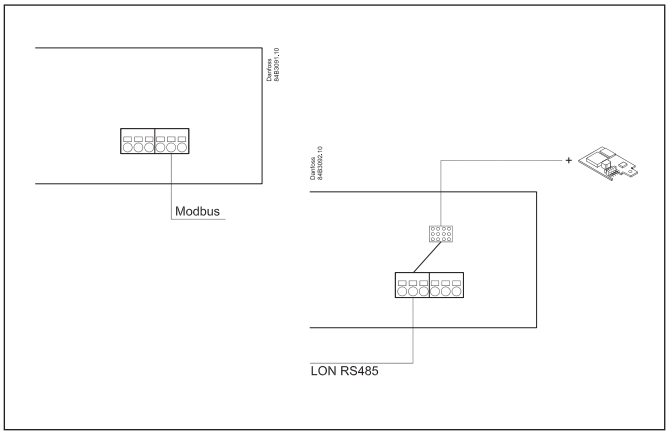


Data communication

The controller has fixed built-in MODBUS data communication.

If there is a requirement for a different form of data communication, a Lon RS 485 module can be inserted in the controller.
The connection must then be to terminal RS 485.

(To use a Lon RS 485 module and gateway type AKA 245 the module must be Version 6.20 or higher.)
It is not possible, however, to show all parameters available in AK-CT 450A).



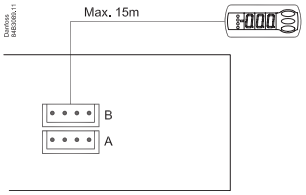
Important

All connections to the data communication MODBUS and RS 485 must comply with the requirements for data communication cables. See literature: RC8AC.

Display

The controller has two plugs for a display. Here display type EKA 163B or EKA 164B (max. length 15m) can be connected.
EKA 163B is a display for readings.
EKA 164B is both for readings and operation.

(It is not possible to connect a display to the Modbus terminals, as in the other AK-CC 450 controllers.)



If there are two cooling sections, the bottom plug will be the A section and the top plug will be the B section.
If there is one cooling section, the displays will be the same for both plugs.

Override

The controller contains a number of functions which can be used together with the override function in the master gateway/system manager.

Function via data communication	Function in gateway/system manager	Used parameters in AK-CT 450A
Start of defrosting	Defrost control / Time schedule / Defrost group	--- Def start
Coordinated defrost	Defrost control / Defrost group	--- HoldAfterDef / - - - DefrostState
Prevent defrost start		--- Disable Def
Day/Night schedule	Day/Night control / Time schedule / Light zone	--- Night setback
Light control	Day/Night control / Time schedule	O39 light Remote
Forced closing	Forced Close / Injection ON / AKC ON	--- Forced cl.
Forced cooling		--- Forced cool
Rail heat link to dew point	/ Enhanced railheat	--- Dew point
P0 optimization	P0 Optimization	The controller supports P0 optimization

Applications

Here is a survey of the controller's field of application.
The applications are all adapted for commercial refrigeration systems in the form of either refrigeration appliances or cold storage rooms.

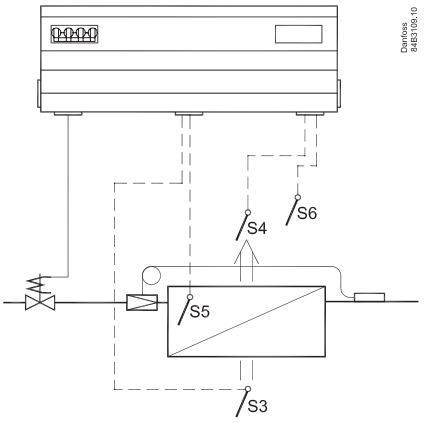
A setting (o61) will define the relay outputs so that the controller's interface will be targeted to the chosen application.

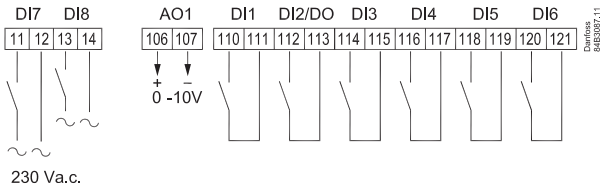
Control sensors and temperature monitoring function
S3 and S4 are temperature sensors. The application will determine whether either one or the other or both sensors are to be used.
S3 is placed in the air flow before the evaporator. S4 after the evaporator.
A percentage setting will determine how the control is to be based.
If there are two cooling sections, S3b is used for section 2.
S5 is a defrost sensor and is placed on/in the fins of the evaporator.
An S5B is also used when there are two evaporators, as well as when there is a long, single evaporator.
S6 is a product sensor. S6B used when there are two sections.

Digital input
DI1 to DI6 is the on/off input that can be used, for example, for one of the following functions: Door function, alarm function, defrost start, external main switch, nighttime operation, thermostat reference switch, appliance cleaning, forced cooling, light, defrost cancellation or defrost coordination.
DI7 and DI8 are 230 V inputs that can activate similar functions. (For light function with two signals, the input is locked for Light 1/Light 2.)
See the functions in the respective settings o02, o37, o84, etc.

Control of night blinds
Night blinds follow the status of the light function – when the light is switched on, the night blinds are up and when the light is switched off, the night blinds are down. In addition a digital input provides the option of forced opening of the blinds so that the appliance can be filled with products.

Heat thermostat
The heat thermostat is typically used if the temperature is to be controlled within narrower limits, e.g. for cutting rooms, etc. The heating thermostat can be set as a difference in relation to the cutout limit for the refrigeration thermostat so that simultaneous refrigeration and heating are avoided.
Varmelegemet tilsluttes DO2 udgangen, og vil være aktiv under
The heating element is connected to the DO2 outlet and will be active during regulation when the temperature becomes too low.
The outlet will also be active if electric defrost is required.
The function is defined by setting the delay time r63 lower than the max. value.
The function cannot be used together with hot gas defrosting.



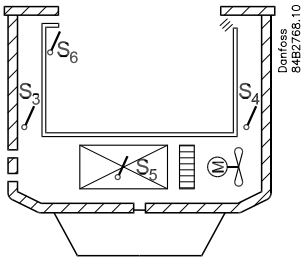


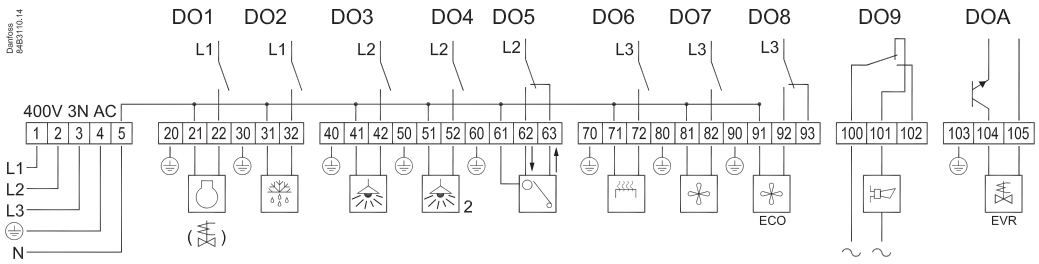
Function	Input/Settings menu								Setting
	DI1	DI2	DI3	DI4	DI5	DI6	DI7	DI8	
	o02	o37	o84	P55	P56	P57	P58	P59	
Not used	+	+	+	+	+	+	+	+	0
Follows DI's status	+	+	+	+	+	+	+	+	1
Door contact function	+	+	+	+	+	+	+	+	2
Door alarm	+	+	+	+	+	+	+	+	3
Start defrost	+	+	+	+	+	+	+	+	4
Main switch	+	+	+	+	+	+	+	+	5
Nighttime operation	+	+	+	+	+	+	+	+	6
Thermostat band	+	+	+	+	+	+	+	+	7
DI alarm when closed	+	+							8
No function			+	+	+	+	+	+	
DI alarm when open	+	+							9
No function			+	+	+	+	+	+	
Appliance cleaning	+	+	+	+	+	+	+	+	10
Forced cooling	+	+	+	+	+	+	+	+	11
Night blind	+	+	+	+	+	+	+	+	12
Coordinated defrost		+							13
No function	+		+	+	+	+	+	+	
Forced close	+	+	+	+	+	+	+	+	14
Appliance shutdown	+	+	+	+	+	+	+	+	15
Light	+	+	+	+	+	+	+	+	16
Extra light	+	+	+	+	+	+	+	+	17
No defrost	+	+	+	+	+	+	+	+	18
Override light	+	+	+	+	+	+	+	+	19

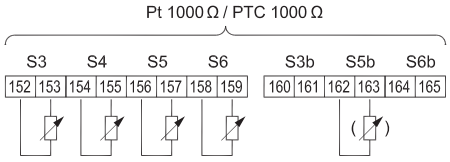
Example
If DI1 is used to start a defrost cycle, o02 must be set to 4.

o61=

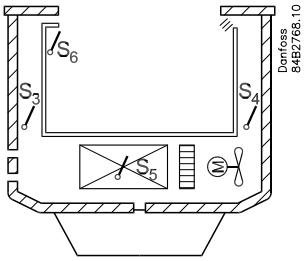
1 **Standard use**

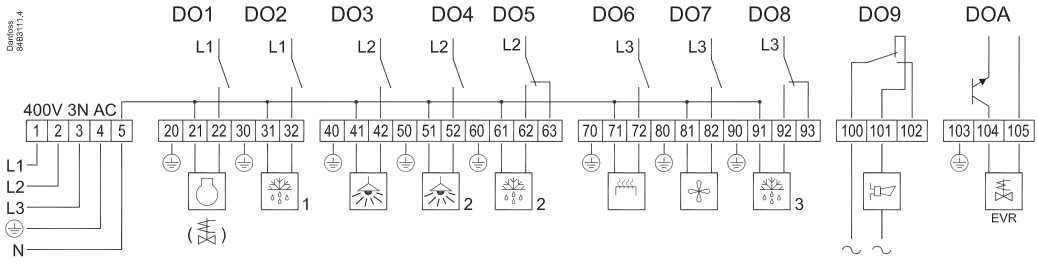


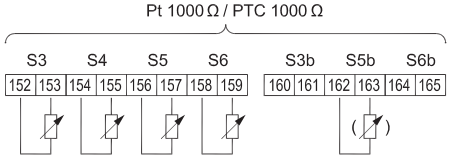




2 **Standard use**
with 3-phase defrost

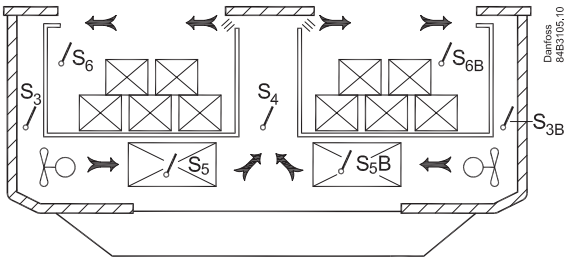


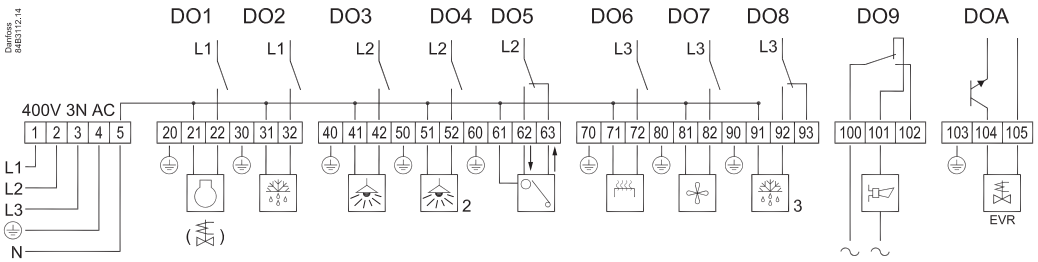


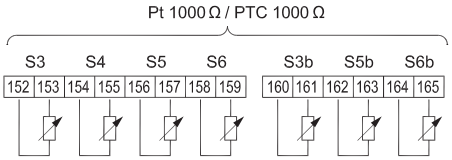


3 Two cooling sections - two evaporators

Standard
Defrost on phase 1 and phase 3
Individual defrost stop with S5 and S5B

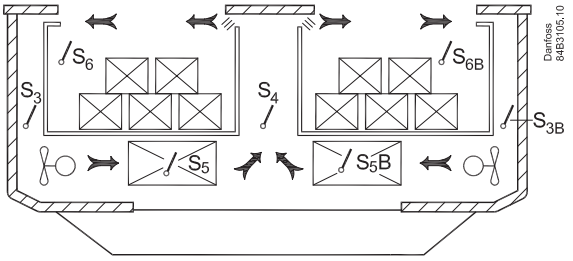


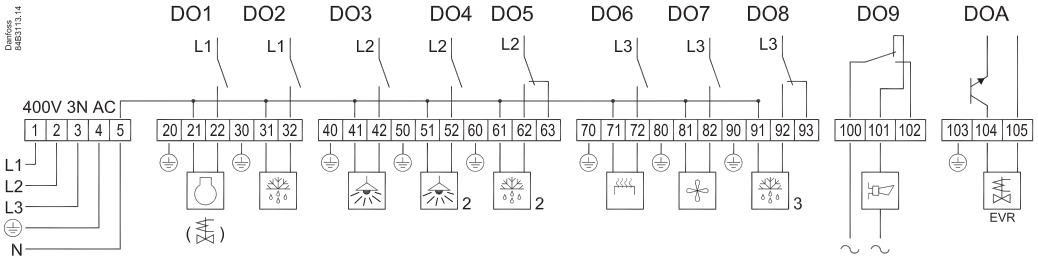


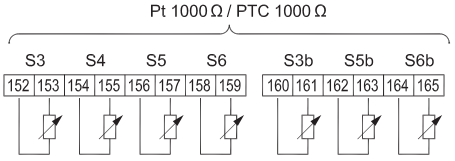


4 Two cooling sections - two evaporators

3-phase defrost

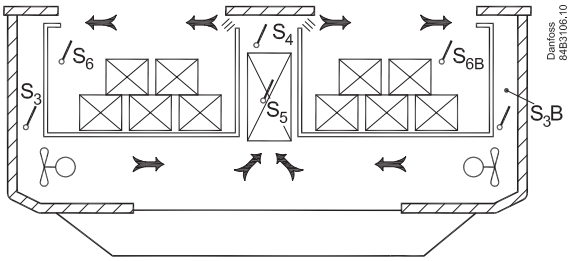


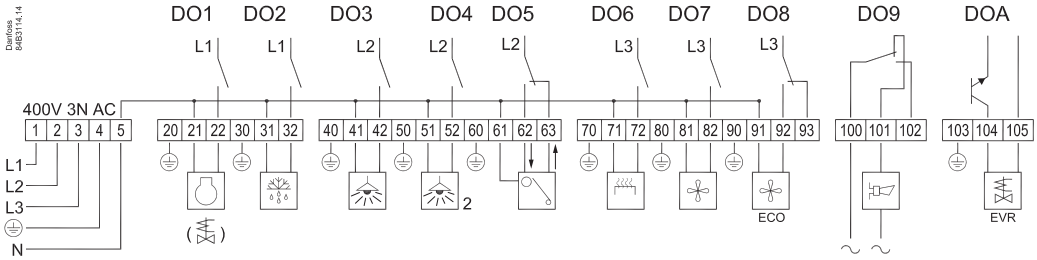


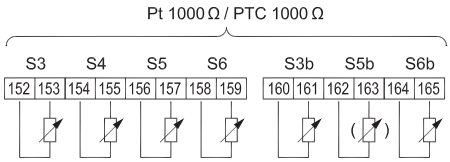


5 Two cooling sections - one evaporator

Standard

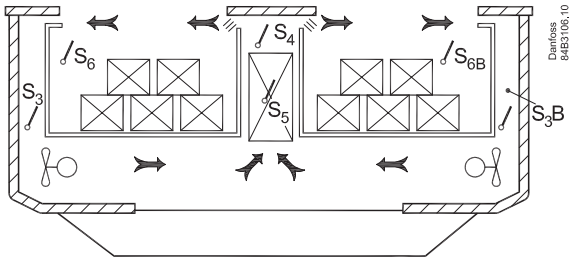


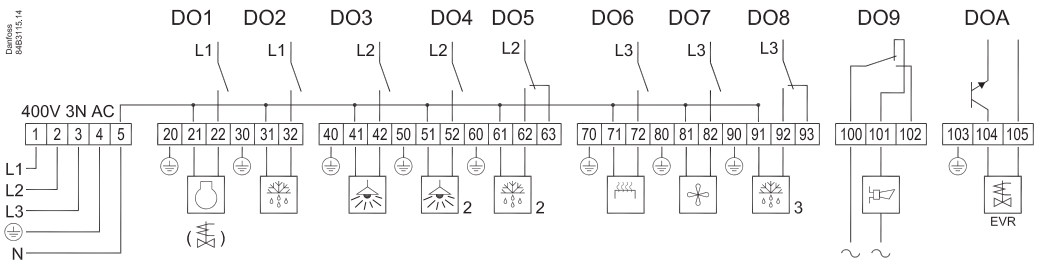


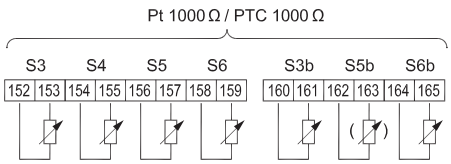


6 Two cooling sections - one evaporator

3-phase defrost

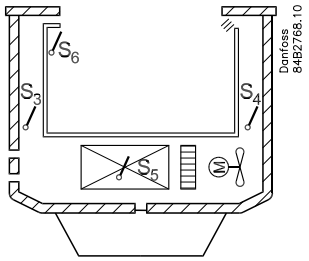


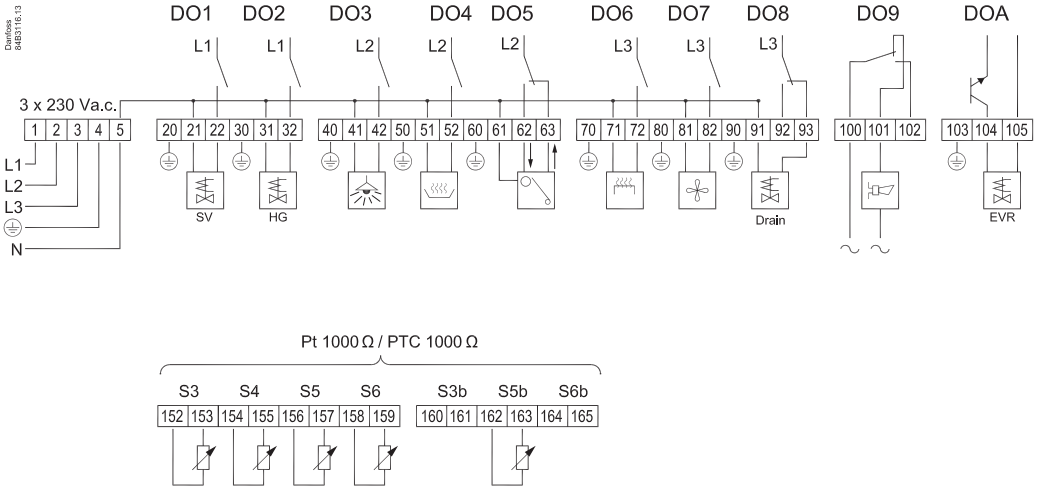




7 Hot gas defrosting.

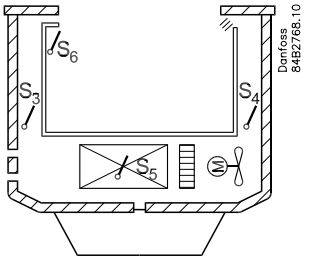
Hot gas defrosting is adapted to commercial appliances/ rooms with limited system filling.
One relay controls the main valve in the suction line.
One relay controls the hot gas valve.
One relay controls the drain valve.
There is no time delay between stops of hot gas and start of draining.

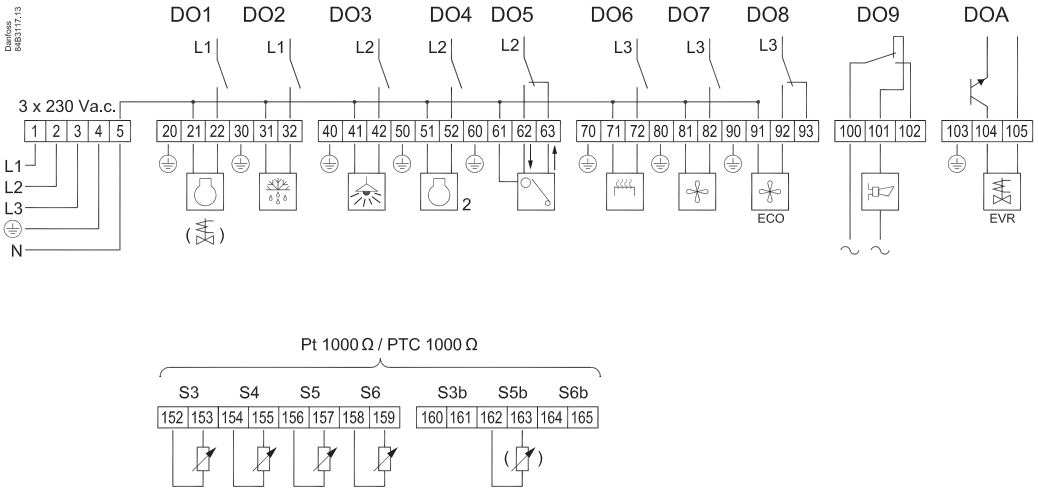




8 "Two-compressor" operation.

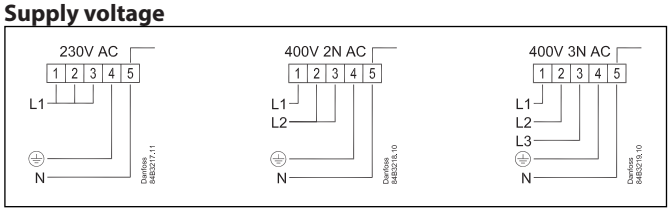
The two compressors must be of the same size. On start-up (after defrosting, operational stop, etc.) both compressors are started with a set time shift. One compressor starts at half the differential so that an optimum adaptation of compressor capacity takes place for the current load in the appliance/ room. There is automatic runtime equalisation between the compressors.





Connections

Supply voltage



230 V, or 2 phases + neutral, or 3 phases + neutral. 50 Hz.
Neutral **must** be fitted. If neutral is not in place, the controller can be damaged. During assembly and disassembly, the power supply must be interrupted).

DO1
Cooling or exhaust port valve

DO2
Defrost cycle or hot gas valve

DO3
Light

DO4
Light 2, compressor 2 or heating element in drip tray

DO5
Night blind or defrost cycle 2

DO6
Rail heat

DO7
Fan

DO8
Fan in economy mode or defrost 3 or drain valve

DO9
Alarm
There is a connection between terminal 100 and 101 in an alarm situation, as well as when the controller is without voltage.

DOA
Connection of solenoid valve type EVR. The coil must be half wave rectified.

S2
Not used

S3, S4, S5, S6
Pt 1000 ohm sensor or PTC 1000 ohm sensor. All have to be of the same type.
S3, air sensor, placed in the warm air before the evaporator
S3B can be used on appliances with two cooling sections
S4, air sensor, placed in the cold air after the evaporator
(the need for either S3 or S4 can be deselected in the configuration)
S5, defrost sensor, placed on the evaporator
S5B can be used on appliances with two evaporators, or on models with long evaporators
S6, product sensor
S6B can be used on appliances with two cooling sections

Pressure transmitter
Not used

AO1
Analogue output signal, 0-10 V
The signal will follow the EVR valve's degree of opening (OD=0% will display 0 V and OD=100% will display 10 V).
The output can be used to control one e.g. 6 minutes modulating valve.**DI1-DI6**
Digital input signal.
The defined function is active when the input is closed/opened.

DI7-DI8
Digital input signal.
The defined function is active when the input receives 230 V.
(Forced closing is, however, active at 0 V)

Data communication
If data communication is used, it is important that the installation of the data communication cable is performed correctly.
See separate literature No. RC8AC…

MODBUS
For data communication.
Terminal 133 = B-
Terminal 134 = A+
Terminal 135 = screen

RS485 (terminal 130, 131,132)
For data communication, but only if a data communication module is inserted in the controller. The module can be a LON RS485.
Terminal 130 = B (B-)
Terminal 131 = A (A+)
Terminal 132 = screen

(For LON RS485 and gateway type AKA 245 the gateway must be version 6.20 or higher.)

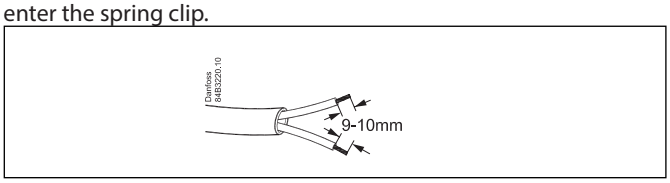
EKA Display
If there is be external reading/operation of the controller, display type EKA 163B or EKA 164B can be connected.

Electric noise
Cables for sensors, DI inputs and data communication **must** be kept separate from other electric cables:
- Use separate cable trays
- Keep a distance between cables of at least 10 cm
- Long cables at the DI input should be avoided.

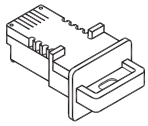
Installation considerations
Accidental damage, poor installation, or site conditions, can give rise to malfunctions of the control system, and ultimately lead to a plant breakdown.
Every possible safeguard is incorporated into our products to prevent this. However, a wrong installation, for example, could still present problems. Electronic controls are no substitute for normal, good engineering practice.
Danfoss will not be responsible for any goods, or plant components, damaged as a result of the above defects. It is the installer's responsibility to check the installation thoroughly, and to fit the necessary safety devices.
Special reference is made to the necessity of signals to the controller when the compressor is stopped and to the need of liquid receivers before the compressors.
Your local Danfoss agent will be pleased to assist with further advice, etc.

Extra connection/terminal strip
There are 3 holes on the base in which a terminal strip (type Wago 862-8593) can be mounted.
There are holes for 2 terminal strips.

Stripping wire
The following demands for stripping, so the insulation does not enter the spring clip.



ID module AK-CT 450A
This module contains a code which, together with the others, will enable regulation using an solenoid valve.



The installation and removal of the module **must always** be performed while the appliance is voltage-free.

When the module is inserted in the plug, the controller can be set. The settings will be saved in both the controller and the module. A module with settings will **always** overwrite the settings in the controller. An overwrite will be finished 3 seconds after the controller is turned on.

The module can be removed from the controller for a short period of time in order to transfer the settings to another, corresponding controller. Remember to disconnect the voltage to ensure the system is voltage-free.

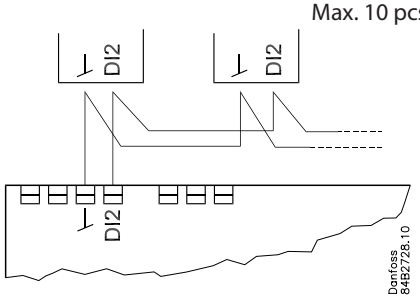
If the controller registers a missing module, an alarm will be issued. This alarm will be regularly repeated until the module is inserted in the controller again.
If the controller is without a module for a longer period of time (several days), the regulation will stop and all outputs are reset.

If it becomes necessary to erase all settings from the module, it can be inserted into the controller and setting P61 can then be activated. Then remove the module without restarting the controller.

A factory-new or "empty" module can be used to retrieve settings based on a corresponding controller.
Insert the module into the controller from which the settings are to be retrieved.
Turn on voltage.
Wait 3 seconds. Turn off again.
The module now contains all settings — including the Modbus address.
Remember to change the address when the module has been inserted into the receiving apparatus.

Coordinated defrost via cable connections

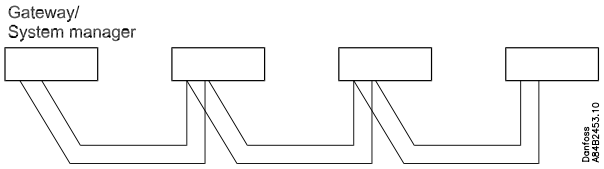
Max. 10 pcs.



The following controllers can be connected up in this way:
EKC 204A, AK-CC 210, AK-CC 250,
AK-CC 450, AK-CC 550
AK-CT 550A, AK-CT 450A,

Refrigeration is resumed when all controllers have "released" the signal for defrost.

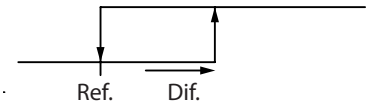
Coordinated defrost via data communication



The setting of controllers to coordinate their defrosting takes place in the gateway/system manager.

Refrigeration is resumed when all controllers have "released" the signal for defrost.

Survey of functions

Function	Para-meter	Parameter by operation via data communication
Normal display		
Normally the temperature value from one of the two thermostat sensors S3 or S4 or a mixture of the two measurements is displayed. In o17 the ratio is determined.		Display air (u56)
Thermostat		**Thermostat control**
Set point Regulation is based on the set value plus a displacement, if applicable. The value is set via a push on the centre button. The set value can be locked or limited to a range with the settings in r02 and r 03. The reference at any time can be seen in "u91 Cutout temp".		Cutout °C
Differential When the temperature is higher than the reference + the set differential, the compressor relay will be cut in. It will cut out again when the temperature comes down to the set reference.  	r01	Differential
Setpoint limitation The controller's setting range for the setpoint may be narrowed down, so that much too high or much too low values are not set accidentally - with resulting damages.		
To avoid a too high setting of the setpoint, the max. allowable reference value may be lowered.	r02	Max cutout °C
To avoid a too low setting of the setpoint, the min. allowable reference value may be increased.	r03	Min cutout °C
Correction of the display's temperature If the temperature at the products and the temperature received by the controller are not identical, an offset adjustment of the display temperature can be carried out.	r04	Disp. Adj. K
Temperature unit Set here if the controller is to show temperature values in °C or in °F.	r05	Temp. unit °C=0. / °F=1 (Only °C on AKM, whatever the setting)
Correction of signal from S4 Compensation possibility due to long sensor cable	r09	Adjust S4
Correction of signal from S3 and S3B Compensation possibility due to long sensor cable	r10	Adjust S3
Start / stop of refrigeration With this setting refrigeration can be started, stopped or a manual override of the outputs can be allowed. (For manual control the value is set at -1. Then the EVR outlet and the relay outlets can be force-controlled by the respective reading parameters (u23, u58, etc.). Here the read value can be overwritten.) Refer also to the menu overview on page 33 Start / stop of refrigeration can also be accomplished with the external switch function connected to a DI input. Stopped refrigeration will give a "Standby alarm".	r12	Main Switch 1: Start 0: Stop -1: Manual control of outputs allowed
Night setback value The thermostat's reference will be the setpoint plus this value when the controller changes over to night operation. (Select a negative value if there is to be cold accumulation.)	r13	Night offset
Thermostat function Here it is defined how the thermostat is to operate. Either as an ordinary ON/OFF thermostat or as a modulating thermostat. 1: ON/OFF thermostat 2: Modulating When operation is "modulating" the EVR valve will limit the flow of refrigerant so that the temperature variation will be less than for the ON/OFF thermostat. The differential (r01) must not be set lower than 2K for "modulating". In a decentralised plant you must select the ON/OFF thermostat setting.	r14	Therm. mode
Selection of thermostat sensor Here you define the sensor the thermostat is to use for its control function. S3, S4, or a combination of them. With the setting 0%, only S3 is used (Sin). With 100%, only S4.	r15	Ther. S4 %

Melt function Only for control of refrigeration (-5 to +10°C). The function ensures that the evaporator will not be blocked by frost. Here you set how often the function is to stop the refrigeration and hence transform the frost to water (or ice if there is too much frost).	r16	MeltInterval
Melt period Here you set how long an on-going melt function is to last.	r17	Melt period
Set point 2 The thermostat's cutout value when the thermostat band 2 is activated via a digital input.	r21	Cutout2 temp
Correction of signal from S6 Compensation possibility due to long sensor cable	r59	Adjust S6
Correction of signal from S6B Compensation possibility due to long sensor cable	r60	Adjust S6B
Selection of thermostat sensor S4% during night operation or night blinds down Here you define the sensor the thermostat is to use for its control function. S3, S4, or a combination of them. With the setting 0%, only S3 is used (Sin). With 100%, only S4.	r61	Ther.S4% Ngt
Heat function Set the size of the Neutral Zone for changeover from cooling to heating	r62	Heat NZ
Time delay on transition from refrigeration phase to heating phase. (there is not time delay on transition from heating phase to refrigeration phase). The heating function is not active when the delay time is set to the max. value (240 min.).	r63	HeatStartDel
Product type This function sets the temperature reference and associated alarm limits. 1=Vegetables, 8°C. 2=Milk, 0°C. 3=Meat/fish, -2°C. 4=Freeze, -20°C. 5=Ice, -24°C. See overview on page 33.	r89	
		Night setbck (start of night signal. 0=Day, 1=Night)
Alarm		**Alarm settings**
The controller can give alarm in different situations. When there is an alarm all the light-emitting diodes (LED) will flash on the controller front panel, and the alarm relay will cut in.		With data communication the importance of the individual alarms can be defined. Setting is carried out in the "Alarm destinations" menu via AKM.
Alarm delay (short alarm delay on air temperature) If the upper or the lower alarm limit values are exceeded, a timer function will commence. The alarm will not become active until the set time delay has been passed. The time delay is set in minutes.	A03	Alarm delay
Time delay for door alarm The time delay is set in minutes. The function is defined for a DI function, see o02, o37 or other DI.	A04	DoorOpen del
Time delay for cooling (long alarm delay) This time delay is used during start-up, during defrost, immediately after a defrost. There will be change-over to the normal time delay (A03) when the temperature has dropped below the set upper alarm limit. The time delay is set in minutes.	A12	Pulldown del
Upper alarm limit Here you set when the alarm for high temperature is to start. The limit value is set in °C (absolute value). The limit value will be raised during night operation. The value is the same as the one set for night setback, but will only be raised if the value is positive. In application 3 and 6, the setting is the same for S3 and S3B.	A13	HighLim Air
Lower alarm limit Here you set when the alarm for low temperature is to start. The limit value is set in °C (absolute value). In application 3 and 6, the setting is the same for S3 and S3B.	A14	LowLim Air
Upper alarm limit for thermostat 2 (Thermostat band 2) (Same function as for thermostat 1)	A20	HighLim2 Air
Lower alarm limit for thermostat 2 (Thermostat band 2) (Same function as for thermostat 1)	A21	LowLim2 Air
Upper alarm limit for S6 temperature at thermostat 1	A22	HighLim1 S6
Lower alarm limit for S6 temperature at thermostat 1	A23	LowLim1 S6
Upper alarm limit for S6 temperature at thermostat 2 (Thermostat band 2)	A24	HighLim2 S6
Lower alarm limit for S6 temperature at thermostat 2 (Thermostat band 2)	A25	LowLim2 S6
S6 temperature alarm delay The alarm is activated if one of the relevant alarm limits A22, A23, A24 or A25 is exceeded. The time delay is set in minutes. (Alarms will not activate when the setting is set to the maximum value. 240 min.)	A26	Al. Delay S6

Delay of a DI1 alarm A cut-out/cut-in input will result in alarm when the time delay has been passed. The function is defined in o02.	A27	AI.Delay DI1
Delay of a DI2 alarm A cut-out/cut-in input will result in alarm when the time delay has been passed. The function is defined in o37	A28	AI.Delay DI2
Signal to the alarm thermostat Here you have to define the ratio between the sensors which the alarm thermostat has to use. S3, S4 or a combination of the two. With setting 0% only S3 is used. With 100% only S4 is used. (The setting also applies to a possible B section - S3B, S4)	A36	Alarm S4%
Time delay on S6 (product sensor) for pull-down (long alarm delay) This time delay is used for start-up, during defrosting, immediately after a defrost and after an appliance clean. A change is carried out to standard time delay (A26) when the temperature has reached below the set upper alarm limit. The time delay is set in minutes.	A52	PullD del.S6
Alarm delay (short alarm delay on section B air temperature) A timer function starts if the top or bottom alarm limit is exceeded. The alarm will first becomes active when the set delay time has been exceeded. The time delay is set in minutes.	A53	AI.Delay S3B
		Reset alarm
		EKC error

Compressor		**Compressor control**
The compressor relay works in conjunction with the thermostat. When the thermostat calls for refrigeration the compressor relay be operated.		
Running times To prevent irregular operation, values can be set for the time the compressor is to run once it has been started. And for how long it at least has to be stopped. The running times are not observed when defrosts start.		
Min. ON-time (in minutes)	c01	Min. On time
Min. OFF-time (in minutes)	c02	Min. Off time
Time delay for couplings of two compressors Settings indicate the time that has to elapse from the first relay cuts in and until the next relay has to cut in.	c05	Step delay
		u58 comp1/LLSV Here you can read the status of the compressor relay.
Defrost		**Defrost control**
The controller contains a timer function that is zeroset after each defrost start. The timer function will start a defrost if/when the interval time is passed. The timer function starts when voltage is connected to the controller, but it is displaced the first time by the setting in d05. If there is power failure the timer value will be saved and continue from here when the power returns. This timer function can be used as a simple way of starting defrosts, but it will always act as safety defrost if one of the subsequent defrost starts is not received. The controller also contains a real-time clock. By means of settings of this clock and times for the required defrost times, defrost can be started at fixed times of the day. Defrost start can also be accomplished via data communication, via contact signals or manual start-up. All starting methods will function in the controller. The different functions have to be set, so that multiple defrosts are avoided.. Defrost can be performed using electricity, hot gas, naturally or brine. The actual defrost will be stopped based on time or temperature with a signal from a temperature sensor.		
Defrost method Here you set whether defrost is to be accomplished with electricity, gas, "air" or brine. During defrost the defrost relay will be cut in.	d01	Def. method 0 = non. 1 = El. 2 = Gas. 3 = Brine. 4 = Air.
Defrost stop temperature The defrost is stopped at a given temperature which is measured with a sensor (the sensor is defined in d10). The temperature value is set.	d02	Def. Stop Temp

Interval between defrost starts The function is zeroset and will start the timer function at each defrost start. When the time has expired the function will start a defrost. The function is used as a simple defrost start, or it may be used as a safeguard if the normal signal fails to appear. If master/slave defrost without clock function or without data communication is used, the interval time will be used as max. time between defrosts. If a defrost start via data communication does not take place, the interval time will be used as max. time between defrosts. When there is defrost with clock function or data communication, the interval time must be set for a somewhat longer period of time than the planned one, as the interval time will otherwise start a defrost which a little later will be followed by the planned one. In connection with power failure the interval time will be maintained, and when the power returns the interval time will continue from the maintained value. The interval time is not active when set to 0.	d03	Def Interval (0=off)
Max. defrost duration This setting is a safety time so that the defrost will be stopped if there has not already been a stop based on temperature or via coordinated defrost. (The setting is the defrost time if d10 is set to 0.)	d04	Max Def. time
Time staggering for defrost cutins during start-up The function is only relevant if you have several refrigeration appliances or groups where you want the defrost to be staggered in relation to one another. The function is furthermore only relevant if you have chosen defrost with interval start (d03). The function delays the interval time d03 by the set number of minutes, but it only does it once, and this at the very first defrost taking place when voltage is connected to the controller. The function will be active after each and every power failure.	d05	Time Stagg.
Drip-off time Here you set the time that is to elapse from a defrost and until the compressor is to start again. (The time when water drips off the evaporator).	d06	DripOff time

Delay of fan start after defrost Here you set the time that is to elapse from compressor start after a defrost and until the fan may start again. (The time when water is "tied" to the evaporator).	d07	FanStartDel
Fan start temperature The fan may also be started a little earlier than mentioned under "Delay of fan start after defrost", if the defrost sensor S5 registers a lower value than the one set here.	d08	FanStartTemp
Fan cut in during defrost Here you can set whether fan is to operate during defrost. 0: Stopped (Runs during pump down) 1: Running (stopped during "fan delay") 2: Running during pump down and defrost. After that stopped	d09	FanDuringDef
Defrost sensor Here you define the defrost sensor. 0: None, defrost is based on time 1: S5 2: S4 3: S5+S5B (In application 3, there is an individual defrost stop at S5 and S5B. In the other applications, the defrost cycle is stopped when both sensors register the stop temperature.)	d10	DefStopSens.
Pumpdown delay Set the time where the evaporator is emptied of refrigerant prior to the defrost.	d16	Pump dwn del.
Drain delay (only in connection with hotgas) Set the time where the evaporator is emptied of condensed refrigerant after the defrost.	d17	Drain del
Defrost on demand – aggregate refrigeration time Set here is the refrigeration time allowed without defrosts. If the time is passed, a defrost will be started. With setting = 0 the function is cut out.	d18	MaxTherRunT
Delay on stop of heating in the drip tray The time applies from the time the defrost stops by time or temperature to the time the heating element in the drip tray needs to be disconnected.	d20	Drip Tray del
Postpone alarm info for timed stop The defrost stop by temperature has failed. It has stopped by time, which will result in an alarm notification. Wait to send an alarm until x consecutive alarms have registered subsequent "timed stop alarms". The counter is reset after each correct stop by temperature.	d26	NumMaxDefAl.

Rail heat during defrost cycle Here you can set how the rail heat is to be regulated during a defrost cycle. 0: No rail heat 1: No change; continues as during regulation. 2: 100% on	d27	Railh. at def
If you wish to see the temperature at the defrost sensor, push the controller's lowermost button. (May be changed to another function in o92.)		Defrost temp.
If you wish to start an extra defrost, push the controller's lowermost button for four seconds. You can stop an ongoing defrost in the same way		Def Start Here you can start a manual defrost
		Hold After Def Shows ON when the controller is operating with coordinated defrost.
		Disable def. Defrost in progress can be stopped
		Defrost State Status on defrost 1= pump down / defrost
		MC def. start The system unit can start/prevent a defrost cycle
Fan		**Fan control**
Fan stop temperature The function stops the fans in an error situation, so that they will not provide power to the appliance. If the defrost sensor S5 registers a higher temperature than the one set here, the fans will be stopped. There will be re-start at 2 K below the setting. The function is not active during a defrost or start-up after a defrost. With setting +50°C (=max. value) the function is interrupted.	F04	FanStopTemp.
Pulse operation of fan 0: No pulse operation 1: Pulse operation when the thermostat does not call for refrigeration 2: Pulse operation when the thermostat does not call for refrigeration, but only during night operation	F05	FanPulseMode
Pulse operation period for fan Here the overall pulse time is set. The sum of ON-to and OFF time.	F06	Fan cycle
ON time for fan Here the % part of the period the fans are to be in operation is set.	F07	Fan ON %
Max. S4 temperature during defrost Here the maximum S4 temperature during a defrost cycle can be set. If the value is exceeded, the fans will be stopped. The function is not active when the thempera-ture is set to max value (15°C).	F22	FanStopS4Def
		u59 Fan Relay Here you can read the fan relay status, or force-control the relay in "Manual control" mode.
Parameter for cooling function		
Period time for the pulse width period (PWM) Expert setting - The value should only be changed by specially trained staff.	n63	Pwm Period
Max. opening degree at PWM	n64	Pwm Max. OD
Min. opening degree at PWM	n65	Pwm Min. OD
Wind up factor at PWM Expert setting - The value should only be changed by specially trained staff.	n66	PwmWindUpFac
Amplification factor at PWM Expert setting - The value should only be changed by specially trained staff.	n67	Pwm Kp fact.
Integration time at PWM Expert setting - The value should only be changed by specially trained staff.	n68	Pwm Tn sec
		Forced cool. (start of forced cooling)
		Forced close (forced stop of cooling)

Internal defrosting schedule/clock function		
(Not used if an external defrosting schedule is used via data communication.) Up to six individual times can be set for the defrost start throughout the day.		
Defrost start, hour setting	t01-t06	
Defrost start, minute setting (1 and 11 belong together, etc.) When all t01 to t16 equal 0 the clock will not start defrosts.	t11-t16	
Real-time clock:: In the event of a power failure of less than four hours, the clock function will be saved.		
Clock: Hour setting	t07	
Clock: Minute setting	t08	
Clock: Date setting	t45	
Clock: Month setting	t46	
Clock: Year setting	t47	
Electricity monitoring		
Current amount of electricity through relay 1	L11	DO1 Amp
Same for relays 2 to 8	L12-18	DO2 Amp.....DO8 Amp
Fuse status for relay circuit 1, Off=interrupted, On=ok. A broken fuse must be restored with the setting="On"	L21	DO1 Fuse
Same for relays 2 to 8	L22-28	DO2 Fuse..... DO8 Fuse
Set the electricity value at which the relay should cut out in the event of overcurrent Recommended setting = measured consumption +25%. (In setting = 0 the current monitor will be cancelled).	L31	DO1 FuseSize
Same for relays 2 to 8	L32-38	DO2 FuseSize..... DO8 FuseSize
Current voltage at phase F1	L51	L1 voltage
Current voltage at phase F2	L52	L2 voltage
Current voltage at phase F3	L53	L3 voltage
Alarm limit for low DO2 load. (Not application 7) An alarm is issued if the electricity consumption becomes lower than the set value.	L62	DO2 Low Load
Alarm limit for low DO5 load (Application 2,4 and 6 only)	L65	DO5 Low Load
Alarm limit for low DO6 load	L66	DO6 Low Load
Alarm limit for low DO8 load (Application 2, 3, 4 and 6 only)	L68	DO8 Low Load
Miscellaneous		Miscellaneous
Delay of output signal after start-up After start-up or a power failure the controller's functions can be delayed so that overloading of the electricity supply network is avoided. Here you can set the time delay.	o01	DelayOfOutp.
Digital input signal - DI1 The controller has a digital input 1 which can be used for one of the following functions: Off: The input is not used 1) Status display of a contact function 2) Door function. When the input is open it signals that the door is open. The refrigeration and the fans are stopped and light switched on. When the time setting in "A04" is passed, an alarm will be given. The cooling will restart when the time in o89 has passed 3) Door alarm. When the input is open it signals that the door is open. When the time setting in "A04" is passed, there will be alarm. 4) Defrost. The function is started with a pulse signal. (see also o37) 5) Main switch. Regulation is carried out when the input is short-circuited, and regulation is stopped when the input is put in pos. OFF. 6) Night operation. When the input is short-circuited, there will be regulation for night operation. 7) Thermostat band changeover. Switch to thermostat 2 (r21) when input is closed. 8) Separate alarm function. Alarm will be given when the input is short-circuited. 9) Separate alarm function. Alarm will be given when the input is opened. (For 8 and 9 the time delay is set in A27) 10) Case cleaning. The function is started with a pulse signal. See also description on page 5. 11) Forced cooling(used for hot gas defrosting) when input is closed. 12) Night cover. Pulse signal activates night blind. 13) Not used. 14) Forced close when input is interrupted. 15) Appliance shutdown when input is closed. 16) Light. DO3 pulls when the input is closed. 17) Extra light. DO4 pulls when the input is closed. 18) Cancel defrost cycle. All defrost cycles are cancelled when the input is closed. 19) Override light (pulse signal)	o02	DI 1 Config. Definition takes place with the numerical value shown to the left. (0 = off) u10 DI1 state (Measurement) The DI input's present status is shown here. ON or OFF.

If the controller is built into a network with data communication, it must have an address, and the master gateway of the data communication must then know this address. The address is set between 0 and 240, depending on the system unit and the selected data communication. If the system unit is gateway type AKA 245, the version must be 6.20 or higher. The address is sent to the gateway when the menu is set in pos. ON IMPORTANT: Before you set o04, you MUST set o61. Otherwise you will be transmitting incorrect data. (The function is not used when the data communication is MODBUS)	o03 o04	
Access code 1 (Access to all settings) If the settings in the controller are to be protected with an access code you can set a numerical value between 0 and 100. If not, you can cancel the function with setting 0. (99 will always give you access).	o05	Acc. code
Sensor type for S3, S4, S5, S6, S3B, S5B, S6B Normally a Pt 1000 sensor with great signal accuracy is used. But you can also use a sensor with another signal accuracy. That may either be a PTC sensor (1000 ohm at 25°C) All the mounted sensors S3-S6 must be of the same type.	o06	SensorConfig Pt = 0 PTC = 1
Max. standby time after coordinated defrost When a controller has completed a defrost it will wait for a signal which tells that the refrigeration may be resumed. If this signal fails to appear for one reason or another, the controller will itself start the refrigeration when this standby time has elapsed.	o16	Max HoldTime
Select signal for the display S4% Here you define the signal to be shown by the display. S3, S4, or a combination of the two. With setting 0% only S3 is used. With 100% only S4.	o17	Disp. S4%

Digital input signal - D2 The controller has a digital input 2 which can be used for one of the following functions: Off: The input is not used. 1) Status display of a contact function 2) Door function. When the input is open it signals that the door is open. The refrigeration and the fans are stopped and light turn on. When the time setting in "A04" has passed, an alarm will be issued. The cooling is restarted when the time in o89 has passed. 3) Door alarm. When the input is open it signals that the door is open. When the time setting in "A04" is passed an alarm will be given. 4) Defrost. The function is started with a pulse signal. The controller will register when the DI input is activated. The controller will then start a defrost cycle. If the signal is to be received by several controllers (coordinated defrost) it is important that ALL connections are mounted the same way (DI to DI and GND to GND). 5) Main switch. Regulation is carried out when the input is short-circuited, and regulation is stopped when the input is put in pos. OFF. 6) Night operation. When the input is short-circuited, there will be regulation for night operation. 7) Thermostat band changeover. Switch to thermostat 2 (r21) when the input is closed. 8) Separate alarm function. Alarm will be given when the input is short-circuited. 9) Separate alarm function. Alarm will be given when the input is opened. (For 8 and 9 delay time is set in A28) 10) Case cleaning. The function is started with a pulse signal. See also description on page 5. 11) Forced refrigeration at hotgas defrost when the input is short-circuited. 12) Night blinds. Pulse signal activates night blind. 13) The input is used for coordinated defrost in conjunction with other controllers of the same type. 14) Forced close when input is interrupted. 15) Appliance shutdown when input is closed. 16) Light. DO3 pulls when the input is closed. 17) Extra light. DO4 pulls when the input is closed. 18) Cancel defrost cycle. All defrost cycles are cancelled when the input is closed. 19) Override light (pulse signal)	o37	DI2 config.

Configuration of light function (If night blind selected, it will be synchronised with the light function) 1) Light is controlled via day/night status 2) Light is controlled via data communication and "Light remote o39" 3) Light is controlled by door contact, as defined via a DI input where the setting is selected as either 2 or 3. When the door is opened the relay will cut in. When the door is closed again there will be a time delay of two minutes before the light is switched off. 4) As "2" but if there are any 15-minute network errors, the light will switch on and the night blind will open. 5) Light controlled with local DI switch and a central signal from either data communication or a 230 V signal on DI7. Both must be on before the light is turned on. 6) Like "5", but manual control of the night blind will also activate the light, which means the light will switch on when the night blind is up.	o38	Light config
Activation of light relay Here the relay can be activated, but only if a setting of 2, 5 or 6 has been defined in o38.	o39	Light remote
Rail heat during day operation The ON period is set as a percentage of the time	o41	Railh.ON day%
Rail heat during night operation The ON period is set as a percentage of the time	o42	Railh.ON ngt%
Rail heat cycle The period of time for the aggregate ON time + OFF time is set in minutes	o43	Railh. cycle
Case cleaning The status of the function can be followed here or the function can be started manually. 0 = Normal operation (no cleaning) 1 = Cleaning with fans operating. All other outputs are Off. 2 = Cleaning with stopped fans. All outputs are Off. If the function is controlled by a signal at a DI-input, the relevant status can be seen here in the menu.	o46	Case clean
Selection of application The controller can be defined in various ways. Here you set which of the 8 applications is required. On page 13 to 16 you can see a survey of applications. *This menu can only be set when regulation is stopped, i.e. "r12" is set to 0.*	o61	Appl. Mode
Access code 2 (Access to adjustments) There is access to adjustments of values, but not to configuration settings. If the settings in the controller are to be protected with an access code you can set a numerical value between 0 and 100. If not, you can cancel the function with setting 0. If the function is used, access code 1 (o05) **must also** be used.	o64	Acc. code 2
Save as factory setting With this setting you save the controller's actual settings as a new basic setting (the earlier factory settings are overwritten).	o67	-
Digital input signal - DI3 Switch signal The controller has a digital input 3 which can be used for one of the following functions: Off: The input is not used. 1) Status display of the switch function 2) Door function. When the input is open it signals that the door is open. The refrigeration and the fans are stopped and light turn on. When the time setting in "A04" has passed, an alarm will be issued. The cooling is restarted when the time in o89 has passed. 3) Door alarm. When the input is open it signals that the door is open. When the time setting in "A04" is passed an alarm will be given. 4) Defrost. The function is started with a pulse signal. (see also o37) 5) Main switch. Regulation is carried out when the input is closed, and regulation is stopped when the input is open. 6) Night operation. When the input closed, there will be regulation for night operation. 7) Thermostat band changeover. Switch to thermostat 2 (r21) when the input is closed. 8) Not used. 9) Not used. 10) Case cleaning. The function is started with a pulse signal. See also description on page 5. 11) Forced refrigeration at hotgas defrost when the input is closed. 12) Night cover. Pulse signal activates night blind 13) Not used 14) Forced closing when input is interrupted. 15) Appliance shutdown when input is closed. 16) Light. DO3 pulls when the input is closed. 17) Extra light. DO4 pulls when the input is closed. 18) Cancel defrost cycle. All defrost cycles are cancelled when the input is closed. 19) Override light (pulse signal)	o84	DI3 config.

Rail heat control The rail heat can be controlled in several ways: 0: The function is not used 1: Pulse control is used with a timer function following the day/night operation (o41 and o42) 2: Pulse control is used with a dew point function. This function requires that a signal is received about the dew point value. The value is measured by a system manager and sent to the controller via the data communication.	o85	Railh. mode
Dew point value where the rail heat is minimum This function is discussed earlier in the manual.	o86	DewP Min lim
Dew point value where the rail heat is maximum This function is discussed earlier in the manual.	o87	DewP Max lim
Lowest permitted rail heat effect Here the % part of the effect to be achieved when the dew point value is minimum.	o88	Rail Min ON%
Start of refrigeration when door is open If the door has been left open, refrigeration must be started after a set time. That time can be set here.	o89	DoorInjStart
Fan operation for forced closing If "forced closing" is activated, it will affect the operation of the fan and the defrosting. Select the desired settings: 0: The fans will stop. Defrosting permitted. 1: The fans will run. Defrosting permitted. (For 0 and 1: If the "forced closing" signal comes during a defrosting cycle, or if a new defrosting cycle begins, the fans will follow the setting in d09.) 2: The fans will stop. Defrosting not permitted. 3: The fans will run. Defrosting not permitted. (For 2 and 3: If the "forced closing" signal interrupts a defrosting cycle but disappears again within 10 minutes, the defrosting cycle will resume.)	o90	Fan forcedCl
Alternative display A reading can be displayed by pressing the lower button on the controller. This reading is set from the factory so that the defrosting stop temperature is displayed. A different setting will give the following reading: 1: (Defrost stop temperature = factory setting) 2: S6 temperature	o92	Displ menu 2
Display of temperature during normal operation 1: Air temperature. Weighted S3 + S4 2: Product temperature S6	o97	Disp. Ctrl.
Light and night blinds definition 0: Light is switched off and night blinds are open when the main switch is off 1: Light and night blinds are independent of main switch.	o98	Light MS = Off
Configuration of alarm relay The alarm relay will be activated upon an alarm signal from the following groups: 0 - No relay function 1 - High temperature alarms 2 - Low temperature alarms 4 - Sensor error 8 - Digital input enabled for alarm 16 - Defrosting alarms 32 - Miscellaneous 64 - Injection alarms 128 - Disconnected fuse The groups that are to activate the alarm relay must be set by using a numerical value which is the sum of the groups that must be activated. (E.g.: a value of 5 will activate all high temperature alarms and all sensor error.	P41	Al.Rel.Conf.
Digital input signal - DI4. Switch signal. See DI3 above	P55	DI4 config.
Digital input signal - DI5. Switch signal. See DI3 above	P56	DI5 config.
Digital input signal - DI6. Switch signal. See DI3 above	P57	DI6 config.
Digital input signal - DI7. High voltage signal. Functions the same as those for DI3, but signal is 0 V/230 V. See also the summary on page 12.	P58	DI7 config.
Digital input signal - DI8. High voltage signal. See DI7 above	P59	DI8 config.
Max. opening time for night blind after manual DI activation The delay time before the night blind automatically goes down again after being manually opened for product stocking.	P60	BlindOpenTim
Reset settings on ID module Reset all settings so that the ID module can receive settings from another controller.	P61	ResetID Mem.
Configuration of night blind function On= night blind function used. Off=night blind function not used.	P64	Blind config

Fan pause while night blind rolls down Here you can set the fan pause time, so the night blind can roll down unhindered to the correct position.	P65	BlindFanStop
Max. on time for light after manual DI activation Delay time before light goes off again after light has been turn on manual due to product stocking.	P66	Light On Time
		Case shutdown

Service		**Service**
Temperature measured with S5 sensor	u09	S5 temp.
Status on DI1 input. on/1=closed	u10	DI1 status
Read the duration of the ongoing defrost or the duration of the last completed defrost.	u11	Defrost time
Temperature measured with S3 sensor	u12	S3 air temp
Status at the day-/night operation (night operation: on/off)	u13	Night Cond.
Temperature measured with S4 sensor	u16	S4 air temp
Thermostat temperature	u17	Ther. air
Read the ongoing cutin time for the thermostat or the duration of the last completed cutin	u18	Ther runtime
Read the valve's actual opening degree	u23	Valve OD %
Read the temperature at the S6 sensor	u36	S6 temp
Status on DI2 input. on/1=closed	u37	DI2 status
Air temperature. Weighted S3 + S4	u56	Display air
Measured temperature for alarm thermostat	u57	Alarm air
* Status on relay for cooling	u58	Comp1/LLSV
Status on relay for fan	u59	Fan relay
* Status on relay for defrost	u60	Def. relay
Status on relay for railheat	u61	Railh. relay
* Status on relay for alarm	u62	Alarm relay
Status on relay for light	u63	Light relay
* Status on relay for hot gas valve	u64	SuctionValve
* Status on relay for compressor 2	u67	Comp2 relay
* Temperature measured with S5B sensor	u75	S5 temp. B
* Temperature measured with S3B sensor	u76	S3 air temp B
* Temperature measured with S6B sensor	u79	S6 temp. B
* Status on relay for hot gas	u80	Hotgas valve
* Status on relay for heating element in drip tray	u81	Drip tray
* Status on relay for night blinds	u82	Blinds relay
* Status on relay for defrost 2	u83	Def. relay 2
* Readout of the actual rail heat effect in %	u85	Rail DutyC %
Readout of which thermostat used for regulation: 1= Thermostat 1, 2= Thermostat 2	u86	Ther. band
Status on input DI3 (closed / open)	u87	DI3 status
Readout of the actual cutin value for the thermostat	u90	Cutin temp.
Readout of the actual cut out value for the thermostat	u91	Cutout temp.
* Measured temperature for alarm thermostat for B section	U34	Alarm air B
* Air temperature. Weighted S3 + S4 temp. for B section	U35	Display air B
* Status of relay for light 2	U36	Extra light
* Status of relay for ECO fan	U37	Fan Eco
* Status of relay for defrost 3	U38	Def. relay 3
Status of DI4 input. On=closed	U39	DI4 status
Status of DI5 input. On=closed	U40	DI5 status
Status of DI6 input. On=closed	U41	DI6 status
Status of high-voltage input DI7, 230 V = 1 = closed	U42	DI7 status
Status of high voltage input DI8, 230 V = 1 = closed	U43	DI8 status
0-10 V output indicates EVR valve's degree of opening	U44	AO1 voltage

Modbus communication status, 0% = none; 100% = everything ok	U45	Comm. status
Read usage of DI2 signal: 0 = see status in u37; 1 = output for coordinated defrost	U54	DI2 In/Out
Status of relay for drain valve, 1 = on	U55	Drain valve
ON indicates controller error		EKC error
Dewpoint value received from system unit		Dew point

*) Not all will be displayed. Only the function belonging to the selection application is displayed.

Operating status		(Measurement)
The controller goes through some regulating situations where it is just waiting for the next point of the regulation. To make these "why is nothing happening" situations visible, you can see an operating status on the display. Push briefly (1s) the upper button. The individual status codes have the following meanings:		Ctrl. state: (Shown in all menu displays)
Waiting for end of the coordinated defrost	S1	1
When the compressor is operating it must run for at least x minutes.	S2	2
When the compressor is stopped, it must remain stopped for at least x minutes.	S3	3
The evaporator drips off and waits for the time to run out	S4	4
Refrigeration stopped by main switch. Either with r12 or a DI-input	S10	10
Refrigeration stopped by thermostat	S11	11
Defrost sequence. Defrost in progress	S14	14
Defrost sequence. Fan delay — water attaches to the evaporator	S15	15
Forced closing. Refrigeration stopped due to stopped injection function	S16	16
Door is open. DI input is open	S17	17
Melt function in progress. Refrigeration is interrupted	S18	18
Modulating thermostat control	S19	19
Emergency cooling due to sensor error	S20	20
Normal control	S23	23
Manual control of outputs	S25	25
Case cleaning	S29	29
Forced cooling	S30	30
Delay on outputs during start-up	S32	32
Heat function is active	S33	33
Appliance shutdown	S45	45
Other displays:		
The defrost temperature cannot be displayed. There is stop based on time	non	
Defrost in progress / First cooling after defrost when temperature is still over the thermostat band.	-d-	
Password required. Set password	PS	
Regulation is stopped via main switch	OFF	

*) Emergency cooling will take effect when there is lack of signal from a defined S3 or S4 sensor. The regulation will continue with a registered average cutin frequency. There are two registered values – one for day operation and one for night operation.

Fault message

In an error situation the LED's on the display will flash and the alarm relay will be activated. If you push the top button in this situation you can see the alarm report in the display.
There are two kinds of error reports - it can either be an alarm occurring during the daily operation, or there may be a defect in the installation.
A-alarms will not become visible until the set time delay has expired.
E-alarms, on the other hand, will become visible the moment the error occurs.
(An A alarm will not be visible as long as there is an active E alarm).
Here are the messages that may appear:

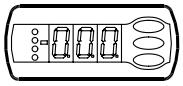
Code / Alarm text via data communication	Description	Alarm relay groups (P41)
A1/--- High t.alarm	High temperature alarm	1
A2/--- Low t. alarm	Low temperature alarm	2
A4/--- Door alarm	Door alarm	8
A5/--- Max hold time	The "o16" function is activated during a coordinated defrost	16
A13/--- High temp S6	Temperature alarm. High S6	1
A14/--- Low temp S6	Temperature alarm. Low S6	2
A15/--- DI1 alarm	DI1 alarm	8
A16/--- DI2 alarm	DI2 alarm	8
A45/--- Standby mode	Standby position (stopped refrigeration via r12 or DI input)	-
A59/--- Case clean	Case cleaning. Signal from DI input	-
A70/--- High temp S3B	High temperature alarm, B section	1
A71/--- Low temp S3B	Low temperature alarm, B-section	2
A72/--- High temp S6B	High temperature alarm, B section	1
A73/--- Low temp S6B	Low temperature alarm, B-section	2
E1/--- Ctrl. error	Faults in the controller	32
E6/--- RTC error	Check clock	32
E25/--- S3 error	Error on S3 sensor	4
E26/--- S4 error	Error on S4 sensor	4
E27/--- S5 error	Error on S5 sensor	4
E28/--- S6 error	Error on S6 sensor	4
E34/--- S3 error B	Error on S3B sensor	4
E37/--- S5 error B	Error on S5B sensor	4
E38/--- S6 error B	Error on S6B sensor	4
E40/--- ID ModuleErr	Incorrect communication with ID module	1
E41/--- DO1 Fuse err.	Excess current on DO1. Fuse has cut out	128
E42.....E48 / DO2....DO8	As above; fuse has cut out on the respective relay(s)	128
E52/--- DO2 Low Load	Low power consumption on DO2. Check the load	128
E55/--- DO5 Low Load	Low power consumption on DO5. Check the load	128
E56/--- DO6 Low Load	Low power consumption on DO6. Check the load	128
E58/--- DO8 Low Load	Low power consumption on DO8. Check the load	128
---/--- Max Def.Time	Defrost stopped on time instead of temperature	16

Data communication
The importance of individual alarms can be defined with a setting. The setting must be carried out in the group "AKM Alarm destinations"

Settings from System manager	Settings from AKM (Alarm destination)	Log	Alarm relay			Send via Network
			Non	High	Low-High	
High	1	X		X	X	X
Middle	2	X			X	X
Low	3	X			X	X
Log only		X				
Disabled						

Operation

Display
The values will be shown with three digits, and with a setting you can determine whether the temperature is to be shown in °C or in °F.



Light-emitting diodes (LED) on front panel
The three lower bottom LEDs will light up when the relevant relay is activated.
°
° = Refrigeration
° = Defrost
° = Fan running

The light-emitting diodes will flash when there is an alarm. In this situation you can download the error code to the display and cancel/sign for the alarm by giving the top button a brief push.

The buttons
When you want to change a setting, the upper and the lower buttons will give you a higher or lower value depending on the button you are pushing. But before you change the value, you must have access to the menu. You obtain this by pushing the upper button for a couple of seconds - you will then enter the column with parameter codes. Find the parameter code you want to change and push the middle buttons until value for the parameter is shown. When you have changed the value, save the new value by once more pushing the middle button.

Examples

Set menu
1. Push the upper button until configuration access cFg is shown.
2. Push the upper or the lower button and find that parameter you want to change.
3. Push the middle button to enter the group.
4. Push the upper or the lower button and find that parameter you want to change.
5. Push the middle button until the parameter value is shown.
6. Push the upper or the lower button and select the new value
7. Push the middle button again to freeze the value.

Cutout alarm relay / receipt alarm/see alarm code
• A short press of the upper button
If there are several alarm codes they are found in a rolling stack. Push the uppermost or lowermost button to scan the rolling stack.

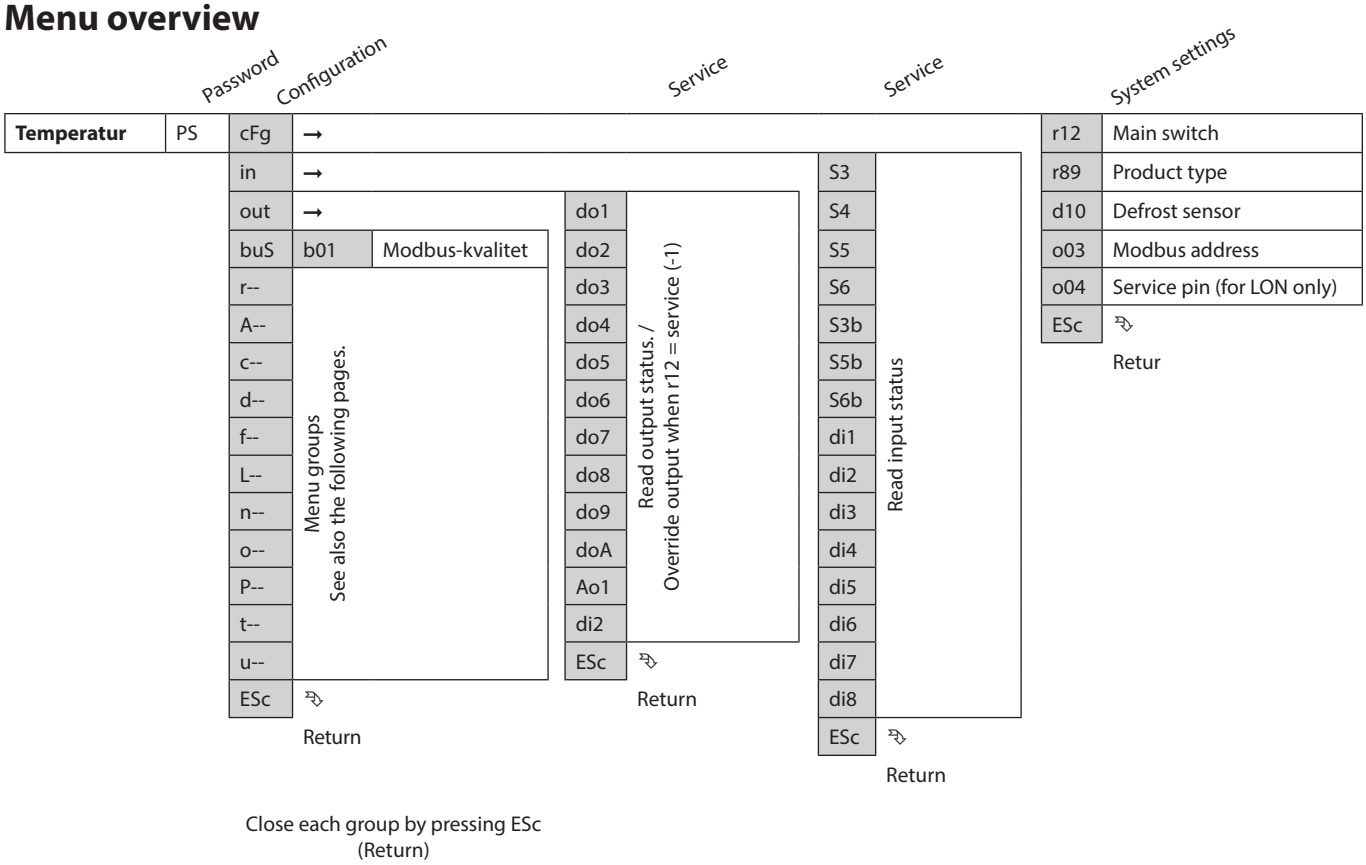
Set temperature
1. Push the middle button until the temperature value is shown.
2. Push the upper or the lower button and select the new value.
3. Push the middle button again to conclude the setting.

Reading the temperature at defrost sensor (Or product sensor, if selected in o92.)
• A short press of the lower button.

Manuel start or stop of a defrost
• Push the lower button for four seconds.

Return to previous menu
1. Press the top or bottom button until ESc is shown.
2. Press the middle button.

Menu overview



Get a good start

With the following procedure you can start regulation very quickly:

1 Basic settings entered by appliance manufacturer

2 Enter the system-defined settings as shown above

3 End with parameter r12 = 1 to start the regulation
(in a new and not previously set unit, r12 will already be set to 0 which means stopped regulation.)

4 Send address to system unit:
- MODBUS: Activate scan function in system unit
- If another data communication card is used in the controller:
  - LON RS485: Activate the function o04

Product type

Setting of pre-settings (r89). After setting 1-5, setting is returned to 0. **Product type =**	1 **Vege-tables**	2 **Milk**	3 **Meat/ fish**	4 **Frost**	5 **Ice**
Temperature (SP)	8°C	0°C	-2°C	-20°C	-24°C
Max. temp. setting (r02)	10°C	4°C	2°C	-16°C	-20°C
Min. temp. setting (r03)	4°C	-4°C	-6°C	-24°C	-28°C
Upper alarm limit (A13)	14°C	8°C	8°C	-15°C	-15°C
Lower alarm limit (A14)	0°C	-5°C	-5°C	-30°C	-30°C

Can only be set when r12=0.

Menu

SW = 1.8x

Parameter			El-diagram page 12 to 16								Min.-value	Max.-value	Factory setting	Actual setting
Function		Code	1	2	3	4	5	6	7	8				
Normal operation														
Temperature (setpoint)	***	- - -	1	1	1	1	1	1	1	1	-50°C	50°C	2	
Thermostat	r-													
Differential		r01	1	1	1	1	1	1	1	1	0.1 K	20 K	2	
Max. limitation of setpoint setting		r02	1	1	1	1	1	1	1	1	-49°C	50°C	50	
Min. limitation of setpoint setting		r03	1	1	1	1	1	1	1	1	-50°C	49°C	-50	
Adjustment of temperature indication		r04	1	1	1	1	1	1	1	1	-10	10	0	
Temperature unit (°C/°F)		r05	1	1	1	1	1	1	1	1	0/°C	1/F	0/°C	
Correction of the signal from S4		r09	1	1	1	1	1	1	1	1	-10 K	10 K	0	
Correction of the signal from S3 and S3B		r10	1	1	1	1	1	1	1	1	-10 K	10 K	0	
Manual service, stop regulation, start regulation (-1, 0, 1)	***	r12	1	1	1	1	1	1	1	1	-1	1	0	
Displacement of reference during night operation		r13	1	1	1	1	1	1	1	1	-50 K	50 K	0	
Define thermostat function 1=ON/OFF, 2=Modulating		r14	1	1	1	1	1	1	1	1	1	2	1	
Definition and weighting, if applicable, of thermostat sensors - S4% (100%=S4, 0%=S3)		r15	1	1	1	1	1	1	1	1	0 %	100 %	100	
Time between melt periods		r16	1	1	1	1	1	1	1	1	0 hrs	10 hrs	1	
Duration of melt periods		r17	1	1	1	1	1	1	1	1	0 min.	30 min.	5	
Temperature setting for thermostat band 2 . As differential use r01	***	r21	1	1	1	1	1	1	1	1	-50°C	50°C	2	
Correction of the signal from S6		r59	1	1	1	1	1	1	1	1	-10 K	10 K	0	
Correction of the signal from S6B		r60			1	1	1	1			-10 K	10 K	0	
Definition and weighting, if applicable, of thermostat sensors when night cover is on. (100%=S4, 0%=S3)		r61	1	1	1	1	1	1	1	1	0 %	100 %	100	
Heat function Neutral zone between refrigeration and heat function		r62	1	1	1	1	1	1	1	1	0 K	50 K	5	
Time delay at switch between refrigeration and heat function. For setting = after 240 min. the heating function is deactivated		r63	1	1	1	1	1	1	1	1	0 min.	240 min.	240	
Product type: use settings listed in table.	***	r89	1	1	1	1	1	1	1	1	0	5	0	
Alarms	A-													
Delay for temperature alarm		A03	1	1	1	1	1	1	1	1	0 min.	240 min.	30	
Delay for door alarm		A04	1	1	1	1	1	1	1	1	0 min.	240 min.	60	
Delay for temperature alarm after defrost		A12	1	1	1	1	1	1	1	1	0 min.	240 min.	90	
High alarm limit for thermostat 1		A13	1	1	1	1	1	1	1	1	-50°C	50°C	8	
Low alarm limit for thermostat 1		A14	1	1	1	1	1	1	1	1	-50°C	50°C	-30	
High alarm limit for thermostat 2		A20	1	1	1	1	1	1	1	1	-50°C	50°C	8	
Low alarm limit for thermostat 2		A21	1	1	1	1	1	1	1	1	-50°C	50°C	-30	
High alarm limit for sensor S6 at thermostat 1		A22	1	1	1	1	1	1	1	1	-50°C	50°C	8	
Low alarm limit for sensor S6 at thermostat 1		A23	1	1	1	1	1	1	1	1	-50°C	50°C	-30	
High alarm limit for sensor S6 at thermostat 2		A24	1	1	1	1	1	1	1	1	-50°C	50°C	8	
Low alarm limit for sensor S6 at thermostat 2		A25	1	1	1	1	1	1	1	1	-50°C	50°C	-30	
S6 alarm time delay With setting = 240 the S6 alarm will be omitted		A26	1	1	1	1	1	1	1	1	0 min.	240 min.	240	
Alarm time delay or signal on the DI1 input		A27	1	1	1	1	1	1	1	1	0 min.	240 min.	30	
Alarm time delay or signal on the DI2 input		A28	1	1	1	1	1	1	1	1	0 min.	240 min.	30	
Signal for alarm thermostat. S4% (100%=S4, 0%=S3)		A36	1	1	1	1	1	1	1	1	0 %	100 %	100	
Delay for S6 (product sensor alarm) after defrost		A52	1	1	1	1	1	1	1	1	0 min.	240 min.	90	
Delay for temperature alarm S3B		A53			1	1	1	1			0 min.	240 min.	90	
Compressor	c-													
Min. ON-time		c01	1	1	1	1	1	1		1	0 min.	30 min.	0	
Min. OFF-time		c02	1	1	1	1	1	1		1	0 min.	30 min.	0	
Time delay for cutin of comp.2		c05								1	0 sec	999 sec	5	
Defrost	d-													
Defrost method: 0=none, 1= EL, 2= Gas, 3=Brine, 4=Air		d01	1	1	1	1	1	1	1	1	0/No	4/Air	1/EL	
Defrost stop temperature		d02	1	1	1	1	1	1	1	1	0°C	50°C	6	
Interval between defrost starts		d03	1	1	1	1	1	1	1	1	0 hrs/Off	240 hrs	8	
Max. defrost duration		d04	1	1	1	1	1	1	1	1	0 min.	360 min.	45	

Continued		Code	1	2	3	4	5	6	7	8	Min.	Max.	Fac.	Actual
Displacement of time on cutin of defrost at start-up		d05	1	1	1	1	1	1	1	1	0 min.	240 min.	0	
Drip off time		d06	1	1	1	1	1	1	1	1	0 min.	60 min.	0	
Delay for fan start after defrost		d07	1	1	1	1	1	1	1	1	0 min.	60 min.	0	
Fan start temperature		d08	1	1	1	1	1	1	1	1	-50 °C	0 °C	-5	
Fan cutin during defrost 0: Stopped 1: Running 2: Running during pump down and defrost		d09	1	1	1	1	1	1	1	1	0	2	1	
Defrost sensor: 0 =Stop on time, 1=S5, 2=S4, 3=S5 og S5B)		d10	1	1	1	1	1	1	1	1	0	3	0	
Pump down delay		d16	1	1	1	1	1	1	1	1	0 min.	60 min.	0	
Drain delay (used at hot gas defrost only)		d17							1		0 min.	60 min.	0	
Max. aggregate refrigeration time between two defrosts		d18	1	1	1	1	1	1	1	1	0 hrs	48 hrs	0/OFF	
Heat in drip tray. Time from defrosting stops to heating in the drip tray is switched off		d20							1		0 min.	240 min.	30	
Number of permissible extended defrost cycles before an alarm is issued		d26	1	1	1	1	1	1	1	1	1	10	1	
Rail heat during defrost cycle: 0=inactive, 1=continues as set, 2=100% on		d27	1	1	1	1	1	1	1	1	0	2	2	
Fan	F-													
Fan stop temperature (S5)		F04	1	1	1	1	1	1	1	1	-50°C	50°C	50	
Pulse operation on fans: 0=No pulse operation, 1=At thermostat cuts out only, 2= Only at thermostat cut outs during night operation		F05	1	1	1	1	1	1	1	1	0	2	0	
Period time for fan pulsation (on-time + off-time)		F06	1	1	1	1	1	1	1	1	1 min.	30 min.	5	
On-time in % of period time		F07	1	1	1	1	1	1	1	1	0 %	100 %	100	
Max. permissible S4 temperature during defrost cycle. If the value is exceeded, the fans will stop. (Setting = 15 = no function)		F22	1	1	1	1	1	1	1	1	-15°C	15°C	15	
Electricity monitoring	L-													
Current measured electricity through relay 1 (DO1)		L11	1	1	1	1	1	1	1	1	Ampere			
Same for relays 2 to 8		L12-L18	1	1	1	1	1	1	1	1	Ampere			
Fuse status for relay 1/Forced control of relay 1./ Reconnection		L21	1	1	1	1	1	1	1	1	0/off	1/on	1/on	
Same for relays 2 to 8		L22-L28	1	1	1	1	1	1	1	1	0/off	1/on	1/on	
Electrical current value at which relay cuts out; 0 = not used Recommended setting = measured consumption + 25%		L31	1	1	1	1	1	1	1	1	0 /4A	16 A	16	
Same for relays 2 to 8		L32-L38	1	1	1	1	1	1	1	1	0 /4A	16 A	16	
Current measured voltage in phase L1		L51	1	1	1	1	1	1	1	1	V			
Current measured voltage in phase L2		L52	1	1	1	1	1	1	1	1	V			
Current measured voltage in phase L3		L53	1	1	1	1	1	1	1	1	V			
Alarm limit for low consumption on DO2		L62	1	1	1	1	1	1		1	0 A	10 A	1	
Alarm limit for low consumption on DO5		L65		1		1		1		1	0 A	10 A	1	
Alarm limit for low consumption on DO6		L66	1	1	1	1	1	1	1	1	0 A	10 A	0	
Alarm limit for low consumption on DO8		L68		1	1	1		1			0 A	10 A	1	
Parameters for refrigeration function	n-													
Period time for the pulse width period (PWM)		n63	1	1	1	1	1	1	1	1	30 sec.	900 sec.	300	
Max. opening degree at PWM		n64	1	1	1	1	1	1	1	1	10%	100%	100	
Min. opening degree at PWM		n65	1	1	1	1	1	1	1	1	0%	90%	0	
Expert setting. Windup at PWM		n66	1	1	1	1	1	1	1	1	0.2	1.0	1.0	
Expert setting. Kp at PWM		n67	1	1	1	1	1	1	1	1	0.5	10.0	4.0	
Expert setting. Tn at PWM		n68	1	1	1	1	1	1	1	1	60 sec	1800 sec	300	
Miscellaneous	o-													
Delay of output signals after start-up		o01	1	1	1	1	1	1	1	1	0 sec	600 sec	5	
Input signal on DI1. Function: 0=not used. 1=status on DI1. 2=door function with alarm when open. 3=door alarm when open. 4=defrost start (pulse-signal). 5=ext.main switch. 6=night operation 7=thermostat band changeover (activate r21). 8=alarm function when closed. 9=alarm function when open. 10=case cleaning (pulse signal). 11=forced cooling at hot gas defrost, 12=night cover. . 13=not used. 14=forced close. 15=appliance shutdown. 16=light. 17=extra light. 18=cancel defrost. 19=override light.		o02	1	1	1	1	1	1	1	1	0	19	0	
Network address		o03	1	1	1	1	1	1	1	1	0	240	0	
On/Off switch (Service Pin message) IMPORTANT! o61 **must** be set prior to o04 (used at LON 485 only)		o04	1	1	1	1	1	1	1	1	0/Off	1/On	0/Off	
Access code 1 (all settings)		o05	1	1	1	1	1	1	1	1	0	100	0	
Used sensor type : 0=Pt1000, 1=Ptc1000,		o06	1	1	1	1	1	1	1	1	0/Pt	1/Ptc	0/Pt	

Continued		Code	1	2	3	4	5	6	7	8	Min.	Max.	Fac.	Actual
Max hold time after coordinated defrost		o16	1	1	1	1	1	1	1	1	0 min.	360 min.	20	
Select signal for display view. S4% (100%=S4, 0%=S3)		o17	1	1	1	1	1	1	1	1	0 %	100 %	100	
Input signal on DI2. Function: 0=not used. 1=status on DI2. 2=door function with alarm when open. 3=door alarm when open. 4=defrost start (pulse signal). 5=ext. main switch. 6=night operation 7=thermostat band changeover (activate r21). 8=alarm function when closed. 9=alarm function when open. 10=case cleaning (pulse signal). 11=forced cooling at hot gas defrost, 12=night cover.13=coordinated defrost). 14=forced close. 15=appliance shutdown. 16=light. 17=extra light. 18=cancel defrost. 19=override light.		o37	1	1	1	1	1	1	1	1	0	19	0	
Configuration of light function: 1=Light follows day/night operation, 2=Light control via data communication via 'o39', 3=Light control with a DI-input, 4=As with "2", but light switch on and night cover will open if the network cuts out for more than 15 minutes. 5=Light goes on when a signal is received from both DI and central signal (DI7 or data communication). 6=Like "5", but light also goes on for manual activation of night blind.		o38	1	1	1	1	1	1	1	1	1	6	1	
Activation of light relay (only if o38=2, 5 or 6)		o39	1	1	1	1	1	1	1	1	0/Off	1/On	0/Off	
Rail heat On time during day operations		o41	1	1	1	1	1	1	1	1	0 %	100 %	100	
Rail heat On time during night operations		o42	1	1	1	1	1	1	1	1	0 %	100 %	100	
Rail heat period time (On time + Off time)		o43	1	1	1	1	1	1	1	1	1 min.	60 min.	10	
Case cleaning. 0=no case cleaning. 1=Fans only. 2=All output Off.	***	o46	1	1	1	1	1	1	1	1	0	2	0	
Select application. See overview page 13 to 16	*	o61	1	1	1	1	1	1	1	1	1	8	1	
Access code 2 (partial access)	***	o64	1	1	1	1	1	1	1	1	0	100	0	
Replace the controllers factory settings with the present settings		o67	1	1	1	1	1	1	1	1	0/Off	1/On	0/Off	
Input signal on DI3. Function: (0=not used. 1=status on DI3. 2=door function with alarm when open. 3=door alarm when open. 4=defrost start (pulse-signal). 5=ext. main switch 6=night operation, 7=thermostat band changeover (activate r21). 8=Not used. 9=Not used. 10=case cleaning (pulse signal). 11=forced cooling at hot gas defrost, 12=night cover. 13=Not used. 14=Refrigeration stopped (forced closing). 15=appliance shutdown. 16=light. 17=extra light. 18=cancel defrost. 19=override light.		o84	1	1	1	1	1	1	1	1	0	19	0	
Rail heat control 0=not used, 1=pulse control with timer function (o41 and o42), 2=pulse control with dew point function		o85	1	1	1	1	1	1	1	1	0	2	0	
Dew point value where the rail heat is minimum		o86	1	1	1	1	1	1	1	1	-10°C	50°C	8	
Dew point value where the rail heat is 100% on		o87	1	1	1	1	1	1	1	1	-9°C	50°C	17	
Lowest permitted rail heat effect in %		o88	1	1	1	1	1	1	1	1	0 %	100 %	30	
Time delay from "open door" refrigeration is started		o89	1	1	1	1	1	1	1	1	0 min.	240 min.	30	
Fan operation on stopped refrigeration (forced closing): 0: The fans will be stopped and defrosting will be permitted. 1: The fans will run and defrosting will be permitted. 2: The fans will be stopped and defrosting will not be permitted. 3: The fans will run and defrosting will not be permitted.		o90	1	1	1	1	1	1	1	1	0	3	1	
Definition of readings on lower button: 1=defrost stop temperature, 2=S6 product temperature,		o92	1	1	1	1	1	1	1	1	1	2	1	
Display of temperature 1= u56 Air temperature 2= u36 product temperature		o97	1	1	1	1	1	1	1	1	1	2	1	
Light and night blinds defined 0: Light is switch off and night blind is open when the main switch is off 1: Light and night blind is independent of main switch		o98	1	1	1	1	1	1	1	1	0	1	0	
Configuration of alarm relay The alarm relay will be activated upon an alarm signal from the following groups: 1 - High temperature alarms 2 - Low temperature alarms 4 - Sensor error 8 - Digital input enabled for alarm 16 - Defrosting alarms 32 - Miscellaneous 64 - Injection alarms 128 - Fuse cut out The groups that are to activate the alarm relay must be set by using a numerical value which is the sum of the groups that must be activated. (E.g.: a value of 5 will activate all high temperature alarms and all sensor error.		P41	1	1	1	1	1	1	1	1	0	255	239	
Input signal on DI4. Switch signal. See DI3 above		P55	1	1	1	1	1	1	1	1	0	19	0	

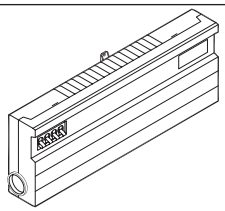
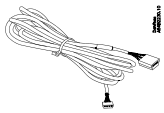
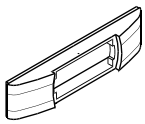
Continued		Code	1	2	3	4	5	6	7	8	Min.	Max.	Fac.	Actual
Input signal on DI5. Contact switch. See DI3 above		P56	1	1	1	1	1	1	1	1	0	19	0	
Input signal on DI6. Contact switch. See DI3 above		P57	1	1	1	1	1	1	1	1	0	19	0	
Input signal on DI7. High voltage signal. See DI3 above		P58	1	1	1	1	1	1	1	1	0	19	0	
Input signal on DI8. High voltage signal. See DI3 above		P59	1	1	1	1	1	1	1	1	0	19	0	
Max. opening time of night blind following manual override with DI activation.		P60	1		1		1		1	1	0 min.	60 min.	5	
Erase all current controller settings on ID module.		P61	1	1	1	1	1	1	1	1	0 / off	1 / on	0 / off	
Configuration of night blind relay. On= night blind used		P64	1		1		1		1	1	0 / off	1 / on	1 / on	
Stop time for fan while night blind rolls down		P65	1		1		1		1	1	0 sec	300 sec	60	
Max. on time for light and night blind following manual DI activation		P66	1	1	1	1	1	1	1	1	0 min.	60 min.	30	
Real time clock	t-													
Six start times for defrost. Setting of hours. 0=OFF		t01 - t06	1	1	1	1	1	1	1	1	0 hrs	23 hrs	0	
Six start times for defrost. Setting of minutes. 0=OFF		t11 - t16	1	1	1	1	1	1	1	1	0 min.	59 min.	0	
Clock - Setting of hours		t07	1	1	1	1	1	1	1	1	0 hrs	23 hrs	0	
Clock - Setting of minute		t08	1	1	1	1	1	1	1	1	0 min.	59 min.	0	
Clock - Setting of date		t45	1	1	1	1	1	1	1	1	1 day	31 day	1	
Clock - Setting of month		t46	1	1	1	1	1	1	1	1	1 mon.	12 mon.	1	
Clock - Setting of year		t47	1	1	1	1	1	1	1	1	0 year	99 year	0	
Service	u-													
Temperature measured with S5 sensor		u09	1	1	1	1	1	1	1	1				
Status on DI1 input. on/1=closed		u10	1	1	1	1	1	1	1	1				
Actual defrost time (minutes)		u11	1	1	1	1	1	1	1	1				
Temperature measured with S3 sensor		u12	1	1	1	1	1	1	1	1				
Status on night operation (on or off) 1=on		u13	1	1	1	1	1	1	1	1				
Temperature measured with S4 sensor		u16	1	1	1	1	1	1	1	1				
Thermostat temperature		u17	1	1	1	1	1	1	1	1				
Run time of thermostat (cooling time) in minutes		u18	1	1	1	1	1	1	1	1				
Opening degree of EVR valve	**	u23	1	1	1	1	1	1	1	1				
Temperature measured with S6 sensor (product temperature)		u36	1	1	1	1	1	1	1	1				
Status on DI2 input. on/1=closed		u37	1	1	1	1	1	1	1	1				
Air temperature . Weighted S3 and S4		u56	1	1	1	1	1	1	1	1				
Measured temperature for alarm thermostat		u57	1	1	1	1	1	1	1	1				
Status on relay for cooling	**	u58	1	1	1	1	1	1		1				
Status on relay for fan	**	u59	1	1	1	1	1	1	1	1				
Status on relay for defrost	**	u60	1	1	1	1	1	1		1				
Status on relay for rail heat	**	u61	1	1	1	1	1	1	1	1				
Status on relay for alarm	**	u62	1	1	1	1	1	1	1	1				
Status on relay for light	**	u63	1	1	1	1	1	1	1	1				
Status on relay for hot gas valve	**	u64							1					
Status on relay for compressor 2	**	u67								1				
Temperature measured with S5B sensor		u75	1	1	1	1	1	1	1	1				
Temperature measured with S3B sensor		u76			1	1	1	1						
Temperature measured with S6B sensor		u79			1	1	1	1						
Status on relay for hot gas valve / drain valve	**	u80							1					
Status on relay for heating element in drip tray	**	u81							1					
Status on relay for night blinds	**	u82	1		1		1		1	1				
Status on relay for defrost 2	**	u83		1		1		1						
Readout of the actual rail heat effect		u85	1	1	1	1	1	1	1	1				
1: Thermostat 1 operating, 2: Thermostat 2 operating		u86	1	1	1	1	1	1	1	1				
Status on DI3 input. on/1=closed		u87	1	1	1	1	1	1	1	1				
Readout of thermostats actual cut in value		u90	1	1	1	1	1	1	1	1				
Readout of thermostats actual cut out value		u91	1	1	1	1	1	1	1	1				
Measured temperature for alarm thermostat in section B		U34			1	1	1	1						
Air temperature in section B		U35			1	1	1	1						
Status of relay for light 2	**	U36	1	1	1	1	1	1						

Continued		Code	1	2	3	4	5	6	7	8	Min.	Max.	Fac.	Actual
Status of relay for ECO fan	**	U37	1				1			1				
Status of relay for defrost 3	**	U38		1	1	1		1						
Status of DI4 input. On=closed		U39	1	1	1	1	1	1	1	1				
Status of DI5 input. On=closed		U40	1	1	1	1	1	1	1	1				
Status of DI6 input. On=closed		U41	1	1	1	1	1	1	1	1				
Status of high-voltage input DI7, 230 V = 1 = closed		U42	1	1	1	1	1	1	1	1				
Status of high voltage input DI8, 230 V = 1 = closed		U43	1	1	1	1	1	1	1	1				
0-10 V output indicates EVR valve's degree of opening	**	U44	1	1	1	1	1	1	1	1				
Modbus communication status, 0% = none; 100% = everything ok		U45	1	1	1	1	1	1	1	1				
Read usage of DI2 signal: 0 = see status in u37; 1 = output for coordinated defrost	**	U54	1	1	1	1	1	1	1	1				
Status of relay to drain valve: 1 = drawn	**	U55							1					

*) Can only be set when regulation is stopped (r12=0)
**) Can be controlled manually, but only when r12=-1
***) With access code 2 the access to these menus will be limited

Factory setting
Follow these steps if you need to return to the factory-set values:
- Connect a display with control buttons to the controller
- Activate setting P61 to reset the ID module
- Disconnect the supply voltage to the controller
- Remove the ID module from the controller
- Hold in the top and bottom buttons on the display while reconnecting the supply voltage
- Disconnect the supply voltage to the controller
- Insert the ID module into the controller
- Connect the supply voltage to the controller

Ordering

Type		Function	Code no.
AK-CT 200A		Controller tray for controlling refrigeration appliance. With MODBUS data communication	**084B0040**, (1 pc.) **084B0070**, (6 pcs.)
AK-CT 450A		ID module with code for controlling thermostatic controlled expansion valve.	**084B0042,** (1 pcs.) **084B0072, (**60 pcs.)
EKA 163B		External display with plug for direct connection	**084B8574**
EKA 164B		External display with operation buttons and plug for direct connections	**084B8575**
		Cable with plug for display unit (24 pcs.) 0.3 m 2 m 3 m 6 m 9 m	**084B7500** **084B7179** **084B7099** **084B7097** **084B7630**
		Console for mounting display on wall	**084B8584**
EKA 175		Data communication module LON RS 485	**084B8579**

Data

Supply voltage	400 V 3N a.c. / 400 V 2N a.c. / 230 V N a.c. +10/-15%, 30 VA, 50 Hz	
Main switch	Automated fuse, 4 terminals, 16 A, SIL-approved	
Sensor S2	Not used	
Sensor S3, S3B, S4, S5, S5B, S6, S6B	Pt 1000 or PTC 1000 ohm / 25°C (All must be of the same type)	
Accuracy	Measuring range	-60 to +120°C
	Controller	±1 K below -35°C ± 0,5 K between -35 to +25°C; ±1 K above +25°C
	Pt 1000 sensor	±0,3 K at 0°C ±0,005 K per degree
	I-reading L11 - L18	0-10 A: +/- 15% min. +/- 1A
Display	2 plugs for connecting external display	
External display	EKA 163B or 164B	
Digital inputs DI1, DI2, DI3, DI4, DI5, DI6	Signal from contact functions Requirements to contacts: None Cable length must be max. 15 m Use auxiliary relays when the cable is longer	
Digital inputs DI7, DI8	230 V a.c.	On: DI > 80 V a.c. Off: DI < 24 V a.c.
Electrical connection cable	Max. 2.5 mm^2	
Relays	DO1-DO8	Max. 16 A (12) A I max: (adjustable 4-16 A) I max. = 0 = cut out cancelled
	Alarm relay	4 (3) A. Min. 100 mA*
Solid state output	DOA (for coil)	Max. 240 V half wave rectified Max. 0.5 A Leakage < 1 mA Max. 1 coil Electronic coil controller EEC may not be used
Analogue voltage outlet	AO1	0-10 V R_{Load} > 1 kΩ
Environments	0 to +55°C, During operations -40 to +70°C, During transport	
	20 - 80% Rh, not condensed	
	No shock influence / vibrations	
Enclosure	IP 20	
Weight	3.8 kg	
Data communication	Fixed	MODBUS
	Extension options	LON RS485
Power reserve for the clock	24 hours	
Approvals	EU Low Voltage Directive and EMC demands re CE-marking complied with LVD-tested acc. EN 60730-1, EN 60730-2-1 and EN 60730-2-9 EMC-tested acc. EN 61000-6-2 and EN 61000-6-3	

*) Gold plating ensures make function with small contact loads.