ENGINEERING
TOMORROW

User Guide

Case controller for semi plug-in Type **AK-CC55 Water Loop**

SW Ver. 1.2x
For refrigeration appliances and cold storage rooms.

Contents

Introduction

Application
Refrigeration appliance control for semi plug-in cabinets with a water cooled condenser.

Advantages:
- Broad application coverage for single compressor, dual compressor, variable speed compressor and variable speed brine pump
- Quick set-up with predefined settings
- Easy configuration and service using a mobile app with Bluetooth
- Robust and precise temperature control via variable speed control of compressor or brine pump
- Oil return management ensuring a long lifetime of the variable speed compressor
- Safety monitoring of high condenser brine inlet temperature
- Option for second condenser outlet brine temperature
- Safety monitoring of compressor and/or variable speed drive

Principle
The temperature in the appliance is registered by one or two temperature sensors 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.

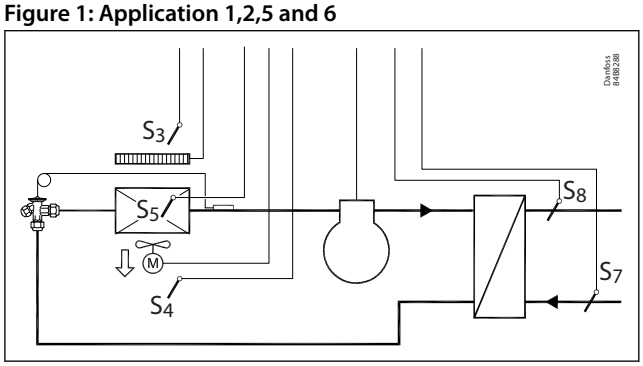
The temperature of the evaporator is registered with the S5 sensor which can be used as a defrosting sensor.

On the condenser side, an S7 sensor is to be mounted at the brine inlet temperature and optionally an S8 sensor can be mounted at the brine outlet.

The outputs will be configured based on the selected application and for some applications some of the digital outputs can be user defined.

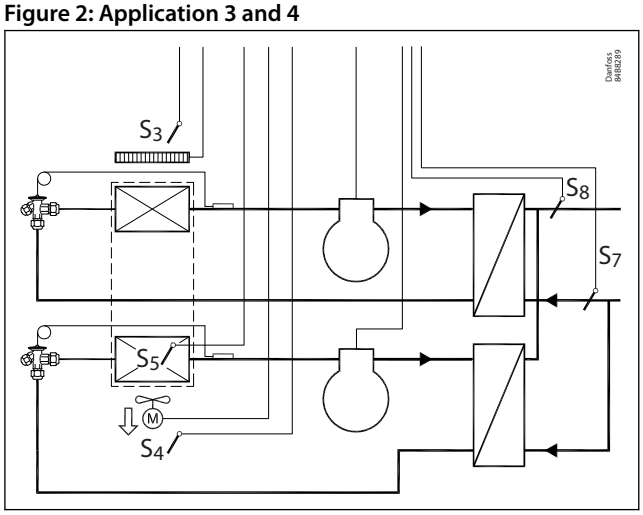
Application coverage
The AK-CC55 Water Loop controller has a broad application coverage and supports the following main applications:

Figure 1: Application 1,2,5 and 6



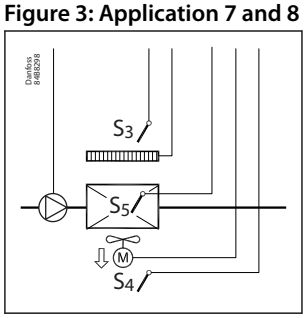
Single compressor application with either on/off or variable speed control of the compressor.

Figure 2: Application 3 and 4



Dual compressor application with either sequential or cyclic on/off control of the two compressor circuits.

Figure 3: Application 7 and 8

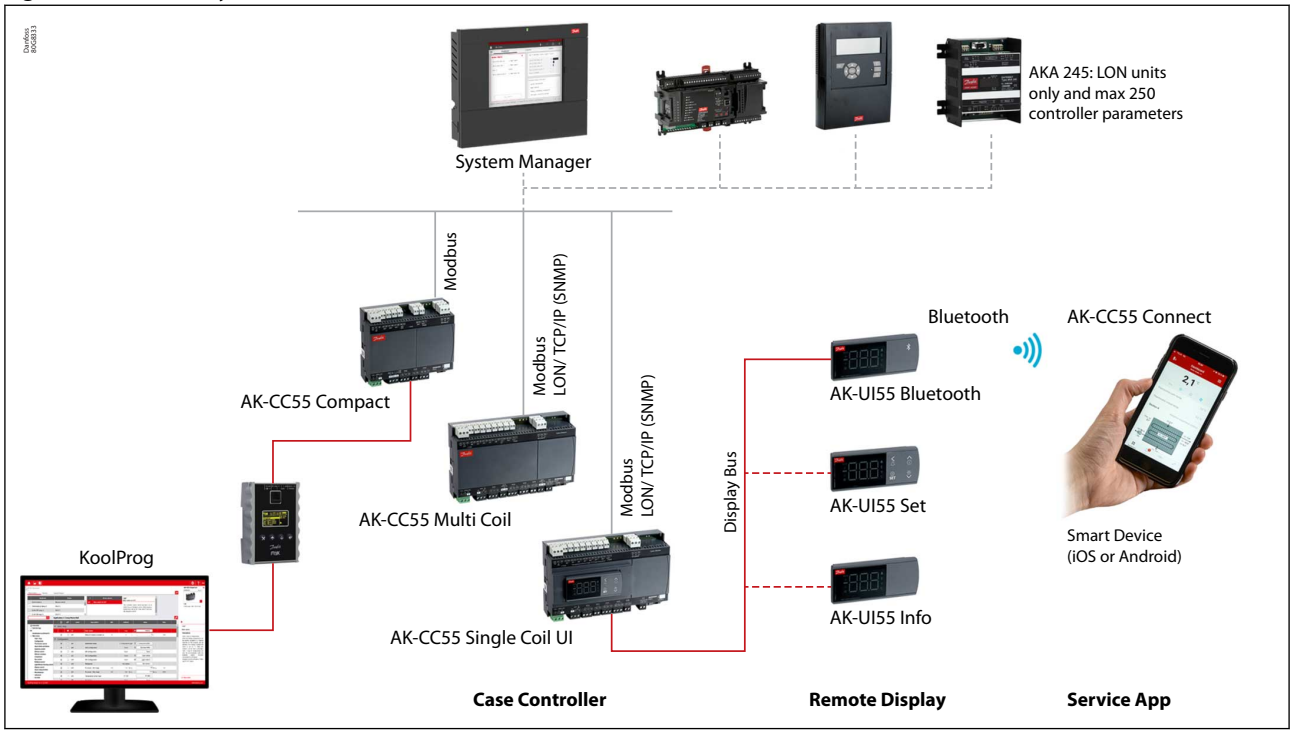


Variable speed control of a feeding brine pump.

Connectivity

The diagram outlines the connectivity options presented by AK-CC55 for the design of system functionality.

Figure 4: Connectivity



Data communication

The AK-CC55 Water Loop controller has built-in MODBUS data communication only.

AK-CC55 Water Loop

An application mode setting will configure inputs and outputs for the desired use. There are eight applications to choose from.

Temperature control is performed by on/off control of a single or dual compressor, variable speed control of a compressor or a brine pump.

AK-CC55 Water Loop is without display, and can be extended with one external display (see Figure 5 and Figure 6):

Figure 5: AK-CC55 Water Loop

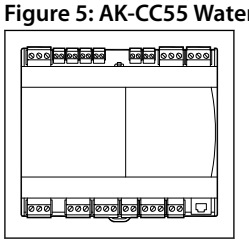
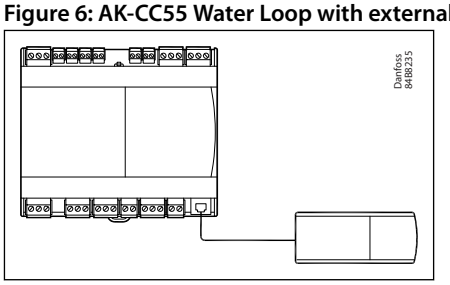


Figure 6: AK-CC55 Water Loop with external display.



External display

There are three versions available with different functions:

- AK-UI55 Info: Temperature display.
- AK-UI55 Set: Temperature display with control buttons on the front.
- AK-UI55 Bluetooth: Temperature display with Bluetooth communication, for use with AK-CC55 Connect Mobile app.

Figure 7: AK-UI55 Info

Figure 8: AK-UI55 Set

Figure 9: AK-UI55 Bluetooth

Controller functionality

Functions

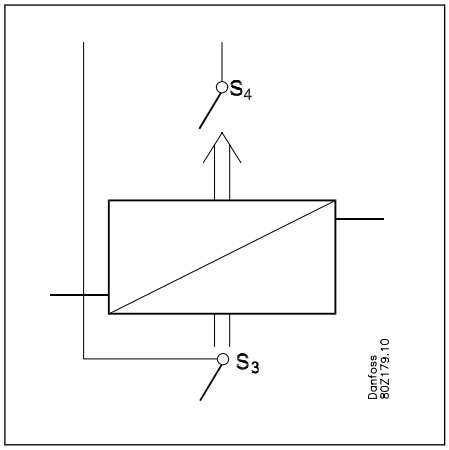
- ON/OFF temperature control via a single or dual compressor
- Precise temperature control via variable speed control of compressor or brine pump
- Variable speed control via voltage (0 – 10 V), frequency or PWM signal
- Oil return management for extended lifetime of compressor
- Resonance avoidance range for eliminating mechanical noise from unit
- Safety monitoring of condenser inlet temperature and compressor safety chain
- Switch between thermostat bands via digital input
- Start of defrost via schedule, runtime, digital input, network or setting display
- Natural, electrical or simple hot gas defrost
- Stop of defrost on time and/or temperature
- Coordination of defrosting among several controllers in a line-up
- Pulsing or ECO control of fans when thermostat is satisfied
- Appliance cleaning function for documentation of HACCP procedure
- Rail heat control via day/night load or dew point
- Door function
- Control of night blinds
- Light control
- Heat thermostat
- High accuracy inputs:
  - to guarantee a better measuring accuracy than stated in the standard EN ISO 23953-2 without subsequent calibration (Pt1000 ohm sensor)
- Integrated MODBUS communication

Temperature control

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

The actual temperature control can take place in two ways:
1. As an ordinary ON/OFF regulation with a differential, or
2. As a modulating control where the temperature variation will not be nearly as high as in ON/OFF control.

Figure 10: Control methods



Temperature monitoring

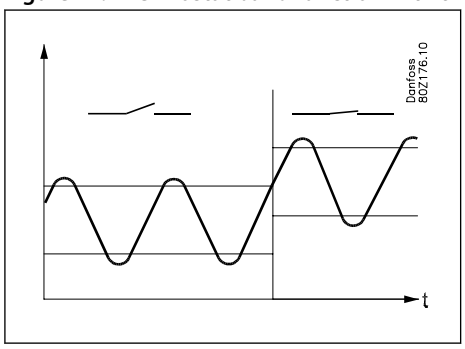
Just as is possible for the thermostat, the alarm monitoring can be set with a weighting between S3 and S4 so that you can decide how much the two sensor values should influence the alarm monitoring. Minimum and maximum limits can be set for alarm temperature and time delays. A longer time delay can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

Thermostat bands

Thermostat bands can be used beneficially for appliances where different product types are stored, which requires 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.

For the defrost control, separate defrost stop temperature and max. defrost time can be set for each thermostat band. For the compressor control it is possible to disable the second compressor in thermostat band 2 if required.

Figure 11: Thermostat band function with two different band settings

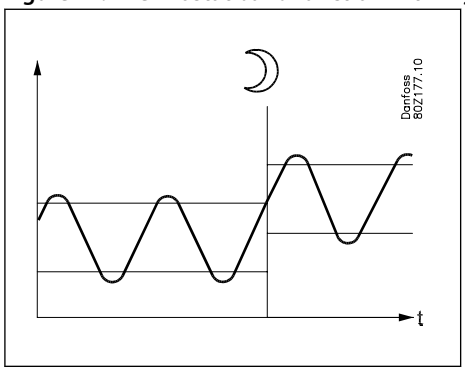


Night setback of thermostat value

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 connected to a digital input.
- via a signal from the data communication system.

Figure 12: Thermostat band function with Night setback



Temperature sensor types

For the S3, S4, S5, S7 and S8 sensors, the user can select between the following sensor types:

0 = Pt1000 (Danfoss AKS 11)
1 = PTC1000 (Danfoss EKS 111)
2 = NTC 5k (Danfoss EKS 211)
3 = NTC 10k (Danfoss EKS 221)
4 = User-defined

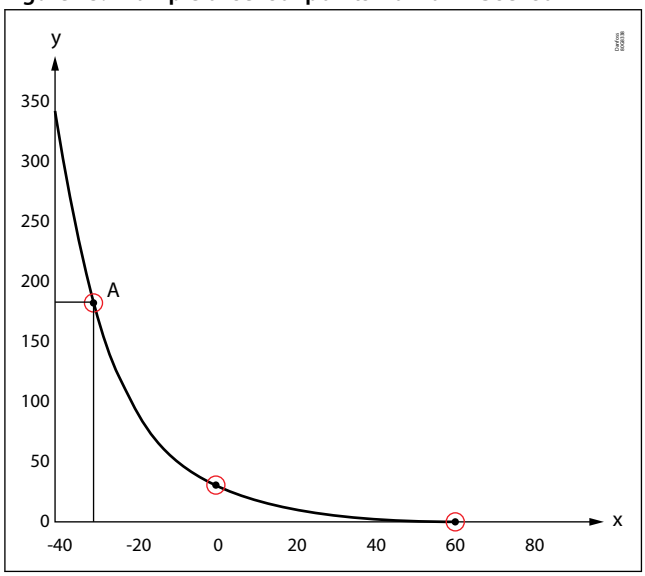
If “User-defined” is selected, three sensor measuring points must be provided and based on these three sensor points, a sensor characteristic is generated.

A sensor point is defined by setting a temperature value and the corresponding resistance value at this temperature. The resistance value is set via two values for kohm and ohm respectively. These values can be found in the data sheet for the sensor.

The three sensor points must be:
1. Lowest temperature in wanted measuring range
2. Highest temperature value in wanted temperature range
3. Temp. value in the middle where a high measuring accuracy is required

A sensor error is detected at temperature values below/above the min./max. temperature values typed in for the sensor points.

Figure 13: Example of sensor points from a NTC sensor



x	Temp [°C]
y	R [kohm]
A	Sensor point (-30 °C, 180 kΩ)

Limitations:
A user defined temperature sensor can only be be defined within the temperature range from -40 – +60 °C and within the resistance range from 400 – 179.999 ohm.

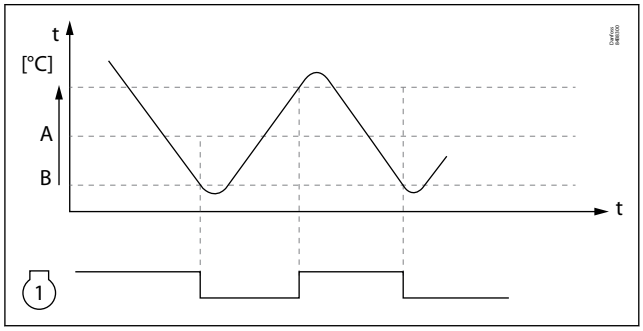
When applying a new user defined sensor type, please contact Danfoss for validation of compliance and measuring accuracy.

Compressor and Pump control

Single compressor (Application 1 and 2)
The single compressor is on/off controlled, based on the thermostat temperature and the defined cut-out and cut-in limits.

At the cut-in limit the compressor is started and at the cut-out limit the compressor is stopped.

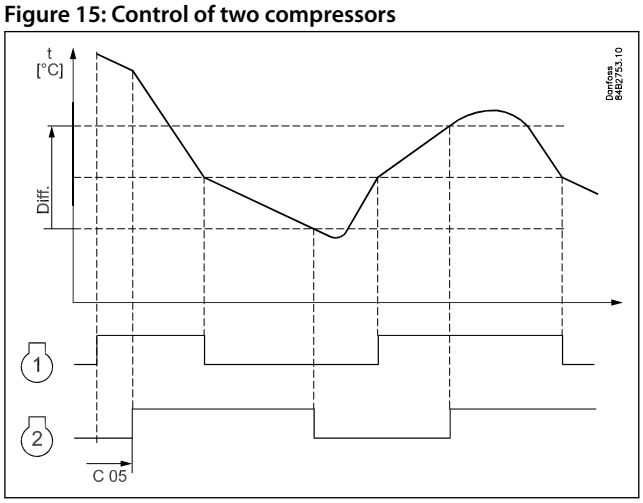
Figure 14: Control of single compressor



A	Difference
B	Cut-out

Dual compressors (Application 3 and 4)
Two compressor steps can be controlled cyclic or sequentially. At cyclic control, the two compressors must be of the same size, while in sequential control compressor step 1 can be larger than step 2.

Figure 15: Control of two compressors



Cyclic control
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 cut-out 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.

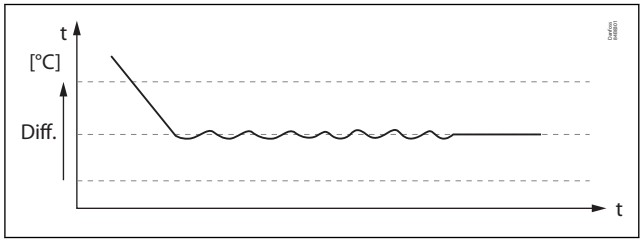
Sequential control
Compressor steps are controlled in the same manner as described for cyclic control, but compressor step 1 will always be started first and cut out as the last one. No time equalization is available in sequential control mode.

Variable speed compressor/pump (Application 5/6 and application 7/8)
Here the compressor/pump will be started when the controller requests cooling.

The analogue output signal will then be used to control the speed so that the temperature is kept very accurate at the reference. The PI controller will automatically adapt the amplification, depending on how far the thermostat air temperature is from the actual set reference temperature and thereby ensure fast pull-down when needed and precise control when close to the reference temperature.

The actual reference is placed in the middle of the cut-out and cut-in temperatures (cut-out + ½ diff).

Figure 16: Temperature variable

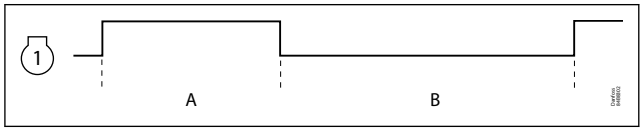


To eliminate overshoot/undershoot at high load changes, the rate of change in speed can be limited via a max. slope setting, which defines the maximum allowed change in speed per second (%/s).

Emergency control
If the thermostat air temperature becomes invalid due to a sensor error on the thermostat sensor, the controller will go into an emergency control mode where cooling will be maintained.

For single or dual compressor applications the compressor cut-in and cut-out periods can be defined as shown in the Figure 17.

Figure 17: Compressor cut-in/cut-off period



A	c86 ON time emergency
B	c87 OFF time emergency

For dual compressors it will only be one compressor, which will follow the defined cut-in and cut-out periods. Variable speed-controlled compressor/pump will run with a defined emergency speed during the emergency cooling. As soon as the thermostat sensor is okay again, normal control will be resumed.

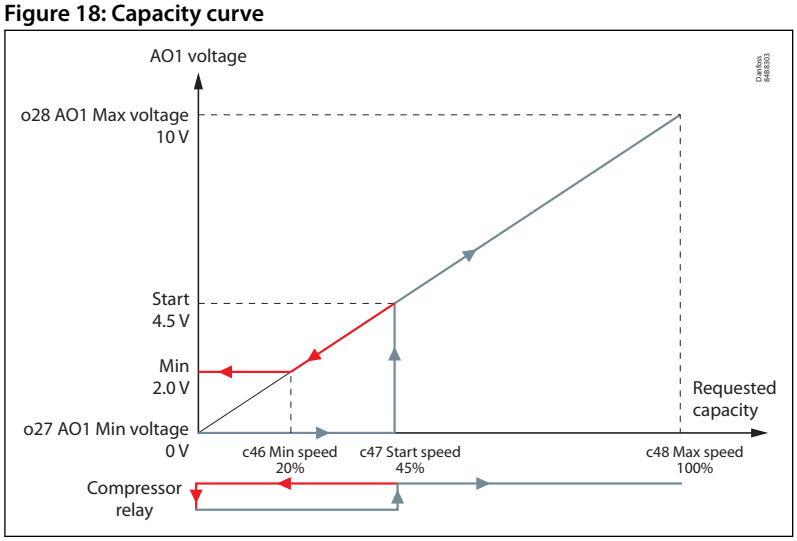
Variable speed signal
The speed control signal is provided via the analogue output AO1 and it can be set up for:
- Voltage
- Frequency
- PWM

For the selected control signal, the user must define the minimum output signal and the maximum output signal which will then correspond to respectively 0% and 100% capacity.

Based on the compressor data, a minimum speed and a start speed must be defined as a percentage of full capacity.

Voltage signal

Figure 18: Capacity curve



A capacity curve could look like shown in Figure 18. The analogue output signal is set to 0 – 10 V and the minimum speed is set at 20% and start speed at 45%.

Example:
o09 AO1 signal type = voltage
o28 AO1 max. voltage = 10 V
o27 AO1 min. voltage = 0 V
c46 min. speed = 20%
c47 start speed = 45%
c48 max. speed = 100%

When a cooling demand arises, the requested capacity will increase and as soon as it reaches the set start speed of 45%, the analogue output signal will go to the corresponding start signal (4,5 V) and the compressor will be started via the relay output. Now the compressor will run at start speed for 10 seconds, before the variable speed control takes over. From here on, the analogue output signal will vary with the requested capacity of the compressor and ensure a precise temperature control in the cabinet.

If the requested capacity reaches the defined minimum speed limit of 20%, the compressor will continue to run at this speed until the requested capacity reaches 0%. At this point, the analogue output will drop to the defined minimum signal and the compressor will be cut-out via the relay signal.

Frequency signal

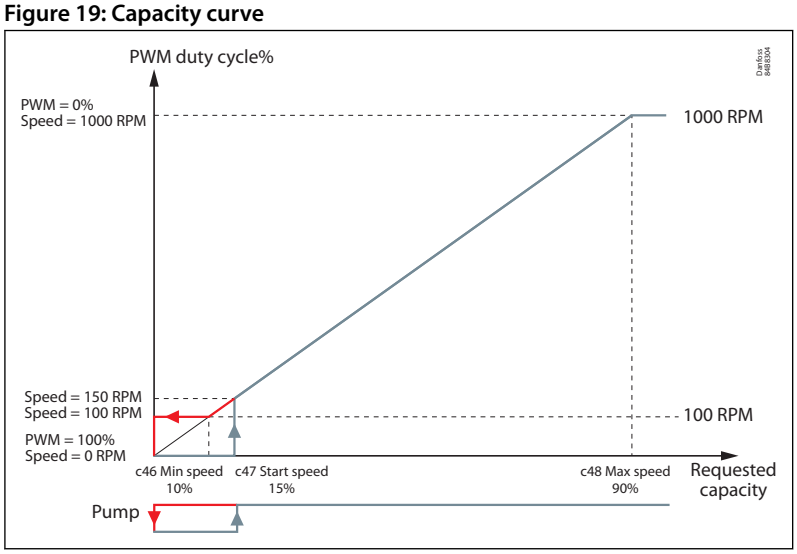
The example above also applies for a frequency control signal.

PWM signal

The PWM signal is a Pulse Width Modulated signal with a fixed frequency, where the duty cycle is modulated from 0 – 100%. Variable speed brine pumps are often controlled via a PWM signal and the capacity signal is normally inverted, meaning that a high pump speed corresponds to a low duty cycle of the PWM signal. Therefore, the analogue output signal provides the option for inverting the output signal.

A capacity curve could look like shown in Figure 19.

Figure 19: Capacity curve



Example:
o09 AO1 signal type = PWM
P97 AO1 PWM frequency = 200Hz
P98 AO1 invert signal = Yes
C46 min. speed = 10%
C47 start speed = 15%
C48 max. speed = 90%

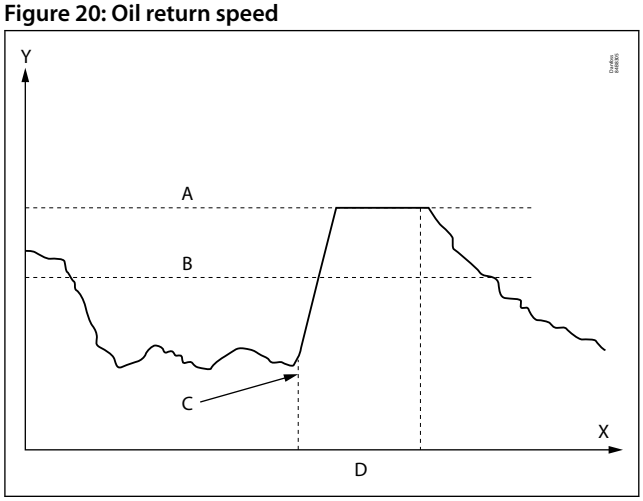
When a cooling demand arises, the requested capacity will increase and as soon as it reaches the set start speed of 15%, the PWM duty cycle will go to the corresponding start signal (85% duty cycle = 150 rpm) and the pump will be started via the relay output. Now the pump will run at start speed for 10 seconds before the variable speed control takes over. From here on, the PWM signal will vary with the requested capacity of the pump and ensure a precise temperature control in the cabinet.

If the requested capacity reaches the defined minimum speed limit of 10% (90% duty cycle = 100 rpm), the pump will continue to run at this speed until the requested capacity reaches 0%. At this point, the PWM signal will go to a duty cycle of 100% equal to 0% capacity and the pump will be cut-out via the relay signal.

Oil return management
If the variable speed compressor is running with a low speed for a long period, there is a risk that oil will be trapped

in the system and will not return to the compressor. The oil return management feature will prevent this from happening. If the variable speed compressor has been running below a set oil return speed for a set period of time, the compressor will increase the speed for a defined period of time and thereby ensure that oil is returned to the compressor due to the higher refrigerant velocity in the pipes.

Figure 20: Oil return speed



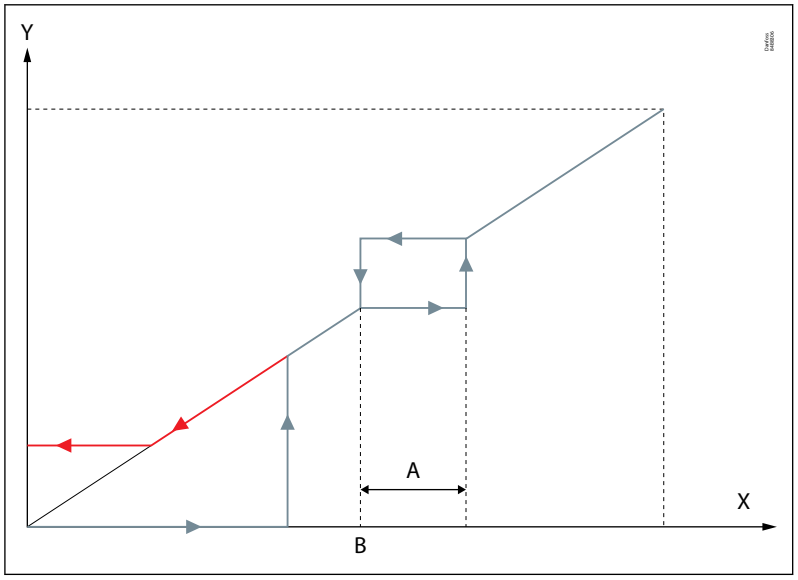
X	Time
Y	Compressor speed %
A	P79 Oil return speed
B	P77 Oil return speed limit
C	P78 Oil return interval runs out
D	P80 Oil return time period

Resonance elimination

Speed control can cause mechanical resonance vibrations to occur in the system and thereby create irritating noise. To prevent this, AK-CC55 Water Loop features an option of eliminating the speed range where the mechanical vibrations are present.

The speed resonance range is defined as a minimum resonance limit and a resonance zone. Within the defined resonance range, the speed will be kept constant - please refer to the curve below.

Figure 21: Resonance curve



X	Requested capacity
Y	AO1 voltage
A	P40 Resonance band
B	P39 Resonance band start

Compressor safety monitoring

The safety chain of the compressor or alternatively a speed drive can be monitored via a digital input signal. If the safety chain is broken e.g. HP switch open, a compressor safety alarm will be generated, and the compressor will be stopped. Once the problem has been remedied, the compressor will be started, provided that the min. OFF timer for the compressor has expired.

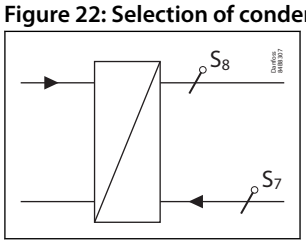
For the dual compressor application, only an alarm will be generated as it is not possible to identify which compressor that has been cut-out on safety.

Condenser monitoring and control

Selection of condenser sensors
The selection of condenser sensors is done via the parameter "P99 Condenser sensors" with the following options:
0= None
1= S7
2= S7 and S8

The S7 brine inlet temperature is used to monitor the temperature of the brine entering the condenser. Optionally, a second S8 brine outlet temperature can be defined to monitor the brine outlet temperature of the condenser. The S8 sensor will be connected on the AI5/DI1 input of the controller, meaning that the DI input will be omitted.

Figure 22: Selection of condenser sensors



High S7 Brine inlet temperature
The temperature at the brine inlet is monitored by the S7 temperature sensor. If the temperature gets higher than the set value, an alarm will be generated and the controller will reduce the cooling capacity, so that the load on the heat exchanger is reduced. Once the S7 temperature has dropped with the set alarm differential, normal capacity control is resumed.

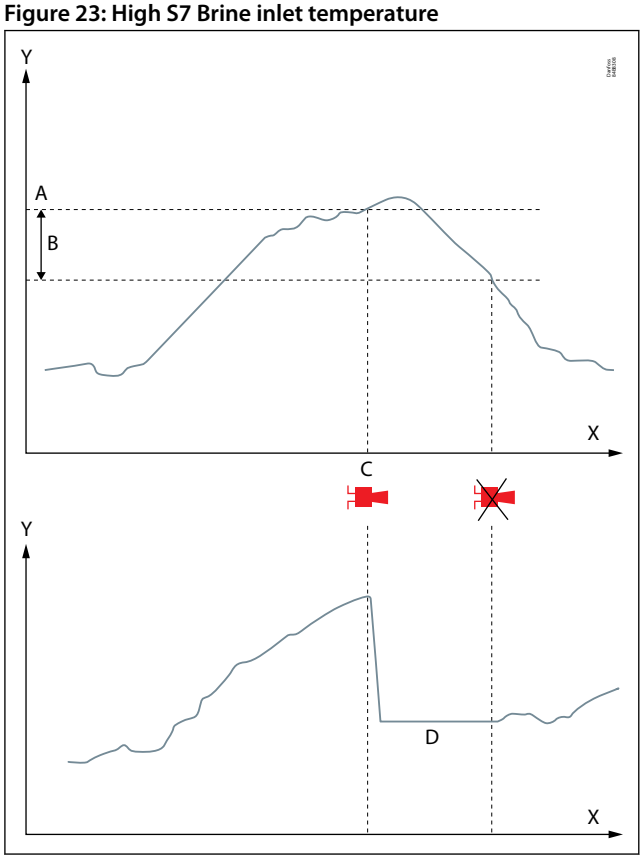
With variable speed control the compressor speed will be reduced to the value defined by parameter "c93 Speed emergency".

For two-compressor operation, one compressor will be taken out of operation.

For single step compressor, only the alarm will be generated as the compressor capacity cannot be reduced, without full loss of cooling.

The high S7 temperature monitoring is not enabled for the brine pump applications as there is no condenser present.

Figure 23: High S7 Brine inlet temperature

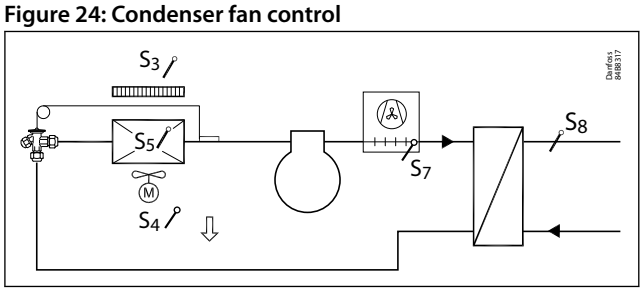


X	Time
Y	Compressor speed%
A	A76 Max. S7 Brine temp.
B	A77 Max. S7 Brine temp. diff.
C	AA4 S7 Max. brine temp.
D	c93 Speed emergency

Condenser fan control (only with custom set-up)

On hybrid water loop systems an air-cooled condenser is also part of the refrigerant circuit, see Figure 24.

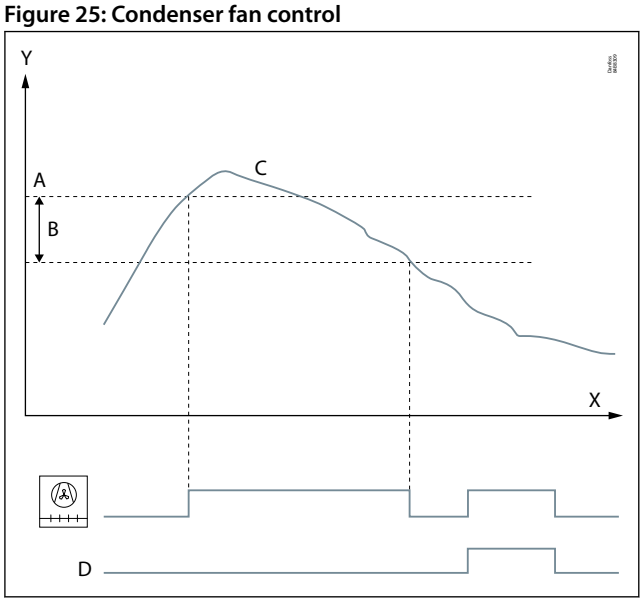
Figure 24: Condenser fan control



For such a hybrid system, the condenser fan can be configured for one of the outputs via the user defined applications, and the S7 sensor can be used to control the condenser fan on/off. The S7 sensor is placed on the air-cooled condenser to measure the condensing temperature. If the measured temperature increases above a set cut-in limit, the condenser fan is started, and if the temperature decreases with a set differential, the condenser fan is stopped again.

Furthermore, a condenser fan override function can be defined for one of the digital inputs, so that the air-cooled condenser can be used to provide heat to the store if needed.

Figure 25: Condenser fan control



X	Time
Y	Temperature °C
A	F24 Cond. fan cut-in
B	F25 Cond. fan diff.
C	S7 Cond. temp.
D	DI signal force cond. fan

Appliance cleaning

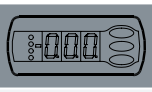
This function makes it easy for the shop's staff to carry out a cleaning of the appliance according to a standard procedure. Appliance cleaning is activated via a pulse signal – as a rule via a key switch placed on the appliance or via the AK-CC55 Connect mobile app.

Appliance cleaning is carried out via three activations:
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.

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.

There are no temperature alarms during appliance cleaning.

Table 1: Appliance cleaning function

			
-	+	+	°C
1	÷	+	Fan
2	÷	÷	Off
3	+	+	°C

Appliance shutdown

The function is used to shut down an appliance for a peiod of time e.g. over a weekend. 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 control

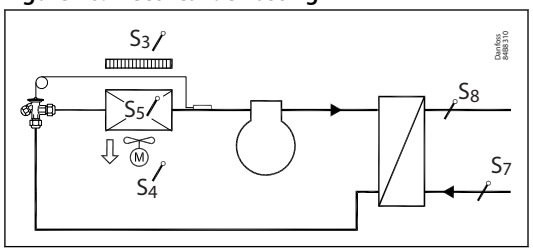
Defrost method
The following defrost methods can be selected:
0: None

1: Electrical
2: Hot gas defrost (Simple)
3: Natural

Electrical defrosting

At electrical defrost, an electrical heater is placed in front of the evaporator and the fan will “pull” the hot air through the evaporator during defrosting.

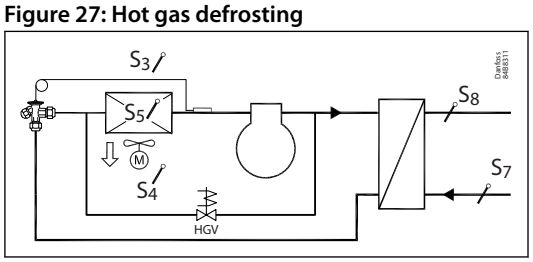
Figure 26: Electrical defrosting



Hot gas defrosting

At hot gas defrosting, the compressor will be running and a hot gas valve (HGV) is bypassing the discharge gas to the evaporator inlet and the evaporator is defrosted by means of the hot gas. Here the evaporator fans are normally not running and if a condenser fan is defined, it will not be running during the defrost sequence.

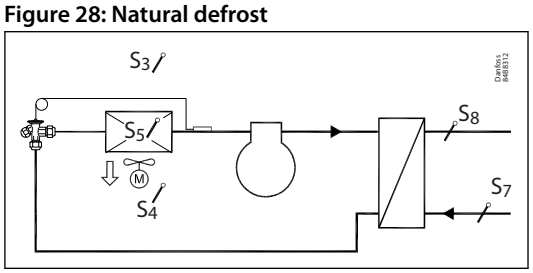
Figure 27: Hot gas defrosting



Natural defrost

At natural defrost the ice is melted by only running the fans and thereby circulating air through the evaporator.

Figure 28: Natural defrost



Start of defrost

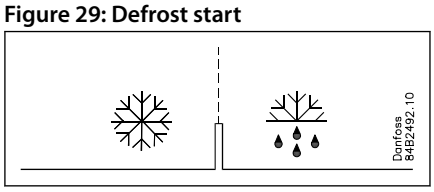
A defrost can be started in different ways:

Interval:
Defrost is started at fixed time intervals like e.g. 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.

Week schedule:
Here defrost can be started at fixed times of the day and night. However, max. 6 defrosts per day.

Contact:
Defrost is started with a contact signal on a digital input.

Figure 29: Defrost start



Network:
The defrost start signal is received from a system manager via data communication.

Max. thermostat runtime:
When the aggregate thermostat runtime has passed a preset value, a defrost will be initiated.

Manual:
An extra defrost can be activated from the defrost button on the AK-UI55 Set display via the app, or via the parameter setting.

All the mentioned methods can be used in parallel – if just one of them is activated, a defrost will be started.

Stop of defrost

Defrosting can be stopped by either:
- Time
- S4 temperature (with time as safety)
- S5 temperature (with time as safety)

When the selected defrost stop sensor reaches the set defrost stop limit, the defrost is terminated. If the defrost stop sensor does not reach the set defrost stop limit within the set max. defrost time, the defrost will be terminated on time.

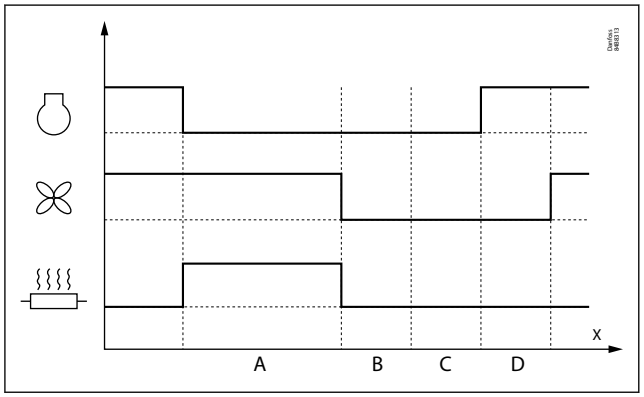
Minimum defrost time
When using hot gas for defrosting, the heat is coming from within the evaporator, and this means that the S5 sensor is rising fast when the inner layer of ice is melted. This will sometimes cause parts of the evaporator not to be defrosted when defrost is terminated on S5 evaporator temperature.

To prevent this, the user is given the option of setting a minimum defrost time. When a defrost is initiated, it will have to run for the set minimum time even if the set defrost stop limit has been reached by the selected defrost stop sensor.

Defrost sequence

When a defrost is initiated, the controller will run through the following sequence:
1. Defrost, where the ice is melted
2. Hold after defrosting, where multiple controllers wait for each other (coordinated defrost)
3. Drip off, where remaining water is dripping off evaporator
4. Fan delay, where the fans are restarted when the remaining water on the evaporator has turned into ice

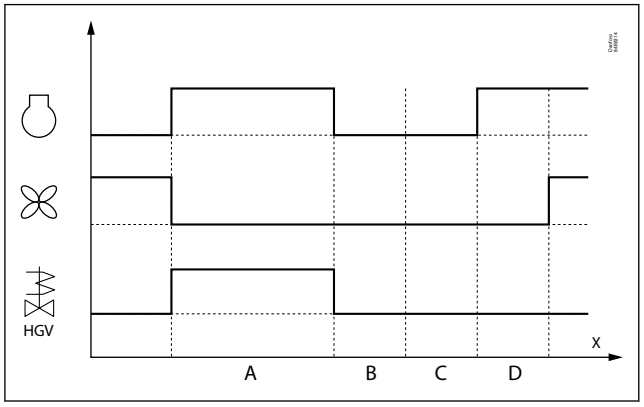
Figure 30: Electrical defrost



X	Time
A	Defrost
B	Hold
C	Drip
D	Fan delay

Electrical defrost sequence where the defrost heater is ON during defrost, compressor is stopped and fans are running during defrost but stopped during drip.

Figure 31: Hot gas defrost



X	Time
A	Defrost
B	Hold
C	Drip
D	Fan delay
HGV	Hot Gas Valve

Hot gas defrost sequence where compressor and hot gas valve is ON during defrost and fans are OFF.

Fan control during defrost
During the defrost sequence, the evaporator fans can be controlled in one of the following ways:
1. The fan is OFF during the entire defrost sequence
2. The fan is ON during the entire defrost sequence except during fan delay state
3. The fan is ON during defrost state and is OFF during the rest of the defrost sequence
4. Like option 2, however the fans can be stopped if the selected defrost stop sensor exceeds a set fan stop limit

Real-time clock

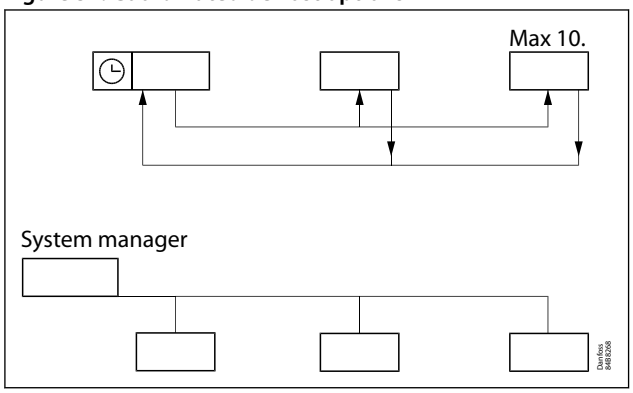
The controller has a built-in real-time clock which can be used to start defrosts. This clock has a power reserve of four days.

If the controller is equipped with data communication, the clock will automatically be updated from a Danfoss system manager.

Coordinated defrost

There are two ways in which coordinated defrost can be arranged.

Figure 32: Coordinated defrost options



Either with wire connections between the controllers or via data communication:

Wire connections
The digital input DI2 must be configured for coordinated defrost and wiring must be connected between the relevant 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 the last controller ends defrosting, the defrost sequence will continue with drip delay.

Coordination via data communication
Here the system manager handles the coordination. The controllers are gathered in defrosting groups and the system manager 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 manager and then goes into a waiting position. When the last controller ends defrosting the defrost sequence will continue with drip delay.

Melt function

This function will prevent 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.

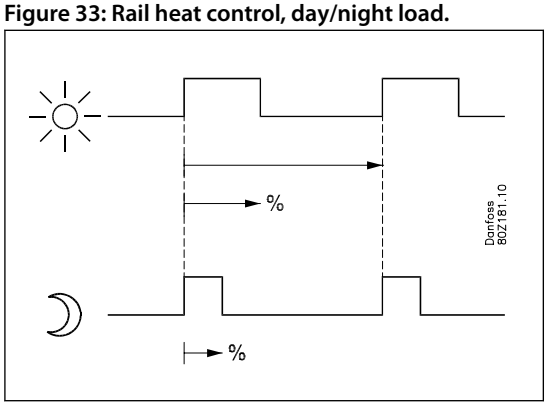
Rail heat

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 dewpoint.

Relay or analogue output
A relay output can be used when long cycle times are permitted. If fast pulsing is required, the AO1/PWM output can be used. The output must be connected to an external power solid state relay. The cycle time must be configured for the relay output in o43 or for analogue output in P82.

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

Figure 33: Rail heat control, day/night load.

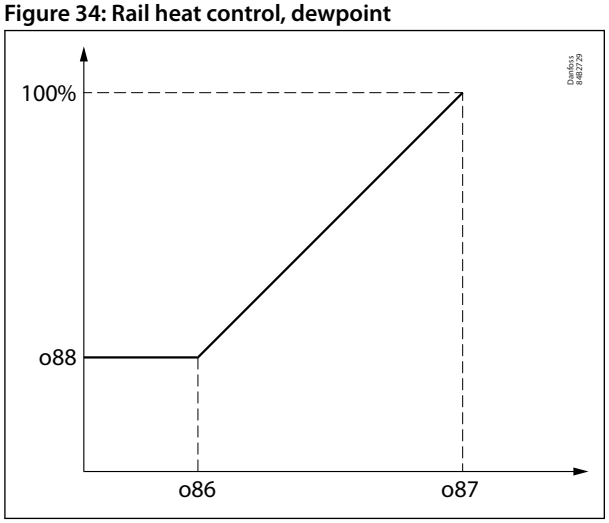


Pulse control according to dewpoint
In order to use this function, a system manager of the type AK-SM is required which can measure ambient temperature and humidity to calculate dewpoint and distribute to the appliance controllers. For this the rail heat's ON period is controlled according to the distributed dewpoint.

Two dewpoint 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 dewpoint which is equal to or lower than the value in o86, the effect will be the value indicated in o88. In the area between the two dewpoint values, the controller will manage the power to be supplied to the rail heat.

Figure 34: Rail heat control, dewpoint



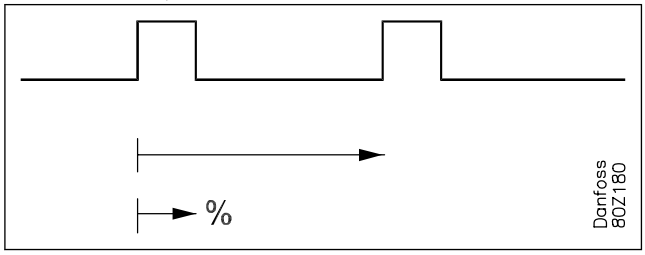
During defrosting
During defrosting, rail heat will be active, as selected in setting d27.

Fan

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

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

Figure 35: Fan cycle time



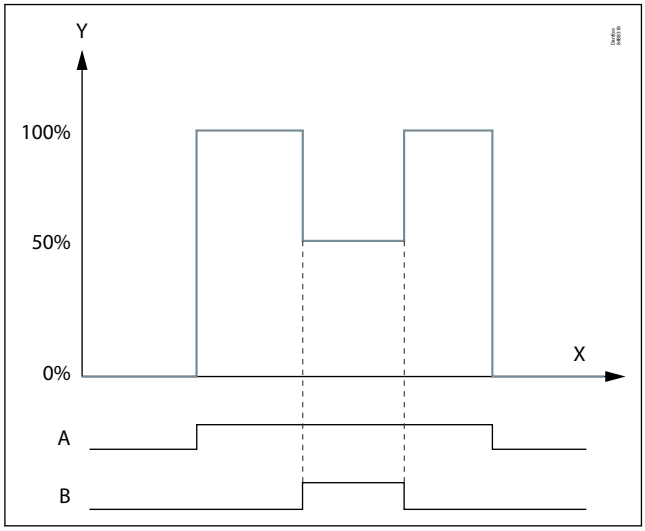
Fan ECO operation (only custom setup)
Fan ECO operation is used to reduce fan speed during night operation – typically on cabinets with night blinds.

The function is enabled when a relay has been configured for Fan ECO function in one of the applications with custom setup of relay functions.

The fan economy control (fan speed) is controlled via the two fan outputs:
- Fan output
- Fan Eco output

If the Fan output is activated, then the fan is running with 100% speed.
If the Fan ECO output also is activated, then the fan is running with reduced speed (typically 50%).
If both fan outputs are de-activated, then the fans are stopped.

Figure 36: Fan ECO control – Fan speed reduced to 50% during night operation



X	Time
Y	Fan speed
A	Fan
B	Fan ECO

The fans will always run with full speed during day operation, case cleaning, defrost, forced cooling and when air heating is active.

Cut-out 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 emission of heat 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. The fans will start running again when the S5 temperature has dropped 2K below the set limit. (The function can also be used as a type of MOP function. Here the load on the compressors is limited until the S5 temperature has fallen below the configured value).

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 several ways:
1. The light is controlled via the day/night function. A digital input setup for light control can switch light ON, if the light is switched off during night
2. The light is controlled by a system manager via the parameter o39. A digital input setup for light control can switch light ON, if the light is switched off by the system manager.
3. Light is controlled via the door switch. Light is switched ON when door is opened and switched OFF 2 minutes after the door has been closed.
4. Like option 2, but here the light is switched ON automatically if the communication to the system manager has been lost for 15 minutes
5. Light is only controlled via a digital input setup for light control

The light load must be connected to the NC terminals on the relay.
This ensures that the light remains ON in the appliance if power to the controller should fail.

A setting defines how light is controlled when regulation is stopped via r12 Main switch = OFF (see o98). The light is switched off when the appliance cleaning function is activated.

Night blind (only with custom set-up)

Motorised night blinds 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 open, 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 switch signal on the digital input. If this pulse signal is activated, the night blinds will open and the refrigeration appliance can be filled with new products. If the pulse signal is activated again, the blinds close.

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 opened when the appliance cleaning function is activated.

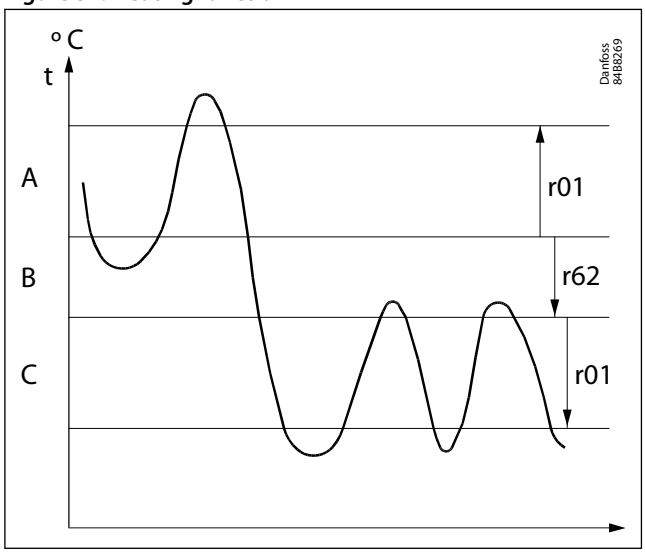
A setting can define that the night blind is opened when "r12" (Main switch) is set to off (see o98).

When the night blind rolls down, the fan will be stopped for the set time. The night blind can thereby roll down to the correct position.

Heating function (only with custom set-up)

The heating function is used to prevent the temperature from becoming too low, e.g. in a cold room, etc. The limit for when the heating function cuts off is set as an offset value below the current cut-out 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.

Figure 37: Heating function



A	Refrigeration
B	Neutral zone
C	Heat

Digital inputs

There are two digital inputs, DI1 and DI2, with dry contact function. They can be used for the following functions:

Table 2: Function table and DI settings

Function	Input / Settings menu		Setting
	DI1	DI2	
	o02	o37	
None	+	+	0
DI Status	+	+	1
Door function	+	+	2
Door alarm	+	+	3
Defrost start	+	+	4
Main switch	+	+	5
Night setback	+	+	6
Thermostat band	+	+	7
Alarm at closed	+	+	8
Alarm at open	+	+	9
Case cleaning	+	+	10
Forced cooling	+	+	11
Open blinds	+	+	12
Coordinated defrost		+	13
Shutdown	+	+	15
Light control	+	+	16
Leak detection	+	+	20
Compressor safety	+	+	24

Function	Input / Settings menu		Setting
	DI1	DI2	
	o02	o37	
Speed drive trip	+	+	25
Force cond. fan ON	+	+	26
Door fan stop	+	+	29

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

Door contact

The door contact function can via the digital inputs be defined for three 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 compressor and the fan are stopped and light switches 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.

Alarm monitoring and stop of fans:
When the door is opened, only the fans are stopped. If the door remains open in longer time than the set alarm delay, an alarm is triggered and the fans will start running again.

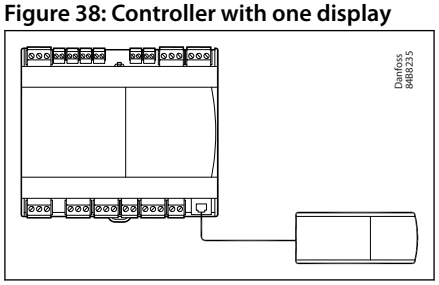
Display

The controller has one plug for an external display.
One of the following display types can be connected:
- AK-UI55 Info (temperature display).
- AK-UI55 Set (temperature display and operation).
- AK-UI55 Bluetooth (temperature display and app interface).

The connection between the display and the controller must be made using an AK-UI55 cable.

The distance between the controller and the display must not exceed 100 m.

Figure 38: Controller with one display



Override

The controller contains a number of override functions which can be used together with Master Control functions in the Danfoss gateway/system manager:

Table 3: Override functionality

Master control function	Description
MC Ther. toggle	Master control signal used for switching case load ON/OFF depending on the load condition
MC Load request	Master control signal used to control the load balance between multiple case controllers on the same suction line
MC Night setback	Master control signal for changing between day and night time operation
MC Case shutdown	Master control signal used to shut down a case for a time period. During shutdown there will be no alarm monitoring
MC Forced cooling	Master control signal that will provide forced cooling
MC Defrost start	Master control signal for starting a defrost. At adaptive defrost the defrost might be skipped if the defrost is not needed

Master control function	Description
MC Defrost state	Read out the actual state of the defrost
MC Hold after defrost	Master control signal used for co-ordinated defrost control to hold cabinets from returning to normal refrigeration after a defrost until all cabinets have terminated defrost
MC Stop defrost	Master control signal used to prevent a defrost start in a controller.
MC Light signal	Master control signal for control of light via a data communication signal from the system manager
MC Actual dewpoint	Master control signal sending the actual measured dewpoint from the system manager to the controller over the network.
MC Po load factor	Calculated load factor for the refrigerated appliance. Used for suction pressure optimization.
MC Key/Bluetooth lock	Master control signal that will lock down all Bluetooth data communication and optionally also lock the display keyboard (parameter P89)
MC Force cond. fan	Mater control signal for starting condenser fan in plug-in cabinets in order to reclaim heat in the store

Applications

AK-CC55 Water Loop is designed for control of semi plug-in units with a water/brine cooled condenser. The following semi plug-in unit applications are selected via a single application mode setting.

Figure 39: Application 1+2 – Single circuit/compressor

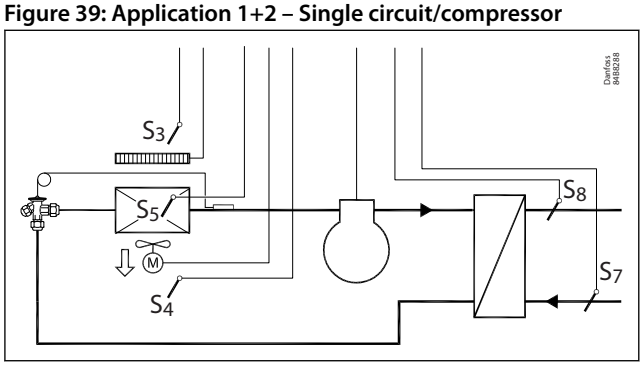


Figure 40: Application 3+4 – Dual circuit/compressor

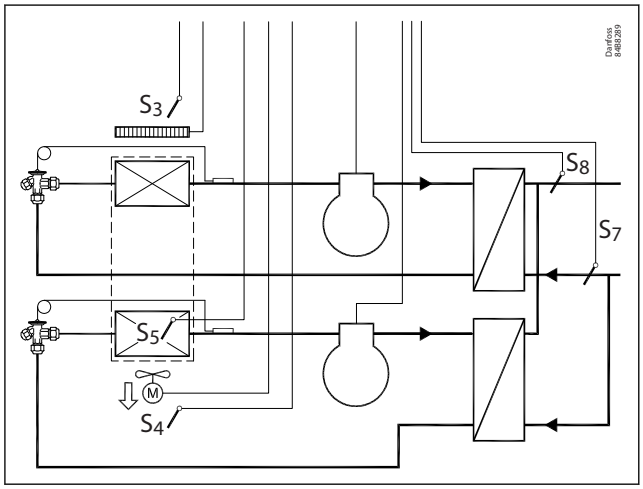


Figure 41: Application 5+6 – Variable speed compressor

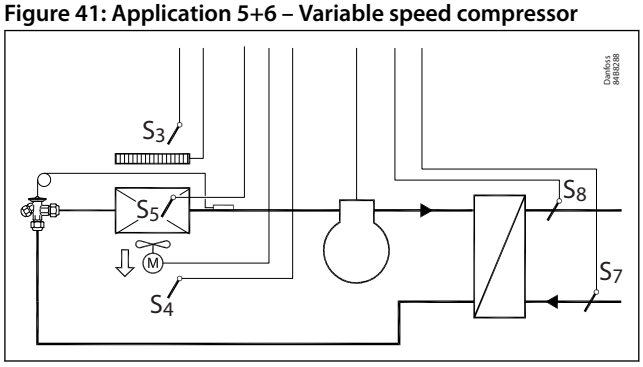
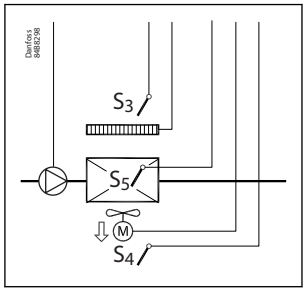
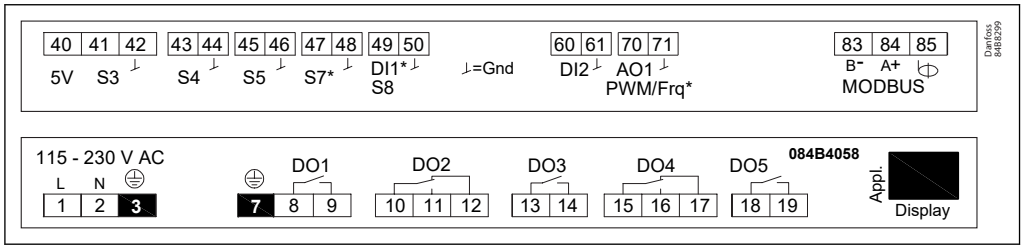


Figure 42: Application 7+8 – Variable speed brine pump



AK-CC55 Water Loop connections and application options

Figure 43: Electrical connections AK-CC55 Water Loop



*	DI1 can optionally be configured for a condenser S8 Brine outlet temperature

When selecting an application, the inputs and outputs of the controller will automatically be configured for the selected application. The Table 4 shows the relation between the selected application and the definition of inputs and outputs.

Table 4: Application with digital and analogue in/output specification

Sl.	Application	DO1	DO2	DO3	DO4	DO5	AO1	AI1	AI2	AI3	AI4	DI1[1]	DI2
1	1 compressor							S3	S4	S5	S7	DI1/S8	DI2
2	1 compressor custom		●	●	●	●		S3	S4	S5	S7	DI1/S8	DI2
3	2 compressor							S3	S4	S5	S7	DI1/S8	DI2
4	2 compressor custom		●	●		●		S3	S4	S5	S7	DI1/S8	DI2
5	Speed compressor							S3	S4	S5	S7	DI1/S8	DI2
6	Speed compressor custom		●	●	●	●		S3	S4	S5	S7	DI1/S8	DI2
7	Speed pump							S3	S4	S5	S7	DI1/S8	DI2
8	Speed pump custom		●	●	●	●		S3	S4	S5	S7	DI1/S8	DI2

[1] The DI1 input can optionally be configured for a condenser S8 Brine outlet temperature.

● = The output function can be user defined.

Table 5: Sensor description

S3	S3 Air ON evaporator
S4	S4 Air OFF evaporator
S5	S5 Evaporator
S7	S7 Brine inlet temp.
S8	S8 Brine outlet temp.

Application 2 / 4 / 6 and 8

The applications 2/4/6 and 8 have digital outputs that can be user defined for the following functions:

- Fan
- Fan ECO
- Defrost
- Rail heat

- Alarm
- Light
- Night blinds
- Air heater
- Condenser fan (not application 8)

Wiring diagram

The detailed wiring diagrams for each application selection are shown below:

Figure 44: Wiring diagram for application 1 - Single compressor

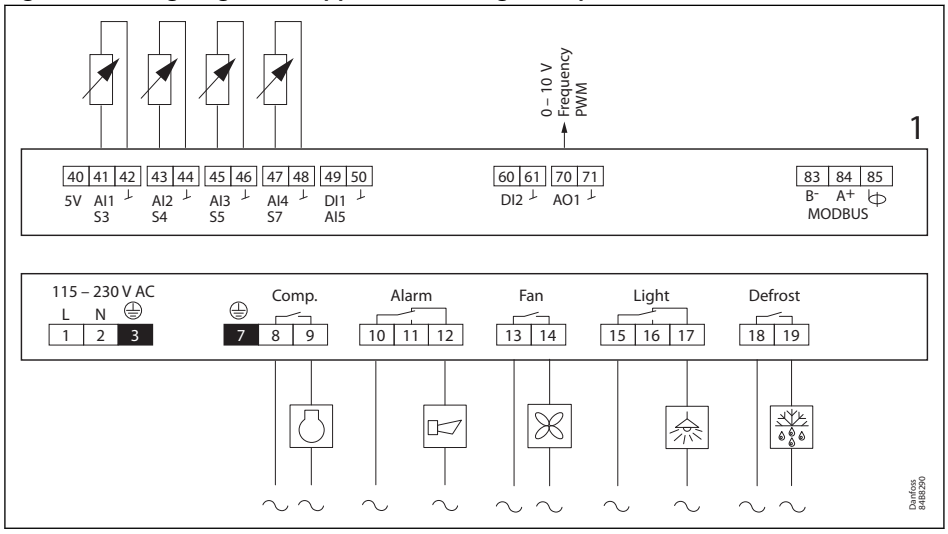


Figure 45: Wiring diagram for application 2 - Single compressor with user defined outputs

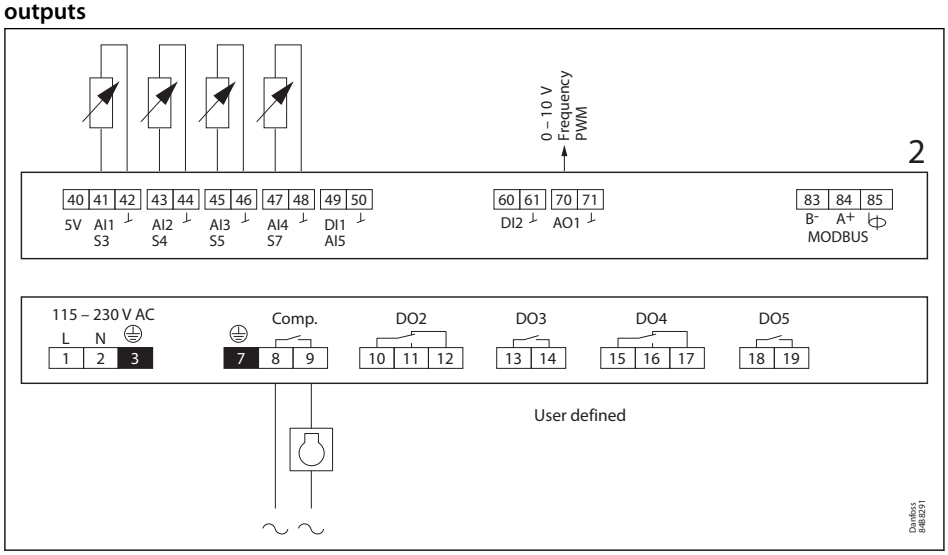


Figure 46: Wiring diagram for application 3 - Dual compressor

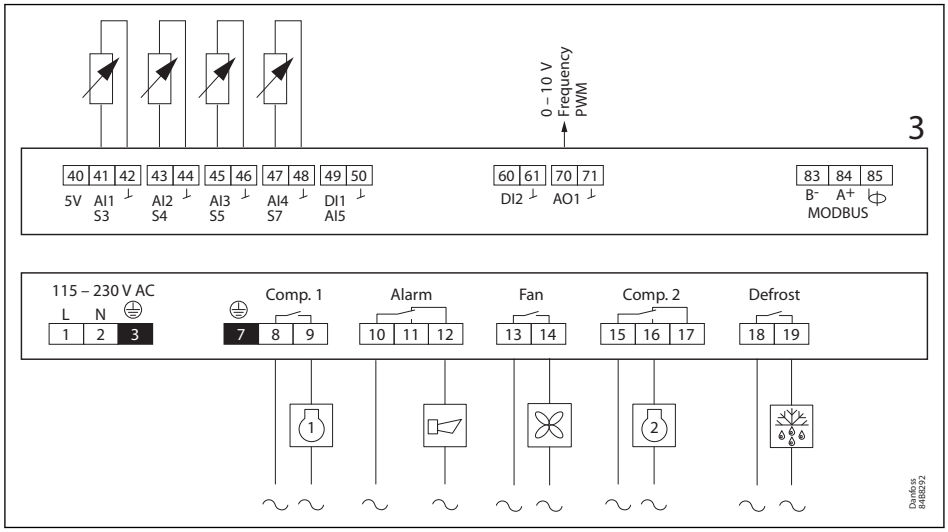


Figure 47: Wiring diagram for application 4 - Dual compressor with user defined outputs

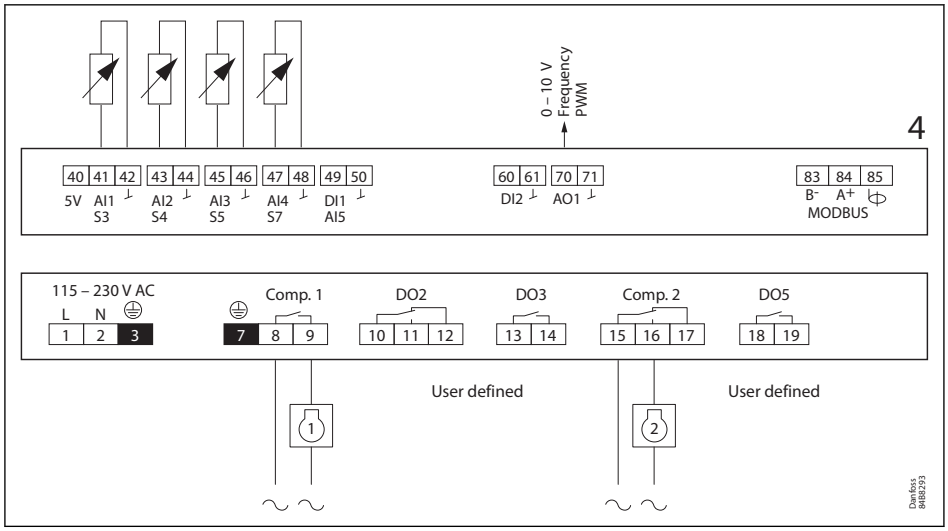


Figure 48: Wiring diagram for application 5 - Variable speed compressor

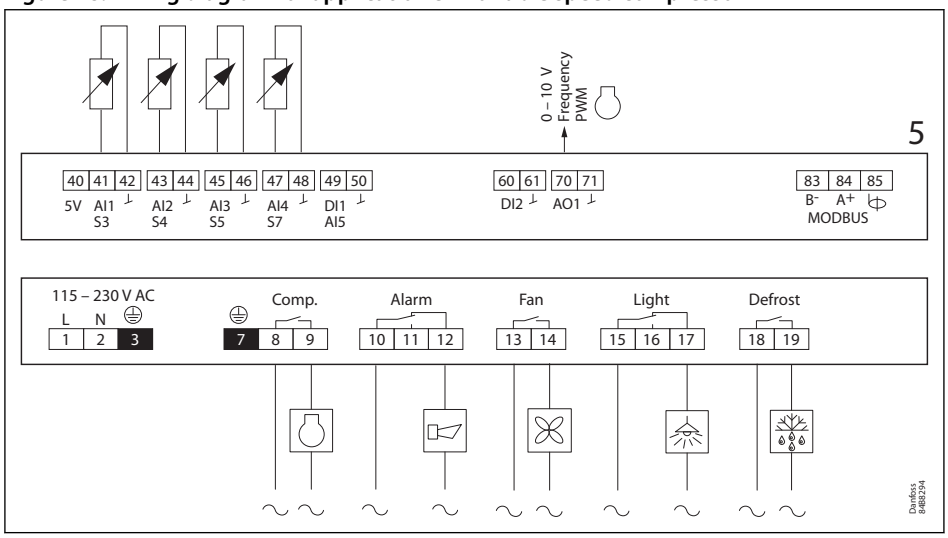


Figure 49: Wiring diagram for application 6 - Variable speed compressor with user defined outputs

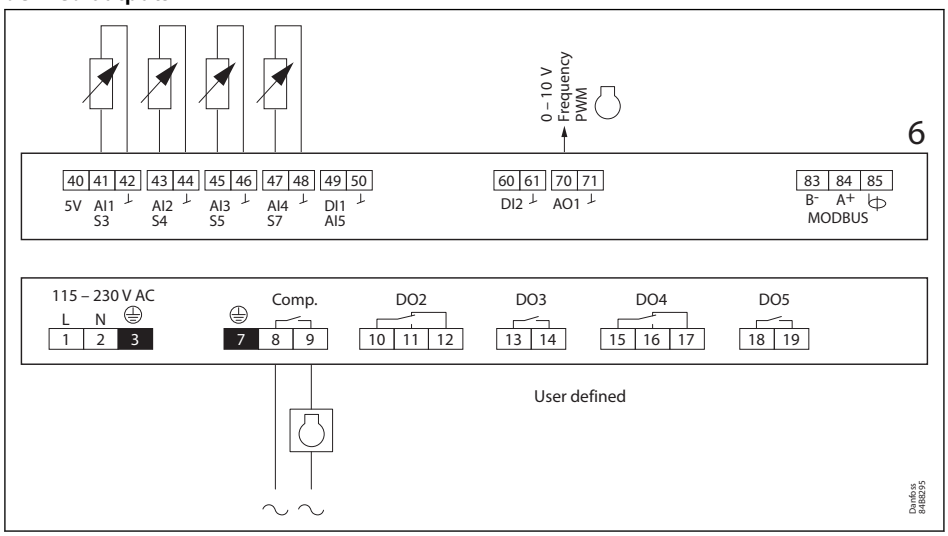


Figure 50: Wiring diagram for application 7 - Variable speed brine pump

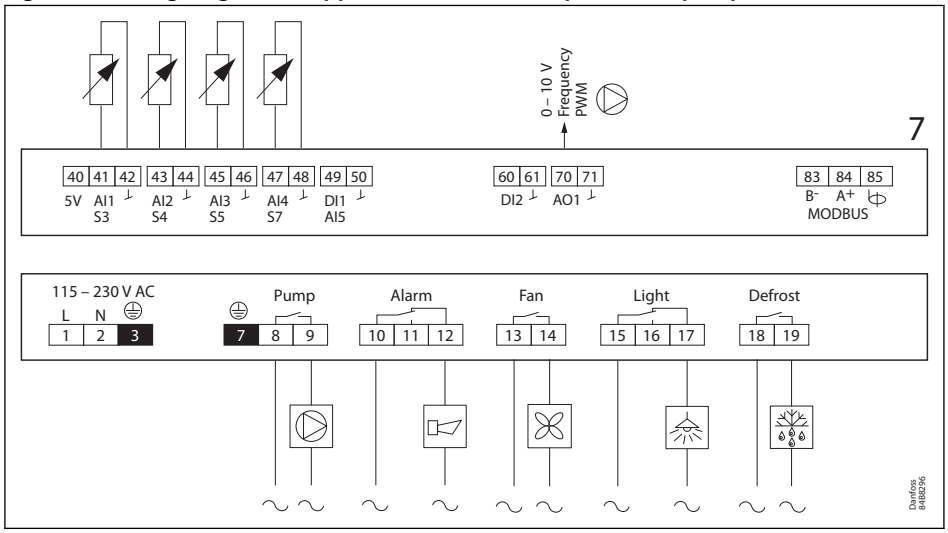
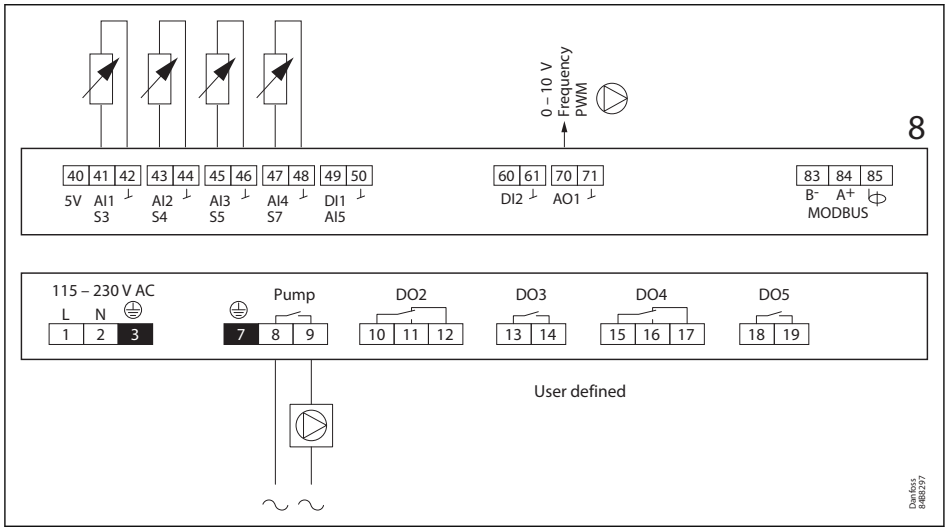


Figure 51: Wiring diagram for application 8 - Variable speed brine pump with user defined outputs



Wiring

Table 6: Wiring details

AI1 - AI5	**Temperature inputs** • *S3, S4, S5, S7, S8* Pt 1000 AKS11, PTC 1000 EKS111, NTC5K EKS211, NTC10K EKS221 or a user-defined sensor type. All have to be of the same type. • *S3, air sensor, placed in the warm air before the evaporator* • *S4, discharge air sensor, placed in the cold air after the evaporator* (the need for either S3 or S4 can be selected in the configuration) • *S5, defrost sensor, placed in the evaporator* • *S7, Brine inlet, placed at the inlet of the water cooled condenser* • *S8, Brine outlet, placed at the outlet of the water cooled condenser* (If the S8 sensor is in use, DI1 input will appear as AI5.)
DI1	**Digital input signal** The defined function is active when the input is short-circuited or opened, depending on the function defined in o02.
DI2	**Digital input signal** The defined function is active when the input is short-circuited or opened, depending on the function defined in o37.
AO1	• In application mode 1-4 the output can be used to drive an external high-powered solid-state relay for fast pulsing of rail heat • In application 5 and 6 the output is used for speed control of compressor • In application 7 and 8 the output is used for speed control of a brine pump The following output signals are supported: • 0 – 10 V DC • Frequency • Pulse Width Modulation (PWM)
MODBUS	For data communication. • Terminal 83 = B- • Terminal 84 = A+ • Terminal 85 = screen
Supply voltage	230 V AC or 115 V AC
DO1	*Compressor or brine pump:* There is connection between terminal 8 and 9 when the compressor/brine pump is ON.
DO2	*Alarm:* There is a connection between terminal 10 and 12 in alarm situations and when the controller is without power.
DO3	*Fan:* There is connection between terminal 13 and 14 when the fan is ON.
DO4	*Light or compressor 2:* There is connection between terminal 15 and 16 when compressor 2 is ON. There is connection between terminal 15 and 17 when light is ON.
DO5	*Defrost:* There is connection between terminal 18 and 19 when defrosting takes place.
Application 2 / 4 / 6 and 8	Here, the free outputs can be user defined for one of the following functions: • Fan • Fan ECO • Defrost • Rail heat • Alarm • Light • Night blinds • Air heater • Condenser fan

Display (RJ12 plug)

If readings/operation of the controller is required, an external display can be connected.
The max. cable length is 100 m.

Electric noise

Cables for sensors, low voltage 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 low voltage 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 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.

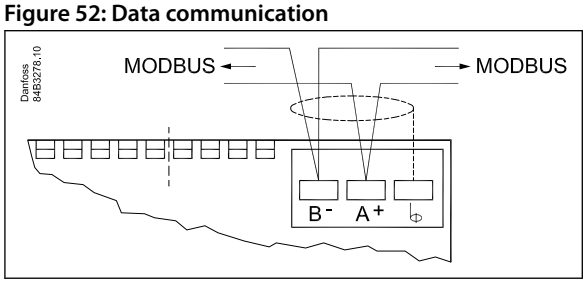
Special reference is made to the necessity of signals to the controller when the compressor is stopped and to the need of liquid receivers before the compressors.

Your local Danfoss agent will be pleased to assist with further advice, etc.

Special wiring details

Data communication

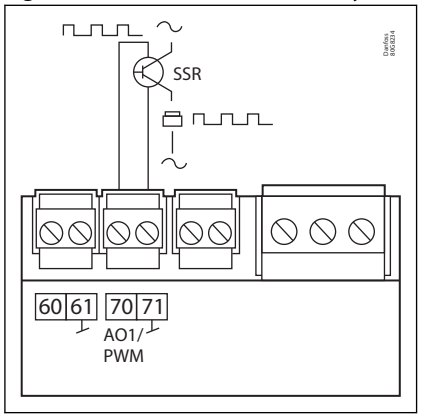
Figure 52: Data communication



IMPORTANT:
It is important that the installation of the data communication cable is performed correctly with sufficient distance to high voltage cables.

External solid state relay for rail heat

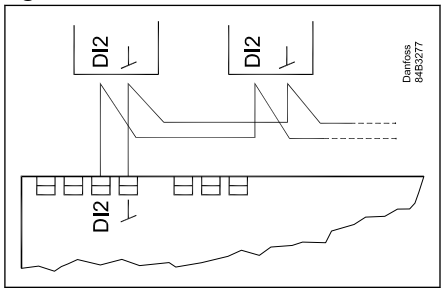
Figure 53: External solid state relay for rail heat



0 / 10 V Pulse Width Modulated (PWM)
Max. 15 mA.

Coordinated defrost via cable connections

Figure 54: Coordinated defrost via cable connections

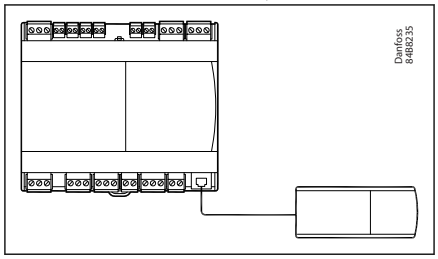


Max. 10
The following controllers can be connected in this way:
EKC 204A, AK-CC 210, AK-CC 250, AK-CC 450, AK-CC 550 and AK-CC55.

Refrigeration is resumed at the same time when all controllers have terminated defrost.

External display AK-UI55

Figure 55: External display AK-UI55



(Total length: max. 100 m)

Operation

The controller can be operated in different ways depending on the user interface.

The following options are available:
- Via data commmunication
- Via AK-UI55 Setting display
- Via AK-UI55 Bluetooth display

Operation via data communication

Via system manager's display
All AK-CC55 controllers can be operated from a central location, e.g. AK-SM 800.
Data communication is to take place via MODBUS.

Via system manager and service tool
Operation can also be performed from a central location with PC software "Service Tool" connected to a system manager AK-SM 720 via MODBUS.

Programming via KoolProg
Programming by use of PC software type KoolProg® via interface MMIMYK connected to RJ12 display connector.

Smart phone and app via AK-UI55 Bluetooth display

The "AK-CC55 connect" app is used for smart phone operation.
AK-CC55 connect can be downloaded freely to a compatible iOS/Android smartphone device.
Menu operation is established by activating Bluetooth communication to the app.

Operation via AK-UI55 Set

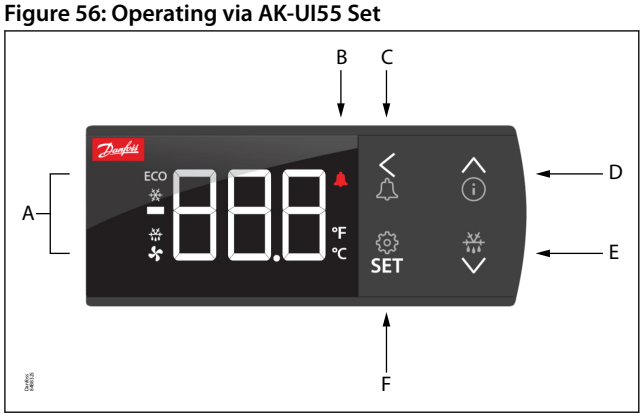
Display AK-UI55 Set
The values will be shown with three digits, and with a setting you can determine whether the temperature is to be shown in °C or in °F.

To prevent any passing-by user from making unauthorized changes, the access to the display menu is restricted by access codes.

Besides this, the parameter P89 provides the following options for handling of the display keyboard:

0	The display keys are always operative
1	The display keys will be locked automatically when not used for some time and the keyboard must be unlocked by pressing the arrow-up and arrow-down keys at the same time.
2	The display keys will be locked and unlocked by means of a master control signal from the System Manager.

Figure 56: Operating via AK-UI55 Set



A	Lights up in event of: Energy optimization, Cooling, Defrosting, Fan operation
B	Lights in event of alarm
C	Long press (3 seconds) on alarm button alarm — relay is reset — alarm code displayed — e.g. “A1”
D	Long press (3 seconds) gives access to the information menu “InF” Up arrow / Down arrow / Arrow to left: Navigation in the menu and setting of values.
E	Long press (3 seconds) will start a defrost, “-d-” is shown in the display. Ongoing defrosting can be stopped by a long press.
F	SET: Long press (3 seconds) gives access to the “SEt” menu. If the operation is locked with a password, “PS” is shown. Enter the code. Shows the setting for a chosen parameter / saves a changed setting. Short press gives access to entering of the thermostat’s cut-out limit.

Table 7: Messages provided by the display

Display readout	Denomination
-d-	Defrost is in progress
Err	The temperature cannot be displayed due to a sensor error
Er1	The display cannot load data from the controller. Disconnect and then reconnect the display
Er2	Lost display communication
ALA	The alarm button is activated. The first alarm code is then shown
- - -	At top position of the menu or when max. value has been reached, the three dashes are shown in the top of the display
- - -	At bottom position of menu or when min. value has been reached, the three dashes are shown in the bottom of the display
Loc	The menu operation is locked. Unlock by pressing (for 3 seconds) on the ‘up arrow’ and ‘down arrow’ simultaneously
UnL	The menu operation is unlocked
- - -	The parameter has reached min. or max. limit
PS	A password is required for access to the menu
Fan	Appliance cleaning has been initiated. The fans are running
OFF	Appliance cleaning is activated and the appliance can now be cleaned
OFF	The main switch is set to Off
SEr	The main switch is set to service / manual operation

Factory setting

If you need to return to the factory-set values, do the following:

- Cut off the supply voltage to the controller
- Keep up "∧" and down "∨" arrow buttons depressed at the same time as you reconnect the supply voltage
- When FAc is shown in the display, select "yes"

NOTE:

The OEM factory setting will either be the Danfoss factory settings or a user defined factory setting if one has been made.

The user can save his setting as OEM factory setting via parameter o67.

Parameter groups when operating via display

Figure 57: SET button parameter list

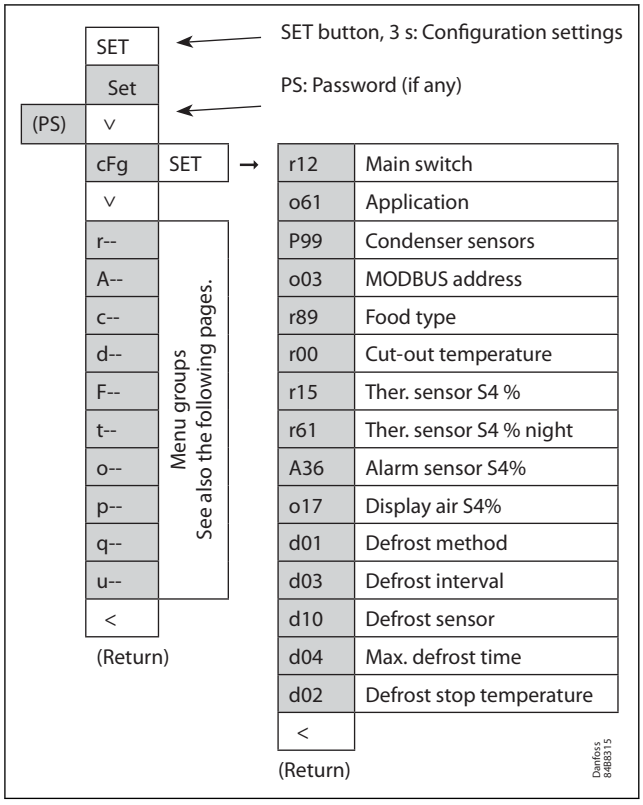
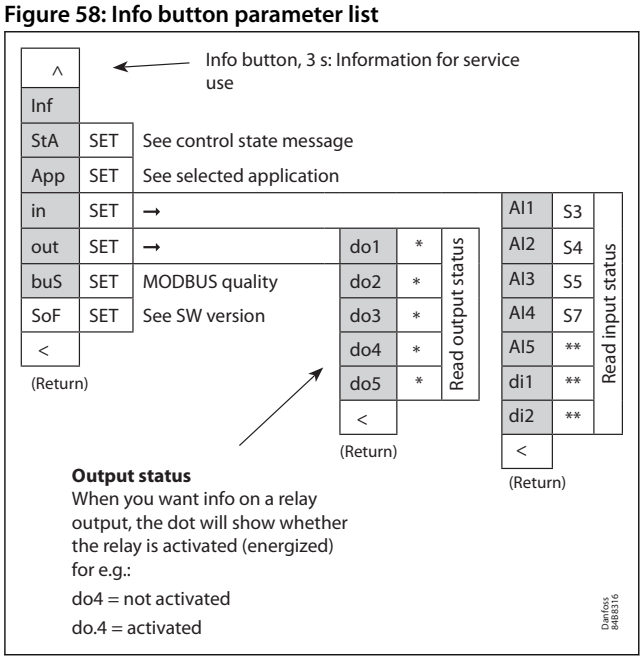


Figure 58: Info button parameter list



*	The output's function (determined at configuration). DOs and AOs can also be forced controlled from this menu, when r12 Main switch has been set to position "service". Forced control of a function can also be performed in codes q12 to q50.
**	The input's function (determined at configuration)
StA	See control state message in Table 38

Get a good start

With the following procedure you can start regulation very quickly:

1. Open parameter r12 and stop the regulation (in a new and not previously set unit, r12 will already be set to 0 which means stopped regulation.)
2. Select application based on the Wiring diagram
3. Open parameter o61 and set the application number
4. Select whether to use one or two temperature sensors for the water cooled condenser

5. For network. Set the address in o03
6. Then select a set of presets from the "Food type" help table
7. Open parameter r89 and set the number for the array of presettings. The few selected settings will now be transferred to the menu
8. Set the desired cut-out temperature r00
9. Set the weighted thermostat air temperature between S4 and S3 sensor r15
10. Set the weighted thermostat air temperature between S4 and S3 during night operation r61
11. Set the weighted alarm air temperature between S4 and S3 A36
12. Set the weighted display readout between S4 and S3 o17
13. Set the desired defrost method in d01
14. Set the interval time between defrost starts in d03
15. Set the desired defrost sensor in d10
16. Set the maximum defrost time in d04
17. Set the defrost stop temperature in d02
18. Open parameter r12 and start the regulation
19. Go through the parameter list and change the factory values where needed
20. Get the controller up and running on network:
    - MODBUS: Activate scan function in system unit

Table 8: Food type settings

Setting of presettings (r89). After setting 1-5, setting is returned to 0.	1	2	3	4	5
Food type	**Vegetables**	**Milk**	**Meat/fish**	**Frozen food**	**Ice cream**
Temperature (r00)	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
Upper alarm limit for S6 (A22)	14 °C	8 °C	8 °C	-15 °C	-15 °C
Lower alarm limit for S6 (A23)	0 °C	-5 °C	-5 °C	-30 °C	-30 °C

AK-UI55 display menu (SW ver. 1.2x)

R-W	If the operation is protected by one or more passwords, reading and setting the parameter will be limited to: R or W
R	This setting can be seen with password no. _ or higher (3 is the highest level).
W	This setting can be performed with password no. _ or higher (3 is the highest level).
*****	The asterisk indicates in which application from 1-8 the parameter is applicable

Thermostat

Table 9: Thermostat

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	Min.value	Max.value	Fact.value
Cut-out 1		0-0	r00	*	*	*	*	*	*	*	*	r03	r02	2.0 °C
Differential 1		1-2	r01	*	*	*	*	*	*	*	*	0,1 °C	20.0 °C	2.0 °C
Max cut-out limit		0-2	r02	*	*	*	*	*	*	*	*	r03	50.0 °C	50.0 °C
Min cut-out limit		0-2	r03	*	*	*	*	*	*	*	*	-50.0 °C	r02	-50.0 °C
Display readout adjustment		1-2	r04	*	*	*	*	*	*	*	*	-10.0 °C	10.0 °C	0.0 °C
Temperature unit	0=Celsius, 1=Fahrenheit	1-2	r05	*	*	*	*	*	*	*	*	0	1	0
S4 Air OFF evap. A - Adjustment		1-2	r09	*	*	*	*	*	*	*	*	-10.0 °C	10.0 °C	0.0 °C
S3 Air ON evap. A - Adjustment		1-2	r10	*	*	*	*	*	*	*	*	-10.0 °C	10.0 °C	0.0 °C
S5 Evaporator A - Adjustment		0-2	r11	*	*	*	*	*	*	*	*	-10.0 °C	10.0 °C	0.0 °C
Main switch	-1=Manual, 0=Stop, 1=Start	0-2	r12	*	*	*	*	*	*	*	*	-1	1	0
Night offset		1-2	r13	*	*	*	*	*	*	*	*	-50.0 °C	50.0 °C	0.0 °C
Thermostat mode	2=Modulating, 1=ON/OFF	0-X	r14	*	*	*	*	*	*	*	*	1	2	1
Thermostat sensor S4 %		1-2	r15	*	*	*	*	*	*	*	*	0 %	100 %	100%
Melt interval		1-2	r16	*	*	*	*	*	*	*	*	0 h	10 h	1 h
Melt period		1-2	r17	*	*	*	*	*	*	*	*	0 min	30 min	5 min
Cut-out 2		0-2	r21	*	*	*	*	*	*	*	*	-50.0 °C	50.0 °C	2.0 °C
Thermostat sensor S4 % night		1-2	r61	*	*	*	*	*	*	*	*	0 %	100 %	100%
Air heater neutral zone		1-2	r62		*		*		*		*	0.0 °C	50.0 °C	5.0 °C
Air heater start delay		1-2	r63		*		*		*		*	0 min	240 min	240min
Food type	0=None, 1=Vegetables, 2=Dairy, 3=Meat and fish, 4=Frozen food, 5=Ice cream	1-2[1]	r89	*	*	*	*	*	*	*	*	0	5	0
Differential 2		1-2	r93	*	*	*	*	*	*	*	*	0.1 °C	20.0 °C	2.0 °C
S4 frost protection		1-2	r98	*	*	*	*	*	*	*	*	-50.0 °C	50.0 °C	-50.0 °C

[1] In order to change this parameter the regulation must be stopped via the parameter r12 Main switch = OFF.

Alarm settings

Table 10: Alarm settings

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	Min.value	Max.value	Fact.value
Alarm delay A		1-2	A03	*	*	*	*	*	*	*	*	0 min	240 min	30 min
Door open alarm delay		1-2	A04	*	*	*	*	*	*	*	*	0 min	240 min	60 min
Alarm delay pull down A		1-2	A12	*	*	*	*	*	*	*	*	0 min	240 min	90 min
High alarm limit 1		1-2	A13	*	*	*	*	*	*	*	*	-50.0 °C	50.0 °C	8.0 °C
Low alarm limit 1		1-2	A14	*	*	*	*	*	*	*	*	-50.0 °C	50.0 °C	-30.0 °C
High alarm limit 2		1-2	A20	*	*	*	*	*	*	*	*	-50.0 °C	50.0 °C	8.0 °C
Low alarm limit 2		1-2	A21	*	*	*	*	*	*	*	*	-50.0 °C	50.0 °C	-30.0 °C
Alarm delay DI 1		1-2	A27	*	*	*	*	*	*	*	*	0 min	240 min	30 min
Alarm delay DI 2		1-2	A28	*	*	*	*	*	*	*	*	0 min	240 min	30 min

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	Min.value	Max.value	Fact.value
Alarm sensor S4% A		1-2	A36	*	*	*	*	*	*	*	*	0 %	100 %	100%
Max. S7 Brine temp.		1-2	A76	*	*	*	*	*	*			-50.0 °C	110.0 °C	8.0 °C
Max. S7 Brine temp. diff.		1-2	A77	*	*	*	*	*	*			0,1 °C	10.0 °C	3.0 °C

Compressor

Table 11: Compressor

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	Min.value	Max.value	Fact.value
Min ON time		1-2	c01	*	*	*	*	*	*			0 min	30 min	0 min
Min OFF time		1-2	c02	*	*	*	*	*	*			0 min	30 min	0 min
Delay between comp.		1-2	c05			*	*					0 s	999 s	5 s
Step control mode	1=Sequential, 2=Cyclic	1-2	c08			*	*					1	2	2
Min. speed		1-2[1]	c46					*	*	*	*	0 %	c47	30%
Start speed		1-2	c47					*	*	*	*	c46	c48	50%
Max. speed		1-2[1]	c48					*	*	*	*	c47	100 %	100%
Speed Kp		1-2	c82					*	*	*	*	3	30	20
Speed Tn		1-2	c83					*	*	*	*	30 s	360 s	60 s
Comp. 2 ctrl. Th. band 2	0=OFF, 1=ON	1-2	c85	*	*	*	*	*	*	*	*	0	1	1
ON time emergency		1-2	c86	*	*	*	*					0 min	240 min	15 min
OFF time emergency		1-2	c87	*	*	*	*					0 min	240 min	15 min
Speed emergency		1-2	c93					*	*	*	*	c47	100%	60%
Max. speed slope		1-2	c96					*	*	*	*	0.1 %/s	5 %/s	1 %/s
Comp. defrost speed		1-2	c97					*	*			c47	c48	100%
Max. Kp factor		1-2	c98					*	*	*	*	5	50	20

[1] In order to change this parameter the regulation must be stopped via the parameter r12 Main switch = OFF.

Defrost

Table 12: Defrost

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	Min.value	Max.value	Fact.value
Defrost method	0=None, 1=Electrical, 2=Hot gas, 4=Air/Offcycle	1-3	d01	*	*	*	*	*	*	*	*	0	4	1
Defrost stop limit 1		1-2	d02	*	*	*	*	*	*	*	*	0.0 °C	50.0 °C	6.0 °C
Defrost start interval		1-2	d03	*	*	*	*	*	*	*	*	0 h	240 h	8h
Max. defrost time 1		1-2	d04	*	*	*	*	*	*	*	*	0 min	360 min	45 min
Time staggering power-up		1-2	d05	*	*	*	*	*	*	*	*	0 min	240 min	0 min
Drip off time		1-2	d06	*	*	*	*	*	*	*	*	0 min	60 min	0 min
Fan start delay		1-2	d07	*	*	*	*	*	*	*	*	0 min	60 min	0 min
Fan start temperature		1-2	d08	*	*	*	*	*	*	*	*	-50.0 °C	10.0 °C	-5.0 °C
Fan control during defrost	0=OFF, 1=ON, 2=OFF at drip, 3=OFF at high temp	1-2	d09	*	*	*	*	*	*	*	*	0	3	1
Defrost stop method	0=Time, 1=S5 sensor, 2=S4 sensor	1-2	d10	*	*	*	*	*	*	*	*	0	2	0
Max. thermostat run time		1-2	d18	*	*	*	*	*	*	*	*	0 h	240 h	0h
Min. defrost time		1-2	d24	*	*	*	*	*	*	*	*	0 min	180 min	0 min
Rail heat during defrost	0=OFF, 1=ON, 2=Normal control	1-2	d27	*	*	*	*	*	*	*	*	0	2	1
Defrost stop limit 2		1-2	d28	*	*	*	*	*	*	*	*	0.0 °C	50.0 °C	6.0 °C
Max. defrost time 2		1-2	d29	*	*	*	*	*	*	*	*	0 min	360 min	45 min
Display delay after defrost		1-2	d40	*	*	*	*	*	*	*	*	5 min	240 min	30 min
Fan stop temperature		1-2	d41	*	*	*	*	*	*	*	*	-20.0 °C	20.0 °C	0.0 °C

Fan control

Table 13: Fan control

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	Min.value	Max.value	Fact.value
Fan stop high S5 temp.		1-2	F04	*	*	*	*	*	*	*	*	-50.0 °C	50.0 °C	50.0 °C
Fan pulsing mode	0=No pulsing, 1=Pulsing cut-out, 2=Pulsing cut-out night	1-2	F05	*	*	*	*	*	*	*	*	0	2	0
Fan period time		1-2	F06	*	*	*	*	*	*	*	*	1 min	30 min	5 min
Fan ON cycle		1-2	F07	*	*	*	*	*	*	*	*	0 %	100 %	100%
Cond. fan cut-in		1-2	F24		*		*		*		*	10.0 °C	110.0 °C	60.0 °C
Cond. fan diff.		1-2	F25		*		*		*		*	1.0 °C	20.0 °C	5.0 °C

Defrost schedule

Table 14: Defrost schedule

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	Min.value	Max.value	Fact.value
Defrost schedule	0=No, 1=Yes	1-2	t00	*	*	*	*	*	*	*	*	0	1	0
Def. start 1 - h		1-2	t01	*	*	*	*	*	*	*	*	0 h	23 h	0h
Def. start 1 - min		1-2	t11	*	*	*	*	*	*	*	*	0 min	59 min	0 min
Def. start 2 - h		1-2	t02	*	*	*	*	*	*	*	*	0 h	23 h	0h
Def. start 2 - min		1-2	t12	*	*	*	*	*	*	*	*	0 min	59 min	0 min
Def. start 3 - h		1-2	t03	*	*	*	*	*	*	*	*	0 h	23 h	0h
Def. start 3 - min		1-2	t13	*	*	*	*	*	*	*	*	0 min	59 min	0 min
Def. start 4 - h		1-2	t04	*	*	*	*	*	*	*	*	0 h	23 h	0h
Def. start 4 - min		1-2	t14	*	*	*	*	*	*	*	*	0 min	59 min	0 min
Def. start 5 - h		1-2	t05	*	*	*	*	*	*	*	*	0 h	23 h	0h
Def. start 5 - min		1-2	t15	*	*	*	*	*	*	*	*	0 min	59 min	0 min
Def. start 6 - h		1-2	t06	*	*	*	*	*	*	*	*	0 h	23 h	0h
Def. start 6 - min		1-2	t16	*	*	*	*	*	*	*	*	0 min	59 min	0 min
Time h		0-1	t07	*	*	*	*	*	*	*	*	0 h	23 h	0h
Time min		0-1	t08	*	*	*	*	*	*	*	*	0 min	59 min	0 min
Time date		0-1	t45	*	*	*	*	*	*	*	*	1	31	1
Time month		0-1	t46	*	*	*	*	*	*	*	*	1	12	1
Time year		0-1	t47	*	*	*	*	*	*	*	*	0	100	0
Monday - Follow schedule	0=No, 1=Yes	1-2	t51	*	*	*	*	*	*	*	*	0	1	1
Tuesday - Follow schedule	0=No, 1=Yes	1-2	t52	*	*	*	*	*	*	*	*	0	1	1
Wednesday - Follow schedule	0=No, 1=Yes	1-2	t53	*	*	*	*	*	*	*	*	0	1	1
Thursday - Follow schedule	0=No, 1=Yes	1-2	t54	*	*	*	*	*	*	*	*	0	1	1
Friday - Follow schedule	0=No, 1=Yes	1-2	t55	*	*	*	*	*	*	*	*	0	1	1
Saturday - Follow schedule	0=No, 1=Yes	1-2	t56	*	*	*	*	*	*	*	*	0	1	1
Sunday - Follow schedule	0=No, 1=Yes	1-2	t57	*	*	*	*	*	*	*	*	0	1	1

Miscellaneous

Table 15: Miscellaneous

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	Min.value	Max.value	Fact.value
Delay of outputs at power-up		1-2	o01	*	*	*	*	*	*	*	*	0 s	600 s	5 s
DI1 Configuration	0=None, 1=DI status, 2=Door function, 3=Door alarm, 4=Defrost start, 5=Main switch, 6=Night set-back, 7=Thermostat band, 8=Alarm at closed, 9=Alarm at open, 10=Case cleaning, 11=Forced cooling, 12=Open blinds, 15=Shut-down, 16=Light control, 20=Leak detection, 24=Comp. safety, 25=Speed drive alarm, 26=Force cond. fan ON, 29=Door fan stop	1-2[(1)]	o02	*	*	*	*	*	*	*	*	0	29	0
Network address		1-3[(1)]	o03	*	*	*	*	*	*	*	*	0	240	0

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	Min.value	Max.value	Fact.value
Access code 3		3-3	o05	*	*	*	*	*	*	*	*	0	999	0
Temperature sensor type	0=Pt 1000, 1=PTC 1000, 2=NTC 5k, 3=NTC 10k, 4=User-defined	1-3(1)	o06	*	*	*	*	*	*	*	*	0	4	0
AO1 Signal type	0=None, 1=Voltage, 2=Frequency, 3=PWM	1-3(1)	o09					*	*	*	*	0	3	0
Max. hold time		1-2	o16	*	*	*	*	*	*	*	*	0 min	360 min	20 min
Display air S4%		1-2	o17	*	*	*	*	*	*	*	*	0 %	100 %	100%
AO1 Min. voltage		1-3(1)	o27					*	*	*	*	0.0 V	o28	0.0V
AO1 Max. voltage		1-3(1)	o28					*	*	*	*	o27	10.0 V	10.0V
DI2 Configuration	0=None, 1=DI status, 2=Door function, 3=Door alarm, 4=Defrost start, 5=Main switch, 6=Night setback, 7=Thermostat band, 8=Alarm at closed, 9=Alarm at open, 10=Case cleaning, 11=Forced cooling, 12=Open blinds, 13=Coordinated defrost, 15=Shutdown, 16=Light control, 20=Leak detection, 24=Comp. safety, 25=Speed drive alarm, 26=Force cond. fan ON, 29=Door fan stop	1-2(1)	o37	*	*	*	*	*	*	*	*	0	29	0
Light control mode	1=Day and night, 2=Network, 3=Door switch, 4=Network (Fallback), 5=Digital input	1-2	o38	*	*		*	*	*	*	*	1	5	1
MC Light signal	0=OFF, 1=ON	1-2	o39	*	*	*	*	*	*	*	*	0	1	0
Rail heat ON cycle day		1-2	o41	*	*	*	*	*	*	*	*	0 %	100 %	100%
Rail heat ON cycle night		1-2	o42	*	*	*	*	*	*	*	*	0 %	100 %	100%
Rail heat period time		1-2	o43	*	*	*	*	*	*	*	*	6 min	60 min	6min
Case cleaning mode	0=OFF, 1=Fans run, 2=Cleaning	0-1	o46	*	*	*	*	*	*	*	*	0	2	0
Application mode	1=1: One comp., 2=2: One comp. custom, 3=3: Two comp., 4=4: Two comp. custom, 5=5: Speed comp., 6=6: Speed comp. custom, 7=7: Speed pump, 8=8: Speed pump custom	1-3(1)	o61	*	*	*	*	*	*	*	*	1	8	1
Access code 2		2-2	o64	*	*	*	*	*	*	*	*	0	999	0
Make new factory	0=OFF, 1=ON	3-3(1)	o67	*	*	*	*	*	*	*	*	0	1	0
Rail heat control mode	0=ON, 1=Day/Night timer, 2=Dewpoint ctrl.	1-2	o85	*	*	*	*	*	*	*	*	0	2	0
Dewpoint min. limit		1-2	o86	*	*	*	*	*	*	*	*	-10.0 °C	o87	8.0 °C
Dewpoint max. limit		1-2	o87	*	*	*	*	*	*	*	*	o86	50.0 °C	17.0 °C
Rail heat min. ON cycle		1-2	o88	*	*	*	*	*	*	*	*	0 %	100 %	30%
Door restart inj. delay		1-2	o89	*	*	*	*	*	*	*	*	0 min	240 min	30 min
Light at Main switch OFF	0=OFF, 1=Normal ctrl.	1-2	o98	*	*		*	*	*	*	*	0	1	0

(1) In order to change this parameter the regulation must be stopped via the parameter r12 Main switch = OFF.

Control

Table 16: Control

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	Min.value	Max.value	Fact.value
Resonance band start		1-2	P39					*	*			c46	100 %	100%
Resonance band		1-2	P40					*	*			0 %	15 %	0%
Alarm relay priority	0=Not used, 1=High Priority, 2=Medium priority, 3=All	1-2	P41	*	*	*	*	*	*	*	*	0	3	2
Blinds max. open time		1-2	P60		*		*		*		*	0 min	60 min	5 min
Fan stop at blinds closing		1-2	P65	*	*		*	*	*	*	*	0 s	300 s	0 s
Oil return speed limit		1-2	P77					*	*			0 %	100 %	40%
Oil return interval		1-2	P78					*	*			5 min	720 min	20 min

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	Min.value	Max.value	Fact.value
Oil return speed		1-2	P79					*	*			P77	100 %	50%
Oil return time period		1-2	P80					*	*			10 s	600 s	60 s
Rail heat PWM - Period time		1-2	P82	*	*	*	*					4 s	60 s	10 s
Access code 1		1-1	P88	*	*	*	*	*	*	*	*	0	999	0
Display keyboard lock	0=None, 1=Local, 2=Network	1-2	P89	*	*	*	*	*	*	*	*	0	2	0
AO1 Min. frequency		1-3[1]	P95					*	*	*	*	0 Hz	P96	50Hz
AO1 Max. frequency		1-3[1]	P96					*	*	*	*	P95	500 Hz	100Hz
AO1 PWM frequency		1-3[1]	P97					*	*	*	*	100 Hz	500 Hz	200Hz
AO1 Invert signal	0=No, 1=Yes	1-3[1]	P98					*	*	*	*	0	1	0
Condenser sensors	0=None, 1=S7, 2=S7 and S8	1-3[1]	P99	*	*	*	*	*	*	*	*	0	2	1

[1] In order to change this parameter the regulation must be stopped via the parameter r12 Main switch = OFF.

DO config and manual

Table 17: DO config and manual

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	Min.value	Max.value	Fact.value
DO2 Configuration	0=None, 1=Fans, 2=Fan ECO, 3=Defrost, 4=Rail heat, 5=Alarm, 6=Light, 7=Blinds, 10=Air heater, 12=Condenser fan	1-3[1]	q02		*		*		*		*	0	12	5
DO3 Configuration	0=None, 1=Fans, 2=Fan ECO, 3=Defrost, 4=Rail heat, 5=Alarm, 6=Light, 7=Blinds, 10=Air heater, 12=Condenser fan	1-3[1]	q03		*		*		*		*	0	12	1
DO4 Configuration	0=None, 1=Fans, 2=Fan ECO, 3=Defrost, 4=Rail heat, 5=Alarm, 6=Light, 7=Blinds, 10=Air heater, 12=Condenser fan	1-3[1]	q04		*				*		*	0	12	6
DO5 Configuration	0=None, 1=Fans, 2=Fan ECO, 3=Defrost, 4=Rail heat, 5=Alarm, 6=Light, 7=Blinds, 10=Air heater, 12=Condenser fan	1-3[1]	q05		*		*		*		*	0	12	3
AO1 Configuration	0=None, 1=Rail heat PWM, 3=Comp. speed, 4=Brine pump speed	1-3[1]	q09	*	*	*	*					0	4	0
Compressor 1 - override	0=MAN OFF, 1=MAN ON	1-2[2]	q12	*	*	*	*	*	*			0	1	0
Fan - override	0=MAN OFF, 1=MAN ON	1-2[2]	q13	*	*	*	*	*	*	*	*	0	1	0
Defrost A - override	0=MAN OFF, 1=MAN ON	1-2[2]	q14	*	*	*	*	*	*	*	*	0	1	0
Rail heat - override	0=MAN OFF, 1=MAN ON	1-2[2]	q15		*		*		*		*	0	1	0
Alarm relay - override	0=MAN OFF, 1=MAN ON	1-2[2]	q16	*	*	*	*	*	*	*	*	0	1	0
Light - override	0=MAN OFF, 1=MAN ON	1-2[2]	q17	*	*		*	*	*	*	*	0	1	0
Compressor 2 - override	0=MAN OFF, 1=MAN ON	1-2[2]	q19			*	*					0	1	0
Blinds - override	0=MAN OFF, 1=MAN ON	1-2[2]	q21		*		*		*		*	0	1	0
Air heater - override	0=MAN OFF, 1=MAN ON	1-2[2]	q23		*		*		*		*	0	1	0
Fan ECO - override	0=MAN OFF, 1=MAN ON	1-2[2]	q24		*		*		*		*	0	1	0
Rail heat PWM - override		1-2[2]	q27	*	*	*	*					0 %	100 %	0%
High temperature - Priority	0=Disabled, 3=Low, 2=Medium, 1=High	1-2	q28	*	*	*	*	*	*	*	*	0	3	1
Low temperature - Priority	0=Disabled, 3=Low, 2=Medium, 1=High	1-2	q29	*	*	*	*	*	*	*	*	0	3	1
Sensor errors - Priority	0=Disabled, 3=Low, 2=Medium, 1=High	1-2	q30	*	*	*	*	*	*	*	*	0	3	1
DI alarms - Priority	0=Disabled, 3=Low, 2=Medium, 1=High	1-2	q31	*	*	*	*	*	*	*	*	0	3	2
Defrost - Priority	0=Disabled, 3=Low, 2=Medium, 1=High	1-2	q32	*	*	*	*	*	*	*	*	0	3	3
Miscellaneous - Priority	0=Disabled, 3=Low, 2=Medium, 1=High	1-2	q33	*	*	*	*	*	*	*	*	0	3	2

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	Min.value	Max.value	Fact.value
Control stopped - Priority	0=Disabled, 3=Low, 2=Medium, 1=High	1-2	q35	*	*	*	*	*	*	*	*	0	3	3
Leak detection - Priority	0=Disabled, 3=Low, 2=Medium, 1=High	1-2	q36	*	*	*	*	*	*	*	*	0	3	2
Food temp. sensor	1=Thermostat air, 2=Alarm air, 3=S3 Air ON evap.	1-2[1]	q39	*	*	*	*	*	*	*	*	1	3	2
Brine pump - override	0=MAN OFF, 1=MAN ON	1-2[2]	q47							*	*	0	1	0
Condenser fan - override	0=MAN OFF, 1=MAN ON	1-2[2]	q48		*		*		*			0	1	0
Compressor speed - override		1-2[2]	q49					*	*			0 %	100 %	0%
Brine pump speed - override		1-2[2]	q50							*	*	0 %	100 %	0%
Compressor - Priority	0=Disabled, 3=Low, 2=Medium, 1=High	1-2	q53	*	*	*	*	*	*			0	3	2
Condenser - Priority	0=Disabled, 3=Low, 2=Medium, 1=High	1-2	q54	*	*	*	*	*	*	*	*	0	3	2

[1] In order to change this parameter the regulation must be stopped via the parameter r12 Main switch = OFF.
[2] In order to change this parameter the parameter r12 Main switch must be set in position "SEr" allowing manual control of outputs.

Service

Table 18: Service

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	Min.value	Max.value	Fact.value
Control state A	0=Normal ctrl., 1=Hold after defrost, 2=Min ON timer, 3=Min OFF timer, 4=Drip off, 10=Main switch OFF, 11=Thermostat cut-out, 12=Frost protection S4, 14=Defrost, 15=Fan delay, 17=Door open, 18=Melt period, 19=Modulating temp. control, 20=Emergency control, 25=Manual control, 29=Case cleaning, 30=Forced cooling, 32=Power-up delay, 33=Air heating, 34=Comp. safety cut-out, 45=Shut down controller, 50=High S7 Brine inlet	0-X	u00	*	*	*	*	*	*	*	*	0	50	0
S5 Evaporator A		0-X	u09	*	*	*	*	*	*	*	*	-200.0 °C	200.0 °C	0.0 °C
DI1 Status	0=OFF, 1=ON	0-X	u10	*	*	*	*	*	*	*	*	0	1	0
Defrost time A		0-X	u11	*	*	*	*	*	*	*	*	0 min	900 min	0 min
S3 Air ON evap. A		0-X	u12	*	*	*	*	*	*	*	*	-200.0 °C	200.0 °C	0.0 °C
Night condition	0=OFF, 1=ON	0-X	u13	*	*	*	*	*	*	*	*	0	1	0
S4 Air OFF evap. A		0-X	u16	*	*	*	*	*	*	*	*	-200.0 °C	200.0 °C	0.0 °C
Thermostat air temp. A		0-X	u17	*	*	*	*	*	*	*	*	-200.0 °C	200.0 °C	0.0 °C
Thermostat run time A		0-X	u18	*	*	*	*	*	*	*	*	0 min	999 min	0 min
DI2 Status	0=OFF, 1=ON	0-X	u37	*	*	*	*	*	*	*	*	0	1	0
Compressor speed		0-X	u52					*	*			0 %	100 %	0%
Display readout 1		0-X	u56	*	*	*	*	*	*	*	*	-200.0 °C	200.0 °C	0.0 °C
Alarm air temp. A		0-X	u57	*	*	*	*	*	*	*	*	-200.0 °C	200.0 °C	0.0 °C
Compressor 1	0=OFF, 1=ON	0-X	u58	*	*	*	*	*	*			0	1	0
Fan	0=OFF, 1=ON	0-X	u59	*	*	*	*	*	*	*	*	0	1	0
Defrost A	0=OFF, 1=ON	0-X	u60	*	*	*	*	*	*	*	*	0	1	0
Rail heat	0=OFF, 1=ON	0-X	u61		*		*		*		*	0	1	0
Alarm relay	0=OFF, 1=ON	0-X	u62	*	*	*	*	*	*	*	*	0	1	0
Light	0=OFF, 1=ON	0-X	u63	*	*		*	*	*	*	*	0	1	0
Compressor 2	0=OFF, 1=ON	0-X	u67			*	*					0	1	0
Blinds	0=OFF, 1=ON	0-X	u82		*		*		*		*	0	1	0
Air heater	0=OFF, 1=ON	0-X	u84		*		*		*		*	0	1	0
Rail heat power		0-X	u85	*	*	*	*	*	*	*	*	0 %	100 %	0%
Thermostat band	1=Band 1, 2=Band 2	0-X	u86	*	*	*	*	*	*	*	*	1	2	1
Thermostat cut-in temp.		0-X	u90	*	*	*	*	*	*	*	*	-200.0 °C	200.0 °C	4.0 °C
Thermostat cut-out temp.		0-X	u91	*	*	*	*	*	*	*	*	-200.0 °C	200.0 °C	2.0 °C

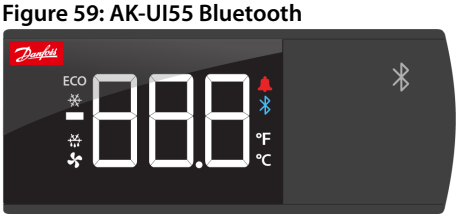
Function	Values	R-W	Code	1	2	3	4	5	6	7	8	Min.value	Max.value	Fact.value
S8 Brine outlet temp.		0-X	u93	*	*	*	*	*	*	*	*	-200.0 °C	200.0 °C	0.0 °C
S7 Brine inlet temp.		0-X	u98	*	*	*	*	*	*	*	*	-200.0 °C	200.0 °C	0.0 °C
Condenser fan	0=OFF, 1=ON	0-X	U16		*		*		*			0	1	0
Brine pump	0=OFF, 1=ON	0-X	U17							*	*	0	1	0
Brine pump speed		0-X	U28							*	*	0 %	100 %	0%
Fan ECO	0=OFF, 1=ON	0-X	U37		*		*		*		*	0	1	0
Network status		0-X	U45	*	*	*	*	*	*	*	*	0 %	100 %	0%
Rail heat PWM		0-X	U59	*	*	*	*					0 %	100 %	0%
Food temperature A		0-X	U72	*	*	*	*	*	*	*	*	-200.0 °C	200.0 °C	0.0 °C
Defrost sensor temperature A		0-X	U73	*	*	*	*	*	*	*	*	-200.0 °C	200.0 °C	0.0 °C

Operation via AK-UI55 Bluetooth

Access to parameters via Bluetooth and app

1. App can be downloaded from App Store and Google Play.
   - Name = AK-CC55 Connect
   - Start the app.
2. Click on the display's Bluetooth button for 3 seconds.
   - The Bluetooth light will then flash while display is showing the controller's address.
3. Connect to the controller from the app.

Figure 59: AK-UI55 Bluetooth



Display info:

- Loc
- The operation is locked and cannot be operated via Bluetooth.
- Unlock from the system manager.

Figure 60: Connect to controller

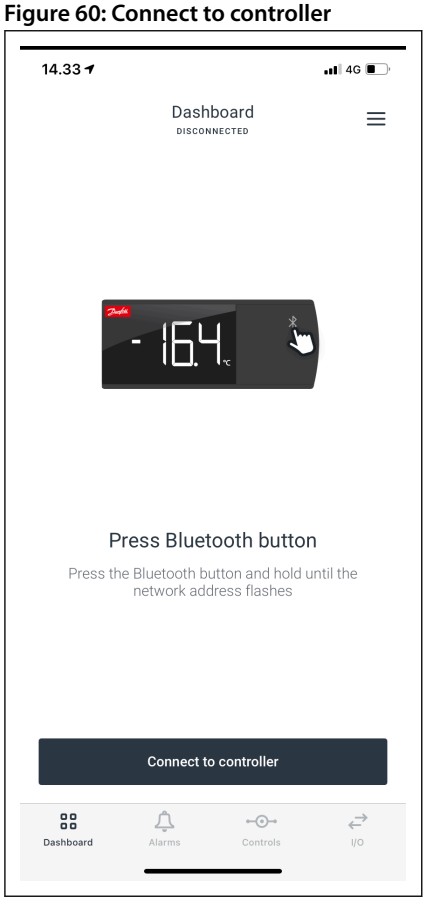


Figure 61: Controller dashboard

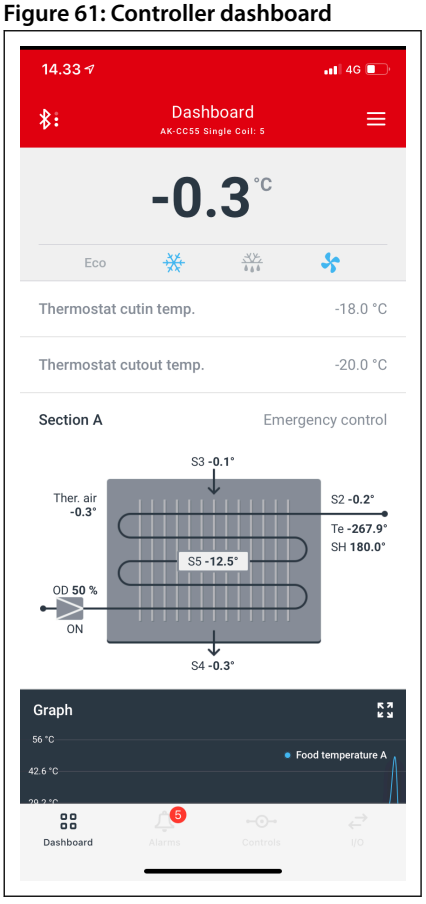
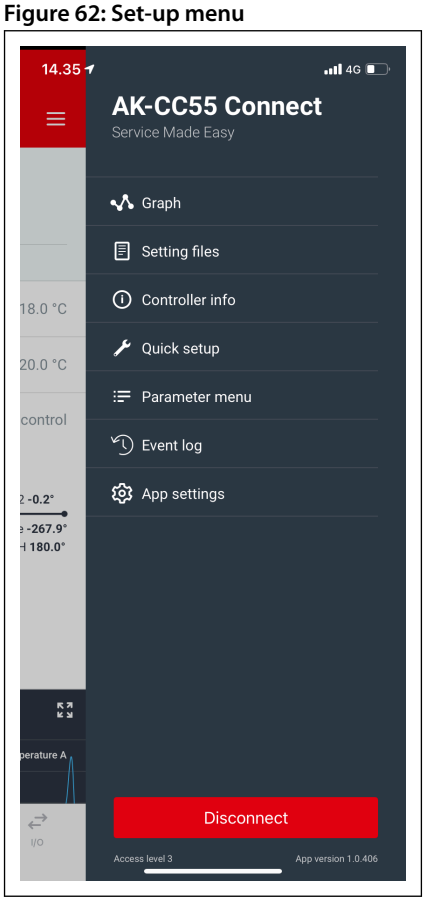


Figure 62: Set-up menu



The functions are described on Page 48 – Page 60.

AK-CC55 Connect menu (SW ver. 1.2x)

Start / Stop

Table 19: Start / Stop

Function	Description	Values	Code	Short name
Main switch	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 outputs can be force controlled. Start / stop of refrigeration can also be accomplished with the external switch function connected to a DI input.Stopped control will give a "Main switch OFF" alarm.	-1=Manual, 0=Stop, 1=Start	r12	r12 Main switch
Delay of outputs at power-up	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	o01 DelayOfOutp.

Configuration

Table 20: Configuration

Function	Description	Values	Code	Short name
Main switch	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 outputs can be force controlled. Start / stop of refrigeration can also be accomplished with the external switch function connected to a DI input.Stopped control will give a "Main switch OFF" alarm.	-1=Manual, 0=Stop, 1=Start	r12	r12 Main switch
Application mode	Selection of application The controller covers several applications for control of a refrigerated case. Here you set which of the possible applications is required.This menu can only be set when regulation is stopped, i.e. "r12 Main Switch" is set to 0.	1=1: One comp., 2=2: One comp. custom, 3=3: Two comp., 4=4: Two comp. custom, 5=5: Speed comp., 6=6: Speed comp. custom, 7=7: Speed pump, 8=8: Speed pump custom	o61	o61 Appl. mode
Condenser sensors	Select if an additional S8 Brine outlet sensor is to be used as monitoring sensor for the brine cooled condenser.	0=None, 1=S7, 2=S7 and S8	P99	P99 Cond Sensors
DO2 Configuration	Select the function of the digital output	0=None, 1=Fans, 2=Fan ECO, 3=Defrost, 4=Rail heat, 5=Alarm, 6=Light, 7=Blinds, 10=Air heater, 12=Condenser fan	q02	q02 DO2 Config.
DO3 Configuration	Select the function of the digital output	0=None, 1=Fans, 2=Fan ECO, 3=Defrost, 4=Rail heat, 5=Alarm, 6=Light, 7=Blinds, 10=Air heater, 12=Condenser fan	q03	q03 DO3 Config.
DO4 Configuration	Select the function of the digital output	0=None, 1=Fans, 2=Fan ECO, 3=Defrost, 4=Rail heat, 5=Alarm, 6=Light, 7=Blinds, 10=Air heater, 12=Condenser fan	q04	q04 DO4 Config.
DO5 Configuration	Select the function of the digital output	0=None, 1=Fans, 2=Fan ECO, 3=Defrost, 4=Rail heat, 5=Alarm, 6=Light, 7=Blinds, 10=Air heater, 12=Condenser fan	q05	q05 DO5 Config.
AO1 Configuration	Select the function of the analogue output	0=None, 1=Rail heat PWM, 3=Comp. speed, 4=Brine pump speed	q09	q09 AO1 Config.
AO1 Signal type	Select the signal type of the analogue output	0=None, 1=Voltage, 2=Frequency, 3=PWM	o09	o09 AO1 Signal
AO1 Min. voltage	Minimum voltage signal of the analogue output		o27	o27 AO1 Min volt
AO1 Max. voltage	Maximum voltage signal of the analogue output		o28	o28 AO1 Max volt
AO1 Min. frequency	Minimum frequency signal of the analogue output		P95	P95 AO1 Min freq
AO1 Max. frequency	Maximum frequency signal of the analogue output		P96	P96 AO1 Max freq
AO1 PWM frequency	Frequency of the PWM signal from the analogue output		P97	P97 AO1 PWM Freq
AO1 Invert signal	Option for inverting the analogue output signalt	0=No, 1=Yes	P98	P98 AO1 Invert
DI1 Configuration	Select the function of the digital input	0=None, 1=DI status, 2=Door function, 3=Door alarm, 4=Defrost start, 5=Main switch, 6=Night setback, 7=Thermostat band, 8=Alarm at closed, 9=Alarm at open, 10=Case cleaning, 11=Forced cooling, 12=Open blinds, 15=Shutdown, 16=Light control, 20=Leak detection, 24=Comp. safety, 25=Speed drive alarm, 26=Force cond. fan ON, 29=Door fan stop	o02	o02 DI1 Config.

Function	Description	Values	Code	Short name
DI2 Configuration	Select the function of the digital input	0=None, 1=DI status, 2=Door function, 3=Door alarm, 4=Defrost start, 5=Main switch, 6=Night setback, 7=Thermostat band, 8=Alarm at closed, 9=Alarm at open, 10=Case cleaning, 11=Forced cooling, 12=Open blinds, 13=Coordinated defrost, 15=Shut-down, 16=Light control, 20=Leak detection, 24=Comp. safety, 25=Speed drive alarm, 26=Force cond. fan ON, 29=Door fan stop	o37	o37 DI2 Config.
Temperature sensor type	Sensor type for S3, S4 and S5. Normally a Pt 1000 sensor with great signal accuracy is used. But you can also use a sensor with another signal accuracy. That could e.g. be a PTC sensor (1000 ohm at 25 °C). All the mounted sensors S3-S5 must be of the same type.	0=Pt 1000, 1=PTC 1000, 2=NTC 5k, 3=NTC 10k, 4=User-defined	o06	o06 SensorConfig
	Sensor point 1 - Temp.	The temperature value for the user-defined temperature sensor in the reference point	X20	--- SP1 Temp
	Sensor point 1 - kohm	The resistance value in kohm for the user-defined temperature sensor in the reference point	X21	--- SP1 kohm
	Sensor point 1 - ohm	The resistance value in ohm for the user-defined temperature sensor in the reference point	X22	--- SP1 ohm
	Sensor point 2 - Temp.	The temperature value for the user-defined temperature sensor in the reference point	X23	--- SP2 Temp
	Sensor point 2 - kohm	The resistance value in kohm for the user-defined temperature sensor in the reference point	X24	--- SP2 kohm
	Sensor point 2 - ohm	The resistance value in ohm for the user-defined temperature sensor in the reference point	X25	--- SP2 ohm
	Sensor point 3 - Temp.	The temperature value for the user-defined temperature sensor in the reference point	X26	--- SP3 Temp
	Sensor point 3 - kohm	The resistance value in kohm for the user-defined temperature sensor in the reference point	X27	--- SP3 kohm
	Sensor point 3 - ohm	The resistance value in ohm for the user-defined temperature sensor in the reference point	X28	--- SP3 ohm
Defrost method	Select method of defrost	0=None, 1=Electrical, 2=Hot gas, 4=Air/Offcycle	d01	d01 Def. method
Defrost stop method	Here you define whether a defrost cycle is to be stopped by time or by a temperature sensor	0=Time, 1=S5 sensor, 2=S4 sensor	d10	d10 DefStopSens.
Defrost stop limit A	When the selected defrost stop sensor reaches the set limit, the defrost cycle is terminated		d02	d02 Def.StopTemp
Food type	When changing the food type the controller will automatically adapt temperature setpoints and alarm limits according to the selected food type. Please be aware that the setting will revert to "None" after having been changed.	0=None, 1=Vegetables, 2=Dairy, 3=Meat and fish, 4=Frozen food, 5=Ice cream	r89	r89 Food type
Food temp. sensor	Select the temperature to be used for the food temperature representation	1=Thermostat air, 2=Alarm air, 3=S3 Air ON evap.	q39	q39 Food sensor
Network address	Network address of the controller		o03	o03 Unit addr.
DO1 Function	Function associated to the physical input/output		U61	U61 DO1 Config.
DO2 Function	Function associated to the physical input/output		U62	U62 DO2 Config.
DO3 Function	Function associated to the physical input/output		U63	U63 DO3 Config.
DO4 Function	Function associated to the physical input/output		U64	U64 DO4 Config.
DO5 Function	Function associated to the physical input/output		U65	U65 DO5 Config.
DI1 Function	Function associated to the physical input/output		Y55	DI1 Config
DI2 Function	Function associated to the physical input/output		Y56	DI2 Config
AI1 Function	Function associated to the physical input/output		Y58	AI1 Config
AI2 Function	Function associated to the physical input/output		Y59	AI2 Config
AI3 Function	Function associated to the physical input/output		Y60	AI3 Config
AI4 Function	Function associated to the physical input/output		Y61	AI4 Config
AI5 Function	Function associated to the physical input/output		Y62	AI5 Config
AO1 Function	Function associated to the physical input/output		U69	U69 AO1 Config.

Thermostat control

Table 21: Thermostat control

Function	Description	Values	Code	Short name
Control state A	Readout of the actual control state of the controller	0=Normal ctrl., 1=Hold after defrost, 2=Min ON timer, 3=Min OFF timer, 4=Drip off, 10=Main switch OFF, 11=Thermostat cut-out, 12=Frost protection S4, 14=Defrost, 15=Fan delay, 17=Door open, 18=Melt period, 19=Modulating temp. control, 20=Emergency control, 25=Manual control, 29=Case cleaning, 30=Forced cooling, 32=Power-up delay, 33=Air heating, 34=Comp. safety cut-out, 45=Shut down controller, 50=High S7 Brine inlet	u00	u00 Ctrl. state
Thermostat air temp. A	Thermostat temperature		u17	u17 Ther. air
Food temperature A	Readout of food temperature		U72	U72 Food temp.
S3 Air ON evap. A	Actual sensor value		u12	u12 S3 air temp.
S4 Air OFF evap. A	Actual sensor value		u16	u16 S4 air temp.
Night condition	Status of the day/night operation (night operation: on/off)	0=OFF, 1=ON	u13	u13 Night Cond.
Thermostat cut-in temp.	Readout of the actual cut-in value for the thermostat		u90	u90 Cutin temp.
Thermostat cut-out temp.	Readout of the actual cut-out value for the thermostat		u91	u91 Cutout temp.
Thermostat run time A	Read the ongoing cut-in time for the thermostat or the duration of the last completed cut-in		u18	u18 Ther runtime
Thermostat band	Readout of which thermostat is used for regulation:1= Thermostat band 12= Thermostat band 2	1=Band 1, 2=Band 2	u86	u86 Ther. band
Air heater	Actual status of output function	0=OFF, 1=ON	u84	u84 Heat relay
Thermostat mode	Here it is defined how the thermostat is operating. For application mode 1-4 the thermostat mode will be ON/OFF. For application modes 5-6 the thermostat mode will be Modulating due to speed control of compressor/ pump.	2=Modulating, 1=ON/OFF	r14	r14 Therm. mode
Cut-out 1	Setpoint. The thermostat's cut-out value when the given thermostat band is in use		r00	r00 Cutout
Differential 1	When the temperature is higher than the set cut-out + the set differential, the compressor relay will be cut-in. It will cut-out again when the temperature comes down to the set cut-out limit		r01	r01 Differential
Cut-out 2	Setpoint. The thermostat's cut-out value when the given thermostat band is in use		r21	r21 Cutout 2
Differential 2	When the temperature is higher than the set cut-out + the set differential, the compressor relay will be cut-in. It will cut-out again when the temperature comes down to the set cut-out limit		r93	r93 Diff Th2
Max cut-out limit	Setpoint limitation - The controller's setting range for the thermostat setpoint may be narrowed down, so that too high or 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	r02 Max cutout
Min cut-out limit	Setpoint limitation - The controller's setting range for the thermostat setpoint may be narrowed down, so that too high or too low values are not set accidentally - with resulting damages.To avoid a too low setting of the setpoint, the min. allowable reference value may be increased		r03	r03 Min cutout
Thermostat sensor S4 %	Selection of thermostat sensor. Here you define the sensor that the thermostat is to use for its control function. S3, S4, or a combination of them. With the setting 0%, only S3 is used. With 100%, only S4.		r15	r15 Ther. S4 %
Thermostat sensor S4 % night	Selection of thermostat sensor S4% during night operation with night blinds. Here you define the sensor that the thermostat is to use for its control function. S3, S4, or a combination of them. With the setting 0%, only S3 is used. With 100%, only S4.		r61	r61 Ther.S4% Ngt
Night offset	Night setback value.The thermostat's reference will be the setpoint plus this value when the controller changes over to night operation.		r13	r13 Night offset

Function	Description	Values	Code	Short name
S4 frost protection	Frost protection on S4 air temperature. If the S4 temperature sensor measure a temperature lower than the set limit, refrigeration will be stopped in order to protect products from ice formation. Refrigeration will start again when the S4 temperature has risen 2K above the set limit		r98	r98 S4 Min Lim
Air heater neutral zone	Heat function. Set the width of the Neutral Zone for changeover from cooling to heating		r62	r62 Heat NZ
Air heater start delay	Time delay on transition from refrigeration phase to heating phase (there is no time delay on transition from heating phase to refrigeration)		r63	r63 HeatStartDel
Melt interval	Melt function. Only for control of MT cases/rooms (-5 to +10°C). The function ensures that the evaporator will not be blocked by ice crystals. Here you set how often the function is to stop the refrigeration and hence transform the ice crystals to water.		r16	r16 MeltInterval
Melt period	Melt period. Here you set how long an ongoing melt function is to last		r17	r17 Melt period

Alarm limits and delays

Table 22: Alarm limits and delays

Function	Description	Values	Code	Short name
Control state A	Readout of the actual control state of the controller	0=Normal ctrl., 1=Hold after defrost, 2=Min ON timer, 3=Min OFF timer, 4=Drip off, 10=Main switch OFF, 11=Thermostat cut-out, 12=Frost protection S4, 14=Defrost, 15=Fan delay, 17=Door open, 18=Melt period, 19=Modulating temp. control, 20=Emergency control, 25=Manual control, 29=Case cleaning, 30=Forced cooling, 32=Power-up delay, 33=Air heating, 34=Comp. safety cut-out, 45=Shut down controller, 50=High S7 Brine inlet	u00	u00 Ctrl. state
Alarm status	Actual alarm status	0=OFF, 1=ON	x16	--- Sum alarm
Alarm air temp. A	Measured temperature for alarm thermostat		u57	u57 Alarm air
High alarm limit	Readout of actual high alarm limit for the temperature monitoring		y10	--- High al. lim
Low alarm limit	Readout of actual low alarm limit for the temperature monitoring		y11	--- Low al. lim
S3 Air ON evap. A	Actual sensor value		u12	u12 S3 air temp.
S4 Air OFF evap. A	Actual sensor value		u16	u16 S4 air temp.
Reset alarms	Command for resetting all alarms, unless they are still active	0=OFF, 1=ON	x15	--- Reset alarm
Alarm sensor S4% A	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		A36	A36 Alarm S4 %
High alarm limit 1	Upper alarm limit. The limit value is set in absolute value. The limit value will be raised with the night offset during night operation.		A13	A13 HighLim Air
Low alarm limit 1	Lower alarm limit. The limit value is set in absolute value		A14	A14 LowLim Air
High alarm limit 2	Upper alarm limit. The limit value is set in absolute value. The limit value will be raised with the night offset during night operation.		A20	A20 HighLim2 Air
Low alarm limit 2	Lower alarm limit. The limit value is set in absolute value		A21	A21 LowLim2 Air
Alarm delay A	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	A03 Alarm delay
Alarm delay pull down A	Alarm delay at tempeature pull down conditions (long alarm delay). This time delay is used during start-up, during defrost and immediately after a defrost. There will be a change-over to the normal time delay when the temperature has dropped below the set upper alarm limit.		A12	A12 Pulldown del
Door open alarm delay	Time delay for door alarm		A04	A04 DoorOpen del

Function	Description	Values	Code	Short name
Door restart inj. delay	Start of refrigeration when the door is open. If the door has been left open, refrigeration will be started after the set time.		o89	o89 DoorInjStart
Alarm delay DI 1	Time delay for digital input alarm		A27	A27 Al.Delay DI1
Alarm delay DI 2	Time delay for digital input alarm		A28	A28 Al.Delay DI2

Defrost control

Table 23: Defrost control

Function	Description	Values	Code	Short name
Control state A	Readout of the actual control state of the controller	0=Normal ctrl., 1=Hold after defrost, 2=Min ON timer, 3=Min OFF timer, 4=Drip off, 10=Main switch OFF, 11=Thermostat cut-out, 12=Frost protection S4, 14=Defrost, 15=Fan delay, 17=Door open, 18=Melt period, 19=Modulating temp. control, 20=Emergency control, 25=Manual control, 29=Case cleaning, 30=Forced cooling, 32=Power-up delay, 33=Air heating, 34=Comp. safety cut-out, 45=Shut down controller, 50=High S7 Brine inlet	u00	u00 Ctrl. state
Defrost sensor temperature A	Actual temperature of selected defrost stop sensor		U73	U73 Def.StopTemp
S5 Evaporator A	Actual sensor value		u09	u09 S5 temp.
Defrost A	Actual status of output function	0=OFF, 1=ON	u60	u60 Def. relay
Defrost time A	Read the duration of the ongoing defrost or the duration of the last completed defrost.		u11	u11 Defrost time
Start defrost	Command for starting a defrost	0=OFF, 1=ON	x09	--- Def. Start
Stop defrost	Command for stopping an ongoing defrost cycle	0=OFF, 1=ON	x10	--- Def. Stop
Defrost method	Select method of defrost	0=None, 1=Electrical, 2=Hot gas, 4=Air/Offcycle	d01	d01 Def. method
Defrost stop method	Here you define whether a defrost cycle is to be stopped by time or by a temperature sensor	0=Time, 1=S5 sensor, 2=S4 sensor	d10	d10 DefStopSens.
Defrost stop limit 1	When the selected defrost stop sensor reaches the set limit, the defrost cycle is terminated		d02	d02 Def.StopTemp
Defrost stop limit 2	Defrost stop temperature limit when thermostat band 2 is in operation.When the selected defrost stop sensor reaches the set limit, the defrost cycle is terminated		d28	d28 DefStopTemp2
Min. defrost time	Min. duration of a defrost cycle. The defrost cycle will as a minimum run for the set minimum defrost time once it is started		d24	d24 Min Def Time
Max. defrost time 1	Max. duration of a defrost cycle. The setting is also used as a safety time if the defrost is stopped on temperature. If the selected defrost stop sensor does not reach the set defrost stop temperature limit within the set time, the defrost will be stopped anyway.		d04	d04 Max Def.time
Max. defrost time 2	Max duration of a defrost cycle when thermostat band 2 is in operation. The setting is also used as a safety time if the defrost is stopped on temperature. If the selected defrost stop sensor does not reach the set defrost stop temperature limit within the set time, the defrost will be stopped anyway.		d29	d29 MaxDefTime2
Defrost start interval	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 communcation 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. 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. he interval time is not active when set to 0		d03	d03 Def.Interval

Function	Description	Values	Code	Short name
Time staggering power-up	Time staggering for defrost cut-ins 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. The function delays the interval time 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	d05 Time stagg.
Max. thermostat run time	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 not in use.		d18	d18 MaxTherRunT.
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	d06 DripOff time
Max. hold time	Max. standby time after coordinated defrost. When a controller has completed a defrost it will wait for a signal tellingthat the refrigeration may be resumed. If this signal fails to appear for one reason or another, the controller itself will start the refrigeration when the standby time has elapsed.		o16	o16 MaxHoldTime
Fan control during defrost	Fan operation during defrost Here you can set how the 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 stopped3: Running during pump down and defrost until defrost stop sensor reaches fan stop temperature limit	0=OFF, 1=ON, 2=OFF at drip, 3=OFF at high temp	d09	d09 FanDuringDef
Fan start delay	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 remaining water is transformed into ice on the evaporator).		d07	d07 FanStartDel
Fan start temperature	Temperature limit for starting the fans after a defrost. When the measured S5 evaporator temperature is getting below the set limit, the fans are started		d08	d08 FanStartTemp
Fan stop temperature	If the fan control during defrost has been set up for it, the fans can be stopped during the defrost if the defrost sensor exceeds the set temperature limit		d41	d41 Def Fan Stop
Rail heat during defrost	Define how rail heat is controlled during defrost0: Rail heat is OFF all the time1: Rail heat is ON all the time2: Normal rail heat control	0=OFF, 1=ON, 2=Normal control	d27	d27 Railh.at def
Display delay after defrost	Set the maximum time the display should show the defrost code "-d-" after a defrost. The normal temperature readout is normally started when the temperature in the case is OK again or if a high temperature alarm is raised.		d40	d40 Disp. d del.

Defrost schedules

Table 24: Defrost schedules

Function	Description	Values	Code	Short name
Defrost schedule		0=No, 1=Yes	t00	t00 Def.Schedule
Def. start 1 - Hours	Time in hours for start of defrost		t01	t01 Def. 1 hr.
Def. start 1 - Minutes	Time in minutes for when defrost cycle is to be started		t11	t11 Def. 1 min.
Def. start 2 - Hours	Time in hours for start of defrost		t02	t02 Def. 2 hr.
Def. start 2 - Minutes	Time in minutes for when defrost cycle is to be started		t12	t12 Def. 2 min.
Def. start 3 - Hours	Time in hours for start of defrost		t03	t03 Def. 3 hr.
Def. start 3 - Minutes	Time in minutes for when defrost cycle is to be started		t13	t13 Def. 3 min.
Def. start 4 - Hours	Time in hours for start of defrost		t04	t04 Def. 4 hr.
Def. start 4 - Minutes	Time in minutes for when defrost cycle is to be started		t14	t14 Def. 4 min.
Def. start 5 - Hours	Time in hours for start of defrost		t05	t05 Def. 5 hr.
Def. start 5 - Minutes	Time in minutes for when defrost cycle is to be started		t15	t15 Def. 5 min.

Function	Description	Values	Code	Short name
Def. start 6 - Hours	Time in hours for start of defrost		t06	t06 Def. 6 hr.
Def. start 6 - Minutes	Time in minutes for when defrost cycle is to be started		t16	t16 Def. 6 min.
Monday - Follow schedule		0=No, 1=Yes	t51	t51 Mon.Schedule
Tuesday - Follow schedule		0=No, 1=Yes	t52	t52 Tue.Schedule
Wednesday - Follow schedule		0=No, 1=Yes	t53	t53 Wed.Schedule
Thursday - Follow schedule		0=No, 1=Yes	t54	t54 Thu.Schedule
Friday - Follow schedule		0=No, 1=Yes	t55	t55 Fri.Schedule
Saturday - Follow schedule		0=No, 1=Yes	t56	t56 Sat.Schedule
Sunday - Follow schedule		0=No, 1=Yes	t57	t57 Sun.Schedule

Compressor/Pump control

Table 25: Compressor/Pump control

Function	Description	Values	Code	Short name
Control state A	Readout of the actual control state of the controller	0=Normal ctrl., 1=Hold after defrost, 2=Min ON timer, 3=Min OFF timer, 4=Drip off, 10=Main switch OFF, 11=Thermostat cut-out, 12=Frost protection S4, 14=Defrost, 15=Fan delay, 17=Door open, 18=Melt period, 19=Modulating temp. control, 20=Emergency control, 25=Manual control, 29=Case cleaning, 30=Forced cooling, 32=Power-up delay, 33=Air heating, 34=Comp. safety cut-out, 45=Shut down controller, 50=High S7 Brine inlet	u00	u00 Ctrl. state
Thermostat air temp. A	Thermostat temperature		u17	u17 Ther. air
Thermostat cut-in temp.	Readout of the actual cut-in value for the thermostat		u90	u90 Cutin temp.
Thermostat cut-out temp.	Readout of the actual cut-out value for the thermostat		u91	u91 Cutout temp.
Compressor 1	Actual status of output function	0=OFF, 1=ON	u58	u58 Comp1/LLSV
Compressor 2	Actual status of output function	0=OFF, 1=ON	u67	u67 Comp2 relay
Compressor speed	Actual status of output function		u52	u52 Comp. Cap.
Brine pump	Actual status of output function	0=OFF, 1=ON	U17	U17 Brine pump
Brine pump speed	Actual status of output function		U28	U28 Pump speed
S7 Brine inlet temp.	Actual sensor value		u98	u98 S7 temp
S8 Brine outlet temp.	Actual sensor value		u93	u93 S8 temp
Min ON time	Minimum time the compressor is to run once it has been started.		c01	c01 Min. On time
Min OFF time	Minimum time the compressor has to be stopped		c02	c02 Min.Off time
Delay between comp.	Time delay for couplings of two compressors. The step delay is the time that has to elapse from the first compressor cuts in and until the next compressor can cut in.		c05	c05 Step delay
Step control mode	Selection of step control mode for compressors. At sequential mode compressor 1 will always be the first to start and the last to stop. In cyclic mode the run time between the compressor will be equalized.	1=Sequential, 2=Cyclic	c08	c08 Step mode
Comp. 2 ctrl. Th. band 2	Select whether compressor 2 is to be in operation in thermostat band 2	0=OFF, 1=ON	c85	c85 Cmp2 In Th2
Min. speed	The minimum allowed speed		c46	c46 Min speed
Start speed	The requested start speed (must be set to a higher value than “Min. speed”). After start, this speed is maintained for 10 seconds before speed control is started		c47	c47 Start speed
Max. speed	The maximum allowed speed		c48	c48 Max speed
Comp. defrost speed	The compressor will run with the defined speed during the hot gas defrost		c97	c97 DefrostSpeed
Max. speed slope	Limitation on how fast the speed can ramp up/down (set in % per. second)		c96	c96 MaxSlopeRate

Function	Description	Values	Code	Short name
Speed Kp	Amplification factor Kp for PI control of speed		c82	c82 Speed Kp
Speed Tn	Integration factor Tn for PI control of speed		c83	c83 Speed Tn
Max. Kp factor	Max. Kp value at high deviation from the temperature setpoint		c98	c98 Speed Kp Max
ON time emergency	Thermostat ON time at thermostat sensor error		c86	c86 Emergency ON
OFF time emergency	Thermostat OFF time at thermostat sensor error		c87	c87 EmergencyOFF
Speed emergency	The fixed speed during emergency control due to an error on the thermostat sensor		c93	c93 Emerg. Speed
Oil return speed	Set the speed at which the compressor will run during an oil return cycle		P79	P79 OilRtrnSpeed
Oil return time period	Set the time period for which the compressor will run at increased speed during an oil return cycle		P80	P80 OilRtPeriod
Oil return speed limit	If the compressor is running below the set speed limit, an oil return counter is increased. When the counter reaches the defined "Oil return cycle time", an oil return cycle will be initiated		P77	P77 OilRtSpdLim
Oil return interval	When the counter for low speed operation reaches this value, an oil return cycle is initiated		P78	P78 OilRtIntrval
Resonance band start	Variable speed level at which the resonance band starts		P39	P39 Reson. start
Resonance band	Width of the resonance band		P40	P40 Reson. band

Condenser control

Table 26: Condenser control

Function	Description	Values	Code	Short name
Control state A	Readout of the actual control state of the controller	0=Normal ctrl., 1=Hold after defrost, 2=Min ON timer, 3=Min OFF timer, 4=Drip off, 10=Main switch OFF, 11=Thermostat cut-out, 12=Frost protection S4, 14=Defrost, 15=Fan delay, 17=Door open, 18=Melt period, 19=Modulating temp. control, 20=Emergency control, 25=Manual control, 29=Case cleaning, 30=Forced cooling, 32=Power-up delay, 33=Air heating, 34=Comp. safety cut-out, 45=Shut down controller, 50=High S7 Brine inlet	u00	u00 Ctrl. state
S7 Brine inlet temp.	Actual sensor value		u98	u98 S7 temp
S8 Brine outlet temp.	Actual sensor value		u93	u93 S8 temp
Condenser fan	Actual status of output function	0=OFF, 1=ON	U16	U16 Cond. fan
Max. S7 Brine temp.	Max. temperature safety limit for the condenser entering brine temperature. If the limit is violated, the compressor capacity will be reduced and an alarm will be activated. If the temperature decreases with the set differential, the alarm will be deactivated again and the compressor capacity will no longer be restricted.		A76	A76 MaxS7BrineT.
Max. S7 Brine temp. diff.	Temperature differential for the safety limit "Max. S7 Brine temp.". If the max. temperature safety limit for the condenser entering brine temperature is violated, the compressor capacity will be reduced and an alarm will be activated. If the temperature decreases with the set differential, the alarm will be deactivated again and the compressor capacity will no longer be restricted.		A77	A77 S7Brine Diff
Cond. fan cut-in	Temperature setting at which the condenser fan is started		F24	F24 Cond. Cutin
Cond. fan diff.	Temperature differential for stopping condenser fan		F25	F25 Cond. diff.

Fan control

Table 27: Fan control

Function	Description	Values	Code	Short name
Control state A	Readout of the actual control state of the controller	0=Normal ctrl., 1=Hold after defrost, 2=Min ON timer, 3=Min OFF timer, 4=Drip off, 10=Main switch OFF, 11=Thermostat cut-out, 12=Frost protection S4, 14=Defrost, 15=Fan delay, 17=Door open, 18=Melt period, 19=Modulating temp. control, 20=Emergency control, 25=Manual control, 29=Case cleaning, 30=Forced cooling, 32=Power-up delay, 33=Air heating, 34=Comp. safety cut-out, 45=Shut down controller, 50=High S7 Brine inlet	u00	u00 Ctrl. state
Fan	Actual status of output function	0=OFF, 1=ON	u59	u59 Fan relay
Fan ECO	Actual status of output function	0=OFF, 1=ON	U37	U37 Fan Eco
Fan pulsing mode	Pulse operation of fan 0: No pulse operation 1: Pulse operation when the thermostat is cut out2: Pulse operation when the thermostat is cut out, but only during night operation	0=No pulsing, 1=Pulsing cut-out, 2=Pulsing cut-out night	F05	F05 FanPulse-Mode
Fan period time	Period time for pulsing of fan		F06	F06 Fan cycle
Fan ON cycle	ON time for fan. The ON period is set as a percentage of the period time		F07	F07 Fan ON %
Fan stop high S5 temp.	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 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.		F04	F04 FanStop temp
Fan stop at blinds closing	When blinds are closing the fans are stopped in the defined time delay in order to ensure that the blinds are closed correctly		P65	P65 BlindFan-Stop

Railheat control

Table 28: Railheat control

Function	Description	Values	Code	Short name
Control state A	Readout of the actual control state of the controller	0=Normal ctrl., 1=Hold after defrost, 2=Min ON timer, 3=Min OFF timer, 4=Drip off, 10=Main switch OFF, 11=Thermostat cut-out, 12=Frost protection S4, 14=Defrost, 15=Fan delay, 17=Door open, 18=Melt period, 19=Modulating temp. control, 20=Emergency control, 25=Manual control, 29=Case cleaning, 30=Forced cooling, 32=Power-up delay, 33=Air heating, 34=Comp. safety cut-out, 45=Shut down controller, 50=High S7 Brine inlet	u00	u00 Ctrl. state
Dewpoint	Actual dewpoint received from system manager via network		x18	--- Dew point
Rail heat	Actual status of output function	0=OFF, 1=ON	u61	u61 Railh. relay
Rail heat power	Readout of the actual rail power in %		u85	u85 Rail DutyC %
Rail heat PWM	Actual status of output function		U59	U59 Railheat PWM
Rail heat control mode	The rail heat can be controlled in several ways: 0: Rail heat is running all the time 1: Pulse control is used with a timer function following the day/night operation 2: Pulse control is used with a dewpoint function. This function requires that a signal is received about the dewpoint value. The value is measured by a system manager and sent to the controller via the data communication.	0=ON, 1=Day/Night timer, 2=Dewpoint ctrl.	o85	o85 Railh. mode
Rail heat ON cycle day	Rail heat power during day time. The ON period is set as a percentage of the period		o41	o41 Railh.ONday%
Rail heat ON cycle night	Rail heat power during night time. The ON period is set as a percentage of the period time		o42	o42 Railh.ONngt%
Rail heat period time	Period time for pulsing of rail heat		o43	o43 Railh.cycle
Rail heat PWM - Period time	Period time for the pulse width modulation		P82	P82 RailCyclePWM

Function	Description	Values	Code	Short name
Rail heat min. ON cycle	Lowest permitted rail heat power. When the measured dewpoint is below the defined minimum limit the rail heat will run with the set minimum power		o88	o88 Rail Min ON%
Dewpoint min. limit	If the measuered dewpoint is below the set value the rail heat is running at minimum heat		o86	o86 DewP Min lim
Dewpoint max. limit	If the measured dewpoint is above the set value the rail heat is maximum		o87	o87 DewP Max lim

Light/Blinds/Cleaning control

Table 29: Light/Blinds/Cleaning control

Function	Description	Values	Code	Short name
Control state A	Readout of the actual control state of the controller	0=Normal ctrl., 1=Hold after defrost, 2=Min ON timer, 3=Min OFF timer, 4=Drip off, 10=Main switch OFF, 11=Thermostat cut-out, 12=Frost protection S4, 14=Defrost, 15=Fan delay, 17=Door open, 18=Melt period, 19=Modulating temp. control, 20=Emergency control, 25=Manual control, 29=Case cleaning, 30=Forced cooling, 32=Power-up delay, 33=Air heating, 34=Comp. safety cut-out, 45=Shut down controller, 50=High S7 Brine inlet	u00	u00 Ctrl. state
Night condition	Status of the day/night operation (night operation: on/off)	0=OFF, 1=ON	u13	u13 Night Cond.
Light	Actual status of output function	0=OFF, 1=ON	u63	u63 Light relay
Blinds	Actual status of output function	0=OFF, 1=ON	u82	u82 Blinds relay
Light control mode	Configuration of light function1: Light is controlled via day/night status 2: Light is controlled via data communication and master control parameter "MC Light signal" 3: Light is controlled by door contact on DI input. 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 is controlled via DI input signal	1=Day and night, 2=Network, 3=Door switch, 4=Network (Fallback), 5=Digital input	o38	o38 Light config
Light at Main switch OFF	Define how light and blinds are to be controlled at Main switch OFF 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.	0=OFF, 1=Normal ctrl.	o98	o98 Light MS=Off
Blinds max. open time	Time delay from when blinds have been opened manually until they close again		P60	P60 BlindOpenTim
Case cleaning mode	The status of the function can be seen here or the function can be started manually.0 = Normal operation (no cleaning) 1 = Only fans are running to defrost the evaporator. All other outputs are Off. 2 = Cleaning with stopped fans. All outputs are Off. If the function is controlled by a digital input signal, the relevant status can be seen here in the menu.	0=OFF, 1=Fans run, 2=Cleaning	o46	o46 Case clean

Display control

Table 30: Display control

Function	Description	Values	Code	Short name
Control state A	Readout of the actual control state of the controller	0=Normal ctrl., 1=Hold after defrost, 2=Min ON timer, 3=Min OFF timer, 4=Drip off, 10=Main switch OFF, 11=Thermostat cut-out, 12=Frost protection S4, 14=Defrost, 15=Fan delay, 17=Door open, 18=Melt period, 19=Modulating temp. control, 20=Emergency control, 25=Manual control, 29=Case cleaning, 30=Forced cooling, 32=Power-up delay, 33=Air heating, 34=Comp. safety cut-out, 45=Shut down controller, 50=High S7 Brine inlet	u00	u00 Ctrl. state
Display readout 1	Readout of the temperature shown on the display		u56	u56 Display air
Display air S4%	Signal to the display sensor. Here you have to define the ratio between the sensors which the display has to use. S3, S4 or a combination of the two. With setting 0% only S3 is used. With 100% only S4 is used		o17	o17 Disp. S4 %

Function	Description	Values	Code	Short name
Display readout adjustment	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	r04 Disp. Adj. K
Temperature unit	Select whether temperatures are to be shown as °C or as °F.	0=Celsius, 1=Fahrenheit	r05	r05 Temp.unit
Display keyboard lock	With this setting it is possible to lock the keyboard operation of the local display. None: Display keyboard operation will never be locked. Local: When not used for some time, the local display will lock the keyboard operations and a special key combination is required in order to enable the keyboard operations. Network: When the controller receives a master control signal (--- Key/BT lock) via the network, the display keyboard operations will be locked. The keyboard operations can only be activated again by setting the master control signal OFF via the System Manager.	0=None, 1=Local, 2=Network	P89	P89 LockDispKey

Alarm relay priorities

Table 31: Alarm relay priorities

Function	Description	Values	Code	Short name
Alarm relay	Actual status of output function	0=OFF, 1=ON	u62	u62 Alarm relay
Alarm relay priority	Set which alarm priorities that are to activate the alarm relay: 0=Not used, alarm relay is not used1: High. Alarm with high priority will activate relay2: Medium. Alarms with high or medium priority will activate the alarm relay3: All. All alarms will activate alarm relay	0=Not used, 1=High Priority, 2=Medium priority, 3=All	P41	P41 Al.Rel.Prio
Mute alarm	When muting alarms, the alarm relay will stop signalling the alarm until a new alarm arises	0=OFF, 1=ON	q38	q38 Mute Alarm
High temperature - Priority	Select the priority of the alarms assigned to the alarm group. Be aware - by selecting "Disable", the alarms will not be shown on the display or be routed to the alarm relay or to the network.	0=Disabled, 3=Low, 2=Medium, 1=High	q28	q28 Hi Temp Prio
Low temperature - Priority	Select the priority of the alarms assigned to the alarm group. Be aware - by selecting "Disable", the alarms will not be shown on the display or be routed to the alarm relay or to the network.	0=Disabled, 3=Low, 2=Medium, 1=High	q29	q29 Lo Temp Prio
Sensor errors - Priority	Select the priority of the alarms assigned to the alarm group. Be aware - by selecting "Disable", the alarms will not be shown on the display or be routed to the alarm relay or to the network.	0=Disabled, 3=Low, 2=Medium, 1=High	q30	q30 Sensor Prio
DI alarms - Priority	Select the priority of the alarms assigned to the alarm group. Be aware - by selecting "Disable", the alarms will not be shown on the display or be routed to the alarm relay or to the network.	0=Disabled, 3=Low, 2=Medium, 1=High	q31	q31 DIAlarm Prio
Defrost - Priority	Select the priority of the alarms assigned to the alarm group. Be aware - by selecting "Disable", the alarms will not be shown on the display or be routed to the alarm relay or to the network.	0=Disabled, 3=Low, 2=Medium, 1=High	q32	q32 Defrost Prio
Miscellaneous - Priority	Select the priority of the alarms assigned to the alarm group. Be aware - by selecting "Disable", the alarms will not be shown on the display or be routed to the alarm relay or to the network.	0=Disabled, 3=Low, 2=Medium, 1=High	q33	q33 Misc Prio
Control stopped - Priority	Select the priority of the alarms assigned to the alarm group. Be aware - by selecting "Disable", the alarms will not be shown on the display or be routed to the alarm relay or to the network.	0=Disabled, 3=Low, 2=Medium, 1=High	q35	q35 CtrlOFF Prio

Function	Description	Values	Code	Short name
Leak detection - Priority	Select the priority of the alarms assigned to the alarm group. Be aware - by selecting "Disable", the alarms will not be shown on the display or be routed to the alarm relay or to the network.	0=Disabled, 3=Low, 2=Medium, 1=High	q36	q36 Leak Prio
Compressor - Priority	Select the priority of the alarms assigned to the alarm group. Be aware - by selecting "Disable", the alarms will not be shown on the display or be routed to the alarm relay or to the network.	0=Disabled, 3=Low, 2=Medium, 1=High	q53	q53 Comp. Prio
Condenser - Priority	Select the priority of the alarms assigned to the alarm group. Be aware - by selecting "Disable", the alarms will not be shown on the display or be routed to the alarm relay or to the network.	0=Disabled, 3=Low, 2=Medium, 1=High	q54	q54 Cond. Prio

Miscellaneous

Table 32: Miscellaneous → Access codes

Function	Description	Values	Code	Short name
Access code 3	Access code for local display		o05	o05 Acc. code 3
Access code 2	Access code for local display		o64	o64 Acc. code 2
Access code 1	Access code for local display		P88	P88 Acc. code 1

Table 33: Miscellaneous → Network

Function	Description	Values	Code	Short name
Network status	Quality of the network communication		U45	U45 Comm. status
Network address	Network address of the controller		o03	o03 Unit addr.
Baudrate	Communication speed of network	1=Auto, 2=9600 Baud, 3=19200 Baud, 4=38400 Baud	x96	--- Bus baudrate
Parity and stop bit	Select parity and stop bit of Modbus messages	0=None, 1=Even, 2=Odd	x97	--- Parity bit

Table 34: Miscellaneous → Sensor adjustment

Function	Description	Values	Code	Short name
S3 Air ON evap. A - Adjustment	Correction of sensor signal e.g. due to long sensor cable		r10	r10 Adjust S3
S4 Air OFF evap. A - Adjustment	Correction of sensor signal e.g. due to long sensor cable		r09	r09 Adjust S4
S5 Evaporator A - Adjustment	Correction of sensor signal e.g. due to long sensor cable		r11	r11 Adjust S5

Table 35: Miscellaneous → Factory reset

Function	Description	Values	Code	Short name
Make new factory	With this command you save the controller's actual settings as a new factory setting (the earlier factory settings are overwritten).	0=OFF, 1=ON	o67	o67 Make factory
Reset to factory settings	Command which will revert all controller settings to factory values.	0=OFF, 1=ON	z06	Reset factory

Advanced

Table 36: Advanced → Master control

Function	Description	Values	Code	Short name
Regulation condition A	Readout of the actual control state of the controller.	0=Main switch OFF, 1=Injection start, 2=Superheat ctrl., 3=Fill evap., 4=Defrost, 5=Post defrost, 6=Forced closing, 7=Injection fault, 8=Emergency control, 9=Modulating ctrl., 10=Melt period, 11=Door open, 12=Case cleaning, 13=Cutout, 14=Forced cooling, 15=Shut down	x62	--- Reg. Cond.
MC Actual cut-in temp.			x63	--- Cutin temp.
MC Actual cut-out temp.			x64	--- Cutout temp.
MC Ther. toggle	Master control signal used for switching case load ON/OFF depending on the load condition.	0=No action, 1=Toggle ON, 2=Toggle OFF	x81	--- TherToggle
MC Night setback	Master control signal for changing between day and night time operation.	0=OFF, 1=ON	x06	--- Night setbck
MC Case shutdown	Master control signal used to shut down a case for a time period. During shutdown there will be no alarm monitoring	0=OFF, 1=ON	x17	--- Case shutdwn
MC Forced cooling	Master control signal that will provide forced cooling.	0=OFF, 1=ON	x08	--- Forced cool.

Function	Description	Values	Code	Short name
MC Defrost start	Master control signal for starting a defrost. At adaptive defrost the defrost might be skipped if the defrost is not needed.	0=OFF, 1=ON	x13	--- MC def.start
MC Defrost state	Read out the actual state of the defrost	0=OFF, 1=ON	x14	--- DefrostState
MC Hold after defrost	Master control signal used for co-ordinated defrost control to hold cabinets from returning to normal refrigeration after a defrost until all cabinets have terminated defrost.	0=OFF, 1=ON	x11	--- HoldAfterDef
MC Stop defrost	Master control signal used to prevent a defrost start in a controller.	0=OFF, 1=ON	x12	--- Disable def.
MC Light signal	Master control signal for control of light via a data communication signal from the system manager.	0=OFF, 1=ON	o39	o39 Light remote
MC Actual dewpoint	Master control signal sending the actual measured dewpoint from the system manager to the controller over the network.		x03	--- Act.DewPoint
MC Po load factor			x83	--- Load factor
MC Key/Bluetooth lock	Master control signal that will lock down all Bluetooth data communication and optionally also the operation of the display keys (depend upon selection in P89 Display keyboard lock).	0=OFF, 1=ON	aaa	--- Key/BT Lock
MC Load request	Master control signal used to control the load balance between multiple case controllers on the same suction line		x82	--- LoadReq
MC Force cond. fan	Master control signal for starting condenser fan in plug-in cabinets in order to reclaim heat in the store.	0=OFF, 1=ON	x85	--- Cond. Fan

Fault message

In an error situation the alarm LED on the front will be on and the alarm relay will be activated (depending on priority). If you push the alarm button for 3 seconds you can see the alarm report in the display. (Alarm priorities can be changed. See the Alarm relay priorities.) Here are the messages that may appear:

Table 37: Fault message

Code	Alarm text	Description
E01	Hardware failure	The controller has a hardware failure
E06	Clock lost time	Clock has lost valid time
E25	S3 Air ON evap. A - sensor error	Sensor signal is out of range. Please check the sensor for correct operation
E26	S4 Air OFF evap. A - sensor error	Sensor signal is out of range. Please check the sensor for correct operation
E27	S5 Evaporator A - sensor error	Sensor signal is out of range. Please check the sensor for correct operation
E50	S7 Brine inlet temp. sensor error	Sensor signal is out of range. Please check the sensor for correct operation
E65	S8 Brine outlet temp. sensor error	Sensor signal is out of range. Please check the sensor for correct operation
A01	High temperature alarm A	The alarm temperature has been above the max alarm limit for a longer time period than the set alarm delay.
A02	Low temperature alarm A	The alarm temperature has been below the min alarm limit for a longer time period than the set alarm delay.
A04	Door open alarm	The door has been open for a too long time
A05	Max defrost hold time exceeded	The controller has been waiting longer time than permitted after a co-ordinated defrost.
A15	DI alarm 1	Alarm signal from digital input signal
A16	DI alarm 2	Alarm signal from digital input signal
A19	Compressor safety alarm	Alarm from digital input monitoring function
A45	Main switch set OFF	The controller manin switch has been set to either Stop or Manaual control. Alternatively a digital input set up for "main switch" function, has stopped control
A59	Case in cleaning mode	A case cleaning operation has been started on a case
A93	Speed drive alarm	Alarm from digital input monitoring function
AA3	Refrigerant leak detected	Refrigerant is leaking from the refrigeration system
AA4	S7 Max. brine temp.	The S7 brine temperature has exceeded the set maximum temperature alarm limit
a04	Wrong IO configuration	Inputs and outputs have not been configured correctly
Z01	Max defrost time exceeded A	The last defrost cycle has stopped on time instead of set temperature

NOTE:

Data communication

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

Operating status

Table 38: Operating status

Ctrl. State/ Code	Operating status	Description
	Push the info button for 3 seconds to see status. If there is a status code, it will be shown on the display. The individual status codes have the following meanings:	
S0	Normal ctrl.	The controller is running normal control. There is no other control taking priority
S1	Hold after defrost	The controller is waiting for other controllers to terminate coordinated defrost
S2	Min ON timer	The compressor is restricted from stopping until the minimum ON timer expires
S3	Min OFF timer	The compressor is restricted from starting until the minimum OFF timer expires
S4	Drip off	The defrost has terminated and the controller is waiting for drip delay to expire, while the water is dripping off the evaporator
S10	Main switch OFF	The controller has been stopped because the parameter r12 Main switch has been set in OFF or Service position or the controller has been stopped via Main switch function on DI input
S11	Thermostat cut-out	The air temperature has reached the thermostat cut-out value
S12	Frost protection S4	The air off temperature is below the minimum S4 frost limit (r98, S4 frost protection)
S14	Defrost	The controller is running a defrost cycle
S15	Fan delay	The evaporator fans are waiting to start after a defrost cycle (d07, Fan start delay and d08, Fan start temperature)
S17	Door open	DI signal indicates that the cold room door is open
S18	Melt period	The controller has stopped refrigeration for a short while to turn ice crystals into water and thereby improve air flow through the evaporator
S19	Modulating temp. control	The air temperature is controlled close to the set point via a modulating temperature control
S20	Emergency control[1]	The air temperature is controlled according to an emergency procedure due to sensor error (Pe, S2, S3 or S4)
S25	Manual control	Main switch has been set in Service position for manual control of outputs
S29	Case cleaning	A case cleaning operation has been initiated via parameter o46 Case cleaning mode or via a signal on a digital input or via the AK-CC55 Connect app
S30	Forced cooling	The thermostat has been overruled to run forced cooling via a signal on a digital input
S32	Power-up delay	The controller has just been powered up and the output control is waiting for the power-up delay to expire (parameter o01, Delay of outputs at power-up)
S33	Air heating	The air heater is energized in order to raise the air temperature (parameters r62, Air heater neutral zone and r63, Air heater start delay)
S34	Compressor safety cut-out	The compressor has been cut-out via its safety chain
S45	Shut down controller	The control has been stopped due to a digital input signal or from the system manager
S50	High S7 brine inlet temperature	The S7 brine inlet temperature on the condenser has violated the max. alarm limit

[1] Emergency control:
- If the thermostat air sensor fails, the compressor will operate with the set emergency on/off duty times. For variable speed compressor/ pump it will operate with the set emergency speed level.

Product specification

Technical data

Electrical specifications

Table 39: Electrical specifications

Electrical data	Value
Supply voltage AC [V]	115 V / 230 V, 50/60 Hz
Power consumption [VA]	5 VA
Power ON indicator	Green LED
Electrical cable dimensioning [mm²]	Max.1.5 mm² multi-core cable

Sensor and measuring data

Table 40: Sensor and measuring data

Sensor and measuring data	Value
Sensor S3, S4, S5, S7, S8	Pt 1000 AKS11 PTC 1000 EKS111 NTC5K EKS211 NTC10K EKS221 sensor (All 5 must be of the same type)
Temperature measuring accuracy	Pt1000: -60 – 120 °C. ±0.5 K PTC1000: -60 – 80 °C. ±0.5 K NTC5K: -40 – 80 °C. ±1.0 K NTC10K: -40 – 120 °C. ±1.0 K
Pt1000 sensor specification	±0.3 K at 0 °C ±0.005 K per degree

Input and output relay specifications

Table 41: Input and output relay specifications

Input and output relay specifications	Input/output	Description
Digital input	DI1 DI2	Signal from dry contact functions Requirements to contacts: Gold plating Cable length must be max. 15 m Use auxiliary relays when the cable is longer Open loop: 12 V (SELV) Contact 3.5 mA
Relays	DO1 DO2 DO3 DO4 DO5	115 V / 230 V AC Load max.: CE. 8 (6)A UL. 8A res. 3FLA 18LRA Load min.: 1VA Inrush: DO2 DO3 DO4 TV-5 80A
Analogue output	AO1	0 – 10 V DC, Max. 2 mA Frequency, 10 – 500 Hz, Max. 2 mA PWM, 0/10V Pulse Width Modulated (100 – 500 Hz), Max. 2 mA PWM Rail heat: 4 – 60 s. period time, Max. 15 mA

NOTE:

- DO1 – DO5 are 16 A relays.
- Max. load must be observed.
- DO2 / DO3 / DO4 is recommended for load with high inrush current e.g. EC Fan and LED light.
- All relays are sealed for use with flammable refrigerant like Propane R290.
- Compliance with EN 60 335-2-89: 2010 Annex BB.

Function data

Table 42: Function data

Function data	Value
Display	LED 3 digit
External display, AK-CC55 Water Loop	1 external display
External display connection	RJ12
Max. display cable length [m]	100 m

Function data	Value
Data communication built-in	MODBUS
Clock battery backup power reserve	4 days
Mounting	DIN rail

Environmental conditions

Table 43: Environmental conditions

Environmental conditions	Value
Ambient temperature range, operating	0 – 55 °C
Ambient temperature range, transport	-40 – 70 °C
Enclosure rating IP	IP20
Relative humidity range [%]	20 – 80%, non-condensing
Shocks/Vibrations	No shocks and vibrations allowed

Dimensions

Measurements are in mm.

Figure 63: AK-CC55 Water Loop

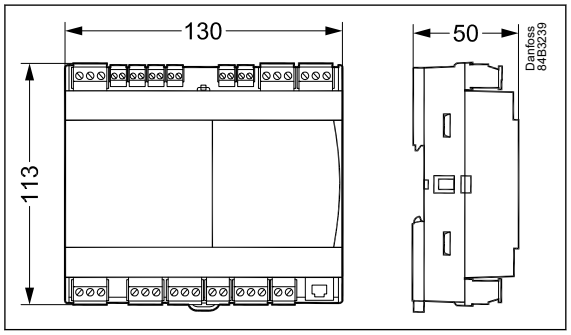
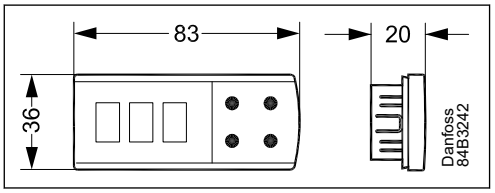


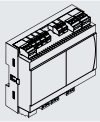
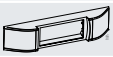
Figure 64: AK-CC55 Set



Ordering

The list contains the components that make up an AK-CC55 Water Loop setup. For other Danfoss products mentioned in the document, such as sensors and valves, refer to relevant product documentation.

Table 44: Ordering

Type	Symbol	Function	Code no.
AK-CC55 Water Loop		Case controller for plug-in and semi plug-in cabinets	**084B4058**
AK-UI55 Info		External display	**084B4077**
AK-UI55 Bluetooth		External display with Bluetooth operation	**084B4075**
AK-UI55 Set		External display with control buttons	**084B4076**
AK-UI55 Mounting Base		Mounting kit for display types: AK-UI55 Set, AK-UI55 Bluetooth, AK-UI55 Info	**084B4099**
AK-UI cable		External display cable with RJ12 connector. 3 m	**084B4078**
AK-UI cable		External display cable with RJ12 connector. 6 m	**084B4079**
MMIMYK		Gateway between AK-CC55 and PC installed with KoolProg software	**080G0073**

Certificates, declarations, and approvals

The list contains all certificates, declarations, and approvals for this product type. Individual code number may have some or all of these approvals, and certain local approvals may not appear on the list.

Some approvals may change over time. You can check the most current status at danfoss.com or contact your local Danfoss representative if you have any questions.

Table 45: Controller

Control	Certification	Mark	Country
Water Loop	EMC/LVD/RoHS	CE	EU
Water Loop	UL recognized	cURus	NAM (US and Canada)
Water Loop	ACMA (EMC)	RCM	Australia/New Zealand
Water Loop	LVE/EMC/RoHS	EAC	Russia, Kazakhstan, Belarus
Water Loop	LVD/EMC/RoHS	UA	Ukraine

Table 46: Display module

Display module	Certification	Mark	Country
AK-UI55 Bluetooth	RED	CE	EU
AK-UI55 Bluetooth	FCC	FCC ID	USA
AK-UI55 Bluetooth	IC (ISED)	IC ID	Canada
AK-UI55 Bluetooth	CMIIT	CMITT ID	China
AK-UI55 Bluetooth	ACMA (EMC/Wireless)	RCM	Australia
AK-UI55 Bluetooth	RSM (EMC/Wireless)	RCM	New Zealand
AK-UI55 Bluetooth	EMC/LVD/Wireless	UA	Ukraine
AK-UI55 Bluetooth	Anatel	ID: 04034-21-10104	Brazil
AK-UI55 Info	EMC/LVD	UA	Ukraine
AK-UI55 Info	ACMA (EMC)	RCM	Australia
AK-UI55 Info	RSM (EMC)	RCM	New Zealand
AK-UI55 Info	RoHS	EAC	Russia, Kazakhstan, Belarus
AK-UI55 Set	EMC/LVD	UA	Ukraine
AK-UI55 Set	ACMA (EMC)	RCM	Australia
AK-UI55 Set	RSM (EMC)	RCM	New Zealand
AK-UI55 Set	RoHS	EAC	Russia, Kazakhstan, Belarus

Controllers/displays/option module:
CB certificate including all deviation according to IEC 60730-1 and 2-9

Statements for the AK-UI55 Bluetooth display

FCC COMPLIANCE STATEMENT

⚠ CAUTION:

Changes or modifications not expressly approved could void your authority to use this equipment This device complies with Part 15 of the FCC Rules. Operation to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

INDUSTRY CANADA STATEMENT

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

ENGINEERING
TOMORROW

Online support

Danfoss offers a wide range of support along with our products, including digital product information, software, mobile apps, and expert guidance. See the possibilities below.

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