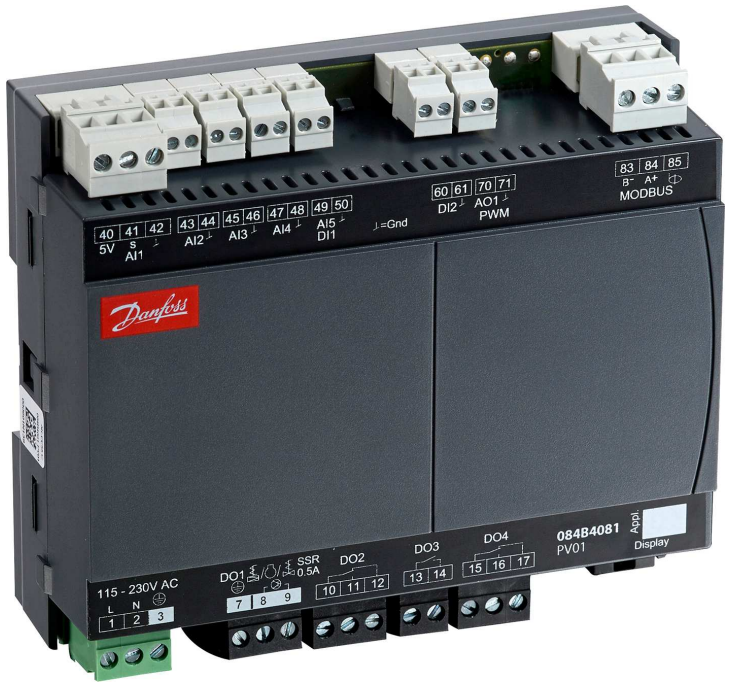
User guide



Case/room controller (EEV)

AK-CC55 Compact

SW ver. 2.3x

For refrigeration appliances and cold storage rooms

Contents

Introduction

Overview

Application
Refrigeration appliance control with great flexibility to adapt to refrigeration appliances and cold storage rooms.

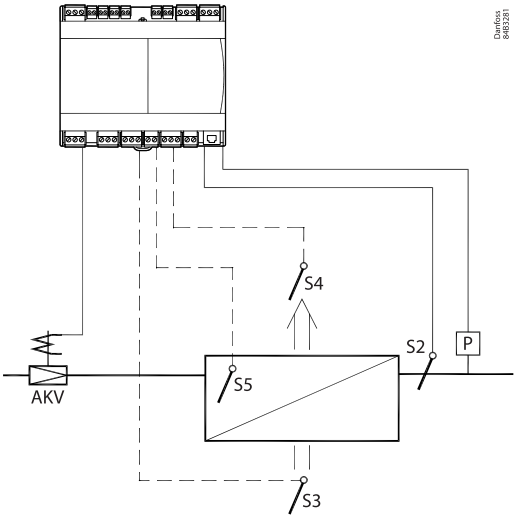
Advantages:
- Control of Thermostatic Expansion Valve (TEV) and Electronic Expansion valve(EEV) applications
- Quick set-up with predefined settings
- Easy configuration and service using a mobile app with Bluetooth
- Adaptive Minimum Stable Superheat (MSS) control is performed with lowest possible superheat
- Allows the suction pressure to be raised several degrees
- Adaptive Liquid Control (ALC) can be performed with superheat down to 0 degrees on transcritical CO_2 systems with liquid ejectors

Principle
The temperature in the appliance is registered by one or two temperature sensors which are located in the air flow before the evaporator (S3) or after the evaporator (S4) respectively. A setting for thermostat, alarm thermostat and display reading determines the influence the two sensor values should have for each individual function.

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

In addition to the output of the electronic AKV injection valve, the controller has relay outputs which are defined by the application setting.

Figure: AK-CC55 with evaporator, AKV valve and sensor positions



Ordering code

Product code numbers

Type	Function	Packing format	Quantity per packing format	Code number
AK-CC55 Compact	TXV/AKV, Pe, 3 Relays	Single pack	1	084B4081
AK-CC55 Compact	TXV/AKV, Pe, 3 Relays	Industrial pack	12	084B4181

Accessories code numbers

084B4198

Electron. control accessories, AK-UI55 6m Cable I-Pack

AK-UI55 6m Cable I-Pack, Packing format: Industrial pack, Quantity per packing format: 24

Related products

084B4081 084B4181

084B4194

AK-UI55 Set

Function: Remote Display, Packing format: Industrial pack, Quantity per packing format: 24

Related products

084B4081 084B4181

084B4078

Electron. control accessories, AK-UI55 3m Cable M-Pack

AK-UI55 3m Cable M-Pack, Packing format: Multi pack, Quantity per packing format: 24

Related products

084B4081 084B4181

084B4079

Electron. control accessories, AK-UI55 6m Cable M-Pack

AK-UI55 6m Cable M-Pack, Packing format: Multi pack, Quantity per packing format: 24

Related products

084B4081 084B4181

080G0073

Programming key, MMIMYK

Function: Programmable Controller, Supply voltage [V] AC: 24, Communication type: TTL; CANBUS; RS485; MODBUS, Packing format: Single pack, Quantity per packing format: 1

Related products

084B4081

084B4077

AK-UI55 Info

Function: Remote Display, Packing format: Multi pack, Quantity per packing format: 30

Related products

084B4081 084B4181

084B4196

Electron. control accessories, AK-UI55 3m Cable I-Pack, AK-UI55

AK-UI55 3m Cable I-Pack, Used for product: AK-UI55, Packing format: Industrial pack, Quantity per packing format: 24

Related products

084B4081 084B4181

084B4076

AK-UI55 Set

Function: Remote Display, Packing format: Multi pack, Quantity per packing format: 30

Related products

084B4081 084B4181

084B4195

AK-UI55 Info

Function: Remote Display, Packing format: Industrial pack, Quantity per packing format: 24

Related products

084B4081 084B4181

084B4193

AK-UI55 Bluetooth

Function: Remote Display, Communication type: Bluetooth, Packing format: Industrial pack, Quantity per packing format: 24

Related products

084B4081 084B4181

084B4099

Electron. control accessories, AK-UI55 Mounting Base S/M-pac

AK-UI55 Mounting Base S/M-pac, Packing format: Multi pack, Quantity per packing format: 16

Related products

084B4081 084B4181

084B4075

AK-UI55 Bluetooth

Function: Remote Display, Communication type: Bluetooth, Packing format: Multi pack, Quantity per packing format: 30

Related products

084B4081 084B4181

084B4189

Electron. control accessories, Conn.bag for Compact I-pack, AK-CC55 Compact

Conn.bag for Compact I-pack, Used for product: AK-CC55 Compact, Packing format: Industrial pack, Quantity per packing format: 48

Related products

084B4181

Product overview

Product portfolio

The AK-CC55 portfolio contains four controllers with different functionalities and application settings, as outlined in the table.

	AK-CC55 Compact	AK-CC55 Single Coil	AK-CC55 Single Coil UI	AK-CC55 Multi Coil
Product image				
Valve	1 x TXV or AKV	1 x AKV	1 x AKV	3 x AKV
Digital Output	3	5	5	4
Digital input	1(2)	3 (2)	3 (2)	3 (2)
Analogue Output	1	1	1	1
Analogue Input	5(4)	6 (7)	6 (7)	6 (7)
Display	1 remote	2 remote	1 remote + 1 Integrated	2 remote
Comm. module	Modbus	Modbus	Modbus	Modbus
Optional comm. module		LON module	LON module	LON module

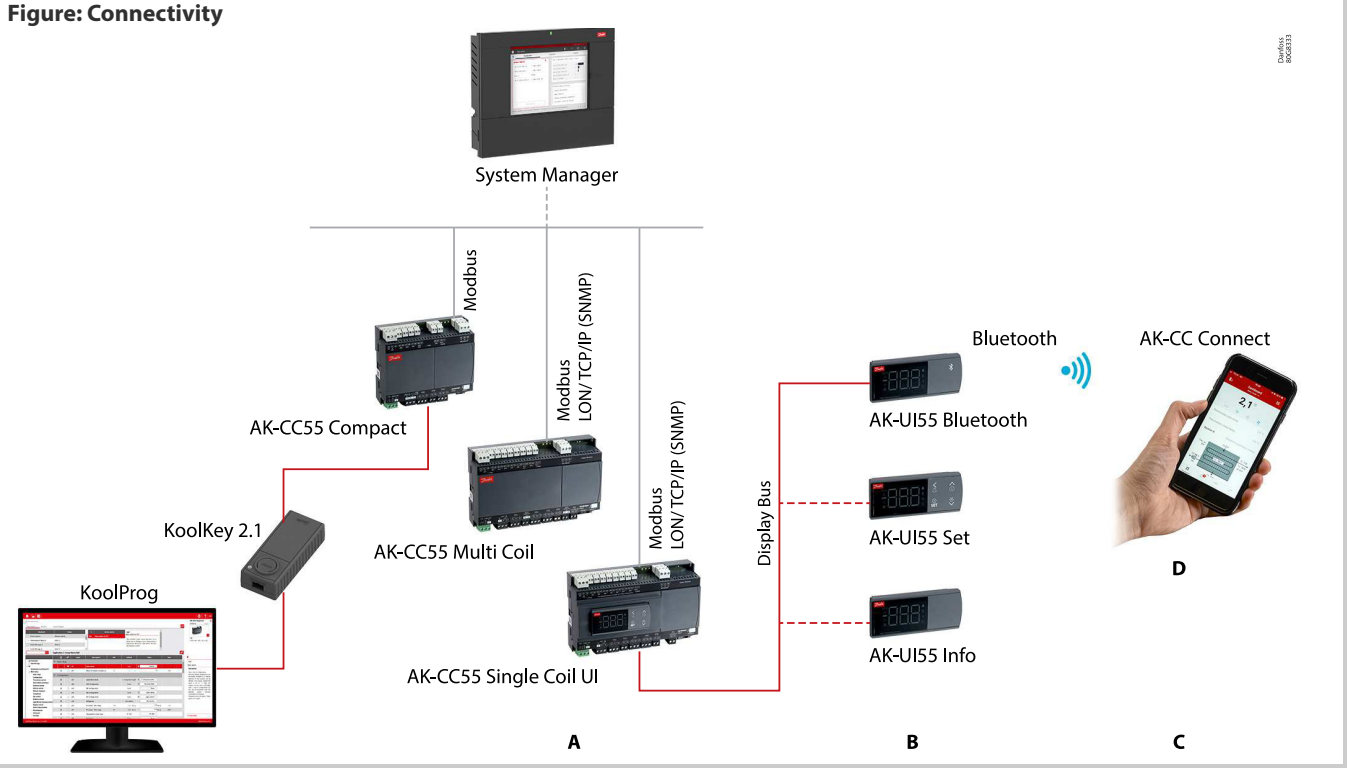
Function overview

Application	Compact	Single Coil Single Coil UI	Multi Coil
AKV - application (electrically operated expansion valve)	x	x	x
0 – 10 V to control external stepper driver	x	x	
TXV - application (thermostatic expansion valve + solenoid valve or compressor)	x		
Remote hot gas - application		x	
One valve, one evaporator, one refrigeration section	x	x	x
One valve, one evaporator, two refrigeration sections		x	
One valve and two evaporators, two refrigeration sections		x	
Two valves and two evaporators (same refrigeration section)			x
Three valves and three evaporators (same refrigeration section)			x
Custom configuration of relay outputs	x	x	
Two compressors	x	x	
Heating function	x	x	
Control of air humidity		x	x
Variable fan speed		x	
Adaptive superheat	x	x	x
Adaptive liquid control (zero superheat control for transcritical CO_2 systems with liquid ejectors)	x	x	x
Adaptive defrosting		x	
Product sensor		x	
Oil recovery		x	
RS485 Lon, option (AK-OB55)		x	x

Connectivity

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

Figure: Connectivity



A	Case controller	**C**	Service App
B	Remote display	**D**	Smart device (iOS or Android)

Data communication

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

AK-CC55 Compact

Compact version for controlling one evaporator.

An application mode setting will configure inputs and outputs for the desired use. There are nine applications to choose from. Regulation is performed using a TXV in combination with a liquid line solenoid valve, controlling a compressor or an AKV expansion valve.

AK-CC55 Compact is without display, and can be extended with one external display (see figures below).

Figure: AK-CC55 Compact

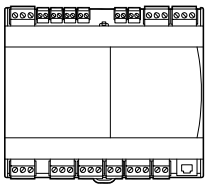
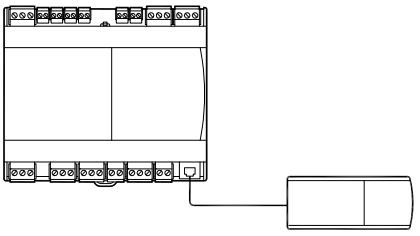


Figure: AK-CC55 Compact with external display



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-CC Connect app.

AK-UI55 Info	AK-UI55 Set	AK-UI55 Bluetooth
		

Functions

Controller functions

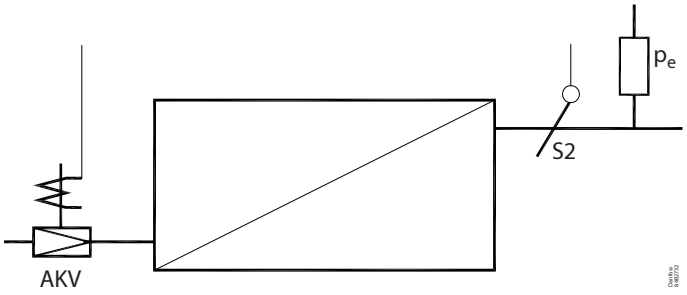
- Day/night thermostat with ON/OFF or modulating principle
- Switch between thermostat settings via digital input
- Adaptive superheat control
- Adaptive liquid control
- Modulating PWM control of brine valve
- Precise temperature control via variable speed compressor
- Variable speed control via voltage (0 – 10 V), frequency or PWM signal
- Start of defrost via schedule, digital input, network or setting display
- Natural, electric, simple hot gas, or warm brine 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 two compressors
- 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)
- Support of user defined temp. sensor type
- Integrated Modbus communication

Injection control

Adaptive superheat control

Liquid injection in the evaporator is controlled by an electronic injection valve of the type AKV. The valve operates as both expansion valve and solenoid valve. The controller opens and closes the valve based on sensor readings.

Figure: Adaptive superheat control with AKV valve



The superheat is measured via a pressure sensor Pe and temperature sensor S2. By using a pressure sensor, and temperature sensor a correct measurement of superheat is achieved under all conditions which ensures a very robust and precise control. The signal from one pressure transmitter can be shared by max. 10 controllers, but only if there is no significant pressure difference between the evaporators in question.

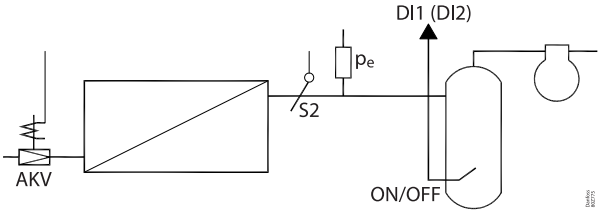
The function contains an adaptive algorithm which independently adjusts the valve's opening so that the evaporator constantly supplies optimum amount of refrigerant.

Adaptive liquid control

Adaptive liquid control is used in transcritical CO_2 ejector systems, which allow liquid flow. When adaptive liquid control is initiated, the superheat of the evaporator will be minimized so that a controlled amount of liquid is present at the outlet of the evaporator.

This type of control requires that the controller receives an on/off signal from (for example) a suction accumulator in the suction line.

Figure: Adaptive liquid control with AKV valve



A level switch in the tank will register when the liquid level exceeds the max. level. When this happens, the controller will switch to dry expansion, and then back to liquid control when the liquid level has dropped. The function is defined in setting o02, o37 or o84.

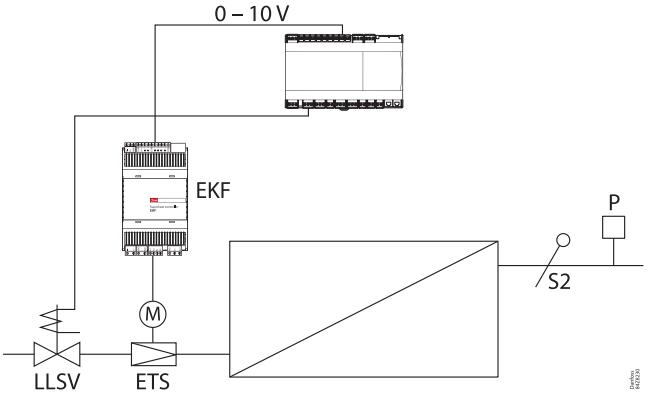
The function can also be activated via data communication from a system unit. If the adaptive liquid control signal is lost, the controller will automatically switch back to dry expansion.

⚠ Warning:
Accidental actuation may allow liquid throughput to the compressor. It is the installer's responsibility to ensure that signal loss to the controller will not result in liquid throughput to the compressor. Danfoss accepts no responsibility for damage resulting from inadequate installation.

Liquid injection by use of stepper valve

Stepper valve control is only supported in application mode 5 – 9.
Instead of AKV, an external stepper driver can be connected to AO1 (0 – 10 V) to drive a stepper valve. DO1 (AKV output) is then configured to close a liquid line solenoid valve (LLSV) when the stepper valve output is 0%. The LLSV is also closed at power failure.

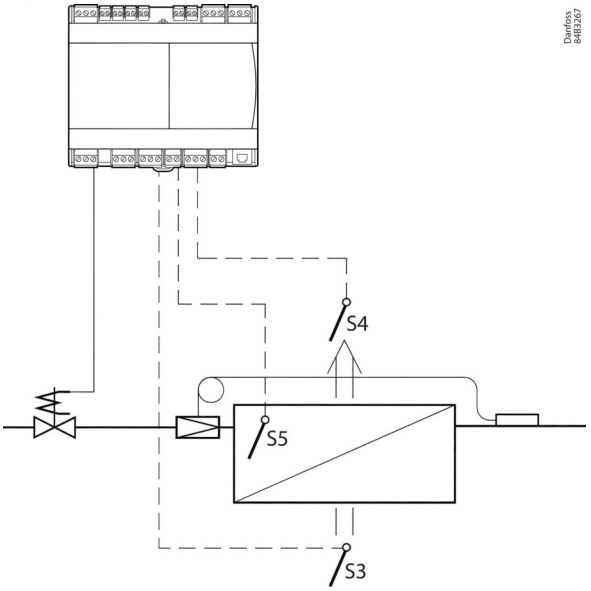
Figure: Injection control via step motor valve and liquid line solenoid valve (LLSV)



Thermostatic expansion valve control

In the compact version the refrigeration (injection) can be controlled either by starting/stopping a compressor or by opening/closing a solenoid valve in the liquid line.

Figure: AK-CC55 Compact with evaporator, solenoid valve, expansion valve and sensor positions



Brine control

When changing from ON/OFF control to modulating control in TXV applications, a solenoid valve can be PWM controlled with a set period time from 30 – 900 sec. A number of additional brine control parameters are available in the injection control menu. When brine control is enabled, a dedicated brine defrost can also be set up in order to force open the brine valve while defrosting.

Temperature control

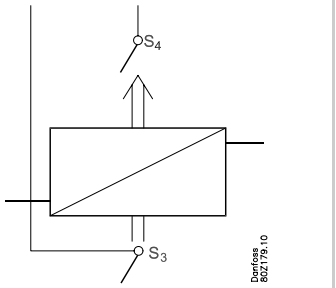
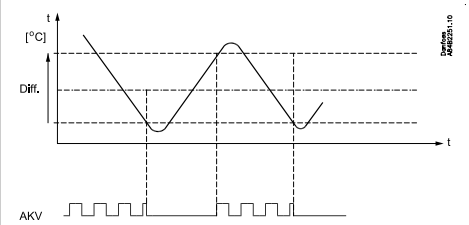
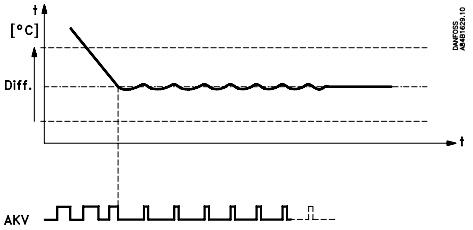
The temperature in the appliance is registered by one or two temperature sensors which are located in the return air before the evaporator (S3) or after the evaporator (S4) respectively. A setting for the thermostat, night thermostat, alarm thermostat and display reading determines how much the two sensor 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:

- As an ordinary ON/OFF regulation with a differential, or
- As a modulating control where the temperature variation will not be nearly as high as in ON/OFF control.

There is, however, a limit to the use of a modulating control as it can only be used in remote cabinets. It is not recommended to use modulating thermostat control in low temperature applications. In applications with one evaporator and one compressor, the thermostat function with ON/OFF control should be selected. In remote cabinets, the thermostat function may either be selected for ON/OFF control or modulating control.

Table: Control methods

	ON/OFF control	Modulating control
		

Temperature monitoring

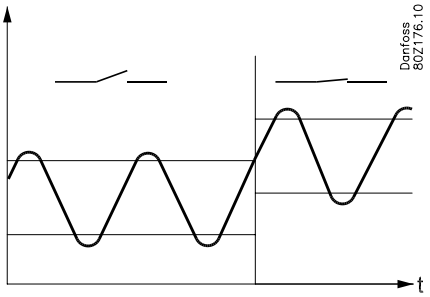
Just as is possible for the thermostat, the alarm monitoring can be set with a weighting between S3 and S4 so that you can decide how much the two sensor values should influence the alarm monitoring. Minimum and maximum limits can be set for alarm temperature and time delays. A longer time delay can be set for high temperature 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: Thermostat band function with two different band settings



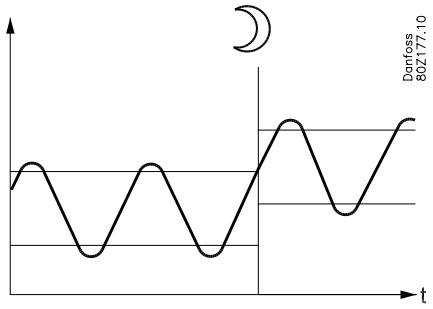
Night setback of thermostat value

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: Thermostat band function with night setback



Night event schedule

Two daily scheduled events can be defined and associated to different weekdays. For each event, the user shall be able to define a time for opening of the store (daytime) and a time for closing of the store (Night-time). Besides these two scheduled events, the user can select pre-defined events for a full day closed and a full day open.

For each weekday, the user shall be able to define which event that applies to the weekday in question - either "Open all day", "Closed all day", "Event 1" or "Event 2".

Table: Night event schedule

Parameter	Value	Description
t58 Event 1 day	0 – 23 hours	Event 1 - Start of daytime - hours
t59 Event 1 day	0 – 59 min	Event 1 - Start of daytime - minutes
t60 Event 1 day	0 – 23 hours	Event 1 - Start of night-time - hours
t61 Event 1 day	0 – 59 min	Event 1 - Start of night-time - minutes
t62 Event 2 day	0 – 23 hours	Event 2 - Start of daytime - hours
t63 Event 2 day	0 – 59 min	Event 2 - Start of daytime - minutes
t64 Event 2 day	0 – 23 hours	Event 2 - Start of night-time - hours
t65 Event 2 day	0 – 59 min	Event 2 - Start of night-time - minutes
t66 Monday event	0: Open all day 0: Open all day 1: Closed all day 2: Event 1 3: Event 2	Select event for Monday
t67 → t72	As above	Select daily events for Tuesday to Sunday

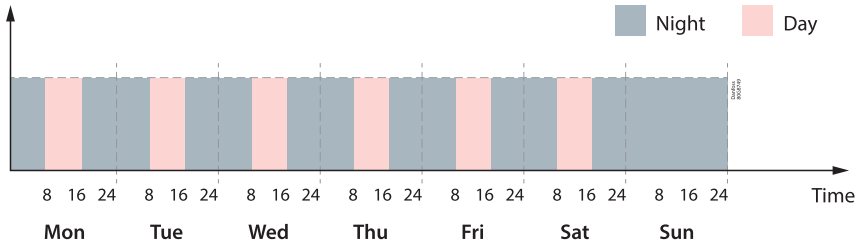
Example:
Event 1
Daytime 08:00
Night-time 16:00

Event 2
Daytime 09:00
Night-time 20:00

Monday to Friday: Event 1
Saturday: Event 2
Sunday: Night all day

Based on the above, the weekly night schedule will be as shown in the figure below.

Figure: Weekly night schedule based on defined events



Temperature sensor types

The S2 and S6 sensors always have to be Pt1000 sensors due to the high measuring accuracy.

For the S3, S4 and S5 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

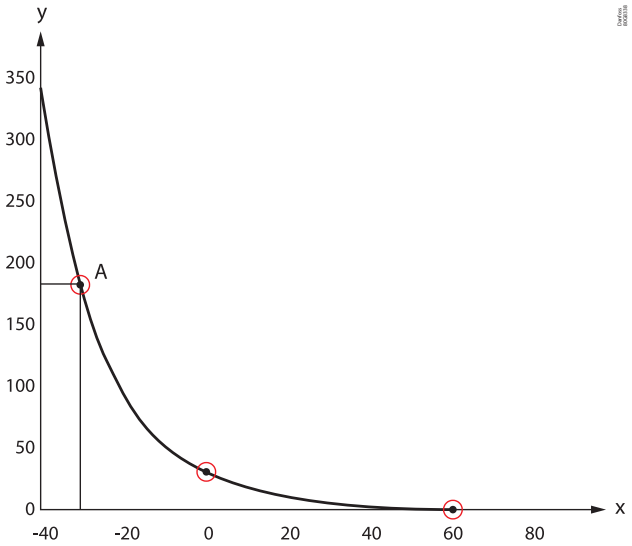
If "User-defined" is selected, three sensor measuring points must be provided and based on these three sensor points, a sensor characteristic is generated.

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: Example of sensor points from a NTC sensor



x	Temp [°C]
y	R [kΩ]
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.

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 phases:
1. At the first activation, the refrigeration is stopped, but the fans keep on operating in order to defrost the evaporators. "Fan" is shown on the display.
2. At the second activation, the fans are also stopped and the appliance can now be cleaned. "OFF" is shown on the display.

3. At the third activation, refrigeration is recommenced. The display will show the actual appliance temperature, o97 setting.

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: Appliance cleaning function

-	+	+	°C
1	÷	+	Fan
2	÷	÷	Off
3	+	+	°C

Appliance shutdown

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

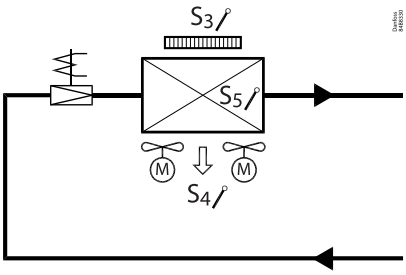
Defrost control

The following defrost methods can be selected:
0: None
1: Electrical
2: Hot gas defrost (simple)
3: Brine defrost
4: Natural
5. Electrical pulsing heaters

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: Electrical defrosting



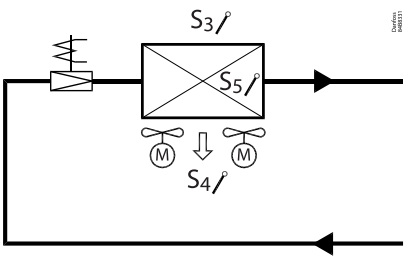
Simple hot gas defrosting

If hot gas defrost is selected in application 1-5, the compressor will be running during defrost and a hot gas valve (HGV) is bypassing the compressor discharge gas to the evaporator inlet and thereby the evaporator is defrosted.

Natural defrost

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

Figure: Natural defrost

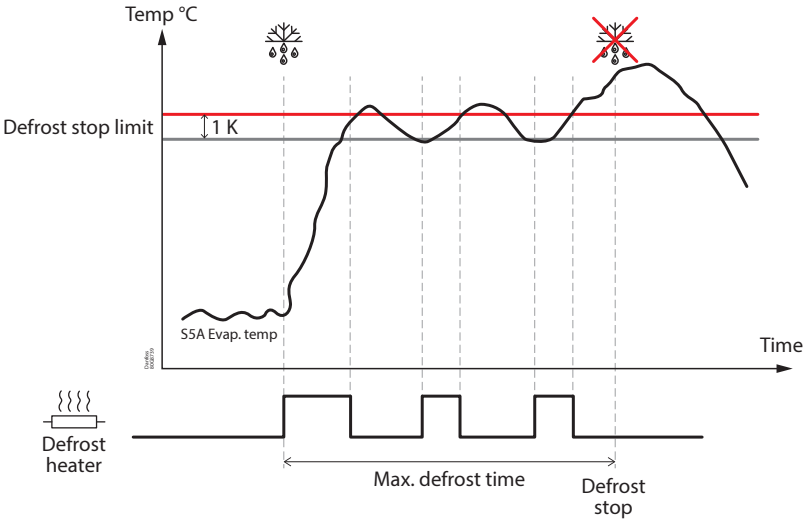


Electrical defrost with pulsing heaters

During the defrost state, the electrical heaters will be kept ON, until the defrost stop sensor reaches the set defrost stop limit. At this point in time the defrost heaters will be switched OFF. If the temperature of the selected defrost stop sensor decreases 1K below the set defrost stop limit, the defrost heaters will be switched ON again and kept ON until the defrost stop sensor reaches the defrost stop limit once again whereby the heaters are switched OFF.

This pattern is repeated until the max defrost time has expired whereby the active defrost state is terminated and the defrost sequence continues with the next defrost state - please refer to the figure below.

Figure: Electrical defrost with pulsing heaters



Start of defrost

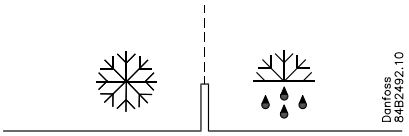
A defrost can be started in different ways:

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: Defrost start



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

Max. thermostat runtime:
When the aggregate time 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
- S4A temperature (with time as safety)
- S5A temperature (with time as safety)
- S5A and S5B temperatures (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.

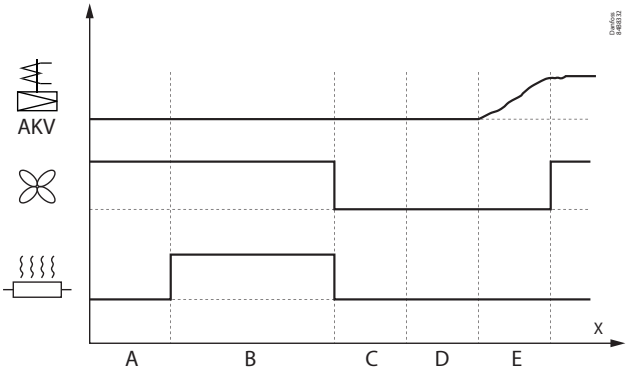
To prevent this, the user is given the option of setting a minimum defrost time. When a defrost is initiated, it will have to run for the set minimum time even if the set defrost stop limit has been reached by the selected defrost stop sensor.

Defrost sequence

When a defrost is initiated, the controller will run through the following sequence:

1. **Pump down:** where the evaporator is emptied of refrigerant
2. **Defrost:** where the ice on the evaporator is melted
3. **Hold after defrosting:** where multiple controllers wait for each other (coordinated defrost)
4. **Drip off:** where remaining water is dripping off evaporator
5. **Drain delay (Hot gas only):** where the drain valve is opened to drain the liquid refrigerant
6. **Fan delay:** where the fans are restarted when the remaining water on the evaporator has turned into ice

Figure: Electrical defrost sequence



x	Time
A	Pump down
B	Defrost
C	Hold
D	Drip
E	Fan delay

During an electrical defrost sequence where the defrost heater is ON during defrost, AKV valve is closed and fans are running during defrost but stopped during drip.

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 in 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 in 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

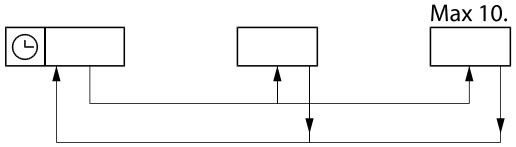
The controller has a built-in real-time clock which can be used to start defrosts. This clock has a power reserve of four days.

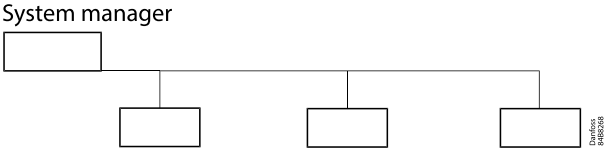
If the controller is equipped with data communication, the clock will automatically be updated from a Danfoss system manager.

Coordinated defrost

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

Figure: 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 all are in waiting position there will be a change-over to refrigeration.

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 every controller in the group is in a waiting position, refrigeration is again permitted in all the individual controllers.

Melt function

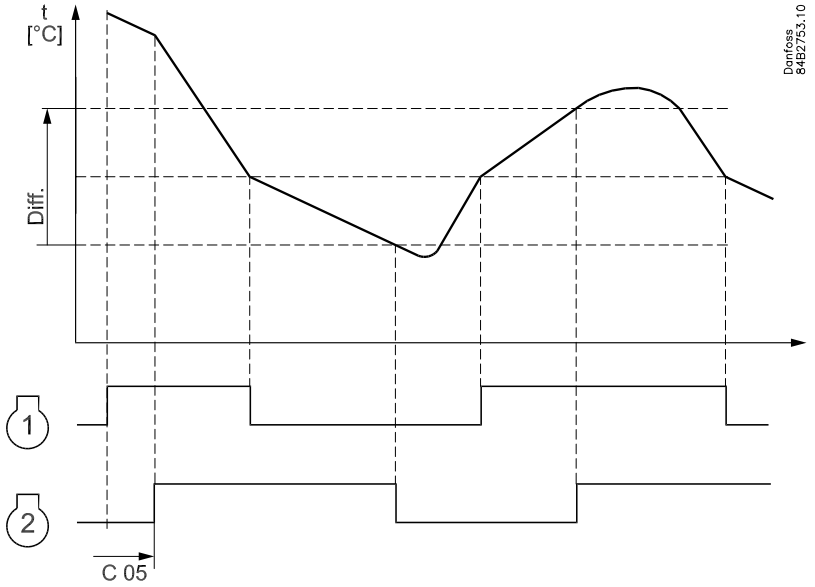
This function will prevent the air flow in the evaporator from being reduced by frost created by uninterrupted operation for a long time.

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.

Control of two compressors (only with custom set-up)

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

Figure: 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.
The compressor's settings for "Min. On time" and "Min. Off time" will always have top priority during normal regulation. But if one of the override functions is activated, like e.g. defrost, door open function, case shutdown, forced closing, the "Min. On time" will be disregarded.

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.

Thermostat band
In thermostat band 2, it is possible to disable the operation of the second compressor.

Variable speed compressor

Variable speed compressor is only supported in application modes 1 – 4 with TXV valve.
Variable speed control is enabled when the analogue output AO1 is configured for a variable speed compressor. The speed of the VSC will be controlled via a frequency signal on AO1. The speed of the VSC compressor will be controlled, so that the air temperature is kept at the mid-point between the cut-out and cut-in value.

Variable speed signal

The speed control signal is provided via the analogue output AO1 and it can be set up for:

- Voltage signal
- Frequency signal
- PWM signal

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.

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: Oil return management for variable speed compressor

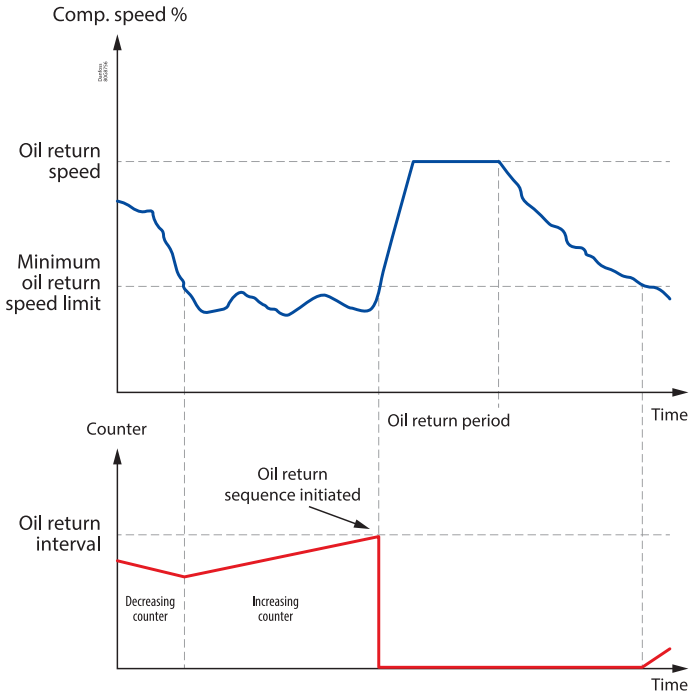


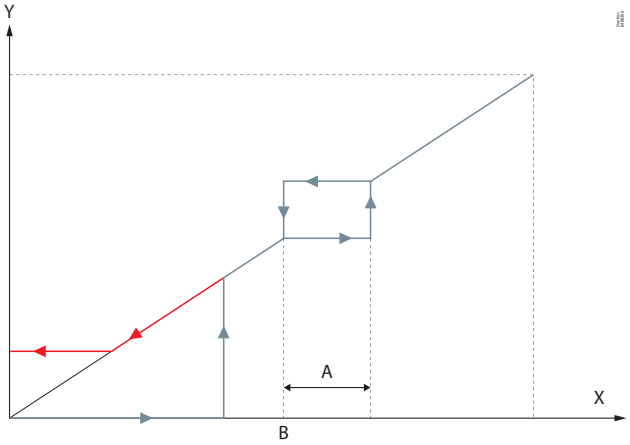
Table: Oil return management

Parameter	Value	Description
P79 Oil return speed	P77 – 100%	Speed at oil return cycle – in percentage of max speed
P80 Oil return time period	10 – 600 s	Duration of oil return cycle
P77 Oil return speed limit	0 – 100%	When the speed is below, the oil return counter increases When the speed is above, the oil return counter decreases
P78 Oil return interval	5 – 720 min.	When oil return counter reaches this value, an oil return cycle is initiated

Resonance band

Speed control can cause mechanical resonance vibrations to occur in the system and thereby create irritating noise. To prevent this, the speed control 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: Resonance curve



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

Table: Resonance band

Parameter	Value	Description
P39 Resonance band start	0 – 100%	Speed at start of resonance band - set in percentage of max speed
P40 Resonance band	0 – 15%	Width of resonance band

Compressor anti cycle timers

The compressor anti cycle timer function applies to each compressor in a given compressor configuration. If a compressor is started, it has to run for a set minimum ON time. If a compressor is stopped, it has to be at standstill for a set minimum OFF time.

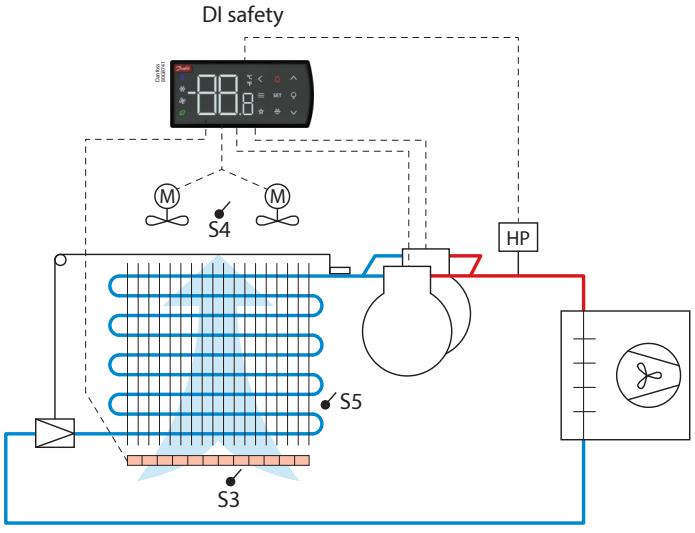
Table: Compressor anti cycle timers

Parameter	Value	Description
c01 Min ON time	0 – 30 min.	Minimum time a compressor shall run once started
c02 Min OFF time	0 – 30 min.	Minimum time a compressor shall stand still once stopped

Compressor safety monitoring

The safety chain of the compressor 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.

Figure: Safety monitoring of compressor via digital input



Semi-automatic safety protection and lockout of compressor

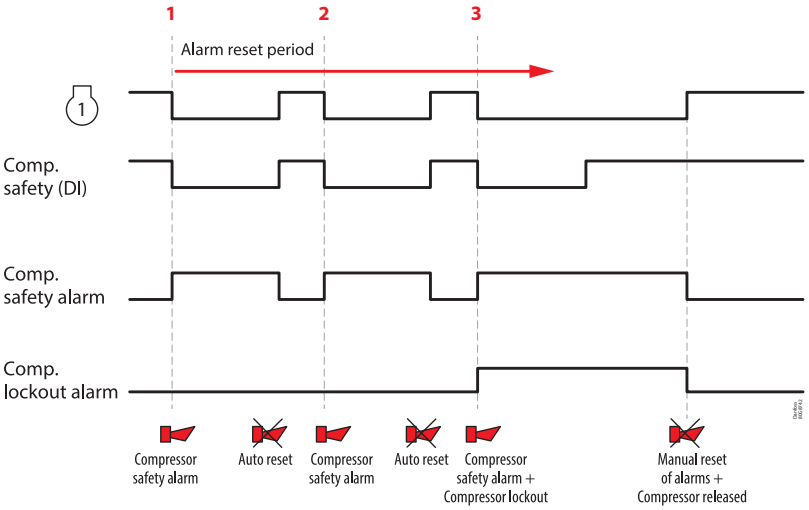
Normally alarms are reset automatically when an alarm condition is cleared. However, if the semi-automatic reset option is enabled for the compressor safety monitoring via DI, then the associated alarm will be reset automatic when the alarm condition is "False" (DI input is closed) unless it is raised more than a max defined number of times within a defined period of time, whereby the compressors are locked out and prevented from starting. At this point in time, also a "Compressor lockout" alarm is generated, and a clearance of the safety alarm and the lockout alarm shall require a manual reset action.

The maximum no. of alarms that are allowed to be raised before a manual reset is required can be defined. Please refer to example below where the max no. of compressor safety alarms is defined as 2 within a set alarm reset period. When the alarm is raised the third time a compressor lockout alarm is generated, and a manual reset is required to reset the safety alarm and the lockout alarm and release the compressor for a new start-up.

Table: Semi-automatic safety protection

Parameter	Value	Description
P92 Safety action	0: None 1: Lights off	Select the action taken if repeated condenser block alarms result in lockout of compressors
P93 Safety event period	0 – 120 min	Time period for counting maximum number of allowed safety events for compressor safety and condenser block safety
P94 Max safety events	0 – 20	The maximum of repeated compressor safety and condenser block safety events before the compressors are lockout
--- Alarm reset	ON/OFF	Network parameter for resetting safety lockout alarm

Figure: Semi-automatic reset and lockout of compressor operation



The safety lockout alarm can be reset in one of the following ways:

- Putting main switch in OFF position
- Powering down the controller
- Via network parameter
- By a long press on display alarm button while in alarm menu

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.

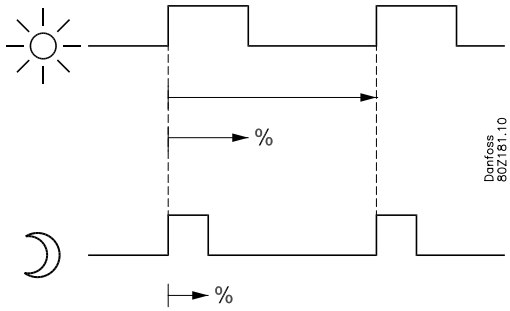
Relay or analogue output

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: Rail heat control, day/night load



Pulse control according to dewpoint

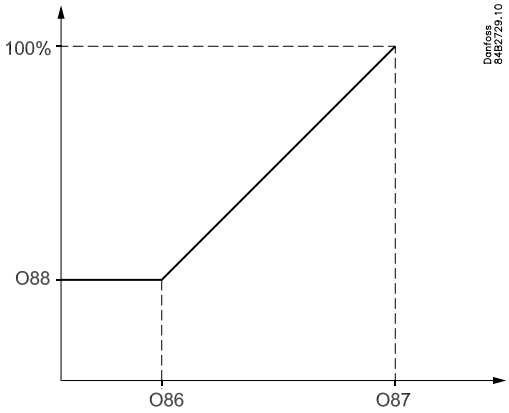
In order to use this function, a system manager of the type AK-SM is required which can measure ambient temperature and humidity to calculate dewpoint and distribute to the appliance controllers. For this the rail heat's ON period is controlled according to the distributed dewpoint.

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 086, 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: Rail heat control, dewpoint



During defrosting

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

Fan

Pulse control

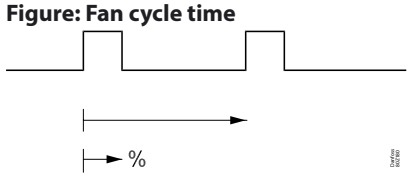
To obtain energy savings, it is possible to pulse control the power supply to the evaporator fans.

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) (The function is not actual when r14=2, i.e. modulating regulation).

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

Figure: Fan cycle time



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).

Fan ECO operation (only custom set-up)

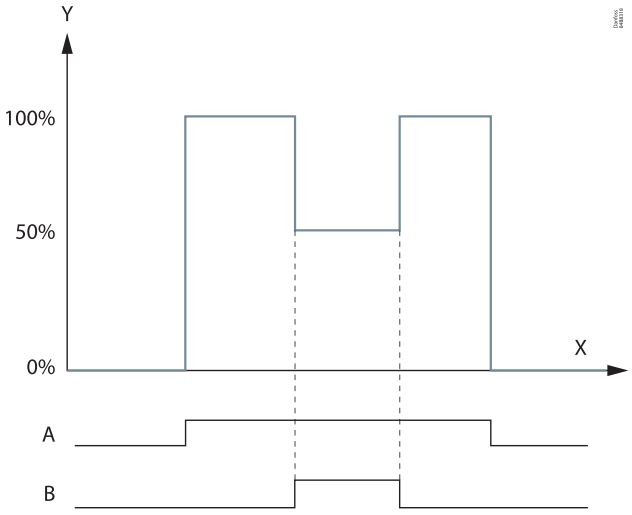
Fan ECO operation is used to reduce fan speed during night operation – typically on cabinets with night blinds.

The function is enabled when a relay has been configured for Fan ECO function in one of the applications with custom set-up 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 is also activated, then the fan is running with reduced speed (typically 50%).
If both fan outputs are de-activated, then the fans are stopped.

Figure: 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, first stage of case cleaning, defrost, forced cooling and when air heating is active.

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

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.

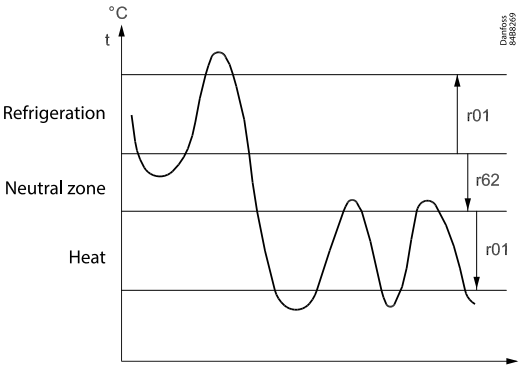
A night blind is opened when the appliance cleaning function is activated.
A setting can define that the night blind is opened when "r12" (Main switch) is set to off (see o98).

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: 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: 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
Forced closing	+	+	14
Shutdown	+	+	15

Light control	+	+	16
Leak detection	+	+	20
Adaptive liquid control	+	+	21
Door fan stop	+	+	29

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

Forced closing

The AKV valves can be closed with an external signal ("Forced closing").

The function must be used in connection with the compressor's safety circuit, so that there will be no injection of liquid into the evaporator when the compressor is stopped by the safety controls and cannot start again (however not at low pressure – LP).

Via a setting (see o90 Fan at forced closing) it is possible to define whether the fan should be ON or OFF during forced closing and whether an ongoing defrost is suppressed (i.e. put in standby position for a period of upto 10 minutes before it is cancelled) - this feature can be used in CO_2 systems to eliminate excessive heating while compressors cannot run.

The signal can be received from the DI-input or via the data communication.

Door contact

The door contact function can via the digital inputs be defined for two different applications:

Alarm monitoring:
The controller monitors the door contact and delivers an alarm message if the door has been opened for a longer period than the set alarm delay.

Alarm monitoring and stop of refrigeration:
When the door is opened, the refrigeration is stopped, i.e. the injection, the compressor and the fan are stopped and light 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 for a longer time than the set alarm delay, an alarm is triggered and the fans will start running again.

Display

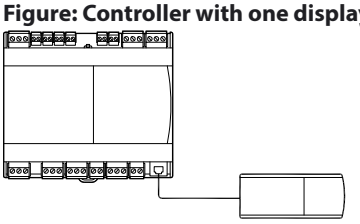
The controller has one plug for an external display.

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: 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:

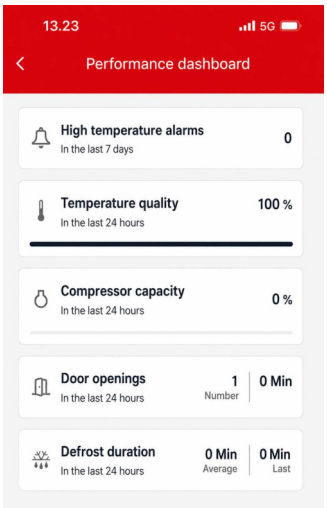
Table: Override functionality

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 Max. Te offset	Requested offset to actual evaporating temperature in order to keep the air temperature at the actual setpoint
MC Liquid control	Master control signal allowing switch to adaptive liquid control
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 closing	Master control signal that will close the injection valve
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
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
MC Min. delta T	Required minimum delta temperature across evaporator (S3 - Te) in order to keep the air temperature at the actual setpoint

Performance monitoring

The controller can monitor certain key performance indicators, telling something about how well the unit is operating. These key performance indicators are available in the AK-CC Connect app.

Figure: Performance dashboard in AK-CC Connect app



Number of high temp. alarms

The controller keeps track of the number of high temperature alarm for the last 7 days.

Temperature quality

The temperature quality tells how well the unit is performing temperature wise over a time window of 24 hours. The temperature quality read-out is a weighted value taking the temperature deviation and time into account. If the thermostat air temperature is within the band of "thermostat cutin + a set offset" and "Thermostat cutout – a set offset" the temperature quality will be 100%. The further away the thermostat air temperature is from this band, the lower the temperature quality will be. If the thermostat air temperature reaches the high or low alarm limit, the air quality will be 0%.

Note: the temperature quality will never be 100% as defrost cycles and other interruptions will be counted into the performance. But the value can be used to optimize control.

Figure: Temperature quality as function of deviation from thermostat cut-in and cut-out limits

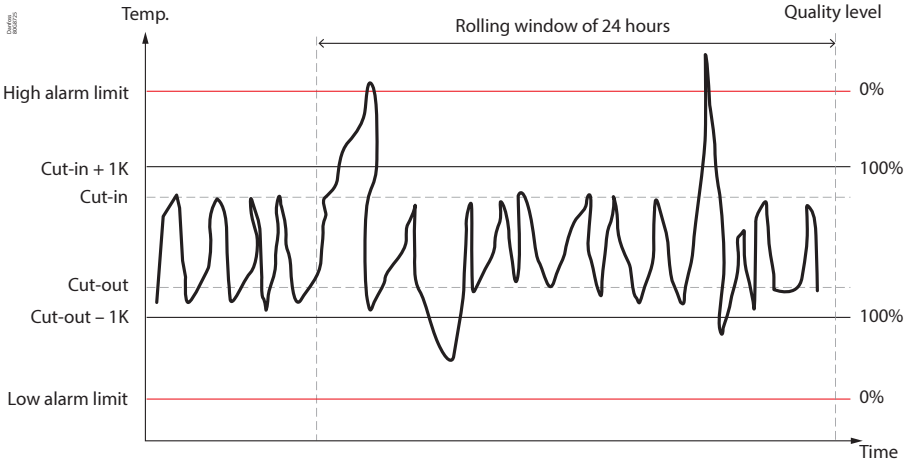


Table: Temperature quality

Parameter	Value	Description
X31 Air temp. performance	0 – 100%	Readout of actual thermostat air quality for the last 24 hours
X32 Temp. offset	0 – 10 K	Offset to thermostat cut-in and cut-out limits, where air quality is 100%

Door openings and door open time

Readout of the actual number and accumulated opening time of the door for the last 24 hours.

Defrost duration

Readout of the duration of the last defrost cycle as well as the average duration of the last 10 defrost cycles. These values can be used to evaluate whether the defrost cycles are running at optimal conditions and with a correct stop limit.

Network integration

The controller is supported by the following Danfoss system managers:

- AK-SM 800A

When installing the controller into a Danfoss network system, follow the following procedure:

1. Select the application mode (o61)
2. Set the unit address (o03)
3. Perform a network scan from the system manager

The controller can also be integrated into third party Modbus network systems and then the following network parameters might need to be set:

Table: Network integration

Parameter	Values		Description
o03	Network address	0 – 240	Network address When used in a network system with a Danfoss system manager AK-SM 800A, the address has to be set in the range 1 – 199.
oa1	Baudrate	1: Auto 2: 9600 baud 3: 19200 baud 4: 38400 baud 5: 115200 baud	Baudrate of data communication. When installed in a Danfoss network system, leave the setting at "Auto".
oa2	Parity and stop bit	0: None 1: Even 2: Odd	None: No parity bit and two stop bits Even: Even parity bit and one stop bit Odd: Odd parity bit and one stop bit

A list of Modbus register numbers can be found at danfoss.com

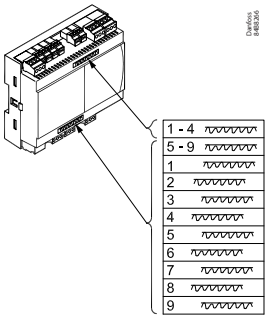
Applications

Product identification

The controller is provided with labels from the factory, indicating a generic application. When selecting the required application, specific labels are provided so that you can mount the relevant one.

The application number is indicated on the left-hand side of the labels. Use the label fitting the selected application.
Some of the labels are applicable to multiple application options.

Figure: Labels used to indicate application number



The chapter outlines application examples:

- Standard display case
- Cold rooms

An application setting will configure inputs and outputs so that the controller's operation interface is reflecting the selected application.

In application 4 and 9, users can custom define the functions of relay 2, 3 and 4, e.g.:

- Controlling two compressors
- Controlling the night blind
- Controlling the heat function
- ECO operations of fans

Figure: Standard display case, upright or normal, with one evaporator

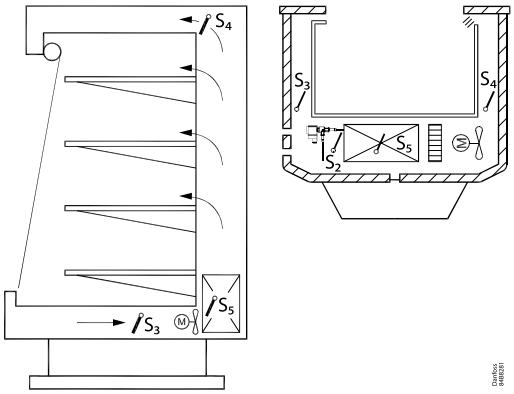
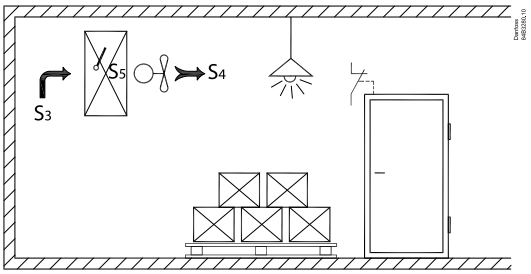
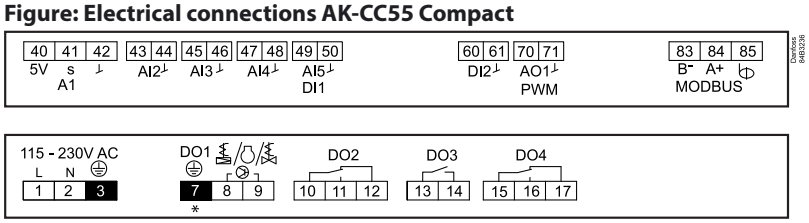


Figure: Cold room configuration with door, light and heat control function



AK-CC55 Compact connections and application options

Figure: Electrical connections AK-CC55 Compact



* Max. 0.5 A - No overload protection!

AK-CC55 Compact is optimised for control of one evaporator plus different combinations of light, rail heat and alarm relays.

It has 4 Digital Outputs (DO), known as DO1 – DO4, one Analogue Output (AO), known as AO1, 4 Analogue Inputs (AI), known as AI1 – AI4, an input that can be used as either an AI5 or as a DI (Digital Input) DI1, and one Digital Input (DI2).

It has 9 different application options (Application 1 – Application 9) to control the functions of the input and output relays.

Table: Application with digital and analogue input/output specification

No.	Application description	DO1	DO2	DO3	DO4	AO1	AI1	AI2	AI3	AI4	AI5/ DI1	DI2
1	TXV appl.					•		S3	S4	S5	•	•
2	TXV appl.					•		S3	S4	S5	•	•
3	TXV appl.					•		S3	S4	S5	•	•
4	TXV appl./ User def. config.		User def.	User def.	User def.	•	User def.	User def.	User def.	User def.	User def.	•
5	EEV appl.					•	Pe	S2	S3	S4	S5	•
6	EEV appl.					•	Pe	S2	S3	S4	S5	•
7	EEV appl.					•	Pe	S2	S3	S4	S5	•
8	EEV appl.					•	Pe	S2	S3	S4	S5	•
9	EEV appl./ User def. config.		User def.	User def.	User def.	•	Pe	S2	User def.	User def.	User def.	•

Dot • = Optional use

Table: Sensor description

Pe	Evaporating pressure
S2	Gas outlet of evaporator
S3	Return air temperature
S4	Discharge air temperature
S5	Evaporator temperature
S5B	Second evaporator temperature

Application set-ups and IO connections

AK-CC55 Compact is designed for control of one evaporator + different combinations of light, rail heat, defrost and alarm relays.

The most important variations are:

Applications 1 – 4: TEV applications

Control of compressor or solenoid valve, alarm relay, lights, rail heat, defrost heater.

Application 4: Configurable outputs and inputs, e.g.: Dual compressor operation, heat function, night blind, ECO fan

Applications 5 – 9: EEV applications

Control of AKV valve, compressor, alarm relay, light, rail heat, defrost heater.

Application 9: Configurable outputs and inputs, e.g.: Dual compressor operation, heat function, night blind, ECO fan

Figure: Connections for application 1

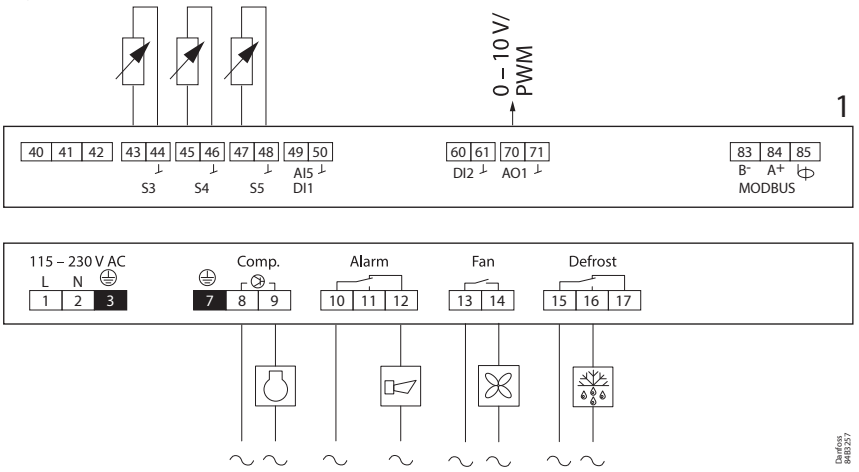


Figure: Connections for application 2

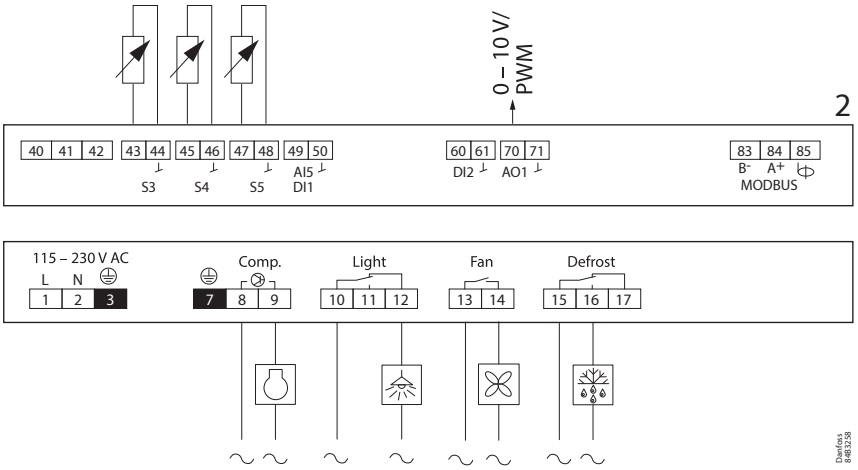
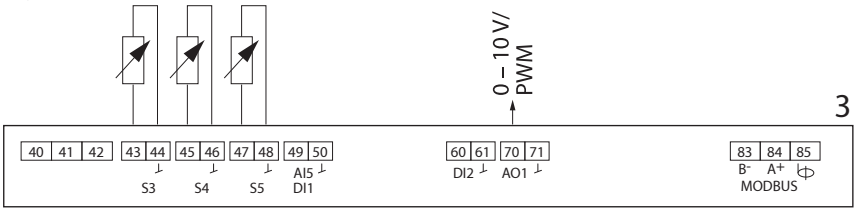


Figure: Connections for application 3



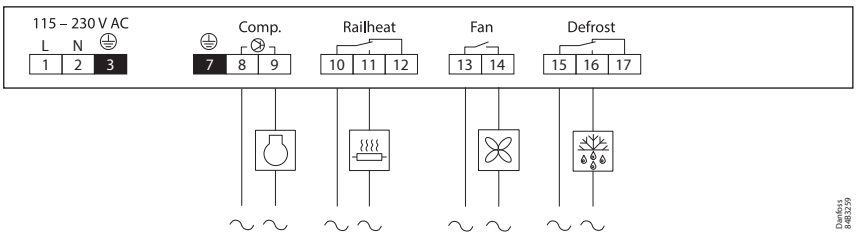
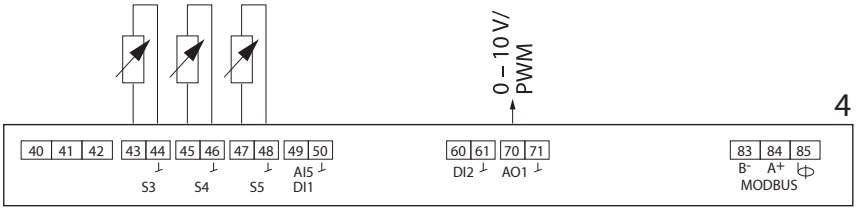


Figure: Connections for application 4



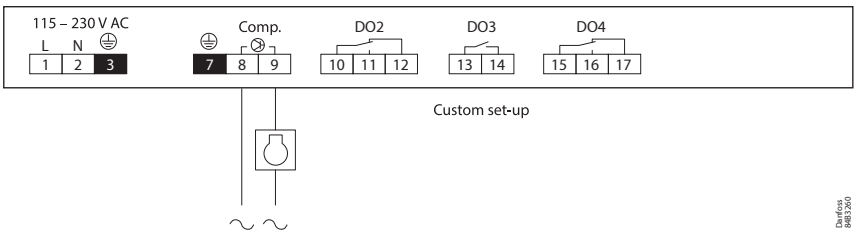


Figure: Connections for application 5

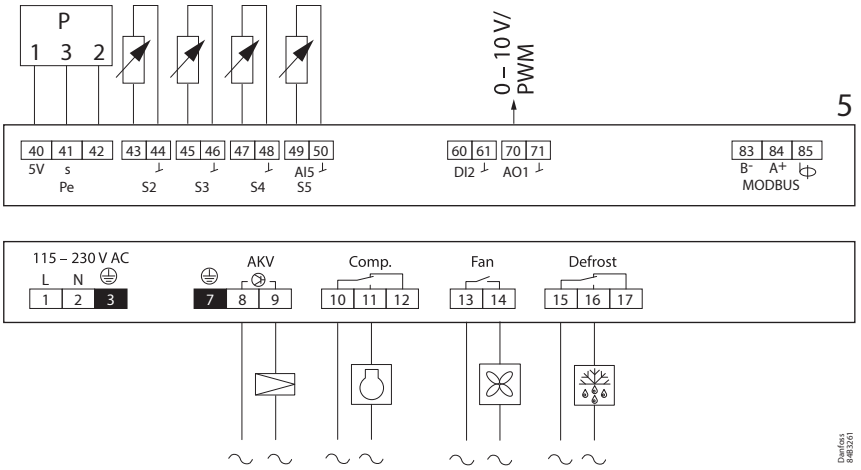


Figure: Connections for application 6

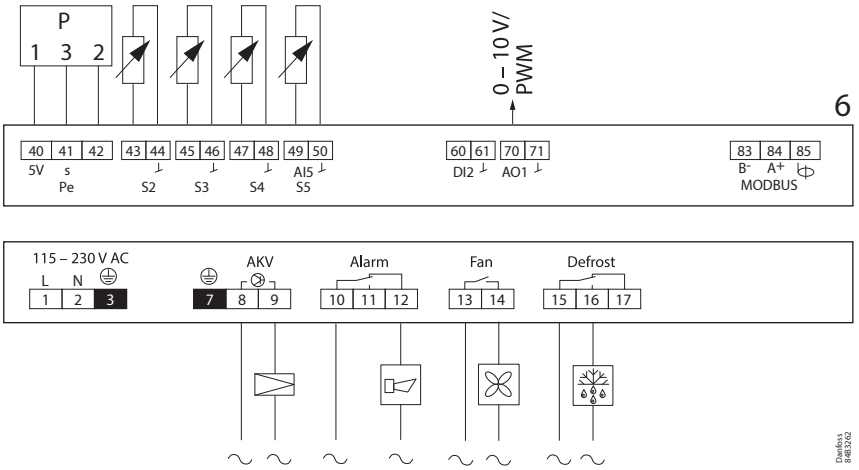


Figure: Connections for application 7

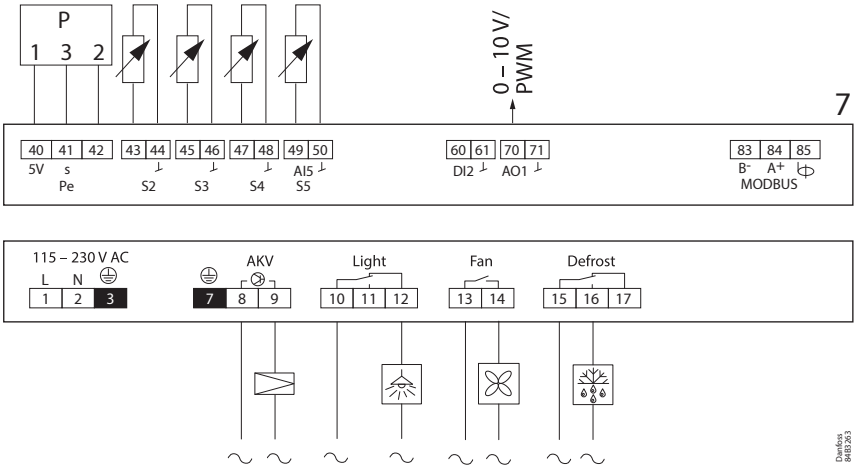


Figure: Connections for application 8

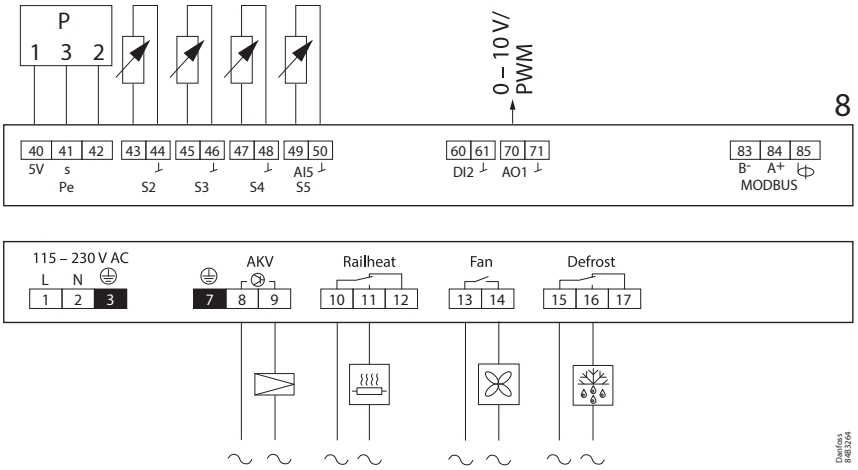
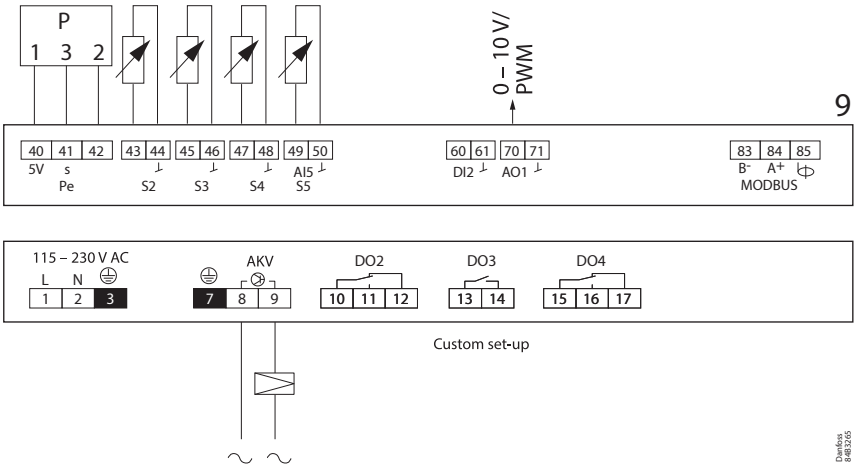


Figure: Connections for application 9



User configuration of inputs and outputs

Digital outputs

Application 4 and 9

For these flexible application modes, the function of the digital outputs DO2 - DO4 can be defined by the user.
The following functions are selectable for digital outputs:

Table: Selectable digital output functions

Value	Function
0	None
1	Fan
2	Fan ECO
3	Defrost
4	Rail heat
5	Alarm
6	Light
7	Blinds
8	Compressor
9	Compressor 2
10	Air heater

Note: DO1 is always used for either compressor (application 1 – 4) or AKV valve (application 5 – 9) and cannot be changed. However, if the analogue output is set up for stepper valve driver, then the DO1 output will switch function to control a liquid line solenoid valve in front of the stepper valve.

It is recommended to configure the alarm and light functions on the digital outputs with double contact set (DO2 or DO4) as they must be connected to the NO contact, so that the light will be switched ON and an alarm will be raised if the power to the controller should fail.

Analogue inputs

Application 4 and 9

For these flexible application modes, the function of the analogue inputs AI1 - AI5 can be defined by the user.
The following functions are selectable for analogue inputs:

Table: Selectable analogue input functions

Value	Function
0	None
3	S3 Air ON evap. (before evaporator)
4	S4 Air OFF evap. (after evaporator)
5	S5A Evaporator sensor
10	S5B Evaporator sensor

Analogue outputs

For all application modes, the analogue output AO1 function can be selected.

Table: Selectable analogue output functions

Value	Function
0	None
1	Rail heat PWM (fast pulsing)
2	Stepper valve driver
3	Variable compressor speed

Digital inputs

There are two digital inputs, DI1 and DI2, with dry contact function.
For all application modes, the following functions can be selected:

Table: Function table and DI settings

Function	Input / Settings menu			Setting
	D11	D12	D13	
	o02	o37	o84	
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
Forced closing	+	+	+	14
Shutdown	+	+	+	15
Light control	+	+	+	16
Leak detection	+	+	+	20
Adaptive liquid control	+	+	+	21
Door fan stop	+	+	+	29

Handling of illegal IO configurations

If an illegal IO configuration has been made, a "Wrong IO config" alarm will be raised, and the control cannot be started.
If the controller has been set up for using a specific sensor and the sensor has not been configured, a "Wrong IO config" alarm will be raised and a sensor alarm will be raised for the missing sensor.
Please refer to Appendix A for further details on illegal IO configurations

Installation

Dimensions

Measurements are in mm.

Figure: AK-CC55 Compact

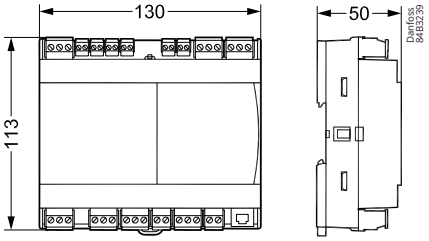
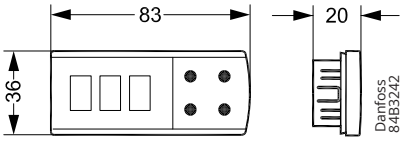


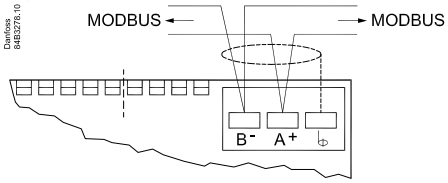
Figure: AK-CC55 Set



Connections

Data communication

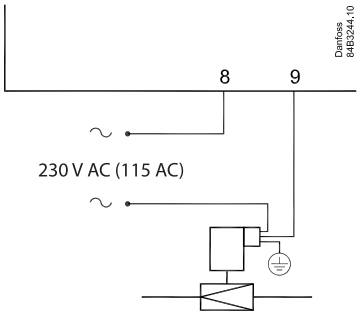
Figure: Data communication



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

AKV info

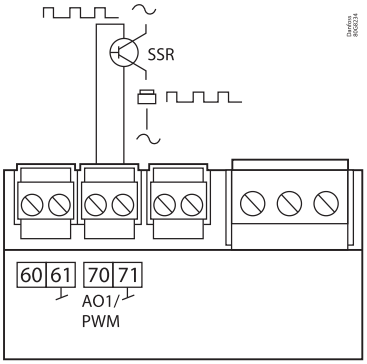
Figure: AKV info



230 V or 115 V
AC coil
Max. 0.5 A
Not overload protected

External solid state relay for rail heat

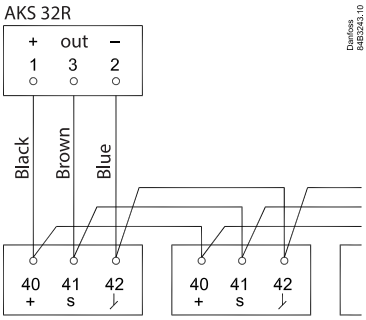
Figure: External solid state relay for rail heat



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

AKS 32R info

Figure: AKS 32R info

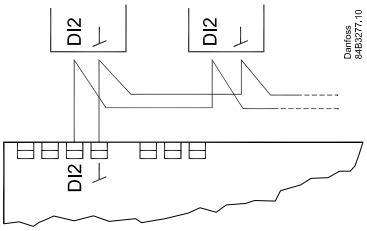


Note: A ratiometric pressure transmitter with a 5 V, 10 – 90% voltage output signal must be used.

The signal from one pressure transmitter can be received by up to 10 controllers. There must not be a significant pressure drop from the pressure transmitter's position in the suction line to the individual evaporators.

Coordinated defrost via cable connections

Figure: Coordinated defrost via cable connections

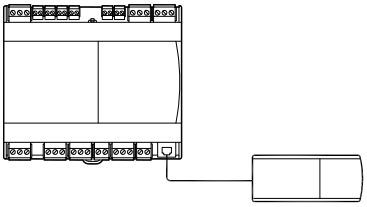


Max. 10
The following controllers can be connected in this way:
EKC 204A, AK-CC 210, AK-CC 250, AK-CC 450, AK-CC 550 and AK-CC55.

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

External display AK-UI55

Figure: External display AK-UI55



(Total length: max. 100 m)

Connections

Table: Connection details

AI1	**Pressure transmitter** AKS 32R Connect to terminal 40, 41 and 42. (Use cable 060G1034: Black=40, Brown=41, Blue=42) The signal from one pressure transmitter can be received by up to 10 controllers. But only if there are no significant pressure drops between the evaporators to be controlled. See *Figure: AKS 32R info*
AI2 - AI5	**Primarily for temperature inputs** • *S2* Pt 1000 ohm sensor AKS11, placed at the evaporator outlet • *S3, S4, S5* Pt 1000 AKS11, PTC 1000 EKS111, NTC5K EKS211 or NTC10K EKS221 sensor or a user-defined sensor type. All have to be of the same kind. • *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* (If the DI1 input is used for a temperature measurement, it 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	**Analogue output signal** • *Analogue 0 – 10 V (currently not used)* • *Pulse width modulated signal* Can be used for fast pulse control of rail heat via an external power solid state relay.
MODBUS	For data communication: • Terminal 83 = B- • Terminal 84 = A+ • Terminal 85 = screen
Supply voltage	230 V AC or 115 V AC
DO1	*AKV valve:* Connection of expansion valve type AKV, AKVA, AKVH or AKVP. The coil must be a **230 V or 115 V AC coil**
	Compressor: Connection of a relay. The coil must be a **230 V or 115 V AC coil**. **Max. 0.5 A**
	Solenoid valve: The coil must be a **230 V or 115 V AC coil**. **Max. 0.5 A**
DO2	*Alarm:* There is a connection between terminal 10 and 12 in alarm situations and when the controller is without power. DO2 has reinforced insulation that can be used with 24 V.
	Light, Rail heat, Compressor/Liquid line valve: There is connection between terminal 10 and 11 (10 and 12 at light) when the function is ON.

DO3	*Fan:* There is connection between terminal 13 and 14 when the fan is ON.
DO4	*Defrost:* There is connection between terminal 15 and 16 when defrosting takes place.
DO2-DO4 + AO1 and Application 4 / 9	Here, the different outputs can be custom defined in q02 – q09

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.

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.

Direct operation

Operation via AK-UI55 setting display
The display can be located at a distance of up to 100 meters from the controller.

Smart phone and app via AK-UI55 Bluetooth display
The **AK-CC connect** app is used for smart phone operation.
AK-CC 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

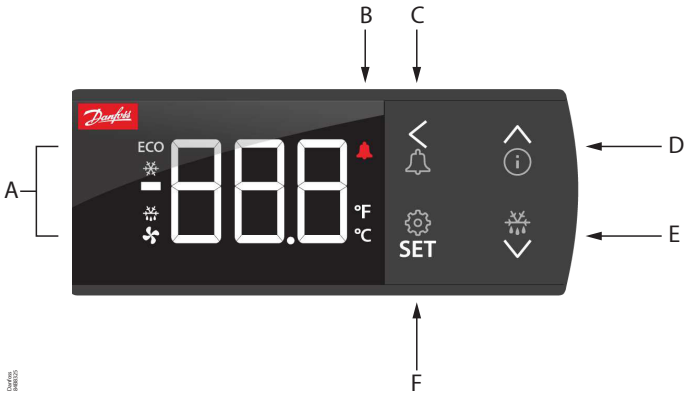
Display AK-UI55 Set
The values will be shown with three digits, and with a setting you can determine whether the temperature is to be shown in °C or in °F.

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: 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: 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
CO2	Flashes: Will display in event of a refrigerant leakage alarm, but only if the refrigerant is set up for CO_2

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: SET button parameter list

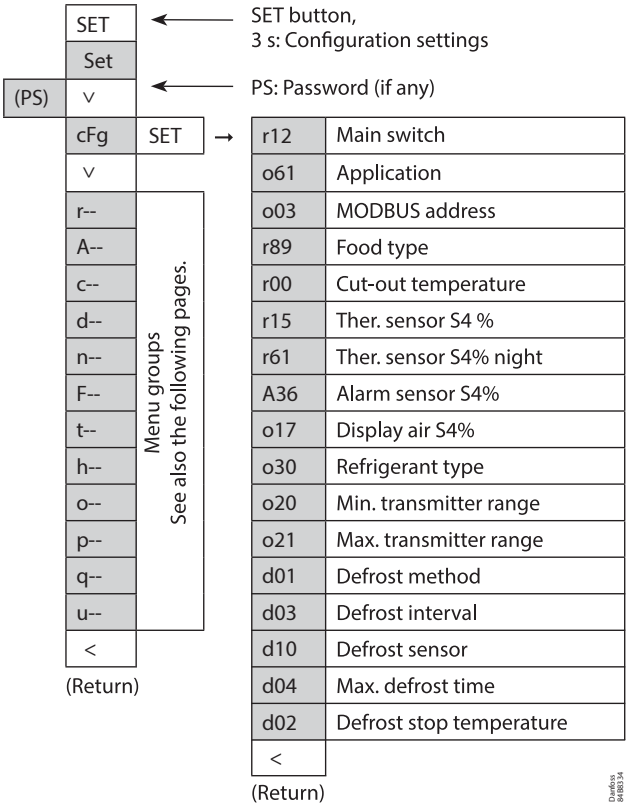
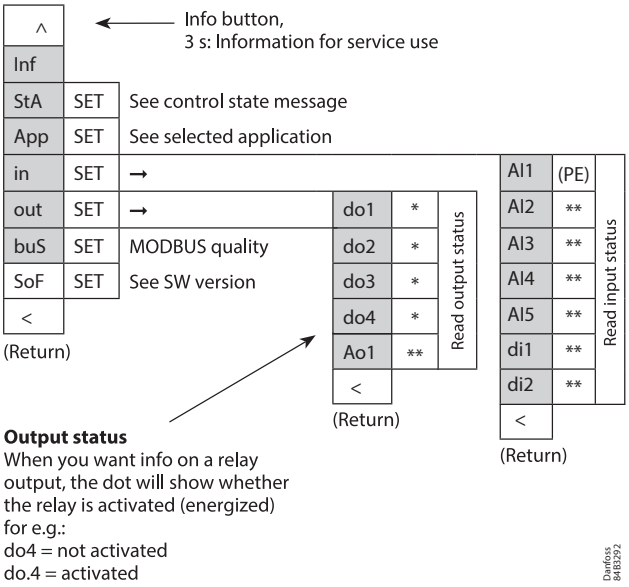


Figure: Info button parameter list



*	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 q11 to q27.
**	The input's function (determined at configuration)
StA	See control state message in *Table: Operating status*

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 diagrams (see *Application set-ups and IO connections*)
3. Open parameter o61 and set the application number
4. For network. Set the address in o03
5. Then select a set of presets from the "Food type" help table
6. Open parameter r89 and set the number for the array of presettings. The few selected settings will now be transferred to the menu
7. Set the desired cut-out temperature r00
8. Set the weighted thermostat air temperature between S4 and S3 sensor r15
9. Set the weighted thermostat air temperature between S4 and S3 during night operation r61
10. Set the weighted alarm air temperature between S4 and S3 A36
11. Set the weighted display readout between S4 and S3 o17
12. Select refrigerant via parameter o30 (only application 5 – 9)
13. Set the pressure transmitter min. and max. range via parameter o20 and o21 (only application 5 – 9)
14. Set the desired defrost method in d01
15. Set the interval time between defrost starts in d03
16. Set the desired defrost stop method in d10
17. Set the maximum defrost time in d04
18. Set the defrost stop temperature in d02
19. Open parameter r12 and start the regulation
20. Go through the parameter list and change the factory values where needed
21. Get the controller up and running on network:
    MODBUS: Activate scan function in system unit

Table: 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

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-CC 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.

Download the app here:	
App Store	Play Store

Figure: AK-UI55 Bluetooth

Display info:

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

Figure: Connect to controller

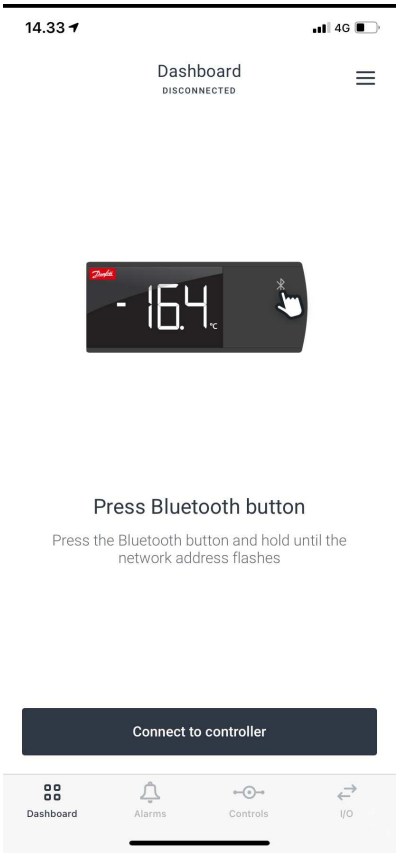


Figure: Controller dashboard

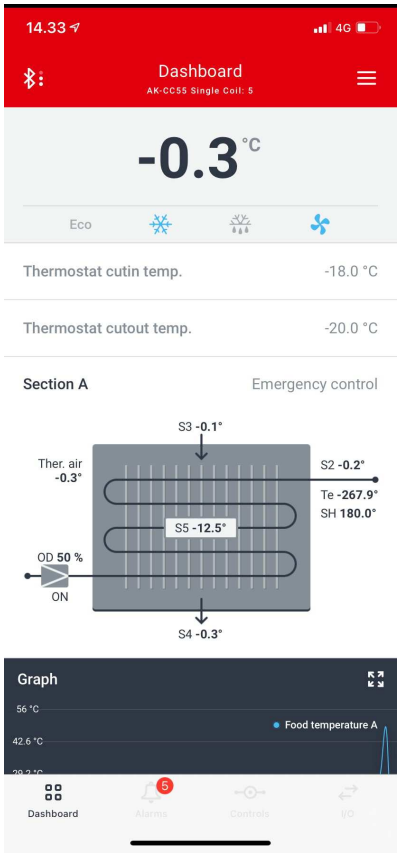
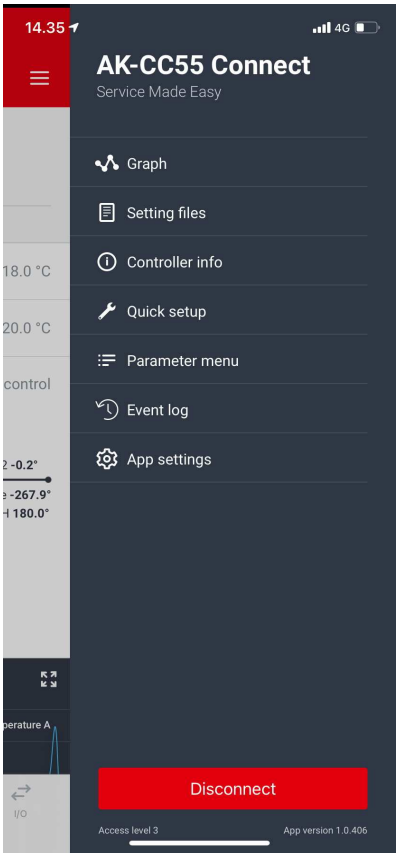


Figure: Set-up menu



The functions are described on the chapter *AK-CC55 connect menu*.

Parameters

AK-UI55 display menu (SW ver. 2.3x)

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 1-9 the parameter is applicable

Thermostat

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	9	Min.value	Max.value	Fact.value
Cut-out 1		0-0	r00	*	*	*	*	*	*	*	*	*	r03	r02	2 °C
Differential 1		1-2	r01	*	*	*	*	*	*	*	*	*	0.1 °C	20 °C	2 °C
Max cut-out limit		0-2	r02	*	*	*	*	*	*	*	*	*	r03	50 °C	50 °C
Min cut-out limit		0-2	r03	*	*	*	*	*	*	*	*	*	-60 °C	r02	-60 °C
Display readout adjustment		1-2	r04	*	*	*	*	*	*	*	*	*	-10 °C	10 °C	0 °C
Temperature unit	0=Celsius, 1=Fahrenheit	1-2	r05	*	*	*	*	*	*	*	*	*	0	1	0
S4 Air OFF evap. - Adjustment		1-2	r09	*	*	*	*	*	*	*	*	*	-10 °C	10 °C	0 °C
S3 Air ON evap. - Adjustment		1-2	r10	*	*	*	*	*	*	*	*	*	-10 °C	10 °C	0 °C
S5 Evaporator - Adjustment		1-2	r11	*	*	*	*	*	*	*	*	*	-10 °C	10 °C	0 °C
Main switch	-1=Manual, 0=Stop, 1=Start	0-2	r12	*	*	*	*	*	*	*	*	*	-1	1	0
Night offset		1-2	r13	*	*	*	*	*	*	*	*	*	-50 °C	50 °C	0 °C
Thermostat mode	2=Modulating, 1=ON/OFF	1-2	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
S2 Gas outlet - Adjustment		1-2	r19					*	*	*	*	*	-10 °C	10 °C	0 °C
Cut-out 2		0-2	r21	*	*	*	*	*	*	*	*	*	-60 °C	50 °C	2 °C
Thermostat sensor S4 % night		1-2	r61	*	*	*	*	*	*	*	*	*	0%	100%	100%
Air heater neutral zone		1-2	r62				*					*	0 °C	50 °C	5 °C
Air heater start delay		1-2	r63				*					*	0 min	240 min	240 min
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 °C	2 °C
S4 frost protection		1-2	r98	*	*	*	*	*	*	*	*	*	-60 °C	50 °C	-60 °C

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

Alarm settings

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	9	Min.value	Max.value	Fact.value
Alarm delay		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		1-2	A12	*	*	*	*	*	*	*	*	*	0 min	240 min	90 min
High alarm limit 1		1-2	A13	*	*	*	*	*	*	*	*	*	-60 °C	50 °C	8 °C
Low alarm limit 1		1-2	A14	*	*	*	*	*	*	*	*	*	-60 °C	50 °C	-30 °C
High alarm limit 2		1-2	A20	*	*	*	*	*	*	*	*	*	-60 °C	50. °C	8 °C
Low alarm limit 2		1-2	A21	*	*	*	*	*	*	*	*	*	-60 °C	50 °C	-30 °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
Alarm sensor S4%		1-2	A36	*	*	*	*	*	*	*	*	*	0%	100%	100%

Compressor

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	9	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
Comp. 2 ctrl. Th. band 2	0=OFF, 1=ON	1-2	c85				*					*	0	1	1
Min. speed		1-2[1]	c46	*	*	*	*						0%	c47	0%
Start speed		1-2	c47	*	*	*	*						c46	c48	20%
Max. speed		1-2[1]	c48	*	*	*	*						c47	100%	100%
Speed Kp		1-2	c82	*	*	*	*						3,0	30	20
Speed Tn		1-2	c83	*	*	*	*						30 s	900 s	60 s
Max speed slope		1-2	c96	*	*	*	*						0.1	5,0	1,0
Comp. defrost speed		1-2	c97	*	*	*	*						0%	100%	100%
Max. Kp factor		1-2	c98	*	*	*	*						5,0	50	20
Comp cut-out delay		1-2	c99	*	*	*	*						0 s	600 s	0 s

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

Defrost

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	9	Min.value	Max.value	Fact.value
Defrost method	0=None, 1=Electrical, 2=Hot gas, 3=Brine, 4=Air/Offcycle, 5=Electrical pulsing	1-3	d01	*	*	*	*	*	*	*	*	*	0	5	1
Defrost stop limit		1-2	d02	*	*	*	*	*	*	*	*	*	0 °C	50 °C	6 °C
Defrost start interval		1-2	d03	*	*	*	*	*	*	*	*	*	0 h	240 h	8 h
Max. defrost time		1-2	d04	*	*	*	*	*	*	*	*	*	d24	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	*	*	*	*	*	*	*	*	*	-60 °C	10 °C	-5 °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, 3=S5A and S5B	1-2	d10	*	*	*	*	*	*	*	*	*	0	3	0
Pump down delay		1-2	d16	*	*	*	*	*	*	*	*	*	0 min	60 min	0 min
Max. thermostat run time		1-2	d18	*	*	*	*	*	*	*	*	*	0 h	240 h	0 h
Min. defrost time		1-2	d24	*	*	*	*	*	*	*	*	*	0 min	d04	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 °C	50 °C	6 °C
Max. defrost time 2		1-2	d29	*	*	*	*	*	*	*	*	*	d24	360 min	45 min
Display delay after defrost		1-2	d40	*	*	*	*	*	*	*	*	*	5 min	240 min	30 min
Fan stop temperature		1-2	d41	*	*	*	*	*	*	*	*	*	-20 °C	20 °C	0 °C

Injection control

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	9	Min.value	Max.value	Fact.value
Max. superheat limit		1-2	n09					*	*	*	*	*	n10	20.0 °C	12.0 °C
Min. superheat limit		1-2	n10					*	*	*	*	*	2.0 °C	n09	3.0 °C
MOP temperature		1-2	n11					*	*	*	*	*	-60 °C	15 °C	15 °C
EEV Period time		1-2[1]	n13					*	*	*	*	*	3 s	6 s	6 s
Brine valve - Period time		1-2	n63	*	*	*	*						30 s	900 s	300 s
Brine valve max OD		1-2	n64	*	*	*	*						n65	100%	100%
Brine valve min OD		1-2	n65	*	*	*	*						0%	n64	0%
Brine valve wind-up		1-2	n66	*	*	*	*						0,2	1,0	1,0
Brine valve Kp		1-2	n67	*	*	*	*						0,5	10	4,0
Brine valve Tn		1-2	n68	*	*	*	*						60 s	1800 s	300 s
LLSV closing delay		1-2	na1					*	*	*	*	*	0 s	300 s	5 s

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

Fan control

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	9	Min.value	Max.value	Fact.value
Fan stop high S5 temp.		1-2	F04	*	*	*	*	*	*	*	*	*	-60 °C	50 °C	50 °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	120 min	5 min
Fan ON cycle		1-2	F07	*	*	*	*	*	*	*	*	*	0%	100%	100%

Defrost schedule

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	9	Min.value	Max.value	Fact.value
Defrost schedule	0=No, 1=Yes	1-2	t00	*	*	*	*	*	*	*	*	*	0	1	0
Def. start 1 - Hours		1-2	t01	*	*	*	*	*	*	*	*	*	0 hour	23 hours	0 h
Def. start 1 - Minutes		1-2	t11	*	*	*	*	*	*	*	*	*	0 min	59 min	0 min
Def. start 2 - Hours		1-2	t02	*	*	*	*	*	*	*	*	*	0 hour	23 hours	0 h
Def. start 2 - Minutes		1-2	t12	*	*	*	*	*	*	*	*	*	0 min	59 min	0 min
Def. start 3 - Hours		1-2	t03	*	*	*	*	*	*	*	*	*	0 hour	23 hours	0 h
Def. start 3 - Minutes		1-2	t13	*	*	*	*	*	*	*	*	*	0 min	59 min	0 min
Def. start 4 - Hours		1-2	t04	*	*	*	*	*	*	*	*	*	0 hour	23 hours	0 h
Def. start 4 - Minutes		1-2	t14	*	*	*	*	*	*	*	*	*	0 min	59 min	0 min
Def. start 5 - Hours		1-2	t05	*	*	*	*	*	*	*	*	*	0 hour	23 hours	0 h
Def. start 5 - Minutes		1-2	t15	*	*	*	*	*	*	*	*	*	0 min	59 min	0 min
Def. start 6 - Hours		1-2	t06	*	*	*	*	*	*	*	*	*	0 hour	23 hours	0 h
Def. start 6 - Minutes		1-2	t16	*	*	*	*	*	*	*	*	*	0 min	59 min	0 min
Time hours		0-1	t07	*	*	*	*	*	*	*	*	*	0 hour	23 hours	0 h
Time minutes		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
Event 1 Day h		1-2	t58	*	*	*	*	*	*	*	*	*	0 hours	23 hours	0 hours
Event 1 Day min		1-2	t59	*	*	*	*	*	*	*	*	*	0 min	59 min	0 min
Event 1 Night h		1-2	t60	*	*	*	*	*	*	*	*	*	0 hour	23 hours	0 hours
Event 1 Night min		1-2	t61	*	*	*	*	*	*	*	*	*	0 min	59 min	0 min
Event 2 Day h		1-2	t62	*	*	*	*	*	*	*	*	*	0 hour	23 hours	0 hours
Event 2 Day min		1-2	t63	*	*	*	*	*	*	*	*	*	0 min	59 min	0 min
Event 2 Night h		1-2	t64	*	*	*	*	*	*	*	*	*	0 hour	23 hours	0 hours
Event 2 Night min		1-2	t65	*	*	*	*	*	*	*	*	*	0 min	59 min	0 min
Monday event	0=Day, 1=Night, 2=Event 1, 3=Event 2	1-2	t66	*	*	*	*	*	*	*	*	*	0	3	0
Tuesday event	0=Day, 1=Night, 2=Event 1, 3=Event 2	1-2	t67	*	*	*	*	*	*	*	*	*	0	3	0
Wednesday event	0=Day, 1=Night, 2=Event 1, 3=Event 2	1-2	t68	*	*	*	*	*	*	*	*	*	0	3	0
Thursday event	0=Day, 1=Night, 2=Event 1, 3=Event 2	1-2	t69	*	*	*	*	*	*	*	*	*	0	3	0
Friday event	0=Day, 1=Night, 2=Event 1, 3=Event 2	1-2	t70	*	*	*	*	*	*	*	*	*	0	3	0
Saturday event	0=Day, 1=Night, 2=Event 1, 3=Event 2	1-2	t71	*	*	*	*	*	*	*	*	*	0	3	0
Sunday event	0=Day, 1=Night, 2=Event 1, 3=Event 2	1-2	t72	*	*	*	*	*	*	*	*	*	0	3	0

Miscellaneous

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	9	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 setback, 7=Thermostat band, 8=Alarm at closed, 9=Alarm at open, 10=Case cleaning, 11=Forced cooling, 12=Open blinds, 13=Coordinated defrost, 14=Forced closing, 15=Shutdown, 16=Light control, 20=Leak detection, 21=Adaptive liquid control, 29=Door fan stop, 24=Comp. safety, 31=Comp. safety 2	1-2(1)	o02	*	*	*	*					*	0	31	0
Network address		1-3(1)	o03	*	*	*	*	*	*	*	*	*	0	240	0
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%
Pe Min range		1-3(1)	o20					*	*	*	*	*	-1,0 bar	5,0 bar	-1,0 bar
Pe Max range		1-3(1)	o21					*	*	*	*	*	6 bar	200 bar	12 bar
AO1 Min. voltage		1-3(1)	o27	*	*	*	*	*	*	*	*	*	0 V	o28	0 V
AO1 Max. voltage		1-3(1)	o28	*	*	*	*	*	*	*	*	*	o27	10 V	10 V
Refrigerant	0=Not selected, 6=R13, 7=R13b1, 2=R22, 8=R23, 14=R32, 11=R114, 3=R134a, 12=R142b, 24=R170, 15=R227, 25=R290, 16=R401A, 18=R402A, 19=R404A, 21=R407A, 22=R407B, 20=R407C, 37=R407F, 49=R407H, 23=R410A, 32=R413A, 30=R417A, 31=R422A, 33=R422D, 34=R427A, 35=R438A, 40=R448A, 41=R449A, 48=R449B, 43=R450A, 42=R452A, 44=R452B, 50=R454A, 45=R454B, 51=R454C, 52=R455A, 54=R469A, 9=R500, 4=R502, 10=R503, 17=R507, 36=R513A, 53=R516A, 26=R600, 27=R600a, 5=R717, 28=R744, 46=R1233zdE, 38=R1234ze, 39=R1234yf, 47=R1234zeZ, 29=R1270, 1=User defined display, 13=User defined	1-3(1)	o30					*	*	*	*	*	0	54	0
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, 14=Forced closing, 15=Shutdown, 16=Light control, 20=Leak detection, 21=Adaptive liquid control, 29=Door fan stop, 24=Comp. safety, 31=Comp. safety 2	1-2(1)	o37	*	*	*	*	*	*	*	*	*	0	31	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	6 min
Case cleaning mode	0=OFF, 1=Fans run, 2=Cleaning	0-1	o46	*	*	*	*	*	*	*	*	*	0	2	0
Application mode	1=1. Comp/Alarm/Fan/Defrost, 2=2. Comp/Light/Fan/Defrost, 3=3. Comp/Rail heat/Fan/Defrost, 4=4. Comp/Custom, 5=5. EEV/Comp/Fan/Defrost, 6=6. EEV/Alarm/Fan/Defrost, 7=7. EEV/Light/Fan/Defrost, 8=8. EEV/Rail/Fan/Defrost, 9=9. EEV/Custom	1-3(1)	o61	*	*	*	*	*	*	*	*	*	1	9	5
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 °C	o87	2 °C
Dewpoint max. limit		1-2	o87	*	*	*	*	*	*	*	*	*	o86	50.0 °C	12.0 °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
Fan at forced closing	0=OFF, 1=ON, 2=OFF and suppress defrost, 3=ON and suppress defrost	1-2	o90	*	*	*	*	*	*	*	*	*	0	3	1
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

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	9	Min.value	Max.value	Fact.value
Resonance band start		1-2	P39	*	*	*	*						0%	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
Oil return speed		1-2	P79	*	*	*	*						0%	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
Refrigerant factor K1		1-3(1)	P83					*	*	*	*	*	-999	999	300
Refrigerant factor K2		1-3(1)	P84					*	*	*	*	*	-999	999	300
Refrigerant factor K3		1-3(1)	P85					*	*	*	*	*	-999	999	300
Max. superheat liquid ctrl.		1-2	P86					*	*	*	*	*	P87	20.0 °C	3.0 °C
Min. superheat liquid ctrl		1-2	P87					*	*	*	*	*	0.0 °C	P86	1.0 °C
Access code 1		1-1	P88	*	*	*	*	*	*	*	*	*	0	999	0
Display keyboard lock	0=None, 1=Local, 2=Network	1-2	P89	*	*	*	*	*	*	*	*	*	0	2	0
Safety action	0=None, 1=Lights off	1-2	P92	*	*	*	*	*				*	0	1	0
Safety event period		1-2(1)	P93	*	*	*	*	*				*	0 hours	120 hours	0 hours
Max safety events		1-2(1)	P94	*	*	*	*	*				*	0	20	0
AO1 Min. frequency		1-3(1)	P95	*	*	*	*						0 Hz	P96	0 Hz
AO1 Max. frequency		1-3(1)	P96	*	*	*	*						P95	500 Hz	100 Hz
AO1 PWM frequency		1-3(1)	P97	*	*	*	*						100 Hz	500 Hz	200 Hz

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

DO config and manual

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	9	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, 8=Compressor/LLSV, 9=Compressor 2, 10=Air heater	1-3[1]	q02				*					*	0	10	6
DO3 Configuration	0=None, 1=Fans, 2=Fan ECO, 3=Defrost, 4=Rail heat, 5=Alarm, 6=Light, 7=Blinds, 8=Compressor/LLSV, 9=Compressor 2, 10=Air heater	1-3[1]	q03				*					*	0	10	8
DO4 Configuration	0=None, 1=Fans, 2=Fan ECO, 3=Defrost, 4=Rail heat, 5=Alarm, 6=Light, 7=Blinds, 8=Compressor/LLSV, 9=Compressor 2, 10=Air heater	1-3[1]	q04				*					*	0	10	9
AO1 Configuration	0=None, 1=Rail heat PWM, 2=Valve driver, 3=Comp. speed	1-3[1]	q09	*	*	*	*	*	*	*	*	*	0	3	0
EEV override A		1-2[2]	q11					*	*	*	*	*	0%	100%	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
Injection - Priority	0=Disabled, 3=Low, 2=Medium, 1=High	1-2	q34					*	*	*	*	*	0	3	2
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
Liquid line solenoid - override	0=MAN OFF, 1=MAN ON	1-2[2]	q45					*	*	*	*	*	0	1	0
Compressor speed - override		1-2[2]	q49	*	*	*	*						0%	100%	0%
Compressor - Priority	0=Disabled, 3=Low, 2=Medium, 1=High	1-2	q53	*	*	*	*	*	*	*	*	*	0	3	2
AI1 Configration	0=None, 1=Pe Evap. pressure, 2=S2 Gas outlet, 3=S3 Air ON evap., 4=S4 Air OFF evap., 5=S5 Defrost, 8=S5 Defrost B	1-3[1]	q60				*						0	8	0
AI2 Configration	0=None, 1=Pe Evap. pressure, 2=S2 Gas outlet, 3=S3 Air ON evap., 4=S4 Air OFF evap., 5=S5 Defrost, 8=S5 Defrost B	1-3[1]	q61				*						0	8	0
AI3 Configration	0=None, 1=Pe Evap. pressure, 2=S2 Gas outlet, 3=S3 Air ON evap., 4=S4 Air OFF evap., 5=S5 Defrost, 8=S5 Defrost B	1-3[1]	q62				*					*	0	8	0
AI4 Configration	0=None, 1=Pe Evap. pressure, 2=S2 Gas outlet, 3=S3 Air ON evap., 4=S4 Air OFF evap., 5=S5 Defrost, 8=S5 Defrost B	1-3[1]	q63				*					*	0	8	0
AI5 Configration	0=None, 1=Pe Evap. pressure, 2=S2 Gas outlet, 3=S3 Air ON evap., 4=S4 Air OFF evap., 5=S5 Defrost, 8=S5 Defrost B	1-3[1]	q64				*					*	0	8	0

[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

Function	Values	R-W	Code	1	2	3	4	5	6	7	8	9	Min.value	Max.value	Fact.value
Control state	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, 16=Forced closing, 17=Door open, 18=Melt period, 19=Modulating temp. control, 20=Emergency control, 23=Adaptive superheat control, 24=Start injection, 25=Manual control, 26=No refrigerant selected, 29=Case cleaning, 30=Forced cooling, 31=Door open, 32=Power-up delay, 33=Air heating, 34=Comp. safety cut-out, 45=Shut down controller, 48=Adaptive liquid control, 51=Oil recovery, 53=Comp. lockout, 55=Wrong IO Config	0-X	u00	*	*	*	*	*	*	*	*	*	0	53	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		0-X	u11	*	*	*	*	*	*	*	*	*	0 min	900 min	0 min
S3 Air ON evap.		0-X	u12	*	*	*	*	*	*	*	*	*	-200 °C	200 °C	0 °C
Night condition	0=OFF, 1=ON	0-X	u13	*	*	*	*	*	*	*	*	*	0	1	0
S4 Air OFF evap.		0-X	u16	*	*	*	*	*	*	*	*	*	-200 °C	200 °C	0 °C
Thermostat air temp.		0-X	u17	*	*	*	*	*	*	*	*	*	-200 °C	200 °C	0 °C
Thermostat run time		0-X	u18	*	*	*	*	*	*	*	*	*	0 min	999 min	0 min
S2 Gas outlet		0-X	u20					*	*	*	*	*	-200 °C	200 °C	0 °C
Superheat		0-X	u21					*	*	*	*	*	-200 °C	200 °C	0 °C
Superheat reference		0-X	u22					*	*	*	*	*	-200 °C	200 °C	0 °C
EEV opening		0-X	u23					*	*	*	*	*	0%	100%	0%
Pe Evap. pressure		0-X	u25					*	*	*	*	*	-1,0 bar	200.0 bar	0.0 bar
Te Evap. temp.		0-X	u26					*	*	*	*	*	-200 °C	200 °C	0 °C
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 °C	200 °C	0 °C
Alarm air temp.		0-X	u57	*	*	*	*	*	*	*	*	*	-200 °C	200 °C	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 output	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 °C	200 °C	4 °C
Thermostat cut-out temp.		0-X	u91	*	*	*	*	*	*	*	*	*	-200 °C	200 °C	2 °C
Brine valve opening		0-X	U02	*	*	*	*						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		0-X	U72	*	*	*	*	*	*	*	*	*	-200 °C	200 °C	0 °C
Defrost sensor temperature		0-X	U73	*	*	*	*	*	*	*	*	*	-200 °C	200 °C	0 °C
Liquid line solenoid	0=OFF, 1=ON	0-X	U95					*	*	*	*	*	0	1	0
Average defrost time		0-X	ua2	*	*	*	*	*	*	*	*	*	0 min	600 min	0 min

AK-CC55 Connect menu (SW ver. 2.3x)

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. Be aware: some configuration parameters requires that main switch is set in OFF position in order to be changed	-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

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. Be aware: Some configuration parameters requires that main switch is set in OFF position in order to be changed	-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. Comp/Alarm/Fan/Defrost, 2=2. Comp/Light/Fan/Defrost, 3=3. Comp/Rail heat/Fan/Defrost, 4=4. Comp/Custom, 5=5. EEV/Comp/Fan/Defrost, 6=6. EEV/Alarm/Fan/Defrost, 7=7. EEV/Light/Fan/Defrost, 8=8. EEV/Rail/Fan/Defrost, 9=9. EEV/Custom	o61	o61 Appl. mode
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, 8=Compressor/LLSV, 9=Compressor 2, 10=Air heater	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, 8=Compressor/LLSV, 9=Compressor 2, 10=Air heater	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, 8=Compressor/LLSV, 9=Compressor 2, 10=Air heater	q04	q04 DO4 Config.
AO1 Configuration	Select the function of the analogue output	0=None, 1=Rail heat PWM, 2=Valve driver, 3=Comp. 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
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, 13=Coordinated defrost, 14=Forced closing, 15=Shutdown, 16=Light control, 20=Leak detection, 21=Adaptive liquid control, 29=Door fan stop, 24=Comp. safety, 31=Comp. safety 2	o02	o02 DI1 Config.

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, 14=Forced closing, 15=Shutdown, 16=Light control, 20=Leak detection, 21=Adaptive liquid control, 29=Door fan stop, 24=Comp. safety, 31=Comp. safety 2	o37	o37 DI2 Config.
AI1 Configration	Select the function of the analogue input	0=None, 1=Pe Evap. pressure, 2=S2 Gas outlet, 3=S3 Air ON evap., 4=S4 Air OFF evap., 5=S5 Defrost, 8=S5 Defrost B	q60	q60 AI1 Config.
AI2 Configration	Select the function of the analogue input	0=None, 1=Pe Evap. pressure, 2=S2 Gas outlet, 3=S3 Air ON evap., 4=S4 Air OFF evap., 5=S5 Defrost, 8=S5 Defrost B	q61	q61 AI2 Config.
AI3 Configration	Select the function of the analogue input	0=None, 1=Pe Evap. pressure, 2=S2 Gas outlet, 3=S3 Air ON evap., 4=S4 Air OFF evap., 5=S5 Defrost, 8=S5 Defrost B	q62	q62 AI3 Config.
AI4 Configration	Select the function of the analogue input	0=None, 1=Pe Evap. pressure, 2=S2 Gas outlet, 3=S3 Air ON evap., 4=S4 Air OFF evap., 5=S5 Defrost, 8=S5 Defrost B	q63	q63 AI4 Config.
AI5 Configration	Select the function of the analogue input	0=None, 1=Pe Evap. pressure, 2=S2 Gas outlet, 3=S3 Air ON evap., 4=S4 Air OFF evap., 5=S5 Defrost, 8=S5 Defrost B	q64	q64 AI5 Config.
Refrigerant	Select the type of refrigerant. If the required refrigerant is not part of the list, the user defined option can be used. Please contact Danfoss for detailed informationWarning: Wrong selection of refrigerant may cause damage to the system.	0=Not selected, 6=R13, 7=R13b1, 2=R22, 8=R23, 14=R32, 11=R114, 3=R134a, 12=R142b, 24=R170, 15=R227, 25=R290, 16=R401A, 18=R402A, 19=R404A, 21=R407A, 22=R407B, 20=R407C, 37=R407F, 49=R407H, 23=R410A, 32=R413A, 30=R417A, 31=R422A, 33=R422D, 34=R427A, 35=R438A, 40=R448A, 41=R449A, 48=R449B, 43=R450A, 42=R452A, 44=R452B, 50=R454A, 45=R454B, 51=R454C, 52=R455A, 54=R469A, 9=R500, 4=R502, 10=R503, 17=R507, 36=R513A, 53=R516A, 26=R600, 27=R600a, 5=R717, 28=R744, 46=R1233zdE, 38=R1234ze, 39=R1234yf, 47=R1234zeZ, 29=R1270, 1=User defined display, 13=User defined	o30	o30 Refrigerant
Refrigerant factor K1	Refrigerant factor for a custom refrigerant - please contact Danfoss for detailed information		P83	P83 RfgFac.K1
Refrigerant factor K2	Refrigerant factor for a custom refrigerant - please contact Danfoss for detailed information		P84	P84 RfgFac.K2
Refrigerant factor K3	Refrigerant factor for a custom refrigerant - please contact Danfoss for detailed information		P85	P85 RfgFac.K3
Refrigerant factor A1	Refrigerant factor for a custom refrigerant - please contact Danfoss for detailed information		x65	--- Rfg.Fac.A1
Refrigerant factor A2	Refrigerant factor for a custom refrigerant - please contact Danfoss for detailed information		x66	--- Rfg.Fac.A2
Refrigerant factor A3	Refrigerant factor for a custom refrigerant - please contact Danfoss for detailed information		x67	--- Rfg.Fac.A3
Pe Min range	Minimum measuring range for pressure sensor		o20	o20 MinTransPres
Pe Max range	Maximum measuring range for pressure sensor		o21	o21 MaxTransPres
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 10001 = PTC 10002 = NTC 5k3 = NTC 10k4 = User definedInfo: S2 and S6 sensors always have to be Pt1000 sensors	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, 3=Brine, 4=Air/Offcycle, 5=Electrical pulsing	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, 3=S5A and S5B	d10	d10 DefStopSens.
Defrost stop limit	When the selected defrost stop sensor reaches the set temperature 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 with the physical input or output		U61	U61 DO1 Config.
DO2 Function	Function associated with the physical input or output		U62	U62 DO2 Config.
DO3 Function	Function associated with the physical input or output		U63	U63 DO3 Config.
DO4 Function	Function associated with the physical input or output		U64	U64 DO4 Config.
DI1 Function	Function associated with the physical input or output		Y55	DI1 Config
DI2 Function	Function associated with the physical input or output		Y56	DI2 Config
AI1 Function	Function associated with the physical input or output		Y58	AI1 Config
AI2 Function	Function associated with the physical input or output		Y59	AI2 Config
AI3 Function	Function associated with the physical input or output		Y60	AI3 Config
AI4 Function	Function associated with the physical input or output		Y61	AI4 Config
AI5 Function	Function associated with the physical input or output		Y62	AI5 Config
AO1 Function	Function associated with the physical input or output		U69	U69 AO1 Config.

Thermostat control

Function	Description	Values	Code	Short name
Control state	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, 16=Forced closing, 17=Door open, 18=Melt period, 19=Modulating temp. control, 20=Emergency control, 23=Adaptive superheat control, 24=Start injection, 25=Manual control, 26=No refrigerant selected, 29=Case cleaning, 30=Forced cooling, 31=Door open, 32=Power-up delay, 33=Air heating, 34=Comp. safety cut-out, 45=Shut down controller, 48=Adaptive liquid control, 51=Oil recovery, 53=Comp. lockout, 55=Wrong IO Config	u00	u00 Ctrl. state
Thermostat air temp.	Thermostat temperature		u17	u17 Ther. air
Food temperature	Readout of food temperature		U72	U72 Food temp.
S3 Air ON evap.	Actual temperature of S3 Air ON sensor placed in air flow before evaporator		u12	u12 S3 air temp.
S4 Air OFF evap.	Actual temperature of S4 Air OFF sensor placed in air flow after evaporator		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.
Air temp. performance	Average air temperature performance of the unit in the last 24 hours. A high value means that the average air temperature is within the thermostat operational band		X31	--- TQAvgTmpPerf
Average air temp.	Average thermostat air temperature for the last 24 hours		X30	--- TQAvgAirTemp
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	Readout of the ongoing cut-in period for the thermostat or the duration of the last completed cut-in period		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 air heater output	0=OFF, 1=ON	u84	u84 Heat relay
Door openings 24h	Number of door openings for the last 24 hours		X70	--- DoorOpen24h
Door open time 24h	Accumulated door opening time for the last 24 hours		X71	--- DoorTime24h
Thermostat mode	Here it is defined how the thermostat is to be operated. Either as an ordinary ON/OFF thermostat or as a modulating thermostat.When operation is "modulating" the valve/speed compressor will limit the flow of refrigerant so that the temperature variation will be less than for the ON/OFF thermostat.The thermostat differential (r01) must not be set lower than 2K for "modulating".	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
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
Temp. offset	Temperature offset value used to calculate temperature performance. Air temperature has 100% performance within the cutIn+Offset and cutOut-Offset band		X32	--- TQTempOffset

Day/Night schedule

Function	Description	Values	Code	Short name
Event 1 Day h	Start day time in hours		t58	t58 Event1 Day h
Event 1 Day min	Start day time in minutes		t59	t59 Event1 Day m
Event 1 Night h	Start night time in hours		t60	t60 Event1 Ngt h
Event 1 Night min	Start night time in minutes		t61	t61 Event1 Ngt m
Event 2 Day h	Start day time in hours		t62	t62 Event2 Day h
Event 2 Day min	Start day time in minutes		t63	t63 Event2 Day m
Event 2 Night h	Start night time in hours		t64	t64 Event2 Ngt h
Event 2 Night min	Start night time in minutes		t65	t65 Event2 Ngt m
Monday event	Select scheduled event for Mondays	0=Day, 1=Night, 2=Event 1, 3=Event 2	t66	t66 Mon Event
Tuesday event	Select scheduled event for Tuesdays	0=Day, 1=Night, 2=Event 1, 3=Event 2	t67	t67 Tue Event
Wednesday event	Select scheduled event for Wednesdays	0=Day, 1=Night, 2=Event 1, 3=Event 2	t68	t68 Wed Event
Thursday event	Select scheduled event for Thursdays	0=Day, 1=Night, 2=Event 1, 3=Event 2	t69	t69 Thu Event
Friday event	Select scheduled event for Fridays	0=Day, 1=Night, 2=Event 1, 3=Event 2	t70	t70 Fri Event
Saturday event	Select scheduled event for Saturdays	0=Day, 1=Night, 2=Event 1, 3=Event 2	t71	t71 Sat Event
Sunday event	Select scheduled event for Sundays	0=Day, 1=Night, 2=Event 1, 3=Event 2	t72	t72 Sun Event

Alarm limits and delays

Function	Description	Values	Code	Short name
Control state	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, 16=Forced closing, 17=Door open, 18=Melt period, 19=Modulating temp. control, 20=Emergency control, 23=Adaptive superheat control, 24=Start injection, 25=Manual control, 26=No refrigerant selected, 29=Case cleaning, 30=Forced cooling, 31=Door open, 32=Power-up delay, 33=Air heating, 34=Comp. safety cut-out, 45=Shut down controller, 48=Adaptive liquid control, 51=Oil recovery, 53=Comp. lockout, 55=Wrong IO Config	u00	u00 Ctrl. state
Alarm status	Actual alarm status	0=OFF, 1=ON	x16	--- Sum alarm
Alarm air temp.	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.	Actual temperature of S3 Air ON sensor placed in air flow before evaporator		u12	u12 S3 air temp.
S4 Air OFF evap.	Actual temperature of S4 Air OFF sensor placed in air flow after evaporator		u16	u16 S4 air temp.
High temp alarms 7 days	The number of high temperature alarms for the last 7 days. The number will be reset at power failure		xx2	--- NoHighTempAl
Low temp alarms 7 days	The number of low temperature alarms for the last 7 days. The number will be reset at power failure		xx3	--- NoLowTempAl
Reset alarms	Command for resetting all alarms, unless they are still active	0=OFF, 1=ON	x15	--- Reset alarm
Alarm sensor S4%	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 when the corresponding thermostat band is in use. 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 when the corresponding thermostat band is in use. 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	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	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
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

Injection control

Function	Description	Values	Code	Short name
Control state	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, 16=Forced closing, 17=Door open, 18=Melt period, 19=Modulating temp. control, 20=Emergency control, 23=Adaptive superheat control, 24=Start injection, 25=Manual control, 26=No refrigerant selected, 29=Case cleaning, 30=Forced cooling, 31=Door open, 32=Power-up delay, 33=Air heating, 34=Comp. safety cut-out, 45=Shut down controller, 48=Adaptive liquid control, 51=Oil recovery, 53=Comp. lockout, 55=Wrong IO Config	u00	u00 Ctrl. state
Thermostat air temp.	Thermostat temperature		u17	u17 Ther. air
S3 Air ON evap.	Actual temperature of S3 Air ON sensor placed in air flow before evaporator		u12	u12 S3 air temp.
S4 Air OFF evap.	Actual temperature of S4 Air OFF sensor placed in air flow after evaporator		u16	u16 S4 air temp.
EEV opening	Actual opening degree of electronic expansion valve		u23	u23 EEV OD %
Pe Evap. pressure	Actual pressure at the Pe evaporating pressure transmitter		u25	u25 EvapPress Pe
Te Evap. temp.	Temperature converted from pressure		u26	u26 EvapTemp Te
S2 Gas outlet	Actual temperature of S2 sensor placed at the outlet of the evaporator		u20	u20 S2 temp.
Superheat	Readout of actual superheat at the outlet of the evaporator		u21	u21 Superheat
Superheat reference	Readout of the actual superheat reference		u22	u22 SuperheatRef
OD Ctrl. status	Readout showing which part of the injection function that is in control of the valve opening degree	0=Adaptive SH control, 1=MOP, 2=Superheat close, 3=MTR	Y32	--- OD Status
Liquid line solenoid	Actual status of output function	0=OFF, 1=ON	U95	U95 LLSV
Brine valve opening	Actual status of output function		U02	U02 PWM OD %
Min. superheat limit	Min. value for the superheat reference		n10	n10 Min SH
Max. superheat limit	Max. value for the superheat reference		n09	n09 Max SH
MOP temperature	MOP temperature. The valve opening degree is reduced until the evaporating temperature reaches the set MOP limit. If no MOP function is required, select the highest value that corresponds to OFF		n11	n11 MOP temp.
EEV Period time	Period time for the pulse width modulation		n13	n13 AKV Period
LLSV closing delay	Closing delay for liquid line solenoid valve		na1	na1 LLSV OFF del
Min. superheat liquid ctrl	Min. value for the superheat reference during adaptive liquid control		P87	P87 SH Min Liq.
Max. superheat liquid ctrl.	Max. value for the superheat reference during adaptive liquid control		P86	P86 SH Max Liq.
Brine valve - Period time	Period time for the pulse width modulation		n63	n63 Pwm Period
Brine valve max OD	Expert setting - please contact Danfoss for further info		n64	n64 Pwm Max. OD
Brine valve min OD	Expert setting - please contact Danfoss for further info		n65	n65 Pwm Min. OD
Brine valve wind-up	Expert setting - please contact Danfoss for further info		n66	n66 PwmWindUpFac
Brine valve Kp	Expert setting - please contact Danfoss for further info		n67	n67 Pwm Kp fact.
Brine valve Tn	Expert setting - please contact Danfoss for further info		n68	n68 Pwm Tn sec

Defrost control

Function	Description	Values	Code	Short name
Control state	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, 16=Forced closing, 17=Door open, 18=Melt period, 19=Modulating temp. control, 20=Emergency control, 23=Adaptive superheat control, 24=Start injection, 25=Manual control, 26=No refrigerant selected, 29=Case cleaning, 30=Forced cooling, 31=Door open, 32=Power-up delay, 33=Air heating, 34=Comp. safety cut-out, 45=Shut down controller, 48=Adaptive liquid control, 51=Oil recovery, 53=Comp. lockout, 55=Wrong IO Config	u00	u00 Ctrl. state
Defrost sensor temperature	Actual temperature of selected defrost stop sensor		U73	U73 Def.StopTemp
S5 Evaporator A	Actual temperature of S5A Evaporator sensor placed inside evaporator		u09	u09 S5 temp.
S5 Evaporator B	Actual temperature of S5B Evaporator sensor placed inside evaporator		u75	u75 S5 temp. B
Defrost output	Actual status of defrost output	0=OFF, 1=ON	u60	u60 Def. relay
Defrost time	Read the duration of the ongoing defrost or the duration of the last completed defrost.		u11	u11 Defrost time
Average defrost time	The average defrost time for the last 10 defrosts		ua2	ua2 Avr Def 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, 3=Brine, 4=Air/Offcycle, 5=Electrical pulsing	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, 3=S5A and S5B	d10	d10 DefStopSens.
Defrost stop limit	When the selected defrost stop sensor reaches the set temperature 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 temperature limit, the defrost cycle is terminated		d28	d28 DefStopTemp2
Min. defrost time	Minimum 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	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

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.
Pump down delay	Set the time where the evaporator is emptied of refrigerant prior to the actual defrost cycle		d16	d16 Pump dwn del
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

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 start of defrost		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 start of defrost		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 start of defrost		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 start of defrost		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 start of defrost		t15	t15 Def. 5 min.
Def. start 6 - Hours	Time in hours for start of defrost		t06	t06 Def. 6 hr.
Def. start 6 - Minutes	Time in minutes for start of defrost		t16	t16 Def. 6 min.
Monday - Follow schedule	Shall the schedule apply for this day	0=No, 1=Yes	t51	t51 Mon.Schedule
Tuesday - Follow schedule	Shall the schedule apply for this day	0=No, 1=Yes	t52	t52 Tue.Schedule

Wednesday - Follow schedule	Shall the schedule apply for this day	0=No, 1=Yes	t53	t53 Wed.Schedule
Thursday - Follow schedule	Shall the schedule apply for this day	0=No, 1=Yes	t54	t54 Thu.Schedule
Friday - Follow schedule	Shall the schedule apply for this day	0=No, 1=Yes	t55	t55 Fri.Schedule
Saturday - Follow schedule	Shall the schedule apply for this day	0=No, 1=Yes	t56	t56 Sat.Schedule
Sunday - Follow schedule	Shall the schedule apply for this day	0=No, 1=Yes	t57	t57 Sun.Schedule

Compressor

Function	Description	Values	Code	Short name
Compressor 1	Actual status of compressor output	0=OFF, 1=ON	u58	u58 Comp1/LLSV
Compressor 2	Actual status of compressor 2 output	0=OFF, 1=ON	u67	u67 Comp2 relay
Compressor speed	Compressor speed		u52	u52 Comp Cap %
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. 1: At sequential mode compressor 1 will always be the first to start and the last to stop. 2: In cyclic mode the run time between the compressor will be equalized. 3: At Dual circuit, both compressors are alwaysh running at the same time and only have a step delay between them when starting	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
Comp cut-out delay	The time the thermostat air temperature is allowed to be below the thermostat cut-out limit before the variable speed compressor is stopped		c99	c99 CmpCutOutDel
Max speed slope	Limitation on how fast the speed can ramp up/down (set in % per. second)		c96	c96 MaxSlopeRate
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
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
Max safety events	The maximum of repeated compressor safety and condenser block safety events before the compressors are lockout and a manual alarm reset is required to restart compressor operation		P94	P94 SafetyEvents
Safety event period	Time period for counting maximum number of allowed safety events for compressor safety and condenser block safety		P93	P93 SafetyPeriod
Safety action	Select the action taken if repeated condenser block alarms or compressor safety alarms result in lockout of compressors	0=None, 1=Lights off	P92	P92 SafetyAction

Fan control

Function	Description	Values	Code	Short name
Control state	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, 16=Forced closing, 17=Door open, 18=Melt period, 19=Modulating temp. control, 20=Emergency control, 23=Adaptive superheat control, 24=Start injection, 25=Manual control, 26=No refrigerant selected, 29=Case cleaning, 30=Forced cooling, 31=Door open, 32=Power-up delay, 33=Air heating, 34=Comp. safety cut-out, 45=Shut down controller, 48=Adaptive liquid control, 51=Oil recovery, 53=Comp. lockout, 55=Wrong IO Config	u00	u00 Ctrl. state
Fan	Actual status of fan output	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 FanPulseMode
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.With a value of 50 °C this function is disabledWith a value lower than 50 °C, the fan stops by the result of the S5 temperature.		F04	F04 FanStop temp
Fan at forced closing	You can set whether fans should be operational or stopped if the function "Forced closing" is activated here. 0: Fans are OFF1: Fans are ON2: Fans are OFF and defrost is not permitted3: Fans are ON and defrost is not permitted	0=OFF, 1=ON, 2=OFF and suppress defrost, 3=ON and suppress defrost	o90	o90 Fan ForcedCl
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 BlindFanStop

Railheat control

Function	Description	Values	Code	Short name
Control state	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, 16=Forced closing, 17=Door open, 18=Melt period, 19=Modulating temp. control, 20=Emergency control, 23=Adaptive superheat control, 24=Start injection, 25=Manual control, 26=No refrigerant selected, 29=Case cleaning, 30=Forced cooling, 31=Door open, 32=Power-up delay, 33=Air heating, 34=Comp. safety cut-out, 45=Shut down controller, 48=Adaptive liquid control, 51=Oil recovery, 53=Comp. lockout, 55=Wrong IO Config	u00	u00 Ctrl. state
Dewpoint	Actual dewpoint received from system manager via network		x18	--- Dew point
Rail heat	Actual status of rail heat output	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
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

Function	Description	Values	Code	Short name
Control state	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, 16=Forced closing, 17=Door open, 18=Melt period, 19=Modulating temp. control, 20=Emergency control, 23=Adaptive superheat control, 24=Start injection, 25=Manual control, 26=No refrigerant selected, 29=Case cleaning, 30=Forced cooling, 31=Door open, 32=Power-up delay, 33=Air heating, 34=Comp. safety cut-out, 45=Shut down controller, 48=Adaptive liquid control, 51=Oil recovery, 53=Comp. lockout, 55=Wrong IO Config	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 light output	0=OFF, 1=ON	u63	u63 Light relay
Blinds	Actual status of blinds output	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

Function	Description	Values	Code	Short name
Control state	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, 16=Forced closing, 17=Door open, 18=Melt period, 19=Modulating temp. control, 20=Emergency control, 23=Adaptive superheat control, 24=Start injection, 25=Manual control, 26=No refrigerant selected, 29=Case cleaning, 30=Forced cooling, 31=Door open, 32=Power-up delay, 33=Air heating, 34=Comp. safety cut-out, 45=Shut down controller, 48=Adaptive liquid control, 51=Oil recovery, 53=Comp. lockout, 55=Wrong IO Config	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 %
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 lockedLocal: 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 operationsNetwork: 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

Function	Description	Values	Code	Short name
Alarm relay	Actual status of alarm output	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
Injection - 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	q34	q34 Inject 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
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

Miscellaneous

Miscellaneous → Access codes

Function	Description	Values	Code	Short name
Access code 3	Access code for commissioning / OEM		o05	o05 Acc. code 3
Access code 2	Access code for service		o64	o64 Acc. code 2
Access code 1	Access code for daily operations		P88	P88 Acc. code 1

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, 6=115200 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

Miscellaneous → Time

Function	Description	Values	Code	Short name
Time hours	Hour setting for clock		t07	t07 Clock Hour
Time minutes	Minutes setting for clock		t08	t08 Clock Minute
Time date	Date setting for clock		t45	t45 Clock Date
Time month	Month setting for clock		t46	t46 Clock Month
Time year	Year setting for clock		t47	t47 Clock Year

Miscellaneous → Sensor adjustment

Function	Description	Values	Code	Short name
S2 Gas outlet - Adjustment	Correction of sensor signal e.g. due to long sensor cable		r19	r19 Adjust S2
S3 Air ON evap. - Adjustment	Correction of sensor signal e.g. due to long sensor cable		r10	r10 Adjust S3
S4 Air OFF evap. - Adjustment	Correction of sensor signal e.g. due to long sensor cable		r09	r09 Adjust S4
S5 Evaporator - Adjustment	Correction of sensor signal e.g. due to long sensor cable		r11	r11 Adjust S5

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 basic 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

Advanced → Advanced injection control

Function	Description	Values	Code	Short name
Superheat ctrl. mode	Select how to control the superheat of the evaporator. At adaptive control the superheat reference is adapted automatically to give the best utilization of the evaporator surface. At load based control the superheat reference is increased at high loads	1=Adaptive, 2=Load based	n21	n21 SH mode
Superheat close	Minimum superheat limit where the valve is closing		x68	--- SH close
Superheat close liquid ctrl.	Minimum limit of superheat where the valve is closing during adaptive liquid control		x87	--- SH close Liq
Superheat Kp min.	Min limit for amplification factor of the PI controller adjusting the valve opening degree (expert setting)		x70	--- SH Kp min
Superheat Kp max.	Max limit for amplification factor of the PI controller adjusting the valve opening degree (expert setting)		x71	--- SH Kp max
Superheat Tn	Integration time of the PI controller adjusting the valve opening degree (expert setting)		x72	--- SH Tn
Te feedback gain	Gain factor for feedback of evaporating temperature signal Te to the PI controller controlling the superheat (expert setting)		x73	--- Te-gain
Kp MTR control	Amplification factor for modulating temperature control (Expert setting)		x77	--- MTR Kpfactor
Tn MTR control	Integration time for modulating temperature control (Expert setting)		x78	--- MTR Tn sec
SH Band	Expert injection setting - contact Danfoss for further information		Y28	--- SH Band
P-gain	Expert injection setting - contact Danfoss for further information		Y31	--- P - Gain
Ther. duty cycle SP	Expert setting - contact Danfoss for further information		Y29	--- ThDutyCycle
AFident	Expert readout - contact Danfoss for further information		x79	--- AFident
AFidentForce	Expert setting - contact Danfoss for further information		x69	--- AFidentForce
Calculated Max OD	Calculated maximum opening degree of the injection valve (expert readout)		x80	--- Max OD %
OD Ctrl. status	Readout showing which part of the injection function that is in control of the valve opening degree	0=Adaptive SH control, 1=MOP, 2=Superheat close, 3=MTR	Y32	--- OD Status
Ther. duty cycle	Expert injection setting - contact Danfoss for further information		Y30	--- ActDutyCycle
SH Impact factor	Superheat impact factor is used in the superheat reference search. The higher the impact factor, the more unstable the superheat signal is allowed to be before the reference superheat value is decreased		Y35	--- SH ImpactFac
SH Std deviation	Standard deviation in superheat signal. The higher the value, the more instabillity in the superheat signal		Y36	--- SH Std Dev
Start-up OD	The valve will operate with the set start opening degree for the set start time. Do not set the start time and opening degree at too high values as this could result in getting liquid back to the compressor. When the start time is set to 0, the injection will not start with a fixed opening degree at start up		n17	n17 Start OD %
Start up injection period	The valve will operate with the set start opening degree for the set start time. Do not set the start time and opening degree at too high values as this could result in getting liquid back to the compressor. When the start time is set to 0, the injection will not start with a fixed opening degree at start up		n15	n15 StartUp Time
Reset injection	Injection control will go back to factory condition	0=No, 1=Yes	x88	--- Reset Inj.

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.	Readout of the actual cut-in value for the thermostat		x63	--- Cutin temp.
MC Actual cut-out temp.	Readout of the actual cut-out value for the thermostat		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 Load request	Master control signal used to control the load balance between multiple case controllers on the same suction line		x82	--- LoadReq
MC Max. Te offset	Requested offset to actual evporating temperature in order to keep the air temperature at the actual setpoint		x84	--- MaxTeOffset
MC Liquid control	Master control signal allowing switch to adaptive liquid control	0=OFF, 1=ON	x85	--- MC Liq. Ctrl
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 closing	Master control signal that will close the injection valve	0=OFF, 1=ON	x07	--- Forced close
MC Forced cooling	Master control signal that will provide forced cooling	0=OFF, 1=ON	x08	--- Forced cool.
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	Master control signal calculating the actual load of the unit		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	X33	--- Key/BT Lock
MC Min. delta T	Required minimum delta temperature across evaporator (S3 - Te) in order to keep the air temperature at the actual setpoint		y04	--- Min Delta T

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 Table: Alarm relay priorities.) Here are the messages that may appear:

Table: Fault message

Code	Alarm text	Description
E01	Hardware failure	The controller has a hardware failure
E06	Clock lost time	Clock has lost valid time
E20	Pe Evap. pressure A - Sensor error	Sensor signal is out of range. Please check the sensor for correct operation
E24	S2 Gas outlet A - Sensor error	Sensor signal is out of range. Please check the sensor for correct operation
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
E37	S5 Evaporator B - 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.
A11	Refrigerant not selected	The refrigerant has not been selected hence control can not be initiated
A15	DI alarm 1	Alarm signal from digital input signal
A16	DI alarm 2	Alarm signal from digital input signal
A19	Comp. safety	Alarm from digital input monitoring the safety chain of compressor 1
A45	Main switch set OFF	The controller main switch has been set to either Stop or Manual 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
AA2	CO_2 leak detected	CO_2 is leaking from the refrigeration system
AA3	Refrigerant leak detected	Refrigerant is leaking from the refrigeration system
a04	Wrong IO configuration	Inputs and outputs have not been configured correctly
a12	Comp. safety 2	Alarm from digital input monitoring the safety chain of compressor 2
a13	Compressor safety lockout[1]	The compressors/condenser have violated safety limits more times than allowed within the defined safety period and the clearance of the alarm will require a manual reset of the alarm, which can be done in one of the following ways: 1. Navigate to alarm list on display and press the alarm button for 3 seconds 2. Power down the controller 3. Set Main switch OFF and back ON again

[1] Alarm requires manual reset via one of the following options:

1. Power off controller
2. Long press on display alarm button while in alarm menu
3. Set the parameter "r12 Main switch" OFF and ON again

Alarm routing

If an alarm relay is defined, the priority of the alarms that are send to the alarm relay can be defined – please refer to the table below:

Table: P41Alarm relay priority

Parameter	Value	Description
P41Alarm relay priority	0: None (No alarms are routed to relay) 1: High priority 2: High and Medium priority 3: All alarms (except disabled alarms)	Select the alarm priorities that are sent to the alarm relay

The alarms are grouped, and the priorities of each alarm group can be set in accordance with the table below:

Table: Alarm group

Alarm group	Priority	Code	Alarm
High Temp.	q28 High temperature - Priority	A01	High temperature alarm A
Low temp.	q29 Low temperature - Priority	A02	Low temperature alarm A
Sensor error	q30 Sensor errors - Priority	E20	Pe Evap. pressure A - sensor error
		E24	S2 Gas outlet A - sensor error
		E25	S3 Air ON evap. A - sensor error
		E26	S4 Air OFF evap. A - sensor error
		E27	S5 Evaporator A - sensor error
		E37	S5 Evaporator B - sensor error
DI alarms	q31 DI alarms - Priority	A04	Door open alarm
		A15	DI alarm 1
		A16	DI alarm 2
Defrost	q32 Defrost - Priority	A05	Max defrost hold time exceeded
			Max defrost time exceeded A
Miscellaneous	q33 Miscellaneous - Priority	E01	Hardware failure
		E06	Clock lost time
		a04	Wrong IO configuration
Injection	q34 Injection - Priority	A11	Refrigerant not selected
Stop of control	q35 Control stopped - Priority	A45	Main switch set OFF
		A59	Case in cleaning mode
Leak detection	q36 Leak detection - Priority	AA2	CO2 leak detected
		AA3	Refrigerant leak detected
Compressor	q53 Compressor - Priority	A19	Comp. safety 1
		a12	Comp. safety 2
		a13	Comp. safety lockout

Operating status

Table: Operating status

Ctrl. State/Code	Operating status	Description
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)
S16	Forced closing	The injection valve has been forced closed via a signal on a digital input or from the system manager (compressor pack is restricted from starting)
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)
S23	Adaptive superheat control	The superheat of the evaporator is optimized
S24	Start injection	The liquid injection into the evaporator has started
S25	Manual control	Main switch has been set in Service position for manual control of outputs
S26	No refrigerant selected	The refrigerant type has not been selected (parameter o30 Refrigerant)
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	Comp. safety	Compressor safety (DI input function)
S45	Shut down controller	The control has been stopped due to a digital input signal or from the system manager
S48	Adaptive liquid control	The superheat control is running adaptive liquid control with reduced superheat for transcritical CO2 systems with ejectors. Signal is provided via digital input or from the system manager
S53	Comp. lockout	Compressor lockout on safety
S55	Wrong IO config	An illegal IO configuration has been made, please refer to Appendix B for further details

[1] Emergency control:

– If Pe or S2 sensor fails, the controller will operate with a safe opening degree based on normally registered opening degree during day and night operation.

– If S3 or S4 sensor fails, the thermostat will operate with a registered ON/OFF duty cycle during day and night operation.

Product details

General data

Table: Electrical specifications

Feature	Value
Supply voltage AC [V]	115/230 V, +10/-15%, 50/60 Hz
Power consumption [VA]	5 VA
Power ON indicator	Green LED
Electrical cable dimensioning [mm^2]	Max. 1.5 mm^2 multi-core cable

Table: Sensor and measuring data

Feature	Value
Sensor S2	Pt 1000 AKS11
Sensor S3, S4, S5	Pt 1000 AKS11 PTC 1000 EKS111 NTC5K EKS211 NTC10K EKS221 sensor (All 3 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
Pe measuring	AKS 32R Ratiometric pressure transmitter: 10 – 90%

Table: Input and output relay specifications

Feature	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
Solid state output	DO1 (for AKV coil)	115 V / 230 V AC Max. 0.5 A (No overload protection!) Max. 1 x 20 W AKV for 115 V AC 2 x 20 W AKV for 230 V AC **Note:** 2 EC coils are not supported.
Relays	DO2 DO3 DO4	115 V / 230 V AC Load max.: CE. 8 (6)A UL 8A res. 3FLA 18LRA Load min.: 1VA Inrush: DO2 DO3 TV-5 80A
Analogue output/ PWM	AO1	0 / 10 V Pulse Width Modulated (PWM) max. 15 mA. 0 – 10 V variable, max. 2 mA

Note:
- DO2 to DO4 are 16 A relays.
- Max. load must be observed.
- DO2 / DO3 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.

Table: Function data

Feature	Value
Display	LED 3 digit
External display, AK-CC55 Compact	1 external display
External display connection	RJ12
Max. display cable length	100 m
Data communication built-in	MODBUS
Clock battery backup power reserve	4 days
Mounting	DIN rail

Performance and environmental conditions

Table: Environmental conditions

Environmental conditions	Value
Ambient temperature range, operation	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

Appendices

Appendix A:

Handling of illegal IO configuration

At the following illegal IO combinations, the controller will raise a "Wrong IO config" alarm, control state (55) will readout "Wrong IO config" and control will not be able to start:

1. If Fan Eco has been configured and Fan has not been configure
2. If no air temperature sensors have been configured (Either S3 or S4 must be configured)
3. If the same analogue input function is selected for several analogue hardware inputs
4. If compressor 2 has been configured without having configured a compressor 1
5. If compressor 2 has been defined and brine control is enabled
6. If two compressors have been configured, and the analogue output has been configured for compressor speed
7. If evap. sensor S5B has been configured without having configured an evap. sensor S5
8. If blinds are configured, but no light output is configured

If the controller application requests a specific sensor to be present and the sensor has not been configured, an "Wrong IO config" alarm and a sensor error alarm for the missing sensor will be raised.
Appendix B has a table showing when sensors are being requested by the application.

Appendix B:

Sensor alarms

The controller will only raise a sensor alarm if the parameter setup requires a specific sensor and this sensor is not configured or is defective.
The table below shows when a specific sensor is requested.

Parameter setting	Value	Pe	S2	S3	S4	S5A	S5B
o61 Application mode	>=5	x	x				
r15 Thermostat sensor S4 %	= 0%			x			
	= 100%				x		
	0% < Setting < 100%			x	x		
r61 Thermostat sensor S4 % night	= 0%			x			
	= 100%				x		
	0% < Setting < 100%			x	x		
r98 S4 frost protection	> -60°C				x		
A36 Alarm sensor S4%	= 0%			x			
	= 100%				x		
	0% < Setting < 100%			x	x		
d10 Defrost stop method	= 1 (S5A)					x	
	= 2 (S4)				x		
	= 3 (S5A & S5B)					x	x
d08 Fan start temperature	< 50°C					x	
F04 Fan stop high S5 temp.	< 50°C					x	
o17 Display air S4%	= 0%			x			
	= 100%				x		
	0% < Setting < 100%			x	x		
q39 Food temp. sensor	= 3 (S3)			x			

Certificates, declarations and approvals

Approval type	Title	Issuer	Approval topic
EMC Certificate	ACMA CF13198_AU-Rev.00	ACMA - Australian Communication and Media Authority	RCM
UA Declaration	Danfoss UA 8537	Danfoss	UA RoHS
CB Test Certificate	CB US-35091-M1-UL	UL - Underwriters Laboratories inc.	
EU-UK Declaration	Danfoss EU-UK 084R0835.AB	Danfoss	LVD, EMC, EU RoHS, UK RoHS
Manufacturer's Declaration	Danfoss MD 080R1237.01	Danfoss	EAEU RoHS
EAC Declaration	EAC KZ 7100841.13.12.01062	EAC - Eurasian Customs Union	EMC
Electrical Safety Certificate	EAC KZ 7100841.01.01.01245	EAC - Eurasian Customs Union	LVD, EMC
Export Control Declaration	Case/room controller (EEV)	Danfoss	
EU Declaration	PL25 EU Declaration packaging	Danfoss	Packaging

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

Relays:
Tested according to IEC 60079-15

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.

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