ENGINEERING
TOMORROW

User Guide

Case controller
Type **EKC 223** and **EKC 224**

SW Ver. 1.0x
For refrigerated display cabinets, cold storage rooms and simple heating applications.

Contents

Introduction

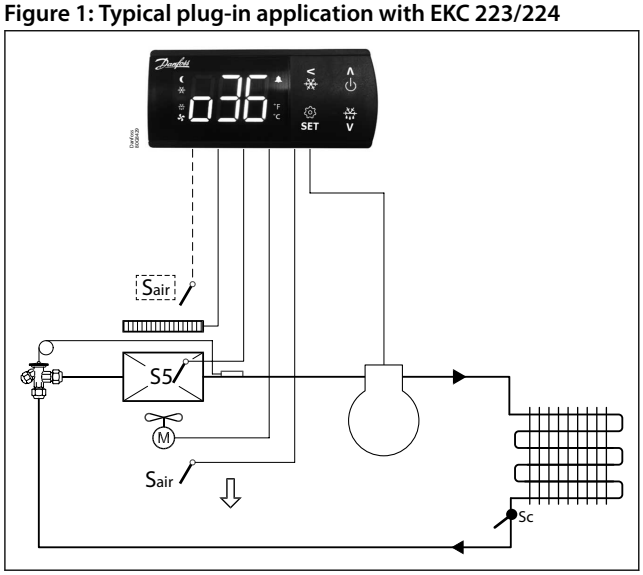
Application

EKC 223/224 are multipurpose refrigeration controllers designed to fulfill today's requirement of food retail refrigeration applications. This controller is suitable for high, medium, and low temperature cabinets and cold rooms with natural, electrical, or hot gas defrost.

Principle

The EKC 223/224 controls the temperature in the cabinet based on the measurement from a single sensor – Sair. This sensor can be placed in the cold airflow after the evaporator or in the warm airflow before the evaporator, depending on the construction and usage of the cabinet. A measurement of the defrost temperature can be obtained using an S5 evaporator sensor or indirectly by using the Sair measurement.

Figure 1: Typical plug-in application with EKC 223/224



EKC 223/224 controllers come with four push buttons, a big display, easy and intuitive menu structure, and pre-defined applications ensure ease of use. Controller is loaded with energy efficiency features like smart evaporator fan management, day/night mode and defrosts on demand features.

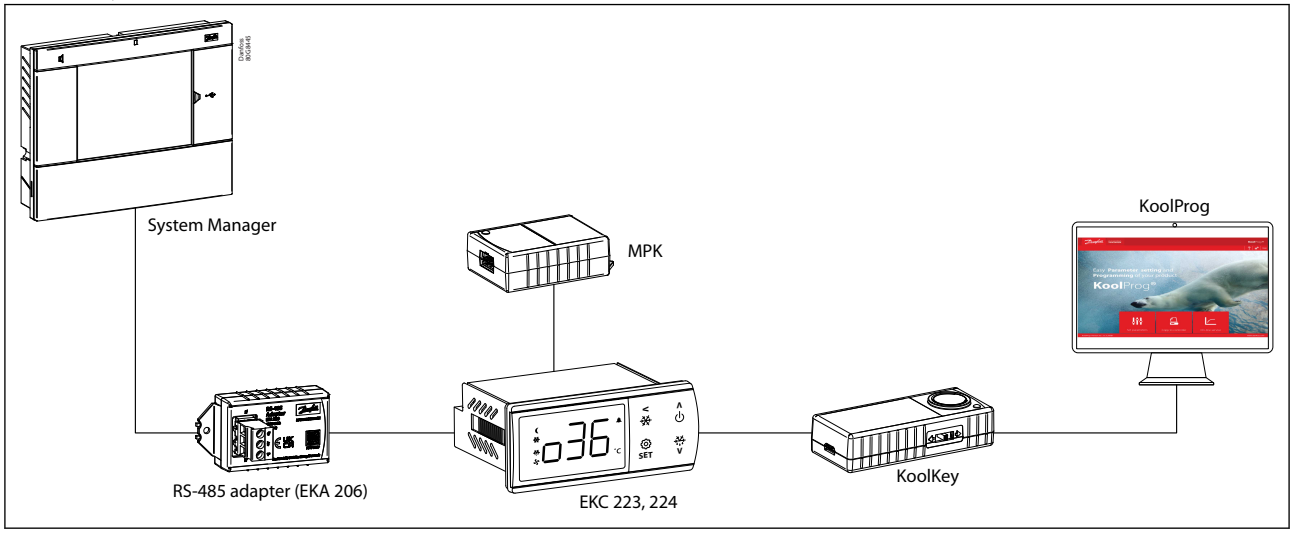
Advantages

- Several applications in same unit
- Quick setup for fast commissioning
- Digital inputs for various functions
- Control of compressor or liquid line solenoid valve
- High Effect 16 A relay enable direct connection of heavy loads without use of intermediate relay: up to 2 hp compressors depending on its power factor and motor efficiency
- Alarm monitoring of condenser temperature with compressor stop protection
- Easy to integrate into Danfoss network systems via RS-485 adapter (EKA 206)
- Accurate temperature measurements

System overview

The EKC 223/224 controllers have a TTL port on the rear side of the controller and this TTL port allows the controller to be connected to various interfaces.

Figure 2: System interfaces of EKC 223/224



The RS-485 adapter (EKA 206) adapter allows to integrate the controller on a Modbus fieldbus. The controller is supported by the following Danfoss front ends:

- AK-SM 720 system manager
- AK-SM 800 system manager
- AK-SM 800A system manager

The KoolKey (EKA 200) allows to connect the EKC controllers to the PC application named "KoolProg". Via KoolProg it is possible to perform on-line and off-line programming of the EKC controllers. It can also perform production line programming of multiple controllers and show on-line trend curves on selected parameters.

Finally "KoolProg" can also load controller setup files into the MPK - Mass Programming Key (EKA 201) which can be used for simple production line programming of EKC controllers.

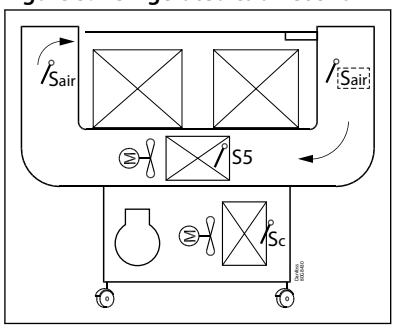
Please refer to the KoolProg® User Guide for detailed instructions on how to use KoolProg®. Download KoolProg® at: http://koolprog.danfoss.com. Refer to the installation guides of KoolKey (EKA 200) and Mass Programming Key (EKA 201) for further details on how to interface and use these modules.

Functions

Temperature sensors

One thermostat sensor – Sair – can be connected to the controller, and the relevant application defines the placement. It can be placed in the air flow before the evaporator or in the air flow after the evaporator. The latter is mainly used where there is a risk of too low temperature at the products.

Figure 3: Refrigerated cabinet shown with sensor positions



Defrost sensor

The best signal concerning the evaporator's temperature is obtained from a S5 defrost sensor mounted directly on the evaporator. Here the signal may be used by the defrost function, so that the shortest and most energy-saving defrost can take place. If a defrost sensor is not required, defrost can be stopped based on time, or Sair can be selected.

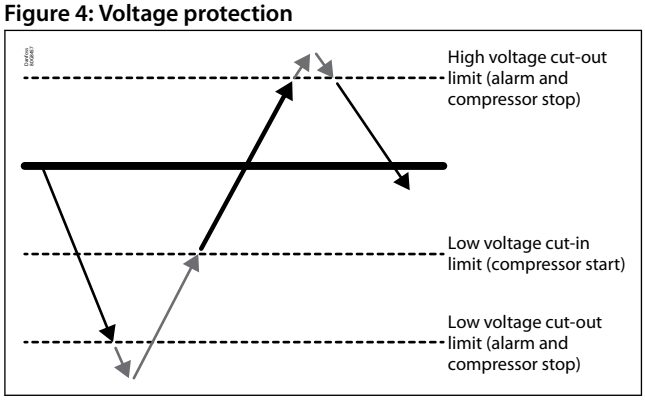
Condenser temperature sensor

A condenser temperature sensor – Sc – can be used for monitoring the temperature on the condenser. Depending on settings, alarms can be generated, and a safety stop of the compressor, can be initiated based on this temperature.

Voltage protection

The voltage protection ensures that the compressor motor is operating within safe voltage ranges. If the power supply voltage gets outside the specified high/low voltage cut-out ranges, the compressor is cut-out or restricted from starting. Normal compressor operation is resumed when the power supply voltage is back in the area between the high voltage cut-out limit and the low voltage cut-in limit.

Figure 4: Voltage protection

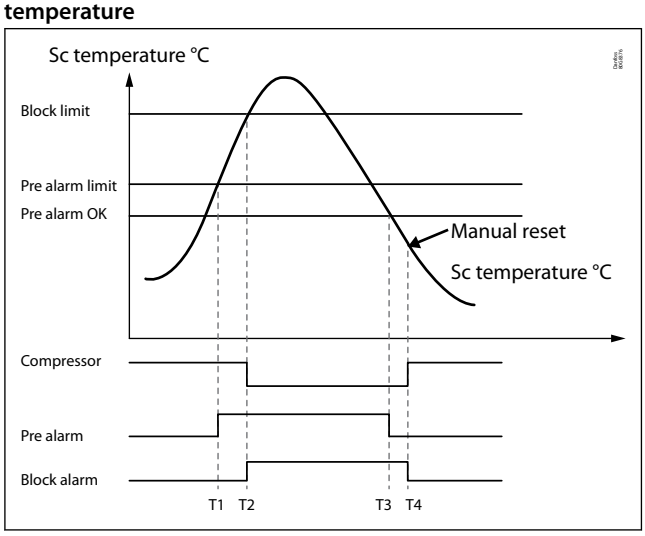


Condenser temperature monitoring

If the condenser is blocking up with dirt and thereby reaches a too high condensing temperature, the controller will give the user early warning through condenser alarm and if temperature rises further, it will switch the compressor OFF. If the temperature measured by the condenser sensor (Sc) is reaching the set "pre-alarm limit" an alarm is raised, but no further action is taken.

This is used to indicate to the user that something is wrong with the condenser. Often the reason is that that the air flow to the condenser is restricted (dirt) or because the condenser fan is broken. The alarm will reset if the condenser temperature drops back by 5 °C. If the measured condenser temperature continues to increase and reaches the set “Block limit” the compressor is stopped, and it is restricted from starting again until the alarm is reset manually. The alarm can be reset manually by setting the parameter r12 Main switch to OFF position and back to ON position or by powering the controller down.

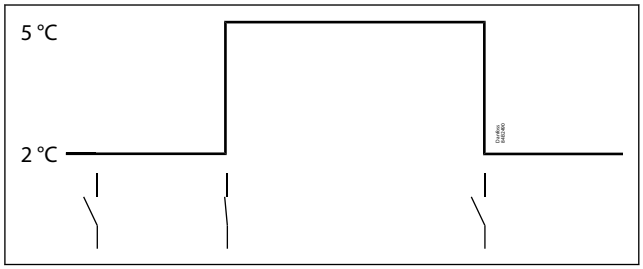
Figure 5: Compressor protection against high condensing temperature



Change of temperature reference

In an impulse appliance, for example, used for various product groups the temperature reference is changed easily with a contact signal on a digital input. The signal changes the normal thermostat setpoint by a predefined value. At the same time the high and low alarm limits will be displaced with the same value.

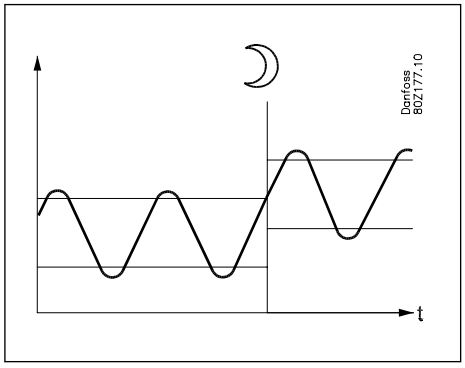
Figure 6: Change of temperature reference



Night setback

The thermostat reference can be displaced with an offset at night. The alarm limits will not be displaced at night operation.

Figure 7: Night setback

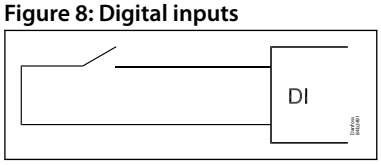


Digital inputs

There are two digital inputs, DI1 and DI2, with dry contact function.

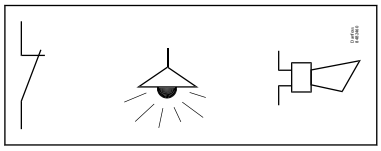
They can be used for the following functions:
- Status readout
- Door function with stop of cooling and door alarm
- Door alarm only
- Main switch (start/stop of cooling)
- Night setback
- Reference offset
- External alarm
- Defrost start
- Pulldown cycle
- Sc condenser sensor (only DI1)

Figure 8: Digital inputs



Door contact function

In cold rooms and frost rooms the door switch can switch the light on and off, start and stop the refrigeration and give alarm if the door has remained open for too long.



Defrost

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

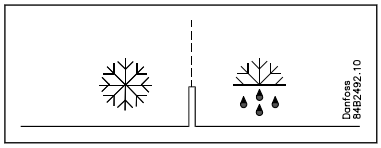
- *Natural:* Here the fans are kept operating during defrost
- *Electric:* The heating element is activated during active defrost
- *Hot gas:* The defrost output is used to control a solenoid that lets the hot gas flow through the evaporator. The compressor is kept running to generate hot gas.

Start of defrost

A defrost can be started in different ways:
- *Interval:* Defrost is started at fixed time intervals, e.g., every eighth hour
- *Compressor runtime:* Defrost is started at fixed compressor runtime intervals. In other words, a low need for refrigeration will "postpone" the coming defrost.
- *Contact:* Defrost is started with a contact signal on a digital input.
- *Network:* The signal for defrost is received from a system unit via the data communication.
- *Defrost on demand*: In 1:1 system the efficiency of the evaporator can be followed. Icing-up will start a defrost.
- *Manual:* An extra defrost can be activated from the controller's lower-most button (though not for application 4).

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

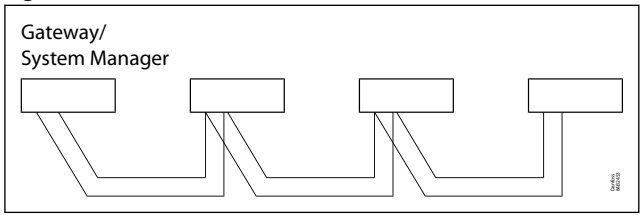
Figure 9: Start of defrost



Coordinated defrost via network

A coordinated defrost among multiple controllers can be obtained via data communication. The controllers will have to be added to a coordinated defrost group in the AK-SM system manager. When a defrost cycle is scheduled the system manager will start a defrost in all controllers. After the defrost, the individual controllers will move into waiting position. When all controllers have terminated the defrost all controllers will continue with the rest of the defrost cycle (drip delay and fan delay).

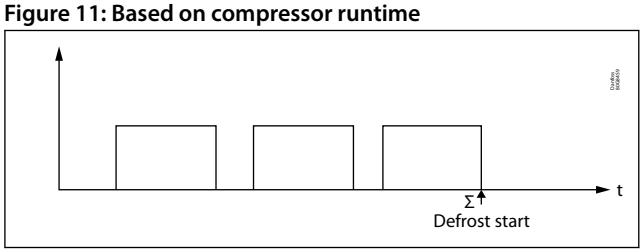
Figure 10: Coordinated defrost



Defrost on demand

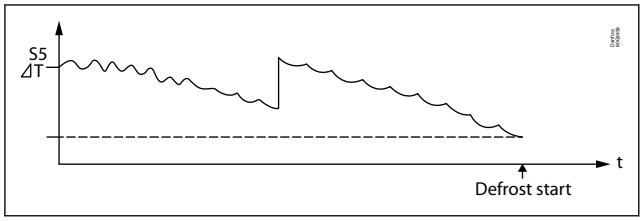
1. Based on compressor runtime: when the aggregate compressor runtime has passed a set time, a defrost will be started.

Figure 11: Based on compressor runtime



2. Based on temperature: the controller will constantly follow the temperature at S5. Between two defrosts, the S5 temperature at compressor cut-out will become lower the more the evaporator ices up (the compressor operates for a longer time and pulls the S5 temperature further down). When the S5 temperature passes a set allowed difference, compared to the set thermostat cut-out value the defrost will be started. This function can only work in 1:1 system.

Figure 12: Based on temperature



Applications

EKC 223 and 224 are developed for refrigerated plug-in cabinets with one compressor or for remote cabinets controlling the liquid line solenoid valve. 3 sensors can be connected; Sair, S5 (Defrost termination), and Sc (Condenser temperature).

The configuration of the relays is done via the parameter "o61 Application mode"

The Table 1 and Table 2 shows the application modes for EKC 224 and 223 respectively.

EKC 224 applications

Table 1: EKC 224 applications

o61	Applications	DO1	DO2	DO3	DO4	AI1	AI2	DI1[1]	DI2[1]
1	MT/LT, electrical defrost, light					Sair	S5	DI1/Sc	DI2
2	MT/LT, electrical defrost, alarm					Sair	S5	DI1/Sc	DI2
3	MT, natural defrost, light, alarm					Sair	S5	DI1/Sc	DI2
4	Heating thermostat					Sair	S5	DI1	DI2

[1] The digital inputs DI1 and DI2 can be configured for multiple functions and DI1 can also be configured for a condenser temperature sensor Sc.

EKC 223 applications

Table 2: EKC 223 applications

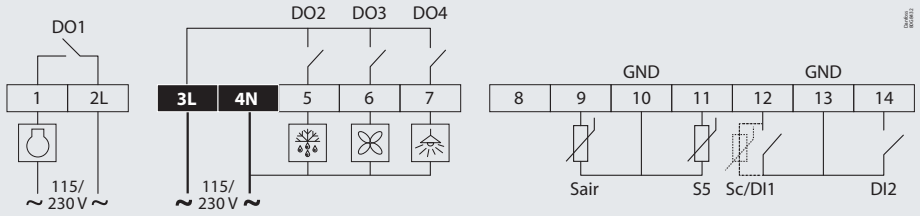
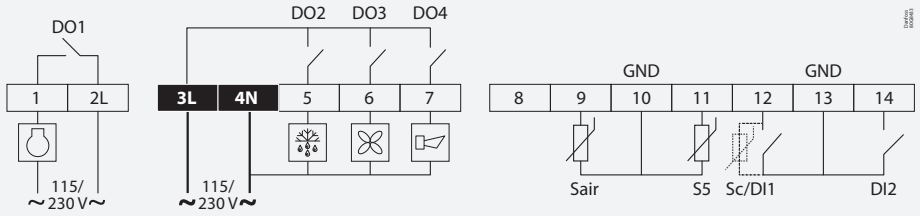
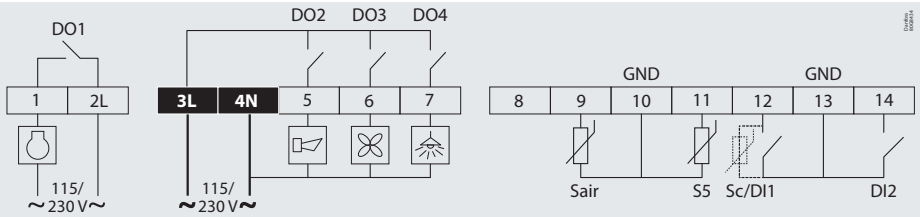
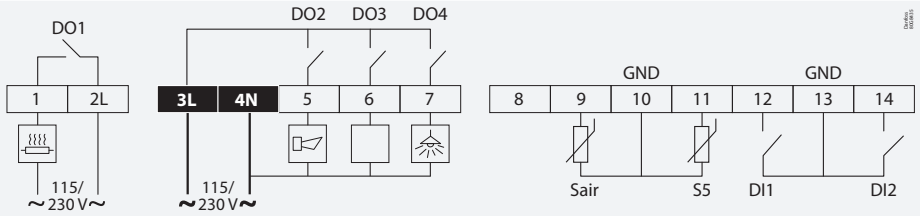
o61	Applications	DO1	DO2	DO3	AI1	AI2	DI1[1]	DI2[1]
1	MT/LT, electrical defrost				Sair	S5	DI1/Sc	DI2
2	MT, natural defrost, light				Sair	S5	DI1/Sc	DI2
3	MT, natural defrost, alarm				Sair	S5	DI1/Sc	DI2
4	Heating thermostat				Sair	S5	DI1	DI2

[1] The digital inputs DI1 and DI2 can be configured for multiple functions and DI1 can also be configured for a condenser temperature sensor Sc.

Wiring diagrams

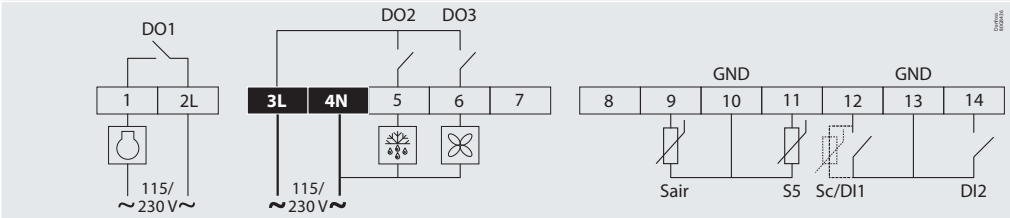
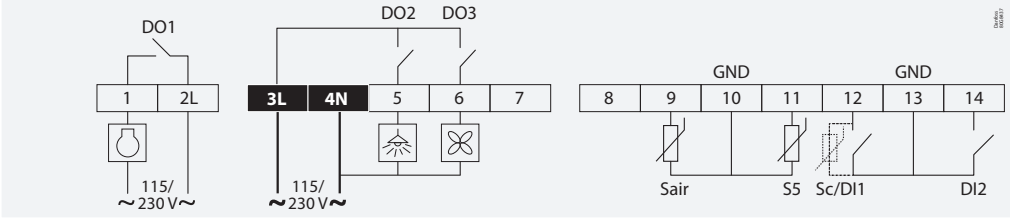
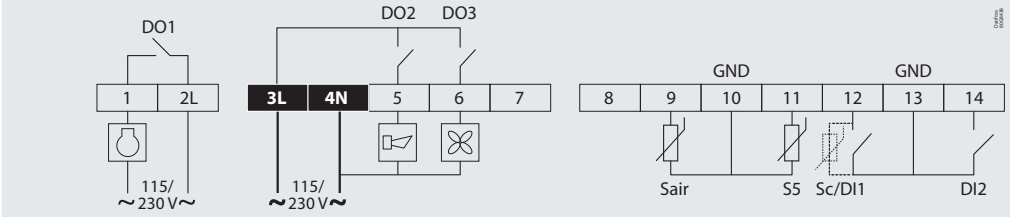
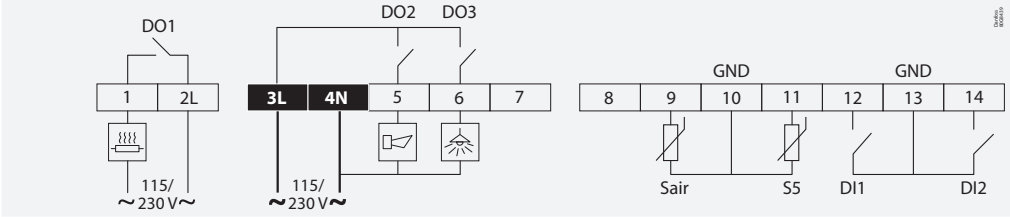
EKC 224

Table 3: The electrical wiring diagrams for the selection of 4 applications

Applications	Wiring diagrams
1.	
2.	
3.	
4.	

EKC 223

Table 4: The electrical wiring diagrams for the selection of 4 applications

Application	Wiring diagrams
1.	
2.	
3.	
4.	

NOTE:

1. Cables for sensors, DI inputs and data communication must be kept separate from other high voltage cables to avoid electric noises.
   - Use separate cable trays
   - Keep a distance between cables of at least 10 cm
   - Long cables at the DI input should be avoided
2. Do not use excessive force while securing wires in to the connectors, allowed tightening torque and wire sizes are:
   - Power connectors: wire size = 0.5 – 1.5 mm^2, max. tightening torque = 0.4 Nm
   - Low voltage signal connectors: wire size = 0.15 – 1.5 mm^2, max. tightening torque = 0.2 Nm
   - 2L and 3L must be connected to the same phase

Electrical connections

Table 5: Connection details

Name	Terminals	Description
Power supply	**3L – 4N**	115 V AC / 230 V AC / 50/60 Hz (refer to the controller label)
AI1-AI2	**9, 10, 11**	**Temperature sensor inputs:** • *Sair*, Air temperature sensor • *S5* Evaporator sensor Sensor types: Pt 1000 (AKS11), PTC 1000 (EKS111), NTC5K (EKS211), NTC10K (EKS221). All sensors must be of the same type.
DI1	**12,13**	**Digital input signal** The defined function is active when the input is short-circuited or opened, depending on the function defined in o02. **Note:** DI1 can also be used for a Sc Condenser sensor
DI2	**13,14**	**Digital input signal** The defined function is active when the input is short-circuited or opened, depending on the function defined in o37.

Name	Terminals	Description
DO1	**1,2L**	**Digital output signal** • *Compressor or Heating element:* There is connection between terminal 1 and 2 when the function is ON.
DO2	**3L, 5**	**Digital output signal** • *Defrost and Light:* There is connection between terminal 3L and 5 when the function is ON. • *Alarm:* There is connection between terminal 3L and 5 when the function is ON, but via the parameter P75 the alarm relay action can be inverted.
DO3	**3L, 6**	**Digital output signal** • *Fan and Light:* There is connection between terminal 3L and 6 when the function is ON.
DO4	**3L, 7**	**Digital output signal** • *Light:* There is connection between terminal 3L and 7 when the function is ON. • *Alarm:* There is connection between terminal 3L and 7 when the function is ON, but via the parameter P75 the alarm relay action can be inverted.
TTL port		

Installation

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 because 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.

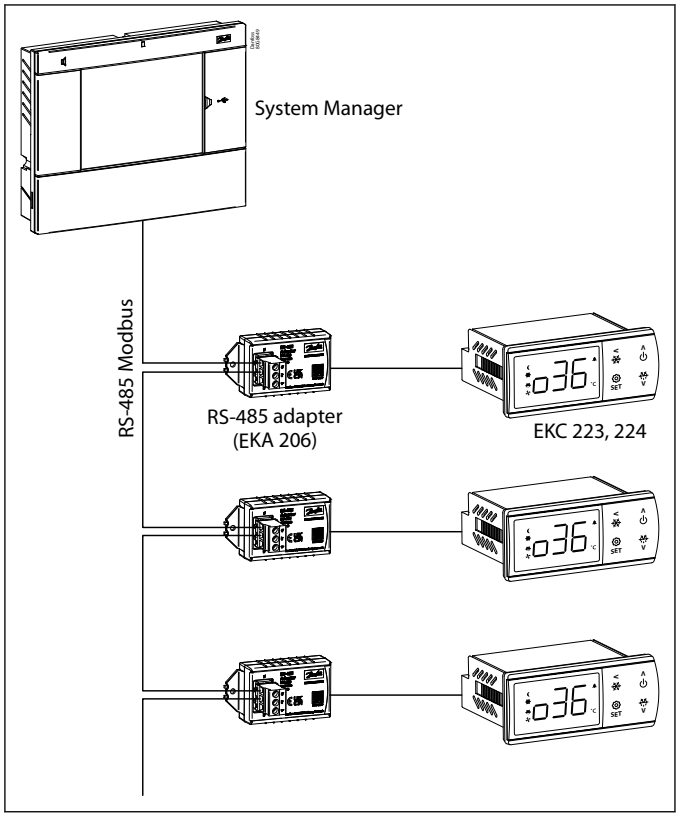
Integration into network systems

The EKC 223/224 controllers have a TTL port on the rear side of the controller and this TTL port allows the controller to be connected to various interfaces

The RS-485 adapter (EKA 21x) allows to integrate the controller on a Modbus fieldbus. The controller will be supported by the following Danfoss front ends:

- AK-SM 720 system manager
- AK-SM 800 system manager
- AK-SM 800A system manager

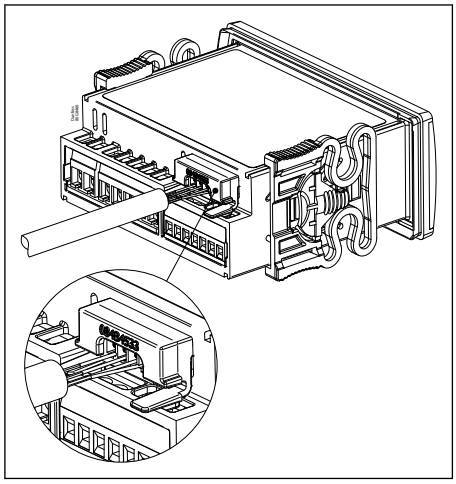
Figure 13: Integration of EKC 22x to RS-485 Modbus fieldbus on AK-SM 8xx system manager



Installation

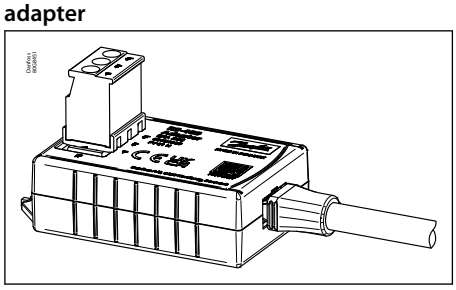
The controller must be connected to the RS-485 adapter via an interface cable (080N0327). Remember to fasten the cable plug to the controller via the cable clip, see Figure 14. Please refer to the installation guide for RS-485 adapter (EKA 206) for detailed instruction on how to install the adapter correctly.

Figure 14: Correct mounting of cable and cable clip



The other end of the cable must be plugged into the RS-485 adapter.

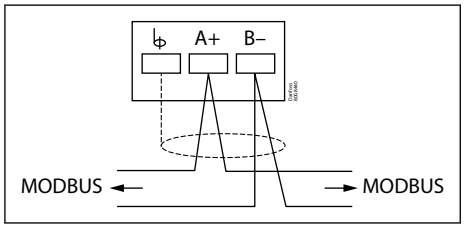
Figure 15: Connection of RS-485 adapter



Wiring

The Modbus cable must be wired as shown in Figure 16.

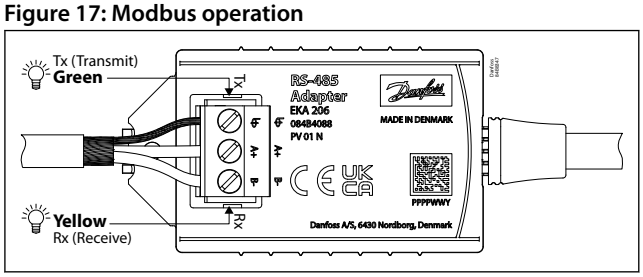
Figure 16: Modbus cable



Operation

When the controller is powered up, the two LEDs placed next to the terminal block on the RS-485 adapter will show the data communication taking place. The Tx LED (green) indicates when the controller transmits a message on Modbus and the Rx LED (yellow) indicates data communication on the Modbus.

Figure 17: Modbus operation



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

Integration into network

The "o03 network address" must be set up in the controller. The network must be set in the range 1 – 120 for integration with a Danfoss front end.

Master control via network

The system manager can perform various control via the network. For the EKC controllers the system manager can via internal schedules control the day/night status, light status and defrost, including coordinated defrost among multiple controllers:

Table 6: Override functions

Function via data communication	Functions to be used in the gateway's override function	Used parameter in AK-CC 210B
Start of defrosting	Defrost control Time schedule	- - - Def.start
Coordinated defrost	Defrost control	- - - HoldAfterDef u60 Def.relay
Night setback	Day/night control Time schedule	- - - Night setbck
Light control	Day/night control Time schedule	o39 Light Remote

Configuration

DI input configuration

The digital inputs DI1 and DI2 can be configured for multiple functions and the table below shows the options and the polarity of the digital input signals.

Table 7: DI input configuration

Function	Description	Polarity	DI1	DI2	Value
			o02	o37	
DI Status	Only a status of the digital input.	Closed = ON Open = OFF	*	*	1
Door function	When door is opened, cooling and fan is stopped but they will resume when the door alarm delay expires.	Closed = Door is closed Open = Door is open	*	*	2
Door alarm	When door is opened, cooling and fan is stopped and they will not resume operation when the door alarm delay expires.	Closed = Door is closed Open = Door is open	*	*	3
Main switch	Used for starting and stopping control.	Closed = Normal control Open = Stop control	*	*	4
Night setback	Used to put controller into night mode.	Closed = Night mode Open = Day mode	*	*	5
Reference offset	Used to add a reference offset to the thermostat setpoint.	Closed= Reference is offset Open = No offset	*	*	6
External alarm	Used to generate alarm from an external signal.	Closed = No alarm Open = Alarm	*	*	7
Defrost start	Used to initiate a defrost cycle (toggle switch).	From open to closed: Defrost cycle is started	*	*	8
Pulldown cycle	Used to initiate a temperature pull down cycle (toggle switch).	From open to closed: Pulldown cycle is started	*	*	9
Sc sensor	A Sc condenser sensor is used to monitor the condensing temperature.	Not applicable	*		10

Alarm codes

In an alarm situation the display will alternate between readout of the actual air temperature and readout of the alarm codes of active alarms. There are two kinds of alarms - it can either be an alarm occurring during the daily operation, or there may be a defect in the installation. A-alarms will not become visible until the set time delay has expired. E-alarms, on the other hand, will become visible the moment the error occurs.

Here are the messages that may appear:

Table 8: Alarm codes

Code	Alarms	Description	Network alarm
E29	Sair sensor error	Air temperature sensor is defect or electrical connection is lost	--- Sair Error
E27	Def sensor error	S5 Evaporator sensor is defect or electrical connection is lost	--- S5 Error
E30	Sc sensor error	Sc Condenser sensor is defect or electrical connection is lost	--- Sc Error
A01	High temp alarm	Air temperature in cabinet is too high	--- High t.alarm
A02	Low temp alarm	Air temperature in cabinet is too low	--- Low t. Alarm
A99	High Volt alarm	Supply voltage is too high (compressor protection)	--- High Voltage
AA1	Low Volt alarm	Supply voltage is too low (compressor protection)	--- Low Voltage
A61	Condenser alarm	Condenser temp. too high - check air flow	--- Cond Alarm
A80	Cond. block alarm	Condenser temp. too high - manual reset of alarm required[1]	--- Cond Blocked
A04	Door alarm	Door has been open for too long	--- Door alarm
A15	DI Alarm	External alarm from DI input	--- DI Alarm
A45	Standby Alarm	Control has been stopped by "r12 Main switch"	--- Standby mode

[1] The condenser block alarm can be reset by setting r12 Main switch OFF and ON again or by powering down the controller.

Control status

The controller has a special control status parameter which tells what the controller is doing. This parameter can be readout in the display as parameter “u00 Control state” and this can provide valuable information to a service technician to understand what the controller is doing.

The individual status codes have the following meanings:

Table 9: Control status

Code	Description
S0	Normal control
S1	Waiting for end of the coordinated defrost
S2	Compressor is running on Min ON timer
S3	Compressor stopped due to Min OFF timer
S4	Defrost cycle is in drip off delay
S10	Control has been stopped by "r12 Main switch"
S11	Compressor is stopped due to thermostat cut-out
S14	Defrost cycle is in progress
S15	Fan delay after defrost
S17	Door is open
S20	Emergency cooling
S25	Manual control of outputs (r12 Main switch set to -1)
S30	Temperature pulldown cycle in progress
S32	Power up delay
S33	Heating is activated

Operation

Operation via display

EKC 223/224 controllers come with four push buttons, a big display, easy and intuitive menu structure, and pre-defined applications ensure ease of use.

The values will be shown with three digits, and with a “r05 Temp. unit” setting you can determine whether the temperature is to be shown in °C or in °F.

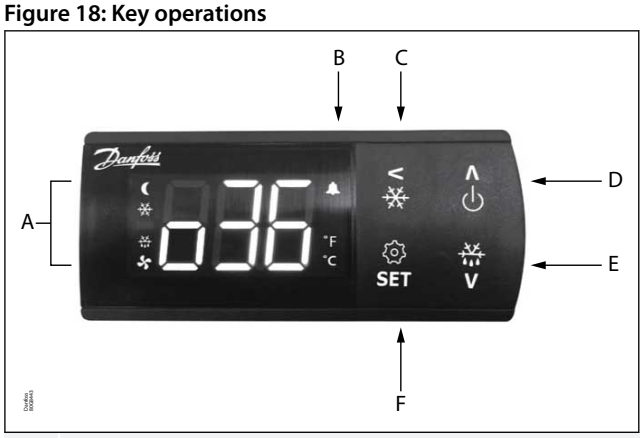
To prevent any walk-up user from making unauthorized changes, the access to the display menu is restricted by access codes. Besides this, the parameter “P76 Keyboard lock” provides the following options for handling of the display keyboard:

1. The display keys are always operative.
2. 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.

Key operations

The buttons on the front of the display can be operated with short and long (3s) presses.

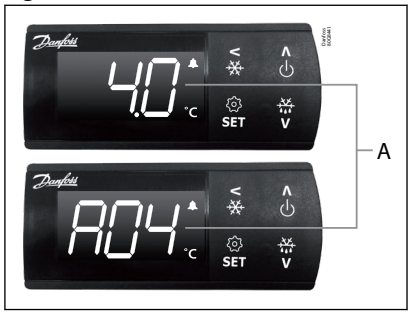
Figure 18: Key operations



A	**Status indication:** LEDs light up at ECO/Night mode, cooling, defrost and fan running.
B	**Alarm indication:** Alarm icon flashes in case of an alarm.
C	**Short press** = Navigate back **Long press** = Initiate pulldown cycle. Display will show “Pud” to confirm start.
D	**Short press** = Navigate up **Long press** = Switch controller ON/OFF (setting r12 Main switch in ON/OFF position)
E	**Short press** = Navigate down **Long press** = Start defrosting cycle
F	**Short press** = Change set point **Long press** = Go to parameter menu

View alarms

Figure 19: View alarms



A	Temperature and alarm codes alternate flashes until the alarm is resolved. The alarm bell flashes during alarm condition.

Lock keyboard

Figure 20: Lock keyboard

A	• After 5 minutes of no activity, the keypad is locked (if P76=yes). • When the keypad is locked any button press shows “LoC” in the display. • Press UP and DOWN buttons simultaneously for 3 seconds to unlock the keyboard. “unl” is displayed for 3 seconds.

Factory resetting

The controller can be set back to factory settings by using the following procedure:

1. Power OFF controller.
2. Keep up "∧" and down "∨" arrow buttons pressed while reconnecting the supply voltage.
3. When the code “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.

Display codes

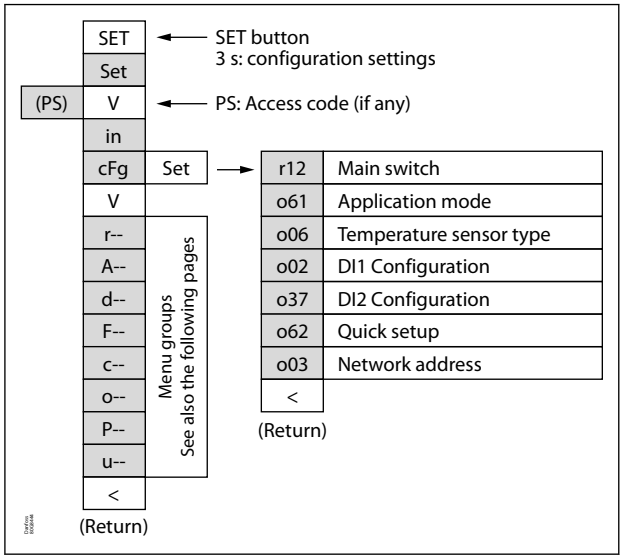
Table 10: Display codes

Code	Description
-d-	Defrost cycle is in progress
Pud	A temperature pulldown cycle has been initiated
Err	The temperature cannot be displayed due to a sensor error
---	Shown in top of display: The parameter value has reached max. Limit
---	Shown in bottom of display: The parameter value has reached min. Limit
Loc	The display keyboard is locked
UnL	The display keyboard has been unlocked
PS	The access code is required to enter the parameter menu
Axx/Exx	Alarm or error code flashing with normal temp. readout
OFF	Control is stopped as r12 Main switch is set OFF
On	Control is started as r12 Main switch is set ON (code shown in 3 seconds)
Fac	The controller is reset to factory setting

Parameter list

The parameter menu is accessed by pressing the “SET” key for 3 seconds. If an access protection code “o05” has been defined the display will ask for the access code by showing the code “PS”. Once the access code has been provided by the user, the parameter list will be accessed.

Figure 21: SET button parameter list



Quick setup – get a good start

With the following procedure you can start regulation very quickly:

1. Press the “SET” button for 3 seconds and access the parameter menu (display will show “cFg”).
2. Press the down button “∨” to go to “cFg” menu (display will show “cFg”)
3. Press the right “>” key to open the configuration menu (display will show r12).
4. Open the “r12 Main switch” parameter and stop control by setting it OFF (Press SET).
5. Open the “o61 application mode” and select the needed application mode (Press SET).
6. Open the “o06 Sensor type” and select the temperature sensor type used (n5=NTC 5 K, n10=NTC 10 K, Ptc=PTC, Pt1=Pt1000) – (Press “SET”).
7. Open the “o02 DI1 Configuration” and select the function associated to digital input 1 (see DI input configuration) – (Press “SET”).
8. Open the “o37 DI2 Configuration” and select the function associated to digital input 2 (see DI input configuration) – (Press “SET”).
9. Open the “o62 Quick setting” parameter and select the presetting that fits with the application in use (see Table 11: Quick setting) – (Press “SET”).
10. Open the "o03 Network address" and set the Modbus address if required
11. Navigate back to parameter “r12 Main switch” and set it in “ON” position to start control.
12. Go through the entire parameter list and change the factory settings where needed.

Table 11: Quick setting

Parameter	1	2	3	4	5	6	7
	Cabinet MT Natural def. Stop on time	Cabinet MT El. def. Stop on time	Cabinet MT El. def. Stop on temp	Cabinet LT El. def. Stop on temp	Room MT El. def. Stop on time	Room MT El. def. Stop on temp	Room LT El. def. Stop on temp
r00 Cut-out	4 °C	2 °C	2 °C	-24 °C	6 °C	3 °C	-22 °C
r02 Max Cut-out	6 °C	4 °C	4 °C	-22 °C	8 °C	5 °C	-20 °C
r03 Min Cut-out	2 °C	0 °C	0 °C	-26 °C	4 °C	1 °C	-24 °C
A13 HighLim Air	10 °C	8 °C	8 °C	-15 °C	10 °C	8 °C	-15 °C
A14 LowLim Air	-5 °C	-5 °C	-5 °C	-30 °C	0 °C	0 °C	-30 °C
d01 Def. Method	Natural	Electrical	Electrical	Electrical	Electrical	Electrical	Electrical
d03 Def.Interval	6 hour	6 hour	6 hour	12 hour	8 hour	8 hour	12 hour
d10 DefStopSens.	Time	Time	S5 Sensor	S5 Sensor	Time	S5 Sensor	S5 Sensor
o02 DI1 Config.					Door fct.	Door fct.	Door fct.

Parameters

Parameter description

Configuration

Table 12: Configuration

Code	Text on network	Description
CFg	**Configuration**	
r12	r12 Main switch	**Start / stop of refrigeration** With this setting refrigeration can be started, stopped or a manual override of the outputs can be allowed. Start / stop of refrigeration can also be accomplished with the external switch function connected to a DI input. Stopped refrigeration will give a "Standby alarm". • (1) *ON* : Start • (0) *OFF* : Stop • (-1) *SEr* : Manual control of outputs allowed
o61[1]	o61 Appl. Mode	**Selection of application** The controller can be defined in various ways. Here you set which of the 4 applications is required. Please refer to Wiring diagrams for the controller in question.
o06[1]	o06 SensorConfig	**Sensor type selection** This parameter is for defining type of temperature sensors connected to the controller. All the mounted sensors (Sair, S5 and Sc) must be of same type. • (0) *n5* = NTC 5k (Danfoss type EKS211) • (1) *n10* = NTC 10k (Danfoss type EKS 221) • (2) *Pt* = Pt1000 (Danfoss type AKS11, AKS12, AKS21) • (3) *Ptc* = PTC 1000 (Danfoss type EKS 111)
o02[1]	o02 DI1 Config.	**DI1 configuration** Here you can configure the DI1 to one of the functions listed below. • (0) *oFF* = not used • (1) *Sdc* = status display output • (2) *doo* = door function. When the door is opened the compressor and fan are stopped after "C04 Compressor door open delay". If the door alarm delay expires an alarm is generated and cooling is resumed. • (3) *doA* = door alarm. When the door is opened the compressor and fan are stopped after "C04 Compressor door open delay". If the door alarm delay expires an alarm is generated (cooling is not resumed). • (4) *SCH* = main switch. Regulation is carried out when the input is short-circuited, and regulation is stopped when the input is put in position OFF. • (5) *nig* = day/night mode. When the input is short-circuited, there will be regulation for night operation. • (6) *rFd* = reference displacement. Value in "r40" is added to the reference "r00" when the input is short-circuited • (7) *EAL* = external alarm. Alarm will be given when the input is short-circuited. • (8) *dEF* = defrost. Defrost is initiated when the input is short-circuited. Edge triggering is used. Defrost exit can take place by time, temperature or by manually pressing defrost push button on the front panel. • (9) *Pud* = pull down. Pull down is initiated when the input is short-circuited. Edge triggering is used. It will come out of pull down based on time and temperature defined under parameter "r96" and "r97" or can be stopped manually by pressing pull down push button on front panel. • (10) *Sc* = condenser sensor
o37[1]	o37 DI2 Config.	**DI2 configuration** Here you can configure the DI2 to one of the functions listed below. • (0) *oFF* = not used • (1) *Sdc* = status display output • (2) *doo* = door function. When the door is opened the compressor and fan are stopped after "C04 Compressor door open delay". If the door alarm delay expires an alarm is generated and cooling is resumed. • (3) *doA* = door alarm. When the door is opened the compressor and fan are stopped after "C04 Compressor door open delay". If the door alarm delay expires an alarm is generated (cooling is not resumed). • (4) *SCH* = main switch. Regulation is carried out when the input is short-circuited, and regulation is stopped when the input is put in position OFF. • (5) *nig* = day/night mode. When the input is short-circuited, there will be regulation for night operation. • (6) *rFd* = reference displacement. Value in "r40" is added to the reference "r00" when the input is short-circuited • (7) *EAL* = external alarm. Alarm will be given when the input is short-circuited. • (8) *dEF* = defrost. Defrost is initiated when the input is short-circuited. Edge triggering is used. Defrost exit can take place by time, temperature or by manually pressing defrost push button on the front panel. • (9) *Pud* = pull down. Pull down is initiated when the input is short-circuited. Edge triggering is used. It will come out of pull down based on time and temperature defined under parameter "r96" and "r97" or can be stopped manually by pressing pull down push button on front panel.
o62[1]	o62 Quick Setup	**Transfer a set of presettings to the controller** It is possible to select a quick setting of a number of parameters. It depends on whether a cabinet or a room is to be controlled and whether defrost is to be stopped based on time or based on temperature. After the setting, the value will return to 0. Any subsequent adjustment/setting of parameters can be made, as required. Please refer to Quick setup – get a good start.
o03[1]	o03 Unit Addr	**Network address for Modbus fieldbus** Data communication is possible through external EKA 206 to RS-485 adapter. The network address must be set in the range between 1 – 120 to be integrated on a Modbus fieldbus. **Note:** Network address must be set to 0, when connected to KoolProg through KoolKey.

(1) This menu can only be set when regulation is stopped, i.e. "r12" is set to 0.

Thermostat

Table 13: Thermostat

Code	Text on network	Description
r--	**Thermostat**	
r00	r00 Cutout	**Temperature setpoint** Regulation is based on the set value plus a displacement, if applicable. The value is set via a push on the SET button. The set value can be locked or limited to a range with the settings in r02 and r 03. The reference at any time can be seen in "u28 Temp. ref".
r01	r01 Differential	**Differential** When the temperature is higher than the reference + the set differential, the compressor relay will be cut in. It will cut out again when the temperature comes down to the set reference. In heating application, heater will cut-in when the temperature reaches cutout - differential.
r02	r02 Max cutout	**Max. Setpoint limitation** The controller's setting range for the setpoint may be narrowed down, so that much too high or much too low values are not set accidentally - with resulting damages. To avoid a too high setting of the setpoint, the max. allowable reference value must be lowered.
r03	r03 Min cutout	**Min. Setpoint limitation** The controller's setting range for the setpoint may be narrowed down, so that much too high or much too low values are not set accidentally - with resulting damages. To avoid a too low setting of the setpoint, the min. allowable reference value must be increased.
r04	r04 Disp. Adj. K	**Correction of the display's temperature readout** If the temperature at the products and the temperature received by the controller are not identical, an offset adjustment of the shown display temperature can be carried out.
r05	r05 Temp.unit	**Temperature unit** Here you set whether the controller display is to show temperature values in °C or in °F.
r09	r09 Adjust Sair	**Correction of signal from Sair** Compensation possibility through long sensor cable.
r12	r12 Main switch	**Start / stop of refrigeration** With this setting refrigeration can be started, stopped or a manual override of the outputs can be allowed. Start / stop of refrigeration can also be accomplished with the external switch function connected to a DI input. Stopped refrigeration will give a "Standby alarm". • (1) *ON* : Start • (0) *OFF* : Stop • (-1) *SEr* : Manual control of outputs allowed
r13	r13 Night offset	**Night setback value** The thermostat's reference will be the setpoint plus this value when the controller changes over to night operation. (Select a negative value if there is to be cold accumulation.)
r40	r40 Th Offset K	**Thermostat reference displacement** The thermostat reference and the alarm limits are offset with the set value when the displacement is activated. Activation can take place via input DI1 or DI2 (defined in o02 or o37).
r96	r96 Pulld. dur.	**Pull-down duration** Maximum duration of the pull-down mode
r97	r97 Pd limit tmp	**Pull-down limit temperature** A safety feature; the lowest temperature allowed during pull-down. If the set limit is reached, the pulldown is terminated.
---	--- Night setbck	**Night setback** Master control signal used by network system manager to put the controller into night condition. Only used on Modbus datacommunication

Alarm settings

Table 14: Alarm settings

Code	Text on network	Description
A--	**Alarm settings**	The controller can give alarm in different situations. When there is an alarm, the display will indicate the alarm code, and the alarm relay will cut in.
A03	A03 Alarm delay	**Alarm delay (short alarm delay)** If one of the two limit values is 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.
A12	A12 Pulldown del	**Pull-down alarm delay (long alarm delay)** This time delay is used during start-up, during defrost, during pull-down. There will be change-over to the normal alarm time delay "A03" when the temperature falls within the alarm limits.
A13	A13 HighLim Air	**High alarm limit** Here you set the alarm limit for the high temperature alarm. The limit is set in °C (absolute value). During night condition, the limit value will be changed with the same value as the night offset. The change will only be applied for positive night offset. The limit value will also be changed in connection with reference displacement r39. Regardless, whether this is positive or negative

Code	Text on network	Description
A14	A14 LowLim Air	**Low alarm limit** Here you set the alarm limit for low temperature alarms. The limit value is set in °C (absolute value). During night condition, the limit will remain unchanged, while a reference displacement r39, will increase or lower the limit with the value given by r40.
A27	A27 Al.Delay DI1	**Delay of a DI1 alarm** If "DI1" is configured as a door open alarm or as an external alarm, this time delay is used before raising the alarm. The function is defined in o02
A28	A28 Al.Delay DI2	**Delay of a DI2 alarm** If "DI2" is configured as a door open alarm or as an external alarm, this time delay is used before raising the alarm. The function is defined in o37.
A37	A37 Cond T Alarm	**Condenser high alarm limit** If the condenser temperature reaches above this limit, condenser alarm is raised immediately and no action is taken. The alarm is zeroset if temperature falls 5 K below the set temperature
A54	A54 Cond T Block	**Condenser high block limit** If the condenser temperature continues to increase above the "A37" limit and reaches this temperature limit, condenser block alarm is raised and compressor is stopped. It is restricted to starting again until alarm is reset manually. Manual reset of condenser block alarm can be performed in two ways: • Power controller OFF and power ON controller again. • Switch controller OFF and ON again via main switch or front button.
A72	A72 Volt Protect	**Voltage protection enable** This parameter is used to enable and disable the voltage protection feature, which protects compressor from adverse line voltage conditions.
A73	A73 Min U CutIn	**Minimum cut-in voltage** When the compressor is due to start, the voltage of the power supply will be checked and the compressor will only be allowed to start if it is at least the value given in this parameter.
A74	A74 Min U CutOut	**Minimum cut-out voltage** When the compressor is running, it will be switched OFF if the voltage goes below that given in this parameter.
A75	A75 Max U CutIn	**Maximum voltage** When the compressor is running, it will be switched OFF if the voltage exceeds that given in this parameter. If the compressor is already stopped, it will remain switched OFF.
---	--- Sum Alarm	**Sum Alarm** Indication of the overall alarm status of the controller. Only used on Modbus datacommunication.

Defrost

Table 15: Defrost

Code	Text on network	Description
d--	**Defrost**	The controller contains a timer function that is zeroset after each defrost start. The timer function will start a defrost if/when the interval time is passed. The timer function starts after voltage is connected to the controller, but it is displaced the first time by the setting in d05. If there is power failure, the timer value will be saved and continue from here when the power returns. This timer function can be used as a simple way of starting defrosts, but it will always act as safety defrost if one of the subsequent defrost starts is not received. Defrost start can also be accomplished via data communication, via contact signals or manual start-up. All starting methods will function in the controller. The different functions have to be set, so that defrosts do not "come tumbling" one after the other. Defrost can be accomplished with natural air cycling, electricity or hot gas. The actual defrost will be stopped based on time or temperature with a signal from a temperature sensor.
d01	d01 Def. Method	**Defrost method** Here you set whether defrost is to be accomplished with electricity, gas or "non". During defrost the defrost relay will be cut in. • (0) *no* = none • (1) *nAt* = natural • (2) *EL* = electrical • (3) *gAS* = gas
d02	d02 Def.StopTemp	**Defrost stop temperature** The defrost is stopped at a given temperature which is measured with a sensor (the sensor is defined in d10). The temperature value is set.
d03	d03 Def.Interval	**Interval between defrost starts** The function is zeroset and will start the timer function at each defrost start. When the time has expired the function will start a defrost. The function is used as a simple defrost start, or it may be used as a safeguard if the normal signal fails to appear. If a defrost start via data communication does not take place, the interval time will be used as max. time between defrosts. When there is defrost with clock function or data communication, the interval time must be set for a somewhat longer period of time than the planned one, as the interval time will otherwise start a defrost which a little later will be followed by the planned one. In connection with power failure the interval time will be maintained, and when the power returns, the interval time will continue from the maintained value. The interval time is not active when set to 0.
d04	d04 Max Def.time	**Max. defrost duration** This setting is a safety time so that the defrost will be stopped if there has not already been a stop based on temperature or via coordinated defrost.

Code	Text on network	Description
d05	d05 Time Stagg	**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 (d03). The function delays the interval time d03 by the set number of minutes, but it only does it once, and this at the very first defrost taking place after voltage is connected to the controller. The function will be active after each and every power failure.
d06	d06 DripOff time	**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).
d07	d07 FanStartDel	**Delay of fan start after defrost** Here you set the time that is to elapse from compressor start after a defrost and until the fan may start again. (The time when water is "tied" to the evaporator).
d08	d08 FanStartTemp	**Fan start temperature** The fan may also be started a little earlier than mentioned under "Delay of fan start after defrost", if the defrost sensor S5 registers a lower value than the one set here.
d09	d09 FanDuringDef	**Fan cut-in during defrost** This parameter is used to define whether fan is to operate during defrost or not
d10[1]	d10 DefStopSens.	**Defrost sensor** This parameter is to define which sensor has to be used to exit/terminate the defrost. • (0) *non* = none, defrost is based on time set in do4 • (1) *Air* = Sair sensor • (2) *dEF* = S5 (defrost) sensor
d18	d18 MaxTherRunT.	**Compressor accumulated runtime to start defrost** When the accumulated compressor runtime is equal to the value set in this Parameter, defrost will be triggered. If the compressor runtime is less than the set value during the define defrost interval "d03", defrost will be triggered based on the defrost interval "d03". This feature is disabled when this parameter is set to zero.
d19	d19 Cutout S5Dif	**Defrost on demand – S5 temperature** The controller will follow the effectivity of the evaporator, and via internal calculations and measurements of the S5 temperature it will be able to start a defrost when the variation of the S5 temperature becomes larger than required. Here you set how large a slide of the S5 temperature can be allowed. When the value is passed, a defrost will start. The function can only be used in 1:1 systems when the evaporating temperature will become lower to ensure that the air temperature will be maintained. In central systems the function must be disabled. With setting = 20 the function is disabled.
d30	d30 Pd Def Delay	**Defrost delay after pull down** This parameter defines the time delay to start the defrost after pull down cycle. This has to ensure defrost doesn't happen immediately after pull down cycle.
dA1	--- Def. Start	**Defrost start** Parameter used by the network system manager to initiate a scheduled defrost cycle. Only used on Modbus datacommunication.
dA2	--- HoldAfterDef	**Hold after defrost** Parameter used by the network system manager to coordinate the defrost cycle among multiple controllers. Only used on Modbus datacommunication.
dA3	--- DefrostState	**Defrost state** Parameter used by the network system manager to coordinate the defrost cycle among multiple controllers. Only used on Modbus datacommunication.

[1] This menu can only be set when regulation is stopped, i.e. "r12" is set to 0.

Fan

Table 16: Fan

Code	Text on network	Description
F--	**Fan**	
F01	F01 Fan Stop CO	**Fan at compressor cut-out** This parameter define the fan operation during compressor OFF cycle. • (0) *FFC* = fan follow compressor • (1) *Fao* = fan always ON • (2) *FPL* = fan Pulsating
F04	F04 FanStop 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 setting +50°C the function is disabled.
F07	F07 Fan ON	**Fan ON cycle** This parameter is applicable only when the Fan at Compressor cut out "F01" is set to Fan Pulsating mode. The Fan pulsating ON time will be as per the time set in this parameter.
F08	F08 Fan OFF	**Fan OFF cycle** This parameter is applicable only when the Fan at Compressor cut out "F01" is set to Fan Pulsating mode. The Fan pulsating OFF time will be as per the time set in this parameter.

Compressor

Table 17: Compressor

Code	Text on network	Description
c--	**Compressor**	
c01	c01 Min. On time	**Compressor minimum ON time** This parameter determines the minimum number of minutes the compressor must run before a cut-out can take effect based on temperature. This is to avoid sudden switching ON and OFF of the compressor.
c02	c02 Min.Off time	**Compressor minimum OFF time** This parameter determines the minimum number of minutes the compressor must switched OFF before a cut-in can take effect based on temperature. This is to avoid sudden switching OFF and ON of the compressor.
c04	c04 Cmp Del Door	**Compressor OFF delay at door open** This parameter sets the delay in seconds before the compressor stops when the door is opened. If set to zero, the function is disabled.
c70	c70 Zero Cross	**Zero crossing selection** This feature will increase the relay life time, reduce the contact welding and switching noise by switching ON at Zero crossing. Disable zero crossing when external relay is used.

Miscellaneous

Table 18: Miscellaneous

Code	Text on network	Description
o--	**Miscellaneous / Other**	
o01	o01 DelayOfOutp.	**Delay of outputs at power-up** After power-up the controller functions can be delayed by the time delay defined here so that overloading of the electricity supply network is avoided.
o02[1]	o02 DI1 Config.	**DI1 configuration** Here you can configure the DI1 to one of the functions listed below. • (0) *oFF* = not used • (1) *Sdc* = status display output • (2) *doo* = door function When the door is opened the compressor and fan are stopped after "C04 Compressor door open delay". If the door alarm delay expires an alarm is generated and cooling is resumed. • (3) *doA* = door alarm When the door is opened the compressor and fan are stopped after "C04 Compressor door open delay". If the door alarm delay expires an alarm is generated (cooling is not resumed). • (4) *SCH* = main switch Regulation is carried out when the input is short-circuited, and regulation is stopped when the input is put in position OFF. • (5) *nig* = day/night mode When the input is short-circuited, there will be regulation for night operation. • (6) *rFd* = reference displacement Value in "r40" is added to the reference "r00" when the input is short-circuited. • (7) *EAL* = external alarm Alarm will be given when the input is short-circuited. • (8) *dEF* = defrost Defrost is initiated when the input is short-circuited. Edge triggering is used. Defrost exit can take place by time, temperature or by manually pressing defrost push button on the front panel. • (9) *Pud* = pull down Pull down is initiated when the input is short-circuited. Edge triggering is used. It will come out of pull down based on time and temperature defined under parameter "r96" and "r97" or can be stopped manually by pressing pull down push button on front panel. • (10) *Sc* = condenser sensor
o03[1]	o03 Unit Addr	**Network address for Modbus fieldbus** Data communication is possible through external EKA 206 to RS-485 adapter. The network address must be set in the range between 1 – 120 to be integrated on a Modbus fieldbus. **Note:** Network address must be set to 0, when connected to KoolProg through KoolKey.
o05	o05 Acc Code	**Access code** If the settings in the controller are to be protected with an access code you can set a numerical value between 0 and 999. If not, you can cancel the function with setting 0.
o06[1]	o06 SensorConfig	**Sensor type selection** This parameter is for defining type of temperature sensors connected to the controller. All the mounted sensors (Sair, S5 and Sc) must be of same type. • (0) *n5* = NTC 5k (Danfoss type EKS211) • (1) *n10* = NTC 10k (Danfoss type EKS 221) • (2) *Pt* = Pt1000 (Danfoss type AKS11, AKS12, AKS21) • (3) *Ptc* = PTC 1000 (Danfoss type EKS 111)
o15	o15 Disp Step	**Display resolution** This parameter defines the steps in which the temperature must be displayed by 0.1 or 0.5 or 1
o16	o16 MaxHoldTime	**Max. standby time after coordinated defrost** When a controller has completed a defrost it will wait for a signal which tells that the refrigeration may be resumed. If this signal fails to appear for one reason or another, the controller will itself start the refrigeration when this standby time has elapsed.

Code	Text on network	Description
o37[1]	o37 DI2 Config.	**DI2 configuration** Here you can configure the DI2 to one of the functions listed below. • (0) *oFF* = not used • (1) *Sdc* = status display output • (2) *doo* = door function When the door is opened the compressor and fan are stopped after "C04 Compressor door open delay". If the door alarm delay expires an alarm is generated and cooling is resumed. • (3) *doA* = door alarm When the door is opened the compressor and fan are stopped after "C04 Compressor door open delay". If the door alarm delay expires an alarm is generated (cooling is not resumed). • (4) *SCH* = main switch Regulation is carried out when the input is short-circuited, and regulation is stopped when the input is put in position OFF. • (5) *nig* = day/night mode When the input is short-circuited, there will be regulation for night operation. • (6) *rFd* = reference displacement Value in "r40" is added to the reference "r00" when the input is short-circuited. • (7) *EAL* = external alarm Alarm will be given when the input is short-circuited. • (8) *dEF* = defrost Defrost is initiated when the input is short-circuited. Edge triggering is used. Defrost exit can take place by time, temperature or by manually pressing defrost push button on the front panel. • (9) *Pud* = pull down Pull down is initiated when the input is short-circuited. Edge triggering is used. It will come out of pull down based on time and temperature defined under parameter "r96" and "r97" or can be stopped manually by pressing pull down push button on front panel.
o38	o38 Light config	**Light control** This parameter defines the way the light must be controlled. Below are the three light control modes available. • (0) *on* = always on • (1) *dAn* = day/night • (2) *doo* = based on door action • (3) *nEt* = Network signal from system manager
o39	o39 Light remote	**Light remote** Parameter used by the network system manager to control the light status. Only used on Modbus datacommunication and if the parameter o38 has been set at (3) nEt.
o61[1]	o61 Appl. Mode	**Selection of application** The controller can be defined in various ways. Here you set which of the 4 applications is required.
o62[1]	o62 Quick Setup	**Transfer a set of presettings to the controller** It is possible to select a quick setting of a number of parameters. It depends on whether a cabinet or a room is to be controlled and whether defrost is to be stopped based on time or based on temperature. After the setting, the value will return to 0. Any subsequent adjustment/setting of parameters can be made, as required.
o67	o67 Make factory	**Save settings as factory** This parameter when set to YES. The current controller Parameter settings are stored as Factory default. ⚠ **WARNING:** Original factory settings are overwritten.
o91	o91 Displ At Def	**Display at defrost** You can set what is to be displayed during defrost here. • (0) *Air* = actual air temperature • (1) *FrE* = freezed temperature (display the temperature just before starting defrost) • (2) *-d-* = Defrost code "-d-" is displayed.

[1] This menu can only be set when regulation is stopped, i.e. "r12" is set to 0.

Polarity

Table 19: Polarity

Code	Text on network	Description
P--	**Polarity**	
P75	P75 Invert Alarm	**Invert alarm relay** Alarm relay operation can be inverted here. • 0=normal • 1=invert relay action
P76	P76 Keypad lock	**Keyboard lock enable** YES=enable keyboard lock functionality after 5 minutes of no activity on the keypad.

Service

Table 20: Service

Code	Text on network	Description
u--	**Service**	
u00	u00 Ctrl. State	**Control state** Here the actual control state of the controller can be readout: • (0) S0=Normal ctrl. • (1) S1=Wait after defrost • (2) S2=Min ON timer • (3) S3=Min OFF timer • (4) S4=Drip off • (10) S10=Main switch OFF • (11) S11=Thermostat cutout • (14) S14=Defrost • (15) S15=Fan delay • (17) S17=Door open • (20) S20=Emergency control • (25) S25=Manual control • (30) S30=Pulldown cycle • (32) S32=Powerup delay • (33) S33=Heating
u01	u01 Air Temp	**Air temperature** Temperature measured with Sair sensor.
u09	u09 S5 temp.	**S5 Evaporator temperature** Temperature measured with S5 sensor
u10	u10 DI1 status	**Status of DI1 input** Status on DI1 input. on/1=closed
u13	u13 Night Cond.	**Night condition** Status on night operation (on or off)
u37	u37 DI2 status	**Status of DI2 input** Status on DI2 input. on/1=closed
u28	u28 Temp Ref	**Actual reference** Read the present temperature regulation reference
u58	u58 Comp1/LLSV	**Compressor / Liquid line solenoid valve** Status on relay for cooling
u59	u59 Fan relay	**Fan relay** Status on relay for fan
u60	u60 Def. Relay	**Defrost relay** Status on relay for defrost
u62	u62 Alarm relay	**Alarm relay** Status on relay for alarm
u63	u63 Light relay	**Light relay** Status on relay for light
u80	u80 SW Version	**Firmware version readout**
u82	u82 Code No	**Controller code no.** Last 4 ciffers of controller code no.
u84	u84 Heat relay	**Heat relay** Status on relay for heating element
U09	U09 Sc Temp	**Sc Condenser temperature** Temperature measured with Sc sensor

EKC 223, 224 display menu

Configuration

Table 21: Configuration

Code	Short text manual	Min.	Max.	De-fault	Unit	R/W	EKC 224 Appl.				EKC 223 Appl.			
							1	2	3	4	1	2	3	4
CFg	**Configuration**													
r12	Main switch (-1=service / 0=OFF / 1=ON)	-1	1	0		R/W	*	*	*	*	*	*	*	*
o61[1]	Selection of application mode. The controller can be defined in various ways. Here you set which of the 4 applications is required. Please refer to Wiring diagrams for the controller in question.	1	4	1		R/W	*	*	*	*	*	*	*	*
o06[1]	Sensor type selection (0) n5 = NTC 5k, (1) n10 = NTC 10k, (2) Pt = Pt1000, (3) Ptc = PTC 1000	0	3	2		R/W	*	*	*	*	*	*	*	*

Code	Short text manual	Min.	Max.	De-fault	Unit	R/W	EKC 224 Appl.				EKC 223 Appl.			
							1	2	3	4	1	2	3	4
o02[1]	DI1 configuration (0) *oFF*=not used, (1) *Sdc*=status, (2) *doo*=door function, (3) *doA*=door alarm, (4) *SCH*=main switch, (5) *nig*=day/night mode, (6) *rFd*=reference displacement, (7) *EAL*=external alarm, (8) *dEF*=defrost, (9) *Pud*=pull down, (10) *Sc*=condenser sensor	0	10	0		R/W	*	*	*	*	*	*	*	*
o37[1]	DI2 configuration (0) *oFF*=not used, (1) *Sdc*=status, (2) *doo*=door function, (3) *doA*=door alarm, (4) *SCH*=main switch, (5) *nig*=day/night mode, (6) *rFd*=reference displacement, (7) *EAL*=external alarm, (8) *dEF*=defrost, (9) *Pud*=pull down	0	9	0		R/W	*	*	*	*	*	*	*	*
o62[1]	Quick presetting of primary parameters 0 = Not used 1 = MT, Natural defrost, stop on time 2 = MT, El defrost, stop on time 3 = MT, El defrost, stop on temp. 4 = LT, El defrost, stop on temp 5 = Room, MT, El defrost, stop on time 6 = Room, MT, El defrost, stop on temp. 7 = Room, LT, El defrost, stop on temp.	0	7	0		R/W	*	*	*		*	*	*	
o03[1]	Network address	0	247	0		R/W	*	*	*	*	*	*	*	*

[1] Parameter can only be changed while r12 Main switch is in position OFF.

Thermostat

Table 22: Thermostat

Code	Short text manual	Min.	Max.	De-fault	Unit	R/W	EKC 224 Appl.				EKC 223 Appl.			
							1	2	3	4	1	2	3	4
r--	**Thermostat**													
r00	Temperature setpoint	r03	r02	2.0	°C	R/W	*	*	*	*	*	*	*	*
r01	Differential	0.1	20.0	2.0	K	R/W	*	*	*	*	*	*	*	*
r02	Max. limitation of setpoint setting	r03	105.0	50.0	°C	R/W	*	*	*	*	*	*	*	*
r03	Min. limitation of setpoint setting	-40.0	r02	-35.0	°C	R/W	*	*	*	*	*	*	*	*
r04	Adjustment of the display's temperature readout	-10.0	10.0	0.0	K	R/W	*	*	*	*	*	*	*	*
r05	Temperature unit (°C / °F)	0 / C	1 / F	0 / C		R/W	*	*	*	*	*	*	*	*
r09	Correction of the signal from Sair sensor	-20.0	20.0	0.0	°C	R/W	*	*	*	*	*	*	*	*
r12	Main switch (-1=service / 0=OFF / 1=ON)	-1	1	0		R/W	*	*	*	*	*	*	*	*
r13	Displacement of reference during night operation	-50.0	50.0	0.0	K	R/W	*	*	*	*	*	*	*	*
r40	Thermostat reference displacement	-50.0	20.0	0.0	K	R/W	*	*	*	*	*	*	*	*
r96	Pull-down duration	0	960	0	min	R/W	*	*	*		*	*	*	
r97	Pull-down limit temperature	-40.0	105.0	0.0	°C	R/W	*	*	*		*	*	*	

Alarm settings

Table 23: Alarm settings

Code	Short text manual	Min.	Max.	De-fault	Unit	R/W	EKC 224 Appl.				EKC 223 Appl.			
							1	2	3	4	1	2	3	4
A--	**Alarm settings**													
A03	Delay for temperature alarm (short)	0	240	30	min	R/W	*	*	*	*	*	*	*	*
A12	Delay for temperature alarm at pulldown (long)	0	240	60	min	R/W	*	*	*	*	*	*	*	*
A13	High alarm limit	-40.0	105.0	8.0	°C	R/W	*	*	*	*	*	*	*	*
A14	Low alarm limit	-40.0	105.0	-30.0	°C	R/W	*	*	*	*	*	*	*	*
A27	Alarm delay DI1	0	240	30	min	R/W	*	*	*	*	*	*	*	*
A28	Alarm delay DI2	0	240	30	min	R/W	*	*	*	*	*	*	*	*
A37	Alarm limit for condenser temperature alarm	0.0	200.0	80.0	°C	R/W	*	*	*		*	*	*	
A54	Limit for condenser block alarm and comp. Stop	0.0	200.0	85.0	°C	R/W	*	*	*		*	*	*	
A72	Voltage protection enable	0/No	1/ Yes	0/No		R/W	*	*	*		*	*	*	
A73	Minimum cut-in voltage	0	270	0	Volt	R/W	*	*	*		*	*	*	
A74	Minimum cut-out voltage	0	270	0	Volt	R/W	*	*	*		*	*	*	
A75	Maximum cut-in voltage	0	270	270	Volt	R/W	*	*	*		*	*	*	

Defrost

Table 24: Defrost

Code	Short text manual	Min.	Max.	De-fault	Unit	R/W	EKC 224 Appl.				EKC 223 Appl.			
							1	2	3	4	1	2	3	4
d--	**Defrost**													
d01	Defrost method (0) *non* = None, (1) *nat* = Natural, (2) *El* = Electrical, (3) *gas* = Hot gas	0	3	2		R/W	*	*	*		*	*	*	
d02	Defrost stop temperature	0.0	50.0	6.0	°C	R/W	*	*	*		*	*	*	
d03	Interval between defrost starts	0	240	8	hour	R/W	*	*	*		*	*	*	
d04	Max. defrost duration	0	480	30	min	R/W	*	*	*		*	*	*	
d05	Time offset for start of first defrost at start-up	0	240	0	min	R/W	*	*	*		*	*	*	
d06	Drip off time	0	60	0	min	R/W	*	*	*		*	*	*	
d07	Delay for fan start after defrost	0	60	0	min	R/W	*	*	*		*	*	*	
d08	Fan start temperature	-40.0	50.0	-5.0	°C	R/W	*	*	*		*	*	*	
d09	Fan operation during defrost	0/Off	1/ On	1/On		R/W	*	*	*		*	*	*	
d10[1]	Defrost sensor (0=time, 1=Sair, 2=S5)	0	2	0		R/W	*	*	*		*	*	*	
d18	Max. comp. runtime between two defrosts	0	96	0	hour	R/W	*	*	*		*	*	*	
d19	Defrost on demand - S5 temperature's permitted variation during frost build-up. On central plant choose 20 K (=off)	0.0	20.0	20.0	K	R/W	*	*	*		*	*	*	
d30	Defrost delay after pull-down (0 = OFF)	0	960	0	min	R/W	*	*	*		*	*	*	

[1] This menu can only be set when regulation is stopped, i.e. "r12" is set to 0.

Fan

Table 25: Fan

Code	Short text manual	Min.	Max.	De-fault	Unit	R/W	EKC 224 Appl.				EKC 223 Appl.			
							1	2	3	4	1	2	3	4
F--	**Fan**													
F01	Fan at stop of compressor (0) *FFC* = Follow comp., (1) *Fao* = ON, (2) *FPL* = Fan pulsing	0	2	1		R/W	*	*	*		*	*	*	
F04	Fan stop temperature (S5)	-40.0	50.0	50.0	°C	R/W	*	*	*		*	*	*	
F07	Fan pulsing ON cycle	0	180	2	min	R/W	*	*	*		*	*	*	
F08	Fan pulsing OFF cycle	0	180	2	min	R/W	*	*	*		*	*	*	

Compressor

Table 26: Compressor

Code	Short text manual	Min.	Max.	De-fault	Unit	R/W	EKC 224 Appl.				EKC 223 Appl.			
							1	2	3	4	1	2	3	4
c--	**Compressor**													
c01	Min. ON-time	0	30	1	min	R/W	*	*	*		*	*	*	
c02	Min. OFF-time	0	30	2	min	R/W	*	*	*		*	*	*	
c04	Compressor OFF delay at door open	0	900	0	sec	R/W	*	*	*		*	*	*	
c70	Zero crossing selection	0/No	1/ Yes	1/ Yes		R/W	*	*	*		*	*	*	

Miscellaneous

Table 27: Miscellaneous

Code	Short text manual	Min.	Max.	De-fault	Unit	R/W	EKC 224 Appl.				EKC 223 Appl.			
							1	2	3	4	1	2	3	4
o--	**Miscellaneous**													
o01	Delay of outputs at start-up	0	600	10	sec	R/W	*	*	*	*	*	*	*	*
o02[1]	DI1 configuration (0) *oFF*=not used, (1) *Sdc*=status, (2) *doo*=door function, (3) *doA*=door alarm, (4) *SCH*=main switch, (5) *nig*=day/night mode, (6) *rFd*=reference displacement, (7) *EAL*=external alarm, (8) *dEF*=defrost, (9) *Pud*=pull down, (10) *Sc*=condenser sensor	0	10	0		R/W	*	*	*	*	*	*	*	*
o03[1]	Network address	0	247	0		R/W	*	*	*	*	*	*	*	*
o05	Access code	0	999	0		R/W	*	*	*	*	*	*	*	*

Code	Short text manual	Min.	Max.	De-fault	Unit	R/W	EKC 224 Appl.				EKC 223 Appl.			
							1	2	3	4	1	2	3	4
o06[1]	Sensor type selection (0) n5 = NTC 5k, (1) n10 = NTC 10k, (2) Pt = Pt1000, (3) Ptc = PTC 1000	0	3	2		R/W	*	*	*	*	*	*	*	*
o15	Display resolution (0) 0.1 , (1) 0.5 , (2) 1.0	0	2	0		R/W	*	*	*	*	*	*	*	*
o16	Max. standby time after coordinated defrost	0	360	20	min	R/W	*	*	*		*	*	*	
o37[1]	DI2 configuration (0) *oFF*=not used, (1) *Sdc*=status, (2) *doo*=door function, (3) *doA*=door alarm, (4) *SCH*=main switch, (5) *nig*=day/night mode, (6) *rFd*=reference displacement, (7) *EAL*=external alarm, (8) *dEF*=defrost, (9) *Pud*=pull down	0	9	0		R/W	*	*	*	*	*	*	*	*
o38	Configuration of light function (0) *on*=always on, (1) *dAn*=day/night, (2) *doo*=based on door action, (3) *nEt* = Network	0	3	1		R/W	*		*	*		*		*
o39	Light control via network (only if o38=3 (nEt))	0/Off	1/ On	1/ On		R/W	*		*	*		*		*
o61[1]	Selection of application mode. The controller can be defined in various ways. Here you set which of the 4 applications is required. Please refer to the Wiring diagrams for the controller in question.	1	4	1		R/W	*	*	*	*	*	*	*	*
o62[1]	Quick presetting of primary parameters 0 = Not used 1 = MT, Natural defrost, stop on time 2 = MT, El defrost, stop on time 3 = MT, El defrost, stop on temp. 4 = LT, El defrost, stop on temp 5 = Room, MT, El defrost, stop on time 6 = Room, MT, El defrost, stop on temp. 7 = Room, LT, El defrost, stop on temp.	0	7	0		R/W	*	*	*		*	*	*	
o67	Replace the controllers factory settings with the present settings	0/No	1/ Yes	0/No		R/W	*	*	*	*	*	*	*	*
o91	Display at defrost (0) *Air*=Sair temperature (1) *FrE*=freeze temperature (2) *-d-*="-d-" is displayed	0	2	2		R/W	*	*	*		*	*	*	

[1] Parameter can only be changed while r12 Main switch is in position OFF.

Polarity

Table 28: Polarity

Code	Short text manual	Min.	Max.	De-fault	Unit	R/W	EKC 224 Appl.				EKC 223 Appl.			
							1	2	3	4	1	2	3	4
P--	**Polarity**													
P75	Invert alarm relay (1) = Invert relay action	0	1	0		R/W		*	*	*			*	*
P76	Keyboard lock enable	0/No	1/ Yes	0/No		R/W	*	*	*	*	*	*	*	*

Service

Table 29: Service

Code	Short text manual	Min.	Max.	De-fault	Unit	R/W	EKC 224 Appl.				EKC 223 Appl.			
							1	2	3	4	1	2	3	4
u--														
u00	Control state	0	33	0		R	*	*	*	*	*	*	*	*
u01	Sair Air temperature	-100.0	200.0	0.0	°C	R	*	*	*	*	*	*	*	*
u09	S5 Evaporator temperature	-100.0	200.0	0.0	°C	R	*	*	*	*	*	*	*	*
u10	Status of DI1 input	0/Off	1/ On	0/Off		R	*	*	*	*	*	*	*	*
u13	Night condition	0/Off	1/ On	0/Off		R	*	*	*	*	*	*	*	*
u37	Status of DI2 input	0/Off	1/ On	0/Off		R	*	*	*	*	*	*	*	*
u28	Actual thermostat reference	-100.0	200.0	0.0		R	*	*	*	*	*	*	*	*
u58	Compressor / Liquid line solenoid valve	0/Off	1/ On	0/Off		R	*	*	*		*	*	*	
u59	Fan relay	0/Off	1/ On	0/Off		R	*	*	*		*	*	*	
u60	Defrost relay	0/Off	1/ On	0/Off		R	*	*			*			

Code	Short text manual	Min.	Max.	De-fault	Unit	R/W	EKC 224 Appl.				EKC 223 Appl.			
							1	2	3	4	1	2	3	4
u62	Alarm relay	0/Off	1/ On	0/Off		R		*	*	*			*	*
u63	Light relay	0/Off	1/ On	0/Off		R	*		*	*		*		*
u80	Firmware version readout					R	*	*	*	*	*	*	*	*
u82	Controller code no.					R	*	*	*	*	*	*	*	*
u84	Heat relay	0/Off	1/ On	0/Off		R				*				*
U09	Sc Condenser temperature	-100.0	200.0	0.0		R	*	*	*		*	*	*	

Product specification

Technical specification

Table 30: Technical specification

Features	Description
Purpose of control	Operating temperature sensing control suitable for incorporation into commercial air-conditioning and refrigeration applications
Construction of control	Incorporated control
Power supply	115 V AC or 230 V AC 50/60 Hz, galvanic isolated low voltage regulated power supply
Rated power	Less than 0.7 W
Inputs	Sensor inputs, Digital inputs, Programming key Connected to SELV limited energy <15 W
Allowed sensor types	NTC 5000 Ohm at 25 °C, (Beta value=3980 at 25/100 °C - EKS 211) NTC 10000 Ohm at 25 °C, (Beta value=3435 at 25/85 °C - EKS 221) PTC 990 Ohm at 25 °C, (EKS 111) Pt1000, (AKS 11, AKS 12, AKS 21)
Accuracy	Measuring range: -40 – 105 °C (-40 – 221 °F)
	Controller accuracy: ±1 K below -35 °C, ±0.5 K between -35 – 25 °C ±1 K above 25 °C
Type of action	1B (relay)
Output	DO1 - Relay 1: 16 A, 16 (16) A, EN 60730-1 10 FLA / 60 LRA at 230 V, UL60730-1 16 FLA / 72 LRA at 115 V, UL60730-1
	DO2 - Relay 2: 8 A, 2 FLA / 12 LRA, UL60730-1 8 A, 2 (2 A), EN60730-1
	DO3 - Relay 3: 3 A, 2 FLA / 12 LRA, UL60730-1 3 A, 2 (2 A), EN60730-1
	DO4 - Relay 4: 2 A
Display	LED display, 3 digits, decimal point and multi-function icons, °C + °F scale
Operating conditions	-10 – 55 °C (14 – 131 °F), 90% Rh
Storage conditions	-40 – 70 °C (-40 – +158 °F), 90% Rh
Protection	Front: IP65 (Gasket integrated) Rear: IP00
Environmental	Pollution degree II, non-condensing
Overvoltage category	II - 230 V supply version - (ENEC, UL recognized) III - 115 V supply version - (UL recognized)
Resistance to heat and fire	Category D (UL94-V0) Temperature for ball pressure test statement According to Annex G (EN 60730-1)
EMC category	Category I

Mounting

Figure 22: Mounting

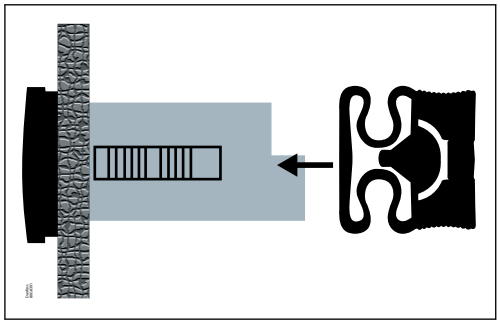
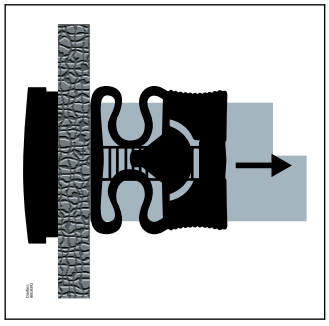


Figure 23: Dismounting

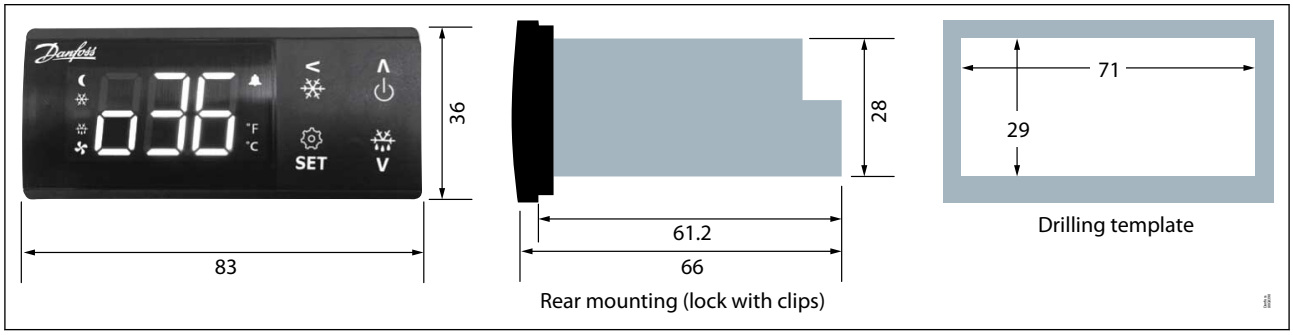


Installation steps

- Place the wired controller in the slot and ensure rubber sealing is resting properly on the mounting surface.
- Slide the mounting clips along the rails of the rear plastic from the rear side of the panel.
- Slide the clips towards mounting surface until controller is firmly fixed.
- To remove the controller, unlatch the snapping tab and pull the clips backwards.

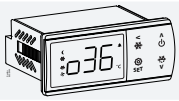
Dimensions

Figure 24: Dimensions (mm)



Ordering

Table 31: Ordering

Type	Symbol	Description	Code no.	
			Single Pack	I pack
EKC 223		S/M pack, 115 V AC, 3 relays	084B4053	084B4153
		S/M pack, 230 V AC, 3 relays	084B4054	084B4154
EKC 224		S/M pack, 115 V AC, 4 relays	084B4055	084B4155
		S/M pack, 230 V AC, 4 relays	084B4056	084B4156
EKA 206		RS-485 Network adapter Modbus	084B4088	084B4188
		Interface cable for RS-485 adapter	080N0327	-

Certificates, declarations, and approvals

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

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

Certificates, declarations, and approvals

Table 32: Certificates, declarations, and approvals

Controller	Certification	Mark	Country
EKC 223/224	EMC/LVD/RoHS	CE	EU
EKC 223/224	UL recognized	cURus	NAM (US and Canada)
EKC 223/224	LVE/EMC/RoHS	EAC	Russia, Kazakhstan, Belarus
EKC 223/224	EMC/LVD/RoHS	UKCA	UK
EKC 223/224	LVD/EMC/RoHS	UA	Ukraine
EKC 223/224	EMC/LVD/RoHS	CMIM	Morocco

R290/R600a end-use applications employing in accordance with the IEC60079-15 requirements.

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