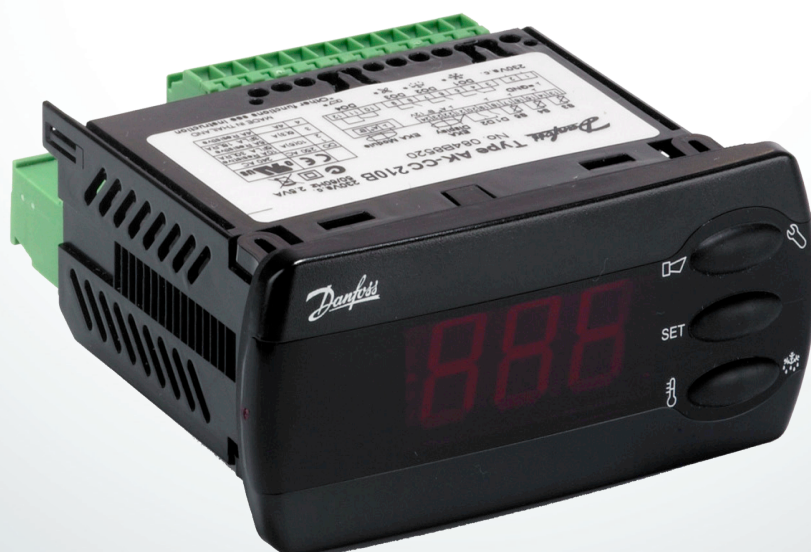ENGINEERING
TOMORROW

Danfoss

User Guide

Controller for temperature control
AK-CC 210B, SW 1.0x

ADAP-KOOL® Refrigeration Control System

Contents

Introduction

Application
The AK-CC 210B is dedicated for "plug-in cabinets" in supermarkets.

Principle
The AK-CC 210B 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 directly through the use of an S5 sensor or indirectly through the use of the Sair measurement.

Relays: the first 3 relays are dedicated for Refrigeration, Defrost and Light, respectively. The usage of relay 4 is selected by the application setting, and can be Alarm, Fan, Rail heat, Condenser fan or Compressor 2.

The different applications are described on page 6.

Advantages
- Many applications in the same unit
- The controller has integrated refrigeration-technical functions, so that it can replace a whole collection of thermostats and timers
- Buttons and seal imbedded in the front
- Alarm monitoring of condenser temperature with compressor stop protection.
- Sealed relays for use with R290 refrigerants
- Can control two compressors
- Easy to remount data communication
- Quick set-up
- Two temperature references
- Digital inputs for various functions
- Clock function with super cap back-up
- Factory calibration that will guarantee a better measuring accuracy than stated in the standard EN ISO 23953-2 without subsequent calibration (Pt 1000 ohm sensor)
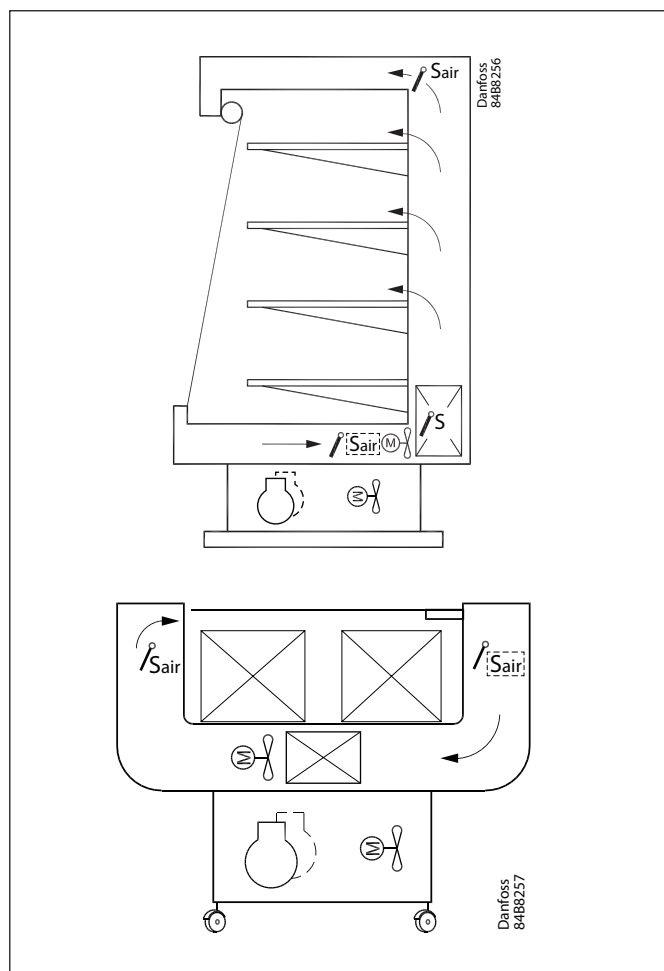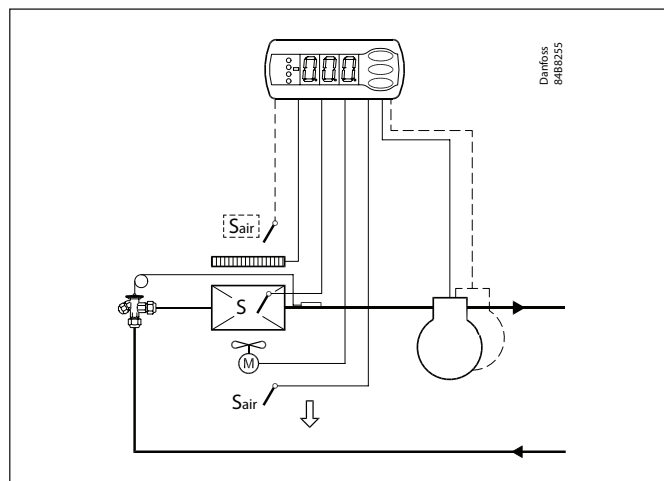
Operation

Operation - 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 before the evaporator or in the airflow after the evaporator. The latter is mainly used where there is a risk of too low temperature at the products.

Defrost sensor
The best signal concerning the evaporator's temperature is obtained from a 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 other actions, including safety stop of compressor, can be initiated based on this temperature.
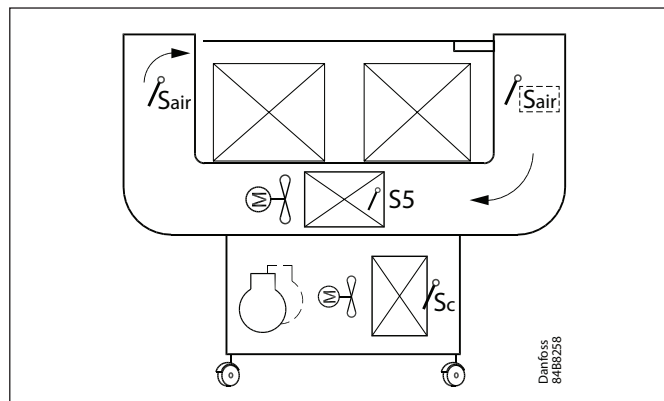

Condenser temperature alarms and actions

An alarm warning can be activated when the temperature gets above a set Condenser Alarm limit and a critical alarm can be activated at a higher Condenser Block Alarm limit. At this critical level, different actions can be initiated e.g. turning off the light in the cabinet, turning off the compressor, or both. The wanted action is defined by parameter "P92".

Compressors can be permanently stopped if a defined number of critical alarms occur within a defined time period. If the number of events exceeds the setting in parameter "P94" within a period defined in "P93", the last event will always include a compressor stop, together with other actions defined in "P92".
This state requires a manual reset before the compressor can start again.
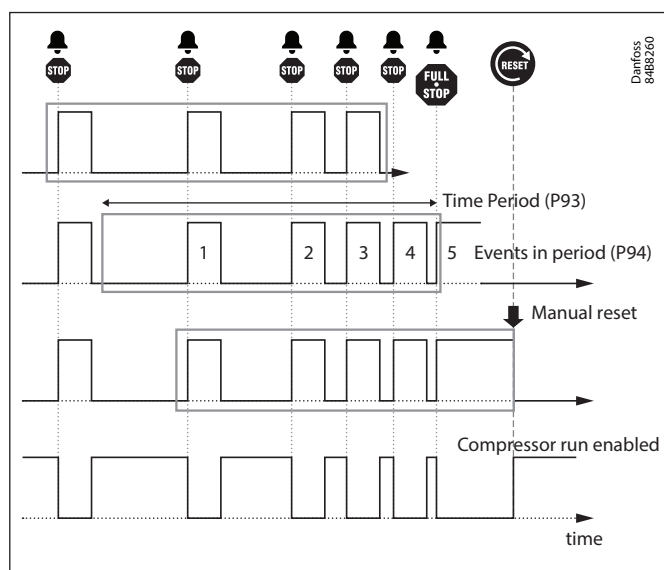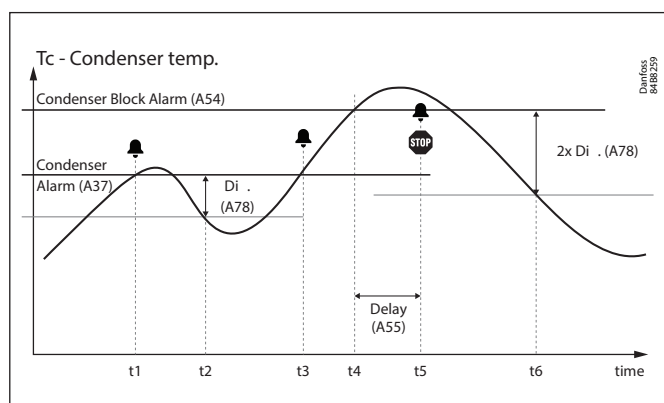
Control of two compressors

This control is used for controlling two compressors of the same size. The principle for control is that one of the compressors connects at ½ the differential of the thermostat, and the other at the full differential. When the thermostat cuts in, the compressor with the fewest operating hours is started. The other compressor will only start after a set time delay, so that the load will be divided between them. The time delay has a higher priority than the temperature.

When the air temperature has dropped by half the differential, one of the compressors will stop, while the other will continue working and not stop until the required temperature is achieved.

The compressors used must be of a type that is capable of starting up against a high pressure.
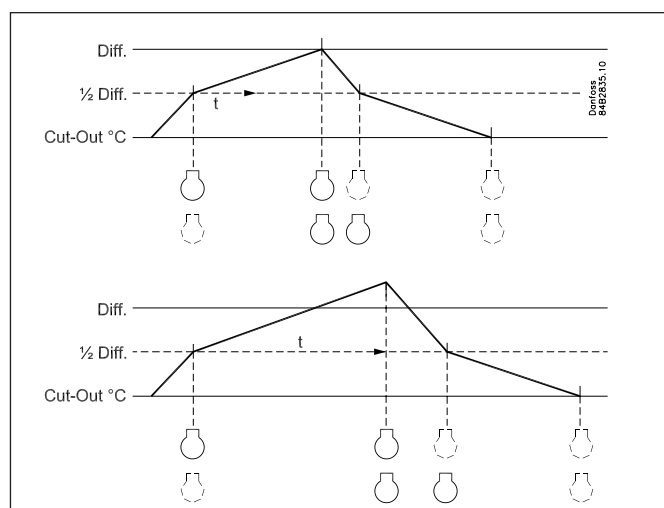
Change of temperature reference

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.
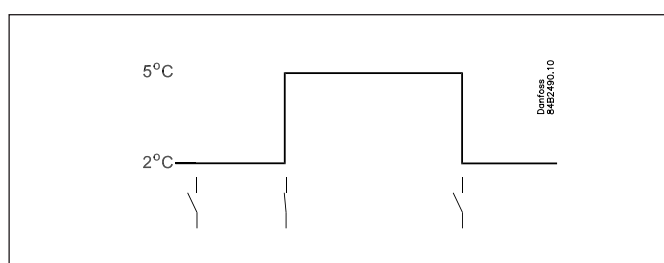
Night setback

The thermostat reference can be displayed with an offset at night. The alarm limit value will be changed with the same value as the night offset. The change will only be applied for positive night offset.

Digital inputs

There are two digital inputs, both of which can be used for the following functions:
- Case cleaning
- Door contact function with alarm
- Starting a defrost
- Coordinated defrost (DO2 only)
- Night setback
- Change-over between two temperature reference
- Report state of digital input via data communication
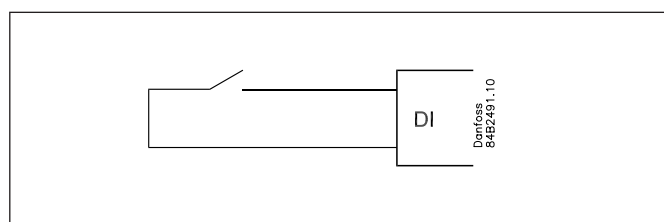
Case cleaning function

This function makes it easy to steer the refrigeration appliance through a cleaning phase. Via three pushes on a switch you change from one phase to the next phase.

The first push stops the refrigeration – the fans keep working.
"Later": The next push stops the fans
"Still later": The next push restarts refrigeration
The different situations can be followed on the display.

On the network, a cleaning alarm is transmitted to the system unit. This alarm can be "logged" so that proof of the sequence of events is provided.

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.
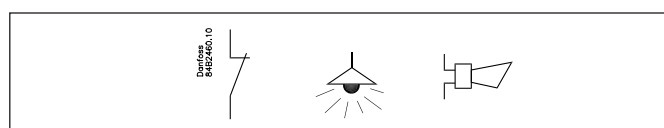
Defrost

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
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.

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

Start of defrost
A defrost can be started in different ways:

Interval: Defrost is started at fixed time intervals, e.g. every eighth hour

Refrigeration time: Defrost is started at fixed refrigeration time intervals. In other words, a low need for refrigeration will "postpone" the coming defrost.

Schedule: Here defrost can be started at fixed times of the day and night. However, max. 6 times.

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

Network: The signal for defrost is received from a system unit via the data communication.

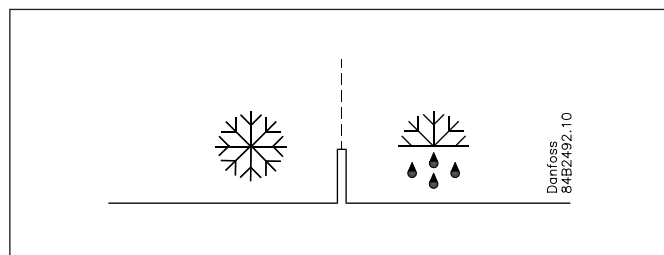S5 temp In 1:1 systems the efficiency of the evaporator can be followed. Icing-up will start a defrost.

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.

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

Wire connections
One of the controllers is defined to be the controlling unit and a battery module may be fitted in it so that the clock is ensured back-up. When a defrost is started, 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. (If just one in the group demands defrost, the others will follow suit).
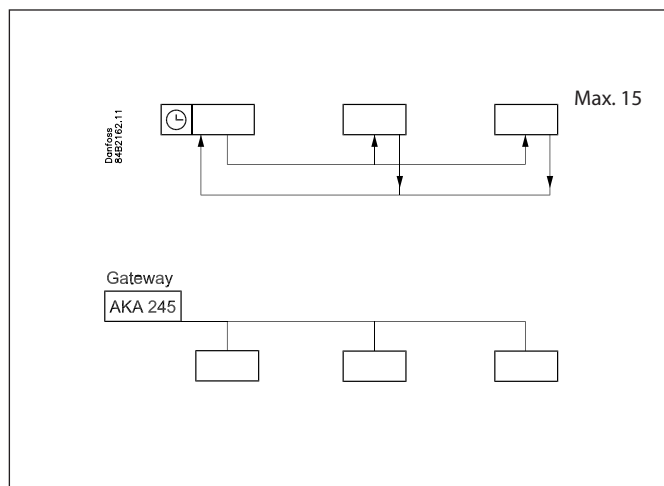
Defrost via data communication
All controllers are fitted with a data communication module, and via the override function from a gateway the defrost can be coordinated.

Defrost on demand
1. Based on refrigeration time
When the aggregate refrigeration time has passed a set time, a defrost will be started.

2. Based on temperature
The controller will constantly follow the temperature at S5. Between two defrosts, the S5 temperature 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 temperature passes a set allowed variation, the defrost will be started.
This function can only work in 1:1 systems.
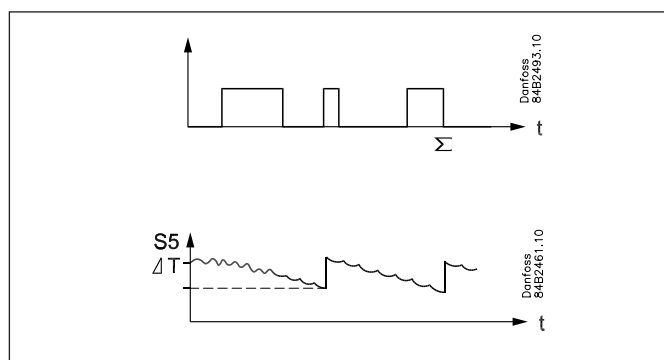
Service request alarm
The controller will register the accumulated on-time in days, and a limit can be set to activate a "service request alarm" to indicate that inspection and cleaning of the fan and condenser is imminent. After doing so, the Runtime counter can be reset and a new period initiated.

Extra module

• The controller can afterwards be fitted with an insertion module if the application requires it.
  The controller has been prepared with plug, so the module simply has to be pushed in.
  - *Battery module*
    The module guarantees voltage to the controller if the supply voltage should drop out for more than four hours. The clock function can thus be protected during a power failure.
  - *Data communication*
    If you require operation from a PC, a data communication module has to be placed in the controller.

• *External display*
  If it is necessary to indicate the temperature on the front of the refrigeration appliance, a display type EKA 163A can be mounted. The extra display will show the same information as the controller's display, but does not incorporate buttons for operation. If operation from the external display is needed a display type EKA 164A must be mounted.
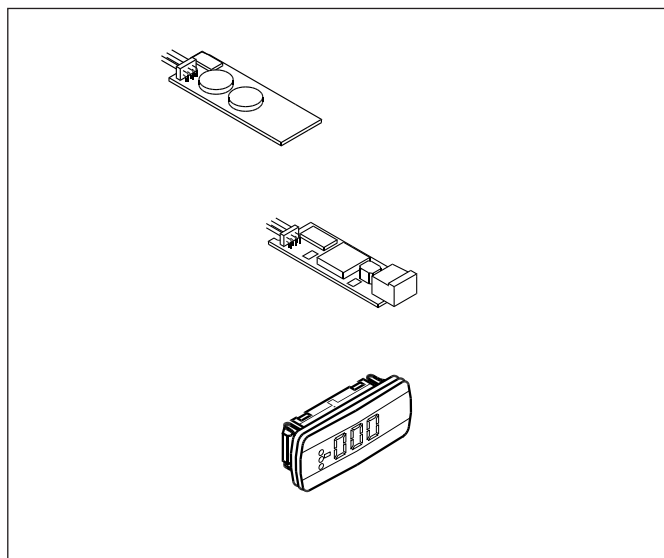
Applications

AK-CC 210B is developed for refrigerated plug-in cabinets with one or 2 compressors.
3 sensors can be connected; Sair, S5 (Defrost termination), and Sc (Condenser temperature).
The first 3 relays are used for compressor on-off, defrost, and light while relay 4 is configurable via "o61" application setting. The relay can be configured for 5 different applications:
1. Alarm relay
2. Evaporator fan control
3. Rail Heat Control
4. Condenser fan control
5. Second compressor control

DI1, and DI2 are flexible Dry Contact inputs that can be configured for multiple functions via "o02" or "o37" (see settings page 12-13).

Application dependent connections
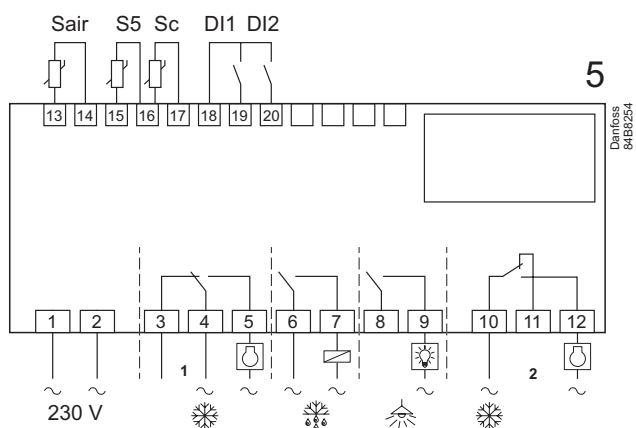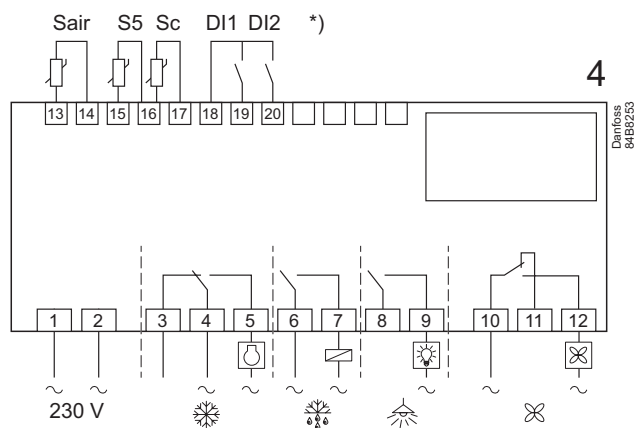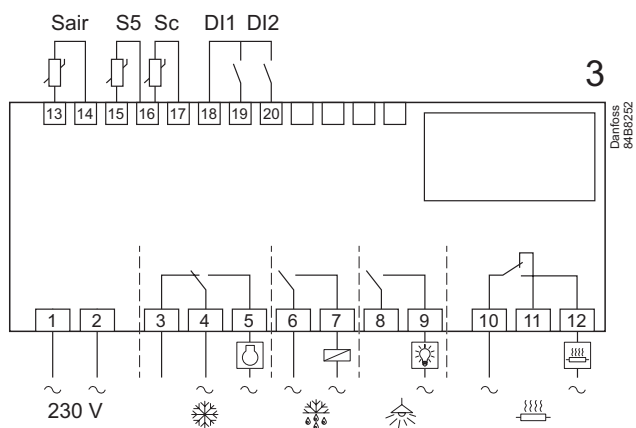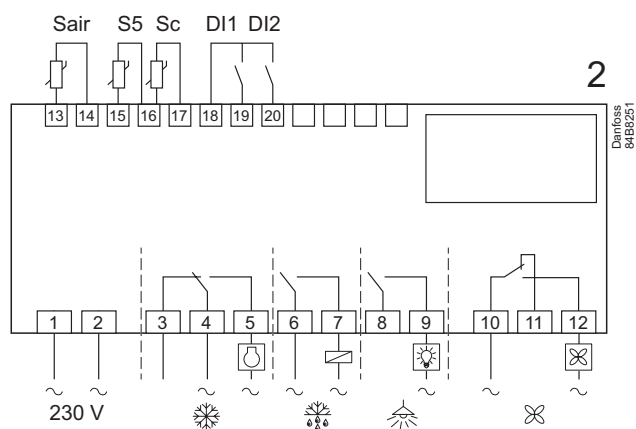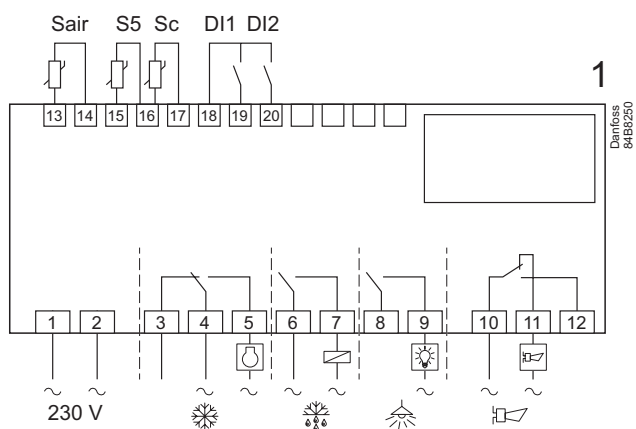
Survey of functions

Function	Para-meter	Parameter by operation via data communication
Normal display		
Normally the temperature value from the thermostat sensor Sair is displayed.		Display air (u56)
Thermostat		**Thermostat control**
Setpoint Regulation is based on the set value plus a displacement, if applicable. The value is set via a push on the centre button. The set value can be locked or limited to a range with the settings in r02 and r 03. The reference at any time can be seen in "u28 Temp. ref".		Cutout °C
Differential When the temperature is higher than the reference + the set differential, the compressor relay will be cut in. It will cut out again when the temperature comes down to the set reference. Ref. Dif.	r01	Differential
Setpoint limitation The controller's setting range for the setpoint may be narrowed down, so that much too high or much too low values are not set accidentally - with resulting damages.		
To avoid a too high setting of the setpoint, the max. allowable reference value must be lowered.	r02	Max cutout °C
To avoid a too low setting of the setpoint, the min. allowable reference value must be increased.	r03	Min cutout °C
Correction of the display's temperature showing 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.	r04	Disp. Adj. K
Temperature unit Here you set whether the controller display is to show temperature values in °C or in °F.	r05	Temp. unit °C=0. / °F=1
Correction of signal from Sair Compensation possibility through long sensor cable	r09	Adjust Sair
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".	r12	Main Switch 1: Start 0: Stop -1: Manual control of outputs allowed
Night setback value The thermostat's reference will be the setpoint plus this value when the controller changes over to night operation. (Select a negative value if there is to be cold accumulation.)	r13	Night offset
Activation of reference displacement When the function is changed to ON, the thermostat reference will be displaced by the value in r40. Activation can also take place via input DI1 or DI2 (defined in o02 or o37). r40 Diff	r39	Th. offset
Value of reference displacement The thermostat reference and the alarm values are shifted the following number of degrees when the displacement is activated. Activation can take place via r39 or input DI	r40	Th. offset K
		Night setbck (start of night signal)
		Forced cool. (start of forced cooling)

Alarm		Alarm settings
The controller can give alarm in different situations. When there is an alarm, all the light-emitting diodes (LED) will flash on the controller front panel, and the alarm relay will cut in.		With data communication the importance of the individual alarms can be defined. Setting is carried out in the "Alarm destinations" menu.
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.	A03	Alarm delay
Time delay for door alarm The time delay is set in minutes. The function is defined in o02 or in o37.	A04	DoorOpen del
Time delay for cooling (long alarm delay) This time delay is used during start-up, during defrost and immediately after a defrost. There will be change-over to the normal time delay (A03) when the temperature has dropped below the set upper alarm limit. The time delay is set in minutes.	A12	Pulldown del
Upper alarm limit Here you set 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.	A13	HighLim Air
Lower 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.	A14	LowLim Air
Delay of a DI1 alarm A cut-out/cut-in input will result in alarm when the time delay has been passed. The function is defined in o02.	A27	Al.Delay DI1
Delay of a DI2 alarm A cut-out/cut-in input will result in alarm when the time delay has been passed. The function is defined in o37	A28	Al.Delay DI2
Condenser alarm limit Setpoint for the condenser temperature alarm, the warning level without compressor stop. The alarm will clear when the condenser temperature is decreased with the value defined in parameter A78.	A37	Cond Al.Lim
Condenser block alarm limit Setpoint for the condenser block alarm. Activation of this alarm can trigger an action – light off, compressor stop or both (see parameter P92) The alarm will clear when the condenser temperature is decreased with **2 times** the value defined in parameter A78.	A54	Cond T. Block
Condenser alarm delay Delay for the condenser block alarm and potential action. The delay starts when the condenser temperature exceeds the limit in parameter A54.	A55	Al.Del.Cond
Condenser alarm difference Difference band below the condenser alarm temperature settings (A37 and A54) for clearing the alarms.	A78	Cond Al.Diff
		Reset alarm
		EKC error

Compressor		Compressor control
The compressor relay works in conjunction with the thermostat. When the thermostat calls for refrigeration the compressor relay will be operated.		
Running times To prevent irregular operation, values can be set for the time the compressor is to run once it has been started, and for how long it at least has to be stopped. The running times are not observed when defrosts start.		
Min. ON time (in minutes)	c01	Min. On time
Min. OFF time (in minutes)	c02	Min. Off time
Time delay for couplings of two compressors Settings indicate the time that has to elapse from the first relay cuts in and until the next relay has to cut in.	c05	Step delay

The LED on the controller's front will show whether refrigeration is in progress.		Comp Relay Here you can read the status of the compressor relay, or you can force-control the relay in the "Manual control" mode
Defrost		**Defrost control**
The controller contains a timer function that is zeroset after each defrost start. The timer function will start a defrost if/when the interval time is passed. The timer function starts when voltage is connected to the controller, but it is displaced the first time by the setting in d05. If there is power failure, the timer value will be saved and continue from here when the power returns. This timer function can be used as a simple way of starting defrosts, but it will always act as safety defrost if one of the subsequent defrost starts is not received. The controller also contains a real-time clock. By means of settings of this clock and times for the required defrost times, defrost can be started at fixed times of the day. If there is a risk of power failure for periods longer than four hours, a battery module should be mounted in the controller. 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 electricity or hot gas. The actual defrost will be stopped based on time or temperature with a signal from a temperature sensor.		
Defrost method Here you set whether defrost is to be accomplished with electricity, gas or "non". During defrost the defrost relay will be cut in.	d01	Def. method 0 = non 1 = El 2 = Gas
Defrost stop temperature The defrost is stopped at a given temperature which is measured with a sensor (the sensor is defined in d10). The temperature value is set.	d02	Def. Stop Temp
Interval between defrost starts The function is zeroset and will start the timer function at each defrost start. When the time has expired the function will start a defrost. The function is used as a simple defrost start, or it may be used as a safeguard if the normal signal fails to appear. If master/slave defrost without clock function or without data communication is used, the interval time will be used as max. time between defrosts. If a defrost start via data communication does not take place, the interval time will be used as max. time between defrosts. When there is defrost with clock function or data communication, the interval time must be set for a somewhat longer period of time than the planned one, as the interval time will otherwise start a defrost which a little later will be followed by the planned one. In connection with power failure the interval time will be maintained, and when the power returns, the interval time will continue from the maintained value. The interval time is not active when set to 0.	d03	Def Interval (0=off)
Max. defrost duration This setting is a safety time so that the defrost will be stopped if there has not already been a stop based on temperature or via coordinated defrost.	d04	Max Def. time
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 when voltage is connected to the controller. The function will be active after each and every power failure.	d05	Time Stagg.
Drip-off time Here you set the time that is to elapse from a defrost and until the compressor is to start again. (The time when water drips off the evaporator).	d06	DripOff time
Delay of fan start after defrost Here you set the time that is to elapse from compressor start after a defrost and until the fan may start again. (The time when water is "tied" to the evaporator).	d07	FanStartDel

Fan start temperature The fan may also be started a little earlier than mentioned under "Delay of fan start after defrost", if the defrost sensor S5 registers a lower value than the one set here.	d08	FanStartTemp
Fan cut-in during defrost Here you can set whether fan is to operate during defrost. 0: Stopped (Runs during pump down) 1: Running (stopped during "fan delay") 2: Running during pump down and defrost. After that it is stopped.	d09	FanDuringDef
Defrost sensor Here you define the defrost sensor. 0: None, defrost is based on time 1: S5 2: Sair	d10	DefStopSens.
Pumpdown delay Set the time where the evaporator is emptied of refrigerant prior to the defrost.	d16	Pump dwn del.
Defrost on demand – aggregate refrigeration time Here the refrigeration time allowed without defrosts is set. If the time is passed, a defrost will be started. With setting = 0 the function is cut out.	d18	MaxTherRunT
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 cut out. With setting = 20 the function is cut out	d19	CutoutS5Dif.
Max. duration of -d- in the display Controls the readout of "-d-" after defrost, so that "-d-" is shown until the temperature is ok, the set delay has expired, or a temperature alarm becomes active.	d40	Disp. D del.
If you wish to see the temperature at the defrost sensor, push the controller's lowermost button.		Defrost temp.
If you wish to start an extra defrost, push the controller's lowermost button for four seconds. You can stop an ongoing defrost in the same way.		Def Start Here you can start a manual defrost
The LED on the controller's front will indicate whether a defrost is going on.		Defrost Relay Here you can read the defrost relay status or you can force-control the relay in "Manual control" mode.
		Hold After Def Shows ON when the controller is operating with coordinated defrost.
		Defrost State Status on defrost 1= pump down / defrost

Fan		**Fan control**
Fan stopped at cut-out compressor Here you can select whether the fan is to be stopped when the compressor is cut out.	F01	Fan stop CO (Yes = Fan stopped)
Delay of fan stop when compressor is cut out If you have chosen to stop the fan when the compressor is cut out, you can delay the fan stop when the compressor has stopped. Here you can set the time delay.	F02	Fan del. CO
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 interrupted.	F04	FanStopTemp.

The LED on the controller's front will indicate whether the fan is running.		Fan Relay Here you can read the fan relay status, or force-control the relay in "Manual control" mode.
Internal defrosting schedule/clock function		
(Not used if an external defrosting schedule is used via data communication.) Up to six individual times can be set for the defrost start throughout the day.		
Defrost start, hour setting	t01-t06	
Defrost start, minute setting (1 and 11 belong together, etc.) When all t01 to t16 equal 0 the clock will not start defrosts.	t11-t16	
Real-time clock Setting the clock is only necessary when there is no data communication. In the event of a power failure of less than four hours, the clock function will be saved. When mounting a battery module the clock function can preserved longer. There is also a date indication used for registration of temperature measurements.		
Clock: Hour setting	t07	
Clock: Minute setting	t08	
Clock: Date setting	t45	
Clock: Month setting	t46	
Clock: Year setting	t47	
Miscellaneous		Miscellaneous
Delay of output signal after start-up Start-up after a power failure the controller's functions can be delayed so that over-loading of the electricity supply network is avoided. Here you can set the time delay.	o01	DelayOfOutp.
Digital input signal - DI1 The controller has a digital input 1 which can be used for one of the following functions: Off: The input is not used 1. Status display of a contact function 2. Door function: When the input is open it signals that the door is open. The refrigeration and the fans are stopped. When the time setting in "A4" is passed, an alarm will be given and refrigeration will be resumed. 3. Door alarm: When the input is open it signals that the door is open. When the time setting in "A4" is passed, there will be an alarm. 4. Defrost: The function is started with a pulse signal. The controller will register when the DI input is activated. The controller will then start a defrost cycle. If the signal is to be received by several controllers it is important that ALL connections are mounted the same way (DI to DI and GND to GND). 5. Main switch: Regulation is carried out when the input is short-circuited, and regulation is stopped when the input is put in pos. OFF. 6. Night operation: When the input is short-circuited, there will be regulation for night operation. 7. Reference displacement when DI1 is short-circuited. Displacement with "r40". 8. Separate alarm function: Alarm will be given when the input is short-circuited. 9. Separate alarm function: Alarm will be given when the input is opened. (For 8 and 9 the time delay is set in A27) 10. Case cleaning: The function is started with a pulse signal. Cf. also description on page 4.	o02	DI 1 Config. Definition takes place with the numerical value shown to the left. (0 = off) DI state (Measurement) The DI input's present status is shown here. ON or OFF.
If the controller is built into a network with data communication, it must have an address, and the master gateway of the data communication must then know this address. These settings can only be made when a data communication module has been mounted in the controller and the installation of the data communication cable has been finished. This installation is mentioned in a separate document "RC8AC".		After installation of a data communication module, the controller can be operated on an equal footing with the other controllers in ADAP-KOOL® refrigeration controls.
The address is set between 1 and 60 (119), gateway determined.	o03	
The address is sent to the gateway when the menu is set in pos. ON IMPORTANT: Before you set o04, you MUST set o61. Otherwise you will be transmit-ting incorrect data.	o04	
Access code 1 (Access to all settings) If the settings in the controller are to be protected with an access code you can set a numerical value between 0 and 100. If not, you can cancel the function with setting 0. (99 will always give you access).	o05	-

Sensor type Normally a Pt 1000 sensor with great signal accuracy is used. But you can also use a sensor with another signal accuracy. That may either be a PTC 1000 sensor (1000 ohm) or an NTC sensor (5000 Ohm at 25°C). All the mounted sensors must be of the same type.	o06	SensorConfig Pt = 0 PTC = 1 NTC = 2
Local readout of software version	o08	SW version
Display step Yes: Gives steps of 0.5° No: Gives steps of 0.1°	o15	Disp. Step = 0.5
Max. standby time after coordinated defrost When a controller has completed a defrost it will wait for a signal which tells that the refrigeration may be resumed. If this signal fails to appear for one reason or another, the controller will itself start the refrigeration when this standby time has elapsed.	o16	Max HoldTime
Digital input signal - D2 The controller has a digital input 2 which can be used for one of the following functions: Off: The input is not used. 1. Status display of a contact function 2. Door function: When the input is open it signals that the door is open. The refrigeration and the fans are stopped. When the time setting in "A4" is passed, an alarm will be given and refrigeration resumed. 3. Door alarm: When the input is open it signals that the door is open. When the time setting in "A4" is passed an alarm will be given. 4. Defrost: The function is started with a pulse signal. The controller will register when the DI input is activated. The controller will then start a defrost cycle. If the signal is to be received by several controllers it is important that ALL connections are mounted the same way (DI to DI and GND to GND). 5. Main switch: Regulation is carried out when the input is short-circuited, and regulation is stopped when the input is put in pos. OFF. 6. Night operation: When the input is short-circuited, there will be regulation for night operation. 7. Reference displacement when DI2 is short-circuited. Displacement with "r40". 8. Separate alarm function: Alarm will be given when the input is short-circuited. 9. Separate alarm function: Alarm will be given when the input is opened. 10. Case cleaning: The function is started with a pulse signal. Cf. also description on page 4. 11. Not used 12. The input is used for coordinated defrost in conjunction with other controllers of the same type.	o37	DI2 config.
Configuration of light function (relay 4 in applications 2 and 6) 1) The relay cuts in during day operation 2) The relay to be controlled via data communication 3) The relay to be controlled by the door switch defined in either o02 or o37 where the setting is selected to either 2 or 3. When the door is opened the relay will cut in. When the door is closed again there will be a time delay of two minutes before the light is switched off.	o38	Light config
Activation of light relay The light relay can be activated here, but only if defined in o38 with setting 2.	o39	Light remote
Rail heat during day operation The ON period is set as a percentage of the time.	o41	Railh.ON day%
Rail heat during night operation The ON period is set as a percentage of the time.	o42	Railh.ON ngt%
Rail heat cycle The period of time for the aggregate ON time + OFF time is set in minutes.	o43	Railh. cycle
Case cleaning The status of the function can be followed here or the function can be started manually. 0 = Normal operation (no cleaning) 1 = Cleaning with fans operating. All other outputs are Off. 2 = Cleaning with stopped fans. All outputs are Off. If the function is controlled by a signal at the DI1 or DI2 input, the relevant status can be seen here in the menu.	o46	Case clean
Selection of application The controller can be defined in various ways. Here you set which of the 5 applications is required. On page 6 you can see a survey of applications. *This menu can only be set when regulation is stopped, i.e. "r12" is set to 0.*	o61	--- Appl. Mode

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 an application or a room is to be controlled and whether defrost is to be stopped based on time or based on temperature. The survey can be seen on page 22. *This menu can only be set when regulation is stopped, i.e. "r12" is set to 0.* After the setting, the value will return to 0. Any subsequent adjustment/setting of parameters can be made, as required.	o62	-
Access code 2 (Access to adjustments) There is access to adjustments of values, but not to configuration settings. If the settings in the controller are to be protected with an access code you can set a numerical value between 0 and 100. If not, you can cancel the function with setting 0. If the function is used, access code 1 (o05) **must also** be used.	o64	-
Save as factory setting With this setting you save the controller's actual settings as a new basic setting (the earlier factory settings are overwritten).	o67	-
Runtime readout Readout of the accumulated controller runtime in days (powered up and main switch on). Can be cleared or adjusted when r12 Main switch is off.	P48	Unit runtime
Service alarm request Days of operation before Service alarm request. Value = 0 disables function	P91	CondServ req
Defines action when Condenser blocked alarm activates 0 = Function disabled, 1 = Turn off Light, 2 = Stop compressor, 3 = Light and comp off, 4 = Stop comp, Rail heat and light off, 5 = Comp, Light and RH off	P92	Cond action
Period for counting condenser events before permanent stop Number of hours for counting events. Events that are older than the set period are discarded.	P93	Cond period
Number of condenser events within period before permanent stop The period is defined by parameter P93. Value = 0 disables function	P94	Cond Ev cnt
		- - - Night Setback 0=Day 1=Night

Service		Service
Temperature measured with Sair sensor	u01	Sair temp.
Temperature measured with S5 sensor	u09	S5 temp.
Status on DI1 input. on/1=closed	u10	DI1 status
Status on night operation (on or off) 1=closed	u13	Night Cond.
Read the present regulation reference	u28	Temp. ref.
Status on DI2 output. on/1=closed	u37	DI2 status
Temperature measured with Sc sensor	U09	Sc temp.
Temperature shown on display	u56	Display air
** Status on relay for cooling	u58	Comp1/LLSV
** Status on relay for fan	u59	Fan relay
** Status on relay for defrost	u60	Def. relay
** Status on relay for rail heat	u61	Railh. relay
** Status on relay for alarm	u62	Alarm relay
** Status on relay for light	u63	Light relay
** Status on relay for compressor 2	u67	Comp2 relay
** Status on relay for condenser fan	u71	Condenser fan relay
*) Not all items will be shown. Only the function belonging to the selected application can be seen.		

Fault message		Alarms
In an error situation the LEDs on the front will flash and the alarm relay will be activated. If you push the top button in this situation you can see the alarm report in the display. If there are more keep on pushing to see them. There are two kinds of error reports - it can either be an alarm occurring during the daily operation, or there may be a defect in the installation. A-alarms will not become visible until the set time delay has expired. E-alarms, on the other hand, will become visible the moment the error occurs. (An A alarm will not be visible as long as there is an active E alarm). Here are the messages that may appear:		1 = alarm
A1: High temperature alarm		High t. alarm
A2: Low temperature alarm		Low t. alarm
A4: Door alarm		Door Alarm
A5: Information. Parameter o16 is expired		Max Hold Time
A15: Alarm. Signal from DI1 input		DI1 alarm
A16: Alarm. Signal from DI2 input		DI2 alarm
A45: Standby position (stopped refrigeration via r12 or DI input) (Alarm relay will not be activated)		Standby mode
A59: Case cleaning. Signal from DI1 or DI2 input		Case cleaning
A61: Condenser temperature alarm		Cond Alarm
A80: Condenser blocked alarm		Cond blocked
AA4: Service request alarm		Cond ServReq
		Max. def time
E1: Faults in the controller		EKC error
E6: Fault in real-time clock. Check the battery / reset the clock.		-
E27: Sensor error on S5		S5 error
E29: Sair sensor error		Sair error
E64: Sc sensor error		Sc error
		Alarm destinations
		The importance of the individual alarms can be defined with a setting (0, 1, 2 or 3)

Operating status		(Measurement)
The controller goes through some regulating situations where it is just waiting for the next point of the regulation. To make these "why is nothing happening" situations visible, you can see an operating status on the display. Push briefly (1s) the upper button. If there is a status code, it will be shown on the display. The individual status codes have the following meanings:		EKC State: (Shown in all menu displays)
S0: Regulating		0
S1: Waiting for end of the coordinated defrost		1
S2: When the compressor is operating it must run for at least x minutes.		2
S3: When the compressor is stopped, it must remain stopped for at least x minutes.		3
S4: The evaporator drips off and waits for the time to run out		4
S10: Refrigeration stopped by main switch. Either with r12 or a DI-input		10
S11: Refrigeration stopped by thermostat		11
S14: Defrost sequence. Defrost in progress		14
S15: Defrost sequence. Fan delay — water attaches to the evaporator		15
S17: Door is open. DI input is open		17
S20: Emergency cooling *)		20
S25: Manual control of outputs		25
S29: Case cleaning		29
S32: Delay on outputs during start-up		32
S34: Condenser blocked event active		34
Other displays:		
non: The defrost temperature cannot be displayed. There is stop based on time		
-d-: Defrost in progress / First cooling after defrost		
PS: Password required. Set password		

*) Emergency cooling will take effect when there is lack of signal from the Sair sensor. The regulation will continue with a registered average cut-in frequency. There are two registered values – one for day operation and one for night operation.

Warning ! Direct start of compressors *
To prevent compressor breakdown, parameter c01 and c02 should be set according to suppliers requirements or in general:
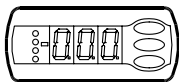Hermetic Compressors c02 min. 5 minutes
Semihermetic Compressors c02 min. 8 minutes and c01 min. 2 to 5 minutes (motor from 5 – 15 kW)
*) Direct activating of solenoid valves does not require settings different from factory (0)

Operation

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

Light-emitting diodes (LED) on front panel
The other LEDs on the front panel will light up when the belonging relay is activated.

❄ = Refrigeration
❅ = Defrost
✦ = Fan running

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

Defrost
During defrost a –d- is shown in the display.
After defrost is finished, the readout of –d- will be continued until one of the following conditions are met:
- The temperature is OK (below the cut-in limit)
- A high temperature alarm becomes active
- The delay set with the d40 parameter expires
- The regulation is stopped with "Main switch"

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

Examples:
Set menu
1. Push the upper button until a parameter r01 is shown.
2. Push the upper or the lower button and find the parameter you want to change.
3. Push the middle button until the parameter value is shown.
4. Push the upper or the lower button and select the new value.
5. Push the middle button again to freeze the value.

Cut-out alarm relay / receipt alarm/see alarm code
• Push the upper button shortly.
   If there are several alarm codes they are found in a rolling stack. Push the uppermost or lowermost button to scan the rolling stack.

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

Reading the temperature at defrost sensor
• Push the lower button shortly

Manual start or stop of a defrost
• Push the lower button for four seconds.
   (Though not for application 4).

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 dependent connections based on the drawings on page 7.

3 Open parameter o61 and set the electric connection number in it.

4 Now select one of the preset settings from the table on page 20.

5 Open parameter o62 and set the number for the array of presettings. The few selected settings will now be transferred to the menu.

6 Open parameter r12 and start the regulation

7 Go through the survey of factory settings. The values in the grey cells are changed according to your choice of settings. Make any necessary changes in the respective parameters.

8 For network. Set the address in o03 and then install on the system unit by scanning, or for Lon via setting o04.

Menu survey

Grey marked settings will be changed by the Quick setting function. See table on page 20.

SW = 1.0x

Parameters			Codes	Variant of AK-CC 1	2	3	4	5	Min.-value	Max.-value	Factory setting	Actual setting
Function												
Normal operation												
Temperature (set point)			---						-50.0 °C	50.0 °C	2.0 °C	
Thermostat												
Differential	***		r01						0.1 K	20.0K	2.0 K	
Max. limitation of setpoint setting	***		r02						-49.0 °C	50 °C	50.0 °C	
Min. limitation of setpoint setting	***		r03						-50.0 °C	49.0 °C	-50.0 °C	
Adjustment of temperature indication			r04						-20.0 K	20.0 K	0.0 K	
Temperature unit (°C/°F)			r05						°C	°F	°C	
Correction of the signal from Sair			r09						-10.0 K	10.0 K	0.0 K	
Manual service, stop regulation, start regulation (-1, 0, 1)			r12						-1	1	0	
Displacement of reference during night operation			r13						-20.0 K	20.0 K	0.0 K	
Activation of reference displacement r40			r39						OFF	ON	OFF	
Value of reference displacement (activate via r39 or DI)			r40						-50.0 K	50.0 K	0.0 K	
Alarm												
Delay for temperature alarm			A03						0 min.	240 min.	30 min.	
Delay for door alarm	***		A04						0 min.	240 min.	60 min.	
Delay for temperature alarm after defrost			A12						0 min.	240 min.	90 min.	
High alarm limit	***		A13						-50.0 °C	50.0 °C	8.0 °C	
Low alarm limit	***		A14						-50.0 °C	50.0 °C	-30.0 °C	
Alarm delay DI1			A27						0 min.	240 min.	30 min.	
Alarm delay DI2			A28						0 min.	240 min.	30 min.	
Alarm limit for condenser temperature alarm			A37						20.0 °C	120.0 °C	60.0 °C	
Limit for condenser block alarm and comp. stop			A54						20.0 °C	140.0 °C	70.0 °C	
Delay for condenser block alarm			A55						0 min.	30 min.	0 min.	
Difference for clearing condenser alarms			A78						1.0 K	30.0 K	10.0 K	
Compressor												
Min. ON-time			c01						0 min.	30 min.	0 min.	
Min. OFF-time			c02						0 min.	30 min.	0 min.	
Time delay for cut-in of comp.2			c05						0 sec	900 sec	5 sec	
Defrost												
Defrost method (none/EL/GAS)			d01						none	GAS	none	
Defrost stop temperature			d02						0.0 °C	25.0 °C	6.0 °C	
Interval between defrost starts			d03						0 hours	240 hours	8 hours	
Max. defrost duration			d04						0 min.	180 min.	45 min.	
Displacement of time on cut-in of defrost at start-up			d05						0 min.	240 min.	0 min.	
Drip off time			d06						0 min.	60 min.	0 min.	
Delay for fan start after defrost			d07						0 min.	60 min.	0 min.	
Fan start temperature			d08						-15.0 °C	0.0 °C	-5.0 °C	
Fan cut-in during defrost 0: Stopped 1: Running 2: Running during pump down and defrost			d09						0	2	1	
Defrost sensor (0=time, 1=S5, 2=Sair)			d10						0	2	0	
Pump down delay			d16						0 min.	60 min.	0 min.	
Max. aggregate refrigeration time between two defrosts			d18						0 hours	48 hours	0 hours	
Defrost on demand - S5 temperature's permitted variation during frost build-up. On central plant choose 20 K (=off)			d19						0.0 K	20.0 K	20.0 K	
Max. duration of -d- in display			d40						5 min.	240 min.	30 min.	
Fan												
Fan stop at cut-out compressor			F01						no	yes	no	
Delay of fan stop			F02						0 min.	30 min.	0 min.	
Fan stop temperature (S5)			F04						-50.0 °C	50.0 °C	50.0 °C	
Real time clock												
Six start times for defrost. Setting of hours. 0=OFF			t01-t06						0 hours	23 hours	0 hours	
Six start times for defrost. Setting of minutes. 0=OFF			t11-t16						0 min.	59 min.	0 min.	
Clock - Setting of hours	***		t07						0 hours	23 hours	0 hours	
Clock - Setting of minutes	***		t08						0 min.	59 min.	0 min.	
Clock - Setting of date	***		t45						1	31	1	
Clock - Setting of month	***		t46						1	12	1	
Clock - Setting of year	***		t47						0	99	0	
Miscellaneous												
Delay of output signals after start-up			o01						0 s	600 s	5 s	
Input signal on DI1. Function: 0=not used. 1=status on DI1. 2=door function with alarm when open. 3=door alarm when open. 4=defrost start (pulse-signal). 5=ext.main switch. 6=night operation 7=change reference (activate r40). 8=alarm function when closed. 9=alarm function when open. 10=case cleaning (pulse signal).			o02						0	10	0	
Network address			o03						0	240	0	
On/Off switch (Service Pin message) IMPORTANT! o61 **must** be set prior to o04			o04						OFF	ON	OFF	

Description		Par.	Min	Max	Factory
Access code 1 (all settings)		o05	0	100	0
Used sensor type (Pt /PTC/NTC)		o06	Pt	ntc	Pt
Readout of software version		o08			
Display step = 0.5 (normal 0.1 at Pt sensor)		o15	no	yes	no
Max. hold time after coordinated defrost		o16	0 min.	60 min.	20 min.
Input signal on DI2. Function: (0 = not used. 1 = status on DI2. 2 = door function with alarm when open. 3 = door alarm when open. 4 = defrost start (pulse-signal). 5 = ext. main switch. 6 = night operation. 7 = change reference (activate r40). 8 = alarm function when closed. 9 = alarm function when open. 10 = case cleaning (pulse signal). 11 = not used. 12 = defrost coordination.		o37	0	12	0
Configuration of light function (relay 4) 1=ON during day operation. 2=ON / OFF via data communication. 3=ON follows the DI-function, when DI is selected to door function or to door alarm		o38	1	3	1
Activation of light relay (only if o38=2)		o39	OFF	ON	OFF
Rail heat On time during day operations		o41	0%	100%	0%
Rail heat On time during night operations		o42	0%	100%	100%
Rail heat period time (On time + Off time)		o43	6 min.	60 min.	10 min.
Case cleaning. 0=no case cleaning. 1=Fans only. 2=All output Off.	***	o46	0	2	0
Selection of EL diagram. See page 7	*	o61*	1	5	1
Download a set of predetermined settings. See overview previous page.	*	o62*	0	2	0
Access code 2 (partly access)	***	o64	0	100	0
Replace the controllers factory settings with the present settings		o67	OFF	On	OFF
Readout of Unit runtime in days	*	P48	0 days	999 days	0 days
Service Alarm request. Days of operation (Unit runtime) before Service request alarm Value = 0 disables function		P91	0 days	960 days	0 days
Defines action when Condenser blocked alarm activates: 0 = Function disabled. 1 = Turn off Light, 2 = Stop compressor. 3 = Light and comp off, 4 = Stop comp, Rail heat and light off. 5 = Comp, Light and RH off		P92	0	5	0
Period for counting condenser events before permanent stop		P93	0 hours	96 hours	0 hours
Number of condenser events within period before permanent stop Value = 0 disables function		P94	0	50	0
Service					
Status codes are shown on page 16		S0-S34			
Temperature measured with Sair sensor		u01			
Temperature measured with S5 sensor	***	u09			
Status on DI1 input. on/1=closed		u10			
Status on night operation (on or off) 1=closed	***	u13			
Read the present regulation reference		u28			
Status on DI2 output. on/1=closed		u37			
Temperature measured with Sc sensor		U09			
Temperature shown on display		u56			
Status on relay for cooling	**	u58			
Status on relay for fan	**	u59			
Status on relay for defrost	**	u60			
Status on relay for rail heat	**	u61			
Status on relay for alarm	**	u62			
Status on relay for light	**	u63			
Status on relay for compressor 2	**	u67			
Status on relay for condenser fan	**	u71			

*) Can only be set when regulation is stopped (r12=0)

**) Can be controlled manually, but only when r12=-1

***) With access code 2 the access to these menus will be limited

Factory setting

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

- Cut off the supply voltage to the controller

- Keep both buttons depressed at the same time as you reconnect the supply voltage
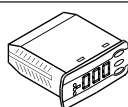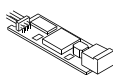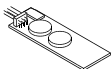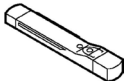
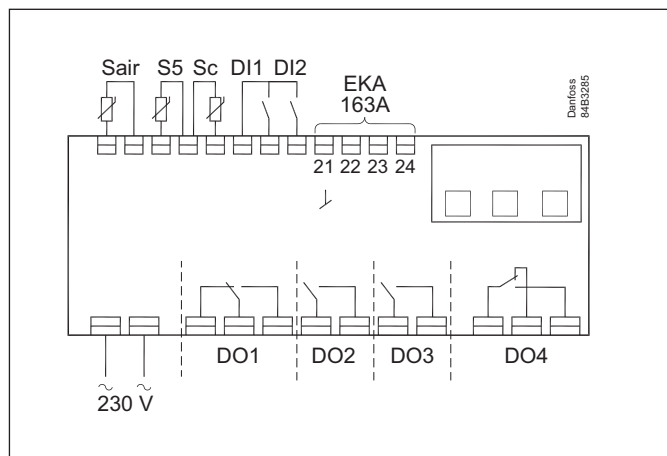| Table for Quick settings	MT (cooling) cabinet	LT (frost) cabinet
Preset setting – via o62	**1**	**2**
Temperature (SP)	4.0 °C	-24.0 °C
Max. temp. setting (r02)	6.0 °C	-22.0 °C
Min. temp. setting (r03)	2.0 °C	-26.0 °C
Alarm limit high (A13)	10.0 °C	-15.0 °C
Alarm limit low (A14)	-5.0 °C	-30.0 °C

Override

The controller contains a number of functions that can be used together with the override function in the master gateway / System Manager.

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

Ordering

Type		Function	Code no.	
AK-CC 210B		Refrigeration controller without data communication but prepared for mounting of one module.	**230 V AC**	**084B8544**
EKA 178A		Data communication module MODBUS	**084B8564**	
EKA 179A		Data communication module LON RS 485	**084B8565**	
EKA 181C		Battery module that will protect the clock in case of lengthy power failure.	**084B8577**	
EKA 183A		Programming key	**084B8582**	
EKA 163A		External display for AK-CC 210B	**084B8562**	

Connections

Power supply
230 V AC

Sensors
Thermostat temperature is measured with Sair.
S5 is a defrost sensor and is used if defrost has to be stopped based on temperature.
The Sc sensor is used for monitoring and controlling the condenser temperature.

Digital On/Off signals
A cut-in input will activate a function. The possible functions are described in menus o02 and o37.

EKA 163A – External display
Here an external display type EKA 163A or EKA 164A can be connected – please see the Instruction for EKA 16xA (literature no. 084R9970)

Relays
The general uses are mentioned here. See also page 6-7 where the different applications are shown.
DO1: Refrigeration. The relay will cut in when the controller demands refrigeration
DO2: Defrost. The relay will cut in when defrost is in progress
DO3: Light. The relay cuts in when the light has to be switched on.
DO4: For either alarm, rail heat, fan, condenser fan or compressor 2.
  Alarm: Cf. diagram. The relay is cut in during normal operation and cuts out in alarm situations and when the controller is dead (de-energised)
  Rail heat: The relay cuts in when rail heat is to operate.
  Fans: The relay will cut in when the fans have to operate.
  Condenser fan: The relay follows the compressor except during defrost.
  Compressor 2: The relay will cut in when refrigeration step 2 has to be cut in.

Data communication
The controller is available in several versions where data communication can be carried out with one of the following systems: MODBUS or LON-RS485.
If data communication is used, it is important that the installation of the data communication cable is performed correctly.
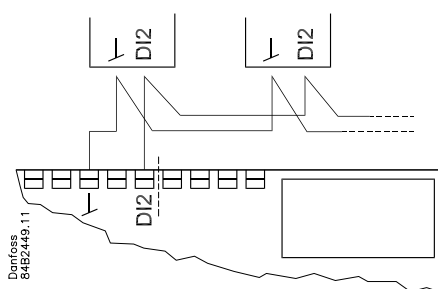See separate literature No. RC8AC…

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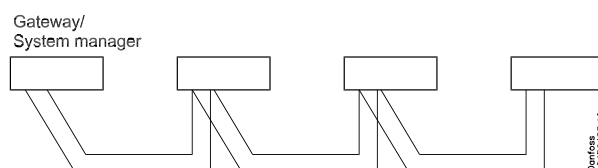
Coordinated defrost via cable connections

The following controllers can be connected up in this way:
AK-CC 210, AK-CC 250, AK-CC 450, AK-CC 550 and AK-CC55.
Max. 10.
Refrigeration is resumed when all controllers have "released" the signal for defrost.

Coordinated defrost via data communication

Data

Supply voltage	230 V AC +10/-15 %. 2.5 V A, 50/60 Hz		
Sensors 3 pcs off either	Pt 1000 or PTC 1000 or NTC-M2020 (5000 ohm / 25 °C)		
Accuracy	Measuring range	-60 – 99 °C	
	Controller	±1 K below -35 °C ±0.5 K between -35 – 25 °C ±1 K above 25 °C	
	Pt 1000 sensor	±0.3 K at 0°C ±0.005 K per degree	
Display	LED, 3-digits		
External display	EKA 163A		
Digital inputs	Signal from contact functions. Requirements to contacts: Gold plating Cable length must be max. 15 m Use auxiliary relays when the cable is longer.		
Electrical con-nection cable	Max. 1.5 mm² multi-core cable		
Relays*		CE (250 V AC)	UL *** (240 V AC)
	DO1. Refrigeration	8 (6) A	10 A Resistive 5FLA, 30LRA
	DO2. Defrost	8 (6) A	10 A Resistive 5FLA, 30LRA
	DO3. Fan	6 (3) A	6 A Resistive 3FLA, 18LRA 131 VA Pilot duty
	DO4. Alarm	4 (1) A Min. 100 mA**	4 A Resistive 131 VA Pilot duty
Environments	0 – 55 °C, during operations -40 – 70 °C, during transport		
	20 – 80% Rh, not condensed		
	No shock influence / vibrations		
Density	IP 65 from front. Buttons and packing are imbedded in the front.		
Escapement reserve for the clock	4 hours		
Approvals	EU Low Voltage Directive and EMC demands re CE-marking complied with LVD tested acc. EN 60730-1 and EN 60730-2-9, A1, A2 EMC tested acc. EN61000-6-3 and EN 61000-6-2		

* DO1 and DO2 are 16 A relays. The mentioned 8 A can be increased up to 10 A, when the
  ambient temperature is kept below 50 °C. DO3 and DO4 are 8 A relays. Max. load must be kept.
** Gold plating ensures make function with small contact loads
*** UL-approval based on 30000 couplings.