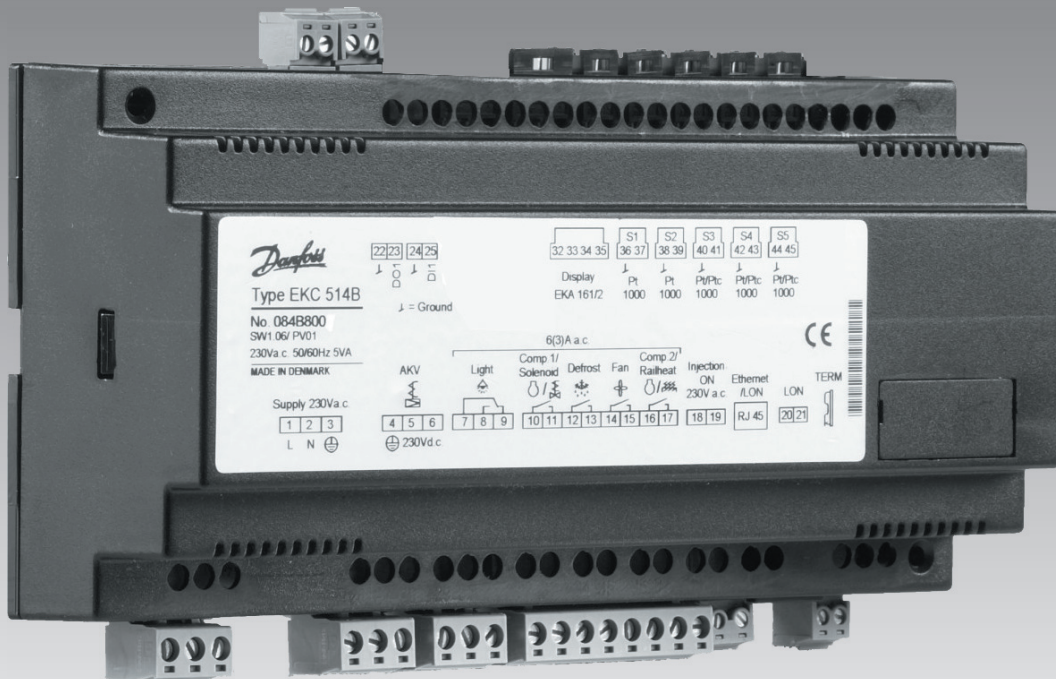


# **Preface to EKC 514B1**

**Code number:  
084B8009**

This controller is only sold to OEM's in the refrigeration appliance trade and cannot be ordered generally.





# Controller for operation of a refrigerant appliance EKC 514B1 - 084B8009

## Introduction

### Application

The controller is a complete control unit for refrigeration appliances with integrated refrigeration-technical functions capable of replacing a setup of thermostats and timers.

It contains:

- Evaporator control with adaptive regulation
- Changeover between two thermostat functions
- Relays for operating of:
  - Light
  - Compressor
  - Defrost
  - Fan
  - Rail heat or compressor no. 2.

It is recommended that the controller be equipped with data communication as several of the functions can only be used in this way.

*The controller should only be used in systems where the placing of the S1 sensor, and hence the signal reliability, has been examined beforehand.*

### Operation

The controller comes without operating buttons on the front panel, and it will require no operation once it has been set and started up.

When the controller is operated, it can be done in one of the following ways:

- Connection of an external display with operating buttons
  - The display will currently show measurements and settings in the menu system
  - In case of malfunction the relevant error code will be shown on the display
  - Four light-emitting diodes will show the system's actual function:
    - › refrigeration
    - › power for the AKV valve
    - › defrost
    - › fan operating
  - › when there is an alarm the three LED's will flash
- Data communication
 

The controller can be hooked up with other products in the series of ADAP-KOOL® refrigeration controls. The operation, monitoring and data collection can then be performed from a PC – either on site or at a service company.

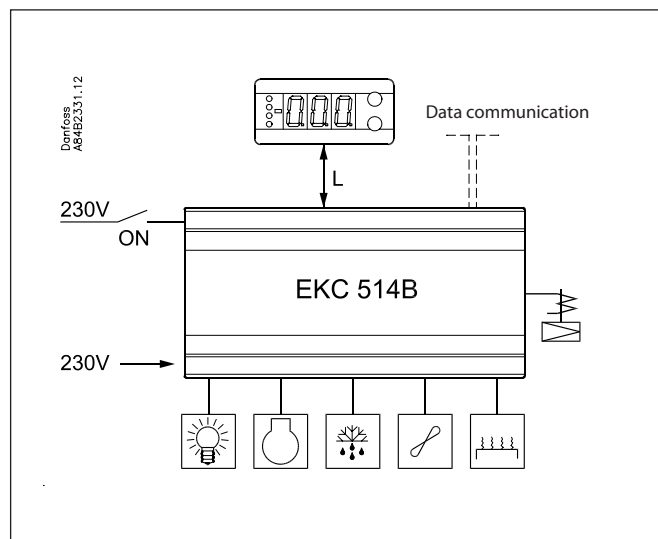
### Customer display

If the temperature in the appliance is to be visible to, say, customers, a display without control knobs may be mounted instead of the display with control knobs.

### Digital inputs

One digital input can be defined for following applications:

- Cleaning of appliance
- Door alarm with delay
- Defrost start
- Night operation
- Start/stop of regulation
- Joint defrost start/stop with a master/slave function



### Inject ON function

The expansion valve is closed when the signal on the 230 V input is removed. In this way it is ensured that the expansion valve will not charge the evaporator if the compressor is prevented from starting. This signal can also be received via data communication.

### Light function

The light in the refrigeration appliance can be regulated. Periods with the light on may follow the controller's day/night period or it may follow a timetable via the data communication.

### Alarms

There is no alarm relay in the controller. All alarms have to be transmitted via data communication.

### Data communication

The controller has been prepared for data communication with either:

- LON RS 485
- LON FTT 10 or
- Ethernet

A module with the required communication has to be mounted in the controller.

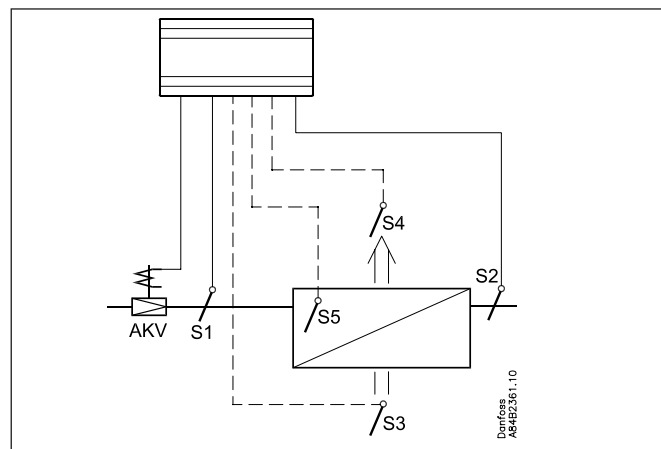
## Function

### Liquid supply

The liquid supply is regulated based on signals from three sensors (S1, S2 and an air sensor that may be placed before or after the evaporator). The sensors register the difference between the temperature at the evaporator outlet (S2) and the temperature at the evaporator inlet (S1). In combination with the air temperature the sensors create a signal, so that superheat is continually kept at a minimum whatever the operating conditions.

*The placing of the S1 sensor is of paramount importance for a reliable signal, and hence for a satisfactory regulation.*

The AKV valve functions both as expansion valve and solenoid valve. The valve opens and closes based on signals from the controller.



### Temperature control

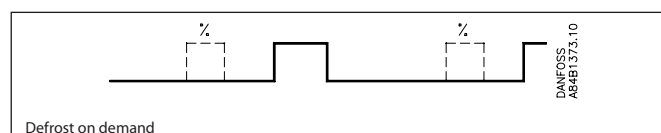
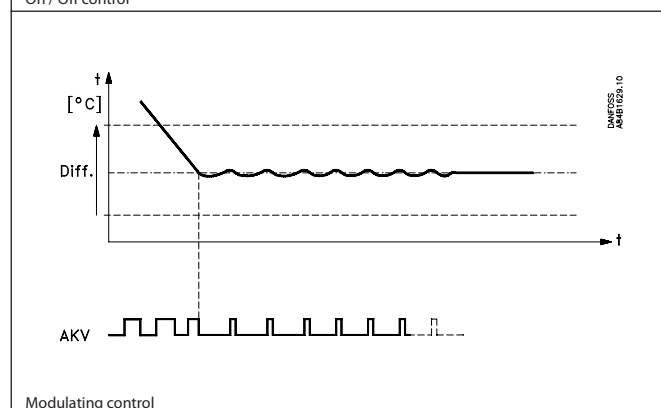
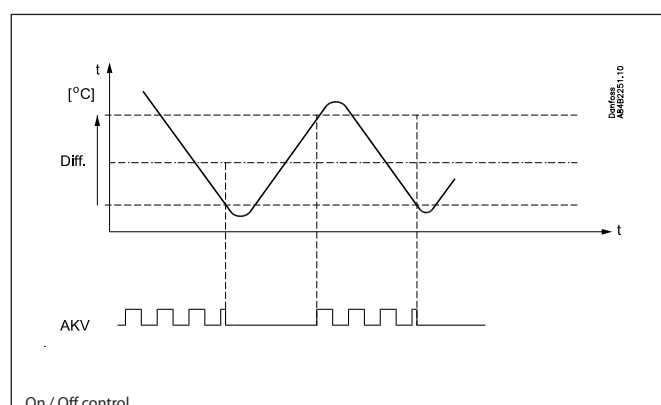
The temperature is controlled on the basis of signals from one or two temperature sensors. If there is only one sensor it may optionally be placed in the air before or after the evaporator. If there are two sensors, one must be placed before and one after the evaporator. With a setting it is subsequently defined how large an influence the individual sensor is to have on the control. The actual temperature control can take place in two ways: as an ordinary ON/OFF regulation with a belonging differential, or as a modulating control there the temperature variation will not be nearly as great as in ON/OFF control. There is however a limit to the use of them as a modulating control can only be used in central plant. In a decentralised plant the thermostat function with ON/OFF control should be selected.

In a central plant the thermostat function may either be selected for ON/OFF control or modulating control.

### Defrost

With a simple function defrost can be started x times per day and night. But the controller may also receive a signal from a defrost clock or from another unit via the data communication, so that defrost will take place at defined times of the day or night. An on-going defrost can be stopped based on temperature, normally the one measured with the S5 sensor, or it may be stopped based on time.

By means of a function the controller can itself determine whether an approaching defrost will be necessary, or whether it may be skipped. This function can only be used together with data communication.



## Survey of functions

Function	Parameter	Operation via data communication
<b>Thermostat function</b>		<b>Thermostat control</b>
<b>Set point 1</b> The thermostat regulates on the basis of the set value.	-	Cutout1 temp
<b>Differential</b> 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.  Reference = Set point + night setback, if applicable <div style="text-align: center;"> </div>	r01	Differential
<b>Temperature unit</b> Set here if the controller is to show temperature values in °C or in °F.	r05	Temp. unit °C=0 (Only °C on AKM, whatever the setting)
<b>Start / stop of refrigeration</b> With this setting refrigeration can be started and stopped. Start / stop of refrigeration can also be accomplished with the external switch function connected to the DI1 input.	r12	Main switch
<b>Night setback value</b> The thermostat's set point will be increased by this value when the controller changes over to night operation. (Select a negative value if there is to be cold accumulation.)	r13	Night offset
<b>Thermostat function</b> Here it is defined how the thermostat is to operate. Either as an ordinary ON/OFF thermostat or as a modulating thermostat. 1: ON/OFF thermostat 2: Modulating  When operation is "modulating" the AKV valve will limit the flow of refrigerant so that the temperature variation will be less than for the ON/OFF thermostat.  In a decentralised plant you must select the ON/OFF thermostat setting.  The thermostat's settings for cutout value and differential must be identical no matter which of the two functions is selected. E.g. 5 K, if S4 is the thermostat sensor, or 3 K, if S3 is the thermostat sensor.	r14	Therm. mode
<b>Selection of thermostat sensor</b> Here you define the sensor the thermostat is to use for its control function. S3, S4, or a combination of them. With the setting 0%, only S3 is used. With 100%, only S4.	r15	S4 %
<b>Melt function</b> Only for control of refrigeration (-5 to +10°C). The function ensures that the evaporator will not be closed by frost. Here you set how often the function is to stop the refrigeration and hence transform the frost to water (or ice if there is too much frost).	r16	Melt Interval
<b>Melt period</b> Here you set how long an on-going melt function is to last.	r17	Melt period
<b>Set point 2</b> The thermostat regulates on the basis of the set value.	r21	Cutout2 temp
<b>Selection of thermostat</b> Here you set which of the two setpoints are to be used for the regulation: <b>0</b> = no thermostat / regulation stopped <b>1</b> =Regulation according to setpoint 1 <b>2</b> =Regulation according to setpoint 2	r22	Ther. band
		Night setback OFF gives day operation ON gives night operation

Alarm settings		Alarm Settings
The controller can give alarm in different situations. When there is an alarm the light-emitting diodes (LED) will flash on the front panel of EKA 162.		EKC error Here you can read the alarm status.
<b>Delay on temperature alarm</b> If one of the two limit values A13, A14, A20 or A21 is exceeded, a timer function will be started. The alarm will only become visible when time delay is passed. The time delay is set in minutes.	A03	Alarm delay
<b>Time delay for cooling</b> This time delay is used during start-up, during defrost, immediately after a defrost, and when the "Injection-ON" function has been used. 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
<b>Upper alarm limit for thermostat 1</b> Here you set when the alarm for high temperature is to start. The limit value is set in °C (absolute value). The limit value will be raised during night operation with the value set for night setback. But will only be raised if the value is positive.	A13	HighLim1 Air
<b>Lower alarm limit for thermostat 1</b> Here you set when the alarm for low temperature is to start. The limit value is set in °C (absolute value).	A14	LowLim1 Air
<b>Upper alarm limit for thermostat 2</b> (Same function as for thermostat 1)	A20	HighLim2 Air
<b>Lower alarm limit for thermostat 2</b> (Same function as for thermostat 1)	A21	LowLim2 Air
<b>Delay time for a DI1 alarm</b> The time delay is set in minutes.	A27	Al. Delay DI1
<b>Selection of sensor for the alarm thermostat</b> The alarm thermostat will monitor the low and high temperature values for both thermostat functions 1 and 2. The measured value involved will come from the following sensor combination: <b>1</b> =Weighted value (r15) is used for both low and high temperature alarm. <b>2</b> =Weighted value (r15) is used for high temperature alarm. S4 is used for low temperature alarm. <b>3</b> =S4 is used for high temperature alarm. Used as low temperature alarm is 50% S4 + 50% S3. <b>4</b> =Highest measurement of either S4 or S5 is used for high temperature alarm. Used as low temperature alarm is 50% S4 + 50% S3.	A33	AirAlarm Cfg
		Reset alarm The function resets all alarms when set in pos. ON.
Compressor function		Compressor control
The compressor relay works in conjunction with the thermostat. When the thermostat calls for refrigeration the compressor relay be operated. The controller can use two relay outputs for a simple compressor control. Cf. also "o40".		
<b>Running times</b> 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.		
Min. ON-time (in minutes)	c01	Min. ON-time
Min. OFF-time (in minutes)	c02	Min. OFF-time

<p><b>Time delay for two compressor couplings</b> Only used if the function is defined in "o40". The settings indicate the time interval between the first relay's cutin and the following relay's cutin.</p>	c05	Step delay
<b>Defrost</b>		<b>Defrost control</b>
<p>A defrost can be started in four ways: via the data communication, via a signal at the DI input, via an internal timer function or by a pushon on the controller's buttons. It is recommended to set the timer function even if one of the two first options is used. The timer function will then act as safety period if the original defrost start should be overdue. The defrost itself can be stopped based on time, or a temperature sensor can be placed on the evaporator so that defrost can be stopped based on temperature value. See d10".</p>		
<p><b>Defrost stop temperature</b> If a defrost sensor has been mounted on the evaporator, the defrost can be stopped at a given temperature. The temperature value is set. If a defrost sensor has not been mounted, the defrost will be stopped based on time. See "d04".</p>	d02	Def.StopTemp
<p><b>Interval between defrost starts</b> It is recommended to start the defrost via the data communication or via a signal at the DI input and then use this setting as precautionary measure if the normal defrost signal should fail to appear (the time interval must be greater than the longest period between defrosts. But the interval function may also be used as a simple defrost start function where the defrost is started periodically, say, every eight hours. If defrost is to be performed at specific times of the day, the setting must be made accordingly. The time interval is reset at each defrost start.</p>	d03	Def.Interval
<p><b>Max. defrost duration</b> If you have chosen to stop defrost based on temperature, this setting will constitute a safety period where the defrost will be stopped if no stop based on temperature has taken place by then. If you have selected defrost stop based on time, this setting will be the defrost time. If you use the function "Defrost on demand (d14)" the controller must be able to calculate the time until the next expected defrost start.</p>	d04	Max Def.time
<p><b>Time displacement of defrost cutins during start-up</b> The function is only relevant, if you have several refrigeration appliances or groups where you would like the defrost to be displaced. This function is also only relevant if you have selected defrost with interval start (d03). The function delays the defrost by the set number of minutes, but for the very first defrost it only does it when the controller has been energised.</p>	d05	Time stagg.
<p><b>Drip-off time</b> Here you set the time that is to elapse from the end of a defrost and until the refrigeration is to be resumed. (The time when water is dripping off the evaporator).</p>	d06	DripOff time
<p><b>Fan start delay after defrost</b> Here you set the time that is to elapse from when the refrigeration is started after a defrost and until the fan may resume operation. (The time where the water is "bound" to the evaporator).</p>	d07	FanStartDel.
<p><b>Fan start temperature</b> The fan may also be started a little earlier than mentioned under "Delayed fan start after defrost" if the defrost sensor registers a permissible value. Here you can set the value for when the fan may start.</p>	d08	FanStartTemp
<p><b>Fan cut in during defrost</b> Here you set whether the fan is to operate during defrost. If the ON function is selected, the settings in d07 and d08 are not relevant</p>	d09	FanDuringDef
<p><b>Defrost sensor</b> Here you set whether the defrost sensor is to be S4, S5 or if there is not going to be a defrost sensor at all. <b>0</b>= S4 <b>1</b>= S5 <b>2</b>= No defrost sensor. Defrost stop is based on time <b>3</b>=S4 and S5. The lowest value is used.</p>	d10	DefStopSens.



<p><b>Defrost on demand</b> The controller contains a function that examines whether a planned defrost should be accomplished or whether it should be skipped. This function can only be used if defrost is started based on a defrost schedule via the data communication. <b>0</b>=The function is not used. <b>1-6</b>=Defrost on demand permitted. Select the setting between 1 and 6 corresponding to the number of defrost starts per 24 hours used in the defrost schedule.</p> <p>When the function has been selected and is operative, the following settings will be available: <b>7</b>=Zero setting of counters for accomplished defrosts and for the number of defrosts that have been skipped. <b>8</b>=Zero setting of values which the function learns and saves in the course of time. (Used, for example, if the products in the refrigeration appliance are changed to something completely different. For instance, packed products to unpacked products, or vice versa. <b>9</b>=Manual startup of a defrost via the data communication. (Used when defrost on demand has to be bypassed).</p> <p>When settings 7 to 9 have been selected the controller will itself return to the earlier setting between 1 and 6.</p>	d14	DOD Control
<p><b>Max. settings that may be skipped</b> When there is defrost on demand the controller must be told how many defrosts in a row may be skipped.</p>	d15	Max Def.Skip
		Defrost start Here you can start a manual defrost. (If defrost on demand in "d14" has been selected, a manual defrost must be started from the "d14" function).
		HoldAfterDef. Shows ON when the controller is operating with coordinated defrost. (waits for all controllers to finish the defrost).
<b>Injection control</b>		<b>Injection control</b>
<p><b>Expansion valve</b> Normally an expansion valve type AKV is used, but the controller can also be used in systems with a thermostatic expansion valve. Start/stop of refrigeration must then be made with a solenoid valve in the liquid line. The solenoid valve must then be connected to the relay output on 10-11. Setting: <b>1</b>=AKV valve <b>2</b>=TEV and solenoid valve</p>	n03	Valve type
<p><b>Max. value for the superheat reference</b></p>	n09	Max SH
<p><b>Min. value for the superheat reference</b></p>	n10	Min SH
<p><b>MOP temperature</b> If no MOP function is required, select pos. OFF</p>	n11	MOP temp. (A value of 15 corresponds to OFF)
<p><b>Temperature glide</b> If a zeotrope refrigerant is used, a value for temperature glide must be set.</p>	n12	Glide
The following settings are special settings:		
<p><b>AKV valve's time period in seconds</b> Should only be set to a lower value if it is a decentralised plant and the suction pressure fluctuates a lot and in line with the opening of the AKV valve.</p>	n13	AKV Period
<p><b>Adaptive control</b> With adaptive control the controller will itself adjust the valve's opening degree so that the evaporator will all the time have the lowest permissible superheat (MSS). If the function is put in pos. = OFF, the settings in n16 and n17 will be used for the regulation. Setting in pos. OFF should only be carried out by specially trained staff.</p>	n14	Adap. inject
<p><b>Startup time for signal reliability</b> If the controller does not obtain a reliable S1 signal within this period of time it will in other ways try to create a stable signal. (A too high value may result in a flooded evaporator). The value should only be changed by specially trained staff.</p>	n15	StartUp time
<p><b>Average opening degree</b> The controller continuously registers the valve's opening degree and uses the value in its regulation. The value should only be changed by specially trained staff.</p>	n16	AKV Dim.

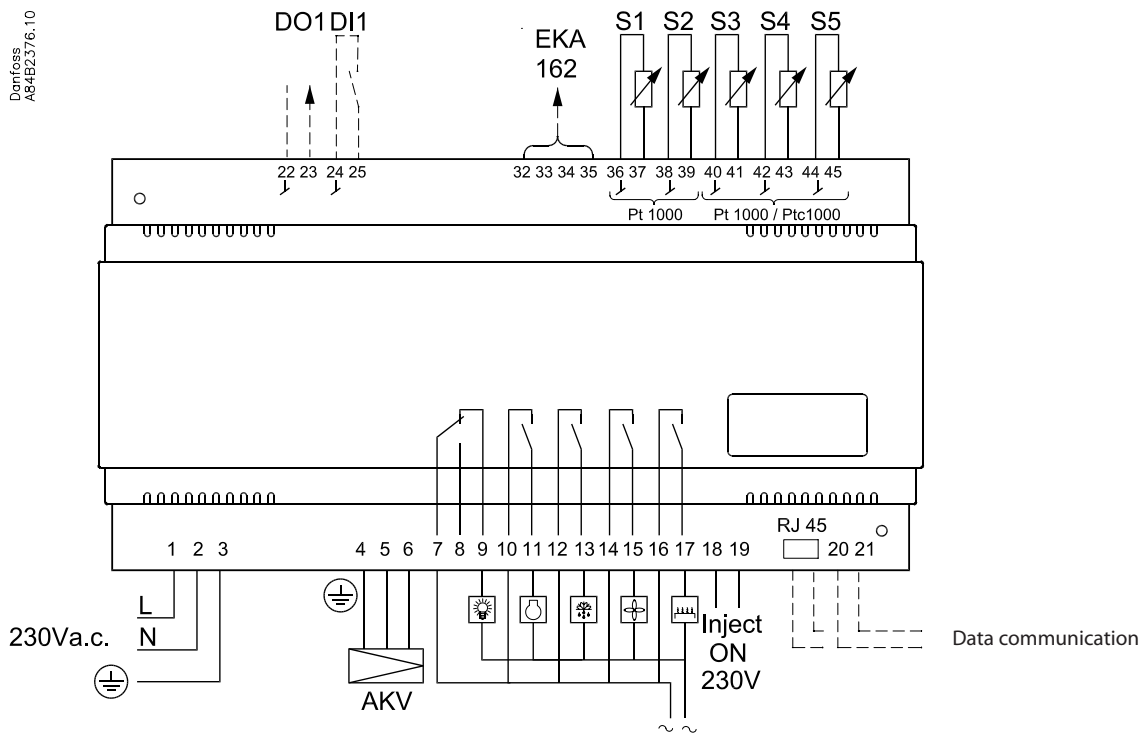
<p><b>Signal reliability at startup</b> The regulation uses the value as start value for the valve's opening degree for each thermostat cutin. In connection with adaptive control the controller continuously calculates a new value. The value should only be changed by specially trained staff.</p>	n17	Start OD %
<p><b>Stability factor for regulation of superheat</b> With a higher value the control function will allow a greater fluctuation of the superheat before the reference is changed. The value should only be changed by specially trained staff.</p>	n18	-
<p><b>Forced closing</b> The AKV valve will close when the function is set in pos. ON.</p>	n36	Inject Close
<b>Miscellaneous</b>		<b>Miscellaneous</b>
<p><b>Delay of output signal after start-up</b> After start-up or a power failure the controller's functions can be delayed so that overloading of the electricity supply network is avoided. Here you can set the time delay.</p>	o01	DelayOfOutp.
<p><b>Digital input control</b> The controller has a digital input "DI" which can be used for one of the following functions:  <b>0</b>= Input not used.  <b>1</b>= Alarm when the input is short-circuited and the time delay A27 has expired.  <b>2</b>= Defrost. A contact function with return spring is fitted. The controller will register when the 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 (DI1 to DI1 and GND to GND).  <b>3</b>= Night operation. Connect a switch. When the switch is cut in, there will be night operation.  <b>4</b>= Main switch. Regulation is carried out when the input is short-circuited, and regulation is stopped when the input is put in pos. OFF.  <b>5</b>= Coordinated defrost with cable connections. See wiring diagram. (If coordinated defrost via data communication is used, setting 5 must not be used).  <b>6</b>= Cleaning of refrigeration appliance. When the input is cut out, refrigeration stops and other outputs are put in pos.OFF.  <b>7</b>= As "1", but with open switch function.</p>	o02	DI1 Config.
<p><b>Address</b> 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 completed. This installation is mentioned in a separate document "RC.8A.C".</p>		
The address is set between 1 and 60	o03	
The address is sent to the gateway when the menu is set in pos. ON	o04	
<p><b>Access code</b> 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 OFF.</p>	o05	
<p><b>Sensor type</b> (S3, S4, S5 and S6) Normally a Pt 1000 sensor with great signal accuracy is used. But you may also use a PTC sensor (R25 = 1000) in special situation.  <b>0</b>= All the sensors used are Pt1000  <b>1</b>= The four mentioned sensors are type PTC1000  <b>2</b>= Application where temperature measurement takes place with two sensors before the evaporator and two sensors after the evaporator. All the sensors used are Pt1000, but inputs S3, S4 and S5 are specially connected. The S3 input shares the signal from two sensors. The S5 input is used for signals from another S4 sensor. Read the section "Connections".</p>	o06	SensorConfig Pt=0 PTC=1 Special application = 2
<p><b>Frequency</b> Set the net frequency. 50/60 Hz.</p>	o12	50/60 Hz (50=0, 60=1)

<p><b>Coordinated defrost with wire connections</b>  Connections to the controller must be made as described on page 12.  <b>0</b>= No coordinated defrost with wire connections  <b>1</b>= Master (only one controller in the group can be master)  <b>2</b>= Slave</p>	o13	DO1 Config. Not used = 0 Master = 1 Slave = 2
<p><b>Max. standby time after coordinated defrost</b>  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.</p>	o16	MaxHoldTime (See display "Defrost control")
<p><b>Select sensor signal for the display</b>  With a % value you can set whether the display should show the S3 temperature, the S4 temperature or a mixture of the two.  With setting 0%, only the S3 temperature is shown.  With setting 100%, only the S4 temperature is shown.</p>	o17	Display S4%
<p><b>Manual control of outputs</b>  In connection with service the individual relay outputs and the digital output can be changed to pos. ON.  <b>0/Off</b>= No override  <b>1</b>=Light relay is On  <b>2</b>=Compressor relay is ON  <b>3</b>=Defrost relay is On  <b>4</b>=Fan relay is On  <b>5</b>=Compressor relay 2 / rail heat relay is On  <b>6</b>=AKV output is 100% open  <b>7</b>=DO1 signal to slave controllers, to be defrosted  <b>8</b>= Not used  <b>9</b>= Not used  <b>10</b>=All relay output and DO1, LED1 and LED2 are Off. AKV is closed.  <b>11</b>=All relay output and DO1, LED1 and LED2 are On. AKV is open.  <b>12</b>=Light, compressor and fan relay are On. AKV is 30% open.  <b>13</b>=Light, compressor and fan relay are On. AKV is 60% open  Remember to reset the function to OFF when forced control is terminated.</p>	o18	Man. Outputs (See display "Service")  Remember to reset the function to OFF
<p><b>Stop of injection function</b>  Here you define which functions are to be active when "Injection ON" input does not receive signals or when "n36" is put in pos. ON:  <b>1</b>= The fan relay is On. There is alarm monitoring.  <b>2</b>= The fan relay is Off. There is alarm monitoring.  <b>3</b>= The fan relay is Off. There is no alarm monitoring.  <b>4</b>= The fan relay is On. There is no alarm monitoring.  For 3 and 4 (and 7 and 8) applies that a defrost cannot be started (any defrost in progress will be terminated in the normal way).   Re data communication:  If the injection function is stopped via the data communication ("n36"), voltage must not be supplied to terminals 18-19. Settings 5-8 must instead be selected:  <b>5</b>=See 1  <b>6</b>=See 2  <b>7</b>=See 3  <b>8</b>=See 4</p>	o29	InjectCl.Cfg
<p><b>Definition of light function</b>  <b>1</b>=Light follows the day/night function.  <b>2</b>=Light controlled externally via the data communication and follows the setting in "o39".</p>	o38	Light Config
<p><b>External control of light function</b>  The light relay will follow the value in this menu. (ON = lit, OFF = no light).</p>	o39	Light Remote
<p><b>Use of relay No. 5 on connection 16-17</b>  <b>1</b>=Rail heat control (further settings made in "o41" to "o43").  <b>2</b>=Compressor control where the capacity is the same as for compressor 1. With this setting the compressors will be cut in cyclically, so that they will have identical operating times. Time delay "c05" is used between cutins and cutouts.  <b>3</b>=Compressor control step 2. The relay cuts in when the time delay in "c05" has been passed.</p>	o40	Relay5Config

<b>Rail heat during day operation</b> The ON period is set in % of the time	o41	Railh.OnDay%
<b>Rail heat during night operation</b> The ON period is set in % of the time	o42	Railh.OnNgt%
<b>Rail heat cycle</b> The time period for the aggregate ON time is set in minutes	o43	Railh. cycle
<b>Cleaning of appliance</b> Here the status of the function can be followed, or the function can be started manually. <b>0</b> =Normal operation (no cleaning). <b>1</b> =Cleaning with fans operating. All other outputs are OFF. <b>2</b> =Cleaning with fans stopped. All outputs are OFF. If the function is controlled by a signal on the DI1 input, the actual status can be seen here in the menu.	o46	Case Clean
<b>Service</b>		<b>Service</b>
A number of controller values can be printed for use in a service situation		
Read the temperature at the S5 sensor	u09	S5 temp.
Read status of input DI1	u10	DI1 status
Read the duration of the ongoing defrost or the duration of the last completed defrost.	u11	Defrost time
Read the temperature at the S3 sensor	u12	S3 air temp.
Read status at the day-/night operation (night operation: on/off)	u13	Night condition (Depicted in the "Thermostat control" illustration)
Read status at the ON input	u14	Inject ON
Read status at the DO1 output	u15	DO1 status
Read the temperature at the S4 sensor	u16	S4 air temp.
Read the temperature according to which the thermostat function regulate	u17	Ther. air
Read the ongoing cutin time for the thermostat or the duration of the last completed cutin	u18	Ther runtime
Read the temperature at the S1 sensor	u19	S1 temp.
Read the temperature at the S2 sensor	u20	S2 temp.
Read superheat	u21	SH
Read the control's actual superheat reference	u22	SH ref.
Read the valve's actual opening degree	u23	AKV OD %
Read status of relay5 (railheat / compressor 2)	u41	Rail./Comp2
Read counter for number of accomplished defrosts	u42	Acc.Def.
Read counter for number of skipped defrosts	u43	Acc.Def.Skip
Read of weighted temperature value for S3/S4 measurements	u56	Display CPT
<b>Factory setting</b> If you need to zeroset the controller and reset the factory-set values, proceed as follows: Remove the supply voltage – keep both buttons in at the same time as you reconnect the supply voltage.		
		The relay status can be read for the following functions: --- Light --- Comp1/LLSV --- Defrost --- Fan

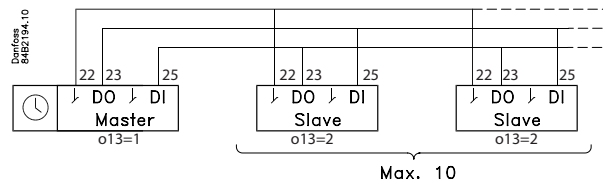
Fault message		Alarm text
<p>In an error situation the LED's on the display unit will flash. If you push the top button in this situation you can see the alarm report in the display.</p> <p>There are two kinds of error reports - it can either be an alarm occurring during the daily operation, or there may be a defect in the installation.</p> <p>A-alarms will not become visible until the set time delay has expired.</p> <p>E-alarms, on the other hand, will become visible the moment the error occurs.</p> <p>(An A alarm will not be visible as long as there is an active E alarm).</p>		<p>The importance of the individual alarms can be defined with a setting (0, 1, 2 or 3) in the menu <b>Alarm destinations</b>. See AKM literature.</p>
High temperature alarm	A1	HighTemp air
Low temperature alarm	A2	Low temp air
The "o16" function is activated during a coordinated defrost	A5	Max HoldTime
Control problem	A10	Inject. prob.
Alarm from input DI1	A15	DI1 alarm
Regulation stopped (ambient mode)	A42	Amb. mode
Defrost stopped based on time instead of, as wanted, on temperatur	-	Max Def. Time
Fault in controller	E1	Contr. fault
Sensor fault S1	E23	S1 error
Sensor fault S2	E24	S2 error
Sensor fault S3	E25	S3 error
Sensor fault S4	E26	S4 error
Sensor fault S5	E27	S5 error
Operating status		(Measurement)
<p>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. (The operating status cannot be seen, however, if there is an active A or E alarm).</p> <p>The status number means the following:</p>		<p>EKC State</p> <p>In AKM the operating status can be seen regardless of the alarm situation</p>
Waiting for end of the coordinated defrost	S1	1
When the compressor is operating it must run for at least x minutes.	S2	2
When the compressor is stopped, it must remain stopped for at least x minutes.	S3	3
The evaporator drips off and waits for the time to run out	S4	4
Refrigeration stopped by the internal or external start/ stop	S10	10
Thermostat is cut-out	S11	11
Defrost sequence. Defrost in progress	S14	14
Defrost sequence. The fan waits for the time to run out	S15	15
Refrigeration stopped due to stopped injection function or stopped regulation	S16	16
Melt function in progress. Refrigeration is interrupted	S18	18
Modulating thermostat control	S19	19
Emergency cooling due to sensor error	S20	20
Regulation problem in the injections function	S21	21
Start-up phase 2. Evaporator being charged	S22	22
Adaptive control	S23	23
Start-up phase 1. Signal reliability from sensors is controlled	S24	24
Manual control of outputs	S25	25
Stopped regulation (ambient mode)	S28	28
Stopped regulation (cleaning of appliance)	S29	29
Delay on outputs during start-up	non	0

## Connection

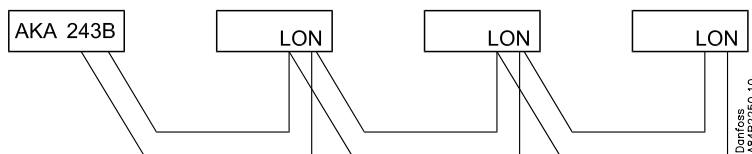


Cable length between an external display (EKA 162 or EKA 161) and EKC 514B1 must be max. 15 m

### Coordinated defrost via cable connections



### Coordinated defrost via data communication

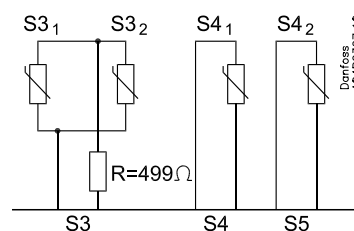


### Additional air sensors

If there is a need for sharing the S3 signal on two sensors and the S4 signal on two sensors, it can be done in the following way: (The S5 input can in this case not be used as defrost sensor). The function is defined in o06.

**NB!**

The S3 measurement is not accurate. Any temperature change at one of the S3 sensors will not make itself fully felt in the controller.



### Necessary connections

- 36 - 37 Pt 1000 ohm sensor. Refrigeration outlet (S1)
- 38 - 39 Pt 1000 ohm sensor. Refrigeration outlet (S2)
- 40 - 41 Air temperature sensor before evaporator (S3)
- 42 - 43 Air temperature sensor after evaporator (S4)  
(It is application determined whether S3 or S4 or both has to be mounted. *The sensors may either be Pt 1000 ohm or Ptc 1000 ohm*).
- 1 - 2 Supply voltage 230 V 50/60 Hz
- 3, 4 Protective earth connection
- 5 - 6 Expansion valve type AKV (230 V d.c.)
- 18 - 19 230 V input signal for start/stop of the injection function. (The connection may however be omitted if the function is created via the data communication).

### Application dependent connections

- 22 - 23 Output signal on terminal 23, if there is coordinated defrost with cable connections
- 24 - 25 Input signal from a contact function. Or signal on terminal 25, if there is coordinated defrost with cable connections
- 32 - 35 Possibility of connecting an external display type EKA 161 or an external display with operating knobs type EKA 162
- 44 - 45 Defrost sensor on the evaporator (S5)  
(S5 must be of the same type as S3/S4).
- 7 - 9 Light relay. There is connection between 7 and 9 when the controller is de-energised.
- 10 - 11 Refrigeration. Relay for compressor or solenoid valve.
- 12 - 13 Defrost relay
- 14 - 15 Fan relay
- 16 - 17 Refrigeration 2 relay or rail heat relay.
- 20 - 21 Data communication (RS 485 or FTT 10)  
If Ethernet is used, it must be connected to plug RJ45. (FTT 10 can be connected both places).  
It is important that the installation of the data communication cable be done correctly. Cf. separate literature No. RC.8A.C...  
Gateway AKA 243A/B must be version 5.3x or newer version.

### Plug

The controller comes factory-mounted with one part of a plug connection. The other part is of the type Phoenix and AMP with the following type designations:

#### ConnectionType

1-3:	MSTB 2,5/3-ST-5,00
4-6:	""
7-9:	""
10-17:	MSTB 2,5/8-ST-5,00
18-19:	MC1,5/2-ST1-5,08
RJ 45:	Net plug RJ 45
20-21:	MC1,5/2-ST-3,81
22-23:	""
24-25:	""

Display: AMP ital mod 2, housing 280 359, crimp contact 280 708-2

S1:	AMP ital mod 2, housing 280 358, crimp contact 280 708-2
S2:	""
S3:	""
S4:	""
S5:	""

The screw terminals (Phoenix plug) are not bypacked for some of the code numbers.

Sensors and display supplied with plug.

### Installation considerations

Accidental damage, poor installation, or site conditions, can give rise to malfunctions of the control system, and ultimately lead to a plant breakdown.

Every possible safeguard is incorporated into our products to prevent this. However, a wrong installation, for example, could still present problems. Electronic controls are no substitute for normal, good engineering practice.

Danfoss will not be responsible for any goods, or plant components, damaged as a result of the above defects. It is the installer's responsibility to check the installation thoroughly, and to fit the necessary safety devices.

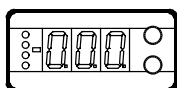
Special reference is made to the necessity of signals to the controller when the compressor is stopped and to the need of liquid receivers before the compressors.

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

## Operation

Operation of the controller can take place via data communication or from a separate display. Operation via data communication may be performed via the AKM programme and a text that can be seen in the earlier section "Survey of functions". Operation from EKA 162 is described below:

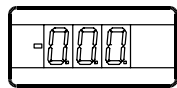
### EKA 162



Display with operating buttons and LED indication of relay functions:

- Refrigeration
- AKV valve
- Defrost
- Fan

### EKA 161



Display for mounting on refrigeration appliance.

The showing in the display follows the showing in EKA162

### The buttons (EKA 162 only)

When you want to change a setting, the two 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 two buttons simultaneously. When you have changed the value, save the new value by once more pushing the two buttons simultaneously. Or briefly:

- Gives access to the menu (or cutout an alarm)
- Gives access to changes
- Saves a change

### Temperature setting

When it is the temperature setting you wish to change, do not enter the menu. Push both buttons simultaneously and you will be allowed to change the temperature reference for thermostat 1 when the display answers back by flashing.

### Forced control

In addition to the normal way of operating the controller you are now able to perform a number of forced control functions which you start, as follows:

- Check alarm code
  - Push the upper button
- Read the defrost sensor's temperature
  - Push the lower button
- Manual start or stop of defrost
  - Push the lower button for four seconds.

### Examples of operations

What to do	Initial controller setup	Operating the two pushbuttons Display readout What the controller does automatically	Resulting controller setup
Read or change room temp. setting	Normal operation Room temp. 1		Normal operation Room temp. 2
Read or change parameter codes and settings	Normal operation (or alarm) Unknown codes and settings		Normal operation (or alarm) Known codes and settings
Re-establish all factory settings	Unknown settings		All parameter settings = factory settings
Read defrost sensor temp.	Normal operation or alarm		Normal operation
Manually start of a defrost operation	Normal operation		Normal operation
Manually stop of a defrost operation	Defrost operation		Normal operation
Read codes cause of alarm mode	Alarm		Alarm

Or examples put in another way:

*Set the temperature for thermostat 1*

1. Push the two buttons simultaneously
2. Push one of the buttons and select the new value
3. Push both buttons again to conclude the setting  
(Thermostat 2 is set in menu r21.)

*Set a menu*

1. Push the upper button until a parameter is shown
2. Push one of the buttons and find the parameter you want to change
3. Push both buttons simultaneously until the parameter value is shown
4. Push one of the buttons and select the new value
5. Push both buttons again to conclude the setting

*See the temperature at the defrost sensor*

1. Give the lower button a brief push (1 sec.)

Examples of displays:

- d- Defrost going on
- 180 Sensor has not been mounted
- no Defrost sensor not selected



## Menu survey

SW = 1.2x

Function	Parameter	Min.	Max.
<b>Normal display</b>			
Shows the temperature (weighted value between S3 and S4) The display can also be seen in u17.	-	°C	
If you wish to see the temperature at the defrost sensor, give the lower button a brief push (1 sec.)	-	°C	
<b>Thermostat</b>			
Differential	r01	0.1 K	10.0 K
Temperature unit (°C/°F)	r05	°C	°F
Start/Stop of refrigeration	r12	OFF	ON
Reference displacement during night operation	r13	-20.0 K	20.0 K
Define thermostat function 1=ON/OFF, 2=Modulating	r14	1	2
Definition and weighting, if applicable, of thermostat sensors. 100%=S4 (S <sub>out</sub> ), 0%=S3 (S <sub>in</sub> ). The weighted measurement can be seen in u17	r15	0%	100%
Time between melt periods	r16	0 h	10 h
Duration of melt periods	r17	0 min.	10 min.
Temperature setting for thermostat band 2	r21	-50°C	50°C
Select thermostat 0: no thermostat / regulation stopped 1: Thermostat 1 2: Thermostat 2	r22	0	2
<b>Alarm</b>			
Alarm time delay (both thermostat 1 and 2)	A03	0 min.	120 min
Time delay during cooling (pulldown delay)	A12	0 min.	240 min
High alarm limit for thermostat 1	A13	-50°C	50°C
Low alarm limit for thermostat 1	A14	-50°C	50°C
High alarm limit for thermostat 2	A20	-50°C	50°C
Low alarm limit for thermostat 2	A21	-50°C	50°C
Alarm time delay or signal on the DI1 input	A27	0 min.	90 min
The alarm thermostat will monitor high and low temperatures for both thermostats 1 and 2 based on the following definition: 1: High = weighted value (r15). Low = weighted value (r15) 2: High = weighted value (r15). Low = S4 3: High = S4. Low = S3 and S4. (50% from each) 4: High = S4 or S5. (Higher value is used) Low = S3 and S4 (50% from each)	A33	1	4
<b>Compressor</b>			
Min. ON-time	c01	0 min	50 min
Min. OFF-time	c02	0 min	50 min
Time delay for cutin of compressor 2	c05	0 s	999 s
<b>Defrost</b>			
Defrost stop temperature	d02	0	25°C
Interval between defrost starts	d03	OFF	48 h
Max. defrost duration (If "defrost on demand" is selected this setting must be longer than the longest time between two defrost starts in the schedule).	d04	0	180 min
Time displacement of defrost cut-ins during start-up	d05	0	240 min
Drip-off time	d06	0	60 min
Fan start delay after defrost	d07	0	60 min
Fan start temperature	d08	-15	0°C

Fan cut-in during defrost (yes/no)	d09	no	yes
Defrost sensor 0 = S4, 1 = S5, 2 = None (stop based on time), 3 = S4 and S5 (lower value is used)	d10	0	3
Defrost on demand 0: Function not used 1-6: Function used Defrost start must be made via the data communication from a schedule in the gateway. Set the same number of defrost starts in this menu as the number of defrost starts per 24 hours indicated in the schedule. 7: Zerostetting of counters 8: Zerostetting of the function 9: Manual startup of a defrost via the data communication.	d14	0	9
Max. number of defrosts that may be skipped in sequence	d15	0	10
<b>Injection control function</b>			
Expansion valve type definition: 1: AKV valve 2: Thermostatic expansion valve	n03	1	2
Max. value of superheat reference	n09	3.0 K	15.0 K
Min. value of superheat reference	n10	3.0 K	10.0 K
MOP temperature	n11	-50.0°C	15°C/ off
Temperature glide	n12	0.0 K	10.0 K
AKV valve's time period	n13	3 sek.	6 sek.
Adaptive regulation Should only be changed to OFF by trained staff	n14	OFF	ON
Signal reliability during startup. Time of reliability Changes should only be made by trained staff.	n15	30 sek.	600 sek
Average opening degree – AKV dimension Changes should only be made by trained staff	n16	10.0%	75.0%
Signal reliability during startup – opening degree start value. Changes should only be made by trained staff	n17	5.0%	70.0%
Stability factor for superheat control. Changes should only be made by trained staff	n18	0	10
Forced closing. AKV valve shut in pos. ON	n36	OFF	ON
<b>Miscellaneous</b>			
Delay of output signal after start-up	o01	0 sec.	600 sec
Define digital input signal (DI1): 0=not used, 1=Alarm, 2=defrost start, 3=Night operation, 4=External start/stop, 5=Coordinated defrost with cable connections, 6 = Cleaning of appliance, 7 = As "1", but reversed switch function	o02	0	7
Network address (range = 0-60)	o03	0	990
ON/OFF switch (service-pin message)	o04	OFF	ON
Access code	o05	OFF	100
Used sensor type for S3, S4, S5 and S6 0: All are Pt1000 1: All 4 are PTC 1000 2: All are Pt 1000, but specially connected. See under connections.	o06	0	2
Set supply voltage frequency	o12	50 Hz	60 Hz
Define digital output signal (DO): 0=not used Coordinated defrost with cable connections: 1=Master, 2= Slave	o13	0	2
Max. standby time after coordinated defrost	o16	1 min	30 min
Display S4% 0% = S3 100% = S4	o17	0%	100%

To be continued

<b>Continued from previous page</b>			
Manual control of outputs: OFF=No override 1: Light relay is ON 2: Compressor relay is ON 3: Defrost relay is ON 4: Fan relay is ON 5: Compressor relay 2 is ON 6: AKV output is 100% open 7: DO1 output is ON 8: Not used 9: Not used 10: All relay outputs, DO1, LED1, LED2 are OFF and AKV is closed 11: All relay output, DO1, LED1, LED2 are ON and AKV is 100% open 12: Light, comp., and fan are ON, AKV=30% 13: Light, comp., and fan are ON, AKV=60% Remember to reset pos. OFF	o18	OFF	13
Injection ON definition When the "Injection ON" input is cut out refrigeration is stopped. Here you define how the fan relay and the alarm function are to act: 1 = Fan relay = ON, alarm monitoring active 2 = Fan relay = OFF, alarm monitoring active 3 = Fan relay = OFF, no alarm monitoring 4 = Fan relay = ON, no alarm monitoring If the "Injection ON" function receives signal via the data communication, setting 5-8 must be selected. 5= See 1 6= See 2 7= See 3 8= See 4	o29	1	8
Light function definition: 1 = light follows the day/night function 2 = light controlled externally (see o39)	o38	1	2
External control of light (defined in o38) ON = lit OFF = no light.	o39	OFF	ON
Definition of use of relay 5 (terminals 16-17): 1= rail heat control (see also o41-o43) 2= compressor 2 (identical capacity / cyclic operation) 3= compressor 2 (capacity stage 2)	o40	1	3
Rail heat during day operation Setting of ON period in % of time	o41	0%	100%
Rail heat during night operation Setting of ON period in % of time	o42	0%	100%
Rail heat setting Time period for aggregate ON/OFF time	o43	6 min.	60 min.
Status and manual startup of appliance cleaning: 0=normal operation (no cleaning) 1=cleaning with fan ON, all other outputs OFF 2=cleaning with all outputs OFF (When appliance cleaning is started with a switch function, the setting in this menu will show the status)	o46	0	2
<b>Service</b>			
The following readouts can be performed via the belonging parameter			
Defrost sensor S5	u09		°C
Status on DI-input	u10		
Defrost time	u11		min.
Air temperature S3	u12		°C
Status on night operation (on or off)	u13		

Status on ON-input	u14	
Status on DO1-output	u15	
Air temperature S4	u16	°C
Thermostat temperature	u17	°C
Thermostat cut-in time	u18	min.
Temperature at S1	u19	°C
Temperature at S2	u20	°C
Superheat	u21	K
Superheat reference	u22	K
AKV valve's actual opening degree	u23	%
Status on relay 5 (rail heat/compressor 2)	u41	
Counter for number of accomplished defrosts	u42	
Counter for number of omitted defrosts	u43	
Readout of weighted value between S3 and S4 on display (CPT)	u56	°C

The controller can give the following messages:		
E1	<b>Error message</b>	Fault in controller
E23		S1 sensor error
E24		S2 sensor error
E25		S3 sensor error
E26		S4 sensor error
E27		S5 sensor error
A1	<b>Alarm message</b>	High temperature alarm
A2		Low temperature alarm
A5		Function "O16" activated during a coordinated defrost
A10		Control problem
A15		DI1 alarm
A42		Regulation stopped (ambient mode)
S1	<b>Status message</b>	Waiting for end of the coordinated defrost
S2		Waiting for end of compressor ON time
S3		Waiting for end of compressor OFF time
S4		Defrost sequence. Evaporator drips off and waits for the time to expire
S10		Refrigeration stopped by the internal or external start/stop function
S11		Thermostat cut out
S14		Defrost sequence. Defrost in progress
S15		Defrost sequence. Fan waiting for time to elapse
S16		Refrigeration stopped due to open ON input
S18		Melt function in progress (refrigeration interrupted)
S19		Modulating thermostat control
S20		Emergency refrigeration due to sensor error
S21		Regulation problem for the injection function
S22		Start-up phase 2. Evaporator is charged
S23		Adaptive control
S24		Start-up phase 1. Signal reliability from the sensors is checked
S25	Manual control of outputs	
S28	Regulation stopped (ambient mode)	
S29	Regulation stopped (appliance cleaning)	
non	Time delay on outputs during start-up	

## Data

Supply voltage	230 V +10/-15%, 50/60 Hz, 5 VA	
Sensors	Pt 1000 ohm for refrigerant temperatures Pt 1000 ohm or PTC (R25 = 1000 ohm) for air temperatures	
Controller sensor system	Measuring range	-60 to +50°C
	Accuracy	±0.5°C for sensor temperature = -35 til +50°C
Display/operation	The controller has no display or operating buttons on front panel. Operation takes place via a separate, connected display or via data communication	
	It is possible to connect two displays with 0.1% reading accuracy in the measuring range: EKA 161, LED, three digits EKA 162, LED, three digits, two operating buttons	
Digital input DI1	If a contact function is connected, it can be used for alarm function, defrost start, night operation, start/stop of the regulation or cleaning signal	
	If other EKC 514B units are connected, coordinated defrost can be performed via cable connections	
Digital output DO1	May in conjunction with the digital input be used for coordinated defrost via cable connections	
230V input	0 V: regulation stopped. The compressor relay, the defrost relay and the fan relay are cut out. 230 V a.c.: regulation	
AKV connection	Max. 1 AKV or AKVA. Coil = 230 V d.c.	
Relays	Light relay	SPDT, $I_{max} = 6$ A ohmic / 3 A AC 15* inductive
	Compressor relay	SPST NO, $I_{max} = 6$ A ohmic / 3 A AC 15* inductive
	Defrost relay	SPST NO, $I_{max} = 6$ A ohmic / 3 A AC 15* inductive
	Fan motor relay	SPST NO, $I_{max} = 6$ A ohmic / 3 A AC 15* inductive
	Rail heat relay	SPST NO, $I_{max} = 6$ A ohmic / 3 A AC 15* inductive
Ambient temperature	0 to +55°C, during operation	
	-40 to +70°C, during transport	
	20-80% RH, not condensing No shock influences / vibrations	
Mounting	On DIN rail or on wall	
Density	IP 20	
Weight	0.4 kg	
Approvals	EU Low Voltage Directive and EMC demands re CE-marking complied with. LVD-tested acc. to EN 60730-1 and EN 60730-2-9 EMC-tested acc. to EN 50081-1 and EN 50082-2	

\* AC 15 load acc. to EN 60947-5-1

## Ordering

Description	Type	Code no.
Refrigeration appliance control (with plug)	EKC 514B1	<b>084B8009</b>
Display unit	EKA 161	<b>084B7019</b>
Display unit with operating buttons	EKA 162	<b>084B7039</b>
Cable for display unit	2 m with plug, 1 pcs.	<b>084B7298</b>
	6 m with plug, 1 pcs.	<b>084B7299</b>
Data communication module, FTT 10	EKA 173	<b>084B7092</b>
Data communication module, RS 485	EKA 175	<b>084B7093</b>
Data communication module, Ethernet	EKA 177	<b>084B8031</b>

## References

Description	Type	Please see catalogue/technical brochure
Temperature sensor Pt 1000	AKS 11	RK0YG / RD5FK
Temperature sensor Ptc 1000	EKS 111	RK0YG / RD5FL
Expansion valve	AKV__	RK0YG / RD8AB

## Mounting

EKC 514B1

When the unit is mounted on a wall, the two points on the DIN fastening are cut off.

IP 20

Only for front mounting (IP 40)  
Only connection via plugs

Display type EKA 161 / 162

## Data communication (LON)

This page contains a description of a few of the possibilities you will have with data communication.

*It is important that the installation of the data communication cable is carried out correctly. Please refer to separate literature No. RC.8A.C*

### Example

The controller has been prepared for data communication.

The data communication module is placed in the controller.

The data communication takes place via a two-core twisted cable.

Up to 60 controllers may be connected to one cable.

This cable is also connected to a gateway type AKA 243B.

This gateway will now control the communication to and from the controllers.

It will collect temperature values and it will receive alarms. When there is an alarm the alarm relay will be activated for two minutes.

The gateway can now be connected to a modem.

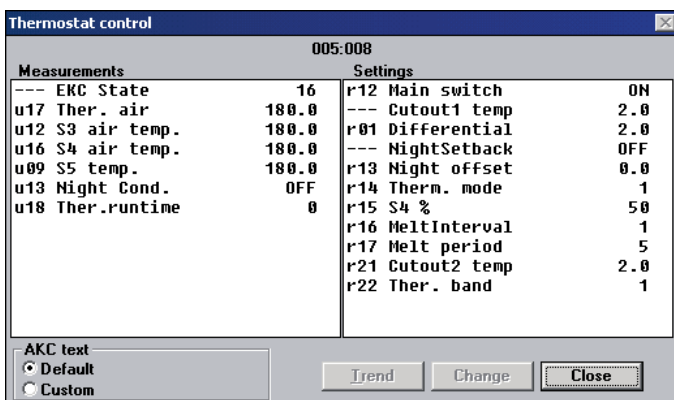
When an alarm occurs from one of the controllers, the gateway will - via the modem - make a phone call to the service company.

At the service company a modem, gateway and PC with system software type AKM have been installed.

All the controllers' functions can now be operated from the various menu displays.

The programme will for example upload all the collected temperature values once a day.

### Example of menu display



- Measurements are shown at one side and settings at the other.
- You will also be able to see the parameter names of the functions on page 4-11.

- With a simple change-over the values can also be shown in a trend diagram.
- If you wish to check earlier temperature measurements, you can see them in the log collection.

### Alarms

If the controller is extended with data communication, it will be possible to define the importance of the transmitted alarms.

The importance is defined with the setting: 1, 2, 3 or 0. When the alarm then arises at some time, it will result in one of the following activities:

1 = Alarm

The alarm message is sent off with alarm status 1. This means that the gateway with address 125 in the system will have its alarm relay output activated for two minutes. Later, when the alarm ceases, the alarm text will be retransmitted, but now with status value 0.

2 = Message

The alarm text is transmitted with status value 2. Later, when the "message" lapses, the alarm text is retransmitted, but now with status value 0.

3 = Alarm

As "1", but the master gateway's relay output is not activated.

0 = Suppressed information

The alarm text is stopped at the controller. It is transmitted nowhere.

## Override

The controller contains a number of functions that can be used together with the override function in the master gateway. They can therefore only be used in combination with data communication.

Function via data communication	Functions to be used in the gateway's override function	Selection of parameter in EKC 514B1 084B8009 Sw.1.2x
Stop of injection when the compressor is stopped	AKC ON	n36 InjectClose
Start of defrost	Defrost control and time schedule	--- Def.start
Coordinated defrost	Defrost control	--- HoldAfterDef --- Defrost
Night setback	Day/night control and time schedule	--- NightSetback
Light control	Day/night control and time schedule	o39 Light Remote
Suction pressure optimisation	P0 optimisation	Select controller address (The parameters are found automatically and do not become visible)

---

**List of literature**

- Instructions      RI.8H.R-02  
Here you can see how controllers are mounted and programmed.
- Installation guide for extended operation      RC.8A.C