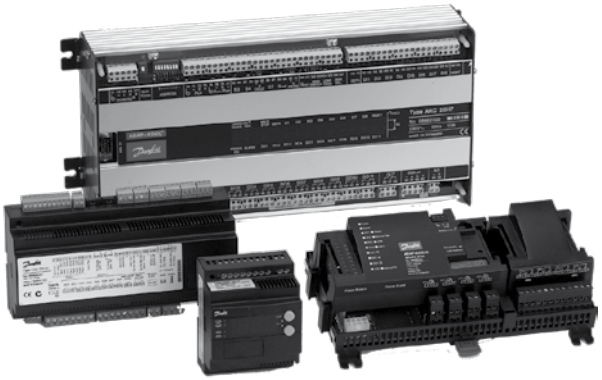
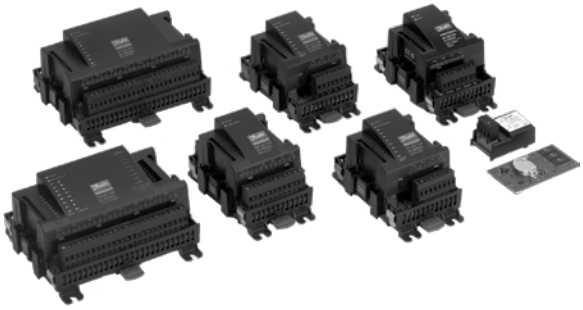
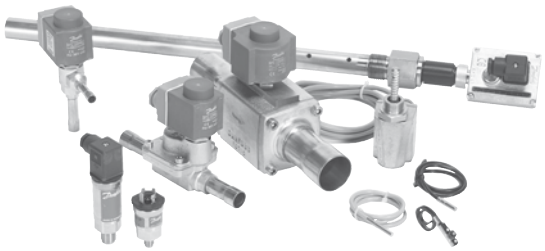
ADAP-KOOL® Refrigeration control systems

Contents



Introduction **4**
Compressor- and condenser controls **6**
Introduction 6
Capacity control 8
EKC 331T 8
AK-PC 530 12
AK-PC 840 18
AK-PC 730 20
AKC 25H1 22
AKC 25H3 23
AKC 25H5 24
Water chiller control 25
AKC 25H7 25
AK-CH 650 26
Dry cooler 28
AK-PC 420 28
Liquid injection in the suction line 30
EKC 319A 30
Speed control of compressor and condenser **32**
Introduction 32
AKD 2800 33
AKD 5000 34
Accessories for AKD 35
RGE 36
Evaporator controls and thermostatic expansion valves **38**
Introduction 38
Temperature control 40
EKC 100 40
EKC 102 42
Refrigeration appliance controls 50
EKC 301 50
EKC 202 56
EKC 202D 62
AK-CC 210 70
AK-CC 250 79
AK-CC 450 80
Media temperature control 82
EKC 361 82
EKC 368 86
Evaporator controls and electrically operated expansion valves **90**
Introduction 90
Refrigeration appliance controls 92
EKC 414A 92
EKC 414A1 96
EKC 414C1 101
EKC 514B1 106
AK-CC 550 112
AK-CC 750 114
AKC 114-116 116
AKC 121A 117
Cold storage room control 118
AKC 72A 118
AKC 121B 119
AKC 151R 120





Water chiller control 122
EKC 312 122
EKC 315A 126
EKC 316A 130
Liquid level control 134
EKC 347 134
Wireless temperature monitoring 138
AK-Wireless 138
Accessories 140
IO modules for the AK series 140
Module overview 141
AK-XM 101A 142
AK-XM 102A/B 142
AK-XM 204A/B 143
AK-XM 205A/B 144
AK-OB 101A 145
AK-XM 107A 145
AK-PS 075/150/250 146
AK-OB 003A 147
AK-XM 208B 147
Display 148
EKA 161/162/163/164 148
Display console 150
EKA 165 151
AKA 14 152
AKA 15 152
Thermometer 153
EKA 151 153
Temperature sensors 154
AKS 11, AKS 12, AKS 21 154
EKS 111 156
EKS 211 157
Pressure transmitters 158
AKS 32, AKS 33 and AKS 32R 158
Level transmitter 161
AKS 41 161
Expansion valves 162
AKV 10, AKV 15, AKV 20 162
AKVA 10 AKVA 15, AKVA 20 165
Coils for expansion valves 168
ETS 170
ICM 172
Evaporation pressure valve 174
KVS 174
Gas detector 176
GD 176

System units **178**
System unit 1 178
AK-SM 720 179
AK-PI 200 179
Web-based operation 180
AK-ST 500 180
EM 100 181
Optimisation 182
System unit 2 184
AK-SM 350 184
System unit 3 186
AK-SC 255 186
System unit 4 188
AKA 245 188
AKA 243A 188
AKA 241 188
Operation 189
AKA 21 189
AK-Monitor 189
MIMIC 189
AKM 4 189
AKM 5 189
Optimisation 190
Accessories 192
AKA 231 192
AKA 222/223 193
Appendix **194**
Ordering survey AK series 194

Introduction

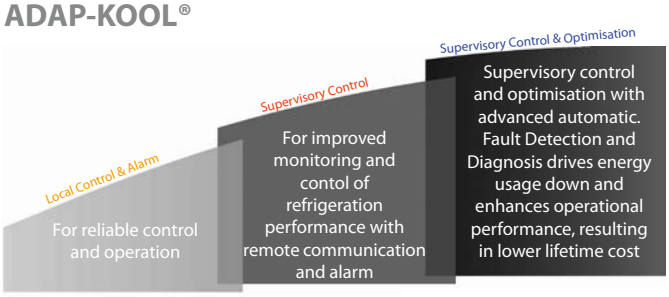
Danfoss has s a comprehensive offer to the food retail industry that consists of electronic controls, compressors, condensing units, line components and services which provide optimisation control of refrigeration system and energy savings with HACCP compliance at the same time.

Electronic controls, as vital part of ADAP-KOOL® Refrigeration Control System, offer a complete electronic system for control, monitoring, and alarm handling for supermarket refrigeration covering Compressor and condensers capacity control, Evaporator and cold room control, HVAC and lighting control and CO_2 applications in refrigeration.

ADAP-KOOL® Refrigeration Control System and its features make possible optimisation of refrigeration performance and energy savings with variety of features and function according to application requirements. That is possible due intelligent features such as adaptive superheat control, floating condensing pressure and suction pressure optimisation enabled by using electronic expansion valve AKV, speed control of compressors and/or condensers using AKD variable speed drives, intelligent defrost, automatic fault detection and diagnosis, etc.

Advanced ADAP-KOOL® solutions are Hazard Analysis Critical Control Point (HACCP) compliant and provide HACCP registration. ADAP-KOOL® refrigeration control system makes the job of complying with HACCP much easier where controllers maintain critical temperature points, to selected limits, at measured time intervals which can be accurately monitored, and logged against defined parameters providing appropriate documented evidence of HACCP compliance through simple and automatic recording of the critical points. Data logs can be set-up to identify critical temperatures for each area, cabinet or cold room as required and can be easily adapted to identify and note any incidents such as case cleaning etc. for your HACCP registration either gathered via communication system or direct from controllers. ADAP-KOOL® controller series combined with AKS Pt 1000 temperature sensors maintain close and accurate set-point temperature control less then +/- 1°C as it is required in EN441-13 without additional calibration.

Three Level of Control ADAP-KOOL®



ADAP-KOOL® Refrigeration Control System is compact, flexible, easy to install and program and enables the solution to grow with the application needs. This flexible modular concept allows the constantly adaptation to the application development easy retrofitting an existing installation. ADAP-KOOL® controls offer three levels of control for different application demands with growing benefits and energy savings features according to your needs:

- **Local control and alarm** solutions ensure accurate control and reliable operation of refrigeration system with possibility of HACCP compliance.
- **Supervisory control** as more advanced solution comprises remote alarm with data communication, some energy savings features with HACCP registration.
- **Supervisory Control and Optimisation** provides optimised control with furthermore energy saving features like master control, intelligent defrost, fault detection and diagnosis with extended remote service capabilities and HACCP registration and compliance.

Electronic controls described in this catalogue consist of the following controls:

Compressor and condensers capacity controls are used from relatively small basic systems with just two hermetic compressors, to large power packs with multiple semi-hermetic compressors equipped with variable speed drives and unloaders. ADAP-KOOL® Pack controls offer different levels of solutions: From compressor capacity control and step/variable control with local alarm ensuring accurate control and operational confidence, to advanced solutions of control up to 12 compressors or fans with intelligent control that optimised both suction and condensing pressure according to the load and external temperatures.

Evaporator and cold room controls cover regulation from simple thermostat controls with room temperature control via pump down or compressor start/stop regulation up to electronic expansion valves regulation with many intelligent functions and energy savings. In addition, different levels of evaporator solutions are offered: From local temperature control of one evaporator with alarm ensuring easy and reliable control and operational confidence, to advanced control up to 4 evaporators where controllers are capable to regulate simultaneously temperature, defrosting, door frame, rail heat, light and fan operation. Advanced features like defrost function, adaptive superheat control with AKV electronic expansion valve, intelligent fault detection with diagnosis and pulsing of rail heat and fans making possible optimal functionality of refrigeration system saving energy and keep food quality in display cases and cold rooms.

Variable speed control of compressors and condenser fan with variable speed drive AKD reduces energy consumption and refrigerant charge as well noise level. Use of AKD stabilise condensing pressure and reduce dirt build-up on condenser.

All ADAP-KOOL® controls are designed to be used as stand alone or to be integrated into a complete ADAP-KOOL® refrigeration control system solution using data communication. That enables local or remote monitoring with alarm handling, control of your refrigeration system and proactive service management while reducing running costs.

ADAP-KOOL® controls in CO_2 refrigeration applications
Due environmental and cost reasons, CO_2 is becoming more and more utilised refrigerant in Food Retail refrigeration applications. Installation costs as well as energy costs are on the same level as in traditional refrigeration systems without any extra costs while the performance of refrigeration systems remains consistent. ADAP-KOOL® refrigeration control system is designed to handle the challenges with CO_2. All the benefits of the advanced adaptive control system as e.g. energy saving master control functions can also be utilised in a CO_2 based refrigeration plant. At present Danfoss control solutions are available for all cascade systems and during the last years several large installations has been installed running with CO_2 controlled by ADAP-KOOL® for both medium and low temperature applications. Danfoss is preparing a control solution for trans critical CO_2 system and also the necessary line components.

Enterprise Level Services - RETAIL-CARE™
For chain-store customer with many and diverse outlets further services like Alarm/Service management, Energy management, performance reports including HACCP documentation and key asset performance indicators are essential to optimise operating cost. For these services, Danfoss has developed a suite of expert services under the banner of RETAIL-CARE™, delivering a complete set of management tools to assist retailers in the ongoing management and reduction of operational costs. Within Food Retail business, these services also help to provide, maintain and document food quality. ADAP-KOOL® refrigeration controls are an integral part of RETAIL-CARE™ services.

Danfoss' extensive product range lets you configure a complete solution for your business from a vast array of products for different applications, including not only the ADAP-KOOL® range, but also compressors, sight glasses, solenoid valves, check valves, ball valves, shut-off valves, filter driers (cores and casings), pressure controls and expansion valves. Details about these components are available in other Danfoss literature.

Compressor- and condenser controls

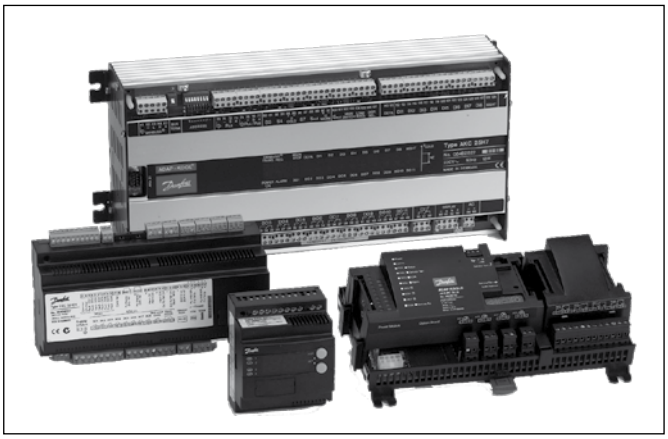
Introduction

Compressor and condensers capacity controls are used from compact systems with just two hermetic compressors up to large power-packs with multiple semi-hermetic compressors equipped with variable speed drives and unloaders.

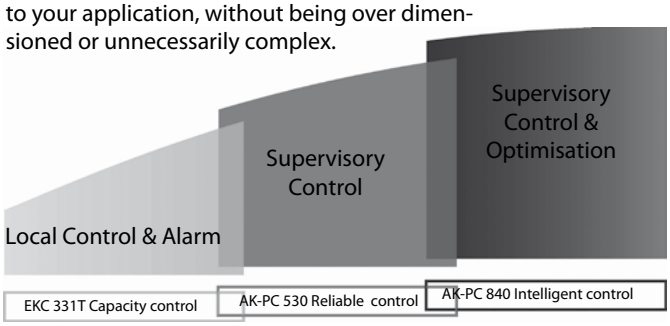
ADAP-KOOL® Pack controls offer different levels of solutions: from compressor capacity control and step/variable control with local alarm ensuring accurate control and operational confidence, to advanced solutions of control up to 12 compressors or fans with intelligent control that optimised both suction and condensing pressure according to the load and external temperatures. Intelligent features such as floating condensing pressure control and suction pressure optimisation are enabled.

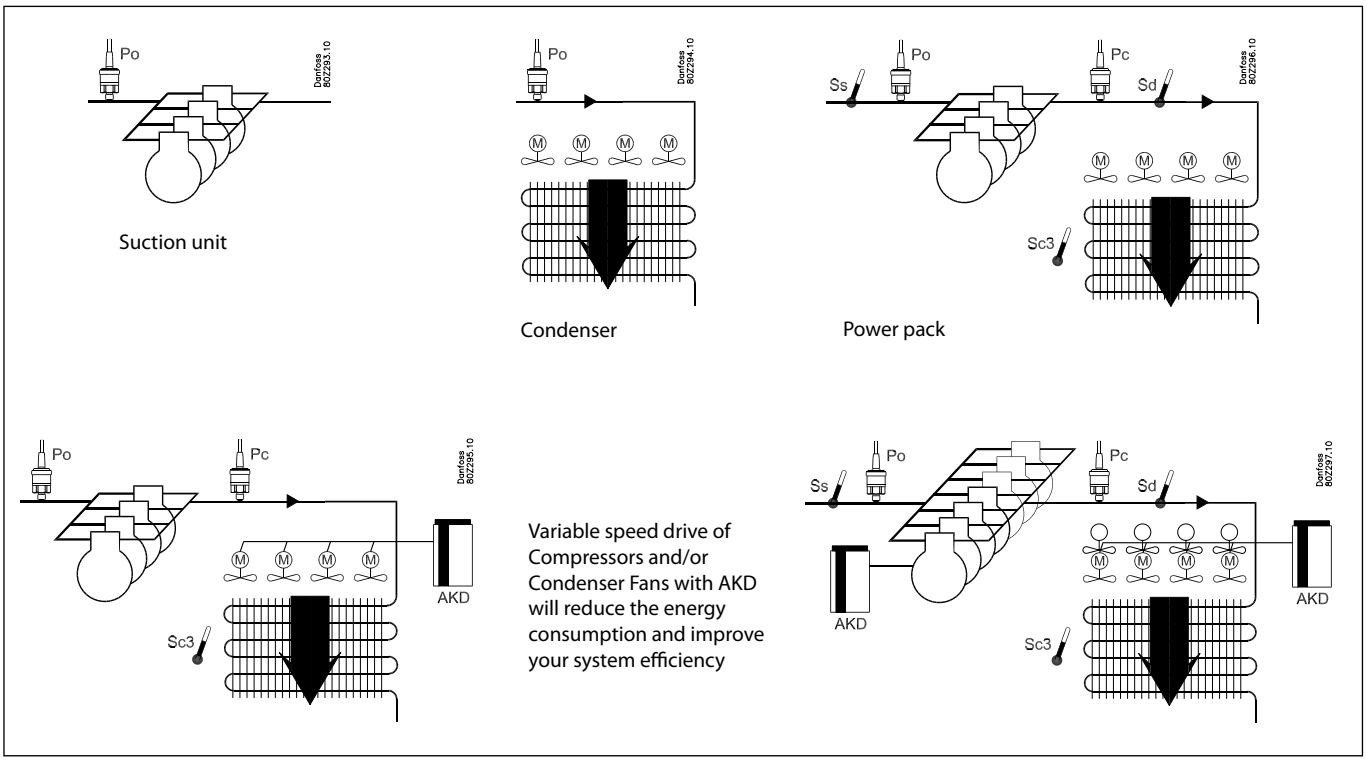
Further energy savings are achieved with variable speed control of condenser fans and compressors and other advanced features such as adaptive defrost, self-diagnosis and automatic fault detection of blocked condenser. These features reduce service and maintance costs and achieving optimal efficiency of refrigeration system.

Among many benefits of having ADAP-KOOL® Refrigeration Control System with full communication offer a well informed and structured diagnostic tool for remote service. Almost all parameters are accessible via this remote communication. For example, signals like "night setback" are sent to all controllers in the network, which avoid extra installation wiring and site labour costs, while ensuring system optimisation.



Danfoss provides solutions in three different levels to cover different applications. These ensure you that in choosing Danfoss Pack Controllers your refrigeration control system perfectly matched to your application, without being over dimensioned or unnecessarily complex.





Brief outline about some of the controls

EKC 331T controller is used for capacity regulation of compressors or condensers in compact refrigerating systems monitoring minimum and maximum pressure. Regulation can be carried out with up to 4 identical capacity steps. Step control with EKC 331T reduces number of cut in/cut out cycles using patented smart neutral zone control of the compressor. Using optional LON module, EKC 331T can be integrated into ADAP-KOOL® system.

AK-PC 530 controller is used for capacity regulation of compressors or condensers in refrigerating systems where compressor and condenser control is based on a pressure transmitter or temperature sensor. There are eight outputs for control up to 8 compressors and/or 8 fans. More fan outputs can be added via the connection of one or two EKC 331T as slave modules (up to 8 fan steps). This analogue output can also be used for an external AKD speed drive to control all condensers. Setup of controller is very user-friendly by selection of a pre-defined compressor configuration.

Controller series AKC 25H_ is a complete control unit for capacity regulation of compressors and condensers in small refrigerating systems ensuring precise and stable refrigeration plant suction and condensing pressure regulation. Being a part of ADAP-KOOL® Refrigeration control systems, the compressor control ensures optimum monitoring and alarm procedures and the possibility of different monitoring functions to optimise refrigeration plant operation.

AK-PC 840 controller is used for capacity control of complete power pack in medium to big refrigeration systems. The modular design with AK extension modules allows up to 12 compressors with 3 unloaders, and up to 12 condenser fans. The controller offers universal thermostats, pressostats, alarm inputs and analogue inputs, based on already available measurements or extra inputs. This functionality minimises the use of extra external equipment.

Comparison of controls in this section

Capacity control

Function	Compressor and Condenser						Cascade	Chiller	Dry cooler
Type	**EKC 331T**	**AK-PC 530**	**AKC 25H1**	**AKC 25H3**	**AKC 25H5**	**AK-PC 840**	**AK-PC 730**	**AK-CH 650**	**AK-PC 420**
Number of outlets	5	10	11	11	11	Basis 8	Basis 8	Basis 8	10
Expansion of number of outlets		2x EKC 331T				Up to 40	Up to 40	Up to 40	
Total number of inputs and outlets	8	33 + 8	27	34	32	Up to 80	Up to 40		30
Max. number of compressors	4	8	9	9	9	12	4		
Compressor control	Step	Step	Step	Step	Step/Speed	Step/Speed	Step/Speed	Step/Speed	
Control	NZ	NZ	NZ	NZ	PI	PI	PI	PI	
Control sensor, compressor	Pressure/ Temperature	Pressure/ Temperature	Pressure	Pressure	Pressure	Pressure/ Temperature		Temperature	
Safety signal per compressor		1	Up to 6 via AKC 22H	Up to 6 via AKC 22H	Up to 6 via AKC 22H	Up to 6	Up to 6	Up to 6	
Night setback	X	X	X	X	X	X	X	X	
P0 - optimisation		X	X	X	X	X	X	X	
Load shedding					X	XX	XX	X	
Three-way valve control									X
Pump control								X	X
Max. number of fans	4	8	9	9	9	12	6		6
Fan control	Step	Step/Speed				Step/Speed	Step/Speed	Step/Speed	Step/Speed
PI/P control	NZ	P/PI	NZ	PI	PI	P/PI	P/PI	PI	P/PI
Control sensor, condenser	Pressure/ Temperature	Pressure/ Temperature	Pressure	Pressure	Pressure	Pressure/ Temperature	Pressure/ Temperature	Pressure/ Temperature	Pressure/ Temperature
Floating condenser pressure		X		X	X	X	X	X	X
Heat recovery function		X		X	X	X	X	X	X
Condenser error monitoring						X	X		X
Display	Yes	Option				Option	Option	Option	Option
Data communication	Option	Option	DANBUSS			LON RS 485	LON RS 485	LON RS 485	Option
General alarm input		5				Max. 10	Max. 10	Max. 10	3
General thermostat						Max. 5	Max. 5	Max. 5	
General pressure switch						Max. 5	Max. 5	Max. 5	
General analogue input						Max. 5	Max. 5	Max. 5	

Expanded water cooling control

Function	AKC 25H7
Capacity control of brine system	X

Fluid injection in the suction pipe

Function	EKC 319
Limiting the discharge gas temperature	X

Note
Adjustable speed is not available on all compressors.
Check compressor data.

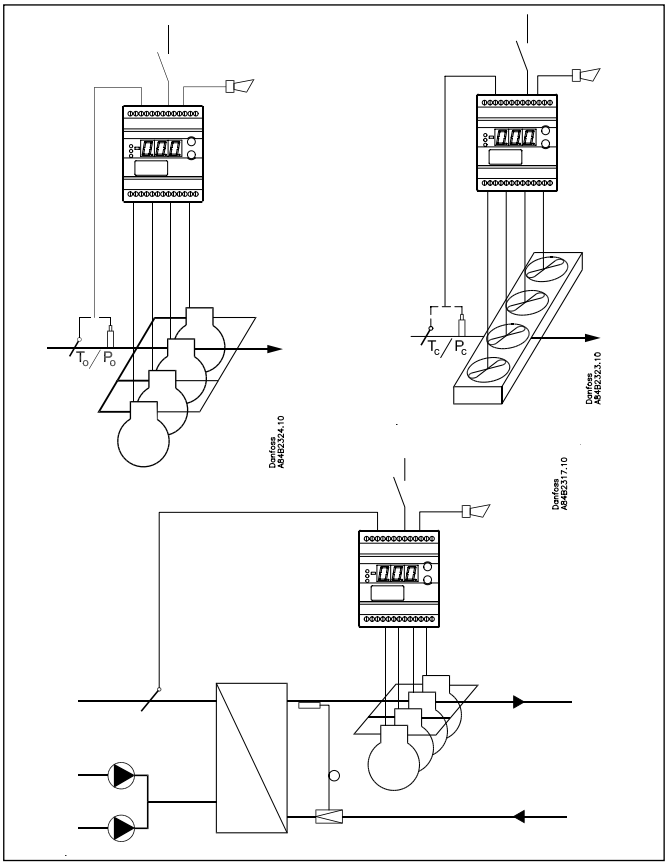
A list of AKC controls can be found at the back of the catalogue.

EKC 331T

Application
The controller is used for capacity regulation of compressors or condensers in small refrigerating systems.
Regulation can be carried out with up to four identical capacity steps.

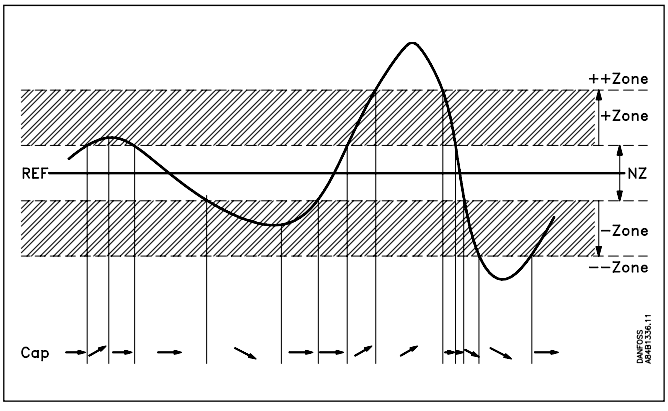
Advantages
- Patented neutral zone regulation
- Sequential or cyclic operation

Functions
- Regulation
  Regulation with up to four relay outputs can be carried out. Regulation takes place with a set reference which is compared to a signal from a pressure transmitter or a temperature sensor.
- Relay module
  It is possible to use the controller as relay module, so that the relays are cut in or out by means of an external voltage signal.
- Alarmfunction
  A relay becomes activated when the set alarm limits are exceeded.
- Digital input
  The digital input can be used for:
  - night operation where the suction pressure is raised
  - heat recovery where the condensing pressure is raised
  - external start/stop of the regulation.
  - Monitoring of safety circuit
- Possibility of data communication

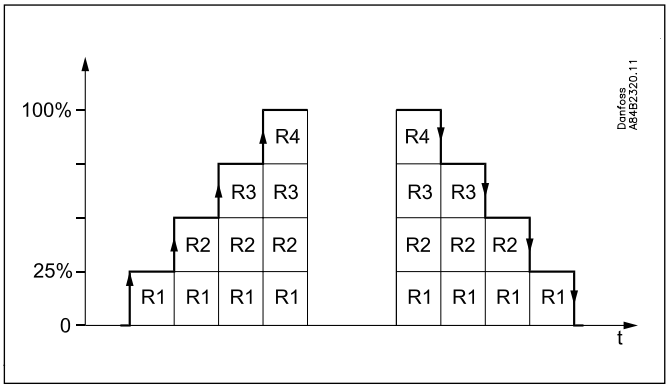


Display
A signal from a pressure transmitter will always be converted and shown as a temperature value.
Settings are made as for temperature values.

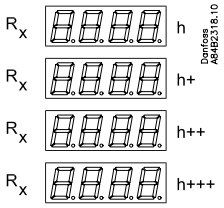
Capacity regulation
The cut-in capacity is controlled by signals from the connected pressure transmitter (temperature sensor) and the set reference. Outside the reference a neutral zone is set where the capacity will neither be cut in nor out.
Outside the neutral zone (in the hatched areas named +zone and -zone) the capacity will be cut in or out if the regulation registers a change of pressure (the temperature) "away" from the neutral zone. Cutin and cutout will take place with the set time delays.
If the pressure (the temperature) however "approaches" the neutral zone, the controller will make no changes of the cut-in capacity.
If regulation takes place outside the hatched area (named ++zone and --zone), changes of the cut-in capacity will occur somewhat faster than if it were in the hatched area.
Cutin of steps can be defined for either sequential or cyclic operation.



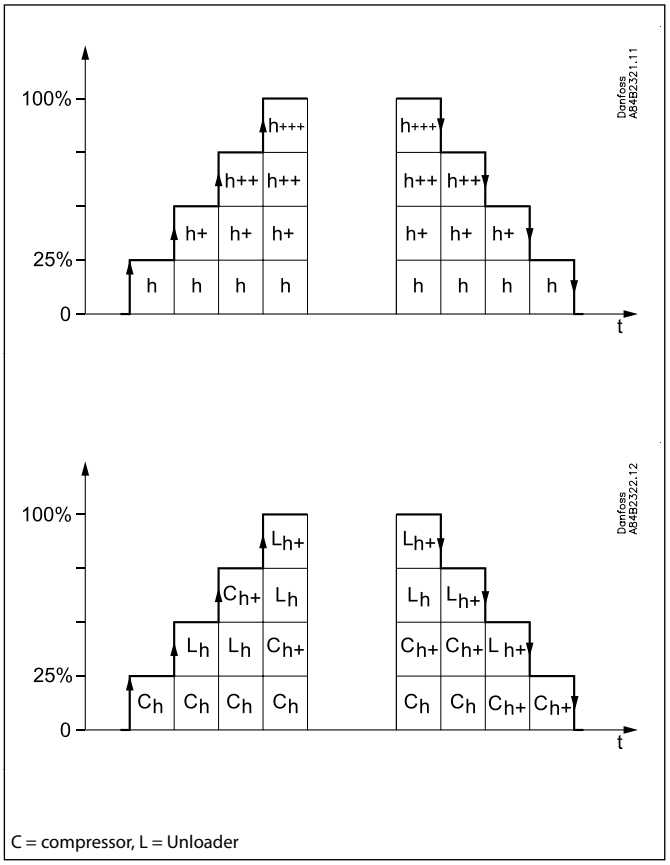
Sequential
The relays are here cut in in sequence – first relay number 1, then 2, etc.
Cutout takes place in the opposite sequence, i.e. the last cut-in relay will be cut out first.



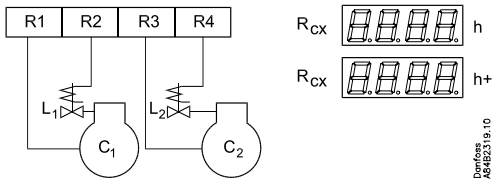
Cyclic
The relays are coupled here so that the operating time of the individual relays will become equalised.
At each cutin the regulation scans the individual relays' hours, cutting in the relay with least time on it.
At each cutout a similar thing happens. Here the relay is cut out that has most hours on the hours.



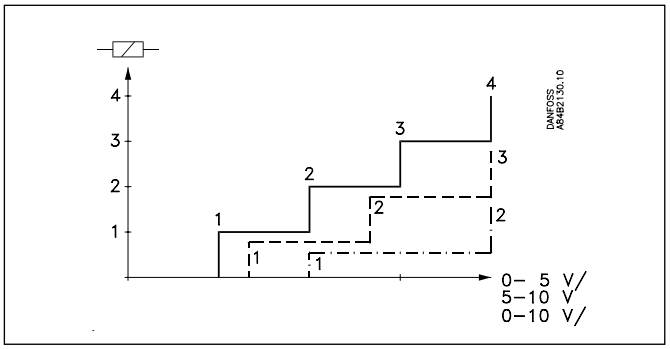
Rx = random relay
h = number of hours



If capacity regulation is carried out on two compressors with one unloader each, the following function can be used:
Relays 1 and 3 are connected to the compressor motor.
Relays 2 and 4 are connected to the unloaders.
Relays 1 and 3 will operate in such a way that the operating time for the two relays will become equalised.



Relay module
The controller can also be used as a relay module where the relays in the module are operated by the received voltage signal. The signal must be connected to terminal 15-16.
Depending on the definition of the signal and the number of relays used, the relays will be "distributed" over the signal.
A hysteresis at the individual coupling points will ensure that the relay will not cut in or out when not required.



Menu survey

SW: 1.1x

Function	Parameter	Min.	Max.	Factory setting
Normal display				
Shows the signal from the temperature sensor/ pressure transmitter	-		°C	
Reference				
Set the regulation's set point	-	-60 °C	170 °C	3
Neutral zone	r01	0.1 K	20 K	4.0
Max. limitation of set point setting	r02	-60 °C	170 °C	50
Min. limitation of set point setting	r03	-60 °C	50 °C	-60
Correction of signat from the sensor	r04	-20 K	20 K	0.0
Select unit (C-b=°C and F-P= °F)	r05	C-b	F-P	C-b
Reference displacement by signal at DI input	r13	-50 K	50 K	0
Capacity				
Min. ON time for relays	c01	0 min.	30 min	2
Min. time period between cutins of same relay	c07	0 min.	60 min.	4
Definition of regulation mode 1: Sequential (step mode/FILO) 2: Cyclic (step mode/FIFO) 3: Compressor with unloader	c08	1	3	1
If the regulation mode 3 has been selected, the relays for the unloaders can be defined to: no: Cut in when more capacity is required nc: Cut out when more capacity is required	c09	no	nc	no
Regulation parameter for + Zone	c10	0.1 K	20 K	3
Regulation parameter for + Zone min.	c11	0.1 min.	60 min.	2
Regulation parameter for ++ Zone seconds	c12	1 s	180 s	30
Regulation parameter for - Zone	c13	0 K	20 K	3
Regulation parameter for - Zone min.	c14	0.1 min.	60 min.	1
Regulation parameter for - - Zone seconds	c15	1 s	180 s	30
Alarm				
Alarm time delay	A03	1 min.	90 min.	30
Upper alarm limit (absolute value)	A10	-60 °C	170 °C	50
Lower alarm limit (absolute value)	A11	-60 °C	50 °C	-60
Miscellaneous				
Controllers address	o03*	1	60	0
On/off switch (service-pin message)	o04*	-	-	-
Access code	o05	off(-1)	100	-
Define input signal and application: 0: no signal /regulation stopped 1: 4-20 mA pressure transmitter - compressor reg. 2: 4-20 mA pressure transmitter - condenser reg. 3: AKS 32R pressure transmitter - compressor reg. 4: AKS 32R pressure transmitter - condenser reg. 5: 0 - 10 V relay module 6: 0 - 5 V relay module 7: 5 - 10 V relay module 8: Pt 1000 ohm sensor - compressor reg. 9: Pt 1000 ohm sensor - condenser reg. 10: PTC 1000 ohm sensor - compressor reg. 11: PTC 1000 ohm sensor - condenser reg.	o10	0	11	0
Set supply voltage frequency	o12	50 Hz	60 Hz	50
Manual operation with "x" relays	o18	0	4	0
Define number of relay outputs	o19	1	4	4
Pressure transmitter's working range - min. value	o20	-1 bar	0 bar	-1
Pressure transmitter's working range - max. value	o21	1 bar	40 bar	12
Define DI input: 0: not used 1: Contact displaces reference 2: Contact starts and stops regulation 3: Interrupted contact will cut out the capacity, and alarm will be given.	o22	0	3	0
Operating hours of relay 1 (value times 10)	o23	0 h	999 h	0
Operating hours of relay 2 (value times 10)	o24	0 h	999 h	0
Operating hours of relay 3 (value times 10)	o25	0 h	999 h	0
Operating hours of relay 4 (value times 10)	o26	0 h	999 h	0
Setting of refrigerant 1=R12. 2=R22. 3=R134a. 4=R502. 5=R717. 6=R13. 7=R13b1. 8=R23. 9=R500. 10=R503. 11=R114. 12=R142b. 13=User defined. 14=R32. 15=R227. 16=R401A. 17=R507. 18=R402A. 19=R404A. 20=R407C. 21=R407A. 22=R407B. 23=R410A. 24=R170. 25=R290. 26=R600. 27=R600a. 28=R744. 29=R1270. 30=R417A	o30	0	30	0

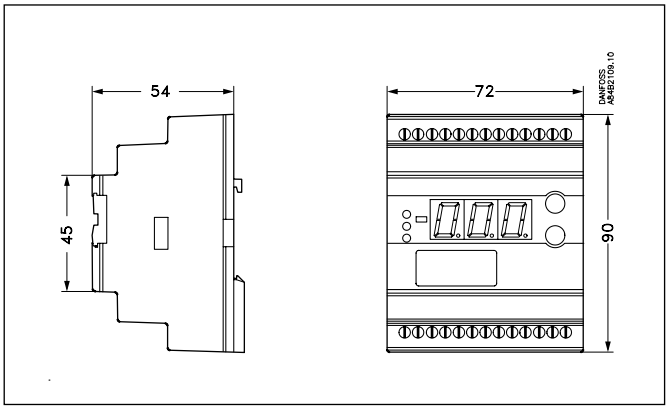
*) This setting will only be possible if a data communication moduel has been installed in the controller.

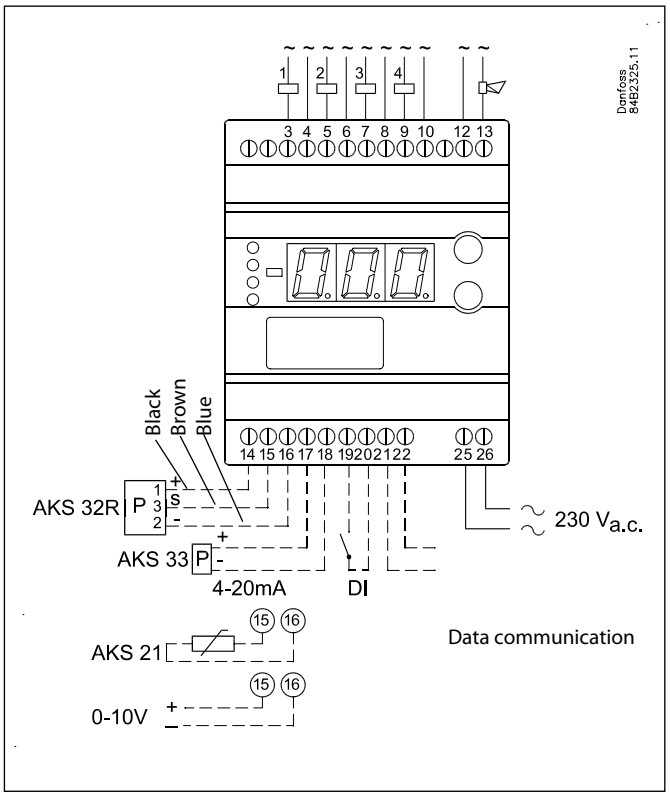
Data

Supply voltage	230 V a.c. +/-15% 50/60 Hz, 5 VA	
Input signal	Pressure transmitter*) with 4-20 mA or temperature sensor Pt 1000 ohm or temperature sensor PTC 1000 ohm or voltage signal (0 - 5 V, 0 - 10 V or 5 - 10 V)	
	Digital input to external contact function	
Relay output	4 pcs. SPST	AC-1: 4 A (ohmic) AC-15: 3 A (inductive)
Alarmrelay	1 pcs. SPST	AC-1: 4 A (ohmic) AC-15: 1 A (inductive)
Data communication	Possible to connect a data communication module	
Environments	-10 - 55°C, during operation -40 - 70°C, during transport	
	20 - 80% Rh, not condensed	
	No shock influence/vibrations	
Enclosure	IP 20	
Weight	300 g	
Mounting	DIN rail	
Display	LED, 3 digits	
Terminals	max. 2.5 mm² multicore	
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 EN50081-1 and EN 50082-2	

*) As pressure transmitter can be used AKS 32R or AKS 33.

The installation of data communications must comply with the requirements described in literature sheet no. RC8AC



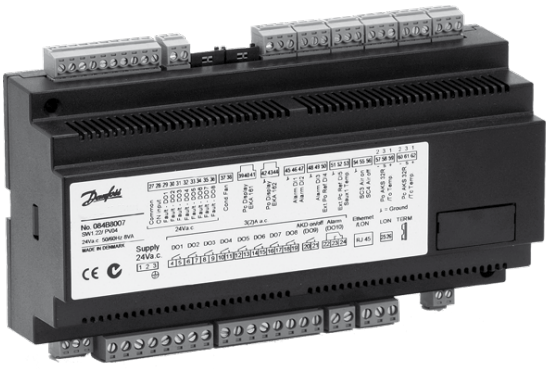


Ordering

Type	Function	Ordering
EKC 331T	Capacity controller	**084B7105**
EKA 175	Data communication module (accessories), (RS 485 module)	**084B7093**

Additional information!
Manual: RS8CU

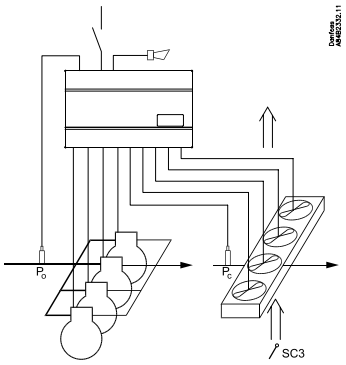
AK-PC 530



Application
The controller is used for capacity regulation of compressors or condensers in small refrigerating systems.
Numbers of compressors and condensers can be connected, as required.
There are eight outputs and more can be added via an external relay module.

Advantages
- Patented neutral zone regulation
- Many possible combinations for compressor constellations
- Sequential or cyclic operation
- Possibility of suction pressure optimisation via the data communication

Regulation
Regulation is based on signals from one pressure transmitter for the compressor regulation and one pressure transmitter for the condenser regulation plus one temperature sensor for the air temperature before the condenser.
The two pressure transmitters can be replaced by two temperature sensors when regulation has to be carried out on brine systems.
- Pressure regulation P0 (pack)
- Temperature regulation Sx (chiller)
- Pressure regulation Pc (pack/chiller)
- Pressure regulation with variable reference (Sc3)

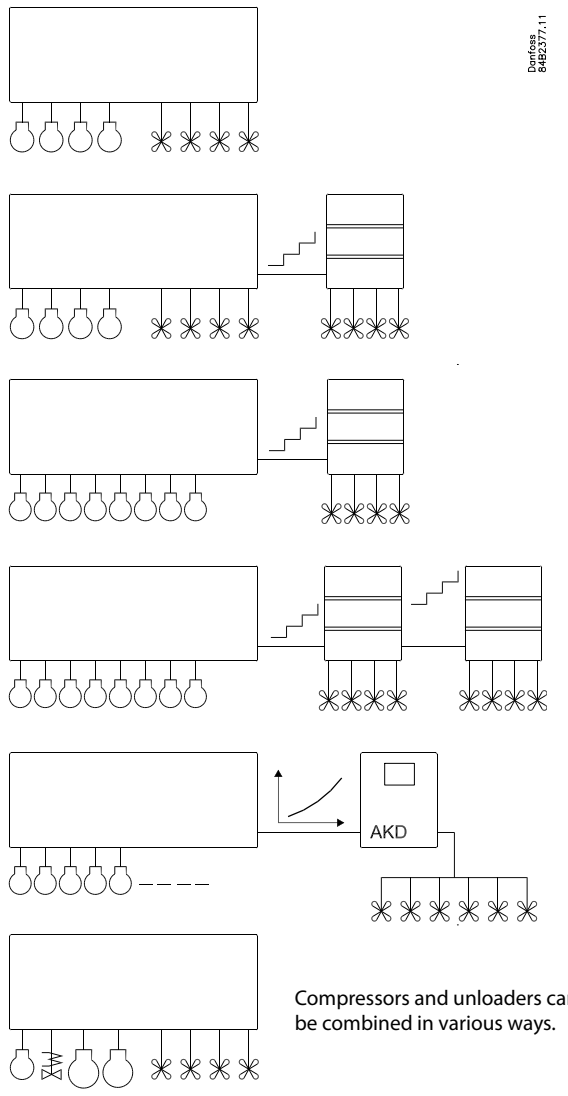


Functions
- Relays for compressor and condenser regulation
- Voltage output for capacity regulation of condenser
- Status inputs. An interrupted signal indicates that the safety circuit has been activated and the respective circuit stopped
- Contact inputs for indication of alarms
- Contact inputs for displacement of references or for indication of alarms
- Alarm relay
- External start/stop of regulation
- Possibility of data communication

Operation
All operation takes place either via data communication or via connection of a display type EKA 164 or EKA 165.

Combinations
The controller has ten relay outputs two of which have been reserved for the alarm function and for the "AKD start/stop" function.
For a start relays are reserved for compressor capacities starting from DO1, DO2, etc.
The remaining relays up to and including DO8 will then be available for fans. If more are required, one or more relay modules type EKC 331 with max. eight steps can be connected. The signals to these modules are to be taken from the controller's analog output. Another solution could be that the fan speed is controlled via the analog output and a frequency converter.

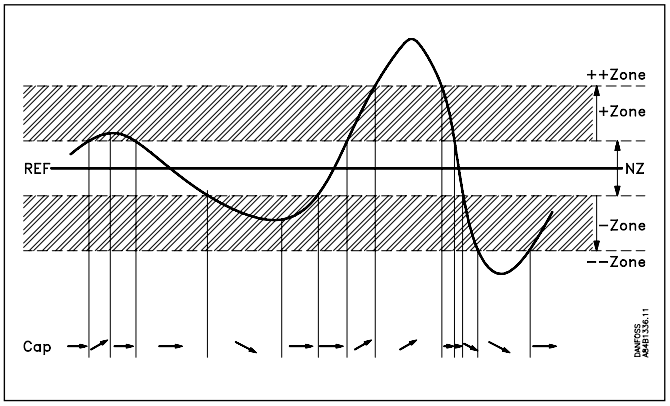
If the alarm function and the "AKD start/stop" function are left out, all ten relay outputs may be used for compressors and fans (but max. eight for compressors and max. eight fans).



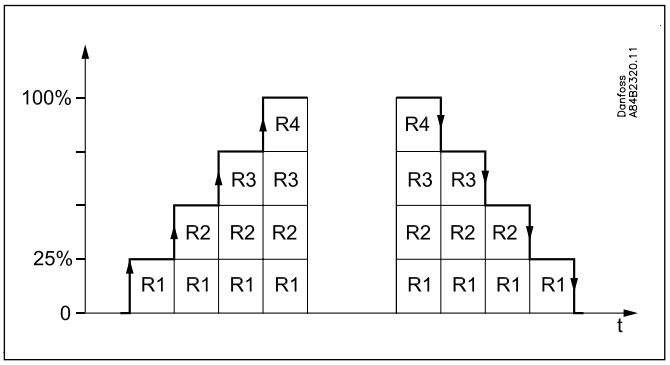
Compressors and unloaders can be combined in various ways.

Capacity regulation

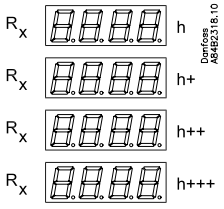
The cut-in capacity is controlled by signals from the connected pressure transmitter/temperature sensor and the set reference.
Outside the reference a neutral zone is set where the capacity will neither be cut in nor out.
Outside the neutral zone (in the hatched areas named +zone and -zone) the capacity will be cut in or out if the regulation registers a change of pressure "away" from the neutral zone. Cutin and cutout will take place with the set time delays.
If the pressure however "approaches" the neutral zone, the controller will make no changes of the cut-in capacity.
If regulation takes place outside the hatched area (named ++zone and --zone), changes of the cut-in capacity will occur somewhat faster than if it were in the hatched area.
Cutin of steps can be defined for either sequential, cyclic, binary or "mix & match" operation.



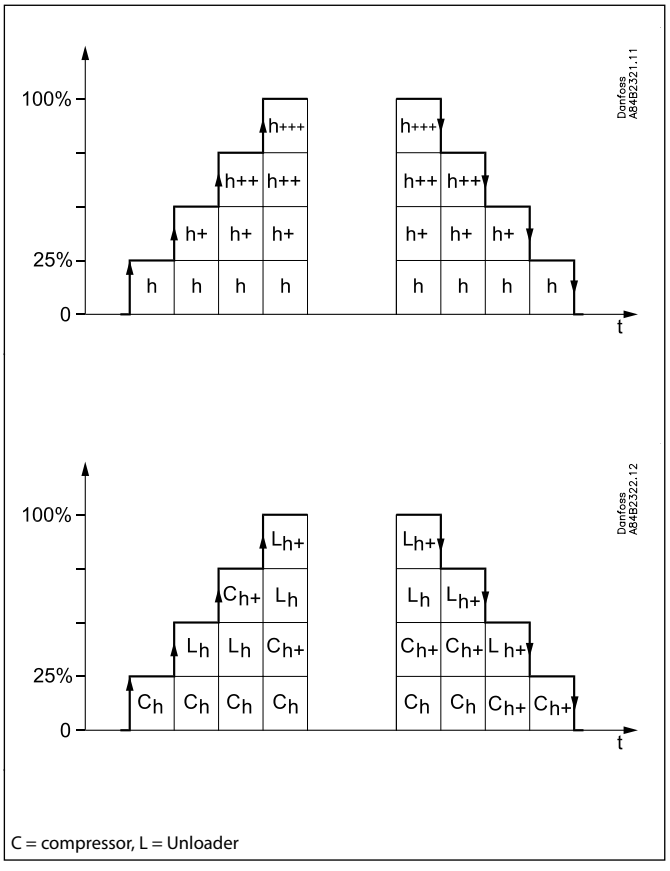
Sequential (first in - last out)
The relays are here cut in in sequence – first relay number 1, then 2, etc.
Cutout takes place in the opposite sequence, i.e. the last cut-in relay will be cut out first.



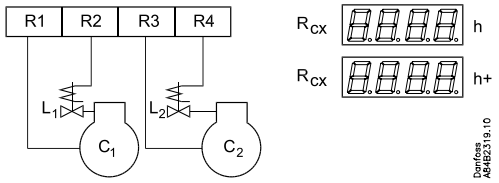
Cyclic (first in - first out)
The relays are coupled here so that the operating time of the individual relays will become equalised.
At each cutin the regulation scans the individual relays' hours, cutting in the relay with least time on it.
At each cutout a similar thing happens. Here the relay is cut out that has most hours on the hours.



Rx = random relay
h = number of hours



If capacity regulation is carried out on two compressors with one unloader each, the following function can be used:
Relays 1 and 3 are connected to the compressor motor.
Relays 2 and 4 are connected to the unloaders.
Relays 1 and 3 will operate in such a way that the operating time for the two relays will become equalised.



Menu survey

Sequence

1. o61 must be set as the first parameter. This parameter determines which of the four operating interfaces (application mode) are activated. This must be set via the display keys. It cannot be set via data communication. (Active functions are shown below in shaded fields.)

2. Quick- start
To get the system up and running quickly so that cooling can be commenced, start it by setting the following parameters (these parameters can only be set when the regulation is stopped, r12=0):
r23, r28 and then either (c08, c09 and c16) or (c17 to 28) – continue with c29, o06, o30, o75, o76, o81 **and finally r12=1**.

3. Once the regulation is under way, you can go through the other parameters and adjust them in situ.

Function	Parameter	o61 = 1	2	3	4	Min.	Max.	Factory setting
Normal display								
Shows P0 in EKA 165 (display with buttons)	-	°C	P	°C	P	°C/bar		
Shows Pc in EKA 163	-	°C	P	°C	P	°C/bar		
P0 reference								
Neutral zone	r01					0.1°C/0.1 bar	20°C /5.0 bar	4.0°C/0.4 bar
Correction of signal from P0 sensor	r04					-50°C /-5.0 bar	50°C/5.0 bar	0.0
Select unit (0=bar and °C, 1=Psig and °F)	r05					0	1	0
Start/Stop of regulation	r12					OFF	ON	OFF
Reference offset for P0 (see also r27)	r13					-50°C/-5.0 bar	50°C/5.0 bar	0.0
Set regulation setpoint for P0	r23					-99°C/-1 bar	30°C/60.0 bar	0.0°C/3.5 bar
Shows total P0 reference (r23 + various displacements)	r24						°C/bar	
Limitation: P0 reference max. value (also applies to regulation with reference displacement)	r25					-99°C/-1.0 bar	30°C/60.0 bar	30.0°C/40.0 bar
Limitation: P0 referencen min. value (also applies to regulation with reference displacement)	r26					-99°C/-1.0 bar	30°C/40.0 bar	-99.9°C/-1.0 bar
Displacement of P0 (ON=active "r13")	r27					OFF	ON	OFF
Pc reference								
Set regulation setpoint for Pc	r28					-25°C/0.0 bar	75°C/60.0 bar	35°C/15.0 bar
Shows total Pc reference	r29						°C/bar	
Limitation: Pc referencen max. value	r30					-99.9°C/-0.0 bar	99.9°C/60.0 bar	55.0°C/60.0 bar
Limitation: Pc referencen min. value	r31					-99.9°C/0.0 bar	99.9°C/60.0 bar	-99.9°C/0.0 bar
Correction of signal from Pc sensor	r32					-50°C/-5.0 bar	50°C/5.0 bar	0.0
Pc reference variation.1 and 2 are PI-regulation 1: Fixed reference. "r28" is used 2: Variable reference. Outdoor temperature (Sc3) included in the reference 3: As 1, but with P-regulation (Xp-band) 4: As 2, but with P-regulation (Xp-band)	r33					1	4	1
Reference offset for Pc	r34					-50°C/-5.0 bar	50°C/5.0 bar	0.0
The mean temperature difference across the condenser at maximum load (dim tm K)	r35					3.0	50.0	10.0
The mean temperature difference across the condenser at the lowest relevant compressor capacity (min tm K)	r56					3.0	50.0	8.0
This is where you can see the actual pressure (P0) that is being measured by the pressure transmitter.	r57						°C/bar	
This is where you can see the actual pressure (T0) that is part of the regulation. From the sensor which is defined in "o81"	r58						°C	
Capacity								
Min. ON time for relays	c01					0 min	30 min.	0
Min. time period between cutins of same relay	c07					0 min.	60 min	4
Definition of regulation mode 1: Sequential (step mode/FILO) 2: Cyclic (step mode/FIFO) 3: Binary and cyclic	c08					1	3	1
If a regulation mode with unloaders is selected, the relay must be defined to: 0: Cut in when more capacity is required 1: Cut out when more capacity is required	c09					0	1	0
Regulation parameter for + Zone	c10					0.1 K/0.1 bar	20 K/2.0 bar	4.0/0.4 bar
Regulation parameter for + Zone	c11					0.1 min	60 min	4.0
Regulation parameter for ++ Zone	c12					0.1 min.	20 min	2.0
Regulation parameter for - Zone	c13					0.1 K/0.1 bar	20 K/2.0 bar	4.0/0.3 bar

To be continued

Regulation parameter for - Zone	c14					0.1 min.	60 min	1.0
Regulation parameter for - - Zone	c15					0.02 min.	20 min	0.5
Definition of compressor connections.	c16					1	26	0
Following "c17" to "c28" is another way to define compressorw than with "c16". A code will then have to be set for the relays that are to be ON at the different steps: Step 1 (M&M operation)	c17					0	15	0
Step 2 (M&M operation)	c18					0	15	0
Step 3 (M&M operation)	c19					0	15	0
Step 4 (M&M operation)	c20					0	15	0
Step 5 (M&M operation)	c21					0	15	0
Step 6 (M&M operation)	c22					0	15	0
Step 7 (M&M operation)	c23					0	15	0
Step 8 (M&M operation)	c24					0	15	0
Step 9 (M&M operation)	c25					0	15	0
Step 10 (M&M operation)	c26					0	15	0
Step 11 (M&M operation)	c27					0	15	0
Step 12 (M&M operation)	c28					0	15	0
Definition of condenser: **1-8:** Total number of fan relays or voltage step on the voltage output **9:** Only via analog output and start of frequency converter **10:** Not used **11- 18:** Total number of fan relays which are to be connected with alternating start-up.	c29					0/OFF	18	0
Cut in compressor capacity with manual control. See also "c32"	c31					0%	100%	0
Manual control of compressor capacity (when ON, the value in "c31" will be used)	c32					OFF	ON	OFF
Pump down limit. Limit value where the last compressor is cut out.	c33					-99.9°C/-1.0 bar	100°C/60 bar	100°C/60 bar
Proportinal band Xp for (P= 100/Xp) condenser regulation	n04					0.2 K/0.2 bar	40.0 K/10.0 bar	10.0 K/3.0 bar
I: Integration time Tn for condenser regulation	n05					30 s	600 s	150
Cutin condenser capacity with manual control. See also "n53"	n52					0%	100%	0
Manual control of condenser capacity (when ON, the value in "n52" will be used)	n53					OFF	ON	OFF
Start speed The voltage for the speed regulation is kept at 0 V until the regulation requires a higher value than the value set here.	n54					0%	75%	20%
Min. speed. The voltage for the speed regulation switches to 0 V when the regulation requires a lower value than the value set here.	n55					0%	50%	10%
Alarm								
Delay time for a A32 alarm	A03					0 min.	90 min.	0 min.
Low alarm and safety limit for P0	A11					-99°C/-1.0 bar	30°C/40 bar	-40°C/0.5 bar
Delay time for a DI1 alarm	A27					0 min. (-1=OFF)	999 min.	OFF
Delay time for a DI2 alarm	A28					0 min. (-1=OFF)	999 min.	OFF
Delay time for a DI3 alarm	A29					0 min. (-1=OFF)	999 min.	OFF
Upper alarm and safety limit for Pc	A30					-10 °C/0.0 bar	99 °C/60.0 bar	60.0°C/60.0 bar
Upper alarm limit for sensor "Saux1"	A32					1°C (0=OFF)	150°C	OFF
Delay time for a P0 alarm	A44					0 min. (-1=OFF)	999 min.	0 min.
Delay time for a Pc alarm	A45					0 min. (-1=OFF)	999 min.	0 min.
Miscellaneous								
Controllers address	o03*					1	990	
On/off switch (service-pin message)	o04*					-	-	
Access code	o05					1 (0=OFF)	100	OFF
Used sensor type for Sc3, Sc4 and "Saux1" **0=**Pt 1000, **1=**PTC1000 2-7=variations with temperature sensor on P0 and Pc. See earlier in the manual.	o06					0	7 (1)	0
Set supply voltage frequency	o12					50 Hz	60 H	0
Manual control of outputs: **0:** No override **1-10:** 1 will cut in relay 1, 2 relay 2, etc. **11-18:** Gives voltage signal on the analog output. (11 gives 1.25 V, and so on in steps of 1.25 V	o18					0	18	0

*) This setting is only possible if data communication module is mounted in the controller

To be continued

P0 pressure transmitter's working range - min. value	o20					-1 bar	0 bar	-1.0
P0 pressure transmitter's working range - max. value	o21					1 bar	60 bar	12.0
Use of DI4-input **0=**not used. **1=**P0 displacement. **2=**alarm function. Alarm="A31"	o22					0	2	0
Operating hours of relay 1 (value time 1000)	o23					0.0 h	99.9 h	0.0
Operating hours of relay 2 (value time 1000)	o24					0.0 h	99.9 h	0.0
Operating hours of relay 3 (value time 1000	o25					0.0 h	99.9 h	0.0
Operating hours of relay 4 (value time 1000)	o26					0.0 h	99.9 h	0.0
Setting of refrigerant 1=R12. 2=R22. 3=R134a. 4=R502. 5=R717. 6=R13. 7=R13b1. 8=R23. 9=R500. 10=R503. 11=R114. 12=R142b. 13=User defined. 14=R32. 15=R227. 16=R401A. 17=R507. 18=R402A. 19=R404A. 20=R407C. 21=R407A. 22=R407B. 23=R410A. 24=R170. 25=R290. 26=R600. 27=R600a. 28=R744. 29=R1270. 30=R417A. 31=R422A.	o30					0	31	0
Use of DI5-input **0=**not used. **1=**Pc displacment. **2=**alarm function. Alarm="A32"	o37					0	2	0
Pc pressure transmitter's working range - min. value	o47					-1 bar	0 bar	-1.0
Pc pressure transmitter's working range - max. value	o48					1 bar	200 bar	34.0
Read temperature at sensor "Saux1"	o49							°C
Operating hours of relay 5 (value time 1000)	o50					0.0 h	99.9 h	0.0
Operating hours of relay 6 (value time 1000)	o51					0.0 h	99.9 h	0.0
Operating hours of relay 7 (value time 1000)	o52					0.0 h	99.9 h	0.0
Operating hours of relay 8 (value time 1000)	o53					0.0 h	99.9 h	0.0
Selection of application 1. Temperature signal and "c16" mode 2: Pressure signal and "c16" mode 3. Temperature signal and M&M mode 4. Pressure signal and M&M mode	o61	1	2	3	4	1	4	1
Function for relay output DO9: 0. Start/stop of speed regulation 1. Inject on signal for evaporator control 2. Boost ready (at least one compressor is on) 3. Start /stop of condenser fan	o75					0	3	0
Function for relay output DO10: 0. Alarm relay 1. Start/stop of condenser fan	o76					0	1	0
Definition of alarm message at DI1 signal: 0. Not used 1. Fan failure (A34) 2. DI1 alarm (A28)	o78					0	2	0
Definition of the signal to the P0 regulation when temperature signal. If frost protection is required, the setting must be 1 or 2. 0. Pressure transmitter AKS 32R on P0 1. Temperature input Saux 2. Temperature input S4	o81					0	2	0
Display connection Off: EKA 164 On: EKA 165 (extended display with light-emitting diodes)	o82					Off	On	Off
Service								
Status on DI1 input	u10							
Status on DI2 input	u37							
Read temperature at sensor "Sc3"	u44							°C
Read temperature at sensor "Sc4"	u45							°C
Status on DI3 input	u87							
Status on DI4 input	u88							
Status on DI5 input	u89							

Data

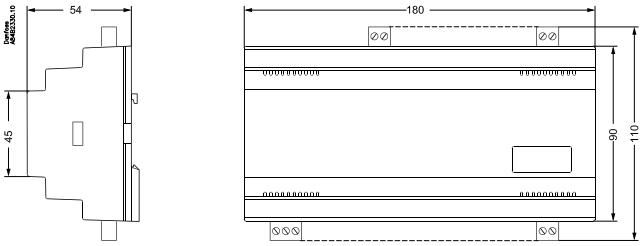
Supply voltage	24 V a.c. +/-15% 50/60 Hz, 5 VA	
Input signal	2 pcs. Pressure transmitters type AKS 32R (temperature sensor in brine systems)	
	3 pcs. temperature sensor input for PT 1000 ohm/0°C or PTC 1000 ohm/25°C	
Digitale input from contact function.	1 pcs. for Start/stop of regulation	
	8 pcs. for monitoring of safety circuits	
	3 pcs. for alarm function	
	2 pcs. for alarm function or for displacement of references	
Relay output for capacity regulation	8 pcs. SPST	AC-1: 3 A (ohmic) AC-15: 2 A (inductive)
"AKD start/stop" relay	1 pcs. SPST	
Alarm relay	1 pcs. SPDT	AC-1: 6 A (ohmic) AC-15: 3 (inductive)
Voltage output	0-10 V d.c.	
Display outputs	EKA 163	Pc display
	EKA 165(164)	Operation, P0 display and LED
Data communication	Possible to connect a data communication module	
Environments	0 - 55°C, during operation -40 - 70°C, during transport	
	20 - 80% Rh, not condensing	
	No shock influence/vibrations	
Enclosure	IP 20	
Weight	0.4 kg	
Mounting	DIN rail or on wall	
Terminals	max. 2.5 mm² multicore	
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 EN61000-6-2 and 3	

Ordering

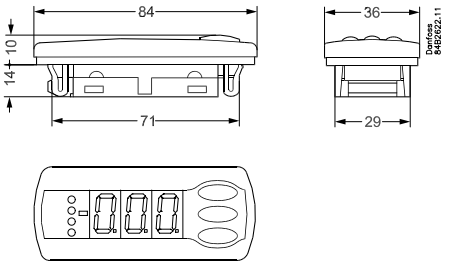
Type	Function	Ordering
AK-PC 530	Capacity controller	**084B8007**
EKA 163B	Display unit	**084B8574**
EKA 164B	Display unit with operation buttons	**084B8575**
EKA 165	Display unit with operation buttons and light-emitting diodes for input and output	**084B8573**
	Cable for display unit 2 m, 1 pcs.	**084B7298**
	Cable for display unit 6 m, 1 pcs.	**084B7299**
EKA 175	Data communication module, FTT 10	**084B7093**
EKA 178B	Data communication module, MOD-bus	**084B8571**

The installation of data communications must comply with the requirements described in literature sheet no. RC8AC

Montage

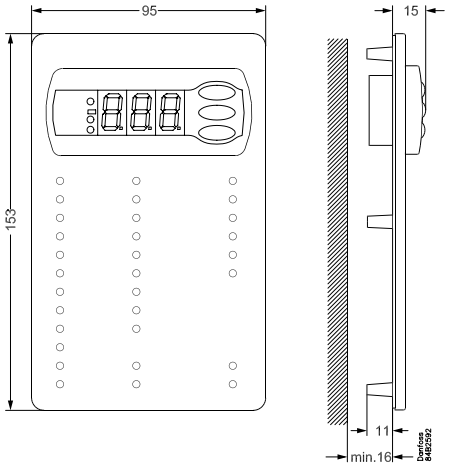


AK-PC 530



Only for front mounting (IP 65)
Only connection via plugs

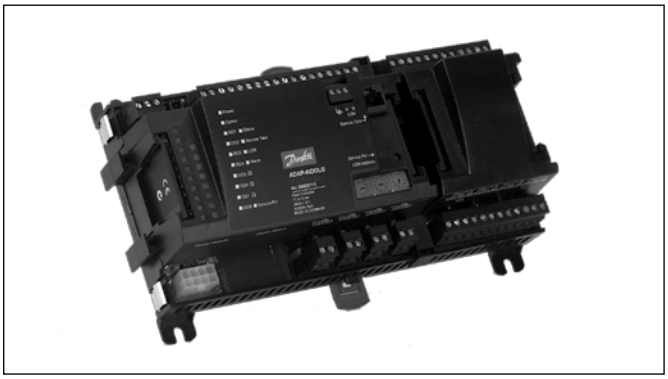
Display type EKA 163/EKA 164



Display type EKA 165

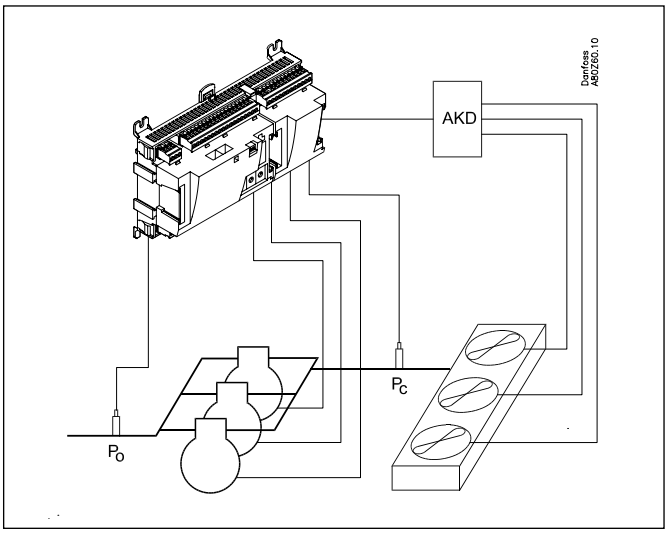
Additional information!
Manual: RS8EJ

AK-PC 840



Application
AK-PC 840 is a complete regulating unit for capacity control of compressors and condensers in commercial refrigeration.
In addition to capacity control the controller can give signals to other controllers about the operating condition, e.g. forced closing of expansion valves, alarm signals and alarm messages.

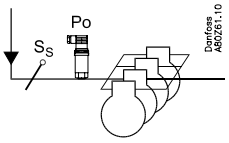
Advantages
- Control of up to 12 compressors, which can have up to three unloaders each
- Speed control of two compressors
- Suction pressure optimisation via data communication
- It can handle different compressor sizes
- Control of up to 12 fans
- Speed control of fans
- PI control
- Error detection of dirty condenser
- Separate functions independent of control



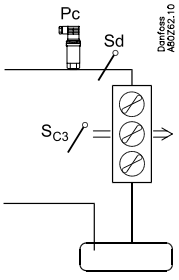
Control
The controller's main function is to control compressors and condensers so that operation all the time takes place at the energy-optimum pressure conditions. Both suction pressure and condensing pressure are controlled by signals from pressure transmitters transmitting a voltage signal, e.g. types AKS 32 and AKS 32R.

Functions
- Monitoring of safety automation can be connected.
- When the compressors stop when there is an error in the system, a signal can be given to other controls so that the electronic expansion valves are closed.
- Alarm signals can be generated directly from the controller and via data communication.
- Alarms are shown with texts so that the cause of the alarm is easy to see.
- Liquid injection into suction line
- The status of the outputs and inputs is shown by means of light-emitting diodes on the front panel
- Plus some completely separate functions thar are totally independent of the regulation – such as alarm, thermostat and pressure control functions.

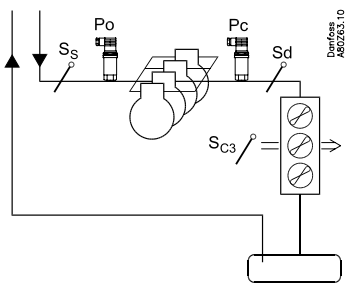
Single compressor control



Single condenser control



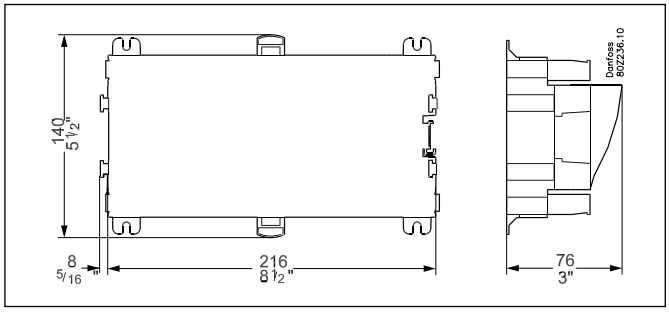
Both compressor and condenser control

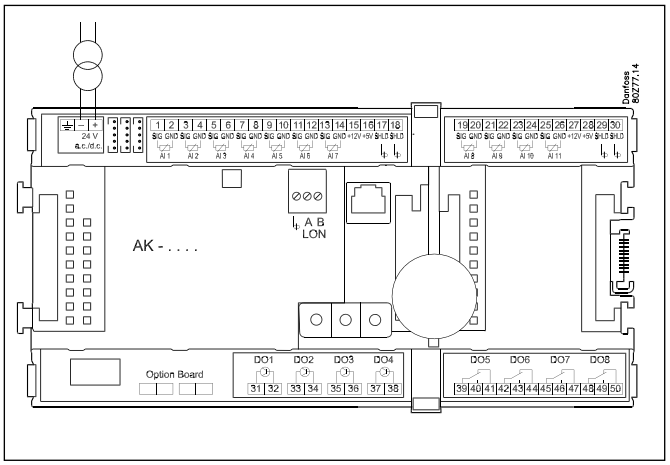


Data

Supply voltage	24 V a.c. +/- 20%	
Power consumption	AK-PC 840	12 VA
Analoge indgange	Pt 1000 ohm /0°C	Dissolution: 0.1°C Accuracy: +/- 0.5°
	Pressure transmitter type AKS 32R / AKS 32 (1-5 V)	Dissolution 1 mV Accuracy +/- 10 mV Max. connection of 5 pressure transmitters on one module
	Voltage signal 0-10 V	
	Contact function (On/Off)	On at R < 20 ohm Off at R > 2K ohm (Gold -plated contacts not necessary)
On/off supply voltage inputs	Low voltage 0/80 V a.c./d.c.	Off: U < 2 V On: U > 10 V
	High voltage 0/260 V a.c.	Off: U < 24 V On: U > 80 V
Relay outputs SPDT	AC-1 (ohmic)	4 A
	AC-15 (inductive)	3 A
	U	Min. 24 V Max. 230 V Low and high voltage must not be connected to the same output group
	Fuse	5 A (T)
Solid state outputs	Can be used for loads that are cut in and out frequently, e.g. : Loads, rail heat, fans and AKV valve	Max. 240 V a.c. , Min. 48 V a.c. Max. 0.5 A, Leak < 1 mA Max. 1 AKV
Ambient temperature	During transport	-40 to 70°C
	During operation	-20 to 55°C , 0 to 95% RH (non condensing) No shock influences/vibrations
Enclosure	Material	PC/ABS
	Enclosure	IP10 , VBG 4
	Mounting	For mounting on wall or DIN rail
Weight with screw terminals	Modules in100-/200-/controller-series	Ca. 200 g/500 g/600 g
Approvals	EU low voltage directive and EMC requirements are complied with	LVD tested according to EN 60730 EMC tested Immunity according to EN 61000-6-2 Emission according to EN 50081-1
	UL 873, c UL us	UL file number: E166834

The installation of data communications must comply with the requirements described in literature sheet no. RC8AC



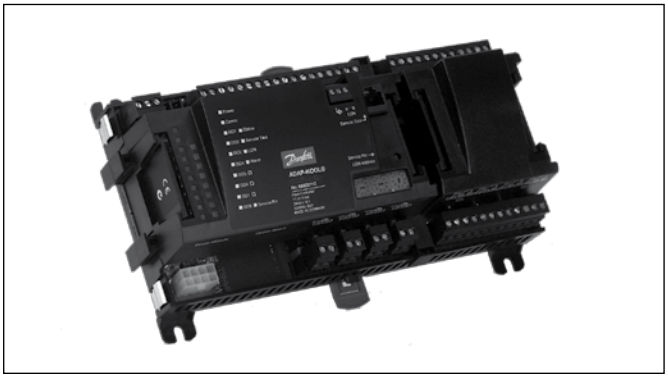


Ordering

Type	Function	Application	Language	Code no.
Controller				
AK-PC 840	Controller for capacity control of compressors and condensers	compressor/ condenser/ both	English, German, French, Italian, Dutch	**080Z0111**
			English (UK), Spanish, Portuguese, English (US)	**080Z0112**
			English (UK), Danish, Swedish, Finnish	**080Z0113**
Miscellaneous				
Extension modules if several connections are needed				**See section Accessories - AK modules**
Software for operation of AK controllers			AK-ST 500	
Cable between PC and AK controller				
Cable between zero modem cable and AK controller				
External display that can be connected to the controller module. For showing, say, the suction pressure			EKA 163B, EKA 164B	
Real time clock for use in controllers that require a clock function, but are not wired with data communication.			AK-OB 101A	

Additional information!
Manual: RS8EG--

AK-PC 730

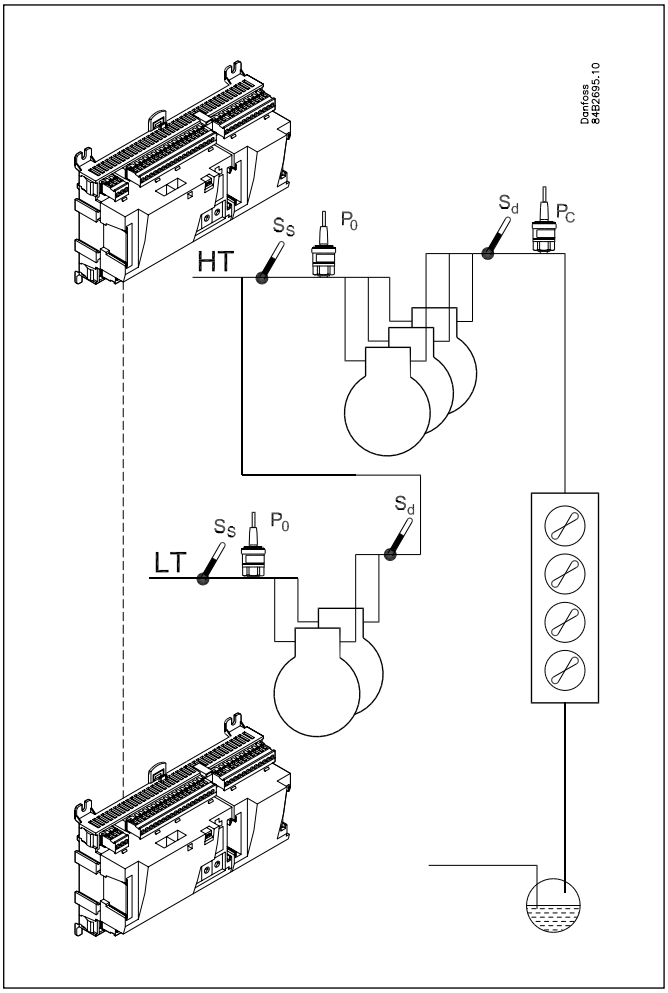


Application
AK-PC 730 is particularly well-suited to capacity control of cascade or booster systems.
By using two controllers, a complete capacity control of both circuits is achieved.

Advantages
- Start-up coordination ensures optimum interaction between the high pressure and low pressure circuits in cascade/booster systems
- Start/stop signal for injection in cascade heat exchanger
- Optimisation of suction pressure from the refrigeration area that is used most
- Optimisation of condenser in relation to ambient temperature
- Error detection of dirty condenser
- Flexible hardware platform with extension modules
- Fast set-up using pre-defined set-ups

Control
- Compressor capacity is controlled via the suction pressure P0, a media temperature of S4 or an alternative control pressure Pctrl. The reference can either be overide with a day/night signal or it can be optimised automatically via the data communication.
- Fan capacity is controlled either via the condensing pressure Pc or a media temperature S7 (dry cooler). The reference can be optimised via ambient temperature measurement and changed during heat recovery.
- The Ss and Sd sensors are used for monitoring of overheating of suction pipe and pressure pipe temperature respectively.

Additional functions
- Control of up to 4 compressor steps
- Compressors of the same or different size
- Speed control of one or two compressors
- Equalising of operating time between compressors
- Anti-cycle timers for each compressor
- Up to 6 safety inputs per compressor
- Capacity limit of compressors via two digital inputs
- Step or speed control of up to 6 fans
- Monitoring of fans
- Coordination function between high-pressure and low-pressure circuits
- Injection signal for cascade heat exchanger
- Monitoring of too low suction pressure P0 and of high condensing pressure Pc
- 5 digital inputs for alarm monitoring
- 5 thermostats and pressure switches for monitoring/control
- 5 voltage inputs 0-10 V d.c. for signal monitoring



Additional information!
Manual: RS8EK

Ordering

Type	Function	Application	Language	Code no.
AK-PC 730	Capacity control	compressor/condenser/both	English, German, French, Italian, Dutch	**080Z0116**
			English (UK), Spanish, Portuguese, English (US)	**080Z0117**
			English (UK), Danish, Swedish, Finnish	**080Z0118**

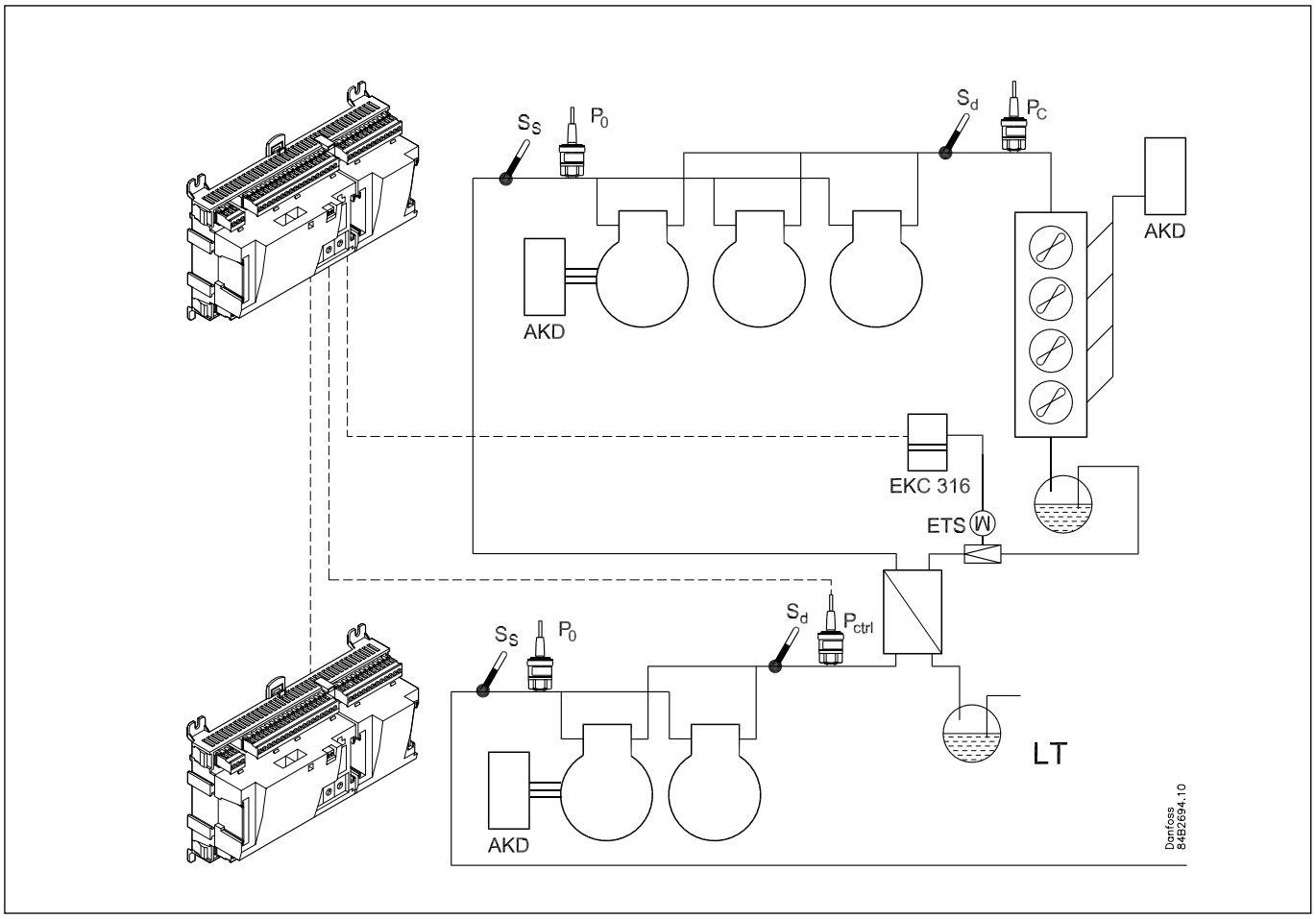
Example
The example below uses 2 no. AK-PC 730 to control a complete cascade system with R404A for refrigeration and e.g. CO_2 for freezing.

High-pressure circuit
Consists of 3 compressors, of which the first is speed-controlled via a frequency converter type AKD.
The condenser consists of 4 fans which are all speed-controlled via a frequency converter type AKD.
The compressor capacity is adjusted according to the pressure measurement Pctrl which is located in the low-pressure circuit.
The suction pressure P0 is used for low-pressure monitoring.

Low-pressure circuit
Consists of 2 compressors, of which one is speed-controlled via a frequency converter type AKD. Here the pressure measurement Pctrl is used as high-pressure monitoring.

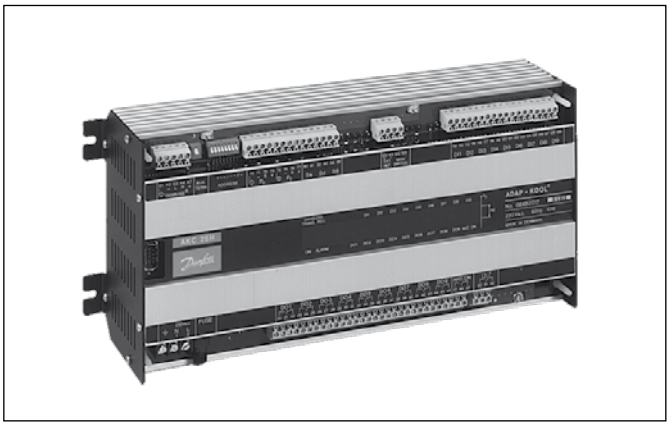
Coordination
Start-up coordination between high-pressure and low-pressure circuits can be carried out in two ways:
1) The low-pressure circuit is only allowed to start compressors when at least one high-pressure compressor is running.
2) The high-pressure circuit starts compressors, when the load on the low-pressure circuit requires that compressors should be started.

Cascade heat exchanger
The injection in the cascade heat exchanger takes place via a step motor valve type ETS and control type EKC 316. The signal for start/stop of injection comes from AK-PC 730 in the high-pressure circuit, but it could also come from the other AK-PC 730 in the low-pressure circuit.



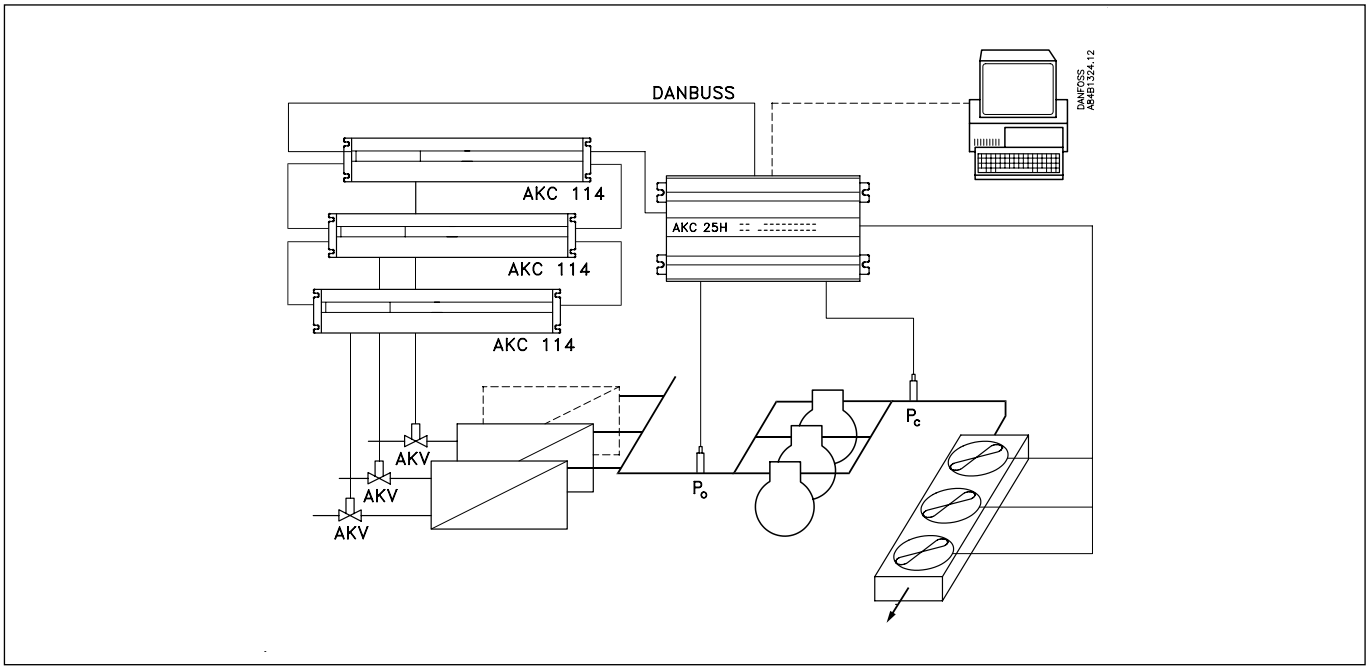
AKC 25H1

AKC 25H1 is a capacity controller for compressors and condensors. AKC 25H1 controls up to nine stages distributed between the compressor and/or condensing stage.



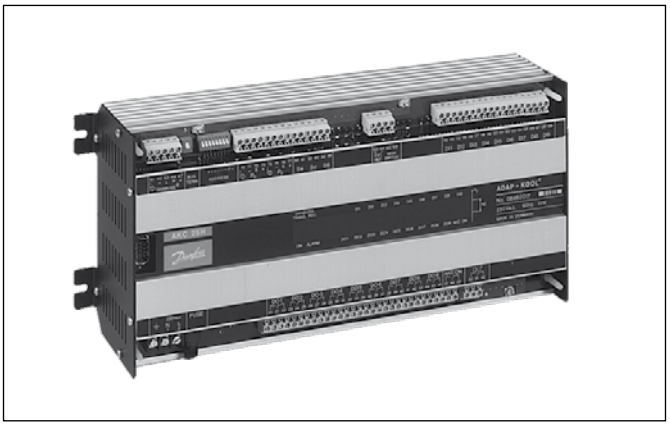
Description
- Possibility of connection to both main and relief stages of identical sizes.
- Neutral zone adjustment of suction pressure and condensing pressure.

Application example



Additional information!
Technical brochure: RC1J4
Function description: RC1JZ

AKC 25H3

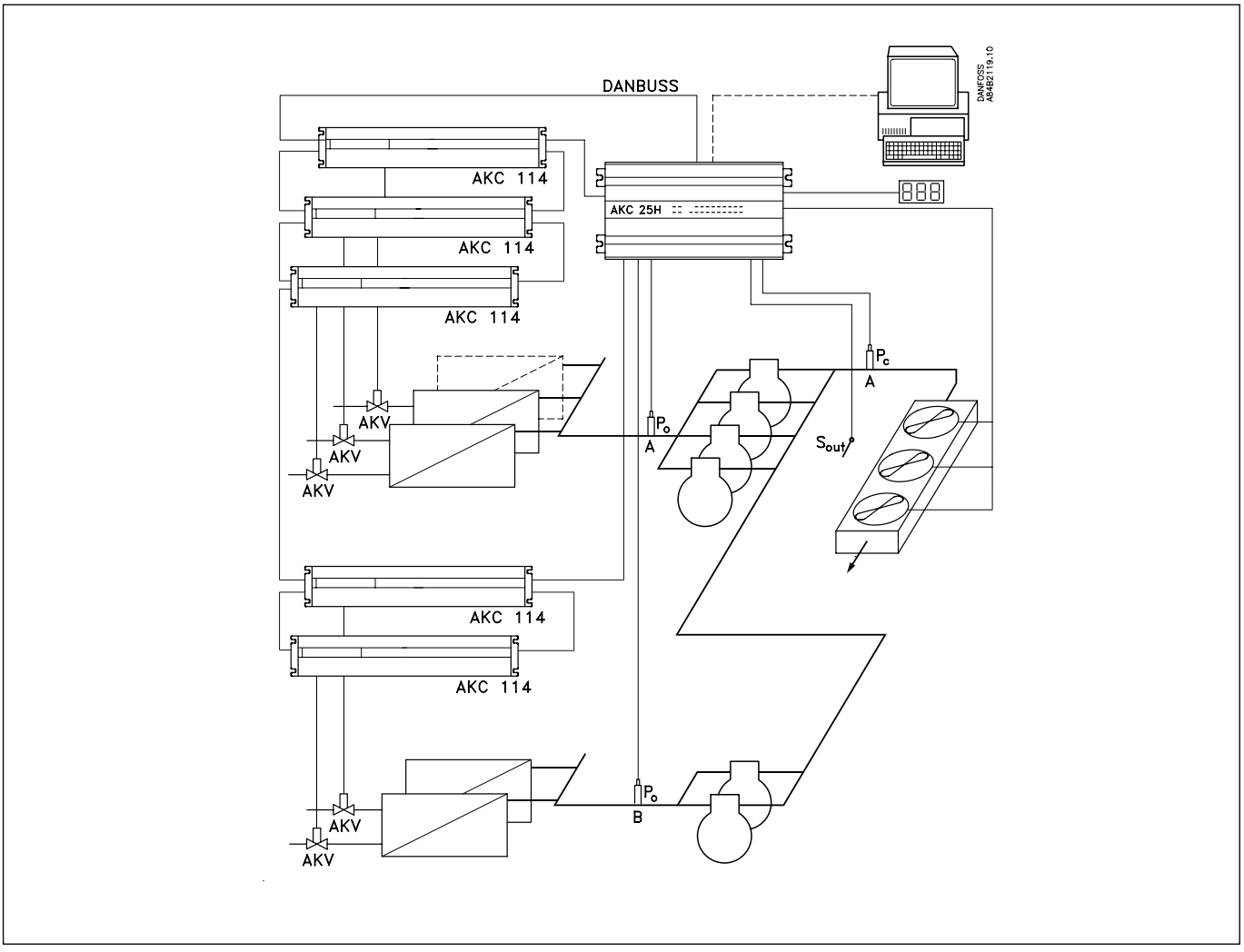


The control has the same functions as AKC 25H1, but can additionally be used to control two independent refrigeration circuits.

Description

- Neutral zone adjustment of suction pressure and condensing pressure.
- PI regulation of condensing pressure.
- Regulation of condensing pressure as a function of outdoor temperature
- Possibility of variable speed regulation of condenser fan or connection of a relay module for further step-by-step coupling of condenser steps
- Internal day/night clock
- Connection of display to show selected operating parameters

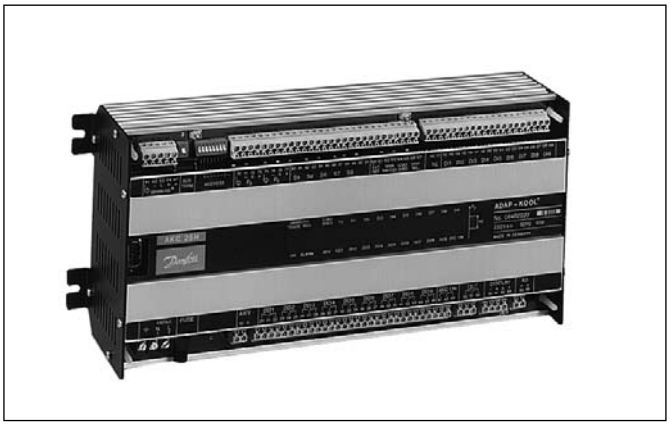
Application example



Additional information!
Technical brochure: RC1J4
Function description: RC8AH

AKC 25H5

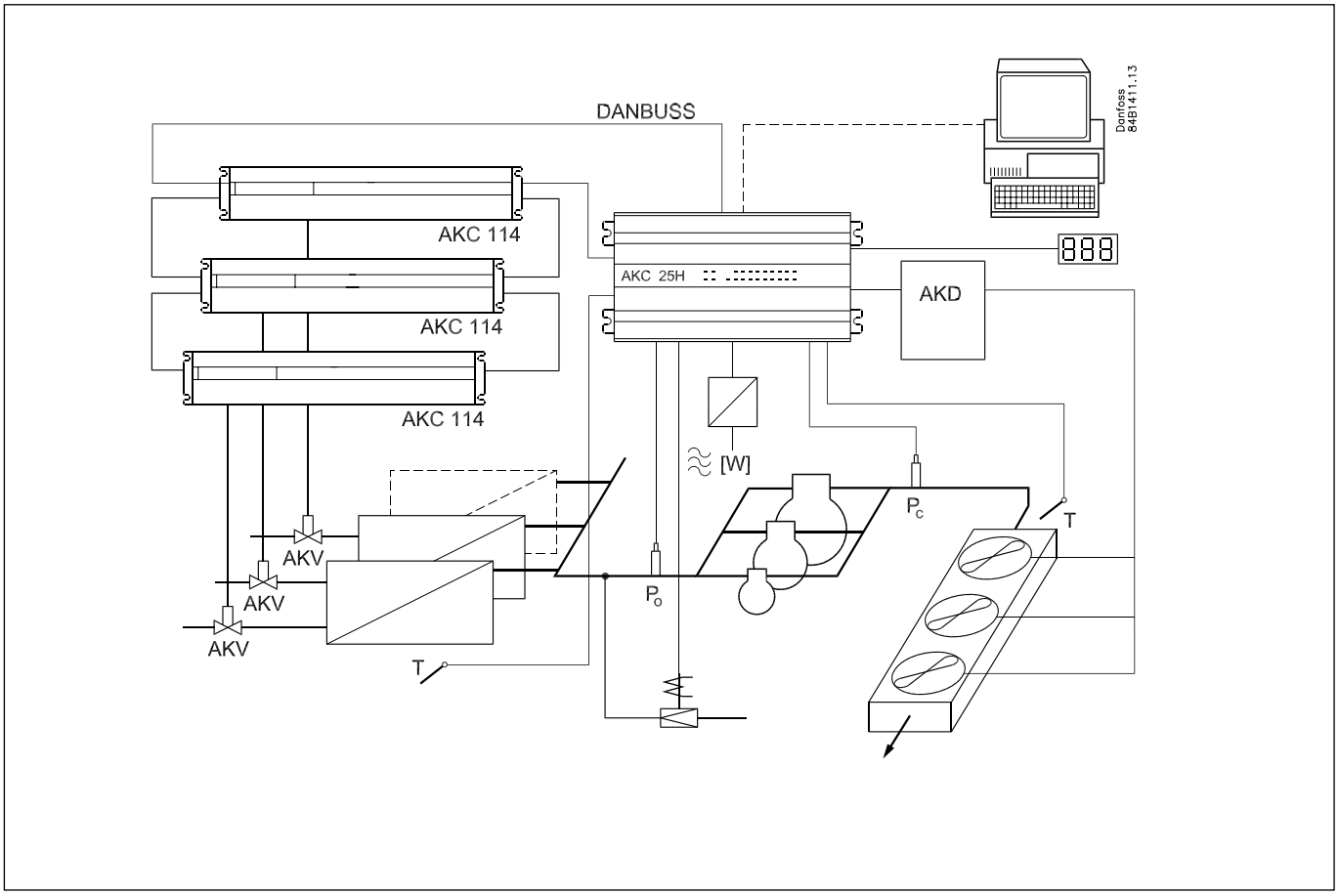
The controller has the same functions as the AKC 25H1 but also offers the possibility of controlling the different stage intervals and speed adjustment. This ensures even better capacity adaptation to the actual load.



Description
- Possibility of connection to both main and relief stages of different sizes.
- PI regulation of suction and condensing pressure.
- Possibility of connection to VLT frequency converter for the speed regulation of a compressor stage or condensing stage.

Further functions
- Regulation of condensing pressure as a function of outdoor temperature
- Internal day/night clock
- Possibility of heat recovery or liquid injection in suction line
- Connection of display to show selected operating parameters
- Possibility of connecting external energy monitoring equipment so that the maximum coupled compressor capacity can be limited

Application example



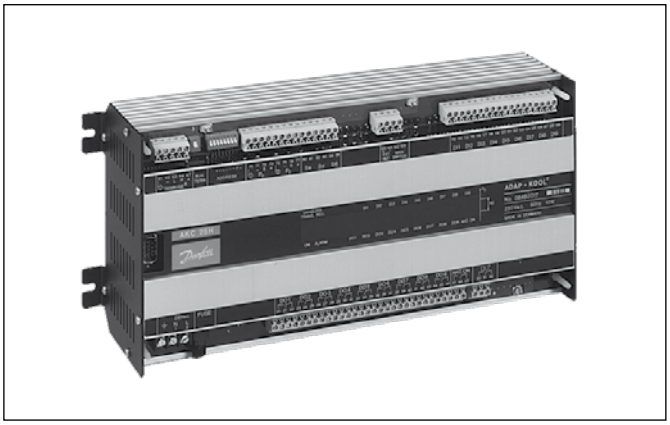
Additional information!
Technical brochure: RC1J4
Function description: RC1J5

Water chiller control

AKC 25H7

AKC 25H7 is a complete brine cooler control unit that has been developed for indirect refrigerating systems in supermarkets.

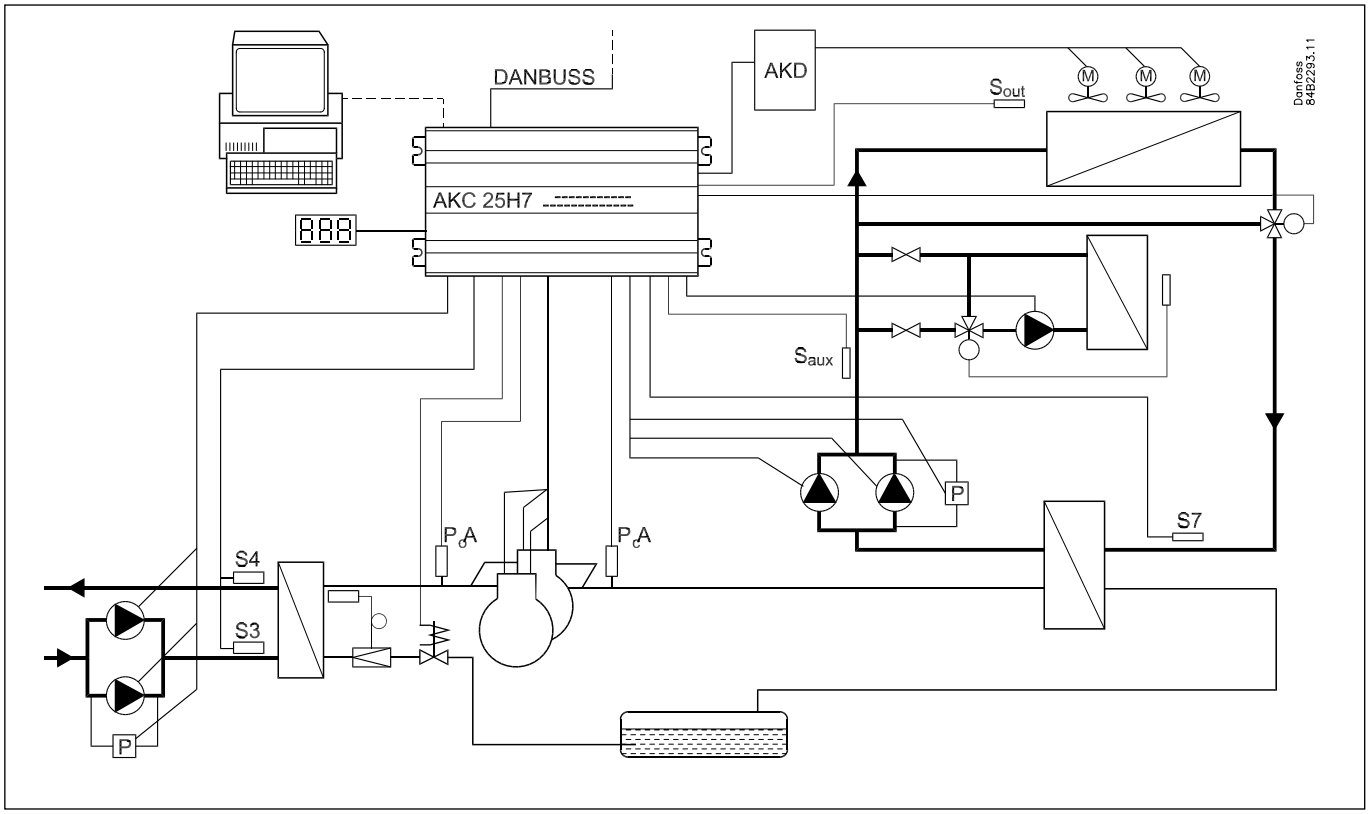
The controller's main function is to control compressors and condensers in such a way that the required brine temperature is maintained on the cold and warm side of the compressor system.



The controller contains all the functions required for the control of a brine cooler:

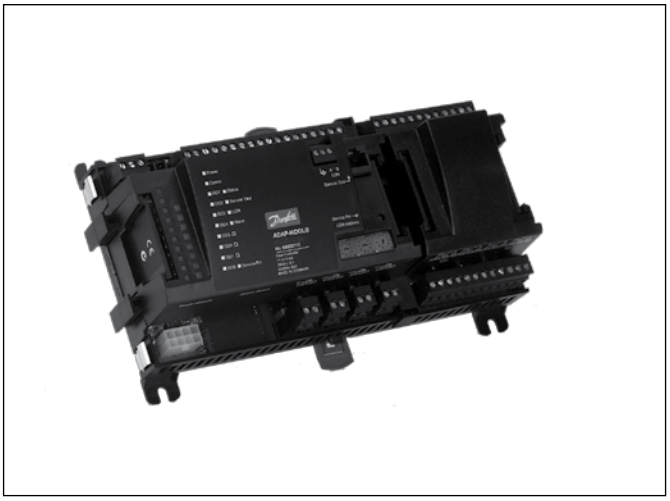
- The cold brine temperature can be controlled according to the shop temperature or the enthalpy
- Day/night programmes for the temperature reference (economy control)
- Alarm limits and delays on forward and return flow temperatures
- Capacity control and monitoring of compressors distributed on one or two groups
- Sequential control or time equalisation of compressors
- Frost cutout for monitoring of suction pressure P0
- Peak load limitation via external signal
- Central defrost control or weekly programme (stop based on temperature or time)
- Signal given when injection is permitted
- Control and monitoring of single pump or twin pump on cold and warm brine
- Built-in rotation between twin pumps
- Automatic pump change when pump is defective
- Control and monitoring of air-cooled or brine-cooled condenser
- Condenser can be controlled based on pressure (Pc) or warm brine temperature (S7)
- Monitoring of max. condensing pressure
- Step regulation or speed regulation of fans
- Condensing pressure can be controlled according to outdoor temperature and an external voltage signal
- Control of heat recovery temperature with built-in safeguard against too low condensing pressure
- Heat recovery temperature can be controlled according to outdoor temperature and an external voltage signal
- Monitoring of the compressors' safety circuit can be supplemented with alarm module type AKC 22H

Application example



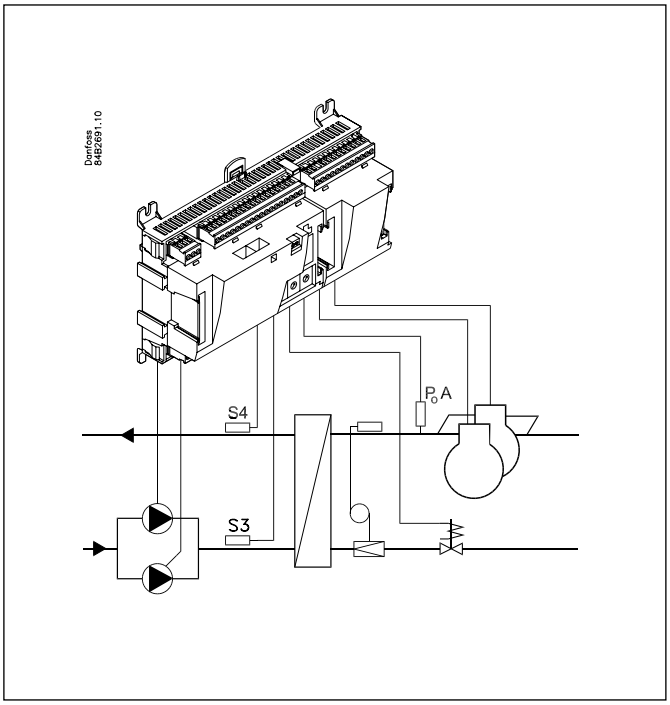
Additional information!
Function description: RC1NP

AK-CH 650



Application
AK-CH 650 is for capacity control of chillers.
The controller can control compressors, fans, pumps, defrosting sequences and start/stop injection in a heat exchanger.
(If complete dry refrigeration control is required including a three-way valve for the condenser, AK-PC 420 is recommended.)

Advantages
- Optimisation of charge temperature from the refrigeration area which is used most
- Optimisation of condenser in relation to ambient temperature
- Flexible hardware platform with extension modules
- Fast set-up using pre-defined set-ups.



Control
- Compressor capacity is controlled via the charge temperature S4. The reference can either be over-ridden via day/night signal, an external 0-10 V signal, temperature signal or optimised automatically from the refrigeration area which is used most
- Fan capacity is controlled either via the condensing pressure Pc or a media temperature S7 (dry refrigeration). The reference can be optimised via ambient temperature and changed during heat recovery.
- The Ss and Sd sensors are used for monitoring of overheating of the suction pipe and pressure pipe temperature respectively.

Additional functions
- Control of up to 6 compressors
- Compressors of the same or different size
- Speed control of one or two compressors
- Equalising of operating time between compressors
- Anti-cycle timers for each compressor
- Up to 6 safety inputs per compressor
- Capacity limit of compressors via 2 digital inputs
- Step or speed control of up to 8 fans
- Monitoring of fans
- Signal for start/stop of injection in heat exchangers
- Control and monitoring of 2 twin pumps. Automatic rotation
- Defrost control according to internal schedule, digital input or network signal
- Defrost stop according to temperature and/or time
- Alarm monitoring of low suction pressure P0 (frost protection), high condensing pressure and high brine temperature.
- Monitoring of external frost protection
- 5 digital inputs for alarm monitoring
- 5 thermostats and pressure switches for monitoring/control
- 5 voltage inputs 0-10 V d.c. for signal monitoring

Example

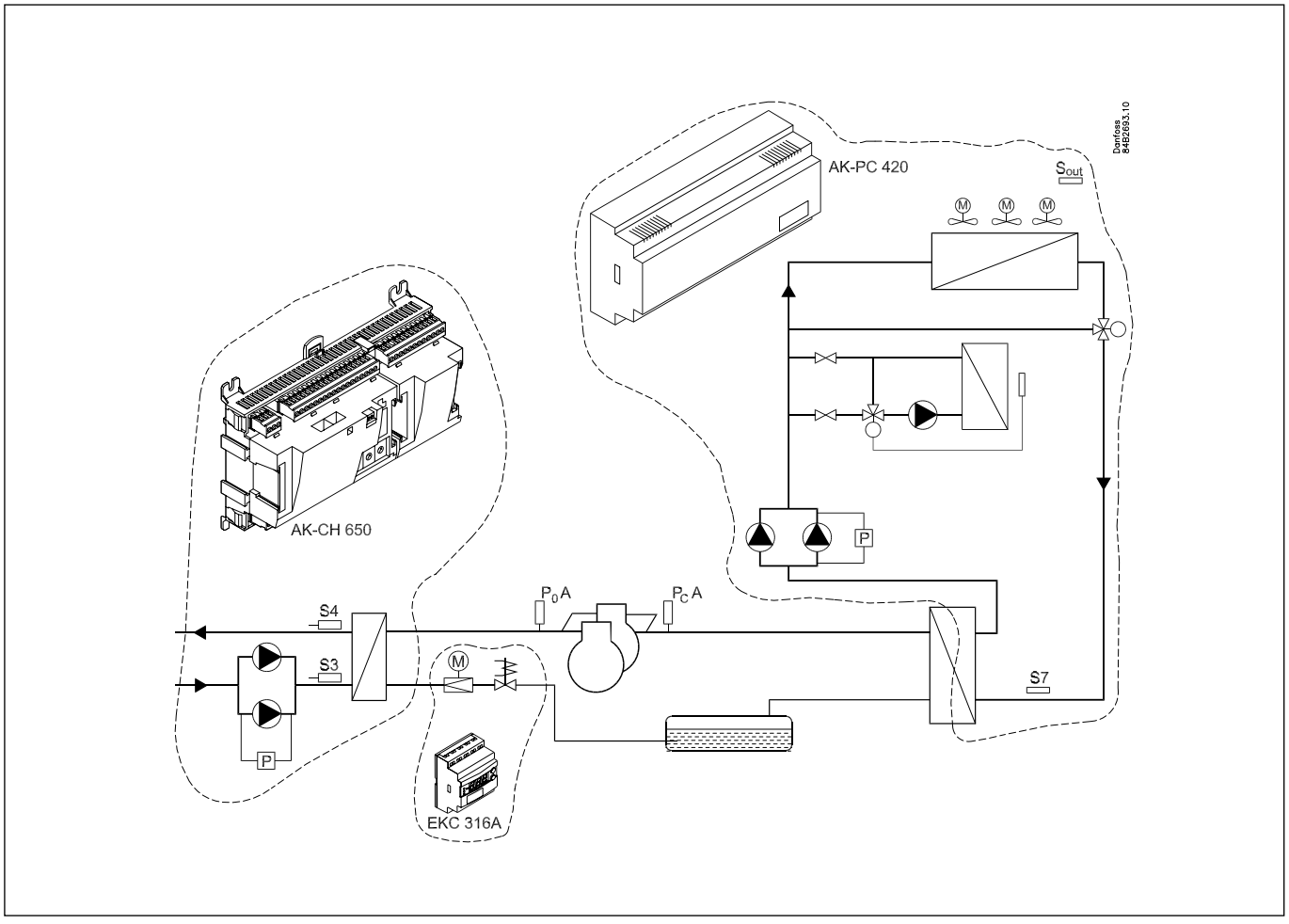
Compressors
Compressor capacity is controlled by charge temperature S4 and by suction pressure P0 as frost protection.
Three compressors are used with speed control on the first compressor. Pc is used for high pressure monitoring.

Pumps
Two twin pumps controlled by time-based rotation. The pumps are monitored by a pressure difference pressure switch. If pump errors occur, automatic switch to the other pump takes place.

Defrosting
For defrosting the compressors are stopped and the connected refrigeration areas are defrosted by circulation of brine. Defrosting is stopped at S3 temperature with subsequent drip off delay before the compressors are restarted.

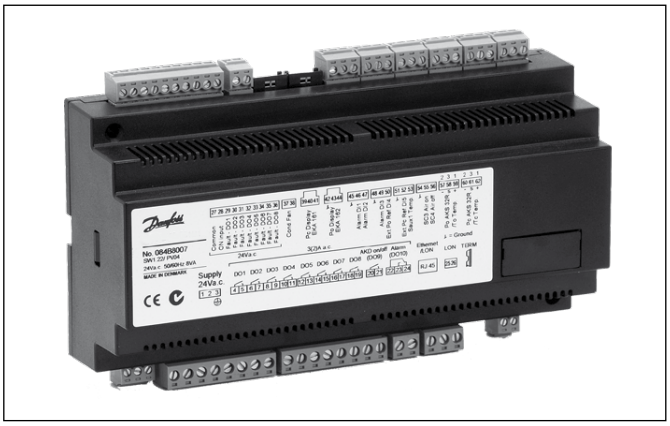
Condenser/dry cooler
AK-PC 420 is used for:
- Fan speed control
- Three-way valve control
- Pump control
- Heat recovery control
- Capacity control from signal from condensing pressure Pc.

Injection
EKC 316A is used for optimum control of superheat.
The valve is an expansion valve with a step motor.



Additional information!
Manual: RS8ER

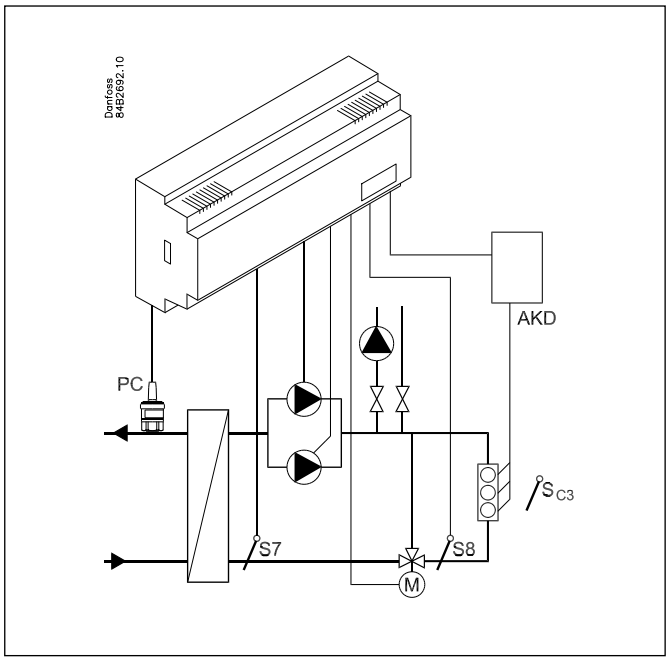
AK-PC 420



Application
AK-PC 420 is a complete capacity control of a dry cooler including fans, three-way valve, pumps and heat recovery.

Advantages
- Complete capacity control of dry cooler
- Option of choosing control sensor (S7/Pc and/or S8)
- Control according to one loop or two loop principles for optimum operation on all system types
- Fan speed control
- Fan connection according to sequential or rotational operation
- Reference according to ambient temperature

Control
- Capacity control according to condensing pressure Pc or brine return temperature S7.
- Reference temperature according to fixed settings with option of overriding via ambient temperature or external 0-10 V signal. Separate reference for heat recovery.
- For one-loop control a capacity adjustment of the three-way valve and fans is carried out via Pc or S7.
- For two-loop control individual capacity adjustment of the two circuits is carried out: three-way valve via Pc/S7 and fans via S8. This ensures that even difficult systems with long tubes can be handled optimally.



Additional information!
Manual: RS8EL

Functions
- Control and monitoring of max. 6 fans via step or speed control
- Sequential or rotational fan operation
- Three-way valve control
- Over-riding of reference temperature via ambient temperature Sc3 or 0-5 V d.c. signal
- Separate reference temperature for heat recovery with overriding via 0-5 V d.c. signal
- Input for start and outlet for activation of heat recovery
- Control and monitoring of two twin pumps with rotational operation
- Safety function for high condensing pressure
- Alarm relay
- External control start/stop

Operation
All operation takes place either via data communication or by connection of a display of the type EKA 164. Extra readout via display of the type EKA 163.

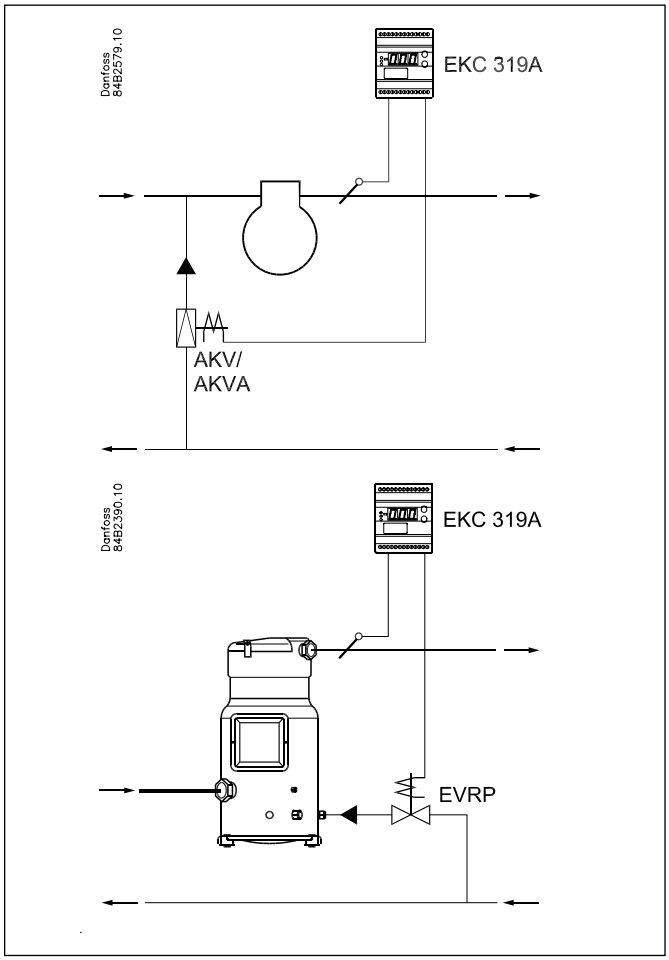
Liquid injection in the suction line

EKC 319A

Application
The controller limits the pressure gas temperature in compressors by opening up for liquid injection in the suction line.

Control
A temperature sensor will register the discharge gas temperature. If the temperature reaches the set temperature value, opening of the valve will be commenced.
A PI regulation will adapt the opening degree of the valve so that the temperature will be limited.

Temperature sensor
Type AKS 21 can be used. It can stand the high temperature.



Valve
If the liquid injection is carried out directly in the suction line an expansion valve type AKV, or a type AKVA (for NH_3), is used. The capacity requirement is determined by the size of the valve. If the compressor is provided with a connection for liquid injection a pulse solenoid valve type EVRP is used in the liquid supply.

Alarm function
The controller will sound an alarm if the set alarm limit is exceeded.
The alarm will activate the alarm relay.

Menu survey

SW = 1.1x

Function	Parameter	Min.	Max.	Fac. setting
Normal display				
Read the measured discharge gas temperature	-		°C	
If you wish to see the actual opening degree, give the lower button a brief push	-		%	
If you wish to set the temperature reference you obtain access by pushing both buttons simultaneously	-	-70°C	160°C	125
Display/Control				
Select unit (0=°C, 1=°F)	r05	0	1	0
Start/stop of regulation	r12	OFF	ON/on	on
Alarm				
Alarm limit	A16	-50°C	150°C	135
Time delay for alarm	A17	0 s	999 s	0
Function of the alarm relay when the temperature exceed the alarm limit 0: Alarm relay active 1: Alarm relay not active	A19	0	1	1
Regulating parameters				
Proportionale factor Kp	n04	0,5	30	15
I: Integration time Tn	n05	60 s	600 s/Off	120
Periode time	n13	3 s	10 s	3
Miscellaneous				
Controller's address	o03*	0	119	-
ON/OFF switch (service-pin message)	o04*	OFF	ON	-
Set supply voltage frequency	o12	0/50 Hz	1/60 Hz	50
Select the showing of the "normal display": 0: Discharge gas temperature is shown 1: Valve's opening degree is shown	o17	0	1	0
Manual control of outputs: OFF: No manual control 1: Valve output put in pos. ON 2: Alarm relay activated (cut out)	o18	OFF	2	off
Service				
Read discharge gas temperature	u01		°C	
Read temperature reference	u02		°C	
Read status of input DI	u10			
Read valve's opening degree	u24		%	

*) This setting will only be possible if a data communication module has been installed in the controller.

Factory setting
If you need to return to the factory-set values, it can be done in this way:
- Cut out the supply voltage to the controller
- Keep both buttons depressed at the same time as you reconnect the supply voltage

Ordering

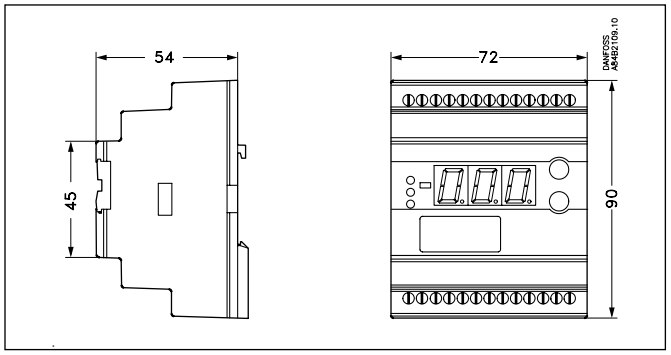
Type	Function	Ordering
EKC 319A	Temperature controller	**084B7251**
EKA 175	Data communication module (accessories), (RS 485 modul)	**084B7093**

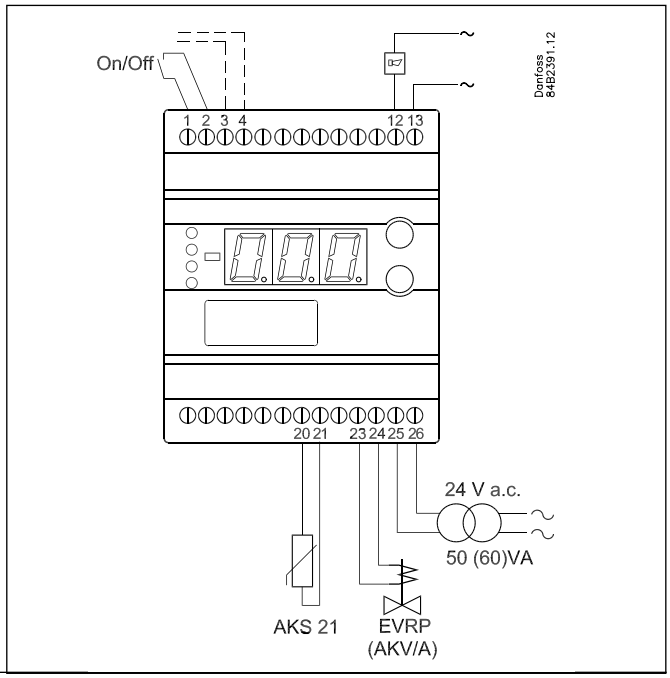
The installation of data communications must comply with the requirements described in literature sheet no. RC8AC

Additional information!
Manual: RS8EB

Data

Supply voltage	24 V a.c. +/-15% 50/60 Hz, 60 VA (the supply voltage is galvanically separated from the input and output signals. Input/output are not individual galvanic isolated)	
Power consumption	Controller 20 W coil for AKV/A Coil for EVRP	5 VA 55 VA 40 VA
Input signal	Temperature sensor	Pt 1000 ohm/0°C
	Contact function start/stop of regulation	
Alarm relay	SPST	AC-1: 4 A (ohmic) AC-15: 3 A (inductive)
Valve connection	AKV, AKVA or EVRP via 24 a.c. Pulse-Width Modulating output	
Data communication	Possible to connect a data communication module	
Environments	0 - 55°C, during operation -40 - 70°C, during transport	
	20 - 80% Rh, not condensed	
	No shock influence/vibrations	
Enclosure	IP 20	
Weight	300 g	
Montage	DIN Rail	
Display	LED, 3-digits	
Terminals	max. 2.5 mm² multicore	
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 EN50081-1 and EN 50082-2	





Speed control of compressor and condenser

Introduction

AKD-Variable Speed Drives are engineered to optimize performance in your refrigeration system and as a part of ADAP-KOOL® system are dedicated to the following refrigeration applications:

- Pack or Compressor Control
- Pumps
- HVAC (Centrifugal fans and pumps)
- Condensers

AKD-Variable Speed Drives offer a variety of benefits in the refrigeration systems:

Energy savings
The continuous variable speed control by AKD makes intelligent capacity control possible. It creates stability while balancing the capacity to the actual load, resulting in improved system COP and significant energy savings. Intelligent compressor and condenser fan control is a "must" in any optimised refrigeration system.

Improved control and product quality
Stabilizing and optimising pressures result in less ice formation on evaporators producing optimal airflow, air temperature and reduced temperature "pull-down" resulting in improved product quality. A stabilized condensing pressure will result in less migration of refrigerant thereby reducing the amount of refrigerant needed in the system.

Noise reduction in many ways
AKD variable speed technology reduces the acoustic noise level of condenser fan motors significantly.
AKD also protects the environment against electrical noise by having an excellent RFI filter in accordance with international standards (EN 55011 class 1A or1B).

Longer lifetime
Continuous control with AKD reduces the total number of start/stops required, as well as the mechanical wear of rotating components.

Easy to install and use
AKD eliminates the need for special starting equipment due to the inherent built-in current reduction. It offers motor protection against overload and high temperature conditions and has built-in crank case heater function. It is easy to integrate the AKD into your facility due to the time saving, user-friendly set-up and installation procedures. In addition, the built-in PI controller provides direct control of specific applications.

ADAP-KOOL® system integration
Thanks to LON module for data communication AKD-Variable Speed Drives are easily integrated into ADAP-KOOL® system making possible:
- Monitoring of the energy consumption
- Alarm monitoring and alarming
- Monitoring of actual capacity of pumps, compressors and fans
- Remote access to data via modem/gateway
- Remote commissioning through up/download of parameter files, significantly simplifying the installation

AKD can be easily applied with the standard EKC 531 and AK-PC Pack controller for infinitely variable speed control and energy optimisation of Condenser fans and/or Compressors, matching required capacity to load variations.
In HVAC applications around the refrigeration system, they can be applied to AHU fans and circulation pumps, maximising energy savings and improving system efficiency.

AKD 2800

AKD 2800 is a frequency converter for use in refrigeration system in book form design and with local control panel. It has an IP 20 enclosure and is available in versions with or without RFI filter. (Please note that Danfoss recommend that for Food Retail applications the drive is always purchased complete with the RFI filter.)
A LON module for data communication with ADAP-KOOL® is available as accessory - see section "AKD Variable Speed Drives, accessories and spare parts".
For single phase versions, please contact Danfoss.

AKD 2800 Variable Speed Drives 220-240 V
AKD 2800 Serie 220-240V is available from 0.37 kW to 3.7 kW.

AKD 2800 Variable Speed Drives 380-440 V
AKD 2800 Serie 380-440V is available from 0.55 kW to 18.5 kW.
In the table only types with RFI filter are listed.
A LON module for data communication with ADAP-KOOL® is available as accessory - see section "AKD Variable Speed Drives, accessories and spare parts".

Type	Rated Power [kW]	Output. current 160% cont. For condenser fan, HVAC and compresor applications	Weight	Code No.
AKD 2805	0.55 kW	1.7 A	3.00	175B4538
AKD 2807	0.75 kW	2.1 A	3.10	175B4539
AKD 2811	1.1 k W	3 A	3.10	175B4540
AKD 2815	1.5 kW	3.7 A	3.10	175B4541
AKD 2822	2.2 kW	5.2 A	4.20	175B4542
AKD 2830	3 kW	7 A	4.20	175B4543
AKD 2840	4 kW	9.1 A	4.30	175B4544
AKD 2855	5.5 kW	12 A	6.50	175B4545
AKD 2875	7.5 kW	16 A	6.50	175B4546
AKD 2880	11 kW	24 A	18.50	175B4547
AKD 2881	15 kW	32 A	18.50	175B4548
AKD 2882	18.5 KW	37.5 A	18.50	175B4549

AKD 5000

AKD 5000 is a frequency converter for use in refrigeration systems in compact cabinet design, with a local control panel. It is available in versions with IP 20 or IP 54 enclosure and is available in versions with RFI filter.

Variable Speed Drives, 220-240 V
AKD 5000 Series 220-240 V is available from 0.75 kW to 75 kW.

ADAP-KOOL® LON module
For AKD 5000 versions supplied without LON module an optional module is available - see section "AKD Variable Speed Drives, accessories and spare parts".
For other versions and configurations, please contact Danfoss.

Variable Speed Drives 380-440 V
AKD 5000 Series 380-440 V is available from 0.75 kW to 75 kW.

ADAP-KOOL® LON module
AKD 5000 with build in LON module is available.
For AKD 5000 versions supplied without LON module an optional module is available - see section "AKD Variable Speed Drives, accessories and spare parts".
For other versions and configurations, please contact Danfoss.

Type	Rated Power [kW]	Outp. curr. 160% cont. Compressor Application	Output. curr. 110% cont. condenser fan or HVAC fan/pump applications	RFI filter	Weight [Kg]	Encl.	Code No.	
							Incl. RFI	Incl. RFI Incl. LON *
AKD 5001	0.75 kW	2.2 A	2.2 A	Class 1B	8.20	IP 20	178B4648	178B4663
					12.60	IP 54	178B4706	178B4721
AKD 5002	1.1 kW	2.8 A	2.8 A		9.00	IP 20	178B4649	178B4664
					13.30	IP 54	178B4707	178B4722
AKD 5003	1.5 kW	4.1 A	4.1 A		9.00	IP 20	178B4650	178B4665
					13.40	IP 54	178B4708	178B4723
AKD 5004	2.2 kW	5.6 A	5.6 A		9.00	IP 20	178B4651	178B4666
					13.80	IP 54	178B4709	178B4724
AKD 5005	3 kW	7.2 A	7.2 A		9.40	IP 20	178B4652	178B4667
					12.30	IP 54	178B4710	178B4725
AKD 5006	4 kW	10 A	10 A		11.10	IP 20	178B4653	178B4668
					14.00	IP 54	178B4711	178B4726
AKD 5008	5.5 kW	13 A	13 A		11.20	IP 20	178B4655	178B4669
					14.00	IP 54	178B4712	178B4727
AKD 5011	7.5 kW	16 A	16 A	Class 1A	11.80	IP 20	178B4654	178B4670
					16.50	IP 54	178B4713	178B4728
AKD 5016	11 kW	24 A	32 A	Class 1B	24.00	IP 20	178B4656	178B4671
					45.90	IP 54	178B4714	178B4729
AKD 5022	15 kW	32 A	37.5 A		25.70	IP 20	178B4657	178B4672
					44.20	IP 54	178B4715	178B4730
AKD 5027	18.5 kW	37.5 A	44 A		29.20	IP 20	178B4658	178B4673
					45.60	IP 54	178B4716	178B4731
AKD 5032	22 kW	44 A	61 A		31.00	IP 20	178B4659	178B4674
					56.90	IP 54	178B4717	178B4732
AKD 5042	30 kW	61 A	73 A		43.30	IP 20	178B4660	178B4676
					60.10	IP 54	178B4718	178B4733
AKD 5052	37 kW	73 A	90 A		46.10	IP 20	178B4661	178B4677
					61.90	IP 54	178B4719	178B4734
AKD 5062	45 kW	90 A	106 A		45.00	IP 20	178B4662	178B4678
					45.00	IP 54	178B4720	178B4735
AKD 5072	55 kW	106 A	147 A	Class B	50.00	IP 54	178B7377	178B7378
AKD 5102	75 kW	147 A	177 A		50.00	IP 20	178B7117	178B7381
					50.00	IP 54	178B7379	178B4362

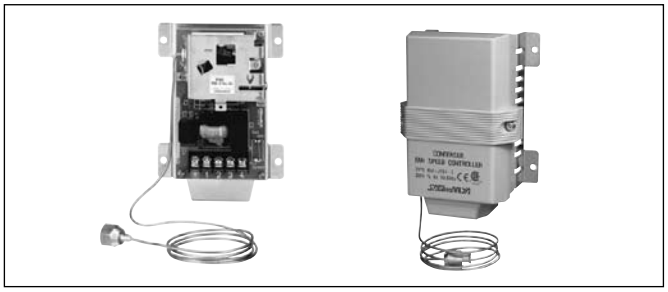
*) With LON module for ADAP-KOOL® data communication

Accessories for AKD

Type	Code No.	Description
Terminal cover	195N1900	AKD 2803-2815, 200-240 V, AKD 2805-2815, 380-480 V
	195N1901	AKD 2822-2840, 200-240 V, AKD 2822-2840, 380-480 V
	195N1902	AKD 2840, 200-240 V, AKD 2855-2875, 380-480 V
Top cover IP 21	195N2179	AKD 2803-2815, 200-240 V, AKD 2805-2815, 380-480 V
	195N2180	AKD 2822, 200-240 V, AKD 2822-2840, 380-480 V
	195N2181	AKD 2840, 200-240 V, AKD 2855-2875, 380-480 V
	195N2182	AKD 2880-2882, 380-480 V
Filter modul	195N3103	VLT 2803-2875
LON Interface	195N2100	AKD 2800 series
	175Z4362	AKD 5000 series

RGE

RGE, Variable Speed Control, is used for fan speed control, and is available in single and three phase versions. RGE is a simple and efficient all-in-one pressure sensor and fan speed control, featuring a reliable sensing mechanism using bellows. RGE is easy to install and set up, and can be used for a large number of refrigerants: R 22, R 407C, R 404A, R 134a and R 410A. RGE is CE/EMC approved.



Type	Code No.	Refrigerants	Motor rating [A]	Voltage [V]	No. of phases	Current [A]	Adj. range [bar]	P-band [bar]	Factory setting [bar]
RGE-Z3T4-7DS	061H3050	R22/R404A/ R407C	0.2-7 A	200-240	3	7 A	116-406 psig/ 8-28 bar	4 bar	16 bar
RGE-X3R4-7DS	061H3006	R22/R404A/ R407C	0.2-5 A	380-415	3	5 A	116-406 psig/ 8-28 bar	4 bar	16 bar
RGE-Z1N4-5H	061H3013	R407C/R404A/ R134a/R22	0.2-2 A	200-240	1	2 A	116-406 psig/ 8-28 bar	4 bar	19 bar
RGE-Z1L4-7DS	061H3045	R407C/ R404A/ R134a/R22	0.2-2 A	200-240	1	2 A	116-406 psig/ 8-28 bar	6 bar	19 bar
RGE-Z1N4-7DS	061H3005	R407C/ R404A/ R134a/R22	0.2-4 A	200-240	1	4 A	116-406 psig/ 8-28 bar	4 bar	19 bar
RGE-Z3R4-7DS	061H3003	R407C/ R404A/ R134a/R22	0.2-5 A	200-240	3	5 A	116-406 psig/ 8-28 bar	4 bar	16 bar
RGE-Z1P4-7DS	061H3008	R407C/ R404A/ R134a/R22	0.2-6 A	200-240	1	6 A	116-406 psig/ 8-28 bar	4 bar	19 bar
RGE-Z1Q4-7DS	061H3009	R407C/ R404A/ R134a/R22	0.2-8 A	200-240	1	8 A	116-406 psig/ 8-28 bar	4 bar	19 bar
RGE-Z1L6-7DS	061H3048	R410A	0.2-2 A	200-240	1	2 A	16-39 bar/232-566 psig	9 bar	32 bar
RGE-Z1N6-7DS	061H3021	R410A	0.2-4 A	200-240	1	4 A	16-39 bar/232-566 psig	8 bar	32 bar
RGE-Z3R6-7DS	061H3027	R410A	0.2-5 A	200-240	3	5 A	16-39 bar/232-566 psig	8 bar	32 bar
RGE-Z1P6-7DS	061H3022	R410A	0.2-6 A	200-240	1	6 A	16-39 bar/232-566 psig	8 bar	32 bar
RGE-Z3T6-7DS	061H3051	R410A	0.2-7 A	200-240	3	7 A	16-39 bar/232-566 psig	8 bar	32 bar
RGE-Z1Q6-7DS	061H3023	R410A	0.2-8 A	200-240	1	8 A	16-39 bar/232-566 psig	8 bar	32 bar
RGE-X3R6-7DS	061H3028	R410A	0.2-5 A	380-415	3	5 A	16-39 bar/232-566 psig	8 bar	32 bar

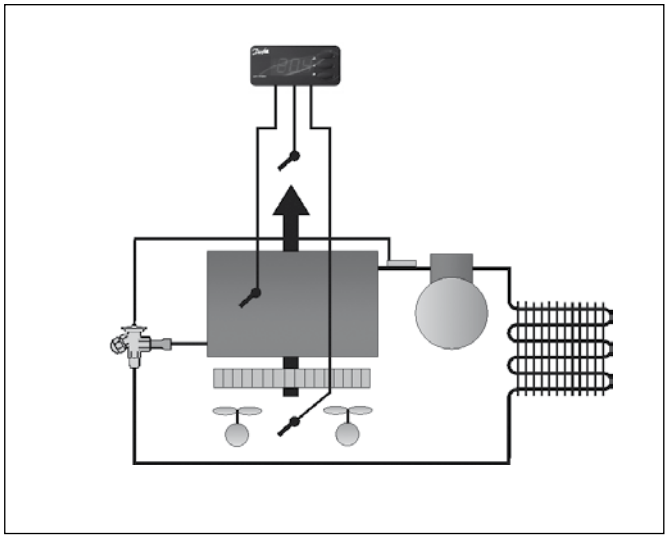
Evaporator controls and thermostatic expansion valves

Introduction

Thermostatic expansion valves are used in traditional refrigeration systems and refrigeration appliances with limited possibility of energy savings where injection of refrigerant liquid into evaporator is controlled by the refrigerant superheat. Therefore, thermostatic expansion valves are especially suitable for liquid injection in "dry" evaporators where the superheat at the evaporator outlet is proportional to the evaporator load.

The evaporator controls for regulating refrigeration appliances with thermostatic expansion valves or compressor are capable of regulating different types of functions in order to fulfil any evaporator control demand. The controls have functions for regulating/monitoring temperature, defrosting, doors, rail heating, light and fan operation.

With remote communication as a part of ADAP-KOOL® refrigeration control system, evaporator controls comprise monitoring and control of display cases and cold rooms including alarm monitoring improving performance of refrigeration system.



EKC controllers 102, 202 and AK-CC 210 improve operation routines with cost optimised design for most common applications

Characteristic of the EKC controllers 102, 202 and AK-CC 210 is easy panel installation due to the integrated mounting brackets. The controllers have high-effect 16A relays which enable direct connection of heavy loads, such as compressor or defrost. Also, all the controllers have built-in 230 V a.c. supply and supports different types of sensors (Pt 1000, NTC and PTC).

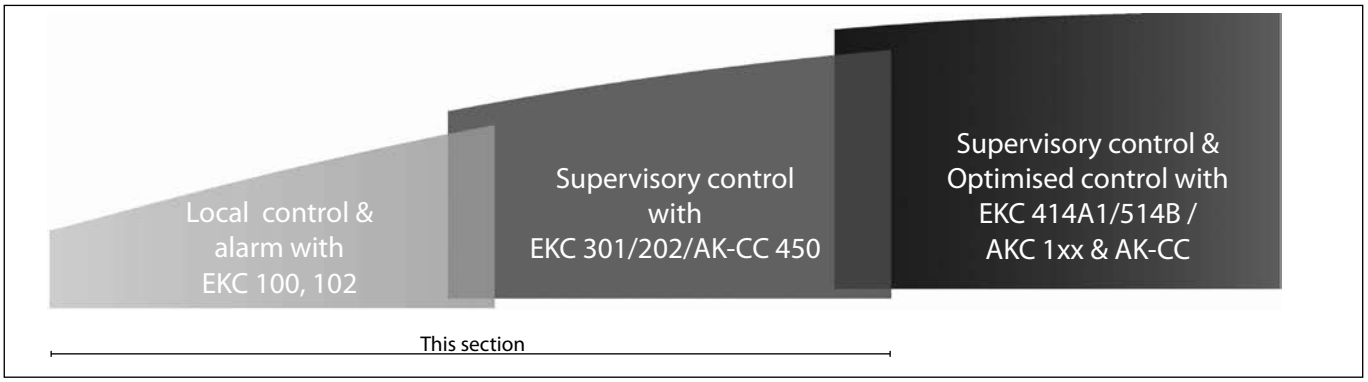
The controllers have enhanced life-time and reliability thanks to IP 65 rating, so no water spray can damage it. Copy key with room for 25 controller setups ensures a fast and easy programming.

Factory calibration ensures that the measuring accuracy of controllers in combination with a Pt 1000 sensor is better than required in EN 441-13 without any subsequent calibration ensuring compliance with HACCP.

EKC 301 as DIN-rail mounting controller is designed for room temperature control via pump down or compressor start/stop. EKC 301 is controlling compressor, fan, defrost and alarm and it replaces several traditional controllers and defrost clocks due optional Real time clock module.

There are other controllers like AKC 121 which are used in applications where TEV-valves are used but additional hardware or functions are required. The controls are capable of regulating one or more evaporators, depending on the type of controls. The controls are capable of regulating simultaneously temperature, defrosting, door frame, rail heat, light and fan.

ADAP-KOOL® evaporator controllers offer three levels of control for different application demands.



Comparison of controls in this section

Temperature control of refrigeration appliances and cold storage rooms

Type	EKC 100	EKC 102A	EKC 102B		EKC 102C		EKC 102D		EKC 202A		EKC 202B	EKC 202C	EKC 202D	AK-CC 210	AK-CC 450	EKC 301
Relays	1	1	2		2		3		2		3	4	4	4	6	4
Compressor/ Valve, Amp:	10 (SPST)	10	10	10	10	10	10		10	10	10	10	10	10	½	6
Defrost, Amp:					10		10		4		10	10	10	10	4	6
Fan, Amp:							6				6	6	6	6	4	6
Alarm/Light/Aux/, Amp:				10		10				4		4	4	4	4	4
Second compressor, Amp:			10												4	
Analogue inputs		1	2	2	2	2	2		2	2	2	2	3	3	6	2
Digital inputs			1	1	1	1	1		1	1	1	1	2	2	3	1
Pt 1000 sensor		YES														
PTC and NTC Sensor	NTC	YES														
Copy key as option		YES														
Data communication as option									YES							
Real time clock									YES							
HACCP compliance via system									YES							
HACCP function														YES		
Application selection switch													YES	YES		
Weighted sensor output													YES	YES		
Coordinated defrost													YES	YES		
Coordinated defrost via system									YES							

Current specifications and relay sizes:
10 = 10 (6) A. The relay is a 16 A relay.
6 = 6 (3) A. The relay is a 8 A relay.
4 = 4 (1) A. The relay is a 8 A relay.
PCB paths and derating mean that the specified values may not be exceeded.

Temperature control with high accuracy

Type	EKC 361	EKC 368
Code No.	084B7060	084B7079
Application	Cold storage rooms for e.g. fruit Work areas in the food industry	Delicatessen appliances Cold storage rooms for meat product

EKC 100

Introduction
The controller is used for temperature control of refrigeration plant.

Operation, setting and programming are optimised and simplified as much as possible.

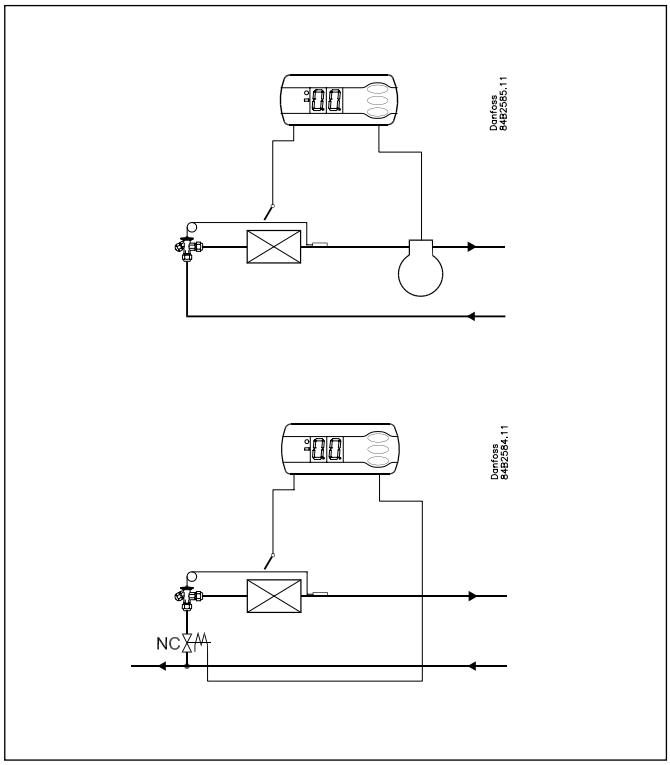
The controller is designed so that temperature control and defrost control can be made via pump down or start/stop of the compressor.

Menu survey

SW = 1.1X

Parameter		Min. value	Max. value	Factory setting
Function	**Code**			
Normal operation				
Temperature (set point)	---	-60°C	50°C	0°C
Thermostat				
Differential	r1	1 K	20 K	2 K
Display adjust	r4	-20 K	20 K	0 K
Compressor				
Min. ON-time	c1	0 min.	30 min.	0 min.
Min. OFF-time	c2	0 min.	30 min.	0 min.
Defrost				
Defrost stop temperature	d2	0°C	25°C/off	25°C/off
Interval between defrost starts	d3	0 hours	48 hours	8 hours
Max. defrost duration	d4	0 min.	99 min.	45 min.
Displacement of time on cutin of defrost at start-up	d5	0 min.	15 min.	0 min.
Miscellaneous				
Delay of output sigal after start-up	o1	0 min.	15 min.	0 min.
Fault code				
Sensor error	Er			

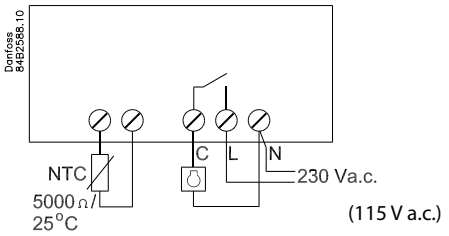
Regulation starts when the voltage is on.



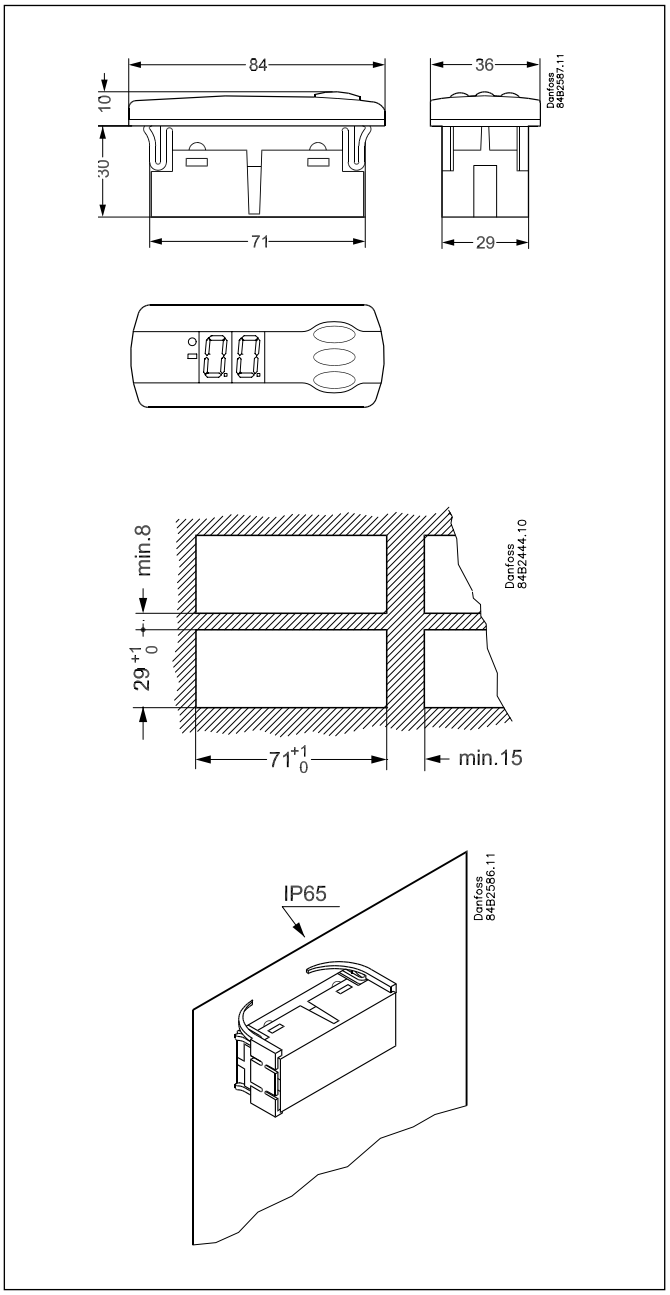
Technical data

Supply voltage	230 V a.c. +10/-15 %. 0.5 VA		
Sensor connection	NTC 5000 ohm/25°C. e.g. type EKS 211		
Accuracy	Measuring range	-60 to +50°C	
	Controller	±1 K below -0°C ±0.5 K between -0 to +10°C ±1 K above +10°C	
	NTC sensor	±0.5 K at 0°C	
Display	LED, 2 digits		
Light-emitting diode (LED)	Indicates cut-in relay		
Electrical connection cable	Max.1,5 mm² multi-core cable on supply and relays. Max. 1 mm² on sensors Terminals are mounted on the circuit board		
Relay		CE	UL
	Rated voltage	250 V	240 V a.c.
	I	10 (6) A	10 A Resistive 5FLA 30LRA
	The relay is a 16 A relay, but conductor lanes and derating mean that 10 (6) A must not be exceeded		
Environments	0 - 55°C, during operation -40 - 70°C, during transport		
	20 - 80% Rh, not condensed		
	No shock influence/vibrations		
Enclosure	IP 20/IP 65 from front. Buttons are imbedded in the front.		
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. EN50082-1 and EN 60730-2-9, A2		

Electrical connection



NTC - temperature sensor type EKS 211:



Ordering

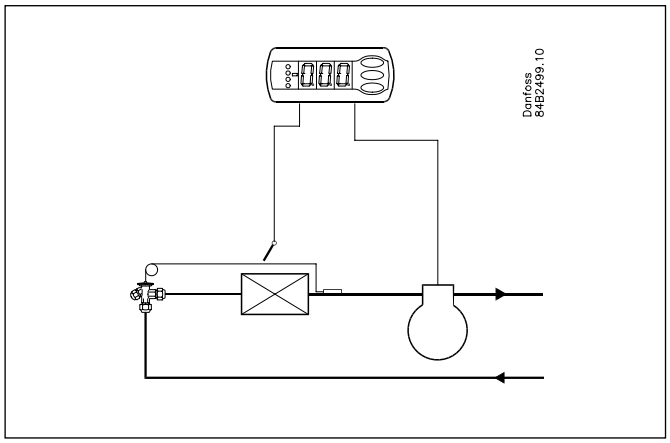
Type		Function	Voltage	Number	Code No.
EKC 100		Temperature controller	230 V	60 pcs	**084B8610**
			115 V	60 pcs	**084B8611**

Additional information!
Data sheet: RD8AZ

EKC 102

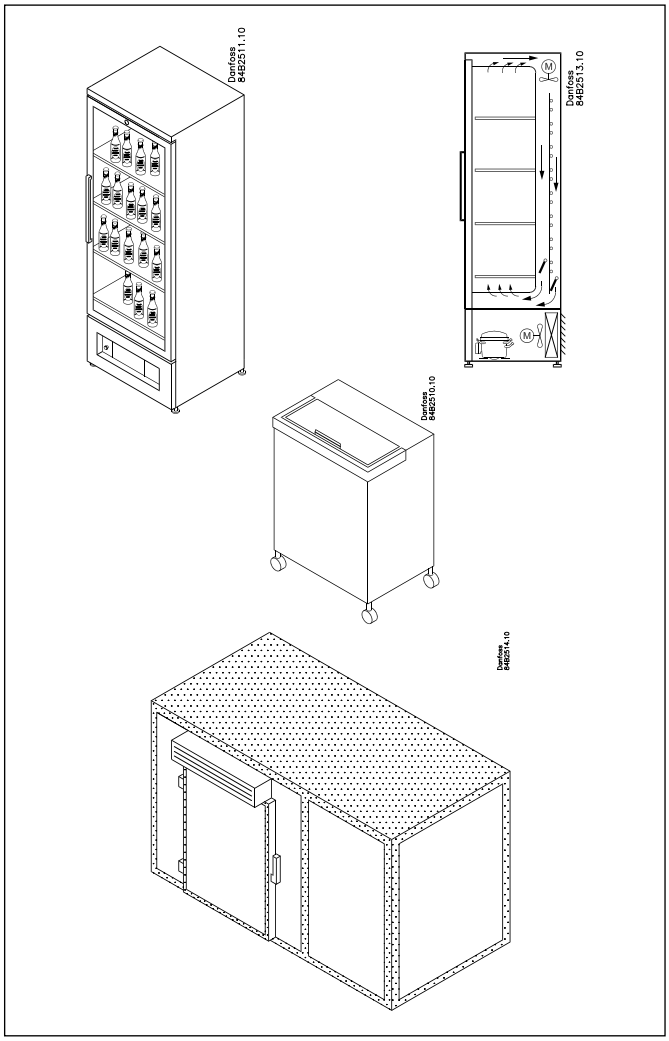
Application
- The controller is used for temperature control refrigeration appliances and cold room
- Defrost control
- For front panel mounting

Advantages
- Integrated refrigeration-technical functions
- Defrost on demand in 1:1 systems
- Buttons and seal imbedded in the front
- IP 65 enclosure from the front panel
- Can control two compressors
- Digital input for either:
  - Door alarm
  - Defrost start
  - Start/stop of regulation
  - Night operation
  - Change-over between two temperature reference
  - Case cleaning function
- Instant programming via programming key
- HACCP
  Factory calibration that will guarantee a better measuring accuracy than stated in the standard EN 441-13 without subsequent calibration (Pt 1000 ohm sensor)



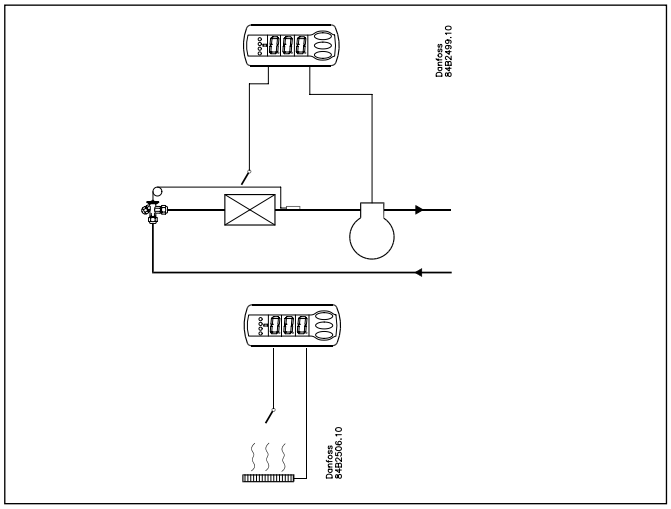
Control
The controller contains a temperature control where the signal can be received from one temperature sensor.
The sensor is placed in the cold air flow after the evaporator or in the warm air flow just before the evaporator.
The controller controls the defrost with either natural defrost or electric defrost. Renewed cutin after defrost can be accomplished based on time or temperature.
A measurement of the defrost temperature can be obtained directly through the use of an S5 sensor.
One, two or three relays will cut the required functions in and out – the application determines which:
- Refrigeration (compressor or solenoid valve)
- Defrost
- Alarm
- Refrigeration 2 (compressor 2)
- Fan

The different applications are described on next page.



The series
There are four controllers in the series:
A-model for simple regulation
B-model where an alarm function and possibly also a digital input will be required
C-model where the defrost temperature also enjoys top priority
D-model with fan function, change-over between temperature reference and case cleaning function

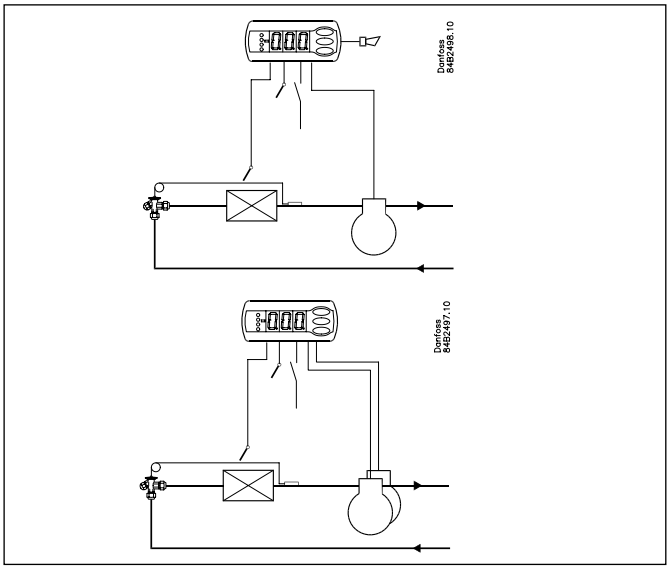
All these four controllers are **without** data communication.
If data communication or additional functions are required, we refer you to the EKC 202 or AK-CC 210 series.



EKC 102A
Controller with one relay output and one temperature sensor.

Temperature control at start/stop of compressor.
Natural defrost at stop of compressor.
Instead of the compressor a solenoid valve may of course be connected in the liquid line.

Heating function
The controller can also be used as a simple on/off thermostat for heating applications.

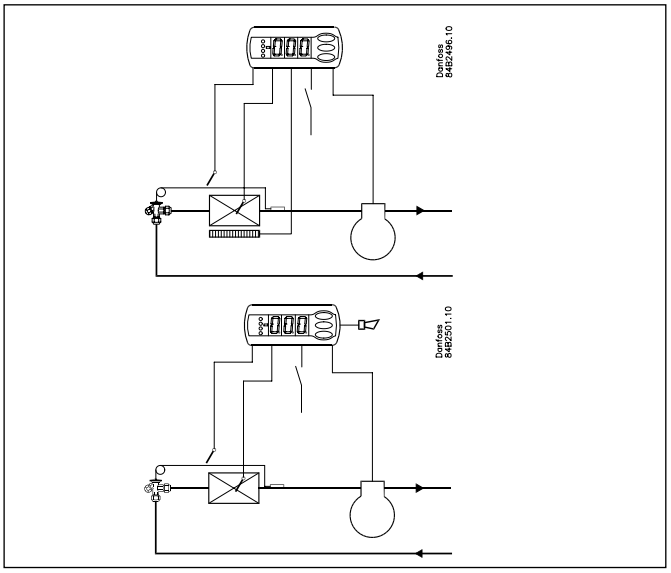


EKC 102B
Controller with two relay outputs, extra temperature sensor and digital input.

Relay output 2 can be used for alarm function or for cutin and cutout of a refrigeration step 2.

The extra temperature signal can be used for product sensor or for condenser sensor with alarm function.

The digital input can be used for door alarm, defrost start, start/stop of refrigeration or for night signal.

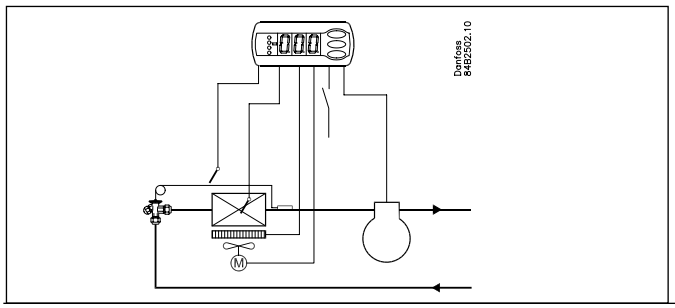


EKC 102C
Controller with two relay outputs, extra temperature sensor and digital input.

Relay output 2 can be used for electric defrost or for an alarm function.

Temperature signal 2 can be used for defrost stop based on temperature or for product sensor.
In a 1:1 sysem and with the sensor mounted on the evaporator the controller will be able to use the "defrost on demand" function. The function will start a defrost when the evaporator's refrigeration capacity drops due to icing-up.

The digital input can be used for door alarm, defrost start, start/stop of refrigeration or for night signal.



EKC 102D
Controller with three relay outputs, two temperature sensors and digital input.

Temperature control at start/stop of compressor/solenoid valve
Defrost sensor
Electrical defrost /gas defrost
Relay output 3 is used for control of fan.

Menu survey EKC 102A

SW = 1.1x

Parameters		Min.-value	Max.-value	Factory setting
Function	**Codes**			
Normal operation				
Temperature (set point)	---	-50°C	99°C	2°C
Thermostat				
Differential	r01	0,1 K	20 K	2 K
Max. limitation of setpoint setting	r02	-49°C	99°C	99°C
Min. limitation of setpoint setting	r03	-50°C	99°C	-50°C
Adjustment of temperature indication	r04	-20 K	20 K	0 K
Temperature unit (°C/°F)	r05	°C	°F	°C
Correction of the signal from Sair	r09	-10 K	10 K	0 K
Manual service (-1), stop regulation (0), start regulation (1)	r12	-1	1	1
Compressor				
Min. ON-time	c01	0 min	30 min	0 min
Min. OFF-time	c02	0 min	30 min	0 min
Compressor relay must cutin and out inversely (NC-function)	c30	OFF	On	OFF
Defrost				
Defrost method (0=none/1=natural)	d01	0	1	1
Defrost stop temperature	d02	0°C	25°C	6°C
Interval between defrost starts	d03	0 hours	48 hours	8 hours
Max. defrost duration	d04	0 min	180 min	45 min
Displacement of time on cutin of defrost at start-up	d05	0 min	240 min	0 min
Defrost sensor (0=time, 1=Sair)	d10	0	1	0
Defrost at start-up	d13	no	yes	no
Miscellaneous				
Delay of output signals after start-up	o01	0 s	600 s	5 s
Access code	o05	0	100	0
Used sensor type (Pt /PTC/NTC)	o06	Pt	ntc	Pt
Refrigeration or heat (rE=refrigeration, HE=heat)	o07	rE	HE	rE
Display step = 0.5 (normal 0.1 at Pt sensor)	o15	no	yes	no
Save the controllers present settings to the programming key. Select your own number.	o65	0	25	0
Load a set of settings from the programming key (previously saved via o65 function) (Can only be set when regulation is stopped (r12=0)	o66	0	25	0
Replace the controllers factory settings with the present settings	o67	OFF	On	OFF
Service				
Status on relay Can be controlled manually, but only when r12=-1	u58			

Regulation starts when the voltage is on.

Fault code display	
A45	Standby mode
Alarm code display	
E1	Fault in controller
E29	Sair sensor error
Status code display	
S0	Regulating
S2	ON-time Compressor
S3	OFF-time Compressor
S11	Refrigeration stopped by thermostat
S14	Defrost sequence. Defrosting
S20	Emergency cooling
S32	Delay of output at start-up
non	The defrost temperature cannot be displayed. There is no sensor
-d-	Defrost in progress/First cooling after defrost
PS	Password required. Set password

Factory setting
If you need to return to the factory-set values, it can be done in this way:
- Cut out the supply voltage to the controller
- Keep upper and lower button depressed at the same time as you reconnect the supply voltage

Menu survey EKC 102B and EKC 102C

SW = 1.1X

Parameters		EKC	EKC	Min.-	Max.-	Factory
Function	**Codes**	**102B**	**102C**	**value**	**value**	**setting**
Normal operation						
Temperature (set point)	---			-50°C	50°C	2°C
Thermostat						
Differential	r01			0,1 K	20 K	2 K
Max. limitation of setpoint setting	r02			-49°C	50°C	50°C
Min. limitation of setpoint setting	r03			-50°C	49°C	-50°C
Adjustment of temperature indication	r04			-20 K	20 K	0 K
Temperature unit (°C/°F)	r05			°C	°F	°C
Correction of the signal from Sair	r09			-10 K	10 K	0 K
Manual service, stop regulation, start regulation (-1, 0, 1)	r12			-1	1	1
Displacement of reference during night operation	r13			-10 K	10 K	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°C	50°C	8°C
Low alarm limit	A14			-50°C	50°C	-30°C
High alarm limit for condenser temperature (o69)	A37			0°C	99°C	50°C
Compressor						
Min. ON-time	c01			0 min	30 min	0 min
Min. OFF-time	c02			0 min	30 min	0 min
Time delay for cutin of comp.2	c05			0 sec	999 sec	5 sec
Compressor relay must cutin and out inversely (NC-function)	c30			OFF	On	OFF
Defrost						
Defrost method (0=none/1=natural)	d01		*	0	1	1
Defrost stop temperature	d02			0°C	25°C	6°C
Interval between defrost starts	d03			0 hours	48 hours	8 hours
Max. defrost duration	d04			0 min	180 min	45 min
Displacement of time on cutin of defrost at start-up	d05			0 min	240 min	0 min
Defrost sensor 0=time, (B:1=Sair.) (C: 1=S5, 2=Sair)	d10	1=Sair	1=S5	0	1 (2)	0
Defrost at start-up	d13			no	yes	no
Max. aggregate refrigeration time between two defrosts	d18			0 hours	48 hours	8 hours
Defrost on demand - S5 temperature's permitted variation during frost build-up. On central plant choose 20 K (=off)	d19			0 K	20 k	2 K
Miscellaneous						
Delay of output signals after start-up	o01			0 s	600 s	5 s
Input signal on DI1. Function: (0=not used. , 1= door alarm when open. 2=defrost start (pulse-pressure). 3=ext.main switch. 4=night operation	o02			0	4	0
Access code 1 (all settings)	o05			0	100	0
Used sensor type (Pt /PTC/NTC)	o06			Pt	ntc	Pt
Display step = 0.5 (normal 0.1 at Pt sensor)	o15			no	yes	no
Access code 2 (partly access)	o64			0	100	0
Save the controllers present settings to the programming key. Select your own number.	o65			0	25	0
Load a set of settings from the programming key (previously saved via o65 function) (Can only be set when regulation is stopped (r12=0)	o66			0	25	0
Replace the controllers factory settings with the present settings	o67			OFF	On	OFF
Select application for Saux sensor (0=not used, 1=product sensor, 2=condenser sensor)	o69			0	2	0
Select application for S5 sensor (0=defrost sensor, 1= product sensor)	o70			0	1	0
Select application for relay 2: 1=compressor-2/defrost, 2= alarm relay	o71	Comp. / Alarm	Defrost/ Alarm	1	2	1
Service						
Temperature measured with Saux sensor	u03					
Temperature measured with S5 sensor	u09					
Status on DI1 input. on/1=closed	u10					
Status on relay for cooling Can be controlled manually, but only when r12=-1	u58					
Status on relay 2 Can be controlled manually, but only when r12=-1	u70					

Regulation starts when the voltage is on.

Alarm code display	
A1	High temperature alarm
A2	Low temperature alarm
A4	Door alarm
A45	Standby mode
A61	Condenser alarm
Fault code display	
E1	Fault in controller
E27	S5 sensor error
E29	Sair sensor error
E30	Saux sensor error
Status code display	
S0	Regulating
S2	ON-time Compressor
S3	OFF-time Compressor
S10	Refrigeration stopped by main switch
S11	Refrigeration stopped by thermostat
S14	Defrost sequence. Defrosting
S17	Door open (open DI input)
S20	Emergency cooling
S25	Manual control of outputs
S32	Delay of output at start-up
non	The defrost temperature cannot be displayed. There is no sensor
-d-	Defrost in progress/First cooling after defrost
PS	Password required. Set password

Factory setting
If you need to return to the factory-set values, it can be done in this way:
- Cut out the supply voltage to the controller
- Keep upper and lower button depressed at the same time as you reconnect the supply voltage

* 1=>EL if o71 = 1

EKC 102D

SW = 1.2X

Parameters		Min.-	Max.-	Factory
Function	**Codes**	**value**	**value**	**setting**
Normal operation				
Temperature (set point)	---	-50°C	50°C	2°C
Thermostat				
Differential	r01	0,1 K	20 K	2 K
Max. limitation of setpoint setting	r02	-49°C	50°C	50°C
Min. limitation of setpoint setting	r03	-50°C	49°C	-50°C
Adjustment of temperature indication	r04	-20 K	20 K	0.0 K
Temperature unit (°C/°F)	r05	°C	°F	°C
Correction of the signal from Sair	r09	-10 K	10 K	0 K
Manual service(-1), stop regulation(0), start regulation (1)	r12	-1	1	1
Displacement of reference during night operation	r13	-10 K	10 K	0 K
Activation of reference displacement r40	r39	OFF	on	OFF
Value of reference displacement (can be activated by r39 or DI)	r40	-50 K	50 K	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°C	50°C	8°C
Low alarm limit	A14	-50°C	50°C	-30°C
Alarm delay DI1	A27	0 min	240 min	30 min
High alarm limit for condenser temperature (o70)	A37	0°C	99°C	50°C
Compressor				
Min. ON-time	c01	0 min	30 min	0 min
Min. OFF-time	c02	0 min	30 min	0 min
Compressor relay must cutin and out inversely (NC-function)	c30	0/OFF	1/on	0/OFF
Defrost				
Defrost method (none/EL/gas)	d01	no	gas	EL
Defrost stop temperature	d02	0°C	25°C	6°C
Interval between defrost starts	d03	0 hours	48 hours	8 hours
Max. defrost duration	d04	0 min	180 min	45 min
Displacement of time on cutin 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°C	0°C	-5°C
Fan cutin during defrost	d09	no	yes	yes
Defrost sensor (0=time, 1=S5, 2=Sair)	d10	0	2	0
Defrost at start-up	d13	no	yes	no
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 K	20 K	20 K
Fans				
Fan stop at cutout compressor	F01	no	yes	no
Delay of fan stop	F02	0 min	30 min	0 min
Fan stop temperature (S5)	F04	-50°C	50°C	50°C
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-pressure). 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 pressure). 11=Inject off when open.	o02	0	11	0
Access code 1 (all settings)	o05	0	100	0
Used sensor type (Pt /PTC/NTC)	o06	Pt	ntc	Pt
Display step = 0.5 (normal 0.1 at Pt sensor)	o15	no	yes	no
Case cleaning. 0=no case cleaning. 1=Fans only. 2=All output Off.	o46	0	2	0
Access code 2 (partly access)	o64	0	100	0
Save the controllers present settings to the programming key. Select your own number.	o65	0	25	0
Load a set of settings from the programming key (previously saved via o65 function) Can only be set when regulation is stopped (r12=0)	o66	0	25	0
Replace the controllers factory settings with the present settings	o67	OFF	On	OFF
Select application for S5 sensor (0=defrost sensor, 1= product sensor, 2=condenser sensor with alarm)	o70	0	2	0
Service				
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 relay for cooling (Can be controlled manually, but only when r12=-1)	u58			
Status on relay for fans (Can be controlled manually, but only when r12=-1)	u59			
Status on relay for defrost. (Can be controlled manually, but only when r12=-1)	u60			
Temperature measured with Sair sensor	u69			

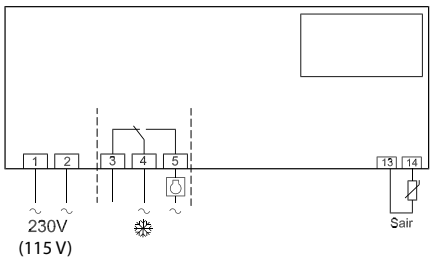
Regulation starts when the voltage is on.

Alarm code display	
A1	High temperature alarm
A2	Low temperature alarm
A4	Door alarm
A15	DI 1 alarm
A45	Standby mode
A59	Case cleasning
A61	Condenser alarm
Fault code display	
E1	Fault in controller
E27	S5 sensor error
E29	Sair sensor error
Status code display	
S0	Regulating
S2	ON-time Compressor
S3	OFF-time Compressor
S4	Drip-off time
S10	Refrigeration stopped by main switch
S11	Refrigeration stopped by thermostat
S14	Defrost sequence. Defrosting
S15	Defrost sequence. Fan delay
S16	Refrigeration stopped because of open DI input
S17	Door open (open DI input)
S20	Emergency cooling
S25	Manual control of outputs
S29	Case cleaning
S32	Delay of output at start-up
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

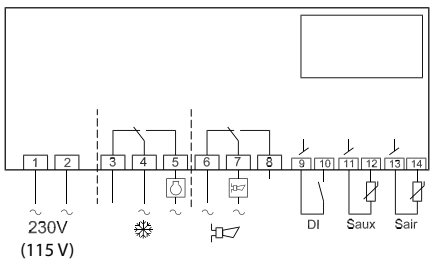
Factory setting
If you need to return to the factory-set values, it can be done in this way:
- Cut out the supply voltage to the controller
- Keep upper and lower button depressed at the same time as you reconnect the supply voltage

Connections

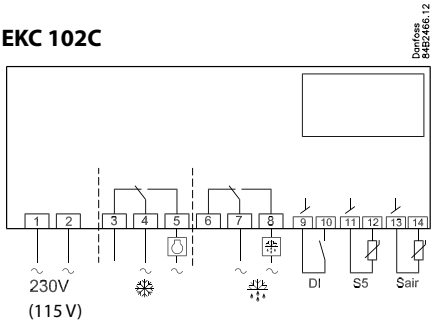
EKC 102A



EKC 102B



EKC 102C



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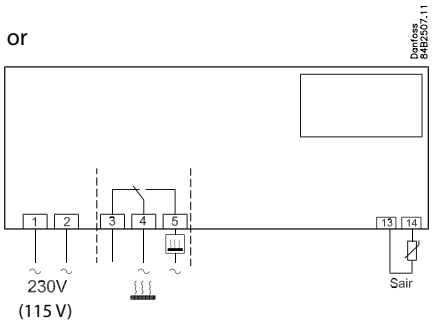

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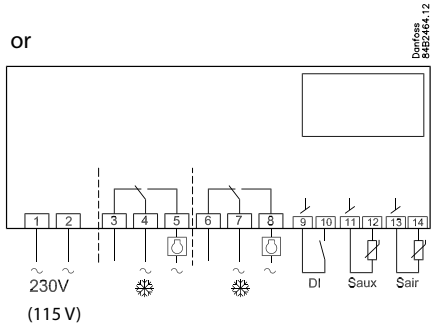

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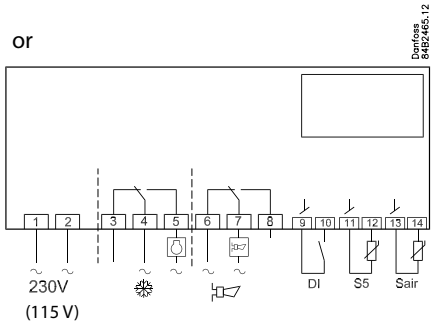
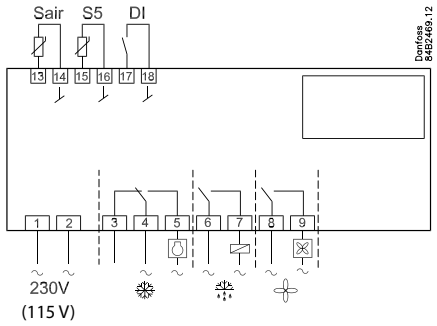


EKC 102D



Power supply
230 V a.c. or 115 V a.c. See controller.

Sensors
Sair is thermostat sensors.
Saux is an extra sensor for measuring e.g. the condenser temperature.
S5 is a defrost sensor and is used if defrost has to be stopped based on temperature.
It may however also be used as product sensor or condenser sensor.

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

Relays
The general connections are:
Relay 1
Refrigeration. The contact will cut in when the controller demands refrigeration
Relay 2
Alarm. The relay is cut out during normal operation and cuts in in alarm situations and when the controller is dead (de-energised)
Refrigeration 2. The contact will cut in when refrigeration step 2 has to be cut in
Defrost. The contact will cut in when defrost is in progress
Relay 3
Fan

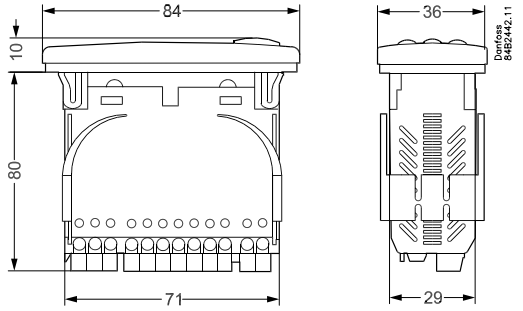
The controller cannot be hooked up with a monitoring unit type m2 or AK-SM

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

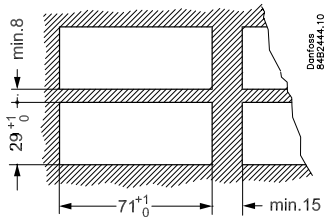
Data

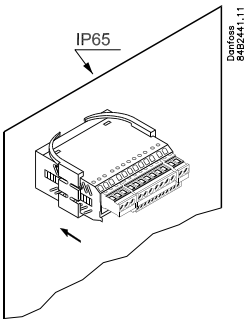
Supply voltage	230 V a.c.(115 V) +10/-15 %. 1.5 VA		
Sensors	Pt 1000 or PTC (1000 ohm/25°C) or NTC-M2020 (5000 ohm/25°C)		
Accuracy	Measuring range	-60 to +99°C	
	Controller	±1 K below -35°C ±0.5 K between -35 to +25°C ±1 K above +25°C	
	Pt 1000 sensor	±0.3 K at 0°C ±0.005 K per grad	
Display	LED, 3 digits		
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 connection cable	Max.1.5 mm² multi-core cable on supply and relays. Max. 1 mm² on sensors - and DI inputs. Terminals are mounted on the circuit board		
Relays*		CE (250 V a.c.)	UL ** (240 V a.c.)
	DO1. Refrigeration	10 (6) A	10 A Resistive 5FLA, 30LRA
	DO2. Alarm/ Defrost/ Refrigeration	10 (6) A	10 A Resistive 5FLA, 30LRA
	DO3. Fan	6 (3) A	6 A Resistive 3FLA, 18LRA 131 VA Pilot duty
Environments	0 to +55°C, During operations -40 to +70°C, During transport		
	20 - 80% Rh, not condensed		
	No shock influence/vibrations		
Enclosure	IP 65 from front. Buttons and packing are imbedded in the front.		
Approvals	EU Low Voltage Directive and EMC demands re CE-marking complied with LVD tested acc. EN 60730-1 og EN 60730-2-9, A1, A2 EMC tested acc. EN50082-1 og EN 60730-2-9, A2		

* DO1 and DO2 are 16 A relays. DO3 is a 8 A relay. Max. load must be keept.
** UL-approval based on 30000 couplings

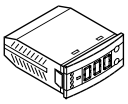
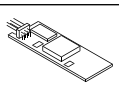


Weight = 170 g



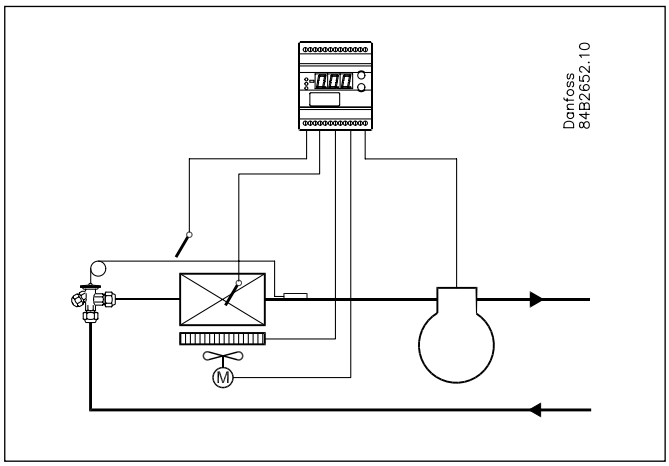


Ordering

Type		Function	Supply	Code No.
EKC 102A		Temperature controller	230 V a.c.	**084B8500**
			115 V a.c.	**084B8503**
EKC 102B		Temperature controller with alarm function	230 V a.c.	**084B8501**
			115 V a.c.	**084B8504**
EKC 102C		Temperature controller for electric defrost	230 V a.c.	**084B8502**
			115 V a.c.	**084B8505**
EKC 102D		Controller for refrigeration with fan function	230 V a.c.	**084B8506**
			115 V a.c.	**084B8507**
EKA 182A		Copy key EKC - EKC		**084B8567**

Additional information!
Manual: RS8DY

EKC 301



Application
The controller is a simple thermostat regulator in which some refrigeration-technical functions have been integrated so that it can replace a link-up of a group of thermostats and timers.

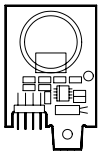
Advantages
- One electronic controller is able to replace several traditional controllers and defrost clocks
- Temperatures, times, operating conditions, parameter codes and alarm and fault codes can be read from the display
- Three LEDs indicate the actual condition of the system:
  - refrigeration
  - defrost
  - fan running
- Easy to re-establish factory setting
- In the event of error function, the actual parameter code can be displayed
- All alarms are indicated bya the three LEDs fashing at once
- Easy to install data communication at a later date

Functions
controller comes in several versions with a growing number of functions - from the simple one with just one relay to more advanced versions with three relays. All versions are furthermore available with an alarm function. The number of relays will then be increased by one.
The relays are used for controlling:
- compressor
- fan
- defrost
- alarm

One of the connections to the controller is a digital input. This input will register the position of a connected switch and depending on the functions you want to use, it will work, as follows:
- activate a door alarm if the door remains open for longer than allowed
- start a defrost
- or transmit the signal to the data communication

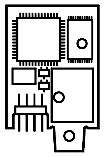
Accessories

The controller can be extended by one insertion module if the application warrants it.
The controller comes prepared with plug and terminals, so all you have to do is to push the module into place.



If you want to change the periodical defrost, so that it can be performed at specific times of the day, a clock module may be fitted.

Up to six defrost cycles per day can now be set. The module is provided with battery backup. (Type = EKA 172)



If it is required that operation is to take place from a PC, a data communication module must be placed in the controller.
Two types of insertion modules for data communication can be had - they are LON modules with FFT10 interface or RS 485 interface.

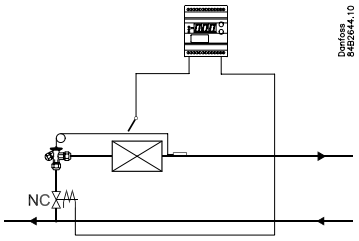
Controller application overview

Function	Application no.			
	1	2	3	4
Room temperature control by pump down or compressor start/stop	■	■	■	■
Natural defrost	■			
Temperature controlled defrost with electricity or hot gas		■		■
Time-controlled defrost with electricity or hot gas			■	
Fan motor control			■	■

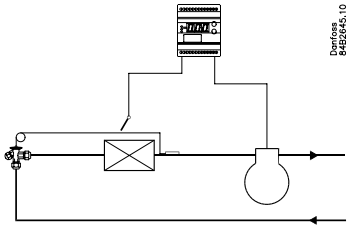
Example: Controller for application number 3 satisfies requirement for

- room temperature control (thermostat) by pump down or compressor start/stop.
- time controlled defrost using hot gas or electricity
- fan motor control

Application no. 1

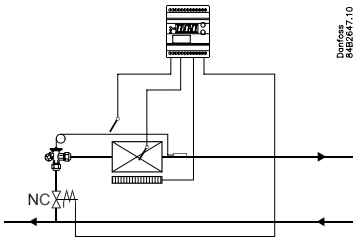


Room temperature control by pump down.
Natural defrost on pump down.

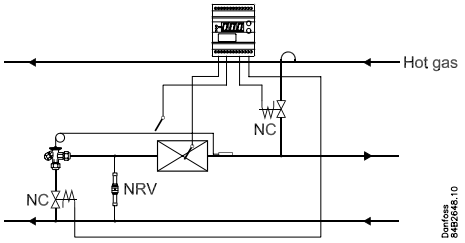


Room temperature control by compressor start/stop.
Natural defrost on compressor stop.

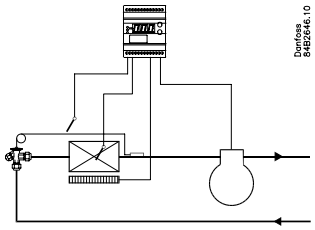
Application no. 2



Room temperature control by pump down.
Temperature-controlled electric defrost.

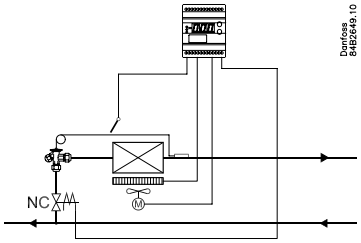


Room temperature control by pump down.
Temperature-controlled hot gas defrost.

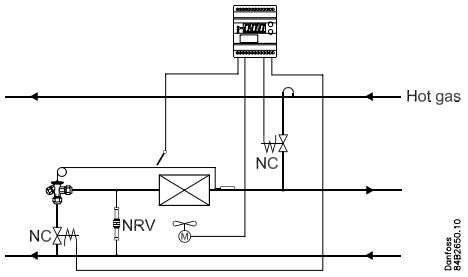


Room temperature control by compressor start/stop.
Temperature-controlled electric defrost.

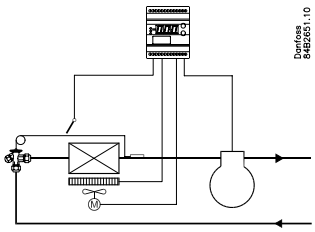
Application no. 3



Room temperature control by pump down.
Time-controlled electric defrost.

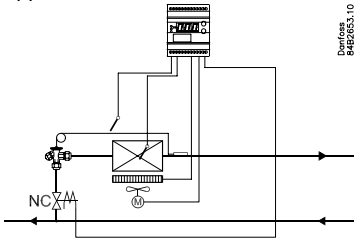


Room temperature control by pump down.
Time-controlled hot gas defrost.

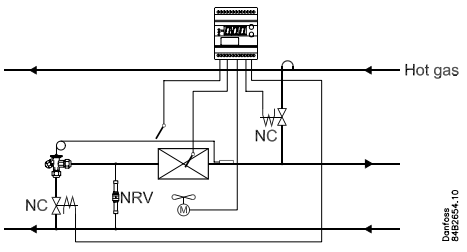


Room temperature control by compressor start/stop.
Time-controlled electric defrost.

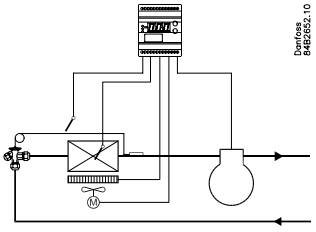
Application no. 4



Room temperature control by pump down.
Temperature-controlled electric defrost.



Room temperature control by pump down.
Temperature-controlled hot gas defrost.

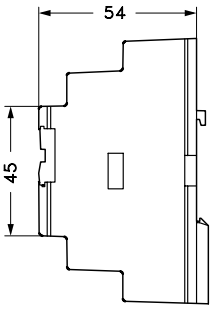


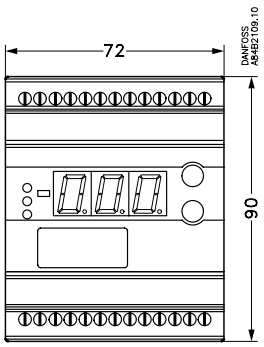
Room temperature control by compressor start/stop.
Temperature-controlled electric defrost.

Data

Supply voltage	230 V +10/-15%, 50/60 Hz	
Power consumption	5.0 VA	
Sensors	Pt 1000 ohm or PTC (R_{25} = 1000 ohm)	
Controller sensor system	Measuring range	-60 to +50°C
	Accuracy	±0.5°C for sensor temperature -35 to +25°C; ±1°C for sensor temperature -60 to -35°C
Display	LED, three digits (0.1°C read-off accuracy in measuring range)	
External alarm contact	Standard SPST contact (door alarm)	
Electrical connection cable	max. 2.5 mm² multi-core cable	
Relays	Controller 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
	Alarm relay	SPST NC, $I_{max.}$ = 4 A ohmic/1 A AC 15* inductive $I_{min.}$ = 1 mA on 100 mV**
Environments	0 to +55°C during operation -40 to +70°C during transport	
	20 - 80% Rh, not condensed	
	No shock influence/vibrations	
Enclosure	IP 20	
Approvals	EU low-voltage directive and EMC stipulations on CE marking are complied with. LVD-tested to EN 60730-1 and EN 60730-2-9 EMC-tested to EN 50081-1 and EN 50082-1	

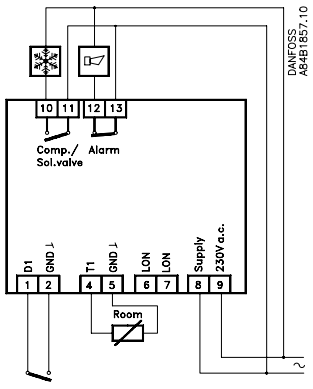
* AC 15 load to EN 60947-5-1
** Gold plating ensures make function with small contact loads



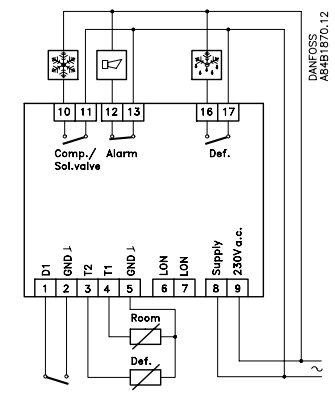


Weight: 300 g

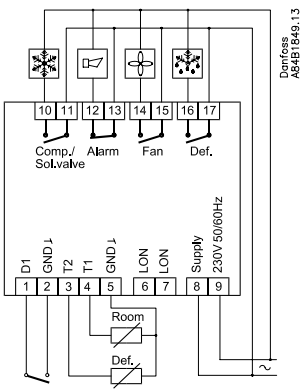
Electrical connection



Application 1 with alarm relay



Application 2 with alarm relay



Application 3 and 4 with alarm relay

Menu survey

Setting and read-off parameters	Parameter codes	Controller application no.				Min.-value	Max.-value	Factory setting [5]	Actual settings
		1	2	3	4				
Normal operation									
Temperature controller, temperature						-60°C	50°C	3°C	
Thermostat									
Differential [1]	r01					0.1 K	20 K	2 K	
Max. limitation of set temperature	r02					-59°C	50°C	50°C	
Min. limitiation of set temperature	r03					-60°C	49°C	-60°C	
Adjustment of temperature indication	r04					-20 K	20 K	0.0 K	
Temperature unit (°C/°F)	r05							°C	
Alarm									
Upper deviation (above temp.setting + differential) [2]	A01					0 K	50 K	10 K	
Lowe devaition (below temp. setting) [2]	A02					-50 K	0 K	-10 K	
Temperature alarm delsy	A03					0 min	90 min	30 min	
Door alarm delay	A04					0 min	90 min	60 min	
Compressor									
Min. ON-time	c01					0 min	15 min	0 min	
Min. OFF-time	c02					0 min	15 min	0 min	
Cut-in frequency on sensor fault [3]	c03					0%	100%	0%	
Compressor stop at open door (yes/no)	c04							no	
Defrost									
Defrost method (EL/GAS)	d01							EL	
Defrost stop temperature	d02					0°C	25°C	6°C	
Interval mbetween defrost starts	d03					OFF	48 hour	8 hour	
Max. defrost duration	d04					0 min	180 min	45 min	
Defrost time delay (after power up)	d05					0 min	60 min	0 min	
Drip-off time	d06					0 min	20 min	0 min	
Fan start delay after defrost	d07					0 min	20 min	1 min	
Fan start temperature	d08					-15°C	0°C	-5°C	
Fan cut-in during defrost (yes/no)	d09							no	
Defrost sensor (yes/no)	d10							yes	
Temperature alarm delay after defrost	d11					0 min	199 min	90 min	
Delay of display view after defrost stop	d12					0 min	15 min	1 min	
Defrost at start-up	d13					no	yes	no	
Fan									
Fan stop on compressor cut-out (yes/no)	F01							no	
Fan stop delay	F02					0 min	30 min	0 min	
Fan stop at open door (yes/no)	F03							yes	
Miscellaneous									
Delay of output signal after start-up	o01					0 s	600 s	5 s	
Digital input signals [4] (0=not used. 1=door alarm. 2=defrost. 3=bus. 4=Main switch.)	o02							0	
Access code	o05					OFF	100	OFF	
Used sensor type (Pt /PTC)	o06							Pt/PTC	
Real time clock (if fitted)									
Six start times for defrost All can be cut out by setting on OFF	t01-t06					0	23	OFF	
Hour setting	t07					0 hour	23 hour	0 hour	
Minute setting	t08					0 min	59 min	0 min	

Fault code display		Alarm code display		Status code display	
E 1	Fault in controller	A 1	High temperature alarm	S 2	ON-time
E 2	Disconnected room sensor	A 2	Low temperature alarm	S 3	OFF-time
E 3	Short-circuited room sensor	A 4	Door alarm	S 4	Drip-off time
E 4	Disconnected defrost sensor			S 10	Cooling stopped
E 5	Short-cirucuited defrost sensor				
E 6	Change battery + check clock				

[1] The compressor relay closes when the room temperature exceeds the setting value and differential.

[2] Alarm is released and sensor failure is indicated, if the room temperature reaches 5°C or more outside the setting range –60° to +50°C.

[3] After start-up and throughout three days and nights this value is used by the controller. Afterwards the controller is capable by itself to calculate the average value of previous cut-in times.

[4] Function possibilities with SPST contact, connected to the terminals 3 and 4 are the following:
Door alarm: If SPST is cut out, alarm signalling starts and the fan is stopped, cf. A04 or F03.
Defrost: If SPST is cut in, defrost starts. (However, if d03 is not OFF, defrost will during contact break down start with the programmed time intervalles).
Bus: With installed communication card, the position of the SPST contacts will be registered in the BUS system.
Main Switch: Start/stop control

[5] Factory settings are indicated for standard units. Other code numbers have customized settings.

Factory setting
If you need to return to the factory-set values, it can be done in this way:
- Cut out the supply voltage to the controller
- Keep both buttons depressed at the same time as you reconnect the supply voltage

Ordering

EKC 301, controllers for DIN-rail mounting

Application no.	Controller	
	Without alarm relay	With alarm relay
1	**084B7513**	**084B7516**
2	**084B7514**	**084B7517**
3	**084B7515**	**084B7518**
4	**084B7515**	**084B7518**

Accessories

Plug-in modules

Description	**Type**	**Code No.**
Real time clock	**EKA 172**	**084B7069**
Bus communication card RS 485	**EKA 175**	**084B7093**

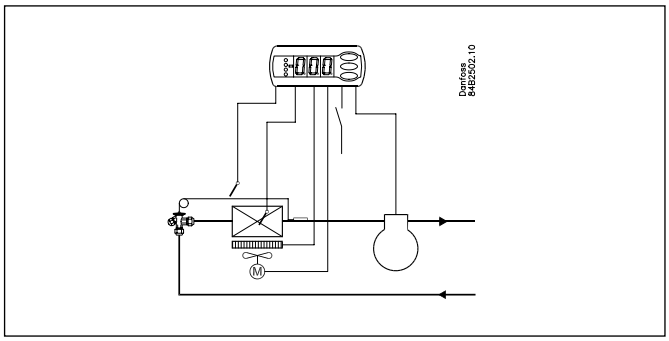
The installation of data communications must comply with the requirements described in literature sheet no. RC8AC

Additional information!
Technical brochure: RD8AE
Manual: RS8AV

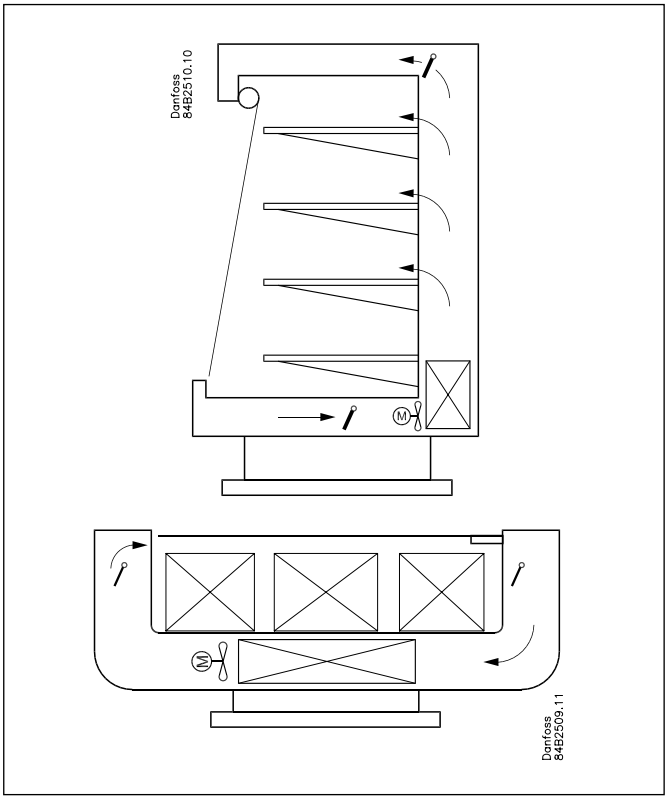
EKC 202

Application
- The controller is used for temperature control refrigeration appliances and cold room in supermarkets
- Control of defrost, fans, alarm and light
- For front panel mounting

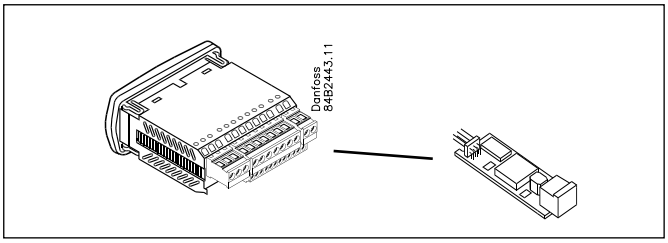
Advantages
- Integrated refrigeration-technical functions
- Defrost on demand in 1:1 systems
- Buttons and seal imbedded in the front
- IP 65 enclosure from the front panel
- Digital input for either:
  - Door contact function with alarm
  - Defrost start
  - Start/stop of regulation
  - Night operation
  - Change-over between two temperature reference
  - Case cleaning function
- Instant programming via programming key
- HACCP
  Factory calibration that will guarantee a better measuring accuracy than stated in the standard EN 441-13 without subsequent calibration (Pt 1000 ohm sensor)



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 and buzzer 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.
  - Coordinated defrost via data communication



Regulering
The controller contains a temperature control where the signal can be received from one temperature sensor.
The sensor is placed in the cold air flow after the evaporator or in the warm air flow just before the evaporator.
The controller controls the defrost with either natural defrost or electric defrost. Renewed cutin after defrost can be accomplished based on time or temperature.
A measurement of the defrost temperature can be obtained directly through the use of a defrost sensor.
Two to four relays will cut the required functions in and out – the application determines which:
- Refrigeration (compressor or solenoid valve)
- Defrost
- Fan
- Alarm
- Light

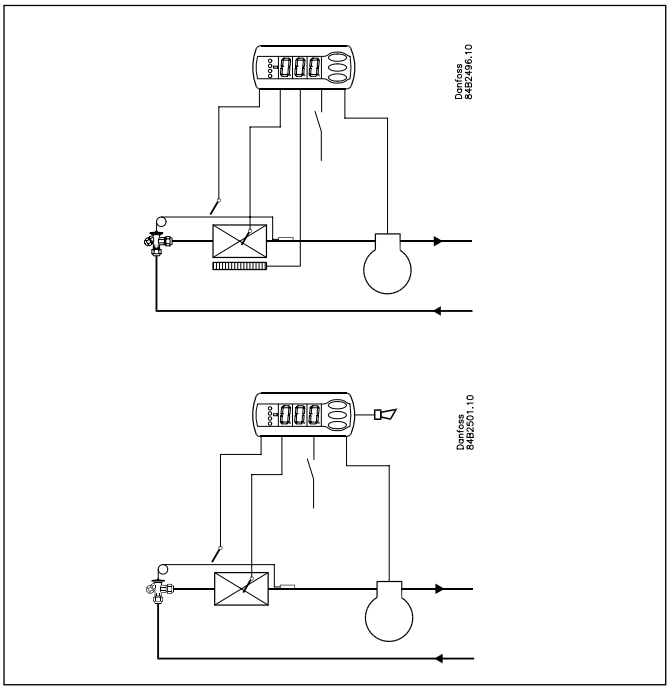


The different applications are described on next page.

EKC 202A
Controller with two relay outputs, two temperature sensors and digital input.

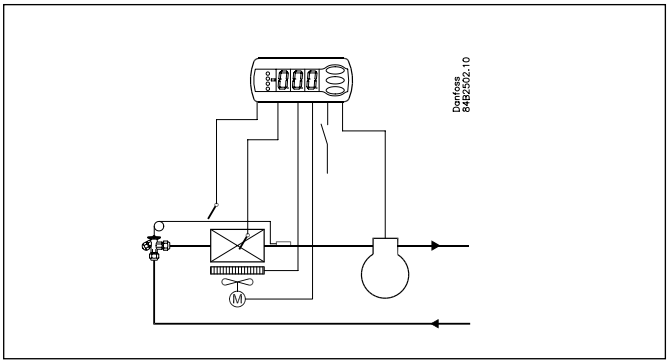
Temperature control at start/stop of compressor/solenoid valve
Defrost sensor
Electrical defrost/gas defrost

Alarm function
If an alarm function is required, relay number two may be used for it.
Defrost is performed here with circulation of the air as the fans are operating continuously.



EKC 202B
Controller with three relay outputs, two temperature sensors and digital input.

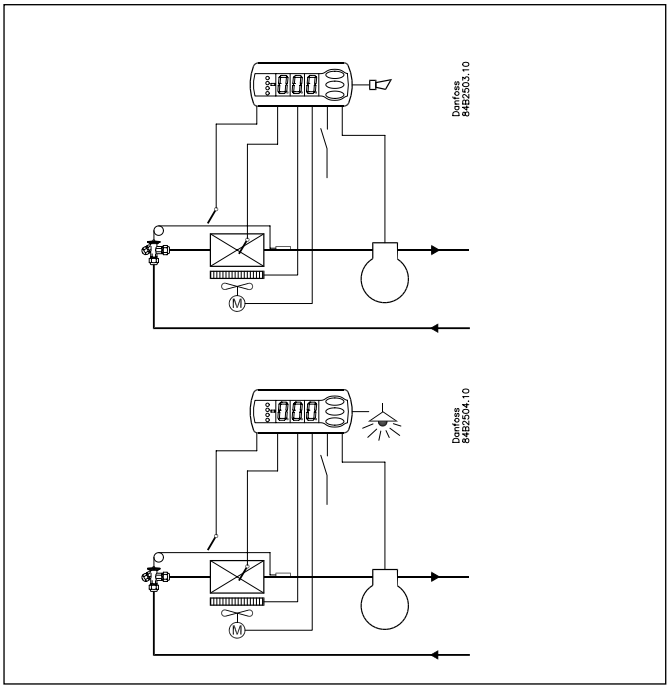
Temperature control at start/stop of compressor/solenoid valve
Defrost sensor
Electrical defrost /gas defrost
Relay output 3 is used for control of fan.



EKC 202C
Controller with four relay outputs, two temperature sensors and digital input.

Temperature control at start/stop of compressor/solenoid valve
Defrost sensor
Electrical defrost /gas defrost
Control of fan

Relay output 4 can be used for an alarm function or for a light function.



Menu survey

SW = 1.2x

Parameters		Controller			Min.-value	Max.-value	Factory setting	Actual setting
Function	**Codes**	**EKC 202A**	**EKC 202B**	**EKC 202C**				
Normal operation								
Temperature (set point)	---				-50°C	50°C	2°C	
Thermostat								
Differential	r01				0,1 K	20 K	2 K	
Max. limitation of setpoint setting	r02				-49°C	50°C	50°C	
Min. limitation of setpoint setting	r03				-50°C	49°C	-50°C	
Adjustment of temperature indication	r04				-20 K	20 K	0.0 K	
Temperature unit (°C/°F)	r05				°C	°F	°C	
Correction of the signal from Sair	r09				-10 K	10 K	0 K	
Manual service(-1), stop regulation(0), start regulation (1)	r12				-1	1	1	
Displacement of reference during night operation	r13				-10 K	10 K	0 K	
Activation of reference displacement r40	r39				OFF	on	OFF	
Value of reference displacement (activation by r39 or DI)	r40				-50 K	50 K	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°C	50°C	8°C	
Low alarm limit	A14				-50°C	50°C	-30°C	
Alarm delay DI1	A27				0 min	240 min	30 min	
High alarm limit for condenser temperature (o70)	A37				0°C	99°C	50°C	
Compressor								
Min. ON-time	c01				0 min	30 min	0 min	
Min. OFF-time	c02				0 min	30 min	0 min	
Compressor relay must cutin and out inversely (NC-function)	c30				0/OFF	1/on	0/OFF	
Defrost								
Defrost method (none/EL/gas)	d01				no	gas	EL	
Defrost stop temperature	d02				0°C	25°C	6°C	
Interval between defrost starts	d03				0 hours	48 hours	8 hours	
Max. defrost duration	d04				0 min	180 min	45 min	
Displacement of time on cutin 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°C	0°C	-5°C	
Fan cutin during defrost	d09				no	yes	yes	
Defrost sensor (0=time, 1=S5, 2=Sair)	d10				0	2	0	
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 K	20 K	20 K	
Fans								
Fan stop at cutout compressor	F01				no	yes	no	
Delay of fan stop	F02				0 min	30 min	0 min	
Fan stop temperature (S5)	F04				-50°C	50°C	50°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 minute	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-pressure). 5=ext.main switch. 6=night operation 7=change reference (r40 will be activated) 8=alarm function when closed. 9=alarm function when open. 10=case cleaning (pulse pressure). 11=Inject off when open.	o02				0	11	0	
Network address	o03				0	240	0	
On/Off switch (Service Pin message)	o04				OFF	ON	OFF	
Access code 1 (all settings)	o05				0	100	0	
Used sensor type (Pt /PTC/NTC)	o06				Pt	ntc	Pt	
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	
Configuration of light function (relay 4) 1=ON during night 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	
Case cleaning. 0=no case cleaning. 1=Fans only. 2=All output Off.	o46				0	2	0	
Access code 2 (partly access)	o64				0	100	0	
Save the controllers present settings to the programming key. Select your own number.	o65				0	25	0	
Load a set of settings from the programming key (previously saved via o65 function) Can only be set when regulation is stopped (r12=0)	o66				0	25	0	
Replace the controllers factory settings with the present settings	o67				OFF	On	OFF	
Re alternative application for the S5 sensor (maintain the setting at 0 if it is used as defrost sensor, otherwise 1 = product sensor and 2 = condenser sensor with alarm)	o70				0	2	0	
Select application for relay 4: 1=defrost/light, 2= alarm	o72	Defrost / Alarm		Light / Alarm	1	2	2	

Service								
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 relay for cooling (Can be controlled manually, but only when r12=-1)	u58							
Status on relay for fans (Can be controlled manually, but only when r12=-1)	u59							
Status on relay for defrost. (Can be controlled manually, but only when r12=-1)	u60							
Temperature measured with Sair sensor	u69							
Status on relay 4 (alarm, defrost, light).(Can be controlled manually, but only when r12=-1)	u71							

Factory setting
If you need to return to the factory-set values, it can be done in this way:
- Cut out the supply voltage to the controller
- Keep upper and lower button depressed at the same time as you reconnect the supply voltage

Fault code display	
E1	Fault in controller
E6	Change battery + check clock
E 27	S5 sensor error
E 29	Sair sensor error

Alarm code display	
A 1	High temperature alarm
A 2	Low temperature alarm
A 4	Door alarm
A 5	Max. Hold time
A 15	DI 1 alarm
A 45	Standby mode
A 59	Case cleasning
A 61	Condenser alarm

Status code display	
S0	Regulating
S1	Waiting for end of the coordinated defrost
S2	ON-time Compressor
S3	OFF-time Compressor
S4	Drip-off time
S10	Refrigeration stopped by main switch
S11	Refrigeration stopped by thermostat
S14	Defrost sequence. Defrosting
S15	Defrost sequence. Fan delay
S16	Refrigeration stopped because of open DI input
S17	Door open (open DI input)
S20	Emergency cooling
S25	Manual control of outputs
S29	Case cleaning
S32	Delay of output at start-up
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

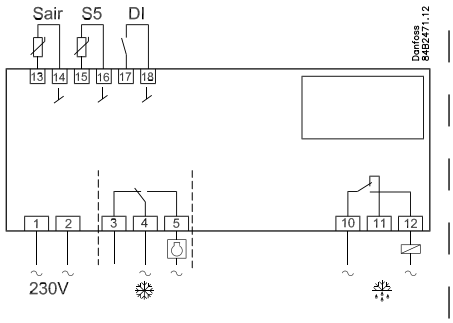
Start-up:

Regulation starts when the voltage is on.

1 Go through the survey of factory settings. Make any necessary changes in the respective parameters.
2 For network. Set the address in o03 and then transmit it to the gateway/system unit with setting o04.

Connections

EKC 202A



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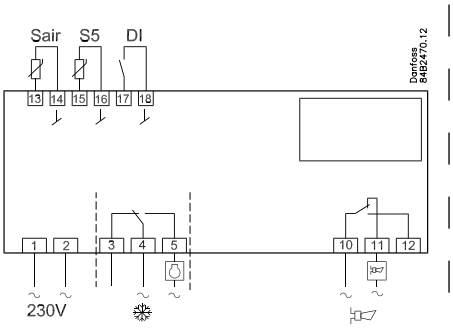
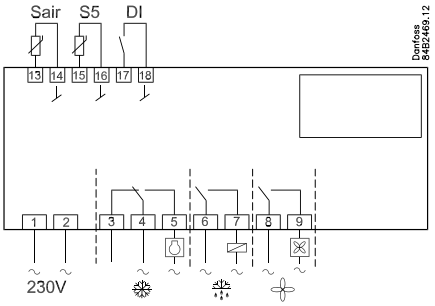
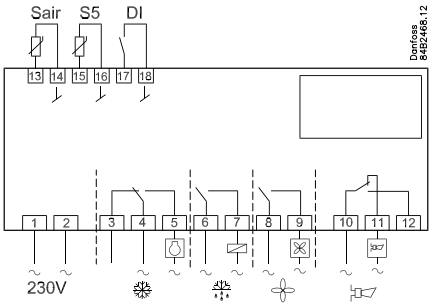


EKC 202B



EKC 202C



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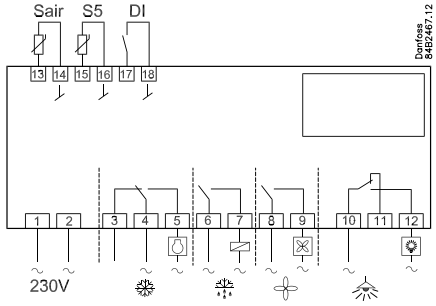


Power supply
230 V a.c.

Sensors
Sair is thermostat sensors.
S5 is a defrost sensor and is used if defrost has to be stopped based on temperature. It may however also be used as product sensor or condenser sensor.

Digital On/Off signal
A cut-in input will activate a function. The possible functions are described in menu o02.

Relays
The general connections are:

Refrigeration. The contact will cut in when the controller demands refrigeration

Defrost.

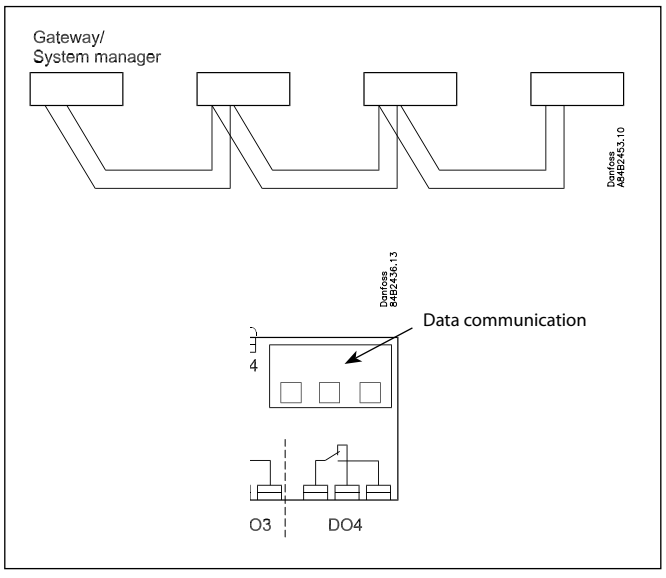
Fan.

Alarm. The relay is cut out during normal operation and cuts in in alarm situations and when the controller is dead (de-energised)

Light. The contact will cut in when the controller demands light.

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

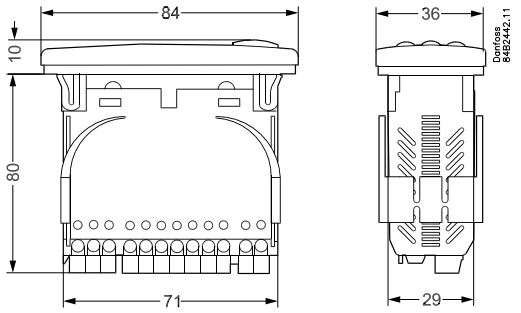
Data communication
If data communication is used, it is important that the installation of the data communication cable is performed correctly.
See separate literature No. RC8AC..



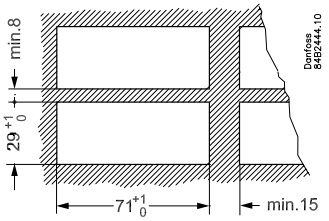
Data

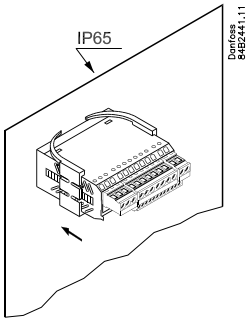
Supply voltage	230 V a.c. +10/-15 %. 1.5 VA		
Sensors	Pt 1000 or PTC (1000 ohm/25°C) or NTC-M2020 (5000 ohm/25°C)		
Accuracy	Measuring range	-60 to +99°C	
	Controller	±1 K below -35°C ±0,5 K between -35 to +25°C ±1 K above +25°C	
	Pt 1000 sensor	±0.3 K at 0°C ±0.005 K per grad	
Display	LED, 3 digits		
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 connection cable	Max.1,5 mm² multi-core cable on supply and relays. Power current terminals are mounted on the circuit board. Max. 1 mm² on sensors - and DI inputs. Low current terminals are with plugs		
Relays*		CE (250 V a.c.)	UL *** (240 V a.c.)
	DO1. Refrigeration	10 (6) A	10 A Resistive 5FLA, 30LRA
	DO2. Defrost	10 (6) A	10 A Resistive 5FLA, 30LRA
	DO3. Fan	6 (3) A	6 A Resistive 3FLA, 18LRA 131 VA Pilot duty
	DO4. Alarm or light	4 (1) A Min. 100 mA**	4 A Resistive 131 VA Pilot duty
Environments	0 to +55°C, During operations -40 to +70°C, During transport		
	20 - 80% Rh, not condensed		
	No shock influence/vibrations		
Enclosure	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 og EN 60730-2-9, A1, A2 EMC tested acc. EN50082-1 og EN 60730-2-9, A2		

* DO1 and DO2 are 16 A relays. DO3 and DO4 are 8 A relays. Max. load must be keept.
** Gold plating ensures make function with small contact loads
*** UL-approval based on 30000 couplings

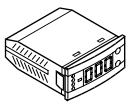
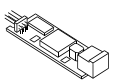
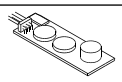
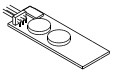
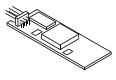


Weight = 200 g





Ordering

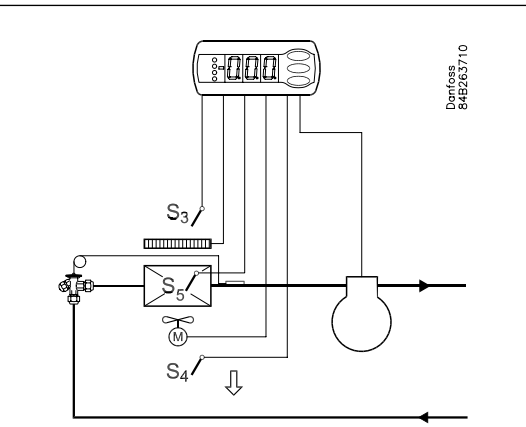
Type		Function	Code No.
EKC 202A		Refrigeration controller	**084B8521**
EKC 202B		Refrigeration controller with fan function	**084B8522**
EKC 202C		Refrigeration controller for electric defrost	**084B8523**
EKC 178A		Data communication module MOD bus	**084B8564**
EKC 179A		Data communication module RS 485	**084B8565**
EKC 181A		Battery and buzzer module that will protect the clock in case of lengthy power failure	**084B8566**
EKC 181C		Battery module that will protect the clock in case of lengthy power failure	**084B8577**
EKC 182A		Copy key EKC - EKC	**084B8567**

Additional information!
Manual: RS8DZ

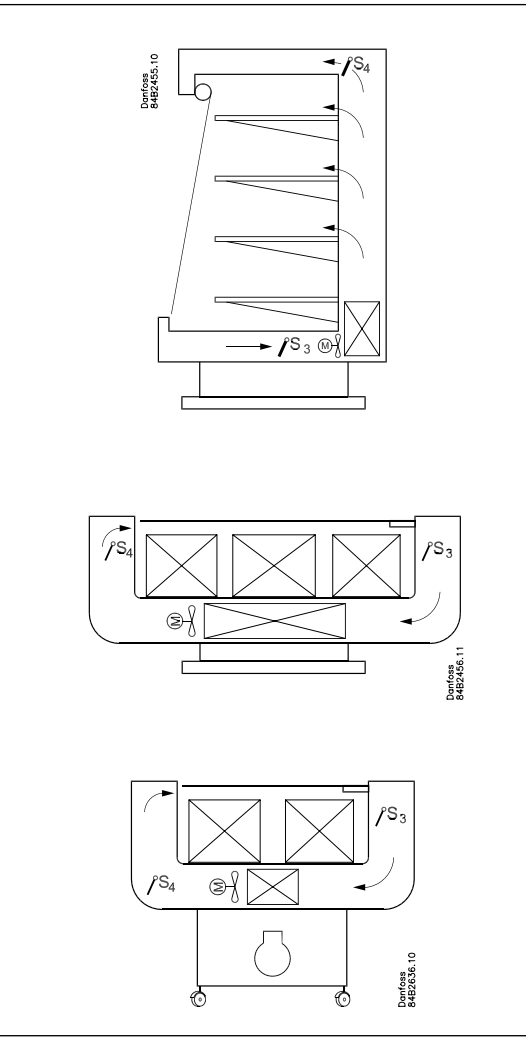
EKC 202D

Application
- The controller is used for temperature control refrigeration appliances in supermarkets
- With many predefined applications one unit will offer you several options. Flexibility has been planned both for new installations and for service in the refrigeration trade

Advantages
- Several 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
- Easy to remount data communication
- Two temperature references
- Digital inputs for various functions
- Clock function with backup



Control
The controller contains a temperature control where the signal can be received from one or two temperature sensors.
The thermostat sensors are either placed in the cold air flow after the evaporator, in the warm air flow just before the evaporator, or both. A setting will determine how great an influence the two signals are to have on the control.
A measurement of the defrost temperature can be obtained directly through the use of an S5 sensor or indirectly through the use of the S4 measurement. Four relays will cut the required functions in and out – the application determines which. The options are the following:
- Refrigeration (compressor or relay)
- Fan
- Defrost
- Rail heat
- Alarm
- Light



Sensors
Up to two thermostat sensors can be connected to the controller. The relevant application determines how.

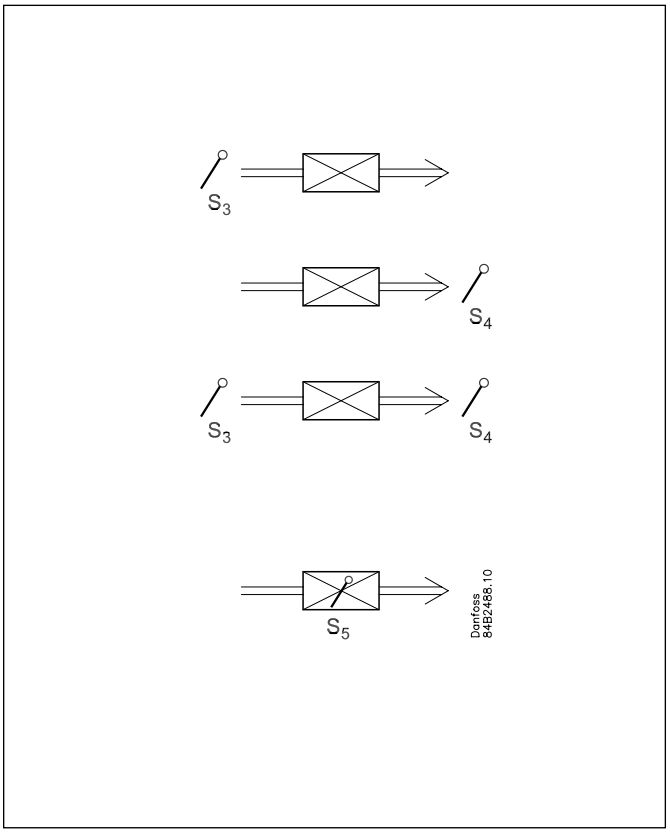
A sensor in the air before the evaporator:
This connection is primarily used when control is based on area.

A sensor in the air after the evaporator:
This connection is primarily used when refrigeration is controlled and there is a risk of a too low temperature near the products.

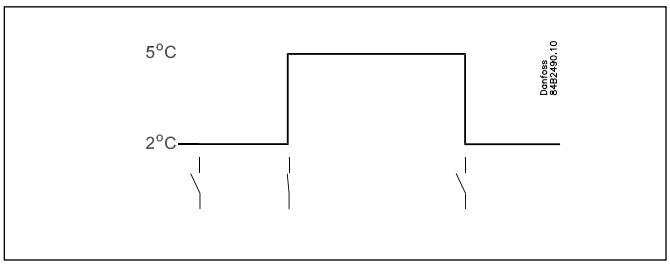
A sensor before and after the evaporator:
This connection offers you the possibility of adapting the thermostat, the alarm thermostat and the display to the relevant application. The signal to the thermostat, the alarm thermostat and the display is set as a weighted value between the two temperatures, and 50% will for example give the same value from both sensors.
The signal to the thermostat, the alarm thermostat and the display can be set independently of one another.

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 S4 can be selected.



Change of temperature reference
In an impulse appliance, for example, used for various product groups. Here the temperature reference is changed easily with a contact signal on a digital input. The signal raises the normal thermostat value by a predefined amount. At the same time the alarm limits with the same value are displaced accordingly.



Application
Here is a survey of the controller's field of application.

A setting will define the relay outputs so that the controller's interface will be targetted to the chosen application.

On next page you can see the relevant settings for the respective wiring diagrams.

S3 and S4 are temperature sensors. The application will determine whether either one or the other or both sensors are to be used. S3 is placed in the air flow before the evaporator. S4 after the evaporator.
A percentage setting will determine according to what the control is to be based. S5 is a defrost sensor and is placed on the evaporator.
DI1 and DI2 are contact functions that can be used for one of the following functions: door function, alarm function, defrost start, external main switch, night operation, change of thermostat reference, appliance cleaning, forced refrigeration or coordinated defrost. See the functions in settings o02 and o37.

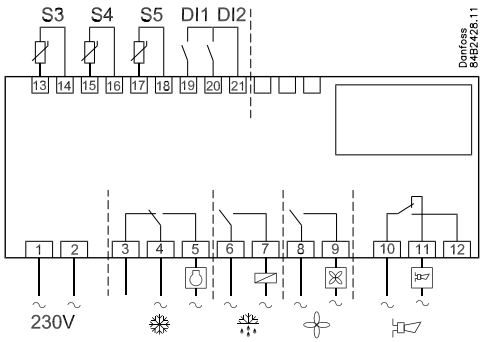
Refrigeration control with one compressor
The functions are adapted to small refrigeration systems which either may be refrigeration appliances or coldrooms.
The three relays can control the refrigeration, the defrost and the fans, and the fourth relay can be used for either alarm function, light control or rail heat control

- The alarm function can be linked up with a contact function from a door switch. If the door remains open longer than allowed there will be an alarm.
- The light control can also be linked up with a contact function from a door switch. An open door will switch on the light and it will remain lit for two minutes after the door has been closed again.
- The rail heat function can be used in refrigeration or freezing appliances or on the door's heating element for frostrooms.

The fans can be stopped during defrost and they may also follow a door switch's open/close situation.

There are several other functions for the alarm function as well as the light control, rail heat control and fans. Please refer to the respective settings.

1



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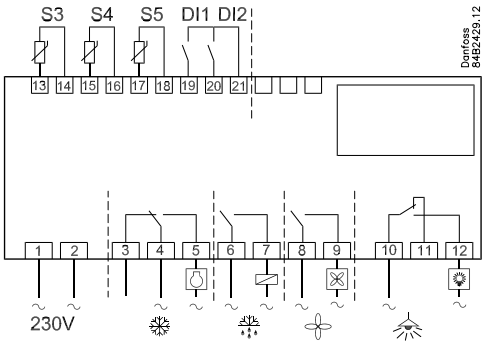

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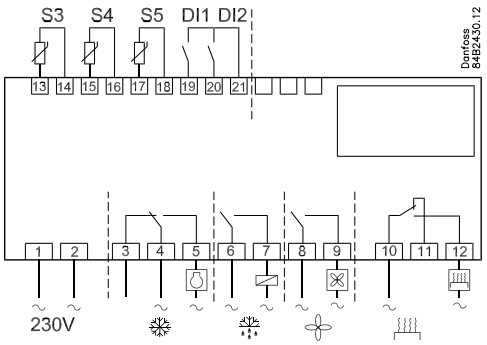


Menu survey

SW = 2.0x

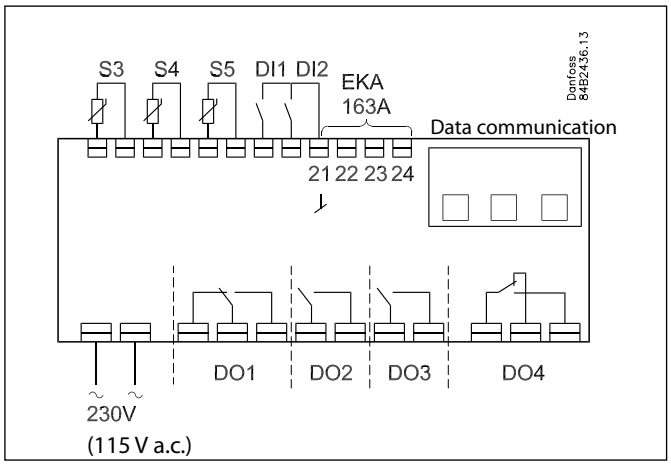
Parameters			EL-diagram number			Min.-value	Max.-value	Factory setting	Actual setting
Function		**Codes**	**1**	**2**	**3**				
Normal operation									
Temperature (set point)		---				-50.0°C	50.0°C	2.0°C	
Thermostat									
Differential	***	r01				0.0 K	20.0K	2.0 K	
Max. limitation of setpoint setting	***	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 S4		r09				-10.0 K	+10.0 K	0.0 K	
Correction of the signal from S3		r10				-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				-10.0 K	10.0 K	0.0 K	
Definition and weighting, if applicable, of thermostat sensors - S4% (100%=S4, 0%=S3)		r15				0%	100%	100%	
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	
Signal for alarm thermostat. S4% (100%=S4, 0%=S3)		A36				0%	100%	100%	
Compressor									
Min. ON-time		c01				0 min	30 min	0 min	
Min. OFF-time		c02				0 min	30 min	0 min	
Compressor relay 1 must cutin and out inversely (NC-function)		c30				0 OFF	1 ON	0 OFF	
Defrost									
Defrost method (none/EL/GAS/BRINE)		d01				no	bri	EL	
Defrost stop temperature		d02				0.0°C	25.0°C	6.0°C	
Interval between defrost starts		d03				0 hours	48 hours	8 hours	
Max. defrost duration		d04				0 min	180 min	45 min	
Displacement of time on cutin 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 cutin during defrost		d09				no	yes	yes	
Defrost sensor (0=time, 1=S5, 2=S4)		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	
Fan									
Fan stop at cutout 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 minute	***	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-pressure). 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 pressure). 11=forced cooling at hot gas defrost.		o02				1	11	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	
Access code 1 (all settings)		o05				0	100	0	
Used sensor type (Pt /PTC/NTC)		o06				Pt	ntc	Pt	
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	
Select signal for display view. S4% (100%=S4, 0%=S3)		o17				0%	100%	100%	

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-pressure). 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 pressure). 11=forced cooling at hot gas defrost.). 12=coordinaded defrost)		o37				0	12	0	
Configuration of light function (relay 4) 1=ON during night 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%	0	
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.	*	o61	**1**	**2**	**3**	1	3	1	
Access code 2 (partly access)	***	o64				0	100	0	
Save the controllers present settings to the programming key. Select your own number.		o65				0	25	0	
Load a set of settings from the programming key (previously saved via o65 function)	*	o66				0	25	0	
Replace the controllers factory settings with the present settings		o67				OFF	On	OFF	
Service									
Status codes		S0-S33							
Temperature measured with S5 sensor	***	u09							
Status on DI1 input. on/1=closed		u10							
Temperature measured with S3 sensor	***	u12							
Status on night operation (on or off) 1=closed	***	u13							
Temperature measured with S4 sensor	***	u16							
Thermostat temperature		u17							
Read the present regulation reference		u28							
Status on DI2 output. on/1=closed		u37							
Temperature shown on display		u56							
Measured temperature for alarm thermostat		u57							
Status on relay for cooling	**	u58							
Status on relay for fan	**	u59							
Status on relay for defrost	**	u60							
Status on relay for railheat	**	u61							
Status on relay for alarm	**	u62							
Status on relay for light	**	u63							

*) 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 menues will be limited

Factory setting
If you need to return to the factory-set values, it can be done in this way:
- Cut out the supply voltage to the controller
- Keep both buttons depressed at the same time as you reconnect the supply voltage

Connections



Power supply
230 V a.c. (115 V version available)

Sensors
S3 and S4 are thermostat sensors.
A setting determines whether S3 or S4 or both of them are to be used.
S5 is a defrost sensor and is used if defrost has to be stopped based on temperature.

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

External display
Connection of display type EKA 163A.

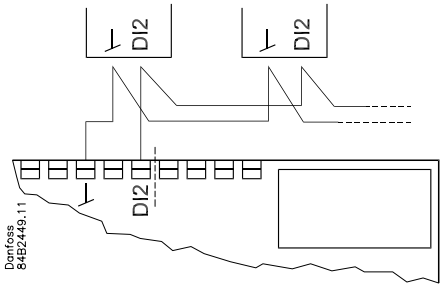
Relays
The general uses are mentioned here.
DO1: Refrigeration. The relay will cut in when the controller demands refrigeration
DO2: Defrost. The relay will cut in when defrost is in progress
DO3: Fans
The relay will cut in when the fans have to operate
DO4: For either alarm, rail heat or light
Alarm: 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
Light: The relay cuts in when the light has to be switched on

Data communication
The controller is available in several versions where data communication can be carried out with one of the following systems: MOD-bus or LON-RS 485.
If data communication is used, it is important that the installation of the data communication cable is performed correctly.
See separate literature No. RC8AC…

The controller cannot be hooked up with a monitoring unit type m2.

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

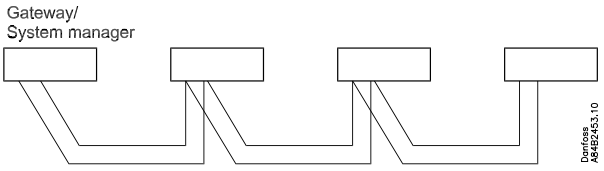
Coordinated defrost via cable connections



The following controllers can be connected up in this way:
EKC 204A, EKC 202D and AK-CC 210

Refrigeration is resumed when all controllers have "released" the signal for defrost.

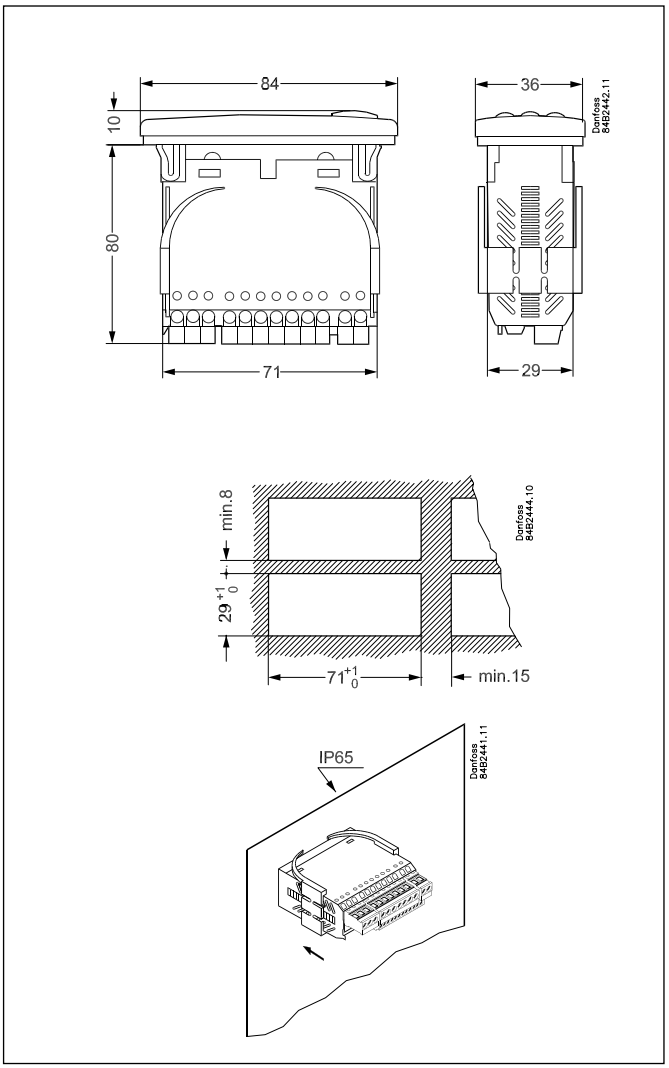
Coordinated defrost via data communication



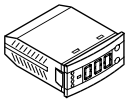
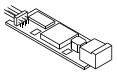
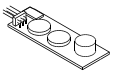
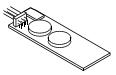
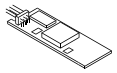
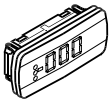
Data

Supply voltage	230 V a.c.(or 115 V version) +10/-15 %. 2.5 VA		
Sensors 3 pcs off either	Pt 1000 or PTC (1000 ohm/25°C) or NTC-M2020 (5000 ohm/25°C)		
Accuracy	Measuring range	-60 to +99°C	
	Controller	±1 K below -35°C ±0.5 K between -35 to +25°C ±1 K above +25°C	
	Pt 1000 sensor	±0.3 K at 0°C ±0.005 K per grad	
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 connection cable	Max.1.5 mm² multi-core cable		
Relays*		CE (250 V a.c.)	UL *** (240 V a.c.)
	DO1. Refrigeration	10 (6) A	10 A Resistive 5FLA, 30LRA
	DO2. Defrost	10 (6) A	10 A Resistive 5FLA, 30LRA
	DO3. Fan	6 (3) A	6 A Resistive 3FLA, 18LRA 131 VA Pilot duty
	DO4. Alarm, light or rail heat	4 (1) A Min. 100 mA**	4 A Resistive 131 VA Pilot duty
Environments	0 to +55°C, During operations -40 to +70°C, During transport		
	20 - 80% Rh, not condensed		
	No shock influence/vibrations		
Enclosure	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 og EN 60730-2-9, A1, A2 EMC tested acc. EN50082-1 og EN 60730-2-9, A2		

* DO1 and DO2 are 16 A relays. DO3 and DO4 are 8 A relays. Max. load must be keept.
** Gold plating ensures make function with small contact loads
*** UL-approval based on 30000 couplings

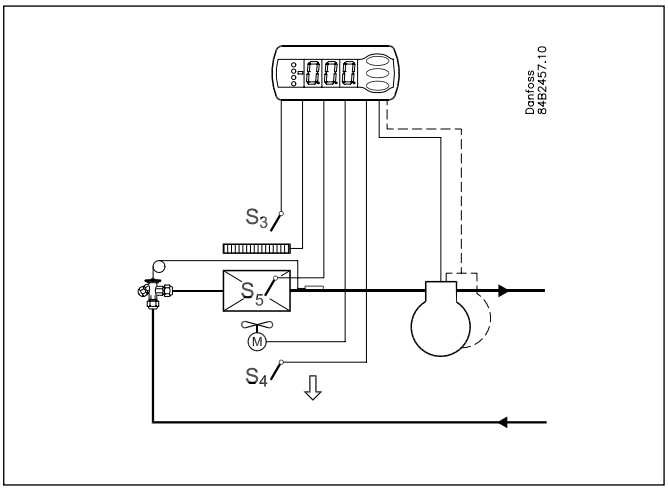


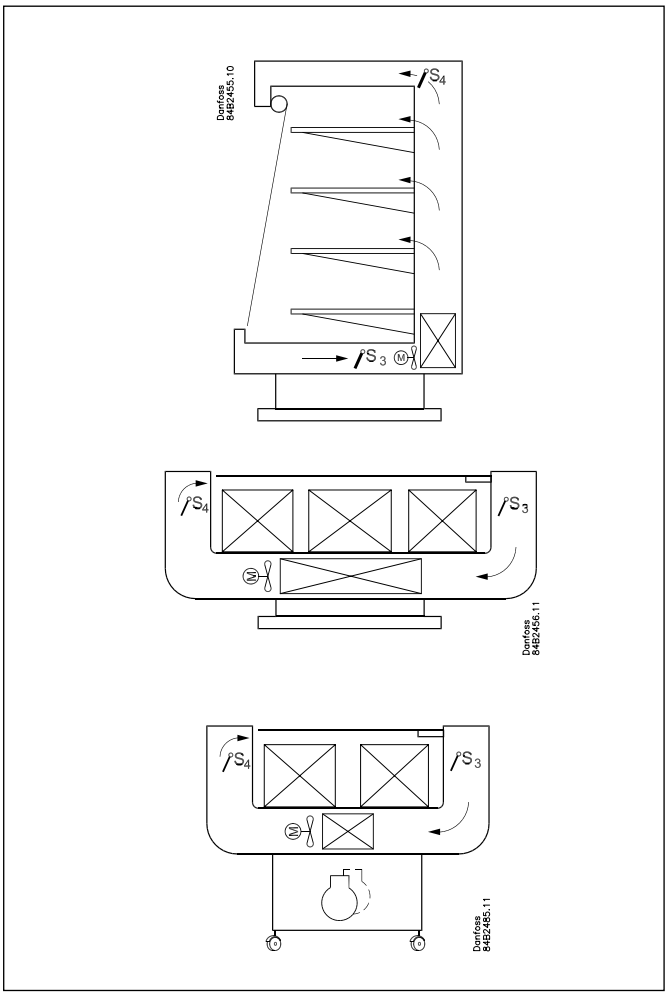
Ordering

Type		Function	Voltage supply	Code No.
EKC 202D		Refrigeration controller without data communication but prepared for mounting of one module	230 V a.c.	**084B8536**
			115 V a.c.	**084B8537**
EKA 178A		Data communication module, MOD bus		**084B8564**
EKA 179A		Data communication module, LON RS 485		**084B8565**
EKA 181A		Battery and buzzer module that will protect the clock in case of lengthy power failure		**084B8566**
EKA 181C		Battery module that will protect the clock in case of lengthy power failure		**084B8577**
EKA 182A		Copy key EKC - EKC		**084B8567**
EKA 163A		External display		**084B8562**

Additional information!
Manual: RS8EE

AK-CC 210





Application

- The controller is used for temperature control refrigeration appliances in supermarkets
- With many predefined applications one unit will offer you many options. Flexibility has been planned both for new installations and for service in the refrigeration trade

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
- Can control two compressors
- Easy to remount data communication
- Quick setup
- Two temperature references
- Digital inputs for various functions
- Clock function with backup
- HACCP (Hazard Analysis and Critical Control Points)
  - Temperature monitoring and registration of period with too high temperature
  - Factory calibration that will guarantee a better measuring accuracy than stated in the standard EN 441-13 without subsequent calibration (Pt 1000 ohm sensor)

Control

The controller contains a temperature control where the signal can be received from one or two temperature sensors.
The thermostat sensors are either placed in the cold air flow after the evaporator, in the warm air flow just before the evaporator, or both. A setting will determine how great an influence the two signals are to have on the control.
A measurement of the defrost temperature can be obtained directly through the use of an S5 sensor or indirectly through the use of the S4 measurement. Four relays will cut the required functions in and out – the application determines which. The options are the following:

- Refrigeration (compressor or relay)
- Fan
- Defrost
- Rail heat
- Alarm
- Light
- Fans for hotgas defrost
- Refrigeration 2 (compressor 2 or relay 2)

Sensors
Up to two thermostat sensors can be connected to the controller. The relevant application determines how.

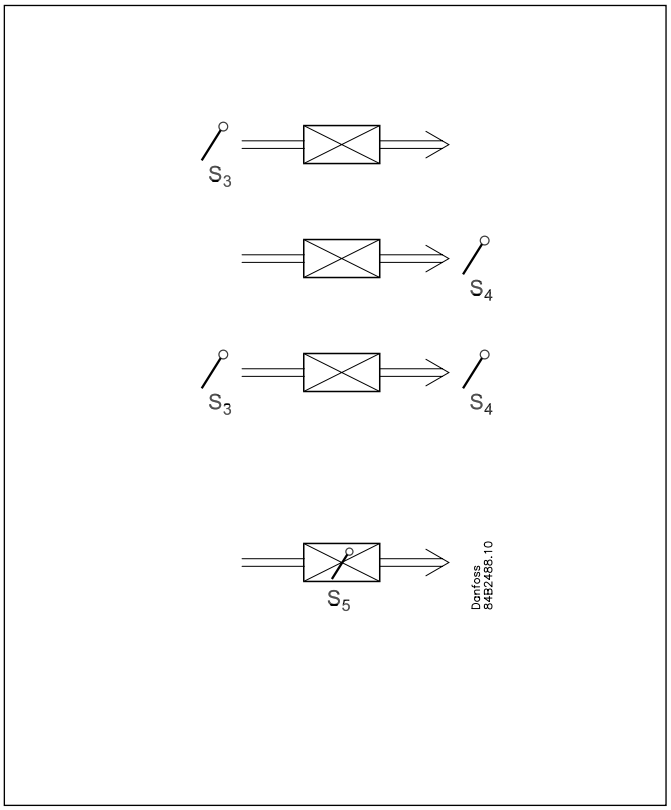
A sensor in the air before the evaporator:
This connection is primarily used when control is based on area.

A sensor in the air after the evaporator:
This connection is primarily used when refrigeration is controlled and there is a risk of a too low temperature near the products.

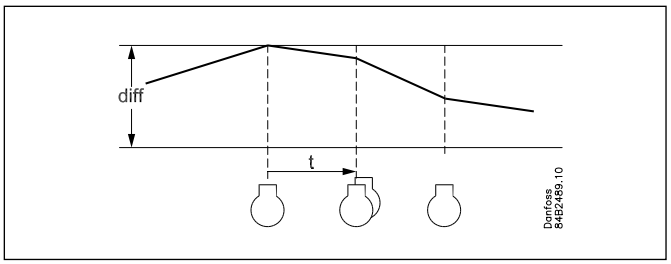
A sensor before and after the evaporator:
This connection offers you the possibility of adapting the thermostat, the alarm thermostat and the display to the relevant application. The signal to the thermostat, the alarm thermostat and the display is set as a weighted value between the two temperatures, and 50% will for example give the same value from both sensors.
The signal to the thermostat, the alarm thermostat and the display can be set independently of one another.

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.

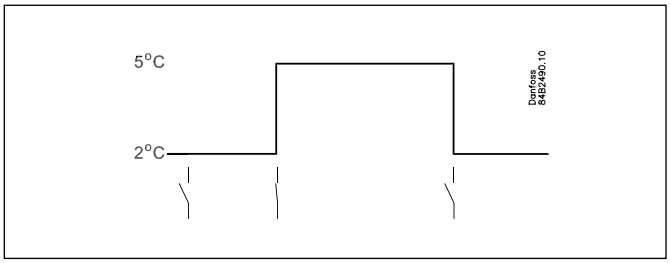
If a defrost sensor is not required, defrost can be stopped based on time, or S4 can be selected.



Control of two compressors
This control is used for controlling two compressors of the same size. The principle of the control is that one compressor cuts in and out based on the thermostat's differential and the other on half the 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.
When the air temperature has dropped by half the differential the one compressor will stop, the other will continue working and not stop until the required temperature is acheived.
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. Here the temperature reference is changed easily with a contact signal on a digital input. The signal raises the normal thermostat value by a predefined amount. At the same time the alarm limits with the same value are displaced accordingly.



Application
Here is a survey of the controller's field of application.

A setting will define the relay outputs so that the controller's interface will be targetted to the chosen application.

S3 and S4 are temperature sensors. The application will determine whether either one or the other or both sensors are to be used.
S3 is placed in the air flow before the evaporator. S4 after the evaporator.
A percentage setting will determine according to what the control is to be based. S5 is a defrost sensor and is placed on the evaporator.
DI1 and DI2 are contact functions that can be used for one of the following functions: door function, alarm function, defrost start, external main switch, night operation, change of thermostat reference, appliance cleaning, forced refrigeration or coordinated defrost. See the functions in settings o02 and o37.

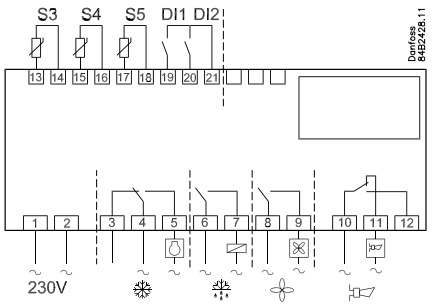
Refrigeration control with one compressor
The functions are adapted to small refrigeration systems which either may be refrigeration appliances or coldrooms.
The three relays can control the refrigeration, the defrost and the fans, and the fourth relay can be used for either alarm function, light control or rail heat control

- The alarm function can be linked up with a contact function from a door switch. If the door remains open longer than allowed there will be an alarm.
- The light control can also be linked up with a contact function from a door switch. An open door will switch on the light and it will remain lit for two minutes after the door has been closed again.
- The rail heat function can be used in refrigeration or freezing appliances or on the door's heating element for frostrooms.

The fans can be stopped during defrost and they may also follow a door switch's open/close situation.

There are several other functions for the alarm function as well as the light control, rail heat control and fans. Please refer to the respective settings.

1



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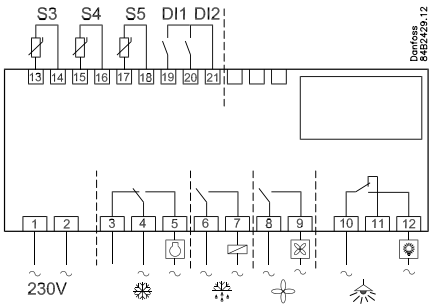

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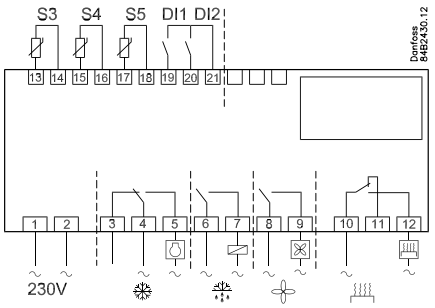
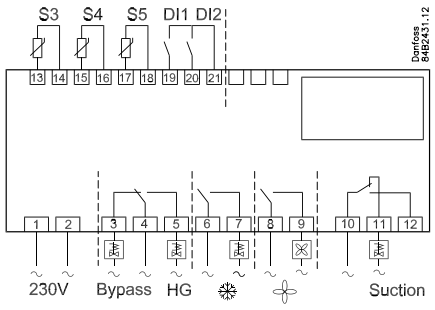


Hot gas defrost
This type of connection can be used on systems with hotgas defrost, but only in small systems in, say, supermarkets – the functional content has **not** been adapted to systems with large charges. Relay 1's change-over function can be used by the bypass valve and/or the hotgas valve.
Relay 2 is used for refrigeration.

Must not be used together with PMLX and GPLX valves, unless a time delay relay is installed, which ensures that the PMLX/GPLX valve is closed completely before the hotgas is turned on.

4



Refrigeration control with two compressors

This group of applications can be used if the controller is to cut two compressors in and out.
The functions can be compared with wiring diagrams 1 to 3, but instead of controlling fans the relay is here used for compressor 2.

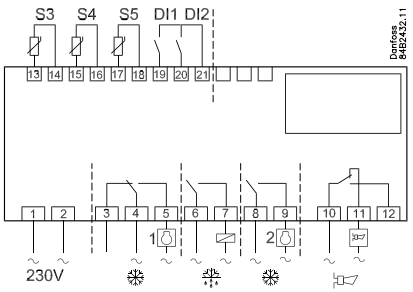
The two compressors must be of the same size. When the controller demands refrigeration it will first cut in the compressor with the shortest operating time. After the time delay the second compressor will be cut in.

When the temperature has dropped to "the middle of the differential", the compressor with the longest operation time will be cut out.
If the running compressor does not manage to reduce the temperature to the cutout point, the other compressor will be cut in again. This happens when the temperature reaches the top part of the differential. If the temperature is instead "stuck" in the differential for two hours, there will be a change-over between the two compressors so that the operating time can be equalised.
The two compressors must be of a type that can start up against a high pressure.

The compressors's settings for "Min On time" and "Min Off time" will always have top priority during normal regulation. But if one of the override functions is activated, the "Min On time" will be disregarded.

If the controller is to cut 2 compressor and 1 fan in and out, relay 4 must cut the fan in and out.
This function is activated in application 10.

5



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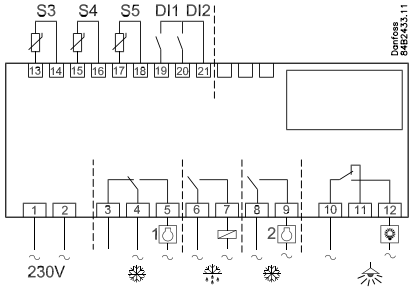

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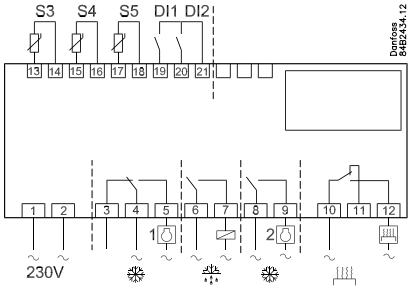

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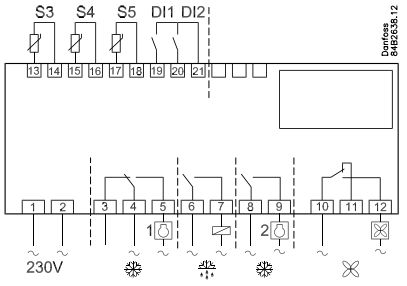
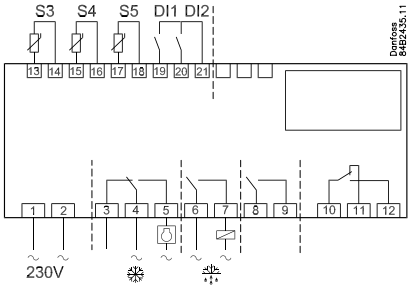


Simple refrigeration with defrost

This application can be used where there is only regulation of refrigeration and defrost.

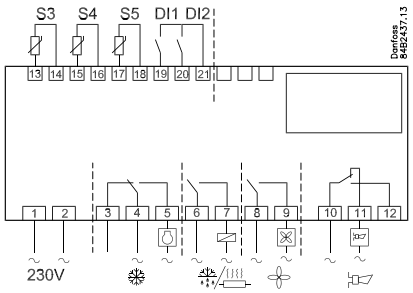
8



Heating function

This application is the same as under 1, but a heating function has been added which protects the unit against too low temperature. The defrost function's heating element is here used for heating.
This application is used where the temperature can go below the set cutout temperature for the refrigeration. To ensure that the temperature will not become too low the heating element is activated x degrees below the reference value.
The S3 sensor **must** be mounted. It supplies the signal when there is heating.

9



Menu survey

SW = 2.0x

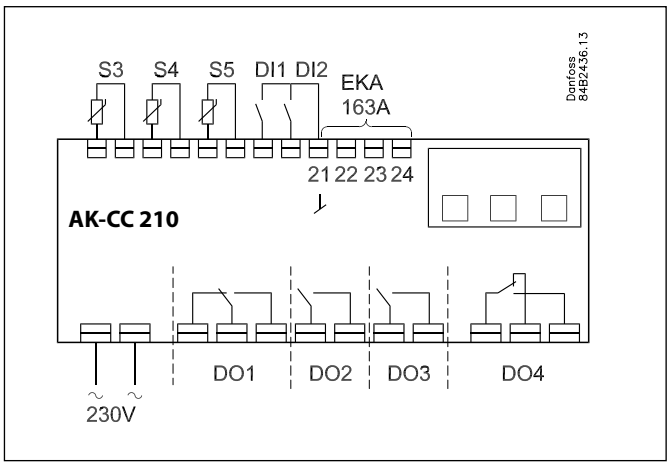
Parameters			EL-diagram number										Min.-	Max.-	Factory
Function		**Codes**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**value**	**value**	**setting**
Normal operation															
Temperature (set point)		---											-50.0°C	50.0°C	2.0°C
Thermostat															
Differential	***	r01											0.0 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 S4		r09											-10.0 K	+10.0 K	0.0 K
Correction of the signal from S3		r10											-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											-10.0 K	10.0 K	0.0 K
Definition and weighting, if applicable, of thermostat sensors - S4% (100%=S4, 0%=S3)		r15											0%	100%	100%
The heating function is started a number of degrees below the thermostats cutout temperature		r36											-15.0 K	-3.0 K	-15.0 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
Signal for alarm thermostat. S4% (100%=S4, 0%=S3)		A36											0%	100%	100%
Compressor															
Min. ON-time		c01											0 min	30 min	0 min
Min. OFF-time		c02											0 min	30 min	0 min
Time delay for cutin of comp.2		c05											0 sec	999 sec	0 sec
Compressor relay 1 must cutin and out inversely (NC-function)		c30											0 OFF	1 ON	0 OFF
Defrost															
Defrost method (none/EL/GAS/BRINE)		d01											no	bri	EL
Defrost stop temperature		d02											0.0°C	25.0°C	6.0°C
Interval between defrost starts		d03											0 hours	48 hours	8 hours
Max. defrost duration		d04											0 min	180 min	45 min
Displacement of time on cutin 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 cutin during defrost		d09											no	yes	yes
Defrost sensor (0=time, 1=S5, 2=S4)		d10											0	2	0
Pump down delay		d16											0 min	60 min	0 min
Drain delay		d17											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
Fan															
Fan stop at cutout 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
HACCP															
Actual temperature measurement for the HACCP function		h01													
Last registered peak temperature		h10													
Selection of function and sensor for the HACCP function. 0 = no HACCP function. 1 = S4 used (maybe also S3). 2 = S5 used		h11											0	2	0
Alarm limit for the HACCP function		h12											-50.0°C	50.0°C	8.0°C
Time delay for the HACCP alarm		h13											0 min.	240 min.	30 min.
Select signal for the HACCP function. S4% (100% = S4, 0% = S3)		h14											0%	100%	100%
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 minute	***	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

			1	2	3	4	5	6	7	8	9	10			
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-pressure). 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 pressure). 11=forced cooling at hot gas defrost.		o02											1	11	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
Access code 1 (all settings)		o05											0	100	0
Used sensor type (Pt /PTC/NTC)		o06											Pt	ntc	Pt
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
Select signal for display view. S4% (100%=S4, 0%=S3)		o17											0%	100%	100%
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-pressure). 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 pressure). 11=forced cooling at hot gas defrost.). 12=coordinaded defrost)		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%	0
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.	*	o61*											1	10	1
Download a set of predetermined settings.	*	o62*											0	6	0
Access code 2 (partly access)	***	o64											0	100	0
Save the controllers present settings to the programming key. Select your own number.		o65											0	25	0
Load a set of settings from the programming key (previously saved via o65 function)	*	o66*											0	25	0
Replace the controllers factory settings with the present settings		o67											OFF	On	OFF
Service															
Status codes.		S0-S33													
Temperature measured with S5 sensor	***	u09													
Status on DI1 input. on/1=closed		u10													
Temperature measured with S3 sensor	***	u12													
Status on night operation (on or off) 1=closed	***	u13													
Temperature measured with S4 sensor	***	u16													
Thermostat temperature		u17													
Read the present regulation reference		u28													
Status on DI2 output. on/1=closed		u37													
Temperature shown on display		u56													
Measured temperature for alarm thermostat		u57													
Status on relay for cooling	**	u58													
Status on relay for fan	**	u59													
Status on relay for defrost	**	u60													
Status on relay for railheat	**	u61													
Status on relay for alarm	**	u62													
Status on relay for light	**	u63													
Status on relay for valve in suction line	**	u64													
Status on relay for compressor 2	**	u67													

*) 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 menues will be limited

Factory setting
If you need to return to the factory-set values, it can be done in this way:
- Cut out the supply voltage to the controller
- Keep both buttons depressed at the same time as you reconnect the supply voltage

Connections



Application adaptation:
Via a simple selection the controller can be adapted to 10 different applications.

Application no.	Outputs				Inputs				
	DO1	DO2	DO3	DO4	DI1	DI2	S3	S4	S5
1					●	●	●	●	●
2					●	●	●	●	●
3					●	●	●	●	●
4	*1	*2		*3	●	●	●	●	●
5					●	●	●	●	●
6					●	●	●	●	●
7					●	●	●	●	●
8					●	●	●	●	●
9					●	●	●	●	●
10					●	●	●	●	●

*1: Hotgas and bypass valve
*2: Liquid line solenoid valve
*3: Suction line solenoid valve

Power supply
230 V a.c.

Sensors
S3 and S4 are thermostat sensors.
A setting determines whether S3 or S4 or both of them are to be used.
S5 is a defrost sensor and is used if defrost has to be stopped based on temperature.

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

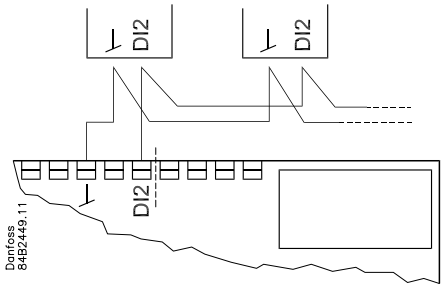
Relays
The general uses are mentioned here.
DO1: Refrigeration. The relay will cut in when the controller demands refrigeration
DO2: Defrost. The relay will cut in when defrost is in progress
DO3: For either fans or refrigeration 2
Fans: The relay will cut in when the fans have to operate
Refrigeration 2: The relay will cut in when refrigeration step 2 has to be cut in
DO4: For either alarm, rail heat, light or hotgas defrost
Alarm: See 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
Light: The relay cuts in when the light has to be switched on
Hotgas defrost: See diagram. The relay will cut in when defrost has to be done.

Data communication
The controller can be carried out with the data communication. If data communication is used, it is important that the installation of the data communication cable is performed correctly.
See separate literature No. RC8AC…

The controller cannot be hooked up with a monitoring unit type m2.

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

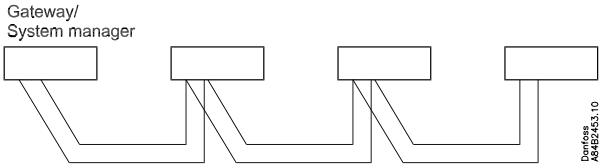
Coordinated defrost via cable connections



The following controllers can be connected up in this way:
AK-CC 210

Refrigeration is resumed when all controllers have "released" the signal for defrost.

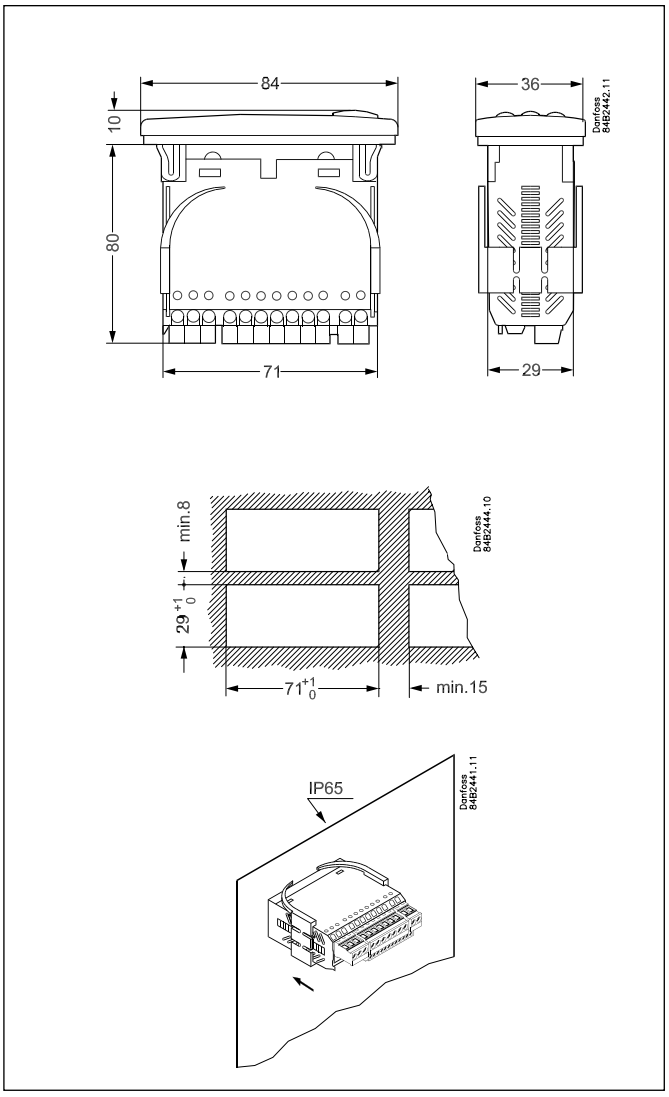
Coordinated defrost via
data communication



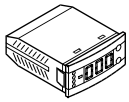
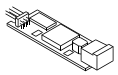
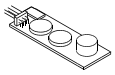
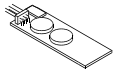
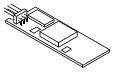
Data

Supply voltage	230 V a.c. +10/-15 %. 2.5 VA		
Sensors 3 pcs off either	Pt 1000 or PTC (1000 ohm/25°C) or NTC-M2020 (5000 ohm/25°C)		
Accuracy	Measuring range	-60 to +99°C	
	Controller	±1 K below -35°C ±0.5 K between -35 to +25°C ±1 K above +25°C	
	Pt 1000 sensor	±0.3 K at 0°C ±0.005 K per grad	
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 connection cable	Max.1,5 mm² multi-core cable		
Relays*		CE (250 V a.c.)	UL *** (240 V a.c.)
	DO1. Refrigeration	10 (6) A	10 A Resistive 5FLA, 30LRA
	DO2. Defrost	10 (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 to +55°C, During operations -40 to +70°C, During transport		
	20 - 80% Rh, not condensed		
	No shock influence/vibrations		
Enclosure	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 og EN 60730-2-9, A1, A2 EMC tested acc. EN50082-1 og EN 60730-2-9, A2		

* DO1 and DO2 are 16 A relays. DO3 and DO4 are 8 A relays. Max. load must be keept.
** Gold plating ensures make function wiht small contact loads
*** UL-approval based on 30000 couplings



Ordering

Type		Function	Code no.
AK-CC 210		Refrigeration controller without data communication but prepared for it	**084B8520**
EKA 178A		Data communication module MOD-BUS	**084B8564**
EKA 179A		Data communication module LON RS 485	**084B8565**
EKA 181A		Battery and buzzer module that will protect the clock in case of lengthy power failure	**084B8566**
EKA 181C		Battery module that will protect the clock in case of lengthy power failure	**084B8577**
EKA 182A		Copy key EKC - EKC	**084B8567**

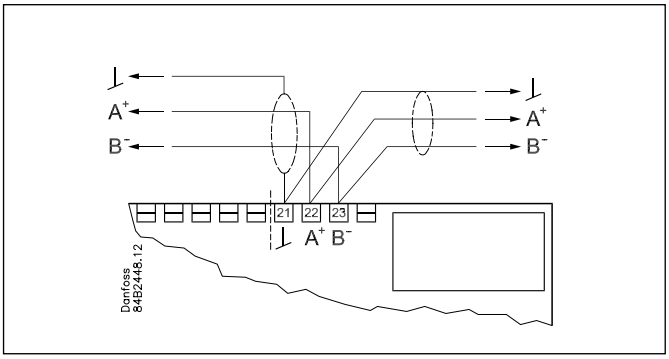
Additional information!
Manual: RS8EP

AK-CC 250

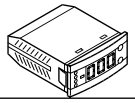
This control is a variant of AK-CC 210. It differs on the following points:
- Fixed MOD-BUS data communication
- No option of connection to external display

In addition:
- No module with other data communication can be mounted
- The menus are the same with the exception of o04, which has been removed.

Connection of data communication



Ordering

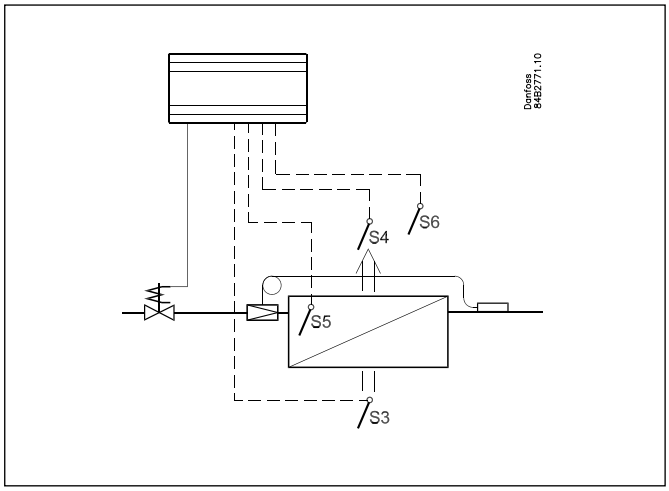
Type		Function	Code No.
AK-CC 250		Refrigeration control with MOD bus data communication	**084B8524**

AK-CC 450

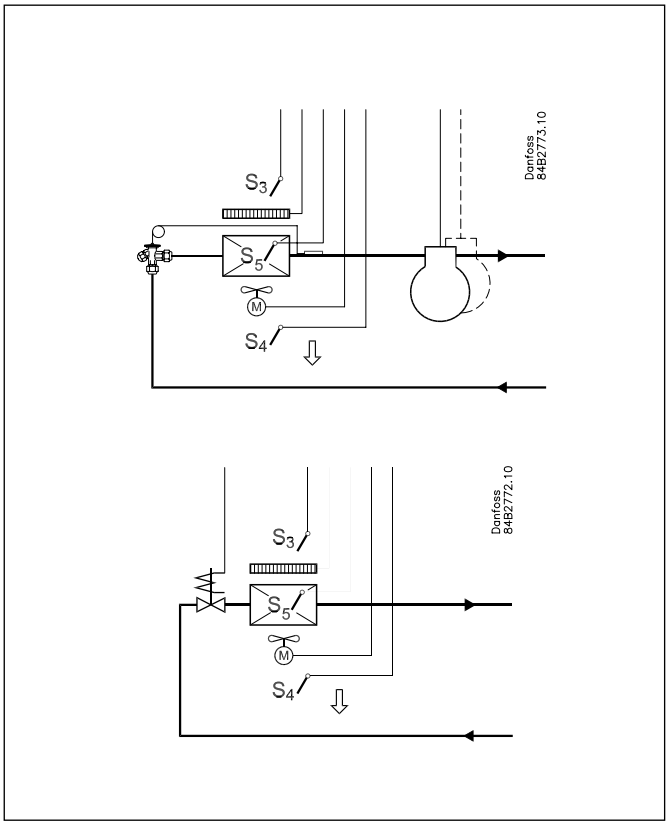
Application
Complete refrigeration appliance control with great flexibility to adapt to all types of refrigeration appliances and cold storage rooms.
• For cooling with brine
• For use with a thermostatic expansion valve.

Advantages
• Energy optimisation of the whole refrigeration appliance
• One controller for several different refrigeration appliances
• Integrated display at the front of the controller
• Quick set-up with predefined settings
• Built-in data communication
• Built-in clock function with power reserve

Principle
The temperature in the appliance is registered by one or two temperature sensors which are located in the air flow before the evaporator (S3) or after the evaporator (S4) respectively. A setting for thermostat, alarm thermostat and display reading determines the influence the two sensor values should have for each individual function.
In addition product sensor S6, which can be optionally placed in the appliance, can be used to register the temperature near the required product in a certain place within the appliance.
The temperature of the evaporator is registered with the S5 sensor which can be used as a defrosting sensor.
In addition to the outlet to the solenoid valve, the controller has 5 relay outputs which are defined by the use selected.



Functions
• Day/night thermostat with ON/OFF or modulating principle
• Product sensor S6 with separate alarm limits
• Switch between thermostat settings via digital input
• Start of defrost via schedule, digital input or network
• Natural, electric or hot gas defrost
• Stop of defrost on time and/or temperature
• Coordination of defrosting among several controls
• Pulsing of fans when thermostat is satisfied
• Case cleaning function for documentation of HACCP procedure
• Rail heat control via day/night load or dew point
• Door function
• Control of two compressors
• Control of night blinds
• Light control
• Heat thermostat
• Factory calibration that will guarantee a better measuring accuracy than stated in the standard EN 441-13 without subsequent calibration (Pt 1000 ohm sensor)
• Integrated MODBUS communication with the option of mounting a LonWorks or Ethernet communication card



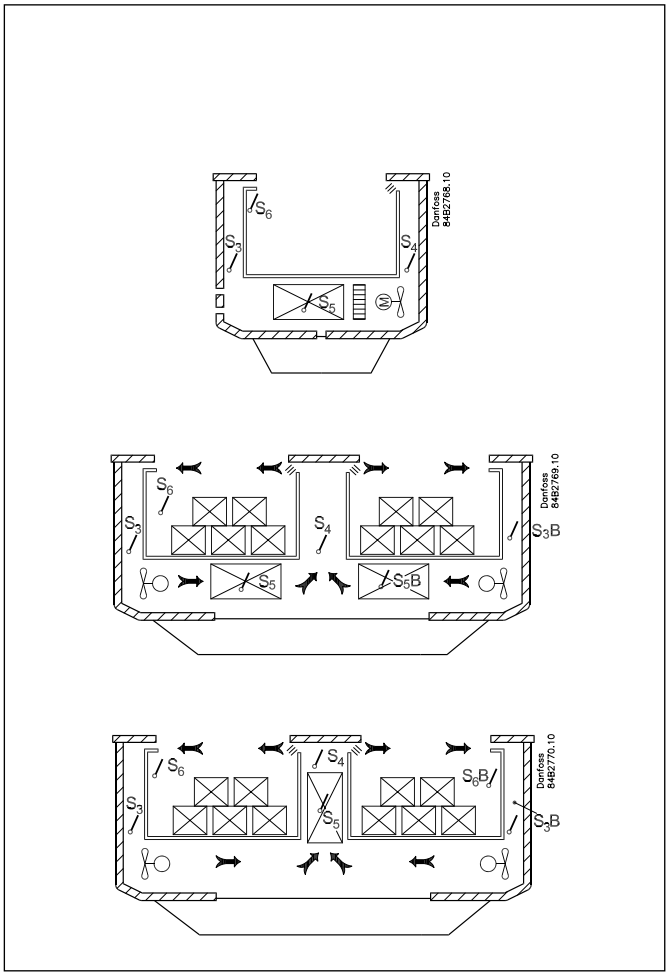
Applications

Here is an overview of the controller's usage options.
A setting will configure input and outputs so that the controller's operation interface is directed at the selected application.

Application 1-5
These uses are applied to standard appliances or cold storage rooms with one valve, one evaporator and one refrigeration section.
The sensors are used according to standard principles.
The output functions change depending on the selected application.

Application 6
This use is for refrigeration appliances with one valve, two evaporators and two refrigeration sections.
Here the temperature and alarm monitoring are always controlled using the S4 sensor.
The two S3 temperatures are used to display the reading for each cooling section.
There are two defrost sensors – one for each evaporator.

Application 7
This use is for refrigeration appliances with one valve, one evaporator and two refrigeration sections.
Here temperature is always controlled using the S4 temperature.
The two S3 temperatures are used for alarm monitoring and display readings for each refrigeration section. There are separate alarm delays. There are two product sensors S6, one for each cooling section.



Application	DO1	DO2	DO3	DO4	DO5	DO6	DI1	DI2	DI3	AI1	AI2	AI3	AI4	AI5	AI6
1							●	●	●			S3	S4	S5	S6
2		Blinds					●	●	●			S3	S4	S5	S6
3	1		2				●	●	●			S3	S4	S5	S6
4		suction		hotgas			●	●	●			S3	S4	S5	S6
5			heat				●	●	●			S3	S4	S5	S6
6			B	A			●	●	●	S3B	S5B	S3A	S4	S5	S6
7							●	●	●	S3B	S6B	S3A	S4	S5	S6A

Digital input

There are three digital inputs available with many usage options for all settings. The two inputs are connection inputs and the third is a 230 V input.

Extra modules

A module can be mounted in the control. It can be for one of the following functions:
Data communication with MOD bus
Data communication with LON RS 485
Battery module with extra power reserve.

General data

- Supply = 230 V a.c.
- Sensor inputs = 6 no.
- Compressor / solenoid valve output = 1 no.
- Number of relay outputs = 5 no.
- Pt 1000 ohm sensors on all outputs (all air sensors can however be changed to PTC 1000 ohm)
- Two versions with different sensor connections:
  - Screw terminals
  - AMP plug

Ordering

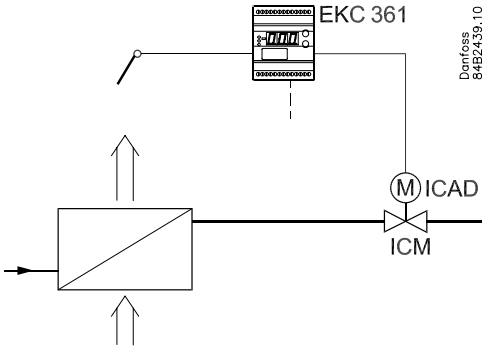
Designation	Type	**Code No.**
Refrigeration appliance (with screw terminals)	AK-CC 450	**084B8022**

Additional information!
Manual: RS8EU

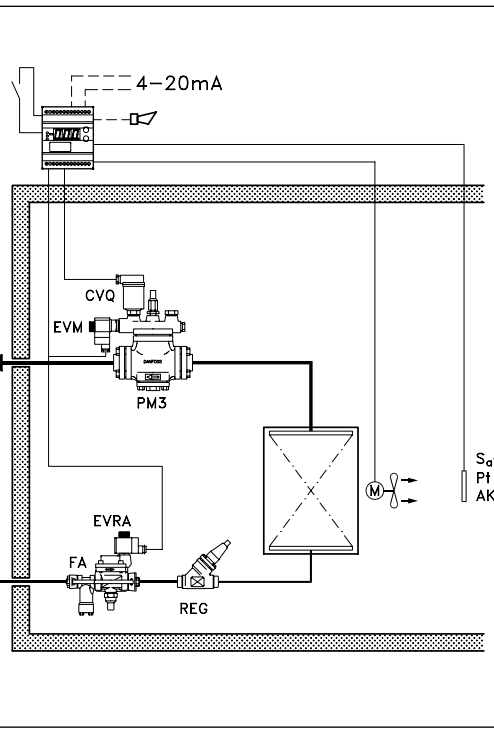
EKC 361

Application
The controller and valve can be used where there are stringent requirements to accurate temperature control in connection with refrigeration.
E.g.:
- Cold room for fruits and food products
- Refrigerating systems
- Work premises in the food industry
- Process cooling of liquids

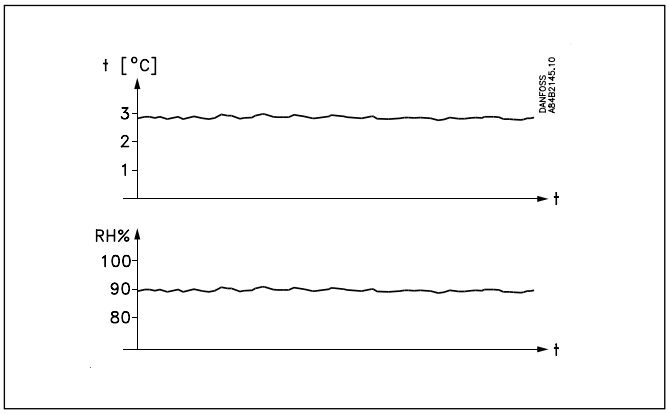
Advantages
- The temperature is kept within an accuracy of ±0.25°C or better after a transient phenomenon
- The evaporator's temperature is kept as high as possible, so that the air humidity is kept high and waste is limited
- A transient phenomenon can be controlled with the adaptive function. Select either:
  - Fast build-up where underswings are allowed
  - Not quite so fast build-up where underswings are less pronounced
  - Build-up without underswings
- PID regulation
- p_0 limitation



Functions
- Modulating temperature control
- Digital ON/OFF input for start/stop of regulation ICS/PM or forced closing of ICM
- Alarm if the set alarm limits are exceeded
- Relay output for fan
- Relay output for solenoid valves
- Analog input signal that can displace the temperature reference
- Analog Output signal corresponding to selecting temperature as running display value. Please observe : Not possible if ICM is selected as valve

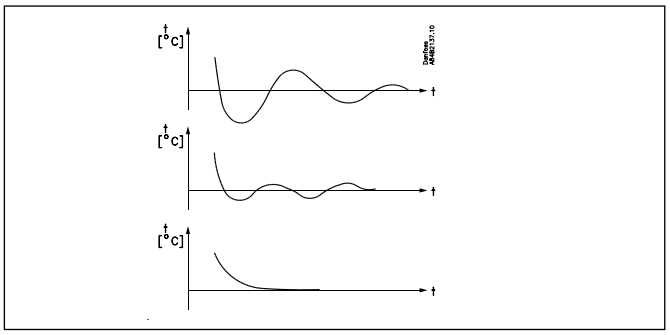


Very accurate temperature control
With this system where controller, pilot valve and main valve have been adapted for optimum use in the refrigerating plant, the refrigerated products may be stored with temperature fluctuations of less than ±0.25°C.

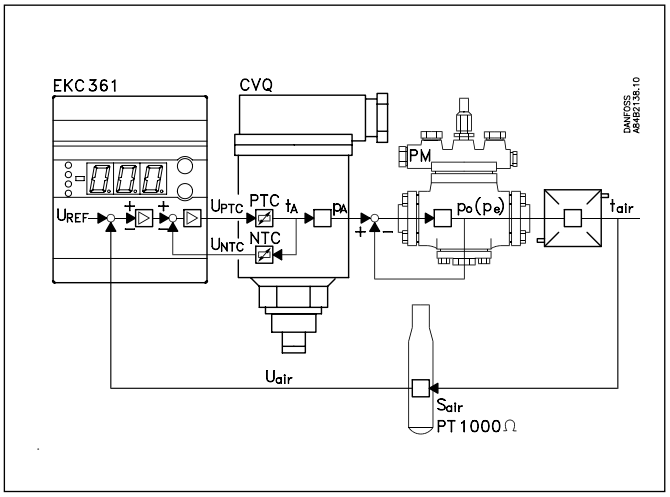


High air humidity
As the evaporating temperature is constantly adapted to the refrigeration needs and will always be as high as possible with a very small temperature fluctuation, the relative air humidity in the room will be kept at a maximum.
Drying-out of the products will in this way be reduced to a minimum.

Temperature is quickly attained
With the built-in PID control and the possibility of choosing between three transient phenomena, the controller can be adapted to a kind of temperature performance that is optimum for this particular refrigerating plant. See parameter (n07).
- **Fastest** possible cooling
- Cooling with **less** underswing
- Cooling where underswing is **unwanted.**



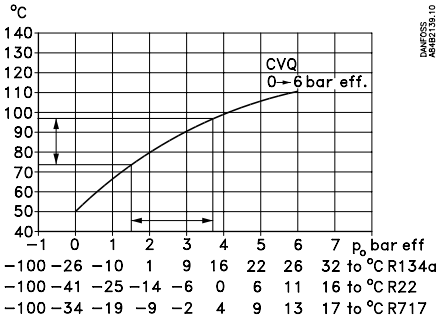
Regulation ICS/PM with CVQ
The controller receives signals from room sensor S_{air}. This room sensor must be placed at the air outlet from the evaporator to obtain the best possible regulation. The controller sees to it that the required room temperature is maintained.
Built-in between the controller and the actuator is a so-called inner control loop which constantly checks the temperature (pressure) in the actuator's pressure vessel. In this way a very stable control system is obtained.
If there is a deviation between the required and the registered temperature the controller will immediately send more or fewer pulses to the actuator to counteract the error. A change of the number of pulses will act on the temperature and hence the pressure in the pressure vessel. As the charging pressure and the evaporating pressure p_0 follow each other, a changed charging pressure will produce the effect that the valve's opening degree is also changed. The ICS/PM with CVQ system maintains the pressure in the evaporator whatever pressure changes there may be on the suction side (on the ICS/PM valve's outlet).



Evaporating pressure limitation (p_0 limitation)
The inner control loop mentioned above also causes the evaporating pressure to stay within a fixed limit. In this way the system is safeguarded against a too low supply air temperature.
It offers the following advantages:
- High-temperature systems can be connected to low-temperature compressor units
- Protection against icing on evaporator
- Frost protection of liquid coolers

The allowed temperature in the actuator determines the evaporating pressure

Actuator temperature



Regulation with ICM
When using ICM as selected valve the system will still control ICM in order to maintain S_{air} according to entered setpoint.
This system does not inlude any inner control loop.
It is a direct operating and pressure independent valve for controlling media temperatur. (S_{air}).

Menu survey

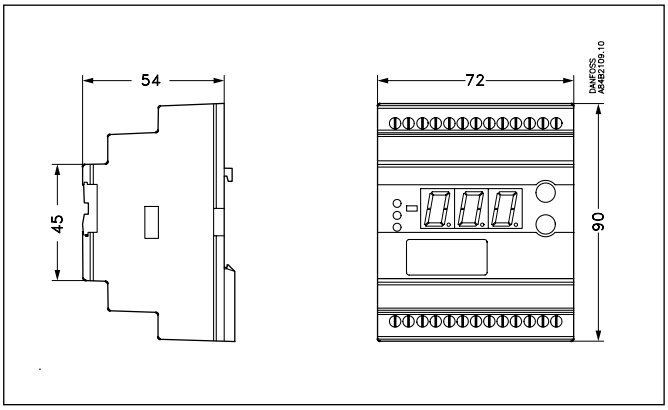
SW =1.5x

Function	Para-meter	Min.	Max.	Fac. setting
Normal display				
Shows the temperature at the selected sensor At ICM valve OD also can be selected	-		°C	
Reference				
Set the required room temperature	-	-70°C	160°C	10°C
Temperature unit	r05	°C	°F	°C
Input signal's temperature influence	r06	-50°C	50°C	0.0
Correction of the signal from S_{air}	r09	-10.0°C	10,0°C	0.0
Correction of the signal from S_{aux}	r10	-10.0°C	10,0°C	0.0
Start/stop of refrigeration	r12	OFF/0	On/1	On/1
Alarm				
Upper deviation (above the temperature setting)	A01	0	50 K	5.0
Lower deviation (below the temperature setting)	A02	0	50 K	5.0
Alarm's time delay	A03	0	180 min	30
Regulating parameters				
Actuator max. temperature	n01	41°C	140°C	140
Actuator min. temperature	n02	40°C	139°C	40
Actuator type (1=CVQ-1 to 5 bar, 2=CVQ 0 to 6 bar, 3=CVQ 1.7 to 8 bar, 4= CVMQ, 5=KVQ, 6= ICM)	n03	1	6	2
P: Amplification factor Kp	n04	0.5	50	3
I: Integration time Tn (600 = off)	n05	60 s	600 s	240
D: Differentiation time Td (0 = off)	n06	0 s	60 s	10
Transient phenomenon 0: Ordinary control 1: Underswing minimised 2: No underswing	n07	0	2	2
OD - Opening degree - max. limit - ICM only	n32	0%	100%	100
OD - Opening degree min limit - ICM only	n33	0%	100%	0
Miscellaneous				
Controller's address (0-120)	o03*	0	990	0
ON/OFF switch (service-pin message)	o04*	-	-	
Define output signal of analog output: 0: no signal, 1: 4 - 20 mA, 2: 0 - 20 mA	o09	0	2	0
Define input signal of analog input 0: no signal, 1: 4 - 20 mA, 2: 0 - 20 mA	o10	0	2	0
Language (0=english, 1=German, 2=French, 3=Danish, 4=Spanish and 6=Swedish.)When you change the setting to an other language you must activate o04 before "the new language" can be visible from the AKM program.	011*	0	6	0
Set supply voltage frequency	o12	50 Hz/0	60 Hz/1	0
Select of running display value	o17	Au/0	Air/1	Air/1
(Setting for the function o09) Set the temperature value where the output signal must be minimum (0 or 4 mA)	o27	-70°C	160°C	-35
(Setting for the function o09) Set the temperature value where the output signal must be maximum (20 mA)	o28	-70°C	160°C	15
Service				
Read temperature at the S_{air} sensor	u01		°C	
Read regulation reference	u02		°C	
Read temperature at the S_{aux} sensor	u03		°C	
Read valve's actuator temperature	u04		°C	
Read reference of the valve's actuator temperature	u05		°C	
Read value of external current signal	u06		mA	
Read value of transmitted current signal	u08		mA	
Read status of input DI	u10		on/off	
ICM opening degree. (only at ICM)	u24		%	

*) This setting will only be possible if a data communication module has been installed in the controller.

Data

Supply voltage	24 V a.c. +/-15% 50/60 Hz, 80 VA (the supply voltage is galvanically separated from the input and output signals)	
Power consumption	Controller Actuator	5 VA 75 VA
Input signal	Current signal	4-20 mA or 0-20 mA
	Digital input from external contact function	
Sensor input	2 pcs. Pt 1000 ohm	
Output signal	Current signal	4-20 mA or 0-20 mA Max. load: 200 ohm
Relay output	2 pcs. SPST	a.c.-1: 4 A (ohmic) a.c.-15: 3 A (inductive)
Alarm relay	1 pcs. SPST	
Actuator	Input	Temperature signal from sensor in the actuator
	Output	Pulsating 24 V a.c. to actuator
Data communication	Possible to connect a data communication module	
Ambient temperature	During operation During transport	-10 - 55°C -40 - 70°C
Enclosure	IP 20	
Weight	300 g	
Mounting	DIN rail	
Display	LED, 3 digits	
Terminals	max. 2.5 mm² multicore	
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 EN50081-1 and EN 50082-2	

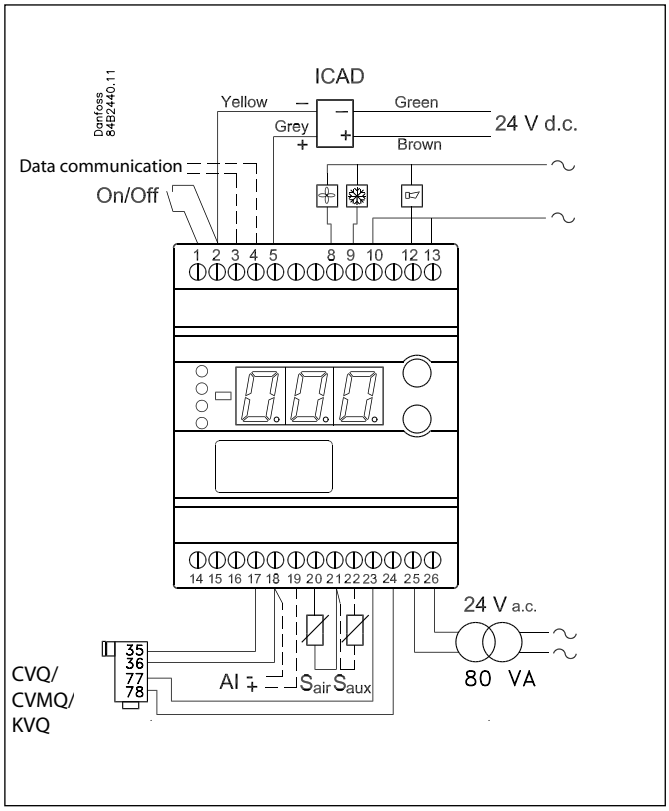


Ordering

Type	Function	Code No.
EKC 361	Evaporating pressure controller	**084B7060**
EKA 174	Data communication module (accessories), (RS 485 module) with galvanic separation	**084B7124**

The installation of data communications must comply with the requirements described in literature sheet no. RC8AC

Connections



Additional information!
Manual: RS8AE

EKC 368

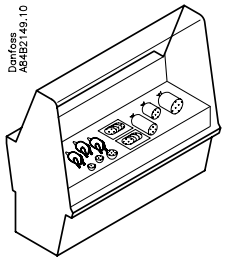
Application
Controller and valve are used where there are high requirements to refrigeration of unpacked food products, e.g.:

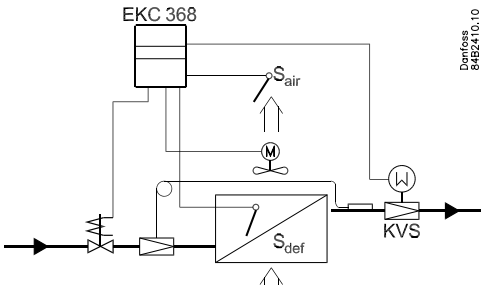
- Delicatessen appliances
- Cold rooms for meat products
- Cold rooms for fruits and vegetables
- Containers
- Air conditioning plant

Advantages
- Wastage is reduced because the air humidity around the products is kept as high as possible.
- The temperature is kept within an accuracy of ±0.25°C or better after a transient phenomenon
- A transient phenomenon can be controlled with the adaptive function so that temperature variations is kept on a minimum.
- Defrost sensor, so that the defrost time will be as short as possible.
- PID regulation

System
A KVS valve is used. The capacity determines the size of it.
A solenoid valve is mounted in the liquid line which is to close when the controller stops refrigeration.
Sensor S_{air} must be placed in the cold air current after the evaporator.

Functions
- Modulating temperature control
- Defrost function: electricity, hotgas or natural
- Alarm if the set alarm limits are exceeded
- Relay outputs for defrost function, solenoid valve, fan and alarmgiver
- Input signal that can displace the temperature reference

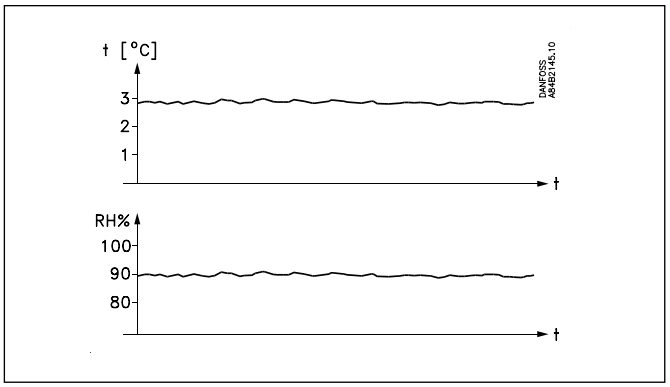




LED's on front panel

	KVS - signal
	Refrigeration
	Fan
	Defrost

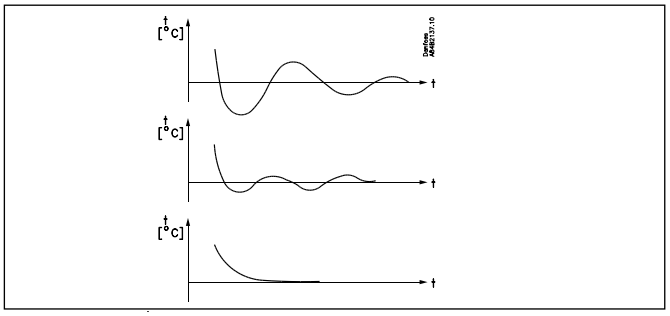
Very accurate temperature control
With this system where controller and valve have been adapted for optimum use in the refrigerating plant, the refrigerated products may be stored with temperature fluctuations of less than ±0.5°C.



High air humidity
As the evaporating temperature is constantly adapted to the refrigeration needs and will always be as high as possible with very small temperature fluctuations, the relative air humidity in the room will be kept at a maximum.
Drying-out of products will therefore be reduced to a minimum.

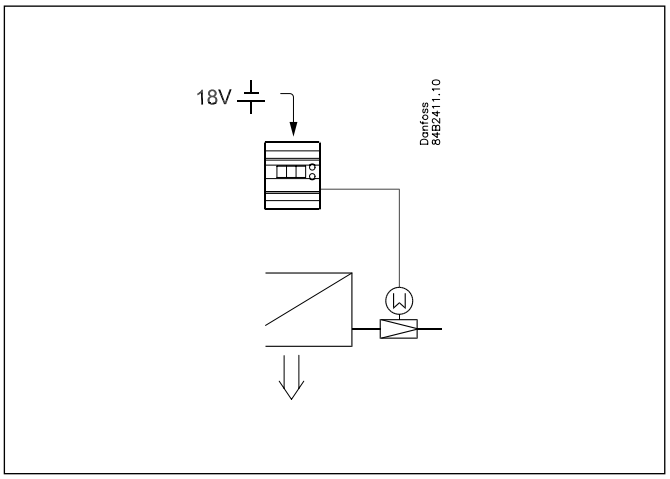
Temperature is quickly attained
With the built-in PID control and the possibility of choosing between three transient phenomena, the controller can be adapted to a kind of temperature performance that is optimum for this particular refrigerating plant.

- **Fastest** possible cooling
- Cooling with less underswing
- Cooling where underswing is **unwanted**



Valve
The valve is an evaporating pressure valve and is available in several capacity sizes.
The valve is mounted on a step engine which receives impulses from the controller.
The controller is adapted to this valve. There is therefore only very few settings for the valve.

In case of power failure that valve's opening degree will be maintained. If the application requires the valve open in this situation a battery can be connected to the controller.



Menu survey

SW =1.6x

Function	Parameter	Min.	Max.	Fac. setting
Normal display				
Shows the temperature at the room sensor	-		°C	
Give the lower button a brief push to see the temperature at the defrost sensor	-		°C	
Reference				
Set the required room temperature	-	-70°C	160°C	10
Temperature unit	r05	°C	°F	°C
External contribution to the reference	r06	-50 K	50 K	0
Correction of the signal from Sair	r09	-10.0 K	10,0 K	0
Correction of the signal from Sdef	r11	-10.0 K	10,0 K	0
Start/stop of refrigeration	r12	OFF	On	On
Alarm				
Upper deviation (above the temperature setting)	A01	0	50 K	5
Lower deviation (below the temperature setting)	A02	0	50 K	5
Alarm's time delay	A03	0	180 min	30
Monitoring of battery	A34	Off	On	Off
Defrost				
Defrost method (ELECTRICITY/GAS)	d01	Off	GAS	Off
Defrost stop temperature	d02	0	25°C	6
Max. defrost duration	d04	0	180 min	45
Drip-off time	d06	0	20 min	0
Delay for fan start or defrost	d07	0	20 min	0
Fan start temperature	d08	-15°C	0°C	-5
Fan cut in during defrost (yes/no)	d09	no	yes	no
Delay for temperature alarm after defrost	d11	0	199 min	90
Regulating parameters				
Actuator type: 1=KVS15-22, 2=KVS28-35, 3=KVS42-54 4=User defined via AKM/For Danfoss only Setting of menu only when r12 = off.	n03	1	4	1
P: Amplification factor Kp	n04	1	50	4
I: Integration time Tn (600 = off)	n05	60 s	600 s	120
D: Differentiation time Td (0 = off)	n06	0 s	60 s	0
Transient phenomenon 0: Fast cooling 1: Cooling with less underswing 2: Cooling where underswing is unwanted	n07	0	2	1
Start-up time after hotgas defrost	n08	0 min	20 min	1
Miscellaneous				
Controller's address	o03*	1	60	0
ON/OFF switch (service-pin message)	o04*	-	-	Off
Define input signal of analog input 0: no signal 1: 0 - 10 V 2: 2 - 10 V	o10	0	2	0
Set supply voltage frequency	o12	50 Hz	60 Hz	50
Service				
Read temperature at the Sair sensor	u01		°C	
Read regulation reference	u02		°C	
Read value of external voltagt signal	u07		V	
Read temperature at the Sdef sensor	u09		°C	
Read status of input DI	u10		on/off	
Read duration of defrost	u11		m	
Opening degree of the valve	u23		%	

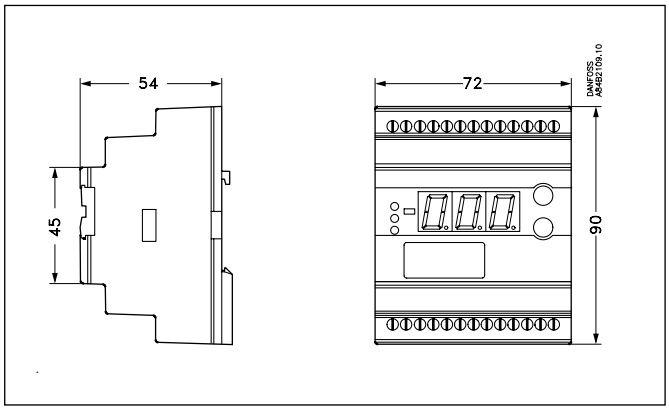
*) This setting will only be possible if a data communication module has been installed in the controller.

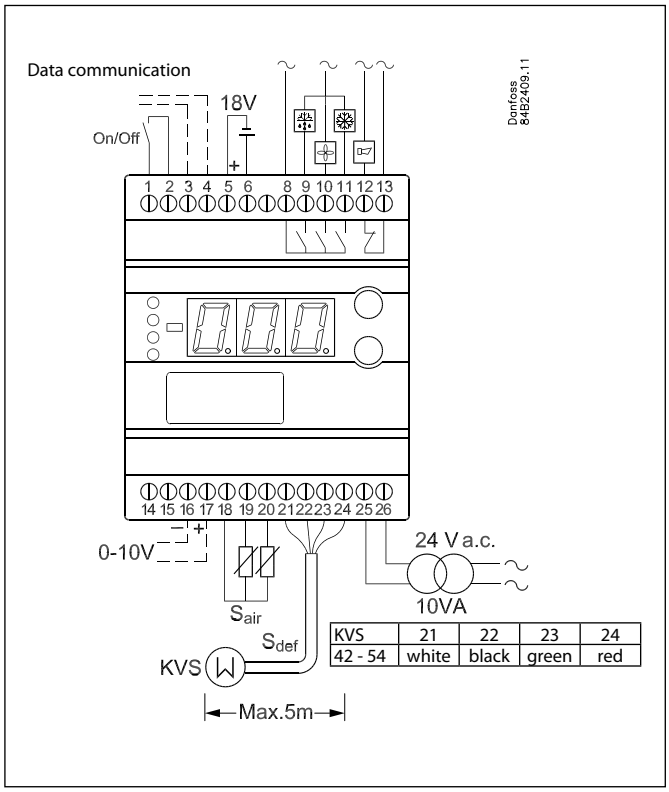
Factory setting
If you need to return to the factory-set values, it can be done in this way:
- Cut out the supply voltage to the controller
- Keep both buttons depressed at the same time as you reconnect the supply voltage

Data

Supply voltage	24 V a.c. +/-15% 50/60 Hz, 10 VA (the supply voltage is galvanically separated from the input and output signals)	
Power consumption	Controller KVS-step motor	5 VA 1.3 VA
Input signal	Voltage signal	0-10 V or 2-10 V
	Digital input from external contact function	
	Short-circuit (pulse signal) of 18-20 will start a defrost	
Sensor input	2 pcs. Pt 1000 ohm	
Relay output	3 pcs. SPST	a.c.-1: 4 A (ohmic) a.c.-15: 3 A (inductive)
Alarm relay	1 pcs. SPST	
Step motor output	Pulsating 100 mA	
Data communication	Possible to connect a data communication module	
Ambient temperature	During operation During transport	-10 - 55°C -40 - 70°C
Enclosure	IP 20	
Weight	300 g	
Mounting	DIN rail	
Display	LED, 3-digits	
Terminals	max. 2.5 mm2 multicore	
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 EN50081-1 and EN 50082-2	

If battery backup is used:
Requirements to battery: 18 V d.c. min. 100 mAh





Ordering

Type	Function	Ordering
EKC 368	Evaporating pressure controller	**084B7079**
EKA 172	Realtime clock	**084B7069**
EKA 175	Data communication module (accessories), (RS 485 module)	**084B7093**
EKA 174	Data communicationsmodule (accessories), (RS 485 module) with galvanic separation	**084B7124**

The installation of data communications must comply with the requirements described in literature sheet no. RC8AC

Additional information!
Manual: RS8DG

Evaporator controls and electrically operated expansion valves

Introduction

Since the introduction of the AKV pulse-width modulated electronic expansion valve has contributed to energy savings in the supermarket refrigeration systems, and is continuously under development to ensure further efficiency. Investment into intelligent and adaptive controls brings lower energy consumption and also lower running costs of the supermarket refrigeration systems.

In order to achieve efficient and optimal liquid injection, installation of an electronic expansion valve and controller with adaptive control of the superheat is required. Adaptive automatic refrigeration control system is possible as no manual setting is required, and the system itself finds the optimal superheat level according to current operating conditions.

The electronic expansion valve is also a precondition for further optimisation of the refrigeration installation because not only does it provide accurate control, but it also transmits valuable information about the load and performance of the refrigeration system.

The AKV pulse-width modulated electronic expansion valve together with the corresponding evaporator controller and other ADAP-KOOL® controllers make energy savings even higher by ensuring suction and condensing pressure optimisation.

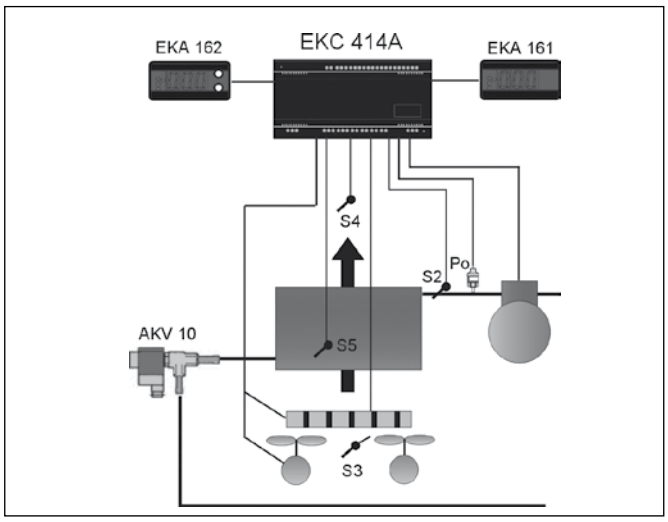
ADAP-KOOL® evaporator controls enable optimal functionality of refrigeration system, and, at the same time, save energy and keep food quality in display cases and cold rooms thanks to features like defrost function, adaptive superheat control with AKV electronic expansion valve and others.

Among the controls there are three different families of controllers with the following features:

1) **EKC 414/ EKC 514** series are dedicated evaporator controllers that can control one evaporator in a display case or cold room. It controls temperature, fan, compressor, defrost, lighting and rail heat or alarm. Advanced control features like adaptive superheat control with AKV electronic expansion valve, adaptive suction pressure control, modulating temperature control and defrost co-ordination of this controller help to achieve energy savings and keeping food quality.

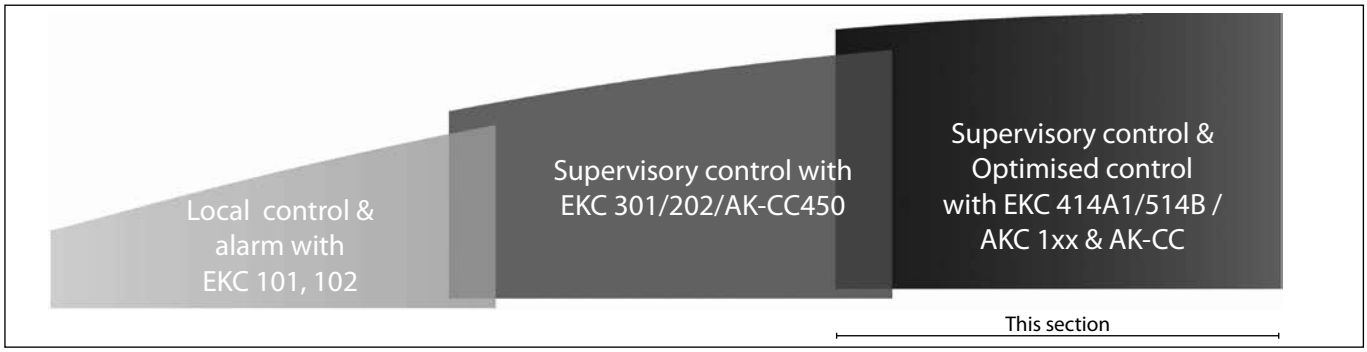
2) **AKC 1xx** series are evaporator controls for refrigeration appliances and small cold rooms where the system consists of controller, up to 3 valves and sensors. The system, on the whole, replaces all other automatic controls, as it contains an injection function for optimum utilisation of evaporators, day and night thermostats, defrost function, fan control, rail heat control, light control, alarm function, and so on.
AKC controllers have built-in DANBUSS data communication.

3) **AK-CC 550** is for controlling an evaporator. It is extremely flexible and can be used for different types of refrigeration appliances.
A software setting is used to define one of 10 possible applications, where the function and the connection points are specified.



4) **AK-CC 750** is a modular evaporator controller that can be used for case or cold room applications up to 4 evaporators in a case line-up or a room. AK-CC 750 comprises wide range of energy savings features like intelligent fault detection and diagnosis. This controller features a new intelligent defrost functionality. By using the AKV valve as refrigerant mass flow meter, the controller can monitor the ice formation on the evaporator. When the normal defrost schedule cannot cope with extra load conditions the controller will automatically add an extra defrost and thereby avoid expensive service calls to iced up evaporators.

ADAP-KOOL® evaporator controllers offer three levels of control for different application demands.



Comparison of controls in this section

Controls with complete refrigeration appliance management

Type	EKC 414A	EKC 414A1	EKC 414C1	EKC 514B1	AK-CC 550	AK-CC 750
Number of evaporators	1	1	1	1	1	4
Supply = 230 V a.c.	X	X	X	X	X	
Supply = 24 V a.c.						X
Number of outlets	6	6	6	6	6	10 +
Rail heat		Option	X	Option	There are 10 different applications. See control	X
Compressor 2				Option		
Alarm	X	X	Option			X
Light	X	X	Option	X		X
AKV valve	230 V d.c.	230 V d.c.	230 V d.c.	230 V d.c.	230 V a.c	230 V a.c.
Sensor connection	AMP plug	Screw terminal	AMP plug	AMP plug	AMP plug/ Screw terminal	Screw terminal
Other connections are included	X	X	NO	NO	X	X
P0 measurement with AK32R pressure transmitter	X	X			X	X
P0 measurement with AKS 11 temperature sensor (S1)			X	X	X	
Fixed data communication with LON RS 485	X	X	X			X
Fixed data communication with MOD bus					X	
Data communication module LON RS 485 can be mounted				X	X	
Data communication module MOD bus can be mounted				X	X	
Data communication module Ethernet can be mounted				X		
Separate features: Thermostat, pressure switch, alarm						X

Controls with complete refrigeration appliance management and DANBUSS data communication

Type	AKC 114-116	AKC 121A	AKC 72	AKC 121B	AKC 151R
Complete refrigeration appliance controls 1-3 evaporators	X				
Refrigeration appliance controls for brine cooling		X			
Control of cold storage rooms			X		
Control of cold storage rooms for brine cooling				X	
Refrigeration and freezer rooms with flooded evaporator					X

A list of AKC controls can be found at the back of the catalogue

Water cooler controls

Type	EKC 312	EKC 315A	EKC 316A
Superheat control	X	X	X
Thermostat function		X	X
Also for air coolers, e.g. freezer stores	X	X	X
AKV valve		X	
Step motor valve	X		X

Level control

Type	EKC 347
Level control	X

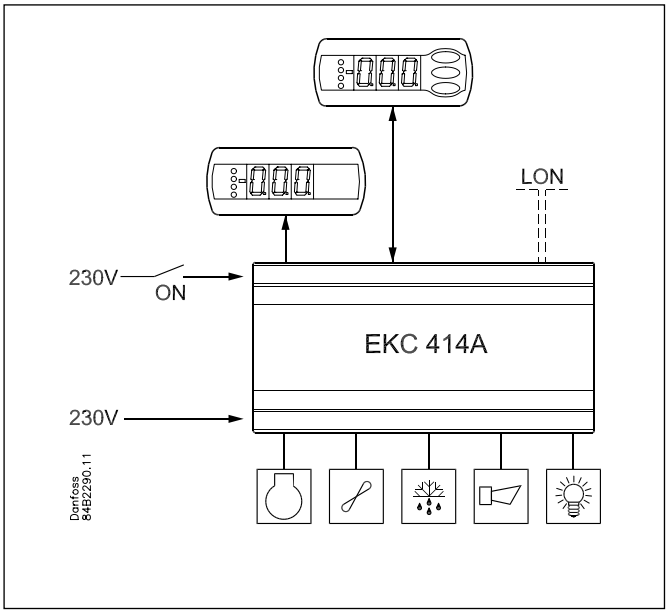
EKC 414A

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.

The relays are used for operating:
- Compressor
- Fan
- Defrost
- Alarm
- Light

The controller can operate one evaporator.

The intended placing of the controller is "on/near the refrigeration appliance" and the controller is therefore provided with plugs at the sensor connection points. All sensors used must therefore be fitted with a belonging plug.



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.

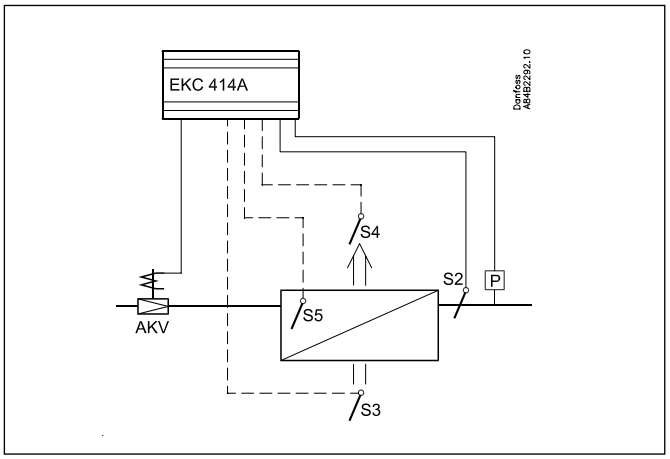
Customer display
If the temperature in the appliance is to be visible to, say, customers, a display can be mounted.

Inject ON function
The expansion valve closes when the signal at the 230V input is removed or receives a signal via the data communication. In this way it is ensured that the expansion valve will not charge the evaporator when the compressor has stopped.
(The threading of the function may be cancelled via a setting).

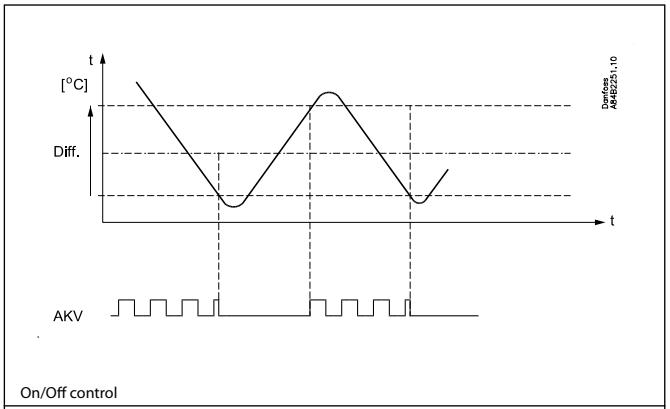
Digital input
A digital input can be defined for one of the following applications:
Door alarm
Defrost start
Nigh operation
Start/stop of regulation
Joint defrost start/stop with a master/slave function

Liquid supply
The supply of liquid is controlled on the basis of signals from the pressure transmitter, temperature sensor S2 and the air temperature. The sensors create a signal so that the superheat is continuously kept at a minimum whatever the operating conditions.

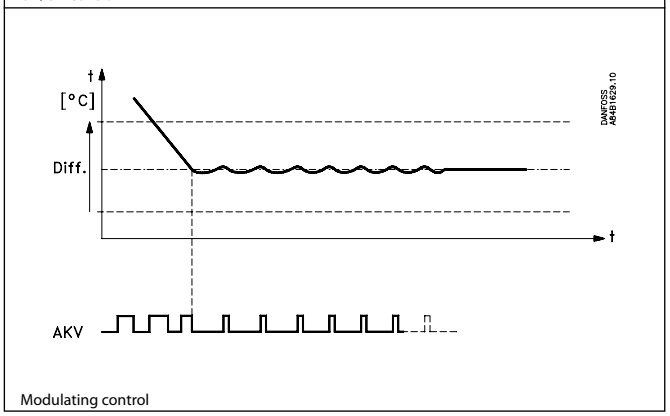
The AKV valve functions both as expansion valve and solenoid valve. The valve opens and closes based on signals from the controller.



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.



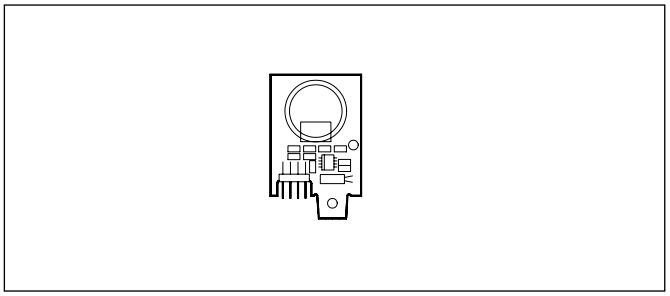
On/Off control



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. A combination with stop based on temperature and with the time factor as a precautionary measure is also a possibility.

Clock module (accessory)
If the controller is mounted without data communication and defrost has to be carried out at specific times, a clock module can be mounted.
The controller comes prepared with plug and terminals so that the module just has to be pushed in.
Subsequently, up to six defrosts per day can be set. The module has battery back-up.

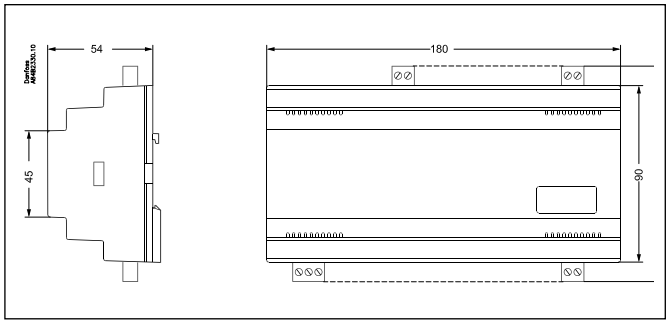


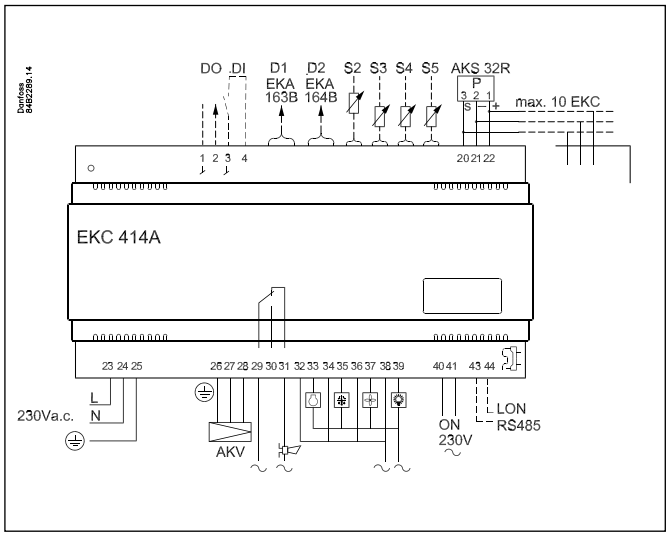
Menu survey

SW: 1.1x

Function	Parameter	Min.	Max.	Factory settings
Normal display				
Shows the temperature at the selected sensor Define view in O17	-		°C	
If you wish to see selected defrost stop temperature, give the lower button a brief push (1 sec.) no= stop on temperature not selected	-		°C	
Thermostat				
Differential	r01	0.1 K	10.0 K	2.0
Max. limitation of thermostat's setting temperature	r02	-49°C	50°C	50.0
Min. limitation of thermostat's setting temperature	r03	-50°C	49°C	-50.0
Temperature unit (°C/°F)	r05	°C	°F	0/°C
Correction of signal from S4 (S_{out})	r09	-10.0 K	10.0 K	0.0
Correction of signal from S3 (S_{in})	r10	-10.0 K	10.0 K	0.0
Start/Stop of refrigeration	r12	OFF	ON	OFF
Reference displacement during night operation	r13	-20.0 K	20.0 K	0.0
Define thermostat function 1=ON/OFF, 2=Modulating	r14	1	2	1
Definition and weighting, if applicable, of thermostat sensors 100%=S4 (S_{out}), 0%=S3 (S_{in}). The thermostat temperature can be seen in U17	r15	0%	100%	100
Time between melt periods	r16	0 h	10 h	1
Duration of melt periods	r17	0 min	10 min.	5
Alarm				
Alarm time delay	A03	0 min.	120 min	30
Door alarm time delay	A04	0 min.	90 min.	60
Time delay during cooling	A12	0 min.	240 min	120
High alarm limit	A13	-50°C	50°C	5.0
Low alarm limit	A14	-50°C	50°C	-30.0
Compressor				
Min. ON-time	c01	0 min	50 min	0.0
Min. OFF-time	c02	0 min	50 min	0.0
Defrost				
Defrost stop temperature	d02	0	25°C	6.0
Interval between defrost starts	d03	OFF	48 h	8
Max. defrost duration	d04	0	180 min	45
Time displacement of defrost cut-ins during start-up	d05	0	240 min	0
Drip-off time	d06	0	60 min	0
Fan start delay after defrost	d07	0	60 min	0
Fan start temperature	d08	-15	0°C	-5.0
Fan cut-in during defrost (yes/no)	d09	no	yes	no
Defrost sensor 0=S4 (S_{out}) , 1=S5 (S_{def}), 2=non. Stop on time	d10	0	2	2
Defrost at power up	d13	no	yes	no
RTC module (if installed) see RTC instructions	t01 to t16			
Injection control function				
Max. value of superheat reference	n09	3.0 K	15.0 K	12.0
Min. value of superheat reference	n10	3.0 K	10.0 K	3.0
MOP temperature	n11	-50.0°C	15°C/off	15°C
AKV valve's time period Should only be changed to OFF by trained staff	n13	3 sec.	6 sec.	6
Adaptive control Should only be changed to OFF by trained staff	n14	OFF	ON	on
Average opening degree Should only be changed by trained staff	n16	10%	75%	30.0
Start-up time for signal reliability Should only be changed by trained staff.	n17	5%	70%	30.0
Stability factor for superheat control. Changes should only be made by trained staff	n18	0	10	4
Forced closing.. AKV valve shut in pos. ON	n36	OFF	ON	OFF
Fan				
Fan stop on compressor cut out	F01	no	yes	no
Delayed fan stop when compressor is cut out	F02	0 min	30 min	0
Safety function. The fan stops if the S5 temperature reaches this value	F04	-50.0	50.0/off	50.0
Miscellaneous				
Delay of output signal after start-up	o01	0 sec.	600 sec	5
Define digital input signal (DI: OFF=not used, 1=Door alarm, 2=defrost start, 3=Night operation, 4=External start/stop, 5 = Coordinated defrost with cable connections	o02	OFF	5	0
Network address (range = 0-60)	o03	0	990	0
ON/OFF switch (service-pin message)	o04	OFF	ON	OFF
Access code	o05	OFF	100	OFF
Used sensor type for S3, S4 and S5 (Pt/PTC)	o06	Pt	Ptc	0/Pt
Set supply voltage frequency	o12	50 Hz	60 Hz	50
Define digitalt output signal (DO: 0=not used Coordinated defrost with cable connections: 1=Master, 2= Slave	o13	0	2	0
Max. standby time after coordinated defrost	o16	1 min	30 min	20
Display S4 % (S_{out}) 0%=S3 (S_{in}) 100%=S4 (S_{out})	o17	0%	100%	100
Manual control of outputs: OFF=No override 1: Compressor reay is ON 2: Defrost relay is ON 3: Fan relay is ON 4: Alarm relay is OFF 5: DO output is ON 6: AKV output is ON 7: Light relay is ON When manual control is terminated, the setting must be changed to OFF	o18	OFF	7	OFF
Pressure transmitter working range – min. value	020	-1 bar	5 bar	-1
Pressure transmitter working range – max. value	021	6 bar	36 bar	12
Inject-ON definition When the 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 5 to 8= as 1 to 4, but without connection to terminal 40-41.	o29	1	8	5
Refrigerant setting 1=R12. 2=R22. 3=R134a. 4=R502. 5=R717. 6=R13. 7=R13b1. 8=R23. 9=R500. 10=R503. 11=R114. 12=R142b. 13=User defined. 14=R32. 15=R227. 16=R401A. 17=R507. 18=R402A. 19=R404A. 20=R407C. 21=R407A. 22=R407B. 23=R410A. 24=R170. 25=R290. 26=R600. 27=R600a. 28=R744. 29=R1270. 30=R417A	o30	0	30	0

Continued from previous page	Parameter			
Service				
The following readouts can be performed via the belonging parameter				
Defrost sensor S5 S_{def}	u09	°C		
Status on DI-input	u10			
Defrost time	u11	min.		
Air temperature S3 (S_{in})	u12	°C		
Status on night operation (on or off)	u13			
Status on ON-input	u14			
Status on DO-output	u15			
Air temperature S4 (S_{out})	u16	°C		
Thermostat temperature	u17	°C		
Thermostat cut-in time	u18	min.		
Temperature at S2	u20	°C		
Superheat	u21	K		
Superheat reference	u22	K		
AKV valve's actual opening degree	u23	%		
Evaporating pressure	u25	bar		
Evaporating temperature	u26	°C		





The installation of data communications must comply with the requirements described in literature sheet no. RC8AC

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 to +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 163, LED, three digits EKA 164, LED, three digits, two operating buttons	
1 digital input	If a contact function is connected, ir can be used for door alarm, defrost start, night operation or start/stop of the regulation	
	If other EKC 414 units are connected, coordinated defrost can be performed via cable connections	
1 digital output	May in conjunction with the digital input be used for coordinated defrost via cable connections	
230 V input	0 V: regulation stopped. The compressor relay, the defrost relay, the fan relay and the light relay are cut out. 230 V a.c.: regulation (The function can be opted out).	
Sensor connection	Sensors with AMP plug	
AKV connection	Max. 1 coil = 230 V. d.c.	
Relays	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
	Light relay	SPST NO, $I_{max.}$ = 6 A ohmic / 3 A AC 15* inductive
	Alarm relay	SPDT, $I_{max.}$ = 6 A ohmic / 3 A AC 15* inductive
Environments	0 to +55°C, During operations -40 to +70°C, During transport	
	20 - 80% Rh, not condensed	
	No shock influence / vibrations	
Mounting	On DIN rail or on wall	
Enclosure	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	

*) a.c. 15 load acc. to EN 60947-5-1

Ordering

Description	Type	Code no.
Refrigeration control controller with plug connections and data communication	EKC 414A	**084B8002**
Display unit	EKA 163B	**084B8574**
Display unit with operating buttons	EKA 164B	**084B8575**
Cable for display unit (2 m with plug, 24 pcs)		**084B7179**
Cable for display unit (6 m with plug, 24 pcs)		**084B7097**
Realtime clock	EKA 172	**084B7069**

Additional information!
Manual: RS8CK

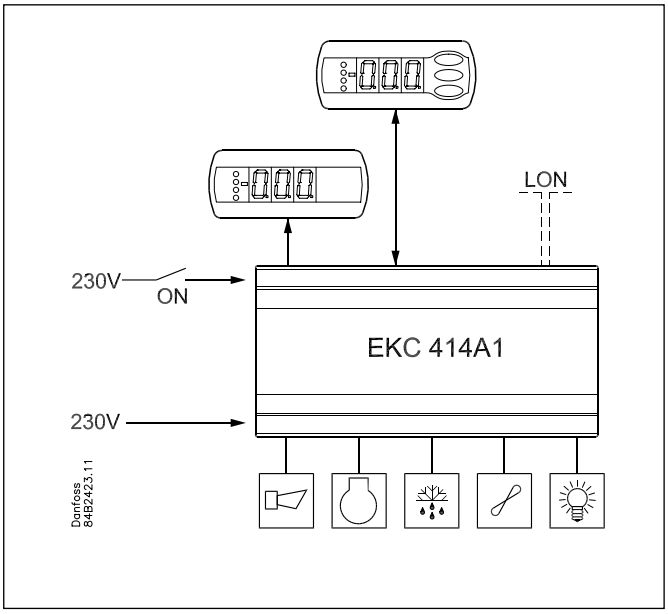
EKC 414A1

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.

The relays are used for operating:
- Compressor
- Fan
- Defrost
- Alarm
- Light

The controller can operate one evaporator.

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 can be mounted.

Inject ON function
The expansion valve closes when the signal at the 230 V input is removed or receives a signal via the data communication. In this way it is ensured that the expansion valve will not charge the evaporator when the compressor has stopped.
(The threading of the function may be cancelled via a setting).

Digital input
A digital input can be defined for one of the following applications:
Door alarm
Defrost start
Night operation
Start/stop of regulation
Joint defrost start/stop with a master/slave function

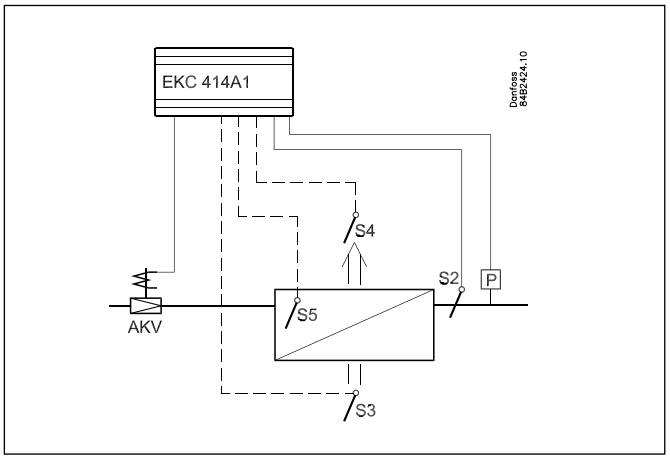
Light relay
The function of the relay will follow the day/night function, but can be reconfigured so that it follows the door function via the digital input.

Rail heat function
If a rail heat function is required one of the following relays can be redefined, so that it can be used for rail heat control. This redefinition can be made either on the alarm relay, compressor relay or light relay.

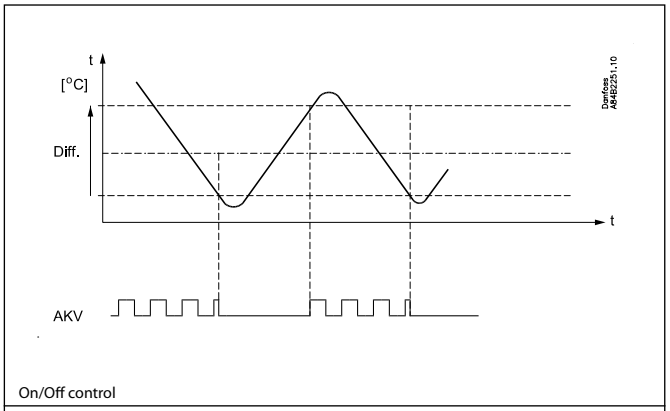
Data communication
The controller is provided with LON RS 485 data communication.

Liquid supply
The supply of liquid is controlled on the basis of signals from the pressure transmitter, temperature sensor S2 and the air temperature. The sensors create a signal so that the superheat is continuously kept at a minimum whatever the operating conditions.

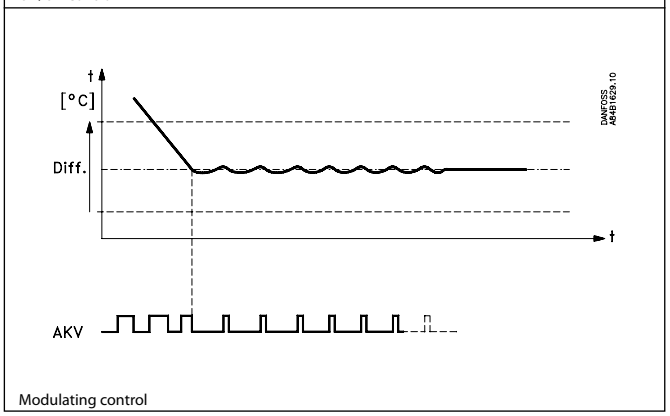
The AKV valve functions both as expansion valve and solenoid valve. The valve opens and closes based on signals from the controller.



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.



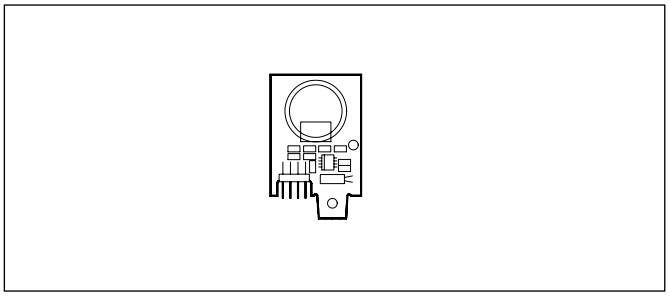
On/Off control



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. A combination with stop based on temperature and with the time factor as a precautionary measure is also a possibility.

Clock module (accessory)
If the controller is mounted without data communication and defrost has to be carried out at specific times, a clock module can be mounted.
The controller comes prepared with plug and terminals so that the module just has to be pushed in.
Subsequently, up to six defrosts per day can be set. The module has battery back-up.



Menu survey

SW: 1.0x

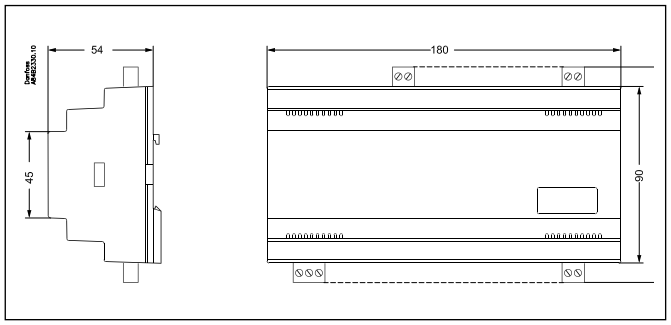
Function	Para meter	Min.	Max.	Factory settings
Normal display				
Shows the temperature at the selected sensor Define view in O17	-		°C	
If you wish to see selected defrost stop temperature, give the lower button a brief push (1 sec.) no= stop on temperature not selected	-		°C	
Thermostat				
Differential	r01	0.1 K	10.0 K	2.0
Max. limitation of thermostat's setting temperature	r02	-49°C	50°C	50.0
Min. limitation of thermostat's setting temperature	r03	-50°C	49°C	-50.0
Temperature unit (°C/°F)	r05	°C	°F	0/°C
Correction of signal from S4 (S_{out})	r09	-10.0 K	10.0 K	0.0
Correction of signal from S3 (S_{in})	r10	-10.0 K	10.0 K	0.0
Start/Stop of refrigeration	r12	OFF	ON	OFF
Reference displacement during night operation	r13	-20.0 K	20.0 K	0.0
Define thermostat function 1=ON/OFF, 2=Modulating	r14	1	2	1
Definition and weighting, if applicable, of thermostat sensors 100%=S4 (S_{out}), 0%=S3 (S_{in}). The thermostat temperature can be seen in U17	r15	0%	100%	100
Time between melt periods	r16	0 h	10 h	1
Duration of melt periods	r17	0 min	10 min.	5
Alarm				
Alarm time delay	A03	0 min.	120 min	30
Door alarm time delay	A04	0 min.	90 min.	60
Time delay during cooling	A12	0 min.	240 min	120
High alarm limit	A13	-50°C	50°C	5.0
Low alarm limit	A14	-50°C	50°C	-30.0
Setting of the weighting between S3/S4 to be used by the alarm function. The alarm temperature can be seen in u57	A36	0%	100%	100
Compressor				
Min. ON-time	c01	0 min	50 min	0
Min. OFF-time	c02	0 min	50 min	0
Defrost				
Defrost stop temperature	d02	0	25°C	6.0
Interval between defrost starts	d03	OFF	48 h	8
Max. defrost duration	d04	0	180 min	45
Time displacement of defrost cut-ins during start-up	d05	0	240 min	0
Drip-off time	d06	0	60 min	0
Fan start delay after defrost	d07	0	60 min	0
Fan start temperature	d08	-15	0°C	-5.0
Fan cut-in during defrost (yes/no)	d09	no	yes	no
Defrost sensor 0=S4 (S_{out}) , 1=S5 (S_{def}), 2=non. Stop on time	d10	0	2	2
Defrost at power up	d13	no	yes	no
RTC module (if installed) see RTC instructions	t01 to t16			
Injection control function				
Max. value of superheat reference	n09	3.0 K	15.0 K	12.0
Min. value of superheat reference	n10	3.0 K	10.0 K	3.0
MOP temperature	n11	-50.0°C	15°C/off	15°C
AKV valve's time period Should only be changed to OFF by trained staff	n13	3 sec.	6 sec.	6
Adaptive control Should only be changed to OFF by trained staff	n14	OFF	ON	on
Average opening degree Should only be changed by trained staff	n16	10%	75%	30.0
Start-up time for signal reliability Should only be changed by trained staff.	n17	5%	70%	30.0
Stability factor for superheat control. Changes should only be made by trained staff	n18	0	10	4
Forced closing.. AKV valve shut in pos. ON	n36	OFF	ON	OFF
Fan				
Fan stop on compressor cut out	F01	no	yes	no
Delayed fan stop when compressor is cut out	F02	0 min	30 min	0
Safety function. The fan stops if the S5 temperature reaches this value	F04	-50.0	50.0/ off	50.0
Miscellaneous				
Delay of output signal after start-up	o01	0 sec.	600 sec	5
Define digital input signal (DI: OFF=not used, 1=Door alarm, 2=defrost start, 3=Night operation, 4=External start/stop, 5 = Coordinated defrost with cable connections, 6 = door function	o02	OFF	6	0
Network address (range = 0-60)	o03	0	990	0
ON/OFF switch (service-pin message)	o04	OFF	ON	OFF
Access code	o05	OFF	100	OFF
Used sensor type for S3, S4 and S5 (Pt/PTC)	o06	Pt	Ptc	0/Pt
Set supply voltage frequency	o12	50 Hz	60 Hz	50
Define digitalt output signal (DO: 0=not used Coordinated defrost with cable connections: 1=Master, 2= Slave	o13	0	2	0
Max. standby time after coordinated defrost	o16	1 min	30 min	20
Display S4 % (S_{out}) 0%=S3 (S_{in}) 100%=S4 (S_{out}) The display temperature can be seen in u56	o17	0%	100%	100
Manual control of outputs: OFF=No override 1: Compressor reay is ON (railheat relay = ON) 2: Defrost relay is ON 3: Fan relay is ON 4: Alarm relay is OFF (Railheat relay = on) 5: DO output is ON 6: AKV output is ON 7: Light relay is ON (Railheat = on) When manual control is terminated, the setting must be changed to OFF	o18	OFF	7	OFF
Pressure transmitter working range – min. value	020	-1 bar	5 bar	-1
Pressure transmitter working range – max. value	021	6 bar	36 bar	12
Inject-ON definition When the 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 5 to 8= as 1 to 4, but without connection to terminal 40-41.	o29	1	8	5
Refrigerant setting 1=R12. 2=R22. 3=R134a. 4=R502. 5=R717. 6=R13. 7=R13b1. 8=R23. 9=R500. 10=R503. 11=R114. 12=R142b. 13=User defined. 14=R32. 15=R227. 16=R401A. 17=R507. 18=R402A. 19=R404A. 20=R407C. 21=R407A. 22=R407B. 23=R410A. 24=R170. 25=R290. 26=R600. 27=R600a. 28=R744. 29=R1270. 30=R417A	o30	0	30	0
Rail heat during day operation. Setting of ON period in percentage of the time in "o43"	o41	0%	100%	100
Rail heat during night operation. Setting of ON period in percentage of the time in "o43"	o42	0%	100%	100

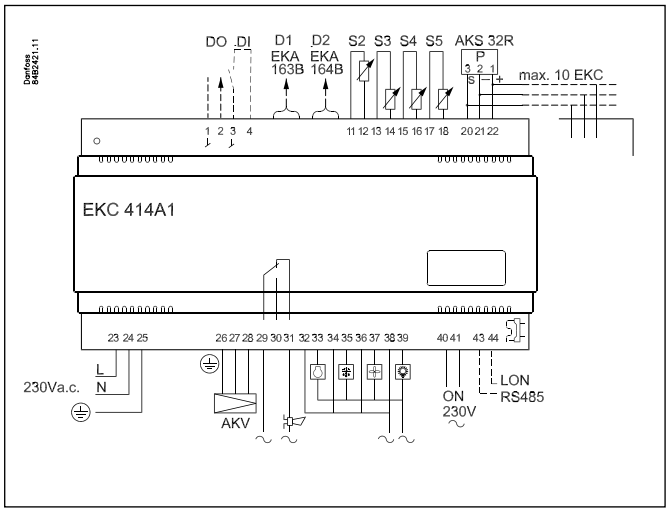
Rail heat Time period for the aggregate ON/OFF time	o43	6 min	60 min	10
Rail heat definition 0 = no rail heat relay 1 = alarm relay changed into rail heat relay 2 = compressor relay changed into rail heat relay 3 = no function 4 = no function 5 = light relay changed into rail heat relay	o68	0	5	0
Service				
The following readouts can be performed via the belonging parameter				
Defrost sensor S5 (S_{def})	u09		°C	
Status on DI-input	u10			
Defrost time	u11		min.	
Air temperature S3 (S_{in})	u12		°C	
Status on night operation (on or off)	u13			
Status on ON-input	u14			
Status on DO-output	u15			
Air temperature S4 (S_{out})	u16		°C	
Thermostat temperature	u17		°C	
Thermostat cut-in time	u18		min.	
Temperature at S2	u20		°C	
Superheat	u21		K	
Superheat reference	u22		K	
AKV valve's actual opening degree	u23		%	
Evaporating pressure	u25		bar	
Evaporating temperature	u26		°C	
Weighted S3/S4 temperature shown in the display	u56		°C	
Weighted S3/S4 temperature used by the alarm function	u57		°C	

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 to +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 163, LED, three digits EKA 164, LED, three digits, two operating buttons	
1 digital input	If a contact function is connected, ir can be used for door alarm, defrost start, night operation or start/stop of the regulation	
	If other EKC 414 units are connected, coordinated defrost can be performed via cable connections	
1 digital output	May in conjunction with the digital input be used for coordinated defrost via cable connections	
230 V input	0 V: regulation stopped. The compressor relay, the defrost relay, the fan relay and the light relay are cut out. 230 V a.c.: regulation (The function can be opted out).	
AKV connection	Max. 1. Coil = 230 V d.c.	
Relays	Compressor relay	SPST NO, $I_{max.}$ = 6 A ohmic/ 3 A a.c. 15* inductive
	Defrost relay	SPST NO, $I_{max.}$ = 6 A ohmic/3 A a.c. 15* inductive
	Fan motor relay	SPST NO, $I_{max.}$ = 6 A ohmic/3 A a.c. 15* inductive
	Light relay	SPST NO, $I_{max.}$ = 6 A ohmic/3 A a.c. 15* inductive
	Alarm relay	SPDT, $I_{max.}$ = 6 A ohmic/3 A a.c. 15* inductive
Environments	0 to +55°C, During operations -40 to +70°C, During transport	
	20 - 80% Rh, not condensed	
	No shock influence/vibrations	
Mounting	On DIN rail or on wall	
Enclosure	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 in accordance with EN 60947-5-1





The installation of data communications must comply with the requirements described in literature sheet no. RC8AC

Ordering

Description	Type	**Code no.**
Refrigeration control controller with plug connections and data communication	EKC 414A1	**084B8011**
Display unit	EKA 163B	**084B8574**
Display unit with operating buttons	EKA 164B	**084B8575**
Cable for display unit (2 m with plug, 24 pcs)		**084B7179**
Cable for display unit (6 m with plug, 24 pcs)		**084B7097**
Realtime clock	EKA 172	**084B7069**

Additional information!
Manual: RS8DU

EKC 414C1

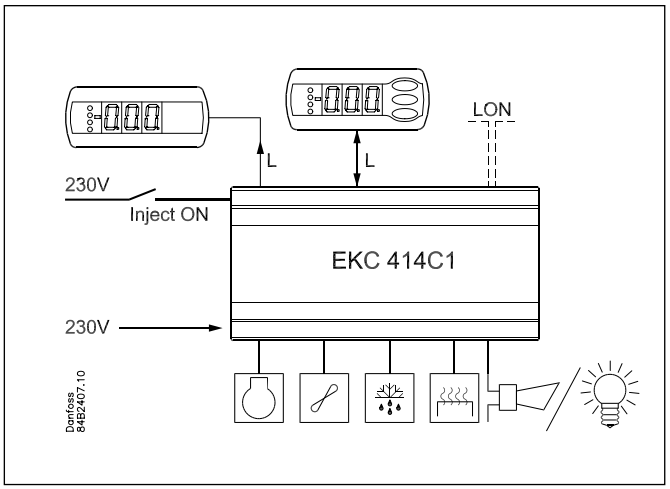
Application
The controller is a complete control unit for refrigeration appliances with integrated refrigeration-technical functions capable of replacing a setup of thermostats and timers.

The relays are used for operating:
- Compressor
- Fan
- Defrost
- Rail heat
- Alarm or light function

The controller should only be used in installations where the placing of the S1 sensor, and hence the signal reliability, has been checked in advance.

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 can be mounted.



Inject ON function
The expansion valve closes when the signal at the 230 V input is removed. In this way it is ensured that the expansion valve will not charge the evaporator when the compressor has stopped.
In stead of wiring the function can be made via data communication.

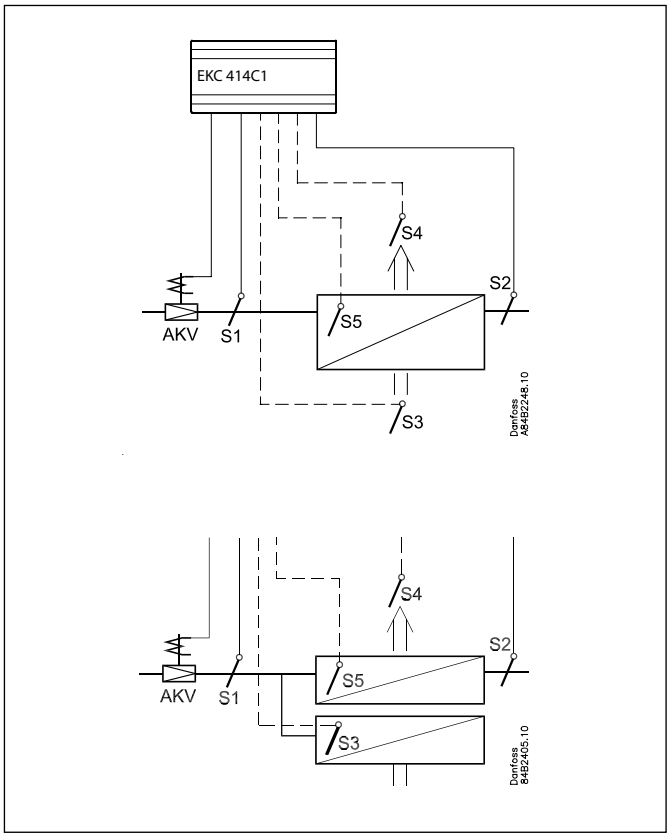
Digital input
A digital input can be defined for one of the following applications:
Door alarm
Defrost start
Night operation
Start/stop of regulation
Joint defrost start/stop with a master/slave function

Liquid supply
The supply of liquid is controlled on the basis of signals from three sensors (S1, S2 and an air sensor which 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 conjunction with the air temperature the sensors create a signal, so that superheat is continuously kept at a minimum, whatever the operating conditions.

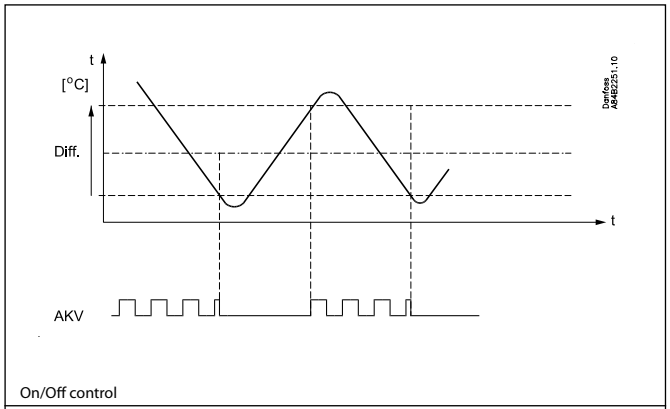
The placing of the S1 sensor is of crucial importance for a reliable signal, and hence for a satisfactory operation.

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

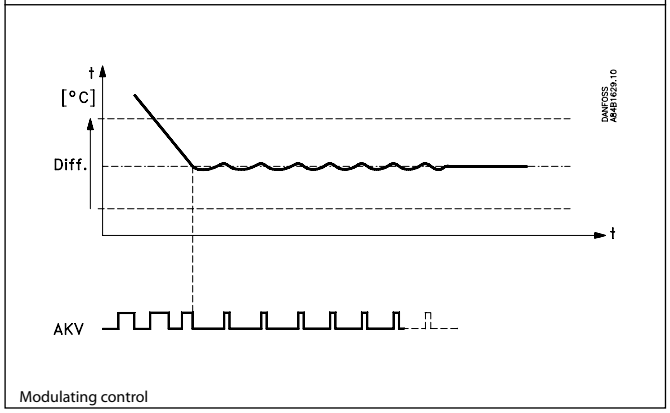
The controller can be used in refrigeration appliances where the evaporator consists of two spirals. The S3 sensor is here used as defrost sensor for spiral 2/section 2.



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.



On/Off control



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. A combination with stop based on temperature and with the time factor as a precautionary measure is also a possibility.

Menu survey

SW 1.3x

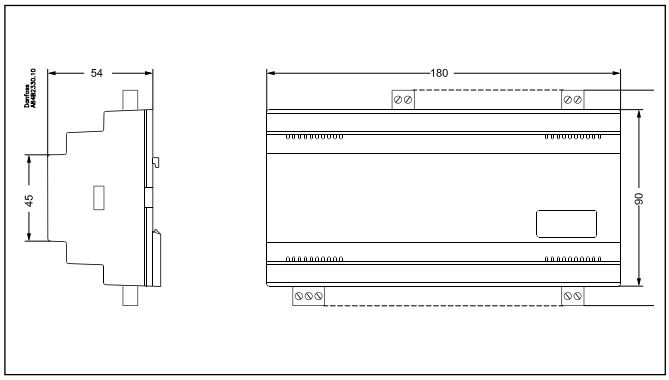
Function	Parameter	Min.	Max.	Factory settings
Normal display				
Shows the temperature at the selected sensor Define view in O17	-		°C	-2.0
If you wish to see selected defrost stop temperature, give the lower button a brief push (1 sec.) no= stop on temperature not selected.)	-		°C	
Thermostat				
Differential	r01	0.1 K	10.0 K	1
Max. limitation of thermostat's setting temperature	r02	-49°C	50°C	20
Min. limitation of thermostat's setting temperature	r03	-50°C	49°C	-5
Temperature unit (°C/°F)	r05	°C	°F	°C
Correction of signal from S4 (S_{out})	r09	-10.0 K	10.0 K	0
Correction of signal from S3 (S_{in})	r10	-10.0 K	10.0 K	0
Start/Stop of refrigeration	r12	off	on	on
Reference displacement during night operation	r13	-20.0 K	20.0 K	2.5
Define thermostat function 1=ON/OFF, 2=Modulating	r14	1	2	1
Definition and weighting, if applicable, of thermostat sensors 100%=S4 (Sout), 0%=S3 (Sin). The thermostat temperature can be seen in U17	r15	0%	100%	100
Time between melt periods	r16	0 h	10 h	1
Duration of melt periods	r17	0 min.	10 min.	5
Alarm				
Alarm time delay	A03	0 min.	120 min	30
Door alarm time delay	A04	0 min.	90 min.	30
Time delay during cooling	A12	0 min.	240 min	120
High alarm limit	A13	-50°C	50°C	7
Low alarm limit	A14	-50°C	50°C	-4
Compressor				
Min. ON-time	c01	0 min	50 min	0
Min. OFF-time	c02	0 min	50 min	0
Defrost				
Defrost stop temperature	d02	0	25°C	12
Interval between defrost starts	d03	OFF	48 h	6
Max. defrost duration	d04	0	180 min	57
Time displacement of defrost cut-ins during start-up	d05	0	240 min	0
Drip-off time	d06	0	60 min	3
Fan start delay after defrost	d07	0	60 min	0
Fan start temperature	d08	-15	0°C	-5
Fan cut-in during defrost (yes/no)	d09	no/0	yes/1	1
Defrost sensor 0=S4 (Sout) , 1=S5 (Sdef) 2=non. Stop on time. 3=Both S5 and S3.	d10	0	3	1
Defrost at power up	d13	no	yes	no

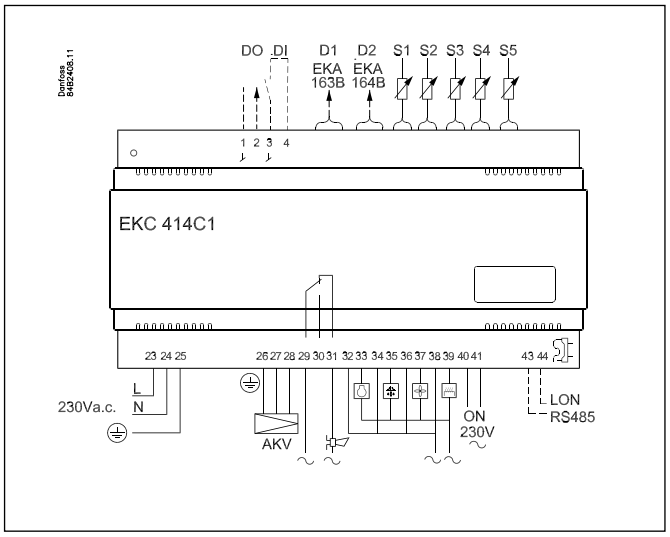
Injection control function				
Max. value of superheat reference	n09	3.0 K	15.0 K	12
Min. value of superheat reference	n10	3.0 K	10.0 K	3
MOP temperature	n11	-50.0°C	15°C/ off	off
Temperature glide	n12	0.0 K	10.0 K	0
AKV valve's time period	n13	3 sek.	6 sek.	6
Adaptive control Should only be changed to OFF by trained staff	n14	off/0	on/1	on/0
Signal reliability during start-up. Safety time period. Should only be changed by trained staff	n15	30 sek.	600 sek	180
Average opening degree – AKV dimension. Should only be changed by trained staff	n16	10.0%	75.0%	43,4
Signal reliability during start-up – Opening degree's start value. Should only be changed by trained staff.	n17	5.0%	70.0%	33,8
Stability factor for superheat control. Changes should only be made by trained staff	n18	0	10	4
Forced closing. AKV valve shut in pos. ON	n36	off/0	on/1	off/0
Forced cooling. AKV valve opens in pos. ON	n49	off/0	on/1	off/0
Fan				
Fan stop on compressor cut out	F01	no	yes	no
Delayed fan stop when compressor is cut out	F02	0 min	30 min	0
Safety function. The fan stops if the S5 temperature reaches this value	F04	-50.0	50.0/off	off
Miscellaneous				
Delay of output signal after start-up	o01	0 sec.	600 sec	0
Define digital input signal (DI: OFF=not used, 1=Door alarm, 2=defrost start, 3=Night operation, 4=External start/stop, 5 = Coordinated defrost with cable connections, 6 =Door function	o02	OFF/0	6	3
Network address (range = 0-60)	o03	0	990	0
ON/OFF switch (service-pin message)	o04	off	on	off
Access code	o05	off	100	off
Used sensor type for S3, S4 and S5 (Pt/PTC)	o06	Pt/0	Ptc/1	Ptc/1
Set supply voltage frequency	o12	50 Hz	60 Hz	50
Define digitalt output signal (DO: 0=not used Coordinated defrost with cable connections: 1=Master, 2= Slave	o13	0	2	0
Display step no=0.1 , yes=0.5	o15	no	yes	no
Max. standby time after coordinated defrost	o16	1 min	30 min	20
Display S4 % (Sout) 0%=S3 (Sin) 100%=S4 (Sout)	o17	0%	100%	100
Manual control of outputs: OFF=No override 1: Compressor reay is ON 2: Defrost relay is ON 3: Fan relay is ON 4: Alarm relay is OFF (when light control is ON) 5: DO output is ON 6: AKV output is ON 7': Rail heat output is ON When manual control is terminated, the setting must be changed to OFF	o18	OFF	7	off

Continued from previous page	Parameter	Min.	Max.	Fac. setting
AKV-ON definition When the 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 5 to 8 = as 1 to 4, but without connection to terminal 40-41.	o29	1	8	6
Function for relay on terminal 29-31 1=Alarm relay. 2=Light relay	o36	1	2	1
Rail heat during day operation Setting of ON period in % of time	o41	0%	100%	100
Rail heat during night operation Setting of ON period in % of time	o42	0%	100%	100
Rail heat setting Time period for aggregate ON/OFF time	o43	6 min.	60 min.	10
Service				
The following readouts can be performed via the belonging parameter				
Defrost sensor S5 S_{def}	u09			°C
Status on DI-input	u10			
Defrost time	u11			min.
Air temperature S3 (S_{in})	u12			°C
Status on night operation (on or off)	u13			
Status on ON-input	u14			
Status on DO-output	u15			
Air temperature S4 (S_{out})	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 rail heat	u41			
Weighted temperature for S3/S4 (CPT-temp.)	u56			°C

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 to +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 163, LED, three digits EKA 164, LED, three digits, + operating buttons	
1 digital input	If a contact function is connected, ir can be used for door alarm, defrost start, night operation, door function or start/stop of the regulation	
	If other EKC 414C1 units are connected, coordinated defrost can be performed via cable connections	
1 digital output	May in conjunction with the digital input be used for coordinated defrost via cable connections	
230 V input	0 V: regulation stopped. The compressor relay, the defrost relay, the fan relay and rail heat relay are cut out. 230 V a.c.: regulation	
Real time clock	For start of defrost. Can be mounted if data communication not is used.	
Electric connection	Via separate plug	
AKV connection	Max. 1 AKV or AKVA. Coil = 230 V d.c.	
Relays	Compressor relay	SPST NO, $I_{max.}$ = 6 A ohmic/ 3 A a.c. 15* inductive
	Defrost relay	SPST NO, $I_{max.}$ = 6 A ohmic/3 A a.c. 15* inductive
	Fan motor relay	SPST NO, $I_{max.}$ = 6 A ohmic/3 A a.c. 15* inductive
	Rail heat relay	SPST NO, $I_{max.}$ = 6 A ohmic/3 A a.c. 15* inductive
	Relay for alarm function or for light function	SPDT, $I_{max.}$ = 6 A ohmic/3 A a.c. 15* inductive
Environments	0 to +55°C, during operations -40 to +70°C, during transport	
	20 - 80% Rh, not condensed	
	No shock influence/vibrations	
Mounting	On DIN rail or on wall	
Enclosure	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	





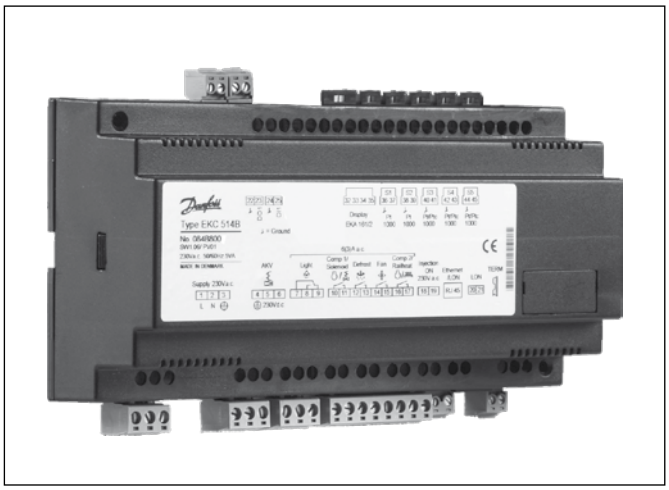
Ordering

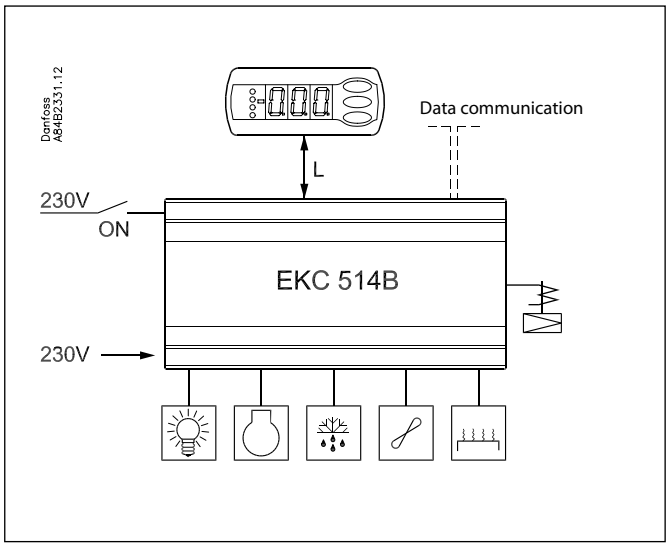
Description	Type	Code no.
Refrigeration control controller with plug connections and data communication. The other plug part is not supplied.	EKC 414C1	**084B8010**
Display unit	EKA 163B	**084B8574**
Display unit with operating buttons	EKA 164B	**084B8575**
Cable for display unit (2 m with plug, 24 pcs)		**084B7179**
Cable for display unit (6 m with plug, 24 pcs)		**084B7097**
Real time clock	EKA 172	**084B7069**

Additional information!
Manual: RS8DF

The installation of data communications must comply with the requirements described in literature sheet no. RC8AC

EKC 514B1





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.

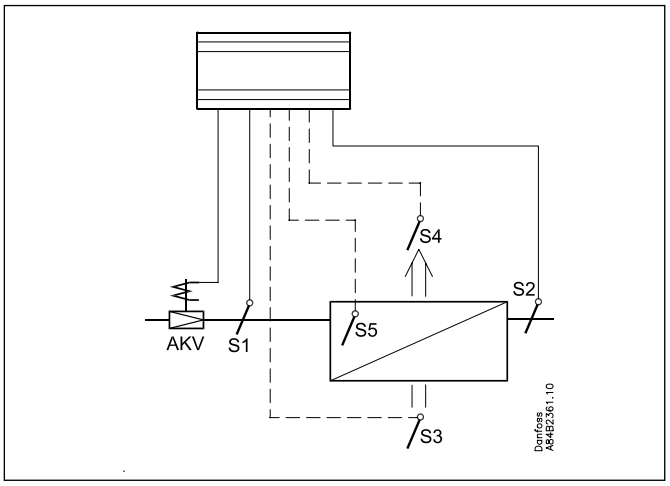
Data communication
The controller has been prepared for data communication with either:
- LON RS 485
- LON FTT 10 or
- Ethernet

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

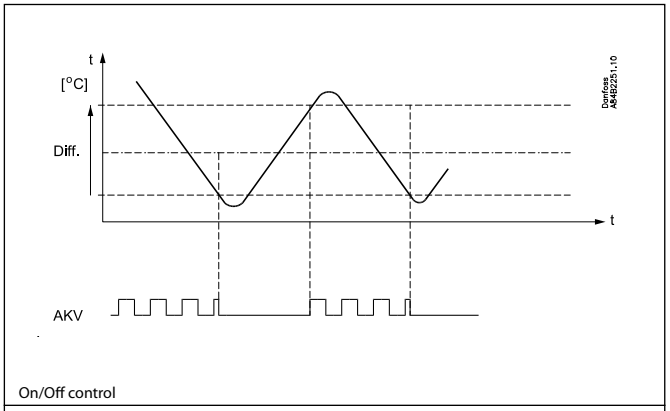
Liquid supply
The liquid supply is regulated based on signals from three sensors (S1, S2 and an air sensor that may be placed before or after the evaporator). The sensors register the difference between the temperature at the evaporator outlet (S2) and the temperature at the evaporator inlet (S1). In 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.

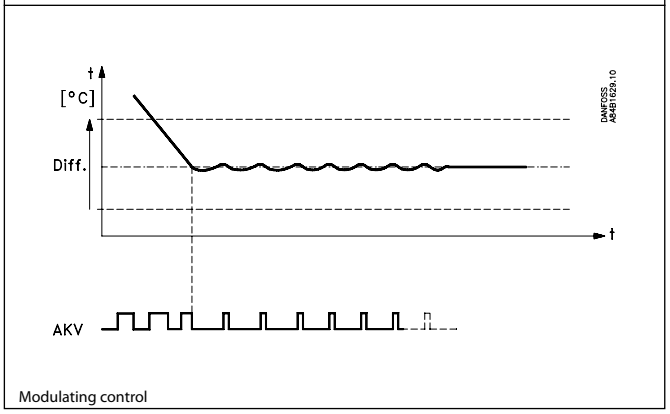
The AKV valve functions both as expansion valve and solenoid valve. The valve opens and closes based on signals from the controller.



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.



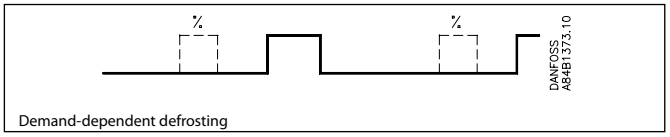
On/Off control



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.



Demand-dependent defrosting

Menu survey

SW = 1.2x

Function	Parameter	Min.	Max.	Factory setting
Normal display				
Shows the temperaturen (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	
Thermostat				
Differential	r01	0.1 K	10.0 K	2.0
Temperature unit (°C/°F)	r05	°C	°F	
Start/Stop of refrigeration	r12	OFF	ON	1
Reference displacement during night operation	r13	-20.0 K	20.0 K	0.0
Define thermostat function 1=ON/OFF, 2=Modulating	r14	1	2	1
Definition and weighting, if applicable, of thermostat sensors. 100%=S4 (S_{out}), 0%=S3 (S_{in}). The weighted measurement can be seen in u17	r15	0%	100%	50
Time between melt periods	r16	0 h	10 h	1
Duration of melt periods	r17	0 min.	10 min.	5
Temperature setting for thermostat band 2	r21	-50°C	50°C	2.0
Select thermostat 0: no thermostat/regulation stopped 1: Thermostat 1 2: Thermostat 2 This setting can also be switched via a signal to input 28.	r22	0	2	1
Alarm				
Alarm time delay (both thermostat 1 and 2)	A03	0 min.	120 min	30
Time delay during cooling (pulldown delay)	A12	0 min.	240 min	60
High alarm limit for thermostat 1	A13	-50°C	50°C	5.0
Low alarm limit for thermostat 1	A14	-50°C	50°C	-50.0
High alarm limit for thermostat 2	A20	-50°C	50°C	5.0
Low alarm limit for thermostat 2	A21	-50°C	50°C	-50.0
Alarm time delay or signal on the DI1 input	A27	0 min.	120 min	30
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	1
Compressor				
Min. ON-time	c01	0 min	50 min	0
Min. OFF-time	c02	0 min	50 min	0
Time delay for cutin of compressor 2	c05	0 s	999 s	0
Defrost				
Defrost stop temperature	d02	0	25°C	12.0
Interval between defrost starts	d03	OFF	48 h	6
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	45
Time displacement of defrost cut-ins during start-up	d05	0	240 mi	0
Drip-off time	d06	0	60 min	0
Fan start delay after defrost	d07	0	60 min	0
Fan start temperature	d08	-15	0°C	-5.0
Fan cut-in during defrost (yes/no)	d09	no	yes	0
Defrost sensor 0 = S4, 1 = S5, 2 = None (stop based on time), 3 = S4 and S5 (lower value is used)	d10	0	3	1
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: Zerosetting of counters 8: Zerosetting of the function 9: Manual startup of a defrost via the data communication.	d14	0	9	0
Max. number of defrosts that may be skipped in sequence	d15	0	10	3
Injection control function				
Expansion valve type definition: 1: AKV valve 2: Thermostatic expansion valve	n03	1	2	1
Max. value of superheat reference	n09	3.0 K	15.0 K	12.0
Min. value of superheat reference	n10	3.0 K	10.0 K	3.0
MOP temperature	n11	-50.0°C	15°C/ off	15.0
Temperature glide	n12	0.0 K	10.0 K	0.0
AKV valve's time period	n13	3 sec.	6 sec.	6
Adaptive regulation Should only be changed to OFF by trained staff	n14	OFF	ON	1
Signal reliability during startup. Time of reliability Changes should only be made by trained staff.	n15	30 sec.	600 sec	180
Average opening degree – AKV dimension Changes should only be made by trained staff	n16	10.0%	75.0%	29.9
Signal reliability during startup – opening degree start value. Changes should only be made by trained staff	n17	5.0%	70.0%	30.0
Stability factor for superheat control. Changes should only be made by trained staff	n18	0	10	0
Forced closing. AKV valve shut in pos. ON	n36	OFF	ON	0
Miscellaneous				
Delay of output signal after start-up	o01	0 sec.	600 sec	5
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	0
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 Pt 1000 1: All 4 are PTC 1000 2: All are Pt 1000, but specially connected. See under connections.	o06	0	2	0
Set supply voltage frequency	o12	50 Hz	60 Hz	0
Define digitalt output signal (DO: 0=not used Coordinated defrost with cable connections: 1=Master, 2= Slave	o13	0	2	0
Max. standby time after coordinated defrost	o16	1 min	30 min	20
Display S4% 0% = S3 100% = S4	o17	0%	100%	100

Continued from previous page				
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	0
IInjection 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	1
Light function definition: 1 = light follows the day/night function 2 = light controlled externally (see o39)	o38	1	2	1
External control of light (defined in o38) ON = lit OFF = no light.	o39	OFF	ON	0
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	1
Rail heat during day operation Setting of ON period in % of time	o41	0%	100%	100
Rail heat during night operation Setting of ON period in % of time	o42	0%	100%	100
Rail heat setting Time period for aggregate ON/OFF time	o43	6 min.	60 min.	10
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	0

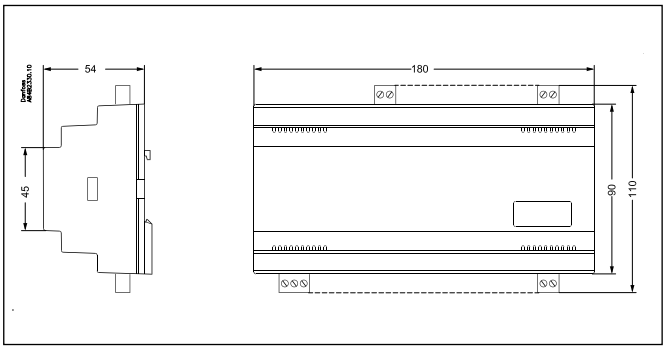
Service			
The following readouts can be performed via the belonging parameter			
Defrost sensor S5	u09	°C	
Status on DI-input	u10		
Defrost time	u11	min.	
Air temperature S3	u12	°C	
Status on night operation (on or off)	u13		
Status on ON-input	u14		
Status on DO1-output	u15		
Air temperature S4	u16	°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	

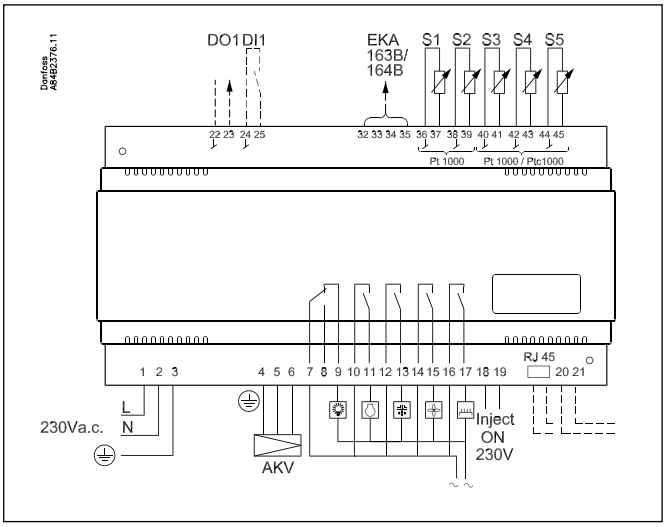
Data

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 to +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 163, LED, three digits EKA 164, LED, three digits, operating buttons	
Digital input DI1	If a contact function is connected, ir 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 a.c. 15* inductive
	Compressor relay	SPST NO, $I_{max.}$ = 6 A ohmic/ 3 A a.c. 15* inductive
	Defrost relay	SPST NO, $I_{max.}$ = 6 A ohmic/3 A a.c. 15* inductive
	Fan motor relay	SPST NO, $I_{max.}$ = 6 A ohmic/3 A a.c. 15* inductive
	Rail heat relay	SPST NO, $I_{max.}$ = 6 A ohmic/3 A a.c. 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	
Enclosure	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	

*) a.c. 15 load acc. to EN 60947-5-1

The installation of data communications must comply with the requirements described in literature sheet no. RC8AC



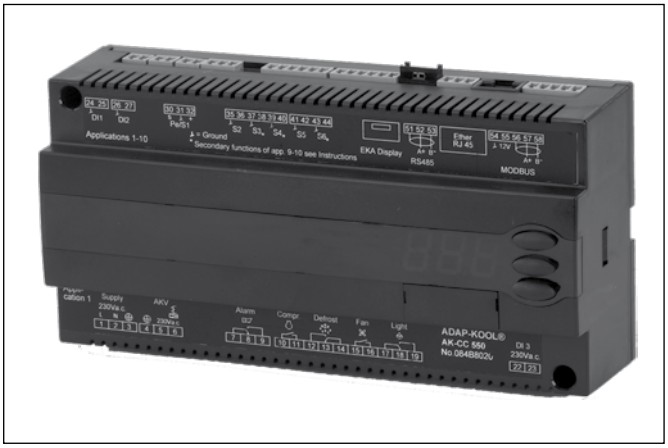


Ordering

Description		Type	Code No.
Refrigeration appliance control (with plug)		EKC 514B1	**084B8009**
Display unit		EKA 163B	**084B8574**
Display unit with operating buttons		EKA 164B	**084B8575**
Cable for display unit	2 m with plug, 1 pcs.		**084B7298**
	6 m with plug, 1 pcs.		**084B7299**
Data communication module, MOD-bus		EKA 178B	**084B8571**
Data communication module, RS 485		EKA 175	**084B7093**
Data communication module, Ethernet		EKA 177	**084B8031**

Additional information!
Manual: RS8DC

AK-CC 550

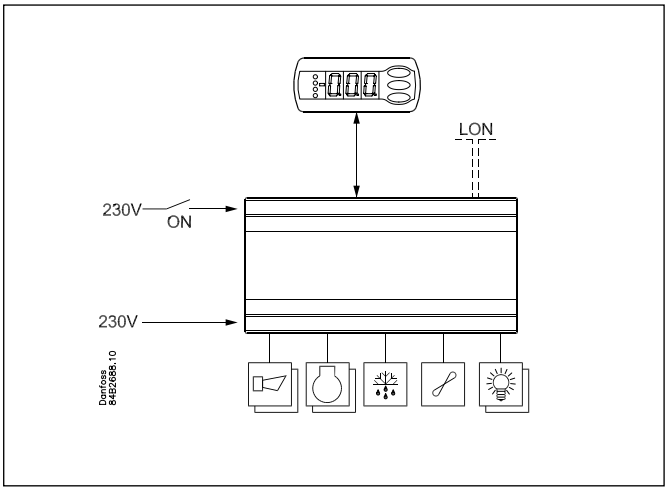


Application
Complete refrigeration appliance control with great flexibility to adapt to all types of refrigeration appliances and cold storage rooms.

Advantages
- Complete refrigeration appliance control
- Energy optimisation of the whole refrigeration appliance
- Adaptation to all refrigeration appliances/rooms via a simple choice of application
- Fast set-up using pre-defined set-ups
- Built-in clock function with power reserve

Principle

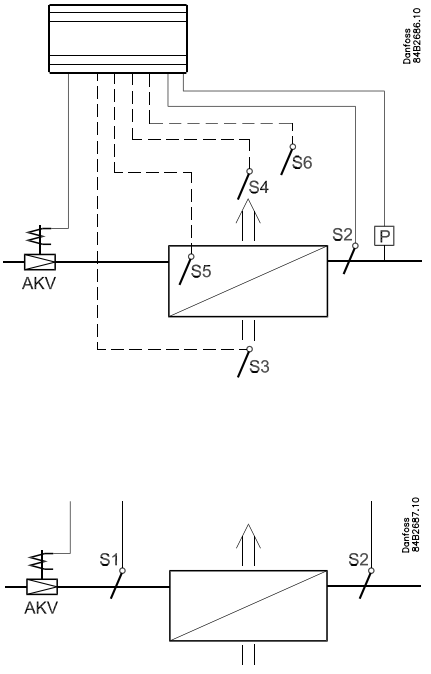
Sensors
The temperature in the appliance is registered by one or two temperature sensors which are located in the air flow before the evaporator (S3) or after the evaporator (S4) respectively. A setting for thermostat, alarm thermostat and display reading determines the influence the two sensor values should have for each individual function.
In addition product sensor S6, which can be optionally placed in the appliance, can be used and which can be used to register the temperature near the required product in a certain place within the appliance.
The temperature of the evaporator is registered with the S5 sensor which can be used as a defrosting sensor.



Injection
Liquid injection in the evaporator is controlled by an electronic injection valve of the type AKV. The control controls the opening degree of the valve so that the evaporator is used optimally under all conditions.
Superheat can be measured by using one of the following two principles:
- Pressure sensor Pe and S2
- Two temperature sensors S1 and S2

Operation and data communication
The control has inbuilt MOD-bus data communication which can be used for:
- Network connection
- Display connection
  EKA 163 is used for display connection if only readouts are needed or EKA 164 if operation is also needed.

If both data communication and display are required, the inbuilt MOD-bus should be used for display. A loose data communication module must also be mounted in the control. The module can either be a MOD-bus module or a LON RS 485 module.



The location of the S1 sensor is crucial to a reliable signal and hereby to satisfactory control.

Functions

- Adaptive control of superheat for optimum use of evaporator
- Day/night thermostat according to ON/OFF or modulating principle
- Temperature and alarm according to S3 and/or S4 temperature
- Product sensor S6 with separate alarm limits
- Change between thermostat settings via digital input
- Start of defrosting via internal schedule, digital input or network signal
- Natural, electric or warm gas defrosting
- Stop of defrosting by time and/or temperature S5
- Adaptive defrosting based on intelligent registering of evaporator performance
- Coordination of defrosting among several controls
- Pulsing of fans when thermostat is disconnected
- Appliance cleaning function for documentation of HACCP procedure
- Rail heat control according to day/night use or according to current dew point
- Door function
- Control of 2 compressors
- Control of night curtain
- Light control according to day/night or network signal
- Heat thermostat
- Multi-function digital inputs

Application

A setting in the control will activate one of the 10 applications for which the control is pre-programmed.

Output

The setting will configure the outputs in the following way:

Output used for	**Setting**									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Fan	■	■	■	■	■	■	■	■	■	■
Rail heat		■	■	■	■		■		■	■
Compressor	■	■	■		■					
Compressor 2					■					
Defrosting	■	■	■	■	■	■	■	■	■	■
Defrosting 2									■	
Suction line valve						■				
Heating element in drip tray						■	■			
Night curtain										
Heat thermostat								■		
Alarm	■		■	■				■		■
Light	■	■		■		■	■	■	■	■
AKV valve, 230 V a.c.	■	■	■	■	■	■	■	■	■	■

Sensors

Setting 1-8

The sensors are used as normal. See illustration.

Setting 9

Intended for special appliances with two compartments and two evaporators (AKV valve feeds both evaporators).
The temperature is controlled with the S4 sensor.
Defrosting with the S5 sensor on Evaporator A.
Sensor input S6 is used as defrosting sensor on Evaporator B.
There is no product sensor.

Setting 10

Intended for special appliances with two compartments and one evaporator.
The temperature is controlled with the S4 sensor.
Temperature display and alarm monitoring with S3 and S6.
There is no product sensor.

Digital input

There are three digital inputs available with many usage options for all settings. The two inputs are connection inputs and the third is a 230 V input.

General data

- Supply = 230 V a.c.
- Sensor inputs = 6 no. (of which one for either pressure or temperature)
- AKV output = 1 no.
- Supply to AKV valve = 230 V a.c.
- Number of relay outputs = 5 no.
- Pt 1000 ohm sensors on all outputs (all air sensors can however be changed to PTC 1000 ohm)
- Pressure transmitter = AKS 32R
- Two versions with different sensor connections:
  - Screw terminals
  - AMP plug (one is however with screw terminals for pressure/S1 temperature)

Extra modules

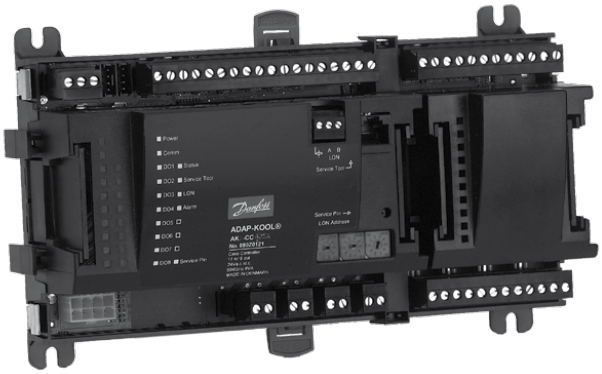
A module can be mounted in the control. It can be for one of the following functions:
Data communication with MOD bus
Data communication with LON RS 485
Battery module with extra power reserve.

Ordering

Designation	Type	**Code No.**
Refrigeration appliance (with screw terminals)	AK-CC 550	**084B8020**

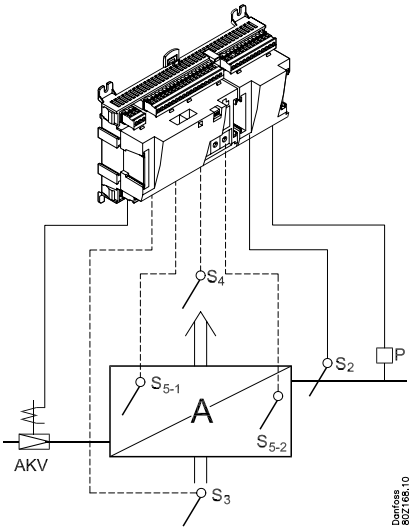
Additional information!
Manual: RS8EN

AK-CC 750



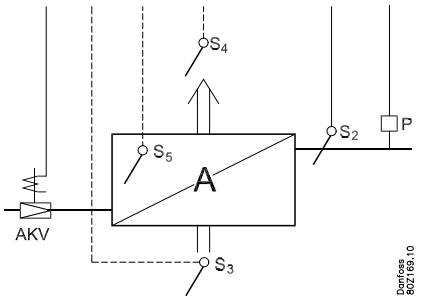
Application
AK-CC 750 controllers are complete regulating units which together with valves and sensors constitute complete evaporator controls for refrigeration appliances and freezing rooms within commercial refrigeration.
Generally speaking they replace all other automatic controls containing, inter alia, day and night thermostats, defrost, fan control, rail heat control, alarm functions, light control, thermo valve control, solenoid valve, etc.
The controller is equipped with data communication and is operated via a PC.
In addition to evaporator control the controller can give signals to other controllers about the operating condition, e.g. forced closing of expansion valves, alarm signals and alarm messages.

Advantages
- Control of up to 4 evaporator sections
- Adaptive superheat control ensures optimum evaporator usage in all operational circumstances.
- Electronic injection with AKV valve
- ON/OFF or modulating temperature control
- Weighted thermostat and alarm thermostat
- Defrost on demand based on evaporator capacity
- Appliance cleaning function
- Light control using door switch or network signal depending on day/night operation
- Rail heat pulsing depending on day/night operation.
- Monitoring of door alarm and control of light/refrigeration depending on location of door switch.
- Log function for registration of historical parameter values and alarm modes.

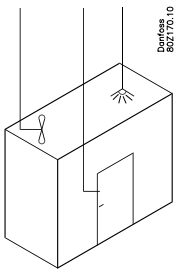


Control
The controller's main function is to control the evaporator so that the system constantly operates with the most energy-friendly refrigeration.
A specific function for registration of the need for defrost will adapt the number of defrosts so that no energy is wasted on unnecessary defrosts and subsequent cooling-down cycles.

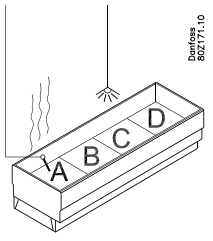
Adaptive defrosting
AK-CC 750 is equipped with an adaptive defrosting function. By using an AKV valve as mass flow sensor for the supply of refrigerant the control can monitor ice formation on the evaporator. If the usual defrosting programme cannot handle a larger load, the control initiates further automatic defrosting which means that expensive service visits due to iced-up evaporators are avoided.



Evaporator control of one, two, three or four evaporators



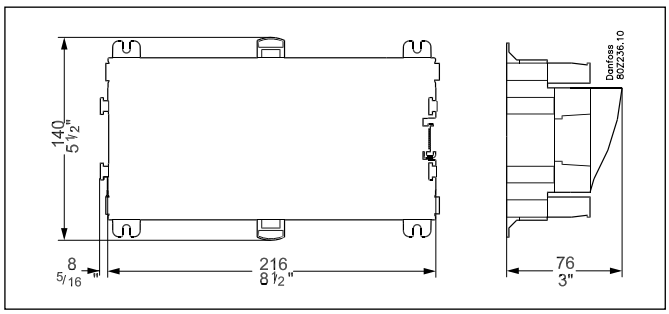
Control of cool or defrost room



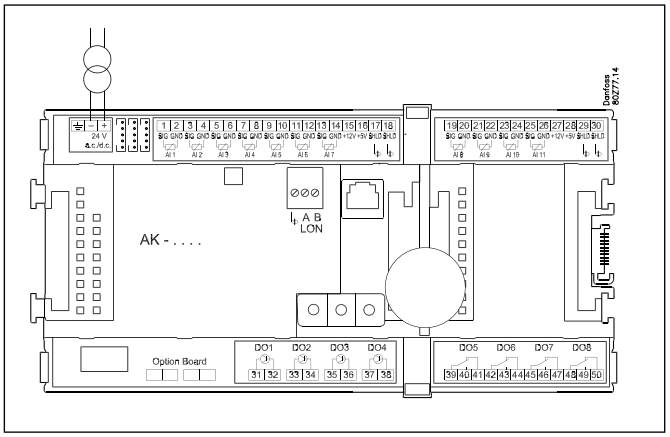
Control of cool or defrost appliance

Data

Supply voltage	24 V a.c. +/- 20%	
Power consumption	AK-CC 750	12 VA
Analogue inputs	Pt 1000 ohm /0°C	Dissolution: 0.1°C Accuracy: +/- 0.5°
	Pressure transmitter type AKS 32R / AKS 32 (1-5 V)	Dissolution 1 mV Accuracy +/- 10 mV Max. connection of 5 pressure transmitters on one module
	Voltage signal 0-10 V	
	Contact function (On/Off)	On at R < 20 ohm Off at R > 2K ohm (Gold -plated contacts not necessary)
On/off supply voltage inputs	Low voltage 0/80 V a.c./d.c.	Off: U < 2 V On: U > 10 V
	High voltage 0/260 V a.c.	Off: U < 24 V On: U > 80 V
Relay outputs SPDT	AC-1 (ohmic)	5 A
	AC-15 (inductive)	3 A
	U	Min. 24 V Max. 230 V Low and high voltage must not be connected to the same output group
	Fuse	5 A (F)
Solid state outputs	Can be used for loads that are cut in and out frequently, e.g. : Decompression, rail heating, fans and AKV valve	Max. 240 V a.c. , Min. 48 V a.c. Max. 0.5 A, Leak < 1 mA Max. 1 AKV
Ambient temperature	During transport	-40 to 70°C
	During operation	-20 to 55°C , 0 to 95% RH (non condensing) No shock influences/vibrations
Enclosure	Material	PC/ABS
	Enclosure	IP 10 , VBG 4
	Mounting	For mounting on wall or DIN rail
Weight with screw terminals	Modules in100-/200-/controller-series	Ca. 200 g/500 g/600 g
Approvals	EU low voltage directive and EMC requirements are complied with	LVD tested according to EN 60730 EMC tested Immunity according to EN 61000-6-2 Emission according to EN 50081-1
	UL file number	E166834



The installation of data communications must comply with the requirements described in literature sheet no. RC8AC



Ordering

Type	Function	Application	Language	Code no.
Controller				
AK-CC 750	Controller for evaporator control	1, 2, 3 or 4 sections	English, German, French, Italian, Dutch	**080Z0121**
			English (UK), Spanish, Portuguese, English (US)	**080Z0122**
			English (UK), Danish, Swedish, Finnish	**080Z0125**
Miscellaneous				
Expansion modules if several connections are needed				**See section Accessories - AK modules**
Software for operation of AK controllers			AK-ST 500	
Cable between PC and AK controller				
Cable between zero modem cable and AK controller				
External display that can be connected to the controller module. For showing, say, the suction pressure			EKA 163B, EKA 164B	
Real time clock for use in controllers that require a clock function, but are not wired with data communication.			AK-OB 101A	

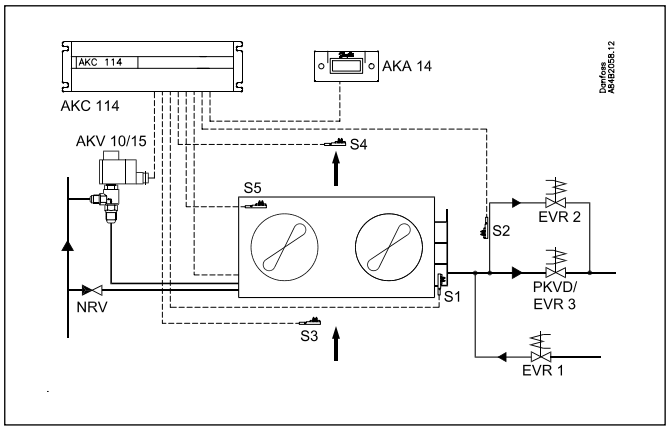
Additional information!
Manual: RS8EM

AKC 114-116

Application
AKC controllers for up to three evaporators in refrigeration appliances and cold rooms with hot gas defrosting.

Advantages
Depending on the type, a controller will serve one, two or three evaporators.
- Appliance and cold room control with AKV or thermostatic expansion valves
- Refrigeration appliance and cold room monitoring.
- Refrigeration plants with hot gas defrosting.
- Brine chillers.
- Stand-alone deep-freeze and cold rooms.

General functions
- Thermostats with alarm function
- ON/OFF or modulating temperature regulation
- Night thermostats with built-in clock
- Connection of LCD display for indication of media temperature
- Defrost function, internal defrost program
- Defrost stop according to temperature or time
- Fan and/or rail heating control
- Compressor signal
- Sensor calibration
- Service mode



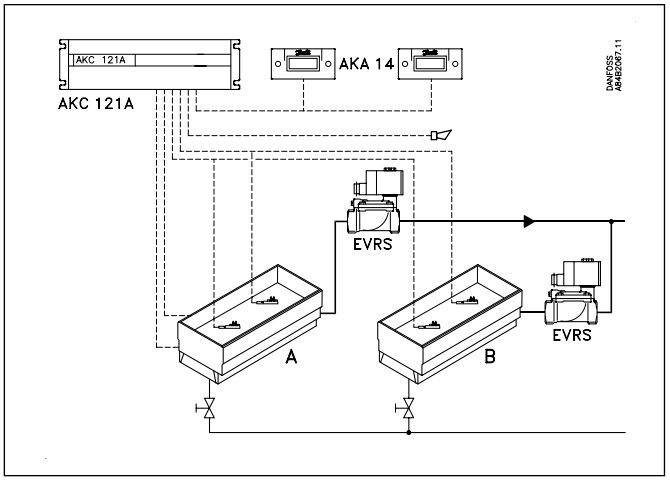
Special functions
- Timers for hot gas defrosting
- Possibility of operation with thermostatic expansion valve or AKV valve

Additional information!
Technical brochure: RC1HC
Function description: RC1HU

AKC 121A

Application
AKC controllers for two cooling coils in refrigeration appliances with brine cooling or with thermostatic expansion valves.

Functions
- Two separate thermostats with alarm function
- Night thermostats with built-in clock
- Connection of two LCD displays for indication of media temperature
- Defrost function, internal defrost program
- Defrost stop according to temperature or time
- Fan and/or rail heater control
- Sensor calibration
- Service mode
- Load equalisation



Energy savings from
Fan/rail heater pulsation/light control
Defrost stop according to temperature
Modulating temperature regulation
Night set back

Additional information!
Function description: RC1MD

Cold storage room control

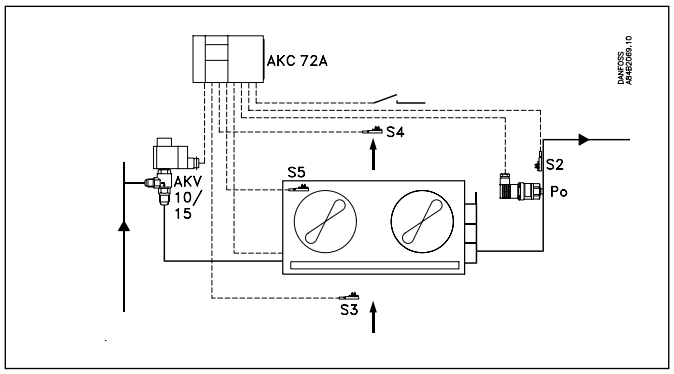
AKC 72A

Application
AKC 72A controller primarily for cold room and cold store control.
AKC 72A has a built-in log memory and alarm log.
The controller is available in two different versions:
AKC 72A with communication
AKC 72A without communication

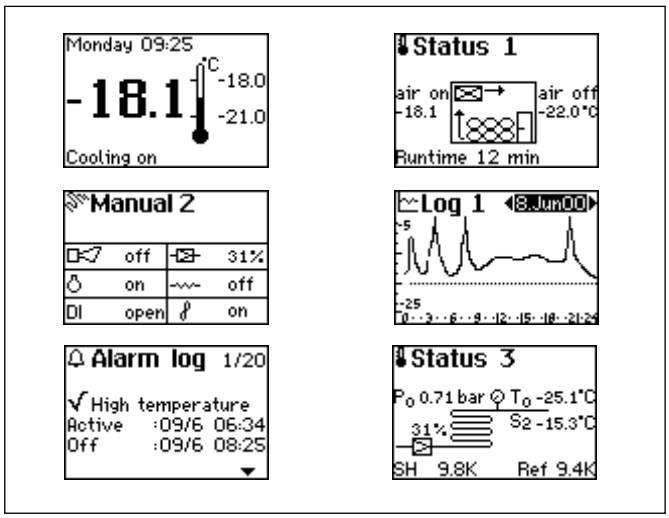
Functions
- Quick programming
- Thermostat with alarm function
- Night thermostat with built-in clock
- Defrost function
- Clear defrost clock
- Stop according to temperature or time
- Fan control
- Door alarm
- Sensor calibration
- Service mode
- Encoding of access code
- Compressor or lighting control

Energy savings from
Adaptive superheating adjustment with AKV
fan pulsation
Defrost on demand (DOD)
Defrost stop according to temperature
Modulating temperature regulation
Night set back

Application example



Example of display

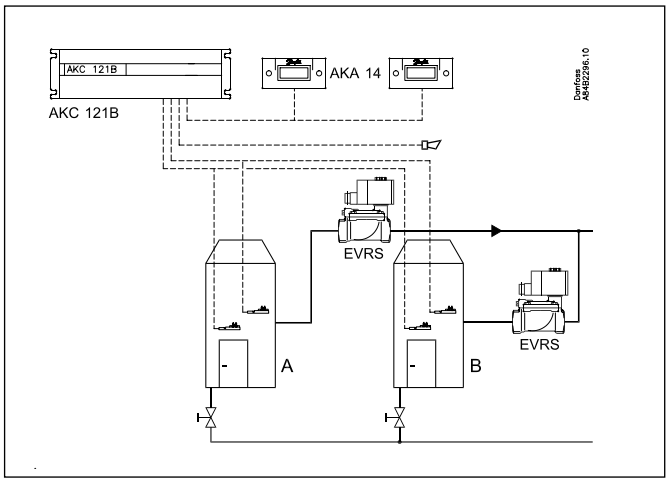


Additional information!
Technical brochure: RC8AB

AKC 121B

Application
AKC controllers for two cooling coils in cold rooms with brine cooling or with thermostatic expansion valves.

Functions
- Two separate thermostats with alarm function
- Night thermostats with built-in clock
- Connection of two LCD displays for indication of media temperature
- Defrost function, internal defrost program
- Defrost stop according to temperature or time
- Light control or defrost
- on/off input from door switch
- Sensor calibration
- Service mode
- Load equalisation



Additional information!
Technical brochure: RC1HC
Function description: RC1MD

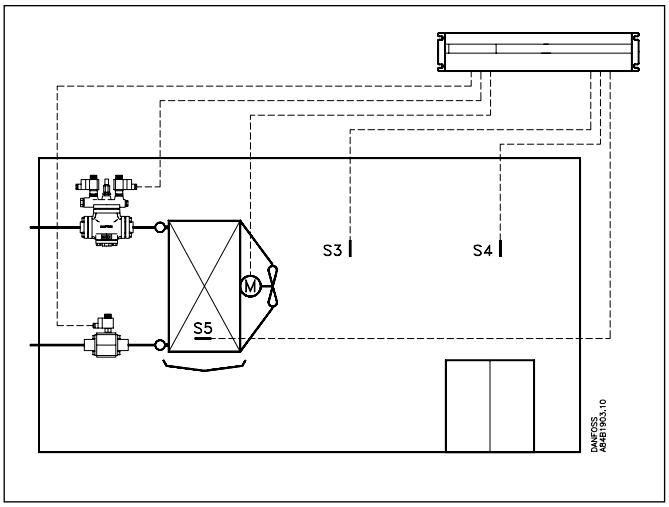
Energy savings from
Fan/rail heater pulsation/light control
Defrost stop according to temperature
Modulating temperature regulation
Night set back

AKC 151R

Application
AKC controller for cold room and cold store control where flooded evaporator are used.
- Cold store
- Brewerie
- Slaughterhouse
- Dairy

Advantages
Energy savings from
Fan pulsation
Defrost stop according to temperature
Night set back

Functions
- Thermostat set back allows the reduction of the room temperature, when the electricity tariff is low
- Fan operation during cutout
- Normally hot gas or electric defrost
- Weekly defrost programme
- Liquid drain function
- Complete compressor functionality during operation with hot gas defrost
- Injection delay
- Fan delay
- Supply valve bypasses delay
- Quick-start function (requires AKVA valve)
- Data collection via AKM: temperature, alarms etc.
- Modem communication facility
- Separate display can be connected



Additional information!
Technical brochure: RC4JD

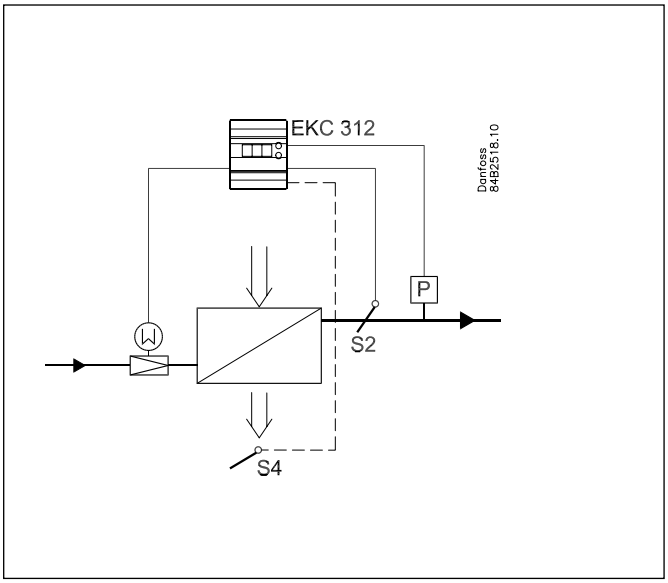
Water chiller control

EKC 312

Application
The controller and valve can be used where there are requirements to accurate control of superheat in connection with refrigeration.
E.g.:
- Processing plant (water chillers)
- Cold store (air coolers)
- A/C plant

Advantages
- The evaporator is charged optimally – even when there are great variations of load and suction pressure.
- Energy savings – the adaptive regulation of the refrigerant injection ensures optimum utilisation of the evaporator and hence a high suction pressure.
- The superheating is regulated to the lowest possible value.

Functions
- Regulation of superheat
- MOP function
- ON/OFF input for start/stop of regulation
- PID regulation



System
The superheat in the evaporator is controlled by one pressure transmitter P and one temperature sensor S2.
The expansion valve is with step motor of the type ETS.

For safety reasons the liquid flow to the evaporator must be cut off if there is power failure for the controller. As the ETS valve is provided with step motor, it will remain open in such a situation.

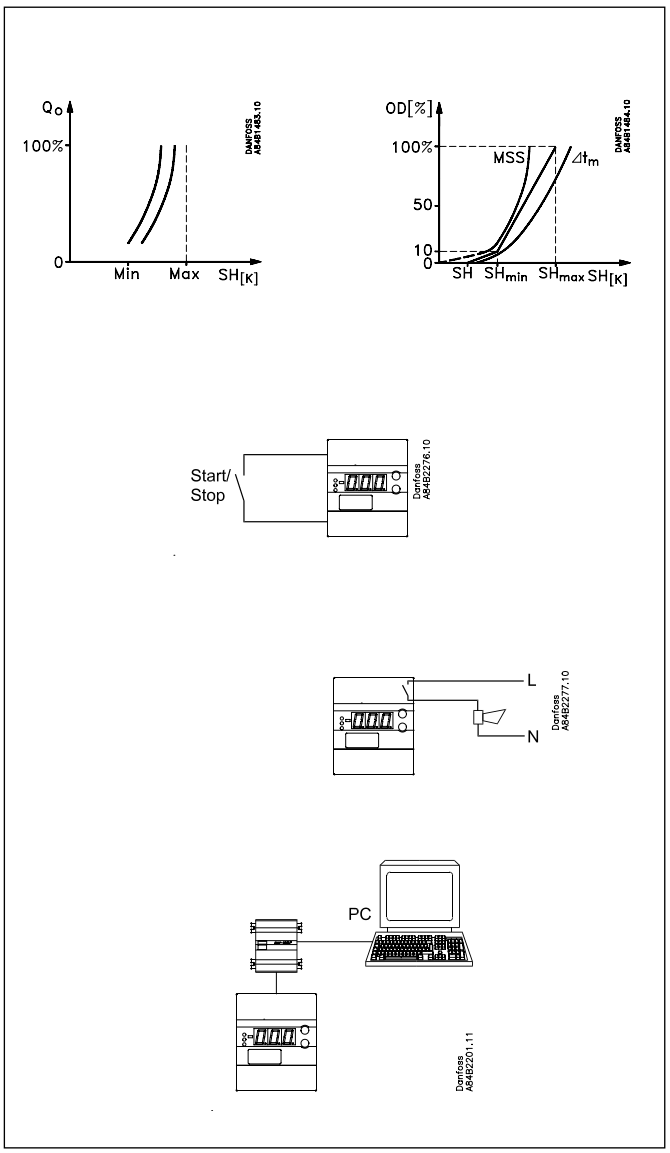
Superheat function
You may choose between two kinds of superheat, either:
- Adaptive superheat or
- Load-defined superheat

MOP
The MOP function limits the valve's opening degree as long as the evaporating pressure is higher than the set MOP value.

External start/stop of regulation
The controller can be started and stopped externally via a contact function connected to input terminals 1 and 2. Regulation is stopped when the connection is interrupted. The function must be used when the compressor is stopped. The controller then closes the solenoid valve so that the evaporator is not charged with refrigerant.

Alarm relay
The relay for the alarm function works in such a way that the contact is cut in in alarm situations and when the controller is de-energised.

PC operation
The controller can be provided with data communication so that it can be connected to other products in the range of ADAP-KOOL® refrigeration controls. In this way operation, monitoring and data collection can be performed from one PC – either on the spot or in a service company.



Menu survey

SW =1.2x

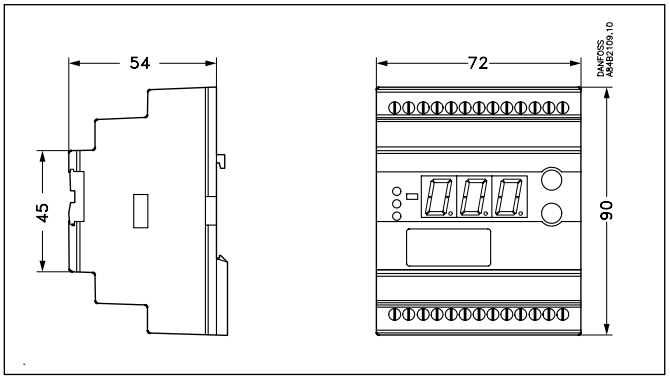
Function	Parameter	Min.	Max.	Fac. Settings
Normal display				
Shows the actual superheat/ valve's opening degree/ temperature Define view in o17	-		K	
If you wish to see the expansion valve's actual opening degree, give the lower button a brief push (1s). Define view in o17	-		%	
Reference				
Units (0=°C+bar /1=°F+psig)	r05	0	1	0
Start/stop of refrigeration	r12	OFF	On	1
Regulating parameters				
P: Amplification factor Kp	n04	0.5	20	3
I: Integration time T	n05	30 s	600 s	120
Max. value of superheat reference	n09	2 K	30 K	10
Min. value of superheat reference	n10	1 K	12 K	4
MOP	n11	0.0 bar	20 bar	20
Amplification factor for superheat Changes should only be made by trained staff	n20	0.0	10.0	0,4
Value of min. superheat reference for loads under 10%	n22	1 K	15 K	2
"n37" and "n38" are adapted to valve type ETS 50 and should only be changed through the use of another valve.				
Number of steps from 0-100% opening degree (x10) (ETS 50= 263. ETS 100 = 353)	n37	000 stp*	5000 stp *	263
Number of steps per second	n38	10 stp/s	300 stp/s	250
Integration time for inner loop (TnT0)	n44	10 s	120 s	30
Miscellaneous				
Controller's address	o03*	1	60	
ON/OFF switch (service-pin message)	o04*	-	-	
Set supply voltage frequency	o12	50 Hz	60 Hz	50
Select display for "normal picture" 1: Superheat 2: Valve's opening degree 3: Air temperature	o17	1	3	1
Manual control of outputs: OFF: no manual control 3: Alarm relay activated (cut out) At settings 3, "o45" will be active	o18	off	3	0
Working range for pressure transmitter – min. value	o20	-1 bar	60 bar	-1.0
Working range for pressure transmitter – max. value	o21	-1 bar	60 bar	12
Refrigerant setting 1=R12. 2=R22. 3=R134a. 4=R502. 5=R717. 6=R13. 7=R13b1. 8=R23. 9=R500. 10=R503. 11=R114. 12=R142b. 13=User defined. 14=R32. 15=R227. 16=R401A. 17=R507. 18=R402A. 19=R404A. 20=R407C. 21=R407A. 22=R407B. 23=R410A. 24=R170. 25=R290. 26=R600. 27=R600a. 28=R744. 29=R1270.	o30	0	29	0
Manual control of the valve's opening degree. The function can only be operated if "o18" has been set.	o45	0 %	100 %	0
Selection of loop ctrl: 1=Normal 2 = double loop	o56	1	2	1

Service		
Read status of input DI	u10	on/off
Temperature at S2 sensor	u20	°C
Superheat	u21	K
Superheat reference	u22	K
Read AKV valve's opening degree	u24	%
Read evaporating pressure	u25	bar
Read evaporating temperature	u26	°C
Temperature at S4 sensor	u27	°C
Read signal at pressure transmitter input	u29	mA

*) This setting will only be possible if a data communication module has been installed in the controller.

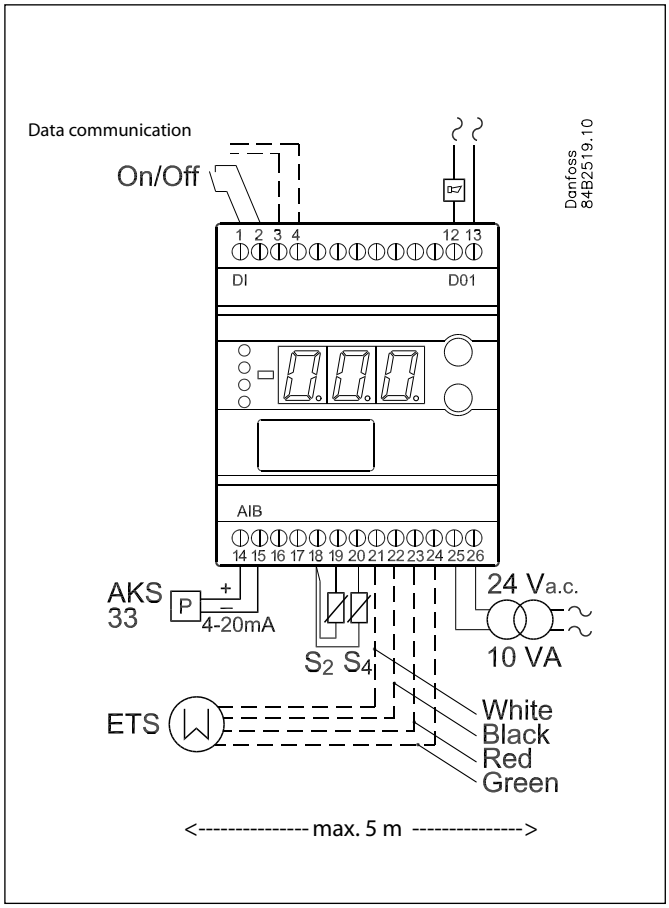
Data

Supply voltage	24 V a.c. +/-15% 50/60 Hz, 10 VA (the supply voltage is galvanically separated from the input and output signals)	
Power consumption	Controller ETS step motor	5 VA 1.3 VA
Input signal	Pressure transmitter	4-20 mA from AKS 33
	Digital input from external contact function	
Sensor input	2 pcs. Pt 1000 ohm	
Alarm relay	1 pcs. SPST	AC-1: 4 A (ohmic) AC-15: 3 A (inductive)
Step motor output	Pulsating 100 mA	
Data communication	Possible to connect a data communication module	
Ambient temperature	-10 - 55°C, During operation -40 - 70°C, During transport	
	20 - 80% Rh, not condensed	
	No shock influence/vibrations	
Enclosure	IP 20	
Weight	300 g	
Mounting	DIN rail	
Display	LED, 3 digits	
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 EN50081-1 and EN 50082-2	



Ordering

Type	Function	Code No.
EKC 312	Superheat controller	**084B7250**
EKA 175	Data communication module (accessories), (RS 485 module)	**084B7093**
EKA 174	Data communication module (accessories), (RS 485 module) with galvanic separation	**084B7124**



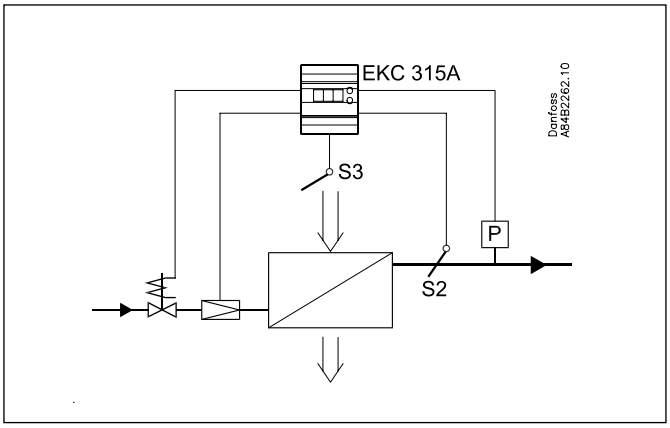
The installation of data communications must comply with the requirements described in literature sheet no. RC8AC

Additional information!
Manual: RS8EA

EKC 315A

Application
The controller and valve can be used where there are requirements to accurate control of superheat and temperature in connection with refrigeration.
E.g.:
- Cold store (air coolers)
- Processing plant (water chillers)
- A/C plant

Advantages
- The evaporator is charged optimally – even when there are great variations of load and suction pressure
- Energy savings – the adaptive regulation of the refrigerant injection ensures optimum utilisation of the evaporator and hence a high suction pressure
- Exact temperature control – the combination of adaptive evaporator and temperature control ensures great temperature accuracy for the media
- The superheating is regulated to the lowest possible value at the same time as the media temperature is controlled by the thermostat function



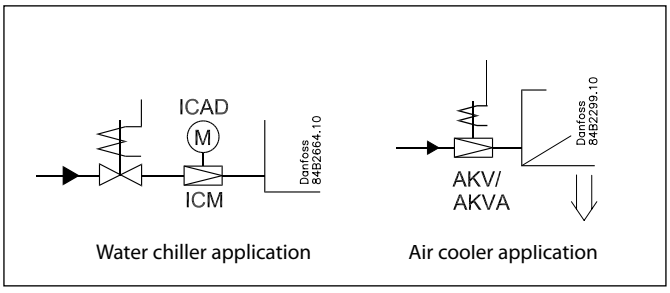
Functions
- Regulation of superheat
- Temperature control
- MOP function
- ON/OFF input for start/stop of regulation
- Input signal that can displace the superheat reference or the temperature reference
- Alarm if the set alarm limits are exceeded
- Relay output for solenoid valve
- PID regulation
- Output signal following the temperature showing in the display

System
The superheat in the evaporator is controlled by one pressure transmitter P and one temperature sensor S2.
The valve can be one of the following types:
- ICM
- AKV (AKVA)

ICM is an electronically, directly run engine valve, controlled by an ICAD type actuator. It is used with a solenoid valve in the liquid line.

AKV is a pulsating valve.
Where the AKV valve is used it also functions as solenoid valve.

Temperature control is performed based on a signal from temperature sensor S3 which is placed in the air current before the evaporator. Temperature control is in the shape of an ON/OFF thermostat that shuts off the liquid flow in the liquid line.



Superheat function
You may choose between two kinds of superheat, either:
- Adaptive superheat or
- Load-defined superheat

MOP
The MOP function limits the valve's opening degree as long as the evaporating pressure is higher than the set MOP value.

Override function
Via the analog input a displacement can be made of the temperature reference or of the superheat reference. The signal can either be a 0-20 mA signal or a 4-20 mA signal. The reference can be displaced in positive or negative direction.

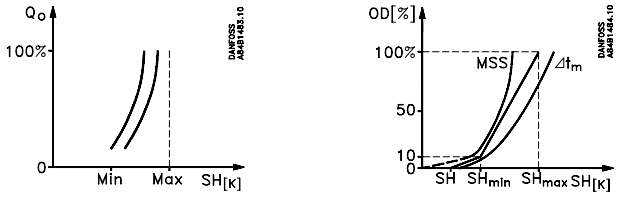
External start/stop of regulation
The controller can be started and stopped externally via a contact function connected to input terminals 1 and 2. Regulation is stopped when the connection is interrupted. The function must be used when the compressor is stopped. The controller then closes the solenoid valve so that the evaporator is not charged with refrigerant.

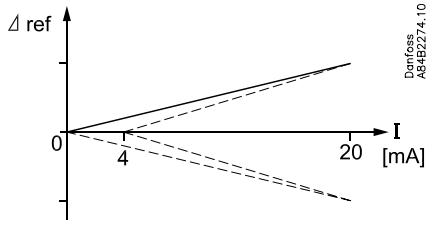
Relays
The relay for the solenoid valve will operate when refrigeration is required. The relay for the alarm function works in such a way that the contact is cut in in alarm situations and when the controller is de-energised.

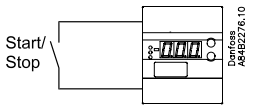
Modulating/pulsating expansion valve
In 1:1 systems (one evaporator, one compressor and one condenser) with small refrigerant charge ICM is recommended.

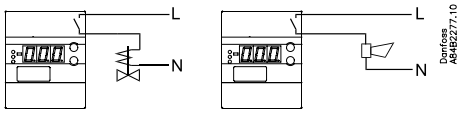
In a system with an AKV valve the capacity can be distributed by up to three valves if slave modules are mounted. The controller will displace the opening time of the AKV valves, so that they will not pulsate at the same time.
Used as slave module is a controller of the type EKC 347.

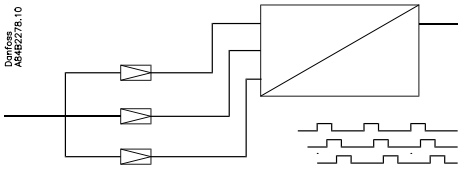
Analog output
The controller is provided with an analog current output which can be set to either 0-20 mA or 4-20 mA. The signal will either follow the superheat, opening degree of the valve or the air temperature.
When an ICM valve is in use, the signal is used for control of the valve via the ICAD actuator.

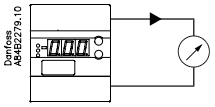












Menu survey

SW =1.3x

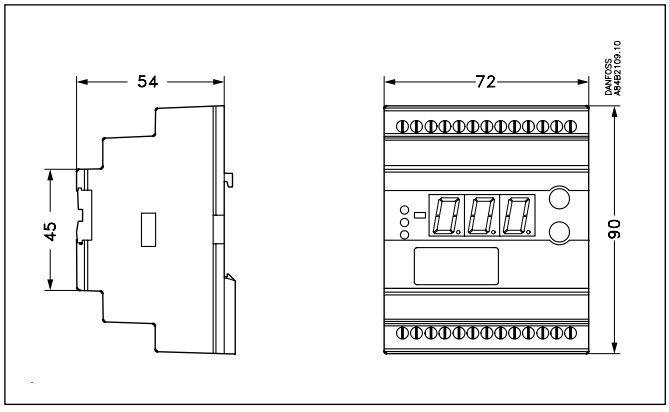
Function	Para-meter	Min.	Max.	Factory setting
Normal display				
Shows the actual superheat/ valve's opening degree/ temperature Define view in o17	-		K	
Temperature, superheating, or the temp. reference is displayed if the bottom button is pressed briefly. Define view in o17	-		%	
Reference				
Set the requirede set point	-	-60°C	50°C	10
Differential	r01	0.1 K	20 K	2.0
Units (0=°C+bar /1=°F+psig)	r05	0	1	0
External contribution to the reference	r06	-50 K	50 K	0
Correction of signal from S2	r09	-10.0 K	10.0 K	0.0
Correction of signal from S3	r10	-10.0 K	10.0 K	0.0
Start/stop of refrigeration	r12	OFF	On	1
Define thermostat function (0= no thermostat function, 1=On/off thermostat)	r14	0	1	0
Alarm				
Upper deviation (above the temperature setting)	A01	3.0 K	20 K	5.0
Lower deviation (below the temperature setting)	A02	1 K	10 K	3.0
Alarm's time delay	A03	0 min.	90 min.	30
Regulating parameters				
P: Amplification factor Kp	n04	0.5	20	3.0
I: Integration time T	n05	30 s	600 s	120
D: Differentiation time Td (0 = off)	n06	0 s	90 s	0
Max. value of superheat reference	n09	2 K	50 K	6
Min. value of superheat reference	n10	1 K	12 K	4
MOP (max = off)	n11	0.0 bar	60 bar	60
Period time (only when AKV/A valve is used)	n13	3 s	10 s	6
Stability factor for superheat control. Changes should only be made by trained staff	n18	0	10	5
Damping of amplification around reference value Changes should only be made by trained staff	n19	0.2	1.0	0.3
Amplification factor for superheat Changes should only be made by trained staff	n20	0.0	10.0	0.4
Definition of superheat control 1=MSS, 2=LOADAP	n21	1	2	1
Value of min. superheat reference for loads under 10%	n22	1	15	2
Standby temperature when valve closed (TQ valve only) Changes should only be made by trained staff	n26	0 K	20 K	0
Standby temperature when valve open (TQ valve only) Changes should only be made by trained staff	n27	-15 K	70 K	20
Max. opening degree Changes should only be made by trained staff	n32	0	100	100
Min. opening degree Changes should only be made by trained staff	n33	0	100	0
Miscellaneous				
Controller's address	o03*	0	119	-
ON/OFF switch (service-pin message)	o04*	-	-	-
Define valve and output signal: 0: Off 1: TQ. AO: 0-20 mA 2: TQ. AO: 4-20 mA 3: AKV, AO: 0-20 m 4: AKV, AO: 4-20 mA 5: AKV, AO: EKC 347-SLAVE 6: ICM, AO: 0-20 mA/ICM OD% 7: ICM, AO: 4-20 mA/ICM OD%	o09	0	7	0
Define input signal on the analoge input AIA: 0: no signal, 1: Temperature setpoint. 0-20 mA 2: Temperature setpoint. 4-20 mA 3: Displacement of superheat reference. 0-20 mA 4: Displacement of superheat reference. 4-20 mA	o10	0	4	0
Set supply voltage frequency	o12	50 Hz	60 Hz	0
Select display for "normal picture" (Display the item indicated in parenthesis by briefly pressing the bottom button) 1: Superheat (Temperature) 2: Valve's opening degree (Superheat) 3: Air temperature (Temperature reference)	o17	1	3	1
Manual control of outputs: OFF: no manual control 1: Relay for solenoid valve: select ON 2: AKV/A output: select ON 3: Alarm relay activated (cut out)	o18	off	3	Off
Working range for pressure transmitter – min. value	o20	-1 bar	60 bar	-1.0
Working range for pressure transmitter – max. value	o21	-1 bar	60 bar	12
(Setting for the function o09, only AKV and TQ) Set the temperature value or opening degree where the output signal must be minimum (0 or 4 mA)	o27	-70°C	160°C	-35
(Setting for the function o09, only AKV and TQ) Set the temperature value or opening degree where the output signal must be maximum (20 mA)	o28	-70°C	160°C	15
Refrigerant setting 1=R12. 2=R22. 3=R134a. 4=R502. 5=R717. 6=R13. 7=R13b1. 8=R23. 9=R500. 10=R503. 11=R114. 12=R142b. 13=User defined. 14=R32. 15=R227. 16=R401A. 17=R507. 18=R402A. 19=R404A. 20=R407C. 21=R407A. 22=R407B. 23=R410A. 24=R170. 25=R290. 26=R600. 27=R600a. 28=R744. 29=R1270.	o30	0	29	0
Service				
TQ valve's actuator temperature	u04			°C
Reference of the valve's actuator temperature	u05			°C
Analog input AIA (18-19)	u06			mA
Analog output AO (2-5)	u08			mA
Read status of input DI	u10			on/off
Thermostat cut-in time	u18			min.
Temperature at S2 sensor	u20			°C
Superheat	u21			K
Superheat reference	u22			K
Read AKV valve's opening degree	u24			%
Read evaporating pressure	u25			bar
Read evaporating temperature	u26			°C
Temperature at S3 sensor	u27			°C
Temperature reference	u28			°C
Read signal at pressure transmitter input	u29			mA

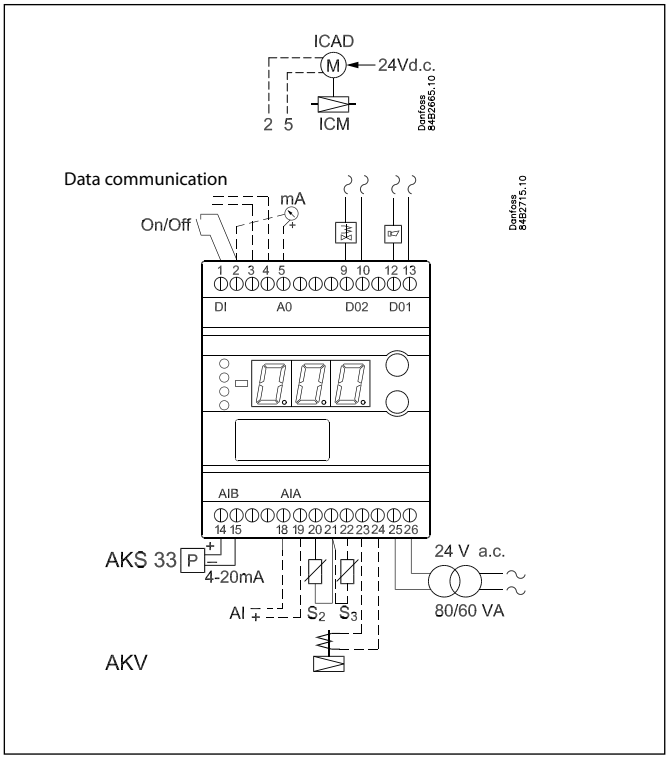
*) This setting will only be possible if a data communication module has been installed in the controller.

Data

Supply voltage	24 V a.c. +/-15% 50/60 Hz, (80 VA) (the supply voltage is galvanically separated from the input and output signals)	
Power consumption	Controller AKV coil	5 VA 55 VA
Input signal	Current signal	4-20 mA or 0-20 mA
	Pressure transmitter	4-20 mA from AKS 33
	Digital input from external contact function	
Sensor input	2 pcs. Pt 1000 ohm	
Output signal	Current signal	4-20 mA or 0-20 mA
	Load	Max. 200 ohm
Relay output	1 pcs. SPST	AC-1: 4 A (ohmic) AC-15: 3 A (inductive)
Alarm relay	1 pcs. SPST	
ICAD	ICAD mounted on ICM	Current signal 4-20 mA or 0-20 mA
Data communication	Possible to connect a data communication module	
Environments	-10 to 55°C, during operations -40 to +70°C, during transport	
	20 - 80% Rh, not condensed	
	No shock influence/vibrations	
Enclosure	IP 20	
Weight	300 g	
Mounting	DIN rail	
Display	LED, 3 digits	
Terminals	max. 2.5 mm² multicore	
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 EN50081-1 and EN 50082-2	

The installation of data communications must comply with the requirements described in literature sheet no. RC8AC





Ordering

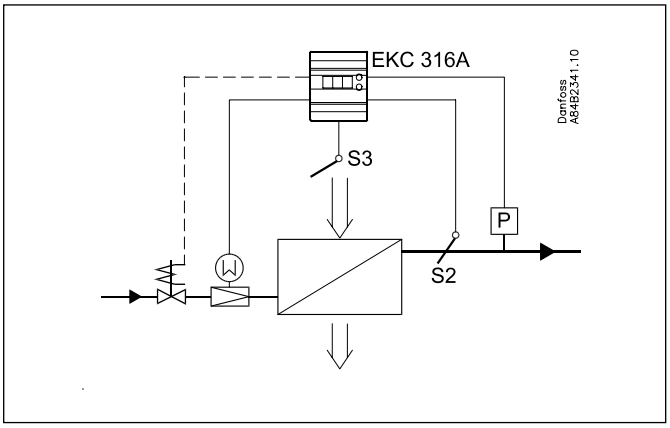
Type	Function	Code no.
EKC 315A	Superheat controller	**084B7086**
EKA 175	Data communication module (accessories), (RS 485 modul)	**084B7093**
EKA 174	Data communication module (accessories), (RS 485 module) with galvanic separation	**084B7124**

Additional information!
Manual: RS8CS

EKC 316A

Application
The controller and valve can be used where there are requirements to accurate control of superheat and temperature in connection with refrigeration.
E.g.:
- Processing plant (water chillers)
- Cold store (air coolers)
- A/C plant

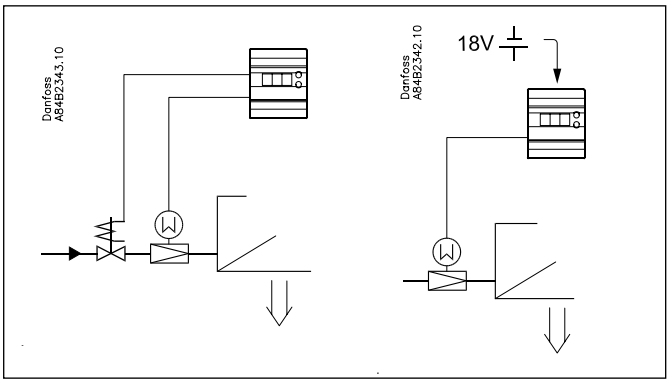
Advantages
- The evaporator is charged optimally – even when there are great variations of load and suction pressure.
- Energy savings – the adaptive regulation of the refrigerant injection ensures optimum utilisation of the evaporator and hence a high suction pressure.
- The superheating is regulated to the lowest possible value at the same time as the media temperature is controlled by the thermostat function.



Functions
- Regulation of superheat
- Temperature control
- MOP function
- ON/OFF input for start/stop of regulation
- Input signal that can displace the superheat reference or the temperature reference
- Alarm if the set alarm limits are exceeded
- Relay output for solenoid valve
- PID regulation

System
The superheat in the evaporator is controlled by one pressure transmitter P and one temperature sensor S2.
The expansion valve is with step motor of the type ETS.

If temperature control is required, this can be accomplished via a signal from temperature sensor S3 placed in the air flow before the evaporator. The temperature control is an ON/OFF thermostat that opens for the liquid flow when refrigeration is required – the ETS valve opens and the thermostat relay cuts in.



For safety reasons the liquid flow to the evaporator must be cut off if there is power failure for the controller. As the ETS valve is provided with step motor, it will remain open in such a situation. There are two ways of coping with this situation:
- Mounting of a solenoid valve in the liquid line
- Mounting of battery backup for the valve

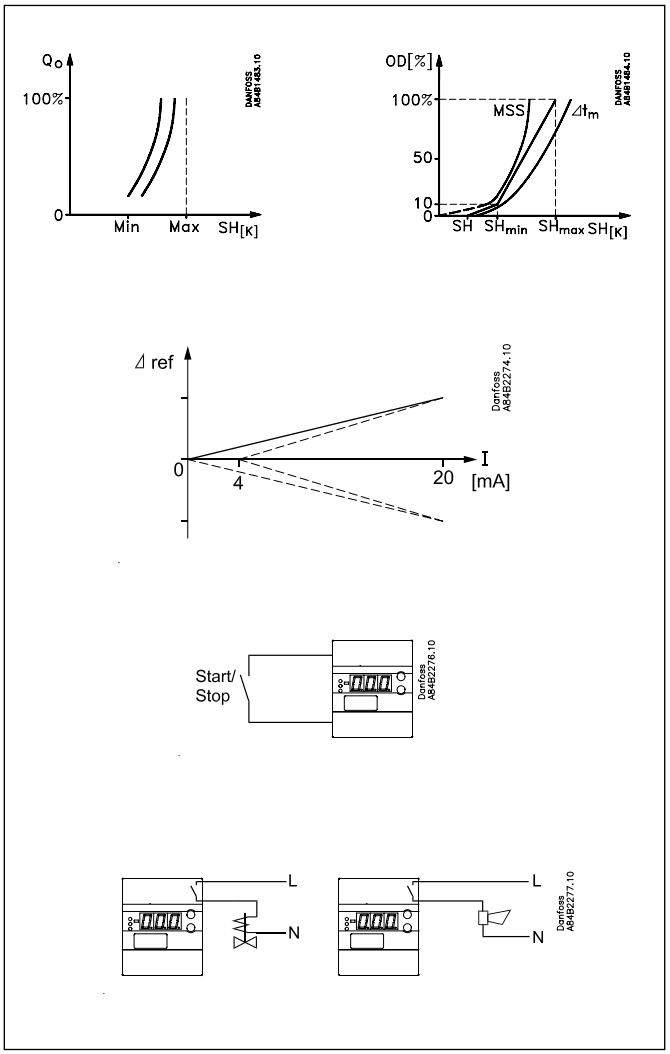
Superheat function
You may choose between two kinds of superheat, either:
- Adaptive superheat or
- Load-defined superheat

MOP
The MOP function limits the valve's opening degree as long as the evaporating pressure is higher than the set MOP value.

Override function
Via the analog input a displacement can be made of the temperature reference or of the superheat reference. The signal can either be a 0-20 mA signal or a 4-20 mA signal. The reference can be displaced in positive or negative direction.
The signal can be used to override the valve's opening degree.

External start/stop of regulation
The controller can be started and stopped externally via a contact function connected to input terminals 1 and 2. Regulation is stopped when the connection is interrupted. The function must be used when the compressor is stopped. The controller then closes the solenoid valve so that the evaporator is not charged with refrigerant.

Relays
The relay for the solenoid valve will operate when refrigeration is required. The relay for the alarm function works in such a way that the contact is cut in in alarm situations and when the controller is de-energised.



Menu survey

SW =1.2x

Function	Parameter	Min.	Max.	Fac. sett.
Normal display				
Shows the actual superheat/ valve's opening degree/ temperature Define view in o17	-		K	
If you wish to see the expansion valve's actual opening degree, give the lower button a brief push (1s). Define view in o17	-		%	
Reference				
Set the required set point for the thermostat	- *	-60°C	50°C	3.0
Differential	r01 *	0.1 K	20.0 K	2.0
Units (0=°C+bar /1=°F+psig)	r05	0	1	0
External contribution to the reference	r06	-50 K	50 K	0..0
Correction of signal from S2	r09	-10.0 K	10.0 K	0.0
Correction of signal from S3	r10	-10.0 K	10.0 K	0.0
Start/stop of refrigeration	r12	OFF	On	On
Define thermostat function (0= no thermostat function, 1=On/off thermostat)	r14	0	1	0
Alarm				
Upper deviation (above the temperature setting)	A01 *	3 K	20 K	5
Lower deviation (below the temperature setting)	A02 *	1 K	10 K	3
Alarm's time delay	A03 *	0 min.	90 min.	30
Battery monitoring	A34	Off	On	Off
Regulating parameters				
P: Amplification factor Kp	n04	0.5	20	3.0
I: Integration time T	n05	30 s	600 s	120
D: Differentiation time Td (0 = off)	n06	0 s	90 s	0
Max. value of superheat reference	n09	2 K	30 K	10
Min. value of superheat reference	n10	1 K	12 K	4
MOP (max = off)	n11	0.0 bar	20 bar	20
Signal reliability during start-up. Safety time period. Should only be changed by trained staff	n15	0 s	90 s	0
Signal reliability during start-up – Opening degree's start value. Should only be changed by trained staff.	n17	0	100	0
Stability factor for superheat control. Changes should only be made by trained staff	n18	0	10	5
Damping of amplification around reference value Changes should only be made by trained staff	n19	0.2	1.0	0.3
Amplification factor for superheat Changes should only be made by trained staff	n20	0.0	10.0	0.4
Definition of superheat control 1=MSS, 2=LOADAP	n21	1	2	1
Value of min. superheat reference for loads under 10%	n22	1 K	15 K	2
Max. opening degree Changes should only be made by trained staff	n32	0 %	100 %	100
"n37" to "n42" are adapted to valve type ETS 50 and should only be changed through the use of another valve.				
Number of steps from 0-100% opening degree (x10) (ETS 50 = 263. ETS 100 = 353)	n37	000 stp**	5000 stp **	263
Number of steps per second	n38	10 stp/s	300 stp/s	250
Compensation of spindle play at the valve's closing point	n39	0 stp	100 stp	50
Compensation of spindle play in the control range	n40	0 stp	100 stp	100
Valve status when power supply interrupted: 1 = NC, 2 = NO (special application)	n41	1	2	1
Compensation of spindle play at the closing point must take place: 1=when the valve opens, 2=when the valve closes	n42	1	2 stp	1
Attenuation factor for inner loop	n43	0,1	1	0.4
Integration time for inner loop (TnT0)	n44	10 s	120 s	30
Safety value for lower temperature difference for inner loop	n45	1 K	20 K	3.0
Miscellaneous				
Controller's address	o03***	0	119	0
ON/OFF switch (service-pin message)	o04***	-	-	-
Define input signal on the analoge input AIA: 0: no signal, 1: Temperature setpoint. 0-20 mA 2: Temperature setpoint. 4-20 mA 3: Displacement of superheat reference. 0-20 mA 4: Displacement of superheat reference. 4-20 mA 5: Forced control of valve's max. opening degree. 0-20 mA 6: Forced control of valve´s max. opening degree 4-20 mA	o10	0	6	0
Set supply voltage frequency	o12	50 Hz	60 Hz	50
Select display for "normal picture" 1: Superheat 2: Valve's opening degree 3: Air temperature	o17	1	3	1
Manual control of outputs: OFF: no manual control 1: Relay for solenoid valve: select ON 2: Relay for solenoid valve: select OFF 3: Alarm relay activated (cut out) 4: Forced control of valve's opening degree. 0-20 mA 5: Forced control of valve´s opening degree 4-20 mA At settings 1-3, "o45" will be active	o18	off	5	0
Working range for pressure transmitter – min. value	o20	-1 bar	60 bar	-1.0
Working range for pressure transmitter – max. value	o21	-1 bar	60 bar	12.0
Refrigerant setting 1=R12. 2=R22. 3=R134a. 4=R502. 5=R717. 6=R13. 7=R13b1. 8=R23. 9=R500. 10=R503. 11=R114. 12=R142b. 13=User defined. 14=R32. 15=R227. 16=R401A. 17=R507. 18=R402A. 19=R404A. 20=R407C. 21=R407A. 22=R407B. 23=R410A. 24=R170. 25=R290. 26=R600. 27=R600a. 28=R744. 29=R1270.	o30	0	29	0
Manual control of the valve's opening degree. The function can only be operated if "o18" has been set.	o45	0 %	100 %	0
Selection of control mode: 1=Normal 2 = With inner loop (T0) 3 = With inner loop (S media temperature less T0)	o56	1	3	1
Service				
Analog input AIA (16-17)	u06			mA
Read status of input DI	u10			on/off
Thermostat cut-in time	u18			min.
Temperature at S2 sensor	u20			°C
Superheat	u21			K
Superheat reference	u22			K
Read AKV valve's opening degree	u24			%
Read evaporating pressure	u25			bar
Read evaporating temperature	u26			°C
Temperature at S3 sensor	u27			°C
Temperature reference	u28			°C
Read signal at pressure transmitter input	u29			mA

*) Used only when thermostat function (r14 = 1) is selected.

**) The display on the controller can show 3 digits only, but the setting value has 4 digits. Only the 3 most important will be shown. It means f.ex. . 250 will give a setting of 2500.

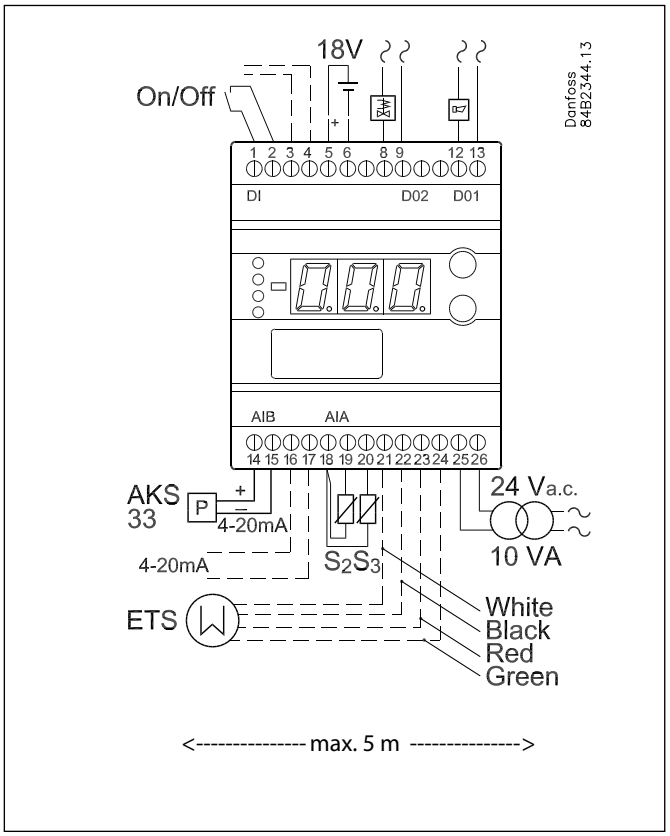
***) This setting will only be possible if a data communication module has been installed in the controller.

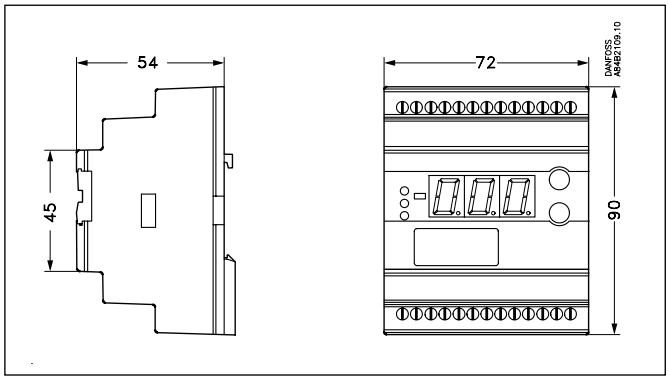
Configuration settings available only when regulation is stopped.

Data

Supply voltage	24 V a.c. +/-15% 50/60 Hz, 10 VA (the supply voltage is galvanically separated from the input and output signals)	
Power consumption	Controller ETS step motor	5 VA 1.3 VA
Input signal	Current signal	4-20 mA or 0-20 mA
	Pressure transmitter	4-20 mA from AKS 33
	Digital input from external contact function	
Sensor input	2 pcs. Pt 1000 ohm	
Thermostat relay	1 pcs. SPST	AC-1: 4 A (ohmic) AC-15: 3 A (inductive)
Alarm relay	1 pcs. SPST	
Step motor output	Pulsating 100 mA	
Data communication	Possible to connect a data communication module	
Environments	-10 to +55°C, during operations -40 to +70°C, during transport	
	20 - 80% Rh, not condensed	
	No shock influence/vibrations	
Enclosure	IP 20	
Weight	300 g	
Mounting	DIN rail	
Display	LED, 3 digits	
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 EN50081-1 and EN 50082-2	

If battery backup is used: Battery requirement =18 V d.c. min. 100 mAh





The installation of data communications must comply with the requirements described in literature sheet no. RC8AC

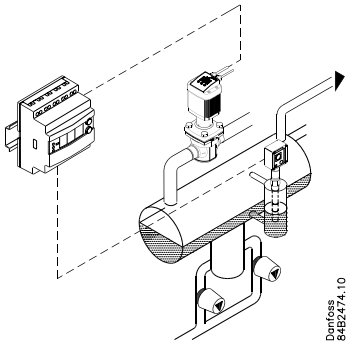
Ordering

Type	Function	Code No.
EKC 316A	Superheat controller	**084B7088**
EKA 175	Data communication module (accessories), (RS 485 module)	**084B7093**
EKA 174	Data communication module (accessories), (RS 485 module) with galvanic separation	**084B7124**

Additional information!
Manual: RS8CX

EKC 347

Application
The controller is used for regulation of the refrigerant level in:
- Pump reservoirs
- Separators
- Intermediate coolers
- Economisers
- Condensers
- Receivers

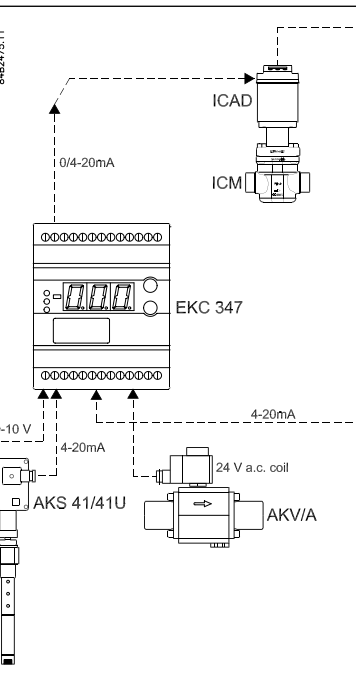


System
A signal transmitter will constantly measure the refrigerant liquid level in the reservoir - the controller will receive the signal and subsequently control the valve, in order to control the refrigerant liquid level according to liquid level setpoint.

Signaltransmitter
With the capacitive rod it is possible to set the refrigerant level within a wide range.

EKC 347
The controller receive a signal and are then able to contol low or high side applications. A analog input signal (voltage/ current) can displace the setpoint and then remote change of setpoint is thus possible.
EKC 347 does support 2 types of Danfoss expansion valves. (see below)
One analog input is available as feed back from ICM in order to indicate Opening degreee of the ICM.

Expansions valve
Two types of Danfoss expansion valves can be used
ICM - ICM are direct operated motorized valves driven by digital stepper motor type ICAD
AKV/A - AKVA or AKV are pulse-width modulating expansion valves.



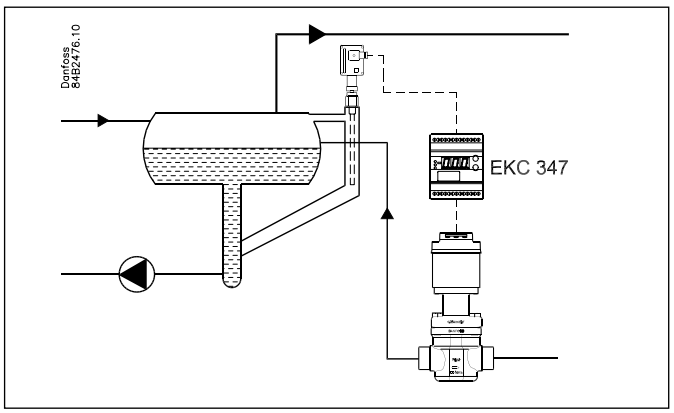
Functions
- Liquid level control
- Alarm if the set alarm limits are exceeded
- Relay outputs for upper and lower level limits and for alarm level
- Analog input signal which can displace the reference
- PI control
- Low or High side control
- When AKV/A is selected, a MASTER/SLAVE system can run up to 3 AKV/A with distributed Opening Degree
- Manual control of output
- Limitation of Opening degree possible
- ON/OFF operation with hysteresis

LED's on front panel

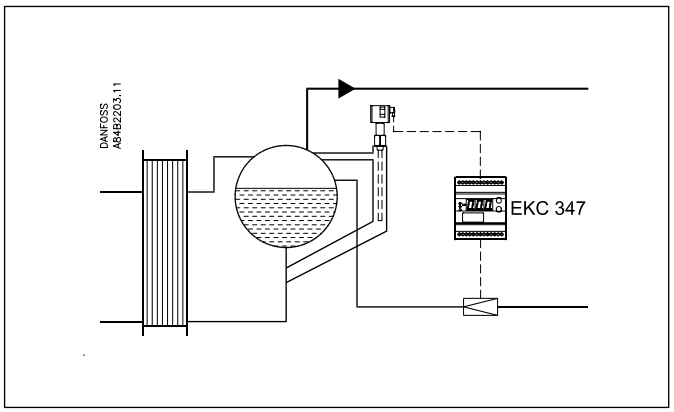
⊠	Opening signal to valve
▲	Indication of upper level limit
▼	Indication of lower level limit
All	Indication of alarm level

Application examples

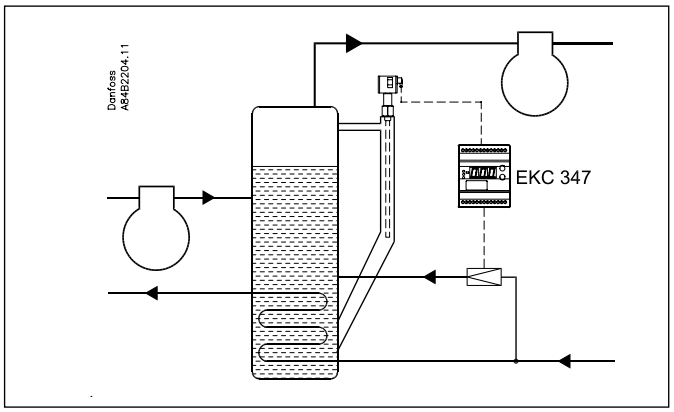
Pump reservoir
Modulating control of injection makes for a more stable liquid level and suction pressure.



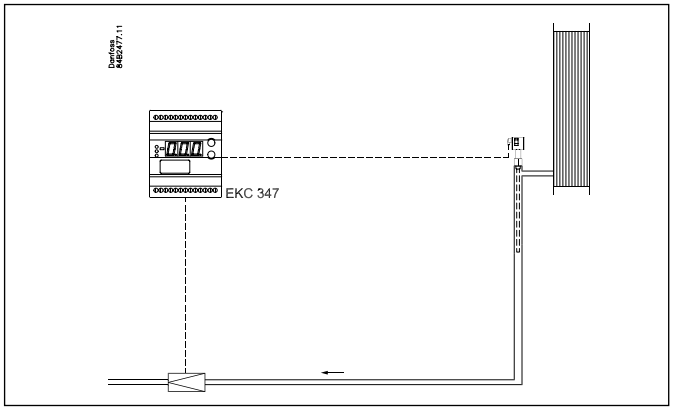
Separator on flooded evaporator
Modulating control and the valve's large capacity range ensure a stable level - even under conditions of quickly changing loads.



Intermediate cooler
The level transmitter's wide measuring range enables it to monitor the liquid at all levels of the reservoir - and hence to use the signal for safety functions in connection with the max. permissible level



Receiver/condenser
The control system's short reaction time makes it very suited for high-pressure float systems with small refrigerant charges.



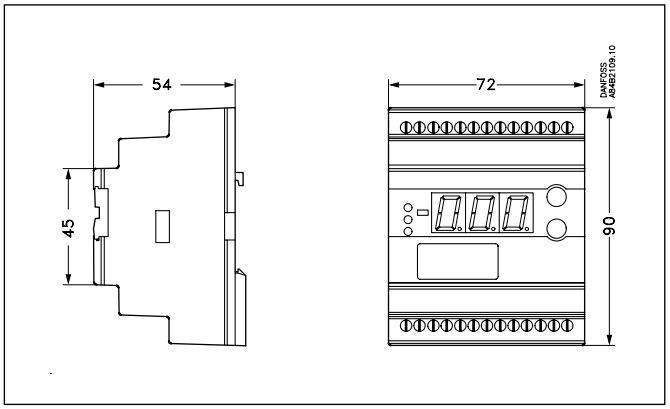
Menu survey

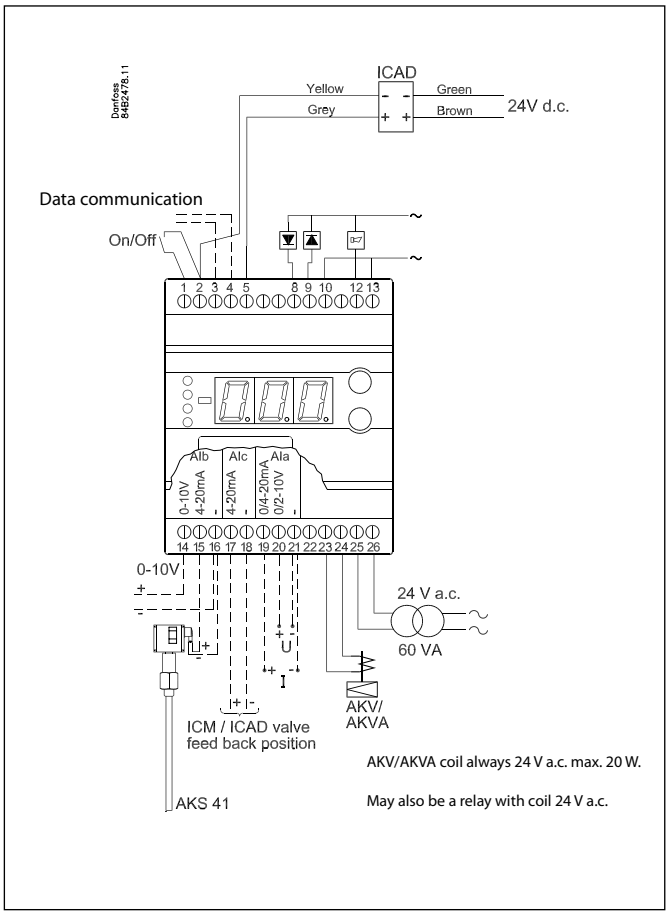
SW = 1.1

Function	Parameter	Min.	Max.	Fac. setting
Normal display				
Read the measured liquid level	-		%	50.0
If you wish to see the actual opening degree, give the lower button a brief push	-		%	0
If you wish to set the required setpoint you obtain access by pushing both buttons simultaneously	-	0%	100%	100
Level control				
External contribution to the reference. Cf. also o10. Value is set in %-points.	r06	-100	100	0.0
Start/stop of level control	r12	OFF/0	ON/1	1
Alarm				
Upper level limit	A01	0 %	100%	85
Lower level limit	A02	0%	100%	15
Time delay for upper level limit	A03	0 s	999 s	50
Time delay for lower level limit	A15	0 s	999 s	10
Level alarm limit	A16	0 s	999 S	20
Delay for level alarm	A17	0 s	999 s	0
The level alarm is linked to: 0: Rising level (higher level than A16) 1: Falling level (lower level than A16) 2: Same function as if A18=0. When A2 alarm is generated and Relay for lower level limit, gives OFF signal (cut out). 3: Same function as if A18=1 When A2 alarm is generated and Relay for lower level limit, gives OFF signal (cut out).	A18	0	3	0
Function for Alarm relay when A1, A2 or A3 alarms are detected. 0: Alarm relay to be activated when A1 or A2 or A3 are detected. 1: Alarm relay only to be activated when A3 is detected.	A19	0	1	0
Regulating parameters				
P - band	n04	0%/Off	200%	30
I: Integration time Tn	n05	60	600/ Off	400
Period time (only if AKV/A valve is used)	n13	3 s	10 s	6
Max. opening degree	n32	0%	100%	100
Min. opening degree	n33	0%	100%	0
Neutral zone (only for ICM valve)	n34	2%	25%	2
Definition of regulating principle Low: On the low-pressure side (valve closes when liquid level is rising) High: On the high-pressure side (valve opens when liquid level is rising)	n35	Low/0	Hig/1	0
Miscellaneous				
Controller's address	o03*	0	60	0
ON/OFF switch (service-pin message)	o04*	OFF	ON	
Define valve and output signal: 1: ICM. AO: 4-20 mA 2: ICM. AO: 0-20 mA 3: AKV/A, AO: 4-20 mA 4: AKV/A, AO: 0-20 mA Or if a master/slave function is used: 5: AKV/A, MASTER 6: AKV/A, SLAVE 1/1. AO:4-20 mA 7: AKV/A, SLAVE 1/1. AO:0-20 mA 8: AKV/A, SLAVE 1/2. AO:4-20 mA 9: AKV/A, SLAVE 1/2. AO:0-20 mA 10: AKV/A, SLAVE 2/2. AO:4-20 mA 11: AKV/A, SLAVE 2/2. AO:0-20 mA 12: AKV/A, SLAVE 1/1. AO:4-20 mA - AO always updated 13: AKV/A, SLAVE 1/1. AO:0-20 mA- AO always updated 14: AKV/A, SLAVE 1/2. AO:4-20 mA- AO always updated 15: AKV/A, SLAVE 1/2. AO:0-20 mA- AO always updated 16: AKV/A, SLAVE 2/2. AO:4-20 mA- AO always updated 17: AKV/A, SLAVE 2/2. AO:0-20 mA- AO always updated	o09	1	17	1
Define the input signal on terminals 10, 20, 21 (external reference displacement) 0: OFF 1: 4-20 mA 2: 0-20 mA 3: 2-10 V 4: 0-10 V	o10	0	4	0
Language 0=English, 1=German, 2=Frensh, 3=Danish, 4=Spanish, 5=Italian, 6=Swedish. When you change the setting you must also activate o04.	o11	0	6	0
Set supply voltage frequency	o12	0/50 Hz	1/60 Hz	0
Selection of parameter for display and AO (except from when o09=1,2 or 5) If o34 = 0: 0: Liquid level is show 1: Valve's opening degree OD will be shown If o34 = 1: 0: Liquid level is show 1: The ICM valve position feed back signal [%] will be shown	o17	0	1	0
Manual control of outputs: OFF: No manual control 1: Upper level relay put in pos. ON 2: Lower level relay put in pos. ON 3: AKV/A output put in pos. ON 4: Alarm relay activated (cut out)	o18	OFF	4	0
Define input signal (level signal) on terminals 14, 15, 16 0: OFF 1: 4-20 mA 2: 0-10 V (also set the voltage values in the next two menus) Read functional description if the connection used is a master/slave function.	o31	0	2	1
Define input signal's lower value for terminal 14, if required	o32	0.0 V	4.9 V	4.0
Define input signal's upper value for terminal 14, if required	o33	5.0 V	10 V	6.0
Define input signal on terminals 17-18 0: Not used 1: ICM mA feedback signal from ICAD connected 2: Not used	o34	0	2	0
Service				
Read liquid level	u01			%
Read liquid level reference	u02			%
Read external contribution to the reference	u06			mA
Read external contribution to the reference	u07			V
Read current signal on the analog output	u08			mA
Read status of input DI	u10			
Read valve's opening degree	u24			%
Read level signal	u30			mA
Read level signal	u31			V
Read signal from ICM/ICAD	u32			mA
Read signal from ICM/ICAD converted into %	u33			%

Data

Supply voltage	24 V a.c. +/-15% 50/60 Hz, 60 VA (the supply voltage is galvanically separated from the input and output signals. Input/output are not individual galvanic isolated)	
Power consumption	Controller 20 W coil for AKV	5 VA 55 VA
Input signal	Level signal	4-20 mA or 0-10 V
	Reference displacement	4-20 mA, 0-20 mA, 2-10 V or 0-10 V
	ICM valve feedback signal	From ICAD 0/4-20 mA
	Contact function start/stop of regulation	
Relay output	2 pcs. SPST	AC-1: 4 A (ohmic) AC-15: 3 A (inductive)
Alarm relay	1 pcs. SPST	
Current output	0-20 mA or 4-20 mA Max. load: 500 ohm	
Valve connection	ICM - via current output AKV/A- via 24 a.c. Pulse-Width Modulating output	
Data communication	Possible to connect a data communication module	
Environments	-10 - 55°C, during operation -40 - 70°C, during transport	
	20 - 80% Rh, not condensed	
	No shock influence/vibrations	
Enclosure	IP 20	
Weight	300 g	
Mounting	DIN rail	
Display	LED, 3-digits	
Terminals	max. 2.5 mm² multicore	
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 EN50081-1 and EN 50082-2	





Ordering

Type	Function	Code No.
EKC 347	Liquid level controller	**084B7067**
EKA 174	Data communication module (accessories), (RS 485 module) with galvanic separation	**084B7124**

The installation of data communications must comply with the requirements described in literature sheet no. RC8AC

Additional information!
Manual: RS8AX

Wireless temperature monitoring

AK-Wireless

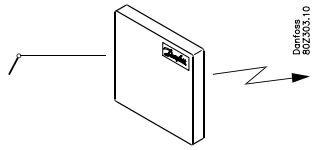
Application
- Units for monitoring and data collection of temperatures.
- Can be installed in all system types where temperature monitoring is required
- The unit can also supplement existing equipment:
  - Input control
  - Temperature measurement in refrigeration areas.

Advantages
- Compact unit for registering temperatures
- No wiring
- Good coverage. Wireless measuring points can use each other to reach the receiver
- Simple set-up
- Can be connected to existing ADAP-KOOL® equipment

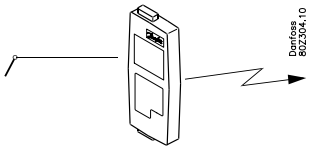
Functions
- 99 measuring points via wireless measuring points
- Temperature alarm for high and low temperature
- Log for each measuring point
- Handheld unit with 64 measuring points
- Sending of log and alarm via GSM, IP, RS232
- Alarm relay

Operation
- Limited local user interface
- Service tool user interface
- AKM user interface
- Web interface

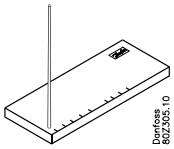
Principles



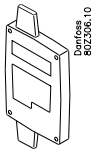
Temperature sensor — Mounted transmitter AK-WS 100



Temperature sensor or Infrared measuring — Handheld transmitter AK-WT 150

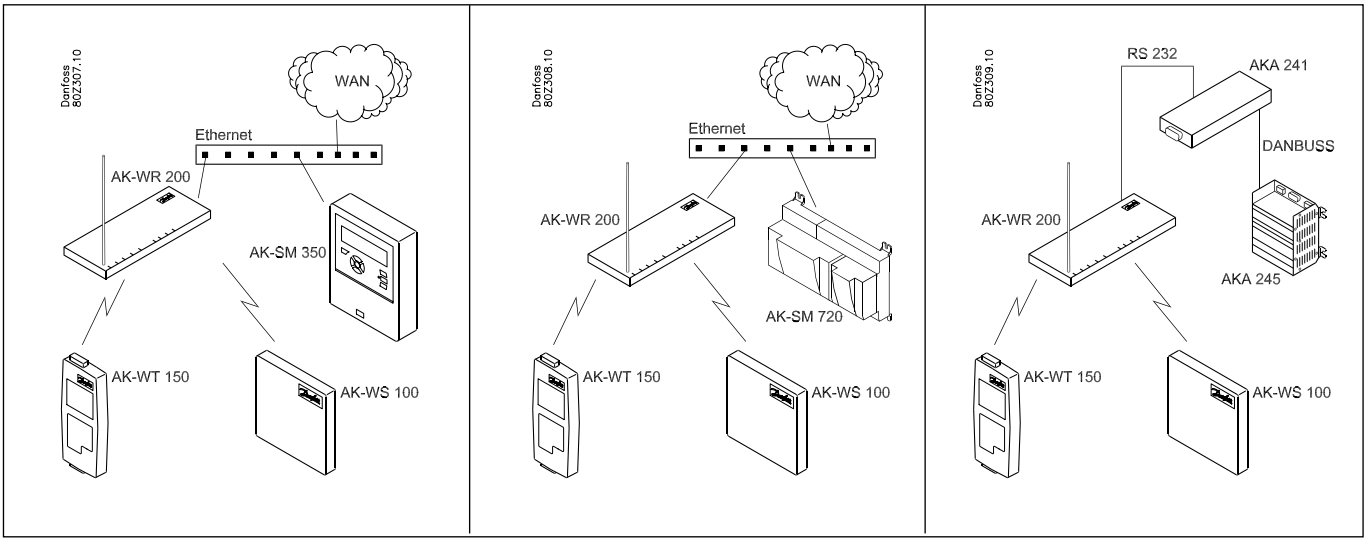


For system solutions — Receiver AK-WR 200



For stand alone — Receiver AK-WD 250

System examples



Data

AK-WD 250 data logger and AK WR 200 receiver

Power supply	30 V a.c. via ext. power adapter
Display WD250	2 lines, 20 characters
Total number of points	99
Number of hand terminals	5
Battery backup	WD 250 (24 hours)
Data communication	IP, Danbuss (RS 232)
Wireless communication	RF868 Mhz
Ambient temperature	0 to -50°C during operation -40 to +70°C during transport 20-80% RH
Connections	RS 232: DSUB-9 IP: RJ45
Assembly	On wall

AK-WT 150 handheld terminal

Power supply	Rechargeable battery
Display	2 lines, 16 characters
Total number of points	64
Wireless communication	RF868 Mhz
Range	15 m
Measuring range	-30 to 70°C
Accuracy of measurement	± 1°C (temp. probe) ± 2°C (IR sensor)
Ambient temperature	0 to -50°C during operation -40 to +70°C during transport 20-80% RH
Connections	Plug for temperature sensor

AK-WS 100 Sensor node

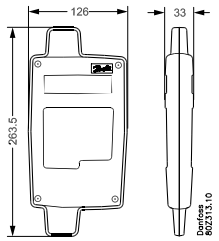
Power supply	Battery
Number of points	1
Wireless communication	RF868 Mhz
Range	15 m
Sensor	Pt 1000 ohm/0°C
Measuring range	-30 to 70°C
Accuracy of measurement	± 1°C
Ambient temperature	0 to -50°C during operation -40 to +70°C during transport 20-80% RH
Connections	Screw terminals for temperature probe

Important
Installation of data communication cables and repeaters must comply with the requirements contained in the document: Data communication between ADAP-KOOL® Refrigeration system controls.
Number = RC8AC.

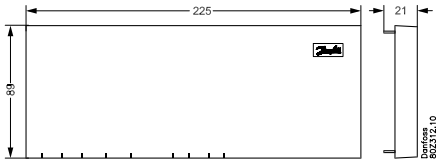
Additional information!
Manual: RS8ET

Dimensions

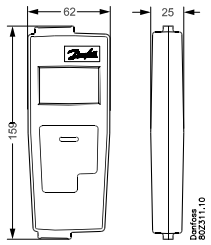
AK-WD 250



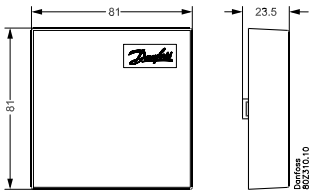
AK-WR 200



AK-WT 150



AK-WS 100



Ordering

Type	Description	Power supply	Code No.
AK-WD 250	Wireless data logger	EU	080Z3000
AK-WD 250	Wireless data logger	UK	080Z3013
AK-WR 200	Wireless receiver	EU	080Z3001
AK-WR 200	Wireless receiver	UK	080Z3014
AK-WT 150	Wireless handheld terminal	EU	080Z3002
AK-WT 150	Wireless handheld terminal	UK	080Z3015
AK-WS 100	Wireless sensor node for 1 sensor	EU	080Z3003
AK-WS 100	Wireless sensor node for 4 sensors	EU	080Z3008
	230 V power adaptor for sensor node	EU	080Z3010
	230 V power adaptor for sensor node	UK	080Z3016
	RS232 cable for AK-WD and AK-WR		080Z3012

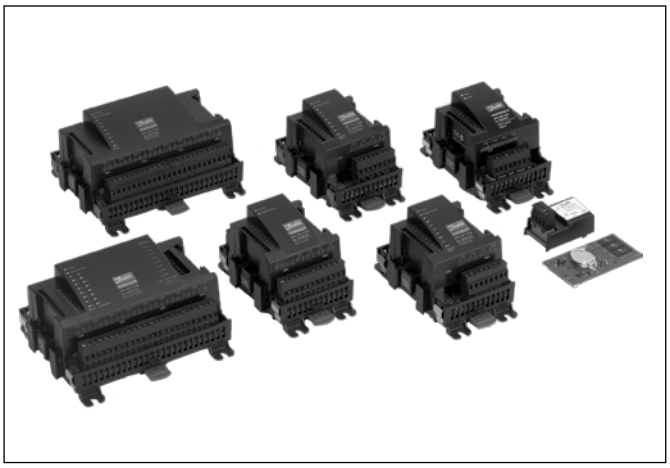
IO modules for the AK series

Introduction

One of the control series can be expanded as the size of the system is increased. It has been developed for refrigeration control systems, but not for any specific application – variation is created through the read-in software and the way you choose to define the connections.

It is the same modules that are used for each regulation and the composition can be changed, as required. With these modules (building blocks) it is possible to create a multitude of various kinds of regulations. But it is you who must help adjusting the regulation to the actual needs – these instructions will assist you to find your way through all the open questions so that the regulation can be defined and the connections made.

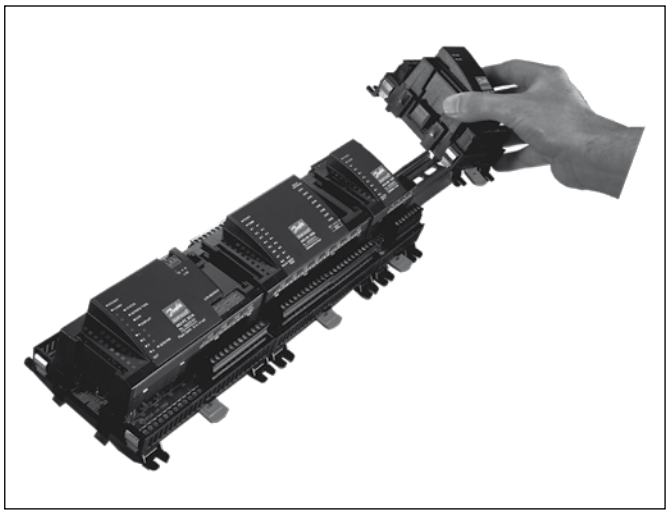
Programming and setup of the controller will take place at a later time.



Application

Controller for refrigeration control systems. See e.g. the regulations:

- Capacity regulation of compressor and condenser groups
- Evaporator control of freezing and refrigeration appliances
- Network control



Advantages

- The controller's size can "grow" as systems grow
- The software can be set for one or more regulations
- Several regulations with the same components
- Extension-friendly when systems requirements are changed
- Flexible concept:
  - Controller series with common construction
  - One principle – many regulation uses
  - Modules are selected for the actual connection requirements
  - The same modules are used from regulation to regulation

Principles

- Controller module – capable of handling minor plant requirements.
- Extension modules.
  When the complexity becomes greater and additional inputs or outputs are required, modules can be attached to the controller. A plug on the side of the module will transmit the supply voltage and data communication between the modules.
- Upper part
  The upper part of the controller module contains the intelligence. This is the unit where the regulation is defined and where data communication is connected to other controllers in a bigger network.
- Connection types
  There are various types of inputs and outputs. One type may, for example, receive signals from sensors and switches, another may receive a voltage signal, and a third type may be outputs with relays etc. The individual types are shown in the table next to.
- Optional connection
  When a regulation is planned (set up) it will generate a need for a number of connections distributed on the mentioned types. This connection must then be made on either the controller module or an extension module. The only thing to be observed is that the types must not be mixed (an analog input signal must for instance not be connected to a digital input).
- Programming of connections
  The controller must know where you connect the individual input and output signals. This takes place in a later configuration where each individual connection is defined based on the following principle:
  - to which module
  - at which point ("terminals")
  - what is connected (e.g. pressure transmitter/type/ pressure range)

Module overview

A control in this series should be defined and selected with information contained in the manual for the respective control.

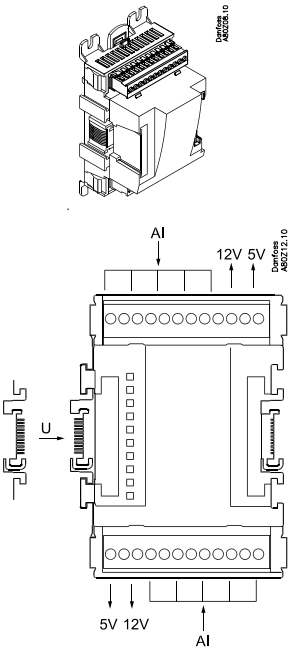
The overview below is for information and reordering

Type	Analog inputs	On/Off outputs		On/off supply voltage (DI signal)		Analog outputs	Module with switches	Code No.
	For sensors, pressure transmitters etc.	Relay (SPDT)	Solid state	Low voltage (max. 80 V)	High voltage (max. 260 V)	0-10 V d.c.	For override of relay outputs	With screw terminals
Controller	11	4	4	-	-	-	-	-
The control module has the connections indicated in the line above. If further connections are needed, one of the following modules should be used.								
Extension modules								
AK-XM 101A	8							**080Z0007**
AK-XM 102A				8				**080Z0008**
AK-XM 102B					8			**080Z0009**
AK-XM 204A		8						**080Z0006**
AK-XM 204B		8					x	**080Z0016**
AK-XM 205A	8	8						**080Z0005**
AK-XM 205B	8	8					x	**080Z0015**
AK-XM 107A Pulse module								**080Z0020**
AK-XM 208 Stepper output module								**080Z0022**
AK-OB 003A Analog output module						2		**080Z0251**

Miscellaneous

Type	Function	Application	Code No.
AK-ST 500	Software for operation of AK controllers	AK-operation	**080Z0161**
-	Cable between PC and AK controller	AK - Com port	**080Z0262**
-	Cable between zero modem cable and AK controller	AK - RS 232	**080Z0261**
AK-OB 101A	Real time clock with battery backup.	To be mounted in an AK controller	**080Z0252**
AK-PS 075	Power supply 18 VA	Can be mounted to the left of the control	**080Z0053**
AK-PS 150	Power supply 36 VA	Can be mounted to the left of the control	**080Z0054**
AK-PS 250	Power supply 60 VA	Can be mounted to the left of the control	**080Z0055**
AK-CM 101A	Communication module		**080Z0061**
	Humidity sensor		**080Z2171**
	Light sensor		**080Z2172**

Extension module
AK-XM 101A



Function
The module contains 8 analog inputs for sensors, pressure transmitters, voltage signals and contact signals.

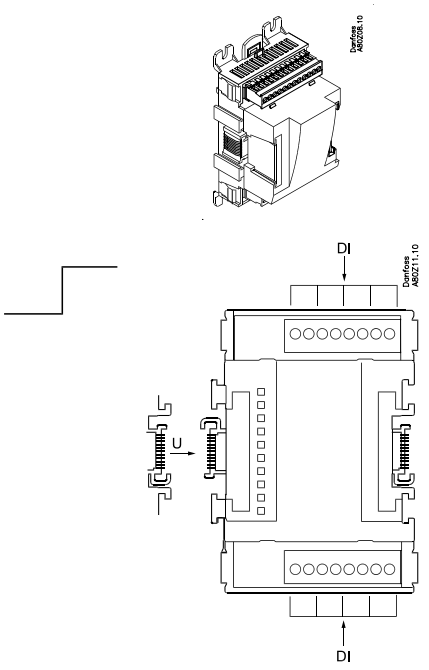
Supply voltage to a pressure transmitter can be taken from either the 5 V output or the 12 V output.

Ordering

Type	Function	Code No.
AK-XM 101A	Extension module for sensors, pressure transmitters, contact signals	**080Z0007**

Additional information!
See the control's manual.

Extension module
AK-XM 102A/B



24 V On: DI > 10 V a.c.
Off: DI < 2 V a.c.

115/230 V On: DI > 80 V a.c.
Off: DI < 24 V a.c.

Funktion
The module contains 8 inputs for on/off voltage signals.

Light-emitting diodes
• Status on the individual inputs (when lit = voltage)

Ordering

Type	Function	Code No.
AK-XM 102A	Extension module for on/off voltage signals Low voltage (24 V)	**080Z0008**
AK-XM 102B	Extension module for on/off voltage signals High voltage (230 V)	**080Z0009**

Additional information!
See the control's manual.

Extension module
AK-XM 204A/B

Function
The module contains 8 relay outputs.

AK-XM 204B has eight change-over switches at the front which make is possible to override the function of the relay.
Either to position OFF or ON.
In position Auto the controller carries out the control.

Light-emitting diodes
Status on outputs DO1 to DO8

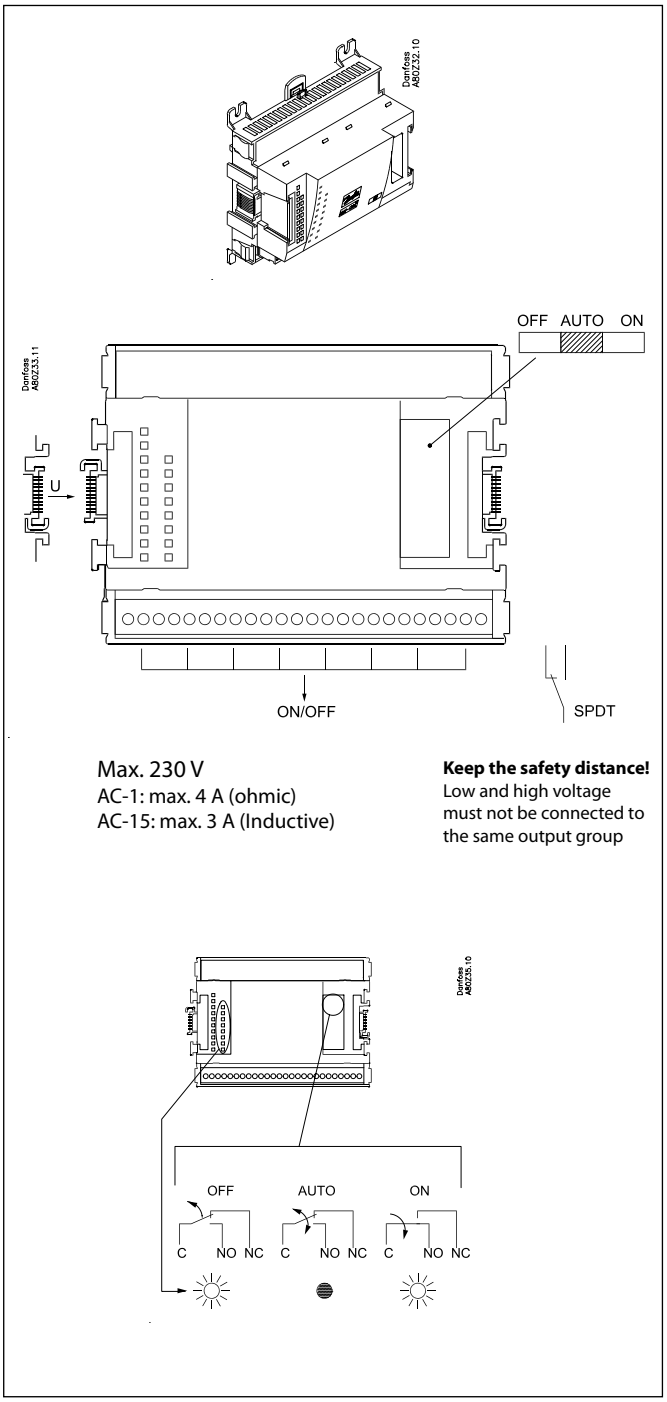
AK-XM 204B also has a number of LEDs, which show whether the relays are being overridden.
Light ON = override
Light OFF = no override

Fuses
Behind the upper part there is a fuse for each output.

Ordering

Type	Function	Code No.
AK-XM 204A	Extension module for on/off relay outputs	**080Z0006**
AK-XM 204B	Extension module for on/off relay outputs with overriding function	**080Z0016**

Additional information!
See the control's manual.



Extension module
AK-XM 205A/B

Function
The module contains:
8 analog inputs for sensors, pressure transmitters, voltage signals and contact signals.
8 relay outputs.

AK-XM 205B has eight change-over switches at the front which make is possible to override the function of the relay.
Either to position OFF or ON.
In position Auto the controller carries out the control.

Light-emitting diodes
Status on outputs DO1 to DO8

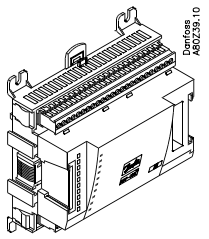
AK-XM 205B also has a number of LEDs, which show whether the relays are being overridden.
Light ON = override
Light OFF = no override

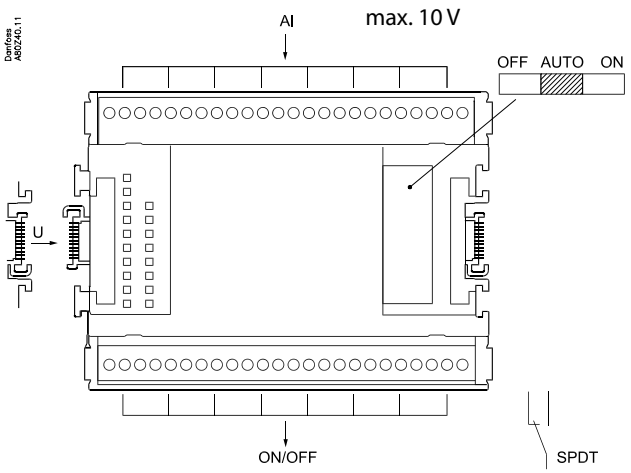
Fuses
Behind the upper part there is a fuse for each output.

Ordering

Type	Function	Code No.
AK-XM 205A	Extension module for sensors, pressure transmitters and on/off outputs	**080Z0005**
AK-XM 205B	Extension module for sensors, pressure transmitters and on/off output with overriding function	**080Z0015**

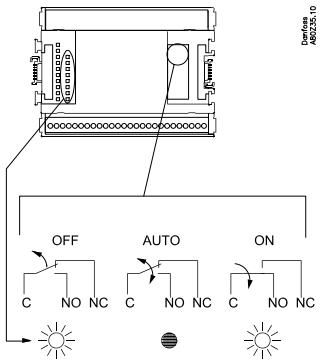
Additional information!
See the control's manual.



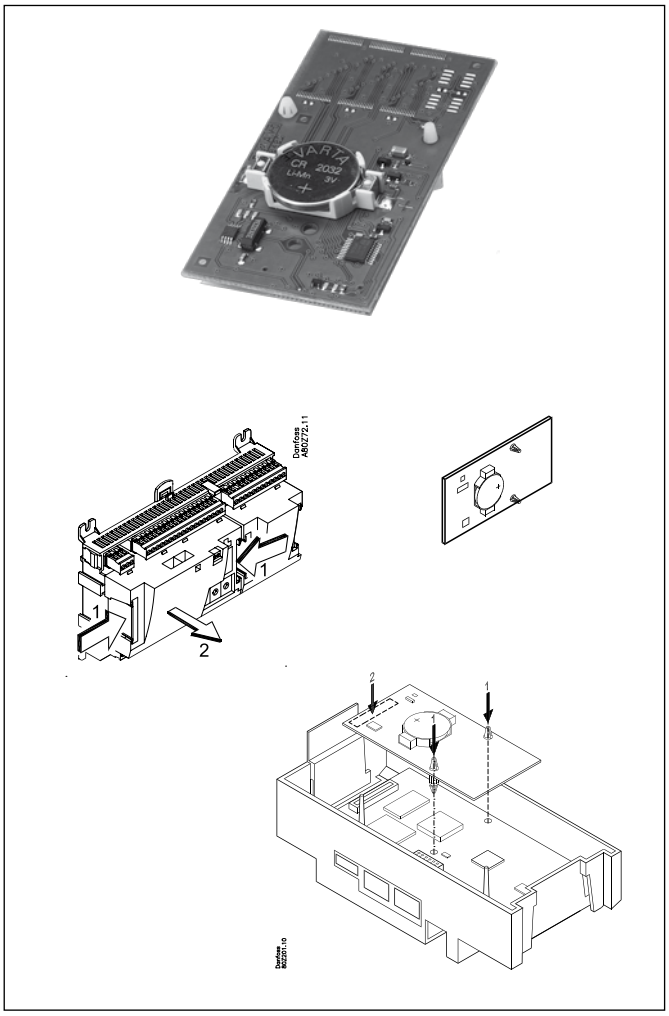


Max. 230 V
AC-1: max. 4 A (ohmic)
AC-15: max. 3 A (Inductive)

Keep the safety distance!
Low and high voltage must not be connected to the same output group



Extension module
AK-OB 101A



Function
The module is a clock module with battery backup.

The module can be used in controllers that are not linked up in a data communication unit together with other controllers. The module is used here if the controller needs battery backup for the following functions
- Clock function
- Fixed times for day/night change-over
- Fixed defrost times
- Saving of alarm log in case of power failure
- Saving of temperature log in case of power failure

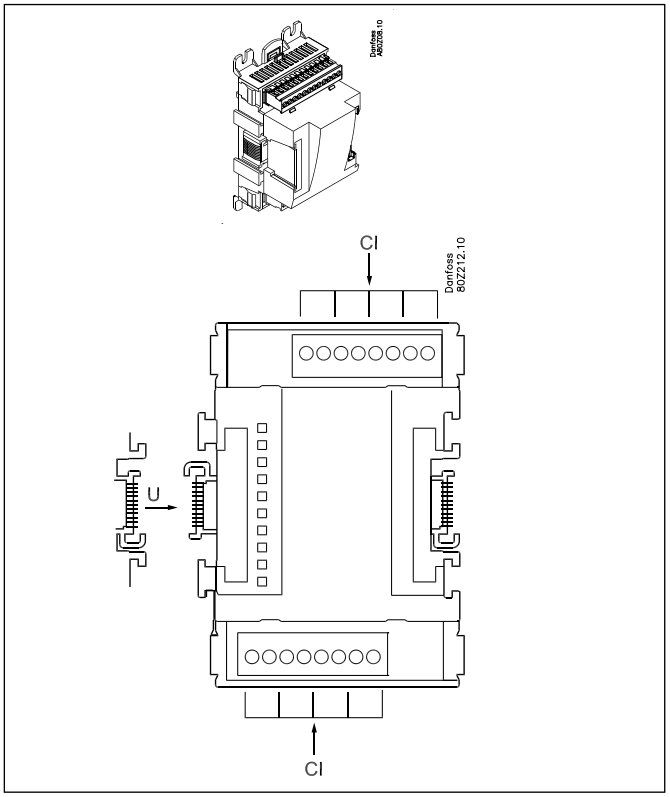
Placing
The module is placed on the PC board inside the upper part.

Working life of the battery
The working life of the battery is several years – also if there are frequent power failures.
An alarm is generated when the battery has to be replaced.
After the alarm there are still several months of operating hours left in the battery.

Ordering

Type	Function	Code No.
AK-OB 101A	Real-time clock with battery backup.	**080Z0252**

Extension module
AK-XM 107A



Function
The module contains eight digital inputs for pulse measuring or for registering on/off signals from a switch function.
The pulses are measured according to the DIN 43864/S01 interface.

Ordering

Type	Function	Code No.
AK-XM 107A	Extension module for pulse measuring	**080Z0020**

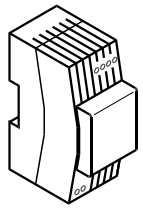
Extension module
AK-PS 075/150/250

Transformer module/Power supply

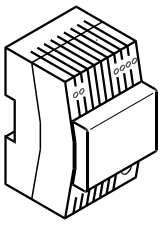
Function
24 V supply for controller.

Supply voltage
230 V a.c or 115 V a.c. (from 100 V a.c. to 240 V a.c.)

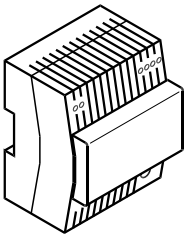
Placing
On DIN-rail



AK-PS 075
18 VA



AK-PS 150
36 VA



AK-PS 250
60 VA

Ordering

Type	Function	Code No.
AK-PS 075	Transformer module, 18 VA	**080Z0053**
AK-PS 150	Transformer module, 36 VA	**080Z0054**
AK-PS 250	Transformer module, 60 VA	**080Z0055**

Additional information!
See the control's manual.

Extension module
AK-OB 003A

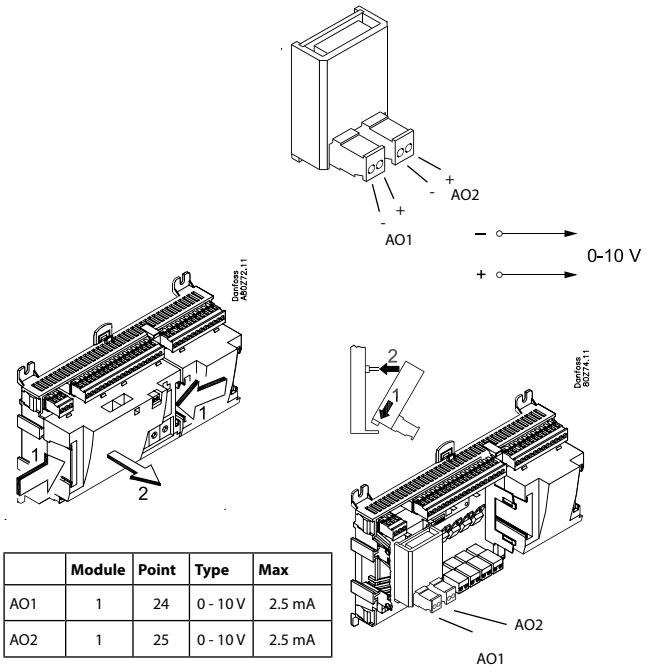
Function
The module contains two analog voltage outputs of 0 – 10 V.

Placing
The module is placed on the PC board in the controller module.

Ordering

Type	Function	Code No.
AK-OB 003A	Analog output module	**080Z0251**

Additional information!
See the control's manual.



	Module	Point	Type	Max
AO1	1	24	0 - 10 V	2.5 mA
AO2	1	25	0 - 10 V	2.5 mA

Extension module
AK-XM 208B

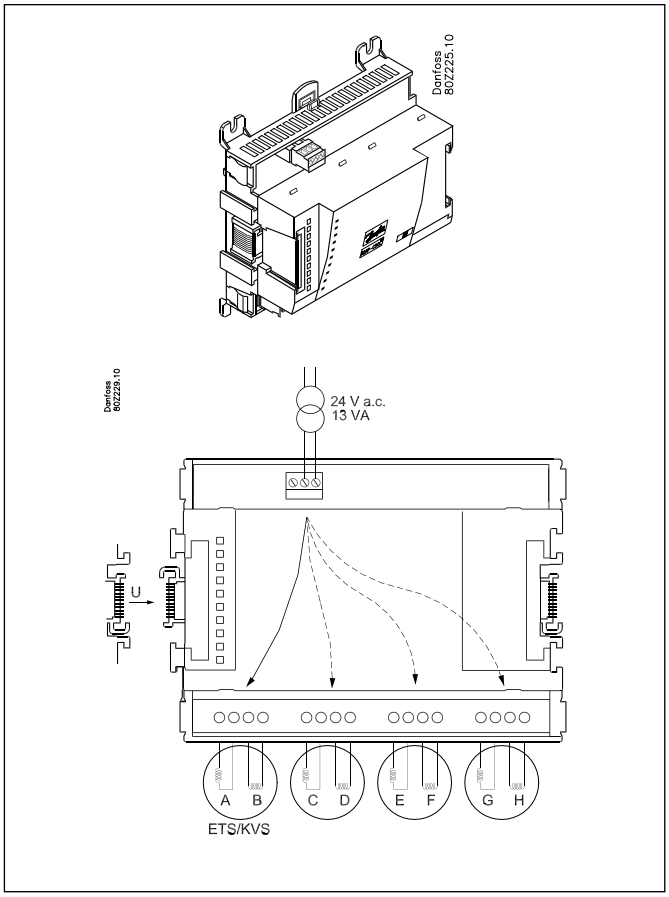
Function
The module contains four outputs for the control of a step motor valve type ETS or KVS.

Power supply
The power to the step motor valves must be connected separately.

Ordering

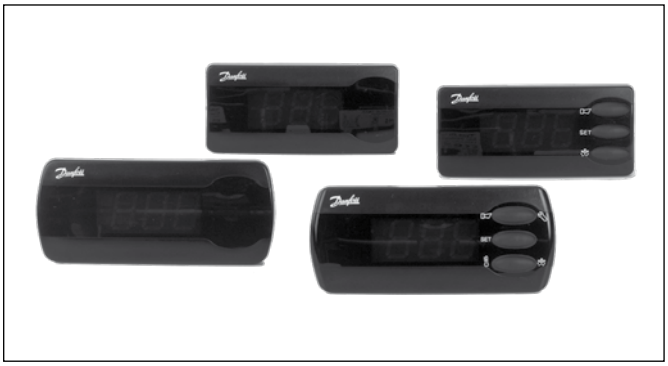
Type	Function	Code No.
AK-XM 208B	Stepper output module	**080Z0022**

Additional information!
Manual: RB8DQ122
Instr. : RI8KG102



Display

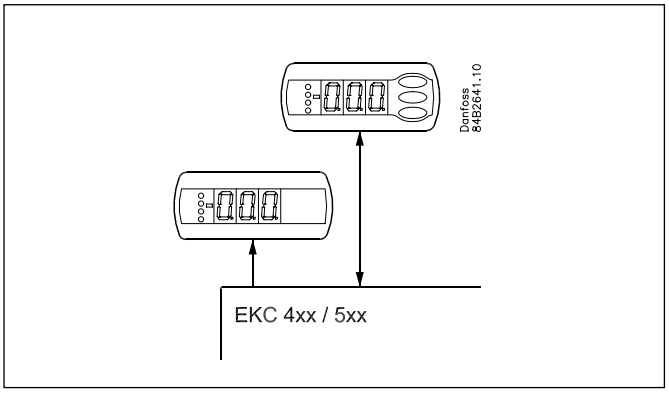
EKA 161/162/163/164



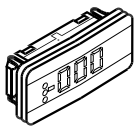
Application
The displays may be used in conjunction with some of the controllers in the EKC series, e.g. EKC 414, EKC 514

EKA 161 and 163 has no operating buttons and can be mounted on the refrigeration appliance in such a way that the customer can see the temperature at the goods.

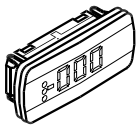
EKA 162 and 164 has operating buttons so that settings can be made in the controller's menu system.



Display for show of measurements

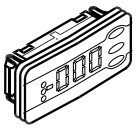


EKA 161

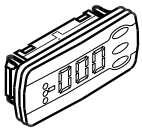


EKA 163

Display for show of measurements and operating buttions for setting of the controllers functions



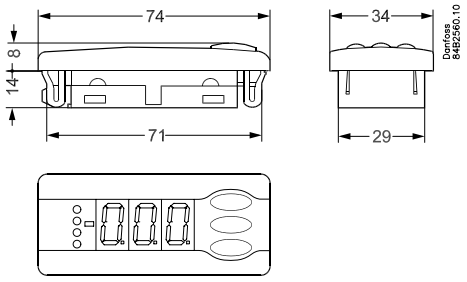
EKA 162



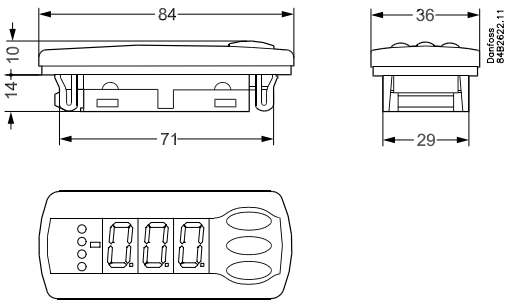
EKA 164

Comparison
The primary difference between the four display is as follows:
- Design
  EKA 161 and EKA 162 follow the design in the EKC 201 series.
  EKA 163 and EKA 164 follow the design in the EKC 102 and 202 series.
- With or without operation
- Enclosure IP40 or IP65
- Plug connection or screw terminals

Dimensions



EKA 161/EKA 162



EKA 163/EKA 164

Data

Supply	12 V +/-15% (from controller)	
Display/ operation	Readout accuracy in measuring range: 0,1°C EKA 161 /163, LED, 3-digits EKA 162 /164, LED, 3-digits, operation buttons	
Electrical connection	EKA 161 EKA 162	Via plug
	EKA 163A EKA 164A	Via screw terminals
	EKA 163B EKA 164B	Via plug
Environments	-10 - 55°C, during operation -40 - 70°C, during transport	
	20 - 80% Rh, non condensing	
	No shock influence/no vibrations	
Enclosure	From back	IP 20
Front mounting	EKA 161 EKA 162	IP 40
	EKA 163 EKA 164	IP 65

Installationen of data communication must keep the requirements which are described in literature no. RC8AC

Ordering

Type	Description		Code no.
EKA 161	Display unit	With plug	**084B8568**
EKA 162	Display unit with operation buttons		**084B8569**
EKA 163A	Display unit	Screw terminals	**084B8562**
EKA 163B		With plug	**084B8574**
EKA 164A	Display unit with operation buttons	Screw terminals	**084B8563**
EKA 164B		With plug	**084B8575**
	Cable for display unit (2 m m/plug)	1 pc.	**084B7298**
		24 pcs.	**084B7179**
	Cable for display unit (6 m m/plug)	1 pc.	**084B7299**
		24 pcs.	**084B7097**
	Cable for display unit (3 m m/plug)	24 pcs.	**084B7099**

See also the connection option for the actual controller

Display console

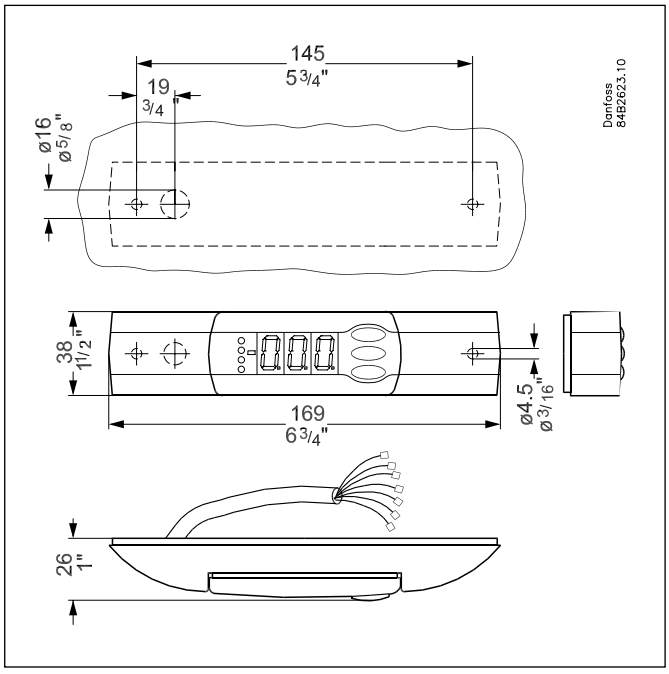
This console can be used for a display of the type EKA 163 or EKA 164.

The console can be used on refrigeration appliances where there is no option of embedding the display in the front.

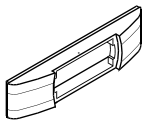
The console is fixed with two screws and the connection to the display is led backwards.

Data

Mounting	On plate with two screws. Screws are included.
Enclosure	IP 65



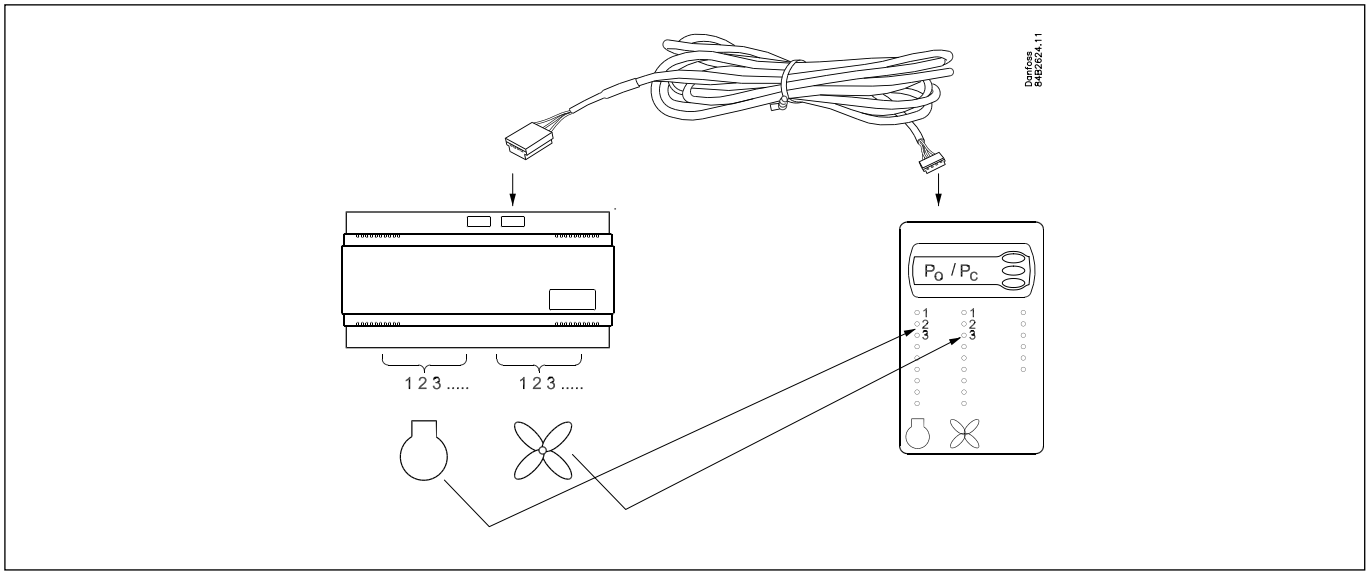
Ordering

Description	Application	Code No.
Mounting kit	Together with EKA 163 or EKA 164	**084B8584**
		

EKA 165

The display can be used with compressor controls of the type AK-PC 530.
The display will show P0 or Pc and the control situation around the neutral zone.
The LEDs on the plate will show the compressors and condensers that are connected.

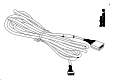
There are LEDs for the following functions:
- Compressors
- Fans
- Speed control
- Digital input
- Optimisation function
- Alarm



Data

Power supply	From controller
Display/ operation	Reading accuracy in the measured area: 0.1% LED, three digits, operation buttons
Electrical connection	Via plug
Ambient environment	-10 to 55°C, during operation -40 to 70°C during transport
	20-80% RH, non-condensed
	No shock loads/vibrations
Mounting	Front assembly
Enclosure	IP 65

Ordering

Description		Type	Code No.
Display unit with operation buttons and LEDs		EKA 165	**084B8573**
Connection to display unit (2 m w/plug)	1 pc.		**084B7298**
	24 pcs		**084B7179**
Connection to display unit (6 m w/plug)	1 pc.		**084B7299**
	24 pcs		**084B7097**
Connection to display unit (3 m w/plug)	24 pcs		**084B7099**

Additional information!
AK-PC 530-Manual: RS8EJ

AKA 14

Application
Temperature display is used with controllers of the type AKC.
External fitting

Function
LCD - displays
Supplied with 3 m cable

Ordering numbers can be found at the back of the catalogue together with numbers for AKC controllers.

AKA 15

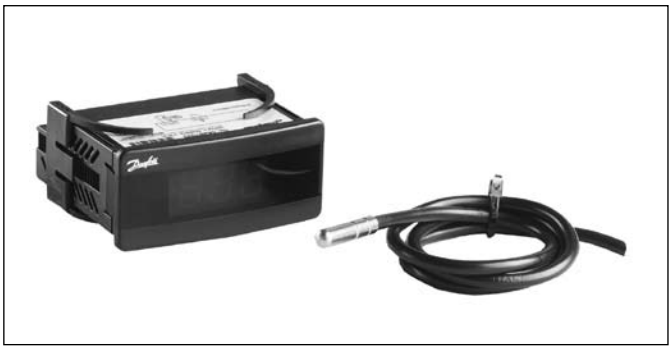
Application
Temperature display is used with controllers of the type AKC.
Installed in front panel

Function
LED displays
Cable must be ordered separately.

Ordering numbers can be found at the back of the catalogue together with numbers for AKC controllers.

Thermometer

EKA 151

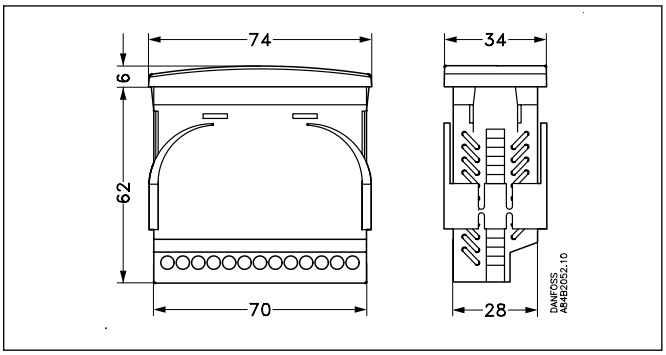


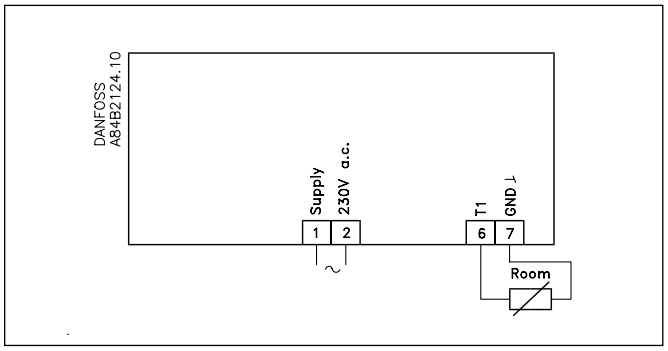
Application
The thermometer is an independent unit for showing the temperature at a refrigerating point. Design and mounting same as the other controllers in the Danfoss EKC 201 series.

Function
The thermometer operates in conjunction with a PTC temperature sensor which must be 1000 ohm at 25°C.
The sensor can be supplied with the thermometer.

Data

Supply voltage		230 V +10/-15%, 50/60 Hz, 2.5 VA
Sensor connection		PTC 1000 ohm at 25°C e.g. type EKS 111 Cable length = max. 10 m
Display		LED-three digits with 1 decimal
Measurement range		-60 to +50°C
Degree of accuracy		+/-1 K in range 0 to +10°C +/-2 K in range below 0°C +/-2 K in range above 10°C
Enclosure		IP 54
Ambient temperature	-10 - 55°C, under operation -40 - 70°C, under transport	
	20 - 80% Rh, 20-80% RH, non-condensed	
	No shock loads/vibrations	
Approvals		EN 60730-1 and EN 60730-2-9 EN 50081-1 and EN 50082-1





Ordering

Type	Description	Code No.
EKA 151	Thermometer	**084B7023**
	Thermometer and EKS 111 with 1.5 m cable	**084B7623**

Pt 1000 ohm/0°C

AKS 11, AKS 12, AKS 21

Application
The sensor is recommended for accurate temperature measurements such as e.g. superheating, food safety logs and other important temperature measurements.

Function
The sensor unit consists of a platinum element the resistance value of which changes proportionally with the temperature. Pt 1000 ohm sensor (1000 ohm at 0°C).
The sensors are adjusted and meet the tolerance requirements of EN 60751 Klasse B.

Type	Description	Temperature range °C	Sensor/ sensor body	Connection/ cable	Enclosure	Time constant in seconds	Cable length m	No.	Code no.
AKS 11 *)	Surface and duct sensor	-50 to +100	Toppart: PPO (Noryl) Bottom: Stainless Steel	PVC cable, 2 x 0.2 mm²	IP 67	3 [1] 10 [2] 35 [3]	3.5 m	1	**084N0003**
							3.5 m with AMP plug	110	**084N0050**
							5.5 m	1	**084N0005**
							5.5 m with AMP plug	70	**084N0051**
							8.5 m	1	**084N0008**
							8.5 m with AMP plug	50	**084N0052**
AKS 12	Air temperature sensor	-40 to 80	18/8 Stainless steel	PVC cable 2 x 0.22 mm²	IP 67	15 [1]	1.5 m	1	**084N0036**
								30	**084N0035**
							3.5 m	30	**084N0039**
							5.5 m	30	**084N0038**
							5.5 m with AMP plug	30	**084N0037**
							13.5 m	20	**084N0034**
AKS 21A **)	Surface sensor with clip	-70 to +180	18/8 Stainless steel	Fire-resistive silicone rubber cable 2 x 0.2 mm²	IP 67	6 [1] 14 [2] 35 [3]	2.5 m	1	**084N2007**
							5.0 m	1	**084N2008**
	Surface sensor with screened cable and clip	-70 to +180					2.0 m	1	**084N2024**
AKS 21M	Multipurpose sensor	-70 to +180					2.5 m	1	**084N2003**
AKS 21W	Immersion sensor with cable and senor pocket, Weld version	-70 to +180	Immersion sensor: 18/8 stainless steel tube	Fire-resistive silicone rubber cable 2 x 0.2 mm²	IP 56	18 [1]	2.5 m	1	**084N2017**
			Weld nipple:Free cutting steel						
			Thread nipple:Free cutting steel						

*) Recommended for measuring superheat
**) Recommended for hotgas systems

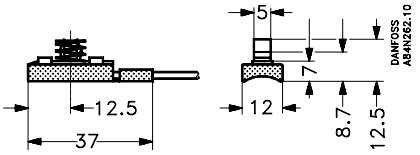
[1]) Agitated liquid.
[2]) Clamped to pipe.
[3]) Air 4 m/s.

AKS 11, AKS 12, AKS 21

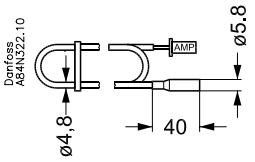
°C	ohm	°C	ohm
0	1000.0		1000.0
1	1003.9	–1	996.1
2	1007.8	–2	992.2
3	1011.7	–3	988.3
4	1015.6	–4	984.4
5	1019.5	–5	980.4
6	1023.4	–6	976.5
7	1027.3	–7	972.6
8	1031.2	–8	968.7
9	1035.1	–9	964.8
10	1039.0	–10	960.9
11	1042.9	–11	956.9
12	1046.8	–12	953.0
13	1050.7	–13	949.1
14	1054.6	–14	945.2
15	1058.5	–15	941.2
16	1062.4	–16	937.3
17	1066.3	–17	933.4
18	1070.2	–18	929.5
19	1074.0	–19	925.5
20	1077.9	–20	921.6
21	1081.8	–21	917.7
22	1085.7	–22	913.7
23	1089.6	–23	909.8
24	1093.5	–24	905.9
25	1097.3	–25	901.9
26	1101.2	–26	898.0
27	1105.1	–27	894.0
28	1109.0	–28	890.1
29	1112.8	–29	886.2
30	1167.7	–30	882.2
31	1120.6	–31	878.3
32	1124.5	–32	874.3
33	1128.3	–33	870.4
34	1132.2	–34	866.4
35	1136.1	–35	862.5
36	1139.9	–36	858.5
37	1143.8	–37	854.6
38	1147.7	–38	850.6
39	1151.5	–39	846.7
40	1155.4	–40	842.7
41	1159.3	–41	838.8
42	1163.1	–42	835.0
43	1167.0	–43	830.8
44	1170.8	–44	826.9
45	1174.7	–45	822.9
46	1178.5	–46	818.9
47	1182.4	–47	815.0
48	1186.3	–48	811.0
49	1190.1	–49	807.0
50	1194.0	–50	803.1

~ 3,9 ohm/K

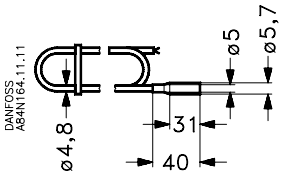
AKS 11



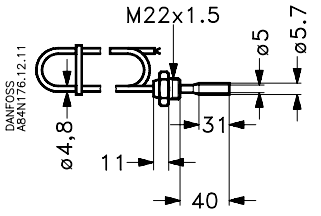
AKS 12



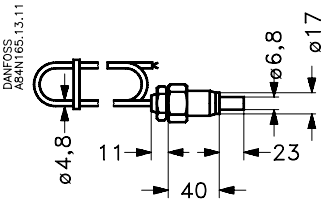
AKS 21A,
AKS 21M



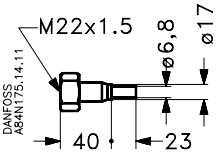
AKS 21W



AKS 21W
in welded version



Pocket in welded version
for AKS 21W



Sensors with AMP plug:
Plug is of the type: AMP ital mod 2, housing 280 358,
crimp contact 280 708-2.

PTC 1000 ohm/25°C

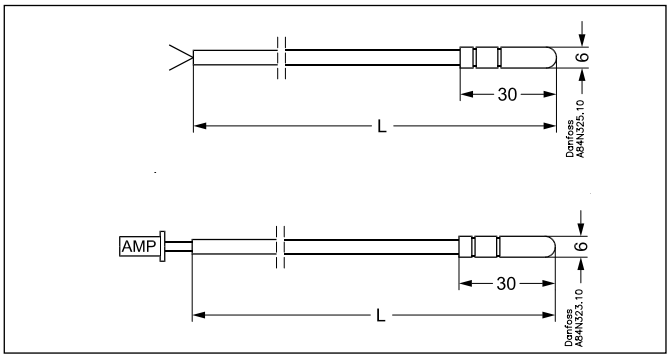
EKS 111

Application
This sensor is primarily used with controls of the type EKC 202, AK-CC 210 and EKC 301, but only if the tolerance can be accepted or eliminated.

Function
The sensor is based on a PTC element with a resistance of 1000 ohm at 25°C.

Technical data

Nominal resistance		1000 ohm at 25°C
Temperature range		-55 to 100°C
Cable material		PVC
Sensor tube		Stainless steel AISI 304
Time constant	Water	30 seconds
Enclosure		IP 67
AMP plug		AMP ital mod 2, housing 280 358 Crimp contact 280 708-2



R (Typ.) Ohm	Temp. °C	Error K	Temp. °F
1679	100	+/-3.5	212
1575	90		194
1475	80		176
1378	70		158
1286	60		140
1196	50		122
1111	40		104
1029	30		86
990	25	+/-1.3	77
951	20		68
877	10		50
807	0		32
740	-10		14
677	-20		-4
617	-30		-22
562	-40		-40
510	-50		-58
485	-55	+/-3.0	-67

The sensor has a relatively big tolerance on the resistance. This means that the sensor cannot be employed for measuring values used for food safety logs or regulation of superheat.

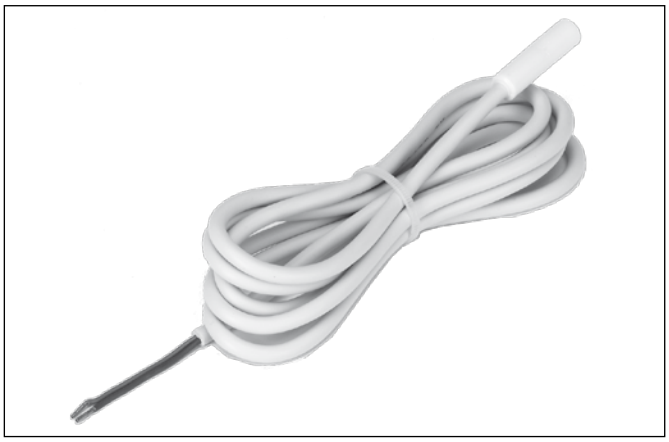
Ordering

Type	Sensor		Cable length (L)	Number	Code No.
EKS 111	PTC	1000 ohm/25°C	1.5 m	1	**084N1178**
				150	**084N1161**
			3.5 m	1	**084N1179**
				150	**084N1163**
			6 m	1	**084N1180**
				80	**084N1173**
			8.5 m	60	**084N1168**
			1.5 m with AMP-plug	1	**084N1181**
				150	**084N1174**
			3.5 m with AMP-plug	1	**084N1182**
				150	**084N1170**
			6 m with AMP-plug	1	**084N1177**
				80	**084N1171**

not for measuring superheat/
not for safety log

NTC 5000 ohm/25°C

EKS 211

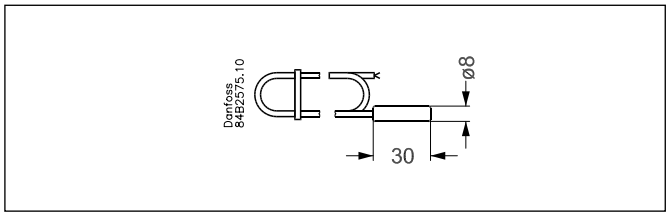


Application
This sensor is primarily used with controls of the type EKC 100 where the tolerance can be accepted.

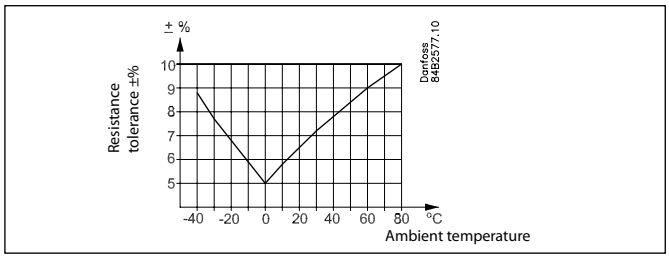
Function
NTC sensor for temperature measurements in the following areas:
- Refrigeration
- Air conditioning
- Heating

Technical data

Nominal resistance		5000 ohm at 25°C
Temperature range		-40 to 80°C
Cable material		PVC, 2 x 0.22 mm²
Sensor housing		PBT (Thermo-Plastic Polyester)
Time constant	Water	25 seconds
	Air	80 seconds
Enclosure		IP 67



Tolerance



R_nom Ohm	Temp. °C	Temp. °F
631.0	80	176
743.2	75	167
878.9	70	158
1044	65	149
1247	60	140
1495	55	131
1803	50	122
2186	45	113
2665	40	104
3266	35	95
4029	30	86
5000	25	77
6246	20	68
7855	15	59
9951	10	50
12696	5	41
16330	0	32
21166	-5	23
27681	-10	14
36503	-15	5
48614	-20	-4
65333	-25	-13
88766	-30	-22
121795	-35	-31
169157	-40	-40

The sensor has a relatively big tolerance on the resistance. This means that the sensor cannot be employed for measuring values used for food safety logs.

Ordering

Type	Sensor element		Connection	Cable	Number	Code No.
EKS 211	NTC	5000 ohm/25°C	-	1.5 m	300	**084B4403**
				3.5 m	150	**084B4404**

not for safety log

AKS 32, AKS 33 and AKS 32R

Introduction

AKS 32 and AKS 33 are pressure transmitters that measure a pressure and convert the measured value to a standard signal:

- 1 → 5 V d.c. for AKS 32
- 4 → 20 mA for AKS 33

AKS 32R is a ratiometric pressure transmitter that converts the measured pressure to a linear output signal. The min. value of the output signal is 10% of the actual supply voltage. The max. value is 90% of the actual supply voltage.

At a supply voltage of 5 V, a linear output signal is thus obtained, i.e.

- 0.5 V at min. pressure of the pressure transmitter
- 4.5 V at max. pressure of the pressure transmitter

Application:

- A/C systems
- Refrigeration plant
- Process control
- Laboratories

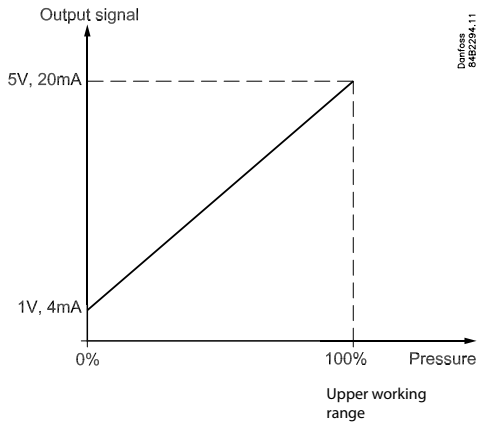
Advantages

Highly developed sensor technology means high pressure regulation accuracy, a very important factor in the precise and energy-economic capacity regulation of refrigeration plant.

- Temperature compensation for LP and HP pressure transmitters, developed specially for refrigeration plant:
  LP: −30 → +40°C (≤16 bar)
  HP: 0 → +80°C (>16 bar)
- Compatibility with all refrigerants incl. ammonia means less stock and greater application flexibility.
- Effective protection against moisture means that the sensor can be mounted in very harsh environments, e.g. in the suction line encapsulated in an ice block.
- Robust construction gives protection against mechanical influences such as shock, vibration and pressure surge. AKS sensors can be mounted direct on to the plant.
- No adjustment necessary. With the highly developed sensor technology and sealed gauge principle, the accuracy of the factory setting is maintained independent of variations in ambient temperature and atmospheric pressure. This is very important when ensuring evaporating pressure control in air conditioning and refrigeration applications.
- Built-in voltage stabiliser
- EMC protection according to EU EMC-directive (CE-marked)
- UL approved

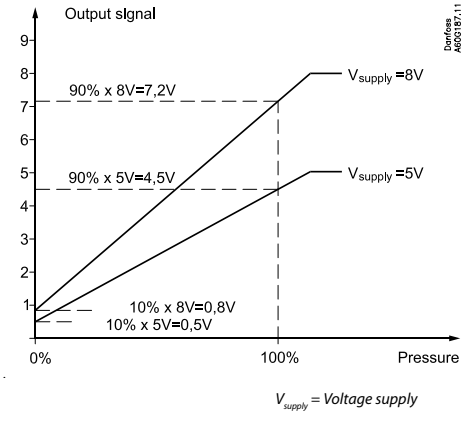
Output signal

AKS 32, AKS 33



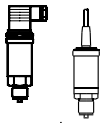
AKS 32R

The diagram indicates the relationship between output signal from AKS 32R, supply voltage and pressure.

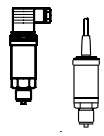


Ordering

AKS 32, version 1 → 5 V

	Operating range bar	Permissible working pressure PB bar	Compensated temperature range °C	Code No.					
				DIN 43650 plug			Cable		
				1/4 NPT 1)	G 3/8 A 2)	1/4 flare 3)	1/4 NPT 1)		1/4 flare 3)
	-1 to 6	33	-30 to +40	**060G2000**	**060G2004**	**060G2068**			
	-1 to 12	33	-30 to +40	**060G2001**	**060G2005**	**060G2069**	**060G2017**		**060G2073**
	-1 to 20	40	0 to +80	**060G2002**	**060G2006**	**060G2070**			
	-1 to 34	55	0 to +80	**060G2003**	**060G2007**	**060G2071**			

AKS 33, version 4 → 20 mA

	Operating range bar	Permissible working pressure PB bar	Compensated temperature range °C	Code No.					
				DIN 43650 plug			Cable		
				1/4 NPT 1)	G 3/8 A 2)	1/4 flare 3)	1/4 NPT 1)	G 3/8 A 2)	1/4 flare 3)
	-1 to 5	33	-30 to +40	**060G2112**	**060G2108**	**060G2047**			
	-1 to 6	33	-30 to +40	**060G2100**	**060G2104**	**060G2048**	**060G2116**	**060G2120**	
	-1 to 9	33	-30 to +40	**060G2113**	**060G2111**	**060G2044**			**060G2062**
	-1 to 12	33	-30 to +40	**060G2101**	**060G2105**	**060G2049**	**060G2117**		
	-1 to 20	40	0 to +80	**060G2102**	**060G2106**	**060G2050**	**060G2118**		
	-1 to 34	55	0 to +80	**060G2103**	**060G2107**	**060G2051**	**060G2119**		**060G2065**
	0 to 16	40	0 to +80	**060G2114**	**060G2109**				
	0 to 25	40	0 to +80	**060G2115**	**060G2110**	**060G2045**		**060G2127**	**060G2067**

AKS 32R

	Operating range bar	Permissible working pressure PB bar	Compensated temperature range °C	Code No.			
				1/4 NPT 1)	G 3/8 A 2)	1/4 flare 3)	3/8 solder
	-1 to 12	33	-30 to +40	**060G1037**	**060G1038**	**060G1036**	**060G3551**
	-1 to 34	55	0 to +80			**060G0090**	**060G3552**
	Connecting plug with 5 m cable (mounted on pressure transmitter obtains IP 67)			**060G1034**			

1) 1/4-18 NPT.
2) Thread ISO 228/1 - G 3/8 A (BSP).
3) 7/16-20 UNF.

CO_2 system

The following pressure transmitters can be used on CO_2 systems.
The type is an MBS 2050 and comes with a pulse-snubber.
The electrical connection is as an AKS 32R.

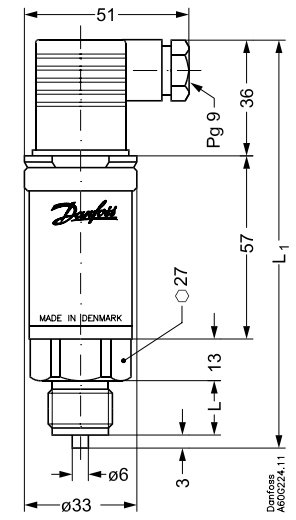
	Operating range bar	Permissible working pressure PB bar	Compensated temperature range °C	Code No.		
				G 1/4 DIN3852-E	G 3/8 EN 837 M5	G 1/4 DIN3852-G Special
	0 to 60	100	0 to +80	**060G3896**	**060G3840**	
	0 to 160	300				**060G1404**

Additional information!
Data sheet IC.PD.P20.L

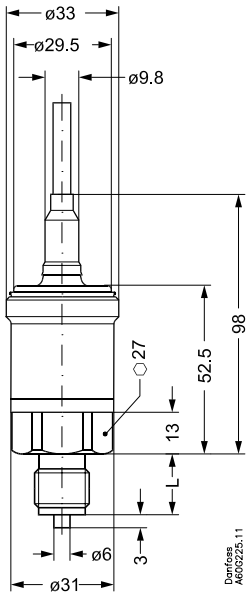
Dimensions and weights

AKS 32, AKS 33

Version with DIN 43650 plug



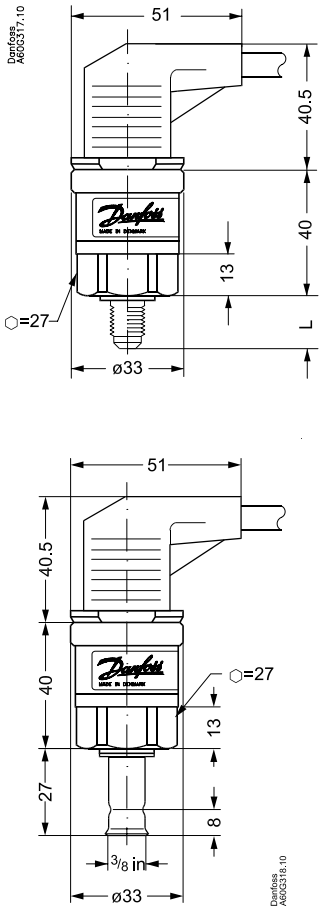
Cable version



Pressure connection	$\frac{1}{4}$-18 NPT	G $\frac{3}{8}$ A ISO 228/1	$\frac{1}{4}$ in. flare $\frac{7}{16}$-20 UNF
L_1 [mm]	122	127	122.5
L [mm]	16	18	16,5

Weight approx. 0.3 kg

AKS 32R



Additional information!

AKS 32 and AKS 33
Data sheet: RD5GH

AKS 32R
Data sheet: RD5G.J

Level transmitter

AKS 41

Introduction
AKS 41 is a liquid level transmitter used to measure the liquid level in refrigerant vessels.

Application
- Together with controller type EKC 347
- Supports the following refrigerants:
  - R 717
  - R 22
  - R 404A
  - R 134a

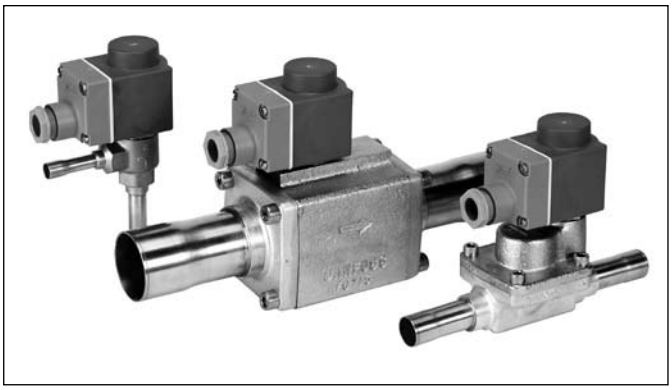
Additional information
Technical brochure: RD8AA

Expansion valves

Main data for the most standard products are briefly described below.
Further data can be found in the respective technical brochures.

Especially for valve dimensioning more information needs to be obtained.

AKV 10, AKV 15, AKV 20



Application
AKV are electrically operated expansion valves designed for refrigerating plant.
The AKV valves can be used for HCFC-, HFC and R744-refrigerants.
The AKV valves are normally controlled by a controller from Danfoss' range of ADAP- KOOL® controllers.

Advantages
- The valve requires no adjustment
- Wide regulation range
- Replaceable orifice assembly
- Both expansion valve and solenoid valve.

Function
The AKV valves are supplied as a component programme, as follows:
- Separate valve
- Separate coil with terminal box or cable
- Spare parts in the form upper part, orifice and filter

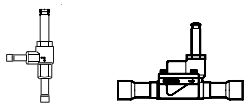
The individual capacities are indicated with a number forming part of the type designation. The number represents the size of the orifice of the valve in question. A valve with orifice 3 will for example be designated AKV 10-3.
The orifice assembly is replaceable.

Approvals
DEMKO, Denmark
SETI, Finland
SEV, Switzerland
UL listed (separate code. nos.)
CSA certified (separate code. nos.)

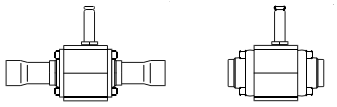
Technical data

Valve type	AKV 10	AKV 15	AKV 20
Tolerance of coil voltage	+10/–15%		
Enclosure acc. to IEC 529	Max. IP 67		
Working principle	PBM (Pulse-width modulation)		
Recommend period of time	6 seconds		
Capacity (R22)	1 to 16 kW	25 to 100 kW	100 to 630 kW
Regulation range (Capacity range)	10 - 100%		
Connection	Solder	Solder	Solder or weld
Evaporating temperature	– 60 to 60°C	– 50 to 60°C	– 40 to 60°C
Ambient temperature	– 50 to 50 °C	– 40 to 50 °C	– 40 to 50 °C
Leak of valve seat	< 0.02% of kv-value		
MOPD	18 bar	22 bar	18 bar
Filter, replaceable	Internal 100 µm	External 100 µm	External 100 µm
Max. working pressure	Ps = 42 bar	AKV 15-1,2,3: Ps = 42 bar. AKV 15-4: Ps = 28 bar	Ps = 28 bar

Rated capacity and Ordering



Valve type	Rated capacity in kW [1]				k_v-value	Connections			
						Solder ODF			
	R22	R 134a	R 404A R 507	R 407C	m^3/h	Inlet × outlet in.	**Code no.**	Inlet × outlet in.	**Code no.**
AKV 10-1	1.0	0.9	0.8	1.1	0.010	$^3/_8 \times ^1/_2$	**068F1161**	10 × 12	**068F1162**
AKV 10-2	1.6	1.4	1.3	1.7	0.017	$^3/_8 \times ^1/_2$	**068F1164**	10 × 12	**068F1165**
AKV 10-3	2.6	2.1	2.0	2.5	0.025	$^3/_8 \times ^1/_2$	**068F1167**	10 × 12	**068F1168**
AKV 10-4	4.1	3.4	3.1	4.0	0.046	$^3/_8 \times ^1/_2$	**068F1170**	10 × 12	**068F1171**
AKV 10-5	6.4	5.3	4.9	6.4	0.064	$^3/_8 \times ^1/_2$	**068F1173**	10 × 12	**068F1174**
AKV 10-6	10.2	8.5	7.8	10.1	0.114	$^3/_8 \times ^1/_2$	**068F1176**	10 × 12	**068F1177**
AKV 10-7	16.3	13.5	12.5	17.0	0.209	$^1/_2 \times ^5/_8$	**068F1179**	12 × 16	**068F1180**
AKV 15-1	25.5	21.2	19.6	25.2	0.25	$^3/_4 \times ^3/_4$	**068F5000**	18 × 18	**068F5001**
AKV 15-2	40.8	33.8	31.4	40.4	0.40	$^3/_4 \times ^3/_4$	**068F5005**	18 × 18	**068F5006**
AKV 15-3	64.3	53.3	49.4	63.7	0.63	$^7/_8 \times ^7/_8$	**068F5010**	22 × 22	**068F5010**
AKV 15-4	102	84.6	78.3	101	1.0	$1^1/_8 \times 1^1/_8$	**068F5015**	28 × 28	**068F5016**



Valve type	Rated capacity in kW [1]				k_v-value	Connections					
						Solder ODF				Weld	
	R22	R 134a	R 404A R 507	R 407C	m^3/h	Inlet × outlet in.	**Code no.**	Inlet × outlet mm	**Code no.**	Inlet × outlet in.	**Code no.**
AKV 20-1	102	84.6	78.3	101	1.0	$1^3/_8 \times 1^3/_8$	**042H2020**	35 × 35	**042H2020**	$1^1/_4 \times 1^1/_4$	**042H2021**
AKV 20-2	163	135	125	170	1.6	$1^3/_8 \times 1^3/_8$	**042H2022**	35 × 35	**042H2022**	$1^1/_4 \times 1^1/_4$	**042H2023**
AKV 20-3	255	212	196	252	2.5	$1^5/_8 \times 1^5/_8$	**042H2024**	42 × 42	**042H2025**	$1^1/_4 \times 1^1/_4$	**042H2026**
AKV 20-4	408	338	314	404	4.0	$2^1/_8 \times 2^1/_8$	**042H2027**	54 × 54	**042H2027**	$1^1/_2 \times 1^1/_2$	**042H2028**
AKV 20-5	643	533	494	637	6.3	$2^1/_8 \times 2^1/_8$	**042H2029**	54 × 54	**042H2029**	2 × 2	**042H2030**

[1] Rated capacities are based on
Condensing temperature t_c = 32°C
Liquid temperature t_l = 28°C
Evaporating temperature t_e = 5°C

Dimensioning

To obtain an expansion valve that will function correctly under different load conditions it is necessary to consider the following points when the valve has to be dimensioned:
These points must be dealt with in the following sequence:

1) Evaporator capacity
2) Pressure drop across the valve
3) Correction for subcooling
4) Correction for evaporating temperature
5) Determination of valve size
6) Correctly dimensioned liquid line

Additional information!
Technical brochure DKRCC.PD.VA1.A

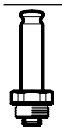
Spare parts

AKV 10

Orifice

Orifice no.	**Code no.**	Contents
1	**068F0506**	1 pc. orifice 1 pc. Al. gasket 1 pc. cap for coil
2	**068F0507**	
3	**068F0508**	
4	**068F0509**	
5	**068F0510**	
6	**068F0511**	
7	**068F0512**	

Filter: **Code no. 068F0540**
Contents: 10 pcs. filters
10 pcs. Al. gaskets



Upper part: **Code no. 068F0541**
Contents: 1pc. armature ass.
1pc. armature tube
1pc. Al. gasket

Gasket for upper part: **Code no. 068F0549**
Contents: 25 pcs. Cu/Tn gaskets

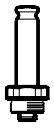
AKV 15

Piston

Type	**Code no.**	Contents
AKV 15-1	**068F5265**	1 pc. piston assembly 1 pc. gasket 1 pc. O-ring 2 pcs. labels
AKV 15-2	**068F5266**	
AKV 15-3	**068F5267**	
AKV 15-4	**068F5268**	

Gasket set: **Code no. 068F5263**
Contents: 30 pcs. O-rings
10 pcs.Cu-gaskets
10 pcs. gaskets

Filter: **Code no. 068F0540**
Contents: 10 pcs. filters
10 pcs. Al. gaskets



Upper part: **Code no. 068F5045**
Contents: 1pc. armature ass.
1pc. armature tube
1pc. Al. gasket

Gasket for upper part: **Code no. 068F0549**
Contents: 25 pcs. Cu/Tn gaskets

AKV 20

Piston

Type	**Code no.**	Contents
AKV 20-0.6	**042H2039**	1 pc.piston assembly 3 pcs.O-rings
AKV 20-1	**042H2040**	
AKV 20-2	**042H2041**	
AKV 20-3	**042H2042**	
AKV 20-4	**042H2043**	
AKV 20-5	**042H2044**	

Orifice set

Type	**Code no.**	Contents
AKV 20-0.6	**068F5270**	Main orifice, dia. 8 mm Pilot orifice, dia. 1.8 mm 2 pcs. Al. gaskets O-ring
AKV 20-1	**068F5270**	
AKV 20-2	**068F5270**	
AKV 20-3	**068F5270**	
AKV 20-4	**068F5271**	Main orifice, dia. 14 mm Pilot orifice, dia. 2.4 mm 2 pcs. Al. gaskets O-ring
AKV 20-5	**068F5271**	

Gasket set: **Code no. 042H0160**
Contents: Complete gasket set for new and old valves

Upper part: **Code no. 068F5045**
Contents: 1pc. armature ass.
1pc. armature tube
1pc. Al. gasket

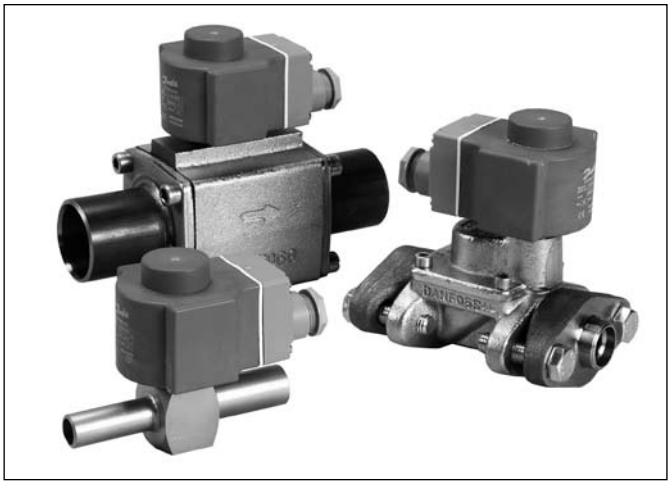
Gasket for upper part: **Code no. 068F0549**
Contents: 25 pcs. Cu/Tn gaskets

AKVA 10 AKVA 15, AKVA 20

AKVA are electrically operated expansion valves designed for ammonia refrigerating plant. The AKVA valves are normally controlled by a controller from Danfoss' range of ADAP-KOOL® controllers.

The AKVA valves are supplied as a component programme, as follows:
- Separate valve
- Separate coil with terminal box or cable
- Spare parts in the form upper part, orifice and filter

The individual capacities are indicated with a number forming part of the type designation. The number represents the size of the orifice of the valve in question.
A valve with orifice 3 will for example be designated AKVA 10-3.
The orifice assembly is replaceable.



Features
- For ammonia (R 717), R744, HCFC, HFC
- The valve requires no adjustment
- Wide regulation range
- Replaceable orifice assembly
- In some applications AKVA can be used both as expansion valve and solenoid valve
- Wide range of coils for d.c. and a.c.

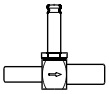
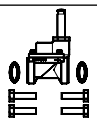
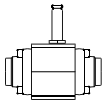
Approvals
DEMKO, Denmark
SETI, Finland
SEV, Switzerland
UL listed to U.S. and Canadian standards (separate code. nos.)

AKVA 20 is CE certified according to pressure directive 97/23.

Technical data

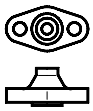
Valve type	AKVA 10	AKVA 15	AKVA 20
Tolerance of coil voltage	+10/–15%		
Enclosure to IEC 529	Max. IP 67		
Working principle	PBM Pulse-width modulation)		
Recommend period of time	6 seconds		
Capacity (R717)	4 to 100 kW	125 to 500 kW	500 to 3150 kW
Regulation range (Capacity range)	10 - 100%		
Connection	Weld		
Media temperature	– 50 to 60°C	– 40 to 60°C	– 40 to 60°C
Ambient temperature	– 50 to 50 °C	– 40 to 50 °C	– 40 to 50 °C
Leak of valve seat	< 0.02% of kv-value		
MOPD	18 bar	22 bar	18 bar
Filter, replaceable	Internal 100 µm, replaceable	External 100 µm	External 100 µm
Permissible operation pressure	Ps = 42 bar g	Ps = 42 bar g	Ps = 42 bar g

Rated capacity and Ordering

Symbol	Valve type	Nominal capacity [1]		Kv-value	Connection inlet x outlet in.	Code No.	Connection inlet x outlet in.	Code No.
		kW	tons	m³/h				
	AKVA 10-1	4	1.1	0.010	3/8 × 1/2	**068F3261**	1/2 × 3/4	**068F3281**
	AKVA 10-2	6.3	1.8	0.015	3/8 × 1/2	**068F3262**	1/2 × 3/4	**068F3282**
	AKVA 10-3	10	2.8	0.022	3/8 × 1/2	**068F3263**	1/2 × 3/4	**068F3283**
	AKVA 10-4	16	4.5	0.038	3/8 × 1/2	**068F3264**	1/2 × 3/4	**068F3284**
	AKVA 10-5	25	7.1	0.055	3/8 × 1/2	**068F3265**	1/2 × 3/4	**068F3285**
	AKVA 10-6	40	11.4	0.103	3/8 × 1/2	**068F3266**	1/2 × 3/4	**068F3286**
	AKVA 10-7	63	17.9	0.162			1/2 × 3/4	**068F3267**
	AKVA 10-8	100	28.4	0.251			1/2 × 3/4	**068F3268**
	AKVA 15-1	125	35	0.25	Flange	**068F5020**[2]		
	AKVA 15-2	200	60	0.40	Flange	**068F5023**[2]		
	AKVA 15-3	300	90	0.63	Flange	**068F5026**[2]		
	AKVA15-4	500	140	1.0	Flange	**068F5029**[2]		
	AKVA 20-1	500	140	1.0	1 1/4 × 1 1/4	**042H2101**		
	AKVA 20-2	800	240	1.6	1 1/4 × 1 1/4	**042H2102**		
	AKVA 20-3	1250	350	2.5	1 1/4 × 1 1/4	**042H2103**		
	AKVA 20-4	2000	600	4.0	1 1/2 × 1 1/2	**042H2104**		
	AKVA 20-5	3150	900	6.3	2 x 2	**042H2105**		

[1] Rated capacities are based on
Condensing temperature t_c = 32°C
Liquid temperature t_l = 28°C
Evaporating temperature t_e = 5°C
[2] Incl. bolts and gaskets but without flanges

Flange set for AKVA 15

Symbol	Valve type	Connection in.	**Code No.**
	AKVA 15-1 to 4	3/4	**027N1220**
		1	**027N1225**

Filter

For installations with ammonia and similar industrial installations, a filter must be mounted before AKVA 15 and AKVA 20
AKVA 10 has a built-in filter and an external filter is not necessary.

Recommended filters for AKVA 20

Filter type	**Code No.**	
	House	**Filter insert100 µm**
FIA 20 D STR	**148H3086**	**148H3122**
FIA 25 D STR	**148H3087**	**148H3123**
FIA 32 D STR	**148H3088**	
FIA 40 D STR	**148H3089**	
FIA 50 D STR	**148H3090**	**148H3157**

Additional information: See catalogue RD6CD

Dimensionsing

To obtain an expansion valve that will function correctly under different load conditions it is necessary to consider the following points when the valve has to be dimensioned:
These points must be dealt with in the following sequence:

1) Evaporator capacity
2) Pressure drop across the valve
3) Correction for subcooling
4) Correction for evaporating temperature
5) Determination of valve size
6) Correctly dimensioned liquid line

Additional information!
Technical brochure DKRCC.PD.VA1.B

Spare parts

AKVA 10

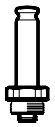
Orifice

Type	Code No.	Contents
AKVA 10-1	**068F0526**	1 pc. orifice 1 pc. Al. gasket 1 pc. cap for coil
AKVA 10-2	**068F0527**	
AKVA 10-3	**068F0528**	
AKVA 10-4	**068F0529**	
AKVA 10-5	**068F0530**	
AKVA 10-6	**068F0531**	
AKVA 10-7	**068F0532**	
AKVA 10-8	**068F0533**	

Filter

Code No.	Contents
068F0540	10 pc. filters 10 pc. Al. gaskets

Upper part



Code No.	Contents
068F5045	1 pc. armature 1 pc. armature tube 1 pc. Al. gasket

Gasket for upper part

	Code No.	Contents
	068F0548	25 pc. Al. gaskets

AKVA 15

Piston

Type	Code No.	Contents
AKVA 15-1	**068F5265**	1 pc. piston assembly 1 pc. gasket 1 pc. O-ring 2 pcs. labels
AKVA 15-2	**068F5266**	
AKVA 15-3	**068F5267**	
AKVA 15-4	**068F5268**	

Gasket set	**068F5264**	Complete gasket set

Orifice set

Code No.	Contents
068F5261	Main orifice Pilot orifice Al. gaskets O-rings Gaskets

Upper part

Code No.	Contents
068F5045	1 pc. armature 1 pc. armature tube 1 pc. Al. gasket

Gasket for upper part

	Code No.	Contents
	068F0548	25 pc. Al. gaskets

Filter

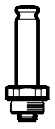
Code No.	Contents
068F0540	10 pc. filters 10 pc. Al. gaskets

AKVA 20

Piston

Type	Code No.	Contents
AKVA 20-0.6	**042H2039**	1 pc. piston assembly 3 pcs. O-rings
AKVA 20-1	**042H2040**	
AKVA 20-2	**042H2041**	
AKVA 20-3	**042H2042**	
AKVA 20-4	**042H2043**	
AKVA 20-5	**042H2044**	

Upper part



Code No.	Contents
068F5045	1 pc. armature 1 pc. armature tube 1 pc. Al. gasket

Gasket for upper part

	Code No.	Contents
	068F0548	25 pc. Al. gaskets

Orifice set

Type	Code No.	Contents
AKVA 20-0.6	**068F5270**	Main orifice, dia. 8 mm Pilot orifice, dia. 1.8 mm 2 pcs. Al. gaskets O-ring
AKVA 20-1		
AKVA 20-2		
AKVA 20-3		
AKVA 20-4	**068F5271**	Main orifice, dia. 14 mm Pilot orifice, dia. 2.4 mm 2 pcs. Al. gaskets O-ring
AKVA 20-5		

Gasket set	**042H0160**	Complete gasket set for new and old valve versions

Coils for expansion valves

The coils are used together with expansion valves types AKV and AKVA.

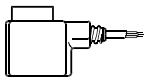
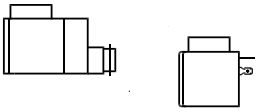
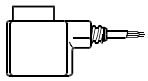
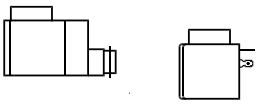
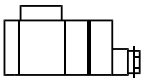
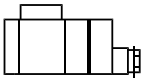
Data

3-core cable
The external thread in the screwed cable entry suits flexible steel hose or corresponding cable protection.

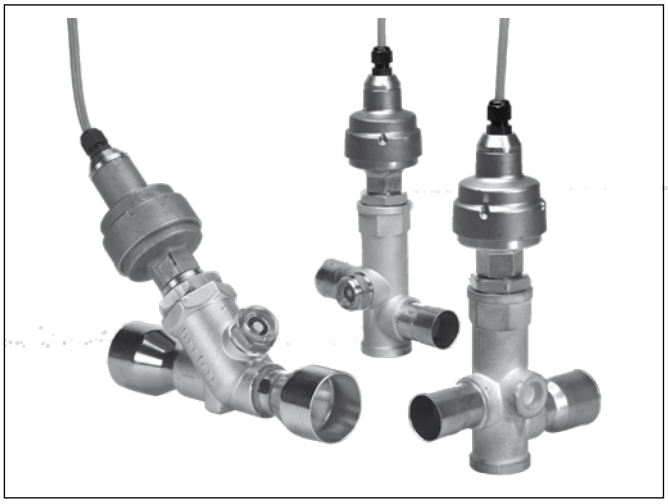
Terminal box
Leads are connected to terminal screws in the terminal box. The box is fitted with a Pg 13.5 screwed entry for 6 → 14 mm cable. Max. lead cross section: 2.5 mm^2.

Enclosure
IP 67

Coils for AKV and AKVA valves

Voltage	Type	Cable/terminal box/DIN plug	Power consumption	Code No.
230 V d.c.		With 2.5 m cable	18 W	**018F6288**
		With 4 m cable		**018F6278**
		With 8 m cable		**018F6279**
		With terminal box	18 W	**018F6781**
		Without terminal box		**018F6991**
230 V a.c.		With 1 m cable	10 W, 50 Hz (AKV 10, 1-6) (AKV 15)	**018F6251**
		With terminal box		**018F6701**
		Without terminal box		**018F7351**
		With terminal box	12 W, 50 Hz (AKV 10, 1-7) (AKV 15) (AKV 20)	**018F6801**
24 V a.c.		With terminal box	12 W, 50 Hz	**018F6807**
			12 W, 60 Hz	**018F6815**
			20 W, 50 Hz	**018F6901**
			20 W, 60 Hz	**018F6902**

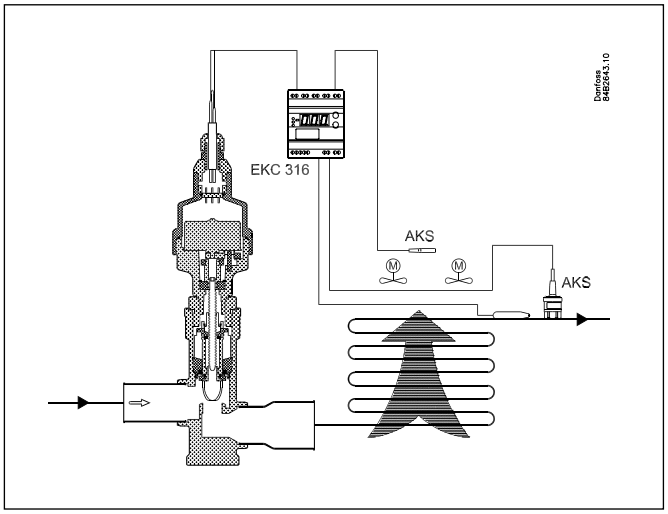
ETS



Application
ETS is a series of electrically operated expansion valves for precise liquid injection in evaporators for air conditioning and refrigeration applications.

Function
The valve piston and linear positioning design is fully balanced, providing bi-flow feature as well as solenoid tight shut-off function in both flow directions.

Advantages
- Precise positioning for optimal control of liquid injection.
- ETS 50 and 100 are designed for HFC/HCFC conditions including R410A, providing 45.5 bar (660 psig) working pressure.
- ETS 50 and 100 have bi-metal connections providing "waterless brazing", improved process and productivity.
- A built-in sight glass is an option for ETS 50 and 100.
- ETS 250 and 400 are designed for HFC/HCFC conditions, providing 34 bar (493 psig) working pressure.
- ETS 250 and 400 are both designed with built-in sight glass.
- Balanced design providing bi-flow operation as well as solenoid tight shut-off function in both flow directions at MOPD 33 bar (478.6 psig).
- Cable connectors on request.
- For manual operation and service of ETS valves an AST-g service driver is available.
  For further information, see lit. RI4JY.



Technical data

Parameter	ETS 50B/ETS 100B	ETS 250/ETS 400
Compatibility	HFC, HCFC	HFC, HCFC
CE marking	Yes	Yes
MOPD	33 bar (478 psi)	33 bar (478 psi)
Max. working pressure (PS/MWP)	45.5 bar (660 psi)	34 bar (493 psi)
Refrigerant temperature range	–40°C to 10°C (–40°F to 50°F)	–40°C to 10°C (–40°F to 50°F)
Ambient temperature	–40°C to 60°C (–40°F to 140°F)	–40°C to 60°C (–40°F to 140°F)
Total stroke	13 mm/16 mm (0.5 in./0.6 in.)	17.2 mm (0.68 in.)
Motor enclosure	IP 67	IP 67

Electrical data

Parameter	ETS 50-400
Stepper motor type	Bi-polar - permanent magnet
Step mode	2 phase full step
Phase resistance	52Ω ±10%
Phase inductance	85 mH
Holding current	Depends on application. Full current allowed (100% duty cycle)
Step angle	7.5° (motor), 0.9° (lead screw), Gearing ration 8.5:1. $(38/13)^2$:1
Nominal voltage	(Constant voltage drive) 12 V d.c. -4% +15%, 150 steps/sec.
Phase current	(Using chopper drive) 100 mA RMS -4% +15%,
Max. total power	Voltage/current drive: 5.5/1.3 W (UL: NEC class 2)
Step rate	150 steps/sec. (constant voltage drive) 0-300 steps/sec. 300 recommended (chopper current drive)
Total steps	ETS 50: 2625 [+160/-0] steps ETS 100: 3530 [+160/-0] steps ETS 250 and 400: 3810 [+160/-0] steps
Full travel time	ETS 50: 17/8.5 sec. (voltage/current) ETS 100: 23/11.5 sec. (voltage/current) ETS 250 and 400: 25.4/12.7 sec. (voltage/current)
Lifting height	ETS 50: 13 mm (0.5 in.) ETS 100: 16 mm (0.6 in.) ETS 250-400: 17.2 mm (0.7 in.)
Reference position	Overdriving against the full close position
Electrical connection	4 wire 0.5 mm^2 (0.02 in^2), 2 m (6.5 ft) long cable

Stepper motor switch sequence:

	STEP	Coil I		Coil II		
		Red	Green	White	Black	
↑ CLOSING ↑	1	+	-	+	-	↓ OPENING ↓
	2	+	-	-	+	
	3	-	+	-	+	
	4	-	+	+	-	
	1	+	-	+	-	

Capacity

Type	Rated capacity[1]									
	R410A		R407C		R22		R134a		R404A	
	kW	TR	kW	TR	kW	TR	kW	TR	kW	TR
ETS 50B [2]	262.3	75.7	240.5	69.1	215	62	170	48.9	161.4	46.3
ETS 100B	488.4	140.9	447.8	128.7	400.4	115.4	316.5	91.2	300.5	86.6
ETS 250	-	-	1212	349	1106	319	874	252	828	239
ETS 400	-	-	1933	556	1764	509	1394	402	1320	381

[1] The Rated capacity is based on:
Evaporating temperature t_e: 5°C (40°F)
Liquid temperature t_l: 28°C (82°F)
Condensing temperature t_c: 32°C (90°F)
Full stroke opening.

[2] ETS 25B is available upon request.
Please contact Danfoss.

Ordering

Valve incl. actuator – industrial pack

Type	Connection [in]			Connection [mm]		
	ODF × ODF	Industrial pack	**Code No. Industrial pack**	ODF × ODF	Industrial pack	**Code No. Industrial pack**
ETS 50B	$^7/_8 \times ^7/_8$	9 pc.	**034G1000**	22 × 22	9 pc.	**034G1050**
	$^7/_8 \times 1^1/_8$	9 pc.	**034G1001**	22 × 28	9 pc.	**034G1051**
	$^7/_8 \times 1^3/_8$	9 pc.	**034G1002**	22 × 35	9 pc.	**034G1052**
	$1^1/_8 \times 1^1/_8$	9 pc.	**034G1003**	28 × 28	9 pc.	**034G1053**
	$1^1/_8 \times 1^3/_8$	9 pc.	**034G1004**	28 × 35	9 pc.	**034G1054**
ETS 100B	$1^1/_8 \times 1^1/_8$	9 pc.	**034G0000**	28 × 28	9 pc.	**034G0050**
	$1^1/_8 \times 1^3/_8$	9 pc.	**034G0001**	28 × 35	9 pc.	**034G0051**
	$1^1/_8 \times 1^5/_8$	9 pc.	**034G0002**	28 × 42	9 pc.	**034G0052**
	$1^3/_8 \times 1^3/_8$	9 pc.	**034G0003**	35 × 35	9 pc.	**034G0053**
	$1^3/_8 \times 1^5/_8$	9 pc.	**034G0004**	35 × 42	9 pc.	**034G0054**
	$1^5/_8 \times 1^5/_8$	9 pc.	**034G0005**	42 × 42	9 pc.	**034G0055**

Valve incl. actuator and sight glass – single pack

Type	Connection		
	ODF × ODF [in.]	ODF × ODF [mm]	**Code No. Single pack**
ETS 50B [2]	$^7/_8 \times ^7/_8$	22 × 22	**034G1008**
	$^7/_8 \times 1^1/_8$	22 × 28	**034G1005**
	$1^1/_8 \times 1^1/_8$	28 × 28	**034G1006**
ETS 100B	$1^1/_8 \times 1^1/_8$	28 × 28	**034G0007**
	$1^3/_8 \times 1^3/_8$	35 × 35	**034G0008**
ETS 250	$1^1/_8 \times 1^1/_8$	28 × 28	**034G2000**
	$1^3/_8 \times 1^3/_8$	35 × 35	**034G2001**
	$1^5/_8 \times 1^5/_8$		**034G2002**
ETS 400	$1^5/_8 \times 1^5/_8$		**034G3000**
	$2^1/_8 \times 2^1/_8$	54 × 54	**034G3001**

Additional information!
Technical brochure: DKRCC.PD.VD1.A

ICM
Motor valve

Application
ICM valves are intended for regulation of expansive processes in liquid lines with or without phaseshift, or for control of the pressure or the temperature in dry

Function
ICM motor valves belong to the ICV (Industrial Control Valve) family. The motor valve comprises three main components: valve body, combined top cover/function module and actuator.

ICM are direct operated motorised valves driven by actuator type ICAD (Industrial Control Actuator with Display).

ICM valves are designed so that the opening and closing forces are balanced, therefore, only two sizes of ICAD actuators are needed for the complete range of ICM from DN 20 to DN 65. The ICM motorised valve and ICAD actuator assembly offers a very compact unit with small dimensions.

The ICM motorised valve and ICAD actuator combinations are as follows:

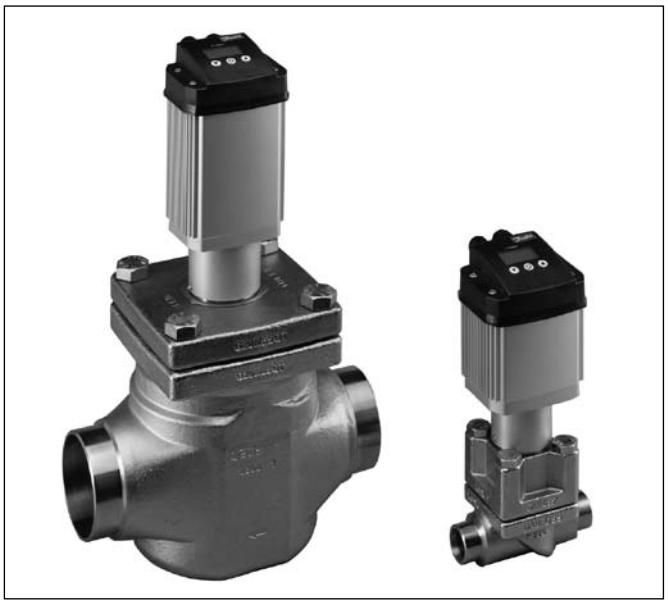
Actuator	ICAD 600	ICAD 900
Valve size	ICM 20	ICM 40
	ICM 25	ICM 50
	ICM 32	ICM 65

ICAD 600/ICAD 900
ICAD actuators can be controlled using the following signals:
- 0-20 mA
- 4-20 mA (default)
- 0-10 V
- 2-10 V

ICAD actuators can also operate an ICM valve as an On/Off function supported by a digital input.

The ICM valve can be operated manually via the ICAD actuator or the Multi-function tool for ICM (see the ordering section).

Fail Safe supply options
In the event of a power failure, multiple fail safe options are possible, provided that a ICAD-UPS or similar is used. During power failure, ICM can be selected to:
- Close ICM
- Open ICM
- Stay in the same position, as when power failure occurs
- Go to a specific ICM valve opening degree



Advantages
- Designed for Industrial Refrigeration applications for a maximum working pressure of 52 bar/754 psig.
- Applicable to all common refrigerants including R717 and R744 (CO_2) and non corrosive gases/liquids.
- Direct coupled connections.
- Connection types include butt weld, socket weld, solder and threaded connections.
- Low temperature steel body.
- Low weight and compact design.
- V-port regulating cone ensures optimum regulating accuracy particularly at part load.
- Cavitation resistant valve seat.
- Modular Concept
  - Each valve body is available with several different connection types and sizes.
  - Valve overhaul is performed by replacing the function module.
  - Possible to convert ICM motor valve to ICS servo valve.
- Manual opening possible via ICAD or Multi-function tool.
- PTFE seat provides excellent valve tightness.
- Magnet coupling - real hermetic sealing.

Design

Connections
There is a very wide range of connection types available with ICM valves:
D: Butt weld, DIN (2448)
A: Butt weld, ANSI (B 36.10)
J: Butt weld, JIS (B S 602)
SOC: Socket weld, ANSI (B 16.11)
SD: Solder connection, DIN (2856)
SA: Solder connection, ANSI (B 16.22)
FPT: Female pipe thread (ANSI/ASME B 1.20.1)

Approvals
The ICV valve concept is designed to fulfil global refrigeration requirements.
For specific approval information, please contact Danfoss.

The ICM valves are approved in accordance with the European standard specified in the Pressure Equipment Directive and are CE marked.
For further details/restrictions - see Installation Instruction.

Valve body and top cover material
Low temperature steel

ICM valves		
Nominal bore	DN ≤ 25 (1 in.)	DN 32-65 mm ($1^1/_4$ - $2^1/_2$ in.)
Classified for	Fluid group I	
Category	Article 3, paragraph. 3	II

Technical data

Refrigerants
Applicable to all common refrigerants including R717 and R744 (CO_2) and non- corrosive gases/liquids.
Use with flammable hydrocarbons cannot be recommended.

Temperature range:
Media: –60/+120°C (–76/+248°F).

Pressure
The valve is designed for:
Max. working pressure: 52 bar g (754 psig)

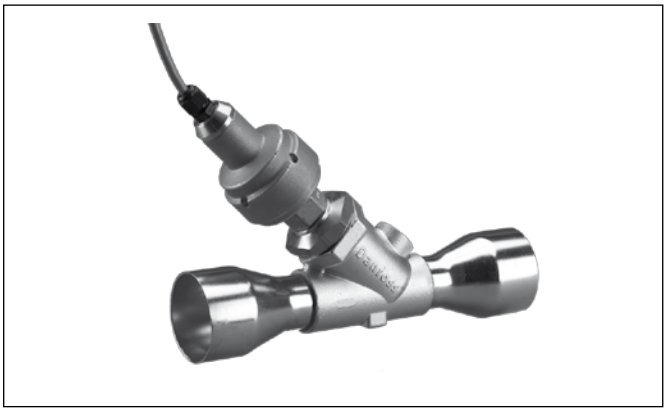
Surface protection
ICM 20-65:
The external surface is zinc-chromated to provide good corrosion protection.

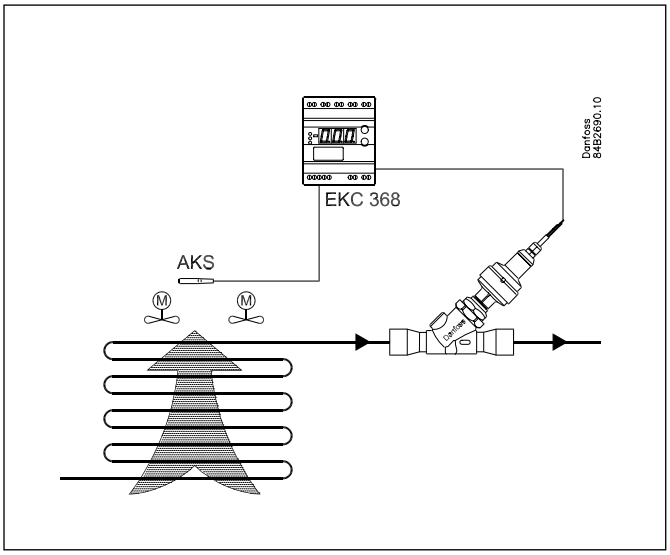
Max. openening pressure differential (MOPD)
– ICM 20-32: 52 bar (750 psi)
– ICM 40: 40 bar (580 psi)
– ICM 50: 30 bar (435 psi)
– ICM 65: 20 bar (290 psi)

Additional information!
Technical brochure: DKRCI.PD.HT0.A

Evaporation pressure valve

KVS





Application
KVS is a series of electrically operated suction modulating control valves for AC transport and refrigeration applications.

Function
Accurate temperature or pressure control is obtained by modulating the refrigerant flow in the evaporator with a current or voltage driver.

With an EKC 368 controller (current driver) and an AKS sensor placed in the media to be controlled, an accuracy better than ± 0.5 K can be obtained.

The balanced design provides bi-flow operation as well as solenoid shut-off function in both flow directions at MOPD 33 bar (478 psi).

Advantages
- Balanced port design.
- High resolution for precise control.
- Solenoid tight shut-off.
- Low power consumption.
- Corrosion resistant design external as well as internal.

Technical data

Parameter	KVS 42-54
Compatibility	HFC, HCFC
CE marking	Yes
MOPD	33 bar (478 psi)
Max. working pressure	34 bar (493 psig)
Refrigerant temperature range	–40 to +10°C (–40 to +50°F)
Ambient temperature	–40 to +60°C (–40 to +140°F)
Total stroke	17.2 mm (0.68 in.)
Motor enclosure	IP 67

Electrical data

Parameter	KVS 42-54
Stepper motor type	Bi-polar - permanent magnet
Step mode	2 phase full step
Phase resistance	52Ω ±10%
Phase inductance	85 mH
Holding current	Depends on application. Full current allowed (100% duty cycle)
Step angle	7.5° (motor), 0.9° (lead screw), Gearing ration 8.5:1. $(38/13)^2$:1
Nominal voltage	(Constant voltage drive) 12 V d.c. -4% +15%, 150 steps/sec.
Phase current	(Using chopper drive) 100 mA RMS -4% +15%,
Max. total power	Voltage/current drive: 5.5/1.3 W (UL: NEC class 2)
Step rate	150 steps/sec. (constant voltage drive) 0-300 steps/sec. 300 recommended (chopper current drive)
Total steps	3810 [+160/-0] steps
Full travel time	25.4/12.7 sec. (voltage/current)
Lifting height	17.2 mm (0.68 in.)
Reference position	Overdriving against the full close position
Electrical connection	4 wire 0.5 mm^2 (0.02 in^2), 2 m (6.5 ft) long cable

Stepper motor switch sequence:

	STEP	Coil I		Coil II	
		Red	Green	White	Black
↓ Opening ↓	1	+	-	+	-
	2	+	-	-	+
↑ Closing ↑	3	-	+	-	+
	4	-	+	+	-
	1	+	-	+	-

Ordering

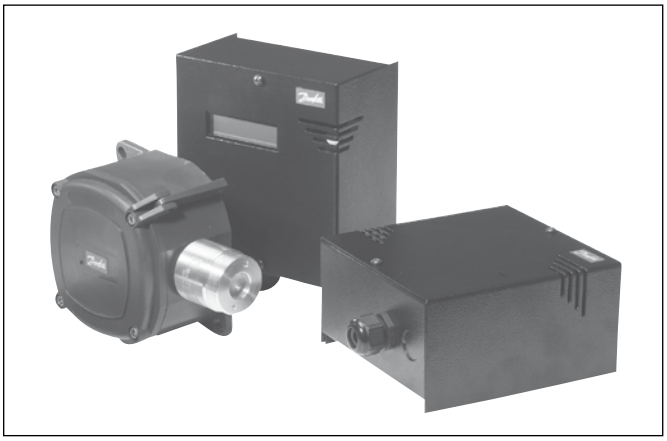
Type	Rated capacity[1]						Valve KVS + actuator AST		
	R22		R134a		R404A/R507		Connection		Code No. single pack
	kW	TR	kW	TR	kW	TR	mm	in.	
KVS 42	40.4	11.4	29.3	8.3	35.3	10.0	22	7/8	**034G2058**
							28	1 1/8	**034G2050**
							35	1 3/8	**034G2051**
								1 5/8	**034G2052**
KVS 54	55.5	15.7	40.3	11.4	48.5	13.7		1 5/8	**034G3050**
							54	2 1/8	**034G3051**

[1]) Rated capacity is the valve capacity at evaporating temperature t_e = −10°C (14°F), condensing temperature t_c = +25°C (77°F) and pressure drop across valve Δp = 0.2 bar (2.9 psig).

Additional information!
Technical brochure KVS: DKRCC.PD.VC1.A

Gas detector

GD



Application
GD detects a wide range of commonly used refrigerants including Ammonia, Carbon Dioxide, Halo-Carbons and Hydro-Carbons.

Advantages
- Alarm levels can be set locally.
- GD can be connected directly to a Danfoss m2 monitoring unit. No additional add on is required.

Technical data

Refrigerants:	Ammonia (R 717)	Type GDA	0-100 ppm
			0-1000 ppm
			0-10000 ppm
			0-30000 ppm
	Carbon Dioxide (R 744)	Type GDC	0-10000 ppm
	Halo-Carbon, HCFC (R 22, R 123)	Type GDHC	0-1000 ppm
	HFC (R404A, R410A, R134A, R407C, R507)	Type GDHF	0-1000 ppm
	Hydro-carbon Propane (R 290, R 600, R 600A, R 1270)	Type GDH	0-5000 ppm
Temperature range	Standard, LCD display, IP 65 and EExd	–20°C/+50°C (–4°F/122°F)	
	Low temperature model	–40°C/+50°C (–40°F/122°F)	
Enclosure	Standard	IP 30 (NEMA 1)	
	LCD display	IP 30 (NEMA 1)	
	IP 65	IP 65 (NEMA 4)	
	EExd	IP 65 (NEMA 4)	
	Low temp.	IP 40 (NEMA 2)	
Cable connection	1 gland for 6-13 mm cable (0.2"-0.5")		
	1 Ø 20 mm (0.8") hole with blanking plug		
	1 extra gland can be fitted (only Standard, LCD display, IP 65 and EExd).		
Weight	Standard	1015 grams (1.24 lb)	
	LCD display	1045 grams (2.30 lb)	
	IP 65	778 grams (1.72 lb)	
	EExd	4200 grams (9.26 lb)	
	Low temp.	520 grams (1.15 lb)	
Approvals	CE	EN55011: 1998	
		EN61326: 1996	
		Following the provisions of 89/336/EEC, EMC directives and, Cenelec	
		EN61010-2 : 2001	
		Following the provisions of 73/23/EEC, Low Voltage directive (LVD)	
	ATEX for EExd-model:	Directive 94/9/EC Group 2, Category2, G and D, Zones 1 and 2.	
Supply voltage	12-24 V a.c 12-30 V d.c Max load : 4 W		
Analog output	4-20 mA Max. 400Ω 0-10 V Min. 10 kΩ 0-5 V Min. 10 kΩ		
RS 485 Communication	To Danfoss m2 monitoring unit		
Digital output – volt free contacts	Load: 1 A, 24 V a.c/d.c		

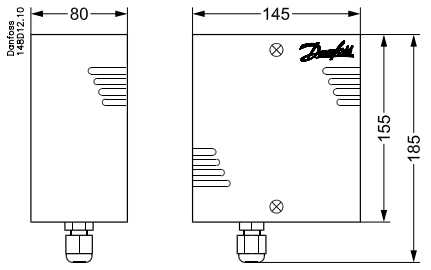
The installation of data communications must comply with the requirements described in literature sheet no. RC8AC

Additional information!
Data sheet: RD7HA

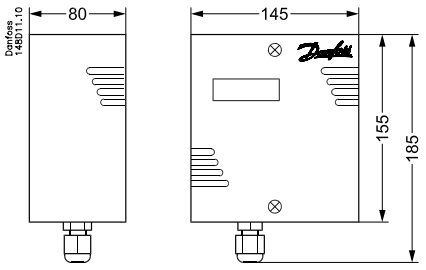
Ordering

Type of gas	All models					Standard	With LCD display	IP 65 version	EExd	Low Temp –40/+40C
	Type	Range [PPM]	Alarm limits. Low/High [PPM]	Response Delay [s]	Sensor type	Code no.				
Ammonia - NH_3										
R 717	GDA EC 100	0-100	25/35	0	Electro-chemical	**148H5000**	**148H5001**	**148H5002**	**148H5003**	**148H5004**
	GDA EC 1000	0-1,000	500/900	0	Electro-chemical	**148H5010**	**148H5011**	**148H5012**	**148H5013**	**148H5014**
	GDA SC 10000	0-10,000	5000/9000	0	Semi-Con-ductor	**148H5020**	**148H5021**	**148H5022**	**148H5023**	**148H5024**
	GDA CT 30000	0-30,000	500/10000	0	Catalytic	**148H5030**	**148H5031**	**148H5032**	**148H5033**	**148H5034**
Carbon Dioxide - CO_2										
R 744	GDC IR 10000	0-10,000	5000/9000	0	Infrared	**148H5070**	**148H5071**			
Halo-Carbon										
HCFC (R 22, R 123)	GDHC SC 1000	0-1,000	500/900	300	Semi-Con-ductor	**148H5100**	**148H5101**	**148H5102**		**148H5104**
HFC (R 404A, R410A, R134A, R 407C, R 507)	GDHF SC 1000	0-1,000	500/900	300	Semi-Con-ductor	**148H5110**	**148H5111**	**148H5112**		**148H5114**
Hydro-carbon										
(R 290(Propane), R 600, R 600A, R 1270)	GDH CT 5000	0-5,000	2000/4000	0	Catalytic	**148H5160**	**148H5161**		**148H5163**	

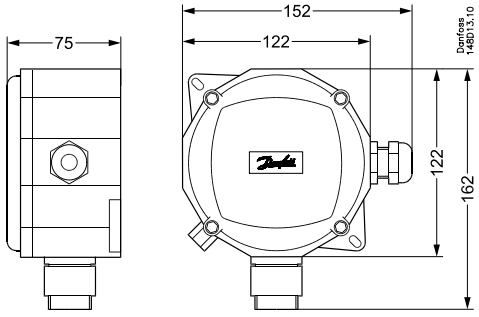
Dimensions



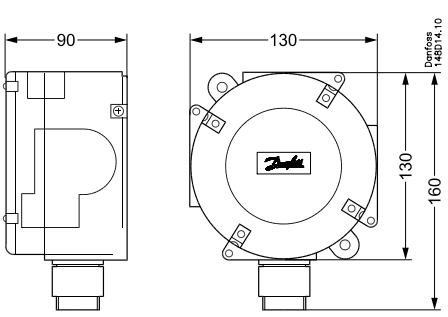
Standard



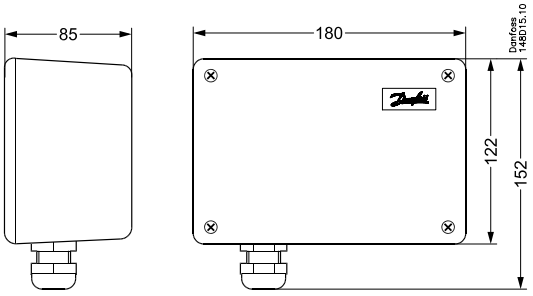
LCD display



IP 65



EExd



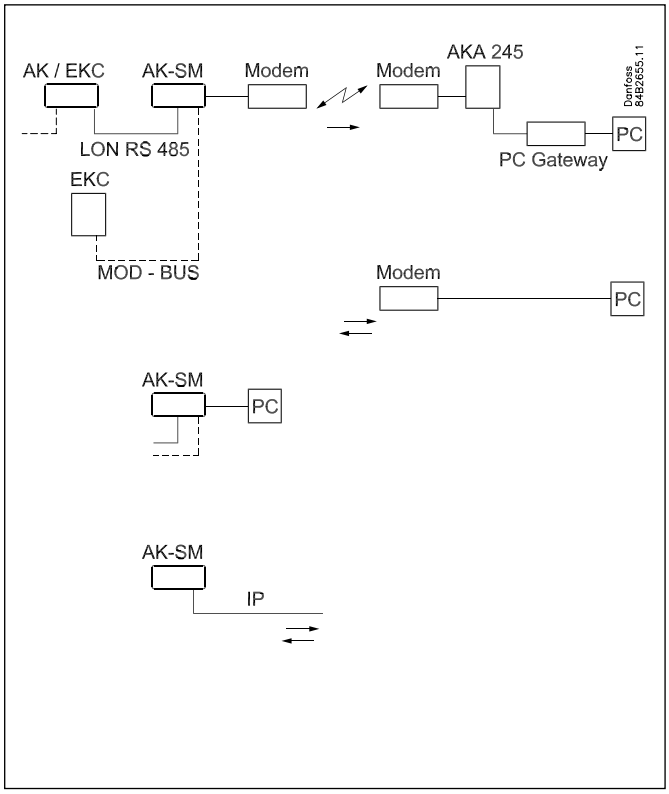
Low temperature

System manager

System manager AK-SM__ is a system unit for use with controls in the AK- series.

The system manager makes it possible to build up complex control systems with alarm monitoring and data logging of decentralised refrigeration systems.

Controls are connected to a data communication system and various communication forms exist depending on control type:
LON RS 485
MOD-bus
TCP/IP
Modem



Important
Installation of data communication cables and repeaters must comply with the requirements contained in the document: Data communication between ADAP-KOOL® Refrigeration system controls.
Number = RC8AC.

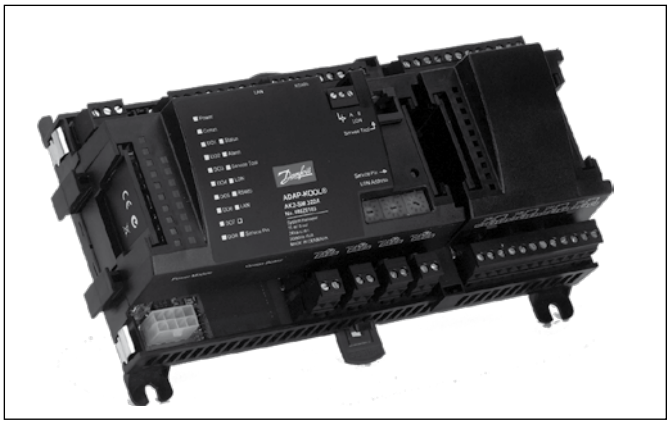
AK-SM 720

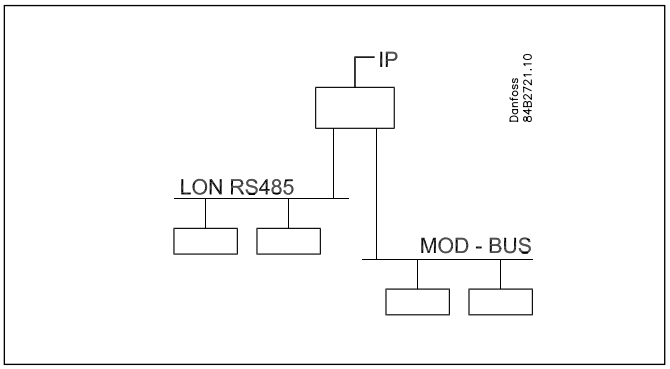
Used where data communication takes place using LON RS 485 or MOD-BUS.
200 controllers can be connected which must be distributed on LON RS 485 and MOD-bus.
Several system managers can be connected via the IP connection so that measurement from up a total of 400 controllers can be registered.

For remote control a modem can be connected or the connection can take place via an IP network.

Remote control takes place with software type AK-ST or EM 100.

The system manager can send alarms and logs to system software type AKM, but the system manager and the connected controllers cannot be remote-controlled from AKM.





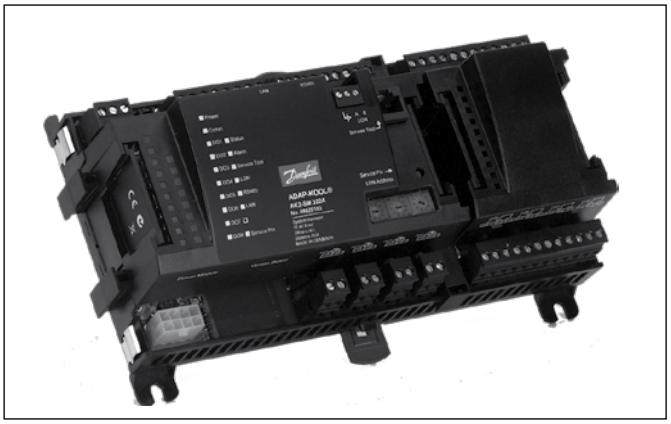
Ordering

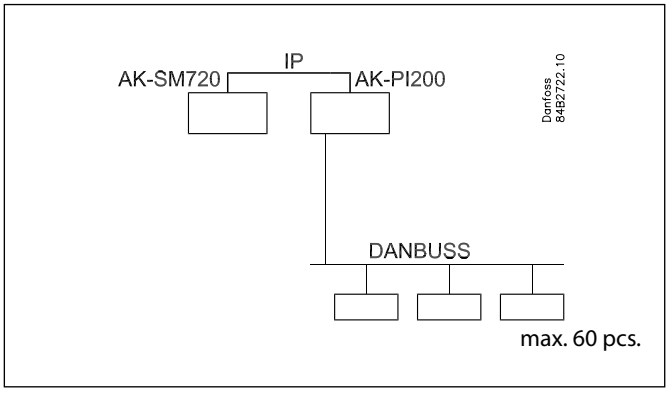
Type	Description	Language	Code No.
AK-SM 720	System manager	English, German, French, Italian, Dutch	**080Z8511**
		English (UK), Spanish, Portuguese, English (US)	**080Z8512**
		English (UK), Danish, Swedish, Finnish	**080Z8513**

Additional information!
Manual: RS8EC

AK-PI 200

Used if AKC controllers with DANBUSS need to be connected to the system.
A unit can be connected to 60 controllers, and two units can be connected to one system manager.



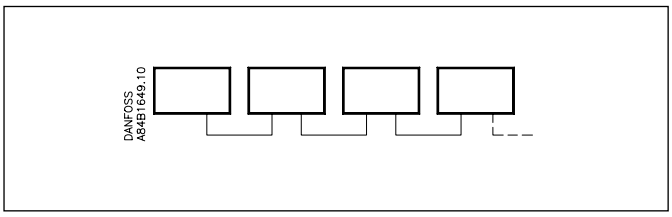


Ordering

Type	Description	Language	Code No.
AK-PI 200	Gateway	English, German, French, Italian, Dutch	**080Z8521**
		English (UK), Spanish, Portuguese, English (US)	**080Z8522**
		English (UK), Danish, Swedish, Finnish	**080Z8523**

Web-based operation

In general
All controllers in the AK series are equipped with data communication. Operation of individual controllers must take place by connection to the data communication. This can take place directly on the system or it can take place at a distance, e.g. via a modem. A combination is also possible.

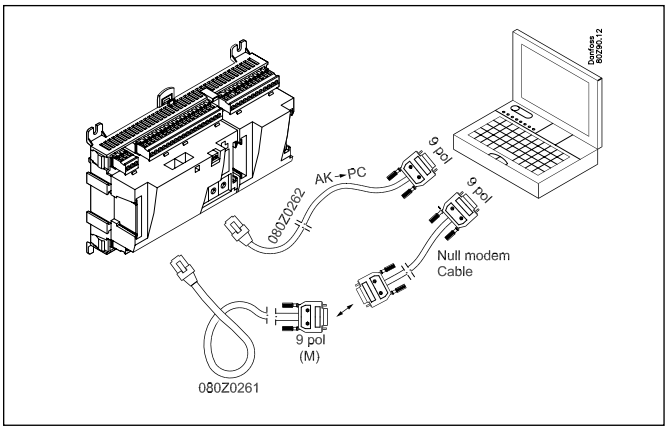


AK-ST 500

Application
Operational software for AK controllers

Function
The programme is an advanced software tool for operating refrigeration controls on a network where it works as a kind of browser for the controllers involved as it has only one user interface. Functions and settings are presented in a number of menus shown on the right.

Principle
The AK controller is connected to the PC tool that the programme has installed. The PC may be portable or stationary.
All settings are then set using Windows menus.



Ordering

Type	Function	Application	Code No.
AK-ST 500	Operational software for AK controls	AK operation	**080Z0161**
-	Cable between PC and AK controller	AK - Com port	**080Z0262**
-	Cable between zero modem cable and AK controller	AK - RS 232	**080Z0261**

Additional information!
Manual: RS8ES

EM 100

The EM100 provides a web based graphical user interface of a store which allows a range of daily users to monitor data, alarms and reports, either locally or remotely.

The Store Mimic is a visual representation of a store which displays the readings of all the assets and their controllers contained within the store. It provides an overall view of the store and its individual assets in real time, providing up-to-date informations due to automatic refreshes. The Store Mimic allows you to see at a glance if there are any assets in a state of alarm and act upon them quickly.

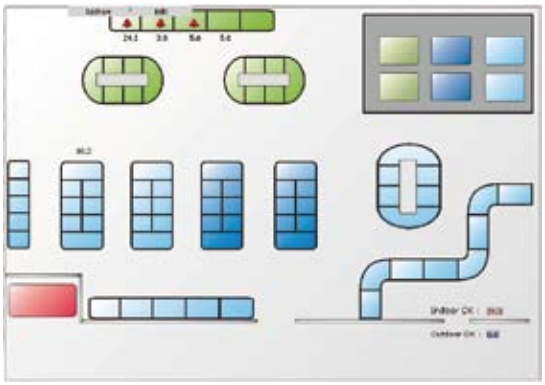
Advantages
- complete overview of store
- alarm monitoring
- provides up-to-date information in real time
- multi-user access
- easy to use web based front end
- allows staff to focus on key daily tasks

Technical Specification
- Fan less embedded PC
- VIA PLE133 chipset
- VIA C3/Eden CPU
- 512 MB SDRAM
- 50 mm(H) x 275 mm(W) x 172 mm(D)
- 2.0+0.5 kg
- AC100~240 V (50/60 Hz)
- 60 W

Not included
- Monitor
- Keyboard
- Mouse (pointing device)
- Patch cable

Ordering

Description	Application	Code No.
EM 100	Operating AK system	**080Z3100**



Store Mimic
A graphical representation of the store which contains all of the assets and their points of measurement. Depending on level of the users access, it can be used for viewing information within the store such as alarm checking, carrying out certain commands, and editing of the mimic itself.

Store Operations
Store Operations contains information relating to both the overall store and it's individual assets. From here the user can view several types of reports, graphs, check the current alarm status, and configure asset details, as well as carry out some commands such as defrosting or switching on/off a refrigeration unit.

HACCP Reports
Provides a HACCP report for all of the assets measurement points within the store. The report shows the average measurements for the available points which can be compared to the recommended set point value, as well as highlighting significant discrepancies by using colour codes.

Historical Alarms
Depending on access rights, Historical Alarms provides seven types of reports, ranging from the total number of alarms to the worst performing asset.

Trending
Depicts a graph of a point(s) which updates automatically to provide live data for a set period of time. Used for closely monitoring points.

Graph Report
Displays a graph for one or more points over a user specified time.

Commissioner Toolbox
This is where the majority of the configuration between the EM 100 and the gateway takes place.

Administration
The administration section contains different levels depending on access rights of the user.

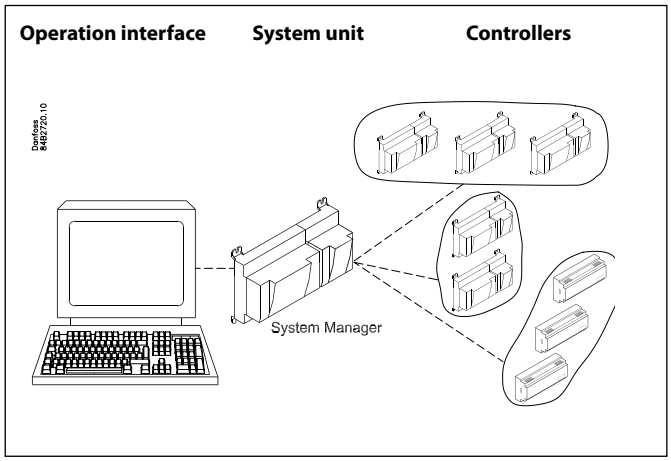
Actual Alarm List
Shows the latest alarm when the mouse is placed over it. Clicking on the icon takes you to the Actual Alarm list page.

Introduction

The system unit in an ADAP-KOOL® refrigeration system contains over-riding functions which transfer signals between selected controls via the data communication.

Depending on the chosen fuction, the controls are gathered in groups.
When override is activated, all controls in the group will receive the same overide signal.

The system unit must be a:
• System manager



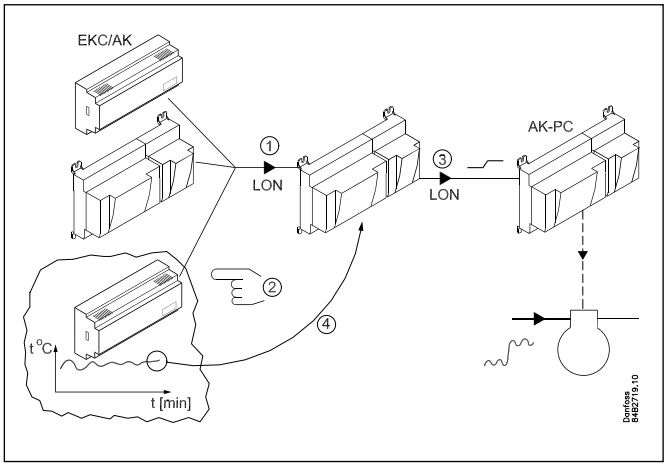
P0-/suction pressure optimisation

The override function makes it possible for you to optimise the suction pressure so that it will be adapted to the system's actual load. During the optimisation data are collected that tell you which refrigeration points are most heavily loaded.

The individual controllers handle the temperature control in the refrigeration appliances. Some controllers control two, others three refrigeration points in the same appliance. The load and operating condition of each refrigeration point are continuously uploaded to the gateway via the data communication. The collected data are accumulated here and the "most heavily loaded" refrigeration point identified. An adaptation will now be made of the suction pressure so that the air temperature at the refrigeration point is maintained. Only after a period of, say, 20 minutes, or if the operating condition of the refrigeration point is changed (defrost, cutout, etc.) can another refrigeration point be designated as the "most heavily loaded one".
It is the system unit that collects data from the refrigeration points and it is the systesm unit that transmits an offset signal to the compressor control so that the suction pressure reference is changed to suit the needs at the "most heavily loaded" refrigeration point.

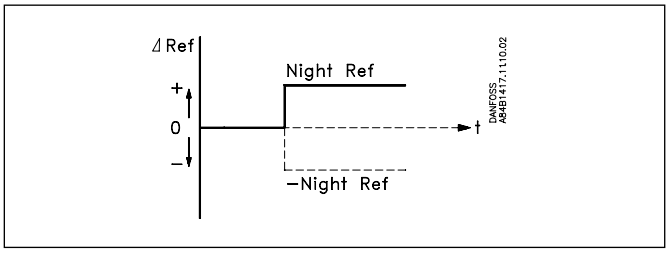
The set min./max. limits for the suction pressure will of course be observed.

The time during which a refrigeration point has been designated "the most heavily loaded one" will be summed up in a log (history) in the shape of minutes. These data can be presented in a display containing "the last 24 hours" and "the last 168 hours (one week)". The oldest values will continuously be overwritten.
It will typically be the same pattern that is formed on the two charts, but if "new ones" emerge and differ from the rest this should be examined more closely.



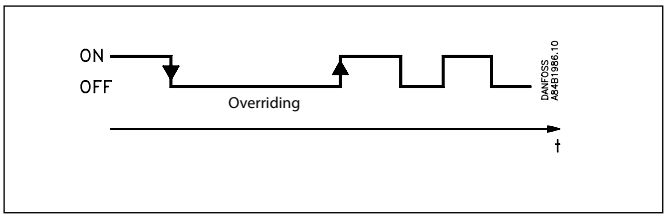
Day/night control

This function transmits a signal to selected controllers. The signal can be used for raising the temperature reference and for raising the suction pressure reference.
When the individual controllers receive the signal, the reference will be changed by the value set in the individual controllers.



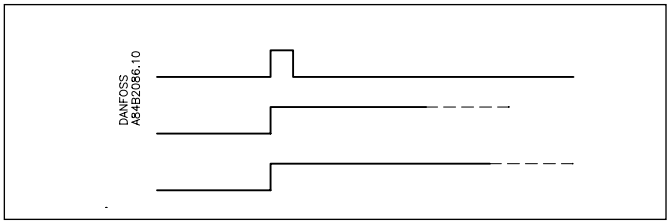
Time schedule

The override function enables you to define a number of time schedules.
Example of use:
Input signal for day/night control.



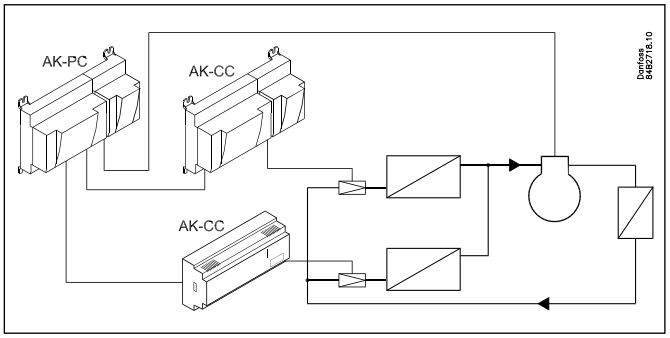
Defrost control

The override function enables you to define and start a number of defrost cycles.
When the defrost has been started, it is up to the individual controllers to determine how it is to be terminated again. In some it may stop based on time, in others based on temperature.



Stopping liquid injection on service interruption (Inject on)

All controls controlling an expansion valve have an "Inject on" function. By activating this function the control will close the valve so that no fluid flows through the evaporator.
In this way it is ensured that the valve closes when the compressor has stopped due to a service interruption.
The function can be created directly via wire connections between a compressor control and the current controllers or it can be created via data communication from a compressor control and via a system unit to the current controllers.

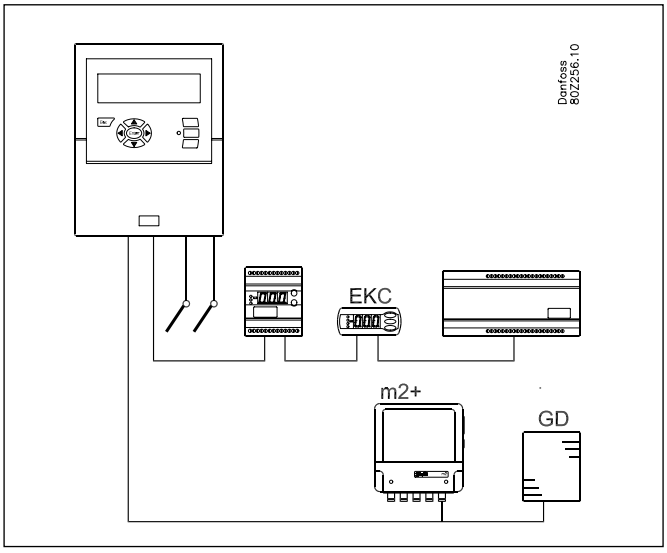


Additional information!
Setup guide: RI8AL

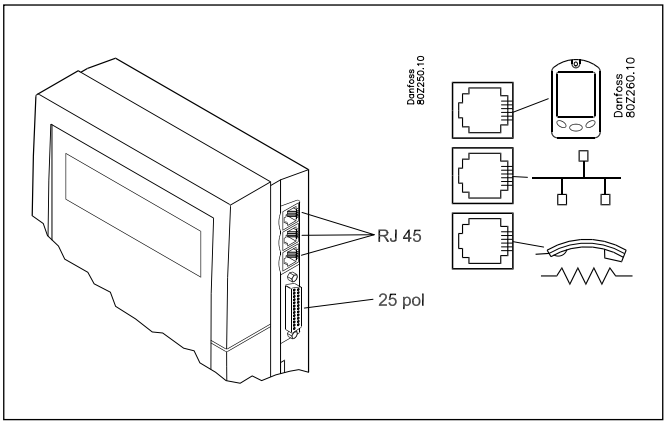
AK-SM 350

Application
The unit is a combined data collection unit and monitoring unit for smaller refrigeration installations.
- Corner shops
- Smaller supermarkets
- Restaurants
- Food manufacturers

Advantages
Compact unit for registering temperatures
- Collects temperature data to present to authorities
- Alarm function
  - Local alarm or via modem/IP
  - Alarm at deviations in temperature
  - Alarms when doors to cold storage rooms and freezer rooms are open
- Text describing the measuring area can be added to the measuring points



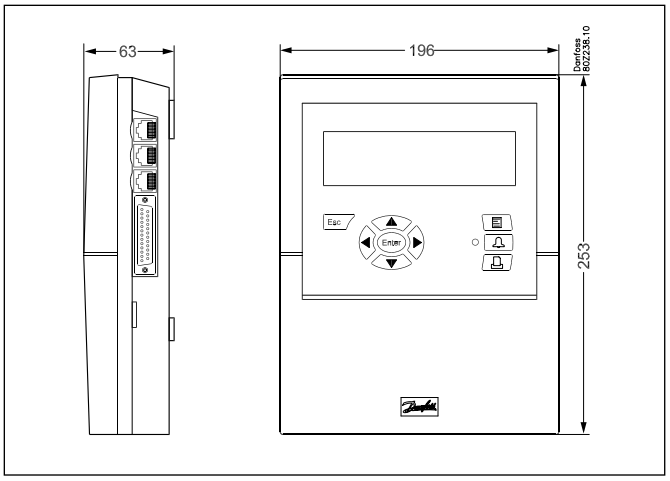
Functions
The monitoring unit can monitor up to 65 measurements. They can originate from:
- up to 16 direct connections from sensors or switch functions
- signals from separate refrigeration controllers, EKC and AK types, via data communication
- signals from connections on the expansion module m2+ and from gas detectors. These readings are also transferred via data communication.
- Pulse counting function for energy display
- All defined points can be recorded and saved with the set time intervals.
- The values can be viewed on the display and retrieved by connecting a printer or connecting a PC or modem.



External connections
- Modem
  A modem can be connected so that the unit can be in contact with external alarm destinations or service companies.
  The modem can be a standard telephone modem or a GSM modem for mobile telephony.
- Ethernet
  If connection to a TCP/IP network is required, a server can be connected. Contact Danfoss for further information about recommended types.
- PC
  A PC can be connected to the unit. The PC may be stationary, portable or handheld. Setups and/or alarm receipt can be performed via an operating program.

Data

Supply		115 V/230 V +10/-15%, 50/60 Hz, 10 VA
Connection		PT 1000 ohm at 0°C or PTC 1000 ohm at 25°C or NTC 5000 ohm at 25°C or Termistor (-80 to 0, -40 to 40 or 0 to 100°C) Digital On/Off signal or Standard 0 - 10 V /4 - 20 mA signal
Display		Graphic LCD, 240 x 64
Direct measuring points		16
Total number of points		65
Measuring range, general		-60 to +50°C
Measuring accuracy at Pt 1000		Resolution 0.1 K Accuracy: +/- 0.5 K
Measuring interval		15, 30, 60, 120 or 240 minutes
Data capacity		55 log points, every 15 min. for 1 year
Battery backup		Button cell for clock function
Power supply for e.g. pressure transmitter		5 V max. 50 mA 12 V max. 50 mA
Pulse counter inputs for output reading		Acc. to DIN 43864. (Only for inputs 1 and 2)
Printer connection		HP PCL-3, Parallel
Modem connection		RJ 45
TCP/IP connection		RJ 45
PC connection		RJ 45
Data communication		RS232, RS 485 (LON), RS 485 (MODbus), RS 485 (TP) (TP= Third Party)
Relays	Quantity	2
	Max. load	24 V a.c. or 230 V a.c. Imax (AC-1) = 5 A Imax (AC-15) = 3 A
Enclosure		IP 20
Ambient environment	0 to 50°C, during operation -20 to +70°C, during transport 20-80% RH, Non-condensed No shock loads/vibrations	
Approvals		EN 60730-1 and EN 60730-2-9 EN 50081-1 and EN 50082-1
Weight		1.6 Kg



Ordering

Type	Measuring points	Description	Language	Code No.
AK-SM 350	16	With inputs for PT 1000 ohm & PTC 1000 ohm	English, German, French, dutch, Italian	**080Z8500**
			English (UK), Spanish, Portuguese, English (US)	**080Z8502**
			English, Danish, Swedish, Finnish	**080Z8503**
m2+	16			**080Z8005**
Printer cable 3 m (parallel)				**080Z8401**
Cable for PC (see also AK-ST 500 literature)		RJ 45 - Com port		**080Z0262**

Important
Installation of data communication cables and repeaters must comply with the requirements contained in the document: Data communication between ADAP-KOOL® Refrigeration system controls.
Number = RC8AC.

Additional information!
Manual: RS8EF

AK-SC 255

Application
The feature-filled AK-SC 255 system controller is the heart of your control and monitoring system. It gives you a brilliant full color high resolution display, context-sensitive soft keys, easy navigation to every part of your system, an on-board Ethernet port, a complete suite of maintenance management tools, extensive alarm capability, and much more.

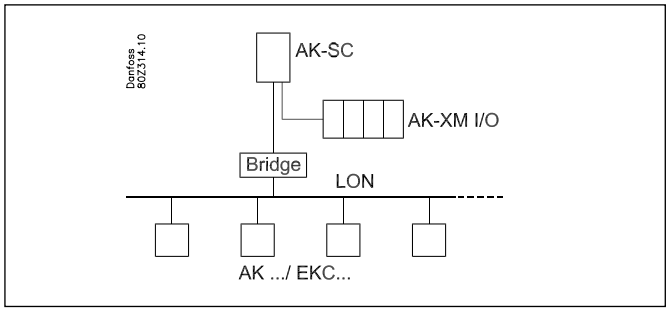
Advantages
Front-end for ADAP-KOOL®
- Supports Pack, Evaporator controllers, I/O Modules
- Temperature monitoring and Alarming
- Enables HACCP Compliance
- Local access with key-pad and VGA screen
- Full remote access (serial, Internet)
- Energy optimization with adaptive master control
- Flexibility with Boolean logic
- Lighting Control
- Off Line programming allowing for off site commissioning
- Host Network – connect up to 10 AK-SC 255 units to cover massive application range
- Alarm via e-mail
- Scalable solution from convenience store to hypermarket
- Reduces service cost and call-outs via remote access and alarming
- User friendly menus and short-keys

Regulating
The AK-SC 255 will control and monitor up to 5 suction and condensing groups, with up to 40 circuits per suction group.
With its compressed storage, it provides a huge history capacity.
There is a user-programmable logic processor for custom strategies.
Standard and custom alarms protect food products and equipment.
Software options can include up to 30 lighting zones, including motorized panels, and up to 40 HVAC systems.

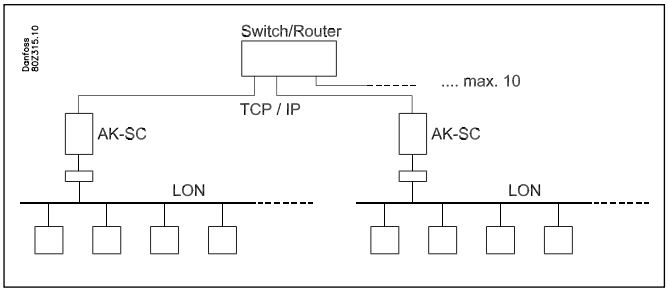
Network
The AK-SC 255 can control and monitor multiple network types to suit different levels of application. Communication types include;
- TCP/IP EKC controllers
- Modbus EKC controllers
- LonWorks TP78, FTT10, RS 485 AK- & EKC
- LonWorks AK I/O Modules

Lighting:
- 5 lighting zones
- 6 relays per zone
- Standard or relative schedules
- 8 schedules per zone
- Auto override for burglar or fire alarm
- Switch override with OVR override box

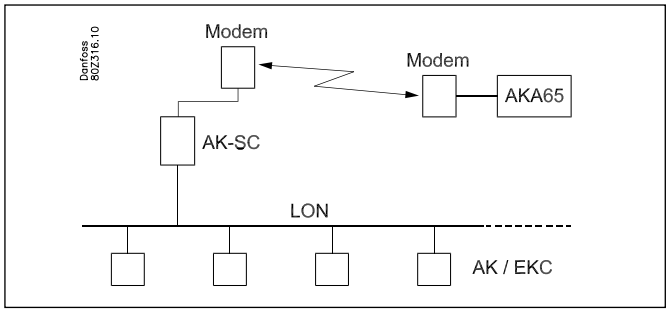
Miscellaneous Points
- 96 Misc Boolean Logic statements per AK-SC 255
- 64 Misc relay DO per AK-SC 255
- 48 Misc VO per AK-SC 255
- 10 Misc Conversion factors
- 64 Miscellaneous sensor inputs & ON/OFF inputs – monitoring & alarming



Closed plant with controllers



Several plants connected so that setup and readout is made central from AK-SC 255.
Communication between the plants is made via TCP/IP.



System Manager with controllers and modem for remote control of the plant via AKA 65.

Technical data

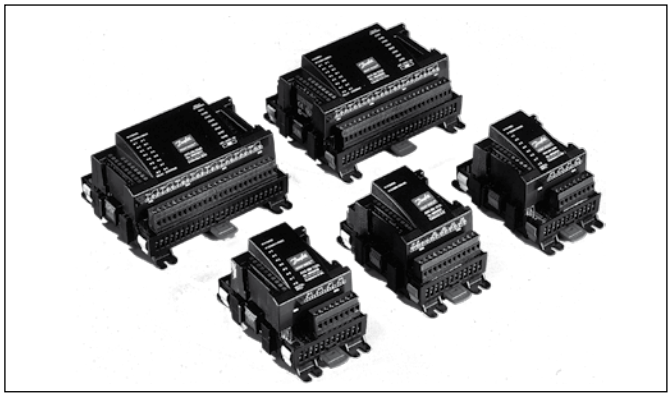
Recommened individual controller capacity(s) - per AK-SC 255	Type AK-CC 750	60	Max. configured evaporator section 150
	Type EKC (SNMP, Lonworks)	120	1 controller per evaporator section
Recommened Remote AK I/O capacity (in addition to controllers)	AK I/O	64 points (max 8 AK CM)	Analog (General I/O, HVAC, Lighting)
	AK I/O	64 points (max 8 AK CM)	Digital (General I/O, HVAC, Lighting)
Available Network Protocol	Ethernet Port (used for EKC SNMP controllers, 255 host network & remote AKA65 software tool) RS 485 Host Bus (used for multiple AK-SC 255) MODBUS RS232 Port (used for AKA 65 software tool) Modem Port (used for serial modem) LonWorks TP78 (used for AK/IO modules) LonWorks RS 485 (use TP78 - RS 485 bridge - 084B2254)		
Power KWh Meter Pulse input capacity	AK-XM107A Pulse Module, Max 8 inputs		
Additional AK-SC255 units interconnected (Host Network)	Max of 10 AK-SC255 units (1 Master & 9 Slave)		
History Data points	600		
History Capacity	10 minute samples on 120 points = 1 year		
Remote connection software	AKA 65 v5.1 : Modem Ethernet Serial		
Recommended Modem Support	Zoom V.92 56k Modem (Model 3049)		
	AKA 231 'Phoenix' modem		
Environmental Data	Operating temperature	32 to 104°F (0 to +40°c) @ 95% RH (non condensing)	
		32 to 122°F (0 to +50°c) @ 0 to 90% RH (non condensing)	
	Storage temperature	-4 to 122°F (-20 to +50°c)	

AK input-output module family

Put line-ups of up to nine self-addressing I/O modules wherever you need them, and in any combination. Modules are available with:

- 8 relays (with or without override)
- 8 relays (with or without override) and 8 universal inputs
- 8 universal inputs
- 8 digital inputs (high and low voltage versions)
- 4 bi-polar EEPR outputs

Each module lineup begins with a communications and power module that is connected to the AK-SC 255 system controller via Echelon® Lonworks®. No wiring to individual modules is required because of a unique intermodular bus.



AK-SC 255 Solution components:

- Communication module
- I/O modules
- Pulse counter

Ordering

Type	Function	Code no.
AK-SC 255	Refrigeration	**080Z2047**
AK-SC 255	Refrigeration, light, HVAC	**080Z2048**
AK-SC 255	Refrigeration, light, HVAC For DIN rail mounting (without screen)	**080Z2083**

Furhter information!
Manual: RS.8D.M/DKRCE.EC.000.M2.22

Important
Installation of data communication cables and repeaters must-comply with the requirements mentioned in the document: Data communication between ADAP-KOOL® Refrigeration controls. Literature number = RC8AC.

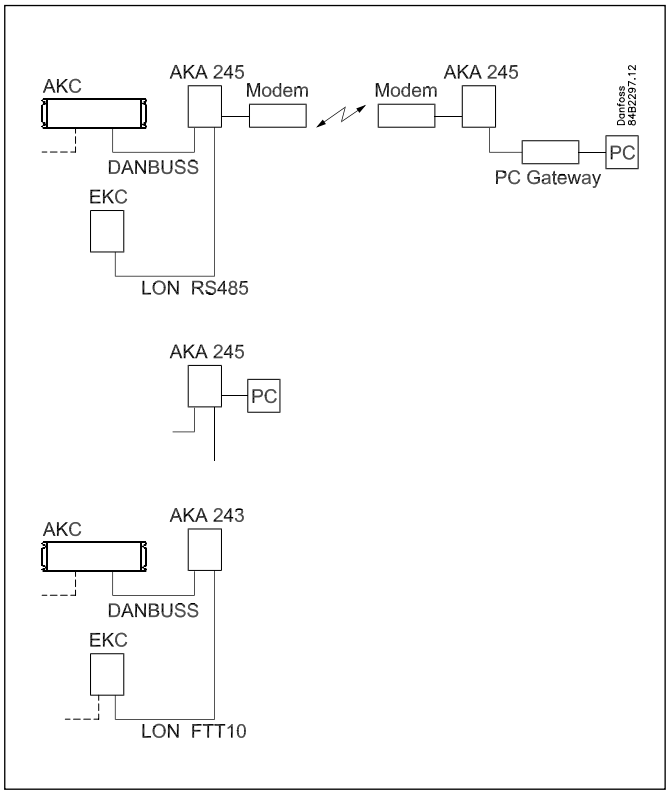
Gateways

AKA 241, AKA 243 and AKA 245 gateways are system components for use together with controllers in ADAP-KOOL® Refrigeration control systems, and where operation occurs in AKM type system software.
Gateways make it possible to construct complex control systems with alarm monitoring and data logging in connection with decentralised refrigeration plants.

Controllers are connected to a data communication system and various communication forms exist depending on controller type. DANBUSS, LON RS 485, LON FTT10.

A gateway is connected to the data communication system and linked up with a PC with AKM, a printer og a modem or a controller type EKC.

If a controller from the series "AK with extension modules" is connected, operation to this control will be limited to the 300 most important parameters. Alarms and logs can be received by the gateway.



AKA 245

Used where data communication takes place with DANBUSS and/or LON RS 485.
120 no. controllers can be connected which must be distributed on DANBUSS and LON RS 485.
A modem for remote control can be connected or a PC for direct operation of the system.

AKA 243A

Is used where data communication takes place fully or partly with LON FTT10
Up to 60 controllers can be connected to the DANBUSS unit.
Up to 60 controllers can be connected to the LON FTT10 unit.

AKA 241

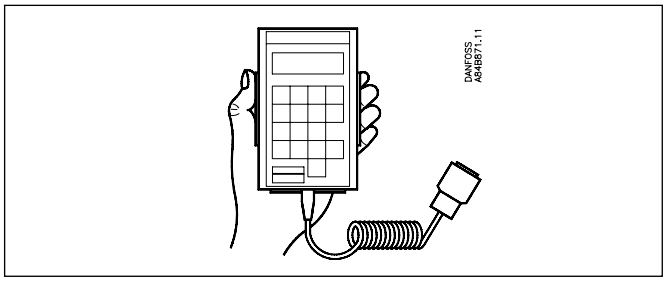
PC gateway
Is used where an AKA 243 or an AKA 245 is to be connected to a PC. For example on a centrally placed PC receiving data from several refrigeration installations.

Important
Installation of data communication cables and repeaters must-comply with the requirements mentioned in the document: Data communication between ADAP-KOOL® Refrigeration controls. Literature number = RC8AC.

Additional information!
Technical brochure: RC0XL
Manual: RS8AA-
Manual: RS8DT-

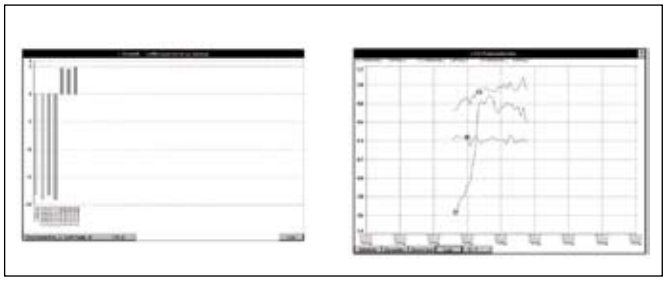
AKA 21

Only for DANBUSS data communication.
This unit is only recommended for small systems and for use in service situations,
The unit is provided with plugs that can connect it to the data communication.
Settings are made in the individual controllers via a menu system.



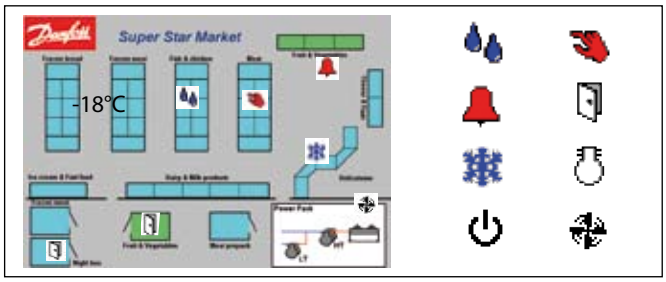
AK-Monitor

Is a PC programme with a few well arranged functions selected from the more comprehensive AKM 4 programme.
In AK Monitor importance has been attached to simple operation, monitoring and log collection of temperatures
Settings and function surveys are obtained from specially designed general layout displays.



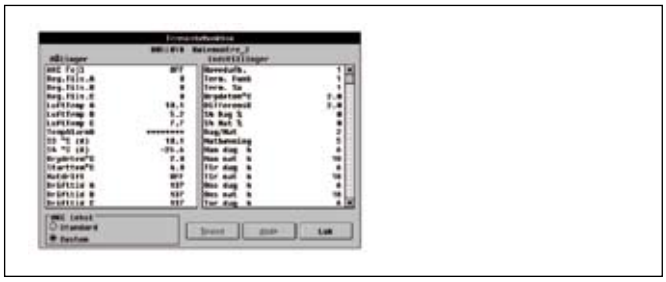
MIMIC

(AK Monitor with extended graphic user interface).
A picture is drawn of the placing of the refrigeration points This drawing is subsequently used as background on the PC screen, and temperatures and functions can now be seen in connection with the refrigeration point. An on-going defrost, for example, will be shown together with a "drop" symbol.



AKM 4

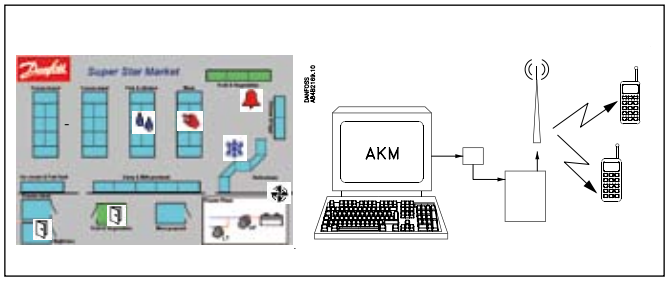
Systems software type AKM 4 is used for service and for setup of a system.
The programme can also be used for larger systems where there are employees with refrigeration-technical knowledge.
A central service company can use the programme for downloading data from various systems.



AKM 5

Is AKM 4 with an extended graphic user interface.

If alarms have to be transmitted to a mobile phone, it can be done via AKM 4 or AKM 5.



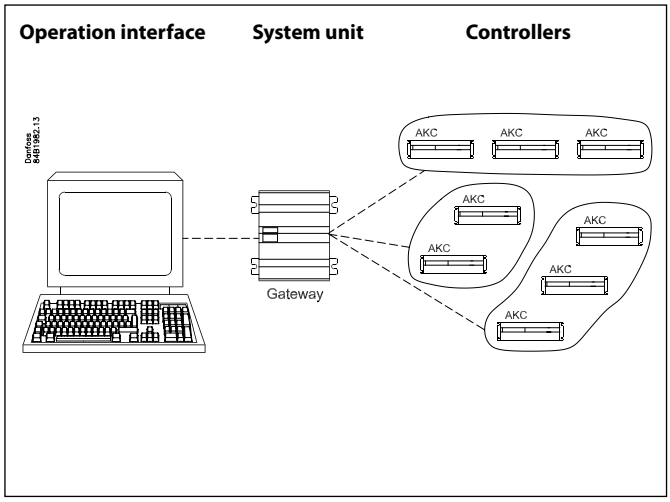
Additional information!
Technical brochure: RC0XL

Introduction

The system unit in an ADAP-KOOL® refrigeration system contains overriding functions which transfer signals between selected controls via the data communication.

Based on the selected function the controllers are gathered in groups. So when there is override, all controllers in the group will receive the same override signal.

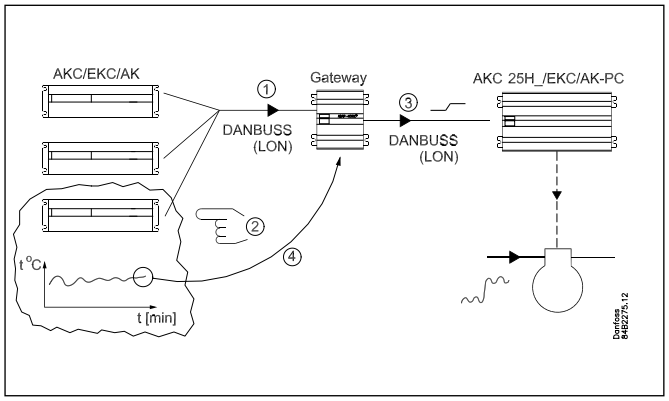
The system unit must be a:
• Gateway.



P0-/suction pressure optimisation

The override function makes it possible for you to optimise the suction pressure so that it will be adapted to the system's actual load. During the optimisation data are collected that tell you which refrigeration points are most heavily loaded.

The individual controllers handle the temperature control in the refrigeration appliances. Some controllers control two, others three refrigeration points in the same appliance. The load and operating condition of each refrigeration point are continuously uploaded to the gateway via the data communication. The collected data are accumulated here and the "most heavily loaded" refrigeration point identified. An adaptation will now be made of the suction pressure so that the air temperature at the refrigeration point is maintained. Only after a period of, say, 20 minutes, or if the operating condition of the refrigeration point is changed (defrost, cutout, etc.) can another refrigeration point be designated as the "most heavily loaded one".
It is the gateway that collects data from the refrigeration points and it is the gateway that transmits an offset signal to the compressor control so that the suction pressure reference is changed to suit the needs at the "most heavily loaded" refrigeration point.

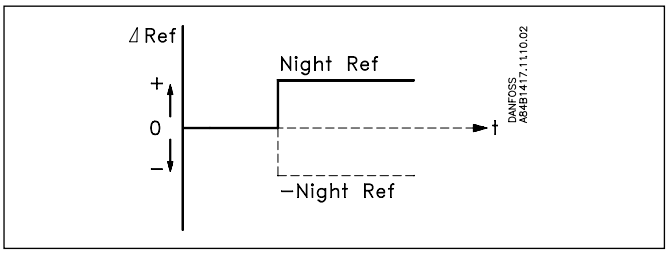


The set min./max. limits for the suction pressure will of course be observed.

The time during which a refrigeration point has been designated "the most heavily loaded one" will be summed up in a log (history) in the shape of minutes. These data can be presented in a display containing "the last 24 hours" and "the last 168 hours (one week)". The oldest values will continuously be overwritten.
It will typically be the same pattern that is formed on the two charts, but if "new ones" emerge and differ from the rest this should be examined more closely.

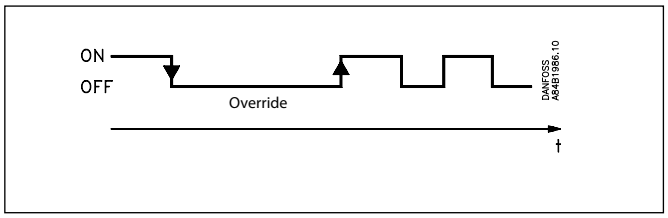
Day/night control

This function transmits a signal to selected controllers. The signal can be used for raising the temperature reference and for raising the suction pressure reference.
When the individual controllers receive the signal, the reference will be changed by the value set in the individual controllers.



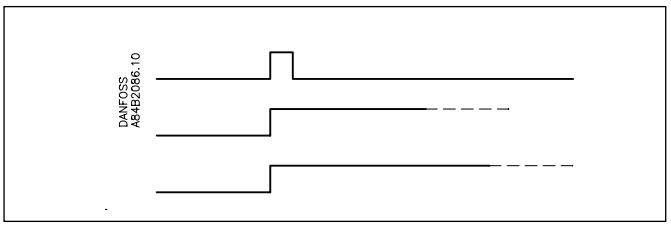
Time schedule

The override function enables you to define a number of time schedules.
Example of use:
Input signal for day/night control.



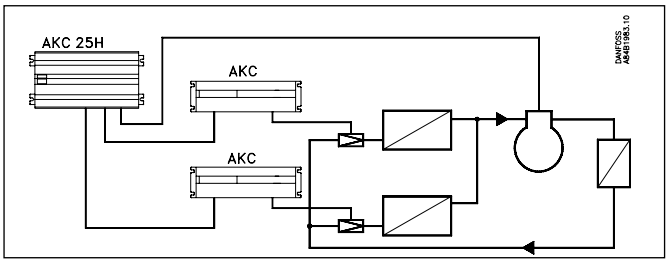
Defrost control

The override function enables you to define and start a number of defrost cycles.
When the defrost has been started, it is up to the individual controllers to determine how it is to be terminated again. In some it may stop based on time, in others based on temperature.



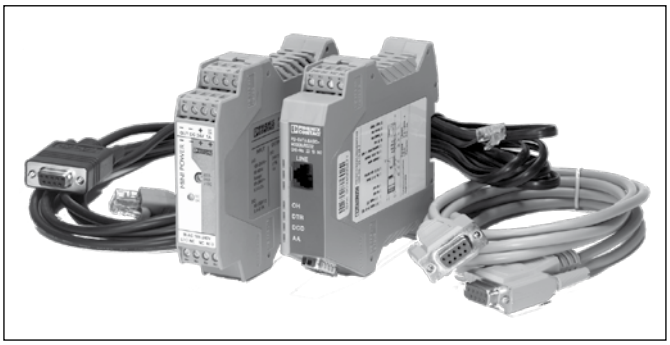
Stopping liquid injection on service interruption (Inject on)

All controls controlling an expansion valve have an "Inject on" function. By activating this function the control will close the valve so that no fluid flows through the evaporator.
In this way it is ensured that the valve closes when the compressor has stopped due to a service interruption.
The function can be created directly via wire connections between a compressor control and the current controllers or it can be created via data communication from a compressor control and via a system unit to the current controllers.



Additional information!
Setup guide: RI8AL

AKA 231
Modem



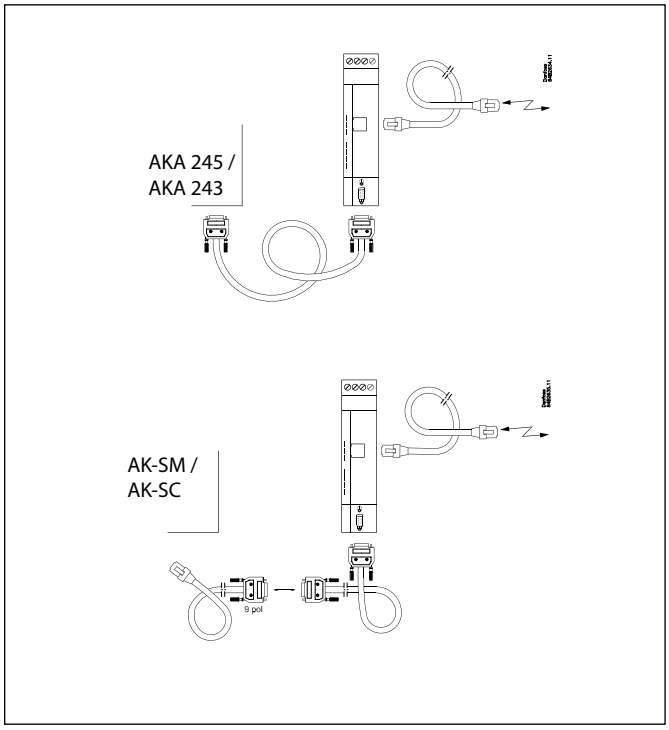
Application
The AKA 231 is a modem for use together with ADAP-KOOL® Refrigeration system control. It can transmit data between the refrigeration system's ADAP-KOOL® system unit and an external operating interface that is also an ADAP-KOOL® product. Transmission is via the telephone network.

Advantages
The modem is a PSI-DATA/BASIC-Modem/RS232 V.24 and is designed for use in an industrial environment with harsh EMC conditions.

Technical data

Power supply	For power supply	100 - 240 V AC 50/60 Hz (Supplies modem with 24 V d.c.) At 115 V: 750 mA At 230 V: 450 mA
Connection	To system unit	9-pol D-SUB
	To telephone network	RJ12 6 pos.
Data format	Serial asynchronous UART/NRZ, 7/8 data, ½ stop, 1 parity, 10/11 bits character length	
Serial transmission speed	Automatic adjustment to: 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200 bps	
CE compliance	In accordance with EMC directive 89/336/EEC	
Approvals	TBR21 TIA-968-A CS-03 for Europe, USA and Canada	
Ambient temperature	0 - 55°C	
Assembly	DIN rail	
Measurements (H x W x D)	99 mm x 22,5 mm x 114,5 mm	
Weight	Modem	165 g
	Power supply	290 g
Internal earth	Linked to DIN bar via the housing	

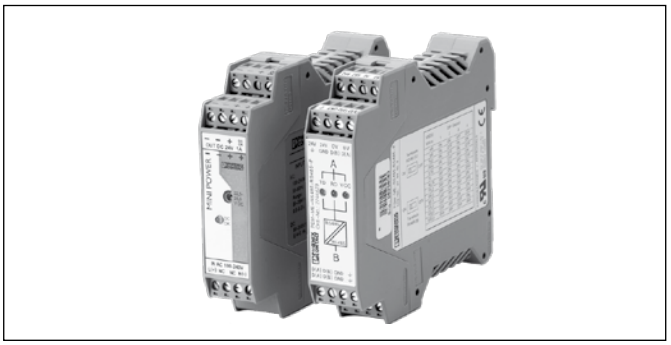
Connections



Ordering

Type	Description	Code No.
AKA 231	Modem (PSI-data/basic modem/RS232) + Power supply + Cable to AKA 243 and AKA 245 + Cable to AK - unit + Cable to telephone network	**084B2242**

AKA 222/223
Repeater

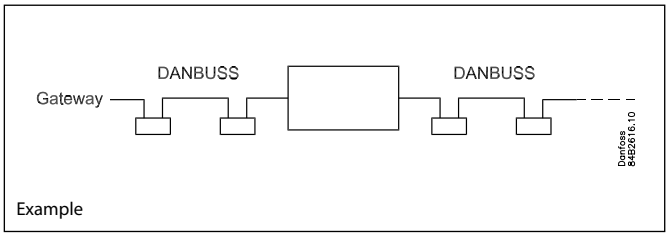


Application
The module is a repeater for use together with ADAP-KOOL® control systems. It can strengthen and regenerate the signal on the data communication cable between the refrigeration system's controls and the system unit.
Can be used for the following communication:
• DANBUSS
• Lon RS 485
• MOD-bus

Function
Regenerates the data signal when there are long wire sections and when many controls are connected.

Technical data

Power supply	For power supply	100 - 240 V a.c. 50/60 Hz (Supplies repeater with 24 V d.c. 90 mA)
Connection	Screw clamps	
Baud rate	Lon (RS 485)	78.1 (factory setting)
	DANBUSS	4800 (factory setting)
	Mod-bus	38.4 (must be set)
CE compliance	In accordance with EMC directive 89/336/EEC	
Ambient temperature	0 - 55°C	
Assembly	DIN rail	
Measurements (H x W x D)	99 mm x 22.5 mm x 114.5 mm	
Weight	Repeater	200 g
	Power supply	290 g



Example

Ordering

Type	Description	Code No.
AKA 222	Repeater for data communication DANBUSS and MOD-bus (Power supply attached)	**084B2240**
AKA 223	Repeater for data communication Lon (RS 485) (Power supply attached)	**084B2241**

Important
Installation of data communication cables and repeaters must-comply with the requirements mentioned in the document: Data communication between ADAP-KOOL® Refrigeration controls. Literature number = RC8AC.

Appendix

Ordering survey AK series

This list is intended for customers who know our products in the AKC series and need an overview.

Type	Description	Language	Code No
AKC 114	Refrigeration appliance controls for 1 evaporator	GB, DE, FR	084B6027
AKC 114	Refrigeration appliance controls for 1 evaporator	GB, DK, ES	084B6028
AKC 115	Refrigeration appliance controls for 2 evaporators	GB, DE, FR	084B6042
AKC 115	Refrigeration appliance controls for 2 evaporators	GB, DK, ES	084B6046
AKC 116	Refrigeration appliance controls for 3 evaporators	GB, DE, FR	084B6043
AKC 116	Refrigeration appliance controls for 3 evaporators	GB, DK, ES	084B6047
AKC 114D	Refrigeration appliance controls for 1 evaporator	GB, DE, FR	084B6029
AKC 115D	Refrigeration appliance controls for 2 evaporators	GB, DE, FR	084B6044
AKC 115D	Refrigeration appliance controls for 2 evaporators	GB, DK, ES	084B6048
AKC 116D	Refrigeration appliance controls for 3 evaporators	GB, DE, FR	084B6045
AKC 116D	Refrigeration appliance controls for 3 evaporators	GB, DK, ES	084B6049
AKC 114A	Refrigeration appliance controls for 1 evaporator	GB, DE, FR	084B6171
AKC 114A	Refrigeration appliance controls for 1 evaporator	GB, DK, ES	084B6172
AKC 115A	Refrigeration appliance controls for 2 evaporators	GB, DE, FR	084B6173
AKC 115A	Refrigeration appliance controls for 2 evaporators	GB, DK, ES	084B6174
AKC 116A	Refrigeration appliance controls for 3 evaporators	GB, DE, FR	084B6175
AKC 116A	Refrigeration appliance controls for 3 evaporators	GB, DK, ES	084B6176
AKC 114F	Refrigeration appliance controls for 1 evaporator	GB, DE, FR	084B6178
AKC 115F	Refrigeration appliance controls for 2 evaporators	GB, DE, FR	084B6179
AKC 121A	Refrigeration appliance controls for 2 evaporators	GB, DE, FR, DK, ES, SE	084B2051
AKC 121B	Cold room controls for 2 evaporators	GB, DE, FR, DK, ES, SE	084B2904
AKC 72A	Cold room controls for 1 evaporator, without data communication	GB, DE, FR	084B1202
AKC 72A	Cold room controls for 1 evaporator, without data communication	ES, IT, PT	084B1208
AKC 72A	Cold room controls for 1 evaporator, with data communication	GB, DE, FR	084B1203
AKC 72A	Cold room controls for 1 evaporator, with data communication	ES, IT, PT	084B1209
AKC 72A	Cold room controls for 1 evaporator, with data communication	GB, PL, NL	084B1211
	Base for AKC 72A for wall mounting		084B1241
	Base for AKC 72A for mounting in front panel or DIN rail		084B1240
AKC 151R	Cold room control for one flooded evaporator	GB	084B6195
AKC 24W2	Water chiller control	GB	084B2027
AKC 24W3	Water chiller control, extended	GB	084B2043
AKC 25H7	Capacity control of brine cooler units	GB, DE, FR	084B2022
AKC 25H7	Capacity control of brine cooler units	GB, DK, SE	084B2023

Type	Description	Language	Code no.
AKC 25H1	Compressor control	GB, DE, FR	084B2017
AKC 25H1	Compressor control	GB, ES, DK	084B2018
AKC 25H3	Compressor control, double	GB, DE, FR, ES, DK	084B2039
AKC 25H5	Compressor control, extended	GB, DE, FR	084B2020
AKC 25H5	Compressor control, extended	GB, ES, DK	084B2021
AKC 22H	Alarm module		084B2050
AKL 111A	Monitoring and alarm units	GB, DE, FR, DK, ES, IT, SE	084B6039
AKL 25	Monitoring and alarm units, extended	GB	084B2012
AKA 14	Display		084B6040
AKA 15	Display		084B6130
	3 m cable for AKA 15 (24 pcs.)		084B6145
AKA 21	Setting module		084B2002
	Terminal box for AKA 21		084B2071
AK-Monitor	System software for end users (1 user version)		084B4100
AK-MIMIC	AK-Monitor with graphic user interface (1 user version)		084B4101
AKM 4	System software for refrigeration technicians (1 user version)		084B4012
AKM 5	AKM 4 with graphic user interface (1 user version)		084B4015
AKA 222	Signal amplifier, DANBUSS		084B2240
AKA 223	Signal amplifier, LON		084B2241
AKA 241	PC-gateway		084B2262
AKA 243A	Gateway, DANBUSS + LON (FTT10)		084B2265
AKA 245	Gateway DANBUSS		084B2268
	Cable, PC gateway, 9-9 pole		084B2094
	Cable, PC gateway, 9-25 pole		084B2096
	Cable, PC-MSS server, MSS server-gateway		084B2098

The installation of data communications must comply with the requirements described in literature sheet no. RC8AC