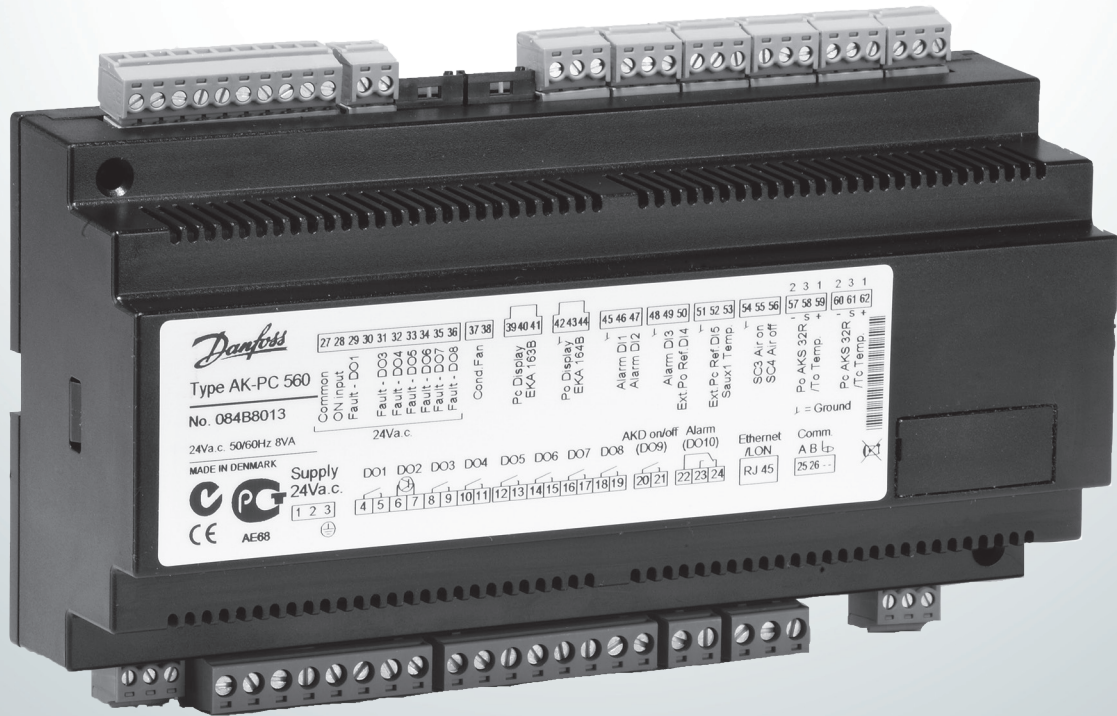**User Guide**

Capacity controller
for digital scroll
AK-PC 560

ADAP-KOOL® Refrigeration control systems

Introduction

Application
The controller is used for capacity regulation of compressors or condensers in small refrigerating systems.

Two outputs are dedicated to a digital scroll compressor. The other compressors and condensers can be connected, as required.

If more outputs than the 8 on the controller are required, extra ones can be connected via an external relay module.

Advantages
• Digital scroll compressor control
• Sequential or cyclic operation
• Possibility of suction pressure optimization 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.
• Pressure regulation P0
• Pressure regulation Pc
• Pressure regulation with variable reference (Sc3)

Functions
• Pulse width modulated signal for controlling a digital scroll compressor
• 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
• Temperature monitoring of the digital scroll compressor
• 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 digital scroll and two other 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. seven for compressors and max. eight fans).

Compressors connections can be seen on page 11.
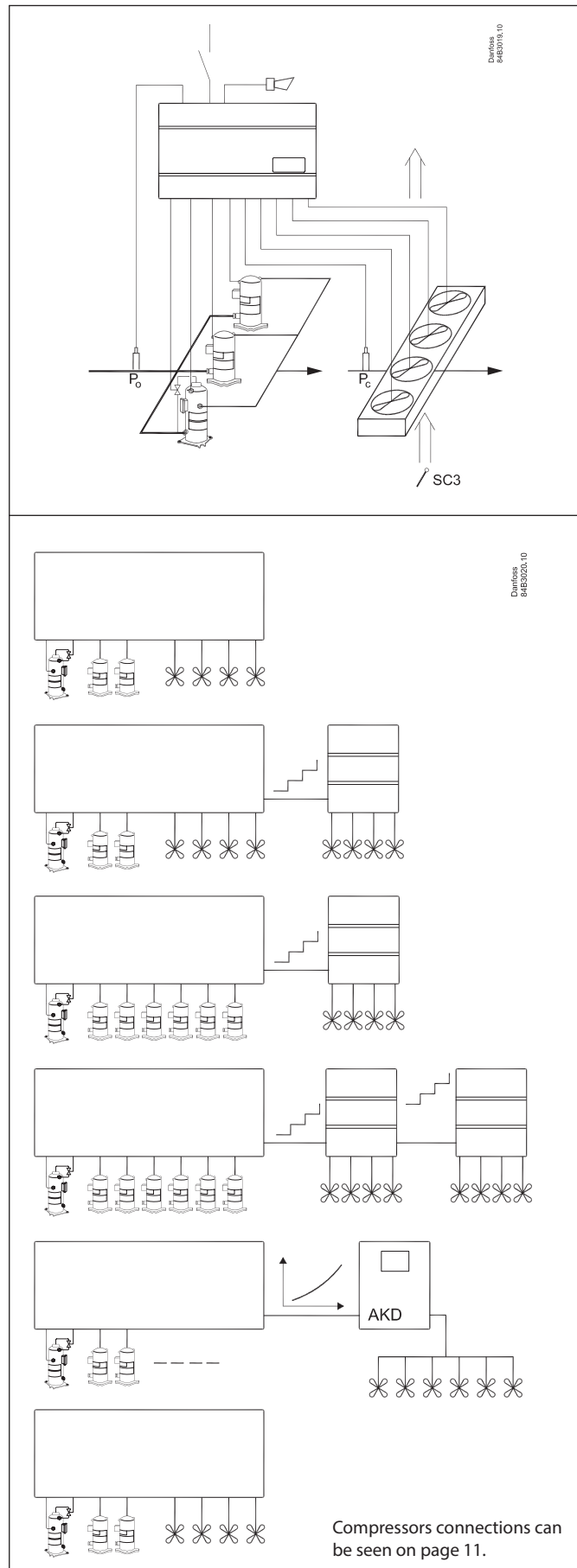
Function

Capacity regulation
The cut-in capacity is controlled by signals from the connected pressure transmitter and the set reference.
Outside the reference a neutral zone is set .
The digital scroll compressor controls the capacity in the neutral zone in order to maintain the pressure. When the digital scroll compressor can no longer maintain the pressure within the neutral zone, the controller will cut out or cut in the next compressor in the row.
When extra capacity is either cut out or cut in, the capacity from the digital scroll will be modified accordingly to maintain the pressure within the neutral zone.
- When the pressure is higher than the "reference + half neutral zone", cut-in of the next compressor (arrow up) is permitted.
- When the pressure is lower than the "reference - half neutral zone", cut-out of a compressor (arrow down) is permitted.
- When the pressure is within the neutral zone, the process continues with the compressors already cut in, and the digital scroll will modulate the capacity.
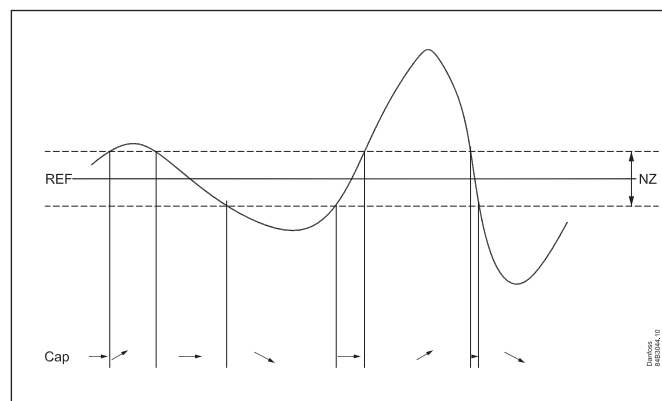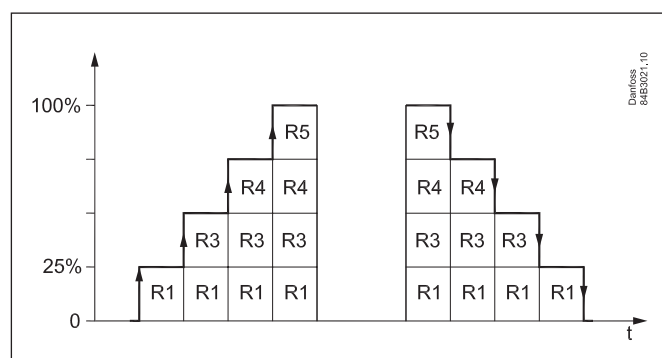
Cutin of steps can be defined for either sequential or cyclic.

Sequential (first in - last out)
The relays are here cut in in sequence – first relay number 1, then 3, etc.
Cutout takes place in the opposite sequence, i.e. the last cut-in relay will be cut out first.
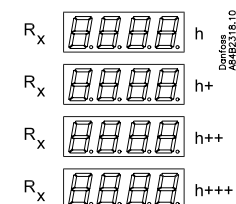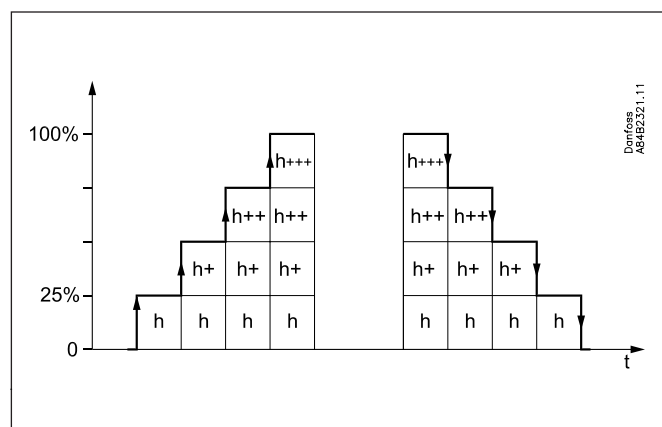
Cyclic (first in - first out)
The relays are coupled here so that the operating time of the individual relays will become equalised.
At each cutin the regulation scans the individual relays' timer, cutting in the relay with least time on it.
At each cutout a similar thing happens. Here the relay is cut out that has most hours on the timer.

Rx = random relay (3 - 8)
h = number of hours

Suvey of functions

The total function content is shown below – not all functions are present at the same time. The setting of o61 determines which functions are present.
The menu overview on page 14 shows the various functions and settings.

Function	Para-meter	Parameter by operation via data communication
Normal display		
If the two displays are mounted: P0 will be shown on EKA 165 (the one with buttons) Pc will be shown on EKA 163. Both readouts will be in temperature or in bar.		P0 °C or P0 b Pc °C or Pc b
Compressor regulation reference		**Compressor control**
P0 setpoint Regulation is based on the set value plus an offset, if applicable. An offset can be created from night setback r13 and/or from a system units override function.	r23	P0Set Point °C / P0Set Point b
Offset The set reference may be displaced with a fixed value when a signal is received at the DI4 input or from the function "Night setback" (r27). (Cf. also Definition of DI4 input).	r13	Night offset
Night setback **OFF:** No change of the reference **ON:** Offset value forms part of the reference	r27	NightSetBack
Reference The regulation reference is shown here	r24	P0 ref. °C / P0 ref. b
Set point limitation With these settings the setpoint can only be set between the two values. (This also apply if regulation with displacements of the reference).		
Max. permissible set point value.	r25	P0RefMax °C / P0RefMax b
Min. permissible set point value.	r26	P0RefMin °C / P0RefMin b
Neutral zone There is a neutral zone around the reference. See also page 3.	r01	Neutral zone
Correction of pressure measurement An offset adjustment of the registered pressure can be made.	r04	AdjustP0Sens
Unit Here you can select whether the display is to indicate in SI units or US units. **0:** SI (°C / bar) **1:** US (°F / psig)	r05	Unit (In AKM only SI (bar and °C) is used, whatever the setting)
Start/stop of refrigeration With this setting the refrigeration can be started and stopped. Start/stop of refrigeration may also be performed with an external contact function connected to the input named "ON input". (The input **must** be wired).	r12	Main Switch
Condenser regulation reference		**Condenser control**
Pc set point Regulation is based on the set value plus an offset, if applicable. An offset can be created via the "r34" function and/or from a system units override function.	r28	PcSet Point °C / PcSet Point b
Offset The set reference may be displaced with a fixed value when a signal is received at the DI5 input. (Cf. also Definition of DI5 input).	r34	PcRefOffset
Pc reference variation. See also page 22 Regulation with setting 1 (or 2 if the reference is to vary with the outdoor temperature) will give the best regulation if the system is in balance. But if a lot of condenser steps are cut in and out and the compressor capacity often becomes low, it will be necessary to select setting 3 instead (or 4, if there is regulation with the outdoor temperature). (Settings 3 and 4 will generally be preferable if a Pc-offset at max. compressor capacity can be accepted). **1:** No change of the reference. Regulation based on set set point. And offset with the DI5 function is allowed. **2:** Outdoor temperature forms part of the reference. The outdoor temperature is measured with Sc3. When the outdoor temperature drops one degree, the reference is lowered one degree. Here is offset with the DI5 function not allowed. At DI5 signal the reference will change to the set set point. Setting 1 and 2 operate with a PI regulation, but if the system is unstable and the PI regulation not satisfactory the I element may be left out, so that the controller will be with P regulation only. **3:** As 1, but with P regulation (xp-band) **4:** As 2, but with P regulation (xp-band)	r33	Pc mode
Condenser reference The regulation reference is shown here.	r29	Pc ref. °C / Pc ref. b

Setting	Code	Config
Set point limitation With these settings the set point can only be set between the two values. (This also applies to regulations where the Xp band lies above the reference).		
Max. permissible set point value.	r30	PcRefMax °C / PcRefMax b
Min. permissible set point value.	r31	PcRefMin °C / PcRefMin b
Correction of pressure measurement An offset adjustment of the registered pressure can be made.	r32	AdjustPcSens
Dimensioning temperature Dim tm The mean temperature difference across the condenser at maximum load (tm difference at max. load). This is the temperature difference between the air and condensing temperature.	r35	Dim tm K
Dimensioning temperature Min tm The mean temperature difference across the condenser at the lowest relevant compressor capacity (tm difference at min. load). This is the temperature difference between the air and condensing temperature.	r56	Min tm K
Compressor capacity		**Compressor pack config.**
Running time To prevent frequent start/stop, values have to be set for how the relays are to cut in and out.		
Min. ON time for relays.	c01	Min.ON time
Min. time period between cutin of same relay.	c07	Recycle time
Pump down limit The factory setting for this function is OFF. Activate by setting a value corresponding to pressure under the regulation area and over the P0 min. limit. The function keeps the last capacity step going until the pressure comes down to the pump down limit. When this value is reached the last compressor will cut out. Do not reconnect capacity until the pressure is once more above the neutral zone.	c33	PumpDownLim.
Compressor configuration Here you set the of number of compressors **1=** One compressor, **2** = two compressors **3**=3, **4**=4, **5**=5, **6**=6, **7**=7. See survey on page 11	c16	Compr mode
Selection of coupling mode (See also the overview page 11) **1.** S. Sequential: First relay 1 cuts in, then relay 3, etc. Cutout takes place in the opposite sequence. ("First in, last out"). **2.** Cyclic: An automatic operating time equalisation is arranged between the remaining compressors.	c08	Step mode
Manual control of compressor capacity This sets the capacity that is to be cut when switching to manual control. (c01 and c07 will still apply)	c31	CmpManCap%
Manual control Manual control of the compressor capacity is enabled here. When set to ON, the capacity that is set in "c31" is cut in.	c32	CmpManCap
Time delay for incorrect cut-out Applies to compressor 1	c77	C1 fault del
Time delay for incorrect cut-out Applies to the other compressors	c78	Cx fault del
Pulse width period for the capacity modulation The digital scroll compressor's by-pass valve can be turned on and off during this period, but only one sequence. This is where you set how often the by-pass valve is to be activated	c79	DS PWM per
Max. capacity in the pulse width period It is possible to limit the capacity for the period here. If the setting is 100%, then there is no limit.	c80	PWM Max cap
Min. capacity in the pulse width period A minimum capacity for the period must be set here. Without this minimum capacity the compressor will not be cooled.	c81	PWM Min cap
Kp factor For PI regulation of the digital scroll	c82	DS Kp
Tn factor For PI regulation of the digital scroll	c83	DS Tn
Compressor conditions This is where the size of the digital compressor's capacity is set in relation to the capacity of one of the other compressors. Setting range = 100 to 200%.	c84	DS Size
		- - - Comp. Cap % Read cut-in compressor capacity

		Actuel zone state: 0=off. 2=-zone. 3=Neutral zone. 4=+zone.
Condenser capacity		
Definition of condenser and number of fans Here you set the number of fan steps with which regulation has to be carried out (but max. eight). **1-8:** All fans are cut in and out with relays. The first vacant relay number is assigned to fan 1, the next to number 2, etc. Steps after DO8 must be executed through connection of a relay module type EKC 331 to the analog output. Cf. drawing on page 12. **9:** All fans controlled via the analog output and a frequency converter. **10:** Not used **11-18:** Total number of fan relays (as 1-8), but here the starting sequence is altered after each time all fans are stopped.	c29	Fan mode
Read temperature at sensor Sc3	u44	Sc3 temp
Read temperature at sensor Sc4 (sensor is only used for monitoring)	u45	Sc4 temp
	-	- - - Fan Cap % Read cut-in condenser capacity
Regulation parameters for the condenser regulation		
Proportional band xp (P = 100/Xp) If the Xp value is increased, the regulation becomes steadier	n04	Xp K / Xp b
I: Integration time Tn If the Tn value is increased, the regulation becomes steadier	n05	Tn s
Manual control of condenser capacity This sets the capacity that is to be cut in when switching to manual control.	n52	FanManCap%
Manual control Manual control of the condenser capacity is enabled here. When set to ON, the capacity that is specified in "n52" is cut in.	n53	FanManCap
Speed control start value Speed control will only be activated when the capacity requirement reaches this value.	n54	StartSpeed
Speed control stop value Speed control will be stopped when the capacity requirement falls below this value.	n55	MinSpeed
Alarm		**Alarm settings**
The controller can give alarm in different situations. When there is an alarm the light-emitting diodes (LED) will flash on the display and the alarm relay will cut in. (In AK-PC 560 the alarm relay may be used for a fan, if required).		
P0 min. (Alarm and safety function, see also page 20.) Here you set when the alarm at too low suction pressure is to enter into effect. The value is set as an absolute value.	A11	Min. P0.°C / Min. P0. b
Alarm delay P0 alarm The time delay is set in minutes. At min. setting the alarm is cancelled.	A44	P0AlrmDelay
Pc max. (Alarm and safety function, see also page 20.) Here you set when the alarm at too high condensing pressure is to enter into effect. The value is set as an absolute value.	A30	Max. Pc.°C / Max. Pc. b
Alarm delay Pc alarm The time delay is set in minutes. At min. setting the alarm is cancelled.	A45	PcAlrmDelay
Alarm delay DI1 (an interrupted input will give alarm). The time delay is set in minutes. At max. setting the alarm is cancelled.	A27	DI1AlrmDelay
Alarm delay DI2 (an interrupted input will give alarm). The time delay is set in minutes. At max. setting the alarm is cancelled.	A28	DI2AlrmDelay
Alarm delay DI3 (an interrupted input will give alarm). The time delay is set in minutes. At max. setting the alarm is cancelled.	A29	DI3AlrmDelay
Alarm limit for high temperature of the "Saux1" sensor If an alarm is generated the digital scroll stops. With setting = Off the alarm has been opted out.	A32	Saux Al Lim
Alarm delay from "Saux1" (A32) If the limit value is exceeded, a timer function will commence. The alarm will not become active until the set time delay has been passed. The time delay is set in minutes.	A03	Alarm delay
Give the top button a brief push to zeroset the alarm and to have the message shown on the display.		Reset alarm The function zerosets all alarms when set in pos. ON.

			With data communication the importance of the individual alarms can be defined. Setting is carried out in the "**Alarm destinations**" menu.

Miscellaneous			Miscellaneous
Choice of application The controller can be configured in two ways. The functions for the two applications can be viewed on page 14. *This menu must be set as the first of all menus, as it enables the associated settings to be set.* 1. Show temperature 2: Show pressure		o61	This setting cannot be made via data communication. It must be set directly on the controller.
Sensor type This is where you set which temperature sensor is connected to the Saux input. The sensor measures the discharge gas temperature in the digital scroll compressor. 1: Built-in NTC sensor in the digital scroll. (A resistor must also be fitted here across terminals 51-53 in order for the reading to be registered correctly. The resistor enables the measuring range to be optimised between 80 and 140°C.) 2: Pt 1000 ohm sensor, e.g. AKS 21		o06	Sensor type
Display connection This is where you define the type of display that is connected to the controller Off: EKA 164 On: EKA 165. The extended display with LEDs.		o82	DisplaySel
Pressure transmitter's working range Depending on the pressure, a pressure transmitter with a given working range is used. This working range must be set in the controller (e.g.: -1 to 12 bar The values must be set in bar if display in °C has been selected. And in psig, if °F has been selected.			If the values are to be set from the AKM programme, they must be set in bar.
P0-Min. value		o20	P0MinTrsPres
P0-Max. value		o21	P0MaxTrsPres
Pc-Min. value		o47	PcMinTrsPres
Pc-Max. value		o48	PcMaxTrsPres
Use of DI1 input The digital input can be connected to a contact function, and the contact can now be used for one of the following functions: Setting / function: **0**: DI input not used **1:** Fan alarm when contact cuts out. Alarm "A34" is given. **2:** Alarm function when the contact cuts out. Alarm "A28" is given. There is time delay for the alarm. Setting in "A27".		o78	DI1 control
Use of DI4 input The digital input can be connected to a contact function, and the contact can now be used for one of the following functions: Setting / function: **0**: DI input not used **1:** Regulation reference P0 displaced when contact is cut in **2:** Alarm function when the contact cuts out. Alarm "A31" is given. There is no time delay.		o22	DI4 control
Use of DI5 input The digital input can be connected to a contact function, and the contact can now be used for one of the following functions: Setting / function: **0**: DI input not used **1:** Regulation reference Pc displaced when contact is cut in **2:** Alarm function when the contact cuts out. Alarm "A32" is given. There is no time delay		o37	DI5 control
Operating hours The operating hours for the compressor relays can be read and set in the following menus. The read value is multiplied by 1000 to obtain the number of hours (f.ex. shows 2.1 for 2100 hours). On reaching 99.9 hours the counter stops and must now be reset to, say, 0. There will be no alarm or error message for counter overflow.			(In the AKM display the hour number has not been multiplied)
Value for relay number 1, 3 and 4		o23 o25 o26	DO1 run hour...... DO3 run hour DO4 run hour
Value for relay number 5 to 8		o50- o53	DO5 run hour ...... DO8 run hour

Refrigerant setting Before refrigeration is started, the refrigeration must be defined. You may choose between the following refrigerants: 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, 32=R413A. 33=R422D. 34=R427A. 35=R438A. 36=XP10. 37=R407F. Warning: Wrong selection of refrigerant may cause damage to the compressor. Other refrigerants: Select setting 13 here, and subsequently three factors have to be set – fac1, fac2 and fac3 – via AKM.	o30	Refrigerant
Manual control (stopped regulation only) From this menu the relays can be cut in and out manually. **0** gives no override, but a number between 1 and 10 will cut in a belonging relay. **1** will cut in relay number 1, **2** relay 2, etc. **11-18** will produce voltage on the analog output. In this way the relays on the external relay module can be activated. Setting **11** will give a voltage of 1.25 V, setting 12 will give 2.5 V, etc.	o18	Manual control
Frequency Set the net frequency.	o12	50 / 60 Hz (50=0, 60=1)
Address If the controller is built into a network with data communication, it must have an address, and the master gateway of the data communication must then know this address. These settings can only be made when a data communication module has been mounted in the controller and the installation of the data communication cable has been completed. This installation is mentioned in a separate document "RC8AC".		Following installation of a data communication module, the controller can be operated on a par with the other controllers in ADAP-KOOL® refrigeration controls.
The address is set between 1 and 240 (gateway determined)	o03	
The address is sent to the gateway when the menu is set in pos. ON	o04	
Access code If the settings in the controller are to be protected by a numerical code, you can set a numerical value between 0 and 100. If not, you can cancel the function with setting OFF.	o05	
Special settings Outputs DO9 and DO10 are normally used for the "AKD start/stop" function and for the alarm function, but they may be redefined in special cases.		
DO9 function: 0: AKD Start/stop 1: Inject-on function (see drawing below) 2: Boost ready function (see drawing below) 3: Fan relay	o75	DO9 function
DO10 function: 0: Alarm relay 1: Fan relay	o76	DO10 function
Status on the digital inputs The signal on the DI inputs can be read in the following menus:		
Status on DI 1	u10	DI 1 Status
Status on DI 2	u37	DI 2 Status
Status on DI 3	u87	DI 3 Status
Status on DI 4	u88	DI 4 Status
Status on DI 5	u89	DI 5 Status
Temperature read outs		
Read temperature at sensor Saux (discharge gas temperature)	u03	Saux temp
Read temperature at sensor "Sc3"" (outdoor temperature)	u44	Sc3 temp
Read temperature at sensor "Sc4"	u45	Sc4 temp
Capacity from the digital scroll		
Read off the control capacity in % on the digital scroll	U28	DS PWM cap

Configuration settings (compressor and fan definitions, coupling mode and refrigerant) can <u>only</u> take place when regulation is stopped.

Warning ! Direct start of compressors *
To prevent compressor breakdown parameter c01 and c07 should be set according to suppliers requirements or in general :
Hermetic Compressors c07 min. 5 minutes
Semihermetic Compressors c07 min. 8 minutes and c01 min. 2 to 5 minutes (Motor from 5 to 15 KW)
*) Direct activating of solenoid valves does not require settings different from factory (0)

DO9 function:

Inject-on function
DO9 is here used for the Inject ON function. Here all the electronic expansion valves are closed when all the compressors are **stopped and P0 > +Zone.**
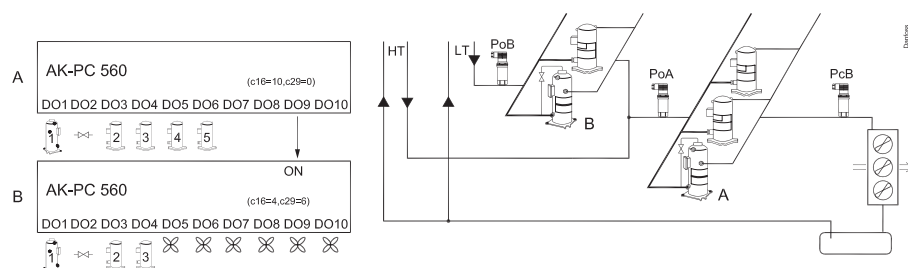Wiring is carried out as shown below.
The function may however also be generated via data communication. In this way the relay output is made available for other applications.
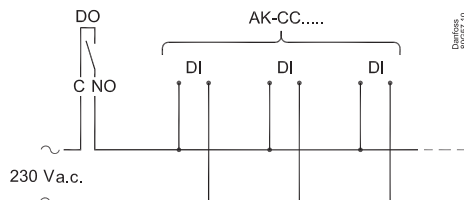
Boost ready function
If two controllers are to capacity regulate the high-temperature part and the low-temperature part, respectively, they must be connected in such a way that low-temperature regulation cannot be started until the high-temperature part is operating. The signal can be taken from DO9 of one controller and received on the ON input of the other controller.
Example:

Operating status	
The controller goes through some regulating situations where it is just waiting for the next point of the regulation. To make these "why is nothing happening" situations visible, you can see an operating status on the display. Push briefly (1s) the upper button. If there is a status code, it will be shown on the display. The individual status codes have the following meanings	EKC state
S0: Regulation	0
S2: When the relay is operated, it must be activated for min. x minutes (cf. c01)	2
S5: Renewed cutin of the same relay must not take place more often than every x minutes (cf. c07)	5
S10: Regulation stopped with the internal og external start/stop	10
S25: Manual regulation of outputs	25
S34: Safety cutout. Setting A30 is exceeded	34
Alarm messages	**Alarms "Destinations"**
A2: Low P0	A02 Low P0 alarm
A11: No refrigerant has been selected (cf. o30)	A11 No RFG Sel
A17: High Pc	A17 Hi Pc alarm
A19 ..... A25: Compr. fault. Interrupted signal on actual input (terminal 29-36)	A19 ...... A25 Comp._fault
A27: High temperature alarm from sensor "Saux". The digital scroll is stopped.	A27 Saux high
A28 ..... A32: External alarm. Interrupted signal on input "DI1" /2/3/4/5	A28 ...... A32 DI_ Alarm
A34: Fan alarm. There is no signal on DI1 input	A34 Fan fault
A45: Regulation stopped with setting or with external switch	A45 Stand by
E1: Error in the controller	E1 Ctrl. fault
E2: Control signal outside the range (short-circuited/interrupted) At water cooler management without frost protection may alarm from a not mounted P0 input suppressed by connecting the signal from the PC (terminal 61) to P0 (terminal 58).	E2 Out of range

Compressor configuration when o61 =1 or 2 (This is where you can choose between the options shown.)
Setting "c16" will define the configuration.
Setting "c08" will define coupling mode.

Compressor connections								Coupling mode	
Relay no.								Set "c16" to	Set "c08" to
1	2	3	4	5	6	7	8		
1								1	-
1		2						2	-
1		2	3					3	1 / 2
1		2	3	4				4	1 / 2
1		2	3	4	5			5	1 / 2
1		2	3	4	5	6		6	1 / 2
1		2	3	4	5	6	7	7	1 / 2

Capacity step
All capacity steps are presumed to be identical.

Coupling mode
Coupling mode 1 = *sequential* operation.
   Compressor 1 will be the first to start. Then compressor 2 and so on.
Coupling mode 2 = *cyclic* operation.
   Compressor 1 will always be in operation when cooling is required. After this the compressor with the lowest number of operating hours will be started.

The capacity from the digital scroll compressor

The capacity is divided into period times as "PWM per". 100% capacity is delivered when cooling takes place for the whole period.
An off time is required by the by-pass valve within the period and an on time is also permitted. There is "no cooling" when the valve is on.
The controller itself calculates the capacity needed and will then vary it according to the cut-in time of the by-pass valve.
A limit is introduced if low capacity is needed so that the cooling does not go below 10%. This is because the compressor can cool itself. This value can be increased if necessary.
The capacity can similarly be limited so that the compressor cannot deliver 100% capacity. It is not normally necessary to limit this max. capacity.
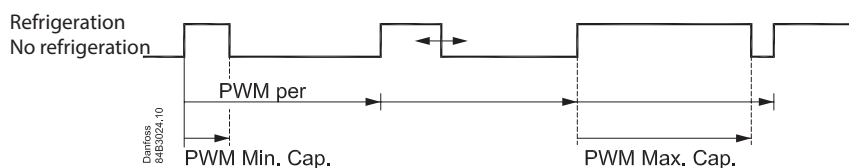
Condenser couplings

When the compressor relays have been established the turn comes to the fan relays.
The first vacant relay (DO3-DO8) will become the first fan relay. It will be followed by the subsequent relays. If more relays are required than the vacant DO relays, a relay module can be connected to the analog output. The function is, as follows:
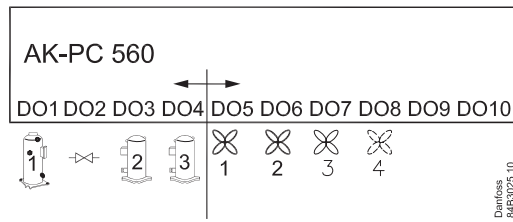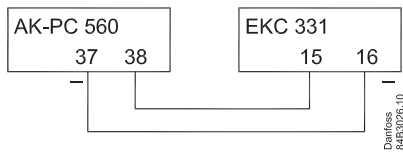

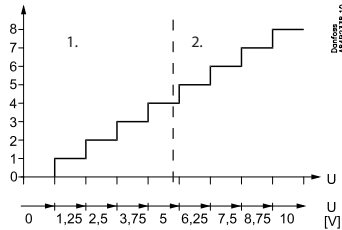If there are up to four external fans on an EKC 331:
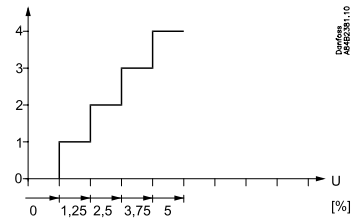
Output signal from AK-PC 560
In EKC 331 the voltage range must be set to 0-5 V ("o10" = 6).
In EKC 331 the number of steps must be set to 4 ("o19" = 4) (also when fewer fans are connected).
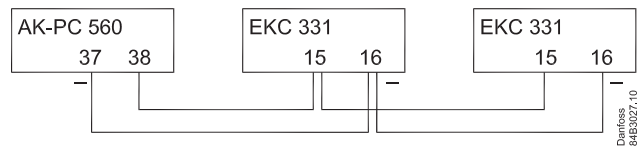
If there are more than four external fans on two EKC 331 units:

Output signal from AK-PC 560
In the first EKC 331, set 0-5 V ("o10" = 6).
In the second EKC 331, set 5-10 V ("o10" = 7).
In both EKC's the number of steps must be set to 4 ("o19" = 4) (also when fewer fans are connected to the second EKC).

Connection

Connection

Alternating start-up of fans (only if c29 is 11 to 18)
The fans can be defined to start alternately when they have all been stopped.
The first time regulation is started, fan 1 will be started first – the regulation determines whether additional fans will be started.
After the next time all fans are stopped, fan 2 will be the first to be started, and so on.
Fan 1 will again be the first fan to be started when the rotation has been through the total number of fans.
If there is more than one fan on an EKC 331, it will not be possible to start the other fans first. Here, the fan with the lowest voltage step will **always** be the one which is started first.
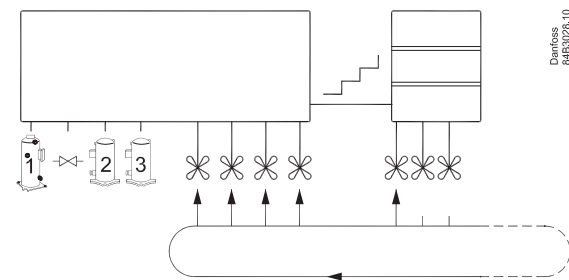
If the entire condenser capacity is to be controlled by a frequency converter, AK-PC 560 must send an analog signal about the required capacity ("c29" = 9).
The signal varies from 0 to 10 V. Signal and capacity have the following context.
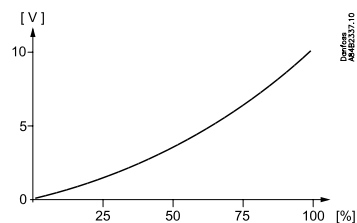
Operation

Data communication
If the controller is extended with data communication, the operation can be performed from a system unit. The parameter names for the functions can be viewed in the right-hand column on pages 4–10.

The importance of the alarms that are sent can be defined with the setting: 1 (High), 2 (Medium), 3 (Low) or 0 (No alarm).

Operation via external display
The values will be shown with three digits, and with a setting you can determine whether the pressures are to be shown in SI units (°C / bar) or US units (°F / psig.).
There are three options for the display.

P0 is over the neutral zone
P0 is under the neutral zone

1: Relay digital scroll
2: Relay comp. 2
3: Relay comp. 3
.
.
.
10: Capacity form the digital scroll

EKA 165

EKA 163

EKA 164

EKA 165
To operate the controller and view the evaporation pressure.
If the lowermost key is pressed, the condensation pressure will be shown briefly in the display. (If regulation is based only on the condensation pressure, the display will always show Pc).

During normal operation the light-emitting diodes in the display will indicate where regulation is taking place.
Second highest : Over neutral zone
"None" : Neutral zone
Second lowest : Under neutral zone

The other LEDs on the display will show the functions that are active:
• Relays for compressors
• The capacity can be read from the digital scroll compressor
• Relays for fans
• Input signals for the digital inputs
• The optimization LED will light up when the reference is 2 K or more over the set point.

EKA 163
If the condensation pressure is to be shown constantly, a display without operating keys can be connected.

EKA 164
To operate the controller and view the evaporation pressure.
If the lowermost key is pressed, the condensation pressure will be shown briefly in the display.
Like the EKA 165, the LEDs in the display will show where the regulation is located.

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

Or short:
1. Push the upper button (long push) until a parameter is shown
2. Push one of the buttons and find the parameter you want to change
3. Push the middle button until the setting value is shown
4. Push one of the buttons and select the new value
5. Push the middle button again to conclude the setting

(A brief pushing will show the active alarm codes. See page 17.)

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, c08, c16, c29, o06, o30, o75, o76 **and finally r12=1**.

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

SW: 1.0x

Function	Para-meter	o61 = 1	2	Min.	Max.	Factory setting
Normal display						
Shows P0 in EKA 165 (display with buttons)	-	°C	P		°C / bar	
Shows Pc in EKA 163	-	°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 view; SI or US. 0=SI (bar /°C), 1=US (Psig /°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 set point 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 reference 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 set point for Pc	r28			-25°C / 0.0 bar	75°C / 110.0 bar	35°C / 15.0 bar
Shows total Pc reference	r29				°C / bar	
Limitation: Pc reference max. value	r30			-99.9°C / -0.0 bar	99.9°C/ 130.0bar	55.0°C / 60.0 bar
Limitation: Pc reference 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
Capacity						
Min. ON time for relays	c01			0 min	30 min.	0
Min. time period between cutins of same relay	c07			2 min.	60 min	2
Definition of regulation mode 1: Sequential (step mode / FILO) 2: Cyclic (step mode / FIFO)	c08			1	2	1
Definition of compressor connections. See options on page 11.	c16			1	7	1
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 (0)	ON (1)	OFF (0)

Fortsættes

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
Time delay for incorrect cut-out, compressor 1	c77			0 s	240 s	60 s
Time delay for incorrect cut-out, compressor x; x=2, 3 and so on.	c78			0 s	240 s	60 s
Pulse width period for the digital scroll modulation	c79			10 s	30 s	20 s
Max. capacity in the pulse width period	c80			50 %	100 %	100 %
Min. capacity in the pulse width period	c81			10 %	50 %	10 %
Kp factor for PI regulation of the digital scroll	c82			2	20	5
Tn factor for PI regulation of the digital scroll	c83			40 s	300 s	50 s
The digital scroll's capacity compared to one of the other compressors	c84			100%	200%	100%
Proportional 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 (0)	ON (1)	OFF (0)
Start speed The voltage for the speed regulation is kept at 0V 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 0V 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)	480 min.	OFF
Delay time for a DI2 alarm	A28			0 min. (-1=OFF)	480 min.	OFF
Delay time for a DI3 alarm	A29			0 min. (-1=OFF)	480 min.	OFF
Upper alarm and safety limit for Pc	A30			-10 °C / 0.0 bar	200°C/200 bar	60.0°C / 60.0 bar
Upper alarm limit for sensor "Saux1" If a higher value is measured then the digital scroll stops.	A32			1°C (0=OFF)	150°C	130°C
Delay time for a P0 alarm	A44			0 min. (-1=OFF)	480 min.	0 min.
Delay time for a Pc alarm	A45			0 min. (-1=OFF)	480 min.	0 min.
Miscellaneous						
Controllers address	o03*			1	240	
On/off switch (service-pin message)	o04*			-	-	
Access code	o05			1 (0=OFF)	100	OFF
Used sensor type for Saux **1**=Internal Copeland NTC. (A fixed resistor must also be fitted.) **2**=Pt 1000	o06			1	2	1
Set supply voltage frequency	o12			50 Hz (0)	60 H (1)	50Hz (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
P0 pressure transmitter's working range - min. value	o20			-1 bar	5 bar	-1.0
P0 pressure transmitter's working range - max. value	o21			6 bar	199 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 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. 32=R413A. 33=R422D. 34=R427A. 35=R438A. 36=XP10. 37=R407F	o30			0	37	0
Use of DI5-input **0**=not used. **1**=Pc displacement. **2**=alarm function. Alarm="A32"	o37			0	2	0
Pc pressure transmitter's working range - min. value	o47			-1 bar	5 bar	-1.0
Pc pressure transmitter's working range - max. value	o48			6 bar	199 bar	34.0
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

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

Operating hours of relay 8 (value time 1000)	o53			0.0 h	99.9 h	0.0
Selection of application 1. Show temperature and "c16" mode 2: Show pressure and "c16" mode	o61	1	2	1	2	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
Display connection Off: EKA 164 On: EKA 165 (extended display with light-emitting diodes)	o82			Off	On	Off
Service						
Temperature at Saux (discharge gas temperature)	u03					
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					
Read regulation capacity in % of the digital scroll	U28					

The controller can give the following messages		
E1	**Error message**	Fault in controller
E2		Regulation is outside the range, or the control signal is defective
A2	**Alarm message**	Low P0
A11		Refrigerant not selected
A17		High Pc
A19		Compressor 1 error (29)
A20		Compressor 2 error (31)
A21		Compressor 3 error (32)
A22		Compressor 4 error (33)
A23		Compressor 5 error (34)
A24		Compressor 6 error (35)
A25		Compressor 7 error (36)
A27		Saux discharge gas temperature to high . Digital scroll is stopped
A28		DI 1 alarm. Terminal 46 interrupted
A29		DI 2 alarm. Terminal 47 interrupted
A30		DI 3 alarm. Terminal 49 interrupted
A31		DI 4 alarm. Terminal 50 interrupted
A32		DI 5 alarm. Terminal 52 interrupted
A34		Fan alarm. There is no signal on DI1 input
A45		Regulation stopped
S0	**Status message**	Regulation
S2		Wait for "c01"
S5		Wait for "c07"
S10		Refrigeration stopped by the internal or external start/stop function
S25		Manual control of outputs
S34		Safety cutout. Setting A30 is exceeded or all safety inputs (29-36) are open
PS	**Info**	Access code is required before you have access to the settings

Note spanning cells A19–A25: The actual compressors safety circuit is interrupted. That is to say the signal is missing on one of the terminals 29-36
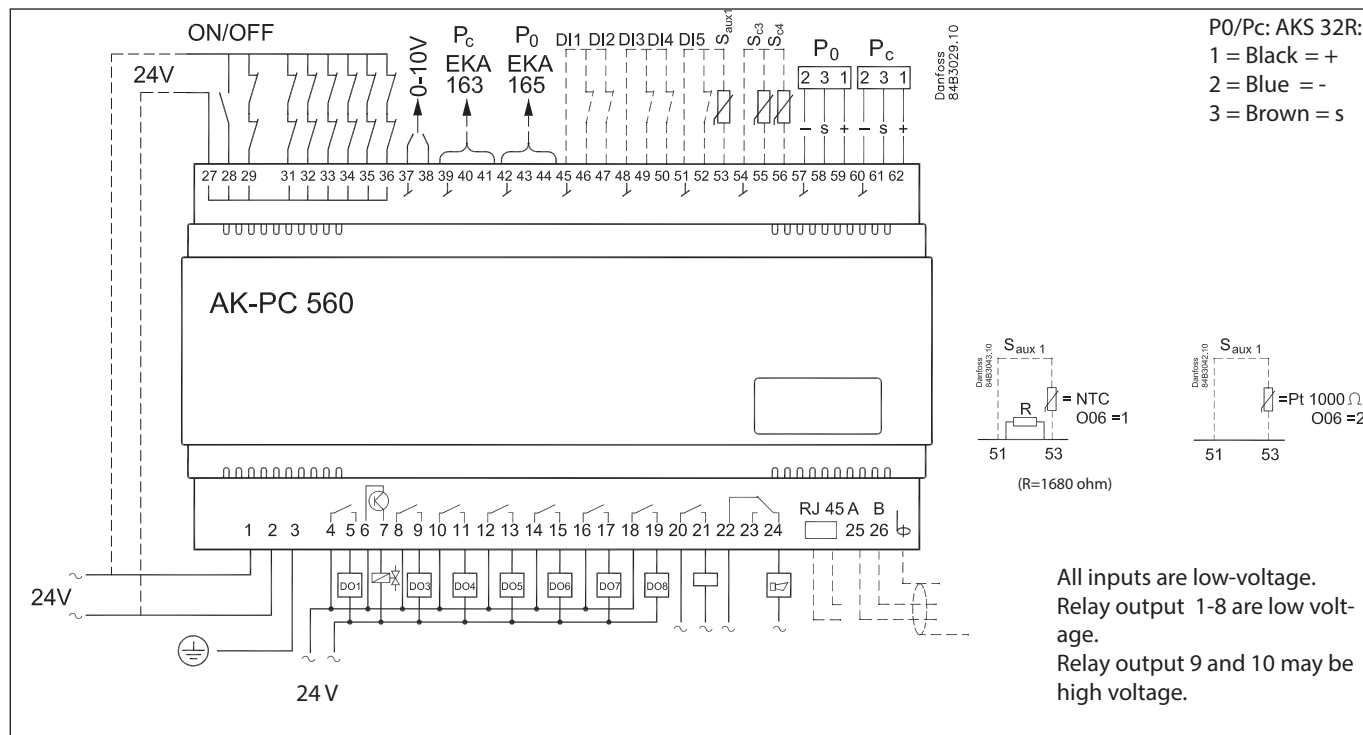
Messages can be brought up on the display by briefly pressing the uppermost key. If there is more than one alarm, they can be scrolled through

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

ON/OFF

24V

0-10V P_c EKA 163 P_0 EKA 165 DI1 DI2 DI3 DI4 DI5 S_aux1 S_c3 S_c4 P_0 2 3 1 P_c 2 3 1

Danfoss 84B3029.10

P0/Pc: AKS 32R:
1 = Black = +
2 = Blue = -
3 = Brown = s

27 28 29 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62

AK-PC 560

Danfoss 84B3043.10 S_aux 1 R = NTC O06 =1 51 53 (R=1680 ohm)

Danfoss 84B3042.10 S_aux 1 =Pt 1000 Ω O06 =2 51 53

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 RJ 45 A B 25 26

DO1 DO3 DO4 DO5 DO6 DO7 DO8

24V

24 V

All inputs are low-voltage.
Relay output 1-8 are low voltage.
Relay output 9 and 10 may be high voltage.

Necessary connections
Terminals:
1-2	Supply voltage 24 V a.c.
4-5	Relay outputs for digital scroll compressor
6-7	Solid state relay for digital scroll compressor's unloader
8- 19	Relay outputs for either compressors or fan motors
22-24	Alarm relay *

There is connection between 22 and 24 in alarm situations and when the controller is dead

27-28	24 V signal to start / stop of regulation
27-29	24 V signal from the safety circuit Digital scroll
30	No function
27-31	24 V signal from the safety circuit DO 3
27-32	24 V signal from the safety circuit DO 4
27-33	24 V signal from the safety circuit DO 5
27-34	24 V signal from the safety circuit DO 6
27-35	24 V signal from the safety circuit DO 7
27-36	24 V signal from the safety circuit DO 8
57-59	Suction pressure. Voltage signal from AKS 32R **
60-62	Condenser pressure. Voltage signal from AKS 32R **

Application dependent connections
20-21	AKD start/stop * The relay cutin when the frequency converter have to start.
37-38	Voltage signal to external condenser control (see settings page 12)
39-41	Possibility of connecting an external display type EKA 163 or display of Pc
42-44	Possibility of connecting an external display type EKA 163 for display of P0, or EKA 165 for operation and display of P0
45-46	DI1 - Contact function for alarm signal
45-47	DI2 - Contact function for alarm signal
48-49	DI3 - Contact function for alarm signal
48-50	DI4 - Contact function for displacement of the suction pressure reference or for alarm signal.
51-52	DI5 - Contact function for displacement of the condenser pressure reference or for alarm signal.
51-53	Separate sensor Saux. Discharge gas temperature. Sensor signal from Pt 1000 (AKS 21) or Copeland-NTC and with supplied resistor mounted.
54-55	Outdoor ambient temperature (Sc3). Sensor signal from Pt 1000, AKS 11 or AKS 21 (mounted if r33 = 2 or 4).
54-56	Air temperature at condenser outlet. Sensor signal from a Pt 1000, AKS 11 or AKS 21.

Data communication
25-26	Mount only, if a data communication module has been fitted. For ethernet communication the plug connection RJ45 must be used. (LON FTT10 can also be connected in this way.) It is important that the installation of the data communication cable be done correctly. Cf. separate literature No. RC8AC.

*)
Relays DO9 and DO10 may in special cases be reconfigured so that they can be used as fan relays. See also page 8.

**)
If the controller has to control only the compressor or the fans, respectively Pc and P0 sensor can be dispensed

Data

Supply voltage	24 V a.c. +/-15% 50/60 Hz, 5 VA
Input signal	2 pcs. Pressure transmitters type AKS 32R
	3 pcs. temperature sensor input for Pt 1000 ohm/0°C (With NTC and a fixed resistor on Saux, the measuring range becomes 80-140°C.)
Digitale input from contact function.	1 pcs. for Start/stop of regulation
	7 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	7 pcs. SPST
AKD start/stop relæ	1 pcs. SPST
	AC-1: 3 A (ohmic) AC-15: 2 A (inductive) DO1 - DO8 are low voltage
Digital output for scroll unloader	Solid State
	24 V a.c. Imax. = 500mA Imin. = 70 mA. Leak <4mA
Alarm relay	1 pcs. SPDT
	AC-1: 6 A (ohmic) AC-15: 3 (inductive)
Voltage output	0-10 V d.c. Max. 5 mA, Ri min. 2.2 kohm
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

Pressure transmitter / temperature sensor
Please refer to catalogue RK0YG...

Capacitive load
The relays cannot be used for the direct connection of capacitive loads such as LEDs and on/off control of EC motors.
All loads with a switch mode power supply must be connected with a suitable contactor or similar.

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

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

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

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

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

Ordering

| Type	Function	Code no.
AK-PC 560	Capacity controller for digital scroll	**084B8013**
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, RS 485	**084B8579**
EKA 178B	Data communication module, MOD-bus	**084B8571**
EKA 174	Data communication module, LON RS 485, with galvanic separation (recommended when output 0-10 V is used)	**084B7124**

Dimensions

AK-PC 560

Only for front mounting (IP 40)
Only connection via plugs
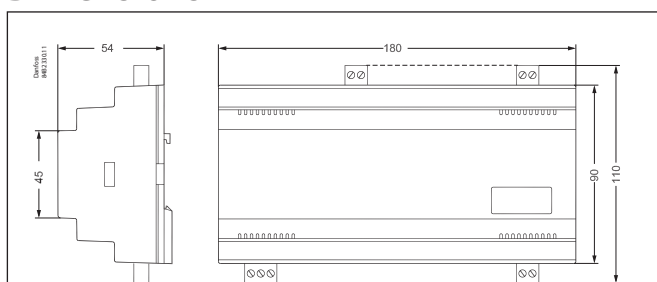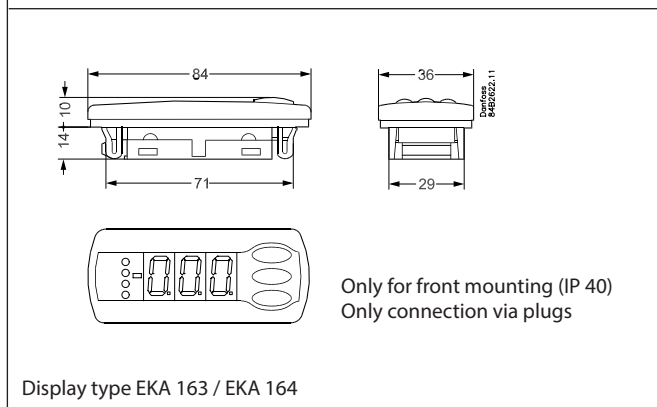
Display type EKA 163 / EKA 164
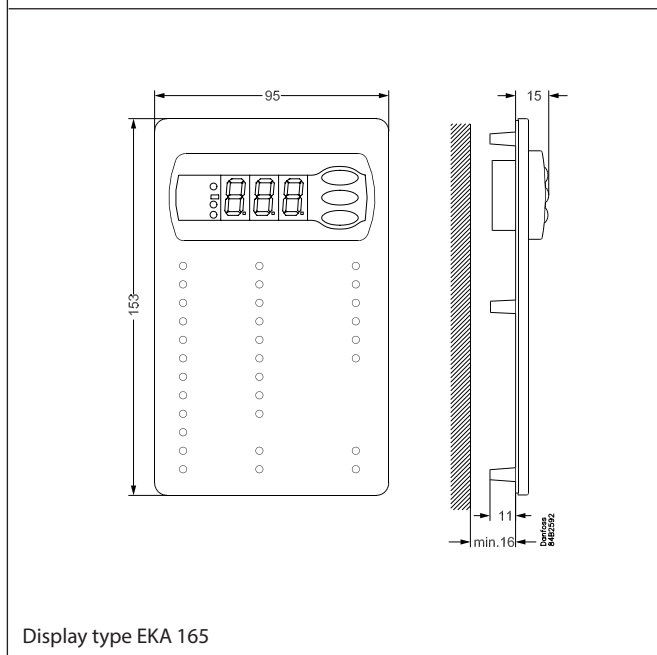
Display type EKA 165

Safety function

Criterion	Compressor control	Condenser control
P0 < P0 min (A11)	0% capacity. (Min ON time (c01) overridden)	No change
P0 signal failure (P0 reading < 5%)	Calculated average capacity	No change.
Pc > Pc max. minus 3 K (The "HP" LED on EKA 165 lights up)	The capacity changes to 2/3 of the actual capacity. After 30 seconds it changes to half capacity. After a further 30 seconds there is a full cut-out.	100% capacity
Pc > Pc max. (A30)	0% capacity	100% capacity
Pc signal failure (Pc reading < 5%)	No change	100% capacity
Sc3 signal failure (Variable reference (r33) is set to 2 or 4)	No change	The variable part is omitted. Reference (r29) = Setting (r28)
Saux > Saux Al Lim.	Compressor cut out	No changes

Exercising fans
On the setting c29 = 1-8 the last fans will hardly be activated during the winter.
To ensure that the fans are 'exercised' a test will be carried out every 24 hours to check whether all relays have been in operation.
The relays that have not been used will now be activated for 30 seconds, but with a pause of one hour between individual relays.

Override

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

Function via data communication	Functions to be used in the system units override function	Selection of parameter in AK-PC 560 084B8013 Sw. 1.0x
Stop of injection when the compressor is stopped	Forced Close / Injection ON / AKC ON	- - - MC Inject ON
Night setback	Day/night control and time schedule	r27 NightSetback
Suction pressure optimisation	P0 optimisation	Select controller address (The parameters are found automatically and do not become visible).
The system unit registers the refrigeration point which handles the largest capacity (requires the lowest suction pressure). The parameter may be logged for use in a service situation.		- - - MLC

Appendix

The regulation functions are explained in more detail below.

The PC reference

You may choose between four different regulation modes.
Basically 1 or 2 are recommended. But if the plant is unstable it may become necessary to change over to 3 or 4.
1. PI regulation. Fixed reference i.e. constant condensing pressure.
2. PI regulation. Floating reference with outdoor temperature i.e. variable condensing pressure.
3. As "1", but with P regulation. A somewhat higher condensing pressure than indicated by the reference must be accepted here.
4. As "2", but with P regulation. A somewhat higher condensing pressure than indicated by the reference must be accepted here.

To limit the variation in the reference, if floating reference is chosen (mode 2 & 4), two limit values will have to be set. A max. limit (r30) and a min. limit (r31). The total regulation reference (r29) will not be able to go beyond these limits.
As a safeguard against too high condenser temperature a Pc max. value (A30) also has to be set. If the temperature approaches this value a cutout of the compressor will be started.

The different regulation modes are as follows:

1. PI regulation with fixed reference
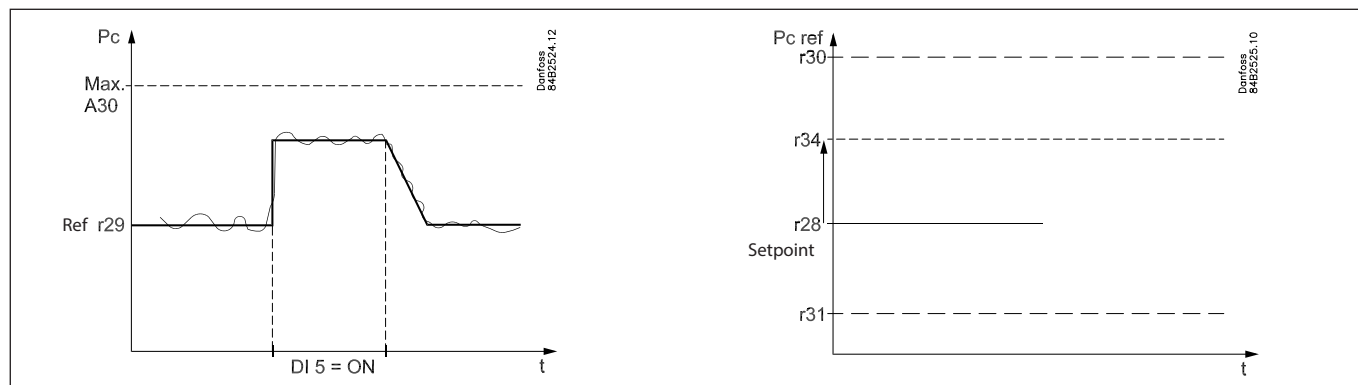
The reference at any time, on the basis of which the controller regulates, can be seen in "r29".
A reference (r28) is set here which with certainty can cope with all kinds of loads.

If you need to raise the condensing temperature for, say, heat recovery, an offset value (r34) has to be set.
The DI5 function must be defined to 1.
When a signal is subsequently received on the DI5 input the reference will be raised.

2. PI regulation with floating reference
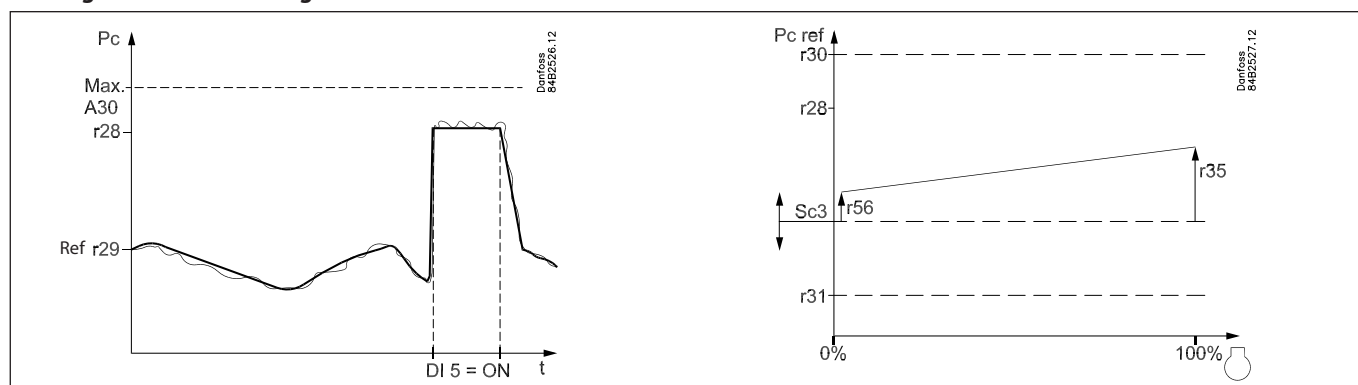
The reference follows the outdoor temperature Sc3. If the outdoor temperature drops one degree the reference will also drop one degree. The reference is adjusted according to the compressor capacity with max. Xp value.
If you need to raise the condensing temperature for, say, heat recovery, the setpoint (r28) must be set to this temperature.

The DI5 function must be defined to 1.
When a signal is subsequently received on the DI5 input the reference will be changed to the r28 setting.
The reference at any time, on the basis of which the controller regulates, can be seen in "r29".
If there is sensor failure on the outdoor temperature sensor the reference will change over to the r28 setting.
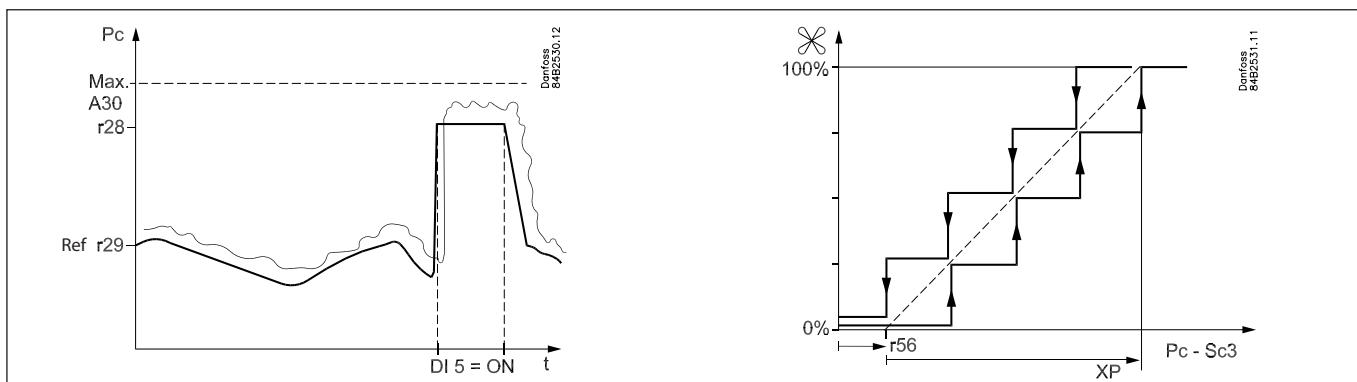
3. P regulation with fixed setting
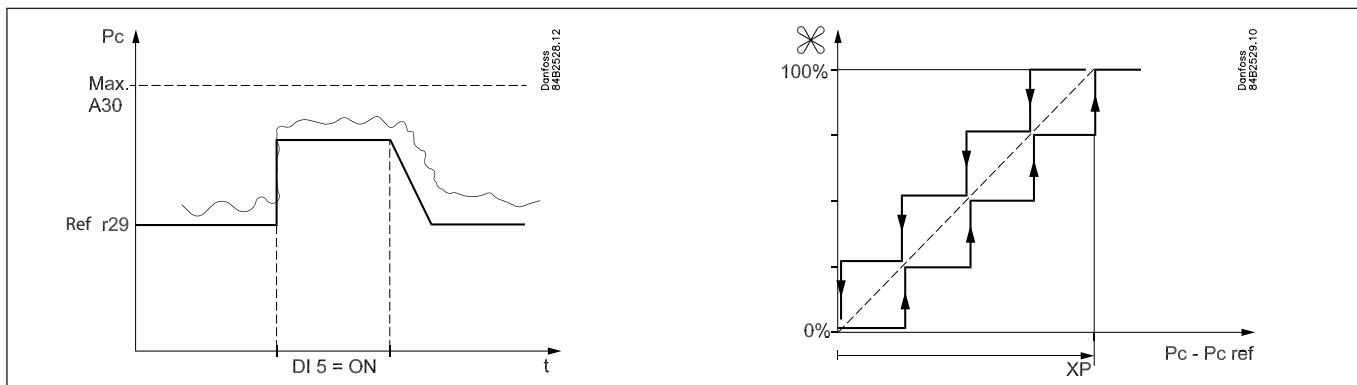
As "1", but an increasing deviation from the reference must be accepted as the controller uses the difference between the actual condenser temperature and the set reference for indicating the number of fans that has to be cut in.

The number of fan steps is divided up based on the Xp value.
Recommended setting for Xp is the ΔT of the condenser, typically 10 to 15 K.
The cutin and cutout of fans are shown in the drawing.
If the entire condenser capacity is controlled by speed regulation, the capacity will be indicated on the broken line.

4. P regulation with floating reference

As "2", but an increasing deviation from the reference must be accepted as the controller uses the difference between the actual condenser temperature and the actual outdoor temperature for indicating the number of fans that has to be cut in. (The first "r56-degrees" are left out, as there must be a possibility of cooling via the condenser).

The number of fan steps is divided up based on the Xp value.
Recommended setting for Xp is the ΔT of the condenser, typically 10 to 15 K.
The cutin and cutout of fans are shown in the drawing.
If the entire condenser capacity is controlled by speed regulation, the capacity will be indicated on the broken line.

Important settings for avoiding unwanted alarms

When r33 = 1 or 2:
Set Pc ref max. to at least 5 K under Pc max. (A30).

When r33 = 3 or 4:
Set Pc ref max. to at least (Xp value +5) K under Pc max. (A30).

List of literature

Installation guide for extended operation   RC8AC--
               Here you can see how a data communication connection to ADAP-KOOL® Refrigeration controls can be established.

ADAP-KOOL®