

ENGINEERING  
TOMORROW

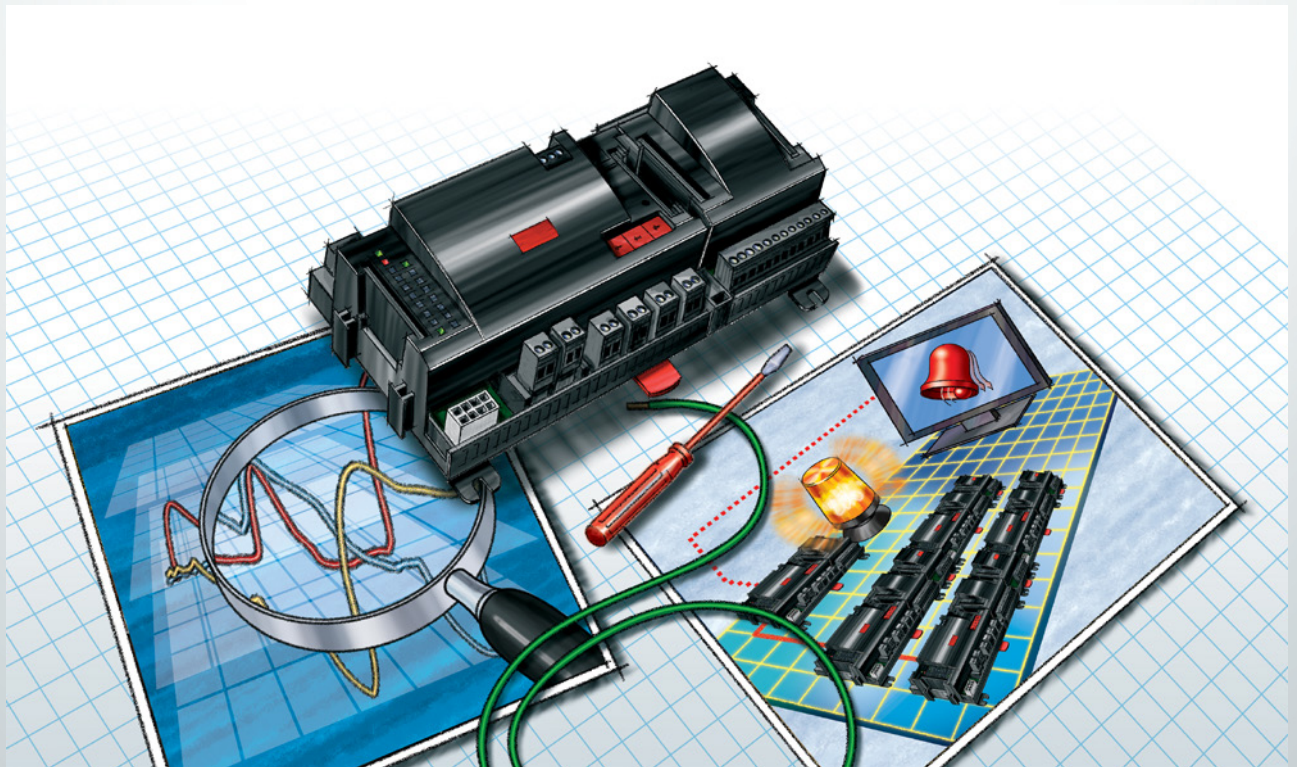
*Danfoss*

Design Guide

# Network control

## AK-SM 720

ADAP-KOOL® Refrigeration control systems



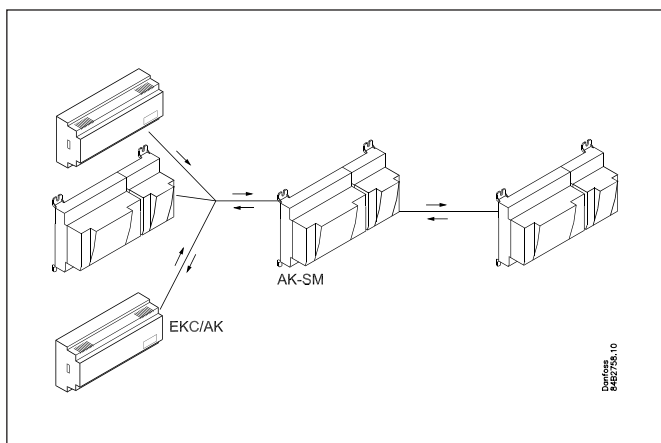
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# 1. Introduction

## Application

AK-SM 720 is a complete system manager to control data communication to ADAP-KOOL® Refrigeration Control Systems. The system unit makes it possible to transmit alarms and system functions to external receivers.



The main function of the system manager is to transmit alarms. It also contains the primary functions that the refrigeration system's controllers can use to sub-optimize the individual refrigeration sites.

To mention some of the various functions briefly:

- Alarm receiver
- Forward alarms
- Collect logs
- Schedules
- Defrost groups
- Light functions
- Energy-saving functions
- Design of Boolean functions

Local data communication can be:

- LON RS 485
- MODBUS
- DANBUSS (this does, however, also require a protocol interface type AK-PI 200. Literature no. RS8EX)
- There is a maximum of 200 controllers on the data communication.
- A maximum of 120 units of the EKC incl. SLV, where there must be a maximum of 15 different types and software versions.
- TCP/IP

External data communication can be:

- TCP/IP
- Modem

Operation must take place using:

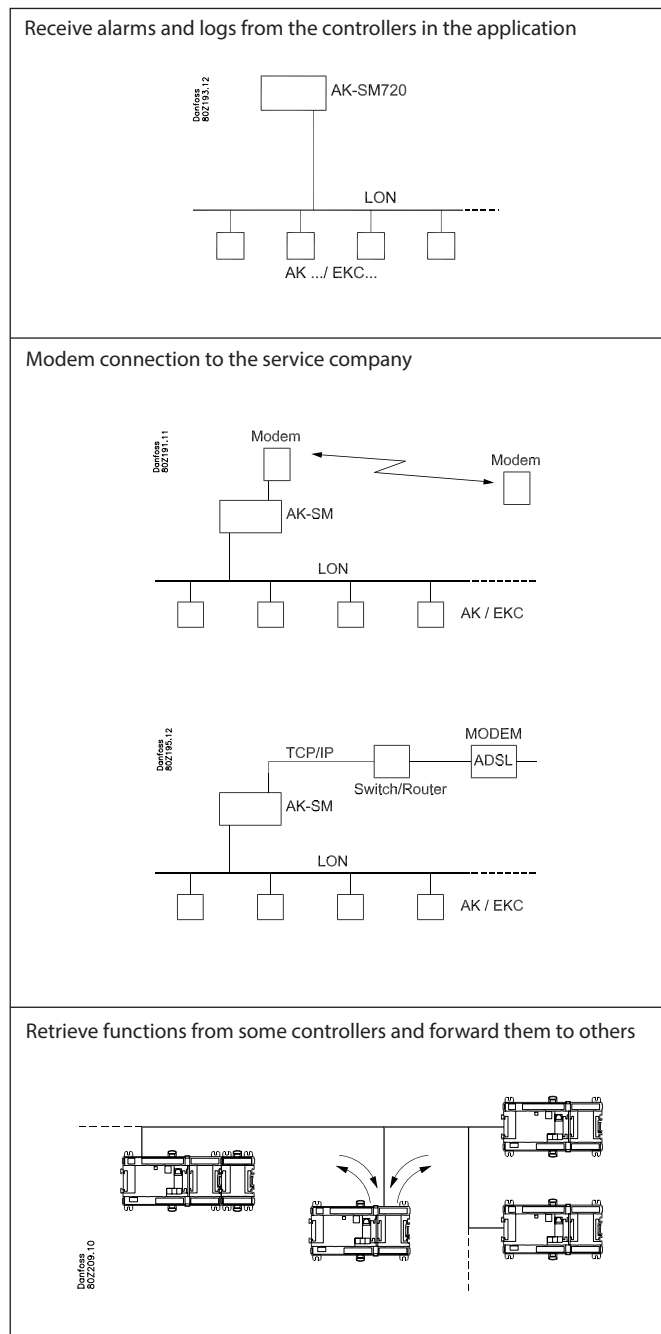
- Service tool type AK-ST

The system unit can transmit alarms and logs to:

- System software type AKM

## Examples

Here are a couple of examples where the system manager takes care of communication to other units.



## Principles

The great advantage of this series of controllers is that it can be extended as the size of the plant 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 questions so that the regulation can be defined and the connections made.

### 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

**Controller**

**Extension modules**

The controller is the cornerstone of the regulation. The module has inputs and outputs capable of handling small systems.

- The bottom part – and hence the terminals – are the same for all controller types.
- The top part contains the intelligence with software. This unit will vary according to controller type. But it will always be supplied together with the bottom part.
- In addition to the software the top part is provided with connections for data communication and address setting.

If the system grows and more functions have to be controlled, the regulation can be extended. With extra modules more signals can be received and more relays cut in and out – how many of them – and which – is determined by the relevant application.

---

**Examples**

A regulation with few connections can be performed with the controller module alone

If there are many connections one or more extension modules have to be mounted

### Direct connection

Setup and operation of an AK controller must be accomplished via the "AK-Service Tool" software program.

The programme is installed on a PC, and setup and operation of the various functions are carried out via the controller's menu displays.

### Displays

The menu displays are dynamic, so that different settings in one menu will result in different setting possibilities in other menus.

A simple application with few connections will give a setup with few settings.

A corresponding application with many connections will give a setup with many settings.

From the overview display there is access to further displays for the compressor regulation and the condenser regulation.

At the bottom of the display there is access to a number of general functions, such as "network overview", "time table", "log function", "alarms", "plant control" and "service" (configuration).

### Data communication

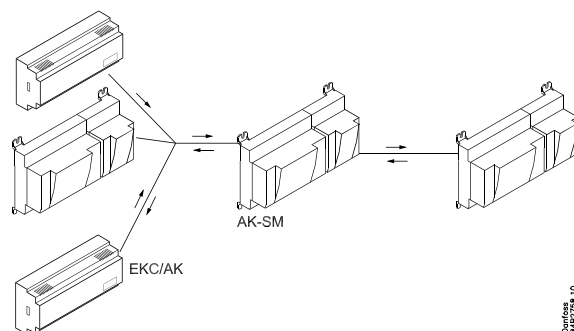
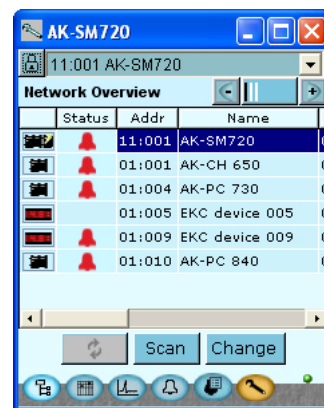
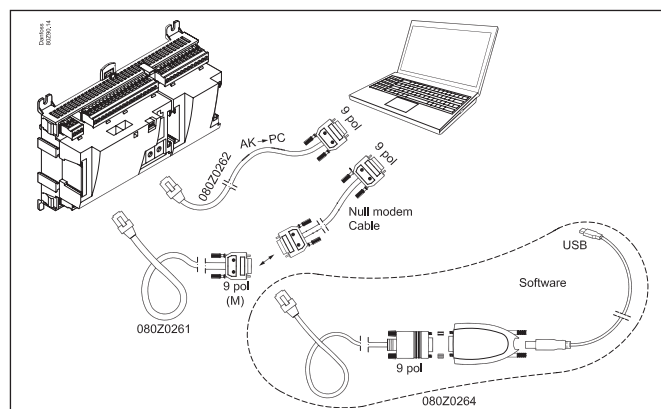
The controller forwards the data communication to all of the connected controllers. It receives measurements from selected functions. The measurements are sent to other controllers, which use the value in the control function.

The controller receives alarms from all connected controllers and forwards them to the defined receivers.

### Users

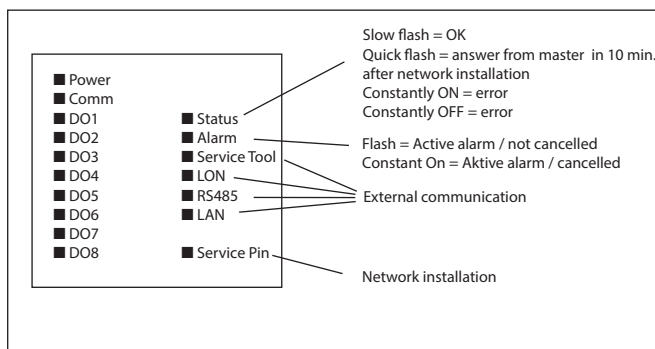
All users must be assigned a user profile which either gives access to full operation or gradually limits the operation to the lowest level that only allows you "to see".

Users are added and defined in the menu item "Configuration"/ "Authorisation".



### Light-emitting diodes

A number of light-emitting diodes makes it possible to follow the signals that are received and transmitted by the controller.

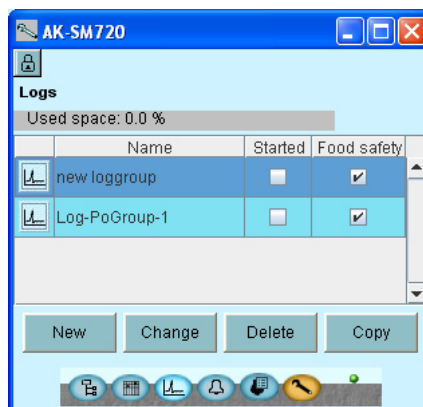


### Log

From the log function you can define the measurements you wish to be shown.

The collected values can be printed, or you may export them to a file. You can open the file in Excel.

If you are in a service situation you can show measurements in a trend function. The measurements are then made realtime and displayed instantly.

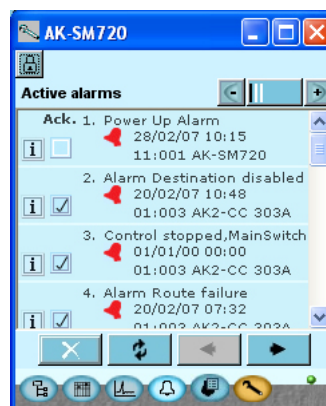


### Alarm

The display gives you an overview of all active alarms. If you wish to confirm that you have seen the alarm you can cross it off in the acknowledge field.

If you want to know more about a current alarm you can click on it and obtain an information display on the screen.

A corresponding display exists for all earlier alarms. Here you can upload information if you need further details about the alarm history.



## 2. Design of a controller

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This section describes how the controller is designed.

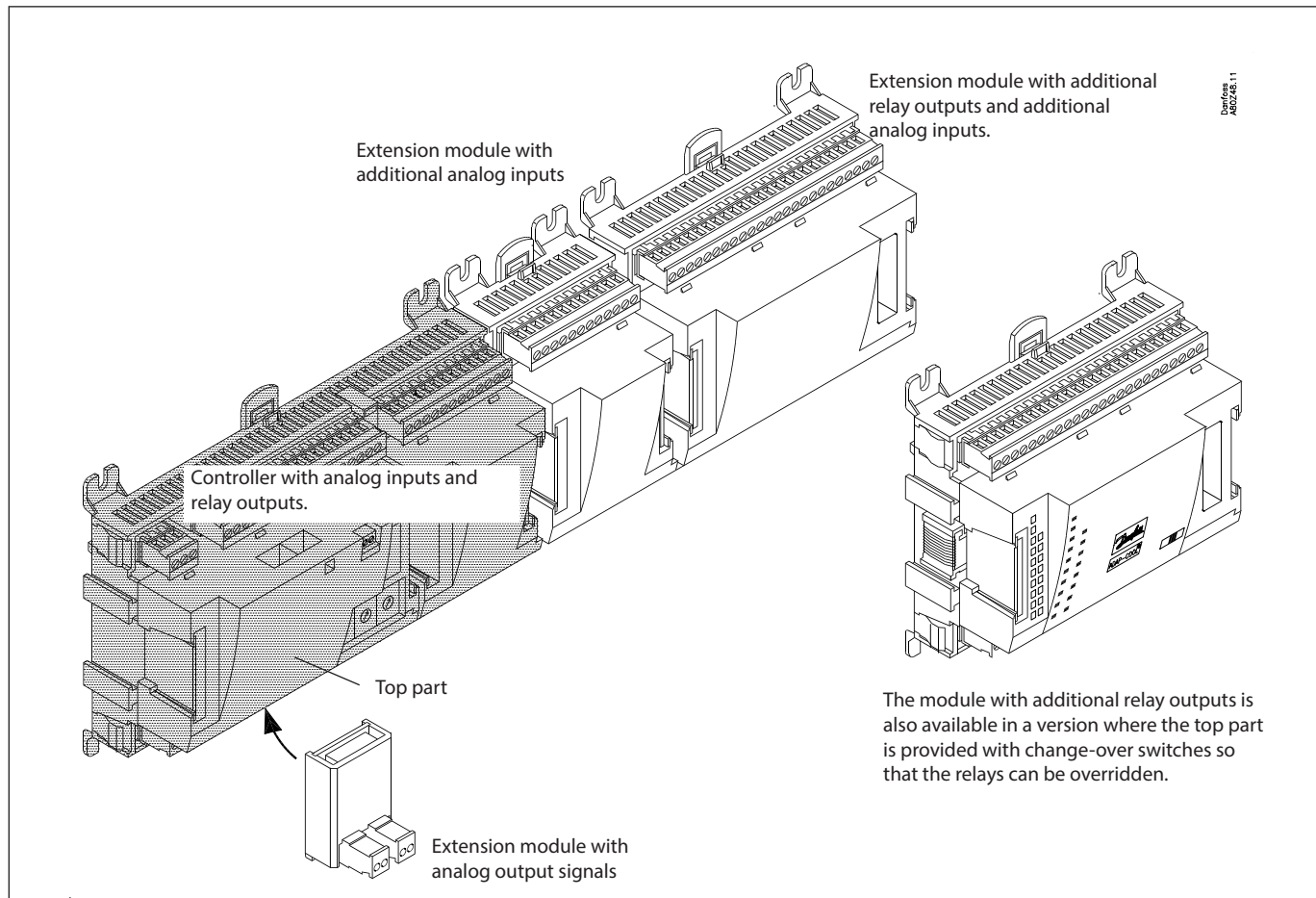
The controller in the system is based on a uniform connection platform where any deviations from regulation to regulation is determined by the used top part with a specific software and by which input and output signals the relevant application will require. If it is an application with few connections, the controller module (top part with belonging bottom part) may be sufficient. If it is an application with many connections it will be necessary to use the controller module plus one or more extension modules.

This section will give you a survey of possible connections plus assistance in selecting the modules required by your actual application.

# Module survey

- 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.
- Top 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 below.

- 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)





### 1. Controller

Type	Function	Application
AK-SM 720	System manager	Control data communication

### 2. Extension modules and survey of inputs and outputs

Type	Analog inputs	On/Off outputs		On/off supply voltage (DI signal)			Analog outputs	Module with switches
	For sensors, pressure transmitters etc.	Relay (SPDT)	Solid state	Low voltage (max. 80 V)	High voltage (max. 260 V)	Pulse counter Low voltage (max 30 V)	0-10 V d.c.	For override of relay outputs
System manager	11	4	4	-	-	-	-	-
Extension modules								
AK-XM 101A	8							
AK-XM 102A				8				
AK-XM 102B					8			
AK-XM 204A		8						
AK-XM 204B		8						x
AK-XM 205A	8	8						
AK-XM 205B	8	8						x
AK-XM 107A						8		
The following extension module can be placed on the PC board in the controller module. There is only room for one module.								
AK-OB 110							2	

### 3. AK operation and accessories

Type	Function	Application
<b>Operation</b>		
AK-ST 500	Software for operation of AK controllers	AK-operation
-	Cable between PC and AK controller	AK - Com port
-	Cable between zero modem cable and AK controller	AK - RS 232
<b>Accessories</b>		
<b>Power supply modul 230 V / 115 V to 24 V d.c.</b>		
AK-PS 075	18 VA d.c.	Supply for controller
AK-PS 150	36 VA d.c.	

On the following pages there is data specific to each module.

## Common data for modules

Supply voltage	24 V d.c./a.c. +/- 20%	
Power consumption	AK-SM 720	8 VA
	AK-XM 101, 102, 107	2 VA
	AK-XM 204, 205	5 VA
Analog inputs	Pt 1000 ohm /0°C	Resolution: 0.1°C Accuracy: +/- 0.5°C
	Pressure transmitter type AKS 32R / AKS 32 (1-5 V)	Resolution: 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
Solid state outputs	Can be used for loads that are cut in and out frequently, e.g. : 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
	Density	IP10 , VBG 4
	Mounting	For mounting on panel wall or DIN rail
Weight with screw terminals	Modules in 100- / 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 61000-6-3

The mentioned data applies to all modules.

If data is specific, this is mentioned together with the module in question.

## Dimensions

The module dimension is 72 mm.

Modules in the 100-series consist of one module

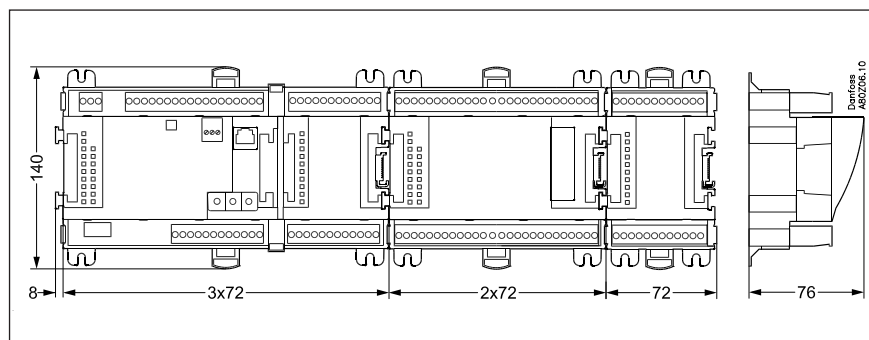
Modules in the 200-series consist of two modules

Controllers consist of three modules

The length of an aggregate unit =  $n \times 72 + 8$

A power supply module is either 36 mm or 54 mm

If there is space on the DIN rail, the power supply module can be positioned to the left of the system manager.



# System manager AK-SM

## Function

There are several controllers in the series. The function is determined by the programmed software, but outwardly the controllers are identical – they all have the same connection possibilities:

11 analog inputs for sensors, pressure transmitters, voltage signals and contact signals.

8 digital outputs, with 4 Solid state outputs and 4 relay outputs

## Supply voltage

24 V a.c. or d.c. to be connected to the controller.

The 24 V must **not** be retransmitted and used by other controllers as it is not galvanically separated from inputs and outputs. In other words, you **must** use a transformer for each controller. Class II is required. The terminals must **not** be earthed.

The supply voltage to any extension modules is transmitted via the plug on the right-hand side.

The size of the transformer is determined by the power requirement of the total number of modules.

The supply voltage to a pressure transmitter can be taken either from the 5 V output or from the 12 V output depending on transmitter type.

## Data communication

The installation has to be made as mentioned in the separate instructions.

## Address setting

When the system manager is configured, the address must be set in the range 1 to 10. 1 must always be used. If there are more than one, the rest must be set with addresses 2 to 10.

## Service PIN

When the address has been set, the software must know the setting. This is done by pressing the Service PIN button. The "Status" LED will flash when acceptance is received.

## Operation

The configuration operation of the controller must take place from the software programme "Service Tool". The program must be installed on a PC, and the PC must be connected to the controller via the network plug on the front of the unit.

## Light-emitting diodes

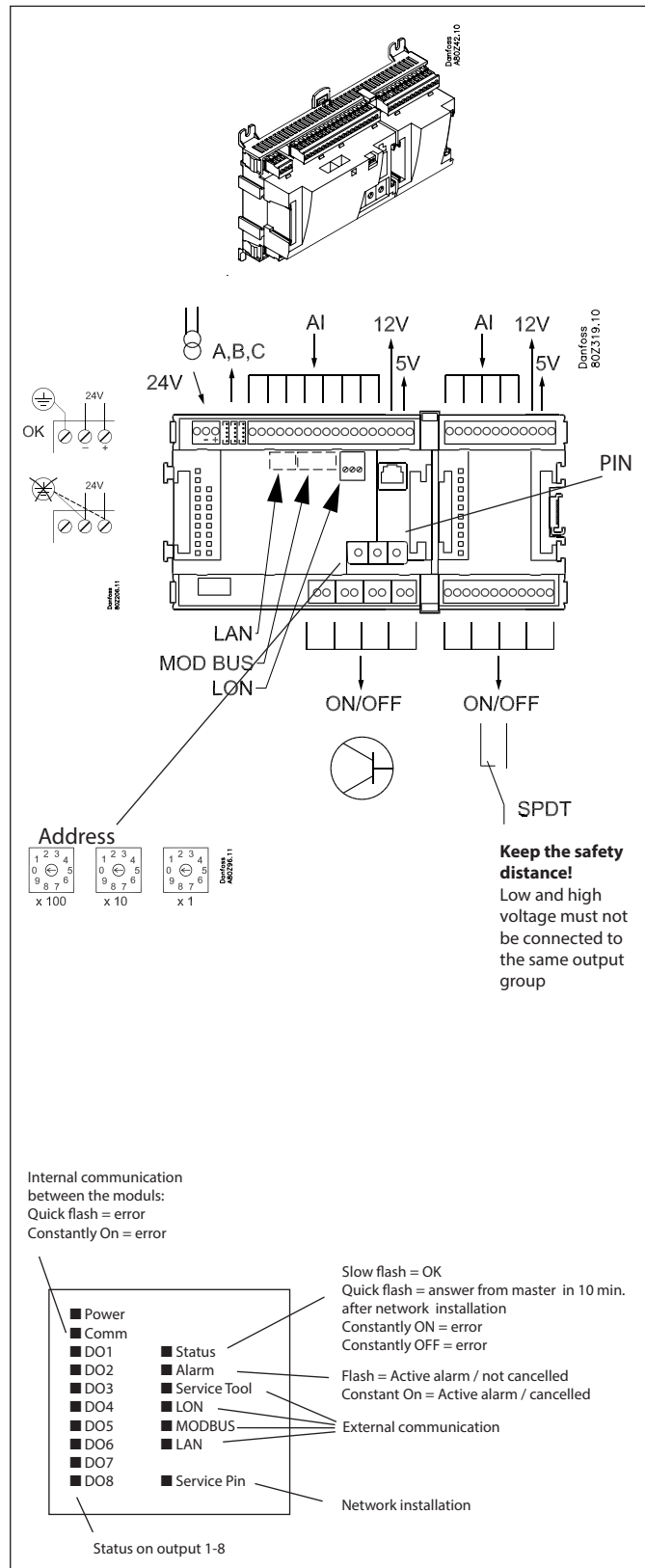
There are two rows with LED's. They mean:

Left row:

- Voltage supply to the controller
- Communication active with the bottom PC board (red = error)
- Status of outputs DO1 to DO8

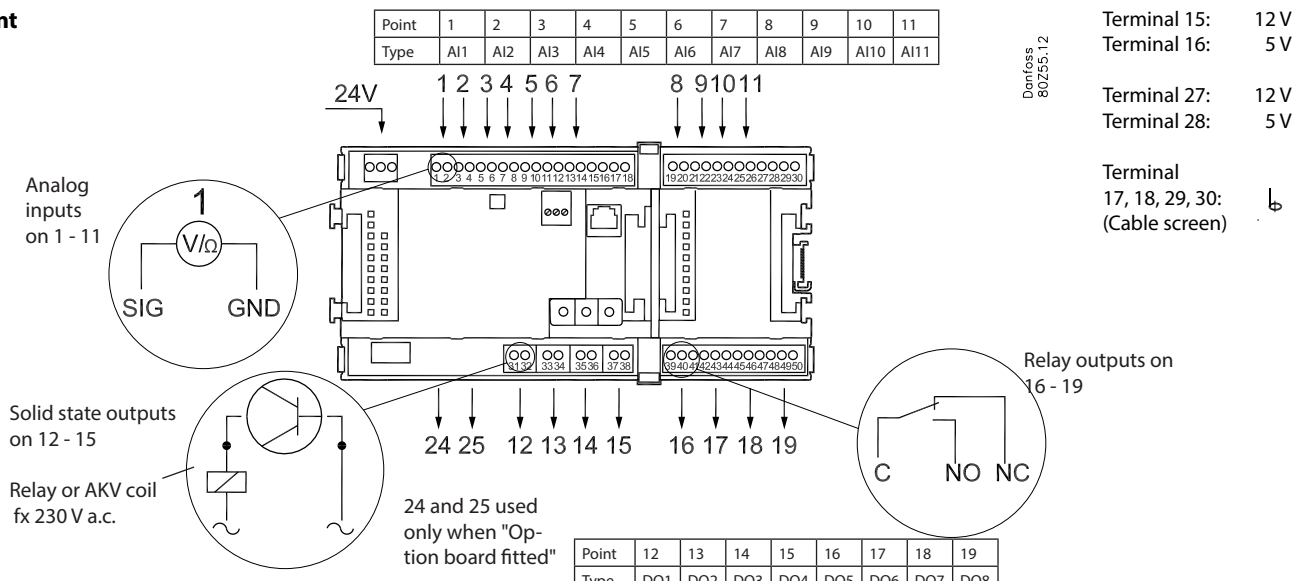
Right row:

- Software status
- Alarm when LED flashes. Alarm acknowledged = constant light
- Communication with Service Tool
- Communication on LON
- Communication on MODBUS
- Communication on TCP/IP
- "Service Pin" switch has been activated



A small module (option board) can be placed on the bottom part of the controller. The module is described later in the document.

**Point**



	Signal	Signal type
<b>S</b> Pt 1000 ohm/0°C	S1 S2 Saux1 SSA SdA	Pt 1000
<b>P</b> AKS 32R AKS 32	3: Brown SIG 2: Blue GND 1: Black 5V  3: Brown SIG 2: Black GND 1: Red 12V	P0A POB PcA PcB  AKS 32R -1 - xx bar AKS 32 -1 - zz bar
<b>U</b>	+ SIG - GND	0 - 5V 0 - 10V
<b>On/Off</b>	Ext. Main switch Day/Night Door	<b>Active at:</b> Closed / Open
<b>DO</b>	AKV Comp 1 Comp 2 Fan 1 Alarm Light Rail heat Defrost	<b>Active at:</b> On / Off
<b>Option Board</b>	Please see the signal on the page with the module.	

Signal	Module	Point	Terminal	Signal type / Active at
	<b>1</b>	1 (AI 1)	1 - 2	
		2 (AI 2)	3 - 4	
		3 (AI 3)	5 - 6	
		4 (AI 4)	7 - 8	
		5 (AI 5)	9 - 10	
		6 (AI 6)	11 - 12	
		7 (AI 7)	13 - 14	
		8 (AI 8)	19 - 20	
		9 (AI 9)	21 - 22	
		10 (AI 10)	23 - 24	
		11 (AI 11)	25 - 26	
		12 (DO 1)	31 - 32	
		13 (DO 2)	33 - 34	
		14 (DO 3)	35 - 36	
		15 (DO 4)	37 - 38	
		16 (DO 5)	39 - 41	
		17 (DO6)	42 - 44	
		18 (DO7)	45 - 47	
		19 (DO8)	48 - 50	
		24	-	
		25	-	

## Extension module AK-XM 101A

### Function

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

### Supply voltage

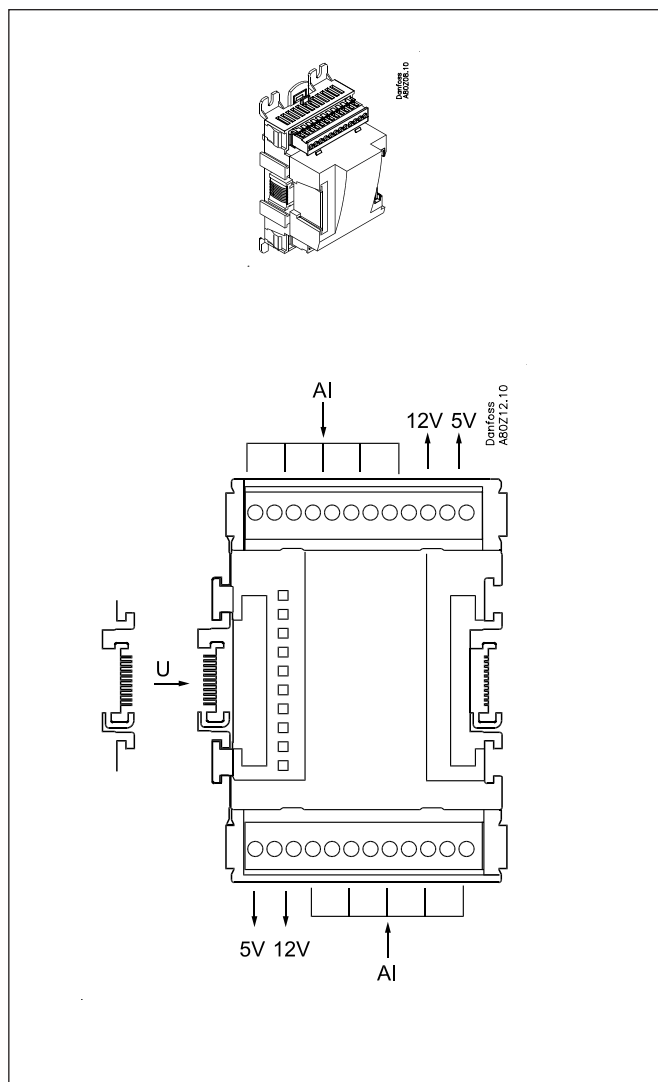
The supply voltage to the module comes from the previous module in the row.

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

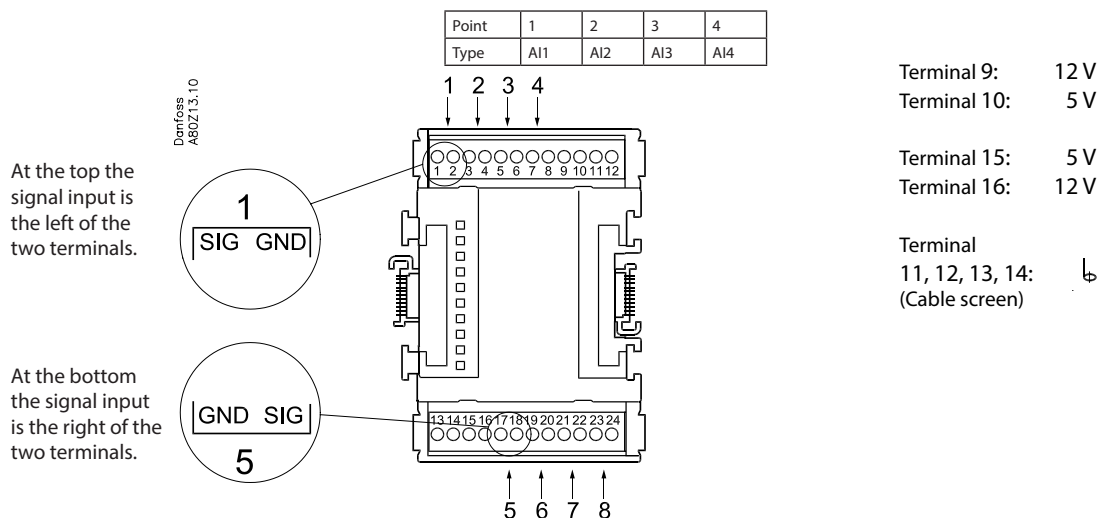
### Light-emitting diodes

Only the two top LED's are used. They indicate the following:

- Voltage supply to the module
- Communication with the controller is active (red = error)



**Point**

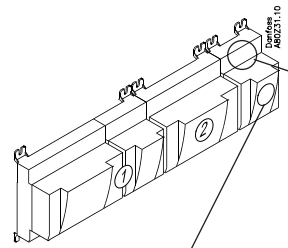


Point	1	2	3	4
Type	AI1	AI2	AI3	AI4

- Terminal 9: 12 V
- Terminal 10: 5 V
- Terminal 15: 5 V
- Terminal 16: 12 V
- Terminal 11, 12, 13, 14: Cable screen

Point	5	6	7	8
Type	AI5	AI6	AI7	AI8

	Signal	Signal type
<b>S</b> Pt 1000 ohm/0°C 	S1 S2 Saux1 Saux2 SSA SdA	Pt 1000
<b>P</b> AKS 32R  AKS 32 	POA POB PcA PcB	AKS 32R -1 - xx bar AKS 32 -1 - zz bar
<b>U</b> 	...	0 - 5 V 0 - 10 V
<b>On/Off</b> 	Ext. Main switch Day/Night Door	<b>Active at:</b> Closed / Open



Signal	Module	Point	Terminal	Signal type / Active at
		1 (AI 1)	1 - 2	
		2 (AI 2)	3 - 4	
		3 (AI 3)	5 - 6	
		4 (AI 4)	7 - 8	
		5 (AI 5)	17 - 18	
		6 (AI 6)	19 - 20	
		7 (AI 7)	21 - 22	
		8 (AI 8)	23 - 24	

## Extension module AK-XM 102A / AK-XM 102B

### Function

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

### Signal

AK-XM 102A is for low voltage signals.

AK-XM 102B is for high voltage signals.

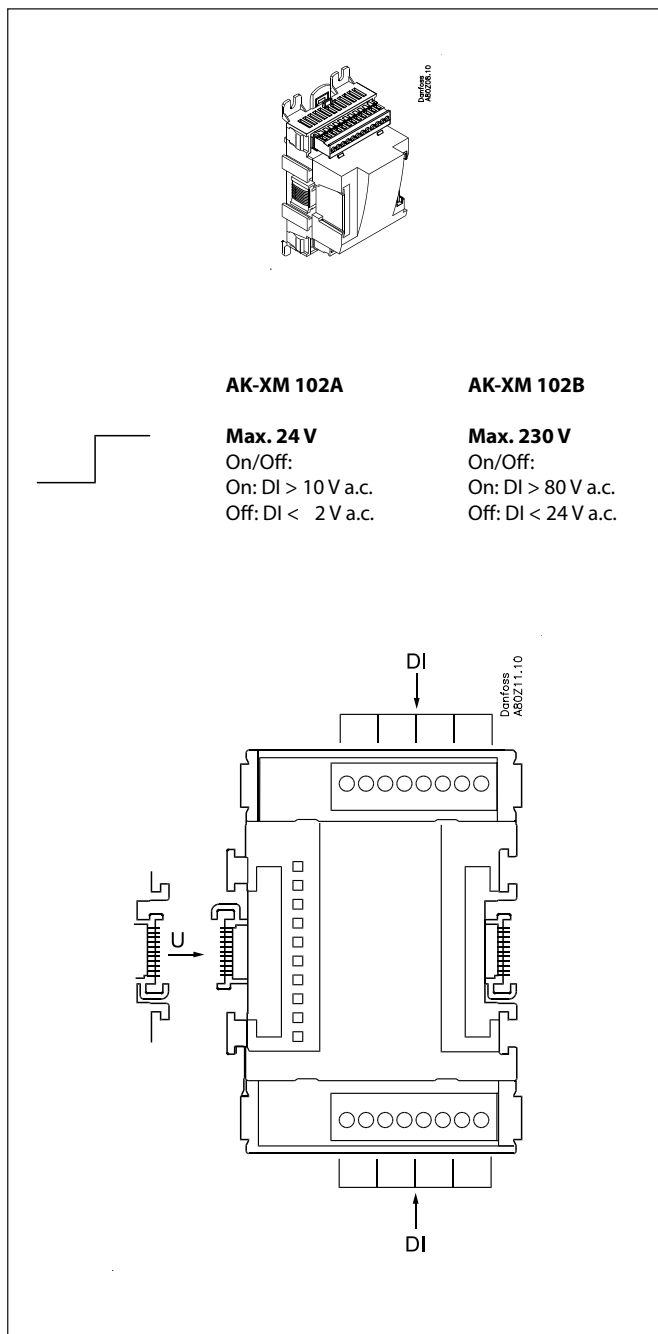
### Supply voltage

The supply voltage to the module comes from the previous module in the row.

### Light-emitting diodes

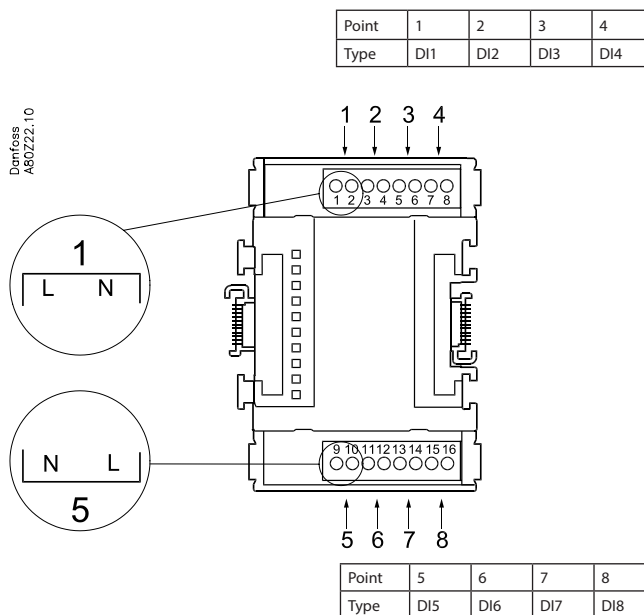
They indicate:

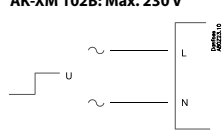
- Voltage supply to the module
- Communication with the controller is active (red = error)
- Status of the individual inputs 1 to 8 (when lit = voltage)

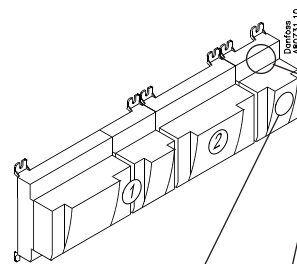




Point



	Signal	Active at
<b>DI</b>  <b>AK-XM 102A: Max. 24 V</b> <b>AK-XM 102B: Max. 230 V</b>  	Ext. Main switch  Day/ Night  Comp. safety 1  Comp. safety 2	<b>Closed</b> (voltage on)  /  <b>Open</b> (voltage off)



Signal	Module	Point	Terminal	Active at
		1 (DI 1)	1 - 2	
		2 (DI 2)	3 - 4	
		3 (DI 3)	5 - 6	
		4 (DI 4)	7 - 8	
		5 (DI 5)	9 - 10	
		6 (DI 6)	11 - 12	
		7 (DI 7)	13 - 14	
		8 (DI 8)	15 - 16	

## Extension module AK-XM 204A / AK-XM 204B

### Function

The module contains 8 relay outputs.

### Supply voltage

The supply voltage to the module comes from the previous module in the row.

### AK-XM 204B only

#### Override of relay

Eight change-over switches at the front make it possible to override the relay's function.

Either to position OFF or ON.

In position Auto the controller carries out the control.

### Light-emitting diodes

There are two rows with LED's. They indicate the following:

Left row:

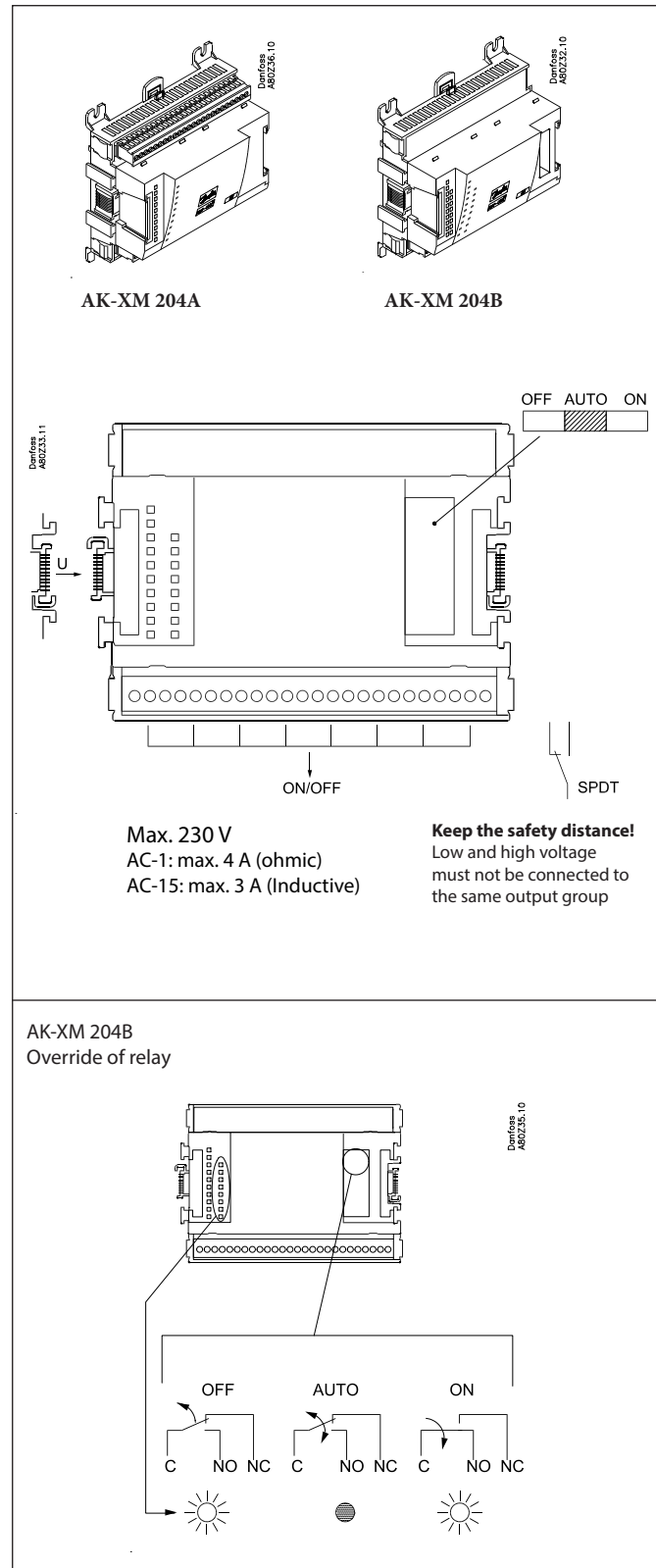
- Voltage supply to the controller
- Communication active with the bottom PC board (red = error)
- Status of outputs DO1 to DO8

Right row: (AK-XM 204B only):

- Override of relays
- Light ON = override
- Light OFF = no override

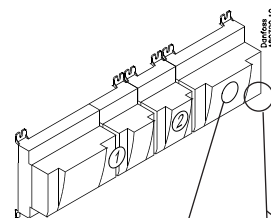
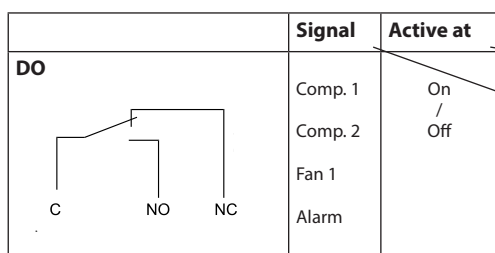
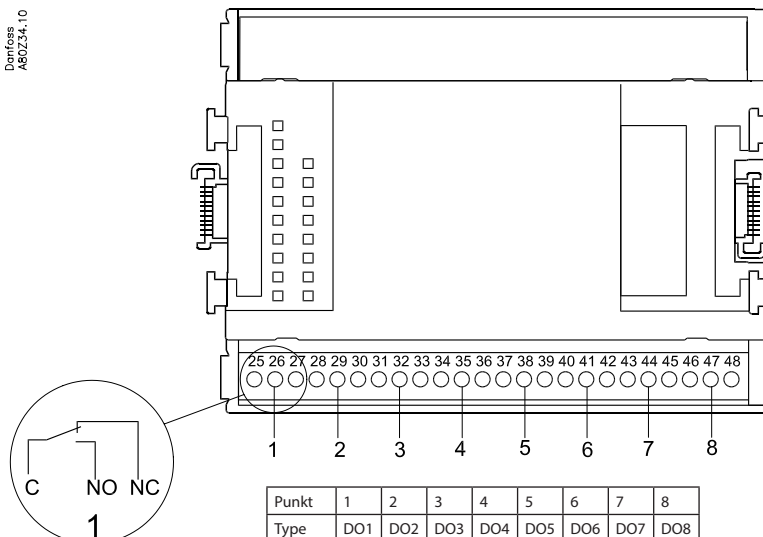
### Fuses

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



Point

Danfoss  
A80Z34.10



Signal	Module	Point	Terminal	Active at
		1 (DO 1)	25 - 27	
		2 (DO 2)	28 - 30	
		3 (DO 3)	31 - 33	
		4 (DO 4)	34 - 36	
		5 (DO 5)	37 - 39	
		6 (DO 6)	40 - 42	
		7 (DO 7)	43 - 45	
		8 (DO 8)	46 - 48	

## Extension module AK-XM 205A / AK-XM 205B

### Function

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

### Supply voltage

The supply voltage to the module comes from the previous  
 module in the row.

### AK-XM 205B only

#### Override of relay

Eight change-over switches at the front make it possible to  
 override the relay's function.  
 Either to position OFF or ON.  
 In position Auto the controller carries out the control.

### Light-emitting diodes

There are two rows with LED's. They mean:

Left row:

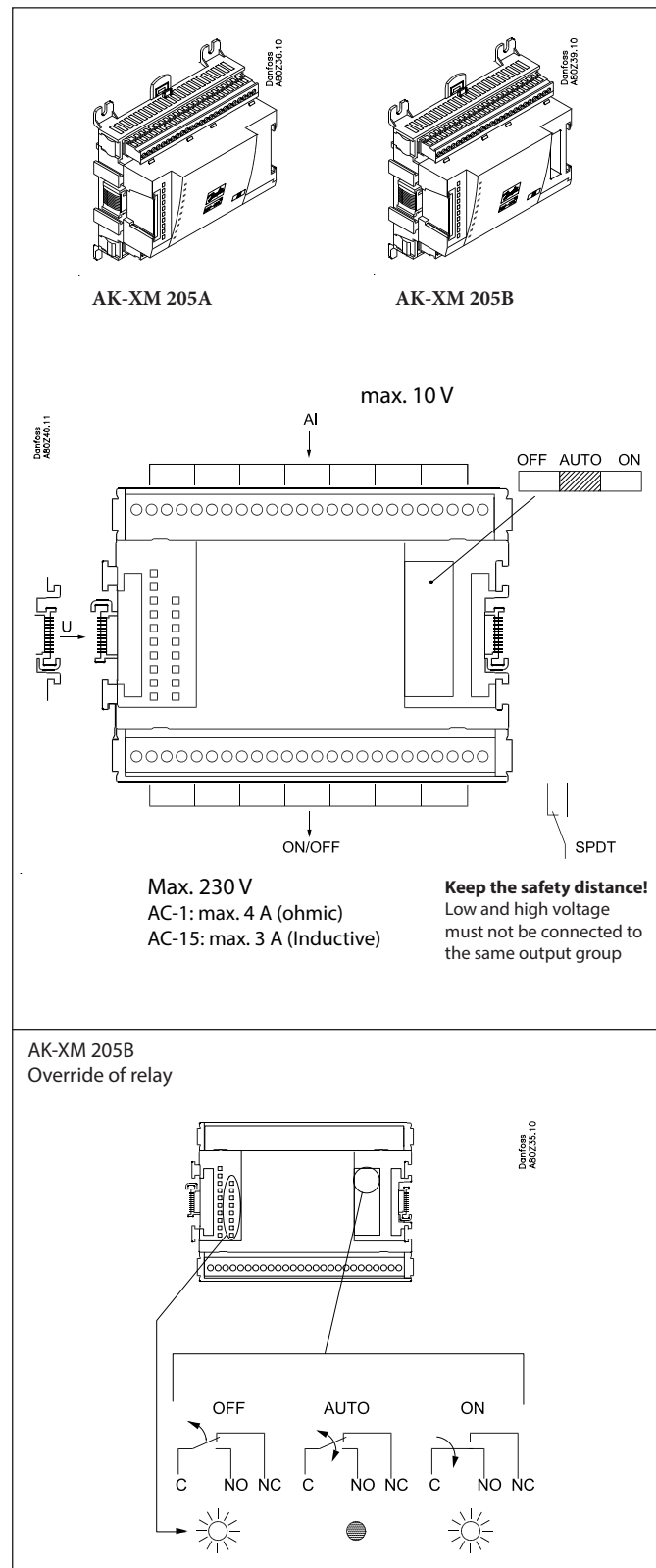
- Voltage supply to the controller
- Communication active with the bottom PC board (red = error)
- Status of outputs DO1 to DO8

Right row: (AK-XM 205B only):

- Override of relays  
 ON = override  
 OFF = no override

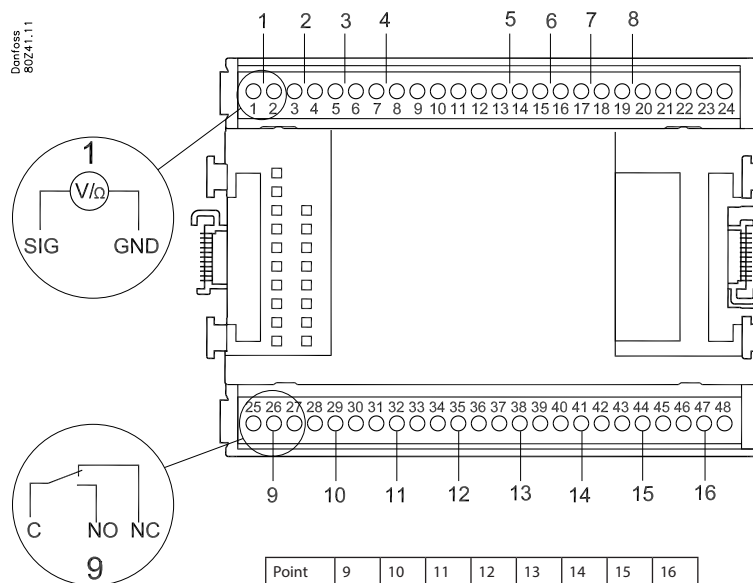
### Fuses

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



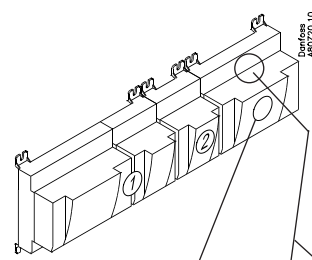
Point

Point	1	2	3	4	5	6	7	8
Type	AI1	AI2	AI3	AI4	AI5	AI6	AI7	AI8



Point	9	10	11	12	13	14	15	16
Type	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8

	Signal	Signal type
<b>S</b> Pt 1000 ohm/0°C 	S1 S2 Saux1 Saux2 SSA SdA	Pt 1000
<b>P</b> AKS 32R  AKS 32 	POA POB PcA PcB	AKS 32R -1 - xx bar  AKS 32 -1 - zz bar
<b>U</b> 	...	0 - 5 V 0 - 10 V
<b>On/Off</b> 	Ext. Main switch Day/Night Door	<b>Active at:</b> Closed / Open
<b>DO</b> 	Comp 1 Comp 2 Fan 1 Alarm Light Rail heat Defrost	<b>Active at:</b> on / Off



Signal	Module	Point	Terminal	Signal type / Active at
		1 (AI 1)	1 - 2	
		2 (AI 2)	3 - 4	
		3 (AI 3)	5 - 6	
		4 (AI 4)	7 - 8	
		5 (AI 5)	13 - 14	
		6 (AI 6)	15 - 16	
		7 (AI 7)	17 - 18	
		8 (AI 8)	19 - 20	
		9 (DO 1)	25 - 27	
		10 (DO 2)	28 - 30	
		11 (DO 3)	31 - 33	
		12 (DO 4)	34 - 36	
		13 (DO 5)	37 - 39	
		14 (DO 6)	40 - 42	
		15 (DO 7)	43 - 45	
		16 (DO 8)	46 - 48	

## Extension module AK-XM 107A

### Function

The module contains eight inputs for pulse counting. As an alternative, the input can be used to register an On/Off signal. (DI function).

### Supply voltage

The supply voltage for the module comes from the previous module in the sequence.

### LEDs

These indicate the following:

- Voltage of the module
- Communication with the controller is active (red = error)

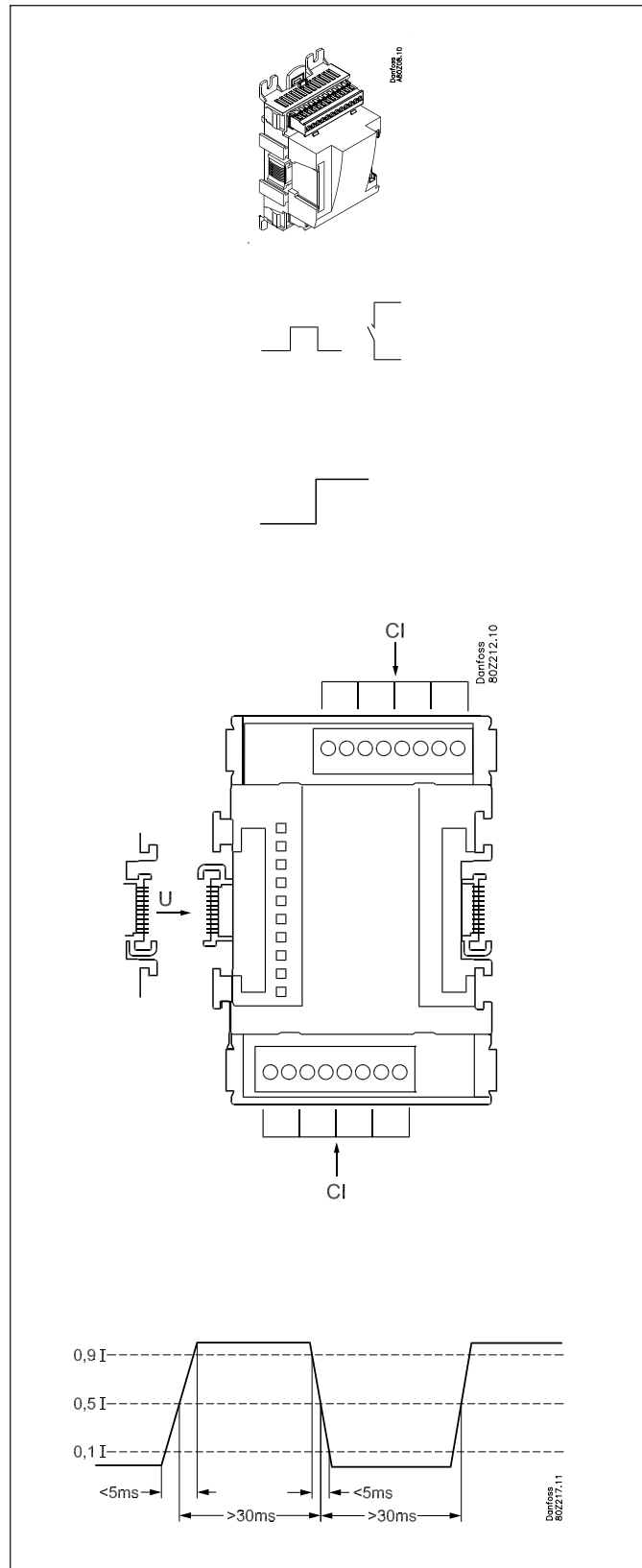
*(There is no LED indication for the individual signal inputs)*

### Signal

The signal is registered in accordance with DIN 43864.

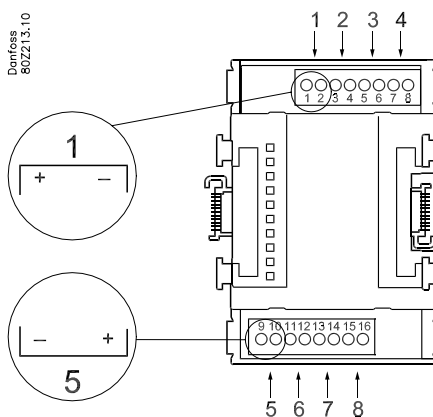
Rise times and fall times must be less than 5 ms.

On and off times must be greater than 30 ms.



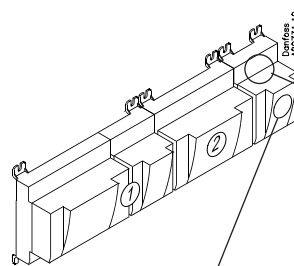
Point

Point	1	2	3	4
Type	CI1	CI2	CI3	CI4



Point	5	6	7	8
Type	CI5	CI6	CI7	CI8

	Signal	Active at
CI		---



Signal	Module	Point	Terminal	Active at
		1 (CI 1)	1 - 2	---
		2 (CI 2)	3 - 4	---
		3 (CI 3)	5 - 6	---
		4 (CI 4)	7 - 8	---
		5 (CI 5)	9 - 10	---
		6 (CI 6)	11 - 12	---
		7 (CI 7)	13 - 14	---
		8 (CI 8)	15 - 16	---

## Extension module AK-OB 110

### Function

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

### Supply voltage

The supply voltage to the module comes from the controller module.

### Placing

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

### Point

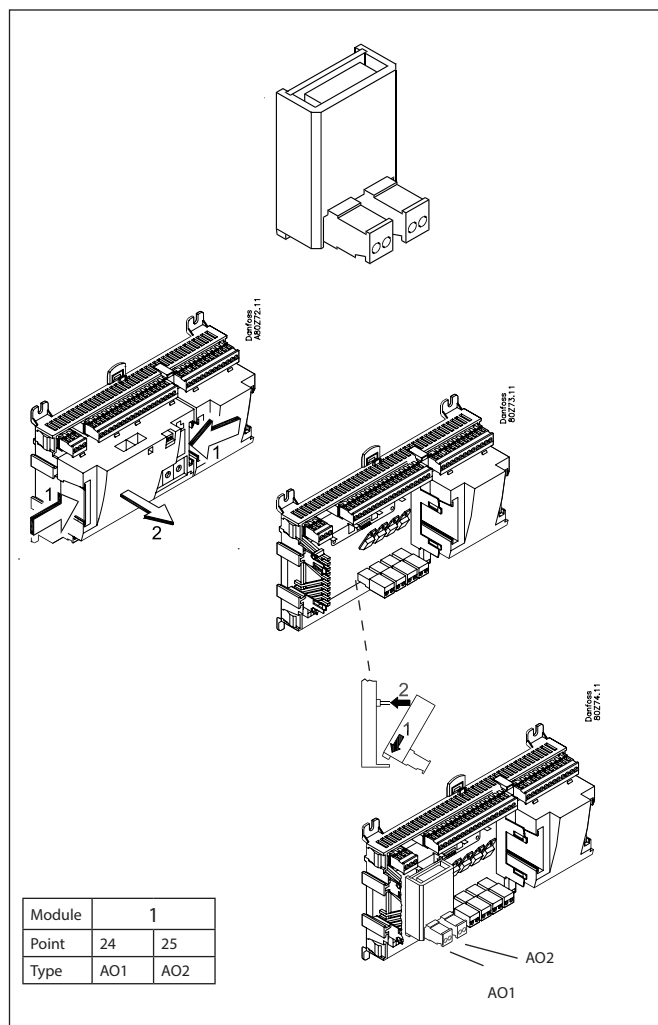
The two outputs have points 24 and 25. They are shown on the earlier page where the controller is also mentioned.

Max. load

$I < 2.5 \text{ mA}$

$R > 4 \text{ kohm}$

<b>AO</b>	-	→	0-10 V	<b>AO</b>	0 - 10 V
	+	→			



Module	1	
Point	24	25
Type	AO1	AO2



## Power supply module AK-PS 075 / 150

### Function

24 V supply for controller.

### Supply voltage

100 V a.c. to 240 V a.c. 50/60Hz

### Placing

On wall or DIN-rail

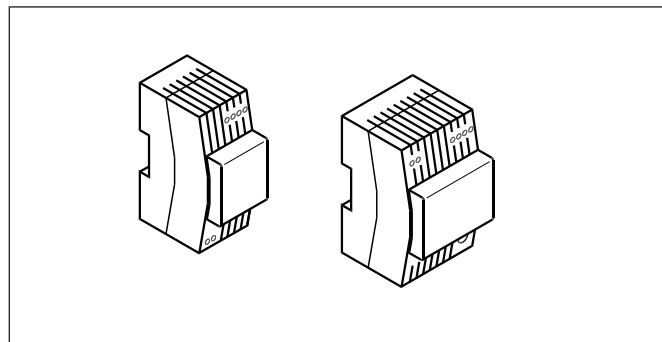
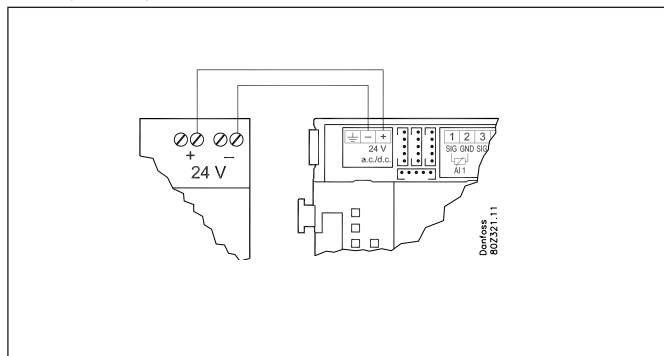
### Effect

Type	Output tension	Output current	Power
AK-PS 075	24 V d.c.	0.75 A	18 VA
AK-PS 150	24 V d.c. (adjustable)	1.5 A	36 VA

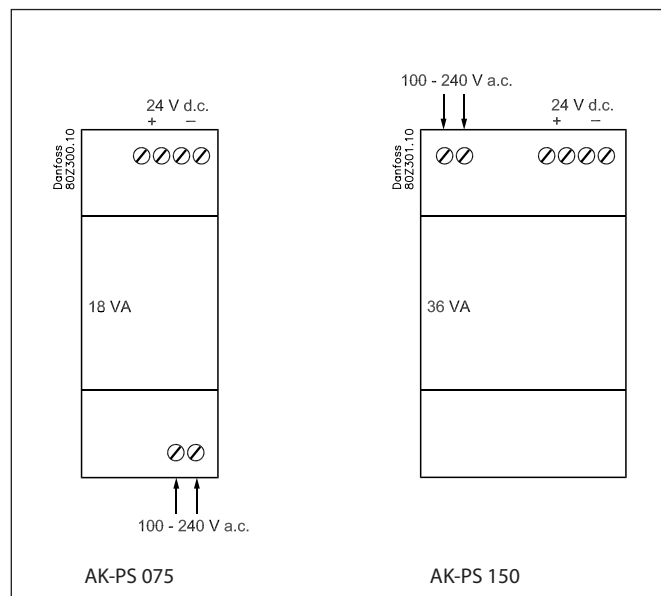
### Dimension

Type	High	Width
AK-PS 075	90 mm	36 mm
AK-PS 150	90 mm	54 mm

### Supply to a System manager



### Connections



## Preface to design

In most cases the system manager may be able to manage the control process without any kind of supplementary modules. Expansion modules will only be needed when measuring consumption, when using a large number of relays or when using Boolean functions.

Be aware of the following when the number of extension modules is being planned. A signal may have to be changed, so that an additional module may be avoided.

- An ON/OFF signal can be received in two ways. Either as a contact signal on an analog input or as voltage on a low or high-voltage module.
- An ON/OFF output signal can be given in two ways. Either with a relay switch or with solid state. The primary difference is the permitted load and that the relay switch contains a cutout switch.

Mentioned below is a number of functions and connections that may have to be considered when a regulation has to be planned. There are more functions in the controller than the ones mentioned here, but those mentioned have been included in order that the need for connections can be established.

## Functions

### Clock function

Clock function and change-over between summer time and winter time are contained in the system manager. The clock's setting is retained if there is a power failure.

### Start/stop of regulation

Regulation can be started and stopped via the software. It cannot be stopped with a switch function.

### Alarm function

If the alarm is to be sent to a signal transmitter, a relay output will have to be used.

### System controls

Some of the possible system controls will require input signals or output signals.

- *Weekly schedule with the store's hours of business*  
If there has to be an override to "day", a switch function will be required.  
If there has to be an override to "night", a switch function will be required.
- *Weekly schedule for day/night operation*  
A switch signal will be required to override a schedule
- *Weekly schedule for defrost*  
A switch signal will be required to override a schedule
- *Weekly schedule for light*  
A switch signal will be required to override a schedule
- *Inject ON function (closes the evaporator controls' expansion valves in the event of operational problems with the compressors)*  
The function can be enabled via data communication or it can be wired outside the system manager

### • Light control

A signal can be received from two light sensors. Each sensor requires an analogue input.  
Up to eight zones can be controlled. Each zone will require a relay output or a triac output.

### • Adaptive rail heat

A signal can be received from three dew point sensors. Each sensor requires two analogue inputs.

### • Consumption measurement

When measuring consumption an expansion module must be used for pulse counting.  
A synchronisation signal will require an analogue or a digital input.  
A tariff signal will require an analogue or a digital input. Two tariff signals can be received.

### • Peak load limitation

This function requires a signal from a consumption measurement.  
Up to ten relays can be connected.

### Data communication

The controller module has terminals for LON data communication. The requirements to the installation are described in a separate document.

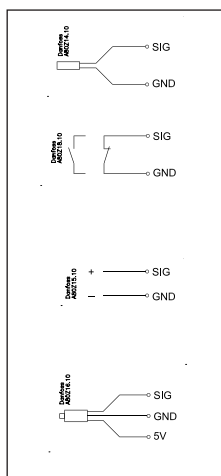
## Connections

In principle there are the following types of connections:

### Analog inputs "AI"

This signal must be connected to two terminals. Signals can be received from the following sources:

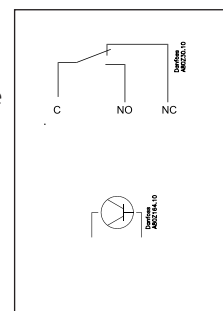
- Temperature signal from Pt 1000 ohm temperature sensor
  - Contact signal where the input is short-circuited or "opened", respectively
  - Voltage signal from 0 to 10 V
  - Signal from pressure transmitter AKS 32 or AKS 32R
- The supply voltage is supplied from the module's terminal board where there is both a 5 V supply and a 12 V supply. When programming the pressure transmitter's pressure range must be set.



### ON/OFF output signals "DO"

There are two types, as follows:

- Relay outputs  
All relay outputs are with change-over relay so that the required function can be obtained when the controller is without voltage.
- Solid state outputs  
Reserved for AKV valves, but output can cut an external relay in and out, as with a relay output.  
The output is only found on the controller module.



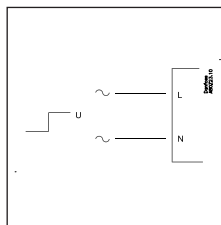
When programming the function must be set:

- Active when the output is activated
- Active when the output is not activated.

### ON/OFF voltage inputs "DI"

This signal must be connected to two terminals.

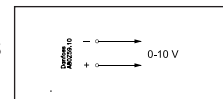
- The signal must have two levels, either 0 V or "voltage" on the input.  
There are two different extension modules for this signal type:
  - low-voltage signals, e.g. 24 V
  - high-voltage signals, e.g. 230 V



### Analog output signal "AO"

This signal is to be used if a control signal is to be transmitted to an external unit, e.g. a frequency converter.

When programming the signal range must be defined: 0-5 V, 1-5 V, 0-10 V or 2-10 V.

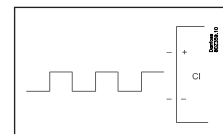


When programming the function must be set:

- Active when the input is without voltage
- Active when voltage is applied to the input.

### Pulse counter inputs

This signal must be used if consumption measurement is to take place.



## Limitations

As the system is very flexible regarding the number of connected units you must check whether your selection complies with the few limitations there are.

The complexity of the controller is determined by the software, the size of the processor, and the size of the memory. It provides the controller with a certain number of connections from which data can be downloaded, and others where coupling with relays can be performed.

There must be a maximum of 200 controllers on the data communication.

A maximum of 120 units of the EKC type, where there must be a maximum of 15 different types and software versions.

- ✓ The sum of connections cannot exceed 80.
- ✓ The number of extension modules must be limited so that the total power will not exceed 32 VA (including controller).
- ✓ No more than five pressure transmitters may be connected to one controller module.
- ✓ No more than five pressure transmitters may be connected to one extension module.

# Design of a System manager

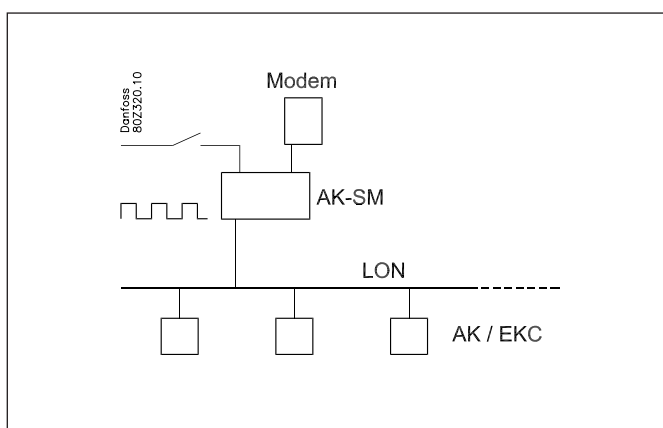
## Procedure:

1. Make a sketch of the system in question
2. Check that the controller's functions cover the required application
3. Consider the connections to be made
4. Use the planning table. / Note down the number of connections. / add up
5. Are there enough connections on the controller module? – If not, can they be obtained by changing an ON/OFF input signal from voltage signal to contact signal, or will an extension module be required?
6. Decide which extension modules are to be used
7. Check that the limitations are observed
8. Calculate the total length of modules
9. The modules are linked together
10. The connection sites are established
11. Draw a connection diagram or a key diagram
12. Size of supply voltage/power supply

← Follow these 12 steps

## 1

### Sketch



Make a sketch of the system in question

## 2 System functions

<b>Application</b>	
Control of data communication on the refrigeration system	x
Control of data communication for external operation	x
Forward alarms and data collected	x
<b>Local data communication</b>	
LON RS485 together with - Controllers type EKC - Controllers type AK - Frequency converter type AKD	x
MODBUS together with similar controllers that have MODBUS communication	x
TCP/IP together with other AK-SM	x
TCP/IP to AK-PI 200 and onwards to controllers with DANBUSS	x
Max. number of controllers (addresses) in a network	200, although max. 120 EKC incl. SLV
<b>External data communication</b>	
Via modem and phone net	x
Via TCP/IP and Internet	x
<b>Alarm management</b>	
LOG of alarms	x
Routing of alarms to Systemssoftware	x
A relay can be defined to an alarm relay	x
<b>System controls</b>	
Weekly schedule with the store's hours of business	x
Weekly schedules with time specified in relation to hours of business	x
On/off control	5
Weekly schedules for use together with day/night operation and start of defrost	10
Override weekly schedules with a switch function	10
Switch between day operation and night operation	Max. 20 groups of max. 30 controllers
Defrost start	Max. 20 groups of max. 30 controllers
Coordinated defrost (common start after defrost)	x
Inject ON function (closes the evaporator controls' expansion valves in the event of operational problems with the compressors)	5 / 120 sections
P0-control	5 / 120 sections
Light control	2 light sensors, 8 relais, 8 zones
Adaptive rail heat	3 groups / 30 sections
Adaptive defrost	10 groups / 30 sections
Consumption measurement	8
Load sheeding	x
Synchronising signal	x
<b>LOG</b>	
Stores LOG data from the connected controllers	x

<b>User registration</b>	
User interface with Password and authorisation levels	x
History Event	x
<b>Operation</b>	
Via PC and software type AK-ST	x
<b>Clock</b>	
Clock function with battery backup	x
Resets the clock in the controllers after a power failure	x
<b>Safety</b>	
Communication control	x
Watchdog function with adjustable interval time	x
Data communication with "I'm a live" information	x
High level of security against undesired user access	x

### A bit more about the functions ("2" continued)

**Here is a little more about some of the functions that must use an input or an output.**

#### Modem connection

It is recommended that the supply voltage to the modem be provided through a relay, so that the system manager can start the modem in a controlled way.

#### The "Inject On" override function

This function closes expansion valves on evaporator controls when all compressors have stopped. The function can take place via data communication, or it can be wired via a relay output on the compressor control.

#### Boolean functions

A function in the system unit makes it possible to set up some logical functions. The functions can have both inputs and outputs. The function is described in a separate document. Please refer to literature sheet number RC8CA. This setup of Boolean functions should only be undertaken by trained personnel.

**If you want to know more about the functions, go to chapter 5.**

### 3 Connections

Here is a survey of the possible connections. The texts can be read in context with the table on the next page.

#### Analog inputs

##### Temperature sensors

Up to 3 sensors for dew point measurement and 4 sensors for boolean logic can be connected.

##### Pressure transmitter

A pressure transmitter type AKS 32 or AKS 32R can supply signals to a maximum of five controllers.

##### Voltage signal

- 0-10 V

Used when signal is received from another control.

E.g. signal from dew point sensor. (A dew point sensor delivers two signals – a temperature sensor signal and a voltage signal)

#### On/Off-inputs

Contact function (on an analog input)

or

Voltage signal (on an extension module)

- Switches to override a weekly schedule
- Switches to override light control
- Signal to register tariff levels

Pulse counter input (on an expansion module)

- E.g. for energy registration

#### On/off-outputs

Relay outputs

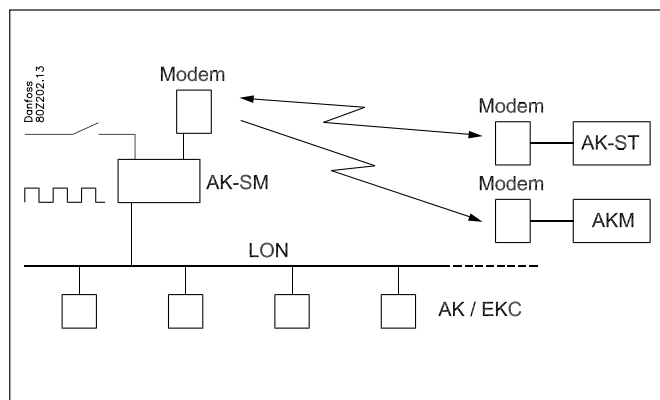
- Voltage supply to modem
- Watch dog function
- Injection On function (signal to evaporator control. One each suction group)
- Alarm relay
- Light control
- Load shedding

#### Solid state outputs

The solid state outputs on the controller module may be used for the same functions as those mentioned under “relay outputs”. (The output will always be “OFF” when the controller has a power failure).

#### Example

- AK-SM 720 is with data communication for EKC controllers
- Modem connection for alarm routing (for System software AKM)
- Modem connection for external operation (for Service tool)
- Alarm output
- Contact to reset alarms
- Energy measurement, which receives puls signal from extern unit.



Data from this example is used on the next page.

The result is that the following modules should be used:

- AK-SM 720 controller
- AK-XM 107A pulse module

#### 4 Planning table

The table helps you establish whether there are enough inputs and outputs on the system manager.  
If there are not enough of them, it must be extended by one or more of the mentioned extension modules.

Note down the connections you will require and add them up

	Analog input signal Example	On/off voltage signal Example	On/off voltage signal Example	Pulse module Example	On/Off output signal Example	7 Limitations
<b>Analog inputs</b>						Pressure transmitters: Max. 5 each/module  Boolean logic: There are limitations to the number of functions. Refer to separate document RC8CA.
Temperature signal from dew point sensor (max. 3)						
Voltage signal from dew point sensor (max. 3)						
Voltage signal from a light sensor (max. 2)						
<b>On/off inputs</b>	Contact	24 V	230 V			
Contact for overriding of week schedule for day/night operation						
Contact to overriding of weekly schedule for light						
Pulse signal from meter for electr., gas, water etc.				1		
On/Off signal about tariff change						
Pulse pressure for stop of alarm	1					
<b>On/off outputs</b>						
Voltage supply for modem (reset function)					1	
Alarm relay					1	
Light zones (up to 8 relays)						
Load shedding limit (up to 10 relays)						
<b>6 Sum of connections</b>	1			1	2	Sum = max. <b>80</b>
Number of connections on a System manager	11 11	0 0	0 0	0 0	8 8	
<b>Missing connections, if applicable</b>	0	-	-	1	0	
<b>The missing connections to be supplied by one or more extension modules:</b>						Sum of power
AK-XM 101A (8 analog inputs)						___ pcs. á 2 VA = __
AK-XM 102A (8 digital low voltage inputs)						___ pcs. á 2 VA = __
AK-XM 102B (8 digital high voltage inputs)						___ pcs. á 2 VA = __
AK-XM 107A (8 pulse inputs)				1		___ pcs. á 2 VA = __
AK-XM 204A / B (8 relay outputs)						___ pcs. á 5 VA = __
AK-XM 205A / B (8 analog inputs + 8 relay outputs)						___ pcs. á 5 VA = __
						1 pcs. á 8 VA = 8
						Sum =
						Sum = max. <b>32 VA</b>
						Example: None of the 3 limitations are exceeded => OK

## 8 Length

If you use many extension modules the controller's length will grow accordingly. The row of modules is a complete unit which cannot be broken.

The module dimension is 72 mm.

Modules in the 100-series consist of one module

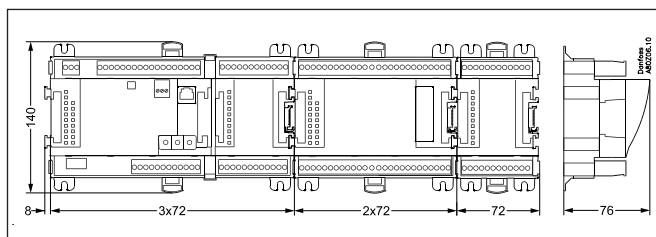
Modules in the 200-series consist of two modules

The controller consist of three modules

The length of an aggregate unit =  $n \times 72 + 8$

or in another way:

Module	Type	Number	at	Length
Controller module		1	x	224
Extension module	200-series	—	x	144
Extension module	100-series	—	x	72
<b>Total length</b>				= ___ mm



Example continued:  
Controller module + Pulse module = 224 mm + 72 mm = 296 mm.

## 9 Linking of modules

Start with the controller module and then mount the selected extension modules. The sequence is of no importance.

However, you must **not** change the sequence, i.e. rearrange the modules, after you have made the setup where the controller is told which connections are found on which modules and on which terminals.

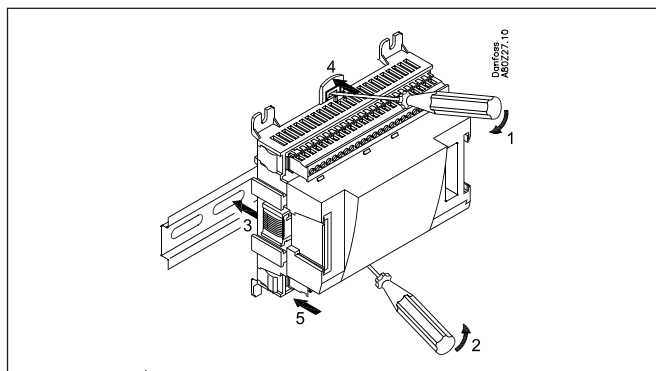
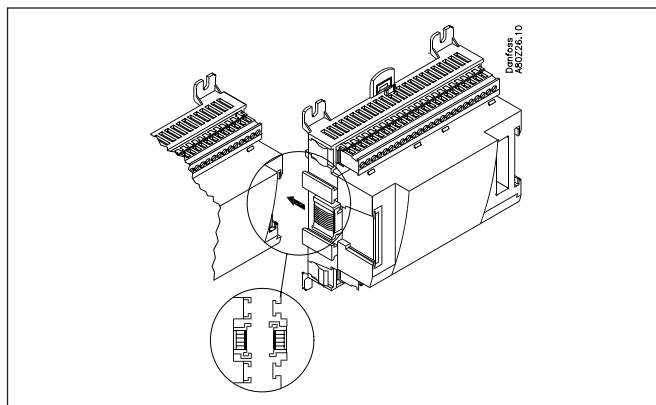
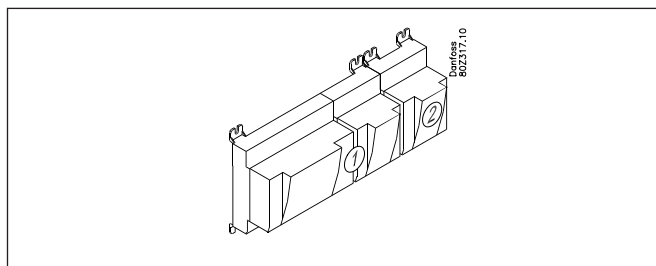
The modules are attached to one another and kept together by a connection which at the same time transmits the supply voltage and the internal data communication to the next module.

Mounting and removal must always be performed when there is no voltage.

The protective cap mounted on the controller's plug connection must be moved to the last vacant plug connection so that the plug will be protected against short-circuit and dirt.

When the regulation has started the controller will all the time check whether there is connection to the connected modules. This status can be followed by the light-emitting diode.

When the two catches for the DIN rail mounting are in open position the module can be pushed into place on the DIN rail – no matter where in the row the module is found. Removal is likewise carried out with the two catches in the open position.





## 10 Determine the connection points

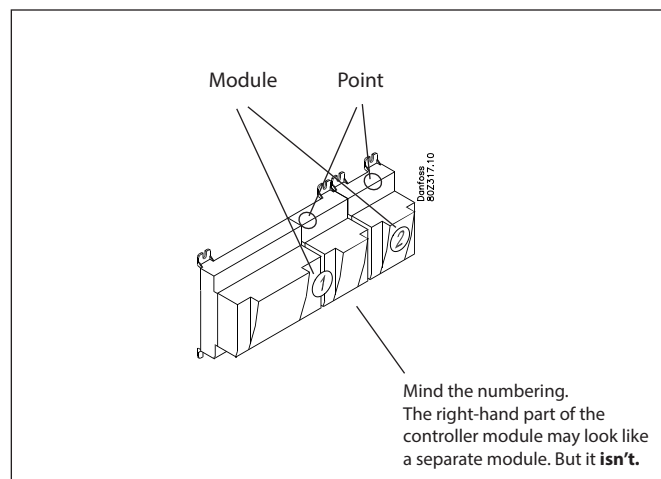
All connections must be programmed with module and point, so in principle it does not matter where the connections are made, as long as it takes place on a correct type of input or output.

- The controller is the first module, the next one is 2, etc.
- A point is the two or three terminals belonging to an input or output (e.g. two terminals for a sensor and three terminals for a relay).

The preparation of the connection diagram and the subsequent programming (configuration) should take place at the present time. It is most easily accomplished by filling in the connection survey for the relevant modules.

Principle:

Name	On module	On Point	Function
fx Light 1	x	x	Close
fx Light 2	x	x	Close
fx Alarm relay	x	x	NC
fx Modem	x	x	Close
fx P0	x	x	AKS 32R 1-6 bar



The connection survey from the controller and any extension modules are uploaded from the paragraph "Modules". See later in the manual E.g. controller module:

Signal	Module	Point	Terminal	Signal type / Active at
		1 (AI 1)	1 - 2	
		2 (AI 2)	3 - 4	
		3 (AI 3)	5 - 6	
		4 (AI 4)	7 - 8	

- Columns 1, 2, 3 and 5 are used for the programming.
- Columns 2 and 4 are used for the connection diagram.

Example continued:

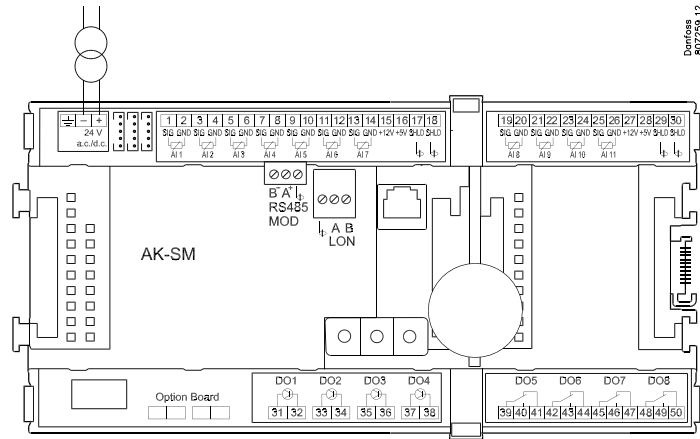
Signal	Module	Point	Terminal	Signal type / Active at
Pulse pressure to set off the alarm relay	<b>1</b>	1 (AI 1)	1 - 2	-
		2 (AI 2)	3 - 4	
		3 (AI 3)	5 - 6	
		4 (AI 4)	7 - 8	
		5 (AI 5)	9 - 10	
		6 (AI 6)	11 - 12	
		7 (AI 7)	13 - 14	
		8 (AI 8)	19 - 20	
		9 (AI 9)	21 - 22	
		10 (AI 10)	23 - 24	
		11 (AI 11)	25 - 26	
		12 (DO 1)	31 - 32	
		13 (DO 2)	33 - 34	
		14 (DO 3)	35 - 36	
		15 (DO 4)	37 - 38	
Supply voltage to modem		16 (DO 5)	39 - 41	ON
Alarm relay for high priority alarms		17 (DO 6)	42 - 44	OFF
		18 (DO 7)	45 - 47	
		19 (DO 8)	48 - 50	
	24	-		
	25	-		

Signal	Module	Point	Terminal	Active at
Pulse signal	<b>2</b>	1 (CI 1)	1 - 2	---
		2 (CI 2)	3 - 4	---
		3 (CI 3)	5 - 6	---
		4 (CI 4)	7 - 8	---
		5 (CI 5)	9 - 10	---
		6 (CI 6)	11 - 12	---
		7 (CI 7)	13 - 14	---
		8 (CI 8)	15 - 16	---

# 11 Connection diagram

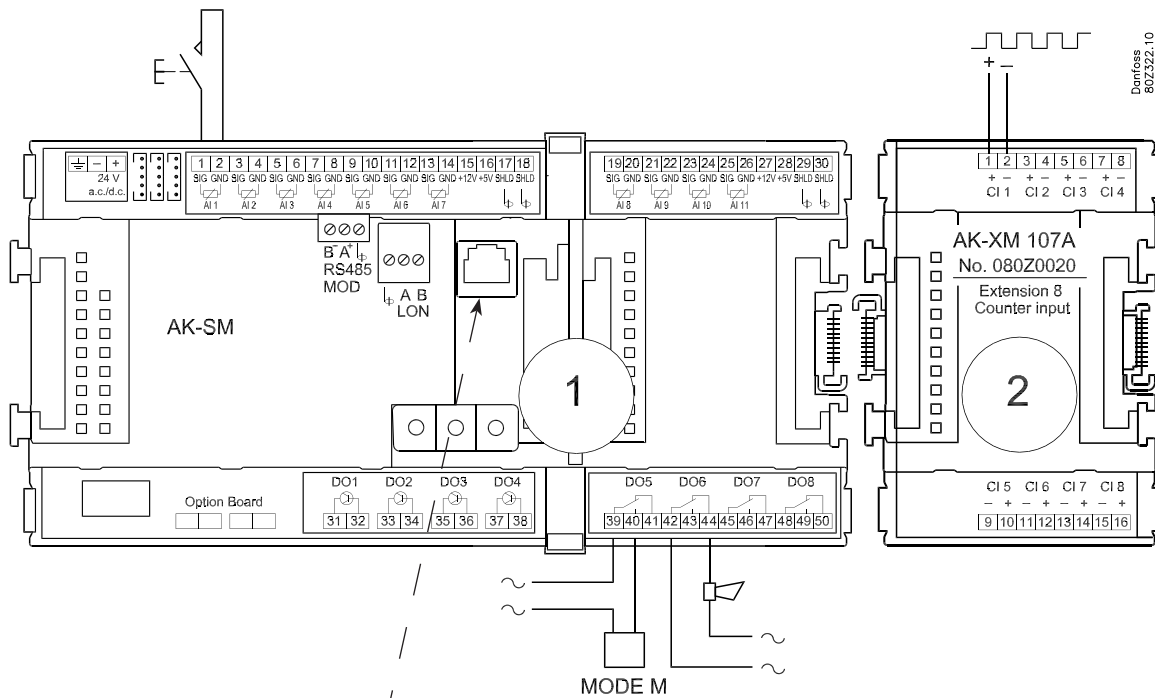
Drawings of the individual modules may be ordered from Danfoss.  
Format = dwg and dxf.

You may then yourself write the module number in the circle and draw the individual connections.



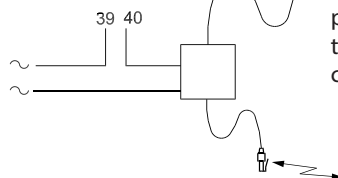
Danfoss  
802239.12

Example continued:



Danfoss  
802322.10

Danfoss  
802132.10



The modem connection is made to this plug, but the plug is also used by AK-ST 500.  
So the modem plug can only be positioned when all settings in the system manager have been completed.

## 12 Supply voltage

Supply voltage is only connected to the controller module. The supply to the other modules is transmitted via the plug between the modules. The supply must be 24 V +/-20%. One power supply must be used for each controller. The transformer must be a class II. The 24 V must not be shared by other controllers or units. The analog inputs and outputs are **not** galvanically separated from the supply.

The + and - 24V input must not be earthed.

### Power supply size

The power consumption grows with the number of modules used:

Module	Type	Number	á	Effect
Controller		1	x 8 =	8 VA
Extension module	200-series	_	x 5 =	_ VA
Extension module	100-series	_	x 2 =	_ VA
Total				_ VA

Example continued:

Controller module	8 VA
Pulse counter module	2 VA
	-----
Size of power supply	10 VA

# Ordering

## 1. Controller

Type	Function	Application	Language	Code no.	Example continued
AK-SM 720	System manager	Control data communication	English, German, French, Dutch, Italian	<b>080Z8511</b>	<b>x</b>
			English (UK), Spanish, Portuguese, English (US)	<b>080Z8512</b>	
			English, Danish, Swedish, Finnish	<b>080Z8513</b>	

## 2. Extension modules and survey for inputs and outputs

Type	Analog inputs	On/Off outputs		On/off supply voltage (DI signal)			Analog outputs	Module with switches	Code no.	Example continued
	For sensors, pressure transmitters etc.	Relay (SPDT)	Solid state	Low voltage (max. 80 V)	High voltage (max. 260 V)	Pulse counter	0-10 V d.c.	For override of relay outputs	With screw terminals	
Controller	11	4	4	-	-		-	-	-	
Extension modules										
AK-XM 101A	8								<b>080Z0007</b>	
AK-XM 102A				8					<b>080Z0008</b>	
AK-XM 102B					8				<b>080Z0013</b>	
AK-XM 204A		8							<b>080Z0011</b>	
AK-XM 204B		8						x	<b>080Z0018</b>	
AK-XM 205A	8	8							<b>080Z0010</b>	
AK-XM 205B	8	8						x	<b>080Z0017</b>	
AK-XM 107A						8			<b>080Z0020</b>	<b>x</b>
The following extension module can be placed on the PC board in the controller module. There is only room for one module.										
AK-OB 110							2		<b>080Z0251</b>	

## 3. AK operation and accessories

Type	Function	Application	Code no.	Example continued
<b>Operation</b>				
AK-ST 500	Software for operation of AK controllers	AK-operation	<b>080Z0161</b>	<b>x</b>
-	Cable between PC and AK controller	AK - Com port	<b>080Z0262</b>	<b>x</b>
-	Cable between zero modem cable and AK controller	AK - RS 232	<b>080Z0261</b>	
<b>Accessories</b>	<b>Power supply module 230 V / 115 V to 24 V d.c.</b>			
AK-PS 075	18 VA, 24 V d.c.	Supply for controller	<b>080Z0053</b>	<b>x</b>
AK-PS 150	36 VA, 24 V d.c.		<b>080Z0054</b>	
<b>Modem</b>	Please use a modem from Danfoss's approved suppliers list.			<b>x</b>

## 3. Mounting and wiring

---

This section describes how the controller:

- Is fitted
- Is connected

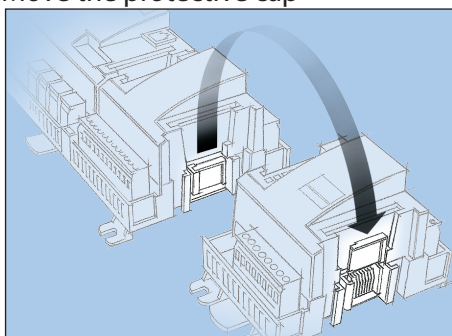
We have decided to work on the basis of the example we went through previously, i.e. the following modules:

- AK-SM 720 controller module
- AK-XM 107A pulse counter module

# Mounting

## Mounting of extension module on the basic module

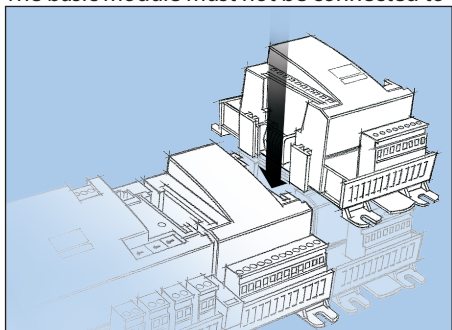
### 1. Move the protective cap



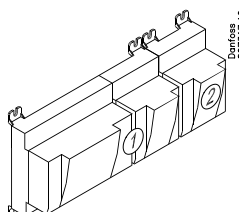
Remove the protective cap from the connection plug on the right-hand side of the basic module.  
Place the cap on the connection plug to the right of the I/O module that is to be mounted on the extreme right-hand side of the AK assembly.

### 2. Assemble the I/O module and the basic module

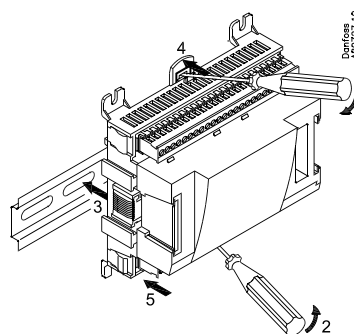
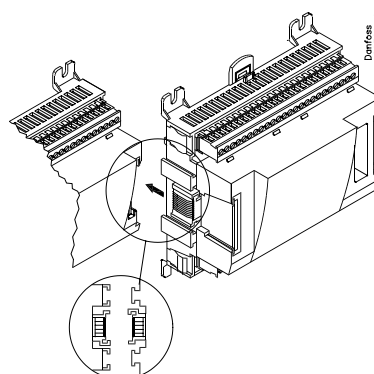
The basic module must not be connected to voltage.



In our example one extension module is to be fitted to the basic module.



All of the subsequent setting are determined by the module positions. Here 1 and 2.



When the two snap catches for the DIN rail mounting are in the open position, the module can be pushed into place on the DIN rail – regardless of where the module is on the row.  
Disassembly is thus done with the two snap catches in the open position.

# Wiring

Decide during planning which function is to be connected and where this will be.

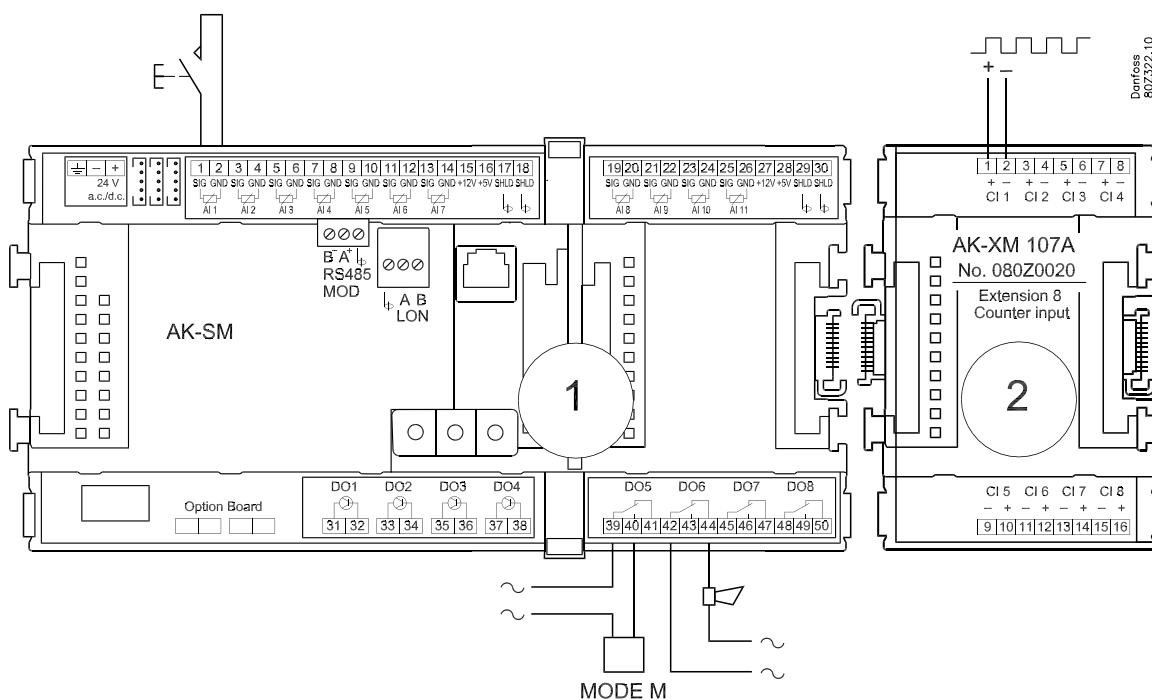
**Important**  
Keep signal cables away from cables with high voltages.

Here are the tables for the example:

## 1. Connect input and outputs

Signal	Module	Point	Terminal	Signal type/Active at
Pulse pressure for stopping the alarm relay	1	1 (AI 1)	1 - 2	-
Supply voltage to modem		16 (DO 5)	39 - 41	ON
Alarm relay for high priority alarms		17 (DO6)	42 - 44	OFF

Signal	Module	Point	Terminal	Active at
Pulse signal	2	1 (CI 1)	1 - 2	---



## 2. Connect LON and MODBUS communication network

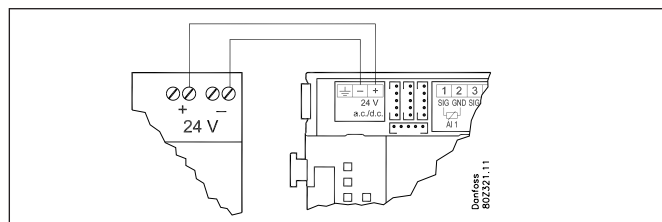
Check that data communication is terminated at either end

**The installation of the data communication must comply with the requirements set out in document RC8AC.**

## 3. Connect supply voltage

Is 24 V, and the supply must not be used by other controllers or devices.

**The two terminals must not be earthed.**



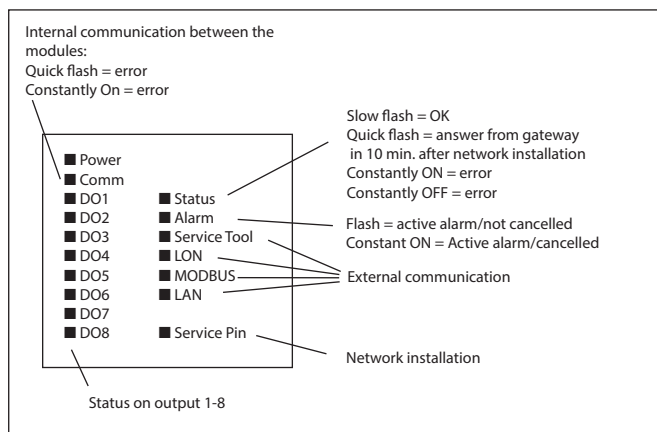
#### 4. Follow light-emitting diodes

When the supply voltage is connected the system manager will go through an internal check. The controller will be ready in just under one minute when the light-emitting diode "Status" starts flashing slowly.

#### 5. When there is a network

Set the address and activate the Service Pin. See next paragraph

#### 6. The system manager is now ready for configuration.





## 4. Configuration and operation

---

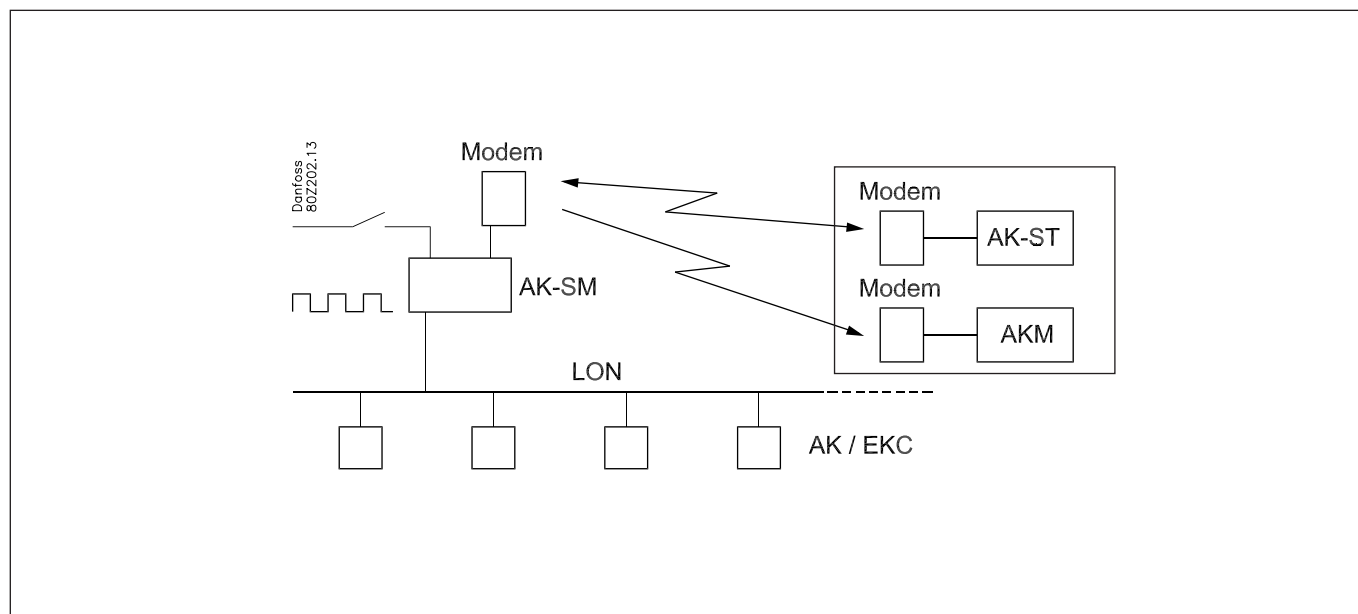
This section describes how the controller:

- Is configured
- Is operated

We have decided to work on the basis of the example we went through previously.  
The example is shown overleaf.

## Plant example

We have decided to describe the setup by means of an example comprising a system manager and a number of controllers. The example is the same as the one given in the "Design" section, i.e. the system manager and one extension module.



### Controllers:

- The controllers are of types AK- and EKC
- They are connected in a LON network
- They transmit alarms to the system manager

### Modem:

- The modem is a type from the positive list
- It is connected to the system manager (it cannot be connected until the setup has been completed as it is the same plug that is used)

### Operation:

- The setup is performed on the plant with PC and software programme AK-ST
- After the setup operation can also take place via the modem and AK-ST

### Alarms:

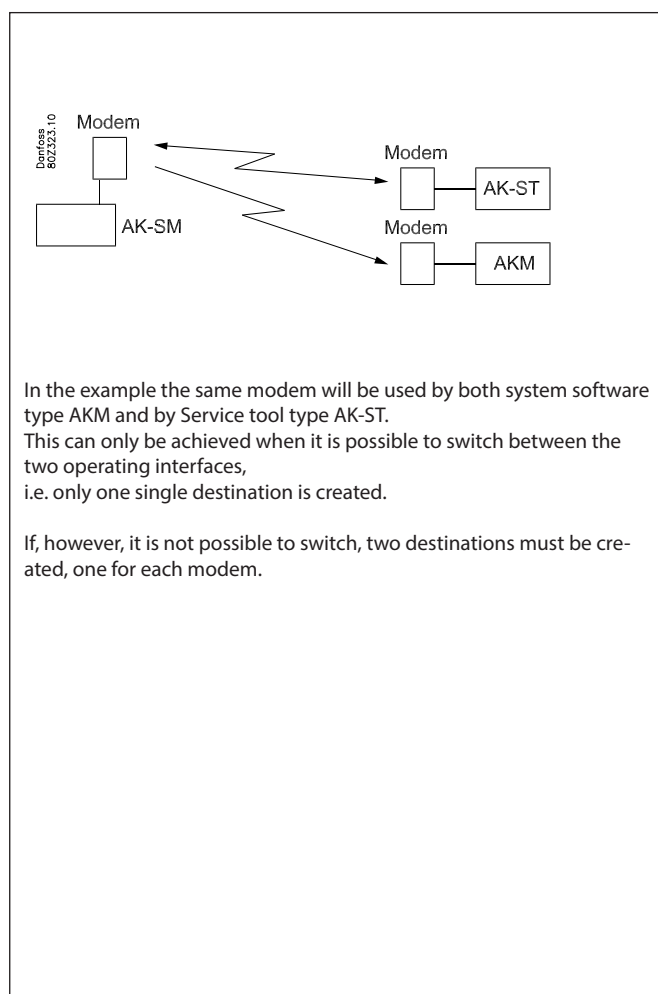
- The alarm destination is System software type AKM at the external modem

### Alarm routing:

- To System software type AKM at the external modem

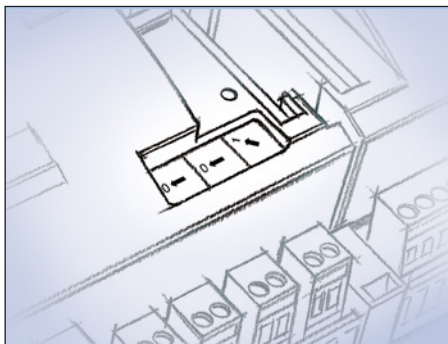
### Controls:

- A table is set up for the shop's opening hour
- Logs are collected in the system manager
- Logs are downloaded from the system manager with AKM
- Day/night hours for the refrigeration appliances are managed by the system manager
- Defrost start is carried out by the system manager
- Consumption measurement (pulse signal is received from an external unit)
- Switch to override the day/night schedule
- Switch (pulse pressure) to reset alarm



# Installation in network

## 1. Set net number

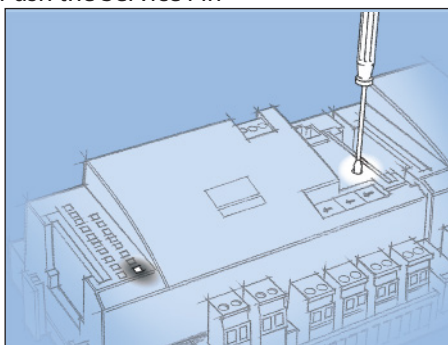


In our example the system manager must have address 1.

Turn the right-hand address switch so that the arrow will point at 1.

The arrow of the two other switches must point at 0.

## 2. Push the Service Pin



Press down the service pin and keep it down until the Service Pin LED lights up.

## 3. Wait for answer

## 4. Carry out new login via Service Tool

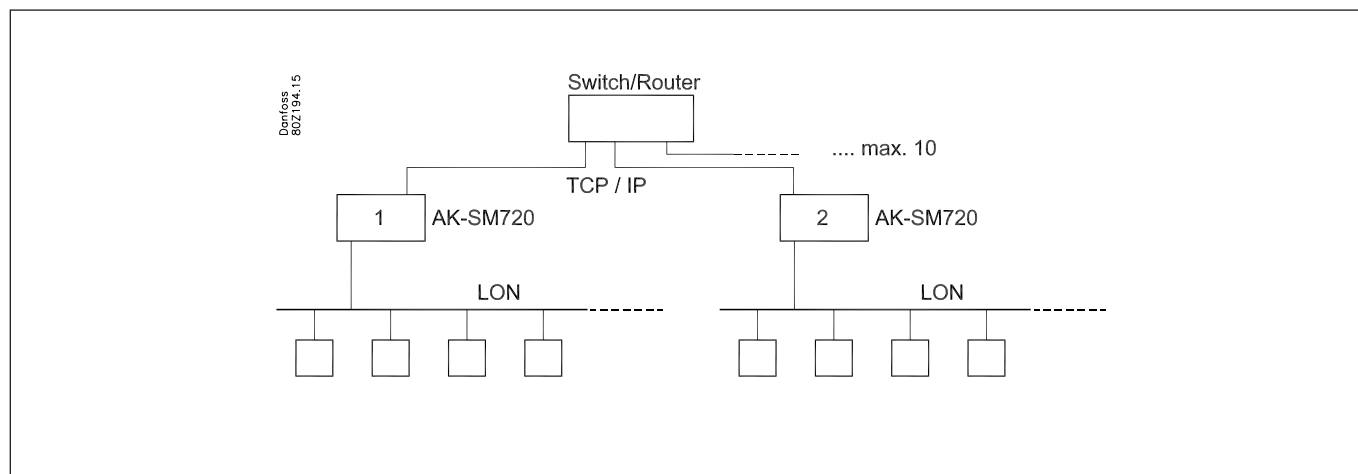
The system manager will be the master of a number of controllers in a network. The number of this network can be set between 1 and 10. In any network there must **always** be a number 1 as number 1 will appear as master and coordinate the communication if there are several system managers on the same network.

**A change of the setting of the switch will only take place after activation of the service pin button.**

When the "Status" light emitting diode starts flashing faster than normal the network number has been installed. There will be a flash every half second and change-back to slow flashing again after some 10 minutes.

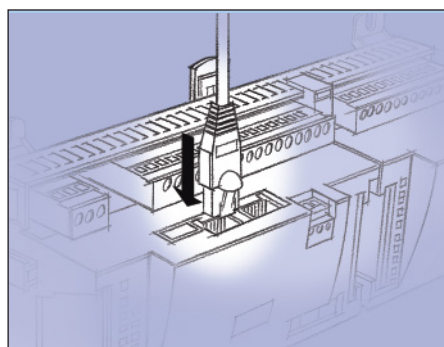
If the Service Tool was connected to the System manager while you installed it in the network, you must carry out a new login to the system manager via the Service Tool.

(If there are several network and with that several system managers)



If several system managers are linked up, the subsequent units must have network numbers 2 and up, but max. 10.

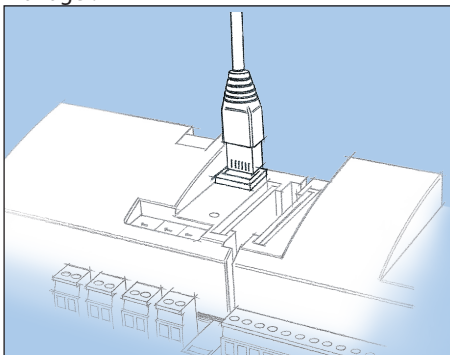
Communication between the system managers takes place via the TCP/IP network.



# Configuration

## Connect PC

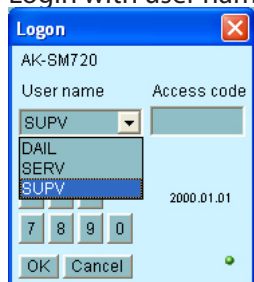
PC with the program "Service Tool" is connected to the system manager.



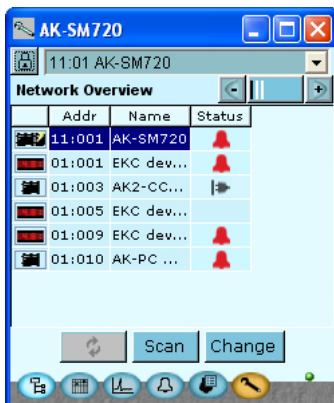
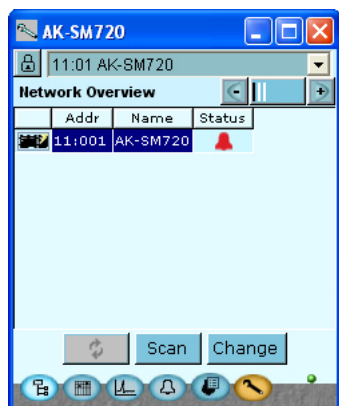
The controller must be switched on first and the LED "Status" must flash before the Service Tool programme is started.

## Start Service Tool programme

### Login with user name SUPV

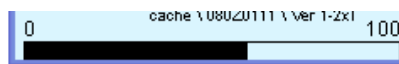


Select the name **SUPV** and key in the passcode.



The AK Service Tool is mentioned at the beginning of the manual. For connection: please see AK-ST.

The first time the Service Tool is connected to a new version of a controller the start-up of the Service Tool will take longer than usual while information is retrieved from the controller. Time can be followed on the bar at the bottom of the display.



When the controller is supplied the SUPV access code is 123. When you are logged into the controller an overview of it will always appear.

When you are logged in on the system manager an overview of the connected controllers will always appear.

In this case the overview is empty. This is because the system manager and the controllers have not yet been set up.

The red alarm bell at the bottom right tells you that there is an active alarm in the system manager. In our case the alarm is due to the fact that the time has not yet been set.

The address is shown as 11:001.

This means that the master network is 11 and that this network is 1 (the master network will **always** be 11, and this **cannot** be changed).

Subsequently the overview will also show the connected controllers with their respective addresses. The illustration here has only been included for your information so that you can see that the network number is 1.

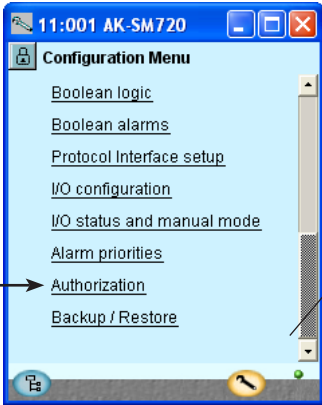
# Authorization

## 1. Go to Configuration menu

Press the orange setup button with the spanner at the bottom of the display.



## 2. Select Authorization



When the controller is supplied it has been set with a standard authorization for different user interfaces. This setting should be changed so it is adapted to the plant. You can change this now or later.

You will use this button again and again whenever you want to get to this display. On the left-hand side are all the functions not shown yet. There will be more here the further into the setup we go.

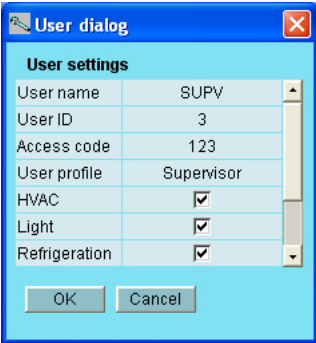
Press the line **Authorization** to get to the user setup display.

## 3. Change setting for the user 'SUPV'



Mark the line with the user name **SUPV**. Press the button **Change**

## 4. Select user name and access code



This is where you can select the supervisor for the specific system and a corresponding access code for this person.

In earlier versions of the service tool AK-ST 500 it was possible to select the language in this menu. An updated version of the service tool will be released in the spring of 2009. If the controller is operated with the new version, language selection will happen automatically in connection with the configuration of the service tool. The controller will utilize the same language that is selected in the service tool but only if the controller contains this language. If the language is not contained in the controller, the settings and readings will be shown in English.

## 5. Carry out a new login with the new user name and the new access code

To activate the new settings you must carry out a new login to the controller with the new user name and the relevant access code. You will access the login display by pressing the padlock at the top left corner of the display.

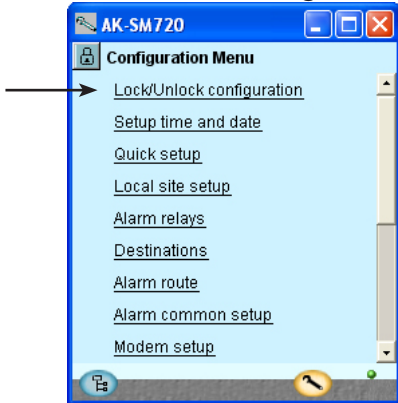


## Unlock the configuration of the controllers

1. Go to Configuration menu

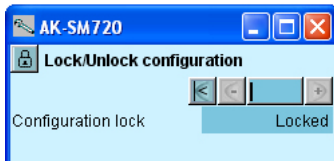


2. Select Lock/Unlock configuration



3. Select Configuration lock

Press the blue field with the text **Locked**



4. Select Unlocked

Select **Unlocked** and press **OK**.



The controller can only be configured when it is unlocked. It can only be adjusted when it is locked.

The values can be changed when it is locked, but only for those settings that do not affect the configuration.

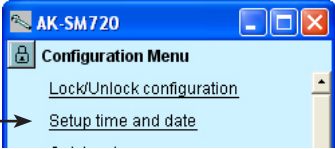
(The configuration lock blocks for all settings concerning the setup of inputs and outputs as well as the setting of the IP address).

### Clock function

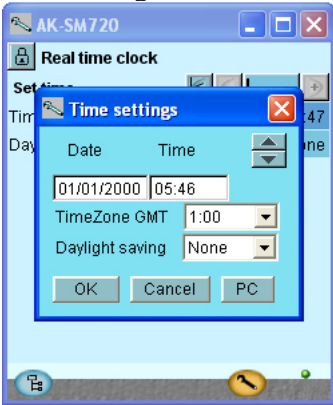
1. Go to Configuration menu



2. Select Setup time and date



3. Time setting



Press in the blue field with a setting.  
An auxiliary setting will now be shown. Press the "PC" button and then "OK" to transfer the PC's times to the system manager.  
The system manager's times will automatically be retransmitted to the individual controllers on the network.

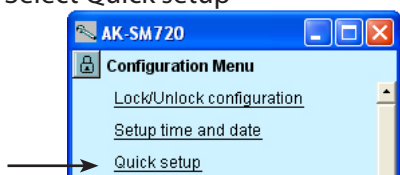
A battery will protect the clock function if there is power failure. The working life of the battery is several years. The battery is checked continuously and an alarm will be given when it is time for a replacement. After a replacement the clock has to be reset.



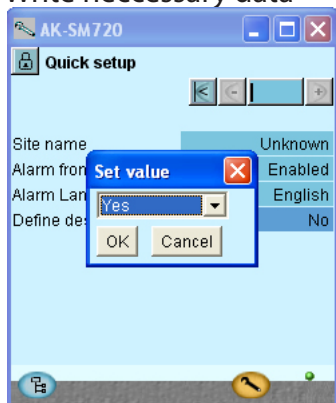
## Quick setup

1. Go to Configuration menu

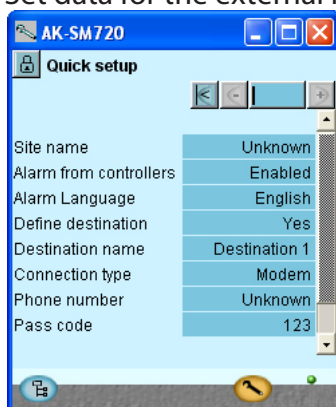
2. Select Quick setup



3. Write necessary data



4. Set data for the external recipient



In this menu the necessary settings have been gathered so that a simple alarm routing can be established. All settings will be transferred to other respective displays.

- Site name
- Receive alarms from controllers on network
- The language in which the alarms are to be received
- Select the alarms to be retransmitted to an external recipient

Press the OK button to gain access to the settings for the external recipient.

- Give the destination a name
- The connection to take place via a modem
- Write the phone number
- Write passcode
- Define that alarms are to be sent (next line a little further down on the screen)
- Define the alarm priorities that are to be sent (the next line a little further down in the display).

Setting	Log	Alarm relay selection			Net-work	AKM-dest.
		Non	High	Low - High		
High	X		X	X	X	1
Middle	X			X	X	2
Low	X			X	X	3
Log only	X					
Disabled						

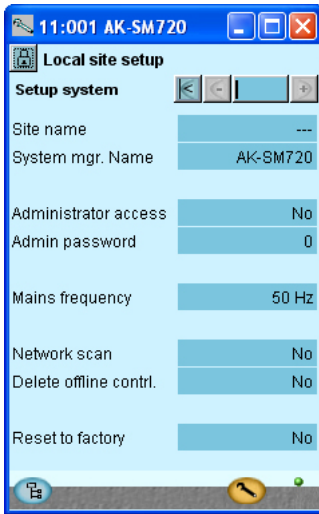
## Plants main data

1. Go to Configuration menu

2. Select Local site setup



3. State main data

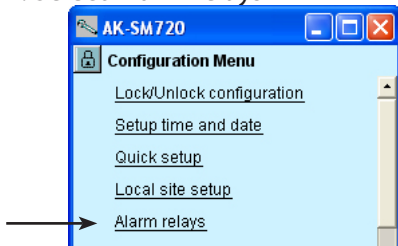


- Write the name (it will already be there if you entered it under "Quick setup").
- The name of the system manager will also be the same if you entered it under "Quick setup". You may overwrite the name if it is to be changed. (This is the name that will be shown in the general view of the plant).
- The two lines with "Administrator access" may allow a user access that overrides the normal safety control. With the setting = "Yes" and password = "0", Danfoss can access and then help in a service situation.
- Set Mains frequency
- The two settings Scanning the network and "Delete offline controller" are intended for service situations. The scan function is the same as on the overview display (it can be activated later on in the setup). Once the scanning function has registered a controller on the network, it will remain on the overview display. Only by activating the function "Delete controller, there is no longer contact to", can it be removed from the overview display.

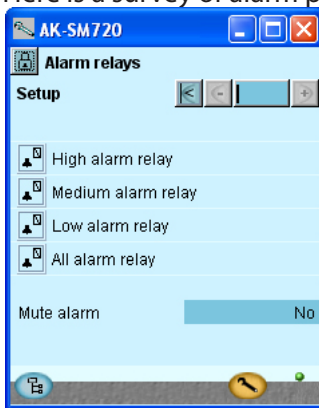
## Alarm relay on plant

1. Go to Configuration menu

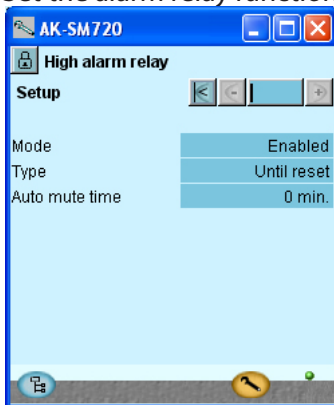
2. Select Alarm relays



3. Here is a survey of alarm priorities



4. Set the alarm relay function



If the relay is to be activated by high priority alarms you must select the top line. Press the icon to proceed to the next page.

(The "Mute alarm" operation on the bottom line can zeroset the alarm relay when it is activated).

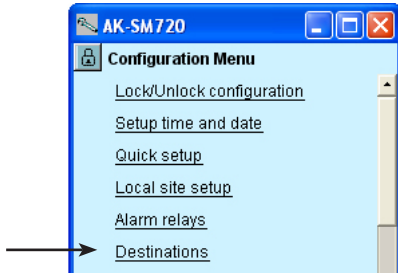
- Set the "Enable alarms" function
- Set that relay is to remain activated until the alarm is zeroset
- Set the max. activation time for the alarm relay.

The "High Alarm relay" is the only one that can be set to track alarm status, i.e. it is always triggered when an alarm sounds. Zero-set is not possible.

## Destinations to be communicated with

1. Go to Configuration menu

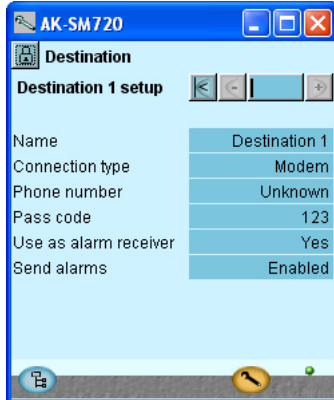
2. Select Destinations



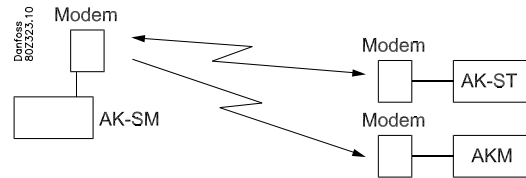
3. Here is a survey of the plants that can be connected.



4. Here is the destinations data



All contacts must have a preset destination. Both those that can be called and those that can call in to the system manager. This applies for contacts via both modem and TCP/IP.



In our example there is just one destination. It originates from the setting under "Quick setup".

The text "Destination 1" will be changed if you changed the text under "Quick setup".

Set data for the network.

**The name must be 100% identical with the recipient's setting. (It is used for ID check-up).**

Remember that if the system manager is to receive alarms from the connected units the setting "yes" must be selected.

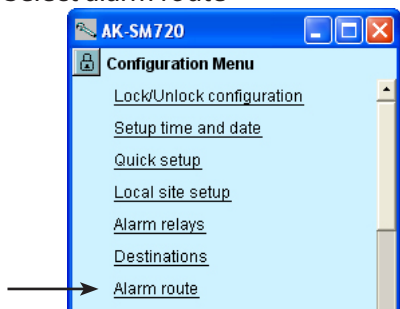
If changes need to be made in the set up, "Send alarms" must be set to "Disable" before changes can be made. Remember to reselect "Enable".

Use "New" under point 3 if there are several networks to be communicated with.

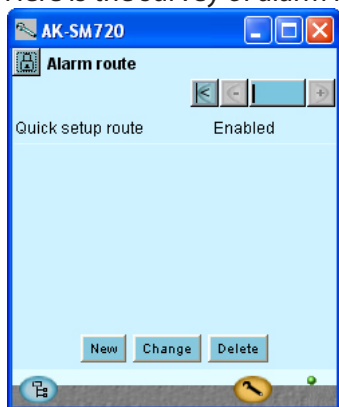
## Routing of alarms

1. Go to Configuration menu

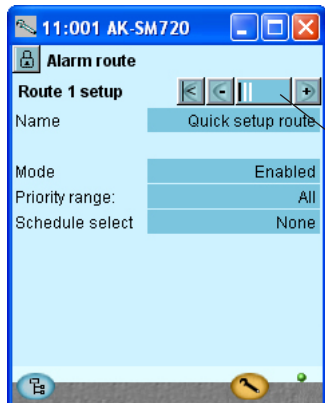
2. Select alarm route



3. Here is the survey of alarm routes



4. Set data for the alarm route



Press the + -button to go on to the next page

An alarm route has earlier been set up - this happened under "Quick setup".

**If more routes are required, the following menus must be used.**

Correct name and settings for automatic setup route, if any.

**(Only the system manager that is assigned address 1 can route alarms.)**

You gain access to establish new routes via the "New" button. If you wish to make changes in an existing route it must be selected, and you then continue with "Change".

The following displays show the possible settings.

Fill in/check data for the route

Priority options
All
High only
Middle only
Middle and high
Low and middle
Disabled


There are several pages, one after the other. The black bar in this field tells you which of the pages is currently displayed.

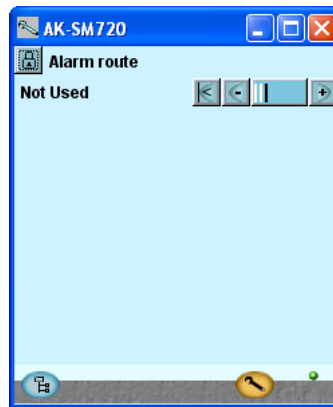
Move between the pages using the + and - buttons.

5. Settings for the alarm route are continued here



Repeat points 1 to 5 if there are several alarm routes.

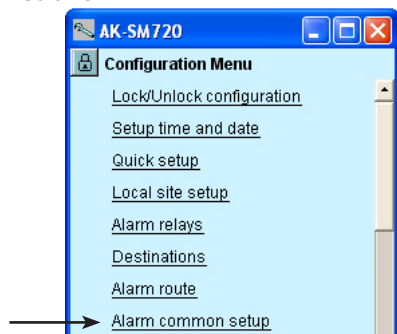
The third picture in the row that can be reached via the +- button  is not used at the present time.



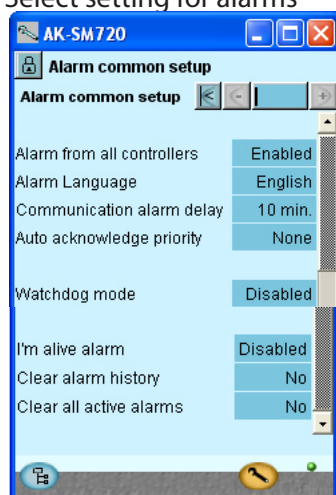
(The "Night" alarm route only becomes visible when you select a schedule under item 4.)

## Alarms from controllers

1. Go to Configuration menu
2. Select the common alarm functions



3. Select setting for alarms



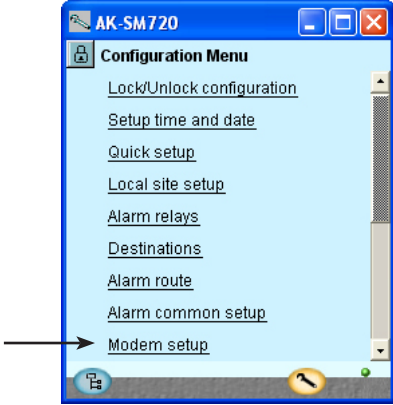
Set that alarms should be received from all the connected controllers.

The "I'm alive alarm" function will report that there is connection between the plant and the alarm receiver.

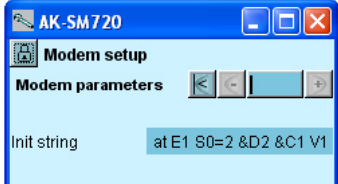
# Modem and IP settings

1. Go to Configuration menu

2. Select modem setup

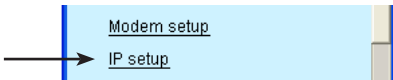


3. Check the commands for initiation of the modem.

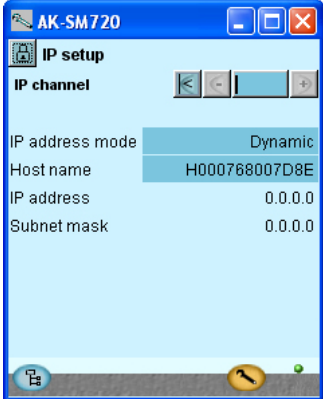


4. If the system manager forms part of an IP network, the IP unit must also be set.

Next line after Modem setup is IP setup. Press the line.



5. Check the settings for the IP setup



Normally, it is not necessary to change commands.

Select Dynamic if the address is assigned automatically from a router or a DHCP server.  
In connection with static address the address must be ordered from the local IT department..

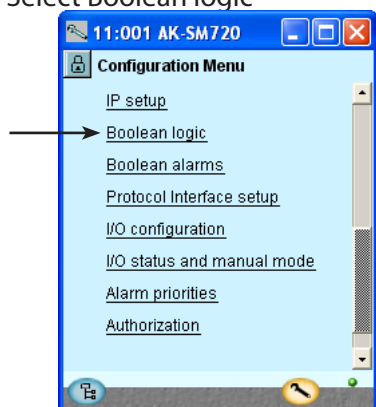
**If the system is to be called from AKM or from Service Tool, a "static address" must be used.**

Selecting "Static" a line appears where you must set up an address for the IP gateway (the IP gateway address).  
(The systems manager uses port number 1041.)



## Design some functions yourself

1. Go to Configuration menu
2. Select Boolean logic

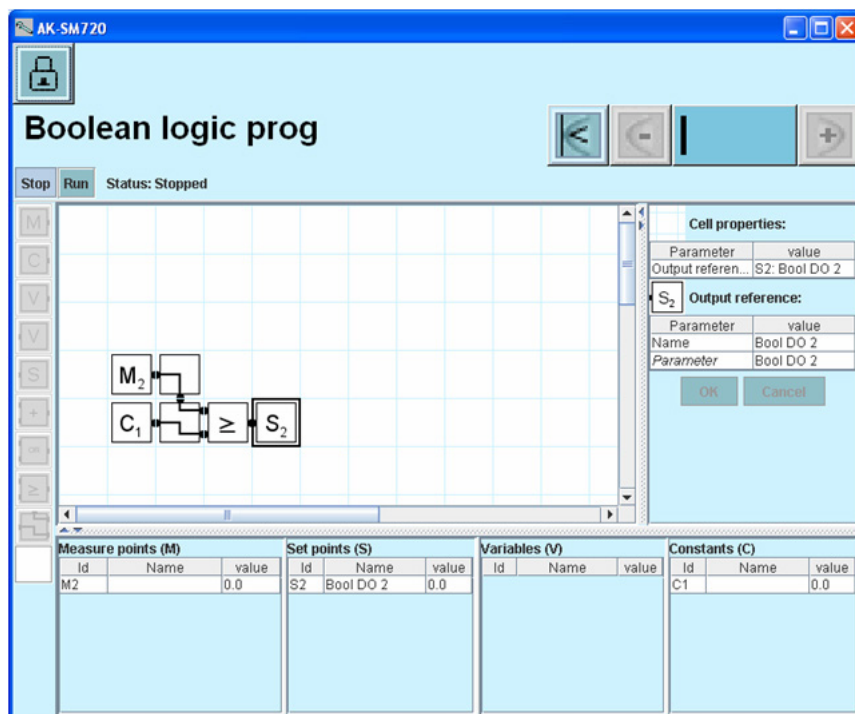


In our example we have not used boolean logic. The pictures shown have only been included for your information.

**Design of boolean functions should be left to specially trained staff.**

The application is described in a separate document RC8CA. In this document you will also find the limitations in the number of functions.

3. Design a function on the network in the display.



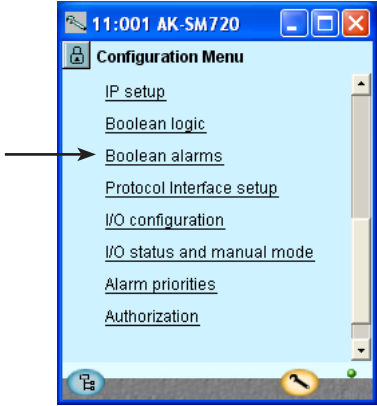
Place the cursor in a field and download a part function from the menu bar left

4. Activate the designed function(s)  
Press **Run**

## Alarms for boolean functions

1. Go to Configuration menu

2. Select Boolean alarms

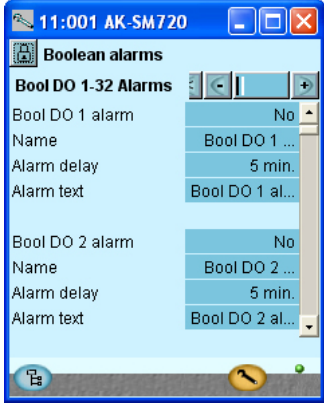


In our example we have not used boolean alarms. The pictures shown have only been included for your information.


**Design of boolean functions should be left to specially trained staff.**

Give the defined alarms a name and an alarm text.

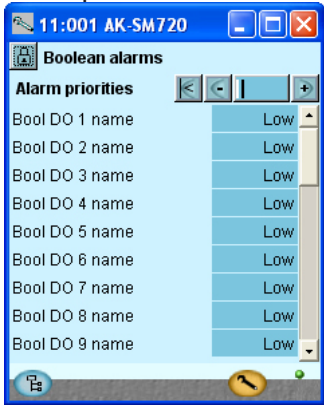
3. Name and alarm text



Give the defined alarms a priority.

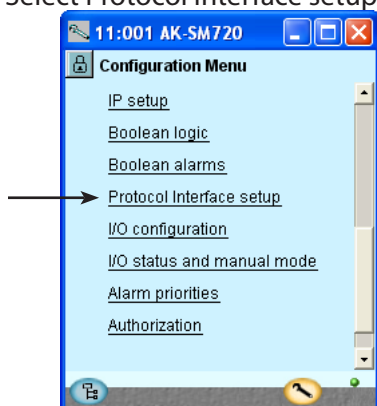
 Press the +-button to go on to the next page

4. Alarm priorities

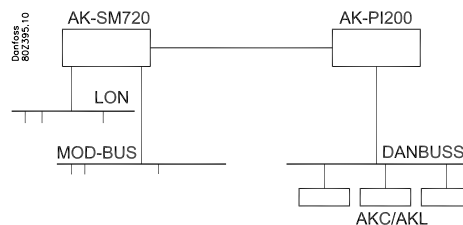


## AKC controllers on DANBUSS

1. Go to Configuration menu
2. Select Protocol Interface setup



In this example we do not have AKC controllers and therefore we do not use the function. This is only included for your information.



This function is only used if the system manager needs to exchange data with controllers of the type AKC which are controllers with DAN-BUSS data communication.

Controllers can be accessed via protocol interface type AK-PI 200.

Installation and setup are described in the manual for AK-PI 200. Literature sheet number RS8EX.

## Are there other inputs and outputs? — Any that must be used by system controls?

Here we have to interrupt the setup sequence to make the system manager display the functions in the system controls that require outputs and inputs. This takes place from page 71 onwards in points 1 to 56.


**A “!” symbol is displayed by the settings that will require an input or output. If you want to use the function displayed, you must enable it.**


You must only enable this setting – you must **not** implement the remaining settings for the control. These may only be set when there is contact to the controllers via data communication. (When there is contact, the system manager itself can recognise the function of the various controllers.)

Once you have completed points 1-56, return here. We will then continue the setup process.

### How to go to the settings discussed in points 1-56:

1. Go to the overview

Press the blue overview button at the bottom left of the display 

2. Proceed to plant operations 

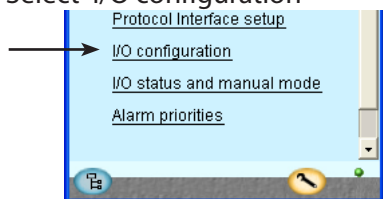
.  
. .  
. .  
. .  
. .

3. Once you have been through the system controls, you can proceed to the next page with the section entitled “Configuration of input and outputs”.

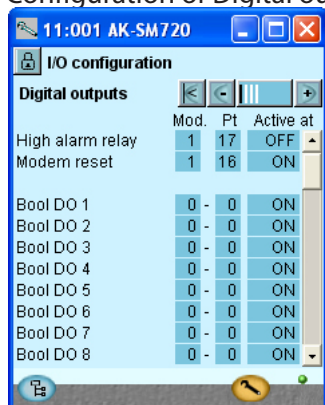
## Configuration of inputs and outputs

1. Go to Configuration menu

2. Select I/O configuration

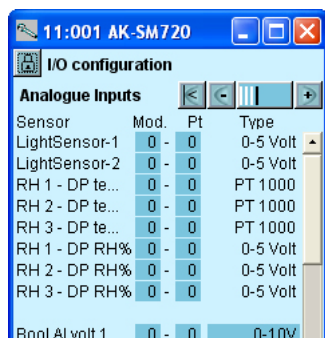
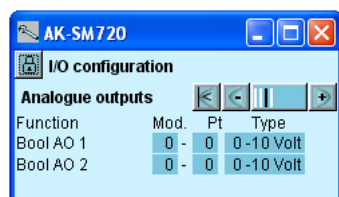
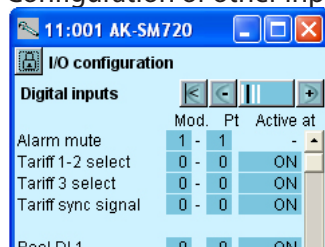


3. Configuration of Digital outputs



Press the + - button to go on to the next page

4. Configuration of other input and output



The succeeding displays will depend on the earlier definitions. The displays will show which connections the earlier settings will require.

Load	Output	Module	Point	Active at
Modem reset	DO5	1	16	ON
Alarm relay for high priority alarms	DO6	1	17	OFF

Enter module number and point number for each connections. We furthermore select for each connection whether the load is to be active when the output is in pos. **ON** or **OFF**.

Please disregard the depicted "Boolean logic" functions. They have only been shown for your information. This also applies to the boolean functions that are shown on the next page.

Function	Input/output	Module	Point	Active at
Stop of alarm (pulse pressure)	AI1	1	1	

A contact function with pulse pressure is connected. The function stops the alarm relay.

In our example no further functions have been selected, but if it had been a matter of overriding with a switch function of a day/night schedule or a defrost schedule, this is where the input would have to be defined.

Pulse counter input

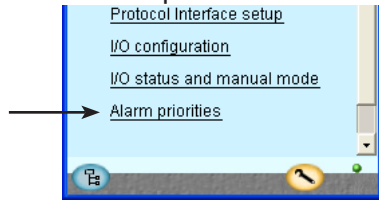
At present this function is not defined, so no space has been assigned for module number and point number. The "Controls" will be defined later.

You can either skip forward and define the control (page 84) or you can continue and then return here to set the module number and point number.

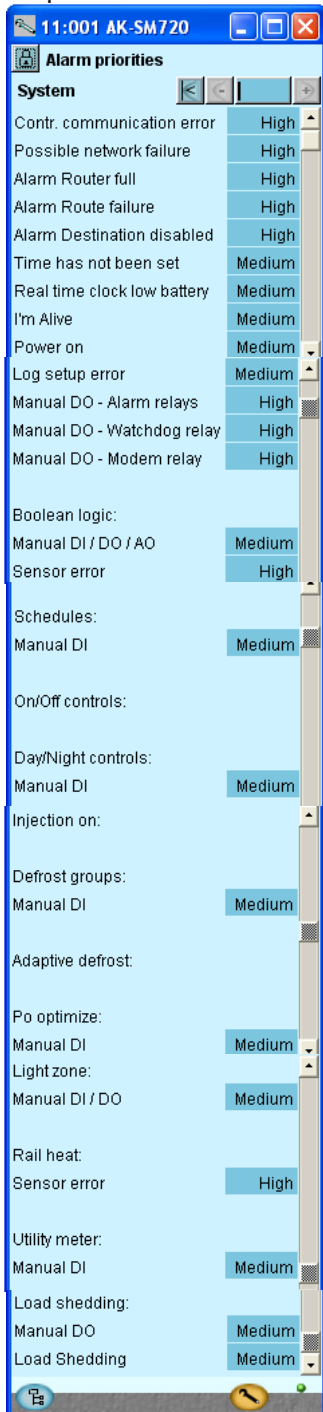
## Set alarm priorities

1. Go to Configuration menu

2. Select alarm priorities



3. Set priorities



Very many functions have an alarm connected.

Your choice of functions and settings has connected all the relevant alarms that are current. They will be shown with text in the three pictures.

All alarms that can occur can be set for a given order of priority:

- "High" is the most important one
- "Log only" has lowest priority
- "Disconnected" gives no action

The interdependence between setting and action can be seen in the table.

Setting	Log	Alarm relay selection			Net-work	AKM-dest.
		Non	High	Low - High		
High	X		X	X	X	1
Medium	X			X	X	2
Low	X			X	X	3
Log only	X					
Discon- nected						

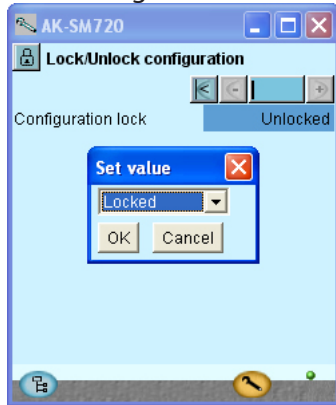
In our example we select the settings shown here in the display

## Lock configuration

1. Go to Configuration menu
2. Select Lock/Unlock configuration



3. Lock Configuration



Press in the field against **Configuration lock**.  
 Select **Locked**.  
 Press **OK**.

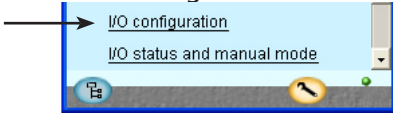
The setup of the controller has now been locked. If you subsequently want to make any changes in the controller's setup, remember first to unlock the configuration.

The system manager will now make a comparison of selected functions and define inputs and outputs. The result can be seen in the next section where the setup is controlled.

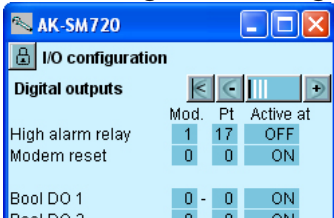
## Check configuration

1. Go to Configuration menu

2. Select I/O configuration

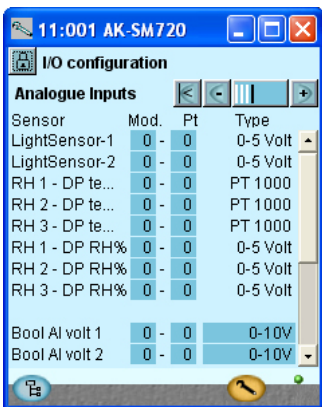
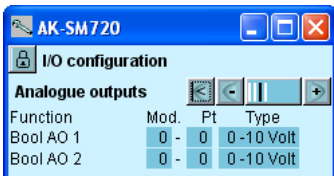
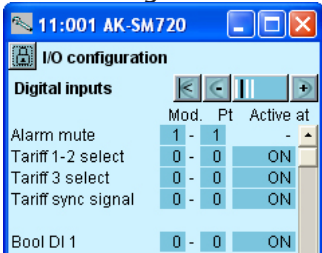


3. Check configuration of Digital Outputs

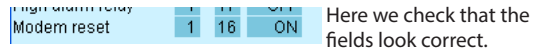


Press the + -button to go on to the next page

4. Check configuration of other inputs and outputs



**This control requires that the setup is locked.**



Here we check that the fields look correct.

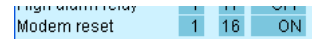
In our case the setup of the output to the modem has returned to 0-0 for module and point number.

This may be due to the following:

A selection has been made of a combination of module number and point number that does not exist or will create a conflict.

Fx the selected point number on the module had been set up for something different.

The error is corrected by setting up the output for the modem correctly. In our case to **module 1 point 16**.



Remember that the setup must be unlocked before you can change module and point numbers.

**(If one of the fields go red it means that the function which used to require a connection has been opted out again. By setting module and point number in pos. 0, the connection is also opted out.)**

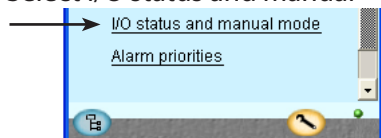
The shown "Boolean logic" functions are not used.



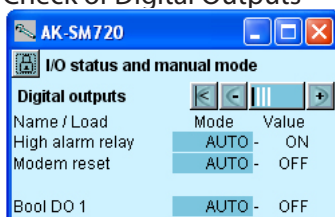
# Check of connections

1. Go to Configuration menu

2. Select I/O status and manual

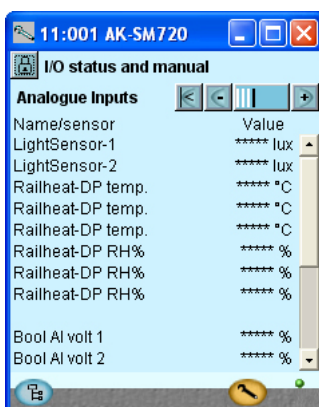
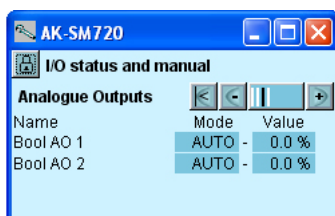
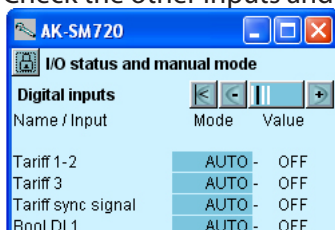


3. Check of Digital Outputs

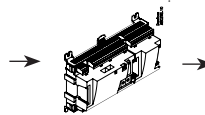


Press the + -button to go on to the next page

4. Check the other inputs and outputs



Before the system manager is started we check that all inputs and outputs have been connected as expected.



Here we check whether the inputs and outputs are working.

***This control requires that the setup is locked.***

By means of the manual control of each output it can be checked whether the output has been correctly connected.:

- AUTO**            The output is controlled by the system manager
- MAN OFF**        The output is forced to pos. OFF
- MAN ON**         The output is forced to pos. ON

The illustrations is for your information.

# Find the controllers on the network

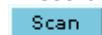
## 1. Go to the overview

Press the blue overview button at the bottom left of the display.



## 2. Scan the network

Press the scan-button

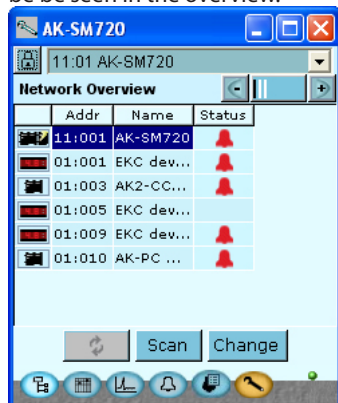


## 3. Await the scanning

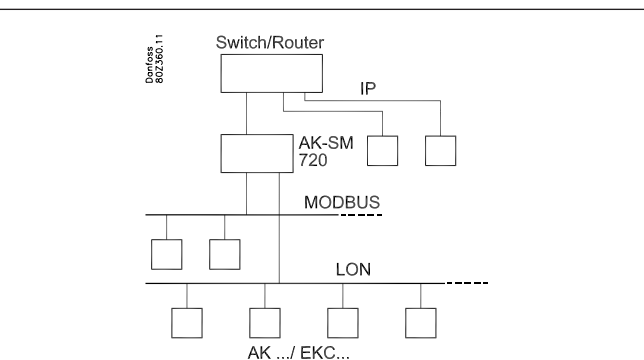
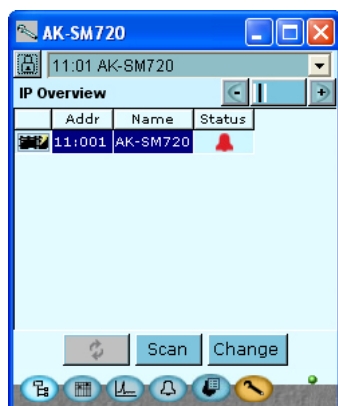
## 4. Show result

Press Update button

All controllers on the LON network and MOD-bus network can be seen in the overview.



Press the + -button to go on to the next page where the IP network is shown.



All controllers on the data communication must have an address set before this point is carried out.

There must not be two controllers with the same address. If there are, only one of them will be registered.

There may be up to 200 addresses on the LON and MOD connection.

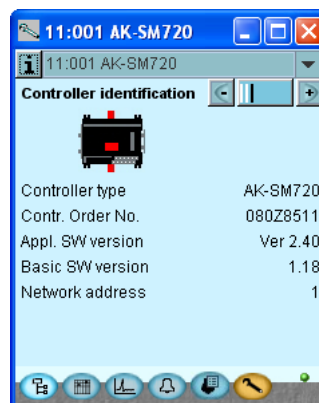
There can however be max. 100 on the MOD bus connection.

Both LON network, MOD-bus network and IP network will be scanned now.

The system manager scans the network and whenever it finds a controller it will send a confirmation to the respective controller – the controller's display will flash with the registered address. After about five minutes the display will return to normal.

If you want to change the name of the controller to something more user-friendly, select the controller and then press "Change".

All the registered controllers can be seen in the two displays.




The final screen in the sequence contains data for the system manager.

# Setup of controllers

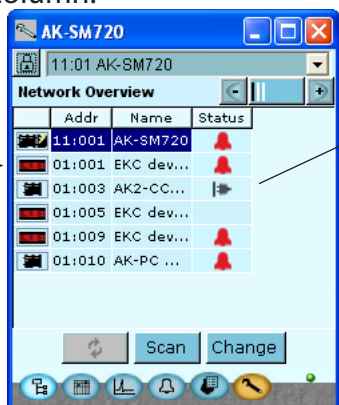
## From the system manager

### 1. Go to the overview

Press the blue overview button at the bottom left of the display.. 

### 2. Select controller

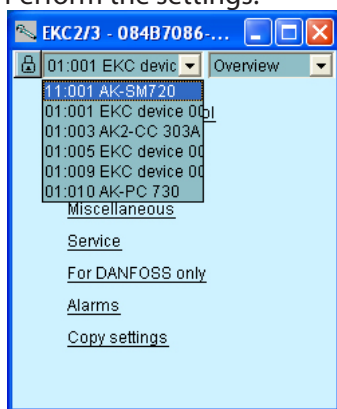
Press one of the controller symbols in the left-hand column.



There is now access to all the connected controllers. If they have not already been set up individually it can be done via data communication from the system manager, or the modem may be cut in and the setup can then take place via the modem communication.

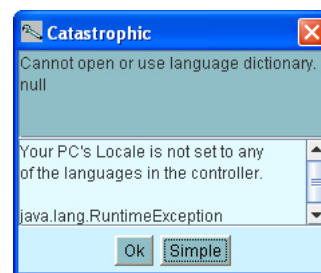
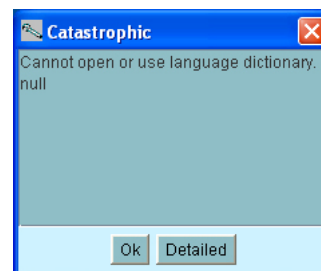
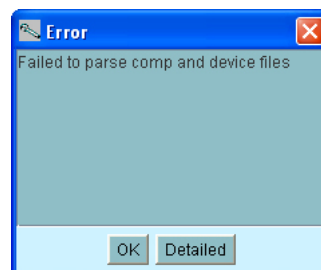
If this symbol is shown the controller falls off the network. Check the data communication.

### 3. Perform the settings!



When you have made the settings in the controller you proceed to the next controller or return to the system manager via the survey.

Here are a couple of examples of the information that can appear if the connection to the controller cannot be created.



## From modem connection

1. The modem is cut in as shown on page 86 (90). Settings can now be made as explained above.

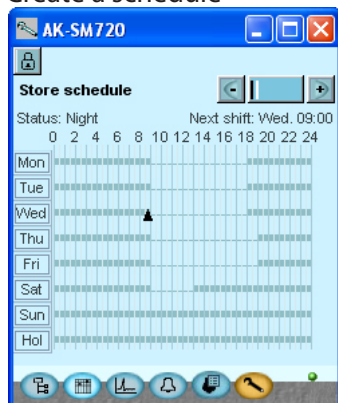
# Setup functions

## Schedule for shop's opening hours

1. Go to the overview
2. Move on with the schedule



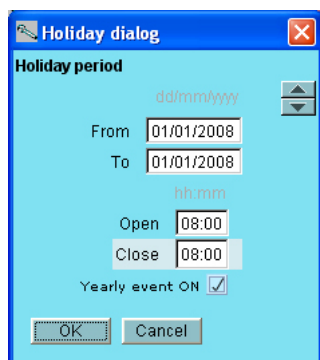
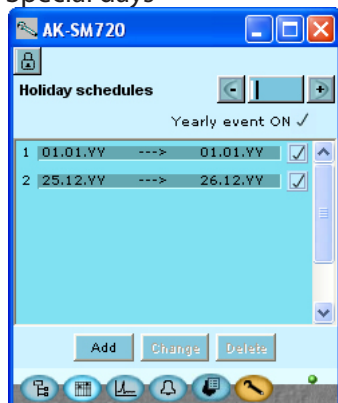
3. Create a schedule



4. Setup the schedule

Press the +-button to go on to the next page

5. Special days



A schedule must be established that indicates the shop's opening hours. The schedule is later to be used in connection with day/night operation of refrigeration appliances. (The day/night changeover can be set relative to this schedule. A later change of opening hours will merely require an adjustment in this schedule.)

Shown here is the final result when the schedule has been set.

Press a weekday and set the times for the day period.  
Move on with the other weekdays

In this display we enter the days of the year where the the shops opening hours deviate from normal.

If there are special days where the shop is open outside of the earlier defined schedule, they may also be entered here. The opening hours must then also be defined.

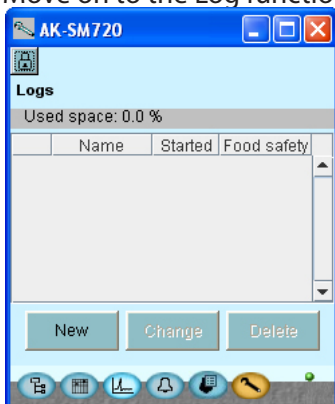
If these days recur year after year they can be marked accordingly.

The underlying picture of the time setting looks like this:  
The period is indicated as "from one date" – "to another date" (both days being inclusive).  
If the period comprises whole closing days, the settings for "opening" and "closing time" must be set at the same hour. The value does not matter.

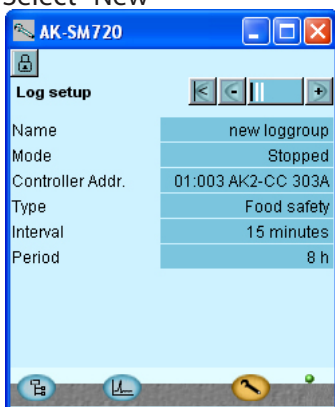
## Logs


1. Go to the overview

2. Move on to the Log function 

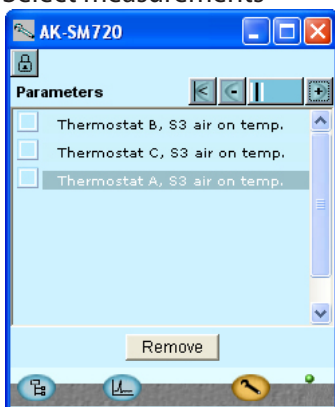



3. Select "New"



 Press the +-button to go on to the next page

4. Select measurements



 Press the +-button to go on to the next page, where the measurement has to be selected.

The log display will now show one line for each of the defined logs. The definition takes place via the "New" knob, or an existing log may be selected whereupon you press "Change". The showing of the measured data is placed behind each log icon.

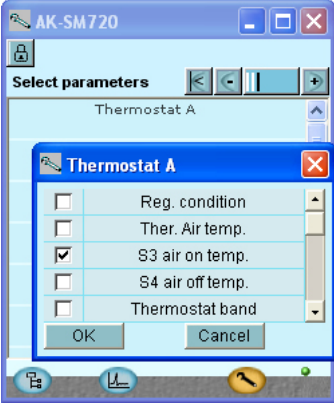
Log extraction may take place once the clock has been set.



Setup the functions:

- Give the Log a name
- Select the address from which the data are to be downloaded.
- Continue by defining the log type and how often collection is to be made.
  - It is recommended that a food safety log lasts 15 min. or more.
  - A service log can be less than 15 min.
  - It depends what is being logged.
- The time period is the time during which the measurement is to be accessible in the system manager. After this time period it will be overwritten.

The **final result** is shown here when the measurements have been selected.

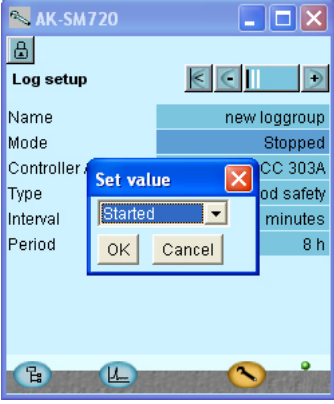
5. Select the section and then the measurement



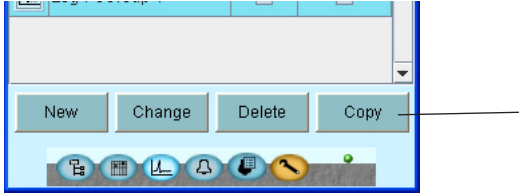
After the selection you may press the minus button  to see what has been selected.  
Or you may press the plus button  to move to the start display.

6. Start the collection

Change the setting "Stopped" to "Started".



If you want to create similar logs in a series of identical controllers, you can use the copy function in the bottom right-hand corner.

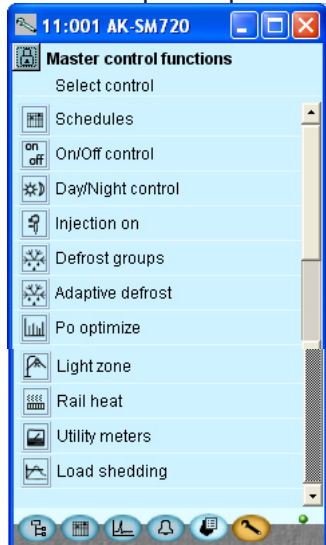


7. If several logs have to be established, points 3 to 5 must be repeated.

## Plant operations

1. Go to the overview

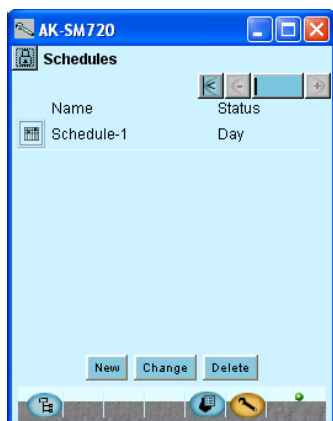
2. Proceed to plant operations



The display will now show one line for each of the general operations. Behind each icon there will be a number of displays with the different settings. It is all these settings we will be going through.

### Schedules

3. Select schedules



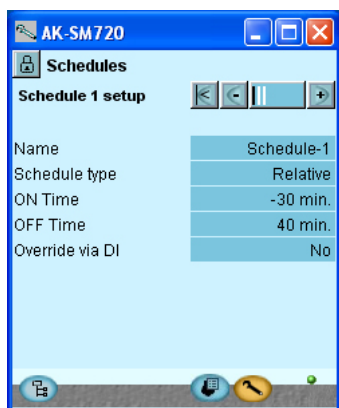
Schedules set up via this operation can be used for day/night signal. The signal is transmitted via the data communication to selected controllers.

(We have earlier set up a schedule for the shop's opening hours. The function of the schedule in this section can be seen as an extra schedule or a schedule for another control. If the schedule for the shop's opening hours is adequate, this schedule can be dispensed with).

(The final result is shown here when the schedule has been set up.)

4. Create a schedule

Press "New".




We select "Relative" because the schedule has to relate to the schedule for the shop's opening hours.

We select the schedule times to be 30 minutes before opening hours and 40 minutes after opening hours.

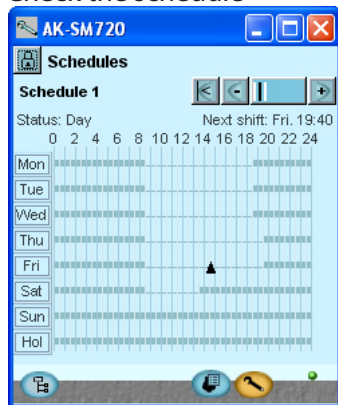
! If you enable this function, a line will automatically be created and reserved in the I/O configuration. The line will contain the name of the function. In this line you must set a Module Number and a Point Number. See also page 60 onwards.


5. Give the schedule a name

6. Select schedule type

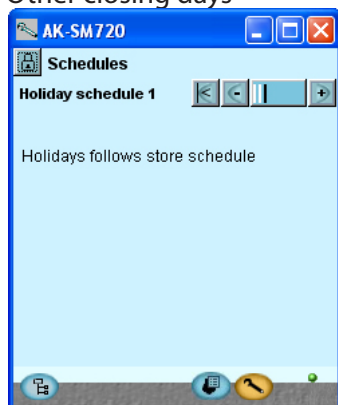
 Press the +-button to go on to the next page

7. Check the schedule



 Press the +-button to go on to the next page

8. Other closing days



9. If there are several schedules, repeat points 3 to 8.

At "Relative" there are no settings.  
The system manager combines the opening hours with the set hours from the preceding display.  
In the display you can see the start and stop times directly.

At "Relative" there are no settings.  
This follows the schedule for the store's hours of business.



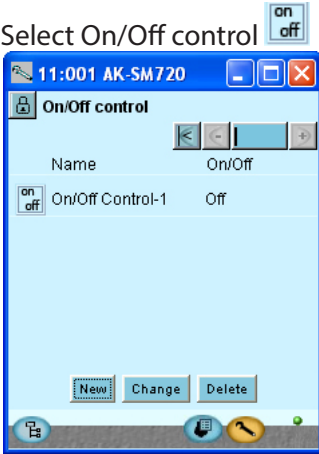
----- On / Off -----

10. Return to the overview display

Press the plant control button.

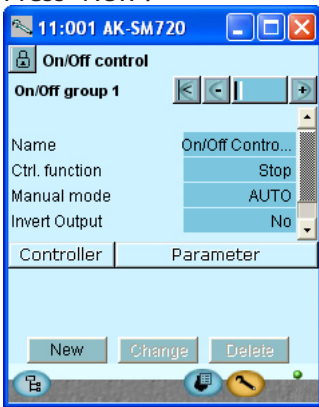


11. Select On/Off control



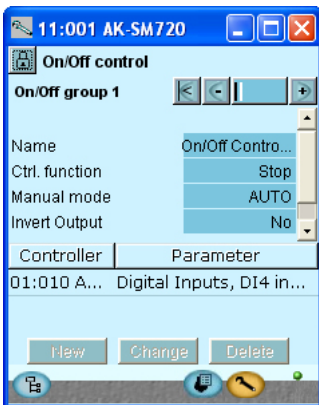
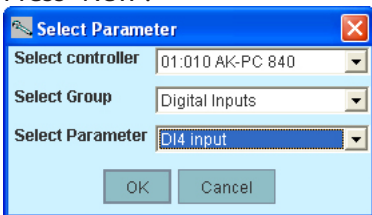
12. Setup a new ON/Off group

Press "New".



13. Define where the reading is to be collected.

Press "New".



The groups that are set up via this control can collect signals from one On/Off function in any controller on the network. This signal is then forwarded to another On/Off function on the network.

A maximum of 5 groups may be setup.

Give the group a name


The function can be stopped or started. When the function has been started, it will follow the reference signal but only in the "AUTO" position. If the receiver function needs to be force controlled, the setting must be set to "Manual On" or to "Manual Off".

The signal can be inverted.

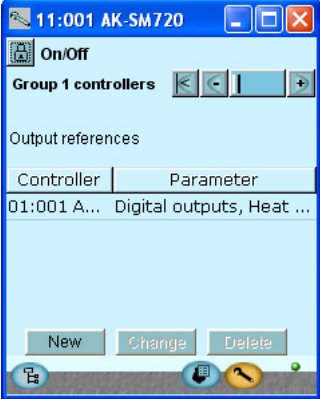
Select the required reference parameter

Only an On/Off function can be selected as a reference.

When the OK button has been pressed, the function reference can be seen at the bottom of the display. Only one reference can be chosen per group.

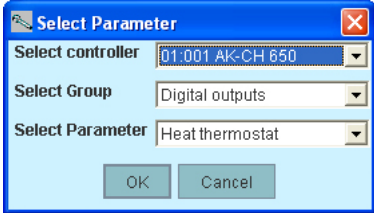
 Press the +-button to go on to the next page

14. Define what the signal is to activate



Up to 30 signal receivers can be selected.

15. Press "New" and then select the parameter



When the OK button has been pressed, the function receiver can be seen in the previous display.

A receiver can only receive override signals from one group. It should not be selected for other groups as well. If this happens the last setup will be replaced.

**NOTE!**  
Selecting a receiver should only be carried out by trained personnel. Only On/Off functions can be selected for receivers. It is possible to select other functions but it can lead to disastrous setting errors.

16. If you wish to setup more groups of On/Off controls, repeat points 12-15.

----- **Day / night** -----

17. Return to the overview.

Press plant operations. 

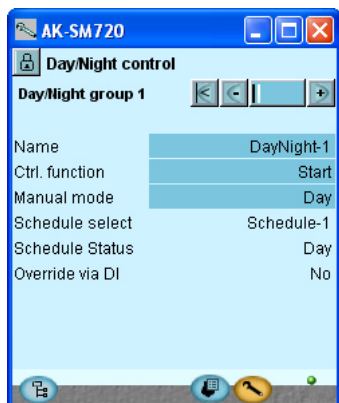
18. Select day/night control 



Groups established via this operation receive the day/night signal at the same time. Activation of the signal either takes place from a schedule and/or from a switch.

(The final result is shown here when the group has been set up.)

19. Setup a new day/night group  
Press "New".



Give the group a name.

Do not start the function until it has been defined.

(Manual mode is an override function)

Select which schedule the control has to follow

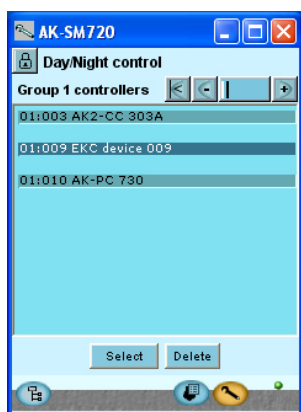
! If you enable this function, a line will automatically be created and reserved in the I/O configuration. The line will contain the name of the function. In this line you must set a Module Number and a Point Number. See also page 60 onwards.

Here you can see the controllers that receive the day/night signal. The picture to the left shows the final result. The three controllers in the next display have been selected earlier.

Controllers can only be selected if the function is stopped in the previous screen.

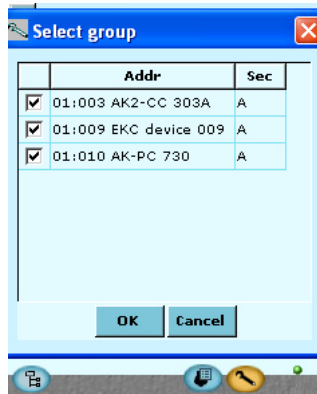
Only controllers with day/night function are displayed in the screen. A controller should only be included in one single day/night group.

Press the +-button to go on to the next page



20. Press "Select"

21. The controllers that are to belong to the group are marked here.



Finish with "OK".

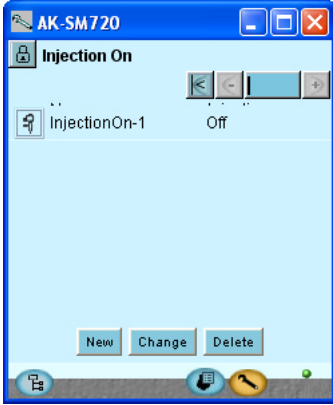
22. If several groups of day/night controls are to be established, points 19 to 21 must be repeated.

----- **Inject-on** -----

23. Return to the overview.

Press "operations".

24. Select Inject-on control

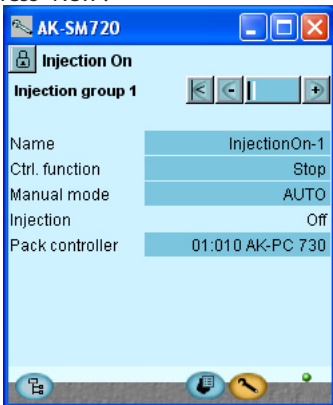


Groups established via this operation receive a signal so that liquid injection is stopped. Activation of the signal takes place via a compressor control.

(Shown here is the final result when the group has been set up.)

25. Setup a new Inject-on group

Press "New".



Give the group a name

Select which compressor control is to supply the signal. The compressor control may have several suction circuits. Select the relevant one.

Press the +-button to go on to the next page

26. Here you can see which controllers receive the Inject-ON signal.



The picture to the left shows the final result. The controllers have been selected via the "Select" button. Only select controllers belonging to the selected suction group.

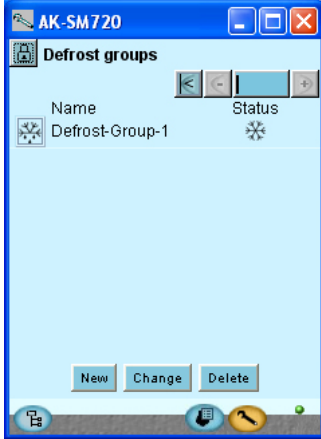
27. If several groups of Inject-ON controls have to be set up, points 25 to 26 have to be repeated.

--- Defrost groups ---

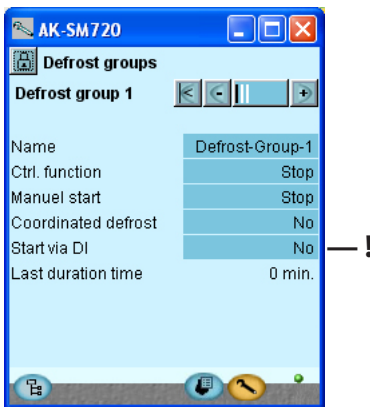
28. Return to the overview.

Press "operations"

29. Select Defrost group control.



30. Setup a new defrost group  
Press "New".



Press the +-button to go on to the next page



Press the +-button to go on to the next page

Groups established via this operation will start defrost at the same time. Start after a defrost can take place individually, or there may be a coordination so that all units start at the same time. (Shown here is the final result when the group has been set up.)

Give the group a name.

Do not enable the group until the whole group has been defined (controllers can only be selected when the function has stopped).

(Manual start is an override. In daily operation it can be used to start an extra defrost process.)

Select whether there is to be coordinated defrost. That is, all will wait for a defrost stop, so that all will start at the same time.

! If you enable this function, a line will automatically be created and reserved in the I/O configuration. The line will contain the name of the function. In this line you must set a Module Number and a Point Number. See also page 60 onwards.

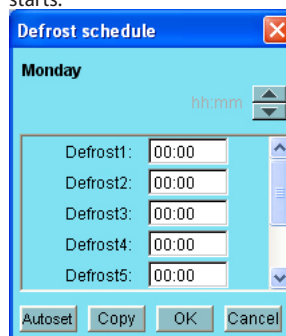
Here you can see which controllers are gathered in the group. The picture to the left shows the final result. (The controllers have been selected via the "Select" button.)

If you have a controller selected that does not support the function, an alarm will be triggered each time the defrosting starts.

## 31. Set the defrost schedule for the group



Press on a day of the week and set the times for the various defrost starts.



If there are several days with identical defrost processes, use the copy function. The end result with two defrost processes a day can be seen in this screen.

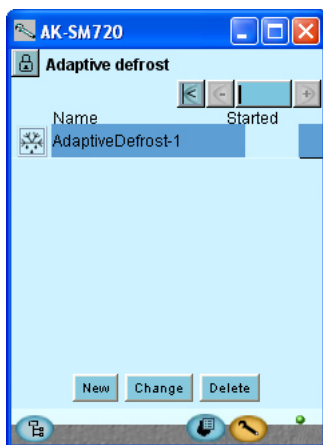
## 32. If several groups are to be set up, repeat points 30 to 31.

--- Adaptive defrost ---

## 33. Return to the overview.

Press plant operations.

## 34. Select the control "Adaptive Defrost"



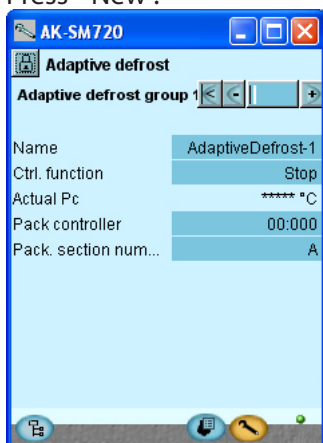
A group created via this control will use the "Adaptive defrost" function. The controllers in the group receive signals of the current condensation temperature from the condenser control. Only controllers with this function can be selected for the group.

Shown here is the final result when the group has been set up.

Up to ten zones can be set up.

## 35. Setup a new group

Press "New".



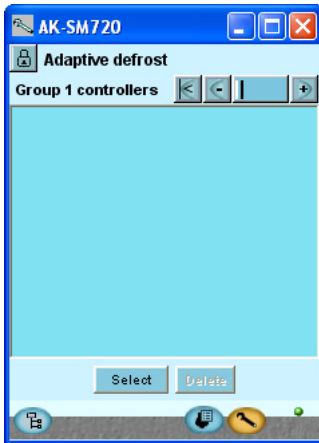
Give the group a name.

Do not enable the group until the whole group has been defined (controllers can only be selected when the function has stopped).

Specify the current address and section for the compressor/condenser control that belongs to the controllers.

**A controller should only be included in one single defrost group.**

Press the +-button to go on to the next page



The screen on the left shows the end result. The controllers are selected via the "Select" button.

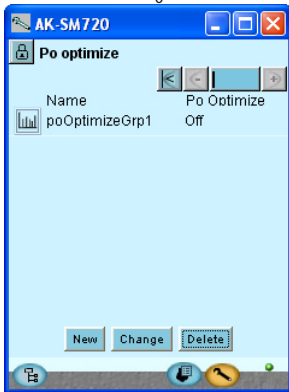
36. If several groups are to be set up, repeat point 35.

----- **P<sub>0</sub> optimize** -----

37. Return to the overview.

Press plant operations.

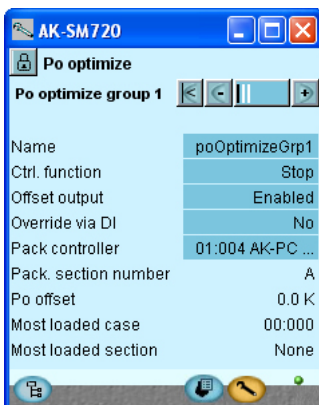
38. Select the "P<sub>0</sub> optimize" control



Groups established via this control will follow the temperature in the selected cooling sections and transmit a signal to the compressor control to the effect that the suction pressure can be displaced.

Shown here is the final result when the group has been set up..

39. Setup a new optimization group  
Press "New".



Give the group a name.

Do not enable the group until the whole group has been defined (controllers can only be selected when the function has stopped).

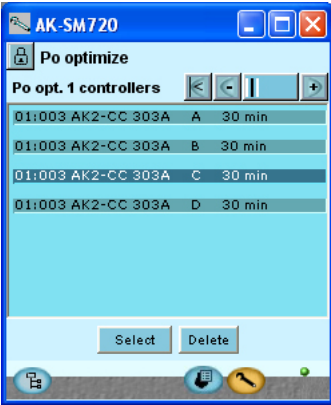
Allow the suction pressure to be displaced.

If the PO optimization needs to be disconnected in periods during control, you must activate the function "override via signal on a DI input". ! If you enable this function, a line will automatically be created and reserved in the I/O configuration. The line will contain the name of the function. In this line you must set a Module Number and a Point Number. See also page 60 onwards.

Select the compressor control that regulates the suction pressure

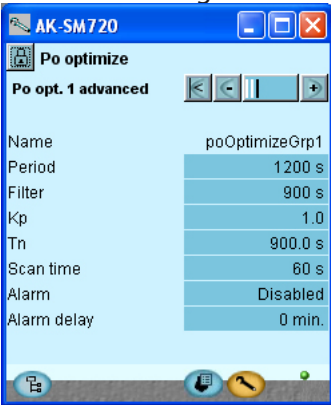
If it is a compressor control with several sections, the relevant section must also be selected.

Press the +-button to go on to the next page



Press the +-button to go on to the next page

40. Advanced settings



41. If several groups are to be set up, repeat point 39.

Here you can see which controllers are gathered in the group. The picture to the left shows the final result. The controllers have been selected via the "Select" button.

**Only select controllers belonging to the selected suction group.**

Most settings are regulating parameters. Avoid changes – they should be reserved for specially trained staff.

**Avoid making changes – only trained personnel may implement these.**

At the bottom of the display there is an alarm function which can give alarm if the optimization function displaces (reduces) the suction pressure towards 90% of the compressor control's P0 min. setting.

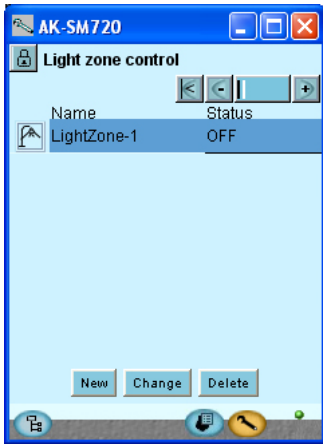


----- **Light control** -----

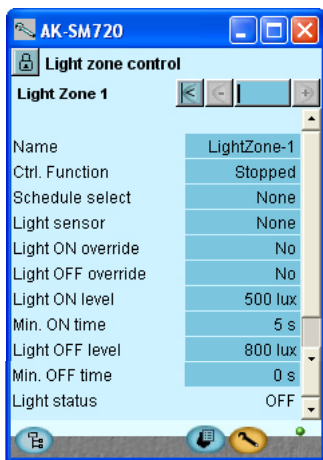
42. Return to the overview.

Press plant operations.

43. Select the control "Light Zone"



44. Setup a new light group  
Press "New".



45. If several groups are to be set up, repeat point 44.

A group created via this control will switch the light connected to the defined relay on and off.

Shown here is the final result when the group has been set up..

Up to eight zones can be set up.

Give the group a name.

Do not enable the group until the whole group has been defined (controllers can only be selected when the function has stopped).

If necessary, select a light sensor.

Define whether switches are to be connected to override the light. There can be either a switch or pulse pressure. If pulse pressure is used, a timer function can also be used so that the light is automatically switched off when the time has expired.

! If you enable this function, a line will automatically be created and reserved in the I/O configuration. The line will contain the name of the function. In this line you must set a Module Number and a Point Number. See also page 60 onwards.

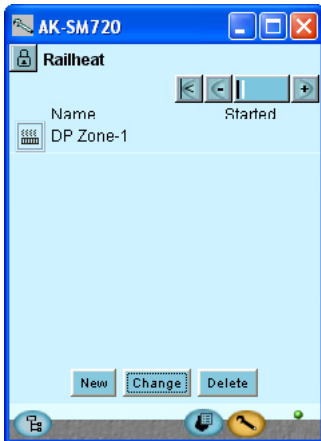
The light level and subsequent functions are only used if a light sensor is used.

- - - **Adaptive Railheat** - - -

46. Return to the overview.

Press plant operations.

47. Select the control "Adaptive Railheat"



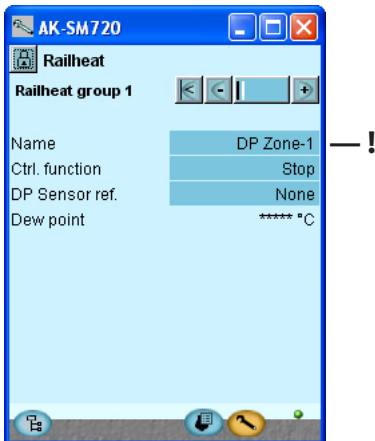
A group created via this control will use the "Adaptive rail heat" function.  
 The controllers in the group receive signals of the current dew point from a dew point sensor. The dew point sensor must be connected to the system manager.  
 Only controllers with this function can be selected for the group.

Shown here is the final result when the group has been set up.

Up to three zones can be set up, each with its own dew point sensor. (A dew point sensor will deliver a temperature signal and a voltage signal.)

48. Setup a new group

Press "New".



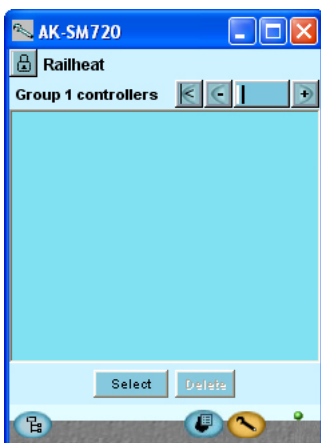
! If you enable this function, two lines will automatically be created and reserved in the I/O configuration. The lines will contain the name of the function. In these lines you must set a Module Number and a Point Number. See also page 60 onwards.

Give the group a name.

Do not enable the group until the whole group has been defined (controllers can only be selected when the function has stopped).

State which of the three dew point sensors is to transmit a signal to this group.

Press the +-button to go on to the next page



The screen on the left shows the end result.  
 The controllers are selected via the "Select" button.

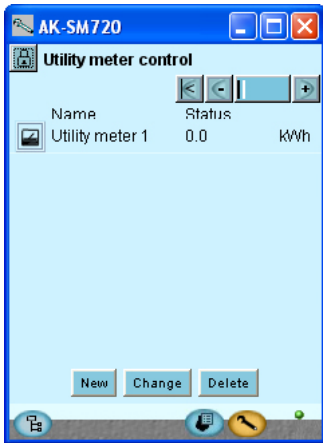
49. If several groups are to be set up, repeat point 48.

----- **Utility meter** -----

50. Return to the overview.

Press plant operations.

51. Select the control "Utility meter"

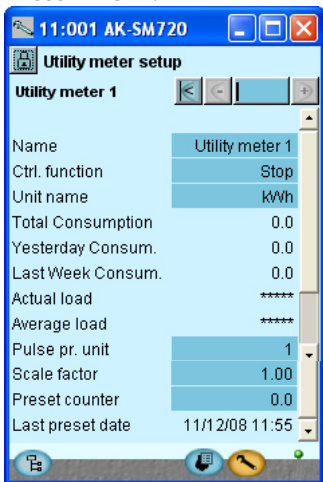


This function will require a signal from a pulse counter. Consumption can then be monitored in the screens displayed. Up to eight measurements can be set up.

! If you enable this function, a line will automatically be created and reserved in the I/O configuration. The line will contain the name of the function. In this line you must set a Module Number and a Point Number. See also page 60 onwards.

52. Setup a new group

Press "New".



Give the function a name.

Do not enable the function until the whole function has been defined (settings can only be defined when the function has stopped).

Specify the unit of measure. kWh when measuring current, m3 when measuring gas.

Also define:

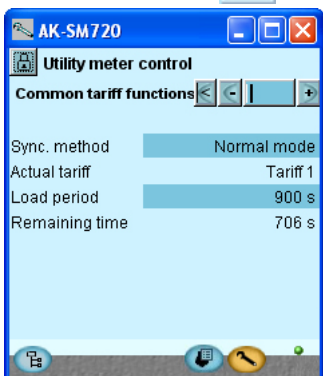
- How many pulses are to be received for each unit of measure.
- Any necessary scaling.
- Any reset (or other start value) of the display.

The measurement can be monitored in the five fields. These display the total consumption, the current load and the average load over the period of time.

53. If several groups are to be set up, repeat point 52.

54. Common functions

You access the joint functions from the 1st screen, where you press the + button



Here you must define the joint data for the tariff functions.

The synchronisation method will be time-based if no input is connected with a tariff signal.


- Normal: A new period starts when the synchronisation input is switched on.
- Special: As normal, but a new period also starts when the tariff input is changed.

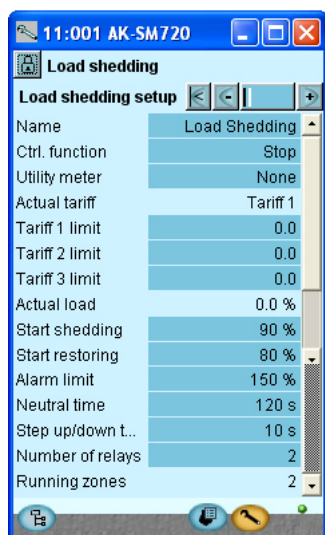
Load period is the expected time between two synchronisation signals.


-- -- **Load shedding** -- --

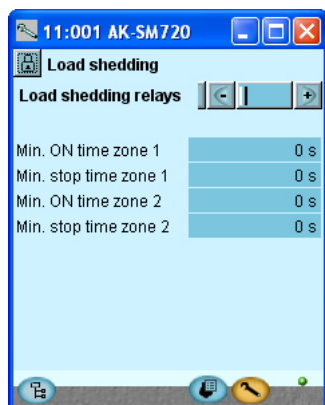
55. Return to the overview.

Press plant operations. 

56. Select the control "Load shedding" 



 Press the +-button to go on to the next page



This function can only be used together with the earlier "Consumption measurement" function.  
If consumption rises to a peak situation, some of the load can be disengaged so that consumption does not exceed a defined value.

! If you enable this function, a line will automatically be created and reserved in the I/O configuration. The line will contain the name of the function. In this line you must set a Module Number and a Point Number. See also page 60 onwards.

Do not enable the function until the whole function has been defined (settings can only be defined when the function has stopped).

Give the function a name.

Select the utility meter which will be sending the signal. A utility meter must be defined before you can select this.

Set max. values for the individual tariffs.

In the "Current load %" line you can see the current consumption as a % of the maximum permitted consumption.

Start shedding: This is where you adjust the percentage value of the tariff where the cutout is to start. The highest zone number cuts out first.

Start restoring: This is where you can adjust the percentage value of the tariff where any cutouts are cut back in.

Define a value in the "Alarm limit" line. If this value is exceeded, an alarm will be transmitted.

Neutral time is the time after a new synchronisation when loads are not disengaged, regardless of consumption.

Delay between engaging and disengaging the individual zones.

Number of zones that can be disengaged.

Zones in operation

In the next display the minimum-on and minimum-off times for the zones can be set.

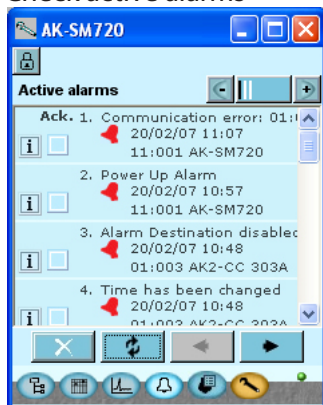
## First start of system manager

### Check alarms

1. Go to the overview 

2. Go to the Alarm list 

3. Check active alarms



In our case we have alarms both from the system manager itself (address 11:001) and from other controllers on the network.

We wish to start a fresh survey which only shows alarms that are active.

4. Remove cancelled alarm from the alarm list

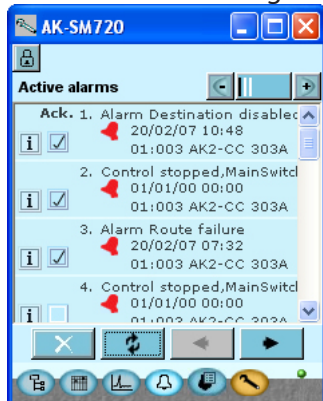


- Mark off all alarms (to show and acknowledge that you have seen the alarm)



- Press the update button. Subsequently all alarms that have stopped will be cancelled. Left now will be the actual alarms.


5. Check active alarms again



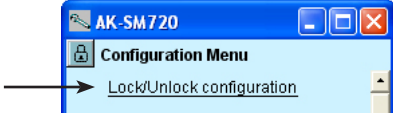
If active alarms still remain the reason for them must be found and corrected.

## Lock configuration of connections

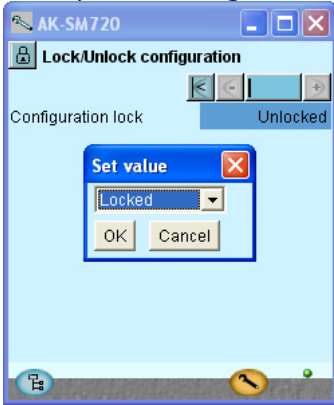
We locked the setup earlier in the process. Check that it is still locked.

1. Go to Configuration menu 

2. Select Lock configuration



3. Start system manager

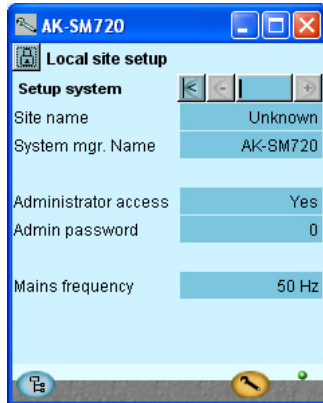


Set the setup to **Locked**.

The setup lock only has influence on changes of connections and definitions in the four menus under I/O setup and IP setup. All other settings may freely be made.

## Check level for safety

### 1. Select the display with plant data



### 2. Check the line with "Administrator access"

#### Administrator access:

If setting = "Yes" access will only be permitted if the names with the ID are 100% identical.

If "No" is set, ID is ignored.

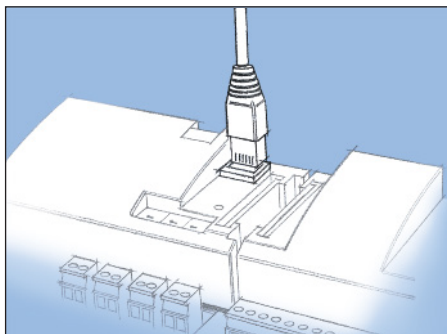
The setting may be used in start-up situations where IDs are not yet in place or in a service situation where Danfoss needs to have access.

If you set "password" = 0 the password function is ignored.

## Conclusion

### 1. Conclude the Service tool programme.

### 2. Connect modem



The plug from the Service tool programme is removed from the controller and the modem plug is connected in its stead.





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## 5 Regulating functions

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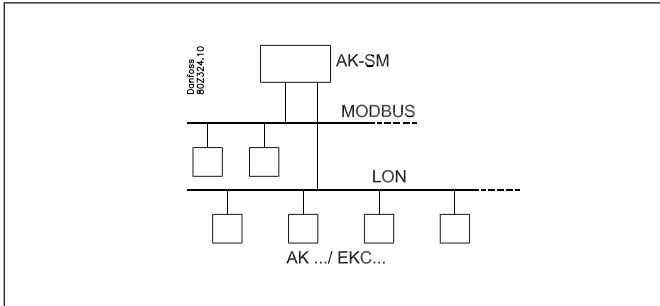
This section describes how the different functions work

# Function

## Data communication

AK-SM is a system manager that co-ordinates the data communication to and from the refrigeration controllers type AK- and EKC. The system manager receives alarms and data collections, which are then forwarded to defined recipients.

The system manager has control functions that are forwarded to the individual controllers via data communication – functions that do not therefore need wiring.



## Functions

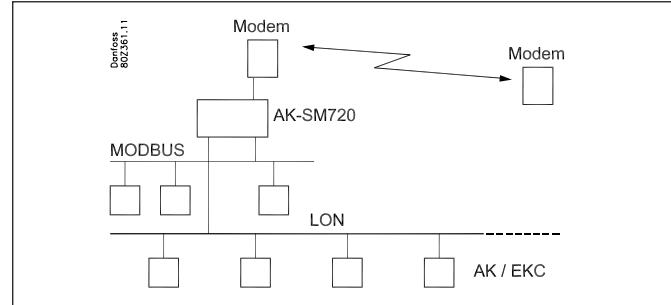
In addition to the data communication the system manager can control other functions between the controllers — functions that do not therefore need wiring.

The functions are as follows:

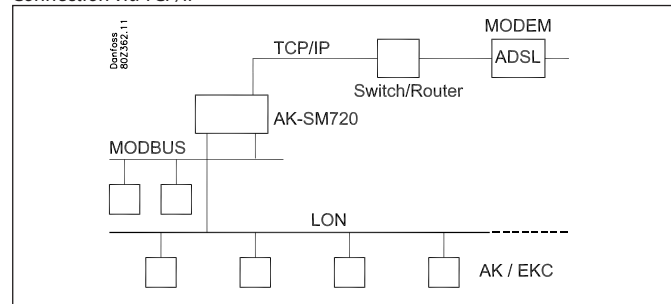
- Alarm coordination
- Alarm routing
- Coordination of clock function for all controllers
- Weekly schedule for different functions
- Control of defrost times
- Master control functions:
  - Coordinated defrost
  - Inject-on function
  - On/off control
  - Day/night control
  - Adaptive defrost
  - Adaptive railheat
- User access with password and authorization level
- Communication control
- Safety wiht:
  - Watchdog function
  - "I'm a live" messages
- Central functions:
  - Light control
  - Utility meter
  - Load sheeding

## Examples of the structure of a system

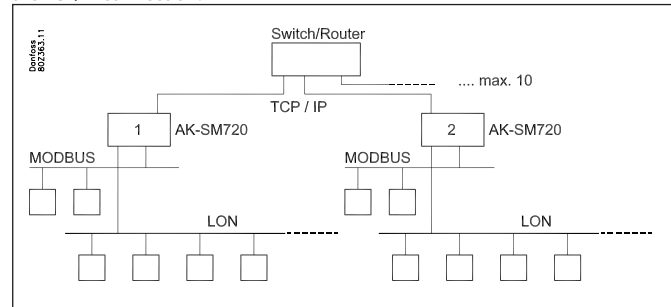
### Connection via modem



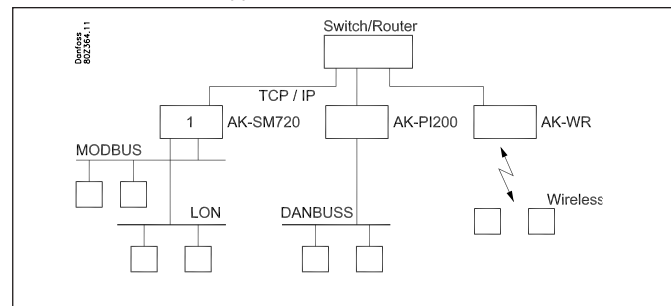
### Connection via TCP/IP



In larger networks several System Managers are connected to one another via the TCP/IP connection.



Controllers with DANBUSS data communication can be connected via a TCP/IP connection. The same applies to wireless units



# Local data communication

## Communication control

This function checks communication between the units connected to data communication. There is also continued control of whether all units are still present. Units that drop out are discovered within two minutes (short-term dropouts will not always be discovered).

If a unit drops out, e.g. as a consequence of a power failure, the function will discover this and transmit an alarm, e.g. after ten minutes.

A new unit in the network will not be registered until the scan function is enabled in the system manager.

If more than one system manager is connected in a network, the control function in system manager with address 1 will check the communication with the other system managers.

## Addresses

### One or more system managers

A system manager in a system must have address number 1. All of the connected group of controllers will then have network number 1.

If there are several system managers connected together, the other system managers are allocated addresses 2, 3, etc. However, there may be a maximum of ten.

The address is set at the front of the system manager, but is only transferred to the software when the "Service PIN" button is enabled.

The address can then be viewed in the system manager's overview screen as "11:001".

The network here is number 1, as denoted by the final digit. All controllers connected to this network will be assigned network number 1, e.g.

001: xxx

001: yyy

in which xxx and yyy are the addresses of the respective controllers.

If there are several system managers connected in the same network, the addresses of the others will look like this:

11:002

11:003

The figure 11 will always be 11, and this cannot be changed.

The system manager with address 1 is the master for the total number of system managers and controllers. All functions and controls are defined in the master unit. A total of 200 addresses can be connected.

### Other units in the TCP/IP network

As the first ten addresses are reserved for other system managers, the subsequent ones can have addresses 11 to 999.

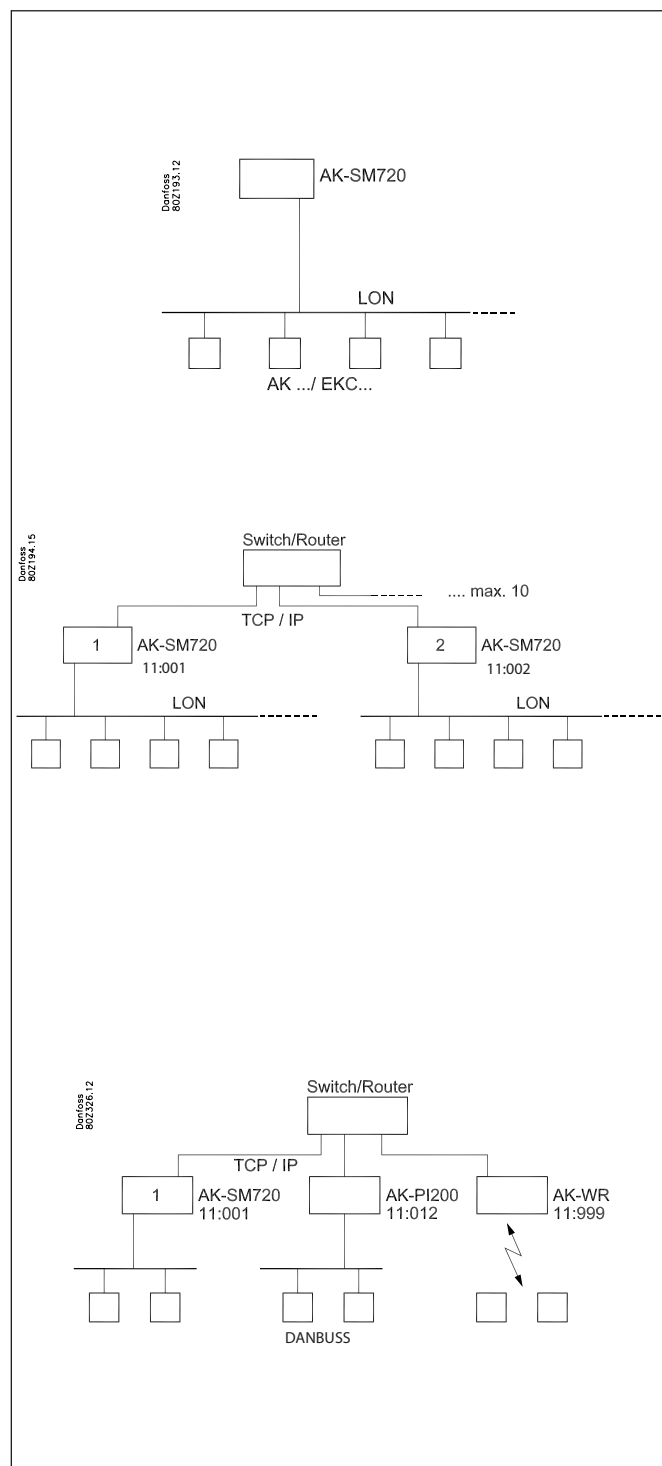
However, 999 is permanently reserved for a wireless unit.

Examples:

11:011 can, for example, be an AK-PI 200

11:012 can, for example, be an AK-PI 200

11:999 will be a wireless device.



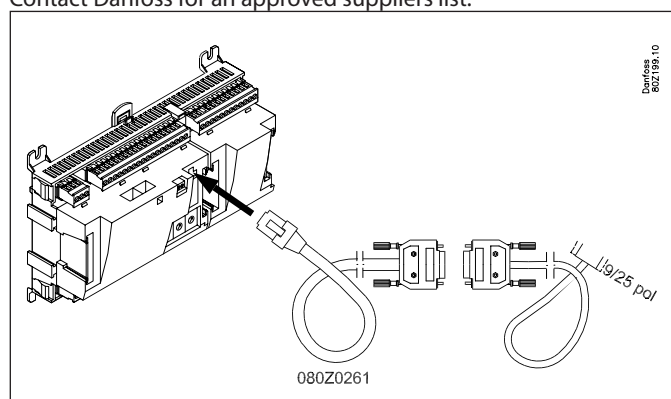
## Extern data communication

If the system manager is to have a connection from the system, this can be achieved via:

- Modem and fixed network
- Modem and mobile network
- TCP/IP net

### Modem

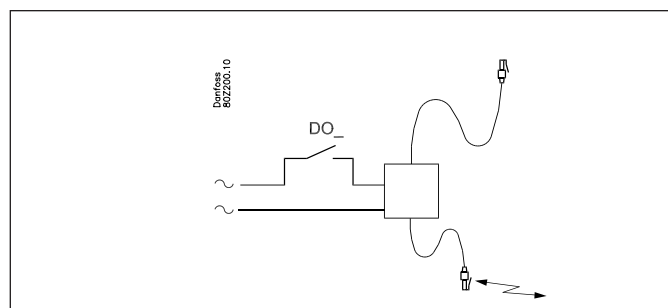
The modem used must have been tested by Danfoss. Contact Danfoss for an approved suppliers list.



The modem is connected to the socket on the front (the same socket that a Service tool uses).

Two cables are used, a 080Z0261 and a standard zero modem cable.

Both cables are supplied when you order a modem type AKA 231 from Danfoss.



The supply voltage to the modem must be connected via a relay output. This enables the system manager to reset the modem. The modem will also be switched on and started in a controlled way when the system manager is switched on.

It is possible to set commands for controlling the connected modem. These commands are in the form of an initialization string transmitted to the modem when it is switched on.

From the factory a system manager contains the following AT command string:

```
AT Z < CR > AT E1 SO = 2 &D2 V1
```

The command has the following meaning:

AT	Attention sequence
Z	Reset modem to power-up status
E1	Echo on
V1	Verbose result codes (e.g."CONNECT 1200" instead of "4").
&D2	HW mode for on hook via DTR
SO=2	Auto answer ON, answer after 2 rings

The initialization command string can be changed. However, this will only be necessary in very few instances.

**E0, V0, S0=0, S0=0, &D0, &D1 and &D3 must not be contained in the command string.**

For further information about these commands, please refer to your modem manual.

A number of modem codes can be keyed in together with a telephone number.

These modem codes attach to a specific telephone number and are sent on to the modem together with the telephone number. The following codes can be keyed and attached to a telephone number in the router table:

P:	Pulse dialling. Used in old telephone exchanges and private switching systems.
T:	Tone dialling. Used in new telephone exchanges.
W:	Wait for ring back tone (dial tone)
, :	2-second pause
%n:	Modifies the calling speed for this particular call
* :	Special character for private switching system
# :	Special character for private switching system

For further information about these commands and codes, see the modem manual.

### Call-back function

The function can be used for service and transmission of log data via the telephone network.

The call-back function is selected from the extern system software fx. the AKM programme and is essential for all systems from which service or log data are collected.

The function sees to it that the system manager will return the call to the AKM programme, and hence pay for the transmission time.

#### Procedure

The AKM programme calls the system manager and starts the call-back function.

15 seconds later the system manager establishes a telephone connection to the AKM programme. If the connection is not established at the first try, two more attempts will be made at 5-minute intervals.

When the master gateway has established the telephone connection the AKM programme will take over.

An automatic log transmission is carried out in this way:

Based on the individual log definitions, the AKM programme knows how often it has to collect data from a system. The AKM programme starts the procedure, and when the connection has been established, the collection will commence.

If the system manager does not manage to establish a telephone connection, the AKM programme will call again, and collection will then be started immediately.

### Modem and mobile network

A GSM modem is used here.

Danfoss recommend Cinterion MC52iT / MC55iT.

Functions are as for a fixed network modem.

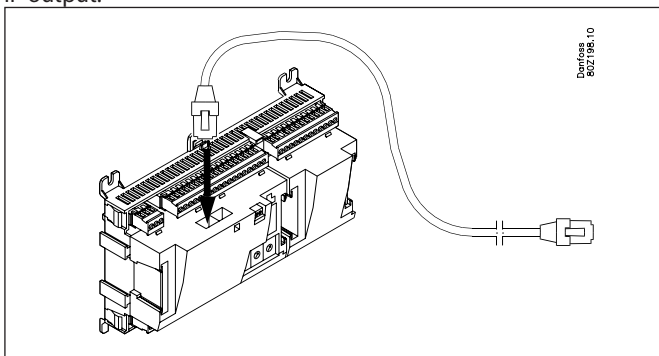
### SMS

Alarms may be sent to a destination via SMS. (System manager version 1.6x or later).

(Destination ID and Pass code are cancelled.)

### TCP/IP

Outgoing communication can also be undertaken from the TCP/IP output.



A HUB, Switch or Router can be connected as required. If a HUB or Switch is used, the system manager must be assigned a fixed IP address.

**System manager number 1 must always have a fixed IP address.**

This must be obtained from the local IT department.  
(Danfoss AK controllers use port 1041.)

The following can have a dynamic IP address:

- System manager number 2 upwards
- Protocol interface AK-PI
- Wireless AK-WR

# Alarm handling

## Alarm handling

When setting up the system manager there is one setting that enables alarms from all of the connected controllers. All alarms received are recorded in an alarm list, where they are held for further processing.

If the system manager is not to receive alarms for the alarm list and further processing, this function must be deselected.

The first thing the system manager do when it receives an alarm from a controller is to send a acknowledge (transport receipt) to the controller that triggered the alarm. The controller will now know that the alarm has been received and registered. If it did not receive this accept, the controller would repeat the alarm message five minutes later.

The second thing that happens is that the alarm is time-stamped and ID codes (net ID and bus ID) must be entered, if applicable. The third, that the alarm will be passed on to the defined alarm receiver(s).

Alarms from EKC controllers will also be registered by AKA 245, but if the data connection between the EKC controllers and the gateway is interrupted, only an active alarm, if any, will be present when the connection is reestablished. In other words, all alarms occurring during the period without data communication will not be registered.

## Alarm status

When an error occurs, an alarm will appear with the status "active". Once the error has been rectified, a new alarm will appear with the status "inactive".

## The alarm list

The alarm list can contain the 200 most recent alarms. Once the list is full and a new alarm arrives, the oldest alarm will be deleted. In terms of view, alarms are divided into "active" and "inactive" alarms.

An alarm will have the status "active" until it once more becomes "inactive" and the "inactive" one has been acknowledged.

## Alarm priority

The various alarms generated by an individual controller or by the system manager can be assigned a priority. The priority is used to define how the individual alarm is dealt with.

The priorities are:

- High
- Middle
- Low
- Log
- Disabled.

- High, medium and low are forwarded to various alarm receivers.
- High is normally used for alarms where immediate action is required.
- Log will only be registered in the alarm list as an inactive alarm.
- Cancelled will not be registered anywhere.

In system software type AKM alarm status and alarm priority will have the following relationships:

Alarm status	Priority	AKM Status
Active	High	1
Active	Middle	2
Active	Low	3
Inactive	High, middle, low	0

## Alarm indicator

### Alarm LED

When there are active alarms in the system manager, "Alarm" will flash.

If alarms are forwarded, "Alarm" will flash from the alarm being registered until it is forwarded to the primary or secondary alarm receiver and confirmation of delivery has been received.

### Alarm relays

The priorities high, medium and low can be assigned an alarm relay, which is enabled when an alarm of the priority in question occurs.

A time can be defined for the enable function, so that the relay is only enabled for a preset time.

The relay can also be set to be disabled when there are no active alarms with the priority in question.

### Alarm routing

Alarm routing forwards the alarm to a specified receiver, but the system manager retains a copy of the alarm for its own use. A little later, when the receiver has received the alarm, the receiver will return an acknowledgement of receipt. Action then rests with the receiver.

### Alarm receivers

First of all fixed data must be defined for everyone who is to communicate with the system manager. There can be one or more alarm receivers, or others who must have access to make calls to the system.

Only then can the various alarm routes be defined.

(In other words: only when we know some addresses can we decide what we want to transmit and when.)

A name and access code are defined for every single receiver.

- Name and access code are the receiver's access validation, if this person makes calls to the system using Danfoss software type AK-ST, AKM or EM.
- For every single receiver communication type is selected, as well as the associated details that are valid for this type.
- A receiver may not be used until the receiver has been enabled.
- If a receiver is disabled, a message will be sent to the receiver stating that disabling has taken place.

### What can be transmitted

Several different alarm routes can be defined. An alarm route can be defined to deal with one single alarm priority or a combination of several priorities. The options available are all, high, medium, low, high to medium and low to medium. The combinations are chosen that are suitable for the individual application.

Once the number of routes has been defined and named, a route can be assigned a receiver.

#### Receiver types

##### Primary destination

An alarm receiver who is to have the alarm because this person is responsible for rectifying the error. The system manager will always resend to a primary receiver if this person for some reason has not acknowledged receipt. Re-sending stops if a secondary receiver is defined who acknowledges the alarm.

##### Secondary destination

An alarm receiver who is to be used if the primary alarm receiver does not acknowledge the alarm. The secondary receiver is also responsible for rectifying the error or for making sure that the primary alarm receiver is informed of the alarm. The alarm is resent to the secondary alarm receiver until the primary or secondary alarm receiver has acknowledged the alarm.

##### Copy destination

A receiver who is not responsible for rectifying the error. The receiver is notified about problems. If the copy receiver does not acknowledge an alarm, it is resent for up to one hour, after which no alarms are resent.

### Alarm route full

The alarm route system can handle up to 50 alarms at the same time. Alarms can occur so quickly that distribution of the previous ones has not been completed when a new alarm occurs. The routing system can therefore transmit several alarms in one call. If connection cannot be established to an alarm receiver, an alarm dispatch cannot be completed. A repeat transmission process is initiated. If several alarms occur that are for the same alarm receiver, the alarm route can become full. The system manager then issues an "Alarm route full alarm".

When this happens future alarms will be registered, but not transmitted.

When the fault has been rectified, the alarm list must be reviewed manually to see whether there are been any alarms that have occurred and been sent and that require the system to be adjusted. The alarms that are active for the system when the connection is OK will be sent to the alarm receiver.

### Alarm repeat

If an alarm message cannot be delivered within 5 mins, it will be re-transmitted every 5 mins until it can be delivered. The diagram below shows the repeat delivery process.

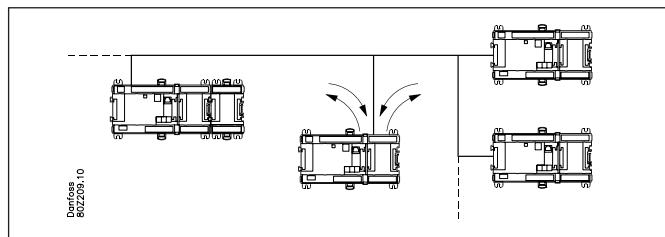
Start	Pause in minutes / Receiver/ Repeat trail											
0 / Pri / 3	5 / Pri / 3	5 / Sec / 3	5 / Pri / 3	5 / Sec / 3	5 / Pri / 3	5 / Pri / 3	5 / Sec / 3	5 / Pri / 3	5 / Sec / 3	5 / Pri / 3	5 / Sec / 3	etc.
0 / Copy 3	5 / Copy 3	5 / Copy 3	5 / Copy 3	5 / Copy 3	5 / Copy 3	5 / Copy 3	5 / Copy 3	5 / Copy 3	5 / Copy 3	5 / Copy 3	5 / Copy 3	etc. Max. 1 h





# Plant controls

The system manager contains functions that retrieve data from selected controllers for the data communication process. It then processes the information and concludes by defining values in other selected controllers in the network. The individual controllers will then perform the function specified.



The following functions can be set up:

## Schedules

A schedule will define a series of on/off times (signals), which can be used by other functions.

A schedule is based on a weekly clock, where special days can also be assigned that deviate from the schedule's normal weekly layout, e.g. public holidays or other fixed days off.

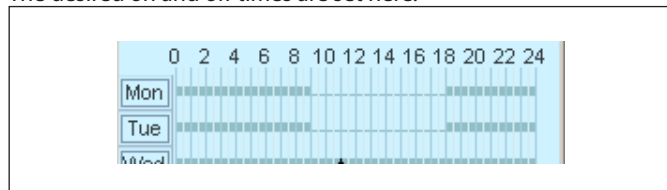
These special days are defined on an annual basis either as days repeated year after year or as days for which the date is only valid for the current year.

### Schedule of the store's hours of business

A schedule can be created to represent the store's hours of business. It also includes the days of the year when the store is closed. A combination of this schedule and a relative schedule will mean that only one schedule needs to be adjusted if the hours of business change from the fixed pattern.

#### Schedule of fixed times

The desired on and off times are set here.

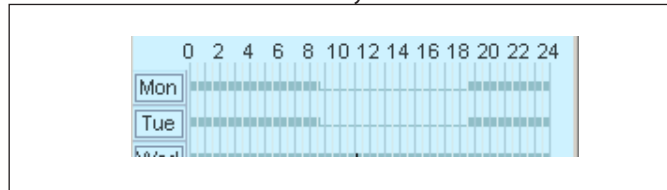


#### Schedule of relative times

Here the times are set so that they relate to another schedule, i.e. the on time, for example, is 15 minutes before the times in another schedule and the off time, for example, is 30 minutes after the times in another schedule. The second schedule will typically be the schedule containing the store's hours of business.

Schedule Type	Relative
ON Time	-15 min.
OFF Time	30 min.
Override via DI	No

The result of a relative schedule and one with the store's hours of business from 09:00 until 18:00 may be seen below:



Both types of schedule can be overridden with a switch function. If the switch is activated when the schedule is off (night), it will create an on (day) status.

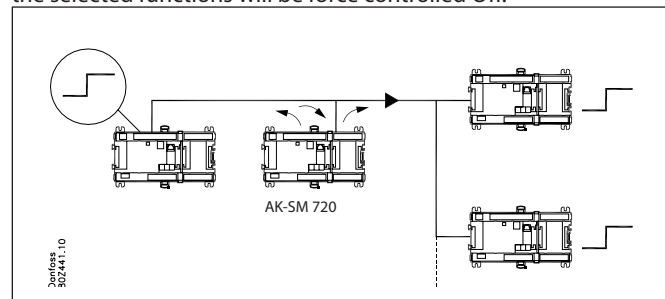
If the switch is activated when the schedule is on (day), it will have no function.

## On/Off function

This function monitors a selected On/Off signal on a selected controller. When the signal is registered to On, the system manager will override selected functions on other controllers to On.

All the defined functions will follow the signal.

The signal can be inverted. This means that when On is registered, the selected functions will be force controlled Off.

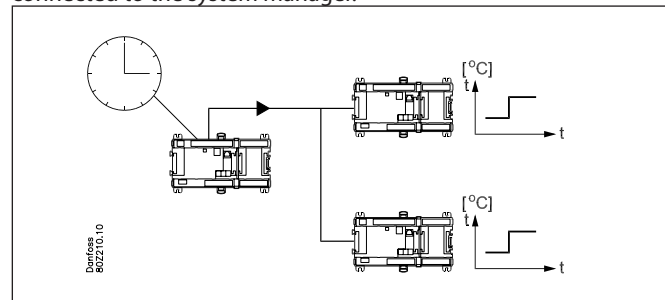


## Day/night function

The function will transmit a signal for night operation to the various refrigeration sites. The function is used, for example, on appliances that are protected by a night cover during the night. The function here will displace the thermostat reference.

All of the defined controllers will follow the signal.

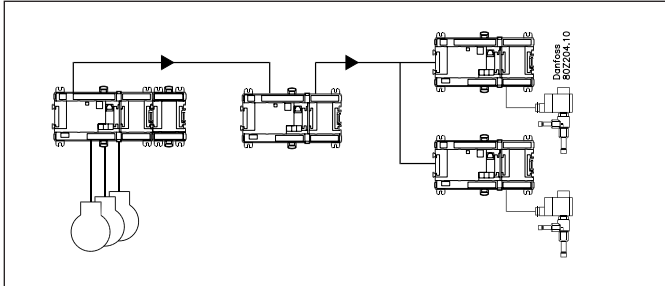
The signal is generated by a schedule or from a switch function connected to the system manager.



## Inject ON Signal

This function is used to close the expansion valves on all evaporator controls when all of the associated compressors have been stopped by the automatic safety function. This avoids the presence of liquid in the evaporator, which is passed on to the compressor when it restarts.

For example: when the compressor stops, the compressor control transmits a signal via data communication. The system manager then forwards the signal to the defined controllers, which then close the valve.



Signals can be received from compressor controls of the following type:

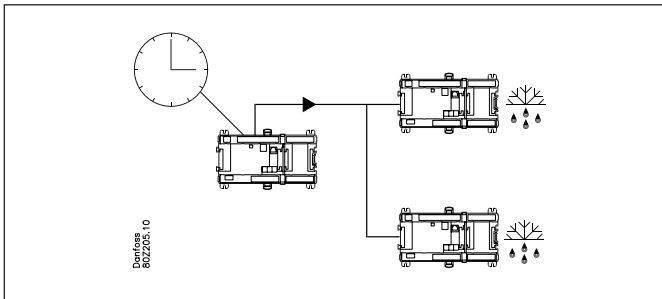
- AK-PC
- EKC

Signals can be transmitted to controllers of the following type:

- AK-CC
- EKC.

## Defrost groups

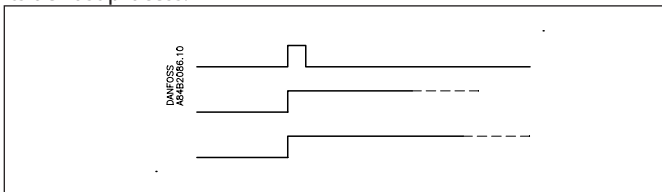
This function transmits the signal of a defrost start to a group of controllers.



The defrost process start can come from a weekly schedule or from a switch function connected to the system manager. When defrost has started, it is up to the individual controllers to determine how it is concluded. Some based on time, others based on temperature.

Refrigeration commences when the controller gives permission for it.

If, however, refrigeration is to start at the same time for the whole group of controllers, the "Coordinated defrost" function must be selected. When the defrost process has been ended by the individual controller, the controller switches to hold. The whole group is not released for refrigeration until the final controller has ended its defrost process.



To provide security, a time must be set in the individual controllers. There is a maximum permitted hold time to wait for the start signal for refrigeration. If this time is passed, refrigeration will be restarted regardless of signals from data communication.

## Adaptive defrost

This function is an optimisation of the defrost time in the individual evaporator controls.

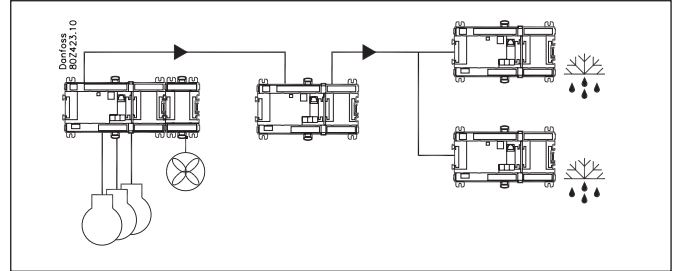
For the evaporator control to be able to optimise this function, it must recognise the condensation temperature  $T_c$ .

The system manager reads the condensation temperature in the condenser control and sends the value to all evaporator controls in the group.

Up to ten groups of evaporator controls can be defined. One evaporator control can only be a member of one group.

There can be up to 30 evaporator controls in a group.

The signal from the condenser control can be used by several groups.

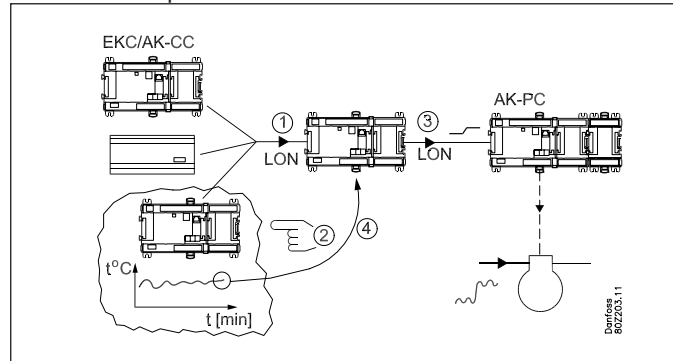


### Possible problem

If the signal with the value of the condensation temperature of an evaporator control is not available, the evaporator control will switch to an error compensation status, which takes account of the absent signal.

## P0 optimization

This function will adapt the refrigeration system's suction pressure, so that the suction pressure does not become lower than that the most heavily loaded refrigeration appliance can maintain the desired temperature.



This is achieved by the system manager continuously:

- questioning selected controllers
- finding the appliance that requires most refrigeration at the current suction pressure and monitoring the temperature
- sending a signal to the compressor control to the effect that the suction pressure can be adapted
- finding the suction pressure at which the temperature is precisely maintained

The process is repeated continuously.

An appliance will not start to work when it has just completed a defrost process. Data is only retrieved from the controller after 30 minutes.

The time can be configured.

## Light control

This function is used to control the lighting in a number of zones in a store. The function is controlled on the basis of a schedule. When light is needed, a light meter will register whether there is sufficient daylight or whether electric light has to be switched on. The user can override the automatic light status with a switch function.

The system manager can handle up to two light sensors, which must be type 080Z2172.

The system manager can handle up to eight zones.

The need for light is entered into one or more schedules. The same schedule can be used for several zones.

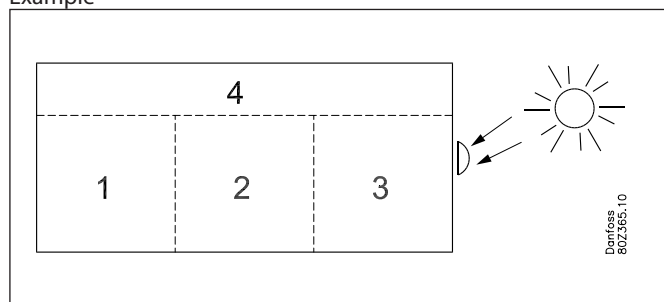
For each zone you select the relevant light sensor as well as the on and off light levels for the zone. Minimum times are also set, so that the light is not switched off during short-term changes in the light level.

All zones can be fitted with override switches, which render the automatic function powerless.

It is also possible to define a switch that is valid for all zones.

This can, for example, receive signals from other equipment, e.g. fire or alarm systems.

### Example



A store is divided into four zones: three sales areas and one warehouse area.

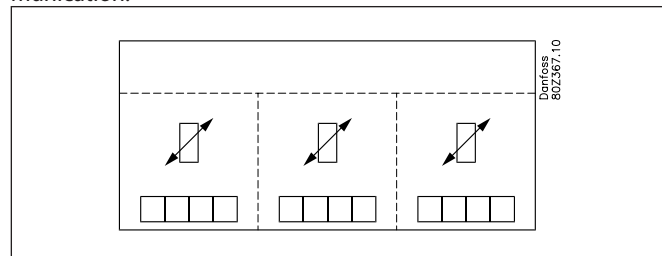
- The three sales areas use the same schedule.
- In the warehouse area there is a need for light two hours before and one hour after the hours of business.
- Two relative schedules are created with reference to the store's hours of business.
- The light sensor is positioned outside the building and measures the general daylight.
- The light levels for the zones are set so that the light is switched off when the daylight provides sufficient light in the zone. The individual zones have different values, according to how much daylight comes in.
- An override switch is set up in the warehouse area, making it possible to switch on the light outside the planned schedule, e.g. for goods deliveries at night. A delay function means that the light is switched off one hour after the override has been enabled.
- Signals are received from alarm systems and fire alarms, so that all lights are switched on if a signal is received.

## Adaptive rail heat

Adaptive rail heat is used to obtain energy-efficient control of the rail heat of refrigeration appliances.

Evaporator controls with this function must receive a signal with the current dew point value.

A dew point sensor is connected to the system manager, which then transmits the value to the various controllers via data communication.



Up to three groups of evaporator controls can be defined. Each group must have its specific dew point sensor. The dew point sensor must be located in the same room as the refrigeration appliances that are to receive the signal.

One evaporator control can only be a member of one group. There can be up to 30 evaporator controls in a group.

The dew point sensor must be type 080Z2171.

### Possible problem

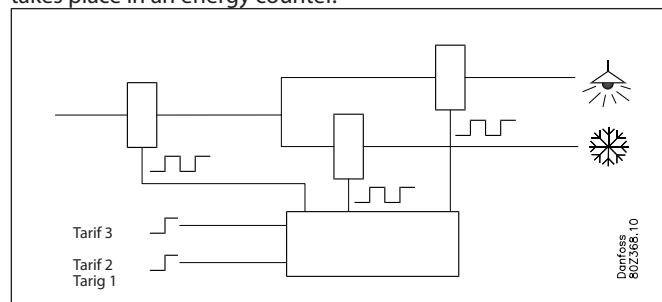
If the signal with the value of the dew point of an evaporator control is not available, the evaporator control will switch to an error compensation status, which takes account of the absent signal.

## Consumption measurement

This function registers the consumption of electricity, water, gas, etc.

These measurements are saved in the system manager and can be retrieved later for presentation, analysis and settlement.

An expansion module type XM107A must be used. The module is a pulse counter module, which measures pulses in accordance with DIN 43 864. Conversion from, for example, current to pulses takes place in an energy counter.



Energy counters can be divided into several groups, e.g. one main meter and several ancillary meters.

The main meter measures all of the consumption for the installation. Some main meters are fitted with tariff and synchronisation switches.

- The tariff switches change position, depending on tariff changes.
- The synchronisation switch changes at regular intervals (typically every 15 mins) and indicates that a new measurement period has started.

These switches can be connected to the system manager, which will monitor the switches and save the tariff information and consumption data for all of the energy meters connected when a new measurement period starts.

Ancillary meters measure an element of consumption. It might be interesting to know, for example, the freezer department's energy consumption.

Measurement intervals and the consumption of synchronisation and tariff inputs are set jointly for all energy meters. If these inputs are not used, the system manager will define its own measurement period.

The system manager supports up to eight energy meters.

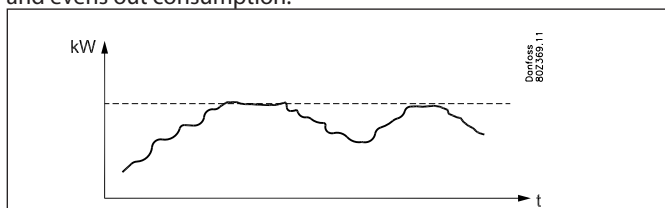
The conversion ratio, unit and pulses per unit must be set on the basis of the current configuration. The conversion ratios for current and voltage transformers are multiplied. The conversion ratio is defined as primary/secondary signal. Each measurement can be named, to make it easier to review data later. The unit can also be given any name. Each individual energy counter can be started and stopped. It is also possible to reset the current counter value to 0 or to another value. E.g. when changing energy counter. The time of this setting will be saved.

## Load shedding

This function makes it possible to avoid high peak loads. Energy prices can be billed differently, e.g.

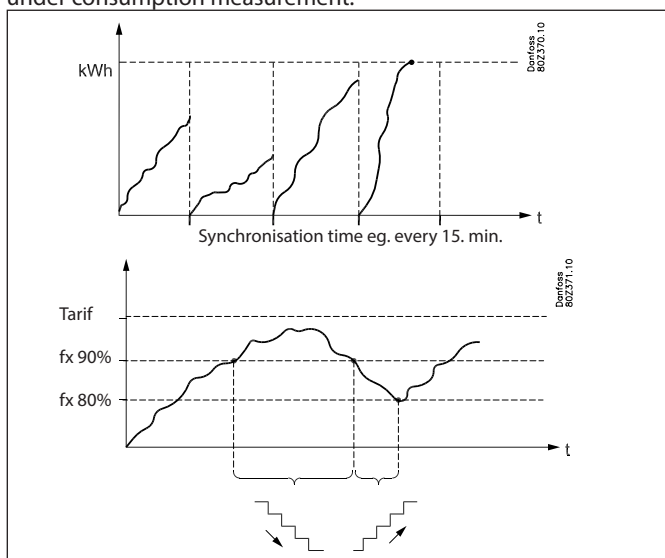
- peak consumption
- peak consumption in a period
- different value at different times of the day

This function places a ceiling over consumption within a period and evens out consumption.



Consumption is monitored within a measurement period. If consumption rises above a limit, consumption will gradually be disengaged with the aid of relays. One consumption has fallen below the limit once more, re-engagement takes place. Disengagement can take place in ten steps.

As already mentioned, current consumption must be registered under consumption measurement.



At the beginning of a period all consumption will be engaged during an adjustable period of time, so that the function has a basis for calculation before control commences.

To achieve stable control, the commencement of disengagement and engagement must be definable as a percentage of maximum consumption.

Disengagement will take place in order of priority, so the consumption that is most suitable for disengagement must be connected to the output with the lowest priority.

Relay 1 has the highest priority and is the last one to be cut out. Relay number 2 has the next highest priority etc. The highest number is cut out first.

When re-engagement takes place, the relay that was most recently disengaged is the first to be engaged.

Disengagement of consumption is protected by an adjustable minimum timer, which makes sure that the relay does not change more often than consumption permits.

The current limit, current calculation of consumption and relay status can be read via Service tool.

- The function is named
- The energy meter in relation to which regulation takes place is specified.
- There can be different tariffs.

Signals can be received from two inputs on different tariffs.

Three limits can be defined on the basis of the signals.

The various limits are enabled as follows:

Tariff 1-2 (input)	Tariff 3 (input)	Actual tariff
Inactive	Inactive	Tariff 1 limit
Active	Inactive	Tariff 2 limit
Inactive	Active	Tariff 3 limit
Active	Active	Tariff 3 limit

For each tariff a limit must be defined, according to which the system manager will disengage.

## Limitations

It is important to observe the following limitations otherwise data communication will be overloaded.

Function	Max. number of groups	Max. number each group
Day-/night function	20	30 controllers
Inject On signal	5	120 sections
Defrost group	20	30 controllers
Adaptive defrost	10	30 controllers
P0-optimisation	5	120 sections
Light control	2 light sensors and 8 relays	
Adaptive Railheat	3	30 controllers
Consumption measurement	8 pulse counters	

# Logs

## Data collection in the system manager

Data collection is performed in the system manager to which the individual controllers are connected.

For definition, start, stop and presentation of a data collection (logs) it will be necessary to have a switch for an operating interface. During the rest of the time the system manager itself will take care of data collection.

Data can thus be collected for a system that is not directly connected to a PC. The data collected can then be downloaded at intervals to a PC, so that it can be presented. Downloading can take place, for example, via a telephone connection.

Two different types of logs can be created in the system manager:

- 1) Food Safety logs ("authority logs") and
- 2) Service logs.

The difference between these lies mainly in the intervals at which data can be logged, and thus the length of the period of time for which the memory has the capacity.

Limitations:

- It is possible to create max. 200 logs in a system manager.
- Each log will represent one controller
- Each log can contain a maximum of ten parameters
- The interval for Food Safety logs is between 15 minutes and 24 hours
- The interval for Service logs is between 1 minute and 4 hours
- If too many service logs are created, data communication will be overloaded and there will be "gaps" in the log data.

When setting up logs, the system manager will show how much of the capacity is being reserved. If the max. capacity is being approached, either the interval must be made longer or the log period shorter.

The log function is able to continuously collect and save data from the controllers that are connected to the network for which the system manager in question is the master.

Definition, start, stop and presentation of a data collection (logs) must be undertaken from software type AK-ST.

Data collections can also be retrieved and presented in software type AKM.

All logs in the system manager are "rolling", i.e. data are overwritten if they are not downloaded within the preset period of time (expiry time).

**The log setup will be deleted and all data collected will be lost if the system address of the system manager is changed or if the supply voltage is removed and the battery is defective or has been removed.**

If logs (a single one or all of them) are deleted without the logged data being downloaded, these data will be lost. No alarm is issued in the event of such a deletion.

When a log starts, data collection will not necessarily take place immediately, as all data readings will take place at times adjusted according to the log interval.

This means, for example, that in a log with an interval of 15 minutes, data will be read at times that are multiples of these 15 minutes, i.e. at 0, 15, 30 and 45 minutes past the hour. By the same token, a log with an interval of 2 hours will be read at even hours, i.e. 0:00, 2:00, 4:00, 6:00, etc. until 22:00. If the interval is 6 hours, the times will be 0:00, 6:00, 12:00, 18:00. These fixed log times cannot be changed.

If a log has been stopped for a period and then restarted, there will be no data for the period in question.

The system manager performs ongoing checks on all log setups by means of a simple check total calculation. In the event of any error, the log in question will be deleted. An alarm is then issued with details of the log number.

### Data collection takes up this much room

When a log is established, room is set aside for data. Just how much room is reserved is determined by various parameters.

The amount of room that will be reserved can be seen when new logs are established.

Example:

Only Food Safety logs are collected.

If six parameters from 20 controllers with one hour time interval are logged and the period time is set to 540 hours it will give a 9% utilisation of the storage capacity.

(After the 540 hours (22,5 days and nights) the oldest data will be overwritten by new data.)

Below examples are given of three system sizes with different log definition options:

Number of controllers	Log type		Number of logs	Number of parameters per log	Time interval	Period of time	Utilised capacity (%)	
							One type	Combination
20	One type	Food Safety	20	6	1 h	540 h	9	6
			20	10	4 h	960 h	6	
	Combination	Food Safety	20	6	1 h	180 h	3	
			Service	4	10	1 min.	12 h	
50	One type	Food Safety	50	6	1 h	216 h	10	9
			50	6	4 h	864 h	10	
	Combination	Food Safety	50	6	4 h	360 h	6	
			Service	6	10	1 min.	6 h	
100	One type	Food Safety	100	6	1 h	100 h	10	20
			100	6	4 h	360 h	8	
	Combination	Food Safety	100	8	4 h	120 h	12	
			Service	10	10	1 min.	12 h	

### Alarm logs:

See alarms

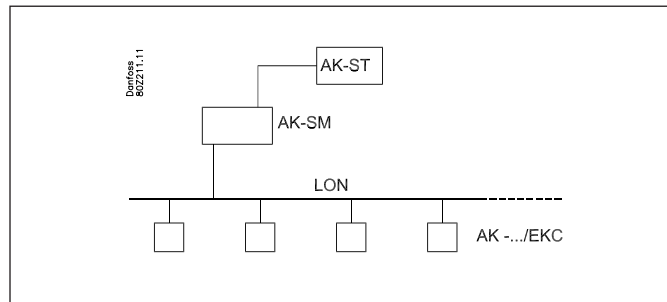
### Event logs:

See alarms.

# Operation

## Direct operation

Setup and operation are performed using software type AK-ST. Access is provided via the correct password.



## Remote operation

After setup, operation can be performed remotely – either via a modem or via an IP network. Operation is also performed using software type AK-ST. Access is provided via the correct password.

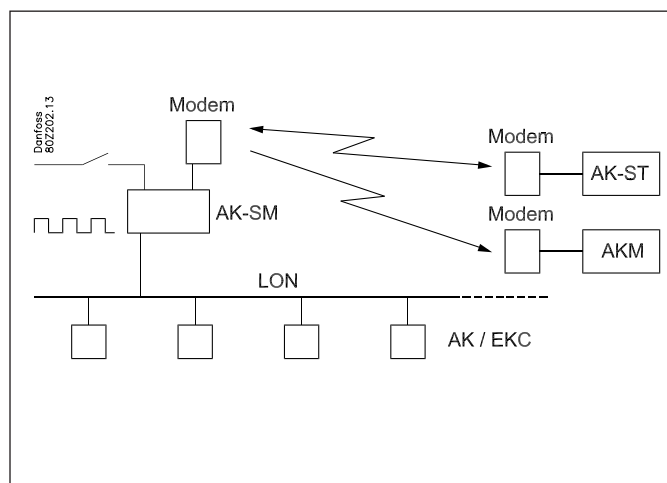
### Security

During setup of the system manager a destination and a password must be entered:

The same settings are defined for the external system.

When a call is made the name is cross-checked, and contact is only created if the name is 100% identical.

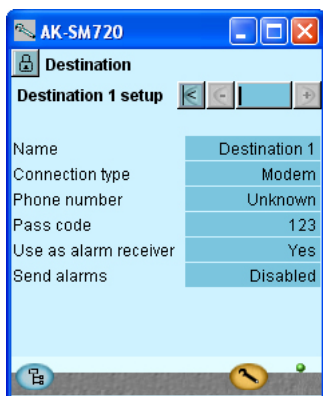
After contact is made, the correct password is also required in order to identify the user.



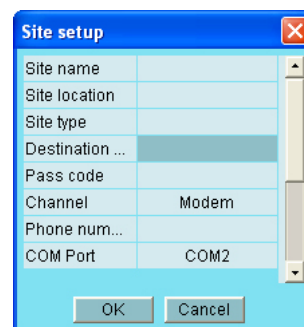
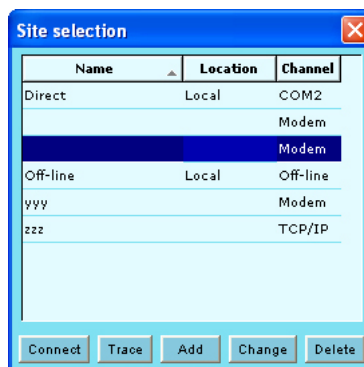
### System software type AKM

The system manager can not be operated from AKM, although AKM can receive alarms and logs. Please refer to the relevant sections.

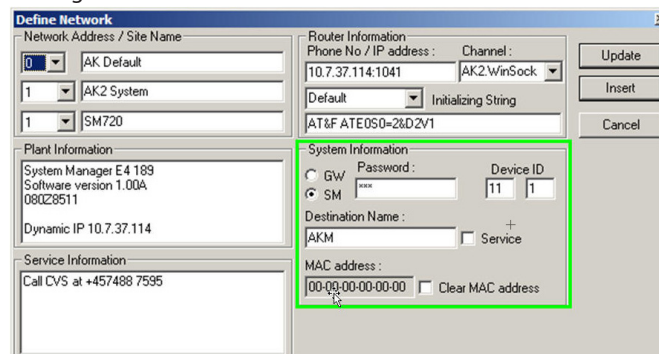
Settings in System manager



Settings in Service tool



Setting in AKM



# Clock

## Clock function

The system manager has a built-in clock function, which is used for:

- Time stamping of alarms.
- Synchronisation of clocks in all connected controllers.
- Switching between summer/winter time settings.
- Schedule functions, e.g. for day/night controls.
- Log function. Logs can only be collected when the clock is started.

The system manager that is assigned address 1 for a network is given primary clock function.

This system manager will synchronise the clocks in all controllers in the network. If other system managers are also connected via the IP network, they will also have their clocks synchronised from address 1.

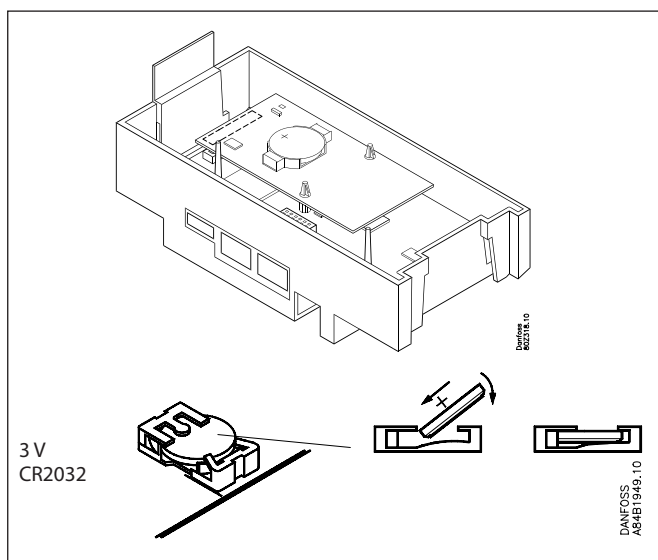
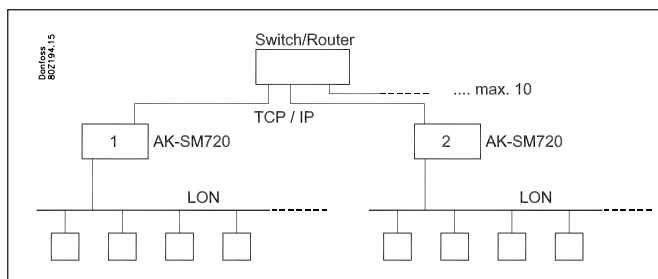
The clocks are synchronised after each startup of the system manager, and thereafter at least once every 24 hours. If a controller has been without power for more than two minutes, the clock will be synchronised when the controller is once more registered in the network.

The clock module is fitted in the system manager in the factory.

Only the clock uses battery backup. The other functions are independent of battery backup.

An alarm message will be issued when the battery needs replacing.

The clock function must be set after the battery has been replaced.





### **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.

