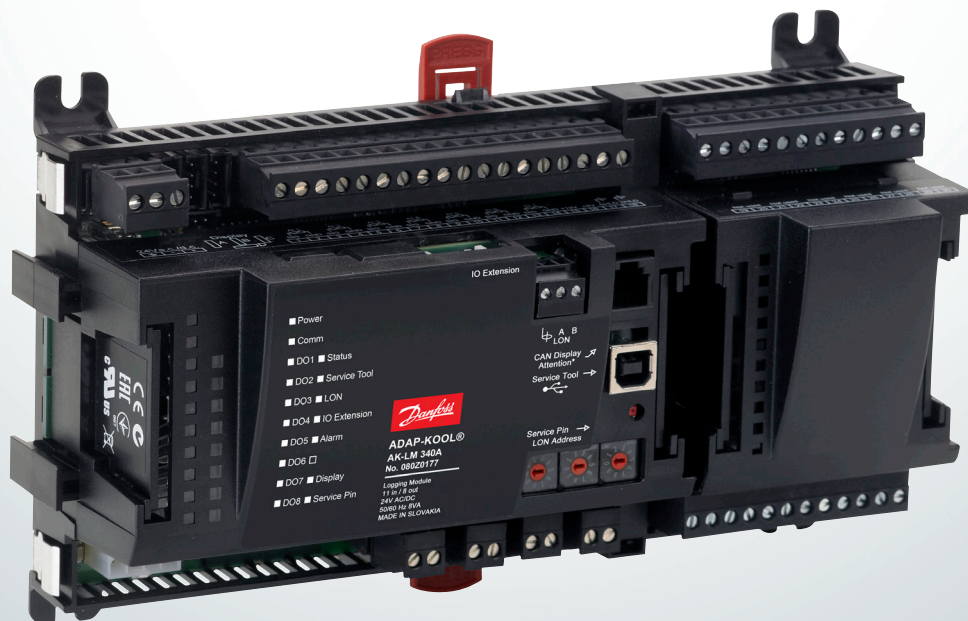


User Guide

# Monitoring unit with PI regulation AK-LM 340A

ADAP-KOOL® Refrigeration control systems



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# 1. Introduction

## Application

AK-LM 340A is a complete monitoring unit with the option of regulation functions via relay switches, stepper valves, PWM outputs and voltage outputs.

The monitoring unit is used to detect temperature, pressure, functions etc. in and around appliance cases and cold rooms for commercial and industrial cooling.

The monitoring unit is equipped with data communication and is operated via a PC.

### Functions

#### Temperature

- Temperature detection
- Temperature monitoring with alarm function
- Extension of the alarm delay when a defrost signal (DI) is received
- Interruption of alarm monitoring when a switch signal (DI) is received
- Temperature control with relay function
- Difference thermostat with relay function
- Two-sensor thermostat with relay function

#### Pressure

- Pressure detection
- Pressure monitoring with alarm function
- Pressostat with relay function
- Difference pressostat with relay function

#### Voltages of 0-10 V

- Voltage detection
- Voltage monitoring with alarm function
- Voltage monitoring with relay function

#### On/Off signals

- Detection of switch signals
- Alarm function with delay + relay function, if applicable
- The switch signal can be inverted
- Hour counter for On time
- Counter for number of changes

#### Pulse signals

- Registration of electricity, water, gas, etc.
- Energy reading
- Energy reading in a set synchronisation period
- Energy reading in a period between synchronisation pulses
- Receiving synchronisation signal

#### Alarm relay

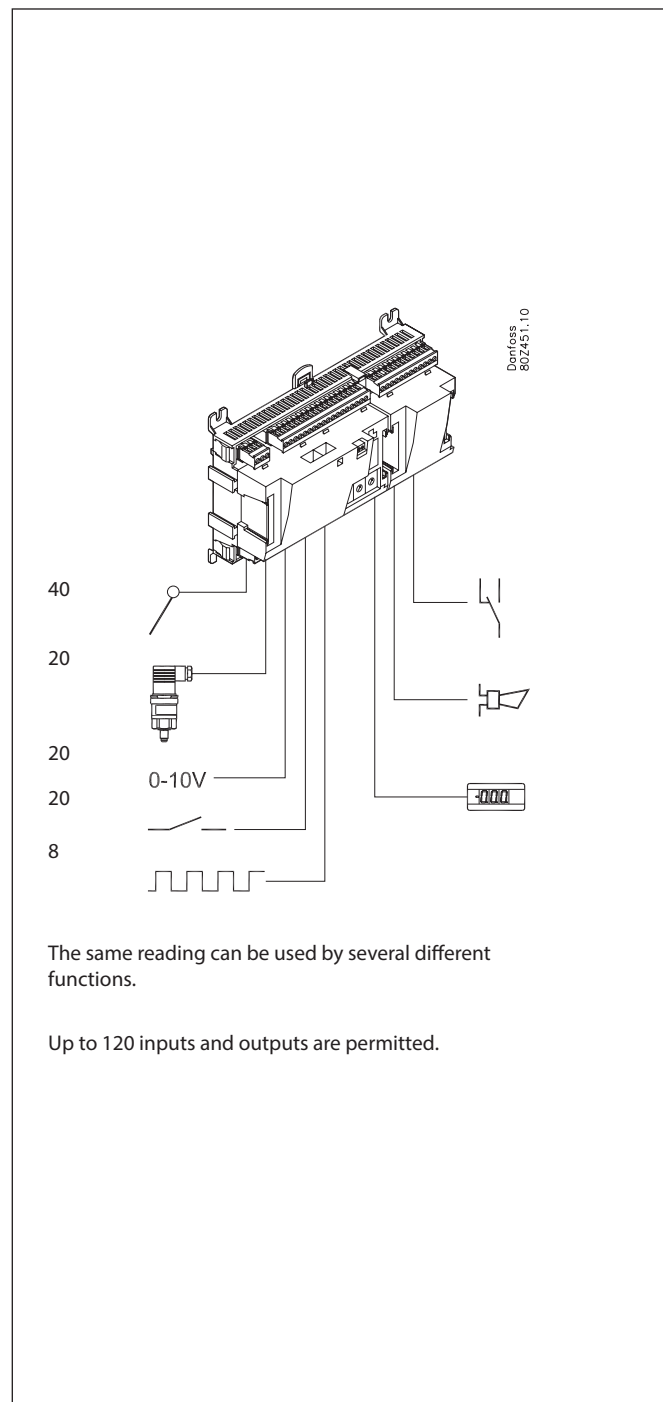
- Two alarm relays that are enabled on different alarm priorities

#### PI regulations

- 10 separate functions can be constructed.

#### Display

- 4 display connections for read-out of the signals received



### Data communication

- Connection to system manager
- Monitoring and data collection
- Customised alarm texts

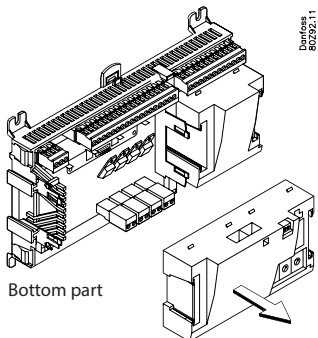
# Principles

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**



Top part

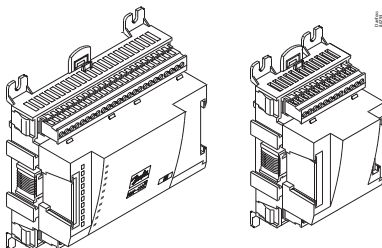
Bottom part

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

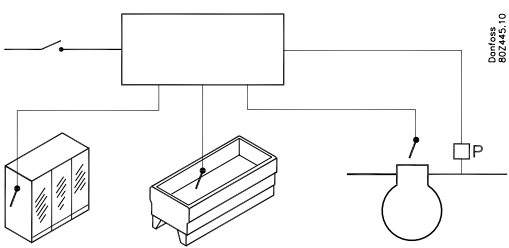
- The bottom part – and hence the terminals – are the same for all controller types.
- The top part contains the intelligence with software. This unit will vary according to controller type. But it will always be supplied together with the bottom part.
- In addition to the software the top part is provided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

**Extension modules**

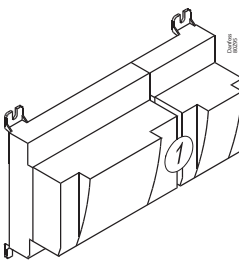


If the system grows and more functions have to be controlled, the regulation can be extended. With extra modules more signals can be received and more relays cut in and out – how many of them – and which – is determined by the relevant application.

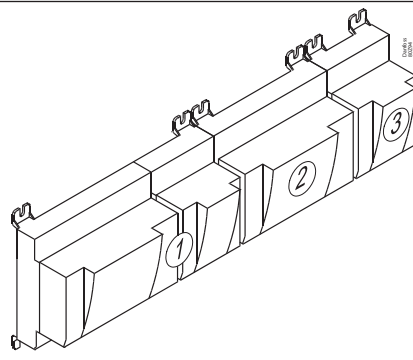
**Examples**



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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 "overview", "manual operation", "log function", "alarms", and "service" (configuration).

## Network linking

The controller can be linked up into a network together with other controllers in an ADAP-KOOL® refrigeration control system.

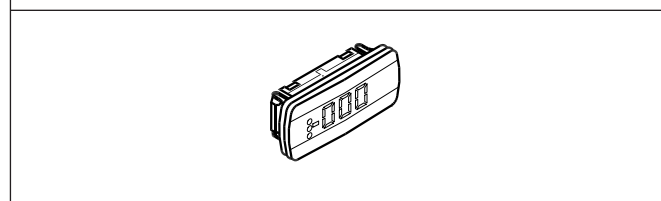
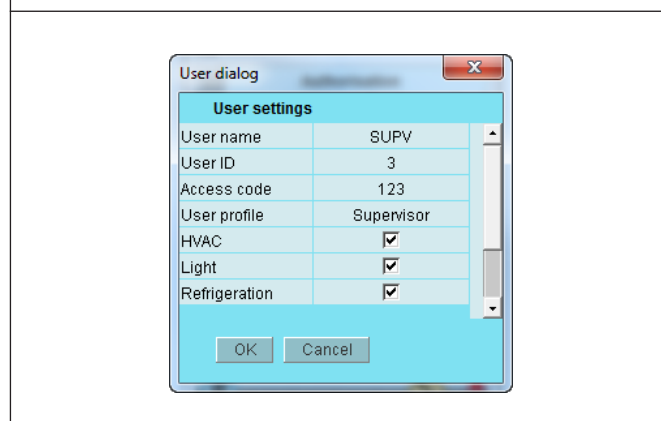
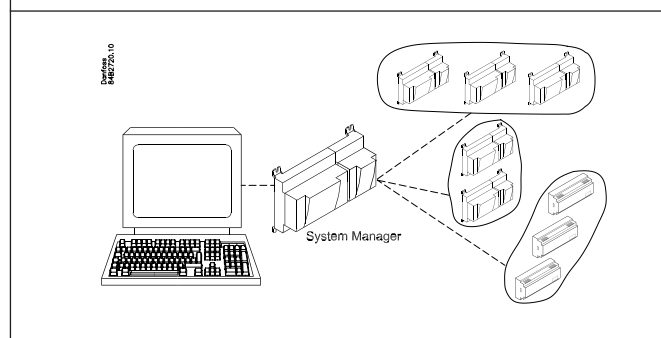
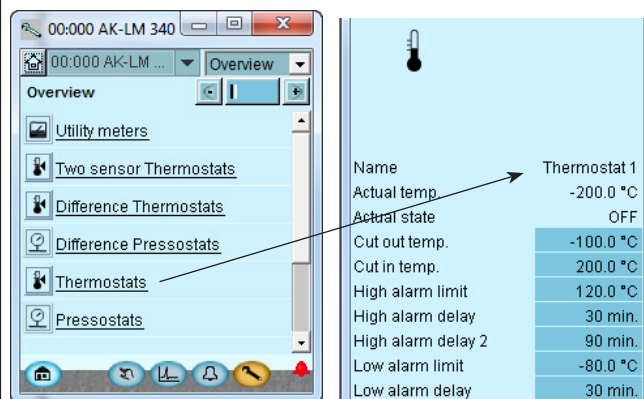
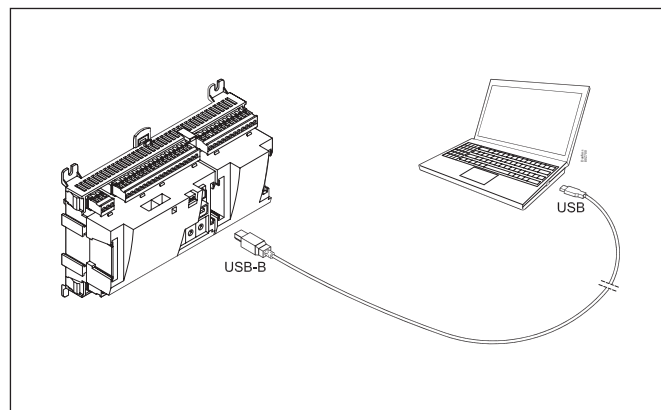
After the setup operation can be performed at a distance with, say, our software program type AK-Service tool.

## Users

The controller comes supplied with several languages, one of which can be selected and employed by the user. If there are several users, they may each have their choice of language. 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".

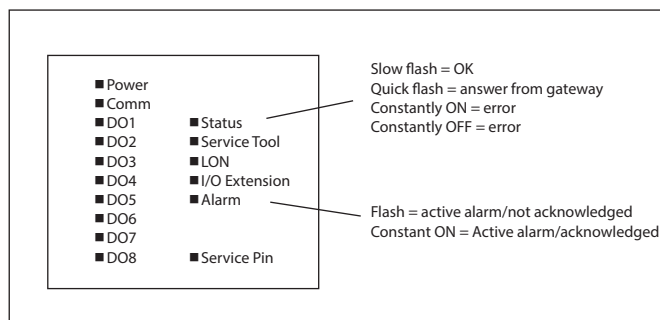
## External display

An external display can be fitted in order for readings of the temperatures to be displayed. Up to 4 display can be mounted.



## 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

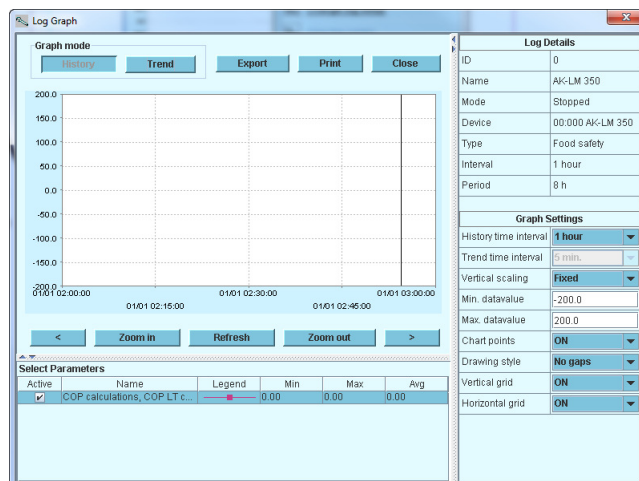
From the log function you can define the measurements you wish to be shown.

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

(The log function is only available via AK-ST 500.)

A log should usually be created on the system unit. The system unit has a larger memory and can contain more data.

If you are in a service situation you can show measurements in a trend function. The measurements are then made real-time 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.



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## 2. Design of a controller

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This section describes how the monitoring unit is designed.

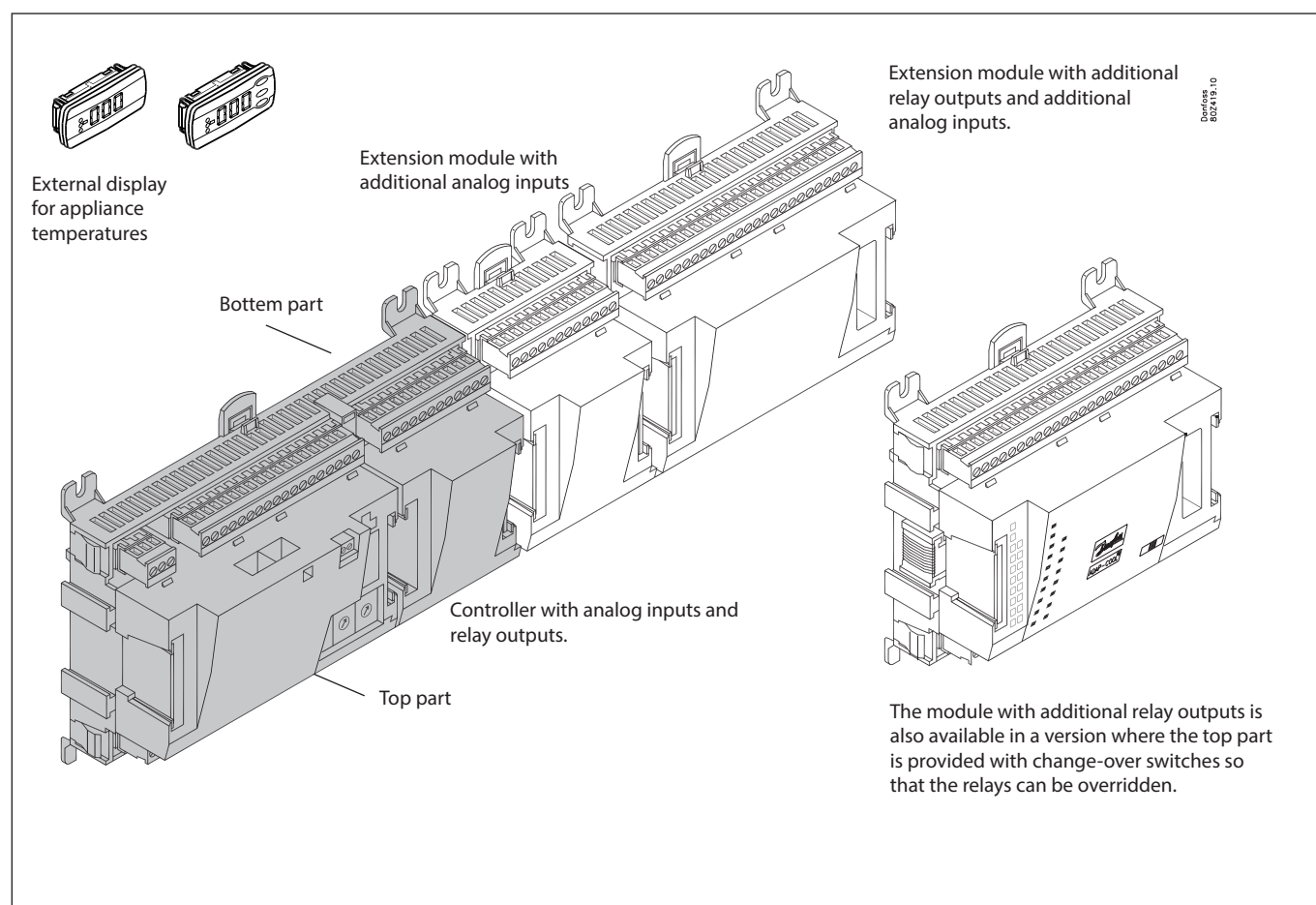
The controller in the system is based on a uniform connection platform where any deviations from regulation to regulation is determined by the used top part with a specific software and by which input and output signals the relevant application will require. If it is an application with few connections, 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-LM 340A	Monitoring unit with PI regulation	Monitoring of temperatures, pressure, voltage etc.

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

Type	Analog inputs	On/Off outputs		On/off supply voltage (DI signal)			Analog outputs	Stepper output	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 valves with step control	For override of relay outputs
Controller	11	4	4	-	-		-		-

#### Extension modules

AK-XM 101A	8								
AK-XM 102A				8					
AK-XM 102B					8				
AK-XM 103A	4						4		
AK-XM 204A		8							
AK-XM 204B		8							x
AK-XM 205A	8	8							
AK-XM 205B	8	8							x
AK-XM 107A						4(8)			
AK-XM 208C	8							4	

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		
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### 3. AK operation and accessories

Type	Function	Application
Operation		
AK-ST 500	Software for operation of AK controllers	AK-operation
-	Cable between PC and AK controller	USB A-B (Standard IT cable)
Accessories	Power supply module 230 V / 115 V to 24 V d.c.	
AK-PS 075	18 VA, 24 V d.c.	Supply for controller
AK-PS 150	36 VA, 24 V d.c.	
Accessories	External display that can be connected to the controller module. For showing, say, the appliance temperature	
EKA 163B	Display	
EKA 164B	Display with operation buttons	
-	Cable between display and controller	Length = 2 m
		Length = 6 m
Accessories	Communication modules for controllers where modules cannot be connected continuously	
AK-CM 102	Communication module	Data communication for external extension modules

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-__ (controller)	8 VA
	AK-XM 101, 102, 103, 107	2 VA
	AK-XM 204, 205, 208	5 VA
Analog inputs	Pt 1000 ohm /0°C	Resolution: 0.1°C Accuracy: +/- 0.5°C +/- 0.5°C between -50°C and +50°C +/- 1°C between -100°C and -50°C +/- 1°C between +50°C and +130°C
	Pressure transmitter type AKS 32R / AKS 2050/ AKS 32 (1-5 V)	Resolution: 1 mV Accuracy +/- 10 mV Max. connection of 5 pressure transmitters on one module
	Other pressure transmitter: Ratiometric signal Min. and max. pressure must be set Min and max. voltage must be set	
	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 <b>must not</b> 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
	UL 873, c 	UL file number: E31024 for LM modul
	UL 916, c 	UL file number: E357029 for XM and CM-moduler

The mentioned data applies to all modules.

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

## Dimensions

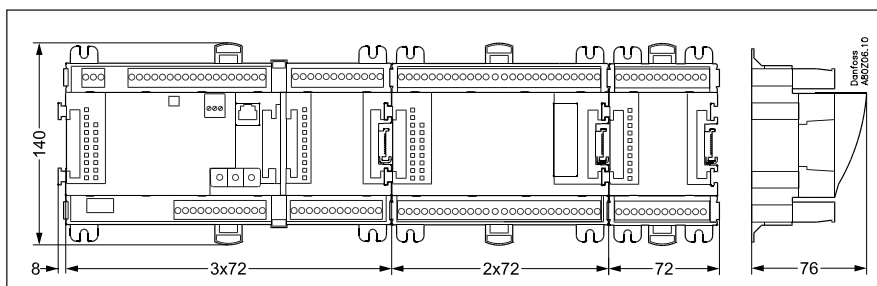
The module dimension is 72 mm.

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 =  $n \times 72 + 8$



## Controller

### 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

If the controller is to be included in a system, communication must take place via the LON connection.

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

### Address setting

1-999 if it is connected to a system manager AK-SM.

### Service PIN

When the controller is connected to the data communication cable the gateway must have knowledge of the new controller. This is obtained by pushing the key PIN. The LED "Status" will flash when the gateway sends an acceptance message.

### 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

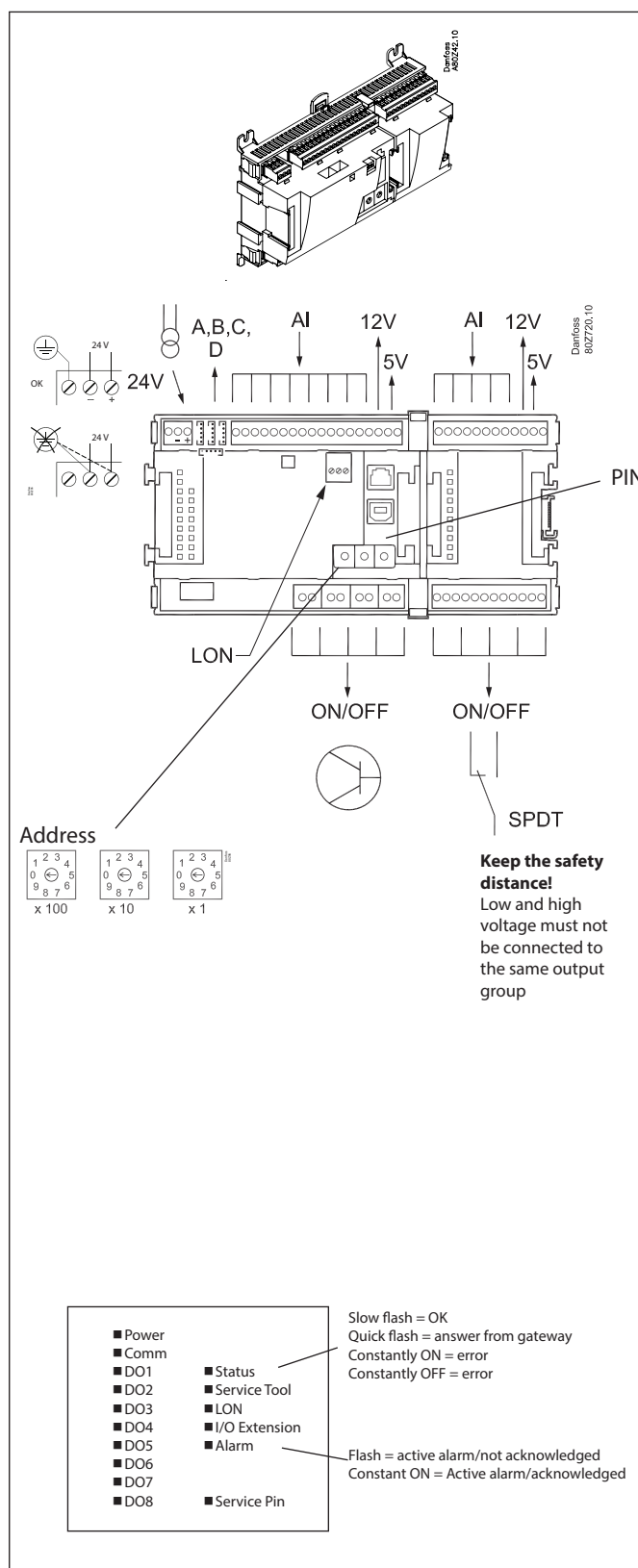
There are two rows with LED's. They mean:

Left row:

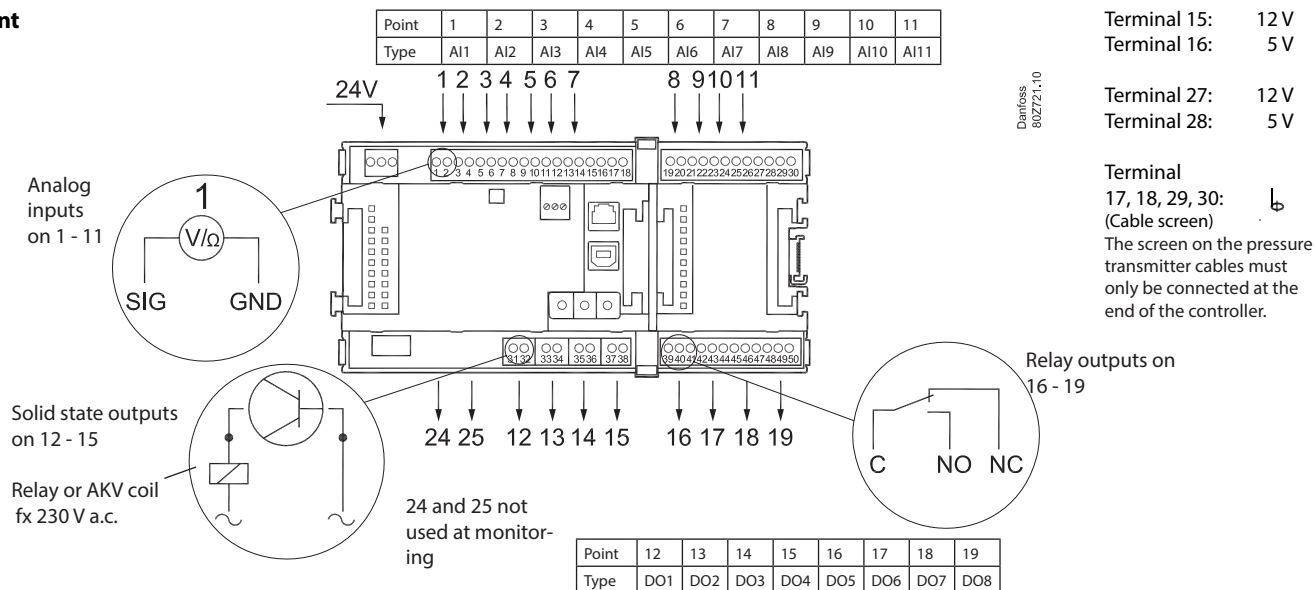
- Voltage supply to the controller
- Communication active with the bottom PC board (red = error)
- Status of outputs DO1 to DO8

Right row:

- Software status (slow flash = OK)
- Communication with Service Tool
- Communication on LON
- Communication with AK-CM 102
- Alarm when LED flashes
- 2 LED's that are not used
- "Service Pin" switch has been activated



Point



	Signal	Signal type	
<b>S</b> Pt 1000 ohm/0°C 	S...	Pt 1000	
<b>P</b> AKS 32R 3: Brown SIG 2: Blue GND 1: Black 5V AKS 32 3: Brown SIG 2: Black GND 1: Red 12V	P...	AKS 32R AKS 2050 MBS 8250 -1 - xx bar AKS 32 -1 - zz bar	
<b>U</b> + SIG - GND	Volt input...	0 - 5 V 0 - 10 V	
<b>On/Off</b> 		<b>Active at:</b> Closed / Open	
<b>DO</b> 		<b>Active at:</b> On / Off	
	Signal	Module	Point
			Terminal
			Signal type / Active at
			1 (AI 1)
			2 (AI 2)
			3 (AI 3)
			4 (AI 4)
			5 (AI 5)
			6 (AI 6)
			7 (AI 7)
			8 (AI 8)
			9 (AI 9)
			10 (AI 10)
			11 (AI 11)
			12 (DO 1)
			13 (DO 2)
			14 (DO 3)
			15 (DO 4)
			16 (DO 5)
			17 (DO 6)
			18 (DO 7)
			19 (DO 8)

## Extension module AK-XM 101A

### Function

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

### Supply voltage

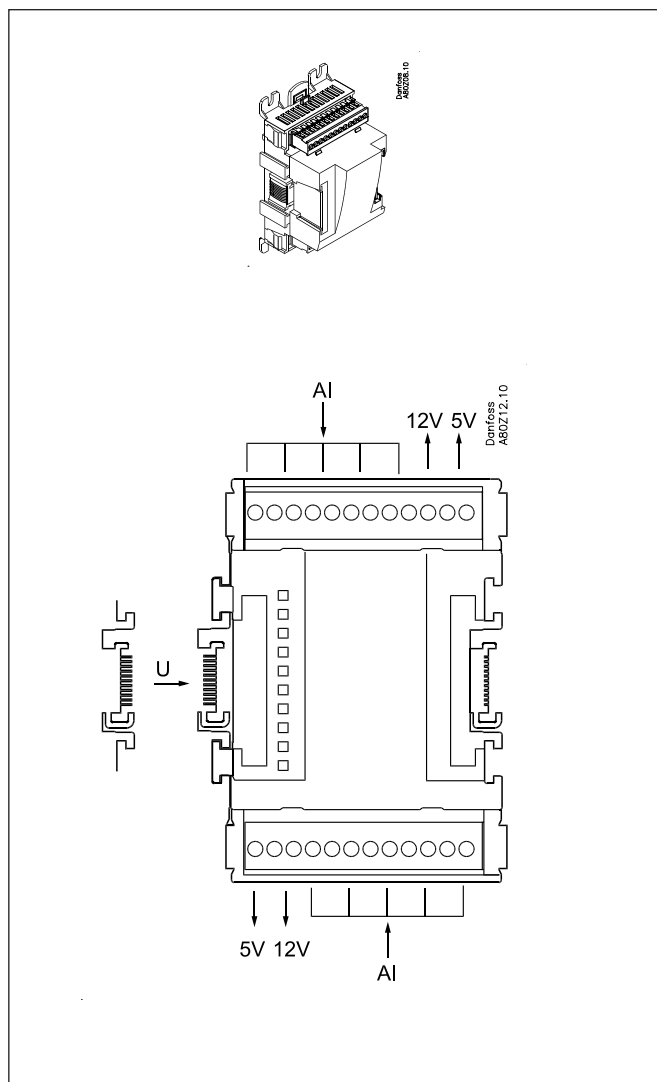
The supply voltage to the module comes from the previous module in the row.

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:

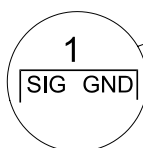
- Voltage supply to the module
- Communication with the controller is active (red = error)



**Point**

At the top the signal input is the left of the two terminals.

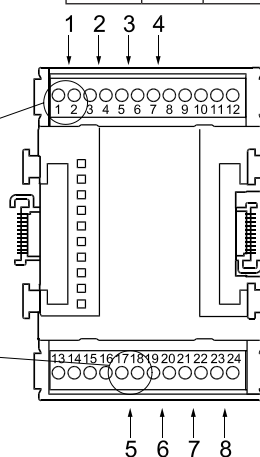
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At the bottom the signal input is the right of the two terminals.



Point	1	2	3	4
Type	AI1	AI2	AI3	AI4



Terminal 9: 12 V  
Terminal 10: 5 V

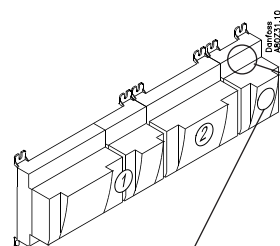
Terminal 15: 5 V  
Terminal 16: 12 V

Terminal

11, 12, 13, 14: (Cable screen)

The screen on the pressure transmitter cables must only be connected at the end of the controller.

	Signal	Signal type
<b>S</b> Pt 1000 ohm/0°C 	S...	Pt 1000
<b>P</b> AKS 32R AKS 2050  AKS 32 	P...	AKS 32R AKS 2050 MBS 8250 -1 - xx bar AKS 32 -1 - zz bar
<b>U</b> + ——— SIG - ——— GND	V...	0 - 5 V 0 - 10 V
<b>On/Off</b> 	Day/ Night Door Defrost	<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.

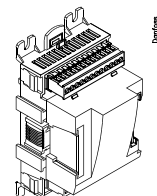
### Supply voltage

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)



#### AK-XM 102A

##### Max. 24 V

On/Off:

On: DI > 10 V a.c. / d.c.

Off: DI < 2 V a.c. / d.c.

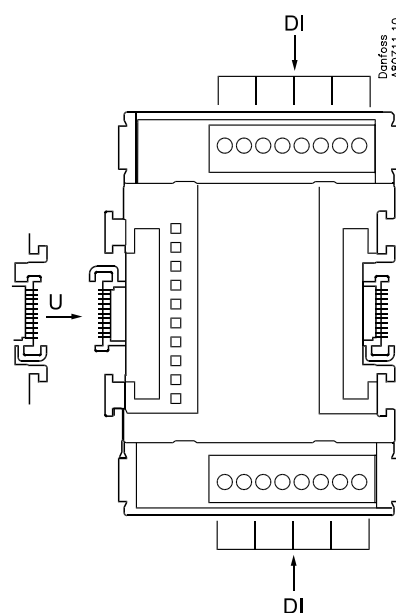
#### AK-XM 102B

##### Max. 230 V

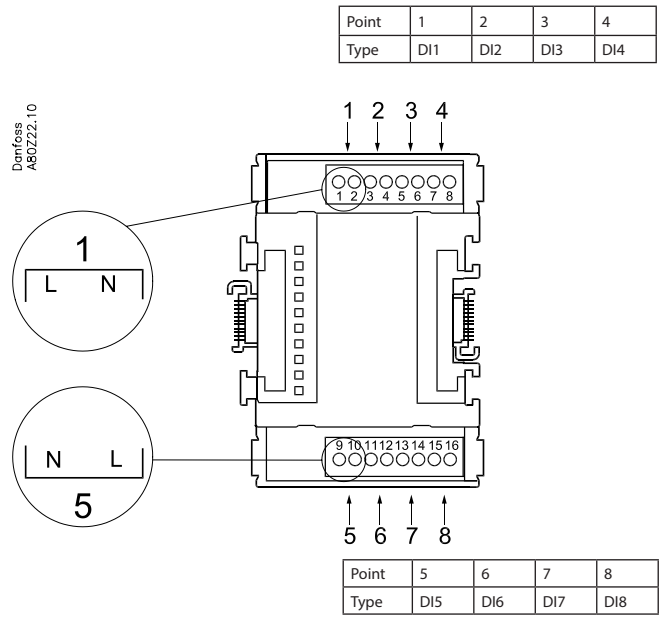
On/Off:

On: DI > 80 V a.c.

Off: DI < 24 V a.c.

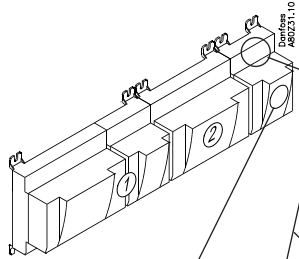


Point



	Signal	Active at
DI	<div><div>AK-XM 102A: Max. 24 V</div><div>AK-XM 102B: Max. 230 V</div><div></div></div>	<div>Day/ Night</div> <div>Door.</div> <div>Defrost</div> <div>Closed (voltage on)</div> <div>/</div> <div>Open (voltage off)</div>

(The module can not register a pulse signal from e.g. a reset function.)



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 103A

### Function

The module contains :

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

4 analog voltage outputs of 0 - 10 V

### 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.

### Galvanic isolation

The inputs are galvanically separated from the outlets.

The outlets AO1 and AO2 are galvanically separated from AO3 and AO4.

### Light-emitting diodes

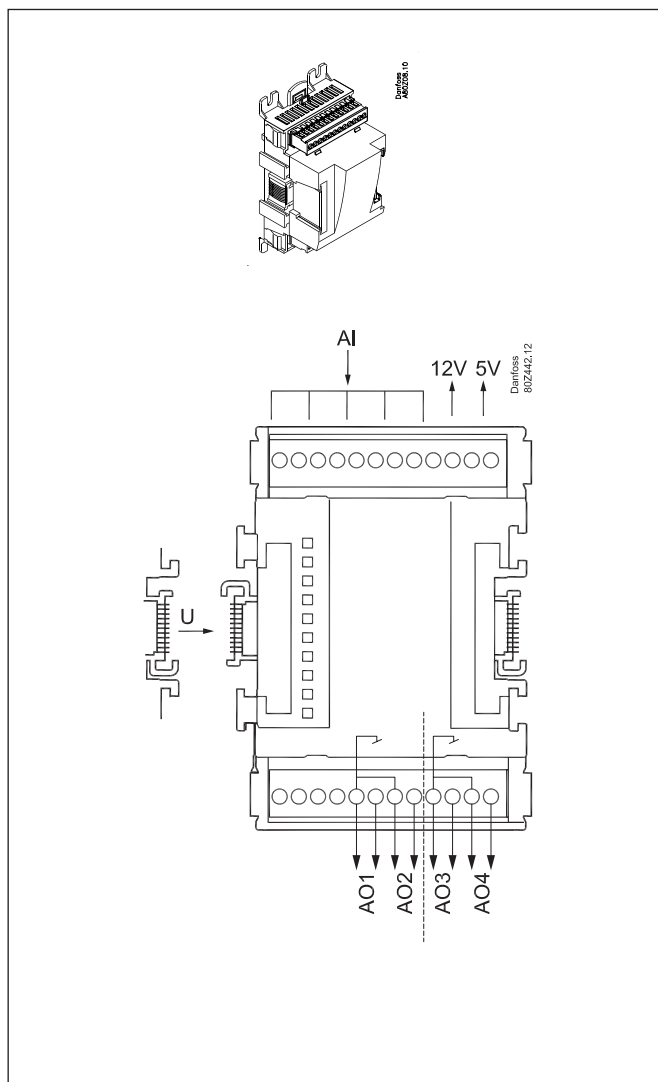
Only the two top LED's are used. They indicate the following:

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

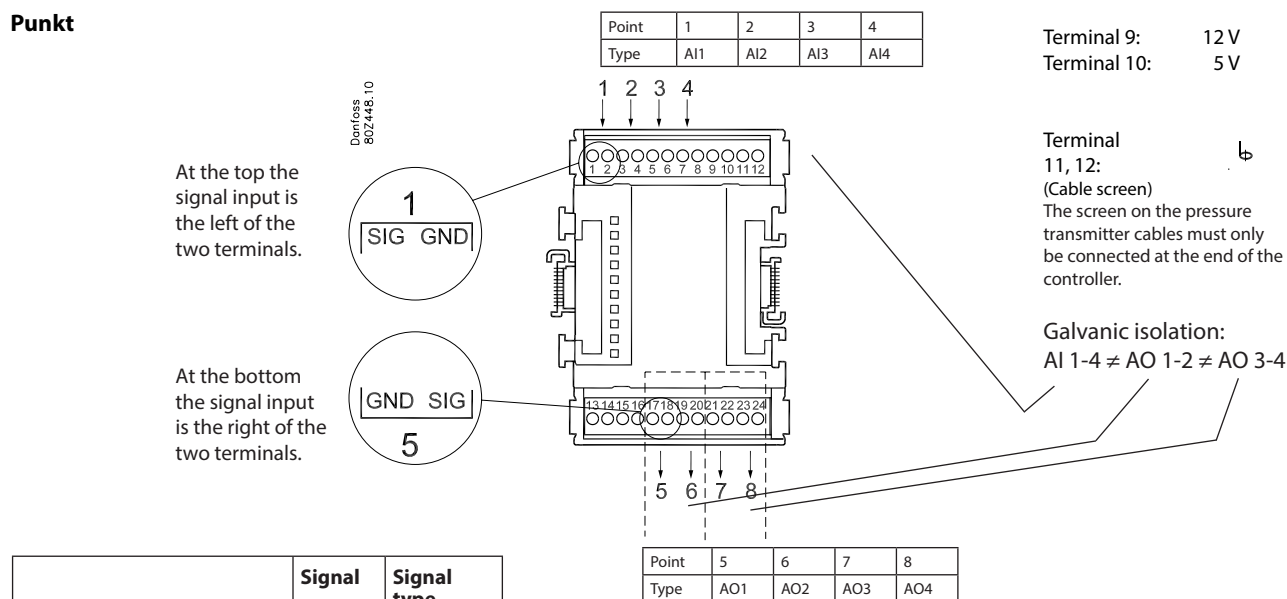
### Max. load

$I < 2.5 \text{ mA}$

$R > 4 \text{ k}\Omega$



# Punkt



	Signal	Signal type
<b>S</b> Pt 1000 ohm/0°C 	S...	Pt 1000
<b>P</b> AKS 32R  AKS 32 	P...	AKS 32R / AKS 2050 MBS 8250 -1 - xx bar  AKS 32 -1 - zz bar
<b>U</b> 	V...	0 - 5 V 0 - 10 V
<b>On/Off</b> 	Day/ Night  Door Level switch	<b>Active at:</b>  Closed / Open
<b>AO</b> 		0-10 V

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 (AO 1)	17 - 18	
		6 (AO 2)	19 - 20	
		7 (AO 3)	21 - 22	
		8 (AO 4)	23 - 24	

## 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:

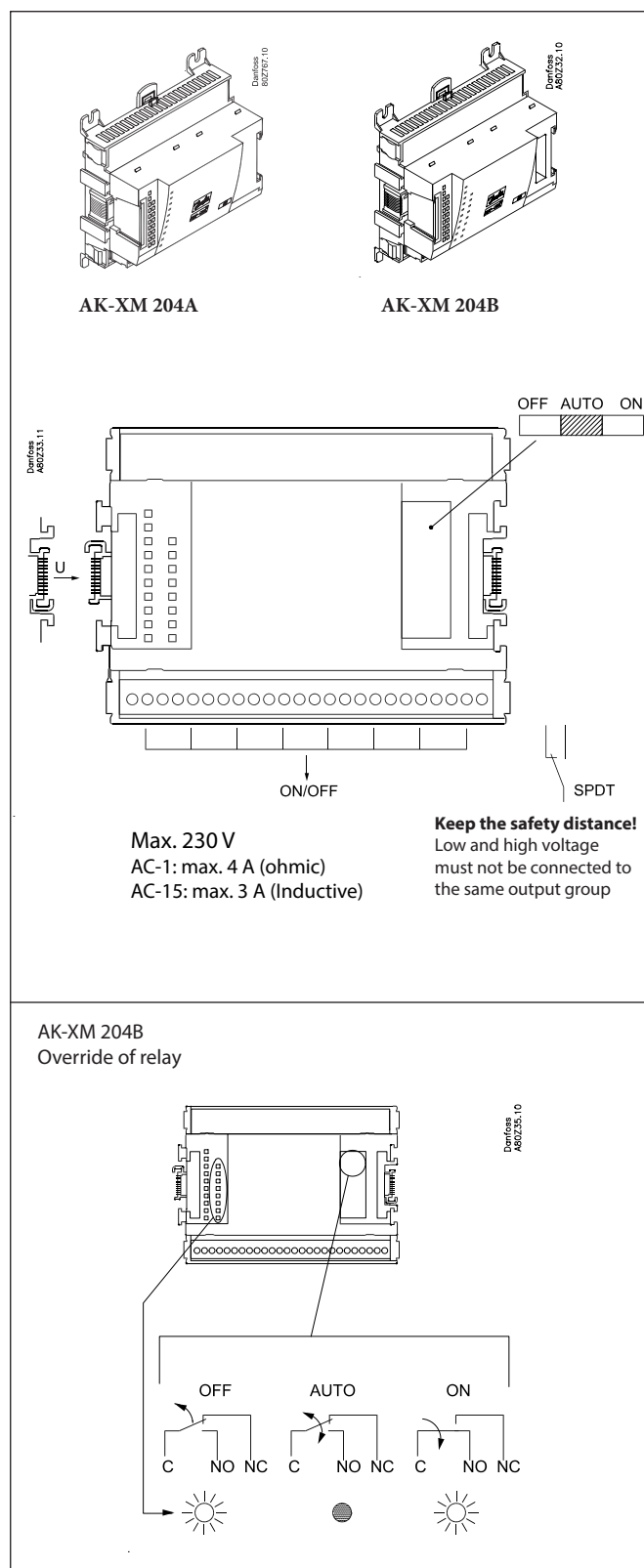
- Voltage supply to the controller
- Communication active with the bottom PC board (red = error)
- Status of outputs DO1 to DO8

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

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

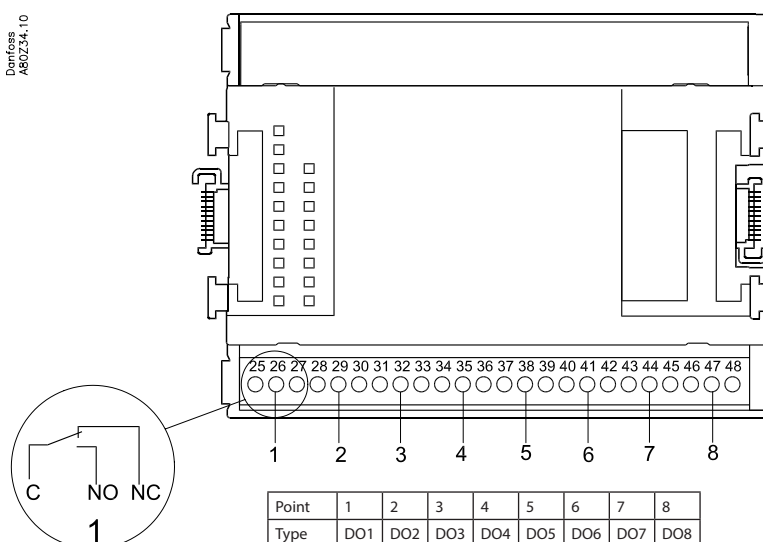
### Fuses

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

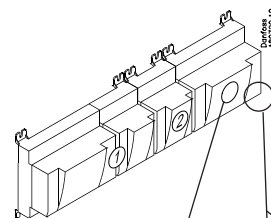


# Point

Danfoss  
A80234.10



	Signal	Active at
DO	Fan Alarm Light Rail-heat Defrost Night blinds Valves Compressor	On / Off



Signal	Module	Point	Terminal	Active at
		1 (DO 1)	25 - 26 - 27	
		2 (DO 2)	28 - 29 - 30	
		3 (DO 3)	31 - 32 - 33	
		4 (DO 4)	34 - 35 - 36	
		5 (DO 5)	37 - 38 - 39	
		6 (DO 6)	40 - 41 - 42	
		7 (DO 7)	43 - 44 - 45	
		8 (DO 8)	46 - 47 - 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:

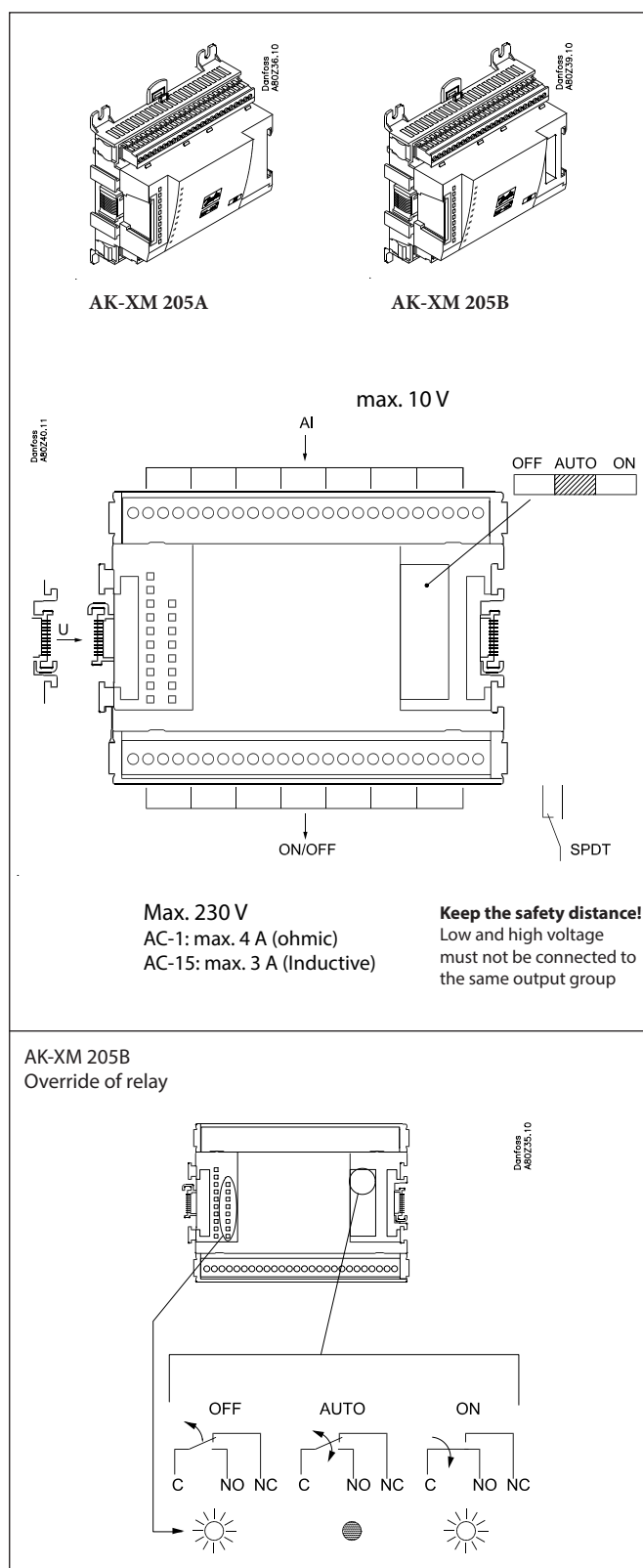
- Voltage supply to the controller
- Communication active with the bottom PC board (red = error)
- Status of outputs DO1 to DO8

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

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

### Fuses

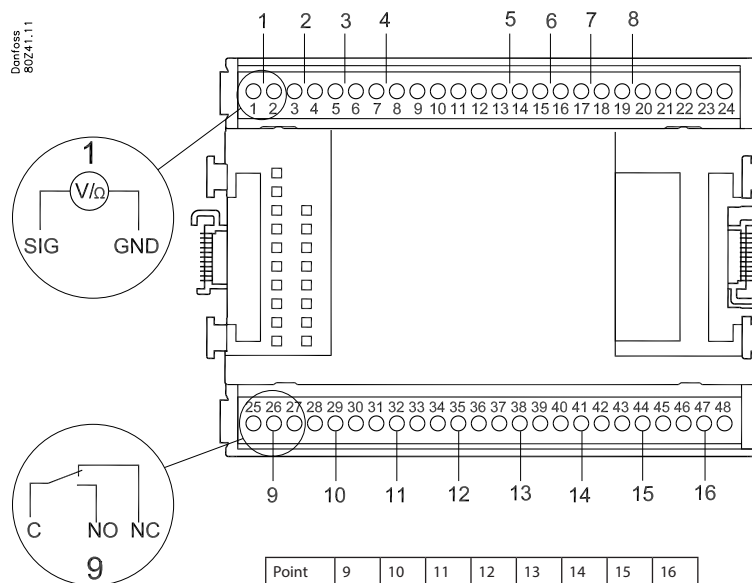
Behind the upper part there is a fuse for each output.





Point

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



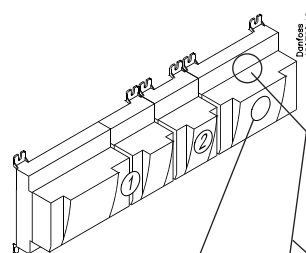
Terminal 9: 12 V  
Terminal 10: 5 V

Terminal 21: 12 V  
Terminal 22: 5 V

Terminal 11, 12, 23, 24: 6  
(Cable screen)  
The screen on the pressure transmitter cables must only be connected at the end of the controller.

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 	S...	Pt 1000
<b>P</b> AKS 32R AKS 2050  AKS 32 	P...	AKS 32R AKS 2050 MBS 8250 -1 - xx bar  AKS 32 -1 - zz bar
<b>U</b> 	V...	0 - 5 V 0 - 10 V
<b>On/Off</b> 	Day/ Night Door Defrost	<b>Active at:</b> Closed / Open
<b>DO</b> 	Fan Alarm Light Rail heat Defrost Night blinds Valves Compressors	<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 - 26 - 27	
		10 (DO 2)	28 - 29 - 30	
		11 (DO 3)	31 - 30 - 33	
		12 (DO 4)	34 - 35 - 36	
		13 (DO 5)	37 - 36 - 39	
		14 (DO 6)	40 - 41 - 42	
		15 (DO 7)	43 - 44 - 45	
		16 (DO 8)	46 - 47 - 48	

## Extension module AK-XM 107A

### Function

The module contains eight inputs for pulse counting. AK-LM 340A can detect signals from 8 pulse signals. As an alternative, the input can be used to register a signal for synchronising or 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)

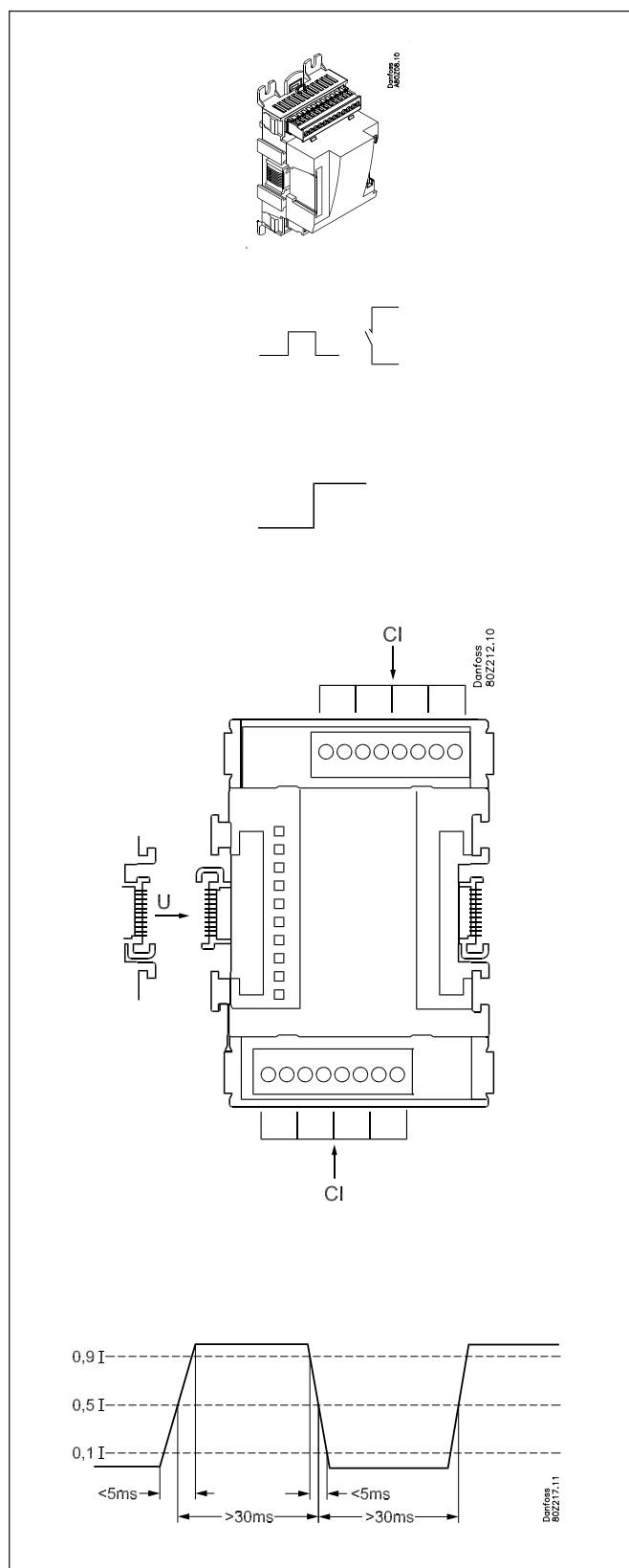
(There is no LED indication for the individual signal inputs)

### Signal

The signal is registered in accordance with DIN 43864.

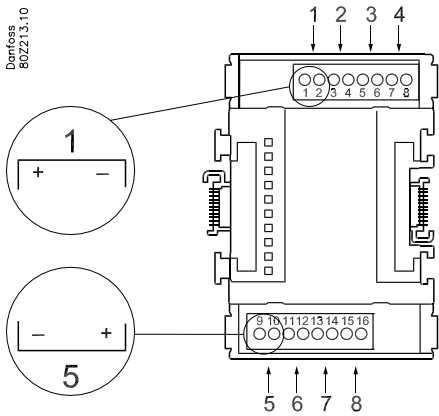
Rise times and fall times must be less than 5 ms.

On and off times must be greater than 30 ms.



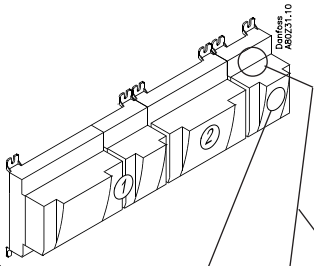
Point

Point	1	2	3	4
Type	CI1	CI2	CI3	CI4



Point	5	6	7	8
Type	CI5	CI6	CI7	CI8

	Signal	Active at
CI	 Pulse	---



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-XM 208C

### Function

The module contains:

- 8 analog inputs for sensors, pressure transmitters, voltage signals and contact signals.
- 4 outputs for stepper motors.

### Supply voltage

The supply voltage to the module comes from the previous module in the row. Here supplied with 5 VA.

The supply voltage to the valves must be from a separate supply, which must be galvanically separated from the supply for the control range. Class II is required.

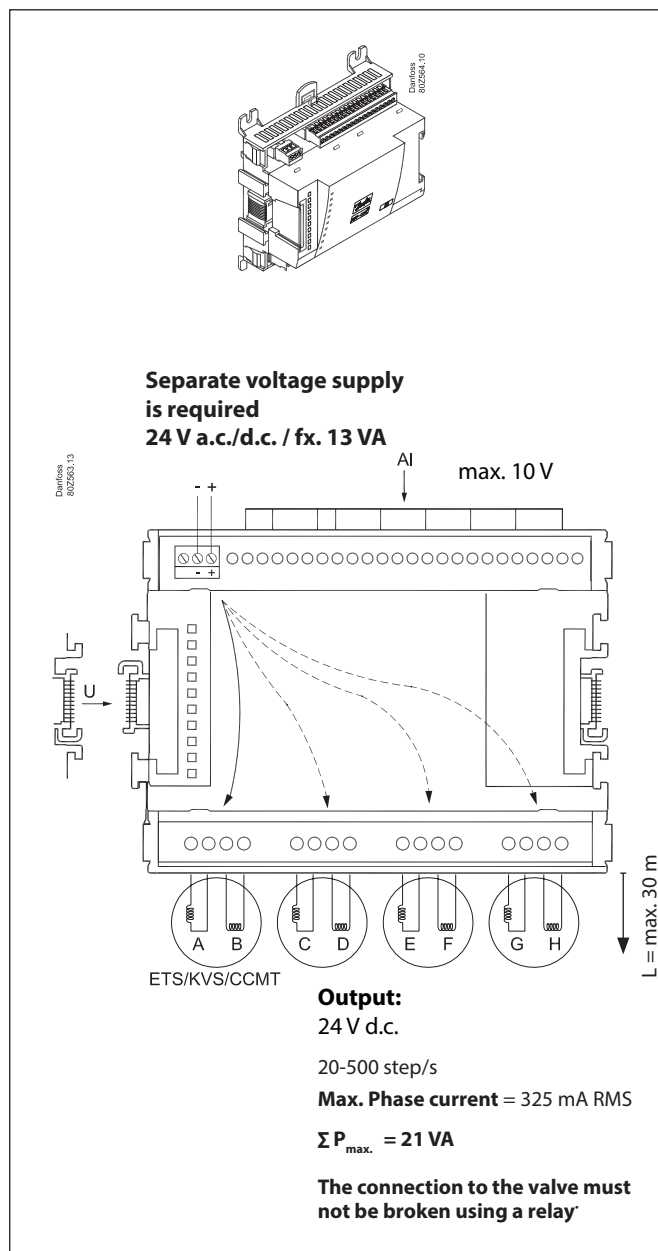
(Power requirements: 7.8 VA for controller + xx VA per valve).

A UPS may be necessary if the valves need to open/close during a power failure.

### Light-emitting diodes

There is one row with LED's. It indicate the following:

- Voltage supply to the module
- Communication active with the bottom PC board (red = error)
- Step1 to step4 OPEN: Green = Open
- Step1 to step4 CLOSE: Green = Close
- Red flash = Error on motor or connection



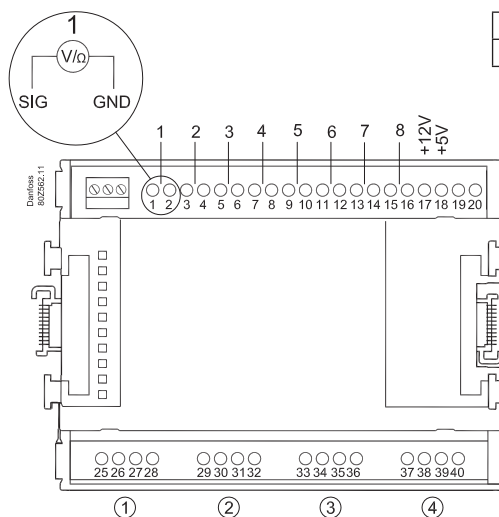
Valve data	
Type	P
ETS 12.5 - ETS 400 KVS 15 - KVS 42 CCMT 2 - CCMT 8 CCM 10 - CCM 40 CTR 20	1.3 VA
CCMT 16 - CCMT 42	5.1 VA

### Power supply to AK-XM 208C:

$$Fx: 7.8 + (4 \times 1.3) = 13 \text{ VA} \Rightarrow \text{AK-PS 075}$$

$$Fx: 7.8 + (4 \times 5.1) = 28,2 \text{ VA} \Rightarrow \text{AK-PS 150}$$

## Point



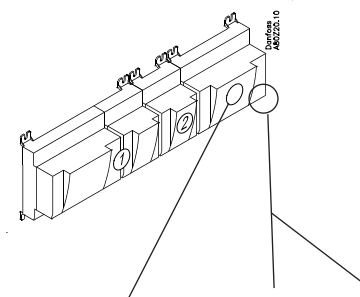
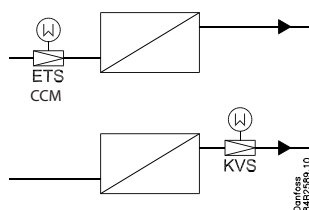
Point	1	2	3	4	5	6	7	8
Type	AI1	AI2	AI3	AI4	AI5	AI6	AI7	AI8


Terminal 17: 12 V  
Terminal 18: 5 V

Terminal 19, 20:  
(Cable screen)  
The screen on the pressure transmitter cables must only be connected at the end of the controller.

Point	9	10	11	12
Step	1	2	3	4
Type	AO			

Step / Terminal	1	25	26	27	28
	2	29	30	31	32
	3	33	34	35	36
	4	37	38	39	40
ETS CCM / CCMT CTR KVS		White	Black	Red	Green



Valve	Module	Step	Terminal
 ETS/KVS/CCMT		1 (point 9)	25 - 28
		2 (point 10)	29 - 32
		3 (point 11)	33 - 36
		4 (point 12)	37 - 40

## 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

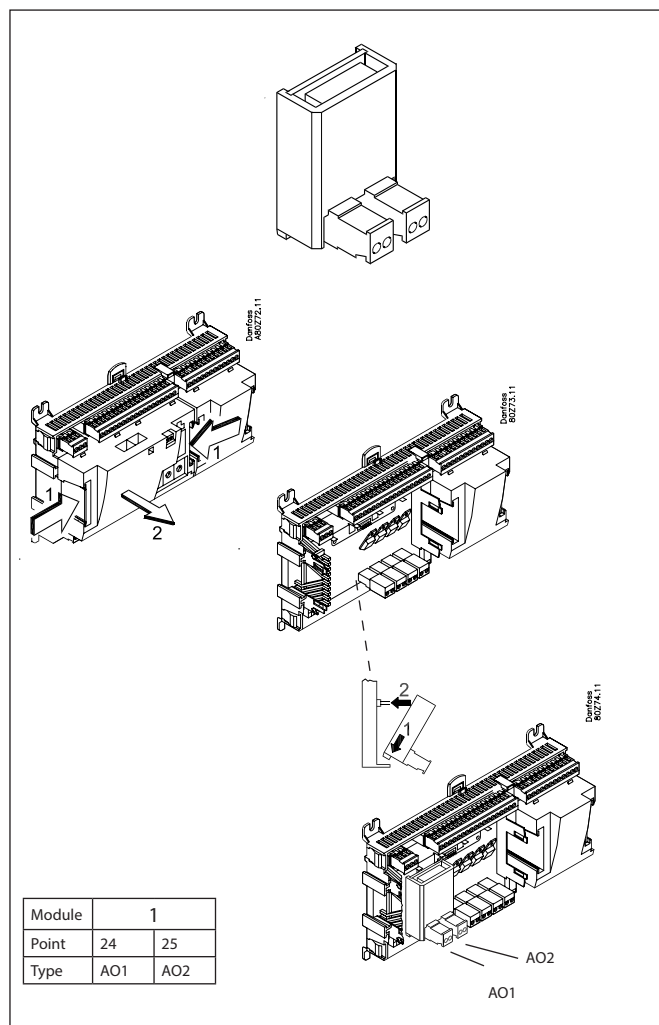
The two outputs have points 24 and 25. They are shown on the earlier page where the controller is also mentioned.

Max. load

$I < 2.5 \text{ mA}$

$R > 4 \text{ kohm}$

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



## Display module EKA 163B / EKA 164B

### Function

Display of important measurements, e.g. appliance temperature.  
Setting of the individual functions can be performed by using the display with control buttons.  
It is the monitoring unit used that determines the measurements and settings that can occur.

### Connection

The extension module is connected to the controller module via a cable with plug connections. You have to use one cable per module. The cable is supplied in various lengths.

Both types of display (with or without control buttons) can be connected to either display output A, B, C and D.

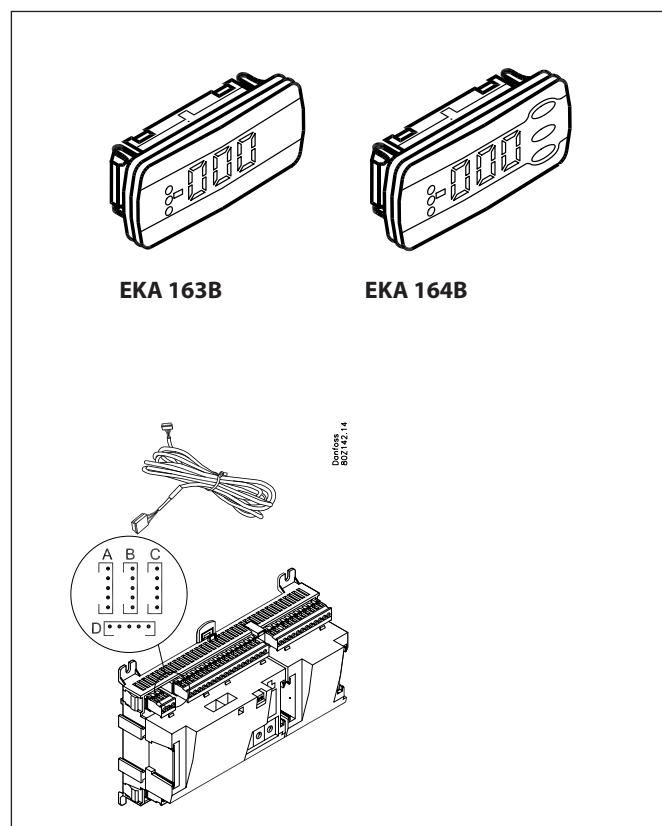
When the controller starts up, the display will show which output is connected. -- 1 = output A, -- 2 = output B, etc.

### Placing

The extension module can be placed at a distance of up to 15 m from the controller module.

### Point

No point has to be defined for a display module – you simply connect it.





## Communication module AK-CM 102

### Function

The module is a new communication module, meaning the row of extension modules can be interrupted.

The module communicates with the regulator via data communication and forwards information between the controller and the connected extension modules.

### Connection

Communication module and controller fitted with RJ 45 plug connectors.

**Nothing** else should be connected to this data communication; a maximum of 5 communication modules can be connected to one controller.

### Communication cable

One metre of the following is enclosed:  
ANSI/TIA 568 B/C CAT5 UTP cable w/ RJ45 connectors.

### Positioning

Max. 30 m from the controller  
(The total length of the communication cables is 30 m)

### Supply voltage

24 volt AC or DC should be connected to the communication module.

The 24 V can be sourced from the same supply that supplies the controller. (The supply for the communication module is galvanically separated from the connected extension modules).

The terminals must **not** be earthed.

The power consumption is determined by the power consumption of the total number of modules.

The controller strand load must not exceed 32 VA.

Each AK-CM 102 strand load must not exceed 20 VA.

### Point

Connection points on the I/O modules should be defined as if the modules were an extension of each other.

### Address

The address for the first communication module should be set to 1. Any second module should be set to 2. A maximum of 5 modules can be addressed.

### Termination

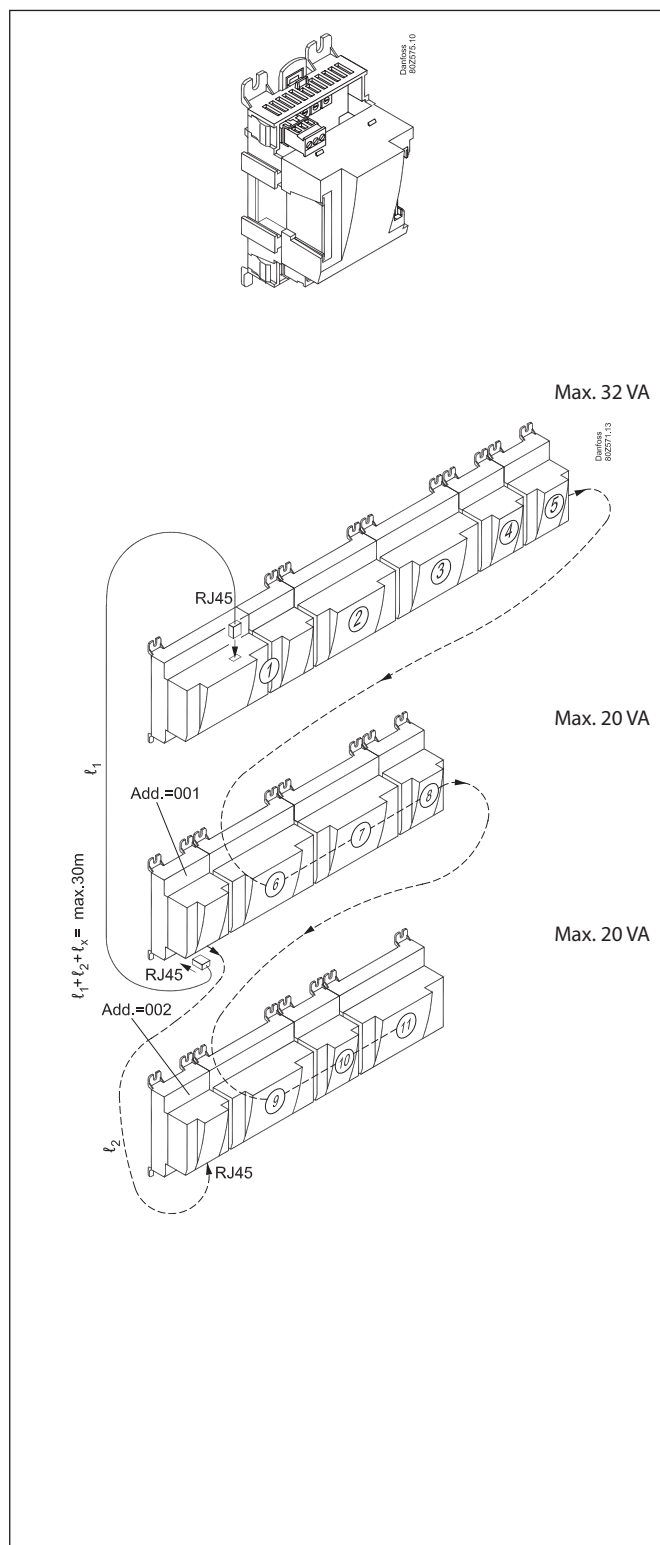
The termination switch on the final communication module should be set to ON.

The controller should permanently be set to = ON.

### Warning

Additional modules may only be installed following the installation of the final module. (Here following module no. 11; see the sketch.)

After configuration, the address must not be changed.



## Transformer module AK-PS 075 / 150

### Function

24 V supply for controller.

### Supply voltage

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

### Placing

On DIN-rail

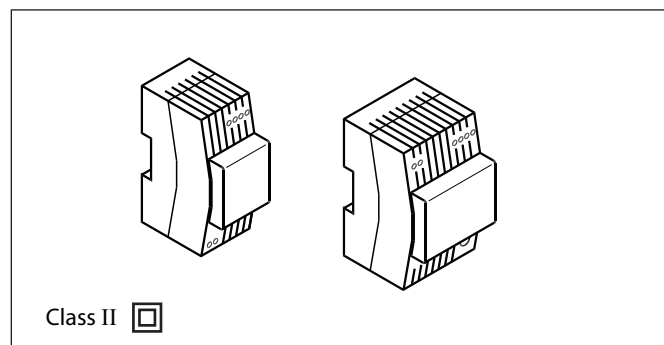
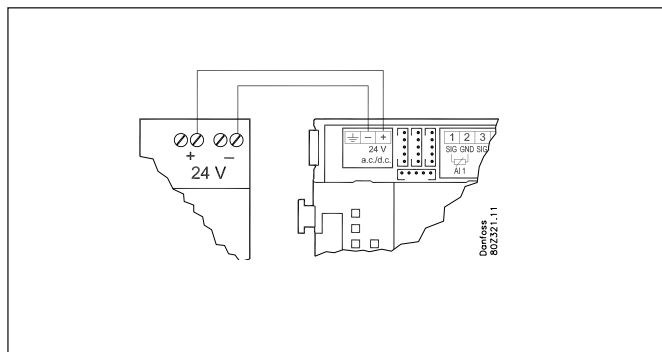
### Effect

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

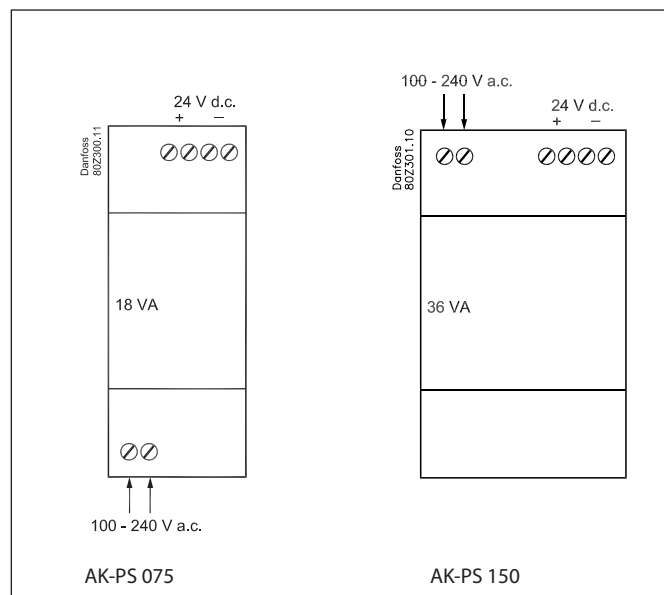
### Dimension

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

### Supply to a controller



### Connections



---

## Preface to design

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 controller.

The clock setting is maintained for at least 12 hours at a power failure.

The clock setting is kept updated if the controller is linked up in a network with a system manager.

### **Start/stop of regulation**

Regulation can be started and stopped via the software.

### **Alarm function**

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

### **Forced control**

The software contains a forced control option. If an extension module with relay outputs is used, the module's top part can be with change-over switches – switches that can override the individual relays into either OFF or ON position.

### **Data communication**

The controller module has terminals for LON data communication. The requirements to the installation are described in a separate document. Literature no. RC8AC.

## Connections

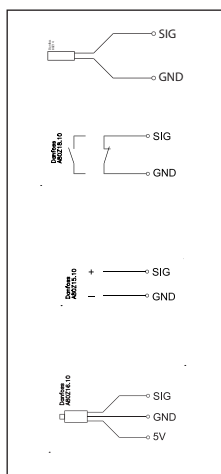
In principle there are the following types of connections:

### 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, AKS 32R or AKS 2050.

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.



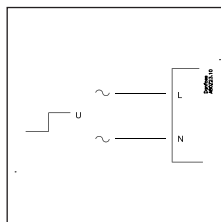
### ON/OFF voltage inputs "DI"

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



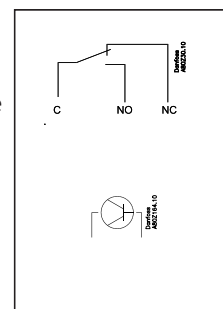
When programming the function must be set:

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

### 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  
Primarily for AKV valves that switch frequently, but the output can connect an external relay as well as a relay output. The output is only found on the controller module.

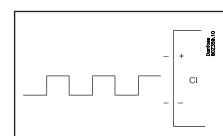


When programming the function must be set:

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

### Pulse counter inputs "CI"

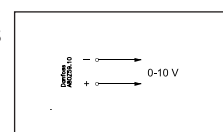
This signal must be used if consumption measurement is to take place.



### 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.

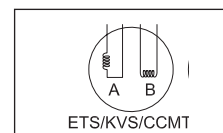
When programming the signal range must be defined: 0-5 V, 1-5 V, 0-10 V or 2-10 V.



### Pulse signal for the stepper motors.

This signal is used by valve motors of the type ETS, KVS and CCMT.

The valve type should be set during programming.



## 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.

- The sum of connections cannot exceed 120.
- 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.

### Common pressure transmitter

If several controllers receive a signal from the same pressure transmitter, the supply to the affected controllers must be wired so that it is not possible to switch off one of the controllers without also switching off the others. (If one controller is switched off, the signal will be pulled down, and all the other controllers will receive a signal which is too low)

# Design of a monitoring

## Procedure:

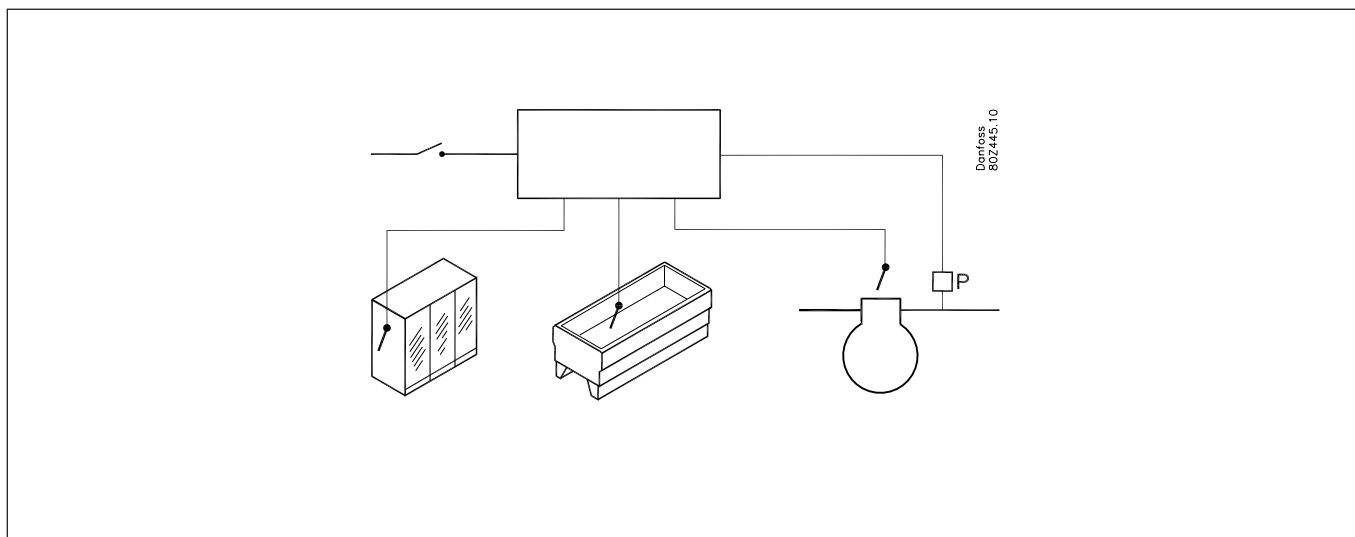
1. Make a sketch of the system in question
2. Check that the controller's functions cover the required application
3. Consider the connections to be made
4. Use the planning table. / Note down the number of connections  
./ add up
5. Are there enough connections on the controller module? – If not, can 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/transformer

**Follow these 12 steps**



## 1

### Sketch



Make a sketch of the system in question.

## 2

### Monitoring unit

	AK-LM 340A
<b>Application</b>	
Monitoring of temperatures, pressure, voltages and On/off signals	x
PI regulation	10
General relay functions for thermostats, pressostats, voltages and On/Off signals	x
Consumption measurement via pulse inputs	x
Alarm relays	x
<b>Thermostat function</b>	
Thermostat function	10
Difference thermostat	10
Two sensor thermostat	10
Cutin and Cutout values for relay	x
Alarm limits and delay times	x
Extended delay time during defrost	x
Alarms suspend during case cleaning	x
<b>Pressostat functions</b>	
Pressostat function	5
Difference pressostat	10
Cutin and Cutout values for relay	x
Alarm limits and delay times	x
<b>Voltage signal</b>	
Number	5
Scaling of read out signal. for ex. 0-10 V = 0-100% humidity	x
Cutin and Cutout values for relay	x
Alarm limits and delay times	x
Delay times on cutin and cutout of relays	x
<b>On/Off signals</b>	
Number	16
Closed contact / 24 V signal / 230 V signal	x
Alarm and relay function with delay	x
Counter function for switch to "On"	x
Time Counter for "On"	x
<b>Consumption measurement</b>	
Number	8
Pulse signal acc. DIN 43864	x
Synchronising signal (connected to a separate pulse input)	1
Read out of the consumption of the last 24 hours	x
Read out of the consumption during the last week	x
Read out of the total consumption since the last reset	x
<b>Alarm relay</b>	
Number	2
Priority "high" or priority "low to high"	x
<b>Miscellaneous</b>	
Alarm priorities	x
Sensor correction	x
Option for connection of separate display	4
Max. input and output	120

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 in point 4.

#### Analog inputs

##### Temperature sensors

Temperature sensors that can be used by thermostats for monitoring, relay control and alarm functions (S1 - S40).

##### Voltage signal

Voltage signals that can be used for monitoring, relay control and alarm functions (Volt input 1-20).

##### Pressure transmitters

Pressure transmitter signals that can be used by pressostats for monitoring, relay control and alarm functions (P1 - P20).

#### On/Off-inputs

Contact function (on an analog input)

or

Voltage signal (on an extension module)

On/off signals that are used for monitoring, relay control and alarm functions (DI1-DI20).

- Defrosting signals that are used to extend alarm delays for thermostats.
- Appliance cleaning signal to stop alarms from the thermostat.
- Signal to reset the alarm relay (mute function).

#### Pulse inputs

- Energy reading
- Synchronisation

#### On/off outputs

##### Relay outputs

- Thermostat functions 1-10
- Voltage signals 1-5
- Pressostat functions 1-5
- Digital alarm functions 1-16
- Alarm relays 1-2
- Two sensor thermostats 1-10
- Difference thermostats 1-10
- Difference pressostats 1-10

##### 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).

#### Analog output

- Voltage signal for PI functions 1-10

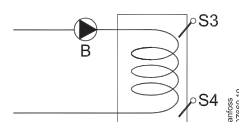
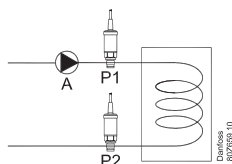
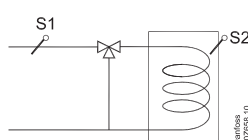
#### Stepper output

- Stepper signal for PI functions 1-10

#### Example

Three separate controls:

- Difference thermostat
- Difference pressostat
- Two sensor thermostat



Data from this example is used on the next page.

The result is that the following modules should be used:

- AK-LM 340A Monitoring unit
- No extension modules

## 4 Planning table

The table helps you establish whether there are enough inputs and outputs on the basic controller. If there are not enough of them, the controller 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 signal Example		On/Off output signal Example		Analog output signal 0-10 V Stepper output Example		Limitations
<b>Analog inputs</b>													
Temperature sensors S1 - S40		4											P = Max. 5
Voltage signals Volt-input 1-20													
Pressure transmitter P1 - P20		2											
<b>On/off inputs (DI1 - DI20)</b>	Contact		24 V		230 V								The example: None of the 3 limitations are exceeded => OK
Monitoring													
Extended defrost delays													
Case cleaning signal													
Signal to reset alarm relay													
<b>Pulse inputs</b>													
Energy measurement (1-8)													
Synchronizing signal													
<b>On/off outputs</b>													
Relays for thermostat functions (1-25)									2				
Relays for voltage signals (1-5)													
Relays for pressostat functions (1-25)									1				
Relays for digital input functions (1-16)													
Relays for alarm function (1-2)													
<b>Analog control signal, 0-10 V</b>													
Frequency converter, Compressor, fans, pumps, valves etc.													
<b>Valves with stepper motor. Parallel valves, if applicable</b>													
<b>5 Sum of connections for the regulation</b>		6							3				Sum = max. 120
Number of connections on a controller module	11	11	0	0	0	0	0	0	8	8	0	0	0
<b>Missing connections, if applicable</b>		0							0				
<b>6 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 103A (4 analog inputs. 4 analog outputs)													___ pcs. á 2 VA = ___
AK-XM 107A (8 pulse inputs)													___ pcs. á 2 VA = ___
AK-XM 204A / B (8 relay outputs)													___ pcs. á 5 VA = ___
AK-XM 205A / B (8 analog inputs + 8 relay outp.)													___ pcs. á 5 VA = ___
AK-XM 208C (8 analog inputs + 4 stepper outputs)													___ pcs. á 5 VA = ___
AK_OB 110 (2 analog outputs)													___ pcs. á 0 VA = ___
													1 pcs. á 8 VA = 8
													Sum =
													Sum = max. 32 VA



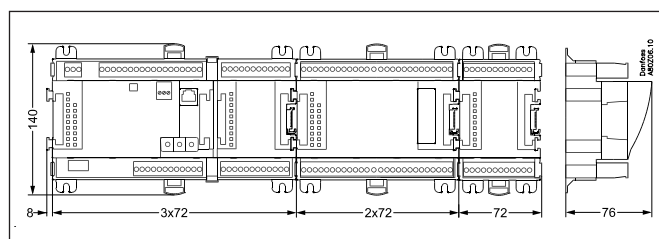
## 8 Length

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.  
If the row becomes longer than desired, the row can be broken by using AK-CM 102.

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 an other 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 = 224 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.

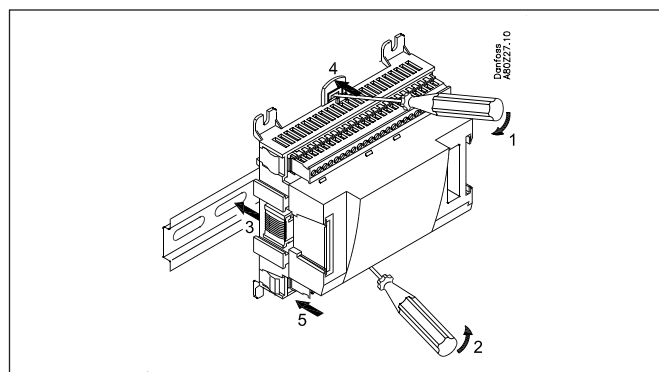
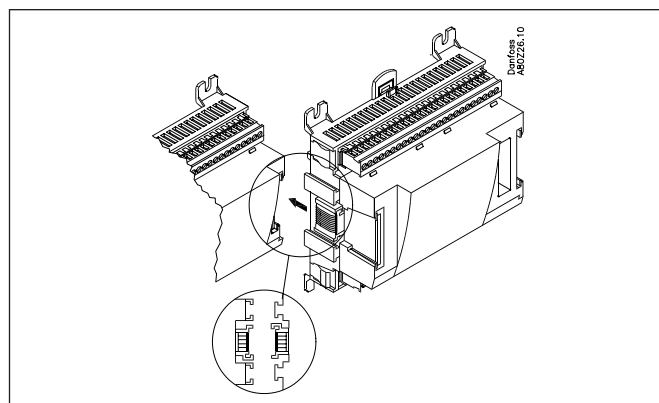
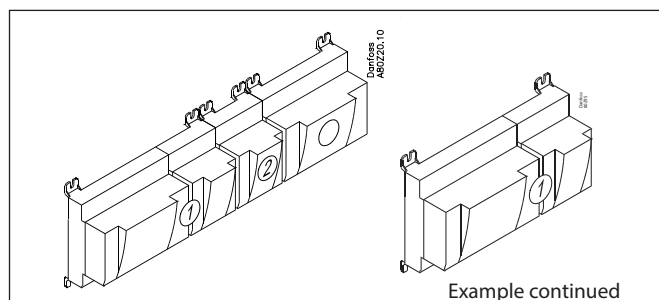
The modules are attached to one another and kept together by a connection which at the same time transmits the supply voltage and the internal data communication to the next module.

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

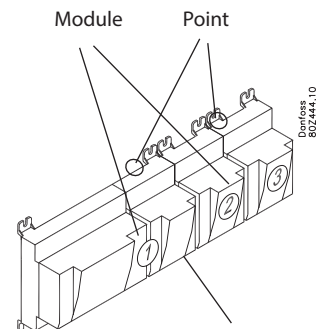
All connections must be programmed with module and point, so in principle it does not matter where the connections are made, as long as it takes place on a correct type of input or output.

- 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 Compressor 1	x	x	ON
fx Compressor 2	x	x	ON
fx Alarm relay	x	x	OFF
fx P0	x	x	AKS 32R 1-6 bar



Mind the numbering.  
The right-hand part of the controller module may look like a separate module. But it **isn't**.

The connection survey from the controller and any extension modules are uploaded from the paragraph "Module survey. 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.

Signal	Module	Point	Terminal	Signal type / Active at
S1	1	1 (AI 1)	1 - 2	Pt 1000
S2		2 (AI 2)	3 - 4	Pt 1000
S3		3 (AI 3)	5 - 6	Pt 1000
S4		4 (AI 4)	7 - 8	Pt 1000
		5 (AI 5)	9 - 10	
		6 (AI 6)	11 - 12	
P1		7 (AI 7)	13 - 14	AKS 32R-12
		8 (AI 8)	19 - 20	
		9 (AI 9)	21 - 22	
		10 (AI 10)	23 - 24	
P2		11 (AI 11)	25 - 26	AKS 32R-12
		12 (DO 1)	31 - 32	
		13 (DO 2)	33 - 34	
		14 (DO 3)	35 - 36	
		15 (DO 4)	37 - 38	
Relay for valve		16 (DO 5)	39-40-41	ON
		17 (DO6)	42-43-44	
Relay for pump A. (Difference pressostat)		18 (DO7)	45-46-47	ON
Relay for pump B (Two sensor thermostat)		19 (DO8)	48-49-50	ON
		24	-	
		25	-	

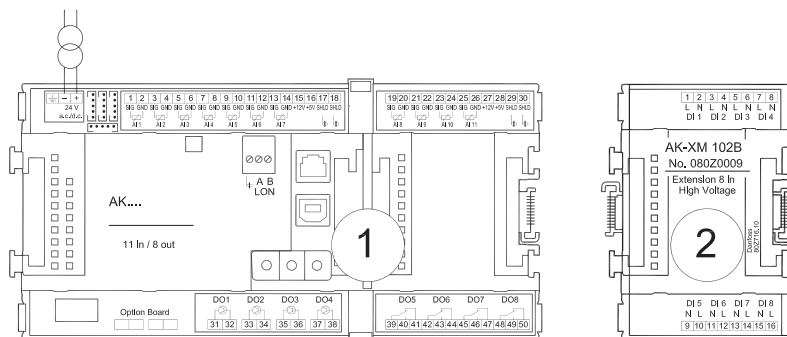
# 11

## Connection diagram

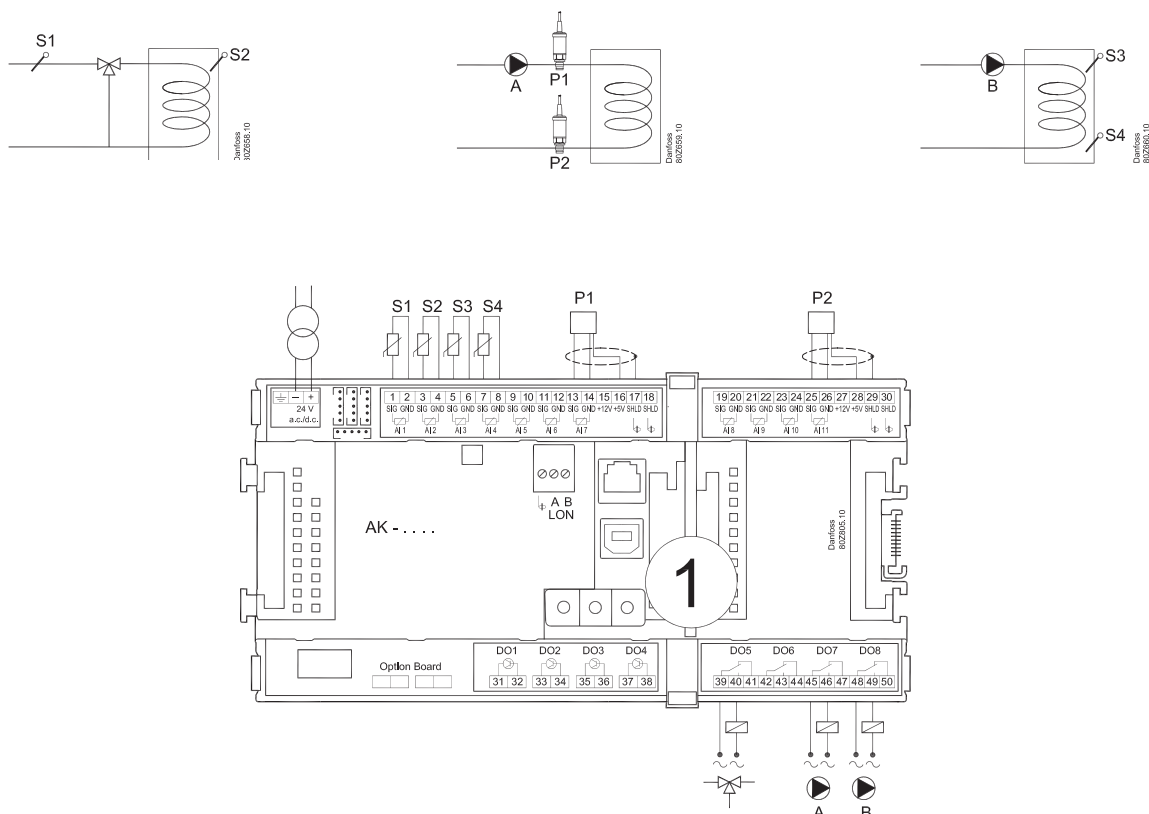
Drawings of the individual modules may be ordered from Danfoss.  
Format = dwg and dxf.

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

The supply voltage for the pressure transmitter should be taken from the same module that receives the pressure signal.  
The screen on the pressure transmitter cables must only be connected at the end of the controller.



Example continued:



## 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 power supply 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

### Common pressure transmitter

If several controllers receive a signal from the same pressure transmitter, the supply to the affected controllers must be wired so that it is not possible to switch off one of the controllers without also switching off the others. (If one controller is switched off, the signal will be pulled down, and all the other controllers will receive a signal which is too low)

Example continued:

Controller module	8 VA
	-----
Power supply size (least)	8 VA

# Ordering

## 1. Controller

Type	Function	Application	Language	Code no.	Example continued
AK-LM 340A	Monitoring unit with PI control	Monitoring of temperatures, pressure, voltages etc. Separate PI control	English, German, French, Dutch, Italian, Spanish, Portuguese, Danish, Finnish, Russian, Polish, Czech, Chinese	<b>080Z0177</b>	x

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

Type	Analog inputs	On/Off outputs		On/off supply voltage (DI signal)			Analog outputs	Stepper 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 valves with step control	For override of relay outputs	With screw terminals	
Regulator	11	4	4	-	-				-	-	
Udvidelsesmoduler											
AK-XM 101A	8									<b>080Z0007</b>	
AK-XM 102A				8						<b>080Z0008</b>	
AK-XM 102B					8					<b>080Z0013</b>	
AK-XM 103A	4						4			<b>080Z0032</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>	
AK-XM 208C	8							4		<b>080Z0023</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	USB A-B (Standard IT cable)	-	<b>x</b>
<b>Accessories</b>	<b>Poser supply module 230 V / 115 V to 24 V d.c.</b>			
AK-PS 075	18 VA	Supply for controller	<b>080Z0053</b>	<b>x</b>
AK-PS 150	36 VA		<b>080Z0054</b>	
<b>Accessories</b>	<b>External display that can be connected to the controller module. For showing, say, the appliance temperature</b>			
EKA 163B	Display		<b>084B8574</b>	
EKA 164B	Display with operation buttons		<b>084B8575</b>	
-	Cable between display and controller	Length = 2 m	<b>084B7298</b>	
		Length = 6 m	<b>084B7299</b>	
<b>Accessories</b>	<b>Communication modules for controllers where modules cannot be connected continuously</b>			
AK-CM 102	Communication module	Data communication for external extension modules	<b>080Z0064</b>	

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## 3. Mounting and wiring

---

This section describes how the controller:

- Is fitted
- Is connected

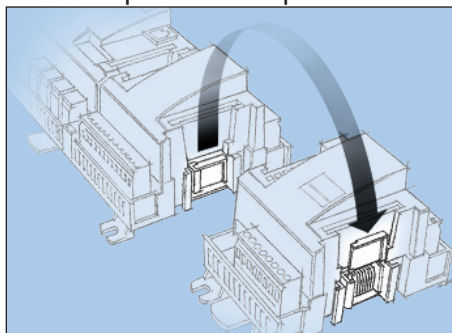
We have decided to work on the basis of the example we went through previously, i.e. the following modules:

- AK-LM 340A Monitoring unit

# Mounting

## Mounting of extension module on the basic module

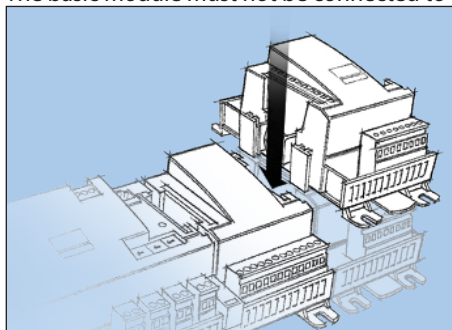
### 1. Move the protective cap



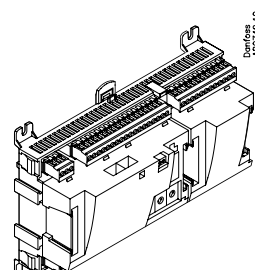
Remove the protective cap from the connection plug on the right-hand side of the basic module.  
Place the cap on the connection plug to the right of the extension module that is to be mounted on the extreme right-hand side of the AK assembly.

### 2. Assemble the extension module and the basic module

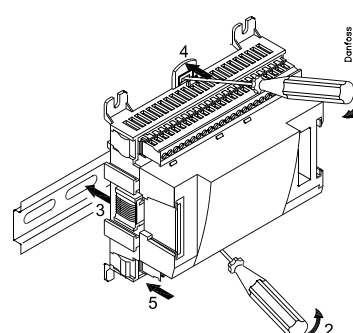
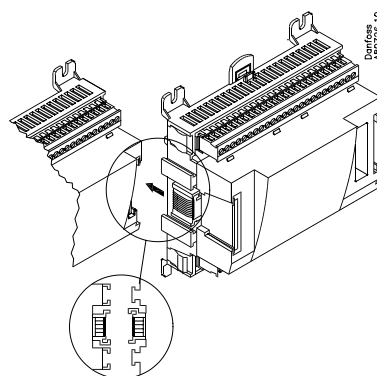
The basic module must not be connected to voltage.



In our example no extension modules are to be fitted to the basic module.



If expansion modules have been mounted, all of the following settings will be determined in the selected order.



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.

### 1. Connect inputs and outputs

Here are the tables for the example:

Signal	Module	Point	Terminal	Signal type / Active at
S1	1	1 (AI 1)	1 - 2	Pt 1000
S2		2 (AI 2)	3 - 4	Pt 1000
S3		3 (AI 3)	5 - 6	Pt 1000
S4		4 (AI 4)	7 - 8	Pt 1000
		5 (AI 5)	9 - 10	
		6 (AI 6)	11 - 12	
P1		7 (AI 7)	13 - 14	AKS 32R-12
		8 (AI 8)	19 - 20	
		9 (AI 9)	21 - 22	
		10 (AI 10)	23 - 24	
P2		11 (AI 11)	25 - 26	AKS 32R-12
		12 (DO 1)	31 - 32	
		13 (DO 2)	33 - 34	
		14 (DO 3)	35 - 36	
		15 (DO 4)	37 - 38	
Relay for valve		16 (DO 5)	39-40-41	ON
		17 (DO 6)	42-43-44	
Relay for pump A. (Difference pressostat)		18 (DO 7)	45-46-47	ON
Relay for pump B (Two sensor thermostat)		19 (DO 8)	48-49-50	ON
		24	-	
		25	-	

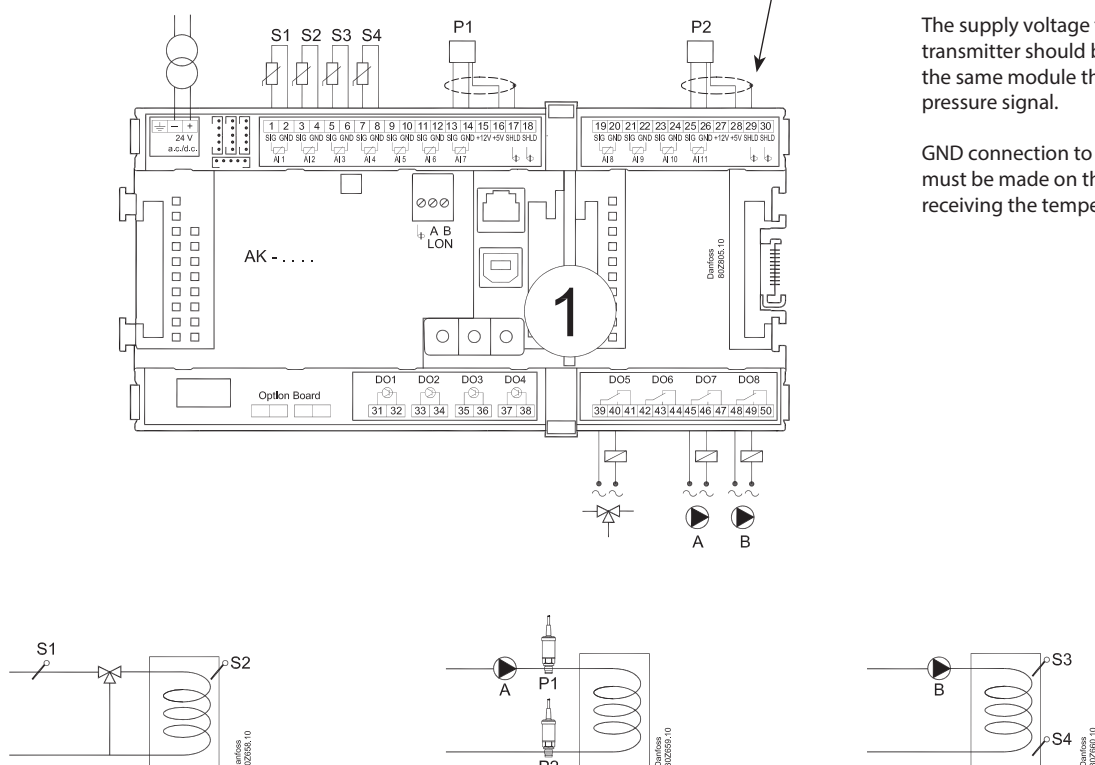
The function of the switch functions can be seen in the last column.



The connections for the example can be seen here.

**Warning**  
Keep signal cables separate from cables with high voltage.

The screen on the pressure transmitter cables must only be connected at the end of the controller.  
(both controllers)



The supply voltage for the pressure transmitter should be taken from the same module that receives the pressure signal.

GND connection to a sensor signal must be made on the same module receiving the temperature signal.

## 2. Connect LON communication network

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 terminals **must not** be earthed.

## 4. Follow light-emitting diodes

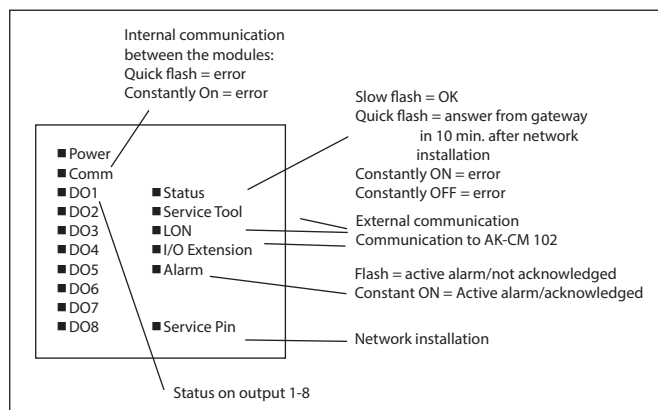
When the supply voltage is connected the controller will go through an internal check. The controller will be ready in just under one minute when the light-emitting diode "Status" starts flashing slowly.

## 5. When there is a network

Set the address and activate the Service Pin.

When the controller is set correct on the network the LED "status" will flash quickly for 10 minutes.

## 6. The controller is now ready to be configured.



---

## 4. Configuration and operation

---

This section describes how the controller:

- Is configured
- Is operated

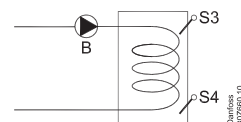
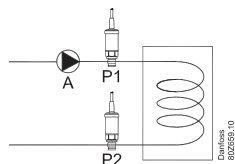
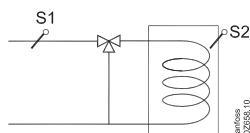
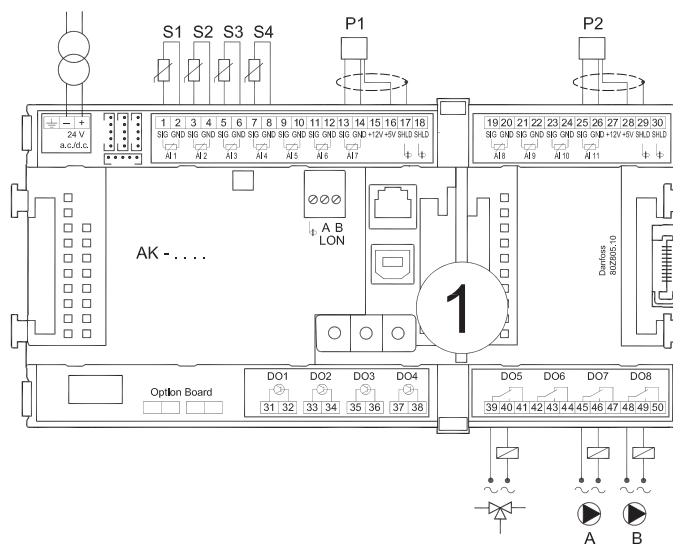
We have decided to work on the basis of the example we went through previously, i.e.

- Difference thermostat,
- Difference pressostat
- Two-sensor thermostat.

The example is shown overleaf.

## Refrigerating plant example

We have decided to describe the setup by means of an example comprising the connections shown below.  
The example is the same as the one given in the "Design" section, i.e. the controller is an AK-LM 340A.



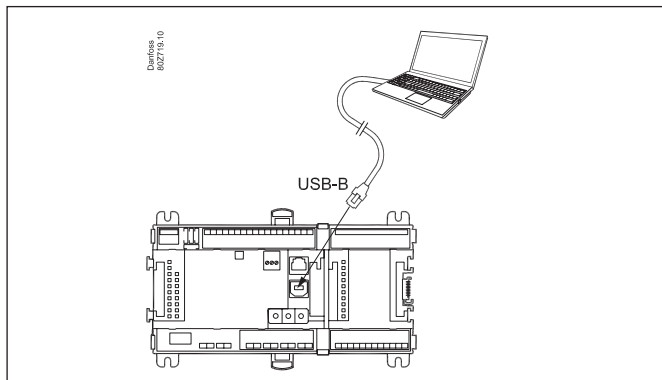
Three separate controls:

- Difference thermostat
- Difference pressostat
- Two-sensor thermostat

# Configuration

## Connect PC

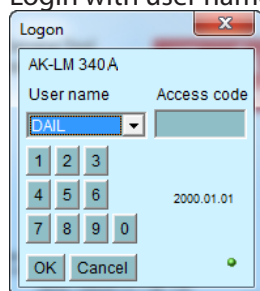
PC with the program "Service Tool" is connected to the controller.



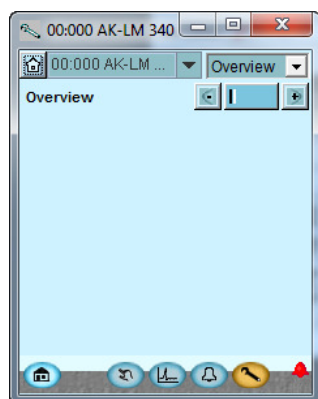
The controller must be switched on first and the LED "Status" must flash before the Service Tool programme is started.

## Start Service Tool programme

### Login with user name SUPV

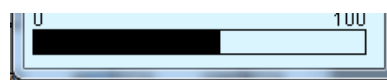


Select the name **SUPV** and key in the access code.



For connecting and operating the "AK service tool" software, please see the manual for the software.

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.

In this case the overview is empty. This is because the controller has not yet been set up. The red alarm bell at the bottom right tells you that there is an active alarm in the controller. In our case the alarm is due to the fact that the time in the controller has not yet been set.

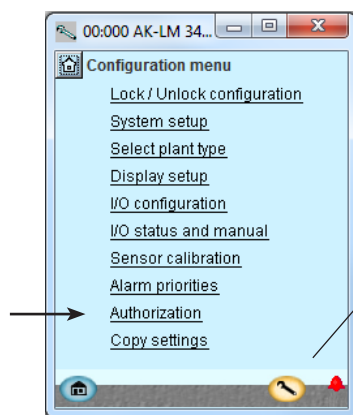
## Authorization

### 1. Go to Configuration menu

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



### 2. Select Authorization



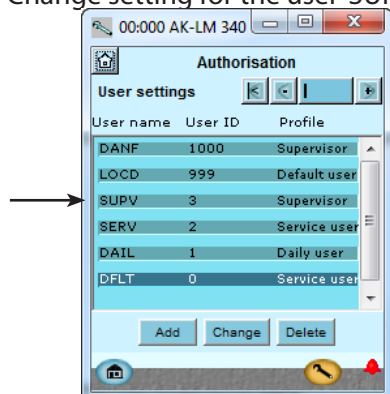
When the controller is supplied it has been set to show the default authorization for the different user interfaces. This setting should be changed and adapted to the plant. The changes can be made now or later.

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.

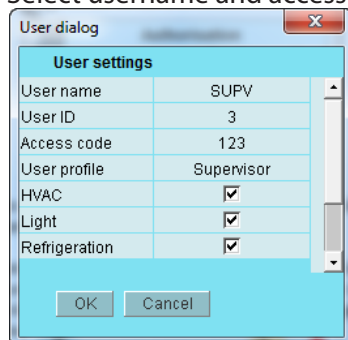
### 3. Change setting for the user 'SUPV'



Mark the line with the user name **SUPV**.

Press the button **Change**

### 4. Select username and access code



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

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 display of the texts in the required language you must carry out a new login to the controller with the user name SUPV and the relevant access code.

You will access the login display by pressing the icon at the top left corner of the display.

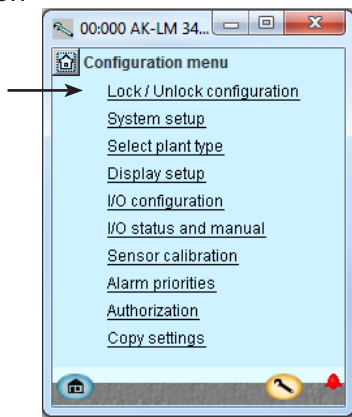
## Unlock the configuration of the controllers

### 1. Go to Configuration menu



If you want to know more about the different configuration options, they are listed below.  
The number refers to the number and picture in the column on the left.

### 2. Select Lock/Unlock configuration



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

Changes to the input and output settings are only enabled when the controller is "Locked"

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

### 3-

#### Main Switch

Used to start and stop regulation.  
When the main switch is set to Off, all outputs are in standby mode and all alarms are cancelled.

The main switch must be set to Off before the Configuration lock can be Unlocked.

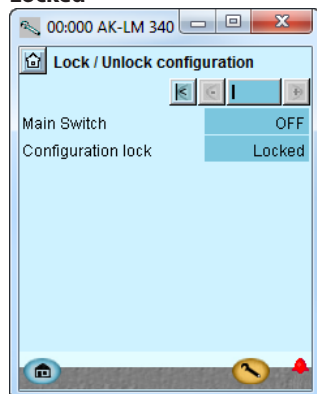
#### Configuration lock

The controller can only be fully configured when the configuration lock is set to Unlocked.

The settings are only applied when it is set to Locked again. At this point, the controller checks the functions set and compares them with the input and output settings. Important settings can then no longer be changed unless the configuration is unlocked again.

### 3. Select Configuration lock

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



#### In general

**Many settings are dependent on previous settings. This is shown by the fact that a function can only be seen (and thus set) if an earlier parent function allows access to this subordinate function**

For example, the "Configuration lock" line will not be shown if the main switch is set to On. Only when the main switch is set to Off, and regulation has therefore been stopped, is it possible to set the configuration lock.

### 4. Select Unlocked

Select **Unlocked**

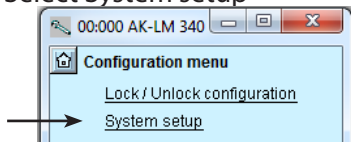


## System setup

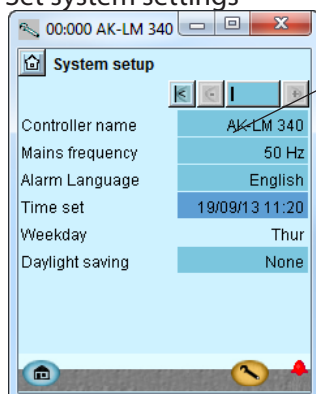
### 1. Go to Configuration menu



### 2. Select System setup



### 3. Set system settings



#### General

All system settings can be changed by pressing in the blue field with the setting and then indicating the value of the required setting.

#### 3-

##### Controller name

In the first field you enter a name for what the controller will be controlling.

##### Main frequency

Set frequency.

##### Alarm language

Select the language that alarm text should be displayed in here.

Alarm text can be in a different language to the operating language.

##### Clock

When the time is set the PC's time can be transferred to the controller.

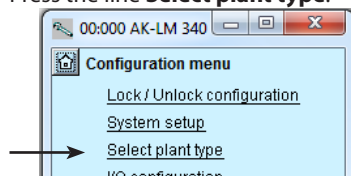
When the controller is connected to a network, date and time will automatically be set by the system unit in the network. This also applies to change-over Daylight saving. Power failure, the clock will be kept running for at least 12 hours.

## Set plant type

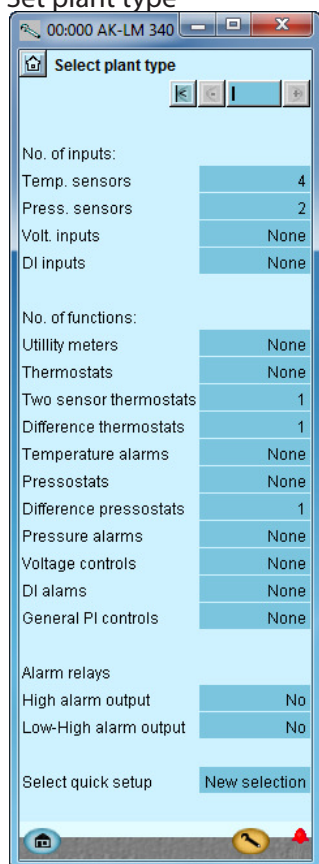
1. Go to Configuration menu

2. Select plant type

Press the line **Select plant type**.



3. Set plant type



In the example, we have decided to use the following number of input signals :

- 4 temperature sensors
- 2 pressure sensors

and following functions::

- 1 two sensor thermostat
- 1 difference thermostat
- 1 difference pressostat

3-

### Select plant type

Select how many measurements of each type that will be used by the controller here.

One measurement can be used by several functions, so that, later, when setting the individual function, you select the measurement that will be used.

### Measurements

- Number of temperature sensors:
- Number of pressure readings:
- Number of voltage inputs:
- Number of digital inputs (DIs):

### Function

- Number of energy readings:
- Select whether an external synchronisation signal is required.
- Number of thermostats
- Number two-sensor thermostats
- Number difference thermostats
- Number temperature alarms
- Number of pressostats
- Number of difference pressostats
- Number of pressure alarms
- Number of voltage controls
- Number of DI alarms
- Number of PI controls

### Alarm relays

- Define whether a relay which is enabled for alarms with high priority is to be used.
- Define whether a relay which is enabled for alarms with all priorities is to be used.

If an alarm relay is defined, it will activate an alarm that must be reset externally.

### Quick setup

The function is reserved for a later, quick setup sequence.

It also contains a "return to factory settings" function.

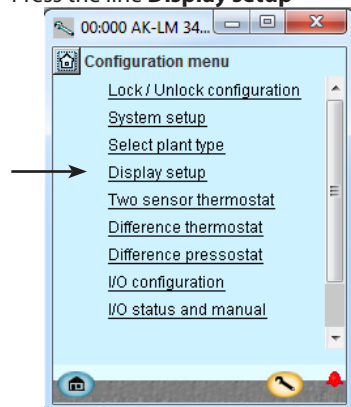


## Set Display setup

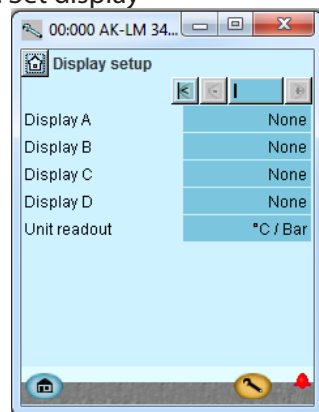
1. Go to Configuration menu

2. Select Display

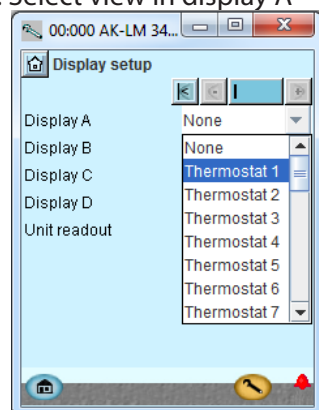
Press the line **Display setup**



3. Set display



4. Select view in display A



5. Select view for other display

6. Select measuring unit i.e. °C



We have not used this function in our example. The image is included for guidance only.

Up to four displays can be fitted. Each display can continuously show a value for the function concerned.

For thermostats it is the temperature reading after calibration.

For pressostats it is the pressure reading after calibration.

For On/Off signals it is the current alarm's status (the input status after the end of the delay time).

The following displays can be selected:

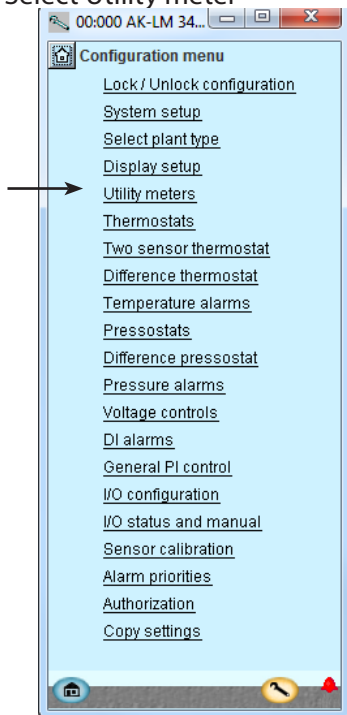
Thermostat 1  
Thermostat 2  
Thermostat 3  
Thermostat 4  
Thermostat 5  
Thermostat 6  
Thermostat 7  
Thermostat 8  
Thermostat 9  
Thermostat 10  
Pressostat 1  
Pressostat 2  
Pressostat 3  
Pressostat 4  
Pressostat 5  
DI1 ALM  
DI2 ALM  
DI3 ALM  
DI4 ALM  
DI5 ALM  
DI6 ALM  
DI7 ALM  
DI8 ALM  
DI9 ALM  
DI10 ALM  
DI11 ALM  
DI12 ALM  
DI13 ALM  
DI14 ALM  
DI15 ALM  
DI16 ALM

## Utility meters

### 1. Go to Configuration menu



### 2. Select Utility meter

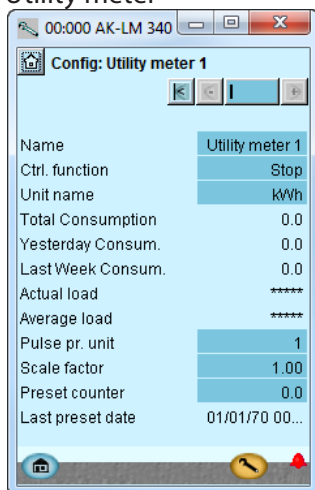


### 3. Utility meter

- Give the function a name.
- Start/stop  
Do not enable the function until the whole function has been defined (settings can only be defined when the function has stopped).
- Select unit  
kWh when measuring current,  
m3 when measuring gas.
- Pulses per unit  
The number of pulses to be received for each unit of measurement.
- Scale factor  
Any scale factor
- Counter  
The value can be reset (or a new start value can be set)

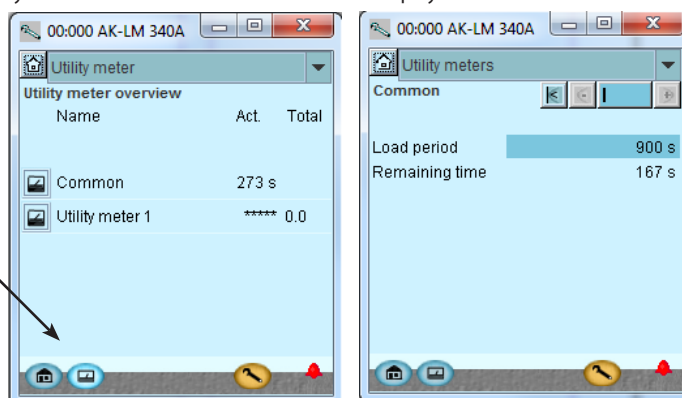
The measurement can be monitored in the five fields. These display the total consumption, the current load and the average load over the period of time.

### 3. Utility meter



We have not used this function in our example. The image is included for guidance only.

Synchronisation is shown in the overview display



Here you must define the common data for the synchronisation.

Period is the expected time between two synchronisation signals. A new period starts when the synchronisation signal is received or when the period expires.

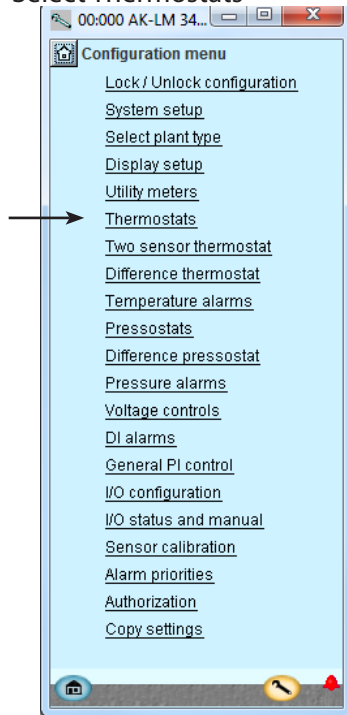
If no synchronisation signal is connected, the calculations will be based on the start of each period. (Without synchronisation the readings will be displaced and cannot be directly compared with electricity company readings).

## Thermostat functions

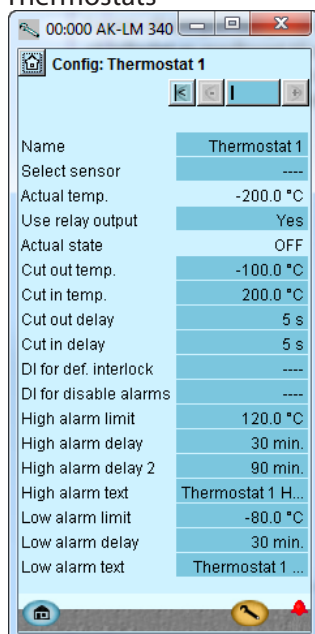
### 1. Go to Configuration menu



### 2. Select Thermostats



### 3. Thermostats



We have not used this function in our example. The image is included for guidance only.

The name of the function may be xx and further down in the display the alarm texts may be entered.

#### 3 - Thermostats

The general thermostats can be used for thermostat functions with relay output.

The function can be connected to alarm limits and alarm texts.

##### For each thermostat set / readout

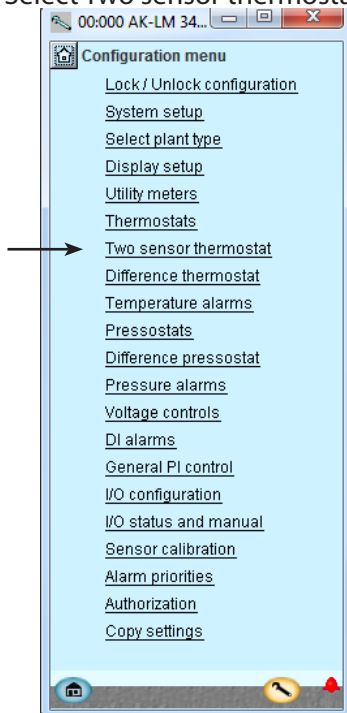
- **Name**
- **Which of the sensors is used**
- **Actual temp.**  
Temperature measurement on the sensor that is attached to the thermostat
- **Relay**  
Define whether a relay will be used for this function.
- **Actual state**  
Actual status on the thermostat outlet
- **Cut out temp.**  
Cut-out value for the thermostat
- **Cut in temp.**  
Cut-in value for the thermostat
- **Cut out delay**
- **Cut in delay**
- **DI-input for defrost interlock**  
DI signal, which will change the delay time to "High Alarm delay 2"
- **DI input for omitting alarms**  
If a signal is received, all alarms will be omitted from the function
- **High alarm limit**  
High alarm limit
- **Alarm delay high**  
Time delay for high alarm
- **High alarm delay 2**  
Time delay for high alarm  
A slightly longer delay period used for signals on the input "DI for def. Interlock"
- **Alarm text high**  
Indicate alarm text for the high alarm
- **Low alarm limit**  
Low alarm limit
- **Alarm delay low**  
Time delay for low alarm
- **Alarm text low**  
Indicate alarm text for low alarm

## Two sensor thermostat

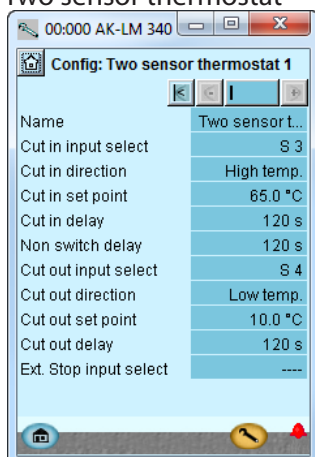
### 1. Go to Configuration menu



### 2. Select Two sensor thermostat



### 3. Two sensor thermostat



In our example we use the settings shown.

### 3 - Two sensor thermostat

The general two-sensor thermostats can be used for functions with relay outputs.

The following is to be set/read for each two-sensor thermostat:

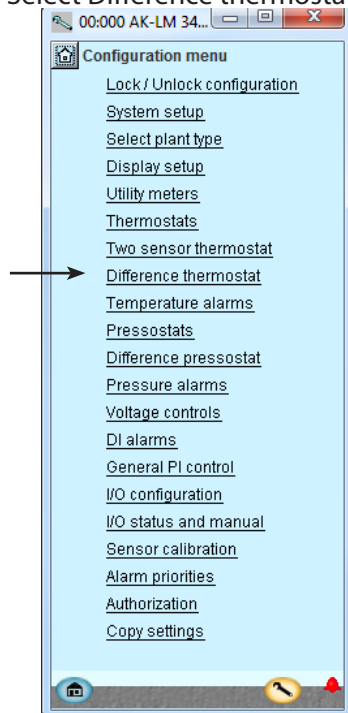
- **Name**
- **Define the sensor to be used for cut-in temperature**
- **Cut in direction**  
Select whether the relay cut-in is to occur when temperatures higher or lower than the setpoint are recorded
- **Cut in set point**  
The relay cuts in when the measurement has been over (or under) the value for the entire delay period
- **Cut in delay**
- **Delay period for two consecutive cut-ins**
- **Select the sensor to be used for cut-out temperature**
- **Cut out direction**  
Choose whether the relay cut-out is to occur when the temperature is recorded higher or lower than the set value.
- **Cut out set point**  
The relay cuts out when the measurement has been above (or below) the value for the entire delay period.
- **Cut out delay**
- **DI -input for stop of function**  
The regulation stops immediately when a signal is received. Delay time will not be considered.

## Difference thermostat

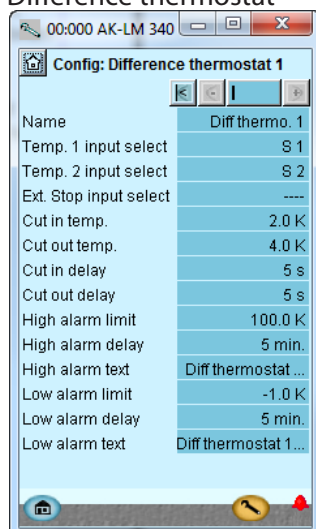
### 1. Go to Configuration menu



### 2. Select Difference thermostat



### 3. Difference thermostat



In our example we use the settings shown.

### 3 - Difference thermostat

The general differential thermostats can be used for functions with relay outputs.

The function can be connected to alarm limits and alarm texts.

For each differential thermostat, the following must be set/read:

- **Name**
- **Which of the sensors is connected as temperature 1**
- **Which of the sensors is connected as temperature 2**

(the difference is calculated as temperature 1 minus temperature 2)

- **Ext. Stop input select**

When a signal is received, the regulation is stopped and all alarms from the function are omitted

- **Cut in temp.**

In the event of a low temperature difference, the relay cuts in, but only once the measurement has remained low for the entire delay period

- **Cut out temp.**

In the event of a high temperature difference, the relay cuts out again, but only once the measurement has remained high for the entire delay period

- **Cut in delay**

- **Cut out delay**

- **High alarm limit**

High alarm limit

- **Alarm delay high**

Time delay for high alarm

- **Alarm text high**

Indicate alarm text for the high alarm

- **Low alarm limit**

Low alarm limit

- **Alarm delay low**

Time delay for low alarm

- **Alarm text low**

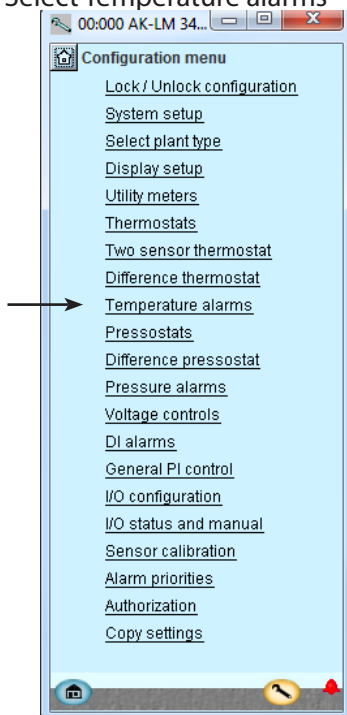
Indicate alarm text for low alarm

## Temperature alarms

### 1. Go to Configuration menu



### 2. Select Temperature alarms



### 3. Temperature alarms

The function monitors a temperature and issues an alarm if the set value is exceeded.

- **Name**

- **Temp. input select**

- **Alarm limit**

- **Alarm type**

Define whether the alarm is to be activated at temperatures that are too high or too low.

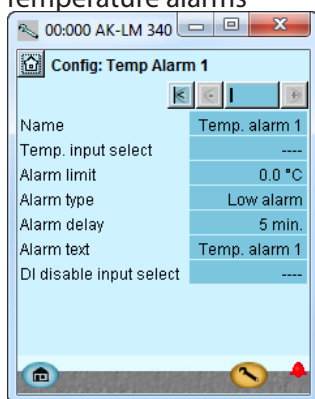
- **Alarm delay**

Time delay before the alarm becomes active

- **Alarm text**

Here a DI signal can be selected, which can stop the alarm from the function.

### 3. Temperature alarms



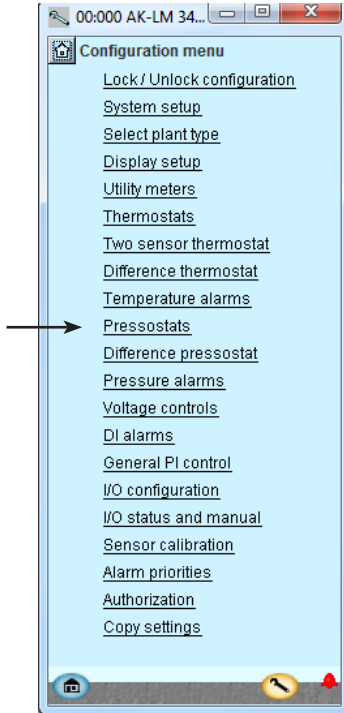
We have not used this function in our example. The image is included for guidance only.

## Pressostat functions

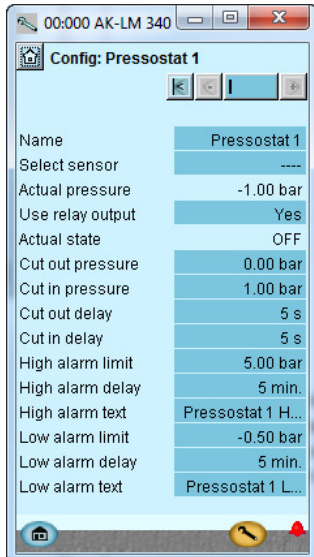
### 1. Go to Configuration menu



### 2. Select Pressostats



### 3. Pressostats



We have not used this function in our example. The image is included for guidance only.

The name of the function may be xx and further down in the display the alarm texts may be entered.

#### 3 - Pressostats

The general pressostats can be used for pressostat functions with relay output.

The function can be connected to alarm limits and alarm texts.

##### For each pressostat set / readout

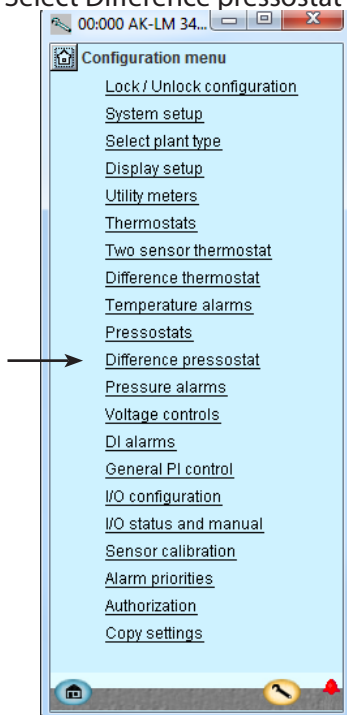
- **Name**
- **Which of the sensors is used**
- **Actual pressure.**  
Pressure reading on the sensor connected to the pressure switch
- **Used relay output**  
Define whether a relay is to be used for this pressure switch function
- **Actual state**  
Actual status on the pressostat outlet
- **Cut out pressure**  
Cut-out value for the pressostat
- **Cut in pressure**  
Cut-in value for the pressostat
- **Cut out delay**
- **Cut in delay**
- **High alarm limit**  
High alarm limit
- **Alarm delay high**  
Time delay for high alarm
- **Alarm text high**  
Indicate alarm text for the high alarm
- **Low alarm limit**  
Low alarm limit
- **Alarm delay low**  
Time delay for low alarm
- **Alarm text low**  
Indicate alarm text for low alarm

## Difference pressostat

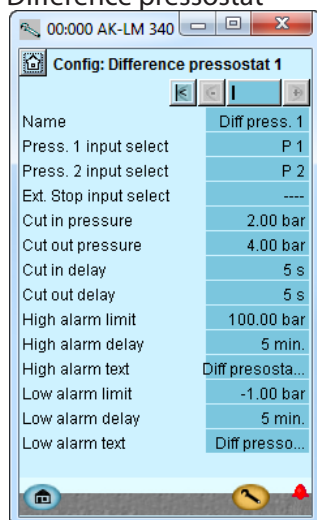
### 1. Go to Configuration menu



### 2. Select Difference pressostat



### 3. Difference pressostat



In our example we use the settings shown.

### 3 - Difference pressostat

The general differential pressostats can be used for functions with relay outputs.

The function can be connected to alarm limits and alarm texts.

The following is to be set/read for each differential pressostat:

- **Name**
- **Which sensor is connected as pressure 1**
- **Which sensor is connected as pressure 2**  
(the difference is calculated as pressure 1 minus pressure 2)
- **Ext. Stop input select**  
When the signal is received, the regulation is stopped and all alarms from the function are omitted.
- **Cut in pressure.**  
In the event of a low pressure difference, the relay cuts in, but only when the measurement has remained low for the entire delay period.
- **Cut out pressure.**  
In the event of a high pressure difference, the relay cuts out again, but only when the measurement has remained high for the entire delay period.
- **Cut in delay**
- **Cut out delay**
- **High alarm limit**  
High alarm limit
- **Alarm delay high**  
Time delay for high alarm
- **Alarm text high**  
Indicate alarm text for the high alarm
- **Low alarm limit**  
Low alarm limit
- **Alarm delay low**  
Time delay for low alarm
- **Alarm text low**  
Indicate alarm text for low alarm

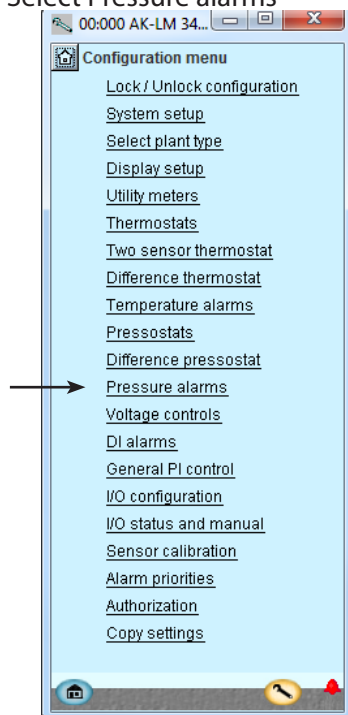


## Pressure alarms

### 1. Go to Configuration menu



### 2. Select Pressure alarms

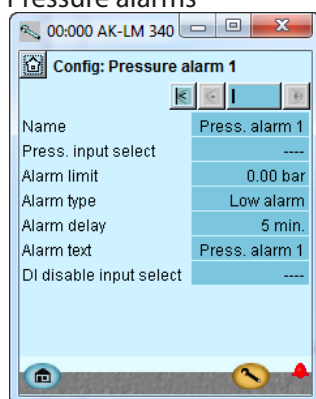


### 3. Pressure alarms

The function monitors a pressure and issues an alarm if the set value is exceeded.

- **Name**
- **Which sensor is connected**
- **Alarm limit**
- **Alarm type**  
Define whether the alarm is to be issued for a low or high pressure level.
- **Alarm delay**  
Time delay before the alarm becomes active
- **Alarm text**
- **DI signal**  
Here a DI signal can be selected, which can stop the alarm from the function.

### 3. Pressure alarms



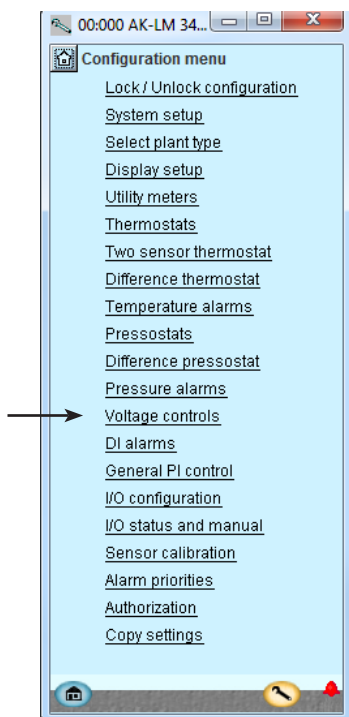
We have not used this function in our example. The image is included for guidance only.

## Voltage controls

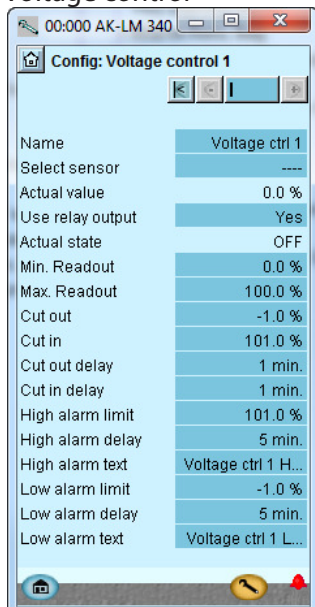
### 1. Go to Configuration menu



### 2. Select Voltage control



### 3. Voltage control



We have not used this function in our example. The image is included for guidance only.  
The name of the function may be xx and further down in the display the alarm texts may be entered.

The "Min. and Max. reading" values are your settings that represent the voltage range's lower and upper values. For example, 2 V and 10 V (the voltage range is selected under I/O set-up).

#### 3 - Voltage inputs

The general volt inlet can be used to monitor external voltage signals. Each volt inlet has a separate outlet to control external automatic controls.

**For each voltage function setup /:**

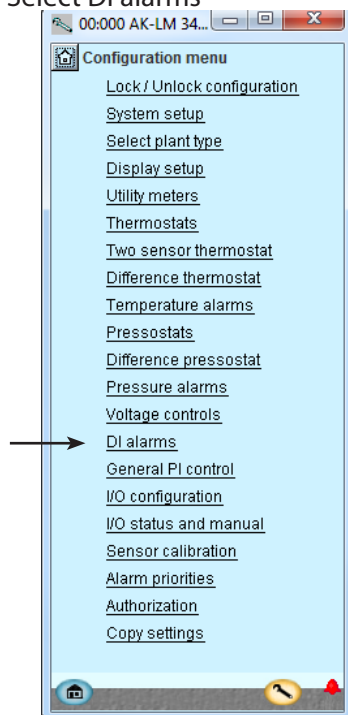
- **Name**
- **Which voltage measurement is used**
- **Actual value**  
= read-out of the measurement in %
- **Choose whether the function is to use a relay**
- **Actual state**  
= read-out of outlet status
- **Min. readout**  
State read-out values at minimum voltage signal
- **Max. readout**  
State read-out values at maximum voltage signal
- **Cutout**  
Cut-out value for outlet (scaled value)
- **Cutin**  
Cut-in value for outlet (scaled value)
- **Cutout delay**  
Time delay for cut-out
- **Cut in delay**  
Time delay for cut-in
- **High alarm limit**  
High alarm limit
- **High alarm delay**  
Time delay for high alarm
- **High alarm text**  
Set alarm text for high alarm
- **Low alarm limit**  
Low alarm limit
- **Low alarm delay**  
Time delay for low alarm
- **Low alarm text**  
Indicate alarm text for low alarm

## DI-alarms

### 1. Go to Configuration menu



### 2. Select DI alarms

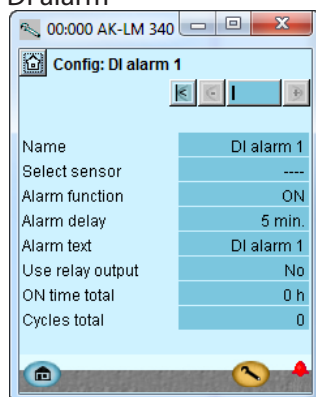


### 3. DI alarm

This function monitors an On/Off signal and issues an alarm if a change occurs.

- **Name**
- **Select sensor**
- **Alarm limit**
- **Alarm function**  
Define whether the alarm is to be issued when the signal switches to On or Off.
- **Alarm delay**  
Time delay before the alarm becomes active
- **Alarm text**
- **Use relay output**  
Choose whether a relay is to be connected to the function
- **ON time total**  
Here the user can see how long the function has been in alarm mode. All ON times are summed up. It is possible to reset or change the read-out.
- **Cycles total**  
Here the user can see how many times the alarm has been ON. It is possible to reset or change the read-out.

### 3. DI alarm



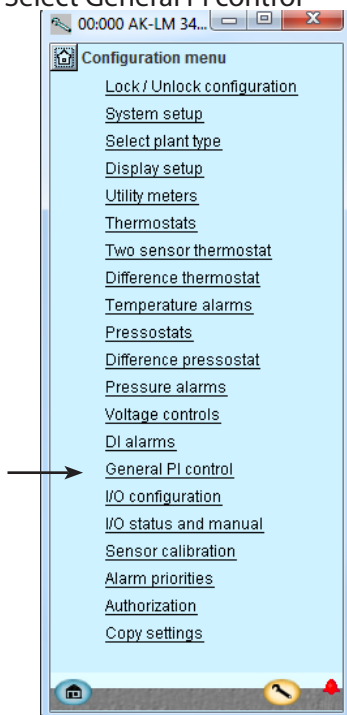
We have not used this function in our example. The image is included for guidance only.

## General PI control

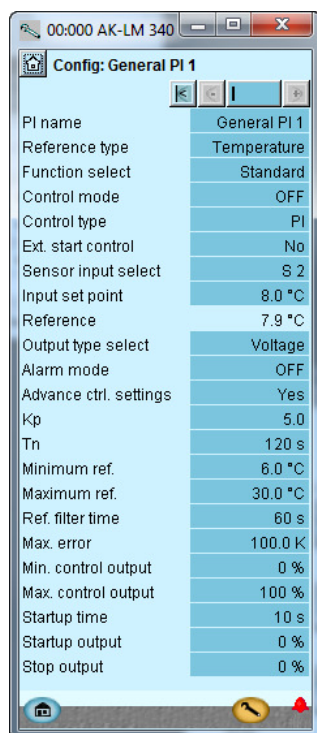
### 1. Go to Configuration menu



### 2. Select General PI control



### 3. General PI control



We have not used this function in our example. The image is included for guidance only.

### 3 - General PI Control

The function can be used for optional regulation.

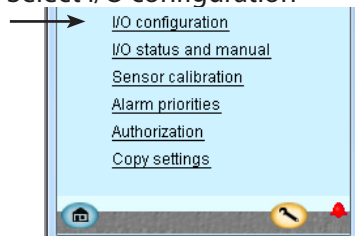
#### Adjust for each regulation

- Name
- Reference type  
Select between: Temperature, pressure or voltage signal
- Function selection  
Select between: Standard, reference+offset with DI signal or 2-sensor (variable signal as reference)
- Control mode: Off, Manual or Auto
- Control type: P or PI
- Ext. start control: Adjusted to On if there is an external DI-switch that can start/stop the regulation.
- Sensor input select: Choose which signal the regulation shall receive: Temperature (S1, S2...), pressure (P1, P2...), voltage signal (V1, V2...)
- Set point: Set a fixed value for reference
- Variable reference (the next 3 setting with variable reference are now shown in the display)
  - Signal input: Choose which signal the regulation shall receive: Temperature (S1, S2...), pressure (P1, P2...), voltage signal (V1, V2...)
  - Ref sensor Gain: Amplification factor, if variable reference is used
  - Reading the signal for the variable reference
- Reading the total reference
- Output. Here you select the outlet function (PWM = pulse width modulated (fx AKV valve)), Stepper signal for a stepper motor or voltage signal.
- Alarm mode: Choose whether an alarm shall be attached to the function. If it is set to ON, alarm texts and alarm limits can be entered.
- Advanced ctrl. settings: Regulation parameters can now be selected.
- PWM period time: Period during which the signal has been on and off.
- Kp: Amplification factor
- Tn: Integration time
- Minimum reference: Lowest permitted reference
- Maximum reference: Maximum permitted reference
- Filter for reference: Duration for smooth changes to the reference
- Max. error: Maximum permissible fault signal at which the integrator remains in the regulation
- Min. control output: Lowest permitted output signal
- Max. control output: Maximum permitted output signal
- Star up time: Time at startup at which the output signal is force-controlled
- Startup output: The output signal size at the startup time.

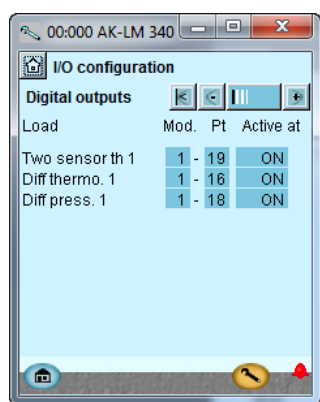
## Configuration of inputs and outputs

### 1. Go to Configuration menu

### 2. Select I/O configuration

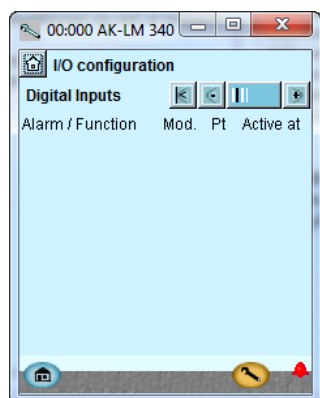


### 3. Configuration of Digital outputs



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

### 4. Setup On/off input functions



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

The following displays will depend on the earlier definitions. The displays will show which connections the earlier settings will require. The tables are the same as shown earlier.

- Digital outputs
- Digital inputs
- Analog inputs

Relay outlets are not used in our example.

ON / OFF outputs	Output	Module	Point	Active at
	DO1	1	12	
	DO2	1	13	
	DO3	1	14	
	DO4	1	15	
Relay for valve	DO5	1	16	ON
	DO6	1	17	
Relay for pump A. (Difference pressostat)	DO7	1	18	ON
Relay for pump B (Two-sensor thermostat)	DO8	1	19	ON

We set up the controller's digital outputs by keying in which module and point on this module each one of these has been connected to.

We furthermore select for each output whether the load is to be active when the output is in pos. **ON** or **OFF**.

(Functions with relay:

A relay connection was reserved for each function when the number of functions was defined. Keep the 0-0 setting for those functions that are not going to use a relay connection. The line is removed automatically when set up of the function continues).

ON / OFF input signals	Input	Module	Point	Active at
	DI1			
	DI2			
	DI3			
	DI4			
	CI1			---

We set up the controller's digital input functions by keying in which module and point on this module each one of these has been connected to.

We furthermore select for each output whether the function is to be active when the output is in pos. **Closed** or **Open**.

(There are no DI input signals in this example)

### 3 - Outputs

The possible functions are the following:

Alarm, high priority  
Alarm, all priority  
Thermostat 1 -  
Pressostat 1 -  
Voltage input 1 -  
etc. and  
PWM for PI function

### 4 - Digital inputs

Alarm mute:

Only shown if an alarm relay has been defined and it needs to be fitted with a switch function (pulse pressure).

DI 1 - 16:  
Definition of on/off inputs.

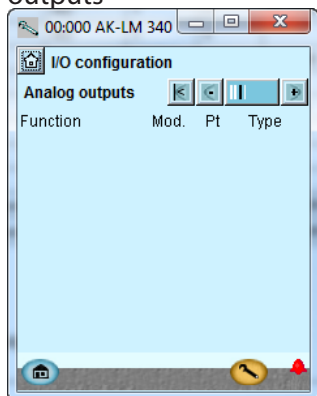
Synchronisation signal:

Only shown if a pulse reading with related synchronisation is defined. A synchronisation signal can be connected to the pulse module.

Pulse reading:

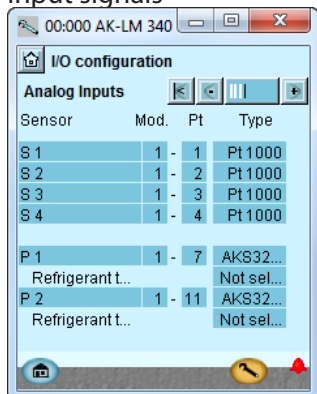
Here pulse measurements can be connected in accordance with DIN 43864.

## 5. Configuration of Analog outputs



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

## 6. Configuration of Analog input signals



Analog outputs	Output	Module	Point	Type
	AO_			
	Step_			

(There are no AO - output signals in the example)

Analog signals	Inlet	Module	Point	Type
S1	AI1	1	1	Pt 1000
S2	AI2	1	2	Pt 1000
S3	AI3	1	3	Pt 1000
S4	AI4	1	4	Pt 1000
	AI5	1	5	
	AI6	1	6	
P1	AI7	1	7	AKS 32R-12
	AI8	1	8	
	AI9	1	9	
	AI10	1	10	
P2	AI11	1	11	AKS 32R-12

We set up the analog inputs for the sensors

In our example, it is not necessary to set the refrigerant.

It is only necessary to set the refrigerant for a PI regulation in which a conversion between pressure and temperature must be made.

### 5 - Analog inputs

The possible signals are the following:

- 0-10V
- 2-10V
- 0-5V
- 1-5V
- Stepper output
- User defined

### 6 - Analog inputs

The possible signals are the following:

Temperature sensors:

S1 -

Setting:

- Pt1000
- PTC 1000

Pressure transmitters::

P1 -

Setting:

- AKS 32, -1 - 6 Bar
- AKS 32R, -1 - 6 Bar
- AKS 32, -1 - 9 Bar
- AKS 32R, -1 - 9 Bar
- AKS 32, -1 - 12 Bar
- AKS 32R, -1 - 12 Bar
- AKS 32, -1 - 20 Bar
- AKS 32R, -1 - 20 Bar
- AKS 32, -1 - 34 Bar
- AKS 32R, -1 - 34 Bar
- AKS 32, -1 - 50 Bar
- AKS 32R, -1 - 50 Bar
- AKS 2050, -1 - 59 Bar
- AKS 2050, -1 - 99 Bar
- AKS 2050, -1 - 159 Bar
- MBS 8250, -1 - 159 Bar
- User defined (1-5 V)
- Min Press. (1 V)
- Max Press (5 V)

Voltage signals:

Voltage input 1 -

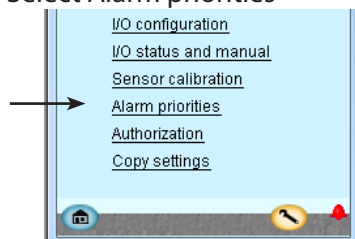
Setting:

- 0 - 5
- 1 - 5
- 0 - 10
- 2 - 10

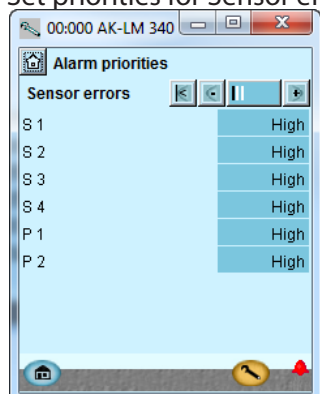
## Set alarm priorities


### 1. Go to Configuration menu

### 2. Select Alarm priorities

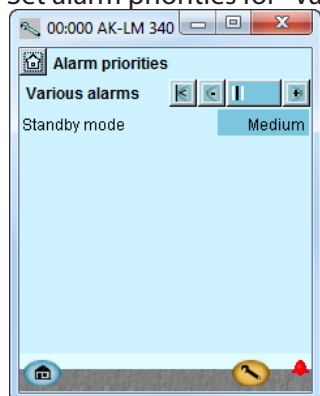



### 3. Set priorities for Sensor error



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

### 4. Set alarm priorities for "Various"



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

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

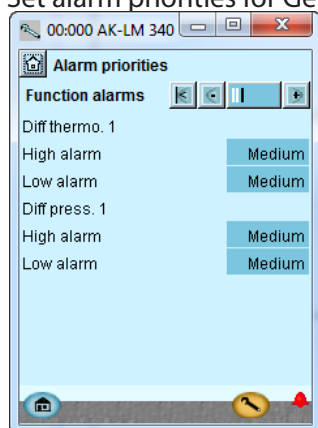
The interdependence between setting and action can be seen in the table.

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

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

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

## 5. Set alarm priorities for General alarms

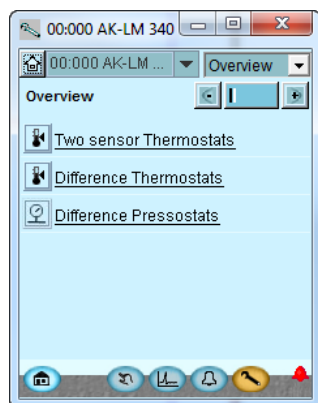


In our example we select the settings shown here in the display



# Check of settings

## 1.Go to the overview



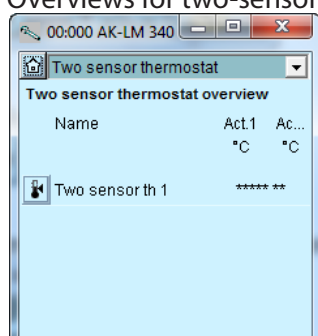
Before the control starts, we check that all the settings are as they should be.

The overview display will now show one line for each of the general functions. Behind each icon there is a number of displays with the different settings. It is all these settings that have to be checked.

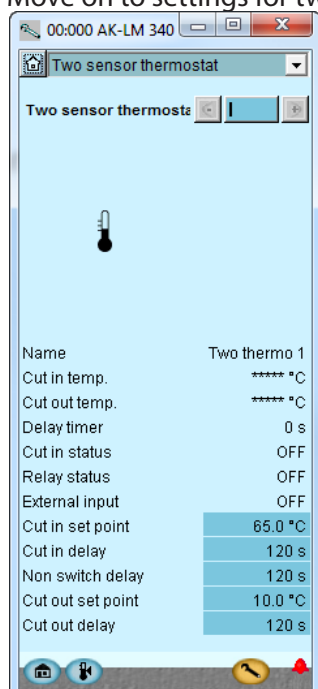
## 2. Select two-sensor thermostats



## 3. Overviews for two-sensor thermostats



## 4. Move on to settings for two-sensor thermostat no.1



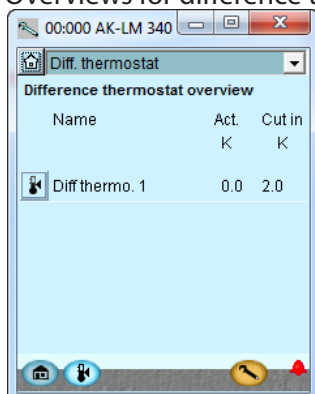
Check settings and measurements

External input = Signal on DI-input stops alarmsr

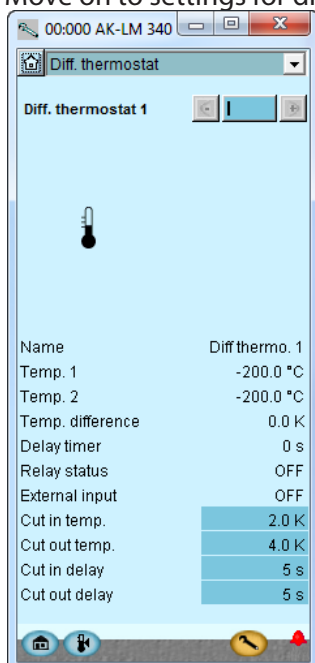
## 5. Select Difference thermostat



## 6. Overviews for difference thermostats



## 7. Move on to settings for difference thermostat 1



Check settings and measurements

8. Select difference pressostats



9. Overviews for difference pressostats



10. Move on to settings for difference pressostat 1

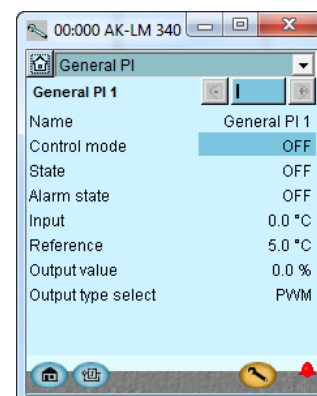
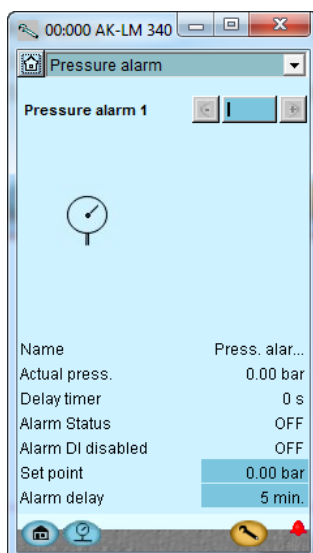
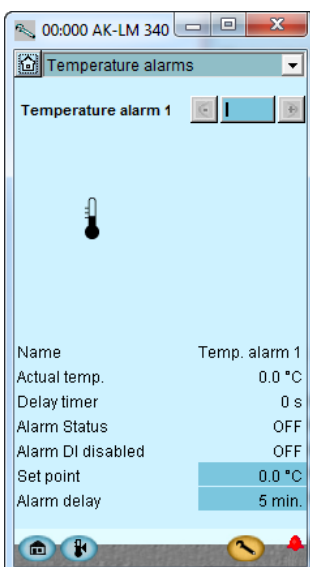
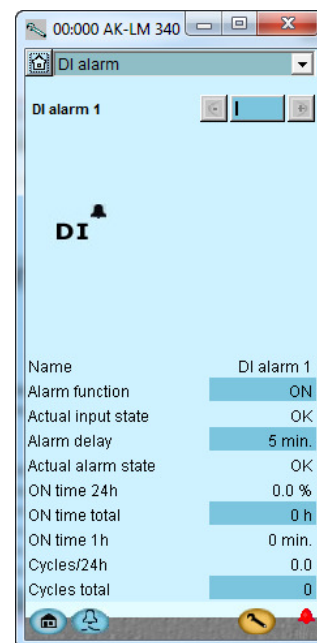
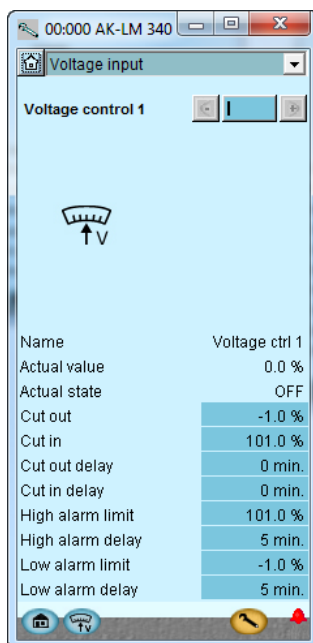
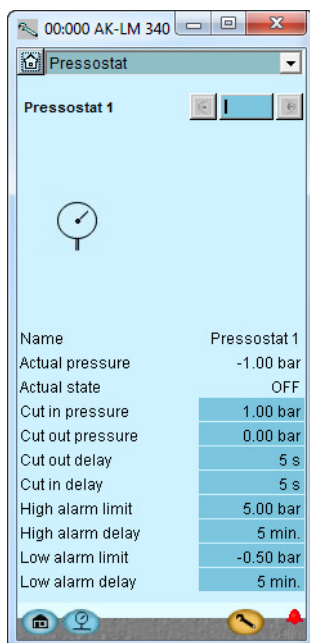
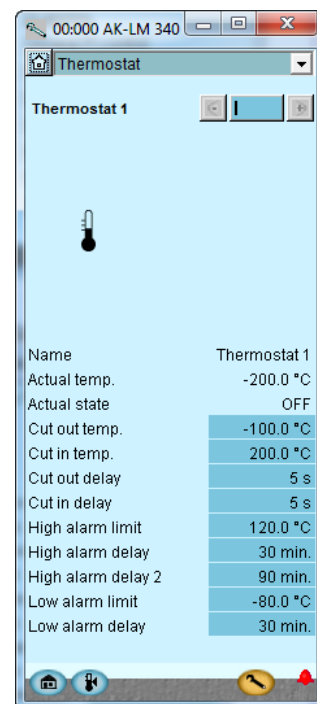
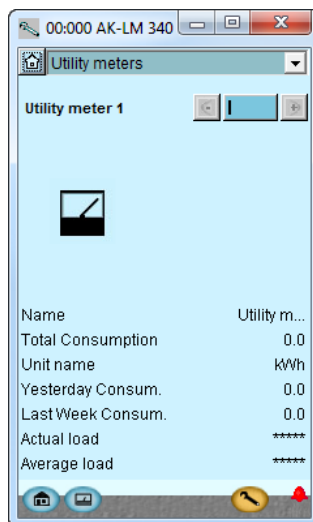


Check settings and measurements

11. Repeat the settings for the other functions  
(The settings for the other functions are shown on the pages that follow.)

# Check of settings - continued

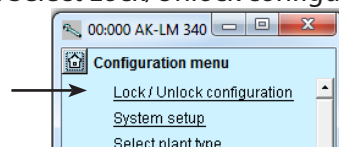
The other functions are not used in the example. They are shown here only for your information.



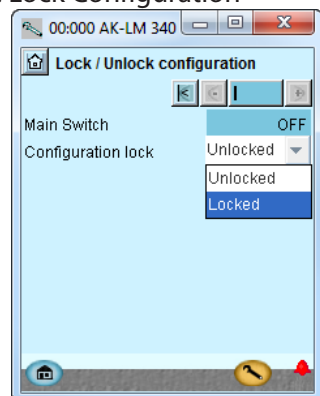
## Lock configuration

1. Go to Configuration menu

2. Select Lock/Unlock configuration



3. Lock Configuration



Press in the field against **Configuration lock**.

Select **Locked**.

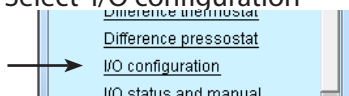
The setup of the controller has now been locked. If you subsequently want to make any changes in the controller's setup, remember first to unlock the configuration.

The controller 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.

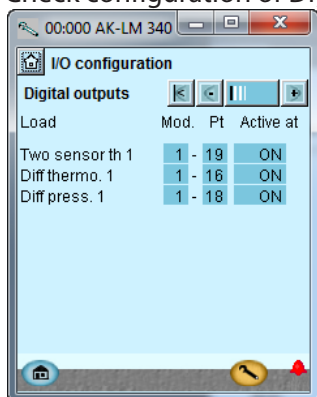
## Check configuration

1. Go to Configuration menu

2. Select I/O configuration

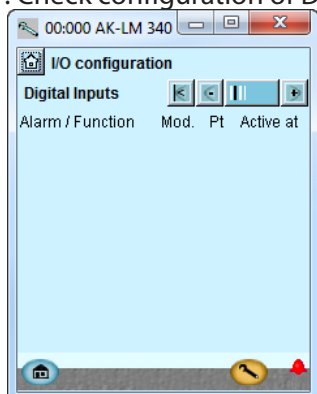


3. Check configuration of Digital Outputs



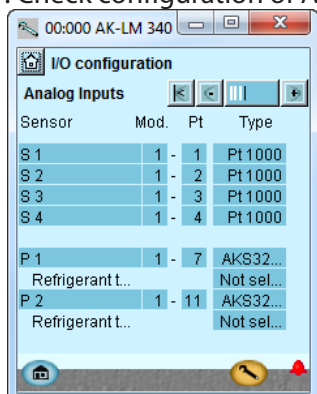
Press the + -button to go on to the next page

4. Check configuration of Digital inputs



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

5. Check configuration of Analog inputs



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

(Only when the setup is locked are all settings for in- and outputs activated.)

The setup of the digital outputs appears as it is supposed to according to the wiring made.

The setup of the digital inputs appears as it is supposed to according to the wiring made.

The setup of the analog inputs appears as it is supposed to according to the wiring made.

**An error has occurred, if you see the following:**



A **0 - 0** next to a defined function.

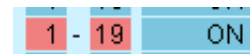
If a setting has reverted to 0-0, you must control the setup again.

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

The error is corrected by setting up the output correctly.

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



The settings are shown on a **RED** background.

If a setting has turned red, you must control the setup again.

This may be due to the following:

- The input or the output has been set up; but the setup has later been changed so that it should no longer be applied.

The problem is corrected by setting **module number to 0 and point number to 0.**

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

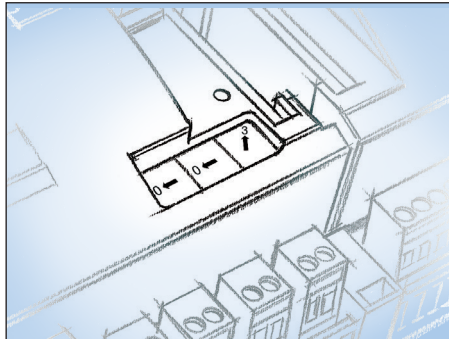


# Installation in network

## 1. Set the address (here, for example 3)

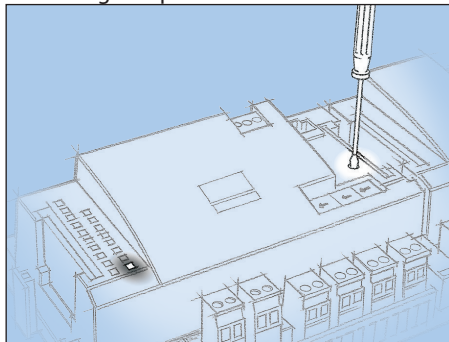
Turn the right-hand address switch so that the arrow will point at 3.

The arrow of the two other address 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 from the system unit

Depending on the size of the network it may be up to one minute before the controller receives an answer as to whether it has been installed in the network.

When it has been installed the Status LED will start to flash faster than normal (once every half second). It will continue with this for about 10 minutes

## 4. Carry out new login via Service Tool



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

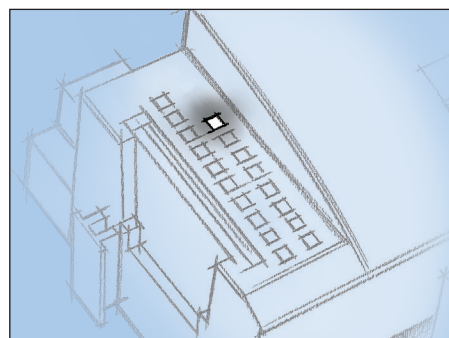
The controller has to be remote-monitored via a network. In this network we assign address number 3 to the controller.

The same address must not be used by more than one controller in the same network.

### Requirement to the system unit

The system unit can be a:

- AK-SM 350
- AK-SM 720
- AK-SM 800



### If there is no answer from the system unit

If the Status LED does not start flashing faster than normal, the controller has not been installed in the network. The reason for this may be one of the following:

#### The controller has been assigned an address out of range

Address 0 cannot be used.

#### The selected address is already being used by another controller or unit in the network:

The address setting must be changed to another (vacant) address.

#### The wiring has not been carried out correctly.

#### The termination has not been carried out correctly.

The data communication requirements are described in the document: "Data communication connections to ADAP-KOOL® Refrigeration Controls" RC8AC.



# First start of control

## Check alarms

1. Go to the overview



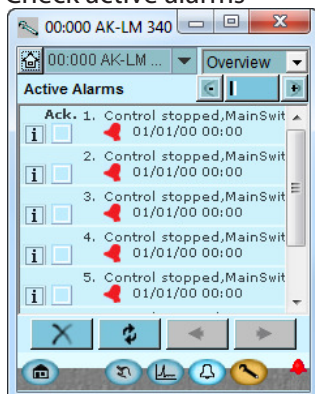
Press the blue overview button at the bottom left of the display.

2. Go to the Alarm list



Press the blue button with the alarm bell at the bottom of the display.

3. Check active alarms



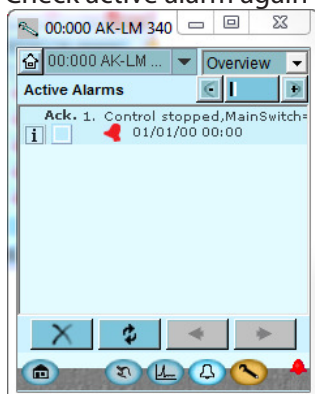
In our case, we have a series of alarms. We will tidy them up so that we only have those that are relevant.

4. Remove cancelled alarm from the alarm list



Press the red cross to remove cancelled alarms from the alarm list.

5. Check active alarm again



In our case an active alarm remains because the control has stopped. This alarm must be active when control has not started. We are now ready for the startup of control.

Please note that active plant alarms are automatically cancelled when the main switch is in pos. OFF.  
If active alarms appear when the control is started the reason for these should be found and remedied.

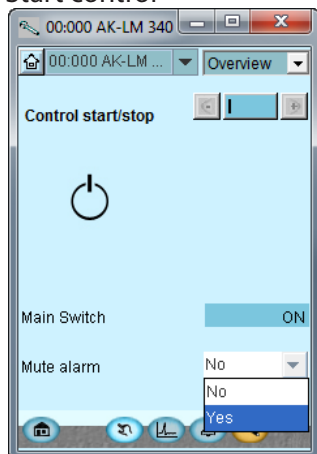
## Start the control

### 1. Go to Start/Stop display



Press the blue manual control button at the bottom of the display.

### 2. Start control



Press in the field against **Main switch**.  
Select **ON**.

If the alarm relay is enabled, the alarm relay can be reset using this function.  
Remember to investigate where the alarm comes from.

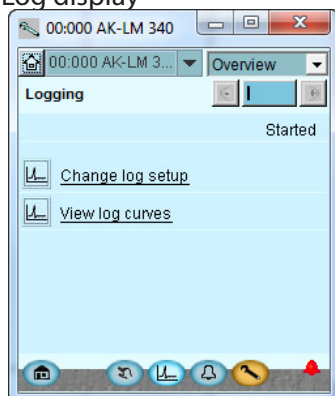
## Setup logs

### 1. Go to the overview

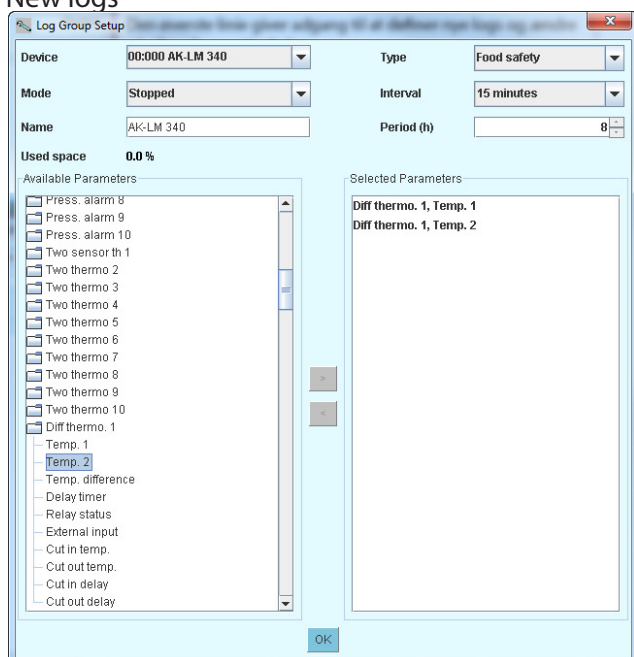


Press the blue overview button with the log symbol.

### 2. Log display



### 3. New logs



### 4. Selection of parameters

If data need to be collected from some of the set parameters, this should be done using a logo setting in a system manager. This can store a larger amount of data.

If you want to set up a log in the monitoring unit, consider the following:

The log function **requires** that the clock function is **set**.

If you want to ensure that the clock is always set, the controller must be installed in a network together with a system unit.

The top line gives access to definition of new logs and to changes of already established logs.

The next line enables you to see a selection of the defined logs

Here is the start display for new logs

Start by defining which type of log has to be defined

Here it is determined which parameters have to be included in the setup of data. Select a function here, then a parameter, and finish with OK.

A LOG CAN ONLY BE DISPLAYED IF:

- THE CLOCK HAS BEEN SET AND
- THE CONFIGURATION IS LOCKED

---

## 5. Regulating functions

---

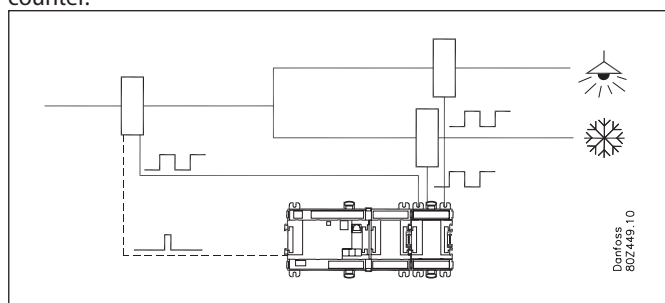
This section describes how the different functions work

# Monitoring functions

## Consumption reading (8 units)

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

These readings are saved in the monitoring unit and can be retrieved later for presentation/analysis. An expansion module type AK-XM 107A 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 AK-LM 340A can receive the synchronisation signal.

The synchronisation switch changes at regular intervals (typically every 15 mins) and indicates that a new measurement period has started.

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

Measurement intervals for synchronisation are set jointly for all energy meters.

If the synchronisation signal is not used, the monitoring unit will define its own measurement period.

The monitoring unit supports up to 8 energy meters.

Each consumption meter has the following available functions:

- Name
- Start/stop of consumption measurement
- Setting the consumption measurement
- Setting the meter
- Selection of number of pulses per unit of measurement
- The conversion factor is defined as primary/secondary ratio
- Setting the consumption value, e.g. by installation of counter

In addition it is possible to read historical and current values:

- Total consumption (since start-up or reset the counter)
- Consumption for past week (from Monday at 0 until Sunday at 24 o'clock)
- Consumption for past day (from 0 to 24 o'clock)
- Current output (average power the last 60 seconds. Updated every 5<sup>th</sup> seconds)
- Average output (average power in the measurement interval, typically 15 minutes).

## Relay Position at sensor failure

For the following functions with relays applies:

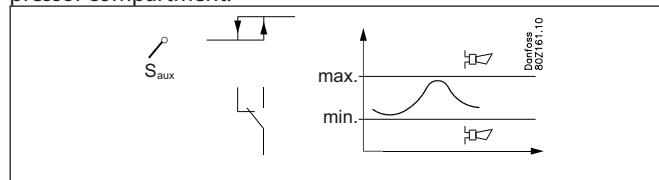
If the signal from a temperature sensor or a pressure transmitter fails, the relay function switch to off when the delay time has passed.

## Thermostats (10 units)

The function may freely be used for:

- Temperature registration
- Temperature monitoring with alarm function
- Temperature control with relay function

An example could be thermostat control of the fan in the compressor compartment.



The thermostat can be used as one of the sensors S1, S2, S3, .. etc. Cutin and cutout limits are set for the thermostat. Coupling of the thermostat's output will be based on the actual sensor temperature. Alarm limits can be set for low and high temperature, respectively, including separate alarm delays.

The individual thermostat function can be adapted to the relevant application as it is possible to give the thermostat a name and to indicate alarm texts.

Each thermostat function can also detect two digital signals which can be used to change alarm signals.

One signal that will change the alarm delay so that a change is made to the long alarm delay. This signal is primarily used with a defrosting so that no alarm is triggered during a defrosting.

A signal that stops the alarm. This signal is primarily used during stoppage of a refrigeration appliance, e.g. during cleaning.

Each thermostat has the following available functions:

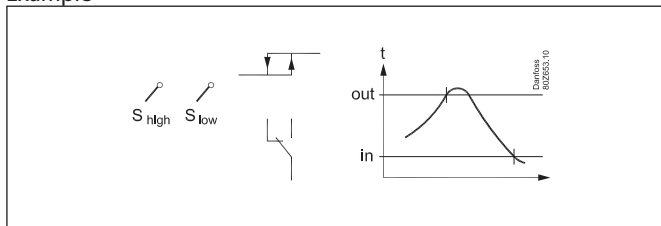
- Name
- Sensor signal
- Display of the current reading
- Selection of relay function
- Setting the cut-out value for relays
- Setting the cut-in value for relays
- Setting of the delay time for cutout
- Setting of the delay time for cutin
- Selection of the input signal that changes to Alarm Delay 2
- Selection of the input signal that stops alarms
- High alarm limit
- Delay time for 'high alarm'
- Delay time 2 for 'high alarm'
- Alarm text for 'high alarm'
- Low alarm limit
- Delay time for 'low alarm'
- Alarm text for 'low alarm'

### Two-sensor thermostat (10 units)

The function can be used for:

- Temperature control with relay function

#### Example



The thermostat can use two of the sensors (S1, S2, S3, etc.).

As a point of departure, use the outlet point at which the relay will cut in and where it will cut out.

#### Cut-in:

- Define which sensor will introduce the cut-in
- Set the temperature value
- Define whether the cut-in will happen when the temperature is above or below the temperature value.

The cut-in will happen when the temperature has exceeded the set temperature value throughout the entire delay period.

#### Cut-out:

- Define which sensor will introduce the cut-out
- Set the temperature value
- Define whether the cut-out will occur when the temperature is above or below the temperature value.

The cut-out will occur when the temperature has exceeded the set temperature value throughout the entire delay period.

#### Min. re-engagement

A timer function starts after each cut-out. The next cut-in will only be permitted when the time for this timer function has elapsed.

#### Priority

Cut-out will always have a higher priority than cut-in.

#### DI signal

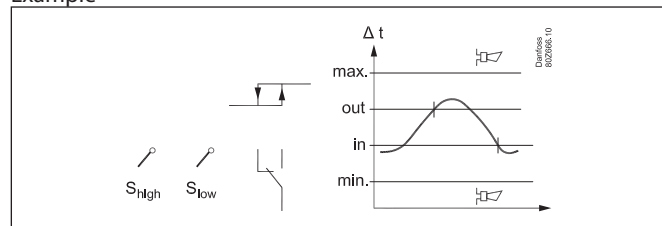
A DI signal can be defined for the function. When this signal is ON, the thermostat function will be stopped and the relay will cut out. This happens without delay.

### Difference thermostat (10 units)

The function can be used for:

- Temperature control with relay function
- Temperature monitoring with alarm function

#### Example



The thermostat can use two sensors (S1, S2, S3, etc.).

The function will activate a relay depending on how great a temperature difference there is on the two sensors.

The relay will be cut in for a low temperature difference.

The cut-in will occur when the temperature difference has dropped to the set value and has remained below it for the entire delay period.

The relay will cut out again for a high temperature difference.

The cut-out will occur when the temperature difference has exceeded the set value and has remained there for the entire delay period.

A high alarm limit can be set. If the temperature difference becomes greater than the set value, an alarm will be issued, but only once the delay period has elapsed.

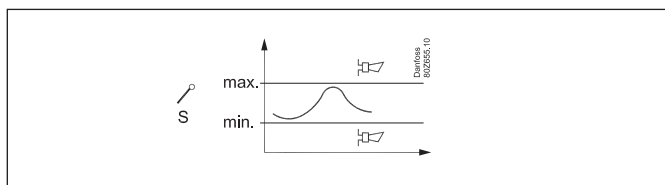
A low alarm limit can be set. If the temperature difference becomes lower than the set value, an alarm will be issued, but only once the delay period has elapsed.

#### DI signal

A DI signal can be defined for the function. When this signal is ON, the thermostat function will be stopped and the relay will cut out.

## Temperature alarms (10 units)

This function can be used to monitor an external temperature.



The function can receive signals from one sensor: S1, S2, etc. Set a temperature limit at which the alarm is to be activated. There can be an alarm to notify of a temperature that is too low or too high. The alarm will be active when the temperature has exceeded the temperature limit throughout the entire delay period.

### DI signal

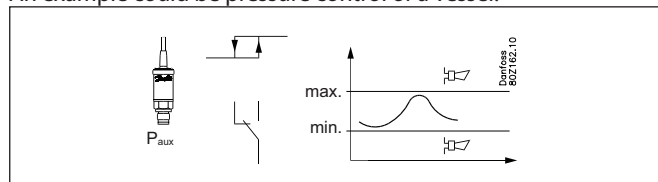
A DI signal can be defined for the function. When this signal is ON, the function will be stopped and no alarms can be issued.

## Pressostats (5 units)

The function may freely be used for:

- Pressure registration
- Pressure monitoring with alarm funktion
- Pressure control with relay function

An example could be pressure control of a vessel:



The pressostat can use one of the pressure transmitters P1, P2, P3... etc.

Set cut-in and cut-out limits for the pressostat. The pressostat output is connected based on the current pressure.

Alarm limits can be set for low and high pressure including separate alarm delays.

The individual pressostat function can be adapted to the current use as it is possible to name the pressostat control and customise alarm texts.

Each pressostat has the following available functions:

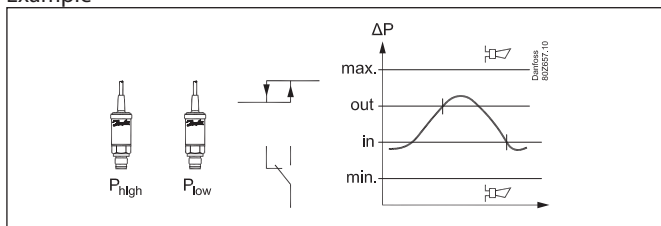
- Name
- Pressure signal
- Display of the current reading
- Selection of relay function
- Setting the cut-out value for relays
- Setting the cut-in value for relays
- Setting of the delay time for cutout
- Setting of the delay time for cutint
- High alarm limit
- Delay time for 'high alarm'
- Alarm text for 'high alarm'
- Low alarm limit
- Delay time for 'low alarm'
- Alarm text for 'low alarm'

### Difference pressostats (10 units)

The function can be used for:

- Pressure control with relay function
- Pressure monitoring with alarm function

#### Example



The pressostat can use two of the pressure transmitters (P1, P2, P3, etc.).

The function will activate a relay depending on how great a pressure difference there is between the two pressure transmitters.

The relay will cut in at a low pressure difference.

The cut-in will occur when the pressure difference has dropped to the set value and has remained below it for the entire delay period.

The relay will cut out again at a high pressure difference.

The cut-out will occur when the pressure difference has exceeded the set value and has remained above it for the entire delay period.

A high alarm limit can be set. If the pressure difference becomes greater than the set value, an alarm will be issued, but only once the delay period has elapsed.

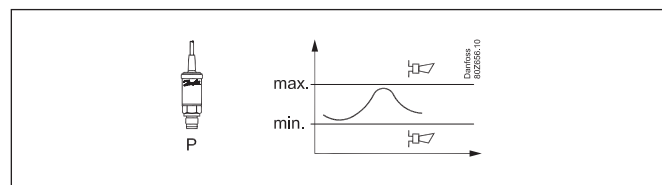
A low alarm limit can be set. If the pressure difference becomes lower than the set value, an alarm will be issued, but only once the delay period has elapsed.

#### DI signal

A DI signal can be defined for the function. When this signal is ON, the differential pressure function will be stopped and the relay will cut out.

### Pressure alarms (10 units)

This function can be used to monitor an external pressure.



The function can receive signals from one pressure transmitter (P1, P2, etc.).

Set a pressure limit at which the alarm is to be activated.

It can be an alarm for pressure levels that are either too high or too low.

The alarm will become active once the pressure has exceeded the limit throughout the entire delay period.

#### DI signal

A DI signal can be defined for the function. When this signal is ON, the function will be stopped and no alarms can be issued.

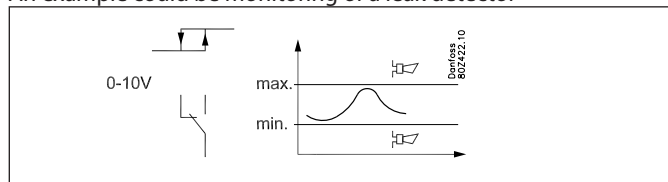


## Voltage signals (5)

The function can be used for:

- Voltage detection
- Voltage monitoring with alarm function
- Voltage monitoring with relay function

An example could be monitoring of a leak detector



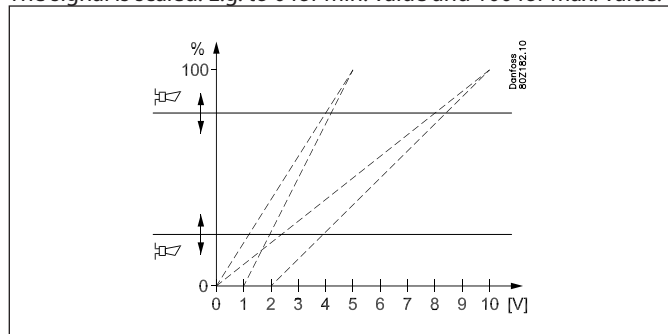
The function can use one of the voltage readings V1, V2, V3,... etc.

The following signals can be received:

- 0-5 V
- 1-5 V
- 0-10 V
- 2-10 V

A current signal can also be detected if external resistances are placed on the input so that the signal is adapted.

The signal is scaled. E.g. to 0 for min. value and 100 for max. value.



The function uses the scaled values for settings and readings.

Cut-in and cut-out limits are set for the relay. The relay is connected based on the current live voltage.

Alarm limits can be set for low and high values including separate alarm delays.

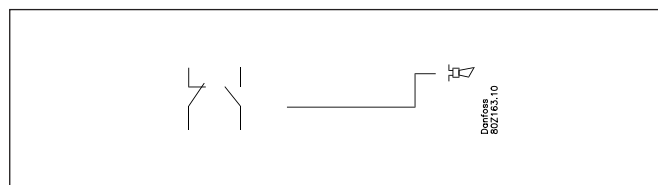
The individual functions can be adapted to the current use as it is possible to name the function and customise alarm texts.

Each voltage control has the following available functions:

- Name
- Display of the current reading
- Selection of relay function
- Display value that represents the input signal's min. value
- Display value that represents the input signal's max. value
- Setting the cut-out value for relay + delay time for cut-in
- Setting the cut-in value for relay + delay time for cut-in
- High alarm limit
- Delay time for 'high alarm'
- Alarm text for 'high alarm'
- Low alarm limit
- Delay time for 'low alarm'
- Alarm text for 'low alarm'

## DI Alarms (on/off signals)(16)

This function can be used to monitor an external signal.



The function can receive the following signals:

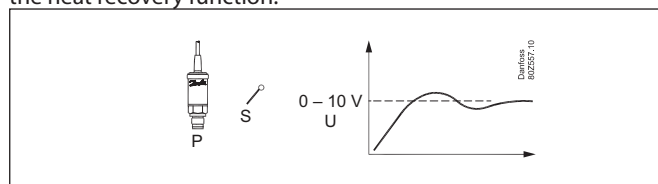
- 0 / 24 V on a low voltage DI input
- 0 / 230 V on a high voltage DI input
- Open/closed input for an analogue input

Each alarm input has the following available functions:

- Name
- Reading of the current status of the input (the overview display)
- Selection of alarm function
- Selection of relay function
- Delay time from detection to alarm and relay change
- Reading of the current status of the alarm
- Alarm text
- Alarm history with the following information:
  - On time in% for the last 24 hours
  - Total On time
  - Number of changes in the last 24 hours
  - Total number of changes.

## General PI functions (10 units)

The function can be freely used for controlling a required function, or it can be used to send signals to the controller regarding operating states. An example could be an out/in control for the use of the heat recovery function.



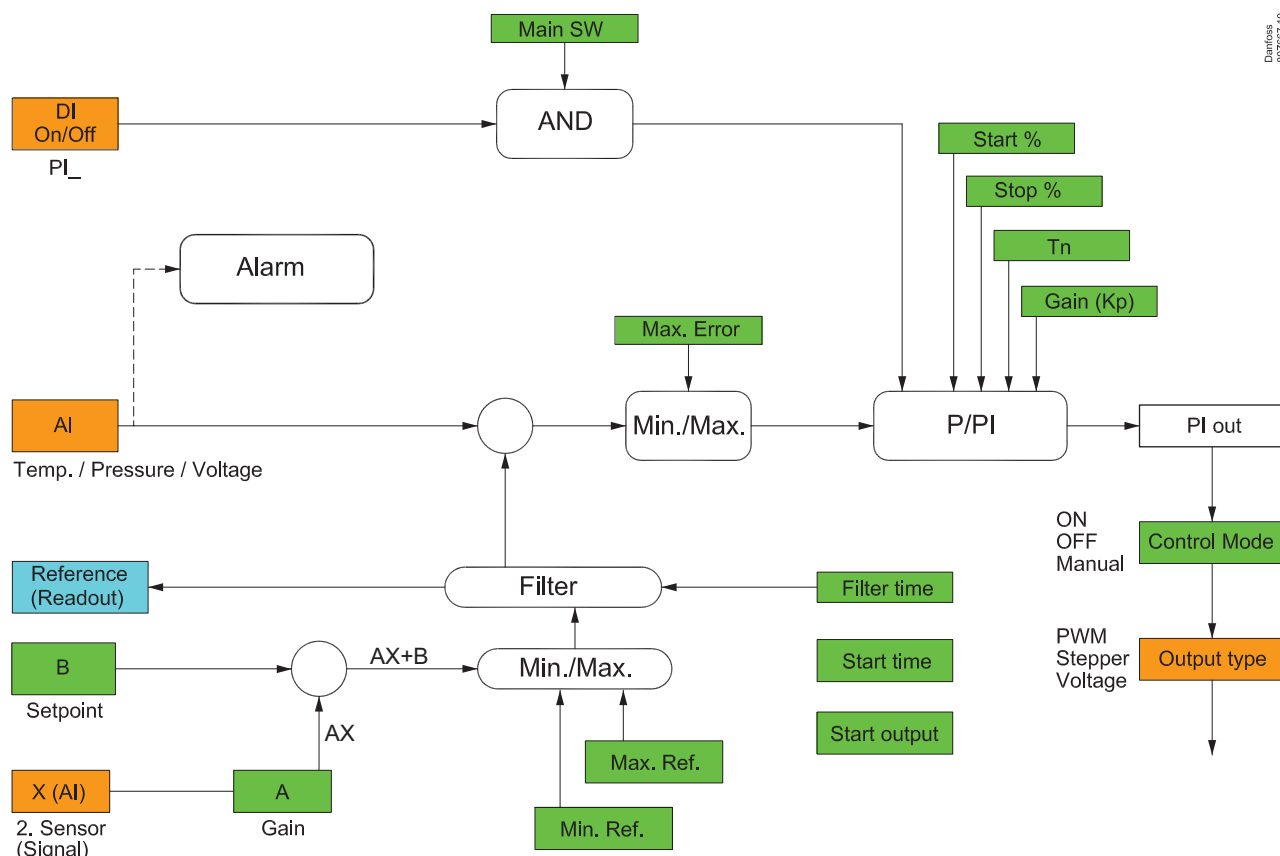
Signals can be received from the following:

- Temperature sensor
- Pressure transmitter
- Voltage signal

Signals can be sent to the following output signals:

- Voltage signal
- Valve with stepper motor
- PWM (pulse width modulated) signal for AKV valve.

The PI function is shown overleaf.



Variable reference part = "Input ref. select".  
It will be included in the reference as "x" together with Set point.

### General

Signal and setting values are converted and adjusted as a percentage value of the signal.

A slow process will normally not be critical for the setting of P-part and I-part.  
However, if the process is quick, more careful setup is required.

A general balancing might be:

- Check max. and min. settings
- Increase the integration time so that it is not mixed up with the balancing
- Reduce Kp to start with
- Start the process
- Adjust Kp until the process starts fluctuating and is constantly fluctuating
- Adjust Kp to half the value
- Adjust Tn down until the process starts fluctuating again
- Adjust Tn to double values

### Settings

00:00 AK-LM 340

Config: General PI 1

PI name	General PI 1
Reference type	Temperature
Function select	Standard
Control mode	OFF
Control type	PI
Ext. start control	No
Sensor input select	S 2
Input set point	8.0 °C
Reference	7.9 °C
Output type select	Voltage
Alarm mode	OFF
Advance ctrl. settings	Yes
Kp	5.0
Tn	120 s
Minimum ref.	6.0 °C
Maximum ref.	30.0 °C
Ref. filter time	60 s
Max. error	100.0 K
Min. control output	0 %
Max. control output	100 %
Startup time	10 s
Startup output	0 %
Stop output	0 %

Temperature  
Pressure  
Voltage

Standard  
Reference offset  
2.sensor

PWM  
Stepper  
Voltage

## Miscellaneous

### Main switch

The main switch is used to stop and start the controlling function. The switch-over has 2 positions:

- Normal controlling state (Setting = ON)
- Control stopped. (Setting = OFF)

If the main switch is set at OFF, all the control's functions are inactive and an alarm is generated to draw attention to this – all other alarms cease.

### Sensor calibration:

The input signal from all connected sensors can be corrected. A correction will only be necessary if the sensor cable is long and has a small cross-sectional area. All displays and functions will reflect the corrected value.

### Clock function

The controller contains a clock function.

The clock function is used by the Log function.

The year, month, date, hour and minutes must be set.

In the event of a power failure, the time setting will be remembered for at least 12 hours.

### Alarms and messages

In connection with the controller's functions, there are a number of alarms and messages that become visible in cases of fault or erroneous operation.

### Alarm history:

The controller contains an alarm history (log) that contains all active alarms as well as the last 40 historical alarms. In the alarm history you can see when the alarm began and when it stopped. In addition, one can see the priority of each alarm as well as when the alarm has been acknowledged and by which user.

### Alarm priority:

Differentiation is made between important and not-so-important information. The importance – or priority – is set for some alarms whilst others can be changed voluntarily (this change can only be done with attachment of AK-ST service tool software to the system and settings must be made in each individual controller).

The setting decides which sorting / action must be carried out when an alarm is sounded.

- "High" is the most important
- "Log only" is the lowest
- "Interrupted" results in no action

### Alarm relay

If the controller must give an alarm on a relay output the relay must be defined:

2 relays can be defined:

- One which is active at alarms with priority "high"
- One which is active at alarms with the priority "low", "middle" and "high".

The relationship between alarm priority and action appears in the schedule below.

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

An alarm disappears when acknowledged or it ceases by itself.

### Alarm acknowledgement

If the controller is connected to a network with an AK system manager as alarm receiver, these will automatically acknowledge the alarms that are sent to them.

If the controller on the other hand is not included in a network, the user must acknowledge all alarms.

### Alarm LED

The alarm LED on the front of the controller indicates the controller's alarm status.

Blinking: There is an active alarm or an unacknowledged alarm.

Fixed light: There is an active alarm that has been acknowledged.

Switched off: There are no active alarms and no unacknowledged alarms.

### IO Status and manual

The function is used in connection with installation, servicing and fault-finding on the equipment.

With the help of the function, the connected outputs are controlled.

### Measurements

The status of all inlets and outlets can be read and controlled here.

### Forced operation

One can carry out an override of all outlets here to control whether these are correctly attached.

Note: There is no monitoring when the outlets are overridden.

### Logging/registration of parameters

As a tool for documentation and fault-finding, the controller provides the possibility of logging of parameter data in the internal memory.

Via AK-ST 500 service tool software one can:

- Select up to 10 parameter values the controller will continuously register
- State how often they must be registered

The controller has a limited memory but as a rule of thumb, the 10 parameters can be saved, which are registered every 10 minutes for 2 days.

Via AK-ST 500 one can subsequently read the historical values in the form of graph presentations.

## Operating AKM / Service tool

The setup of the controller itself can only be carried out via AK-ST 500 service tool software. The operation is described in fitters on site guide.

If the controller is included in a network with an system manager one can subsequently carry out the daily operation of the controller via system software, i.e. one can see and change daily read-outs/settings.

Note: AKM system software does not provide access to configuration settings of the controller.  
Measurements from all of the signals received and from the most important displays of the individual functions can be seen.  
All alarms can be received by AKM.

## Authorisation / Passwords

The controller can be operated with System software type AKM and service tool software AK-ST 500.

Both methods of operation provide the possibility for access to several levels according to the user's insight into the various functions.

System software type AKM:

The various users are defined here with initials and key word.  
Access is then opened to exactly the functions that the user may operate.  
The operation is described in the AKM manual.

Service tool software AK-ST 500:  
The operation is described in fitters on site guide.

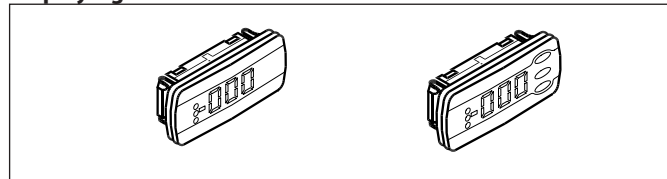
When a user is created, the following must be stated:

- a) State a user name
- b) State a password
- c) Select user level
- d) Select units – either US (e.g. °F and PSI) or Danfoss SI (°C and Bar)
- e) Select language

Access is given to four user levels.

- 1) DFLT – Default user – Access without use of password  
See daily settings and read-outs.
- 2) Daily – Daily user  
Set selected functions and carry out acknowledgement of alarms.
- 3) SERV – Service user  
All settings in the menu system except for creation of new users
- 4) SUPV – Supervisor user  
All settings including the creation of new users.

## Display signal



The values measured can be read from a display. This display must be of display type EKA 163B or EKA 164B. Up to four displays per controller can be fitted.

Connection is effected by means of wires with plug connectors.  
The display can be placed on an appliance front, for example.  
When a display with operating buttons is selected, the unit can be operated with ease by means of a menu system as well as displaying temperatures and operating situations. E.g. the alarm relay can be reset by pressing the top button.

### LEDs on the front

The LEDs will flash when an alarm has been triggered.  
In this situation, you can call up the error code on the display by briefly pressing the top button.

### The buttons

When you want to change a setting, the top and bottom buttons will give a higher or a lower value depending on which button you press. Before you can change the value, you must access the menu. This is done by holding down the top button for a couple of seconds; this takes you into the list of parameter codes. Find the parameter code you want to change, then press the centre button to display the parameter value. When you have changed this value, save the new value by pressing the centre button again

### Examples:

#### Setting a menu

1. Press the top button to display a parameter
2. Press the top or bottom button and find the parameter you want to set
3. Press the centre button to display the value
4. Press the top or bottom button and set the new value
5. Press the centre button again to save the value.

### Read codes

Normally the selected temperature signal can be read from the display, but under certain conditions the display may show other codes in order to notify the user of various operating states.

Function	Display readout
OFF	When the "main switch" is set to OFF, the display will read "OFF"
PAS	Requirement for access code. If operation of the display is to be protected by an access code, both the definition and the access code must be set in the controllers' authorisation menu for the local display (LOCD).
Alarm	The three LED's will flash if an alarm is triggered. The alarm code can be viewed by pressing the top button. Pressing the button will also reset the alarm relay
---	When three dashes appear, the valid temperature reading is faulty (sensor switched off or short-circuited), or else the display has been deactivated.

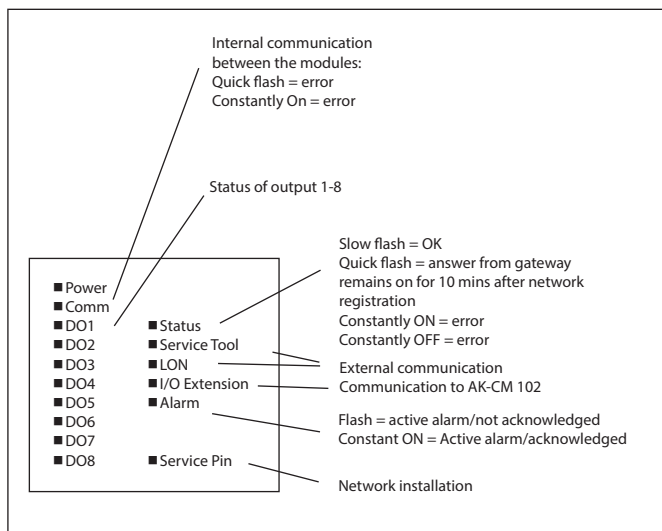
#### Menu overview:

Parameter name	Function
r12	Main switch: 0: Controller stopped 1: Regulation
u1-u31	Readouts for use in service situations
u1	Temperature measurement, thermostat 1
u2	Temperature measurement, thermostat 2
u3	Temperature measurement, thermostat 3
u4	Temperature measurement, thermostat 4
u5	Temperature measurement, thermostat 5
u6	Temperature measurement, thermostat 6
u7	Temperature measurement, thermostat 7
u8	Temperature measurement, thermostat 8
u9	Temperature measurement, thermostat 9
u10	Temperature measurement, thermostat 10
u11	Pressure measurement, pressostat 1
u12	Pressure measurement, pressostat 2
u13	Pressure measurement, pressostat 3
u14	Pressure measurement, pressostat 4
u15	Pressure measurement, pressostat 5
u16	Status on alarm DI 1
u17	Status on alarm DI 2
u18	Status on alarm DI 3
u19	Status on alarm DI 4
u20	Status on alarm DI 5
u21	Status on alarm DI 6
u22	Status on alarm DI 7
u23	Status on alarm DI 8
u24	Status on alarm DI 9
u25	Status on alarm DI 10
u26	Status on alarm DI 11
u27	Status on alarm DI 12
u28	Status on alarm DI 13
u29	Status on alarm DI 14
u30	Status on alarm DI 15
u31	Status on alarm DI 16

#### Alarm overview:

A01	High alarm thermostat 1
A02	Low alarm thermostat 1
A03	High alarm thermostat 2
A04	Low alarm thermostat 2
A05	High alarm thermostat 3
A06	Low alarm thermostat 3
A07	High alarm thermostat 4
A08	Low alarm thermostat 4
A09	High alarm thermostat 5
A10	Low alarm thermostat 5
A11	High alarm thermostat 6
A12	Low alarm thermostat 6
A13	High alarm thermostat 7
A14	Low alarm thermostat 7
A15	High alarm thermostat 8
A16	Low alarm thermostat 8
A17	High alarm thermostat 9
A18	Low alarm thermostat 9
A19	High alarm thermostat 10
A20	Low alarm thermostat 10
A21	Low alarm pressostat 1
A22	High alarm pressostat 1
A23	Low alarm pressostat 2
A24	High alarm pressostat 2
A25	Low alarm pressostat 3
A26	High alarm pressostat 3
A27	Low alarm pressostat 4
A28	High alarm pressostat 4
A29	Low alarm pressostat 5
A30	High alarm pressostat 5
A31	Low alarm voltage input 1
A32	High alarm voltage input 1
A33	Low alarm voltage input 2
A34	High alarm voltage input 2
A35	Low alarm voltage input 3
A36	High alarm voltage input 3
A37	Low alarm voltage input 4
A38	High alarm voltage input 4
A39	Low alarm voltage input 5
A40	High alarm voltage input 5
A41	Alarm DI 1
A42	Alarm DI 2
A43	Alarm DI 3
A44	Alarm DI 4
A45	Alarm DI 5
A46	Alarm DI 6
A47	Alarm DI 7
A48	Alarm DI 8
A49	Alarm DI 9
A50	Alarm DI 10
A51	Alarm DI 11
A52	Alarm DI 12
A53	Alarm DI 13
A54	Alarm DI 14
A55	Alarm DI 15
A56	Alarm DI 16
A60	Manual control of DO / DI
E01	Sensor alarm
E02	System alarm
-- 1	Initiation. Display is connected to output A. (- - 2 = output B, etc.)

## Light-emitting diodes on the controller



## 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.

## Alarm texts

Settings	Default priority		Alarm text	Description
S X sensor error (X=1-40)	High		S X sensor error	S X temp. sensor signal is faulty
P X sensor error (X=1-20)	High		P X sensor error	P X pressure transmitter signal is faulty
Standby mode	Medium		Control stopped, MainSwitch=OFF	The control has been stopped via the setting "Main switch" = OFF
Thermostat X – Low temp. alarm (X=1-10)	Medium		Thermostat X - Low alarm	Thermostat temperature has been below the set low temperature limit for longer time than set delay
Thermostat X – High temp. alarm (X=1-10)	High		Thermostat X - High alarm	Thermostat temperature has been above the set high temperature limit for longer time than the set delay
Pressostat X – Low pressure alarm (X=1-5)	Medium		Pressostat X - Low alarm	The pressure has been below the set low pressure limit for longer than the set delay
Pressostat X – alarm limit high pressure (X=1-5)	Medium		Pressostat X - High alarm	The pressure has been above the high pressure limit for longer than the set delay time
Voltage input X – Low alarm (X=1-5)	Medium		Analog input X - Low alarm	The voltage signal has been below the low alarm limit for longer time than set delay
Voltage input X – High alarm (X=1-5)	Medium		Analog input X - High alarm	The voltage signal has been above the high alarm limit for longer time than set delay
DI X alarm input (X=1-16)	Medium		DI X alarm	Alarm on general alarm input DI x
Stepper alarm	High		Stepper PI X - open coil - shorted output - error - power failure	Alarm from stepper valve Check valve and stepper module AK-XM 208C

### System alarms

The alarm priority can not be altered on system alarms				
	Medium		Clock has not been set	Time has not been set
	Medium		System Critical exception	A unrecoverable critical system failure has occurred – exchange the controller
	Medium		System alarm exception	A minor system failure has occurred – power off controller
	Medium		Alarm destination disabled	When this alarm is activated the alarm transmission to the alarm receiver has been deactivated. When the alarm is cleared the alarm transmission to the alarm receiver has been activated.
	Medium		Alarm route failure	Alarms can not be transmitted to alarm receiver – check communication
	High		Alarm router full	The internal alarm buffer has an overrun – this might occur if the controller can not send the alarms to the alarm receiver. Check communication between controller and AKA gateway.
	Medium		Device is restarting	The controller is restarting after flash updating of the software
	Medium		IO module error	There is a communication fault between the controller module and the extension modules – the fault must be corrected as soon as possible
	Low		MAN DI.....	The output in question has been put in manual control mode via the AK-ST 500 service tool software
	Low		MAN DO.....	The output in question has been put in manual control mode via the AK-ST 500 service tool software