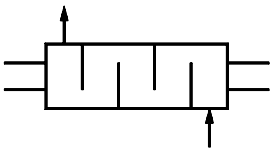
Technical brochure

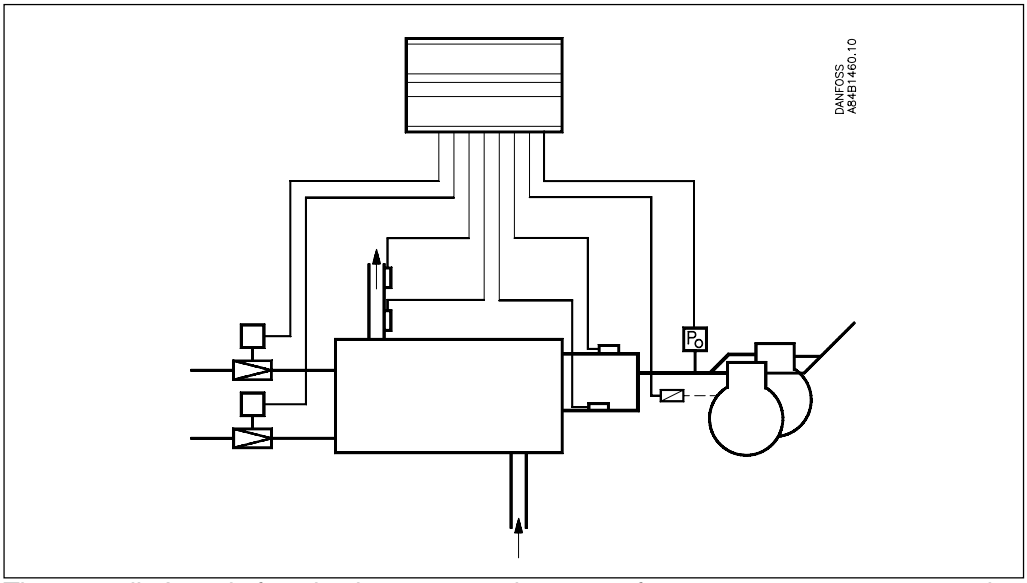
ADAP-KOOL®



Controller for control of water chillers
AKC 24W and AKC 24W2

Introduction

AKC 24W is a complete control unit for the regulation of water chillers. The controller encompasses capacity regulation of compressors as well as electronic expansion valve regulation.
The controller can be used together with other regulators in Danfoss' ADAP-KOOL® refrigeration control series.
In addition to the above mentioned regulations, the controller can transmit signals to other controllers about operating conditions, e.g. forced closing of the expansion valve or alarms.



The controller's main function is to operate the steps of one or two compressors, so that a constant temperature is maintained at the outlet at all times. The controller will at the same time ensure the optimum supply of liquid to the evaporator.
There are two versions of the controller using an electrically operated expansion valve type TQ, PHTQ and TEAQ (AKC 24W) or type AKV (AKC 24W2), respectively.

Application

AKC 24W may be used in all refrigerating plant with capacities between 2 kW and 2 x 2000 kW (R22), e.g. in:

- water chillers and brine coolers
- industrial heat pumps
- air conditioning

Advantages

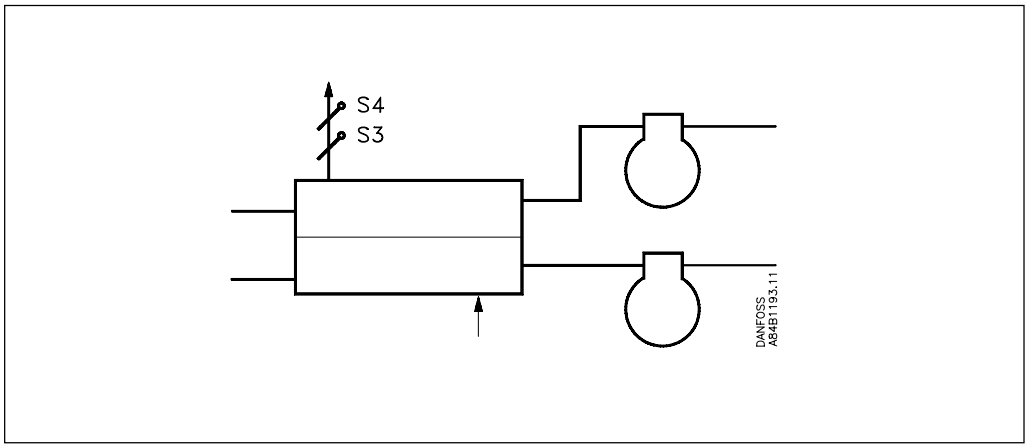
- Energy savings
  Adaptive setting of the expansion valves and effective optimisation of compressor capacity means reduced running costs.
- Easy installation
  One integrated control contains all of the necessary functions for the plant.
- Exact temperature regulation. A combination of adaptive evaporator and compressor regulation gives you the smallest possible energy consumption and great temperature accuracy of the cooled medium.
- PC connection
  When the controller is connected to a PC, central operation and data collection are made possible.
- Diagnose function
  Temperatures and functions are monitored constantly. When there is an alarm, the cause of it is shown on the display unit.
- Choice of refrigerant
  All types of refrigerant can be used.

Total control

AKC 24W is the perfect unit for total control of water chillers and brine coolers, where capacity regulation, evaporator regulation and monitoring functions are all integrated in the same controller.

Capacity regulation

The temperature of the medium is regulated by controlling the compressor capacity.



Temperature control regulation

Temperature control takes place when AKC 24W receives a signal from a Pt 1000 ohm temperature sensor (S3). The sensor is normally placed in the evaporator's water outlet. Via neutral zone regulation of the cut-in and cut-out of compressor steps the evaporating pressure is obtained that provides a constant water temperature. The controller has eight on/off outputs for the control of compressor steps. The steps may be distributed on one or two compressors.
Minimum periods for compressor step cut-in and cut-out can be set between 0 and 15 min.

Temperature control (frost protection)

A Pt 1000 ohm temperature sensor (S4) can be mounted at the point where monitoring of low temperature is required. The permissible minimum temperature for the medium, measured at the temperature sensor, is entered in the controller. If the temperature becomes too low, the compressor is stopped and the alarm is activated.

Safety control

Signals from high or low-pressure controls or from other kinds of automatic controls can be connected to the controller. When a signal is received, the expansion valves will close and the compressor steps cut out.

Cut-in of extra capacity

The control function registers the number of cut-in compressor steps. If all steps have been cut-in and there is still a need for capacity, an output will be activated. The output may, for example, be used to start-up of a spare water chiller.

Heat pump control

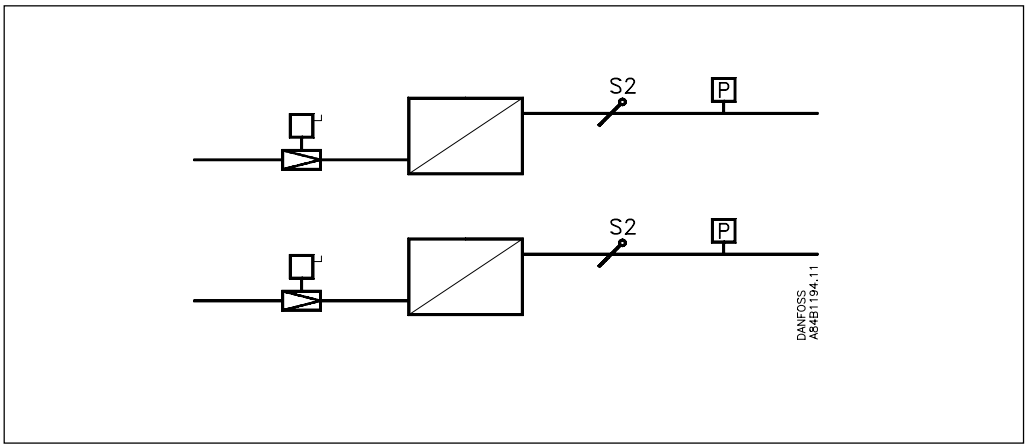
A setting in the controller permits change-over to heat pump control. Capacity steps will then be cut in when the media temperature drops.

Monitoring/fault-finding

AKC 24W constantly registers temperatures via sensor signals. If deviations exceed the permitted values, the alarm will sound and the associated functions will cut-out. A broken sensor will immediately set off the alarm, for example. A diagnose function ensures quick and effective fault-finding.

Expansion valve function

The controller can operate one or two electronic expansion valves type TQ (PHTQ/ TEAQ) or AKV.
The expansion valve function is adaptive so that the evaporators always have an optimum charge of refrigerant. In this way we obtain the lowest possible consumption of energy for the water chiller as a whole. The adaptive function will itself find the evaporator characteristics at different capacity levels. This provides a quick and accurate adjustment of the evaporator charge when compressor step are cut-in and out.



Superheat
Superheat of the evaporator is registered by means of a pressure measurement (P0) and a temperature measurement (S2). If there is a common evaporating pressure for the two evaporator circuits, measurement of the pressure may be performed with one pressure transmitter only.

You may choose between controllers that can regulate with a load-dependent superheat or with a superheat that depends on compressor steps..
When regulation depends on hte load, the controller varies the superheat between low superheat for small loads and high superheat for large loads.
When regulation depends on compressor steps, a superheat value must be set for each cut-in capacity step.
AKC 24W contains both types of regulation, while AKC 24W2 contains the load-dependent superheat feature.

MOP function
(MOP = Maximum Operating Pressure)
A maximum pressure can be set for each expansion valve, to protect the compressor against overload.

Forced closing
If the S2 sensor is shortcircuited or a safety circuit cuts out, the relevant expansion valve will close.

Operation

All settings and measurements are presented via a menu system. The menu system can be displayed via our DANBUSS Data Communication on one of the following two operating interfaces:

Control panel type AKA 21

The control panel is connected to the network, or, controller the different settings and displays can now be arranged via the menu system.

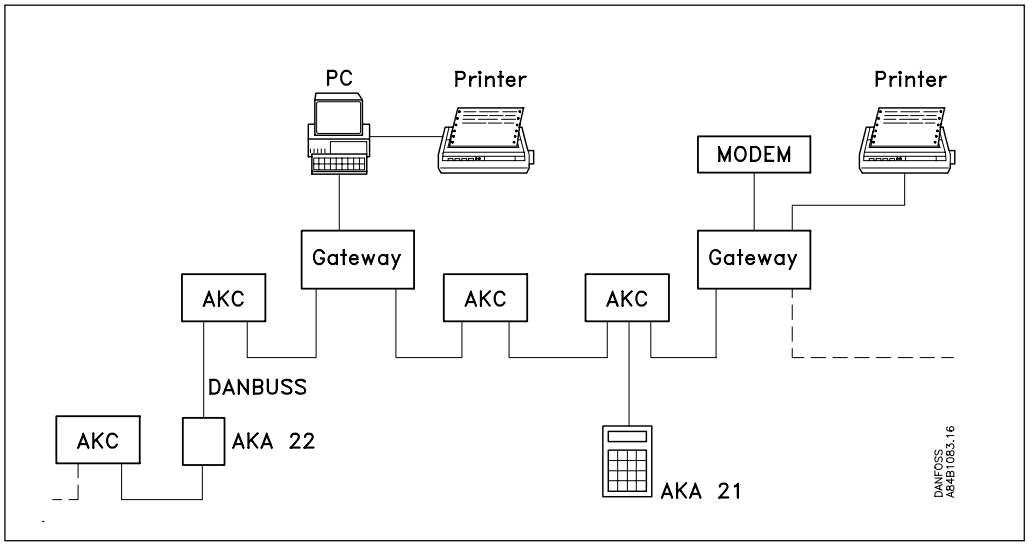
System software type AKM

DANBUSS Data Communication can be connected to a PC via a gateway type AKA 244. The software programme “System software type AKM” is installed on the PC. When this has been accomplished, all settings, displays and receipt of alarms can take place from the PC.

Via an authorisation system each user may be granted access to selected functions.

Data communication

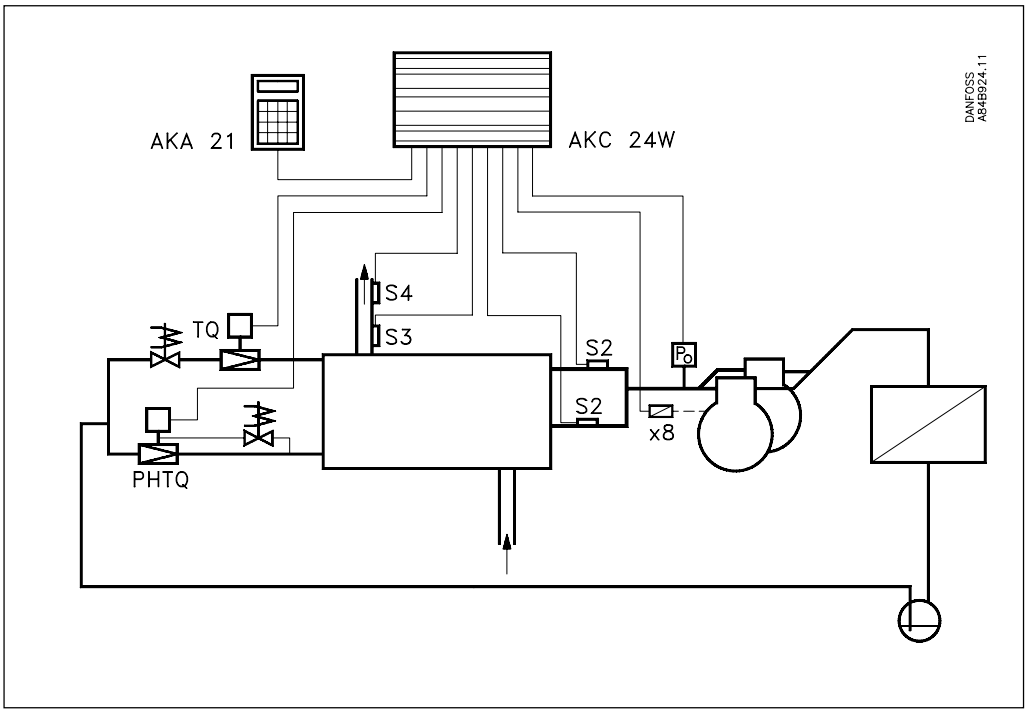
Data communication between AKC 24W controllers and other units in the ADAP-KOOL® product range of refrigeration controls takes place via an RS 485 bus standard. The protocol is a DANFOSS standard with the registered name DANBUSS. Here it is possible to define a number of networks and each network may consist of up to 124 units.



The system is operated either by:

1. Using control panel type AKA 21.
   The control panel may either be stationary or a portable model. One control panel may be common to several controllers.
2. Using a PC.
   The PC is connected via a DANFOSS gateway type AKA 244. Monitoring of the system and collection of data are possible, when a PC is used.
3. Communication via a modem connection.
   Operation can subsequently take place, as described above.

Application example



The example shows a water chiller with two circuits in the evaporator.
Accurate temperature control of the water is required.
An AKC 24W unit is used for the control.

Expansion valve control
Control is carried out by AKC 24W which will provide optimum regulation of liquid injection into the two evaporators.
Signals are received from pressure transmitter P0 and from temperature sensors S2.
Used as actuator in one circuit is a TQ valve, and in the other circuit the larger PHTQ valve.

Regulation of temperature of medium
The temperature signal is received from the S3 sensor.
AKC 24W supplies signals to eight compressor steps (distributed on two compressors).
The S4 sensor has been mounted to protect the unit against frost.

Operation
Operation of the system takes place from control panel type AKA 21.
The panel may be placed in another room than the controller.

Monitoring
The controller monitors all pressure and temperature conditions in the system.
If the programmed limit values are exceeded, the alarm function will be activated.

Advantages
- Integrated compressor control and injection function
- Optimum evaporator charge
- Accurate temperature control
- Optimisation of compressor capacity
- Alarm and safety functions
- Remote operation

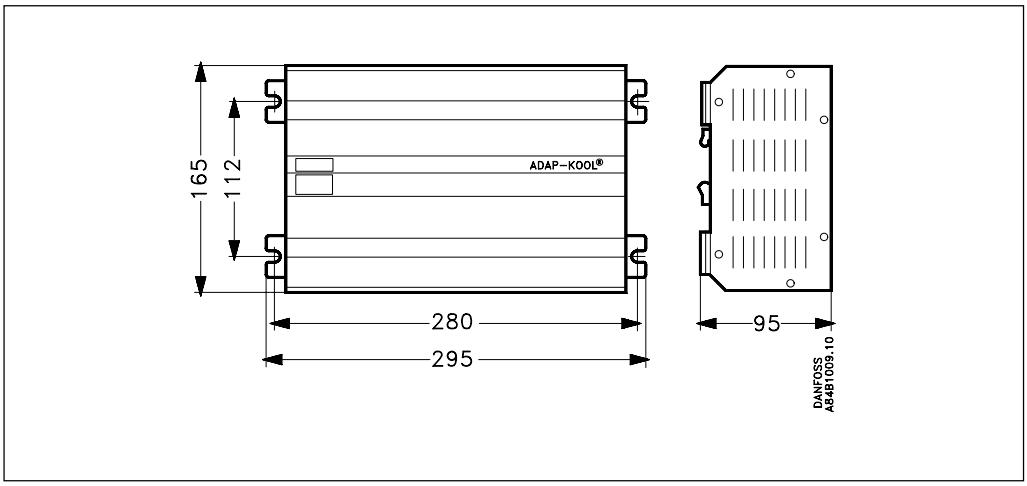
Technical data

Supply voltage	24 V a.c. +25/-15%, 50/60 Hz		
Power consumption	AKC 24W		6 VA
	TQ / PHTQ (AKC 24W)		2 pcs a 50W(75)VA each
	AKV (AKC 24W2)		2 pcs a 12W(26)VA each
	Outputs		10 pcs. a 10 VA each
Inputs	Temperature sensors	Pt 1000 ohm	2 x 2 pcs. +2 pcs.
		Temperature range	-70 to 160°C
		Sensor type	AKS 21 / 11
	Pressure transmitter	AKS 32 for regulation (-1 to 12 bar, 1 to 5 V)	2 pcs.
		AKS 32 for monitoring (-1 to 34 bar, 1 to 5 V)	1 pcs.
	On/off signals	Function switch	1 pcs.
		Signal from safety controls	2 pcs.
		Requirements to switches	Gold plating
	Voltage signal	Displacement of reference voltage	2-10 V
Outputs (triac)	Actuator	AKC 24W	2 pcs. TQ/PHTQ
		AKC 24W2 (Time period = 3-6 seconds)	2 pcs. AKV, 24 V a.c.
	Compressor steps	Number	8 pcs.
		Voltage	24 V a.c.
		Min. load	0.03 A
		Max. load	0.7 A
	"More capacity"	Number	1 pcs.
		Voltage	24 V a.c.
		Min. load	0.03 A
		Max. load	0.7 A
Alarm outputs (relay)	Imax.cont.	AC-1	3 A (ohmic)
		AC-15	1.5 A (inductive)
	Voltage (min / max)	20 / 250 V a.c.	
	Pmin.	1 VA	
Temperature setting	-50 to +60°C		
Neutral zone setting	0.1 to 5 K		
Refrigerant	All (special refrigerants are set with three constants)		
Data communication	Hardware	RS 485	
	Software	DANBUSS	
Operation	Control panel	AKA 21	
	PC System software	AKM	
Ambient temperature	During operation	-20 to +55°C	
	During transport	-50 to +70°C	
Enclosure	Material	Anodised aluminium	
	Density	IP 10, VBG 4	
	Weight	2 kg	
	Mounting	For wall or DIN-rail mounting. Fittings are bypacked	

Ordering

Type	Function	For valve type	Code no.
AKC 24W	Water chilling	TQ, PHTQ or TEAQ	**084B2003**
AKC 24W2	Water chilling	AKV or AKVA	**084B2027**

Dimensions



Literature

Technical brochure. Controller type AKC 24W for control of water chillers RC.1J.E
Function description AKC 24W RC.1J.F
Function description AKC 24W2 ..... RC.1J.6
Catalogue. Pressure transmitters type AKS 32 ..... RK.00.H
Catalogue. Temperature sensors type AKS and ESM RK.00.H
Catalogue. Electronic expansion valves type AKV and AKVA RK.00.H
Technical brochure. Electronically operated valves type TQ / PHTQ... ..... RC.0X.B
Installation guide for data communication cable RC.0X.A
AKC 24W. Menu operation via AKA 21 (software-based) RC.1J.C
AKC 24W. Menu operation via AKM (software-based) RC.1J.P
AKC 24W. Mounting instructions (by-packed unit) RI.1J.F
AKC 24W. Table for entry of menu settings (by-packed unit) RI.1J.C
AKC 24W2. Menu operation via AKA 21 (software-based) RC.1J.7
AKC 24W2. Menu operation via AKM (software-based) RC.1J.8
AKC 24W2. Mounting instructions (by-packed unit) RI.1J.Y
AKC 24W2. Table for entry of menu settings (by-packed unit) RI.1J.2

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