

Manual

Liquid level controller *EKC 347*



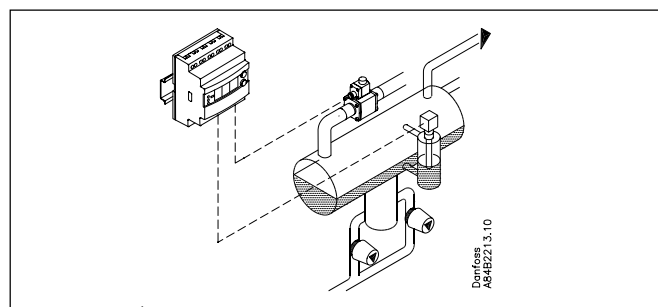
ADAP-KOOL®
Refrigeration control systems

Introduction

Application

The controller is used for regulation of the refrigerant level in:

- Pump reservoirs
- Separators
- Intermediate coolers
- Economisers
- Condensers
- Receivers



Principle

A signal transmitter will constantly register the refrigerant level in the reservoir - the controller will receive the signal and subsequently open and close the valve, so that the refrigerant level will be kept within the given limits.

Signaltransmitter

It is possible to choose between two signal transmitters – either a capacitive rod or a level float.

With the capacitive rod it is possible to set the refrigerant level in a wide range. The level float, on the other hand, provides a limitation due to the stroke which is only a few centimeters long.

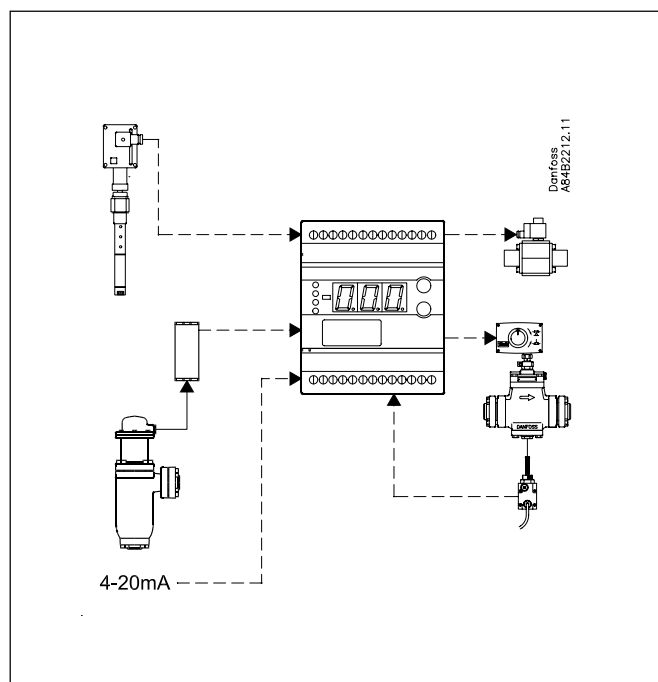
EKC 347

The controller can receive a signal which can displace the reference. If a motor-operated valve is used, the controller can receive a resetting signal from a position transmitter.

Expansionsvalve

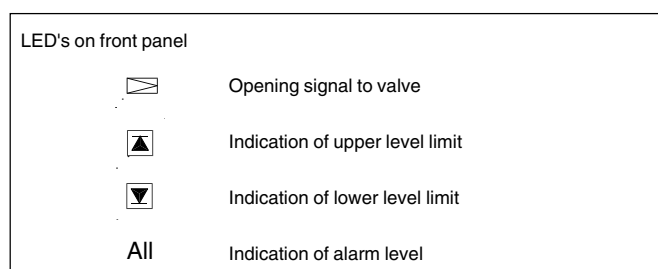
On the valve side it will be the required capacity and application which will determine the type of expansion valve that will be needed.

AKV and AKVA are pulse-width modulating expansion valves where AKVA is for ammonia. MEV is a motor-operated modulating valve where the motor is of type SMVE.



Functions

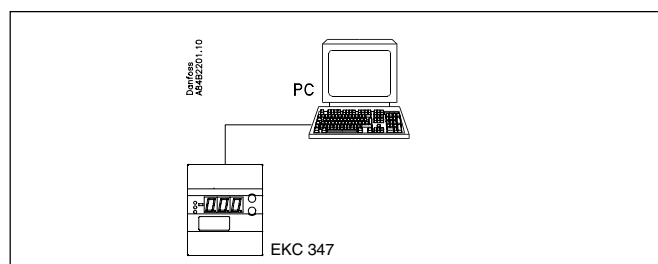
- Liquid level control
- Alarm if the set alarm limits are exceeded
- Relay outputs for upper and lower level limits and for alarm level
- Analog input signal which can displace the reference



Extra options

- PC operation

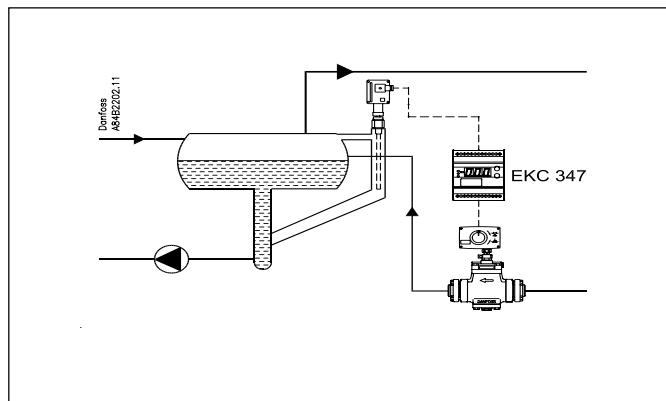
The controller can be provided with data communication, so that it may be hooked up with other products in the ADAP-KOOL® range of refrigeration controls. Operation, monitoring and data collection can then be performed from a PC - either in situ or at a service company.



Application examples

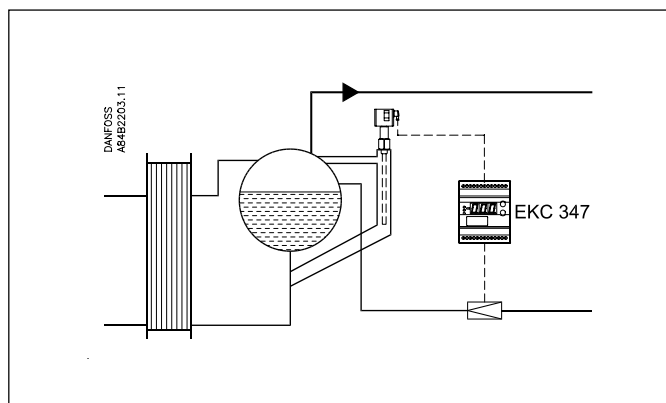
Pump reservoir

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



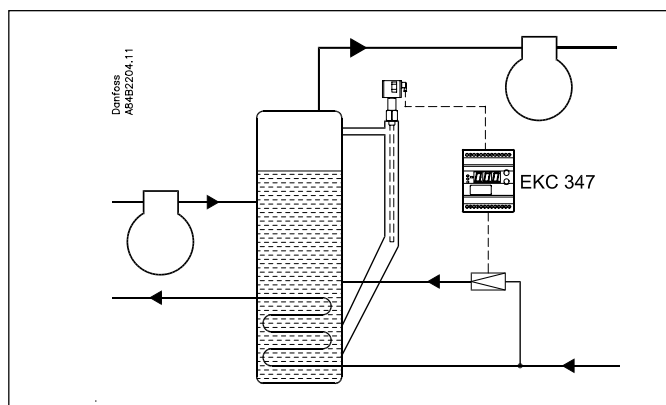
Separator on flooded evaporator

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



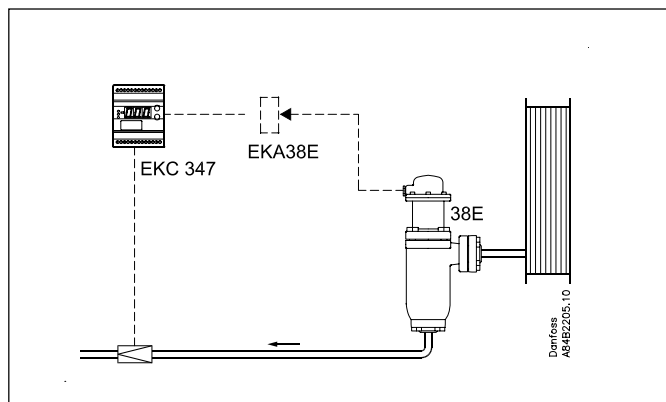
Intermediate cooler

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



Receiver / condenser

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



Survey of functions

Function	Parameter	Parameter by operation via data communication
Normal display		Level control
The liquid level is indicated in % The % value is calculated on the basis of the input signal and the definition in "o31".	-	Liquid level
The valve's actual opening degree can be displayed by giving the lower button a brief push (1s). Cf. also o17.	-	OD %
Reference		
Set point Regulation is based on the set value provided that there is no external contribution (o10). (Push both buttons simultaneously to set the setpoint).	-	SP Liquid Level
External contribution to the reference This setting determines how large a contribution is to be added to the set reference when the input signal is max (20 mA or 10 V. Cf. also o10). The value is set in %-points.	r06	Ext. Ref.offset
Start/stop of regulation With this setting the level regulation can be started and stopped. Start/stop of level regulation can also be performed with the external contact function. Regulation is stopped if just one of them is OFF.	r12	Main Switch
Alarm		Level Alarms
The controller can give alarm in different situations. When there is an alarm the three lowest LED's at the front of the controller will flash, and the alarm relay is cut in		
Limit for upper level Here you set the limit value for the upper level indication. The value is set in %. The relay for the upper level will become activated when the level exceeds the set value.	A01	Upper deviation
Limit for lower level Here you set the limit value for the lower level indication. The value is set in %. The relay for the lower level will become activated when the level drops below the set level.	A02	Lower deviation
Time delay for upper level limit When the limit value is exceeded a timer function will start. The relay will not become activated until the set time delay has been passed.. The time delay is set in seconds.	A03	Upper Alm. delay
Delay for lower limit level When the limit value is exceeded a timer function will start. The relay will not become activated until the set time delay has been passed. The time delay is set in seconds.	A15	Lower Alm. delay
Limit for alarm level An alarm level can be set which when passed will activate the alarm relay- The value is set in %. Cf. also the definition in A18.	A16	Limit Alarm
Time delay for alarm level When the alarm level is exceeded a timer function will start. The relay will not become activated until the set time delay has been passed. The time delay is set in seconds.	A17	Limit Alm. delay
Definition of alarm level You must define whether the alarm is to enter into force at rising or falling level: 0: Rising level (alarm at higher level than the setting in A16) 1: Falling level (alarm at lower level than the setting in A16) If the alarm function is not required, it can be avoided by means of the following setting in A16: • 100, if the rising level definition has been chosen • 0, if the falling level definition has been chosen.	A18	Lim. Alm. ris/fal

Alarm for upper and lower levels, if required When the relay for the upper or lower limit level becomes activated, it is also possible to activate the alarm relay: 0: Alarm relay to be activated 1: Alarm relay not to be activated	A19	Alarm type (With setting = 0 the alarm is also transmitted via the data communication)
Alarm relay The alarm relay will become activated if one of the set limits is exceeded or if the controller loses the input signal from the level-measuring unit.		With data communication the importance of the individual alarms can be defined. Setting is carried out in the "Alarm destinations" menu. See also page 11.
Control parameters		Injection Settings
Definition of regulating principle Here you set whether the controller is to open or close the valve when the liquid level is rising. Low (0): Regulation on the low-pressure side. The valve closes when liquid level is rising. High (1): Regulation on the high-pressure side. The valve opens when liquid level is rising.	n35	Low/High press.
Period time An AKV/A valve is operated with pulses of a given length. The length depends on the opening degree required. If a large opening degree is required, the pulse will last for an entire period time. A period time will thus comprise both open and closed valve.	n13	Periodtime
P - band If the value is reduced the regulating range will be reduced. (The P-band will be near the reference).	n04	P-band
I: Integration time Tn The I-link can be made passive by setting the value at max. (600s) (If the Tn value is increased the regulation becomes slower).	n05	Tn sec.
Neutralzone The function is only active if the connected expansion valve is of type MEV with motor type SMVE.	n34	Neutralzone
Min. opening degree Here you can make a setting if you require a limitation of the valve's working range.	n33	OD Min.
Max. opening degree Here you can make a setting if you require a limitation of the valve's working range.	n32	OD Max.
Miscellaneous		Miscellaneous
Valve and output signal The controller can transmit signals to two types of expansion valves – MEV or AKV/A. With AKV/A up to three controllers can be linked up to a master/slave function (this function is only used if there is a need for several parallel expansion valves). The application is defined with one of the following settings: 1: MEV. AO: 4-20 mA 2: MEV. AO: 0-20 mA 3: AKV/A, AO: 4-20 mA 4: AKV/A, AO: 0-20 mA or, if the master/slave function is used: 5: AKV/A, MASTER 6: AKV/A, SLAVE 1/1. AO:4-20 mA 7: AKV/A, SLAVE 1/1. AO:0-20 mA 8: AKV/A, SLAVE 1/2. AO:4-20 mA 9: AKV/A, SLAVE 1/2. AO:0-20 mA 10: AKV/A, SLAVE 2/2. AO:4-20 mA 11: AKV/A, SLAVE 2/2. AO:0-20 mA With settings 1 and 2 the AO signal is used for the motor valve. With settings 3, 4, 6, 7, 8, 9, 10 or 11 the AO signal can be detected so that the level can be read.	o09	AO type

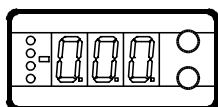
Reference displacement If you wish to connect a signal that is to displace the controller's control reference, the signal must be defined in this menu. The signal is connected to terminals 19-21 or 20-21 0: No signal 1: 4 - 20 mA 2: 0 - 20 mA 3: 2 - 10 V 4: 0 - 10 V (The min. value will give no displacement. The max. value will displace the reference with the value set in menu r06).	o10	Ext. Ref. Type
Input signal from the level-measuring unit The input signal for terminals 14-16 or 15-16 must be defined: 0: No signal 1: Current signal of 4-20 mA 2: Voltage signal. The voltage range must be set in the next two menus. (If the connections are a master/slave system and the signal to the master is 4 to 20 Ma, the setting in the slave modules must also be selected to 1 – this must be done, even if the signal is connected to the voltage input).	o31	Levelsign. type
Voltage signal's lower value (only if the setting in 031 = 2).	o32	Lev. Voltage Low
Voltage signal's upper value (only if the setting in o31 = 2)	o33	Lev. Voltage Hig
Position signal If a motor valve is used, you may also connect a position transmitter type AKS 45. This transmitter can subsequently provide information about the valve's opening degree. AKS 45 must be connected to terminals 17-18, and the signal must be defined: 0: Not used 1: Signal used for displays only 2: Signal used in the regulation as "inner regulating loop"	o34	AKS 45 mode
Frequency Set the net frequency.	o12	50 / 60 Hz (50=0, 60=1)
Address If the controller is built into a network with data communication, it must have an address, and the master gateway of the data communication must then know this address. These settings can only be madewhen a data communication modulehas been mounted in the controller and the installation of the data communication cable has been completed. This installation is mentioned in a separate document "RC.8A.C"..		Following installation of a data communication module, the controller can be operated on a par with the other controllers in ADAP-KOOL® refrigeration controls.
The address is set between 1 and 60	o03	-
The address is sent to the gateway when the menu is set in pos. ON (The setting will automatically change back to Off after a few seconds.)	o04	-
Language This setting is only required when data communication is connected to the controller. Settings: 0=English, 1=German, 2=French, 3=Danish, 4=Spanish, 5=Italian, and 6= Swedish When the controller is operated via data communication, the texts in the right-hand column will be shown in the selected language. When you change the setting to an other language you must activate o04 before "the new language" can be visible from the AKM program.	o11	Language
Selection of parameter for displays The selection depends on the setting made in menu "o34". If o34 has been set at 0, the subsequent setting of o17 will produce this effect: 0: The liquid level will be shown in the "normal display" 1: The valve's opening degree will be shown in the "normal display" If o34 has been set at 1 or 2, the subsequent setting of o17 will produce this effect: 0: The liquid level will be shown in the "normal display" 1: The position signal from AKS 45 will be shown in the "normal display" The normal display has now been selected. If at a later stage you wish to see the other parameter, just give the controller's lowest button a brief push. This will give a display from, say, liquid level to opening degree – or vice versa. After five seconds the display will revert to the original mode.	o17	Display / AO

Manual control of outputs In connection with service the individual relay outputs and the AKV/A output can be put in pos. ON. But not until regulation has been stopped. OFF: No override 1: Relay for upper level is ON 2: Relay for lower level is ON 3: AKV/A output is ON 4: Alarm relay is activated (terminals 12 and 13 will be connected)	o18	-
Service		Service
A number of controller values can be printed for use in a service situation		
Read liquid level	u01	Liquid level
Read the control reference (Set reference + any contribution from external signal)	u02	Liquid level ref.
Read valve's opening degree	u24	OD %
Read value of the external current signal (reference displacement) which is received on terminals 19-21	u06	Ext. Ref. mA
Read value of the external voltage signal (reference displacement) which is received on terminals 20-21	u07	Ext. Ref. V
Read value of the current signal (level signal) received on terminals 15-16	u30	Levelsign. mA
Read value of the voltage signal (level signal) received on terminals 14-16	u31	Levelsign. V
Read value of the current signal (position signal from the valve) received on terminals 17-18	u32	AKS 45 mA
Read position signal from the valve. The value is converted into % of the total opening degree	u33	AKS %
Read value of the delivered current signal (terminals 2-5)	u08	AO signal mA
Read status of input DI (start/stop input)	u10	DI
	--	DO1 Limit alarm Read status of alarm relay ON is operating status with alarm
	--	DO2 Upper alarm Read status of the relay for the upper level limit
	--	DO3 Lower alarm Read status of the relay for the lower level limit
Operating status		
Operating status of the controller can be called forth in the display. Push briefly (1s) the upper button. If there is a status code, it will be shown on the display. (Status codes have lower priority than alarm codes. In other words, you cannot see a status code, if there is an active alarm). The individual status codes have the following meanings:		EKC Status (0 = regulation)
S10: Level regulation stopped by the internal or external start/ stop		10
S12: Level regulation stopped by the internal or external start/ stop		12

Operation

Display

The values will be shown with three digits, and after an operation the controller will return to its standard mode and show the measured liquid level.



Light-emitting diodes (LED) on front panel

There are LED's on the front panel which will light up when the belonging relay is activated.

The upper LED will indicate the valve's opening degree. A short pulse indicates a slow liquid flow and a long pulse a fast liquid flow.

The three lowermost LED's will flash, if there is an error in the regulation.

In this situation you can upload the error code on the display and cancel the alarm by giving the uppermost button a brief push.

The buttons

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

- Gives access to the menu (or cutout an alarm)
- Gives access to changes
- Saves a change

Examples of operations

Set reference

1. Push the two buttons simultaneously
2. Push one of the buttons and select the new value
3. Push both buttons again to conclude the setting

Set one of the other menus

1. Push the upper button until a parameter is shown
2. Push one of the buttons and find the parameter you want to change
3. Push both buttons simultaneously until the parameter value is shown
4. Push one of the buttons and select the new value
5. Push both buttons again to conclude the setting

Literature survey:

Manual for EKC 347 RS.8A.X-.-
 Instruction for EKC 347 RI.8B.Y-.-
 Installation guide, "Data communication link
 for ADAP-KOOL® " RC.8A.C-.-

Menu survey

SW = 1.0x

Function	Parameter	Min.	Max.
Normal display			
Read the measured liquid level	-		%
If you wish to see the actual opening degree, give the lower button a brief push	-		%
If you wish to set the required setpoint you obtain access by pushing both buttons simultaneously	-	0%	100%
Level control			
External contribution to the reference. Cf. also o10. Value is set in %-points.	r06	-100	100
Start / stop of level control	r12	OFF	ON/on
Alarm			
Upper level limit	A01	0 %	100%
Lower level limit	A02	0%	100%
Time delay for upper level limit	A03	0 s	999 s
Time delay for lower level limit	A15	0 s	999 s
Level alarm limit	A16	0%	100%
Delay for level alarm	A17	0 s	999 s
The level alarm must start at: 0: Rising level (higher level than A16) 1: Falling level (lower level than A16)	A18	0/ris	1/fal
Alarm (optional) for upper and lower level limit 0: If the upper or lower level limit is exceeded, alarm must also be given 1: If the upper or lower level limit is exceeded, alarm must not be given	A19	0	1
Regulating parameters			
P - band	n04	0%/Off	200%
I: Integration time Tn	n05	60	600/Off
Period time (only if AKV/A valve is used)	n13	3 s	10 s
Max. opening degree	n32	0%	100%
Min. opening degree	n33	0%	100%
Neutral zone (only for MEV valve)	n34	2%	25%
Definition of regulating principle Low: On the low-pressure side (valve closes when liquid level is rising) High: On the high-pressure side (valve opens when liquid level is rising)	n35	Low/0	Hig/1
Miscellaneous			
Controller's address	o03*	0	60
ON/OFF switch (service-pin message)	o04*	OFF	ON
Define valve and output signal: 1: MEV. AO: 4-20 mA 2: MEV. AO: 0-20 mA 3: AKV/A, AO: 4-20 mA 4: AKV/A, AO: 0-20 mA Or if a master/slave function is used: 5: AKV/A, MASTER 6: AKV/A, SLAVE 1/1. AO:4-20 mA 7: AKV/A, SLAVE 1/1. AO:0-20 mA 8: AKV/A, SLAVE 1/2. AO:4-20 mA 9: AKV/A, SLAVE 1/2. AO:0-20 mA 10: AKV/A, SLAVE 2/2. AO:4-20 mA 11: AKV/A, SLAVE 2/2. AO:0-20 mA	o09	1	11
Define the input signal on terminals 10, 20, 21 (external reference displacement) 0: OFF 1: 4-20 mA 2: 0-20 mA 3: 2-10 V 4: 0-10 V	o10	0	4
Language 0=English, 1=German, 2=Frensh, 3=Danish, 4=Spanish, 5=Italian, 6=Swedish. When you change the setting you must also activate O04.	o11*	0	6

Continued from previous page			
Set supply voltage frequency	o12	0/50 Hz	1/60 Hz
Select the showing of the "normal display"			
If o34 = 0:			
0: Liquid level is shown			
1: Valve's opening degree is shown	o17	0	1
If o34 = 1 or 2:			
0: Liquid level is shown			
1: Position signal from AKS 45 is shown			
Manual control of outputs:			
OFF: No manual control			
1: Upper level relay put in pos. ON			
2: Lower level relay put in pos. ON			
3: AKV/A output put in pos. ON			
4: Alarm relay activated (cut out)	o18	OFF	4
Define input signal (level signal) on terminals 14, 15, 16			
0: OFF			
1: 4-20 mA			
2: 0-10 V (also set the voltage values in the next two menus)	o31	0	2
Read functional description if the connection used is a master/slave function.			
Define input signal's lower value for terminal 14, if required	o32	0.0 V	4.9 V
Define input signal's upper value for terminal 14, if required	o33	5.0 V	10 V
Define input signal on terminals 17-18			
0: Not used			
1: 4-20 mA from AKS 45. The signal is used for information only			
2: 4-20 mA from AKS 45, The signal is used in the regulation as an "inner regulating loop"	o34	0	2
Service			
Read liquid level	u01		%
Read liquid level reference	u02		%
Read external contribution to the reference	u06		mA
Read external contribution to the reference	u07		V
Read current signal on the analog output	u08		mA
Read status of input DI	u10		
Read valve's opening degree	u24		%
Read level signal	u30		mA
Read level signal	u31		V
Read signal from AKS 45	u32		mA
Read signal from AKS 45 converted into %	u33		%

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

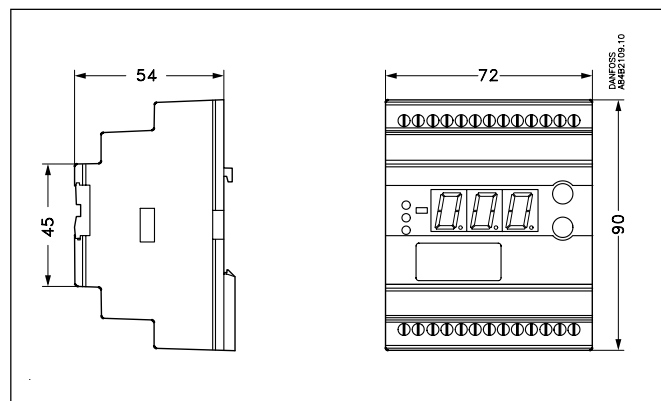
Factory setting

If you need to return to the factory-set values, it can be done in this way:

- Cut out the supply voltage to the controller
- Keep both buttons depressed at the same time as you reconnect the supply voltage

Data

Supply voltage	24 V a.c. +/-15% 50/60 Hz, 60 VA (the supply voltage is galvanically separated from the input and output signals)	
Power consumption	Controller	5 VA
	20 W coil for AKV	55 VA
Input signal	Level signal	4-20 mA or 0-10 V
	Reference displacement	4-20 mA, 0-20 mA, 2-10 V or 0-10 V
	MEV feedback signal	From AKS 45
	Contact function start/stop of regulation	
Relay output	2 pcs. SPST	AC-1: 4 A (ohmic)
Alarm relay	1 pcs. SPST	AC-15: 3 A (inductive)
Current output	0-20 mA or 4-20 mA Max. load: 500 ohm	
Valve connection	Either AKV/A valve or MEV motor valve. If an AKV/A valve is used, the controller must supply the power to the coil.	
Data communication	Possible to connect a data communication module	
Ambient temperature	During operation	-10 - +55°C
	During transport	-40 - +70°C
Enclosure	IP 20	
Weight	300 g	
Mounting	DIN rail	
Display	LED, 3-digits	
Terminals	max. 2.5 mm ² multicore	
Approvals	EU Low Voltage Directive and EMC demands re CE-marking complied with. LVD-tested acc. to EN 60730-1 and EN 60730-2-9 EMC-tested acc. to EN50081-1 and EN 50082-2	



Error messages

The controller can give the following messages:		
E1	Error message	Errors in the controller
E12		The external reference contribution is outside the range
E21		Level signal outside the range
E22		Signal from AKS 45 outside the range
A1	Alarm message	Upper level limit reached
A2		Lower level limit reached
A3		Alarm level limit reached

Ordering

Type	Function	Code No.
EKC 347	Liquid level controller	084B7067
EKA 173	Data communication module (accessories), (FTT 10 module)	084B7092
EKA 174	Data communication module (accessories), (RS 485 module) with galvanic separation	084B7124

Level transmitter/controller: Kindly refer to catalogue RK.00.I
 AKV / AKVA Valves: Kindly refer to catalogue RK.00.I
 MEV valves and SMVE
 motor operation Kindly refer to catalogue RD.4M.A

Connections

Necessary connections

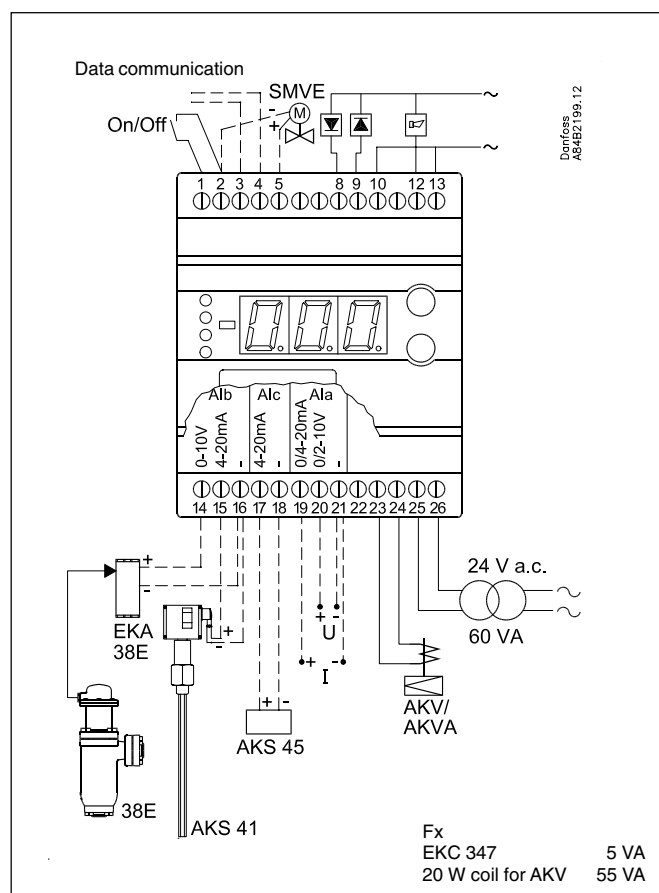
Terminals:

- 25-26 Supply voltage 24 V a.c.
- 15-16 Signal from level transmitter type AKS 41 **or**
- 14-16 Signal from converter unit type EKA 38E
- 23-24 Expansion valve type AKV or AKVA **or**
- 2-5 Expansion valve type MEV with SMVE motor
- 1-2 Switch function for start/stop of regulation. If a switch is not connected, terminals 1 and 2 must be shortcircuited.

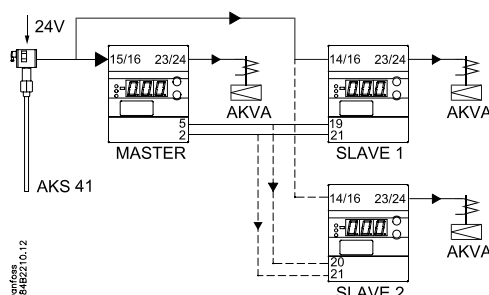
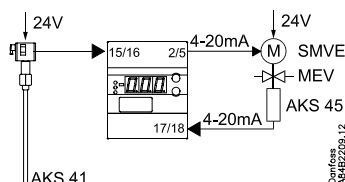
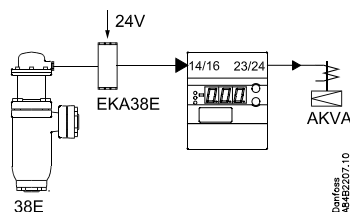
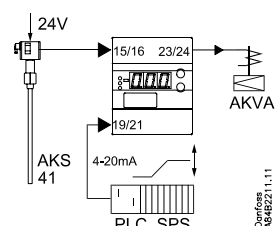
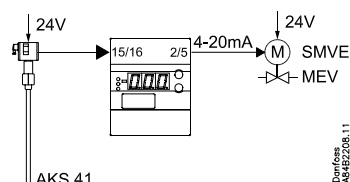
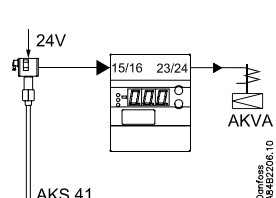
Application dependent connections

Terminal:

- 12-13 Alarm relay
There is connection between 12 and 13 in alarm situations and when the controller is dead
- 8-10 Relay for lower level limit. There is connection between 8 and 10 when the set value is passed
- 9-10 Relay for upper level limit. There is connection between 9 and 10 when the set value is passed
- 17-18 Resetting signal (optional) from AKS 45 if MEV valve with SMVE motor is used
- 19-21 Current signal **or**
- 20-21 Voltage signal from other regulation (for external reference displacement)
- 3-4 Data communication
Mount only, if a data communication module has been mounted.
It is important that the installation of the data communication cable be done correctly. Cf. separate literature No. RC.8A.C...



Connections examples

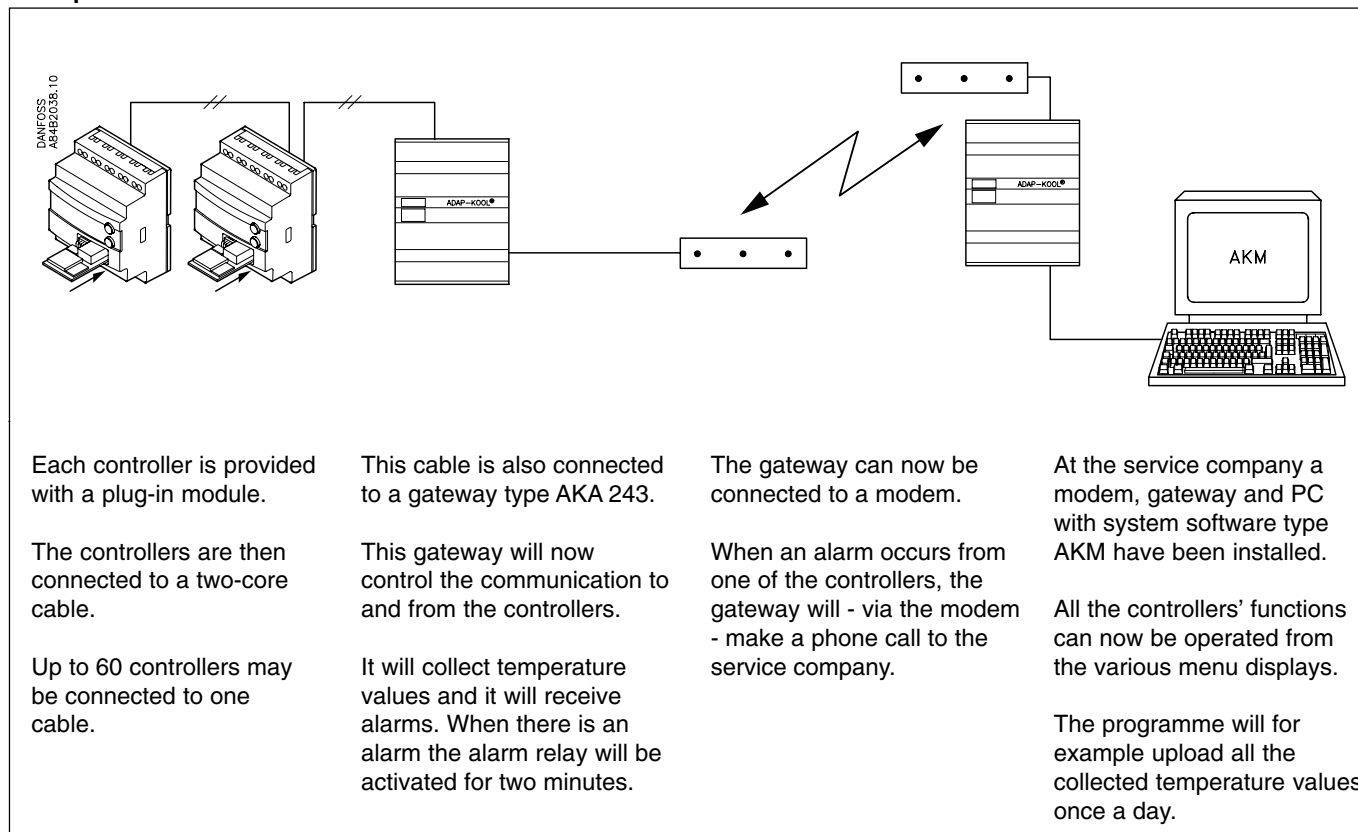


Data communication

This page contains a description of a few of the possibilities you will have when the controller is provided with data communication.

If you want to know more about operation of controllers via PC, you may order additional literature.

Examples



Example of menu display

Level control			
005:005			
Measurements		Settings	
EKC State	10	Main Switch	0N
Liquid Level	0.0	SP Liquid Level	50.0
Liquid Level ref	50.0	Ext.Ref.offset K	0.0
OD %	0.0	Upper deviation	85
		Lower deviation	15
		Limit Alarm	50
		Upper Alm. delay	10
		Lower Alm. delay	20
		Limit Alm. delay	0
		Lim.Alm. ris/fal	0
		Alarm type	0

AKC text
☒ Default
☐ Custom

Trend Change Close

- Measurements are shown at one side and settings at the other.
- You will also be able to see the parameter names of the functions on page 4-7.
- With a simple change-over the values can also be shown in a trend diagram.
- If you wish to check earlier temperature measurements, you can see them in the log collection.

Alarms

If the controller is extended with data communication, it will be possible to define the importance of the transmitted alarms.

The importance is defined with the setting: 1, 2, 3 or 0. When the alarm then arises at some time, it will result in one of the following activities:

1 = Alarm

The alarm message is sent off with alarm status 1. This means that the gateway that is the master in the system will have its alarm relay output activated for two minutes. Later, when the alarm ceases, the alarm text will be retransmitted, but now with status value 0.

2 = Message

The alarm text is transmitted with status value 2. Later, when the "message" lapses, the alarm text is retransmitted, but now with status value 0.

3 = Alarm

As "1", but the master gateway's relay output is not activated.

0 = Suppressed information

The alarm text is stopped at the controller. It is transmitted nowhere.

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