

## **Liquid level transmitter**

### **Type AKS 41 / 41U**

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Introduction



AKS 41 / 41U liquid level transmitters are used to measure the liquid level in refrigerant vessels.

The AKS 41 / 41U transmits an active 4-20 mA signal which is proportional to the refrigerant liquid level.


The 4-20 mA signal from AKS 41 / 41U can be used in conjunction with a controller to control the refrigerant liquid level.

The Danfoss EKC 347 liquid level controller, is a dedicated controller for use with the AKS 41 / 41U.

Special features

- *"Plug and Play"*: no calibration required.
- *Service friendly*: electronic head and sensor tube can be separated without emptying the standpipe.
- *Damping of output signal available.*
- *Improved calibration*: AKS 41 / 41U range/signal output can be adapted to suit the actual application.
- AKS 41 / 41U can be supplied with a LED Bargraph indication of Liquid Level, as option

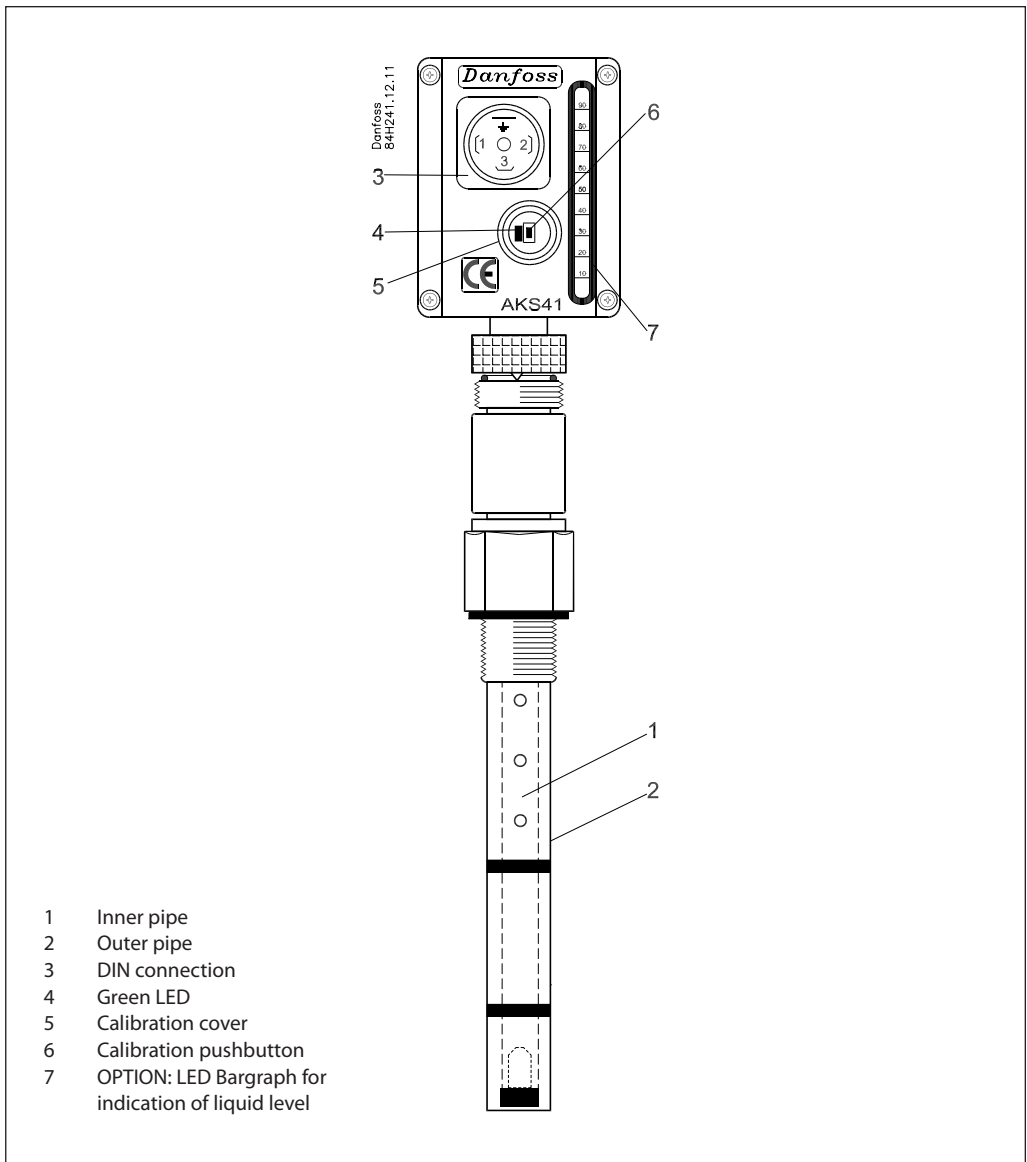
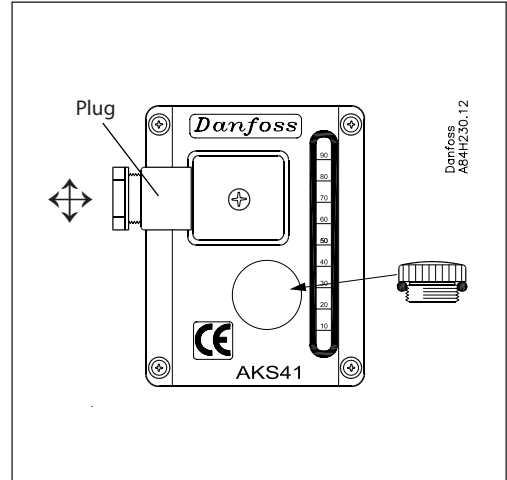
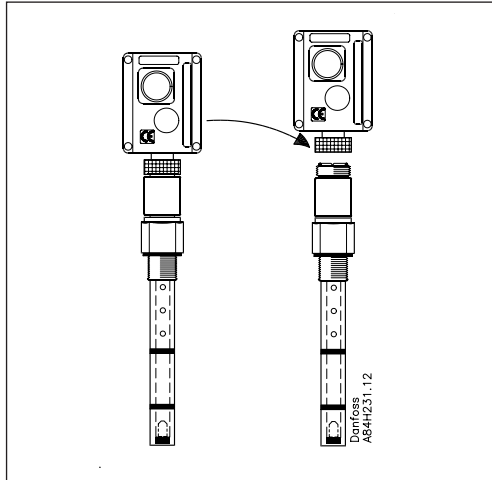
Technical data

- **Supply voltage and load:**  
24 V a.c, -15% / +25%, 50/60 Hz  
24 V d.c, ±10%  
1.5 W
- **Signal output:**  
4-20 mA
- **Refrigerants:**  
AKS 41 / 41U supports the following refrigerants:  
R717 (factory setting)  
R22  
R404A  
R134a  
R744  
R718 (H<sub>2</sub>O) - R717 and R718 will give the same AKS 41 output
- **Temperature range:**  
-60/+100°C (-76/+212°F)
- 
 When used in refrigerant above +60°C (140°F), a Min. Calibration must be carried out after 1 week of operation. Subsequently only a Min. Calibration once a year is needed.
- **Pressure range:**  
The AKS 41 / 41U is designed for:  
Max. working pressure: 100 bar g (1450 psig)
- **Connection:**  
Pipe thread ISO 228/1 - G 1A or 3/4 " NPT
- **Max. load resistance:**  
500 ohm
- **Ambient temperature:**  
During operation: -25 to +55°C (-13/+131°F).  
During transport: -40 to +70°C (-40/+158°F).
- **Enclosure:**  
IP65
- **Connection:**  
4-pole plug (DIN 43650)
- **Approvals:**  
EMC directive 89/336/EEC  
EMD directive 92/31/EEC  
EN 50081-1  
EN 50082-1
- **Material:**  
Thread: Stainless steel. AISI 303  
Reference pipe: Stainless steel. AISI 304  
Inner electrode: PTFE  
Electronic top part: Cast Aluminium

Design

■ Electronic head and sensor tube can be separated without emptying the standpipe.

■ Plug can be mounted in 4 different positions.



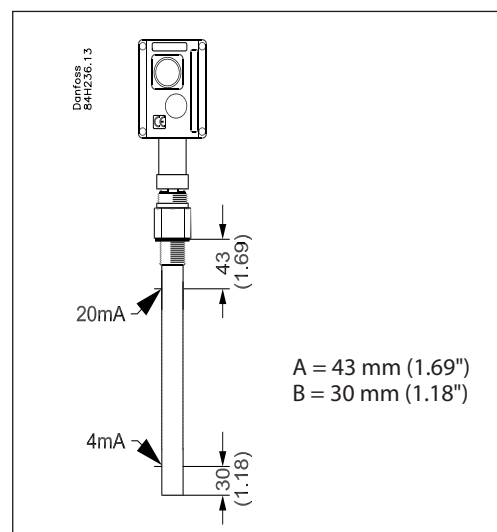
**Function and factory setting**

The rod consists of two pipes - an inner pipe and an outer pipe. The liquid will flow up between the two pipes and by measuring the electrical capacitance between the pipes, the length of rod immersed in the liquid refrigerant is registered.

The signal is transmitted as a current signal from 4 to 20 mA (4 mA when the rod does not register liquid - and 20 mA when the entire rod is surrounded by liquid).

**Factory setting:**

The rod comes factory calibrated for R717 (NH<sub>3</sub>), so that it will cover 4 to 20 mA throughout the rod's whole measuring range. Any disturbances in connection with the level measurement will be damped internally.



**R717 (NH<sub>3</sub>) / R718 (H<sub>2</sub>O)**

It is not necessary to change the settings. The factory setting can be used.

**R22 / R404A / R134a / R744**

Setting for the required refrigerant **must** be made by following the procedure described in next section.



**NOTE!**

If an alternative refrigerant other than the listed is used, a new Min/max calibration of the level transmitter is required.

Please observe that when used in R718, over time a lime coating on the outer reference pipe can be experienced. Danfoss recommend removing this lime coating on regular basis.

**Setting of refrigerant**

The setting may be carried out before the level transmitter is mounted on the plant.

1. To give in the refrigeration mode setting push the calibration pushbutton and keep it pressed while 24 V a.c. is connected and then release the pushbutton.



**NOTE!**

This sequence **must** be observed. If the supply voltage is connected before the calibration pushbutton is activated, the signal damping will be changed.

2. Release the calibration pushbutton. Observe the present refrigerant setting and measure the 4-20 mA output signal.

- 1 flash of Green LED - output signal is ~ 5 mA = R717 (factory setting)
- 2 flashes of Green LED - output signal is ~ 6 mA = R22
- 3 flashes of Green LED - output signal is ~ 7 mA = R404A
- 4 flashes of Green LED - output signal is ~ 8 mA = R134a
- 5 flashes of Green LED - output signal is ~ 9 mA = R744

3. Activate the calibration pushbutton to select required refrigerant. Each activating will cause AKS 41 / 41U to step to next refrigerant according to below sequence:  
 ~ 5 mA = R717 or R718 (factory setting)  
 ~ 6 mA = R22  
 ~ 7 mA = R404A  
 ~ 8 mA = R134a  
 ~ 9 mA = R744

4. When the current corresponds to the required refrigerant, wait 10 seconds until the green LED is constant ON (not flashing). This indicates that the required refrigerant has been selected.

5. To leave the setting mode isolate the voltage supply to the level transmitter.

Go through step 1, 2 and 5 if you wish to control the setting.

**Signal damping**

Signal damping is factory-set at 15 seconds. This setting can be altered by activating the calibration switch (see page 4). The setting range is 1 to 120 seconds.

Settings can also be made whilst the system is operating.

**Procedure:**

1. *Connect the supply voltage.*
2. *Push the calibration pushbutton once for each second by which you want to increase the damping.*

Example:

- 1. push           ⇒ 1 sec.
- 2. pushes        ⇒ 2 sec.
- etc.
- 120. pushes     ⇒ 120 sec.
- 121. pushes     ⇒ 120 sec.

10 seconds after the last push, the value will be saved in the memory and the green LED will start flashing again.

After 10 seconds, a further push will start 1-second signal damping again. (If the damping setting is set too high, restart the procedure from step 1).

**Calibration of the AKS 41 / 41U**

AKS 41 / 41U will not need calibration if it is installed in refrigerant which is defined in AKS 41 / 41U and the ordered length corresponds to actual refrigerant measuring range.

Calibration of the AKS 41 / 41U may be relevant:-

- If the default setting does not fit and the max. /min. calibration points have to be adjusted.
- If the AKS 41 / 41U is used in a refrigerant, not already defined in AKS 41 / 41U.
- If the electronic head is replaced on an existing AKS 41 / 41U sensor.

Default factory setting is:  
 0% (AKS 41 / 41U free of liquid) output signal: 4 mA  
 100% (AKS 41 / 41U fully covered by liquid) output signal: 20 mA

The max. /min. points can be set to any value.

Usually the min. calibration point is chosen to be 4 mA and the max. calibration point to be 20 mA, but it is also possible to calibrate the transmitter at other calibration points.

This opportunity can be useful when calibrating on a plant with no possibility of bringing the level to the limit points.

**Adjusting the min. /max. calibration points:**

**Min. calibration:**

1. *Bring the refrigerant liquid level to desired minimum level.*
2. *Press the calibration pushbutton and keep it activated in approx. 5 seconds, until green LED stops flashing.*
3. *Activate, within the next 10 seconds, the calibration pushbutton once (If calibration pushbutton is not activated within 10 seconds, it will automatically leave calibration mode and return to normal operation)*

Green LED is ON in a few seconds, and then flashing.

Output is now 4 mA and AKS 41 / 41U is in normal operation

**Max. calibration:**

1. *Bring the refrigerant liquid level to desired maximum level.*
2. *Press the calibration pushbutton and keep it activated in approx. 5 seconds, until green LED stops flashing.*
3. *Activate, within the next 10 seconds, the calibration pushbutton twice (If calibration pushbutton is not activated within 10 seconds, it will automatically leave calibration mode and return to normal operation)*

Green LED is ON in a few seconds, and then flashing.

Output is now 20 mA and AKS 41 / 41U is in normal operation

Continued next page....

**Calibration of the AKS 41 / 41U**

(Continued)

**Min. calibration when minimum refrigerant level must be different from 4 mA:**

1. Bring the refrigerant liquid level to desired minimum level.
2. Press the calibration pushbutton and keep it activated in approx. 5 seconds, until green LED stops flashing.
3. Activate, within the next 10 seconds, the calibration pushbutton once and keep it activated. (If calibration pushbutton is not activated within 10 seconds, it will automatically leave calibration mode and return to normal operation)
4. Observe the output mA signal increasing fast starting at 4 mA.
5. Release the calibration pushbutton when the output signal is approx. 0.5 mA from the desired point.
6. All the next activations will increase the output signal by approx. 0.05 mA
7. Approx. 10 seconds after the latest activation the LED starts flashing
8. Output now corresponds to the value measured at the latest activation.

**Max. calibration when maximum refrigerant level must be different from 20 mA:**

1. Bring the refrigerant liquid level to desired maximum level.
2. Press the calibration pushbutton and keep it activated in approx. 5 seconds, until green LED stops flashing.
3. Activate, within the next 10 seconds, the calibration pushbutton twice and keep it activated. (If calibration pushbutton is not activated within 10 seconds, it will automatically leave calibration mode and return to normal operation)
4. Observe the output mA signal decreasing fast starting at 20 mA.
5. Release the calibration pushbutton when the output signal is approx. 0.5 mA from the desired point.
6. All the next activations will decrease the output signal by approx. 0.05 mA
7. Approx. 10 seconds after the latest activation the LED starts flashing
8. Output now corresponds to the value measured at the latest activation.

**Reset to factory setting**

AKS 41 / 41U can always be reset to factory setting regardless of any revised calibration values.

1. Press the calibration pushbutton and keep it activated in min. 20 seconds, until green LED starts flashing.
2. Release the calibration pushbutton.
3. When LED starts flashing, reset to factory setting is completed.

AKS 41 / 41U is now operating according to the factory settings.

**Green LED indication**

When voltage is applied the LED will flash rapidly as many times as it has been calibrated through its lifetime.

**Please note:** The current mA output is activated as soon as the flashing sequence has changed from rapid to slowly flashing.

*Normal operation:*

At normal operation the Green LED will be flashing slowly.

Generally the Green LED is ON every time calibration pushbutton is activated.

*Calibration mode*

In calibration mode (Press the calibration pushbutton and keep it activated in approx. 5 seconds) the Green LED is OFF.

*Change of refrigerant*

In refrigeration mode setting (Push the calibration pushbutton and keep it pressed while 24 V a.c. is connected and then release the pushbutton) the green LED is OFF until the pushbutton is released.

After this the green LED will flash according to the type of refrigerant.

When the refrigerant has been selected, the green LED is constantly ON.

**Ordering - AKS 41**

Type	Length		Measuring range		AKS 41 without Bargraph Code no.	AKS 41 with Bargraph Code no.
	mm	in.	mm	in.		
AKS 41-3	280	11.02	207	8.1	<b>084H4053</b>	<b>084H4153</b>
AKS 41-5	500	19.69	427	16.8	<b>084H4055</b>	<b>084H4155</b>
AKS 41-8	800	31.5	727	28.6	<b>084H4058</b>	<b>084H4158</b>
AKS 41-10	1000	39.37	927	36.5	<b>084H4060</b>	<b>084H4160</b>
AKS 41-12	1200	47.24	1127	44.4	<b>084H4062</b>	<b>084H4162</b>
AKS 41-15	1500	59.06	1427	56.2	<b>084H4065</b>	<b>084H4165</b>
AKS 41-17	1700	66.93	1627	64.1	<b>084H4067</b>	<b>084H4167</b>
AKS 41-22	2200	86.61	2127	83.7	<b>084H4072</b>	<b>084H4172</b>
AKS 41-30	3000	118.1	2927	115.2	<b>084H4080</b>	<b>084H4180</b>

**Ordering - accessories**

AKS 41 only:	Code no.
Alu-gasket, 10 pcs. 1" connection	<b>084H4081</b> <b>027F1010</b>

AKS 41 and AKS 41U:	Without Bargraph indication Code no.	With Bargraph indication Code no.
Electronic top part <sup>1)</sup>	<b>084H4150</b>	<b>084H4151</b>

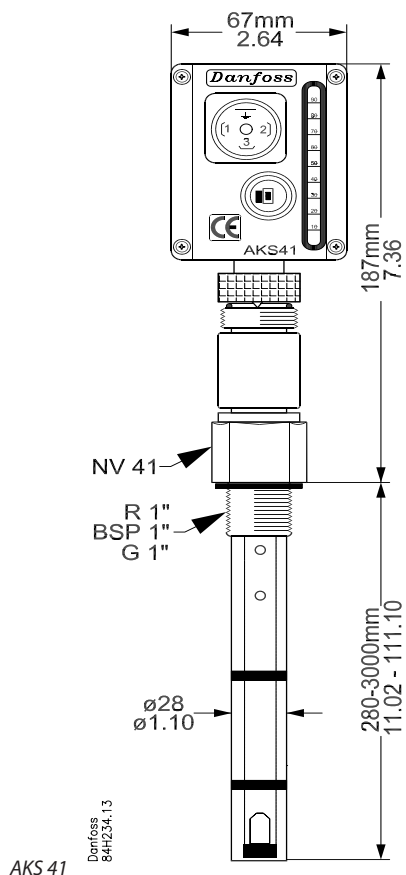
<sup>1)</sup> Must always be calibrated when mounted on actual sensor rod

**Ordering - AKS 41U**

Type	Length		Measuring range		AKS 41U without Bargraph Code no.	AKS 41U with Bargraph Code no.
	in.	mm	in.	mm		
AKS 41U-6"	6	152	3.13	79	<b>084H4100</b>	<b>084H4101</b>
AKS 41U-8"	8	203	5.13	130	<b>084H4102</b>	<b>084H4103</b>
AKS 41U-12"	12	305	9.13	232	<b>084H4104</b>	<b>084H4105</b>
AKS 41U-15.3"	15.3	389	12.43	316	<b>084H4106</b>	<b>084H4107</b>
AKS 41U-19.2"	19.2	488	16.33	415	<b>084H4108</b>	<b>084H4109</b>
AKS 41U-23.1"	23.1	587	20.23	514	<b>084H4110</b>	<b>084H4111</b>
AKS 41U-30"	30	762	27.13	689	<b>084H4112</b>	<b>084H4113</b>
AKS 41U-35"	35	889	32.13	816	<b>084H4114</b>	<b>084H4115</b>
AKS 41U-45"	45	1143	42.13	1070	<b>084H4116</b>	<b>084H4117</b>
AKS 41U-55"	55	1397	52.13	1324	<b>084H4118</b>	<b>084H4119</b>
AKS 41U-65"	65	1651	62.13	1578	<b>084H4122</b>	<b>084H4123</b>
AKS 41U-85"	85	2159	82.13	2086	<b>084H4126</b>	<b>084H4127</b>
AKS 41U-105"	105	2667	102.13	2594	<b>084H4130</b>	<b>084H4131</b>
AKS 41U-120"	125	3048	119.25	3029	<b>084H4132</b>	<b>084H4133</b>

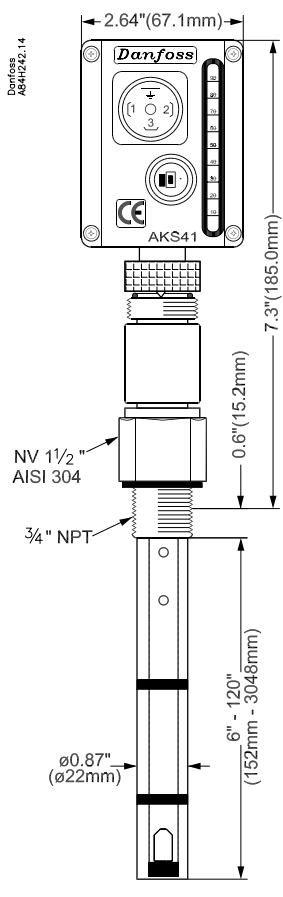


**AKS 41**  
Dimensions and weights



Type	Insertion length	Weight kg / lb
AKS 41-3	280 mm (11.02")	1.7 / 3.7
AKS 41-5	500 mm (19.69")	2.0 / 4.4
AKS 41-8	800 mm (31.50")	2.4 / 5.3
AKS 41-10	1000 mm (39.37")	2.7 / 6.0
AKS 41-12	1200 mm (47.24")	3.1 / 6.8
AKS 41-15	1500 mm (59.06")	3.5 / 7.7
AKS 41-17	1700 mm (66.93")	3.8 / 8.4
AKS 41-22	2200 mm (86.61")	4.6 / 10.1
AKS 41-30	3000 mm (118.10")	5.8 / 12.8

**AKS 41U**  
Dimensions and weights



Type	Insertion length	Weight lb / kg
AKS 41U-6"	6" (152 mm)	2.9 / 1.32
AKS 41U-8"	8" (203 mm)	3.1 / 1.41
AKS 41U-12"	12" (305 mm)	3.4 / 1.55
AKS 41U-15.3"	15.3" (389 mm)	3.8 / 1.72
AKS 41U-19.2"	19.2" (488 mm)	4.0 / 1.82
AKS 41U-23.1"	23.1" (587 mm)	4.3 / 1.96
AKS 41U-30"	30" (762 mm)	4.9 / 2.22
AKS 41U-35"	35" (889 mm)	5.2 / 2.38
AKS 41U-45"	45" (1143 mm)	6.0 / 2.71
AKS 41U-55"	55" (1397 mm)	6.8 / 3.1
AKS 41U-65"	65" (1651 mm)	7.7 / 3.5
AKS 41U-85"	85" (2159 mm)	9.5 / 4.3
AKS 41U-105"	105" (2667 mm)	10.9 / 4.93
AKS 41U-120"	120" (3048 mm)	12.6 / 5.7

AKS 41U





