

Danfoss



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

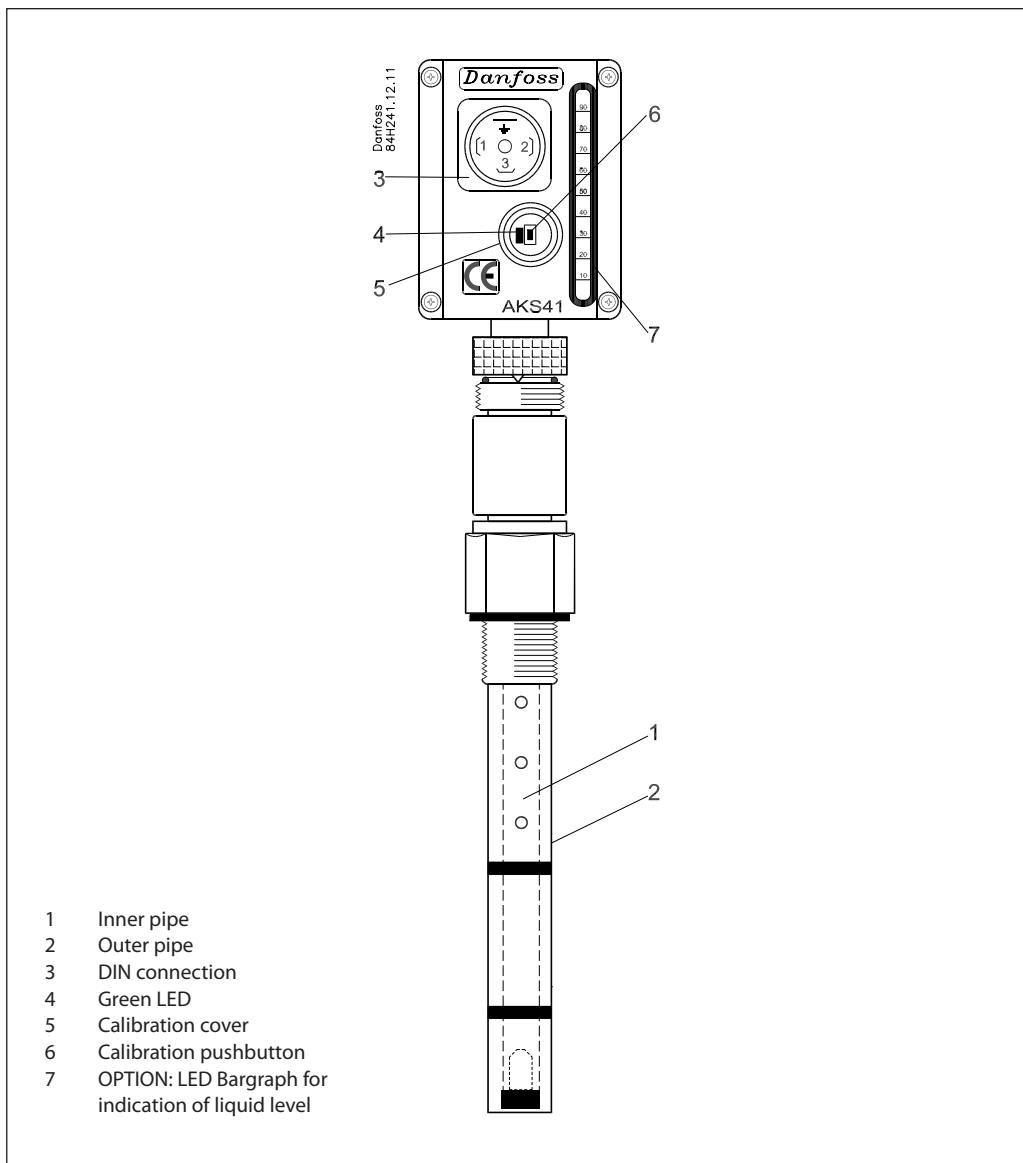
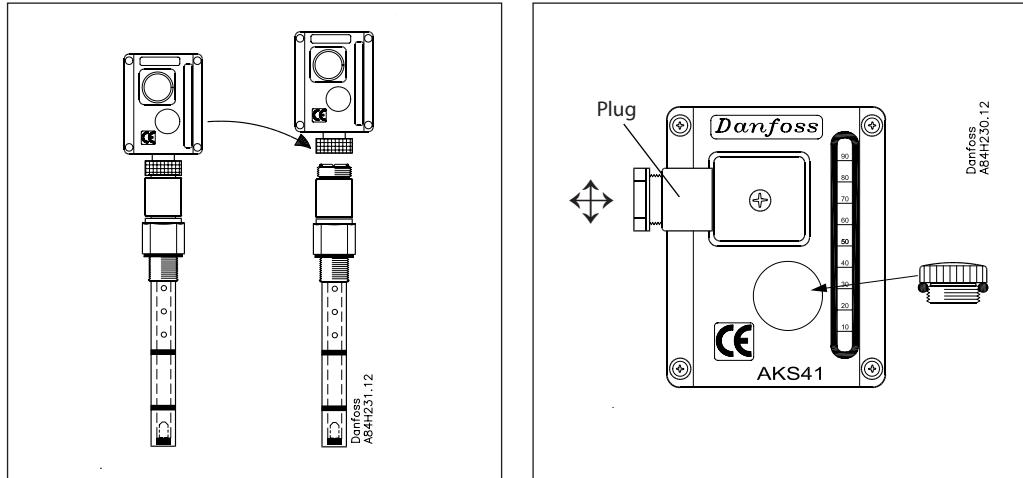
- *"Plug and Play"*: no calibration required.
- *Service friendly*: electronic head and sensor tube can be separated without emptying the standpipe.
- *Damping of output signal available*.
- *Improved calibration*: AKS 41 / 41U range/signal output can be adapted to suit the actual application.
- AKS 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_2O) - 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.



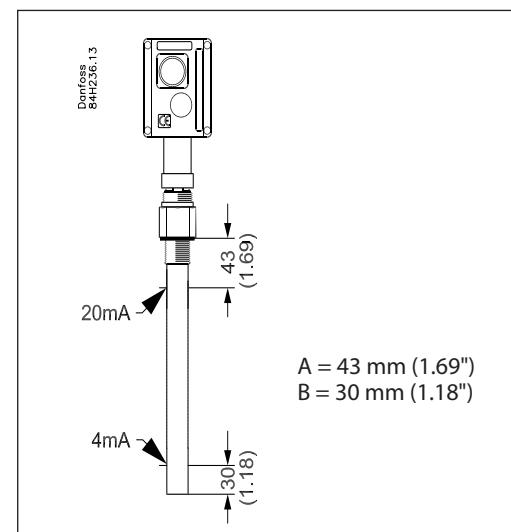
Function and factory setting

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_3), 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_3) / R718 (H_2O)**

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

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

Ordering - accessories

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

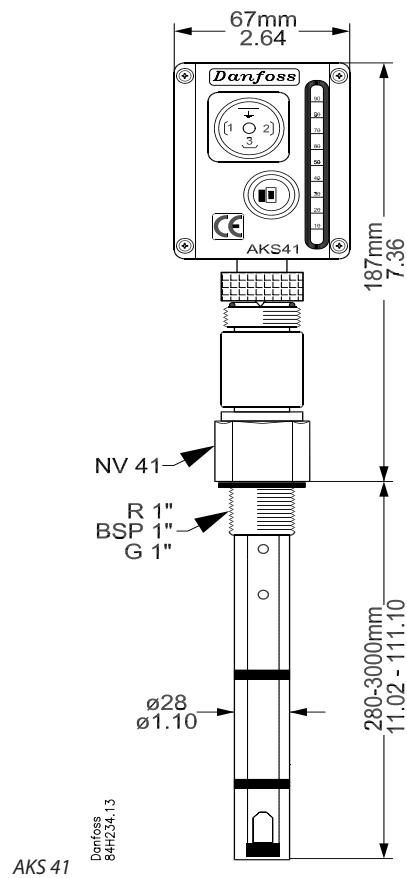
AKS 41 and AKS 41U:

Without Bargraph indication Code no.	With Bargraph indication Code no.
084H4150	084H4151

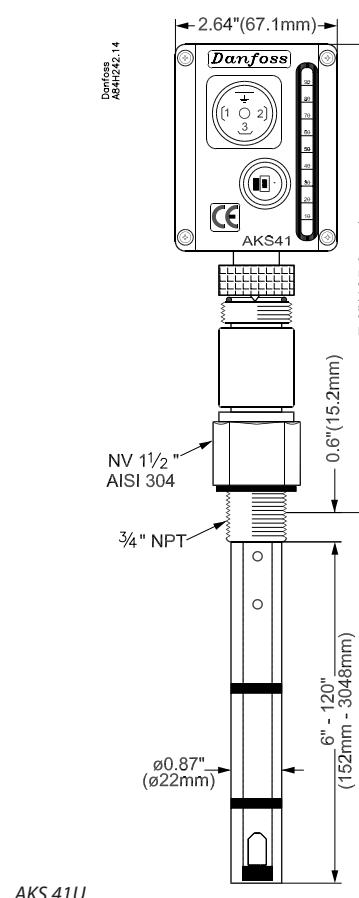
¹⁾ Must always be calibrated when mounted on actual sensor rod

Ordering - AKS 41U

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

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

