Technical brochure

Liquid Level Sensor AKS 4100/4100U

AKS 4100/4100U - Cable Version

AKS 4100/4100U - Coaxial Version

The AKS 4100/4100U liquid level sensor is designed specifically to measure liquid levels in a wide range of refrigeration applications.

The AKS 4100/4100U liquid level sensor is based on a proven techhology called Time Domain Reflectometry (TDR) or Guided Micro Wave.

AKS 4100/4100U liquid level sensor can be used to measure the liquid level of many different refrigerants in vessels, accumulators, receivers, standpipes, etc.

The electrical output is a 2-wired, loop powered 4-20 mA output signal, which is proportional to the refrigerant liquid level.

AKS 4100/4100U in a cable version is suitable for most commonly used refrigerants, including R717(ammonia), HCFC, HFC and non corrosive gases/ liquids except CO_2, and differing lengths from 800 mm(31.5 in.) and up to 5000 mm (197 in.).

The coaxial version of AKS 4100/4100U is designed for use with CO_2. It can also be used for all other appoved commonly used refrigerants.

The AKS 4100/4100U coaxial version should always be used for marine applications for all refrigerant types.

The AKS 4100/4100U cable version should NOT be used for CO_2 or marine applications.

Dust, foam, vapour, agitated surfaces, boiling surfaces, changes in density or in the dielectric constant , εr, for the liquid have no influence on the AKS 4100/4100U performance.

Oil accumulated in the bottom of a standpipe will not disturb the liquid level signal and it is not necessary to remove AKS 4100/4100U for cleaning after oil has been drained out of the standpipe.

Features

- Approved and qualified by Danfoss for refrigeration applications
- One product covering several probe lengths (cable version)
- A single product for all commonly used refrigerants (cable version)
- Cable version requires less top-end clearance for installation and service
- Proven operation with all refrigerants in combination with oil.
- No need to clean cable version when fully covered by oil.
- The cable version is very compact and easy to handle, ship, install and use with different lengths and refrigerants
- Changes of the liquid dielectric constant (εr) do not affect operation.
- 5000 mm (197 in.) probe length with cable version
- 2-wire loop powered; no separate transformer needed.

  Please Note:
  If used together with Danfoss EKC 347 Level Controller, a 14-30 V d.c supply is required.
- Multi language HMI.
  Level and setting readout in mm,cm,m(ft, in.)

For further details regarding mechanical and electrical installation please refer to the product instructions PI.SC0.D (CABLE version) and PI.SC0.E (COAXIAL version).

Contents **Page**

Product concept

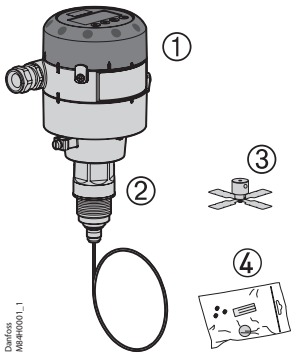
AKS 4100/4100U is available in two different versions:

- Cable version
- Coaxial version

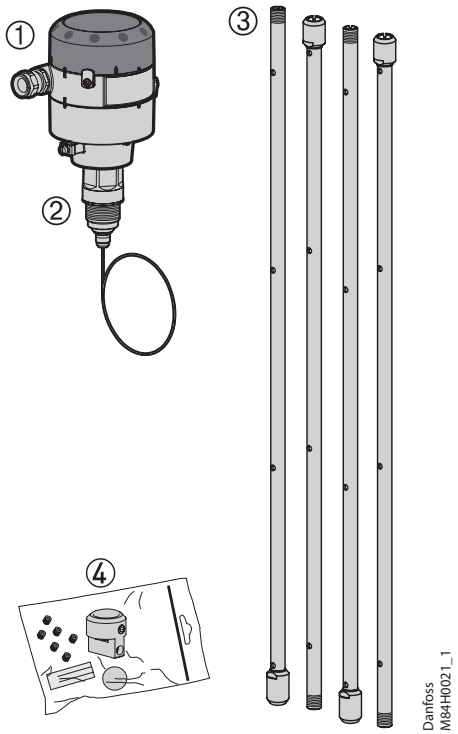
Both Cable and Coaxial versions are available with two different mechanical process connections:

- AKS 4100: G1 in. pipe thread. Aluminium gasket included
- AKS 4100U: ¾ in. NPT

CABLE version:



COAXIAL version:



Cable version

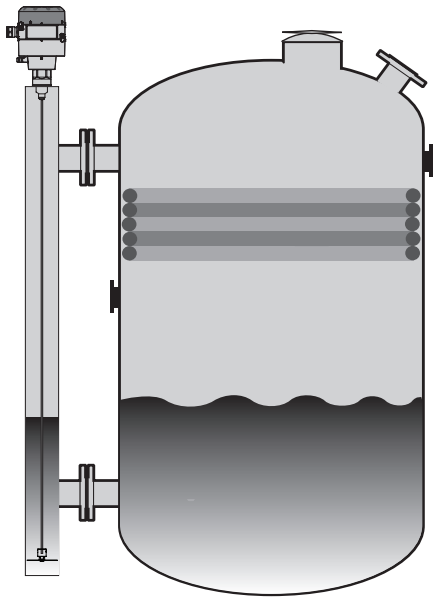
Cable version

The cable version consists of:

① Signal converter, which can be supplied with or without HMI
② Mechanical process connection with 5 m (197 in.) ø2 mm (0.08 in.) stainless cable
③ Counterweight
④ Accessory bag comprising:
3 mm set screws
Red cover to protect mechanical process connection ② prior to mounting signal converter.
Setting label.

With the cable version it is possible to adapt the AKS 4100/4100U to any possible length in the range of 800 mm (31.5 in.) to 5000 mm (196.9 in.)

AKS 4100/4100U cable version must ALWAYS be installed in a standpipe.



Coaxial version

Coaxial version

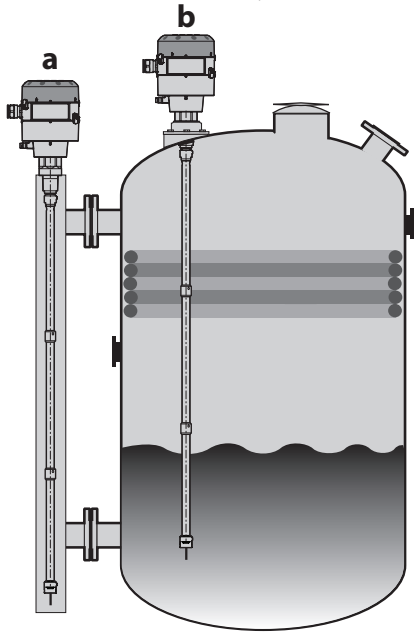
The Coaxial version consists of:

① Signal Converter (with or without HMI)
② Mechanical process connection with 5 m (197 in.) Ø2 mm (0.08 in.) stainless wire
③ Tube(s) depending on required length
④ Accessory bag comprising:
End Connector (incl. 3 mm (0.12 in.) set screws.)
3 mm (0.12 in.) set crews (1 set screw pr. tube)
Red cover to protect mechanical process connection ②, before Signal Converter is mounted.
Setting label.

The coaxial version is available in the following probe lengths:

- AKS 4100, 500 mm
- AKS 4100, 800 mm
- AKS 4100, 1000 mm
- AKS 4100, 1200 mm
- AKS 4100, 1500 mm
- AKS 4100, 1700 mm
- AKS 4100, 2200 mm
- AKS 4100U, 19.2 in.
- AKS 4100U, 30 in.
- AKS 4100U, 45 in.
- AKS 4100U, 55 in.
- AKS 4100U, 65 in.
- AKS 4100U, 85 in.

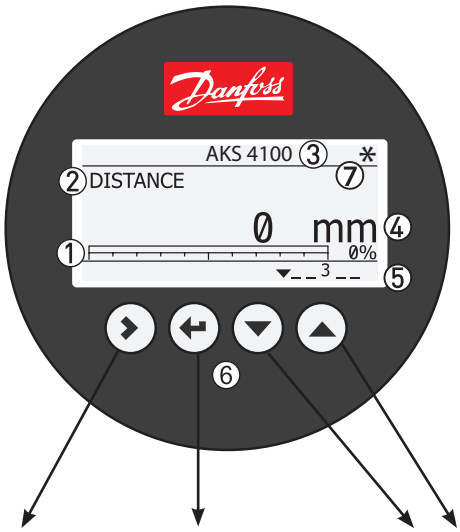
AKS 4100/4100U, Coaxial can be installed in a standpipe (a) or directly in a vessel (b).



Optional HMI

The optional HMI Service/Display unit is used for commissioning and quick on-site setup and is easily mounted on the AKS 4100/4100U.

The service unit supports mulitple languages in both SI and US units.
Supported standard languages:
English (default), German, French, Spanish



① 4-20 mA output displayed as bar graph and in percentage [%]
② Measurement name (in this example, DISTANCE)
③ Device tag name
④ Measurement reading and unit
⑤ Device status (markers)
1 = Hardware problem (any hardware problem making the device unable to provide a correct measurement (communication, memory problem…)
2 = No Reference Pulse
3 = Low Voltage or Measurement Old
4 = Level Lost
⑥ Keypad buttons
⑦ Flashing star indicating unit in operation.

Enter menu system
Enter QUICK SETUP

Unit change at distance/level readout:
m, cm, mm, in, ft

Change between:
Distance*
Level**
Output (%)***
Output (mA)****

* DISTANCE is a display option.
If the display is set to "DISTANCE" the displayed value will be the distance from the Reference point to the top surface of the liquid refrigerant (see page 7 and 8).

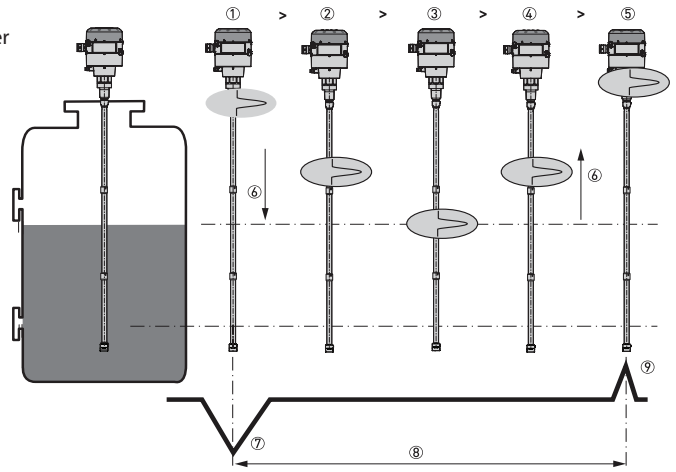
** LEVEL is display option.
If the display is set to "LEVEL" then the value displayed will be:
PROBE LENGTH (entered in QUICK SETUP) – DISTANCE (see page 7 and 8).

*** OUTPUT (%) is display option.
Will represent the level of refrigerant,in percent, scaled (entered in QUICK SETUP) according to: SCALE 4 mA (0%), SCALE 20 mA (100%) (see page 7 and 8)

**** OUTPUT I (mA) is display option.
Will represent the level of refrigerant,in 4-20 milliampere, scaled (entered in QUICK SETUP) according to: SCALE 4 mA (4 mA), SCALE 20 mA (20 mA) (see page 7 and 8).

Measuring principle (Cable and Coaxial)

1. The electromagnetic (EM) pulse is transmitted by the signal converter
2. The pulse goes down the probe at the speed of light in air, V1
3. The pulse is reflected
4. The pulse goes up the probe at speed, V1
5. The converter receives the pulse and records the signal
6. The EM pulse moves at speed, V1
7. Transmitted EM pulse
8. Half of this time is equivalent to the distance from the reference point of the device (the flange facing) to the surface of the product
9. Received EM pulse



The AKS 4100/4100U electronic converter emits low-intensity, high frequency electromagnetic pulses with a width of approximately 1 nanosecond, which travel at the speed of light along the probe (wire or coaxial cable) down to the liquid surface.

The pulses are reflected by the liquid surface, guided back along the probe, and received and analysed by the AKS 4100/4100U electronic converter and then converted into a liquid level reading. This method is called time domain reflectometry (TDR) or guided microwave.

The dielectric constant, εr, of the liquid is a key parameter and has a direct impact on the degree of reflection of the high frequency electromagnetic pulses. Liquids with high εr values, such as ammonia, produce strong reflections, while liquids with low εr values, such as CO_2, produce weak reflections.

As long as the εr value of the liquid refrigerant is higher than 1.2, AKS 4100/4100U can detect the liquid level and level measurement accuracy is not affected.

If the temperature condition in the standpipe/ vessel is known, a constant (dielectric constant of the refrigerant gas) can be entered (parameter 2.5.3 GAS EPS.R), in order to obtain improved Top and Bottom Dead Zone values.

Refer to pages 7 to 8 for Measuring range of AKS 4100/4100U - CABLE version and COAXIAL version.

For details of gas constant values for different temperatures and refrigerants plus the procedure for entering these via the HMI, refer to pages 13 to 16.

Main technical data

(see a complete list of all technical data on page 11)

Supply Voltage
14-30 V d.c. Min/Max. Value for an output of 22 mA at the terminal.

Ambient temperature supply voltage limitations:
-40°C/+80°C(–40°F / +176°F) : 16-30 V d.c.
-20°C/+80°C(–4°F / +176°F) : 14-30 V d.c.

Load
RL [Ω] ≤ ((Uext -14 V)/20 mA).
– Default (Error output set to 3.6 mA)
RL [Ω] ≤ ((Uext -14 V)/22 mA).
– (Error output set to 22 mA)

Cable gland
AKS 4100 PG 13, M20×1.5 ;
(cable diameter: 6-8 mm (0.24-0.31in.)
AKS 4100U ½ in. NPT

Refrigerant temperature
–60°C/100°C (–76°F/212°F)

Ambient temperature
–40°C / +80°C (–40°F / +176°F)
For HMI : –20°C / +60°C (–4°F / +140°F)

Process pressure
–1 barg / 100 barg (–14.5 psig / 1450 psig)

Terminals (spring loaded)
0.5-1.5 mm^2 (~20-15 AWG)

Enclosure:
IP 66/67 (~NEMA type 4X)

Mechanical connection
Cable version/Coaxial version:
AKS 4100: G1 in. pipe thread.
Aluminium gasket included
AKS 4100U: ¾ in. NPT

Refrigerants
The listed refrigerants are qualified and approved by Danfoss
R717 / NH_3 –40°C / +50°C (–40°F / +122°F)
R744 / CO_2 –50°C / +15°C (–58°F / +59°F)

HCFC: R22 –50°C / +48°C (–58°F / +118°F)
HFC: R404A –50°C/ +15°C (–58°F / +59°F)
R410A –50°C /+15°C (–58°F / +59°F)
R134A –40°C /+50°C (–40°F /+122°F)

The listed refrigerants may be used in the complete temperature range of AKS 4100/4100U, however, the accuracy may be affected if the above listed temperature range is exceeded.

Other refrigerants within the groups of HCFC and HFC can be detected and measured if the following conditions are fulfilled:

Reference conditions
Dielectric constant
Cable version to be used in R717 / NH_3, HCFC and HFC
εr, liquid > 5.6

The coaxial version is mandatory for R744 / CO_2
εr, liquid > 1.3 and marine applications.

The coaxial version can also be used in
R717 / NH_3, HCFC and HFC.

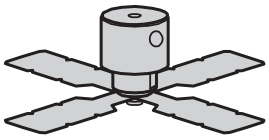
Measuring range of AKS 4100/4100U - CABLE version

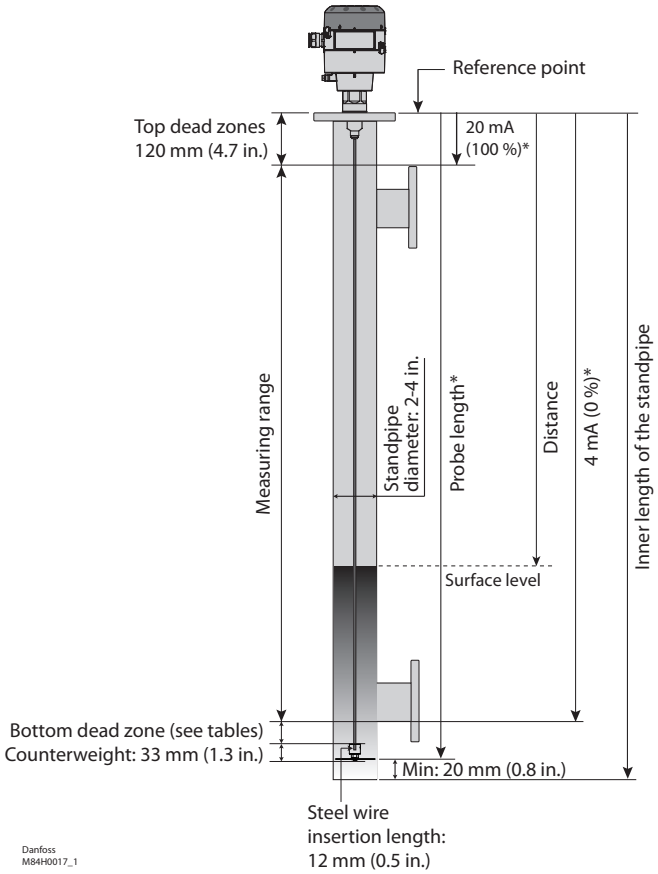
Bottom deadzone values based on the factory setting of dielectric constant

Refrigerant	Probe length range		Bottom dead zone	
	[mm]	[in.]	[mm]	[in.]
Ammonia, HFC, HCFC	800	31.5	115	4.2
	801 - 999	31.5 - 39	120	4.7
	1000 - 1999	39 - 79	150	5.9
	2000 - 2999	79 - 118	180	7.1
	3000 - 3999	118 - 157	210	8.3
	4000 - 5000	157 - 197	240	9.4

Improved Bottom dead zone values after the adjustment of dielectric constant

Refrigerant	Probe length range		Bottom dead zone	
	[mm]	[in.]	[mm]	[in.]
Ammonia, HFC, HCFC	800 - 5000	31.5 - 197	90	3.5





* Values to be entered into HMI Quick Setup menu and recorded on the setting label.
Stick the setting label onto the Signal Converter either inside or outside.

Measuring range of AKS 4100/4100U - COAXIAL version

Please note: It is mandatory to input dielectric constant for CO_2 applications.

AKS 4100

Dielectric Constant εr always set during Quick Setup

Refrigerant	Probe Length [mm]	Probe Length [in.]	Bottom Dead Zone [mm]	Bottom Dead Zone [in.]
CO_2	500	19.7	170	6.7
	800	31.5		
	1000	39.4		
	1200	47.2		
	1500	59.1		
	1700	66.9		
	2200	86.6		

Factory setting

Refrigerant	Probe Length [mm]	Probe Length [in.]	Bottom Dead Zone [mm]	Bottom Dead Zone [in.]
Ammonia	500	19.7	95	3.7
	800	31.5	104	4.1
	1000	39.4	110	4.3
	1200	47.2	116	4.6
	1500	59.1	125	4.9
	1700	66.9	131	5.2
	2200	86.6	146	5.8

Improved Bottom dead zone values after the adjustment of dielectric constant

Refrigerant	Probe Length [mm]	Probe Length [in.]	Bottom Dead Zone [mm]	Bottom Dead Zone [in.]
Ammonia	500	19.7	80	3.2
	800	31.5		
	1000	39.4		
	1200	47.2		
	1500	59.1		
	1700	66.9		
	2200	86.6		

Factory setting

Refrigerant	Probe Length [mm]	Probe Length [in.]	Bottom Dead Zone [mm]	Bottom Dead Zone [in.]
HCFC,HFC	500	19.7	115	4.5
	800	31.5	124	4.9
	1000	39.4	130	5.1
	1200	47.2	136	5.4
	1500	59.1	145	5.7
	1700	66.9	151	5.9
	2200	86.6	166	6.5

Improved Bottom dead zone values after the adjustment of dielectric constant

Refrigerant	Probe Length [mm]	Probe Length [in.]	Bottom Dead Zone [mm]	Bottom Dead Zone [in.]
HCFC,HFC	500	19.7	100	3.9
	800	31.5		
	1000	39.4		
	1200	47.2		
	1500	59.1		
	1700	66.9		
	2200	86.6		

AKS 4100U

Dielectric Constant εr always set during Quick Setup

Refrigerant	Probe Length [in.]	Bottom Dead Zone [in.]	Bottom Dead Zone [mm]
CO_2	19.2	6.7	170
	30		
	45		
	55		
	65		
	85		

Factory setting

Refrigerant	Probe Length [in.]	Bottom Dead Zone [in.]	Bottom Dead Zone [mm]
Ammonia	19.2	3.73	95
	30	4.05	103
	45	4.50	114
	55	4.80	122
	65	5.10	130
	85	5.70	145

Improved Bottom dead zone values after the adjustment of dielectric constant

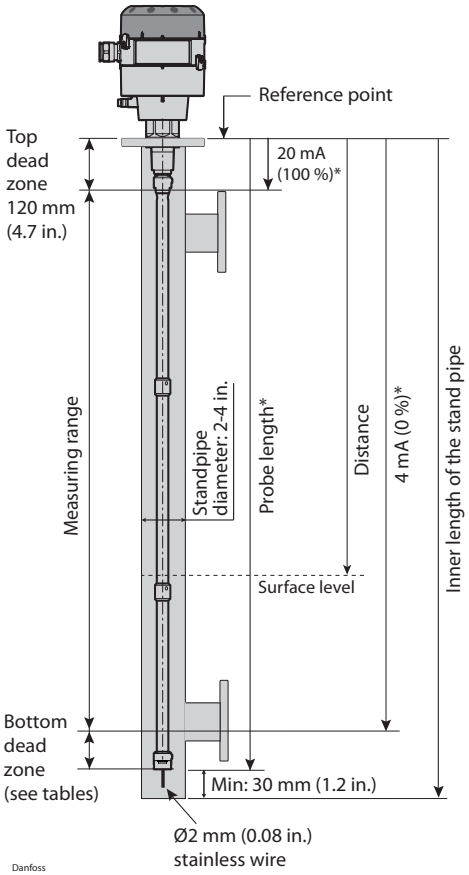
Refrigerant	Probe Length [in.]	Bottom Dead Zone [in.]	Bottom Dead Zone [mm]
Ammonia	19.2	3.1	80
	30		
	45		
	55		
	65		
	85		

Factory setting

Refrigerant	Probe Length [in.]	Bottom Dead Zone [in.]	Bottom Dead Zone [mm]
HCFC,HFC	19.2	4.52	115
	30	4.84	123
	45	5.29	134
	55	5.59	142
	65	5.89	150
	85	6.49	165

Improved Bottom dead zone values after the adjustment of dielectric constant

Refrigerant	Probe Length [in.]	Bottom Dead Zone [in.]	Bottom Dead Zone [mm]
HCFC,HFC	19.2	3.94	100
	30		
	45		
	55		
	65		
	85		



* Values to be entered into HMI Quick Setup menu and recorded on the setting label.
Stick the setting label onto the Signal Converter either inside or outside.

Ordering AKS 4100/4100U

*** When ordering without HMI please observe:**

Each AKS 4100/AKS 4100 must always be programmed via the HMI display unit.

The HMI display unit can be ordered separately and there are two possibilities:

- **084H4540**
  AKS 4100/4100U HMI display unit with rear cover and mounting bracket.
  The mounting bracket is very useful when the AKS 4100/4100U have to be programmed.
  The same AKS 4100/4100U HMI display unit can be used to programme more AKS 4100/4100U and both Cable and Coaxial versions.
- **084H4548**
  AKS 4100/4100U HMI display unit (usually spare part).

Cable *version - AKS 4100/4100U*

Description	Code number With HMI	Code number Without HMI*
AKS 4100 with 5 m (197 in.) Ø2 mm (Ø0.08 in.) stainless cable and counterweight	**084H4501**	**084H4500**
AKS 4100U with 5 m (197 in.) Ø2 mm (Ø0.08 in.) stainless cable and counterweight	**084H4521**	**084H4520**

Coaxial *version - AKS 4100/4100U (available in predefined lengths, with or without HMI)*

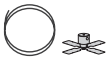
Description	Probe length mm	Probe length in.	Code number With HMI	Code number Without HMI*
AKS 4100 - Coaxial	500		**084H4510**	**084H4503**
AKS 4100 - Coaxial	800		**084H4511**	**084H4504**
AKS 4100 - Coaxial	1000		**084H4512**	**084H4505**
AKS 4100 - Coaxial	1200		**084H4513**	**084H4506**
AKS 4100 - Coaxial	1500		**084H4514**	**084H4507**
AKS 4100 - Coaxial	1700		**084H4515**	**084H4508**
AKS 4100 - Coaxial	2200		**084H4516**	**084H4509**
AKS 4100U - Coaxial		19.2	**084H4530**	**084H4524**
AKS 4100U - Coaxial		30	**084H4531**	**084H4525**
AKS 4100U - Coaxial		45	**084H4532**	**084H4526**
AKS 4100U - Coaxial		55	**084H4533**	**084H4527**
AKS 4100U - Coaxial		65	**084H4534**	**084H4528**
AKS 4100U - Coaxial		85	**084H4535**	**084H4529**

Accessories

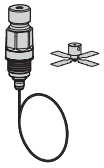
Description	Code number
AKS 4100/4100U HMI Service/Display unit with rear cover and mounting bracket	**084H4540**
AKS 4100/4100U HMI Display	**084H4548**

Description	Code number
AKS 4100/4100U Signal Converter **without** HMI, excluding cable gland	**084H4541**

Service kits



Description	Content	Code number
Cable and counterweight for **AKS 4100/4100U** - CABLE version	Cable - 5 m (197 in.) Ø2 mm (Ø0.08 in.)	**084H4542**
	Crimp	
	Counterweight	
End connector incl screws for **AKS 4100/4100U** - COAXIAL version	End connector (incl. 3 mm (0.12 in) set screws)	**084H4549**



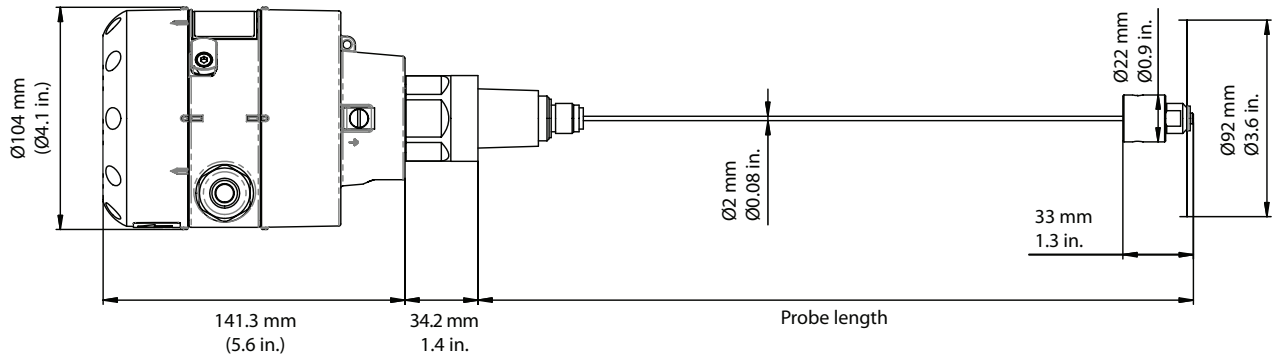
Process connection, counterweight and 5 m (197 in.) Ø2 mm (Ø0.08 in.) cable for **AKS 4100** - CABLE and COAXIAL version	1in. process connection	**084H4545**
	Counterweight	
Process connection, counterweight and 5 m (197 in.) Ø2 mm (Ø0.08 in.) cable for **AKS 4100U** - CABLE and COAXIAL version	3/4in. NPT process connection	**084H4546**
	Counterweight	

Other spare parts

Description	Code number
AKS 4100/4100U Coaxial tube. Tube length : 680 mm (26.8 in.)	**084H4543**
AKS 4100/4100U blank top cover for signal converter	**084H4544**
AKS 4100/4100U Aluminium gaskets (10 pcs.) for 1in. process connection	**084H4547**
AKS 4100 1. in. welding connection	**027F1010**

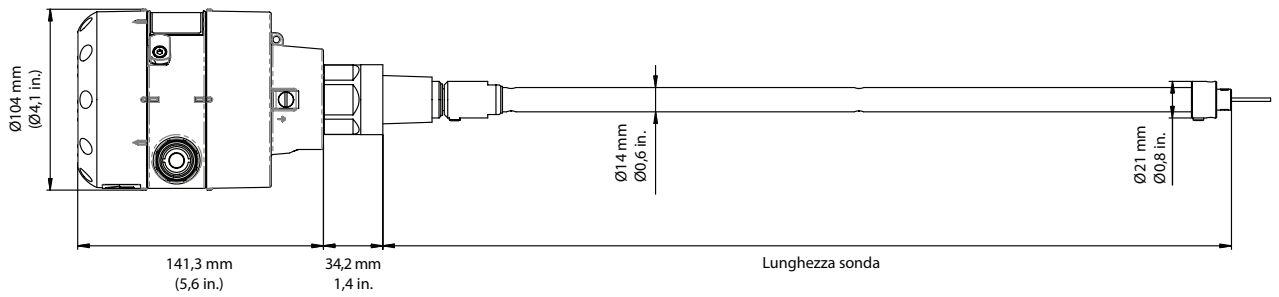
Dimensions and weights

CABLE version



Weight: approx. 2.0 kg (4.4 lbs)

COAXIAL version



Weight: approx. 3.5 kg (7.7 lbs)

Technical data

Measuring system

Measuring principle	2-wire loop-powered level transmitter; Time Domain Reflectometry (TDR)
Application range	Level measurement of liquid refrigerants. Approved refrigerants: Halogen Free / Environmently friendly: R717 / NH_3, R744 / CO_2 HCFC: R22 HFC: R404A, R410A, R134A
Primary measured value	Time between the emitted and received signal
Secondary measured value	Distance or level

Design

Options	**Probe types** *Cable* Mechanical process connection with 5 m (197 in.) Ø2 mm (0.08 in.) stainless cable: Mechanical thread on the mechanical process connection AKS 4100: G1 in. pipe thread. Aluminium gasket included AKS 4100U: ¾ in. NPT *Coaxial* Mechanical process connection with 5 m (197 in.) Ø2 mm (0.08 in.) stainless cable: Mechanical thread on the mechanical process connection AKS 4100: G1 in. pipe thread. Aluminium gasket included AKS 4100U: ¾ in. NPT Stainless steel tubes supporting the available probe length
	LCD display
Max. measuring range	Coaxial AKS 4100: 500, 800, 1000, 1200, 1500, 1700 and 2200 mm AKS 4100U: 19.2, 30, 45, 55, 65, 85 in.
	Single cable Ø2 mm / 0.08 in.: 800-5000 mm (31.5-197 in.)
Dead zone	This depends on the type of probe. (see pages 7 and 8)

Display and User interface

Display	Integrated LCD display
	128 × 64 pixels in 8-step greyscale with 4-button keypad
Interface languages	English (default), German, French, Spanish

Operating conditions

Temperature:

Ambient temperature	–40°C / +80°C (–40°F / +175°F) For HMI : –20°C / +60°C (–4°F / +140°F)
Storage temperature	-40…+85°C / -40…+185°F
Process connection temperature	**Standard** –60°C/100°C (–76°F/212°F)

Pressure:

Operating pressure	**Standard:** –1 barg / 100 barg (–14.5 psig / 1450 psig)

Other conditions:

Liquid dielectric constant (εr)	Cable version to be used in R717 / NH_3, HCFC and HFC εr, liquid > 5.6 Coaxial version is mandatory in R744 / CO_2 εr, liquid > 1.3
Vibration resistance	EN 60721-3-4 (1...9 Hz: 3 mm / 10...200 Hz:1g; 10g shock half-wave sinusoidal: 11 ms)
Protection category	IP 66/67 equivalent to NEMA type 4X (housing) and type 6P (probe)

Installation conditions

Dimensions and weights	See page 10

Technical data
(continued)

Material

Housing	Aluminium
Coaxial (segmented)	Standard: Stainless steel (1.4404 / 316L)
Single cable	Standard: Stainless steel (1.4401 / 316)
Process fitting	Standard: Stainless steel (1.4404 / 316L)
Gaskets	EPDM (-50...+150°C / -58...+300°F)
Cable gland	Plastic (black)

Process connections

Thread:

Single cable Ø2 mm / 0.08¨	AKS 4100: G1 inch pipe thread. Aluminium gasket included AKS 4100U: ¾ in. NPT
Coaxial	AKS 4100: G1 inch pipe thread. Aluminium gasket included AKS 4100U: ¾ in. NPT

Electrical connections

Power supply	**Terminals output:** 14-30 V d.c. Min./Max. Value for an output of 22 mA at the terminal. Ambient temperature limitations: -40°C/+80°C(–40°F / +176°F) : 16-30 V d.c. -20°C/+80°C(–4°F / +176°F) : 14-30 V d.c.
Current output load	RL [Ω] ≤ ((Uext -14 V)/20 mA). – Default (Error output set to 3.6 mA) RL [Ω] ≤ ((Uext -14 V)/22 mA). – (Error output set to 22 mA)
Cable gland	AKS 4100: PG 13, M20×1.5 ; (cable diameter: 6-8 mm (0.24-0.31in.) AKS 4100U: ½ in. NPT
Cable entry capacity (terminal)	0.5-1.5 mm² (~20-15 AWG)

Input and output

Current output:

Output signal	4…20 mA or 3.8…20.5 mA acc. to NAMUR NE 43
Resolution	±3 µA
Temperature drift	Typically 75 ppm/K
Error signal	High: 22 mA; Low: 3.6 mA acc. to NAMUR NE 43; Hold (frozen value - not available with NAMURNE 43 compliant output.

Approvals and certification

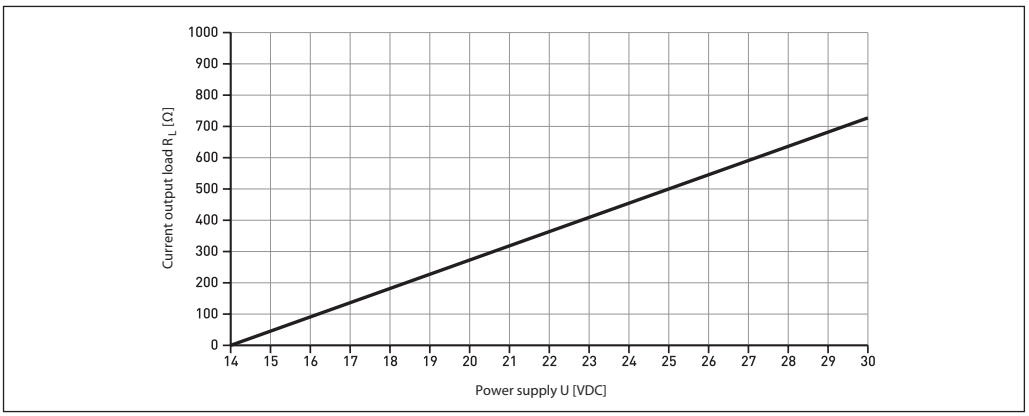
CE	This device fufills the statutory requirements of the EMC directives. The manufacturer certifies successful testing of the product by applying the CE mark.

Other standards and approvals:

EMC	EMC Directives 2004 / 108 / EC and 93 / 68 / EEC in conjunction with EN 61326-1 (2006) and EN 61326-2-3 (2006). The device conforms to these standards if : - the device has a coaxial probe or - the device has a single probe that is installed in a metallic tank.
LVD	Low-Voltage Directives 2006 / 95 / EC and 93 / 68 / EEC in conjunction with EN 61010-1 (2001)
NAMUR	NAMUR NE 21 Electromagnetic Compatibility (EMC) of Industrial Process and Laboratory Control Equipment
	NAMUR NE 43 Standardization of the Signal Level for the Failure Information of Digital Transmitters

Minimum power supply voltage

Use this graph to find the minimum power supply voltage for a given current output load:



Minimum power supply voltage for an output of 22mA at the terminal

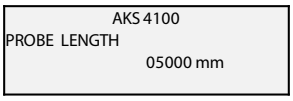
Note:
The signal converter can be programmed with or without mechanical process connector assembled.

Quick Setup (all values below are only examples)

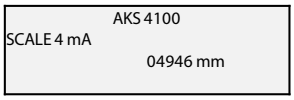
- Connect the device to the power supply (see the section "Electrical installation/ connection".
- Press (›) 3 times.

- Press (›)

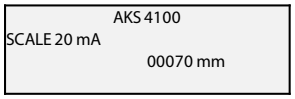
- Press (▼) or (▲) to select either SINGLE or COAXIAL. Press (↵) to confirm.



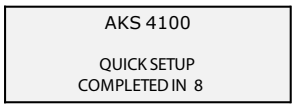
- Press (›) to change the PROBE LENGTH.
  Press (›) to change the position of the cursor.
  Press (▼) to decrease the value or (▲) to increase the value.
  Press (↵) to confirm.



- Press (›) to change of SCALE 4 mA.
  Press (›) to change the cursor position.
  Press (▼) to decrease the value or (▲) to increase the value.
  Press (↵) to confirm.



- Press (›) to change of SCALE 20 mA.
  Press (›) to change the cursor position.
  Press (▼) to decrease the value or (▲) to increase the value.
  Press (↵) to confirm.



- Wait for QUICK SETUP to complete 8-second timeout

- Press (↵) to confirm.

- Press (▼) or (▲) to select either STORE NO or STORE YES.
  Press (↵) to confirm.

Default screen appears:

Quick Setup completed

You have the possibility of checking your settings by pressing (›) twice.

Press (↵) (▲) (↵) to return to default screen.

COAXIAL version

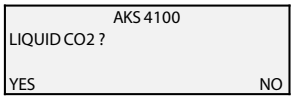
Quick Setup (all values below are only examples)

When CO_2 is used:

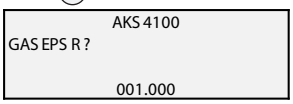
- Connect the device to the power supply (see the product instruction for detail on electrical installation/connection).
- Press ⊙ 3 times.

- Press ⊙

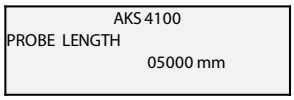
- Press ⊙ or ⊙ to select between SINGLE or COAXIAL. Choose COAXIAL and press ⊙ to confirm.



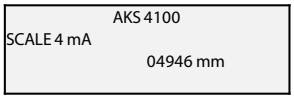
- Press ⊙ (YES) to confirm



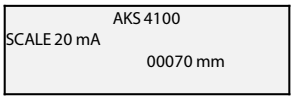
- Press ⊙ to change GAS EPS.R. (Select the correct value from the tables on page 16)
  Press ⊙ to change cursor-position.
  Press ⊙ to decrease the value or ⊙ to increase the value.
- Press ⊙ to confirm.



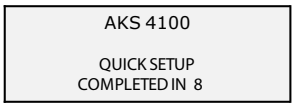
- Press ⊙ to change the PROBE LENGTH.
  Press ⊙ to change the position of the cursor.
  Press ⊙ to decrease the value or ⊙ to increase the value.
  Press ⊙ to confirm.



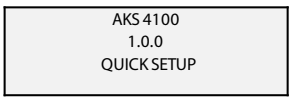
- Press ⊙ to change of SCALE 4 mA.
  Press ⊙ to change the cursor position.
  Press ⊙ to decrease the value or ⊙ to increase the value.
  Press ⊙ to confirm.



- Press ⊙ to change of SCALE 20 mA.
  Press ⊙ to change the cursor position.
  Press ⊙ to decrease the value or ⊙ to increase the value.
  Press ⊙ to confirm.



- Wait for QUICK SETUP to complete. Count down from 8 sec.



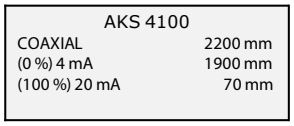
- Press ⊙ to confirm.

- Press ⊙ or ⊙ to select between STORE NO or STORE YES.
  Press ⊙ to confirm.

Default screen appears:

Quick Setup completed

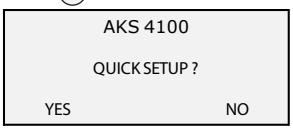
You have the possibility of checking your settings by pressing ⊙ twice.



Press ⊙ ⊙ ⊙ to return to default screen.

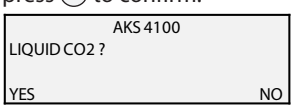
For all other refrigerants:

- Connect the device to the power supply
- Press ⊙ 3 times.

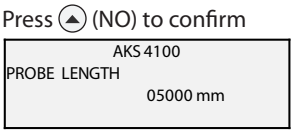


- Press ⊙

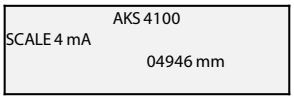
- Press ⊙ or ⊙ to select between SINGLE or COAXIAL. Choose COAXIAL and press ⊙ to confirm.



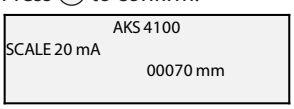
- Press ⊙ (NO) to confirm



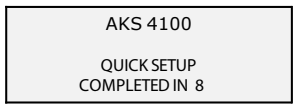
- Press ⊙ to change the PROBE LENGTH.
  Press ⊙ to change the position of the cursor.
  Press ⊙ to decrease the value or ⊙ to increase the value.
  Press ⊙ to confirm.



- Press ⊙ to change of SCALE 4 mA.
  Press ⊙ to change the cursor position.
  Press ⊙ to decrease the value or ⊙ to increase the value.
  Press ⊙ to confirm.



- Press ⊙ to change of SCALE 20 mA.
  Press ⊙ to change the cursor position.
  Press ⊙ to decrease the value or ⊙ to increase the value.
  Press ⊙ to confirm.



- Wait for QUICK SETUP to complete. Count down from 8 sec.

- Press ⊙ to confirm.

- Press ⊙ or ⊙ to select between STORE NO or STORE YES.
  Press ⊙ to confirm.

Default screen appears:

Quick Setup completed

CABLE and COAXIAL version

Forcing mA output (all values below are only examples)

Default screen

AKS 4100
DISTANCE
5000 mm

- Press ›

AKS 4100
1.0.0
QUICK SETUP

- Press ▲

AKS 4100
2.0.0
SUPERVISOR

- Press ›

AKS 4100
2.0.0
_____

Enter password:
› ↵ ▼ ▲ › ↵

AKS 4100
2.1.0
INFORMATION

- Press ▲

AKS 4100
2.2.0
TESTS

- Press ›

AKS 4100
2.2.1
SET OUTPUT

- Press ›

AKS 4100
SET OUTPUT
3.5 mA

- Press ▼ to decrease the value or ▲ to increase the value.
  Press ↵ to confirm.

AKS 4100
SET OUTPUT
8 mA

- Press ↵ 4 times to return to default screen.

Default screen appears:

AKS 4100
DISTANCE
5000 mm

Force mA completed and disabled

Optional Procedure

If the temperature condition in the stand pipe is known, a constant (dielectric constant of the refrigerant gas) **can be** entered (parameter 2.5.3 GAS EPS.R), in order to obtain lower Top and Bottom Dead Zone values **(see pages 7 and 8)**.

Entering refrigerant dielectric gas constant (all values below are only examples)

Default screen

AKS 4100
DISTANCE
5000 mm

- Press ›

AKS 4100
1.0.0
QUICK SETUP

- Press ▲

AKS 4100
2.0.0
SUPERVISOR

- Press ›

AKS 4100
2.0.0
_____

Enter password:
› ↵ ▼ ▲ › ↵

AKS 4100
2.1.0
INFORMATION

- Press ▲ 4 times.

AKS 4100
2.5.0
APLICATION

- Press ›

AKS 4100
2.5.1
TRACING VEL.

- Press ▲ 2 times.

AKS 4100
2.5.3
GAS EPS. R

- Press › to change GAS EPS.R. (Select the correct value from the tables on page 16)
  Press › to change cursor-position.
  Press ▼ to decrease the value or ▲ to increase the value.

AKS 4100
GAS EPS. R
1.066

- Press ↵ to confirm.

AKS 4100
2.5.3
GAS EPS. R

- Press ↵ 3 times.

AKS 4100
1.0.0
STORE NO

- Press ▼ or ▲ to select between STORE NO or STORE YES.
  Select STORE YES by pressing ↵

Default screen appears:

AKS 4100
DISTANCE
5000 mm

Entering the dielectric constant of refrigerant gas completed

Saturated vapour dielectric constant (default value: 1.066)

R717 (NH_3)

Temperature range:
–40°C → +50°C (–40°F → +122°F)

Temperature [°C]	Temperature [°F]	Dielectric constant of refrigerant gas Parameter 2.5.3 GAS EPS.R
–40 → –18	–40.0 → 0	1.01
–17 → –5	1 → 23	1.02
–4 → 4	24 → 39	1.03
5 → 12	40 → 54	1.04
13 → 18	55 → 64	1.05
19 → 24	65 → 75	1.06
25 → 28	76 → 82	1.07
29 → 33	83 → 91	1.08
34 → 37	92 → 99	1.09
38 → 40	100 → 104	1.10
41 → 44	105 → 111	1.11
45 → 47	112 → 117	1.12
48 → 50	118 → 122	1.13

R22

Temperature range:
–50°C → +48°C (–58°F → +118°F)

Temperature [°C]	Temperature [°F]	Dielectric constant of refrigerant gas Parameter 2.5.3 GAS EPS.R
–50 → –25.0	–58 → –13	1.00
–24 → –10	–12 → 14	1.02
–9 → 0	15 → 32	1.03
1 → 8	33 → 46	1.04
9 → 15	47 → 59	1.05
16 → 21	60 → 70	1.06
22 → 26	71 → 79	1.07
27 → 31	80 → 88	1.08
32 → 35	89 → 95	1.09
36 → 39	96 → 102	1.10
40 → 42	103 → 108	1.11
43 → 45	109 → 113	1.12
46 → 48	114 → 118	1.13

R410A

Temperature range:
–50°C → +15°C (–58°F → +59°F)

Temperature [°C]	Temperature [°F]	Dielectric constant of refrigerant gas Parameter 2.5.3 GAS EPS.R
–50 → –47	–58 → –52	1.01
–46 → –35	–51 → –31	1.02
–34 → –26	–30 → –14	1.03
–25 → –19	–13 → –2	1.04
–18 → –13	–1 → 9	1.05
–12 → –8	10 → 18	1.06
–7 → –4	19 → 25	1.07
–3 → 0	26 → 32	1.08
1 → 4	33 → 40	1.09
5 → 7	41 → 45	1.10
8 → 10	46 → 50	1.11
11 → 12	51 → 54	1.12
13 → 15	55 → 59	1.13

R744 (CO_2)

Temperature range:
–50°C → +15°C (–58°F → +59°F)

Temperature [°C]	Temperature [°F]	Dielectric constant of refrigerant gas Parameter 2.5.3 GAS EPS.R
–50.0 → –42.0	–58.0 → –43	1.01
–41.0 → –28.0	–42 → –18	1.02
–27.0 → –17.0	–17 → 2	1.03
–16.0 → –9.0	3 → 16	1.04
–8.0 → –3.0	17 → 27	1.05
–2.0 → 2	28 → 36	1.06
3 → 7	37 → 45	1.07
8 → 11	46 → 52	1.08
12 → 14	53 → 58	1.09
15	59	1.10

R134a

Temperature range:
–40°C → +50°C (–40°F → +122°F)

Temperature [°C]	Temperature [°F]	Dielectric constant of refrigerant gas Parameter 2.5.3 GAS EPS.R
–40.0 → –18	–40 → –0	1.01
–17 → –4	1 → 25	1.02
–3 → 5	26 → 41	1.03
6 → 13	42 → 56	1.04
14 → 20	57 → 68	1.05
21 → 25	69 → 77	1.06
26 → 30	78 → 86	1.07
31 → 34	87 → 94	1.08
35 → 38	95 → 100	1.09
39 → 42	101 → 108	1.10
43 → 45	109 → 113	1.11
46 → 48	114 → 119	1.12
49 → 50	120 → 122	1.13

R404A

Temperature range:
–40°C → +15°C (–40°F → +59°F)

Temperature [°C]	Temperature [°F]	Dielectric constant of refrigerant gas Parameter 2.5.3 GAS EPS.R
–40 → –35	–40 → –31	1.02
–34 → –26	–30 → –14	1.03
–25 → –19	–13 → –2	1.04
–18 → –14	–1 → 7	1.05
–13 → –9	8 → 16	1.06
–8 → –4	17 → 25	1.07
–3 → 0	26 → 32	1.08
1 → 3	33 → 38	1.09
4 → 6	39 → 43	1.10
7 → 9	44 → 49	1.11
10 → 12	50 → 54	1.12
13 → 15	55 → 59	1.13

How to change the language setting (Default: English)

Default screen

AKS 4100
DISTANCE
5000 mm

- Press ›

AKS 4100
1.0.0
QUICK SETUP

- Press ▲

AKS 4100
2.0.0
SUPERVISOR

- Press ›

AKS 4100
2.0.0
_____

Enter password:
› ↵ ▼ ▲ › ↵

AKS 4100
2.1.0
INFORMATION

- Press ▲ 6 times

AKS 4100
2.7.0
DISPLAY

- Press ›

AKS 4100
2.7.1
LANGUAGE

- Press ›

AKS 4100
LANGUAGE
ENGLISH

- Press ▼ or ▲ to see the language possibilities
  Press ↵ to confirm.

AKS 4100
2.7.1
LANGUAGE

- Press ↵ 3 times

AKS 4100
2.0.0
STORE NO

- Press ▼ or ▲ to select between STORE NO or STORE YES.
  Select STORE YES by pressing ↵
  Default screen appears:

AKS 4100
DISTANCE
5000 mm

Language setup completed

Reset to factory setting

Default screen

AKS 4100
DISTANCE
5000 mm

- Press › once and ▲ twice

AKS 4100
3.0.0
SERVICE

- Press ›

AKS 4100
3.0.0
_____

Enter password:
› ↵ › ▼ › ▲

AKS 4100
3.1.0
SENSOR

- Press ▲ twice

AKS 4100
3.3.0
CONFIG/RESET

- Press ›

AKS 4100
3.3.1
RESET FACTORY

- Press ›

AKS 4100
RESET FACTORY
NO

- Select YES by pressing ▲ and confirm with ↵
- Press ↵ 3 times to return to default screen.

  Default screen appears:

AKS 4100
DISTANCE
5000 mm

Factory reset completed