PiloTREK

NON-CONTACT RADAR LEVEL TRANSMITTER

- **Non-contact level transmitter for liquids and solids**
- **Not influenced by dielectric constant, temperature, pressure and density variations**
- **Accuracy up to ±1 mm**
- **Measuring range up to 100 m**
- **Tank bottom tracing (TBF) mode for mediums with low dielectric constant**
- **Flange temperature up to 250 °C**
- **Medium temperature –60 °C … +600 °C**
- **Pressure up to 64 bar**
- **HART, Profibus PA, FF, RS485**
- **ATEX explosion-proof approvals**

ABOUT PILOTREK

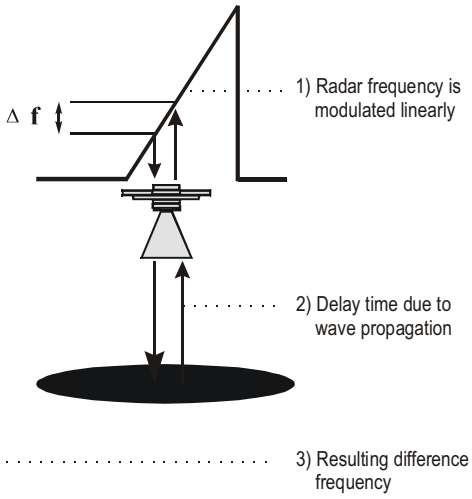
PiloTREK being an FMCW (frequency modulated continuous wave) type radar level gauge offers the highest standard of non-contact level metering technology for liquids and solids without any compromise in the performance with an accuracy also suitable for Custody transfer measurement.

The four models range from the 2-wire low cost to the 4-wire high precision version. Their horn antenna or wave stick come with a wide variety of materials, while the most different sealings provide the chance of the proper choice for any application.

The FMCW radar uses high frequency wave of 8,5 GHz with a 1 GHz frequency sweep for the measurement. A wave is emitted by the antenna and received with a time delay depending on the distance of the measured surface The lower frequency of the emitted wave is compared with the frequency generated at the time the reflected wave reaches the antenna. This ∆frequency difference is transformed via a Fast Fourier Transformation (FFT) into a frequency spectrum from which distance and level is calculated.

The unique TBF and partial TBF method provides for reliable measurement even with very low relative dielectric constants between 4 and 1,05 when the waves reflected from the surface of the medium are very weak. TBF (tank bottom following) method uses the electromagnetic waves going through the medium.

In this case the level is calculated from the virtual moving away of the bottom caused by the „impeding" effect of the waves in the material. Partial TBF represents the possibility to activate the TBF only below a certain filling level above which the direct measurement is applied automatically.



TECHNICAL DATA

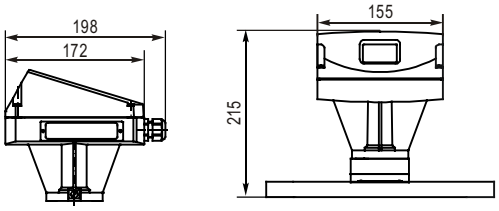
TYPE		PILOTREK 2-WIRE LOW COST
Special features		Empty tank spectrum recording, Partial or Full TBF mode, Low cost LP flange system
Range		max. 20 m
Min. top block distance	horn	For storage tanks: antenna extension + antenna length + 100 mm, for process tanks additional +100 mm
	wave stick	wave stick length – 200 mm
	still well	antenna extension + antenna length + 300 mm
Error of measurement		Range <5 m: ±10 mm Range >5 m: ±0.2%
Analogue output		4 ... 20 mA passive
Communication		HART
Power supply		Non Ex: 17 ... 35 V DC For Ex i application: intrinsically safe power supply required
Flange temperature (with heating device or temperature adapter)		horn: -30 °C (-60 °C) .... +130 °C (+250 °C); stick: -40 °C .... +130 °C (+150 °C); with LP flange –20 °C .... +130 °C
Ambient temperature		-20 °C .... +55 °C
Process pressure		horn: max. 40 bar; wave stick with plate: -1...16 bar, wave stick without plate and LP flange: max. 2 bar
Relative dielectric constant		$\varepsilon_r \geq 1,5$ (with wave stick: $\varepsilon_r \geq 4$) $\varepsilon_r < 3$: still well or wave guide or TBF mode is recommended
Conduit (quantity, pc.)		M 20 x 1.5 (1), Quickon (1), ½" NPT (1), BSP ½" (1)
Antenna types and materials		horn: 316L, 316Ti, Hastelloy, Titanium, Tantalum, Monel, wave-stick with plate: PTFE with plate, wave-stick w/out plate: PP or PTFE + Kalrez sealing SW wave-stick: PTFE with plate for still well only, still well (on request) of 316 stst.
Max. tracing velocity		10 m / min
Weight		6 kg (with DN 50 flange)
Wetted parts		1.4571 (316 Ti), 1.4435 (316L), Hastelloy C4 or B2, Titanium, Tantalum, PP, PTFE, Enamel
Gaskets		FPM Viton (standard), Kalrez 4079, 2035, 6375, 1091
Ex approvals		EEx 1G (Zone 0) (with horn or for WS + flange only), EEx 2G (Zone 1)
Ingress protection		IP 66 / 67

TYPE		PILOTREK 4-WIRE LOW COST	PILOTREK 4-WIRE HIGH PERFORMANCE	PILOTREK 4-WIRE HIGH PRECISION
Special features		Empty tank spectrum recording, Partial TBF mode, Low cost LP flange system	Empty tank spectrum recording For difficult applications, Partial or full TBF mode, Programmable Digital input + Switching output,	High accuracy, Empty tank spectrum recording, Partial TBF mode, Digital input + Switching output
Range		max. 20 m	max. 40 (100) m (with wave stick: max. 20 m)	0.5 m....35 m (in still well: max. 30 m)
Min. top block distance	horn	for storage tanks: antenna extension + antenna length + 100 mm, for process tanks: antenna extension + antenna length + 200 mm		
	stick	stick length – 200 mm		
	still well	antenna extension + antenna length + 300 mm		
Error of measurement		horn antenna: ±10 mm <2 m range<: ±0.3% wave stick: ±15 mm <2 m range<: ±0.3%	horn ant.: ±10 mm <2 m range< : ±0.3% special calibration: ±5 mm <5 m range <: ±0.1% wave stick: ±15 mm <2 m range<: ±0.3%	<10 m: ±1 mm >10 m: ±0.01%
Analogue output		4 ... 20 mA active	4 ... 20 mA active or 4 ... 20 mA passive	
Communication		HART	HART, Profibus PA, Fieldbus Foundation, RS 485 Smart protocol	
Power supply		19.2 ... 28.8 V DC / 20.4 ... 26.4 V AC	200 ... 240 V AC or 100 ... 120 V AC or 18 ... 31.2 V DC/ 18 ... 26.4 V AC	
Flange temperature (with heating or temp. adapter)		horn: -30 °C (-60 °C) .... +130 °C (+250 °C) stick: –40 °C .... +130 °C (+150 °C) with LP flange: -20 °C .... +130 °C	horn: -30 °C (-60 °C) .... +130 (250 °C) stick: -40 °C .... +130 (150 °C)	horn: -30 °C (-60 °C) .... +130 °C (250 °C)
Ambient temperature		-20 °C .... +55 °C	-20 °C .... +55 °C (-40 °C...+70 °C for maximum 2 hours)	-20°C ... +55 °C
Process pressure		horn antenna: -1 ... 64 bar wave stick with plate: (p=43-0,3T): -1....16 bar wave stick without plate and LP flange: max. 2 bar	horn antenna: -1 ... 64 bar wave stick with plate: -1 ... 16 bar	horn antenna: -1 ... 64 bar
Minimum dielectric constant $\varepsilon_r \geq 1,5$		(with wave stick: $\varepsilon_r \geq 4$) between 1.5 and 3 still well or wave guide or TBF mode		still well or wave guide or TBF mode is recommended
Conduit (quantity, pc.)		M 25 x 1.5 (2), M 25 x 1.5 for –40 °C (2), ½" NPT (2)	M 25 x 1.5 (2), M 25 x 1.5 for –40 °C (2), ½" NPT (3), BSP ½" (3)	
Antenna types and materials		horn: 316L, 316Ti, Hastelloy, Ti, Ta, Monel, wave-stick with plate: PTFE wave-stick w/out plate: PP or PTFE + Kalrez SW wave-stick: PTFE with plate for still well only still well (on request) of 316 st.st.	horn: 316L, 316Ti, Hastelloy, Ti, Ta, Monel, Enamel wave-stick with plate: PTFE wave-stick w/out plate: PP or PTFE + Kalrez sealing SW wave-stick: PTFE with plate for still well only wave-guide antenna: 316L still well (on request): 316	horn: 316L, 316Ti, Hastelloy, Ti, Ta, Monel, Enamel, wave-guide antenna: 316L still well (on request): 316L
Max. tracing velocity		10 m / min		1 m / min
Weight		10 .... 30 kg	12 ... 32 kg	
Wetted parts		1.4571 (316 Ti), 1.4435 (316L), Hastelloy C4 or B2, Titanium, Tantalum, Monel, PP, PTFE. Enamel		1.4571 (316 Ti), 1.4435 (316L), Hastelloy C4 or B2, Ti, Ta, Monel, Enamel
Gaskets		FPM Viton (standard), Kalrez 6375, 4079, 2035, Parofluor, FEP coated FPM		
Ex approvals		EEx d, EEx de 1G (Zone 0) EEx d, EEx de 2G (Zone 1)	EEx d 1G (Zone 0) EEx de 1G (Zone 0)	EEx d 1G (Zone 0) EEx de 1G (Zone 0)
Ingress protection		IP 66 / 67		

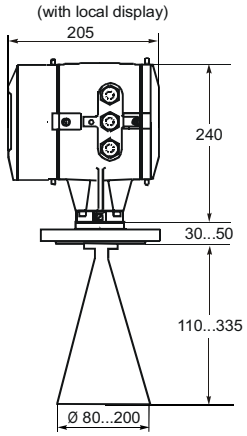
DIMENSIONS

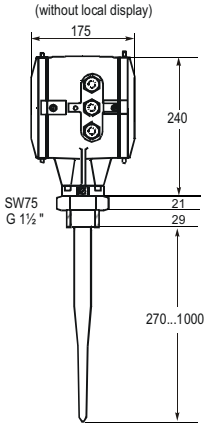
Dimensions in mm

2-WIRE LOW COST INSTRUMENT

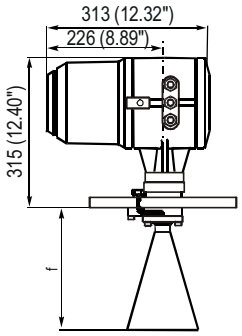


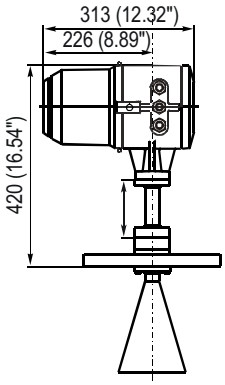
4-WIRE LOW COST INSTRUMENT

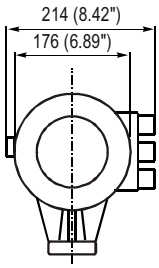




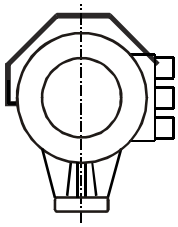
4-WIRE HIGH PERFORMANCE AND HIGH PRECISION INSTRUMENTS







SUNSHADE

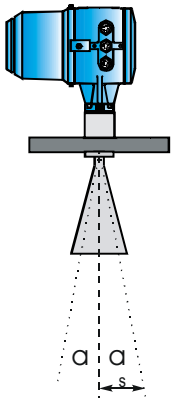


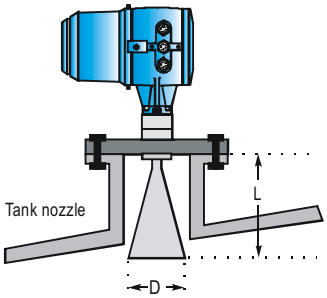
Recommended as protection for the signal converter against direct sunshine. Increases overall height by approx. 20 mm (0.79").

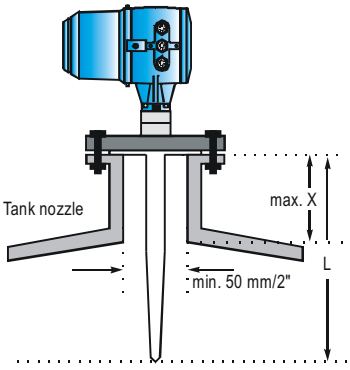
ANTENNA TYPE	MATERIAL	ANTENNA DIAMETER	ANTENNA LENGTH	MAX. EXTENSION OF THE CONNECTING NOZZLE**	TRANSMISSION ANGLE	LOBE EXPANSION PER 1 M DISTANCE
		D	L	X	α	s
Horn	316L, Hastelloy	80 mm / 3" *	110 mm	–	16° *	300 mm / 12"
		100 mm / 4" *	150 mm	–	12° *	220 mm / 9"
		140 mm/ 5.5"	220 mm	215 mm	8°	140 mm / 5.5"
		200 mm / 8"	340 mm	335 mm	6°	100 mcm / 4"
	enamel (for max. 10 m)	145 mm	220 mm	100 mm	8°	140 mm / 5.5"
wave-stick	PP, PTFE	25 mm / 1"	270 mm/10.6"	50 mm	9°	160 mm / 6.3"
			384 mm/15.1"	150 mm		
			500-1000 mm/20-40"	L-234		
wave-guide	316L, Hastelloy	DN 25 mm / 1"	600-3000 mm for Ex 600-6000 mm for non Ex	–	Propagation only inside the wave-guide	
still well	316L	DN 50-200 mm /2-8"	> 600 mm	–	Propagation only inside the still well	

* Should only be used in conjunction with still well. The transmission angle given applies to line-of-sight propagation, i.e. without still well.

** Antenna extensions are available from 100 to 2000 mm (4" to ~80") in steps of 100 mm (~4"). Several extensions can be joined up.

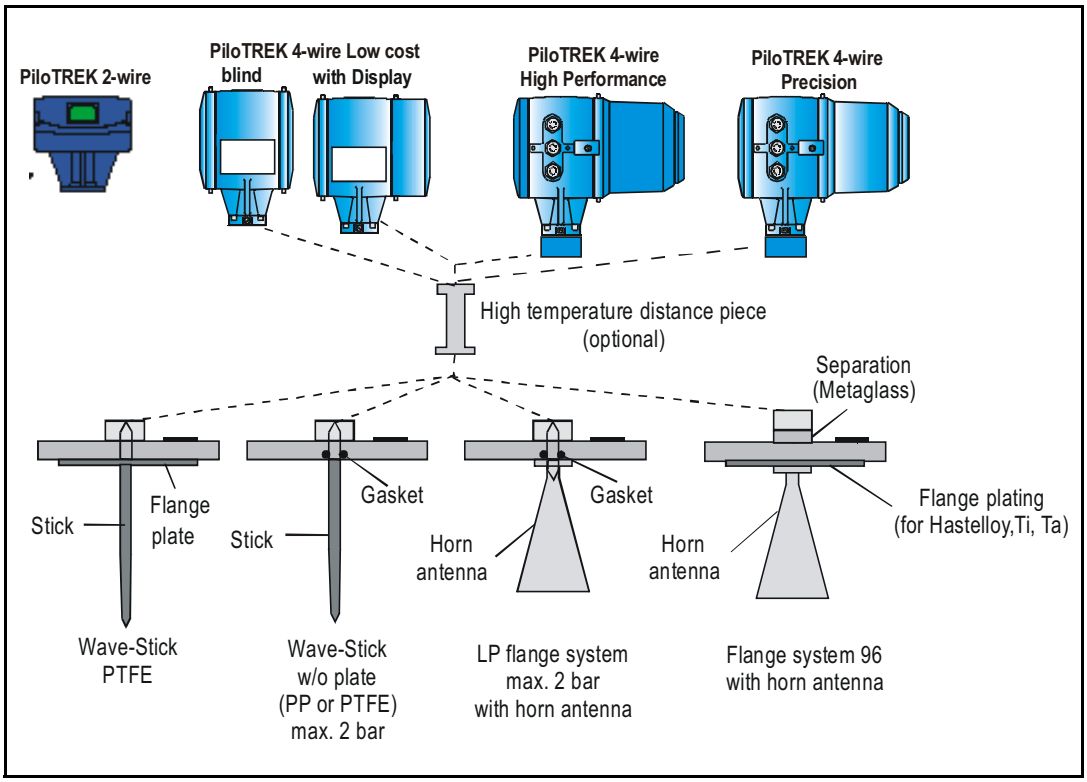






APPLICATION

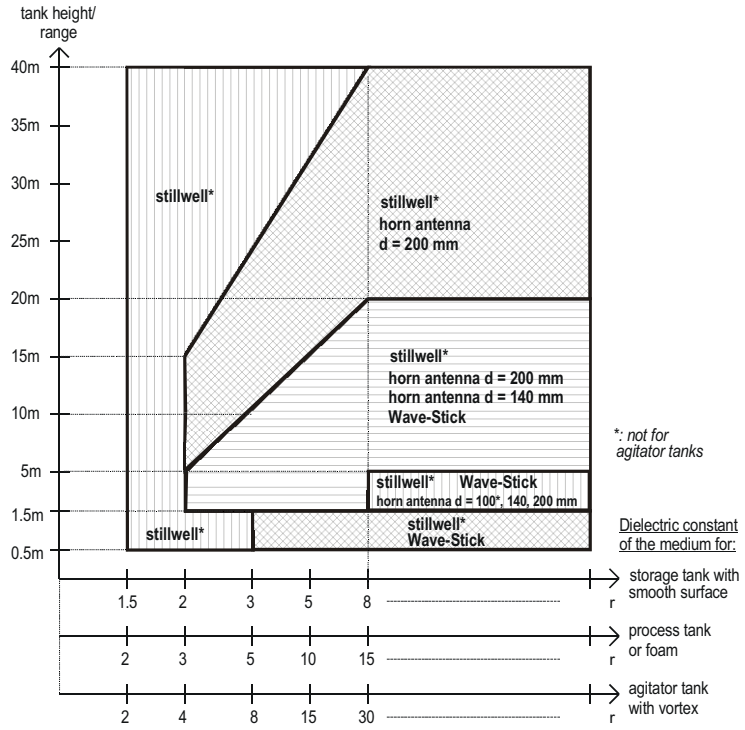
Modular system of PiloTREK offers easy selection of moduls for ideal configuration.



Looking at the Technical data, special features of the units provide guidance to the best choice. There is a recommendation below based on application experience for the optimum application range, in order to minimize potential problems. If the recommended antenna cannot be accepted, any other configuration may also be tested.

Antennas d = 80 and 100 mm should only be used with still wells.

For PiloTREK 4-wire high precision always d = 200 mm horn antenna is suggested. If the application requires the use of still well, it should be of DN ≥ 100 mm / 4".



How to use the diagram:

- Determine the following application parameters:

a) Tank height or maximum measuring range (e.g. H = 15m)

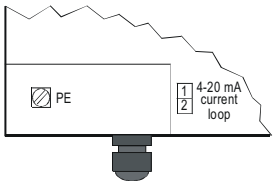
b) Tank type (one of the three types shown, e.g. process tank)

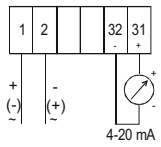
c) Relative dielectric constant of the product (e.g. $\varepsilon_r = 5$)

- Find the relative dielectric constant on the relevant horizontal axis (e.g. 5 on the middle axis)
- Draw a line up to the required tank height = vertical axis (e.g. 15 m)
- The end point of the line defines the application range. The text contained in that area indicates the suitable antenna types (in the example: still well or horn antenna d = 200 mm)

WIRING

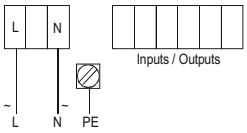
PiloTREK 2-wire Low Cost	PiloTREK 4-wire Low Cost
Power supply: 17...35 V DC max. 22 mA The polarity of the 4-20 mA connection is arbitrary. Output: Passive 4-20 mA with HART	Power supply: 24 V DC ±20% 24 V AC +10/ -15% Current consumption: <300 mA Output: Active 4-20 mA with HART Load: max.350 Ω



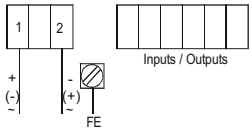


PiloTREK 4-wire High Performance and PiloTREK 4-wire High Precision

Power Supply connections

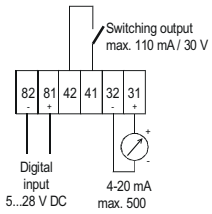


High voltage connection for 100...120 V AC or 200...240 V AC

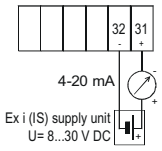


Low voltage connection for 18...31,2 V DC / 18...26,4 VAC
Connection of a FE functional ground is not mandatory.

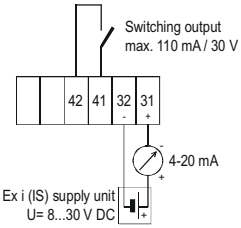
Output / Input connections



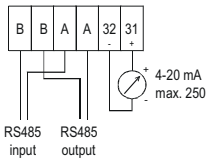
* standard electronics version
Active current output with HART, Ex e
Digital input for freeze or warmstart and Switching output *



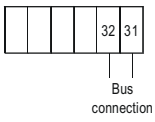
Passive current output with HART, Ex i



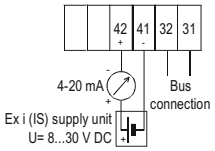
Passive current output with HART, Ex i Switching output



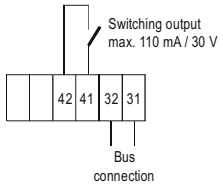
RS485 and Active current output



Profibus PA or Foundation Fieldbus (FF)

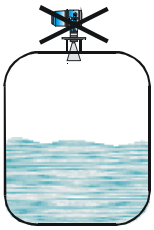


Profibus PA or FF and Passive current output



Profibus PA or FF with Switching output

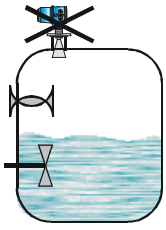
INSTALLATION



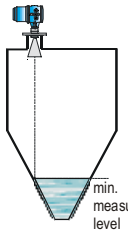
Do not position in tank centreline!
(multiple reflections!)

Do not mount dead centre on manhole cover!
(multiple reflections!)

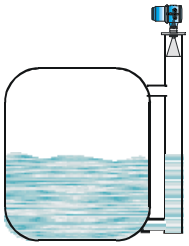
A standard Wave/Stick will not function in a stilling well!



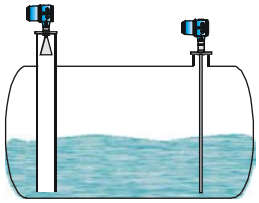
Do not position above internals!
(interference reflections!)



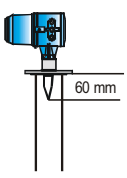
Lower measuring range limited when tank has tapered bottom.



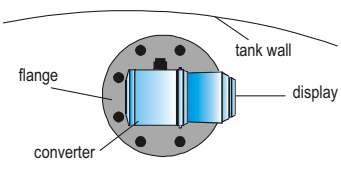
Horn antenna in a side vessel



Use still well or wave quide horizontal vessel



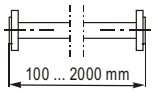
Stick SW type antenna for stilling wells DN=40-55 mm



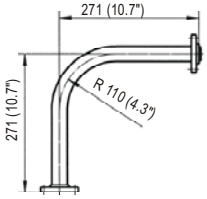
Mount the flange the axis of the (direction display) is oriented tangentially to the tank wall (example)

aka1s04a0601a

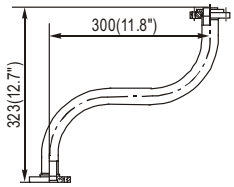
ACCESSORIES



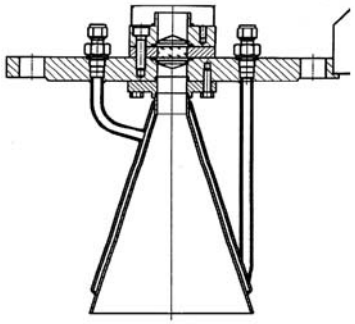
Straight antenna extension AAE - 1☐☐



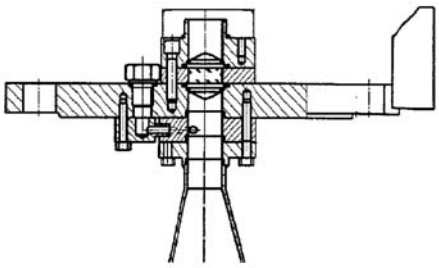
L-shape antenna extension AAL - 101



S-shape antenna extension AAS - 101



Antenna heating/cooling device ≥ DN150 (6")



Antenna purging device ≥ DN100 (4")

ORDER CODES (NOT ALL COMBINATIONS ARE POSSIBLE)

PiloTREK A ☐☐-☐☐☐-☐

TRANSMITTERS	CODE
2 wire low cost	
Transmitter	K
Transmitter + display	L
Transmitter + HT	M
Transmitter + displ. + HT	N
4 wire low cost	
Transmitter	P
Transmitter + display	R
Transmitter + HT	S
Transmitter +displ. + HT	T
4 wire precision	
Transmitter	U
Transmitter + display	V
Transmitter + HT	Z
Transm. + display + HT	W
4 wire high performance	
Transmitter	O
Transmitter + HT	H
Transmitter + display	Y
Transmitter+displ. + HT	J
Special version	X

ANTENNA TYPE	CODE
Stick, SW / EU	A
Stick, SW /USA	B
Stick / EU / LP	C
Stick / USA / LP	D
Horn	F
Horn / LP	G
Horn enamelled	E
Wave guide pipe	H
Special version	X

PROCESS CONNECTION	CODE
1½" BSP	H
1½" NPT	J
DN 50 PN 40	1
DN 80 PN 16	2
DN 100 PN 16	3
DN 150 PN 16	5
DN 200 PN 10	6
DN 250 PN 10	O
2" ANSI 150 lb	A
3" ANSI 150 lb	B
4" ANSI 150 lb	C
6" ANSI 150 lb	D
8" ANSI 150 lb	T
50 A JIS 10 K	P
80 A JIS 10 K	I
100 A JIS 10 K	V
150 A JIS 10 K	W
200 A JIS 10 K	F
DN 50 Milch	L
DN 65 Milch	G
DN 80 Milch	E
2" Tri Clamp	N
3" Tri Clamp	K
Special version	X

ANTENNA SIZE/TYPE	CODE
D = 80 mm/Horn [1]	1
D = 100 mm/Horn [1]	2
D = 140 mm/Horn [2]	3
D = 200 mm/Horn	4
D = 300 mm/Horn	5
L = 384 mm/Stick [3,5]	6
L = 5 00 mm/Stick [4,5]	7
L = 600 mm/Stick [5]	8
L = 800 mm/Stick [5]	9
L = 60 mm/SW [1]	A
Special version	X

WAVE G. LENGTH FOR A☐H -☐ TYPE	CODE
< 1.0 m	A
< 1.5 m	B
< 2.0 m	C
< 2.5 m	D
< 3.0 m	E
< 3.5 m	F
< 4.0 m	G
< 4.5 m	H
< 5.0 m	J
< 5.5 m	K
< 6.0 m	L

HORN, WAVE GUIDE/SEALING	CODE
1.4571 / Viton	1
1.4571 / Kalrez 2035	2
1.4571 / Kalrez4079	3
1.4571 / Kalrez 6375	4
HC4 / Viton	5
HC4 / Kalrez 2035	6
HC4 / Kalrez 4079	7
HC4 / Kalrez 6375	8
Special version	X

STICK / SEALING MATERIAL	CODE
PTFE / PTFE plate	A
PTFE-LP / Kalrez 6375	B
PP-LP / Viton	C

POWER SUPPLY	CODE
230 V AC	1
110 V AC	2
24 V DC [6]	3
24 V AC/DC	4
EX VERSIONS	
230 V AC / EEx de	5
110 V AC / EEx de	6
24 V DC / EEx 1G (Zone0) [6]	7
24 V AC/DC / EEx de	8
230 V AC / EEx d	A
110 V AC / EEx d	B
24 V DC/EEx 2G (Zone1) [6]	C
24 V AC/DC / EEx d	D
Special version	X

ACCESSORIES

AAE-101-0M : straight antenna extension 100 mm
: in 100 mm steps
AAE-120-0M antenna extension 2000 mm
AAS-101-0M "S" type 323/300 mm antenna extension
AAL-101-0M 90° "L" type 271/271 mm antenna extension

NOTICE

[1] Only for stilling well (measuring pipe)
[2] D = 145 mm for enamelled A☐E-53 type
[3] L = 270 mm for LP flange system
[4] L = 400 mm for LP flange system
[5] EEx 1 G (Zone 0) not possible
[6] Only for 2-wire instrument

Technical specification may be changed without notice

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