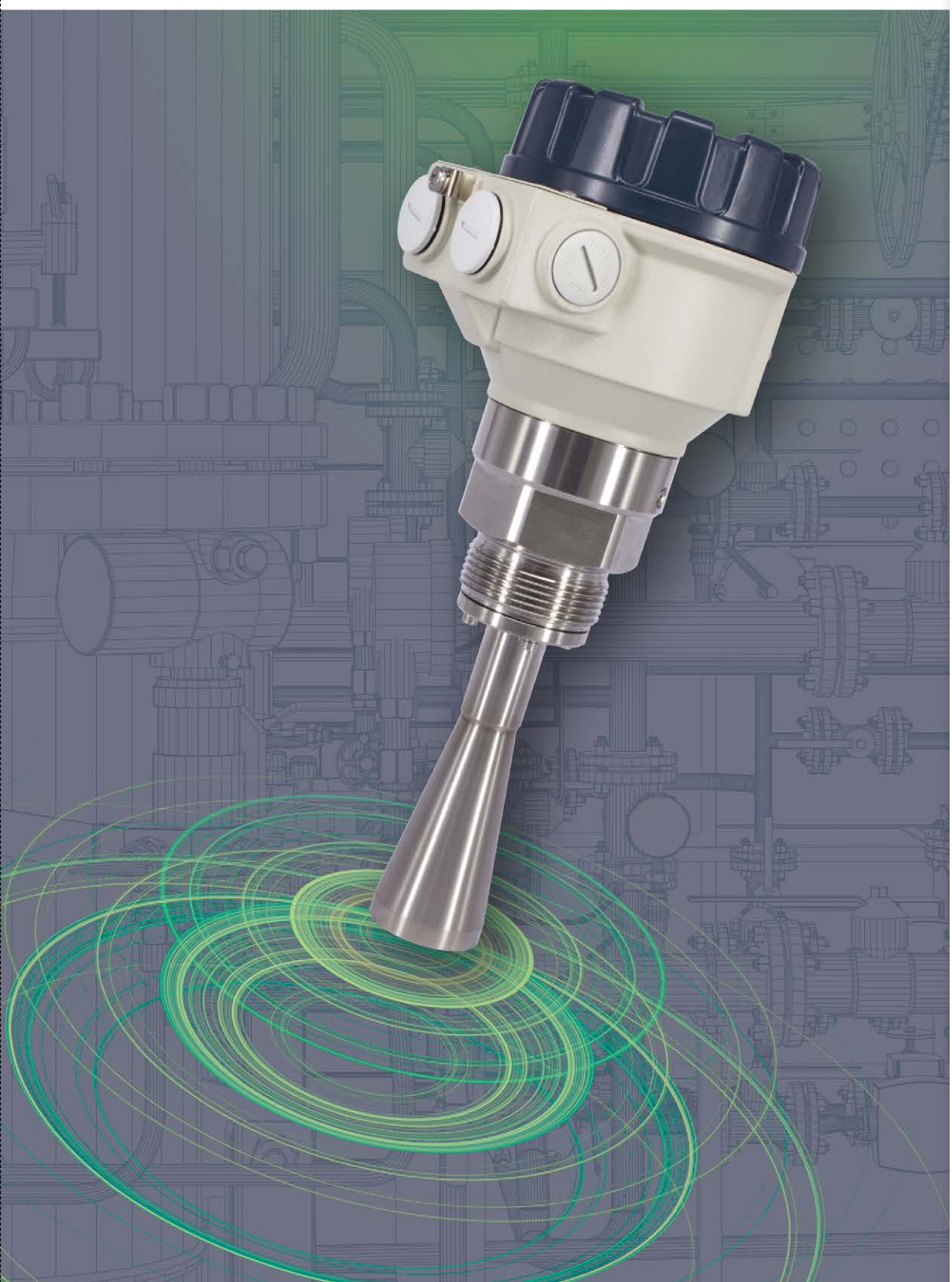
PiloTREK

PULSE BURST RADAR LEVEL TRANSMITTERS
K-BAND RADAR FOR LIQUIDS



5 YEARS WARRANTY

NIVELCO

LEVEL TRANSMITTERS

MAIN FEATURES

- *2-wire K-band Pulse Burst Radar*
- *25 GHz frequency*
- *Max. 23 m (75 feet) measuring range for liquids and slurries*
- *±3 mm (0.12 inch) accuracy*
- *Easy installation due to small antennas*
- *Parabolic, horn, planar and enclosed antenna types*
- *IP68 rated integrated type*
- *Sanitary types for meeting high hygienic requirements*
- *High temperature version*
- *Plug-in graphical display module*
- *Ex version*
- *FM & CSA approved*

INDUSTRY SEGMENTS

- *Water, wastewater*
- *Power generation*
- *Food and beverage*
- *Pharmaceutical*
- *Chemical*

APPLICATIONS

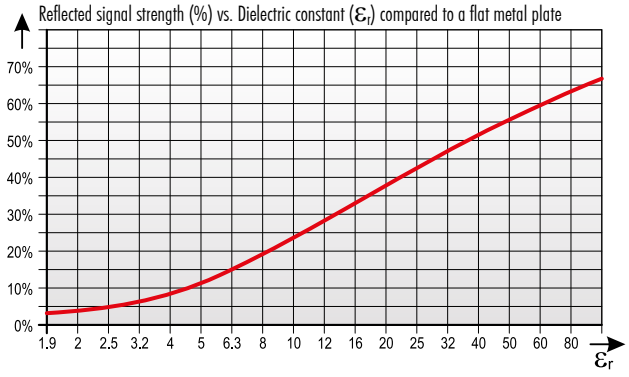
- *Level measurement of liquids, slurries, emulsions and other chemicals up to 23 m (75 feet)*
- *For mid / large-size vessels, chemical tanks*
- *Level measurement through plastic tank wall*

GENERAL DESCRIPTION

The 25 GHz (K-band) **PiloTREK** Pulse Radars are regarded as the most progressive non-contact level transmitters of the industrial process automation field. Their accuracies are excellent and their short and narrow antennas make their installation simple and low cost. **NIVELCO**'s K-band radar featuring ±3 mm (0.12 inch) accuracy and short dead band excels with its versatile housing concept lining up plastic, aluminium and stainless steel versions. Its antenna range incorporates stainless steel horn or parabolic planar antenna and enclosed plastic tube varieties. The enclosed antenna versions can be replaced without removing the antenna enclosure from the process. Local programming of the **PiloTREK** is aided by a plug-in display module. If on-site reading is not desired this module may not be required thus reducing cost of ownership. The signal processing algorithm of the **PiloTREK** is based on **NIVELCO**'s 35 years of experience with non-contact level measurement making it an excellent choice for applications simple and challenging alike.

OPERATION

The operation of the non-contact microwave level transmitters is based on the measurement of the time of flight of the microwave burst. The propagation speed of microwave impulses is practically the same in air, gases and in vacuum, independently from the process temperature and pressure, so the measured distance is not affected by the physical parameters of medium to be measured. The level transmitter induces microwave impulses a few nanosecond long in the antenna and a part of the energy of the emitted signals is bounced (reflected) back from the measurement surface depending on the measured media. The time of flight of the reflected signal is measured and processed by the electronics, and then this is converted to distance, level or volume proportional data. The measurability of the level of a specific medium is depending on the signal strength of the reflected microwave impulses. The signal strength of the reflected impulses is considerably depending on the distance to be measured, the relative dielectric constant of the measured medium and the turbulence of the surface. The relative dielectric constant (ε_r) of the medium should be more than 1.4 in case of parabolic design, or it should be more than 1.9 with horn antenna types.

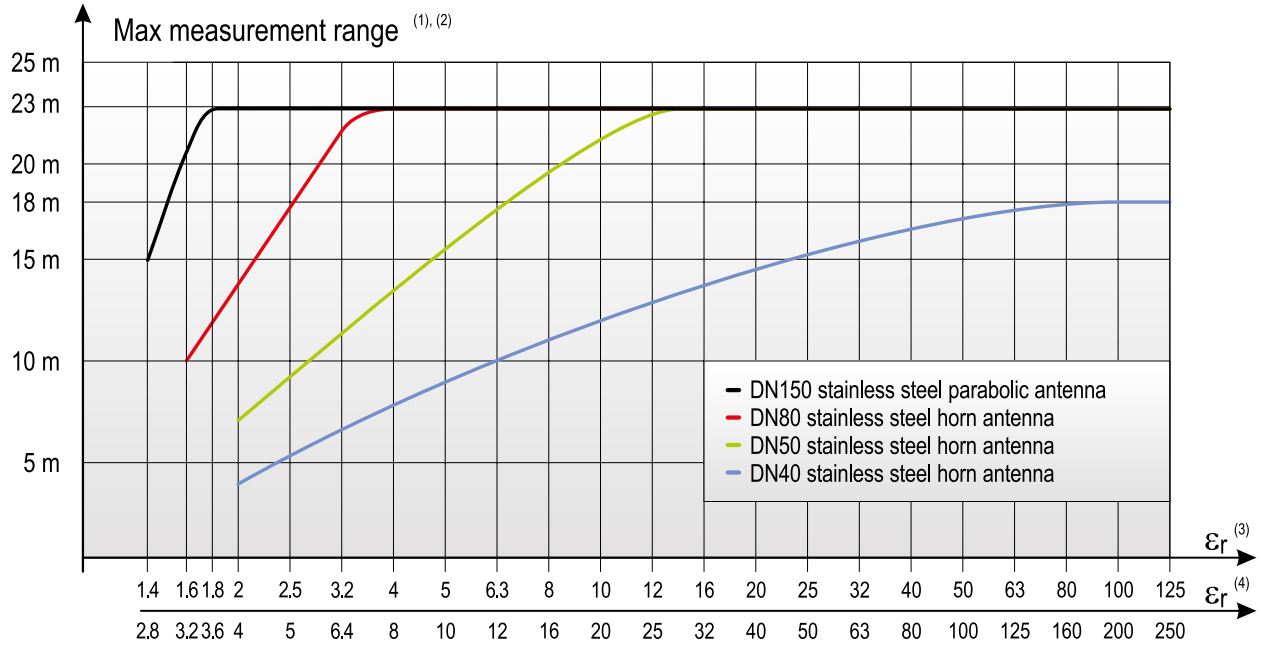


Informative ε_r values			
Petroleum	2.1	Acetone	21
Crude oil		Ethyl alcohol	24
Diesel oil		Ethanol	25.1
Benzene	2.2	Methyl alcohol	33.1
Gasoline	2.3	Methanol	33.7
Bitumen	2.6	Glycol	37
Carbon disulfide		Nitrobenzene	40
Ethers	4.4	Glycerol	41.1
Acetic acid	6.2	Water	80
Ammonia	17 – 26	Sulphuric acid (T=20 °C)	84

ANTENNA TYPES

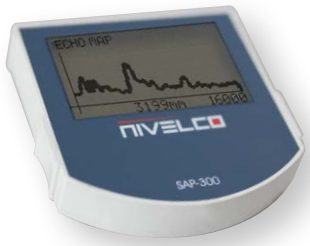
Antenna type	Antenna diameter						
	DN40 (1½")			DN50 (2")	DN80 (3")	DN150 (6")	48 mm (1.9 inch)
	Process connection						
	1½" BSP/NPT	2"TRICLAMP	DN50 MILCH	2" BSP/NPT	DN80, DN150 flanges		2" BSP/NPT
Stainless steel (1.4571 / 316Ti) horn	■	–	–	■	■	–	–
Plastic (PP) enclosure	■	–	–	■	–	–	–
Plastic (PTFE) enclosure	■	■	■	■	–	–	–
Stainless steel (1.4571 / 316Ti) parabolic	–	–	–	–	–	■	–
Planar 2" (PP) enclosure	–	–	–	–	–	–	■

SPECIAL DATA OF THE ANTENNA VARIATIONS



(1) *Under reference conditions of reflection (as per EN 61298-3, moreover in case of interference-free environment, from min. 10 m² target surface) and stabilized temperature. The plastic antenna enclosures result 10% (PTFE) or 20% (PP) decrease in the maximal measurement range!*
(2) *In some instances (e.g. disturbing reflections, steam or gas condensation, EMC noises) the maximal measurement range might decrease by 50%!*
(3) *Dielectric constant (ε_r) of liquids used in storage tanks with flat liquid surface*
(4) *Dielectric constant (ε_r) of liquids used in process tanks or where liquid surface is waving*

PROGRAMMING, ECHO MAP



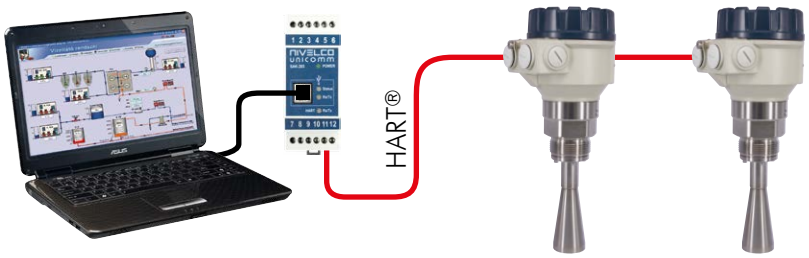
With the help of the **SAP-300** plug-in display a simplified full-parameter programming can be accomplished, the parameters of measurement and output can be set using the text-based menu system.

The large LCD dot-matrix display displays the measured values in numerical and bar graph form. The Echo Map feature helps to detect false reflections and aids the optimization of the measurement configuration.

BACKGROUND MAPPING

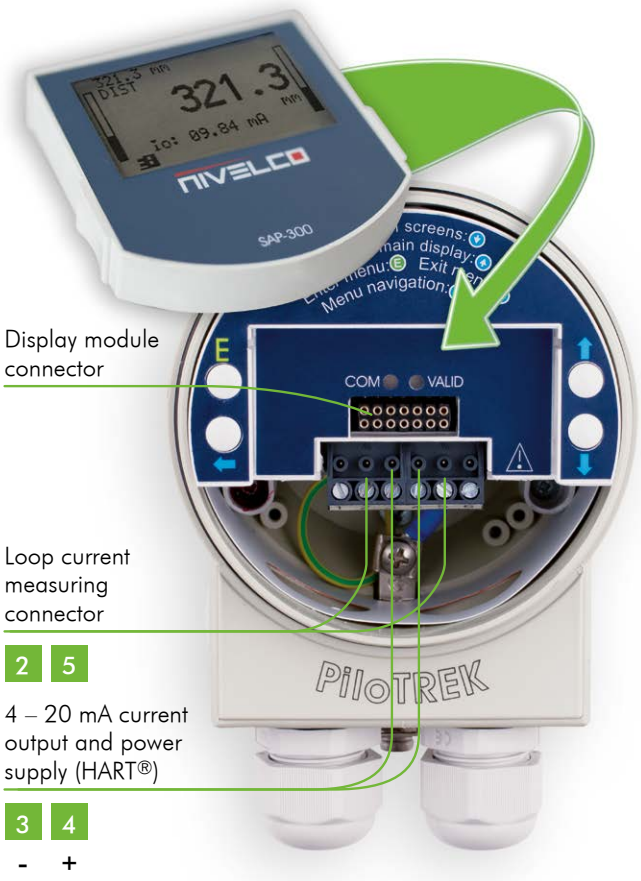
The background mapping feature provides excellent solution to ignore unwanted false reflections coming from (not-moving) disturbing objects. For this purpose the instrument needs to map the totally empty tank to create a "background image". Then the measurement evaluation software of **PiloTREK** will automatically recognise and ignore the false reflections coming from the disturbing objects inside the tank.

PiloTREK TRANSMITTERS IN SYSTEM WITH A PC



The instruments with HART® output can be connected to a PC using a **UNICOMM** HART®-USB modem. Max. 15 normal instruments can be connected to a single HART® loop. All measured values can be visualized and/or the instruments can be remote programmed via digital HART® communication.
Applicable software: EView2 configuration software or **NIVISION** process visualization software.

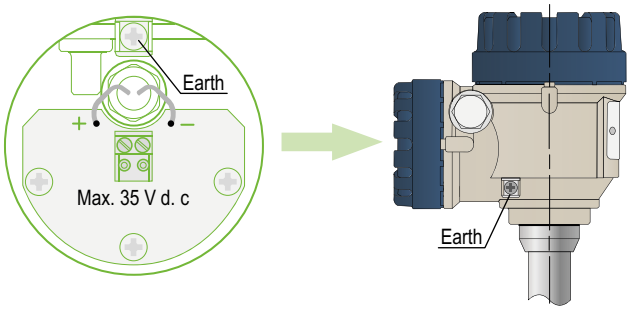
WIRING



WIRING FOR CLASS I DIV 2 RATED DEVICES

Electrical data:

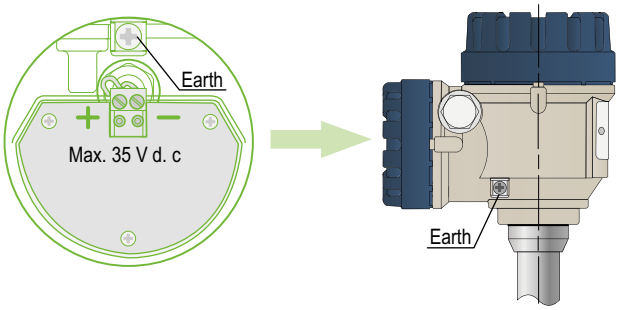
$C_i \leq 16$ nF $L_i \leq 0.2$ mH $I_i \leq 22$ mA $U_i \leq 35$ V d.c

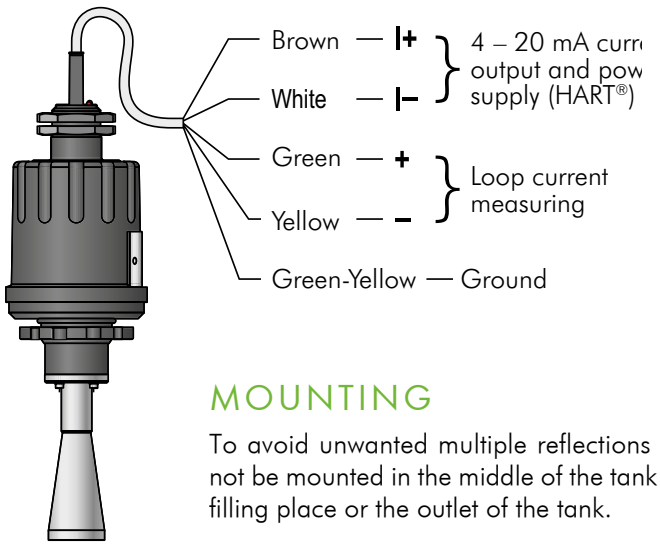


WIRING FOR CLASS I DIV 1 RATED DEVICES

Maximal allowed input voltage:

$U_{max} = 35$ V d.c $U_m = 250$ V





MOUNTING

To avoid unwanted multiple reflections the instrument should not be mounted in the middle of the tank or in the vicinity of the filling place or the outlet of the tank.

The ideal position for the **PiloTREK** is on the r = (0.3 – 0.5) R in case of vertical cylindrical tank. The distance between the sensor and the tank wall should be at least 200 mm (7 7/8"). The mounting placement should be as far as possible from the disturbing objects inside the tank and from the sources of disturbing effects such as waving, vortex or strong vibrations.

The antenna face should be parallel to the medium surface within ±2 – 3°. To avoid overheating the instrument should be protected against direct sunshine.

TECHNICAL DATA

Type		Integrated	Compact		
			Plastichousing	Metal housing	Hightemperatureversion
Measured values		Level, Distance; Calculated values: Volume, Mass			
Frequency of the measurement signal		~25 GHz (K-band)			
Measuring range		0.2 m – 23 m (0.6 ft – 75 ft) (depending on the antenna type – see: special data of the antenna variations)			
Linearity error [1]		<0.5 m (1.65 ft): ±25 mm (±1 in); 0.5 – 1 m (1.65 – 3.3 ft): ±15 mm (±0.6 in); 1m – 1.5 m (3.3 – 5 ft): ±10 mm (±0.4 in); 1.5 – 8 m (5 – 26.25 ft): ±3 mm (±0.12 in); >8 m (26.25 ft): ±0.04% of the measured distance			
Minimal beam angle		11° (depending on the antenna type)	6° (depending on the antenna type; see: special data of the antenna variations)		
Minimal ε_r of the medium		1.9 (depending on the meas. range)	1.4 (depending on the meas. range; see: max. meas. range vs. ε_r diagram)		
Resolution		1 mm (0.04 inch)			
Temperature error (as per EN 61298-3)		0.05% FSK / 10 °C (50 °F) (-20 °C … +60 °C [-4 °F … +140 °F])			
Power supply		20 V – 36 V DC [2]			
Output	Digital communication	4 – 20 mA + HART®			
	Display	–	SAP-300 graphical display unit		
Measuring frequency		10 – 60 sec as per the application settings			
Antenna diameter		38 mm (1½"), 48 mm (2"), 75 mm (3"), 148 mm (6")			
Antenna material		Horn, Parabolic: 1.4571 (316Ti) stainless steel; enclosure: PP, PTFE			Horn, Parabolic: 1.4571 (316Ti); enclosure: PTFE
Process temperature		-30 °C … +100 °C (-22 °F … +212 °F), (up to 120 °C (248 °F) for max. 2 minutes) with PP antenna enclosure: max.: 80 °C (+176 °F)			-30 °C … +180 °C (-22 °F … +356 °F)
Maximal process pressure		25 bar (363 psig) at 120 °C (248 °F); with plastic antenna enclosure: 3 bar (44 psig) at 25 °C (77 °F)			
Ambient temperature		-20 °C … +60 °C (-4 °F … +140 °F)			
Process connection		Threaded, Flanged or Sanitary connections (as per order codes)			
Ingress protection		IP68	IP67		
Electrical connection		LiYCY type. 2x 0.5 mm² (AWG20) shielded Ø6 mm (0.25 in) cable; standard cable length: 5 m (16.5 ft) (can be ordered up to 30 m (100 ft))	2x M20 x1.5 cable glands + internal thread for 2x ½" NPT cable protective pipe, cable outer diameter: Ø7 – Ø13 mm (0.3 – 0.5 inch), wire cross section: max. 1.5 mm² (AWG 15)		
Electrical protection		Class III			
Housing material		Plastic (PP)	Plastic (PBT)	Paint coated aluminium or stainless steel	
Sealing		Viton®, EPDM			
Communication certifications		R&TTE, FCC			
Mass		1 – 1.6 kg (2.2 – 3.5 lb)		Aluminium: 2 – 2.6 kg (4.4 – 5.7 lb) Stainless steel: 3.3 – 3.9 kg (7.9 – 8.6 lb)	Aluminium: 2.7 – 3.3 kg (6.6 – 7.9 lb) Stainless steel: 4 – 4.6 kg (8.8 – 10 lb)

[1] Under reference conditions of reflection and stabilized temperature. [2] In case of FM devices see Special Data table.

SPECIAL DATA OF THE ANTENNA VARIATIONS

Type	W□M / W□S / W□K-14□	W□M / W□S / W□K-15□	W□M / W□S / W□K-18□	W□M / W□S / W□K-11□
Name	DN40 (1½") stainless steel horn antenna	DN50 (2") stainless steel horn antenna	DN80 (3") stainless steel horn antenna with flange	DN150 (6") stainless steel parabolic antenna
Process connection	1½" BSP, NPT	2" BSP, NPT	DN80, DN150 flanges	DN150 flange
Material of wetted parts	1.4571 (316Ti), PTFE; in case of WPM: 1.4571 (316Ti), PTFE, PP			1.4571, PTFE
Beam angle	19°	16°	11°	6°
Dead zone	0.2 m (0.65 ft)			0.4 m (1.3 ft)

Type	WPM-1A□	W□P-14□	W□P-15□	W□M / W□S / W□K-14□ + WAT-14T-0	W□M / W□S / W□K-14□ + WAT-14R-0
Name	PP enclosured Planar antenna	DN40 (1½") PP or PTFE encapsulated antenna	DN50 (2") PP or PTFE encapsulated antenna	Sanitary type DN40 (1½") horn antenna with PTFE antenna enclosure	
Housing	Plastic			Plastic / Paint coated aluminium / Stainless steel	
Process connection	2" BSP, NPT	1½" BSP, NPT	2" BSP, NPT	2" TriClamp	DN50 Milch
Material of wetted parts	PP	PP or PTFE		1.4571 (316Ti), PTFE	
Dead zone	0.2 m (0.66 ft)	0.3 m (1 ft)			

APPROVALS

FM APPROVED	FM Canada, Certificate No.:FM17CA0074X
FM APPROVED	FM US, Certificate No.:FM17US0134X
Ex	BKI ATEX, Certificate No.:BKI13ATEX0017X/2
IEC	BKI IECEx, Certificate No.:IECEx BKI 13.0005issue No.:1
EAC	Ex Russia, Certificate No.:RU C-HU.MF62.B.04401
INMETRO	INMETRO, Certificate No.:DNV 15.0065 X
FC	Certificate No.:S7W-WES100

SPECIAL DATA FOR EX CERTIFIED MODELS

Type		Plastic housing, integrated WPM-1□□-□	Plastic housing, compact W□M-1□□-□	Metal housing W□S-1□□-□ W□K-1□□-□	High temperature version with metal housing WH□-1□□-□, WJ□-1□□-□
Ex marking	IEC Ex	Ex ia IIB T6 … T5 Ga	Ex ia IIB T6 … T5 Ga/Gb	Ex ia IIB T6 … T4 Ga Ex ia IIIC T85°C … T110°C Da/Db Ex ta/tb IIIC T85°C … T110°C Da/Db	Ex ia IIB T6 … T3 Ga Ex ia IIIC T85°C … T180°C Da/Db Ex ta/tb IIIC T85°C … T180°C Da/Db
	ATEX	⟨Ex⟩ II 1 G Ex ia IIB T6 … T5 Ga	⟨Ex⟩ II 1/2 G Ex ia IIB T6 … T5 Ga/Gb	⟨Ex⟩ II 1G Ex ia IIB T6 … T4 Ga ⟨Ex⟩ II 1/2 D Ex ia IIIC T85°C … T110°C Da/Db ⟨Ex⟩ II 1/2 D Ex ta/tb IIIC T85°C … T110°C Da/Db ⟨Ex⟩ II 1/2 G Ex d [ia Ga] IIB T6 … T4 Ga/Gb	⟨Ex⟩ II 1G Ex ia IIB T6 … T3 Ga ⟨Ex⟩ II 1/2 D Ex ia IIIC T85°C … T180°C Da/Db ⟨Ex⟩ II 1/2 D Ex ta/tb IIIC T85°C … T180°C Da/Db ⟨Ex⟩ II 1/2 G Ex d [ia Ga] IIB T6 … T3 Ga/Gb
Intrinsically safe data		L_i: 200 µH, C_i: 30 nF, U_i: 30 V, I_i: 140 mA, P_i: 1 W	L_i: 200 µH, C_i: 16 nF, U_i: 30 V, I_i: 140 mA, P_i: 1 W		
Power supply		Ex ia: 20 V – 30 V DC, Ex d[ia]: 24 V – 36 V DC			
Ambient temperature		-20 °C … +60 °C (-4 °F … +140 °F)			
Electrical connection		In case of WPM type: LiYCY type. 2x 0.5 mm² (AWG20) shielded Ø6 mm (0.25 in) cable; standard cable length: 5 m (16.5 ft) (can be ordered up to 30 m (100 ft))	2x M20 x1.5 metal cable glands, cable outer diameter: Ø7 – Ø13 mm (0.3 – 0.5 inch), wire cross section: max. 1.5 mm² (AWG 15)		

SPECIAL DATA FOR FM AND CSA CERTIFIED MODELS

Type		W□S-1□□-A	W□S-1□□-B
Marking	US	Class I, Division 1, Group C, D, T6 Ta = -20°C to +60°C, IP67	Class I, Division 2, Group C, D, T6 Ta = -20°C to +60°C, IP67
	Canada	Class I, Division 1, Group C, D, T6 Ta = -20°C to +60°C, IP67	Class I, Division 2, Group C, D, T6 Ta = -20°C to +60°C, IP67
Suitable for hazardous locations		Class I Division 1 Groups C & D Class I Division 2 Groups C & D	Class I Division 2 Groups C & D
Electrical connection		NPT ½" conduit entry; plug-in type terminal blocks for 0.75 to 1.5 mm² (16 to 18 AWG) wire cross section	
Power supply		24 V – 36 V DC	

INMETRO APPROVAL NO.:DNV 15.0065 X

Type	Plastic housing, compact W□M-1□□-□	High temperature version with metal housing WH□-1□□-□ WJ□-1□□-□
Ex marking (ATEX)	Ex ia IIB T6...T5 Ga/Gb	Ex ia IIB T6...T3 Ga
		Ex ia IIIC T85°C...T180°C Da/Db
		Ex ta IIIC T85°C...T180°C Da/Db
Intrinsically safe data	L_i: 200 μH C_i: 16 nF U_i: 30 V I_i:140 mA P_i: 1 W	L_i: 200 μH C_i: 16 nF U_i: 30 V I_i: 140 mA P_i: 1 W

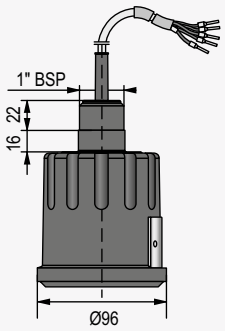
POLARIZATION

The **PiloTREK** pulse burst radar level transmitters emit linearly polarized microwave impulses. The polarization plane of the emitted impulses can be rotated fully in case of **W□S**, **W□M** and the **W□K** types. The rotation of the polarization plane can minimize unwanted false reflections from disturbing objects or from the tank wall. The orientation of the polarization plane coincides with the line drawn between the cable glands.

DIMENSIONS

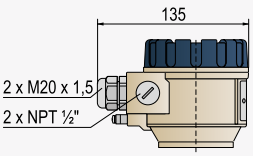
Integrated housing

Plastic (PP)

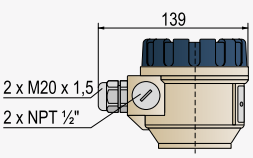


Compact housing

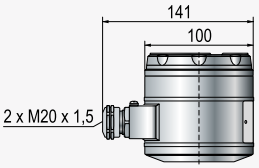
Plastic (PBT)



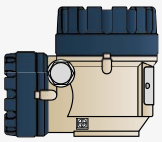
Paint coated aluminium



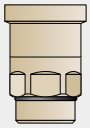
Stainless steel



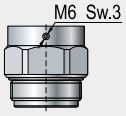
Dual compartment



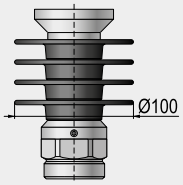
Plastic (PP) process connection



Stainless steel process connection

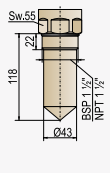


High temperature type with heatsink

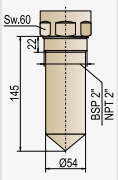


Plastic PP or PTFE antenna enclosure

DN40

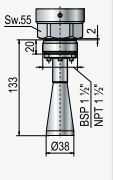


DN50

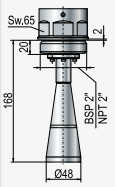


Stainless steel horn antenna

DN40

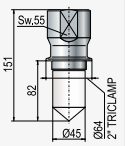


DN50

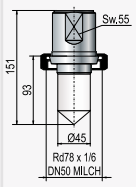


Sanitary type with PTFE antenna enclosure

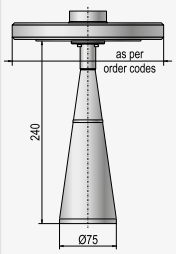
2" TRICLAMP



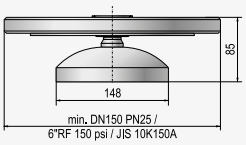
DN50 MILCH



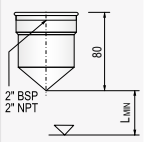
Stainless steel DN80 horn antenna with flange



Parabolic antenna with DN150 flange



Planar antenna



PiloTREK TRANSMITTERS IN HART MULTIDROP LOOP

The **MultiCONT** can handle digital data coming from HART® capable **NIVELCO** transmitters (e.g. level, temperature, pressure, pH, dissolved oxygen, etc.). The digital (HART®) information is processed, displayed and transmitted via RS485 communication line to a PC when needed. Remote programming of the transmitters is also possible. Visualisation on PC can be accomplished with **NIVISION** process visualisation software.

ORDER CODES (NOT ALL COMBINATIONS AVAILABLE)

PiloTREK Pulse Burst Radar level transmitters

PiloTREK W■■-1■■-■ (1)

Version	Code
Transmitter	E
Transmitter + display	G
High temperature transmitter (2)	H
High temperature transmitter + display (2)	J
Integrated	P

Antenna / Housing material	Code
Stainless steel antenna / Aluminium housing	S
Stainless steel antenna / Plastic housing	M
Stainless steel antenna / Stainless steel housing	K
PP encapsulated antenna / Plastic housing (3, 4)	P

Antenna Ø / Process connection size	Code
DN40 Horn / 1½"	4
DN50 Horn / 2"	5
DN80 Horn / Flange	8
DN150 Parabolic / Flange (5)	1
Planar / 2"	A

Output / Haz. rating	Code
4 – 20 mA + HART®	4
4 – 20 mA + HART® / Ex	8
4 – 20 mA + HART® / XP-IS Class I Div 1	A
4 – 20 mA + HART® / NI Class I Div 2	B
4 – 20 mA + HART® / Ex d [ia]	C

Process connection	Code
BSP	0
NPT	N

Processconnection (1.4571 (316 Ti) stainless steel flanges)	Code
DN80 PN25	2
DN100 PN25	3
DN125 PN25	4
DN150 PN25	5
3" RF 150 psi	A
4" RF 150 psi	B
5" RF 150 psi	C
6" RF 150 psi	D
JIS 10K80A	J
JIS 10K100A	K
JIS 10K125A	L
JIS 10K150A	M

Processconnection (PP plastic flanges)	Code
DN80	6
DN100	7
DN125	8
DN150	9
3" FF	E
4" FF	F
5" FF	G
6" FF	H
JIS 80A	P
JIS 100A	R
JIS 125A	S
JIS 150A	T

(1) The order code of an Ex version should end in "Ex"
(2) Only with metal housing
(3) Only with threaded process connection and DN40, DN50 antenna diameter
(4) Ex version not available
(5) Ex version is under approval
(6) Only available for BSP threaded instrument and only available to order together with the instrument. Cannot be ordered with Ex version instrument!

ANTENNA ENCLOSURES (6)

Material	Size	Type	Order code
PP	1½"	BSP	WAP-140-0
		NPT	WAP-14N-0
	2"	BSP	WAP-150-0
		NPT	WAP-15N-0
PTFE	2"	TRICLAMP	WAT-14T-0
	DN50	MILCH	WAT-14R-0
	1½"	BSP	WAT-140-0
		NPT	WAT-14N-0
	2"	BSP	WAT-150-0
		NPT	WAT-15N-0

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E-mail: sales@nivelco.com ▪ www.nivelco.com