

K-BAND RADAR FOR LIQUIDS

# PiLoTREK

PULSE BURST RADAR LEVEL TRANSMITTERS



3 YEARS WARRANTY @ NIVELCO – WHERE ELSE?

# NIVELCO

LEVEL TRANSMITTERS



## PiLoTREK NON-CONTACT MICROWAVE LEVEL TRANSMITTERS FOR LIQUIDS

### MAIN FEATURES

- 2-wire K-band Pulse Burst Radar
- 25 GHz frequency
- Max. 23 m (75 feet) measuring range for liquids and slurries
- $\pm 3$  mm (0.12 inch) accuracy
- Easy installation due to small antennas
- Parabolic, horn 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

### INDUSTRY SEGMENTS

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

### APPLICATIONS

- Liquids and slurries in general

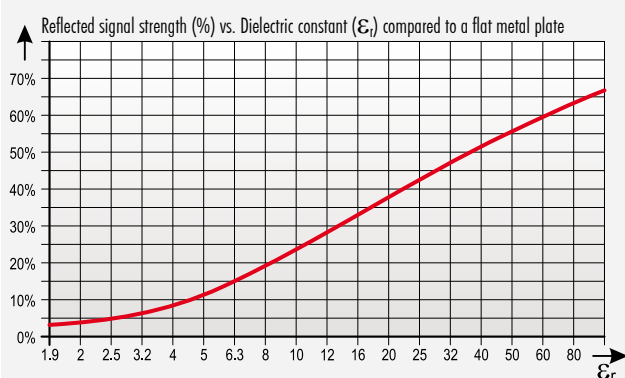


### GENERAL DESCRIPTION

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  $\pm 3$  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 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 30 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 ( $\epsilon_r$ ) 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 $\epsilon_r$ values

Petroleum	2.1	Acetone	21
Crude oil	2.1	Ethyl alcohol	24
Diesel oil	2.1	Ethanol	25.1
Benzene	2.1	Methyl alcohol	33.1
Gasoline	2.3	Methanol	33.7
Bitumen	2.6	Glycol	37
Carbon disulfide	2.6	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 (1 ½")		DN50 (2")	DN80 (3")	DN150 (6")	
	Process connection					
	1½" BSP/NPT	2" TRICLAMP	DN50 MILCH	2" BSP/NPT	DN80 – DN150 flanges	
Stainless steel (1.4571 / 316 Ti) horn	■	–	–	■	■	–
Plastic (PP) enclosure	■	–	–	■	–	–
Plastic (PTFE) enclosure	■	■	■	■	–	–
Stainless steel (1.4571 / 316 Ti) parabolic	–	–	–	–	–	■

## TECHNICAL DATA

Type		Integrated	Compact			
			Plastic housing	Metal housing	High temperature version	
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 feet – 75 feet) (depending on the antenna type - see: special data of the antenna variations)				
Linearity error <sup>(1)</sup>		< 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 $\epsilon_r$ of the medium		1.9 (depending on the meas. range)	1.4 (depending on the meas. range; see: max. measurement range vs. $\epsilon_r$ 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				
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 (1 ½"), 48 mm (2"), 75 mm (3"), 148 mm (6")				
Antenna material		Horn, Parabolic: 1.4571 (316 Ti) stainless steel; enclosure: PP, PTFE			Horn, Parabolic: 1.4571 (316 Ti); enclosure: PTFE	
Medium temperature		-30 °C ... +100 °C (-22 °F ... +212 °F), (up to 120 °C (248 °F) for max. 2 min) with PP antenna enclosure: max.: 80 °C (+176 °F)			-30 °C ... + 180 °C (-22 °F ... +356 °F)	
Maximal medium 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 mm <sup>2</sup> (AWG20) shielded Ø 6 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 mm <sup>2</sup> (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) St. 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)	

<sup>(1)</sup> Under reference conditions of reflection and stabilized temperature

## SPECIAL DATA FOR Ex CERTIFIED MODELS

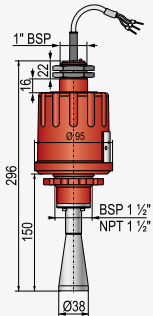
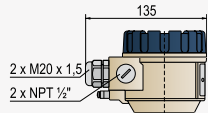
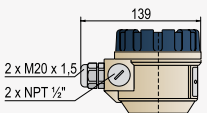
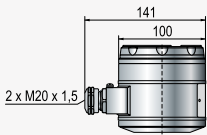


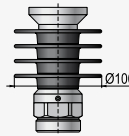
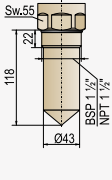
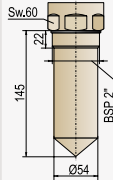
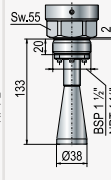
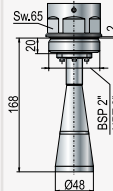
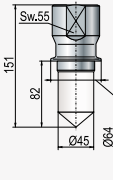
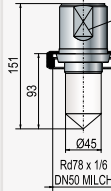
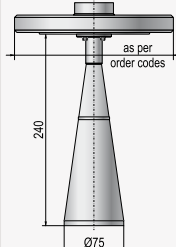
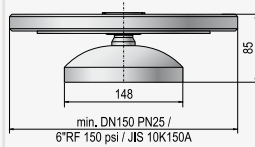
Type		WDM -1□□-8 Ex	WDS / WDK -1□□-8 Ex
Protection type		Intrinsically safe	
Ex marking	ATEX	Ⓔ II 1/2 G Ex ia IIB T6...T5 Ga/Gb	Ⓔ II 1G Ex ia IIB T6...T3 Ga
	IEC Ex (2)	Ex ia IIB T6...T5 Ga/Gb	Ex ia IIB T6...T3 Ga
Intrinsically safe data		Ui = 30 V, li = 140 mA, Pi = 1 W, Ci = 16 nF, Li = 200 μH	
Power supply		20 V ... 30 V DC	
Ambient temperature		-20 °C ... +60 °C	
Electrical connection	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)		
	In case of WPM type: LiYCY type. 2x 0.5 mm² (AWG20) shielded Ø 6 mm (0.25 in) cable; standard cable length: 5 m (16.5 ft) (can be ordered up to 30 m (100 ft))		

## TEMPERATURE DATA FOR Ex CERTIFIED MODELS

<sup>(2)</sup> Need of IEC Ex is to be specified with order

Temperature data	WDM -1□□-8 Ex		WES / WGS -1□□-8 Ex WEK / W GK -1□□-8 Ex		WHS / WJS-1□□-8 Ex WHK / WJK-1□□-8 Ex	
Maximum permissible temperature at the antenna (min.: -30 °C (-22 °F))	+ 80 °C (+ 176 °F)	+ 80 °C (+ 176 °F)	+ 80 °C (+ 176 °F)	+ 90 °C (+ 194 °F)	+ 100 °C (+ 212 °F)	+ 180 °C (+ 356 °F)
Maximum permissible surface temperature of the process connection (min.: -30 °C (-22 °F))	+ 75 °C (+ 167 °F)	+ 80 °C (+ 176 °F)	+ 75 °C (+ 167 °F)	+ 90 °C (+ 194 °F)	+ 100 °C (+ 212 °F)	+ 175 °C (+ 347 °F)
Temperature classes	T6	T5	T6	T5	T4	T3

## DIMENSIONS

Integrated housing		Compact housing					
Plastic (PP)		Plastic (PBT)	Paint coated aluminium	Stainless steel			
							
		Plastic (PP) process connection	Stainless steel process connection	High temperature type with heatsink			
							
Plastic PP or PTFE antenna enclosure		Stainless steel horn antenna		Sanitary type with PTFE antenna enclosure		Stainless steel DN80 horn antenna with flange	Parabolic antenna with DN150 flange
DN40	DN50	DN40	DN50	2" TRICLAMP	DN50 MILCH		
							

## SPECIAL DATA OF THE ANTENNA VARIATIONS

Type	WOM/WOS/ WOK-14□	WOM/WOS/ WOK-15□	WOM/WOS/ WOK-18□	WOM/WOS WOK-11□
Name	DN40 (1 1/2") s. steel horn antenna	DN50 (2") s. steel horn antenna	DN80 (3") stainless steel horn antenna with flange	DN150 (6") s. steel parabolic antenna
Process connection	1 1/2" BSP, 1 1/2" NPT	2" BSP, 2" NPT	DN80 – DN150 flanges	DN150 flange
Material of wetted parts	1.4571 (316 Ti), PTFE; in case of WPM: 1.4571 (316 Ti), PTFE, PP			1.4571 (316 Ti), PTFE
Beam angle	19°	16°	11°	6°
Dead zone	0.2 m (0.65 ft)			0.4 m (1.3 ft)

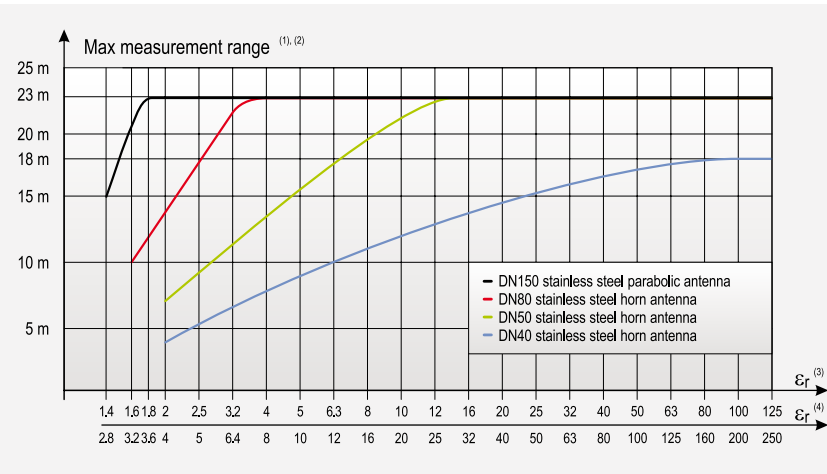
Type	WOP-14□	WOM / WOS / WOK-14□ + WAT-14T-0	WOM / WOS / WOK-14□ + WAT-14R-0	WOP-15□
Name	DN40 (1 ½") PP or PTFE encapsulated antenna	Sanitary type DN40 (1 ½") horn antenna with PTFE antenna enclosure		DN50 (2") PP or PTFE encapsulated antenna
Housing	Plastic	Plastic / Paint coated aluminium / Stainless steel		Plastic
Process connection	1½" BSP, 1½"NPT	2" TRICLAMP	DN50 MILCH	2" BSP, 2" NPT
Material of wetted parts	PP or PTFE	1.4571 (316 Ti), PTFE		PP or PTFE
Dead zone	0.3 m (1 ft)			

## 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.



## SPECIAL DATA OF THE ANTENNA VARIATIONS



<sup>(1)</sup> Under reference conditions of reflection (as per EN 61298-3, moreover in case of interference-free environment, from min. 10 m<sup>2</sup> target surface) and stabilized temperature. The plastic antenna enclosures result 10% (PTFE) or 20% (PP) decrease in the maximal measurement range!

<sup>(2)</sup> In some instances (e.g. disturbing reflections, steam or gas condensation, EMC noises) the maximal measurement range might decrease by 50 %!

<sup>(3)</sup> Dielectric constant ( $\epsilon_r$ ) of liquids used in storage tanks with flat liquid surface

<sup>(4)</sup> Dielectric constant ( $\epsilon_r$ ) of liquids used in process tanks or where liquid surface is waving



## PROGRAMMING, ECHO MAP

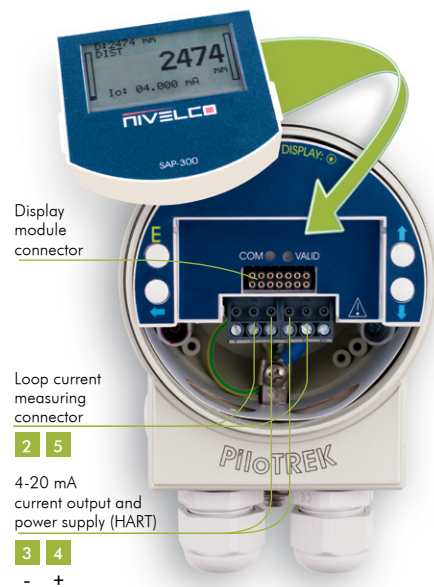
With the help of the SAP-300 plug-in display a simplified full-parameter programming can be accomplished, the parameters of measurement and output can be set using the text-based menu system.

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.



## WIRING

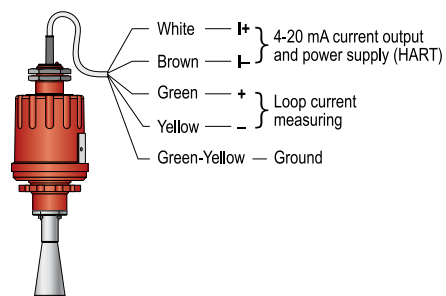


## MOUNTING

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  $r = (0.3 \dots 0.5) R$  in case of cylindrical tank. The distance between the sensor and the tank wall should be at least 200 mm (7 7/8 inch). 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  $\pm 2-3^\circ$ . To avoid overheating the instrument should be protected against direct sunshine.

## 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.

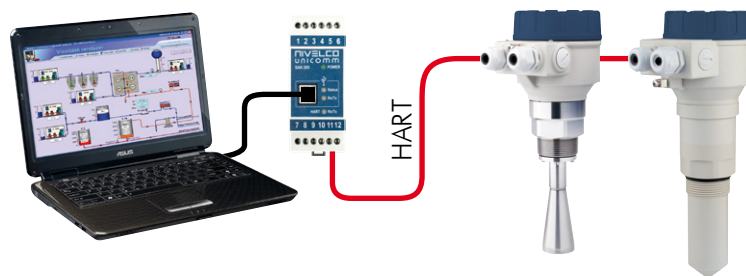


## PiLoTREK TRANSMITTERS IN SYSTEM WITH A PC

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.

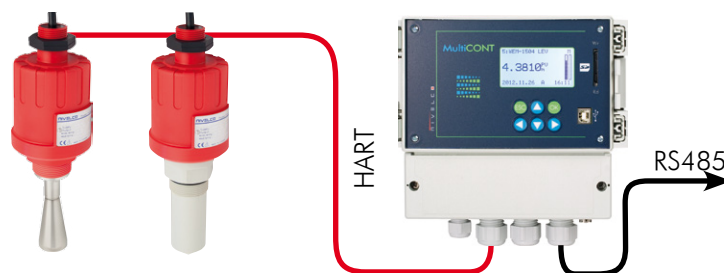
### Applicable software:

EView2 configuration software or NIVISION process visualization software



## 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 horn antenna / Aluminium housing	S
Stainless steel horn antenna / Plastic housing	M
Stainless steel horn antenna / Stainless steel housing	K
PP encapsulated antenna / Plastic housing (3,4)	P

Antenna Ø / Process conn. size	Code
DN40 Horn / 1 1/2"	4
DN50 Horn / 2"	5
DN80 Horn / Flange	8
DN150 Parabolic / Flange (5)	1

Output / Ex	Code
4-20 mA + HART	4
4-20 mA + HART / Ex	8

Process conn.	Code	Process conn.	Code	Process conn.	Code
BSP	O	DN80 PN25	2	DN80	6
NPT	N	DN100 PN25	3	DN100	7
		DN125 PN25	4	DN125	8
		DN150 PN25	5	DN150	9
		3" RF 150 psi	A	3" FF	E
		4" RF 150 psi	B	4" FF	F
		5" RF 150 psi	C	5" FF	G
		6" RF 150 psi	D	6" FF	H
		JIS 10K80A	J	JIS 80A	P
		JIS 10K100A	K	JIS 100A	R
		JIS 10K125A	L	JIS 125A	S
		JIS 10K150A	M	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	1 1/2"	BSP	WAP-140-O
		NPT	WAP-14N-O
	2"	BSP	WAP-150-O
		NPT	WAP-15N-O
PTFE	2"	TRICLAMP	WAT-14T-O
	DN50	MILCH	WAT-14R-O
	1 1/2"	BSP	WAT-140-O
		NPT	WAT-14N-O
	2"	BSP	WAT-150-O
		NPT	WAT-15N-O

