

PiLoTREK

WE-200

2-wire 80 GHz Non-Contact Radar
Level Transmitters

User's Manual
5th Edition



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PiloTREK WE-200 – User's Manual (this document)	
PiloTREK – Programming Guide	

BASIC CONCEPTS AND ELEMENTS

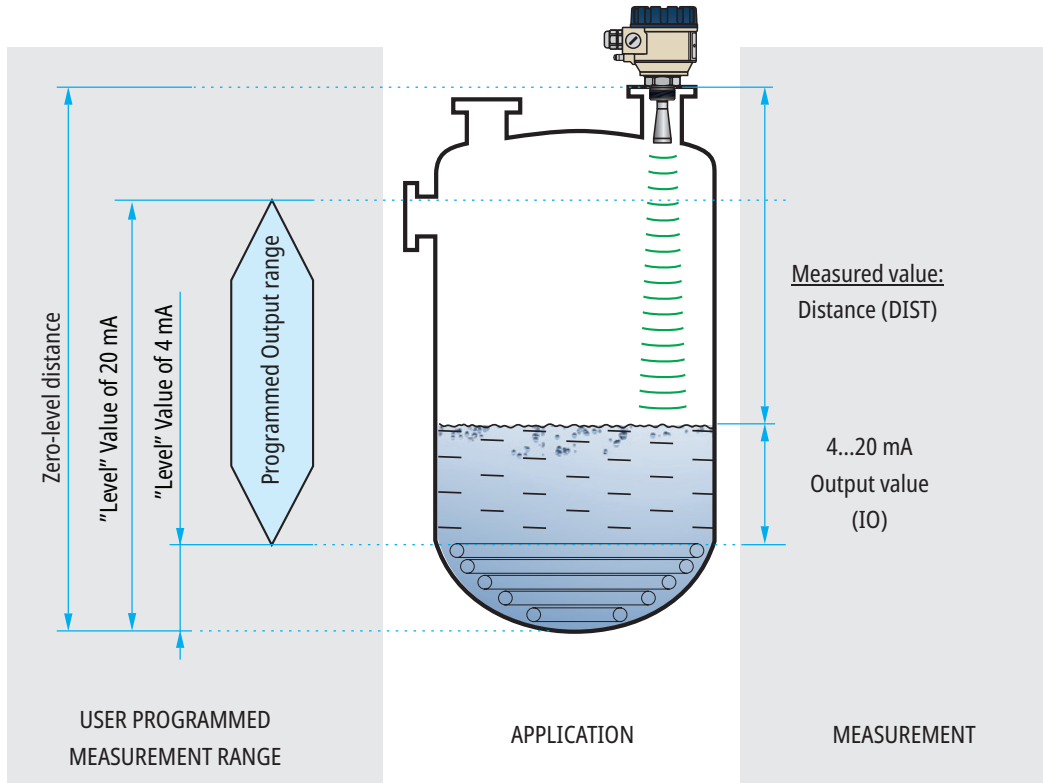


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Thank you for purchasing a NIVELCO product.

1. INTRODUCTION

Application

The **PiloTREK WE-200** compact non-contact radar level transmitters use the most advanced industrial 80 GHz FMCW radar measurement technology. Compared to lower frequencies (5...12 GHz and 25 GHz), 80 GHz radar has the main advantages of a smaller antenna size, better focus, and a narrower beam angle. It uses the latest technology to measure liquids, bulk materials, emulsions, and other chemicals widely used in, for example, the water industry, food industry, energy industry, pharmaceutical industry, and chemical industries, providing measurement results with millimeter accuracy. It can also measure materials prone to vapor formation and liquids with a gas blanket. Since the propagation of millimeter waves does not require a medium, it can also be used in a vacuum.

Operating Principle

The **PiloTREK WE-200** level transmitter is a frequency-modulated continuous wave (FMCW) radar operating at 80 GHz (W-band). Depending on the measured medium, part of the energy of the frequency-modulated wave emitted by the antenna of the level transmitter is reflected from the measured surface. The electronics module calculates the distance of the reflecting surface from the frequency shift proportional to the flight time of the reflected signal with high accuracy and converts it into a signal proportional to distance, level, or volume. The propagation speed of the millimeter-wave signal in air, gases, and vacuum is virtually the same regardless of temperature and pressure, so these factors do not significantly affect the accuracy of the measurement. The signal strength of the reflected millimeter waves depends largely on the measured medium's dielectric constant ($DK = \text{relative dielectric constant } \epsilon_r$). Therefore, the maximum measuring distance achieved may decrease accordingly. For media with a low dielectric constant, it is recommended to use an antenna with a larger diameter and therefore higher gain.

2. ORDER CODE (Not all combinations are available.)

PiloTREK

W ☐ ☐ — 2 ☐ ☐ — ☐ (1)

Version	Code	Antenna / Housing	Code
Transmitter	E	PP	Plastic (PBT) P
Transmitter + Display	G		Aluminum A
			Stainless steel D
Transmitter, high-temperature version ⁽²⁾	H	Stainless steel	Plastic (PBT) M
			Aluminum S
			Stainless steel K
Transmitter + Display, high-temperature version ⁽²⁾	J	PVDF	Plastic (PBT) V
			Aluminum B
			Stainless steel W
		PTFE	Plastic (PBT) F
			Aluminum T
			Stainless steel L
			Plastic (PBT) (lens-antenna version) C
			Aluminum (lens-antenna version) E
			Stainless steel (lens-antenna version) G

Measurement Range	Code
10 m (33 ft)	1
20 m (66 ft)	2
30 m (98.5 ft) ⁽³⁾	3

Process Connection	Code
1" BSP ⁽⁴⁾	2
1" NPT ⁽⁴⁾	3
1½" BSP ⁽⁵⁾	4
1½" NPT ⁽⁵⁾	5
1½" TriClamp ⁽⁴⁾⁽⁶⁾	C
2" TriClamp ⁽⁶⁾	D
3" TriClamp ⁽⁶⁾	E
4" TriClamp ⁽⁶⁾	F
Ø75 mm (2½") / prepared for flange ⁽³⁾⁽⁷⁾	8
Prepared for welded flange ⁽⁸⁾	S

Output / Certificates	Code
–	4
Ex ia IIC	8
Bluetooth®	B
Bluetooth® / Ex ia IIC	E
Relay	H
Bluetooth® + Relay	R

(1) For explosion-proof devices, the article number is followed by "Ex" on the data plate.

(2) Max. +200 °C (+400 °F). High-temperature version with metal housing and stainless-steel or PTFE encapsulated antenna only.

(3) Under development. (4) Only for 10 m (33 ft) measuring range. (5) For 10 m (33 ft) and 20 m (66 ft) measuring range. (6) Only for PTFE antenna version. (7) Only 30 m (98.5 ft) and encapsulated types, flanges available from size DN80 should be ordered separately.

(8) Only for 10 m (33 ft) and 20 m (66 ft) ranges, with 1½" stainless steel antenna, flange type MF□–□□□–L to be ordered separately.

Accessories	Order Code
Display unit	SAP–300–0
HART®–USB/Bluetooth® modem	SAT–504–□
eLink Module	SAT–506–□
HART®–USB/RS485 modem	SAK–305–2
HART®–USB/RS485 modem / Ex ia G	SAK–305–6

Process Connections ⁽⁹⁾	Order Code
DIN and ANSI flanges	MFT–□□□–□
DN40 Milch connection (DIN 11851)	
Seals ⁽⁹⁾	
EPDM	
FFKM	

⁽⁹⁾ The requirement for the above-mentioned process connections and seals must be specified in the order.

3. TECHNICAL DATA

3.1 General Technical Data

PiloTREK W□□-2□□-□			
Measured and derived values		Measured value: distance; derived values: level, volume, weight, flow	
Signal frequency		77...81 GHz (W-band)	
Resolution		0.1 mm (0.004")	
Lowest ϵ_r of medium		1.6 (Under ideal conditions)	
Supply voltage		12...36 V DC	
Output	Analog	4...20 mA; (3.9...20.5 mA); $R_{Lmax} = (U_S - 12 \text{ V}) / 0.02 \text{ A}$	
	Digital	HART® interface, HART® loop resistor $\geq 250 \Omega$	
	Display (optional)	SAP-300-0 graphic display unit	
	Relay (optional)	SPDT, 30 V / 1 A DC; 42 V / 0.5 A AC	
	Service interface	Compatible with SAT-506-0 eLink Module	
Connectivity		Bluetooth® LE 6.0 (optional)	
Measuring frequency		~ 1/s	
Process pressure		Depends on type, see table in section 3.2.	
Process temperature		-40...+80 °C (-40...+176 °F) High-temperature version: -40...+200 °C (-40...+400 °F) ⁽¹⁾	
Ambient temperature ⁽²⁾		-40...+70 °C (-40...+158 °F); with display unit: -20...+70 °C (-4...+158 °F)	
Seal		FPM (Viton®); optional: EPDM, FFKM (perfluoroelastomer, Kalrez® 6375)	
Ingress protection		IP66 / IP67 (NEMA 4 / 6 equivalent)	
Electrical connection		2× M20×1.5 cable gland + 2× ½" NPT conduits, cable outer diameter: Ø6...12 mm (Ø.24... Ø.47") Recommended: shielded cable, wire cross-section: 0.5...1.5 mm² (AWG20...AWG15)	
Electrical protection		Class I overvoltage protection; (Class III [SELV])	
Housing material ⁽³⁾		Fiberglass-reinforced plastic (PBT)	Painted aluminum Stainless Steel 1.4571/1.4404 (316Ti/316L equivalent)
Weight		0.6...0.8 kg (1.32...1.76 lb)	1.1...2 kg (2.43...4.4 lb) 2.4...2.9 kg (5.3...6.4 lb)

⁽¹⁾ High-temperature version with metal housing and stainless-steel or PTFE encapsulated antenna only, for more information see [3.4. Temperature Limits](#) for WH-200.

⁽²⁾ With PP encapsulated antenna: -30...+80 °C (-22...+176).

⁽³⁾ According to order code.

3.2 Type-Specific Data

Antenna type	Encapsulated Horn Antenna (W□P, W□V, W□F)			Lens-antenna (W□C, W□E, W□G)			Stainless Steel Antenna (W□S, W□M, W□K)		
	W□□-212-□ W□□-213-□	W□□-214-□ W□□-215-□	W□□-224-□ W□□-225-□	W□□-212-□ W□□-213-□	W□□-214-□ W□□-215-□	W□□-224-□ W□□-225-□	W□□-212-□ W□□-213-□	W□□-214-□ W□□-215-□	W□□-224-□ W□□-225-□
Antenna material	PP, PVDF, PTFE			PTFE			Stainless steel 1.4571/1.4404 (316Ti/316L equivalent)		
Dead zone ⁽¹⁾	0 m (0 ft)								
Max. measuring distance ⁽²⁾	10 m (33 ft)		20 m (66 ft)	10 m (33 ft)		20 m (66 ft)	10 m (33 ft)		20 m (66 ft)
Accuracy ⁽³⁾	Up to 6 m (19.68 ft): ±2 mm (±0.08") Over 6 m (19.68 ft): ±4 mm (±0.16")	±2 mm (±0.08")		Up to 6 m (19.68 ft): ±2 mm (±0.08") Over 6 m (19.68 ft): ±4 mm (±0.16")	±2 mm (±0.08")		Up to 6 m (19.68 ft): ±2 mm (±0.08") Over 6 m (19.68 ft): ±4 mm (±0.16")	±2 mm (±0.08")	
Antenna insertion length ⁽⁴⁾	56 mm (2.2")	70 mm (2.76")		28 mm (1.1")	46 mm (1.8")		80 mm (3.15")	90 mm (3.54")	
Process pressure	−1...3 bar (−14.5...43.5 psi)						−1...25 bar (−14.5...363 psi)		
Beam angle (−3 dB)	12°	7°		12°	7°		12°	7°	
Process connection	1" BSP / NPT	1½" BSP / NPT		1" BSP / NPT	1½" BSP / NPT		1" BSP / NPT	1½" BSP / NPT	

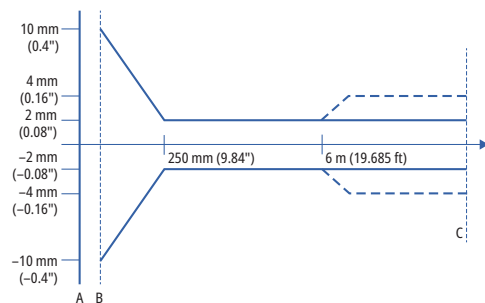
⁽¹⁾ From the tip of the antenna, if dielectric constant (ϵ_r) < 80.

⁽²⁾ May be limited for media with low dielectric constants or non-vertical or non-planar surfaces.

⁽³⁾ With an ideal reflecting surface, according to IEC 62828-1, an accuracy of ±2 mm (±0.08") is not guaranteed for Region 3 and Region 4 settings.

⁽⁴⁾ From process connection.

3.3 Linearity Error

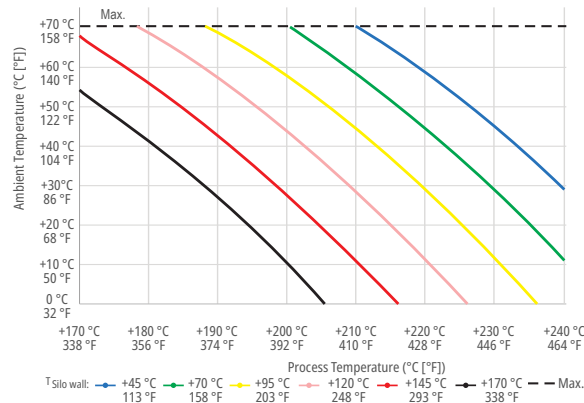


Legend:

- W□□-212-□ / W□□-213-□
- W□□-214-□ / W□□-215-□ / W□□-224-□ / W□□-225-□

- A. Process connection plane of the device
- B. The minimum measurement distance below which the radar cannot measure, due to the insertion length of the antenna (X_{min})
- C. Maximum measurement distance (X_{Max})

3.4 Temperature Limits for WH-200



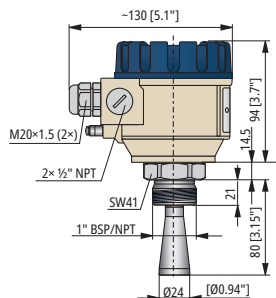
The ambient temperature around the PiloTREK electronics housing must be controlled, for example by appropriate thermal insulation of the process or other suitable methods. The "T_{Silo-wall}" parameter indicates the temperature of the outer surface of the thermal insulation immediately surrounding the PiloTREK. This value directly affects the maximum permissible process temperature.

3.5 Dimensions

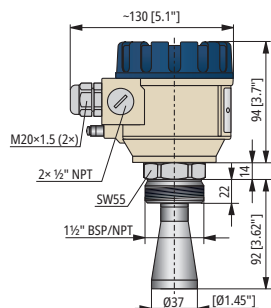
Plastic housing (WOM, WOP, WOV)

Stainless steel antenna

WOM-212-□ / WOM-213-□

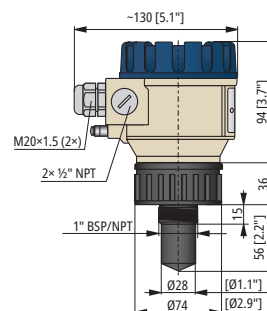


WOM-204-□ / WOM-205-□

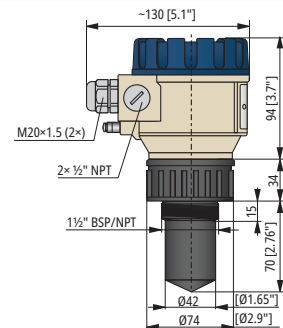


PP/PVDF Encapsulated antenna (WOP, WOV)

WOP-212-□ / WOP-213-□



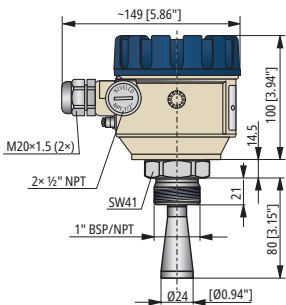
WOP-204-□ / WOP-205-□



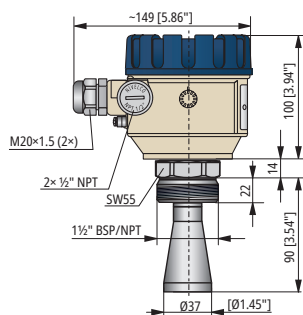
Aluminum housing (WOA, WOB, WOS, WOT)

Stainless steel antenna

WOS-212-□ / WOS-213-□

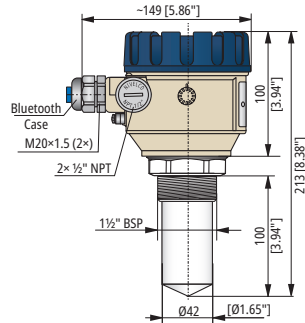


WOS-204-□ / WOS-205-□



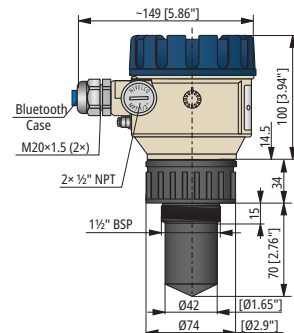
PTFE encapsulated antenna

WOT-204-B / WOT-205-B



PP/PVDF encapsulated antenna (WOB, WOA)

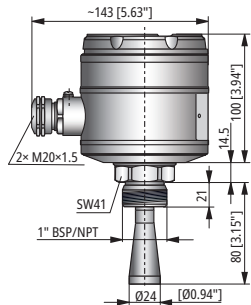
WOB-204-B / WOB-205-B



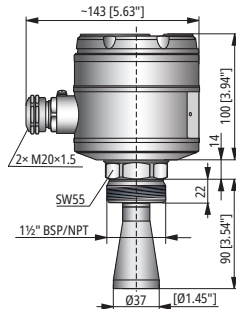
Stainless steel housing (W□K, W□D, W□L)

Stainless steel antenna

WOK-212-□ / WOK-213-□

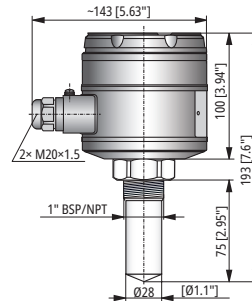


WOK-204-□ / WOK-205-□

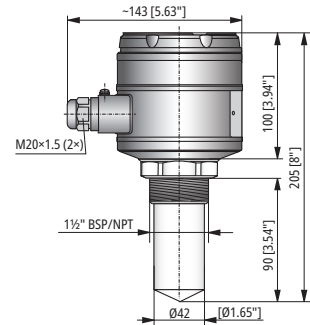


PTFE encapsulated antenna

WOL-212-□ / WOL-213-□



WOL-204-□ / WOL-205-□

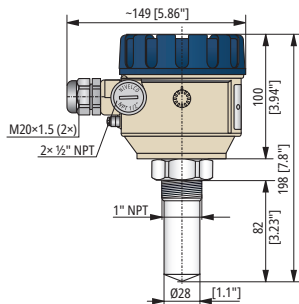


Aluminum housing

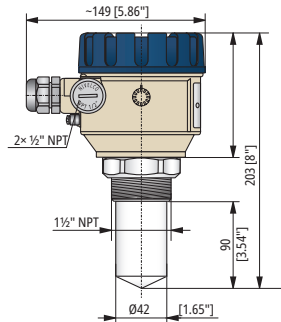
High-temperature version (WHT, WHL, WJT, WJL)

PTFE encapsulated antenna

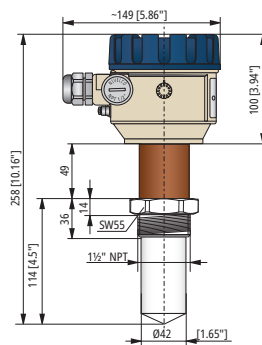
WOT-212-□ / WOT-213-□



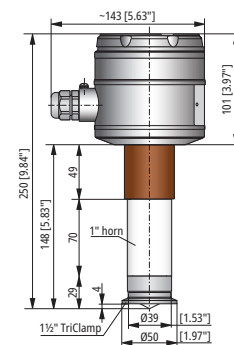
WOT-204-□ / WOT-205-□



WHT-204-□ / WJT-205-□



WHL-21C-□ / WJL-21C-□



PTFE lens-antenna (W□C, W□E, W□G)

Aluminum housing

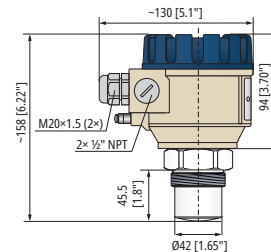
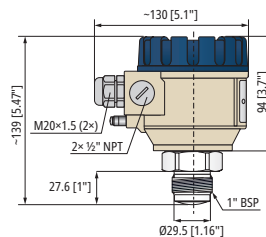
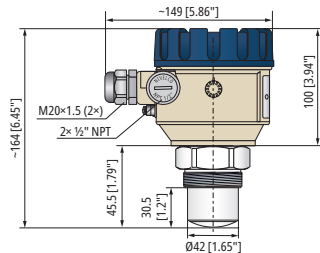
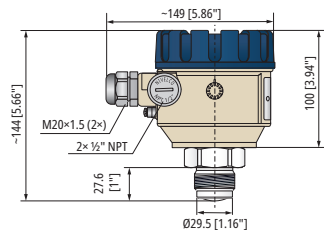
Plastic housing

W□E-212-□ / W□E-213-□

W□E-2□4-□ / W□E-2□5-□

W□C-212-□ / W□C-213-□

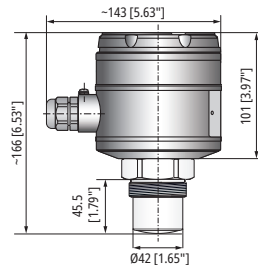
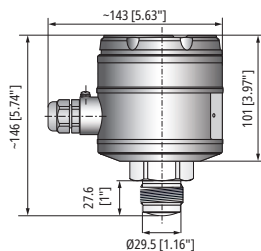
W□C-2□4-□ / W□C-2□5-□



Stainless steel housing

W□G-212-□ / W□G-213-□

W□G-2□4-□ / W□G-2□5-□



3.6 Explosion Protection, Designation, Limit Values

3.6.1 ATEX Intrinsically Safe Protection (Ex ia) – ATEX Certificate No.: BKI24ATEX0001 X

Application group		IIC	IIIC
Standard version		WE□-2□□-8 Ex / WG□-2□□-8 Ex / WE□-2□□-E Ex / WG□-2□□-E Ex	
Ex marking (ATEX)		Ⓔ II 1G Ex ia IIC T6 Ga	Ⓔ II 1D Ex ia IIIC T85°C Da
High-temperature version		WH□-2□□-8 Ex / WJ□-2□□-8 Ex / WH□-2□□-E Ex / WJ□-2□□-E Ex	
Ex marking (ATEX)		Ⓔ II 1G Ex ia IIC T6...T3 Ga	Ⓔ II 1D Ex ia IIIC T85°C...T180°C Da
Ex power supply, intrinsically safety data ⁽¹⁾		U _i = 30 V, I _i = 100 mA, P _i = 0.75 W C _i ≤ 12 nF, L _i ≤ 250 µH	U _i = 30 V, I _i = 140 mA, P _i = 1 W C _i ≤ 12 nF, L _i ≤ 250 µH
Supply voltage		12...30 V DC	
Electrical connection	Cable entry	2× M20×1.5 cable glands + 2× internally threaded ½" NPT connection	
	Cable outer diameter	Ø6...12 mm (Ø0.25...0.5")	
	Wire cross-section	0.5...1.5 mm ² (AWG20...15)	
Temperature limit data		See tables in section 3.6.2.	

⁽¹⁾ In IIB applications, Ex power supply data for IIIC can be used.

3.6.2 Temperature Limit Data for ATEX (Ex ia) Approved Models

Temperature data	Standard version WE□-2□□-8 Ex / WG□-2□□-8 Ex, WE□-2□□-E Ex / WG□-2□□-E Ex	High-temperature version WH□-2□□-8 Ex / WJ□-2□□-8 Ex, WH□-2□□-E Ex / WJ□-2□□-E Ex			
	Ex ia IIC, Ex ia IIIC	Ex ia IIC, Ex ia IIIC			
Temperature class	T6 T85°C	T6 T85°C	T5 T100°C	T4 T135°C	T3 T180°C
Highest process temperature	+80 °C (+176 °F)	+80 °C (+176 °F)	+100 °C (+212 °F)	+135 °C (+275 °F)	+180 °C (+356 °F)
Highest surface temperature at the process connection	+70 °C (+158 °F)	+70 °C (+158 °F)	+100 °C (+212 °F)	+135 °C (+275 °F)	
Highest ambient temperature	+70 °C (+158 °F)	+70 °C (+158 °F)	+70 °C (+158 °F)	+60 °C (+140 °F)	

3.6.3 IECEx Intrinsically Safe Protection (Ex ia) – IECEx Certificate No.: IECEx BKI 26.0003X

Application group		IIC	IIIC
Standard version		WE□–2□□–8 Ex / WG□–2□□–8 Ex / WE□–2□□–E Ex / WG□–2□□–E Ex	
Ex marking (IECEx)		Ex ia IIC T6 Ga	Ex ia IIIC T85°C Da
High-temperature version		WH□–2□□–8 Ex / WJ□–2□□–8 Ex / WH□–2□□–E Ex / WJ□–2□□–E Ex	
Ex marking (IECEx)		Ex ia IIC T6...T3 Ga	Ex ia IIIC T85°C...T200°C Da
Ex power supply, intrinsically safety data ⁽¹⁾		Ui = 30 V, Ii = 100 mA, Pi = 0.75 W Ci ≤ 13 nF, Li ≤ 265 µH	Ui = 30 V, Ii = 140 mA, Pi = 1 W Ci ≤ 13 nF, Li ≤ 265 µH
Supply voltage		12...30 V DC	
Electrical connection	Cable entry	2× M20×1.5 cable glands + 2× internally threaded ½" NPT connection	
	Cable outer diameter	Ø6...12 mm (Ø0.25...0.5")	
	Wire cross-section	0.5...1.5 mm² (AWG20...15)	
Temperature limit data		See tables in section 3.6.4	

⁽¹⁾ In IIB applications, Ex power supply data for IIIC can be used.

3.6.4 Temperature Limit Data for IECEx (EX IA) Approved Models

Temperature data	Standard version WE□–2□□–8 Ex / WG□–2□□–8 Ex, WE□–2□□–E Ex / WG□–2□□–E Ex	High-temperature version WH□–2□□–8 Ex / WJ□–2□□–8 Ex, WH□–2□□–E Ex / WJ□–2□□–E Ex			
	Ex ia IIC, Ex ia IIIC	Ex ia IIC, Ex ia IIIC			
Temperature class	T6 T85°C	T6 T85°C	T5 T100°C	T4 T135°C	T3 T200°C
Maximum process temperature	+80 °C (+176 °F)	+80 °C (+176 °F)	+100 °C (+212 °F)	+130 °C (+266 °F)	+200 °C (+392 °F)
Maximum surface temperature at the process connection	+70 °C (+158 °F)	+70 °C (+158 °F)	+100 °C (+212 °F)	+130 °C (+266 °F)	+180 °C (+356 °F)
Maximum ambient temperature	+70 °C (+158 °F)				

3.6.5 INMETRO Intrinsically Safe Protection (Ex ia) – INMETRO Certificate No.: DNV 24.0166 X

Application group		IIC	IIIC
Standard version		WE□–2□□–8 Ex / WG□–2□□–8 Ex / WE□–2□□–E Ex / WG□–2□□–E Ex	
Ex marking (INMETRO)		Ex ia IIC T6 Ga	Ex ia IIIC T85°C Da
High-temperature version		WH□–2□□–8 Ex / WJ□–2□□–8 Ex / WH□–2□□–E Ex / WJ□–2□□–E Ex	
Ex marking (INMETRO)		Ex ia IIC T6...T3 Ga	Ex ia IIIC T85°C...T180°C Da
Ex power supply, intrinsically safety data ⁽¹⁾		Ui = 30 V, Ii = 100 mA, Pi = 0.75 W Ci ≤ 12 nF, Li ≤ 250 µH	Ui = 30 V, Ii = 140 mA, Pi = 1 W Ci ≤ 12 nF, Li ≤ 250 µH
Supply voltage		12...30 Vcc	
Electrical connection	Cable entry	2× M20×1.5 cable glands + 2× internally threaded ½" NPT connection	
	Cable outer diameter	Ø6...12 mm (Ø0.25...0.5")	
	Wire cross-section	0.5...1.5 mm ² (AWG20...15)	
Temperature limit data		See tables in section 3.6.6	

⁽¹⁾ In IIB applications, Ex power supply data for IIIC can be used.

3.6.6 Temperature Limit Data for INMETRO (Ex ia) Approved Models

Temperature data	Standard version WE□–2□□–8 Ex / WG□–2□□–8 Ex, WE□–2□□–E Ex / WG□–2□□–E Ex	High-temperature version WH□–2□□–8 Ex / WJ□–2□□–8 Ex, WH□–2□□–E Ex / WJ□–2□□–E Ex			
	Ex ia IIC, Ex ia IIIC	Ex ia IIC, Ex ia IIIC			
Temperature class	T6 T85°C	T6 T85°C	T5 T100°C	T4 T135°C	T3 T180°C
Maximum process temperature	+80 °C (+176 °F)	+80 °C (+176 °F)	+100 °C (+212 °F)	+135 °C (+275 °F)	+180 °C (+356 °F)
Maximum surface temperature at the process connection	+70 °C (+158 °F)	+70 °C (+158 °F)	+100 °C (+212 °F)	+135 °C (+275 °F)	
Maximum ambient temperature	+70 °C (+158 °F)	+70 °C (+158 °F)	+70 °C (+158 °F)	+60 °C (+140 °F)	

3.7 Accessories

- | | | |
|-----------------|--------------------------------|-------------------------------------|
| — Warranty card | — EU Declaration of Conformity | — Flat seal (if applicable) |
| — User's Manual | — Two M20×1.5 cable glands | — SAP-300 display unit (if ordered) |

3.8 Conditions for Safe Operation

Compliance with technological process conditions

- If the device is installed in a place subject to overvoltage, the device must be equipped with overvoltage protection of at least overvoltage Class II.
- The device must be connected to the earth of the EP network via its earth screw.

-  The cable extending from the device must be fixed and relieved of any tension.
-  The device may only be powered from a Category 1 (SELV/PELV) power supply unit.

Compliance with local rules and regulations

The PiloTREK WE-200 is a Level Probing Radar (LPR) and must be mounted in a fixed, antenna-down position. In addition, the following two restrictions on antenna placement and height from the ground must be observed:

- a separation distance of 4 km (2.48 miles) from radio astronomy sites operating in the frequency band 75...85 GHz, unless specifically authorized by the relevant national regulatory authority.
- At a distance between 4 and 40 km (2.48 and 24.8 miles) from any radio astronomy site, the height of the radar above ground level must not exceed 15 m (49.2 ft).

Compliance with Ex requirements

- Intrinsically safe devices can only be operated from circuits that comply with the technical specifications, certified and approved as [Ex ia IIC] or [Ex ia 11B] protection.
- The aluminum alloy content in the device housing exceeds the limit, so in explosive (Ex) environments, the equipment must be protected against impact and friction effects.
- The housing of the device is made of a material capable of accumulating static charge. The presence of electrostatic charge poses a risk of spark generation and ignition, so electrostatic charging must be completely prevented in explosive (Ex) environments.
 - The device may only be installed in an environment free from direct air flows that may cause charge transfer or other electrostatic charging effects. Except for Group III applications, where the dust conductivity is greater than $>10^{-9}$ S (at $50 \pm 5\%$ relative humidity) or $>10^{-11}$ S (at $30 \pm 5\%$ relative humidity).
 - Increased caution is required during maintenance when explosive residues may be present in the process tank. Devices used in explosive (Ex) environments may only be handled using a water-moistened or antistatic wipe.

3.9 Maintenance, Repair, and Storage Conditions

The PiloTREK WE-200 does not require regular maintenance. However, there may be cases where the sensor head needs to be cleaned of material deposits. Clean the device carefully, without scratching or pressing the radiating surface. All repairs, whether covered by warranty or not, must be carried out by NIVELCO.

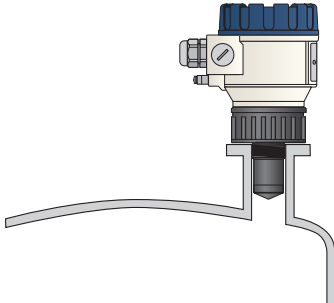
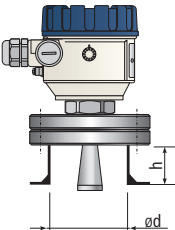
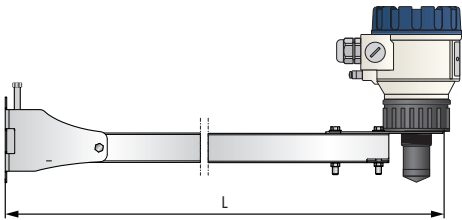
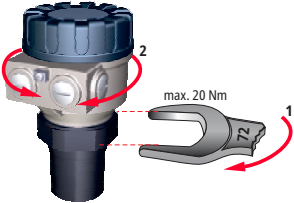
The warranty terms are detailed in the warranty card. For repairs, the user must clean and disinfect the device, neutralize any chemical residues, and complete the [Returned Equipment Handling Form](#), which is available for download on our website. On the form, the user must declare the defect, provide the reason for return, and confirm that the device is clean and free of hazardous substances.

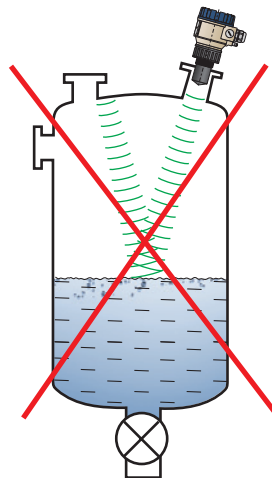
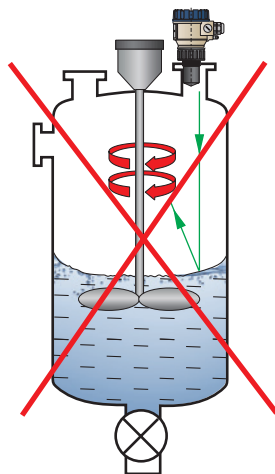
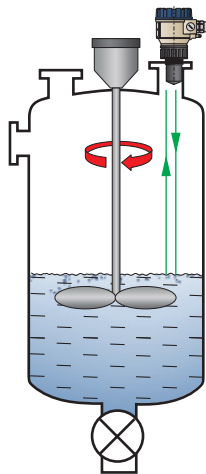
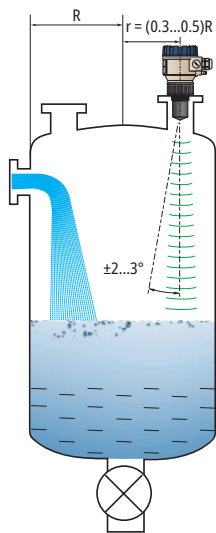
3.10 Firmware Update

The device firmware is continuously improved based on user feedback and application needs. If you want to update the firmware, use the built-in update communication port to upgrade to the latest version. To update, you need the NiFlash Light program; contact your local NIVELCO partner. In addition, the SAT-506-0 eLink communication adapter is required to upgrade the firmware.

4. INSTALLATION AND COMMISSIONING

4.1 Mounting

Pipe thread	Flange	Mounting bracket (SAC-1□1-0)
	 $h \leq \varnothing d$, where h = nozzle height $\varnothing d$ = nozzle diameter If the above condition cannot be met, consult NIVELCO.	 $L = 188 \dots 991 \text{ mm (7.4} \dots 39.02 \text{ in)}$
	Rotating enclosure: After threading-in and tightening the device, the enclosure can be rotated to the desired positions by max. 350°.	



POSITION

The optimal location for PiloTREK (for a cylindrical tank) is at radius $r = (0.3...0.5) R$. The radiation cone angle should always be considered.

The liquid surface must be perpendicular to the axis of the device.

Under no circumstances place the device near the inlet opening. Improper placement may lead to malfunctions.

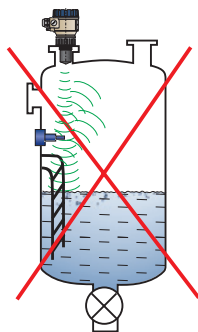
In the case of enclosed antenna designs, moisture on the front surface of the antenna should be minimized.

OBSTACLES

It is essential to avoid objects (pipes, ladders, structural elements, thermometers, etc.) entering the radiation cone.

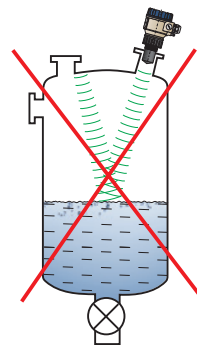


CAUTION! Up to four interfering echoes can be suppressed by configuring the threshold settings in PiloTREK WE-200.



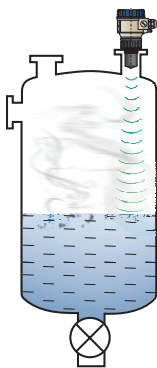
ALIGNMENT

The plane of the process connection must be parallel to the measured surface within $\pm 2...3^\circ$.



GAS / VAPOR

In a closed (especially outdoors, exposed to direct sunlight) tank, vapors/gases above the liquid may reduce the millimeter-wave signal transmission.

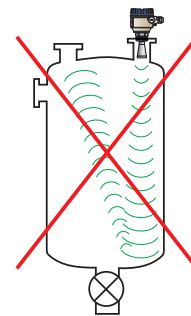


EMPTY TANK

Especially in the case of tanks with convex or conical bottoms or tanks with equipment (e.g., heating element, mixing paddle) at the bottom, the device may indicate an incorrect level when the tank is completely drained.

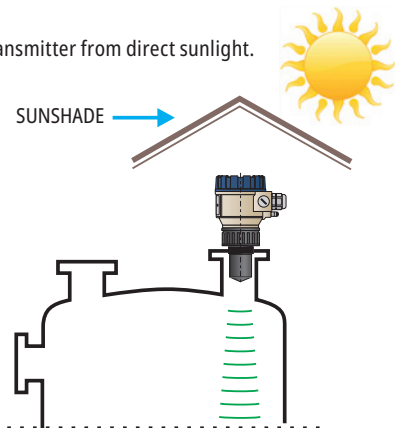
It is because the tank bottom or objects at the bottom of the tank scatter or reflect the millimeter waves emitted to a certain extent, or the lower signal level of the scattered radiation interferes with itself in the tank.

At least 100 mm (3.9") of liquid must cover these interfering devices or the convex or conical tank bottoms for a reliable measurement.



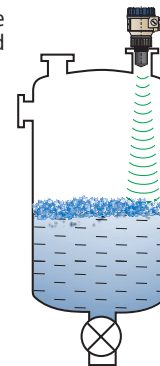
TEMPERATURE

It is recommended to shield the transmitter from direct sunlight.



FOAM

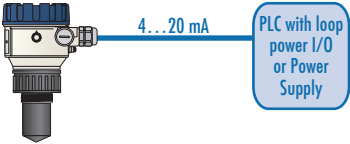
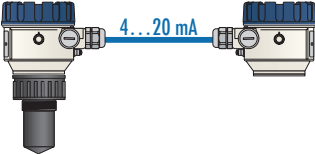
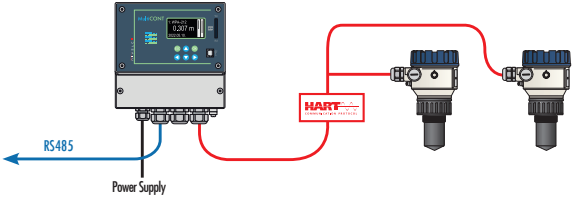
Foam on the measured surface may prevent millimeter-wave level measurement. Therefore, if possible, the sensor should be installed in a location where foam formation is minimal.



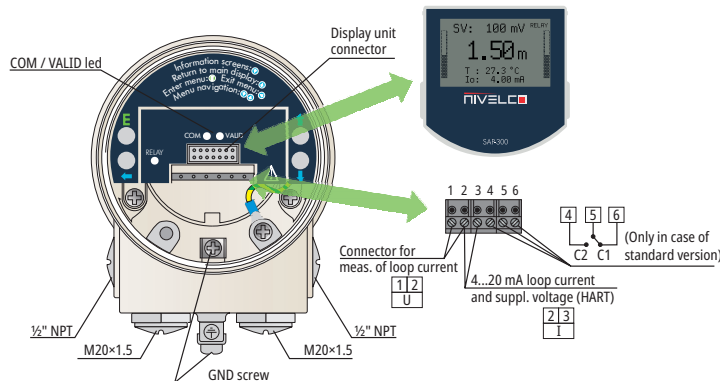
4.2 Open-Channel Flow Measurement Applications

- The device can measure flow in open channels using flumes/weirs or by means of an output conversion table (OCT).
[See the PilotREK User's and Programming Manual on the NIVELCO website for more information.](#)
- The level transmitter should be installed as close as possible to the maximum measured level.
- The level transmitter must be placed in the longitudinal axis of the flume, at a location determined by the flume characteristics. This point is marked on the Parshall flumes sold by NIVELCO and 3rd party flumes.
- Foam may form on the surface of the flowing liquid, which can affect the measurement result. To ensure proper echo formation, a clear and unobstructed liquid surface must be provided in front of the sensor.
- The level transmitter must be secured in its mounting location to prevent it from moving.
- The accuracy of volume flow measurement depends on the size and shape of the flume-weir and the surface of the flowing liquid (rippling, foaming). Open-channel flow measurement accuracy is always lower than level measurement accuracy.
- The level transmitter should be protected from direct sunlight. Use a NIVELCO **NISHADE** cover to protect the device.

4.3 Wiring

Standalone transmitter	Connected to MonoCONT	Connected to MultiCONT (HART® Multidrop)
		
See Chapter 4.3.1.	See MonoCONT User's and programming manual	See MultiCONT User's and programming manual

4.3.1 Wiring of Standalone Transmitter



If the transmitter is equipped with a display unit, gently unplug it by pulling it upwards using two fingers from the sides.

1. Insert the cable through the cable gland or conduit into the housing.
2. Unplug/remove black screw terminal (1-6) for easier wire connection.

3. Check the polarity before inserting the wires into the terminal ports 2 and 3:

Minus (-) to Terminal 2
Plus (+) to Terminal 3

DO NOT perform an insulation test with a test voltage of 500 V AC due to the internal electronic overvoltage protection.



4. Be sure to tighten the cable gland or conduit, as well as the device cover, to prevent humid air, water, and dust from entering the enclosure.

LED states:

• ECHO-LED

- ON, if the device receives a suitable echo.
- BLINKS when the device is searching for an echo.

• COM-LED

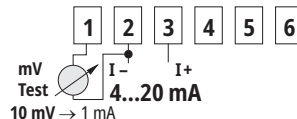
FLASHES UP ONCE if there has been a HART message exchange,

- ON, if the device is in remote programming mode.
- BLINKS for 4 seconds after the device is switched on: service communication connection can be established during this time. If it continues to blink, it indicates a firmware error.

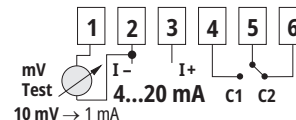
• RELAY LED (optional)

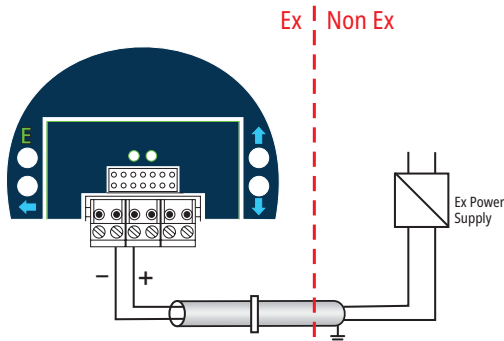
- ON, when CC-C2 is energized.
- OFF, when CC-C1 is energized.

Model with 2-wire Loop power



Model with 2-wire Loop power and NO/NC Relay output





! In non-hazardous areas, the device must be powered through a galvanically isolated power supply.

For devices used in hazardous areas, the requirements in section "[3.8 Conditions for safe operation](#)" must be observed when selecting the power supply.

The insulation test is prohibited due to the internal electronic overvoltage protection.

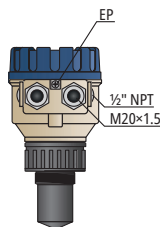
Connecting (grounding) to an equipotential network (EPH)

Earthing connector (EP) on the side of the device housing, maximum conductor cross-section: 4 mm² (AWG12).

The instrument housing must be earthed to a $R < 1 \Omega$ resistive earth.

The shield of the measuring cable must be grounded in the instrument room.

The measuring cable should not be routed near high-power cables, as shielding does not protect against switching harmonics.

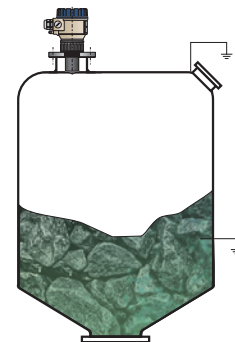


Electrostatic Discharge (E.S.D.)

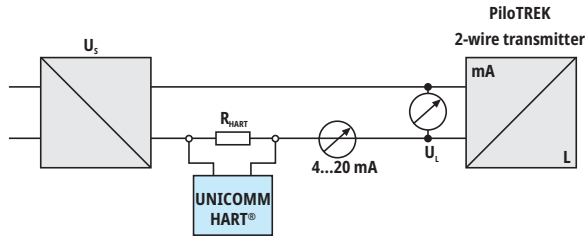
! The device is protected against 4 kV E.S.D.

Warning! The internal protection of the instrument against ESD cannot protect the entire measuring system against electrostatic discharge.

In all cases, it is the user's responsibility to ensure the grounding of the tank and the measured material.



Designing a measuring network



Power supply	
Nominal voltage	24 V DC
Maximum voltage (U_{in}):	36 V DC
Minimum voltage (U_{in}):	Depends on the load impedance. (See diagram)
Loop resistance, R_{Loop}	$R_{HART} + R_{cable} + R_{ammeter}$
Minimum R_{HART}	0 Ω
Maximum R_{HART}	750 Ω
R_{HART} resistance for HART® communication	250 Ω (recommended)

Line "A": minimum voltage at the input terminals of the device

Line "B": minimum supply voltage (voltage across the device and the 250 Ω loop resistor)

Example for calculating the supply voltage:

The required minimum supply voltage at $I_{min} = 4$ mA:

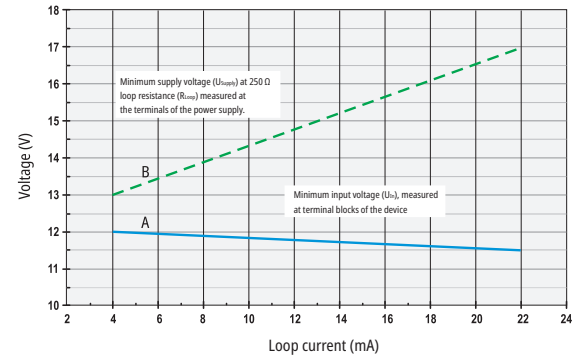
$$U_{Supply\ min.} = U_{IN\ min.} + (I_{min} * R_{Loop}) = 11.5\ V + (4\ mA * 0.25\ k\Omega) = 12.5\ V$$

the required minimum supply voltage at $I_{max} = 22$ mA:

$$U_{Supply\ min.} = U_{IN\ min.} + (I_{min} * R_{Loop}) = 11.5\ V + (22\ mA * 0.25\ k\Omega) = 18.5\ V$$

Therefore, in the case of a loop resistance of 250 Ω , the 17 V supply voltage is just sufficient for the whole 4...20 mA in the measurement range.

In hazardous areas, the data and requirements for designing the network may be different. When designing the measurement network, take into account the data and requirements in "[3.6. Explosion Protection, Designation, Limit Values](#)" and "[3.8. Conditions for safe operation](#)".



4.4 Device Setup and Service Options

- UNIDISP SAP-300 Plug-in graphic display unit and 4-key menu-driven programming (if equipped)
- [MobileEview](#) App for iOS or Android device (if PiloTREK is equipped with Bluetooth® connectivity).
 - Download the free MobileEview App to your iOS or Android device.
 - Bluetooth® operation mode (on/off/time-out, etc.) can be selected based on security policy.
- [MonoCONT](#) and [MultiCONT](#) remote display/controllers.
- Via HART®:
 - [EView2](#) free download SW for Windows devices using a HART® modem. Ex.; [UNICOMM SAT-504-□](#).
 - Via PACTware.
 - 3rd party HART® modem



4.5 BUS (HART®) Communication

The output of the device can be used as:

- Current loop and HART®.
- Multidrop, HART® protocol

MonoCONT and MultiCONT remote display/controllers support both modes. By the Rosemount Standard, HART® communication can be used between the PiloTREK as a “slave” and the HART® master as a point-to-point connection.

Communication can be implemented in two modes. If the device is set to current transmission (4...20 mA, “0” HART short address) only one device can be used in the HART communication loop. In a multidrop operation (4 mA), several devices (up to 15) can be connected in a HART communication loop. The device's short address must be different from 0.

4.6 Commissioning and Setup

The factory default settings are suitable for checking functionality and for simple measurement tasks, but the device's full potential can only be utilized with correct programming tailored to the requirements of the process. Therefore, to get to know the operational characteristics thoroughly and solve complex measuring tasks, it is necessary to read the chapters about programming.

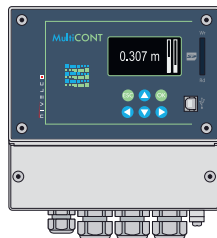
5. USER INTERFACE OPTIONS / PROGRAMMING

Transmitters with Local display via display and 4 push buttons



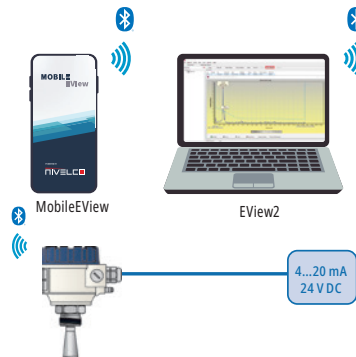
1. Insert display and power up transmitter.
2. Press **E** button to enter menu.
3. See **5.1 Local display / menu handling** for more information.

via MultiCONT field controller



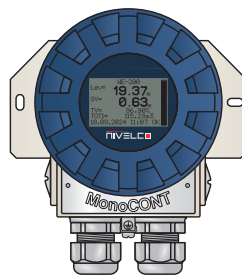
1. See MultiCONT Programming Manual for wiring and handling.
2. See PilotREK Programming Manual for configuration.

Transmitters with Bluetooth via Mobile EView App or EView2 (PC)



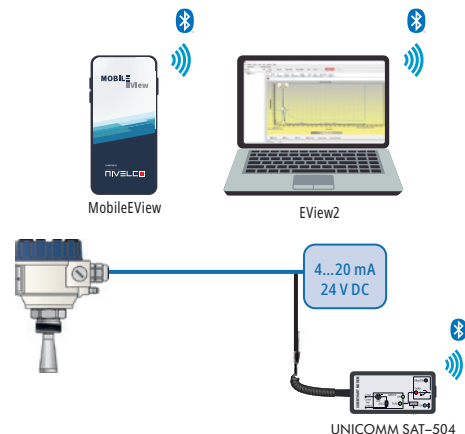
1. Install "MobileEView" App on iOS or Android devices, or download [EView2 software](#) for Windows devices
2. Power up transmitter and connect from software.

via MonoCONT field display



1. See MonoCONT Programming Manual for wiring and handling.
2. See PilotREK Programming Manual for configuration.

Transmitters with HART using HART Modem (SAT-504-□) and EView2 (PC) or MobileEView



1. Connect HART modem to current loop using 250 Ω HART resistor.
2. Connect Laptop to HART modem using USB cable or via Bluetooth if modem has Bluetooth option.
3. Download [EView2 software](#) for Windows devices.
4. Power up transmitter and connect from software.

Transmitters with Modbus interface via Modbus master

1. See Modbus Programming Manual for the supported protocol.
2. See PilotREK Programming Manual for configuration.

5.1 Local Display / Menu Handling

5.1.1 SAP-300 Display Unit (Optional)

PiloTREK WE-200 type compact radar transmitters can be equipped with an SAP-300 display unit. The display shows the actual measurement value and status information by default. The display can also be used to program most of PiloTREK's parameters with the four buttons.

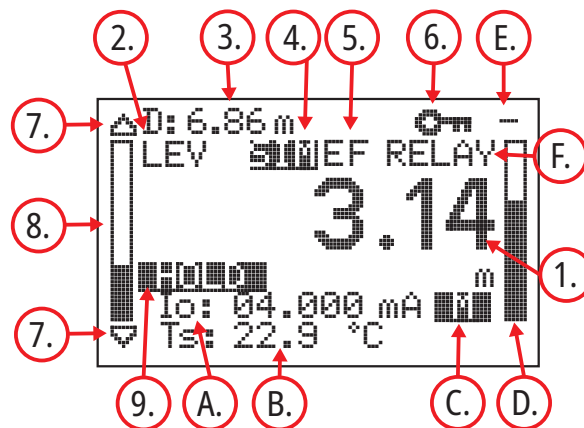
SAP-300 display unit – Technical data		Warning!
Display	64 × 128 dot matrix LCD	⚠ Do not expose the SAP-300 to prolonged heat or direct sunlight, as the display may be damaged.
Operating temperature:	–20...+65 °C (–4...+149 °F)	

Do not leave the SAP-300 in the PiloTREK, if it is not possible to protect the PiloTREK from sunlight or if the PiloTREK is to be used outside the operating temperature range of the SAP-300.



5.1.2 Elements of the Display

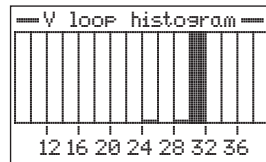
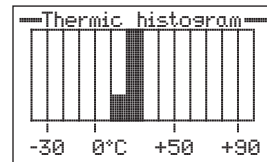
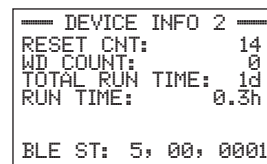
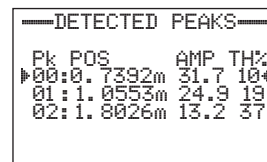
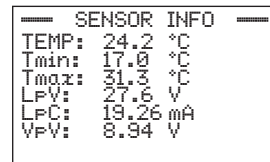
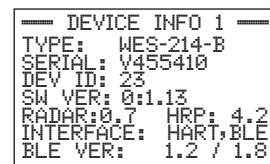
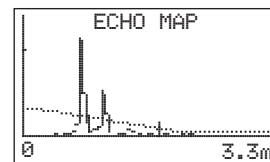
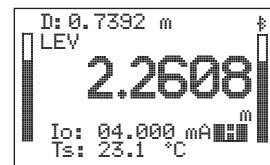
1	Measured Primary Value (PV), with unit indication below (5 digit)		
2	Measured quantity (PV mode): LEV – Level, VOL – Volume, FLOW – Flow, ...		
3	Raw value for PV calculation: ' D :' – Distance, ' L :' – Level, ' H :' – Flow height		
4	SIM – indicator: Simulation mode active. Warning! PV is simulated, not measured.		
5	Empty/Full marker: ' E ' – Tank Empty, ' F ' – Tank Full		
6	Menu locked by: ' KEY ' – Security code, ' REM ' – Remote access active		
7	Trend indicator: ' △ ' – slow increase, ' ▲ ' – fast increase, ' ▽ ' – slow decrease, ' ▼ ' – fast decrease		
8/D	Bar-graph: <i>left</i> – Level % (full range), <i>right</i> – Output % of 4–20 mA output range		
9	Output status indicator: ' OCT ' – Output Conversion Table active speed Level change speed exceeds limit, output holding last valid hold Echo loss, output holding last valid value F/EE cho loss, output continuing last valid trend		
A	Output current value	B	Transmitter temperature
C	Output mode: ' M ' – Manual, ' H ' – HART multi-drop, ' E ' – Error current		
E	Bluetooth® status: ' B ' – Enabled, ' * '– Connected, ' - ' – Disabled, ' X ' – Error		
F	'RELAY' – Relay On (C2 state)		



5.1.3 Info Screens

You can switch between info screens using the   and  buttons.

- Value display: single display mode
- Echo map: dotted line indicates threshold level
- Peak list: Peak no., Position, Amplitude [dB], Threshold relative to peak amplitude
- Device info 1: Type and version info
- Device info 2: Run time info (only for advanced diagnostic purposes)
- Sensor Info: (TEMP) Electronics temperature, (LpV) Loop voltage, (LpC) Loop current, (VpV) Internal buffer voltage.
- Histogram: Thermic histogram, Loop voltage histogram



5.1.4 Menu Handling

Navigating in the menu	Button	Value input	Checkbox setting
Entering the selected menu		Accepting the setting	Accepting the setting
Selecting a menu item	 	Modifying digit value	Selecting an item
Going back to the previous menu		Next digit	Switching checked/unchecked

Menu properties

Enter the main menu from any info screen by pressing the  button.

Menu TOP row: left – MENU TITLE, right –  or  indicates that menu can be scrolled in given direction.

Menu BOTTOM row: left – **<Menu ID>** (M-ID), right – **Parameter-ID** (P-ID), only if relevant

Changes take effect only after you exit the menu. Until then, the transmitter continues to operate with the previous settings.

After 30 seconds of inactivity (or if SAP-300 is unplugged) PiloTREK will automatically exit the menu, discarding all changes.

Local display access and remote programming (**REM**) through Bluetooth, HART or MODBUS block each other. Whichever is first will have priority.

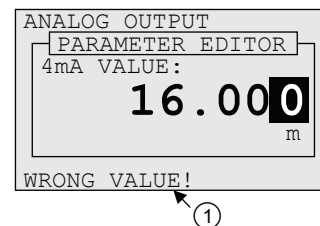
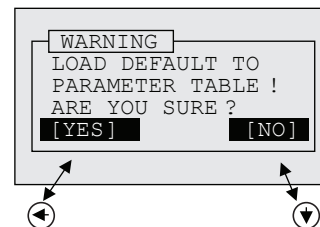
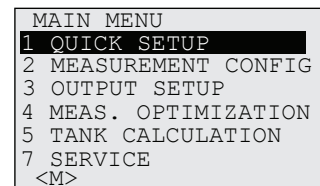
Dialog BOX:  or  buttons perform the function displayed on the screen, e.g., [Yes], [No].

Value input – special key combinations (press simultaneously)

 +  → Return to original value.

 +  → Set to default value.

 +  → Set to actually measured value. (Supported only at some parameters.)

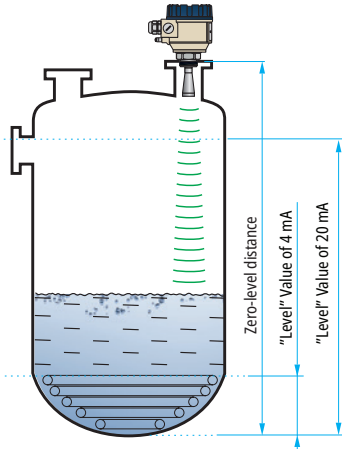


6. PilotREK SETTINGS

6.1 Quick Setup

Local display menu	M-ID	EView2	MonoCONT	P-ID	MultiCONT	Modbus
QUICKSET	Q	—	—	—	—	—

PilotREK W-200 models with integrated display (WG□-2□□-□) offer a built-in Quick Setup feature for simple LEVEL measurement applications. Quick Setup guides you sequentially through the following basic settings. Press  button for 3 seconds to exit Quick Setup any time. [See the PilotREK User's and Programming Manual on the NIVELCO website for more information.](#)

#		Description	
0	REGION	Defines RF compliance and the unit system (Metric/Imperial) to be used. For USA select "US / Imperial".	
1	ZERO-LEVEL DISTANCE	Defines the zero point for level measurement. Enter the distance between the sealing plane of the process connection and the designated zero level	
2	PV VALUE OF 4 mA	Defines the LEVEL value assigned to 4 mA current output, by default the zero-level.	
3	PV VALUE OF 20 mA	Defines the LEVEL value assigned to 20 mA current output, by default the maximum measurable level. The analog output automatically scales the set level range to the 4...20 mA current output range.	
4	ERROR MODE	Defines the behavior of the current output in case of "No echo error", i.e. while no up-to-date LEVEL value is available. Options: – HOLD Keeps last valid value on output (default). Recommended setting. – 3.8 mA Outputs "Low error current". – 22 mA Outputs "High error current". "Error current" setting is recommended only if recognized distinctly from 4 mA/20 mA Zero- or Max-level.	
5	DAMPING TIME	Delay, in seconds, for the output to reach a new value. Larger values smooth output, e.g. to hide waving, smaller values allow faster reaction to sudden changes. Default is 40 s.	



[PilotREK – Programming Guide](#)

wes200en26h05

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