NIVELCO

MicroTREK

HT/HH/HB/HP; HT/HH/HB/HP Ex
two-wire guided microwave level transmitters

Installation and programming manual
3rd edition

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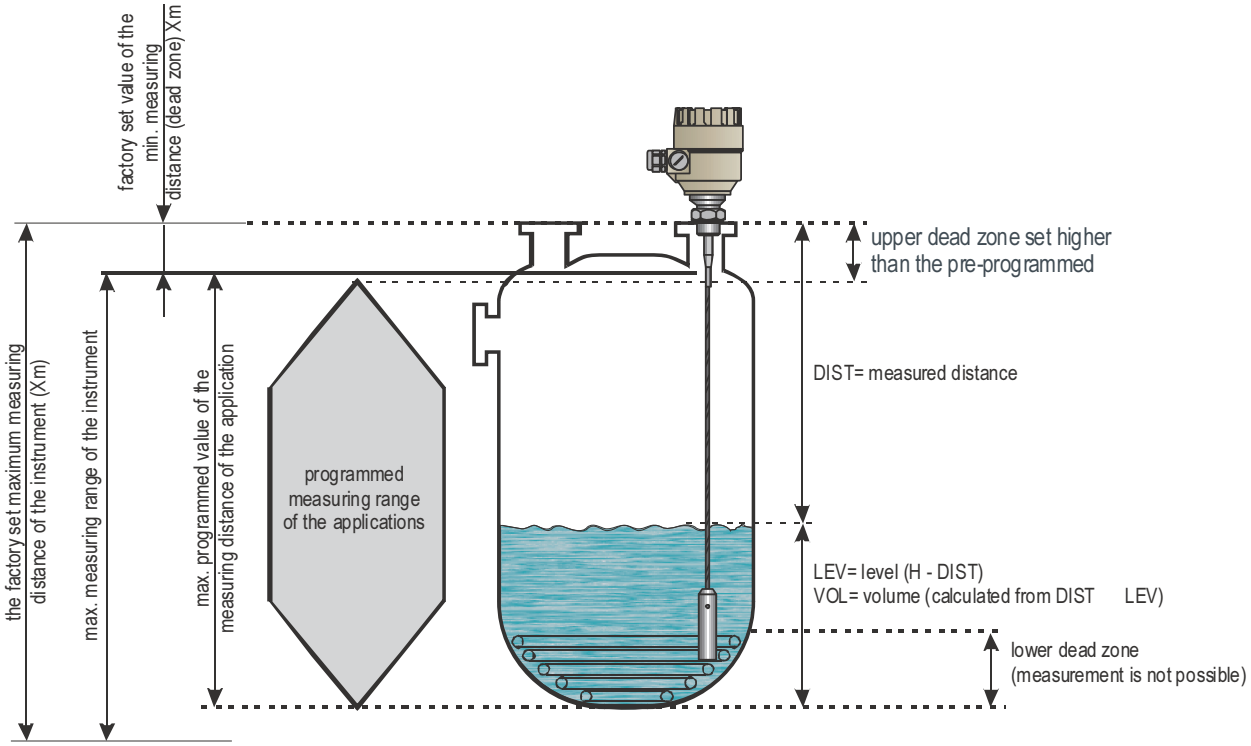
GUIDED MICROWAVE LEVEL MEASUREMENT



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Thank you for choosing a NIVELCO instrument.
We are sure that you will be satisfied throughout its use!

1. INTRODUCTION

Application

The MicroTREK 2-wire level gauge uses the Time Domain Reflectometry (TDR) measuring principle and two-wire technology for level measurement.
It is designed for measuring the distance, level, volume of liquids, pastes, slurries and powder products.
The device is applicable in tank, silo, rigid pipe, reaction vessel and level reference vessel.
The device is HART capable, it can be programmed using a HART Handheld Communicator (HHC), a Multicont universal process controller and EView2 software supplied as standard with the gauge.

Operating principle

The MicroTREK 2-wire guided microwave level transmitter uses the TDR (Time Domain Reflectometry) principle. The instrument sends low power nanosecundum wide pulses along an electrically conductive rod, cable or coaxial probe with a known propagation speed (the speed of light). As the pulse reaches the surface of the medium or phase of two liquids (altered dielectric constant ε_r), a part of it is reflected back to the electronic module. The efficiency of the reflected signal depends on the dielectric constant ε_r difference of the mediums or layers. (From the plain surface of air-water phase the reflected signal's strength will be approx. 80% of the emitted signal). The reflected pulse is detected as an electrical voltage signal and processed by the electronics. Level distance is directly proportional to the flight time of the pulse. The measured level data is converted into 4-20 mA current and HART signals and is displayed on the LCD display. From the level data further derived measuring values can be calculated such as volume and mass. The TDR technology is unaffected by the other properties of the medium as well as that of the space above it.

2. ORDER CODE

MicroTREK H ☐ ☐-☐ ☐ ☐-☐ * **2-wire guided microwave level transmitter**

TYPE	CODE
Transmitter	T
High temp. transmitter	H
Transmitter + display	B
High temp. transmitter + display	P

PROBE / PROC. CONN.	CODE
Caoaxial / 1" BSP	A
Coaxial / 1" NPT	B
Coaxial / 1 1/2" BSP	C
Coaxial / 1 1/2" NPT	H
Rod / 1" BSP	R
Rod / 1" NPT	P
Rod / 1 1/2" BSP	S
Rod / 1 1/2" NPT	Z
Twin rod / 1 1/2" BSP	D
Twin rod / 1 1/2" NPT	E
4mm cable / 1" BSP	K
4mm cable / 1" NPT	L
4mm cable / 1 1/2" BSP	V
4mm cable / 1 1/2" NPT	W
8mm cable / 1 1/2" BSP	N
8mm cable / 1 1/2" NPT	J
4mm twin cable / 1 1/2" BSP	T
4mm twin cable / 1 1/2" NPT	U
4mm FEP coated cable 1"BSP	F
4mm FEP coated cable 1"NPT	G
4mm FEP coat. cable / DN 40 Tricl.	X
4mm FEP coat. cable / DN 40 Milch	Y
PFA fully coated rod / DN 50	Q
4mm FEP fully coat. cable / DN 50	M
PP fully coated rod / DN 50	I
PFA fully coated rod / 1 ½" Triclamp	O

HOUSING	CODE
Aluminium	4
Plastic	5
Stainless steel	6

INSERTION LENGTH	CODE
Coaxial, Rod, Twin rod	
0m	0
1m	1
2m	2
3m	3
Coaxial, Rod (∅14mm)	
4m	4
5m	5
6m	6

Cable version	
0m	0
10m	1
20m	2

INSERTION LENGTH	CODE
Coaxial, Rod, Twin rod	
0m	0
0.1m	1
0.2m	2
0.3m	3
0.4m	4
0.5m	5
0.6m	6
0.7m	7
0.8m	8
0.9m	9

Cable version	
0m	0
1m	1
2m	2
3m	3
4m	4
5m	5
6m	6
7m	7
8m	8
9m	9

OUTPUT / EX	CODE
4 – 20 mA + HART / Normal	4
4 – 20 mA + HART / Ex tD	5
4 – 20 mA + HART / Ex iaD	6
4 – 20 mA + HART / Ex ia	8

** The order code of an Ex version should end in 'Ex'*

3. TECHNICAL DATA

GENERAL DATA

TYPE		PLASTIC HOUSING H□□-5□□-4	ALUMINIUM HOUSING H□□-4□□-4,5,6,8	STAINLESS STEEL HOUSING H□□-6□□-4,5,6,8
Input data	**Measured values**	**Between the reference point of the unit and reflection plane (material surface), distance, level and volume**		
	Measuring range	**Depends on probe type and the properties of the measured medium** (see: Technical data of the probes table)		
Probe types and technical data		**Coaxial, twin cable, mono cable, twin rod and mono rod probes** (see: Technical data of the probes table)		
Housing		**Plastic PBT**	Paint coated aluminium	Stainless steel
Medium temperature		–30 °C ... +200 °C (**see Technical data – MEDIUM TEMPERATURE table**)		
Medium pressure		–0.1 ... 4 MPa (-1...40 bar) (**see Technical data – MEDIUM PRESSURE diagram**)		
Ambient temperature		–30 °C ...+60 °C, **with display**: –20 °C ... +60 °C		
Sealing		FPM (Viton®), **optional for high temp version:** FFKM **Perfluoroelastomer** (Kalrez® 6375), EPDM		
Ingress protection		IP67 (NEMA 4 – 4X)		
Power supply		18 ... 35 V DC, **nominal** 24 V DC, Ex version: 18 ... 28 V DC, **protection against surge transients**		
Output data	**Output signals**	**Analogue**: 4–20 mA, (3.9 ... 20.5 mA) **passive output**, error signal: 22 mA		
		BUS: **serial line**, HART® **interface**, **terminal resistor max.** 750 Ohm		
		Display: SAP-300 plug-in LCD matrix		
	Accuracy*	For liquids: ±5mm; **For probe length** L ≥10m: ±0.05% **of the range**		
		For solids: ±20mm; **For probe length** L ≥ 10m: ±0.2% **of the range**		
	Resolution	±3 μA		
Electrical connection		2x M20x1,5 metal cable glands for ø 7 ... 13 mm cable, or 2x M20x1,5 plastic cable glands for ø 6 ... 12 mm cable wire cross section: 0.5 ... 1.5 mm² (**shielded cable is recommended**) + internal thread for 2x ½" NPT cable protective pipe		
Electrical protection		Class III.		
Mass (housing)		1.5 kg	2.4 kg	4.1 kg

** Under ideal reflection and stabilised temperature conditions.*

SPECIAL DATA FOR EX CERTIFIED MODELS

TYPE	*ALUMINIUM AND STAINLESS STEEL HOUSING* **H□□-□□□-5,6,8**
Ex marking (ATEX)	⟨Ex⟩ II 1 G Ex ia IIC T6…T3 Ga, ⟨Ex⟩ II 1 G Ex ia IIB T6…T3 Ga ⟨Ex⟩ II 1 D Ex ia IIIC T85°C…T180°C Da, ⟨Ex⟩ II 1/2 D Ex ta/tb IIICT85°C… T180°C Da/Db
Ex marking (IEC)	Ex ia IIC T6...T3 Ga ; Ex ia IIB T6...T3 Ga ; Ex ia IIIC T85°C…T180°C Da ; -30 °C ≤ Tamb ≤ +60 °C
Intrinsically safe data (Ex ia IIB and Ex ia IIIC)	Ci ≤ 10 nF, Li ≤ 10 μH, Ui ≤ 30 V, Ii ≤ 140 mA, Pi ≤ 1 W
Intrinsically safe data (Ex ia IIC)	Ci ≤ 10 nF, Li ≤ 10 μH, Ui ≤ 30 V, Ii ≤ 100 mA, Pi ≤ 0.75 W
Medium temperature	–30 °C ... +200 °C (**see Technical data – MEDIUM TEMPERATURE table**)
Medium pressure	–0.1 … 4 MPa (-1…40 bar) (**see Technical data – MEDIUM PRESSURE diagram**)

TEMPERATURE DATA

	EXPLOSIVE GAS ATMOSPHERE				**EXPLOSIVE DUST ATMOSPHERE**			
	ALUMINIUM AND STAINLESS STEEL HOUSING **H□□-□□□-8**				**ALUMINIUM AND STAINLESS STEEL HOUSING** **H□□-□□□-5,6**			
				HIGH TEMPERATURE **HH□-□□□-8** **HP□-□□□-8**				**HIGH TEMPERATURE** **HH□-□□□-6** **HP□-□□□-6**
	Ex ia IIB, Ex ia IIC				**Ex ia IIIC/ Ex ta/tb IIIC**			
Maximum permissible medium temperature at the antenna	+80°C	+90°C	+100°C	+180°C	+80°C	+90°C	+100°C	+180°C
Maximum permissible surface temperature at the process connection	+75°C	+90°C	+100°C	+175°C	+75°C	+90°C	+100°C	+175°C
Temperature class	T6	T5	T4	T3	T85°C	T100°C	T110°C	T180°C

TECHNICAL DATA OF THE PROBES

TYPE	H□K-□□□-□ H□L-□□□-□ H□V-□□□-□ H□W-□□□-□	H□R-□□□-□ H□P-□□□-□	H□S-□□□-□ H□Z-□□□-□	H□N-□□□-□ H□J-□□□-□	H□T-□□□-□ H□U-□□□-□	H□D-□□□-□ H□E-□□□-□	H□A-□□□-□ H□B-□□□-□ H□C-□□□-□ H□H-□□□-□
Denomination	4mm cable	Rod	Rod	8 mm cable	4mm twin cable	Twin rod	Coaxial
Max. measuring distance	24 m	3 m	6 m	24 m	24 m	3 m	6 m
Min. measuring distance $\varepsilon r = 80$ / $\varepsilon r = 2.4$	0.3 m / 0.4 m	0.3 m / 0.4 m	0.3 m / 0.4 m	0.3 m / 0.4 m	0.15 m / 0.3 m	0.15 m / 0.3 m	0 m
Min. distance to objects	∅ 600 mm	∅ 600 mm	∅ 600 mm	∅ 600 mm	∅ 200 mm	∅ 200 mm	∅ 0 mm
Min. medium εr	2.1	2.1	2.1	2.1	1.8	1.8	1.4
Process connection	1" BSP	1" BSP	1½" BSP	1½" BSP	1½" BSP	1½" BSP	1" BSP
	1" NPT						1" NPT
	1½" BSP	1" NPT	1½" NPT	1½" NPT	1½" NPT	1½" NPT	1½" BSP
	1½" NPT						1½" NPT
Probe material	1.4401	1.4571	1.4571	1.4401	1.4401	1.4571	1.4571
Nominal diameter of probe	4 mm	8 mm	14 mm	8 mm	4 mm	8 mm	28 mm
Mass	0.12 kg/m	0.4 kg/m	1.2 kg/m	0.4 kg/m	0.24 kg/m	0.8 kg/m	1.3 kg/m
Separator material	–	–	–	–	PFA, welded on the cable	PTFE-GF25 if length > 1.5m	PTFE, If length > 1.5m
Weight dimensions	∅ 25 x 100 mm	–	–	∅ 40 x 260 mm	∅ 40 x 80 mm	–	–
Weight material	1.4571	–	–	1.4571	1.4571	–	–

TECHNICAL DATA OF THE COATED PROBES

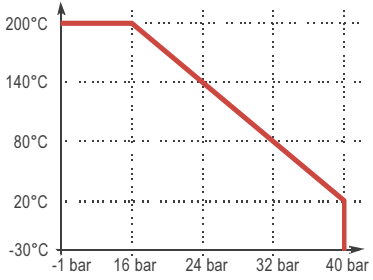
TYPE	H□F-□□□-□ H□G-□□□-□	HTX-□□□-□	HTY-□□□-□	HTM-□□□-□	HTQ-□□□-□	HTI-□□□-□
Denomination	4mm FEP coated cable	4mm FEP coated cable	4mm FEP coated cable	4mm fully FEP coated cable	Fully PFA coated rod	Fully PP coated rod
Max. measuring distance	24 m	24 m	24 m	24 m	3 m	3 m
Min. measuring distance $\varepsilon_r = 80$ / $\varepsilon_r = 2.4$	0.3 m / 0.4 m	0.3 m / 0.4 m	0.3 m / 0.4 m	0.3 m / 0.4 m	0.3 m / 0.4 m	0.3 m / 0.4 m
Min. distance to objects	∅ 600 mm	∅ 600 mm	∅ 600 mm	∅ 600 mm	∅ 600 mm	∅ 600 mm
Min. medium ε_r	2.1	2.1	2.1	2.1	2.1	2.1
Process connection	1" BSP 1" NPT	DN 40 Triclamp	DN 40 Milch	DN 50	DN 50	DN 50
Probe material	1.4401 / FEP	1.4401 / FEP	1.4401 / FEP	1.4401 / FEP	1.4571 / PFA	1.4571 / PP
Nominal diameter of the probe	6 mm	6 mm	6 mm	6 mm	12 mm	16 mm
Mass	0.16 kg/m	0.16 kg/m	0.16 kg/m	0.16 kg/m	0.5 kg/m	0.6 kg/m
Fillet and weight coating material	–	–	–	PFA	PFA	PP
Weight dimensions	∅ 25 x 100 mm	∅ 25 x 100 mm	∅ 25 x 100 mm	∅ 30 x 183 mm	–	–
Weight material	1.4571	1.4571	1.4571	1.4571	–	–
Max. medium temp.	+150 °C	+150 °C	+150 °C	+150 °C	+150 °C	+60 °C

MEDIUM TEMPERATURE TABLE

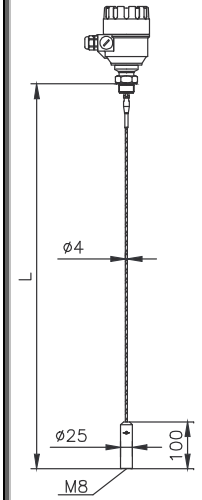
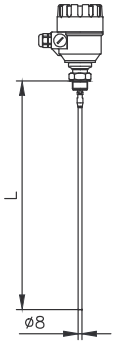
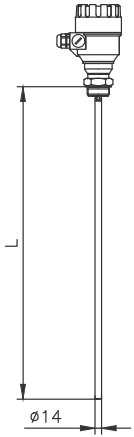
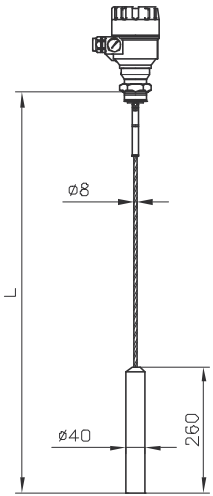
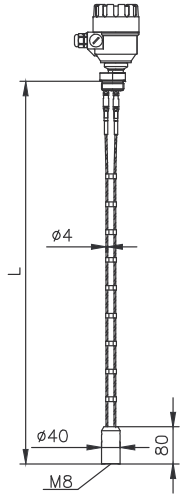
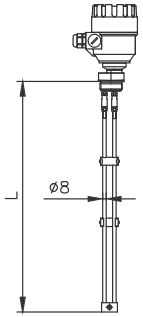
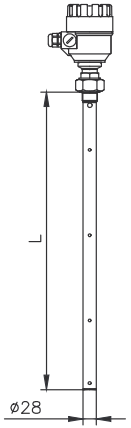
TYPE	FLANGE TEMPERATURE
Transmitter	–30 °C ... +90 °C
High temp. HH_ or HP_ transmitter	–30 °C ... +200 °C

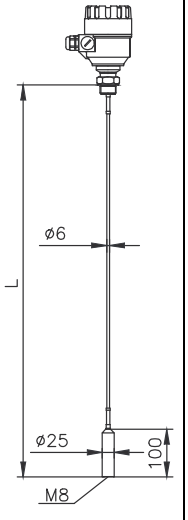
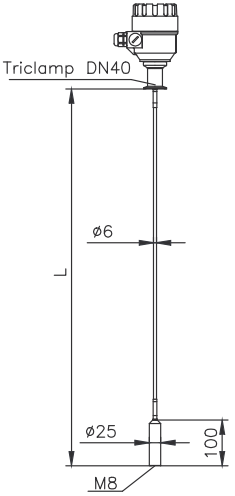
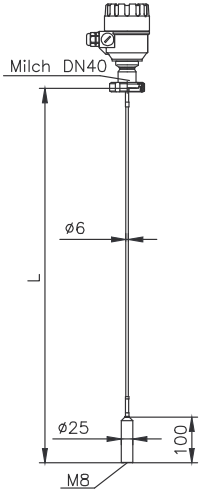
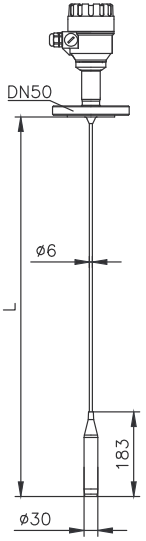
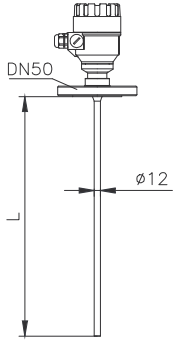
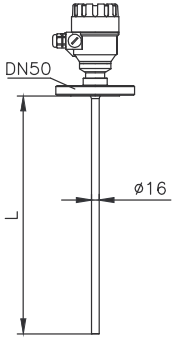
Lower or higher temperature for non-Ex version on special request

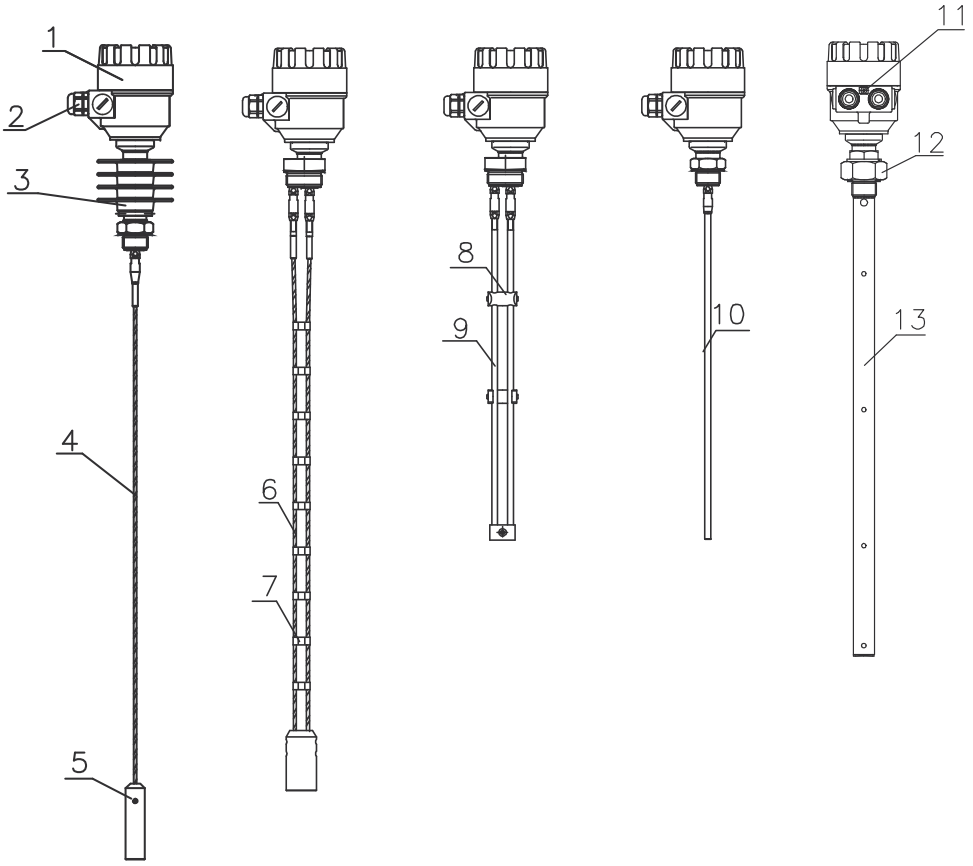
MEDIUM PRESSURE DIAGRAM



DIMENSIONS

HTK-□□□-□ HTL-□□□-□ HTV-□□□-□ HTW-□□□-□	HTR-□□□-□ HTP-□□□-□	HTS-□□□-□ HTZ-□□□-□	HTN-□□□-□ HTJ-□□□-□	HTT-□□□-□ HTU-□□□-□	HTD-□□□-□ HTE-□□□-□	HTA-□□□-□ HTB-□□□-□ HTC-□□□-□ HTH-□□□-□
						

HTF-□□□-□ HTG-□□□-□	HTX-□□□-□	HTY-□□□-□	HTM-□□□-□	HTQ-□□□-□	HTI-□□□-□
					



1 Housing
2 Cable gland
3 High temp. connection
4 Mono cable probe
5 Weight
6 Twin cable probe
7 Twin cable separator
8 Twin rod separator
9 Twin rod probe
10 Mono rod probe
11 Grounding screw
12 Process connection
13 Coaxial probe

3.1 ACCESSORIES

- Warranty Card
- Installation and Programming Manual
- Declaration of Conformity
- EView2 software CD
- 2 pcs M20x1.5 cable gland
- SAP-300 display module (option)

3.2 SAFETY REGULATIONS FOR THE EX APPROVED UNITS

The level transmitter must be operated in intrinsically safe circuit only.
The metal enclosure of the unit must be connected to the EP circuit.

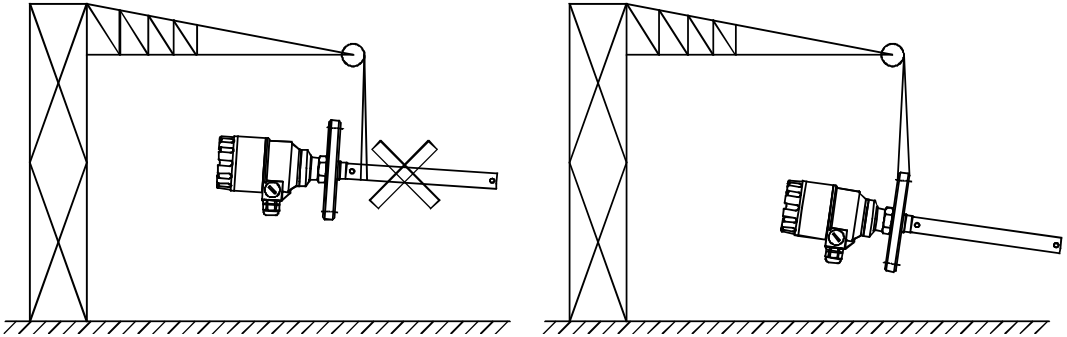
3.3 MAINTENANCE AND REPAIR

MicroTREK does not require maintenance on a regular basis. In some very rare instances, however, the probe may need a cleaning from deposited material. This must be carried out gently, without damaging the probe.
Repairs during or after the warranty period are carried out exclusively at the Manufacturers. The equipment sent back for repairs should be cleaned or neutralised (disinfected) by the User.

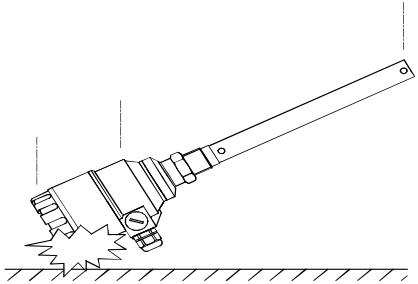
4. MECHANICAL INSTALLATION

4.1 HANDLING AND STORAGE

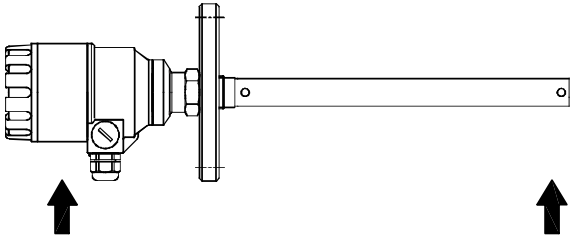
The device will weigh between approximately 3 kg or 7 lb and 12 kg or 25 lb.
Carry using both hands to lift the device carefully by the converter housing. If necessary, use lifting gear.
No attempt should be made to lift the instrument by its probe.
Caution: The probe is a critical gauge component. Do not damage - Handle with care!



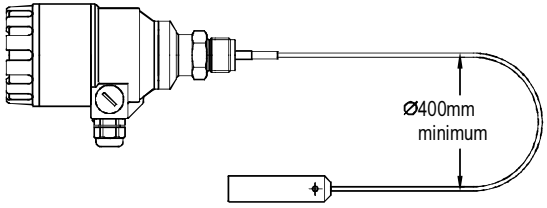
Avoiding blows - avoid hard blows, jolts, impacts, etc.
Caution: fragile electronics



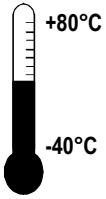
Avoid bending (single rod and coaxial probes) - Support the probe to avoid bending.

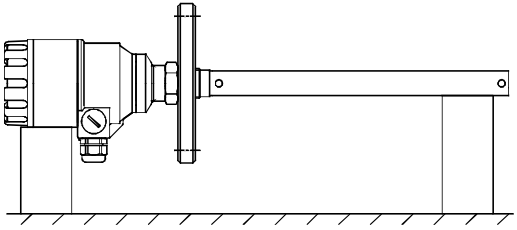


Avoid cable kinks and fraying
Do not coil the cable less than 400 mm or 16 " in diameter. Cable kinks or fraying will cause measurement errors.



Storage temperature



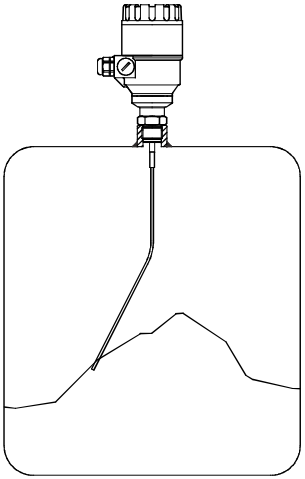


4.2 MOUNTING ON THE TANK

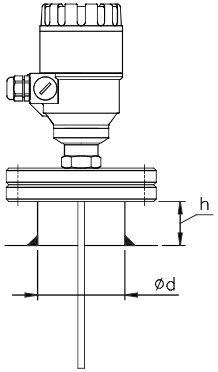
4.2.1 INSTALLATION INSTRUCTIONS: GENERAL NOTES

Prior the installation some consideration is to be made regarding tank fittings and tank shape. Nozzle position in relation to the tank walls and other objects inside the tanks
(Warning: this free area will depend on the probe type selected: refer to later on in this section) type of tank roof, i.e. floating, concrete, integral, etc; and base, i.e. conical, etc. Whenever working on an installation, remember to: Disconnect the power supply before starting work. However, the gauge may be installed when the tank contains product.

Threaded process connections
The simplest and most economic way is to mount the MicroTREK 2-wire directly on the tank with the 1" (1½") BSP or 1" (1½") NPT threaded connection.



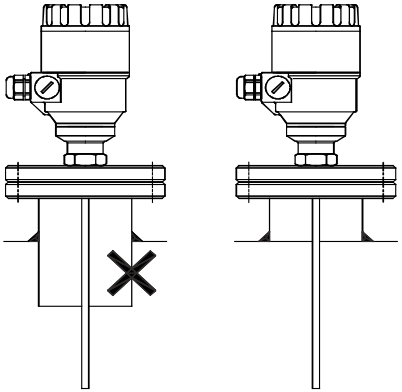
Nozzle height
Do not fit a nozzle longer than its diameter, especially for single probes and powder applications



$h \leq Ød$, where
h = nozzle height and
d = nozzle diameter

Contact NIVELCO if this relationship cannot be respected.

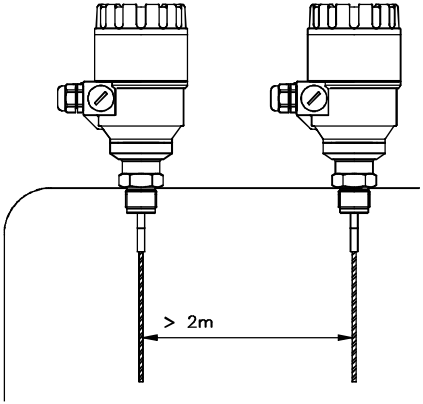
Nozzles penetrating into tank



✗ Caution: Do not use nozzles that penetrate into the tank.
This will disturb the emitted pulse.

Installation of two devices

If two devices are to be used on the same tank, these should be mounted at a distance of at least 2 m or 6.5 ft away from each other. If not, interferences from the electromagnetic (EM) fields generated by both instruments may cause measurement errors.
Coaxial probes: the outer shell of the probe contains the EM field: no minimum distance required.

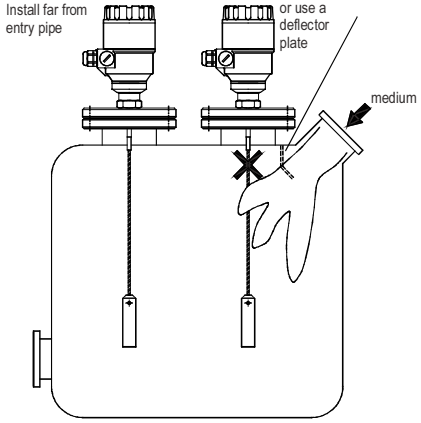


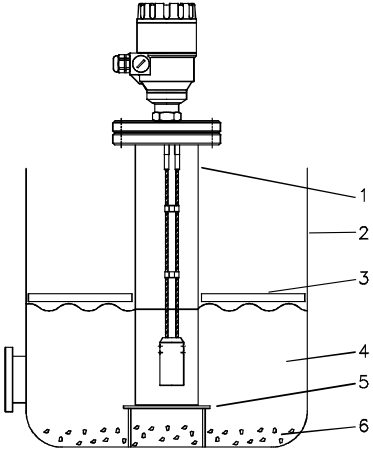
Process connection and entry pipe

Caution: Do not put the nozzle close to the entry pipe.

Pouring the product directly onto the probe will give false readings.

Install deflector plate if impossible to distance gauge from entry pipe.





Stilling wells

Tanks with floating roofs for petrochemical applications: Use a stilling well.

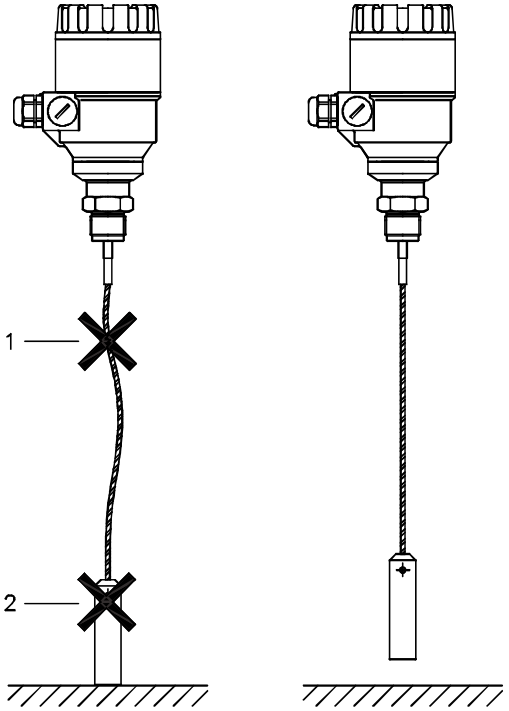
1 Stilling well
2 Tank
3 Floating roof
4 Product (petroleum applications)
5 Well fixed to tank base (no roof deformation)
6 Sediment

Probes: entanglement, straightness and tank bottom clearance

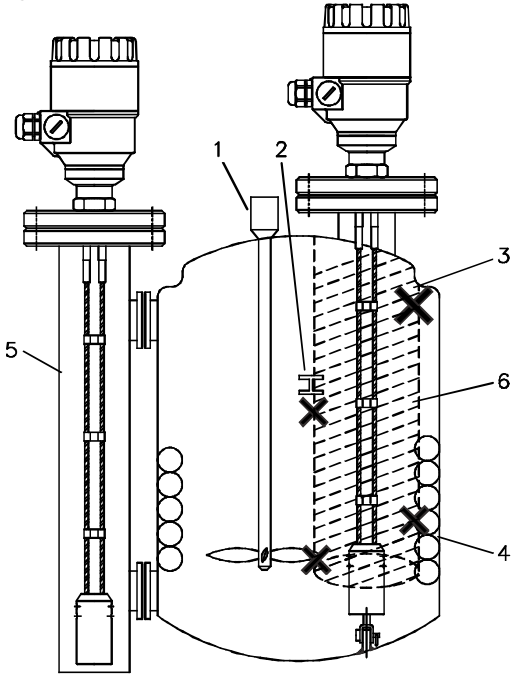
Cable probes must be straight once inserted into the tank.
They must also be far from other objects (e.g. mixers) to avoid entanglement.
In order to maintain the gauge's operating characteristics, it is recommended to avoid touching the tank bottom with the counterweights (for cable probes) or probe end (other types).

Avoid mounting near objects (discontinuities) inside the tank that influence the probe's EM (electromagnetic) field

Install the gauge far from protruding objects such as: heating tubes, sudden changes in tank cross-section, tank wall reinforcements and beams, weld lines and dip-stick pipes, etc...



Agitator in the tank



No electromagnetic field outside the reference chamber.

1 Agitator
2 Support beam perpendicular to the pulse direction
3 Abrupt changes in tank cross section
4 Heating tubes
5 Alternative solution: reference chamber - electromagnetic field is within chamber
6 Gauge electromagnetic field :
Any intruding metallic object will be detected in this zone if perpendicular to the emitted pulse direction.

✕ Do not fit the gauge near to these objects.

When measuring liquids the use of a stilling well or reference chamber is favorable because it ensures electromagnetic protection for an accurate measuring.

Use a sunshade if the unit is exposed to direct sunlight.

Fastening the probe to the tank bottom

Flexible probes can be fastened with a chuck (ring), turnbuckle or similar fastening device to the tank bottom

Shortening cable probes

If required, the cable probe can be shortened, but this applies only when used in liquids.

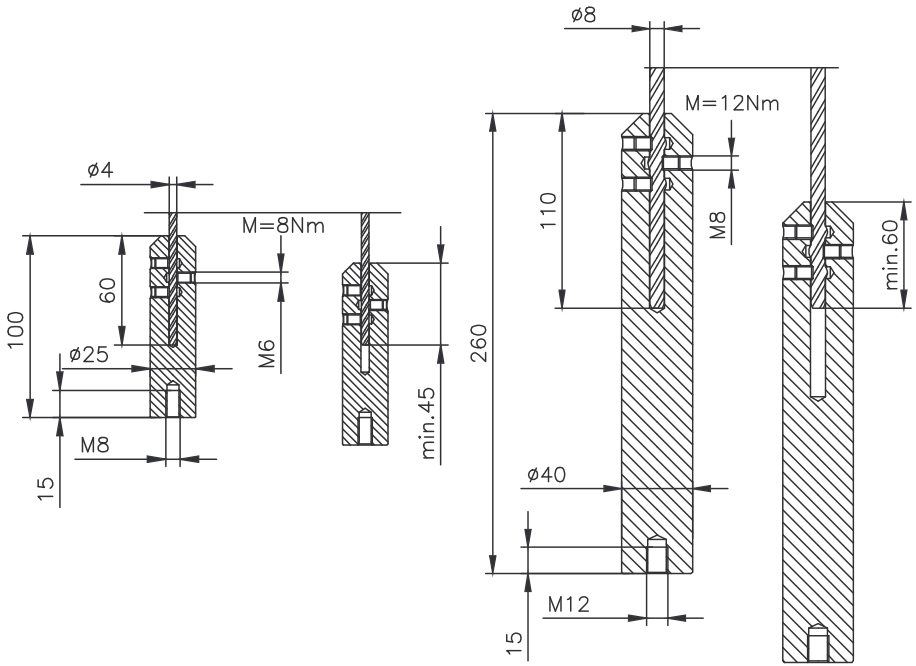
Procedure

1 Detach socket set screw M6x10 (ISO 4026) with 5 mm Allen (hexagon) key (ISO 2936).

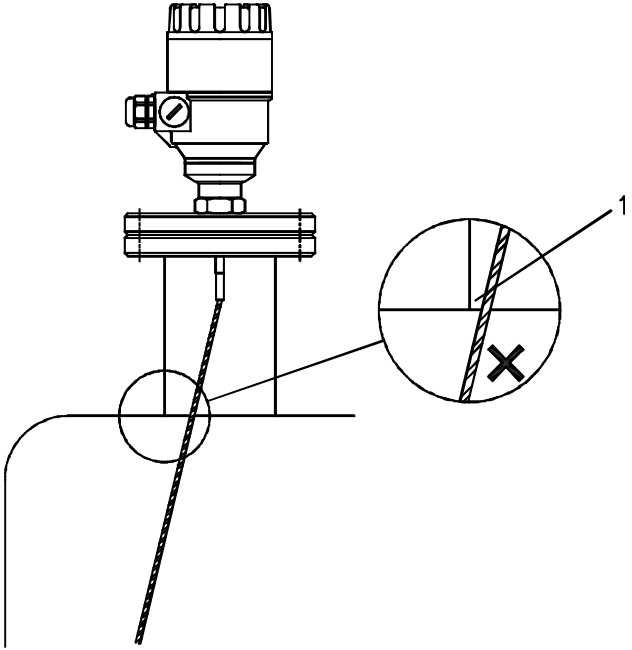
2 Pull cable out of counterweight and shorten to required length using cable cutters to prevent the cable wires and strands from splaying out.

3 Insert cable back into counterweight and tighten down screws

4 Change configuration parameters to new probe length; the reference point is the top edge of the weight (user menu function 1.1.6).



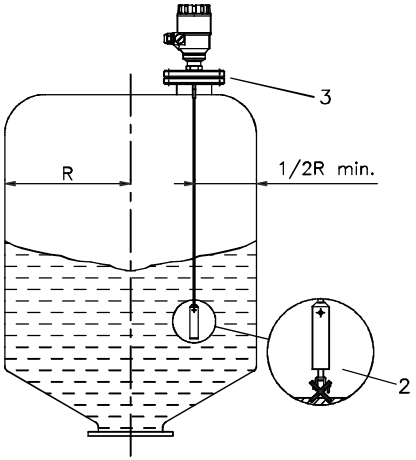
4.2.2 SPECIFIC INSTALLATION INSTRUCTIONS: GAUGE - SOLID APPLICATIONS



FALSE READINGS:

1 Do not let the probe touch the side of the nozzle

Conical silo nozzles, false readings and traction on the cable probes



2 High traction forces:

We recommend that the probe should not be anchored to avoid excessive traction loads on the cable.

3 Bending and traction:

Position the connection on the roof at ½ radius of the tank and with minimum nozzle height. This will avoid damage due to bending and traction during emptying.

Traction load is dependent upon the height and shape of the tank, product particle size & density, and the rate at which the tank is emptied. The table below gives the load up to which cable probes will hold.

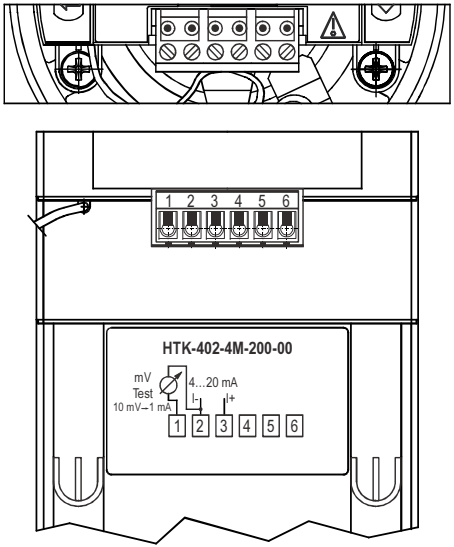
Probe type	Material	Probe Length 6 m	Probe Length 12 m	Probe Length 24 m
Mono cable Ø8 mm, max. load: 3.0 T	Cement	0.6 T	1.2 T	2.4 T
	Fly ash	0.3 T	0.6 T	1.2 T

Product build-up can occur under the nozzle: this may weaken the pulse.
Avoid cavities that permit the build-up of deposits.

Tank roofs should support loads of at least 3 T for gauge installations using Ø8 mm or 0.3" single cable probes.

4.3 WIRING

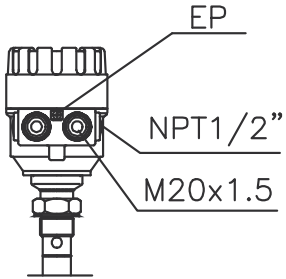
Wiring in non-Ex environment



1 Detach the cover of the unit
2 Guide the cable into the housing through the cable gland
3 Remove a 4 mm length of isolation from the wires and cut away the free part of the shielding.
4 Connect the wires of the current loop to terminals 2 and 3 (any polarity).
5 Pull back the cable till a 10 mm cable length remain in the housing behind the cable gland.
Tighten the cable gland using two spanners.
Check the connection of wires and the tightness at the cable gland.
6 Array the wires in the housing and screw the cover on the housing.
The 500V AC insulation test should not be performed on the instrument because of the overvoltage protection of the electronics.

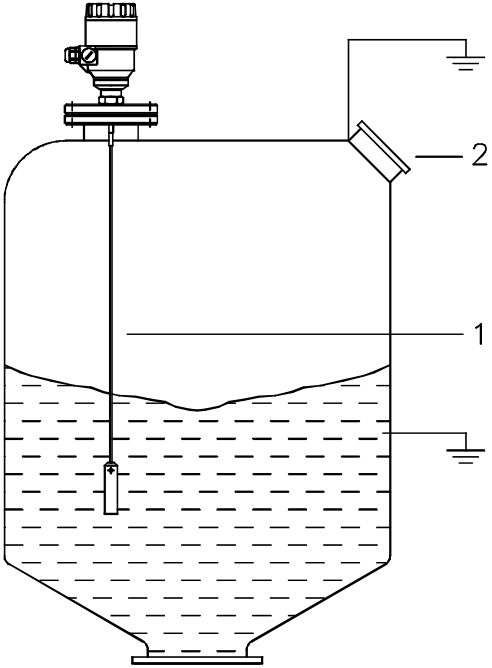
Connection to the EP network (grounding).

Screw type terminal (EP) on the housing max. cable cross-section: 4 mm².
The housing of the MicroTREK must be grounded.
Grounding resistance R < 1 Ohm
The shielding of the signal cable should be grounded at the control room.
Avoid coupling of electromagnetic noises place the singnal cable away from power-current cables.



Electrostatic discharge (E.S.D.)

MicroTREK 2-wire non-Ex and Ex gauge electronics are shielded up to 4 kV against E.S.D.
Note: E.S.D. cannot be solved by MicroTREK 2-wire E.S.D. protection.
It is the customer's responsibility to avoid E.S.D. by grounding the tank, product and probe installation.

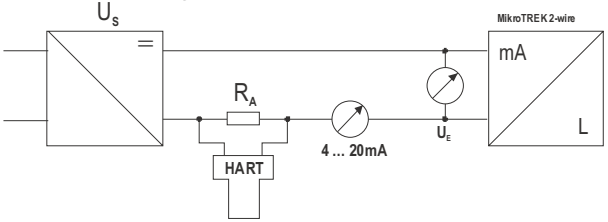


DANGER OF INJURY

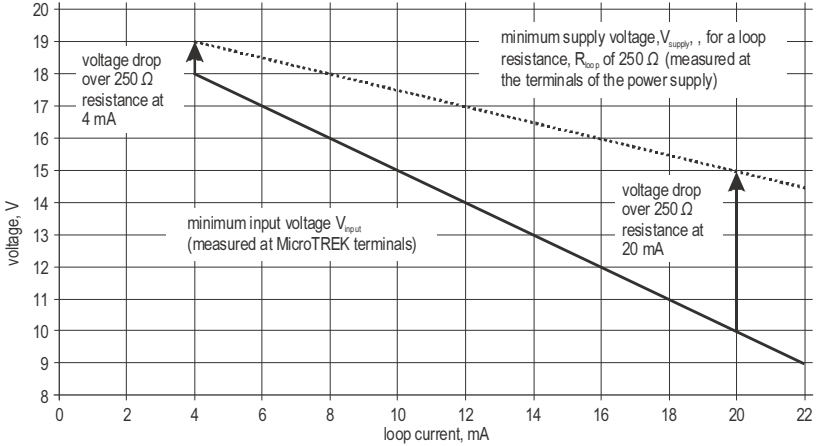
The probe may receive an electrostatic discharge during operation; earth the probe by pushing it against tank wall with a suitably isolated tool just before touching it to avoid receiving a shock.

2 Earth the entry pipe and product.

Non-hazardous-duty version



Power supply		
Nominal voltage	24 V DC	
Maximum voltage (U_{input}):	35 V DC	
Minimum voltage (U_{input}):	dependent on load impedance, see graph below	
Load impedance R_A		
Loop resistance, R_{loop}	$R_{HART} + R_{cable} + R_{ammeter}$	Ohm
Minimum load impedance R_A	0	Ohm
Maximum load impedance R_A	750	Ohm
R_{HART} resistance for HART® communication	250	Ohm, recommended



Line A = minimum voltage at the MicroTREK 2-wire terminals
Line B = minimum supply voltage (for voltage drop caused by a 250 Ohm loop resistance)

Example for calculating the power supply: The voltage drop is tested at 22 mA: $U_{power\ minimum\ 22}$ = 22 mA x load impedance + $U_{input\ minimum\ 22}$

$U_{power\ minimum\ 22}$ = 22 mA x 250 Ohm + 10 V = 5.5 V + 10 V = 15.5 V

In order to cover the whole current range, the voltage drop must also be tested at 4 mA:

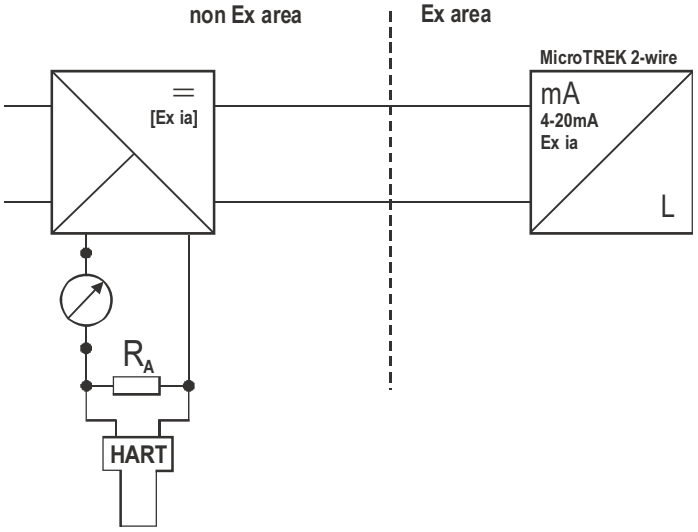
By analogy, the following applies: $U_{power\ minimum\ 4}$ = 4 mA x load impedance + $U_{input\ minimum\ 4}$

$U_{power\ minimum\ 4}$ = 4 mA x 250 Ohm + 18 V = 1 V + 18 V = 19 V

At a load impedance of 250 Ohm a power supply voltage of 19 V is sufficient to energize the current device range of 4 to 20 mA.

Hazardous-duty version

Connect the wires of the current loop to terminals 2 and 3 (any polarity).
The intrinsically safe certified device may only be used in conjunction with an other intrinsically safe certified equipment.
All the allowed electrical safety data indicated on the nameplate must be observed.



An 'Ex' repeater power supply unit must be used.

For calculation of the supply voltage the same applies as for the standard non-'Ex' version.

The connected Ex repeater must be HART®-compatible so that it can be operated with the PCSTAR2 communication software or the HART® communicator.

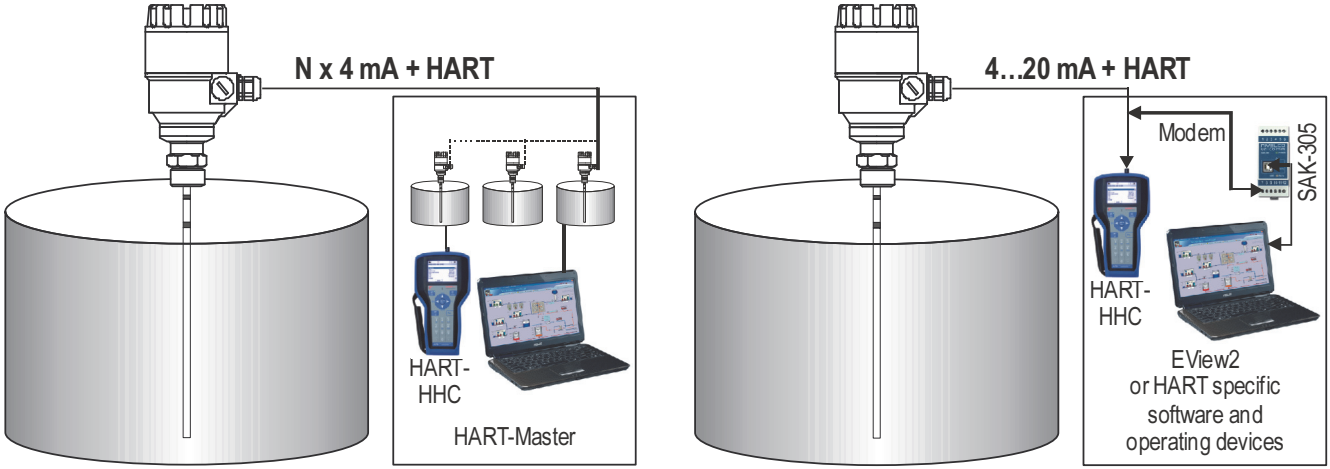
The HART adapter should be connected to the intrinsically safe input of the Ex repeater!

The units with plastic coating can only be used in IIB gas class hazardous area.

4.3.1 BUS (HART®) COMMUNICATION

Microtrek has two output options:	Current out. and HART®,	Passive, HART® protocol
	'Ex ia' current out. and HART®	Intrinsically safe passive, HART® protocol

In accordance with the Rosemount Standard, HART® communication can be used with a MicroTREK 2-wire.
It is used as a point-to-point connection between the MicroTREK 2-wire as slave and the HART® master.



4.4 POWER-ON AND START-UP

The MicroTREK 2-wire is pre-configured in accordance to customer order specifications and measurements can be made immediately.
A start-up time of less than 60 seconds should be allowed once the unit is connected and the power is switched on.
If the probe length has been shortened since delivery, please refer to section
3.3.1: Summary of User Functions, user function 1.1.6: Probe length to modify configured probe length.

4.5 AVAILABLE USER INTERFACES

Programming of MicroTREK can be done using the following instruments / accessories:

PCSTAR 2 software	Accessory shipped with the instrument. See chapter „5.1 Programming with PCSTAR 2 software". (PC needed.)
SAP-300 display unit	Can be ordered. See chapter „5.2. Programming with SAP-300 display unit".
MultiCONT universal process controller	Can be ordered. For programming instructions see the User Manual of Multicont.
HART® (HHC) Handheld Communicator	Sold separately. Automatic device detection on powering. See chapter „5.3 Programming with HART® (HHC) Communicator".

5. PROGRAMMING

MicroTREK can be programmed in three (basic) ways.

- **Programming with PCSTAR 2 software**
- **Programming with SAP-300 display unit**
- **Programming with HART® Handheld (HHC) Communicator** (For operating instruction see the User manual of the HHC)

5.1 PROGRAMMING WITH PCSTAR 2 SOFTWARE

5.1.1 PCSTAR 2: INSTALLATION AND EXECUTION.

PCStar2 is a Windows software. It is used for programming the unit and displaying the measured variables.
System requirements:

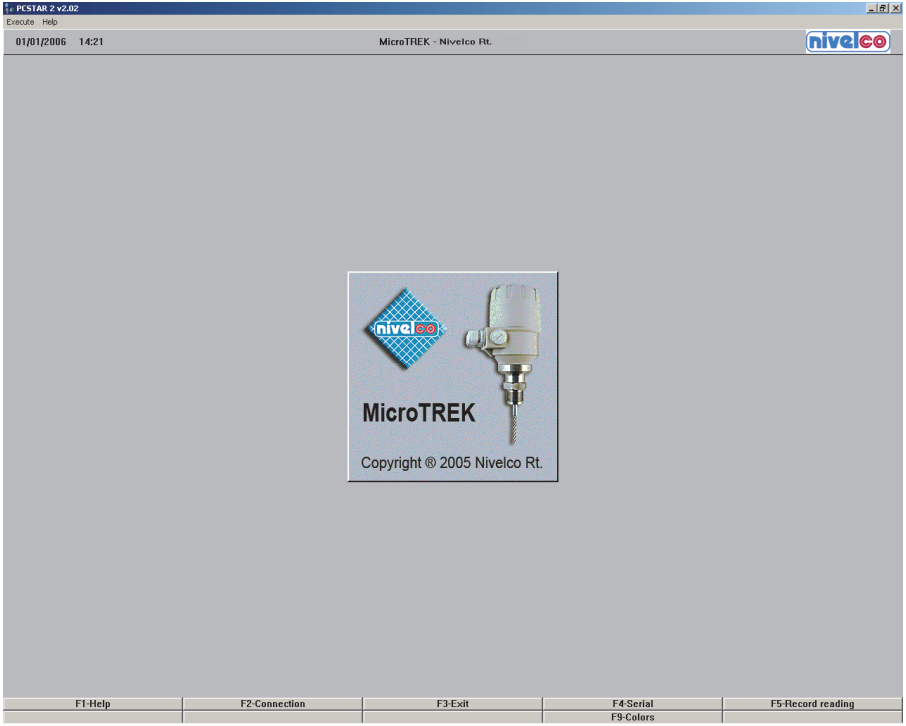
- IBM 486 PC with minimum 75MHz processor, recommended: IBM PC Pentium 120MHz or better
- Microsoft Windows 9x, Me, 2000, NT or XP
- min. 16 MByte RAM
- min. 3 MByte free harddisc space
- Mouse or other pointing device
- Serial RS-232 port

Electrical connections: connect the HART® adapter (can be ordered separately)
through a load impedance of max. 350 Ohm to a serial RS232 port of the PC.

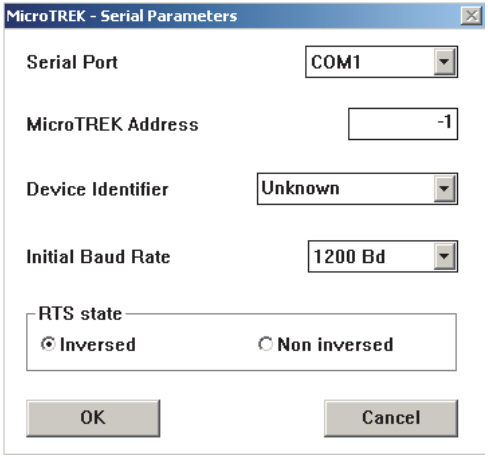
In hazardous-duty systems a HART capable Ex repeater must be inserted in the loop before the interface!
The HART adapter should be connected to the intrinsically safe input of the Ex repeater!

Installing the program: execute the file "PCSTAR.EXE" and follow the instructions on the screen.

Running the program:
once the program is installed, execute the PCST2NT.EXE program. The screen shown below will be displayed.



Define device interface: press F4 or left-click on “F4-Serial” at the bottom of the screen – to define the interface to which the device is to be connected.



Serial port – The serial port allows the user to select a free serial port (COM 1 to 4) on the computer.

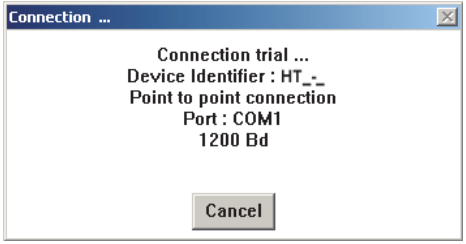
MicroTREK Address – Type the "Address" that you have given a gauge (a value between 0 and 15) and press ENTER or OK.
This will select the required device. If you are in a point to point network leave the box at its default value (-1).

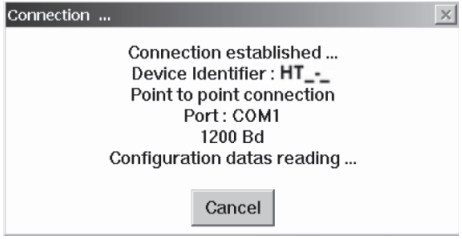
Device identifier – Device Identifier refers to the "Device number" given in User Function No. 1.4.4.

Initial baud rate – Transmission rate of data. Has a default value of 1200 bd.

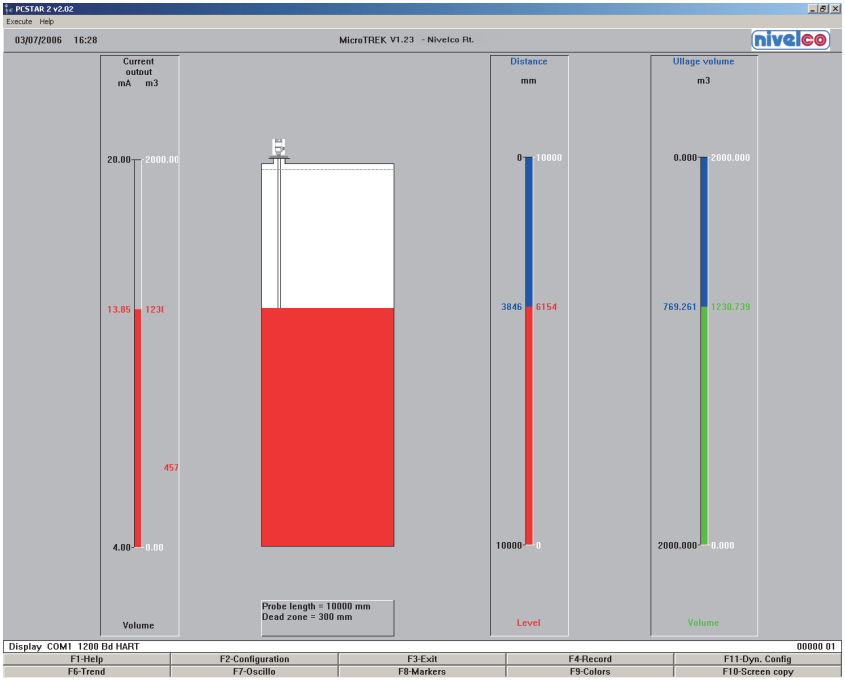
RTS state – The RTS state depends on the type of RS232 converter used.
For RS232<>HARTTM(i.e. VIATOR from MACTEK) use inversed RTS state.

On-line connection with the gauge: Press F2 or left-click on "F2-Connection" to set up the connection with the device – the configuration parameters are automatically loaded into the computer.





After the connection has been established, the following screen is shown. This will show the current status of the tank.
No further configuration should be necessary. The following functions are available on the screen and will be discussed further in section 8.4:



F2 – Device configuration: a summary of the parameters are given on the next page

F7 – Oscilloscope function: displays all reflections detected by the probe

F11 – Dynamic/on-line device configuration

F4 – View and record all information during operation

F6 – Trend: observe the level trend since start of the program
F8 – Marker: read the status of the device

F10 – make printouts (screenshots).

5.1.2 SUMMARY OF USER FUNCTIONS IN PCSTAR 2 (F2 – CONFIGURATION)

The table below provides an overview of all parameters that can be set nt he configuration menu using F2 in PCSTAR2. Default values are in bold type nt he "Input Range" column.

Function	Input Range	Description
1.0.0 Operation		
1.1.0 Basic parameters		
1.1.1 Tank height	Enter 0 … 60 000 mm or 0 … 197 ft. **As per order**	The tank height forms the basis for calculating level measurements and for the relevant current output. It is defined as the distance between the lower flange surface and the reference point at the bottom of the tank. The output unit is determined via Fct. 1.2.4.: Length Unit. The set tank height is the upper limit for Fct. 1.3.4: Scale I1 max Note: the device will not measure beyond the programmed probe length if the current output is configured to measure distance or level .
1.1.2 Dead zone **Warning:** **Critical Parameter**	Fct.1.5.1 Enter a value Fct.1.5.1 (Detection delay) … probe length. **„Minimum measuring distance"** **As probe technical data table**	The dead zone is the minimum measuring distance from the process connection (reference point) to the surface of the product. So as not to impair measurement accuracy, the minimum values given in Section 5.2.3 should be adhered to. The current output can't go inside the dead zone. The output unit is set via Fct. 1.2.4: Length Unit
1.1.3 Time constant	1 … 100 s. **5 s**	This function filters possible signal fluctuations when the tank is turbulent.
1.1.6 Probe length	Minimum 100 mm Maximum 24 000 mm **Ordered length + 100mm**	Set probe length + 100mm. This value should be modified when the probe has been replaced or shortened (cable probes). The output unit is set via Fct. 1.2.4 Length Unit. With an empty tank, using the function F11 in the "Dynamic Configuration" menu an automatic search for the probe tip can be carried out to update the parameter. The value determines simultaneously: - the minimum value of the tank height, Fct. 1.1.1 - the maximum setting range for the dead zone, Fct. 1.1.2. Probe length may be set greater than tank height but less than 24 000 mm for special installations.

Function	Input Range	Description
1.2.0 Display		
1.2.4 Length unit	Select m, cm, mm, inch, ft h optional unit* **mm**	Unit for display of level and distance. *When "optional unit" selected, you get to the menu item Fct. 1.2.6: New unit and can there define user-defined units. The unit selected here is also valid for the following functions, if "Level" or "Distance" is selected in Fct. 1.3.1: Fct. 1.1.1 Tank height, Fct. 1.1.2 Dead zone, Fct. 1.1.6 Probe length, Fct. 1.3.3 Scale I1 min., Fct. 1.3.4 Scale I1max., Fct. 1.5.1 Detection delay and Fct. 1.7.2 Input table* In addition the displayed value will use the selected unit.
1.2.5 Volume unit	Select m^3, l, US Gal, ft^3, bbl, m^3/h, ft^3/h, kg, metric tonnes or tons US **m^3**	Unit of displayed volume / conversion value. Conversion means converting a level value into a "conversion value" (usually volume) in order e.g. to realize a non-linear function as a factor of the level. The unit selected here is also valid for the following functions, if "Volume" selected in Fct. 1.3.1: Fct. 1.3.3 Scale I1 min. Fct. 1.3.4 Scale I1 max. Fct. 1.7.2 Input table
• New unit (length)		Appears only when "Optional unit" is selected in Fct. 1.2.4: Length unit.
1.2.5.1 Unit name	4 ASCII characters **Unit**	Name of the new unit (max. 4 characters)
1.2.5.2 Unit fact.	Minimum: > 0.0 Maximum: 100 000 **1.0**	Reference for the conversion factor is the millimetre. At a conversion factor of 10, the new unit is equivalent to 10 mm. At a conversion factor of 0.1, the new unit is equivalent to 0.1 mm.

Function	Input Range	Description
1.3.0 Current output		
1.3.1 Current 1 item	Select Off, Level, Distance, Volume* or Ullage volume* **Level**	Selection of the required function for the current output.
1.3.2 Current 1 range	Select 4-20mA or 4-20mA + 22 mA on error. **4 – 20mA**	This parameter defines the status which the current output assumes nt he event of a fault: 4-20 mA (last measured value held nt he event of a fault) 4-20 mA / E = 22 mA (is set to 22 mA nt he event of a fault).
1.3.3 Scale I1 min.	Enter a value from 0 mm** to a value lower than that entered for Fct. 1.3.4 Scale I max. **As per order**	This function defines the lower limit of the analog measuring range. It is 4 mA. The value of this parameter always has to be lower than the value selected for Fct. 1.3.4: Scale I1 max..
1.3.4 Scale I1 max.	Enter value higher than the value selected under Fct. 1.3.3. “Scale I min.” up to tank height or the maximum volume table value*** **As per order**	This function defines the upper limit of the analog measuring range. It is 20 mA. The value of this parameter must always be: - lower than or equal to the value selected under Fct. 1.1.1: Tank height or the maximum volume table value, - higher than the value selected under Fct. 1.3.3: Scale I1 min., otherwise an error message will appear during parameter check.
1.3.5 Error delay	Select No delay, 10 sec., 20 sec., 30 sec., 1 min., 2 min., 5 min. or 15 min. **No delay**	This menu is only available when (4-20 mA / E = 22 mA) has been selected under Fct. 1.3.2: Current 1 range. With this parameter, a time delay can be defined for transition of the current output to 22 mA after an error has been noted. During the delay, measurement and the analog output are held. When the error disappears, the delay also serves to return to the measuring mode.

- complete Fct. 1.7.2 “Input table” before selecting “volume“ or “ullage volume”

** or other unit selected in Fct. 1.2.4 Length Unit, 1.2.5 Volume Unit depending nt he item selected in Fct. 1.3.1 Current 1 Item.

*** depends on value selected in Fct. 1.3.1 Current 1 Item

Function	Input Range	Description
1.4 User data		
1.4.3 Checksum	Read only	This value is used for identification of the device software version. The checksum is tested when starting. This helps to detect any problems with the microcontroller.
1.4.4 Tag number	00000 01	This parameter assigns an identification number to the device. A text consisting of maximum 8 ASCII characters can be entered.
1.4.5 Serial number	Read only	This parameter serves to identify the respective measuring device. This number cannot be changed and sets the address for use with HART® interfaces.
1.4.6 French command number	Read only	Factory-programmed number, to be quoted in case of warranty and service claims.
1.4.6 German command Number	Read only	Factory-programmed number, to be quoted in case of warranty and service claims.
Option** (Descriptor)		With this function an ASCII string with max. 15 characters lenght can be entered. (only user information)
1.4.9 Probe type	Single rod, Twin rod, Single cable, Single cable + counterweight, Single cable without counterweight, Twin cable, Twin cable + counterweight, Coaxial, Special 1, Special 2 or Special 3 **As per order**	Information on probe type supplied with signal converter. This is a read-only parameter.
1.5.0 Application		
1.5.1. Detection delay	Minimum value: 0mm Maximum value: Dead Zone **As per order**	This function can be used to define an area directly below the flange in which interference reflections (e.g. from the tank nozzle) are masked. This value has to be smaller than or equal to the dead zone (Fct. 1.1.2.).

1.6.0 Serial I/O		For integrating into a signal network. Standard hardware platform for HART® is the current loop with superposed FSK signals. For a multidrop application the current output is set to "OFF" and consequently to a constant 4 mA. With a multidrop bus, up to 15 HART® devices can be operated.
1.6.2 Address	Addresses from 0 to 15 **0**	With this function, every device connected to a bus is assigned an address between 0 and 15 (HART® protocol). If several devices are connected to a digital bus, each device must be assigned a unique address under which it can then be identified in the bus. 0 = Analogue output active 1 - 15 = Multi-drop mode active, analogue output inactive
1.7.0 Volume table		For calibrating the gauge for volume measurement.
1.7.2. Input table	Select point 01 to 20, enter level and then volume values respectively. 0 (conversion table not created, volume measurement not possible)	This function is used for setting up the strapping table (level/volume). Up to 20 points can be assigned. Every new point must be larger than the preceding one. The units of length and volume can be changed later without affecting the settings in the table. The units selected for length and volume in fct.s 1.2.4 and 1.2.5 will be used here.

5.1.3 QUICK CONFIGURATION: CONFIGURATION EXAMPLES

The minimum functions (fct.) to be configured for a simple measurement are listed below:

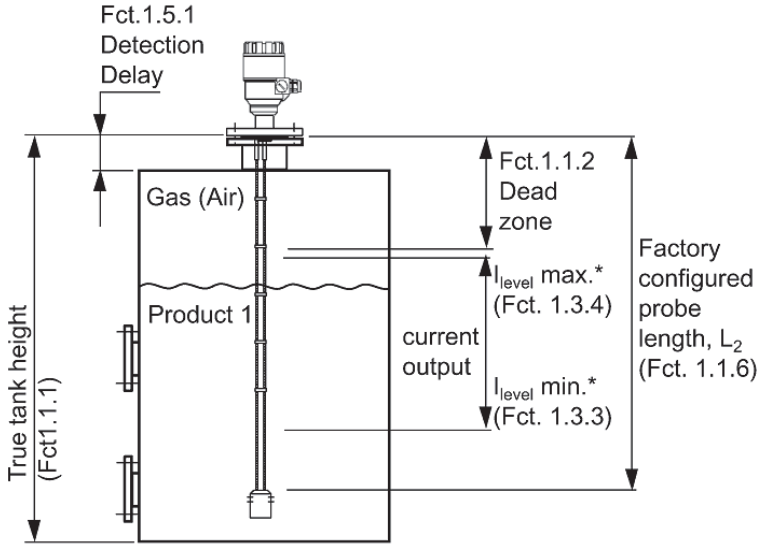
Functions		Definition
PCSTAR 2	HART®	
1.1.1	2.1.1.1	Tank Height
1.1.2	2.1.1.4	Dead zone
1.3.1 … 4	2.1.3.1 … 4	Current Output
1.7.0	2.1.7.0	Volume table*

*For volume measurements

Example procedures for each set of functions are given on the following pages. Each procedure is given in a series of steps in table form and is according to the PCSTAR 2 F2-Configuration parameter list. Please refer to section 3.3.4 for the equivalent parameters available on the HART® Communicator.

Definitions for quick configuration

where PCSTAR 2 Fct. 1.3.1 (HART® Fct. 2.1.3.1) Current I1 Item is configured to “Level”



Typical gauge used for quick configuration examples:

Probe type:	twin Ø4 mm or 0.15" cable probe
Product measured:	Water (dielectric constant, ε_r = 80)
Tank height: (PCSTAR 2: Fct. 1.1.1, HART®: Fct. 2.1.1.1)	10000 mm
Dead zone (PCSTAR 2: Fct. 1.1.2, HART®: Fct. 2.1.1.4)	(see " Technical data of the probes")
Probe length L_2 (PCSTAR 2: Fct. 1.1.6HART®: Fct. 2.1.1.2)	9000 mm (do not modify unless advised to)

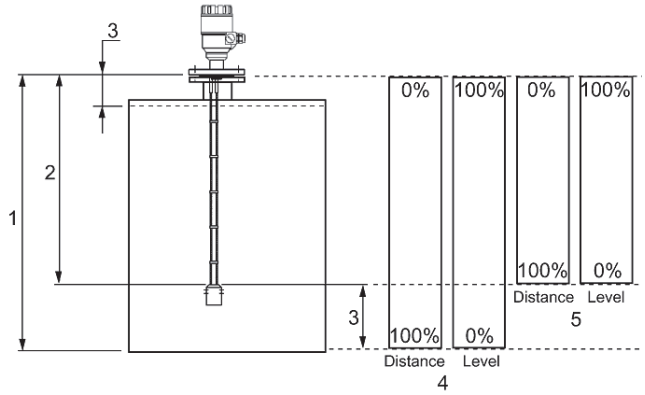
Tank height: configuration of user menu PCSTAR 2 function 1.1.1 (HART® Fct. 2.1.1.1)

This function is usually either defined as true tank height or as factory configured probe length, L_2 if the former is not supplied by the customer in the order.

Why change the tank height?

Setting the distance in PCSTAR 2 Fct 1.1.1 (HART® Fct. 2.1.1.1) to L_2 avoids having a non-measurable zone underneath the probe where the measurement on the display freezes.
When setting up a measurement scale as explained on the following pages, this means that
the level at the end of the probe will be taken as zero instead of the tank bottom.

How tank height affects measurement when either Level or Distance is measured



1 Tank height

2 Measurable height (factory configured probe length, L_2)

3 Non-measurable zone

4 With true tank height (1) set in Function 1.1.1 of the User's menu

5 With factory-configured probe length, L_2, set in Function 1.1.1 of the configuration menu.

Example procedure 1 (using PCSTAR 2):

to change true tank height (10000mm or 33 ft) to factory configured probe length, L_2 (9000mm or 29½ ft) , and then save the new parameter. Refer to item 5 in the diagram above.

Step	Action	Data entered / value set
1	Press F2 to connect to the device	Tank status screen displayed (level reads 6750 mm)
2	Press F2 to enter configuration menu	Configuration menu displayed
3	Click on the data set field for Fct. 1.1.1 Tank height	This field currently reads 10000 (mm)
4	Type in the new value	9000
5	Press the button “F6-Send to MicroTrek” for the MicroTREK 2-wire to immediately accept the new value.	n/a
6	Press “F3-Exit” to quit the configuration menu.	Tank status screen displayed (level now reads 5750 mm)

Dead zone: configuration of user menu PCSTAR 2 function 1.1.2 (HART® Fct. 2.1.1.4)

The top dead zone is the minimum measuring distance between the gauge flange facing (the reference point) and the product. The various probes for the MicroTREK 2-wire have differing top dead zones and these are given in section 5.2.3: Probe measurement limits.

Why is configuration of the dead zone important?

The gauge will not display measurements taken here - the reading is blocked on reaching this zone.

This will avoid the gauge confusing the true level with a parasite (i.e. flange) as the product nears the tank fitting and thereby displaying a false reading. It should be noted that although the reading is frozen, the gauge will continue to follow the reflection. The PCSTAR 2 F8-marker menu will display “Tank full” in this zone.

What is the difference between these functions:

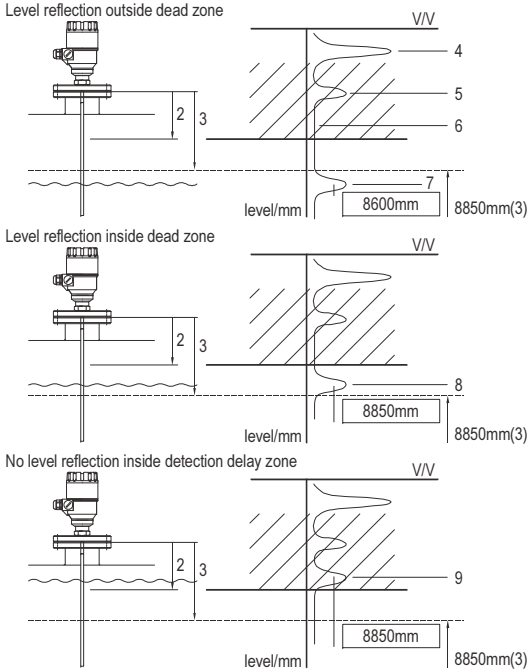
PCSTAR 2 Fct 1.1.2/ HART® Fct. 2.1.1.4: Dead zone

PCSTAR 2 Fct 1.5.1/ HART® Fct. 2.1.5.3: Detection delay?

The “detection delay” function masks all signals (i.e. none are detected by the gauge) up to a defined distance from the flange facing. The detection delay zone size is never greater than the dead zone size.

The PCSTAR 2 F8-marker menu will display “Tank full” and “Level lost” in this zone.

This is illustrated below – the value in the box is the displayed value:



1 Height of tank fitting
2 Detection delay (Fct.1.5.1=120 mm)
3 Dead zone limit (Fct.1.1.2=150 mm)
4 Emitted signal
5 Flange reflection (masked)
6 Masked zone (all signals here are ignored)
7 Level reflection outside dead zone – true level displayed
8 Level reflection inside dead zone – level at dead zone limit displayed (frozen)
9 Level reflection inside detection delay zone – not detected by gauge and level at dead zone limit displayed (frozen)

**(3) = 985 mm Dead zone configured limit in terms of level*

How to set an analogue current output scale

User menu functions 1.3.1 to 1.3.4
This set of functions allows users to set up a scale. The minimum (4mA) and maximum (20mA) values of an analogue current output should ideally lie within the device's active measuring zone, as the device will freeze when the signal is lost.

Refer to the measurement limits table for each probe type in the introduction. Refer also to the start of section 3.3.3 for the advantages of changing tank height.

Example procedure 2 (using PCSTAR 2):

To personalise a measurement scale
select "Level" as the current output parameter for the scale to be set up from the tank bottom
select 4 … 20 mA current range with an error output at 22 mA; choose suitable minimum and maximum values for the scale.

Step	Action	Data entered / value set
1	Press F2 to connect to the device	Tank status screen displayed (level reads 5650 mm)
2	Press F2 to enter configuration menu	Configuration menu displayed
3	Scroll down the screen and click on the data set field for Fct. 1.3.1: Current 1 item. This will reveal a scroll menu.	This field currently reads "distance"
4	Use mouse to scroll down data set field. Click on the new value.	This field now reads "level"
5	Scroll down to Fct. 1.3.2: Current 1 range and click on data set field. This will reveal a scroll menu.	This field currently reads "4-20 mA"
6	Use mouse to scroll down data set field. Click on the new value.	This field now reads "4-20 mA / E = 22 mA"
7	Scroll down to Fct. 1.3.3: Scale I1 min and click on data set field.	This field currently reads "0000 mm"
8	Enter the new value. This will give the level that corresponds to the minimum output of 4 mA.	This field now reads "1000 mm"
9	Scroll down to Fct. 1.3.4: Scale I1 max and click on data set field.	This field currently reads "6000 mm" (std. default: 6000 mm)
10	Change to 9850 mm. This will give the level that corresponds to the maximum output of 20 mA. (and sets max. output at the top dead zone limit)	This field now reads "8850 mm"
11	Press F6-Send to MicroTrek to immediately update the device configuration.	n/a
12	Press F3-Exit to quit the configuration menu screen.	Tank status screen displayed (level reads 5650 mm)

Setting up a volume table - (User menu PCSTAR 2 function 1.7.2 (HART® submenu 2.1.7))

To be able to measure the volume, a conversion table (strapping table) will need to be created using the PCSTAR 2 program or the HART® communicator.

The strapping table assigns defined volumes to the various levels.

In the case of non-symmetrical tanks, e.g. tanks with dished bottom, the accuracy of volumetric measurement will depend on the number of entered “level/volume pairs”. The maximum number of pairs (points) that can be set is 20.
The volume is linearly determined (interpolated) between 2 points.

The conversion table is generally used for volume, but can also be used for mass and flow.
Five points have been set in the following example.

Example procedure 3: creating a strap table by assigning a volume to a user-defined level (using PCSTAR 2)

Step	Action	Data entered/value selected
1	Connect to the gauge as described in section 3.3.1.	n/a
2	Press function key F2 or left click on F2-connection at the bottom of the window. This will open the user configuration menu.	n/a
3	Go to user function 1.1.1: Tank height to enter value (click on field and type in value)	6.00 m
4	Go to user function 1.1.2: Dead zone to enter blocking distance value.	0.40 m
5	Go to user function 1.1.6: Probe length to enter value	5.80 m
6	Go to user function 1.2.4: Length Unit to select length units.	m or ft
7	Go to user function 1.2.5: Volume unit to select volume units	m^3 or ft^3
8	Go to user function 1.7.2: Input table. A maximum of 20 points can be entered. For each point a level and a volume must be entered. Each point should have a value higher than preceding one.	See table below

Input table

Point	Level	Volume
1	0.0 m	0.0 m³
2	0.20 m	0.5 m³
3	0.75 m	1.0 m³
4	1.00 m	1.5 m³
5	5.60 m	16.8 m³

* Max. level = tank height – dead zone = 6000 mm – 400 mm or 19.69 ft – 1.31 ft = 5600 mm or 18.37 ft, equivalent to a volume of 16.80 m³ or 593.3 ft³

Note:
The level can effectively be measured between 200 mm or 8" and 5600 mm or 18½ ft. When the product level drops below the tip of the probe, the MicroTREK 2-wire will indicate that there is still remains of 200 mm or 8". Accordingly, the MicroTREK 2-wire can only indicate a level between 200 mm or 8" and 5600 mm or 18½ ft, since it only measures along the probes. The size of the dead zone depends on the installation and on the probe type.

Supplementary procedure for setting the 4 … 20 mA current to output volume readings (using PCSTAR 2)

Step	Action	Data entered/value selected
1	Go to user function 1.3.1 "Current 1 item" to select measurement function.	Volume
2	Go to user function 1.3.2 "Current 1 range" to set fault status	4 … 20 mA
3	Go to user function 1.3.3 "Scale I1 min" to enter volume value for the minimum output (4 mA)	0.50 m³
4	Go to user function 1.3.3 "Scale I1 max" to enter volume value for the maximum output (20 mA)	16.80 m³
5	Either save the new configuration to disk by left-clicking on F5-Save to disk and download it onto the MicroTREK 2-wire using the F6-Send to MicroTrek key.	n/a
6	Press F3 to exit the configuration menu.	n/a

5.2 PROGRAMMING WITH SAP-300 DISPLAY UNIT

The main parameters of the Microtrek can be also set using the SAP-300 display unit.
The default display shows the primary measured value (which the output current is calculated from).
Besides the numerical display there is a bargraph on the right showing the value of the current output.
Programming is hepled by a text-based menu. Navigation in the menu can be done with Ⓔ / ▲ / ▼ / ◄ buttons.

5.2.1 SAP-300 DISPLAY UNIT

Display	64x128 Dot-matrix LCD, glyphs, units and bargraph
Ambient temperature	– 20°C…+60°C
Housing material	PBT fiberglass, plastic (DuPont®)

SAP-300 is a plug-in LCD display and programming module.

Warning!

The display of the SAP-300 is based on LCD technology,
do not expose the SAP-300 to continuous direct sunlight
to avoid display damage.

If MicroTREK is not equipped with a sunshade and ambient temperature exceeds the operating temperature of SAP-300 do not leave the SAP-300 in the instrument!

5.2.2 MICROTREK'S BEHAVIOUR IN MANUAL PROGRAMMING MODE

After power-up MicroTREK shows the measured value on the SAP display.

REMOTE MODE:

If the instrument senses external HART communication it changes its display mode and shows a "REMOTE MODE" message in the bottom of the display. In this mode the measured values are refreshed according to the queries of the external HART master.

If the HART master does not refresh the display will show the last measured values.
In the absence of SAP-300 the COM LED indicates the HART communication.
If HART communication stops the COM LED turns off after 120 sec.

Entering the menu can be done by pressing the Ⓔ button. Scrolling the menu can be done by pressing ⓐ and ⓥ buttons.
Enter into selected menu point with Ⓔ button. Exit to the previous menu with ⓒ button.
The buttons work only in presence of SAP-300 module.

When leaving the MicroTREK in (programming) menu after 30 minutes the instrument automatically returns to measuring mode.
If SAP-300 is removed the instrument instantly returns to measuring mode.

Because manual programming (with SAP-300) and remote programming (with external HART master, Multicont or PCSTAR2 software) cannot be performed at the same time (as both of them act like a HART master) only one programming mode has priority and this is manual programming.
During manual programming the instrument sends the "BUSY" response to the external HART master device. (HART response code 32 - Device is busy)

5.2.3 MANUAL PROGRAMMING

The menu structure is similar to the PCStar2 parameter structure.

Main menu	Sub-menu	PCSTAR 2 param. ID
BASIC SETUP		
	TANK HEIGHT	1.1.1
	DEAD ZONE	1.1.2
	CLOSE-END BLOCKING	1.5.1
	DAMPING TIME	1.1.3
	PROBE LENGTH	1.1.6
OUTPUT SETUP		
	CURRENT MODE	1.3.1
	FAILURE CURRENT	1.3.2
	CURRENT MIN	1.3.3
	CURRENT MAX	1.3.4
	ERROR DELAY	1.3.5
APPLICATION		
	APPLICATION TYPE	

Changing parameters can be done by selecting a sub-menu and pressing Ⓔ button in two ways:

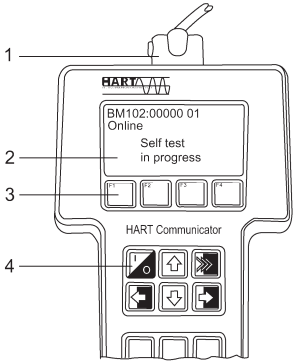
Text-based list: Navigation is the same as in menu lists.
Accept changes with Ⓔ button, cancel changes (and exit) with ⓔ button.

Numerical field: Serves for editing a numeric value.
Editing is helped by a cursor (inverted character).
Change the value of the selected digit with ⓤ / ⓓ buttons
(there is no under-, and overflow between the characters).
Selecting a digit can be done using the ⓔ button.
Accept changes with Ⓔ button.
After accepting the parameter change the Microtrek checks the parameter and downloads it.
If parameter is incorrect the CHECK/WRITE FAILED! message appears.

5.3 PROGRAMMING WITH HART® HANDHELD (HHC) COMMUNICATOR

Display and configuration can also be carried out with a HART® communicator...

Communicator layout

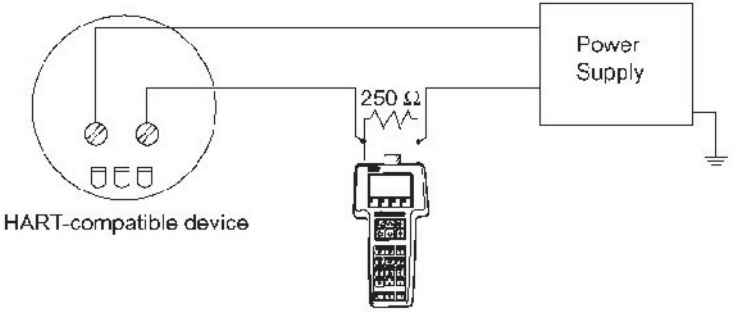


1 Two-pin jack for loop connectors
2 LCD
3 Function keys (F1 … F4)
4 Action keys

On/off	UP Arrow	n/a
LEFT Arrow	DOWN Arrow	RIGHT Arrow

Other functions: LEFT Arrow: Previous menu key
RIGHT Arrow: Select key

Wiring, standard (non-Ex)

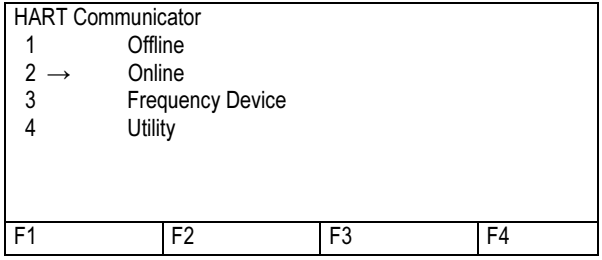


Caution: Refer to the HHC manual for wiring instructions when in an explosive atmosphere.

Displaying readings

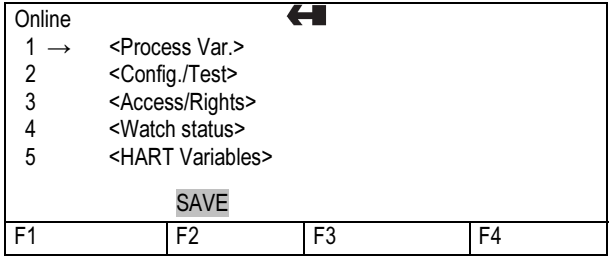
Use the UP and DOWN arrows to move to the correct line and then select with the RIGHT Arrow.

1



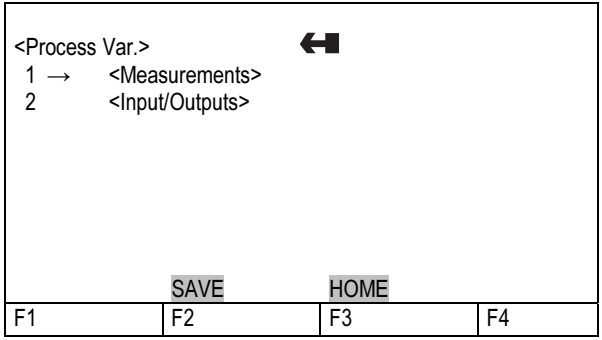
Main menu

2



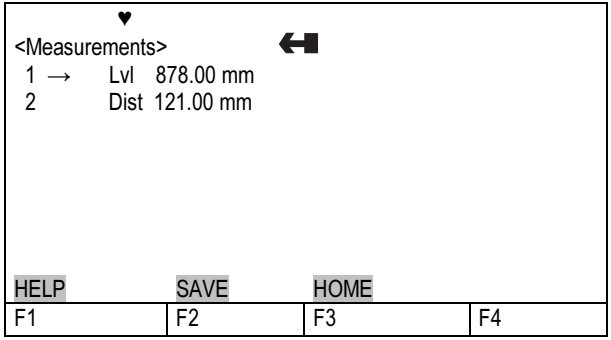
Online menu

3



Measurement & input & output functions menu

4



Measurement display function

Configuration: summary of user functions via HART® Communicator HC 275 (Version 1.00)

Reset default values are in bold type in the “Input Range” column.

Refer to the HART® HC275 Communicator operating instructions for further operating details.

Function (Fct.)		Input Range	Description
1.0	**PROCESS VAR.**		
1.1.0	**MEASUREMENTS**		
1.1.1	LEVEL		Level value
1.1.2	DISTANCE		Distance value
1.1.3	VOLUME		Volume value if a strapping table is programmed
1.1.4	ULLAGE VOLUME		Ullage Volume value if a strapping table is programmed
1.2.0	**INPUTS/OUTPUTS**		
1.2.1	FUNCTION I		Function associated to the current output (Primary Variable).
1.2.2	I		Current output value (mA)
1.2.3	%		Percentage of PV range

Function (Fct.)		Input Range	Description
2.0	**CONFIG./TEST**		
2.1.0	OPERATION		
2.1.1.0	BASIS PARAMETER		
2.1.1.1	TANK HEIGHT	Enter probe length to 60000 mm or 2362” **As per order**	Tank height. The tank height is defined as the distance between the bottom of the tank and the lower flange surface.
2.1.1.2	PROBE LENGTH	Enter 0 mm to tank height but < 24000 mm or 1063” **As per order**	This value has to be equal to the exact length of the probe. The only situation for changing this value is if the probe length has been changed.
2.1.1.3	TIME CONSTANT	Enter to 100 seconds **5 sec.**	The time constant allows filtering of possible signal fluctuations when the product surface is turbulent.
2.1.1.4	DEAD ZONE	Enter a value Fct.1.5.1(Detection delay) … probe length.	Measurements near the flange may not be precise or reliable. Measurement may not be precise in an area less than this recommended value, depending on the probe type.
Warning : Critical Parameter		**See „Minimal measuring distance” Technical data of the probes**	
2.1.1.5 **SENSOR INFO**			
2.1.1.5.1 Sensor upper limit		= Probe length	Read only Menu. Upper sensor limit
2.1.1.5.2 Sensor lower limit		= 0	Read only Menu. Lower sensor limit
2.1.1.5.3 Sensor min. span		= 1 mm	Read only Menu. Sensor minimum span.
2.1.2.0	DISPLAY		

Function (Fct.)	Input Range	Description
2.1.2.1 **LENGTH**		
2.1.2.1.1 LENGTH UNIT	Select m, cm, mm, inch, Ft, optional unit **mm**	Length unit of displayed value (level / distance). The optional unit allows the user to define a new unit (name and factor) see menu 2.1.2.1.3
2.1.2.1.2 DISPLAY FORMAT	0, 1, 2, 3, 4, 5, exponential format, auto **2**	Number of decimal places. Defines the displayed length values format (option of the HART® communicator H275).
2.1.2.1.3.0 **DEFINE NEW UNIT**		
2.1.2.1.3.1 UNIT NAME	4 ASCII characters **"UNIT"**	Optional unit name. User has to enter the unit name before using it in the menu "LENGTH UNIT".
2.1.2.1.3.2 UNIT FACTOR	Enter 0.0 to 100000 **1.0**	Optional unit factor. User has to enter the Unit Factor before using it in the menu "LENGTH UNIT". With a factor 1.0, the unit is equivalent to one millimeter. With a factor 1000.0, the unit is equivalent to one meter.
2.1.2.2.0 **VOLUME**		
2.1.2.2.1 VOLUME UNIT	Select m^3, l, US Gal, Ft^3, bbl, M^3/h, Ft^3/h, kg, Metric Tons, US Tons **m^3**	Unit for conversion values ("volume table"). The selected unit is only used to display the conversion value from the strapping table.
2.1.2.2.2 DISPLAY FORMAT	0, 1, 2, 3, 4, 5, exponential format, auto **2**	Number of decimal places. Defines the displayed volume value format. (Option of the HART® communicator H275).

Function (Fct.)		Input Range	Description
2.1.3.0	ANALOG OUTPUT		
2.1.3.1	FUNCTION I	Select Level, Distance, Volume, Ullage Volume **Level**	Current output function (measured value to be displayed). Volume functions will appear if a volume table exists in menu 2.1.7.0
2.1.3.2	RANGE I	Select 4-20 mA or 4-20 mA + 22 mA if error **4 - 20 mA**	Current output range 4 … 20 mA (1st choice). When the MicroTREK 2-wire is in error mode, the current output is frozen except if the second choice is selected and then the current output is fixed at 22 mA.
2.1.3.3	ERROR DELAY	Select No delay, 10 s, 20 s, 30 s, 1 min, 2 min, 5 min, 15 min **No delay**	This menu is available in case the range I menu is set to 4-20 mA with error 22 mA. This parameter sets the delay before the current output goes to 22 mA after the error mode occurred.
2.1.3.4	SCALE I min. 4 mA	Enter 0 to Scale I max **As per order**	Input the lower range value (corresponding to 4 mA) depending of the parameter 2.1.3.1 chosen.
2.1.3.5	SCALE I max. 20 mA	Enter Scale I min to tank height **As per order**	Input the upper range value (corresponding to 20 mA) depending of the parameter 2.1.3.1 chosen.

Function (Fct.)		Input Range	Description
2.1.4.0	**USER DATA**		
2.1.4.1	TAG	**00000 01**	Tag number of device
2.1.4.2	SERIAL NUMBER		Read only menu. Each device has its own serial number
2.1.4.3	FRENCH COMMISSION NUMBER		Read only menu. This number is factory set. Refer to this number in case of warranty or service claims.
2.1.4.4	GERMAN COMMISSION NUMBER		Read only menu. This number is factory set. Refer to this number in case of warranty or service claims.
2.1.4.5	RELEASE NUMBER		Read only menu. Release number of the device (Software and Hardware version).
2.1.4.5	PROBE TYPE	Rod, Twin Rod, Cable, Cable +counterweight, Cable without counterweight, Twin Cable, Twin Cable + counterweight, Coax, Special 1, Special 2, Special 3 **As per order**	Read only menu. Probe type attached to the flange.
2.1.4.5	CHECKSUM		Read Only menu. Similar to the release number. This parameter allows to identify the software version of device.

Function (Fct.)	Input Range	Description
2.1.5.0 **APPLICATION**		
2.1.5.1.0 THRESHOLD		
2.1.5.1.1 LEV. PULSE AMP.	Read only value.	Dynamic value. Amplitude of level pulse in millivolts.
2.1.5.1.2 LEV. PULSE GAIN	Read only value.	Dynamic value. Amplification of level pulse (gain 0, 1, 2, or 3).
2.1.5.1. THRESHOLD	Enter a value from 50mV to 25000mV **500 mV G3 at 1000 mm**	Threshold of the level pulse (in millivolts). The threshold evolves in terms of gain amplification factor changing by the electronic converter.
2.1.5.2 DISTANCE INPUT	Enter a value from Fct. 2.1.1.4: Dead zone to fct. 2.1.1.2: Probe length	This function forces the MicroTREK 2-wire to search for the product surface in a zone other than the actual measuring zone. If there is no level signal, you can enter an estimated value.
2.1.5.3 DETECTION DELAY	Enter a value 0mm or 0in to Fct. 2.1.1.4: Dead zone **As per order**	This function forces the instrument not to analyse reflections in a zone directly below the flange. The entered value of the detection delay must be smaller than the "dead zone" value.
2.1.5.4 SEARCH PROBE END	Measured in the units configured in fct. 2.1.2.1.1	Measures automatically the probe length. The tank must be empty and the tank height must be configured to a value greater than estimated probe length for this to be done correctly.
2.1.5.5 RESET MicroTREK 2-wire		Restarts the MicroTREK 2-wire.
2.1.6.0 **SERIAL I/O**		
2.1.6.1 ADDRESS	Enter 0 to 15 **0**	Sets the address of the device when this latter is connected on a HART Multidrop networks. The current output drifts to 4 mA. 0 = 4 … 20 mA output current active 1 – 15 = in multidrop mode

2.1.7.0	**STRAP TABLE**		
2.1.7.1	VOLUME UNIT	Select m3, l, US Gal, Ft3, bbl, M3/h, Ft3/h, kg, Metric Tons, US Tons **Liter [l]**	Unit for conversion values ("volume table"). The selected unit is used to define the strapping table values.
2.1.7.2	INPUT TABLE	0 to 20 points **0** (i.e. no volume table)	This function defines the strapping table. The maximum number of points is 20. Each subsequent value must be greater than the previous one. The length and volume units can be changed later without affecting the settings in the table. Calculations are done automatically in the instrument.
2.1.7.3	DELETE TABLE		This function deletes the strapping table.

Function (Fct.)		Input Range	Description
2.2.0	**TESTS**		
2.2.1	TEST OUTPUT	Select 4 mA, 12mA, 20 mA, Other	This function allows the current output to be tested. The output can be set to one of the listed values. With a reference ammeter, the calibration of the current output can be verified.
2.3.0	SERVICE		Restricted access factory configuration menu. These parameters may be accessed via Fct. 3.2 “Specialist PSW (password).
3.0	**ACCESS RIGHTS**		
3.1	MAINTENANCE PSW	Yes or No. Enter 9-character code if “Yes”. **No**	Disables the access lock on the configuration menu. The password must contain exactly 9 characters. E, R or U are used only. The password is displayed in a scrambled format. It allows NIVELCO to decode the password in case it was forgotten.
3.2	SPECIALIST PSW		See NIVELCO Service centre or MicroTREK 2-wire Service Manual for code.
4.0	WATCH STATUS		This function displays the status of the device.

Function (Fct.)		Input Range	Description
5.0	**HART® VARIABLES**		
5.1	MANUFACTURER		Read only menu
		NIVELCO	
5.2	MODEL		Read only menu
5.3	FLD DEV REV		Field device revision.
		1.0	Read only menu
5.4	SOFTWARE REV		Software revision.
		1.0	Read only menu
5.5	HARDWARE REV		Hardware revision.
		1.0	Read only menu.
5.6	DEVICE ID		Read only menu. The device ID is also the serial number of the device.
5.7	MESSAGE		32 bytes of ASCII characters
5.8	DESCRIPTOR		16 bytes of ASCII characters
5.9	DATE		Month Day Year (xx / xx / xx).
5.10	NUM RESP PREAM		Number of preamble in the response frame of the device
5.11	TAG		Tag name of the MicroTREK 2-wire
5.12	POLL ADDRESS		Address of the device.

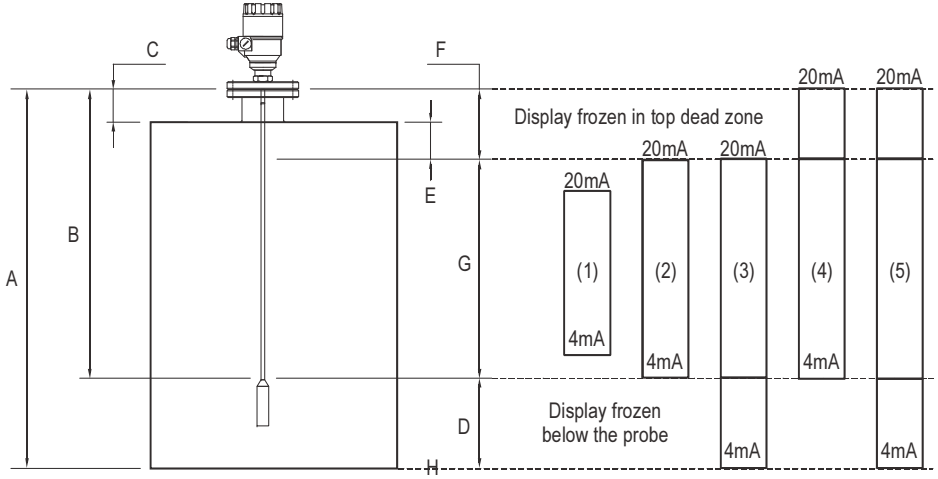
5.3.1 CHARACTERS AVAILABLE FOR ALPHA-NUMERICAL DATA FUNCTIONS IN PCSTAR2 AND ON THE HART® CONSOLE

PCSTAR2			Fct. 12.6.1: Unit name, Fct. 1.4.4: Device number, Fct. 1.4.8: Option				
HART® console (HHC)			Fct. 5.7 Message, Fct. 5.8 Descriptor, Fct. 5.11 Tag				
@	H	P	X	Space	(	0	8
A	I	Q	Y	!	)	1	9
B	J	R	Z	“	*	2	:
C	K	S	[	#	+	3	;
D	L	T	\	$	‘	4	<
E	M	U	]	%	-	5	=
F	N	V	^	&	.	6	>
G	O	W	_	‘	/	7	?

5.4 MICROTREK 2-WIRE T.D.R. METER CHARACTERISTICS

This subsection explains:
the four principle configurations for setting up a measurement scale and what the user should be aware of in each case;
what happens when the tank is full or empty;
what is the level threshold and how to modify it and
what happens when level is measured when more than one product in the tank;

The measurement scale:
five possible configurations for analogue current output – with "Level" selected in PCSTAR 2 function 1.3.1 : Current 1 Item



A Tank height (Fct. 1.1.1)
B Probe length (Fct. 1.1.6)
C Detection delay (Fct. 1.5.1)
D Non-measurable zone
E Minimum distance between non-measurable zone and dead zone (Fct.: 1.1.2 – Fct.: 1.5.1)
F Upper dead zone (Fct. 1.1.2)
G Measuring range
H Reference point at tank bottom (Fct.: 1.3.1 = Level)

The configurations described below are illustrated in the above diagram

(1) The “current output” range is smaller than the max. possible measuring range

(2) The “current output” range is equal to the measuring range:
Scale min.: 4 mA (Fct. 1.3.3) = tank height – probe length + H
Scale max.: 20 mA (Fct. 1.3.4) = tank height – dead zone

(3) The “current output” range is greater than the measuring range:
Scale min.: 4 mA (Fct. 1.3.3) = 0.0
Scale max.: 20 mA (Fct. 1.3.4) = tank height – dead zone

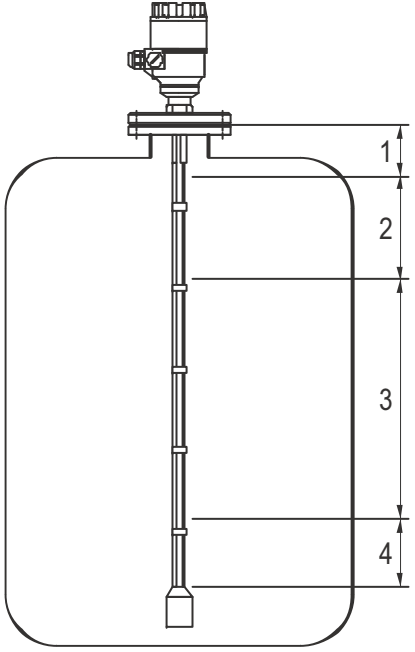
(4) The “current output” range is greater than the measuring range:
Scale min.: 4 mA (Fct. 1.3.3) = tank height – probe length + H
Scale max.: 20 mA (Fct. 1.3.4) = tank height

(5) The “current output” range is greater than the measuring range:
Scale min.: 4 mA (Fct. 1.3.3) = 0.0
Scale max.: 20 mA (Fct. 1.3.4) = tank height

NOTE: The reference point for distance measurements is the bottom of the flange face.

5.4.1 GAUGE OPERATING LOGIC WHEN THE REFLECTION IS LOST

The product reflection pulse is usually lost when the level is in the top dead zone or near the bottom of the tank.
The diagram below shows the action taken by the gauge depending on where the last reflection was lost.
Use PCSTAR 2 - F8-Marker display function to follow the measurement status of the gauge.



Zone 1 : Dead and detection delay zones

Marker “Tank full” and “Level lost” is displayed when
the product enters the dead zone and no reflection is found.
This will also occur once the level reflection is within the detection delay zone.
The gauge assumes the tank is full and displays the maximum level value.
The gauge searches for a reflection along the entire length of the probe.

Zone 2 : Full zone (and dead zone)

Marker “Tank full” is displayed in this zone.
If the gauge loses the signal in this zone,
it reacts as in zone 1: the tank is assumed to be full.
The gauge searches for a reflection along the length of the probe.

Zone 3 : Central measurement zone

The gauge searches along the length of the probe for
the largest pulse reflection.
If the pulse is lost the reading freezes at the last value.
Marker “Level lost” will be displayed.

Zone 4 : Empty zone

If the reflection is lost here then the gauge assumes the tank is empty and marker “tank empty” is displayed.
The gauge searches for a reflection in this zone but makes a search along the entire length of the probe once every minute.
The reading will remain frozen during this time.
The short circuit reflection will become larger than product reflection at this time.

5.4.2 GAIN AND VOLTAGE AMPLITUDE

As explained in the measuring principle in the introduction, the level of a product is converted from a return signal (the product reflection) received by the gauge: this signal has taken a certain amount of time to return to the gauge and it has a certain strength / size measured in milli-volts (dependant on the dielectric constant ε_r of the product).

All pulse signals returning to the gauge electronics block (including flange, obstruction and the product surface reflections) are converted to voltage amplitudes. The gauge's microprocessor looks for part of the largest signal that is over a set voltage amplitude, called the "threshold", and identifies this as the product being measured. For this signal to be usable by the gauge, the microprocessor will amplify the signal by increasing the gain. Once the signal is within a set "working" range, the gauge follows this signal. The gauge registers any changes in time for this part of the signal to return to the converter and translate this into a displayed level or volume.

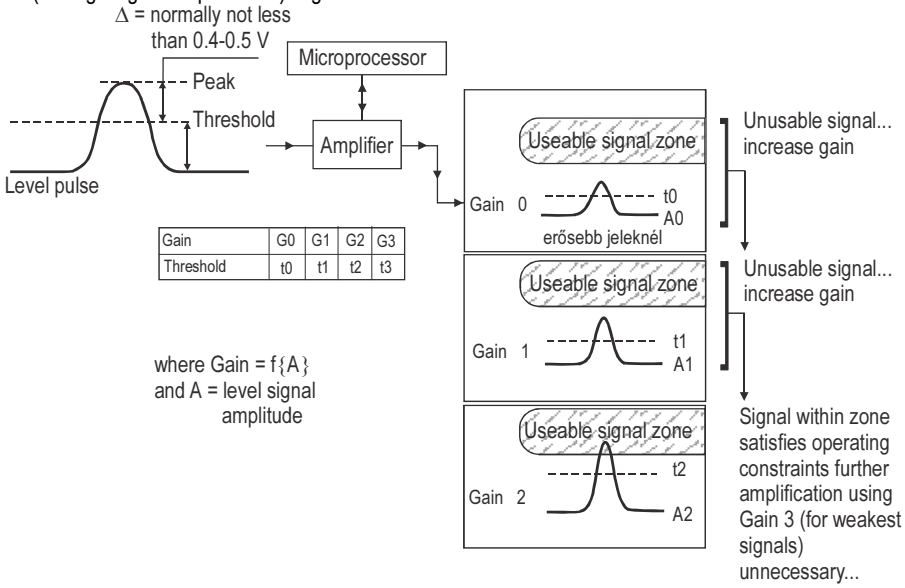
Gain is a function of voltage amplitude.

This defines the default threshold value when the gauge is searching for the product level.

A strong return signal will be given a low gain (i.e. Gain 0 or a small amplification).

However, if the signal is very weak, then a Gain of 3 (i.e. high signal amplification) is given.

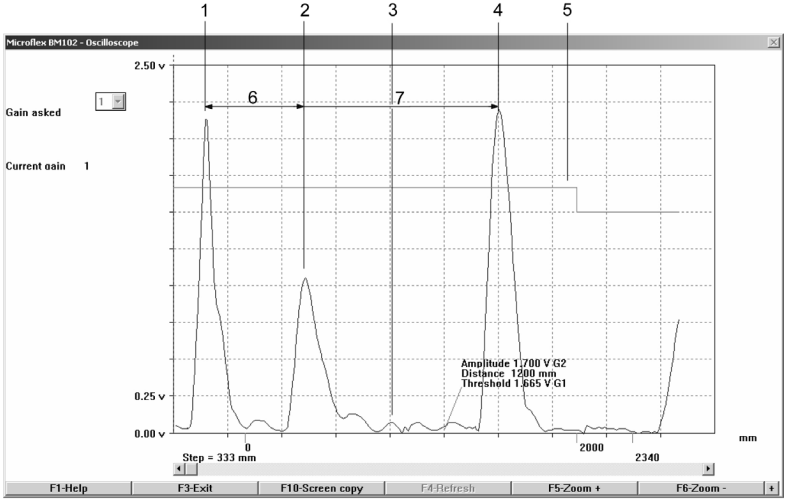
Example of signal amplification:



Level measurement: Level pulse amplitude and threshold

After connection to a power supply, the MicroTREK 2-wire will:
1. Measure reflection pulses in terms of voltage amplitude by cycling through a set of gains.
2. Identify the highest amplitude as being the product level.

This screenshot of the PCSTAR 2 F7-Oscilloscope function while measuring a typical one product application identifies:



1 Initial pulse

2 Flange reflection (except coaxial probe)

3 Non-product reflection (e.g. parasite: agitator)

4 Product level reflection

5 Level threshold (with two-metre steps).
Set in F11-Dynamic configuration menu

6 Offset

7 Distance measured as a function of time

The level signal can be optimized by way of two factors:

Amplification factor

The amplitude of the signals is proportional to the dielectric constant ε_r of the product. At low amplitudes the signal should be amplified.
The amplification factor is dependent on the dielectric constant ε_r and on the probe type. The device sets the gain automatically.

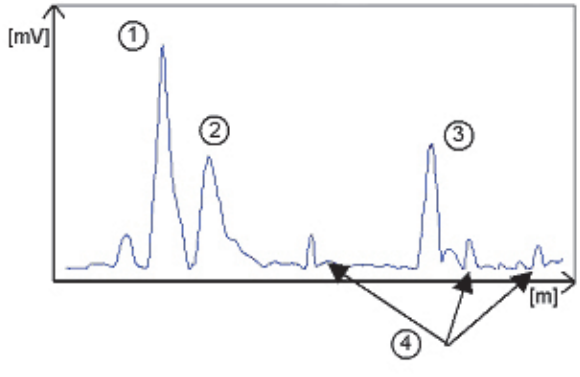
The following factors apply to the set gain:

Gain	Amplification factor
0	1.05
1	2.10
2	4.37
3	8.93

Level threshold

The level threshold suppresses interference signals so that only the reflections from the product surface (level signal) are shown. The factory setting of the level threshold is suitable for standard applications.
The threshold will need to be adjusted in the case of very low dielectric constants ε_r,
multiple interference reflections or unfavourable installation conditions.

The illustrations below show interference signals when the oscilloscope function is used.
These reflections can be due to various causes, e.g. tank internals or multiple reflections within the measuring range.



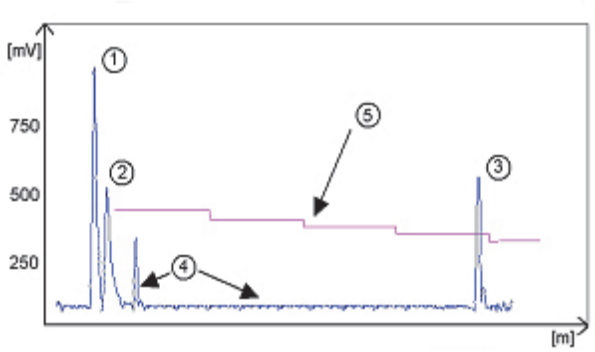
Even though the interference signals are very weak, the threshold should nevertheless be set to a value above these signals.

1 Initial pulse

2 Flange reflection

3 Level signal

4 Interference signal



1 Initial pulse
2 Flange reflection
3 Level signal
4 Interference signal
5 Threshold

In the diagram above it can be seen that the level of the threshold is not constant:
400 mV at 1000 mm or 3.3 ft, and only 250 mV at 10000 mm or 33 ft. No attenuation is required at a probe length ≤ 3000 mm or 10 ft.
The form of the threshold is dependent on attenuation and is automatically adjusted by the device over the measured length.

Setting the level threshold

If the level threshold is set too high, i.e. it is greater than the amplitude of the level reflection,
the device will not find any level even with maximum amplification.

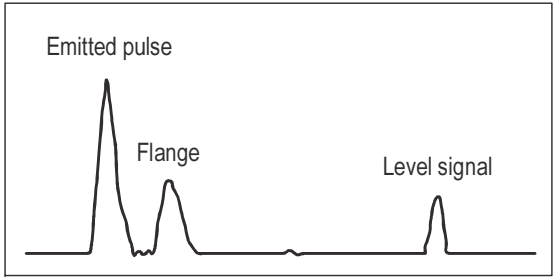
If the level threshold is set too low, i.e. it is below the amplitude of some of the interference signals,
the device will identify and indicate one of these interference signals as a level reflection only if the tank is empty.

Precise setting of the level threshold is especially important when the dielectric constant ε_r is low.

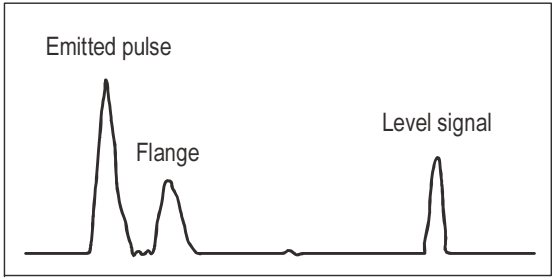
To set, the level (amplitude of the reflection) must be known. A level of 500 mm or 20" is ideal.
The level threshold should be half-way between the invalid interference signals and the level reflection signal.
The reflection from the probe tip, which is clearly identifiable at a low ε_r value, does not need to lie below the level threshold.
Take a look at all the reflections over the entire probe length and then change the level threshold and/or the amplification factor in the "Dynamic configuration (F11)" menu.

5.4.3 TYPICAL SIGNAL TRENDS

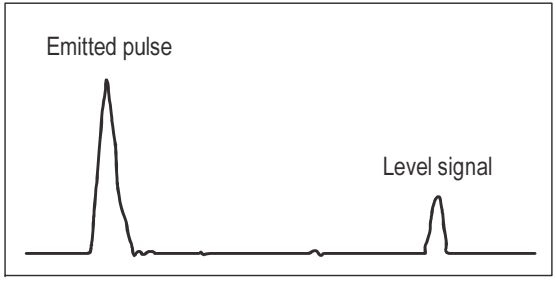
The following diagrams show characteristic signals that have been recorded with the oscilloscope function.



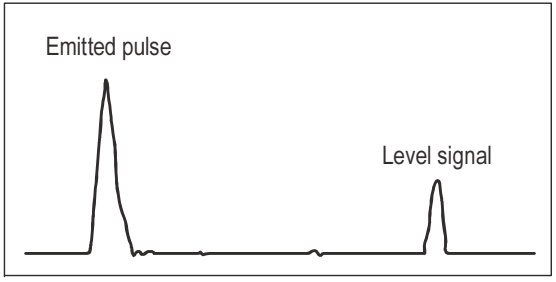
Rod or cable probe with gain 1



Rod or cable probe with gain 2



Coaxial probe with gain 1



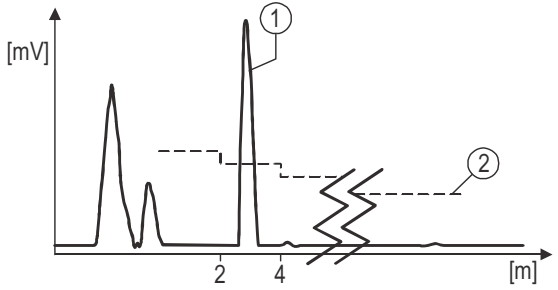
Coaxial probe with gain 2

The signal from coaxial probes does not include the flange reflection,
due to the mechanical setup which does not produce any change in impedance at the flange.

The amplitude of reflection from the product surface increases as the level rises and decreases as the level falls

5.4.4 AUTOMATIC ADJUSTMENT

To maintain a sufficiently strong reflection signal, the gain is adjusted automatically.
When the amplitude of the level reflection decreases, the gain will increase to compensate for the loss in signal amplitude. Gain and level threshold thus maintain the same proportion.
At gain 3, the level signal

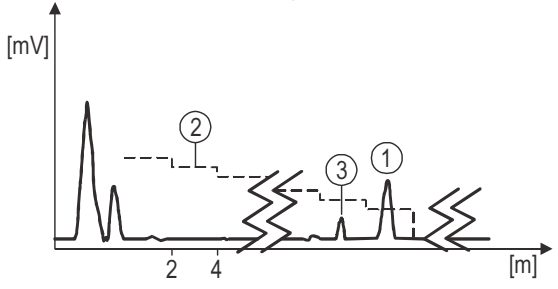


1 is located between a distance of 2000 and 4000 mm or 6.5 and 13 feet.

2 is the level threshold. This is shown below:

The amplification factor is 3

The level has dropped, increasing the distance between level and flange.



1 is located over 4000 mm or 13 feet.

2 threshold

3 interference signals

The interference signals are now below the level threshold (2), whose lower limit is 50 mV.

As in the diagram above, the amplification factor is 3.

In both cases, the automatically adjusted gain of the threshold indicates all signals located above one-half of the amplitude of the level signal.

In the event of operational or installation faults, you can frequently identify the cause of the fault by means of this function and normally eliminate it yourself. Should the fault persist, please send a copy of the screen (screen shots with F10) to your NIVELCO Service Centre.

Procedure (example where the level measured is too low compared to true level):

read off displayed peak amplitude using the oscilloscope function – F7 modify level threshold value

Step	Action	Data entered/ value displayed
1	Execute PCSTAR 2. Press F2 to connect to gauge.	n/a
2	Press F11 to open F11-Dynamic configuration window.	n/a
3	The top of the window gives the distance, peak amplitude in volts and gain.	21000 mm;1500 mV;Gain 2
4	The configured level threshold is listed under peak amplitude in mV. Click on the "Modify" box to activate the "Threshold" field.	n/a
5	Click on the "Threshold" field and enter the new value.	1100 mV
6	If the approximate level is known, click on the "Distance" field and then click on the "Search" button	19000 mm
7	If the value is still too low, try reducing threshold again by small amounts. If this does not resolve the problem, contact the NIVELCO Service Centre.	n/a

Note that the threshold drops every 2000 mm or 6.5 feet.

Solid application notes

Most dry solid applications except powder or flakes with high dielectric constants ε_r, such as coal powder, are measured with a Gain of 3. If it is difficult to measure level at a certain point with the gauge using a Gain from 0 to 2, then an internal tank structure (exposed girder, etc.) is most likely to be within the electromagnetic pulse field area: the gauge will detect the largest signal and assume this is the product level.

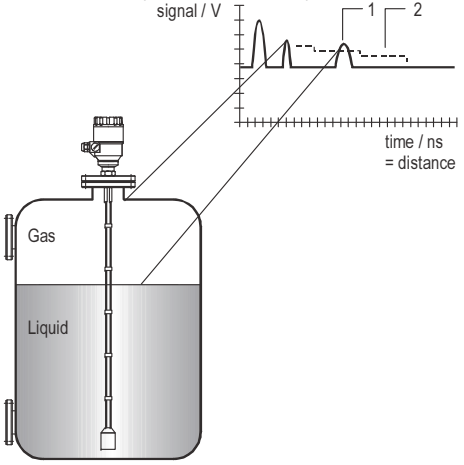
5.4.5 LEVEL MEASUREMENT WHEN MORE THAN ONE PHASE OR LAYER IN THE TANK

Level can be measured with more than one phase in the tank.
This requires setting a parameter in the factory menu (Fct. 1.1.3: Application Type) to the following measurement mode:

2 liquids, 1 level	for measuring level with two or more phases
1 liquid, 1 level	for measuring one phase or liquid

Characteristics
The level of the top product can be detected
if it has a minimum layer of approximately 100 mm - when measuring a top product with a dielectric constant of ε_r =2.4.
The mode "2 liquids, 1 level" permits level to be measured even when more than 2 liquids are present in the tank. The first return signal is identified as being level and the second is ignored.
This mode may be used with all probe types

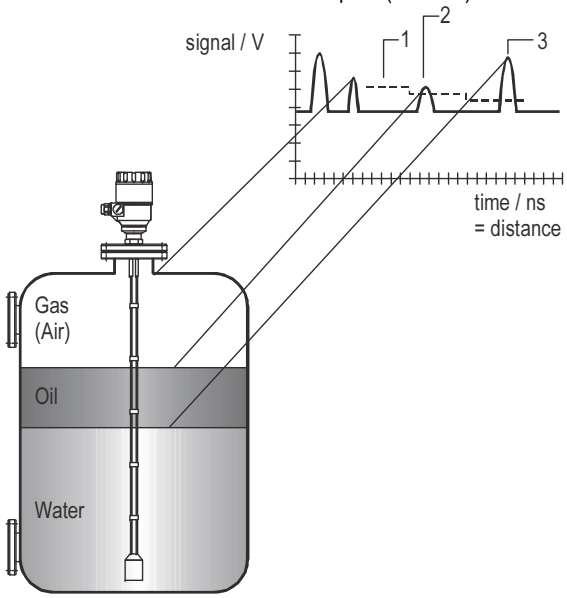
Example application 1:
level measurement of oil (1 liquid in the tank)



With Factory Menu Fct. 1.1.3:
Application Type set to 1 liquid, 1 level, the MicroTREK 2-wire will search for the return signal with the highest amplitude (i.e. higher than the threshold).
It will measure the oil level.

1	Level measurement signal
2	Threshold

Example application 2:
level measurement when there are 2 liquids (oil/water) in the tank – using a correctly configured gauge



With Factory Menu Fct. 1.1.3:
Application Type set to 2 liquids, 1 level, the MicroTREK 2-wire will search for the first return signal higher than the control threshold.
It will correctly measure the oil level (i.e. “level”).

1 Threshold

2 Level signal

3 Oil-water interface signal

For further information, please contact your local NIVELCO Service Centre.

5.5 TROUBLESHOOTING

Event	Fault	Action
Error messages		
"Tank full" status marker on*, reading frozen at max. or min. value	No fault. The level has reached (and possibly risen above) the top configured measurement limit and is either displaying the maximum (when measuring level) or minimum (when measuring distance) output.	None. Measurements should be normal once the level is in the configured measurement range.
"Tank empty" status marker on*, reading frozen at max. or min. value	No fault. The level has entered the gauge's bottom dead zone and can no longer detect a return signal. Either the maximum (when measuring distance) or minimum (when measuring level) output is displayed.	None. Measurements should be normal once the level is in the configured measurement range.
"Tank full" and "Level lost" status marker on*, reading frozen at max. or min. value	No fault. The level has entered the gauge's top dead zone and can no longer detect a return signal.	Empty the tank below the top measurement range limit and check the measurement.
"Level lost" status marker on*, reading is frozen	The instrument has lost the level signal, has searched but not yet found the return pulse. This may occur if the pulse has dropped below the threshold. Parasite signals from the flange or obstructions in the tank may render the gauge unable to identify the correct signal.	Ensure that tank is emptied below maximum level and check the measurement. If the signal is not detected then modify the control threshold manually as shown in sections 5.4.2 using the oscilloscope (F7) and dynamic configuration (F11) windows in PCSTAR 2.
"Reference not found" status marker on*	Occurs when there is a problem with the time base on the HF board.	Please contact NIVELCO.
"Level lost" and "Reference not found" status markers on*, reading frozen	The probe has received an electrostatic discharge.	The gauge will search for the level again and resume readings. If the reading remains frozen then the signal converter may have been damaged by ESD and may need replacing. Please contact NIVELCO.
"Flange not found" status marker on*	The signal converter has been incorrectly configured to measure with a cable or rod probe when it is equipped with a coaxial probe. This may be also due to installation on a long nozzle which has the effect of attenuating the flange pulse.	Contact NIVELCO for the corrective procedure.

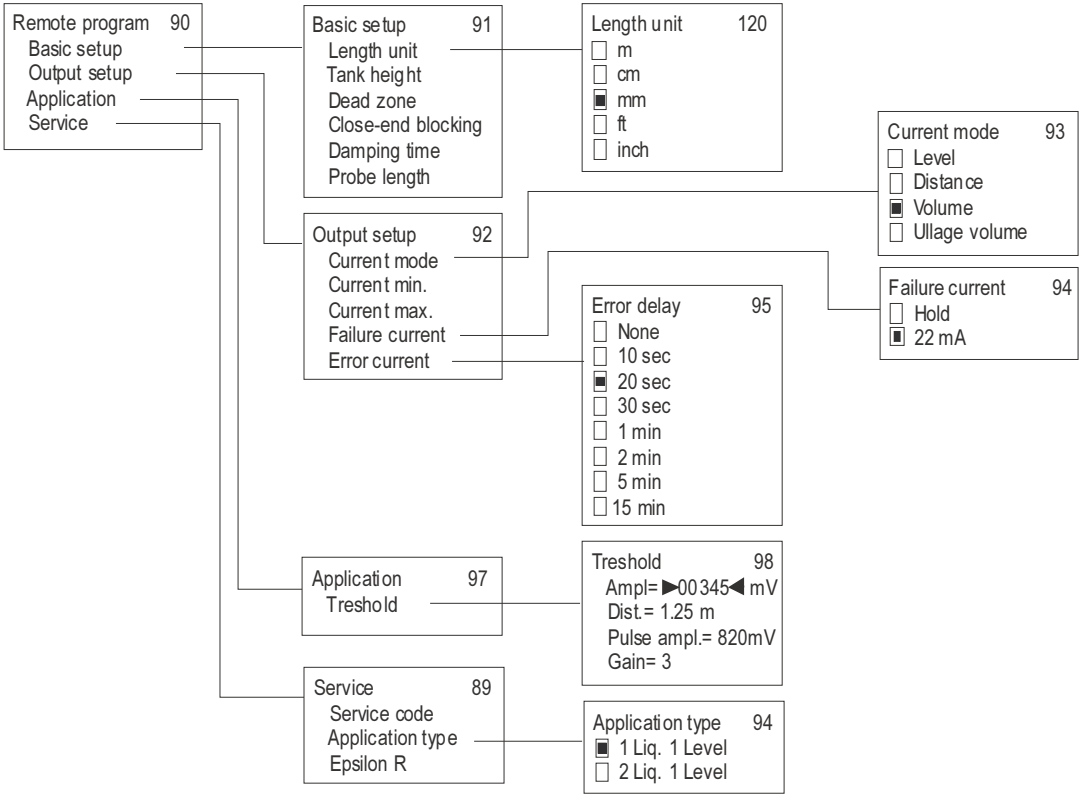
Event	Fault	Action
"Delay out of limits" status marker on*, reading is frozen.	The emitted pulse has not been detected. The gauge will not work until it has been found.	The signal converter may need replacing. Please contact NIVELCO.
"Negative voltage error"*	Occurs when there is a problem with the time base on the HF board.	Please contact NIVELCO.
"VC01 voltage error" *		
"VC02 voltage error" *		
"Reprogramming FPGA" *		

*Gauge connected to PCSTAR2 software or HART Handheld Controller (HHC) with Marker status window (F8) or list displayed

Event	Fault	Action
General operation		
Instrument is not accurate with a product that has a high dielectric constant. A constant offset is observed when taking measurements.	Tank height is not correct.	Check current output and tank height parameters. If the signal converter has been replaced, verify that factory calibration parameters are still the same. Ask NIVELCO for the factory calibration sheet (if not supplied) and the password for access to the factory menu.
The MicroTREK 2-wire indicates an incorrect level value.	The MicroTREK 2-wire measures a non-valid reflection.	Check the tank for obstructions and verify that the probe is clean. In the case the indicated level is close to the nozzle, increase the detection delay and the dead zone with the same ratio or increase the threshold level if the full measurement range is essential. In any case use the PC STAR 2 oscilloscope function to visualise and to analyse the application. The threshold level must be adjusted so that it masks the disturbances. It also gives enough margin for detection of the level pulse. Very large pulses along the measurement signal (same amplitude as the initial pulse) can be caused by a probe which is touching the nozzle or the tank side (see section 1.3.5). Ensure that no contact is possible.
Instrument is not accurate when there are two or more phases in the tank.	The instrument may be incorrectly configured for this type of application i.e. it is measuring the interface instead of the level.	Contact NIVELCO for the corrective procedure or refer to the Service Manual. Check that Factory Menu function 1.1.3: Application Type is set to "2 liquids, 1 level". Check also that there is a layer of more than 100 mm of top product above the bottom product.

Event	Fault	Action
Electrical Connections and Communication Output		
Current Output value < 4 mA.	No power supply	Check the power supply
	Connection of the device is incorrect.	Check the connection between the device and the power supply.
	The calibration of the current output is incorrect.	Execute the calibration if you have authorized access or contact NIVELCO Service centre.
Reads 22 mA.	An error has occurred.	This happens in case the range 4-20 mA / error 22 mA is selected. Check the status of the device by selecting the marker window (F8) or enter the status (4.0) menu of the HART® communicator.
	The device is in its start-up phase	Wait 50 seconds. If the current value drops to a value between 4 and 20 mA, and goes immediately back to 22 mA, contact your NIVELCO Service Centre.
The value at the current output does not correspond to the value at the display (PC STAR 2 or HART® communicator).	The current output settings are incorrect.	Check the current loop and the connections. Configure the output as described in Sect. 3.3.3 (user sub-menu 1.3) of the MicroTREK 2-wire Handbook – also try adjusting the threshold using F11-Dynamic Configuration function (PCSTAR 2) or menu 2.1.5.1.0 (HHC).
Data communication via the digital interface is not working. The MicroTREK 2-wire is in its start up phase, wait 50 seconds and try again.	The communication parameters of the computer are set incorrectly.	Check computer setting (address/device number).
	Bad connection to the interface.	Check connection.
	Current output value is < 4 mA.	If problem persists then contact your NIVELCO Service Centre.
	Current output value is = 22 mA	

5.6 APPENDIX 1 – SET-UP PARAMETERS OF MICROTREK H-400 SERIES IN MULTICONT CONTROLLER



Parameters in the Service Menu are read-only parameters. Changing of these parameters require the service code of the instrument.

htk4014a0600p_02
April, 2016