MicroTREK 2-wire

Guided microwave level transmitter

INSTALLATION
and
PROGRAMMING MANUAL

Manufacturer:
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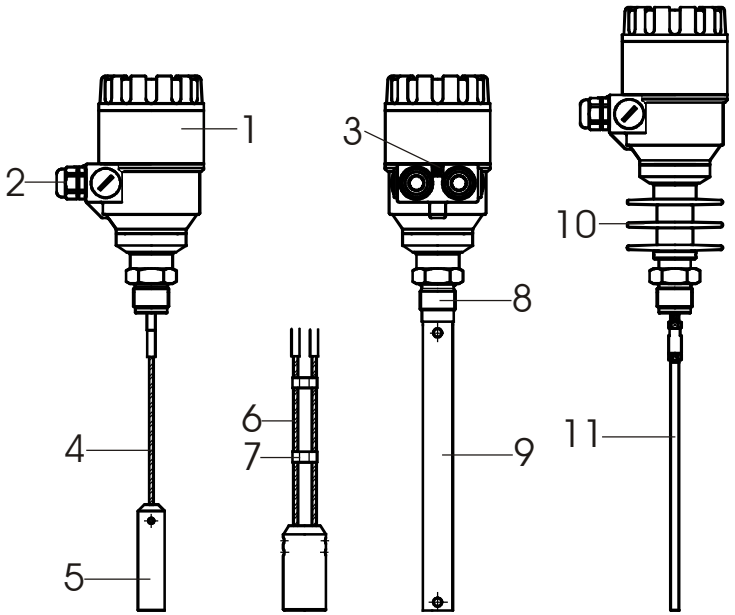
DEVICE DESCRIPTION AND RANGE OF APPLICATIONS

The MicroTREK 2-wire level gauge uses the Time Domain Reflectometry (TDR) measuring principle and two-wire technology for level measurement.
It is designed solely for measuring the distance, level, volume and ullage of liquids, pastes, slurries and powder products.
It can continue to measure the level or distance and total volume in applications with two products.
The level measurement data can be displayed and the gauge configured using either a HART Handheld Communicator console (HHC) or a PC work station equipped with PCSTAR2 software supplied as standard with the gauge.

PRINCIPAL GAUGE COMPONENTS

The device is applicable in tank, silo, rigid pipe, reaction vessel and level reference vessel.
MicroTREK 2-wire guided microwave level transmitter gauge housing and probes (Standard and Intrinsically safe versions).



1 Housing
2 Cable gland
3 Grounding connection
4 Single cable probe
5 Counter weight
6 Twin cable probe
7 Spacer
8 Process connection
9 Coaxial probe
10 Hih temperature option
11 Single rod probe

NAMEPLATE

Nameplate form filling in:

1	TYPE CODE	AS DATA SHEET
2	Serial number	Serial number
3	Date of manufacture	
4	Ambient temperature range	- 30 °C … + 60 °C
5	Mark of explosion protection	AS CHART 2.
6	EC-type examination certificate number	
7	Ci<10nF Li<10uH Ui<30V Ii<150mA Pi<1W	
8	Housing protection class	IP65

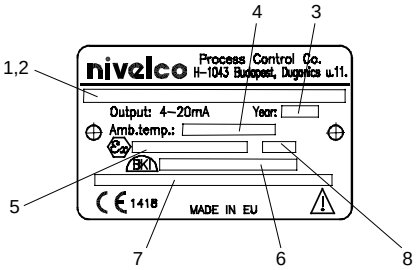


CHART 1.

MARK OF EXPLOSION PROTECTION:

H__-__F-6	II 1 G EEx ia IIB T6 … T3
H__-__G-6	
H__-__X-6	
H__-__Y-6	
H__-__A-6	II 1 G EEx ia IIC T6 … T3
…	
H__-__U-6	
H__-___-8	II 1 / 2 D T100 °C

CHART 2.

Standard nameplate
*eg. HTK-201-4.
The "type code" gives the options chosen for this unit and is defined in the MicroTREK guided microwave level transmitter Data Sheet.

DOCUMENTATION SUPPLIED

Installation & programming manual:
Installation, connection, start-up and safety advice.
Detailed user manual and reference book, including how to configure meter parameters available in the user menu and how to perform basic maintenance.

PRODUCT LIABILITY AND WARRANTY

The MicroTREK 2-wire TDR level gauge is designed for measuring the distance, level, and volume of liquids, pastes, slurries and powders.
It may equally measure level, distance, total volume and ullage in applications where two or more products are present.

Responsibility as to suitability and intended use of these level gauges rests solely with the user.
Improper installation and operation of our level gauges may lead to loss of warranty.
In addition, the "General conditions of sale", forming the basis of the purchasing contract, are applicable.

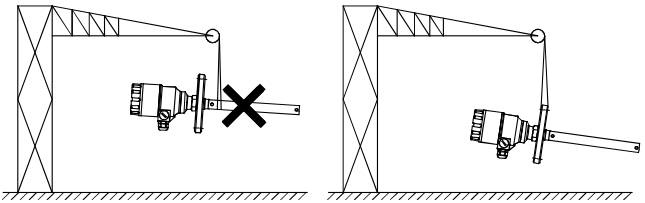
If you need to return measuring instruments to NIVELCO, please note the information given in Appendix B. NIVELCO regrets that they cannot repair or check your device unless it is accompanied by the completed form.

The level gauge does not form part of an overfill protection system (as defined for example in WHG: German water resources act).

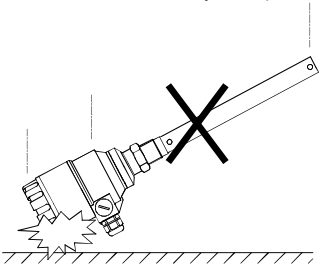
1. MECHANICAL INSTALLATION

1.1 HANDLING AND STORAGE

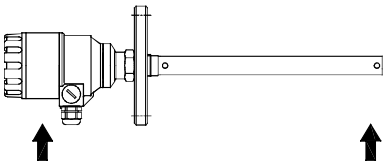
To carry: the device will weigh between approximately 3 kg or 7 lb and 12 kg or 25 lb.
Carry using both hands to lift the device carefully by the converter housing. If necessary, use lifting gear.
No attempt should be made to lift the instrument by its probe.
Caution: The probe is a critical gauge component.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



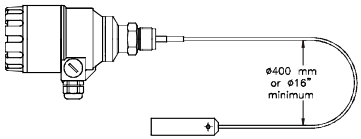
Avoiding blows - When handling the MicroTREK 2-wire, avoid hard blows, jolts, impacts, etc.
Caution: fragile electronics



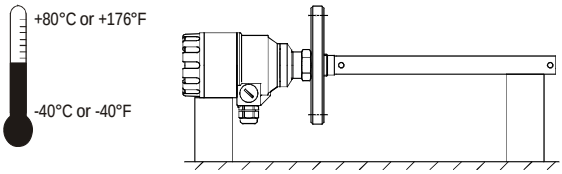
Avoid bending (single rod and coaxial probes) - Support the probe to avoid bending.



Support probe here - 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 - Store within the given storage temperature limits.



1.2 INSTALLATION RESTRICTIONS

Hazardous-duty systems (Ex) - Refer to the MicroTREK 2-wire Installation and Programming manual for further information on installing gauges approved for use in hazardous locations.
Check that the flange, gasket and probe materials are compatible with the product.
Read the information given on the converter nameplate, the flange markings and specifications in the approval certificates.

1.3 MOUNTING ON THE TANK

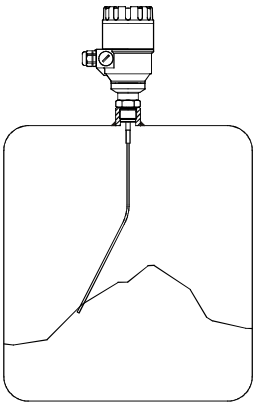
1.3.1 INSTALLATION INSTRUCTIONS: GENERAL NOTES

The fitter should give some thought to 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.

1.3.2 INSTALLATION INSTRUCTIONS: NOZZLE

Threaded process connections

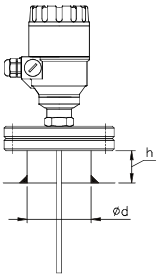
The simplest and most economic way is to mount the MicroTREK 2-wire directly on the tank with the 1"G or 1"NPT threaded connection.



Nozzle height

Recommendation

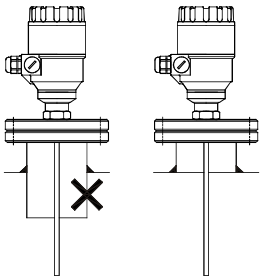
Do not fit a nozzle longer than its diameter, especially for single probes and powder applications



h ≤ Ød , where h = nozzle height and
d = nozzle diameter

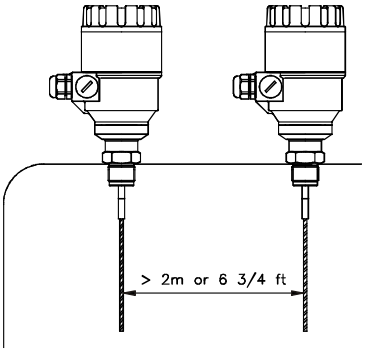
Contact NIVELCO if this relationship cannot be respected.

Nozzles extending into tank - Caution: Do not use nozzles that extend into the tank. This will disturb the emitted pulse.



Installation of two devices

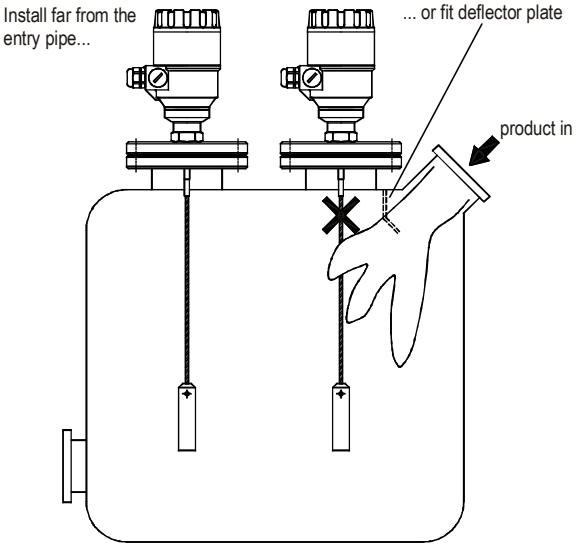
If two devices are to be used on the same tank, these should be mounted at a distance of at least 2 m or 6.5 ft away from each other. If not, interferences from the electromagnetic (EM) fields generated by both instruments may cause measurement errors. Not applicable to coaxial probes - the outer shell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



Process connection

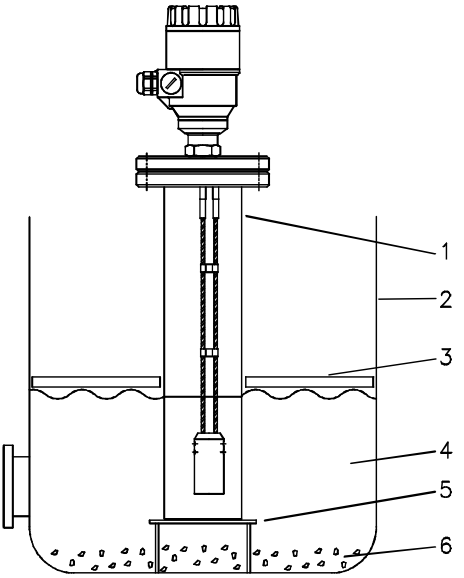
For the gauge to make accurate measurements: the tank process connection must be level.
ensure a good fit with the gauge process connection the tank roof should not deform under the weight of the gauge
Process connection and entry pipe

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)

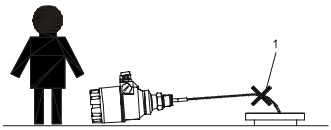
6 Sediment

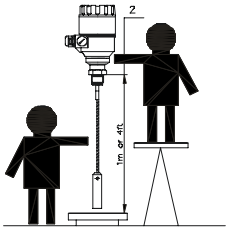
1.3.3 INSTALLATION INSTRUCTIONS: GAUGE - ALL APPLICATIONS

MicroTREK 2-wire gauges are designed to be mounted on a suitable process connection on a tank or sump.
Install the gauge using two people to avoid damaging the probe. Support the housing and the probe.

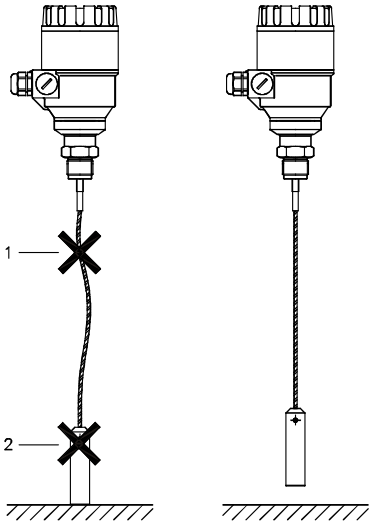
Installation of single and twin cable probe level meters

1 Caution :
Do not over-bend probe!
2 Inserting the probe:
hold more than one metre
above the opening
to avoid cable bending.





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).

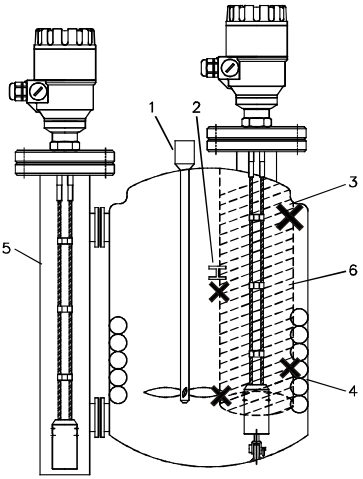
Objects (discontinuities) inside the tank that influence the probe's EM (electromagnetic) field

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...

TDR gauges generate electromagnetic (EM) fields when a measurement pulse is emitted.
This field is affected by any nearby discontinuities and these will weaken and potentially block the emitted pulse.
A minimum distance is recommended depending on the probe type to be installed.
See the table on the next page for recommended free space dimensions.
Alternatively, the fitter may use a reference chamber or stilling well.
However, the chamber walls must be smooth (i.e. no visible weld lines), straight and vertical to maintain the pulse strength and gauge accuracy.

For clean applications only :

Coaxial probes may be used close to or touching objects or walls as the EM field generated by the probe is contained within the probe's outer sheath (refer also to the EM field sizes/free area given in the figures on the next page).



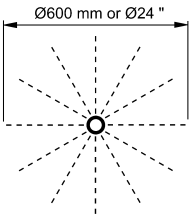
1 Agitator
2 Support beam perpendicular to the pulse direction
3 Abrupt changes in tank cross section
4 Heating tubes
5 Alternative solution: reference chamber - electromagnetic field is contained within chamber
6 Gauge electromagnetic field :
Any intruding metallic object will be detected in this zone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

✕ = DO NOT FIT THE GAUGE NEAR TO THESE OBJECTS.

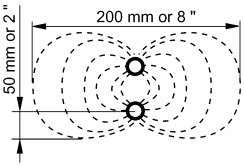
Probe Type	Recommended minimum distance of probe from objects inside the tank
Single cable ∅ 4 mm, Single cable ∅ 8 mm, Single rod	300 mm or 12"
Twin cable	100 mm or 4"
Coaxial	0 mm or 0"

Electromagnetic field shape around probe, by type (not to scale)

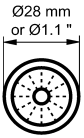
Single cables, single rod



Twin cable



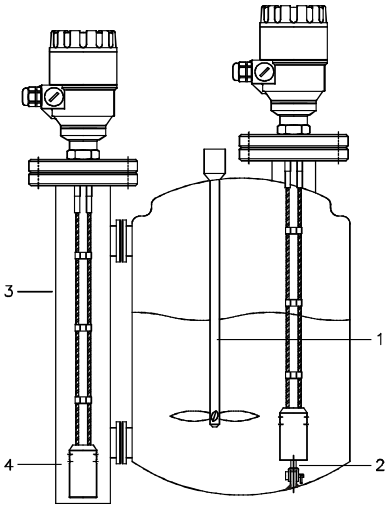
Coaxial



No beam angle for any probe type.
Avoid direct solar radiation.
Fit a sunshade on the gauge for open-air installations: this is either supplied on demand by NIVELCO or provided by the customer. The ambient temperature limits of the gauge are given below.

1.3.4 SPECIFIC INSTALLATION INSTRUCTIONS: GAUGE - LIQUID APPLICATIONS

PROBE BENDING IN AGITATED PRODUCTS: RECOMMENDED SOLUTIONS



1 Agitator

2 Turnbuckle for anchoring probe to tank bottom

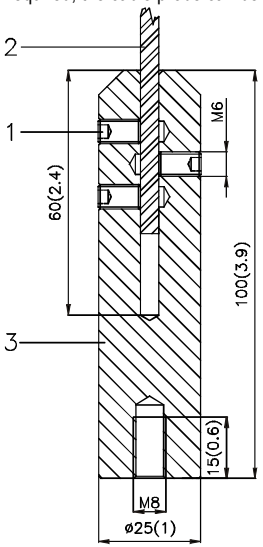
3 Bypass chamber

4 Probe and counterweight (centred on request)

Mounting on a reference vessel or still well is ideal.
To ensure that the probe does not come into contact with the tank wall,
the probe should be fixed to the bottom of the chamber or centred.
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.

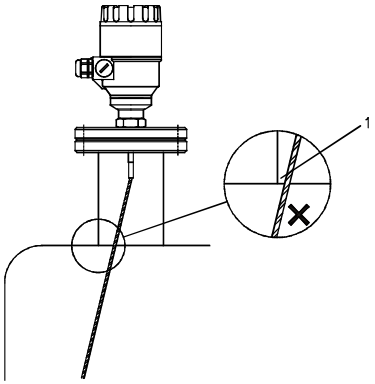


Procedure

Step	Action
1	Detach socket set screw M6x10 (ISO 4026) with 5 mm Allen (hexagon) key (ISO 2936).
2	Pull cable (2) out of counterweight (3) 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). Dimensions in mm (inches).

1.3.5 SPECIFIC INSTALLATION INSTRUCTIONS: GAUGE - SOLID APPLICATIONS

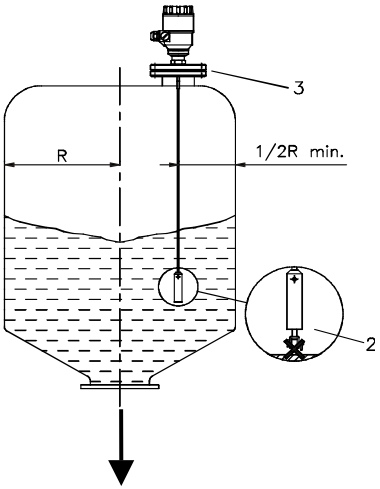
False readings:



1 Do not let probe touch the side of the nozzle

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

Caution



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 forces during emptying cycles for powder applications

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.

Cable maximum design load, traction
Probe: Single cable Ø8 mm or Ø0.3", Maximum Load: 3.5 T or 7700 lb

Traction on cable according to product (approximate value in metric tons)

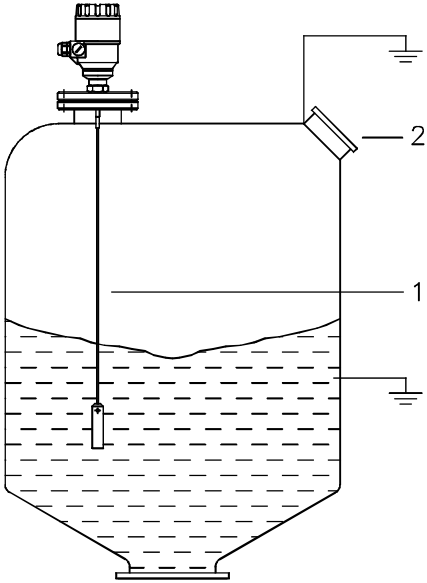
		Probe Length / m (ft)		
Probe used	Material	10 (33)	20 (65.5)	30 (98.5)
Single cable Ø8 mm or Ø0.3"	Cement	1.0 T or 2200 lb	2.0 T or 4410 lb	3.0 T or 6620 lb
	Fly ash	0.5 T or 1100 lb	1.0 T or 2200 lb	1.5 T or 3300 lb

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.



1 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.

Product deposits on the nozzle and probe

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

Tank roof deformation

Tank roofs should support loads of at least 3.5 T or 7700 lb
for gauge installations using Ø8 mm or 0.3" single cable probes.

2 ELECTRICAL CONNECTIONS

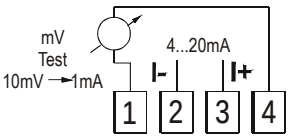
2.1 ELECTRICAL INSTALLATION INSTRUCTIONS

2.1.1 WIRING CONNECTIONS:

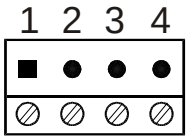
Hazardous-duty systems

Only intrinsically safe certified equipment may be connected to the MicroTREK 2-wire guided microwave level transmitter in hazardous areas.

Terminals:	4 poles. Wire cross-section: max. 1.5 mm² (AWG 16)
Cable entry:	M20 x1,5 cable gland for cable diameter: 8 … 12 mm (0.31 … 0.45"), IP 65
Shielding:	Do not connect it to any terminals of MicroTREK
Signal cable:	Using a shielded cable is recommended



Connect a Voltmeter to terminals 1 and 4 to measure the loop current without disconnecting the loop.
(The voltage value in mV divided by 10 gives the current in mA.)



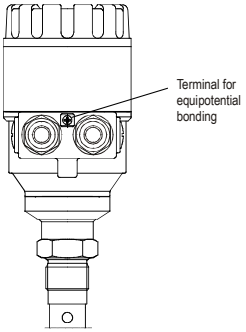
1 Detach the cover of the unit.
2 Guide the cable into the housing through the cable gland.
3 Remove a 4 mm length of isolation from the wires and cut away the free part of the shielding.
4 Connect the wires of the current loop to terminals 2 and 3 (any polarity).
5 Pull back the cable till a 10 mm cable 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.

Hazardous-duty systems
Using MicroTREK in hazardous area,
only intrinsically safe approved equipments may be connected to the terminals 2 and 3.

IMPORTANT: The housing of the MicroTREK must be grounded. Grounging resistance R < 1 Ohm.
The shielding of the signal cable must be grounded at the control room side!
Avoid coupling of electromagnetic noises place the singnal cable away from power-current cables.
The inductive coupling of the AC upper harmonics (that can occur during phase shift driving) is especially critical, because even cable shielding will not give appropriate protection against them.

2.1.2 'EX' EQUALIZING CONDUCTOR

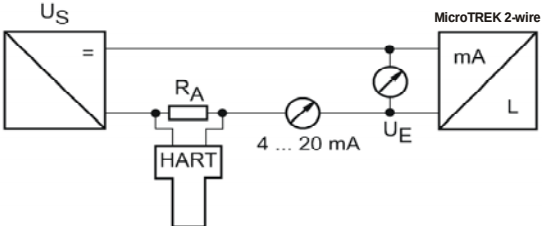
Refer to the MicroTREK 2-wire Supplementary Installation and Operating Instructions for further information.



Terminal for equipotential bonding
U-clamp terminal, maximum conductor cross-section:
4 mm² on 'neck' of signal converter

2.2 POWER SUPPLY

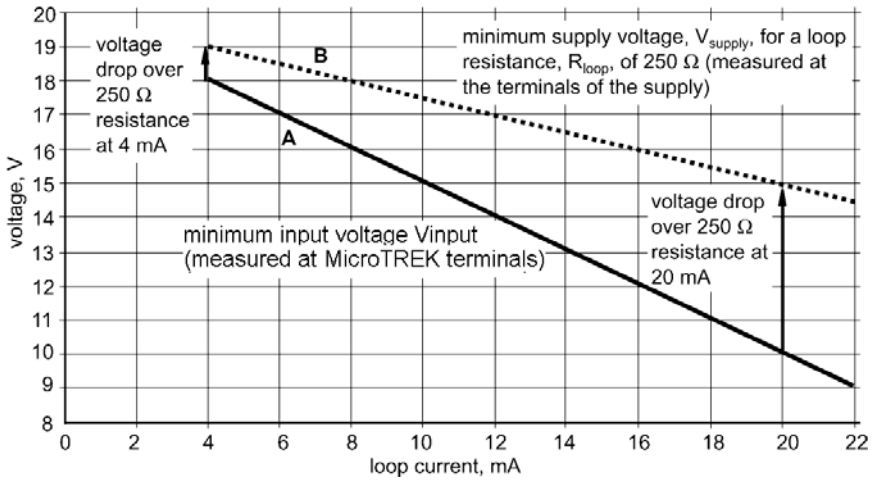
2.2.1 NON-HAZARDOUS-DUTY VERSION



Power supply	
Rated voltage	24 V DC
Maximum voltage (U_{input}):	35 V DC 'Ex' = 28 V DC
Minimum voltage (U_{input}):	dependent on load impedance, see graph below

A supply voltage above 35 V DC can cause irreparable damage to the signal converter.
Also, power supply voltages above the specified maximum values and below the specified minimum values can lead to faulty measurements or to a device reset.

Load impedance R_A		
Loop resistance, R_{loop}	$R_{HART} + R_{cable} + R_{ammeter}$	
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)

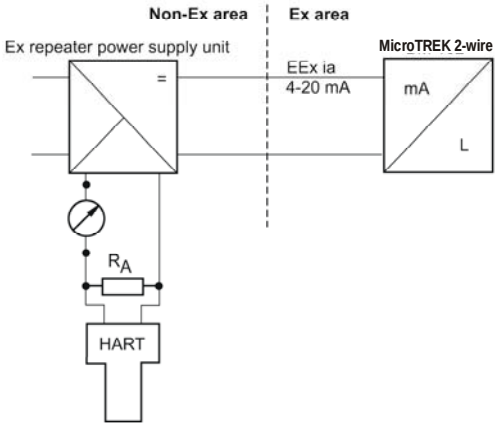
Example for calculating the power supply:
The voltage drop is tested at 22 mA.
$U_{\text{power minimum 22}}$ = 22 mA x load impedance + $U_{\text{input minimum 22}}$
$U_{\text{power minimum 22}}$ = 22 mA x 250 Ohm + 10 V = 5.5 V + 10 V = 15.5 V

In order to cover the whole current range, the voltage drop must also be tested at 4 mA.
By analogy, the following applies:
$U_{\text{power minimum 4}}$ = 4 mA x load impedance + $U_{\text{input minimum 4}}$
$U_{\text{power minimum 4}}$ = 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.

2.2.2 HAZARDOUS-DUTY VERSION

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.
To ensure proper operation, the above specified minimum parameter values for the power supply must be observed to ensure that the connected Ex repeater is adequate for use with the MicroTREK 2-wire guided microwave level transmitter in whole 4-20 mA loop current range.



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.

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

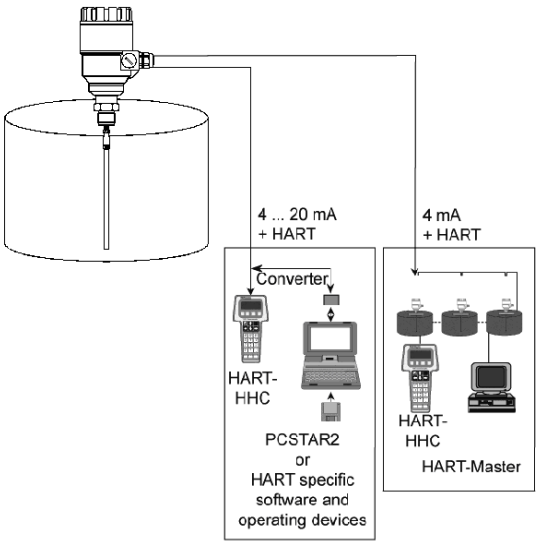
2.3 ELECTRICAL OUTPUT

2.3.1 NETWORK OPTIONS

The output is available in 2 versions:

Current output HART®,	passive, HART® protocol
Current output Ex-ia HART®	intrinsically safe; passive, HART® protocol

All versions with HART® protocol can be operated with the PC-STAR 2 program.



2.3.2 HART® COMMUNICATION 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.

Additional information - The following can be called up via the following interfaces:
Current output: 22 mA for error signal.
Digital HART® interfaces: scanning of error flags and error messages.

3 USER INTERFACE

3.1 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 23 seconds should be allowed for once 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.

3.2 AVAILABLE USER INTERFACES

Measurements may be taken using either:

PC STAR 2 software	included as standard with the instrument. The basic installation & operating instructions are presented in section 3.3.1 (requires PC workstation).
HART® Handheld Communicator (HHC)	sold separately. Automatic recognition of the instrument when connected. A list of HHC-accessible parameters is given in section 3.3.4.
DA 06 local indicator	Sold as an option. For displaying readings only. Refer to section 3.3.5 for technical data.

3.3 OPERATOR CONTROL

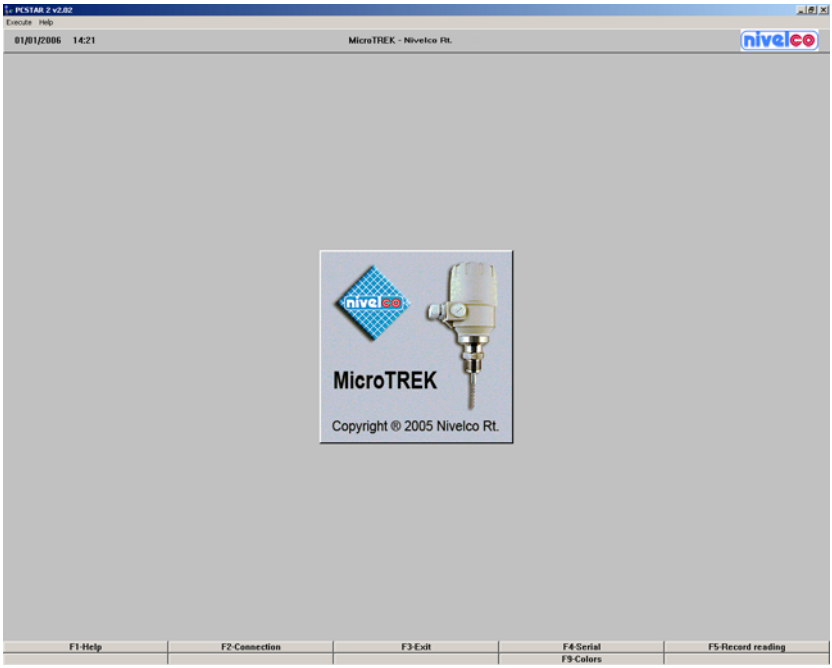
You can configure the device by way of the HHC or the PC-STAR 2 software.
Operator control via the separate HHC is described in the operating instructions supplied with the HHC.

3.3.1 PCSTAR 2 FOR WINDOWS : BASIC INSTALLATION AND OPERATING INSTRUCTIONS

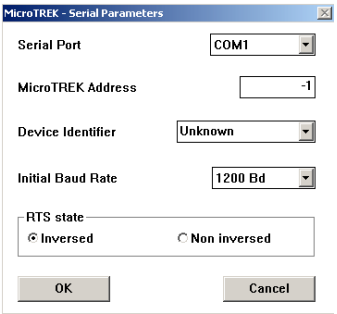
Software description
PC STAR 2 is a Windows program that permits clear and concise display of data and configuration of the MicroTREK 2-wire from a remote location.

PC-STAR 2 system requirements
PC with at least 486 processor 75 MHz, recommended: Pentium 120 MHz or higher
Microsoft Windows 9x, Me, 2000, NT and XP*
minimum 16 MB main memory (RAM)
minimum 3 MB available hard disk storage
Mouse or other pointer device
Serial COM - RS 232 port
* XP may not be automatically recognized by PCSTAR 2 in versions prior to V2.01.
Refer to Section 8.4.2 for the corrective procedure.
Installing and connecting PCSTAR 2 to the gauge
Connect the HART® adapter (not included in supply) through a load impedance of 350 Ohms maximum (for hazardous-duty purposes, fix to the non-intrinsically safe side of the repeater power supply unit) and plug it into a serial interface on your PC. The repeater power supply unit must have HART® capability.
Installing the program: execute the file "setup.exe" and follow the instructions on the screen.

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

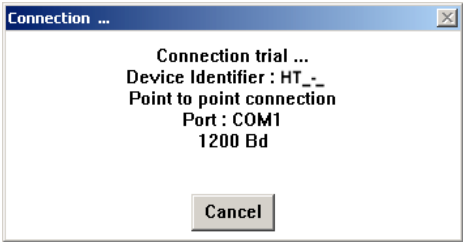


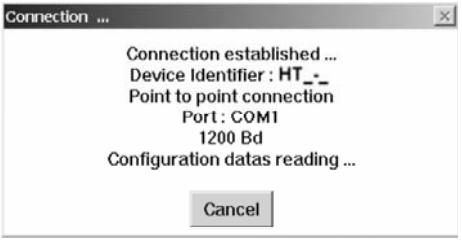
Define device interface: type F4 or left-click on “F4-Serial” at the bottom of the screen - to define the interface to which the device is to be connected.



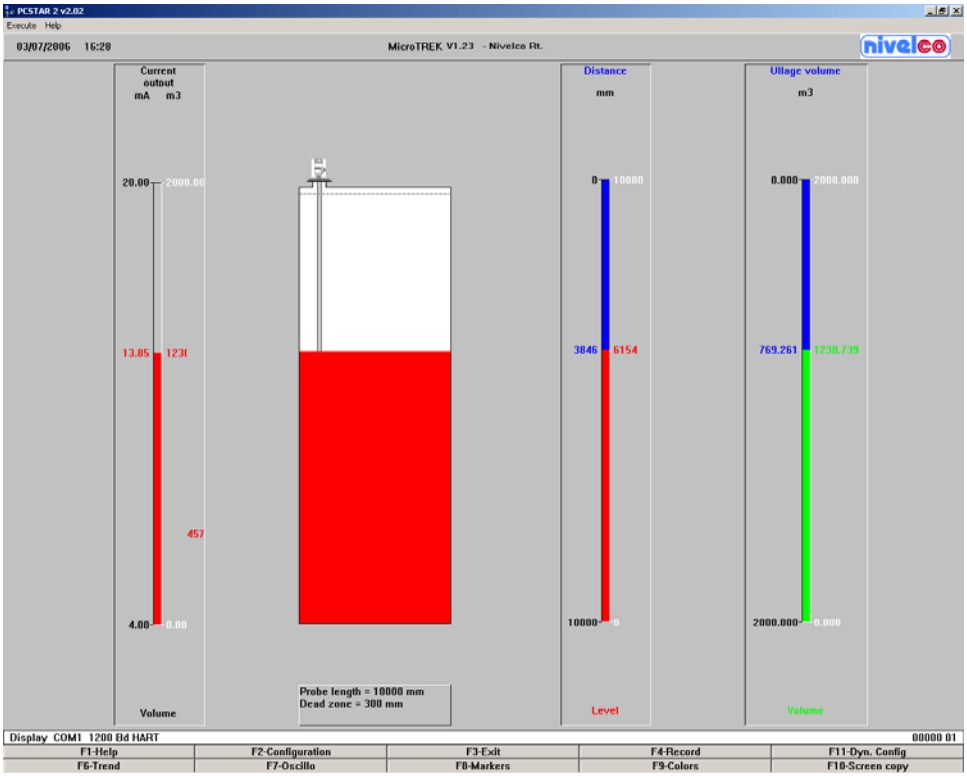
Serial Port
The serial port allows the user to select a free serial port (COM 1 to 4) on the computer.
MicroTrek Address
Type the “Address” that you have given a gauge (a value between 0 and 15) and press ENTER or OK.
This will select the required device. If you are in a point to point network leave 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: have all reflections occurring at the probe displayed,
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
and F10 – make printouts (screen shots).



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

The table below provides an overview of all parameters that can be set in the configuration menu using F2 in PCSTAR2. Reset default values are in bold type in the "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	Enter a value Fct.1.5.1 (Detection delay) … probe length. Twin probe with probe length<1m or 3.3 ft 200 mm or 8 in Single probe or twin probe with probe length >1m or 3.3 ft 400 mm or 16 in Coaxial probe 0 mm or 0 in	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 seconds 5 seconds	This function filters possible signal fluctuations when the tank is turbulent.

Function	Input Range	Description
1.1.6 Probe length	Enter 100 mm or 3.9" … probe length (maximum : 24000 mm or 78¾ ft.) As per order	This value must be equal to the exact length of the probe. 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 or 78¾ ft. for special installations.

Function	Input Range	Description
1.2.0 Display		To display readings in the form and units required
1.2.4 Length unit	Select m, cm, mm, inch, ft or 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 l1 min., Fct. 1.3.4 Scale l1max., 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 l1 min. Fct. 1.3.4 Scale l1 max. Fct. 1.7.2 Input table
1.2.6 New unit (length)		Appears only when "Optional unit" is selected in Fct. 1.2.4: Length unit.
1.2.6.1 Unit name	4 ASCII characters Unit	Name of the new unit (max. 4 characters)
1.2.6.2 Unit fact.	Min.: > 0.0 Max.: 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.
* This table is not exhaustive and see also the Dynamic configuration menu functions in PCSTAR 2.		

Function	Input Range	Description
1.3.0 Current output		This configures the current output. These functions are independent from what is displayed.
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 in the event of a fault: 4-20 mA (last measured value held in the event of a fault) 4-20 mA / E = 22 mA (is set to 22 mA in the 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 on the 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
1.4.0 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 Device number** (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.
1.4.7 German command number	Read only	Factory-programmed number, to be quoted in case of warranty and service claims.
1.4.8. Option** (Descriptor)		This function can be used for entering text of max. 15 ASCII characters (customer information only)
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.

Function	Input Range	Description
1.5.0 Application		For difficult applications
1.5.1 Detection delay	Enter a value 0 mm / 0 in. to Fct. 1.1.2 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 (serial input/output)		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.

3.3.3 QUICK CONFIGURATION: CONFIGURATION EXAMPLES

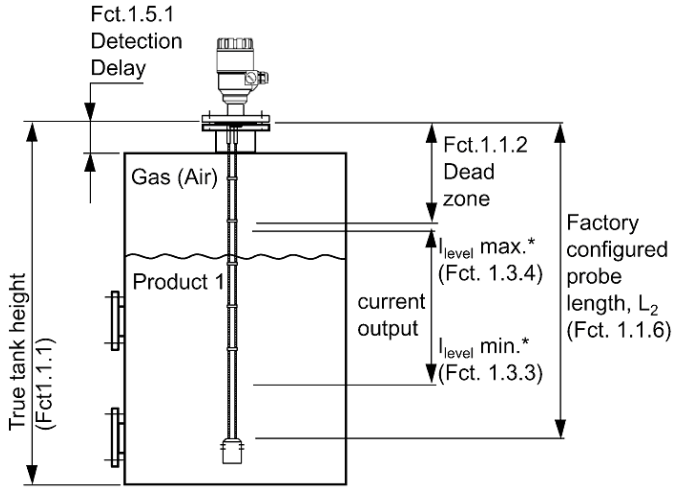
The minimum functions (fct.) to be configured for a simple measurement are listed below:

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 or 33 ft.
Dead zone: (PCSTAR 2: Fct. 1.1.2, HART®: Fct. 2.1.1.4)	150 mm or ½ ft. (see "probe measurement limits" in section 5.2.3 for the Ø4 mm or 0.15" twin cable probe)
Probe length, L_2: (PCSTAR 2: Fct. 1.1.6 HART®: Fct. 2.1.1.2)	9000 mm or 29.5 ft. (do not modify unless advised to)

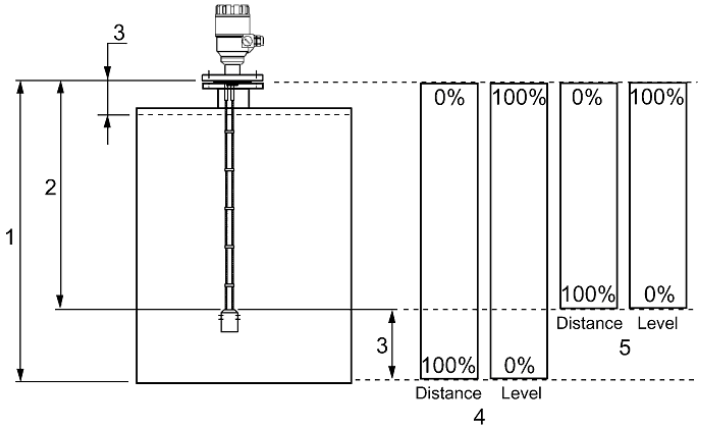
Tank height: configuration of user menu PCSTAR 2 function 1.1.1 (HART® fct. 2.1.1.1)

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.

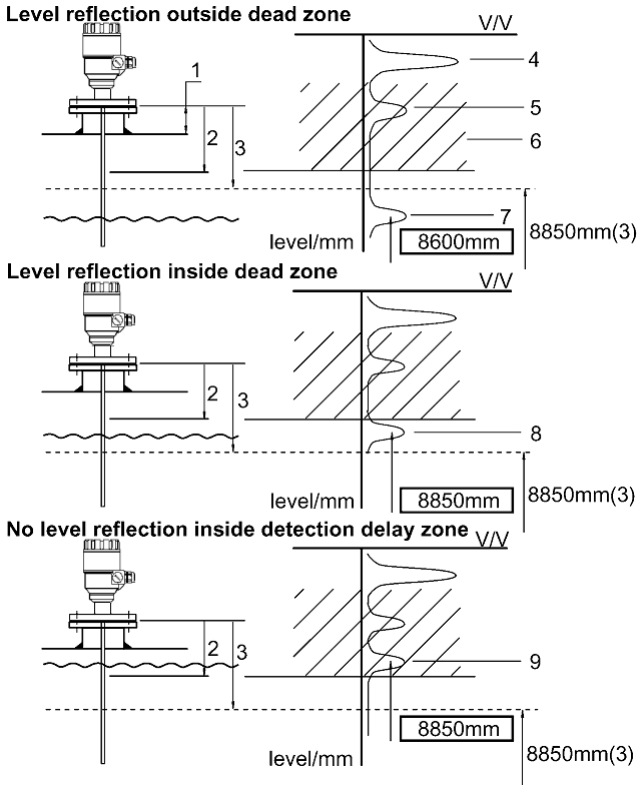
Step	Action	Data entered / value set
1	Press F2 to connect to the device	Tank status screen displayed (level reads 6750 mm)
2	Press F2 to enter configuration menu	Configuration menu displayed
3	Click on the data set field for Fct. 1.1.1 Tank height	This field currently reads 10000 (mm)
4	Type in the 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 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
Refer to procedure 3.
How to configure the gauge to give volume readings
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.

Procedure 3: creating a strap table the probe 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)	6000 mm or 19.69 ft*
4	Go to user function 1.1.2: Dead zone to enter blocking distance value.	400 mm or 1.31 ft*
5	Go to user function 1.1.6: Probe length to enter value	5800 mm or 19.03 ft*
6	Go to user function 1.2.4: Length Unit to select length units.	Mm 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 mm or 0 ft	0.0 m^3 or 0 ft^3
2	200 mm or 0.66ft	0.5 m^3 or 17.66 ft^3
3	750 mm or 2.46ft	1.0 m^3 or 35.31 ft^3
4	1000 mm or 3.28ft	1.5 m^3 or 52.97 ft^3
5	5600 mm or 18.37ft	16.8 m^3 or 593.3 ft^3

*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 m^3 or 593.3 ft^3

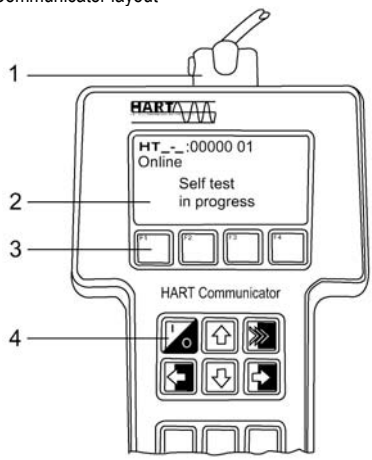
Note:
The level can effectively be measured between 200 mm or 8" and 5600 mm or 18½ ft.
When the product level drops below the tip of the probe, the MicroTREK 2-wire will indicate that there is still remains of 200 mm or 8". Accordingly, the MicroTREK 2-wire can only indicate a level between 200 mm or 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 or 17.66 ft³
4	Go to user function 1.3.3 "Scale I1 max" to enter volume value for the maximum output (20 mA)	16.80 m³ or 52.97 ft³
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

3.3.4 HART® COMMUNICATOR: INSTALLATION & OPERATING INSTRUCTIONS

Display and configuration can also be carried out with a HART® communicator.
Operator control via the separate HHC is described in detail in the operating instructions supplied with the HHC.
Basic instructions for taking measurements
Communicator layout



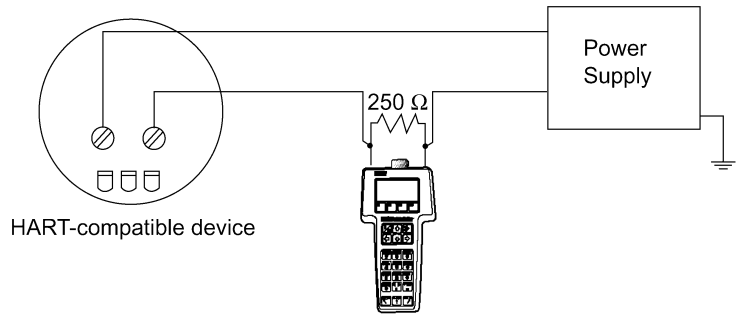
1 Two-pin jack for loop connectors

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

```
HART Communicator
  1      Offline
  2 →    Online
  3      Frequency Device
  4      Utility

F1 | F2 | F3 | F4
```

Main menu

2

```
HT_-_:00000 01
Online                    ↵
  1 →    <Process Var.>
  2      <Config./Test>
  3      <Access/Rights>
  4      <Watch status>
  5      <HART Variables>
         SAVE
F1 | F2 | F3 | F4
```

Online menu

3

```
HT_-_:00000 01
<Process Var.>            ↵
  1 →    <Measurements>
  2      <Input/Outputs>

         SAVE    HOME
F1 | F2 | F3 | F4
```

Measurement & input & output functions menu

4

```
HT_-_:00000 01            ♥
<Measurements>            ↵
  1 →    Lvl   878.00 mm
  2      Dist  121.00 mm

HELP     SAVE    HOME
F1 | F2 | F3 | F4
```

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 seconds	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	Twin probe with	
	Probe length <1000 mm or 3.3 ft	
	200 mm or 8 in	
	Single probe or twin probe with probe length >1000 mm or 3.3 ft	
	400 mm or 16 in	
	Coaxial probe	
	0 mm or 0 in	
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 or 0.04”	Read only Menu. Sensor minimum span.
2.1.2.0 DISPLAY		
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).

Function (Fct.)	Input Range	Description
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 m3, l, US Gal, Ft3, bbl, M3/h, Ft3/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).
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	Read only menu. Probe type attached to the flange.
		As per order	
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 m3	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.	Specialist access to the Service Parameters.

4.0	WATCH STATUS		This function displays the status of the device.

5.0	HART® VARIABLES		
5.1	MANUFACTURER		Read only menu.
5.2	MODEL		Read only menu.
5.3	FLD DEV REV	1.0	Field device revision. Read only menu.
5.4	SOFTWARE REV	1.0	Software revision. Read only menu.
5.5	HARDWARE REV	1.0	Hardware revision. 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.

3.3.5 CHARACTERS AVAILABLE FOR ALPHA-NUMERICAL DATA FUNCTIONS IN PC STAR 2 AND ON THE HART® CONSOLE

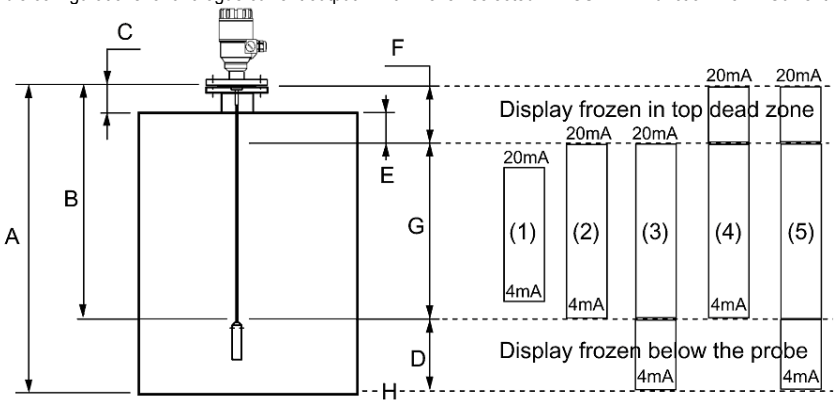
This concerns the following functions:

PCSTAR 2		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	?

3.4 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

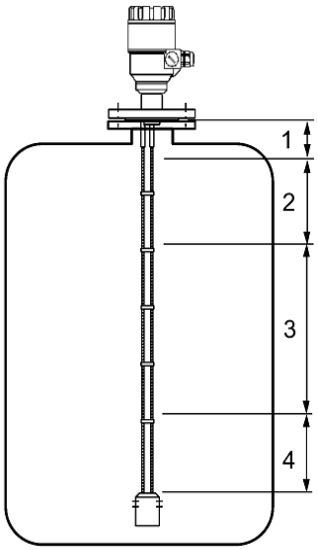
The configurations described below are illustrated in the above diagram:

(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.

3.4.1 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 (& 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.

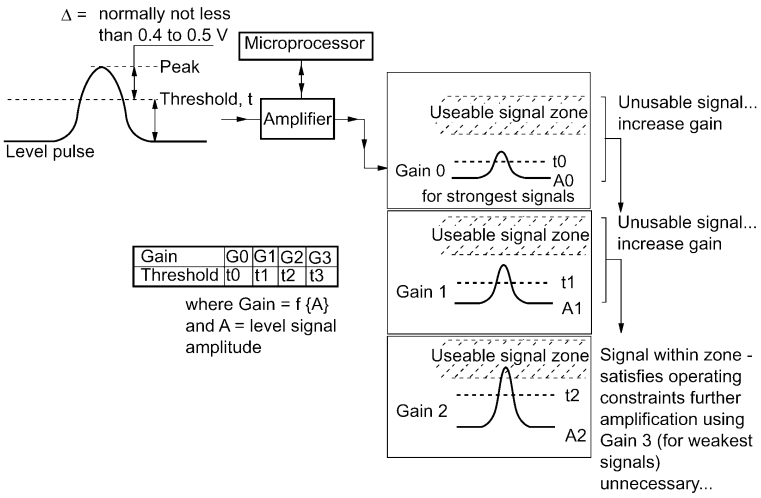
3.4.2 GAIN AND VOLTAGE AMPLITUDE

As explained in the measuring principle in section 6, 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.

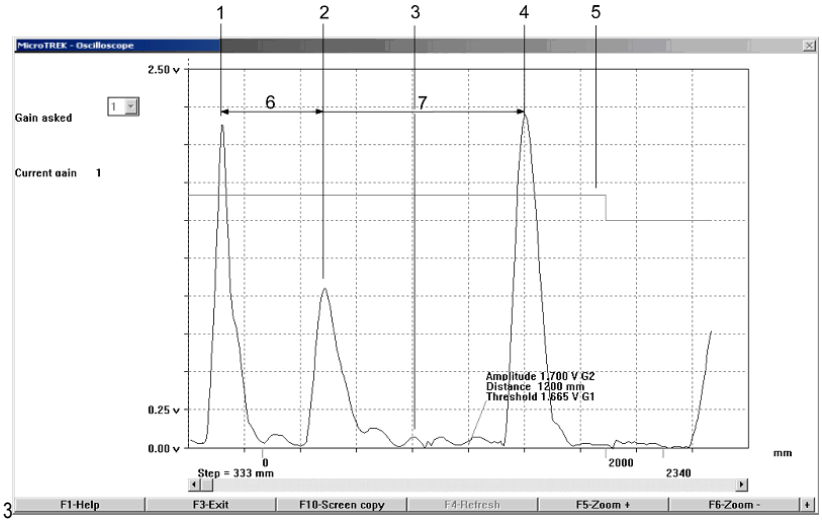
Gain is a function of voltage amplitude.
This defines the default threshold value when the gauge is searching for the product level.
A strong return signal will be given a low gain (i.e. Gain 0 or a small amplification).
However, if the signal is very weak, then a Gain of 3 (i.e. high signal amplification) 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.
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 (see below for definition)
7 Distance measured as a function of time

Offset is the distance for the signal to travel from the converter to the flange
(the gauge's reference point).

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

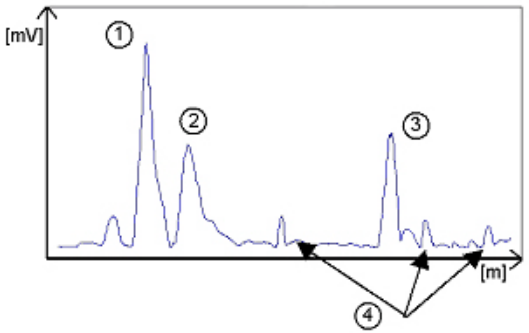
Amplification factor
The amplitude of the signals is proportional to the dielectric constant ε_r of the product.
At low amplitudes the signal should be amplified.
The amplification factor is dependent on the dielectric constant ε_r and on the probe type.
The device sets the gain automatically.

The following factors apply to the set gain:

Gain	Amplification factor
0	1.05
1	2.10
2	4.37
3	8.93

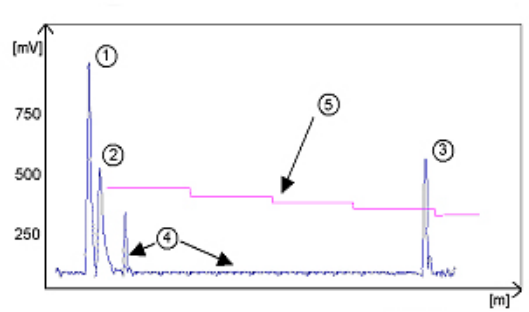
Level threshold
The level threshold suppresses interference signals so that only the reflections from the product surface (level signal) are shown. The factory setting of the level threshold is suitable for standard applications.
The threshold will need to be adjusted in the case of very low dielectric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

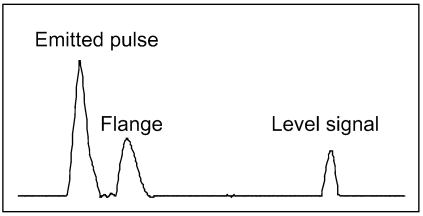
If the level threshold is set too low, i.e. it is below the amplitude of some of the interference signals,
the device will identify and indicate one of these interference signals as a level reflection only if the tank is empty.

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

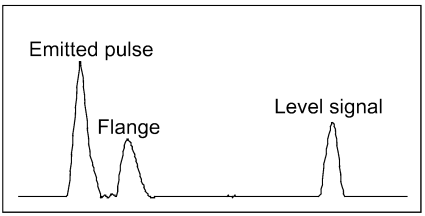
To set, the level (amplitude of the reflection) must be known. A level of 500 mm or 20" is ideal.
The level threshold should be half-way between the invalid interference signals and the level reflection signal.
The reflection from the probe tip, which is clearly identifiable at a low ε_r value,
does 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.

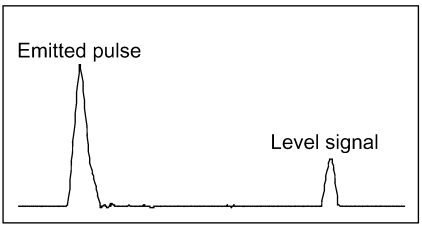
Typical signal trends
The following diagrams show characteristic signals that have been recorded with the oscilloscope function.



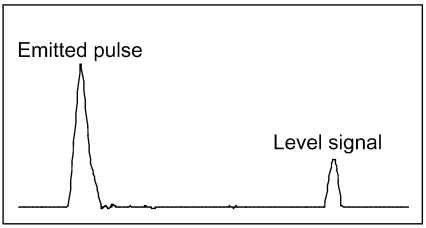
Rod or cable probe with gain 1



Rod or cable probe with gain 2



Coaxial probe with gain 1



Coaxial probe with gain 2

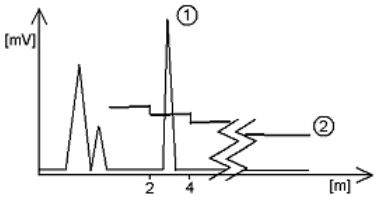
The signal from coaxial probes does not include the flange reflection,
due to the mechanical setup which does not produce any change in impedance at the flange.

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

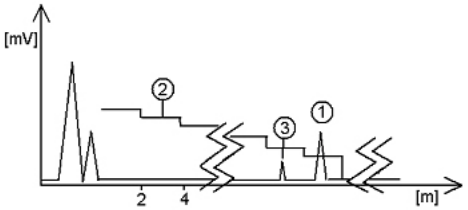
Automatic adjustment:

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 ft.
(2) is the level threshold. This is shown below:



The level has dropped, increasing the distance between level and flange.
The reflection signals for level (1) and interference signals (3) have become weaker (smaller amplitude).
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. Refer to the graph below:



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.

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

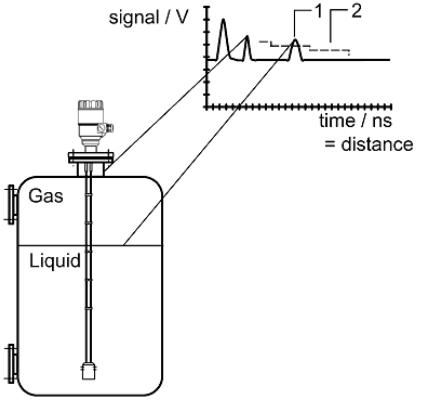
Level can be measured with more than one phase in the tank.
This requires setting a parameter in the factory menu (Fct. 1.1.3: Application Type) to the following measurement mode:

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.

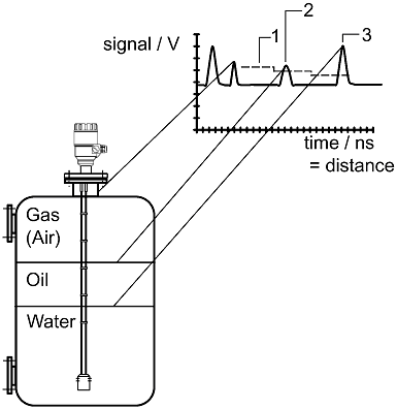
Example application 1:
level measurement of oil (1 liquid in the tank)



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 Level signal
2 Threshold - finds first signal
3 Oil-water interface signal

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

4 SERVICE / MAINTENANCE

Maintenance is normally not required in standard applications.
However, heavy deposits on the probe can cause measurement deviations or faulty operation.
The measuring system is comprised of: a signal converter,
a probe,
seals and
a process connection.

4.1 REPLACEMENT OF THE SIGNAL CONVERTER

MicroTREK 2-wire servicing by the customer is limited by warranty to the removal and replacement of the housing containing the potted signal converter. Other repairs must be done by NIVELCO-authorized service staff.
For safety reasons, signal converter must be detached from the flange system under atmospheric conditions.

Hazardous-duty systems
Before replacing the signal converter in hazardous locations,
make absolutely sure that there is no risk of explosion (gas-free certificate).

For pressurized tanks with a flange connection between the tank and the device,
do not undo the 4 flange bolts - these are used for fastening the complete sealing system.

4.2 FAULT CLEARING

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 3.5.2 and 8.4.2 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.

Event	Fault	Action
"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 also due to installation on a long nozzle which has the effect of attenuating the flange pulse.	Contact NIVELCO for the corrective procedure.
"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" status marker on*	Occurs when there is a problem with the time base on the HF board.	Please contact NIVELCO.
"VC01 voltage error" status marker on*		
"VC02 voltage error" status marker on*		
"Reprogramming FPGA" status marker on*		

*Gauge connected to PC-STAR 2 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. 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.	Contact your NIVELCO Service Centre.
	Current output value is = 22 mA	If problem persists then contact your NIVELCO Service Centre.

5 TECHNICAL DATA

5.1 TECHNICAL DATA

Application	
Range of applications	Continuous level measurement of liquids, pastes, slurries and powders
Function and system design	
Measuring principle	TDR – Time Domain Reflectometry
Equipment architecture	See section 5.2
Input	
Measured variable	Distance (between the reference point – gauge flange facing – and the product surface), level, liquid interface and volume
Measurement range	Variable according to probe type, see Equipment architecture, section 5.2.1
Blocking Distance (dead zone)	Variable according to probe type, see probe measurement limits, see section 5.2.2
Output	
Analogue	4 … 20 mA, passive output Load Passive outputs 750 Ohm Maximum Error signal 22 mA Resolution ± 3 µA
Digital	HART®, passive output
Digital, Ex ia	HART®, passive intrinsically-safe output
Signal on alarm	Status markers via PC STAR 2 or HART® controller (HHC)
Performance characteristics	
Accuracy	
Level measurement	Liquids when probe length, L ≤ 15 m or 50 ft. ± 15 mm or 0.6 " outside the dead zone, Optional: ± 5 mm or 0.2 " Liquids when probe length, L > 15 m or 50 ft. ± 0.1% of the measured distance Optional: ± 0.05% of the measured distance Solids (powders) ± 20 mm or 0.8 " outside the dead zone, with 4 … 20 mA current output ± 0.01% of the measured distance
Reference operating conditions	
Ambient temperature	+20°C ± 5°C or +68°F ± 9°F
Ambient air pressure	1013 mbar abs. ± 20 mbar or 14.69 psig ± 0.29 psi
Relative air humidity	60% ± 15%
Reference target	- coaxial probe : water surface - single probe : Ø 800 mm or Ø 31.5 in. metal plate - twin probe : metal block "short circuit"
Free space diameter	> 300 mm* or 11.81"*
Distance to obstruction	> 1 m or > 3.28 ft.
Test media	water (dielelectric constant, ε_r = 80) cement (dielelectric constant, ε_r = 3)

* not necessary for coaxial probe.

Repeatability	± 2 mm or 0.08 “
Hysteresis	None
Resolution	± 1 mm or 0.04 “
Transient recovery time	The transient recovery time to 1% deviation from the final value amounts to approximately 4.6 times the programmed time constant. However, the transient recovery time may differ if changes in level are very rapid.
Start-up time	≤ 23 seconds
Long term drift	The long term drift is within the specified error of measurement. Allow for the thermal expansion coefficient in the case of liquids (organic liquids : ~0.15%/K)
Influence of ambient temperature	
current output	HART® : typically 70 ppm/K
measured value	Approximately 25 ppm (maximum deviation over whole measurement range).
Atmosphere	-1 ppm/K (above the liquid product).
Digital	No influence on measured value due to regular self-calibration.

Environment	
Ambient temperature	-30°C … +60°C or -20°F … +140°F***
Storage temperature	-40°C … +80°C or –40°F … +176°F
Environment class	Locations exposed direct to open-air climate, D1
Protection	IP 65

Power supply	
Standard	24 V DC,
Hazardous-duty (Ex.)	≤ 28 V DC
Range	18 … 35 V DC

Process	
Process temperature, product	-30°C … +200°C or –22°F … +392°F *** (Ex)****
Process temperature, flange	-30°C … +90°C or –22°F … +194°F***, option +200°C or 390°F
Process pressure, standard	-1 … 16 bar or –14.5 … 232 psig
Process pressure, maximum allowable	40 bar or 580 psig @ 20°C or 45°F with SS316 flange

Minimum dielectric constant ε_r of product measured : probe type limits	
Coaxial	$\varepsilon_r \geq 1.4$
Twin probe	$\varepsilon_r \geq 1.8$
Single probes	$\varepsilon_r \geq 2.1$

Human interface	
Communication, standard	Operator control and data display via PC using PCSTAR 2 software or HART® handheld communicator Point-to-point 1 gauge connected to a PC or HHC Multidrop Up to 15 gauges connected to a PC or HHC

*** See ATEX approval (Chapter 7)
**** Higher or lower temperatures on request (non-Ex).

Construction materials	
Housing	Aluminium with epoxy coating
Probe	Refer to section 5.2.1 : MicroTREK 2-wire mechanical options
Gasket	Viton, optionally Kalrez 6375
Spacers (on twin probes)	Refer to section 5.2.1 : MicroTREK 2-wire mechanical options

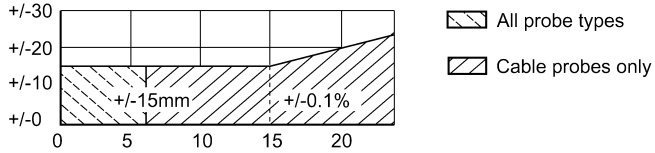
Weight	
Housing	2 kg or 4.4 lb
Single rod Ø 8 mm	0.41 kg/m or 0.28 lb/ft
Single cable Ø 4 mm	0.12 kg/m or 0.08 lb/ft
Twin cable Ø 4 mm	0.24 kg/m or 0.16 lb/ft
Single cable Ø 8 mm	0.41 kg/m or 0.28 lb/ft
Coaxial	1.3 kg/m or 0.87 lb/ft

Standards	
Electromagnetic compatibility and other protection directives followed for EU countries	The level gauge satisfies the protection requirements of : Electromagnetic compatibility Directive 89/336/EEC in conjunction with EN 50081-1 and EN 50082-2 Low voltage electrical equipment Directives 73/23/EEC and 93/68/EEC in conjunction with EN 61010-1. In addition, the requirements in conformity with MSZ EN 50284 :2000, EN 50284 :1999 are in keeping with the NAMUR Recommendation and bear the CE marking. Refer to MicroTREK 2-wire Supplementary Installation and Operating Instructions for requirements and standards for MicroTREK 2-wires used in potentially explosive atmospheres. The devices are EMC-safe in metal containers only (with the exception of the coaxial probe).

5.1.1 ACCURACY

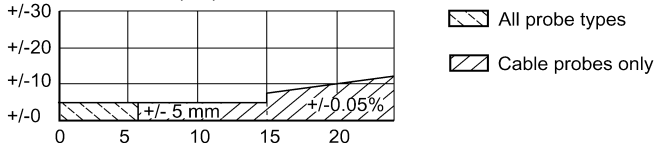
Due to the method of measurement, which primarily determines distance, the measuring accuracy is specified only as a factor of distance.
For that reason, all data in this section refers to the measured distance.

Standard calibration
Error of measurement (mm)



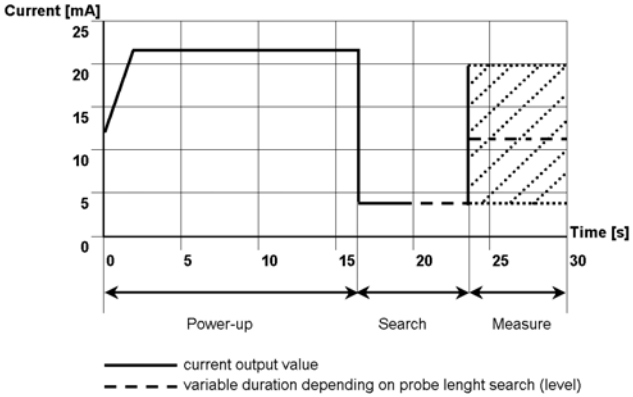
Distance from flange (m)

Special calibration
Error of measurement (mm)



Distance from flange (m)

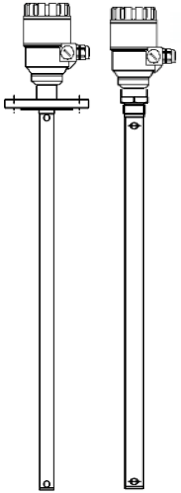
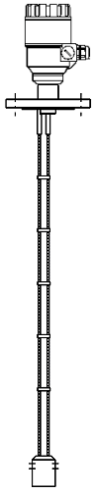
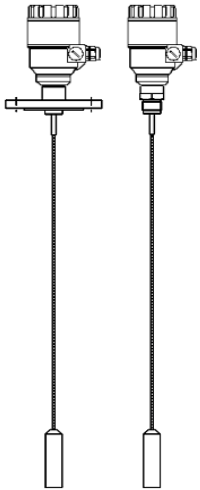
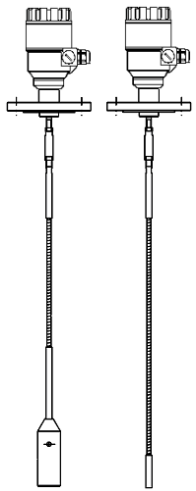
5.1.2 START-UP CHARACTERISTICS



The current output stays at 22 mA for 15 seconds once switched on.
The analogue output subsequently indicates a value between 4 and 20 mA until the level has been found.
After a maximum of 23 seconds, the current output indicates the measured level and follows it.

	Liquid / Liquid Gas applications				
Probe	Coaxial Øext. 28 mm or 1.1”	Twin cable Ø4 mm or 0.15”	Single cable Ø4 mm or 0.15”	Single rod Ø8 mm or 0.3”	Single cable Ø8 mm or 0.3”
Description	Single inner conductor with protective tube.	Two flexible SS316 cables with spacers interspersed along its length, with short circuit and counterweight.	Single flexible cable with countrerweight.	Single rigid rod.	Single flexible cable with counterweight.
Level					
Range, max.	≤ 6 m or 20 ft.	≤ 24 m or 79 ft.	≤ 24 m or 79 ft.	≤ 3 m or 10 ft.**	≤ 24 m or 79 ft.
Free area (no obstructions or discontinuities)	Ø0 mm Or Ø0 “	Ø200 mm or Ø8 “	Ø600 mm or Ø24 “	Ø600 mm or Ø24 “	Ø600 mm or Ø4 “
Minimum dielectric constant, ε_r	1.4	1.8	2.1	2.1	2.1
Minimum process connection	DN50 PN 25/40 2” ANSI 150 lbs 1” G / 1” NPT	DN50 PN 25/40 1 ½ ” ANSI 150 lbs 2” G / 1 ½ ” NPT	DN50 PN 25/40 2” ANSI 150 lbs 1” G / 1” NPT	DN50 PN 25/40 2” ANSI 150 lbs 1” G / 1” NPT	DN50 PN 25/40 2” ANSI 150 lbs 1½” G / 1½” NPT
Probe material	1.4571	1.4401	1.4401 1.4401.FEP coated	1.4571	1.4401
				Powder	

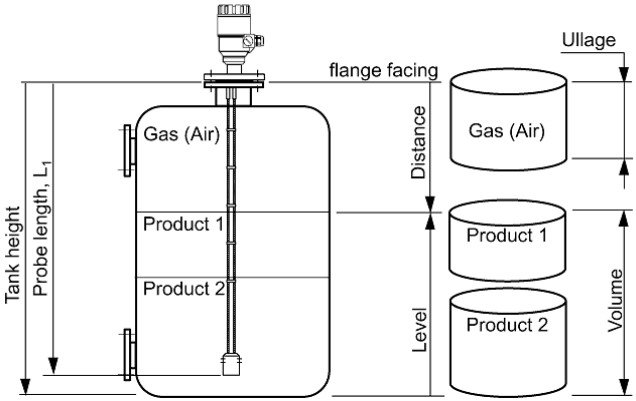
Liquid * gauge with flange connection ** higher on request

	Liquid / Liquid Gas applications				
Probe	Coaxial Øext. 28 mm	Twin cable Ø4 mm	Single cable Ø4 mm	Single rod Ø8 mm	Single cable Ø8 mm
Spacer material	PTFE (if length > 1.5 m)	FEP moulded onto the cable	No spacer	No spacer	No spacer
Counterweight (dimensions in mm)	None	Ø45 x 60 (316L) Turnbuckle (316L)	Ø25 x 100 (316L) Ø25 x 100 (HC22) Ø25 x 100 (HC276) Chuck (316L) Turnbuckle (316L)	None	Ø12 x 100 (316L), where L > 10 m Ø45 x 245 (316L), where L < 10 m Turnbuckle (316L)** Without**
Gauge illiustration					
				Powder	

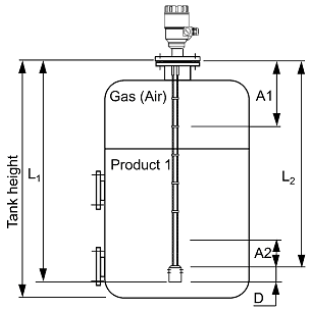
* on request

5.2.2 DEFINITION OF TERMS

Distance	Distance from the face of flange to the level (1 product) or the surface of the top product (2 products).
Level:	Height from the bottom of the of the tank to the surface of the top product (Tank height - distance).
Probe Length:	Ordered length of probe, L1, from face of the hexagon (or of flange) to end of probe (including short circuit and counterweight).
Tank Height:	Distance from the face of the hexagon (or lower edge of flange) to the bottom of the tank.
Ullage (volume):	Unfilled volume.
Volume:	Total volume filled.



5.2.3 PROBE MEASUREMENT LIMITS



A1, the top dead zone,
The minimum distance from the flange to the top limit of the measuring range. The measurement displayed on the gauge will freeze below this distance and status markers will indicate that the reflection has been lost.
A2, the bottom dead zone,
A length at the end of the probe where measurement is not possible. For products with very low dielectric constants ε_r < 5), accuracy may be affected in a non-linear zone up to 150 mm or 6" above the bottom dead zone, A2
D, the non measurement zone,
A zone where measurements cannot be taken (i.e. the counterweight, turnbuckle, etc.*). The measurement displayed on the gauge will freeze to L_2.
L_2, factory configured probe length
Length to the end of the probe (excluding short circuit or counterweight*).
This parameter is given in User Function 1.1.6:
Probe length in the User Configuration Mode.
L_1, with probe length
The length specified by the customer in the order (including the counterweight).

Note : dead zone = blocking distance
*except the Ø12 mm x 100 mm or Ø½ " x 4" counterweight for the Ø8 mm or 0.3 " single cable probe

Warning:

Set PCSTAR 2 User Function 1.1.2 "Dead zone" in the gauge's configuration mode to at least top dead zone size as specified per probe type in the table below, so that the gauge never displays product level within this zone.
Refer to user function 1.1.2 in section 4.2 for more information.

PROBE MEASUREMENT LIMITS

Probe type	Top dead zone, A1 ε_r = 80*	Bottom dead zone, A2 ε_r = 80*	Top dead zone, A1 ε_r = 2.4*	Bottom dead zone, A2 ε_r = 2.4*
Twin cable Ø4mm	150 mm or 6"	20 mm or 0.8"	300 mm or 12"	100 mm or 4"
Single cable Ø4mm	300 mm or 12"	20 mm or 0.8"	400 mm or 15¾"	100 mm or 4"
Single rod	300 mm or 12"	20 mm or 0.8"	400 mm or 15¾"	100 mm or 4"
Single cable Ø8mm	300 mm or 12"	20 mm or 0.8"	400 mm or 15¾"	100 mm or 4"
Coaxial	0 mm or 0"	10 mm or 0.4"	0 mm or 0"	100 mm or 4"

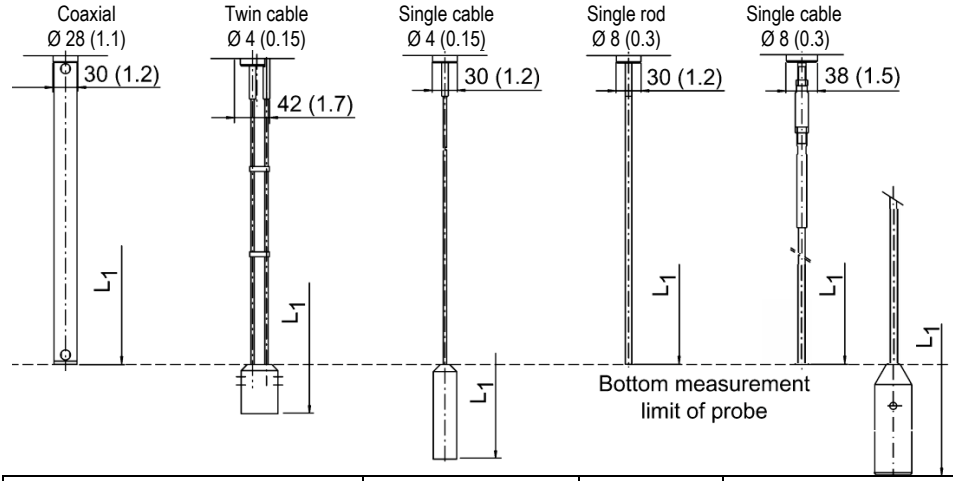
*The dielectric constant ε_r of water is 80. The dielectric constant ε_r of oil is 2.4

If the device is mounted on a tank fitting (e.g. a nozzle), include the height of the tank fitting in the programmed dead zone.

5.3. GAUGE DIMENSIONS

This diagram illustrates standard gauge configurations and overall dimensions.

Standard, M16 terminal box* | Standard, DIN connector** with threaded connection | High temperature version | With raising converter



Standard counterweight				
None	Ø45x60 (Ø1¾x2½)	Ø25x100 (Ø1x4)	None	Ø12x100 (Ø½x4)**** or Ø45x245 (Ø½x9¾)*****
Size of threaded hole in base of counterweight for anchoring				
None	M8	M8	None	M8
Dimensions in mm (inches)				
* with a cable fitting M16X1.5 Ø3.5-Ø8 ** with a cable fitting PG11 Ø8-Ø10 DIN43650-A				
*** the raising converter (i.e. a non-active extension at the top of the probe) may be supplied with the following standard lengths : 100 mm or 4", 200 mm or 8", 300 mm or 12", 400 mm or 16", 500 mm or 20" and 1 m or 40" - for single rod and single cable probe versions only. **** where L_1>10m or >33ft ***** where L_1<10m or <33ft L_1=Ordered probe length				

6 MEASURING PRINCIPLE

6.1 GENERAL PRINCIPLE

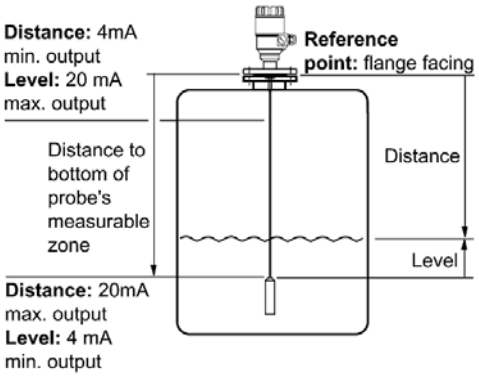
The MicroTREK 2-wire has been developed from a tried and tested technology called “Time Domain Reflectrometry” (TDR). Other modern applications include checking for and locating damage along telecommunication cable lines.

The MicroTREK 2-wire sends low-power electromagnetic pulses of one nanosecond width along a rod or cable conductor. This pulse travels at a known speed: the speed of light. Upon reaching the surface of the product to be measured, the pulses are reflected back with a signal strength that is dependent on the dielectric constant, ε_r of the product (e.g. up to 80% of the pulse strength is reflected from the surface of water).

A product’s dielectric constant, ε_r is an electrical property. The strength of pulse reflection from the surface of the product being measured is registered by the instrument as signal amplitude in volts.

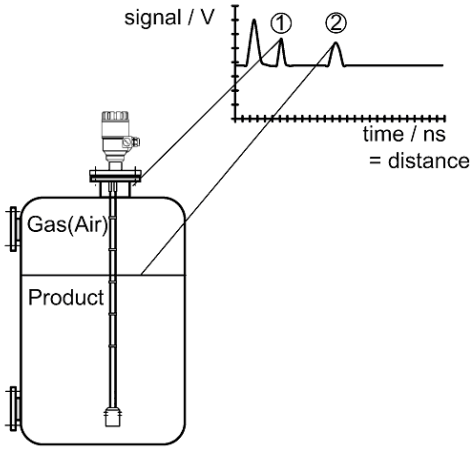
The instrument measures the time between the emission and the reception of the signal: half of this time corresponds to the distance from the instrument reference point (the flange facing) to the product surface. This value of time is converted into an analogue output current between 4 and 20 mA or a digital HART signal corresponding to a calibrated distance which can then be displayed digitally in a variety of forms from a list of choices available in the gauge’s user menu.

Readings taken using this technology have the advantage of being uninfluenced by dust, foam, vapour, agitated and boiling surfaces. Pressure, temperature and density variations also have no effect.



The MicroTREK 2-wire determines level using a “direct” measurement method, explained below.

Level measurement as signal amplitude over time since signal was emitted



1 Flange reflection

2 Level measurement

6.1.1 LEVEL MEASUREMENT OF ONE PRODUCT

The pulse is emitted by the instrument and guided along the probe.
It reflects off the first product surface it meets and returns to the instrument.

The distance from the gauge flange to the product is proportional to the time taken:

$$Distance = \frac{c_0 * time\,taken}{2}$$

, where c_0 is the speed of light in air.

Level is determined by subtracting the distance to the product from the tank height.
Note that the instrument is normally delivered with level being measured from the end of the probe, where the tank is taken to be empty once the product falls below this point.

7 CERTIFICATES AND APPROVALS

Approval and project code	Approved classes and groups
ATEX*	II 1 G EEx ia IIB T6 … T3
BKI 06 ATEX 009X	II 1 G EEx ia IIC T6 … T3
	II 1 / 2 D T100 ^{O}C

Symbols used for the identification of approved equipment

CE 1418 Conformity to E.U. directives and norms

Ex-approved**

* Refer to MicroTREK 2-wire Supplementary Installation and Operating Instructions for further information.
The certificates are available on NIVELCO's download webpage on http://www.nivelco.com/.

**The above symbols, with the exception of the "CE" symbol,
will not appear on gauge nameplates or supplied paperwork unless the approvals are specified
in the order by the customer.

8 PCSTAR 2 SOFTWARE USER'S GUIDE

This section is a complete guide to the functions available in PC STAR 2 V2.01, a software program developed in-house to optimise remote configuration and data display on a PC (Personal Computer) work station.

8.1 SOFTWARE INSTALLATION

Refer to section 3.3.1.

8.2 PCSTAR 2 SOFTWARE

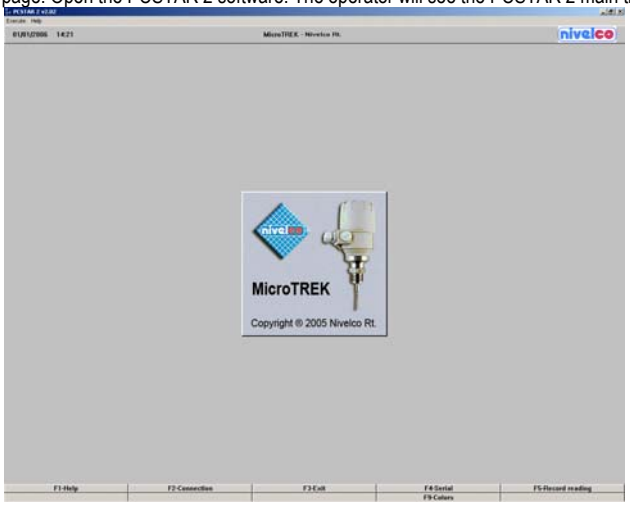
Date of introduction	PC user software (PCSTAR 2) details		
Month/Year	Software release	Compatible operating system (PC)	Compatible MicroTREK 2-wire firmware
01/2006	2.02	Win 9x, 2000, Me, NT, XP	Ver. 1.20 to 1.23

8.3 SUPPORTED NETWORKS

Point-to-point
Multidrop
Refer to section 5.5.1.

8.4 PCSTAR 2 FUNCTIONS

Check that the correct hardware has been installed to allow communication between the gauge and the work station. Once the software is running, the basic functions (and the associated function keys) will be shown at the foot of the first page. Open the PCSTAR 2 software. The operator will see the PCSTAR 2 main title window:



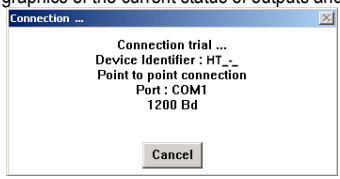
To enter the functions displayed in the diagram above,
move the cursor to the bar concerned and left-click to open or use the keyboard function key (F1 – F10) indicated.
The functions and sub-functions available are discussed in sections 8.4.1 to 8.4.7 below.

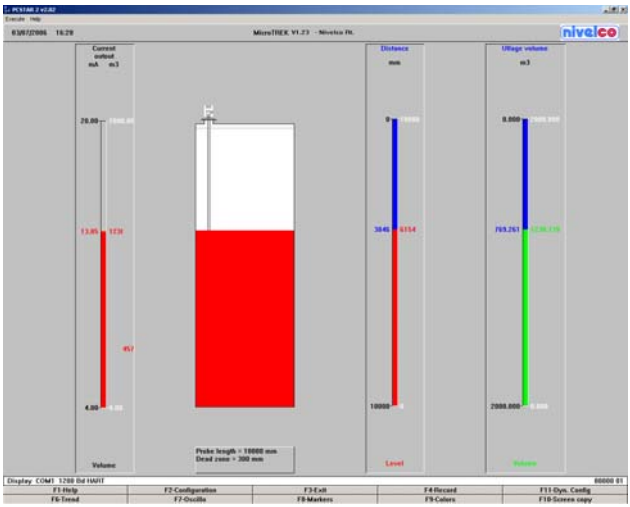
8.4.1 F1 HELP

PCSTAR 2 Off- and On-line Help file for a summary of PCSTAR 2 functions.

8.4.2 F2-CONNECTION: ON-LINE FUNCTIONS

F2-Connection opens a real-time connection between PCSTAR 2 and the gauge.
This establishes a connection with the gauge(s).
A small window will open either confirming the connection or advising the user otherwise.
This will open a window which displays graphics of the current status of outputs and a representation of the tank.





This shows the real-time tank status.
This screen is divided into three parts : In default layout for a single output, this will show a bar with Current output and level graduations on the left hand side, a representation of the tank with its contents in the middle (the top dead zone will be indicated as a grey dotted line) and a bar with distance and level graduations on the right.

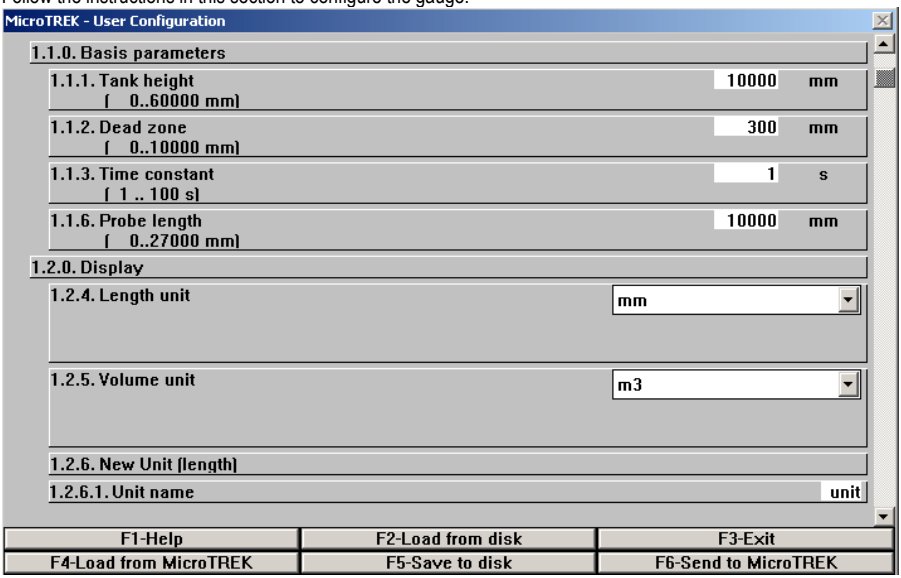
Functions available on this screen are:

F1-Help	On-line help (presents information given in this guide)
F2-Configuration	MicroTREK 2-wire user parameters.
F3-Exit	Disconnect from gauge
F4-Record	Configure PCSTAR to record data from the gauge over a given time period
F6-Trend	level against recording time graph
F7-Oscillo(scope)	Voltage amplitude against distance from flange graph displaying all reflections registered along the probe.
F8-Markers	Status markers on/off graph
F9-Colors	For modifying the colour of display screen elements
F10-Screen copy	Saving and printing this screen
F11-Dyn. Config (dynamic configuration)	For changing the control threshold for detecting reflections manually. Useful when there are obstructions causing parasite signals in the tank.

These functions are described on the following pages.

F1 – Help Menu:
On-line help file.

F2 – CONFIGURATION MENU:
For creating and modifying gauge settings while PCSTAR 2 is connected to the gauge.
The configuration may also be created, modified or saved without sending the new settings to the gauge in this window.
The User configuration menu will be listed as shown in Section 3.3.1 of this manual.
The values displayed will be either default or customer-order specified values.
Follow the instructions in this section to configure the gauge.



Functions available on this page (use scroll slider on the right hand side to show all):-
User functions 1.1.1,1.1.2,1.1.3 & 1.1.6 : Basis Parameters
User functions 1.2.4, 1.2.5 & 1.2.6 : Display Parameters
User functions 1.3.1 to 1.3.5 : Current Output I Parameters
User functions 1.4.3 to 1.4.9 : User Data Parameters
User function 1.5.1 : Application Parameter
User function 1.6.2 : Serial Input/Output Parameter
User function 1.7.0 : Volume Table Parameters and…

F1 – Help: On-line help file

F2 – Load from disk: This loads old settings from the hard disk onto PCSTAR 2 (but not to gauge).

F3 – Exit: Exit configuration page to real-time measurement main window.

F4 – Load from MicroTREK 2-wire: This loads the configuration used by the gauge into PCSTAR 2.

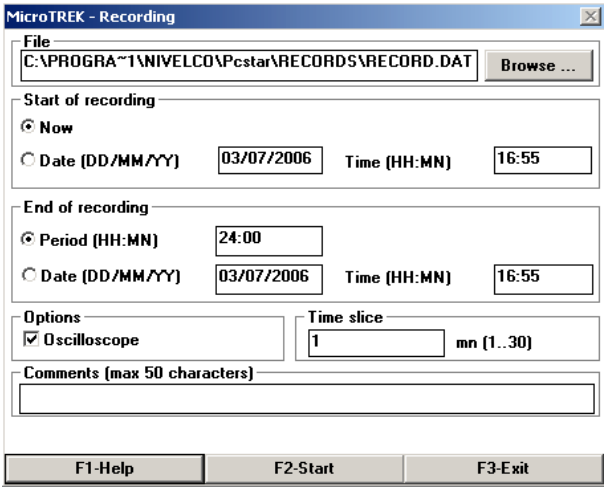
F5 – Save to disk: Press to save a configuration onto disk in *.KRF format.
This allows the user to load configurations later and
also facilitates analysis of the gauge by NIVELCO personnel if a problem is encountered.

F6 – Send to MicroTREK 2-wire: Press this once all configuration parameters have been entered.
This will load the new configuration into the gauge.

F3 – Exit: Quit to main title window.

F4 - RECORD MENU:

The software will temporarily record the last two hours of operation without using the record menu. This information will be displayed on the "Trend" and "Markers" windows.
However, if the user wishes to make a permanent record of measurement data then it is necessary to set and confirm a measurement record period in this menu.
It is also recommended to activate the "Oscilloscope" option in order to have information on pulse reflection times.
This is set in the window below:



Functions available on this page:
F1 – Help: On-line help file

F2 – Start: Start Record

F3 – Exit: Exit to real-time measurement main window

Browse: Find directory and create record file (*.dat)

Recording Options: Start of Recording - Either from now or a delayed start (date and time)

End of Recording - Either in a given number of hours or a given date and time.

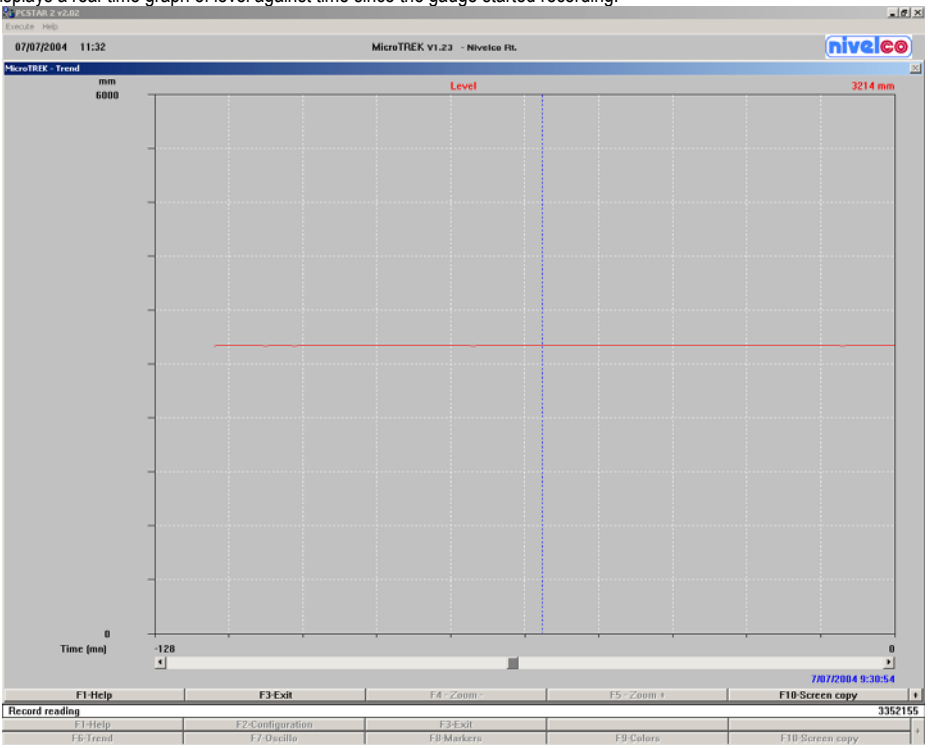
Signal/ Oscilloscope - Activate these zones to record these types of data.

Time slice - Time spacing between each recorded reading. Range: 1 to 30 minutes.

Comments - Complementary information concerning the record (50 characters maximum)

F6 – TREND MENU

Displays a real-time graph of level against time since the gauge started recording.

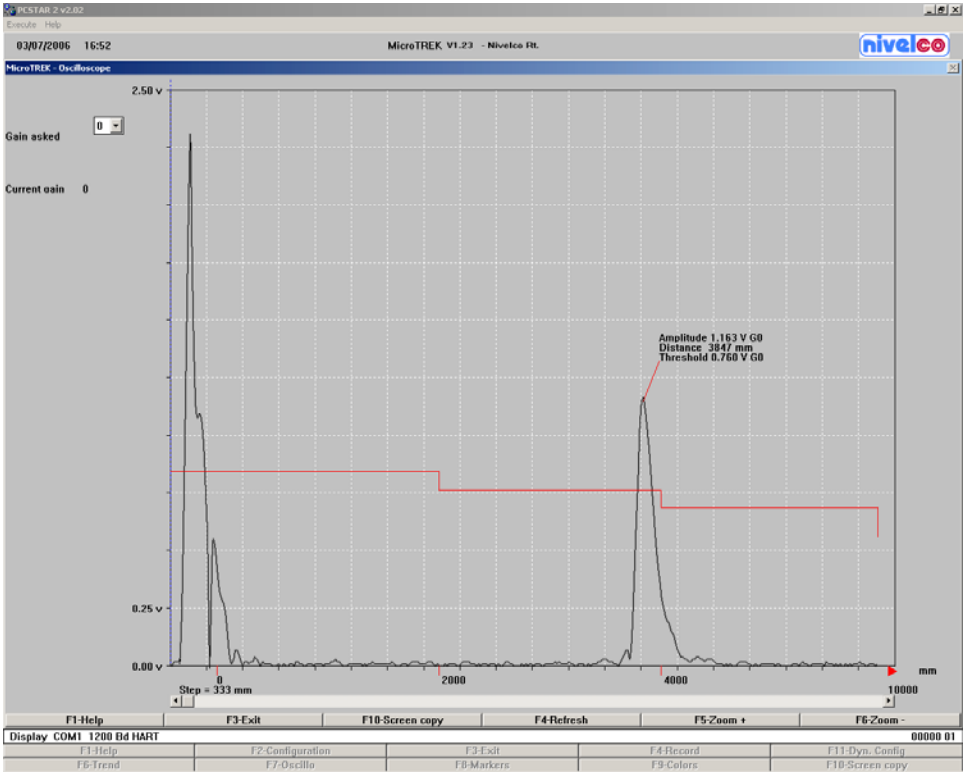


Functions:

F1 – Help:	On-line help file
F3 – Exit:	Exit to real-time measurement main window
F4 – Zoom -:	Reduces the time scale
F5 – Zoom +:	Increases the time scale
F10 – Screen copy	To select a directory and save the current screen as a bitmap file.

F7 – OSCILLOSCOPE FUNCTION

Using the F7 – Oscilloscope function (Oscillo.), all reflections occurring at the probe can be displayed.
This is a help for optimum setting of the dead zone, the non-measurable zone, and the threshold under Function F11.
It provides details on the position and strength (amplitude) of every signal between the initial pulse and the tip of the probe.



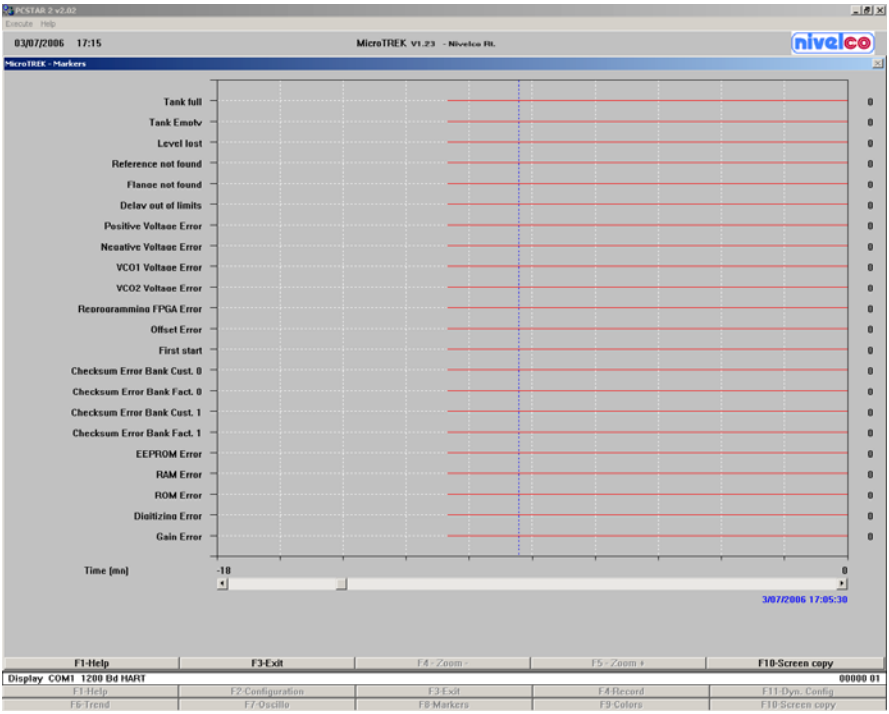
Refer to section 3.4.2: Gain and signal amplitude for information on how to use F7-Oscilloscope and F11-Dynamic Configuration windows to modify Gain and level threshold manually to assist detection of the product surface in unfavourable installation conditions.

Other functions available on the Oscilloscope window:

F1 – Help
On-line help file
F3 – Exit
Exit to real-time measurement main window
F4 – Zoom -
Reduces the time slice scale
F5 – Zoom +
Increases the time slice scale
F10 – Screen copy
To select a directory and save the current screen as a bitmap file.

F8 – MARKERS MENU

Displays a real-time evolving graph of error markers which are either displayed as active (value 1) or inactive (value 0).



Refer to section 4.2 “Fault clearing” for corrective procedures when the markers shown above are active.

Other functions available on the Markers window:

F1 – Help	On-line help file
F3 – Exit	Exit to real-time measurement main window
F4 – Zoom -	Reduces the time slice scale
F5 – Zoom +	Increases the time slice scale
F10 – Screen copy	To select a directory and save the current screen as a bitmap file.

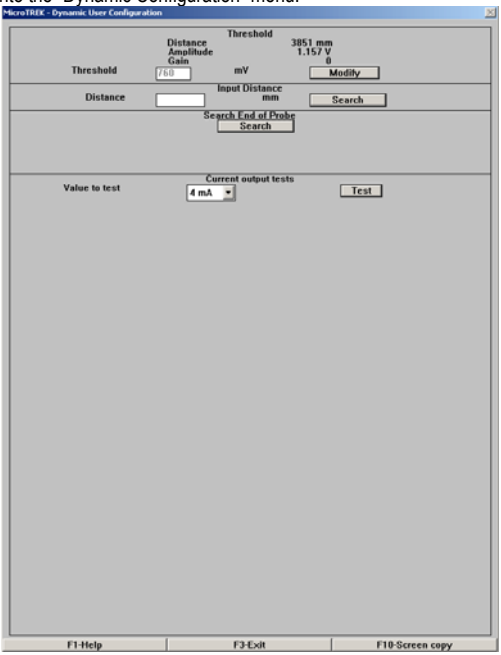
F9 – Colors Menu

Refer to section 8.4.7 for all information concerning this set of functions.

F10 – Screen copy Menu

To save a bitmap image of the active window.

F11 – Dynamic configuration
Use F11-Dyn. Config. to get into the “Dynamic Configuration” menu.



Here, you can:
read the distance to the product surface,
the amplitude and the amplification factor,
change the level threshold,
specify the distance to the product surface,
initiate automatic search of the probe tip and
test the current output.

Fct. Threshold
The level threshold must be adjusted according to the amplitude and the amplification factor of the level reflection signal.
The factory-set threshold is suitable for most applications.

Factory-set threshold	500 mV, gain 3 when distance < 2000 mm or < 6½ ft
Minimum threshold	50 mV, gain 3
Maximum threshold	2500 mV, gain 0

Where interference reflections are caused by tank fittings/nozzles or other internals,
which can lead to faulty measurements, the level threshold must be adjusted.
The interference signals are suppressed and only the signals are indicated whose amplitude lies above the threshold.

Note:

The level threshold may not be set when the tank is full;
rather, it should ideally lie halfway between the level and interference reflections.

To set the level threshold, we recommend the following filling height:
Minimum height: 300 mm or 12" above the probe tip or the upper weight,
Maximum height: distance to flange at least 500 mm or 20"

Fct. Input distance
This function is used to search for the level signal at a pre-configured distance.
The current output is set to the appropriate value directly after the distance has been input.

Note:

If the function is executed during normal operation,
this may possibly have consequences on downstream systems.

Fct. Search end of probe
This function automatically defines the probe length. It is used, for example, after the probe has been shortened.
The tank needs to be empty when this function is executed. If the probe tip is not found,
possibly a level threshold has been set that is too high.
Set the threshold to a lower value so that the reflection signal from the probe tip can be identified.

Fct. Current output tests
This function is used to check the accuracy of the analog output by means of a milliammeter.
For this test a milliammeter must be connected into the loop.
The following current values to be generated can be selected: 4/8/12/20/22 mA.

Other functions:

F1 – Help	On-line help file,
F3 – Exit	Exit to real-time measurement main window,
F10 – Screen copy	To select a directory and save the current screen as a bitmap file.

8.4.3 F3 EXIT:

To quit PCSTAR.

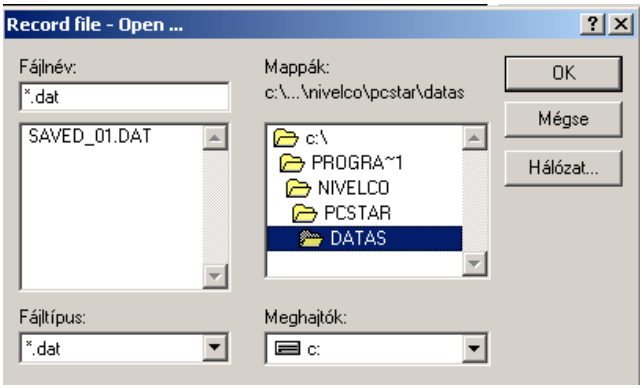
8.4.4 F4 SERIAL (PARAMETERS):

For configuring the gauge for networks. Refer to section 3.3.1 for a list of available parameters.

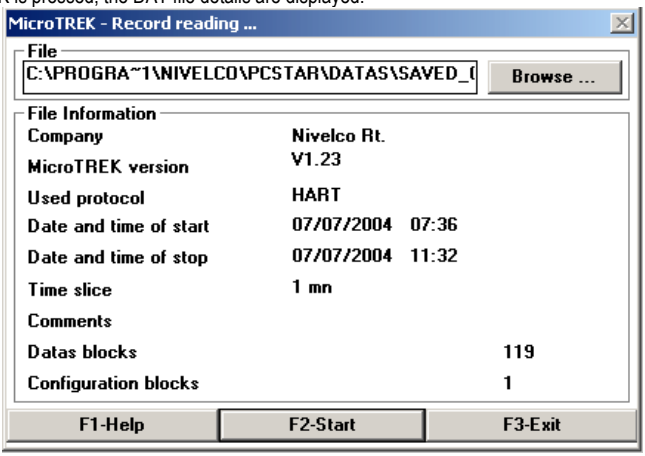
8.4.5 F5 RECORD (READING):

Play back recording functions.

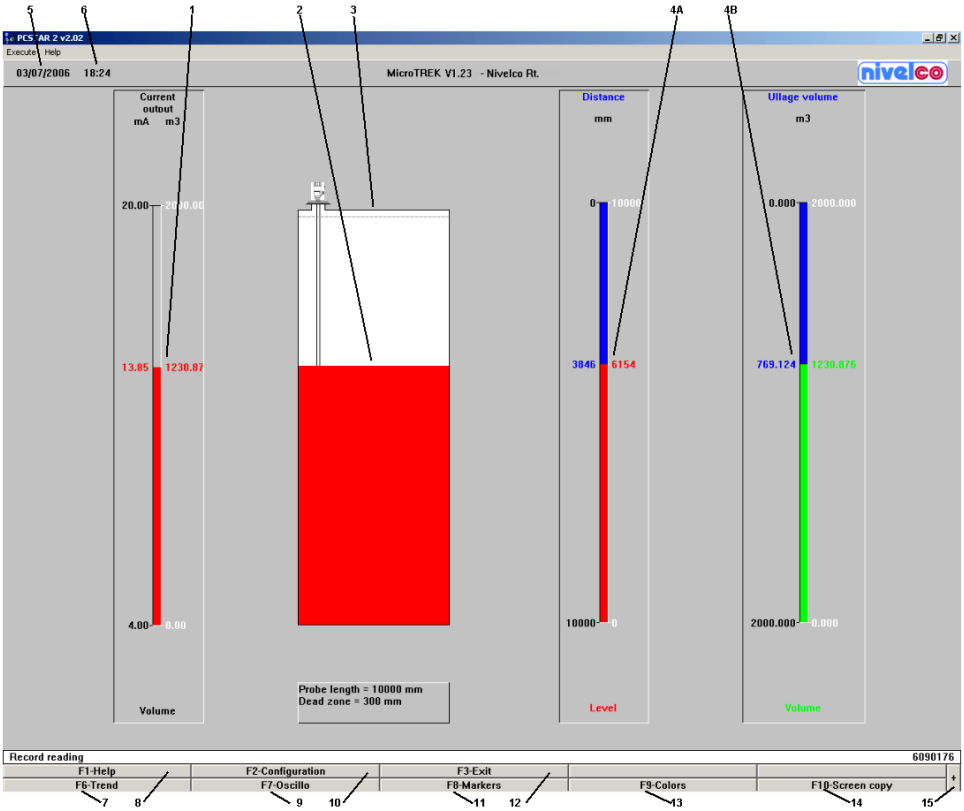
The function will display a window: Record file – Open…. Browse for the DAT file required.
Press OK to open file or Cancel to quit.



When OK is pressed, the DAT file details are displayed.



Functions:
F1 – Help On-line help file.
F2 – Start Start reading the file data. Goes to record reading main window – see below.
F3 – Exit Exit to main title window.



Item	Item Description
1	Current output 1/ level in mA/mm
2	Tank diagram showing current position of level
3	Dead zone limit (configured)
4A	Distance/ level of top product in mm
4B	Ullage volume/ volume in liters* (*configurable display).
5	Date of time slice
6	Time of time slice
7	F6: Trend function – shows level and interface over time recorded
8	F1: Help – on-line help function
9	F7: Oscilloscope – to display signal amplitude/return signal time at a given day and time.
10	F2 : Configuration – access to user menu. The settings here are read-only. This list will also show modifications to the gauge settings over the time measurement data is recorded
11	F8 : Markers – Error indicators activated at a given time and date
12	F3 : Exit Record Reading window
13	F9 : Colors – change screen component colours as shown in Section 8.4.7
14	F10 : Screen copy – function for saving bitmaps of the current screen.
15	+: playback functions – see screenshot below

The Signal, Trend, Markers, Configuration function windows given in the list on the preceding page correspond to those found in the real-time display windows with the exception that the real-time functions are suppressed, i.e. F6 Numerize in the Alt F1 Oscilloscope window.

Bottom of Record Reading main screen when the "+" sign is pressed

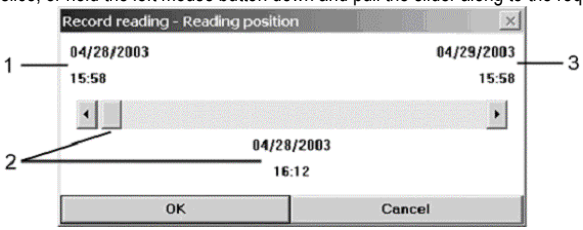
"+" sign …at the bottom right hand side of the window.
This will access the viewing features in the Record Display Window (item 15).

Alt M to view either the data in Continuous mode or in Step by step mode.

Alt N to view "Forward" (Continuous mode) or "Next (step)" (Step by step mode).

Alt P to view "Backwards" (Continuous mode) or "Previous (step)" (Step by step mode).

Alt B Reading Position - A slider control appears to permit the user to browse quickly through the time slices recorded, as shown below. Either click on the arrows at the end of the bar to move back or forward one time slice, or hold the left mouse button down and pull the slider along to the required time slice.



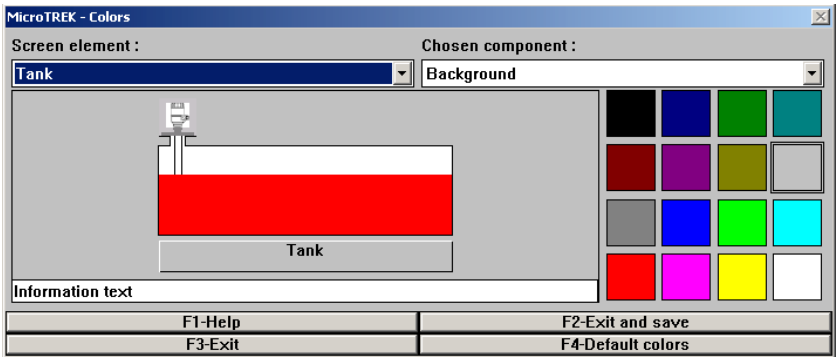
1 Record start time slice

2 Currently displayed time slice

3 Record stop time slice

8.4.6 F9 COLORS

Change colours used on PCSTAR display board. 16 are available.



F1 – HELP On-line PCSTAR Help

F2 – Exit and save Saves new settings for the screen elements concerned

F3 – Exit Exit to main title window without saving modified elements.

F4 – Default colors Reset to original colour scheme

Modifiable color parameters

Screen elements Select display window from the drop-down menu	Chosen component Selected by scrolling through a drop-down menu or by clicking on the element concerned. Click on colour palette to select colour and press F2 to save modified settings and exit.
Tank	Background, tank, text, level, interface level, shadow, information background, information text and light.
Current outputs	Background, current outputs text, current output 2, current output 1,shadow and light.
Measurement bar graphs	Background, level, text, distance, interface level, volume, ullage volume, shadow and light.
Signal	Background, dead zone ,frame, grid, signal, position arrow, actual gain, other gains, shadow and light.
Trend/Markers	Background, markers, frame, grid and position cursor

8.4.7 OTHER IMPORTANT PCSTAR 2 FUNCTIONS

Ctrl Alt R : MicroTREK 2-wire – Reset

This resets the gauge. This should be done before operating with a new configuration.
It empties the old data temporarily stored in the gauge memory and
permits the gauge to go through a series of checks to accept and operate with a new configuration.

8.5 FAULT CLEARING PCSTAR 2

Event	Fault	Action
PCSTAR 2 is unable to connect to the gauge	The RTS Shutdown parameter is unable to assign a value to the PC operating system (WINDOWS XP for PCSTAR 2 versions prior to 2.01). When at default value 0, PCSTAR 2 tests the operating system to identify which one is installed. An RTS Shutdown timing value is assigned depending on the results. However, this test may not recognize Windows XP, so PCSTAR will not work.	Please follow the corrective procedure below :

Corrective procedure to permit gauge to connect to PCSTAR 2 using Operating System WINDOWS XP

Step	Action	Data entered/value set
1	Go to PcSt2NT.ini file in the Windows directory on the hard disk under the PC STAR 2 sub-directory.	N/a
2	Find RTSShutdown in the list of parameters. The default value is 0.	N/a
3	Modify the line.	RTSShutdown = 150
4	Close the file and run PCSTAR 2. No further software configuration problems should be encountered.	N/a

Appendix A : MicroTREK 2-wire Level Gauge Configuration Record

Please enter the data that has been set in the signal converter.				
MicroTREK 2-wire Parameters Checklist	Firmware-Vers. :			Date : …./…../……
Device :			Comm. No. :	
Location :			Medium :	
Contact person :			Telephone :	

Remarks :				
Menu item changed, date :		…./…../…….	…./…../…….	…./…../…….
Fct.	User configuration parameters			
1.1.1	Tank height			
1.1.2	Dead zone			
1.1.3	Time constant			
1.1.6	Probe length			
1.2.4	Length unit			
1.2.5	Volume unit			
1.2.6.1	(new) unit name			
1.2.6.2	(new) unit factor			
1.3.1	Current output 1, item			
1.3.2	Current output 1, range			
1.3.3	Scale I1 min (4mA)			
1.3.4	Scale I1 max (20mA)			
1.3.5	Error delay			
1.4.4	Device number			
1.5.1	Detection delay			
1.6.2	Address			
	Threshold			

Strapping (volume) table values (please specify units)					
Point	Level	Volume	Point	Level	Volume
0			10		
1			11		
2			12		
3			13		
4			14		
5			15		
6			16		
7			17		
8			18		
9			19		
Menu item changed, date :		…./…../…….		…./…../…….	…./…../…….
Fct.	Factory configuration parameters (NIVELCO SERVICE TECHNICIANS ONLY)				
1.1.1	Probe type				
1.1.2	Offset				
1.1.3	Application type				
1.1.4	Epsilon R				
2.1	Electronic offset				
2.4	Electronic Calspeed				
2.5	Mechanical Calspeed				
2.6	Reference frequency				

Appendix B : Returning a device for testing or repair to NIVELCO

Your instrument has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems. Should you nevertheless need to return an instrument for inspection or repair, please pay strict attention to the following points.
Due to statutory regulations on environmental protection and safeguarding the health and safety of our personnel, NIVELCO may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.
This means that NIVELCO can only service your instrument if it is accompanied by the following certificate confirming that the instrument is safe to handle. If the instrument has been operated with toxic, caustic, flammable or water-endangering products, you are kindly requested:
to check and ensure, if necessary by rinsing or neutralizing, that all cavities are free from such dangerous substances,
to enclose a certificate with the level gauge conforming that it is safe to handle and stating the product used.
We cannot service your instrument unless accompanied by such a certificate.

Specimen certificate

Company : _____ Address : _____

Department: _____ Name: _____

Tel. No. : _____ Fax No. : _____

The enclosed level gauge _____

Type : _____

NIVELCO Order No. Or Serial No. : _____

Has been operated with the following process liquid: _____

Because this liquid is

- ☐ water-hazardous
- ☐ toxic
- ☐ caustic
- ☐ flammable

We have

- ☐ checked that all cavities in the instrument are free from such substances,
- ☐ flushed out and neutralized all cavities in the device.

We confirm that there is no risk to humans or environment through any residual liquid contained in the instrument.

Date : _____ Signature : _____

Company stamp:

htk2014a0600p_01
Jan., 2006
Technical specification may be changed without notice.