

# Instruction Manual

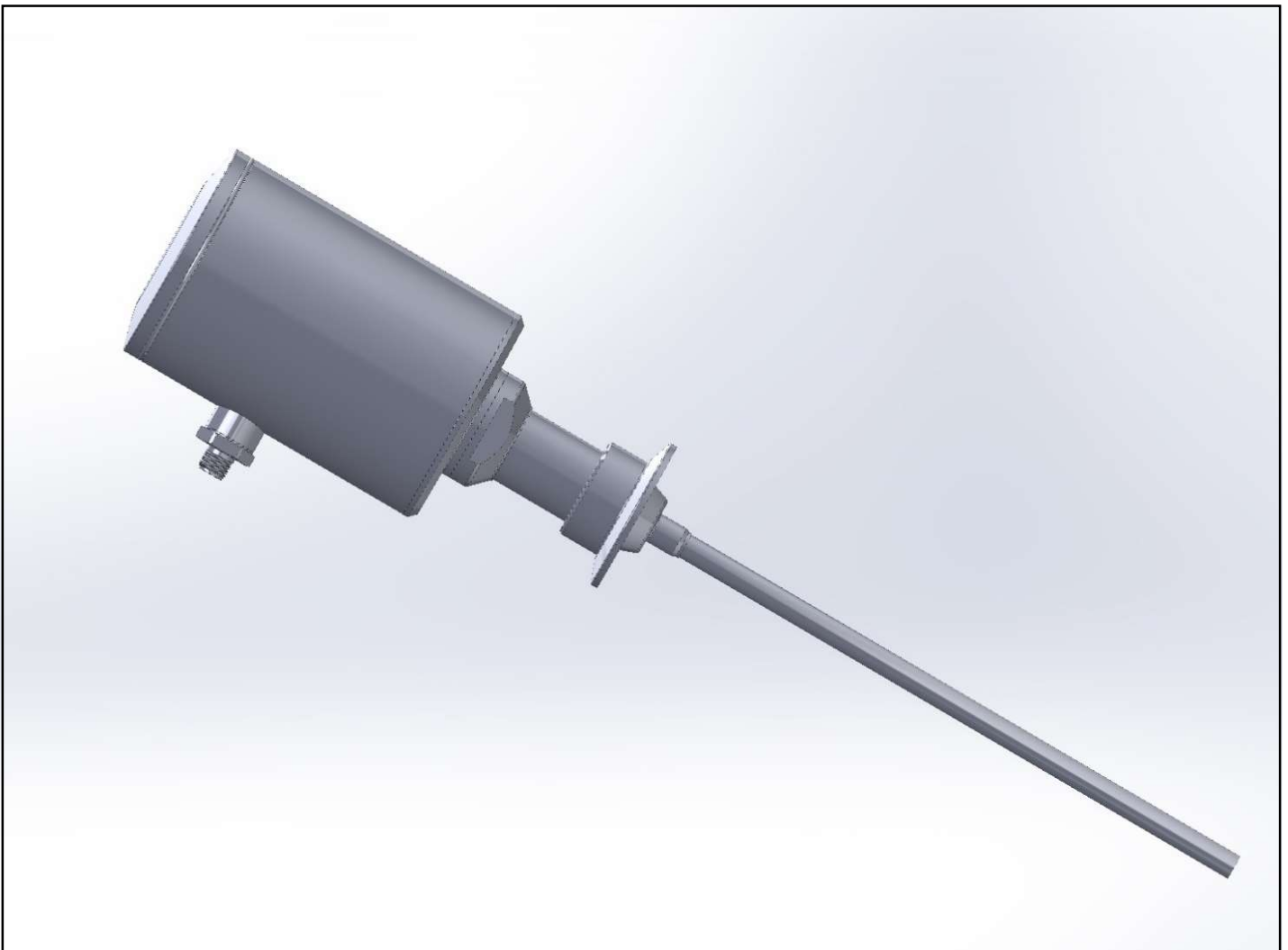


**ANDERSON-NEGELE**

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Instrument Model Number \_\_\_\_\_

Instrument Serial Number \_\_\_\_\_



## **AGW Life Sciences Series Guided Wave Radar**



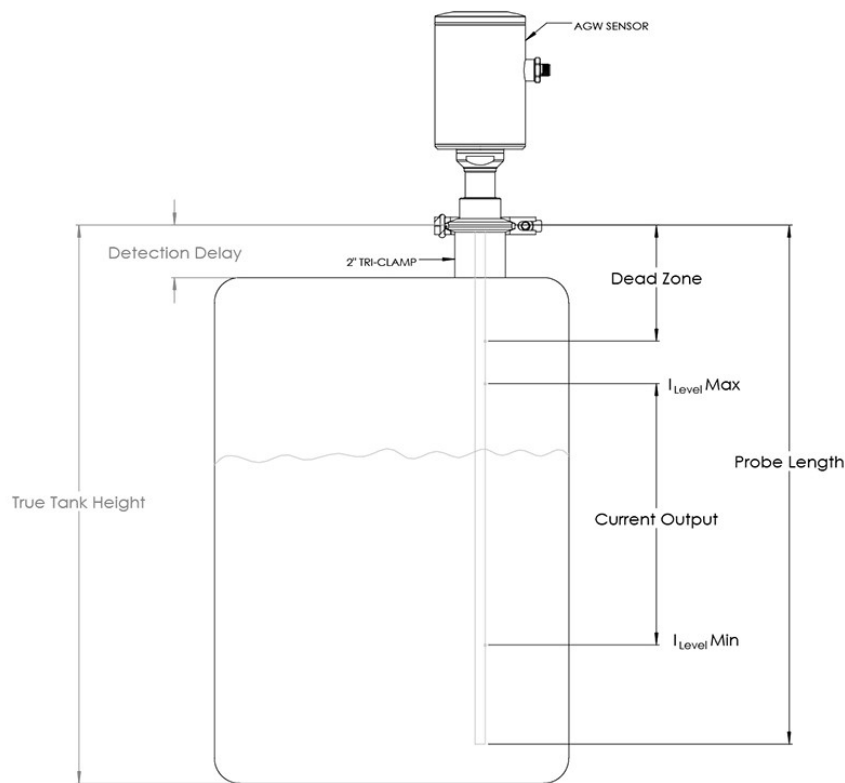
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# 1 INTRODUCTION



## 1.1 APPLICATION

- Continuous level monitoring in vessels up to 10 ft (3 m) in height
- Level measurement in virtually all media in the Life Sciences industry
- Level measurement of foaming media
- Minimum product dielectric of  $\epsilon_K=2$ , suitable to all water based media including WFI

## 1.2 OPERATING PRINCIPLE

The AGW Guided Wave Radar uses the TDR (Time Domain Reflectometry) principle. The instrument sends low power nanosecond wide pulses along an electronically conductive rod with a known propagation speed (the speed of light). When a pulse reaches the surface of the medium that has a higher dielectric than the air/vapor in which it is traveling, the pulse is reflected. The reflected pulse is detected as an electrical voltage signal and processed by the electronics. The level measurement is directly proportional to the time of flight of the pulse. The measured level is converted into 4-20 mA current and HART signals which is displayed on the LCD display. The level data measuring values can be calculated into volume.

## 2 TECHNICAL DATA

<b>Rod length</b>	Product contacting	120 in max. 24 in min 36 in max after bend
<b>Deadband</b>	length beyond process connection	10 in max
<b>Process connection</b>	Tri-Clamp	1...1½", 2", 2½", 3"
<b>Process pressure</b>		230 psi (16 bar) max.
<b>Materials</b>	Connecting head Plastic cap/viewing window Threaded connector Insulating part  Process connection and rod	304 SS Polycarbonate 304 SS USP class VI PEEK (FDA approval number: 21 CFR 177 2415; 3A-20) 316L SS, Ra<20 microinch with EP
<b>Temperature range</b>	Process CIP/SIP cleaning	14...284 °F (-10...140 °C) 290 °F (143 °C) max 120 minutes
<b>Repeatability</b>		+/- .08" (2mm)
<b>Accuracy</b>		+/-0.2" (3.8mm)
<b>Linearity</b>		< 1.0 % of the upper range value (= rod length)
<b>Temperature drift</b>	At 25 °C	≤ 0.1 %
<b>Response time</b>		< 500 ms
<b>Electrical connection</b>	Supply Protection class Output signal  Ohmic resistance	18...36 V DC NEMA 4X Analog 4...20 mA, galvanically separated from housing, 2-wire loop 0...750 Ω
<b>Weight</b>		920 g with rod length of 1.5 m

### 2.1 ACCESSORIES

- USB/Bluetooth Hart modem
- Pre-assembled cable for M12 plug
- Dry bench calibration kit

### 2.2 MAINTENANCE AND REPAIR

AGW does not require maintenance on a regular basis.

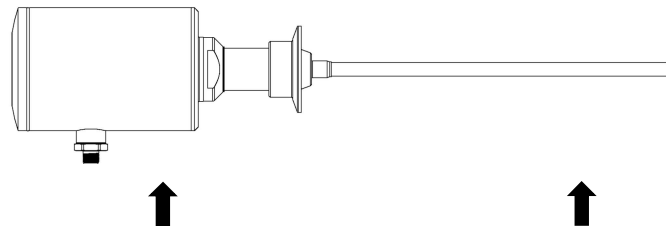
If Cleaning is Required, this must be carried out gently, without damaging the probe.

Equipment sent back for repairs should be cleaned or neutralized (disinfected) by the User.

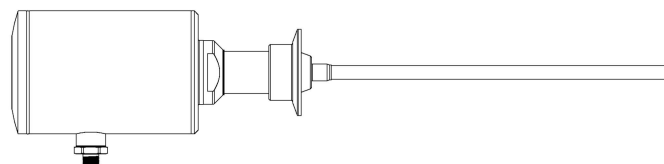
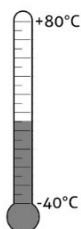
### 3 MECHANICAL INSTALLATION

#### 3.1 HANDLING AND STORAGE

Avoid bending - Support the probe to avoid bending.



Storage temperature



The AGW is shipped with the head and rod assembly in separate boxes. The rod assembly should be installed in the vessel and then the head should be attached using a strap wrench to a torque of 16 ft-lbs

#### 3.2 MOUNTING IN THE TANK

##### 3.2.1 Installation instructions: general notes

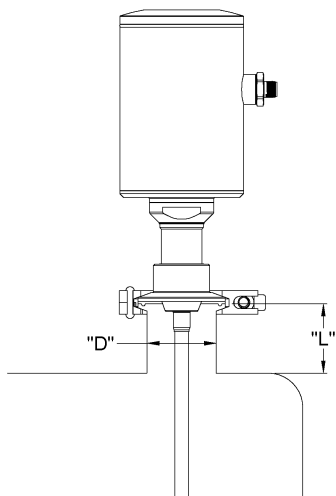
Prior to installation some consideration needs to be made regarding tank fittings and tank shape. Specifically, Ferrule position in relation to the tank walls and other objects inside the tanks

Whenever working on an installation, remember to: Disconnect the power supply before starting work. However, the probe may be installed when the tank contains product.



##### Ferrule height

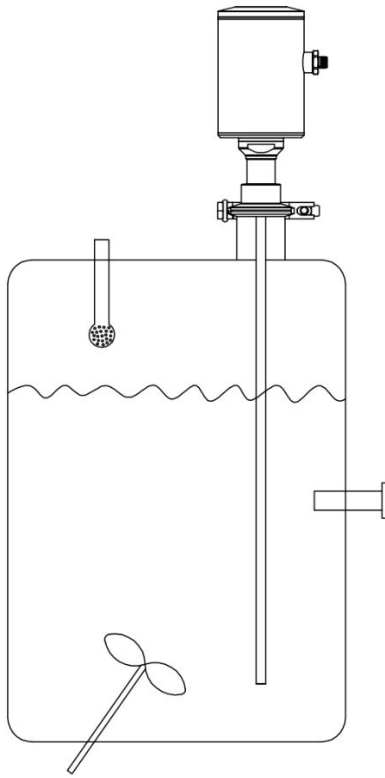
Do not fit a ferrule longer than its diameter



$L \leq \varnothing D$ , where  
 L = ferrule length and  
 D = ferrule diameter

Contact ANDERSON-NEGELE if this relationship cannot be respected.

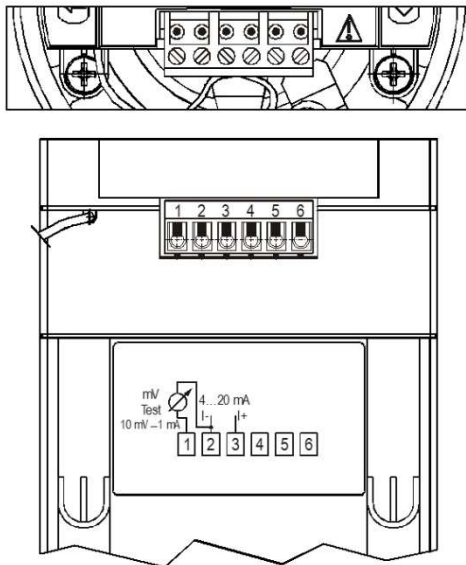
### Agitator in the tank



### Special Considerations

- 1 Agitator
- 2 Support beam perpendicular to the probe
- 3 Abrupt changes in tank cross section
- 4 Beware of false signals from objects protruding into the tank.

## 3.3 WIRING



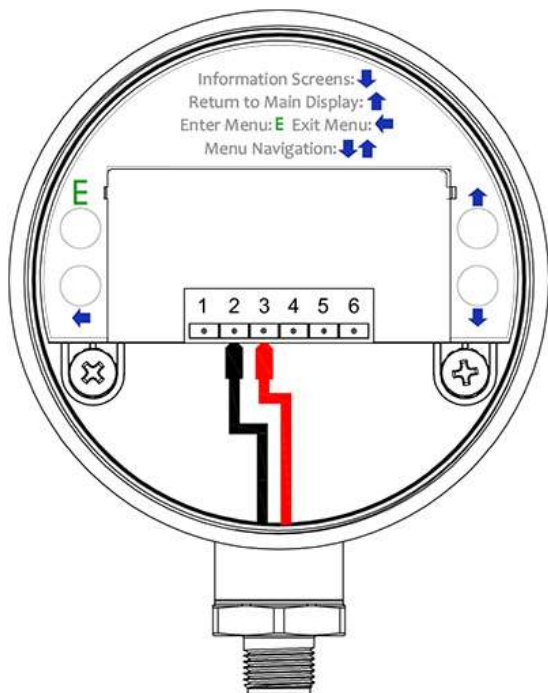
### Wiring for Cable Gland

- 1 Detach the cover of the unit
- 2 Remove display by pulling upward
- 3 Guide the cable into the housing through the cable gland
- 4 Remove a 3/16" length of isolation from the wires and cut away the free part of the shielding.
- 5 Connect the wires of the current loop to terminals 2 and 3 (any polarity).
- 6 Pull back the cable till a 1/2" cable length remains in the housing behind the cable gland.

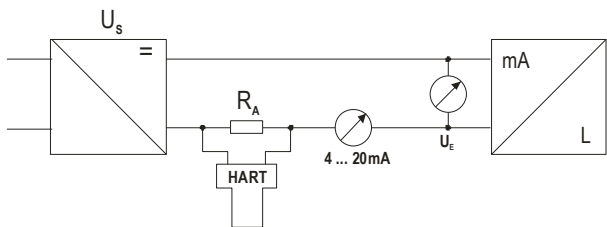
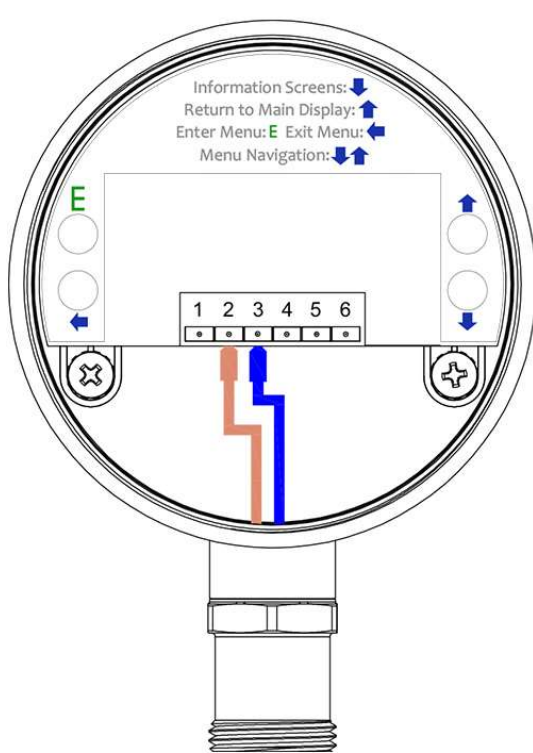
Tighten the cable gland

Check the connection of wires and the tightness at the cable gland.

Wiring for M12



Wiring for MiniFast

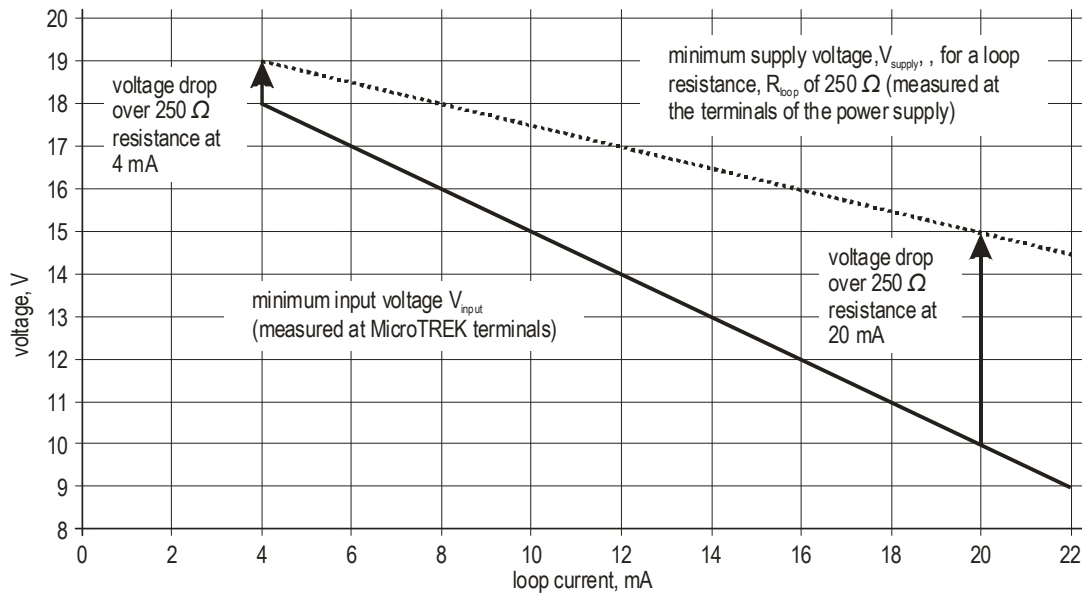


Power Supply

Nominal voltage	24 V DC
Maximum voltage (U input):	35 V DC
Minimum voltage (U input):	dependent on load impedance, see graph below

Load impedance  $R_A$

Loop resistance, $R_{\text{loop}}$	$R_{\text{HART}} + R_{\text{cable}} + R_{\text{ammeter}}$	Ohm
Minimum load impedance $R_A$	0	Ohm
Maximum load impedance $R_A$	750	Ohm
$R_{\text{HART}}$ resistance for HART® communication	250	Ohm, recommended



Line A = minimum voltage at the AGW 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:  $U_{\text{power minimum 22}} = 22 \text{ mA} \times \text{load impedance} + U_{\text{input minimum 22}}$

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

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

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

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

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.

### 3.4 POWER-ON AND START-UP

The AGW is pre-configured in accordance to customer order specifications and measurements can be made immediately.

A start-up time of not less than 60 seconds should be allowed once the unit is connected and the power is switched on.

### 3.5 AVAILABLE USER INTERFACES

Programming of AGW can be done using the following:

Anderson-Negele E-Scope

See chapter "4.1 Programming with A-N E-Scope software". (PC needed.)

Display unit

See chapter "4.2 Programming with display unit".

## 4 PROGRAMMING

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AGW can be programmed in two (basic) ways.

Programming with A-N E-Scope software

Programming with display unit

### 4.1 PROGRAMMING WITH A-N E-SCOPE SOFTWARE

#### 4.1.1 A-N E-Scope: installation and execution.

E-Scope is a Windows software. It is used for programming the unit and displaying the measured variables. Microsoft Windows XP or higher is required.

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

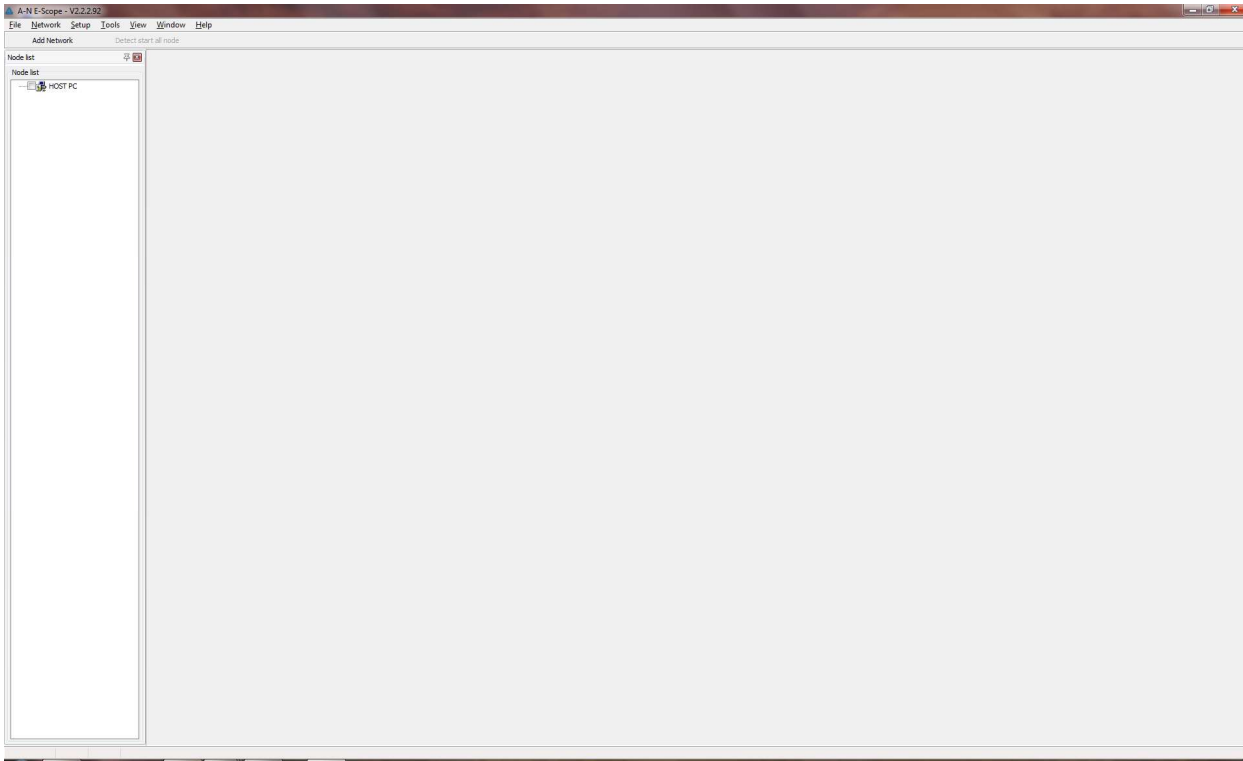
Installing the program: execute the file "escape.exe" and follow the instructions on the screen.

Running the program:

Once the program is installed, execute the “escape.exe” file.



The screen shown below will be displayed.

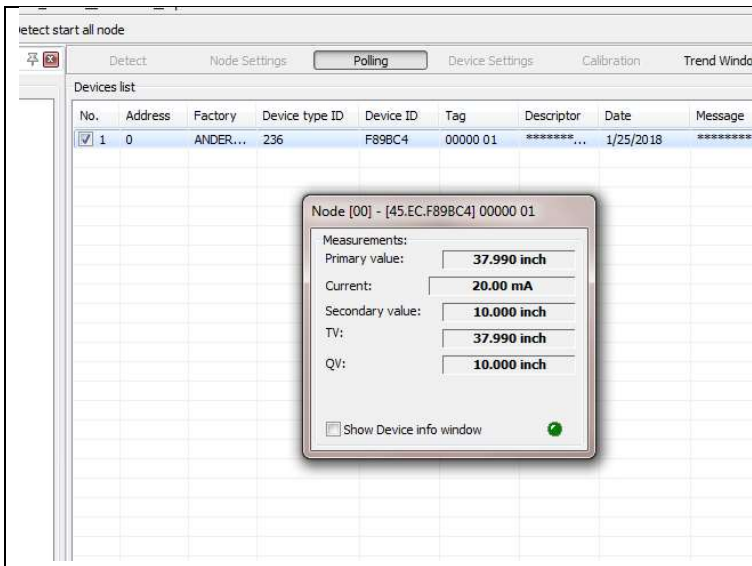


Click on “Add Network”. The serial com port with correct settings should already be selected. Just click “Ok”



Click “Detect” to start scanning the devices. Once the scanning is complete, all the connected devices will be shown in the Devices list. Software will read the parameters for all the connected devices after the scanning is complete. Any device can be monitored, by selecting the check box and clicking “Polling”.

To turnoff monitoring, click “Polling” again.



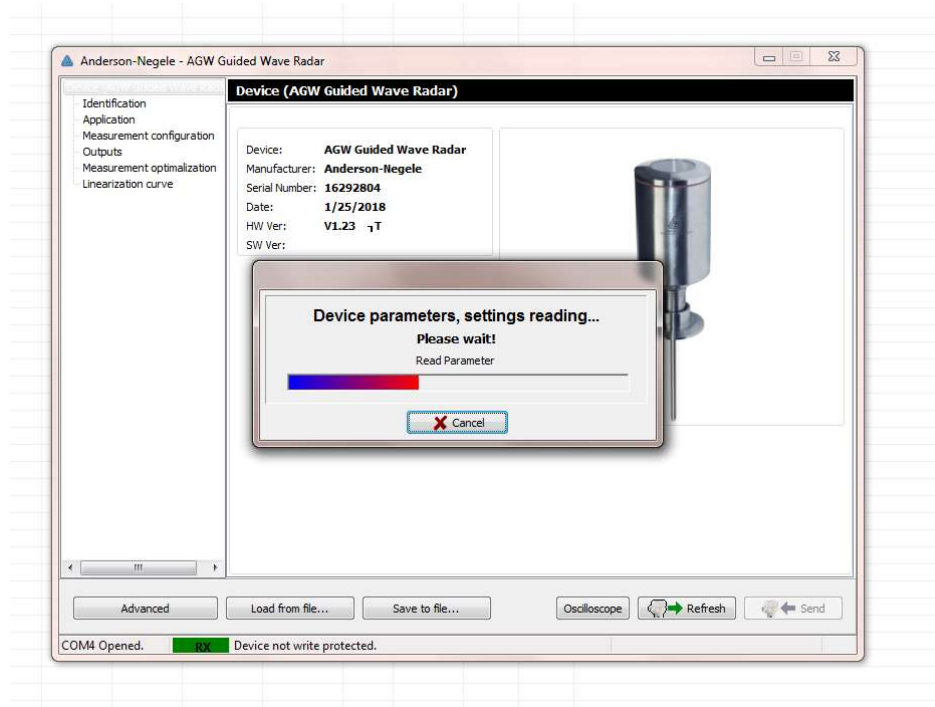
When in level mode;

Primary V=Distance from end of probe (level)

Current =mA output

Second V = Distance from flange to level (Distance)

When the "Polling" is off, "Device Settings" button is active and clicking that will open the configuration dialog box. Basic settings of the device can be modified in the configuration. Also, there is an oscilloscope button which can be used to display the reflections detected by the probe.



Set primary variable to Volume in the unit of measure to be used.

Setting up a volume table – (Use "Linearization Curve" option from the left pane in the Device Settings on the e-scope software.)

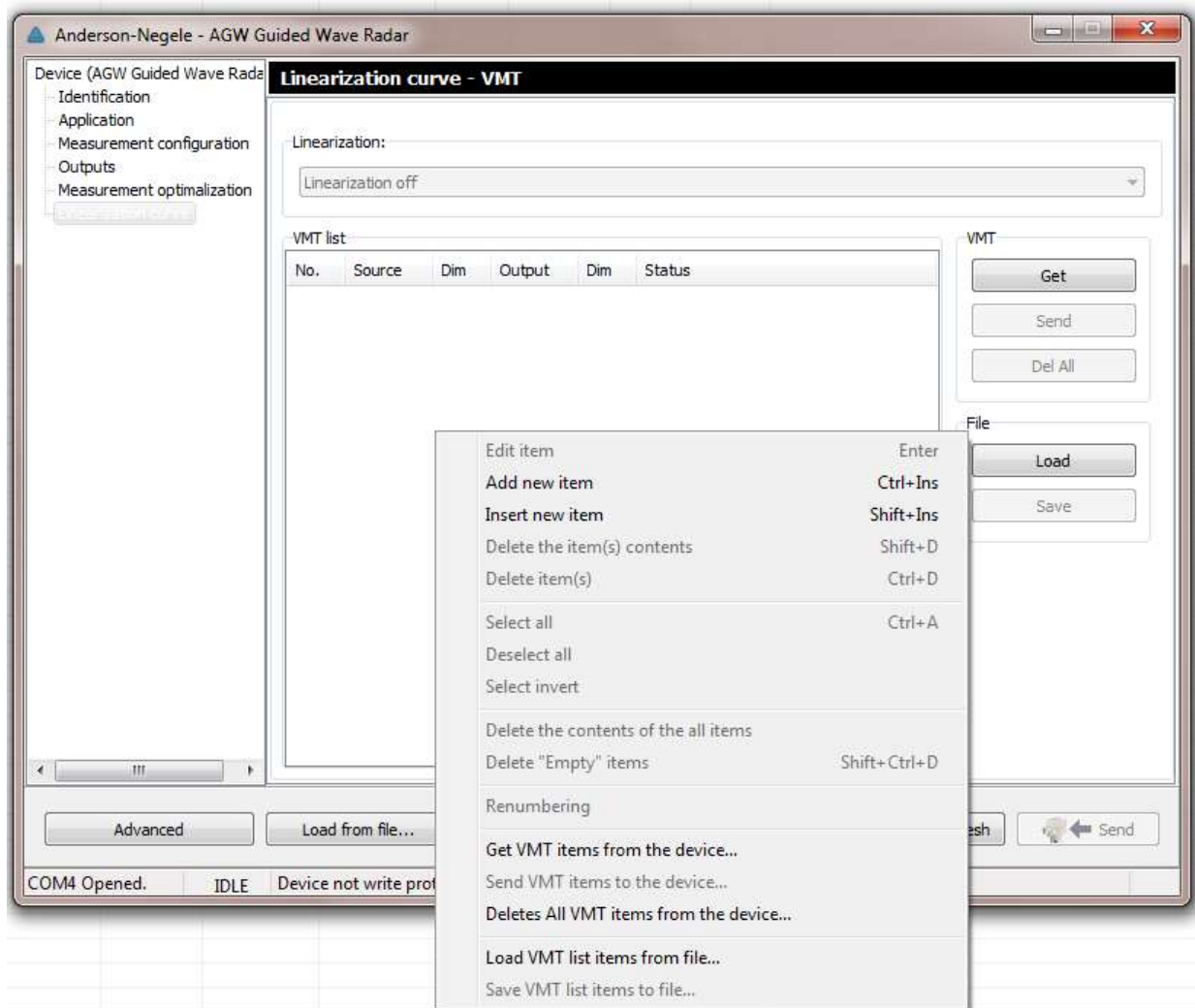
To be able to measure the volume, a conversion table (strapping table) will need to be created using the e-scope program or the HART communicator.

The strapping table assigns defined volumes to the various levels.

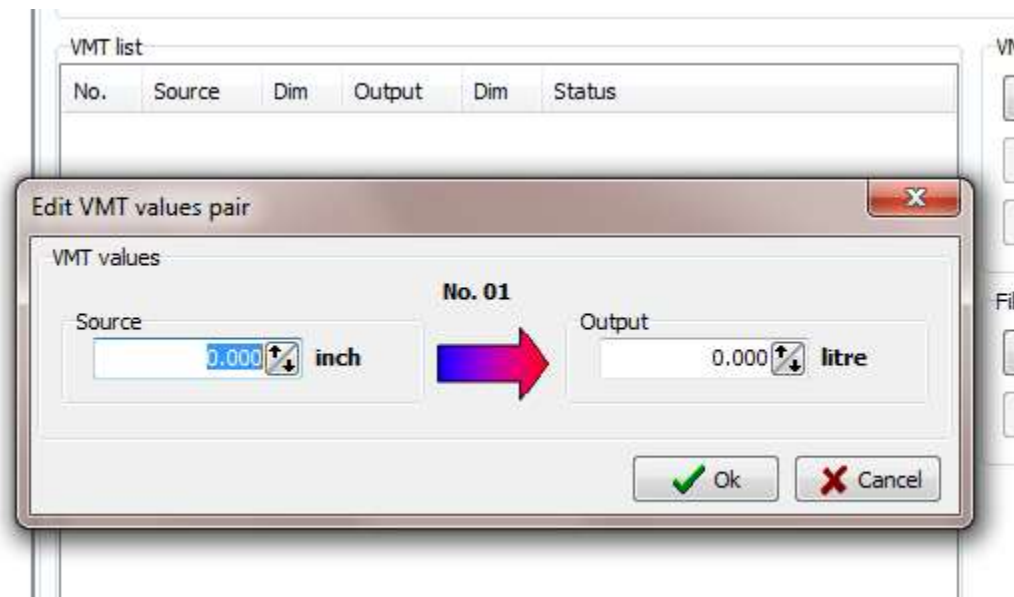
In the case of non-linear tanks, e.g. tanks with dish bottom, the accuracy of volumetric measurement will depend on the number of entered “level/volume pairs.” The maximum number of pairs (point) that can be set is 20. The volume is linearly determined (interpolated) between 2 points.

The conversion table is generally used for volume, but can also be used for mass and flow. Below shows the screenshot on how to enter the points and perform a wet calibration.

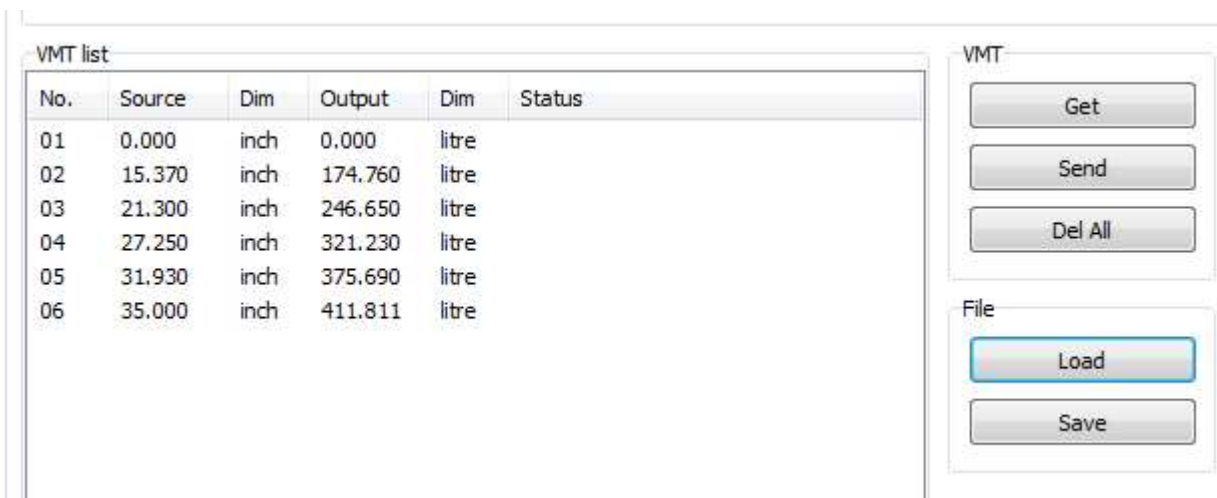
1. When in Linearization Curve option in the Device Settings, do a right click. The below screen with the options would be seen.



- Click on “Add new item” to enter the point and the corresponding volume.

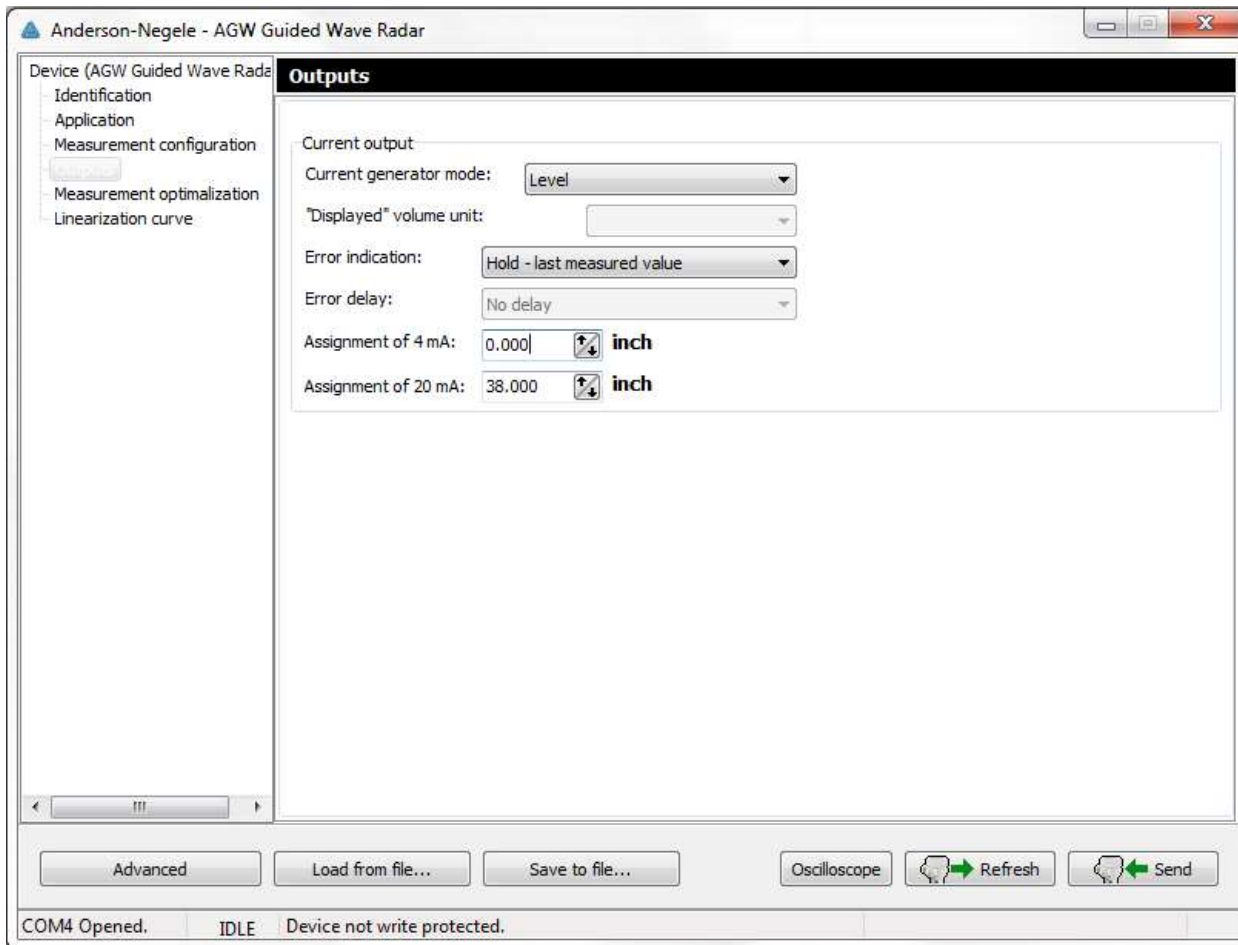


- Repeat the procedure for all the number of points that needs to be entered. For each point a level and a volume must be entered. Each point should have a value higher than preceding one. As the points are being added, they are shown on the screen.



- Once all the points have been entered, click “Send” to perform calibration on the AGW unit.
- It is recommended to click “Save” to save the volume table for the probe and level to your computer
- Clicking “Get” button will retrieve the volume table stored on your computer.

7. There is also an option to “Load/Save” the volume table in the computer; for easy loading of all the parameters in the VMT list box.

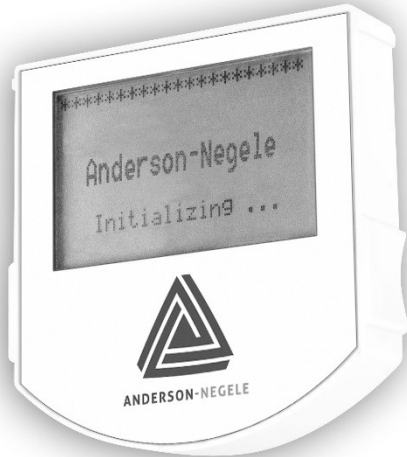


## 4.2 PROGRAMMING WITH DISPLAY UNIT

The main parameters of the AGW can be also set using the display unit. The default display shows the primary measured value (which the output current is calculated from). Besides the numerical display there is a bargraph on the right showing the value of the current output.

Programming is helped by a text-based menu. Navigation in the menu can be done with  $\ominus$  /  $\uparrow$  /  $\downarrow$  /  $\oplus$  buttons.

### 4.2.1 Display unit



Display	LCD
Ambient temperature	– 20°C...+60°C

### 4.2.2 AGW's behavior in manual programming mode

After power-up AGW shows the measured value on the display.

REMOTE MODE:

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

If the HART master does not refresh the display will show the last measured values.

Entering the menu can be done by pressing the  $\ominus$  button. Scrolling the menu can be done by pressing  $\uparrow$  and  $\downarrow$  buttons. Enter the selected menu point with  $\ominus$  button. Exit to the previous menu with  $\oplus$  button.

When leaving the AGW in (programming) menu after 30 minutes the instrument automatically returns to measuring mode.

Because manual programming and remote programming (with external HART master, or E-SCOPE software) cannot be performed at the same time (as both of them act like a HART master) only one programming mode has priority and this is manual programming.

During manual programming the instrument sends the "BUSY" response to the external HART master device. (HART response code 32 - Device is busy)

### 4.2.3 Manual programming

The menu structure is similar to the E-Scope parameter structure.

Main menu	Sub-menu
BASIC SETUP	
	TANK HEIGHT
	DEAD ZONE
	CLOSE-END BLOCKING
	DAMPING TIME
	PROBE LENGTH
OUTPUT SETUP	
	CURRENT MODE
	FAILURE CURRENT
	CURRENT MIN
	CURRENT MAX
	ERROR DELAY
APPLICATION	
	APPLICATION TYPE

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

- Text-based list:            Navigation is the same as in menu lists.  
                                      Accept changes with **Ⓔ** button, cancel changes (and exit) with **⬅** button.
- Numerical field:           Serves for editing a numeric value.

Editing is helped by a cursor (inverted character).

Change the value of the selected digit with **⬆** / **⬇** buttons  
 (there is no under-, and overflow between the characters).

Selecting a digit can be done using the **⬅** button.

Accept changes with **Ⓔ** button.

After accepting the parameter change the AGW checks the parameter and downloads it.

If parameter is incorrect the CHECK/WRITE FAILED! message appears.

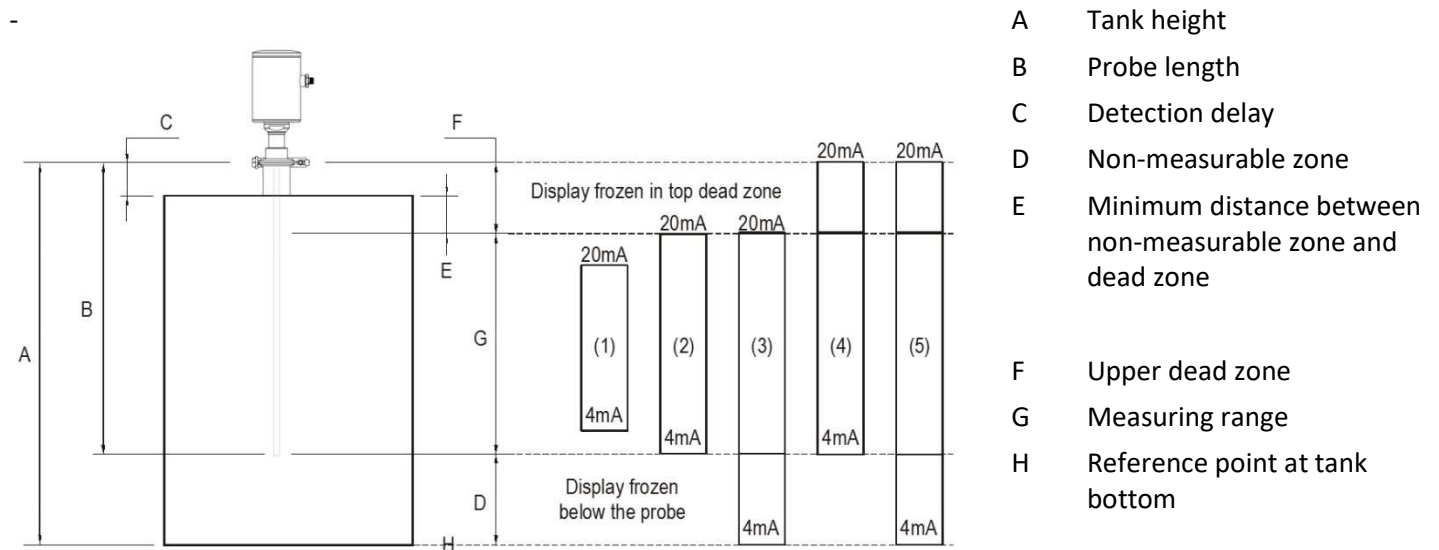
### 4.3 AGW

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 is in the tank;

The measurement scale:

five possible configurations for analogue current output – with “Level” selected in E-SCOPE: Current 1 Item



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 = tank height – probe length + H  
 Scale max.: 20 mA = tank height – dead zone
- (3) The “current output” range is greater than the measuring range:  
 Scale min.: 4 mA = 0.0  
 Scale max.: 20 mA = tank height – dead zone
- (4) The “current output” range is greater than the measuring range:  
 Scale min.: 4 mA = tank height – probe length + H  
 Scale max.: 20 mA = tank height
- (5) The “current output” range is greater than the measuring range:  
 Scale min.: 4 mA = 0.0  
 Scale max.: 20 mA = tank height

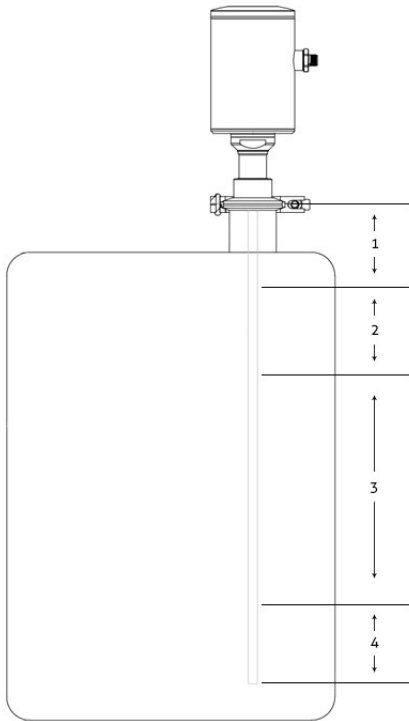


NOTE: The reference point for distance measurements is the bottom of the flange face.

### 4.3.1 Sensor 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 E-SCOPE - F8-Marker display function to follow the measurement status of the gauge.



#### Zone 1: Dead and detection delay zones

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

#### Zone 2: Full zone (and dead zone)

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

#### Zone 3: Central measurement zone

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

#### Zone 4: Empty zone

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

### 4.3.2 Gain and voltage amplitude

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

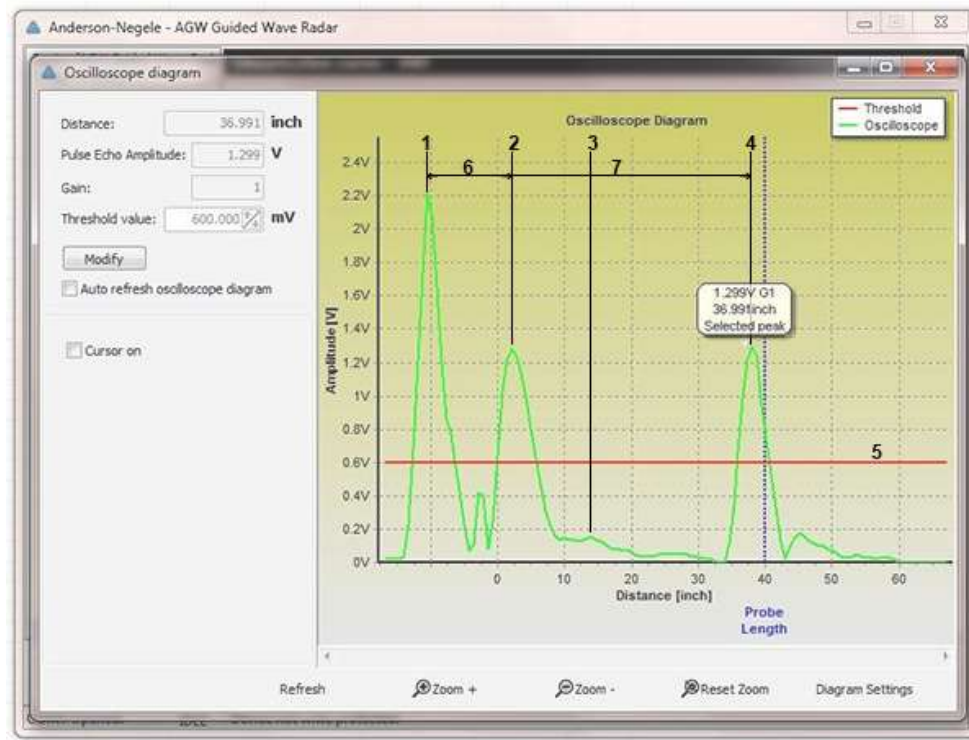
Level measurement: Level pulse amplitude and threshold

After connection to a power supply, the AGW will:

Measure reflection pulses in terms of voltage amplitude by cycling through a set of gains.

2. Identify the highest amplitude as being the product level.

This screenshot of the E-SCOPE 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-meter steps).  
Dynamic configuration menu
- 6 Offset
- 7 Distance measured as a function of time

### 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  $\epsilon_K$ , multiple interference reflections or unfavorable installation conditions.

The level threshold should be half-way between the invalid interference signals and the level reflection signal.

4.3.3 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 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

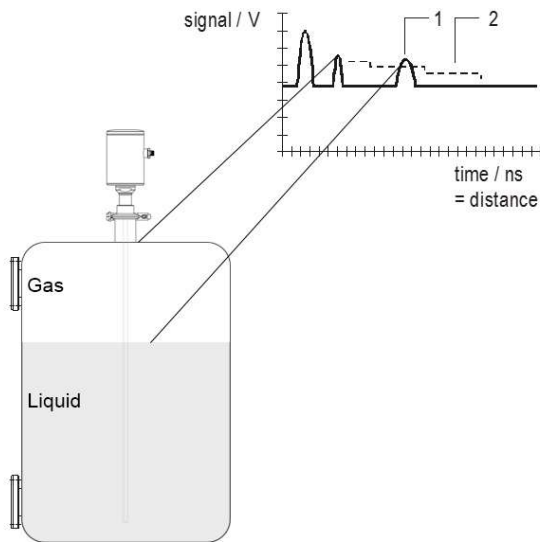
Characteristics

The level of the top product can be detected

if it has a minimum layer of approximately 4” - when measuring a top product with a dielectric constant of  $\epsilon_K = 2.4$ .

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.

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

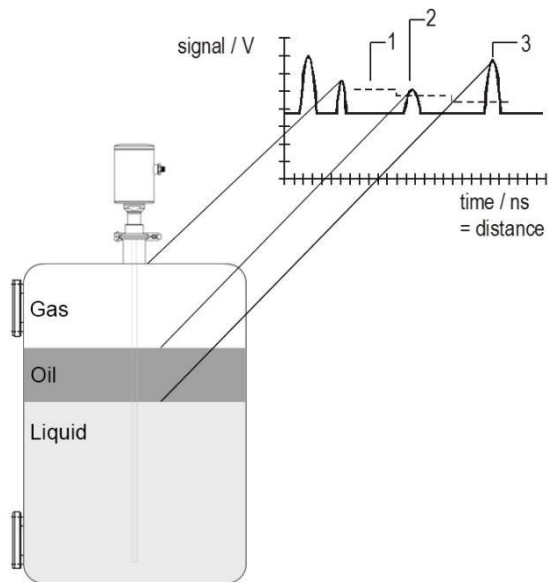


With Factory Menu:  
Application Type set to 1 liquid, 1 level, the AGW 2-wire will search for the return signal with the highest amplitude (i.e. higher than the threshold). It will measure the oil level.

- 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:

Application Type set to 2 liquids, 1 level, the AGW will search for the first return signal higher than the control threshold.

It will correctly measure the oil level (i.e. “level”).

- |   |                            |
|---|----------------------------|
| 1 | Threshold                  |
| 2 | Level signal               |
| 3 | Oil-water interface signal |

For further information, please contact ANDERSON-NEGELE.

## 4.4 TROUBLESHOOTING

Event	Fault	Action
Error messages		
"Tank full" status 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 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 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, 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 dynamic configuration in E-SCOPE.
"Reference not found" status	Occurs when there is a problem with the time base on the HF board.	Please contact ANDERSON-NEGELE.
"Level lost" and "Reference not found" status 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 ANDERSON-NEGELE.
"Flange not found" status	The signal converter has been incorrectly configured to measure with a cable or rod probe when it is equipped with a coaxial probe. This may be also due to installation on a long nozzle which has the effect of attenuating the flange pulse.	Contact ANDERSON-NEGELE for the corrective procedure.

Event	Fault	Action
"Delay out of limits" status reading is frozen.	The emitted pulse has not been detected.	The signal converter may need replacing. Please contact ANDERSON-NEGELE.

	The gauge will not work until it has been found.	
"Negative voltage error" *	Occurs when there is a problem with the time base on the HF board.	Please contact ANDERSON-NEGELE.
"VC01 voltage error" *		
"VC02 voltage error" *		
"Reprogramming FPGA" *		

Event	Fault	Action
General operation		
Instrument is not accurate with a product that has a high dielectric constant. A constant offset is observed when taking measurements.	Tank height is not correct.	<p>Check current output and tank height parameters.</p> <p>If the signal converter has been replaced, verify that factory calibration parameters are still the same.</p> <p>Ask ANDERSON-NEGELE for the factory calibration sheet (if not supplied) and the password for access to the factory menu.</p>
The AGW 2-wire indicates an incorrect level value.	The AGW 2-wire measures a non-valid reflection.	<p>Check the tank for obstructions and verify that the probe is clean.</p> <p>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.</p> <p>In any case use the E-Scope oscilloscope function to visualize and to analyze the application.</p> <p>The threshold level must be adjusted so that it masks the disturbances. It also gives enough margin for detection of the level pulse.</p> <p>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. Ensure that no contact is possible.</p>
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.	<p>Contact ANDERSON-NEGELE for the corrective procedure or refer to the Service Manual.</p> <p>Check that Factory Menu: Application Type is set to "2 liquids, 1 level".</p> <p>Check also that there is a layer of more than 4" of top product above the bottom product.</p>

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 ANDERSON-NEGELE
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
	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 ANDERSON-NEGELE
The value at the current output does not correspond to the value at the display (E-Scope).	The current output settings are incorrect.	Check the current loop and the connections. Configure the output – also try adjusting the threshold
Data communication via the digital interface is not working.  The AGW is in its startup phase, wait 50 seconds and try again.	The communication parameters of the computer are set incorrectly.	Check computer setting (address/device number).
	Bad connection to the interface.	Check connection.
	Current output value is < 4 mA.	If problem persists then contact ANDERSON-NEGELE
	Current output value is = 22 mA	

## 5 WARRANTY AND RETURN STATEMENT

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These products are sold by The Anderson Instrument Company (Anderson) under the warranties set forth in the following paragraphs. Such warranties are extended only with respect to a purchase of these products, as new merchandise, directly from Anderson or from an Anderson distributor, representative or reseller, and are extended only to the first buyer thereof who purchases them other than for the purpose of resale.

### Warranty

These products are warranted to be free from functional defects in materials and workmanship at the time the products leave the Anderson factory and to conform at that time to the specifications set forth in the relevant Anderson instruction manual or manuals, sheet or sheets, for such products for a period of two years.

THERE ARE NO EXPRESSED OR IMPLIED WARRANTIES WHICH EXTEND BEYOND THE WARRANTIES HEREIN AND ABOVE SET FORTH. ANDERSON MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE PRODUCTS.

### Limitations

Anderson shall not be liable for any incidental damages, consequential damages, special damages, or any other damages, costs or expenses excepting only the cost or expense of repair or replacement as described above.

Products must be installed and maintained in accordance with Anderson instructions. Users are responsible for the suitability of the products to their application. There is no warranty against damage resulting from corrosion, misapplication, improper specifications or other operating condition beyond our control. Claims against carriers for damage in transit must be filed by the buyer.

This warranty is void if the purchaser uses non-factory approved replacement parts and supplies or if the purchaser attempts to repair the product themselves or through a third party without Anderson authorization.

### Returns

Anderson's sole and exclusive obligation and buyer's sole and exclusive remedy under the above warranty is limited to repairing or replacing (at Anderson's option), free of charge, the products which are reported in writing to Anderson at its main office indicated below.

Anderson is to be advised of return requests during normal business hours and such returns are to include a statement of the observed deficiency. The buyer shall pre-pay shipping charges for products returned and Anderson or its representative shall pay for the return of the products to the buyer.

Approved returns should be sent to:

ANDERSON INSTRUMENT COMPANY INC.

ATT: REPAIR DEPARTMENT

156 AURIESVILLE ROAD

FULTONVILLE, NY 12072 USA



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