Operating Instructions

for

Guided Wave Radar Level Transmitter

(TDR)

Model: NGM

We don’t accept warranty and liability claims neither upon this publication nor in case of improper treatment of the described products.
The document may contain technical inaccuracies and typographical errors. The content will be revised on a regular basis. These changes will be implemented in later versions. The described products can be improved and changed at any time without prior notice.

1. Contents

Manufactured and sold by:

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2. Note

Please read these operating instructions before unpacking and putting the unit into operation. Follow the instructions precisely as described herein.
The devices are only to be used, maintained and serviced by persons familiar with these operating instructions and in accordance with local regulations applying to Health & Safety and prevention of accidents.

When used in machines, the measuring unit should be used only when the machines fulfil the EC-machine guidelines.

This quick installation guide gives instructions for mounting, wiring, and basic configuration of NGM. This will be sufficient to achieve a fully functional sensor in most applications. For further details and advanced configuration of NGM, please contact your local distributor or KOBOLD directly.

3. Instrument Inspection

Instruments are inspected before shipping and sent out in perfect condition.
Should damage to a device be visible, we recommend a thorough inspection of the delivery packaging. In case of damage, please inform your parcel service / forwarding agent immediately, since they are responsible for damages during transit.

Scope of delivery:
The standard delivery includes:

- Guided Wave Radar Level Transmitter model: NGM
- Operating Instructions

4. Regulation Use

Any use of the Guided Wave Radar Level Transmitter, model: NGM, which exceeds the manufacturer's specification may invalidate its warranty. Therefore, any resulting damage is not the responsibility of the manufacturer. The user assumes all risk for such usage.

5. Operating Principle

NGM uses TDR (Time Domain Reflectometry) technology, which is also known as Guide Microwave or Guided Wave Radar. This means that low-energy and high-frequency electromagnetic impulses, generated by the sensor's circuitry, are propagated along the probe which is immersed in the liquid or solid to be measured.
When these impulses hit the surface of the media, part of the impulse energy is reflected back up the probe to the circuitry which then calculates the level from the time difference between the impulses reflected.
The sensor can output the analysed level as 4...20 m analogue output, or it can convert the values into freely programmable switching output signal.

6. Mechanical Connection

6.1 Mounting

In case NGM is delivered with a detached probe, attach the probe onto the small threaded stud below the hexagon. Ensure that you mount the counter nut first to secure the probe connection: it has to be interlocked against the probe, NOT against the plastic of the feedthrough (this would result in sheering off the small threaded stud; permanently damaging the sensor).

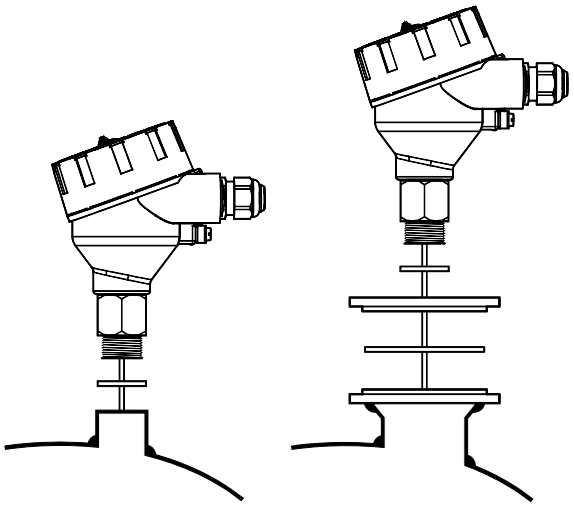


Figure1: mounting

NGM is mounted vertically to the tank via its connection thread, which is screwed directly into a standard threaded tank connection, i.e. weld-in socket, or it can be screwed into a flange, which is then connected to a tank nozzle.
NGM should not be welded directly into the tank. Neither should flanges be welded onto NGM. Welding on the metal parts of NGM will cause serious damage to the sensor.

Do not lift or handle NGM by its probe; this can cause excessive stress on the probe connection. NGM should be handled by the hexagon or the lower section of the housing. Do not screw in NGM by its housing; it should be tightened only via its hexagon (wrench size 32mm).
Tighten the coaxial probe only at its lower hexagon; the upper hexagon of the coaxial probe is not needed for mounting.

The customer has to ensure proper sealing of the sensor connection; based on his process conditions like temperature, pressure and resistance against his process liquids and atmosphere.
G thread connections require a suitable gasket for pressure-tight joints.
The G3/4A connection thread of NGM is supplied with a gasket made of Klingersil C-4400, thickness 2mm. The suggested tightening torque for this thread size, this type of gasket, and a process pressure of max. 40bar is 25Nm (maximum permissible torque: 45 Nm).
For NPT thread connections, pressure-tight joints require a sealant directly on the threads.

6.2 Extended temperature range

NGM with the extended temperature option must be properly included into the tank insulation to prevent excessive temperatures at the sensor housing due to thermal radiation or convection, as well as prevention of condensate formation . However, the insulation layer should not reach higher than the hexagon nut; the cooling fins of the radiator-style temperature extension have to be outside the insulation in order to function properly. If necessary, adjust the height of the mounting socket or nozzle accordingly.

Figure 2: extended temperature option

6.3 PTFE coated single rod probe

PTFE coated probes must be handled carefully to prevent damage to the coating. For detailed instruction show to mount a PTFE coated NGM, please contact your local distributor or KOBOLD directly.

Figure 3: single rod probe, PTFE coated

6.4 Mounting considerations

The probes should be installed so that they are not directly impacted by liquids flowing out of the filling inlet.
They should neither touch nor sway towards other objects inside the tank or the tank/nozzle walls; e.g. by agitator swirls. In applications with very strong fluid movements, which can also cause excessive lateral force on the probe, it is recommended to anchor the probe. The anchoring fixtures are customer supplied.

For further details about mounting NGM or if you would like to anchor the probes, please contact your local distributor or KOBOLD directly.

	single rod / wire rope probe	coaxial probe
nozzle diameter	-[1]	>50mm
nozzle height	-	<300mm
clearance to tank wall or other internal objects	-	>100mm
clearance between probe end and tank bottom	-	>2mm
diameter of bypass chamber / stilling well	-[2]	>25mm

- = no restrictions

[1] enough diameter to fit in the coaxial tube (Ø17,2mm)

[2] enough diameter to fit in the coaxial tube (Ø17,2mm) and enough room around the probe for the liquid to flow in and out of the bypass chamber / stilling well

Figure 4: mounting considerations

The single rod probe is suitable for a very wide range of applications in liquids, but the signal has a wider detection radius around the rod. Thus, it is more responsive for measurement signal disturbances which can be easily overcome by observing a few mounting considerations (see Fig.4) and making simple configuration adjustments to the sensor.

Caution! While using single rod or wire rope probes, activating the powerful disturbance signal suppression feature is strongly recommended.

However, those work most efficiently on stationary interference targets like tall and narrow nozzles or close-by objects. In case that non-stationary interference targets close to the single rod probe, like slowly rotating agitator blades, cause problems with the measurement, it is recommended to use the coaxial probe.
The single rod probe is also the recommended probe type for mounting NGM into bypass chambers or stilling wells. In this case, plastic centering disks are needed to prevent the probe from contacting the wall. Please contact your local distributor or KOBOLD directly for further details.

	covered Probe length								
	6m			12m			20m		
	Tank Ø								
material	3m	6m	9m	3m	6m	9m	3m	6m	9m
Wheat	0,7	0,8	0,9	2	2,7	3	4,1	-	-
Corn	0,6	0,7	0,8	1,8	2,4	2,7	3,7	-	-
Rice	0,5	0,7	0,7	1,5	2,1	2,4	2,8	4,5	
Flour	0,3	0,4	0,4	1,1	1,3	1,5	2,4	3,3	3,7
Sugar	0,7	1	1	1,9	2,8	3,4	3,4	-	-
Silica sand	1,1	1,4	1,5	3,2	4,5	-	-	-	-
Cement	1,2	1,5	1,7	3,2	4,7	-	-	-	-
Alumina	0,9	1,1	1,3	2,3	3,5	4,2	4,3	-	-
Phosphate fertilizer	1,8	2,3	2,6	5	-	-	-	-	-
Fly ash	1	1,3	1,4	2,5	3,9	4,7	4,7	-	-
Coal dust	0,7	0,9	1	1,8	2,7	3,3	3,3	-	-
Plastic pellets	0,4	0,5	0,5	1	1,5	1,7	1,9	3,2	4

- = exceeds the max. tensile load of NGM: 5kN.

Figure 5: approx. pulling forces [kN]

Above figures are guidelines to estimate the approx. pulling forces from free-flowing solids acting on a suspended 4mm wire rope probe without any anchoring in a metal tank with smooth walls

The wire rope probe is recommended for installations in solids, tall tanks and where limited headroom is available. Its performance characteristics and mounting considerations are similar to the single rod probe.

In addition, please consider the following advice when using NGM in solid applications:

The bulk solid inside the tank or silo can exert a considerable tensile load on the wire rope probe, depending on properties of the bulk solid, tank dimension sand covered probe length (see Fig. 5). This can lead to considerable downwards pulling forces on the tank roof, which has to be able to withstand the max. tensile load of NGM: 5kN
It is recommended that the tank be empty during installation. This ensures that the probe hangs down straight and does not get entangled. After installation also regularly check if the wire rope probe got entangled or unbraided
Some bulk solids easily form build-up on the tank wall or on internal structures. This will interfere with the measurements. Choose a mounting position where the wire rope probe is not in contact with, or close to, such product build-up
For anchoring the wire rope probe in solid applications, please contact your local distributor or KOBOLD directly

The coaxial probe does not have restrictions regarding mounting position, tank connection, and proximity to the tank wall or other objects inside the tank.
The coaxial probe is recommended for installing NGM into a non-metallic tank or open pit. If that is not possible, single rod or wire rope probes can be used when NGM is mounted into at least a DN50 metal flange or screwed into a metal sheet with at least Ø150mm.

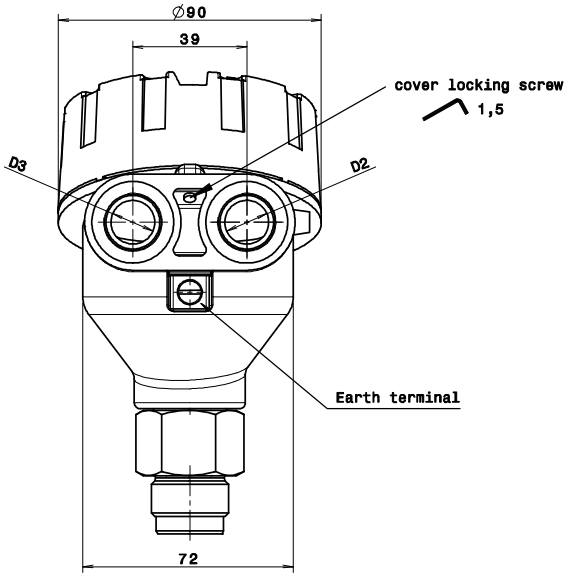


Figure 6: cable entries

6.5 Cable entries and cable glands

The housing has two cable entries and can be ordered with assembled standard screw plugs and cable glands. Nevertheless, the customer has to confirm the suitability of those cable glands for his specific application requirements and cabling; and replace them when necessary.

Both cable entries can be fitted with cable glands or suitable conduit systems. If only one cable gland is fitted, it is recommended to use cable entry D2 (see Fig. 6). Then cable entry D3 has to be closed with a suitable screw plug.

IP68-rated screw plugs and cable glands have to be properly sealed and have to be properly tightened around cable of suitable type and diameter to ensure the IP68 rating of the housing.
Cable entries with metric threads can be sealed by mounting the suitable screw plug or cable gland with matching rubber washers underneath.

Cable entries with NPT threads require a sealant directly on the thread of the screw plug or cable gland.
For M20x1,5 cable entries, NGM comes assembled with:
1 x cable gland M20x1,5, IP68, nylon PA66, for non-armoured cable Ø5…9mm, with EPDM washer, max. tightening torque 6Nm on all hexagons, wrench size 24mm. For protection during shipment it is closed with an EPDM sealing plug which has to be removed for cabling
1 x screw plug, IP68, M20x1,5, nylon PA66, with EPDM washer
For ½" NPT cable entries, NGM comes assembled with:
2 x screw plug, 1/2" NPT, PE-LD. They are not IP68 and are only for housing protection during shipment. They have to be replaced by the customer

When wiring with shielded or armoured cable, suitable cable glands have to be used. The contact between the metal housing and the shielding of the cable is made by using a suitable EMC-type cable gland. Ground the shielding of the cable only on the sensor side; not on the supply side.

7. Electrical Connection

7.1 Wiring

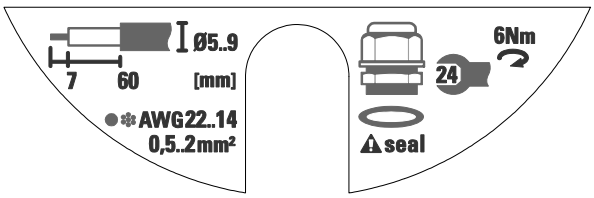


Figure 7: lower sticker on the black plastic cartridge

Verify that the power supply for the sensor is switched off.

Establish an equipotential connection (potential equalization) between the external earth terminal of NGM and the closest ground potential terminal of the tank.

Open the housing cover by turning it counter clockwise. It may be necessary to loosen the cover locking screw with an allen key size 1,5mm. The cover has a safety chain to prevent it from falling to the ground after being unscrewed.

The lower sticker on the black plastic cartridge inside the housing gives instructions for the standard M20x1,5 cable gland (Fig. 7). When other cable glands are being used, their details have to be observed instead.

Loosen the cable gland and pull the cable through the cable gland into the housing. Pull it far enough to have a convenient length for stripping and handling the cable.

Install cable with a drip loop outside the housing where the bottom of the loop must be lower than the cable entry of the housing.
Dismantle the cable carefully and strip the wires as indicated on the sticker.

The stripped wire ends are connected to the sensor electronic via the green screw less, cage clamp terminal block. It can accommodate stranded and solid wires 0,5…2mm² / AWG 22...14. The usage of cable end sleeves with insulation collar is not recommended.

Simply press an orange lever straight down with a small flat tip screwdriver, insert a stripped wire end into the terminal hole, and release the orange lever; the wire is now connected.

The upper sticker inside the housing illustrates the inputs and outputs if the sensor. Connect all wires accordingly, as indicated in Fig. 8.

Pull the cable back, but make sure its mantle does not retract into the cable gland.

Tighten the cable gland to ensure proper sealing function.

Switch on the power supply for the sensor.

The sensor LED should start blinking green within 6 seconds after connecting the power (during this start-up time the LED is solid green). The blinking green LED indicates that the sensor is in measuring mode and working correctly.

Do not tighten the housing cover yet. Some basic configuration is still to be done…

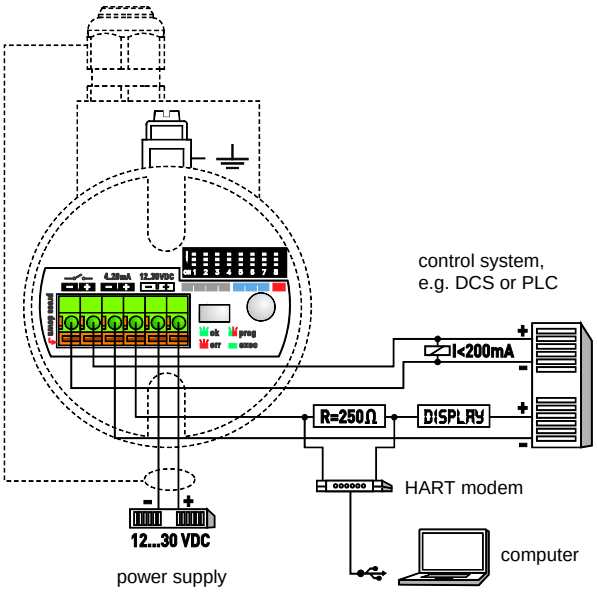


Figure 8: wiring

8. Operation / Configuration / Adjustments

8.1 Control Elements

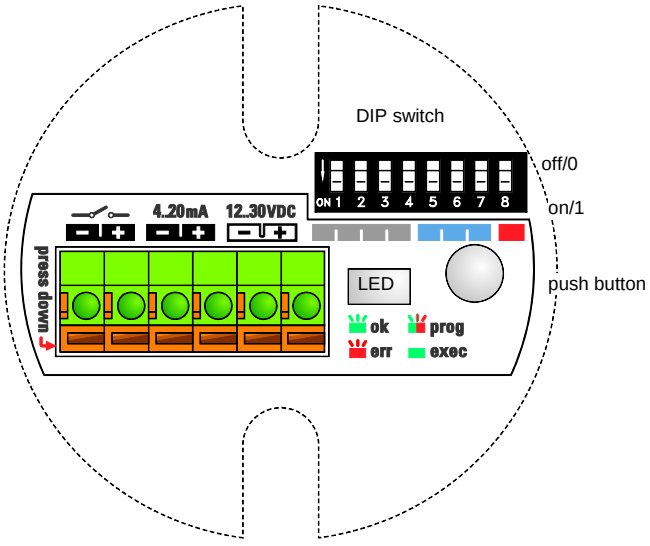


Figure 9: Control Elements

Basic configuration of NGM can be done directly on the device via three control elements: a DIP switch, a single push button and a LED for visual feedback. All settings required to get NGM fully operational can be performed directly on the device; or NGM can be ordered completely pre-configured.

All three control elements are enclosed in the black plastic cartridge inside the housing.

The DIP switch has 8 small white levers. Small numbers from 1 to 8 are printed underneath the levers: they indicate the DIP switch positions and correspond to the ones in Fig.9.
The upper position of a lever is off/0 and the lower position is on/1. On the left side of the DIP switch is also a small indication of the on/1 state.
The off/0 and on/1 states of the DIP switch correspond to the 0/1 indications in Fig.9.

The upper sticker on the black plastic cartridge shows three colour segments close to the DIP switch: red, grey, and blue; they correspond to the coloured rows in Fig.10.
red: indicates DIP switch position 8 which switches between measuring and configuration mode. Only when DIP switch position 8 is on/1, NGM can be configured; configuration mode is indicated by the LED blinking alternately green and red.
When DIP switch position 8 is off/0, NGM is in measuring mode; indicated by the LED blinking green.
It is only possible to enter the configuration mode when DIP switch positions 1 to 7 are off/0 before setting DIP switch position 8 to on/1; otherwise the LED is blinking red to indicate an error
blue: indicates the DIP positions through which groups of functions are selected, e.g. all functions related to the analog current output or the switching output
grey: indicates the DIP positions through which individual functions/configuration settings are selected

When entering into configuration mode, always start from DIP switch position 8 and move towards position 1.
When exiting configuration mode, always set back all the DIP switch positions to 0, starting from position 1 and move towards position 8.

After setting all DIP switch positions to represent the 0/1 sequence of the desired function (as described in Fig.10), the push button has to be pressed to execute the desired function. Execution of the function is indicated by the LED remaining green until the function has been properly executed, in which case the LED returns to blinking alternately green and red.

DIP switch Position							
1	2	3	4	5	6	7	8

DIP switch settings								description
0	0	0	0	0	0	0	0	measuring mode
0	0	0	0	0	0	0	1	configuration mode
function group 1								**analog current output**
0	0	0	1	0	0	1	1	lower range value [4mA]; span 0%
0	0	1	0					upper range value [20mA]; span 100%
0	1	0	0					response time 0,5s[default]
0	1	0	1					response time 2s
0	1	1	0					response time 5s
function group 2								**switching output**
0	0	1	0	0	1	0	1	lower threshold
0	0	1	1					upper threshold
0	1	0	0					NC [default]
0	1	0	1					NO
function group 3								**disturbance signal suppression**
0	0	0	1	0	1	1	1	perform disturbance signal scan
0	0	1	0					disturbance signal scan: do not utilize
0	0	1	1					disturbance signal scan: utilize[default][1]
0	1	0	0					upper dead band: short [default][2] rod probe: 30 mm³ coaxial probe: 0 mm³
0	1	0	1					upper dead band: medium rod probe: 190 mm³ coaxial probe: 160 mm³
0	1	1	0					upper dead band: long rod probe: 390 mm³ coaxial probe: 360 mm³
1	0	0	0					amplitude threshold: low[default]
1	0	0	1					amplitude threshold: medium
1	0	1	0					amplitude threshold: high
1	1	0	0					coaxial probe
1	1	0	1					single rod / wire rope probe
function group 4								**reset**
0	0	0	1	1	0	0	1	reset to delivery configuration
function group 5								**measure probe length**
0	0	0	1	1	0	1	1	measure probe length

[1] for single rod and wire rope probes with a probe length [L] >5.500mm only the top 5.500mm of the probe get scanned for disturbance signals

[2] for single rod and wire rope probes with a probe length [L] >3.000mm the default setting is upper dead band: long

[3] determined at reference point (sealing surface of connection thread, see dimensional drawing)

Function groups 4 and 5 require the push button to be pressed and held for at least 10 seconds for the functions to be executed.

Figure 10: DIP switch settings

8.2 Configuration single rod probe or wire rope probe

For most standard applications, executing the three basic configuration steps below issufficient to achieve a fully functional sensor; providing a continuous level measurement through its analog current output.
For further details and advanced configuration of NGM, please contact your local distributor or KOBOLD directly.

8.2.1 perform disturbance signal scan

- NGM has to be mounted in its final position and the tank has to be completely empty in order to perform a disturbance signal scan
- set the DIP switch positions to the 0/1 sequence in Fig. 11on the left; start from position 8 and move towards position 1!
- LED will blink alternately green and red
- press the push button
- LED will remain green for a few seconds while the disturbance signal scan is being performed
- once the scan is completed successfully, the LED will return to blinking alternately green and red

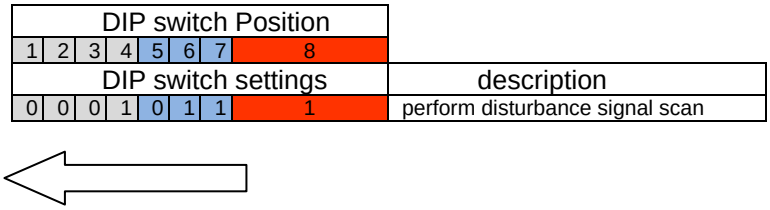


Figure 11: perform disturbance signal scan

8.2.2 lower range value [4MA]; span 0%

- fill the liquid into the tank up to the level where you want to position the lower range value [4mA]; span 0%.
- It is recommended that the lower range value stays within the measuring range [M]
- change DIP switch position 6 to off/0
- press the push button
- LED will remain green briefly while the lower range value setting is being executed
- once it has been executed successfully, the LED will return to blinking alternately green and red

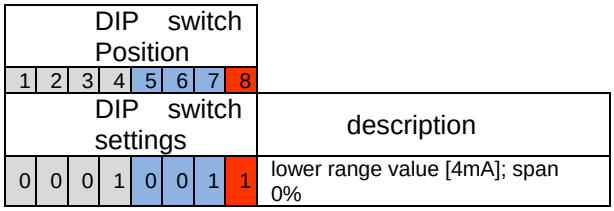


Figure 12: lower range value [4mA]; span 0%

8.2.3 upper range value [20MA]; span 100%

- raise the liquid inside the tank up to the level where you want to position the upper range value [20mA]; span 100%.
- It is recommended that the upper range value stays within the measuring range [M]
- change DIP switch position 3 to on/1
- change DIP switch position 4 to off/0
- press the push button
- LED will remain green briefly while the upper range value setting is being executed
- once it has been executed successfully, the LED will return to blinking alternately green and red
- set all the DIP switch positions to 0 as indicated in Fig.14on the left; start from position 1 and move towards position 8!
- the LED will change to blinking green

DIP switch Position								
1	2	3	4	5	6	7	8	
DIP switch settings								description
0	0	1	0	0	0	1	1	upper range value [20mA]; span 100%

Figure 13: upper range value [20mA]; span 100%

Tighten the housing cover properly by turning it clockwise; make sure the cover safety chain does not tangle up. If desired, tighten the cover locking screw with an allen key size 1,5mm.

DIP switch Position								
1	2	3	4	5	6	7	8	
DIP switch settings								description
0	0	0	0	0	0	0	0	measuring mode

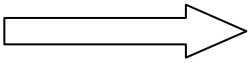


Figure 14: measuring mode

8.3 Configuration Coaxial probe

The coaxial probe has a very robust and reliable measurement performance in almost any application without further configuration. For basic configuration only the range values for the analogue current output have to be set.
For further details and advanced configuration of NGM, please contact your local distributor or KOBOLD directly.

8.3.1 lower range value [4MA]; span 0%

- set the DIP switch positions to the 0/1 sequence in Fig.15on the left; start from position 8 and move towards position 1!
- lower the liquid inside the tank down to the level where you want to position the lower range value [4mA]; span 0%.
  It is recommended that the lower range value stays within the measuring range [M]
- press the push button
- LED will remain green briefly while the lower range value setting is being executed
- once it has been executed successfully, the LED will return to blinking alternately green and red

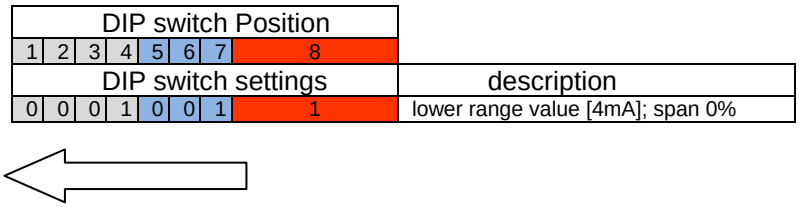


Figure 15: lower range value [4mA]; span 0%

8.3.2 upper range value [20MA]; span 100%

- raise the liquid inside the tank up to the level where you want to position the upper range value [20mA]; span 100%.
  It is recommended that the upper range value stays within the measuring range [M]
- change DIP switch position 3 to on/1
- change DIP switch position 4 to off/0.
- press the push button
- LED will remain green briefly while the upper range value setting is being executed
- once it has been executed successfully, the LED will return to blinking alternately green and red
- set all the DIP switch positions to 0 as indicated in Fig.17on the left; start from position 1 and move towards position 8!
- the LED will change to blinking green

DIP switch Position							
1	2	3	4	5	6	7	8
DIP switch settings							description
0	0	1	0	0	0	1	1	upper range value [20mA]; span 100%

Figure 16: upper range value [20mA]; span 100%

Tighten the housing cover properly by turning it clockwise; make sure the cover safety chain does not tangle up. If desired, tighten the cover locking screw with an allen key size 1,5mm.

DIP switch Position							
1	2	3	4	5	6	7	8
DIP switch settings							description
0	0	0	0	0	0	0	0	measuring mode

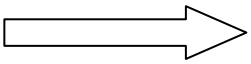


Figure 17: measuring mode

8.4 probe length and measuring range

The reference point for definition of the probe length [L] is always the shoulder of the connection thread. The probe length [L] is an important mechanical dimension which is needed to make sure the probe physically fits into the tank at the anticipated mounting location; it is not equal to the actual measuring range [M] of the sensor!
TDR level sensors have small inactive areas at top [I1] and bottom [I2] of the probe. Those are due to the presence of unavoidable signal disturbances at both ends of the probe. In these inactive areas the measurements are non-linear or have reduced accuracy. Therefore, it is not recommended to actually measure level within those inactive areas. Their length depends on the probe type and the reflectivity (i.e. dielectric constant) of the liquid to be measured.
The measuring range [M] of NGM extends between the top and bottom inactive areas of the probe; this is the area in which NGM will have the specified measurement performance. It is recommended that the maximum and minimum liquid levels to be measured in the tank are actually within the measuring range [M] of the sensor. The span between the lower range value [4mA] and the upper range value [20mA] of the analog current output is equal to 0...100% of your continuous level measurement reading. It is recommended that the span between those two range values stays within the measuring range [M].

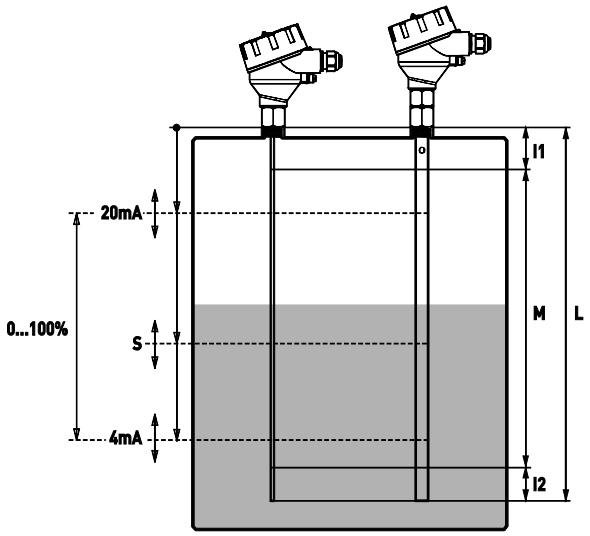


Figure 18: probe length and measuring range

8.5 disturbance signal scan

The disturbance signal scan is a powerful disturbance signal suppression feature of NGM. The sensorscans its entire probe length for any disturbance signals in the application that could potentially be misinterpreted as level readings, memorizes and suppresses them during operation; that way NGM only recognizes the actual level signals caused by the liquid to be measured.
The disturbance signal scan is intended for the single rod probe, since its signal has a wider detection radius around the rod, making it more responsive for measurement signal disturbances.
The disturbance signal scan works most efficiently on stationary interference targets like tall and narrow nozzles or close-by objects. Thus, NGM has to be mounted in its final position and the tank has to be completely empty in order to perform a disturbance signal scan; that will ensure a reliable identification of the actual disturbance signals only. In case that non-stationary interference targets close to the single rod probe, like slowly rotating agitator blades or streams of liquid being filled into the tank, cause problems with the measurement, it is recommended to use the coaxial probe.
Performing a disturbance signal scan is the prerequisite for utilizing this feature of NGM.

8.6 Guide to communicating from a PC to a NGM probe

(Configuration of device specific parameters)

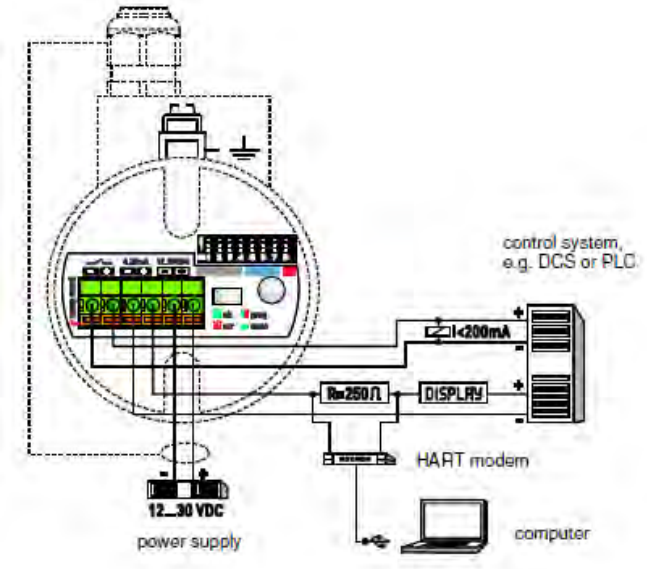
8.6.1 Communication with NGM

Requirements:

- PC with Microsoft Office
- Excel file NGM Configuration Tool LA (HART) V172.xls (for serial no. below 335490 (non-Ex) and serial no. below E5048 (Ex))
- Excel file NGM Configuration Tool LA (HART) V175.xls (from serial no. 335490 (non-Ex) and serial no. E5048 (Ex))
  This file enables the customer to configure measuring parameters, analogue output, measuring length and probe/rope shortening/extending.
- HART Modem with USB connector
- Communication resistor approx. 250 Ohm
- NGM level probe
- Power supply 24VDC

Connection:

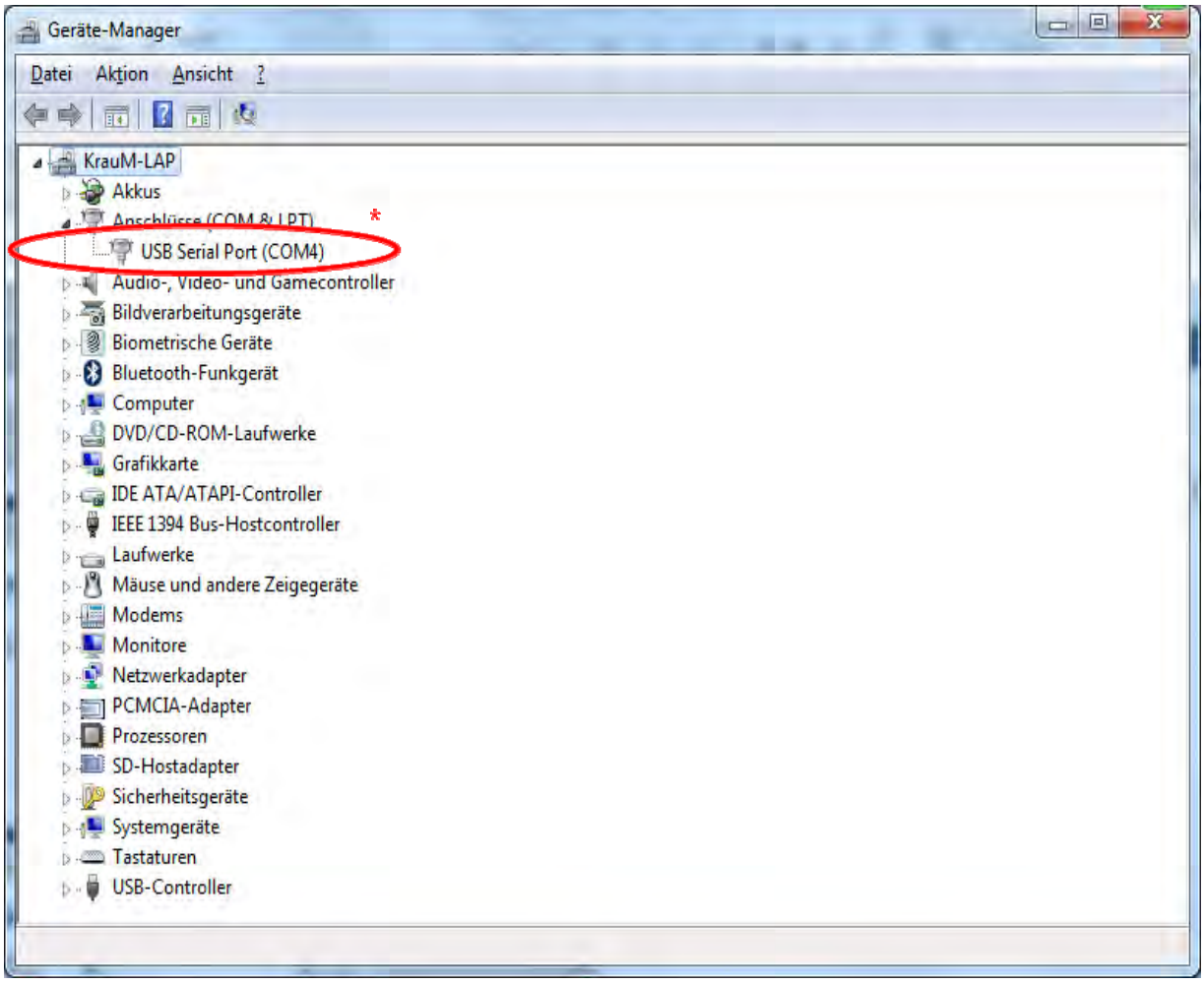
- Connect the NGM probe to the power supply
- The LED at the NGM must start to flash green
- Connect the resistor between + and – of the active 4…20mA output.
- Connect in parallel the HART modem to the resistor and plug in the USB connector to the PC



8.6.2 Connection of a NGM Probe to a PC

- Check the COM port assignment of the PC to the USB HART modem with the Device Manager

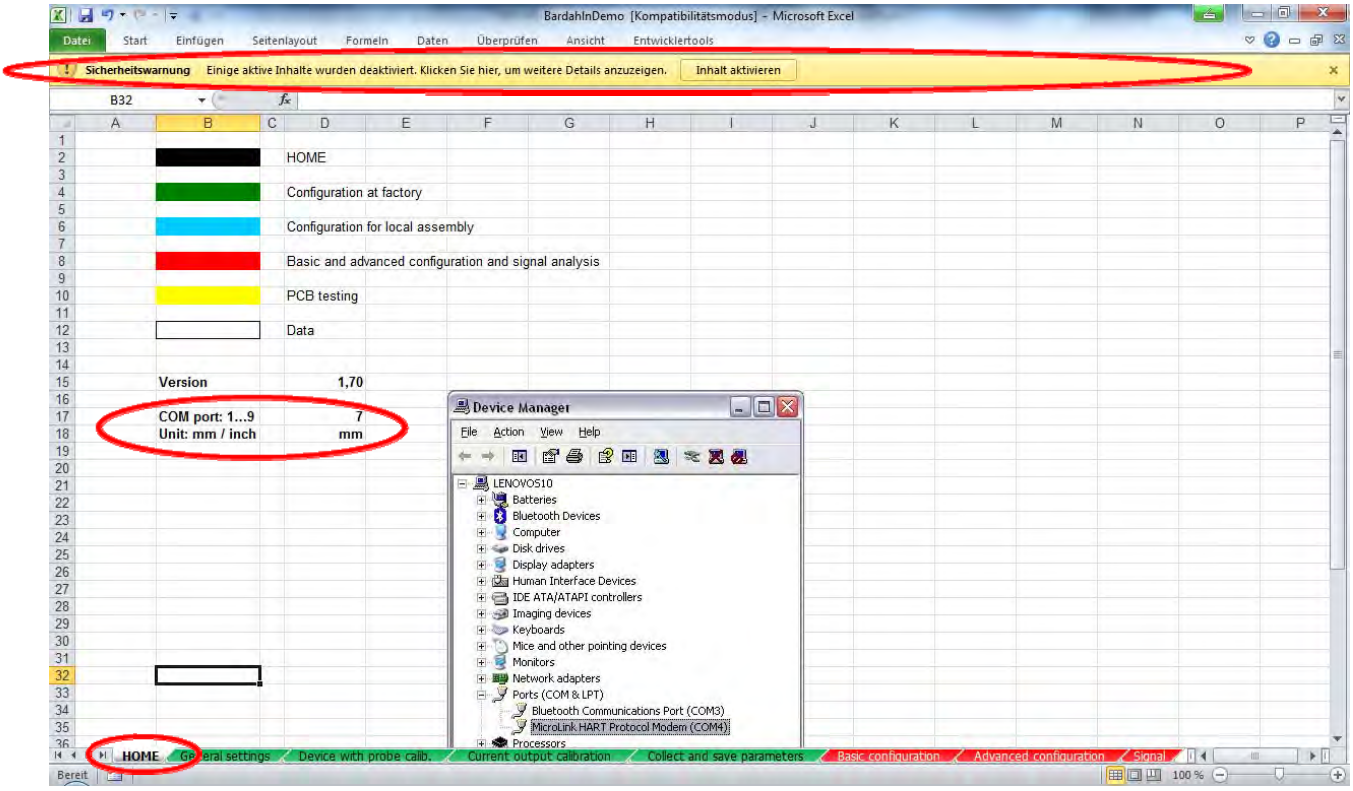
http://www.computerhope.com/issues/ch000833.htm



* In this case COM port 4 has been assigned to the HART modem

8.6.3 First Steps with the Excel Tool

1. Open the Excel file
2. Prerequisite: worksheet is active and the macros are running
   (*Hint: A restart of the Excel file might help to activate the Macros.*)
3. HOME
4. Enter the assigned COM port indicated at the device manager.



For the usage of the Excel tool, a click on the necessary cell activates the communication and/or parameters can be changed. For re-sending the command, click on a free cell elsewhere and move back to the required cell. The OK status has to return for a successful communication.

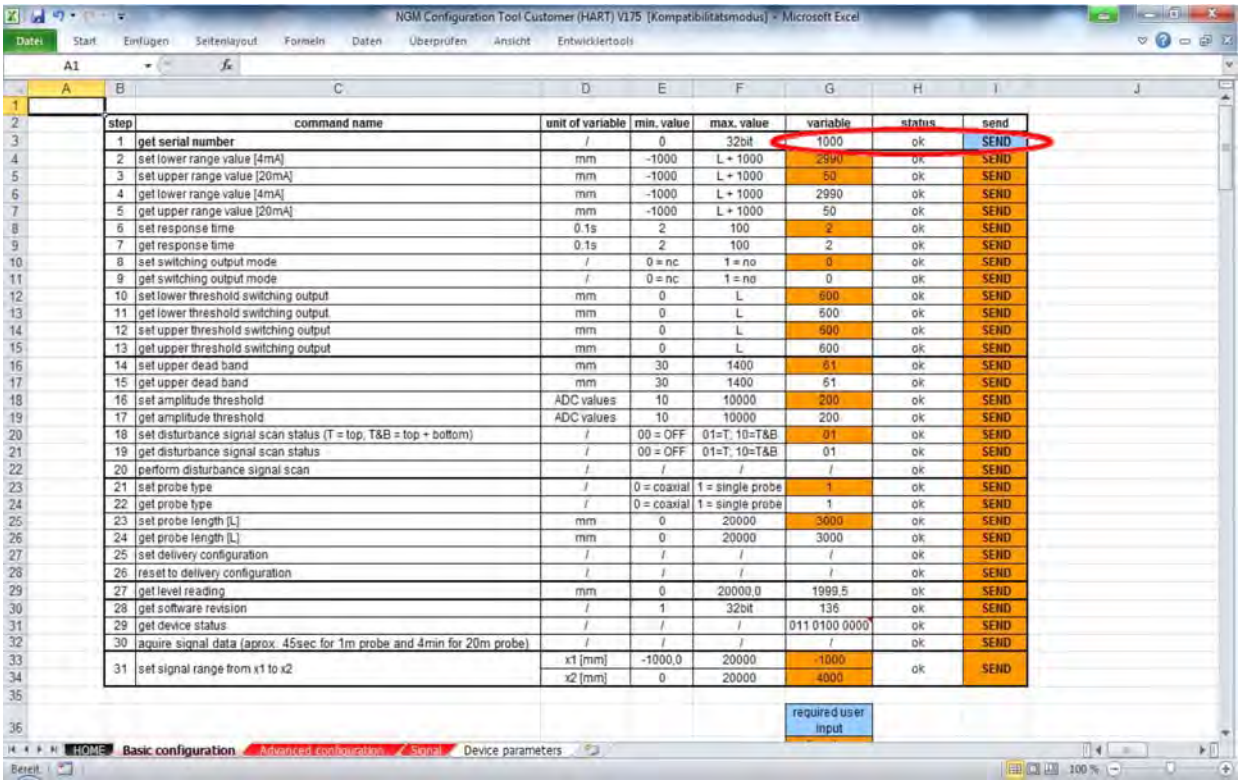
BASIC CONFIGURATION

Establishing a HART communication:

• Serial number obtainable by clicking on the light blue SEND button J2 in step 1 “get serial number”

• Macros are running

• OK status (H2) disappears and reappears after serial number read out and shown in G2



step	command name	unit of variable	min. value	max. value	variable	status	send
1	get serial number	/	0	32bit	1000	ok	SEND
2	set lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
3	set upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
4	get lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
5	get upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
6	set response time	0.1s	2	100	2	ok	SEND
7	get response time	0.1s	2	100	2	ok	SEND
8	set switching output mode	/	0 = nc	1 = no	0	ok	SEND
9	get switching output mode	/	0 = nc	1 = no	0	ok	SEND
10	set lower threshold switching output	mm	0	L	600	ok	SEND
11	get lower threshold switching output	mm	0	L	600	ok	SEND
12	set upper threshold switching output	mm	0	L	600	ok	SEND
13	get upper threshold switching output	mm	0	L	600	ok	SEND
14	set upper dead band	mm	30	1400	61	ok	SEND
15	get upper dead band	mm	30	1400	61	ok	SEND
16	set amplitude threshold	ADC values	10	10000	200	ok	SEND
17	get amplitude threshold	ADC values	10	10000	200	ok	SEND
18	set disturbance signal scan status (T = top, T&B = top + bottom)	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
19	get disturbance signal scan status	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
20	perform disturbance signal scan	/	/	/	/	ok	SEND
21	set probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
22	get probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
23	set probe length [L]	mm	0	20000	3000	ok	SEND
24	get probe length [L]	mm	0	20000	3000	ok	SEND
25	set delivery configuration	/	/	/	/	ok	SEND
26	reset to delivery configuration	/	/	/	/	ok	SEND
27	get level reading	mm	0	20000,0	1999,5	ok	SEND
28	get software revision	/	1	32bit	136	ok	SEND
29	get device status	/	/	/	011 0100 0000	ok	SEND
30	aquire signal data (aprox. 45sec for 1m probe and 4min for 20m probe)	/	/	/	/	ok	SEND
31	set signal range from x1 to x2	x1 [mm]	-1000,0	20000	-1000	ok	SEND
		x2 [mm]	0	20000	4000		
					required user input		

If OK status does not reappear, check the connection or the COM port settings

Now the HART communication is established and the modification of device-specific parameter as well as the read-out of the echo curve can be performed.

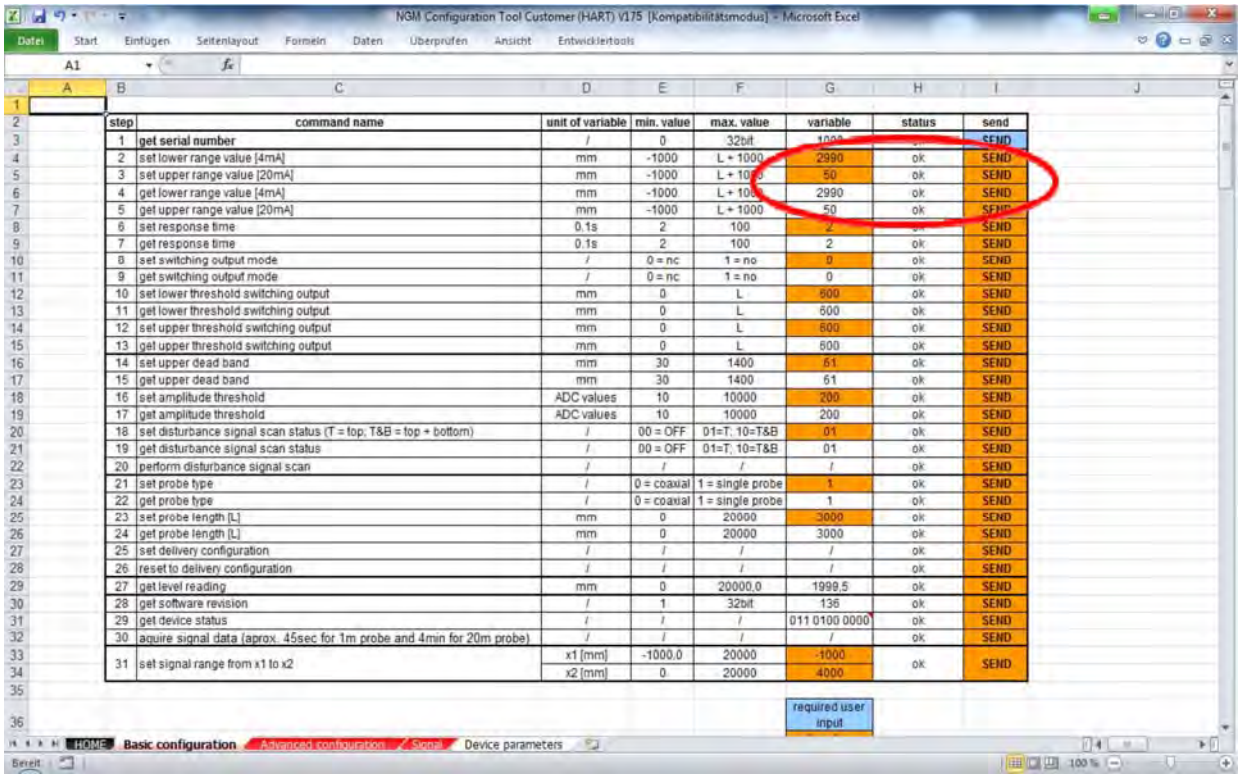
8.6.4 Upper / Lower Range Value

BASIC CONFIGURATION

• Read out actual 4…20mA settings by clicking on I6 and I7

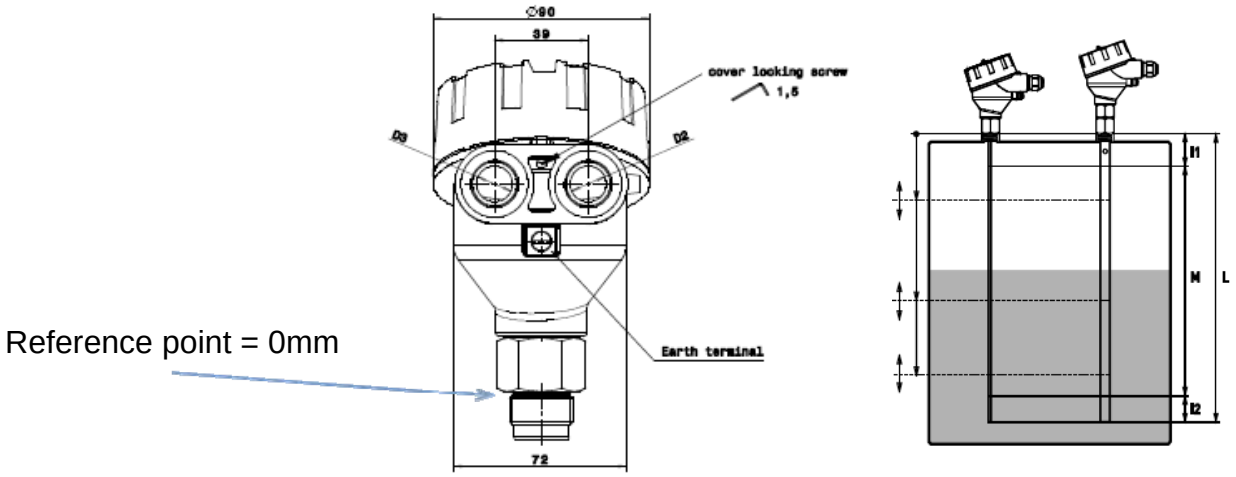
With the command “get lower / upper range value”, the actual 4…20mA values in mm are shown after the OK status disappeared and is visible again.

• Change actual 4…20mA settings by changing the values in G4 and G5 and clicking on I4 and I5 “set lower / upper range value”
• Verify changes by clicking again on I6 and I7 “get lower / upper range value”



step	command name	unit of variable	min. value	max. value	variable	status	send
1	get serial number	/	0	32bit	1000	ok	SEND
2	set lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
3	set upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
4	get lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
5	get upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
6	set response time	0.1s	2	100	2	ok	SEND
7	get response time	0.1s	2	100	2	ok	SEND
8	set switching output mode	/	0 = nc	1 = no	0	ok	SEND
9	get switching output mode	/	0 = nc	1 = no	0	ok	SEND
10	set lower threshold switching output	mm	0	L	600	ok	SEND
11	get lower threshold switching output	mm	0	L	600	ok	SEND
12	set upper threshold switching output	mm	0	L	600	ok	SEND
13	get upper threshold switching output	mm	0	L	600	ok	SEND
14	set upper dead band	mm	30	1400	61	ok	SEND
15	get upper dead band	mm	30	1400	61	ok	SEND
16	set amplitude threshold	ADC values	10	10000	200	ok	SEND
17	get amplitude threshold	ADC values	10	10000	200	ok	SEND
18	set disturbance signal scan status (T = top; T&B = top + bottom)	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
19	get disturbance signal scan status	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
20	perform disturbance signal scan	/	/	/	/	ok	SEND
21	set probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
22	get probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
23	set probe length [L]	mm	0	20000	3000	ok	SEND
24	get probe length [L]	mm	0	20000	3000	ok	SEND
25	set delivery configuration	/	/	/	/	ok	SEND
26	reset to delivery configuration	/	/	/	/	ok	SEND
27	get level reading	mm	0	20000,0	1999,5	ok	SEND
28	get software revision	/	1	32bit	136	ok	SEND
29	get device status	/	/	/	011 0100 0000	ok	SEND
30	aquire signal data (aprox. 45sec for 1m probe and 4min for 20m probe)	/	/	/	/	ok	SEND
31	set signal range from x1 to x2	x1 [mm]	-1000.0	20000	-1000	ok	SEND
		x2 [mm]	0	20000	4000		

required user input



8.6.5 Response Time

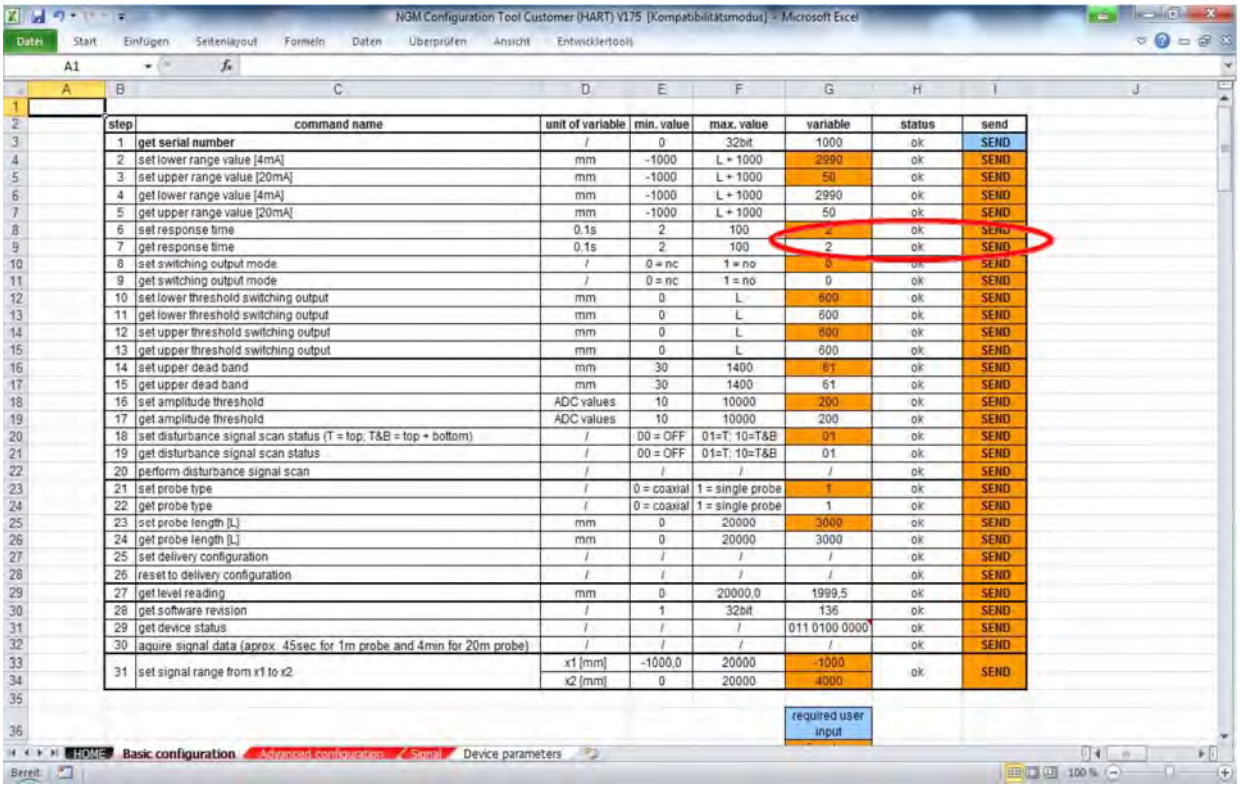
BASIC CONFIGURATION

• Read out actual response time, by clicking on I9.

Field G9 is showing the actual response time multiplied with 0,1ms.

• Change actual response time within a range of 2 … 100 (0,2 … 10sec) in field G8 and clicking on I8 “set response time”.

Use high response times for storage tanks with slow level movements. Use low response times for buffer and process tanks.



step	command name	unit of variable	min. value	max. value	variable	status	send
1	get serial number	/	0	32bit	1000	ok	SEND
2	set lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
3	set upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
4	get lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
5	get upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
6	set response time	0.1s	2	100	2	ok	SEND
7	get response time	0.1s	2	100	2	ok	SEND
8	set switching output mode	/	0 = nc	1 = no	0	ok	SEND
9	get switching output mode	/	0 = nc	1 = no	0	ok	SEND
10	set lower threshold switching output	mm	0	L	600	ok	SEND
11	get lower threshold switching output	mm	0	L	600	ok	SEND
12	set upper threshold switching output	mm	0	L	600	ok	SEND
13	get upper threshold switching output	mm	0	L	600	ok	SEND
14	set upper dead band	mm	30	1400	61	ok	SEND
15	get upper dead band	mm	30	1400	61	ok	SEND
16	set amplitude threshold	ADC values	10	10000	200	ok	SEND
17	get amplitude threshold	ADC values	10	10000	200	ok	SEND
18	set disturbance signal scan status (T = top; T&B = top + bottom)	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
19	get disturbance signal scan status	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
20	perform disturbance signal scan	/	/	/	/	ok	SEND
21	set probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
22	get probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
23	set probe length [L]	mm	0	20000	3000	ok	SEND
24	get probe length [L]	mm	0	20000	3000	ok	SEND
25	set delivery configuration	/	/	/	/	ok	SEND
26	reset to delivery configuration	/	/	/	/	ok	SEND
27	get level reading	mm	0	20000,0	1999,5	ok	SEND
28	get software revision	/	1	32bit	136	ok	SEND
29	get device status	/	/	/	011 0100 0000	ok	SEND
30	aquire signal data (aprox. 45sec for 1m probe and 4min for 20m probe)	/	/	/	/	ok	SEND
31	set signal range from x1 to x2	x1 [mm]	-1000,0	20000	-1000	ok	SEND
		x2 [mm]	0	20000	4000		
					required user input		

Verify changes by clicking again on I9 “get response time”

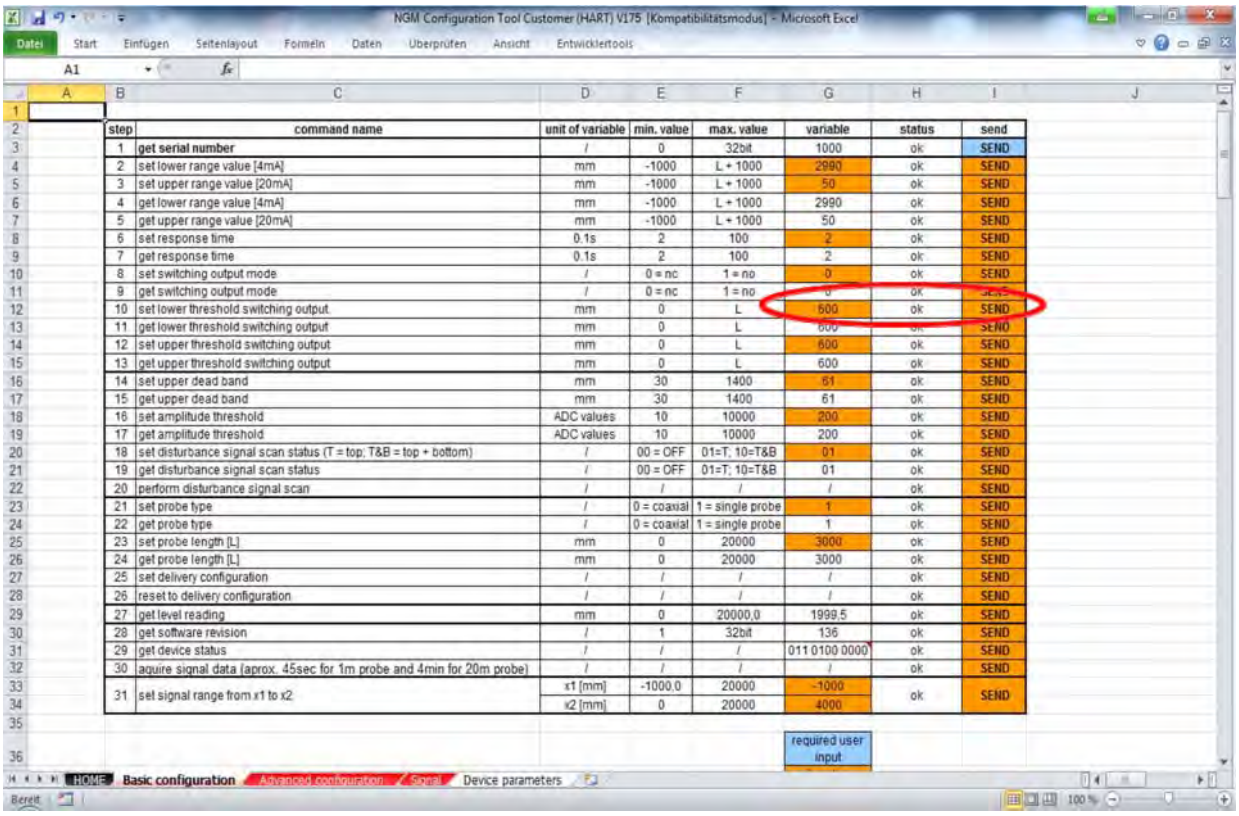
8.6.6 Switching Output Mode

BASIC CONFIGURATION

• Read out actual switching output mode by clicking on I11

Field G11 is showing the actual switching output mode.
– 0 = nc = normally closed
– 1 = no = normally open
Once the probe is powered, the switch output can be open or closed. The standard switch output mode is set to “normally closed”, as it would open at a power failure for highest safety.

• Change actual switching output mode 0 or 1 in field G10 and clicking on I10 “set switching output mode”



step	command name	unit of variable	min. value	max. value	variable	status	send
1	get serial number	/	0	32bit	1000	ok	SEND
2	set lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
3	set upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
4	get lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
5	get upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
6	set response time	0.1s	2	100	2	ok	SEND
7	get response time	0.1s	2	100	2	ok	SEND
8	set switching output mode	/	0 = nc	1 = no	0	ok	SEND
9	get switching output mode	/	0 = nc	1 = no	0	ok	SEND
10	set lower threshold switching output	mm	0	L	600	ok	SEND
11	get lower threshold switching output	mm	0	L	600	ok	SEND
12	set upper threshold switching output	mm	0	L	600	ok	SEND
13	get upper threshold switching output	mm	0	L	600	ok	SEND
14	set upper dead band	mm	30	1400	61	ok	SEND
15	get upper dead band	mm	30	1400	61	ok	SEND
16	set amplitude threshold	ADC values	10	10000	200	ok	SEND
17	get amplitude threshold	ADC values	10	10000	200	ok	SEND
18	set disturbance signal scan status (T = top; T&B = top + bottom)	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
19	get disturbance signal scan status	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
20	perform disturbance signal scan	/	/	/	/	ok	SEND
21	set probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
22	get probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
23	set probe length [L]	mm	0	20000	3000	ok	SEND
24	get probe length [L]	mm	0	20000	3000	ok	SEND
25	set delivery configuration	/	/	/	/	ok	SEND
26	reset to delivery configuration	/	/	/	/	ok	SEND
27	get level reading	mm	0	20000,0	1999.5	ok	SEND
28	get software revision	/	1	32bit	136	ok	SEND
29	get device status	/	/	/	011 0100 0000	ok	SEND
30	aquire signal data (aprox. 45sec for 1m probe and 4min for 20m probe)	/	/	/	/	ok	SEND
31	set signal range from x1 to x2	x1 [mm]	-1000,0	20000	-1000	ok	SEND
		x2 [mm]	0	20000	4000		
					required user input		

Verify changes by clicking again on I11 “get switching output mode”

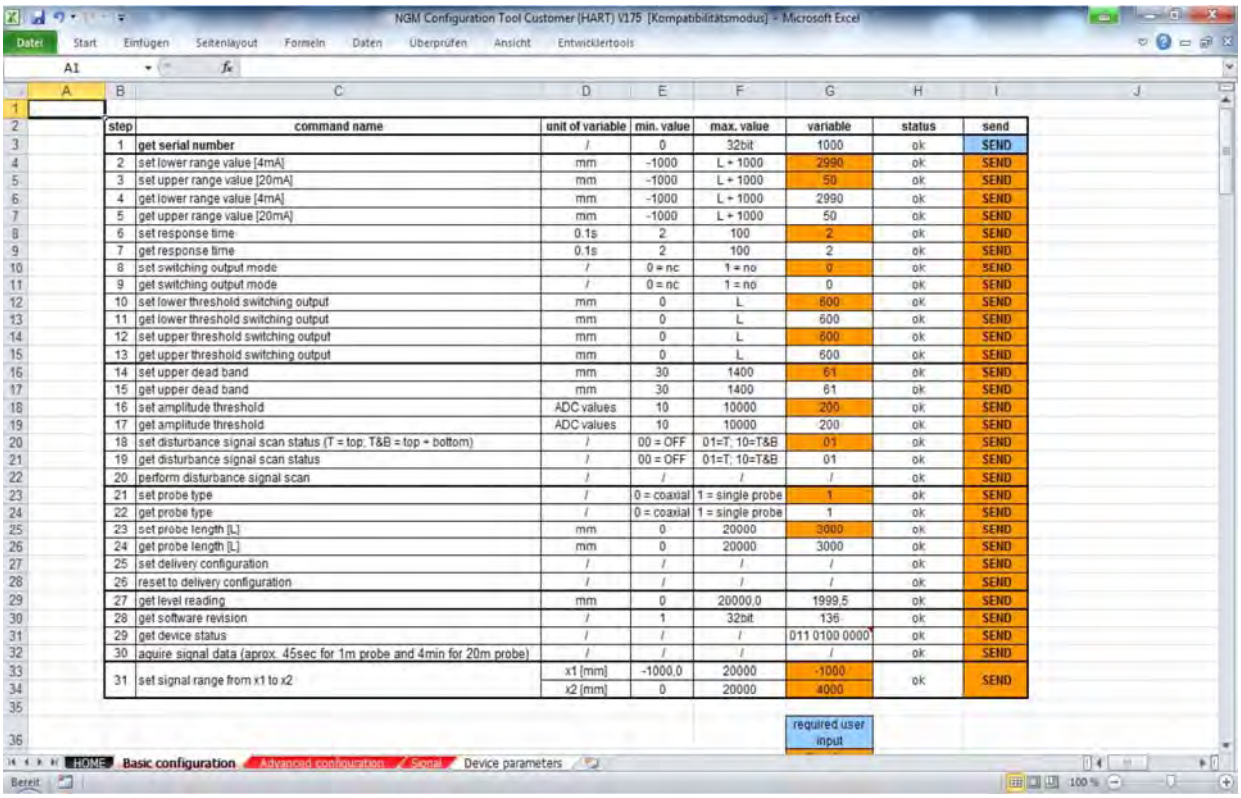
8.6.7 Threshold switching output

BASIC CONFIGURATION

• Read out actual lower / upper threshold switching output, by clicking on I13 and I15.

Field G13/15 indicates the actual lower / upper switching threshold.
With the help of the thresholds, a hysteresis can be programmed to avoid output switching at turbulent levels. First, the upper threshold must be passed to activate the output then the lower threshold for deactivation of the output.

• Change actual lower / upper threshold in field G12 / G14 and click on I12 / I14 “set lower / upper threshold switching output mode”.



step	command name	unit of variable	min. value	max. value	variable	status	send
1	get serial number	/	0	32bit	1000	ok	SEND
2	set lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
3	set upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
4	get lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
5	get upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
6	set response time	0.1s	2	100	2	ok	SEND
7	get response time	0.1s	2	100	2	ok	SEND
8	set switching output mode	/	0 = nc	1 = no	0	ok	SEND
9	get switching output mode	/	0 = nc	1 = no	0	ok	SEND
10	set lower threshold switching output	mm	0	L	600	ok	SEND
11	get lower threshold switching output	mm	0	L	600	ok	SEND
12	set upper threshold switching output	mm	0	L	600	ok	SEND
13	get upper threshold switching output	mm	0	L	600	ok	SEND
14	set upper dead band	mm	30	1400	61	ok	SEND
15	get upper dead band	mm	30	1400	61	ok	SEND
16	set amplitude threshold	ADC values	10	10000	200	ok	SEND
17	get amplitude threshold	ADC values	10	10000	200	ok	SEND
18	set disturbance signal scan status (T = top; T&B = top + bottom)	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
19	get disturbance signal scan status	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
20	perform disturbance signal scan	/	/	/	/	ok	SEND
21	set probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
22	get probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
23	set probe length [L]	mm	0	20000	3000	ok	SEND
24	get probe length [L]	mm	0	20000	3000	ok	SEND
25	set delivery configuration	/	/	/	/	ok	SEND
26	reset to delivery configuration	/	/	/	/	ok	SEND
27	get level reading	mm	0	20000,0	1999,5	ok	SEND
28	get software revision	/	1	32bit	136	ok	SEND
29	get device status	/	/	/	011 0100 0000	ok	SEND
30	aquire signal data (aprox. 45sec for 1m probe and 4min for 20m probe)	/	/	/	/	ok	SEND
31	set signal range from x1 to x2	x1 [mm]	-1000,0	20000	-1000	ok	SEND
		x2 [mm]	0	20000	4000		

required user input

Verify changes by clicking again on I13 / I15 “get lower / upper threshold switching output”

8.6.8 Upper Dead Band

BASIC CONFIGURATION

• Read out actual upper dead band, by clicking on I17.

Field G17 indicates the actual upper dead band.
With the upper dead band, noisy signals or ringing caused by the installation can be blocked. Increase the value for cutting signals left to the dead band, whose position is indicated by a green line. Any signal left to the green line will not be analyzed by the software. Entered values are in mm and are visible at the echo curve.

• Change actual upper dead band in field G16 and click on I16 “set upper dead band”.

step	command name	unit of variable	min. value	max. value	variable	status	send
1	get serial number	/	0	32bit	1000	ok	SEND
2	set lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
3	set upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
4	get lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
5	get upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
6	set response time	0.1s	2	100	2	ok	SEND
7	get response time	0.1s	2	100	2	ok	SEND
8	set switching output mode	/	0 = nc	1 = no	0	ok	SEND
9	get switching output mode	/	0 = nc	1 = no	0	ok	SEND
10	set lower threshold switching output	mm	0	L	600	ok	SEND
11	get lower threshold switching output	mm	0	L	600	ok	SEND
12	set upper threshold switching output	mm	0	L	600	ok	SEND
13	get upper threshold switching output	mm	0	L	600	ok	SEND
14	set upper dead band	mm	30	1400	61	ok	SEND
15	get upper dead band	mm	30	1400	61	ok	SEND
16	set amplitude threshold	ADC values	10	10000	200	ok	SEND
17	get amplitude threshold	ADC values	10	10000	200	ok	SEND
18	set disturbance signal scan status (T = top; T&B = top + bottom)	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
19	get disturbance signal scan status	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
20	perform disturbance signal scan	/	/	/	/	ok	SEND
21	set probe type						
22	get probe type						
23	set probe length [L]						
24	get probe length [L]						
25	set delivery configuration						
26	reset to delivery configuration						
27	get level reading						
28	get software revision						
29	get device status						
30	aquire signal data (aprox. 45sec for 1m probe						
31	set signal range from x1 to x2						

Verify changes by clicking again on I17 “get upper dead band”

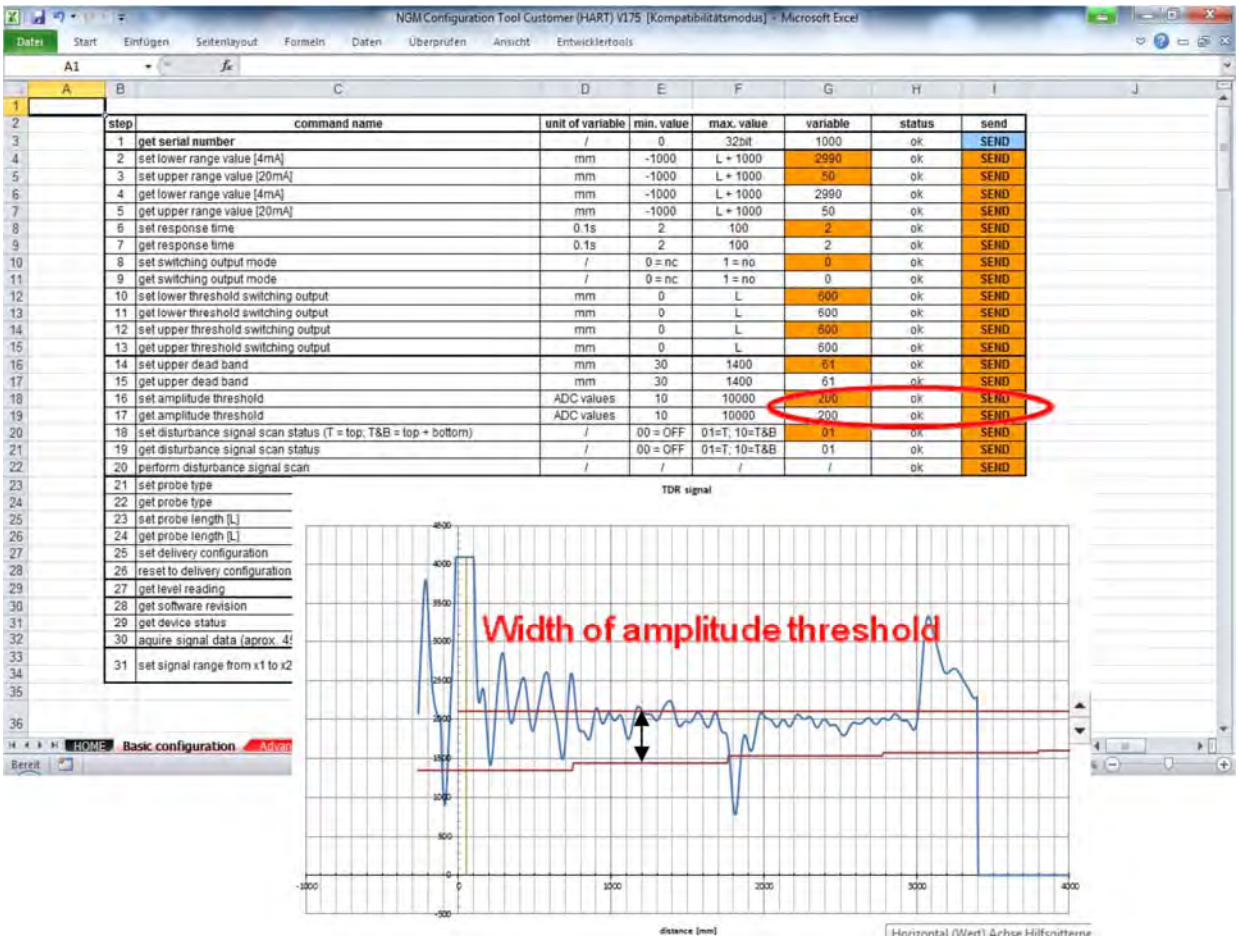
8.6.9 Amplitude threshold

BASIC CONFIGURATION

• Read out actual amplitude threshold, by clicking on I19

Field G19 indicates the actual amplitude threshold. Dynamic noise or ringing can be blocked if it is within the amplitude threshold band. The level reflection should be always 1/3 bigger than the width of the amplitude threshold band.

• Change actual amplitude threshold in field G18 and click on I18 “set amplitude threshold”.



step	command name	unit of variable	min. value	max. value	variable	status	send
1	get serial number	/	0	32bit	1000	ok	SEND
2	set lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
3	set upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
4	get lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
5	get upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
6	set response time	0.1s	2	100	2	ok	SEND
7	get response time	0.1s	2	100	2	ok	SEND
8	set switching output mode	/	0 = nc	1 = no	0	ok	SEND
9	get switching output mode	/	0 = nc	1 = no	0	ok	SEND
10	set lower threshold switching output	mm	0	L	600	ok	SEND
11	get lower threshold switching output	mm	0	L	600	ok	SEND
12	set upper threshold switching output	mm	0	L	600	ok	SEND
13	get upper threshold switching output	mm	0	L	600	ok	SEND
14	set upper dead band	mm	30	1400	61	ok	SEND
15	get upper dead band	mm	30	1400	61	ok	SEND
16	set amplitude threshold	ADC values	10	10000	200	ok	SEND
17	get amplitude threshold	ADC values	10	10000	200	ok	SEND
18	set disturbance signal scan status (T = top; T&B = top + bottom)	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
19	get disturbance signal scan status	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
20	perform disturbance signal scan	/	/	/	/	ok	SEND
21	set probe type						
22	get probe type						
23	set probe length [L]						
24	get probe length [L]						
25	set delivery configuration						
26	reset to delivery configuration						
27	get level reading						
28	get software revision						
29	get device status						
30	aquire signal data (aprox. 4						
31	set signal range from x1 to x2						

Verify changes by clicking again on I19 “get amplitude threshold”

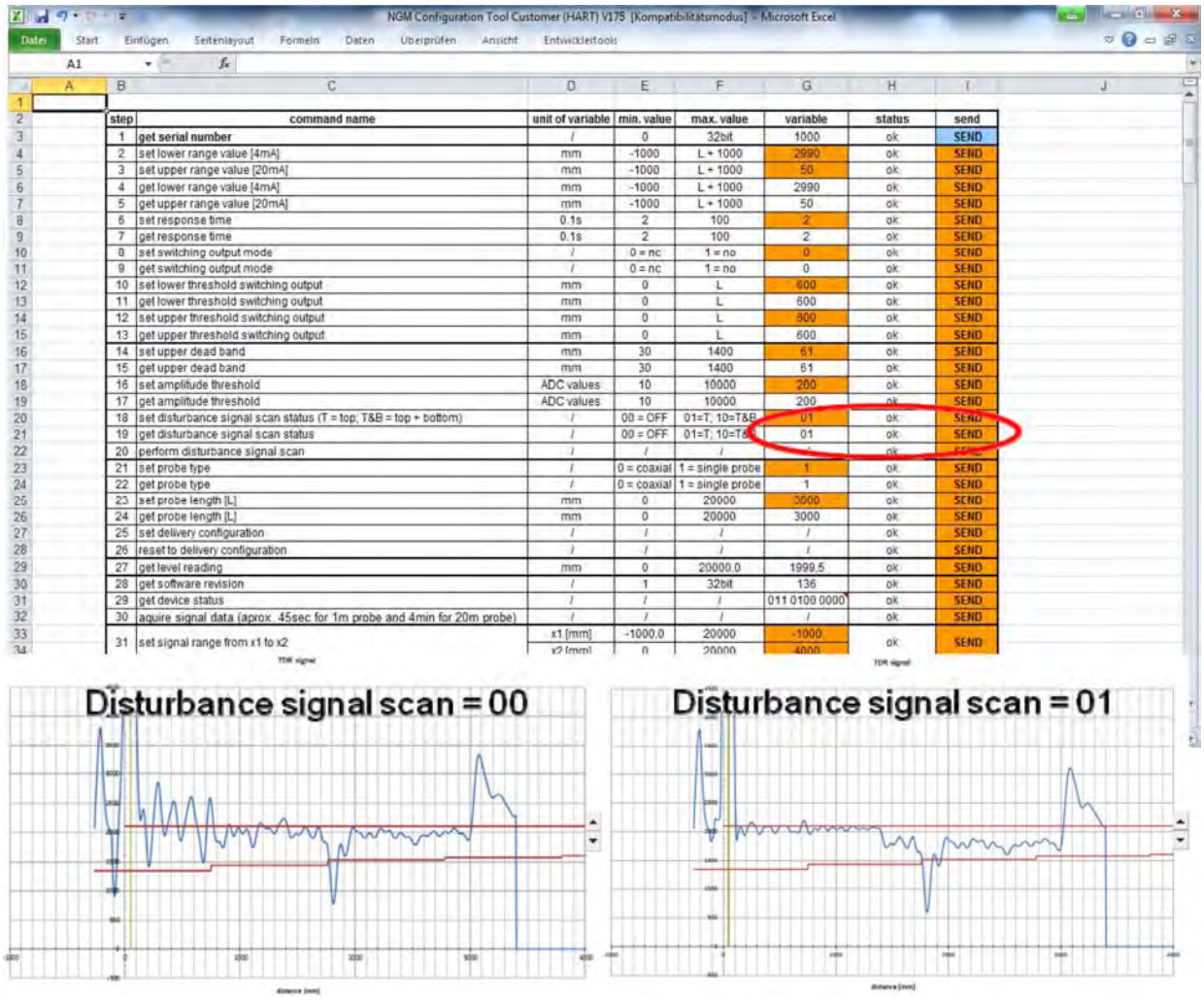
8.6.10 Disturbance Signal Scan Status

BASIC CONFIGURATION

• Read out actual disturbance signal scan status by clicking on I21

Field G21 indicates the actual disturbance scan signal status.
– 00=off, raw echo curve
– 01=disturbance signal active on top
– 10=disturbance signal active on top and bottom

• Change actual disturbance signal scan status in field G20 and click on I20 “set disturbance signal scan status”
• Once changing it to “10” or “01” a disturbance signal scan must be performed with I22.



step	command name	unit of variable	min. value	max. value	variable	status	send
1	get serial number	/	0	32bit	1000	ok	SEND
2	set lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
3	set upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
4	get lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
5	get upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
6	set response time	0.1s	2	100	2	ok	SEND
7	get response time	0.1s	2	100	2	ok	SEND
8	set switching output mode	/	0 = nc	1 = no	0	ok	SEND
9	get switching output mode	/	0 = nc	1 = no	0	ok	SEND
10	set lower threshold switching output	mm	0	L	600	ok	SEND
11	get lower threshold switching output	mm	0	L	600	ok	SEND
12	set upper threshold switching output	mm	0	L	600	ok	SEND
13	get upper threshold switching output	mm	0	L	600	ok	SEND
14	set upper dead band	mm	30	1400	61	ok	SEND
15	get upper dead band	mm	30	1400	61	ok	SEND
16	set amplitude threshold	ADC values	10	10000	200	ok	SEND
17	get amplitude threshold	ADC values	10	10000	200	ok	SEND
18	set disturbance signal scan status (T = top; T&B = top + bottom)	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
19	get disturbance signal scan status	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
20	perform disturbance signal scan	/	/	/	/	ok	SEND
21	set probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
22	get probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
23	set probe length [L]	mm	0	20000	3000	ok	SEND
24	get probe length [L]	mm	0	20000	3000	ok	SEND
25	set delivery configuration	/	/	/	/	ok	SEND
26	reset to delivery configuration	/	/	/	/	ok	SEND
27	get level reading	mm	0	20000.0	1999.5	ok	SEND
28	get software revision	/	1	32bit	136	ok	SEND
29	get device status	/	/	/	011 0100 0000	ok	SEND
30	aquire signal data (aprox. 45sec for 1m probe and 4min for 20m probe)	/	/	/	/	ok	SEND
31	set signal range from x1 to x2	x1 [mm]	-1000.0	20000	-1000	ok	SEND
		x2 [mm]	0	20000	4000		

Verify changes by clicking again on I21 “get disturbance signal scan status”

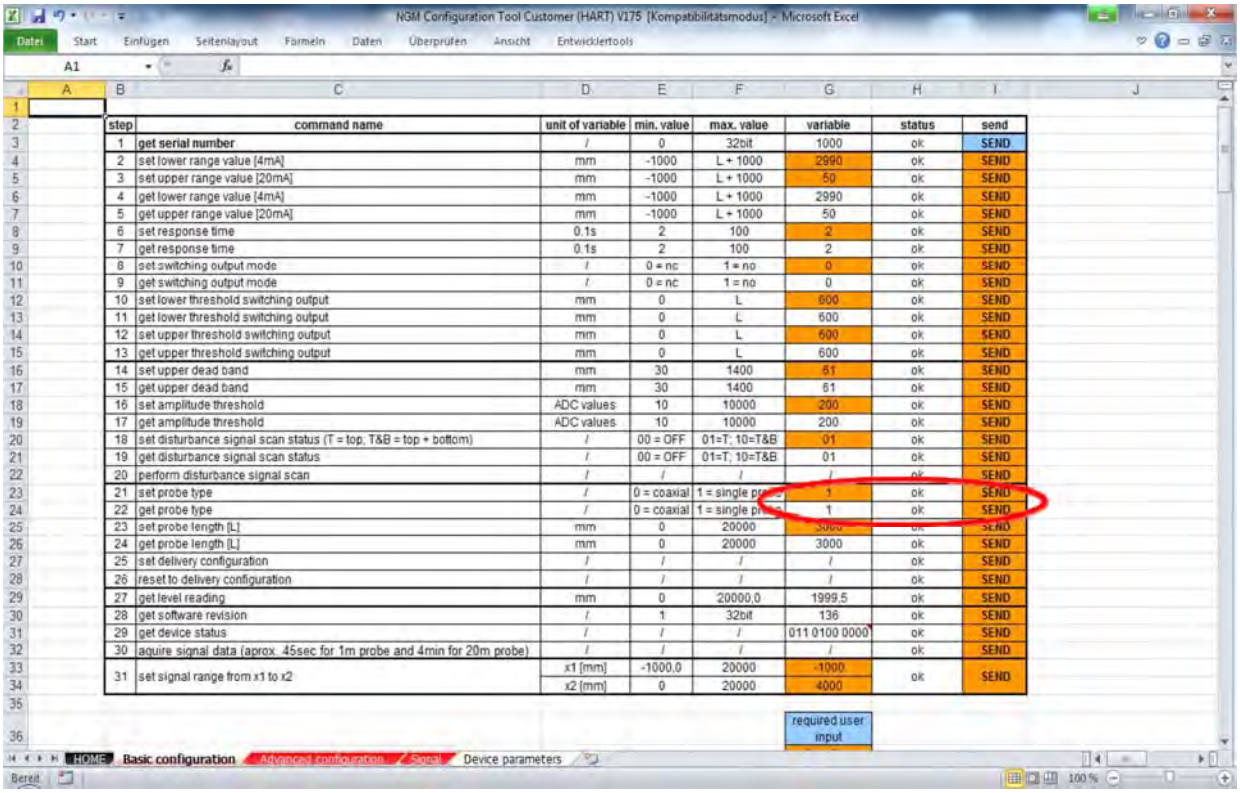
8.6.11 Probe Type

BASIC CONFIGURATION

• Read out actual probe type status, by clicking on I24.

Field G24 indicates the actual probe type status.
– 0= coaxial probe
– 1= single probe rod or rope
Thresholds are adapted automatically by changing this parameter.

• Change actual probe type in field G23 and click on I23 “set probe type”.



step	command name	unit of variable	min. value	max. value	variable	status	send
1	get serial number	/	0	32bit	1000	ok	SEND
2	set lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
3	set upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
4	get lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
5	get upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
6	set response time	0.1s	2	100	2	ok	SEND
7	get response time	0.1s	2	100	2	ok	SEND
8	set switching output mode	/	0 = nc	1 = no	0	ok	SEND
9	get switching output mode	/	0 = nc	1 = no	0	ok	SEND
10	set lower threshold switching output	mm	0	L	600	ok	SEND
11	get lower threshold switching output	mm	0	L	600	ok	SEND
12	set upper threshold switching output	mm	0	L	600	ok	SEND
13	get upper threshold switching output	mm	0	L	600	ok	SEND
14	set upper dead band	mm	30	1400	61	ok	SEND
15	get upper dead band	mm	30	1400	61	ok	SEND
16	set amplitude threshold	ADC values	10	10000	200	ok	SEND
17	get amplitude threshold	ADC values	10	10000	200	ok	SEND
18	set disturbance signal scan status (T = top; T&B = top + bottom)	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
19	get disturbance signal scan status	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
20	perform disturbance signal scan	/	/	/	/	ok	SEND
21	set probe type	/	0 = coaxial	1 = single pr…	1	ok	SEND
22	get probe type	/	0 = coaxial	1 = single pr…	1	ok	SEND
23	set probe length [L]	mm	0	20000	3000	ok	SEND
24	get probe length [L]	mm	0	20000	3000	ok	SEND
25	set delivery configuration	/	/	/	/	ok	SEND
26	reset to delivery configuration	/	/	/	/	ok	SEND
27	get level reading	mm	0	20000,0	1999,5	ok	SEND
28	get software revision	/	1	32bit	136	ok	SEND
29	get device status	/	/	/	011 0100 0000	ok	SEND
30	aquire signal data (aprox. 45sec for 1m probe and 4min for 20m probe)	/	/	/	/	ok	SEND
31	set signal range from x1 to x2	x1 [mm]	-1000,0	20000	-1000	ok	SEND
		x2 [mm]	0	20000	4000		

Verify changes by clicking again on I24 “get probe type”

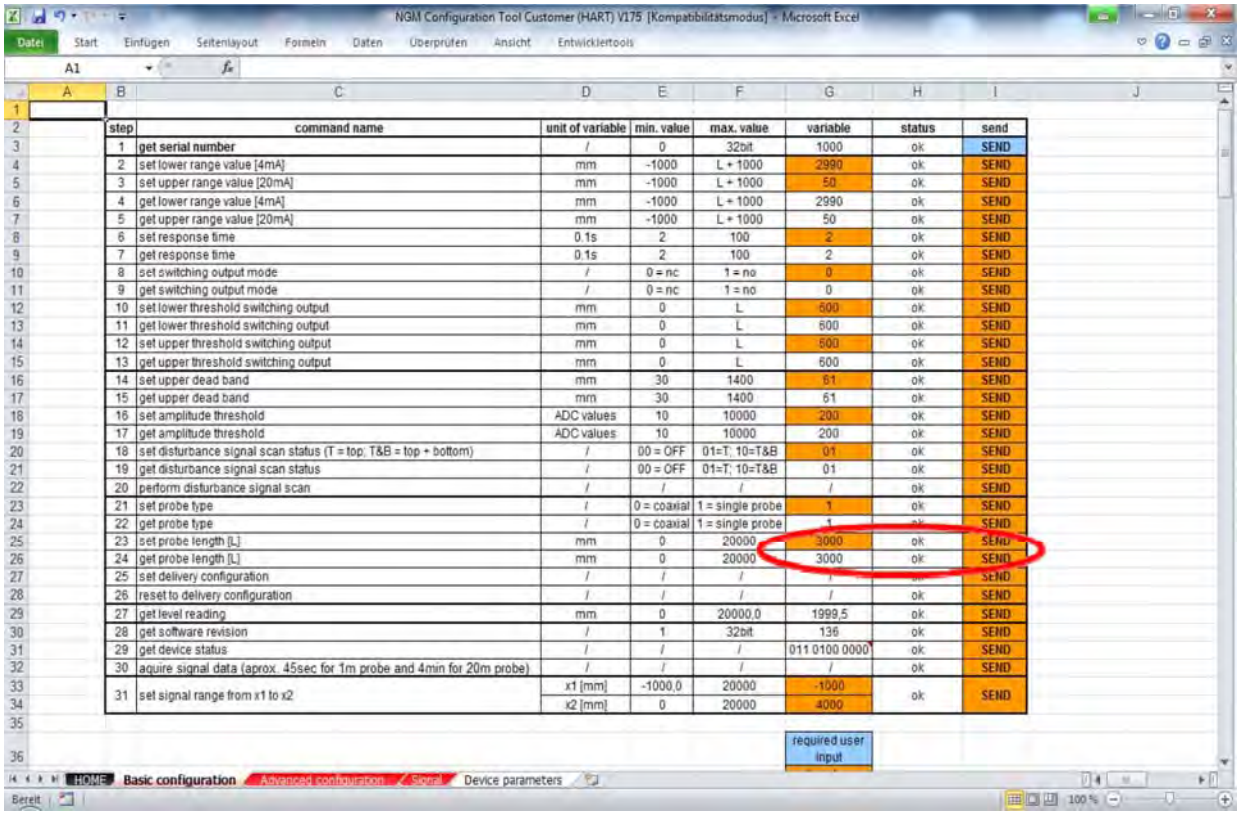
8.6.12 Probe Length

BASIC CONFIGURATION

• Read out actual probe length, by clicking on I26.

Field G26 indicates the actual probe length in mm.

• Change actual probe length in field G25 and click on I25 “set probe length”.



step	command name	unit of variable	min. value	max. value	variable	status	send
1	get serial number	/	0	32bit	1000	ok	SEND
2	set lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
3	set upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
4	get lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
5	get upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
6	set response time	0.1s	2	100	2	ok	SEND
7	get response time	0.1s	2	100	2	ok	SEND
8	set switching output mode	/	0 = nc	1 = no	0	ok	SEND
9	get switching output mode	/	0 = nc	1 = no	0	ok	SEND
10	set lower threshold switching output	mm	0	L	600	ok	SEND
11	get lower threshold switching output	mm	0	L	600	ok	SEND
12	set upper threshold switching output	mm	0	L	600	ok	SEND
13	get upper threshold switching output	mm	0	L	600	ok	SEND
14	set upper dead band	mm	30	1400	61	ok	SEND
15	get upper dead band	mm	30	1400	61	ok	SEND
16	set amplitude threshold	ADC values	10	10000	200	ok	SEND
17	get amplitude threshold	ADC values	10	10000	200	ok	SEND
18	set disturbance signal scan status (T = top; T&B = top + bottom)	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
19	get disturbance signal scan status	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
20	perform disturbance signal scan	/	/	/	/	ok	SEND
21	set probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
22	get probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
25	set probe length [L]	mm	0	20000	3000	ok	SEND
26	get probe length [L]	mm	0	20000	3000	ok	SEND
27	set delivery configuration	/	/	/	/	ok	SEND
28	reset to delivery configuration	/	/	/	/	ok	SEND
29	get level reading	mm	0	20000,0	1999,5	ok	SEND
30	get software revision	/	1	32bit	136	ok	SEND
31	get device status	/	/	/	011 0100 0000	ok	SEND
32	aquire signal data (aprox. 45sec for 1m probe and 4min for 20m probe)	/	/	/	/	ok	SEND
33	set signal range from x1 to x2	x1 [mm]	-1000,0	20000	-1000	ok	SEND
34		x2 [mm]	0	20000	4000		
36					required user input		

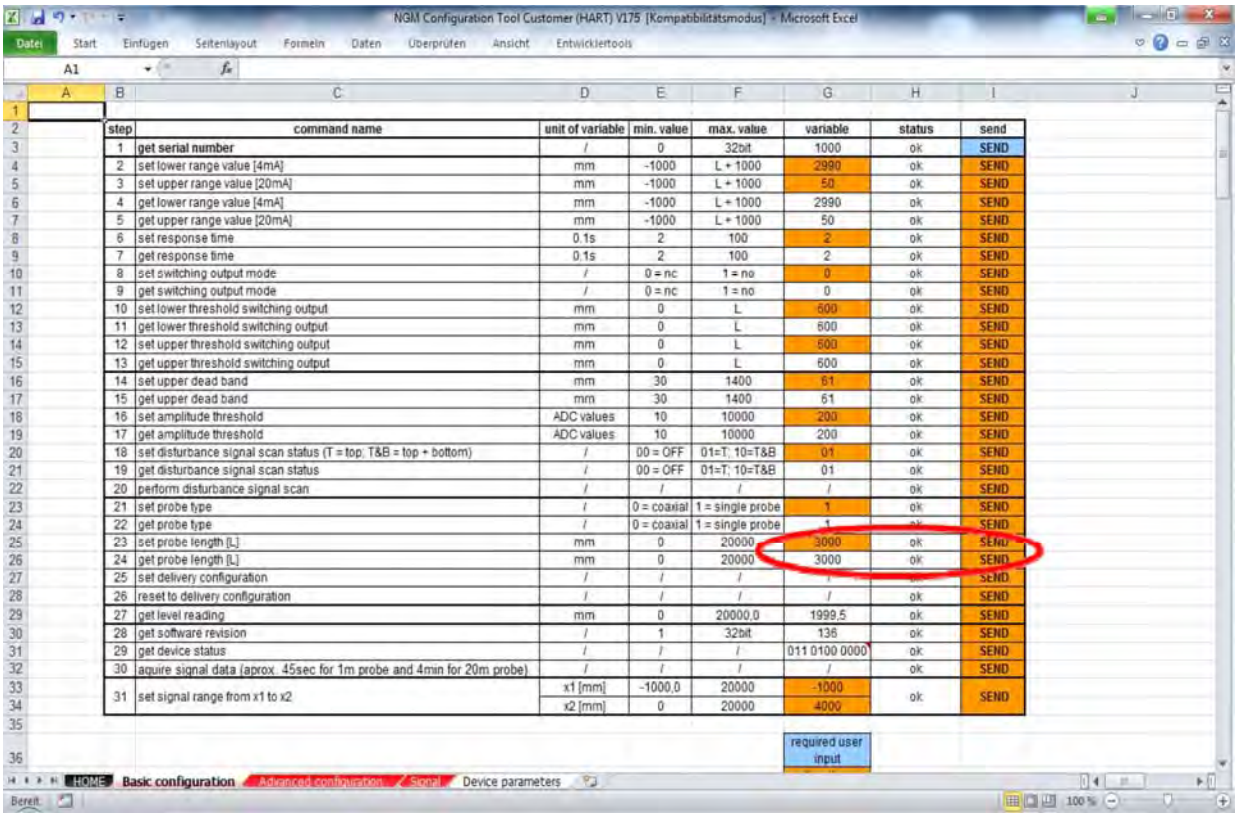
Verify changes by clicking again on I26 “get probe length”

8.6.13 Set Delivery Configuration

BASIC CONFIGURATION

• Set actual parameters as delivery configuration by clicking on I27

Former delivery configuration parameters will be overwritten!
No reset to factory conditions is possible anymore.



step	command name	unit of variable	min. value	max. value	variable	status	send
1	get serial number	/	0	32bit	1000	ok	SEND
2	set lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
3	set upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
4	get lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
5	get upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
6	set response time	0.1s	2	100	2	ok	SEND
7	get response time	0.1s	2	100	2	ok	SEND
8	set switching output mode	/	0 = nc	1 = no	0	ok	SEND
9	get switching output mode	/	0 = nc	1 = no	0	ok	SEND
10	set lower threshold switching output	mm	0	L	600	ok	SEND
11	get lower threshold switching output	mm	0	L	600	ok	SEND
12	set upper threshold switching output	mm	0	L	600	ok	SEND
13	get upper threshold switching output	mm	0	L	600	ok	SEND
14	set upper dead band	mm	30	1400	61	ok	SEND
15	get upper dead band	mm	30	1400	61	ok	SEND
16	set amplitude threshold	ADC values	10	10000	200	ok	SEND
17	get amplitude threshold	ADC values	10	10000	200	ok	SEND
18	set disturbance signal scan status (T = top; T&B = top + bottom)	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
19	get disturbance signal scan status	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
20	perform disturbance signal scan	/	/	/	/	ok	SEND
21	set probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
22	get probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
23	set probe length [L]	mm	0	20000	3000	ok	SEND
24	get probe length [L]	mm	0	20000	3000	ok	SEND
25	set delivery configuration	/	/	/	/	/	SEND
26	reset to delivery configuration	/	/	/	/	ok	SEND
27	get level reading	mm	0	20000,0	1999,5	ok	SEND
28	get software revision	/	1	32bit	136	ok	SEND
29	get device status	/	/	/	011 0100 0000	ok	SEND
30	aquire signal data (aprox. 45sec for 1m probe and 4min for 20m probe)	/	/	/	/	ok	SEND
31	set signal range from x1 to x2	x1 [mm]	-1000,0	20000	-1000	ok	SEND
		x2 [mm]	0	20000	4000		

required user input

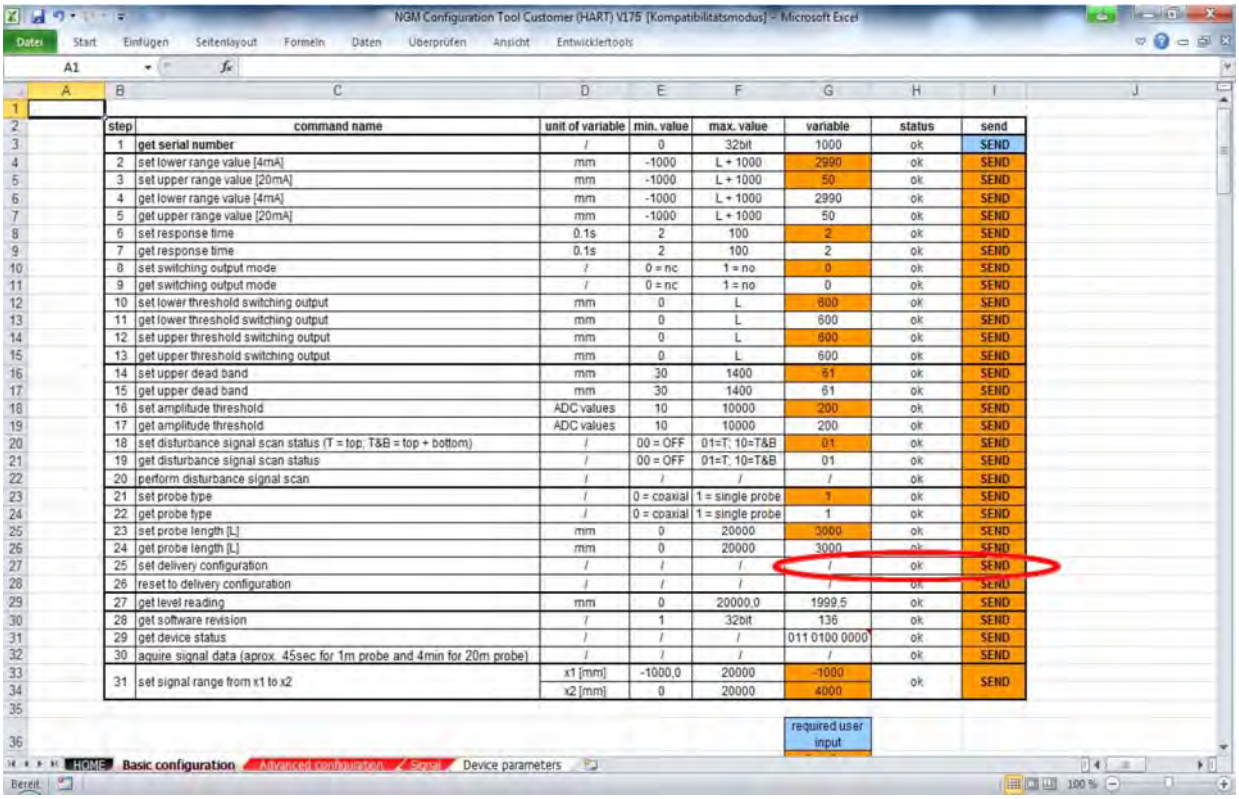
UNDO NOT POSSIBLE!

8.6.14 Reset to Delivery Configuration

BASIC CONFIGURATION

Reset unit back to delivery configuration, by clicking on I28.

4…20mA, response time, switching mode and thresholds, upper dead band, amplitude threshold, disturbance scan, probe type, and probe length will be set back to delivery configuration.



step	command name	unit of variable	min. value	max. value	variable	status	send
1	get serial number	/	0	32bit	1000	ok	SEND
2	set lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
3	set upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
4	get lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
5	get upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
6	set response time	0.1s	2	100	2	ok	SEND
7	get response time	0.1s	2	100	2	ok	SEND
8	set switching output mode	/	0 = nc	1 = no	0	ok	SEND
9	get switching output mode	/	0 = nc	1 = no	0	ok	SEND
10	set lower threshold switching output	mm	0	L	600	ok	SEND
11	get lower threshold switching output	mm	0	L	600	ok	SEND
12	set upper threshold switching output	mm	0	L	600	ok	SEND
13	get upper threshold switching output	mm	0	L	600	ok	SEND
14	set upper dead band	mm	30	1400	61	ok	SEND
15	get upper dead band	mm	30	1400	61	ok	SEND
16	set amplitude threshold	ADC values	10	10000	200	ok	SEND
17	get amplitude threshold	ADC values	10	10000	200	ok	SEND
18	set disturbance signal scan status (T = top; T&B = top + bottom)	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
19	get disturbance signal scan status	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
20	perform disturbance signal scan	/	/	/	/	ok	SEND
21	set probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
22	get probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
23	set probe length [L]	mm	0	20000	3000	ok	SEND
24	get probe length [L]	mm	0	20000	3000	ok	SEND
25	set delivery configuration	/	/	/	/	ok	SEND
26	reset to delivery configuration	/	/	/	/	ok	SEND
27	get level reading	mm	0	20000,0	1999,5	ok	SEND
28	get software revision	/	1	32bit	136	ok	SEND
29	get device status	/	/	/	011 0100 0000	ok	SEND
30	aquire signal data (aprox. 45sec for 1m probe and 4min for 20m probe)	/	/	/	/	ok	SEND
31	set signal range from x1 to x2	x1 [mm]	-1000,0	20000	-1000	ok	SEND
		x2 [mm]	0	20000	4000		

required user input

UNDO NOT POSSIBLE!

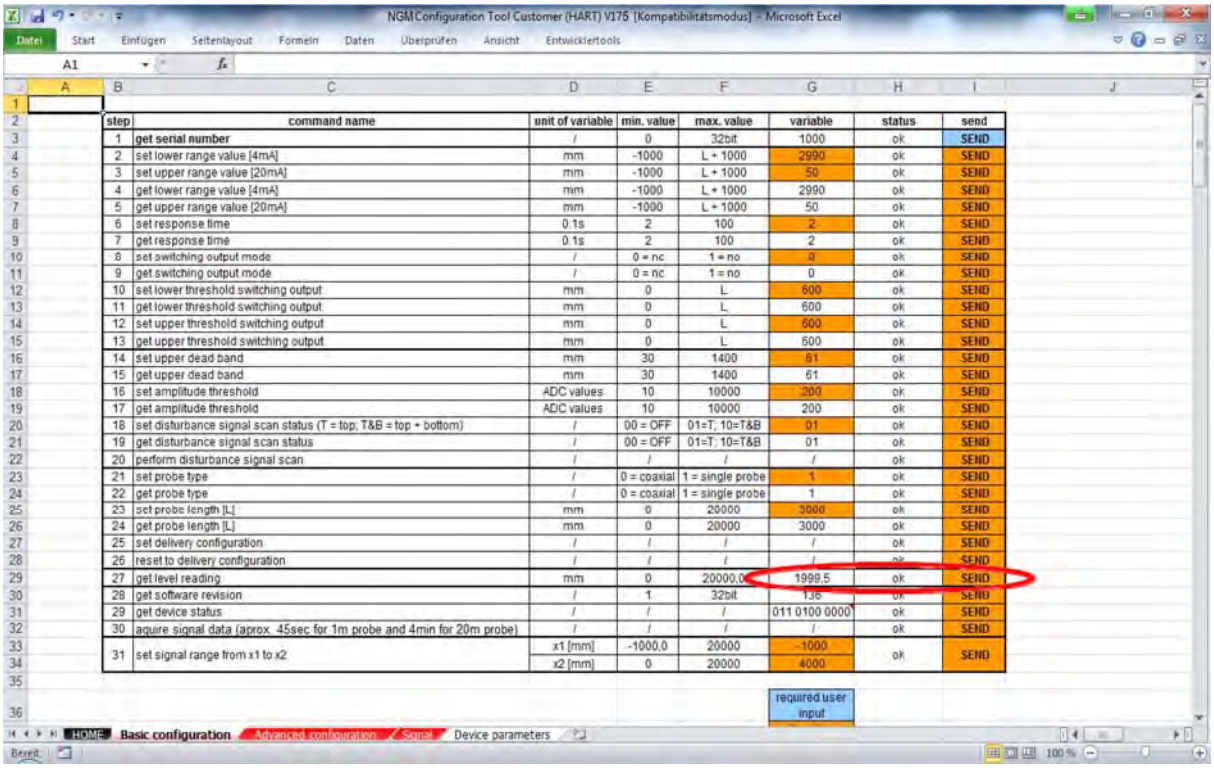
8.6.15 Level Reading

BASIC CONFIGURATION

• Get actual level reading, by clicking on I29.

If you do not measure the current output in series with a Multimeter, it is recommended to read out the level 3 – 5 times to recognize potential current fluctuations.

If a fluctuating current can be observed, the amplitude threshold or dead band needs to be adjusted.



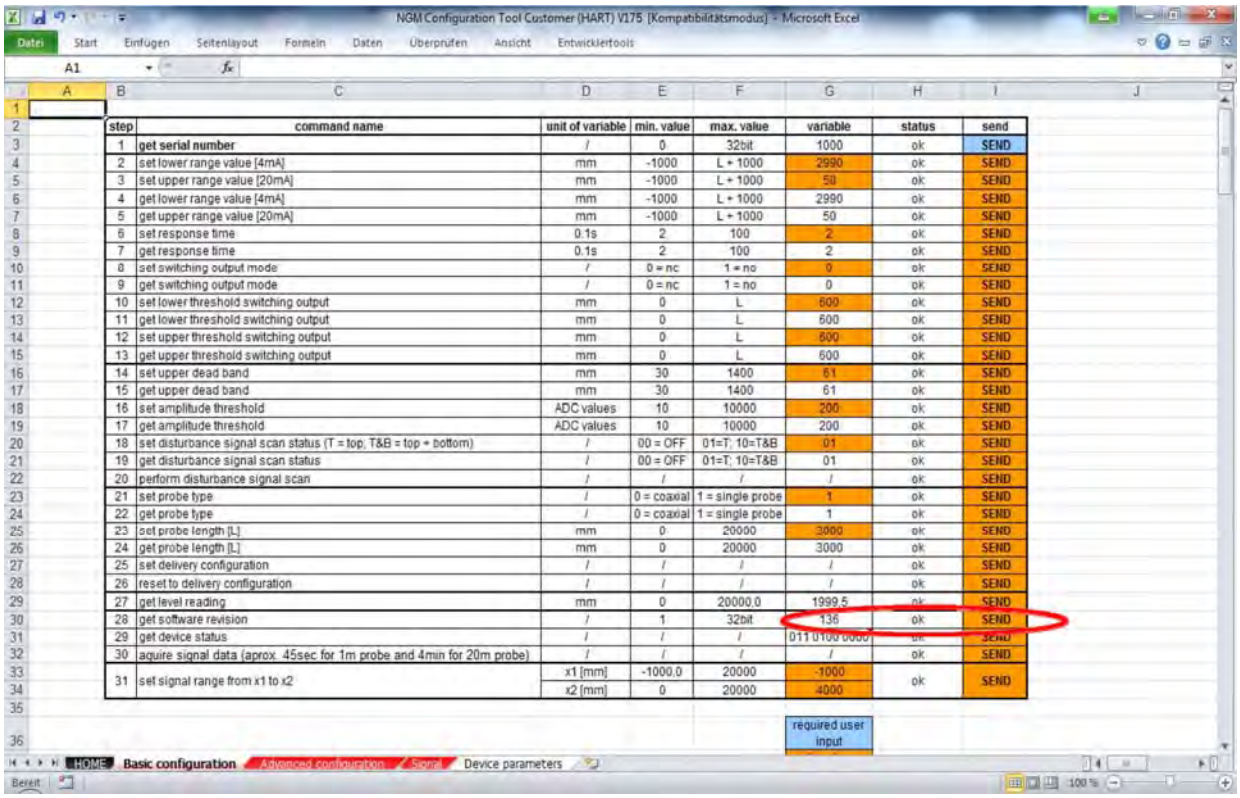
step	command name	unit of variable	min. value	max. value	variable	status	send
1	get serial number	/	0	32bit	1000	ok	SEND
2	set lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
3	set upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
4	get lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
5	get upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
6	set response time	0.1s	2	100	2	ok	SEND
7	get response time	0.1s	2	100	2	ok	SEND
8	set switching output mode	/	0 = nc	1 = no	0	ok	SEND
9	get switching output mode	/	0 = nc	1 = no	0	ok	SEND
10	set lower threshold switching output	mm	0	L	600	ok	SEND
11	get lower threshold switching output	mm	0	L	600	ok	SEND
12	set upper threshold switching output	mm	0	L	600	ok	SEND
13	get upper threshold switching output	mm	0	L	600	ok	SEND
14	set upper dead band	mm	30	1400	61	ok	SEND
15	get upper dead band	mm	30	1400	61	ok	SEND
16	set amplitude threshold	ADC values	10	10000	200	ok	SEND
17	get amplitude threshold	ADC values	10	10000	200	ok	SEND
18	set disturbance signal scan status (T = top; T&B = top + bottom)	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
19	get disturbance signal scan status	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
20	perform disturbance signal scan	/	/	/	/	ok	SEND
21	set probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
22	get probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
23	set probe length [L]	mm	0	20000	3000	ok	SEND
24	get probe length [L]	mm	0	20000	3000	ok	SEND
25	set delivery configuration	/	/	/	/	ok	SEND
26	reset to delivery configuration	/	/	/	/	ok	SEND
27	get level reading	mm	0	20000,0	1999,5	ok	SEND
28	get software revision	/	1	32bit	136	ok	SEND
29	get device status	/	/	/	011 0100 0000	ok	SEND
30	aquire signal data (aprox. 45sec for 1m probe and 4min for 20m probe)	/	/	/	/	ok	SEND
31	set signal range from x1 to x2	x1 [mm]	-1000,0	20000	-1000	ok	SEND
		x2 [mm]	0	20000	4000		

8.6.16 Software Revision

BASIC CONFIGURATION

• Get actual software revision, by clicking on I30.

As of April 30, 2013, the actual software revision is V150.
For an upgrade please contact KOBOLD.



step	command name	unit of variable	min. value	max. value	variable	status	send
1	get serial number	/	0	32bit	1000	ok	SEND
2	set lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
3	set upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
4	get lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
5	get upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
6	set response time	0.1s	2	100	2	ok	SEND
7	get response time	0.1s	2	100	2	ok	SEND
8	set switching output mode	/	0 = nc	1 = no	0	ok	SEND
9	get switching output mode	/	0 = nc	1 = no	0	ok	SEND
10	set lower threshold switching output	mm	0	L	600	ok	SEND
11	get lower threshold switching output	mm	0	L	600	ok	SEND
12	set upper threshold switching output	mm	0	L	600	ok	SEND
13	get upper threshold switching output	mm	0	L	600	ok	SEND
14	set upper dead band	mm	30	1400	61	ok	SEND
15	get upper dead band	mm	30	1400	61	ok	SEND
16	set amplitude threshold	ADC values	10	10000	200	ok	SEND
17	get amplitude threshold	ADC values	10	10000	200	ok	SEND
18	set disturbance signal scan status (T = top; T&B = top + bottom)	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
19	get disturbance signal scan status	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
20	perform disturbance signal scan	/	/	/	/	ok	SEND
21	set probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
22	get probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
23	set probe length [L]	mm	0	20000	3000	ok	SEND
24	get probe length [L]	mm	0	20000	3000	ok	SEND
25	set delivery configuration	/	/	/	/	ok	SEND
26	reset to delivery configuration	/	/	/	/	ok	SEND
27	get level reading	mm	0	20000,0	1999,5	ok	SEND
28	get software revision	/	1	32bit	136	ok	SEND
29	get device status	/	/	/	011 0100 0000	ok	SEND
30	aquire signal data (aprox. 45sec for 1m probe and 4min for 20m probe)	/	/	/	/	ok	SEND
31	set signal range from x1 to x2	x1 [mm]	-1000,0	20000	-1000	ok	SEND
		x2 [mm]	0	20000	4000		

required user input

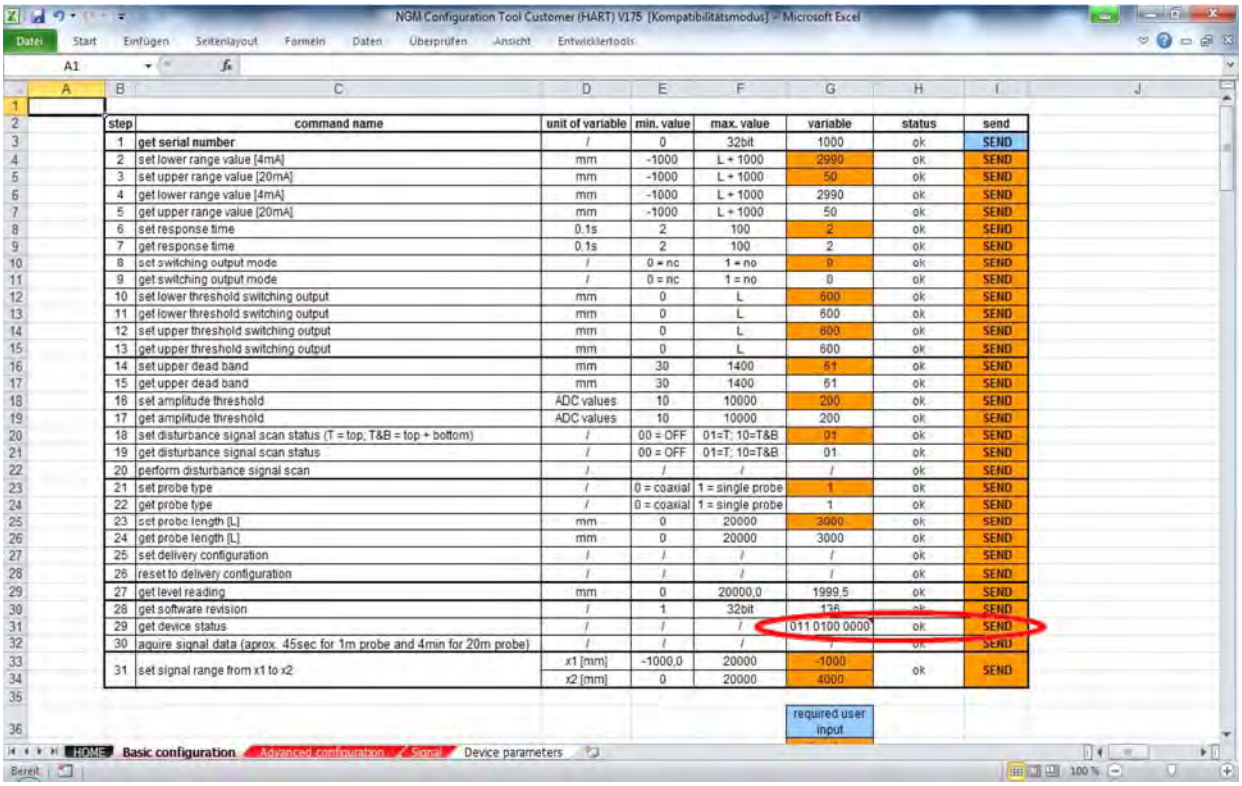
8.6.17 Device Status

BASIC CONFIGURATION

• Get actual devise status, by clicking on I31.

Important probe status information can be communicated.

Click on the small red upper right corner for more details.



step	command name	unit of variable	min. value	max. value	variable	status	send
1	get serial number	/	0	32bit	1000	ok	SEND
2	set lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
3	set upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
4	get lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
5	get upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
6	set response time	0.1s	2	100	2	ok	SEND
7	get response time	0.1s	2	100	2	ok	SEND
8	set switching output mode	/	0 = nc	1 = no	0	ok	SEND
9	get switching output mode	/	0 = nc	1 = no	0	ok	SEND
10	set lower threshold switching output	mm	0	L	600	ok	SEND
11	get lower threshold switching output	mm	0	L	600	ok	SEND
12	set upper threshold switching output	mm	0	L	600	ok	SEND
13	get upper threshold switching output	mm	0	L	600	ok	SEND
14	set upper dead band	mm	30	1400	51	ok	SEND
15	get upper dead band	mm	30	1400	51	ok	SEND
16	set amplitude threshold	ADC values	10	10000	200	ok	SEND
17	get amplitude threshold	ADC values	10	10000	200	ok	SEND
18	set disturbance signal scan status (T = top; T&B = top + bottom)	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
19	get disturbance signal scan status	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
20	perform disturbance signal scan	/	/	/	/	ok	SEND
21	set probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
22	get probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
23	set probe length [L]	mm	0	20000	3000	ok	SEND
24	get probe length [L]	mm	0	20000	3000	ok	SEND
25	set delivery configuration	/	/	/	/	ok	SEND
26	reset to delivery configuration	/	/	/	/	ok	SEND
27	get level reading	mm	0	20000,0	1999,5	ok	SEND
28	get software revision	/	1	32bit	136	ok	SEND
29	get device status	/	/	/	011 0100 0000	ok	SEND
30	aquire signal data (aprox. 45sec for 1m probe and 4min for 20m probe)	/	/	/	/	ok	SEND
31	set signal range from x1 to x2	x1 [mm]	-1000,0	20000	-1000	ok	SEND
		x2 [mm]	0	20000	4000		

required user input

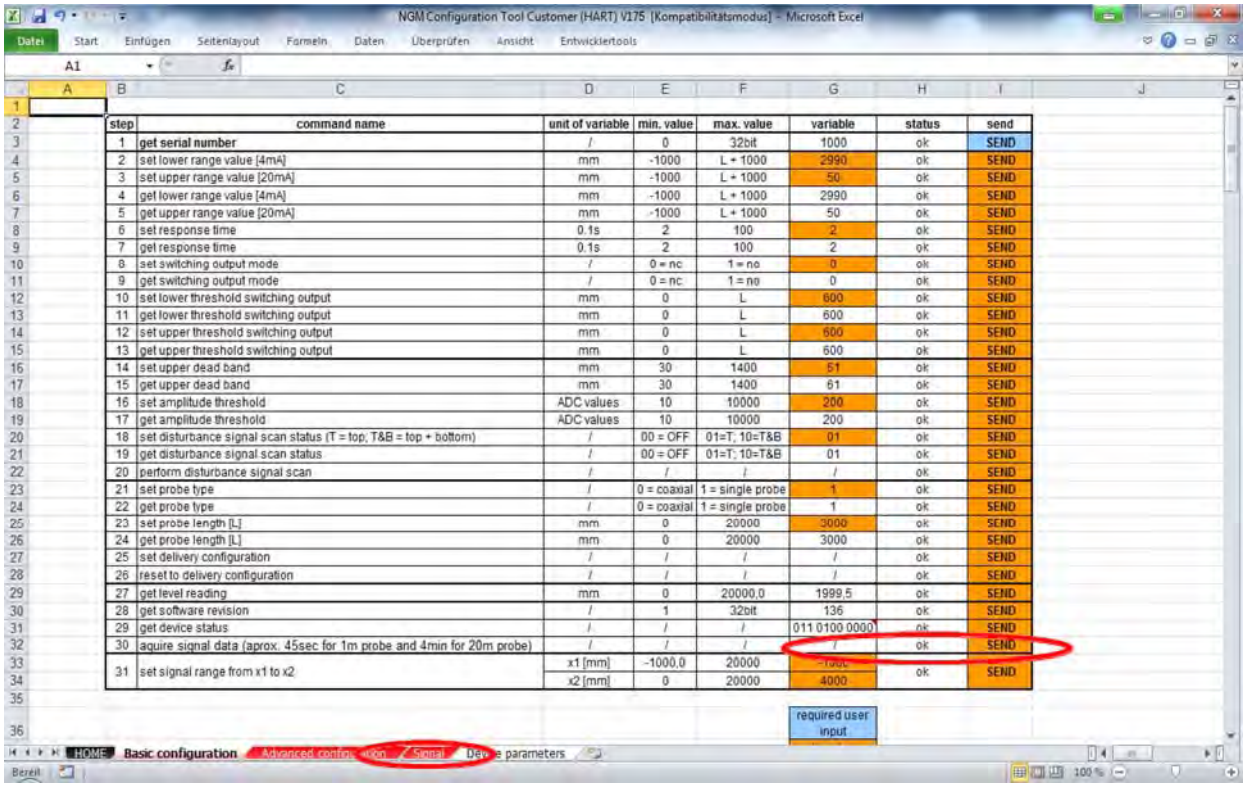
8.6.18 Signal Data – Echo Curve

BASIC CONFIGURATION

• Acquire actual signal data or also called echo curve by clicking on I32

Once the OK status in field H32 does not disappear anymore, the echo curve can be visualized by clicking on worksheet SIGNAL.

Reading out the echo curve from the electronics can take several seconds, as all data must be communicated via the serial HART protocol to the PC.



step	command name	unit of variable	min. value	max. value	variable	status	send
1	get serial number	/	0	32bit	1000	ok	SEND
2	set lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
3	set upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
4	get lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
5	get upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
6	set response time	0.1s	2	100	2	ok	SEND
7	get response time	0.1s	2	100	2	ok	SEND
8	set switching output mode	/	0 = nc	1 = no	0	ok	SEND
9	get switching output mode	/	0 = nc	1 = no	0	ok	SEND
10	set lower threshold switching output	mm	0	L	600	ok	SEND
11	get lower threshold switching output	mm	0	L	600	ok	SEND
12	set upper threshold switching output	mm	0	L	600	ok	SEND
13	get upper threshold switching output	mm	0	L	600	ok	SEND
14	set upper dead band	mm	30	1400	61	ok	SEND
15	get upper dead band	mm	30	1400	61	ok	SEND
16	set amplitude threshold	ADC values	10	10000	200	ok	SEND
17	get amplitude threshold	ADC values	10	10000	200	ok	SEND
18	set disturbance signal scan status (T = top; T&B = top + bottom)	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
19	get disturbance signal scan status	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
20	perform disturbance signal scan	/	/	/	/	ok	SEND
21	set probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
22	get probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
23	set probe length [L]	mm	0	20000	3000	ok	SEND
24	get probe length [L]	mm	0	20000	3000	ok	SEND
25	set delivery configuration	/	/	/	/	ok	SEND
26	reset to delivery configuration	/	/	/	/	ok	SEND
27	get level reading	mm	0	20000,0	1999,5	ok	SEND
28	get software revision	/	1	32bit	136	ok	SEND
29	get device status	/	/	/	011 0100 0000	ok	SEND
30	aquire signal data (aprox. 45sec for 1m probe and 4min for 20m probe)	/	/	/	/	ok	SEND
31	set signal range from x1 to x2	x1 [mm]	-1000,0	20000	-1000	ok	SEND
		x2 [mm]	0	20000	4000		

required user input

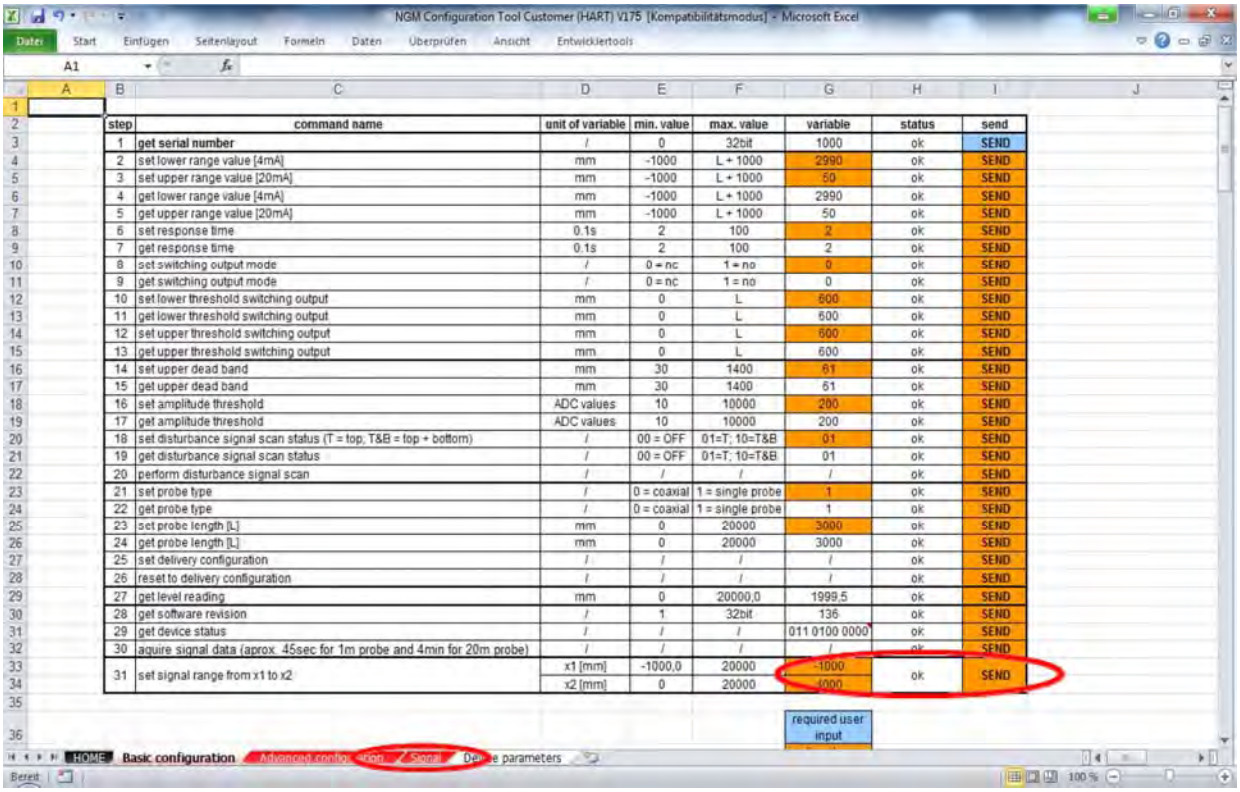
8.6.19 Signal Range

BASIC CONFIGURATION

• Set signal range, by entering values in field G33/34 and clicking on I33/34

Depending on the probe length, the range within the echo curve in worksheet SIGNAL can be adapted.

A negative X1 range of -1000 is always recommended and standard. With this the microwave generation and coupling can be verified.



step	command name	unit of variable	min. value	max. value	variable	status	send
1	get serial number	/	0	32bit	1000	ok	SEND
2	set lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
3	set upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
4	get lower range value [4mA]	mm	-1000	L + 1000	2990	ok	SEND
5	get upper range value [20mA]	mm	-1000	L + 1000	50	ok	SEND
6	set response time	0.1s	2	100	2	ok	SEND
7	get response time	0.1s	2	100	2	ok	SEND
8	set switching output mode	/	0 = nc	1 = no	0	ok	SEND
9	get switching output mode	/	0 = nc	1 = no	0	ok	SEND
10	set lower threshold switching output	mm	0	L	600	ok	SEND
11	get lower threshold switching output	mm	0	L	600	ok	SEND
12	set upper threshold switching output	mm	0	L	600	ok	SEND
13	get upper threshold switching output	mm	0	L	600	ok	SEND
14	set upper dead band	mm	30	1400	61	ok	SEND
15	get upper dead band	mm	30	1400	61	ok	SEND
16	set amplitude threshold	ADC values	10	10000	200	ok	SEND
17	get amplitude threshold	ADC values	10	10000	200	ok	SEND
18	set disturbance signal scan status (T = top; T&B = top + bottom)	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
19	get disturbance signal scan status	/	00 = OFF	01=T; 10=T&B	01	ok	SEND
20	perform disturbance signal scan	/	/	/	/	ok	SEND
21	set probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
22	get probe type	/	0 = coaxial	1 = single probe	1	ok	SEND
23	set probe length [L]	mm	0	20000	3000	ok	SEND
24	get probe length [L]	mm	0	20000	3000	ok	SEND
25	set delivery configuration	/	/	/	/	ok	SEND
26	reset to delivery configuration	/	/	/	/	ok	SEND
27	get level reading	mm	0	20000,0	1999,5	ok	SEND
28	get software revision	/	1	32bit	136	ok	SEND
29	get device status	/	/	/	011 0100 0000	ok	SEND
30	aquire signal data (aprox. 45sec for 1m probe and 4min for 20m probe)	/	/	/	/	ok	SEND
31	set signal range from x1 to x2	x1 [mm]	-1000,0	20000	-1000	ok	SEND
		x2 [mm]	0	20000	4000		

required user input

8.6.20 Signal

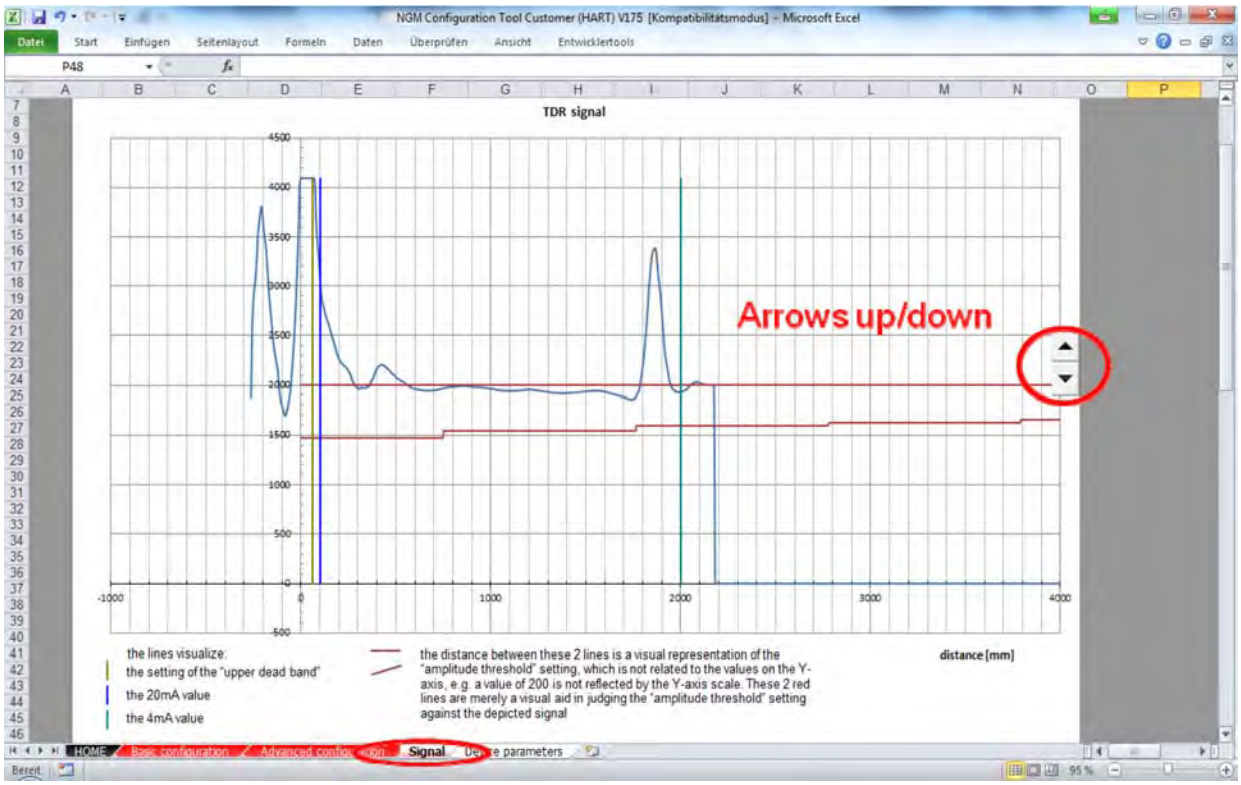
SIGNAL

- Visualization of the actual echo curve, where the level calculation is based on.
- The NGM gets 70 echo curves every second for calculating the level.

The most important parameters (4…20mA; dead band and amplitude threshold) are visualized.

With the arrows up/down, the amplitude threshold can be positioned properly on the average zero line of the echo curve as a means to evaluate the correct value.

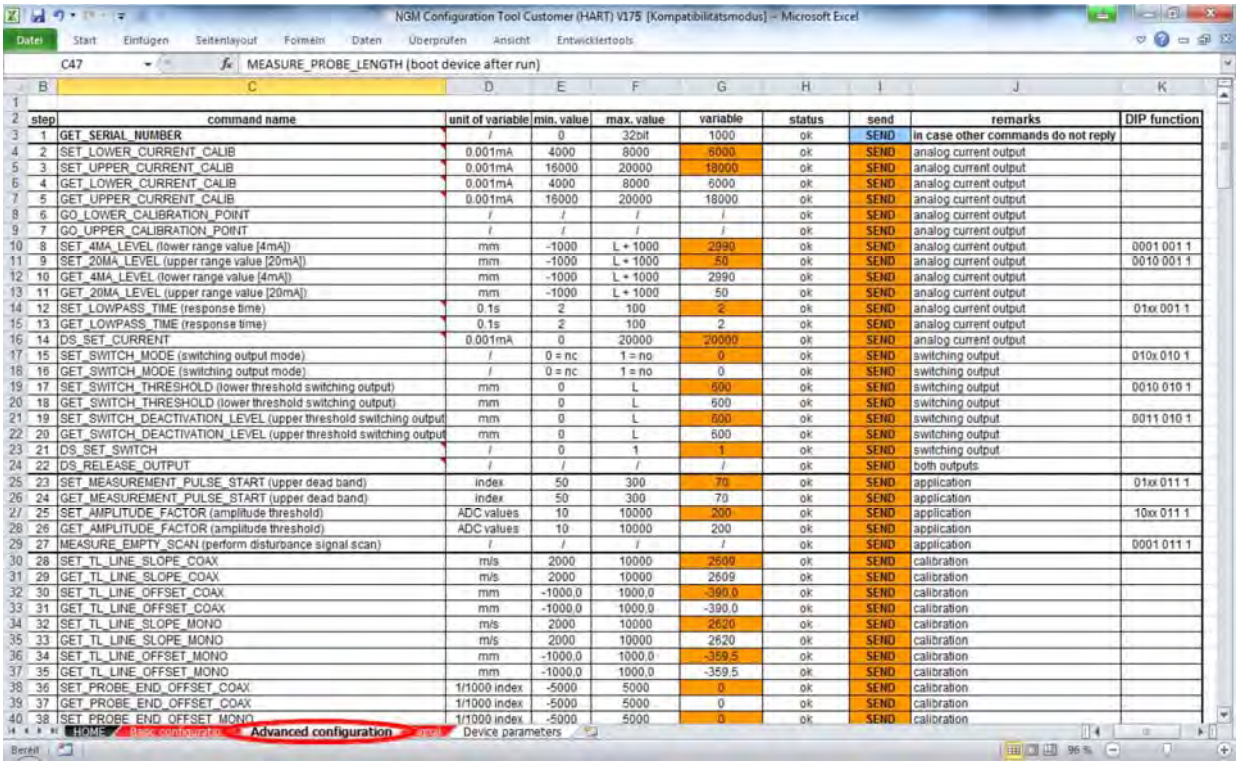
– x-axis: length in mm
y-axis : voltage according to factory-specific scales



8.6.21 More Parameters…

ADVANCED CONFIGURATION

• Parameters within the worksheet ADVANCED CONFIGURATION are only recommended to change by experts.



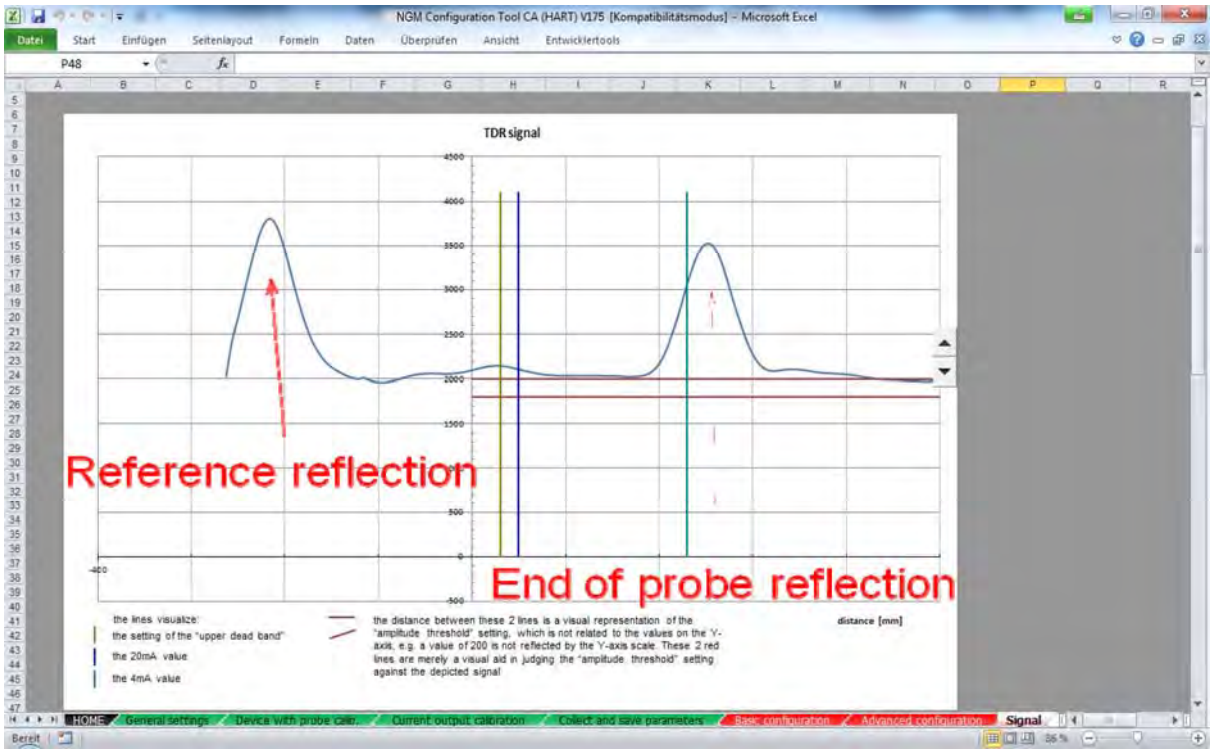
step	command name	unit of variable	min. value	max. value	variable	status	send	remarks	DIP function
1	GET_SERIAL_NUMBER	/	0	32bit	1000	ok	SEND	in case other commands do not reply	
2	SET_LOWER_CURRENT_CALIB	0.001mA	4000	8000	6000	ok	SEND	analog current output	
3	SET_UPPER_CURRENT_CALIB	0.001mA	16000	20000	18000	ok	SEND	analog current output	
4	GET_LOWER_CURRENT_CALIB	0.001mA	4000	8000	6000	ok	SEND	analog current output	
5	GET_UPPER_CURRENT_CALIB	0.001mA	16000	20000	18000	ok	SEND	analog current output	
6	GO_LOWER_CALIBRATION_POINT	/	/	/	/	ok	SEND	analog current output	
7	GO_UPPER_CALIBRATION_POINT	/	/	/	/	ok	SEND	analog current output	
8	SET_4MA_LEVEL (lower range value [4mA])	mm	-1000	L + 1000	2990	ok	SEND	analog current output	0001 001 1
9	SET_20MA_LEVEL (upper range value [20mA])	mm	-1000	L + 1000	50	ok	SEND	analog current output	0010 001 1
10	GET_4MA_LEVEL (lower range value [4mA])	mm	-1000	L + 1000	2990	ok	SEND	analog current output	
11	GET_20MA_LEVEL (upper range value [20mA])	mm	-1000	L + 1000	50	ok	SEND	analog current output	
12	SET_LOWPASS_TIME (response time)	0.1s	2	100	2	ok	SEND	analog current output	01xx 001 1
13	GET_LOWPASS_TIME (response time)	0.1s	2	100	2	ok	SEND	analog current output	
14	DS_SET_CURRENT	0.001mA	0	20000	20000	ok	SEND	analog current output	
15	SET_SWITCH_MODE (switching output mode)	/	0 = nc	1 = no	0	ok	SEND	switching output	010x 010 1
16	GET_SWITCH_MODE (switching output mode)	/	0 = nc	1 = no	0	ok	SEND	switching output	
17	SET_SWITCH_THRESHOLD (lower threshold switching output)	mm	0	L	600	ok	SEND	switching output	0010 010 1
18	GET_SWITCH_THRESHOLD (lower threshold switching output)	mm	0	L	600	ok	SEND	switching output	
19	SET_SWITCH_DEACTIVATION_LEVEL (upper threshold switching output	mm	0	L	600	ok	SEND	switching output	0011 010 1
20	GET_SWITCH_DEACTIVATION_LEVEL (upper threshold switching output	mm	0	L	600	ok	SEND	switching output	
21	DS_SET_SWITCH	/	0	1	1	ok	SEND	switching output	
22	DS_RELEASE_OUTPUT	/	/	/	/	ok	SEND	both outputs	
23	SET_MEASUREMENT_PULSE_START (upper dead band)	index	50	300	70	ok	SEND	application	01xx 011 1
24	GET_MEASUREMENT_PULSE_START (upper dead band)	index	50	300	70	ok	SEND	application	
25	SET_AMPLITUDE_FACTOR (amplitude threshold)	ADC values	10	10000	200	ok	SEND	application	10xx 011 1
26	GET_AMPLITUDE_FACTOR (amplitude threshold)	ADC values	10	10000	200	ok	SEND	application	
27	MEASURE_EMPTY_SCAN (perform disturbance signal scan)	/	/	/	/	ok	SEND	application	0001 011 1
28	SET_TL_LINE_SLOPE_COAX	m/s	2000	10000	2609	ok	SEND	calibration	
29	GET_TL_LINE_SLOPE_COAX	m/s	2000	10000	2609	ok	SEND	calibration	
30	SET_TL_LINE_OFFSET_COAX	mm	-1000,0	1000,0	-390,0	ok	SEND	calibration	
31	GET_TL_LINE_OFFSET_COAX	mm	-1000,0	1000,0	-390,0	ok	SEND	calibration	
32	SET_TL_LINE_SLOPE_MONO	m/s	2000	10000	2620	ok	SEND	calibration	
33	GET_TL_LINE_SLOPE_MONO	m/s	2000	10000	2620	ok	SEND	calibration	
34	SET_TL_LINE_OFFSET_MONO	mm	-1000,0	1000,0	-359,5	ok	SEND	calibration	
35	GET_TL_LINE_OFFSET_MONO	mm	-1000,0	1000,0	-359,5	ok	SEND	calibration	
36	SET_PROBE_END_OFFSET_COAX	1/1000 index	-5000	5000	0	ok	SEND	calibration	
37	GET_PROBE_END_OFFSET_COAX	1/1000 index	-5000	5000	0	ok	SEND	calibration	
38	SET_PROBE_END_OFFSET_MONO	1/1000 index	-5000	5000	0	ok	SEND	calibration	

8.6.22 Signal Discussion 1

Empty Coaxial Probe

- Nice reference reflection at the beginning
- Perfect coupling into the coaxial probe
- Positive end of probe reflection which corresponds to the physical end of probe

Dead band parameter at 30mm.
20mA parameter at 50mm.
4mA parameter at 230mm.
Amplitude threshold at 1000.

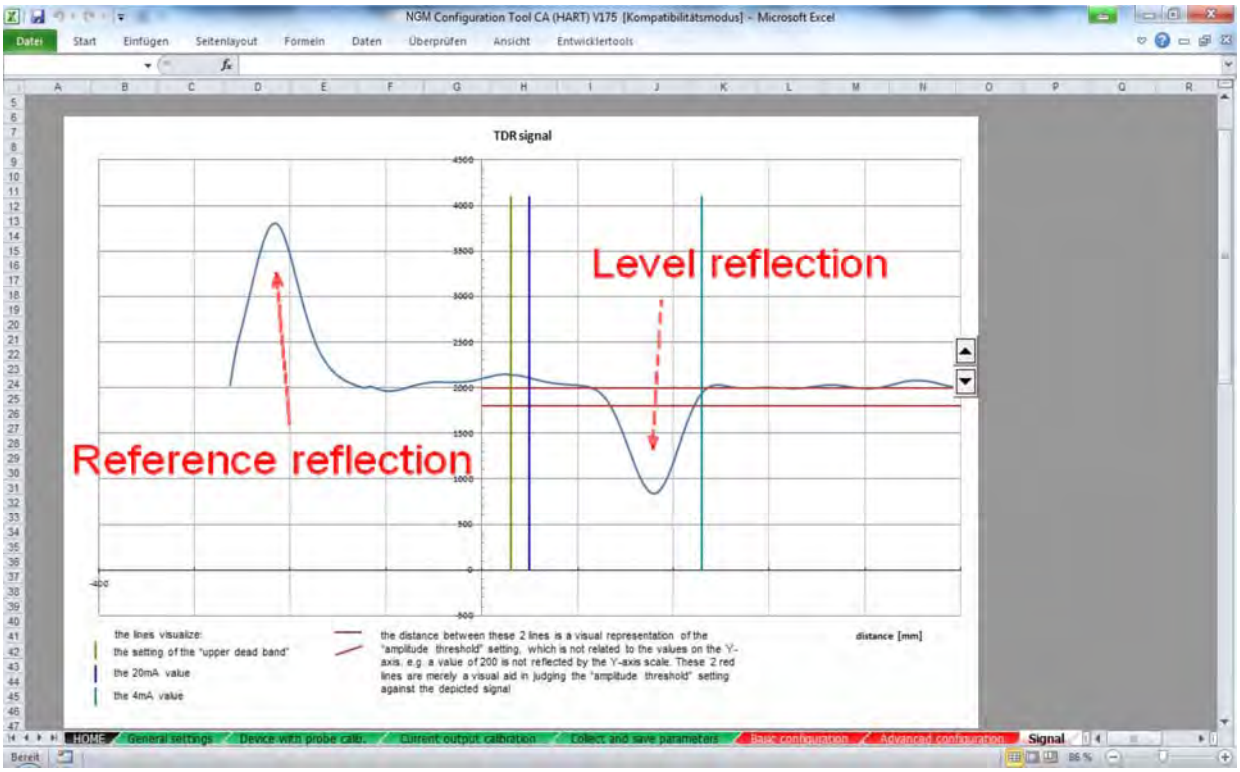


8.6.23 Signal Discussion 2

Level Coaxial Probe

- Stable reference reflection at the beginning
- Negative level reflection at 168mm
- No end of probe reflection as energy is completely reflected at water surface

Dead band parameter at 30mm.
20mA parameter at 50mm.
4mA parameter at 230mm.
Amplitude threshold at 1000.

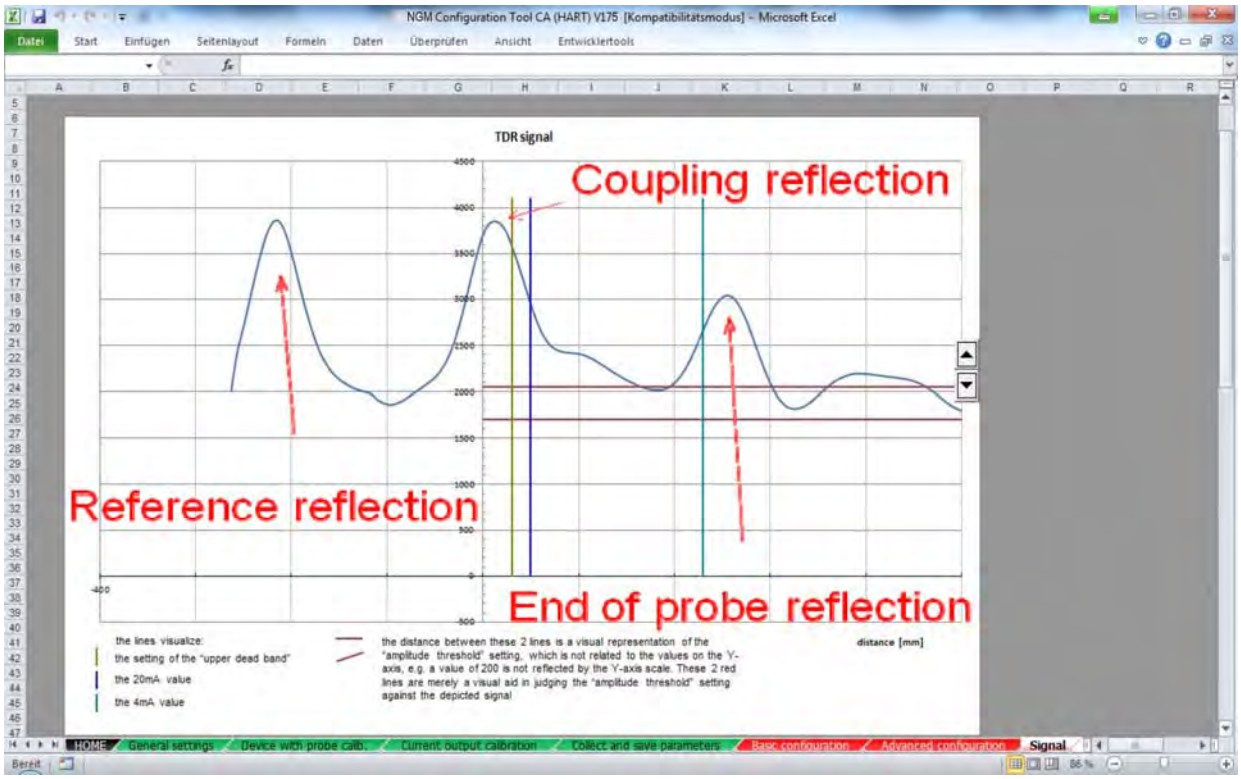


8.6.24 Signal Discussion 3

Empty Rod Probe

- Nice reference reflection at the beginning
- Strong positive impulse at the transition of coupling to the single rod
- Reflection can change with mounting conditions.
- Positive end of probe reflection which corresponds to the physical end of probe

Dead band parameter at 30mm.
20mA parameter at 50mm.
4mA parameter at 230mm.
Amplitude threshold at 1000.

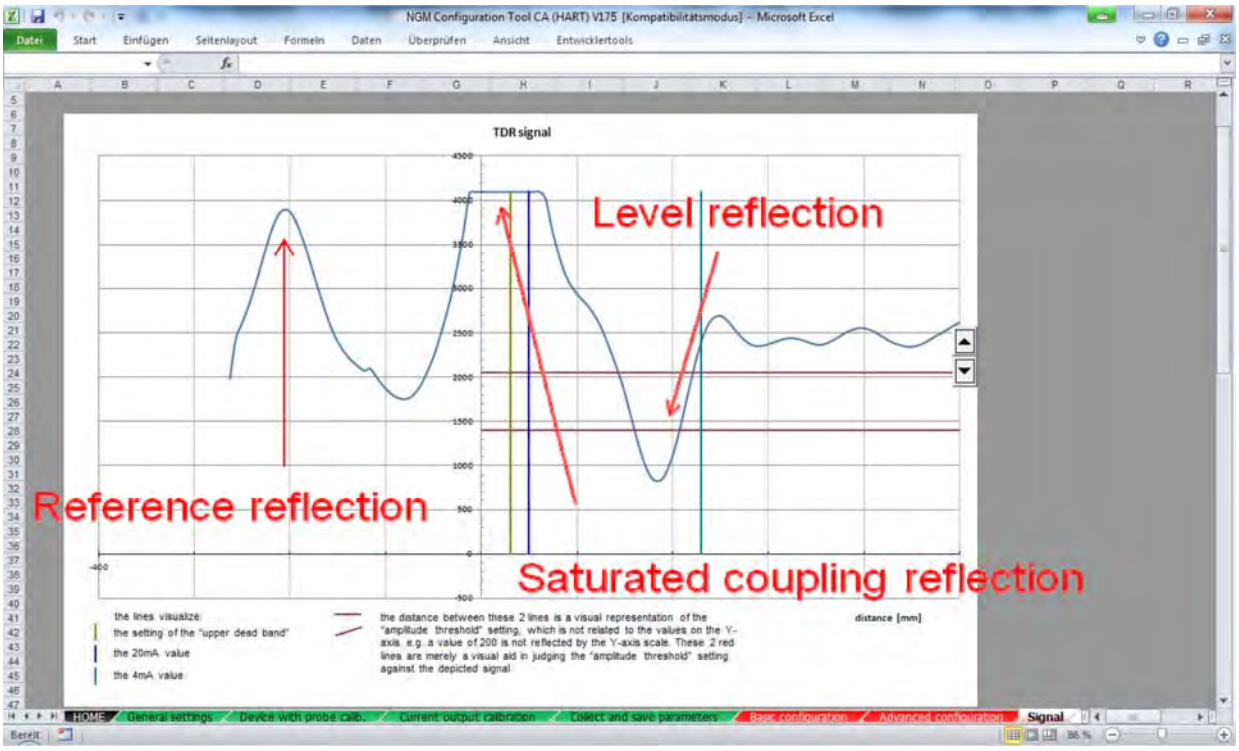


8.6.25 Signal Discussion 4

Level Rod Probe

- Stable reference reflection at the beginning
- Negative level reflection at 168mm
- No end of probe reflection as energy is completely reflected at water surface
- Positive coupling reflection in saturation as amplification factor increased

Dead band parameter at 30mm.
20mA parameter at 50mm.
4mA parameter at 230mm.
Amplitude threshold at 1000.



9. Technical Information

	Single rod	Wire rope	Coaxial
Probe diameter	6 mm	4 mm	17.2 mm
Max. Load	Lateral: 6 Nm = 0,2 kg at 3 m	Tensile: 5 kN	Lateral: 100 Nm = 4.67 kg at 6 m
Probe length L	100...3000 mm	1000...20,000 mm	100...6000 mm (standard) 100...1000 mm (high temperature)
Dielectric Constant (ε_r)	> 1.8	> 1.8	> 1.4
Viscosity (cP)	< 5000	< 5000	< 500
Medium temperature, standard version	-40...+150°C (without PTFE) -15...+100°C (PTFE lining)	-40...+150°C	-40...+130°C (EPDM O-ring) -15...+150°C (FKM O-ring)
High temperature version	-200...+250°C (NBR O-ring) -150...+250°C (FKM O-ring)	Not available	-200...+250°C (NBR O-ring) -150...+250°C (FKM O-ring)
Materials exposed to tank atmosphere	1.4571/316 Ti, PEEK Standard version PTFE, O-ring (see order code), (PTFE lining) 1.4571/316 Ti, PEEK, PTFE O-ring (see order code), (high temperature version) In all cases, in addition, a Klinger SIL® C-4400 gasket at connection thread, 2 mm thick	1.4401/316, PEEK In addition, a Klinger SIL® C-4400 gasket at connection thread, 2 mm thick	1.4404/316 L, PEEK, O-ring (see order code), (standard version) 1.4404/316 L, PEEK, PTFE, O-ring (see order code), (high temperature version) In all cases, in addition, a Klinger SIL® C-4400 gasket at connection thread, 2 mm thick

Measuring principle: Guided Wave Radar (GWR)
Installation position: Vertical
Ambient temperature: -25...+80°C
Storage temperature: -40...+85°C
Max. Pressure: -1...+40 bar (except NGM-19:0...4 bar)
Accuracy*: ±3 mm or 0.03 % of measured distance, whichever is greater
Repeatability*: < 2 mm
Resolution*: < 1 mm
*Reference condition: ε_r = 80, water**,** tank ø 1 m, DN200 metl flange
Velocity of level change: < 1000 mm/s
Medium conductivity: No restrictions
Medium density: No restrictions
Process connection: Thread or flange, see ordering code
Interface
(e.g. oil on top of water): An oil layer of < 70 mm thickness on top of water is not detected by the sensor; in this case the sensor will detect only the water level at a slightly lower position than actual.
From an oil layer thickness > 70 mm onwards, the sensor detects the total level, including the oil layer, according to specifications.

Materials

Housing:	Aluminium alloy, epoxy coated, with safety chain and tin plated 1.4301/SS304 external earth screw Option: Stainless steel 1.4401/SS316
O-ring:	NGM Rod/Rope: None NGM Coaxial: FKM or EPDM NGM high temperature: NBR or FKM

Weights

Housing incl. electronics:	720 g
Stainless steel housing incl. electronics:	1340 g
Connection ¾ (Coaxial):	350 g
1 m Rod probe:	230 g
1 m Rope probe:	66 g + 380 g ballast weight
1 m Coaxial probe:	540 g + 130 g (attachment kit)
Cooling extension for high temperature:	900 g

Electrical data

Supply voltage:	12...30 V_{DC} (reverse-polarity protected < 50 mA) 4 wire-system
Output:	4...20 mA (programmable by HART®modem)
Total load:	< 500 Ω + load resistance approx. 250 Ω
Response time:	0.5 s [default], 2 s, 5 s (selectable)
Temperature drift:	< 0.2 mm/K change in ambient temperature
Switching output	
DC PNP (active):	NC [default] or NO (short-circuit protected)
Load current:	< 200 mA
Signal voltage HIGH:	Supply voltage – 2 V
Signal voltage LOW:	0 V...1 V
Response time:	< 100 ms
Current consumption:	< 50 MA at 24 V_{DC} (no burden)
Start-up time:	< 6 s
Cable terminals:	Clamp terminal block for cable 0.5...2 mm^2
Cable entry:	2 x M20 x 1.5
Protection:	IP68

10. Order Codes

Ordering Data (Example: NGM-1200 G5 A40)

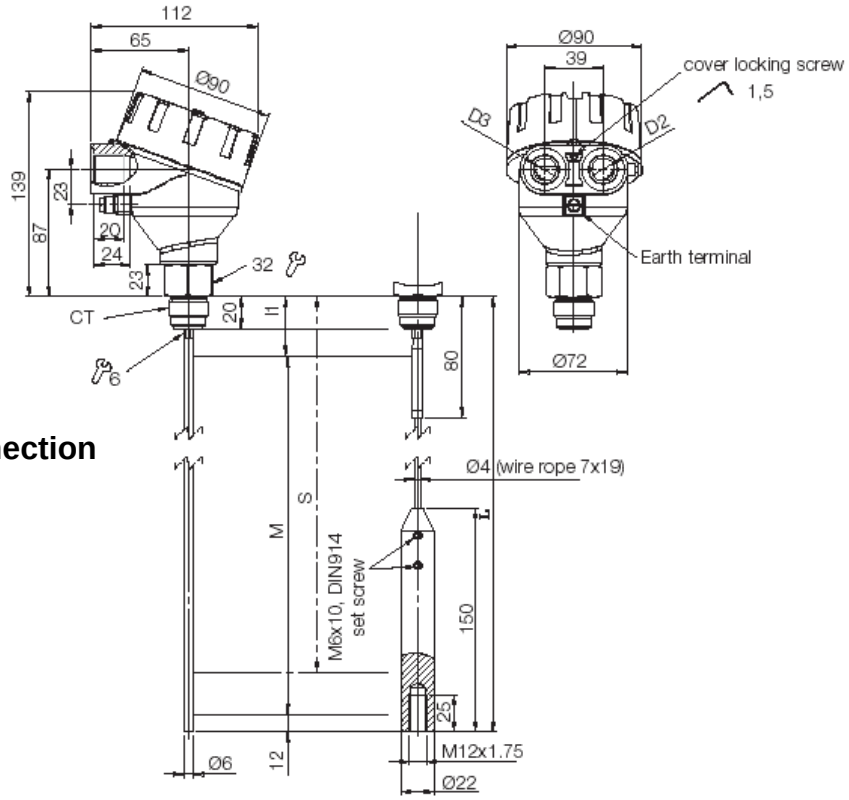
Model		Material (Probe/O-ring)	Connection	Output	Option
NGM-1	**Rod probe**	**200** = stainless steel, PEEK/without O-ring **900**[5] = stainless steel, PEEK/FKM PTFE coating	**G5** = G ¾ male **N5** = ¾ NPT male **F8** = DN40 / PN 40 B1, 1.4404/316L flange EN1092-1 **F9** = DN 50 / PN 40 B1, 316L flange EN1092-1 **FB** = DN 80 / PN 40 B1, 1.4404/316L flange EN1092-1 **FC** = DN 100 / PN16 B1, 1.4404/316L flange EN1092-1 **A8** = 1 ½" ASME B 16.5 CL 150, 1.4404/316L **A9** = 2" ASME B 16.5 CL 150, 1.4404/316L **AA** = 2½ " ASME B 16.5 CL 150, 1.4404/316L **AB** = 3" ASME B 16.5 CL 150, 1.4404/316L **AC** = 4" ASME B 16.5 CL 150, 1.4404/316L **XX** = special (please specify in clear text)	**A4** = 4…20 mA, PNP **E4**[4] = 4…20 mA, PNP, ATEX-version	**00** = without **B3**[1] = mounted in Bypass with DIN-flange DN10 **B4**[1] = mounted in Bypass with DIN-flange DN15 **B5**[1] = mounted in Bypass with DIN-flange DN20 **B6**[1] = mounted in Bypass with DIN-flange DN25 **BB**[1] = mounted in Bypass with ANSI-flange ½“ **BC**[1] = mounted in Bypass with ANSI-flange ¾“ **BD**[1] = mounted in Bypass with ANSI-flange 1“ **S1**[2] = mount. in stilling well DIN-flange DN40/PN40 **S2**[2] = mount. in stilling well DIN-flange DN50/PN40 **S3**[2] = mount. in stilling well DIN-flange DN80/PN40 **S4**[2] = mount. in stilling well DIN-flange DN100/PN16 **SA**[2] = mount. in stilling well ANSI-flange 1½“ 150 lbs **SB**[2] = mount. in stilling well ANSI-flange 2“ 150 lbs **SC**[2] = mount. in stilling well ANSI-flange 2½“ 150 lbs **SD**[2] = mount. in stilling well ANSI-flange 3“ 150 lbs **SE**[2] = mount. in stilling well ANSI-flange 4“ 150 lbs **K0**[3] = mounted in bypass with roller/ball display **YY** = special
NGM-8	**Rod probe, high temperature**	**210** = stainless steel, PEEK/NBR **220** = stainless steel, PEEK/FKM			
NGM-2	**Coaxial probe**	**230** = stainless steel, PEEK/EPDM **220** = stainless steel, PEEK/FKM			
NGM-9	**Coaxial probe, high temperature**	**210** = stainless steel, PEEK/NBR **220** = stainless steel, PEEK/FKM			
NGM-4	**Wire rope ø 4 mm** (liquids and light solids only)	**200** = stainless steel, PEEK/without O-ring			

[1] Bypass specification, see NBK-M data sheet
[2] Please specify probe length L and stilling well length (when different from standard, see drawing dimensions) in clear text while ordering
[3] Bypass specification, see NBK data sheet. Max. possible measuring length ML = 5500 mm. Not possible with NGM-2/-9/-4. Max. medium viscosity 500 cP.
[4] Not possible with NGM-19..., NGM-8..., and NGM-9
[5] Not possible for flange sizes <DN50/PN40 and <2½” ASME CL 150

Note: Please specify probe length L in clear text while ordering

11. Dimensions

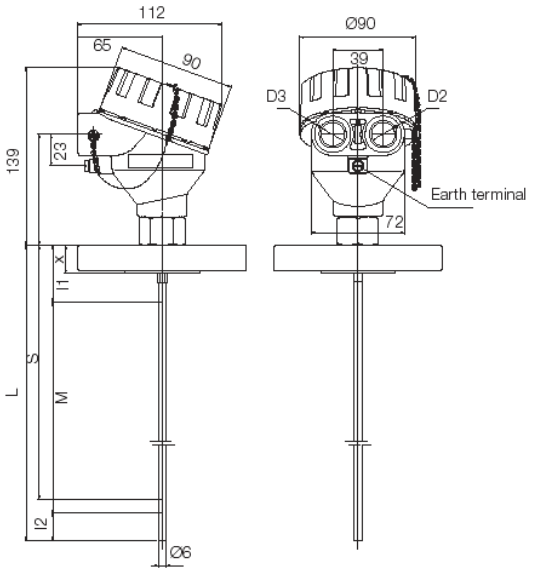
Dimensions in mm



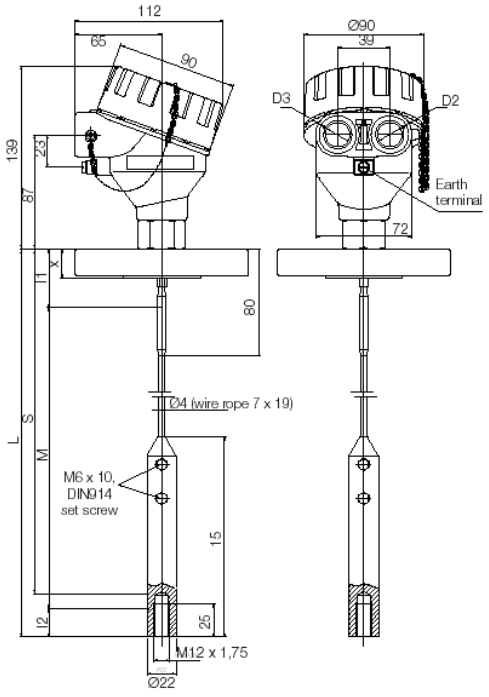
NGM-12.../NGM-42...with thread connection
Single rod/wire rope probe
Standard application temperature

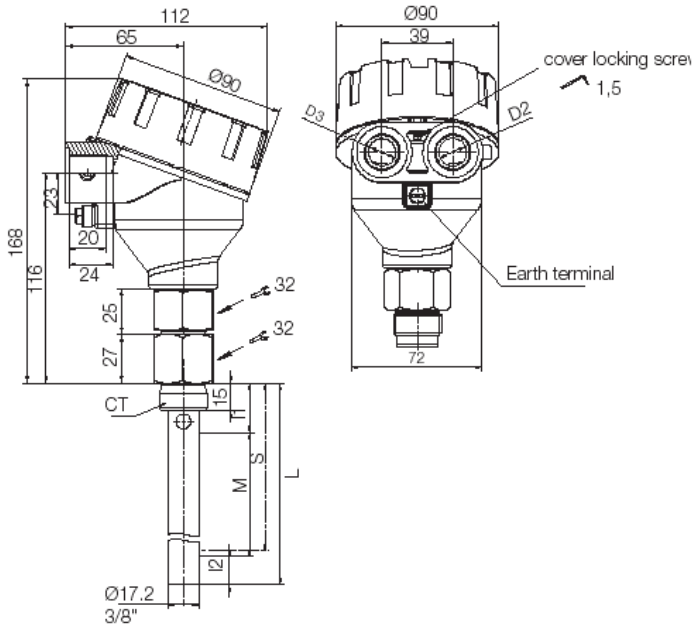
NGM-12.../NGM-42...with flange connection

Single rod version

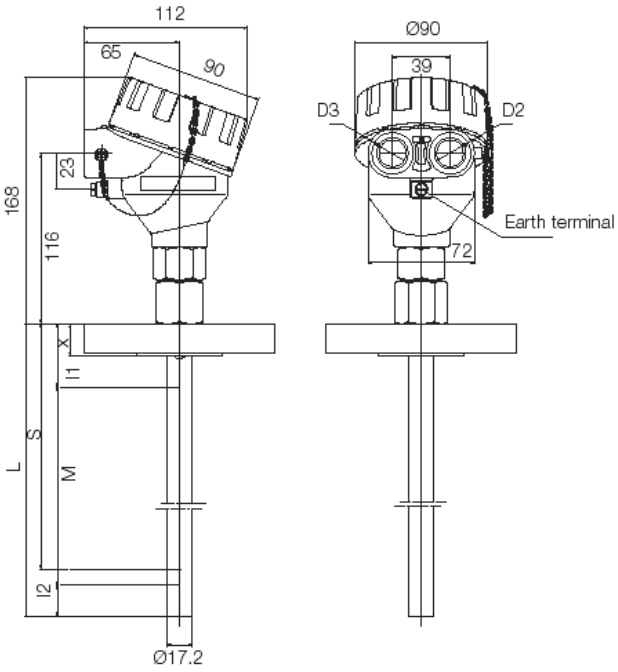


Wire rope version

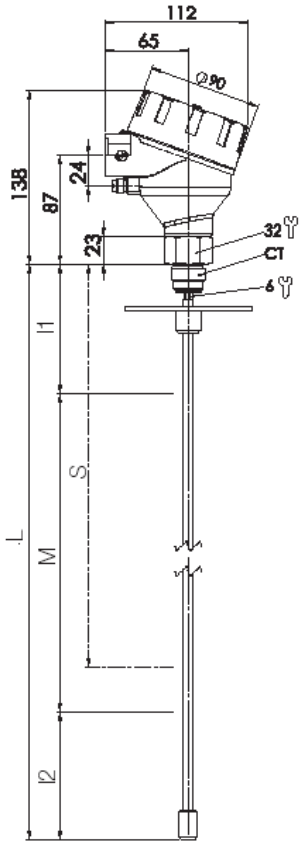




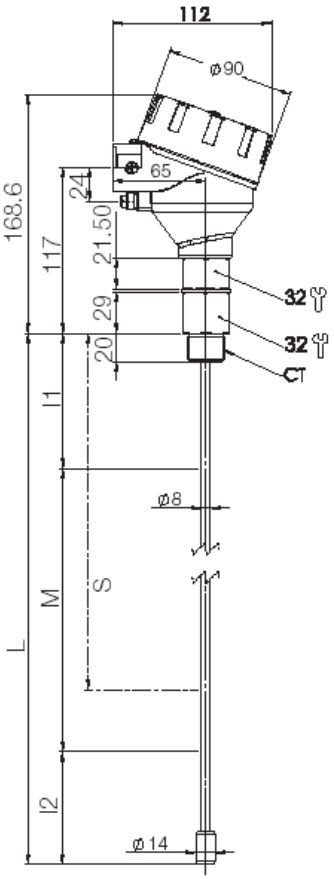
NGM-22 with thread connection
Coaxial probe
Standard application temperature



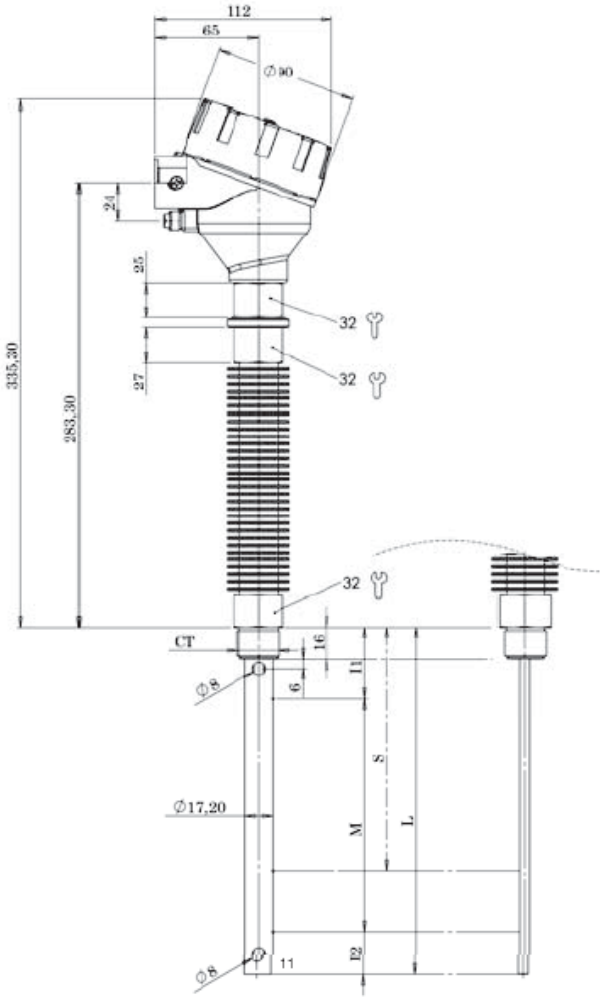
NGM-22…with flange connection



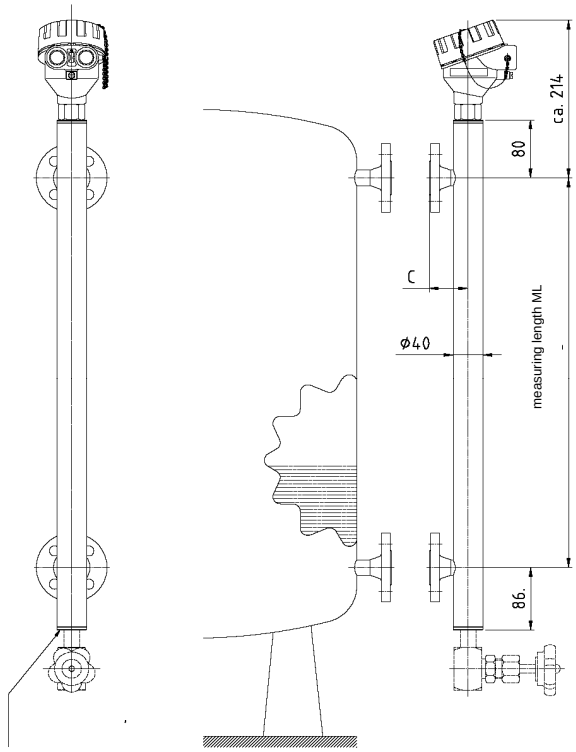
NGM-19…with flange connection
Single rod probe, PTFE coated
Flange disk



NGM-19…with thread connection
Single rod probe, PTFE coated
Connection thread

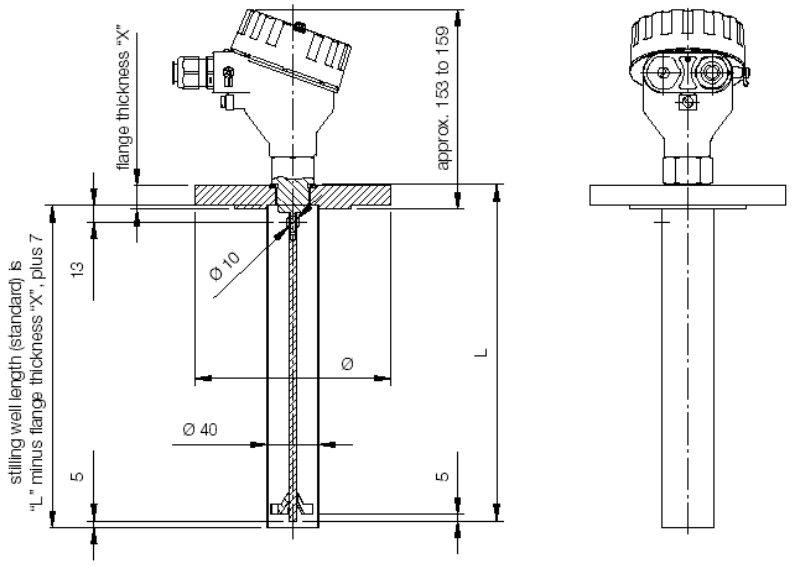


NGM-8…/NGM-9…with thread connection (high temperature version)
Single rod/coaxial probe
Extended application temperature



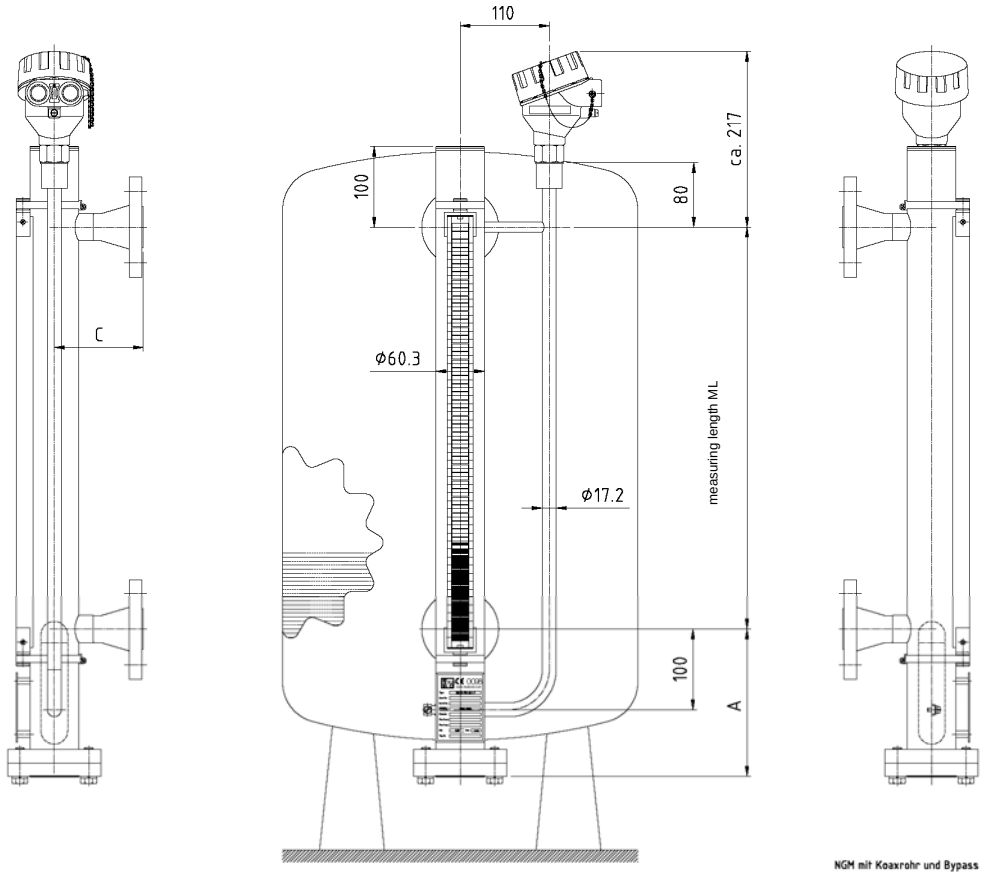
NGM assembled in a bypass tube option B

NBK-M
Bottom cover with G¼ (DIN flanges) or ¼“ NPT (ASME flanges) drain plug or optional needle valve



Connection	Flange	„X“	ø
F8	DN40/PN40	18	150
F9	DN50/PN40	20	165
FB	DN80/PN40	24	200
FC	DN100/PN16	20	220
A8	1½“/CL 150	17.9	125
A9	2“/CL 150	19.5	150
AA	2½“/CL 150	22.7	180
	3“/CL 150	24.3	190
AC	4“/CL 150	24.3	215

NGM with „Top Mounting in Stilling Well“ option S



NGM assembled in a bypass tube with roller/ball display (redundant measurement) option K

12. Safety Instructions for Ex-Versions Model NGM

NGM
4-wire TDR-Sensor with single rod or coaxial probe for continuous level measurement and point level detection in liquids, with analog and switching output.

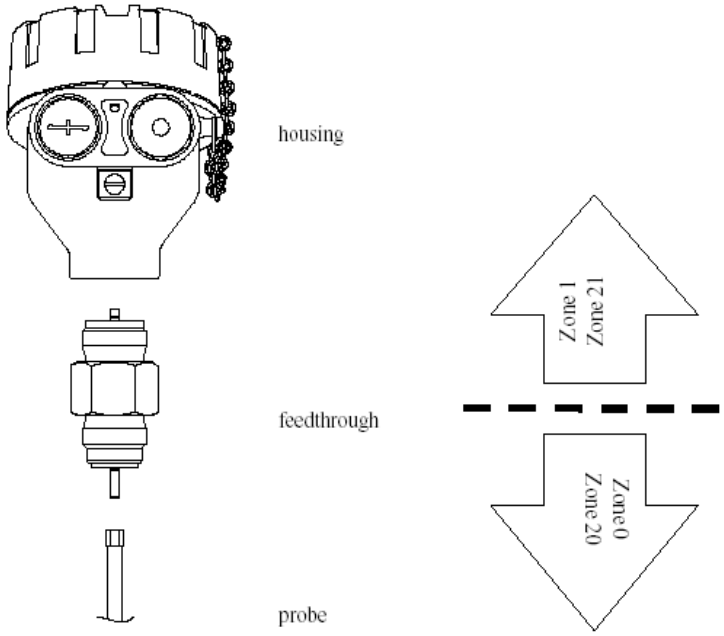
DOCUMENT DESCRIPTION
These safety instructions are part of the NGM Quick Installation Guide and give instructions regarding to proper installation and operation of NGM in hazardous areas.

GENERAL DESCRIPTION
NGM is suitable for applications with hazardous gas or dust atmospheres, for applications requiring instruments of category 1/2G, 1/2D or 2G, 2D. If NGM is installed and operated in hazardous areas, the general hazardous area installation regulations IEC 60079-14, all relevant national, regional and local regulations and standards, as well as these safety instructions must be observed. The installation of electrical equipment in hazardous areas must always be carried out by qualified personnel.

APPROVAL DETAILS
CE 0158 SEV 13 ATEX 0108 X
Ex II 1/2G Ex ia/db IIC T6 Ga/Gb
Ex II 1/2D Ex ia/tb IIIC T86°C IP68 Da/Db
Ex II 2G Ex ia db IIC T6 Gb
Ex II 2D Ex ia tb IIIC T86°C IP68 Db

SENSOR COMPONENTS
NGM consists of three major components: housing, feedthrough, and probe. The only components that are exposed to the atmosphere inside the tank are probe and the part of the feedthrough below the hexagon. NGM has a flameproof metal housing that contains the sensor s electronics and input/output terminals and has no contact to the atmosphere inside the tank. For hazardous applications that require category 1/2G, 1/2D devices, the housing is installed in hazardous areas requiring devices of category 2G, 2D (zone 1, zone 21). The feedthrough of the sensor (acting as separation barrier between zones 0/1, zone 20/21) is installed in the wall which separates areas requiring devices of category 2G, 2D from 1G, 1D. The probe is installed in hazardous areas requiring devices of category 1G, 1D (zone 0, zone 20). For hazardous applications that require category 2G, 2D devices, all components of NGM are installed in hazardous areas requiring devices of category 2G, 2D (zone 1, zone 21).

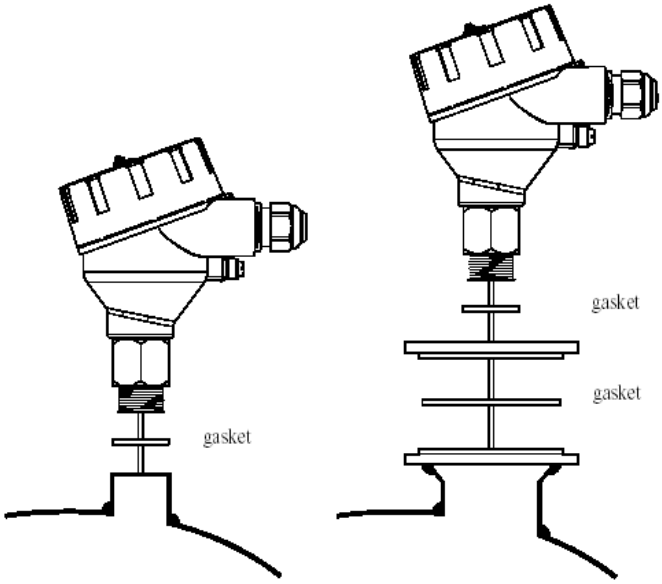
Figure 1: sensor components



MOUNTING

NGM is mounted vertically to the tank via its connection thread, which is screwed directly into a standard threaded tank connection, i.e. weld-in socket, or it can be screwed into a flange, which is then connected to a tank nozzle. NGM should not be welded directly into the tank. Neither should flanges be welded onto NGM. Welding on the metal parts of NGM will cause serious damage to the sensor. Do not lift or handle NGM by its probe; this can cause excessive stress on the probe connection. NGM should be handled by the hexagon or the lower section of the housing. Do not screw in NGM by its housing; it should be tightened only via its hexagon (wrench size 32mm for connection thread G3/4A). Tighten the coaxial probe only at its lower hexagon; the upper hexagon of the coaxial probe is not needed for mounting. The customer has to ensure suitability of all materials exposed to the tank atmosphere as well as proper sealing of the sensor connection; based on his process conditions like temperature, pressure and resistance against his process liquids and atmosphere. G thread connections require a suitable gasket for pressure-tight joints. The G3/4A connection thread of NGM is supplied with a gasket made of Klingersil C-4400, thickness 2mm. The suggested tightening torque for this thread size, this type of gasket, and a process pressure of max. 40bar is 25Nm (maximum permissible torque: 45 Nm). For NPT thread connections, pressure-tight joints require a sealant directly on the threads.

Figure 2: mounting



socket mounting nozzle mounting with flange

MOUNTING CONSIDERATIONS

The probes should be installed so that they are not directly impacted by liquids flowing out of the filling inlet. They should neither touch nor sway towards other objects inside the tank or the tank/nozzle walls; e.g. by agitator swirls. In applications with very strong fluid movements, which can also cause excessive lateral force on the probe, it is recommended to fix the probe. The anchoring fixtures are customer supplied.

The customer is not permitted to disassemble the feedthrough from the housing or perform any mechanical repairs/alterations on either the feedthrough or the enclosure. If the NGM requires service or repair, please contact Kobold.

TEMPERATURE CLASSES

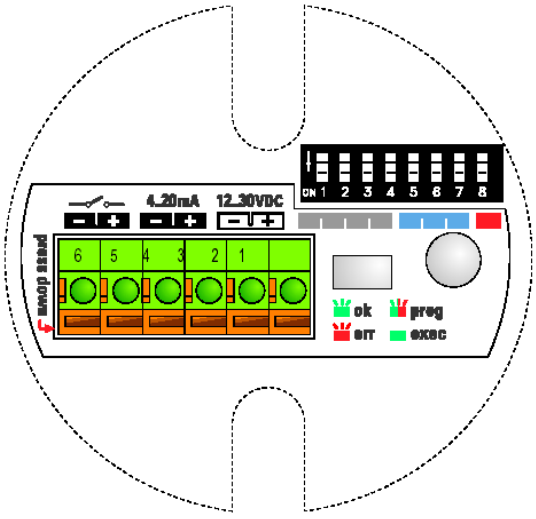
For applications in hazardous gas atmospheres, the maximum permissible application and ambient temperatures, depending on the temperature classes, are specified in figure 3. For applications in hazardous dust atmospheres, the maximum permissible surface temperature is +86°C and the ambient temperature range is -40 +70°C. For hazardous areas that require category 1/2G devices, the application pressure must be between 0,8 1,1 bar. If NGM is operated at temperatures higher than those specified in figure 3, please make sure through appropriate measures that there is no danger of ignition from the hot surfaces. The maximum permissible ambient temperature should not exceed the values specified in figure 3. For application conditions in non-hazardous area, please refer to the data sheet.

Figure 3: temperature classes

CATEGORY 1/2G		
Temperature class	Application temperature	Ambient temperature
T1...T6	-20...+60°C	-40...+70°C
CATEGORY 2G		
T6	-40...+85°C	-40...+70°C
T5	-40...+100°C	-40...+70°C
T4	-40...+135°C	-40...+70°C
T1...T3	-40...+150°C	-40...+70°C
CATEGORY 1/2D AND 2D		
Max. surface temperature: +86°C		-40...+70°C

ELECTRICAL DATA
Supply voltage (terminals 1+2): U = 12 30V DC
Um = 250V AC
Analog output (terminals 3+4): I = 4 20mA
Um = 250V AC
Switching output (terminals 5+6): Us = 0 U
Um = 250V AC

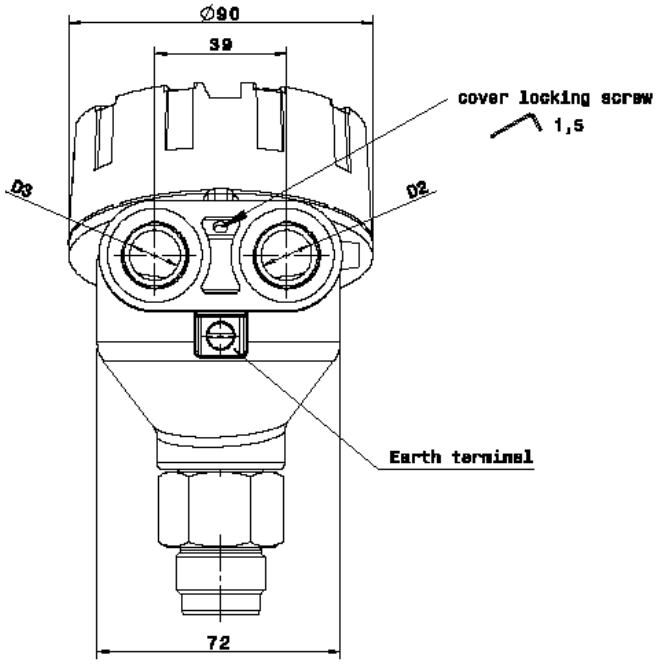
Figure 4: electrical data



CABLE ENTRIES AND CABLE GLANDS
The housing has two cable entries. For installation in hazardous areas, **only cable glands certified according to IEC 60079-1 or certified conduit systems are permitted. The tightening torque specified by the manufacturer of the certified cable glands or conduit systems has to be observed**. The torque mentioned on the sensor electronic only applies to standard cable glands/conduits, which are not permitted for installation in hazardous areas. Both cable entries can be fitted with cable glands/conduits. If only one cable gland/conduit is fitted, it is recommended to use cable entry D2 (see Fig. 5).

Then cable entry D3 has to be sealed with a certified screw plug. The cable entries have to be properly sealed and cable glands have to be properly tightened around cable of suitable type and diameter to ensure the IP68 rating of the housing. **The seals for mounting the cable glands/conduits, the cable glands/conduits themselves and the cable used for wiring have to be rated for a temperature of +86 °C.** When wiring with shielded or armoured cable, suitable cable glands have to be used. The contact between the metal housing and the shielding of the cable is made by using a suitable EMC-type cable gland. Ground the shielding of the cable only on the sensor side; not on the supply side.

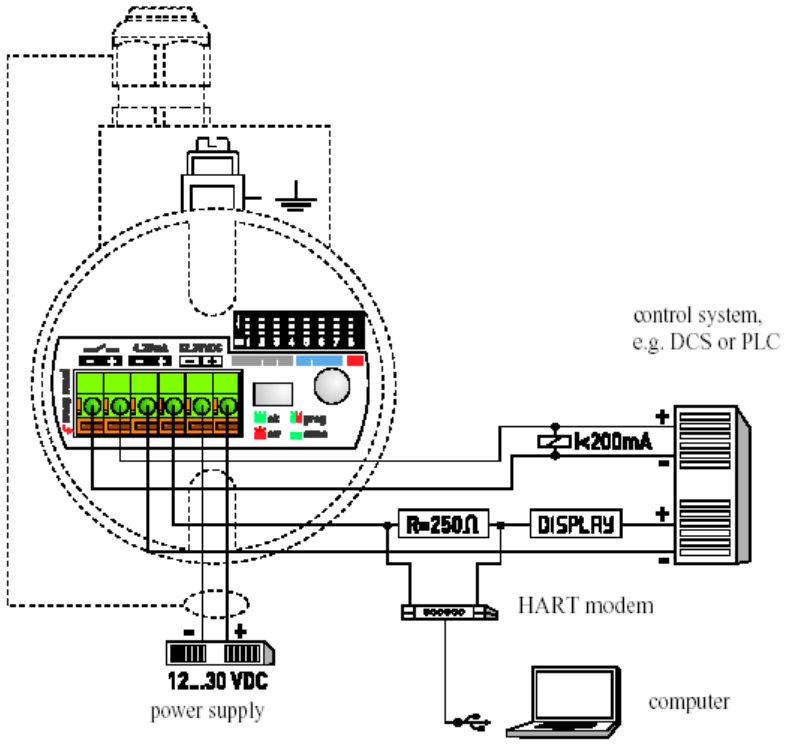
Figure 5: cable entries



WIRING

Before opening the housing cover for any reason, verify that the power supply for the sensor has been switched off for at least 6 minutes or no explosive atmosphere is present. After wiring NGM, tighten the housing cover properly by turning it clockwise (make sure the cover safety chain does not tangle up) and properly tighten the cover locking screw with an allen key size 1,5mm (see Fig. 5). Only when the cover is tightened and secured it is permitted to power up NGM. The housing cover of NGM features a thread acting as a flameproof gap and a caution message; it must not be exchanged for any other cover. Establish an equipotential connection (potential equalization) between the external earth terminal of NGM and the closest ground potential terminal of the tank.

Figure 6: wiring



13. EU Declaration of Conformance

We, KOBOLD Messring GmbH, Hofheim-Ts, Germany, declare under our sole responsibility that the product:

Guided Wave Radar Level **Model: NGM**

to which this declaration relates is in conformity with the standards noted below:

EN 61326-1:2013 Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements

Also the following EC guidelines are fulfilled:

2014/30/EU EMC Directive
2011/65/EU **RoHS**

2014/34/EU
Equipment and Protective systems intended for use in potentially Explosive Atmospheres
Quality Management Production
Certificate number: DMT 03 ATEX ZQS / E 110
Notified body: Deutsche Montan Technologie
Identification number: 0158

Hofheim, 21. March 2017

H. Peters
General Manager

M. Wenzel
Proxy Holder

14. ATEX Certificate

electro suisse

(1) **EU-Type Examination Certificate**

(2) Equipment or protective system intended for use in potentially explosive atmospheres - **Directive 2014/34/EU**

(3) Certificate number: **SEV 13 ATEX 0108 X**

(4) Product: Level Sensor NGM-xxx

(5) Manufacturer: KOBOLD Messring GmbH

(6) Address: Nordring 22-24, 65719 Hofheim, GERMANY

(7) The equipment and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

(8) Electrosuisse SEV, notified body No. 1258, in accordance with article 17 of Directive 2014/34/EU of the European parliament and of the council, dated 26 February 2014, certifies that this product has been found to comply with the essential health and safety requirements relating to the design and construction of products intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential report no 09-IK-0358.40 incl. ext1

(9) Compliance with the essential health and safety requirements has been assured by compliance with:

EN 60079-0:12 + A11:13 **EN 60079-1:14** **EN 60079-11:12**
EN 60079-26:15 **EN 60079-31:14**

Except in respect of those requirements listed at item 18 of the schedule.

(10) If the sign «X» is placed after the certificate number, it indicates that the product is subjected to special conditions for safe use specified in the schedule to this certificate

(11) This EU type examination certificate relates only to design and construction of the specified product. Further requirements of this directive apply to the manufacturing process and supply of this product. These are not covered by this certificate.

(12) The marking of the product shall include the following:

II 1/2G	**Ex ia/db IIC T6 Ga/Gb**	**II 2G**	**Ex ia db IIC T6 Gb**
II 1/2D	**Ex ia/tb IIIC T86 °C IP68 Da/Db**	**II 2D**	**Ex ia tb IIIC T86 °C IP68 Db**

Electrosuisse
Notified Body ATEX

Martin Plüss
Product Certification

www.electrosuisse.ch Fehraltorf, 2016-04-26 page 1 of 3

(13) # Appendix

(14) **EU-Type Examination Certificate**

(15) **Description of product**

4-wire NGM-Sensor with single rod, wire rope or coaxial probe for continuous level measurement and point level detection in liquids, with analog and switching output. The sensor is delivered without cable glands. It is the customer's responsibility to seal the two cable entries with approved cable glands.

Rating:	Supply voltage:	U = 12...30 VDC	(Um 250 VAC)
	Analog output:	I = 4...20 mA	(Um 250 VAC)
	Switching output:	Us = 0...U	(Um 250 VAC)

Rated ambient temperature range: -40 °C to +70 °C

The temperature class depends on ambient temperature and application temperature on the sensor. This relations are shown in the following tables:

CATEGORY 1/2G		
Temperature class	Application temperature	Ambient temperature
T1...T6	-20...+60 °C	-40...+70 °C
CATEGORY 2G		
T6	-40...+85 °C	-40...+70 °C
T5	-40...+100 °C	-40...+70 °C
T4	-40...+135 °C	-40...+70 °C
T1...T3	-40...+150 °C	-40...+70 °C
CATEGORY 1/2D and 2D		
max. surface temperature: +86 °C		-40...+70 °C

(16) **Report number** 09-IK-0358.40 incl. ext1

(17) **Specific conditions of use**
POWER DOWN WARNING:
Marking and Safety Instruction: After de-energizing, wait 6 minutes before opening

CABLE ENTRIES AND CABLE GLANDS:
Safety Instruction: The housing has two cable entries. For installation in hazardous areas, only cable glands certified according to IEC 60079-1 or certified conduit systems are permitted.

(18) **Essential health and safety requirements**
In addition to the essential health and safety requirements (EHSRs) covered by the standards listed at item 9, the following are considered relevant to this product, and conformity is demonstrated in the report:

Clause	**Subject**
Keine	

(19) **Drawings and Documents**
See Test Report "Manufacturer's Documents"