Tutorial: Fluidwell Guidense TDR100 configuration tool version 2.00

1. Introduction:

This document/tutorial is meant as a rough guideline how to use the Fluidwell Guidense TDR100 configuration tool version 2.00.

The configuration tool for the Guidense TDR100 is free and "as is".

The configuration tool can be used to read and alter the most basic settings of a Fluidwell Guidense TDR100, a level instrument or -device according to the Guided Wave Radar (GWR) or Time Domain Reflectometer (TDR) measuring technique. To configure the Guidense TDR100 you need to use a HART® modem connected to your PC.

In measurement of level with guided wave radar, microwave pulses are conducted along a cable or rod probe and reflected by the product surface. The measuring probe of the TDR sensor ensures that the signal reaches the medium undisturbed. Liquids and bulk solids are commonly measured with this measuring technique.

It is assumed that the user of the Fluidwell Guidense TDR100 configuration tool is familiar with level devices according to the Time of Flight measurement principle apart from the general conditions which are applicable using a HART® modem, in example the 250 Ohm load resistance on the analogue output of the Guidense TDR100.

A HART® modem is not part of the delivery nor supplied by Fluidwell. It can be found everywhere on the internet, click on Figure 1 and a Internet browser will open.

Figure 1 : General scheme how to connect a PC to a HART® field device e.g. Guidense TDR100.

2. Connecting a Fluidwell Guidense TDR100 to your PC:

When using a USB HART® modem, the Device Manager of your PC will show which COM port has been selected by the Windows operating system.

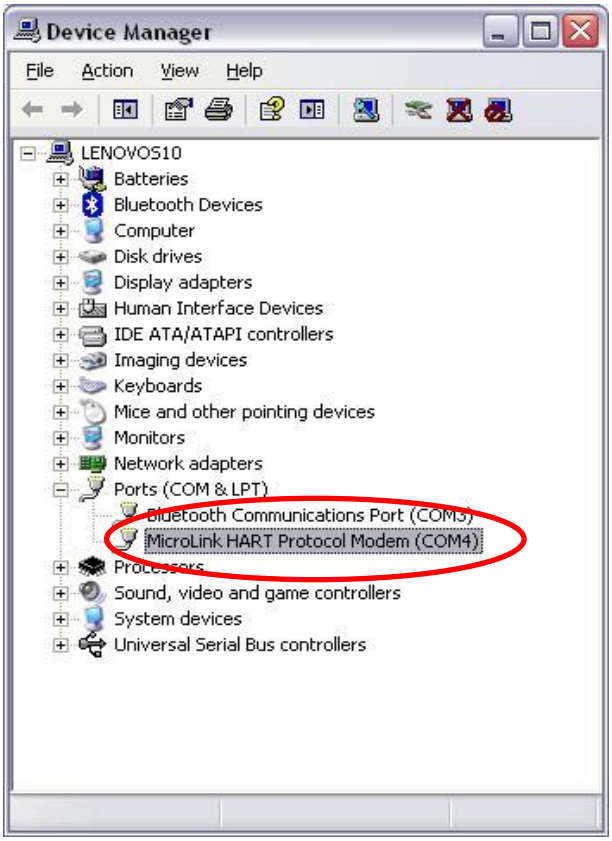

Figure 2 : The Device Manager of Windows shows the appropriate selected COM port.

When the Device Manager doesn't show the selected COM port, it is likely that your HART® modem has not been detected by the Windows operating system.
Please contact your system administrator or ask your HART® modem manufacturer for assistance.

Open the Excel file and select the appropriate COM port on the Sheet <HOME> in cell D15, before you try to set up the communication with the Guidense TDR100.
In cell D16 you can specify the required unit for length: mm (metric) or inch (imperial).

When above settings are completed and the wiring is according to the scheme in *Figure 1*, the HART® communication between PC and Guidense TDR100 can be tested.

Go to Excel Sheet <TDR100> and click on the orange SEND button in cell J12. The serial number of the connected Guidense TDR100 device should appear now in cell H12 followed by "OK" in cell I12 for the status.

When cell I12 does not return "OK", after the orange SEND button in cell J12 was clicked or selected, please check COM port settings on both ends (Windows Device Manager and Guidense TDR100 configuration tool), wiring, including power supply, the load resistance, terminal connections at the Guidense TDR100 device and your HART® modem successively.

When HART® communication failed, please consult Fluidwell Instruments or your local distributor.

3. Getting started: the "READ" & "WRITE" commands

As the HART® communication is supposed to work properly from here, a brief description of all variables/lines at the <TDR100> Sheet is provided here.

General:

The Sheet <TDR100> has been divided in two separate parts. The upper part will only "READ" variables from the TDR100, the lowest part will "WRITE" variables to the TDR100.

The described variable is being read from respectively written to the Guidense TDR100 each time the SEND button in the relevant line is pressed.

The respective "READ" or "WRITE" command may be considered successful when a number appears in column H - variable and "OK" appears in column I - status, after the SEND button in the relevant line was pressed.

Step refers to column C and the accordingly number corresponds to the factory reference.

Step Command name + description

1 Read serial number

Read the serial number in cell H12 from the Guidense TDR100 as assigned during production and configuration at Fluidwell factory.

2 Set lower range value [4mA]

Set the lower range value in cell H34; the value which corresponds with the lowest point of the span or measuring range [4mA], normally approx. 10 to 50 mm, to the end of the rod probe or wire rope.

[Default: single rod; minimum 10 mm, 30 mm from the end of rod probe or wire rope is recommended / coaxial probe; 0 mm]

Note:

- The reference point for definition of length is always the shoulder of the connection thread.
- TDR level sensors have small inactive areas at top [I1] and bottom [I2] of the probe. It is not recommended to actually measure level within those inactive areas as the measurements are non-linear or have reduced accuracy in these inactive areas.
- 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 minimum level to be measured in the tank is actually within the measuring range [M] of the sensor [default]: 4 mA is set at minimum 10 mm above probe end.
- Please refer to page 8 chapter [1.3. Probe length and measuring range] of the Guidense TDR100 Quick Installation manual for more details.

3 Set upper range value [20mA]

Set the upper range value in cell H35; the value which corresponds with the highest point of the span or measuring range [20mA], normally close to the top of the rod probe or wire rope.

[Default: all types; minimum 50 mm below reference point = the shoulder of the connection thread]

Note:

- The reference point for definition of length is always the shoulder of the connection thread.
- TDR level sensors have small inactive areas at top [I1] and bottom [I2] of the probe. It is not recommended to actually measure level within those inactive areas as the measurements are non-linear or have reduced accuracy in these inactive areas.
- *For proper functioning it is strongly recommended that the upper range value in cell H35 is greater than, or at least equal to, the upper dead band/inactive area value as set in cell H40, counted from the reference point.*
- 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.
- Usually the value in cell H34 is greater than the value in cell H35, as the 4…20 mA output is supposed to correspond with empty to full = 0 – 100%, except when the output signal has been inverted.
- It is recommended that the maximum liquid level to be measured in the tank is actually within the measuring range [M] of the sensor [default]: 20 mA is set at 50 mm below reference point minimum.
- Please refer to page 8 chapter [1.3. Probe length and measuring range] of the Guidense TDR100 Quick Installation manual for more details.

4 Read lower range value [4mA]

Read the current lower range value in cell H13; the value which corresponds with the lowest point of the span or measuring range [4mA], normally approx. 10 to 50 mm, to the end of the rod probe or wire rope.

5 Read upper range value [20mA]

Read the current upper range value in cell H14; the value which corresponds with the highest point of the span or measuring range [20mA], normally close to the top, the shoulder of the connection thread, of the rod probe or wire rope.

6 Set response time

Set the response time of the analogue output signal in cell H36 in tenth of a second, e.g. a value of 25 means a response time of 2,5 second.

[Default value: 5 corresponding with 0,5 second]

7 Read response time

Read the current response time of the analogue output signal in cell H15; the value shown is in tenth of a second, e.g. a value of 25 means a response time of 2,5 second.

8 Set switching output mode

Set the switching output mode of the standard point level detection in cell H37;
the value 0 = NC [default]
or 1 = NO (short-circuit protected).

9 Read switching output mode

Read the current switching output mode of the standard point level detection in cell H16; the value 0 = NC [default] or 1 = NO (short-circuit protected).

10 Set lower threshold switching output

Set the current lower threshold value of the standard point level detection in cell H38.
Note:

- The reference point for definition of length is always the shoulder of the connection thread.
- When the lower threshold is smaller than the upper threshold [cell H17 < cell H18], the switching output is configured as a HIGH-level point detection.
- Hysteresis can be set by defining separate upper and lower thresholds; if those are set at the same position, the minimum hysteresis of 3 mm applies [default].

11 Read lower threshold switching output

Read the current lower threshold value of the standard point level detection in cell H17.
Note:

- The reference point for definition of length is always the shoulder of the connection thread.
- When the lower threshold is smaller than the upper threshold [cell H17 < cell H18], the switching output is configured as a HIGH-level point detection.
- Hysteresis can be set by defining separate upper and lower thresholds; if those are set at the same position, the minimum hysteresis of 3 mm applies [default].

12 Set upper threshold switching output

Set the upper threshold value of the standard point level detection in cell H39.
Note:

- The reference point for definition of length is always the shoulder of the connection thread.
- When the upper threshold is smaller than the lower threshold [cell H18 < cell H17], the switching output is configured as a LOW-level point detection.
- Hysteresis can be set by defining separate upper and lower thresholds; if those are set at the same position, the minimum hysteresis of 3 mm applies [default].

13 Read upper threshold switching output

Read the current upper threshold value of the standard point level detection in cell H18.

Note:

- The reference point for definition of length is always the shoulder of the connection thread.
- When the upper threshold is smaller than the lower threshold [cell H18 < cell H17], the switching output is configured as a LOW-level point detection.
- Hysteresis can be set by defining separate upper and lower thresholds; if those are set at the same position, the minimum hysteresis of 3 mm applies [default].

14 Set upper dead band/inactive area

Set the upper dead band/inactive area in cell H40; this value represents [I1] in Figure 3 below.

[Default: single rod; minimum 50 mm, 80 mm below reference point = the shoulder of the connection thread is recommended / coaxial probe; minimum 30 mm, 50 mm is recommended]

Note:

- 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.
- It is recommended that the maximum level to be measured in the tank is actually within the measuring range [M] of the sensor [default]: 20 mA is at least set at 50 mm below reference point.
- *For proper functioning it is strongly recommended that the upper dead band/inactive area value in cell H40 is smaller than, or at least equal to, the upper measuring range.*

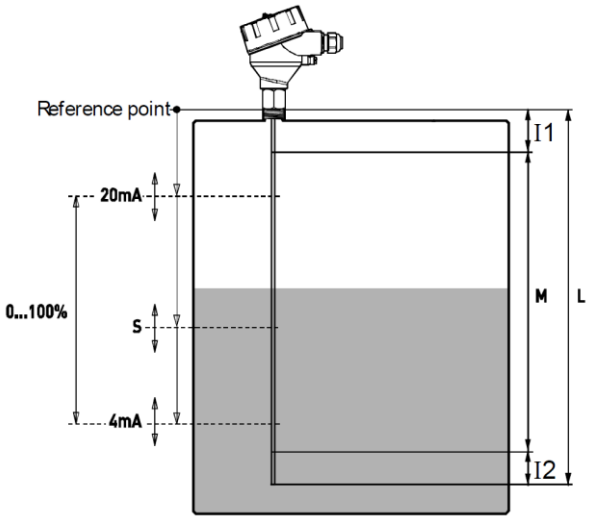

Figure 3 : Probe length and range value as set in cell H35, counted from the reference point.

- The lower dead band/inactive area at the bottom cannot be specified. It is recommended to set the lower range value in cell H34 to approx. 30 mm above the probe end. When a signal (level) would be found below the 4mA point, the output will stay at 4 mA.
- Please refer to page 8 chapter [1.3. Probe length and measuring range] of the Guidense TDR100 Quick Installation manual for more details.

15 Read upper dead band/inactive area

Read the current value for upper dead band/inactive area in cell H19, which represents [I1] in Figure 3.

16 Set amplitude threshold

Set the amplitude threshold value in cell H41; the value represents the threshold below which any reflected electromagnetic impulses will be ignored.

17 Read amplitude threshold

Read the current amplitude threshold value in cell H20; the value represents the threshold below which any reflected electromagnetic impulses will be ignored.

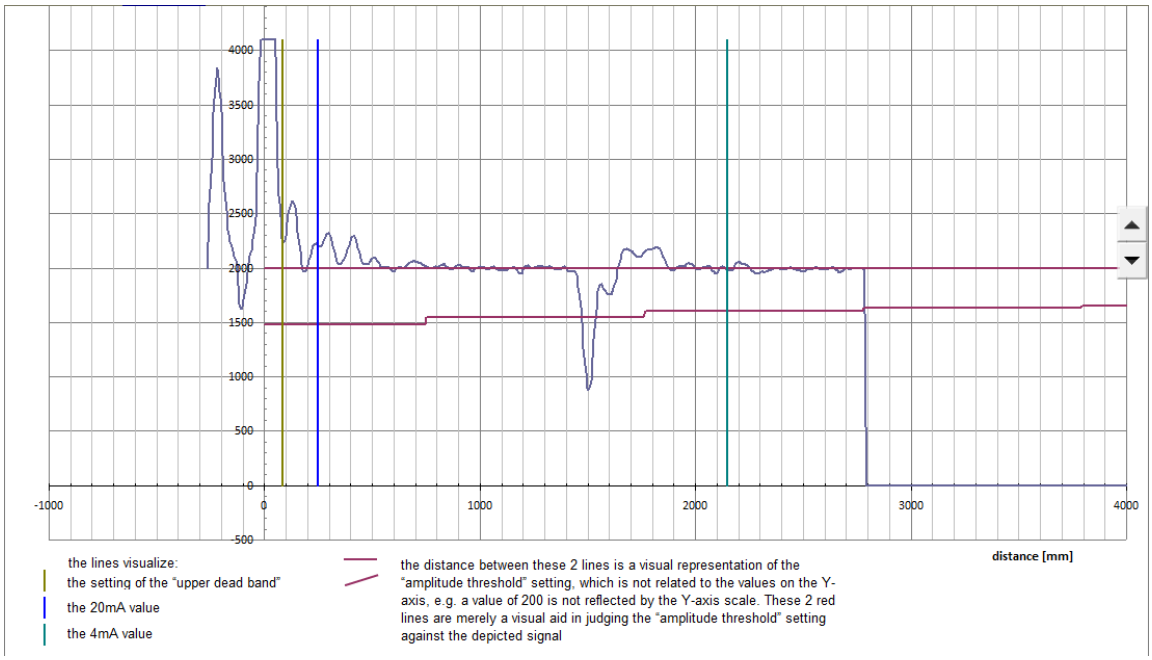

Figure 4 : The reflected impulses for a level measurement with a 2150 mm single rod probe in a caustic soda application.

18 Set disturbance signal scan status (T = top; T&B = top + bottom)

Set the disturbance signal scan status in cell H42; the value 00 will set the status to "Off" – 01 = "Top" only or 10 = "Top & Bottom".

Although the Guidense TDR single rod probe is suitable for a very wide range of applications, the signal has a wider detection radius around the rod, which will make the single rod type more responsive for measurement signal disturbances which can be easily overcome by observing a few mounting considerations (please see page 6 chapter [1.2. Mounting considerations] of the Guidense TDR100 Quick Installation manual) and making simple configuration adjustments to the sensor; in most cases it is enough to activate and utilize the powerful disturbance signal suppression features of the TDR100.

However, this powerful disturbance signal suppression feature work most efficient on stationary obstructions close to the probe like tall- and narrow nozzles, ladders, chains etc. 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.

- Performing a disturbance signal scan is the prerequisite for utilizing this feature of the TDR100.

19 Read disturbance signal scan status

Read the current disturbance signal scan status in cell H21 and for which it is currently set.

The value 00 represents "Off" – 01 = "Top" and 10 = "Top & Bottom".

Note:

- Please refer to page 9 chapter [1.4. Disturbance signal scan] of the Guidense TDR100 Quick Installation manual for more details.

20 Perform disturbance signal scan

This powerful disturbance signal suppression feature work most efficient on stationary obstructions close to the probe like tall- and narrow nozzles, ladders, chains etc.

Note:

- Before performing the disturbance signal scan, the TDR100 has to be mounted in its final position and the tank has to be *completely empty*.
- Please set step 18 [disturbance signal scan status] in cell H42 first, in order to select the area(s) to be scanned; Top only or Top and Bottom, before performing a disturbance signal scan.

21 Set probe type

Set the probe type in cell H44.

The value 0 represents a coaxial probe and 1 = single probe, a single rod or wire rope.

22 Read probe type

Read the current set probe type in cell H22.

The value 0 represents a coaxial probe and 1 = single probe, a single rod or wire rope.

23 Set probe length [L]

Set a new probe length [L] in cell H45; the value should represent the overall length of the rod.

Note:

- 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.
- Probe length [L] less both inactive areas at top and bottom [I1 and I2] in this range the TDR100 will have the specified measurement performance. It is recommended that the maximum and minimum levels to be measured in the tank are actually within the measuring range [M] of the sensor [default]: 4 mA is set at 30 mm above probe end, 20 mA is set at 50 mm below reference point.
- Please refer to page 8 chapter [1.3. Probe length and measuring range] of the Guidense TDR100 Quick Installation manual for more details.

24 Read probe length [L]

Read the current set probe length [L] in cell H23; the value should represent the overall length of the rod.
Note:

- The reference point for definition of the probe length [L] is always the shoulder of the connection thread.
- Please see Figure 4 as explanation of step 14 [set upper dead band/inactive area] on page 6 of this document or refer to page 8 chapter [1.3. Probe length and measuring range] of the Guidense TDR100 Quick Installation manual for more details.

25 Set delivery configuration

This feature will set the actual, current configuration, which can be read in succession from cell H13 to cell H23, as the new preset or default configuration into the memory of the Guidense TDR100.

26 Reset to delivery configuration

This feature will reset the configuration of the Guidense TDR100 to the latest saved preset or default configuration from the memory, usually the factory configuration.

27 Read level reading

Read the current actual level in cell H24; the value represents the level as determined by the Guidense TDR100 based on the current configuration settings, counted/seen from the shoulder of the connection thread.

28 Read software revision

Read the revision of the firmware in cell H25.

29 Read device status

Read the current device status in cell H26; brief declaration of the returned bit pattern:

bit pattern: 11 10 9 8 7 6 5 4 3 2 1

11, 10, 9 = 3 bit ZF gain (e.g. 0 1 0 = gain 2; gain 1 to 5)

8 1 = level pulse is tracked
7 1 = probe end pulse is tracked
6 1 = device reset by user
5 1 = measurement error of ref pulse

4 1 = ZF amplifier saturated
3 1 = error during probe end measurement 1
2 1 = error during probe end measurement 2
1 1 = measurement error of probe end pulse

30 Aquire signal data

This feature makes it possible to visualize the reflected electromagnetic signal impulses for evaluation purposes in Sheet <Signal>. This Sheet will show the behavior of the electromagnetic impulses as a result of the application circumstances and the influence of the Guidense TDR100 configuration settings on them in order to determine the correct reflected impulse equivalent with the actual level.
Please note that it will take approx. 45 seconds for 1 meter probe length and 4 minutes for a 20 m probe.

31 Set signal range from x1 to x2

The only set command in this “READ” section: Allows you to change the scaling of the axis at the Sheet <Signal> in cell H28 and H29.

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