



POCKET-UFM Wall Thickness Gauge

Operating Instructions

Version 1.0



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3.0 Technical Data

1.0 Introduction

A knowledge of the thickness of the pipe wall is important for installing and commissioning a clamp-on ultrasonic flowmeter to the outside of a pipe to achieve accurate flow measurement.

Although the outer diameter of the pipe can be calculated with accuracy from a measurement of circumference the value of pipe wall thickness is often poorly known, if it is known at all.

By connecting a wall thickness gauge (WTG) probe to the Pocket-UFM™ instead of flow transducers, and by selecting the WTG probe in the Human Machine Interface (HMI) an accurate pipe wall thickness measurement can be made.

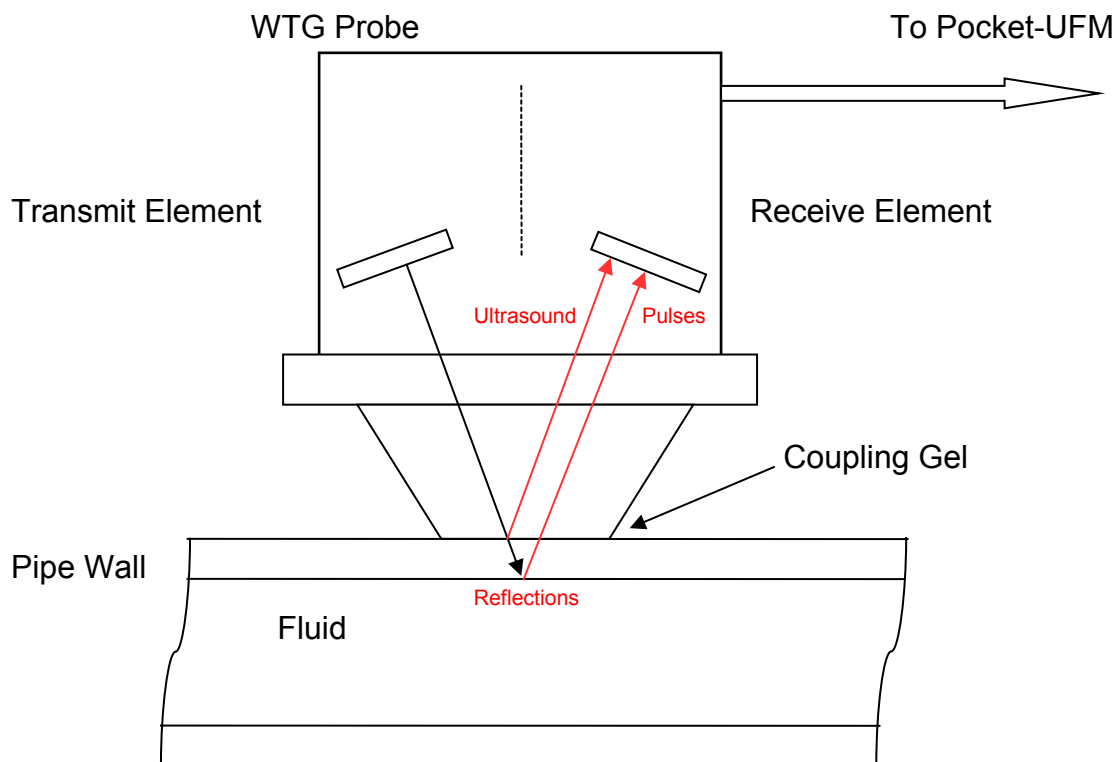
Simply couple the WTG probe to the outside of the pipe using acoustic coupling gel.

This measured value of pipe wall thickness can subsequently be used to accurately setup the meter to make flow measurements.

2.0 Operation

The Sonic Driver™ core ultrasonic transceiver module within the Pocket-UFM uses advanced Digital Signal Processing (DSP) techniques to make an accurate time of flight measurement as longitudinal sound waves propagate through the pipe wall;

- One element of the dual element WTG probe generates an ultrasonic pulse that propagates through the pipe wall, see figure(1).
- The ultrasonic pulse is reflected from both the outer pipe wall and the inside pipe wall, at the pipe//fluid interface.
- The ultrasonic pulse is received on the second element of the WTG probe.
- The time difference between emitting and receiving the ultrasonic pulse is measured.



Figure(1) Wall Thickness Measurement

- Using the longitudinal sound velocity for the material of the pipe wall the pipe wall thickness is calculated using equation(1).

$$\text{Pipe Wall Thickness} = L_{\text{sos}} \cdot T_{\text{diff}} / 2$$

Equation(1) Calculation of Wall Thickness

Where;

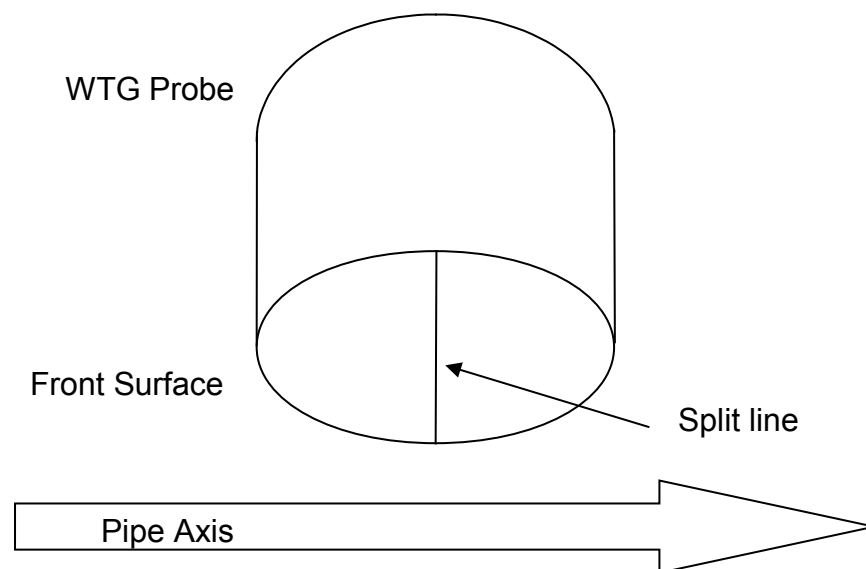
- Pipe wall thickness (m).
- L_{sos} = Pipe material longitudinal sound velocity (m/s).
- T_{diff} = Measured difference in time between reflection from outer wall of pipe and inner wall of pipe (s).

2.1 Couple the WTG Probe to the Pipe

Couple the WTG probe to the pipe wall using coupling gel.

Select an area of the pipe that is ideally bare of paint, corrosion, pitting, etc. It is possible that no reliable, consistent measurement will be achieved on poor pipe surfaces, try a different location or prepare the surface.

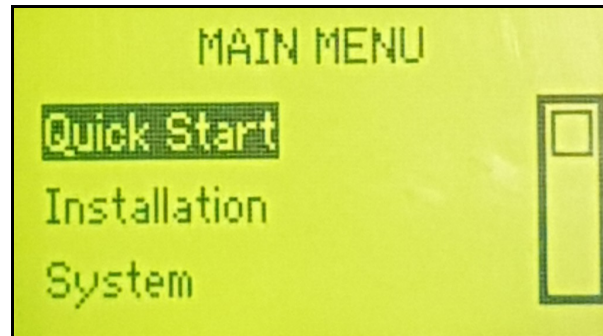
Hold the WTG probe normal to the pipe wall surface and aligned to its axis as shown in figure(2).



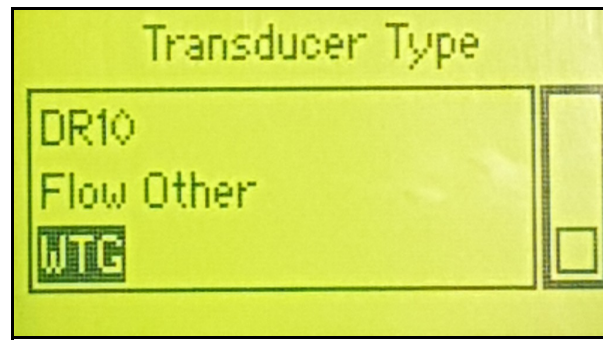
Figure(2) Orientation of WTG Probe on Pipe

2.2 Starting Wall Thickness Measurement

From the HMI select **Main Menu – Quick Start**. Press **ENTER**.

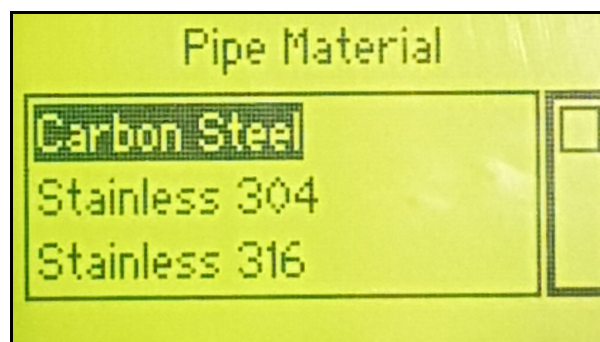


Select **Transducer Type – WTG** from the scrolling list. Press **ENTER**.



When WTG probe rather than one of the flow probes is selected the HMI menus become context driven specific to WTG measurement.

Select **Pipe Material** from the scrolling list. If the pipe wall material is not listed select **Other** and enter a value for the longitudinal sound velocity.



Press **ENTER**.

The Pocket-UFM will begin to make wall thickness measurements.

To stop wall thickness measurement press **Run/Stop**.

2.3 Display Wall Thickness Measurement

There are 3 displays available when making wall thickness measurements. Scroll between the displays by pressing the Enter key;

- Detailed measurement and diagnostic values.
- Ultrasound A-scan.
- Processed data showing measurement echo.

2.3.1 Detailed Measurement and Diagnostic Values

The display screen shows measurement values and diagnostics, see figure(3);

- T – Measured transit time (us)
- B – Peak position (Bin or data point on display x axis figure(5))
- P – Peak position interpolated (sub bin resolution)
- L – Pipe longitudinal sound velocity (m/s)
- Thickness – Measured pipe wall thickness (mm)
- S – Echo signal amplitude (dB)
- N – Electronic noise level (dB)
- Gain – Receiver gain (dB)



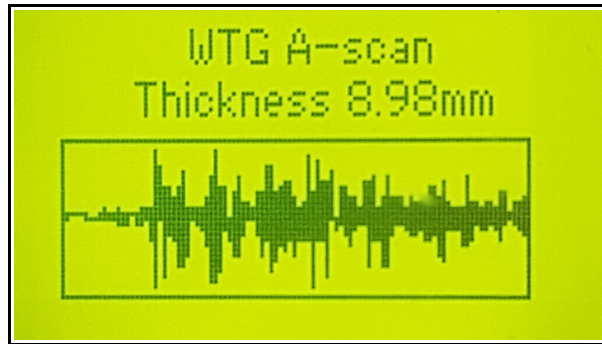
Figure(3) Measurement values and diagnostics

2.3.2 Ultrasound A-scan

This display screen shows an A-scan (Ultrasonic signal against time trace), see figure(4).

It is possible to see that the ultrasonic pulse reverberates and echoes many times across the pipe wall.

By **rolling** the WTG probe on the pipe wall it is possible to optimise the amplitude of the echoes.



Figure(4) A-scan

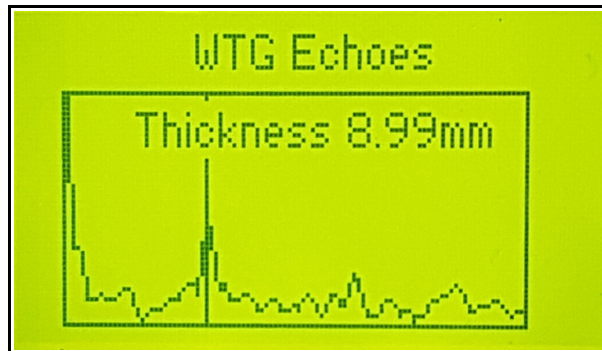
2.3.3 Processed Data Showing Measurement Echo

This display screen shows processed data as a graph, with the preferred echo marked with a vertical line at its peak position, see figure(5).

By **rolling** the WTG probe on the pipe wall it is possible to optimise the amplitude of the peaks.

The Sonic Driver DSP will preferentially pick the nearest, largest peak to the left side of the display to make its measurement.

Clearly, if the DSP should be selecting incorrectly then rolling the WTG probe can make the selection jump to the correct peak.



Figure(5) Processed Data Showing Measurement Echo

3.0 Technical Data

Type	Dual element
Frequency	5 MHz
Size	10 mm diameter
Measurement range	1.... 24 mm
Operating temperature	-20.... 60 °C
Cable length	1 m
Connection	Dual Lemo 00 plugs