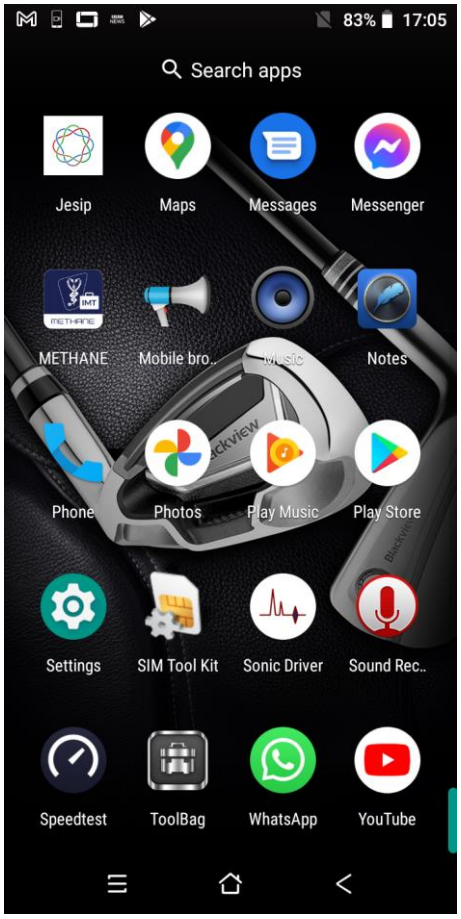
Made in Britain

POCKET MOBILE-UFM Ultrasonic Clamp-on Flowmeter

Operating Instructions

Version 1.0

5th August 2022



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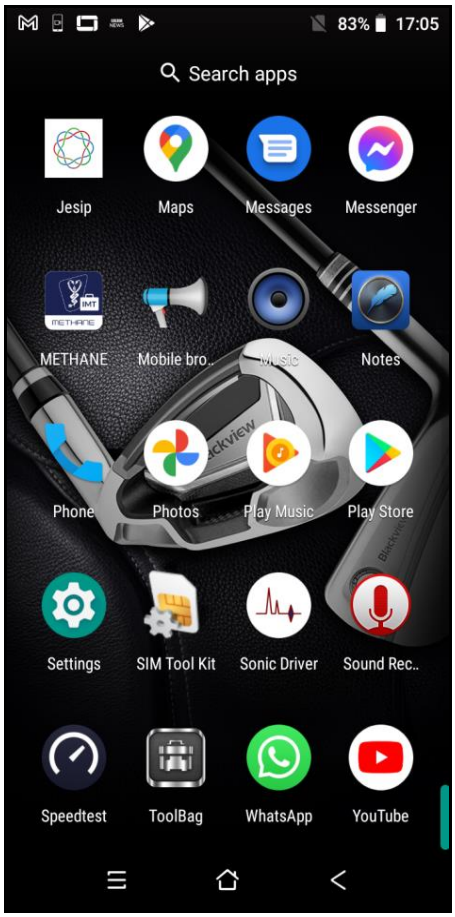
1.0 Introduction

Congratulations on choosing the Sonic Driver POCKET MOBILE-UFM ™ clamp-on ultrasonic flowmeter, figure(1).



Figure(1) Sonic Driver POCKET MOBILE-UFM

The ultrasonic flowmeter (UFM) simply connects to your Android mobile smart phone or tablet device running the Sonic Driver App and turns it into an accurate and reliable clamp-on ultrasonic flowmeter

The UFM makes flow velocity measurements using advanced Digital Signal Processing (DSP) and transit time measurement techniques.

Using information about the installation, entered by the user, using the App and its intuitive and easy to us menu driven User Interface (UI) the UFM can display;

- Flow velocity (m/s)
- Volumetric flow rate (l/min)
- Mass flow rate (kg/min)

Values are averaged and have flow profile compensation applied.

2.0 General Precautions

The content of this manual has been carefully checked and is believed to be accurate.

Sonic Driver Ltd assumes no responsibility for any inaccuracies that may be contained in this manual.

In no event will Sonic Driver be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual, even if we are advised of the possibility of such damages.

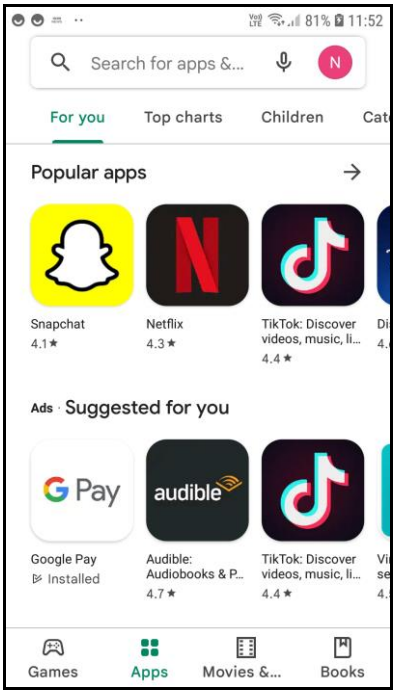
Sonic Driver Ltd reserves the right to make improvements to its manuals, instructions and products at any time, without notice or obligation. The latest revisions may be found on the company web site, www.sonic-driver.com

The UFM is a precision measuring instrument and should be handled and operated with care;

- Before operating the UFM for the first time read the installation manual and operating instruction fully.
- Only use the UFM in the way and for the purpose that it is intended.
- Do not subject the UFM to bumps and shocks such as caused by dropping the UFM.
- Keep the UFM and its transducers and probes clean.
- Only use the UFM within its ambient temperature and stated level of Ingress Protection.
- Avoid excessive stress and bending of transducer cables.
- Always connect the UFM to the mobile device with the device screen unlocked, section 4.0.
- Always use the Exit screen to correctly exit the App, section 12.0, figure(13). Failure to do so will result in multiple instances of the App running, which will each attempt to gain control and use of the mobile device's single communication port. Reliable communication between the mobile device and UFM will fail.
- Unreliable communication between the mobile device and UFM will cause the communication globe to flash orange, section 5.1.10. In addition Device Information, section 5.1.1, USB Device, section 5.1.2 and Test Pattern, section 5.1.3 will become erratic.

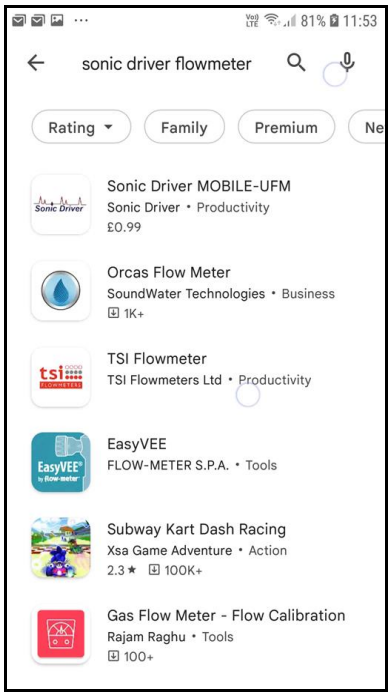
3.0 App installation

On your Android phone or tablet open Google Play Store, or visit Google Play Store on a web browser, figure(2).



Figure(2) Google play Store

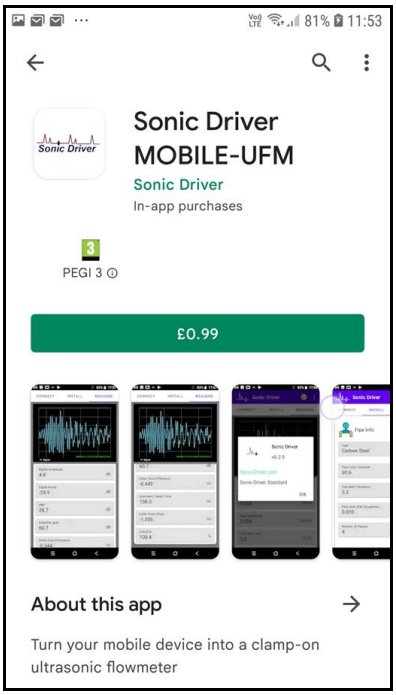
Search or browse for the content “sonic driver flowmeter”, figure(3).



Figure(3) Search for “sonic driver flowmeter”

Scroll through the list and tap the “Sonic Driver MOBILE-UFM” item, the top item in figure(3).

Tap Install or the items price, figure(4).



Figure(4) Install and pay

Follow the on-screen instructions to complete the transaction and get the content.

4.0 Hardware Connection

Before connecting the UFM to your phone or tablet ensure that the device is turned on and its screen lock is off.

Connect the UFM to your phone or tablet.

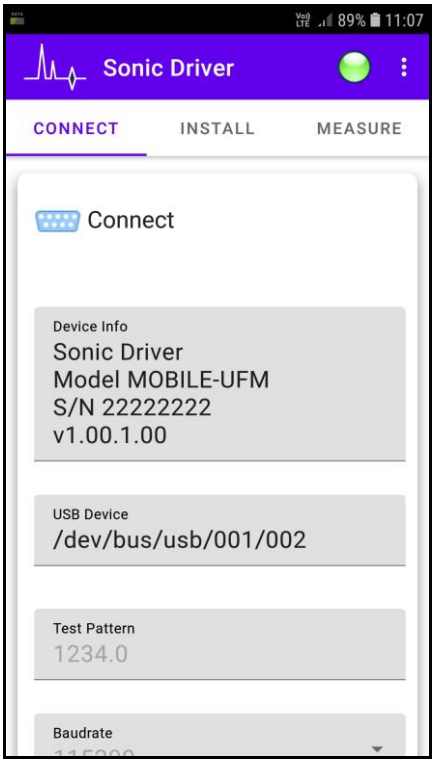
The device will automatically identify the UFM and request that you allow permissions. You may tick the Always Allow box.

The mobile App will now automatically run and attempt to connect to the UFM.

5.0 The User Interface

The App display consists of a standard top bar with company logo, name, communications globe and Settings (3 vertical dots icon) top right

Below the top bar is a bar with 3 tabs; CONNECT, INSTALL and MEASURE, figure(5).



Figure(5) App display

Settings gives About and Exit options.

5.1 Connect Tab

This tab shows useful information about the connection between the mobile device and the UFM.

5.1.1 Device information

Device information consists of;

- Company Name
- Model Name.
- Serial Number uniquely assigned during manufacture.
- Hardware and Software version numbers.

5.1.2 USB Device

The serial communication port on the phone or tablet to which the UFM has connected, for example /dev/bus/usb/001/002.

5.1.3 Test Pattern

Upon successful connection the test pattern 1234.0 should appear.

The following settings are designed for the MOBILE-UFM. They should not be changed. The ability to change the settings is intended for future product enhancements.

5.1.4 Baud Rate

Default is 115200.

5.1.5 Data Bits

Default is 8.

5.1.6 Parity

Default is Even.

5.1.7 Stop Bits

Default is 1.

5.1.8 Flow Control

Default is None.

5.1.9 Slave ID

Default is 1.

5.1.10 Connection Indicator

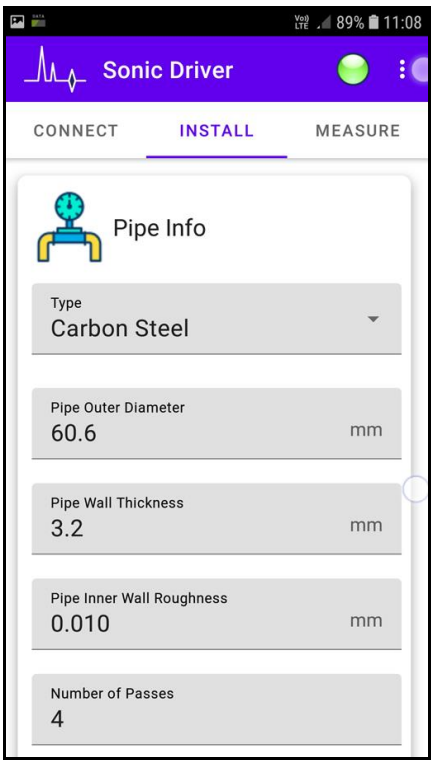
This communications indicator globe will flash green when communications are taking place correctly. If communication is interrupted, then it will flash orange.

5.2 Install Tab

This tab collects all of the information necessary to fully install the UFM on a pipe, see figures(6).

5.2.1 Pipe Information

This menu allows the user to change pipe settings, figure(6).



Figure(6) Pipe Information

5.2.1.1 Pipe Type

The user can select the pipe material from a list;

- Carbon Steel (Default)
- Stainless
- Copper
- PVC

The transverse speed of sound in the pipe material is read from a database held in the UFM.

5.2.1.2 Pipe Outer Diameter

The user is prompted to enter a value for the pipe outer diameter. Allowed values are ranged 15.0 to 500.0 mm, default 60.6 mm.

5.2.1.3 Pipe Wall Thickness

The user is prompted to enter a value for the pipe wall thickness. Allowed values are ranged 0.5 to 100.0 mm, default 3.2 mm.

5.2.1.4 Pipe Inner Wall Roughness

The user is prompted to enter a value for the peak to trough height of the roughness on the inside surface of the pipe. Allowed values are ranged 0.001 to 2.00 mm, default 0.010 mm.

This value is used in flow profile correction calculations. It is unlikely the user will change this value.

5.2.1.5 Number of Passes

The user is prompted to enter the number of times the sound path crosses the pipe. Allowed vales are 1 to 16 passes, the default is 4 passes.

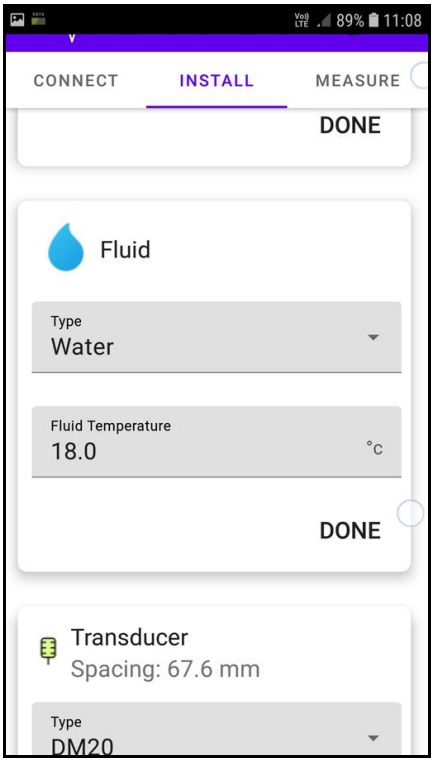
Ideally choose a number of passes that results in a total path length in the fluid of 100 mm or greater.

- 1 pass, most common on large diameter pipes, sensors are on opposite sides of the pipe.
- 2 passes, the most commonly used method, simplest to install as both sensors are on the same side of the pipe.
- 3 passes, used on small diameter pipes.
- 4 passes, used on the lowest diameter pipes.
- 5 to 15 and 16, etc.

It may be that on small diameter pipes then the recommended transducer spacing at 16 passes is not sufficient to allow the transducers to be coupled on the same side of the pipe, an even number of passes as they touch. In this case it is unavoidable to couple the transducers on opposite sides of the pipe using an odd number of passes, for example 15 passes.

5.2.2 Fluid Information

This tab allows the user to change fluid settings, figure(7).



Figure(7) Fluid Information

5.2.2.1 Type

The user can select the fluid in the pipe from a list;

- Water (Default)
- Petrol
- Diesel
- Glycol/Water

The fluid longitudinal sound velocity, kinematic viscosity and density are read from a database held within the UFM.

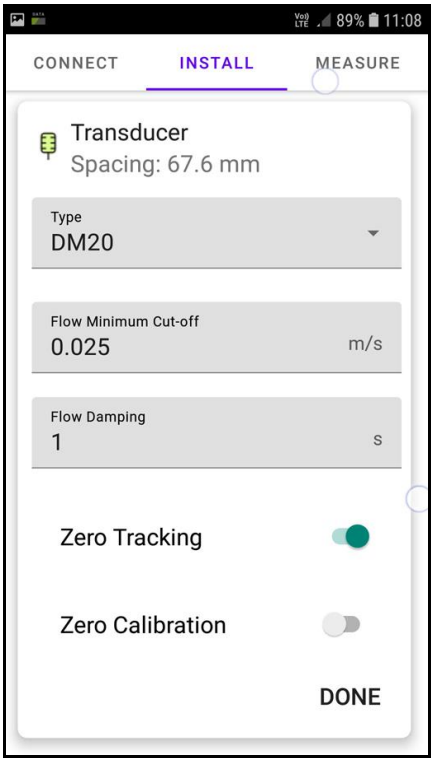
5.2.2.2 Fluid Temperature

The user is prompted to enter the temperature of the fluid in the pipe. Allowed values are ranged -20 to +150 degC, default 18 degC.

Changing Fluid Temperature causes fluid longitudinal sound velocity, kinematic viscosity and density to be recalculated.

5.2.3 Transducer Information

This menu allows the user to change transducer settings, figure(8).



Figure(8) Transducer Information

5.2.3.1 Type

The user is prompted to select the type of sensors mounted on the pipe from a list;

- DN40
- DM10 (Default)
- DM20

DM sensors are Sonic Driver standard PEEK/stainless steel design. DN sensors are Sonic Driver small pipe design.

5.2.3.2 Flow Minimum Cut-Off

If the flow velocity falls below the low flow cutoff value, the measured flow velocity and calculated flow rate indication is driven to zero. This function can prevent the flow meter from reading flow after a pump is shut down but there is still circulating liquid creating movement in the pipe.

Generally, 0.025m/s is recommended as the low flow cutoff point. The low flow cutoff value has no relation to the measurement results once the velocity increases over the low flow cutoff value.

The user is prompted to enter a value in m/s below which the meter reports flow as zero. Allowed values are ranged 0.000 to 1.000 m/s, default 0.025 m/s.

Note. This absolute value is applied to both positive and negative flow as a +/- band either side of zero.

5.2.3.3 Flow Damping

The user is prompted to enter a display damping or averaging time.

Allowed values are ranged 1 to 255 seconds, the default is 10 seconds.

The damping time can be adjusted to stabilise the flow value being displayed. Essentially, it is a type of signal filter applying an RC time constant.

Increasing the damping increases the stability. However, the measurement displayed can be slightly delayed due to over damping. Too much damping may also result in no response to real time fluctuations, especially when flow rate fluctuates wildly.

Therefore, damping should be kept at a minimum and increased just enough to reduce the fluctuation to an acceptable degree.

5.2.4 Transducer Spacing

After entering the required parameters above, the spacing between the ends of the 2 transducers is calculated and displayed. Check the value displayed and space the transducers accordingly.

The Installation Manual that accompanies these Operating Instructions gives more details regarding mounting, coupling and spacing the transducers correctly.

5.2.5 Zero Tracking

When the measured delta time falls below a lower limit then the flow being measured is assumed by the UFM to be zero.

The user can turn a tracking algorithm On/Off so that such a small offset value is tracked/trended to zero.

By default zero tracking is always turned On.

At extremely low flows the meter can mistakenly identify a flow from for example a real leak as an erroneous offset. To avoid the leak being tracked off turn zero tracking Off.

5.2.6 Zero Calibration

If the Zero calibration function is enabled by ticking this box then a zero flow calibration will be made. It is vitally important to ensure that there is zero flow during this procedure.

When the process is complete the user is required to untick this option.

By default Set Zero calibration is turned Off.

NOTE. PIPE MUST BE FULL AND FLOW MUST BE ZERO.

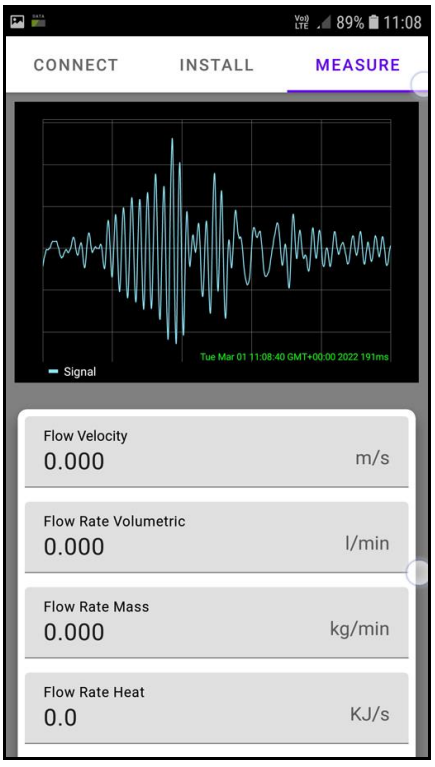
5.3 Measure Tab

The Measurement tab shows a signal display graph, measurement values and diagnostics, figures(9,10,11)

The UFM calculates and displays the following measurements and diagnostics once per second.

5.3.1 Signal Display

The signal display graph is a useful diagnostic to confirm correct transducer installation, figure(9).



Figure(9) Signal Display

5.3.2 Measurements

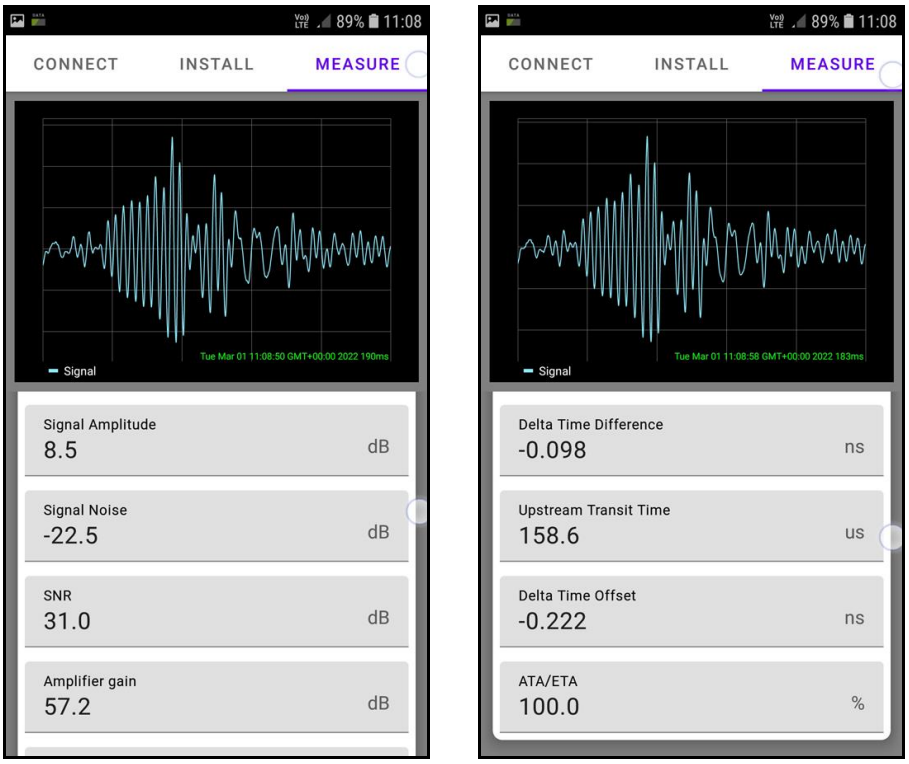
The UFM flow measurement values are shown below the signal display graph.

Flow Velocity - displayed in m/s
Flow Rate Volumetric - displayed l/min
Flow Rate Mass - displayed in kg/min
Flow Rate Heat - future product enhancement

Values are averaged and have flow profile compensation applied.

5.3.3 Diagnostics

Scrolling down the screen will show diagnostic values, figure(10,11).



Figure(10,11) Diagnostics

5.3.3.1 Signal Amplitude

Signal strength indicates the detected strength of the sonic signal in decibels (dB). Signal strength is indicated by numbers from typically -25 to +55.0.

Normally, the stronger the signal strength detected the better and more reliable the flow measurement is, as well as the more stable the measurement value obtained.

Adjust the transducer positioning to the best position, within limits and check to ensure that enough sonic coupling compound is applied during installation in order to obtain the maximum signal strength.

The UFM normally requires signal strength over 0.0dB to measure reliably. If the signal strength detected is too low (is zero or negative), the transducer installation position and the

transducer mounting spacing should be adjusted and the pipe should be re-inspected. If necessary, change the mounting method.

5.3.3.2 Signal Noise

Noise indicates the level of extraneous sonic and electrical noise being detected in dB. Noise is indicated by numbers from typically -25.0 to +55.0.

The UFM normally requires noise strength below +10.0dB to measure reliably.

5.3.3.3 SNR

SNR indicates the quality of the sonic signal detected. SNR is indicated by numbers from typically 1.0 to 99.0, in dB.

1.0 represents the minimum SNR whilst 99.0 represents the maximum.

Normally, the transducer position should be adjusted and coupling compound application should be checked until the SNR detected is as large as possible.

The UFM normally requires SNR over 12.0dB to measure reliably.

5.3.3.4 Amplifier Gain

Gain indicates the amount of electronic gain being used by the UFM receiver amplifier. Gain is indicated by numbers from typically 0.0 to 81.0, in dB.

0.0 represents the minimum gain whilst 81.0 represents the maximum.

Old pipes, attenuating pipes, corrosion, attenuating fluids, etc. can require the UFM to automatically turn up its gain.

The UFM normally operates with a gain typically around 30.0 to 60.0dB.

5.3.3.5 Delta Time Difference

Delta Time is the difference in time between the two absolute transit times through the fluid. Delta Time is of the order of tens of nanoseconds because the absolute upstream and downstream times are so close together in value.

These values can help indicate the accuracy and condition of the installation. The measurement calculations in the UFM are based upon these two values.

Therefore, when transit time difference fluctuates widely, the flow and velocities fluctuate accordingly. This is usually accompanied by a signal strength and/or signal to noise ratio (SNR) that is too low and varying. This may be the result of poor pipe installation conditions, inadequate transducer installation, or incorrect parameter input. Generally, fluctuations should be less than ± 20%.

5.3.3.6 Upstream Transit Time

The absolute upstream transit time through the fluid in the pipe and the absolute downstream transit time through the fluid in the pipe are usually of the order of hundreds of microseconds. They are very nearly identical. For this reason, transit time is simply displaying the absolute upstream transit time through the fluid in the pipe.

5.3.3.7 Delta Time Offset

dT Offset is the offset value currently being used by the zero tracking function. This is usually in the range ± 2.5ns.

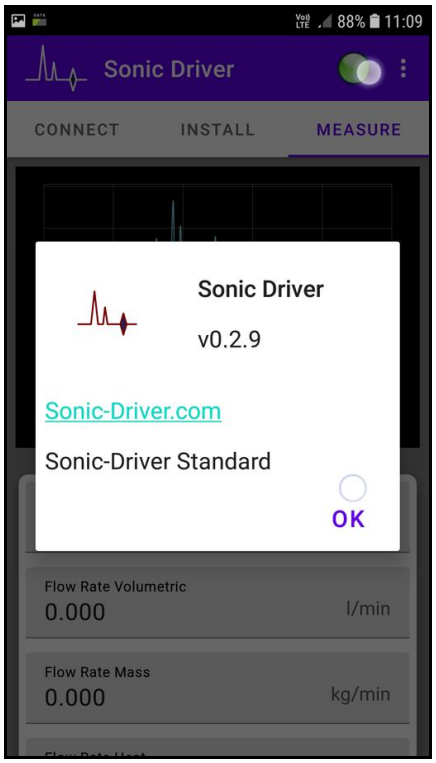
5.3.3.8 ATA/ETA

This is a measure of the ratio of the measured transit time to that which is expected given the parameters entered by the user during installation. It indicates if the transducer mounting and spacing is accurate. The normal transit time ratio should be 100 ± 3% if the installation is correct.

It is acceptable to have to move one of the transducers up to ± 5mm to achieve a figure of 100%. If more movement is necessary, then one of the pipe parameters is probably incorrect. This is most likely to be the value entered for pipe wall thickness as this is often taken from tables or it is an estimated value.

6.0 About

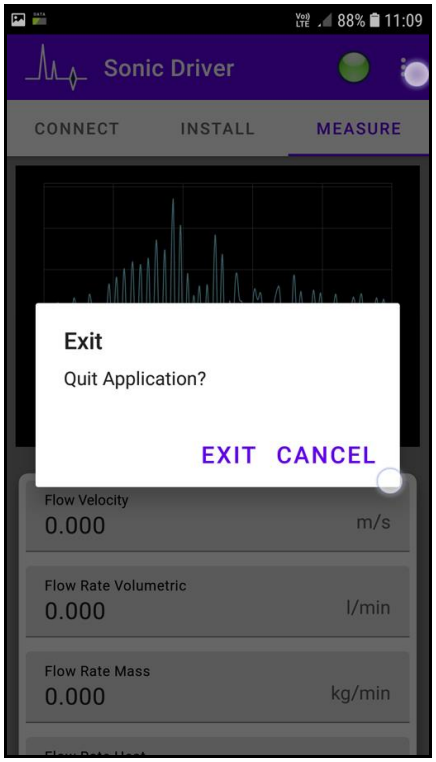
The About screen shows useful information about the App, figure(12).



Figure(12) About

7.0 Exit

Use this screen to correctly exit the App, figure(13). Failure to do so will result in multiple instances of the App running, which will each attempt to gain control and use of the mobile devices single communication port.



Figure(13) Exiting the App

Sonic Driver