Sonic Driver

Made in Britain

Ultrasonic Clamp-on Flowmeter UFM-300

Smart Phone Operating Instructions

Version 1.0

1st July 2024

Contents

1.0 Introduction

Congratulations on choosing the Sonic Driver^{TM} Ultrasonic Flowmeter UFM-300, guide-rail, pipe, wall or panel mounted clamp-on ultrasonic flowmeter, figure (1).

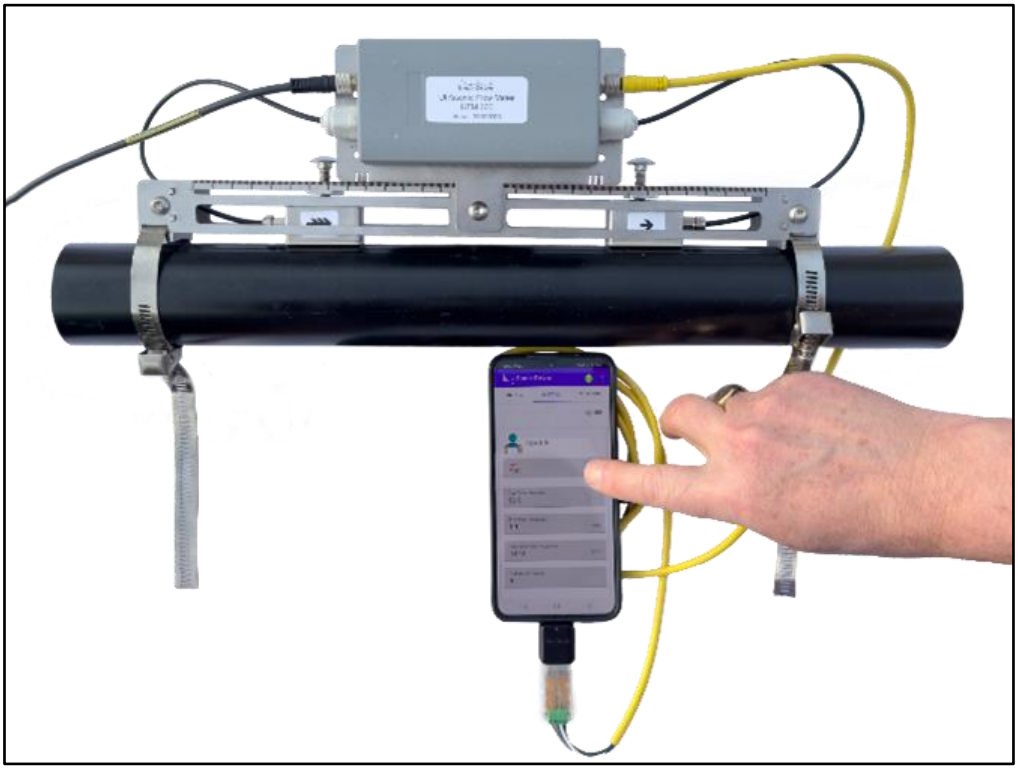

Figure (1) Sonic Driver UFM-300

The UFM uses advanced Digital Signal Processing (DSP) and transit time measurement techniques (Sonic Driver^{TM}) to make accurate and reliable clamp-on ultrasonic flow velocity measurements on liquids flowing in closed pipes.

Using information about the installation, entered by the user, via the meter's Smart phone App or laptop-based configuration program (Windows) the UFM can calculate;

- Flow velocity (m/s)
- Volumetric flow rate (l/min)
- Mass flow rate (kg/min)
- Flow positive total (l)
- Flow negative total (l)
- Flow net total (l)

When using the Smart phone App, the meter will additionally display flow velocity in ft/s and volumetric flow rate in m3/hr, GPM, GPH and ft3/min

All the above flow measurements and a complete set of diagnostics are available over Modbus RTU RS485.

For installation a Smart phone is connected to the UFM via a bidirectional USB to RS485 converter. All installation parameters are available for editing locally via the Smart phone App or remotely over Modbus RTU.

The UFM comes in 2 different versions;

- Standard - outer pipe diameter ranged 10.0 to 115.0 mm
- Medium - outer pipe diameter ranged 115.0 to 225.0 mm

Once installed the Smart phone and converter can be disconnected and the UFM connected to a Modbus RTU RS485 network for remote interrogation or configuration via a control room, Cloud based monitoring applications or 3rd party datalogger where a Modbus Master polls the UFM Slave. However, local interrogation continues to be available by simply unplugging the network and plugging in the Smart phone.

This manual details operating the UFM using the Smart phone configuration App route.

A separate manual details operating the UFM using the laptop Windows configuration program route

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 Smart device with the device screen unlocked, section 4.0.
- Always use the Exit screen to correctly exit the App, section 7.0, figure (16). Failure to do so will result in multiple instances of the App running, which will each attempt to gain control and use of the Smart device's single communication port. Reliable communication between the Smart device and UFM will fail.
- Unreliable communication between the Smart 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.
- It is advised to turn Do Not Disturb on to avoid background tasks interrupting the totaliser.
- Further detail on connecting and using the UFM on a Modus RTU network are available in Sonic Driver Ultrasonic Clamp-on Flowmeter UFM-300 Modbus RTU Protocol, including a full register map.

3.0 App installation

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

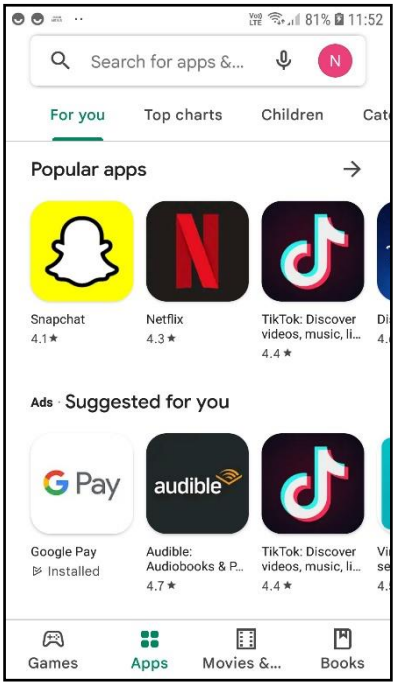

Figure (2) Google play Store

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

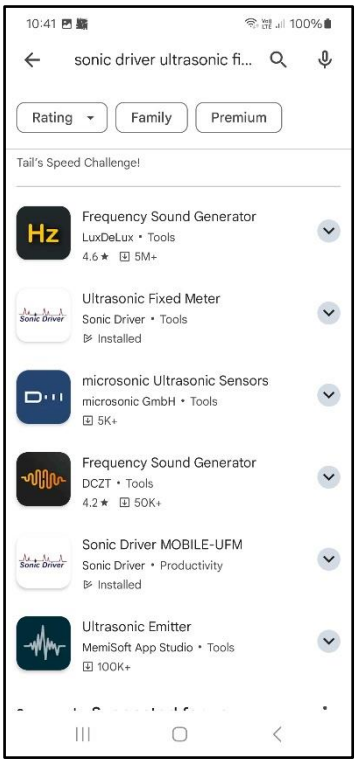

Figure (3) Search for “sonic driver ultrasonic fixed”

Scroll through the list and tap the “Ultrasonic Fixed Meter” item showing the Sonic Driver logo, see the second item down in figure (3).

The “Ultrasonic Fixed Meter” App is an entirely different App to the “Sonic Driver MOBILE-UFM” item which should also be listed, the fifth item down in figure (3). The “Sonic Driver MOBILE-UFM” App is intended for an entirely different Sonic Driver product and should not be used with the UFM-300.

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

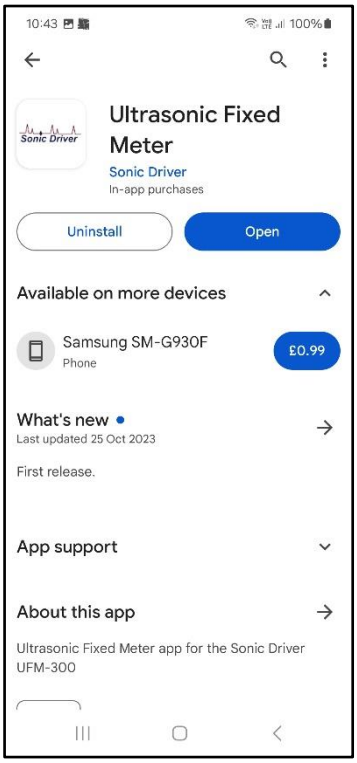

Figure (4) Install and pay

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

4.0 Hardware Connection

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

Connect the UFM to your Smart phone or tablet via a USB to RS485 converter.

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

The 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).

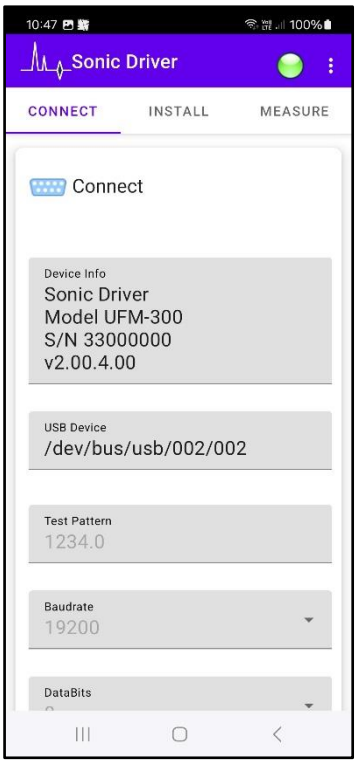

Figure (5) App display

Settings gives About and Exit options.

5.1 Connect Tab

This tab shows useful information about the connection between the Smart 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 Smart phone or tablet to which the UFM has connected, for example /dev/bus/usb/002/002.

5.1.3 Test Pattern

Upon successful connection the test pattern **1234.0** should appear.

The following settings are designed for the 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 19200.

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 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).

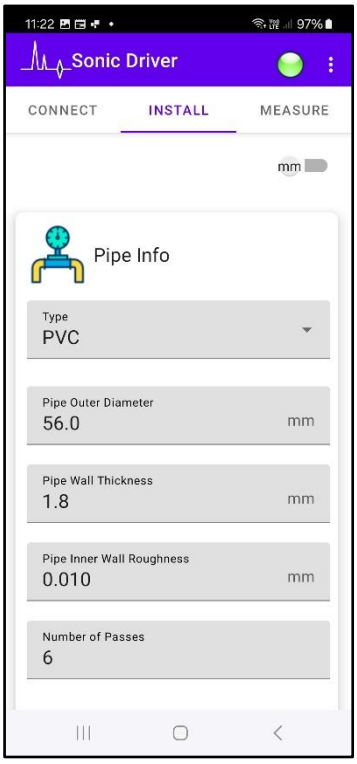

Figure (6) Pipe Information (Metric)

By sliding the switch top right of the screen from “mm” to “in” the entry of values can be made in imperial units or translated into imperial units, see figure (7).

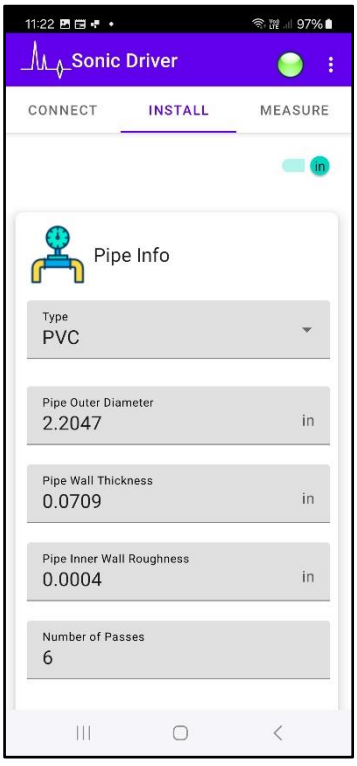

Figure (7) Pipe Information (Imperial)

Other relevant values, such as sensor spacing and fluid temperature are also converted, see figure (8).

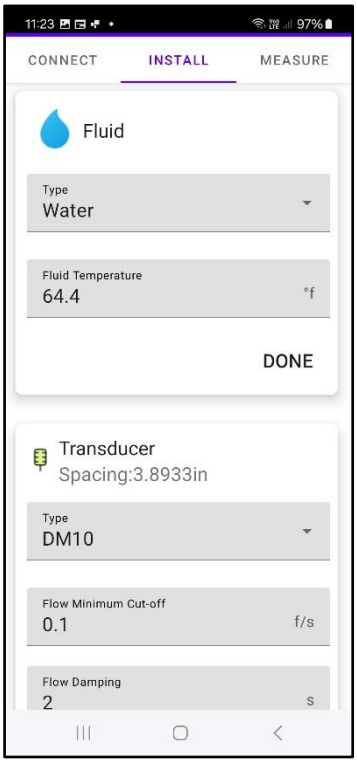

Figure (8) Pipe Information (Imperial)

5.2.1.1 Pipe Type

The user can select the pipe material from a list;

- Carbon Steel
- Stainless
- Copper
- PVC **(Default)**
- Cast Iron
- Ductile Iron
- HDPE

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 56.0 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 1.8 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. Typical values are listed in the product installation manual, Appendix B.

5.2.1.5 Number of Passes

The user is prompted to enter the number of times the sound path crosses the pipe. Allowed values are 1 to 16 passes, the default is 6 passes.

Ideally choose several 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 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 (9).

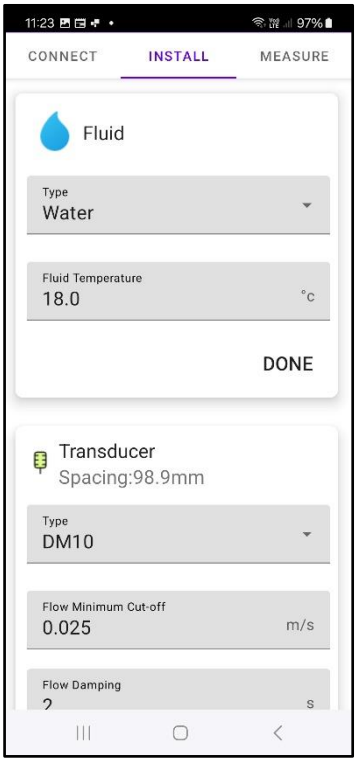

Figure (9) Fluid Information

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 deg C, default 18 deg C.

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 (10).

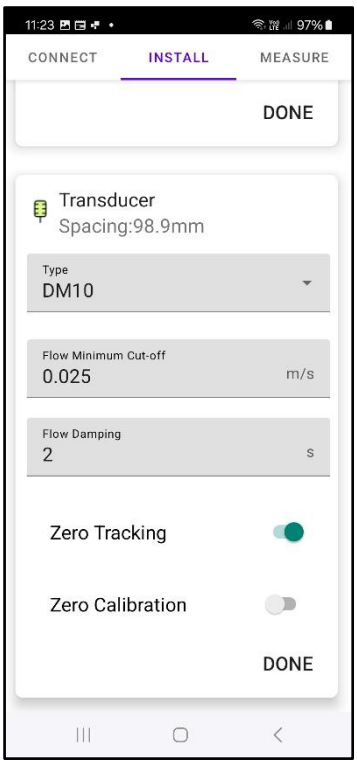

Figure (10) Transducer Information

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
- DS10

DM sensors are Sonic Driver standard PEEK/stainless steel design. DN sensors are Sonic Driver small pipe design. DS sensors are for larger diameter pipes.

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, 0.025 m/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 2 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 (11).

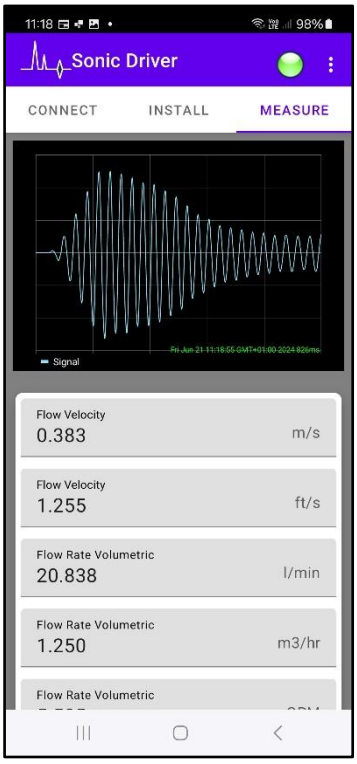

Figure (11) Signal Display

5.3.2 Measurements

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

Flow Velocity - displayed in m/s, ft/s
Flow Rate Volumetric - displayed l/min, m3/hr, GPM, GPH, ft3/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 (12,13).

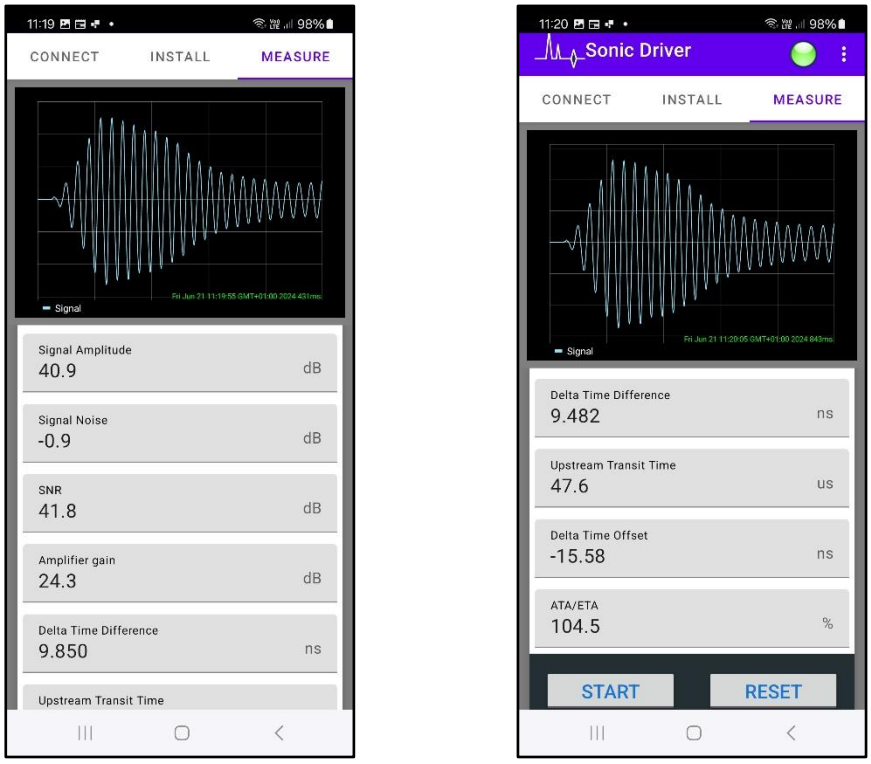

Figure (12,13) Diagnostics

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 to obtain the maximum signal strength.

The UFM normally requires signal strength over 0.0 dB 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 +10.0 dB 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 12.0 dB 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 60.0 dB.

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 ± 2.5 ns.

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.

5.3.4 Totaliser

At the bottom of the Measure Tab it is possible to; START, STOP and RESET the totaliser within the UFM in units of litres, see figure (14).

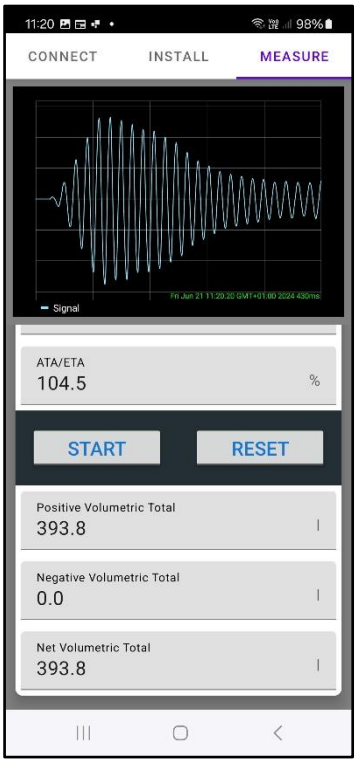

Figure (14) Totaliser Functionality

6.0 About

The About screen shows useful information about the App and a link to the Sonic Driver website, figure (15).

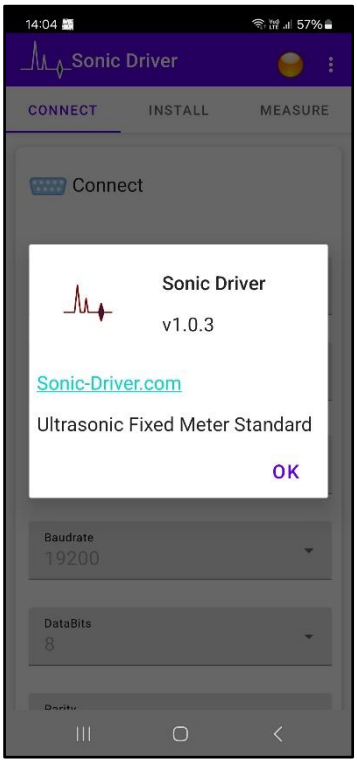

Figure (15) About

7.0 Exit

Use this screen to correctly exit the App, figure (16). Failure to do so will result in multiple instances of the App running, which will each attempt to gain control and use of the Smart devices single communication port.

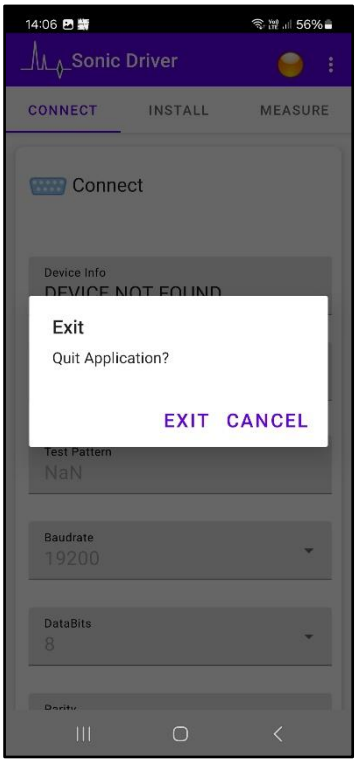

Figure (16) Exiting the App

Sonic Driver