Aqua M300 D

Operating Instructions



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The measuring device was designed and manufactured in line with the latest technological advancements and complies with the requirements as laid down in existing European and national guidelines. Conformity has been proved, and the relevant declarations and documents are in the manufacturer's possession. As the user, you must read and adhere to the following safety instructions in order to ensure that this condition is maintained and that no danger results from the use of this device.

1. Safety Instructions

We do not accept any liability for any damage which might occur due to improper use or due to non-observance of these instructions. The guarantee expires with immediate effect in such cases!

These instructions have to be read in full before the device is put into operation for the first time.
For reasons of safety and CE compliance, you may not on no account carry out any changes or modifications on either the device itself or on any other components which may be used in connection with this measuring device!

- DO NOT carry out any measurement on live components;
- Please observe the measuring range of the measuring sensors;
- Please observe the operating and storage conditions;
- DO NOT immerse the sensor head of the hydrogen sensor in standing water or any other liquid and DO NOT dip into sludge or and sludge-like substance;
- DO NOT bring the sensor head of the hydrogen sensor into contact with fine powder or powdery substances;
- The user is solely responsible for determining whether he or she considers the measurement results to be valid and for any conclusions that are reached or any measures that are taken as a result thereof. We can neither guarantee the validity of any measuring results nor can we accept liability for any such results. We are on no account able to accept liability for any damage which may be caused as a consequence of the use of these measuring results.

2. Intended Use:

The Aqua M300 is a multi-purpose detector designed to allow the user to carry out electroacoustic leak detection on pipe systems carrying water, acoustic leak detection on pipes and to perform non-destructive pinpoint leak detection on pipes which have previously been flooded with trace gas using the indicative measurement of different hydrogen concentrations. The device may be used for the above-stated purposes only within the technical data parameters as specified.

Any other use is considered to be not intended for these purposes.

In accordance with the EU Directive 2002/96/EU on Waste Electrical and Electronic Equipment, issued by the European Parliament and by the European Council on 27 January 2003, electronic equipment must not be treated as domestic waste, but must be disposed of professionally.
Please dispose of this device in a manner appropriate to the relevant legal requirements at the end of its product life.

3. Scope of Delivery and Accessories



1 Aqua M 300D central unit
2 sound-blocking headphones
3 wind-protected ground microphone
4 universal microphone
5 universal microphone with switch

6 testrod
7 spiral cable
8 ABS case, large

9 ABS case, small
10 tripod with magnets, large
11 tripod for microphones (4 + 5), large
12 tripod for microphones (4 + 5), small
13 extensions with tip M 6
14 magnet for microphones (4 + 5)
15 extensions with tip M10
16 adapter M6 / M10
17 components for hydrogen ground sensor
18 hydrogen hand sensor
19 PWG system for pipe detection (irrespective of the pipe material)

4. Control Elements



1 Left-hand volume dial

This dial has two functions: you can either press 2 A or turn 2B the dual-function dial. Turn the dial to adjust the volume of your headphones while measuring is being carried out. Press the dial to clear the current measurement series.

2 On/Off key, start measurement,
- automatic amplification
- automatic filter setting

3 This dial has two functions: you can either press (3)A or turn (3)B the dual-function dial.
Turn the dial to access menu and setting functions and to specify already selected settings.
Press the dial to confirm selections and settings.
Permanent pressing reveals the relevant keyboard configuration for the measurement menu.

4 Cancel key

Press briefly to access the superior menu. Press long to clear the current measurement series.

5 Touch display

6 Connection for PC cable

7 Headphone jack

8 Screw-on battery compartment lid

9 Microphone jack

10 Aqua M300 hydrogen sensor connecting port

5. Powering up and Operating the Device

5.1 Headphone jack and sensor port

First place the batteries into the battery compartment of the Aqua M300 and connect all the components you require to perform the specific measurement operation.

Headphones:

Connect the headphones to the headphone jack of the Aqua M300 (*see chapter 4, legend item 7*) . Use the original Aqua M300 headphones only. The headphones have been designed specifically for acoustic leak detection purposes and features self-developed electronics incorporated in the high-quality hearing protector capsule thus ensuring optimal results while providing excellent soundproofing qualities.

5.1.1. Connecting the Microphones for Acoustic Leak Detection

Please be sure to use one of the following microphones only when carrying out acoustic leak detection with the Aqua M300:

Universal Microphone / Universal Microphone with Switch (*see chapter 3,legend items (4)+(5)*)

The universal microphones can be used in combination with the extensions (13 + 15) as a **stick microphone** to pinpoint leaks. If the magnet is screwed on, the Aqua M300 can be used as a **contact microphone**, and if combined with the tripod adapter (16), the Aqua M300 can be used as a **ground microphone** to pinpoint leaks.

Ground Microphone (*see chapter 3, legend item (3)*)

The ground microphone (3) is a wind-protected ground microphone which can be used when carrying out leak detection on solid, stable surfaces. The geophone can be combined with the tripod magnet (10) for use on loose or unstable surfaces. Depending on the type of acoustic measurement, the microphones can be connected to the Aqua M300 as follows:

Aqua M300 as a Ground Microphone:
Connect the tripod adapter (4+5) to the base of the microphone and connect the microphone to the microphone jack of the Aqua M300 *(see chapter 4, legend item (9))*.

Aqua M300 as a Contact Microphone:
Connect the magnet to the base of the universal microphone and connect the microphone to the microphone jack of the Aqua M300 *(see chapter 4, legend item (9))*.

AquaM300 as a Probe Microphone:
Connect the tip of the testrod to the base of the universal microphone either with or without any extension piece (13 +15) and connect the microphone to the microphone jack of the Aqua M300 *(see chapter 4, legend item (9)).* The adapter (14) can be used depending on the type of extension.

AquaM300 as a wind-protected Ground Microphone:
Connect the tripod magnet (10) to the base of the microphone (3), if necessary. Connect the microphone to the spiral cable (7) and connect the spiral cable to the microphone jack of the Aqua M300 *(see chapter4,legend item (9)*).

5.1.2. Connecting the Hydrogen Sensor

The H2 hydrogen sensors can be connected to the Aqua M300 to carry out non-destructive leak detections in systems that have previously been flooded with trace gas. Connect the sensor to the hydrogen sensor port *(see chapter 4, legend item 10*) of the Aqua M300. For further information on how to carry out the measurement procedure, please refer to Chapter 9. For further practical information guidelines regarding the use of trace gas in leak detection, please refer to Chapter 15.2.

5.2. Powering On and Off

Press the ON/OFF key to **power on** *(see chapter 4, legend item 2).* The start screen appears and changes to the measurement menu as soon as the device is ready for use.
Press the ON/OFF key and hold for approximately 3 seconds to **power off** (*see chapter 4, legend item 1)*.

6. Navigation and Menu Structure

6.1.Navigation

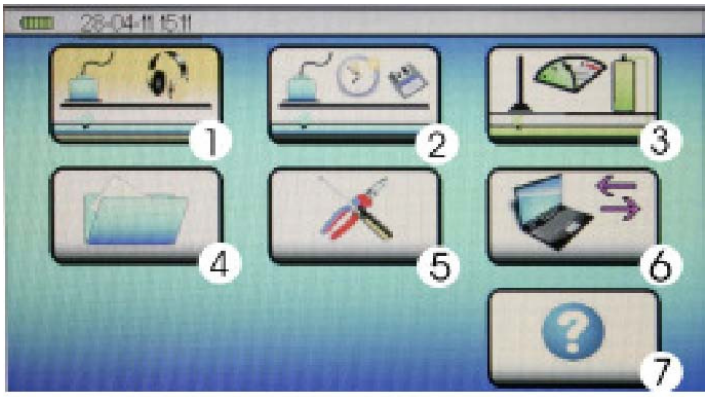
The Aqua M300 has a number of menu and selection boxes which you can select by either using the touch screen or the **navigation dial on the right**. When using the touch screen, simply briefly place your finger on the menu or selection box you wish to select. You can also turn the right-hand dial either clockwise or anti-clockwise continuously to go through all the menu or selection boxes in order to get to the box you wish to select. **Activated menu levels or selection boxes are highlighted in yellow.**

Press the dial when you are finished to confirm your selection. The menu or selection box you have selected will now be shown.

Press the Cancel key 

to leave the menu or selection box which is just being shown and return to the last command line which was confirmed.

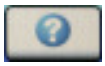
6.2 Main Menu



Help menu (*chapter 8.3*)
Setting menu (5) *(chapter 6.4*)
Measuring operation acoustic leak detection (1) *(chapter 7*)
Measuring operation acoustic long-term measurement (2) *(chapter 8)*
Measuring operation trace gas detection (3) *(chapter 9)*

PC data transfer (6) *(chapter 11)*

Press *menu* in the upper screen bar or the *Cancel* key  to return to the main menu from the selected sector.

6.3 Help 

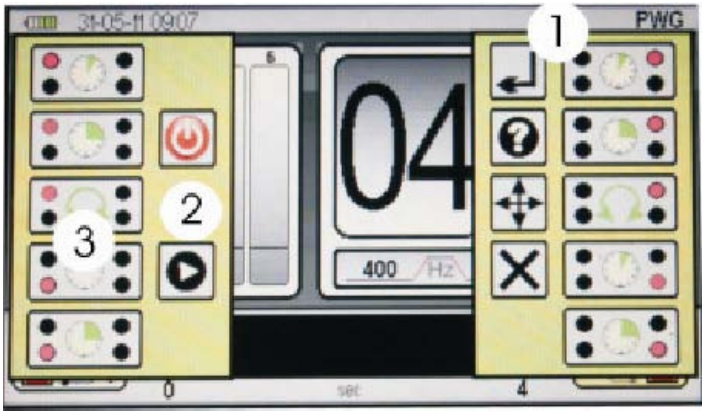
The Aqua M300 is equipped with an integrated help function which can be accessed from either side. Navigate to the menu item *Help* in the upper menu bar as described in Chapter 6.1 to get to the Help main page. Scroll to the Help topic which you would like to find out about and confirm your selection by pressing the dial on the right to get to the help text you require.

Press the door symbol 
to navigate back out of the help sector.

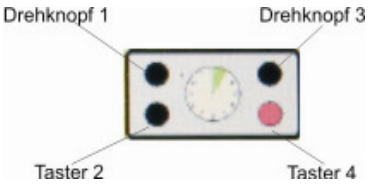
If you want to leave the help sector immediately, press the Cancel key.  You will then return to the main menu.

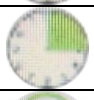
Configuration of the Cancel keys and dials

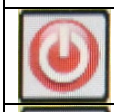
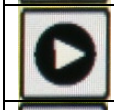
Press continuously the dial (3) to display the functions activated in the particular menu bar as shown in the example below (searching for a pipe):



Meaning of the pictogram



Action		
		Press briefly
		Press long
		Turn

Function		
		Power off
		Start measuring process
		Activate the menu bar
		Display activated functions
		Curser function
		Leave the menu

6.4 Settings 



You can reach the menu *Settings* via the Settings symbol in the main menu.

Navigate to the settings you wish to select and carry out your selection in order to perform the following configurations:

6.4.1. Time and Date

Use the dial on the right to navigate to the selection field of your choice. The selection field you have chosen will be highlighted in yellow. Press the dial on the right to confirm your selection. The field you have selected is now active and highlighted in yellow.
Press the dial again or press the Cancel key to deactivate the field you have selected.
When the selection field is active, you can enter a value by turning the dial on the right and pressing the dial to confirm that the value you have entered is correct. You can now navigate to the next selection field.
To enter the value via the touch screen, first press your finger against the selection field which you wish to activate and then enter the value using the number pad. Press OK to confirm that the value you have entered is correct, and press DEL to clear the value.
Press the Cancel key or the door symbol on the screen to leave the setting menu.

6.4.2. Languages

You can select from a number of languages for the display of the Aqua M300. Scroll down to the language you wish to select and confirm your selection by pressing the dial on the right.
Press the Cancel key or the door symbol on the screen to leave the setting menu.

6.4.3. Power-Off Time

You can conserve battery power by selecting the time between 1 and 60 minutes after which the device then automatically powers off when not in use. Repeat the procedure as described in Time and Date (*see chapter 6.4.1*) to enter the length of time you have selected.

6.4.4. Backlight

The brightness of the display can be adjusted from 0 to 100% to suit your individual requirements. There is also a scale with three individual colour segments which show you just how much battery power the brightness setting you have selected consumes. The batteries will last longest when the scale is green and used up fastest when the scale is red.
Turn the dial on the right to increase or dim the brightness and leave the menu by either pressing the dial or by pressing the Cancel key or the door symbol on your screen.

6.4.5. Frequency Range

Each of the measuring modes that can be used during acoustic leak detection has both a selection of pre-defined filters and a selection of user-defined filters which can be configured in the setting window *Frequency Range*.
The settings of the high-pass filter (HP), the low-pass filter (LP), and the maximum breadth of the colour spectrum can all be changed.
Repeat the procedure as described in Time and Date (*see chapter 6.4.1*) to enter the configuration you have selected.

6.4.6. Hearing Protection

The Aqua M300 is equipped with an automatic noise level absorber which ensures that the noise requirements according to VBG 121 (VGB – Association of Institutions for Statutory Accident Insurance and Prevention) are met when the LD60000 headphones included in the scope of delivery are used. The noise protection intensity of the headphones can be adapted individually to suit the user. The intensity ranges from 0 (relatively low) to 3 (maximum). Each of the three stages compels with the requirements as laid down in VGB 121. The configuration corresponds to the procedure for setting the time and date as described in chapter 6.4.1.

6.4.7. Touch Screen

You can use this setting window to deactivate the touch screen or to carry out a calibration or performance check. Use the dial on the right to navigate to the selection field of your choice and confirm your selection by pressing the dial.

If ON/OFF has been selected, you can activate or deactivate the touch screen function respectively by pressing the dial.

To leave the setting menu either press the dial or press the Cancel key or the door symbol on the screen.

6.4.8. Clearing Memory

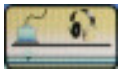
You can clear two different memory values in this setting window.

Clear Memory clears all the values that have been saved in the device.

Clear Parameter Memory clears all the user-defined configurations for the high-pass filter, low-pass filter and the maximum breadth of the frequency spectrum in the Frequency Range setting window *(see chapter 6.4.5,*).

You can also use the touch screen to clear the memory or use the dial on the right to navigate to the selection field you have chosen before pressing the dial to confirm your choice.
A tick symbol will appear to acknowledge that the memory has been cleared.

If you want to leave the setting menu, either press the dial or press the Cancel key or the door symbol on the screen.

7. Acoustic Leakage Detection 

In order to be able to carry out acoustic leak detection with the AquaM300, first activate the symbol for your acoustic leak detection measuring operation in the main menu and confirm your selection.

The first selected mode is the pre-defined smart mode. There are two other modes available in addition to the smart mode: the F&V mode (frequency and volume) as well as the V mode (sound level). These measuring modes will be described in more detail in the chapters 7.2 to 7.4 below.

Regardless of the measuring mode chosen, the following parameters can be set for all the measuring modes that can be used to carry out leak detection in the same consistent manner:



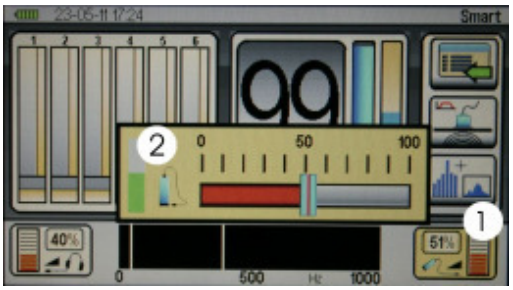
(1) Sensor sensitivity setting

(2) Selection of pre-defined filter settings

(3) Volume setting

7.1 Parameter Settings in the Acoustic Modes

7.1.1 Adjusting the Sensor Sensitivity



To set the sensitivity of the microphone connected to your leak detection device, navigate in the display window to the symbol for the sensor sensitivity setting (1), activate the symbol and confirm your selection.

The sensor sensitivity settings window opens.

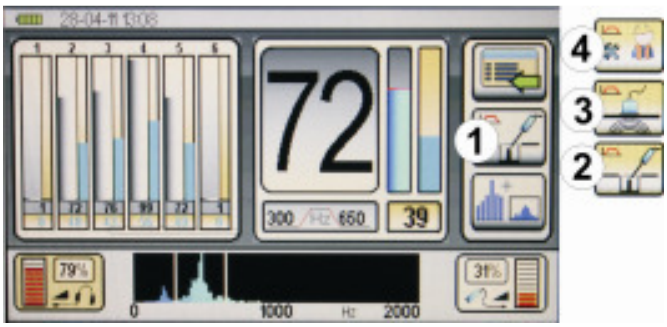
The microphone amplification factor that has been currently selected is displayed on a scale from 0 to 100%. Turn the dial on the right or touch the touch screen and pull your finger to the sensitivity value which you would like to select. The sensitivity value is ideal when the control bar (2) on the left is half red, as shown.

!!! Press the Cancel key (2) to activate automatic amplification.

Press the Cancel key to leave the window without changing the sensitivity value. Press the dial on the right to confirm the new setting or press the Cancel key. You can also confirm your selection by pressing the symbol for the sensor sensitivity (1) on the touch screen.

NOTE: The current measurement series will be cleared when any changes are carried out to the sensitivity settings!

7.1.2 Selecting the Filter Presetting



You can select one of three predefined filters when carrying out acoustic leak detection. Each of the filters can be changed individually during measuring.

To select one of the predefined filter settings, navigate to the filter mode symbol (1) on the display, activate the symbol and confirm your selection.

The window for the filter presetting selection opens.

There are three pre-settings to select from:

Fittings (2)

There is a predefined frequency range from 0 to 2,000Hz with a 200Hz high-pass filter and a 200Hz low-pass filter which are ideal for checking the status of fittings and hydrants.

Ground (3)

There is *one* predefined frequency range from 0 to 1,000Hz with a 50Hz high-pass filter and a 400Hz low-pass filter which are ideal for checking the status of pipe runs. This is the factory default setting and therefore the setting when the device is put into operation for the first time.

User (4)

This presetting uses the filter range defined by you as the user in the *frequency range* settings menu *(see chapter 6.4.5)* according to your own specific filter preferences. When this product leaves the factory, the frequency range is from 0 to 1,200Hz with a 100Hz high-pass filter and a 800Hz low-pass filter.

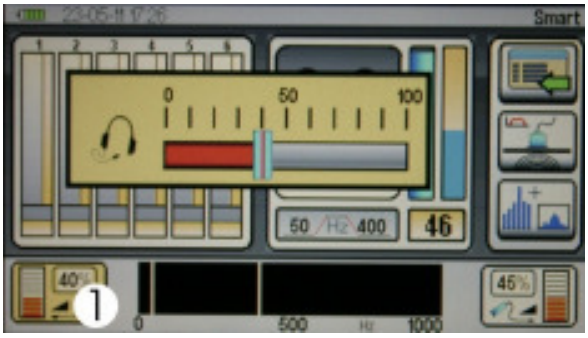
To carry out the setting, navigate in the window to the presetting (2), (3) or (4) you wish to select, activate the particular setting and confirm your selection by pressing the dial on the right. The window then closes and the symbol for the selected filter setting appears as the filter mode symbol (1).

Press the Cancel key to leave the window without changing the filter setting.

Besides the predefined filters, you can also change the predefined filter frequencies manually during acoustic leak detection operations in all the measuring modes at any time between single measurements. In order to do so, please refer to chapter 7.4.

NOTE: The current measurement series will be cleared when any changes are carried out to the filter settings!

7.1.3 Volume Setting



You can adjust the volume of the headphones subject to the predefined hearing protection to suit your requirements *(see chapter 6.4.6.).*
The volume you have selected will either be displayed numerically in the symbol for the volume of the headphones (1) and, in addition, as a bar diagram.

Changing the Volume Before or After Measuring:
To change the volume of your headphones before or after measuring, navigate in the window to the symbol for selecting the headphone volume (1), activate it and confirm your choice.
The window for selecting the headphone volume opens.
The volume that has been selected for your headphones is displayed on a scale from 0 to 100%. Turn the dial on the right or touch the touch screen and pull your finger to the volume which you would like to select.
Press the Cancel key to leave the window without changing the volume setting.

Press the dial on the right to confirm the new setting or press the Cancel key.
You can also confirm the setting change by pressing the symbol for the headphone volume (1) on the touch screen.

A change in volume has no effect on the measuring curve, and the current measurement series remains in the memory and is not cleared.

Changing the Volume during Measurement:

You can change the volume at any time during the measurement by either turning the dial on the left anti-clockwise to turn down the volume or clockwise if you wish to turn up the volume.

7.2 Measurement Modes

7.2.1. Mode Description

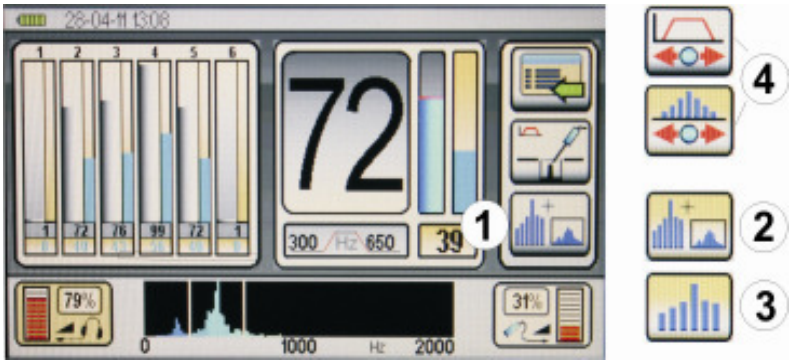
Smart Mode

The Smart Mode displays a double-bar comprising a noise level indicator and the smart indicator for enhanced leak detection. The smart indicator is based on a complex calculation and analysis system which includes factors like frequency, noise levels, and evaluations. This algorithm has been tried and tested and is especially effective when background noise levels are high and the sound emitted by the leak is very quiet.

Volume Mode

The leak-borne noise is displayed as noise level (amplitude). The spot showing the noise peak represents the spot of the leak.
Searching for the pipe (see section – Searching for a Pipe, *chapter 10*)

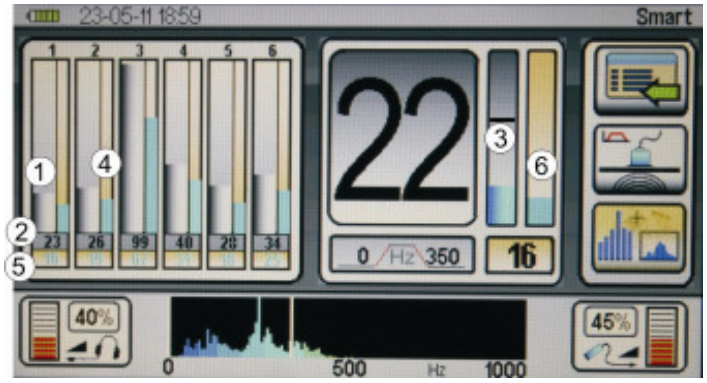
7.2.2. Mode Selection



The measuring mode symbol (1) on the display shows which mode has been set. To call the requested measuring mode, press the dial (3)

(2) Smart Mode
(3) Volume Mode
(4) Searching for a Pipe (*see chapter 10*)

7.2.2.1 Measuring Procedure Smart Mode 



Press the record button or the press button on the handle at the universal microphone (5) to start measuring. Keep the button pressed for the duration of the measurement. The device will stop measuring and save the data when the record button is released.

The display can show a measurement series which is made up of the last six individual measurements as well as the current measurement.

The first measurement saved is displayed on position 1. Each further measurement shifts the previous measurement to the right. When position 6 has been reached, the oldest of the six measurements, the measurement on position one, will be cleared so that the last measurement which was taken is always displayed on position 1.

The double-bar can be used to visualise the following information in smart mode:

The left-hand, broad bar (1) represents the noise amplitude on a scale ranging from 0 to 100. The grey bar shows the minimum value measured, i.e. the lowest noise level, which is relevant for leak detection. This value is also displayed numerically (2) below the bar.

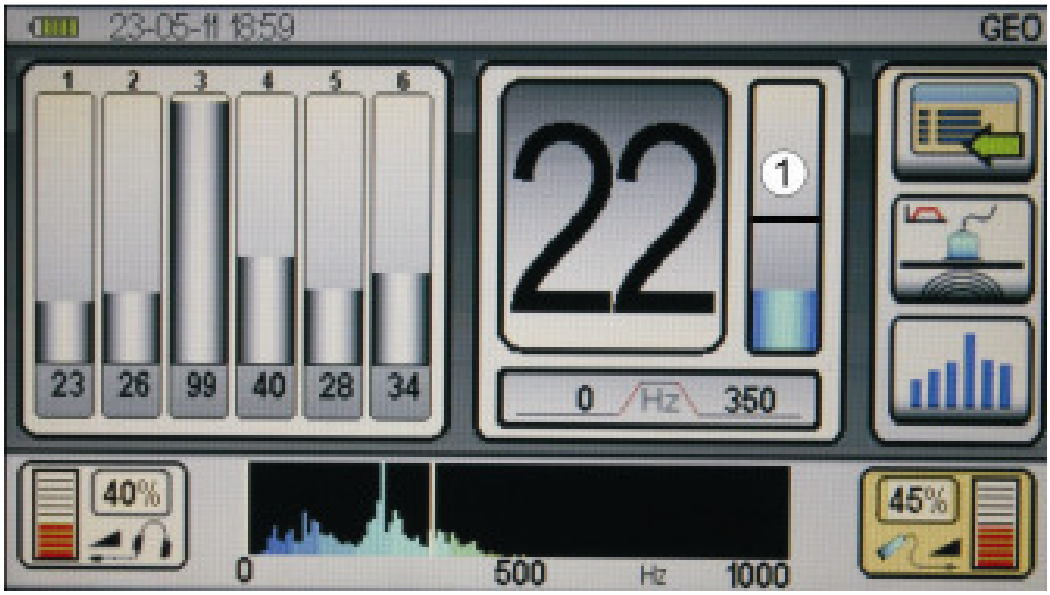
The right-hand, thin bar (4) represents the smart indicator. The smart indicator is based on a complex set of calculations and analysis methods *(see chapter 7.2.1).* The higher the smart indicator value, the more reliable the information on the leak. The smart indicator bar also displays the colour of the frequency which was used for the calculation that is required to provide an indication on the whereabouts of the leak. According to the rule of thumb, the closer the leak, the higher the smart indicator bar value and the lighter the colour.

The smart indicator bar value is also displayed numerically next to the actual bar (5).

NOTE: You can change the measuring mode during measuring at any time and analyse or continue previous measurements in another mode. The measurement series will not be cleared on changing the mode.

7.2.2.2 Measuring Procedure Volume Mode 

Only the noise amplitude of the minimum value measured is displayed as a single bar in the volume mode.



Press the record button or the press button on the handle at the universal microphone (5) to start measuring. Keep the button pressed for the duration of the measurement. The device will stop measuring and save the data when the record button is released.

The display can show a measurement series which is made up of the last six individual measurements as well as the current measurement.

The first measurement saved is displayed on position 1. Each further measurement shifts the previous measurement to the right. When position 6 has been reached, the oldest of the six measurements, the measurement on position one, will be cleared so that the last measurement which was taken is always displayed on position 1.

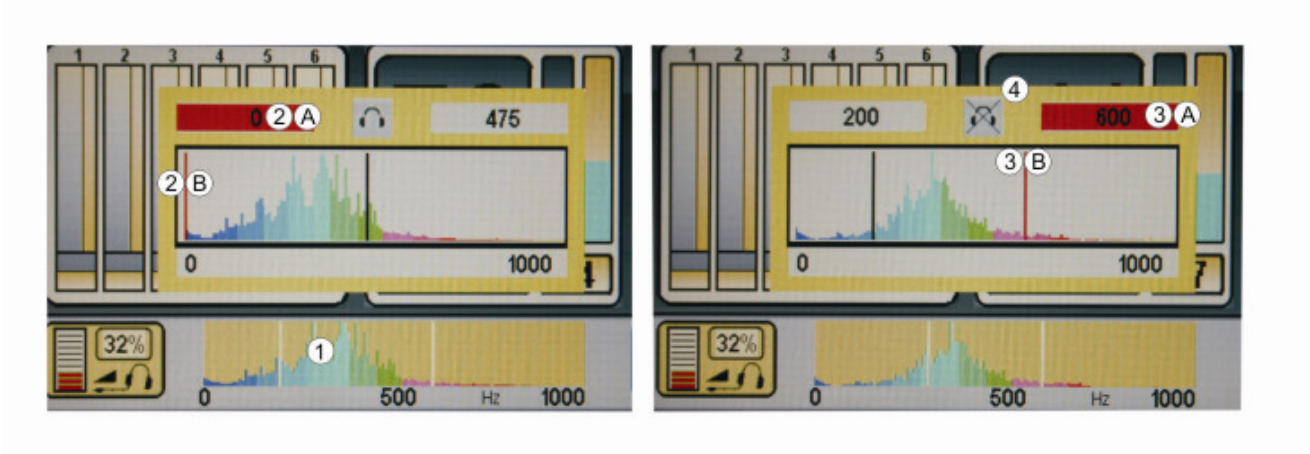
The single bar can be used to visualise the following information in volume mode:

The height of the bar indicates the noise amplitude on a scale ranging from 0 to 100. You are most likely to find the leak at the spot showing the highest amplitude value.

7.3. Clearing the Current Measurement Series

As many as seven individual measurements can be carried out with the Aqua M300 and used as a measurement series which can then be displayed. This series remains in the memory – even when the device is powered off – unless certain parameters are changed. This function is of particular advantage in the field as this means that the last measuring value can then be “carried over” to the next measuring point where the measurement series can then be continued. Please note that the measuring series will be cleared immediately as soon as the sensor sensitivity settings or the predefined filter settings are changed. Follow the instructions in chapter 11 to find out more on how the measurement series can be saved permanently. To clear the individual measurements or the measurement series shown on the display, press the dial on the right (4) and keep it pressed for 3 seconds. All 7 positions in the display have now been cleared and are empty.

7.4 Manual and Automatic Filter Adjustment



You can change the predefined filter frequencies at any time between individual measurements in each of the three acoustic leak detection measuring modes. Navigate to the frequency range display (1), activate the display, and confirm your selection.

The window for the acoustic filter adaptation opens.

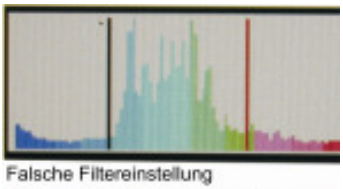
The high-pass filter, the low-pass filter, the frequency spectrum as well as the status symbol for the activation of the headphones are all presented on the display.

The frequency spectrum is also presented as a colour gradient. Dark colours indicate low-frequency sounds, and bright colours indicate high-frequency sounds

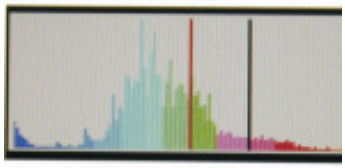
The preset filter configuration is active. This is indicated by the red high-pass filter value field and the red high-pass filter bar (2) A and (2) B in the frequency band as well as the red low-pass filter bars (3) A and (3)B in the frequency band.

To change the frequency value of the filter, turn the dial on the right or touch the touch screen with your finger and pull the high-pass filter bar to the position where you would like it to be.

To change the frequency value of the low-pass filter, press the dial on the left once. The low-pass filter configuration is now active. This is indicated by the red low-pass filter value field 3 A and the red low-pass filter bar (3) B in the frequency band.



Falsche Filtereinstellung



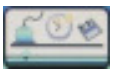
Richtige Filtereinstellung

When working in the field, the setting for the low-pass filter is ideal when all the high-frequency sounds lie within the selected range and the high-pass filter is set so that the bottom left-hand sector of the selection box is on the right-hand sloping flank of the biggest part of the spectrum.

Press the Cancel key or the lower frequency display (1) to leave the window.

Activating the Headphones during Filter Adaptation

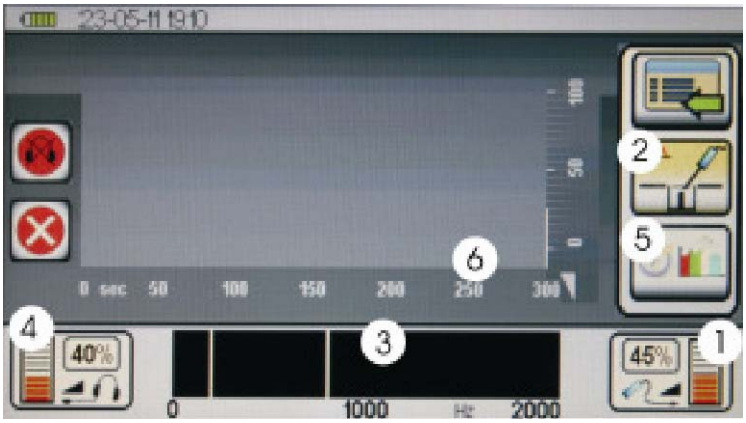
The Aqua M300 features a function for the activation of the headphones while the filters are being set.
This function can be switched on or off by pressing the key on the left (2). The status symbol for the acoustic activation in the window (4) will indicate the current status of the function.
When this function is active, the sound from the microphone is passed on through to the headphones while the filter is being adapted.
This means that you can either enter numerical values to set the limits for the frequency ranges you wish to select or you can set the limits using the acoustic method.

8. Acoustic Long-Term Measuring 

You can carry out acoustic long-term measuring with the Aqua M300 in order to determine over a longer period whether a certain sound can be attributed to either a leak or to environmental sources such as pumps, flow-related noises in canals, etc.. To select the acoustic long-term measuring mode, activate the symbol for acoustic long-term measuring in the main menu and confirm your selection.

You will then arrive at the display.

8.1 Parameter settings for Acoustic Long-Term Measuring



You can set the following parameters and carry out the following actions on the display:

Set the sensor sensitivity (1)
Select the filter presetting (2)
Adapt the filter and activate the acoustics manually (3)
Set the volume (4)
Set time intervals for long-term measuring (5)
Start long-term measuring (chapter 8.2)
Clear the display (chapter 8.2)
Stop/continue long-term measuring (chapter 8.2)

Setting the sensor sensitivity (1):

To set the sensor sensitivity, perform the same steps as described for current measurements in chapter 7.1.1.

Selecting the filter presetting (2):

To select the filter presetting, perform the same steps as described for current measurements in chapter 7.1.2.

Adapting the filter and activating the acoustics manually (3):

To adapt the filter and activate the acoustics manually, perform the same steps as described for current measurements in chapter 7.6.

Setting the volume (4):

To select the volume for long-term measuring, perform the same steps as described for current measurements in chapter 7.1.3.



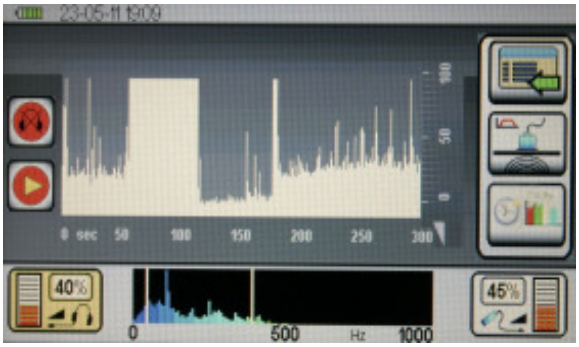
Furthermore, the volume function for long-term measuring can be deactivated at any time by pressing the dial on the left (1) once.

The volume that has been set is not affected by the mute function. The mute function just mutes the headphones.

Selecting the time intervals for long-term measuring (5):

There are four predefined time intervals available for selection: 5, 15, 30, and 60 minutes. To select a time interval, navigate to the time interval symbol (5) on the display, activate the symbol and confirm by pressing your selection. The window for setting the time interval will then open. Navigate to the time interval you wish to select by pressing the dial on the right or by touching the touch screen with your finger and confirm your selection by pressing the dial on the right or press the Cancel key. The time scale (6) on the display will now display the time interval you selected.

8.2. Measuring Procedure

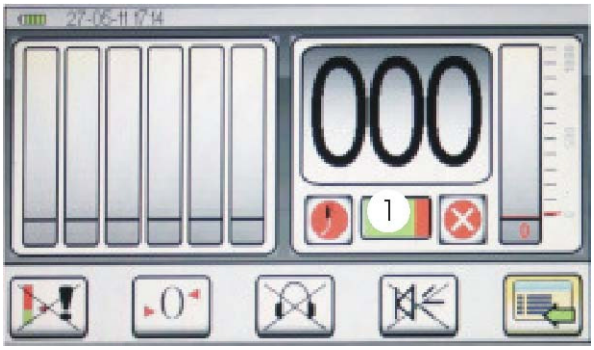


Press the left-hand button (2) to start long-term measuring. The measurement will start and end with the pre-selected times. You can interrupt the recording at any time by pressing the button (2) again.
Continue measuring by pressing the button (2) again. To clear the long-term measurement series on the display, press the right-hand button (4) of the device for 3 seconds.

9. Trace Gas Detection 

The Aqua M300 is excellently suited for detecting leaks together with the optionally available Aqua M300 H2 hydrogen sensor and the formation gas type 95/5, which comprises 95 % nitrogen and 5 % hydrogen. To select the trace gas detection, activate the symbol for the trace gas detection in the main menu and confirm your selection.
You will then arrive at the display.

9.1 Putting the Device into Operation



As soon as you change to trace gas detection on the display when the hydrogen sensor is connected, the device recognises the sensor and warms it up to operating temperature. This warm-up phase takes approximately 3 minutes and is displayed as a green progress bar (1) below the numerical display. The sensor self-calibrates during the warm-up phase. This self-calibration is designed to determine the base value for the different hydrogen concentrations that are detected during measuring. The sensor calibrates independently according to the existing hydrogen concentration in the surrounding air. Therefore, it is especially important that you ensure that the sensor is not near any relevant hydrogen source during the warm-up phase. So we recommend that you either go outside into the open with the Aqua M300 during the warm-up phase or remain in places where you know that the hydrogen concentration is low (<1 ppm H2). As soon as the sensor has reached its operating temperature, the warm-up bar disappears and the Aqua M300 is ready to use.

9.2 Display



You can read and adjust the following parameters and carry out the following actions on the display for trace gas detection:

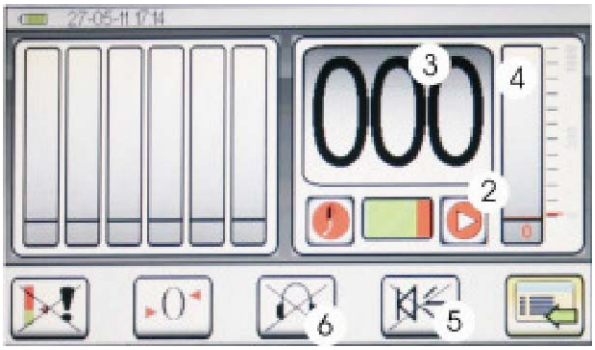
- Bar display (1) and the number which displays the current measurement underneath it
- Preset alarm threshold (2)
- Digital display with the current measuring value (3)
- Six position bars for the bar display (4) and the numerical display (5) of the previous measurements. The first measurement is displayed on position 1, each additional measurement shifts the previous measurement to the right. When position 6 has been reached, the oldest of the six measurements, the measurement on position one, will be cleared so that the last measurement which was taken is always displayed on position 1.
- Start/Stop symbol and recording symbol respectively (6) to start and end a measurement
- Perform zero calibration (7)
- Switch the measuring tone on and off central unit(8)
- Define the alarm threshold (9)
- Switch the measuring tone on and off headphones (8)

The functions and setting options of these parameters will be explained in detail in the following chapters.

9.3 Normal Measuring with Acoustic Feedback

NOTE: Information on the displayed values:

The **Aqua M300** hydrogen sensor is capable of detecting highly resolved hydrogen concentrations from 10 to 20.000 ppm. The **Aqua M300** displays the detected hydrogen concentrations as digits but without any accompanying unit in a range from 0 to 1,000 digits. **Note**: The correlation from display and hydrogen concentration is not linear, but logarithmic. The displayed digital value does not automatically correspond with the ppm value!



Starting Measuring:

Press the left-hand button on the central unit to start a measurement. The measurement will be continued until the button is pressed to discontinue measuring.

A pulsating record symbol (2) indicates that measuring is being carried out.
The current measuring value is displayed numerically on the digital display (3) and on the right-hand bar display (4) also numerically and as a bar. The displayed values are shifted by one measuring interval.
The display will increase if you get closer to an area with a higher hydrogen concentration. The value decreases again when you move away from this area or enter adjoining areas with lower hydrogen concentrations.
There is a hydrogen concentration of 145 digits on the display as shown in the example.

Activating Acoustic Feedback:

As it may become difficult to keep an eye on the display the whole time while trying to detect the direction which the biggest trace gas increase is coming from, the Aqua M300 is also equipped with an acoustic feedback to assist you during leak detection.
The Aqua M300 features an acoustic signal display which is connected to a piezo element and is also capable of transmitting a signal tone to the connected headphones.

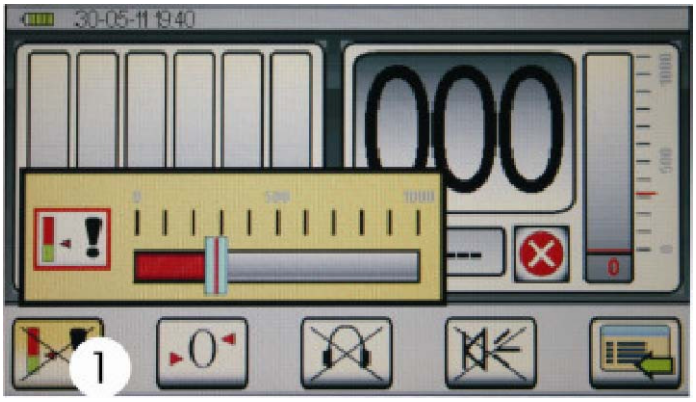
The acoustic feedback is initially set to “deactivated“.
To activate the acoustic feedback, navigate to the measuring tone symbol (5) or to the headphone symbol (6) with the dial on the right and activate the symbol by pressing the right-hand dial or by directly touching the symbols on the touch screen.

When the acoustic feedback has been activated, the sound is emitted via both the connected headphones as well as the internal piezo element.
The sound is emitted in the same volume and the same frequency via the piezo element. The tone frequency increases when the measuring values increase and decreases when the measuring values decrease.

The sound is emitted in the same volume as a continuous tone via the headphones. The frequency depends on the measuring value. The frequency increases when the measuring values increase (the tone becomes higher) and decreases when the measuring values decrease.

9.4 Defining Alarm Thresholds

In order to allow you to identify certain hydrogen concentrations more easily, the Aqua M300 is equipped with a permanent alarm function with alarms thresholds that can be configured individually. An acoustic alarm sounds when the alarm threshold is exceeded. The warning tone sounds different than the standard feedback signal When the **alarm tone sounds via the piezo element**, the signal changes constantly in a tone sequence with long tones in short intervals.



To set the alarm threshold you wish to select, navigate in the display window to the symbol for the threshold setting, activate the symbol and confirm your selection.
The window for setting the alarm threshold will then open.
The current alarm threshold is displayed on a step scale ranging from 0 to 1,000 digits.
You can select a new threshold value by either turning the dial on the right or placing a finger on the touch screen and pulling it to the value you wish to select.
Press the Cancel key to leave the window without changing the alarm threshold value.
Press either the dial on the right or the Cancel key to confirm your selection.

9.5 Measuring with Zero Calibration

It may become necessary to use the zero calibration function to define a reference value during measuring so that fluctuating concentrations at different measuring points can be defined more clearly.
As soon as a reference value has been defined, a value that is relative to the newly defined reference value appears on the display.
This can be of particular advantage when pipe sections are measured in areas with high hydrogen concentrations as it allows you to narrow down the position of the leak on a step-by-step basis.
To determine a reference value, navigate to the zero calibration symbol with the right-hand dial and activate the symbol by pressing the dial. You can also activate the zero calibration symbol by touching the symbol on the touch screen.

NOTE: The current measurement series is cleared when zero calibration is performed!

When you perform zero calibration, you are defining the existing hydrogen concentration, i.e. the current measuring value, as the new reference value.

This in turn changes the displayed measurement value when compared to the normal measurement without zero calibration.

The digit display now shows two values: the relative measured value (relative to the defined reference value, 000 display at the point of zero calibration) as large digits in the middle of the digit display and the measured absolute measurement value beneath as reference value when zero calibration was carried.

The displayed values change as follows when the hydrogen concentration increases:
the relative measured value shows the increasing values in relation to the defined reference value. The absolute measured value shows the actual existing hydrogen concentration. The relative measured value is not only displayed on the digital display but also on the red bar display as well as on the numerical display below.
If the hydrogen concentration values decrease below the defined reference value, the displayed relative measured value no longer changes (000), but the absolute measured value still displays the existing hydrogen concentration.

Here an example to explain how this works:

There are three different hydrogen concentrations in three fictive adjoining zones. The concentration in Zone 1 is 250 digits, the concentration in Zone 2 is 300 digits, and the concentration in Zone 3 is 100 digits.

1. 2. 3. 4.



1 First measuring is carried out in Zone 1; the measured value on the display is 200 digits
2 Now a zero calibration is carried out in zone 1 and the existing hydrogen concentration (250 digits) is defined as the reference value. When a second measurement is carried out in Zone 1, the digital display now shows a relative measured value of 000 and an absolute measured value of 200.
3 A new measurement is carried out in Zone 2. The digital display now shows a relative measured value of 50 and an absolute measured value of 300.
4 Then measuring is carried out in Zone 3. After the measurement has been carried out, the digital display only shows the absolute measured value of 100 and no measuring value (000).

NOTE: The defined alarm thresholds are always set with regard to the relative measured value! An alarm threshold of 150 digits, as shown in the example above, would only trigger a signal after the first measurement in zone 1 before zero calibration although the absolute measured value that was measured in Zone 1 (after zero calibration) **and** in Zone 2 was above the alarm threshold

9.6 Clearing the Measurement Series

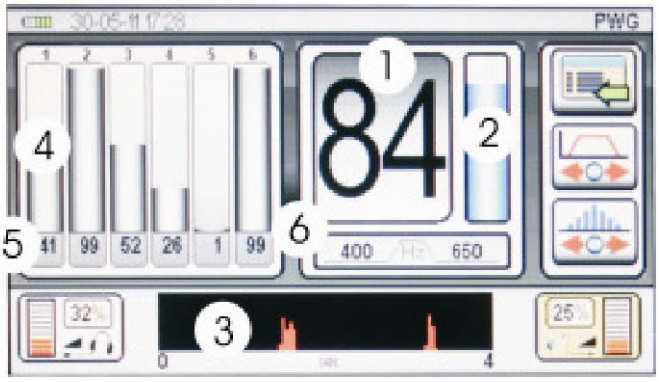
The current measurement series is cleared by keeping the right-hand key for a while.

10. Searching for a Pipe

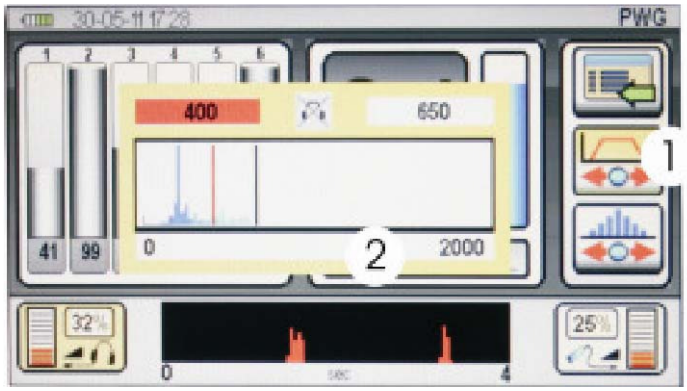
To select the “Searching for a Pipe” measuring mode, perform the same steps as described in chapter 7.2.

Searching for a pipe can be carried out only in combination with the optional FAST-PWG (pulse wave generator) (see Accessories (19)). The PWG is mounted to the pipe and in direct contact with the pressurized liquid (hydrants, boreholes, ventilations, etc.). The PWG generates a periodic pressure wave which can be acoustically received through the pipe.

The pipe amplifies the volume and the frequency of the impulse generated by the PWG most.



Displaying the maximum level of the current measurement (numerical) (1)
Displaying the maximum level of the current measurement (bar display) (2)
Time axis with displaying the PWG impulse (3)
Saved measurements (bar display) (4)
Saved measurements (numerical display) (5)
Displaying the current high-pass / low-pass frequencies (6)



10.1 Setting the Volume, the Sensitivity, and the Frequency

To set the volume, the sensitivity, and the frequency, please perform the same steps as described in chapter 7.1.

To set the **frequency** manually, navigate to the symbol for setting the measuring frequency (1) on the display. In order to set the frequency, use the dial on the right or a finger on the touch screen. The frequency window (2) will open, setting the frequency is carried out as described in chapter 7.4.

10.2 Procedure

Press the left-hand key (2) or, if applicable, the button on the handle, to start the measurement. As soon as the key or the button has been released, the measurement will be stopped and saved.

The frequency and the sensitivity have to be set so that you can clearly see the measuring impulse. Cross the pipe in a diagonal way while performing the measurement. The impulse with the highest amplitude shows the point where you are most likely to find the pipe.

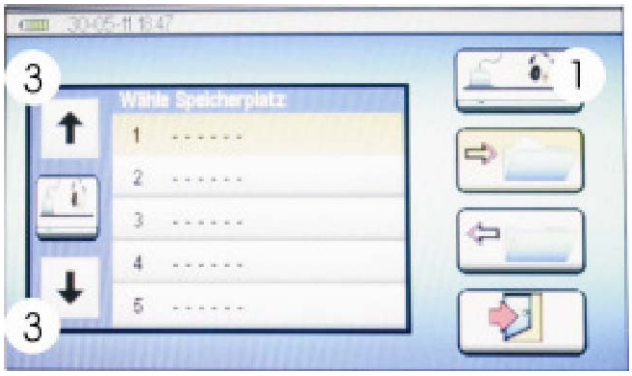
10.3 Clearing Current Measurement Series

The Aqua M300 is capable of carrying out and displaying up to 7 individual measurements as a measurement series. The measurement series will remain in the memory – even when the device is powered off – unless certain parameters are changed. Follow the instructions in chapter 11 to find out more on how the measurement series can be saved permanently. To clear the individual measurements or the measurement series shown on the display, press the dial on the right and keep it pressed for 3 seconds. All 7 positions in the display have now been cleared and are empty.

11. Saving and Loading Measurement Data

All measurement reading and any measurement series can be saved to the internal memory of the Aqua M300 and either called up at a later point of time or transferred to a PC. The menu item “Save” can be called in the main menu. To save a measurement or a measurement series into the memory, navigate to the menu item “Save” with the right-hand dial and press the dial to confirm your selection. You can also use the touch screen to select the memory item “Save”. The display now changes to the memory page.

Saving Measurement Data

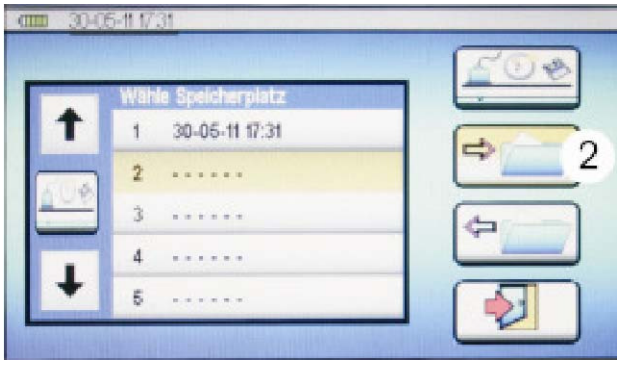


To save your measurement data, navigate to the display symbol *Save Measuring Value* (1) and confirm your selection by pressing the right-hand dial.
You can also confirm your selection directly by pressing the symbol *Save Measuring Value* on the touch screen. The measuring values can then be saved to any memory space you wish. Turn the right-hand dial to navigate to one of the 20 memory spaces and confirm your selection by pressing the display symbol *Save Measuring Value* (1).
The measuring data is now on the memory space which you previously selected.

You can navigate to memory spaces outside the touch screen display by touching the navigation symbols (3).

You can either leave the memory page by pressing the Cancel key or the door symbol on the display.

Loading Measurement Data



To call up any data you have previously saved, navigate to the display symbol *Load Measuring Data* (2) and confirm your selection by pressing the dial on the right.
You can also confirm your selection directly by pressing the symbol *Load Measuring Data* on the touch screen. You can then call up the measuring data you have saved from any one of the memory spaces. Turn the right-hand dial to navigate to the memory space you wish to select and confirm your selection by pressing the display symbol *Load Measuring Data* (2).

The measuring data you have selected is now displayed.

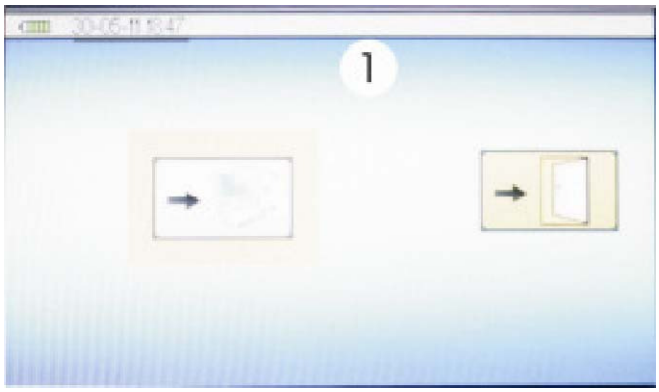
12. Transferring Measurement Data to a PC 

The measuring values you have saved to your internal memory can be transferred to your PC for further assessment or documentation. You will need the PC connecting cable included in the scope of delivery and a software tool which you can download at www.fastgmbh.de or request from FAST and load to your PC.

NOTE: The software tool which you may select to download is absolutely free of charge and is not part of the standard scope of delivery. The software is provided without any form of support and any form of guarantee. The intuitive user interface is exceptionally easy to work with and understand. For further information regarding the software and its use can be found in the application included.

To transfer your data to your PC, navigate to the main menu and select the *Data Transfer* display symbol *(see chapter 6.2)*.
The display now changes to the memory transfer page.

Please ensure that your PC is connected to the Aqua M300 with the PC connecting cable, then navigate to the *Data Transfer* display symbol (1), confirm your selection, and follow the instructions as shown on your PC.



13. Troubleshooting

Acoustic Leak Detection – List of possible errors or faults:		
Error/Fault Description	Possible Cause	Recommended Action
No sound in the headphones	1. The sound receiver or the headphones are not connected properly	Check the connections between the connected sound receiver and the connected headphones and the Aqua M300.
	2. Incorrect filter settings	Select a broader frequency range, e.g. 50Hz to 2,000Hz and generate a clearly audible sound by scratching the surface or turning on a radio, for example. If the action you have carried out causes the numerical or bar display to change and these sounds can be clearly heard in your headphones, then you can be sure that the headphones and microphones are working properly. Now carry out the measurement again and adapt the frequency range to suit the measuring operation.
	3. The cable which connects the sound receiver and the unit appears to be defective	Check the connections between the connected sound receiver and the Aqua M300. Replace the cable with a spare cable, if possible, or use the cable from a second Aqua M300 and check if the sound receiver is working properly.
	4. The cable between the headphones and the central unit seems to be defective (in such a case the sound level indicator on the display works properly!)	Check the connections between the connected headphones and the Aqua M300. Connect a spare pair of headphones which you may have or another pair from a second Aqua M300 to the unit and check the function again.
	5. Memory settings	If the actions you have carried out have not been successful, go to *"Clear Memory"* in the menu *Settings* and clear the parameter memory. If you can still not hear anything over the headphones, please contact our Customer Support Centre.
The screen remains black	1. The batteries are empty	Replace the batteries inside your unit with new ones of the same high quality and type.
	2. The central unit is defective	Please contact our Customer Support Centre
Display brightness too dim	1. The brightness setting has not been set correctly	Go to the menu *Settings* and increase the display brightness.
	2. Battery power very low	Replace the batteries inside your unit with new ones of the same high quality and type.
The company logo remains on the display	1. The central unit is defective	Please contact our Customer Support Centre.

Acoustic Trace Gas Detection – List of possible errors or faults:		
Error/Fault Description	Possible Cause	Recommended Action
You cannot start measuring, the cross symbol above the function key does not disappear, the sensor does not warm up	1. The sensor cable has not been connected properly	Check the connections between the connected H2 sensor and the Aqua M300.
		Replace the sensor with a spare sensor, if possible, or use the sensor of a second Aqua M300 to check if the sensor is working properly.
	2. Port/Jack or plug defective	Check the connections between the connected H2 sensor and the Aqua M300.
		Replace the sensor with a spare sensor, if possible, or use the sensor of a second Aqua M300 to check if the sensor is working properly.
	3. Cable defective	Check the connections between the connected H2 sensor and the Aqua M300.
		Replace the sensor with a spare sensor, if possible, or use the sensor of a second Aqua M300 to check if the sensor is working properly.
	4. Sensor defective	Please contact our Customer Support Centre.
No or hardly and display of existing gas concentrations	1. The sensor was connected to the unit in a room with existing gas concentrations	Leave the room and go somewhere where existing hydrogen levels are normal, e.g. out in the open. *Power up the unit AGAIN* and then return to the room which you had previously left.
	2. Sensor defective	Please contact our Customer Support Centre.
Reaktionszeit des Sensors zu lang	1. Sensor is not working properly	Please contact our Customer Support Centre.

14. Changing the battery, Cleaning, and Maintenance

Changing the battery

There is a battery symbol above the menu bar on the left-hand side of the display that shows you how much power the batteries of the Aqua M300 leak detection device have left. The more green segments there are, the higher the battery capacity. If there is only one red segment left, the batteries need to be replaced very soon.

As soon as the battery voltage drops below the strength required to power the unit, a warning symbol starts to blink in the middle of the display. In this case, the batteries should be replaced immediately.

Change the batteries as follows:

Switch off the unit. Unscrew and remove the battery compartment lid *(see chapter 4, legend item 8)*, take out the used batteries and replace them with new ones.

Please make sure that the poles of the batteries you are inserting are properly aligned with the poles inside the battery compartment.
To power the Aqua M300, you may either choose to use high-quality batteries type LR 14 C, 1.5 V (recommended capacity > 4,500 mAh) or rechargeable batteries.

When using rechargeable batteries, please make sure that you only use NIMH rechargeable batteries, type HR 14, 1.2 V.

Do not dispose of batteries in household waste. Do not throw into water or fire. Please make sure that you dispose of your used batteries according to existing government guidelines and regulations.

Cleaning and Maintenance of the Aqua M300 Measuring Device

Use a slightly moist, lint-free cloth only to clean the main unit. DO NOT use any detergents or cleaning fluids. Use clean, clear water only.
We recommend that you remove the batteries from the battery compartment when you are not planning on using your measuring device for a longer period.

Aqua M300 H2 Hydrogen Sensor

The measuring tip of the hydrogen hand sensor is equipped with a brass-coloured hexagonal protection cap (sinter filter) which is designed to protect the sensor system. Use compressed air to remove any dirt particles which might happen to settle on the sinter filter. Unscrew the sinter filter from the measuring tip and direct the jet of compressed air from behind – from the direction of the inner thread of the filter – towards the filter element to remove any dirt particles from the filter element. Replace the sinter filter back on the sensor tip and screw back on. The swan-neck of the hydrogen sensors can be cleaned with a slightly moist, lint-free cloth, if necessary.

15 Technical Data

Technical Data Aqua M300

Operation modes	Acoustic leak detection (volume, smart, long-term measuring), trace gas detection, and search for pipes Measuring modes for minimum levels, averaged levels, pulse wave measurements
Measuring functions and device functions	Logging function, memory preference for manual filter settings, sound level overmodulation protection, trace gas detection with concentration-dependent signal (optic and acoustic)
Control	via touch screen or keys and dials
Amplification	120dB with low noise factor
Input impedance	1 MΩ
Filter	up to 256 freely selectable (for stick and ground microphone)
Display	Colour LCD (automatic backlight), 480 x 272 pixels
Battery check	via micro-controller
Output impedance	<10 Ω
Power	4 x batteries, type LR14 C, 1.5V
Battery life	up to 14 hrs. In non-stop operation up to 40 hrs. in normal operation
Connections	Bayonet (microphone / sensor) 6.3mm phone jack (headphones)
Protection class	IP 54
Housing	Aluminium, powder-coated
Temperature conditions	Operation: -5°C to +55°C; storage: -25°C to +65°C
Dimensions (approx.)	L210 x B 160 x H60 [mm]
Weight (approx.)	1,050 g

Technical Data H2 Hydrogen Hand Sensor

Reaction sensitivity	1 ppm H2
Measuring range	10 ppm H2 to 20,000 ppm H2
Resolution	1 ppm H2
Response time	0.5 seconds
Design	Hand sensor with flexible swan-neck (length 50 cm) and connecting cable (length 160 cm) for Aqua M300
Temperature conditions	Operation: -10°C to +60°C; storage: -20°C to +60°C

Technical Data H2 Hydrogen Ground Sensor

Reaction sensitivity	1 ppm H2
Measuring range	10 ppm H2 to 20,000 ppm H2
Resolution	1 ppm H2
Response time	0.5 seconds
Design	Ground sensor with two-part stick (length approx. 100 cm) and rubber sleeve, connecting cable (length approx. 200 cm) for Aqua M300
Temperature conditions	Operation: -10°C to +60°C; storage: -20°C to +60°C

16. Information for Use in the Field

16.1. Acoustic Leak Detection

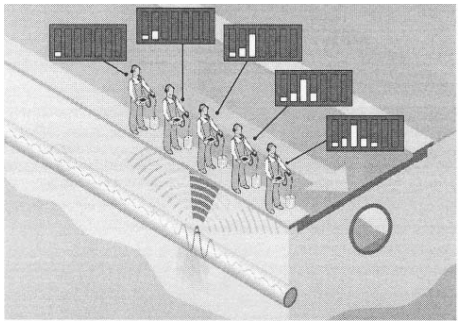
16.1.1. How Sound is Created

When there is a leak in a high-pressure pipe system, water that leaks out generates sound that is caused by the friction that occurs when the water escapes through the hole at high speed. This also leads to oscillations in the pipe itself. The sound travels along the pipe and can be picked up at contact points such as valves, hydrants, fittings, etc. which can actually be quite far from the actual leak itself and can be transformed into audible sound by structure-borne sound microphones.

16.1.1.1. Ground-borne Sound

When water that is escaping from a leak comes into contact with the ground, this causes the parts of the ground that it comes in contact with to oscillate. The sound spreads out from the leak in circles and can be picked up by a ground microphone near the actual leak. The frequency of these signals lies between 30 and 700Hz.

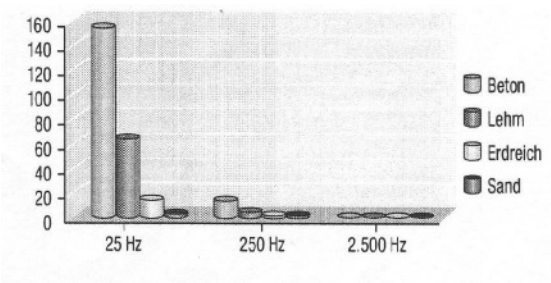
Frequencies whose wave lengths are smaller than the depth that the pipes have been laid in are strongly absorbed because of the low-pass effect of the surrounding soil. This means that only the low frequencies normally reach the surface of the ground.



If the water has been escaping from the leak for a relatively long period of time, a water blister sometimes forms and continues to contain the water that is leaking from the pipe. The sound that is transmitted through the ground is therefore barely audible and is almost impossible to pick up with a ground microphone.

The sound caused by the leak can be made audible again if compressed air can be fed into the pipe system that is being examined. In such a case, the compressed air is fed into the pipe system with a minimal amount of overpressure via a hydrant or house connecting point. This combination of water and air generates a sound at the leak which is clearly audible.

The diagram below shows the influence of the ground formation on the distance that the ground-borne sound waves can travel with reference to the leak frequency in metres. Low-frequency sounds spread out further than high-frequency sounds, and compact ground conducts the sound to the surface better than ground which is not as compact.



16.1.1.2. Structure-borne Sound

Structure-borne sound oscillations occur when water escapes from a leak with high pressure and at a correspondingly high speed which causes the pipe in question to oscillate.

The sound that is generated at the point where the water is escaping spreads out to all sides of the pipe. Small-diameter or thin steel pipes will oscillate strongly and the sound the leak is causing can be picked up at a considerable distance from the leak itself. Thick pipes or especially pipes made of plastic material, on the other hand, do not oscillate as strongly and the sound generated by the leak does not spread out nearly as far.

The frequency and the material of the pipes play a major role as far as the distance the sound travels is concerned. As is the case with ground-borne sound, low-frequency sounds travel further distances, and softer materials like PVC or PE pipes absorb the energy caused by the leak more strongly than metallic pipes.

16.1.1,3 Current-induced Sound
Current-borne sound is generated at narrow points or bottlenecks, for example at valves that are only half or partly open, at household connecting points where pipes can have different diameters or dimensions or when corrosion has formed and pipes are crusted in rust on the inside. These factors can cause turbulent currents which can generate frequencies of over 4,000Hz.

16.1.1.4 Interference Factors
Sounds from surrounding sources that have been absorbed and filtered by the ground have a frequency spectrum similar to the sound that a leak generates. The interference this causes can be likened to stop-and-go traffic on the roads, but with the difference that such a traffic situation is far more disruptive with regard to traffic-flow when it happens on a country road than somewhere in the city centre. The higher the pressure in the pipe on which an inspection is to be carried out, the higher the amount of energy that forms at the leak. This means that leaks become less audible if the pressure in the pipe is lower than 3 bar. If the pressure is lower than 1.5 bar, a leak cannot be heard even when it is in the close vicinity.

16.1.2. Schematic Leak Detection

In order to keep costs down, it often makes sense to adopt a systematic approach to carrying out leak detection. This is especially true when water pipes are concerned, for example. The first thing you need to know is the course of the pipe. You will also need to differentiate clearly between the *preliminary leak detection stage* and the *stage which involves pinpointing the actual leak*. If this first stage is not performed, the whole length of the pipe will have to be inspected in order to determine the exact location of the leak.

16.1.2.1 Narrowing Down the Leak by Using a Stick Microphone
You can narrow down the position of a leak by inspecting the parts of the pipe system which you are able to access with the probe tip of the stick microphone. Particular attention must be paid to the type of sound which is recorded: leaks generate a dull, muffled sound and valves produce a brighter, sharper sound. Both sounds are very helpful when it comes to narrowing down the position of a leak, but it is important to remember that similar sounds – like that of water flowing through a pipe – can be generated when water is taken from the pipe via a tap for example. When narrowing down the leak, it is important to ensure that no value exceeds the range on the display, as otherwise you will not be able to identify the actual maximum value. The fact that the measuring values can be saved into the internal memory is an added benefit, as they can then be “carried over“ to the place where measuring is to be carried out next. This method allows you to determine the particular pipe section with the highest sound level without changing the control settings. The next leak detection stage is then to be carried out on this particular pipe section over ground.

16.1.2.2 Pinpointing the Leak by Using a Ground Microphone

If you have managed to detect a defective pipe section using the stick microphone, you can use the ground microphone to pinpoint the leak. Always make sure that the distance between any two points that you have selected for the ground microphone are not too far apart as otherwise you might miss the leak. As a rule, the distance apart should not be more than one metre.

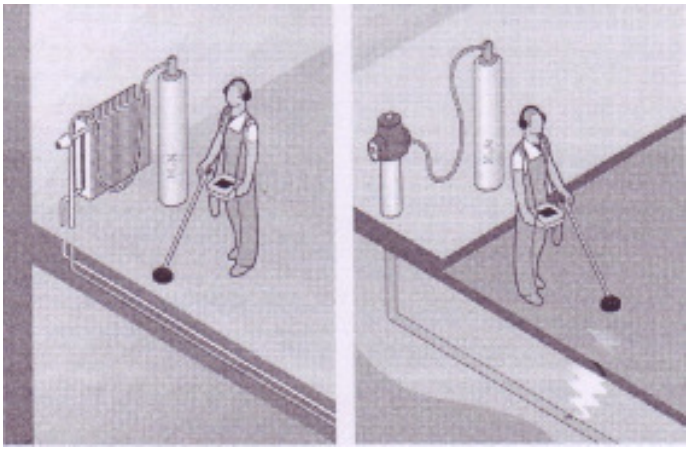
16.2. Leak Detection with Trace Gas

16.2.1 Functional Principle

The optionally available H2 hydrogen hand sensor is excellently suited for trace gas detection in combination with the Aqua M300. In such cases, the pipe subjected to inspection is flooded with forming gas, type 95/5 (95 % nitrogen, 5 % hydrogen). Due to its specific structure, hydrogen is able to penetrate almost all materials such as earth, concrete, tiles, etc.. It can then be easily traced at the surface with the Aqua M300 and the connected hydrogen sensor. Forming gas, type 95/5, is neither toxic nor inflammable. Therefore, it can be considered harmless for leak detection operations and can even be used in fire-protected industrial areas. However, please make sure that you follow the rules and regulations that apply to such areas.

16.2.2 How to Carry Out Leak Detection with a forming Gas

After the pipe subjected to inspection has been emptied, the gas bottle is connected and the pipe is then filled slowly from one end until the hydrogen sensor at the other end of the pipe section or at a control point along the pipe signals that gas concentrations have been detected. Then the second end is sealed and the pressure is gradually increased until the inspection pressure has been reached. It might then take several minutes or even hours for the gas to reach the surface. This depends on the leak and on the type of ground and surface. It takes approximately 60 minutes for the gas to reach the surface when ground in green areas, for example, is slightly moist and the pipes are about 1.5m under the ground. You have to follow the path of the pipe repeatedly until the gas escapes through the surface. Then look for the highest concentration within the area where the gas has escaped and mark this point as the position of the leak.



16.2.3 Determining Correct Quantities Using Experience Gained in the Field

Wif a pressure test with water has already been carried out on the pipe, then the pressure at which water no longer escapes through the leak ca be used to calculate the required quantity of gas — if not, the operating pressure can be used.

On this basis and with the help of the volume table below, it is possible to calculate the maximum amount of forming gas required to locate the leak:

Formula: G = VL x L x D

with

G = Amount of gas with regard to inspection pressure (L)

VL = Volume in litres with regard to 1 metre of pipe length (L)

L = Length of pipe (m)

D = Inspection pressure (bar)

Example:

A DN 125 pipe is 300 metres long and is to be filled with a pressure of approximately5 bar:

Volume per metre x length =

12.27 litres x 300 metre =
3,681 litres at a pressure of 1 bar.
At a pressure of 5 bar: 3,681 litres x 5 bar = 18,405 litres

As a standard 50l bottle contains 10,000 litres of gas at 200 bar, approximately two such bottles of forming gas are required for the above example.

You should also keep in mind when planning how much gas you will need that in addition you will need a reserve for the gas that escapes at the leak.

Volume table of various pipe diameters for calculating the gas amount

Pipe diameter in mm	VL (volume in litres with regard to the length of the pipe section in metres)
40	1.26
50	1.96
60	2.83
80	5.02
100	7.85
125	12.27
150	17.66
200	31.40
250	49.06
300	70.65