

Operator's Manual

AQUA M100D

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1. Description

1.1 General information

The newly developed AQUA M100D leakage detection equipment pools decades of experience, latest electronics and state-of-the-art sensor technique. The AQUA M100D enables even an untrained operator to proceed with his actual task, namely locating leakages. Leakage-borne noises are emphasized, and disturbing noises are reduced due to the application of in-built noise filters. A major advantage of the device is the fully automatic measurement data memory feature. The AQUA M100D releases the operator from tiresome remembering data. Most easy-to-handle technology combined with high-level antinoise amplification features and a special display for the noises generated by the leakage are the peculiarities of this high-tech device. The LCD for the leakage noise level is automatically illuminated at night-time.

2. Technical data & extent of supply

2.1 Specifications

Amplification:	≥ 60.000fold with low noise factor
Input impedance:	1 MΩ
Filter (testrod):	70 Hz - 4.000 Hz 250 Hz - 2.000 Hz 250 Hz - 1.000 Hz
Filter (ground microphone):	200 Hz - 800 Hz 100 Hz - 500 Hz 70 Hz - 250 Hz
Display:	automatically illuminated LCD
Battery control:	through microcontroller
Output impedance:	≤ 10 Ω
Power supply:	7.2 volt
Operating time:	about 12 hours under normal conditions
Microphone socket:	bayonet type
Headphones socket:	6.3 mm (mono) jack type
Service temperature:	between - 15°C and + 55°C
Storage temperature:	between - 25°C and + 65°C
Dimensions L/W/H (central unit):	137 / 85 / 125 mm
Weight (central unit):	about 1050 gram (≈ 2.3 pounds)

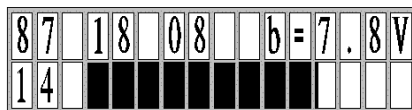
Specifications are subject to change without prior notice.

2.2 Extent of supply

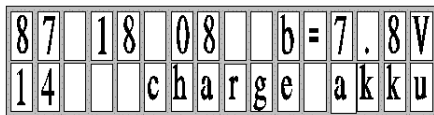
1 unit	AQUA M100D central unit
1 unit	headphones
1 unit	testrod
1 unit	ground microphone including cable
1 unit	levelling base
1 unit	operator's manual
1 unit	charger

3. Illustrations

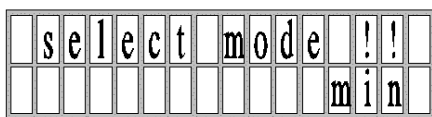
3.1 Display



The current noise level is numerically displayed in the lower part through beams. The upper part of the display shows the saved values and the battery status.



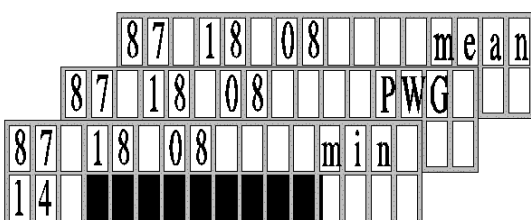
To prevent the battery from a complete discharge, the display will indicate the necessity to charge the battery, when necessary.



The leakage detector features a selection of modes of operation. The operator can select the mode ("MINIMUM", "MEDIUM", and "PWG") through the adjusting knob right after (0.5 sec) having switched on the device

The device offers a variety of modes.

Once the device has been switched on (or also during operation), slowly press the "ON" key twice to enter the menu and then select the desired "MEAN", "PWG", or "MINIMUM" values by turning the frequency selection knob.

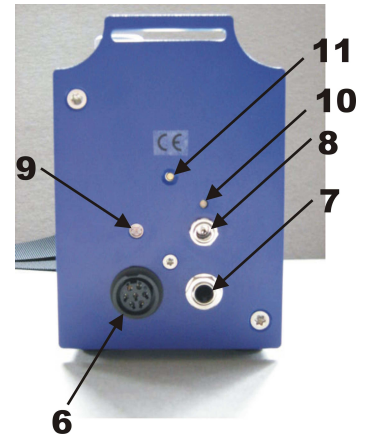
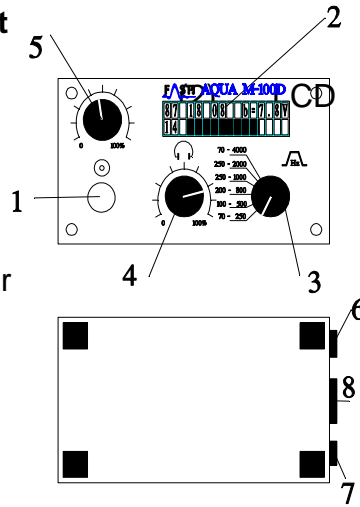


The selected mode will be accepted automatically after 5 seconds.

The mode of operation is shown during the measurement procedure.

3.2 Description of central unit

- (1) ON / OFF switch
- (3) Select frequency & mode of operation
- (4) Volume for headphones
- (5) Display adjustments
- (6) Bayonet-type connection for geophone and testrod
- (7) Headphones connection
- (8) Charger connection
- (9) Photo LED
- (10) Charger status LED
- (11) Charging-Reset button

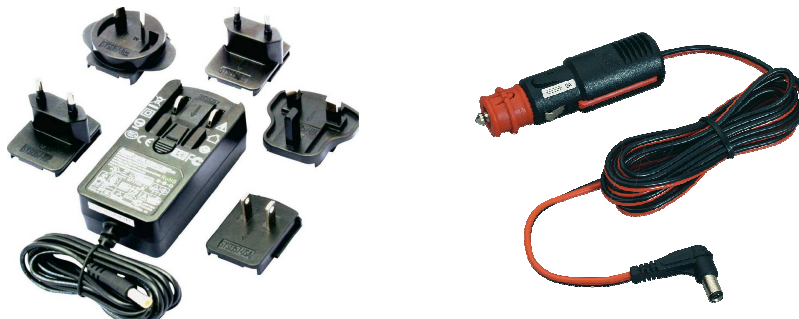


4. Operation

4.1 Charge battery

The AquaM100 shall be charged using the supplied 12 V power supply unit or the 12 V car adpoter charger.

After applying the charging current, the Aqua M200 display will go blank after some time (3 to 4 minutes usually). The battery's current condition will be shown at the side panels LED (10). It is fully charged, if LED lights green.



Charging at 1A setting for 1 hour will give approximately 2 hours operating time. Maximum charging time being about 6 h.

There might be the possibility that the charging does not start [indicated through orange LED, (10)] with deep discharged battery. In this case press charging-reset button (11) for 10-60 sec. after power is supplied.

Attention: observe safety procedures (page 12, item 7)

4.2 Switch on AQUA M100D

AQUA M100D can be switched on either through the ON / Off switch (1) at the central unit or at the handle.

4.3 Battery control

The LCD informs the operator about the current voltage and reminds him to charge the device, when necessary.

4.4 Level display and data memory

The current data is automatically saved when the operating press-button at the handle or at the central unit is released. Simultaneously, the last four levels are shown.

4.5 Microphone connection

On the bottom of the AQUA M100D the operator will find the bayonet-type socket for the ground microphone and the testrod.

a. Testrod (standard equipment)

The testrod is used for acoustically controlling readily accessible spots such as hydrants or stoppers in order to narrow the particular pipeline fractures and leakage spots.

b. Ground microphone (standard equipment)

Broadband type (70 - 800 Hz) for any leakage-borne frequencies. Suitable for acoustic above-surface controlling and applicable to all kinds of soils.

4.6 Adjustments

4.6.1 Adjustment of headphones volume

The volume of the headphones can be adapted to the hearing of the operator either through the adjusting knob (4) or at the receiver earpiece.

4.6.2 Adjustment of the level display

The signal received by the ground microphone and transmitted to the headphones is displayed on the LCD (2). The level of the display is to be adjusted manually through the adjusting knob (5) so that the bar is in the middle of the display and possible ups and downs of the level can be seen. The level adjustments of all former measurements will be cancelled through the new setting.

4.7 Select the mode of operation

“MIN“ is the regular mode of operation when searching for leakages. With this mode, the lowest noise level occurred during the measurement procedure is displayed.

“PWG“ has to be applied, when a **PWG pulse wave generator** is applied to search for pipelines.

“MEDIUM“ mode of operation: the average value of the ups and downs of the level is displayed according to the inertia of the needle.

“GTX“: pipes treated with sound through the loudspeakers can be detected in this mode.

4.8 Entering parameters

Language

Switch-off time

Impact noise limiter for headphones

Definition of terms:

Switch-off time:

The time between the last operational procedure of the geophone and automatic switch-off.

Impact noise limiter for headphones:

Short, loud noises such as hammer blows may lead to hearing impairment. The AquaM100D / 70D geophone is equipped with a hearing protection feature. An impact noise will result in an immediate reduction in amplification in order to prevent any hearing impairment on the user's side. As the hearing ability of a person is subjective, the user can adjust the impact noise limiter level individually.

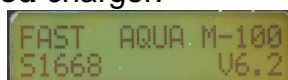
Please note: The device must be switched off before setting the parameters.

The parameters - language -
- switch-off time -
- impact noise limiter -
are entered subsequently.

Procedure:

=> Plug in the **energised** charger.

X As soon as the text appears,





=> press the red "Start" key (1).

X The display now shows the "SETUP" menu.



The desired parameters can be called by turning the knob (2) back and forth.

- Measurement parameters:
- 00 to cancel this sub-menu
 - 01 to select the language
 - 02 switch-off time
 - 03 hearing shock protection MIN, MED., GTX
 - 04 hearing shock protection PWG
 - 05 serial number is displayed
 - 06 version number is displayed



enter numerical value to change measurement parameter

01: Language

As soon as the desired parameter has been set, press "Start" (key 1); the word "IN" will be displayed below the word "SETUP".

=> Turn the knob (key 2) to set the desired number, with the numbers indicating the following languages:

- | | | |
|------------|--------------|------------|
| 0: English | 4: Spanish | 8: Swedish |
| 1: German | 5: Slovenian | |
| 2: French | 6: Polish | |
| 3: Italian | 7: Danish | |

=> Press "Start" (key 1) to activate the selected language.

02: Switch-off time

As soon as the desired measurement parameter has been set, press "Start" (key 1); the word "IN" will be displayed below the word "SETUP".

=> Turn the knob (key 2) to set the desired number, with the numbers indicating the following switch-off times:

- => 1: 1 minute
- 2: 2 minutes
- 3: 3 minutes
- : :
- : :
- 9: 9 minutes
- 10: 10 minutes

=> Press "Start" (key 1) to activate the selected switch-off time.

03: Headphones – overmodulation protection for the operational modes: MIN, MEAN, GTX

As soon as the desired measurement parameter has been set, press "Start" (key 1); the word "IN" will be displayed below the word "SETUP".

=> Turn the knob (key 2) to set the desired number, with the numbers indicating the following noise reduction:

- 0: Monitoring process switched off
- 1: Loudspeaker volume is reduced in case of a low noise level
- 2: Loudspeaker volume is reduced in case of a mean noise level
- 3: Loudspeaker volume is reduced in case of a high noise level

04: Headphones – overmodulation protection for operational mode: PWG

As soon as the desired measurement parameter has been set, press "Start" (key 1); the word "IN" will be displayed below the word "SETUP".

=> Turn the knob (key 2) to set the desired number, with the numbers indicating the following noise reduction:

- 0: Monitoring process switched off
- 1: Monitoring process switched on

05: Serial number is displayed

06: Version number is displayed

5. Leakage-borne noise

Every pressurized pipeline system creates a so-called leakage noise at a leakage spot. Different sizes and dimensions of the pipeline cracks or fractures result in different noise volumes and frequencies. There are two possible ways of transmitting the leakage noise to the person searching for a leakage.

5.1 Noise transmission through the pipeline

Fittings (hydrants, stoppers, connections, etc) transmit a leakage noise. Normally, fractures on plastic pipelines generate low-frequency signals, and fractures on steel or cast iron pipelines generate high-frequency signals.

5.2 Noise transmission through the soil

The soil around the leakage spot is excited due to the energy of the discharging liquid. The vibrations can be acoustically detected at the surface.

5.2.1 Above-surface noise pick-up method

Experience has shown that frequencies between 70 - 800 Hz are indicators for leakages.

5.2.2 Noise pick-up method at the outside of the pipeline

The testrod point picks up the leakage-borne noise at a fitting (water meter, valve, hydrant, etc.). Depending on the pipeline material (plastic or metal), the frequencies picked up differ significantly.

Therefore, the frequency band for the pipeline outside noise pick-up method has to be wider than the frequency band for the above-surface noise pick-up method.

6. Leakage search in practice

Systematic proceeding is necessary when locating a leakage in a water pipeline. The pre-condition to locate a leakage is that the path of the pipeline to be checked is known. First, the particular leakage has to be narrowed, and then it has to be located exactly. Without systematic proceeding, i.e. narrowing a leakage, the complete run of the pipeline has to be checked until the leakage is detected.

6.1 Narrowing the leakage area (testrod)

The accessible contact spots of the pipeline network section to be checked are listened in by the testrod. The operator has to make sure that the noises received are due to a leakage (muffled sound) and that they are not the result of stopper neckings (high sound). Both types of sounds are useful though when narrowing the area of a leakage. Note that flow noises can also be generated through regular discharges. Illustration 2 shows how the leakage area can be narrowed by assessing the measurement data of the contact spot of the particular pipeline. The example shows the highest data between measurement point 3 and measurement point 4. So the leakage itself must be located between these two measurement points.

When narrowing a leakage, the operator has to make sure that the measured values do not exceed the scale range so that the actual maximum value can be identified. If a measurement point shows a full-scale deflection, re-adjust the display with the adjusting knob (5) e.g. up to 40 so that an increase in deflection is visible. If deflection goes down, the listened pipeline section has to be checked once more in order to determine the actual volume increase and decrease and thus to identify the maximum values.

The measurement data memory has proved to be an enormous advantage as the last data is at the user's disposal until the next measurement procedure starts. The pipeline section with the highest noise intensity can be determined if the adjustments of the AQUA M100D are not changed. The following above-surface leakage detection procedure then has to be carried out on the particular pipeline section.

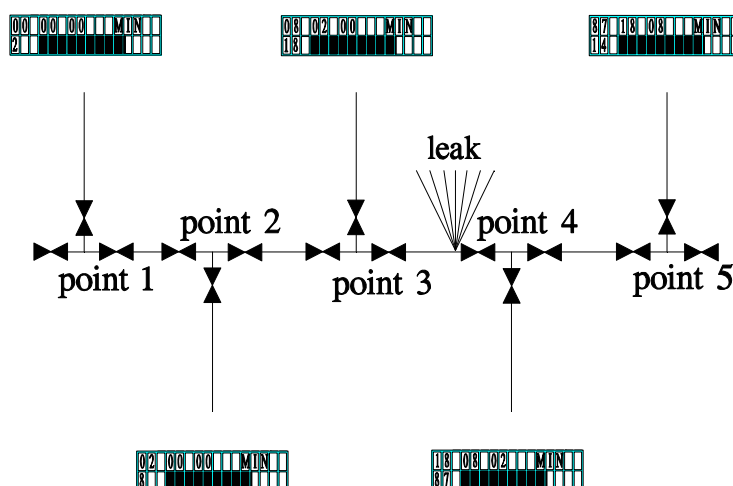


Illustration 2: Narrowing a leakage spot

6.2 Exact determination of the leakage location (ground microphone)

If the testrod has narrowed a defective pipeline section, the ground microphone has to be applied in order to exactly determine the leakage location. When mounting the ground microphone equipment to check the pipeline, the operator has to make sure that the mounting points are not too far away from each other as otherwise the operator will fail to locate the leakage. Illustration 3 below shows the distances to be kept to:

cast iron pipelines	= 250 cm
steel pipelines	= 150 cm
plastic pipelines	= 75 cm

As shown in the chart above, the exact determination of the leakage location should be carried out right above the defective part of the pipeline. For example, an error of 100 cm can already be misleading when searching a leakage on a plastic pipeline. If the path of the pipeline is not known, the operator might have to apply a so-called search pattern the coordination width of which depends on the pipeline material, e.g. 75 cm for PVC pipelines. If neither the path of the pipeline is known nor a search pattern is established, the operator will not succeed in locating the leakage.

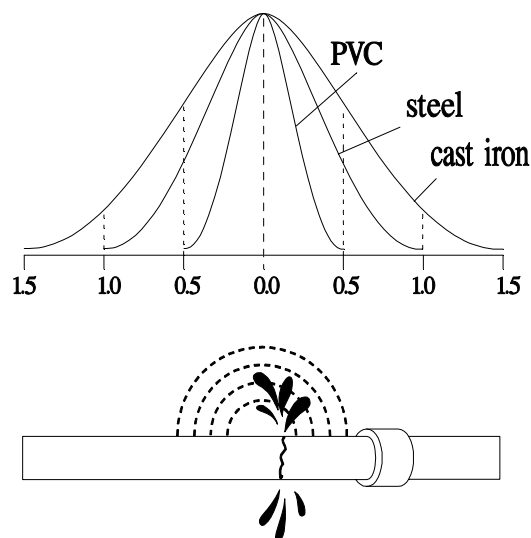


Illustration 3: noise propagation depending on the pipeline material

7. Safety Advice

The charging unit may be operated in closed, dry rooms (230V, AC, power supply). In order to minimize the risk of an electric shock or of a fire, please protect the device against humidity. Make sure that the accumulator set has cooled down before charging. The charging unit has to cool down for at least 15 minutes after a charging process. Do not repeat a charging process until the accumulators have been fully discharged. As soon as the temperature of the accumulators exceeds 55°C, stop the charging process immediately. Make sure that the accumulators have been disconnected before you clean them. Do not open device. Contact your authorized dealer for repair works to be done on the device.