Operating Instructions

Leak locator

Hydrolux

HL 500 / 500 H_2

HL 5000 / 5000 H_2

Mess- und Ortungstechnik
Measuring and Locating Technologies

Elektrizitätsnetze
Power Networks

Kommunikationsnetze
Communication Networks

Rohrleitungsnetze
Water Networks

Leitungsortung
Line Locating

Edition: 3 (07/2010)
ENG

Consultation with SebaKMT

The present system manual has been designed as an operating guide and for reference. It is meant to answer your questions and solve your problems in as fast and easy a way as possible. Please start with referring to this manual should any trouble occur.

In doing so, make use of the table of contents and read the relevant paragraph with great attention. Furthermore, check all terminals and connections of the instruments involved.

Should any question remain unanswered, please contact:

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1 Technical Description

1.1 Introduction

The HL 500/5000 leak locator comprehensively deals with finding leaks in pipe networks for the supply of drinking water. The equipment can of course be used on other pipe systems, provided that the liquid comes out of the pipe under pressure and that the resulting noise carries to the surface of the ground. With the HL 500/5000 it is possible to both pre-locate and to pinpoint the location of the fault. With a special Dual Segment Analysis (DSA) display, both the minimum value of the constant noise as well as the leak noise can be recognised. With the 'Mute' option, used when moving the ground microphone, a new minimum display results. A comparison of the measured values is thus always possible. In the 'HISTOGRAM' function, each measurement location is stored, one by one.

This equipment is the first instance where computer supported reduction of extraneous noise is used, where impulse type disturbances are acoustically suppressed. Preferably, only constant noise (as produced by a leaking pipe) is displayed as a minimum value.

When locating plastic pipes with the assistance of an RSP3 'pipe pecker', picking up impulses is then desirable and improves the results. For this reason, the HL 5000 has a special pipe location mode that is activated, after switching on, by pressing the symbol button.

Another important function of the HL 5000 is the noise level recording with which the course of the development of the noise is shown on the LCD display as a graph over time.

Finally, by means of the H_2 version of the HL 500/5000 not only leak noises can be determined but also tracer gas. For this purpose a gas sensor is connected to the device instead of a ground microphone.

1.2 Construction

The leak location equipment is in a splash-proof housing made of robust plastic. The few control buttons are so arranged that they can also be operated wearing gloves. The display is equipped with backlighting. That means that work is also possible under poor lighting conditions, or at night.

The batteries required to supply the power are housed in the base of the equipment behind a cover which is easy to open to quickly exchange the batteries.

The connections for the microphone / gas sensor and headphones are on the two sides of the equipment and can be quickly plugged in or removed.

1.3 Technical Data

The HL 500/5000 leak locator is specified by the following technical parameters:

Analysis bandwidth:	0 Hz – 4000 Hz
Filter cut-off frequencies:	0 - 70 Hz, 106 Hz, 160 Hz, 240 Hz, 360 Hz, 540 Hz, 800 Hz, 1200 Hz, 1800 – 4000 Hz
Histogram recordings:	9 dual displays
Storage of noise levels:	3 – 10 – 30 min
Display 130 x 36 mm:	LCD display
LCD illumination:	available
Power supply 1: Power supply 2 (option):	10 x AA batteries, (1.5 Volt) 12 x rechargeable batteries (1.2 Volt)
Operating time:	> 35 h (battery), > 15 h (rechargeable battery)
Storage:	9 measurements
Mute button:	available
Operating temperature:	-10 to +50 ℃
Storage temperature:	-10 to +70 ℃
Protection class when in operation:	IP 54
Dimensions (L x W x D):	215 x 95 x 110 mm
Weight: HLE 5000 Weight: PAM W-1 Weight: PAM U	1200 g (with batteries) 3.5 kg (with carrying pole) 500 g

Additional data of HL 500 H_2 and HL 5000 H_2:

Analysis bandwidth:	0 – 10000 ppm
Sensitivity:	0.7 ppm H_2 in air
Response time:	< 1 sec
Warm-up time:	6 sec
Operating life of the replaceable gas sensor	2 to 5 years (depending on intensity of use)

1.4 Scope of Delivery

1.4.1 HL 500/5000 Equipment

Leak location equipment with batteries	HL 500 or HL 5000
Headphones (extraneous noises filtered)	KR 2
Carrying strap	
Case	HLK
Operating instructions	

1.4.2 Selectable Microphone Sets

Professional set consisting of:

Piezo ground microphone (with wind shield)	PAM W-1
Connection cable to PAM W-1	VK 65
3-point foot adapter	PAM W-1D
Carrying pole for PAM W-1	
Universal PAM U microphone	PAM U
Magnetic adapter	
Sensor rod	
3-point foot for PAM U	PAM U-D
Extension rod	VST T-1

Ground microphone (with wind shield) consisting of:

Piezo ground microphone (with wind shield)	PAM W-1
Connection cable to PAM W-1	VK 65
3-point foot adapter	PAM W-1D
Carrying pole for PAM W-1	

Ground microphone:

Piezo ground microphone	PAM B-1
Connection cable to PAM W-1	VK 65
Carrying pole for PAM B-1	

Universal microphone:

Universal microphone	PAM U
Magnetic adapter	
Sensor rod	
3-point foot adapter for PAM U	PAM U-D

1.4.3 Gas Sensor Set

Handheld sensor	PAM H2
Telescopic rod with rubber sleeve and connection cable	

1.4.4 Optional Accessories

Radio module for wireless transmission between microphone and amplifier	PAM 868
Sensor rod extension	VST T-1
Special headphones (highly insulated from extraneous noise)	KM2
Sliding adapter 42 mm	AD S-42
Sliding adapter 20 mm	AD S-20
Magnetic adapter	

2 Design

2.1 Control Elements

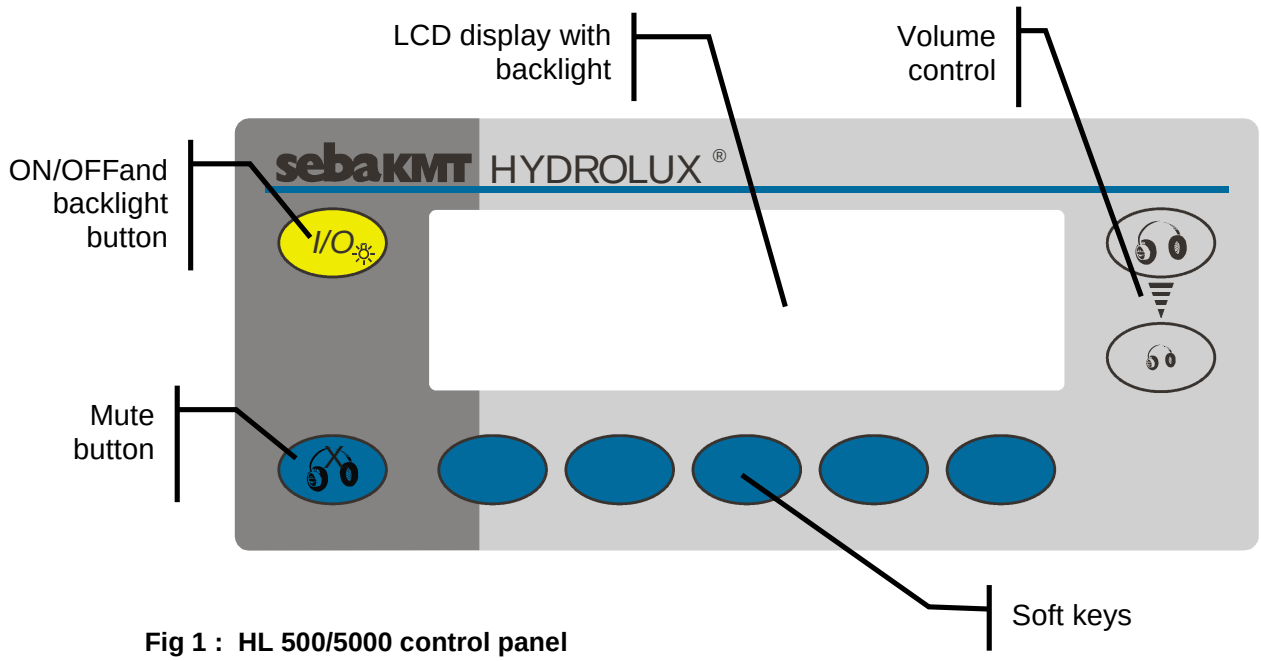


Fig 1 : HL 500/5000 control panel

2.2 Connector Sockets

The sockets for the microphone / gas sensor and the headphones are on the two sides of the equipment. The connections are shown in fig 2.

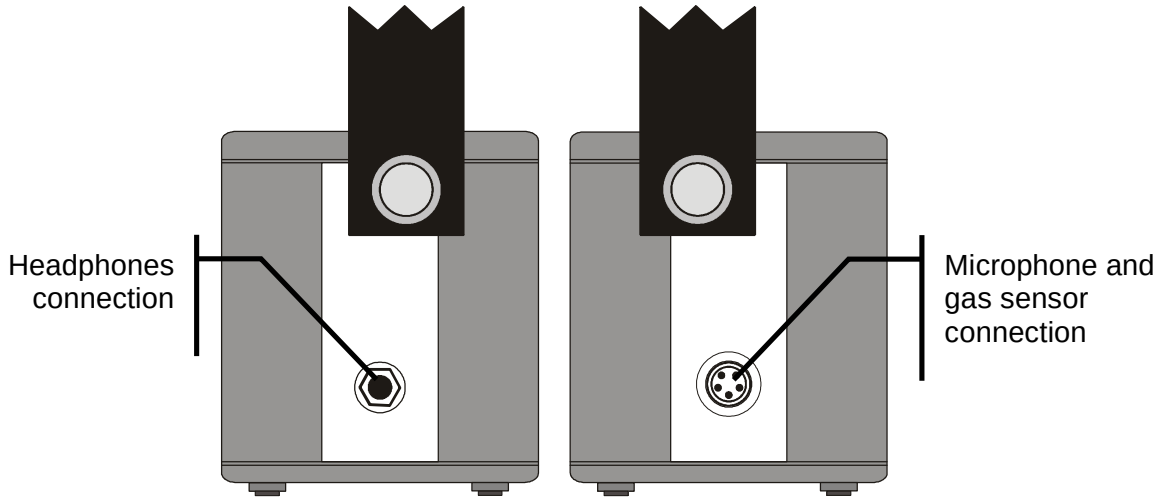


Fig 2 : Side view left and right with connector sockets

The sockets are only suitable for headphones, microphones and gas sensors from SebaKMT. Connecting other accessories can lead to equipment failure or damage to the HL 500/5000.

2.3 Battery Chamber

After opening the base flap (fig. 3) the battery chamber is accessible. When fitting the batteries make sure that the polarity is correct.

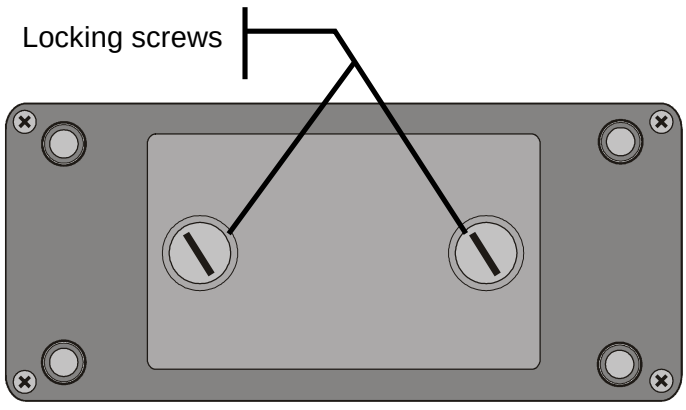


Fig 3 : Base plate with locking screws

2.4 Automatic Battery Monitoring

When working with the leak detection equipment, the state of the batteries is monitored continuously. Should the battery voltage drop too far, this will be indicated by a flashing battery symbol in the top right of the display.

From that point, there is about 4 hours of battery life remaining.

When you have to change the batteries, change all 10 batteries at one time!

2.5 Illumination of the LCD Display

By briefly pushing the on/off button 

when the equipment is turned on, the illumination for the display will be activated / deactivated.

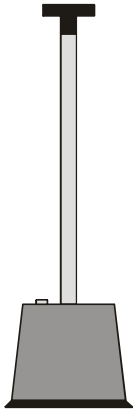
2.6 Microphones

The microphones are connected to the leak location equipment via a cable. The socket for this connection is on the right hand side of the equipment (Fig 2). To record the sound of leaks there are various sensors / ground microphones available. A sensor rod microphone is used to listen to sounds from directly accessible pipe parts, such as hydrants or valves. Each sensor is used as follows:

2.6.1 PAM W-1

The PAM W-1 is an active piezo ground microphone for roads and hard ground coverings. The microphone is particularly well shielded from the wind, using a bell-shaped guard. The carrying pole can be removed with a quarter turn to the left. This is particularly useful in reducing extraneous noise to a minimum when there is a strong wind.

For this ground microphone a VK 65 connection cable is required.

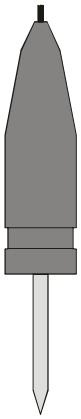


<u>Important note:</u> Piezo-electric microphones should not be subject to shocks, so place them gently in position!

2.6.2 PAM U

PAM U was developed primarily as a sensor rod or contact microphone, but can be used universally by exchanging the contact point for various adapters.

Sensor rod variant:



In this variant the PAM U is suitable for listening to valves, hydrants or even directly on a pipe.

It is particularly good when used as a ground microphone on soft ground (soil, meadow etc.). Push the point as deep as possible into the ground to get optimum acoustic contact to the source of the noise. When using an extension rod VST 1 the working posture is more comfortable but, due to the extension, wind and surrounding sources of noise are more intrusive.

Take care: When pulling the microphone out, always pull the body of the microphone and not the cable, otherwise you may damage the cable.

Fig 4 : PAM U with sensor rod

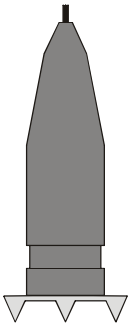
Magnetic variant:

When you hold the microphone, even the smallest movement creates loud noises that can interfere with the measurement. It is thus ideal if you can let go of the microphone during a measurement. The magnet screwed in at the front is suited to that. Due to the high holding force of the magnet an excellent acoustic coupling is achieved. This is however only possible when in contact with ferromagnetic materials, not with plastic, some stainless steels, etc.

Take care: When removing the microphone from a valve, always pull the body of the microphone and not the cable, otherwise you may damage the cable.

Fig 5 : PAM U with magnet

3-point foot variant:



By screwing in a 3-point foot, the PAM U can also be used as a ground microphone on a hard surface. Surrounding noise, particularly wind, is not so well screened off as with the ground microphone PAM W-1, but nevertheless very good results can be achieved with this variant.

Fig 6 : PAM U with 3-point foot

2.7 Gas Sensor

For leak location using tracer gas the HL 500 H_2 and the HL 5000 H_2 are available. They come with a gas sensor placed in a telescopic rod.

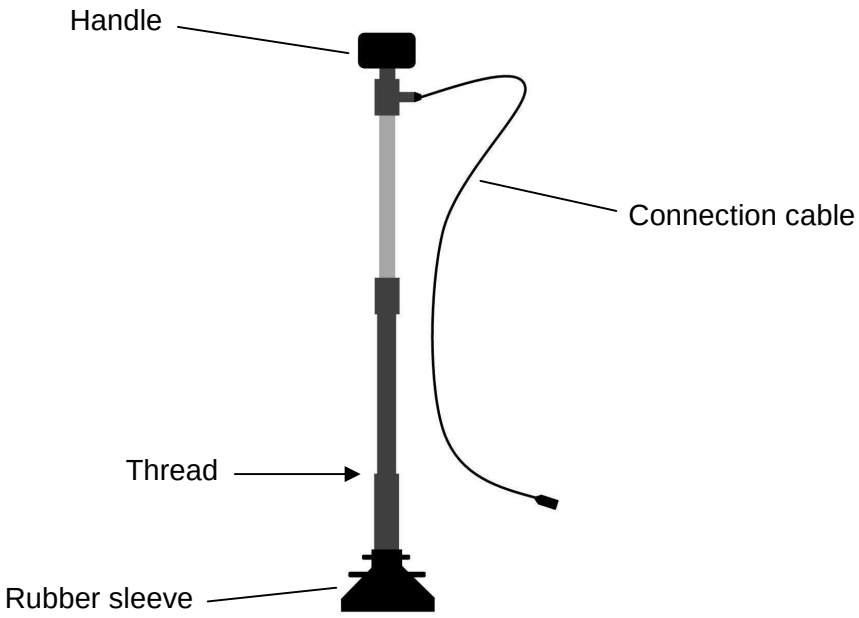


Fig 7 : Gas sensor in a telescopic rod

Due to the telescopic function, the sensor rod can be adapted to the user's individual height. The sensor rod is connected to the microphone connector (see Fig 2) on the right hand side of the device. The gas sensor is located at the bottom of the rod and covered by a rubber sleeve.

2.8 Headphones

The KR 2 headphones with ambient sound insulation are supplied as standard. These electrodynamic headphones reproduce leak sounds well. Other models of headphone should be avoided if at all possible, as hearing protection to VBG 121 can not be guaranteed. According to para. 10 VBG 121 the headphone volume may not exceed 85 dB.

The KM 2 headphones with particularly effective ambient sound insulation are available as an accessory.

3 Commissioning

3.1 Connecting Accessory Parts

Before switching on the HL 500/5000, connect both the headphones and the microphone / gas sensor. The reverse is true when switching off: Always switch the equipment off first and then remove the sensor and headphones.

3.2 Switching the Device On

By pushing the ON/OFF button 

the equipment will be turned on. The start image then appears together with the current version number and the battery status.

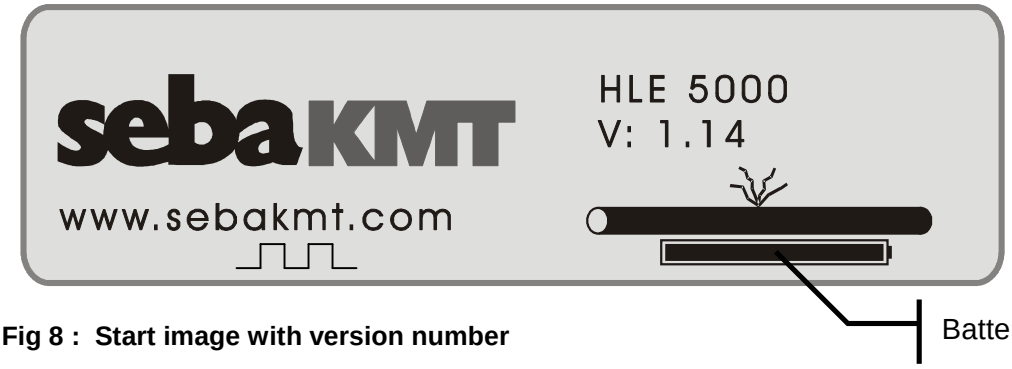


Fig 8 : Start image with version number

After a few seconds the opening menu appears with the last equipment settings.

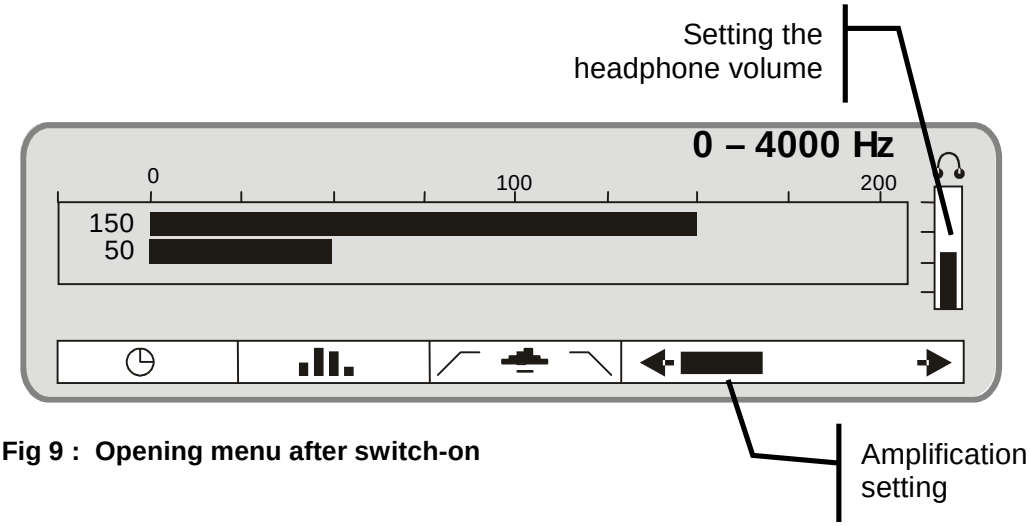


Fig 9 : Opening menu after switch-on

3.3 Adjusting the Volume

Using the two buttons on the right (see Fig 10) the headphone volume can be set. To start a measurement, medium volume – 3 scale units - should be selected.

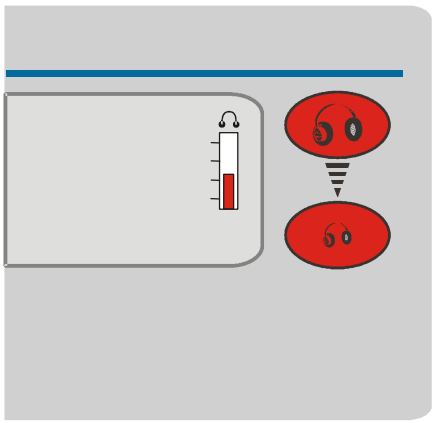


Fig 10 : Setting the volume

3.4 Setting the Gain

The amplification of the microphone signal, the gain, is set via the two soft keys, bottom right (see Fig 10). The gain is shown via a horizontal bar. On top of this bar the gain values of 1 to 8 can be seen.

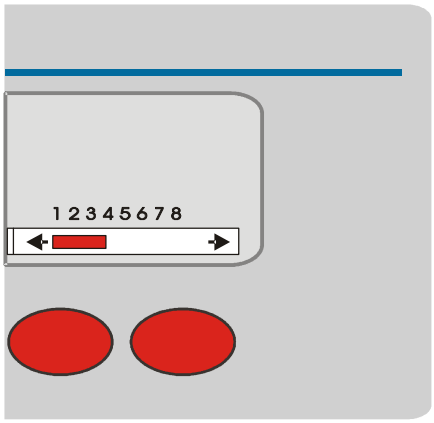


Fig 11 : Setting the gain

To start a measurement, medium gain e.g. 3-4 should be selected.

Changing the gain affects the level bar and the volume in the headphones.

3.5 The Amplification Display

The bar display (Fig 12) shows both the current value of the sound picked up and the amplified sound.

The lower, thicker bar shows the minimum value of the measurement. When considering the nature of a leak sound, which is a continuous noise, the display of this value provides a much better result and is much less susceptible to pulses of interference. This minimum value is recalculated after the mute button has been pushed.

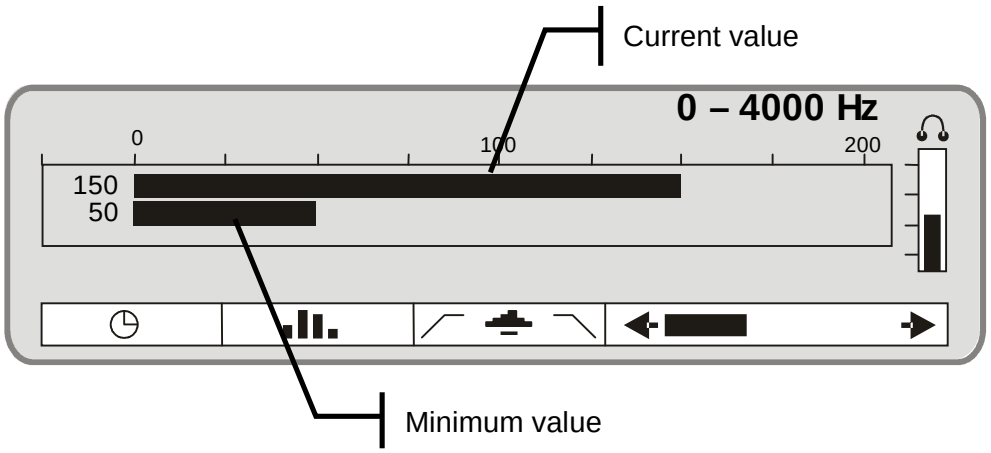


Fig 12 : Current and minimum value

3.6 Setting the Filter (HL 5000 and HL 5000 H_2 only)

Filter settings on the HL 5000 are very easy.
Use the soft key button in the main menu, to get in to the filter settings.
As you can see in Fig 12, in the centre of the display, there are 9 vertical level bars. Underneath, there is a horizontal bar, which identifies the selected filter range.
The lower and upper cut-off is shown to the left and right of the bars respectively.

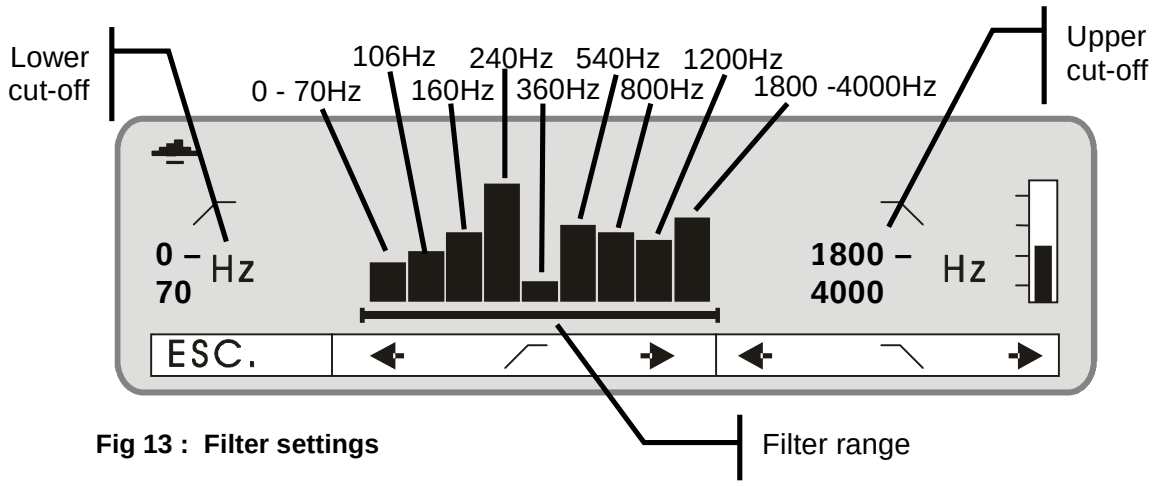


Fig 13 : Filter settings

The following 9 cut-off frequencies can be set:

0 - 70, 106, 160, 240, 360, 540, 800, 1200, 1800 - 4000 Hz

3.6.1 Adjusting the Lower Cut-Off Frequency

To adjust the lower cut-off frequency, use the two soft key buttons underneath , as you can see in Fig 14.

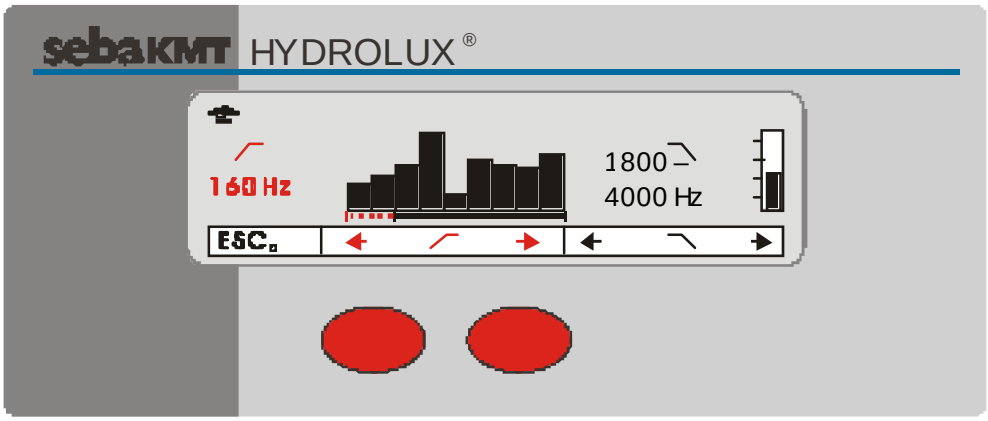


Fig 14 : Adjusting the lower filter cut-off frequency

3.6.2 Adjusting the Upper Cut-Off Frequency

The upper cut-off frequency is adjusted in a similar way, using the two soft key buttons to the right, underneath ◥ (see Fig 15).

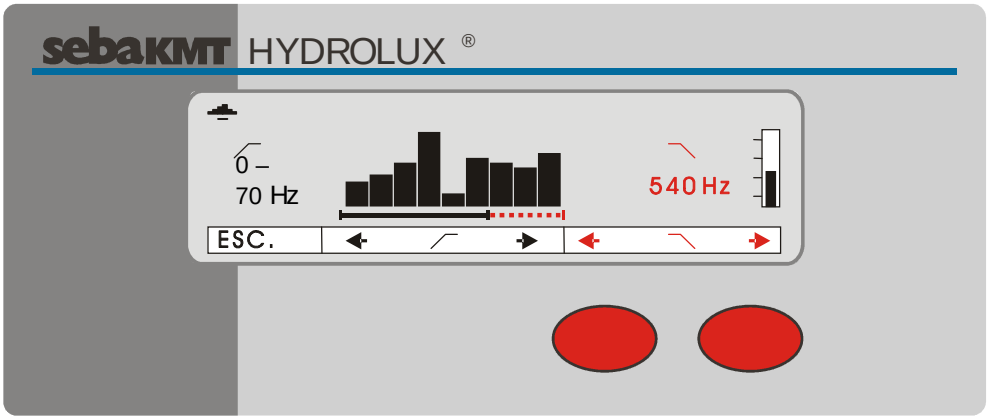


Fig 15 : Adjusting the upper filter cut-off frequency

For the two cut-off frequencies, you can set the 9 frequencies specified above and can thus easily set the special filter range for every measurement.

After the filter range has been correctly set, use the soft key button ‘ESC’ to return to the main menu.

3.7 Filter Selection in Practice

The decision about the filter settings has to be made by the user. In general, one can say that, for measurements with ground microphones, lower frequency ranges should be chosen. For measurements directly on the pipe or valve using the sensor rod, higher frequency ranges should be chosen. Should a measurement not be successful, then a broadband setting is to be recommended, to ensure that none of the leak sound is filtered away.

3.7.1 Filter Selection A (Ground microphone PAM W-1, PAM U with 3-point foot)

As a standard setting, a filter from 240 Hz – 540 Hz should be used. Particularly with plastic pipes and pipes at low operating pressures, lower frequencies can occur.

3.7.2 Filter Selection B (Pam U with sensor rod)

For measurements directly on the pipe with the sensor rod, the frequency range should be set to 540 Hz - 1200 Hz.

3.8 Mute Button

To move the ground microphone, you should first of all push the mute button (see Fig 1). This causes the sound in the headphones to be interrupted and the current level will be 'frozen'. This means that your hearing is protected as the loud contact noises are suppressed. After you have chosen a new location for the ground microphone, the mute button should be pushed again. This switches the headphones back on, the level display is updated and the minimum is recalculated.

3.9 Histogram Function

The 'Histogram' function is used to be able to compare a series of sequentially recorded measurements. This can be used when pre-locating a burst pipe with a sensor rod microphone as well as when pinpointing the actual leak. For the HL 500/5000 a maximum of 9 measurements are displayed.

After pressing the soft key button (see Fig 1) the LCD display switches to the histogram view and the first histogram is activated.

The individual histogram displays consist of a dual segment analysis (DSA), which show the current value and the minimum value. This DSA is shown in Fig 16. The narrow segment stands for the current value and the wide segment shows the minimum value, which is of particular significance when looking for burst pipes.

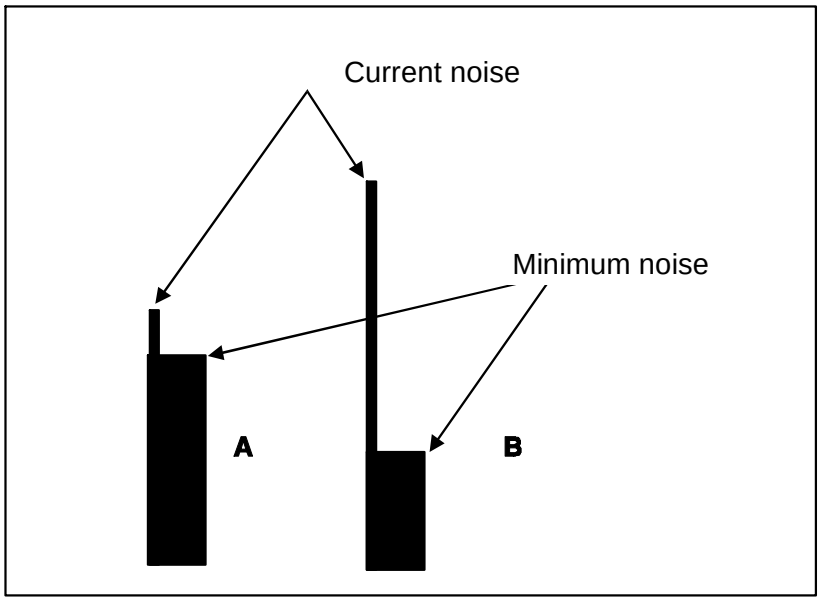


Fig 16 : Dual segment analysis (DSA)

With the first push of the mute button  the current measurement is stored and simultaneously displayed. In this way, nine values can be stored, one after the other. When more than nine values are measured, the first value will be deleted and all other values will be shifted one position to the left. The last nine values are thus always available.

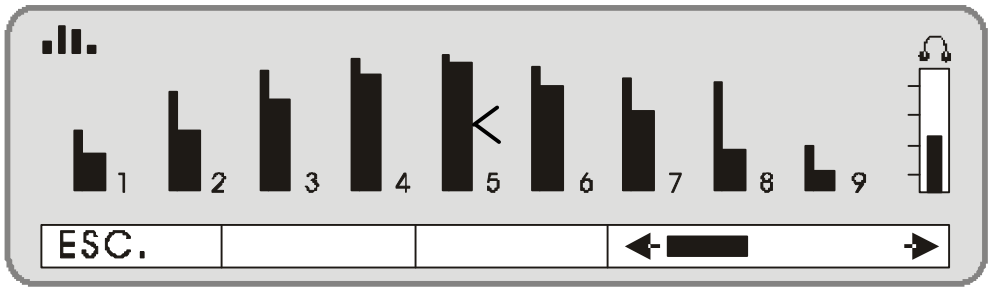


Fig 17 : Histogram measurement

The histogram measurement as shown in Fig 17 shows very different current values. On the other hand the 5th DSA shows a clear maximum for the minimum values. The burst pipe is thus in the vicinity of the 5th measurement location. Additionally a small graphical symbol indicates the maximum measurement for easy recognition. To leave the histogram measurement, press the 'ESC' soft key.

3.10 Long-Term Measurement Function (HL 5000 and HL 5000 H_2 only)

This function is intended to record sounds over a programmable period and then display as a graph. With this method the identity of a water pipe can be established by recording the flow noise of a valve. To do that, the microphone is put onto the pipe and the long-term measurement is started. Then, you close the valve for a certain time (at least 2 minutes) and then open it again. If the pipe at the listening location is identical to the shut-off pipe, then this should be visible on the sound level curve. In Fig 18 a sound level curve like this is shown.

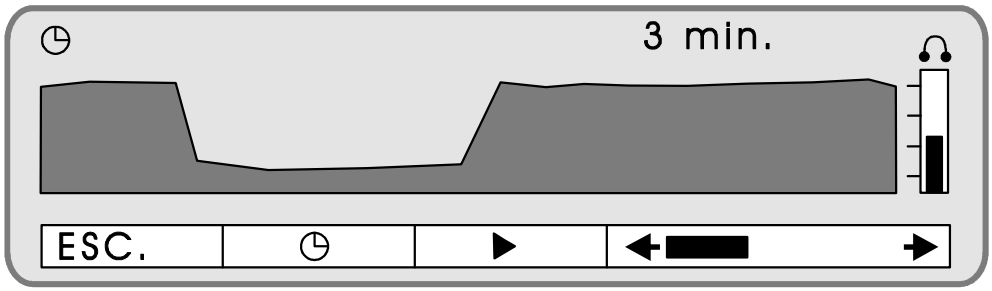


Fig 18 : Long-term measurement

To set this function, the ◷ soft key is pushed (see Fig 1).

The menu for the long-term measurement will appear as in Fig 18.

To specify the duration press the soft key (time) repeatedly until the required measurement time is set, as shown top right in the display. Recording durations of 3 – 10 – 30 minutes are available. After setting the duration, push the (start) soft key. The measurement will start and could be stopped early by pressing the (stop) soft key.

3.11 Acoustic Pipe Location using the RSP-3 or PWG 2000 (HL 5000 and HL 5000 H_2 only)

To switch the HL 5000 into this mode, after switching on, soft key 2 (underneath the impulse symbol) should be pressed whilst the welcome image is displayed.

The HL 5000 is now in pipe location mode, shown by the impulse symbol at the top edge of the display.

This mode of operation is particularly suited to display impulse noise, such as the tapping of the pipe pecker (RSP-3) or the PWG 2000. The horizontal level bars respond particularly sensitively to impulses, the bar is shown much larger and is delayed more and the filters are set to lower frequencies Of course, if required, the filter frequencies can be altered as usual.

The HL 5000 stays in pipe location mode until it is switched off. After being turned on again, it will be in normal mode.

3.12 Switching the Device Off

The equipment is switched off by a longer press on the ON/OFF button I/O. Any measurements stored will be lost. After 35 minutes in operation, the equipment switches off automatically.

In histogram mode the equipment will also switch off automatically after 35 minutes, as long as the mute and the illumination button are not used.

4 Leak Location using Tracer Gas (HL 500 H_2 and HL 5000 H_2 only)

The HL 500/5000 in 'H_2' version cannot only be used for conventional leak noise location using a microphone, but also for leak location by means of tracer gas. For this purpose, a gas sensor (see Fig 7) is connected to the device instead of a microphone. Then, the device automatically operates in 'gas mode' after start up. The display shows the gas mode menu:

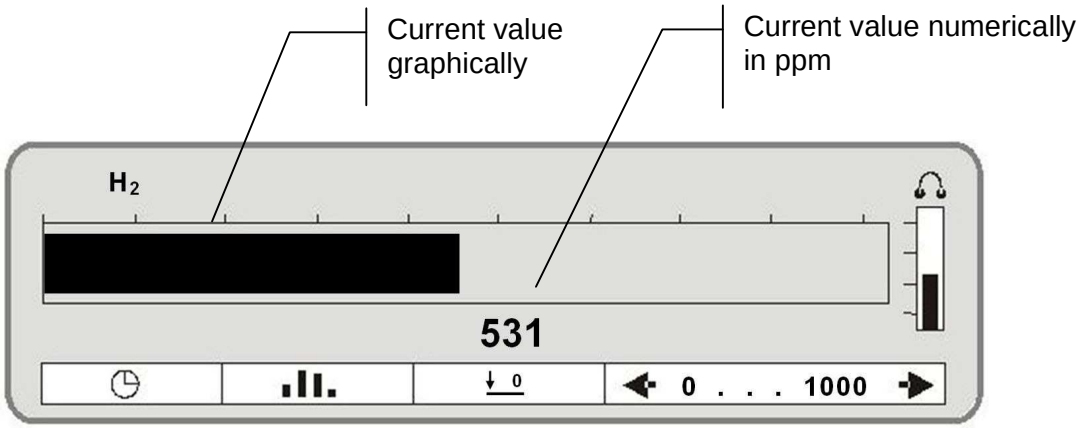


Fig 19 : Gas mode menu after switch on

Operating the system in gas mode is very similar to operating in standard 'noise location mode' as the functions of both modes are almost the same. The measured gas concentration is displayed graphically (as a bar graph) and numerically (in ppm). Simultaneously the measured gas concentration is indicated by a sound signal through the headphones (deeper sound –> low gas level; higher sound –> high gas level).

4.1 Adjusting the Volume

Works as described in section 3.3.

4.2 Adjusting the Sensitivity

Using the two soft keys bottom right, the sensitivity of the system can be set. One of the following ranges can be selected:

0 … 20 ppm
0 … 50 ppm
0 … 100 ppm
0 … 500 ppm
0 … 1000 ppm
0 … 5000 ppm
0 … 10000 ppm

The currently selected sensitivity range is displayed above the soft keys.

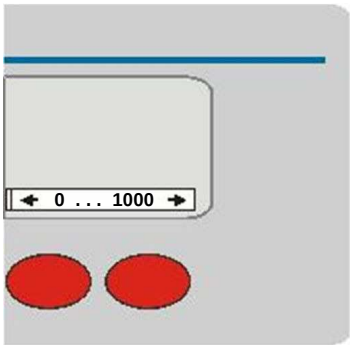


Fig 20 : Adjusting the sensitivity

4.3 Performing a Zero Balance

It is recommended to perform a zero balance prior to every measurement. In order to do so, hold the gas sensor up in the air, far from the ground, and press the soft key under the ↓ 0 symbol briefly. Wait for the numerical gas value to even out at approx. zero, then press the soft key once again in order to finish the zero balance and to return to the gas mode menu.

4.4 Performing a Measurement

The procedure in locating tracer gas doesn't differ from the procedure in locating leak noises: put the gas sensor on a measuring point on the ground – read measured value from the display or listen to the sound on the earphones – press the mute button  (see also section 3.8) – go to the next measuring point – press the mute button again – read measured value – and so on …

4.5 Histogram Function

As described in section 3.9, by the help of the histogram function the last 9 recorded measurements can be displayed in form of bar graphs. The function is available in gas mode, too. The handling is the same as in noise mode. The only difference is that the dual segment analysis (DSA) isn't needed because every bar graph represents exactly one measured gas level.

5 Trouble-shooting

5.1 Can't switch on

Presumably the headphones are not plugged in or headphones are being used which do not belong to the system.

5.2 Battery monitor does not react

One or more batteries are incorrectly fitted. Open base flap and check the polarity of the batteries. See Fig 3.

If the polarity of all of the batteries is OK, the state of every single battery must be checked.

5.3 No sound can be heard

With working equipment there are two possibilities:

a. Headphones not fitted, or fitted incorrectly

b. The mute button  is active, which means that the headphones are switched off. Press the mute button  again to restore the sound.

5.4 Scratching sounds in the headphones

This is usually caused by a poor contact. Check all contacts.

5.5 Gas mode: full deflection doesn't go down

The gas sensor is saturated and cannot be used for a period of time (approx. 1 hour depending on the degree of saturation).

5.6 Gas mode: no deflection (display constantly shows '0')

a. Perhaps the gas sensor came into contact with water. In this case the sensor is damaged and must be replaced.

b. Maybe the end of the sensor's operating life (between 2 and 5 years) is reached. It must be replaced.