OPERATING INSTRUCTIONS
LEAKPEN

Content

Important notice:

These operating instructions are valid for the LEAKPEN:
Hardware version: from 1v6
Firmware version: from 1v1

Manufacturer

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Important information

These operating instructions contain important information regarding the commissioning, operation, maintenance and disposal of this device. They also contain important safety advice and troubleshooting hints.

These operating instructions must always be kept with the device and must be provided if the device is passed on.

The operator of this device is responsible for ensuring that the instructions and advice in these operating instructions are read, understood and followed by the relevant staff before the commissioning of the device.

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The manufacturer assumes no liability for damage caused as a result of failing to follow the operating instructions and advice.

This applies in particular to:

- Damage resulting from improper usage and incorrect operation.
- Damage resulting from failure to follow safety information in the operating instructions or in the warning notices affixed to the device.
- Damage resulting from faulty maintenance works or from failure to carry out maintenance work.

Unauthorised conversions and alterations to the device may affect safety and are not permitted. This may lead to a restriction of warranty and to the loss of product conformity.

1. Device specification

1.1 Scope of delivery

The LEAKPEN measuring system is available in 3 different set versions.

Check the delivery for completeness and visible damage. Report an incomplete or damaged delivery to your dealer/supplier immediately.

LEAKPEN

Item no. 20160 - Set contents

Picture	Number	Description
	1	LEAKPEN without battery
	1	Lanyard with VONROLL HYDRO logo
	1	Battery lithium type AA 1.5 V

LEAKPEN PLUS

Item no. 20161 - Set contents

Picture	Number	Description
	1	LEAKPEN without battery
	1	Bluetooth headphone (In-Ear)
	1	USB cable type A(m) to type C(m); 1m; black
	1	Lanyard with VONROLL HYDRO logo
	1	Battery lithium type AA 1.5 V

LEAKPEN PROFESSIONAL

Item no. 20162 - Set contents

Picture	Number	Description
	1	LEAKPEN without battery
	1	Bluetooth headphones incl. original accessories
	1	LEAKPEN magnet adapter small
	1	LEAKPEN magnet adapter short 35mm
	1	LEAKPEN magnet adapter long 235 mm
	1	LEAKPEN extension adapter
	4	Linkage ø 8 x 200 mm M4 internal thread / M4 external thread
	1	Linkage ø 8 x 200 mm M4 Internal thread / Magnet ø 25 mm
	1	Linkage ø 8 x 200 mm M4 Internal thread / tip
	2	Single open-end spanner 6 mm
	1	Lanyard with VONROLL HYDRO logo
	2	Battery lithium type AA 1.5 V
	1	LEAKPEN device case

1.2 Device overview

Components

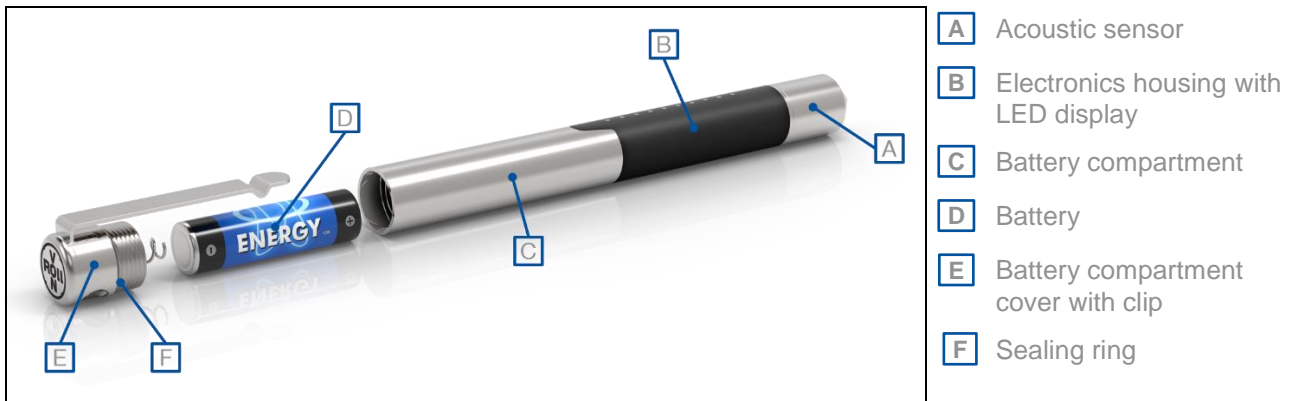|	
A	Acoustic sensor
B	Electronics housing with LED display
C	Battery compartment
D	Battery
E	Battery compartment cover with clip
F	Sealing ring

Figure 1

Visual indication

For the visual display of measured values and the different operating modes, the LEAKPEN has 9 red LEDs and
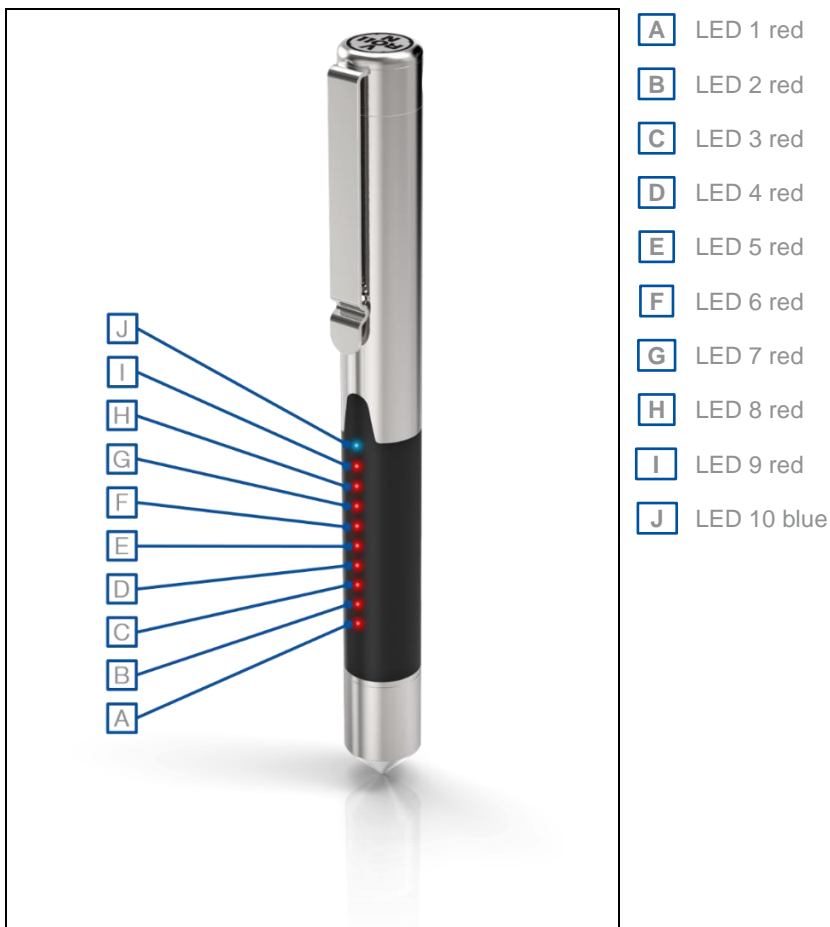1 blue LED.

A	LED 1 red
B	LED 2 red
C	LED 3 red
D	LED 4 red
E	LED 5 red
F	LED 6 red
G	LED 7 red
H	LED 8 red
I	LED 9 red
J	LED 10 blue

Figure 2

2. Function description

2.1 Functional principle

The LEAKPEN is a battery-operated, acoustic measuring and listening device for leak detection in pressurised water pipes.

The acoustic sensor picks up sounds from water pipes under inspection. The leak is located at the point with the loudest sounds.

The LEAKPEN transmits audio signals to headphones using Bluetooth technology. To provide the best audio quality, analogue automatic gain control (AGC) is used.

2.2 Measuring principle

The LEAKPEN continuously measures the audio signal level and displays the minimum measured value within one second intervals via the 9 red LEDs.

Listening to the audio signal provides additional information about the type of sound and its origin.

2.3 Technical specifications

General		
Dimensions (Ø x L)	18 x 191	mm
Housing material	Stainless steel, Polypropylene (PP)	
Weight	170 ±10	g
Surroundings		
Operating surroundings	In- / Outdoor / Wet locations	
Operating altitude above sea level	≤ 2000	m
Operating temperature	-20 ... +50	°C
Storage temperature	-40 ... +60	°C
Humidity	0 ... 100	% RH
Protection rating	IP 65	
Pollution degree rating	IV	
Power supply		
Battery type (recommended)	Energizer ultimate Lithium L91	
Battery size	AA	
Battery voltage	1.5	V
Quantity	1	pcs
Battery life minimum (with new alkaline 2500mAh battery at 21°C)	10	h
Turn ON	One shake along any axis	
Automatic turn OFF if there is no Bluetooth connection after	2	min.
Turn OFF	On Bluetooth connection termination	
Visual indication		
Total 10 LED's	For indication of different functions / modes	
9 red LED's	For leak noise level indication (Main function)	

1 blue LED	For Bluetooth communication status indication (Main function)

Sensors	
Acoustic sensor	Integrated compression type piezo-electric (PE) sensor, VONROLL HYDRO technology
Motion sensor	Integrated digital acceleration sensor for operation control

Signal processing	
Frequency response	340 ... 3'400 Hz
Automatic gain control	Yes

Radio transmission	
Technology	Bluetooth 5.0 Dual Mode
Bluetooth profile	A2DP
Transmit power max.	Max. +4dBm, BER/EDR Class 2 Max. +10dBm, BLE
Antenna	Internal ceramic chip

Special features	
Battery voltage measurement and display at start-up utilizing the LEDs	
ESD latch-up automatic recovery	

3. Preparation

3.1 Insert / replace battery

To avoid discharging the battery during storage and transport, no battery is inserted in the LEAKPEN when it is delivered.
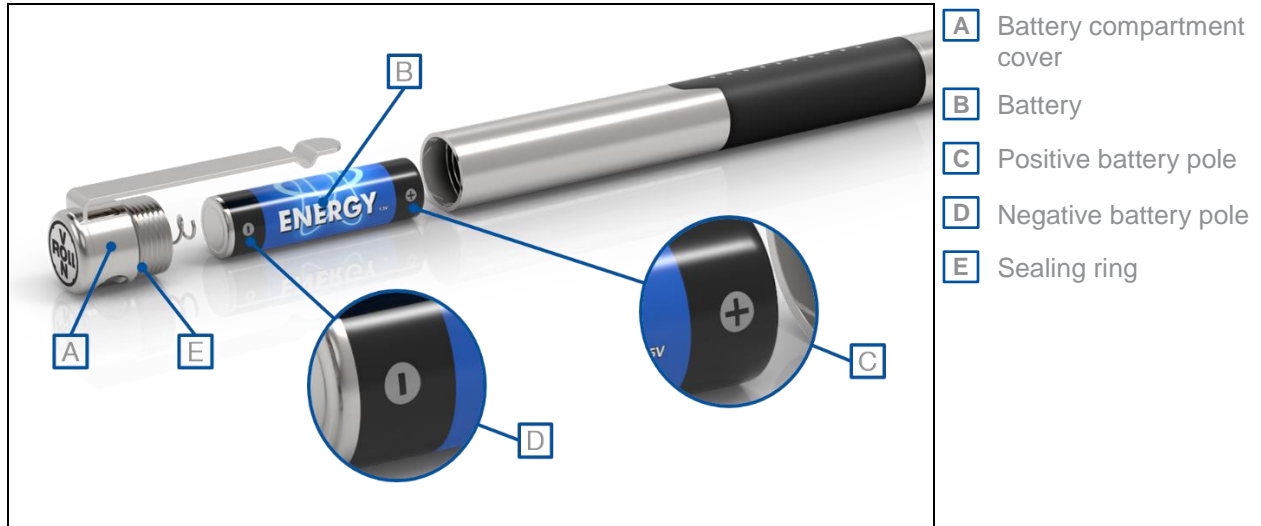

A	Battery compartment cover
B	Battery
C	Positive battery pole
D	Negative battery pole
E	Sealing ring

Figure 3

To install or replace the battery, proceed as follows:

1. Unscrew the battery compartment cover (Figure 3, [A]) from the LEAKPEN.

2. Insert a battery or replace the old one (Figure 3, [B]),
   and pay attention to the polarity of the battery (Figure 3, [C] & [D]).

3. Make sure that the sealing ring (Figure 3, [E]) is correctly seated and not dirty or damaged.

4. Screw the battery compartment cover back onto the LEAKPEN.

5. The LEAKPEN starts directly in bootloader mode (Figure 4 and see chapter 4.4 Bootloader mode)

   a. This will end after 4 minutes and the LEAKPEN will switch to sleep mode (OFF).

   b. If no firmware update is required, the bootloader mode can be terminated and the LEAKPEN can be set to sleep mode (OFF) with one shake.

6. The LEAKPEN can now be switched on (see chapter 3.2 Turn ON / OFF) and used normally.
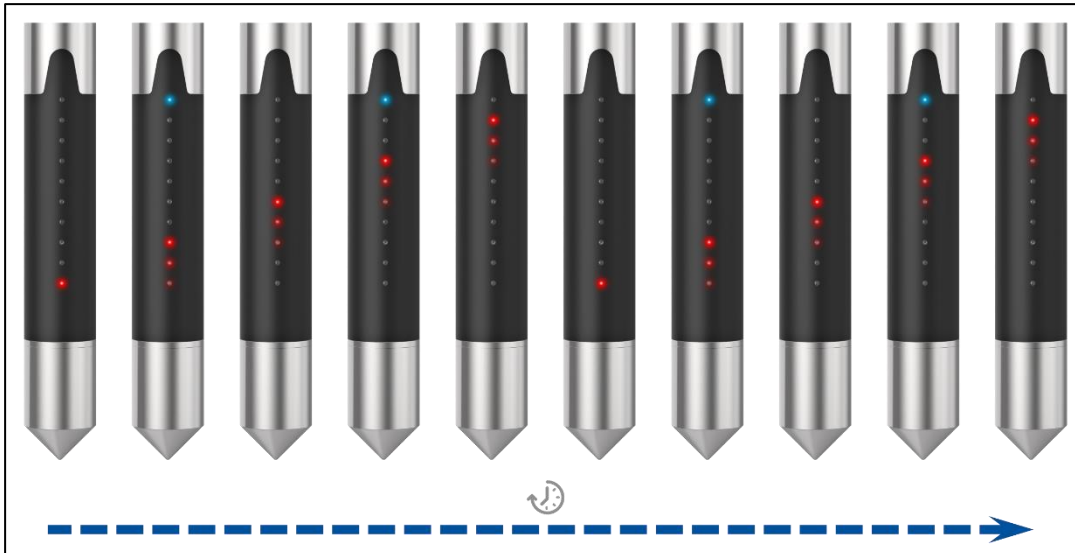
Figure 4   The red LED's runs from no. 1-9 (running light) and the blue LED flashes.

3.2 Turn ON / OFF

An integrated acceleration sensor allows the LEAKPEN to be controlled via movements / gestures.
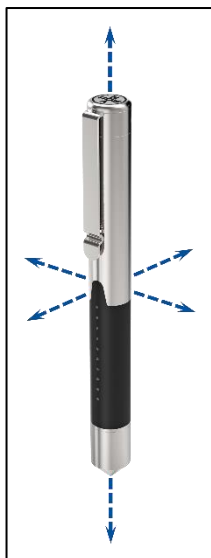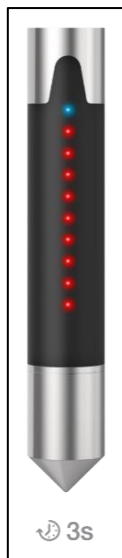

Figure 5   Figure 6

To turn the LEAKPEN on from sleep mode (OFF), proceed as follows:

1. Shake the LEAKPEN once along any axis (Figure 5).

2. All LED's are turned on for 3s (Figure 6) to check their function.

3. Then the current battery voltage level is displayed on the LED's (see chapter 3.2.1 Battery voltage level display).

4. The LEAKPEN now switches to the measuring mode (ON) (see chapter 4.2 Measurement mode (ON).

To turn off the LEAKPEN:

- Depending on the active operating mode, the LEAKPEN is set to sleep mode (OFF) in different ways (see chapter 4.2 Measurement mode (ON) and chapter 4.4 Bootloader mode).

- To switch off the LEAKPEN completely, you must remove the battery (see chapter 3.1 Insert / replace battery).

3.2.1 Battery voltage level display

After turning on, the LEAKPEN first measures the battery voltage and displays it with the help of LED's. They flash 5 times. The number of LED's flashing simultaneously indicates the measured battery voltage according to the following table:

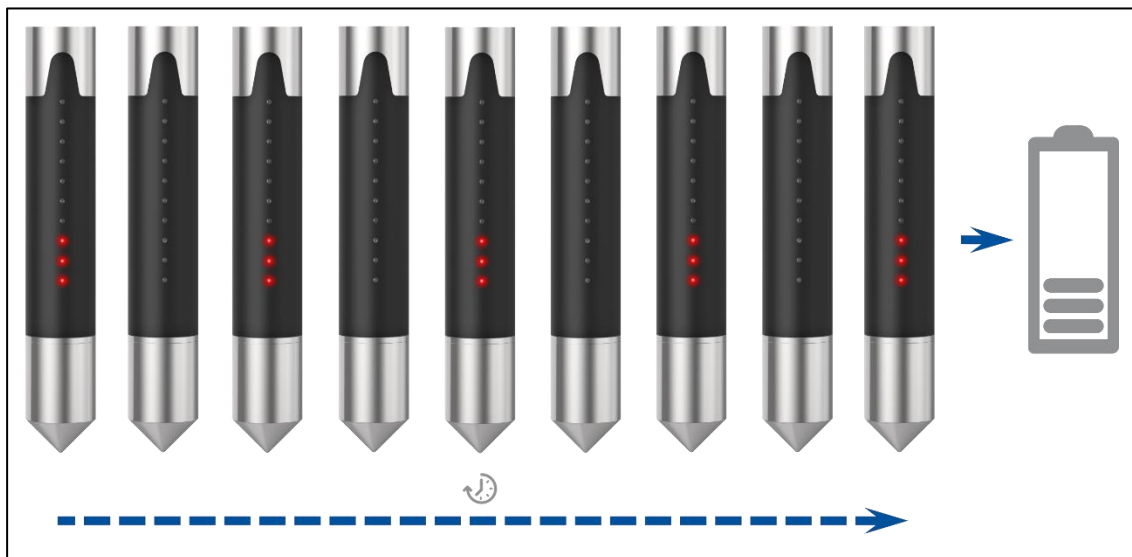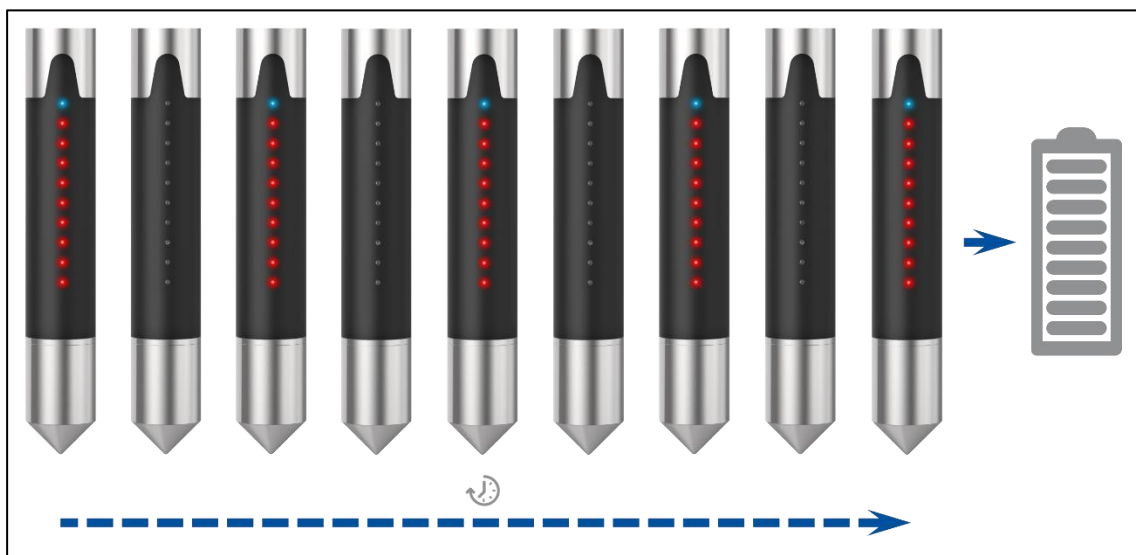| Number of flashing LED's	Battery voltage (VBAT) in the range [V]
0	$0.0\ V\ <\ V_{BAT}\ \leq\ 0.8\ V$
1 (1 red LED)	$0.8\ V\ <\ V_{BAT}\ \leq\ 0.9\ V$
2 (2 red LED's)	$0.9\ V\ <\ V_{BAT}\ \leq\ 1.0\ V$
3 (3 red LED's,Figure 7)	$1.0\ V\ <\ V_{BAT}\ \leq\ 1.1\ V$
4 (4 red LED's)	$1.1\ V\ <\ V_{BAT}\ \leq\ 1.2\ V$
5 (5 red LED's)	$1.2\ V\ <\ V_{BAT}\ \leq\ 1.3\ V$
6 (6 red LED's)	$1.3\ V\ <\ V_{BAT}\ \leq\ 1.4\ V$
7 (7 red LED's)	$1.4\ V\ <\ V_{BAT}\ \leq\ 1.5\ V$
8 (8 red LED's)	$1.5\ V\ <\ V_{BAT}\ \leq\ 1.6\ V$
9 (9 red LED's)	$1.6\ V\ <\ V_{BAT}\ \leq\ 1.7\ V$
10 (9 red LED's and 1 blue LED, Figure 8)	$1.7\ V\ <\ V_{BAT}$

Figure 7

Figure 8

3.3 Bluetooth Headphones - Pairing / Connecting

In order that data can be transmitted wirelessly using Bluetooth technology, the headphones has to be paired (registered) with the LEAKPEN.

To pair or connect headphones, the LEAKPEN must be in sleep mode (OFF) before it is switched on. After switching on, the LEAKPEN starts in measurement mode (ON).

The blue LED indicates the status of the Bluetooth connection.

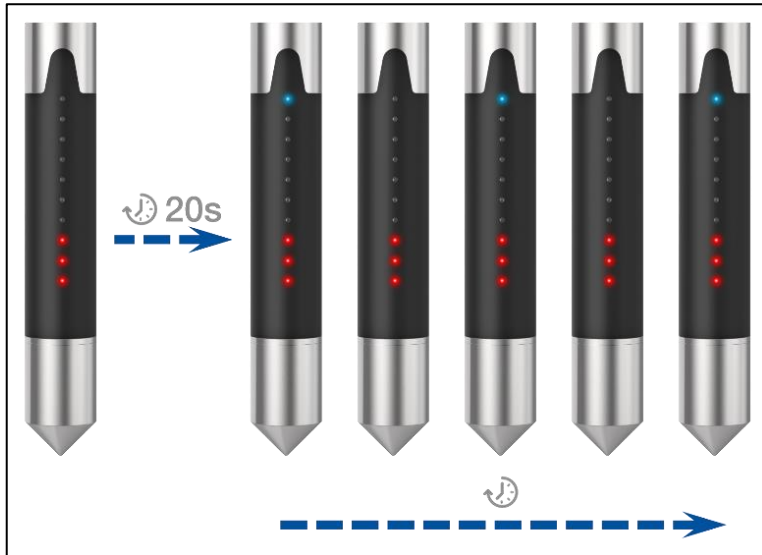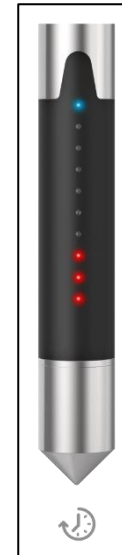Figure 9   Figure 10

Blue LED is off (Figure 9):

There is no Bluetooth connection

During the first 25 seconds after switching on, only a connection with already paired headphones can be established. During this time, the LEAKPEN does not search for new headphones.

Blue LED flashes for 5 seconds every 25 seconds (Figure 9):

There is no Bluetooth connection

As soon as the blue LED starts flashing for the first time, the LEAKPEN also starts searching for new devices to pair.

Blue LED lights up constantly (Figure 10):

Bluetooth connection is established.

3.3.1 Pairing new headphones

To pair new (unregistered) headphones, proceed as follows:

1. Turn on the headphones.

2. Put the headphones in pairing mode (refer to the headphones user manual).

3. Turn on the LEAKPEN from sleep mode (OFF) (see chapter 3.2 Turn ON / OFF).

4. Hold LEAKPEN and headphones close together, distance not more than 10cm (only necessary for pairing).

5. Wait until the blue LED lights up constantly, indicating that a connection has been established and the pairing process has been completed successfully.

3.3.2 Connecting already paired headphones

If the headphones have already been paired, the Bluetooth connection between the LEAKPEN and the headphones is established automatically. If the headphones are only switched on when the LEAKPEN is already in measurement mode (ON) and both devices are within range.

If the headphones are switched on before the LEAKPEN, the "PLAY" button must be pressed on some headphone models to establish the Bluetooth connection.

4. Operation

4.1 Operating modes

The LEAKPEN has 3 different operating modes.

- Measurement mode (ON) (see chapter 4.2 Measurement mode (ON))

Sleep mode (OFF) (see chapter 0

- Sleep mode (OFF))
- Bootloader mode (see chapter 4.4 Bootloader mode)

4.2 Measurement mode (ON)

Measurement mode (ON) is the main operating mode of the LEAKPEN, in which it measures and displays the leak nois level and transmits them via Bluetooth to a connected headphone.

The LEAKPEN enters the measurement mode (ON) when it is shaken in the sleep mode (OFF).

The LEDs have the following functions in this mode:

The red LEDs indicate the level of the leakage noise signal (see chapter 4.2.1 Audio signal level indication).

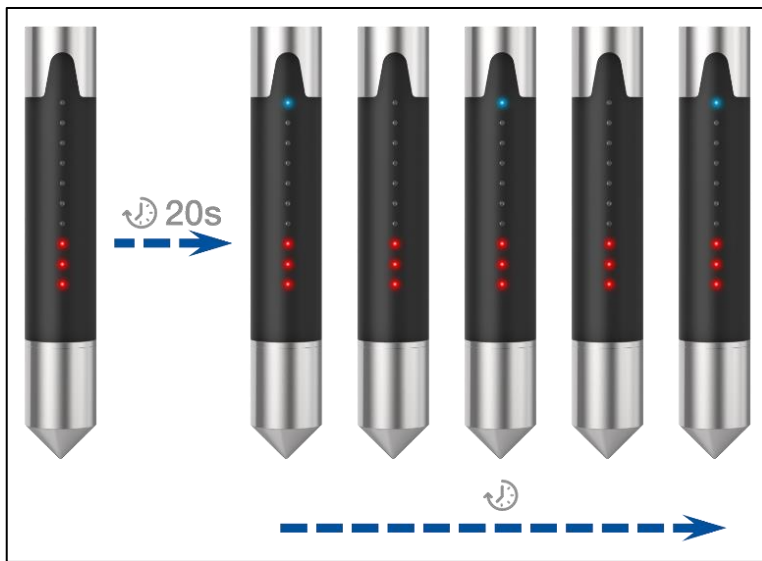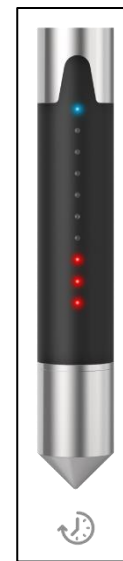The blue LED indicates the status of the Bluetooth connection

Figure 11

Figure 12

Blue LED is off (Figure 11):

There is no Bluetooth connection

During the first 25 seconds after switching on, only a connection with already paired headphones can be established. During this time, the LEAKPEN does not search for new headphones.

Blue LED flashes for 5 seconds every 25 seconds (Figure 11):

There is no Bluetooth connection

As soon as the blue LED starts flashing for the first time, the LEAKPEN also starts searching for new devices to pair.

Blue LED lights up constantly (Figure 12):

Bluetooth connection is established.

In this mode, the LEAKPEN automatically returns to sleep mode (OFF) if there is no Bluetooth connection after 2 minutes. If a connection is established for longer, the LEAKPEN remains in this mode permanently; as soon as the connection is disconnected, the LEAKPEN returns to sleep mode (OFF).

4.2.1 Audio signal level indication

Leak noise level [dB] is indicated by 9 red LED's. Lit red LED's number displays measured audio signal level (Asl) in [dB] according to following chart:

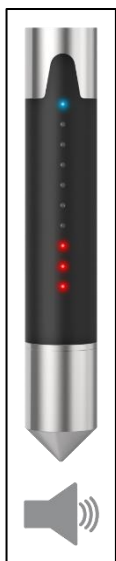| Number of lit LED's	Audio signal level (Asl) in the range [µg]
1 (1 red LED)	Asl ≤ 40 µg
2 (2 red LED's)	40 µg < Asl ≤ 50 µg
3 (3 red LED's)	50 µg < Asl ≤ 63 µg
4 (4 red LED's,Figure 13)	63 µg < Asl ≤ 80 µg
5 (5 red LED's)	80 µg < Asl ≤ 100 µg
6 (6 red LED's)	100 µg < Asl ≤ 126 µg
7 (7 red LED's)	126 µg < Asl ≤ 158 µg
8 (8 red LED's)	158 µg < Asl ≤ 200 µg
9 (9 red LED's, Figure 14**Erreur ! Source du renv introuvable.**)	200 µg < Asl

Figure 13

Figure 14

4.3 Sleep mode (OFF)

The LEAKPEN is in a sleep mode / power saving mode in which everything is turned off except the motion detection, so that the LEAKPEN can be switched on again with a shake.

4.4 Bootloader mode

The bootloader mode can be used to load firmware updates to the LEAKPEN via the Bluetooth connection.

Firmware updates are communicated and instructed by VONROLL.

The LEAKPEN always starts directly in bootloader mode as soon as the battery is replaced or intentionally removed and reinserted.

To show that the LEAKPEN is in bootloader mode, the LEDs have the following functions in this mode:

The red LED's show a running light effect, where they light up one after the other from No. 1 - 9 (Figure 15 and Figure 16).

The blue LED indicates the status of the Bluetooth connection.

Blue LED is blinking (Figure 15):

The LEAKPEN is visible to a Bluetooth Master device (PC, Smart Device, ...) and can be connected to it.

Blue LED lights up constantly (Figure 16):
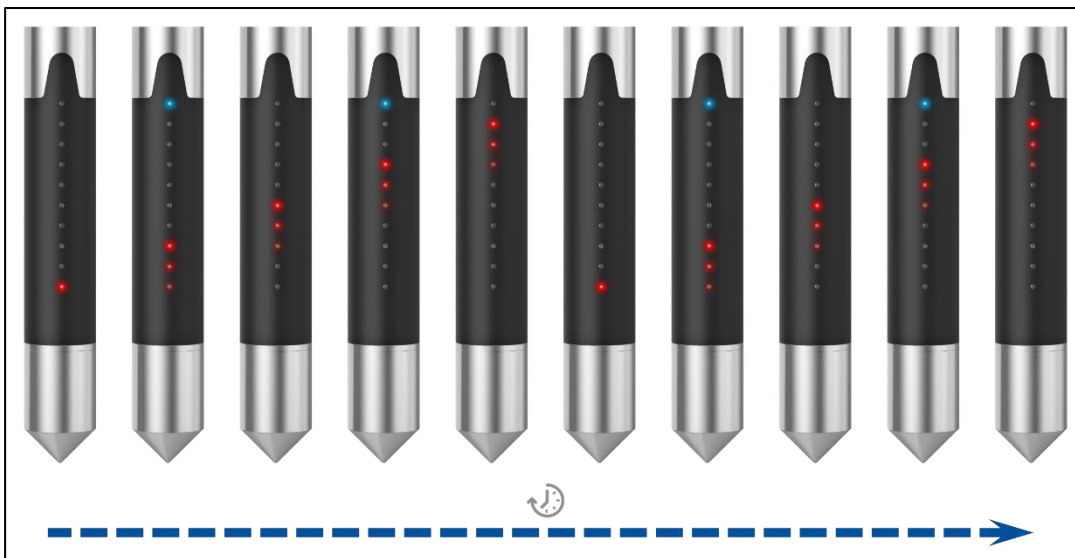
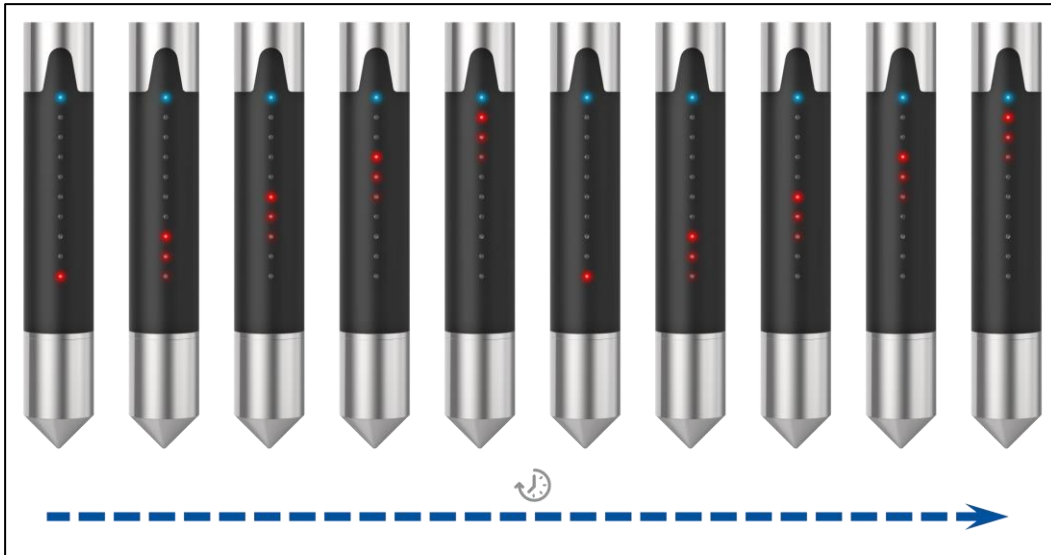Bluetooth connection is established.

Figure 15

Figure 16

The bootloader mode is terminated after 4 minutes if there is no Bluetooth connection and the LEAKPEN switches to sleep mode (OFF).

If no firmware update is required, the bootloader mode can be ended immediately with a shake and the LEAKPEN switches to sleep mode (OFF).