

User Manual

Acoustic generator

Metronome



Consultation with ZIKMUND ELECTRONICS

This system manual has been prepared as both an operating guide and a reference. Please read this manual carefully before using the product for the first time. Its purpose is to provide clear answers to your questions and to help you solve problems quickly and easily. Whenever an issue occurs, please consult this manual first. Use the table of contents to locate the relevant section.

If your question remains unanswered, or if you require assistance from an authorized service center, please contact:

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Terms of Warranty

Subject of warranty

The subject of this warranty is the purchased Metronome acoustic generator (as specified in the handover protocol).

Acceptance of goods

Upon receipt, the operator is obliged to thoroughly check the system and all its components. The delivery protocol serves as proof of fulfillment of the system delivery.

Warranty period

Zikmund electronics, s.r.o. provides a 12-month warranty for its acoustic generator, starting from the handover date confirmed in the handover protocol. Exceptions are parts not manufactured by Zikmund electronics, s.r.o., for which the warranty is provided by the respective component manufacturer. Zikmund electronics, s.r.o. issues a confirmed warranty card.

Place of claim

Warranty claims can be made at the business premises of Zikmund electronics, s.r.o. or at an authorized service center of the manufacturer.

System handling

The buyer is properly trained and tested in the operation of the system, for which a certificate is issued. The equipment must not be operated by untrained personnel.

Claim procedure and settlement period

In the event of a defect covered by this warranty, the operator must notify the manufacturer as soon as possible and arrange for service. Repairs will be carried out as quickly as possible, and no later than 30 calendar days from the date the defect is reported at the business premises or authorized service center.

The warranty does not cover:

- Surface treatment of components
- Mechanical damage to the acoustic generator
- Defects caused by improper handling of the system, including failure to follow the instructions in the user manual.
- Water penetration into the interior of acoustic generator. The manufacturer guarantees system tightness only if the equipment is operated correctly.
- Normal wear and tear of parts due to operation (e.g., wear of seals, wear of the cables etc.)
- Subsequent innovations or equipment upgrades

Loss of warranty

The warranty becomes void if the defect is caused by mechanical damage to the system, operation in unsuitable conditions (chemically aggressive environment, absence of internal air pressure, etc.), or unauthorized tampering with the product (including by non-authorized service technicians). Use in explosive environments is strictly prohibited. Defects caused by natural disasters or force majeure are also excluded from the warranty.

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1. Purpose.

1.1. The multifunctional acoustic generator Metronome is designed to generate low-frequency acoustic signals using as well as special pulses using different types of heads.

1.2. The generator can be used for:

- localization of hidden pipeline routes made of any material, including those made of plastic and cement;
- localization of connections/ branches to the main pipeline of any diameters and materials;
- finding the fact of connecting pipelines (loops);
- determining/selecting your pipe in a bundle of communications;
- route search tasks in difficult electromagnetic conditions: concentration of engineering communications, which does not allow classic electromagnetic route finders to work effectively;
- generation of a special signal to measure the sound velocity in sections of the pipeline, which consists of pipe segments/inserts of different materials and diameters used when searching for hidden leaks using the correlation method.

2. Technical specifications

Metronome is specified by the following parameters:

Parameter	Value
Indicators	2,4" TFT color display/ 320 x 240 pixels LED indicators
Entry	Rotary encoder with enter function
Power supply	Internal rechargeable AGM battery, 12 V DC charging pins
External charger	Input voltage: 100-240V, 50-60Hz. Maximum power consumption: 4W. Rated output voltage: 12VDC. Maximum charging current: 0.25A (+/- 5%).
Operating time	min 2 h
Operating modes and connections	Pulse mode - tension head attachment using a strap or direct magnetic connection. Vibration mode - tension head attachment using a strap or direct magnetic connection. Wave mode - connection via 1" thread.
Connections	Acoustic heads (impact/water, vibration) 12 V DC
Head cable length	10 m
Dimensions	400 x 300 x 168 mm
Weight	2.9 kg
Operating temperature range	-20..+40°C
Storage temperature range	-20..+30°C
Acoustic frequencies	variable in the range from 100 to 1800 Hz
Pulse period of acoustic signals	adjustable from 1 to 5 seconds
Impact pulses period	FAST-1: 0.15 seconds FAST-2: 0.35 seconds MEDIUM-1: 1 seconds MEDIUM-2: 2 seconds SLOW: 4 seconds

3. Scope of delivery

The set comprises the following devices and accessories:

Accessory	Description
Metronome	acoustic generator in waterproof case
Charger	external charger for the battery of acoustic generator
P-head	pulse acoustic head
V-head	vibration acoustic head
W-head	water acoustic head
HC10	10 m long cable for connecting heads

4. Safety instructions

- 4.1. When operating the generator, it is necessary to follow the safety regulations adopted in your region and organization.
- 4.2. It is forbidden to let water (including rain, snow and other liquids) get on the Metronome Generator Unit with the cover open.
- 4.3. It is forbidden to submerge under water pulse acoustic P-head.
- 4.4. It is forbidden to submerge under water vibration acoustic V-head.
- 4.5. It is forbidden to submerge under water acoustic W-head.
- 4.6. It is forbidden to let water (including rain, snow and other liquids) get on the External charger.
- 4.7. The P-head is connected only to the "PULSE/WAVE" connector in the upper left corner on the Metronome Generator front panel ("2" in Fig. 6).
- 4.8. The W-head is connected only to the "PULSE/WAVE" connector in the upper left corner on the Metronome Generator front panel ("2" in Fig. 6).
- 4.9. The V-head is connected only to the "Vibration" connector in the upper right corner on the Metronome Generator front panel ("2" in Fig. 6).
- 4.10. The use of third-party chargers is prohibited.

5. Principle of operation and examples of use.

5.1. A microprocessor circuit with electronic keys and sound amplifiers is used to generate special acoustic signals and pulses.

5.2. A rotary switch with a confirmation function is used to control and change parameters, located on the front panel of the Metronome Generator ("8" in Fig. 6).

5.3. A potentiometer on the front panel of the Metronome Generator ("9" in Fig. 6) is used to adjust the volume.

5.4. The parameters and the working process are indicated using a TFT color display ("5" in Fig. 2).

5.5. The principle of operation is to create acoustic disturbances on the pipeline wall or in the water inside it, which are detected above the pipeline axis on surface at a certain distance from the generator by a ground microphone (not included in the delivery set). In the same way, the locations of branch connections to the main pipeline are localized. That is, above the pipeline axis, the generator signal, which is received by the ground microphone, will have the maximum level.

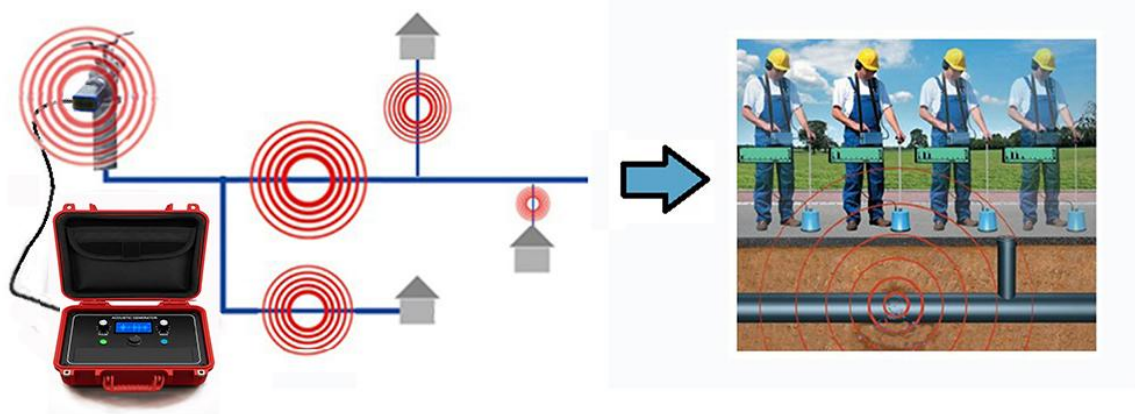


Fig.1.

Figure 2 shows an example of locating an unknown hidden house connection in the main pipeline using signals from a Metronome Generator and a SebaKMT HL7000 ground microphone.

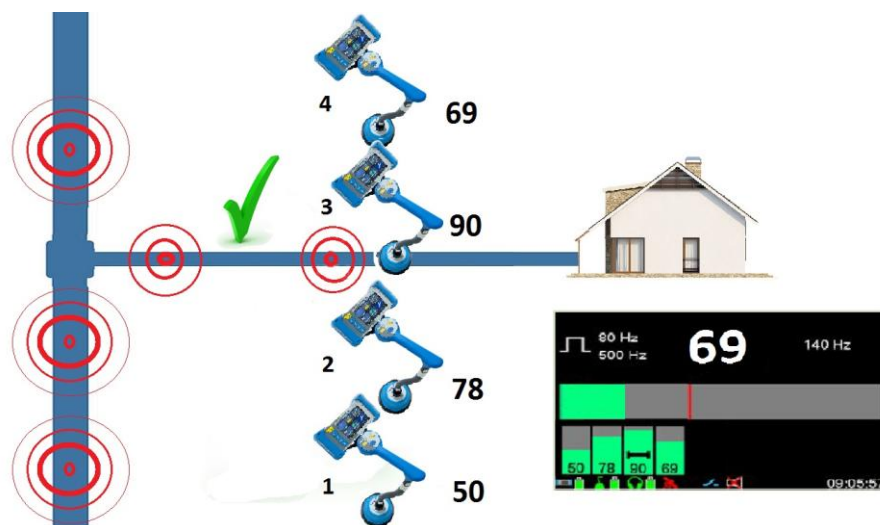


Fig.2.

The signals from the generator propagate through the main pipeline and also along the branches. As the branch is approached (steps 1-2), the ground microphone operator observes an increase in the level of the generator signals received. Above the branch pipeline axis, the signal level will be maximum and is 90 units. After step 3, a decrease in the level is observed (step 4 - 69 units).

The generator can also be used as a source of a special signal to determine the velocity of sound in sections of the pipeline with unknown parameters such as diameter, material, inserts of sections of different pipes. This function is used when searching for leak locations by correlation method (the correlator is not included in the delivery set). Figure 3 shows an example of measuring the speed of sound in a section with unknown inserts. Such a measurement and acceptance of the speed as the working one for the correlator will save you from inaccurate readings of the distance to the leak*.

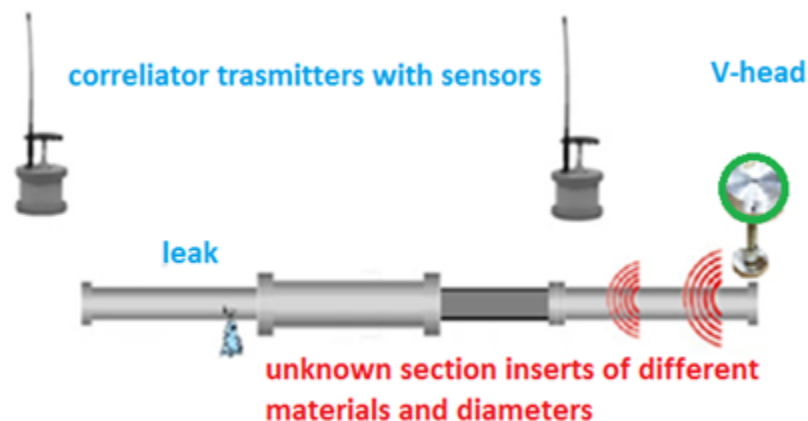


Fig.3.

* The correlator must have the function of measuring/correcting the sound velocity for the section of the pipeline being tested.

Sometimes it is necessary to determine whether two (or more) lines are connected by a hidden jumper. To do this, you can use a generator in the "Vibration" mode and use a microphone for listening to pipelines (for example, PAM B2 SebaKMT). As shown in Fig. 4, the V-head is installed in well No. 1, and the microphone is in well No. 2. The signal from the generator passes through the main pipeline and through the hidden jumper falls on a parallel line, on which it is detected by a microphone. Thus, the fact of connection - presence of a jumper between two pipelines is established. Later, the connection line can be detected by the method of acoustic trace in the "Pulse" or "Wave" mode.



Fig.4.

Another example of using the Metronome generator can be selecting the required pipe from a bundle. Such a situation can arise in internal house wiring when it is necessary to block your pipe (during an accident or repair). As shown in Fig. 5, for this purpose, a V-head is connected to the pipeline being searched and in the “Vibration” mode, search signals are generated, with the help of which the operator selects the required pipe with a special microphone (for example, PAM B2 SebaKMT).

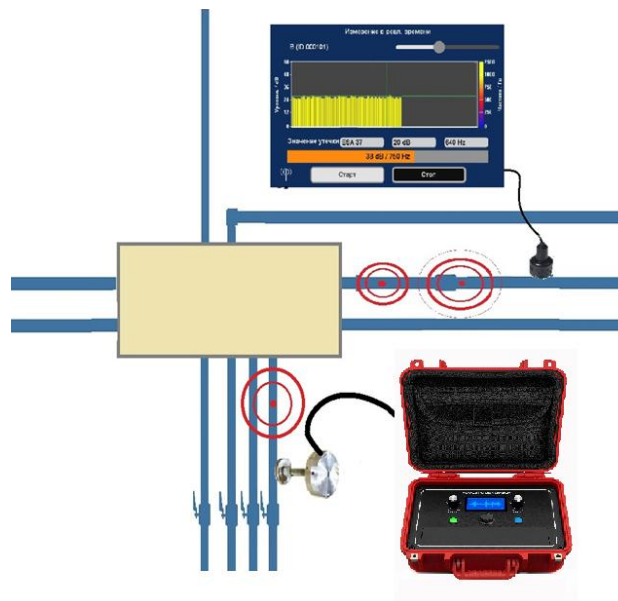


Fig.5.

6. Preparation for operations

6.1. Front panel and controls.

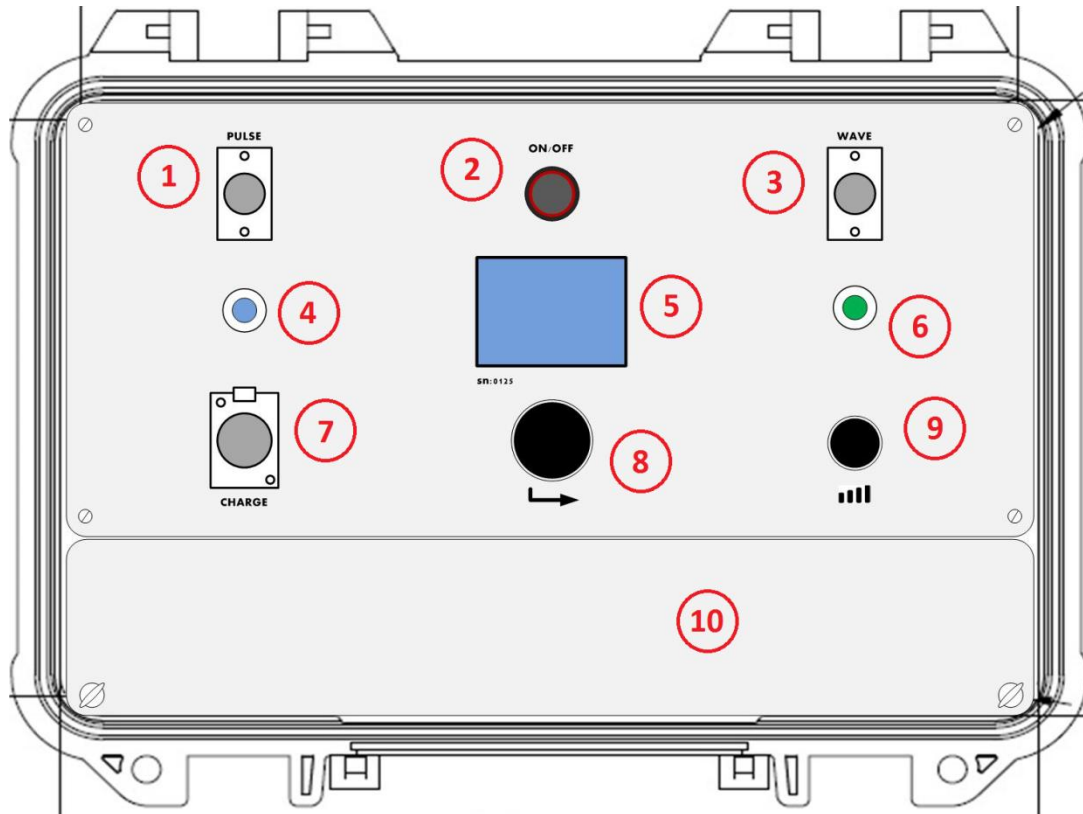


Fig.6.

Front panel and controls.

Item	Description
1	Socket for connecting the P-head, as well as the W-head for operation in "Pulse" and "Wave" mode.
2	On/off button of the Metronome Generator
3	Socket for connecting the V-head for operation in "Vibration" mode
4	Blue LED indicator to indicate Pulse and Wave mode operation
5	TFT color display
6	Green LED indicator to indicate Vibration mode operation
7	Socket for connecting an external charger
8	Rotary encoder with enter function
9	Knob for adjusting the sound volume in "Vibration" mode
10	Storage compartment for acoustic heads

6.2. To prepare the generator for operation in the "Pulse" and "Wave" mode:

6.2.1. Connect the P-head or the W-head to the object of work for example, a water pipeline. The P-head is connected using a special tensioner or powerful magnet, the W-head - using a 1" (inch) threaded connection through, for example, a ball valve or any other available method of connection to the water inside the pipeline.

6.2.2. Connect a flexible hose included in the kit to the output adapter of the W-head to ensure the necessary conditions for creating special waves and discharging water.

Always flush the pipe before connecting the W-head.

Pre-discharge solids, sludge and other contaminants with some water.

6.2.3. Connect the P-head or the W- head to the socket "1" (see Fig. 6).

6.2.4. Press the On/Off Button of the Metronome Generator "2" (see Fig. 6).

6.3. To prepare the generator for operation in the "Vibration" mode:

6.3.1. Attach the V-head to the object of work for example, to a water pipeline. The vibration head is attached using a magnetic mount to the wall of the pipeline or shut-off valves, gate rods, gate bodies, valves, fire hydrants, etc.).

6.3.2. Connect the V-head to the socket "3" (see Fig. 6).

6.3.3. Press the On/Off Button of the Metronome Generator "2" (see Fig. 6).

6.4. To charge the battery, connect the external charger to the socket "7". The charger has an indicator. During charging, the indicator lights up red. After reaching a full charge level, the indicator lights up green. To extend the service life, it is recommended to charge the battery after each use of the generator.

7. Operation with the generator.

7.1. To navigate the main menu, use the rotary encoder and its confirmation button to enter its items (see Fig. 7).



Fig.7.

7.2. If the system battery discharges to an unacceptable level, information will appear on the screen warning about this (see Fig. 8) and further operation will be impossible.

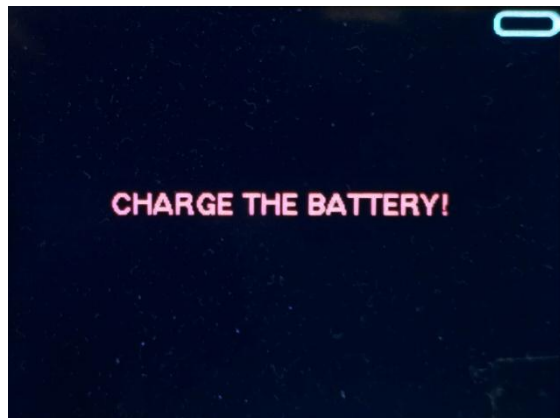


Fig.8.

7.3. To operate the generator in the “Pulse” mode:

7.3.1. Switch to the “Pulse” mode using the rotary switch. This mode is used for route finding tasks, as well as tasks for determining the locations of branch connections to the main pipeline.

7.3.2. Using the rotary switch, select the required submode that determines the speed of the pulses (see table below). The default mode is “MEDIUM-1”.

Pulse periods in the Pulse mode

Submode	Pulse period, sec
MEDIUM-1	1
MEDIUM-2	2
SLOW	4

7.3.3. To start delivering pulses, move to the green “Play” button and press the rotary switch (see Fig. 9).



Fig.9.

7.3.4. To end the delivery of pulses, move the cursor to the red “Stop” button and press the rotary switch (see Fig.10).



Fig.10.

7.3.5. To return to the main menu, click the gray "Back" button (see Fig. 11).



Fig.11.

7.4. To operate the generator in the "Wave" mode:

7.4.1. Switch to the "Wave" mode using the rotary switch (the mode is loaded by default when the generator is turned on). This mode is used for route finding tasks, as well as tasks for determining the locations of branch connections to the main pipeline.

7.4.2. Using the rotary switch, select the required submode that determines the speed of the pulses (see table below). The default mode is "FAST-1".

Pulse periods in the Wave mode

Submode	Pulse period, sec
FAST-1	0.15
FAST-2	0.35
MEDIUM-1	1
MEDIUM-2	2
SLOW	4

7.4.3. To start delivering pulses, move to the green "Play" button and turn the rotary switch (see 7.3.3).

7.4.4. To end the delivery of pulses, move the cursor to the red "Stop" button and turn the rotary switch (see 7.3.4).

7.4.5. To return to the main menu, click the gray "Back" button (see 7.3.5).

Recommendations for choosing a submode:

Submodes MEDIUM-1, MEDIUM-2 and SLOW are suitable to operate with surface P-head. All of submodes FAST-1, FAST-2, MEDIUM-1, MEDIUM-2 and SLOW are designed to operate with the W-head and perform well when creating special pulses inside the pipeline in water. Depending on local conditions and individual operator capabilities, different sub-modes may be applied. It should be remembered that the mode with short pulse periods will drain the battery faster.

7.5. To operate the generator in “Vibration” mode:

7.5.1. Switch to Vibration mode using the rotary switch in main Menu.

7.5.2. Select the submode of operation with the V-head, namely, change to “SOUND VELOCITY” position and activate the submode of generating a special continuous acoustic signal for measuring the speed of sound in the pipeline section (see Fig. 12).

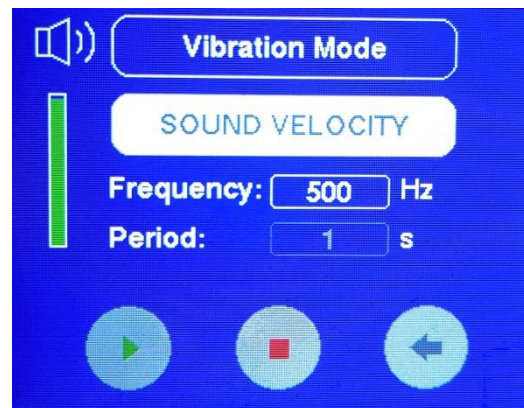


Fig.12.

When operating in this submode, the acoustic signal is continuous and thus the period selection window becomes inactive. The device generates an acoustic signal with a specific carrier frequency for the task of determination of velocity of sound by correlator for precise leak localization. To select the frequency, go to the frequency selection window. The default carrier frequency is 500 Hz. The green bar graph on the left side of the screen displays the currently set signal level.

7.5.3. To activate or stop the acoustic signals, do it in the same way as described previously.

7.5.4. If the submode of supplying acoustic pulses of a certain frequency "ONLY CARRIER" is selected, the operator must select the frequency and time between pulses. This submode is used for route search tasks, as well as tasks for determining the locations of branch connections to the main pipeline, the fact of connections, selecting "your" pipe from the bundle, etc. The frequency and time between pulses are freely selected.

Frequency selection recommendations:

As is known, low-frequency acoustic vibrations propagate over long distances, but not all ground microphones and surface sensors are able to record these vibrations with sufficient quality. In real trace search, the quality of operation and, as a result, the choice of operating frequency is influenced by many factors and their combination, such as, for example, the material and diameter of the pipeline, the depth of its laying, the type of soil, etc. Therefore, the Metronome Generator has implemented the ability to independently select the frequency of the special signal, as well as the carrier frequency of acoustic pulses, to select the best search signal in the current conditions.