

LFG-50

Low frequency generator

USER MANUAL



CONTENTS

Safety regulations	3
Safety precautions	3
Hazard symbols	4
Description and operating principle.....	4
Purpose	4
Operating conditions	5
Storage conditions	5
Marking	14
Proper use	15
Preparation for use.....	15
Operating the device.....	16
Cable route location	16
Direct coupling.....	16
Capacitive coupling method.....	17
Inductive coupling via integrated antenna	18
Inductive coupling via transmitter clamp.....	19
Locating a cable in a bundle	20
Inter-phase cable fault location	21
Pipeline location using earthing spike.....	22
Pipeline location using closed-loop method.....	23
Maintenance.....	24
Changing fuses	24
Internal battery charge	25
Display maintenance	25

This User Manual introduces the operating guidelines of the Low-Frequency Generator LFG-50 (hereinafter – Generator).

The User Manual contains information on the purpose, technical data, operating principle, maintenance of the Generator as well as instructions on preparing the Generator for operation.

The visual content of this document is provided for reference only. It may be different from the actual appearance of the Generator. The differences in appearance do not influence the conditions of the Generator use or its performance capabilities.

The manufacturer retains the right to introduce any changes to the Generator design provided they do not impair its work.

SAFETY REGULATIONS

Safety precautions

To prevent injuries to the staff and damages to this or any other device connected to it, maintenance procedures are to be performed by suitably qualified members of the staff only.

The staff should carefully study the User Manual.

The national standards and safety regulations must be followed!

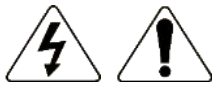
The manufacturer shall not be held responsible for any damage to people or objects resulting from the failure to follow the safety procedures outlined in the User Manual.



CAUTION!

THE FOLLOWING IS PROHIBITED:

- **OPERATING THE SYSTEM WITHOUT GROUNDING;**
- **CONNECTING THE GENERATOR TO AN UNGROUNDED OBJECT BEING EXAMINED;**
- **OPERATING THE GENERATOR IF IT IS OUT OF ORDER;**
- **LEAVING THE GENERATOR ON WITHOUT PROPER SUPERVISION BY THE OPERATING STAFF;**
- **PERFORMING WORK ON THE CABLE DURING FAULT LOCATION**



WARNING!
AT PEAK VALUES OF OUTPUT POWER ON THE OUTPUT OF THE GENERATOR THERE CAN BE VOLTAGE UP TO 380 V; IF THE OUTPUT VOLTAGE EXCEEDS 40 V, THE DISPLAY WILL SHOW THE INDICATOR OF HIGH VOLTAGE "⚡"

Hazard symbols



These symbols can be found on the Generator display or in the User Manual:

CAUTION! Indicates a potential danger that may result in a lethal outcome or a serious injury.



WARNING! Indicates conditions or actions that may result in damage to the Generator or equipment connected to.



Protective earthing.



NOTE. Indicates important information and tips on operating the Generator.

DESCRIPTION AND OPERATING PRINCIPLE

Purpose

The Generator is intended to be used as part of a set, which can help achieve the following:

- cable or pipe network location using direct electrical connection or inductive coupling (direct or inductive coupling);
- cable and pipeline route location;
- coupling location on power and telecommunication cables;
- cable selection using signal coupling;
- locating a cable in a bundle;
- locating low-resistance short-circuits between conductors using signal coupling;
- location of sheath defects using the pace voltage method;
- location of defects on pipe and cable systems with cathode rust-resistant protection.

The Generator is used with a receiver operating in the same frequency range as that emitted by the Generator.

Operating conditions

The values of the environment climatic factors for operating the Generator are specified in Table 1.

Table 1 – Generator operating conditions

Climatic factors	Value
Ambient temperature, °C	- 20 to + 55
Relative air humidity at temperature of + 25°C, %, max	up to 80%
Atmospheric pressure, mm Hg	630 to 800

Storage conditions

The Generator should be stored in dry closed areas preventing the Generator from mechanical damage and dirt.

The values of the environment climatic factors for operating the Generator are specified in Table 2.

Table 2 – Generator storage conditions

Climatic factors	Value
Ambient temperature, °C	- 5 to + 40
Relative air humidity at temperature of + 25°C, %, max	up to 60%
Atmospheric pressure, mm Hg	630 to 800

Specification

The technical data of the Generator are shown in Table 3.

Table 3 – Technical data of Generator

Parameter	Value
Operating frequency of ¹ , Hz	491 982 8440
Number of frequencies used concurrently	3
Output power adjustment range, W	0 ... 50
Increment for manual power adjustment, W	2.5
Frequency selection	manual
Operation modes	continuous pulsed
Load impedance range, Ω	0.5...1000

¹ The operating frequencies can be changed on the customer's request.

Maximum output voltage (RMS value), V	300
Impedance matching	automatic
Range of measured and indicated parameters:	
• output voltage, V _{df}	0.1...300
• current, A	0.01...9.99
• load impedance, Ω	0.5...1000
• phase shift angle, °	0...90
Maximum relative measurement error, %	5.0
Pulse duration (in the pulsed mode), sec	0.5
Pulse refresh rate, Hz	1.0
Power supply and battery charge:	
• battery voltage, V	12
• time of continuous battery-powered operation, hours, min ² ,	1
• average battery charging time, hours	3
• external mains supply voltage, V	230 ± 10 % (50 Hz)
• external power source voltage, V	10..15
Maximum mains power consumption, V·A	100
Maximum current consumption from external power source (12 V), A	8
Dimensions, mm	366×271×178
Weight, kg, max	8

Design and operating principle

The Generator control panel is shown in Figure 1.

The Generator's maximum output power is 50 W adjustable in increments of 2.5 W. The output signal can be transmitted in the continuous or pulsed mode at certain time intervals.

In the standard configuration, frequencies of 491 Hz, 982 Hz and 8440 Hz are generated on the output. A sine wave signal is used; the frequency is stabilized with crystal resonator.

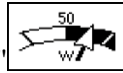
The Generator automatically matches the output impedance with load impedance at each output signal activation. The load impedance is measured and shown in the display.

The output power is adjusted with a knob on the Generator control panel.

² Using lower output power or pulsed mode when the Generator is battery-powered helps significantly conserve the battery.

If the load is not sufficient, when the load impedance exceeds the maximum (over 1000 Ω), or without load, the Generator switches from the mode of setting output power to the mode of setting output voltage. In this case output voltage is set with a knob on the control panel (in increments of 2 per cent of the maximum).

In the case of an overload, when resistance is lower than the maximum (below 0.5 Ω), the Generator will switch off the output signal and display the



overload message " ".

The Generator can be powered by one of three sources: the internal battery, mains supply 230 V or an external DC power source with a voltage of 10...15 V (in-vehicle network, external battery, etc.). The built-in charging device makes it possible to charge the battery using either of the other two sources. In most cases it takes not more than 3 hours to charge the battery. However, if the battery has not been used for a long time, full charging time may be longer. When the Generator is operated, the battery charging process stops. If the Generator is powered by an external source, some time after the output signal has been switched off, it resumes battery charging. After the battery has been fully charged, the Generator switches off automatically.

The Generator can be connected to the line under examination using either direct or inductive coupling. For inductive coupling at a frequency of 8440 Hz the integrated transmitting antenna can be used.

Alternatively, inductive coupling can be achieved using a transmitter clamp, which is positioned around the cable or pipe network being examined. In this case the Generator signal is transmitted selectively to the object being examined. Any available transmitter frequency can be used. A transmitter clamp is supplied as part of a accessory set; its internal diameter is between 15 mm and 150 mm. This method can be used on a cable that is still in operation. This method is also suitable for coupling with telecommunication and signal cables provided they have an earthed sheath, metal sheathing or a protective conductor.

Special protective filters allow direct coupling onto power lines with a voltage of up to 400 V (direct and alternating current). In this case it will be possible to selectively locate a line when it is under voltage. There is no need to disconnect it.



Figure 1 – Control panel

Table 4 – List of controls shown in Figure 1

No.	Name	Symbol	Description
1	Indicator		Provides indication of power supply 230 V, 50 Hz
2	Socket	"~230V AC"	Used to connect AC power cable 230 V, 50 Hz
3	Fuse holder	"1A"	Mains fuse 230 V, 50 Hz
4	Indicator		Provides indication of power supply 12 V
5	Socket	"12V EXT."	Used to connect a cable from an external DC power source 12 V
6	Fuse holder	"10A"	External power source fuse 12 V
7	Socket	USB-B	Used for PC connection
8	Fuse holder	"10A", "BAT."	Battery fuse
9	Fuse holder	"10A"	Output signal fuse
10	Fuse holder	"10A"	Output signal fuse
11	Socket	"⏏"	Used to connect earthing
12	Socket	"~"	Used to connect the signal cable
13	Socket	"~"	Used to connect the neutral cable
14	Encoder knob	"◀...▶" / "PULSE ⏏"	Used to increase/decrease the output power level, switch on/off the pulsed operation mode at an interval of 1 second
15	OLED display		Displaying graphic information
16	Button	"MODE"	Used to select the operation mode:
17	Button	"FREQ"	Used to select operating frequency
18	Button	"RESET"	Used to switch off the Generator in case of the program error (hang-up)
19	Button	"⏻"	Used to switch on/off the Generator power supply

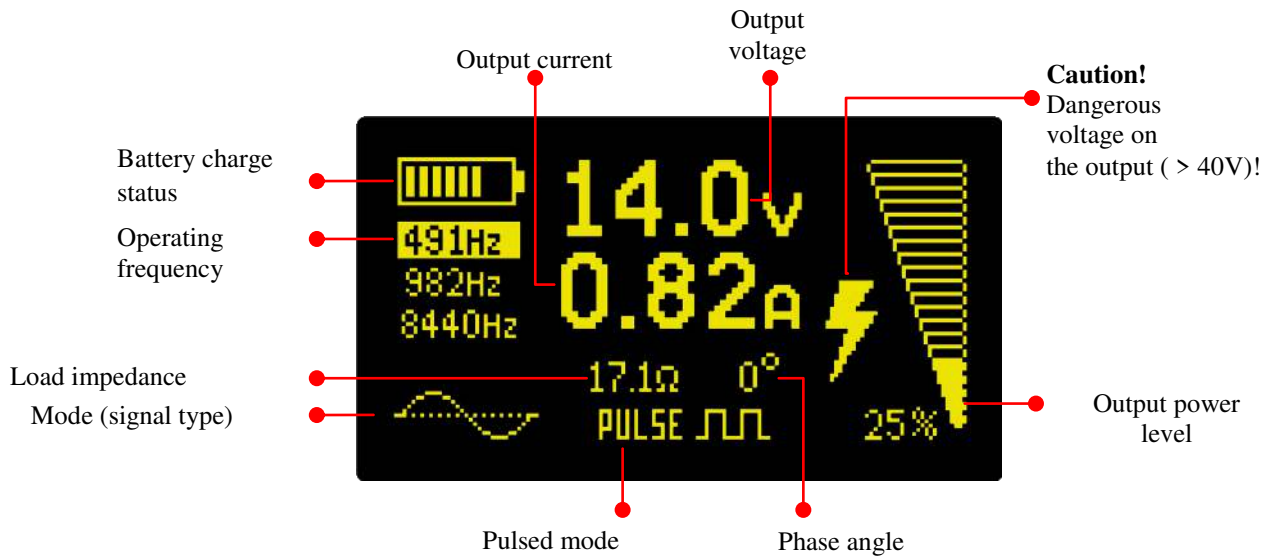


Figure 1 – The Generator display

Switching on/off

The Generator is switched on/off by pressing the button "⏻" (see Figure 1, Item 19).

Protective earthing

The Generator is grounded by connecting one end of the earthing cable to the socket "⏚" (see Figure 1, Item 11), and the other end to the earthing bus or earthing spike (for field testing).

Output sockets

Output sockets "⚡" (see Figure 1, Item 12, 13) are used for connecting the Generator to the object being examined (cable, pipeline, etc.) using respective connecting wires. Output signal is galvanically insulated from the Generator casing and from the other external circuits.



CAUTION!

AT PEAK OUTPUT POWER ON THE OUTPUT OF THE GENERATOR THERE CAN BE VOLTAGE UP TO 380 V

The output sockets "⚡" are galvanically separated from the other sockets.

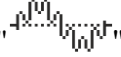
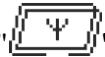
Frequency selection

Frequency is selected by pressing the button "**FREQ**" (see Figure 1, Item 17). Each time the button "**FREQ**" is pressed, the available frequencies change one after another. In multiple-frequency mode frequencies combine to form groups of two or three.

When frequency is changed, the output power level is automatically set at 0 per cent.

Operation mode

The Generator has the following operation modes:

-  – single-frequency sine signal for direct or inductive coupling;
-  – multiple-frequency signal for direct or inductive coupling. A multiple-frequency signal is transmitted to the output sockets; it consists of two or three acoustic signals of different sine wave frequencies.
-  – single-frequency sine wave signal with inductive coupling via the integrated transmitting antenna. The operating frequency is set at 8440 Hz. When the transmitting antenna is used, the output sockets are automatically switched off inside the Generator.

To select the operation mode, press the button "**MODE**" (see Figure 1, Item 16).

The Generator can be operated in the pulsed mode using a single-frequency or multiple-frequency signal. To activate the pulsed mode, press the encoder knob "**PULSE** 

 (see Figure 1, Item 14), in which case at the bottom of the screen you will see the message "PULSE ".

Measurement (V/A/ Ω / φ)

The Generator can measure and display the following parameters (see Figure 1, Item 15):

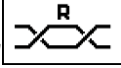
- output voltage;
- output current;
- load impedance;
- phase shift angle.

Voltage is indicated as a warning of a potentially dangerous voltage.

Current is indicated to estimate the electromagnetic field strength along the line.

Load impedance and phase shift angle (between output voltage and current) are defined by the features of the connected object being examined. High load impedance in the case of direct coupling of measurement transducer may be caused by poor earthing. A high value of the phase shift angle (close to 90°) indicates the dominance of a reactive (capacitive or inductive) load time, while a low value of the phase shift angle (close to 0°) indicates the dominance of an active (resistive) load type.

For the Generator to operate properly, the load impedance should be sufficiently stable and not change during the operation by more than 20 per cent. Otherwise, the Generator will switch off the output signal and display

the warning message ".

Activating output signal and setting power level

To activate and deactivate the output signal, set the required level of output power by turning the encoder knob. When the level is set at 0 per cent, the output signal switches off. To increase the level of the Generator output power, smoothly turn the encoder knob "◀.....▶" (see Figure 1, Item 14) right, and to decrease it - left.

A power level of 100% reflects the maximum output power of the Generator, which enables proper operation of the Generator in a wide impedance range.

Before switching on the output signal, the Generator checks the output circuit for extraneous current and voltage. In case there is extraneous current or voltage, the Generator does not switch off the output signal and displays the

warning message ".

To avoid this, follow the earthing requirements and disconnect the object being examined from other voltage sources.

Matching load impedance

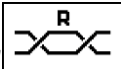
For proper operation of the Generator in a wide range of load impedance, its internal output impedance should be matched with the value of load impedance connected to its output.

Matching should be done every time the output signal is activated. Before setting the selected output signal power level, the Generator studies the load by measuring its full impedance at a selected frequency. Based on the received data, the Generator matches its internal output impedance and then gradually increases output voltage up to the required power level. The matching process takes up to 30-40 seconds. During this time messages with information on the matching process are displayed. After the matching process is over and the required power is set, the Generator switches to the operation mode, and current impedance and phase shift angle are shown in the display. If the pulsed mode is activated, the output signal is emitted at a frequency of 1 Hz.

Operation mode

In the operation mode the Generator emits a signal of the selected output power level to the output. To increase this level, smoothly turn the encoder knob "◀.....▶" (see Figure 1, Item 14) right, and to decrease this level - left.

In the operation mode the Generator monitors the stability of load impedance. If, during operation, load impedance is changed by over 20% or beyond the permissible range, the Generator switches off the output signal and displays

the warning message ".

If there are nonlinear elements in the load circuit (for example, semi-conductors), stray direct voltage may appear in the output circuit. The Generator checks for such voltage. If the reached level makes it dangerous to operate the Generator, the output signal switches off and the display shows

the warning message ".

Warning and notification messages

In various operation modes, in case of an incident, the Generator display may show system-notification icons.

	There is extraneous voltage
	Unstable load impedance
	Overload (output power level is exceeded)
	Overheating
	Matching load
	Please, wait
	Integrated antenna is used

Internal power source

When battery-powered, the Generator uses the internal lithium-pol battery.

The Generator battery life time depends on several factors: the selected output power level, operation mode (continuous or pulsed), load type (active or reactive), ambient temperature, whether the integrated antenna is used. The battery life time is shortest for an active load type, maximum power, in the continuous operation mode. In this case the battery life time is at least 1 hour.

If the load is of a reactive type, in the operating pulsed mode at a medium power, the battery life time may increase up to several hours.

If the Generator is used stationarily, it is powered by AC mains (230 V 50 Hz) or by an external DC source (12 V).

The Generator is connected to mains 230 V using the power cord or to an external power source 12 V using a respective connecting cable.

If the Generator is connected to the mains or an external power source, the external power supply indication LED should be lit (see Figure 1, Item 1, 4). When the Generator is switched on, the battery charging process begins, and the display shows the charging level indicator "", which will be changing steadily according the charging process. When the battery is charged, the Generator will switch to the waiting mode. If the operator has not performed any control actions for some time, the Generator will switch off.

Reset

If there is a software error (because of a high electromagnetic interference level), the Generator may stop responding to the controls, including the on/off button. In this case use the button switching off the power supply mechanically "**RESET**" (see Figure 1, Item 18), located in an indentation.



By lowering the output power you can extend the Generator battery life time.

Marking

On the Generator there is the following marking:

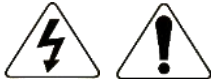
Marking reference designation	Description
	Stand-by (5009, IEC 60417-1)
	AC current (5032, IEC 60417-1)
	Warning! Electrical hazard (2.5, ГОСТ 12.4.026)
	Protective earthing clamp (5019, IEC 60417-1)

On the rear side of the Generator there is a plate with the following marking:
(see Figure 2).



Figure 2 – Plate with marking

PROPER USE



CAUTION!

ALL CONNECTIONS SHOULD ONLY BE DONE IF THE LINE IS DISCONNECTED FROM THE POWER SUPPLY ON BOTH SIDES. TO PREVENT THE GENERATOR FROM GOING OUT OF ORDER, FIRST DISCHARGE THE LINE BY CONNECTING THE CONDUCTORS TO EACH OTHER AND THE EARTHING DEVICE



CAUTION!

THE FOLLOWING IS PROHIBITED:

- **OPERATING THE GENERATOR WITHOUT GROUNDING;**
- **NEVER REMOVE THE EARTHING DEVICE IF THE GENERATOR IS SWITCHED ON;**
- **OPERATING THE GENERATOR IF THERE IS CONDENSATE, MOIST OR FROST ON THE INSULATORS OR CURRENT DISTRIBUTORS;**
- **OPERATING THE GENERATOR IF IT IS OUT OF ORDER;**
- **CONNECTING THE GENERATOR TO AN UNEARTHED OBJECT UNDER TEST;**
- **CONNECTING THE LINE UNDER TEST TO THE GENERATOR IF THE LINE IS NOT DISCONNECTED FROM THE POWER SUPPLY;**
- **LEAVING THE GENERATOR ON WITHOUT SUPERVISION BY THE OPERATING STAFF;**
- **PERFORMING WORK ON THE CABLE DURING FAULT LOCATION**

Preparation for use

Study this guide.

Follow all the organizational and technical directions of the safety regulations ensuring safe device operation. Put up temporary shields, ropes, etc. with the warning "**Stop! High voltage!**".

Disconnect the cable from the connection objects on both sides (prior to this the cable should be disconnected from the power supply).

Connect one end of the earthing wire to the Generator earthing terminal "Ⓛ" (see Figure 1, Item 11), and the other end – to the protective earthing loop/protective earthing spike.



CAUTION!

YOU MUST NOT OPERATE THE DEVICE WITHOUT PROTECTIVE EARTHING!

If need be, connect the Generator to an AC mains 230 V with the power cord or to a DC mains 12 V with a connecting cable 12 V.

The Generator is ready for use.

Operating the device

Cable route location

Direct coupling

Prepare the Generator for use.

Connect the Generator to the object being examined as shown in Figure 3:

- connect one end of the red wire to the red output socket "⚡" of the Generator, and the alligator-clip end – to the conductor, earthed on the other end of the cable being examined; prior to this, the cable should be disconnected from the power supply;
- connect one end of the black wire to the black output socket "⚡" of the Generator, and the alligator-clip end – to the earthed shield of the cable being examined;

Switch on the Generator by pressing the button "⏻".

Select the required operation mode by pressing the button "MODE" (⚡ or ⚡).

Select the required operating frequency by pressing the button "FREQ".

Set the required Generator output power level by smoothly turning the encoder knob "◀▶" right to increase the level, and left - to decrease the level.

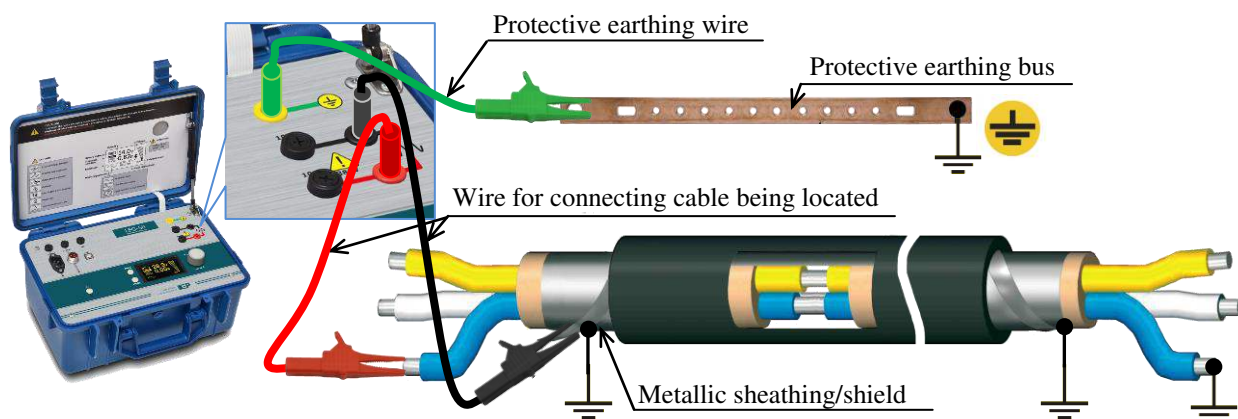


Figure 3 – Generator Connection chart for cable route location and line depth determination
(cable location using direct coupling)

To activate the pulsed mode, press the encoder knob "PULSE ", in which case at the bottom of the screen you will see the message "PULSE ".

Having finished location procedures, switch off the Generator by pressing the button "".

Disconnect the cables and wires in inverse order.

Capacitive coupling method

The capacitive coupling method can be used when only a short section of a cable route needs to be traced. This method allows to trace about 70% of the whole cable length.

Prepare the Generator for use.

Connect the Generator to the object being examined as shown in Figure 4:

- connect one end of the red wire to the red output socket "" of the Generator, and the alligator-clip end – to the conductor of the cable being examined; prior to this, the cable should be disconnected from the power supply;
- connect one end of the black wire to the black output socket "" of the Generator, and the alligator-clip end – to the earthed shield of the cable being examined.

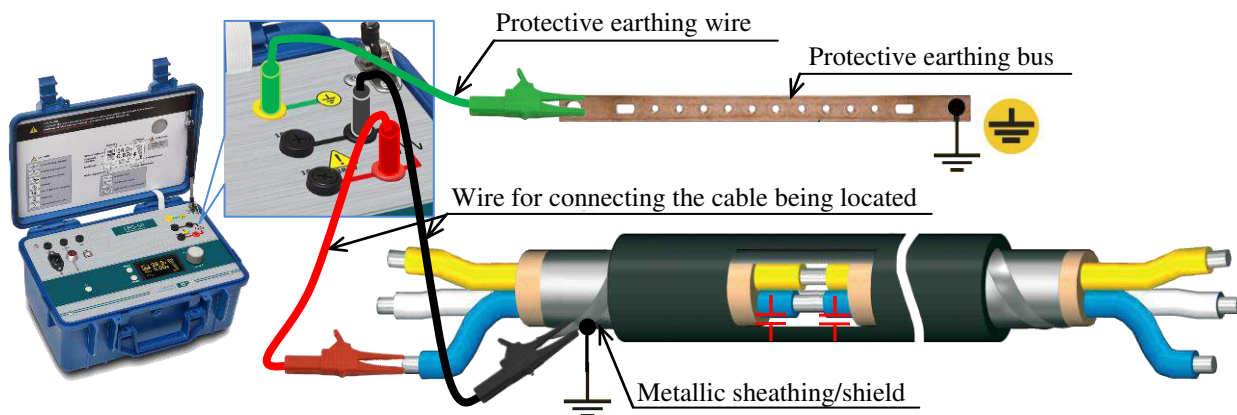
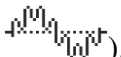


Figure 4 – Generator Connection chart for cable route location and line depth determination (cable location using capacitive coupling)

Switch on the Generator by pressing the button "".

Select the required operation mode by pressing the button "MODE" ( or ).

Select the required operating frequency by pressing the button "FREQ".



For this method a frequency of 8440 Hz is recommended.

Set the required Generator output power level by smoothly turning the encoder knob "◀.....▶" right to increase the level, and left - to decrease the level.

To activate the pulsed mode, press the encoder knob "PULSE ", in which case at the bottom of the screen you will see the message "PULSE .

Having finished location procedures, switch off the Generator by pressing the button ".

Disconnect the cables and wires in inverse order.

Inductive coupling via integrated antenna

Prepare the Generator for use.

Place the Generator with an open lid parallel to the shielded cable/pipeline being located as shown in Figure 5.



Figure 5 – Cable/pipeline location using closed-loop method



Do not place the Generator if you can see large metal objects, e.g. manhole covers, conduit box covers, etc. as they will be in the way of the antenna signal transmitting. When this coupling method is used, the signal is transmitted to all metal pipes and cables in the Generator visibility range.

- Switch on the Generator by pressing the button ".
- Select the operation mode " by pressing the button "MODE".



It is impossible to change the frequency when using this mode. This coupling method can only be used at a frequency of 8440 Hz.

Set the required Generator output power level by smoothly turning the encoder knob "◀.....▶" right to increase the level, and left - to decrease the level.

Having finished location procedures, switch off the Generator by pressing the button "⏻".

Inductive coupling via transmitter clamp

Prepare the Generator for use.

Connect the transmitter clamp to the output sockets "⚡" of the Generator. Connect the Generator to the object being examined as shown in Figure 6:

- close the transmitter clamp around the cable being located.

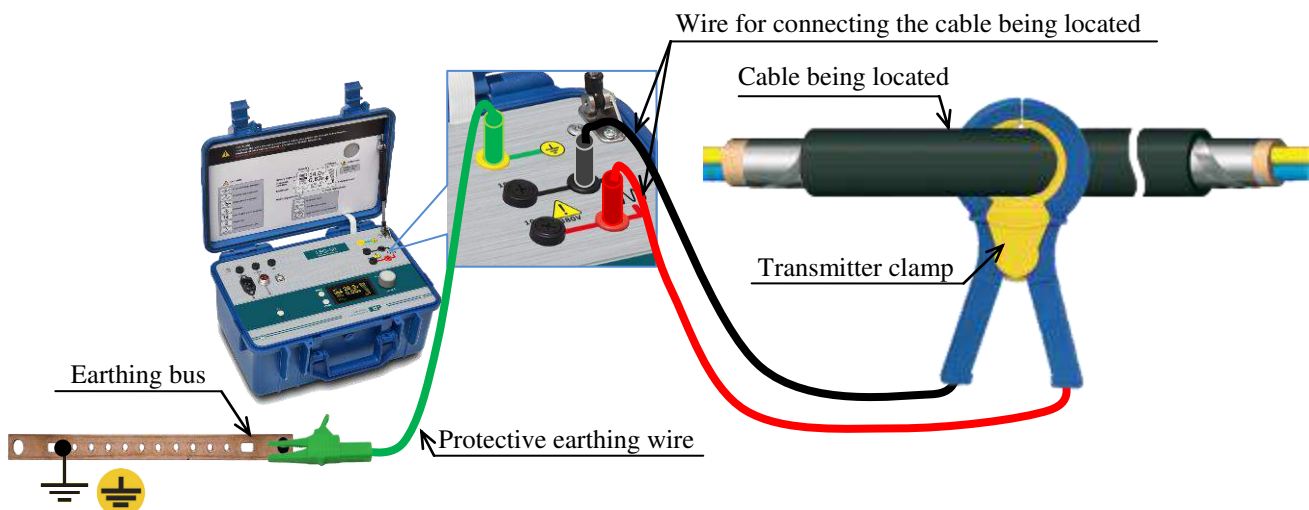


Figure 6 – Connection chart. Connecting the Generator to the cable being located (cable location using inductive coupling via a transmitter clamp)

Switch on the Generator by pressing the button "⏻".

Select the required operation mode by pressing the button "MODE" (⚡ or ⚡⚡⚡).

Select the required operating frequency by pressing the button "FREQ".



For this method a frequency of 8440 Hz is recommended.

Set the required Generator output power level by smoothly turning the encoder knob "◀.....▶" right to increase the level, and left - to decrease the level.

To activate the pulsed mode, press the encoder knob "**PULSE** ", in which case at the bottom of the screen you will see the message "**PULSE** ".

Having finished location procedures, switch off the Generator by pressing the button "".

Disconnect the cables and wires in inverse order.

Locating a cable in a bundle

In some cases, after a trench has been excavated in the area of a possible cable fault, it is necessary to locate a damaged cable in a cable bundle.

To locate such a cable, first prepare the Generator for use.

Connect the Generator to the object being examined as shown in Figure 7:

- connect one end of the red wire to the red output socket "" of the Generator;
- connect one end of the black wire to the black output socket "" of the Generator;
- connect the alligator-clip ends of the red and black wires to the intact cable conductors, the other ends of which should be shorted between themselves with a jumper.

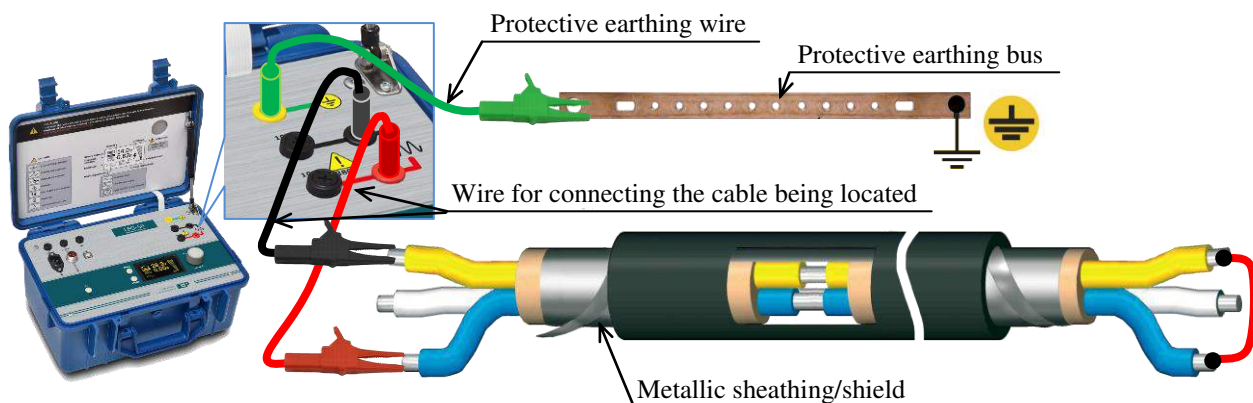
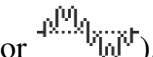


Figure 7 – Chart of Generator connection to cable conductors
(for locating cable in bundle)

Switch on the Generator by pressing the button "".

Select the required operation mode by pressing the button "**MODE**"

( or ).

Select the required operating frequency by pressing the button "**FREQ**".

Set the required Generator output power level by smoothly turning the encoder knob "" right to increase the level, and left - to decrease the level.

To activate the pulsed mode, press the encoder knob "**PULSE** ", in which case at the bottom of the screen you will see the message "**PULSE** ".

Having finished location procedures, switch off the Generator by pressing the button "".

Disconnect the cables and wires in inverse order.

Inter-phase cable fault location

Prepare the Generator for use.

Connect the Generator to the object being examined as shown in Figure 8:

- connect the wires at one side to the output sockets "" of the Generator, and at the alligator-clip ends – to the conductors of the cable being examined; prior to this, the cable should be disconnected from the power supply;
- earth the shield of the cable being examined.

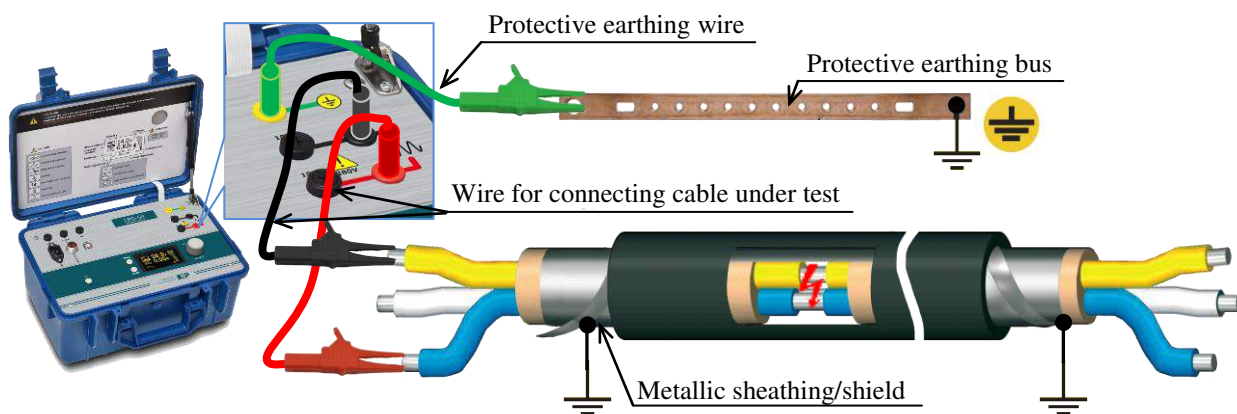


Figure 8 – Chart of Generator connection to cable conductors
 (conductor fault location)

Switch on the Generator by pressing the button "".

Select the required operation mode by pressing the button "**MODE**"

( or ).

Select the required operating frequency by pressing the button "**FREQ**".

Set the required Generator output power level by smoothly turning the encoder knob "" right to increase the level, and left - to decrease the level.

To activate the pulsed mode, press the encoder knob "**PULSE** ", in which case at the bottom of the screen you will see the message "**PULSE** ".

Having finished location procedures, switch off the Generator by pressing the button "".

Disconnect the cables and wires in inverse order.

Pipeline location using earthing spike

Prepare the Generator for use.

Connect the Generator to the object being examined as shown in Figure 9:

- connect one end of the red wire to the red output socket "⚡" of the Generator, and the alligator-clip end – to the pipeline being located; prior to this, the pipeline should be cleared from paint and rust;
- connect one end of the black wire to the black output socket "⚡" of the Generator, and the alligator-clip end – to the earthing spike;
- position the earthing spike in the ground at a distance of 20 m relative to the possible pipeline route. Make sure there is good contact between the ground and the earthing spike.

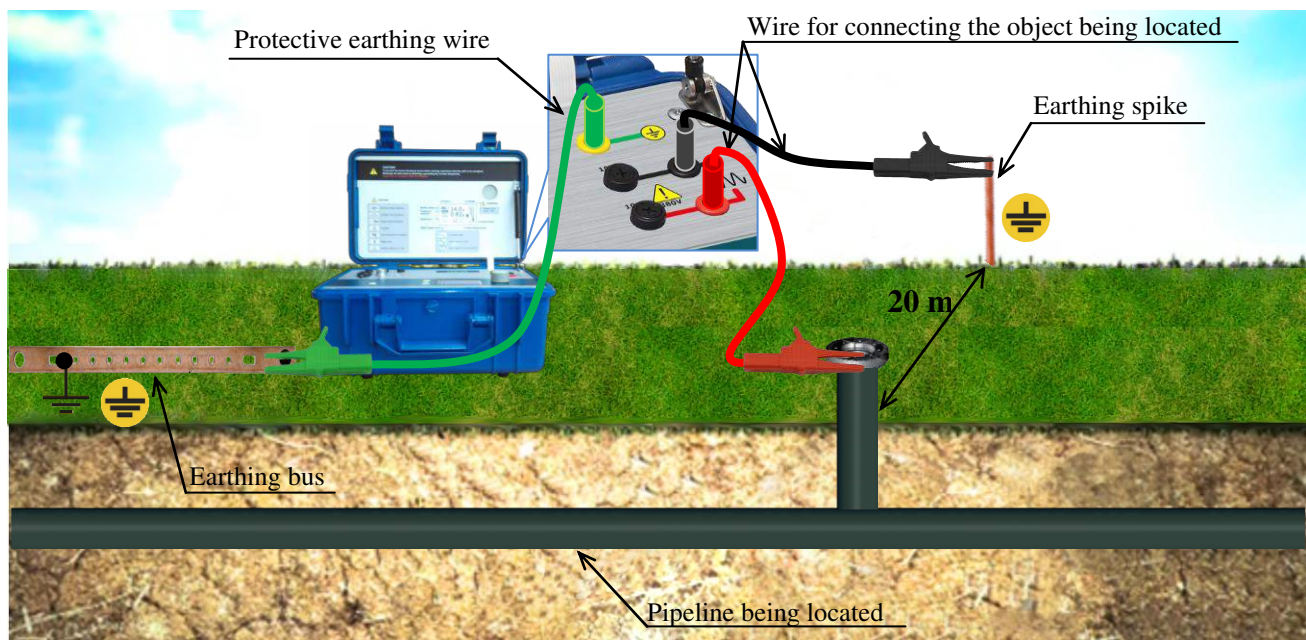


Figure 9 – Connection chart. Connecting Generator to pipeline being connected (direct coupling onto pipeline)

Switch on the Generator by pressing the button "⏻".

Select the required operation mode by pressing the button "MODE" (⚡ or ⚡⚡⚡).

Select the required operating frequency by pressing the button "FREQ".

Set the required Generator output power level by smoothly turning the encoder knob "◀⚡▶" right to increase the level, and left - to decrease the level.

To activate the pulsed mode, press the encoder knob "PULSE ⚡", in which case at the bottom of the screen you will see the message "PULSE ⚡⚡".

Having finished location procedures, switch off the Generator by pressing the button "⏻".

Disconnect the cables and wires in inverse order.



When using long connecting wires, fully unwind them. The connection wires and the line being examined should be spaced as far as possible. If the wires are placed on the line being located, the location results will be distorted.

Pipeline location using closed-loop method

Prepare the Generator for use.

Connect the Generator to the object being examined as shown in Figure 10:

- connect one end of the red wire to the red output socket "⚡" of the Generator, and the alligator-clip end – to the pipeline being located; prior to this, the pipeline should be cleared from paint and rust;
- connect one end of the black wire to the black output socket "⚡" of the Generator, and the alligator-clip end – to the pipeline being located; prior to this, the pipeline should be cleared from paint and rust;

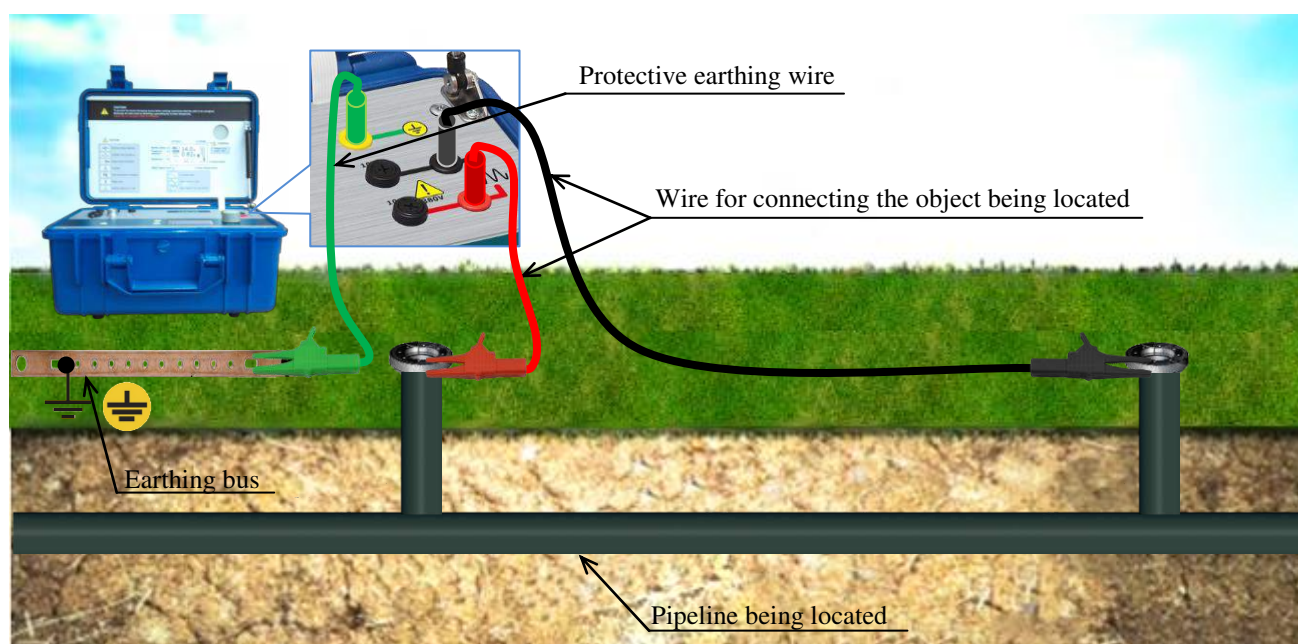


Figure 10 – Connection chart. Connecting the Generator to the pipeline being located (pipeline location using closed-loop method)

Switch on the Generator by pressing the button "⏻".

Select the required operation mode by pressing the button "MODE" (⚡ or ⚡).

Select the required operating frequency by pressing the button "FREQ".

Set the required Generator output power level by smoothly turning the encoder knob "◀.....▶" right to increase the level, and left - to decrease the level.

To activate the pulsed mode, press the encoder knob "PULSE ", in which case at the bottom of the screen you will see the message "PULSE ".

Having finished location procedures, switch off the Generator by pressing the button "".

Disconnect the cables and wires in inverse order.



When using long connection wires, fully unwind them. The connecting wires and the line being examined should be spaced as far as possible. If the wires are placed on the line being located, the location results will be distorted.

MAINTENANCE

Changing fuses



CAUTION!

DANGEROUSLY HIGH VOLTAGE!

BEFORE CHECKING AND REPLACING FUSES, MAKE SURE THE POWER CORD IS DISCONNECTED FROM THE GENERATOR, AND THE GENERATOR IS SWITCHED OFF! ONLY FUSES OF THE SAME CURRENT VALUE AS INDICATED ON THE GENERATOR CONTROL PANEL ARE TO BE USED!

If the Generator appears to be out of order, first check the integrity of the fuses, the holders of which are on the control panel. First of all, check the output fuses as the output of the Generator is more susceptible to incidents.

To check and replace the fuses, do the following:

- unwind the cap of the fuse holder on the control panel of the Generator;
- remove and check the fuse;
- replace the fuse if necessary;
- position the fuse in the holder and screw back in the holder cap.

Internal battery charge

To charge the internal battery, connect the Generator to AC mains 230 V via the power cord or to DC mains 12 V via a connecting cable 12 V. If there is voltage, the LED indicating the presence of mains voltage will be lit (see Figure 1, Items 1, 4). After the button "⏻" is pressed and the Generator is switched on, the battery charging process will begin, the display will show a graphic indicator of battery charge "▢▢▢▢▢", which will be changing according to the charging process. After the battery is fully charged, the Generator will switch to the waiting mode. If the operator has not performed any control actions for some time, the Generator will switch off automatically.

Display maintenance



WARNING!
DO NOT CLEAN THE DISPLAY SCREEN USING ABRASIVE CLEANSERS, FOR INSTANCE, DISSOLVING AGENTS OR BENZINE

To clean the Generator display, use a soft tissue for cleansing with a liquid or a microfibre cloth for dry-type cleansing.