TRACE-LOCATOR
P-410 MASTER

USER'S MANUAL

P-410-MASTER

SVPRIBOR

CONTENTS

# 1 FUNCTION

Trace-locator P-410-MASTER was carefully designed to help with:

1) Trace searching, verifying the underground and open cable lines (open transmission lines) and power cables; metal cords and pipelines (water-, oil- and gas pipelines); supply pipelines that have metallic coat or metallic conductors;
2) continuous positional and directional checking, occurrence depth and current flow in underground supply lines;
3) "maximum"- "minimum" search method;
4) guidance control for channel-identification of signal in line/pipe bottleneck or cable bundles;
5) direct sound locating for orientating in complicated situations and trace-locating of noisy wires;
6) controlling of received frequencies in wideband mode (spectrum);
7) trace-searching in wideband mode;
8) phase (contactless) method of tracing in copper wire coating and fiber optic links (FOL);
9) tracing of cable interruption or cable core short circuits.

In active mode the P-410-MASTER allows you to verify 3-frequency signal and could be used as a unit with TC-310A-2 transmitter, TC-210A-2, TC-210A, TC-21A, as well as with any transmitter 6562,5 ± 1 Hz or (and) 2187,5 ± 1 Hz or (and) 273,5 ± 0,5 Hz frequency.

In passive mode – without using a transmitter – Trace-locator could be used as a controller of received frequencies and for trace-searching of power cables, trace-locating of noisy wires, massive metallic supply lines, and supply lines with metallic coating (pipelines, ropes, etc.).

The Trace-Locator is power supplied by 4-Ni-Mh A-type batteries with 2,3 A/hrs capacity. This provides 13-hour continuous work of the device.

Trace-indication could be done visually and with acoustic reception signal (using headphones and built-in emitter).

# 2 ENVIRONMENTAL SPECIFICATION

- Operation temperature –20 ÷ +50$^{o}$C
- Relative air humidity to 90% at 30$^{o}$C
- Air pressure 86 ÷ 106 kPa

# 3 SPECIFICATION

| | |
|---|---|
| Active Frequency | 6562,5 ± 1 Hz<br>2187,5 ± 1 Hz<br>273,5 ± 0,5 Hz |
| Bandwidth Amplitude –3 dB (≤)<br>for frequency 6562,5 Hz<br>for frequency 2187,5 Hz<br>for frequency 273,5 Hz | <br>45 Hz<br>15 Hz<br>2,5 Hz |
| Depth | 6 m |
| Depth Measurement Accuracy | ±5%+10 cm |
| Trace location accuracy | 10 cm |
| Trace locating of insulation interruption with transitional resistance[1] | 0 – 100 kOhm |
| Spectrum Frequency Range | 10 ÷ 20 000 Hz |
| Battery life (continuous operation) | 13 h |
| Battery Type | 4-Ni-Mh AA<br>type , 2,3 A/h. |
| Charging Time (≤) | 4 h |
| Dimensions | 257x88x685 mm |
| Weight (with the battery) | 1,9 kg |

# 4 SUPPLIED ACCESSORIES

| № | Name | Pieces |
|---|---|---|
| 1. | P-410-MASTER | 1 |
| 2. | Charge adapter 12 V, 0.5 A | 1 |
| 3. | User's manual | 1 |
| 4. | Headphones | 1 |
| 5. | Headphones Bag | 1 |

# 5 PRINCIPLE OF OPERATION and DEVICE CONSTRUCTION

## *5.1 Principle Of Operation*

P-410-MASTER Trace Locator is a signal receiver for searching of underground lines, their depth and signal current, and also the locating of cable interruption.

In active search mode (***"Map", "Level", "LF-HF 273 Hz"*** or ***"Phase 6 kHz" modes***) transmitter is the source of the sound frequency signal that being connected to core of the searched cable. Alternating current produces a magnetic field that induces

[1] Amplitude and phase (contactless) methods.

a signal in the receiver inductive sensor. Sensors are located in the upper and lower parts of the receiver. Signals induced in the sensor then come into the receiving device where analog and digital processing is being done. Then the results are displayed on the LCD and sound emitter.

In passive mode (***"SPECTUM" mode***) the receiver is being registered as an alternating magnetic field in frequency sound range with the source in the power cable with power current and noisy wire nets.

### *5.2 Device Construction*

The device was constructed as a monoblock. You can see the device in the pic.5.1. In the upper panel there are:

- ▲ and ▼ Keys of sensitivity
- LCD Display
- ABTO Ok - ON /OFF Menu Key
- F - Function Key

In the lower panel there are:

- ⏻ - ON/OFF Key
- Headphones Outlet
- AC/DC Adaptor Outlet

The 4-AA batteries compartment locates in the side face of the device.

Pic.5.1. General view

## 6 PREPARING TO WORK

### *6.1 Getting started*

Carefully unpack the trace-locator and make sure it doesn't have any visible mechanical damages of the case. If the device has been stored at hyper humidity or at low temperatures, wait for 24 hours before starting off.

- KEEP OUT WATER

The Trace-Locator is power supplied by 4-Ni-Mh A-type batteries with 2,3 A/hrs capacity. This provides 13-hour continuous work of the device.

Open the battery compartment under the lower panel of the device and insert the batteries in the correct direction by aligning the "+" and "–" marks on the batteries with the polarity markings inside the battery compartment.

- BEFORE USING MAKE SURE THE BATTERIES ARE FULLY CHARGED, IF NECESSARY PLUGS THE DEVICE IN!
- KEEP THE BATTERIES AWAY FROM THE DEVICE TO AVOID THEIR DAMAGE

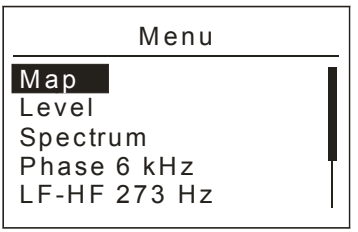
Connect the AC power adaptor to the trace-locator and fully charge the batteries. The process of charging is displayed on the LCD. You can't put the device on by the  when being charged.

New batteries require 10-12 full charge-discharge cycles to obtain maximum level of capacity. The charger indicates the level of operability of the batteries - overcharged or defective batteries wouldn't be charged.

Every time before tracing the batteries should be charged.

Before long-time storage or transporting charge the batteries in order to avoid their damage and take them out of the compartment.

Turn the device ON  . If it is properly connected, then it's serial number and software version will be displayed. The Menu comes on as shown in pic.6.1.



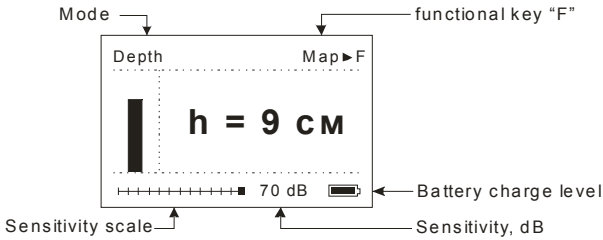

Pic. 6.1. MENU

When the battery is low, the device turns off.

## *6.2 LCD and Menu*

Before using the trace-locator choose/set the mode. To change/set the mode use MENU. Enter the MENU using  as shown in pic.6.1.

MENU appears on the display. To change modes press  and  . To exit from the set menu press  .




Pic.6.2. DISPLAY PANEL

Every mode name and function name F are shown in the upper line on the display, in the lower line you can see the meaning of the gain controller in dB and the battery level. The example of ***"LEVEL"*** mode is shown in pic.6.2. Every mode is described in Table 1.

Table 1. MENU

| Modes | Available Measurements |
|---|---|
| ***"MAP"*** | Frequency Signal Level 2187,5 Hz<br>Direction, Position, Signal Current, Depth |
| ***"LEVEL"*** | Frequency Signal Level 2187,5 Hz<br>Signal Current, Depth, Minimum and Maximum Modes |
| ***"LF-HF 273 Hz"*** | Frequency Signal Level 273,5 Hz<br>Difference of Frequency Signal Level 273,5 Hz and 2187,5 Hz |
| ***"PHASE 6 kHz"*** | Frequency Signal Level 6562,5 Hz<br>Difference of Signal Phases 2187,5 Hz and 6562,5 Hz |
| ***"SPECTRUM"*** | Received Signal Spectrum - Energo (10-500 Hz) and Wide (10-20000 Hz) |
| ***"Direct sound off"*** | Turn ON the "Direct sound" in SPECTRUM mode |

## *6.3 Sensitivity and Auto-sensitivity*

When tracing, press ▲ (<) or ▼ (>) to set the signal level up to 70-80 points. To set the required level automatically, press ▲ and ▼ simultaneously.

In the lower line of the display you'll see the sensitivity scale with grating period 2 dB and the meaning of sensitivity in dB.


Pic 6.9. DISPALAY INDEX WHEN OVERLOADED

If there's a background noise, high sensitivity causes corrupted signal level. If so, OVERLOAD will be displayed.

# 7 TRACING

To trace the underground line, connect the outlet of the transmitter with the 1st wire to the cable core and ground the 2nd wire. Grounding is usually done 10 - 20 м away from the trace. The distant end of the cable core must be grounded.

The test signal transmitter must be connected to the metallic coat of the active cable. Tracing range will get lower.

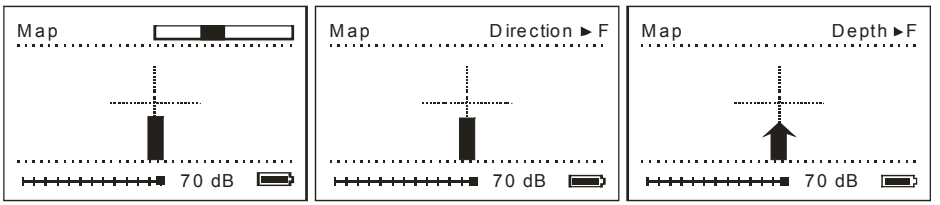
When searching pipelines or ropes, transmitter should be connected to the pipeline with the 1st wire and the 2nd wire must be grounded. Grounding is usually done 10 - 20 м away from the trace. Since pipelines and ropes are not insolated, the tracing range could vary from 0,2 to 5 km, depends on curtain circumstances.

Turn the transmitter on. Set the **"HF**" mode. If there's a lot of industrial noise, we recommend you to use the **"HF-PAUSE**" mode.

Set ***MAP*** mode on the trace-locator**.**

## *7.1 MAP Mode*

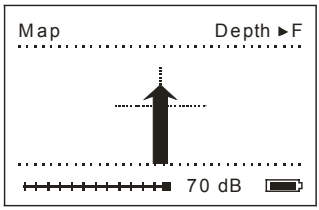
Cable map has easy-readable graphic information that is handy for quick orienting. The mode combines all the innovation methods of tracing: measuring of the signal level, using *minimum* method of indicating above the cable, defining of "own/right-wrong" cable regarding the signal direction.



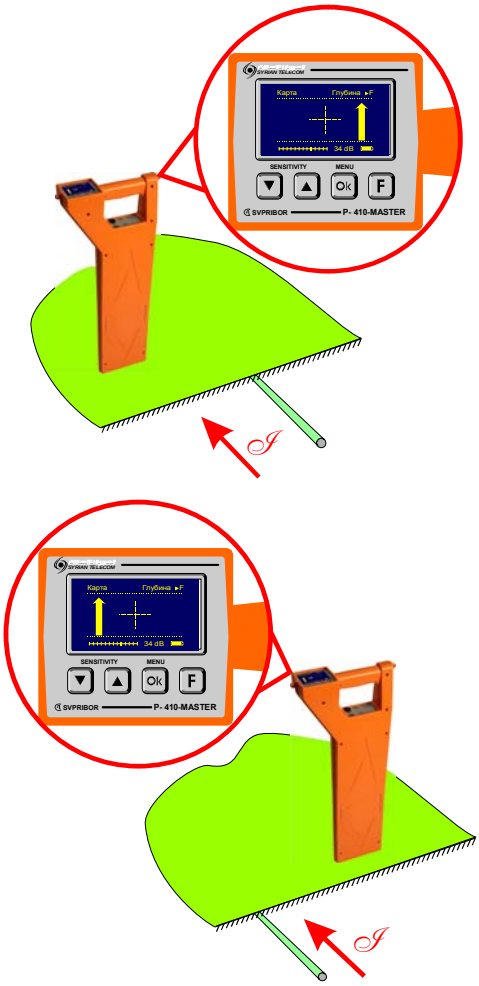

Pic.1. **MAP** Mode. Defining the signal direction

Do the preliminary tracing. The level of the signal will be displayed as a line or pointer. When you get the firm signal, the direction of the cable signal current will be defined in a few seconds (Pic 1,a), but the level indicator wouldn't look as a pointer. Settle the required direction pressing F (Pic. 1,b), then the indicator will be displayed as a pointer again.

Pic. 2, shows the position of the trace-locator above the trace as displayed. When the pointer is in the middle of the cross-point, you can measure the depth pressing F. (Pic. 3).




Pic 3. The position when measuring of the depth is available.

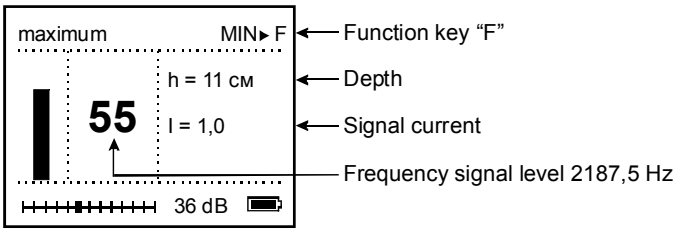



Pic. 2. **Cable MAP**, a – the "right" cable is on the right side of the device: signal from the transmitter goes straight on through the cable; b – the "right" cable is on the left.

## 7.2 ***LEVEL*** *Mode*

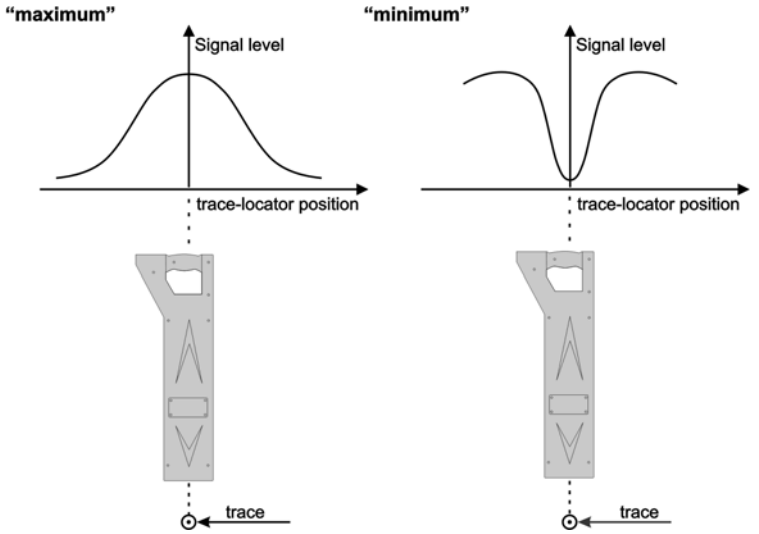
Use ***LEVEL*** mode to define the trace with permanent digital monitoring of the signal level with 2187,5 Hz frequency, depth and signal current[2].

Set ***LEVEL*** mode on the trace-locator**.**




Pic. 4. **LEVEL** mode

Do tracing at maximum signal level. *Maximum* method of indicating helps you to determine approximate trace location. To gain more accurate measurement, use the ***minimum*** method mode.



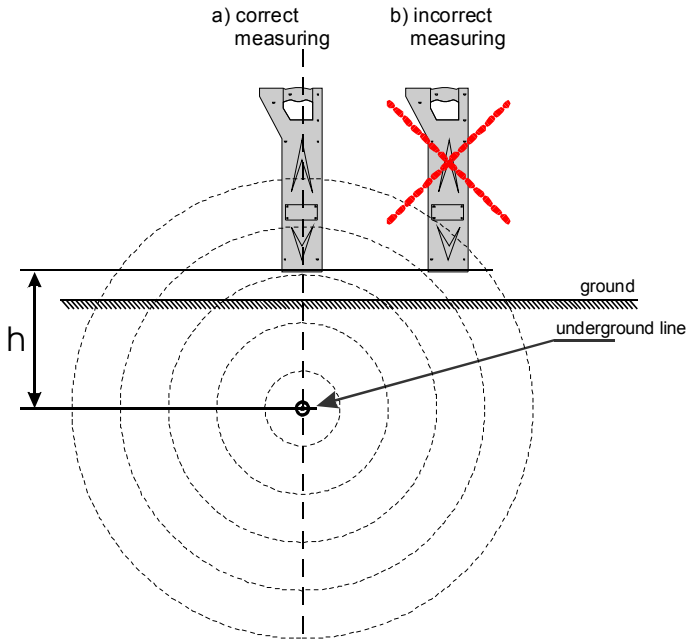

Pic. 5. Dependence of the signal level on the trace-locator position and the search mode

[2] At weak signal, depth and signal current are not displayed

Every mode name and function name F are shown in the upper line on the display. Press F to switch the mode off. You can see dependence of the signal level on the trace-locator position and the search mode in Pic.5.

When tracing at ***minimum*** method mode, follow the ***minimum*** signal level. This mode helps you to determine exact trace location.

At ***LEVEL*** mode the trace with permanent digital monitoring of the depth and signal current are displayed. This measurements are correct at exact point of the trace-locator above the line (pic. 6).




Pic. 6. Depth and signal current measuring

## *7.3 Trace search at the bottleneck of supply lines*

At the bottleneck of supply lines the signal is received both from the cable, connected to the transmitter and from parallel supply lines. To trace the right cable different methods could be used. We recommend you to do the tracing connecting to the grounded distant end of the cable core. Turn the transmitter on.

**Current Direction Method.** This method is based on the principle of the reverse current direction in the parallel supply lines. For this method permanent mode of the signal generation in the transmitter is preferable but you can also use any other mode.

Set ***MAP*** mode on the trace-locator**.**

When the location of the trace out-off the bottleneck is determined, place the trace-locator above the "right" cable, and fix the direction of the cable. The signal level indicator would look as a pointer and it would stay like this till you move along the "right" cable. If you move opposite direction, you'll hear a beep and the pointer will be redirected. The same thing happens if you switch to the near-by line.

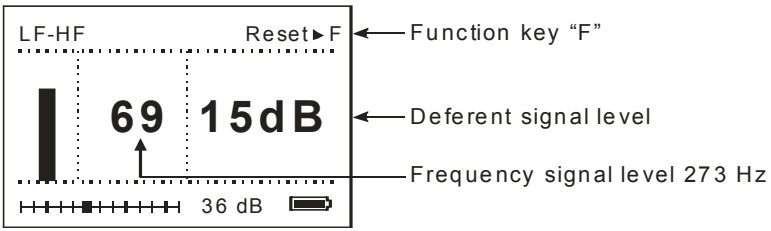
If the trace location is unknown, then choose the cable with the maximum signal level (the most correct results are gained at ***LF-HF 273 Hz*** mode in the trace-locator and ***LF-HF*** – in transmitter). Place the trace-locator above this cable and fix the direction. If this is the "right" cable, the rest of the cable would cause redirection. If this is the "wrong" cable, then only the signal from the "right" cable will redirect the pointer.

At a low signal the pointer showing the direction starts blinking. If in 30 sec the level of the signal doesn't increase, the given direction will be lost, and the level indicator will be displayed as a straight line. In this case you must set up a new direction.

**Current Measuring Method.** This method is based on the fact that the current meaning from the induced signal in the near-by or parallel supply lines is lower than in the cable connected to the transmitter.

You can use any process mode for the transmitter. Set ***LEVEL*** mode on the trace-locator**.** Fix the trace-locator above the cable, set the regular level of the signal, and you'll see the signal current displayed. You should remember that incorrect meaning of the signal current appears only if the trace-locator is exactly above the trace. You can find detailed description of depth and signal current measuring in article 7.2.

**LF-HF method.** This method is based on the fact that the HF induced signal in parallel or near-by supply lines is higher that in LF. Comparison of the signal levels at these frequencies allows determining the "right" cable at fine precision.




Pic. 7.7. ***LF-HF*** mode.

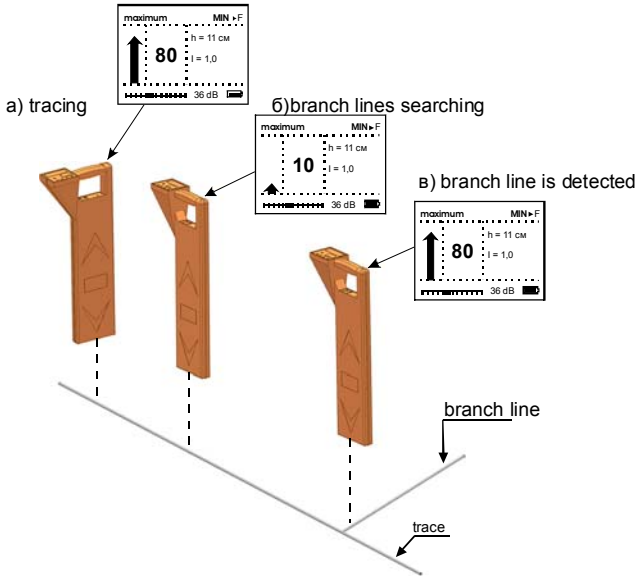
Set ***LF-HF 273 Hz*** mode on the trace-locator**.** Set ***LF-HF*** mode on the transmitter.

- Fix trace-locator exactly above the trace.
- Specify the signal level in the scale range.
- Null the meaning of the level difference pressing F.

Moving along the trace, the meaning of the level difference will be progressively increasing (a few dB by 100 m) because of different or unequal signal propagation at 273 Hz and 2187,5 Hz frequencies in the cable. Big difference increase will be displayed when a "wrong" cable is detected. The meaning is correct regardless of switching the modes till the device is off.

## *7.4 Branch Lines Search*

Set ***LEVEL*** mode on the trace-locator. Do tracing as described in article 7.1. Do the branch lines searching setting the trace-locator parallelly the trace as shown in pic.7.8. In this case the signal level from the "right" cable is minimum (Pic 7.8.b), and the branch lines will cause big increase of the signal level (Pic 7.8.в).




Pic.7.8. Branch lines searching: а) tracing, б) branch lines searching, в) branch line is detected

## *7.5 SPECTRUM mode*

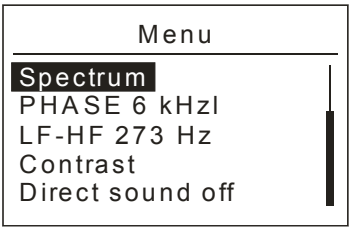
In passive mode – without using a transmitter – Trace-locator could be used as a controller of received frequencies and for trace-searching of power cables, trace-locating of noisy wires, massive metallic supply lines, and supply lines with metallic coating (pipelines, ropes, etc.).

Set ***SPECTRUM*** mode on the trace-locator. You'll see signal spectrum displayed in the frequency range at 10 ÷ 20 000 Hz (***WIDE***). Permanent frequency signal will be displayed on the sound emitter or headphones according to induced

signal level in antenna. Turn on the DIRECT SOUND mode to display the whole induced signal spectrum on sound emitter or headphones.

In MENU switch ***Direct sound OFF*** to ***Direct sound ON***. Set ***SPECTRUM*** mode on the trace-locator to continue the work.

Use *maximum* signal level method to trace the supply lines location.




Pic 7.9. MENU

For detailed displaying of the spectrum at 10-500 Hz (***ENERGO***) press F.

# 8 DEFECT TRACING

## *8.1 Defect Tracing With Amplitude Methods*

Amplitude method is based on reducing of the signal level in the place of defecting. When tracing the defects, it's important to carefully measure the depth since the signal level depends on it. You should remember that signal level and signal current will be smoothly reducing as getting further from the transmitter because of the linear capacitance of the cable.

Defect tracing in this method is also possible when the signal level and signal current are simultaneously controlled. The signal level reduces in the place of defect, so does the signal current.

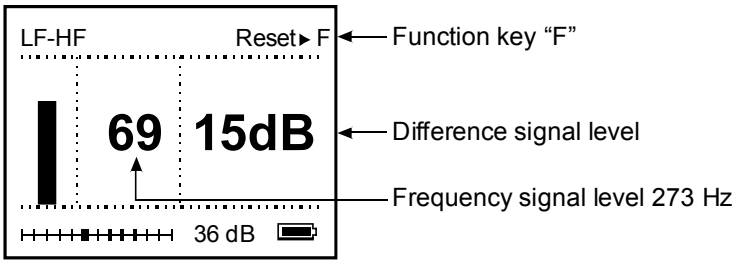
Sensitivity of the method is rather low, and this method could also be used in defect tracing at 1 κOhm.

***LF-HF 273 Hz* Mode**. The ***LF-HF*** method is based on comparising of the signal levels at 273 Hz and 2187,5 Hz frequencies. High-Ohm defects do not really influence the signal level at 2187,5 Hz frequency but you can notice significant reduction at 273 Hz. Comparising of the signal levels at these frequencies allow to determine the insulation defects with high accuracy. This method is more sensitive than the amplitude one and allows you to determine all the defects up to 10 kOhm.

Set ***LF-HF 273 Hz*** mode on the trace-locator. Set ***LF-HF*** mode on the transmitter. Stationary fix the trace-locator above the trace.

- Set the signal level up to 70-80 points.
- Null the level difference meanings pressing F.

While tracing, the meaning will be smoothly increasing (a few dB by100 m), because of the unequal signal propagation at 273 Hz and 2187,5 Hz. Significant difference increasing displays the place of defect. The meaning is correct regardless of switching the modes till the device is off.




Pic. 8.1. ***LF-HF 273 Hz*** mode

## *8.2 Defect tracing in insulation by phase method*

Phase method is used to trace the defects in insulation coat of cables where metallic coating is missing, as well as for tracing the defect in insulation coating of fiber optic links (FOL).

Method is based on the principle that before the defect location, current in cable consists of capacitive current and resistive current leakage in the place of defect. When the place of defect is passed, current in cable has only capacitive constituent, and the phase of the signal current changes. Pic 8.2.

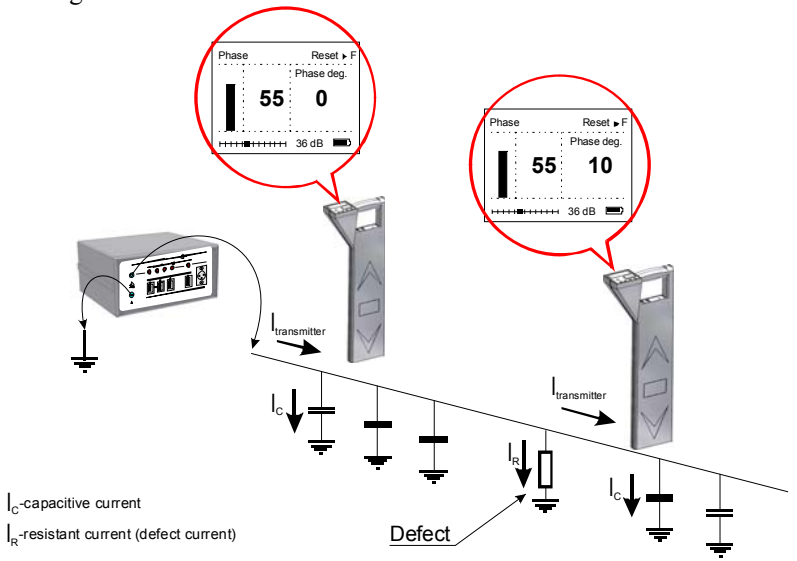
The sensitivity of this method is lower than at contact method and depends on linear capacitance of the cable, as well as on the leakage location. The lower cumulative capacity in a certain piece after leakage of cable is, the higher the sensitivity will be. Maximum sensitivity equals $1^0$ deviation in phase signal which helps to define the leakage up to 50 kOhm at 100 nF capacity in a certain piece after leakage. It’s important to remember that at this level the signal reduces and at the very end of the cable the meter may point low signal level where method doesn’t work.

Keep controlling the deviation in phase signal in the pre-taken trace.

Set ***LF-HF*** mode on the transmitter. Connect the outlet of the transmitter with the 1st wire to the cable core and ground the 2nd wire. Grounding is usually done 10 - 20 m away from the trace. The distant end of the cable core must be insolated.

Set ***PHASE 6 kHz*** mode on the trace-locator. The meaning of the phase difference between signals 2187,5 Hz and 6252,5 Hz is displayed. Fix the trace-locator firmly above the trace choose the sensitivity level pressing ▲ or ▼ and set the signal level not lower than at 70-80 points. The meaning of the difference between phase signals 2187,5 Hz and 6252,5 Hz is displayed. At low signal level there’s a possibility of measurement failure of phase signal. Null the meaning of the

phase pressing F. “***0 deg”*** readout must be stable. If it’s not possible to set *“**0 deg”***, it means that the noise level is excessive. So you can’t apply the phase method of defect tracing.




Pic. 8.2. Defect tracing by phase method

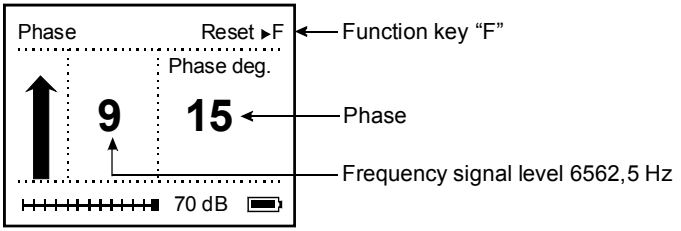



Рисунок 8.3. ***PHASE 6 kHz*** mode

To locate the defect moving along the trace do measuring of phase difference. The meaning of the difference will be progressively increasing (a degree unit by 100 m), because of different or unequal signal propagation at 273 Hz and 2187,5 Hz frequencies in the cable. Significant difference increase will be displayed when a defect is detected. To update the defect locations go back to the previous position and re-measure.

At”***20 deg.”*** level you’ll hear a beep.

## *8.3 Defect tracing in coat insulation of FOL*

To trace low-Ohm defects amplitude method is the most appropriate (effective).

In complicated cases phase and HF-LF methods could be used. Defect tracing in coat insulation of FOL is implemented when moving along the trace and similar to defect tracing in copper cable insulation. Also remember that in this case all the mentioned methods are less sensitive because linear capacity of the FOL coating is much higher than in the copper cable. As a rule sensitivity ≤ kOhm units.

## *8.4 Short-circuit in Cable Core Tracing*

Connect the transmitter to the defective cable core. It's recommended to work on the shortest piece of cable to reduce spurious signal through the cable capacity. Preferably to locate the defect closer to the distant end of the cable located aside from the transmitter.

Short-circuit is defined by the sharp decreasing of the signal level so make sure to control the depth. You can also define short-circuit by decreasing the signal current.

The most correct results are gained at ***LF-HF 273 Hz*** mode in the trace-locator and ***LF-HF*** – in transmitter but you should remember that the signal level in this case will be much lower. That's why you should firstly use **MAP** or **LEVEL** mode and then locate the defects in ***LF-HF 273 Hz*** mode.

## *8.5 Defining interrupts in cable core*

Connect the outlet of the transmitter with the 1st wire to the поврежденной cable core and ground the 2nd wire. Grounding is usually done 10 - 20 m away from the trace. The distant end of the cable core must be insolated.

Interrupt zone in amplitude method is defined by sharp decreasing of the signal level or current level in ***LEVEL*** mode.

Specify the place of interruption at low frequency. Set ***LF-HF 273 Hz*** mode on the trace-locator. Set ***LF-HF*** mode on the transmitter but remember that the signal level will be much lower.

## *8.6 Defining interrupts in ropes or pipelines*

Since the insulation in pipelines and ropes coating is missing, the transmission range may vary between 0,2 to 5 km and also depends on certain conditions. Interruption in ropes or pipelines is defined by the same method as in the core cable.

# 9 DEVICE TESTING

## *9.1 Conditions*

- air temperature 20 ± 2°C;
- relative humidity 65 ± 15%;
- air pressure 84 – 106 kPa.

## *9.2 Means of Testing*

For testing you need the measuring means and secondary equipment (Table 2).

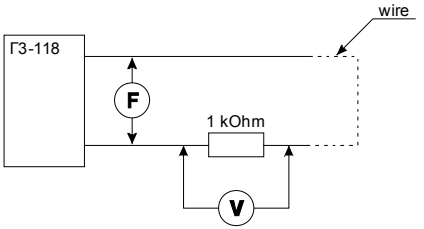
Table 2. The list measuring means and secondary equipment

| Name | Type | Quantity | Main Characteristics |
|---|---|---|---|
| Frequency meter | Ч3-64 | 1 | 20 Hz – 20 кHz accuracy $1x10^{-5}$ |
| Wide-band Millivoltmeter | В3-59 | 1 | 1 mV - 300 V accuracy $0,2x10^{-2}$ |
| LF Transmitter | Г3-118 | 1 | |
| Resistor | | 1 | 1 kOhm |
| Wire | | 10m | Wire 0,75mm$^2$ |

*Note:* For testing other sample means with relevant metrological characteristics could be used.

## *9.3 Testing*

9.3.1. To test the trace-locator you need to charge the battery and then unplug the adapter. Then connect the wire as shown in the pic. 9.1.




Pic. 9.1. Diagram of the trace-locator testing

9.3.2. Sensitivity measuring of trace-locator

Place the trace-locator vertically on the wire as shown in pic. 7.2. Set ***LEVEL*** mode on the trace-locator and set sensitivity at 44 dB. Set the generator at

2187,5 Hz±0,5 Hz and output signal level at 70 points. The resistor voltage measured with millivoltmeter must be at 200 mV.

Set ***PHASE 6 kHz*** mode on the trace-locator and sensitivity at 44 dB. Set the generator at 6562,5 Hz±1 Hz and output signal level at 70 points. The resistor voltage measured with millivoltmeter must be at 2 V.

Set ***LF-HF 273 Hz*** mode on the trace-locator and sensitivity at 44 dB. Set the generator at 273,5 Hz±0,5Hz and output signal level at 70 points. The resistor voltage measured with millivoltmeter must be at 1 B.

9.3.3. Frequency of maximum measuring

Set ***LEVEL*** mode on the trace-locator, on the generator Set the generator at 2187,5 Hz±0,5 Hz and set sensitivity on the trace-locator at 50-90 points, changing the frequency define the maximum meaning of the signal level. The defined frequency measured with the frequency meter must fit the meaning in Table 3.

Set ***PHASE 6 kHz*** mode on the trace-locator, on the generator Set the generator at 6562,5 Hz and set sensitivity on the trace-locator at 50-90 points, changing the frequency define the maximum meaning of the signal level. The defined frequency measured with the frequency meter must fit the meaning in Table 3.

Set ***LF-HF 273 Hz*** mode on the trace-locator, on the generator Set the generator at 273,5 Hz and set sensitivity on the trace-locator at 50-90 points, changing the frequency define the maximum meaning of the signal level. The defined frequency measured with the frequency meter must fit the meaning in Table 3.

9.3.4. Bandwidth calibration is measured by level –3dB. To do this the signal level must be set at 70 points of the frequency of maximum, then at permanent signal level of the generator you must first increase the frequency to gain 50 points; then decrease it to gain the same point. The difference between upper and lower meanings of frequency defines the bandwidth that must fit the meaning in Table 3.

Table 3.

| | | |
|---|---|---|
| Active frequency, Hz: | ***LEVEL*** mode | 2187,5 ± 1 |
| | ***PHASE 6 κHz*** mode | 6562,5 ± 1 |
| | ***LF-HF 273 Hz*** mode | 273,5 ± 0,5 |
| Bandwidth Amplitude –3 dB (≤) | | |
| | ***LEVEL*** mode, 2187,5 Hz | 15 Hz |
| | ***PHASE 6 κHz*** mode, 6562,5 Hz | 45 Hz |
| | ***LF-HF 273 Hz*** mode, 273,5 Hz | 2,5 Hz |

## *9.4 Depth measuring tuning*

Before running of the device, in order to gain the maximum frequency you may tune the depth measuring.

To tune the device you need a separate cable with the certain (known) depth - **h**. Locate and tag the point above the cable center. Turn on tune mode on the device

pressing ▲ and press ⏻ at the same time. In this mode MENU will display additional points:

1. ***SET DEPTH*** – Depth Tuning Function
2. ***DEFAULTS*** – Restore Factory Settings Function

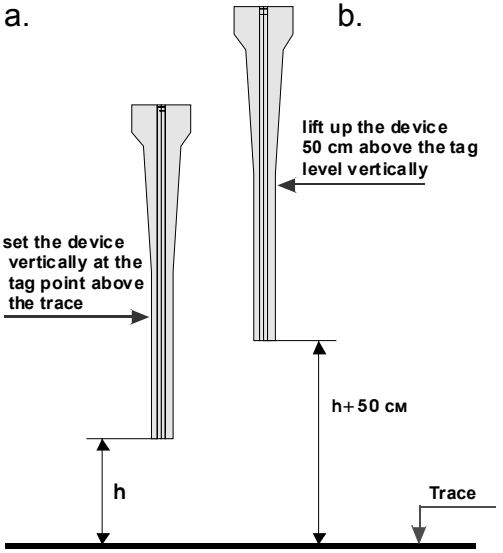
Set ***SET DEPTH*** mode on the trace-locator and press АВТО Ok then follow instructions displayed on LCD:

1. ***"Set the device above the trace and press "OK"*** – set the device vertically at the tag point above the trace (Pic 9.2.a.), press АВТО Ok. Tuning takes about 5 sec.
2. ***"Lift up the device at 50 sm and press "OK"*** – lift up the device 50 sm above the tag level vertically (Pic 9.2.b), press АВТО Ok. Tuning takes about 5 sec.

When the tuning is done, the trace-locator will be working on personal setting. Set ***LEVEL*** mode on the trace-locator and make sure that the displayed depth meaning matches the known depth - h.

If necessary, you may go back to factory settings. In MENU choose ***DEFAULTS*** and press АВТО Ok. Confirm using the factory settings ***"DEFAULTS YES →NO»***, вchoosing ***"YES"***.

***3.***




Pic 9.2. Trace-locator position when tuning the depth

## 10 SHIPPING and STORAGE

For shipping trace-locators must be done carefully packed according to the shipping rules and regulations.

- BEFORE LONG-TIME SHIPPING TO AVOID THE DAMAGE TAKE THE BATTERIES OUT
- BEFORE LONG-TIME STORAGE THE BATTERIES MUST BE FULLY CHARGED

WARNING! Make sure that the condition in the storage rooms or warehouses satisfy the requirements for storing the devices and doesn't have any dust, aggressive gas, acids or harmful crud that could cause rusting!

## 11 PRECIOUS METALS

The device does not include any precious metals

## 12 WARRANTY

Manufacturer guarantees operating capacity of the trace-locator within the warranty period only if all the required operating, storage, shipping conditions are carefully observed.

Warranty period - 24 months from the sale date.

Warranty does not cover the battery and charger.

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## 13 TEST CERTIFICATE

P-410-MASTER, S/N _____satisfies all the technical conditions and admitted and fits for service.

Manufacture Date "___"_____2008

Factory Representative (signature) _____