

Operation Manual

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This Manual is intended for explanation "NR-900S" Non-linear Junction Detector design & principle of operation as well as directions for its use.

For proper equipment use, study this Manual in depth.

The Device has an open UHF radiator of electromagnetic energy.

In active mode it represents a source of active interference that could cause certain malfunction of radio-electronic equipment located in close proximity

It is the responsibility of the User to comply with the corresponding Radio Communication Regulations of the country where 'NR-900S' NLJD is being used

1. APPLICATION

NR-900S Non-linear Junction Detector (fig. 1) is intended for searching concealed eavesdropping devices as well as other electronic items that contain semi-conductor elements.

NR-900S typical targets:

- Radio-mikes
- Microphone amplifiers
- Wired mikes
- Devices with IR or ultrasonic data & control channels
- Video & audio recorders
- Electronic timers, actuating devices of improvised explosive devices (IED) and etc.



NR-900S can detect typical targets in every operational mode: active, stand-by or even switched-off.

NR-900S ensures comprehensive searching capabilities and reliable localization of 'bugs' in fabric constructions, furniture and various office or home items.

NR-900S provides its operator with an opportunity to discriminate between industrial electronic elements and metal-to-metal contacts, so called 'corrosion diodes'.

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2. NR-900S COMPLETE SET (fig. 2)

	Tabl	le I
1	NR-900S main unit with "Pistol-grip" and control unit	1
—	"Rifle-buttstock" control panel (not shown)	1
2	Carry bag	1
3	Headphones	1
4	Car power adapter	1
5	Soshine SC-S1 battery charger	1
6	AC power adapter	1
7	Target imitator (test unit)	1
8	Soshine 18650 rechargeable cells	4
-	Operation manual (not shown)	1



complete set

3. MAIN TECHNICAL PARAMETERS

Target detection range		
Standard imitator tast unit	not loss 1 m	
Standard Initiator - test unit		not less 1 m
(maximum probing signal output &		
maximum receiver sensitivity		
Probing signal level	-max	0 dB
	-mid	-6 dB
	-min	-12 dB
Receiver input signal attenuation		10 dB, 20 dB, 30 dB, 40 dB
Received signal level indication -	-visual	LED display
-audio		Headphones
Power supply		2 x 'Soshine' 18650 Li-ion
		rechargeable cells
		2800mAh 3.7V
Operational condition:		
Operating temperature		$+5^{\circ}C$ $+40^{\circ}C$
Storage and shipping temperature		
D 1 4: 1 11: 12: 12: 12: 12: 12: 12: 12: 12:		Minus 20° C + 50° C
Relative humidity (under +25°C)		93±3 %
Continuous operation time with tw	wo	
sets of fully charged cells		
-Searchnig mode		not less 8 h
-Listening mode		not less 1 h
Weight		
Device in a ready for operation state		1.4 kg
Main unit		1.0 kg
'Pistol-grip' control unit		0.4 kg.
'Rifle-buttstock' control unit		1.2 kg
Complete set in a standard peaking		7.5 kg
Complete set in a standard packing		7.5 Kg

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4. FUNCTION

NR-900S represents a portable tool that consists of antenna system, transmitter and two receivers adjusted for double and triple frequency of the transmitter's signal.

Two operational modes are available: SEARCH and LISTEN.

In a SEARCH mode the probing signal is converted into a polyharmonic one on the radiated nonlinear elements (semi-conductive items or corroded metal-oxide-metal junction) and retransmitted, better say – scattered into ambient space.

Retransmitted $2^{nd} \& 3^{rd}$ harmonics of the probing signal are received and processed by receivers. Signals strength is indicated by LED bar-graph display: scales **2** and **3** accordingly. Moreover, it is reproduced via headphones in the form of interrupted beep-beep audio signal. The audio signal volume is proportional to the received harmonic signal level.

The receiver inputs switching as well as headphones volume control is available from the device control panel.

NR-900S has three output levels for radiated probing signal with 6 dB step and four levels of the receiver input signal attenuation each of 10 dB. The probing signal output level and receiver input signals attenuation can be switched over by Control panel buttons. This info is confirmed by LED display.

An auxiliary **LISTEN** mode is intended for the $2^{nd} \& 3^{rd}$ harmonic signals investigation for possible modulation imposed by internal processes in some active electronic circuits irradiated by the probing signal generated by NR-900S transmitter. At that, 'active' means the circuit is in an operational mode carrying out its particular function. Moreover, this can be done against the existing interference environment.

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5. DESIGN

5.1 MAIN UNIT

NR-900S main unit (see fig.3) represents a mono-block that consists of antenna system, electronic unit (transmitter with two receivers) and LED display - indication panel (pos. 1).



A dedicated quick release plate (pos. 2) is placed on a back side of the Main unit. It is supplied with pin connector (pos. 3) and intended for easy coupling the right Control unit: 'Pistol-grip' or 'Riflebuttstock' version.

NR-900S antenna system consists of two coaxial spiral directional antennas (transmitting and receiving) attached to the \emptyset 250 mm reflector. Main lobes of antennas radiation pattern are oriented along their geometrical axis.

NR-900S is made in dust- and waterproof version and has robust enclosure, ensuring safe operation within wide range of temperatures.

5.2 NR-900S DISPLAY (fig. 4)



- PWR probing signal level 3 red LEDs indication. Each LED corresponds to 6 dB output level increase.
 If the LEDs are dead the transmitter is off.).
- 2. 2nd harmonic bar-graph indicator (16 red LEDs).
- 3. 3rd harmonic bar-graph indicator (16 green LEDs).

NOTE: Both signal level bar-graph displays are divided to 4 equal sections with 4 LEDs in each. Every LED corresponds to 2.5 dB, Thus every section matches to 10 dB of a probing signal level harmonic - 2-nd or 3-rd.

4. **ATT** -received signal attenuation (4 blue LEDs). Each LED corresponds to 10 dB attenuation.

When all four LEDs are on - the sensitivity is maximal.

- 5. **SOUND** headphone commutation proof: 2 or 3 LEDs corresponds to the 2^{nd} or 3^{rd} harmonics audio signal.
- 6. Operation mode indication: **SEARCH**, confirmed by blue LED with **↓** pictogram, or **LISTEN** (the LED is dead).

5.3 CONTROL UNIT.

Control unit is available and 'Rifle-buttstock'(not shown). Both versions have the same control panels and the only difference is in the shape of a handhold.

The 'Pistol-grip' is provided with an ergonomic handle for better operator convenience.

The battery compartment for two Soshine 18650 rechargeable cells is located inside the handle (see fig. 7).

Its bottom cover is supplied with rotating lock.

The 'Rifle-buttstock' version is provided with a similar handle. It consists of 3-elbow telescopic rod (340-1000 mm), a swivel jont with the main unit, folding out elbow support and an auxiliary belt for operator's elbow support. A spiral power cable is inside telescopic rod. An adjustable swivel joint

on the tip of the handle allows operator to adjust tilt angle from -120° to $+90^{\circ}$

Control unit is available in two versions: 'Pistol-grip' (fig.5&6)





5.4 CONTROL PANEL (fig. 8):

PWR + & **PWR** — buttons (pos.1) are used for probing signal output adjustment: **+** for increase and — for decreasing its level.

L button (2) switches over the device's operational modes: **SEARCH** or **LISTEN**.

PHONE + & **PHONE –** buttons (3) are used as headphone volume control.

On button (4) serves for the device switching on and off

2/3 button (5) is for $2^{nd} \& 3^{rd}$ harmonics output switching over in **LISTEN** mode

ATT + & ATT — buttons (6) are used for the receivers sensitivity adjustment: + for the received signal level increase (high sensitivity minimum signal attenuation) and for decreasing the level (maximum attenuation signal low sensitivity).



Fig. 8 Control panel

6. ACCESSORIES

6.1 IMITATOR

Target **Imitator** (test unit) is intended for NR-900S workability control (fig. 9).

Imitator represents highfrequency semi-conductor diode (2D521A referring to the Russian classification) in a \emptyset 14 x 165 mm solid plastic body.



Fig. 9 NR-900S Imitator (test unit)

6.2 NR-900S POWER SUPPLY



Fig. 10 Soshine 18650 cells

NR-900S power supple is provided by the battery of two Li-Ion rechargeable cells -18650 form factor (fig. 10). Cell rated voltage is 3.7V with 2800mAh capacity.

For battery charging **Soshine SC-S1 max** Charger (supplied) is used.

NOTE: After battery discharge below 5,7 V : two LEDs 2 and 3 of the **SOUND** group (headphone commutation) are lighten alternatively.

In this case replace the battery as soon as possible.

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6.3 CHARGER

Soshine SC-S1 max Charger (fig. 11) is intended for rechargeable cells charging. The battery charging is performed in an automatic mode and does not need any operator's assistance.



Fig. 11 NR-900S standard Charger complete set.

- 1 Soshine SC-S1 max charger unit
- 2 Soshine DC 12V car adapter
- 3 **Soshine** AC power adapter

NOTE:

Soshine AC adapter (fig. 11, pos. 3) allows to charge the battery from the mains 100 - 240 V, 50/60 Hz.

In case of another AC adapter in a supplied set – check its parameters referring the label on AC adapter body.

Soshine DC 12V car adapter (fig.11, pos. 2) is intended for battery charging from the motocar 12V DC net.

7. NR-900S OPERATION

7.1 OPERATION CONDITION AND RESTRICTIONS

After long-term exposure to a low temperature keep the device packed in a standard packing at least 2 hours for evening up its temperature with the environment.

Operating NR-900S keep corresponding safety measures

Safety precautions for the open RF emitters:

- Do not direct NR-900S antenna to the human eyes from the distance less than one meter.
- Avoid prolonged presence of personnel in a main lobe of NR-900S antenna' diagram.

NOTE: Probing signal power density at the distance of 1 meter along the maximum of NR-900S antenna directional radiation pattern does not exceed Russian State Standard 12.1.006-84 (Russian State Sanitary Norm) for UHF-equipment serviceman under continuous 8-hours operation.

Keep NR-900S detector from mechanic damages and protected its connectors from moisture and dirt.

Packing NR-900S into the bag use packing layout for reference Wrong packing can lead to mechanic damage and breakdown of the equipment. **Operation Manual**

7.2 GETTING STARTED

Take NR-900S components out of standard packing.

Insert two fresh rechargeable cells (fig. 12) into the battery compartment (1) keeping the cells polarity specified on the compartment side wall (watch an arrow!).



Close the battery compartment cover (2-3) and lock it (4).

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Depending on the set task connect the right Control unit ('Pistolgrip' or 'Rifle-buttstock') to the main unit and fix it (fig.13):



Fig. 13 Control unit coupling

- Turn quick-release-base-plate rotary latch (on the back side of the Main unit) clockwise (fig. 11, step1)

- Insert plug-in plate (on the front side of any Control unit) into the corresponding groove of the base plate (step 2)

- Fix Control unit turning the latch counter-clockwise and tighten it (step 3)

- Plug headphones to the jack on a side wall of Control unit (fig.14).

NOTE: Using 'Rifle-buttstock' Control unit operator can adjust the length of its telescopic bar as desired. To do so release level-locks on the bar set the shaft length and shut the locks.



1. Push **On** button to switch on the device.

The following modes are set on default:

- transmitter is on (bottom **PWR** LED are on)
- receivers are on in a search mode (\mathbf{L} ED is on)
- headphones are connected to the output of the 2nd harmonic (LED
 2 of SOUND scale is on)
- input signals attenuation is at -10 dB (bottom blue LED at ATT scale is on)
- headphones volume control are in the middle position.
- 2. Use button **ATT** + to set maximal sensitivity of the receivers (all LEDs of **ATT** scale are on).
- 3. Analyze the interference environment aiming antenna system to different directions.
- 4. In case of noticeable interference, the antenna should be oriented so that the interference signal is not heard in the headphones.

7.3 NR-900S WORKABILITY TEST (fig.15)

- Reduce the output to the minimum level (only one bottom LED **PWR** is on)
- Place standard imitator (item 7 at the fig. 2) in a space free from any electronic equipment or gadget.
- Point out NR-900S antenna to imitator from the distance of 0,4 m



Fig. 15 NR-900S operation test by means of standard imitator

- Typical tonal audio signal will be head in the headphones while several red LEDs will display the 2nd harmonic level
- Altering the target imitator location in front of antenna system try to obtain the full 2nd harmonic LED-scale indication;
- Keeping imitator's relative position to the device Antenna system press ATT button to suppress receiver's sensitivity and control corresponding 2nd harmonic LED-scale indication alteration. Repeat this step.
- Press **PWR** + button to increase probing signal output verifying corresponding **PWR** scale and 2nd harmonic LED-scale indication alteration.
- Switch off the device
 - NOTE: If the battery is low two LEDs 2 and 3 of the SOUND group (headphone commutation) are lighten alternatively. In this case the battery should be replaced.

NR-900S detector is ready for operation.

USEFUL HINT:

An original schematic design enables to supply NR-900S operator with an outstanding feature: searching for illegal electronics the NLJD user takes notice of an audio alarm signal (tiny beep-beep) prior to custom LED indication.

This point is very important when an operator (a sapper) is searching for such a dangerous target like IED, and all his attention (and eyesight) is concentrated on the environment that might conceal a mine (not blinking lights on display).

7.4 NR-900S SAFETY PRECAUTIONS

NR-900s Detector represents a high sensitive radio-electronic device. Getting started remove from the your pockets and outfit any items that contains semi-conductive components.

Searching for radio-electronic devices that are in active mode, please, take into account that pulse EM signals radiated by Detector can affect the function of these devices.

Searching for improvised explosive devices (IED), start from the position not less than 10 meters from the area to be inspected.

Keep antenna head at least one meter from the article or surface under control.

To avoid accidental triggering of a target, reduce output power to its minimum level immediately after receiving a steady signal.

7.5 DETECTOR OPERATION IN 'LISTEN' MODE

This mode is intended for detecting the target's status (active of switched off) or confirmation the fact that this particular target does not served as a cover for a real active (electronic or mechanical) device.

Switch over Detector to the '**LISTEN'** mode: LED **I** s off.

Set the lowest receivers sensitivity and the minimal probing signal output.

Moving away from the target keep the antenna module orientation (main lobe directed to the target) till the moment when $2^{nd} \& 3^{rd}$ bargraph LED indicators will go out.

Switching over 2/3 button on the **Control unit** panel try to reveal possible modulation of the received signal. That might be a confirmation of an active status of a target – the source of that particular signal.

If necessary, use '**PHONE**' buttons to adjust audio level in the headphones.

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7.6 DETECTOR OPERATION IN 'SEARCH' MODE

- Switch on Detector and carry out its workability test referring pos. **7.3**.
- Switch over Detector to the 'SEARCH' mode (LED $\mathbf{\Lambda}$ is on).
- Push **ATT(+)** button to adjust maximal receiver sensitivity.
- Direct Antenna head to the questioned area starting from the close proximity. Check the ambience scanning it from left to right step-by-step expanding the zone of inspection tilting-up Antenna module.
- If there is no visual indication on 2nd and/or 3rd bar-graph display and no audio signal in the headphones – push 'PWR(+)' button to increase probing signal level to maximal if necessary.
- When the reply signal appears, identify the signal source (target) location by the peak level of the $2^{nd} \& 3^{rd}$ harmonic display and the maximal sound level in the headphones. If necessary decrease the receivers sensitivity by means of button ATT(-).
- Start moving towards the target adjusting (if necessary) probing signal level and receivers sensitivity by means of **PWR (+)** or **(–)** and **ATT(+)** or **(–)** buttons.

NOTE: The practical probing signal level and receivers sensitivity are defined by the interference environment right on spot of the operation. There might be certain outside signals on the receivers adjustment frequencies and/or the presence of nonlinear reflectors, that cannot be removed from the examination area.

- Comparing the 2nd and 3rd harmonics levels make the conclusion concerning the possible nature of the target revealed.

NOTE: If the 2^{nd} harmonic level is higher than the 3^{rd} one more than by 10 dB (difference is more than 4 LEDs) - the target is likely to be an electronic device.

On the contrary, if the 3^{rd} harmonics level excesses 2^{nd} one more than by 10 dB, the signal source is likely to be an object with metal-to-metal contacts.

- When the target location is determined switch off Detector and follow the standing Instruction handling with the revealed target.

8. PACKING

By the end of practical operation do the following:

- Switch off the **Detector**.
- Disconnect Control unit from the Main one.
- In case of 'Rifle-buttstock" version push in the telescopic rod into its shipping-storage position.
- Remove cells from the battery compartment.
- Unplug headphones from the Main unit.
- Check Detector's components condition, wipe them with rag if necessary.
- Cover all sockets with corresponding rubber caps.
- Put Detector's components into the carry bag and fasten it.

9. EMERGENCY ACTIONS

- In case of the equipment malfunction that cannot be corrected by the operator, Detector operation should be stopped.
- If Detector was exposed to external mechanic, electromagnetic or climatic impact and temporarily lost its workability, then before restoring the operation it is required carry out its visual checks and functional test referring pos. 7.3 of this Manual.

OPERATION OF THE FAULT DETECTOR IS NOT ALLOWED.

10. BATTERY CHARGING (fig. 16).

Insert 2 or 4 cells (pos.3) into **Soshine** Charger chamber (if necessary slide 'minus' spring contact)

Pay special attention to cells polarity referring indication on the charger chamber

Couple AC power adapter or DC 12V car adapter to the socket on a side wall of the **Charger** (pos. 2).

Connect **AC power adapter** to the mains (100-240V, 50/60 Hz) or **Car adapter** to a corresponding cigarette lighter socket.

After switching on the power the **Charger** will check every charging channel operability and initiate the charging mode.



Fig. 16 Soshine SC-S1 max Charger with 4 cells ready for charging.

- 1 LED charging channel indication
- 2 Adapter connection socket
- 3 Soshine 18650 2800mAh Li-Ion rechargeable

Charging mode LED indication (see table 5)

Charger LED indication (Fig. 16,	pos.1) Table 5
Charging process status	LED light mode
Charger workability self -test	4 x LED light red then switch over to green
Defective or cells of a wrong type are installed (for instance Ni-MH, Ni-Cd and etc.)	Alter green to red back and forth
Charging mode start	Red
80%-90% charge is obtained	Blinking green
Fully charged	Green
Cell's wrong polarity	Dead

After battery charging completion unplug AC adapter from the mains and then from the **Charger**.

NOTE:

Charging time for Soshine 18650 2800mAh Li-Ion rechargeable cells with Soshine SC-S1 max charger is as follows:

4 hours - for 2 cells, 8 hours - for 4 cells

The battery (cells) can be unplugged from the **Charger** during any charging stage without any failure to the battery or the Charger itself.

Charger operation precautionary measures

- Do not try to charge primary cells! That can initiate an explosion and provoke the fire. Acceptable elements should have an inscription "Rechargeable".
- Do not block vent holes on the bottom of the charger housing. For instance, don't place it on a soft, fleecy surface (carpet, blanket, seat covering and etc.).
- Charger is intended for indoor use only. Protect the device from moisture and perspiration water. Do not switch on the charger and/or power adapters with the obvious presence of moisture inside the device.
- Do not try to disassemble or modify the device. Do not use it as a surrogate power source for a certain gadget. The device terminals are intended for charging appropriate cells only.
- Charger is an electronic device with high frequency circuits and violent operating current. The wrong operation could cause an electrical shock.
- Do not leave the charger and/or AC power adapter coupled to the mains unattended for a long time. In spite of several protection circuits used in the charger circuit there is certain probability of abnormal mode that will cause the fire.

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11. MAINTENANCE

ATTENTION! IT IS FORBIDDEN TO DISASSEMBLE THE DEVICE!

GENERAL INSTRUCTIONS

The NR-900S maintenance should be carried out by the personnel who studied the Operation Manual and have practical experience of NLJD usage.

To keep NLJD in fault-free and ready-to-use condition the following maintenance are provided:

- Check inspection performed at the detector acceptance procedure, preparation for transportation, storage as well as at periodic testing of serviceability, removal from storage and after transportation;
- Daily maintenance performed after each Detector usage, transportation or placing in storage;
- Scheduled maintenance performed once a year during longterm storage.

MAINTENANCE ORDER

Check inspection:

- take NR-900S components, accessories and supporting documentation from the carry bag;
- check **NR-900S** set packaging referring the device packing list;
- verify the seals integrity;
- check NR-900S components exterior;
- verify labels, signs & marking condition on the device component housings;
- carry out the device workability test;
- remove the batteries;
- pack **NR-900S** components into the carry bag.

Daily maintenance

- use clean rag to remove dirt and dust from external surfaces of the device components;
- use brush and soup water to clean the carry bag;
- dry the carry bag;
- correct minor paint coating defects (scratches and chipping) of the device components;
- charge the batteries;
- perform the device workability test;
- remove the batteries;
- pack **NR-900S** components into the carry bag.

Scheduled maintenance

- charge the batteries.

ROUTINE REPAIR

The defective device repair, adjustment and setting-up should be carried out **ONLY** by authorized personal at the Manufacturer's factory.

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12. SHIPPING AND STORAGE

NR-900EMS can be shipped in a standard packing in a passenger cabin by any kind of transport.

Prevent the device in standard packing from shock and vibration. Store packed device under the temperature from +5 up to +40°C and relative humidity no more than 80 % under +25°C

NOTE: THE BATTERIES SHOULD BE STORED IN A CHARGED STATE ONLY.

13. CERTIFICATE OF ACCEPTANCE

Seller _____

Date _____

14. WARRANTY

NR-900S warranty period is 12 months from the date of sale.

Manufacturer guarantees normal functioning of the device on the assumption of the following all requirements of this Manual by the User and in case of malfunction within the Warranty period Manufacturer will repair the device free of charge.

Intended service life of the product before discarding is 8 years including the storage period at the warehouse up to two years.

CUSTOMER COMPLAINTS ARE NOT ACCEPTED AND WARRANTY MAINTENANCE DO NOT COVER THE FOLLOWING CASES:

1. Mechanical damage of the device's units or parts.

2. Traces of independent unauthorized repair and/or warranty sealing damage.

3. The device's Works number mismatches to that mentioned in a Certificate of Acceptance

NOTES:

1. Warranty period does not cover batteries and the Charger.

2: Post-warranty service is accomplished under separate order.

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		FOR NOTES			