

**NON-LINEAR JUNCTION DETECTOR**

**NR-T**

**User Manual**

## CONTENTS

1	Application	5
2	Complete set	6
3	Main technical parameters	7
4	Function	8
5	System design	9
6	Accessories	12
7	Marking	14
8	Operation condition and restriction	14
9	Getting started	16
10	NR-T workability test	17
11	Practical operation	18
12	Emergency action	19
13	Battery charging	20
14	Maintenance	23
15	Shipping and storage	25
16	Certificate of acceptance	25
17	Warranty	26

***This Manual is intended  
for explanation  
NR-T 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-T NLJD will be used**

## **1. APPLICATION**

**Non-linear Junction Detector NR-T** (hereinafter referred to as **Detector**) is intended for concealed electronic devices detection which contains semi-conducting elements (that can be both enabled or disabled).

**Detector** can detect typical targets in every operational mode: active, stand-by or even switched-off.

**Detector** ensures efficient searching and precise target items localization in building envelope elements (floor, ceiling and walls), interior elements and pieces of furniture, clothes and carrying bags.

**Detector** allows an operator to distinguish natural (corrosion) non-linear reflectors from industrial items.

**2. Complete set** (see fig.1)

Table 1

1	Main Unit (transceiver) with Antenna module (1a) and Control unit (1b)	1
2	Target imitator (test unit)	1
3	Offloading Vest	1
4	Remote loudspeaker	1
5	Soshine 18650 rechargeable cells	4*
6	Soshine SC-S1 battery charger	1
7	AC power adapter	1
8	Car power adapter	1
9	Carry bag	1
10	User manual (not shown)	1

\* Two sets with 2 cells in each.



Fig.1 NR-T complete set

### 3. MAIN TECHNICAL PARAMETERS

Table 2

Scale '2' readings (number of LEDs/dB) under following conditions: standard test unit at $0.7 \pm 0.05$ m distance, min output & min received signal attenuation	Not less 12 LEDs /30 dB
Probing signal attenuation	2 steps: min & max
Received signal attenuation	5 steps, 10 dB each: 0, -10, -20, -30, -40 dB
Received signal level indication	LED display & audio
Operating condition: - operating temperature - maximum relative humidity	-5° to +40 °C 80 % (at +25 °C)
Power supply	Two '18650' Li-ion cells; 3.7V
Operating time with one set of fully charged cells	Not less 4h*
<b>Weight</b>	
Device in a ready for operation state	$3.1 \pm 0.3$
Complete set in standard packing	$6.0 \pm 0.5$

\* with 2800mAh cells,

*NOTE: rechargeable cells & battery charger can be replaced by any equivalent version.*

## 4. FUNCTION

**NR-T** Detector represents a portable tool that consists of antenna system, transmitter and two receivers adjusted for double and triple frequency of the transmitter's signal.

In a '**search**' mode the probing signal is converted into a poly-harmonic one on the radiated nonlinear elements (semi-conductive items or corroded metal-oxide-metal junctions) and retransmitted, *better say* – scattered into ambient space.

Retransmitted 2<sup>nd</sup> & 3<sup>rd</sup> harmonics of the probing signal are received and processed by receivers. Signals strength is indicated by LED bar-graph display: scale **2** (red) and scale **3** (green) accordingly. Moreover, it is reproduced via remote loudspeaker in the form of 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 Detector Control panel.

**NR-T** has two output levels for radiated probing signal and five 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.



## 5. SYSTEM DESIGN

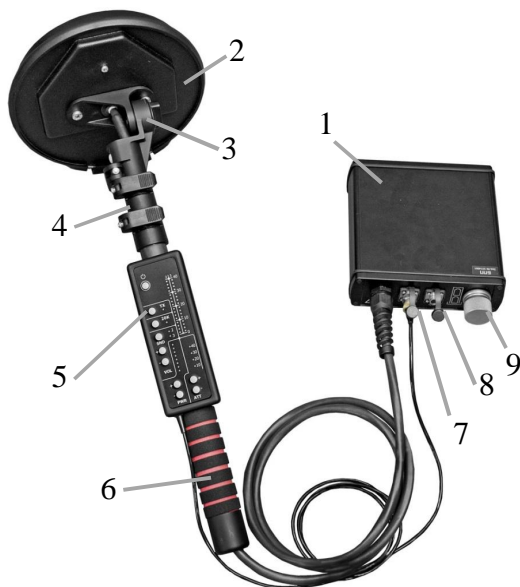


Fig. 2 – NR-T set.

1. Main unit
2. Antenna module
3. Antenna joint
4. Telescopic arm with level-locks
5. Control unit
6. Telescopic arm handle
7. Control unit jack
8. Remote loudspeaker jack
9. Battery compartment cap

**NR-T** Detector consists of Main unit (transceiver), antenna module, telescopic arm and Control unit (see fig. 2).

Telescopic arm is equipped with antenna module, mounted on its tip, and Control unit attached above the arm handle.

UHF-cable with permanent connection to antenna module and Main unit (transceiver) is placed inside the telescopic arm.

The Main unit is equipped with a battery compartment that has a screw-on cap and two jacks for Control unit and remote loudspeaker connection.

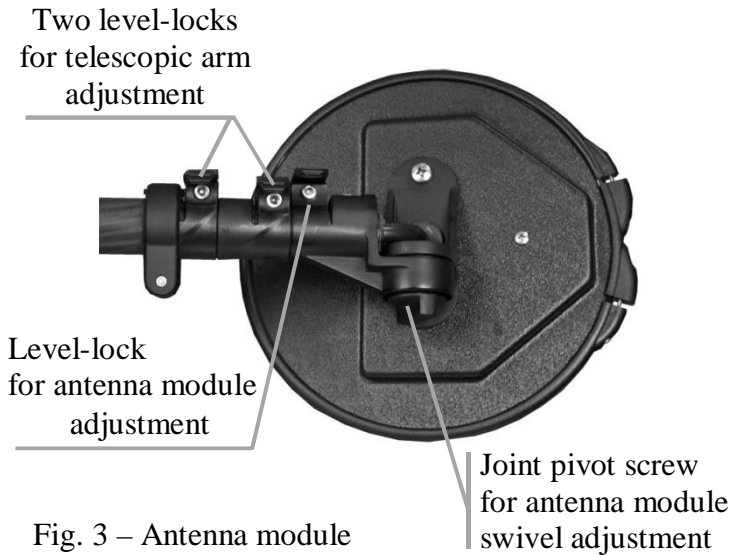


Fig. 3 – Antenna module

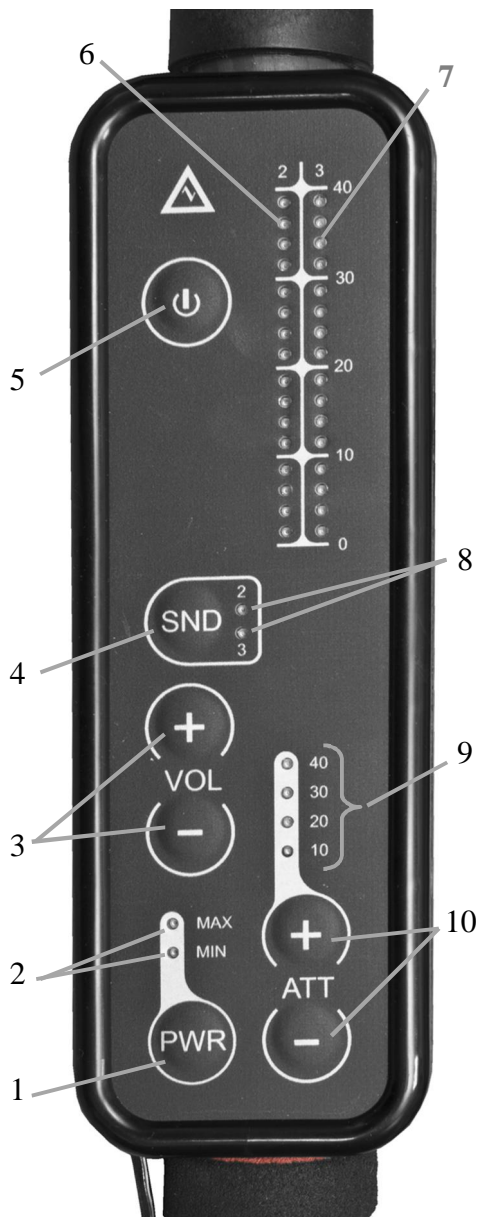
Antenna module can be adjusted in two axes.

*NOTE: Loosen antenna joint pivot screw before antenna module adjustment (fig. 3).*

*To adjust telescopic arm length unclamp its level locks.*

**NR-T Control unit** (fig. 4) is placed on top of the telescopic bar and in essence consists of LED display for representing an acting operational mode and received signals level as well as control board with 7 non-fastening buttons that are used for adjusting and altering A/M operational modes.

***ATTENTION! Don't disconnect Control unit cable from the Main unit jack (item 7, fig. 2) during operation.***




- 1 – **PWR** output level adjustment buttons
- 2 – Probing signal output level
- 3 – **VOL** remote loudspeaker volume control;
- 4 – **SND** 2-nd & 3-rd harmonic switch-over button
- 5 –  power on/off push-button;
- 6 – Received signal 2-nd harmonic LED bar-graph indicator (2.5dB each step)
- 7 – Received signal 3-rd harmonic LED bar-graph indicator (2.5dB each step)
- 8 – 2-nd & 3-rd harmonic switch-over LED confirmation
- 9 – Attenuator scale with 10dB step
- 10 – **ATT** received signal attenuation

Fig. 4 – Control unit

## 6. ACCESSORIES



Fig. 5 Soshine 18650 cells

For battery charging  
**Soshine SC-S1 max  
 Charger** (supplied) is used  
 (fig. 6) - see its operational  
 Manual for reference.

1 – **Soshine SC-S1 max  
 Charger**

2– **Soshine** AC adapter  
 allows battery charging  
 from the mains 100–240 V,  
 50/60 Hz.

2 – **Soshine** DC 12V car  
 adapter is intended for  
 battery charging from  
 the motocar 12V DC net.

## NR-900S POWER SUPPLY

**NR-T** power supply is provided  
 by the battery of two  
 Li-Ion rechargeable cells –  
 ‘18650’ form factor (fig. 5).  
 Cell rated voltage is 3.7V  
 with 2800mAh capacity.

Two sets of batteries are  
 included into the package.



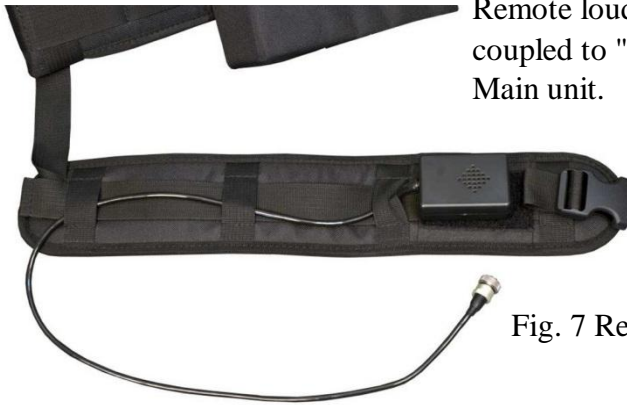
Fig. 6 Soshine SC-S1  
 charger package

Target **Imitator** (test unit) is intended for **Detector** workability control.

Imitator represents high-frequency semi-conductor diode (2D521A - referring its Russian classification) in a Ø14 x 165 mm solid plastic body.



Fig. 6 NR-T Imitator (test unit)



Remote loudspeaker (fig. 8) is coupled to "🎧" jack on the Main unit.

Fig. 7 Remote loudspeaker at the vest strap

Loudspeaker housing is provided with 3.5mm AUB-11/2 audio port for headphones connection - if needed (option).

Detector vest (fig. 9) is a backpack shaped fabric bag with a pocket for the Main unit and a textile strap for remote loudspeaker.

During operation the vest with Detector is worn by the operator.



Fig. 8 – NR-T vest

Carry bag (fig. 9)  
is intended for  
Detector set storage  
and transportation.



Fig. 9 NR-T carry bag

## 7. MARKING

A nameplate with NR-T abbreviation and Detector serial number is located on the Main unit back side.

Screw slots on the top and bottom panels of the Main unit as well as antenna module shell screw are sealed by QC mark.

The carry bag with packed Detector set is sealed with a hanging seal.

## 8. OPERATION CONDITION AND RESTRICTIONS

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

*Operating NR-T keep corresponding safety measures.*

### **Safety precautions for an open RF emitter:**

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

*NOTE: Probing signal power density at the distance of 1 meter along the maximum of NR-T 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-T** Detector from mechanic damages and protect its connectors from moisture and dirt.

Packing **Detector** into the bag use packing layout for reference

*Wrong packing can lead to mechanic damage and equipment breakdown.*

## 9. GETTING STARTED.

Unpack **NR-T** Detector set.

Connect remote loudspeaker to the corresponding jack on the Main unit body (see fig.2 for reference).



Install two fully charged Li-Ion Soshine 18650 cells into Detector's battery compartment.

Pay attention to their polarity referring the label on the Main unit front wall.

Close the battery compartment.


Press  button to switch on NR-T Detector.

Fig. 10 Battery installation

### **At that the following mode is activated:**

- Transmitter is OFF;
- Receivers are ON to control noise surrounding.
- Remote loudspeaker is coupled to the 2-nd harmonic receiver output.
- Input signals attenuation is in -10 dB state confirmed by corresponding LED (pos. 9 at the fig.4);
- Volume control is in a **Mid**-position.



Use **ATT** button to adjust maximum receiver sensitivity.

Turn antenna unit at various directions to estimate noise condition at the device receiving frequencies.

Choose the direction with minimum interference level.

Carry out Detector workability test:

### **10. NR-T WORKABILITY TEST**

- Press **PWR** button to set minimum probing signal power confirmed by corresponding LED (item 2 at the fig.4).
- Place standard imitator (test unit) in front of the antenna module at 0,5-0,7 m from it.
- A tonal signal can be heard from remote loudspeaker as well as received signal level should be indicated by 2-nd harmonic LED bar-graph indicator.
- Alter imitator position in front of antenna module to light-on all 2-nd harmonic LEDs. Then sequentially pressing **ATT**-button adjust received signal attenuation from '0' to '-40 dB' and make sure of a corresponding LED bar-graph indication.
- Press **PWR** button to boost probing signal level. Ensure, that the number of lit LEDs of "2" status bar changes accordingly.

***USERFUL HINT: In case of battery discharge  
'2' & '3' LEDs (item 8 at the fig. 4) are lit by turns  
In this case the battery should be replaced.***

### ***DETECTOR IS READY FOR OPERATION***

*Switch –off Detector if practical operation is not supposed*

## 11. PRACTICAL OPERATION

Switch-on Detector and carry out its functional test referring item at the page 17.

**WARNING:** *NR-T detector is a high-sensitive radio electronic device. Before operation, please, make sure to remove all semiconductor-containing items from your clothing and munitions.*

**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.*

If necessary loosen level-locks (item 3 at the fig. 2) and adjust telescopic arm length for better operator convenience.

Loosen level-lock (see fig. 2 &3) and adjust antenna module against telescopic arm axis for better Detector usability.

Carry out target searching operating Detector , if possible, under maximum probing signal output and receiver sensitivity - that provide maximum detection range.

Searching for targets orient Antenna system on the surface under control and move it along that surface.

When remote loudspeaker starts to emit a tone signal:

- Vary antenna system position and its orientation;
- Use "PWR pushbutton to adjust probing signal power;
- Use "ATT+" & "ATT-" buttons to adjust receivers sensitivity ... to get maximum signal level from remote loudspeaker and maximum LED bar-graph indication of the Control unit.

That will assist in target localization.

The detected target origin can be identified by comparing the levels of input signals of the 2<sup>nd</sup> and 3<sup>rd</sup> harmonics - use "SND" pushbutton to switch over between these modes.

#### USEFUL HINTS:

If the 2<sup>nd</sup> harmonic input signal is much higher than the 3<sup>rd</sup> harmonic reply, this can testify to a good chance of detecting semi-conducting elements within the search range of the Detector.

If the 3<sup>rd</sup> harmonic signal is much higher than the 2<sup>nd</sup> harmonic one, this will mean that the signal is likely to be reflected by a corrosion non-linear reflector.

By the end of operation switch Detector.

Remove the battery, retract the telescopic arm, unplug remote loudspeaker and put the Detector set into the carrying bag as shown at the fig.12.



Fig. 12 – Detector packing

## 12. EMERGENCY ACTIONS

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

***THE FAULT DETECTOR OPERATION  
IS NOT ALLOWED.***

### 13. 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 cells

**Charging mode LED indication (see table 5)****Charger LED indication (Fig. 16, pos.1)****Table 5**

<b>Charging process status</b>	<b>LED light mode</b>
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 Charger. Do not use it as a surrogate power source for a certain gadget. The Charger’s 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.

## 14. MAINTENANCE

***ATTENTION! IT IS FORBIDDEN  
TO DISASSEMBLE DETECTOR!***

### ***GENERAL INSTRUCTIONS***

**The NR-T Maintenance should be carried out by the personnel who studied the Operation Manual and have practical experience of NLJD usage.**

**To keep Detector 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 long-term storage.

### ***MAINTENANCE ORDER***

#### **Check inspection:**

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

**Daily Maintenance**

- **use clean rag to remove dirt and dust from external surfaces of the Detector components;**
- use brush and soap water to clean the carry bag;
- dry the carry bag;
- correct minor paint coating defects (scratches and chipping) of the Detector` components;
- charge the battery;
- perform the Detector workability test;
- remove the battery;
- pack Detector components into the carry bag.

**Scheduled Maintenance**

- charge the battery.

**ROUTINE REPAIR**

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



## 15. SHIPPING AND STORAGE

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

Prevent Detector in standard packing from shock and vibration.

Store packed Detector under the temperature from +5 up to +40°C and relative humidity no more than 80 % under +25°C

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

## 16. CERTIFICATE OF ACCEPTANCE

Non-linear Junction Detector NR-T serial No \_\_\_\_\_  
is in conformity with the Main technical parameters  
and is accepted for use.

Seller \_\_\_\_\_

Date \_\_\_\_\_

## **17. WARRANTY**

NR-T warranty period is 12 months from the date of purchase. Manufacturer guarantees normal functioning of the Detector 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 Detector 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.**

## FOR NOTES

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