

# **'ETA' AUTONOMOUS TECHNICAL FIBER AND OPTICAL ENDOSCOPE**



## **OPERATION MANUAL**

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This Operation Manual (OM) is intended for proper and safe operation of ETA autonomous technical fiber and optical endoscope (hereinafter referred to as 'product' or 'device') and the assessment of its technical condition when considering the necessity to send it for repair. Product maintenance does not require any special training of staff.

## 1. PRODUCT OPERATION

### 1.1 Purpose

ETA autonomous technical fiber and optical endoscope is designed to operate in non-stationary conditions by visually observing images of objects, their individual sections or surface defects, especially those located in hard-to-reach and dimly lit places, operated under moderate conditions climate in the open air and indoors.

### 1.2 Technical characteristics (features)

1.2.1 Type of the operating side of the endoscope: flexible.

1.2.2 Deflection angle of the distal end in one plane within  $(180 \pm 15^\circ)$  for  $\varnothing = 6.0$  mm,  $\varnothing = 8.0$  mm,  $\varnothing = 10.0$  mm,  $(120 \pm 15^\circ)$  for  $\varnothing = 4$  mm.

1.2.3 Angle of the field of view of the endoscope  $(60 \pm 5^\circ)$ . Direction angle of the axis of view is  $0^\circ$  or  $90^\circ$  (as agreed with the Customer).

1.2.4 Lower limit of the depth of field is at least 15 mm.

1.2.5 Diopter adjustment of the eyepiece  $\pm 4$  di-opt.

1.2.6 LED backlight. LED power is at least 1 W.

1.2.7 The product is powered from 4 AA elements. The batteries are charged using charger.

1.2.8 Supply voltage of the product is in the range from 4 V to 6 V.

1.2.9. Time of continuous operation from one set of fully charged batteries under normal climatic conditions is at least 120 minutes.

NOTE - Continuous operation time is specified for pre-charged rechargeable batteries that have passed at least 3 'charge-discharge' cycles before.

1.2.10 The product has the following functions and adjustments:

- the possibility of deflection of the distal end within  $(180 \pm 15^\circ)$  for  $\varnothing = 6.0$  mm,  $\varnothing = 8.0$  mm,  $\varnothing = 10.0$  mm,  $(120 \pm 15^\circ)$  for  $\varnothing = 4$  mm.

- diopter adjustment of the eyepiece  $\pm 4$  diopter;

- backlight brightness adjustment (4 brightness modes: 25%, 50%, 75%, 100%);

- battery discharge indication;

- automatic power off of the device when the batteries are low.

1.2.11. Time to enter operating mode after power-up no more than 5 seconds.

1.2.12. Installation time (or closing-down, with placing in a standard packing) is no more than 3 minutes.

1.2.13 Diameter of the working part of the endoscope (as agreed with the Customer) in the following versions:

-  $(4.0 \pm 0.2)$  mm;

-  $(6.0 \pm 0.4)$  mm;

-  $(8.0 \pm 0.5)$  mm;

-  $(10.0 \pm 0.5)$  mm.

1.2.14 Length of the working part of the endoscope (as agreed with the Customer) in the following versions:

For a diameter of 4 mm: 500, 1000, 1200, 1500 mm;

For a diameter of 6 mm: 500, 1000, 1200, 1500, 2000 mm;

For a diameter of 8 mm: 500, 1000, 1200, 1500, 2000, 2500, 2700 mm;

For a diameter of 10 mm: 500, 1000, 1200, 1500, 2000, 2500, 2700 mm.

Length tolerance for any diameter is  $\pm 100$  mm;

1.2.15 Weight of the product's case without batteries is up to 0.9 kg.

1.2.16 Climatic operating conditions:

- relative humidity not more than 95% at a temperature of plus  $25 \pm 1^\circ\text{C}$ ;

- operating temperature range from minus 25 to plus  $40^\circ\text{C}$ .

1.2.17. The permissible number of drafts or gray fibers of a fiber optic bundle in the field of view of the endoscope is not more than 10 pcs.

### 1.3 In Box

1.3.1 Product Delivery Set is specified in Table 1.

Table 1

Name	Qty
ETA endoscope	1
Charger	1
AA rechargeable batteries	4
Car charger adapter*	1
Optical adapter for camera*	1
Camera*	1
Cloth for cleaning optics	1
Data Sheet	1
Operation Manual	1
Standard transport package (plastic case)	1

**NOTE**

1 Items marked with \* are delivered as agreed with the Customer.

2 Rechargeable batteries are supplied discharged.

3 The length, diameter of the working part, as well as the angle of direction of the axis of view of the endoscope are agreed with the Customer.

1.3.2 Figure 1 shows the main components of the product in standard packaging.

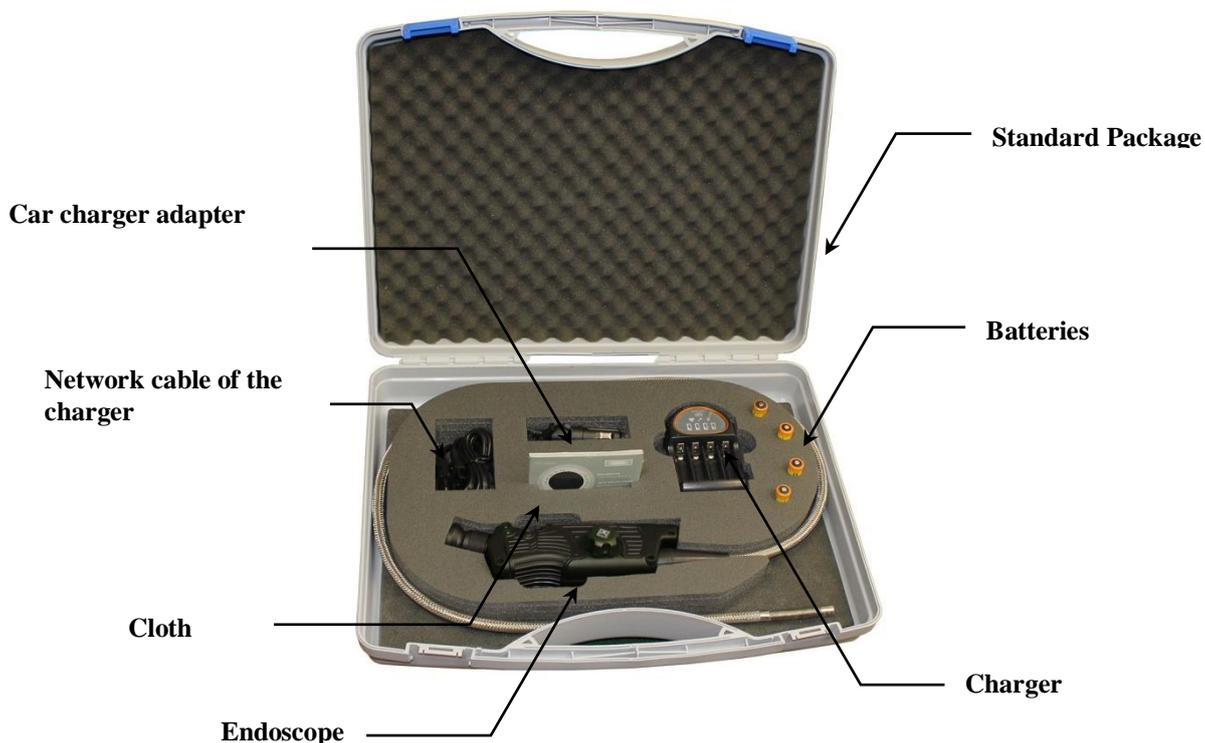


Figure 1

## Attention!

The appearance may vary depending on the design.

### 1.4 Design and Operation

1.4.1 The main components of the device and the location of the controls are shown in Figure 2

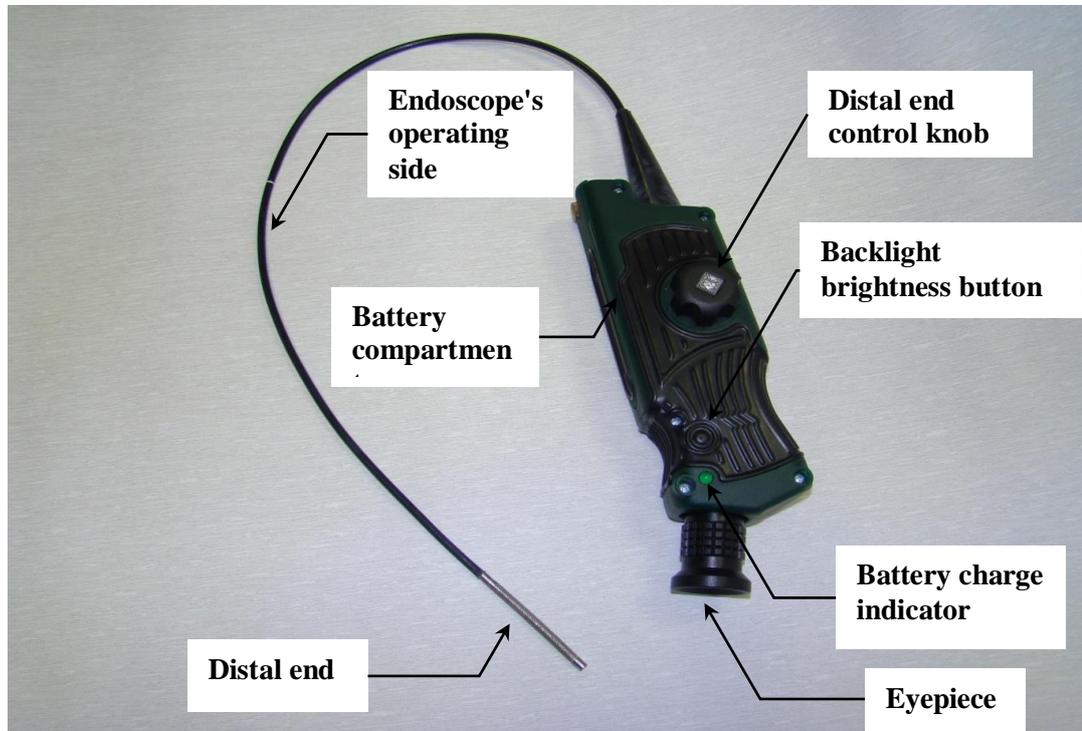


Figure 2



**Attention! The appearance may vary depending on the design.**

1.4.2 Operation control of the device is carried out using distal end control knob and backlight brightness button. Rotating distal end control knob, set the distal end in the desired direction. Successive pressing of backlight brightness button selects the desired backlight brightness (4 brightness levels). Battery charge indicator lights up green at sufficient battery charge level and red when battery charge level is below permissible level.

### 1.5. Marking and Sealing.

1.5.1. Marking of the product, which includes short name of the manufacturer and/or the trademark of the manufacturer, name and/or code of the product, individual serial number and year of manufacture is marked on the code plate on the case of the control panel and on the package (case).

### 1.6. Package

1.6.1. The product is packed in a standard package (plastic case).

1.6.2. When shipping unaccompanied, as well as during transportation over distances of more than 100 km, the standard packaging with the product must additionally be packed in transport packaging (cardboard or plywood box).

## 2 USING THE PRODUCT

### 2.1. Operational restrictions

2.1.1. Before starting, carefully read this Operation Manual

2.1.2 When finished, power off backlight to prevent battery discharge during transportation and storage.

2.1.3. **Do not** open battery compartment of the product, replace batteries, remove protective lid of the battery compartment and lens in the conditions of high humidity (over 90%), condensate, or the possibility of water penetration into the interior content of the product and its parts.

2.1.4 **Do not** immerse the product into water, do not enable backlight in case of water ingress, do not operate the product at temperatures beyond the limits specified in p. 1.2.16.

2.1.5. Replacement of battery should be carried out only when the device is powered off.

2.1.6 To prevent battery explosion, use the charger from the delivery set only for NI-MH batteries. Never charge alkaline or other primary power elements in the supplied charger.

2.1.7. Avoid simultaneous charging of batteries with different degrees of discharge, as well as of different capacities and different manufacturers.

2.1.8 **Do not** use charging device outside or inside the car.

2.1.9 Ambient temperature during charging should be in the range from plus 5°C to plus 40°C.

2.1.10 Do not insert leaked batteries or those with any signs of corrosion into the device or charger.

2.1.11 Rechargeable batteries can heat up during charging; after full charging, they gradually cool to room temperature.

2.1.12 Do not store batteries in the device if the break in its use is more than 3 days.

2.1.13 During operation, **do NOT**:

- hit distal end with hard objects;
- use the endoscope to eliminate any objects preventing clear observation;
- throw the endoscope on hard surfaces, beat and shake it;
- bend the working side of the fiber bundle with a radius of less than 25 diameters of the working part;
- twist, straighten and bend the distal end of the endoscope with hands;
- make sharp turns of the distal end control knob.

## **2.2. Getting Started**

2.2.1. Before using the device, make sure there is no violation of operational restrictions

2.2.2. Remove the device off the standard package.

2.2.3. Make sure there is no mechanical or chemical damage on the power units. Check for any mechanical damage on the product.

2.2.4. Install operational and charged rechargeable batteries into the battery compartment of the device carefully observing polarity.

2.2.5. Close battery compartment lid tight by pulling it to the case with a screw to prevent penetration of foreign objects and water into the case while operating the device.

2.2.6 Press backlight power button to check battery charge level. If battery indicator is green, battery charge level is adequate. If the indicator flashes or stays in red and the backlight is off, then batteries need charging.

2.2.7 Batteries are charged on the charger of GP PB50GS270 type. The external view of the charger is shown in figure 5.

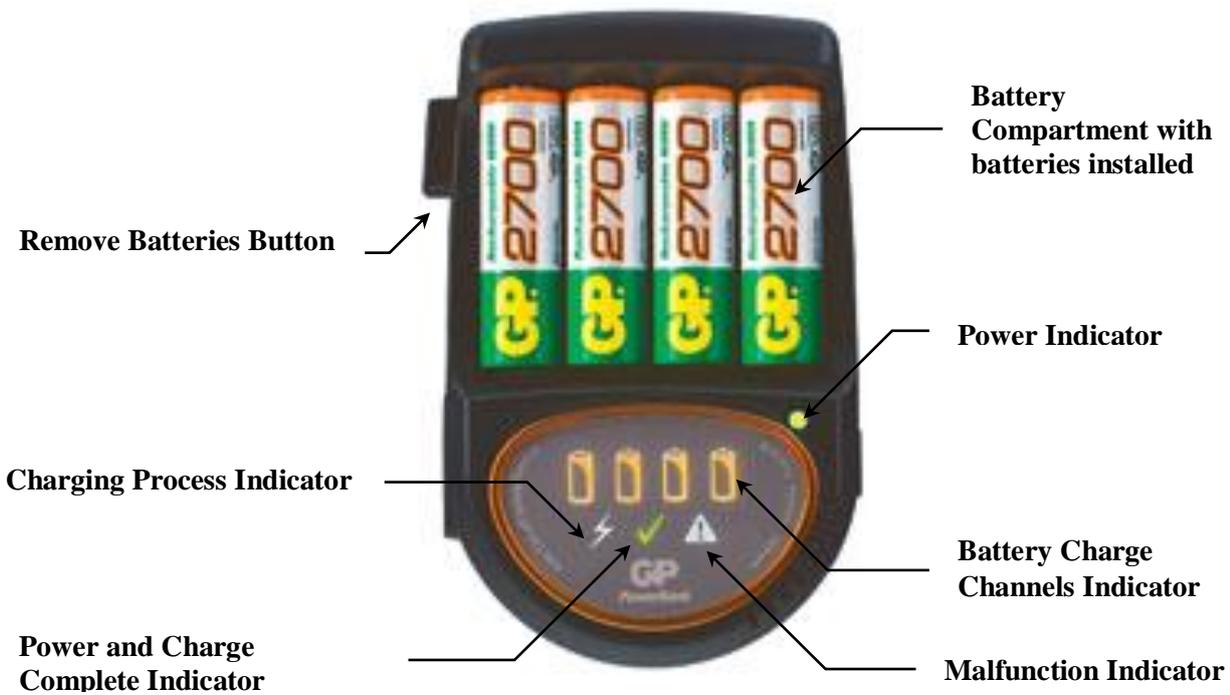


Figure 3

2.2.8 To charge the batteries, follow these steps:

- connect power cord to the charger and AC 220V / 50Hz. When properly connected, the green LED will be on the charger's body;
- install the rechargeable batteries into the charger strictly in accordance with the polarity indicated on the case. During charging, opposite to the installed battery, there will be a battery charge channel indicator and the lightning icon indicating charging process. After charging has been completed, the green indicator (tick) will be on. While this the indicators of the corresponding battery charge channels will be on continuously. If a defective battery or another type of battery is installed into the charger, the 'exclamation sign' indicator and the 'batteries' indicators will be flashing frequently. In case of a malfunction of the charger, green power indicator and the 'exclamation sign' indicator will be flashing, and the charging process will not be launched;
- after the end of charging, disconnect the charger from the 220V / 50 Hz network and remove the batteries using the button located on the side of the charger body.

2.2.9. The approximate time of simultaneous charging of 4 batteries is shown in Table 2.

Table 2

Battery Type	Capacity (mAh)	Charging time (min)
AA	2100	225
AA	2300	250
AA	2500	270
AA	2700	285

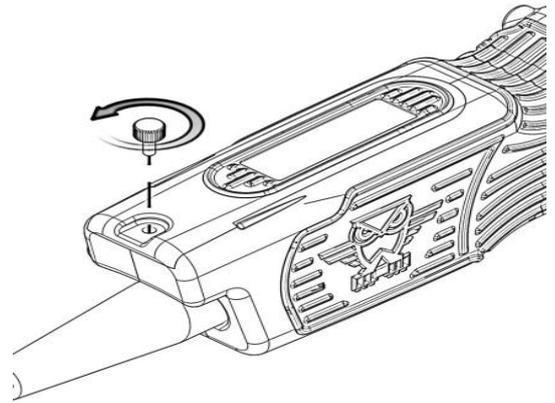
## 2.3 Using the product

2.3.1 Unpack the endoscope.

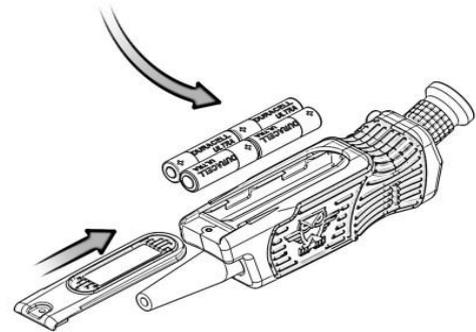
2.3.2 Enable mechanism controlling the position of the distal end in the following order:

- place the endoscope on a flat surface, gently, without effort, straighten the working part without touching the distal end;
- after straightening the working part, straighten the distal end, gently rotating the knob controlling the position of the distal end.

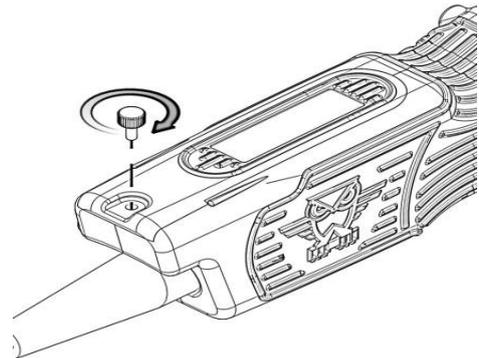
2.3.3 Open battery compartment cover by unscrewing the fixing screw and sliding the cover.



2.3.4 Install the batteries into battery compartment strictly observing polarity indicated on the case.



2.3.5 Place battery cover and tighten the fixing screw.

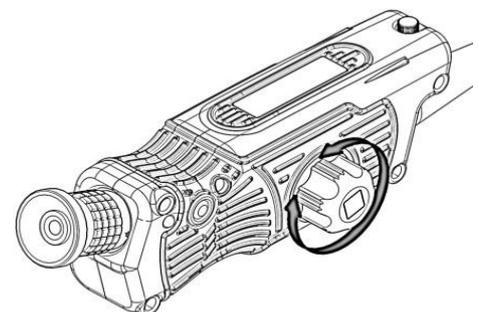
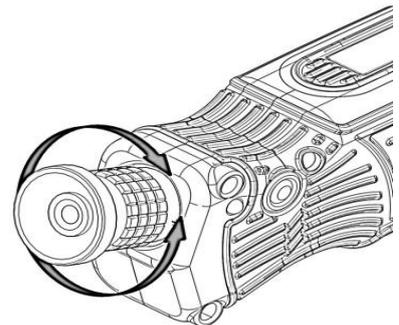


2.3.6 Place the distal end of the viewing bundle in front of any typewritten text at a distance of 50-60 mm.

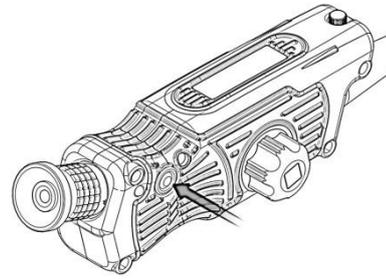
2.3.7 Adjust eyepiece by turning it to the right and left and achieving the best sharpness of the image at a working distance.

2.3.8 Insert the distal end of the viewing fiber into the area inspected or into the interior of the cavity, and inspect by gently turning the control knob.

2.3.9 It is permissible to briefly immerse the working part of the endoscope in liquid media (gasoline, diesel fuel, kerosene, oil, water) for a period of up to 5 minutes. After operating in liquid media, it is required to dry the endoscope in an upright position with the distal end down for 3-5 hours. If necessary, before drying the endoscope, clean the working part using a microfiber cloth.



2.3.10 If it is necessary to illuminate the object under control, enable backlight. The endoscope has 4 brightness modes: 25%, 50%, 75%, 100%. Switch between them using short press of the power button. Double pressing the button activates high brightness mode for 10 seconds.



2.3.11 Upon completion, carefully remove the viewing fiber of the device from the area under inspection, after having straightened the distal end relative to the working part. Turn off backlight and place the components of the product into standard package.

2.3.12 In case of working with phototract, remove the camera and optical adapter from the standard package (case).



2.3.13 Carefully mount the camera on the optical adapter so that the hole on the optical adapter matches the hole for attaching the tripod to the camera.



2.3.14 Tighten the screw to secure optical adapter to the camera.

2.3.15 Press the clip of the optical adapter, install it on the eyepiece of the endoscope.

2.3.16 Turn on the camera. Take a photo of the control object.

2.3.17 Upon completion, turn off the camera, remove optical adapter from the eyepiece of the endoscope and camera by unscrewing the fixing screw. Place the components of the product into the standard package (case).



## 2.4. Operation in extreme conditions.

2.4.1. In case of fire on the device, power off the device and take measures to put out fire.

2.4.2. In case of emergency operating conditions (high temperature, humidity, vibration, etc.), take measures to reduce the impact of emergency factors on the product.

## 3 TECHNICAL MAINTENANCE OF THE PRODUCT

3.1. Product maintenance does not require special training of staff.

3.2. Any oxidation and salt presence on the surfaces of the batteries must be avoided. When any appear, the batteries must be replaced.

3.3. Optical surfaces of the device (eyepiece) when dirty should be cleaned only with a clean cloth made of genuine or microfiber suede, designed for cleaning optical parts (eg glasses). Before that blow away the grains of sand and

dust. To remove heavy grease, use a cotton swab moistened in ethanol, having preliminary removed solids from the optics with a soft brush.

3.4. Product functional testing and its technical inspection is controlled by checking paragraphs 1.2.2.,1.2.3., 1.2.10.

3.5. Preservation (degreasing, reconservation) of the product is carried out by packing it in its standard package (plastic case).

#### 4. PRODUCT MINOR REPAIR

4.1. Minor repair of the product is carried in accordance with Table 3.

Table 3

<b>Failure and damage consequences</b>	<b>Possible Reasons</b>	<b>Troubleshooting</b>
The field of view of the endoscope is blurred, spots are observed.	The outer surface of the eyepiece or the end face of the distal end of the device is dirty.	Wipe the surfaces with a cloth for cleaning optics
Backlight does not enable. When enabling backlight, battery charge indicator is flashing or turns red	Batteries are discharged	Charge the batteries
Backlight is not on. When enabling backlight, charge indicator is off	Rechargeable batteries are discharged below permissible level	Insert proper batteries

#### 5. STORAGE

##### 5.1. Storage conditions.

5.1.1. The device must be stored packed (plastic case) on the shelves in the capital heated rooms at temperature from 5 ° C to + 40 ° C and a relative humidity of 80% at temperature of +25 ° C at no vapors of acids, alkalis, current-conducting dust and other chemically active substances, gases that cause corrosion and destroy insulation. It can be stored in a standard package when stacked (horizontally) on the shelves with up to 6 products. Stacking in a vertical position is not allowed.

##### 5.2. Storage life

5.2.1. Storage life of the product in a standard package is 1 year (without rechargeable batteries) in heated ventilated premises at ambient temperature from + 5<sup>0</sup>C to + 40<sup>0</sup>C and a relative humidity of up to 80% at temperature of 25 ° C.

##### 5.3. Terms of placing the product in storage and withdrawing it from storage.

5.3.1. When placing the product for storage, its components must be packed in standard package and placed on the corresponding cells. When withdrawing it from storage, the components of the product should be removed from the package and kept under standard climatic conditions for at least 12 hours.

## **6 TRANSPORTATION**

### **6.1. Requirements for transportation and transportation conditions.**

6.1.1. Transportation of the device is carried out in a transport container by all kinds of goods and passenger transport at a height of up to 12,000 meters and distance up to 12000 m at ambient temperatures from -40 ° C to + 60 ° C and protected against direct exposure of precipitation and reactive components.

6.1.2 After transportation and before using, keep the product in standard climatic conditions for at least 12 hours.

### **6.2. The procedure to prepare the product for transportation and methods of attachment during transportation.**

6.2.1. Before transporting the product in a standard package, it can be packed into an extra matched shipping container (carton or plywood box). Products in transport containers should be secured in such a way as to ensure the stability of their position, excluding mutual displacement and strokes. During loading, unloading and transporting, the requirements of handling marks on the shipping container must be strictly observed.