POLON-ALFA

DUR-4047
WIRELESS RADIO UNIVERSAL SMOKE OPTICAL DETECTOR

POLON 4000 and POLON 6000 INTERACTIVE FIRE DETECTION AND ALARM SYSTEM

INSTALLATION AND MAINTENANCE MANUAL

IK-E315-001GB

IE Edition

CE

CNBOP-PIB

The DUR-4047 wireless radio optical smoke detector covered by the present manual complies with the requirements of the following European Union Directives:

CPD 89/106/EWG on construction materials;
EMC 2004/108/WE on electromagnetic compatibility.

The DUR-4047 optical smoke detector has been approved with the EC-Certificate of Conformity No. 1438/CPD/0216 issued by the Scientific and Research Centre for Fire Protection (CNBOP) Józefów, Poland, a EU notified authority No. 1438, confirming its compliance with the requirements of PN-EN 54-7:2004 and PN-EN 54-25:2008 standards.

The certificate may be downloaded from www.polon-alfa.pl web site.

CE **1438**
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EN 54-7 EN 54-25 **DUR-4047 Wireless Radio Universal Smoke Detector** (utilising scattered light effect, radio-operated) Application – fire safety
Technical data - IK-E315-001GB manual

Read the manual carefully before the detector assembling and commissioning.

Any nonconformity with the instructions contained in the manual may be harmful or may cause violation of the law in force

POLON-ALFA bears no responsibility for any damage resulting from usage inconsistent with the manual.

A waste product, unsuitable for further use, shall be passed to a waste electric and electronic equipment collection point.	

NOTE: The manufacturer reserves the right to change specifications of products at any time without prior notice.

1 PURPOSE

The DUR-4047 radio universal optical smoke detector is designed for detection of visible smoke that is concurrent with most fire combustion. It enables a fire detection at a start of its flameless stage when material starts to smoulder, and therefore generally, a long time prior to appearance of an open flame and a noticeable rise in temperature. The detector is characterised by high resistance against wind, pressure change and is very sensitive to visible smoke.

The DUR-4047 radio optical smoke detectors interoperate with the POLON 4000 fire detection and alarm system control panels through the ACR-4001 radio adapter. The detectors are power supplied with batteries.

The detector application is recommended when detectors cannot be connected to detection lines, e.g. in historic buildings, churches, etc.

2 TECHNICAL SPECIFICATIONS

Battery power supply	2 CR123 lithium batteries
Operating voltage	3 V
Maximum quiescent current draw	≤ 80 µA
Operation period in monitoring mode	3 years [1)]
Maximum current draw in fault or alarm mode	≤ 1 mA
Radio frequency operating range	863 ÷ 870 MHz
Rated power	< 25 mW
Frequency stabilisation method	frequency synthesizer and quartz resonator
Radio communication method	multi-channel with confirmation
Modulation method	FSK
Antenna type	integrated
Range – dependable on environment damping	up to 100 m
Maximum installation height	12 m [2)]
Maximum supervised area	60 ÷ 80 m^2 [2)]
Number of sensitivity levels	3
Test fire detection suitability	TF1, TF2, TF3, TF4, TF5, TF8
Operating temperature	from -25 °C to +55 °C
Allowable relative humidity	up to 95 % at 40 °C
Dimensions (without base)	Ø 115 mm x 54 mm
Mass (without base)	0.2 kg
Standard colour	white
Address coding method	programmable at the control panel

[1] *In case the detector operates for a long period in a fault mode or in an alarm mode, or is installed in adverse environment due to radio interferences and radio wave propagation, the operation period can be shortened down to 130 days;*

[2] *see design guidelines.*

3 SAFETY CONDITIONS

3.1 Repairs and maintenance

Any maintenance works or periodic inspections shall be executed by skilled personnel employed by companies authorised and trained by POLON-ALFA.

Any repairs must be carried out by the manufacturer. POLON-ALFA bears no responsibility for the operation of any apparatus being repaired by unauthorised personnel.

3.2 Works at height

Any detector installation works carried out at height must be executed with particular care utilising tools and machinery in good working condition.

Special attention shall be given to stability of ladders, elevators, lifts, etc.

Any electric tools shall be used strictly obeying the safety rules stated in instruction manuals by manufacturers.

3.3 Anti-dusting eye protection

It is obligatory to use protective anti-dusting glasses and masks during detector installation works that produce high amount of dust, such as hole drilling in ceilings.

4 DESIGN DESCRIPTION

The DUR-4047 detector mechanical construction is shown on Fig. 1. Its basic part is a detecting optical module consisting of a transmitting diode and a receiving diode. They both are mounted in a holder in such a way that the light emitted by the transmitting diode does not reach the other diode directly. The detecting module (holder with diodes) is fastened directly to a printed board that contains all electronic elements with the detector operation monitoring processor. The optical module penetration by external light is eliminated with a help of a labyrinth. A metal protective net prevents irruption of small insects or pieces of dirt into the detecting module. The whole structure is placed in a white plastic housing consisting of a basket, a detector cover and a screen.

The DUR-4047 detector is mounted on ceilings using the G-40 base (without clamps) which is delivered together with the detector.

5 PRINCIPLES OF OPERATION

The DUR-4047 optical smoke detector operation basis is the Tyndall effect – light ray scattering on smoke particles. Its basic element is a detecting optical module consisting of an electroluminescence diode that transmits light radiation and a photodiode acting as a receiver. The optical module and the surrounding measuring chamber are protected by a labyrinth which is shaped to dump both external light and radiation resulting from internal reflexes of the transmitting diode light.

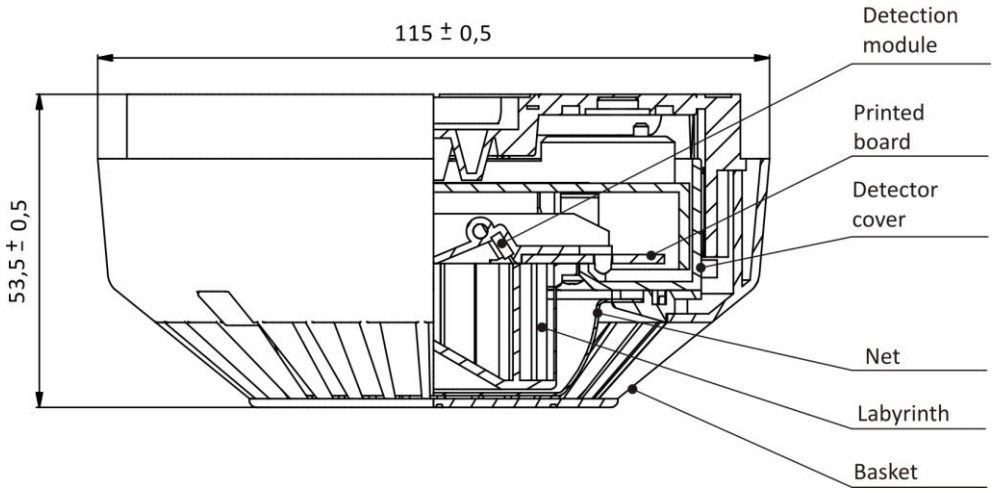

Fig. 1 DUR-4047 detector main elements

When smoke particles enter the measuring chamber, they reflect the light emitted by the transmitting diode. The reflected light reaches the optical diode producing photocurrent which is first strengthened and processed into digital form and then analysed by the microprocessor installed inside the detector. An alarm mode is indicated with a pulse red light emitted by a diode installed in the detector casing. The indicator enables fast location of the activated detector and is helpful in periodic detector inspections.

Communication between the POLON 4000 system control panel and the DUR-4047 detectors is obtained through the ACR-4001 radio adapter. The smoke detector communicates with the adaptor using the radio protocol with confirmation and a possibility of changing the radio channel. During operation, radio interferences are monitored and in an event of an interference occurrence, the radio channel is changed, which allows the detector further uninterrupted operation. Apart from transmitting an evaluation of fire factors and their change tendency, the detector passes to the control panel, on its request, a current analogue value. The detector operation controlling microprocessor monitors correctness of its basic circuits operation and, in case an irregularity is found, reports relevant information to the control panel.

The DUR-4047 is an analogue detector with an automatic sensitivity self-regulation digital mechanism that is it maintains a constant sensitivity level during progressing dirt build-up in the measuring chamber. After exceeding a pre-set threshold of technical alarm, the detector transmits a signal to the control panel denoting the measuring chamber partial contamination. The signal is generated in order to inform the servicing personnel that the detector parameters shall not remain at the declared level in case the dirt build-up tendency is maintained and appropriate measures are not taken. It must be stressed that the detector shall be fully efficient within ca. 1/3 of the time period that passed since the latest maintenance works.

The detector alarm mode is signalled with a flashing red light of the illuminating diode. A fault mode, a technical alarm and the battery fault are signalled with yellow flashes of the diode. The detector indicates the battery fault in case one of the installed batteries is taken out or when a battery approaches the end of its operational period (one month prior to the genuine discharge and impossibility to continue its work).

The detector sensitivity level is adjustable. Its sensitivity is settled from the control panel level choosing one of available sensitivity levels: 1st operation mode – normal sensitivity, 2nd operation mode – increased sensitivity, 3rd operation mode – decreased sensitivity. The detector operation modes (besides the control panel alarm variants) entails that the user is able to adapt, in the best way, its operation characteristics to operation in the determined environment.

6 OPERATION AND SERVICING CONDITIONS

The DUR-4047 batteries should be fixed only after the fire detection and alarm system installation and configuration. Earlier battery connection in detectors that are unable to communicate with an adapter may result in their fast discharge.
The DUR-4047 radio detector is power supplied with two 3 V batteries of CR123A type. It is recommended to use batteries manufactured by Kodak (K123LA), Sanyo (CR123A), Energizer (EL123) and Duracell (DL123A). The batteries delivered by the manufacturer, Polon-Alfa company, may be purchased separately, in order to replace discharged ones already installed in detectors.
In case of battery replacement, it is necessary to exchange a set – 2 batteries. The discharged batteries must not be disposed as industrial waste; it is obligatory to obey environment protection regulations in force (European Union directives No. 91/157/EWG and 93/86/EWG).

During the detectors operation it is obligatory to avoid creation of dew or rime on the detector surface as well as to protect against excessive contamination with dust.

> **For the period of repair works, the detector should be taken out or protected with appropriate for this purpose cover. Such a cover can be obtained from an installer or purchased from the manufacturer. In case the detector is taken out, its base should be protected against being painted utilising a painting tape. Detectors which are damaged during painting and renovation works due to a fault of the persons executing such works (e.g. painted detector casing, stuck-with-paint net, etc.) are not subject to warranty repairs.**

During the operation life, the DUR-4047 detector should be subjected to periodical inspection according to PKN-CEN/TS 54-14:2006 standard, which is executed in order to confirm the detector proper operation and its appropriate interoperation with the control panel. The inspection should be carried out at least once in 6 months.

The detector operation is checked with a smoke simulator or smoke generator.

The DUR-4047 optical smoke detector long-lasting operation may result in dust accumulation inside its internal optical chamber. After exceeding the self-regulation range due to the chamber contamination progress, the detector triggers a technical alarm mode sending excessive contamination information to the control panel. It causes a necessity to clean the detector optical module: the labyrinth and lenses of both diodes – the transmitting one and the photodiode. The chamber contamination evaluation, before a technical alarm signalisation, can be carried out from the control panel through contamination value readout from the control panel service function. A failure to perform the servicing works may result in false alarm evoking in future.

The detector assembling and dismantling is shown on Fig. 2. In order to dismantle the detector it is necessary to:

a) pressing the net long tongue, turn the cover right in the basket until it is taken out;
b) remove two screws that fix the labyrinth and take the labyrinth out;
c) perform the necessary cleaning.

A delicate brush as well as vacuum cleaner is recommended for cleaning; compressed air can be possibly used. It is permitted to wash the labyrinth with warm water with addition of washing-up liquid. No damp patches should remain on the labyrinth internal surfaces after washing and drying.

After cleaning, the detector should be assembled, its functioning should be tested using a smoke imitator or smoke generator and installed again into the detection line.

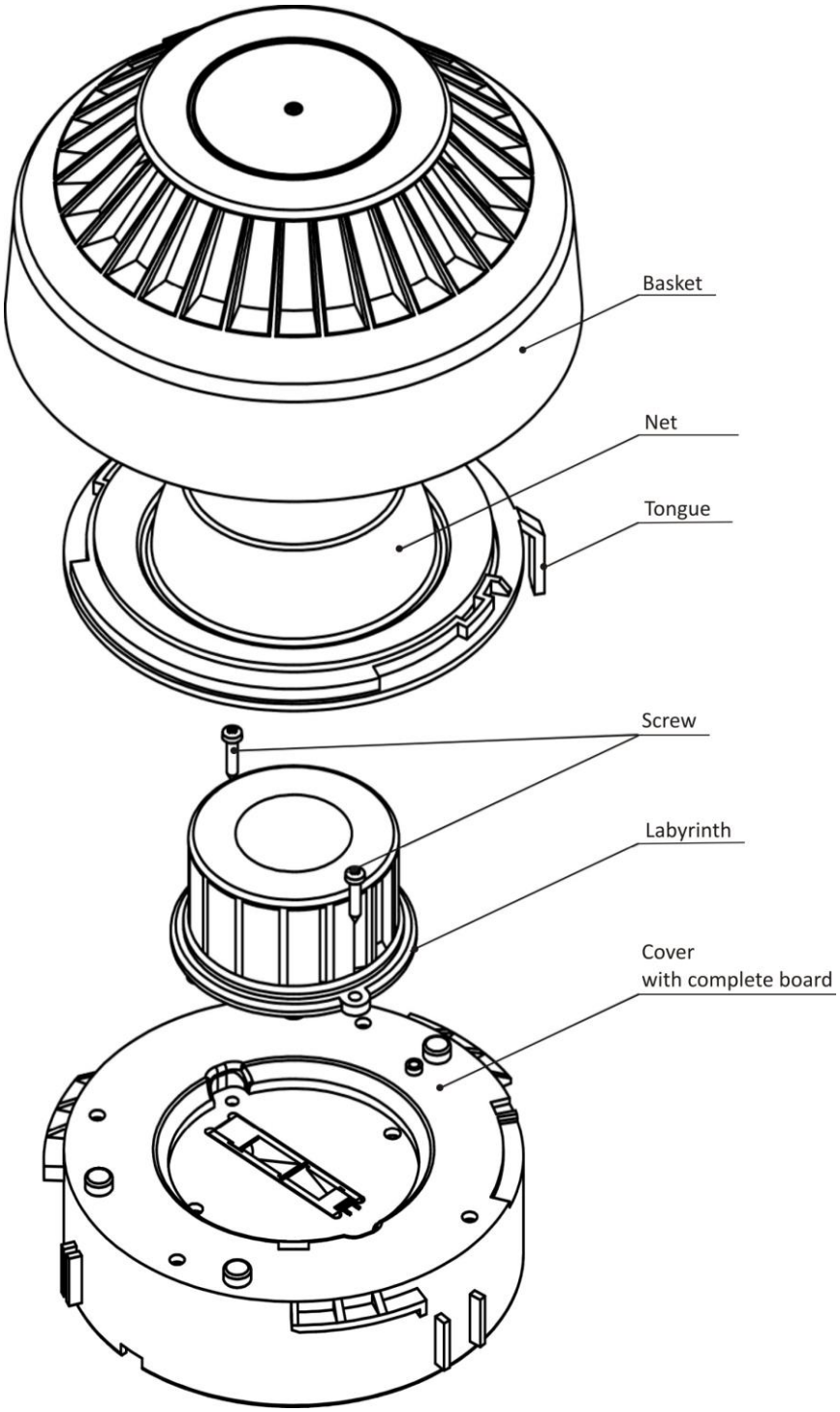

Fig. 2 Detector elements after dismantling

In this order to assemble the detector, it is necessary to:

a) fasten the labyrinth with two screws
b) lay down the basket in the reverse position as that shown on the figure;
c) insert the net into the basket paying attention to its positioning – alignment with the tongues;
d) insert the cover into the basket so that the illuminating diode is placed a little to the right in relation to the glass;
e) turn the cover to the left.

Note: In case the cleaning does not produce the required result, it is necessary to send the detector to the manufacturer for repair.

7 DETECTOR INSTALLATION

The DUR-4047 detectors are installed (height, arrangement) according to the guidelines settled by the Scientific and Research Centre for Fire Protection. They are mounted in premises where the working equipment or stored materials may emit visible smoke when a fire occurs.

Note: The detectors should not be installed in corrosive atmosphere that contains caustic gases and vapours as well as dust. Steam condensation on detectors is impermissible.

8 RADIO SET COMMISSIONING (ACR-4001 ADAPTER + DUR-4047 DETECTORS)

The DUR-4047 detectors and the ACR-4001 adapter disposition is critical; any obstacle in the form of walls, ceilings, doors or windows results in radio signal damping and in the worst case can reduce the operation range from 100 m down to just few meters in case of unfavourable detector arrangement in the building.

It should be ensured that not more than two adapters operating in the same more are installed in radio range, i.e. consecutive adapters placed one next to another should be programmed to operate in '1', '3', '5' or '9' mode. The modes from '3' to '10' are available only for adapters supported with software not older than v. 1.3 and for detectors with software version not lower than v. 1.4. For detectors supported with software versions of v. 1.0, v. 1.1 and v. 1.2 it is possible to choose the adapter's '1' or '2' mode only. The '1' mode is not recommended due to highest number of interferences from neighbouring frequency bands coming from other radio spectrum users.

Table of corresponding operation modes	
Normal operation	Testing
1	2
3	4
5	6
7	8
9	10

The above table presents corresponding operation modes: in the time of normal work and during testing. For a given operation mode pair (e.g. 3 – 4), the detector and the adapter work at the same frequency set. In case the adapter's operation mode is changed for another one (of a non-corresponding pair), then 'lack of communication with the detector' fault may occur for several minutes (if the detector was earlier furnished with batteries). Therefore, operation mode choice choices should be made at the design stage, in accordance with the rule that the neighbouring adapters (in radio range) are set up with different operation modes: consecutively '1', '3', '5', '7' , '9'.

When the DUR-4047 detector and ACR-4001 adapter are mounted in historic buildings, due to the devices working conditions (signal damping value) that may be hard to estimate, it is necessary to simulate the devices disposition in advance.

I. The devices mounting place choice is based on estimation: the detector and the adapter 'see' each other – there are no obstacles between them and the distance is smaller than 60 m.
II. The adapter mounting place choice – when the detector's (detectors') location is known – should be made using the TZCR-4001 testing radio set (supplied from battery, with purposely worsened

radio spectrum parameters – in order to ensure unfailing work of a real adapter). After the detector (with batteries connected) inserting into the base where it is intended to operate, communication between the detector and adapter is checked (red flashes are emitted by a diode placed in the adapter – minimum 1 red flash to provide 30 dB damping margin) using the testing adapter.

Since the adapter communicates with every detector in its operation range, during the test only one detector should operate!

III. The disposition choice, when the adapter mounting place is known and the detectors arrangement can be altered.

Testing communication between the adapter and the detector, it is advised to carry out the device tests at the level as close as possible to the real conditions (under the ceiling, not just above the floor).

The devices commissioning should start from the radio adapter connecting into the POLON 4000 control panel detection line. None detector should be furnished with batteries. In order to check the signal strength in the premises where the detectors are to be mounted, one detector should be used.

1. At the control panel level, numbers of all detectors that are to interoperate with a given adapter (max. 16 detector numbers) should be entered. For the purpose of this, it is necessary to choose at the control panel (at the 3rd access level) the 'SYSTEM CONFIGURATION -> LINE SETUP -> ACR CONFIGURATION' menu.
   a) The number of the line, where the adapter is installed, should be chosen;
   b) The factory serial number should be entered – after its confirmation, the current adapter configuration shall be read in and displayed;
   c) At 1 – 16 positions the numbers of the detectors interoperating with the adapter should be written in.

      Note: Special attention should be given to avoid the same detector assignment to two different adapters as it may cause serious problems during configuration.
   d) The ACR adapter configuration should be saved.
   e) In case of such necessity, the a), b), c) and d) actions should be repeated for other radio adapters.
2. In the control panel menu (at the 3rd access level), it is necessary to choose the 'SYSTEM CONFIGURATION -> LINE SETUP -> AUTOMATIC CONFIGURATION' menu and to pursue automatic elements declaration for a particular detection line. The control panel may signal detector faults as batteries are not connected and the detectors do not function.

   Note: Since wireless radio detectors constitute a line branch, AUTOMATIC CONFIGURATION is possible only when the adapter in installed in a loop-shaped detection line. If it is installed in a radial line, only manual configuration can be carried out.
3. In the control panel menu (at the 3rd access level), it is necessary to choose the 'SYSTEM CONFIGURATION -> LINE SETUP -> MANUAL CONFIGURATION' menu and to settle the ACR-4001 adapter's '2' operation mode (alternatively '4', '6', '8' or '10' – service modes). A collective 'TESTING' indicator is lit in the control panel and, after pressing the button located near the indicator, an 'ACR-4001 IN SERVICE MODE' communique is displayed.
4. One of the declared detectors should be furnished with batteries. As soon as the detector enters the adapter operation range, the indicating diode emits red modulated flashes. In case the detector is unable to establish communication with the adapter, the diode emits modulated yellow flashes. The number of red flashes indicates the signal level (from 1 to 3).
5. It is necessary to test, whether proper radio communication with the adapter is established in the place where the detector is to be installed – regular 3 diode red flashes and no yellow flashes. Additionally, it is possible to check in the control panel 'SYSTEM ELEMENTS TESTING -> TESTS SETUP -> COMMUNICATION WITH RADIO DETECTOR TEST' menu, the number of successful attempts out of latest 31 ones. Optimally the 'COMMUNICATION QUALITY' parameter value should amount to 31; it cannot be lower than 20. Three minutes should be provided for reaching the proper value and its stabilization. Additionally, the 'TRANSMISSION HISTORY' enables latest

transmissions history analysis. In order to provide 30-dB radio band damping, the graph columns should be of maximum height.

Note: The 'TRANSMISSION TIME' parameter should not exceed 10 sec.; if the parameter amounts to more than 60 sec. for the whole 3-minute test period, it is necessary to ascertain that the adapter operates in the '2' (or '4', '6', '8','10') mode.

6. Subsequently, the detector should be placed in a consecutive base and its transmission correctness should be checked as in p. 5.
7. When all the places where detectors are to be installed are checked, the detectors should be furnished with batteries and mounted in the bases which were determined beforehand. It is important to prove at the control panel that every communication fault with the installed detectors has been eliminated.
8. After confirmation that the whole circuit operates properly, the control panel should be set up in the 'SYSTEM CONFIGURATION -> LINE SETUP -> MANUAL CONFIGURATION' menu at the '1' mode (or '3', '5', '7', '9' – normal operation mode) of the ACR-4001 adapter. The collective 'TESTING' indicator should go out; if it does not happen, it is necessary to check whether, after pressing the button located near the diode, the communique 'ACR-4001 IN SERVICE MODE' is still displayed, or another test is being executed.

Note: In case a detector is located in a place where radio communication is hindered (i.e. the detector does not receive a confirmation of every information sent – it receives for instance one confirmation per 20 transmission attempts), it can result in faster batteries discharge and the detector shortened operational period. Low transmission quality is indicated at the control panel by the 'LOW RADIO LINK QUALITY' technical alarm.

STORAGE AND TRANSPORTATION

8.1 Storage

The DUR-4047 detectors should be kept in closed premises free of caustic gases and vapours at the temperature between +0 °C and +40 °C, and relative humidity not exceeding 80 % at +35 °C.

In the time of storing, the detectors should not be exposed to either direct sunlight or heat from heating equipment.

The detectors storage period in transportation packing should not exceed 6 months.

8.2 Transportation

The DUR-4047 detectors should be carried in closed transport means spaces, in packing that meets the requirements of transportation regulations in force. The temperature during transportation should not be lower than -40 °C and higher than +70 °C, and relative humidity should not be higher than 95% at + 45 °C or 80% at +70 °C.

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