

BEAM SMOKE DETECTOR

DOP-3000

POLON 3000 FIRE ALARM SYSTEM

INSTALLATION AND MAINTENANCE MANUAL

IK-E399-001-GB

Change I



The DOP-3000 beam smoke detector, which is the subject of this IM, meets the essential requirements of the following Regulations of the European Parliament and of the Council (EU) and European Union directives:

- CPR CPR/305/2011 Regulation (EU) of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products repealing Council Directive 89/106/EEC;
EMC Directive 2014/30/EU on EMC Electromagnetic Compatibility,
LVD Directive 2014/35/EU on low-voltage electrical equipment.

The product has been issued by CNBOP-PIB, notified body No. 1438, a certificate of constancy of performance confirming the possession of technical features/parameters required by EN 54-12:2015 and EN 54-17:2005+AC:2007.

The Manufacturer's technical features/parameters exceeding the requirements of the listed standards and other features/parameters of the product specified in this manual not specified in the listed standards are confirmed by the Manufacturer.

A Declaration of Performance has been issued for the DOP-3000 beam smoke detector.

The certificate and the Declaration of Performance are available on the website www.polon-alfa.com

Before starting installation and operation, read the contents of this manual.

Failure to follow the recommendations in this manual may prove dangerous or result in a violation of applicable regulations.

Manufacturer: POLON-ALFA S.A. is not responsible for damage caused by use not in accordance with these instructions.



A worn-out product, unfit for further use, should be handed over to one of the points dealing with the collection of waste electrical and electronic equipment.



NOTE! POLON-ALFA reserves the right to make changes to this manual.

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1 PURPOSE

The DOP-3000 beam smoke detector is designed to identify smoke generated at an early stage of fire development. It is particularly suitable for protection of rooms where smoke is expected in the first phase of a fire and where, due to the large area of the room, a significant number of point smoke detectors should be used to protect it. Beam smoke detectors (compared to point smoke detectors) are sensitive to the average value of smoke density over the long infrared beam path therefore are particularly suitable for use under high ceilings/ceilings or where smoke can be scattered over a large area before detection.

Exemplary objects especially suitable for this type detector installation are: churches, cathedrals, historic buildings with ceilings/ceilings of high historical value, theatres, opera houses, entertainment halls, production halls, very high rooms where point detectors would be ineffective, rooms with different ceiling or ceiling structures, etc.

A characteristic feature of the DOP-3000 detector is that the transmitter and receiver are placed in one housing and cooperate with the prism reflector or a set of reflectors located opposite.

A laser pointer is provided in the detector housing to facilitate the alignment of the optical path between the detector and the prism reflector/set of reflectors.

DOP-3000 beam smoke detectors are designed to operate in addressable detection lines of the POLON 3000 fire alarm control panels. The device can also be used with the following conventional fire alarm control panels: CSP-35, CSP-36, IGNIS 1000, IGNIS 2000, TELSAP-2100 addressable systems (via ADC-1 adapter) and CSP-38 (via ADC-38 adapter). The detector can operate in confined rooms, in the temperature range from -25 °C to +55 °C and relative humidity up to 95 % at 40 °C.

2 TECHNICAL SPECIFICATIONS

Detector operating voltage in addressable line	16.5 V to 24.6 V
Detector current consumption in an addressable line	< 300 µA
Address encoding and sensitivity thresholds	programmed from the control panel
Detector operating voltage in a conventional line	10.5 V to 24 V
Supervision current in a conventional line	5 mA or 2.2 mA depending on the system
Conventional line alarming current, at 20 V	20 mA
Current at lumen interruption	< 0.3 mA
Service signal current - optics contamination	< 0.3 mA
Sensitivity thresholds (selectable)	18 %; 30 %; 50 %
Operating range of a detector with a prism reflector (Fig. 9.5)	from 5 m to 50 m
Operating range of the detector with the reflector unit (Fig. 9.6)	from 50 m to 100 m
Detector angular tolerance	±0.5°
Mirror Angle Tolerance	±5°
Number of detectors in the POLON 4000/6000 addressable line	64
Number of detectors on one conventional line	1
Number of detectors behind the ADC-1 adapter	1
Number of detectors behind the ADC-38 adapter	1
Powering the laser sight (during alignment)	6F22 battery (9 V)
Operating Temperature Range	-25 °C to +55 °C
Permissible ambient relative humidity	up to 95 % at +40 °C
Protection	IP40
Dimensions	129 mm x 80 mm x 84 mm

Weight (with adjustment base)	0.35 kg
Housing colour	black
Detected test fires	TF1, TF2, TF3, TF4, TF5, TF7, TF8



Fig. 2.1. DOP-3000 detector with prism reflector

3 PRINCIPLE OF OPERATION

The DOP-3000 detector consists of an infrared (IR) light transmitter and a receiver located in a single enclosure, and an interoperating separate E39-8R prism reflector or 4xE39-8R reflector panel. The detector principle of operation consists in continuous analysis of optical air transparency in a space between the detector and the reflector (reflector panel).

The detector can be in one of four modes: supervision, alarm, fault – light beam break, and fault – caused by contamination. If a certain, defined quantity of aerosol (smoke) is found in the air, reducing optical transparency below a set threshold, then the detector enters an alarm mode. Complete interruption of the radiation beam (or its reflection due to an object occurrence in its optical path) is signalled as a fault, because even the largest smoke concentration in the air does not cause an entire break of the detector optical path. When the air is clear, the detector is in supervision mode.

Long lasting detector operation, especially in high dust level premises, may lead to contamination (dust build-up) of optical parts of the detector and the reflector/reflector panel. In order to maintain constant sensitivity and fire detection ability during a long time period, the detector is equipped with automatic compensation circuits to monitor its contamination and environ impact conditions. The circuits ensure the same sensitivity threshold in the whole compensation range. At a certain contamination level, the detector signals a fault mode denoting a necessity to undertake servicing and cleaning works. However, even in this mode, the detector is still able to detect smoke and initiate an alarm. A contamination caused fault requires cleaning works of the reflector/reflector panel and the detector front surface. After cleaning, the detector adjusts to new external conditions and automatically changes its mode from fault to supervision.

Communication between the POLON 3000 system control panel and the DOP-3000 detectors is provided using a two-wire detection line. A unique, fully digital communication protocol enables transmission of any information from the control panel to the detector and vice versa, such as:

surrounding conditions evaluation (smokiness, temperature), their change tendency and the current analogue value of temperature and smokiness density.

The DOP-3000 addressable smoke detector is equipped with an internal short circuit isolator, which cuts off the efficient detection line from a shorted section, what enables the detector further un failing operation.

Analysis function in the DOP-3000 detector is fulfilled by a microprocessor. After the detector optical path alignment and initiation the analysis process at the control panel level (detectors in an addressable line), or pressing the START push button (detectors in a conventional line), microprocessor circuits analyses the ambient temperature and the settled sensitivity threshold. A self-adjustment program is switched on after entering these data into the detector memory. The self-adjustment process terminates after achieving a reference value with $\pm 5\%$ tolerance. Afterwards, the decision criteria are drawn up for various fire phenomena runs, for instance for fast or slow fire development. The data are kept in the detector non-volatile memory and periodically checked. Any measured value change (against the assumed decision thresholds) caused by a smoke, after triple verification, is treated by the microprocessor as a fire.

4 DESIGN

The design of the DOP-3000 detector is shown in Fig. 2.1 and Fig. 9.2.1. The detector casing, made of plastic, embraces electronic circuits and optical elements of a transmitter and a receiver as well as a laser diode that facilitates the detector easy optical alignment. The lenses for infrared beam focusing are covered with a detachable filter. On the detector back side a connecting block is mounted, to connect power supply wires. The detector is fastened to the wall with a metal adjustment basis. On the detector front part, illuminating diodes are placed as well as the START push button that initiates the detector adjustment process.

The colour of the LED signals, accordingly:

- green - a state of the detector self-adjustment to the prism reflector/set of reflectors when the signal level is too high;
- yellow - a state of the detector self-adjustment to the prism reflector/set of reflectors when the signal level is too low;
- red – an alarm mode;
- no light – supervision mode after proper adjustment of the detector with the reflector/reflector panel.

The START button enables to initiate the detector adjustment process (self-adjustment) and re-set the detector parameters after cleaning the optics during operation.

5 INSTALLATION

The DOP-3000 detector can operate with a set of reflectors and then its range is from 50 m to 100 m or with the E39-R8 prism reflector with a range from 5 m to 50 m.

A maximum of 64 DOP-3000 detectors can operate on one addressable line of the POLON 3000 system. Only one DOP-3000 detector can operate on one conventional detection line or side lines (behind ADC-1 and ADC-38 adapters) without end of line resistors.

The reflector or the set of reflectors as well as the M42-00 00 00 service kit, containing test foils and adjustment mirror are not included in the detector and should be ordered separately.

If the detector is not visible or installed in a hard-to-reach place it is possible to connect the WZ-31 additional operation indicator to be placed in a convenient and visible place.

Before installation, it is necessary to declare an alarm mode and a sensitivity threshold. The operations are executed using appropriate jumpers placed on the back side of the detector casing, pursuant to Fig 9.4. One of the criteria taken into consideration when choosing sensitivity may be the distance between the detector and the reflector/reflector panel, and so:

- at a distance of 5 to 20 m, a sensitivity of 18 % is recommended;
- at a distance of 20 to 50 m, a sensitivity of 30 % is recommended;
- at a distance of 50 to 100 m, a sensitivity of 50 % is recommended.

It is possible to set sensitivity level experimentally: adopting it to a certain environment in the case of the detector difficult operating conditions. The DOP-3000 detector and the reflector/reflector unit are mounted on opposite walls, pillars or other construction elements of the premises. The walls should be stable and vibration-free. The detector adjustment base should be attached to the wall and the reflector/reflector set should be attached on the opposite wall. The detector should be placed on the adjustment base (Fig. 9.2.1), after connecting the wires, in accordance with the connector description (as in Fig. 9.2.2). Then, using three screws accessible from the front of the detector (after removing the cover), screw the detector to the base and connect an external 6F22 battery to the contacts supplying the laser aimer.

Before alignment, the mirror (part of the service kit) should be placed on the reflector panel and press down, as it is shown on Fig. 9.2.1. With the help of three positioning screws, the detector laser beam should be aimed at the centre of the reflector or the mirror from the service kit. The adjustment screws help in precise alignment so that the laser beam returns to the detector front plate after being reflected from the reflector. The mirror should be removed after proper regulation of the optical path between the detector and the reflector.

The prismatic reflector position cannot be adjusted and it is recommended to fix it to a flat substrate with screws or glue. The detector is properly aligned with the reflector/reflector panel when the reflected laser light illuminates the detector. In such the situation the external battery should be disconnected, the detector cover should be mounted and the START push button should be pressed. As a result, one of the diodes: yellow or green shall be lit in a pulse manner. After ca. 40 sec. the diodes should switch off, what stands for a proper adjustment of the infrared beam to the distance between the detector and the reflector/reflector panel. During this adjustment process, the detector, being connected to a control panel, signals a fault mode. After pressing the START push button and adjusting the distance between the detector and reflector/reflector panel, the detector enters a supervision mode.

Note: The detectors should not be exposed to direct sunlight operation.

The detector/reflector alignment with a help of a laser beam should be carried out in a dark room.



Fig. 5.1. DOP-3000 detector during optical path alignment

6 OPERATING CONDITIONS AND MAINTENANCE

The DOP-6001 smoke detector long-lasting operation, especially in dusty premises, may result in contamination (dust, dirt accumulation) of the optical part of the detector and of the reflector/reflector panel. After exceeding a program determined contamination compensation range, the detector transmits a fault signal to the control indicating the necessity to call a maintenance technician. The detector is still able to detect fire threat and enter an alarm mode. The contamination caused fault notification entails cleaning of the reflector/ reflector panel and the detector front plate. After cleaning the above mentioned elements, the START push button (located inside the detector) should be pressed in order to adjust the detector to new external conditions. After the adjustment, the detector automatically alters its mode from a fault to a supervision one.

It is possible to check proper operation of the DOP-3000 detectors installed in fire detection systems during their maintenance inspection by concealing partly the detectors optical path. It can be carried out using a special damping plastic foil with overprints appropriate to the detector three sensitivity levels – 18 %; 30 %; 50 %. A plastic sheet with overprint consistent with the detector set sensitivity level should be put on the detector front plate, what should trigger an alarm mode. The DOP-3000 detector testing foil with overprints is included in the service kit.

During renovation or painting works carried out in the premises where detectors are installed, the detector and reflector/ reflector panel should be taken out. Detectors which are damaged in the time of painting and renovation works due to a fault of persons, who execute them, are not subject to warranty repairs.

7 SAFETY CONDITIONS

7.1 Repairs and Maintenance

Maintenance works and periodic inspections must be carried out by authorized personnel of companies authorized or trained by POLON-ALFA.

All repairs must be carried out by the manufacturer.

POLON-ALFA is not responsible for the operation of equipment maintained and repaired by unauthorized personnel.

7.2 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 the stability of ladders, platforms, etc. Any electric tool shall be used strictly obeying the safety rules specified in the manufacturer instruction manuals.

7.3 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 for detector base mounting on ceilings/walls.

7.4 Eye protection against laser beam operating equipment

During the alignment of the detector optical path with the reflector/reflector panel using a laser pointer, special eye protection against direct laser exposure (3R laser equipment class) must be provided.

8 DESIGN RECOMMENDATIONS

The DOP-6001 beam smoke detector operates properly, similarly to all other smoke detectors, in case it is installed at the height not exceeding 12 m. When it is mounted higher (up to 20 m), another row of detectors shall be provided at an intermediate level, with adequately larger number of detectors.

Maximum width (2D) of an area protected by one detector depends on the room height, according to the following table:

Height H	Operation radius D	Distance from ceiling	
		At gradient up to 20 °	At gradient over 20 °
Up to 6 m	6 m	0.2 m to 0.5 m	0.3 m to 0.5 m
From 6 to 12 m	6.5 m	0.3 m to 0.7 m	0.4 m to 1.0 m
Over 12 m	7 m	0.6 m to 0.9 m	0.8 m to 1.2 m

The maximum area protected by one detector in case the detector/reflector panel distance is 100 m for the ceiling height at 12 m amounts to (2D x 100 m) ca. 1240 m², so the detector can replace a dozen of spot smoke detectors.

The distance between the detector IR beam and the side wall of the room should not exceed 6.2 m, and 12.4 m to the radius of the adjacent detector. The distance of the radius from the obstacle (e.g. a protruding wall perpendicular to the side wall) should not be less than 0.5 m.

The detector should constantly "see" the co-operating reflector, It should be located in the facility in such a way that its optical path is not even temporarily obscured by moving objects or devices, e.g. lifts, cranes, etc. In rooms where people are present, the minimum installation height should be 2.7 m (so that the outstretched hands of a person do not interfere with the optical path). There is no such restriction in the case of low, long or narrow spaces where there are no people, e.g. cable ducts, space above suspended ceilings, etc.

NOTE: The data listed above, especially the size of the operating radius, result from the recalculation of the ratio of the position of the line detector to the point detectors in the test fire chamber and coincide with the data according to the CEN/TS 54-14:2018 specification.

9 STORAGE AND TRANSPORTATION

9.1 Storage

The detectors should be stored in closed premises at ambient temperature ranging from 0 °C to +40 °C and relative humidity up to 80 % at +35 °C, free from volatile sulphur compounds as well as acid and alkaline vapours. The detectors should not be exposed to direct sun; heating devices should not directly influence the detectors or their packing.

9.2 Transport

The detectors transportation should be carried out in transport packing using any transport means and obeying the transport recommendations given on the packages and securing protection against

possibility of mechanical damage and impact of temperatures lower than $-40\text{ }^{\circ}\text{C}$ and higher than $+70\text{ }^{\circ}\text{C}$ and relative humidity higher than 95 %.

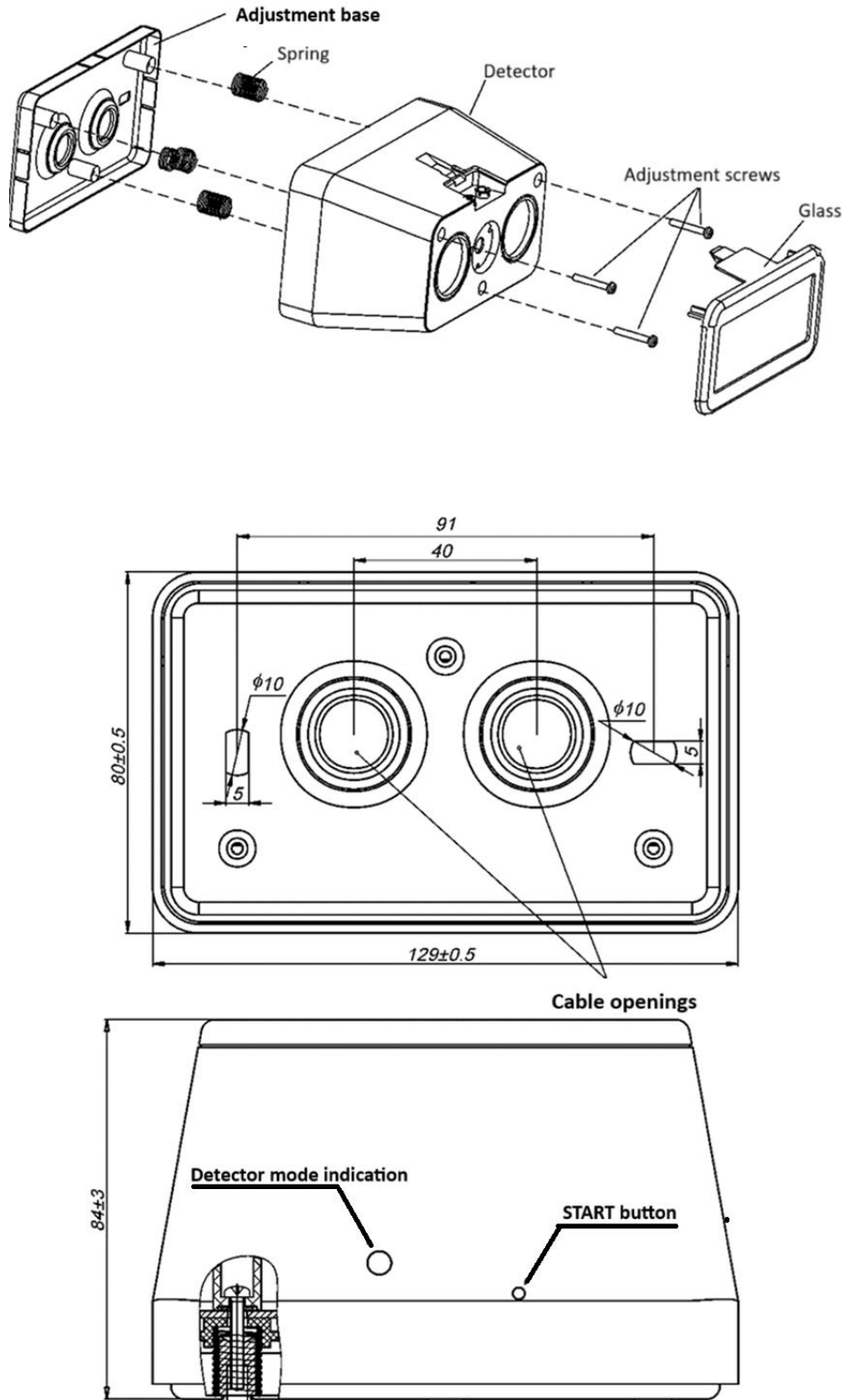


Fig. 9.2.1. DOP-3000 design and overall dimensions

Note:

Only one detector (without an end-of-line resistor) can be installed in a conventional detection line, therefore no line output to the next detector is provided.

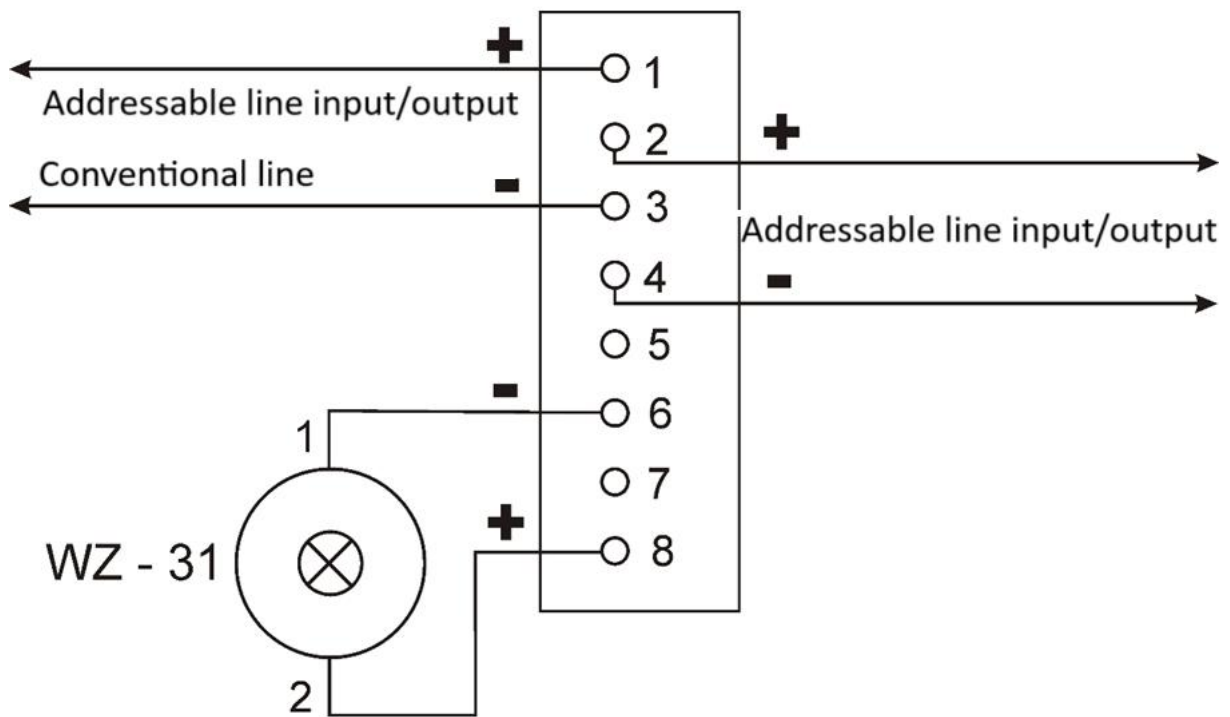


Fig. 9.2.2. DOP-3000 detector installation wires connection

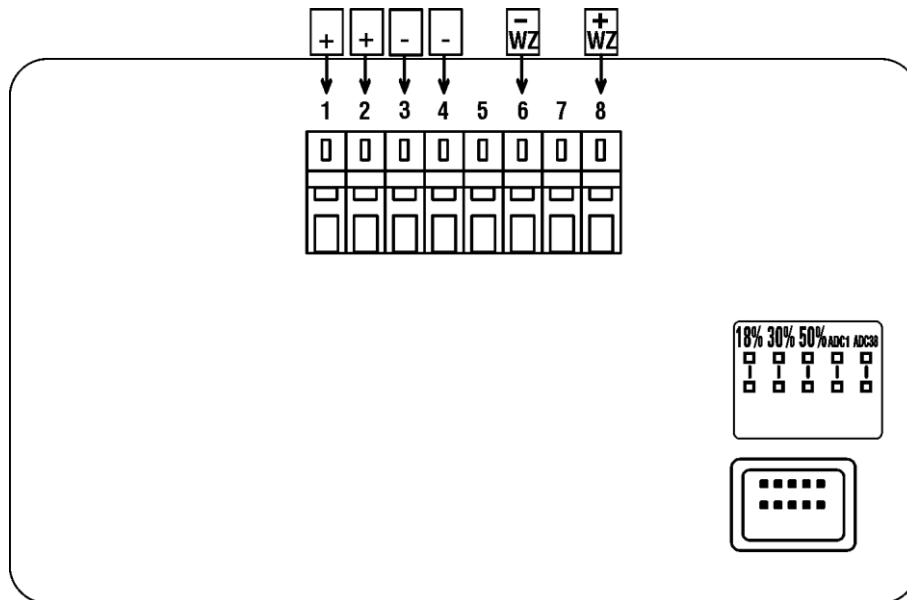


Fig. 9.2.3. DOP-3000 detector internal connections and output terminals diagram

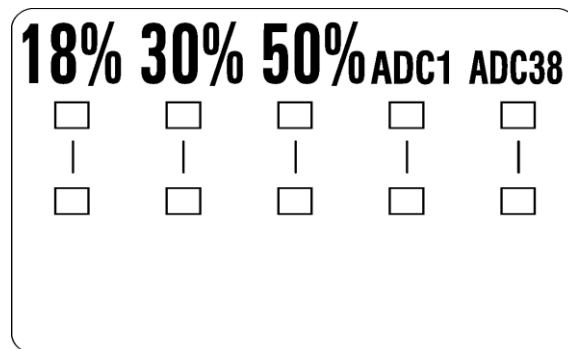


Fig. 9.2.4. Jumpers for detector operation declaration

Declared sensitivity levels:

- jumper in position 50 % - low sensitivity
- jumper in position 30 % - average sensitivity
- jumper in position 18 % - high sensitivity

For the POLON 3000 addressable system, the sensitivity threshold is declared in the control panel and all jumpers must be removed.

Interoperating line declaration:

- no jumper
- TELSAP 2100 side rail behind ADC-1 – jumper in ADC1 position
(this jumper must always be fitted for a conventional system)
- addressable ALFA 3800 system behind ADC-38 – jumper in ADC-38 and ADC1
- conventional IGNIS 1000/2000 and CSP-35 – jumper in ADC38 and ADC1 position

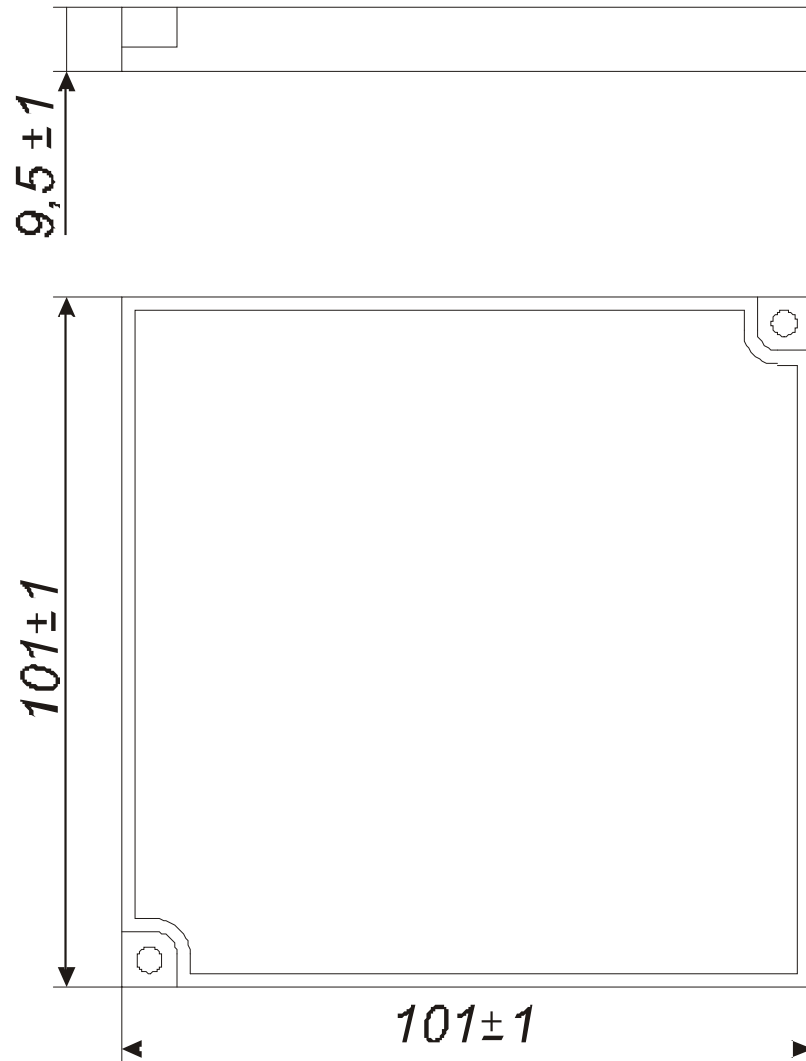


Fig. 9.2.5. Prismatic reflector

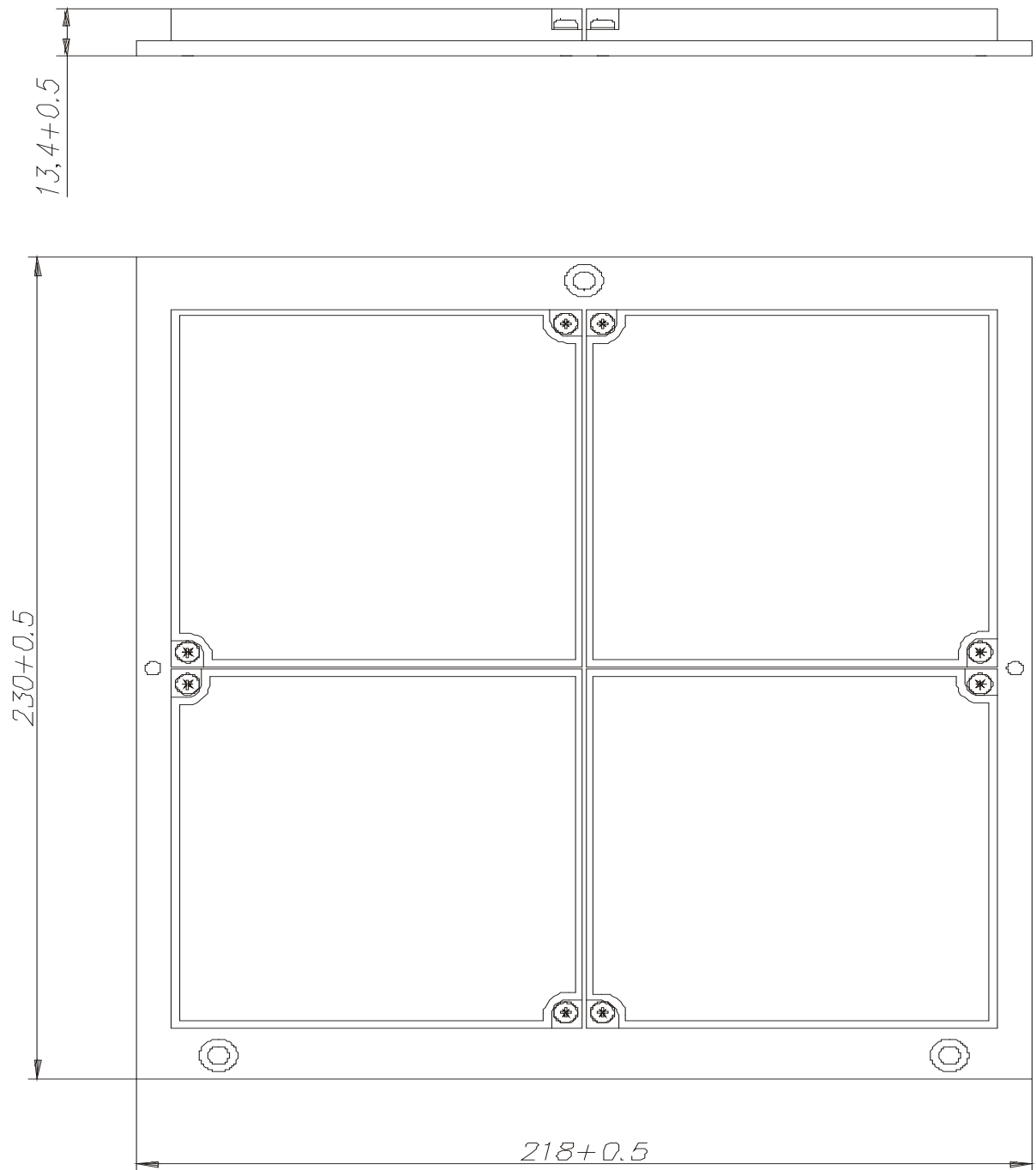


Fig. 9.2.6. Reflector panel

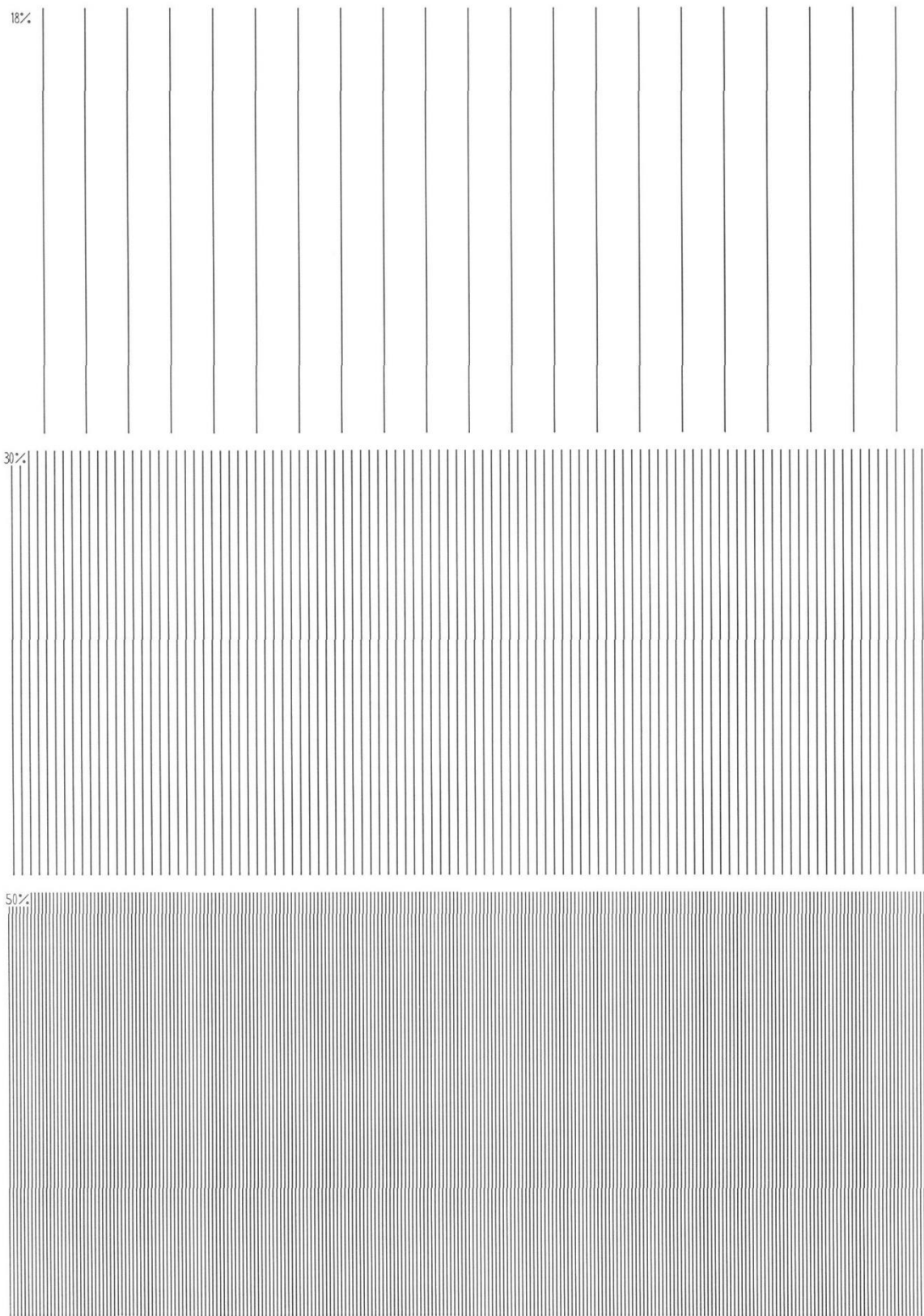


Fig. 9.2.7. DOP-6001 detector testing foul with overprints

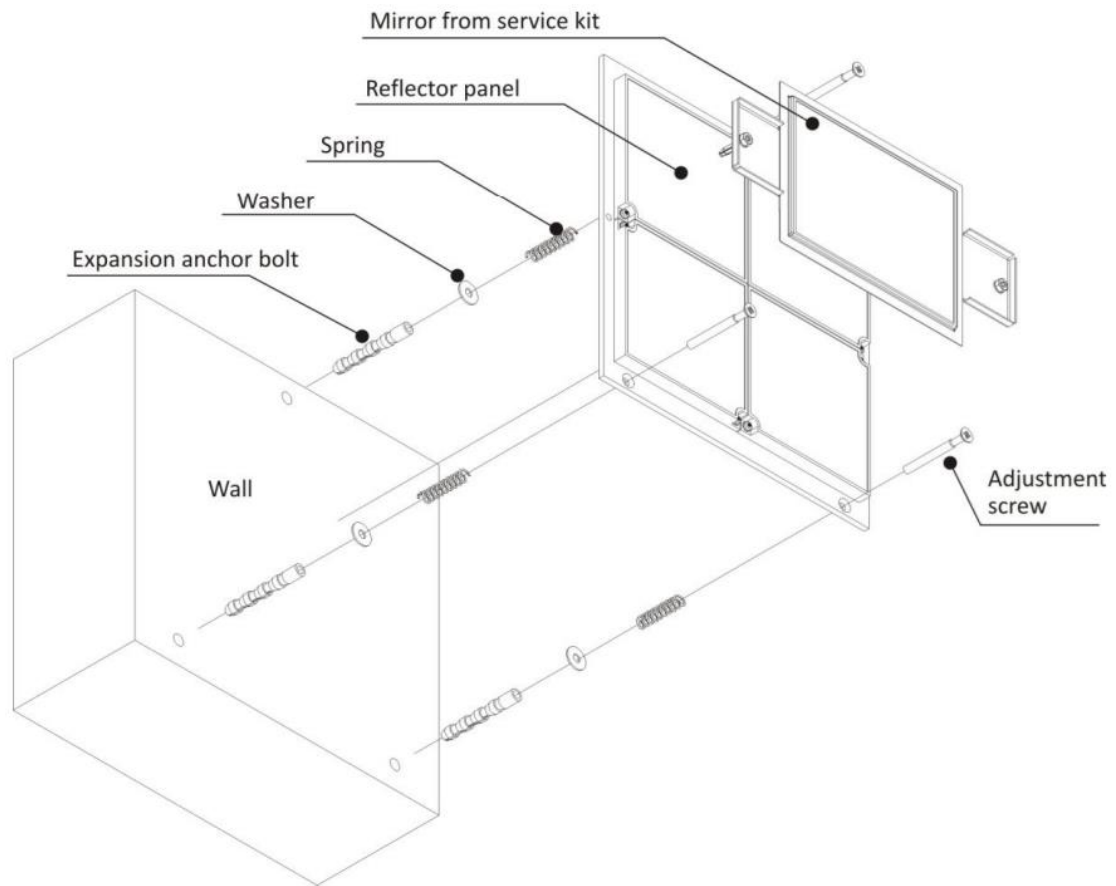


Fig. 9.2.8. Reflector panel assembly

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