

# Linear Smoke Detector

## Fireray 50/100RV



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## 1. Product Description

The Fireray 50/100RV is a linear optical black and white smoke detector. The detector is a retro-operation device, i.e. the transmitter and the receiver are located in one housing with the control unit. A prism reflector is mounted opposite the detector and reflects the infrared beam to the transmitter/receiver combination. If smoke penetrates the section under surveillance, the beam to the receiver, thus the infrared signal received, is smaller. The volume of smoke is assessed and the detector triggers a fire alarm after a specified period of time.

The Fireray 50/100RV smoke detector comprises two components:

- Compact housing with infrared sensor, receiver and control unit
- Prism reflector.

There are two Fireray variants:

- Fireray 50RV with a range of between 5 m and 50 m
- Fireray 100RV with a range of between 50 m and 100 m.

If this documentation refers to both variants, they are combined under the designation Fireray 50/100RV.

It is also possible to connect a key switch, which is mounted within reach, via the RS-485 interface. Alarm tests can be triggered using the key switch without having to reach up to the detector. In addition, the set parameters, the detector status and the current signals can be read and the parameters can be changed. An interface adapter and the Data Viewer software (CD) are also required.

## 2. Scope of Order

Product ID	LE*	Designation
4.998.142.205	ST	Linear smoke detector Fireray 50RV - Device with integrated transmitter, receiver and control unit - 1 prism reflector - 1 test filter - 1 connection cable with plug
4.998.142.206	ST	Linear smoke detector Fireray 100RV: - Device with integrated transmitter, receiver and control unit - 4 prism reflectors - 1 test filter - 1 connection cable with plug

\*LE = Delivery unit



The key switch, the interface adapter and the Data Viewer software (CD) can be ordered as special merchandise.

### 3. Features

- Compact housing with integrated transmitter, receiver, and control unit
- Detector ranges:
  - Fireray 50RV      5 m to 50 m
  - Fireray 100RV    50 m to 100 m
- Side detection breadth of 7.5 m on both sides of the beam center line (according to VdS max. 7 m on both sides of the beam center line)
- Easy to mount; cost-effective retro operation using prism reflectors
- Areas of application:  
Historical buildings, churches, museums, shopping malls, factory halls, warehouses, power plants, contaminated environments, etc.
- The prism reflectors permit angle deviations up to 5° from the center line without signal deterioration.
- With a max. mounting height of 16 m, the monitored room volume can be up to 22,400 m<sup>3</sup>
- Very low current consumption
- Operating voltage 10 V DC to 30 V DC
- Adjustable alarm thresholds/sensitivity
- Alarm storage or automatic reset possible
- Alarm output in the form of a potential-free, latching dry relay contact
- Electronic help for detector alignment and automatic detector calibration procedure
- Automatic compensation for contamination
- LED indicators for:
  - Alarm (red)
  - Malfunction (yellow)
  - Operating indicator (flashes yellow once in every 10 s)
  - End of readjustment due to contamination/aging (flashes yellow once every 2 seconds)
- Can be connected to the local security network via a control coupler (NSB 100)
- Cross zoning possible with connection using a NBK 100 LSN and two NSB 100 LSN
- Fulfills the following regulations:
  - BS 5839 Part 5
  - EN 54 Part 12
  - VdS approval number: **G 203070**

## 4. Device Design

### 4.1. Detectors

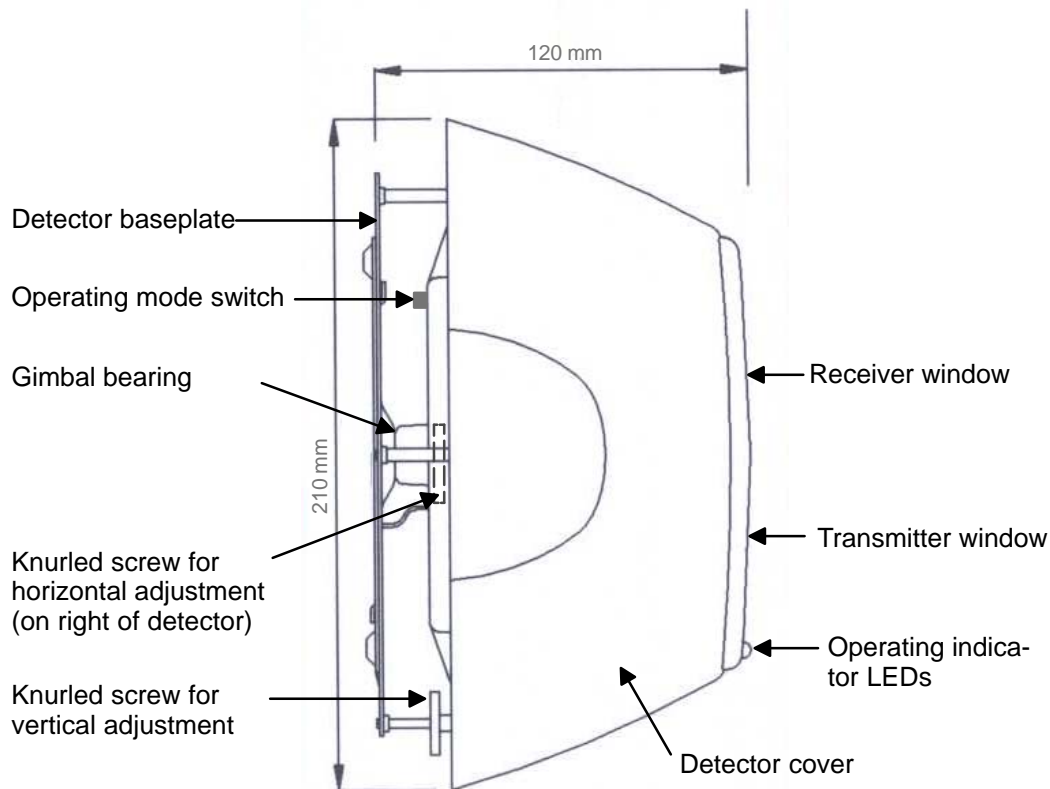


Fig. 1.: Detector side view

### 4.2. Prism reflector

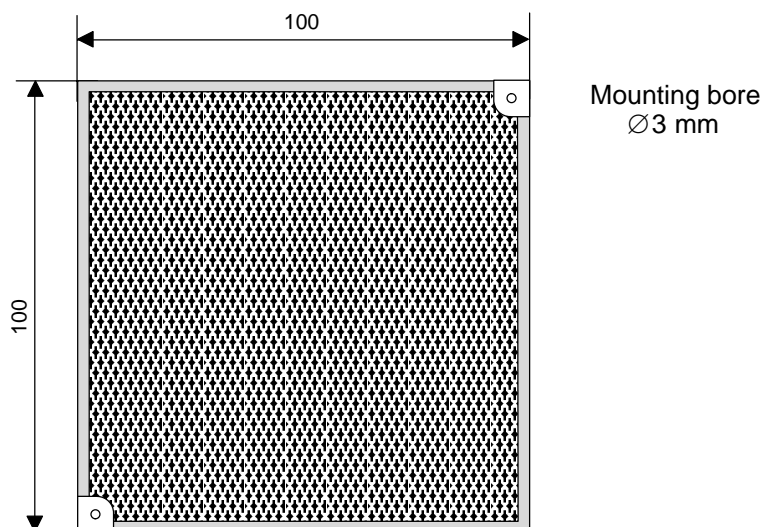


Fig. 2.: Reflection prism dimensional diagram

## 5. Functional Description

The transmitter emits an infrared light beam (880 nm) that is focused through a lens and invisible. The light beam is reflected by 180° by the prism reflector mounted opposite and returned to the transmitter/receiver combination.

If the IR beam is obscured by smoke and the signal received drops below the selected threshold value for 10 s, the Fireray triggers a fire alarm and the alarm relay closes.

The activation threshold can be adjusted to the environmental conditions. Settings 25% (sensitive), 35%, and 50% (non-sensitive) are possible.

The alarm relay has two operating modes:

With Auto Reset, the alarm relay releases again if the volume of smoke drops below the selected alarm threshold for at least 5 s.

In Alarm memory mode, the relay remains active until it is reset. To reset, power is dropped to the detector for at least 5s.

Slow changes to the operating states (e.g. aging of the components, contamination of the lenses, etc.) do not cause false alarms; instead, they are balanced out by the automatic gain control. The state of the system is compared with a default reference value every 15 minutes and in case of deviations, compensated automatically up to 0.7 dB/h. If the readjustment limit is reached, any further signal decay will trigger a «malfunction» (DIP switch 2 = on) or an «alarm» (DIP switch 2 = off).

If the IR beam is obscured for at least 10 seconds by more than 90% with a sharp signal increase, the fault relay switches. The cause can be a blocking of the beam path, detector misalignment, blocking of the reflector, etc. After eliminating the cause of the malfunction, the fault relay is reset and the detector is reset automatically into the detection-ready state after 5 seconds. The malfunction must be reset at the control unit.

The detector has an alarm output in the form of a potential free, latching dry contact.

## 6. Planning Notes

It is very important that the system be carefully planned and precisely adjusted, to ensure that the detector responds as early as possible.

The response time of the system is dependent on the installation location, the volume of smoke generated, the ceiling construction and air ventilation.

**Note:** Since the smoke over a fire source does not just climb vertically upwards, but rather spreads like a mushroom cloud (depending on existing air currents and air pockets), the breadth of the monitoring area is much greater than the diameter of the IR beam.

- According to VdS 2095 and DIN VDE 0833-2, the number of light beam smoke detectors must be selected so that the maximum monitoring range A specified in the table is not exceeded.
- The detectors must be distributed such that no point of the ceiling is further removed from the beam center (horizontal distance) than is specified in column  $D_H$
- The distance between two parallel beams may not be greater than the doubled distance  $D_{D_H}$
- The center line of the monitoring beam may not be closer than 0.5 m to walls, equipment or stored goods.

**Table 1.:** Distances and Monitoring Areas according to VdS

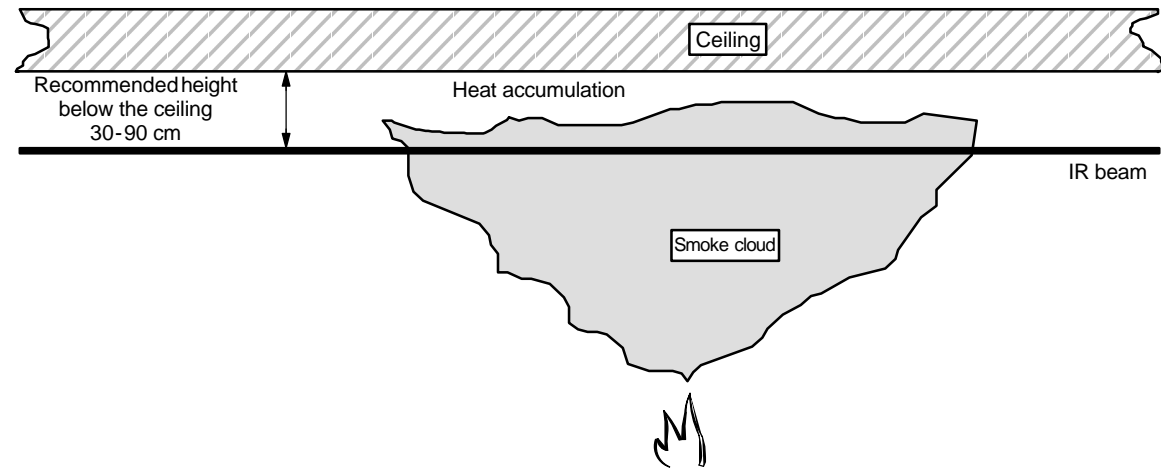
Room height $R_H$	$D_H$	A	Roof pitch $\alpha$	
			$\alpha < 20^\circ$	$\alpha > 20^\circ$
			$D_L$	$D_L$
up to 6 m	6 m	1200 m <sup>2</sup>	0.3 m to 0.5 m	0.3 m to 0.5 m
more than 6 m to 12 m	6.5 m	1300 m <sup>2</sup>	0.4 m to 0.7 m	0.4 m to 0.9 m
more than 12 m to 16 m *)	7 m	1400 m <sup>2</sup>	0.6 m to 0.9 m	0.8 m to 1.2 m

$D_H$  Greatest permissible horizontal distance of any point of the ceiling to the next-closest beam  
A Maximum monitoring range per detector (= double the product of the greatest horizontal distance  $D_H$  and the maximum permissible detector/reflector distance)  
 $D_L$  Distance of the detector to the ceiling  
 $\alpha$  Angle that the roof/ceiling pitch forms with the horizontal; if a roof has different pitches (e.g. sheds), use the smallest existing pitch  
\*) With a room height of more than 12 m, it is recommended that you provide a second monitoring level on which the detectors are arranged offset to the first monitoring level. -

Depends on the use and environmental conditions (e.g. rapid fire development and smoke dissemination)

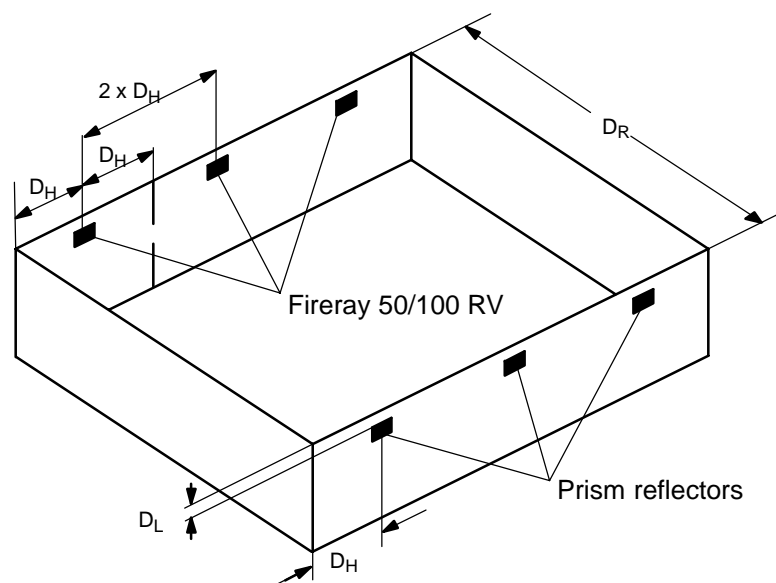
- There must be a constant visual line between the detector and reflector, which may not be interrupted by moving objects (e.g. overhead crane).

- Heat accumulation under roof surfaces can hinder the travel of climbing smoke to the ceiling. The detector must therefore be mounted below an expected heat accumulation. This can mean that the benchmark values for  $D_L$  specified in the table must be exceeded.



- If you are uncertain about the correct position, use a smoke test to establish it.

## 6.1. Arrangement of the detectors on flat ceilings

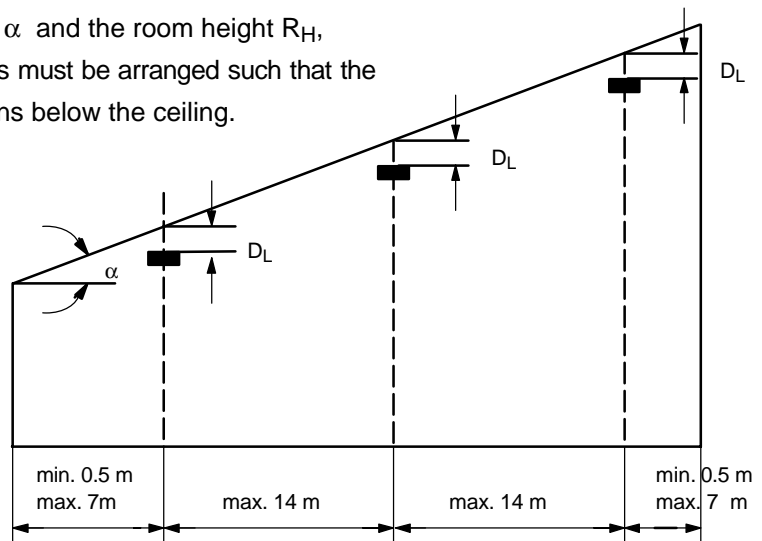


- $D_H$  Horizontal distance to detector and wall 0.5 m to 7.5 m (VdS max. 7.0 m)  
 $2 \times D_H$  Distance between two parallel beams max. 15 m (VdS max. 14 m)  
 $D_L$  Distance from the ceiling 0.3 m to 0.9 m  
 $D_R$  Range = distance between detector and reflector:  
 Fireray 50RV: 5 m to 50 m, Fireray 100RV: 50 m to 100 m  
 $D_H$  und  $D_L$  are not dependent on the room height  $R_H$  (see table 1.).



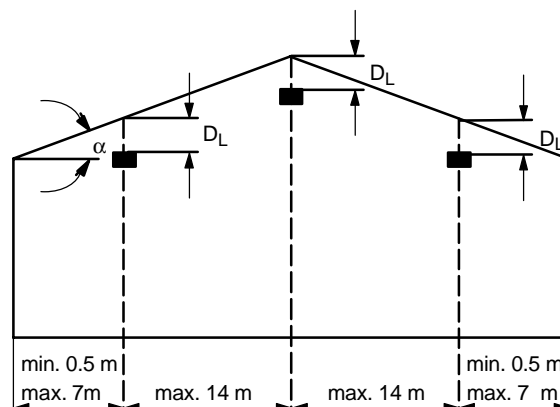
## 6.2. Arrangement of the detectors in a tilted roof

Depending on the roof pitch  $\alpha$  and the room height  $R_H$ , the detector and the reflectors must be arranged such that the light beam in distance  $D_L$  runs below the ceiling.



## 6.3. Arrangement of the detectors in a saddleback roof

Depending on the roof pitch  $\alpha$  and the room height  $R_H$ , the detector and the reflectors must be arranged such that light beam in distance  $D_L$  runs below the ceiling.



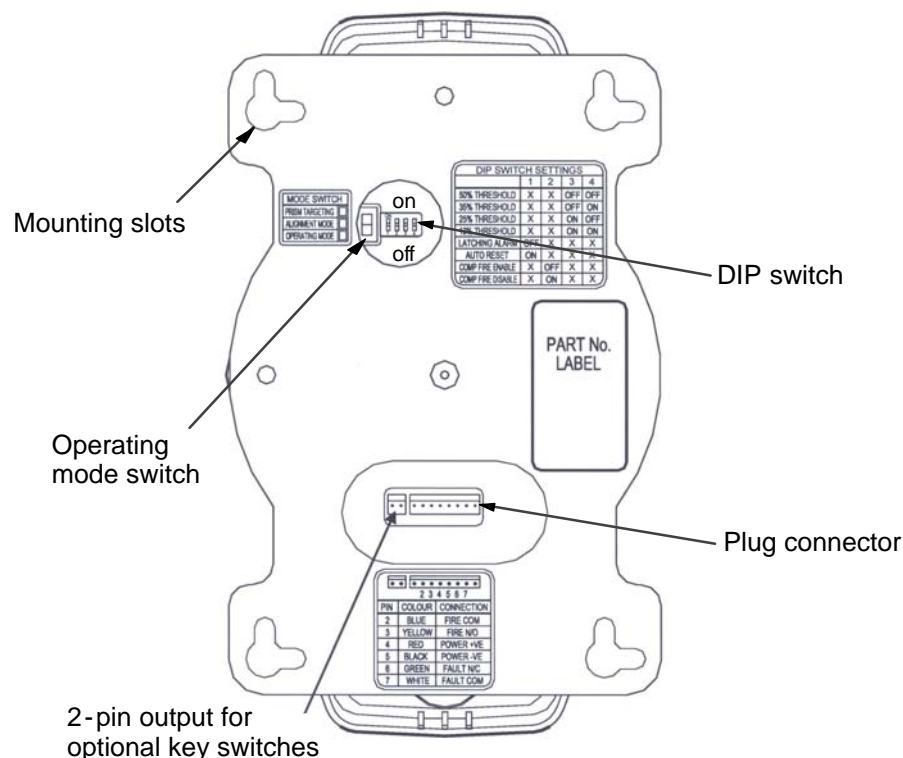
Depending on local rules and regulations, different distances may be prescribed or permissible if necessary.

## 7. Mounting Tips

- Observe the planning notes in Section 6.
- Usually, the detector and the reflector are installed at the same height and oriented towards each other. The relatively broad angle of the IR beam eases adjustment and guarantees reliable long-term stability.
- The mounting surface for the detector must be firm and vibration-free. Metal supports that can be influenced by heat or cold are not suitable for installation.
- The detector must be installed such that sunlight and artificial light do not beam directly into the detector's lenses. Normal environmental light conditions have no effect on the IR beam and the evaluation.
- Mount the reflector on a solid surface at the permissible distance. Ensure that the light beam meets the reflector on the vertical.
- The reflectors must not be mounted on reflective surfaces such as glass or plain sheet surfaces. Additional reflections lead to malfunctions.
- For protection against radio interference, use a shielded cable. When you are installing the cable, possible sources of disturbance must be circumvented and the cable must be protected against mechanical damage.
- A 6 DA mini distributor (product ID 2.798.400.302) is required for wiring.

### 7.1. Connections and DIP switch settings

- The operating mode switches, DIP switches and terminal strips for the plug connector (see Fig. 3.) are located on the back of the detector.



**Fig. 3.:** Reverse side of detector with plug connector, operating mode switch and DIP switch


## DIP switches

- The DIP switches can be accessed through the round recess in the detector base plate.

**Table 2.:** Functions of the DIP switch settings

*	Function	DIP switch settings			
		1	2	3	4
	50% threshold	X	X	OFF	OFF
	35% threshold	X	X	OFF	ON
	25% threshold	X	X	ON	OFF
	12% threshold (extremely sensitive, only for special applications!)	X	X	ON	ON
<b>X</b>	Alarm relay saves the alarm	OFF	X	X	X
	Automatic reset 5 s after the end of the alarm criterion	ON	X	X	X
	Alarm relay after end of readjustment	X	OFF	X	X
<b>X</b>	Fault relay at end of readjustment, no alarm	X	ON	X	X
The factory presets are shaded in gray.					
* The recommended settings for connection to a fire panel are marked with <b>X</b> .					

- Use **DIP switches 3 and 4** to set the required alarm threshold. The factory setting is moderate sensitivity (35%) for normal environmental conditions. Select a threshold of 50% in very dirty environments.
- Use **DIP switch 1** to select the «Save alarm » or «Auto Reset» function.



Select the following settings for connection to a fire panel:

- «Alarm relay saves the alarm»
- «Fault relay at end of readjustment, no alarm».

## Plug connector

- The plug connector can be accessed through the oval recess on the detector base plate.

**Table 3.:** Pin assignment of the 8-pin connector (from left to right)

PIN number	Wire color	Function
1		Not assigned
2	blue	Alarm relay, center contact (COM)
3	yellow	Alarm relay, work contact (NO)
4	red	Power supply +10 to +30 V DC
5	black	Power supply -
6	green	Fault relay, normally closed contact (NC)
7	white	Fault relay, center contact (COM)
8		Not assigned

## 7.2. Mounting the Fireray 50/100RV

- To make mounting easier, you can remove the detector cover by gently raising the upper and lower edges.
- The mounting slots (see Fig. 3.), which are positioned at a 90° angle, enable vertical or horizontal mounting of the detector.
- Locate the four bore holes at the mounting location using the detector base plate. Observe the planning notes and mounting tips!
- Check the plug connector and the DIP switch settings (see Section 7.1.).
- Secure the detector using four screws.
- Refit the detector cover.

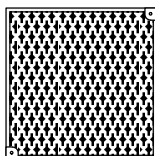


If a key switch is required, a two-wire cable should be routed from the detector within reach during installation (see Section 7.4. for connection details).

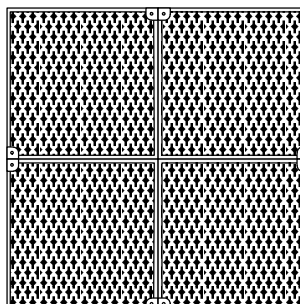
## 7.3. Mounting the prism reflector

- Select the mounting location in line with the mounting tips (Section 7.).
- A prism reflector must be used for the Fireray 50RV, and four prism reflectors arranged in a square for the Fireray 100RV.

Fireray 50RV



Fireray 100RV



**Fig. 4.:** Prism reflectors

- Each reflector is secured using two mounting bores. Arrange the four reflectors for the Fireray 100RV such that there are no mounting holes in the center (see Fig. 4.).



**There must be a free visual line between the detector and reflector. The IR light beam must not be blocked by moved objects!**

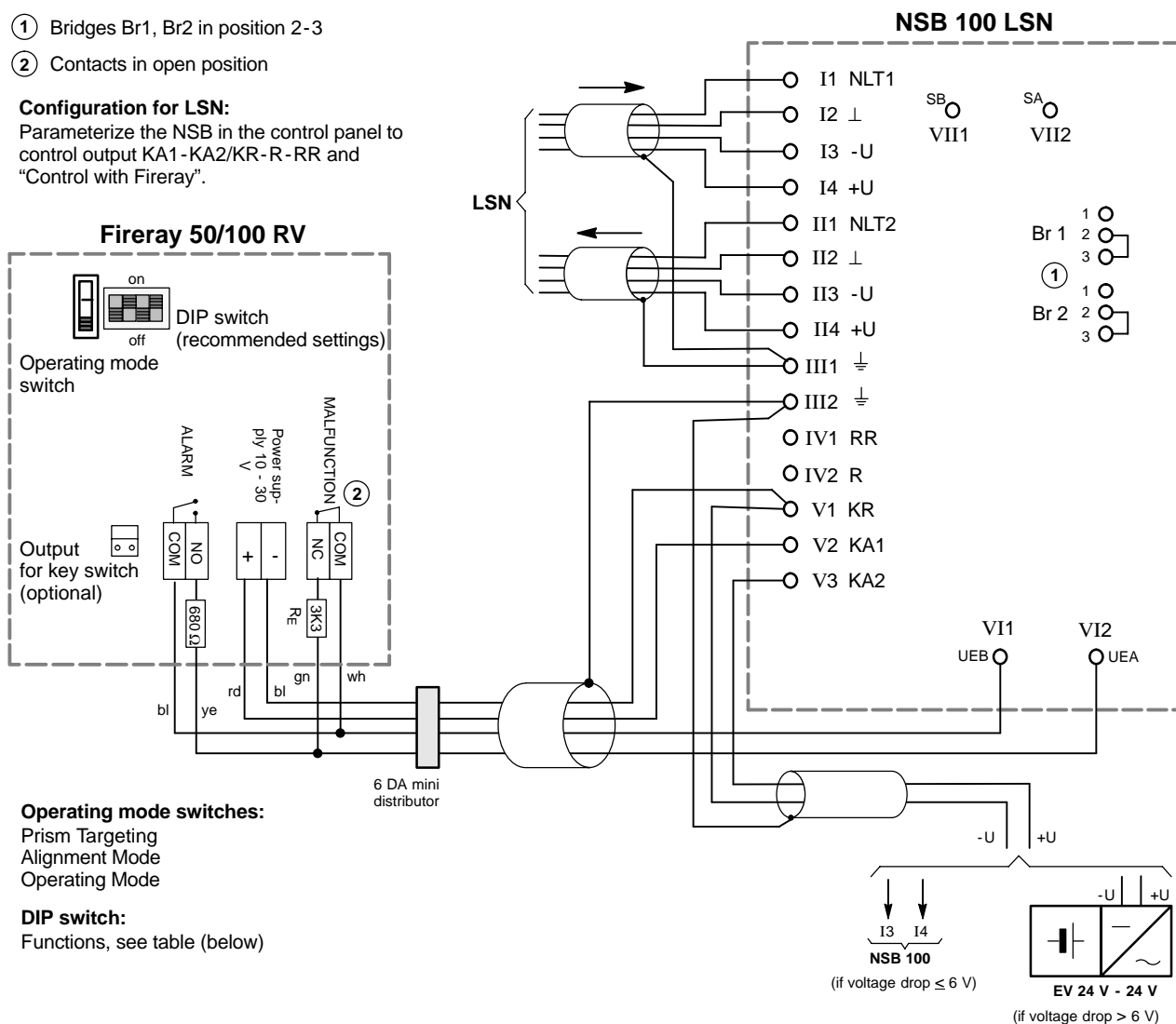
## 7.4. Connection

### Connection of a Fireray 50/100RV using a NSB100 LSN at the fire panel

- ① Bridges Br1, Br2 in position 2-3
- ② Contacts in open position

**Configuration for LSN:**

Parameterize the NSB in the control panel to control output KA1-KA2/KR-R-RR and "Control with Fireray".



*	DIP switch functions	DIP switch setting			
		1	2	3	4
	50% threshold	X	X	OFF	OFF
	35% threshold	X	X	OFF	ON
	25% threshold	X	X	ON	OFF
	Reserved for later use	X	X	ON	ON
X	Alarm relay saves the alarm	OFF	X	X	X
	Automatic reset 5 s after the end of the alarm criterion	ON	X	X	X
	Alarm relay after end of readjustment	X	OFF	X	X
X	Fault relay at end of readjustment, no alarm	X	ON	X	X

The factory presets are shaded in gray.

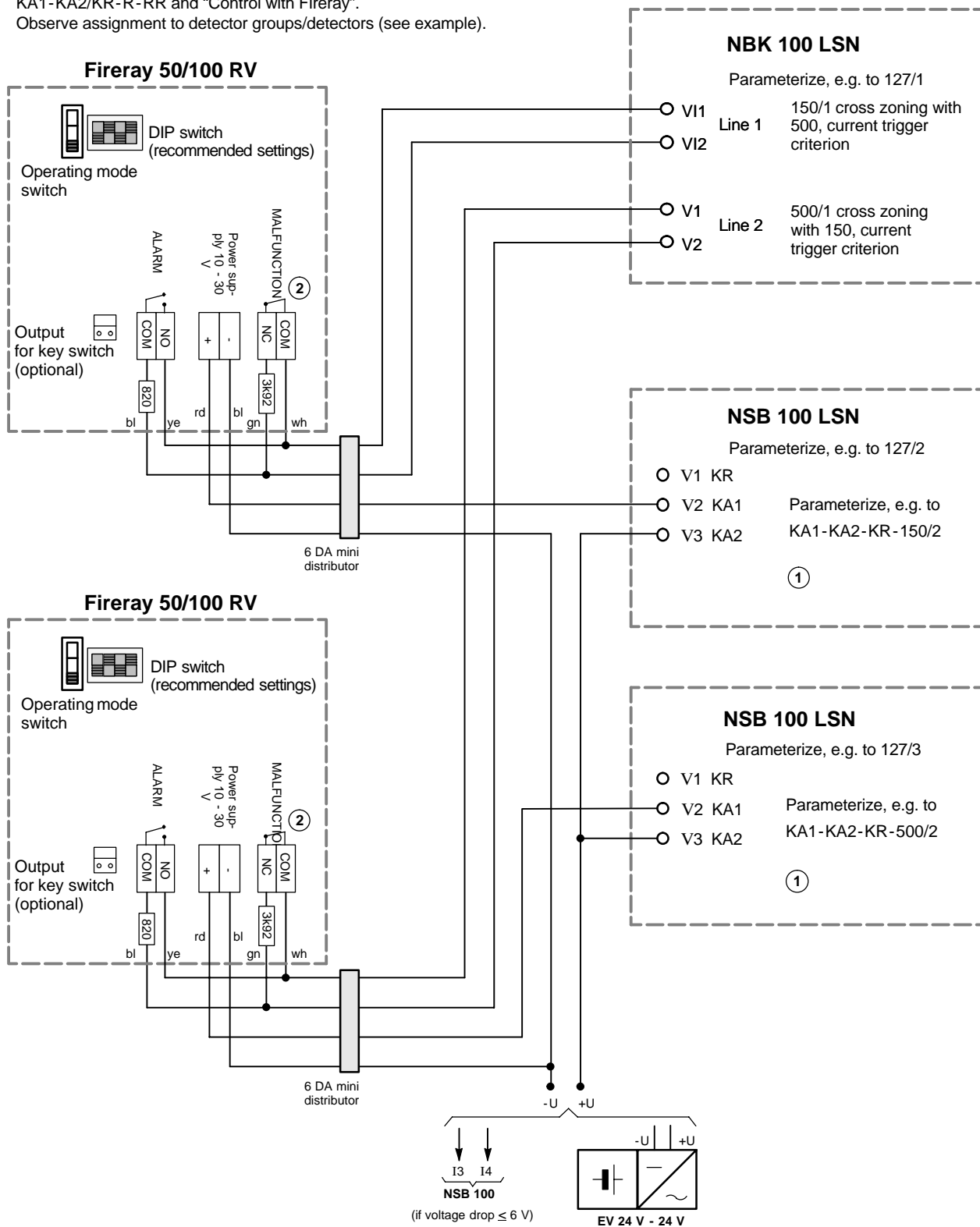
\* The recommended settings for connection to a fire panel are marked with X.

**Connection of two Fireray 50/100RV to fire panel with cross zoning via an NBK 100 LSN and two NSB100 LSNs**

- ① Bridges Br1, Br2 on the NSB 100 in position 2-3 (see connection of one Fireray 50/100RV)
- ② Contacts in open position

**Configuration for LSN:**

Parameterize the NSB in the control panel to control output KA1-KA2/KR-R-RR and "Control with Fireray".  
Observe assignment to detector groups/detectors (see example).



## 8. Start-Up

### 8.1. Setting up the detector

- Start the «**Prism Targeting**» mode by moving the operating mode switch (see Fig. 3.) up (if the detector is mounted vertically) or to the right (if the detector is mounted horizontally).
- Connect the power supply.

 The detector runs in initialization mode for approx. 5 s.

As soon as the detector is ready for use, the red LED flashes (once with the Fireray 50RV and twice with the Fireray 100RV).

- Now direct the detector at the prism, using the two knurled screws, until optimum adjustment is confirmed by a steady yellow LED light. The following LED displays support detector set-up:

Yellow LED display	Detector status in «Prism Targeting» operating mode
off	No signal at receiver
Flashes -> Flashing frequency increasing	Signal is received -> The faster the flashing, the stronger the signal!
Steady light	Optimum alignment achieved



**The signal must only move from the reflector to the receiver, under no circumstances must it move to other light sources or reflective surfaces!**

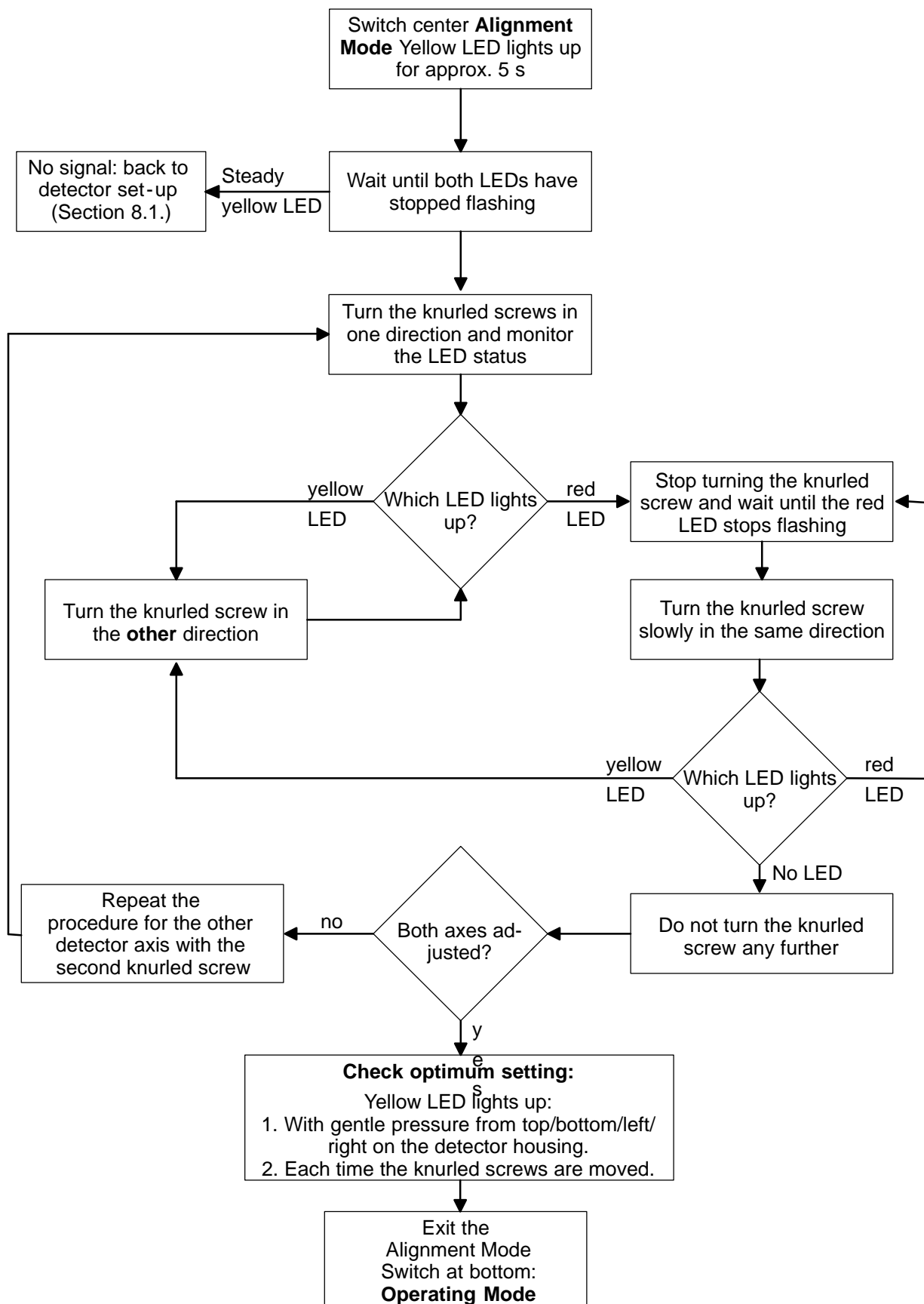
- Cover the prism reflector with a non-reflective material to check. The LED must not be lit. If the yellow LED does not go out, this indicates that a reflector is incorrectly aligned.

### 8.2. Calibrating the detector

- Once the optimum detector set-up has been achieved, set the operating mode switch to the center position without displacing the detector. The detector is now in («**Alignment Mode**»).
- The detector runs through an automatic configuration procedure to optimize the transmission power and the receiver sensitivity. The following detector statuses may be displayed by the LEDs during this procedure:

LED displays	Detector statuses in «Alignment Mode»
Flashing red	Receiver input signal too strong, the transmission power will be reduced. Wait until the LED goes out (max. 20 s).
Steady yellow light	No signal is being received. Switch back to «Prism Targeting» mode and repeat the detector set-up.
Flashing yellow	The receiver is receiving a weak signal, the transmission power will automatically be increased.
off	Transmission power and receiver gain are optimum.
Flashing red and yellow	Automatic calibration in progress.

- Follow the flow chart to perform the calibration process:





- When the calibration procedure is complete, move the operating mode switch (see Fig. 3.) to the bottom (if the detector is mounted vertically) or to the left (if the detector is mounted horizontally). The detector is now in «Operating Mode».
- The detector runs a **calibration test** for approx. 60 s. If the yellow LED lights up as a steady light after the test, you must repeat the detector alignment and calibration procedures (see Sections 8.1. and 8.2.).



If a detector alarm is reset in normal mode by a disruption to the power supply, the detector automatically runs a calibration test. If the test is failed, the detector remains in the alarm position. If the test is positive, the yellow LED goes out, the fault relay is reset and the detector is returned to normal mode.

**In normal mode, the yellow LED flashes every 10 s.**

### 8.3. System test

- The «Alarm» and «Malfunction» functions must be checked before final start-up.

#### Alarm test

- Hold the test filter in front of the receiver lens (upper or right-hand part of detector). Select a volume of smoke slightly greater than the threshold set for the detector (see Section 7.1.). Make sure that you do not also cover the transmitter -lens.
- After approx. 10 s, the red LED must light up and the alarm relay must close.
- With the «Save alarm» detector setting (DIP switch 1 «off»), there must be a reset at the control panel or the power supply must be disrupted for at least 5 s. With the setting «Auto Reset» setting (DIP switch 1 «on»), the alarm is reset automatically if the volume of smoke falls below the selected alarm threshold for at least 5 s.

#### Fault test

- Cover the reflector with a non-reflective material.
- After approx. 10 s, the yellow LED must light up and the fault relay must open. As soon as the obstruction is removed, the detector returns to normal mode automatically after approx. 2 s.

## 9. Tips on Maintenance and Service

For maintenance and inspection work on danger detector systems, in Germany the regulations of DIN VDE 0833 apply, which refer to the maintenance interval according to the manufacturer's instructions.

- Bosch ST recommends a functional and visual inspection at least once a year.
- Maintenance and inspection work should be carried out regularly and by trained personnel.

### 9.1. Repair

**In the event of a defect, the entire device is exchanged.**

### 9.2. Disposal

**Defective devices should be disposed of according to the legal requirements.**

### 9.3. Additional Documentation



For those with access rights, the Bosch ST ExtraNet at [www.boschsecurity.com/emea/fire](http://www.boschsecurity.com/emea/fire) contains the most up-to-date product information and the installation manual supplied with the device can be downloaded in PDF format.

## 10. Technical Data

Operating voltage	10 V DC . . . 30 V DC
Current consumption: - in standby mode - in alarm/malfunction	< 4 mA @ 24 V < 15 mA
Reset control by power disruption	> 5 s
Alarm relay	Open contact, potential-free (2 A @ 30 V DC)
Fault relay	Break contact element, potential-free (2 A @ 30 V DC)
Permissible distance between the detector and the prism reflector: - Fireray 50R - Fireray 100R	5 m to 50 m 50 m to 100m
Optical wavelength	880nm
Adjustable alarm threshold values	2.50 dB (25%) 3.74 dB (35%) 6.02 dB (55%)
Axial deviation tolerance (at 35% sensitivity)	Detector $\pm 0.8^\circ$ Prism reflector $\pm 5.0^\circ$
Operating temperature	-30°C . . . +55°C
Protection type	IP 50
Dimensions (W x H x D)	126 x 210 x 120 mm
Weight	670 g
Housing: - Color - Material	light gray/black ABS, non-flammable
VdS ID number	<b>G 203 070</b>



# 11. Appendices

## 11.1. Installation protocol

Installation company:	
Type of object:	
Installation location:	
Installation date:	
Total number of all linear detectors:	

Detector version:	<input type="checkbox"/> Fireray 50RV <input type="checkbox"/> Fireray 100RV
Detector – reflector distance:	_____ m
Distance of the detector axes to one another	_____ m
Mounting height	_____ m
Mounting surface (e.g. masonry/reinforced concrete/steel beams/wood/etc.)	
Serial number(s):	
Reflector size:	<input type="checkbox"/> 1 x (10 x 10 cm) <input type="checkbox"/> 4 x (20 x 20 cm)
Supply voltage:	_____ V

Correct mechanical adjustment of transmitter (when gentle pressure is applied to the detector housing from the left/right/top/bottom, the yellow LED lights up initially):	<input type="checkbox"/> yes <input type="checkbox"/> no
Alarm triggered with absorption film 35% - 50% tested:	<input type="checkbox"/> yes <input type="checkbox"/> no
Fault triggered by disruption of IR beam tested:	<input type="checkbox"/> yes <input type="checkbox"/> no

DIP switch settings:		1	2	3	4
	on				
	off				

Comments (environmental conditions, e.g. dust, humidity, temperature etc.)
--

Installation tested on: \_\_\_\_\_ by: \_\_\_\_\_

## 11.2. Fault diagnosis

Fault indicator	Possible cause	Action
Fault LED illuminated permanently	Beam path blocked by an obstacle	Check and/or ensure free visual line in the area between the detector and the reflector.
	Reflector is contaminated/covered/has fallen down.	Check the status of the reflector and clean it if necessary.
	Supply voltage too low.	Measure supply voltage directly at detector.
	Mode sliding switch in upper position («Direct»)	Set the switch to «Operation» and wait until the 60 s activation routine is complete.
	Detector set-up changed on switching to «Operation».	When operating the sliding switch following the correct adjustment, make sure that the setting is not changed.
Fault LED flashes	The limit of automatic gain control has been reached	Clean detector lens and reflector and correct mechanical adjustment!
	«MODE Switch» sliding switch in upper position («Direct») <b>and</b> incomplete detector set-up	Align detector vertically and horizontally until the fault LED is permanently illuminated. Then continue using fine adjustment (switch in center position)!
Alarm LED illuminated permanently	DIP switch 1 at OFF («Save alarm »), the alarm display remains saved	Reset the detector by disrupting the supply voltage for at least 5 s or select «Reset» on the fire panel
	Beam path (partially) blocked by an obstacle	Ensure a free visual line in the area between the detector and the reflector!
No fault message when IR beam is disrupted	Detector receives partial IR signal, e.g. via reflective surfaces near the beam axis.	Cover reflector with a dark material to test! Check detector's range of vision for reflective objects!
Alarm triggered when IR beam is disrupted	An object placed in the beam path for testing has acted as the reflector.	For testing, use a non-reflective material, maintain a greater distance to the detector, cover the reflector as directly as possible.
Triggering of false alarms	Sensitivity to existing environmental conditions set too high	Set a less sensitive alarm threshold (DIP switches 3 and 4): normal= 35%, less sensitive= 50%



**Bosch Security Systems**  
**Robert-Koch-Str. 100**  
**D-85521 Ottobrunn**

**Info-Service**

**Telephone: +49 89 6290 - 1039**

**Fax: +49 89 6290 - 1039**

**[www.boschsecurity.com](http://www.boschsecurity.com)**

**[info.service@de.bosch.com](mailto:info.service@de.bosch.com)**