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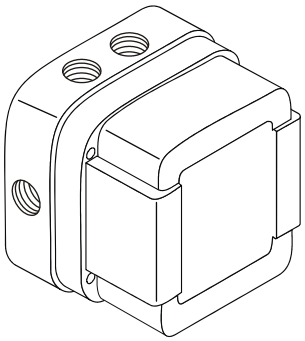

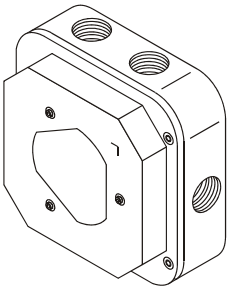

FDL241-9

Linear smoke detector

Technical Manual

007016_i_en_--
2012-09-07

Building Technologies

Control Products and Systems

Legal notice

Technical specifications and availability subject to change without notice.

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Table of contents

1 About this document

Goal and purpose

This document contains all the information you will need on the linear smoke detector FDL241-9.

Following the instructions consistently will ensure that the product can be used safely and without any problems.

In accordance with EN 62471, 'Photobiological Safety of Lamps and Lamp Systems', the linear smoke detector falls into the 'Exempt Group'.

Target groups

The information in this document is intended for the following target groups:

Target group	Activity	Qualification
Product Manager	● Is responsible for information passing between the manufacturer and regional company. ● Coordinates the flow of information between the individual groups of people involved in a project.	● Has obtained suitable specialist training for the function and for the products. ● Has attended the training courses for Product Managers.
Project Manager	● Coordinates the deployment of all persons and resources involved in the project according to schedule. ● Provides the information required to run the project.	● Has obtained suitable specialist training for the function and for the products. ● Has attended the training courses for Project Managers.
Project engineer	● Sets parameters for product depending on specific national and/or customer requirements. ● Checks operability and approves the product for commissioning at the place of installation. ● Is responsible for troubleshooting.	● Has obtained suitable specialist training for the function and for the products. ● Has attended the training courses for Product Engineer.
Installation personnel	● Assembles and installs the product components at the place of installation. ● Carries out a performance check following installation.	● Has received specialist training in the area of building installation technology or electrical installations.
Commissioning personnel	● Configure the product at the place of installation according to customer-specific requirements. ● Check the product operability and release the product for use by the operator. ● Searches for and corrects malfunctions.	● Has obtained suitable specialist training for the function and for the products. ● Has attended the training courses for commissioning personnel.
Maintenance personnel	● Carries out all maintenance work. ● Checks that the products are in perfect working order. ● Searches for and corrects malfunctions.	● Has obtained suitable specialist training for the function and for the products.

Reference document and source language

- The source language of this document is German (de).
- The reference version of this document is the international version in English. The international version is not localized.

The reference document has the following designation:

ID_x_en_--

x = modification index, en = English, -- = international

Document identification

The document ID is structured as follows:

ID code	Examples
ID_ModificationIndex_Language_COUNTRY -- = multilingual or international	A6V10215123_a_de_DE A6V10215123_a_en_-- A6V10315123_a_--_--

Conventions for text marking

Markups

Special markups are shown in this document as follows:

▷	Requirement for a behavior instruction
⇨	Intermediate result of a behavior instruction
⇨	End result of a behavior instruction
[→ X]	Reference to a page number
'Text'	Quotation, reproduced identically
<Key>	Identification of keys

Supplementary information and tips

The 'i' symbol identifies supplementary information and tips for an easier way of working.

1.1 Applicable documents

Document ID	Title
001508	Guidelines Connection factors, line resistances and capacitances for fire detection systems collective, AnalogPLUS, interactive, FDnet
007227	Operation Detector exchanger and tester FDUD292
008331	List of compatibility (for 'Sinteso' product line)
009718	Operation Intelligent detector tester FDUD293
A6V10229261	List of compatibility (for 'Cerberus PRO' product line)
A6V10332811	Mounting/Commissioning Linear smoke detector FDL241-9

1.2 Technical terms

Term	Explanation
ABS	Acrylonitrile-butadiene-styrene (plastic)
ASA	Advanced Signal Analysis
DLR	Reflector
FDL	Linear smoke detector
FDnet/C-NET	Addressed detector line
Collective	Unaddressed detector line
MC link	Maintenance and commissioning link
PC	Polycarbonate (plastic)

1.3 History of changes

The reference document's modification index applies to all languages into which the reference document is translated.

The first edition of a language version or a country variant may for example have the modification index 'd' instead of 'a' if the reference document already has this modification index.

The table below shows this document's history of changes:

Modification index	Edition date	Brief description
i	2012-09-07	Date format changed to meet ISO 8601 specifications (format yyyy-mm-dd); reference to standard EN 62471 added; editorial changes
h	05.2011	Content and layout revised, history of changes redefined and standardized Reference documents adapted
g	01.2009	New label for measurements
f	10.2007	Supplements in the technical data: line separator, standard EN 54-17, LPCB approvals, information about air humidity
e	08.2006	Shielding added in connection diagram Commissioning of the detector and technical data revised
d	05.2005	Compatibility adapted
c	01.2005	Name of division
b	06.2004	Edition with detector heating unit
a	05.2004	First edition

The language versions and country variants produced by a local company have the same modification index as the corresponding reference document. They are not however included in the table below.

The table below shows the published language versions and country variants with the corresponding modification index:

Modification index	en_--	de_--	fr_--	it_--	es_--
i	X	X	X	X	X
h	X	X	X	X	X
g	–	X	–	–	–
f	X	X	–	–	–
e	X	X	–	–	–
d	X	X	–	–	–
c	X	X	–	–	–
b	X	X	X	X	X
a	X	X	X	X	X

X = published

– = no publication with this modification index

2 Safety

2.1 Safety instructions

The safety notices must be observed in order to protect people and property.

The safety notices in this document contain the following elements:

- Symbol for danger
- Signal word
- Nature and origin of the danger
- Consequences if the danger occurs
- Measures or prohibitions for danger avoidance

Symbol for danger

	This is the symbol for danger. It warns of **risks of injury**. Follow all measures identified by this symbol to avoid injury or death.

Additional danger symbols

These symbols indicate general dangers, the type of danger or possible consequences, measures and prohibitions, examples of which are shown in the following table:

 General danger

 Explosive atmosphere

 Voltage/electric shock

 Laser light

 Battery

 Heat

Signal word

The signal word classifies the danger as defined in the following table:

Signal word	Danger level
DANGER	DANGER identifies a dangerous situation, which **will result directly in death or serious injury** if you do not avoid this situation.
WARNING	WARNING identifies a dangerous situation, which **may result in death or serious injury** if you do not avoid this situation.
CAUTION	CAUTION identifies a dangerous situation, which **could result in slight to moderately serious injury** if you do not avoid this situation.
NOTICE	*NOTICE* identifies possible damage to property that may result from non-observance.

How risk of injury is presented

Information about the risk of injury is shown as follows:

	⚠ WARNING
	Nature and origin of the danger Consequences if the danger occurs • Measures / prohibitions for danger avoidance

How possible damage to property is presented

Information about possible damage to property is shown as follows:

!	*NOTICE*
	Nature and origin of the danger Consequences if the danger occurs • Measures / prohibitions for danger avoidance

2.2 Safety regulations for the method of operation

National standards, regulations and legislation

Siemens products are developed and produced in compliance with the relevant European and international safety standards. Should additional national or local safety standards or legislation concerning the planning, assembly, installation, operation or disposal of the product apply at the place of operation, then these must also be taken into account together with the safety regulations in the product documentation.

Electrical installations

⚠ WARNING

Electrical voltage

Electric shock

- Work on electrical installations may only be carried out by qualified electricians or by instructed persons working under the guidance and supervision of a qualified electrician, in accordance with the electrotechnical regulations.

- Wherever possible disconnect products from the power supply when carrying out commissioning, maintenance or repair work on them.
- Lock volt-free areas to prevent them being switched back on again by mistake.
- Label the connection terminals with external external voltage using a 'DANGER External voltage' sign.
- Route mains connections to products separately and fuse them with their own, clearly marked fuse.
- Fit an easily accessible disconnecting device in accordance with IEC 60950-1 outside the installation.
- Produce earthing as stated in local safety regulations.

Assembly, installation, commissioning and maintenance

- If you require tools such as a ladder, these must be safe and must be intended for the work in hand.
- When starting the fire control panel ensure that unstable conditions cannot arise.
- Ensure that all points listed in the 'Testing the product operability' section below are observed.
- You may only set controls to normal function when the product operability has been completely tested and the system has been handed over to the customer.

Testing the product operability

- Prevent the remote transmission from triggering erroneously.
- If testing building installations or activating devices from third-party companies, you must collaborate with the people appointed.
- The activation of fire control installations for test purposes must not cause injury to anyone or damage to the building installations. The following instructions must be observed:
  - Use the correct potential for activation; this is generally the potential of the building installation.
  - Only check controls up to the interface (relay with blocking option).
  - Make sure that only the controls to be tested are activated.
- Inform people before testing the alarm devices and allow for possible panic responses.
- Inform people about any noise or mist which may be produced.
- Before testing the remote transmission, inform the corresponding alarm and fault signal receiving stations.

Modifications to the system design and the products

Modifications to the system and to individual products may lead to faults, malfunctioning and safety risks. Written confirmation must be obtained from Siemens and the corresponding safety bodies for modifications or additions.

Modules and spare parts

- Components and spare parts must comply with the technical specifications defined by Siemens. Only use products specified or recommended by Siemens.
- Only use fuses with the specified fuse characteristics.
- Wrong battery types and improper battery changing lead to a risk of explosion. Only use the same battery type or an equivalent battery type recommended by Siemens.
- Batteries must be disposed of in an environmentally friendly manner. Observe national guidelines and regulations.

Disregard of the safety regulations

Before they are delivered, Siemens products are tested to ensure they function correctly when used properly. Siemens disclaims all liability for damage or injuries caused by the incorrect application of the instructions or the disregard of danger warnings contained in the documentation. This applies in particular to the following damage:

- Personal injuries or damage to property caused by improper use and incorrect application
- Personal injuries or damage to property caused by disregarding safety instructions in the documentation or on the product
- Personal injury or damage to property caused by poor maintenance or lack of maintenance

2.3 Standards and directives complied with

A list of the standards and directives complied with is available from your Siemens contact.

2.4 Release Notes

Limitations to the configuration or use of devices in a fire detection installation with a particular firmware version are possible.

⚠ WARNING

Limited or non-existent fire detection

Personal injury and damage to property in the event of a fire.

- Read the 'Release Notes' before you plan and/or configure a fire detection installation.
- Read the 'Release Notes' before you carry out a firmware update to a fire detection installation.

NOTICE

Incorrect planning and/or configuration

Important standards and specifications are not satisfied.

Fire detection installation is not accepted for commissioning.

Additional expense resulting from necessary new planning and/or configuration.

- Read the 'Release Notes' before you plan and/or configure a fire detection installation.
- Read the 'Release Notes' before you carry out a firmware update to a fire detection installation.

3 Structure and function

3.1 Overview

The linear smoke detector FDL241-9 detects fires according to the principle of light attenuation by smoke. The linear smoke detector works together with a reflector, which is installed opposite the detector.

Properties

- Communication via FDnet /C-NET detector line or collective detector line
- Signal processing with ASAtechnology (ASA = Advanced Signal Analysis)
- Detection distance from 5 to100 m
- Three sensitivity levels

In accordance with EN 62471, 'Photobiological Safety of Lamps and Lamp Systems', the linear smoke detector falls into the 'Exempt Group'.

3.1.1 Details for ordering

Type	Order no.	Designation
FDL241-9	A5Q00002298	Linear smoke detector

3.1.2 Product version ES

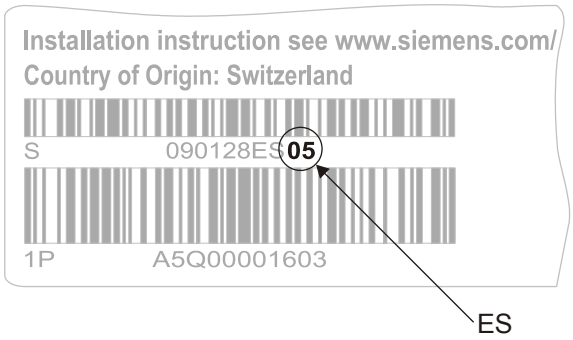
The product version ES provides the technical status of a device in terms of software and hardware. The product version is provided as a two-digit number.

You will find the details of your device's product version:

- On the packaging label
- On the product label or the type plate

Product version on the packaging label

Details of the product version can be found directly on the packaging label in the barcode:



Example of a packaging label with details of the product version

Product version on the product label and the type plate

Details of the product version can be found after the device order number:

Example of a product label with details of the product version

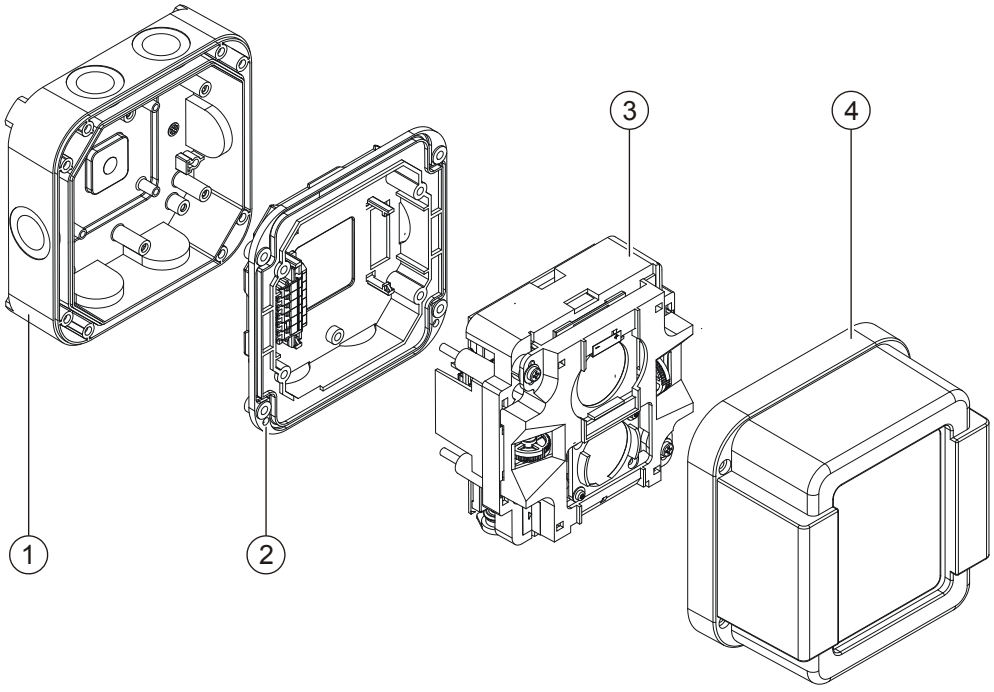
Depending on the product and various approvals, the product labels may differ in terms of the information type and layout.

Look for your device's order number on the product label.

You will find the product version after the order number.

3.2 Setup

The linear smoke detector consists of the detector base (1), the terminal block (2), the detector unit (3) and the hood (4).



Setting up the linear smoke detector

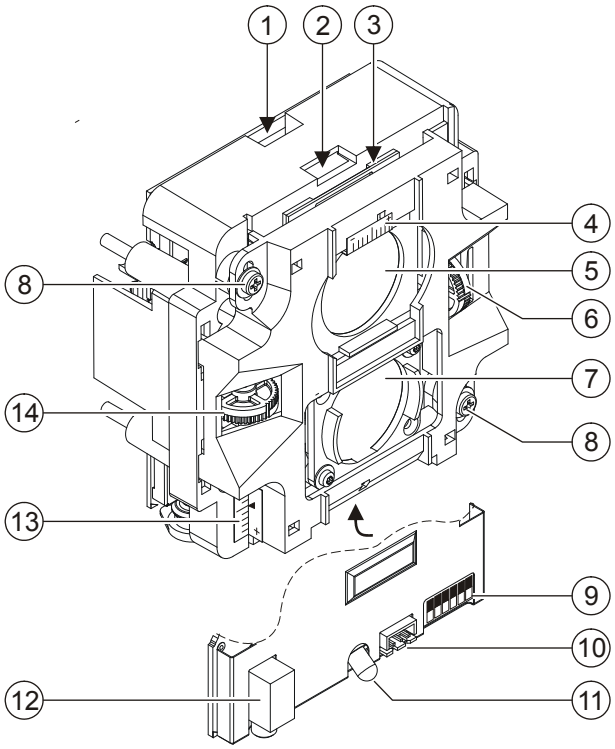
1 Detector base

2 Terminal block

3 Detector unit

4 Hood

Detector unit



Setting up the detector unit

1 Holder for special filter
2 Holder for mirror with visor
3 Holder for notch
4 Horizontal scale
5 Receiver lens
6 Knurled screw for horizontal setting
7 Transmitter lens
8 Safety screws
9 DIP switch
10 Connection for detector heating unit
11 Alarm indicator
12 Connection for adjustment device
13 Vertical scale
14 Knurled screw for vertical setting

Labels

In der Haube sind zwei Etiketten beigelegt. Measurements are entered on these labels when commissioning or checking the linear smoke detector. These measurements serve as a basis for troubleshooting when periodically checking the linear smoke detector.

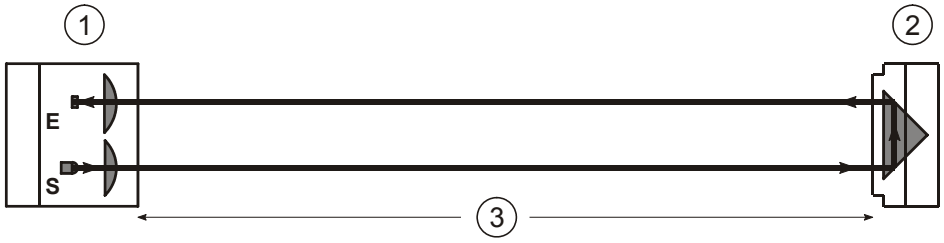
FDL241-9; commissioning & adjustment data
(values displayed on adjustment device)

values / date & action	distance [m]	signal-value [-]	deviate-signal [%]	covered-reflector value [%]
notes				

Label for entering the measurements

3.3 Function

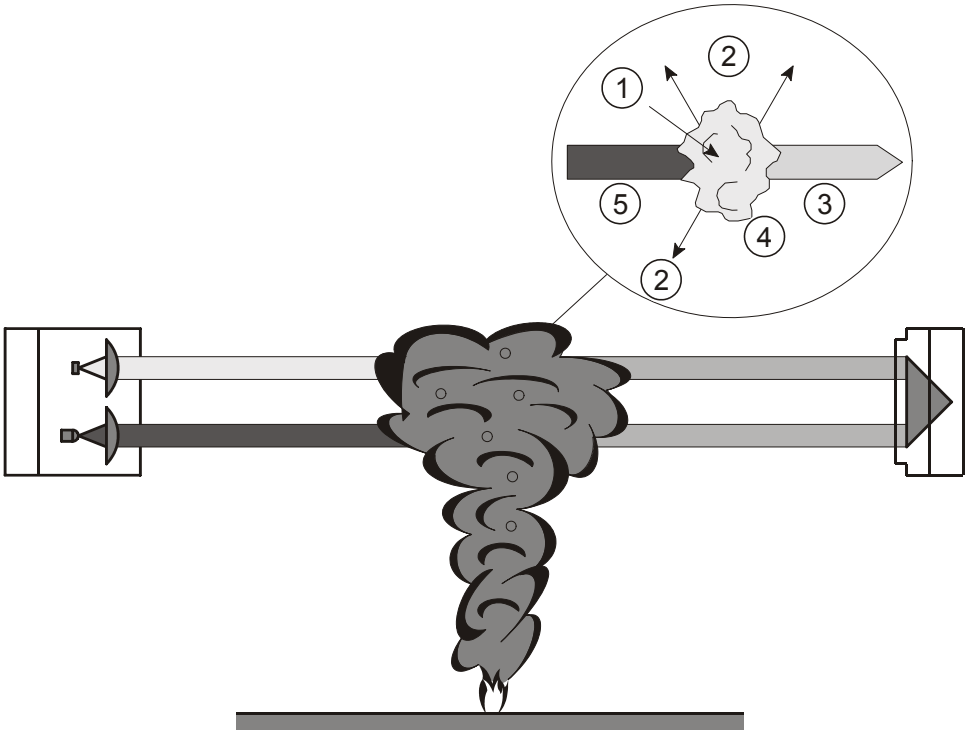
The linear smoke detector smoke detector consists of a transmitter and a receiver and works according to the principle of light attenuation by smoke. The transmitter transmits to the reflector a highly focused, pulse-shaped infrared ray. If no smoke is present, a large part of the infrared ray reaches the reflector and is returned to the receiver. The incoming light generates an electric signal on the receiver's photo diode.



Function of the linear smoke detector without smoke

1 Detector
2 Reflector
3 Measuring section 5…100 m
E Receiver
S Transmitter

When smoke is present, part of the infrared ray is absorbed when it encounters the smoke particles, while another part is scattered by smoke particles. The rest reaches the reflector and is returned to the receiver. The infrared ray is attenuated further. Only a small part of the infrared ray initially transmitted reaches the receiver, and the electrical signal becomes weaker.



Function of the linear smoke detector with smoke

1 Absorption
2 Scattering
3 Attenuated infrared ray
4 Smoke particle
5 Infrared ray

The linear smoke detector measures the distance, which enables an exact alignment of the smoke detector to the reflector when the detector is commissioned.

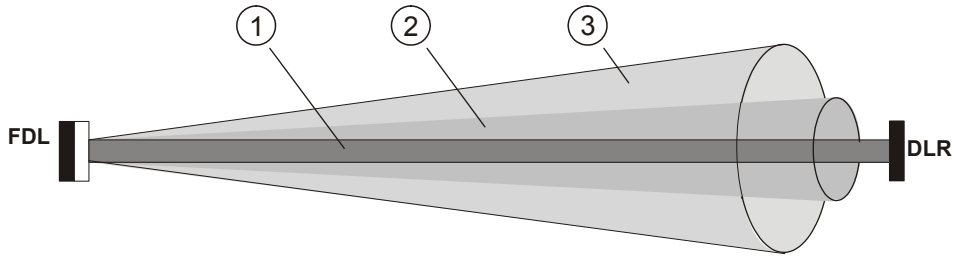
Due to distance measuring, the smoke detector recognizes when the measuring section is crossed by a reflecting object. In this case, the smoke detector sends a fault signal to the control panel.

3.3.1 Infrared ray

Setup of the infrared ray

The infrared ray is scattered, giving it a conical shape. The radiation energy decreases outwards. The infrared ray is divided into the following three ranges:

- Effective range (1): The effective range is the connection between the transmitter, reflector and receiver.
- Core range (2): In the core, enough radiation energy is present to operate the system.
- Scattering range (3): The radiation energy in the scattering range is insufficient and does not ensure the functionality of the system.

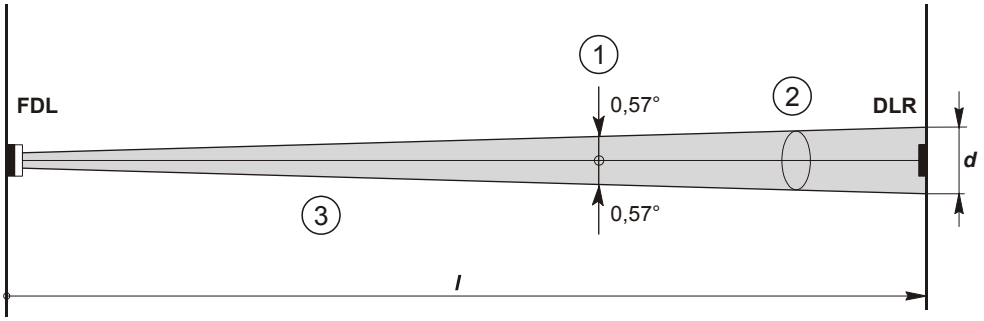


Setup of the infrared ray

1 Effective range

2 Core range

3 Scattering range



Diameter of the core

1 Opening angle

2 Diameter of the core

3 Infrared ray

d Diameter of the core range depending on the detection distance

l Detection distance

Example of calculating the diameter of the core range depending on the detection distance:

Known: Detection distance l = 100 m

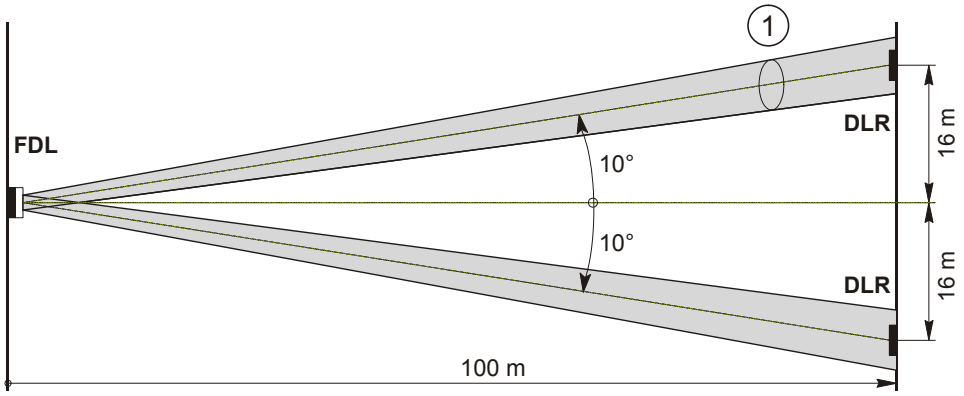
Wanted: Diameter d of the core range

$$d = \frac{2}{100} \times l = \frac{2}{100} \times 100\ \text{m} = 2\ \text{m}$$

Adjustment options for the infrared ray

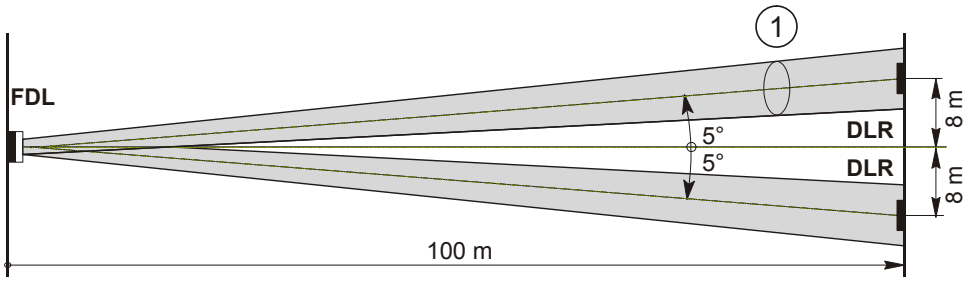
The infrared ray can be adjusted horizontally by a maximum of 10° in either direction and vertically by a maximum of 5° in either direction. This adjustment range can be used for an optimum positioning of the devices. In the case of detection distances greater than 50 m, position the detector and reflector as close to opposite one another as possible. This makes adjustment easier.

One turn of the knurled screw moves the infrared ray by approx. 0.8 m per 100 m distance.



Horizontal adjustment range

1 Diameter of the core



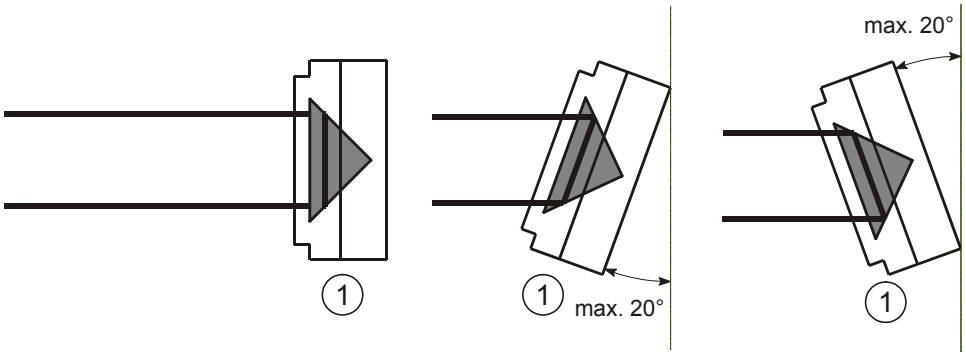
Vertical adjustment range

1 Diameter of the core

3.3.2 Reflectors

Retro-reflectors reflect rays of light that reach them in parallel. The reflector does not necessarily have to be installed at a right angle to the ray of light. Vibrations and distortions on the installation surface do not interfere with this. Interfering light is also reflected in parallel and does not therefore reach the receiver.

The reflectors must be installed at an maximum inclination angle of 20° in all directions.



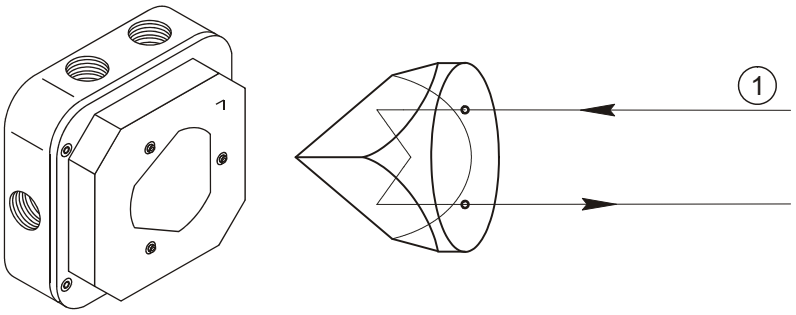
Reflectors with various inclinations

1 Reflector

Reflector for long distance (prism) DLR1191

The reflector for long distance consists of a prism and a housing. The retro-reflecting prism has the shape of an even pyramid, the lateral surfaces of which are made up from isosceles, right-angled triangles. Light rays coming in through the base surface are completely reflected thrice by the lateral surfaces and are than scattered back through the base.

The reflector for long distance is fitted with a heating unit and can therefore be used in environments with a danger of moisture condensation. The heating unit must be connected to a 24 V supply.



Reflector and principle of the reflector

1 Ray of light

Reflector for middle distance (foil) DLR1192 and reflector for short distance (foil) DLR1193

The reflectors for middle distance and for short distance consist of a foil with micro-prismatic elements, which are formed in a transparent, synthetic resin, sealed and mounted on a plastic base. The foil has the same principal effect as the prism.

See also

- Accessories [→ 30]
- Detection distance and reflector selection [→ 40]

3.3.3 Line separator

All FDnet/C-NET devices are equipped with a line separator.

The FDnet/C-NET device is equipped with electronic switches which isolate the defective part in case of a short-circuit on the detector line. The rest of the detector line remains serviceable. On a loop line all FDnet/C-NET devices remain fully functional after a simple error.

3.3.4 Danger levels

The detector can transmit the following danger levels to the control panel:

Danger level	Meaning	Comment
0	No danger	Normal condition
1[1]	Check situation	● You may have to select another parameter set. ● You may have to re-initialize the detector.
2[1]	Warning	Possible danger
3	Alarm	Fire

The evaluation of the danger level and the decisions to be taken (e.g. activation of remote transmission) are configured in the control panel.

[1] Danger levels 1 and 2 are only transmitted to FDnet/C-NET detector lines. On a collective detector line, only danger levels 0 and 3 can be transmitted to the control panel.

3.3.5 Diagnosis levels

For the most part, the linear smoke detector monitors its functionality autonomously.

The following diagnosis levels are derived from the different control measurements:

- Normal
- Observe information
- Fault

For details, see table below.

When a fatal error (one which impairs the detector's function) occurs, a fault message is signaled. To correct the cause of the fault, additional information is available in the detector. This can be displayed by the detector exchanger and tester FDUD292 or the intelligent detector tester FDUD293, for example.

Information displayed on the detector exchanger and tester	Meaning	Measures
'no deviation'	Normal, no fault is present The detector is fully functional	None
'maybe excha.' [1]	Observe information Compensation value is too high or too low Detector is fully functional, reflection or dirt cannot however be compensated for	● In the case of dirt, clean the detector and reflector and re-initialize them ● In the case of reflection, remove or cover reflecting objects
'In 1 problem 3' [1]	Observe information Repeated ray interruption	Prevent interruption or position detector in another place
'In 1 trouble 1' [1]	Fault Detection is no longer ensured Signal interruption: Signal <10 % of the compensation value	● Remove obstacle ● Clean the detector and reflector and re-initialize them
'In 1 trouble 2' [1]	Fault Detection is no longer ensured Distance interruption: distance measuring less than 40 % of the detection distance during initialization	Remove obstacle

Information displayed on the detector exchanger and tester	Meaning	Measures
Any fault message [2]	Invalid parameter settings	Set valid parameters
	Reflection	Remove or cover reflecting objects
	Invalid initialization	Re-initialize detector
	Supply error	● Check voltage of detector line ● Replace detector
	Software error (Watchdog error)	Replace detector
	Memory error	Replace detector
	Communication error involving detector and control panel	Remedy cause

[1] The information displayed on the detector exchanger and tester and intelligent detector tester is always in English; no translation into the country language.

[2] This status can be displayed together with another status, e.g. 'needed excha.' (replacement necessary).

You will find more information in documents 007227 and 009718.

See also

Applicable documents [→ 9]
Repair [→ 81]

3.3.6 Signal processing

The signal processing of the detector efficiently distinguishes between fire events and deceptive phenomena. The basis for reaching a danger level is not only given by measurements below a certain response threshold; moreover, the smoke density progression is observed over a longer period of time and evaluated with ASAtechnology (ASA = Advanced Signal Analysis). The detector processes the signal according to internal diagnoses and reports the result to the control panel.

Correction value

The compensation value is the reference value for the current signal. All response thresholds and evaluations are based on the current compensation value.

The first compensation value is defined during initialization. The compensation value is updated approximately every 60 minutes to compensate for any slow signal drifting. This drift may be caused by dirt on the detector, for example.

The current compensation value is saved in a non-volatile memory every 23 hours and is not lost in a power cut.

The compensation value can be a minimum of 50 % of the compensation value during initialization.

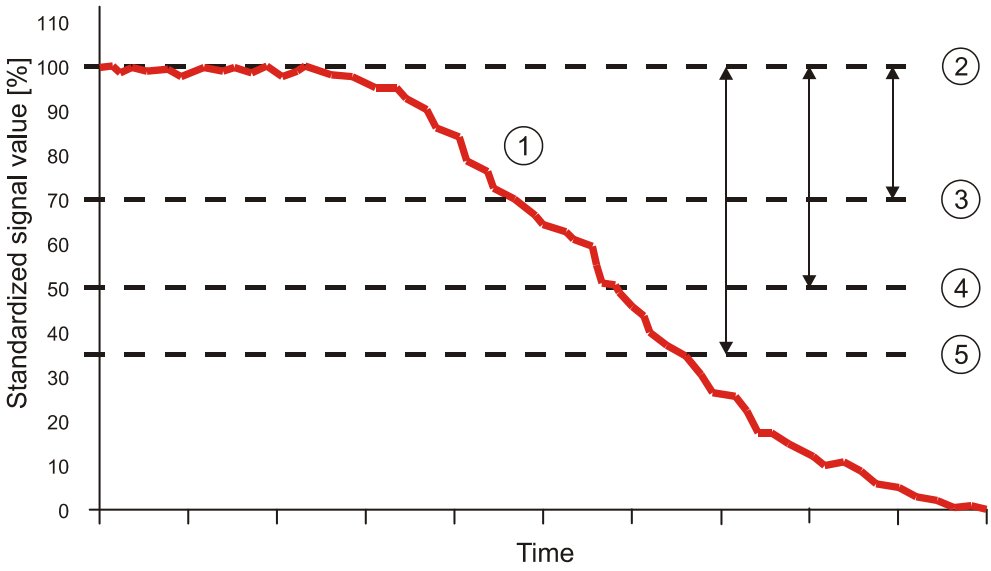
Standardized signal value

The standardized signal value is the signal value (as a percentage) of the current compensation value. If the signal value is the same as the compensation value, the standardized signal value is 100 %. The standardized signal value is displayed on the adjustment device.

Response threshold

The response threshold corresponds to the standardized signal value for danger level 3. When the signal drops below the response threshold, algorithms are activated that trigger an alarm after a certain amount of time. Depending on the sensitivity level of the parameter set selected, the response threshold may be higher or lower:

- Very sensitive: Response threshold is 30 % below the compensation value.
- Sensitive: Response threshold is 50 % below the compensation value.
- Standard: Response threshold is 65 % below the compensation value.



Response threshold for various sensitivity settings

1 Signal (typical signal course during smoke generation)

2 Correction value

3 Response threshold for 'Very sensitive' (30 %)

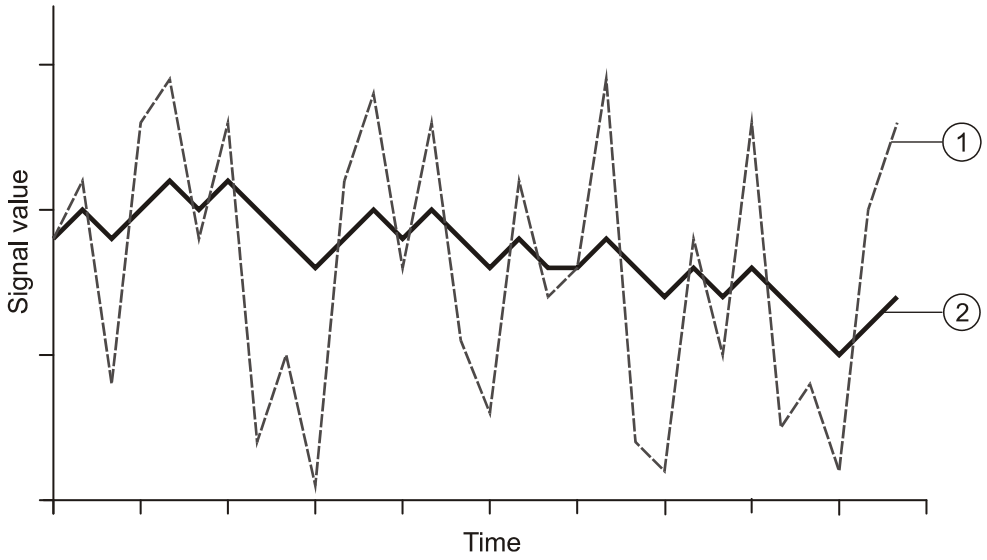
4 Response threshold for 'Sensitive' (50 %)

5 Response threshold for 'Standard' (65 %)

Leveling

The signal is measured four times per second and processed with leveling filters. Extreme values, which may be caused by signal faults, are thereby leveled out.

Further signal processing is based on the leveled signal.



Leveling characteristics

1 Unleveled signal

2 Leveled signal

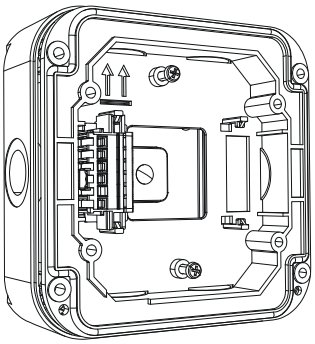
Time until alarm activation

The table below shows the time until alarm activation for various internal detector diagnoses.

Internal detector diagnosis	Time until alarm activation (typical value)
Normal or slow fire	6 s
Background noise or repeated open lines	16 s
Alarm test filter	10 s

3.4 Accessories

3.4.1 Base for linear smoke detector FDLB291

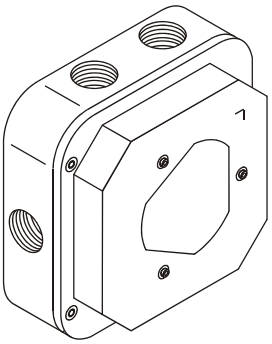


- For installing the linear smoke detector
- Compatible with:
  – Linear smoke detector FDL241-9
- Order no.: A5Q00003941

See also

Installing the detector base [→ 54]

3.4.2 Reflector for long distance (prism) DLR1191

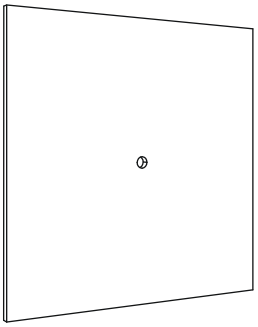


- For reflecting the infrared ray of the linear smoke detector
- Prism-shaped
- Reflection distance: 20…100 m
- With a built-in heating unit
- Compatible with:
  – Linear smoke detector FDL241-9
- Order no.: BPZ:4787710001

See also

Installing the reflector for long distance (prism) [→ 61]

3.4.3 Reflector for middle distance (foil) DLR1192

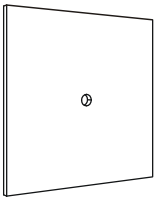


- For reflecting the infrared ray of the linear smoke detector
- Micro-prismatic foil
- Reflection distance: 30 … 65 m
- Dimensions: 200 x 200 x 2.5 mm
- Hole diameter: 4 mm
- Compatible with:
  – Linear smoke detector FDL241-9
- Order no.: BPZ:4788490001

See also

Installing the reflectors for middle distance and short distance (foil) [→ 62]

3.4.4 Reflector for short distance (foil) DLR1193

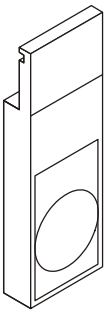


- For reflecting the infrared ray of the linear smoke detector
- Micro-prismatic foil
- Reflection distance: 10 … 30 m
- Dimensions: 100 x 100 x 2.5 mm
- Hole diameter: 4 mm
- Compatible with:
  – Linear smoke detector FDL241-9
- Order no.: BPZ:4787840001

See also

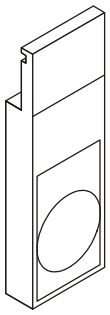
Installing the reflectors for middle distance and short distance (foil) [→ 62]

3.4.5 Short distance filter DLF1191-AA



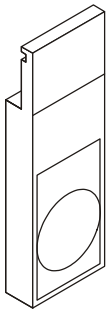
- For toning down the infrared ray over short distances
- Distance: 7…10 m
- Compatible with:
  – Linear smoke detector FDL241-9
- Order no.: BPZ:4933030001

3.4.6 Short distance filter DLF1191-AB



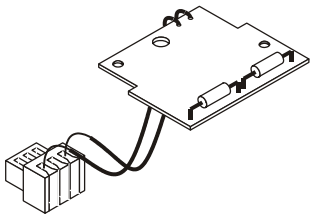
- For toning down the infrared ray over short distances
- Distance: 5…8 m
- Compatible with:
  - Linear smoke detector FDL241-9
- Order no.: BPZ:4933160001

3.4.7 Extraneous light filter DLF1191-AC



- For filtering extraneous light during a high level of extraneous light
- Compatible with:
  - Linear smoke detector FDL241-9
- Order no.: BPZ:5221480001

3.4.8 Detector heating unit DLH1191A

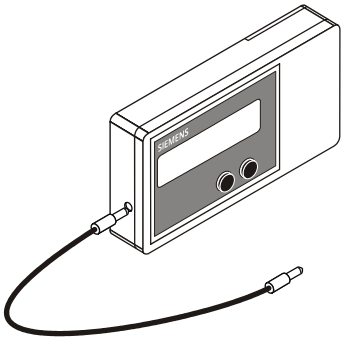


- For applications where there is danger of moisture condensation or icing
- Incl. terminal block for the connection
- Compatible with:
  - Linear smoke detector FDL241-9
- Order no.: BPZ:4787970001

See also

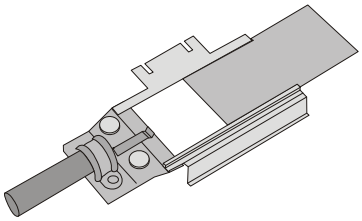
Installing the detector heating unit (optional) [→ 66]

3.4.9 Adjustment kit FDLU291



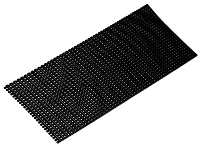
- For commissioning the linear smoke detector
- Components: Adjustment device, alarm test filter, visor, magnet, spiral cable, MC link cable, 9 V battery, suspension fixture with cable gripper and chain, case
- Compatible with:
  – Linear smoke detector FDL241-9
- Order no.: A5Q00004905

3.4.10 Detector tester for linear smoke detector RE10



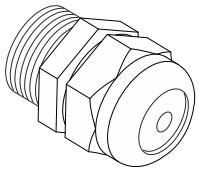
- For undertaking a performance check on the linear smoke detector
- Compatible with:
  – Linear smoke detector FDL241-9
- Order no.: BPZ:3685190001

3.4.11 Alarm test filter TF04



- Alarm test filter for detector tester for linear smoke detector RE10
- Absorption: 77 %
- Dimensions: approx. 170 x 85 mm
- Compatible with:
  – Linear smoke detector FDL241-9
  – Detector tester for linear smoke detector RE10
  – Adjustment kit FDLU291
- Order no.: BPZ:4931090001

3.4.12 M20 x 1.5 metal cable gland



- For introducing a cable into a housing
- Allows for increased IP protection
- Compatible with:
  – M20 x 1.5 metal counter nut
  – Manual call point FDM223
  – Manual call point FDM224
  – Manual call point FDM223H
  – Manual call point FDM224H
- Order no.: A5Q00004478

4 Planning

4.1 Fields of application

Typical fields of application of the linear smoke detector

Application area	Reason
Buildings with historically valuable ceilings	Fire detector installation on ceilings is not desirable or possible.
Atriums, detection on multiple levels	Point detector unaccessible due to height Smoldering fire detection not possible with point detectors
Large rooms and high halls	Lower investment costs
Churches	No impairment of the ceiling by installation or point detectors
Long corridors, cable and energy ducts with a room height of more than 3 m	Lower investment costs
Airplane hangars with stable building construction, in which flame detectors alone do not suffice	Lower investment costs
Saw-tooth roofs, where point detectors must be suspended lower	Lower investment costs

Examples of fields of application of the linear smoke detector

4.2 General planning information

- Between the detector and the reflector therer must be permanent, undisturbed visual contact.
  - The infrared ray must not be interrupted by moving objects, e.g. cranes, ladders, transportable objects, cobwebs.
  - Vision impaired by dust, vapor or smoke generated as a result of operation may impair the system.
- The detector's installation location must be absolutely statically stable, as the admissible deviation of the infrared ray is max. 0.1°. Examples:
  - Concrete and brick walls are suitable.
  - Wood and steel girder constructions are unsuitable, as temperature and humidity fluctuations, wind or snow pressure influence on such constructions.
- The detector and reflector must be securely installed on the installation surface.
- In the case of detection distances greater than 50 m, position the detector and reflector as close to opposite one another as possible. This makes adjustment easier.
- Position the detector near the ceiling, as the smoke is generally only sufficiently think to trigger an alarm in the mushroom cloud.
- Avoid bringing the detector into direct contact with sunlight, halogen lights etc.

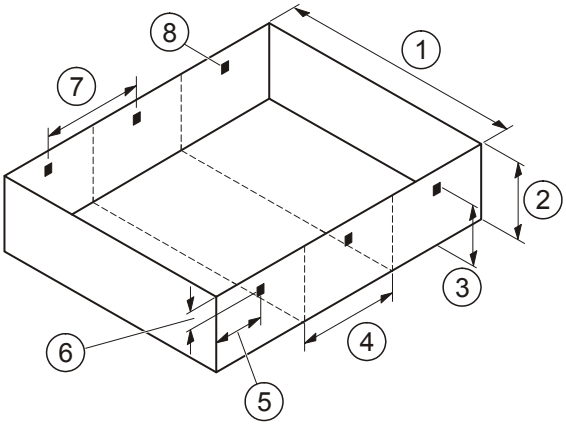
- The infrared ray must be at least 30 cm away from ceilings, walls, fittings and goods in stock to avoid unwanted reflections. You can use the adjustment device to check for unwanted reflections. Instructions for this can be found in the chapter 'Testing detectors [→ 77]', in the 'Testing detection distance' section. If the standardized signal value is greater than 5 %, you must increase the distance by the infrared ray.
- Ensure there is sufficient space around the detector such that the infrared ray's entire adjustment range can be used.
- If you use covers or enclosures for the detector, you must ensure sufficient space around the detector such that e.g. the following work can be carried out efficiently and without hindrance:
  - Connect the adjustment device
  - Set the detector optics
  - Mount hood
- After commissioning for the first time, the service personnel must be able to access the detector safely and with ease, e.g. for maintenance and adjustment work.

See also

Testing detectors [→ 77]

4.3 Planning in rooms with flat ceilings

Please note the following points if you are installing detectors in rooms with flat ceilings. More information about the individual points can be found on the specified pages.



1 Detection distance
2 Room height
3 Installation height
4 Width of monitoring area
5 Minimum distances to ceilings, walls etc.
6 Distance between detector and ceiling
7 Minimum distance between two detectors
8 Detector or reflector

- **Detection distance (1)**: Define the distance to be monitored. Depending on this, define the type and number of reflectors. See [→ 40]
- **Room height (2) and installation height (3)**: Define the installation height. In high rooms, you must install detectors at different levels. See [→ 42]

- **Width of monitoring area (4)**: Define the width of the monitoring area and, depending on this, the number of detectors. See [→ 43]
- **Minimum distances (5):** The infrared ray must be at least 30 cm away from ceilings, walls, fittings and goods in stock to avoid unwanted reflections.
- **Distance between detector and ceiling (6)**: Define the distance between the detector and the ceiling depending on the room height. See [→ 43]
- **Installation surface**: Define the installation surface given the architectural circumstances. The installation surface must be stable and vibration-free. See [→ 45]

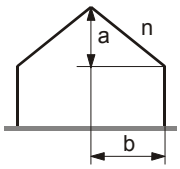
If the room has one or more of the following circumstances, you must also observe further information.

- **Narrow spatial circumstances**: Maintain the minimum distance (7) between two detectors. See [→ 47]
- **Girders**: The detector can be installed in the ceiling panel between the girders or below the girders. See [→ 47]
- **Glass panes**: Detection through glass panes and installation on glass panes are only possible under certain circumstances. See [→ 49]
- **Danger of moisture condensation**: Use the detector heating unit if there is a danger of moisture condensation. See [→ 50]
- **Extraneous light**: Use the extraneous light filter in the case of extremely strong extraneous light. See [→ 51]

4.4 Planning in rooms with inclined ceilings

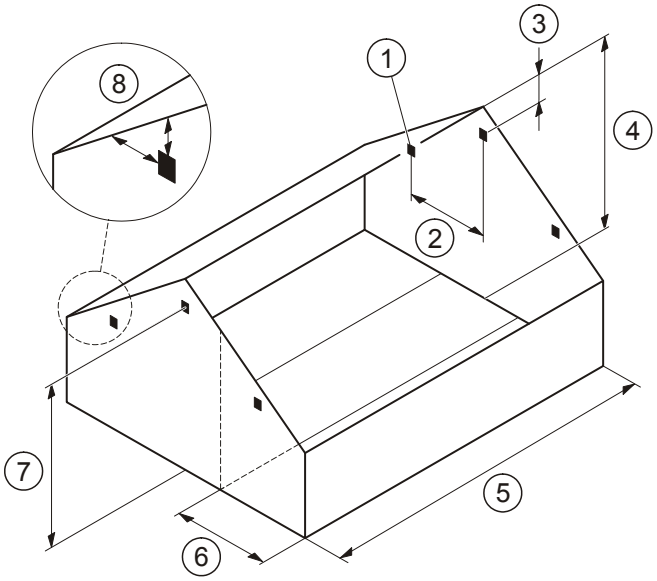
A ceiling is inclined if the incline n is at least 0.2. This corresponds to an inclination angle of 11°.

Calculation of the inclination n:



$$n = \frac{a}{b}$$

Please note the following points if you are installing detectors in rooms with inclined ceilings. More information about the individual points can be found on the specified pages.



Planning in rooms with inclined ceilings

1 Detector or reflector	5 Detection distance
2 Minimum distance between two detectors	6 Width of monitoring area
3 Distance between detector and ceiling	7 Installation height
4 Room height	8 Minimum distances to ceilings, walls etc.

- **Detection distance (5)**: Define the distance to be monitored. Depending on this, define the type and number of reflectors. See [→ 40]
- **Room height (4) and installation height (7)**: Define the installation height. In high rooms, you must install detectors at different levels. See [→ 42]
- **Width of monitoring area (6)**: Define the width of the monitoring area and, depending on this, the number of detectors. See [→ 43]
- **Minimum distances (8):** The infrared ray must be at least 30 cm away from ceilings, walls, fittings and goods in stock to avoid unwanted reflections.

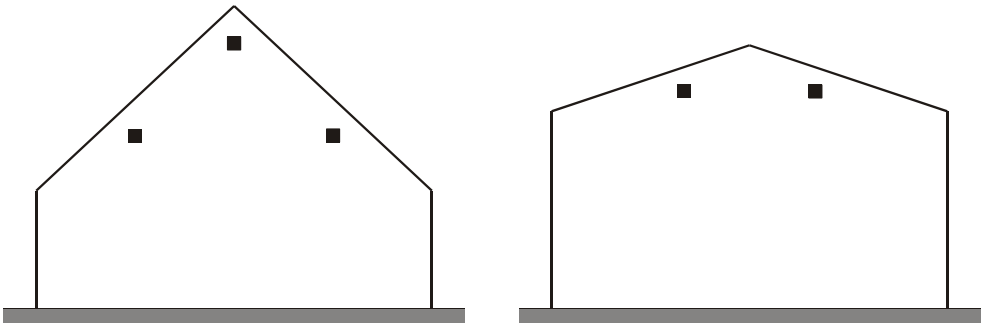
- **Distance between detector and ceiling (3)**: Define the distance between the detector and the ceiling depending on the room height. See [→ 43]
- **Installation surface**: Define the installation surface given the architectural circumstances. The installation surface must be stable and vibration-free. See [→ 45]

If the room has one or more of the following circumstances, you must also observe further information.

- **Ceiling with uneven inclines**: The detector must be slid sideways to the flatter roof incline. See [→ 39]
- **Narrow spatial circumstances**: Maintain the minimum distance (2) between two detectors. See [→ 47]
- **Girders**: The detector can be installed in the ceiling panel between the girders or below the girders. See [→ 47]
- **Glass panes**: Detection through glass panes and installation on glass panes are only possible under restricted circumstances. See [→ 49]
- **Danger of moisture condensation**: Use the detector heating unit if there is a danger of moisture condensation. See [→ 50]
- **Extraneous light**: Use the extraneous light filter in the case of extremely strong extraneous light. See [→ 51]

Infrared ray in the gable

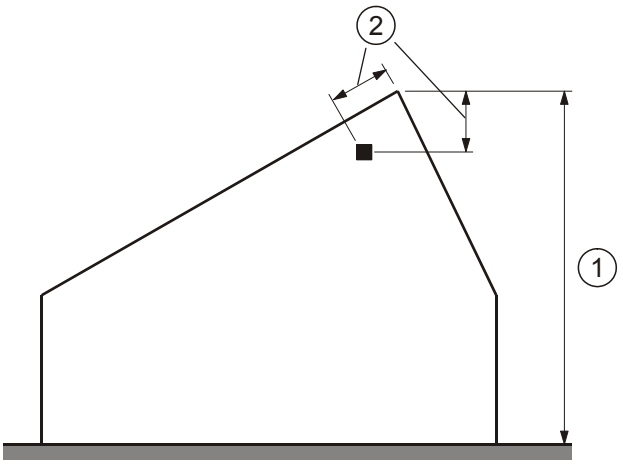
In the case of ceilings with an inclination of n > 0.5, you must always install an infrared ray in the gable. In the case of ceilings with an inclination of n < 0.5, the infrared ray is not necessary in the gable.



Left: Ceiling with inclination of n > 0.5. Right: Ceiling with inclination of n < 0.5

4.4.1 Ceilings with uneven inclines

In the case of ceilings with uneven inclines, the detector must be slid sideways to the flatter roof incline. Define the distance between the detector and the ceiling (2) using the room height (1).



Position on ceilings with uneven inclination

1 Room height

2 Distance between detector and ceiling

Example: In the case of a room height of 10 m, the distance between the detector and ceiling is 40 to 90 cm.

See also

Distance between detector and ceiling [→ 43]

4.5 Detection distance and reflector selection

The detection distance between the detector and reflector is 5 to 100 m. Select the reflectors depending on the detection distance.

The table below shows guidelines for the type and number of reflectors depending on the detection distance.

Detection distance	Type and number of reflectors
5 … 10 m	1 reflector for short distance (foil) DLR1193 + filter for short distance DLF1191
10 … 30 m	1 reflector for short distance (foil) DLR1193
30 … 50 m	1 reflector for middle distance (foil) DLR1192
50 … 65 m	4 reflectors for middle distance (foil) DLR1192
20 … 100 m	1 reflector for long distance (prism) DLR1191

Type and number of reflectors depending on the detection distance

If you are using more than one reflector, always position them close together and in a square shape. The detection distance details are guidelines. They depend on detector and reflector tolerances and may vary by a few meters. It is important that a sufficiently high signal intensity is reached.

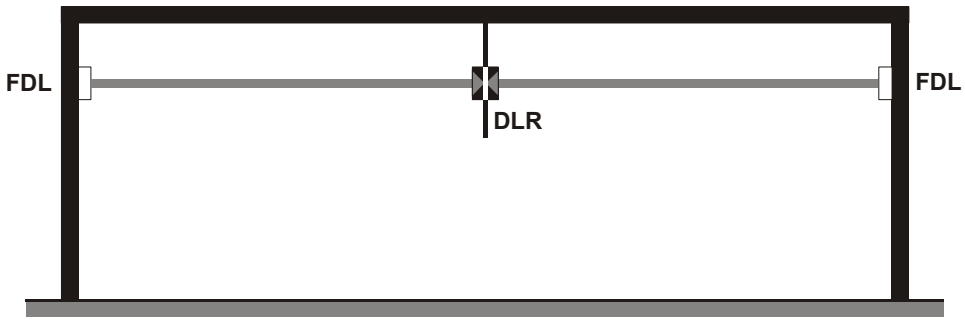
If there is a danger of moisture condensation, always use the reflector for long distance and the built-in heating unit, even for short distances. You may not use the reflectors for middle distance and short distance if there is a danger of moisture condensation.

See also

Accessories [→ 30]

4.5.1 Measures for long distances

Long distances can be split into smaller ones for monitoring. Detectors positioned opposite one another can however have a negative influence on one another. In such a position, install a sufficiently large plate between the reflectors, such that it is not possible for detectors to influence those opposite them.



Subdivision of a longer distance

To check whether two detectors are influencing one another, proceed as follows:

1. Commission the first detector and use the adjustment device to measure the standardized signal value.
2. Commission the second detector.
3. Use the adjustment device to once again measure the standardized signal value of the first detector.
   - If the standardized signal value has not changed since the first measurement, the two detectors are not influencing one another.
   - If the standardized signal value has changed since the first measurement, the two detectors are influencing one another. Install a larger plate between the reflectors or take other suitable measures.
4. Completely cover the reflector and for each detector use the adjustment device to measure the standardized signal value. Measure the signal value once when the the detector opposite is switched on and once when it is switched off. The two signal values measured must not differ.

4.5.2 Measures for short distances

In the case of a short detection distance between 5 and 10 m, you must also use a short distance filter. The following filters are available:

Detection distance	Filter
5…8 m	DLF1191-AB
7…10 m	DLF1191-AA

Short distance filter

See also

Accessories [→ 30]

4.6 Room height and installation height

In rooms with a height greater than 6 m, a second and, if necessary, third infrared ray must be used such that smoldering fires or smaller fires are detected.

Detection of smoldering fires in high rooms on different levels

1 Detector
2 Reflectors

The table below shows examples of the installation height for different room heights.

Room height [m]	Topmost level [m]	Middle level [m]	Bottommost level [m]
6	approx. 6	–	–
12	approx. 12	–	6…7
20	approx. 20	approx. 12	6…7

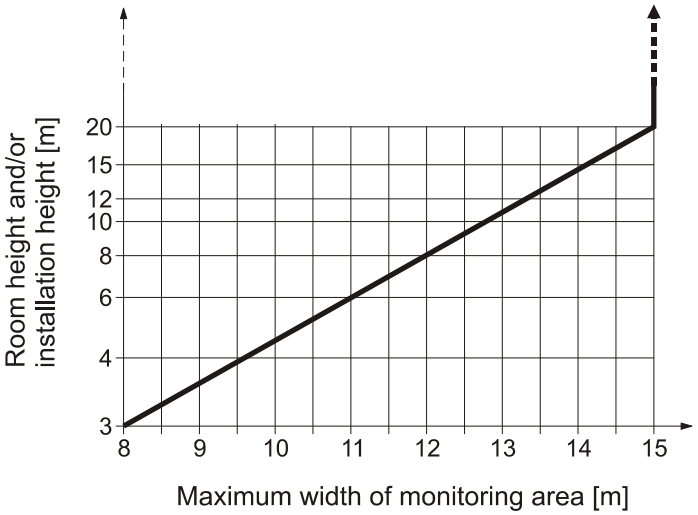
See also

Distance between detector and ceiling [→ 43]

4.7 Width of monitoring area

The higher the room, the greater the width of the monitoring area. To cover heightened risks, you can also select a smaller width of monitoring area.

The figure below shows the maximum widths of monitoring area depending on the room height. If the infrared ray is positioned at a lower level to detect smoldering fires, the distance from the floor to the detector applies instead of the room height.



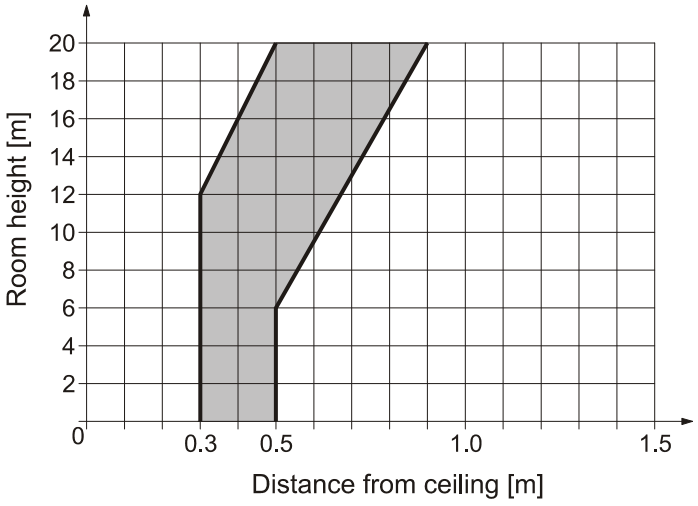
Maximum widths of monitoring area depending on the room height

4.8 Distance between detector and ceiling

In order that the detector can detect smoke, the infrared ray must be positioned immediately below the heat accumulation. Detectors and reflectors must therefore be positioned at an ever-greater distance from the ceiling as the room height increases. The steeper the angle of a gable roof, the greater the distance must be between gable and infrared ray positioned in gable.

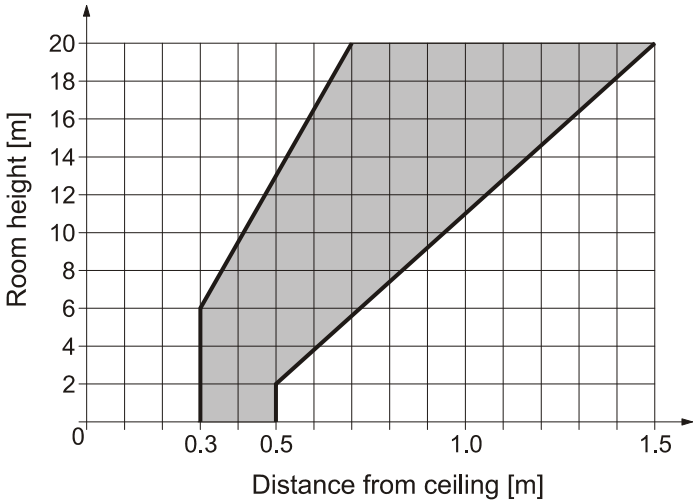
The figures below show the distance between the infrared ray and the ceiling depending on the room height.

Flat ceilings



Flat ceilings: Distance between infrared ray and ceiling

Inclined ceilings



Inclined ceilings: Distance between infrared ray and ceiling

4.9 Installation surface

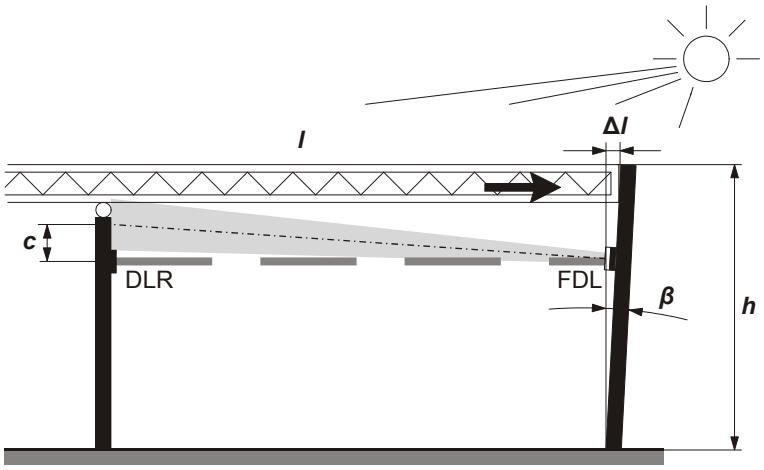
The detector must be installed on a stable and vibration-free surface. Remember that large fluctuations in temperature (e.g. between day and night) can cause slight deformations to iron girders etc. If the detector is installed on an unstable surface, the infrared ray may not reach the reflector and therefore causes an alarm or fault. The following are examples of unstable installation locations:

- Walls of non-insulated rooms with steel constructions. These move due to the lengthwise expansion of steel.
- Bricked walls, on which a steel roof construction is placed.

In such cases, the detector must be installed on a stable surface, while the reflector can be installed on the unstable wall.

Example

The example below illustrates how the infrared ray is deflected by the influence of heat on a hall roof's steel construction.



Incorrect installation: The infrared ray no longer reaches the reflector as a result of deflection.

c Deflection of the infrared ray

Δl Lengthwise expansion

l Length of the roof

h Room height

Wanted: Deflection of the infrared ray c

Known:

l	Length of the roof	80 m
α	Expansion coefficient of steel	12 x 10^{-6} K^{-1}
ΔT	Difference in temperature	40 K
h	Room height	4 m

Calculating the lengthwise expansion of the roof Δl:

$$\Delta l = l \times \Delta T \times \alpha = 80000\ \text{mm} \times 40\ \text{K} \times 0.000012\ \text{K}^{-1} = 38.4\ \text{mm}$$

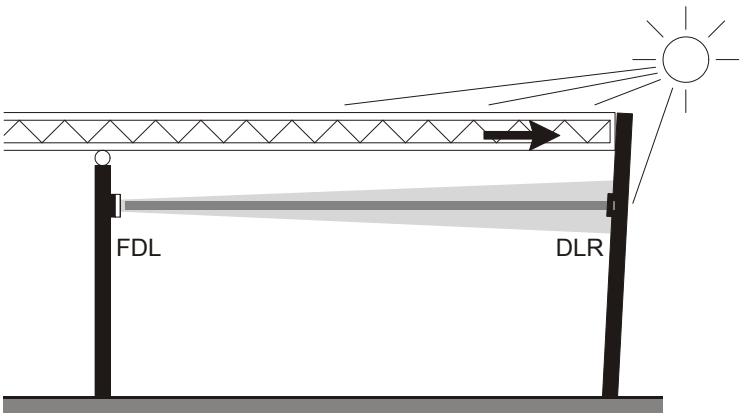
Calculating the angle β:

$$\beta = \arctan\left(\frac{\Delta l}{h}\right) = \arctan\left(\frac{38.4\ \text{mm}}{4000\ \text{mm}}\right) = 0.55°$$

Calculating the deflection c:

$$c = \tan\beta \times l = \tan(0.55) \times 80\ \text{m} = 0.77\ \text{m}$$

The deflection c is 0.77 m.



Possible solution: Install the detector on the stable surface and install the reflector on the unstable wall

4.10 Minimum distance between two detectors

The greater the detection distance, the greater the distance between two detectors must be. This prevents the detectors from influencing one another.

The figure below illustrates the minimum distance between two parallel infrared rays.

Minimum distance between two parallel infrared rays

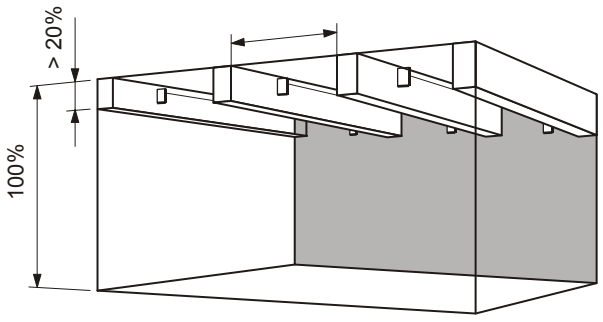
4.11 Arrangement with girders

The detector can be positioned in the ceiling panel between the girders or below the girders.

Girders include building elements (e.g. air conditioning ducts) installed at a distance of at maximum 15 cm below the ceiling.

Position in the ceiling panel between girders

The detector must be positioned in the ceiling panel between the girders if the height of the girders is more than 20 % of the total room height. In this case, the girders are considered as partition elements, and each ceiling panel must be considered as a separate room.



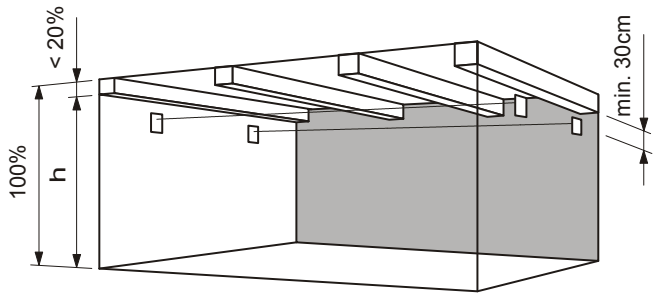
Position in the ceiling panel between girders

Position below girders

The detector can be installed below girders if the following points apply:

- The height of the girders is less than 20 % of the total room height.
- The width of the ceiling panel is at most 50 % of the maximum width of monitoring area.
- The ceiling panel surface is a maximum of 200 m².

Only the room height h up to the girder is relevant when calculating the width of monitoring area.



Position below girders

See also

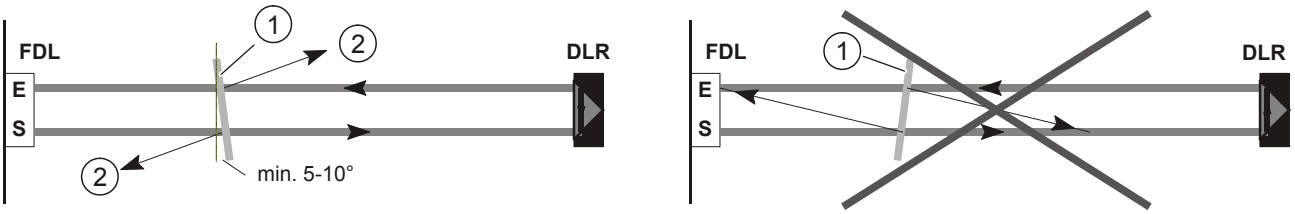
Width of monitoring area [→ 43]

4.12 Position on glass panes

Detection through glass panes

Detection through glass panes is only possible under certain circumstances. Please observe the following points:

- Glass panes must be smooth, clear, and stably fitted.
- A maximum of two glass panes, each max. 5 mm thick, may be penetrated. It is however better to only penetrate one glass pane.
- The detection distance is reduced by 20 m per glass pane.
- Detection is faultless when the standardized signal value is less than 5 % when the reflector is covered.
- Glass panes may never be at a right angle to the infrared ray (see example below).
- Glass panes must never be installed at an angle to the infrared ray, in which the glass pane acts as a mirror and can reflect the infrared ray to the receiver (impact angle = angle of reflection).



Detection through glass panes. Left: Correct use. Right: Incorrect use.

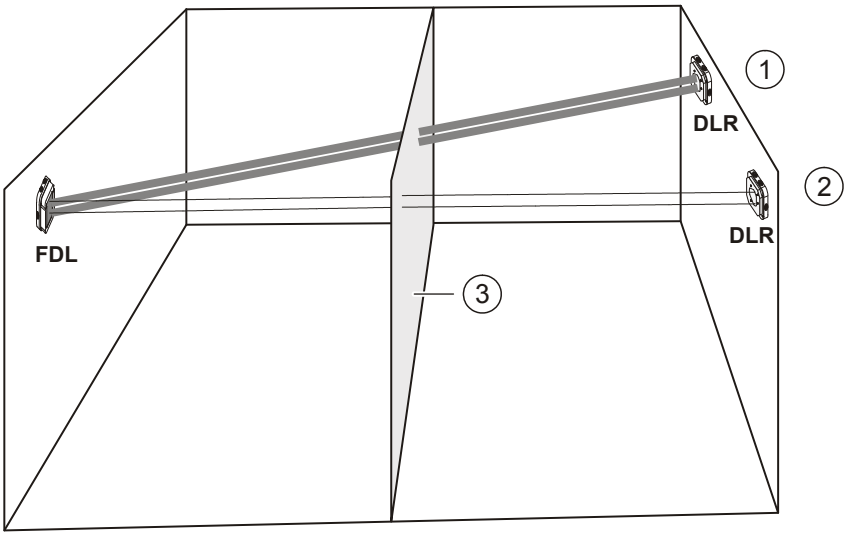
1 Glass pane

2 Light scatter

E Receiver

S Transmitter

Example:



Detection through one glass pane

1 Correct position

2 Incorrect position

3 Glass pane

Mounting reflectors on glass plates

When reflectors are installed on glass panes, there is danger of the glass panes, not the reflector, reflecting the infrared ray. This may even occur after commissioning, when the glass plate is slightly shifted. However, this is not the case when the infrared ray does not hit the glass pane at a right angle, but at a slight angle.

Recommendation: The infrared ray should reach the reflector at an angle of 5 to 10° to avoid unwanted reflection.

4.13 Measures against moisture condensation

Moisture condensation on the detector or reflector can cause faults and false alarms. Moisture condensation can occur e.g. when the detector or reflector is installed in a room with cool outer walls, where high air humidity and rapid temperature increases can be expected as a result of sunshine on a non-insulated roof, for example.

- Use the detector heating unit DLH1191A for the linear smoke detector if there is a danger of moisture condensation.
- If there is a danger of moisture condensation, always use the reflector for long distance and the built-in heating unit, even for short distances. You may not use the reflectors for middle distance and short distance if there is a danger of moisture condensation.

See also

Detector heating unit DLH1191A [→ 32]

4.14 Measures for strong extraneous light

Interferences of the detector by extraneous light are rather rare. If faults occur when there is strong extraneous light, use the extraneous light filter DLF1191-AC.

See also

Extraneous light filter DLF1191-AC [→ 32]

4.15 Determine parameter set

A parameter set can be used to set the linear smoke detector perfectly to the ambient features.

Two types of parameter set, each with three sensitivity levels, exist. The parameter sets with open line and with British Standard Alarm differ in the way the smoke detector responds to a signal interruption.

Parameter sets with interruption	Parameter sets with British Standard Alarm
In the case of a signal interruption (signal less than 10 % of the compensation value), the 'Signal interruption' fault occurs. An alarm is suppressed.	In case of a signal interruption (signal below alarm threshold), an alarm is actuated.
In the case of a distance interruption (signal less than 40 % of the compensation value), the 'Distance interruption' fault occurs. An alarm is suppressed.	In the case of a distance interruption (distance measuring less than 40 % of the initialization distance), the 'Distance interruption' fault occurs. An alarm is suppressed. When the signal drops below the alarm threshold during the fault, an alarm is actuated after 40 s.
After canceling the fault, any possible alarm is delayed for 40 s.	-
With distances of less than 7 m, the distance is not evaluated.	With distances of less than 7 m, the distance is not evaluated.

The table below shows the parameter sets in three sensitivity levels and sample applications of the parameter sets.

Parameter set		Properties of the monitored room	Examples of application
No.	Name		
01	Standard with open line	● Low to medium concentration of valuable property ● Low danger to life ● No smoking ban necessary	Industry, erection shops, diesel vehicle traffic, garages, restaurants, kitchens, smokers' rooms
02	Standard with British Standard Alarm		
03	Sensitive with open line	● Medium concentration of valuable property ● Low danger to life ● No smoking ban necessary	Offices, warehouses, electric vehicle traffic, congress centers
04	Sensitive with British Standard Alarm		
05	Very sensitive with open line	● High concentration of valuable property ● Medium danger to life ● Smoking ban	Clean warehouses, museums, archives, EDP and telecommunication systems in clean environments, high level of air change
06	Very sensitive with British Standard Alarm		

5 Mounting / Installation

Prerequisites

- The installation locations for the detector and reflector are defined according to the planning information.
- The supply network is produced, connected and checked in line with the country-specific installation guidelines.

Sequence

1. Switch detector over to collective operation (optional)
2. Installing the detector base
3. Electrical connection
4. Installing the reflector for long distance (prism)
5. Installing the reflectors for middle distance and short distance (foil)

Information on the individual steps can be found in the following chapters.

The detector is only installed on the detector base during commissioning.

See also

Planning [→ 34]

5.1 Switching detector over to collective operation

When supplied, the detector is set for operation on an FDnet/C-NET detector line. When operating a collective detector line, the control panel normally switches the detector to collective operation automatically.

Some collective control panels do not however automatically switch from FDnet/C-NET operation to collective operation. In these cases, you must switch the detector over manually. If you are not certain whether the detector is switched over automatically, switch it manually to collective operation before installing.

The detector always switches automatically from collective operation to FDnet/C-NET operation.

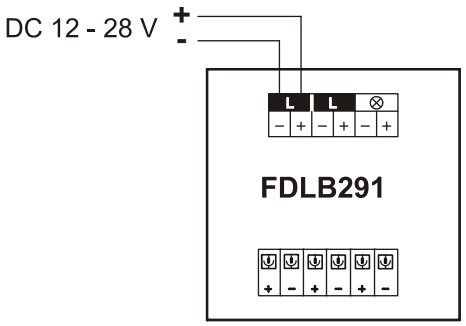
Procedure

Note the positive and negative poles.

▷ The detector base must not be connected to the detector line.

1. Connect the detector base to a DC 12 V to 28 V source of DC voltage, e.g. a battery, according to the connection diagram shown below. Use a screwdriver to remove the load from the spring clip so you can slide in the wire.
2. Insert the detector unit into the detector base.
3. Wait around 15 seconds and then remove the detector unit and source of DC voltage.

⇨ The detector is switched over to collective operation and can be connected to a collective detector line.

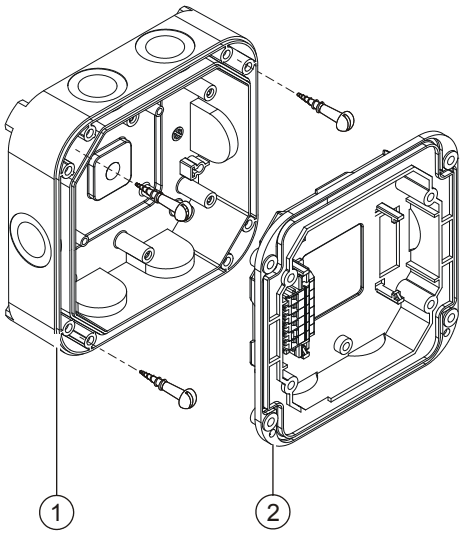


Connection diagram for the source of DC voltage

5.2 Installing the detector base

	⚠ WARNING
	Danger of falling Bodily injury • When installing, use a secured ladder or work platform.

	⚠ CAUTION
	Using the device in a damp and/or corrosive environment Device function is impaired. • Use the M20 x 1.5 metal cable gland in damp and/or corrosive environments.



Installation and electrical connection

1 Detector base
2 Terminal block

1. Break open the plastic parts in the detector base (1) at the openings you require for cable entry. Note the arrows in the detector base indicating which side should be at the top.
2. If necessary screw the M20 x 1.5 metal cable gland into the openings.
3. Install the detector base on a stable, vibration-free surface with two screws.
4. Guide the cables from the detector line and external alarm indicator into the detector base. You will also need a 24 V supply if you are using the detector heating unit DLH1191A.
5. Mount the terminal block (2) with two screws into the detector base. The arrows in the terminal block indicate which side should be at the top.
6. If you are using the detector heating unit DLH1191A, insert the terminal block supplied into the terminal block with the detector heating unit.

⇨ The detector base is installed.

5.3 Electrical connection

The electrical connection depends on the following factors:

- Connection to an FDnet/C-NET detector line or collective detector line
- Use of unshielded cables or shielded cables

The general process is described below. The connection diagrams and more information on the various connection variants can be found in the following chapters.

Note the following with regard to the electrical connection:

	⚠ CAUTION
	Using the device in a damp and/or corrosive environment Device function is impaired. • Use the M20 x 1.5 metal cable gland in damp and/or corrosive environments.

Note the positive and negative poles.

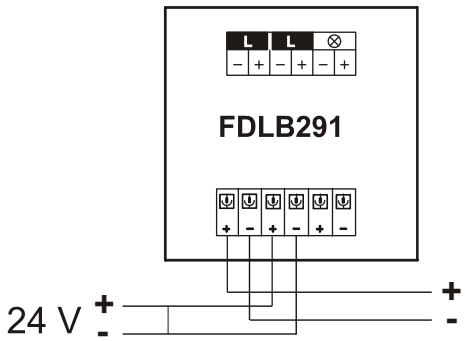
Only connect one wire per terminal. This is the only way of ensuring a problem-free connection over the device's entire service life.

- Wherever possible use twisted, unshielded cables. Shielded cables are only required in special cases, such as strong high-frequency fields. This also applies to connecting the external alarm indicators.
- Only use cables with a wire diameter of 0.2…1.5 mm².

General procedure

▷ The detector base and terminal block are installed.

1. Connect the wires as shown in the corresponding connection diagram. Use a screwdriver to remove the load from the spring clip so you can slide in the wire.
2. If you are using the detector heating unit, connect the wires of the 24 V supply according to the connection diagram shown below.



Connection diagram for the detector heating unit

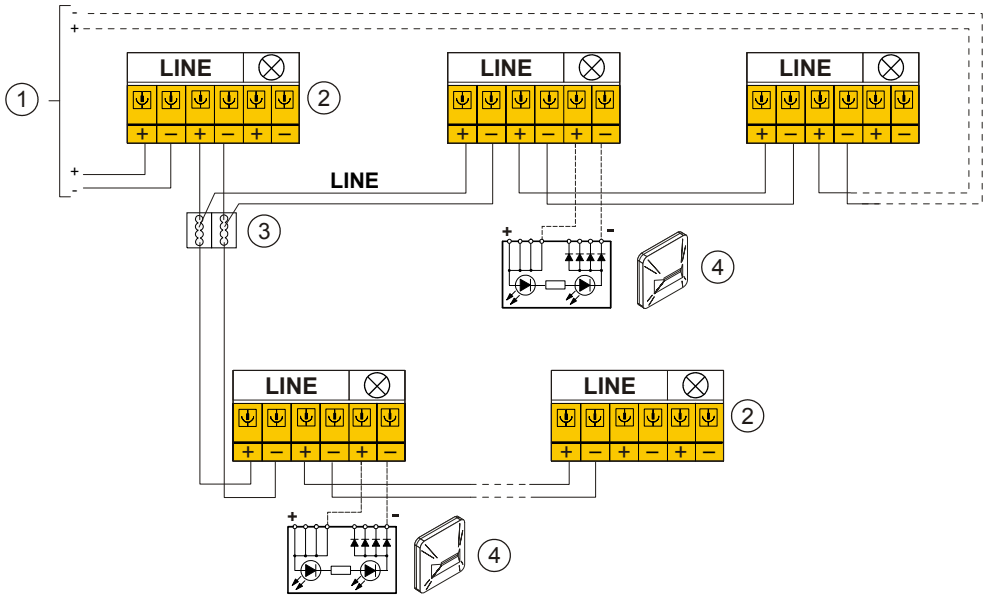
5.3.1 Connection to an addressed detector line

The following applies to FDnet/C-NET detector lines:

- Loops, stubs and T-branches are possible.
- You may only connect external alarm indicators to **one** detector.
- Permissible cables for detectors with more than one external alarm indicator according to the collective connection diagram may be migrated to the FDnet/C-NET without any changes.
- Note document 001508 for installation (calculation of the capacity layer).

5.3.1.1 Use of unshielded cables

The connection is established from base to base using twisted or non-twisted wire pairs.



Connection diagram for addressed detector line with and without external alarm indicators (without shielded cables)

1 Control panel

2 Detector

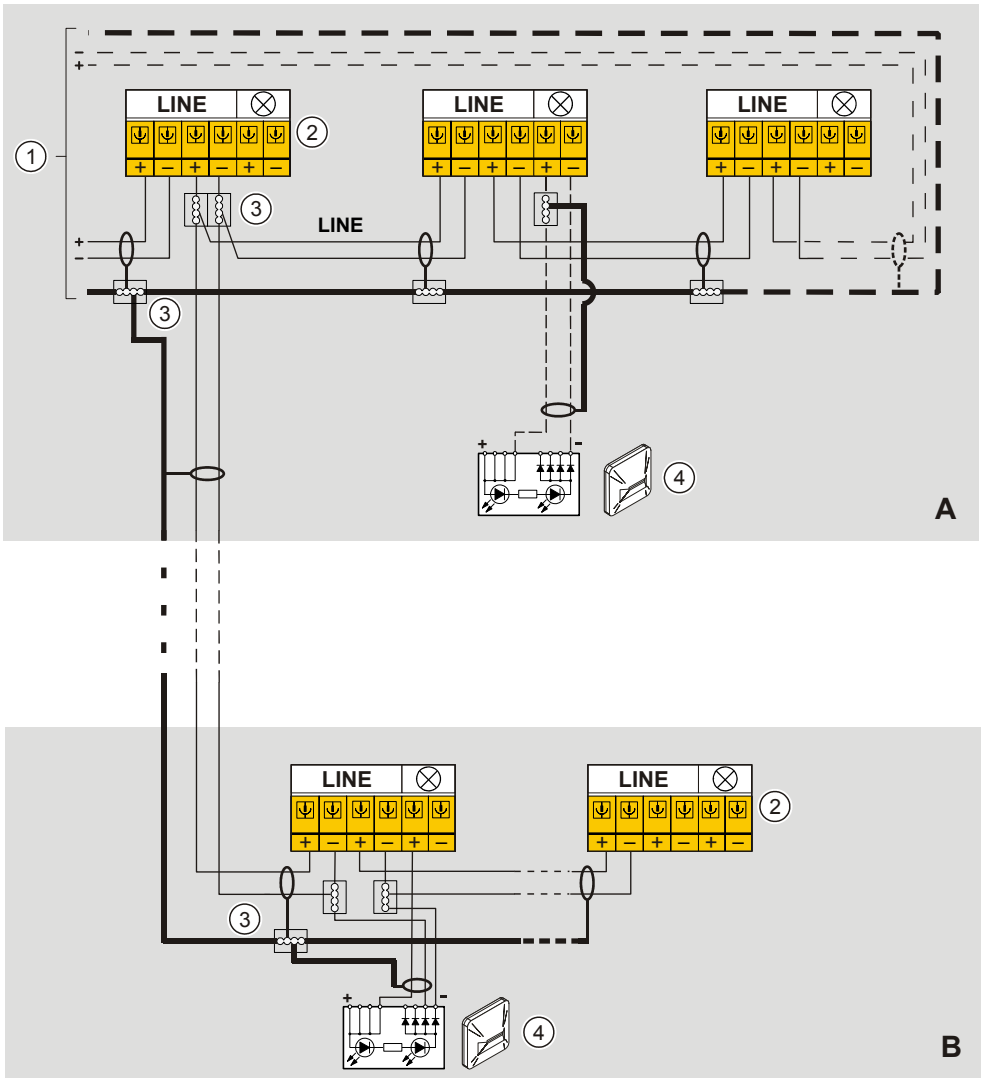
3 Auxiliary terminals DBZ1190-xx

4 External alarm indicator

5.3.1.2 Use of shielded cables

The detector line shielding must be connected through in the detector base with auxiliary terminals DBZ1190-xx.

There are two ways of connecting external alarm indicators:



Connection diagram for addressed detector line with and without external alarm indicators (with shielded cables)

1 Control panel
2 Detector
3 Auxiliary terminals DBZ1190-xx
4 External alarm indicator

Variant A

1. Connect the positive pole of the external alarm indicator to the positive pole for the external alarm indicator on the detector.
2. Connect the negative pole of the external alarm indicator to the negative pole for the external alarm indicator on the detector.
3. Connect the shielding of the connection cable between the external alarm indicator and detector on the detector side to the positive pole for the external alarm indicator via an auxiliary terminal DBZ1190-xx.

Variant B

1. Connect the positive pole of the external alarm indicator to the positive pole for the external alarm indicator on the detector.
2. Leave the negative pole for the external alarm indicator on the detector unoccupied.
3. Connect each of the two negative poles of the external alarm indicator separately to both negative poles of the detector line.

The two negative connections of the external alarm indicator are decoupled externally in the alarm indicator by diodes.

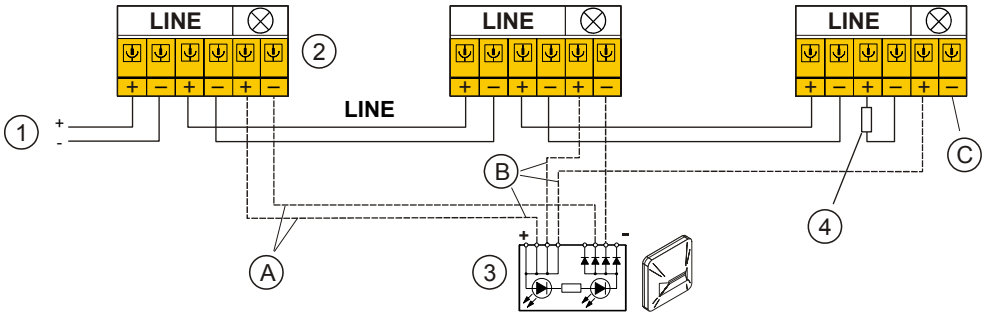
4. Connect the shielding of the detector line with the shielding of the connection cable to the external alarm indicator with an auxiliary terminal DBZ1190-xx.

5.3.2 Connection to a collective detector line

Connect a control panel-specific end-of-line to the end of the collective detector line.

5.3.2.1 Use of unshielded cables

The connection is established from base to base using twisted or non-twisted wire pairs.



Connection diagram for collective detector line with and without external alarm indicators (without shielded cables)

1 Control panel
2 Detector
3 External alarm indicator
4 End-of-line depending on control panel

Standard circuitry

With standard circuitry, the external alarm indicator is connected to the positive and negative poles of each detector.

Wire-saving cabling

!	*NOTICE*
	Cabling for new sites Wire-saving cabling in external alarm indicators is prohibited for new sites.

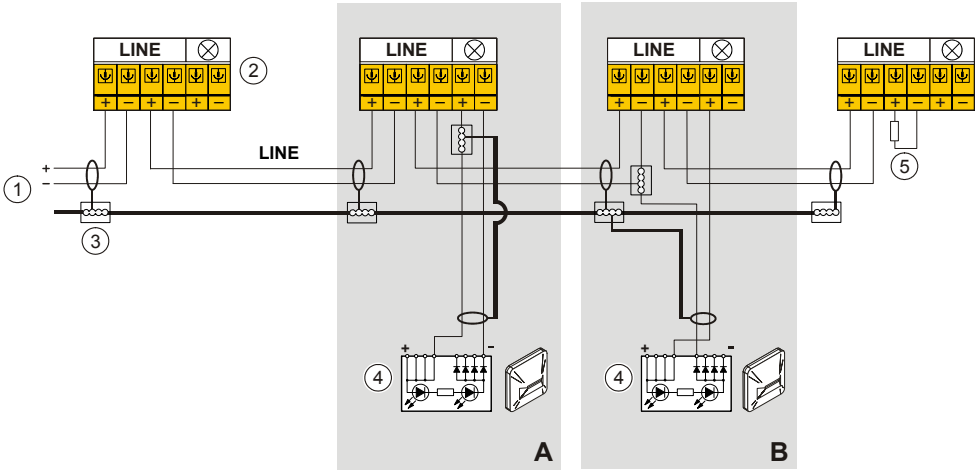
With wire-saving cabling, the external alarm indicator is connected as follows:

- The external alarm indicator must be connected to the positive and negative poles of at least one detector (A).
- The external alarm indicator must be connected to the positive pole of every other detector (B).
- The external alarm indicator need not be connected to the negative pole of every other detector (C).

5.3.2.2 Use of shielded cables

The detector line shielding must be connected through in the detector base with auxiliary terminals DBZ1190-xx.

There are two ways of connecting external alarm indicators:



Connection diagram for collective detector line with and without external alarm indicators (with shielded cables)

1 Control panel
2 Detector
3 Auxiliary terminals DBZ1190-xx
4 External alarm indicator
5 End-of-line depending on control panel

Variant A

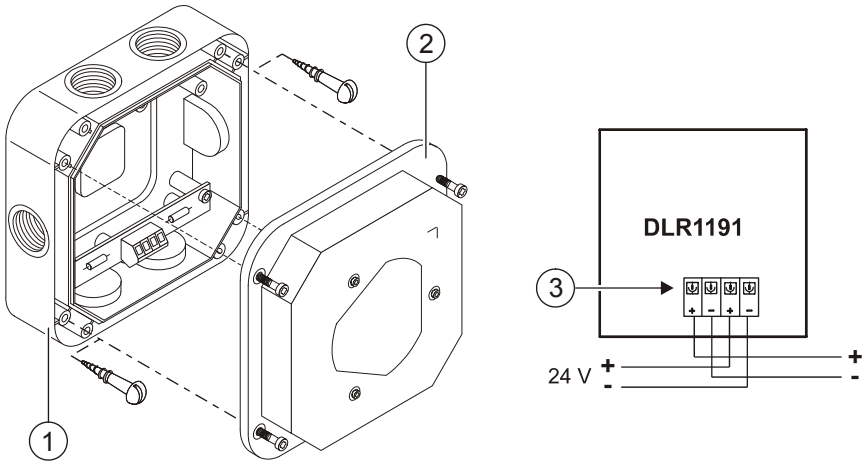
1. Connect the positive pole of the external alarm indicator to the positive pole for the external alarm indicator on the detector.
2. Connect the negative pole of the external alarm indicator to the negative pole for the external alarm indicator on the detector.
3. Connect the shielding of the connection cable between the external alarm indicator and detector on the detector side to the positive pole for the external alarm indicator via an auxiliary terminal DBZ1190-xx.

Variant B

1. Connect the positive pole of the external alarm indicator to the positive pole for the external alarm indicator on the detector.
2. Leave the negative pole for the external alarm indicator on the detector unoccupied.
3. Connect the negative pole of the external alarm indicator with the negative pole on the input side of the detector line on the detector via an auxiliary terminal DBZ1190-xx.
4. Connect the shielding of the detector line with the shielding of the connection cable to the external alarm indicator via an auxiliary terminal DBZ1190-xx.

5.4 Installing the reflector for long distance (prism)

	⚠ WARNING
	Danger of falling Bodily injury • When installing, use a secured ladder or work platform.



Installing the reflector

1 Base

2 Prism unit

3 Terminals for heating unit

Installation without heating unit

▷ The installation location of the reflector is defined according to the planning information.

1. Install the base (1) with two screws on a level surface.
2. Install the prism unit (2) on the base with four screws.

⇨ The reflector is installed.

Installation with heating unit

Note the positive and negative poles.

Only connect one wire per terminal. This is the only way of ensuring a problem-free connection over the device's entire service life.

▷ The installation location of the reflector is defined according to the planning information.

▷ You need a 24 V supply for the heating. Only use cables with a wire diameter of 0.2…1.5 mm^2.

1. Break open the plastic parts in the base (1) at the openings you require for cable entry.

2. If necessary screw the M20 x 1.5 metal cable gland into the openings.
3. Install the base with two screws on a level surface.
4. Insert the cable for the 24 V supply into the base.
5. Connect the wires to the terminals for the heating unit (3) according to the connection diagram.
6. Install the prism unit (2) on the base with four screws.

See also

Planning [→ 34]

5.5 Installing the reflectors for middle distance and short distance (foil)

⚠ WARNING

Danger of falling

Bodily injury

- When installing, use a secured ladder or work platform.

▷ The installation location of the reflector is defined according to the planning information.

- Install the reflector with one screw on a level surface. The diameter of the hole is 4 mm.

6 Commissioning

Sequence

1. Set parameter set
2. Install detector unit
3. Install detector heating unit (optional)
4. Insert filter in detector (optional)
5. Commissioning the adjustment device
6. Checking the signal level and distance
7. Preliminary setting of the detector optics (optional)
8. Fine-tuning of the detector optics
9. Initializing the detector
10. Testing detectors

The types are described in the following chapters.

6.1 Set parameter set

Setting the parameter set depends on the detector line.

FDnet/C-NET detector line

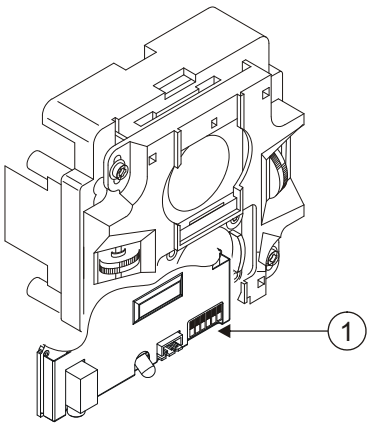
The parameter set is set using control panel.

The procedure for setting the parameter set via the control panel is described in the control panel documentation.

Collective detector line

The parameters are set with the DIP switches in the detector unit.

- Use DIP switches (1) to set the parameter set you want (see table below).



Detector unit with DIP switches

Parameter set			DIP switch					
No.	Name	Alarm for n % attenuation	1	2	3	4	5	6
01	Standard with open line	65 %	ON	OFF	OFF	OFF	OFF	OFF
02	Standard with British Standard Alarm	65 %	OFF	ON	OFF	OFF	OFF	OFF
03	Sensitive with open line	50 %	ON	ON	OFF	OFF	OFF	OFF
04	Sensitive with British Standard Alarm	50 %	OFF	OFF	ON	OFF	OFF	OFF
05	Very sensitive with open line	30 %	ON	OFF	ON	OFF	OFF	OFF
06	Very sensitive with British Standard Alarm	30 %	OFF	ON	ON	OFF	OFF	OFF

Set parameter set

See also

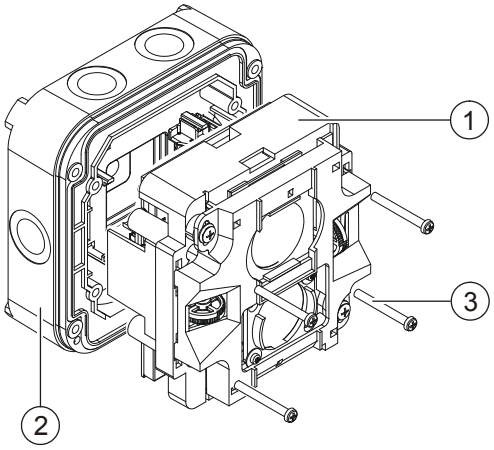
Determine parameter set [→ 51]

6.2 Installing the detector unit

	⚠ WARNING
	Danger of falling Bodily injury • When installing, use a secured ladder or work platform.

▷ The terminal block is installed in the detector base.

1. Insert the detector unit (1) in the base with the terminal block (2) with the LED pointing downwards.
2. Fasten the detector unit with four screws (3). Ensure that the screws are tightened.



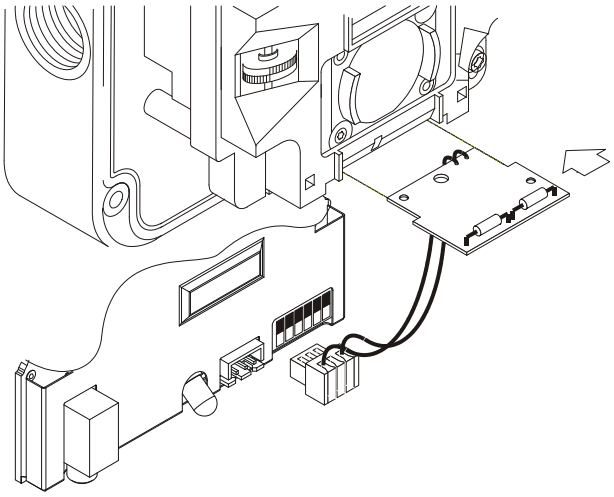
Installing the detector unit

1 Detector unit
2 Detector base with terminal block
3 Screws

6.3 Installing the detector heating unit (optional)

You must install the detector heating unit DLH1191A if there is a danger of moisture condensation. To do this, you need a 24 V supply.

1. Insert the detector heating unit in the detector.
2. Connect the detector heating unit to the printed circuit board.



Installation of the detector heating unit

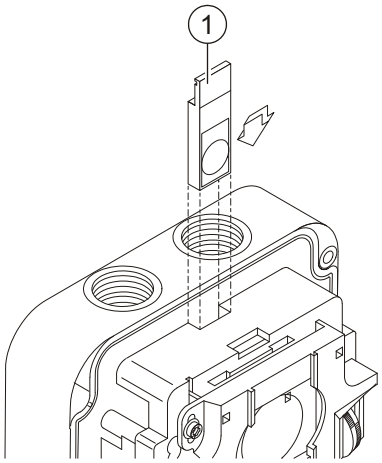
See also

Accessories [→ 30]

6.4 Inserting the filter in detector (optional)

For short detection distances and strong extraneous light, you may have to use a filter.

1. Select the filter according to the planning information:
   - Short distance filter DLF1191-AA
   - Short distance filter DLF1191-AB
   - Extraneous light filter DLF1191-AC
2. Insert the filter (1) in the detector.



Inserting the filter

See also

- Accessories [→ 30]
- Measures for short distances [→ 41]
- Measures for strong extraneous light [→ 51]

6.5 Commissioning the adjustment device

Securing the adjustment device to the detector

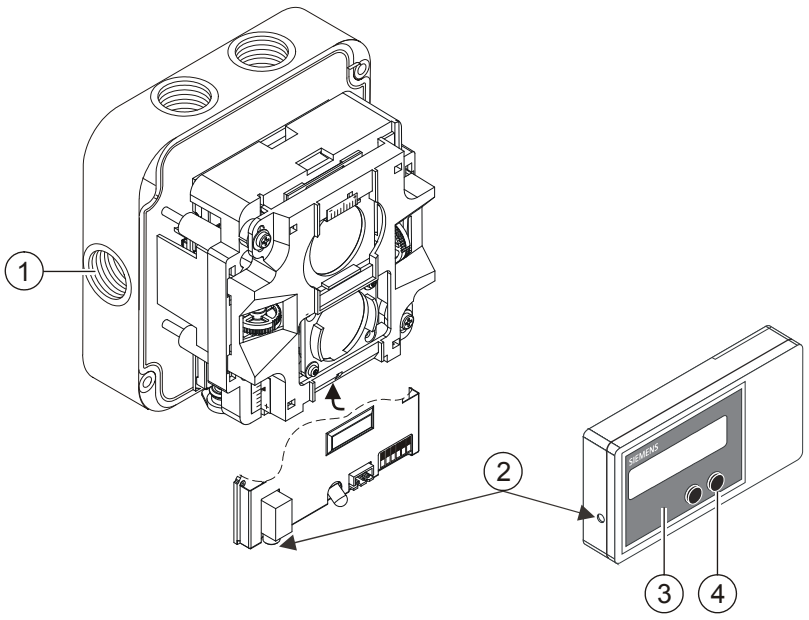
1. From the adjustment set, take the chain with the two cable grippers and the snap hook.
2. Screw one cable gripper into a free opening for the cable entry (1) on the detector base. Cable grippers are available in two different sizes:
   - PG16
   - M20 x 1.5
3. Secure the snap hook on the suspension chain of the adjustment device (3).

⇨ The adjustment device hangs on the detector. You therefore have your hands free to undertake commissioning work.

Connecting the adjustment device

▷ The detector line is switched on.

1. Connect the adjustment device (3) electrically to the detector. To do so, use the MC-Link cable enclosed in the delivery and the connecting sockets (2) on the detector and on the adjustment device.
2. Switch on the adjustment device with the button on the right (4). With the same button, it is possible to switch between 'Adjust' and 'Initialization'.



Detector with adjustment device

1 Opening for cable entry
2 Connection sockets
3 Adjustment device
4 Button

Indication on the adjustment device

The indication before the initialization differs from that after initialization. The indication is described in the table below.

Indication location	Example	Meaning
Top left	555	Signal level before initialization Must be between 255 and 1195 for initialization. Otherwise initialization is not possible.
	100%	Standardized signal value as % of the current compensation value During initialization, the signal level is equalized to the compensation value 100 %.
Bottom left	50m	Distance in meters between detector and reflector
Top right	Adjust	Detector not yet initialized
Bottom right	OK	Last initialization successfully completed

Indication before initialization:

Indication after initialization:

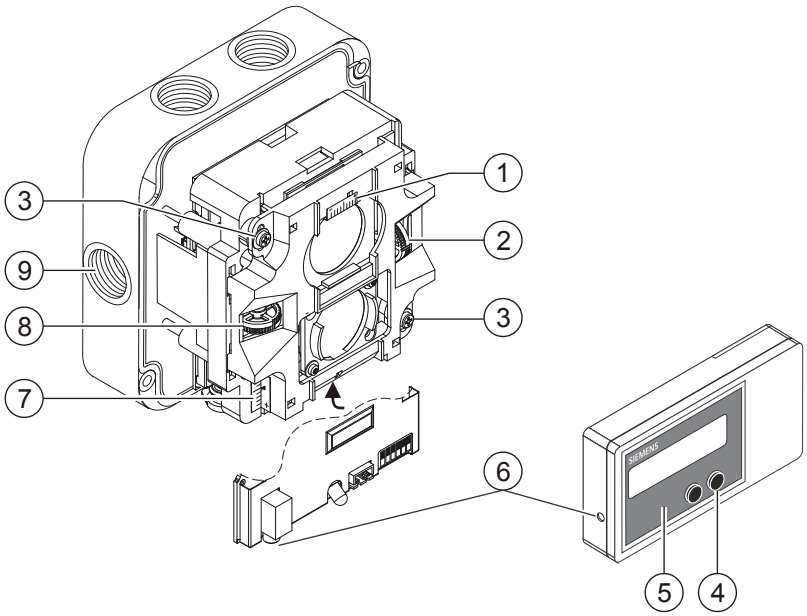
6.6 Checking the signal level and distance

▷ The detector line is switched on.

1. Loosen the two safety screws (3).
2. Make sure that the vertical scale (7) and the horizontal scale (1) are centered (factory setting). Otherwise the scales must be re-adjusted with the knurled screws:
   - the vertical scale (7) with the knurled screw (8)
   - the horizontal scale (1) with the knurled screw (2).
3. Set the 'Adjust' menu with the button (4) on the adjustment device.
4. Read the indicators for the signal level and the distance from the adjustment device:
   - If the signal level is over 100 and the distance indication matches the detection distance, continue fine-tuning the detector optics.
   - If the signal level is below 100 and/or the distance indicator does not match the detection distance, continue with preliminary setting of the detector optics.

Possible reasons for the signal level and distance indication deviating:

- The detector and the reflector are not positioned on the same horizontal or vertical axis.
- The detector is not mounted on an even surface.



Checking the signal level and distance

1 Horizontal scale	6 Connection sockets
2 Knurled screw for horizontal adjustment	7 Vertical scale
3 Safety screws	8 Knurled screw for vertical adjustment
4 Button	9 Opening for cable entry
5 Adjustment device	

Example: Signal level and distance indication in the 'Adjust' menu:

555	**Adjust**
50m	

See also

- Preliminary setting of the detector optics (optional) [→ 72]
- Fine-tuning of the detector optics [→ 73]

6.7 Preliminary setting of the detector optics (optional)

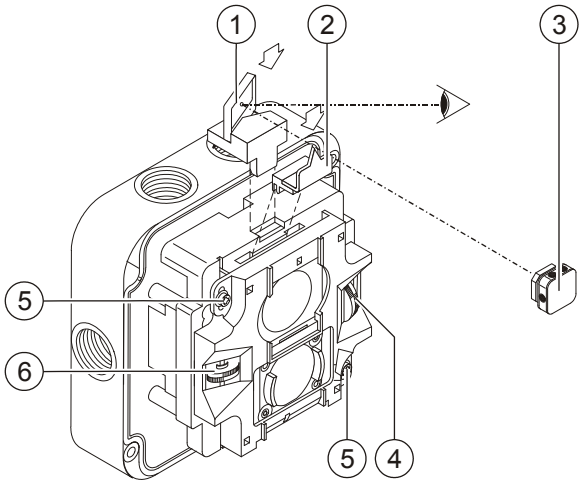
Preliminary setting of the detector optics must only undertaken when the signal level was below 100 and/or the distance indication was incorrect.

▷ The detector line is switched on.

▷ The adjustment device is connected to the detector and must be set to 'Adjust'.

▷ The signal level is below 100 and/or the distance indication does not match the detection distance.

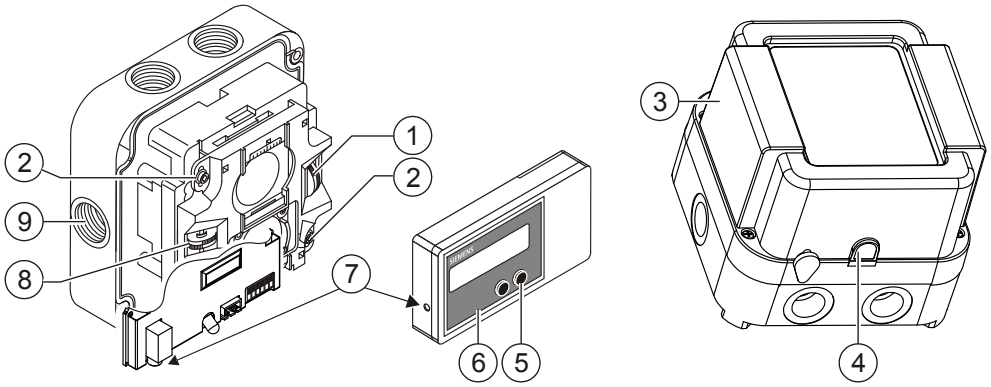
1. Mount the sighting system on the detector. The mirror (1) and the front sight (2) must be free from clearance.
2. Ensure that the two safety screws (5) are loosened.
3. Align the detector optics to the reflector using the knurled screws (3):
   - knurled screw (6) for vertical setting
   - knurled screw (4) for horizontal setting
   - The reflector (3) and the front sight (2) must be on the axis of the circular mark on the mirror.
4. Simultaneously check the signal level and the distance indication on the adjustment device.
   ⇨ Following successful alignment of the detector optics, the signal level must be over 100 and the distance indication match the detection distance with an accuracy of 10 %.
5. Remove the sighting system.



Preliminary setting

1 Mirror
2 Notch
3 Reflector
4 Knurled screw for horizontal setting
5 Safety screws
6 Knurled screw for vertical setting

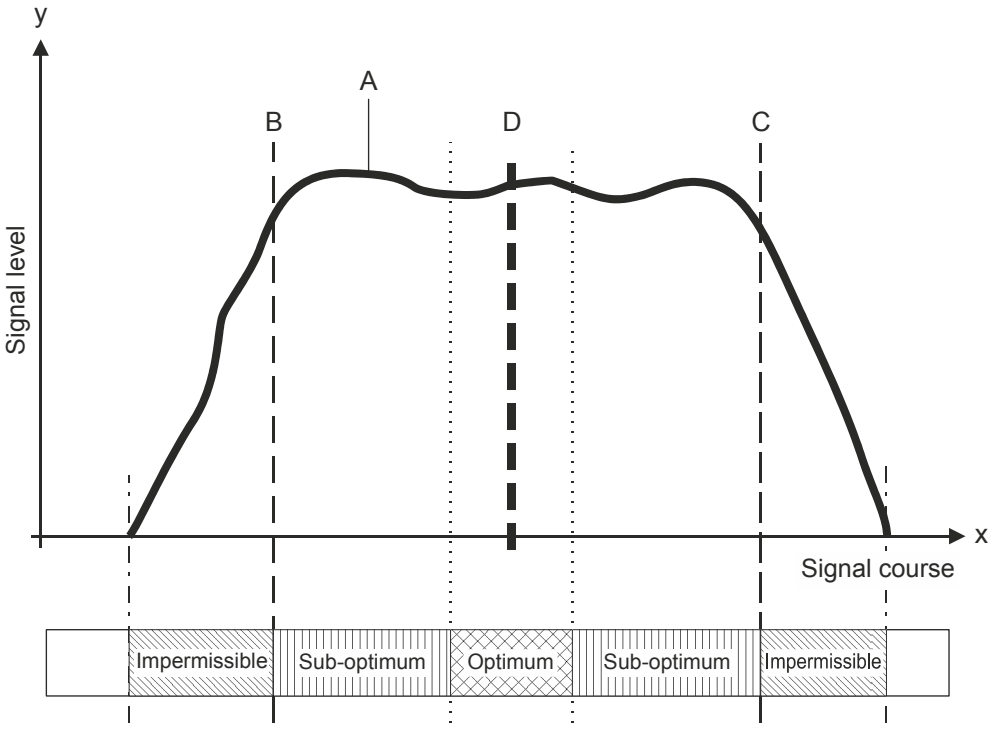
6.8 Fine-tuning of the detector optics



Fine-tuning with the adjustment device

1 Knurled screw for horizontal setting
2 Safety screws
3 Hood
4 Alarm indicator
5 Button
6 Adjustment device
7 Connection sockets
8 Knurled screw for vertical setting
9 Opening for cable entry

When you change the setting, the course of the signal is trapezoidal (see figure below). For optimum setting of the detector optics, the setting must be in the middle of the trapezoid (point D). If the detector optics is not optimally set, e.g. between points B and A, problems and faults may occur during operation, e.g. greater susceptibility to mechanical changes.



x The course of the signal level when changing the setting
y Signal level (display on the adjustment device)

To optimally set the detector optics, proceed as follows:

▷ The detector line is switched on.

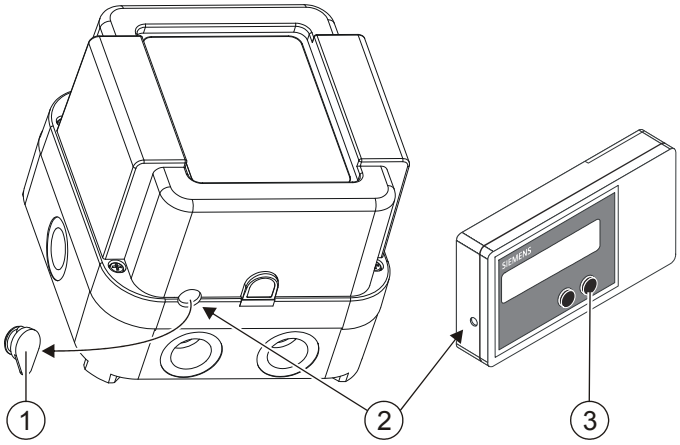
▷ The adjustment device is connected to the detector and must be set to 'Adjust'.

▷ The two safety screws (2) are loosened.

1. Turn the knurled screws (1, 8) until the standardized signal value on the adjustment device is as high and constant as possible (point A in the figure above).
2. Turn the knurled screws back until the standardized signal value decreases considerably (point B).
3. Note point B. Count e.g. the number of knurled screw turns or mark the scale.
4. Turn the knurled screws forwards again until the standardized signal value is as high and constant as possible. Continue turning until the standardized signal value decreases considerably (point C).
5. Note point C. Count e.g. the number of knurled screw turns or mark the scale.
6. Turn the knurled screws back until you reach the middle between points B and C (point D).
   ⇨ The detector optics are optimally set.
   ⇨ The detector indication matches the detection distance with an accuracy of 10 %.
7. Carefully tighten the two safety screws (2). The values indicated on the adjustment device must not change significantly.
8. Pull the MC-Link cable from the detector.
9. Fix the hood (3) on the detector with four screws. The alarm indicator (4) must point downwards.

6.9 Initializing the detector

After the fine-tuning of the detector optics, the detector must be initialized with the hood screwed on.



Initializing the detector

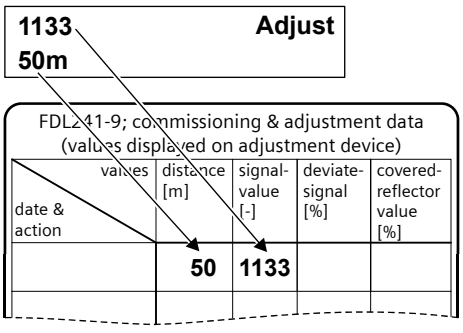
1 End plug
2 Connection sockets
3 Button

▷ The detector line is switched on.

▷ Setting of the detector optics is complete.

1. Remove the sealing plug (1) from the hood.
2. Connect the MC link cable to the connection socket (2) of the detector.

   ⇨ The standardized signal value and the detection distance are displayed in the 'Adjust' menu on the adjustment device. Example:



3. Copy the two display values onto the two labels.

4. Activate the initialization procedure by pressing the button (3). The detection distance must not be interrupted during initialization!

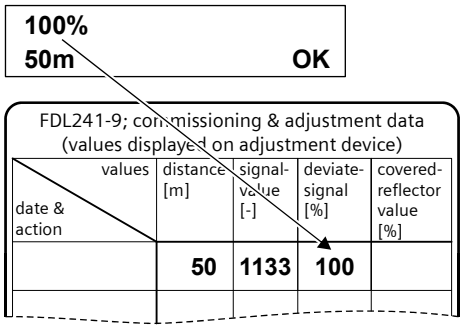
   ⇨ During initialization, the following is displayed on the adjustment device:

Initialization
.....

   ⇨ Following successful initialization, 100 % ±3 % and the effective detection distance is displayed on the adjustment device. Example:

100%	
50m	**OK**

5. Copy the standardized signal value onto the two labels.



⇨ The detector is initialized.

Troubleshooting during initialization

- If the standardized signal value is not within 100 % ±3 % or if the detection indication displayed deviates by more than 10 % from the effective detection distance, repeat the initialization process from step 4.
- If initialization fails, the following is displayed:

Initialization
failed

  Remedy the error and repeat the initialization process. Possible causes for failed initialization:

Signal	Possible cause
Not stable	Moving obstacle
Too high	Strong reflection
Too low	• Detection distance too large • Reflector too small • Reflector aligned incorrectly • Reflector covered

6.10 Testing detectors

Undertake a performance check following initialization.

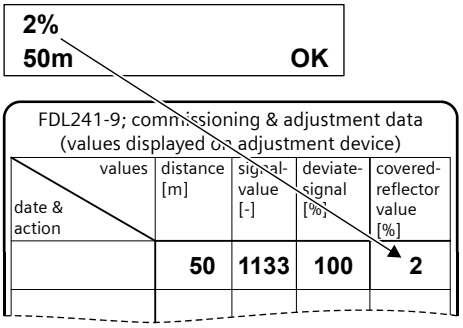
Checking the detection distance

▷ The detector is connected to the adjustment device.

1. Cover the reflector completely, using an appropriate object.

   ⇨ The standardized signal value on the adjustment device must be <5 %; the distance display is frozen.

2. Enter the read-in standardized signal value on the two labels.



3. Stick a label on the hood, at the top or side. The other label is intended for system documentation.

Activating the test alarm

1. On the control panel, switch off the remote transmission of alarms. To do this set the 'Detector test' operating mode on the control panel.
2. Hold the alarm test filter TF04 in front of the hood, such that it covers the detector optics.

   ⇨ The detector activates an alarm after around 10 seconds.

3. Pull the MC-Link cable from the detector and remove the adjustment device.
4. Re-insert the end plug in the hood.
5. On the control panel, switch the remote transmission of alarms back on.

⇨ The detector is ready for operation.

If the alarm doesn’t sound:

- Check whether the standardized signal value is attenuated enough to reach the alarm threshold. Otherwise rotate the alarm test filter a little or turn it round.

7 Maintenance / Repair

7.1 Performance check

Due to the built-in operating monitoring function, the detector is automatically subjected to a performance check. However, an additional performance check should be carried out once a year. To do so, proceed as follows:

Activating the test alarm

1. On the control panel, switch off the remote transmission of alarms. To do this set the 'Detector test' operating mode on the control panel.
2. Hold the alarm test filter TF04 in front of the hood, such that it covers the detector optics.
   ⇨ The detector activates an alarm after around 10 seconds.
3. On the control panel, switch the remote transmission of alarms back on.
4. Check the detector for mechanical damage.
5. Replace detectors that do not respond or are mechanically damaged.

If the alarm doesn’t sound:

- Check whether the standardized signal value is attenuated enough to reach the alarm threshold. Otherwise rotate the alarm test filter a little or turn it round.

Checking the standardized signal value and detection distance

Checking steps	Criteria	Measures
Use the adjustment device to check the standardized signal value and the detection distance.	● The standardized signal value must be 100 % ±3 %. ● The distance indication must not deviate by more than ±10 % from the effective detection distance.	● Repeat initialization. ● Check the coverage area for changes, e.g. obstacles, reflections, structural adaptations. ● Check the signal value during initialization.
Compare the values with those of the last commissioning session. Enter the values on the label in the hood and in the system documentation.	The signal value on the adjustment device must not deviate by more than ±10 % from the value entered under 'Signal value' on the label.	● Check the coverage area for changes. ● Ensure that the detector and reflector are secure.
	The standardized signal value on the adjustment device must not deviate by more than ±3 % from the value entered under 'Deviate signal' on the label.	● Check the coverage area for short-term changes, e.g. dirt, smoke, vapor, insecure installation or installation surface. It is possible that the compensation value has not yet been updated.
	The distance indication on the adjustment device must not deviate by more than ±5 % from the value entered under 'Distance' on the label.	● Check the coverage area for changes, e.g. obstacles, reflections, structural adaptations.
Cover the reflector and use the adjustment device to check the standardized signal value.	The standardized signal value must be less than 5 %.	● Check the coverage area for extraneous light. ● Remove or cover reflecting objects. ● If necessary use the extraneous light filter DLF1191-AC. ● Check whether the detector is aligned correctly.

See also

Initializing the detector [→ 75]
Extraneous light filter DLF1191-AC [→ 32]

7.2 Cleaning

⚠ WARNING

Danger of falling

Bodily injury

- When cleaning, use a secured ladder or work platform.

NOTICE

Damage caused by solvents and/or steam blasters

Detector can be damaged.

- Never use solvents or steam blasters!

Clean the protective hood and the reflector on a regular basis. The interval depends on the ambient conditions (e.g. degree of soiling). Use either a dry, soft cloth or a damp cloth, together with window cleaner or a mild soap solution.

After cleaning, check the detector's function according to the information provided in the chapter 'Performance check [→ 78]'. In case of strong soiling, re-initialization is required.

See also

- Performance check [→ 78]
- Initializing the detector [→ 75]

7.3 Repair

When false alarms or faults occur sporadically, it is important to know the cause. Use the adjustment device and observe the signal strength over a longer period of time. Compare the values with those on the label. The table below provides you with an overview of possible faults and there remedy.

Perform an initialization after troubleshooting.

Fault	Possible cause	Remedy
The detector sporadically triggers false alarms or faults (depending on the selected parameter set).	Initialization has not been performed correctly.	Repeat initialization.
	Fine-tuning of the detector optics was not performed correctly.	Repeat fine-tuning. Make sure that the signal is set to the maximum value. At the end, perform the initialization with the hood fitted.
	The ray is temporarily interrupted by obstacles (cranes, decoration, work within the detection distance etc.).	Avoid interruptions to the infrared ray, or install the detector in a different position.
	The building may warp due to solar radiation. The ray is deflected and no longer reflected.	Mount the detector base on a solid, stable surface.
	The detector or the detector unit has been dislocated, e.g. due to an impact.	Ensure that the detector is fixed and the screws are tightened.
The detector sporadically triggers false alarms.	Moisture condensation of the detector or the reflector.	Install a detector heating unit DLH1191A.
	Detection distance influenced by dust, vapor or mist.	Select a less sensitive parameter set.
	The sun or other strong sources of light directly shine on the detector.	Avoid direct contact with sunlight or use an extraneous light filter DLF1191-AC.
The detector sporadically triggers faults.	The ray is reflected not only by the reflector, but also by other objects (e.g. ventilation ducts). This results in too high a standardized signal value.	Cover the reflector and check the standardized signal value on the adjustment device. This value must be <5 %. If the standardized signal value is greater than 5 %, remove the reflecting objects or cover them with a non-reflecting material.
	Radiant heaters cause air flickering and thus have an influence on the detection distance.	Install the detector and reflector in a different position.
	Strong soiling of the detector or reflector.	Clean the detector and the reflector, then perform initialization.
	Aging of the transmitter diode.	Initialize the detector again. If this does not remedy the fault, replace the detector.
The detector does not react	Fault on the detector line.	Check the line voltage.
	Detector defective.	Replace the detector.
No alarm is triggered with the alarm test filter.	Incorrect handling of the alarm test filter.	• Place the alarm test filter directly on the detector. • Rotate or turn the alarm test filter.
	The alarm test filter does not attenuate the signal enough.	Check the signal attenuation with the adjustment device.
	Detector defective.	Replace the detector.

See also

Accessories [→ 30]
Initializing the detector [→ 75]
Cleaning [→ 80]

8 Specifications

8.1 Technical data

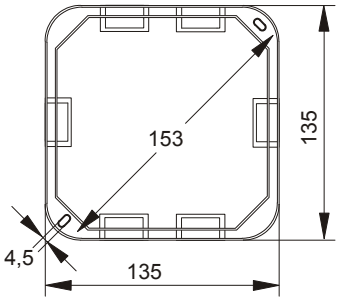
FDnet/C-NET-detector line	Operating voltage	DC 12…33 V
	Operating current (quiescent)	0.8 mA
	Maximum current connection factor	4
	Quiescent current connection factor	4
	Address connection factor	1
	Separator connector factor	1
	Protocol	FDnet/C-NET
	Compatibility	See 'List of compatibility'
Collective detector line	Operating voltage	DC 14…28 V
	Operating current (quiescent)	0.7 mA
	Making current	Max. 1.5 mA
	Connection factor	10
	Alarm voltage at alarm current:	
	● 1 … 15 mA	DC 5…10 V
	● 35 mA	DC 18…22 V
	● 50 mA	DC 26…28 V
	Alarm current at operating voltage DC 5 … 28 V	4 … 50 mA
	Reset voltage	DC 2…4 V
	Reset time at reset voltage DC 2 V	1…2 s
	Protocol	Collective (with and without current limitation)
	Compatibility	See 'List of compatibility'
Line separator	Line voltage:	
	● Nominal	DC 32 V (= V_{nom})
	● Minimum	DC 12 V (= V_{min})
	● Maximum	DC 33 V (= V_{max})
	Voltage at which the separator opens:	
	● Minimum	DC 7.5 V (= $V_{SO\ min}$)
	● Maximum	DC 10.5 V (= $V_{SO\ max}$)
	Permanent current when switches are closed:	Max. 0.5 A (= $I_{C\ max}$)
	Switching current (e.g., in the event of a short-circuit)	Max. 1 A (= $I_{S\ max}$)
	Leakage current when switches are open:	Max. 1 mA (= $I_{L\ max}$)
	Serial impedance when switches are closed:	Max. 0.5 Ω (= $Z_{C\ max}$)

External alarm indicators	Number of external alarm indicators that can be connected	2
	Voltage	DC 6 … 17 V
	Current	9…15 mA
	Length of line	Max. 30 m with unshielded cables (recommended) or if the shielding on the detector is connected to the positive pole for the external alarm indicator
		Max. 5 m, if the shielding is connected to earth
	Flashing interval times on FDnet/C-NET detector line:	
	● Bright	15 ms
	● Dark	1 s
	Flashing interval times on collective detector line	Control panel-specific
Device characteristics	Infrared transmitter:	
	● Wavelength	950 nm
	● Pulse frequency	4 Hz
	Compensation (if the ray attenuates) Compensation speed	2.3 %/h
	Alarm integration	6 … 16 s
	Detection distance:	
	● Without filter	10 … 100 m
	● With filter for short distance DLF1191-AA	8 … 12 m
	● With filter for short distance DLF1191-AB	5 … 10 m
Detector heating unit DLH1191A	Operating voltage	DC 20 … 30 V
	Operating current	30 … 50 mA
	Resistance	600 Ω
Heating unit in reflector for long distance (prism) DLR1191	Operating voltage	DC 20 … 30 V
	Operating current	30 … 50 mA
	Resistance	600 Ω
Connections	Detector line, detector heating unit and external alarm indicator:	
	● Design	Spring clips
	● Cable cross section	0.2…1.5 mm^2
	MC link	Plug-type connection

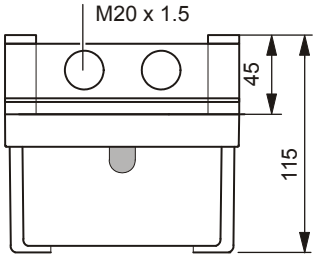
Ambient conditions	Operating temperature	-25 … +60 °C
	Storage temperature	-30 … +75 °C
	Air humidity	≤ 95 % rel.
	Protection categories according to EN 60529 / IEC 60529	IP65
	Electromagnetic compatibility:	
	● 1 MHz … 1 GHz	50 V/m
	● 1 GHz … 2 GHz	30 V/m
Mechanical data	Dimensions (L x W x H)	135 x 135 x 115 mm
	Material	
	● Detector base	ABS/PC-Blend
	● Hood	ABS/PC-Blend
	Color	~RAL 9010 pure white
Standards	European standards	● EN 54-12 ● EN 54-17 ● EN 62471
	International standards	● IEC 60529 ● ISO 9001 ● ISO 9004
	Siemens standards	SN 36350
Approvals	EC Certificate of Conformity (construction products):	CE
	● FDL241-9	0786-CPD-20014
	VdS approvals:	G204063
	LPCB approvals:	126ag/01

8.2 Dimensions

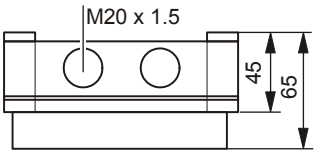
Base for linear smoke detector FDLB291



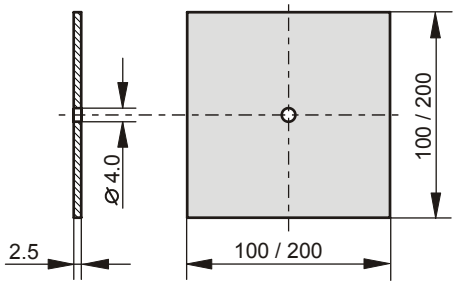
Base for linear smoke detector FDLB291 with linear smoke detector FDL241-9



Reflector for long distance (prism) DLR1191



Reflector for middle distance (foil) DLR1192 and reflector for short distance (foil) DLR1193



8.3 Environmental compatibility and disposal

This device is manufactured using materials and procedures which comply with current environmental protection standards as best as possible. More specifically, the following measures have been undertaken:

- Use of reusable materials
- Use of halogen-free plastics
- Electronic parts and synthetic materials can be separated

Larger plastic parts are labeled according to ISO 11469 and ISO 1043. The plastics can be separated and recycled on this basis.

Electronic parts and batteries must not be disposed of with domestic waste.

- Take electronic parts and batteries to local collection points or recycling centers.
- Contact local authorities for more information.
- Observe national requirements for disposing of electronic parts and batteries.

Index

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