SIEMENS

Cerberus® DO1101, DO1102, DO1103, DO1104
Wide spectrum smoke detectors, collective

Technical description

Fire & Security Products

Siemens Building Technologies Group

1 Overview 1
1.1 Characteristics 1
1.2 Design 2
1.2.1 OptoRex DO1101 2
1.2.2 OptoRex DO1103 2
1.2.3 OptoRex DO1102 / DO1104 2

2 Technical data 3

3 Design 4

4 Principle of operation (see block diagram Fig. 3) 5

5 Measurement of the Δ_{U3A}-voltage 6

6 Response characteristics 6

7 Environmental influences 7
7.1 Influence of the ambient temperature 7
7.2 Other influencing variables 7

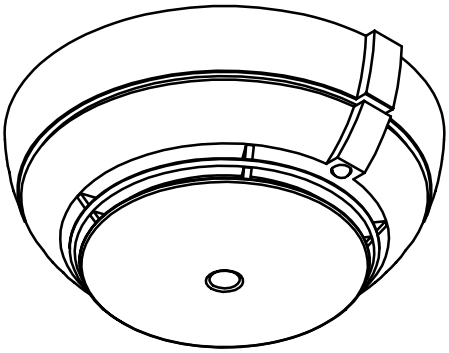
8 Application 8
8.1 Compatibiltiy 8
8.2 Alignment functions 8
8.3 Application 8
8.4 Installation 8

9 Commissioning 9

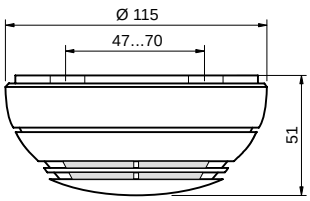
10 Maintenance 9
10.1 Functional check 9
10.2 Overhaul 9

11 Terms 10

1 Overview



Dimensions



incl. base DB1101A

1.1 Characteristics

- **Balanced response behavior and wide range of applications**
- **High reliability and stability through new, high-quality optoelectronic sensor system and fully automatic manufacturing and inspection processes**
- **High resistance to electromagnetic interference achieved through specially screened circuitry**
- **High immunity to contamination, temperature fluctuations, humidity and corrosion achieved through custom developed, protective circuit board coating**
- **Modern design: Fits elegantly into any room**
- **Ecological material concept**
- **Compatible with all Cerberus control units using collective detector evaluation**
- **A Cerberus quality product resulting from decades of international experience**
- **Manufactured in state-of-the-art SMD technology with custom integrated circuit (ASIC) - ensures longer service life**
- **Bayonet fitting for connection to base simplifies detector replacement**
- **No electronics in the base**
- **Comprehensive range of detector base accessories for special applications**

1.2 Design

1.2.1 OptoRex DO1101

The OptoRex DO1101 is eminently suited to early detection of smoldering fires, but it also quickly detects flaming fires that produce smoke. The newly developed, high-quality optoelectronic system ensures a homogenous response behavior across a wide smoke spectrum, ranging from light-colored to dark smoke.

The built-in response indicator (red LED) serves as a local status indicator. Two external response indicators can be connected to the base.

The OptoRex DO1101 conforms to EN 54-7 and is consequently a universal smoke detector.

For periodic factory cleaning the detector can be easily disassembled.

The DB1101 detector base can be either flush mounted directly on a recessed box in the ceiling, or surface mounted with the DBZ1191 base attachment. It is connected to the control unit via a two-wire line. Spring terminals have been provided for wiring the base.

The detector is secured in the base with a vibration-proof bayonet fitting. Efficient installation, removal and testing of a detector is possible by means of the DZ1101 detector extractor and the RE6 testing unit up to a ceiling height of 7m. Base accessories are available for installing the detectors also in locations with unfavorable environmental conditions.

1.2.2 OptoRex DO1103

The OptoRex DO1103 has the same design and mode of operation as the DO1101 but with a monitored IRED. However, the DO1103 has considerably higher response sensitivity than the DO1101 and is therefore suitable for special applications e.g. in air sampling smoke detection systems. The DO1103 does not comply with EN.

1.2.3 OptoRex DO1102 / DO1104

The OptoRex DO1102 and DO1104 have the same design and mode of operation as the DO1101 but with a monitored IRED. However, the DO1104 has higher response sensitivity than the DO1101, while DO1102 has identicat response sensitivity as DO1101. The DO1104 is therefore suitable for applications, where increased response sensitivity is required.

The OptoRex DO1102 and DO1104 conforms to EN 54-7 and they are consequently universal smoke detectors.

2 Technical data

Normal ambient conditions, if nothing else is specified:
Temperature T_a = 20°C (293K)
Air pressure p = 1'000hPa (1'000mbar)

Parameters	Symbol	Value				Conditions
		Unit	min.	typ.	max.	
Operating voltage (quiescent condition)	U_b	V	16		24	
Max. permissible voltage	U_{max}	V			28	
Starting current	I_e	µA			160	max. 25s after switch-on
Operating current (quiescent condition)	I_b	µA			100	
Alarm voltage at I_A = 1 ... 10mA I_A = 60mA	U_A U_A	V V	5 5		10 12	
Alarm current (must be limited externally)	I_A	mA			60DC 100AC	f ≥0.5Hz, Duty Cycle 50%
Reset voltage	U_R	V	2		6	
Reset current	I_R	µA	20		200	
Reset time (U_R = 2V)	t_R	s			2	
Response integrating time	t_A	s		7		3 consecutive measurements
Response sensitivity DO1101 DO1102 DO1103 DO1104	D_1 D_1 D_1 D_1	%/m %/m %/m %/m		3.0 3.0 1.1 1.8		smoke sensitivity with paraffin test aerosol (1m/s)
Electrical sensitivity, signal voltage DO1101 DO1102 DO1103 DO1104	 Δ_{U3A} Δ_{U3A} Δ_{U3A} Δ_{U3A}	 V V V V	 1.4 1.4 1.0 1.2		 2.6 2.6 2.2 2.4	 measurement with DZ1194
Response indicator: external Voltage Current Flashing frequency	 U_{ie} I_{ie} 	 V mA Hz	 3 	 1	2 6 60DC 100AC 	connectable f ≥0.5Hz, Duty Cycle 50% depending on line module
Elektromagnetic compatibility DO1101 DO1102 DO1103 DO1104 		V/m V/m V/m V/m V/m V/m V/m V/m	50 30 50 30 30 20 50 30			1MHz ... 1GHz 1GHz ... 2GHz 1MHz ... 1GHz 1GHz ... 2GHz 1MHz ... 1GHz 1GHz ... 2GHz 1MHz ... 1GHz 1GHz ... 2GHz
Operating temperature	T_a	°C	–25		+60	
Humidity ≤30°C >30°C					≤95% rel. ≤29g/m^3	Transient condensation allowed
Storage temperature	T_l	°C	–30		+75	
Connection factor	KMK			1		

Colour: white ~RAL9010

Classification

	DO1101/DO1102/ DO1104	DO1103
Standards	EN 54-7	—
Application category IEC 60721-3	3K6	3K6
Test category IEC 60068-1	25/060/42	25/060/42
Protection category IEC 60529	IP44	IP44

CE mark of conformity

Environmental compatibility:

- No basic throwaway items such as packing material, protective covers, etc.
- Multiway packing material
- Easy to overhaul
- Easy to uninstall and disassemble
- Plastic material identifiable through embossed code

3 Design

The heart of the OptoRex DO11.. is a high-quality opto-electronic system enclosed in the measurement chamber that screens off extraneous light but optimally detects light and dark smoke particles. The light source, the light stop and the light receivers are arranged in such a way that the light from the source cannot directly reach the receiver (Fig. 1 and Fig. 2). Due to its optimized optical system and specially screened electronics the detector is highly immune to environmental influences such as temperature, humidity, corrosion and electrical stray fields.

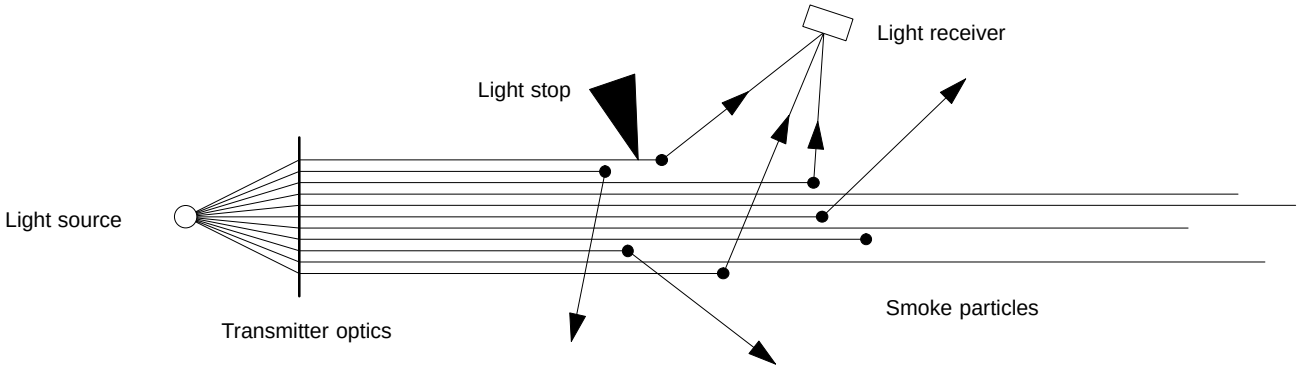


Fig. 1 Principle of the scattered light measurement

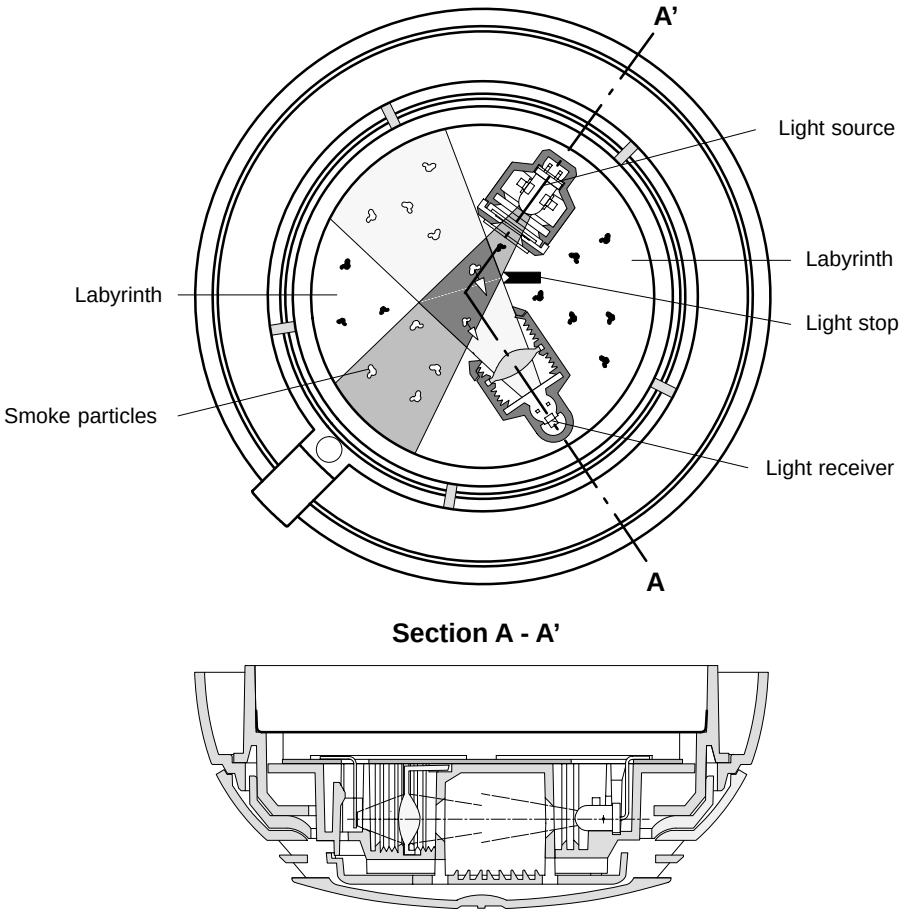


Fig. 2 Detector design

4 Principle of operation (see block diagram Fig. 3)

The OptoRex DO11.. is based on the principle that smoke scatters light. An infrared LED IRED) transmits brief, intensive light pulses into the scattering chamber. The receiving element is screened off from direct IR light incidence and reflections. Smoke entering the chamber scatters the light so that some of it reaches the receiver whose signal is evaluated by the electronics. After three positively evaluated pulses an alarm is transmitted to the control unit.

Time base **2** in the integrated circuit **1** controls the logic unit **3** and produces pulses for controlling the IRED light source **5** via the amplifier **4**. If the detector is not contaminated and the air is clean, no signal is available at the receiver **6**.

If the air contains smoke, the receiver sees a signal that is transmitted via the amplifier **7** to the discriminator **9**. Integrated in the amplifier is a multiple coincidence circuit that generates the difference between a light and a dark measurement which has the effect that no interference signals and «only» smoke induced signals are amplified and transmitted. In circuit **8** a stable reference voltage U_{aref} is produced which in discriminator **9** forms the alarm threshold. The detector sensitivity is set with the trimming resistor **10**. The signal voltage U_{sig} at the output of the receiving amplifier can only be factory-measured with the aid of special measuring equipment. The alarm threshold U_{aref} is used for measuring the alarm stroke Δ_{U3A} on site with the detector measuring instrument DZ1194.

The logic unit **3** evaluates the pulses of discriminator **9** and after the third pulse activates the alarm stage **11** integrated in ASIC. Also activated in the event of an alarm are the internal response indicator **12** and an external response indicator **13** if available. The alarm stage **11** is self-holding and is restored to the initial condition only when reset by the system control unit (through brief interruption of the operating voltage).

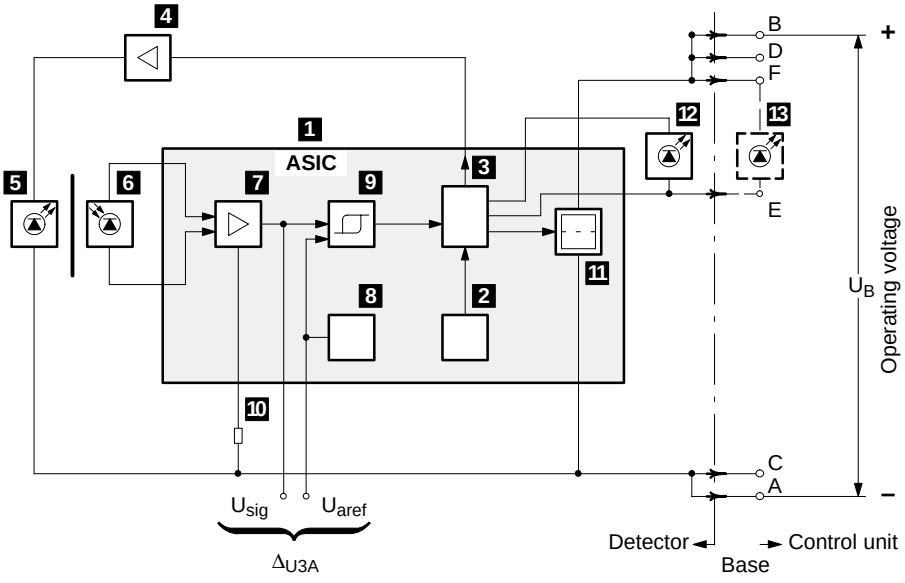


Fig. 3 Block diagram DO11..

5 Measurement of the Δ_{U3A}-voltage

With the DZ1194 detector measuring instrument the Δ_{U3A}-voltage can be measured which is directly proportional to the remaining alarm deviation.

In case of contamination, inadmissible leakage currents or if the detector is filled with smoke, this voltage will be significantly below the standard value.

6 Response characteristics

The extinction measurement principle is used for calibrating all types of optical smoke detectors. It measures the percentage of light obscuration (extinction) across a defined measuring section that is required to cause the detector to respond.

The light extinction by smoke is caused by a absorption and scatter. In the case of dark smoke the absorption dominates, whereas in the case of light-colored smoke the scatter dominates. Since dark smoke produces a lower percentage of light scatter, scattered-light smoke detectors require a larger quantity of dark smoke to reach the alarm threshold than would be necessary for light-colored smoke. Due to the optimized scattering angle of the OptoRex DO11.. this disadvantage has been largely alleviated.

For evaluating the sensitivity of scattered-light smoke detectors, the extinction principle cannot be readily used. The characteristic of the smoke used in the measuring process must be clearly defined. In the case of the OptoRex DO11.. the smoke sensitivity is based on the measurement of defined paraffin test aerosol (Fig. 4, curve 1).

The internationally used unit of measure is dB/m. Measured in this unit the extinction as well as the scattered-light signal «S» are nearly proportional to the smoke density. If the smoke density is low, there is approximate proportionality between dB/m and %/m.

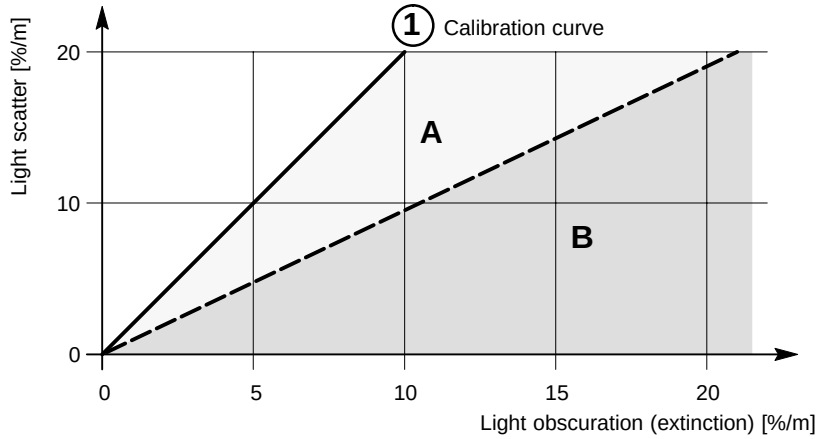


Fig. 4 Light scatter and light obscuration as a function of the smoke characteristic

The graphic representation in Fig. 4 shows the smoke sensitivity difference for the two measuring principles «Obscuration» and «Scatter» obtained with different test smokes or fires. We differentiate between two typical types of fires:

Range A: Smoldering fires

This type of fire is characterized by relatively low temperatures and light-colored smoke. Light-colored, large smoke particles are produced that contribute largely to the light scatter. Typical are: Smoldering wood or cotton, overheating of PVC-insulated electrical conductors, etc.

Range B: Flaming fires

These are generally characterized by elevated temperatures and by barely visible or dark smoke, depending on the material being combusted. Typical fires of this type are: Flaming wood fire, burning diesel fuel, plastic foam, rubber, etc.

7 Environmental influences

7.1 Influence of the ambient temperature

Ambient air temperature

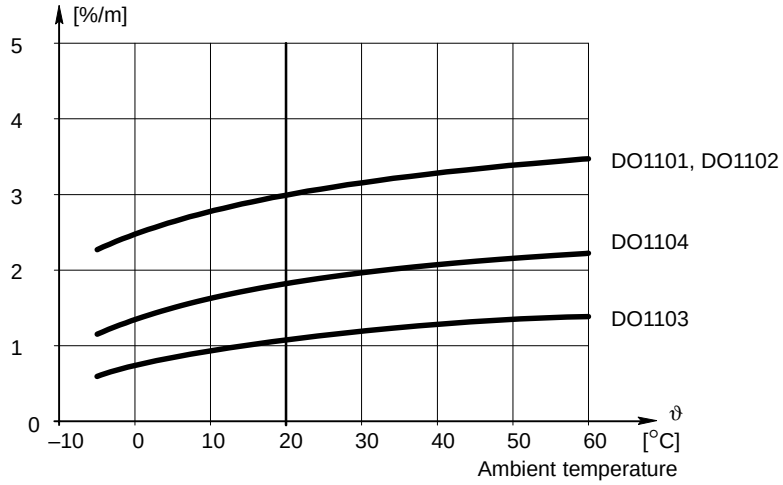


Fig. 5 Smoke sensitivity of the OptoRex DO1101, DO1103, DO1102 and DO1104 as a function of the ambient temperature

7.2 Other influencing variables

Ambient light, air drafts and fluctuations within the specified operating voltage range have no influence on the detector.

8 Application

8.1 Compatibiltiy

Control units:	CZ10 (E4M011), CZ1-02, CC11 (E3M080), CI1110/15
Line modules:	DC11..
Bases:	DB1101

8.2 Alignment functions

None.

8.3 Application

Due to its good response behaviour, the OptoRex DO1101 / DO1102 can be used as a universal smoke detector. The recommended monitoring surfaces, detector spacing, etc. can be found in the national guidelines, the Cerberus planning and application guidelines (CRP), or the Security Guide.

The OptoRex DO1103 is suitable for applications in air sampling smoke detections systems which require increased sensitivity.

The OptoRex DO1104 has higher response sensitivity than the DO1101. The DO1104 is therefore suitable for applications in hospital rooms, archives, museums and other applications where increased response sensitivity is required.

8.4 Installation

The installation is executed with twisted wire pairs from base to base. Screened cabling is required only in special cases, for example, when strong high-frequency fields are present.

Please refer to specifications of the line module regarding the maximum allowed number of detectors per line.

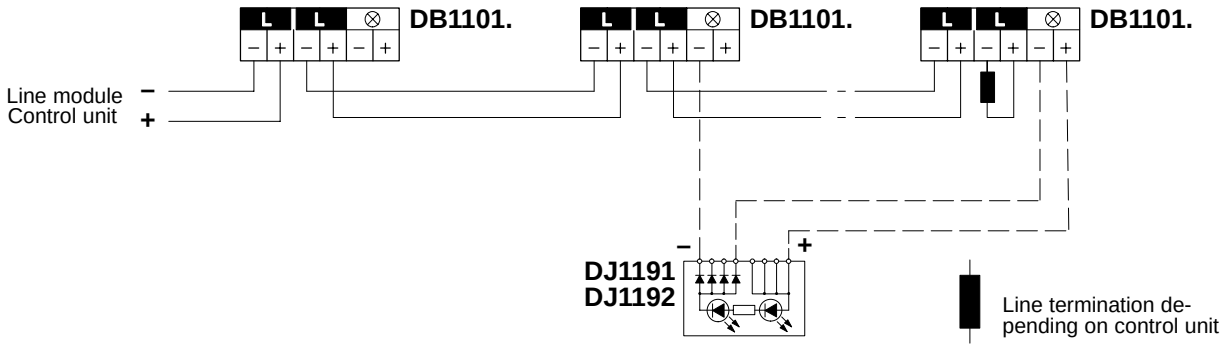


Fig. 6 Connection diagram

9 Commissioning

– To prevent unnecessary soiling during the construction phase, the detectors should be inserted into the bases just before the system is put into service.
– Release the detector with the detector tester.
– If the response indicator on the detector flashes, the detector is working correctly.

10 Maintenance

10.1 Functional check

A functional check of the detectors must be performed periodically (usually once per year) by forcing each detector to respond by means of a suitable testing device (e.g. DZ1193 or RE6). Detectors that do not respond or which are mechanically damaged must be replaced.

10.2 Overhaul

All detectors should be jointly replaced and factory overhauled in intervals of 2 to 8 years, depending on the environmental conditions and the severity of contamination. The degree of contamination can be determined on site by measuring the Δ_{U3A}-voltage with the DZ1194 detector measuring instrument.

11 Terms

ASIC	Application Specific Integrated Circuit
CC11	Fire detection control unit AlgoControl to fire detection system S11
CZ..	Fire detection control unit to fire detection system MS9
DB1101	Base for collective DS11 fire detectors
DJ1191/92	External response indicator
DO1101	OptoRex smoke detector
DO1102	OptoRex smoke detector
DO1103	OptoRex smoke detector with high response sensitivity
DO1104	OptoRex smoke detector with increased response sensitivity
DZ1191	Detector exchanger
DZ1193	Optoelectronic detector tester and exchanger
DZ1194	Detector measuring instrument
EMC	Electro Magnetic Compatibility
EMI	Electro Magnetic Influence
ESD	Electro Static Discharge
IRED	Infra-Red Emitting Diode
RE6	Detector tester
RI (AI..)	Response indicator
S11	Generic term of fire detection system S11

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