SIEMENS

Cerberus® DO1101A-Ex, DT1101A-Ex, DT1102A-Ex
Wide spectrum smoke detector, collective
Heat detectors, collective, intrinsically safe

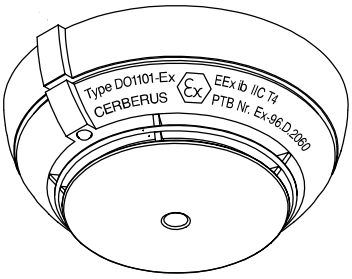
Technical description

Fire & Security Products

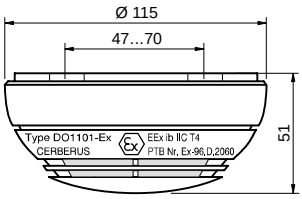
Siemens Building Technologies Group

1 Brief overview

OptoRex DO1101-Ex

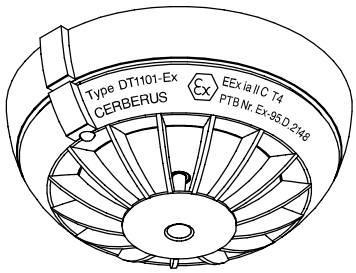


Dimensions

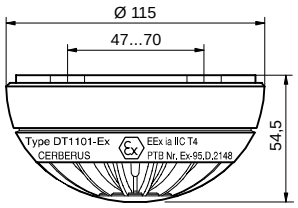


With base DB1101

ThermoRex DT1101-Ex / DT1102-Ex



Dimensions



With base DB1101

1.1 Characteristics

- **For applications in explosion-hazard areas of zones 1 and 2**
- **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**
- **For applications in explosion-hazard areas of zones 1 and 2**
- **Heat detectors to meet the highest requirements**
  - **DT1101-Ex** class A1R heat detector with wide application range (up to +50°C)
  - **DT1102-Ex** class BR heat detector for high ambient temperatures (up to +70°C)
- **Response behaviour immune to deceptive phenomena with rapid and slow increase in temperature through:**
  - Intelligently designed differential characteristics
  - Precise maximum temperature alarm activation with quality thermosensor
- **High degree of reliability and long-term stability**
- **High resistance to:**
  - Electromagnetic interference (EMI) intelligently designed circuit
  - Soiling, temperature fluctuations, humidity and corrosion achieved through custom developed, protective circuit board coating
- **Together with detection line coupler and shunt Zener barrier, compatible with Cerberus control units with collective signal evaluation**
- **Manufactured in state-of-the-art SMD technology**
- **Bayonet fitting for connection to base simplifies detector replacement**
- **Comprehensive range of detector base accessories for special applications**

1.2 Design

OptoRex DO1101-Ex

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

ThermoRex DT1101-Ex / DT1102-Ex

The DT1101-Ex/DT1102-Ex ThermoRex is suitable for the monitoring of rooms in which upon an outbreak of fire, a rapid rise in temperature is to be expected.

The DT1101-Ex ThermoRex complies with standard EN 54-5 and can be used for a wide range of applications. The DT1102-Ex ThermoRex complies with standard EN 54-5 and is suitable for higher ambient temperatures.

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

For periodic factory cleaning the detector can be easily disassembled.

The detectors are fully electronic and are not subject to wear and tear. To protect it against environmental influences the electronic circuit has a specially developed circuit board protective coating.

The DB1101 detector base is mounted on the ceiling direct on the recess box direct, or surface-mounted using the DBZ1191 base attachment and connected to the control unit via twin wire. The base is fitted with spring terminals for connection.

The detectors are secured in the base DB1101 with a vibration-proof bayonet fitting. Efficient installation and removal of a detector is possible by means of the DZ1191 detector extractor. For testing of the DO1101-Ex serves the RE6 testing unit. DT1101Ex and DT1102-Ex can only be tested with RE6T in **non-explosion hazard areas.** By means of extension tubes this work can be carried out up to a height of 7 metres without additional tools.

A range of base accessories is available for installation in wet areas and for protection against theft etc.

2 Technical data

Normal ambient conditions, if nothing else is specified:
Temperature T_a **DO1101-Ex** = 20°C (293K) **DT1101-Ex/DT1102-Ex** = 25°C (298K)
Air pressure p = 1'000hPa (750 Torr)

Parameters	Symbol	Unit	DO1101-Ex	DT1101-Ex	DT1102-Ex	Conditions
Operating voltage (quiescent condition)	U_b	VDC	17 24	16 24	16 24	
Max. permissible voltage	U_{max}	VDC	max. 27	max. 27	max. 27	
Starting current	I_e	µA	max. 160	max. 100	max. 100	max. 25s after switch-on
Operating current (quiescent condition)	I_b	µA	max. 100	max. 100	max. 100	for DT1101-Ex T_a=25...50°C for DT1102-Ex T_a=25...70°C
Alarm voltage at I_A = 1 ... 10mA at I_A = 1...60mA	 U_A U_A	 V V	 5 ..... 10 5 12	 5 ..... 10 5 12	 5 ..... 10 5 12	
Max. alarm current, pulsed	I_A	mA	max. 100	max. 100	max. 100	must be limited externally f≥0.5Hz, Duty Cycle 50%
Reset voltage	U_R	V	2 6	2 6	2 6	
Reset current	I_R	µA	20 500	40 500	40 500	
Reset time (U_R = 2V)	t_R	s	max. 2	max. 2	max. 2	
Response integrating time	t_A	s	typ. 7	—	—	
Response sensitivity	D_1	%/m	typ. 3.0	—	—	smoke sensitivity with paraffin test aerosol (1m/s)
Electrical sensitivity signal voltage	Δ_{U3A}	V	1.2 ..... 2.8	—	—	measurement with DZ1194
Ext. response indicator: Voltage Current Flashing frequency	 U_{ie} I_{ie}	 V mA Hz	 1.5 ..... 6 max. 50 1	 1.5 ..... 6 max. 50 1	 1.5 ..... 6 max. 50 1	 f≥0.5Hz, Duty Cycle 50% depending on line module
Capacitance detection line AI line			≤1nF ≤33nF	≤1nF ≤33nF	≤1nF ≤33nF	
Inductance detection line AI line			- ≤40µH	- ≤40µH	- ≤40µH	
Response sensitivity temperature increase dT/dt = 10K/min. EN 54-5 class A1R max. release temperature EN 54-5 class BR max. release temperature	 dT T_a T_a	 °C °C °C	 — — —	 20 ..... 40 54 62 	 20 ..... 40 74 85	
Electromagnetic compatibility		V/m	min. 50	min. 50	min. 50	1MHz ... 1GHz
Operatic compatibility	T_a	°C	–25 .... +60	–25 .... +50	–25 .... +70	
Humidity ≤34°C >34°C			≤95% rel. ≤35g/m³ abs.	≤100% rel. ≤35g/m³ abs.	≤100% rel. ≤35g/m³ abs.	transient condensation allowed
Storage temperature (continuous)	T_l	°C	–30 .... +75	–30 .... +75	–30 .... +75	
Protection category EN60529/IEC529			IP44	IP44	IP44	
Colour			white ≈RAL9010	white ≈RAL9010	white ≈RAL9010	
Standards – for fire detectors – for explosion-hazard areas			 EN54-7 EN50014 EN50020	 EN54-5 class A1R EN50014 EN50020	 EN54-5 class BR EN50014 EN50020	
Application category IEC 721-3			3K6	3K8H	3K8H	
Ex classification			EEx ib IIC T4 (T_a ≤60°C)	EEx ia IIC T4 (T_a ≤50°C *)	EEx ia IIC T4 (T_a ≤70°C *)	
Ex approvals – PTB Nr. – ASEV Nr.			 Ex-96.D.2060 96.1.10358	 Ex-95.D.2148 95.1.11013	 Ex-95.D.2148 95.1.11013	
Load factor KMK			1.6	1	1	

* not Ex conditional (Alarm release DT1101-Ex 54°C
DT1102-Ex 74°C)

Intrinsic safety:

Intrinsic safety «i» when using a certified shunt Zener diode barrier with the following data:

R_i ≥ 280Ω
U_i ≤ 28V
I_i ≤ 100mA
P_i ≤ 700mW

3 Principle of operation

OptoRex DO1101-Ex

The OptoRex DO1101-Ex 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). The intrinsically safe detector circuit is isolated from the line circuit by protective diodes **14** .

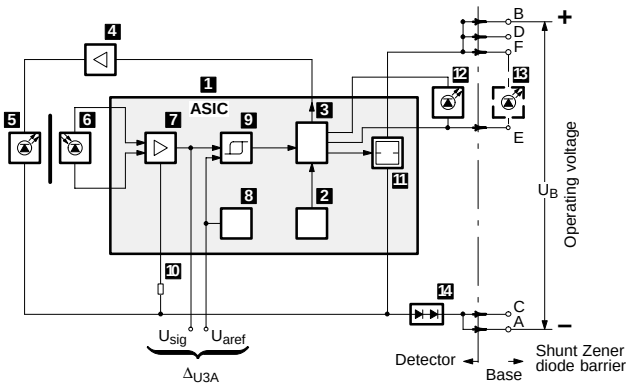


Fig. 1 Block diagram DO1101-Ex

ThermoRex DT1101-Ex / DT1102-Ex

The ThermoRex DT1101/DT1102 measures the ambient temperature with the NTC thermistor R_m in the tip of the sensor and measures the temperature in the detector housing with the NTC thermistor R_g. Rapid temperature changes bring about a faster change of resistance with thermistor R_m than with thermistor R_g. This causes a positive voltage shift at point P. As soon as this voltage exceeds a fixed threshold value, the threshold value detector **3** activates multivibrator **4** and an alarm is given. If, due to a very slow increase in temperature, the resistance values R_m and R_g fall to the same extent, upon reaching a maximum temperature determined by resistors **1** and **2** an alarm is given. At the same time resistor **2** accelerates response for fast changes in temperature.

The weak current I_B flows in non-alarm condition. As soon as the multivibrator **4** becomes conductive, the response indicator alarm current I_A flows. At the same time the response indicator **6** built into the detector is activated via the driver stage **5**. One external response indicator **7** may be connected. The multivibrator remains in self-hold condition until the control unit is reset by briefly interrupting the operating voltage, whereupon it reverts to its original state. The intrinsically safe detector circuit is isolated from the line circuit by protective diodes **8**.

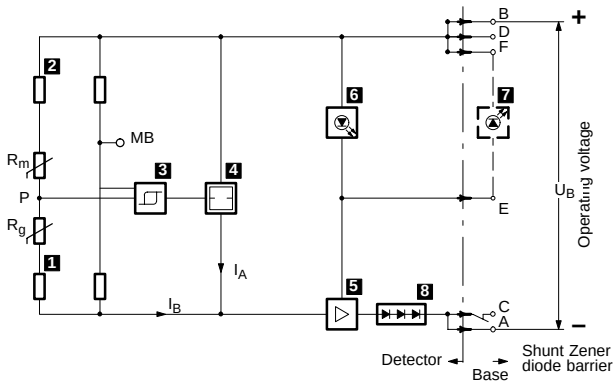


Fig. 2 Block diagram DT1101-Ex/DT1102-Ex

4 Environmental influences

4.1 Influence of the ambient temperature

OptoRex DO1101-Ex

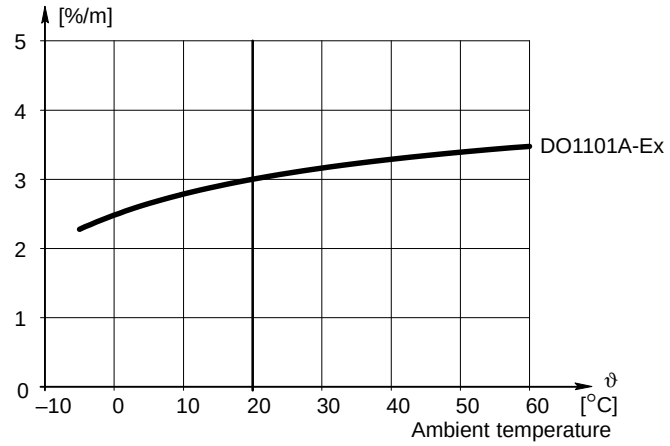


Fig. 3 Smoke sensitivity of the OptoRex DO1101-Ex as a function of the ambient temperature

4.2 Other influencing variables

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

5 Application

5.1 Compatibility

Control units: Compatible with all Cerberus control units with collective signal evaluation together with input/output module DC1192 and shunt Zener barrier

Bases: DB1101

5.2 Alignment functions

None.

5.3 Application

OptoRex DO1101-Ex

The OptoRex DO1101-Ex is suitable for applications in explosion-hazard areas of zones 1 and 2. Due to its EN 54 compliance, the OptoRex DO1101-Ex can be used as a universal smoke detector.

ThermoRex DT1101-Ex / DT1102-Ex

The ThermoRex DT1101-Ex/DT1102-Ex is suitable for applications in explosion-hazard areas of zones 0, 1 and 2. The ThermoRex DT1101-Ex can be used up to a temperature of 50°C and the DT1102-Ex up to a temperature of 70°C. The DT1101-Ex/DT1102-Ex are especially suitable for monitoring rooms and installations in which in the event of fire, a rapid increase in temperature is to be expected, or where other types of detector cannot be used because work processes cause smoke, dust, exhaust gases etc.

The recommended monitoring areas, distances between detectors etc. can be found in the national guidelines, the *Cerberus «Guidelines for Planning and Application» (CRP)*, *«Fire Detection in Explosion-hazard Areas», document e1204.*, or the *«Security Guide»*.

5.4 Installation

Bases are connected together by twisted twin wire. Shielded cable is only required for special applications, e.g. in the case of powerful high frequency fields or special national guidelines.

– For detailed information, see *«Fire Detection in Explosion-hazard Areas», document e1204.* .

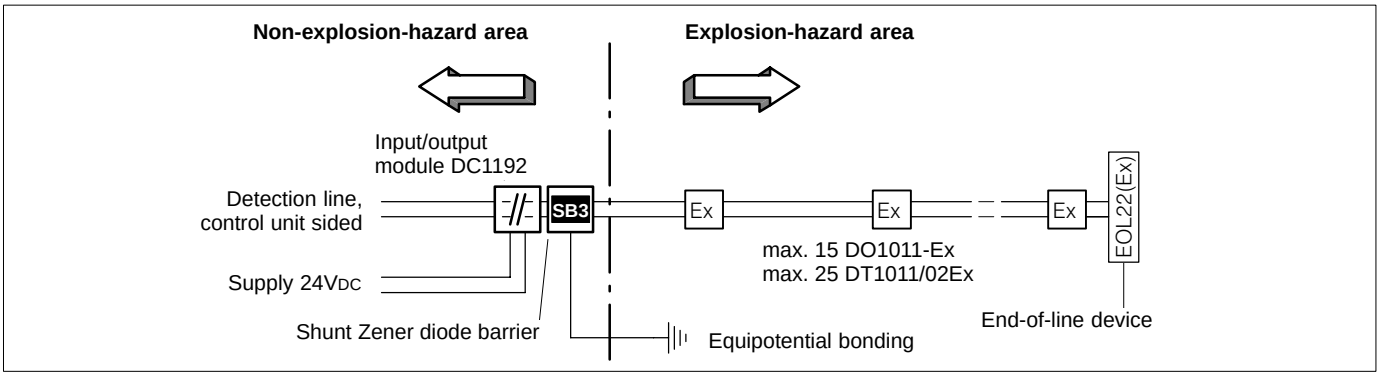


Fig. 4 Connection diagram for DO1101-Ex and DT1101-Ex/DT1102-Ex

6 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.
– For detailed information, see *«Fire Detection in Explosion-hazard Areas», document e1204.* .

7 Maintenance

7.1 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 (RE6 or DZ1192 for DO1101-Ex or RE6T for DT1101-Ex/DT1102-Ex). Detectors that do not respond or which are mechanically damaged must be replaced.

7.2 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.

Important !
The DZ1193 and RE6T detector tester and the DZ1194 detector test set must only be used in areas where there is no explosion-hazard!

Electrostatic danger
The housing is made of plastic and has a surface resistance of >1GigaΩ which means there is a risk of electrostatic discharge. Therefore the manual call point should not be located where there is powerful ventilation. Cleaning with solvents is forbidden.

7.3 On-site measurement with the DZ1194 detector test set

OptoRex DO1101-Ex

The voltage Δ_{U3A} can be measured and alarm activation checked with the DZ1194 detector test set. The Δ_{U3A} voltage measured is directly proportional to the remaining voltage increase for alarm.

ThermoRex DT1101-Ex / DT1102-Ex

The operating current can be measured and alarm activation checked with the DZ1194 detector test set.

Detectors with values which lie outside those in the technical data must be replaced.

8 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
DBZ1191	Base attachment
DC1192	Input/output module
DO1101-Ex	OptoRex smoke detector, for explosion-hazard areas
DT1101-Ex	ThermoRex heat detector with static alarm threshold 60°C, for explosion-hazard areas
DT1102-Ex	ThermoRex heat detector with static alarm threshold 80°C, for explosion-hazard areas
DZ1191	Detector exchanger
DZ1194	Detector test set
EMC	Electro Magnetic Compatibility
EMI	Electro Magnetic Influence
ESD	Electro Static Discharge
IRED	Infra-Red Emitting Diode
KMK	Load factor for collective elements
NTC-Thermistor	Negative Temperature Coefficient Thermistor
RE6	Detector tester
RE6T	Detector tester for heat detectors
R_g	Measuring sensor for housing temperature
R_m	Measuring sensor for ambient temperature
RI (AI..)	Response indicator
S11	Generic term of fire detection system S11
SB	Shunt Zener diode barrier

Siemens Building Technologies AG
Alte Landstrasse 411
CH-8708 Männedorf
Tel. +41 1 – 922 61 11
Fax +41 1 – 922 64 50
www.cerberus.ch