SIEMENS

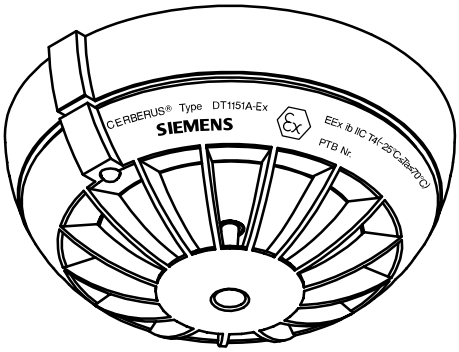
Cerberus® DT1151A-Ex
Heat detector, interactive, intrinsically safe

Technical description

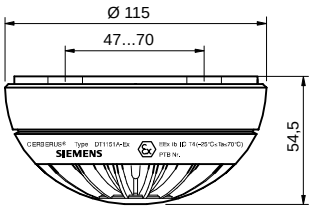
Fire & Security Products

Siemens Building Technologies Group

1 Brief overview



Dimensions



incl. base DB1151A

1.1 Characteristics

- **For application in explosion-hazard areas of zones 1 and 2**
- **Wide application range by means of 4 temperature response categories which can be freely programmed by the control unit**
- **Response behaviour immune to deceptive phenomena with rapid and slow increase in temperature by means of:**
  - marked differential characteristics for rapid changes in temperature
  - maximum activating temperature for slow increases in temperature
- **High degree of reliability, long-term stability and high degree of electromagnetic compatibility (EMC) through protected signal lines, shielded circuits and monitored sensor electronics**
- **High degree of resistance to humidity and corrosion**
- **Transmission of 4 danger levels and operating modes**
- **Automatic comprehensive self-test**

1.2 Design

The ThermoRex DT1151A-Ex is built into a modern, elegant, impact-proof plastic housing which blends unobtrusively in any room. It is inserted in the interactive base DB1151A and held in position with a vibration-proof twist lock. Apart from the identification module, which determines location during commissioning, the base has no electronics.
The detector contains a response indicator (red LED), which provides on-the-spotalarm indication. The response indicator can be activated from the control unit for servicing purposes and also programmed for the indication of servicing data. Each detector has an output for the connection of an external response indicator. In terms of default, it is allocated to the detector connected, but it is programmable and can also be allocated to any detector within the building.
The detector is fully electronic and is not subject to wear and tear. The electronic circuit is shielded to protect it against environmental influences and has a specially developed circuit board coating.
In explosion-hazard rooms the DB1151A detector base is mounted on the ceiling direct by means of the recess box, or surface-mounted together with the DBZ1191 base attachment and connected to the control unit with twin wire via a shunt Zener diode barrier and possibly other devices. The base has spring terminals for connection.
The detector extractor DZ1191 enables efficient insertion and removal of detectors. 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.

IMPORTANT!

The RE6T detector tester is used to check the DT1151A-Ex, but only outside explosion-hazard areas, or in an explosion-hazard area providing there is no danger of explosion at the time of testing.

2 Technical data

Normal ambient conditions unless otherwise mentioned:
Temperature T_a = 25°C (298K)

Parameters	Symbol	Value				Conditions
		Unit	min.	typ.	max.	
Operating voltage	U_b	V	18.5		28	modulated
Operating current (quiescent cond.)	I_b	µA		250	≤350	
Capacity Detection line Response indicator line	 C C	 nF nF			 1 ≤33	
Inductance Detection line Response indicator line	 L L	 mH µH			 – ≤40	
Baud rate		kBd		4.8		
Self test interval	t	min.		15		
Response indicator: Flashing interval times: bright dark Response indicator current		 ms s mA		 20 1.5 9		 depending on control unit
Set of parameter **APS100T** (default) EN 54-5 class A1R temperature increase dT/dt = 10K/min. max. release temperature	 dT T_a	 °C °C	 20 54		 40 62	
Set of parameter **APS105T** EN 54-5 class BR temperature increase dT/dt = 10K/min. max. release temperature	 dT T_a	 °C °C	 20 74		 40 85	
Set of parameter **APS103T** EN 54-5 class A1S max. release temperature	 T_a	 °C	 54		 62	
Set of parameter **APS107T** EN 54-5 class BS max. release temperature	 T_a	 °C	 74		 85	
Elektromagnetic compatibility	E E	V/m V/m	50 30			1MHz...1GHz 1GHz...2GHz
Operating temperature according to set of parameters: EN 54-5 class A1R, A1S (APS100, APS103) EN 54-5 class BR, BS (APS105, APS107)	 T_a T_a	 °C °C	 –25 –25		 +50 +70	
Humidity ≤34°C >34°C	rF abs. F	% g/m^3			≤100 ≤35	
Storage temperature (continuous)	T_l	°C	–30		+75	
Connection factor for interactive elements	IMK			1		

Colour: white ~RAL9010

Classification:

Standards	EN 54-5	
Application category	IEC 721-3:	3K8H
Ex classification	EEx ib IIC T4	(–25°C ≤T_a ≤70°C)
Test category	IEC 68-1:	25/050/42 (EN54-5) 25/070/42 (EN54-5)
Protection category	EN60529 / IEC529:	IP44

Standards for explosion-hazard areas:

EN50014
EN50020

Ex approval DT1151A-Ex:

PTB Nr. Ex-99.E.2155

Environmental compatibility:

– Easy to uninstall and disassemble
– Halogen-free plastic material identifiable through embossed code

Intrinsic safety:

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

$R_i \geq 280\Omega$
$U_i \leq 28V$
$I_i \leq 100mA$
$P_i \leq 700mW$

3 Design

The temperature sensor of the ThermoRex DT1151A-Ex consists of two precision NTC thermistors, which are attached to a holder. The measuring resistanceR_m is located in the tip of the protective cover and measures the ambient temperature. The housing temperature is measured with resistor R_g for precise differential evaluation.
The open protective housing means that the ambient temperature has an almost unhindered effect on the sensor and protects it against mechanical damage.
Intrinsically safe detectors are marked with the model number and the Ex label.

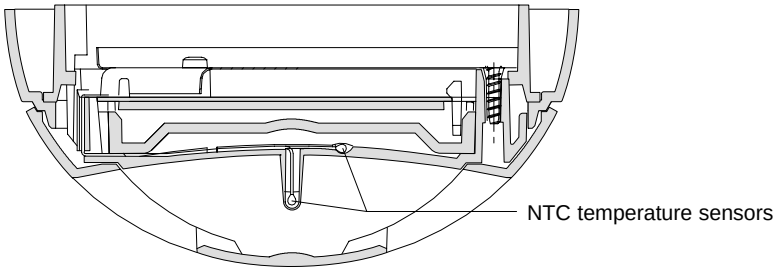


Fig. 1 Detector design

4 **Operating principle** (see block diagram Fig. 2)

The DT1151A-Ex ThermoRex measures the ambient temperature and the temperature in the detector housing with two separate NTC thermistors. The two sensors can differentially and precisely evaluate the rapid increase in temperature irrespective of the starting temperature and signal the corresponding levels of danger to the control unit. If the temperature increases slowly, the corresponding danger levels are activated as the maximum level is approached and where the maximum level is fixed, the highest danger level is activated. Signals are processed by the detector electronics and decisions are taken on danger levels 0-3 which are then transmitted to the control unit.

The microprocessor (µP) **1** controls the various measuring and test sequences, handles data processing and classifies events in the various danger levels and operating modes. Communication with the control unit is also controlled by the µP. A large number of detector characteristics are entered in the non-volatile µP memory (255 byte EEPROM). These can be read and changed by authorized personnel at any time. The contents of the non-volatile memory is automatically monitored approx. every 15 minutes.

The measuring thermistor **4** in the tip of the sensor and the thermistor **5** inside the housing are activated by the combination of circuits **6** / **7** / **8**. Circuit **6** generates the bias voltage for the two thermistors and is controlled and monitored by the µP. Signals from the two temperature sensors are transmitted via filters **7** and **8** to the A/D converter **3**. The filters reduce electromagnetic influence (EMI) and protect the circuit from electrostatic discharge (ESD).

Various electronic circuits such as comparators, oscillators etc. are built into the integrated circuit designed for specific applications **2** (ASIC). The µP communicates with the control unit via the line interface **9** and the twin-wire bus. By means of the data interface **10** the detector receives commands which activate operating modes, stages of diagnosis. The detector transmits response signals, the results of diagnosis polling and status signals back to the control unit.

The drive unit **11** for the response indicators can set the built-inAI **12** and an external AI **13** (activated from the control unit) flashing.

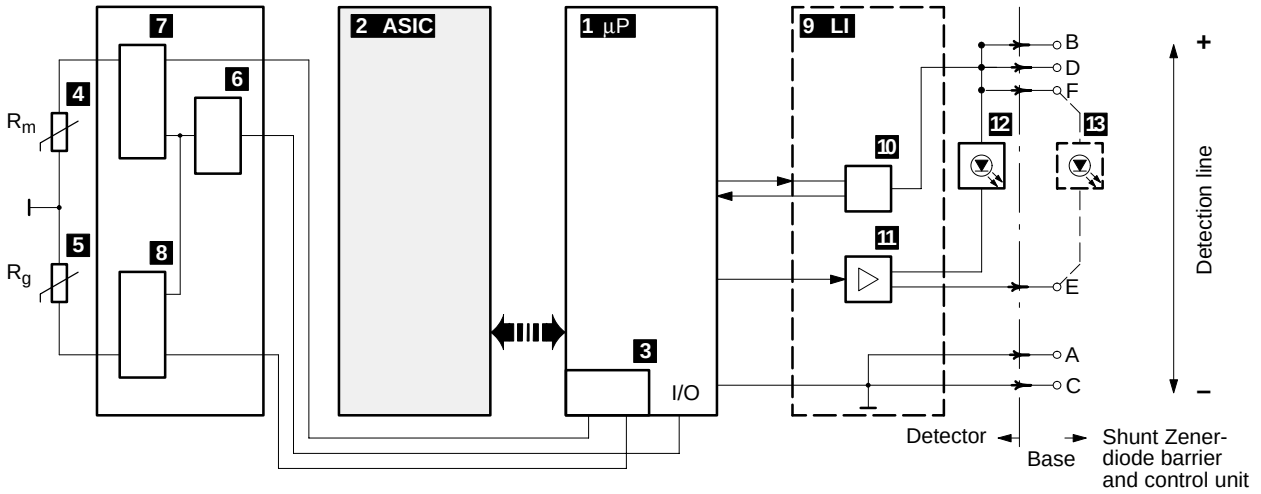


Fig. 2 Block diagram DT1151A-Ex

All circuits are adapted to the standards for explosion-hazard areas.

5 Self-test / Operating mode

Periodically, or upon command from the control unit a comprehensive detector self-test is activated which checks the two thermistors and the EEPROM.
The line voltage and bias voltage for the thermistors etc. are also periodically checked. If the detector signals a change of status, the precise cause can be read from the detector memory by the control unit.
«Function state 0» corresponds to «Normal state».
In the «Normal state» the detector is fully functional.
«Function state 1» corresponds to «Notices».
«Noteces» draw attention to certain irregularities, for example, application errors, but these do not influence the correct functioning of the system.
«Function state 2» corresponds to «Impairment».
«Impairments» are not accurately quantifiable deviations of the system (for example, compensation value too high). The reasons leading to the response of the detector must be taken seriously.
«Function state 3» corresponds to «Fault».
A «Fault» is an impairment of such a serious nature that the response of the detector can no longer be taken to signal a real event but the fault must be immediately remedied.

6 Emergency operation

If the ThermoRex DT1151A-Ex e.g. as a result of a µP malfunction in the control unit, is no longer periodically polled at its address, it automatically switches to emergency operation. In the event of fire this detector also activates a collective alarm signal.

7 Detector response behaviour

The ThermoRex DT1151A-Ex is equipped with efficient algorithms for processing the temperature evaluation. To signal a danger level the detector does not simply respond to a reading above a «response threshold», but rather tracks the progress of temperature over a longer period of time and evaluates it with appropriate algorithms.

8 Application

8.1 Compatibility

Fire detection system:	S11 AlgoRex
Control unit:	CS11 (E3M171)
Base:	DB1151A

8.2 Application

The ThermoRex DT1151A-Ex for explosion-hazard areas is particularly suitable for the monitoring of rooms and installations in which, in the event of an outbreak of fire, a rapid increase in temperature is to be expected, or other types of fire detector cannot be used because work processes cause smoke, dust, exhaust gases etc.

8.3 Adjustment functions / selection of parameter sets

The detector itself cannot be adjusted mechanically. All changes of function are remote controlled from the control unit. The detector is delivered ex works with a basic parameter set. This ensures that each detector is fully functional when it is installed. The additional parameter sets can be programmed in the field with the maintenance unit via the control unit.

8.3.1 DT1151A-Ex

Parameter set	Characteristics of the detector	Application range
APS100T (default)	Rate-of-rise characterisitics	Detecting of temperature increases with additional maximum temperature actuation at 60°C
APS103T	Maximum temperature actuation	Alarm actuation only upon exceeding the maximum temperature of 60°C
APS105T	Rate-of-rise characterisitics	Detecting of temperature increases with additional maximum temperature actuation at 80°C
APS107T	Maximum temperature actuation	Alarm actuation only upon exceeding the maximum temperature of 80°C

8.4 Wiring

The DT1151A-Ex detector and the DB1151A base are used in DS11-Ex with intrinsically safe fire detection lines which consist of an E3M171 line module, a shunt Zener diode barrier and intrinsically safe detectors.

Non-Ex-detectors may also be installed before the shunt Zener diode barrier. After the shunt Zener diode barrier only Ex detectors (DOT1151A-Ex, DT1151A-Ex, DM1153/54-Ex or DF1151-Ex) may be connected. A maximum of 32 devices with IMK1 may be connected to a stub line (total of all devices before and after the shunt Zener diode barrier). T-branches (T-TAP) are admissible. The Ex devices do not have a disconnection function.

Within the explosion-hazard area per detector base DB1151A only one external response indicator DJ1191-Ex, DJ1192-Ex or AJUT24-Ex may be connected.

Wiring comprises of a twisted two-wire circuit without shielding. If shielding is used, the shielding must be earthed on one side at the equipotential bonding.

Further information about installation in explosion-hazard areas can be found in the *document e1204.*

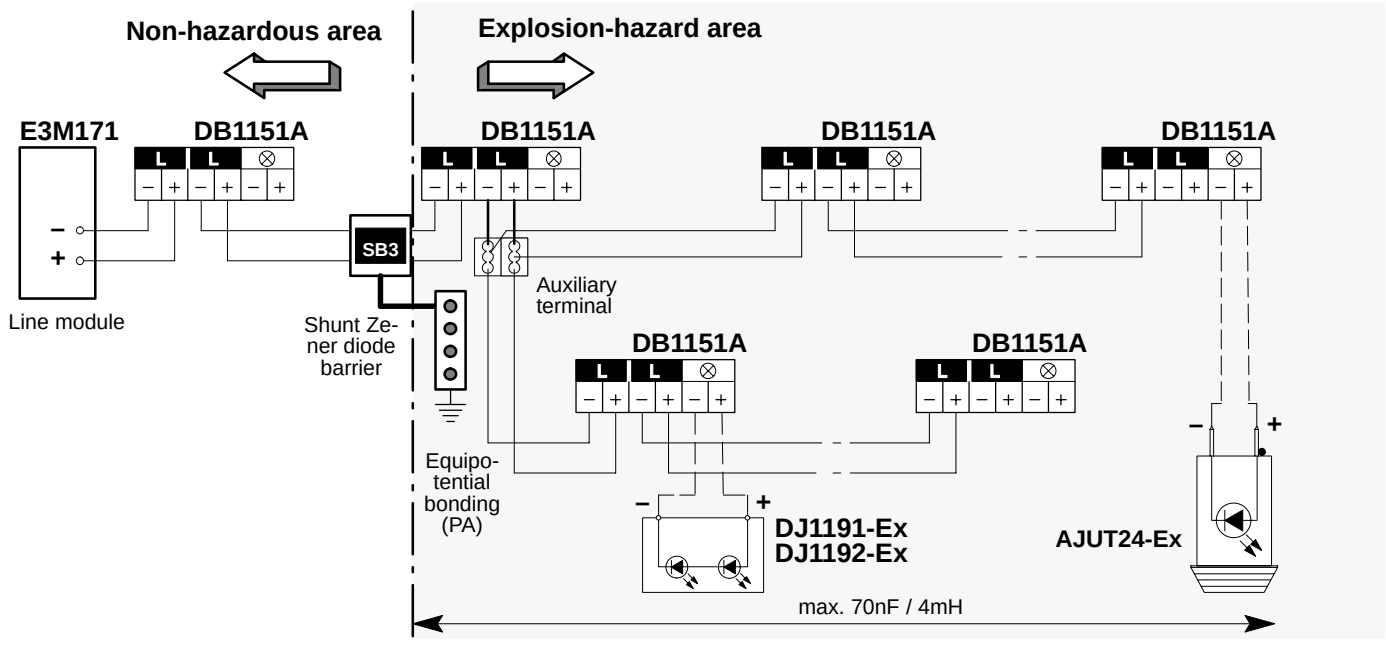


Fig. 3 Connection diagram

9 Commissioning

In order to avoid soiling detectors unnecessarily, they should only be inserted in their bases immediately prior to commissioning.
Each ThermoRex DT1151A-Ex is connected in parallel to a twin-wire detector bus. Addresses for individual detectors are allocated by the sequence in which they are inserted, testing with the detector tester, or by entering the individual detector identification numbers.
By means of the identification module integrated in the base, once addressed detectors have been commissioned, it does not matter if they are mixed up. Thanks to this identification module, the control unit can automatically restore the correct allocation with the correctly set response category. Each base identification module is given its own unique and unchangeable serial number.
If different types of detector are mixed up a trouble signal is activated.

10 Maintenance

10.1 Diagnosis capability

One detector can transmit 4 events to the control unit:

- Danger level 0 (quiescent value)
- Danger level 1 (possible danger)
- Danger level 2 (probable danger)
- Danger level 3 (very probable danger)

Danger level 1
To provide early warning in locations which are difficult for intervention, the number of times danger level 1 is exceeded is counted by the control unit. Upon reaching a pre-programmed level, the message «Application warning» is given.
These messages are entered in the basic parameterization of the control unit in the event memory.

Danger level 2
If danger level 2 is reached, the basic parameterization of the control unit activates a «Warning» message.
This message is also entered in the basic parameterization of the control unit in the event memory.

Danger level 3
Normally, danger level 3 results in immediate alarm activation.
Cross or multiple detection is possible by programming the control unit accordingly.

10.2 Performance check / Servicing

By means of the detector self-test, the DT1151A-Exs are automatically subjected to a thorough electrical performance check. In spite of this it is necessary to carry out an on-site physical performance check on all detectors at regular intervals.
Recommendation: A visual check of the detectors must be performed periodically (usually **at least every 3 years** or according to the recommendations of the local authorities). Detectors that are strongly soiled or which are mechanically damaged must be replaced.

Important!
The RE6T detector tester may only be used to check detectors outside explosion-hazard areas!

If mechanically damaged detectors must be scrapped, the plastic materials can be sorted out based on the embossed code.

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.

11 Terms

AlgoLogic	Protected trade-mark (Algorithm + Logic)
AlgoRex	Interactive fire detection system with AlgoLogic
Algorithm	Special calculation method in the detector processor for optimizing the smoke sensitivity, noise immunity and reliability
APS	Algo Parameter-Set
ASIC	Application Specific Integrated Circuit
CS11	Fire detection control unit AlgoControl to fire detection system S11 (E3M171)
DB1151A	Base for interactive DS11 fire detectors
DBZ1191	Base attachment
DJ1191-Ex	External response indicator
DJ1192-Ex	External response indicator
AJUT24-Ex	External response indicator
DS11-Ex	Intrinsically safe fire detection line in the S11 fire detection system
DT1151A-Ex	ThermoRex heat detector for explosion-hazard areas
DZ1191	Detector extractor
E3M171	Line module
EEPROM	Electrical Erasable Programmable Read Only Memory
EMC	Elektro Magnetic Compatibility
EMI	Elektro Magnetic Influence
ESD	Electro Static Discharge
ILK	Interactive line factor (32)
IMK	Connection factor for interactive elements
LED	Light Emitting Diode
µP	Microprocessor
RE6T	Detector tester for heat detectors
R_g	Measuring sensor for housing temperature
R_m	Measuring sensor for ambient temperature
RI (AI..)	Response indicator
SB3	Recommended shunt Zener diode barrier
S11	Generic term of fire detection system S11
ThermoRex	DT1151A-Ex heat detector for explosion-hazard areas

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