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MDU601Ex INTRINSICALLY SAFE ENHANCED CARBON MONOXIDE FIRE AND HEAT DETECTOR

PRODUCT APPLICATION AND DESIGN INFORMATION

1. INTRODUCTION

The MDU601Ex Intrinsically Safe Enhanced Carbon Monoxide Fire and Heat Detector forms part of the M600Ex series of plug in detectors for ceiling mounting. The detector plugs into the Minerva MUBEx base and is intended for two-wire operation with the majority of control equipment currently manufactured by the company.

2. INTRINSIC SAFETY

The detectors are designed to comply with EN 50 014 and EN50 020 for intrinsically safe apparatus. They are certified:

ATEX code: ⟨Ex⟩ II 1 G

Cenelec code: EEx ia IIC T5

under ATEX certificate number BAS01ATEX1134X.

These detectors are designed and manufactured to protect against other hazards as defined in paragraph 1.2.7 of Annex II of the ATEX Directive 94/9/EC.

2.1 DETECTOR USE

It is recommended that the detector is used in conjunction with a suitable isolator or shunt diode safety barrier in a certified Intrinsically Safe system, ie, System 601.

3. OPERATING PRINCIPLE

3.1 SENSING CELL

The MDU601EX uses an elctrochemical cell to detect the build up of carbon monoxide generated by fires. The cell operates by oxidising carbon monoxide on a platinum sensing electrode. On a corresponding counter electrode the other half of the reaction takes place. The Sensing Cell is represented diagrammatically in Fig. 1.

When this reaction takes place, the potential across the cell tries to change and this causes a current to flow within the circuit around the cell. The current is mirrored into a current to voltage conversion circuit. The resulting output is directly proportional to the carbon monoxide concentration.

The cell itself has a diffusion limiting component to ensure that all carbon monoxide in the area proximate to the sensing electrode is continuously oxidised. This means that the rate of transport of carbon monoxide to the cell is directly proportional to the external concentration and independent of air-speed.

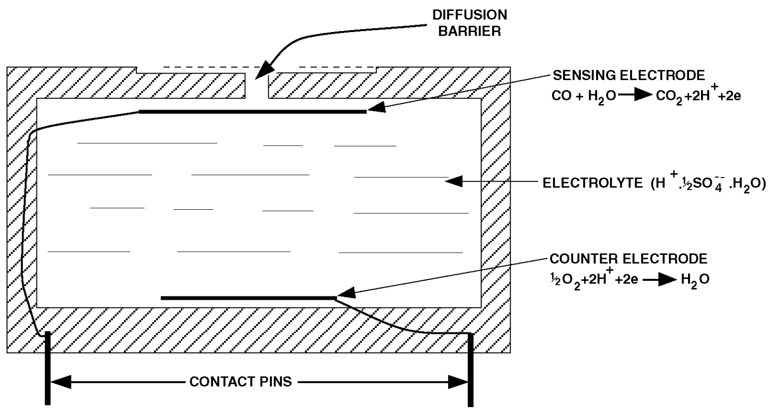

Fig. 1 Representational Diagram of CO Sensing Cell

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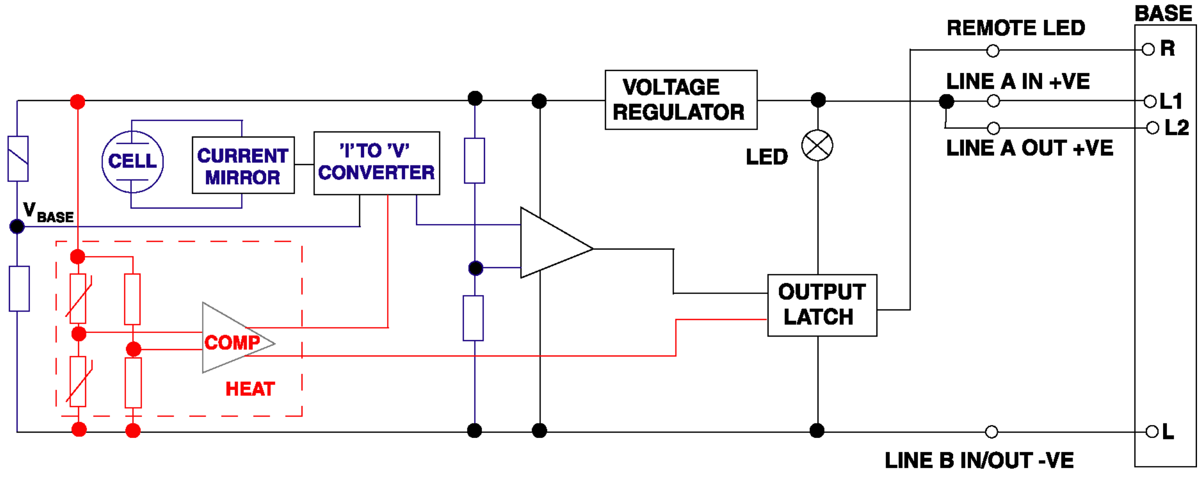

Fig. 2 Simplified Block Schematic Diagram of Detector

3.2 CIRCUIT

A simplified block schematic of the circuit is given in Fig. 2.

3.2.1 CO DETECTOR

The current through the cell circuit is mirrored by the current mirror and added to a fixed baseline voltage V_{base}. This is fed to a current to voltage converter amplifier which buffers and scales the signal. The resultant voltage is fed to a comparator that changes when the voltage exceeds the preset reference level.

This change of state causes the output latch to draw extra current from the supply to signal an 'Alarm' condition and to light the integral alarm indicator LED.

All critical parts of the circuit are fed by an internal voltage regulator to make the sensitivity independent of the supply voltage over a wide range.

3.2.2 HEAT DETECTOR EN54-5 CLASSIFICATION A1R

Two negative temperature coefficient thermistors, Rsens and Rref are used in a bridge configuration as shown. One thermistor, Rsens, is exposed to the air whilst the other, Rref, is thermally lagged inside the detector body. If the temperature of the air around the detector rises quickly, a temperature difference will be established between Rsens and Rref. The values of the bridge components are chosen such that if a particular rate of change of temperature is sustained for sufficient time, the comparator will change state and the detector will signal an alarm condition.

If the rate of temperature increase is very slow, then the temperatures of the sensing and reference thermistors will be more nearly equal. Under these conditions the bridge components ensure that the comparator changes state when the predetermined fixed temperature is reached.

3.2.3 ENHANCED CO DETECTOR

In the event of the thermistor detecting a fast rate of change of temperature, the sensitivity of the CO detector is enhanced.

3.3 WIRING

Loop cabling is connected to base terminals as follows:

L	-VE
L1	+VE IN
L2	+VE OUT
R	Remote LED Drive

4. MECHANICAL CONSTRUCTION

The major components of the detector are:

- Body Assembly
- Printed Circuit/Chamber Assembly
- Cell
- CO Closure
- Outer Cover
- Thermistors

4.1 BODY ASSEMBLY

The body assembly consists of a plastic moulding to which are secured the four detector contacts aligning with contacts in the MB600Ex base. The moulding incorporates securing features to retain the detector in the base.

The PCB is soldered to the body contacts, then the underside of the PCB is epoxy encapsulated.

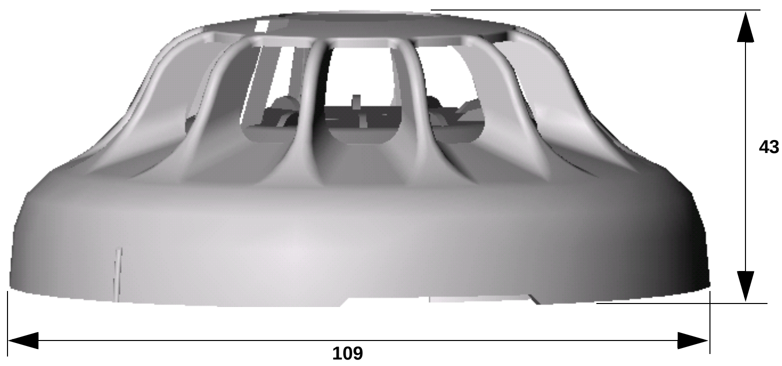

Fig. 3 Overall Dimensions of MDU601Ex Detector

4.2 FINAL ASSEMBLY

The assembly described in Para 3.1 is, in effect, a complete detector but the remaining components provide further protection against external influences.

The closure, in conjunction with the outer cover, is carefully designed to protect the cell and screening can and allow for future possible heat enhancement options. The closure is retained by the outer cover which is a snap fit onto the body assembly.

5. TECHNICAL SPECIFICATION

5.1 MECHANICAL

Dimensions

The overall dimensions are shown in Fig. 3.

Materials

Body, cover, and closure:	FR110 'BAYBLEND' flame retardant.

Weight

Detector:	0.126kg
Detector + Base:	0.190kg

5.2 ENVIRONMENTAL

Temperature

Operating:	-10°C to +55°C
Storage:	-2°C to +55°C

Note:

1) ***The operating temperatures quoted exceed the ATEX Certification limits.***
2) *The detector may be operated for short periods between the limits of -10°C to -20°C but with reduced performance.*
3) *The detector may be operated for short periods between the limits +55°C to +70°C, prolonged use between these limits will degrade the performance and shorten the life of the detector.*

Relative Humidity

Operational:	90% RH continuous (non-condensing) and up to 99% RH intermittent (non-condensing)
Storage:	>40% RH and <70% RH

Shock:
Vibration:
Impact:
Corrosion:
} To EN54 Part 7

5.3 ELECTROMAGNETIC COMPATIBILITY

The detector complies with the following:

Product family standard EN50130-4 in respect of Conducted Disturbances, Radiated Immunity, Electrostatic Discharge, Fast Transients and Slow High Energy

EN50081-1 for Emissions

Note: The above standards fulfil the requirements of the European Directive for EMC (89/336/EEC).

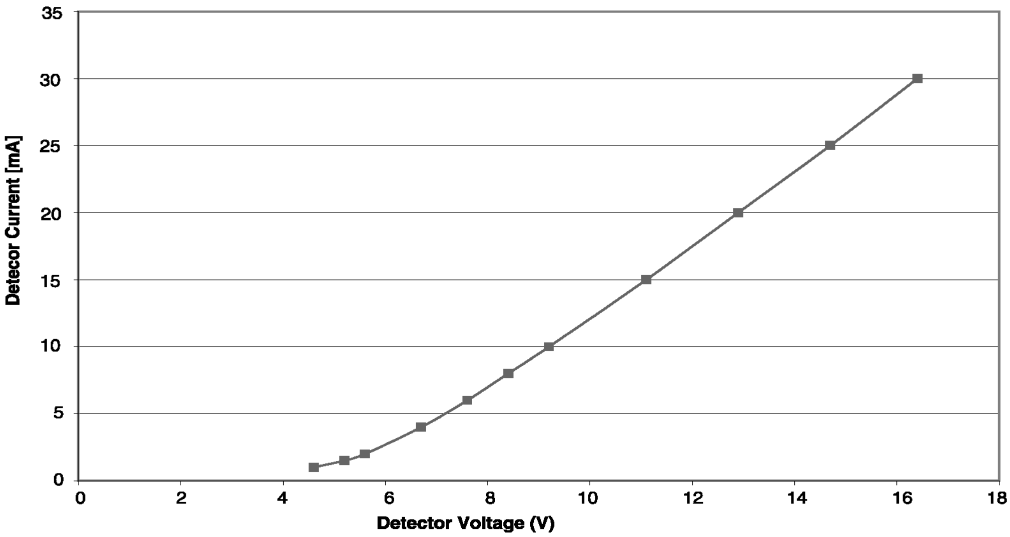

Fig. 4 Alarm Load

5.4 ELECTRICAL

Characteristics	Min.	Typ.	Max.	Unit
Operating Voltage (dc)	16		28	V
Quiescent Current	55		70	µA
Switch-on-Surge			150	µA
Stabilisation Time	12	20	30	sec
Alarm Current	See Fig. 4			mA
Holding Current			1	mA
Holding Voltage			5	V
Reset Time		2	5	sec
Remote LED drive	via a 3.4k resistor			

Table. 1 Electrical Characteristics

Intrinsic Safety Rating:

Maximum Voltage for safety (U_i): 28V

Maximum Current for Safety (I_i): 93mA

Maximum Power Input (P_i): 650mW

Equivalent Inductance (L_i): 0

Equivalent Capacitance (C_i): 0

5.5 PERFORMANCE CHARACTERISTICS

5.5.1 RESPONSE TO CARBON MONOXIDE

The response to carbon monoxide is to indicate an alarm at a threshold level of 40ppm carbon monoxide in air.

5.5.2 EFFECT OF AIRFLOW ON SENSITIVITY

The signal status of the MDU601Ex detector has been specifically designed to be insensitive to abnormal air velocities. The effect of normal air velocities upon sensitivity is negligible.

5.5.3 THE EFFECT OF TEMPERATURE ON SENSITIVITY

The detector incorporates temperature compensation and its condition current will be substantially constant over its specified operating range.

5.5.4 THE EFFECT OF ATMOSPHERIC PRESSURE ON SENSITIVITY

The sensitivity of the detector is not effected by changes in atmospheric pressure unless they happen very quickly, ie, explosions.

5.6 RESPONSE TO FIRES

Carbon Monoxide detectors are generally faster than Ion Chamber or Optical detectors in responding to fires that start by smouldering. They are also more tolerant of positioning and can be mounted in locations where there are likely to be obstacles to free smoke plume movement.

The fire tests defined in BS 5445: Pt. 9 which are intended for ionisation and optical detectors are less appropriate for carbon monoxide fire detectors as their design means that they produce significant levels of carbon monoxide only in their later stages.

6. DETECTOR IDENTIFICATION

The detector is identified by the logo label, as shown in Fig. 5.

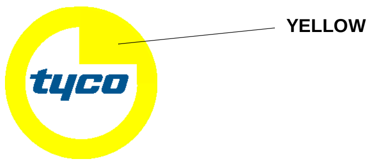

Fig. 5 Detector Identification

7. ORDERING INFORMATION

MDU601Ex Intrinsically Safe Enhanced Carbon Monoxide Fire and Heat Detector:	516.061.001.Y
MUBEx Base for use with Ex Detectors:	517.050.610

JM/em

2nd July 2002

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