DOCUMENT CONTROL NUMBER /

801CHEx INTRINSICALLY SAFE ADDRESSABLE CARBON MONOXIDE + HEAT DETECTOR
PRODUCT APPLICATION & DESIGN INFORMATION

1. INTRODUCTION

The 801CHEx Intrinsically Safe Carbon Monoxide plus Heat Detector forms part of the 800Ex Intrinsically Safe Series of MX Addressable Fire Detectors. The detector plugs into an MUBEx base.

The detector is designed to transmit, to a remote Minerva MX/T2000 fire controller, digital signals which represent status of the carbon monoxide and heat elements of the detector.

Software within the controller is used to interpret the returned Carbon Monoxide and heat values, to raise alarm or other appropriate response according to the type of detector configured in ‘MX CONSYS’ (refer to Publication 17A-06-X1).

The mode of the detector may be:

- Heat only detector (A1R or A2S) (sensitivity: High, Normal or Low),
- Compensated Carbon Monoxide detector (sensitivity: High, Normal or Low),
- Compensated Carbon Monoxide (sensitivity: High or Normal) combined with heat (A1R).

Note:

1) *The heat detection grades are to EN54-5.*
2) *Normal and High sensitivity settings have been approved by the Loss Prevention Council Board.*

1.1 DAY/NIGHT SWITCHING

Two modes of detector operation are selectable from the list of possible modes as follows:

- ‘Normal’ mode, ie, night time operation in which the detector will be evaluated most of the time.
- ‘Day’ mode in which the detector can be switched under certain circumstances, eg, during daytime when the building is occupied with people being able to detect a fire manually. Switching to the ‘daytime’ mode can be done either by user action (pressing the DAY/NIGHT switch on the controller), event or time driven.

1.2 SENSITIVITY SWITCHING

In addition to mode switching, the sensitivity can be changed within the actual mode. This can be done either by user action or be event or time driven (eg, day/night switching). Changing the sensitivity is done by shifting the sensitivity by one level up or down.

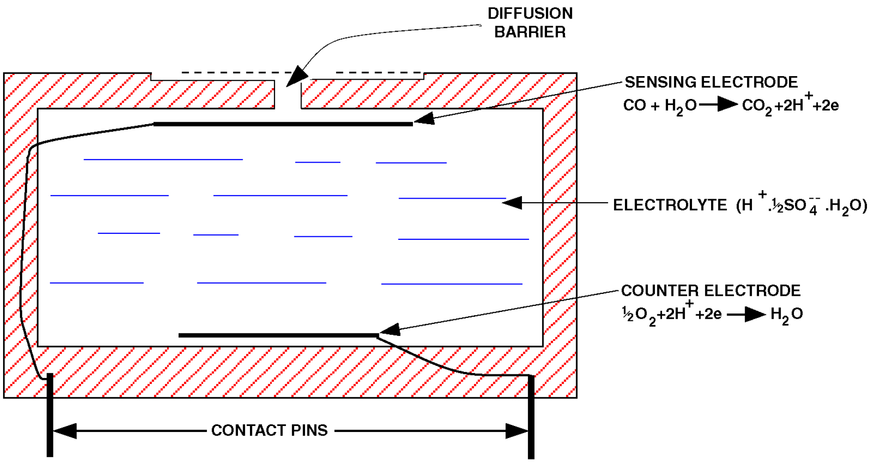

Fig. 1 Representational Diagram of CO Sensing Cell

Registered Office: First Floor North Building Walden CourtParsonage Lane Bishopís Stortford Herts CM23 5DB

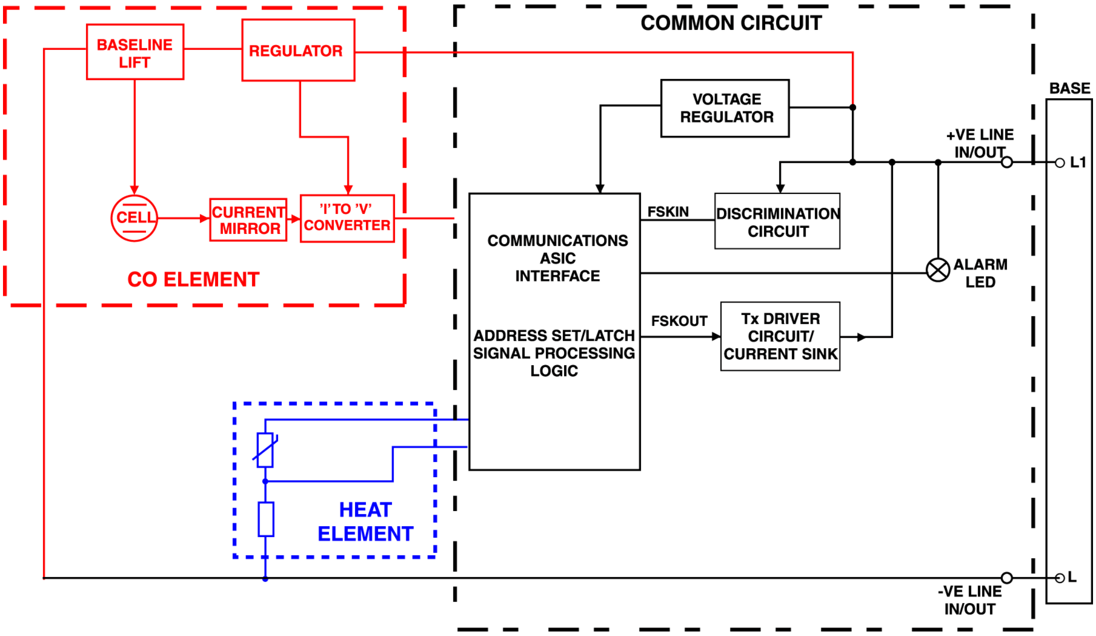

Fig. 2 Simplified Block Schematic Diagram of detector

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 BAS01ATEX1394X.

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

The detector is to be used in conjunction with a suitable galvanic isolator in the certified Intrinsically Safe system, System 800.

3. OPERATING PRINCIPLE

3.1 CARBON MONOXIDE

3.1.1 SENSING CELL

The CO element of the detector uses an electrochemical cell to detect the build up of carbon monoxide generated by fires. The cell operates by oxidising carbon monoxide on a platinum sensing electrode. Whilst on a corresponding counter electrode, the reduction 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, with the resulting output 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.

3.2 HEAT DETECTOR

The heat element of the detector uses a single thermistor to produce an output proportional to temperature. Rate of change of temperature is determined, by the controller, by using differences between consecutive temperature values returned to the controller.

3.3 SELF-TEST

The ‘Self-Test’ facility electrically stimulates the cell when requested by the controller, to produce a sensor output above the alarm threshold, which is then verified on the following polling cycle by the controller.

3.4 CIRCUIT DESCRIPTIONS

3.4.1 CARBON MONOXIDE

Refer to Fig. 2.

The current through the cell circuit is added to a fixed baseline voltage and mirrored by the current mirror. This is fed to a current to voltage converter amplifier, which buffers and scales the signal. The resultant voltage is fed to an analogue input on the common circuit.

3.4.2 HEAT

Refer to Fig. 2.

The negative temperature coefficient thermistor produces an analogue output, which is fed to an analogue input on the common circuit.

3.5 COMMON CIRCUIT

Refer to Fig. 2.

Communications between the controller and detector uses the Frequency Shift Keying (FSK) method.

The 'Discrimination Circuit' filters the FSK signal from the +ve line voltage and converts it to a digital square wave input for the 'Communications ASIC'.

The 'Communications ASIC' decodes the signal and when its own address is decoded, the analogue inputs received from the carbon monoxide and heat sensing elements are converted to corresponding digital values. These digital values are then passed to the 'Tx Driver Circuit/Current Sink' which converts them to FSK signals and applies them to the +ve line for transmission to the controller.

3.6 WIRING

Loop cabling is connected to base terminals L (-ve) and L1 (+ve).

4. MECHANICAL CONSTRUCTION

The major components of the detector are:

- Body Assembly
- Printed Circuit
- CO Cell
- Screening Can
- CO Closure
- Thermistor
- Light Pipe
- Outer Cover

4.1 ASSEMBLY

The body assembly consists of a plastic moulding, which has four embedded detector contacts that align with contacts in the MUBEx base. The moulding incorporates securing features to retain the detector in the base.

The CO cell is inserted onto the PCB followed by the screening can.

The PCB is soldered to the body contacts. These contacts act as a mechanical fixture during assembly and provide electrical contact between the contacts and the PCB. The PCB is then potted.

The light pipe is slotted into the CO closure, which is then clipped to the body. Finally, the outer cover is clipped to the body.

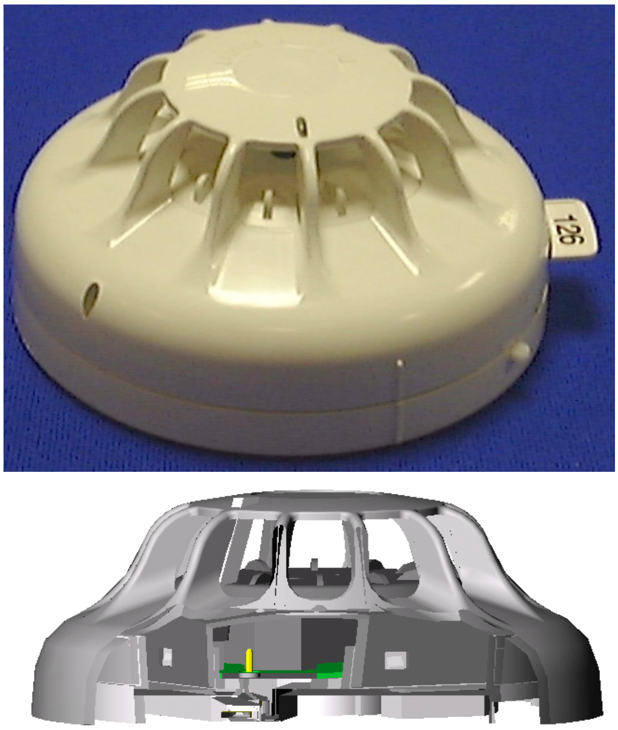

Fig. 3 Sectioned and Top View of the Detector

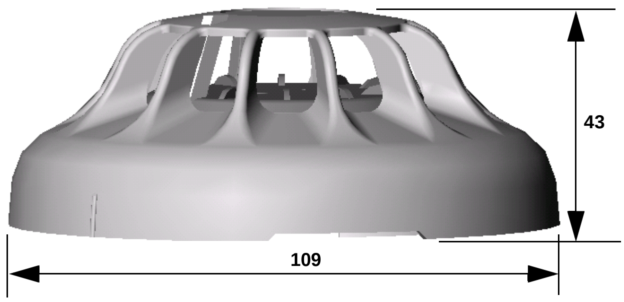

Fig. 4 Overall Dimensions of 801CHEx detector

5. TECHNICAL SPECIFICATION

5.1 MECHANICAL

Dimensions

The overall dimensions are shown in Fig. 4 (less base).

Materials

Body, cover, and closure: FR110 ‘BAYBLEND’ flame retardant.

Weight

Detector: 0.126 kg

Detector + Base: 0.192 kg

5.2 ENVIRONMENTAL

Temperature

Operating: 0^oC to $+55^oC$

Storage: -20^oC to $+55^oC$

Note:

1) *The operating temperatures quoted exceed the ATEX Certification limits.*
2) *The detector may be operated for short periods between the limits of 0^oC to -20^oC but with reduced performance.*
3) *The detector may be operated for short periods between the limits $+55^oC$ to $+70^oC$. Prolonged use between these limits will degrade the performance and shorten the life of the detector.*

Relative Humidity: 95% (non-condensing)

Shock:
Vibration: EN54 Pts. 5 and 7
Impact:

Corrosion: EN54 Pts. 5 and 7

The detectors comply with Lloyd’s Register Test Specification Number 1 (1996). Environmental Category ENV2 plus Salt Mist test.

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.

5.4 ELECTRICAL CHARACTERISTICS

The following characteristics (Table 1) apply at 25^oC and nominal supply voltage of 22V unless otherwise specified.

Characteristic	Min.	Typ.	Max.	Unit
Loop Voltage	18	-	24	V
Quiescent Current	-	300	350	µA
Alarm Current	-	3	3.3	mA

Table 1: Electrical Characteristics

5.5 PERFORMANCE CHARACTERISTICS

5.5.1 CARBON MONOXIDE

The 801CHEx Carbon Monoxide sensing element with base, forms an addressable detector which transmits, to remote equipment, signals representing the state of the sensing cell. The control equipment evaluates these signals against predetermined criteria and decides when an ALARM condition should be signalled. The information given below, therefore, relates to the performance of the carbon monoxide element of the detector simply as a transducer, since the system alarm response is determined by the control unit.

5.5.1.1 RESPONSE TO CARBON MONOXIDE

The response to carbon monoxide will vary from detector to detector. For this reason, each detector is characterised on manufacture and calibration values are stored in the internal detector memory. The controller will then, normalise the output signal from the detector such that, the output is equivalent to 2.5 bits/ppm carbon monoxide above a threshold of 20 bits. Carbon monoxide may be present in some environments under certain circumstances (high values of pollution, or extreme environmental conditions). However, the deviation is unlikely to be significant compared with the alarm threshold level.

5.5.1.2 EFFECT OF AIRFLOW ON SENSITIVITY

The signal status of the 801CHEx detector has been specifically designed to be insensitive to abnormal air velocities. The effect of normal air velocities upon sensitivity is negligible.

5.5.1.3 EFFECT OF TEMPERATURE ON SENSITIVITY

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

5.5.1.4 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.

5.5.2 RESPONSE TO FIRE TESTS

The response of the 801CHEx carbon monoxide detection element of the detector to real or large-scale test fires, will be dependent on the detection mode chosen and the sensitivity set in the control unit.

Other factors, however, such as the rate of development of the fire and relative oxygen supply, are also important. The fire tests defined in EN54 Pt. 7, 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.

However, the 801CHEx uses compensated carbon monoxide combined with A1R heat (sensitivity High and Normal) mode, pass all tests laid down in EN54 pt 7 including the fire tests.

5.5.3 HEAT DETECTOR

5.5.3.1 GENERAL

The performance of heat detectors is defined in European standard EN54-5.

6. DETECTOR IDENTIFICATION

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

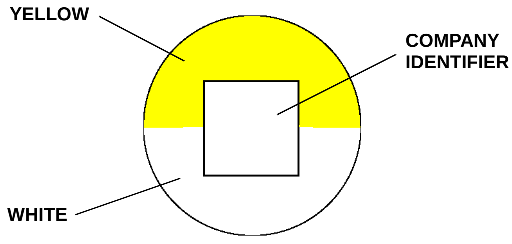

Fig. 5 Detector Identification

7. DETECTOR ADDRESS

The loop address of the detector is held in internal E^2PROM which is programmed either from the controller, or by the 801AP MX Service Tool.

A Servive Tool Dongle (supplied with the EXI800) is required to be fitted to the 'AUX' port to program 800Ex detectors.

Note: The detector must be programmed in the Safe Area when using the MX Service Tool.

8. ADDRESS FLAG

Refer to Fig. 6. The address flag is used to identify the address and zone of the detector. The address flags are supplied in one of two packs (address 1 - 127 or 128 - 255, with a different colour for each loop) and are ordered separately from the detector. The address flag is fitted to the bottom of the detector. When the detector is fitted to the base and turned until fully located, the address flag is then transferred to the base. If the detector is removed from the base, the address flag remains with the base.

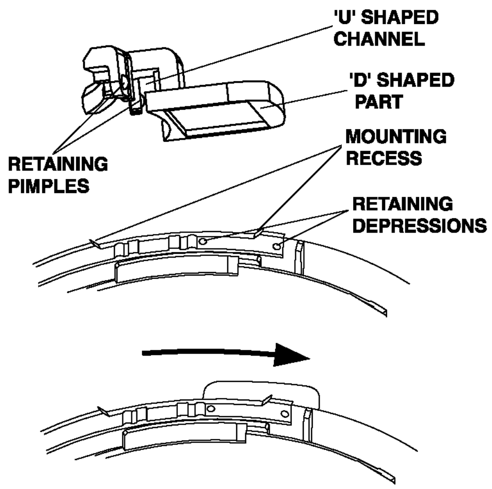

Fig. 6 Fitting Address Flag

9. ORDERING INFORMATION

801CHEx Intrinsically Safe Carbon Monoxide + Heat detector:	516.800.531
MUBEx Base for use with Ex Detectors:	517.050.610
Address Flag Labels - Loop A (White):	516.800.931
Address Flag Labels - Loop B (Yellow):	516.800.932
Address Flag Labels - Loop C (Purple):	516.800.933
Address Flag Labels - Loop D (Green):	516.800.934

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25th November 2002