DOCUMENT CONTROL NUMBER /

801I ADDRESSABLE IONISATION SMOKE DETECTOR PRODUCT APPLICATION & DESIGN INFORMATION

1. INTRODUCTION

The 801I ionisation detector forms part of the 800 Series Addressable Fire detectors. The detector is intended to plug into the following:

- Minerva Universal Base (formerly known as an M600/900 Universal Base)
- 801IB Isolator Base
- 801 Relay Base
- 801SB Sounder Base

The detector is designed to transmit, to a remote Minerva MX/ Minerva SOLO/T2000 fire controller, digital signals which represent status of the ionisation sensing chamber. The ionisation detector also has a self-test facility.

Software within the controller is used to interpret the returned ion chamber 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 ionisation detector has three sensitivities, high, normal and low.

1.1 SENSITIVITY SWITCHING

The sensitivity of the detector can be changed. 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.

Note: Normal and High sensitivity settings meet the requirements of prEN54 : Part 7.

WARNING:

THESE DETECTORS CONTAIN A SMALL AMOUNT OF RADIOACTIVE MATERIAL (Americium 241). DETECTORS ARE SAFE UNDER THE PRESCRIBED CONDITIONS OF USE BUT MUST NOT BE DISMANTLED BY UNAUTHORISED PERSONS. TRANSPORT AND STORAGE OF DETECTORS MUST BE ARRANGED IN ACCORDANCE WITH GOVERNMENTAL SAFETY REGULATIONS.

2. OPERATING PRINCIPLE

2.1 CHAMBER

The 801I uses an ionisation chamber to detect the presence of aerosol combustion products generated in fires, ionised air within the chamber is affected by these products such that an imbalance occurs increasing the potential of the collector. The chamber is represented diagrammatically in Fig. 1.

The small radioactive source (<33.3kBq of Americium 241) ionises the air within the volume enclosed by the slotted outer cover. The ionisation causes a small current to flow between the source and the cover which have a fixed voltage applied between them.

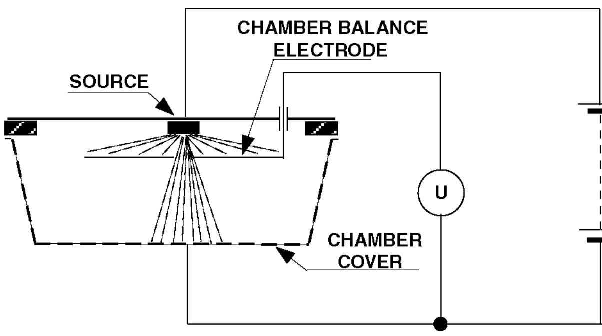

Fig. 1 Representational Diagram of Ion-Chamber

Within the chamber is a perforated electrode known as the collector. This electrode will, under clean air conditions, assume a certain potential relative to the outer cover. This potential is due to the radioactive emissions ionising the air and is relatively stable.

If smoke/aerosols are introduced into the chamber they effect the ionised air such that an imbalance occurs increasing the potential of the collector. The magnitude of this potential can be used to indicate the smoke density. The current that flows across the chamber is very small and the device used to sense the potential of the collector is therefore of very high impedance.

2.2 SELF-TEST

The 'Self-Test' facility saturates the ionisation chamber electronically to signal an alarm condition when requested by the controller.

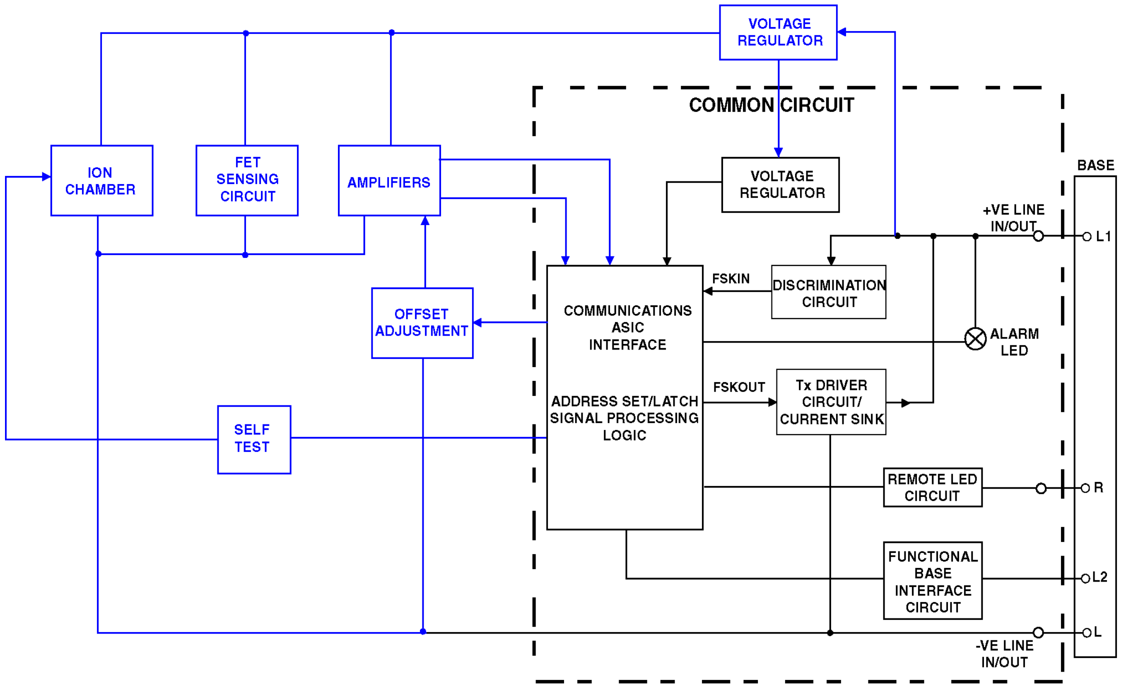

Fig. 2 Simplified Block Schematic Diagram of Detector

2.3 CIRCUIT DESCRIPTIONS

2.3.1 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 ionisation circuit are converted to corresponding digital values. These digital values are then passed to the ‘Tx Driver Circuit/Current Sink’ which applies them to the +ve line for transmission to the controller.

The Common Circuit is also used to:

- Control Sounder and Relay bases via the ‘Functional Base Interface Circuit’ from controller commands.
- Control the operation of the Remote LED via the ‘Remote LED Circuit’ from controller commands.

2.4 WIRING

Loop cabling is connected to base terminals L (-ve) and L1 (+ve). A drive is provided for a remote indicator connected between loop positive and terminal R. Terminal L2 is for use with functional sounder and relay bases.

3. MECHANICAL CONSTRUCTION

The major components of the detector are:

- Body Assembly
- Printed Circuit and Ion Chamber
- Ion Chamber Cover
- Light Pipe
- Outer Cover

3.1 ASSEMBLY

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

The PCB is clipped to the body by four spring contacts. These contacts both hold the assembly together mechanically and provide electrical contact between the base contacts and the PCB.

The chamber cover is clipped to the body.

The light pipe is slotted into the chamber cover. Finally, the outer cover is clipped to the body.

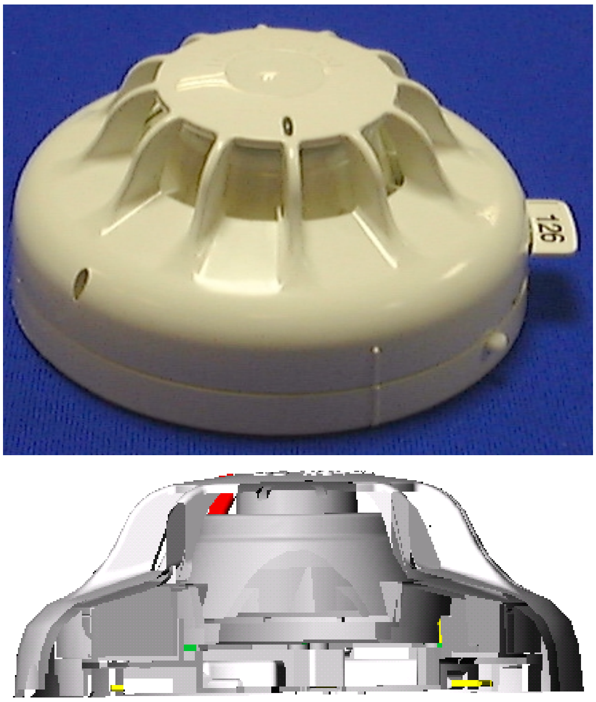

Fig. 3 Ion Chamber Detector Plus Base and Address Flag

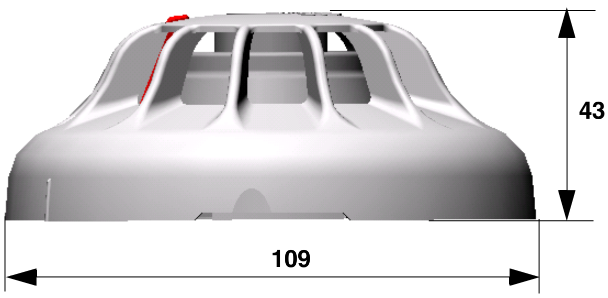

Fig. 4 Overall Dimensions of 801I Detector

4. TECHNICAL SPECIFICATION

4.1 MECHANICAL

Dimensions

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

Materials

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

Weight

Detector: 0.079kg

Detector + Base: 0.143kg

4.2 ENVIRONMENTAL

Temperature

Operating: -25^{o}C to +70^{o}C

Storage: -40^{o}C to +80^{o}C

Relative Humidity: 95% (non-condensing)

Shock:
Vibration: prEN54 Pt. 7
Impact:

Corrosion: prEN54 Pt. 7

4.3 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

4.4 ELECTRICAL CHARACTERISTICS

The following characteristics (Table 1) apply at 25^{o}C and detector nominal supply voltage of 37.5V unless otherwise specified.

Characteristic	Min.	Typ.	Max.	Unit
Loop Voltage	20.0	-	40	V
Quiescent Current	-	330	370	µA
Alarm Current*		3	3.3	mA

Table 1: Electrical Characteristics

* No remote indicator fitted

4.5 PERFORMANCE CHARACTERISTICS

The 801I, together with its base, forms an addressable detector which transmits, to remote equipment, signals representing the state of the sensing chamber. 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 801I simply as a transducer, since the system alarm response is determined by the control unit.

4.5.1 RESPONSE TO SMOKE

The response of an ion-chamber detector is compared against the response of a standard Measuring Ionisation Chamber (MIC). Smoke density is measured as a "y-value", calculated from the change in MIC current, which is proportional to smoke density.

The output of the 801I is a linear function of the 'y-value'. This is shown graphically in terms of "y-value".

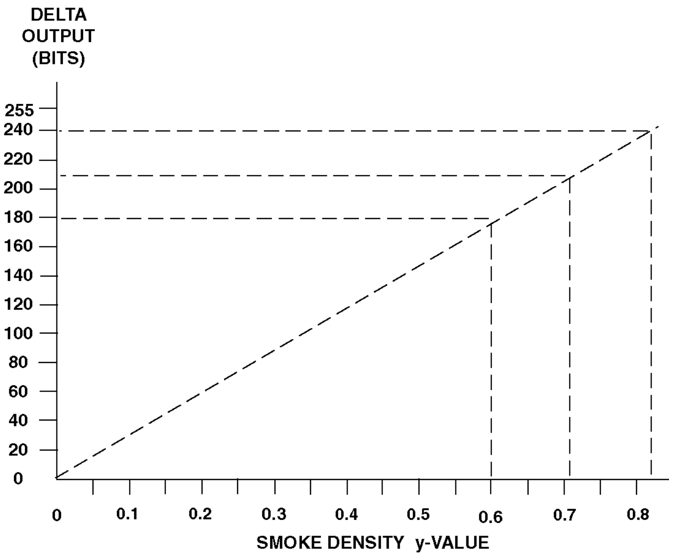

Fig. 5

In clean air conditions (y = 0) the analogue value indicates the quiescent condition of the chamber. Any deviation from 0 bits will indicate a change in the ambient conditions. This deviation may be used in the control equipment to correct the alarm threshold level.

4.5.2 EFFECT OF AIRFLOW ON SENSITIVITY

The 801I detector has been designed to be resistant to abnormal air velocoties.

4.6 RESPONSE TO FIRE TESTS

The response of an ionisation detector to a particular 'real' fire will depend, to a large extent, on the aerosol content of the smoke produced in the fire. However other factors such as the detector smoke entry characteristics, the development of the fire and the thermal lift produced by the fire are also important. In order to evaluate the response under realistic conditions, detectors are subjected to test fires which cover a range of fire types. These tests are defined in prEN54 Pt 7 and include mandatory fire tests, which are:

- TF2 smouldering pyrolysis
- TF3 glowing smouldering (cotton)
- TF4 open plastics (polyurethane foam)
- TF5 liquid (n-heptane)

5. DETECTOR IDENTIFICATION

The detector is identified by the logo label colouring as shown in Fig. 6.

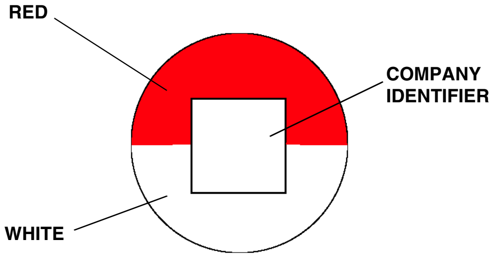

Fig. 6 Detector Identification

6. DETECTOR ADDRESS

The loop address of the detector is held in internal E^2PROM which is programmed either from the controller or by a Field Address Programmer.

7. ADDRESS FLAG

Refer to Fig. 7. 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.

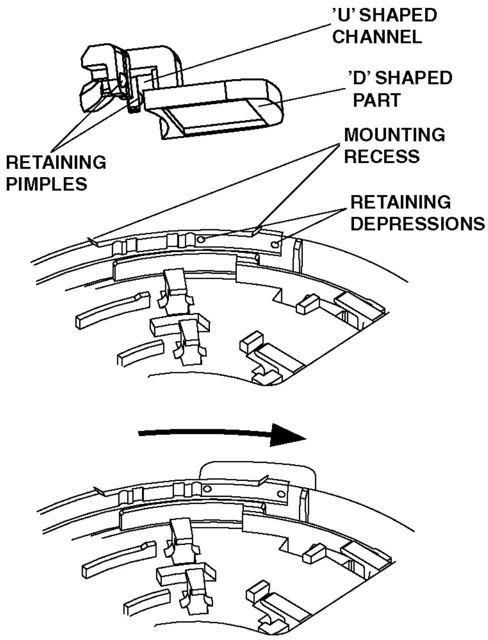

Fig. 7 Fitting Address Label Carrier

8. ORDERING INFORMATION

801I Ionisation Smoke Detector:	516.800.515
Minerva Universal Base:	517.050.001
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

JM/cb

23rd May 2001