



XP95



**INTRINSICALLY SAFE  
ANALOGUE ADDRESSABLE  
SMOKE & HEAT DETECTORS**  
*BASEEFA approved E EX ia IIC T5 (T4 at Ta ≤ 60°C)*  
**ENGINEERING PRODUCT GUIDE**



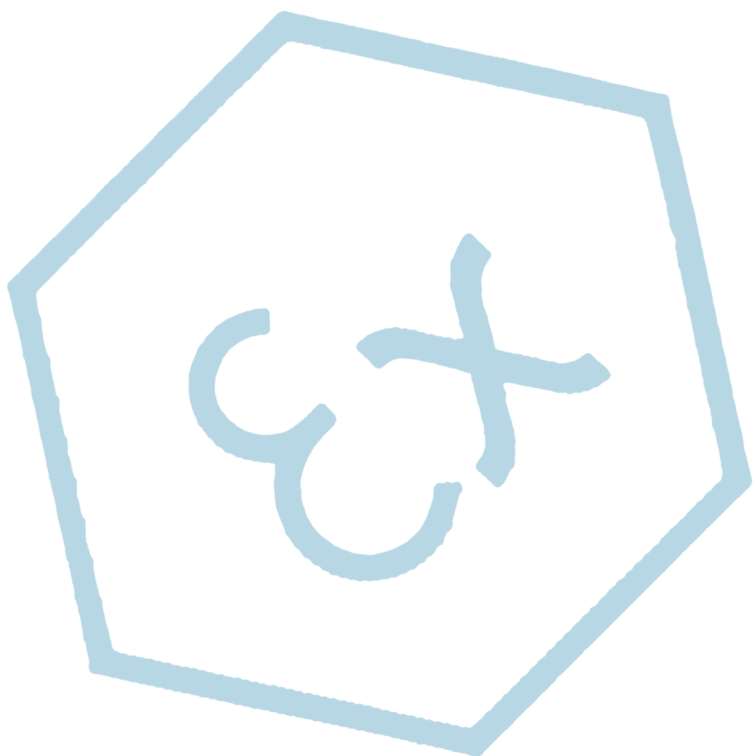
## XP95 INTRINSICALLY SAFE FIRE DETECTORS

Apollo Fire Detectors manufactures fire detectors designed for use in hazardous areas. This Product Guide gives information on the intrinsically safe (I.S.) version of the XP95 analogue, addressable range of smoke and heat detectors which have been approved by BASEEFA. The approvals are to BS EN 60079-0:2004, BS EN 50284:1999, BS EN 50020:2002 and BS EN 60079-26:2004. All types are certified to EEx ia IIC T5 at ambient temperatures up to 40°C, or T4 at ambient temperatures up to 60°C.

The range comprises ionisation and optical smoke detectors, a temperature detector, a detector base and a compatible manual call point. There is also a choice of two translators which ensure integrity of communication between detectors and control equipment within the constraints of an intrinsically safe system.

The guide also provides information on intrinsic safety, the application and installation of the products and the certification documentation. Reference is made to other product guides published by Apollo and the Guide to the care, service and maintenance of Apollo products (publication PP2055). All are available on request.

*Information in this guide is given in good faith, but Apollo Fire Detectors Limited cannot be held responsible for any omissions or errors. The company reserves the right to change specifications of products at any time and without prior notice.*



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## INTRODUCTION TO INTRINSIC SAFETY

There are many places where an explosive mixture of air and gas or vapour is or may be present continuously, intermittently or as a result of an accident. These are defined as hazardous areas by BS EN 60079, the code of practice for installation and maintenance of electrical apparatus in potentially explosive atmospheres.

Hazardous areas are common in petroleum and chemical engineering plants and in factories processing and storing gases, solvents, paints and other volatile substances.

Electrical equipment for use in these areas needs to be designed so that it cannot ignite an explosive mixture, not only in normal operation but also in fault conditions. There are a number of methods available to achieve this - oil immersion, pressurised apparatus and powder filling, for example, but the two in most common use are flameproof enclosures and intrinsic safety.

Flameproof equipment is contained in a box so strong that an internal explosion will neither damage the box nor be

transmitted outside the box. The surface must remain cool enough not to ignite the explosive mixture.

When flameproof equipment is interconnected, flameproof wiring must be used. This method is most valuable when high power levels are unavoidable but it is not acceptable for areas in which an explosive gas/air mixture may be continuously present or present for long periods.

For this reason Apollo fire detectors are made intrinsically safe rather than flameproof. Intrinsically safe equipment operates at such low power and with such small amounts of stored energy that it is incapable of causing ignition:

- in normal conditions
- with a single fault (for ib classification)
- with any combination of two faults (for ia classification)

In any of these conditions every component must remain cool enough not to ignite the gases for which it is approved.

## CLASSIFICATION OF HAZARDOUS AREAS

BS EN 60079-10:2003 defines a hazardous area as one in which explosive gas/air mixtures are, or may be expected to be, present in quantities such as to require special precautions for the construction and use of electrical apparatus.

The degree of risk in any area is a function of:

- the probability of an explosive mixture being present
- the type of gas which may be present
- the temperature at which a gas might ignite spontaneously

These are defined in Table 1, Zone Classification, Table 2, Subdivision of Group II Gases and Table 3, Temperature Classification, respectively.

Zone	Definition	Intrinsically Safe Equipment Approval Required
Zone 0	in which an explosive gas/air mixture is continuously present or present for long periods	Ex ia
Zone 1	in which an explosive gas/air mixture is likely to occur in normal operation	Ex ia or Ex ib
Zone 2	in which an explosive gas/air mixture is not likely to occur in normal operation and if it occurs it will exist only for a short time	Ex ia or Ex ib

XP95 detectors are approved to Ex ia and are suitable for all zones

**Table 1** Zone Classification



Representative Gas	Other Gases, Liquids, Vapours	Intrinsically Safe Equipment Approval Required
Hydrogen	Carbon Disulphide Acetylene	IIC
Ethylene	Butadiene, Formaldehyde, Diethylether	IIB or IIC
Methane	Acetaldehyde, Acetone, Benzene, Butane, Ethane, Hexane, Heptane, Kerosene, Naphtha, Petroleum, Styrene, Xylene	IIA or IIB or IIC

XP95 detectors are approved to IIC and may be used for all gases listed in PD IEC 60079-20:2000.

**Table 2** Subdivision of Group II Gases

Temperature Class	Maximum Surface Temperature (°C)	Gases, Liquids Vapours	Intrinsically Safe Approval Required
T6	85		T6
T5	100	Carbon Disulphide	T5 or T6
T4	135	Acetaldehyde, Diethylether, IsopropylNitrate	T4 or T5 or T6
T3	200	Hexane, Heptane	T3 or T4 or T5 or T6
T2	300	Butane, Butadiene, Ethylene	T2 or T3 or T4 or T5 or T6
T1	450	Acetone, Ammonia, Benzene, Carbon Monoxide, Ethane, Hydrogen, Methane, Propane, Ethylene	T1 or T2 or T3 or T4 or T5 or T6

XP95 detectors are approved to T5 at 40°C and are suitable for all gases listed in PD IEC 60079-20:2000.

**Table 3** Temperature Classification





*Intrinsically Safe Ionisation Smoke Detector*  
**Part no: 55000-540**

## XP95 INTRINSICALLY SAFE PRODUCTS

### XP95 I.S. Ionisation Smoke Detector

The sensing part of the detector consists of two chambers – an open, outer chamber and a reference chamber within.

Mounted in the reference chamber is a low-activity radioactive foil of Americium 241 which enables current to flow across the inner and outer chambers when the detector is powered up.

As smoke enters the detector, it causes a reduction of the current flow in the outer chamber and hence an increase in the voltage measured at the junction between the two chambers. This analogue voltage signal is converted to a digital signal by the electronic circuitry and transmitted to the control panel on interrogation. The micro-processor in the control equipment then compares the signal with stored data and initiates a pre-alarm or fire alarm as smoke density increases. When a fire condition exists, the panel instructs the detector to switch on its indicator LED.

Full details of the principles of operation and electrical description are published in the XP95 Engineering Product Guide. Information on the performance of XP95 in adverse environmental conditions is also given in this guide. XP95 I.S. detectors have the same operating characteristics as the standard versions.

### Safety Note

In the United Kingdom, ionisation smoke detectors are subject to the requirements of the Radioactive Substances Act 1993 and to the Ionising Radiations Regulations 1999 made under the provisions of the Health and Safety at Work Act 1974.

The detectors, independently tested by the National Radiological Protection Board (NRPB), conform to all the requirements specified in the 'Recommendations for ionisation smoke detectors in implementation of radiation standards' published by the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD) 1977.

### Technical Data – XP95 Intrinsically Safe Ionisation

Specifications are typical and given at 23° C and 50% relative humidity unless otherwise specified.

Technical Data for the I.S. ionisation detector is identical to that for the standard version, except for the information given below:

**Detector Part No:**  
55000-540.

**Base Part No:**  
45681-215.

**Supply Wiring:**  
Two wire supply, polarity sensitive.

**Terminal Functions:**  
L1: positive supply.  
L2: negative supply and remote LED negative.  
+R: remote LED positive.

**Notes:** 1. I.S. detectors are polarity sensitive.  
2. There is no requirement for series resistance on remote LED lines.  
3. The remote LED characteristic differs from XP95, see page 16.

**Supply Voltage:**  
14-22 Volts dc.

**Quiescent Current:**  
300µA.

**Operating Temperature:**  
–20°C to +40°C (T5).  
–20°C to +60°C (T4).

**Remote LED Current:**  
1mA (internally limited).

**Guaranteed Temperature Range:**  
(No condensation or icing)  
–20°C to +60°C.

**BASEEFA Certificate No:**  
BAS02ATEX1289.

**Classification:**  
E Ex ia IIC T5 (T4 at Ta ≤ 60°C)

There is no limit to the number of ionisation smoke detectors which may be installed in any fire protection system.

Storage regulations depend on local standards and legislation, but, in the UK, up to 500 detectors may be stored in any premises, although there are stipulations on storage facilities if more than 100 ionisation detectors are stored in one building.

At the end of their recommended working life of ten years, ionisation smoke detectors should be returned to Apollo for safe disposal or disposed of in an otherwise locally approved and environmentally safe manner. Please see "A guide to the care, maintenance and servicing of Apollo products", PP2055.

Guidance on storage and handling can be given by Apollo Fire Detectors and full details can be requested from:  
 Radioactive Substances Regulation Function  
 Environment Agency  
 Rio House, Waterside Drive  
 Aztec West, Almondsbury  
 Bristol BS32 4UD.  
 Outside the UK, please contact the relevant national agency.



*Intrinsically Safe Optical Smoke Detector*  
**Part no: 55000-640**

## XP95 I.S. Optical Smoke Detector

Optical smoke detectors incorporate a pulsing LED located in a labyrinth within the housing of the detector. The labyrinth is designed to exclude light from any external source. At an angle to the LED is a photo-diode which, in clear air conditions, does not receive light directly from the LED. The detector transmits a clear air signal to the control panel. When smoke enters the labyrinth, light is scattered onto the photo-diode and the signal to the panel increases. The signal is processed by the electronic circuitry and transmitted to the control equipment in exactly the same way as in the case of the ionisation smoke detector.

Full details of the principles of operation and the electrical description are published in the XP95 Engineering Product Guide. XP95 I.S. detectors have the same operating characteristics as the standard versions.

## Technical Data – XP95 Intrinsically Safe Optical

Specifications are typical and given at 23°C and 50% relative humidity unless otherwise specified.

Technical Data for the I.S. optical detector is identical to that for the standard version, except for the information below.

**Detector Part No:**  
55000-640.

**Base Part No:**  
45681-215.

**Supply Wiring:**  
Two wire supply, polarity sensitive.

**Terminal Functions:**  
L1: positive supply.  
L2: negative supply and remote LED negative.  
+R: remote LED positive.

**Notes:** 1. I.S. detectors are polarity sensitive.  
2. There is no requirement for series resistance on remote LED lines.  
3. The remote LED characteristic differs from XP95, see page 16.

**Supply Voltage:**  
14-22 Volts dc.

**Quiescent Current:**  
340µA.

**Operating Temperatures:**  
-20°C to +40°C (T5).  
-20°C to +60°C (T4).

**Remote LED Current:**  
1mA (internally limited).

**Guaranteed Temperature Range:**  
(No condensation or icing)  
-20°C to +60°C.

**BASEEFA Certificate No:**  
BAS02ATEX1289.

**Classification:**  
E Ex ia IIC T5 (T4 at Ta ≤ 60°C)



Intrinsically Safe Heat Detector **Part no: 55000-440**

## XP95 I.S. Heat Detector

The XP95 I.S heat detector is distinguishable from XP95 I.S smoke detectors by its low air-flow resistance case which allows good contact between the sensing thermistor and the surrounding air.

The device monitors temperature by using a single thermistor network which provides a voltage output proportional to the external air temperature. The voltage signal is processed and transmitted to the control equipment in the same way as in the case of the ionisation smoke detector.

Full details of the principles of operation and the electrical description are published in the XP95 Engineering Product Guide. XP95 I.S. detectors have the same operating characteristics as the standard versions.

## Technical Data – XP95 Intrinsically Safe Heat

Specifications are typical and given at 23°C and 50% relative humidity unless otherwise specified.

Technical data for the I.S. heat detector is identical to that for the standard version, except for the information below.

**Detector Part No:**  
55000-440.

**Base Part No:**  
45681-215.

**Supply Wiring:**  
Two wire supply, polarity sensitive.

**Terminal Functions:**

L1: positive supply  
L2: negative supply and remote LED negative  
+R: remote LED positive

**Notes:** 1. I.S. detectors are polarity sensitive.  
2. There is no requirement for series resistance on remote LED lines  
3. The remote LED characteristic differs from XP95, see page 16.

**Supply Voltage:**  
14-22 Volts dc

**Quiescent Current:**  
300µA.

**Operating Temperatures (ambient):**  
–20°C to +40°C (T5).  
–20°C to +60°C (T4).

**Remote LED Current:**  
1mA (internally limited)

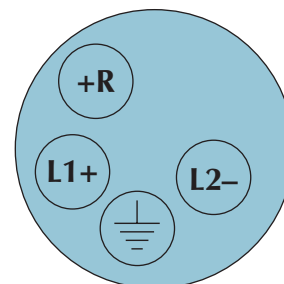
**Guaranteed Temperature Range:  
(No condensation or icing)**  
–20°C to +60°C

**BASEEFA Certificate No:**  
BAS02ATEX1289

**Classification:**  
E Ex ia IIC T5 (T4 at Ta ≤ 60°C)

## XP95 I.S. Base

The base for the intrinsically safe range is not identical with that for the standard range. This ensures that standard detectors cannot inadvertently be fitted to an intrinsically safe system. For full details of the XP95 address mechanism refer to the XP95 Engineering Product Guide PP1039.



**Fig. 1 Terminal Connections Part no: 45681-215**





Intrinsically Safe Manual Call Points

### XP95 I.S. Manual Call Points

When activated, the intrinsically safe call point not only interrupts the polling cycle to indicate to the control panel that it has been operated, but also reports its address. Thus an alarm and its location can be reported in less than 0.2 seconds.

Full details of the principles of operation and the electrical description are published in the XP95 Engineering Product Guide. XP95 I.S. manual call points have the same operating characteristics as the standard versions. They are available in two types of housing and in a number of versions.

The standard call point is based on the KAC waterproof model and is a red, break-glass call point, part no: 55000-940. This model is also available in other colours and a protective lift-up flap is available. Table 4 gives full details of KAC-based versions and part numbers.

Part No.	Colour	Type	IP Rating
55000-940	Red	Without flap	65
55000-942	Yellow	Without flap	65
55000-943	Yellow	With flap	65
55000-944	Blue/white	Without flap	65
55000-945	Blue/white	With flap	65

Table 4 KAC-based manual call points

For heavy-duty applications a robust manual call point based on a model by MEDC is available. This model is made of glass-reinforced polyester and may be ordered as a break-glass or push-button call point and in a variety of colours. Break-glass models may be supplied with or

without a stainless-steel protective flap. Table 5 gives part numbers and full details of MEDC-based call points.

MEDC-based break-glass units have two M20 cable entries on the bottom face of the back-box. Push button units have one M20 cable entry on the bottom face and one on the top face. Other cable entry configurations can be provided to special order.

Part No.	Colour	Type	IP Rating
55000-960	Red	Break-glass	66
55000-962	Yellow	Break-glass	66
55000-964	Blue	Break-glass	66
55000-966	Black/yellow stripes	Break-glass	66
55000-961	Red	Break-glass with flap	66
55000-963	Yellow	Break-glass with flap	66
55000-965	Blue	Break-glass with flap	66
55000-967	Black/yellow stripes	Break-glass with flap	66
55000-970	Red	Push-button	66
55000-971	Yellow	Push-button	66
55000-972	Blue	Push-button	66
55000-973	Black/yellow stripes	Push-button	66

Table 5 MEDC-based manual call points

### Technical Data – XP95 Intrinsically Safe Manual Call Points

Specifications are typical and given at 23°C and 50% relative humidity unless otherwise specified.

Technical data for the I.S. manual call point is identical to that for the standard version, except for the information below.

**Device Part No:**

See Tables 4 and 5.

**Supply Wiring:**

Two wire supply, polarity sensitive.

**Terminal Functions:**

L1: positive supply

L2: negative supply

Note: I.S. devices are polarity sensitive

**Supply Voltage:**

14-22 Volts dc

**Quiescent Current:**

230µA.

**Operating Temperature:**

-20°C to +40°C (T5).

-20°C to +60°C (T4).

**IP Rating:**

See Tables 4 and 5.

**BASEEFA Certificate No:**

BAS02ATEX1290

**Classification:**

E Ex ia IIC T5 (T4 at Ta ≤ 60°C)

**Dimensions:**

**Part No 55000-940** (KAC-based MCP): 124mm x 124mm x 60mm. Weight: approx. 400g

**Part No 5500-961** (MEDC-based MCP): 126mm x 120mm x 67mm (126mm x 120mm x 114mm - push button call point). Weight: approx. 1.20kg

## XP95 INTRINSICALLY SAFE COMMUNICATIONS PROTOCOL

The standard XP95 communications protocol is designed to be very robust and to give the maximum flexibility to designers of loop driver circuits. The current and voltage levels used are chosen to be well above noise levels and to operate in adverse conditions with the minimum of errors. The maximum voltage and current levels used are, however, outside the limits of intrinsically safe systems and it has been necessary to apply lower limiting values for both current and voltage in the I.S. range.

The voltage limitation arises because of the need for safety barriers. The barriers used with Apollo I.S. detectors are rated at 28 volts, the highest rating that is commercially available. These are used to limit the voltage inside the hazardous area to a (practical) maximum of about 26V DC. Although this is within the standard XP95 protocol specification, it is lower than that provided by most loop drivers.

The safety barrier is also responsible for the current limitation because the 28V barriers have a series resistance of at least 300 ohms. This resistance results in unacceptable voltage drops if the normal 20mA current pulses are used. It has therefore been necessary to reduce the amplitude of the current pulses to 10mA.

The differences between the standard protocol and the intrinsically safe are summarised in Table 6.

Parameter	XP95 Standard	XP95 I.S.
DC input voltage	17 – 28V	14 – 22V
Pulse voltage peak to peak	5 - 9V	5 - 9V
DC + pulse voltage	37V max	26.5V max
Current pulse amplitude	18 – 22mA	9 – 11mA
Input voltage polarity	polarity insensitive	L1 positive L2 negative

**Table 6** Protocol Variance Data

### XP95 Protocol Translator

In order to enable the use of standard control and indicating equipment in intrinsically safe systems, Apollo has developed a device to “translate” voltage levels from any loop driver operating within the XP95 limits to levels compatible with the I.S. requirements. The translator also “boosts” the current pulses returned by the I.S. detectors from 10mA to 20mA, thereby ensuring compatibility with standard loop driver thresholds.

The translator is a loop-powered device which draws a low quiescent current and is therefore transparent to both the loop driver and the I.S. detectors. Since the translator is used within the safe area, i.e., before the safety barrier, no



XP95 Protocol Translator **Part no: 55000-855** (single channel)  
**55000-856** (dual channel)

certification is necessary. The translator falls within the generic description “Safe Area Apparatus” on the certified system diagram.

The translator is housed in a moulded plastic enclosure which can be either clipped onto a standard 35mm DIN rail (DIN 46277) or panel mounted by using pull-out latches in the base. The translator is available in single-channel or dual-channel versions. Each channel should only be connected to a single intrinsically safe circuit through an appropriate safety barrier. Each channel is thus capable of supplying up to twenty XP95 I.S. devices.

A block schematic of the dual-channel translator, showing terminal designations, is given in Fig 2. In the single-channel unit the Channel 2 circuit is not fitted and terminal 12 is not used.

The input to the unit consists of the normal XP95 signal, that is a d.c. voltage on which is superimposed the protocol pulses.

### Translator Operation

The translator first regulates the d.c. level to 18V. The incoming protocol pulses are then sensed and re-generated and shaped with a fixed amplitude of 6V, and superimposed on the 18V d.c. output level.

The 10mA current pulses drawn by the I.S. devices are detected by the current pulse sensor whose output is used to switch the 10mA current sink across the input terminals synchronously with the device current pulse. The current boosting mechanism is inhibited during the protocol pulses so that when low resistance loads are connected to the translator output the protocol current is not boosted.

A separate current limiting circuit is incorporated in each channel which limits the maximum (peak) output current to 35mA. This level of current will ensure that safety barrier fuses are not blown in the event of a short-circuit on the barrier output.

When the dual-channel unit is used it must be remembered that the loop input, and the negative side of the output, is common to the two channels. It is not possible, therefore, to connect the two channels to different loops. Although the two channels have a common input, their outputs are individually

current-limited to 35mA (nominal). Hence, a short-circuit on one channel will cause the loop current to increase by 35mA and as long as the panel is able to support this load the second channel will continue to operate normally.

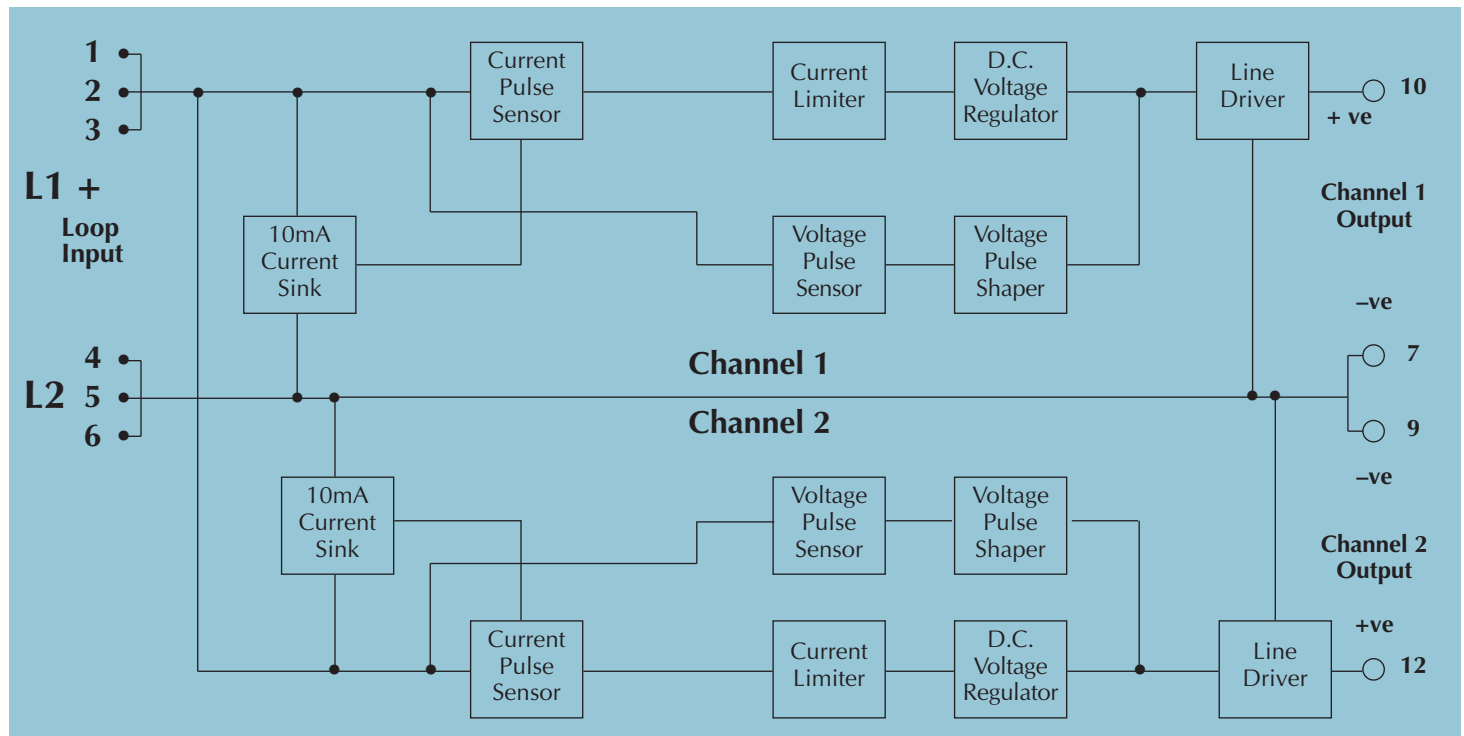


Fig. 2 Schematic Diagram – XP95 Protocol Translator

## Technical Data – XP95 Protocol Translator

Specifications are typical and given at 23°C and 50% relative humidity unless otherwise specified.

### Device Part No:

55000-855 (single channel).  
55000-856 (dual channel).

### Supply Wiring:

Two wire supply, polarity sensitive.

### Supply Voltage:

19 to 28 Volts.

### Modulation Voltage at Translator:

5 to 9 Volts peak to peak.

### Input Current (no load condition):

2mA max (dual channel).  
1mA max (single channel).

### Output Voltage: (to barrier)

16.5 to 19 Volts.

### Output Modulation Voltage: (to barrier)

5 to 6.5 Volts.

### Output Current: (to barrier)

0.2 to 30mA

### Input Pulse Current: (from barrier)

8 to 12mA.

### Output Pulse Current: (drawn from loop)

17 to 23mA.

### Operating Temperature:

-20°C to +60°C.

### Humidity: (no condensation)

10 to 95% relative humidity.

### Dimensions:

92.5 x 110 x 20mm.

### Weights:

Approx. 100g.

### Materials: (housing)

Makrolon 6485 V-0 rated to UL94.

## SYSTEM DESIGN

The design of an intrinsically safe fire detection system should only be undertaken by engineers familiar with codes of practice for detection systems and hazardous area electrical systems. In the UK the relevant standards are BS5839: Part 1 and BS EN 60079-14:2003 respectively.

The fire detection performance of the XP95 I.S. range is the same as that of its standard counterparts. Performance information given in the XP95 Engineering Product Guide is therefore applicable to the I.S. range.

The BASEEFA certification of the I.S. devices covers their characteristics as components of an intrinsically safe system and indicates that they can be used with a margin of safety in such systems. The precise way in which the system can be connected and configured is covered by an additional, "system" certification. The System Diagram, Z20982, see page 19, details cable parameters and permissible configurations of detectors, manual call points and safety barriers which are certified by BASEEFA. Any user wishing to install a system outside the parameters given on this system diagram cannot make use of the Apollo certification and should seek independent certification from a competent certification body.

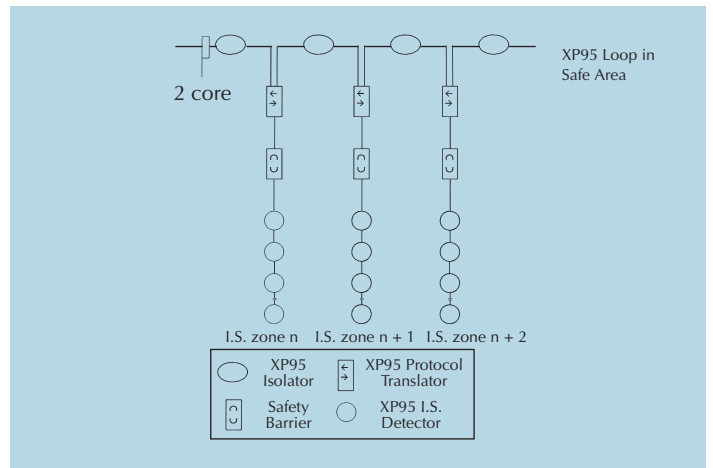
The BASEEFA system certificate number is Ex94C2444.

Any system installed within the parameters specified in Z20982 should be marked in accordance with BS EN 60079-25:2004. The marking should include at least "Apollo XP95 I.S. Fire Detection System, BASEEFA No Ex94C2444 SYST".

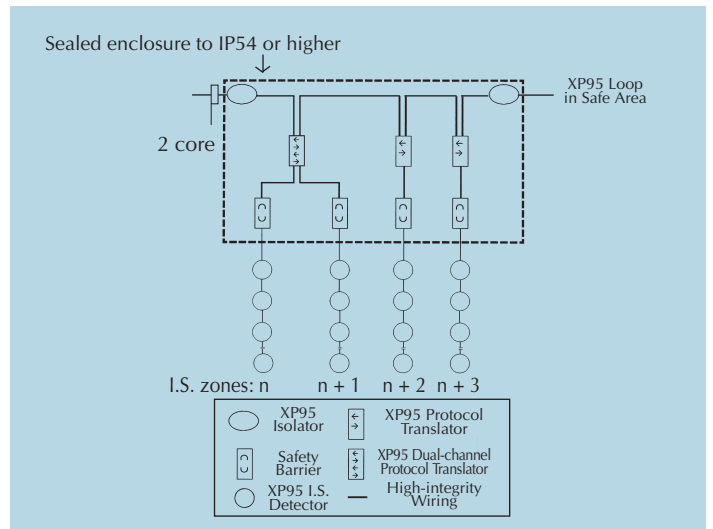
In safe area (standard) applications it will be normal practice to connect the wiring as a loop, with both ends terminated at the control panel. In the event of an open-circuit fault it is then possible to drive both ends simultaneously. In a hazardous area it is not possible to use a loop configuration because the potential to feed power from each end of the loop would double the available energy in the hazardous area and contravene the energy limitations of the I.S. certification. All XP95 I.S. circuits must therefore be connected as spurs from the safe area loop or as radial connections from the control panel.

It is recommended, for the highest system integrity, that each I.S. circuit be restricted to a single zone and that the connection from the safe area loop to the I.S. spur be protected on each side by XP95 isolators. The DIN-rail dual isolator (55000-802) is particularly suited to this application. This configuration, shown in Fig 3, will conform fully with the requirements of BS5839:Part 1 and with the European Guidelines DD CEN/TS 54-14:2004 since a single wiring fault will result in the loss of only one zone of detection.

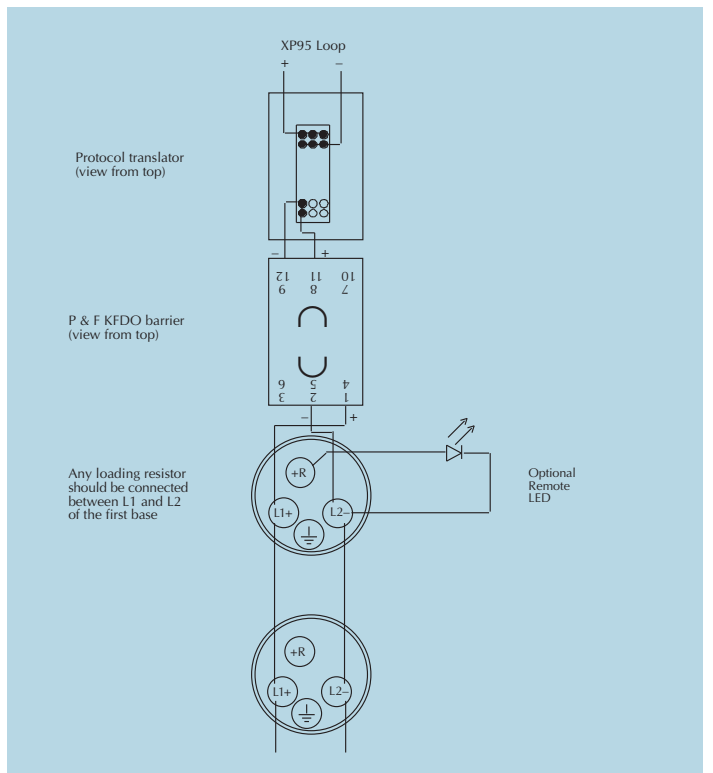
In certain circumstances it may be possible for the simpler configuration, shown in Fig 4, to be used. This arrangement may include single or dual-channel translators, housed, together with the critical wiring, in a robust mechanical enclosure. For further advice, please contact the Technical Sales department at Apollo.



**Fig. 3** Schematic Wiring Diagram of XP95 I.S. Circuit to BS5839



**Fig. 4** Schematic Wiring Diagram of XP95 I.S. Circuit using Dual-channel Protocol Translator



**Fig. 5** Detail of Schematic Wiring Diagram of I.S. Zone



## TYPES OF SAFETY BARRIER

The certified system configurations allow for three types of safety barrier, each of which has its own advantages and disadvantages. A brief outline of their characteristics is given below.

### Single Channel 28V/300 $\Omega$ Barrier

This is the most basic type of barrier and therefore the lowest in cost. Being passive devices, they also impose the minimum of restrictions on the operation of the fire detectors. Thus, single channel barriers are available either as positive or negative polarity where the polarity refers to the polarity of the applied voltage relative to earth. The significance of this is that one side of the barrier must be connected to a high-integrity (safety) earth. Although this earth connection has no effect on the operation of the XP95 I.S. devices and is not needed for their correct operation, it may not be acceptable to the operation of the control and indicating equipment. This is particularly true if the control equipment incorporates earth-leakage monitoring and even without this feature the earthing of the loop may cause unwanted cross-talk between loops.

If the earth connection is not acceptable then the A.C. or isolating barriers should be used.

### Star-connected A.C. Barrier

A.C. barriers are also passive devices and must still be connected to a high-integrity safety earth. However, they are designed to allow either positive or negative voltages with respect to earth and under normal conditions provide a connection to earth via a reverse-biased diode, rather than directly.

The disadvantage of this type of barrier is that the end-to-end resistance is nominally 1200 ohms compared with the 300 ohms of the single channel type. This high resistance results in an extra voltage drop in the circuit.

This type of barrier is not recommended for general use.

### Galvanically Isolated Barrier

Galvanically isolated barriers (also known as transformer isolated barriers) differ from conventional shunt zener barriers in that they provide electrical isolation between the input (safe area) and the output (hazardous area). This is achieved by the use of a D.C./D.C. converter on the input side which is connected to the hazardous area through a voltage-and power-limiting resistor/zener combination similar to a conventional barrier.

The galvanic isolation technique means that the circuit does not need a high integrity (safety) earth and that the intrinsically safe circuit is fully floating. Earth leakage problems for control and indicating equipment are therefore eliminated if this type of interface is used.

*Note: Although the circuit does not require a high-integrity earth, it is permissible to earth either side of the hazardous area circuit if required by other system considerations.*

Although galvanically isolated barriers are widely used with conventional fire detectors the pulse response of standard products has been too slow to allow their use in analogue addressable systems. Apollo has worked closely with Pepperl + Fuchs in the development of a special galvanically isolated barrier which freely transmits the XP95 protocol pulses without introducing severe voltage drops.

This interface is available as single or dual channel versions and is recommended for any application in which direct earth connections are not acceptable. The Pepperl + Fuchs type numbers are KFDO-CS-Ex1.54 and KFDO-CS-Ex2.54 for the single and dual channel devices respectively. Both versions are BASEEFA certified under certificate number BAS00ATEX7087. (The KFDO- types have replaced the earlier KHDO- types.)

The galvanically isolated barrier is a two-wire device which does not need an external power supply. Current drawn from the XP95 loop by the barrier itself is less than 2mA when loaded as specified by the manufacturer. The housing is a rail-mounted type identical to that used for the protocol translator.

## APPROVED SAFETY BARRIERS

The system certification includes a generic specification for barriers, two additional, individually approved barriers and two transformer isolated current repeaters (ie, barriers).

The generic specification is:

any shunt zener diode safety barrier certified by BASEEFA or any EEC approved certification body to

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having the following or lower output parameters:

$$U_z = 28V$$

$$I_{\text{max:out}} = 93.3mA$$

$$W_{\text{max:out}} = 0.67W$$

In any safety barrier used the output current *must be limited* by a resistor 'R' such that

$$I_{\text{max:out}} = \frac{U_z}{R}$$

A number of single-channel barriers meet this specification and examples are given below:

Supplier	Type	Polarity	Mounting
Pepperl & Fuchs Ltd 77 Ripponden Road Oldham Lancs OL1 4EL 0161 633 6431	Z728 Z828 Z428/Ex Z528/Ex	+ve -ve +ve -ve	DIN-rail DIN-rail DIN-rail/surface DIN-rail/surface
Measurement Technology Ltd Power Court Luton Bedfordshire LU1 3JJ 01582450 042	MTL728+ MTL7028+ MTL7128+	+ve +ve +ve	Busbar DIN-rail DIN-rail
Weidmüller (Klippon Microsystems) Ltd 1 Abbeywood Road Kings Hill West Malling Kent ME19 6EX 01732 844 444	S951 E951APOS E951ANEG	+ve (Cat No 980805) +ve (Cat No 980806) +ve -ve	DIN-rail/surface DIN-rail/surface DIN-rail/surface

**Table 7** 28V/300Ω single channel safety barriers

The two individually approved barriers are:

1. Pepperl & Fuchs Z978  
Star connected shunt zener diode safety barrier,  
28V/600Ω, dual channel. BASEEFA certificate no.  
Ex 93C2412, BAS01ATEX7005.
2. Measurement Technology Ltd. MTL 778  
Star connected shunt zener diode safety barrier,  
28V/600Ω. BASEEFA certificate no. Ex 832452,  
BAS01ATEX7202.

The transformer isolated current repeaters (barriers) are described on page 13.

## SAFETY EARTH

Single channel and star connected A.C. safety barriers must be connected to a high integrity earth by at least one and preferably two copper cables, each of cross sectional area of 4mm<sup>2</sup> or greater. The connection must be such that the impedance from the connection point to the main power system earth is less than one ohm.

Intrinsically safe circuits in the hazardous area should be insulated from earth and must be capable of withstanding a 500V RMS A.C. test voltage for at least one minute. When using armoured or copper sheathed cables, the armour or sheath is normally isolated from the safe area busbar.

## WIRING AND CABLE TYPES

It is not permitted to connect more than one circuit in the hazardous area to any one safety barrier and that circuit may not be connected to any other electrical circuit. Both separate and twin cables may be used. A pair contained in a type 'A' or 'B' multicore cable (as defined in clause 12.2.2 of BS EN 60079-14:2004) may also be used, provided that the peak voltage of any circuit contained within the multicore does not exceed 60V.

The capacitance and either the inductance or the inductance to resistance (L/R) ratio of the hazardous area cables must not exceed the parameters specified in Table 8. The reason for this is that energy can be stored in a cable and it is necessary to use cable in which energy stored is insufficient to ignite an explosive atmosphere.

To calculate the total capacitance or inductance for the length of cables in the hazardous area, refer to Table 9, which gives typical per kilometer capacitance and inductance for commonly used cables. (Note: All XP95 I.S. devices have zero equivalent capacitance and inductance.)

Group	Capacitance μF	Inductance mH	L/R Ratio μH/ohm
IIC	0.083	4.2	55
IIB	0.65	12.6	165
IIA	2.15	33.6	440

**Table 8** Limits for Energy Stored in Cables.

Cable Type	Core	Size mm <sup>2</sup>	Conductor resistance ohm/km/core	Inductance mH/km	Capacitance μF/km		Sheath Resistance ohm/km
					core to core	core to sheath	
MICC Pyrotenax light duty	2	1.5	12.1	0.534	0.19	0.21	2.77
MICC Pyrotenax heavy duty	2	1.5	12.1	0.643	0.13	0.17	1.58
Pirelli FP200	all	1.5	12.1		0.08	0.15	
PVC sheathed and insulated to BS 6004	all	1.5	12.1	0.77	0.09		

**Table 9** Examples of electrical characteristics of cables commonly used in fire protection systems.

## MAXIMUM LOADING OF I.S. CIRCUIT

Because of the finite resistance of the safety barrier, there will be a limit to the current drain which can be tolerated before the voltages on the circuit fall outside the specified limits for XP95 I.S. devices. Two components of the current drain must be considered, namely the standing current of the devices by themselves and the maximum drain caused by alarm LEDs being illuminated. The standing current of the devices can be calculated by taking the sum of the individual device currents on the circuit, as given in the section "Technical data" for each product.

The maximum number of LEDs that can be illuminated simultaneously should ideally be limited by the panel software. Because the LED load is often the limiting factor in determining the voltage drop, the later versions of the XP95 I.S. detectors are fitted with high efficiency LEDs. This has allowed a reduction from 2mA to 1mA in the LED current. It is important when fitting remote LEDs that high efficiency types are used.

Table 10 shows the maximum device standing current which can be supported for varying numbers of LEDs illuminated.

Max. number of LEDs illuminated	Max (total) device load (mA)
0	8.0
1	7.0
2	6.0
3	5.0
4	4.0
5	3.0

**Table 10** Maximum Loading (28V/300Ω single channel barrier).

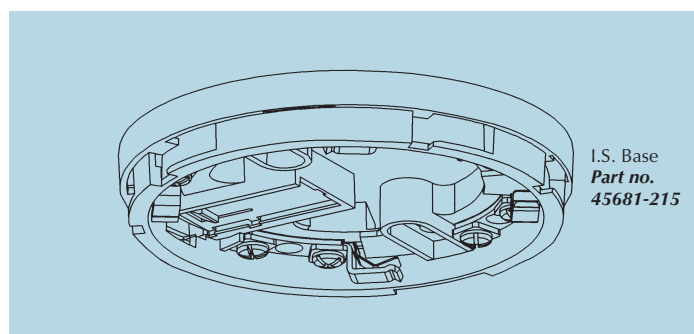
## INSTALLATION

It is important that the XP95 I.S. detectors are installed in such a way that all terminals and connections are protected to at least IP20 when the detector is in the base. Special care must be taken with the rear of the mounting base where live metal parts (rivets) may be accessible. Flush mounting of the base on a flat surface will provide the required degree of protection.

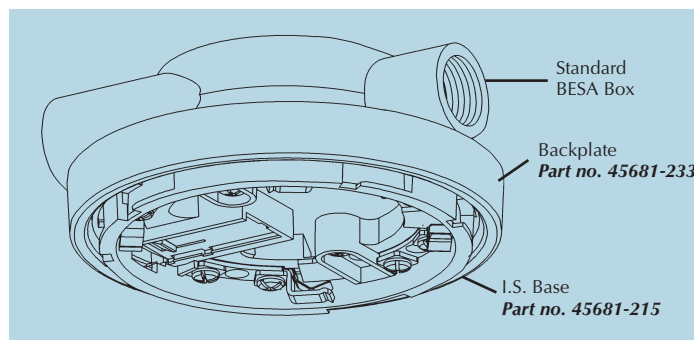
If the base is mounted on a conduit box (e.g. BESA box or similar) whose diameter is less than 85mm then the base should be fitted with a Series 60/XP95 Backplate (Apollo part number 45681-233). Use of the backplate will prevent access to the metal parts and will also protect the rear of the base from water ingress. The conduit box available from Apollo, part no. 45681-204, is also acceptable for mounting I.S. bases. Apollo also supply a range of deckhead mounting boxes. For more information, please refer to PP1089, bases and accessories brochure.

Fig. 6 shows permissible methods of installing intrinsically safe detector bases.

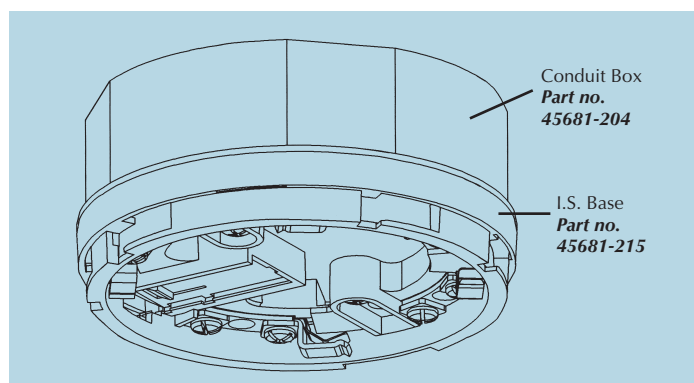
Note that the earth terminal in the base is provided for convenience where continuity of a cable sheath or similar is required. It is not necessary for the correct operation of the detector nor is it provided as a termination point for a safety earth.



Base fitted flush to soffit



Base with backplate and BESA Box



Base fitted to conduit box

**Fig. 6** Permissible methods of mounting I.S. bases

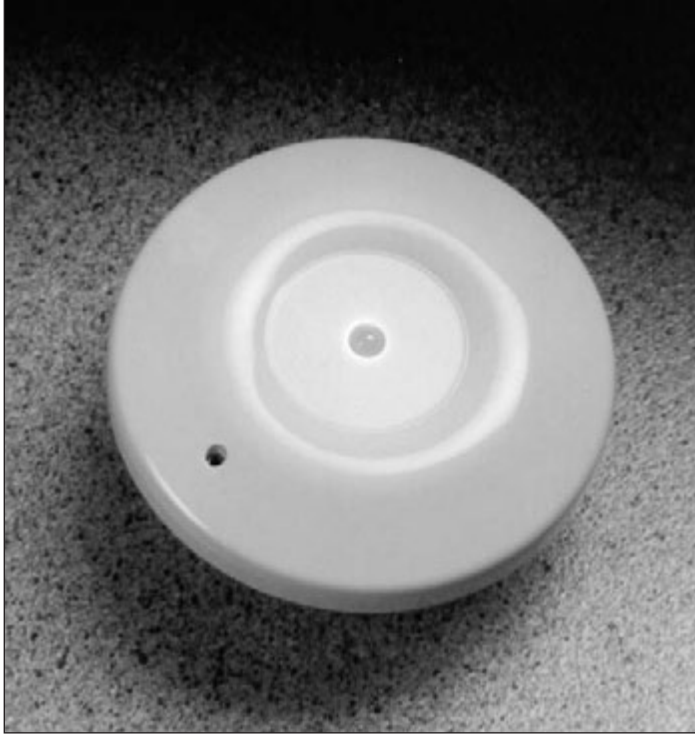
## REMOTE LED CONNECTION

A drive point is provided on each of the XP95 I.S. detectors for a remote LED indicator. For connection details see Fig. 5. The indicator must be a standard high-efficiency **red** LED and does not require a series limiting resistor since current is limited within the detector to approximately 1mA. The remote LED cannot, as in the standard XP95 range, be controlled independently from the integral LED since it is effectively connected in series with the integral LED. The benefit of this configuration is that illumination of the remote LED does not increase the current drawn from the loop.

The system certification allows for the use of any LED indicator having a surface area between 20mm<sup>2</sup> and 10cm<sup>2</sup> which covers all commonly used case styles from T1 (3mm) upwards but would exclude some miniature and surface mounted types. Additional requirements of the certification are that the LED and its terminations must be afforded a degree of protection of at least IP20 and must be segregated from other circuits and conductors as defined in BS EN 60079-14:2003.

The Apollo MiniDisc Remote Indicator (53832-070) is suitable.





MiniDisc Remote Indicator **Part no: 53832-070**

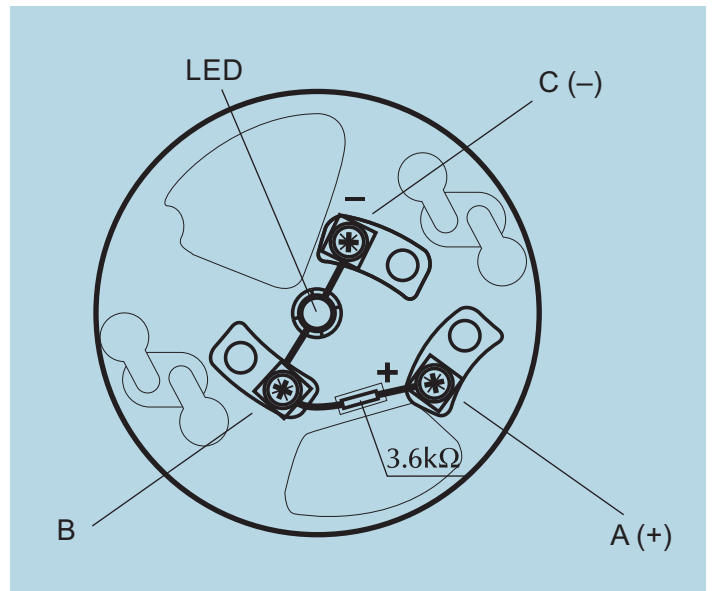
## MiniDisc Remote Indicator

The miniDisc remote indicator is only 20mm high and 80mm in diameter. It composes two parts—the base which is installed onto a wall or soffit and the lid which is fitted to the base with a bayonet lock.

An anti-tamper screw in the lid locks the unit together. A 1.5mm hexagonal driver, part number 29600-095, is available from Apollo.

Two pairs of keyholes are provided—one for 50mm and the other for 60mm fixing centres.

The MiniDisc Remote Indicator is polarity sensitive. Connect positive line to Terminal A or B and negative line to Terminal C. See Table 11.



### Detector Range Connections

Series 60, Series 65, Série 50	A & C
AlarmSense	B & C
Orbis	A & C
Series 60 Intrinsically Safe	A & C
XPlorer	A & C
XP95	A & C
Discovery	A & C
XP95 Intrinsically Safe	B & C
Voltage, A & C	5–36V
Max current, B & C	25mA, up to 40°C
Operating temperature	–10° to +60°C

**Table 11** MiniDisc Remote Indicator electrical connections.

## SERVICING

Servicing of I.S. fire detectors may be carried out only by a BASEEFA authorised body. In practical terms this means that Apollo XP95 I.S. fire detectors may be serviced only by Apollo at its factory. Servicing of the fire protection system should be carried out as recommended by the code of practice BS 5839: Part 1 or other local regulations in force. For more information on servicing Apollo detectors, please refer to the care, service and maintenance guide, PP2055.

## APPROVALS

XP95 I.S. detectors have been approved by LPCB to EN54 and the XP95 I.S. manual call point, part no 55000-940, is LPCB approved to BS5839 : Part 2. These products have also been approved for marine use by the following bodies:

American Bureau of Shipping

Bureau Veritas

Det Norske Veritas

Germanischer Lloyd

Lloyds Register of Shipping

Maritime and Coastguard Agency

Details of approvals held are available on request.

The product Certification Technical Files for the XP95 IS range are held by BASEEFA in accordance with the requirements of the ATEX Directive 94/9/EC. All detectors and manual call points are  marked.

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**Further information on Apollo detector ranges is available. Please quote the relevant PP number when ordering.**

PRODUCT	PUBLICATION NUMBER	PUBLICATION TYPE
XP95 Range	PP1039	Engineering Product Guide
	PP1040	General Sales Brochure
XP95 I.S.	PP1094	Sales Leaflet
Series 60 I.S.	PP2028	PIN Sheet
MiniDisc Remote Indicator	PP2074	PIN Sheet
Bases and Accessories	PP1089	Brochure
All	PP2055	A Guide to the care, service and maintenance of Apollo Products.
Deckhead Mounting Box	PP2040	PIN Sheet



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Certificate number 010



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