orbis™

intrinsically safe

- optical detector
- multisensor detector
- heat detector
- mounting base

product guide

Ex

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intrinsically safe

[IS] CONVENTIONAL DETECTORS

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 but one of the most common is intrinsic safety.

orbis™ IS is a range of conventional detectors which has been developed from the standard range of Orbis smoke and heat detectors.

Orbis IS is a range with modern styling and a TimeSaver IS base. It is electrically compatible with Apollo Series 60 intrinsically safe conventional detectors.

Orbis IS is a demonstration of Apollo's commitment to the market for high quality conventional detectors for use in small to medium size installations. In developing this range Apollo has put ease of installation and reliability in daily operation at the forefront of considerations. Orbis IS is manufactured in Apollo's factory near Portsmouth, England.

Orbis IS is suitable for use in marine and offshore applications as well as in land-based systems and has been tested and approved to the following standards:

European Standard EN54
Fire Detection and Fire Alarm Systems:
EN54–7: 2000
Optical smoke detector
EN54–7: 2000 & CEA 4021: 2003
Multisensor smoke detector
EN54–5: 2000
Heat detector

Electromagnetic Compatibility
EN61000-6-3
EN50130-4

ATEX-related standards:
BSEN60079–0:2004
IEC60079–0:2004
EN50020:2002 and EN/BSEN/IEC60079–26:2004

Marine type approval standards:
American Bureau of Shipping (ABS)
Rules for Building and Classing Steel Vessels 2006
Bureau Veritas (BV)
Rules for the Classification of Steel Ships 2005
Det Norske Veritas (DNV)
Standard for Certification No 2.4: 2004
Germanischer Lloyd (GL)
Rules for Classification and Construction 2003
Lloyds Register (LR)
LR Type Approval System
Marine & Coastguard Agency (MCA)
Merchant Shipping (Marine Equipment) Regulations 1999

Detectors have been declared as being compliant with the essential requirements of the EMC Directive 98/336/EEC, the Construction Products Directive 89/106/EEC and the ATEX Directive 94/9/EC. Intrinsic safety certificates for ATEX is Baseefa 06 ATEX 0007X and for IECEx IECEx BAS 06.0002X.

CE 0832 1180

LPCB UKAS QUALITY MANAGEMENT 007

Assessed to ISO 9001: 2000
Certificate number 010

Information in this guide is given in good faith, but Apollo Fire Detectors 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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Fax for all departments	**+44 (0)23 9249 2754**
Website	**www.apollo-fire.co.uk**

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Intrinsically Safe Range

Orbis IS comprises an optical smoke detector, a multisensor smoke detector, heat detector classes A1R, A1S, A2S, BR, BS, CR and CS and a standard electronics-free base.

Features of Orbis™ IS

Orbis IS incorporates entirely new designs, both mechanical and electronic. The aim has been to make installation quicker, enhance the reliability of detection and reduce the incidence of false alarms. Orbis IS features:

- modern styling
- TimeSaver Base® designed for fast installation and cable termination
- wide operating temperature range
- StartUp™ for fast commissioning
- DustDefy™ housing which limits ingress of dirt into detector
- new optical sensor for high reliability, reduced false alarm and insect related problem incidence
- new multisensor smoke detector for detecting fast-burning fires
- algorithms for transient rejection
- chamber designed to inhibit dirt penetration and thus reduce false alarms
- automatic drift compensation with DirtAlert® warning
- FasTest® which reduces the time taken to test detectors
- optional flashing LED to indicate normal operation
- SensAlert® is a safety feature. In the unlikely event of incorrect detector operation a yellow LED flashes once a second.

Choosing a detector: questions and answers

What types of detector are available in the Orbis IS range?

An optical detector, a multisensor smoke detector and seven classes of heat detector.

How can I tell the Orbis IS range from standard Orbis detectors?

Orbis IS detectors have a printed legend around the lid which identifies them and provides information as to their classification. They must be used with a certified Orbis IS mounting base which also bears a printed legend.

The Orbis IS range does not include an ionisation smoke detector. Why is this?

Ionisation detectors have been in use for many years as extremely reliable smoke detectors and standards such as EN54 recommend both ionisation and optical detectors as good general purpose smoke detectors.

Ionisation detectors, however, use a tiny radioactive foil. Although they are entirely safe to use, ionisation detectors are subject to strict regulations concerning transport, storage and disposal. Thus it is becoming increasingly difficult to transport and hence use ionisation detectors.

Advances in optical technology mean that optical or multisensor detectors can now be used where previously ionisation detectors would have been fitted.

Should I use optical detectors to detect smoke in all applications?

As stated, optical detectors have long been recommended as good general purpose smoke detectors. Laboratory tests have been carried out to compare the performance of optical detectors in the standard test fires described in the European standard EN54–7: 2000.

The results of these tests are given in Fig 1. The graph shows the acceptable response in terms of smoke density which is given as 'm' on the y axis. Detectors must respond before the end of test which is an 'm' value of 2. The performance of Orbis IS detectors is given as a solid line which shows how evenly the optical detectors respond to the test fires.

If detectors respond *too quickly* (the lower shaded portion of the graph) they may be too sensitive and hence likely to generate false alarms.

If detectors respond *too slowly* (the upper shaded portion) they are in danger of not changing to the alarm state before the end of test.

An even response in the centre is the ideal response.

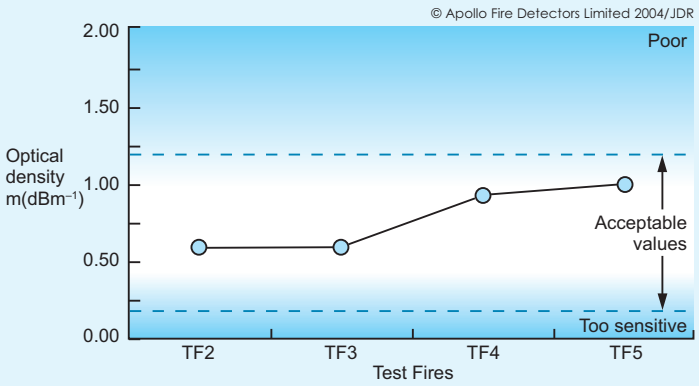

Fig.1 **Orbis Optical detector response to Test Fires**

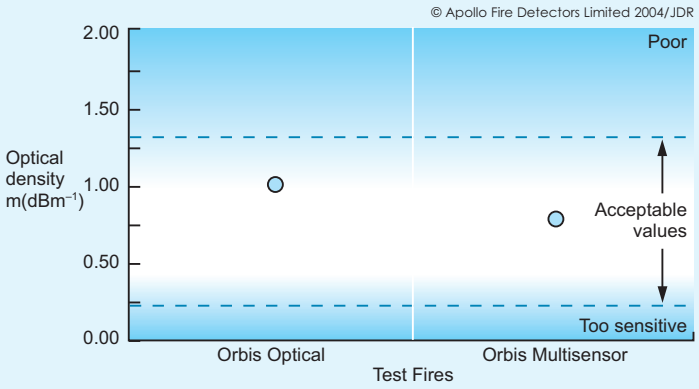

Fig.2 **Comparisons of response between Orbis Optical & Multisensor**

When would I use a multisensor?
Multisensor smoke detectors have a heat sensing element which makes them more sensitive if a fire develops heat as well as smoke. This speeds up the response of the detector in certain fires where heat is generated rapidly, for instance in test fire TF5, which is an open, flaming liquid fire in which n-heptane is burned.

Multisensor smoke detectors are recommended for open flaming fire risks.

If there is any doubt as to whether an optical detector or a multisensor smoke detector should be used it is wise to fit a multisensor smoke detector.

Where would there be a need to install heat detectors?
Heat detectors could be used if it is not possible to use smoke detectors. This will be the case where normal industrial processes produce substances which could be mistaken for smoke by a smoke detector, eg, flour mills, textile mills or chemical stores.

The type of substance encountered here would cause frequent false alarms if smoke detectors were fitted, so a heat detector is used instead.

How are heat detectors classified?
EN54–5: 2000 classifies heat detectors according to the ambient temperature in which they will be working. An additional classification may also be applied to heat detectors in that they may be tested as 'static' detectors (changing to alarm at a preset temperature) or 'rate-of-rise' (changing to alarm at a preset increase of temperature).

All Orbis IS heat detectors are tested and classified as either static or rate-of-rise.

So what is the best way to choose a heat detector?
To make things easier we have produced a flow chart which is shown on page 10.

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IS optical smoke detector

Where to use optical smoke detectors

Optical smoke detectors have always been recognised as good detectors for general use. They are regarded as particularly suitable for smouldering fires and escape routes.

The performance of Orbis IS optical detectors is good in black as well as in white smoke. In this respect Orbis IS is different from traditional optical smoke detectors which perform far better in white smoke than in black.

Orbis IS optical detectors are also designed to reduce significantly the incidence of false alarms through over-sensitivity to transient phenomena.

Orbis IS optical detectors are recommended for use as general purpose smoke detectors for early warning of fire in most areas.

orbis optical smoke detector

The sensing technology in the Orbis IS optical smoke detector is significantly different in design from previous optical detectors. A full description is given in the section 'How do Orbis optical smoke detectors work?' but the advantages of this system and its associated algorithms are:

- improved sensitivity to black smoke
- compensation for slow changes in sensitivity
- extra confirmation of smoke before alarm signal given

The algorithms are used to verify signals from the sensing chamber, to filter out transients and to decide when the detector should change to the alarm state.

All this combines to increase detection reliability and reduce false alarms.

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How does the orbis IS optical detector work?

The Orbis Optical IS smoke detector operates on the well established light scatter principle. The remarkable optical design of the Orbis IS optical smoke detector allows it to respond to a wide spectrum of fires.

The sensing chamber of the Orbis IS optical smoke detector contains an optical sensor which measures back-scattered light as well as the more usual forward-scattered light. Sensitivity to black smoke is greatly improved.

The detector is calibrated so that it is highly reliable in detecting fires but is much less likely to generate false alarms than ionisation smoke detectors.

The stability of the detector–high reliability, low false alarm rate–is further increased by the use of algorithms to decide when the detector should change to the alarm state. This removes the likelihood of a detector producing an alarm as a result of smoke from smoking materials or from another non-fire source.

The sensing chamber has been designed to keep out dust and other airborne contaminants.

Environmental performance

The operating temperature for instrinsically safe detectors is restricted by the gas temperature class. See adjacent column for full details

Classification

II 1G Ex ia IIC –40°C<Ta<+40°C(T5)
–40°C<Ta<+60°C(T4)

BASEEFA Certificate number

ATEX—Baseefa 06 ATEX 0007X
IECEx—IECEx BAS 06.0002X

technical data

All data is supplied subject to change without notice. Specifications are given at 23°C and 50% relative humidity unless otherwise stated.

DETECTOR OPERATING PRINCIPLES

Principle of detection:
Photo-electric detection of light scattered by smoke particles over a wide range of angles. The optical arrangement comprises an infra-red emitter with a prism and a photo-diode at 90° to the light beam with a wide field of view. The detector's microprocessor uses algorithms to process the sensor readings.

Sampling frequency:
Once every 4 seconds

ELECTRICAL

Supply voltage:
14—28V DC

Supply wiring:
2 wires, polarity sensitive

Polarity reversal:
Not allowed

Power-up time:
<20 seconds

Minimum 'detector active' voltage: 12V

Switch-on surge current at 24V:
105µA

Average quiescent current at 24V:
85µA

Alarm load:
325Ω in series with a 1.0V drop

Minimum holding voltage:
5V

Minimum voltage to light alarm LED:
6V

Alarm reset voltage:
<1V

Alarm reset time:
1 second

Remote output LED (–) characteristic:
4.7kΩ connected to negative supply

MECHANICAL

Material:
Detector and base moulded in white polycarbonate.

Alarm Indicator:
Integral indicator with 360° visibility (See Table 1 on page 14 for details of flash rate)

Dimensions and weight of detector:
100mm diameter x 42mm
Weight, 75g

Dimensions and weight of detector in base:
100mm diameter x 50mm
Weight, 135g

ENVIRONMENTALAL

Operating and storage temperature
–40°C to +70°C
Operating temperature is restricted by the intrinsic safety gas classification.
Class T5: –40°C to +40°C
Class T4: –40°C to +60°C
The detctor must be protected from conditions of condensation or icing.

Humidity:
0% to 98% relative humidity (no condensation)

Wind speed:
Unaffected by wind

Atmospheric pressure:
Insensitive to pressure

IP rating to EN 60529: 1992*:
23D

Electromagnetic Compatibility:
The detector meets the requirements of BS EN 61000-6-3 for emissions and BS EN50 130-4 for susceptibility.

**The IP rating is not a requirement of EN 54–7: 2000 since smoke detectors have to be open in order to function. An IP rating is therefore not as significant as with other electrical products.*

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IS multisensor smoke detector

Where to use multisensor smoke detectors

Multisensor smoke detectors are recognised as good detectors for general use but are additionally more sensitive to fast burning, flaming fires–including liquid fires–than optical detectors.

They can be readily used instead of optical smoke detectors but should be used as the detector of choice for areas where the fire risk is likely to include heat at an early stage in the development of the fire.

As with Orbis IS optical smoke detectors the increased reliability of detection is combined with high immunity to false alarms.

orbis IS multisensor smoke detector

The multisensor smoke detector is a thermally enhanced smoke detector and as such will not give an alarm from heat alone. It is a development of the Orbis IS optical detector described in the previous chapter and goes further in its capabilities of fire detection.

How does the orbis IS multisensor detector work?

The optical sensor is identical to the one in the Orbis IS optical detector. Its sensitivity is, however, influenced by a heat sensing element which makes the detector more responsive to fast-burning, flaming fires.

It should be noted that the detector is a smoke detector. Although the Orbis IS multisensor relies on both smoke and heat sensors it is not possible to switch from smoke detection to heat detection.

Environmental performance

The environmental performance of the multisensor detector is the same as that of the Orbis IS optical smoke detector.

Also classification and BASEEFA certificate number are the same as for the optical smoke detector.

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technical data

All data is supplied subject to change without notice. Specifications are given at 23°C and 50% relative humidity unless otherwise stated.

DETECTOR OPERATING PRINCIPLES

Principle of detection:
Photo-electric detection of light scattered by smoke particles over a wide range of angles. The optical arrangement comprises an infra-red emitter with a prism and a photo-diode at 90° to the light beam with a wide field of view. The detector's microprocessor uses algorithms to process the sensor readings. The heat sensing element increases the sensitivity of the detector as the temperature rises.

Sampling frequency:
Once every 4 seconds

ELECTRICAL

Supply voltage:
14—28V DC

Supply wiring:
2 wires, polarity sensitive

Polarity reversal:
Not allowed

Power-up time:
<20 seconds

Minimum 'detector active' voltage: 12V

Switch-on surge current at 24V:
105µA

Average quiescent current at 24V:
85µA

Alarm load:
325Ω in series with a 1.0V drop

Minimum holding voltage:
5V

Minimum voltage to light alarm LED:
6V

Alarm reset voltage:
<1V

Alarm reset time:
1 second

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Remote output LED (–) characteristic:
4.7kΩ connected to negative supply

MECHANICAL

Material:
Detector and base moulded in white polycarbonate.

Alarm Indicator:
Integral indicator with 360° visibility (See Table 1 on page 14)

Dimensions and weight of detector:
100mm diameter x 50mm
Weight, 80g

Dimensions and weight of detector in base:
100mm diameter x 60mm
Weight, 140g

ENVIRONMENTAL

Operating and storage temperature
–40°C to +70°C
Operating temperature is restricted by the intrinsic safety gas classification.
Class T5: –40°C to +40°C
Class T4: –40°C to +60°C
The detctor must be protected from conditions of condensation or icing.

Humidity:
0% to 98% relative humidity (no condensation)

Wind speed:
Unaffected by wind

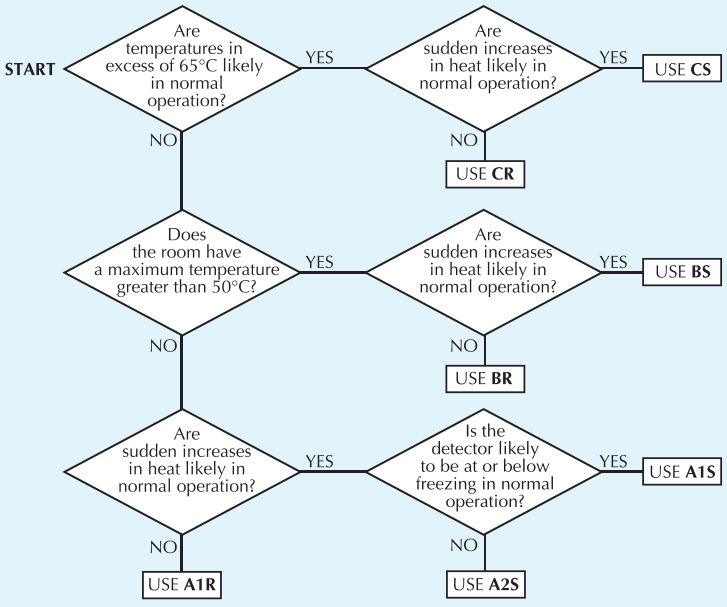
Atmospheric pressure:
Insensitive to pressure

IP rating to EN 60529: 1992*:
23D

Electromagnetic Compatibility:
The detector meets the requirements of BS EN 61000-6-3 for emissions and BS EN50 130-4 for susceptibility.

**The IP rating is not a requirement of EN 54–7: 2000 since smoke detectors have to be open in order to function. An IP rating is therefore not as significant as with other electrical products.*

heat detector



MAXIMUM APPLICATION TEMPERATURE	
A1R, A1S, A2S	50°C
BR, BS	65°C
CR, CS	80°C

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Fig.3 **Choosing a heat detector**

Where to use heat detectors

Heat detectors are used in applications where smoke detectors are unsuitable. Smoke detectors are used wherever possible since smoke detection provides earlier warning of fire than heat detection. There are, however, limits to the application of smoke detectors and these are described in the section 'Choosing a detector' on page 4.

Heat detectors may be used if there is a danger of nuisance alarms from smoke detectors.

orbis IS heat detector

The Orbis IS range incorporates seven heat detector classes to suit a wide variety of operating conditions in which smoke detectors are unsuitable.

The European standard EN54-5:2000 classifies heat detectors according to the highest ambient temperature in which they can safely be used without risk of false alarm. The classes are identified by the letters A to G. (Class A is subdivided into A1 and A2.) In addition to the basic classification, detectors may be identified by a suffix to show that they are rate-of-rise (suffix R) or fixed temperature (suffix S) types.

All heat detectors in the Orbis IS range are tested as static or rate-of-rise detectors and are classified as A1R, A1S, A2S, BR, BS, CR and CS.

Choosing the correct class of heat detector

Heat detectors have a wide range of response characteristics and the choice of the right type for a particular application may not always seem straightforward. It is helpful to understand the way that heat detectors are classified as explained earlier and to memorise a simple rule: use the most sensitive heat detector available consistent with avoiding false alarms.

In the case of heat detectors it may be necessary to take an heuristic approach, ie, trial and error, until the best solution for a particular site has been found. The flowchart (Fig. 3) will assist in choosing the right class of heat detector.

If the fire detection system is being designed to comply with BS 5839–1: 2002 heat detectors should be installed at heights of less than 12 metres with the exception of class A1 detectors, which can be installed at heights up to 13.5 metres.

How do orbis IS heat detectors work?

Orbis IS heat detectors have an open-web casing which allows air to flow freely across a thermistor which measures the air temperature every 2 seconds. A microprocessor stores the temperatures and compares them with pre-set values to determine whether a fixed upper limit–the alarm level–has been reached.

In the case of rate-of-rise detectors the microprocessor uses algorithms to determine how fast the temperature is increasing.

Static heat detectors respond only when a fixed temperature has been reached. Rate-of-rise detectors have a fixed upper limit but they also measure the rate of increase in temperature. A fire might thus be detected at an earlier stage than with a static detector so that a rate-of-rise detector is to be preferred to a static heat detector unless sharp increases of heat are part of the normal environment in the area protected by the heat detector.

Environmental performance

The environmental performance is similar to that of the Orbis IS optical smoke detector but it should be noted that heat detectors are designed to work at particular ambient temperatures (see Fig 3).

Also classification and BASEEFA certificate number are the same as for the optical smoke detector.

technical data

All data is supplied subject to change without notice. Specifications are given at 23°C and 50% relative humidity unless otherwise stated.

DETECTOR OPERATING PRINCIPLES

Principle of detection:
Measurement of heat by means of a thermistor.

Sampling frequency:
Once every 2 seconds

ELECTRICAL

Supply voltage:
14—28V DC

Supply wiring:
2 wires, polarity sensitive

Polarity reversal:
Not allowed

Power-up time:
<20 seconds

Minimum 'detector active' voltage: 12V

Switch-on surge current at 24V:
105µA

Average quiescent current at 24V:
80µA

Alarm load:
325Ω in series with a 1.0V drop

Minimum holding voltage:
5V

Minimum voltage to light alarm LED:
6V

Alarm reset voltage:
<1V

Alarm reset time:
1 second

Remote output LED (–) characteristic:
4.7kΩ connected to negative supply

MECHANICAL

Material:
Detector and base moulded in white polycarbonate.

Alarm Indicator:
Integral indicator with 360° visibility (See Table 1 on page 14 for details of flash rate)

Dimensions and weight of detector:
100mm diameter x 42mm height, 70g

Dimensions and weight of detector in base:
100mm diameter x 50mm height, 130g

ENVIRONMENTALAL

Operating and storage temperature
–40°C to +70°C
Operating temperature is restricted by the intrinsic safety gas classification.
Class T5: –40°C to +40°C
Class T4: –40°C to +60°C
The detector must be protected from conditions of condensation or icing.

Humidity:
0% to 98% relative humidity (no condensation)

Wind speed:
Unaffected by wind

Atmospheric pressure:
Insensitive to pressure

IP rating to EN 60529: 1992*:
23D

Electromagnetic Compatibility:
The detector meets the requirements of BS EN 61000-6-3 for emissions and BS EN50 130-4 for susceptibility.

*The IP rating is not a requirement of EN54–5 : 2000 since most heat detectors feature open-web casings to allow air to flow freely over the thermistor. An IP rating is therefore not as significant as with other electrical products.

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Orbis IS Base®

Orbis IS Adaptor

Orbis IS Adaptor

An adaptor is available which enables Orbis detector heads to be fitted to existing Series 60 IS bases in order to upgrade systems with minimal disruption.

The existing system should conform to ATEX Certificate No. Ex97D2054 SYST. The IS Adaptor is distinguished by the markings "part of instrinsically safe fire detector Baseefa06ATEX0007X".

installing orbis IS

Orbis IS has been designed to make installation fast and simple. Fig 4 shows the TimeSaver Base as it is seen from the installer's point of view.

The E-Z fit fixing holes are shaped to allow a simple three-step mounting procedure:

- Fit two screws to the mounting box or surface
- Place the Orbis IS base over the screws and slide home
- Tighten the screws

The base offers three fixing centres at 51, 60 and 72mm.

A guide on the base interior indicates the length of cable to be stripped. Five terminals are provided for the cables, four being grouped together for ease of termination.

The terminals are:

- positive IN
- positive OUT
- negative IN and OUT (common terminal)
- remote LED negative connection
- functional earth (screen)

The terminal screws are captive screws and will not fall out of the terminals. The base is supplied with the screws unscrewed in order to avoid unnecessary work for the installer.

The end-of-line resistor should be connected between the OUT+ and COM– terminals.

If it is required that all detectors be fitted with their LEDs facing the same direction the bases must be fitted to the ceiling observing the marking on the exterior which indicates the position of the LED.

The bases may be connected as shown in Fig 5 where remote LEDs, if required, are connected to the associated base.

Fig 6 shows how to connect one remote LED to more than one base so that an alarm in any of the detectors connected will switch the remote LED.

fitting orbis detector heads

When the bases have been installed and the system wiring tested, the detector circuits can be populated.

Two methods are suggested:

1. Apply power and fit the detectors one by one, starting at the base nearest the panel and working towards the end of the circuit. As each detector is powered up it will enter 'StartUp' and flash red (see Table 1 on page 14). If the LED does not flash, check the wiring polarity on the base and ensure there is power across IN+ and COM–. If the LED is flashing yellow the detector is not operating correctly and may require maintenance or replacing (see DirtAlert and SensAlert® below and the section 'Servicing' on page 18).
2. Fit all detectors to the circuit, apply power and check detectors by observing the LED status of each device. The StartUp feature lasts for 4 minutes so it may be necessary to reset or de-power the circuit to allow all detectors to be observed. The LED status is the same as method 1.

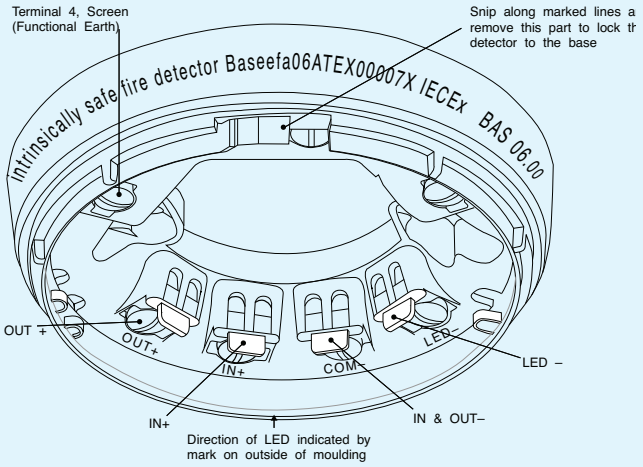

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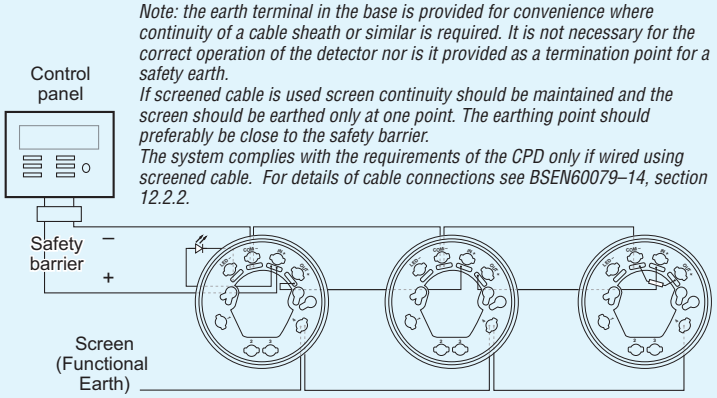
Fig.4 **TimeSaver IS Base®**



Note: 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.
If screened cable is used screen continuity should be maintained and the screen should be earthed only at one point. The earthing point should preferably be close to the safety barrier.
The system complies with the requirements of the CPD only if wired using screened cable. For details of cable connections see BSEN60079–14, section 12.2.2.

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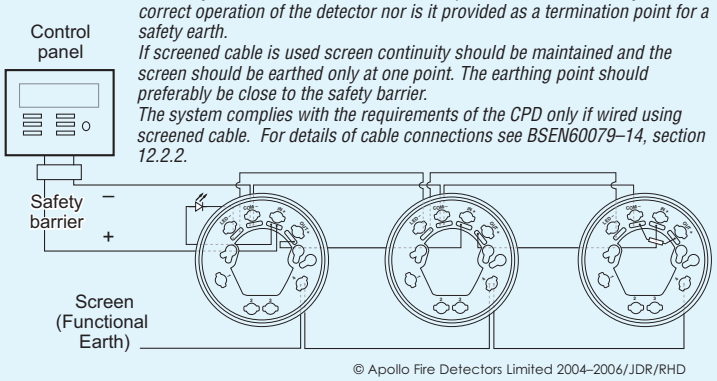
Fig.5 **Base wiring diagram**



Note: 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.
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Fig.6 **3 bases wired with a common LED**

orbis features: LED status

Feature	Description of Feature	Red LED Status	Yellow LED Status
StartUp™	Confirms that the detectors are wired in the correct polarity	Flashes aonce per second	No Flash
FasTest®	Maintenance procedure, takes just 4 secondsto functionally test and confirm detectors arefunctioning correctly	Flashes once per second	No Flash
DirtAlert™	Shows that the drift compensation limit has been reached	No Flash	Flashes once per second in StartUp (Stops flashing when StartUp finishes)
SensAlert®	Indicates that the sensor is not operating correctly	No Flash	Flashes every 4 seconds (Flashes once per second in StartUp)
Normal Operation	At the end of StartUp and FasTest (without flashing LED as standard)	No Flash	No Flash
Flashing LED Version	Detector's red LED flashes in normal operation (at the end of FasTest)	Flashes every 4 seconds	No Flash

Table 1

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. The relevant standards are BS5839: Part 1, BS EN 60079-14:2003 respectively.

The fire detection performance of the Orbis I.S. range is the same as that of its standard counterparts but some electrical parameters are different. Please use the technical data given in this guide for Orbis IS devices. Performance information given in the Orbis Product Guide is applicable to the Orbis 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.

types of safety barrier

The certified system configurations allow for two 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/300Ω 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 Orbis IS devices and is not needed for their correct operation, it may not be acceptable to the operation of the control and indicating equipment. If the earth connection is not acceptable then the isolating barriers should be used.

Galvanically Isolated Barrier

Galvanically isolated barriers. These are also referred to as "transformer isolated d.c. repeaters", "isolating interfaces" and "transformer isolated current repeaters". They 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.

Galvanically isolated barriers are available as single or dual channel versions and are recommended for any application in which direct earth connections are not acceptable. Table 3 shows details of available barriers. The galvanically isolated barrier is a two-wire device which does not need an external power supply.

approved safety barriers

The system certification includes a generic specification for barriers.

The generic specification is:

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

[Ex ia] IIC

having the following or lower output parameters:

U_Z = 28V
I max:out = 93.3mA
W max:out = 0.67W

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

$$\text{I max:out} = \frac{U_Z}{R}$$

A number of shunt zener diode barriers meet this specification and examples are given below:

Manufacturer	Type	Polarity	Mounting
Pepperl & Fuchs	Z728	+ve	DIN-rail
Pepperl & Fuchs	Z828	–ve	DIN-rail
Pepperl & Fuchs	Z428/Ex	+ve	DIN-rail/surface
Pepperl & Fuchs	Z528/Ex	–ve	DIN-rail/surface
MTL	MTL728+	+ve	Busbar
MTL	MTL7028+	+ve	DIN-rail
MTL	MTL7128+	+ve	DIN-rail

Table 2 28V/300Ω single channel safety barriers

Suitable transformer isolated current repeaters (galvanic barriers) are shown in Table 3.

Manufacturer	Type see table on AZ20984	No of channels	Certificate no
Pepperl & Fuchs	KFDO CS EX 1.51P	1	BAS00ATEX 7087
MTL	MTL4061	2	Ex94C2040X
MTL	MTL5061	2	Ex94C2040X

Table 3 Transformer isolated (galvanic) barriers

safety earth

Shunt zener diode 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 4mm² 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 AC 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.

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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 4. 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 5, which gives typical per kilometre capacitance and inductance for commonly used cables. (Note: All Orbis IS devices have zero equivalent capacitance and inductance.)

DIN-rail interface enclosures

Two DIN-rail interface enclosures are available for housing intrinsically safe (IS) barriers. The enclosures have a frosted polycarbonate lid through which LEDs can be viewed. A multi-purpose label, that features a section for use with IS systems is supplied. Part nos 29600-239 (2-way enclosure); 29600-240 (8-way enclosure).

intrinsically safe circuits

When using these enclosures with intrinsically safe systems, it is important that segregation be provided between the IS and non-IS circuits. A distance of at least 50mm must be preserved between live conducting parts of IS and other circuits.

If the enclosure is used as part of an IS circuit, then it must always be installed inside the safe area. **Never install these enclosures in the hazardous area.**

maximum loading of IS 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 Orbis I.S. devices. The system certification allows up to 20 Orbis IS detectors to be connected to a single barrier circuit with an end-of-line resistor of not less than 1.8kΩ. However, it must be ensured that the voltage available at each detector is above the minimum specified in the quiescent condition. It is also important to ensure that the alarm load is suitable for the control and

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 4 Limits for Energy Stored in Cables.

Cable Type	Core	Size mm²	Conductor resistance ohm/km/core	Inductance mH/km	Capacitance µF/km core to core	core to sheath	Sheath Resistance ohm/km
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 5 Examples of electrical characteristics of cables commonly used in fire protection systems.

indicating equipment. The system certification also allows the use of remote LED indicators. These may be connected to individual detectors or may use a connection common to two or more detectors as shown in Fig. 6.

installation

It is important that the Orbis I.S. detectors be 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 may be accessible. Flush mounting of the base on a flat surface will provide the required degree of protection.

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.

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.

remote led connection

A drive point is provided on each of the Orbis 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 by the detectors.

The system certification allows for the use of any LED indicator having a surface area between 20mm^2 and 10cm^2 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) may be used with Orbis IS detectors.

mini disc remote indicator

The MiniDisc remote indicator is only 20mm high and 80mm in diameter. It comprises two parts–the base which is installed onto a wall or soffit and the lid which is fitted to the base with a bayonet fitting.

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 B and negative line to Terminal C.

Part No. 53832-070

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servicing

Servicing of IS fire detectors may be carried out only by a BASEEFA authorised body. In practical terms this means that Apollo Orbis IS fire detectors may be serviced only by Apollo at its factory. Servicing of the fire detection system should be carried out as recommended by the code of practice BS 5839: Part 1 or other local regulations in force.

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

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