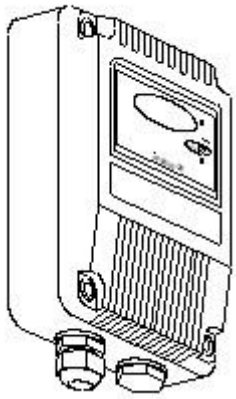
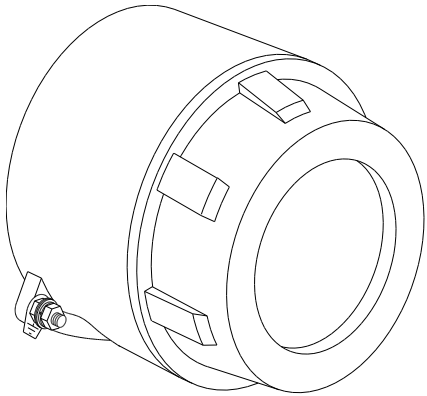
Talentum
Flame Detector
User Guide





This user guide covers all FM Approved Talentum 16000 series flame detectors:

- 16589 – IR3 standard
- 16591 – UV/IR2 standard
- 16519 – IR3 Exd
- 16549 – IR3 Exd SS (Stainless Steel enclosure)
- 16219 – IR3 Exd ET (Extended Temperature)

Models 16519, 16549 and 16219 are suitable for installation into potentially explosive/ hazardous environments.

The flame detector is designed for use where open flaming fires may be expected. It responds to the light emitted from flames during combustion. The detector discriminates between flames and other light sources by responding only to particular optical wavelengths and flame flicker frequencies. This enables the detector to avoid false alarms due to factors such as flickering sunlight.

The diagrams in this user guide show the standard housing, but the advice and instructions are applicable to all models, unless otherwise stated.

Theory of Operation

The detector responds to low-frequency (1 to 15 Hz) flickering IR radiation emitted from flames during combustion.

IR flame flicker techniques enable the sensor to operate through a layer of oil, dust, water vapour, or ice.

Most IR flame sensors respond to 4.3µm light emitted by hydrocarbon flames. By responding to 1.0 to 2.7µm light emitted by every fire, all flickering flames can be detected. Gas fires not visible to the naked eye e.g. hydrogen may also be detected.

The dual (IR^2) and triple (IR^3) IR photoelectric detectors, responding to neighbouring IR wavelengths, enable it to discriminate between flames and spurious sources of IR radiation.

The combination of filters and signal processing allows the sensor to be used with little risk of false alarms in difficult situations characterised by factors such as flickering sunlight.

The detector views the flame at particular optical wavelengths. The more differing optical wavelength signals available the better the detector is at discriminating between flames and false optical sources.
So although IR^3 and UV/IR^2 detectors can detect similar sized flames at the same distances, the UV/IR^2 detector will give the greatest optical false signal immunity as it has the most diverse selection of optical wavelengths.
The detector processes the optical signal information to determine if a flame is in view. This is achieved by comparing the signals with known flame characteristics stored within the detector.

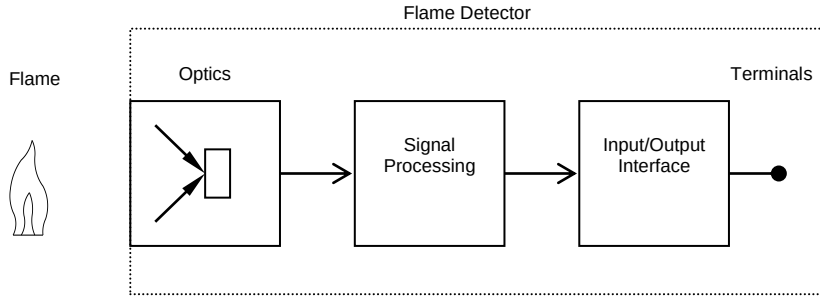


Fig 7 Block Diagram of the Detector Signal Processing

If the detector has interpreted the optical signals as a fire then it produces the required output responses. This will be in the form of supply current changes and the illumination of the red fire LED. The fire relay will also change state if required.
The detector is constantly checking itself to ensure it is performing correctly. If a fault occurs the detector supply current will reduce, the fault relay will de-energise and the green supply LED will no longer illuminate constantly.

Application for Flame Detectors

Flame detectors are used when detection is required to be:

- Unaffected by convection currents, draughts or wind
- Tolerant of fumes, vapours, dust and mist
- Responsive to a flame more than 25m away
- Fast reacting

The detector is capable of detecting the optical radiation emitted by burning material even non-carbonaceous materials. e.g. Hydrogen
Numerous other potential fire sources can be detected such as

Liquids	**Solids**	**Gases**
● Aviation Fuels (kerosene)	● Coal	● Butane
● Ethanol	● Cotton	● Fluorine
● Methylated Spirits	● Grain & Feeds	● Hydrogen
● n-Heptane	● Paper	● Natural Gas
● Paraffin	● Refuse	● Off Gas
● Petrol (gasoline)	● Wood	● Propane

Refer to page 18 for FM-Approved fuels, size of fire and distance from detector.

Typical applications examples are:

● Agriculture	● Coal handling plant	● Pharmaceutical
● Aircraft hangars	● Engine rooms	● Power plants
● Atria	● Generator rooms	● Textiles
● Automotive industry	● Metal fabrication	● Transformer stations
- spray booths	● Paper manufacture	● Waste handling
- parts manufacture	● Petrochemical	● Woodworking

Applications and Locations to Avoid:

● ambient temperatures above 55°C	● large IR sources – heaters, burners, flares
● close proximity to RF sources	● obstructions to field of view
● exposure to severe rain and ice	● sunlight falling directly on the detector optics
● large amounts of flickering reflections	● spot lighting directly on the detector optics

Refer to page 18 for the FM-Approved False Stimuli Response performance.

Quantities Required and Positioning of Detectors

The number of detectors required and their position depends on:

- the anticipated size of the flame
- the distance of the flame from the detector
- the angle of view of the flame detector

The flame detector is designed to detect flames from fuel sources listed on page 18, at a distance of 25m.

In fact, the flame detector will detect fires at greater distances, but the flame size at such distances needs to be proportionally greater in order to be sure of reliable detection.

In a rectangular room the distance from the flame detector to the fire is calculated by the formula:

$$\text{Maximum distance} = \sqrt{L^2 + W^2 + H^2}$$

In the example shown in fig 1 the room in which the flame detector is to be installed measures 20m x 10m x 5m; the maximum distance from the detector to the flame will therefore be;

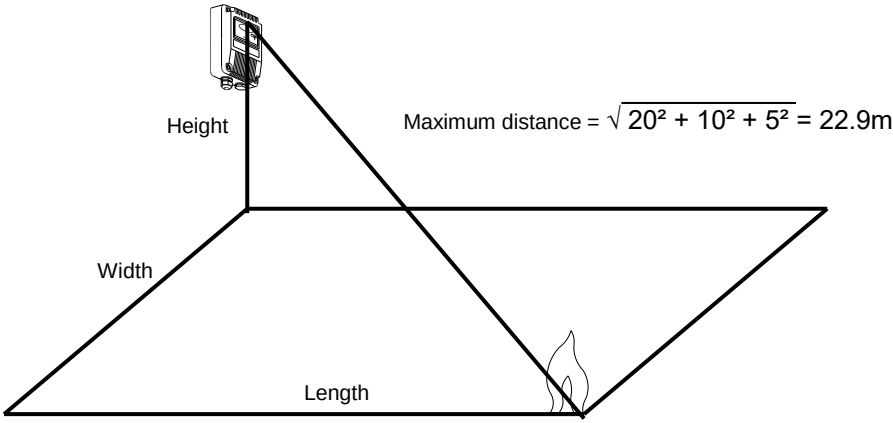


Fig 1 Calculation of distance from detector to flame

Field of View

The flame detector has a conical field of view as shown in Figure 2.

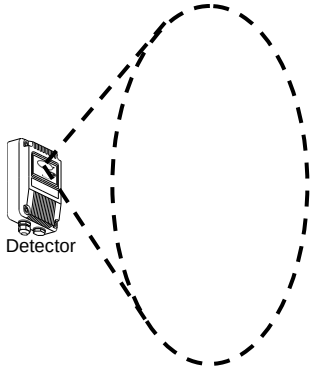


Fig 2 **Conical field of view of the flame detector**

The detection distance of 25m stated for the detector is for when the flame is directly opposite the detector – i.e. at 0°. As the viewing angle to the flame source increases, the detection distance decreases.

For standard units (IR3 and UV/IR2) the maximum viewing angle is ±40°; at 40°, the detection distance is reduced by 50% (i.e. to 12.5m)

For Exd units (IR3 Exd, IR3 Exd SS and IR3 Exd ET) the viewing angle is ±30°; at 30°, the detection distance is reduced by 30% (i.e. to 17.5m)

The flame detector should be positioned at the perimeter of the room, pointing directly at the anticipated flame or at the centre of the area to be protected. If the detector cannot ‘see’ the whole of the area to be protected, one or more additional detectors may be required.

The flame detector is not affected by normal light sources but should be positioned so that sunlight does not fall directly onto the viewing window.

Electrical Connections

The detector requires a 24Vdc (14Vmin. to 30Vmax.) supply to operate. The supply connections to the detector are polarity sensitive.

The flame detector as two methods of outputting its status:

1. The detector can be connected as a two-wire loop powered device increasing its supply current to signal that a flame has been detected. (4-20mA mode – note: not FM approved)

2. Volt free contacts from two internal relays RL1 (Fire) and RL2 (Fault or pre-alarm). Using the relay contacts connected in a four-wire configuration the detector status can be signalled back to control equipment.

Refer to pages 10, 11 and 12 for wiring diagrams for both methods of output.

The flame detector has eight connection terminals as show in Fig 3. Removing the front cover of the flame detector accesses the connections. The cable is passed through the gland holes in the base of the detector.

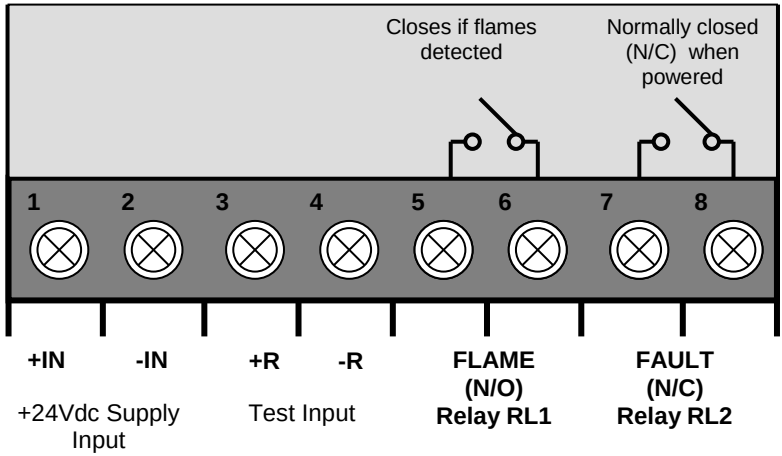
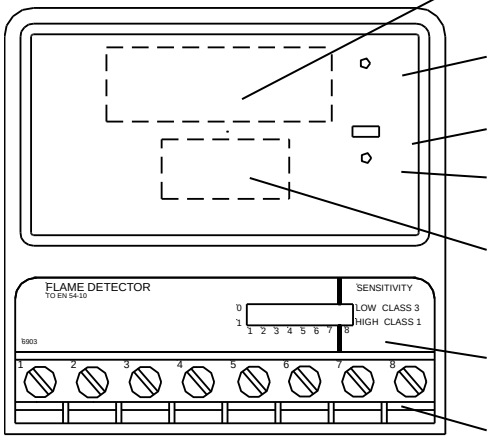


Fig 3 Electrical Connection Terminals

Connection Terminal Descriptions

Terminal No.	Name	Function
1	+IN	Power Supply +V. +IN is the power supply input to the flame detector and is normally 24Vdc with respect to terminal 2. The current consumption of detector can be monitored to determine the detector status (Fault, Normal, Pre-alarm, Fire). If the detector is in latching mode then this supply line must be broken in order to reset the detector. A thermal fuse within the detector will blow and break the +IN connection if the detector operating temperature is exceeded.
2	-IN	Power Supply 0V. –IN is the return path for the detector supply current. -IN is also internally connected to terminal 4.
3	+R	Remote Detector Test Input +V. No connection to +R is necessary if the detector optical and circuit test feature is not required. If 24Vdc is applied to terminals 3 and 4 the detector internal optical test sources will activate to simulate a flame. The detector yellow test LED will flicker to indicate an optical test is progress. The detector will then alarm indicating that the test was successful.
4	-R	Remote Detector Test Input 0V. No connection to -R is necessary if the detector optical and circuit test feature is not required. -R is internally connected to terminal 2.
5 6	RL1	Flame Relay RL1. This volt free contact is normally open (N/O) and only closes when a flame has been detected. If the detector is in latching mode (see DIL switch settings) the contact will remain closed once a flame has been detected. Only when the detector supply +IN is broken will the detector reset and the contact open once again. The contact can be changed to a normally closed (N/C) state by moving the link on JP1 in the rear of the detector. Maximum relay contact ratings: Power=3W, Current=0.25Amp, Voltage=30Vdc. Resistive loads only.
7 8	RL2	Fault or Pre-alarm Relay RL2. This volt free contact is normally closed (N/C) if the detector has no faults and the supply voltage between terminals +IN and –IN is the correct value. If the detector mode is changed (see DIL switch settings) this relay can be de-energised to reduce the detector current consumption. Alternatively RL2 can be set to provide a pre-alarm fire signal. The normal contact state can be changed state by moving the link on JP2 in the rear of the detector. Maximum relay contact ratings: Power=3W, Current=0.25Amp, Voltage=30Vdc. Resistive loads only.

Detector Interior



IR Optics -	IR optical flame sensors & filters
Supply ON (Green) -	Steady if detector functioning correctly
Fire (Red) -	Indicates a FIRE detected
Test (Yellow) -	Indicates detector in test mode
UV Optics (Option) -	UV optical flame sensor if fitted
DIL Switch -	Select detector functions
Connection Terminals	

Fig 4 Detector with Front Cover removed

Selectable Detector Functions

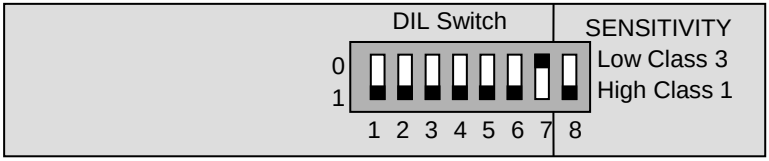


Fig 5 DIL Switch with Detector Front Cover Removed (Normal factory settings shown)

Selectable Functions		**DIL Switch Settings**		
Relay RL2 Function:		**1**		**2**
RL2 off (No fault relay) – For lowest detector current consumption.		0		0
RL2 off, or UV pre-alarm, flame or electrical sparks detected.		1		0
RL2 energised on IR pre-alarm		0		1
RL2 detector fault relay (Energised if detector powered and no faults)		1	~	1
Detector Supply Current (Detector Status): [-/ = see Output Mode below]		**3**		**4**
Low current mode, 3mA / 9mA (RL1 Only), 8mA / 14mA (RL1 & RL2)		0		0
Two-wire current signalling only. No relays operating. 4-20mA, 4/20mA		1		0
Two-wire current signalling 8-20mA, 8/20mA and both relays operating.		0		1
Two-wire current signalling 8/28mA and both relays operating.		1	~	1
Output Mode:		**5**		
(-) Proportional analogue supply current.	Non-latching fire alarm signalling. (-)	0		
(/) Step change, supply current.	Latching fire alarm signalling. (/)	~ 1		
Response Time:		**6**		**7**
	Slowest ≈ 8s	0		0
	Medium ≈ 4s	1	~	0
	Fast ≈ 2s	0		1
Faster response times reduce the optical interference immunity.	Very Fast ≈ 1s	1		1
Sensitivity: See EN 54-10		**8**		
	Low Class 3	0		
	High Class 1	~ 1		

Factory settings ~

Alarm Response Modes

The detector is normally configured to latch into an alarm state when a flame is detected. The supply to the detector has to be broken in order to reset the detector.

The configuration DIL switch within the detector can be set to place the detector into a non-latching mode. The detector can then also produce proportional analogue current alarm signals i.e. 8-28mA or 4-20mA. In non-latching mode the detector only produces an alarm signal when a flame is in view resetting itself to normal when the flame has gone.

Connection Information

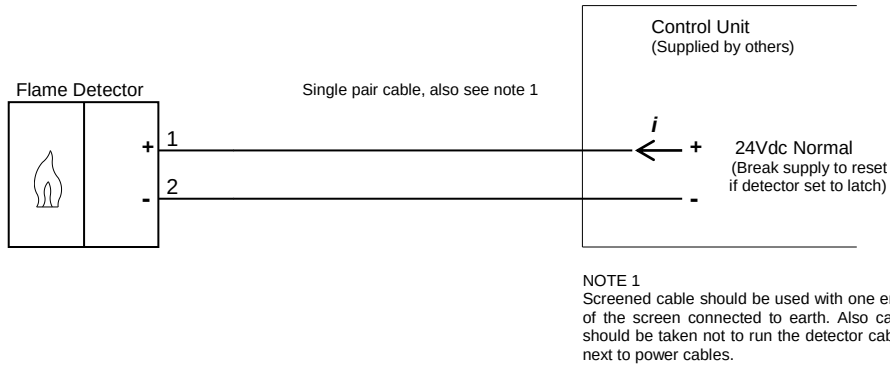


Fig 6 Basic 2 Wire Connection Diagram

The simplest method of connecting the flame detector is in a 2-wire configuration as shown above. With a 24Vdc supply the current (***i***) drawn by a detector/detectors can be monitored to determine the detector status. The DIL switches within the detector can be set to produce different current values (***i***) to suit control systems.

Detector Supply Current *i* @ 24Vdc		**DIL Switch Setting**				**Comment**
Normal Quiescent Current	**Alarm (Fire) Current**	**1**	**2**	**3**	**4**	
3mA	9mA	0	0	0	0	Lowest power configuration, RL1 only
4mA	20mA	0	0	1	0	For 4-20mA systems, no relays
8mA	14mA	1	1	0	0	Lowest power configuration & relays
8mA	20mA	1	1	0	1	For 4-20mA systems & relays
8mA	28mA	1	1	1	1	Fire control panels

If the detector supply current falls below the normal quiescent current consumption then a fault is present. This could be simply an open circuit cable fault or a fault within the detector possibly due to the detector being taken over its rated temperature.
Detectors can be connected in parallel increasing the overall quiescent current required. The alarm current signal will remain the same with the additional quiescent current drawn from other detectors.

The circuit diagrams shown below enable the flame detectors to interface with most types of conventional fire alarm control panel:

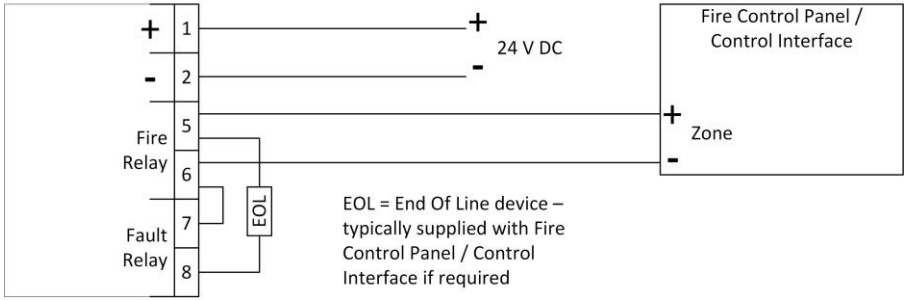


Fig 7a 4 Wire Connection Diagram – single detector

NOTE – Ensure that wiring and external components conform to Hazardous Location requirements or else are outside of the Hazardous area.

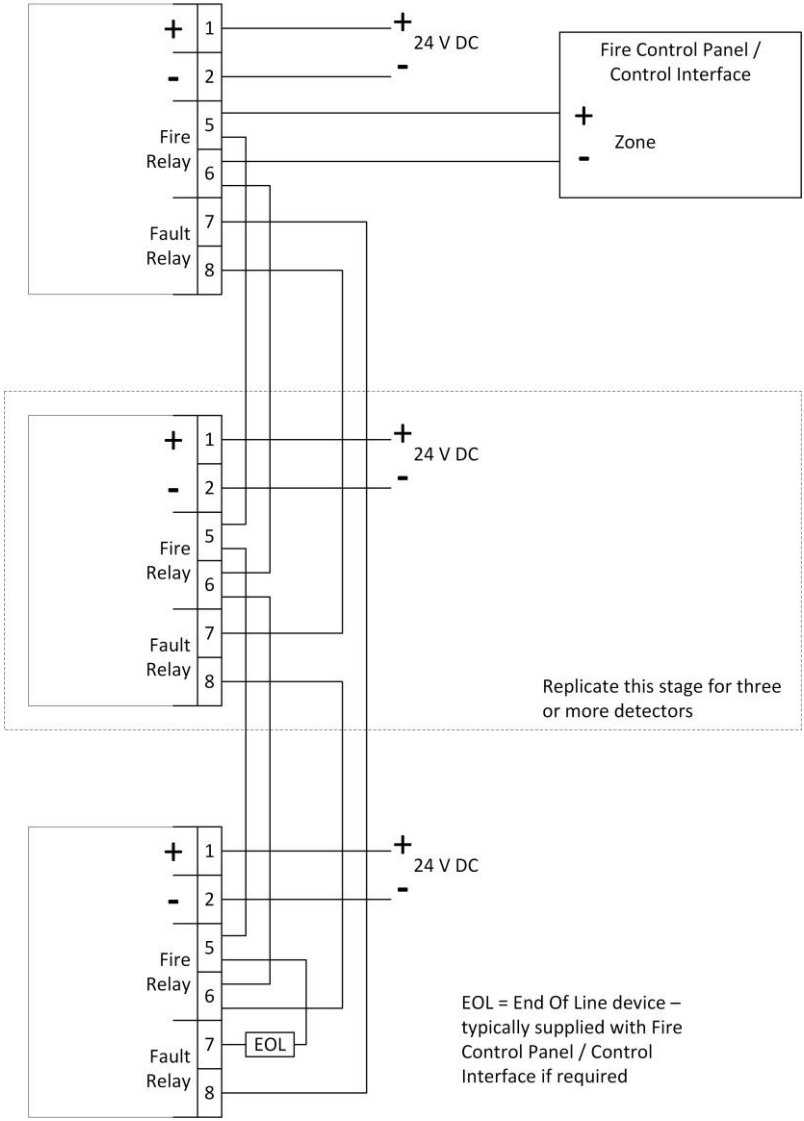


Fig 7b 4 Wire Connection Diagram – multiple detectors

Installation

It is important that the detectors are installed in such a way that all terminals and connections are protected to at least IP20 with the detector cover fitted. The earth bonding terminals are provided for convenience where continuity of a cable sheath or similar if required.

Adjustable mounting brackets and weather shields are available as shown below. These are also available for Exd models.

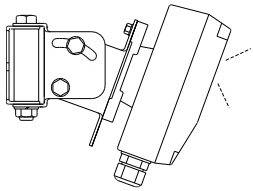


Fig 8 Stainless Steel Adjustable Mount

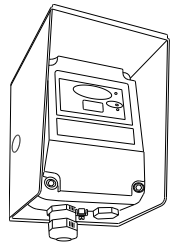


Fig 9 Stainless Steel Weather Shield

The following is applicable to Exd units only:

1. No modification should be made to the enclosure without reference to the manufacturer as unauthorised modification to an approved enclosure will invalidate the certificate/approval.

2. The enclosures are supplied with drilled and tapped entries with metric M20 threads. See enclosure drawing

3. The surface of the machined/threaded flame-paths between cover and body must be protected from scratches or damage during installation. Any such damage can destroy the validity of the enclosure.

4. Before the cover is refitted, the flame-path/threaded joint between cover and body must be thoroughly wiped clean of dirt, grit or other foreign substances, and then a thin coating of an approved form of non-setting grease applied to joint/threads. Ensure the gasket o-ring is free from damage.

5. Threaded covers must be screwed on to a minimum of 5 full threads of engagement and then locked in position with the locking screw provided.

6. All tapped entries must be fitted with an approved flameproof (Exd) device which is equivalent or superior to the gas group and temperature of the enclosure.

7. The enclosure should be mounted using the two rear M6 tapped holes. To prevent damage to the enclosure, the mounting screw thread must not penetrate the fixing hole by more than 8mm.

8. Do not scratch the glass.

9. To maintain the IP66 rating of the product, cable glands of IP66 rating or higher must be used.

10. The earth bonding terminals are provided for convenience where continuity of a cable sheath or similar if required.

Functional Testing

All functional testing outlined below must be carried out **ONLY WHEN SAFE TO DO SO**. Talentum portable flame detector test units and Bunsen burners are **NOT** suitable for use in a hazardous environment.

When 24Vdc power is applied to the detector the green supply on indicator LED will illuminate. The fault relay RL2, if selected with the DIL switch, will energise and the contact between terminals 7 and 8 will close.
If 24Vdc is applied to terminals 3 and 4 or terminal 3 is linked to terminal 1 the detector will perform a self-test. It does this by causing internal optical test sources to simulate the behaviour of flames and the detector will alarm.
Alternatively a portable flame sensor test unit is available to generate simulated flame behaviour and test the detector a few metres in front of the detector. See Fig 12.
Finally, ***PROVIDED IT IS SAFE TO DO SO***, carry out a flame test using a flickering flame source, such as a portable Bunsen burner - See Fig 13.
A still non-flickering flame will not produce a response from the detector.

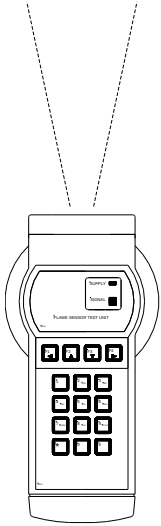


Fig 10 Portable Flame Detector Test Unit

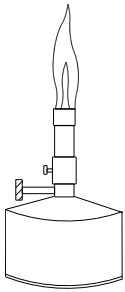


Fig 11 Portable Bunsen Burner

Service & Repairs

Servicing of the fire protection system should be carried out by competent persons familiar with this type of system, or as recommended by the local regulations in force.

Only the manufacturer or equivalent authorised body may carry out repairs to the flame detectors. In practical terms this means that flame detector may be repaired only at the manufacturers factory.

The following is applicable to Exd units only:

1. Frequent inspection should be made. A schedule for the maintenance check should be determined by the environment and frequency of use but should be regular enough to ensure the detector continues to operate in the designed manner. It is recommended that it should be at least once a year.

2. External surfaces of the enclosure should be periodically cleaned to ensure dust deposits are not allowed to accumulate.

3. Check flame-path/threads on enclosure body and lid for signs of corrosion. If badly pitted, replace component.

4. All components that are replaced must be in accordance with the manufactures specification. Failure to use such components may invalidate the certification/approval on the enclosure and may make the enclosure dangerous.

5. After inspection and maintenance have been carried out, items 3 & 4 of the installation instructions should be adhered to when resealing the enclosure.

6. Servicing of the fire protection system should be carried out as recommended by the local regulation in force.

Hazardous Location Equipment Ratings

ATEX & IECEx:

II 2 G D, Ex db IIC T4 Gb
Ex tb IIIC T135°C Db
Tamb = -40°C to +85°C

FM (3600 and 3615 standards) (models 16519, 16549 & 16219 only):

Class I, Div. 1, Groups A, B, C, D T4, IP66
Class I, Zone 1, AEx db IIC Gb T4, IP66
Class II/III, Div. 1, Groups E, F, G T4, IP66
-20°C ≤ Ta ≤ +85°C

(Refer to page 18 for operating range of detectors)
Power rating: 30V DC, 1A

Hazardous Location Equipment Specific Conditions of Use

1. Suitably rated conduit seal required at the enclosure opening
2. Consult the manufacturer if dimensional information on the flameproof joints is necessary.
3. Risk of explosion due to electro-static charge. Static electricity charge may develop when cleaning the product with a dry cloth. It is imperative to avoid static electricity charge in the hazardous environment.

EU Declaration of Conformity
EMC Directive 2014/30/EU
RoHS2 Directive 2011/65/EU
ATEX Directive 2014/34/EU

CE

Product:	The following products are covered by this DoC: 16511 Talentum IR2 Exd Flame Detector 16519 Talentum IR3 Exd Flame Detector 16541 Talentum IR2 SS Exd Flame Detector 16549 Talentum IR3 SS Exd Flame Detector
Description:	Flame detector – for use in fire detection and alarm systems
Manufacturer:	FFE Ltd., 9 Hunting Gate, Hitchin, Hertfordshire, SG4 0TJ, U.K.

This declaration of conformity is issued under the sole responsibility of the manufacturer. We hereby declare that the FFE manufactured products identified above meet the requirements of the EMC Directive 2014/30/EU, RoHS2 Directive 2011/65/EU and ATEX Directive 2014/34/EU and therefore qualify for free movement within markets comprising the European Union (EU) and the European Economic Area (EEA), by application of the following standards:

EN 50130-4:2011+A1:2014	Alarm systems - Part 4: Electromagnetic compatibility - Product family standard: Immunity requirements for components of fire, intruder and social alarm systems
EN 61000-6-3:2007 +A1:2011	Electromagnetic compatibility (EMC). Generic standards. Emission standard for residential, commercial and light-industrial environments
EN 50581:2012	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances
EN 60079-0:2012+A11:2013	Explosive atmospheres. Equipment. General requirements
EN 60079-1:2014	Explosive atmospheres. Equipment protection by flameproof enclosures 'd'
EN 60079-31:2014	Explosive atmospheres. Equipment dust ignition protection by enclosures 't'

Specific to the ATEX Directive:

Relevant provisions fulfilled by the equipment:	II 2 GD Ex db IIC T4 Gb Ex tb IIIC T135°C Db Tamb -40°C to +85°C
Notified body responsible for Initial Type Testing:	Baseefa Ltd, Buxton, SK17 9RZ, Notified Body No. 1180
Notified Body responsible for ongoing production QA:	SIRA Certification Service, Chester, CH4 9JN, UK, Notified Body No. 0518
EC-Type Examination Certificate:	Baseefa08ATEX0270
IECEx Examination Certificate:	IECEx BAS08.0073

For and on behalf of FFE Ltd:

Print Name: JACOB ANDELIN

Signed: _____ Date: 9/11/16

Position: TECHNICAL DIRECTOR

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FM Approval Information

The FM approved modes of operation are:

Relay 2 (RL2) function: RL2 enabled for fault indication (DIL switch 1: ‘1’; DIL switch 2: ‘1’)
Current mode: Both relays operating (DIL switch 3: ‘0’ or ‘1’; DIL switch 4: ‘1’)
Latching Mode: Latching and non-latching approved (DIL switch 5: ‘0’ or ‘1’)
Response Time: 1s, 2s, 4s, 8s approved, detector will respond within 30s. See also response time settings if detector is in an area where false light stimuli are present (DIL switches 6 and 7: ‘0’ or ‘1’)
Sensitivity: High (Class 1) – (DIL switch 8: ‘1’)

Connection to fire control panel must be using relay outputs; current mode output not FM approved.

FM Approved performance characteristics are as follows:

Characteristic	***Model***	***Performance***
FM-Approved Models	Standard Models: 16589 – IR3 16591 – UV/IR2 Explosion-proof models: 16519 – IR3 Exd 16549 – IR3 Exd SS 16219 – IR3 Exd ET	
Operating Temperature	16589, 16591, 16519, 16549 16219	-20°C - +60°C -40°C - +85°C
Humidity	16589, 16519, 16549 16591, 16219	93% RH @ 32°C 95% RH @ 60°C
Voltage	All models	14V DC – 30V DC
Enclosure Rating	16589, 16591 16519, 16549, 16219	IP65 IP66
Fuel Sources	All models	n-Heptane 0.3 x 0.3m pan @25m Methylated Spirit 0.5 x 0.5m pan @25m JP4 Jet Fuel 0.3 x 0.3m pan @25m

The following table shows the FM Approvals tested false stimulus performance. If light sources of the types listed will be present in the area the detector is operating in, then the detector must be placed the minimum specified distance away from the source, and the detector must have its response time set to the minimum delay listed in the table. If the listed performance is 'n/a', then the detector cannot be used where that light source will be present. This is so that there are no false alarms, and also so that the detectors sensitivity is not unduly affected.

All sources are both modulated and unmodulated unless otherwise stated.

Source	***16589 IR3***	***16591 UV/IR2***	***16519 IR3 Exd***	***16549 IR3 Exd SS***	***16219 IR3 Exd ET***
Incandescent 100W	10ft, 1s	10ft, 1s	10ft, 1s	10ft, 1s	40ft, 1s
Fluorescent 80W	10ft, 1s	10ft, 1s	10ft, 1s	10ft, 1s	10ft, 1s
Halogen 500W	10ft, 1s	10ft, 1s	10ft, 1s	10ft, 1s	90ft, 1s
Heater 1500W	80ft, 1s	10ft, 1s	80ft, 1s	80ft, 1s	90ft, 8s
Heater 3000W	10ft, 1s	10ft, 1s	10ft, 1s	10ft, 1s	10ft, 1s
Arc Welder	20ft, 1s	20ft, 1s	20ft, 1s	20ft, 1s	90ft, 8s
Sunlight - unmodulated	20ft, 1s	110ft, 1s	20ft, 1s	20ft, 1s	20ft, 8s
Sunlight – modulated	n/a	110ft, 1s	n/a	n/a	20ft, 8s

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

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