

Talentum I6000
Flame Detector

User Guide



EN

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Contents

- 1. General** 3
 - Applicable models 3
 - Description 3
- 2. Theory of Operation** 4
- 3. Signal Processing** 5
- 4. Applications for Flame Detectors** 6
- 5. Quantities Required and Positioning of Detectors** 8
- 6. Field of View** 10
- 7. Detector Interior** 13
- 8. Electrical Connections** 14
- 9. Connection Terminal Descriptions** 15
- 10. Selectable Detector Functions** 17
 - DIL Switch Settings 17
 - Alarm Response Modes 18
- 11. Alarm Current Output Values** 19
 - Step Change Output Mode (Latching) 20
 - Proportional Output Mode (Non-latching) 21
- 12. Connection Information** 23
- 13. Installation** 26
- 14. Detector Window Contamination** 28
- 15. Functional Testing** 29
 - Self Test 29
 - Talentum TT² Test Unit 30
 - Flame Test 30
- 16. Maintenance Guide** 31
- 17. Service and Repairs** 32

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.

I. General

Applicable models

This User Guide covers the following Talentum I 6000-series Flame Detectors:

- I 657I Intrinsically Safe Conventional IR2 Flame Detector
- I 6579 Intrinsically Safe Conventional IR3 Flame Detector
- I 658I Conventional IR2 Flame Detector
- I 6589 Conventional IR3 Flame Detector
- I 659I Conventional UV/IR2 Flame Detector
- I 65I I Conventional IR2 Ex d Flame Detector
- I 65I9 Conventional IR3 Ex d Flame Detector
- I 652I Conventional UV/IR2 Ex d Flame Detector

Description

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

For additional information on intrinsically safe and Ex d detectors, refer to the following Installation Guides:

0044-086 Flameproof (Ex d) IR Flame Detector Installation Guide

- I 65I I Conventional IR2 Ex d Flame Detector
- I 65I9 Conventional IR3 Ex d Flame Detector

0044-087 Flameproof (Ex d) UV/IR2 Flame Detector Installation Guide

- I 652I Conventional UV/IR2 Ex d Flame Detector

0044-088 Intrinsically Safe Flame Detector Installation Guide

- I 657I Intrinsically Safe Conventional IR2 Flame Detector
- I 6579 Intrinsically Safe Conventional IR3 Flame Detector

2. Theory of Operation

The detector responds to low-frequency (1 to 15 Hz) flickering IR radiation emitted from flames during combustion. The flame detection algorithm enables the detector to operate through a layer of oil, dust, water vapour, or ice.

The dual (IR2) and triple (IR3) sensors respond to neighbouring IR wavelengths, enabling the detector to discriminate between flames and spurious sources of IR radiation. The combination of filters and signal processing allow the sensor to be used with little risk of false alarms in difficult situations.

Most other IR flame detectors respond to $4.3\text{ }\mu\text{m}$ light emitted by hydrocarbon flames. By responding to light at wavelengths ranging from $1.0\text{ }\mu\text{m}$ to $2.7\text{ }\mu\text{m}$ that are 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.

Models that include a UV optical sensor provide further immunity to false alarms. The more differing optical wavelength signals available, the better the detector is at discriminating between flames and false optical sources. Although IR2, IR3 and UV/IR2 detectors can detect similar sized flames at the same distances, the UV/IR2 detector will give the greatest optical false signal immunity as it has the most diverse selection of optical wavelengths.

The narrow spectral response (185 to 260 nm) of the UV sensor is completely insensitive to visible light, but quickly detects weak UV radiation emitted from flames. The UV sensor also responds to high-voltage electrical discharges, but the IR sensors will not. The combination of UV and IR detection, plus signal processing, allows the detector to be used without risk of false alarms in difficult situations such as the presence of flickering blackbody radiation or arc welding.

3. Signal Processing

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.

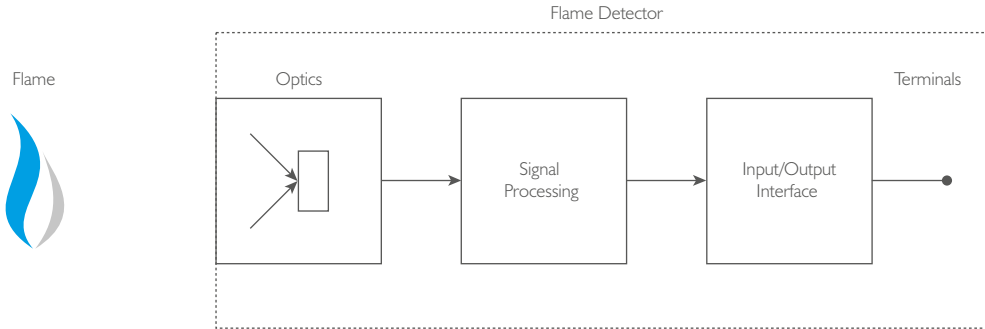


Figure 1. Block diagram of the detector signal processing

If the detector has interpreted the optical signals as a fire, then it produces the required output responses in the form of supply current changes and the illumination of the red “fire” LED. The “fire” relay will also change state, if required.

4. Applications 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 25 metres away
- Fast reacting

The detector is capable of detecting the optical radiation emitted by burning material, even non-carbonaceous materials such as hydrogen.

Flames from numerous other potential fire sources can be detected such as:

Liquids

- Aviation Fuels (kerosene)
- Ethanol
- Methylated Spirits
- n-Heptane
- Paraffin
- Petrol (gasoline)

Solids

- Coal
- Cotton
- Grain and Feeds
- Paper
- Refuse
- Wood

Gases

- Butane
- Fluorine
- Hydrogen
- Natural Gas
- Off Gas
- Propane

Typical application examples include:

- Agriculture
- Aircraft hangars
- Atria
- Automotive industry
 - Spray booths
 - Parts manufacture
- Coal handling plants
- Engine rooms
- Generator rooms
- Metal fabrication
- Paper manufacturing
- Petrochemicals
- Pharmaceuticals
- Power plants
- Textiles
- Transformer stations
- Waste handling
- Woodworking

Applications and locations to avoid:

- Ambient temperatures above 55°C (131°F) or below -10°C (14°F)
- Close proximity to RF sources
- Exposure to severe rain and ice
- Large amounts of flickering reflections
- Large IR sources – heaters, burners, flares
- Obstructions to field of view
- Sunlight falling directly on the detector optics
- Spot lighting directly on the detector optics

5. 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 have a Class 1 performance as defined in BS EN 54-10:2002 on the high sensitivity setting. This is the ability to detect an n-heptane (yellow) fire of 0.1 m² or methylated spirit (clear) fire of 0.25 m² at a distance of up to 25 metres within 30 seconds.

The detector can be set to have to a lower sensitivity setting equivalent to Class 3 performance. Class 3 performance is defined as detecting the same size fires as for Class 1 but only at a distance of up to 12 metres.

In fact, the flame detector will detect fires at distances of up to 40 metres, but the flame size at such distances needs to be proportionally greater in order to be sure of reliable detection. Thus, the yellow flickering flame that can be detected at 25 metres, provided that its size is not less than 0.1 m², will have to be at least 0.4 m² in order to be detected at 40 metres.

In a rectangular area, 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 Figure 2, the area in which the flame detector is to be installed measures 20 m × 10 m × 5 m; the maximum distance from the detector to the flame will therefore be:

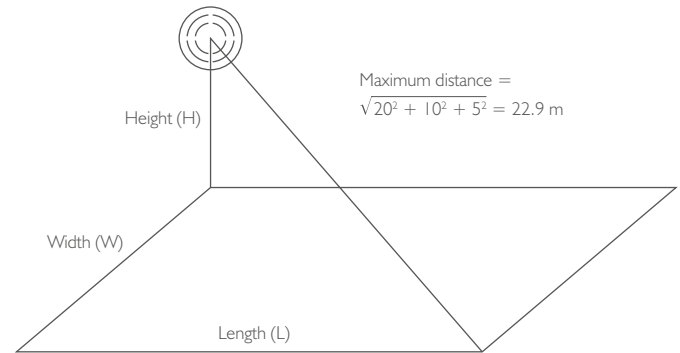
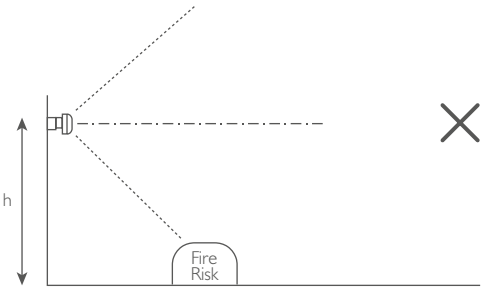


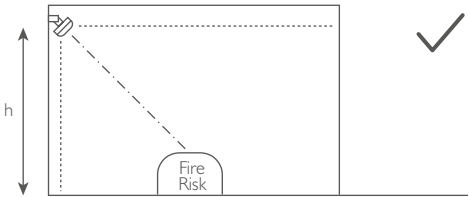
Figure 2. Calculation of distance from detector to flame

The flame detector should be positioned at the perimeter of the area to be protected, pointing directly at the anticipated flame or at the centre of the area. It is not affected by normal light sources but should be positioned so that sunlight does not fall directly onto the viewing window.

Flame Detector fixed flat to wall
(not recommended)



Flame Detector aimed at fire risk
(recommended for enclosed spaces)



Flame Detector aimed to prevent external view
(recommended for partly enclosed or open spaces)

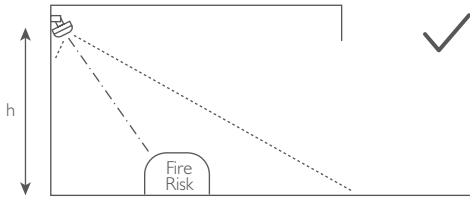


Figure 3. Detector placement

6. Field of View

The flame detector has a conical field of view, as shown in Figure 4 below.

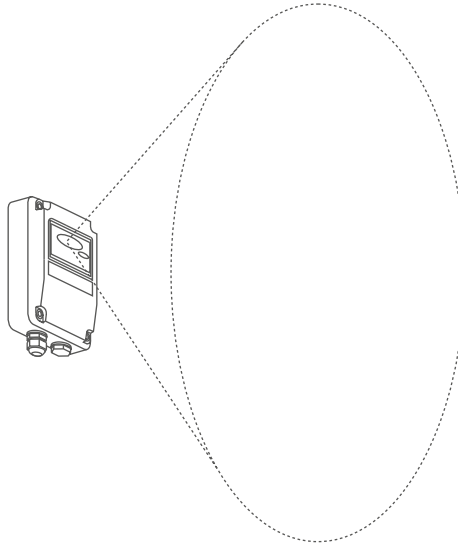


Figure 4. Conical field of view of the flame detector

For models in the standard housing (I657I, I6579, I658I, I6589 and I659I), the polar diagram below (a section through the detector's conical field of view) shows that the maximum detection distance will be achieved 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. The maximum viewing angle is $\pm 40^\circ$; at 40° , the detection distance is reduced by 50%.

If the detector cannot 'see' the whole of the area to be protected, one or more additional detectors may be required.

The uniformity of the detector's responses meet the EN 54-10:2002 clause 5.4 (Directional Dependence) requirements at horizontal and vertical viewing angles of up to $\pm 30^\circ$, but actual performance in an installation will depend on the types of fuel anticipated and the volume of flame present.

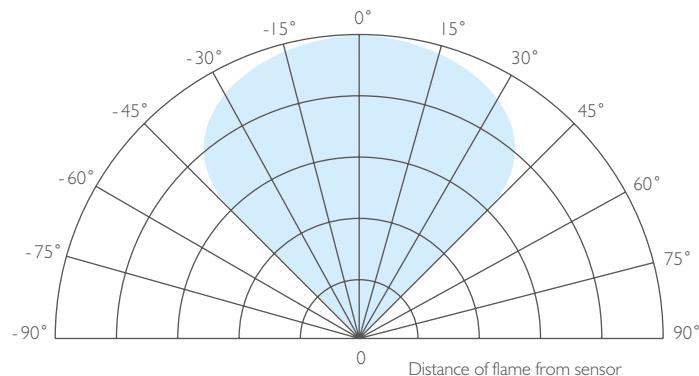


Figure 5. Relative range as a function of viewing angle (standard housing models)

For models in the Ex d housing (16511, 16519 and 16521) the flame detector has a field of view of approximately 90° horizontally and 60° vertically.

The polar diagrams below (sections through the detector's conical field of view) show that the sensor sensitivity is at its greatest along the central axis, falling off rapidly as the angle approaches 45° horizontally and 30° vertically. The variation in relative range against viewing angle is shown as a percentage of peak performance.

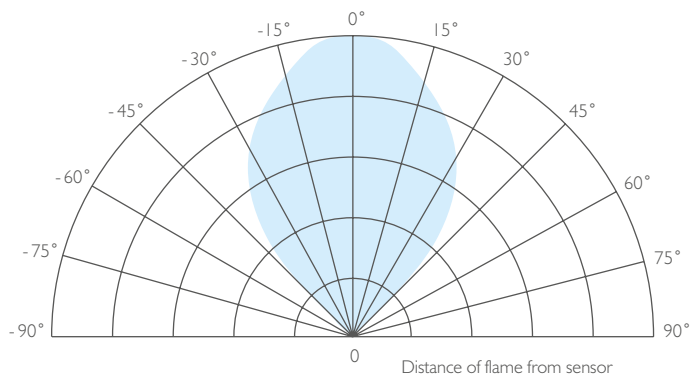


Figure 6. Relative range as a function of horizontal viewing angle (Ex d housing models)

If the detector cannot 'see' the whole of the area to be protected, one or more additional detectors may be required.

The uniformity of the detector's responses meet the EN 54-10:2002 clause 5.4 (Directional Dependence) requirements at horizontal and vertical viewing angles of up to $\pm 30^\circ$, but actual performance in an installation will depend on the types of fuel anticipated and the volume of flame present.

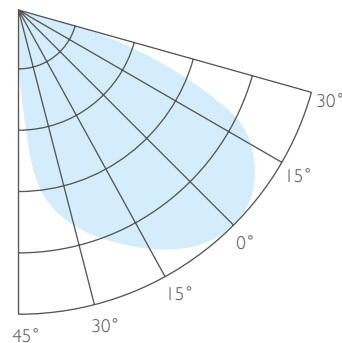


Figure 7. Relative range as a function of vertical viewing angle (Ex d housing models)

7. Detector Interior

Removing the front cover provides access to the detector terminals and configuration DIL switch (see Figure 8).

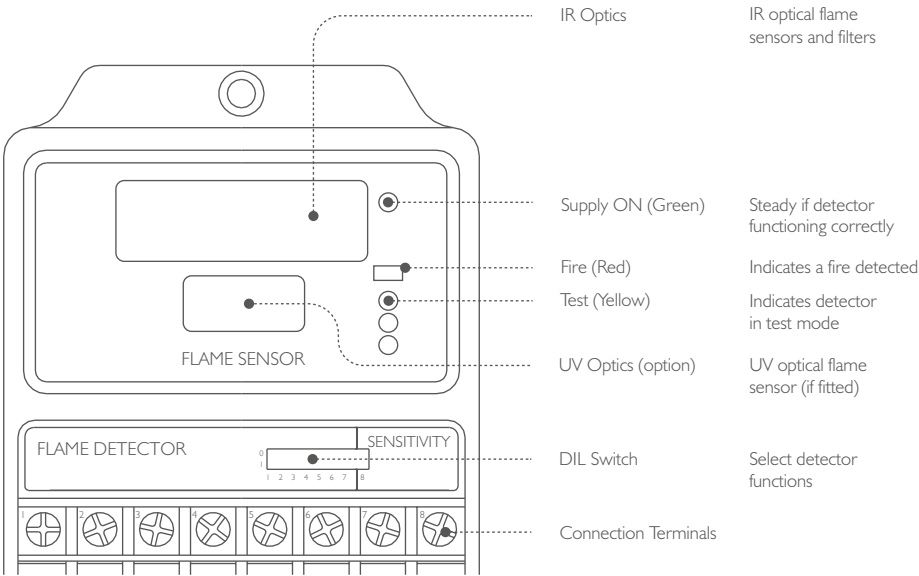


Figure 8. Detector with front cover removed

8. Electrical Connections

The detector requires a 24 Vdc (14 V min. to 30 V max.) supply to operate. The supply connections to the detector are polarity-sensitive.

The flame detector can be connected in different electrical configurations depending on the application. It has two methods of signalling its status:

- 1) Current signalling. The detector can be connected as a two-wire loop-powered device, increasing its supply current to signal that a flame has been detected – see Figure 15.
- 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 – see Figure 16.

The flame detector has eight connection terminals as shown in Figure 9. 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.

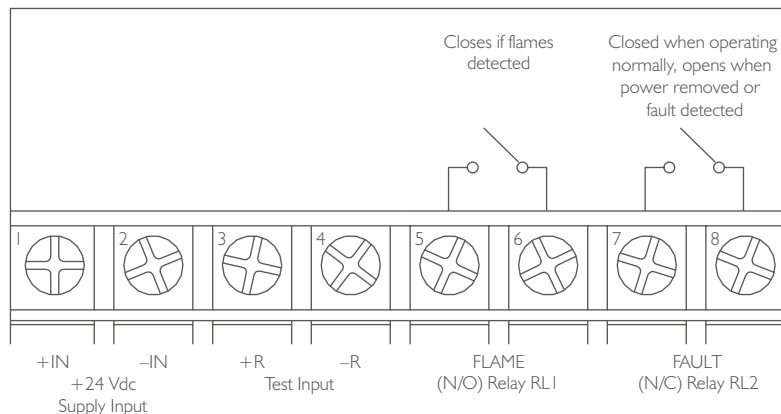


Figure 9. Electrical connection terminals

9. Connection Terminal Descriptions

Terminal No.	Name	Function
1	+IN	Power Supply +V. +IN is the power supply input to the flame detector and is nominally 24 Vdc with respect to terminal 2. The supply voltage should be a minimum of 14 V and a maximum of 30 V. The current consumption of the detector can be monitored to determine the detector status (Fault, Normal, Pre-alarm, Fire). If the detector is in latching mode, 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 0 V. –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. In most installations, this terminal should be connected to terminal 1 to enable the automatic self-test feature. See the Functional Testing section on page 29 for further information.
4	–R	Remote Detector Test Input 0 V. In most installations, no connection to –R is necessary. –R is internally connected to terminal 2.

Terminal No.	Name	Function
5	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.
6		Maximum relay contact ratings (resistive loads only): IS models – Power=3 W, Current=0.25 A, Voltage=30 Vdc. Other models – Power=30 W, Current=0.75 A, Voltage=48 Vdc.
7	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 range. 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.
8		Maximum relay contact ratings (resistive loads only): IS models – Power=3 W, Current=0.25 A, Voltage=30 Vdc. Other models – Power=30 W, Current=0.75 A, Voltage=48 Vdc.

* If required, relays RL1 and RL2 can be configured into the opposite normal state; contact FFE Technical Support for assistance

Table 1. Connection terminal descriptions

10. Selectable Detector Functions

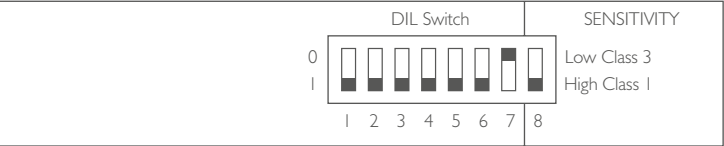


Figure 10. DIL switches with detector front cover removed (normal factory settings shown)

DIL Switch Settings

Factory settings shown with a grey background.

Selectable Functions	DIL Switch Settings	
Relay RL2 Function:	1	2
RL2 off (No fault relay) – For lowest detector current consumption	0	0
Off (IR-only models) or energised on UV pre-alarm (UV/IR2 models)	1	0
RL2 energised on IR pre-alarm	0	1
RL2 is 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, 3 mA / 9 mA (RL1 Only), 8 mA / 14 mA (RL1 & RL2)	0	0
Two-wire current signalling only. No relays operating. 4-20 mA, 4/20 mA	1	0
Two-wire current signalling and both relays operating. 8-20 mA, 8/20 mA	0	1
Two-wire current signalling and both relays operating. 8/28 mA	1	1

Selectable Functions	DIL Switch Settings	
Output Mode: (-) Proportional analogue supply current. Non-latching fire alarm signalling. (/) Step change supply current. Latching fire alarm signalling.	5	
	0	
	1	
Response Time: Faster response times reduce the optical interference immunity. Slowest ≈ 8 s Medium ≈ 4 s Fast ≈ 2 s Very Fast ≈ 1 s	6	7
	0	0
	1	0
	0	1
	1	1
Sensitivity: See EN 54-10 Low – Class 3 High – Class 1	8	
	0	
	1	

Table 2. DIL switch settings

Alarm Response Modes

The factory settings configure the detector 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. DIL switch 5 can be set to 0 to place the detector into a non-latching mode. The detector can then also produce proportional analogue current alarm signals i.e., 8-28 mA or 4-20 mA. 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.

11. Alarm Current Output Values

DIL switches 1-4 can be set to produce current values to suit different control systems.

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

Factory settings shown with a grey background.

Table 3. Detector supply and alarm currents

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.

Step Change Output Mode (Latching)

When DIL switch 5 is set to give a latching alarm output, the normal quiescent current at 24 Vdc with no flame in view will be 3 mA, 4 mA or 8 mA depending on the settings of DIL switches 1 and 2.

- When a flame is in view, the supply current value will increase to the fire current (9 mA, 14 mA, 20 mA or 28 mA), the fire relay RL1 will energise (if enabled) and the red fire LED will illuminate.
- The supply to the detector must be broken in order to reset it.
- Values below 3 mA indicate a fault condition.

See Figure 11 for the typical response with the factory DIL switch settings (DIL switches 1-5 set to 1).

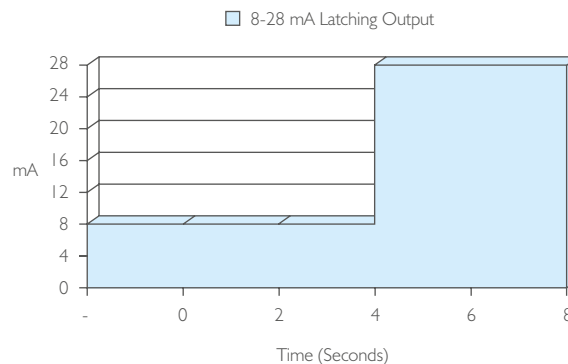


Figure 11. Typical response on seeing flame

Proportional Output Mode (Non-latching)

When DIL switch 5 is set to give a non-latching alarm output, the proportional value of 4-20 mA or 8-20 mA will increase when the detector sees any flame flicker.

- The sensor is set to give a proportional value of 4 mA or 8 mA with no flame in view. The value increments when flame flicker pulses are seen.
- When the output value approaches 20 mA, the fire LED will illuminate.
- Values below 3 mA indicate a fault condition.

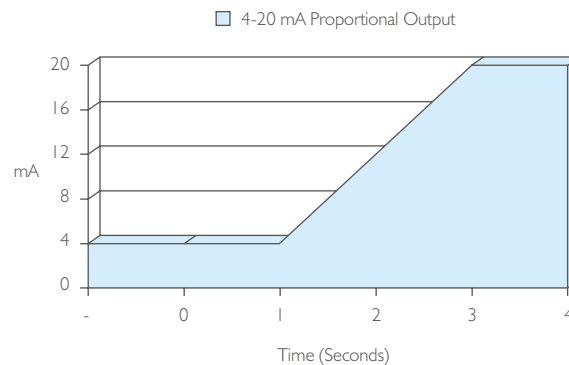


Figure 12. Typical response on seeing flame

The red fire LED (once illuminated) and output value are held for 5 seconds after the last flame has been seen, after which the output value decreases to 4 or 8 mA. See Figure 13.

Proportional output values between 4 or 8 mA and 20 mA can be used to provide an early warning of fire. These values hold only for 3 seconds from the last flame sighting. See Figure 14.

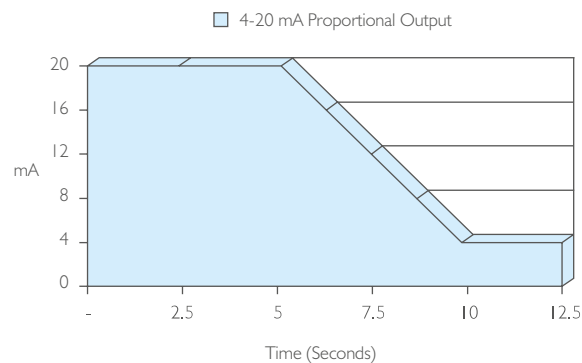


Figure 13. Typical response after last flame seen

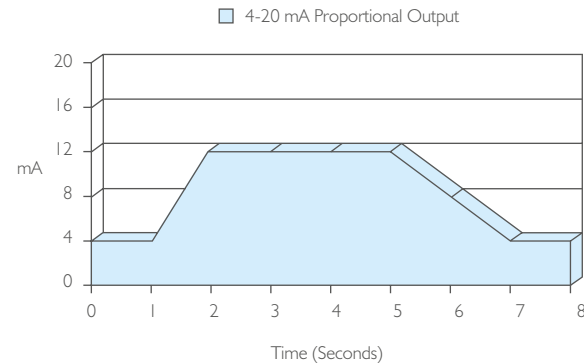


Figure 14. Typical response to burst of flame

12. Connection Information

The information in this section is general guidance. For intrinsically safe models (I657I and I6579), please also refer to the separate *Intrinsically Safe Flame Detector Installation Guide* and for Ex d models (I651I, I6519 and I652I) refer to the *Flameproof (Ex d) Flame Detector Installation Guide*.

The simplest method of connecting the flame detector is in a single-pair configuration as shown below. With a 24 Vdc supply the current (i) drawn by a detector (or multiple detectors) can be monitored to determine the detector status. Use screened cable with one end of the screen connected to earth. Do not run the detector cable next to power cables.

In most installations, terminal 1 (+IN) should be connected to terminal 3 (+R) as shown to enable the automatic self-test feature. See the Functional Testing section on page 29 for further information.

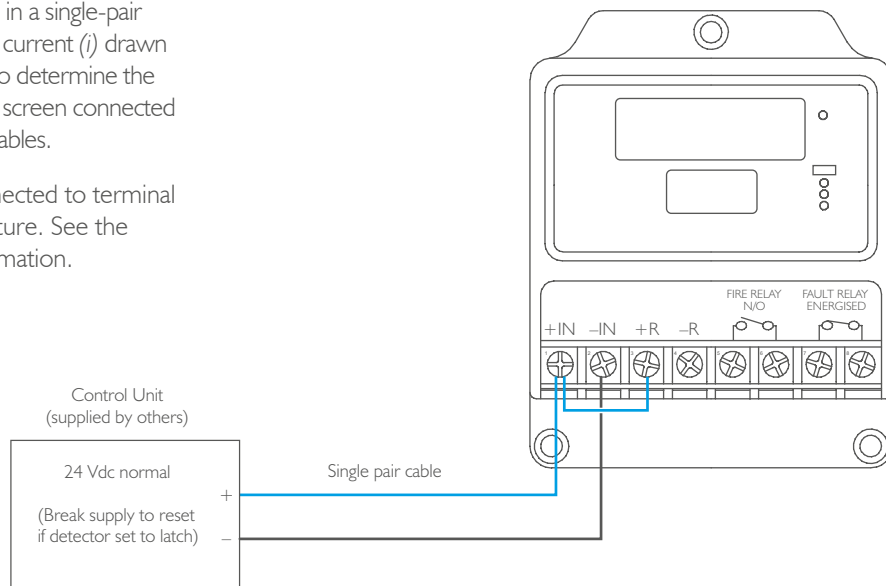


Figure 15. Basic two-wire connection diagram

The two-pair cable configuration shown below enables the flame detectors to interface with most types of conventional fire alarm control panel. The fire relay RL1 is used to switch the alarm load 'R' (not required in NFPA 72 installations) to generate a fire alarm signal. An end of line device 'EOL' mounted in the last detector is required by most systems to provide the ability to monitor the detector fault relay RL2 and the integrity of the interconnecting cables.

In most installations, terminal 1 (+IN) should be connected to terminal 3 (+R) as shown to enable the automatic self-test feature. See the Functional Testing section on page 29 for further information.

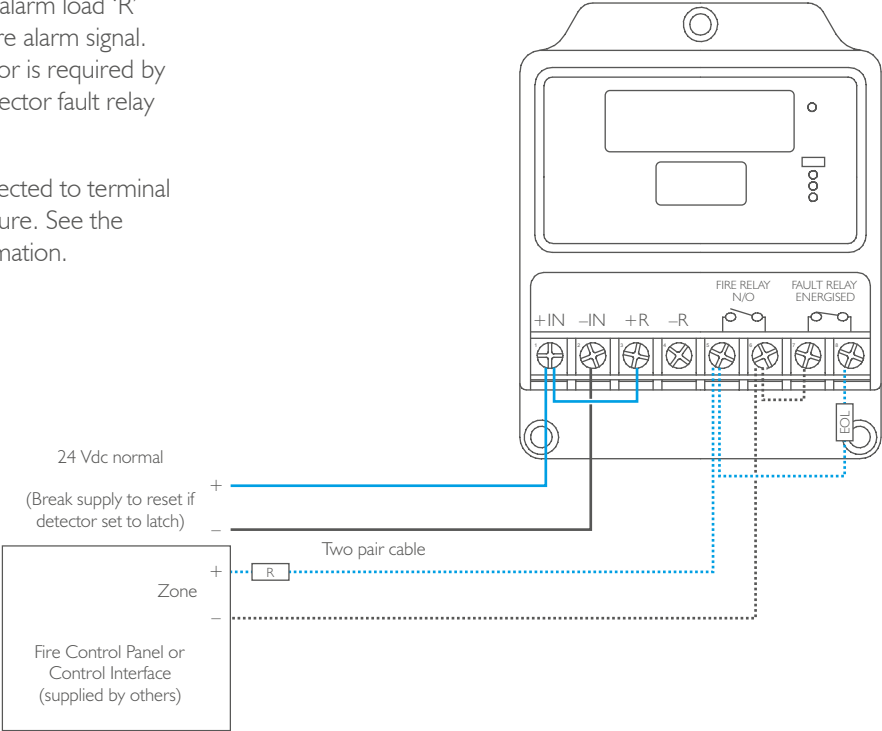


Figure 16. Four-wire connection diagram – single detector

This wiring diagram provides an example of how to wire three (or any number of) detectors to provide a common alarm and fault. Note that this configuration ensures that a fault on one detector does not prevent a fire being signalled by a different detector.

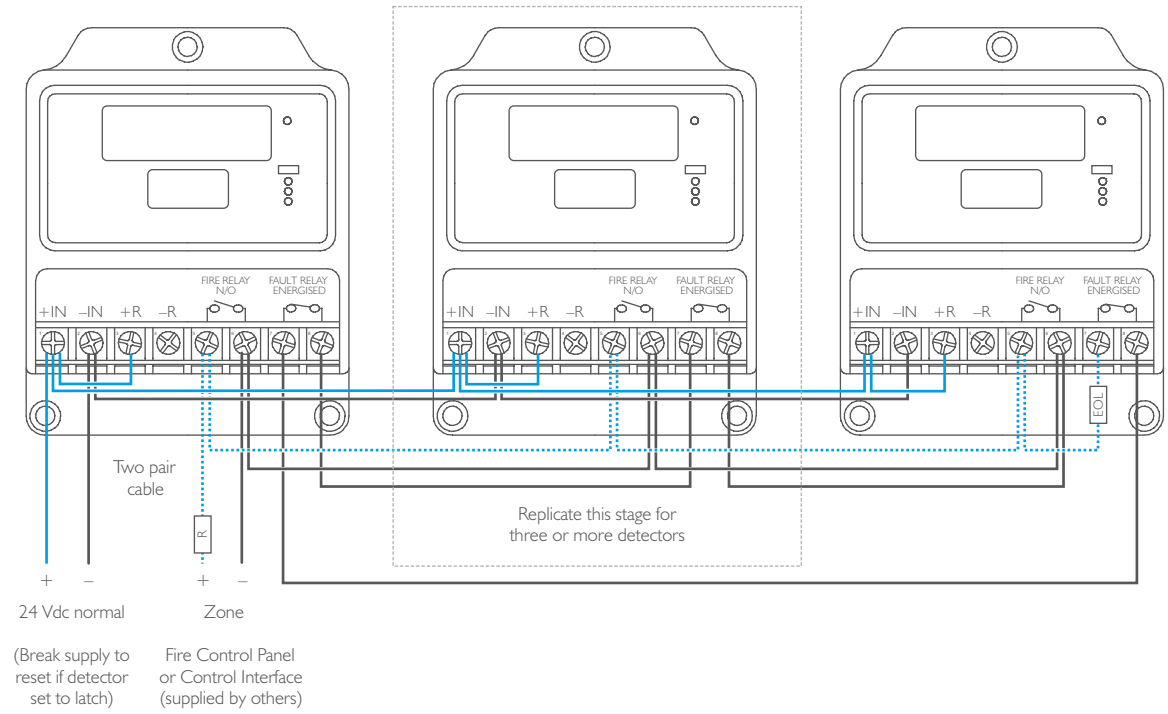


Figure 17. Four-wire connection diagram – multiple detectors

13. Installation

For Intrinsically Safe and Ex d models, please also refer to the separate Installation Guides for important installation information:

- 0044-086 Flameproof (Ex d) IR Flame Detector Installation Guide (for models 16511 and 16519)
- 0044-087 Flameproof (Ex d) UV/IR2 Flame Detector Installation Guide (for model 16521)
- 0044-088 Intrinsically Safe Flame Detector Installation Guide (for models 16571 and 16579)

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 is required.

Adjustable mounting brackets are available as shown below.

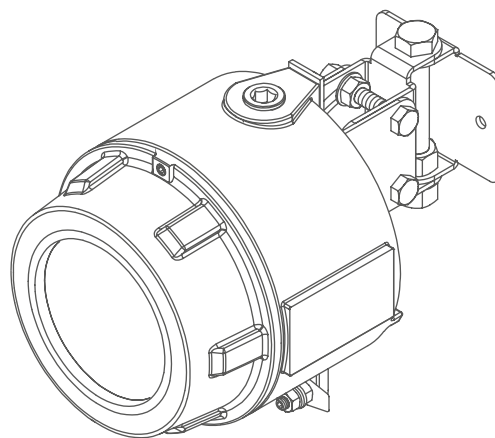
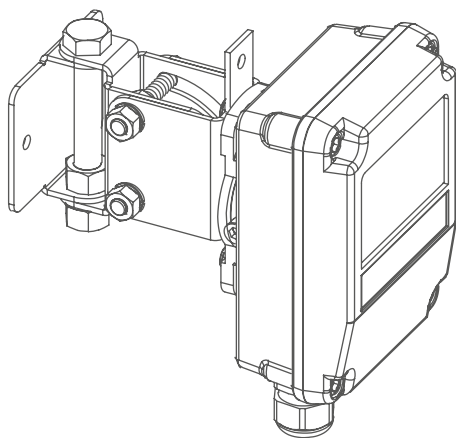


Figure 18. Stainless steel adjustable mount (07127)

Adjustable weather shields are available as shown below.

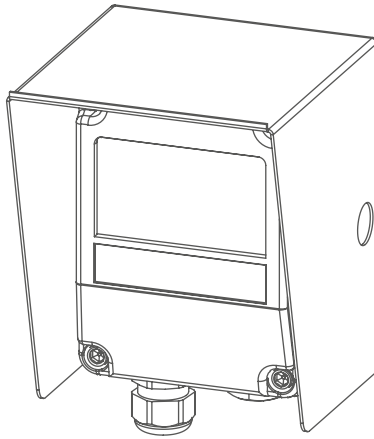


Figure 19. Stainless steel weather shield (12545)

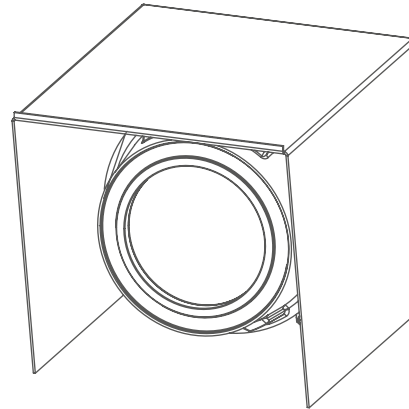


Figure 20. Stainless steel weather shield (07279)

14. Detector Window Contamination

It is important to keep the detector window clean and checks should be carried out at regular intervals – determined locally according to the type and degree of contamination encountered – to ensure optimal performance of the flame detector. Although the IR detectors can detect flames when the window is contaminated, there may be a reduction of sensitivity as shown in Table 4.

Contamination	Typical percentage of normal response
Water spray	75%
Steam	75%
Smoke	75%
Oil film	86%
Salt water film	86%
Dry salt deposits	86%

Table 4. IR detector window contamination

UV/IR detectors are more susceptible to window contamination and must be kept clean.

Air purge kits are available as shown below.

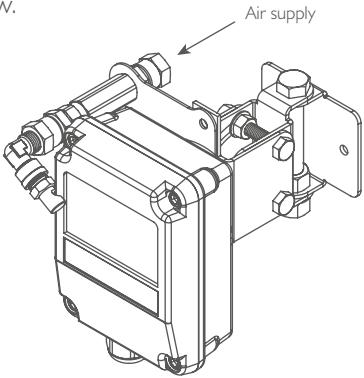


Figure 21. Air purge kit (I 2556)

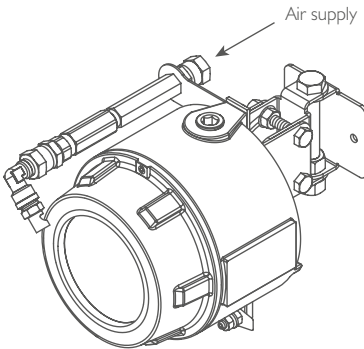


Figure 22. Air purge kit (I 2555)

15. Functional Testing

When 24 Vdc power is applied to the detector and it is operating normally, the green 'supply on' indicator LED will be illuminated. If DIL switches 1 and 2 are both set to 1, the fault relay RL2 will energise and the contact between terminals 7 and 8 will close. If the unit is in a fault state, the green LED will flash rapidly or will not illuminate, and the fault relay will not energise.

Self Test

The detector contains internal optical test sources which can stimulate the IR sensors (and UV sensor if present) to confirm that the detector is operating correctly. While this will confirm the basic operation of the detector, it cannot detect all possible fault conditions, so it is not a substitute for regular scheduled testing with a live flame or the Talentum TT² test unit (see below).

The self-test can be used in two ways:

1) Automatic self-test (recommended)

As described in the Connection Information section on page 23, it is recommended to permanently connect terminal 3 (+R) to terminal 1 (+IN). If the detector is switched on in this configuration, the automatic self-test feature will be enabled, and after 30 seconds the self-test sequence will be carried out, causing the amber test LED to flash. If the self-test fails, the green 'supply on' LED will flash rapidly and the fault relay (if enabled by the DIL switch settings) will de-energise. The self-test sequence will be automatically repeated every 15 minutes.

2) Manual self-test

If terminal 3 (+R) is not connected to terminal 1 (+IN), then when the detector is switched on, the automatic self-test feature is disabled. In this state the self-test can be triggered manually by applying 24 Vdc to terminals 3 and 4, or by linking terminal 3 to terminal 1. The amber test LED will flash while power is applied to terminal 3, and if the detector is working correctly it will alarm after a few seconds – the red fire LED will illuminate, the fire relay RL1 will energise and the contact between terminals 5 and 6 will close (unless RL1 is disabled by the DIL switch settings). If the detector is set to latch, it will remain in the alarm state until power is removed, if not it will reset when power is removed from terminal 3.

Talentum TT² Test Unit

The Talentum TT² (part numbers 1800-101 and 1800-106) recreates the characteristic spectrum of a flame using a combination of UV and IR bulbs. It can be used to test installed detectors from up to 6 m away and should put the detector into an alarm state within 30 seconds. See Figure 23. Please be aware that the Talentum TT² does not have an (Ex) approval for hazardous areas. A permit is required to test a detector in such areas. Alternatively, the flame detector should be removed and placed within a safe location to perform the test.

Flame Test

A live flame test can be performed using a flickering flame source, such as a portable Bunsen burner or a liquid-fuel lighter, but **ONLY IF IT IS SAFE TO DO SO** and the detector is not in a hazardous area. If a lighter is being used then, due to the small size of the flame, it will need to be within one metre of the detector and will need to be moved around to generate sufficient flicker. A still non-flickering flame will not produce a response from the detector.

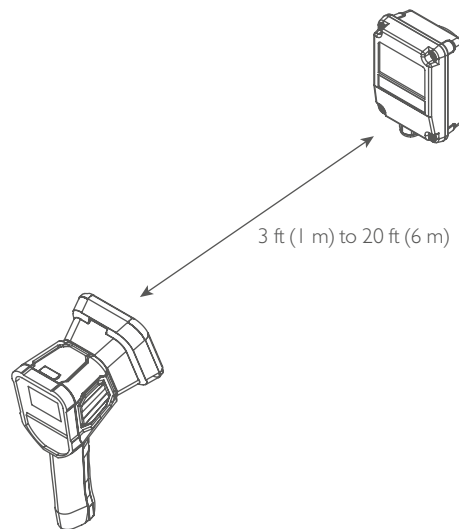


Figure 23. Talentum TT² test unit

16. Maintenance Guide

The flame detectors are designed to give years of trouble-free operation with minimal attention. However, the periodic maintenance steps listed below are essential to maintain reliable fire protection.

1. Inform all appropriate personnel of the intention to work on the flame detectors.
2. Disable any automatic systems that may be activated by the flame detectors if not required as part of the maintenance check.

Alarms	Extinguishers	Control
Audio / Visual	Gas Systems	Plant Stops
Auto Diallers	Water Sprays	Dampers / Doors

3. Check that the control panel for the detectors is functioning correctly and shows no faults.
4. Inspect the detector's viewing window for any build-up of dust or other contaminants on the optical surface. If necessary, clean the optical surface with a cotton wipe wetted with commercial liquid glass cleaner. Rinse with clean water and dry with a clean cloth. The detector specification for performance is with a clean optical sensor window. Contaminants like dust, oil and paint will reduce sensitivity.

5. Visually check the exterior of the detector for any mechanical or corrosive damage.
6. Test the operation of the detector with the Talentum TT² test unit. Please be aware that the Talentum TT² does not have an (Ex) approval for hazardous areas. A permit is required to test a detector in such areas. Alternatively, the flame detector should be removed and placed within a safe location to perform the test with the Talentum TT² test unit or with a flickering flame source. See the Functional Testing section on page 29 for further information.
7. Ensure the detector still has a clear line of sight of the area it is protecting, and no obstacles obstruct its view.
8. Check that the detector is securely fitted.
9. Reinstate any automatic system disabled during maintenance.
10. Inform all appropriate personnel on completion of the maintenance work and if necessary record this work.

17. Service and Repairs

Servicing of the fire protection system should be carried out by competent persons familiar with this type of system, and 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 detectors may only be repaired at the manufacturer's factory.