

# ***FIRERAY 2000***

## ***Installation Guide***

### **Features**

- Range 33ft to 330 ft.
- 24Vdc operation
- Selectable alarm thresholds
- Low current consumption
- Ground level electronics
- Manual or Automatic reset

### **System Description**

***FIRERAY 2000*** comprises a transmitter, which projects a modulated infra-red light beam to a receiver. The received signal is analysed by a controller usually located at ground level. If smoke is present in the beam path for more than approx. 8 to 10 seconds, a fire relay is activated. The system is designed to be mounted to project the beam approx. 19ins below and parallel to a roof or ceiling at ranges up to 330ft. The maximum lateral detection range is 25ft either side of the actual beam.

### **Smoke Detection**

If smoke is present in the beam, the received signal is reduced by a level determined by the density of the smoke. If the smoke reduces the signal strength to between the obscuration threshold and 93%, for more than 8 to 10 seconds, the fire alarm output is activated. The alarm threshold may be set to 25%, 35% or 50%, to suit the installation.

### **Application notes**

- For indoor use only
- For wall mounting only
- Do not install in locations where the normal ambient temperature exceeds 100<sup>0</sup>F
- Install in accordance with NFPA 72 (National Fire Alarm Code)

**Auto Reset:** After a Trouble condition is indicated, the control unit automatically resets if the cause is no longer present. The fire alarm may be latching or non-latching (close 'ALARM' switch for latching).

**Automatic Gain Control (AGC):** Long term degradation of the signal strength by component ageing or build up of dirt on optical surfaces will not generate an alarm because of compensation provided by an AGC circuit. This operates by comparing the received signal against a standard at predetermined time intervals. Differences of more than 7% are corrected by the automatic selection of gain stages. The AGC time interval is factory set to nominally 1.5 hours.

## **Principle of Detection**

The infra-red signal is projected from the Transmitter via an optical system. At 330ft the diameter of this beam is approximately 10ft. This wide-angle beam arrangement helps to simplify alignment and give alignment stability.

It is important that **FIRERAY** is positioned correctly to minimize the detection time. Experiments have shown that smoke from a fire not only rises upwards, but also fans out in a 'mushroom' shape due to air currents and heat layering effects. A fire alarm condition occurs when the infra-red beam is obscured beyond a preset threshold. The indication time depends on the location of **FIRERAY** within the protected area, the volume of smoke produced, the construction of the roof and the ventilation arrangements.

For **FIRERAY** positioned beneath flat ceilings the smoke has to curl its way into the detection zone from the point on the ceiling directly above the fire. The time taken depends upon the distance of the fire from the beam axis, the height of the beam above the source of the fire and the slope of the ceiling.

The maximum distance either side of the beam axis is found to be typically 25ft for satisfactory detection under flat ceilings, providing a maximum total area coverage of 16,500 square feet (50ft x 330ft).

Smoke layering is overcome by mounting **FIRERAY** at the recommended height, so projecting the infra-red beam below the heat layer and into the smoke layer.

Detection time will be longer in a building with a peaked roof if a fire occurs at the fringes of the protected area.

The recommended installation height is approximately 19 inches below the ceiling. However in all installations the national fire standards for that country must be consulted.

Once established, then ensure a clearance of 6" top, bottom and sides of the beam path is maintained for its' entire length.

If there is any doubt on the correct mounting height, positioning may be determined by smoke tests.

## **RETRO Operation**

**FIRERAY** may be configured so as to operate in 'RETRO' mode. For this, the optical heads are mounted adjacent (as close as possible) to each other. The infra-red signal is returned via prisms. This type of operation is useful when access to the opposing wall is restricted, and where wiring is difficult. When installed, a clear line of sight between the heads and the prisms has to be maintained. If a reflective object is placed in the line of sight, then the infra-red signal may be returned via this and not the prisms. As any potential smoke is passing through the projected beam twice, the alarm level should be set accordingly. The recommended positioning of **FIRERAY** is as shown on page 3.

### **Prisms**

See Technical data for Prism details. The Prisms should be mounted at right angles to the infra-red beam.

### **Alignment**

**FIRERAY** is aligned as for conventional operation.

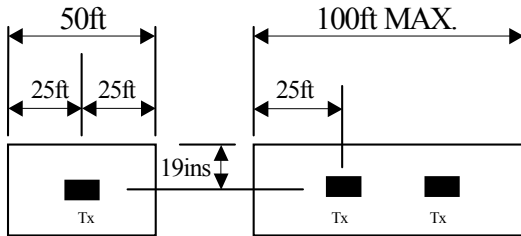
There is an extra test that should be performed. When the system is aligned in the normal operating mode, block off the prisms, (at the prism end). **FIRERAY** should indicate Trouble. If not, it is possible that the signal has been returned via a surface other than the prisms.

**Example Installation Details**

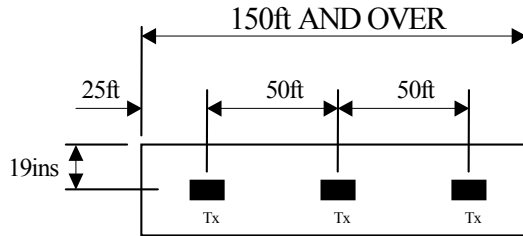
(Note : Fireray 2000 must be installed in accordance with NFPA72)

**SINGLE BEAM**

SEE NOTE 1



**MULTIPLE BEAMS**



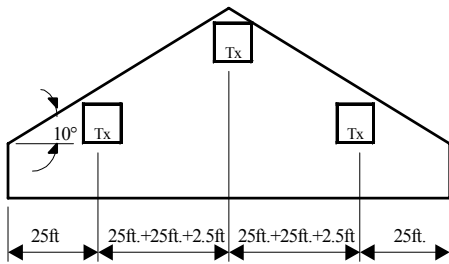
A ceiling or roof with a slope in excess of 3.5 degrees should be regarded as an apex roof.

Note 1: No more than 10ft approx of the beam path should be within 19ins approx of any wall or partitions.

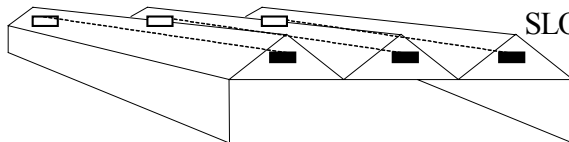
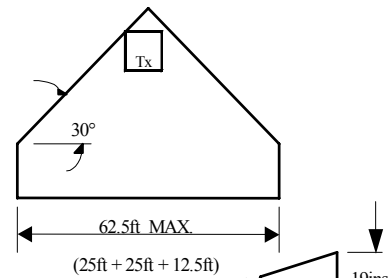
When Firerays are mounted in the apex the horizontal distance may increase by 1% for each degree of ceiling slope, up to 25% maximum, (for Fireray in apex only).

**APEX CEILINGS**

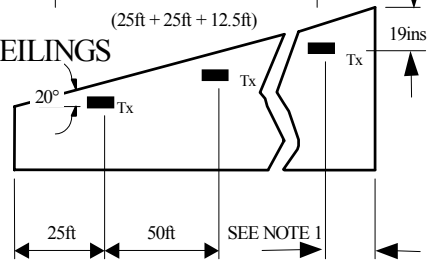
**10° SLOPING ROOF**



**30° SLOPING ROOF**



**SLOPING CEILINGS**



RECEIVER AND TRANSMITTER SHOULD BE POSITIONED APPROX 19ins BELOW THE CEILING

## **Pre-installation at Ground Level**

### **Controller :**

1. The Controller should be positioned so that it is accessible but such that the cable (screened) connecting the Controller to the Receiver is not more than 330ft long. Care should be taken that this cable is routed away from building electrical cables and any switchgear.
2. There are knock-out holes in the upper, lower, and side faces for cable entries. Four (4), 0.275inch dia. fixing holes are located on the rear face, for installing the box to the building structure. Wiring connections are described on a label inside the controller door. See Figure 1.
3. Select the required options, (alarm threshold, alarm relay latching or not, AGC last stage operation).

### **Transmitter:**

1. A range adjuster (potentiometer) is accessed through a removable grommet. For ranges of 330ft set the potentiometer to fully counter clockwise. Fully clockwise is 33ft.
2. The transmitter must be in the sight of the Receiver and mounted rigid on a secure section of the building. **DO NOT INSTALL THE TRANSMITTER DIRECTLY TO CLADDING.**

### **Receiver:**

1. **FIRERAY** is immune to most normal ambient lighting conditions, however, the Receiver should be installed such that strong light sources, (artificial or sunlight), do not project directly into to the Receiver lens.

## **Installation**

### **Transmitters and Receivers**

1. Locate the right angle fixing brackets for the Transmitter and Receiver so that they are on the line of sight and are both installed approximately 19inches below the ceiling.
2. Install the Optical heads on the brackets and position on the line of sight. Align Rx as accurately as possible to the Tx (by eye),
3. To avoid any possibility of working loose under vibration, tighten both the Receiver thumbwheel screws securely, using a suitable coin or wide-bladed screwdriver (Ensure it fills the thumbwheel slot completely to avoid slippage and damage).
4. Install all cables and connect as figure 1. (Heads are supplied with 3.3ft of cable & this should be correctly terminated with the System wiring)

### **Installation (Continued)**

5. Check that the RESET/TEST switch located in the Controller is in the ON position.
6. Position the Gain potentiometer in the Controller to the mid-way position.
7. Connect the supply and check first that it is within limits (13.5Vdc to 28Vdc) at the Transmitter and Controller.
8. At this stage signal High or Low LED's may be illuminated.

### **Alignment: Method 'A'**

#### **Alignment Tool/Range Finder**

Optional extra – (Refer to distributor)

1. Connect a temporary 3 core cable between the Alignment Tool and the Controller :-  
Red to +VE SUPPLY  
Yellow to TEST METER +VE  
Black to –VE SUPPLY
2. Position the Alignment Tool so that it is visible from the transmitter.
3. Move the Transmitter horizontally until a fast flash rate is achieved by the green LED, or until it glows steadily.
4. Move the Transmitter vertically until the green LED glows steadily. If at any time the red LED illuminates, then adjust the range pot on the transmitter body by turning clockwise until the the red LED extinguishes and the green LED glows steadily.
5. Go to Method B, Step 4.

### **Alignment : Method 'B'**

#### **Voltmeter**

1. Connect the required length of two-core cable to the test meter outputs and run to the Transmitter. Connect a DC voltmeter (0 to 10V range) to this cable.
2. Adjust the Transmitter horizontally and vertically until a maximum reading of +5Vdc is obtained, (no signal reading is approximately 2.6V).
3. IF A READING OF GREATER THAN +5Vdc is obtained, reduce transmitter power by adjusting transmitter pot clockwise.
4. To avoid any possibility of working loose under vibration, tighten both the Transmitter thumbwheel screws securely, using a suitable coin or wide-blade screwdriver (Ensure it fills the thumbwheel slot completely to avoid slippage and damage).
5. At the Controller, adjust the Gain control potentiometer anti-clockwise until the high LED *just* extinguishes (both LED's now off).
6. Move the RESET/TEST switch to the OFF position. (NOTE: Both the high and low LED's must be off when switching out of reset, or the AGC will be locked out).
7. Wait at least 45 seconds while the system self-calibrates, before performing any tests.

Hold the test filter in the beam path. After approximately 9 seconds the alarm relay will switch over, and the red alarm lamp will light. Remove the test filter, the alarm will reset after approximately 4 seconds (unless in latching mode).

#### **To RESET after a FIRE alarm**

1. Automatic ('ALARM' switch open).
2. Using the RESET/TEST switch.
3. By disconnecting the Controller supply for one (1) second.
4. By taking to 0v the NRST terminal for one second.

#### **Trouble Alarm Test**

The Trouble relay and the Trouble lamp operate if the beam is totally blocked for approximately 10 seconds. Clearing the beam resets the Trouble indication after approximately 4 seconds.

#### **Trouble Indication**

Causes of trouble alarms

- The controller at ground level being in "RESET" mode
- Infra-red beam being reduced in signal strength by more than 93% for more than 10 seconds.
- The AGC reaching the last stage of compensation (see note 1).
- Loss of power at Ground level Controller or at Transmitter
- Misalignment resulting in a received low signal.

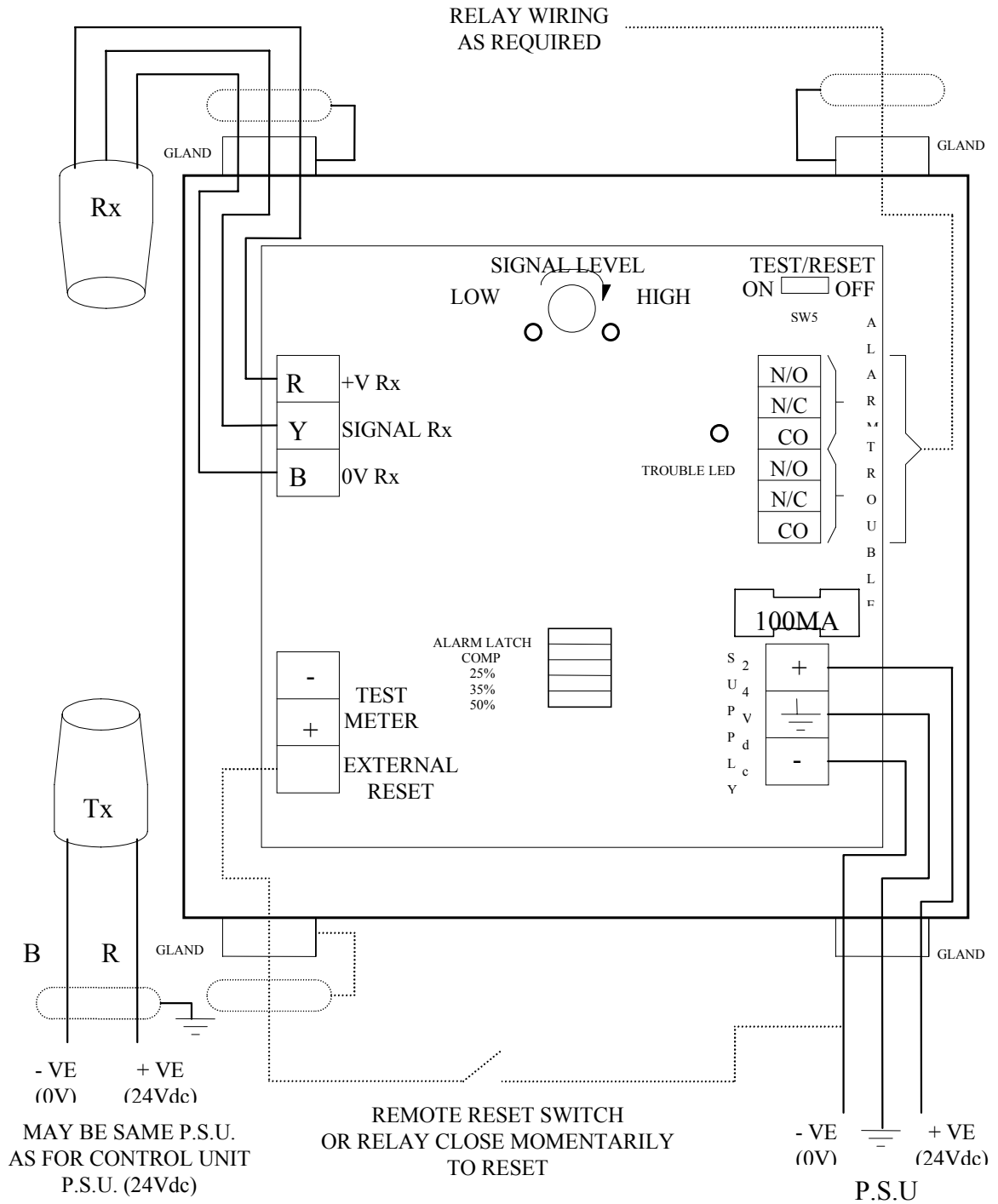
#### **Note**

There are two options available when the AGC runs out of compensation.

1. **FIRERAY** will, at the last stage, signal Trouble, but in the event of further signal loss down to the alarm threshold, a FIRE alarm will be indicated. This is for UK use only. Leave 'COMP' switch open for this option.
2. **FIRERAY** will, at the last gain stage, indicate Trouble and inhibit FIRE alarms. Close 'COMP' switch for this option.

**Connection and wiring diagram**  
**Figure 1**

GOOD QUALITY SHIELDED 16/18 GAUGE CABLE  
BETWEEN CONTROLLER AND RECEIVER HEAD.



- DC Supply (at the Detector) 24Vdc
- Total quiescent current approx. 13 mA
- Total alarm current approx. 20 mA
- Tolerance to Beam misalignment at 35%: Tx: +/-1.0<sup>0</sup> , Rx: +/- 4<sup>0</sup>
- Fire alarm thresholds 1.25dB (25%) 1.87dB (35%) 3.0 dB (50%) \*
- Moisture : 93%RH max, non-condensing
- Optical Wavelength 880nm

**Service/installation Notes**

25% and 35% thresholds are recommended for normal use. 50% threshold is recommended for retro mode.

**Contains ESD sensitive devices.**

Service personnel must take appropriate precautions (eg: wrist straps connected to unit door earth terminal) when entering the Controller unit.

**Not User Serviceable**

Refer to manufacturer or distributor for repair.

**For use as a smoke detector only**

No liability will be accepted for applications not conforming to NFPA regulations.

- Operating range 33ft to 330 ft.
- Alarm and Trouble indication by voltage free change over relay contacts.
- Receiver up to 330 ft cable run from Controller at ground level.
- Transmitter and Controller may be powered from separate/common supply.
- Alarm relay may be latching or non latching.
- Finish : White Rating : IP 50
- Max. Sizes: Control unit 8.5 x 10.5 x 3.5 inches. Heads with Brackets 4 x 3.25 x 3.75 inches.
- Weights: Control Unit - 2.3lbs Heads + Brackets - 1.5lbs.
- When using prisms set the Transmitter range to maximum.

Prisms: Use FFE Part No. 23901

Beam Ranges:-

6.5ft to 82ft – use 1 prism

82ft to 115ft – use 4 prisms (Square)

115ft to 148ft – use 6 prisms (Rectangle)

**Parts List**

- Transmitter with a clear lens
- Receiver with a dark lens
- Ground level controller
- Angle brackets + 4 bolts/washers
- Test Card.

