XP95 BEAM DETECTOR

INSTALLATION GUIDE©

Apollo Fire Detectors, 36 Brookside Road, Havant, Hampshire, England
www.apollo-fire.co.uk

XP95 BEAM DETECTOR

Read this installation guide because…

beam detectors are different from point detectors

beam detectors need to be *aligned*, not just installed

all engineers need to understand the alignment process

by following the advice in this guide you will avoid problems and repeated site vists

Read the guide through once in order to understand the steps needed to install and align correctly. Then, when installing, keep the guide handy and use it to find help on the subject you are currently dealing with.

If you cannot find a help topic related to your problem phone, fax or email the Technical Sales Department at Apollo Fire Detectors.

Phone +44 (0) 23 9249 2412

Fax +44 (0) 23 9249 2754

Email techsales@apollo-fire.co.uk

GENERAL INFORMATION

What is a beam detector?
The XP95 beam detector is made up of a transmitter, a receiver, an interface and, optionally, one or more reflectors.

The transmitter projects a beam of modulated infra-red light to the receiver which converts it to an electrical signal for processing in the interface.

The transmitter and receiver are mounted so that the beam will project approximately 0.3m to 0.6m below and parallel to the roof or ceiling level at distances up to 100m. The maximum lateral detection range is 7.5m either side of the beam. The interface is usually installed at ground level.

How does a beam detector work?
When smoke is present in the beam path the light registered by the receiver is reduced by a level determined by the density of the smoke.

In the event of the smoke obscuring the light by a preselected minimum level for a period of 8 to 10 seconds a fire signal is generated. The detection level can be set to 25%, 35%, 50% or 65% to suit different environments, examples of which are given in the table in the section 'Obscuration Level Setting' on page 6.

Automatic reset
If the beam detector has been in fire or fault condition it will automatically reset, once the fire or fault is no longer present. After a fire condition there is a reset delay of 30 seconds and after a fault a reset delay of 3 seconds.

Automatic signal strength
Over a period of time the light registered by the receiver might be reduced by factors such as dirt building up on the lenses of the detector.

The XP95 beam detector compensates for this automatically in order to reduce the likelihood of unwanted alarms. At the limit of compensation the beam detector transmits a fault signal. In the event of a fire being detected when the beam detector has reached its compensation limit, the fire signal will override the fault signal.

SYSTEM DESIGN

Positioning beam detectors
The XP95 beam detector must be positioned correctly to minimise the detection time. The detection time depends on

—the location of the beam detector within the protected area

—the volume of smoke produced

—the construction of the roof

—the ventilation arrangements

Particular areas where beam detectors should not be fitted include:

- *spaces where very high levels of ambient light are present in normal conditions*
- *areas where excessive amounts of dust, smoke or water vapour are present as part of the normal environment*
- *areas where rapid temperature changes occur*
- *surfaces subject to vibration or movement*
- *buildings in which it is not possible to mount the beam detector rigidly or align it correctly*

When deciding where to install the beam detector, you need to think of the construction of the surface you are fitting it to and to possible changes as a result, for example, of changing seasons. These surfaces must be solid and should not be subject to movement.

The maximum distance either side of the beam axis is typically 7.5m for satisfactory detection under flat ceilings, providing a maximum total area coverage of 1500 square metres (15m x 100m). The maximum recommended installation height is 40m and the distance between the beam and the ceiling should be within 0.3m and 0.6m (Fig 1). No more than 3m of the beam path (measured from the centre of the beam) should be within 500mm of any wall or partitions.

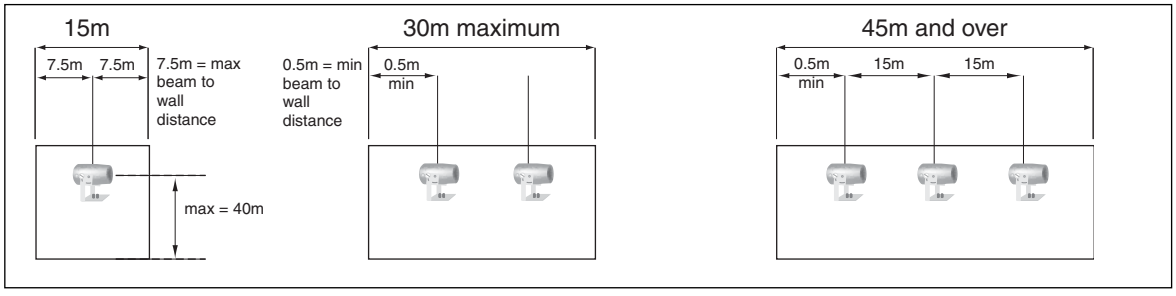


Fig 1 *Positioning detectors under flat ceilings—examples of three building widths*

In buildings with pitched roofs or ceilings the maximum distance either side of the beam *in the apex only* may be increased by 1% for each degree of ceiling pitch up to a maximum of 25% (Fig 2).

Example: Roof pitch = 20°
Span of beam = 15m
15m + (15 x 20%) = 18m

There must be a clear line of sight between the transmitter and receiver at all times. If there is any doubt about the correct mounting of detectors in a particular installation, the position may be determined by smoke tests.

How many XP95 beam detectors can be connected to a loop?

Although the Apollo Beam Detector is loop powered, the total current drawn by the beam detector components combined is considerably higher than a standard point detector (equivalent to approximately 40 point detectors). For this reason care must be taken when designing an analogue loop, bearing in mind the effects of voltage drop—a consequence of loop cable resistance, device loading and control panel specification.

Each beam detector set (consisting of transmitter, receiver and interface) draws approximately 16mA from the analogue addressable loop and, unless proven by

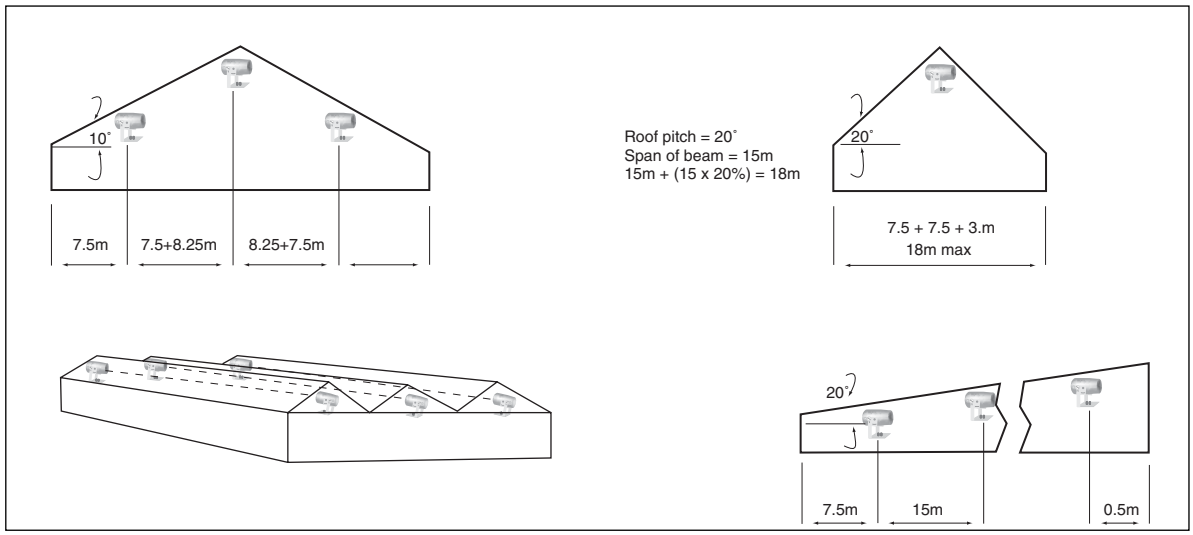


Fig 2 *Positioning detectors under different types of sloped or pitched roofs*

All installations must conform to locally applicable standards and codes of practice.

A ceiling or roof with a slope in excess of 3.5° should be regarded as a pitched roof.

*calculation, it is recommended that *not more than five beam detector sets are powered from each loop* or, alternatively, eight interface/receiver combinations when the transmitter head is independently powered from a remote power supply.

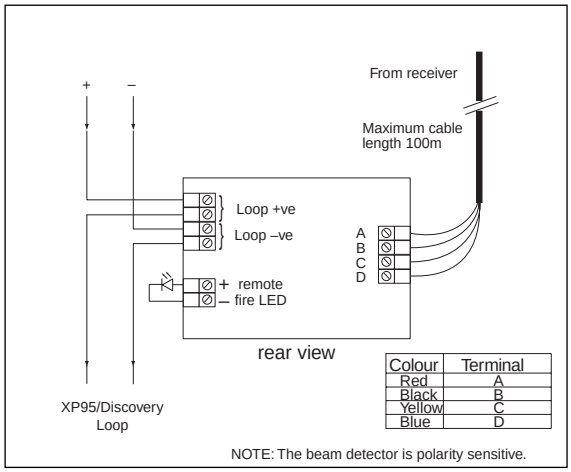
Beam detectors must be protected by short-circuit isolators. For details of these please refer to Apollo PIN sheet PP2090. For calculation purposes the interface should be considered as 12 point detectors and the transmitter 7 point detectors.

**Depending upon the type of panel used, the resistance of cable and the total loop load, it may be possible to install in excess of 10 beam detector sets on a single analogue addressable loop. A mathematical calculation to assess the worst case loop voltage drop should be performed prior to installation in order to prove the intended design. A loop voltage drop calculation program, known as 'Loop Calculator', has been developed by Apollo for use by system designers and is available as a free download from the Apollo web site (www.apollo-fire.co.uk).*

INSTALLING BEAM DETECTORS

Installation of interface

The interface should be positioned so that it is easily accessible and such that the cable connecting the interface to the receiver is not more than 100m long. The use of multi-core cable for connecting two or more receivers is *not* permitted. Care should be taken that this cable is routed away from building electrical cables



Colour	Terminal
Red	A
Black	B
Yellow	C
Blue	D

Fig 3 *Interface wiring diagram*

and any switchgear. Ensure that the cable used has adequate mechanical protection.

Connect cables as shown in Fig 3 and set the address at the DIL switch on the front of the interface as described opposite.

Setting the obscuration level

Set the interface to one of the four obscuration settings shown below.

Obscuration level in %	Typical application
25	Offices, small premises, non-smoking clean areas, eg, museums, theatres
35	Factories, warehouses
50	Hostile environments, eg, mills, foundries
65	Retro mode operation only

Table 1 *Obscuration levels*

Setting the 'total obscuration' signal

Total obscuration is defined as obscuration of the beam to greater than 93% in 8–10 seconds. The interface must be set so that either a 'fire' or a 'fault' signal is generated when this occurs. This is done by moving segment 3 of the sensitivity switch (Fig 4) to '0' for a 'fault' signal or to '1' for a 'fire' signal. The factory default setting is 'fault'.

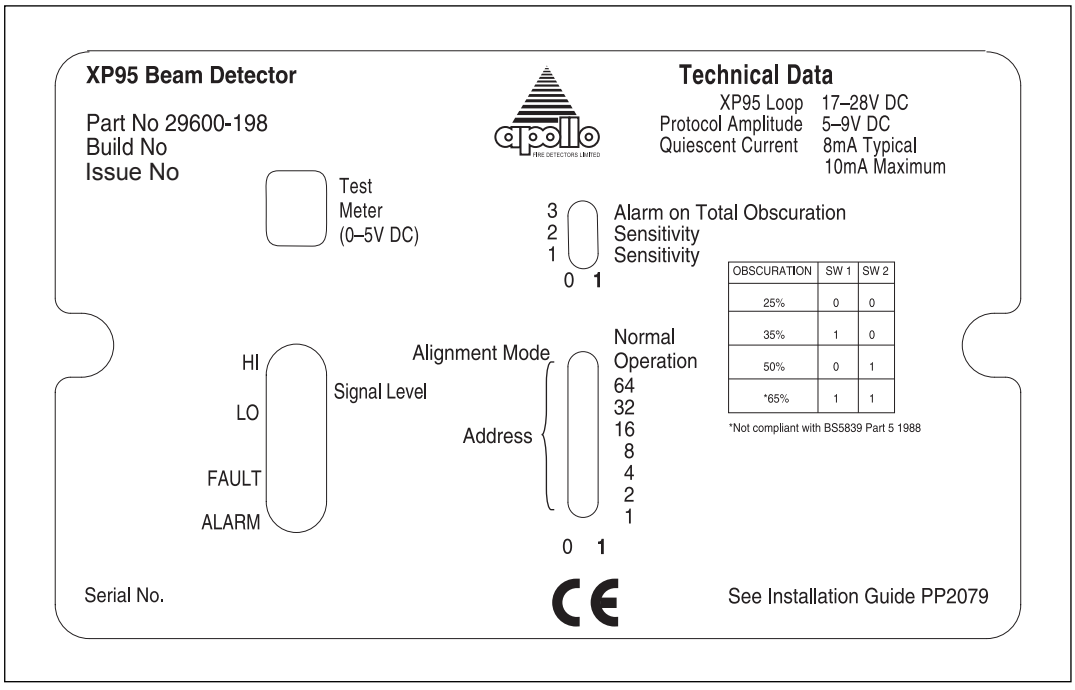
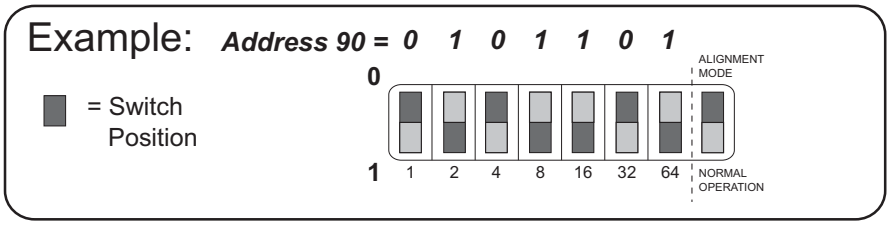
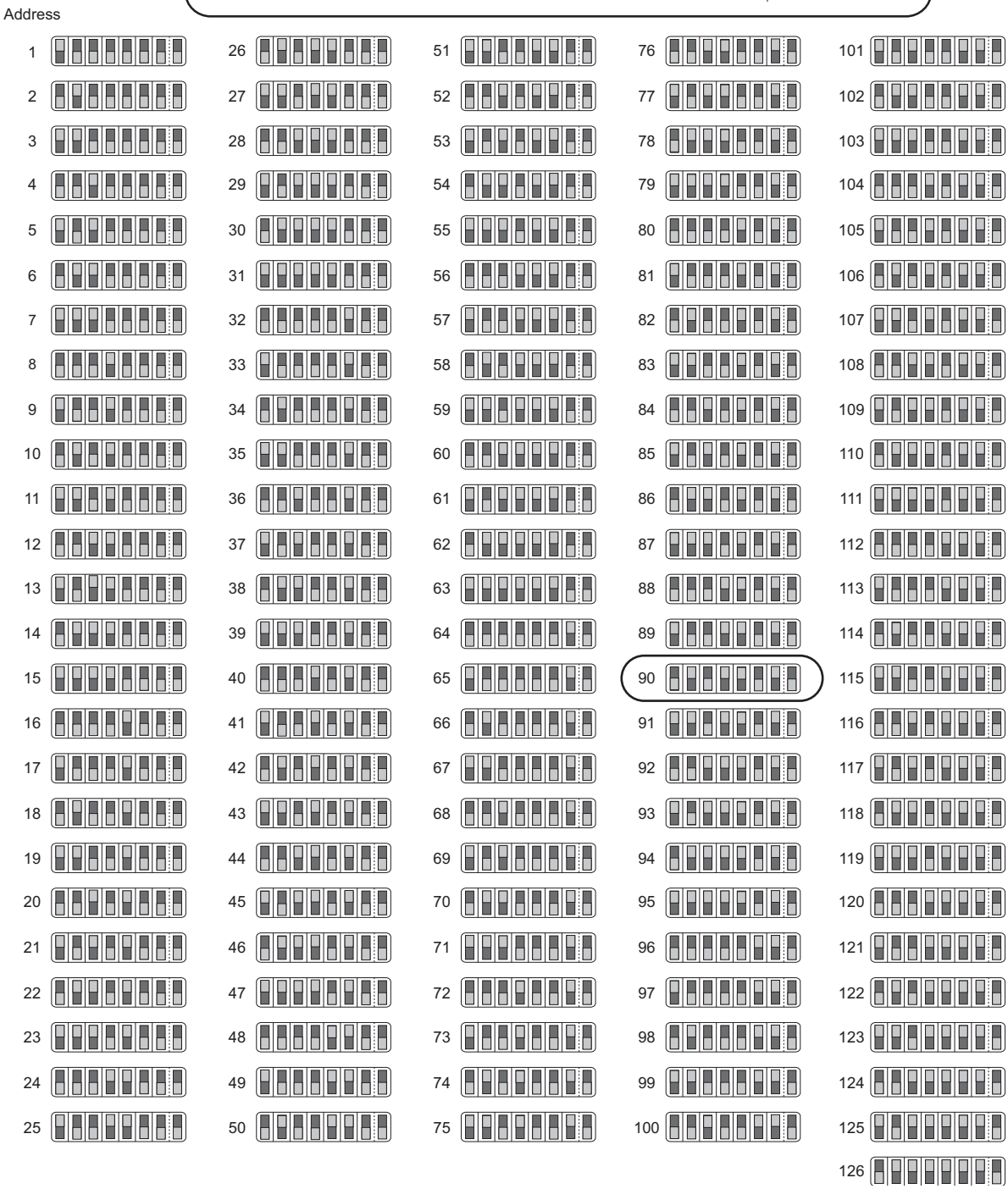


Fig 4 *Front view of interface*

Setting the address
The address of the beam detector is set using the DIL switch. All segments of the switch are set to '0' or '1' using a small screwdriver or similar tool.

Address settings
A complete list of address settings is shown below.





Installing transmitter and receiver

1. The XP95 beam detector is immune to most normal ambient lighting but the receiver should be so installed that strong light sources–either sunlight or artificial–do not project directly into the receiver lens.

2. 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 0.3m to 0.6m below the ceiling. The shorter leg of the bracket is fixed to the mounting surface as shown in Fig 5.

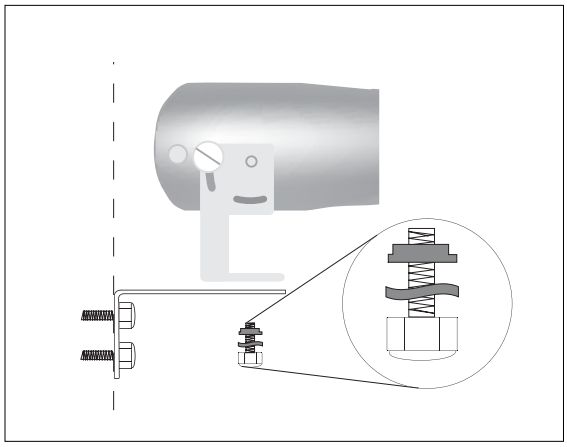


Fig 5 *Mounting bracket for beam detector*

3. Fit the transmitter and receiver to the brackets using the plastic insulating sleeves and washers provided as shown in Fig 5. Align the receiver as accurately as possible to the transmitter by eye. Ensure that the transmitter is fitted so that access to the range potentiometer (under the clear plug on the side) is not impeded.

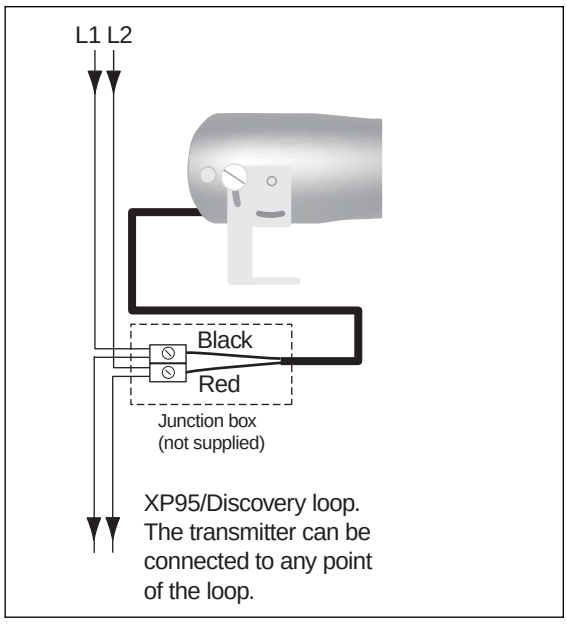


Fig 6a *Connecting the transmitter to the loop*

4. Tighten both the receiver thumbwheel screws securely, using a suitable coin or wide-bladed screwdriver and ensure that all bracket fasteners, eg, bolts, are secure.

5. Install all cables and connect as shown in Figs 6a and 6b. (Transmitter and receiver are each supplied with 1m of cable and this should be correctly terminated with the system wiring).

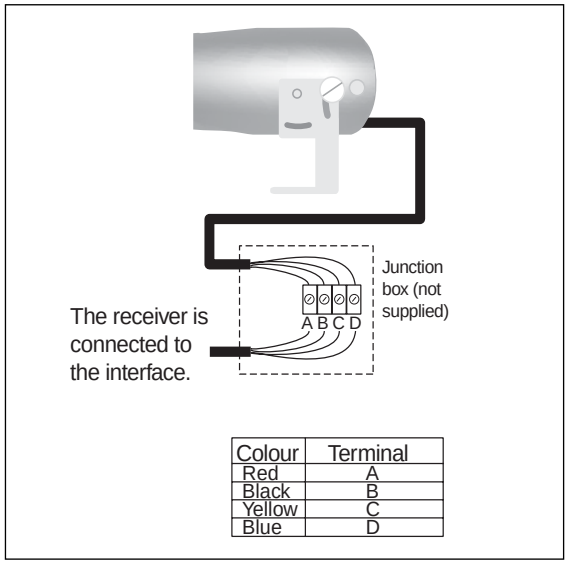


Fig 6b *Connecting the receiver to the interface*

Retro operation

The XP95 beam detector may be configured so as to operate in 'retro' mode*, in which the transmitter and receiver are mounted adjacent and as close as possible to each other, no more than 5mm apart. The infra-red beam is projected onto reflectors mounted on the opposite wall, which reflect it back to the receiver. This type of operation is useful when access to the wall opposite the transmitter is restricted or where wiring is difficult. The reflectors should be mounted at right angles to the infra-red beam. See 'Technical Data' for number of reflectors to use. If more than one reflector is used, they should be fitted so that there are no gaps between them.

A clear line of sight has to be maintained between the transmitter and receiver at one end and the reflectors at the other end of the area to be protected.

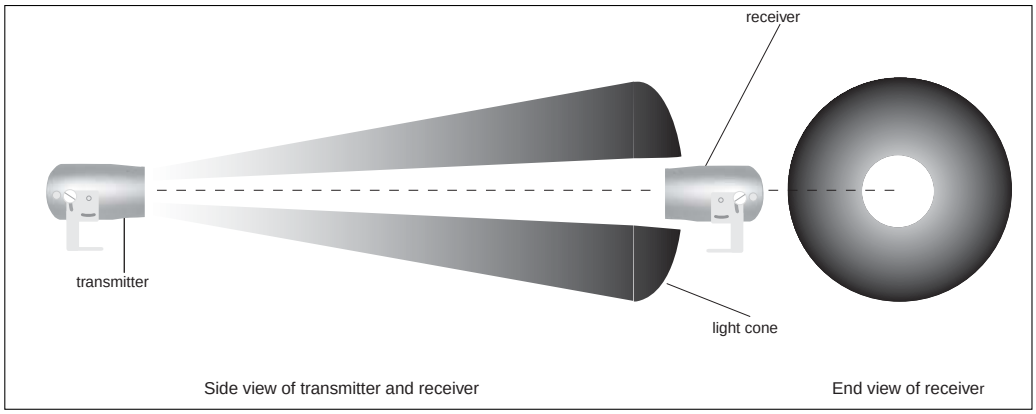


Fig 7 *Beam detector correctly aligned*

The following extra test should be performed after installation for retro operation:

When the system is aligned and in normal operating mode, cover the reflectors. The XP95 beam detector should indicate 'fire' or 'fault', depending on the setting in the interface. (See section 'Installation of interface'). If not, it is possible that the signal has been returned via a surface other than the reflectors.

Alignment and calibration

The transmitter produces a conical beam of light which is approximately 3 metres in diameter at a distance of 100 metres. The purpose of *alignment* is to ensure that the centre of the beam is projected onto the centre of the receiver (Fig 7).

The purpose of *calibration* is to ensure that the amount of light sent by the transmitter is correct for the distance between the transmitter and the receiver.

The accuracy of calibration depends on the accuracy of alignment. The XP95 beam detector is tolerant, to a certain extent, of alignment and calibration that is not optimal, but misalignment may lead to faults at a time subsequent to commissioning, perhaps because structural movement in the building occurs (Fig 8).

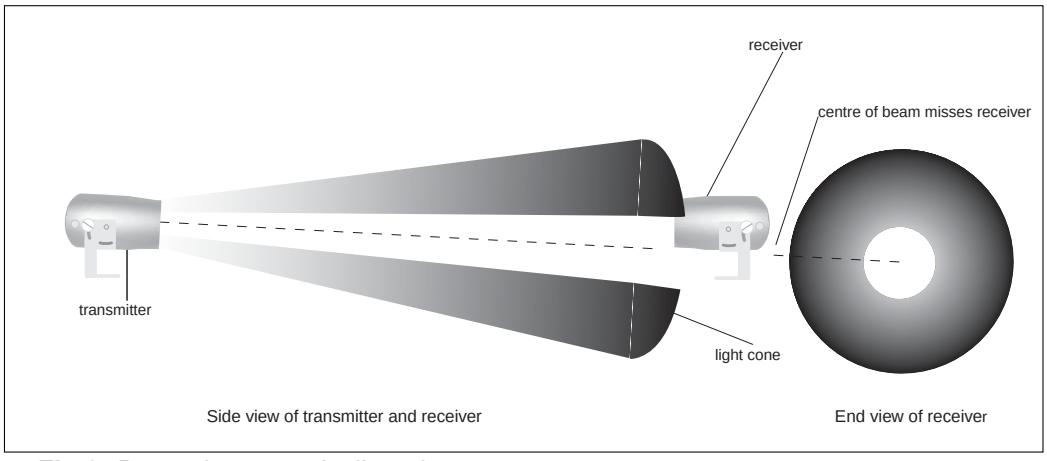


Fig 8 *Beam detector misaligned*

The XP95 beam detector has been designed with ease of commissioning in mind and is aligned and calibrated using an LED.

**In retro operation smoke passes through the projected beam twice; the alarm level should therefore be set to 65% obscuration.*

Aligning the beam detector
The beam detector incorporates alignment by means of an LED in the receiver as this method is convenient and can be carried out by one person without the need for cables or a voltmeter.

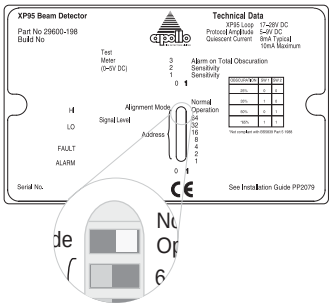
The receiver is fitted with a high-intensity red LED which, in normal conditions, pulses when a fire is detected. During commissioning this LED may also be used to facilitate beam alignment and calibration (note that local light conditions must allow the LED to be visible over the entire beam length, ie, up to 100 metres. During commissioning of the beam detector the LED will be in one of the following states:

Receiver LED flash rate	**Status of alignment**
Fast (4 flashes/sec)	Signal strength too high
No flash	Optimum signal
Slow flash (1 flash/sec)	Signal strength too low or non-existent

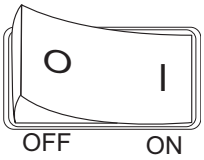
Calibrating the beam detector
The beam detector is calibrated by means of a potentiometer in the transmitter. To access the potentiometer, remove the small clear plug on the side of the transmitter.

Use a small screwdriver to rotate the potentiometer. Do not use excessive force.

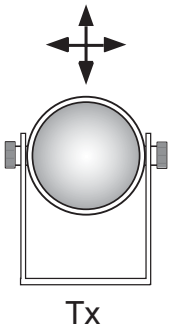
Step by step guide to aligning and calibrating



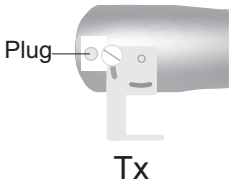
1. Check that the cables at the interface (Fig 4 on page 6) are correctly connected and switch the interface to alignment mode.



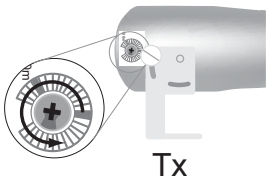
2. Power up the beam detector.



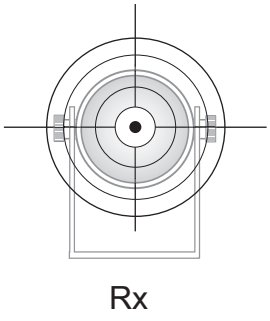
3. After fitting the transmitter and receiver as described in point 3 on page 8, loosen the transmitter so that it can be moved with slight resistance up, down, left and right.



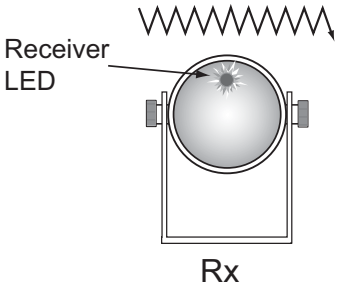
4. Remove the plug on the transmitter.



5. Using a 0 point cross-head or terminal screwdriver turn the potentiometer fully anti-clockwise. This adjusts the transmitter power to maximum.

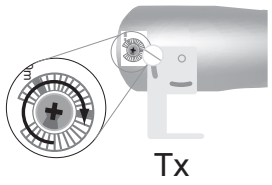


6. The transmitter must be correctly targeted at the receiver by a combination of movements, up and down, right and left until the centre of the beam hits the centre of the receiver.

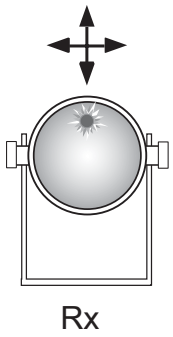


7. Move the transmitter left, right, up, down until the LED on the receiver **flashes fast**. Hold the transmitter in this position.

fast flash	signal too strong
slow flash	signal too weak
no flash	signal correct

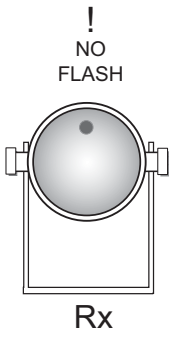


8. Reduce the signal strength by turning the potentiometer slowly clockwise until the receiver stops flashing.



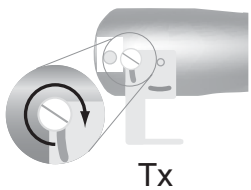
9. Move the transmitter from right to left, in order to see if the receiver LED can be made to flash fast again. If it can, repeat step 8.

   Repeat this procedure but this time move the transmitter up and down.

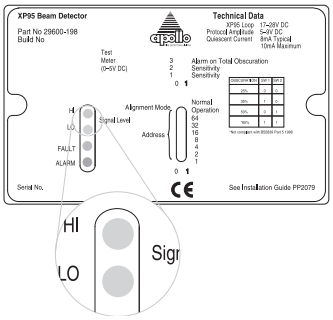


10. The beam detector is correctly aligned if there is no flash after carrying out the movements described.

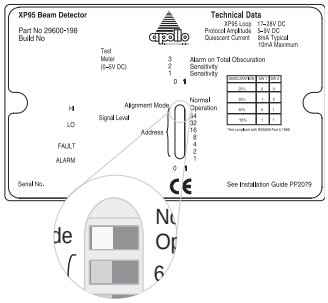
    To confirm the correct alignment of the detector move the transmitter slowly up, down, left and right. Each movement should cause the LED in the receiver to flash slowly. Leave in centre position with no LED flashing.



11. Tighten the securing bolts and screws of the transmitter, making sure it does not move and replace the plug covering the potentiometer. Failure to replace the plug may result in false alarms due to ingress of contaminants.



12. Check the interface to see if the HI and LO LEDs have extinguished. If they have not, the alignment procedure has to be repeated.



13. Set segment 8 of the DIL switch on the interface to normal operation.

Notes

1. *When the beam detector interface is in alignment mode, the fault LED will be continuously lit and a fault signal (analogue value 4) will be transmitted to the control and indicating equipment.*

2. *The signal HI and LO LEDs (green) on the interface operate only when the beam detector is in alignment mode. Only one LED will operate at any given time.*

3. *The beam detector interface is factory programmed to report a fault condition, regardless of whether or not it is in alignment mode, whenever the interface is powered up for the very first time and the beam has not been aligned. This fault condition will only be cleared following successful initial alignment and is designed as a safeguard against poor installation and alignment practice.*

4. *Alignment checks are recommended once per annum. To check the alignment, switch the alignment switch in the interface to 'alignment' and check that only the yellow fault LED is lit. If either green 'HI' or 'LO' LEDs are lit, it will be necessary to re-align the beam detector.*

5. *If at any time components of the system are exchanged the beam detector must be realigned. Information exchanged between the interface and the receiver head is specific to individual receiver heads and interfaces.*

6. *If the fault LED flashes at any time, a fault signal will be sent to the control panel. The flash indicates that the data in the receiver and the interface do not match. This may be due to a number of causes, such as handling the PCB without taking anti-static precautions or a mismatch of transmitter/receiver sets after dismantling and re-installation. In such a case the beam detector must be re-aligned.*

COMMISSIONING TESTS

1. **Alarm test using filter**
   Hold the test filter over the lens of the receiver. After approximately 8–10 seconds an alarm will be signalled and the red LED in the receiver will flash. Check that an alarm has been registered at the control panel. Remove the test filter and the alarm will reset after approximately 30 seconds.

2. **Total obscuration test**
   Depending on the total obscuration option selected, a *fire* or *fault* is signalled if the beam path is blocked by more than 93% for greater than 8 seconds.

   To carry out this test, cover the receiver so that it registers no light at all. Wait 8 seconds for the detector to react and 3 seconds for the interface to operate. Then check that the alarm or fault LED on the interface is illuminated and that a fire or fault signal is registered at the control panel.

   After removal of the blockage the beam detector resets after 20–30 seconds, depending on the option selected.

3. **Response to protocol commands**
   Finally, perform a test of the beam detector response to control panel commands.

   The XP95 beam detector responds to output bits from the XP95 protocol as follows:

   When **output bit 2** is set to **logic 1** on two or more consecutive pollings the beam detector performs an alarm LED test. The red alarm LED on the interface is illuminated and the red LED in the receiver flashes.

   When **output bit 1** is set to **logic 1** on two or more consecutive pollings the beam detector carries out an interface self test. The interface transmits a 'fire' signal, ie, analogue value 64, to the control panel and the red LED in the receiver flashes.

   When **output bit 0** is set to **logic 1** on two or more consecutive pollings, the remote indicator output in the interface is enabled. The remote indicator output is useful in locations where the interface is not easily visible from the ground and confirmation of a fire signal is required.

MAINTENANCE INFORMATION

Replacement Units

If any part of the beam detector set needs to be replaced for reasons of damage or malfunction, the transmitter, receiver and interface can all be ordered separately.

As a result of product enhancements, however, some older issues of interface or receiver are not compatible with new units and it is not possible to replace older versions with the enhanced version separately. In such cases, both interface and receiver must be replaced if a new receiver is to be installed.

The transmitter is not affected.

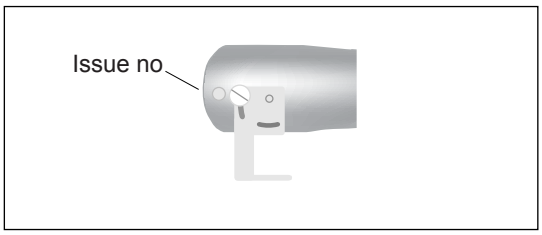


Fig 10 *Issue number label–receiver*

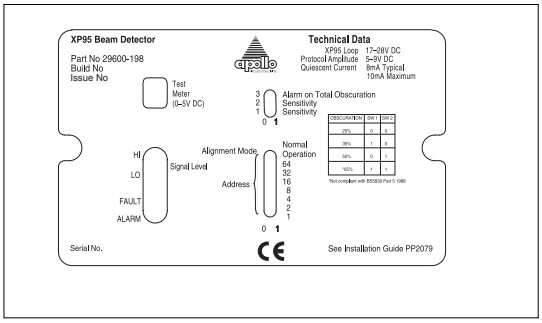


Fig 9 *Issue number label–interface*

Interface and receiver compatibility

Interface issue	Receiver issue			
	1	2	3	4
1	Yes	Yes	Yes	No
2	Yes	Yes	Yes	No
3	Yes	Yes	Yes	No
4 & 5	Yes	Yes	Yes	Yes

Table 2 *Compatibility table*

TROUBLESHOOTING

Before investigating individual units for faults, it is very important to check that the *system* wiring is fault free. Earth faults on a data loop or any ancillary zone wiring may cause communication errors.

Many fault conditions are the result of simple wiring errors. Check all connections to the unit and make sure that the correct value resistors are fitted where necessary.

Fault finding

Unable to obtain fast or slow flashing alignment LED	Voltmeter lead connected to interface No power to interface Receiver incorrectly wired
Receiver has constant slow flashing alignment LED	Transmitter not aligned with receiver Transmitter power too low No power to transmitter Receiver not pointing toward transmitter
Interface alarm LED illuminated	Beam is in alarm condition See notes
Interface HI or LO LED illuminated	Beam out of alignment
Alarm Condition	Beam partially obscured Transmitter or receiver contaminated Environmental conditions
Fault Condition	Interface is in alignment mode Beam out of alignment Beam obscured Receiver incorrectly wired Environmental conditions

Notes
The alarm LED is illuminated by the control panel usually when the beam detector is in alarm condition. However, some control panels illuminate this LED when a device fault is detected. In alignment mode, the beam detector interface returns a fault signal.

TECHNICAL DATA

Supply voltage	17–28V DC
Quiescent current (max) @ 24V DC	
Receiver & interface	10.5mA
Transmitter	6.0mA
Alarm current (max) @ 24V DC	
Receiver & interface	12.0mA
Transmitter	6.0mA
Fire alarm thresholds	1.25dB (25% obscuration) 1.87dB (35% obscuration) 3.0dB (50% obscuration) 4.55dB (65% obscuration)
Operating range	10m to 100m 5m to 45m with reflectors
Tolerance to beam misalignment at 35%	Transmitter ±1°; receiver ±4°
Optical Wavelength	880nm
Receiver/interface cable type & max length	Twin twisted pair (7/0.2), 1 pair A&B, 1 pair C&D or Screened 4-core (MICC, for example) 100m
Finish	White
IP Rating	50
Operating temperature	-20^{0}C to +55^{0}C
Sizes and weights	
Interface	147 x 85 x 22 mm, 200g
Heads with Brackets	83 x 115 x 135 mm, 400g each
Part no. & size of reflectors	29600-201, 100 x 100mm
For beam range 5–25m	use 1 reflector
25–35m	use 4 reflectors, arranged as a square
35–45m	use 6 reflectors, arranged as a rectangle

Factory default settings

Alarm level	35%
Total obscuration option	Fault
Alignment/normal setting	Alignment mode
Address set	1

Spare parts

Part number	Description
55000-265	Beam detector complete
29600-198	Spare interface
29600-199	Spare transmitter
29600-200	Spare receiver
29600-201	Reflector

Apollo Fire Detectors Limited, 36 Brookside Road, Havant, Hants, PO9 1JR, UK
Tel +44 (0)23 9249 2412 Fax +44 (0)23 9249 2754
Email: techsales@apollo-fire.co.uk Website: www.apollo-fire.co.uk