INSTALLATION AND INSTRUCTION

1. Introduction

The PIR-250 is a highly sensitive Passive Infrared Detector designed for long range detection outdoors with a narrow, curtain-shaped differential field of view. It incorporates microprocessor controlled signal processing including signal shape analysis, adaptive threshold level by feedback of environmental effects, temperature compensation and rejection of disturbance signals.

Sensitivity and mounting height adjustments are done with DIP-Switches for each individual unit in function of the required detection range in order to adapt to the specific needs of an installation. Depending on the type of installation, emphasis can be put on maximum detection or lowest possible nuisance alarm probability.

2. Mounting and Installation

The mounting structure should be stiff enough to resist significant deflection in windy conditions. Movement of the PIR-250 caused by vibrations or other movements will result in large swings of the field of view covered by the PIR-250 and could cause strong disturbance signals. These unwanted signals may lead to an increase of the alarm threshold level which reduce the detection probability or in certain cases can lead to unwanted alarms.

The clamp around the body of the PIR-250 should be positioned app. half way between the front window and the back cover to avoid slight deformations of the body near the seals at each end.

- It is very important that the back cover of the PIR-250 is securely tightened. It is not sufficient to close the cover only to the point where the O - ring starts to rub against the inner wall of the housing. It must be tightened to the point where it cannot be closed further with reasonable force when using a lever such as a screw driver in the groove. There will then be hardly any gap between the cover and the housing (considerably less than 1 mm).

The cable entry assembly should not be changed without authorisation by the manufacturer. It is specifically designed to allow air entry and exit so that the inside of the PIR-250 is always at atmospheric pressure. This prevents moisture being sucked into the PIR-250 by drop of internal pressure likely to happen when rainfall rapidly cools down a unit warmed up in the sun.

The nut on the cable entry assembly should be tightened to clamp the cable in place with the nylon grip. If the cable diameter is too small to be held by the grip, insulation tape should be wound around the cable to increase the outside diameter to a suitable size.

3. Connecting the PIR-250

For the definition of the connector board and terminal block see Annex 1.

Alarm Signalling

There are two types of alarm signalling from the PIR-250:

- one set of SPDT potential-free relay contacts
- an open collector transistor to negative supply rail

The relay contacts change state and the transistor switches to low resistance on alarm. The suggested method of configuring the alarm wiring is to select the normally closed relay contact.

Internal Heater

The PIR-250 has an internal heater regulated by a PTC - resistor to prevent condensation on the optical surfaces. The heater has separate terminals to allow for an independent AC or DC power supply to be connected on it, this may be chosen to reduce the required capacity of an emergency power supply having to bridge short mains failures. However in most applications it can be connected across the DC supply to the electronic circuit.

- It is strongly recommended that the heater is connected even in warm climates, as sensitivity may be reduced and internal damage caused by condensation.

Tamper Switch

To detect attempts to open the PIR-250, a tamper switch is fitted for the rear cap. Its contact opens when the cap is unscrewed and should be connected in series with the normally closed relay contact.

Electronics Supply

Ensure that polarity is correct when connecting power to the electronic circuit. Protective circuitry will withstand a short period of reversed polarity, but damage will result if this is not corrected quickly.

4. Field of View

The PIR-250 has a curtain-shaped field of view with three independent detector zones for long, medium and short range detection. Their relative sensitivity is automatically adjusted as a function of the selected range and height setting. The vertical opening angle is app. 70° resulting in an uninterrupted curtain starting at 1.3 m with the PIR-250 mounted at 4.0 m height and aligned for a detection range of 100 m (see Fig. 1).

The mounting should be done in a way to allow easy horizontal and vertical alignment while giving the required long term stability.

5. Alignment

The detection range of a PIR detector is not limited but a function of size, speed and temperature contrast of a target against its background. The PIR-250 should be aligned so that the field of view is terminated by a natural or artificial background at the end of the range.

Where a terminating screen is used its surface should not be glossy to avoid reflected images from outside the field of view. Also the material may be transparent for visible light but it has to block thermal radiation; wood polycarbonate and acrylic are suitable materials. For further details refer to the information in Annex 2.

Effectiveness of a screen has to be checked by walk testing around the screen. Signals from walk tests in front of the screen should still be strong while movements behind the screen should result in signals well below the threshold level. If walk tests or vehicles passing behind the screen are strong enough to trigger an alarm the PIR-250 should be tilted slightly downward. The Installation Tester IT 44 gives accurate information about signal strengths during a test.

Coarse alignment can be done visually by looking along the top of the detector. Accurate fine alignment is easily achieved with the help of the Universal Telescopic Sight ZA P 03 which can be placed on top of the PIR-250 for this purpose.

The graticule of the ZA P 03 corresponds to the axis of the detector. The detection curtain extends from + 1.2° to - 70° in the vertical plane from the axis of the detector. The table below shows the elevation (Z) of the upper edge of the field of view from the axis and the total width (Y) of the field of view as a function of the actual distance from the PIR-250.

Distance X	Total width Y	Elevation Z
25 m	0.6 m	0.5 m
50 m	1.3 m	1.0 m
75 m	1.9 m	1.5 m
100 m	2.5 m	2.0 m
125 m	3.1 m	2.5 m
150 m	3.7 m	3.0 m

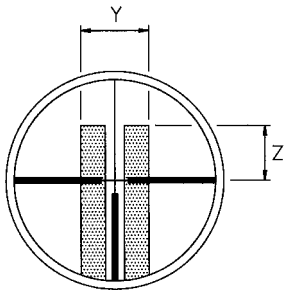


Table 1

Note: The dimensions „Y“ and „Z“ are calculated figures verified by experiments. Actual dimensions will vary with contrast conditions.

Typical vertical alignment for a required detection range of 100 m

The PIR-250 should be aligned vertically so that at least the lower half of a person standing upright at the maximum required range will be within the field of view (see Fig. 1 below).

Side view

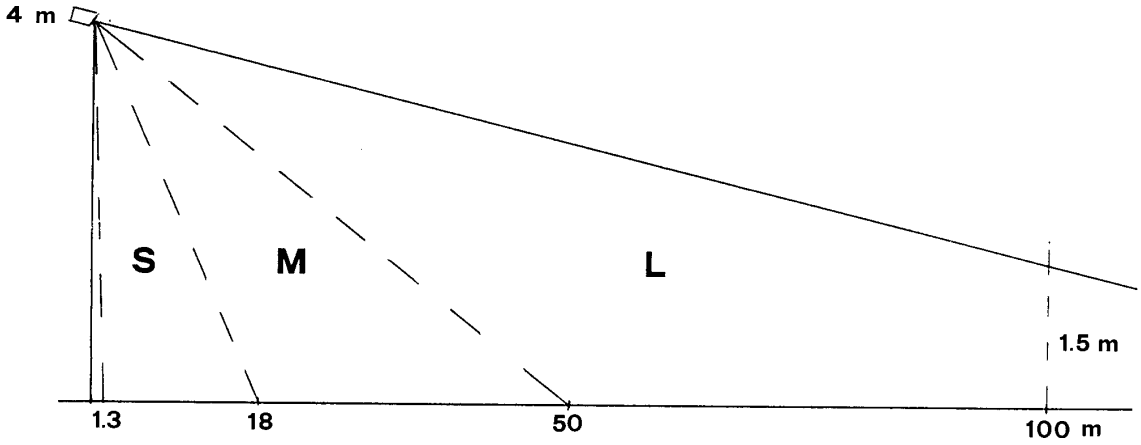


Fig. 1

Typical horizontal alignment

Horizontal alignment should be done in a way to avoid unwanted signals being generated by targets (branches, bushes, fences) likely to be moved by wind (see Fig. 2 below). Movement within the field of view will reduce the sensitivity of the PIR-250 by increasing the alarm threshold level and may lead to unwanted alarms.

Top view

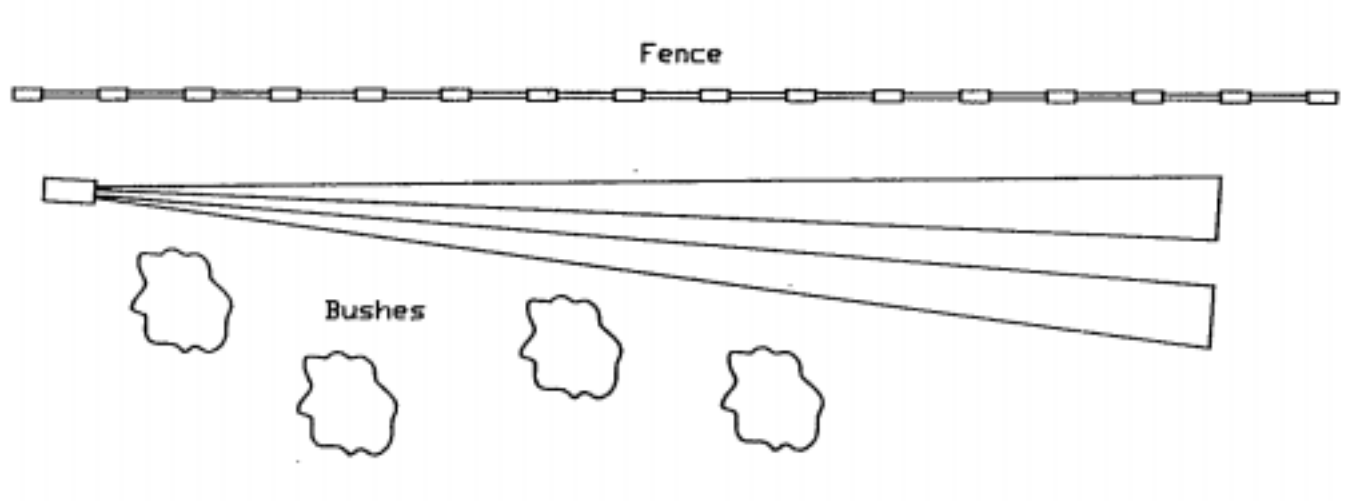


Fig. 2

The ZA P 03 alignment telescope is a convenient alignment aid giving a high degree of accuracy for initial installation. It is nevertheless important to verify correct alignment by monitored walk tests across the field of view.

- When walk testing the unit the threshold level will increase as a result of the signal generated by the target and decrease exponentially in time after the event.. To make sure that original sensitivity is reached, wait at least for 1 minute between each crossing.

If the Installation Tester IT 44 is used for monitored walk tests, the nominal threshold level can be reset instantly after each crossing by pressing the reset button.

6. Sensitivity Adjustment for Range and Mounting Height

The sensitivity of the PIR-250 is adjusted by means of multiple DIP - switches on the connector board for varying required detection ranges and mounting heights.

Recommended settings of the **first and second DIP - switch** as a function of the required **detection range** are as follows:

Switch 1 and 2	**IT 44 Display**	**Detection Range**
on - on	max.	80 to 150 m
on - off	80 m	60 to 80 m
off - on	60 m	40 to 60 m
off - off	40 m	up to 40 m

Vertical alignment is optimal when the upper edge of the field of view is at 1.5 to 2.5 m above ground at the end of the required detection range provided that the field of view is properly terminated. Setting the detection range as specified above does not limit the range but reduce the sensitivity of the „L“ Zone to avoid unnecessary high sensitivity where not needed.

The PIR-250 is designed for mounting at heights between 2.5 and 4.0 m above ground. The **third DIP - Switch** is used to set the relative sensitivity of the medium and short range zones in function of the **mounting height** as recommended:

Switch 3	**IT 44 Display**	**Mounting Height**
on	Hi	above 3.0 m
off	Lo	up to 3.0 m

If the mounting height is less than 2.5 m, a detection gap at app. 10 m distance may be observed for fast movements. This is due to the overlap of the three zones and resulting rejection of simultaneous signals (see paragraph 10 below).

- Since the relative sensitivities of the three zones are carefully balanced and tuned with the settings recommended above, a different setting may result in poor detection or excessively high nuisance alarm rates in most applications. It is therefore not advisable to try to influence the PIR-250's performance by using settings beyond the above recommendations.

7. Alarm Time

Alarm time depends on the shape and amplitude of the alarm signal and can be as short as app. 200 ms. If required by the application the **alarm time** can be selected to be a **minimum of 10 seconds** per event with the **fourth DIP - Switch** set to „**on**“.

8. Internal Temperature Compensation

The PIR-250 is detecting radiation differences of a target against its background. In the course of the day and year the contrast of a person will vary considerably and affect the signal strength. To compensate for this contrast variation, the PIR-250 has an internal temperature compensation with maximum sensitivity at app. 30°C (where the contrast of a human target is weakest) and gradual reduction at higher and lower temperatures.

- When installing a unit the internal temperature may take up to 30 minutes or more to stabilise to the actual external temperature. Sufficient time should be given to the PIR-250 to reach the correct internal temperature and sensitivity before performing walk tests.

During the initial period of operation it is strongly recommended that walk tests are repeated and signals monitored under various weather conditions such as high and low temperatures, wind fog, snow, rain etc. to obtain comparative data and information on the effects of environmental conditions on detection and nuisance alarm probabilities for this particular site. Fine tuning of the detector based on this data by changing DIP - Switch positions may optimise the overall performance.

9. External Sensitivity Adjustment

Overall sensitivity of the PIR-250 can be **set to 50%** by applying a **logic high to position 9 of the terminal block**. This can be done either by a wire link to the supply voltage (position 11 of the terminal block) or remotely from the control room. With this feature the PIR-250 can be set to operate either in the „High Detection“ or the „Low Nuisance Alarm“ mode.

It is suggested to set the mode in function of the application as follows:

- „**High Detection**“ for sites with visual alarm check by eye sight, alarm verification by video or where video motion detection is used as a second detection system.
- „**Low Nuisance Alarm**“ for sites where the PIR-250 is used without alarm verification by video or where non-detection of weak contrast targets can be afforded.

Although the PIR-250 is designed for detection at up to 150 m, it is recommended to divide longer sections into portions not exceeding 100 m. In the „**Low Nuisance Alarm**“ mode, detection at above 100 m may become uncertain under unfavourable conditions.

The external sensitivity adjustment may also be used if overall sensitivity has to be changed at certain periods of the day or year depending on the prevailing thermal contrasts. Field tests in the actual environment will determine the optimum settings.

10. Signal Processing

The background noise is sampled at a rate of app. 300 per second and averaged over a large number of cycles giving a noise dependent value for the alarm threshold and to start the signal shape analysis whenever a certain amplitude value is exceeded.

If the threshold has temporarily been increased by high background noise or repeated movements in the field of view, the exponential decay of the threshold level to its original value will take app. 1 minute from the end of the event.

All sensitivity settings, as described in paragraph 6 above, affect the threshold level and subsequent signal analysis for the alarm generation. The signal amplitudes measured on the test socket or displayed on the Installation Tester IT 44 are not affected by the settings.

- A multiple threshold level decoding with reduced threshold in the areas where two zones overlap, determines the alarm condition. The analysing software takes into consideration the signals generated by a large variety of possible targets, speeds and contrast conditions.

Once the first threshold level value has been exceeded in any one of the three detection zones, the microprocessor starts its signal shape analysis routine where a number of interdependent parameters including peak amplitude, rate of rise, time windows and overall shape are calculated and analysed.

If all three signals reach the threshold level within a defined short time window, as may happen as a result of RF interference, lightning, shock waves or birds flying across the field of view close to the unit, a possible alarm will be rejected. This means also that installation has to be planned in a way that this feature may not lead to uncertain detection of wanted targets (especially when the detector is mounted lower than specified, see paragraph 6).

Only if a signal meets all the predetermined criteria an alarm will be generated.

11. Installation Tester IT 44 and PIRScope Software

The Installation Tester IT 44 is very useful for alignment and signal check during setting up and routine maintenance. It will indicate the amplitudes generated by wanted as well as unwanted targets and help setting the gain control correctly during walk tests and also show the magnitude of disturbance signals.

The information displayed on an LCD once the Installation Tester is connected to the detector includes model and version identification, bar display of signal amplitudes with peak hold feature, instantaneous threshold level, channel identification as well as alarm time and count. A separate description is available with more details.

12. Maintenance

The detector has been designed to be virtually maintenance free but the following precautions are recommended:

1) ***Visual inspection of the front window*** for accumulation of dirt on the outer surface or damage at intervals of app. 6 months. Clean the surface with a paper tissue and avoid rubbing dirt into the surface. Use the same precautions as for a camera lens.

   It can happen, that after a period of operation depending on the quality of the air, small blemishes or spots become visible on the surface of the window. These will normally not affect the performance of the PIR-250.

2) ***Visual inspection of the inside*** for ingress of water is recommended at intervals of 6 to 12 months or whenever the unit is opened for adjustments or tests. Make sure that the sealing rings are in place before closing the back cover tightly again.

3) ***Inspection is recommended following extreme conditions*** such as snow storms, sand storms, hail etc. to make sure that nothing has been damaged and the sensitivity is not reduced by accumulation of snow, sand or dirt on the front window. Snow or dust in front of the window should be removed by hand or by using of a soft instrument such as a wooden stick.

13. General Comment on the PIR-250

- Despite the advanced design and state-of-the-art features of the PIR-250 it is in the nature of a Passive Infrared Detection System that an absolute detection probability and freedom from nuisance alarms cannot be achieved, *masking of the PIR-250 cannot be excluded*.
- Detection is a function of thermal contrast, speed and size of a target crossing the field of view. Contrast conditions can vary significantly in the course of the day and year.
- Detection depends also on the sensitivity settings, the exact aiming and the prevailing weather conditions as well as the nature of the target and background.
- The detection pattern and frequency response of the PIR-250 have been optimised for the detection of human size targets crossing the field of view in an upright position at speeds in the range of 0.2 … 5.0 m/s.
- Detection of slow moving targets at long range may become uncertain under weak contrast conditions. It is strongly recommended to limit the zone length to max. 100 m when human targets moving at the minimum specified speed need to be detected with high probability.
- Animals or crawling people may or may not be detected depending on their size, speed, contrast and distance from the PIR-250.

It is therefore strongly recommended to combine the PIR-250 with an alarm verification such as CCTV or a second system using other physical means of detection.

Any liability for direct or indirect damage resulting from the use of the PIR-250 as a detection device are explicitly disclaimed.

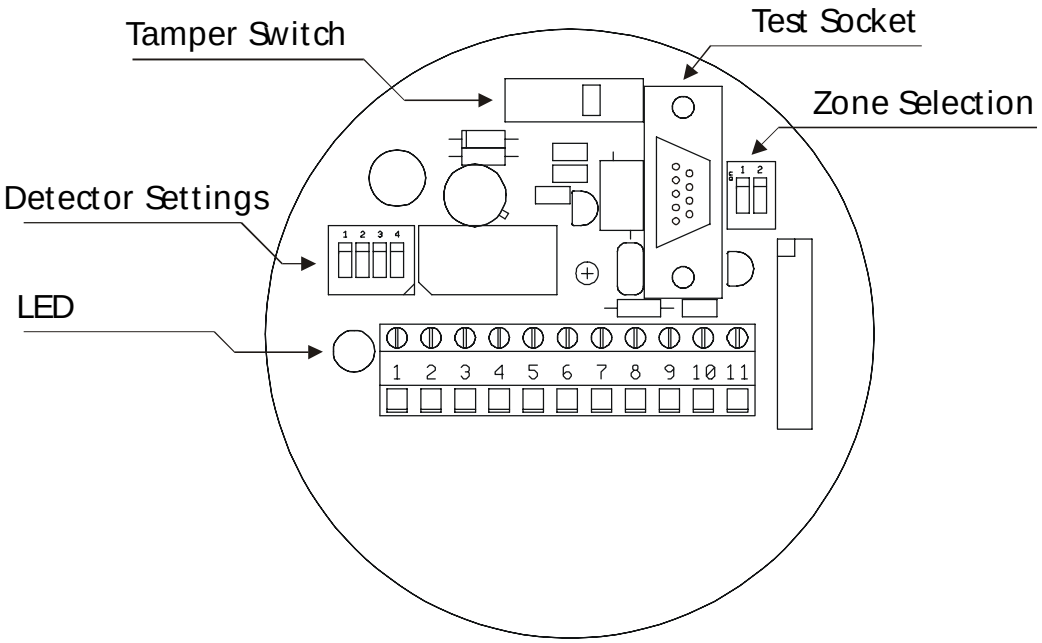
The information in this product manual is based on testing of samples taken at random from production and believed to be representative.

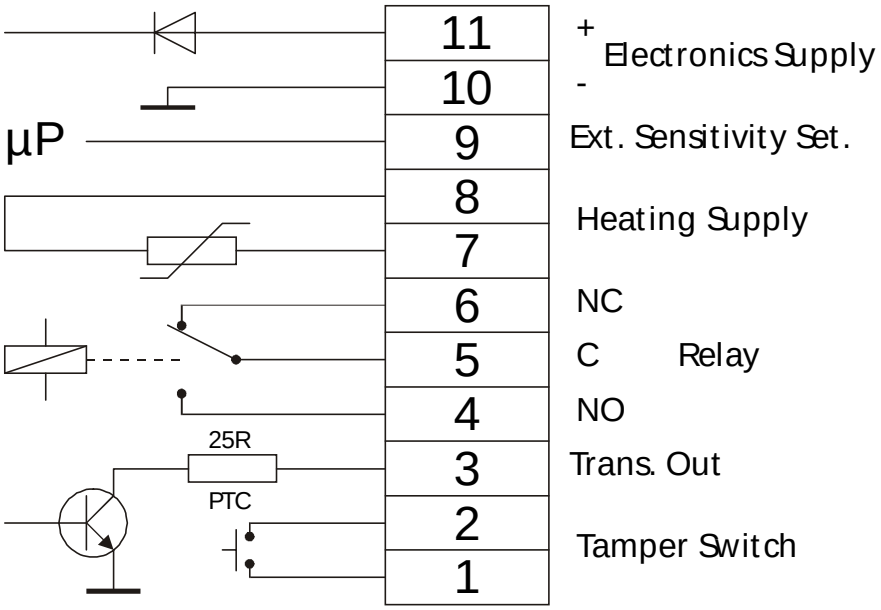
14. Specifications

Nominal Range:	150m (492 ft)
Spectral Response:	8-14 micrometres, double filtered
Sensor:	Differential pyro-electric array
Alarm Output:	SPDT relay, 3W, 0.25A, 28VDC/20VAC Transistor, NPN open collector, 20mA/30V
Output Protection:	PTC resistor
Alarm Indicator:	Internal LED
Alarm Hold Time:	0.2-10 seconds, adjustable
Sensitivity Adjustment:	Switch pressettable for range & mounting height
Temperature Compensation:	Automatic
Target speed	0.2 – 5 m/s
Internal Switches:	Adaptive threshold system on/off
Supply Voltage:	10.5 to 28 VDC (nominal 12VDC)
Supply Current:	Typ. 20 mA at 12VDC (without heater)
Heater Power:	Approx. 1 W at –40°C
Operating Temperature:	-40°C to 60°C (-40°F to 140°F)
Sealing:	Splash proof to IP64 (cable entry spray proof to IP53)
Weight:	1.5 kg (3.3 lbs)
Dimensions:	275mm long x 100mm diameter (13” x 3.5”)
Cable Feedthrough:	Cable diameter 6-14mm (PG16)
Cable Termination:	Screw terminals
Mounting:	UBP-250, Universal mounting bracket (optional)
Test Socket:	For connection to IT44 Install. Tester

Annex 1: Connector Board and Terminal Block

The relay is shown in energised, non - alarm state.





Annex 2: Instructions for Terminating Screens and Ground Surface

Introduction

The detection range of a PIR detector is not limited but a function of size, speed and temperature contrast of a target against its background. Alignment of the detectors should be carried out in such a way that the field of view is terminated by a natural or artificial background at the end of the range. Reflections from inside or outside the field of view have to be avoided as well as possible.

Definition of Field of View

The numbers stated in the technical manual for the vertical and horizontal dimensions are defined – per the usual standards – as the half power points representing 50% of the relative sensitivity at that distance for a typical human target. Absolute signal amplitudes depend on temperature contrast, speed and size of a target and can be up to 20 times (and more for large vehicles) higher than the alarm threshold. For a strong signal the dimensions will appear to be increased compared to the nominal values. This needs to be considered when dimensioning a terminating screen.

Dimensioning a Terminating Screen

From the field of view definition it becomes clear that the width of a terminating screen has to be larger than the actual figures given in the technical manuals, this particularly when a street crosses the field of view behind the screen.

A practical factor for the width of a screen is **1.5 times the width Y** of the field of view at the distance from the detector.

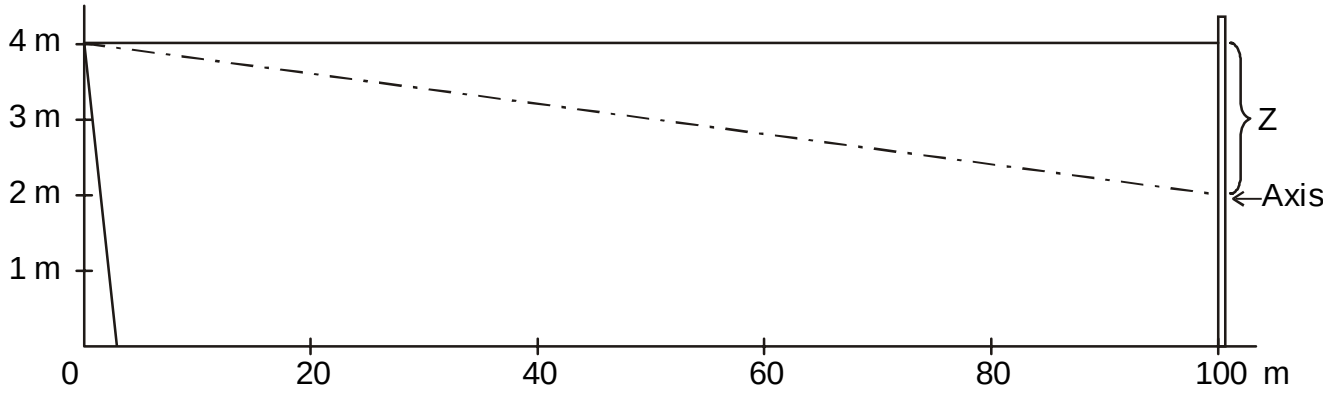
The considerations for the vertical dimension are similar although a certain installation flexibility is given by tilting the unit slightly downward with the risk of losing sensitivity in the uppermost part of the curtain. Therefore it is recommended to extend the screen also vertically in the same way using the same factor of **1.5 times the elevation Z**.

Example: Screen at 100 m for a curtain height of 4 m with a PIR-250 (see Table 1)

Width Y	2.5 m	Screen Width	3.75 m
Elevation Z	2.0 m	Screen Height Above Axis	3.00 m

Total screen height = curtain height - elevation Z + screen height above axis

This results in **minimum** dimensions of **3.75 m wide by 5.0 m high** (4.0 m - 2.0 m + 3.0 m) for the terminating screen.



Typical side view of a terminating screen in 100 m distance from the detector. The dimension „Z“ is app. 2.0 m corresponding to the value of the table in section 5.

Required Properties of a Terminating Screen

The material of the screen has to block the thermal infrared radiation in the first place. Additionally it should be non-reflecting and thermally insulating to avoid unwanted signals from reflected heat sources and secondary radiation from strong sources heating up the screen from behind.

Since smooth surfaces – although dull for visible light – reflect the longer wave-length radiation of the thermal infrared much better, a rough or structured surface has to be used.

Wood has all the required properties if the surface is treated according to the recommendation but almost any plastic material would be suitable. If in doubt about thermal transmission verify the performance with tests or consult the manufacturer.

Reflections from Screen and Ground Surface

Special attention has to be taken to possible reflections from the rising or setting sun which may generate strong signals together with fast moving clouds. In cases where the screen is facing sunrise or sunset at any time of the year the top of the screen has to be tilted towards the detector to reflect the sun into the ground.

The ground has to be as non-reflecting as possible even when wet, use proper drainage to avoid forming of puddles. Reflections from snow can not be avoided technically and an increased occurrence of nuisance alarms while the ground is covered with snow has to be accounted for.

Recommended Screen Dimensions

The following table indicates minimum values for the dimensions of a terminating screen in function of the distance.

Depending on the nature of possible nuisance alarm sources behind the screen, larger dimensions have to be chosen (e.g. sources with strong thermal contrasts like heavy vehicles, trains or aeroplanes) to avoid unwanted alarms.

Distance X	Recommended screen width	Recommended screen height above axis
25 m	1.00 m	0.75 m
50 m	2.00 m	1.50 m
75 m	3.00 m	2.25 m
100 m	4.00 m	3.00 m
125 m	5.00 m	3.75 m
150 m	6.00 m	4.50 m

Annex 3: Installation Tester IT 44 and PIRScope

Introduction

The universal Installation Tester IT 44 is available as accessory for alignment, setting up and fault finding and can be used with all analog or digital detectors. It is recommended for verification of all installations in order to optimise the performance of the detectors.

The following describes the features of the IT 44 and the software program for signal display.

It is strongly recommended that the detection performance of the detector is verified by using the IT 44 Installation Tester. The IT 44 is connected to the detector's test connector from which it receives power and data without interfering with the detector's operation.

The IT 44 displays all relevant detector data on a 4 - line liquid crystal display (LCD) including settings, signal amplitudes with peak-hold and the alarm threshold level. The threshold level is dependent on the sensitivity settings of the detector, the temperature and the amount of disturbance signals including walk tests.

Connection / Reset

The IT 44 is supplied with a cable of app. 3 m length terminated with a 7 pole circular connector. An adapter cable for connection to the Sub-miniature D-type connector of the detector is supplied with the IT 44.

When connected to the detector the IT 44 will be powered, start operation, establish communication between the two microprocessors and display the identification of the Installation Tester „IT 44“ including its version (e. g. „V 0.2“) on line 1, the detector identification „PIR-250“ and version (e. g. V 1.1), „Digital Mode“ on line 3 and „ASIM Technologies“ on line 4 for a short period of time. The same display will appear every time RESET is pressed.

Liquid Crystal Display

The display is divided into 4 lines providing the following information:

Line 1: Signal and Peak Hold

Quasi-logarithmic bar display in 60 steps shows the amplitude of the strongest signal from the three channels. The peak amplitude of each signal exceeding the first threshold level is maintained for app. 6 s.

Line 2: Alarm Threshold Level

Displays the second alarm threshold level in the same scale as in line 1 plus indication of the channel currently displayed on lines 1 and 2 „**L**“ = Long, „**M**“ = Medium, „**S**“ = Short). The threshold level will be increased by disturbance signals and walk tests.

Line 3: Alarm Indicator and Counter

Displays „**Alarm ON**“ or „**Alarm OFF**“ and the number of counts since last reset (display of „**Count**:“ and „**0**“ to „**99**“ or „**–**“ if 99 counts have been exceeded).

Line 4: Settings

Displays the following:

- range setting („**max**“, „**80 m**“, „**60 m**“, „**40 m**“)
- height setting („**Lo**“ or „**Hi**)
- external sensitivity («**1/2**» if selected)
- alarm time („**10 s**“ for minimum 10 seconds alarm if selected)

Audible Alarm

The IT 44 has a high efficiency sounder which allows checking of the installation by a single person. This is engaged by operating the toggle switch on the side of the IT 44.

Digital Output

The digitised detector information is available on a RS 232 interface on a test connector at the side of the IT 44 for display on a PC screen with the **PIRScope** software.

No attempt should be made to make other use of this connector without instructions.

Application of the IT 44

The IT 44 is a most useful tool for checking the alignment and sensitivity setting of the detectors. It greatly facilitates the optimisation of an installation to suit a particular site.

The IT 44 is particularly helpful in situations where a detector is operated under conditions near the recommended operating limits of height, detection range and target speeds. The information supplied by the IT 44 display should be used to monitor the detection performance of the detector and make adjustments if required.

Depending on the site's animal activity, vegetation moving in the wind and/or other sources of disturbance it is possible that unwanted alarms occur. Monitoring and interpreting the information supplied by the IT 44 will help finding the best solution either by adjusting the alignment and/or sensitivity of the detector or by removing disturbance sources from within the field of view.

PIRScope Software for PIR-250

For Display of Signals on a PC Screen Using the IT 44 as Interface Unit.

Procedure

- Connect the PIR-250 to power and connect the IT 44 to the detectors test socket
- Connect the IT 44 output with the serial COM port of the PC
- Load file „PIRSCOPE.EXE", enter language and number of COM port
- Adjust display using the keys as defined on screen
- Display will show signal amplitude (green), threshold (red) and alarm (yellow) for the three channels individually, including the corresponding alarm conditions (yellow) for each channel as well as the actual alarm output (yellow) on the bottom line. Additionally it shows also the model identification including its version
- Press „H" to save a display in the active directory. A file will be generated and saved as „DDMMYYAB.BMP" where AB are used for identification of files within one day.

Note

- When walk testing the PIR-250 make sure to **press the „reset" button before each walk test**, otherwise the detection will become poor due to gradual increase of the thresholds.
- Running „PIRSCOPE.EXE" under Windows may lead to problems therefore exit Windows and **start computer under DOS** to run the program.