

### 1. INTRODUCTION

#### 1.1 Feature Summary

- Microcomputer software signal processing.
- Watchdog microcomputer supervision.
- Microwave and PIR circuit supervision.
- Selectable PIR pulse counter with alternate polarity signal processing.
- Separate diagnostic indications for PIR trip, microwave trip and alarms.
- Temperature compensated PIR circuitry.
- Microwave detector range control
- Dynamic Software Filtering (DSF) selectively filters out fluorescent light interference at 50 and 60 Hz. Also filters away the harmonics of these frequencies and random noise.
- Protection against transients and RFI.
- Dual element PIR detector.
- Six interchangeable lenses with coverage pattern up to 140°.
- Adjustable vertical calibration.
- Look down "creep zone".
- Surface and corner mounting.
- Optional swivel brackets.
- Switchable walk test indication.
- Switchable diagnostic indication for the PIR and microwave sensors.
- State-of-the-art microstrip DRO-stabilized Microwave technology.
- Novel microwave signal-to-noise ratio enhancement by software filtering techniques.
- Controlled power-up procedures.

#### 1.2 PIR Detector

The PIR detector includes an alternate polarity pulse counter. When the PULSE jumper is set to ON (Para 3.5), the PIR detector will function in the 2-pulse alternate polarity mode, and will be tripped by entry into a detection beam followed by exit from the beam. When the PULSE jumper is set to OFF, the PIR will function in the single pulse mode, and will be tripped by every entry into a beam or exit from a beam. The green LED indicates a PIR trip. This indication will be enabled only in the DIAGNOSTIC TEST MODE (selected by the DIAG jumper). A temperature compensating circuitry stabilizes the detection range at all operating temperatures. The microcomputer supervises many aspects of the PIR operation and, in case of malfunction, a TROUBLE indication is initiated (Para. 1.5).

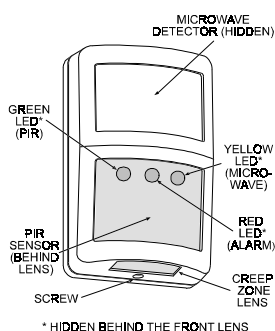


Figure 1. General View

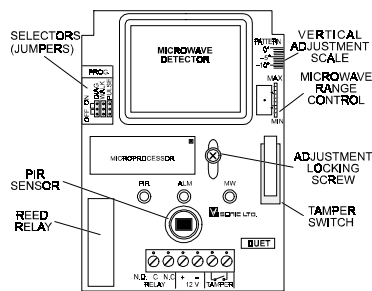


Figure 2. Printed Circuit Board

The PIR detector provides a down looking "creep zone". Various lenses can be used, from the standard lens (No.15D: 100 / 60 X 80 ft) to the ultra wide angle lens (No. 76D: 140° / 60 X 100 ft). See pattern diagrams in section 2.

#### 1.3 Microwave Detector

The microwave detector employs specially-developed state-of-the-art microstrip DRO circuitry. The microwave signal is processed by a microcomputer, using custom-developed pure software techniques. A unique Dynamic Software Filtering (DSF) technique is employed to filter out random noise and fluorescent lighting disturbance at both 50 and 60 Hz (including their harmonics), thereby allowing the microwave detector to detect very fast motion. The filtering software adapts itself to 50 or 60 Hz environments by automatic recognition of the disturbance frequencies. The DSF technique also increases the detection sensitivity and range by enhancing the signal-to-noise ratio much beyond that of a regular microwave detector.

The microwave coverage pattern is specially designed to allow the use of ultra-wide lenses (up to 140°) with the PIR. The micro-computer supervises the operation of the microwave detector in many ways and, in case of malfunction, a TROUBLE indication is initiated (Para. 1.5).

#### 1.4 LED Indicators

The three LEDs provide various indications in accordance with the mode of operation. The red LED provides alarm indications. The yellow LED relates to the microwave detector and indicates microwave trips and troubles. The green LED relates to the PIR detector and indicates PIR trips and trouble. The latter 2 LEDs make it possible to walk-test each detector separately (diagnostic test).

#### LED Response Summary Table

Function	Indication
DIAGNOSTIC TEST (selected by the DIAG jumper)	<b>Green LED</b> is ON for 3 - 5 seconds upon PIR trip <b>Yellow LED</b> is ON for 3 - 5 seconds upon Microwave trip <b>Red LED</b> is ON for 3 - 5 seconds upon dual trip
TROUBLE	<b>PIR trouble:</b> Green and red LEDs flash alternately <b>Microwave trouble:</b> Yellow and red LEDs flash alternately
WALK TEST (selected by the WALK jumper)	Red LED is ON for 3 - 5 seconds upon alarm
STABILIZATION (upon power up)	Red LED flashes for about 100 seconds

#### 1.5 Dynamic Trouble Supervision (DTS)

The DUET microcomputer carries out a continuous, diversified testing of the microwave as well as PIR circuitries to detect a possible failure in either technology. If a failure is detected in any technology, the LEDs identify the faulty detector as follows:

**Microwave trouble:** Yellow and red LEDs flash alternately

**PIR trouble:** Green and red LEDs flash alternately.

The TROUBLE indication will be maintained for as long as the failure condition lasts. The indications will be canceled only upon elimination of the cause for trouble.

### 2. SPECIFICATIONS

#### Electrical

**Input Voltage:** 9-16 VDC

**Current Drain:** Approximately 20 mA at 12 VDC

**PIR Detector:** Dual-element low noise pyroelectric type

**PIR Pulse Counter:** 1 or 2 pulses with alternate polarity signal processing.

**M.W. Detector:** Microstrip DRO-stabilized oscillator.  
**Microwave Frequency:** 10.525 GHz (USA) 10.687 GHz (UK)  
**Microwave Detection Range:** Adjustable between 25% and 100% of total range  
**Alarm Period:** 3-5 seconds  
**Relay Output:** Normally closed contacts with 18 ohms resistor in series. Contact ratings 0.1 A resistive / 30 VDC.  
**Tamper Contacts:** Normally closed, 0.5 A resistive / 24 VDC.

**Optical**

**Detection Patterns:** 6 interchangeable lenses are available (see patterns below).  
**PIR Adjustment:** Vertically, 0° to -12° with calibrated scale.

**Mounting**

**Configuration:** Wall or corner mounting (without additional bracket).  
**Mounting Height:** Up to 3.6 m (12 ft.)  
**Optional Mounting Accessories:**

**BR-1:** Swivel bracket, vertically adjustable 30° downward; horizontally adjustable 45° left/45° right.  
**BR-2:** Kit consisting of BR-1 and a corner adapter.  
**BR-3:** Kit consisting of BR-1 and a ceiling adapter.

**Environmental**

**Operating Temperatures:** -10°C to 50°C (14°F to 122°F)  
**Storage Temperatures:** -20°C to 60°C (-4°F to 140°F)  
**RFI Protection:** Greater than 20 V/m (20 to 1000 MHz)

**Physical**

**Dimensions (H X W X D):** 123 x 76 x 48 mm (4-13/16 x 3 x 1-7/8 in.)  
**Weight:** 145 g (4.5 oz).

**Models Available**

**DUET** - standard version  
**DUET-ST** - SUPER-TECH version

**Patents**

U.S. Patent 5,237,330, Microwave detector.  
 Other international patents applied for.

**Interchangeable Lenses**

<p><b>No. 15D - Corner Mounting (Standard Lens)</b></p> <ul style="list-style-type: none"> <li>No. of Beams: 58</li> <li>Field of View: 100°</li> </ul> <p>Max. Coverage: 18 X 24 m (60 X 80 ft)</p>	<p><b>No. 76D - Ultra Wide Angle</b></p> <ul style="list-style-type: none"> <li>No. of Beams: 36</li> <li>Field of View: 140°</li> </ul> <p>Max. Coverage: 18 X 30 m (60 X 100 ft)</p>	<p><b>No. 37D - Combined Room + Corridor</b></p> <ul style="list-style-type: none"> <li>No. of Beams: 20</li> <li>Field of View: 140°</li> </ul> <p>Max. Coverage: 21 X 30 m (70 X 100 ft)</p>	<p><b>No. 10D - Combined Room + Ceiling</b></p> <ul style="list-style-type: none"> <li>No. of Beams: 76</li> <li>Field of View: 100°</li> </ul> <p>Max. Coverage: 13.5 X 18 m (45 X 60 ft)</p>
<p><b>No. 17D - Pet Alley</b></p> <ul style="list-style-type: none"> <li>No. of Beams: 24</li> <li>Field of View: 100°</li> </ul> <p>Maximum Coverage: 18 X 24 m (60 X 80 ft)</p> <p>For optimum coverage throughout the protected area and for minimum dead zones, this lens requires mounting the detector from 0.8 -1.5 m (2.5 - 5 ft) height and adjusting the coverage pattern carefully above the maximum expected height of the pet's activity.</p> <p><i>Note: The creep zone should be masked</i></p>		<p><b>No. 34D - Long Range</b></p> <ul style="list-style-type: none"> <li>No. of Beams: 16</li> <li>Field of View: 90°</li> </ul> <p>Max. Coverage: 21 X 3 m (70 X 10 ft)</p>	

**3. INSTALLATION**

**3.1 Mounting Instructions**

The DUET can be mounted on a wall (surface mount) or in room corners. Always mount the unit on a firm and stable surface, at a height that provides optimum coverage of the protected area.

**IMPORTANT: This device is for indoor use only!**

Select the mounting location so that the expected motion of an intruder will cross the coverage area of the DUET.

Aim the DUET towards the coolest place in the protected area, thereby obtaining maximum of the PIR section sensitivity where high ambient temperatures are expected.

The recommended mounting height for the wide angle coverage pattern is 2.4 m (8 ft). Built-in installation aids enable you to mount the unit anywhere up to 3.6 m (12 ft) height. An accurate adjustment table (Table 1) includes the recommended angles for various combinations of range and mounting height.

With pet-alley coverage pattern (lens No. 17D), it is recommended to install the sensor at the lowest possible height that enables directing the detection beams about one foot above the maximum level of the pet's activity. When this lens is used, The lockdown lens should be masked as directed in Para. 3.3 c.

### A. Direct Mounting

To mount the detector, proceed as follows:

- Loosen and remove the small screw at the bottom of the detector (near the "lookdown" lens). Remove the cover.
- Punch out the appropriate mounting knockouts and wiring knockouts in the base (Fig. 3). The round knockout at the bottom and the elongated knockout at the top serve for surface mounting. The knockouts at the angled sides are provided for corner mounting.

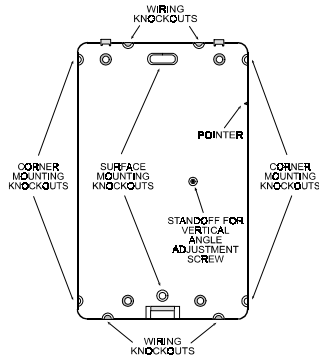


Figure 3. Knockout Locations

- Use the base as a template to mark the drilling points.
- Pass the wires through the punched-out wiring outlets and mount the base in place, complete with printed circuit board.
- Complete all wiring as instructed in Para. 3.2 below.

### B. Swivel Bracket BR-1

The BR-1 is a general purpose adjustable mounting bracket which accommodates the DUET. The BR-1 can be vertically adjusted 30° downward, and horizontally – 45° left and 45° right (Fig. 4).

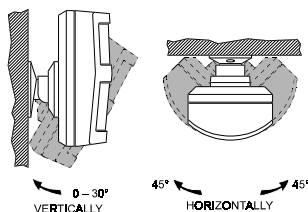


Figure 4. BR-1 Swivel Bracket

**Important:** With swivel brackets in use, the effective detection range may differ from that indicated in table 1.

### 3.2 Wiring

The maximum wiring distance between a detector and its power source depends on the number of units connected in parallel and on the wire gauge. The following table may be used for guidance:

WIRE GAUGE	22	20	18	16
Maximum Wiring Length (ft)	325	550	900	1500
Maximum Wiring Length (m)	115	165	275	450

**Note:** The maximum wiring length given in the table should be divided by the number of detectors connected in parallel. Refer to Figure 5 and connect the wires to the terminal block as outlined below:

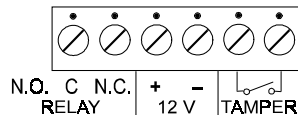


Figure 5. Terminal Block

- Connect the **TAMPER** N.C. terminals to a normally-closed, 24-hour protection zone of the control panel. Tamper switch contacts will open when the detector cover is removed.
- Connect the relay's **N.C.** and **C** terminals to one of the normally closed burglar protection zones of the alarm system's control panel. The relay contacts will open when an intruder is detected or upon power loss.
- Connect the **12V (+)** and **(-)** terminals to a 9 -16 VDC power source, taking care not to reverse the polarity. The power source should have a backup battery capable of supplying emergency power for at least 4 hours.
- Seal all openings in the detector's base with RTV to prevent insects from entering the unit.

**Caution:** when all wiring is completed, bend slack conductors near the terminal block towards the base of the unit to ensure that they do not obstruct the radiation path between the PIR sensor and the creep zone lens at the bottom of the front cover.

- Reinstall the front cover and fasten it securely, using the small screw at the bottom.

### 3.3 Adjusting the Coverage Area

#### A. Vertical Adjustment of the PIR Detector

The DUET is supplied complete with the standard Corner Mounting lens (No. 15D). The vertical adjustment scale (at the upper right side of the printed circuit board) and the plastic pointer facing it on the base, indicate the vertical angle between the upper layer of the PIR detector's coverage pattern and the horizontal line of the unit. Table 1 gives the recommended scale adjustment for various combinations of mounting height and coverage range (indicated in feet and meters).

Table 1. Vertical Adjusting Scale

Mounting Height	Coverage Range													
	7	10	13	17	20	23	26	30	33	40	50	60	70	
ft ⇒	7	10	13	17	20	23	26	30	33	40	50	60	70	
↓ m	2	3	4	5	6	7	8	9	10	12	15	18	21	
3	1	0°	0°	0°	0°	0°	0°	0°	0°	0°	0°	0°	0°	
4	1.2	-8°	-6°	-5°	-4°	-3°	-2°	-2°	-2°	-1°	-1°	-1°	-1°	
5	1.5	-	-12°	-9°	-7°	-6°	-5°	-4°	-4°	-3°	-2°	-2°	-2°	
6	1.8	-	-	-	-11°	-9°	-8°	-7°	-6°	-5°	-5°	-4°	-3°	
7	2	-	-	-	-	-12°	-10°	-9°	-8°	-7°	-6°	-5°	-4°	
8	2.5	-	-	-	-	-	-	-11°	-10°	-9°	-7°	-6°	-5°	
10	3	-	-	-	-	-	-	-	-	-12°	-10°	-9°	-7°	
12	3.6	-	-	-	-	-	-	-	-	-	-12°	-10°	-8°	

**Example:** If you require coverage range of 40 ft (12 m) and wish to install the sensor at a height of 6 ft (1.8 m) from the ground, set the Vertical Adjustment Scale to -5°.

**Note:** The coverage pattern refers to areas where the PIR beams and the microwave pattern completely overlap. The DUET will activate the alarm relay only after motion has been verified by both technologies.

**Important Note:** (60 ft) is the maximum range tested by UL (using Lens 15D).

The table should be used only to the maximum coverage range of the selected lens, as indicated in the lens pattern. The scale permits downward pattern adjustments from 0° to -12°. Setting this scale allows you to compensate for the installation height and obtain the desired coverage. You may verify the actual coverage range by carrying out the Diagnostic Test (see Para 3.9). All DUET detectors are factory preset and shipped with a -5° setting.

To readjust the vertical pattern, loosen the screw which fastens the printed circuit board to the base. Slide the PC board up or down to the desired angle and tighten the screw firmly.

#### B. Setting the PIR Pulse Counter

The DUET is equipped with a programmable pulse counter which can be set to count a single pulse or **2 pulses** with alternate polarity before initiating an alarm. To set the PIR pulse counter, place the **PULSE** jumper at the desired position (see Para. 3.5). Two pulses provide improved protection against false alarms caused by all types of environmental disturbances.

The **1 Pulse** setting actually disables the pulse counter. It should be used when it is necessary to activate an alarm on the first detected pulse, or in high-security installations, when fast 'catch' performance is of greatest importance.

#### C. Beam Masking Material

A special beam masking sheet supplied with each detector can be used to mask individual segments in the lens array which are exposed to potential disturbance sources (heaters, blowers, pets etc.). The material is transparent to visible light but blocks infrared radiation.

To block individual beam(s), locate the corresponding segment(s) in the array. Cut the masking sheet to the exact size of the lens segment to be blocked. Remove the backing paper and apply the mask accurately to the inner surface of the chosen segment.

**Note:** In some cases, more than one layer of the masking material may be required to completely block the lens segment.

#### D. Range Adjustment of the MW Detector

The range control, located under the vertical adjustment scale, should be adjusted to obtain the desired coverage area:

- Rotate the range control to MIN.
- Carry out a Diagnostic Test (Para. 3.9) to determine the actual coverage of the MW detector.

- Increase the range gradually, until detection is assured when you walk straight towards the detector, across the detector's field of view and diagonally within the protected area.

### 3.4 Changing the Lens

- Remove the DUET's front cover.
- Insert a screwdriver blade beneath one of the lens retainer's flexible sides, lever the edge free of the restraining tabs and remove the lens.
- Insert the new lens with its smooth surface outside. Observe its trapezoidal shape and fit the lens into place with the longest side along the bottom of the cover (toward the 'creep zone' lens).

**Note:** Since the lens retainer matches the shape of the lens, position it correctly before performing the next step.

- Insert one edge of the lens retainer below the restraining tabs of the cover and force the other side inward with your fingers until it snaps into place.

Coverage patterns for the interchangeable lenses are shown in Section 2. Lens No. 15D is UL-approved.

### 3.5 Setting the Jumpers

Three jumper selectors control 3 different functions of the DUET detector. Each jumper is set to ON by mounting it on the top and middle pins, and set to OFF by mounting it on the bottom and middle pins (Fig. 6). Before testing the DUET, set all 3 jumpers according to your specific requirements.

#### PULSE – Pulse Count Selector

When this jumper is set to OFF, the PIR operates in the single-pulse mode. When set to ON, the PIR operates in the 2-pulse Alternate Polarity mode. (refer to Para. 3.2).

#### WALK – Alarm Indicator ON/OFF

When the WALK jumper is set to ON, the walk-test indication of the red LED is enabled. When the switch is set to OFF, the walk test indication is disabled.

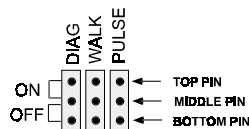


Figure 6. Jumper Selectors

#### DIAG – Diagnostic Indications ON/OFF

When the DIAG jumper is set to ON, the diagnostic indications of the two technologies are enabled. The green LED indicates a PIR trip and the yellow LED indicates a Microwave trip. When the switch is set to OFF, the diagnostic indications are disabled.

### 3.6. Powering Up the Detector

Connect the system to its power source. Since the DUET requires about 100 seconds to stabilize, the relay is maintained energized throughout this period, and the red LED flashes indicating that stabilization is in progress. Normal operation begins after the 100-second delay.

### 3.7 General Testing Information

The DUET enables the installer and the user to check the dual detector combined area coverage (Walk Test) as well as each individual technology (Diagnostic Test).

The UL and other authorities require to switch off the walk test and diagnostic indication after installing the alarm system, to prevent potential intruders from discovering the precise detection pattern of the detector. The WALK jumper, when set to OFF, disables the Walk Test indication. The DIAG jumper, when set to OFF, disables the Diagnostic indications.

### 3.8 Walk Test

When the PIR and Microwave technologies detect motion at the same time, the relay is activated for 3 to 5 seconds and simultaneously the RED LED indicates an alarm condition. This enables the installer and the end-user to check the coverage pattern of the detector and its proper function.

- Set the WALK jumper to ON, to enable the Walk Test indication (red LED).
- Walk test the entire range and coverage area by walking across the field of view of the detector. Observe the red LED. It will light up whenever you are detected by both technologies. Allow two seconds between each test for the unit to stabilize.
- After completing the walk test, disable the red LED by setting the WALK jumper to OFF.

**Attention:** The range and complete coverage area should be checked at least once a year. To assure proper continuous function, the user should be instructed to perform a walk test at the far end of the coverage pattern to assure an alarm signal prior to each time the alarm system is armed.

### 3.9 Diagnostic Test

If required, you can walk-test each technology separately, using the DIAGNOSTIC indication via the GREEN LED (PIR) and the YELLOW LED (MW), to determine the exact detection areas of the PIR and MW detectors. The results of such individual walk tests are helpful in analyzing a detection or false alarm problem and making corrections or adjustments accordingly.

- Set the DIAG jumper to ON, to enable the diagnostic indications (green and yellow LEDs).
- Test the entire range and coverage area by walking across the field of view of the detector in various directions. Observe the yellow and green LEDs. Each will light for 3 to 5 seconds whenever you are detected by the corresponding technology.
- After completing the test, disable the diagnostic indications by setting the DIAG jumper to OFF.

### WARRANTY

Visonic Ltd. and/or its subsidiaries and its affiliates ("the Manufacturer") warrants its products hereinafter referred to as "the Product" or "Products" to be in conformance with its own plans and specifications and to be free of defects in materials and workmanship under normal use and service for a period of twelve months from the date of shipment by the Manufacturer. The Manufacturer's obligations shall be limited within the warranty period, at its option, to repair or replace the product or any part thereof. The Manufacturer shall not be responsible for dismantling and/or reinstallation charges. To exercise the warranty the product must be returned to the Manufacturer freight prepaid and insured.

**This warranty does not apply in the following cases:** improper installation, misuse, failure to follow installation and operating instructions, alteration, abuse, accident or tampering, and repair by anyone other than the Manufacturer.

This warranty is exclusive and expressly in lieu of all other warranties, obligations or liabilities, whether written, oral, express or implied, including any warranty of merchantability or fitness for a particular purpose, or otherwise. In no case shall the Manufacturer be liable to anyone for any consequential or incidental damages for breach of this warranty or any other warranties whatsoever, as aforesaid.

This warranty shall not be modified, varied or extended, and the Manufacturer does not authorize any person to act on its behalf in the modification, variation or extension of this warranty. This warranty shall apply to the Product only. All products, accessories or attachments of others used in conjunction with the Product, including batteries, shall be covered solely by their own warranty, if any. The Manufacturer shall not be liable for any damage or loss whatsoever, whether directly, indirectly, incidentally, consequentially or otherwise, caused by the malfunction of the Product due to products, accessories, or attachments of others, including batteries, used in conjunction with the Products.

The Manufacturer does not represent that its Product may not be compromised and/or circumvented, or that the Product will prevent any death, personal and/or bodily injury and/or damage to property resulting from burglary, robbery, fire or otherwise, or that the Product will in all cases provide adequate warning or protection. User understands that a properly installed and maintained alarm may only reduce the risk of events such as burglary, robbery, and fire without warning, but it is not insurance or a guarantee that such will not occur or that there will be no death, personal damage and/or damage to property as a result.

**The Manufacturer shall have no liability for any death, personal and/or bodily injury and/or damage to property or other loss whether direct, indirect, incidental, consequential or otherwise, based on a claim that the Product failed to function.** However, if the Manufacturer is held liable, whether directly or indirectly, for any loss or damage arising under this limited warranty or otherwise, regardless of cause or origin, the Manufacturer's maximum liability shall not in any case exceed the purchase price of the Product, which shall be fixed as liquidated damages and not as a penalty, and shall be the complete and exclusive remedy against the Manufacturer.

**Warning:** The user should follow the installation and operation instructions and among other things test the Product and the whole system at least once a week. For various reasons, including, but not limited to, changes in environmental conditions, electric or electronic disruptions and tampering, the Product may not perform as expected. The user is advised to take all necessary precautions for his/her safety and the protection of his/her property.

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VISONIC LTD. (ISRAEL): P.O.B 22020 TEL-AVIV 61220 ISRAEL. PHONE: (972-3) 645-6789, FAX: (972-3) 645-6788  
 VISONIC INC. (U.S.A.): 10 NORTHWOOD DRIVE, BLOOMFIELD CT. 06002-1911. PHONE: (860) 243-0833, (800) 223-0020 FAX: (860) 242-8094  
 VISONIC LTD. (UK): UNIT 1, STRATTON PARK, DUNTON LANE, BIGGLESWADE, BEDS. SG18 8QS. PHONE: (01767) 600857 FAX: (01767) 601098  
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