# DUET - ST

**The Dynamic Dual-Technology Detector**

**Visonic Ltd**

**Installation Instructions**

## 1. INTRODUCTION

The DUET-ST includes:
DSF - Dynamic Software Filtering
DTS - Dynamic Trouble Supervision
DRS - Dynamic Review Supervision
DDS - Dynamic Detection Supervision
DMR - Dynamic Motion Route
...and more

***WARNING!*** *Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.*

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The DUET-ST (DUET SUPER-TECH) is an advanced, most intelligent microcomputer-controlled dual-technology detector designed for better protection and false alarm immunity.

Combining two detection technologies, Passive Infra-Red (PIR) and Microwave, it takes advantage of the fact that each detection method is affected by different stimuli and different environmental disturbances. Simultaneous detection by distinct techniques, as applied in the DUET-ST, provides maximum protection against false alarms. To enhance reliability even further, self-test techniques are extensively used in the DUET-ST to ensure that any malfunction will trigger a TROUBLE alert.

Although dual technology detectors are no longer a novelty, the newly developed DUET-ST provides many unique features and software advantages. Strong disturbances that come close to causing a false alarm are registered as "almost alarms", and may be recalled later by the installer for analyzing past events and taking corrective measures.

Many other notable characteristics such as software protection against the adverse effects of fluorescent lighting, enhanced signal-to-noise ratio in the Microwave section and automatic temperature compensation for the PIR are listed in the following FEATURES section.

### 1.1 Features

- Microcomputer software signal processing.
- Watchdog microcomputer supervision.
- Microwave and PIR circuit supervision.
- Selectable alarm memory with exit/entry delays for use in delayed and follower zones.
- Memory indication of first, second and third detector to trip, revealing the point of intrusion and the intruder's route.
- Trouble analysis with visual indication and open-collector outputs.
- Selectable PIR pulse counter with alternate polarity signal processing.
- Separate indications for PIR trip, microwave detector trip and alarms (diagnostic indications).
- 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 from transients and RFI.
- Dual element PIR detector.
- 6 interchangeable lenses with coverage pattern of up to 140°.
- Adjustable vertical calibration.
- Look down "creep zone".
- Surface and corner mounting.
- Optional flush mounting kit.
- Optional swivel bracket kit BR-1.
- Dynamic Review Supervision (DRS) determines whether each technology is blocked, asleep, faulty or false alarming.

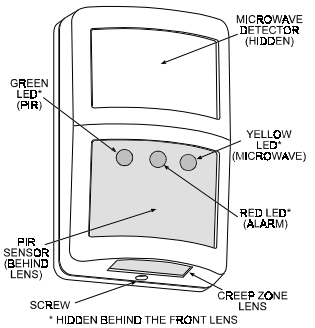



***Figure 1.*** *DUET-ST - General View*

- Dynamic Detection Supervision (DDS) verifies proper detection of each technology.
- Switchable walk test indication.
- Separate switchable diagnostic indication for the PIR and microwave sensors.
- Selectable polarity of the arm/disarm signal - compatible with any control panel.
- State-of-the-art microstrip DRO-stabilized Microwave technology.
- Novel microwave signal-to-noise ratio enhancement by software filtering techniques provides superior motion detection and protection against false alarms.
- Remote control pushbuttons enable testing and selecting features without opening the housing.
- Remote activation of Walk test and Diagnostic test by the installer or by the user.
- Remotely selected environmental test allows locating environmental disturbances affecting PIR or Microwave.
- Memory indication can be cleared by remote control.
- Comprehensive history registration of up to 14 arm/disarm periods. Records and displays alarms, almost alarms, tripping order of detectors, trouble conditions and power failures.
- Audible walk test and diagnostic test.
- Controlled power-up procedures.

### 1.2 PIR Detector

The PIR detector includes an Alternate Polarity pulse counter. When DIP switch SW1 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 SW1 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 SW6) or in the ENVIRONMENTAL TEST MODE (selected by the control switch).

The PIR detector includes a temperature compensating circuitry, to help stabilize the detection range at all operating temperatures. The micro-computer supervises many aspects of PIR operation and, in case of malfunction, a TROUBLE indication is initiated and the TROUBLE output is activated (Para 1.6).

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

### 1.3 Microwave Detector

(U.S. patent 5,237,330)

The microwave detector employs specially-developed

state-of-the-art microstrip DRO circuitry. The microwave signal is processed by microcomputer, using custom-developed pure software techniques. The 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 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 microcomputer supervises operation of the microwave detector in many ways and, in case of malfunction, a TROUBLE indication is initiated and the TROUBLE output is activated (Para. 1.6).

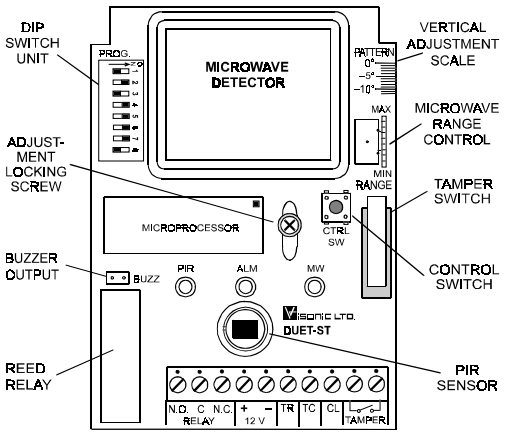



***Figure 2.*** *DUET-ST Printed Circuit Board*

**LED Response Summary Table**

| Function | Indication |
|---|---|
| WALK TEST/DIAGNOSTIC (selected by control switch, 1 pulse) | Green LED is ON for 3-5 seconds upon PIR trip.<br>Yellow LED is ON for 3-5 seconds upon Microwave trip.<br>Red LED is ON for 3-5 seconds upon dual alarm. |
| ENVIRONMENTAL TEST (selected by control switch, 4 pulses) | Green LED is ON for 3-5 seconds upon PIR trip.<br>Yellow LED is ON for 3-5 seconds upon Microwave trip. |
| HISTORY (selected by control switch, 3 pulses) | All 3 LEDs flash according to the coded information retained in the history memory (sec. 5) |
| TROUBLE | **PIR trouble:** Green and red LEDs flash alternately.<br>**Microwave trouble:** Yellow and red LEDs flash alternately. |
| DDS (Dynamic Detection Supervision) TROUBLE | Same as for TROUBLE |
| DRS (Dynamic Review Supervision) TROUBLE | Red LED flashes alternately with yellow and green LEDs. |
| MEMORY | Red LED pulsates or lights continuously as per type of memory (see table in chapter 1, para. 1.5.3) |
| WALK TEST (selected by SW5) | Red LED is on for 3-5 seconds upon alarm. |
| DIAGNOSTIC (selected by SW6) | Same as ENVIRONMENTAL TEST. |

## 1.4 LED Indicators

The three LEDs provide various indications in accordance with the mode of operation. The red LED provides mainly alarm and memory indications. The yellow LED is related to the microwave detector and indicates microwave trips and troubles. The green LED is related 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) and also to check the effect of environmental disturbances on each detector (environmental test).

## 1.5 Memory Function

The DUET-ST memorizes alarm conditions which occurred during the arming period, and conveys the memory contents via the red LED during the following Disarm period. The memory display is enabled by setting SW7 to ON. The red LED lights continuously to indicate which DUET-ST unit tripped during the last Arm period. The red LED also indicates which DUET-ST was first, second or third to trip. The trip order is conveyed by special flashing sequences, as explained in Para. 1.5.3. The availability of this extra trip order information is dependent on an optional control line wire which interconnects the CL (Control Line) terminals of all DUET-STs in the system.

Built-in two-minute exit and entry delays avoid memorizing alarms caused while leaving the premises after arming or upon entering the premises before disarming.

To enable the memory function, the Arm/Disarm signal from the control panel should be applied to all DUET-ST's T.C. terminals. The polarity of the T.C. input can be reversed by SW8, to adapt the DUET-ST to various types of control panels. During the Arm period, the red LED does not function at all, to avoid alerting a potential or an actual intruder.

When an alarm condition occurs during the Arm period, only the relay is activated. The alarm condition will be memorized for display in the subsequent Disarm period, provided that the alarm did not occur during the exit or entry delays. The memory indication persists throughout the Disarm period, and is reset automatically when the system is armed. It can also be reset manually by the pushbutton control switches (Para. 4.6).

The memory function is disabled by setting SW7 to OFF.

### 1.5.1 Arm/Disarm Signal (T.C. Input)

The arm/disarm signal (T.C.) informs the detector whether the alarm system is armed or disarmed. This signal, which originates at the control panel, is transmitted to all DUET-STs via the T.C. wire, and used to control various functions of the detector:

- Registration of alarms which occurred in the Arm mode and displaying them in the Disarm mode.
- Disabling all LED indicators during the Arm period.
- Enabling the DDS function in the Disarm mode (Para. 1.8).
- Separating the history display into arm/disarm periods.

Some control panels provide a 0-Volt signal when armed and an open circuit or 12 Volts when disarmed; others provide the opposite logic. DIP switch SW8 enables changing the logic of the T.C. input to conform with the Arm/Disarm signal of the control panel (refer to SW8 in para 3.5).

**If the T.C. wire is not used, SW8 must be set to OFF, allowing the detector to function in the Disarm mode. Otherwise, no LED indications will be possible.**

### 1.5.2 Exit and Entry Delays

When operating in the memory mode, an alarm condition will be memorized only if it occurs at least two minutes after the control panel is armed, and at least two minutes before the control panel is disarmed.

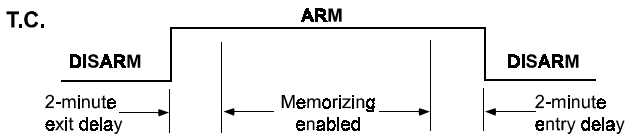



***Figure 3.*** *Alarm Memorizing during an Arm Period*

The relay always functions as usual under both Arm and Disarm conditions, its operation is never delayed or inhibited.

During the exit delay, the LEDs provide Walk Test or Diagnostic Indications (if enabled).

As soon as the exit delay ends, the LEDs no longer indicate anything until the control panel is disarmed again.

### 1.5.3 DMR – Dynamic Motion Route Indication (Memory Indications of First, Second and Third Detector to Trip)

Some police and insurance company regulations require that the

alarm system be able to exhibit which detector was the first, which was the second and which was the third to initiate an alarm during an Arm period. This exposes the point of intrusion as well as the intruder's route.

The DUET-ST meets this requirement by using a special control line wire which interconnects all system detectors (para. 4.6).

The memorized trip order is indicated by the red LED during the Disarm period as follows:

| Trip Order | Red LED Signaling |
|---|---|
| 1st detector to trip | ON for 5 seconds followed by 1 flash |
| 2nd detector to trip | ON for 5 seconds followed by 2 flashes |
| 3rd detector to trip | ON for 5 seconds followed by 3 flashes |
| Detectors which tripped later than 3rd | ON continuously |

If the user initiates a different display function by using a control switch (para. 4.6), the memory display will be suspended and overriden by the requested display. As soon as the other display terminates, the memory display will be resumed.

Arming the system will automatically clear the alarm memory at the beginning of the exit delay, rendering the DUET-ST ready for a new memory sequence. Manual clearing of the alarm memory is also possible without switching to the Arm mode, by means of the control switches (Para 4.6).

## 1.6 DTS–Dynamic Trouble Supervision

The DUET-ST 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 open collector TROUBLE output goes LOW and the LEDs identify the faulty detector as follows:

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

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

A trouble condition may also be initiated by the DRS function (Para. 1.7), which supervises the combined operation of the two technologies.

The TROUBLE output will stay LOW and the TROUBLE indicator will continue flashing as long as the failure condition lasts. Both indications will be cancelled only when the cause for trouble is eliminated.

The TROUBLE INDICATION is displayed only while the detector operates in the Disarm mode, whereas the TROUBLE OUTPUT is always functional.

## 1.7 DRS - Dynamic Review Supervision

The DUET-ST microcomputer determines whether any one of the technologies is blocked, asleep, faulty or generates false alarms. The DRS employs a single counter which increments with each PIR or microwave detector trip. When the counter reaches the predetermined number of trips set by SW2 and SW3 and if no alarm has been triggered, a TROUBLE condition is initiated. The TROUBLE output goes LOW and at the same time the green and yellow LEDs flash together, alternately with the red LED.

***Note:*** *This type of signaling indicates a malfunction, but does not identify which technology is faulty.*

When both technologies trip at the same time, generating an alarm condition, the DRS counter resets and restarts the counting sequence.

Switches SW2 and SW3 set the DRS counter for 50, 100 or 250 trips. The DRS function can be disabled by setting both switches to OFF.

## 1.8 DDS – Dynamic Detection Supervision

The DDS (Dynamic Detection Supervision, patent pending) is a unique feature which is very useful in high security applications, where the Walk Test indicators are disabled during normal operation. The DDS utilizes actual movement of people within the protected area to determine whether any of the technologies is blocked, masked, or fails to detect for any other reason.

The DDS monitors the movement of people in the protected area as detected by each technology. If no motion is detected by either PIR or Microwave within two hours, a TROUBLE message is displayed by the LEDs as follows:

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

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

The TROUBLE OUTPUT, however, is not activated by the DDS.

If motion is later detected by the technology which initiated the TROUBLE condition, the TROUBLE indication ceases immediately. An inspector who enters the protected area can immediately verify, by observing the LEDs, whether one or both technologies function properly. If the flashing LEDs TROUBLE indication terminates upon detecting the presence of the inspector, the detector is assumed to function properly. But, if the trouble indication persists after the inspector has moved within the protected area, he then realizes that the troubling technology is indeed faulty.

The DDS indication functions only during the Disarm period. A failure of any technology to detect is manifested not more than two hours after its occurrence.

In an occupied area where people usually move at least once in two hours, the trouble indication will never appear. In locations where the movement of people is less frequent, the trouble indication may appear, but will be immediately reset at the first movement within the protected area.

The DDS function does not affect regular operation of the alarm relay. If not required, it may be disabled by setting DIP switch SW4 to OFF.

# 2. SPECIFICATIONS

**ELECTRICAL**
**Input Voltage:** 9–16 VDC
**Current Drain:** Approximately 20 mA at 12VDC
**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 / 24 VDC.
**Tamper Contacts:** Normally closed, 0.5A resistive / 24 VDC.
**Trouble Output:** Open collector, 50 mA, protected by 47Ω resistor.

**OPTICAL**
**Detection Patterns:** 6 interchangeable lenses are available
**PIR Detector 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.

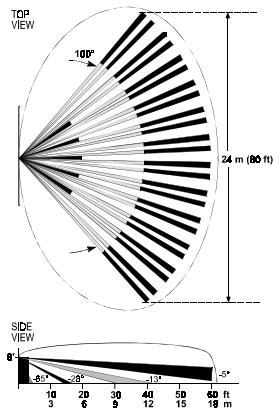
**ENVIRONMENTAL**
**Operating Temperatures:** –10°C to 50°C (14°F to 122°F)
**Storage Temperatures:** –20°C to 60°C (–4°F to 140°F)
**RFI Protection:** > 20V/m (20 to 1000 MHz**)**

**PHYSICAL**
**Dimensions (H XW X D):** 123X76X48 mm (4-13/16X3X1-7/8 in.)
**Weight:** 145 g (4.5 oz).

### Models Available
**DUET - standard version**
**DUET-ST - SUPER-TECH version**

**PATENTS**
**U.S. patent: 5,237,330**
**Other international patents applied for.**

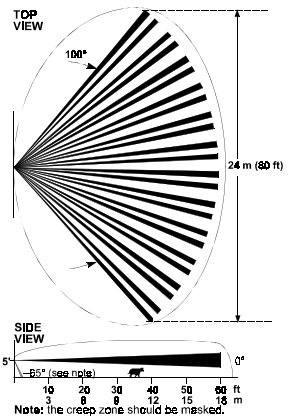
## 2.1 Interchangeable Lenses




**No.15D Corner Mounting (Standard Lens)**

- **No. of Beams: 58**
- **Field of View: 100°**

**Maximum Coverage:18 m X 24 m (60X 80ft)**



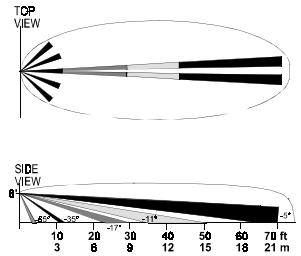

**No. 17D Pet Alley (*)**

**No. of Beams: 24**

**Field of View: 100°**

**Maximum Coverage: 18 m X 24 m ( 60 X 80 ft)**

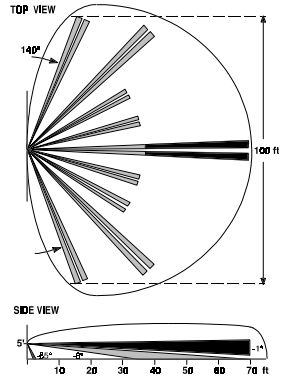
∗ *Lens No. 17D: For optimum coverage throughout the protected area and for minimum dead zones, this lens requires mounting the detector from 0.8 -1.5 m (2.5 - 5 ft) height and adjusting the coverage pattern carefully above the maximum expected height of the pet's activity.*
*The creep zone should be masked*




**No. 34D Long Range**

- No. of Beams: 16
- Field of View: 90°

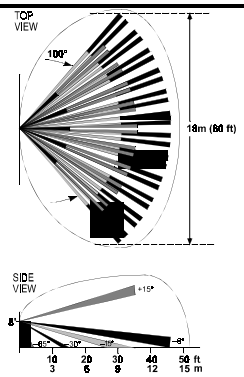
Maximum Coverage: 3 X 21m (10 X 70 ft)




**No. 37D Combined Room + Corridor**

- **No. of Beams: 20**
- **Field of View: 140°**

**Maximum Coverage: 21 m X 30 m (70X100 ft)**

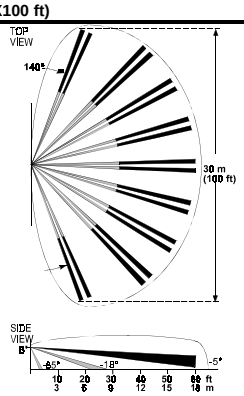



**No. 10D Combined Room + Ceiling**

**No. of Beams: 76**

**Field of View: 100°**

**Maximum Coverage: 13.5 m X 18 m (45 X 60 ft)**




**No. 76D Ultra Wide Angle**

**No. of Beams: 36**

**Field of View: 140°**

**Maximum Coverage: 18 X 30m (60 X 100 ft)**

# 3. INSTALLATION

## 3.1 Mounting Instructions

The DUET-ST dual-technology detector can be mounted directly onto the wall (surface mount) or in room corners. Always mount the unit on a firm and stable surface, at a convenient height that would provide optimum coverage of the protected area.

***Remember:*** *The PIR section is sensitive to changes in infrared energy caused by an object moving across the unit's field of view. Since the changes in infrared energy detected by the PIR depend on the amount of infrared energy transmitted by the moving object and the temperature difference between the object and the background, the PIR may fail to respond under certain temperature and background conditions, in which the temperature difference is too small. It is therefore recommended that the DUET-ST be aimed towards the coolest place in the protected area, thereby obtaining maximum 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 4 m (12 ft) height. An accurate adjustment table (see paragraph 3.3) includes the recommended angles for various combinations of range and mounting height.

With pet-alley coverage pattern (lens No. 17D), it is recommended that the sensor be installed 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, lookdown lens should be masked as directed in para. 3.3.3.

### 3.1.1 Mounting Procedure

To mount the detector, proceed as follows:

a) Loosen and remove the small screw at the bottom of the detector (near the "lookdown" lens). Remove the cover.

**b)** Punch out the appropriate mounting knockouts and wiring knockouts in the base (Fig. 4). The round knockout at the bottom and the elongated knockout at the top of the base plate serve for surface mounting. The knockouts at the angled sides are provided for corner mounting.

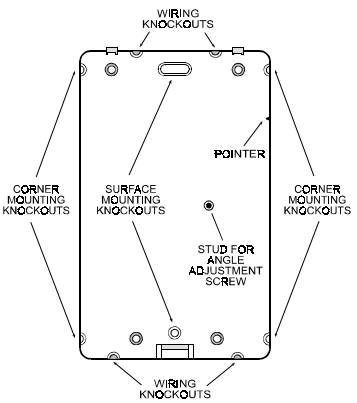



***Figure 4.*** *Knockout Locations*

c) Use the base as a template to mark the drilling points.

***Caution!*** *Take care not to drill through the mounting holes with the box held in place, to avoid contaminating the detector with drilled fragments and dust.*

d) Pass the wires through the punched-out wiring outlets and mount the base in place, complete with printed circuit board.

e) Complete all wiring as instructed in Para. 3.2 below.

### 3.1.2 Optional Swivel Brackets

The BR-1 is a swivel mounting bracket used for greater flexibility when setting the desired detection range. It can be adjusted as shown in Fig. 5. Swivel bracket kits for room corners (BR-2) and for mounting on ceilings (BR-3) are also available (see para. 2).

***IMPORTANT:*** *With the BR-1 swivel bracket 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:

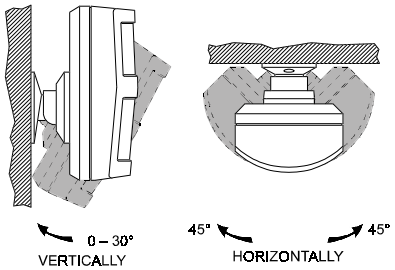



***Figure 5.*** *BR-1 Adjustment Range*

| 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.*

Make no splices within the unit and avoid contact between uninsulated conductors and the printed circuit board. Refer to Fig. 6 and connect the wires to the terminal block as outlined below:

1. Connect 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.
2. 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.
3. Connect the TR (trouble) output if required. This is an open collector type circuit, which becomes negative when actuated.

   Various applications are possible (see Fig. 6):

   - Lighting a TROUBLE LED on a remote plate.
   - Energizing an auxiliary TROUBLE relay or a buzzer connected between this terminal and the positive (+12V) terminal. The relay contacts may be wired to trigger a dedicated TROUBLE zone in the control panel or to actuate a special siren, a buzzer or a digital communicator.
   - Connecting directly to a control panel's zone in parallel with its EOL resistor.
4. Connect the detector's T.C. input terminal to the control panel's Arm/Disarm output.

   ***Note:*** *if the detector's T.C. input is not used, set SW8 to OFF, causing the detector to function in the Disarm mode. Otherwise, no LED indications will be possible.*
5. Connect the CL terminal of each DUET-ST to a common wire(the control line). N.O. momentary pushbutton switches (control switches) can be mounted at a convenient location(s) and connected between this wire and the negative (–) terminal of the 12VDC supply (Fig. 6).

   ***Note:*** *if the control line is not used, 'trip order' memory information will not be provided.*
6. Connect the 12VDC (+) 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.
7. 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 board towards the base of the unit to ensure that they do not block the radiation path between the PIR sensor and the creep zone lense located at the bottom of the front cover.*
8. Reinstall the front cover and fasten it securely, using the small screw at the bottom.

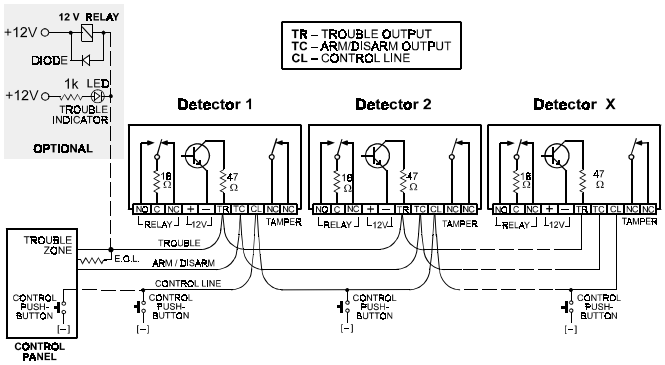



***Figure 6.*** *Duet-ST - Wiring Diagrams*

## 3.3 Adjusting the Coverage Area

### 3.3.1 Vertical Adjustment of the PIR Detector

DUET-ST is supplied complete with the Corner Mounting lens (No. 15D). The vertical adjustment scale (at the upper right side of 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 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). 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 (Para 4.3). All DUET-ST 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.

***Table 1.*** *Vertical Adjusting Scale*

| Mounting Height | | Coverage Range | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ft ⇒ | | 7 | 10 | 13 | 17 | 20 | 23 | 26 | 30 | 33 | 40 | 50 | 60 |
| ⇓ | m | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 12 | 15 | 18 |
| 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° | -2° | -1° | -1° | -1° |
| 5 | 1.5 | – | -12° | -9° | -7° | -6° | -5° | -5° | -4° | -4° | -3° | -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 beam and the microwave pattern completely overlap. The* ***DUET will*** *activate the alarm relay only after motion has been verified by both technologies.*

### 3.3.2 Setting the PIR Pulse Counter

The DUET-ST 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 DIP switch SW1 at the desired position (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.

### 3.3.3 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 dimensions of the

lens segment to be blocked. Remove backing paper and apply mask accurately to the inner surface of the appropriate segment.

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

**3.3.4 Range Adjustment of the MW Detector**

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

1. Rotate the range control to MIN.
2. Carry out a Diagnostic Test (Para 4.3) to determine the actual coverage of the MW detector.
3. Increase microwave range gradually, until detection is assured when you walk straight towards the detector, across detector's field of view and diagonally within protected area.

## 3.4 Changing the Lens

1. Remove the DUET-ST's front cover.
2. 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.
3. Insert new lens with its smooth surface outside. Observe its trapezoidal shape and fit lens into place with the longest side along the bottom of the cover (toward the 'creep zone' lens).

   ***Note:*** *since lens retainer matches the shape of the lens, take care to position it correctly before performing the next step.*
4. 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 - para 2.1

## 3.5 Setting the DIP switch Selector

The DIP switch selector has 8 separate switches, each controlling a different function of the detector. Before testing the DUET-ST, set all 8 switches according to your specific requirements.

**SW1 – Pulse Count Selector**

When this switch is set to OFF, PIR operates in the single-pulse mode. When set to ON, the PIR operates in the 2-pulse Alternate Polarity mode. For pulse count operation, refer to Para. 3.3.2.

**SW2 & SW3 – Dynamic Review Super-vision (DRS) Setting**

These switches select the number of single-technology trips (PIR and MW) to be counted by the DRS before the TROUBLE output and indication are activated. The various settings are given in the following table:

| SW2 | SW3 | DRS Function |
|---|---|---|
| OFF | OFF | DRS disabled |
| ON | OFF | 50 trips |
| OFF | ON | 100 trips |
| ON | ON | 250 trips |

For description of the DRS function, see Para 1.7.

**SW4 – Dynamic Detection Supervision (DDS) On/Off**

When set to ON, this switch enables the DDS (Dynamic Detection Supervision) visual indication. When the switch is set to OFF, the DDS indication is unavailable. For description of the DDS function, refer to Para 1.8.

**SW5 – Alarm Indicator ON/OFF**

When SW5 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.

**SW6 – Diagnostic Indication ON/OFF**

When SW6 is set to ON, the diagnostic detection indications of the two technologies is 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 indication is disabled.

**SW7 – Memory ON/OFF**

When set to ON, DUET-ST will provide alarm memory indications. If memory display is not required, this switch should be set to OFF. For memory function description, refer to Para 1.5.

**SW8 - Arm/Disarm (T.C.) Input Polarity**

This switch allows the user to adopt the logic of detector's T.C. input to the Arm/Disarm output of the control panel as follows:

| SW8 | Arm mode | Disarm mode |
|---|---|---|
| OFF | 0 Volts | Open circuit or 12V |
| ON | Open circuit or 12V | 0 Volts |

For further details see Para. 1.5.1.

***Note:*** *If the Arm/Disarm input is not used, set SW8 to OFF, causing the detector to function in the Disarm mode. Otherwise, no LED indications will be possible.*

## 3.6 Powering Up the Detector

Connect the system to its power source and disarm the control panel. Since the DUET-ST 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. If the system is armed, the red LED will not flash. Normal operation begins after the 100-second delay.

# 4. TESTING PROCEDURE

## 4.1. General Information

The DUET-ST enables the installer and the user to check the dual detector combined area coverage (Walk Test) as well as each individual technology (Diagnostic Test). A special high-sensitivity test may also be conducted (Environmental 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. Switch **SW5**, when set to OFF, disables the walk test alarm indication. Switch **SW6**, when set to OFF, disables the DIAGNOSTIC indication.

Nevertheless, the user can carry out a WALK TEST and DIAGNOSTIC test without having to open the detector's enclosure, by pressing any of the control switches mounted at a convenient location or on the system's control panel (Para 4.6).

***Note:*** *The following three tests can only be carried out in the Disarm mode.*

## 4.2 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.

1. Set DIP switch SW5 to ON, to enable the Walk Test indication (red LED).
2. 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.
3. After completing the walk test, disable the red LED by setting DIP switch SW5 to OFF.

   ***Note:*** *The Walk test may also be initiated by depressing any one of the control switches once (Para. 4.6).*

> ***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.*

## 4.3 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.

1. Set DIP switch SW6 to ON, to enable the diagnostic indications (green and yellow LEDs).
2. 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 corres-ponding technology.
3. After completing the test, disable the diagnostic indications by setting DIP switch SW6 to OFF.

   ***Note:*** *The diagnostic test may also be initiated by depressing any one of the control switches once (Para. 4.6).*

## 4.4 Environmental Test

The environmental test allows you to detect any internal or external disturbances which could cause false alarms. Throughout the test, the sensitivity of the PIR is increased by 50 percent, and the walk test as well as the diagnostic indicators are functional. The detector will switch automatically to the single pulse mode in order to display every single disturbance.

To initiate the test, press the control switch (fig. 2) of any of the tested DUET-ST units 4 times. Alternatively, you may use one of the remote control push-buttons (see para. 4.6). **The test duration is automatically limited to 15 minutes,** after which the detector automatically reverts to the normal operating mode.

## 4.5 Buzzer-Aided Testing

The DUET-ST provides a buzzer output which enables you to perform the Walk Test, the Diagnostic Test, or the Environmental Test by listening to a buzzer instead of watching the LEDs. Just plug the buzzer module (Visonic Ltd. Type BUZ-2) onto the two BUZZER pins on the DUET-ST circuit board.

When PIR detector trips, buzzer beeps slowly (about once per second). When microwave detector trips, buzzer beeps rapidly. In case of a dual alarm, the buzzer sounds continuously. Operation of buzzer is not influenced by the settings of the DIP switches.

## 4.6 Control Line (CL) and Control Switches

As mentioned in Para 1.5, the function of the trip order memory depends on a special control line which interconnects the CL (Control Line) terminals of all DUET-STs in the system.

Pushbutton control switches, wired to that same control line, can also be used during the Disarm period to select four useful functions. The control switches should be of the open-circuit momentary pushbutton type, and must be wired between the control line and a –12 Vdc point (see wiring diagram - Fig. 6).

Any number of control switches may be wired in parallel and installed at various locations. The recommended location is the control panel, but any other location will do.

A built-in control switch is also included in each DUET-ST (Fig. 2). This switch, accessible by removing the front cover, enables the installer to select the various functions for that individual detector in exactly the same manner as from the remote switch.

While a remote control switch selects the function for all detectors connected to the control line, the local control switch affects only its own detector and none of the others.

To select a function, the control button has to be pressed repeatedly, in accordance with the number of pulses specified for each function. The four functions selected by the control pushbuttons are:

ONE PULSE:

Activates the WALK TEST and DIAGNOSTIC indications for 15 minutes (this is equivalent to setting SW5 and SW6 to ON for 15 minutes). After 15 minutes, the unit automatically reverts to its previous operating mode. This method of initiating the tests allows the end user to carry out a daily check of all DUET-ST detectors, without opening their front covers. For Walk Test and Diagnostic Test description, refer to Para. 4.2 and 4.3.

THREE PULSES: Activates the HISTORY display - see chap. 6.

FOUR PULSES: Activates the ENVIRONMENTAL TEST for 15 minutes. For test description - refer to Para 4.4. After 15 minutes, the unit automatically reverts to its previous operating mode.

FIVE PULSES: Clears the MEMORY indication of the red LED.

**Notes:**

- Whenever a control switch is pressed, the red LED lights, thus giving you on-line visual verification of your keying action.
- If you press the control pushbutton continuously for more than 3 seconds, the selected function will be aborted and the detector will revert to normal operation. The red LED will light throughout the duration of these 3 seconds and will then turn off. This assures you that your "abort" command has been accepted and that you may release the pushbutton.
- While a selected function is running, the output relay will continue to operate as usual. If while processing a selected function the system is switched to Arm, the DUET-ST will immediately quit that function and revert to normal operation.
- You may activate another function while the previously selected function is still running, without having to first abort the previous function.

# 5. HISTORY DISPLAY

DUET-ST analyzes, retains and displays a comprehensive history information including: alarms, troubles, false alarm probability and power interruptions. For the user as well as the installer, history information is a powerful tool, permitting to review past events as well as to analyze and solve false alarm problems.

The information retained in the History register is divided into 14 periods, each comprising an Arm and subsequent Disarm periods. For **each arm/disarm period,** the microcomputer registers the following information:

- Detector trip order (i.e. first, second, third etc. to alarm) during that Arm period.
- Number of times the detector tripped during that Arm period.
- The number of 'almost alarm' events during the that Arm period (Para. 5.1).
- Trouble alarms (i.e. activation of the TROUBLE output) which occurred throughout the Arm/Disarm period.
- Power interruption to the detector during that Arm and Disarm period (Para. 5.2).

## 5.1 "Almost Alarm" History

An almost alarm is a condition which had almost caused the detector to false alarm during the Arm period. This means that the microwave detector tripped, but the PIR counted only one pulse instead of two alternate-polarity pulses.

The history displays the number of "almost alarms" which occurred during each Arm period, thereby providing the installer with information concerning past behavior and future probability of false alarms. The installer can accordingly eliminate possible sources of false alarms, and over the next several days the system may be monitored to find out whether the measures taken have reduced the number of "almost alarms".

Three "almost alarm" events can be registered in the history for each Arm period. Additional events of this kind are not registered.

## 5.2 Power Failure History

Wiring problems, loose connections or power supply problems cause temporary power loss at the detector. Even a short power failure during the Arm period will cause a false alarm. A power failure will erase all previous events from the history memory.

To further assist the installer in interpreting the power failure event, the history memory distinguishes between power interruptions which occur during the Arm period and those which occur during the Disarm period.

## 5.3 "Trouble" History

The Trouble history includes any trouble event which activated the TROUBLE output during the Arm and the subsequent Disarm period (Para 1.6). The stored information may be retrieved and analyzed by the installer, to determine the cause for trouble. A

recurrently 'troubling' detector can be additionally tested or replaced if suspected as faulty.

## 5.4 History Display Structure (Fig. 7)

The history information can be recalled only during the Disarm period, by pressing any one of the control pushbuttons three times in succession. The detector will wait 15 seconds before displaying the history messages. This delay allows whoever requested this display to proceed from the location of the remote pushbutton to a point where he can view the detector. During the 15-second delay, the yellow LED lights up indicating that the 15-second delay is now in progress.

***Table 2.*** *History Interpretation*

| | Indication ⇓ | 1st Message | 2nd Message | 3rd Message | 4th Message |
|---|---|---|---|---|---|
| CODE ⇓ | **Red LED flashes** | Detector trip order | Number of alarms | Number of almost alarms | Trouble events |
| **0** | **Rapid flashing** | Neither 1st, 2nd or 3rd to trip | No alarms | No 'almost alarms' | No trouble |
| **1** | **One pulse** | 1st to trip | One alarms | One 'almost alarms' | Trouble alarm |
| **2** | **2 successive pulses** | 2nd to trip | Two alarms | Two 'almost alarms' | Power restored in *Disarm* period |
| **3** | **3 successive pulses** | 3rd to trip | Three alarms | Three 'almost alarms' | Power restored in *Arm* period |

The history is divided into groups of coded messages displayed by flash sequences of the red LED. Each group represents an arm/disarm period. After the display of each group, the green LED lights up for 2 seconds, indicating that the next arm/disarm period is ready to be displayed.

The first data group displayed represents the most recent arm/disarm period. The second group represents the previous arm/disarm period and so on until the oldest period retained in the history memory is displayed.

Each group of coded data contains four messages conveyed by flashing sequences of the red LED, separated by 2-second intervals (see table 2 and Fig. 7).

## 5.5 History Display Interpretation (Fig. 7)

**Group A (last arm/disarm period):**

- The detector was first to trip (1st message =1).
- The detector tripped twice (2nd message = 2).
- 1 'almost alarm' occurred (3rd message = 1)
- No TROUBLE alarms occurred during this period (4th message = 0).

**Group B (previous arm/disarm period):**

- Detector did not trip or tripped later than 3rd (1st message = 0)
- The detector did not trip (2nd message = 0)
- 2 'almost alarms' occurred (3rd message = 2)
- 1 trouble alarm occurred (4th message = 1).

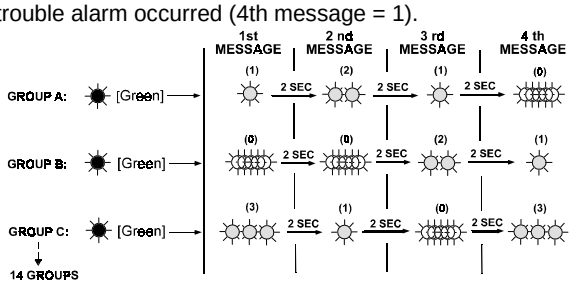



***Figure 7.*** *History Display Example*

**Group C (oldest arm/disarm period):**

- The detector was third to trip (1st message = 3), meaning that at least two other detectors tripped before it.
- The detector tripped once (2nd message = 1).
- There were no "almost alarms" (3rd message = 0)
- The detector recovered from a power loss during the arm period (4th message = 3).
  All previous history registrations have been probably erased due to the power loss.

***Notes:***

- *To avoid registration of recurrent events, only events separated by at least a 2 minute interval will be registered.*
- *A new Arm period starts only after the two-minute exit delay. If the alarm system is disarmed within the exit delay period, the history function will disregard that arming event.*

## 5.6 Noting down the History

It is easier to note down the coded messages in table form during the flashing of the LEDs, and later to decipher the meaning of each message. Prepare a simple form as in the sample below:

| | 1st | 2nd | 3rd | 4th |
|---|---|---|---|---|
| **Group A** | 1 | 2 | 1 | 0 |
| **Group B** | 0 | 0 | 2 | 1 |
| **Group C** | | | | |
| ⇓ | | | | |

When the LED's start flashing, note down the groups of messages, in their order of appearance. You can later take your own time in reviewing the data and analyzing it.

## 5.7 Terminating the History Display

After displaying all possible 14 periods, the yellow LED lights up for 2 seconds, and the detector returns to normal operation. It is possible to terminate the history display before it times out by pressing the control button constantly for 3 seconds. Arming the alarm system automatically terminates the history display.

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