SILENT KNIGHT

1500 SERIES

SUPERVISED RF SECURITY SYSTEM

INSTALLATION MANUAL

REVISED SEPTEMBER 1990

PART NUMBER 150499

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1 INTRODUCTION TO WIRELESS INSTALLATIONS

In order to install alarm systems in a professional manner, one needs basic wire installation skills and some knowledge of electronics. For RF based alarm systems, one should in addition have some knowledge of radio waves and how these are propagated through the air and through building structures.

RF (Radio Frequency) installations, which can also be called wireless installations, are different from hard wire installations in a number of ways. They may require special tools.

Some of the test procedures and instruments that are being used for wire based installations may not work in RF installations. For example, continuity tests with an ohm meter or a volt meter cannot be performed. Instead, to determine if a transmitter and a receiver really can communicate between two different locations, testing is best performed by using the two units and to tape them in place during the test procedure.

This installation and operation manual is designed to provide you with the information that you will need to install, operate and to maintain the Silent Knight 1500 series RF system. It also attempts to cover the basic RF principles that are involved in the system. It is best to read through the manual in its entirety before you begin to install a Silent Knight 1500 system. If you should have any questions or encounter any problems that are not being addressed in this manual, you may call the Silent Knight Technical Support Department at its toll free number 1-800-328-0103.

1.1 SUPERVISED WIRELESS

Supervision is a term which is much used in the security industry. This means that the equipment which is being supervised has been equipped with circuits which enables it to check its own functions. Among these functions are power supply problems, problems in the wires or wireless circuit which it uses to communicate, and problems in the battery.

While the first RF based security systems were mostly unsupervised, modern RF based security systems such as the 1500 series are supervised. This way, if a transmitter in the system should stop functioning, or if its battery should become discharged, the user will be informed about the situation.

The concept of "Supervised" wireless allows the alarm system to alert the user and ultimately the alarm dealer to any condition that might inhibit the proper operation of the alarm system.

The supervision of the Silent Knight wireless equipment is accomplished in several ways:

1. Each transmitter sends a supervisory data report every hour. During this report, the transmitter tells the receiver its present condition and then the receiver will log this data into its memory.

If a transmitter fails to report in within a programmable time factor, the receiver will automatically "flag" that transmitter and cause an audible and/or visual trouble condition report locally. During this time, a trouble condition report may also be sent to the alarm dealers central station.

2. Status reports are sent any time a condition which is monitored by the transmitter changes. This means that a transmitter monitoring a door for example, will send one type of status report when the door is open (alarm report) and a different type of report when it is closed. With these separate status reports, the control panel used with the Silent Knight 1500 series system will know the condition of all the sensors within the system. One very important point is that the system cannot be inadvertently armed with doors or windows left open.

3. The battery of each transmitter is as important as the sensor which the transmitter monitors. Only good quality batteries should be used with any RF transmitter. It is recommended that you use Duracell 7K67 or Eveready 539 batteries for replacement. Even good quality batteries eventually wear out. As they do, the Silent Knight transmitters will detect this and send a special "low-battery" status report. This report is sent at least 1 to 4 weeks prior to total discharge of the battery, allowing plenty of time for replacement. During this time the transmitter will function normally.

   The RF receiver will "flag" and latch into memory the "low-battery" report sent by individual transmitters and will not reset this latch until the battery is replaced and a transmission is sent using the new battery.

With these methods of supervision, the Silent Knight 1500 series RF system instills the same degree of confidence which a dealer may have in a hard-wired system and maybe more so since the transmitters are reporting hourly and report the present status each time.

1.2 RADIO FREQUENCY THEORY

Radio Waves are used to communicate information over some distance without the use of wires. While RF security systems utilize radio waves to communicate over rather short distances, radio waves can also be used for communications over much larger distances. Examples of everyday use of radio waves are found in television and radio broadcast stations, which use radio waves to transmit video and audio signals to their audiences. In fact, almost all types of information can be transmitted over radio waves, including digital communications between computers, facsimile communications for illustrations and teletype communications for written messages.

There are several factors which influence the reliability of an RF security system. The relative position of the receiver with regards to the transmitter will determine how strong the received signal will be. Obstructions, distance and the lack of power, will all have adverse effects on reception. The lower the power at the transmitter, the shorter the distance a signal can be sent. Obstructions can greatly reduce the amount of signal that reaches the receiver. In some instances, the signal may not

pass through an obstruction but instead will bounce off in another direction. Refer to illustrations 1 to 5 below. These illustrations depict what may happen to the distance which a signal may cover when it passes through a medium that would be found in a building.

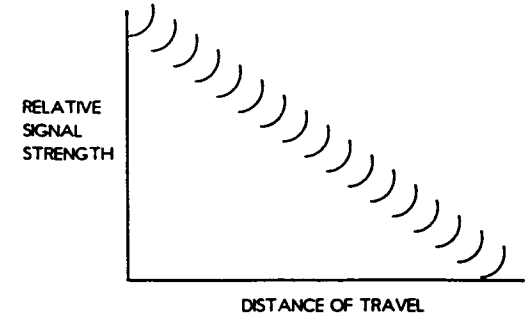


Illustration #1: This illustration shows the distance of travel when the signal does not come in contact with any obstructions.

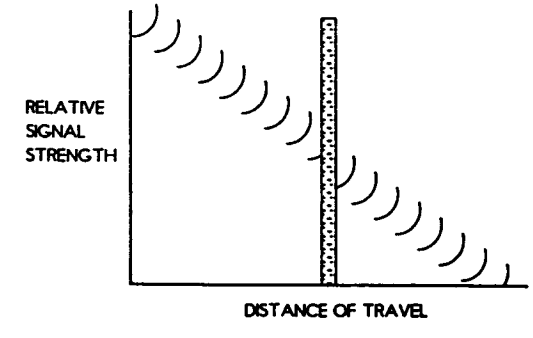


Illustration #2: When the signal passes through plasterboard or wood, it loses up to 10% of its power.

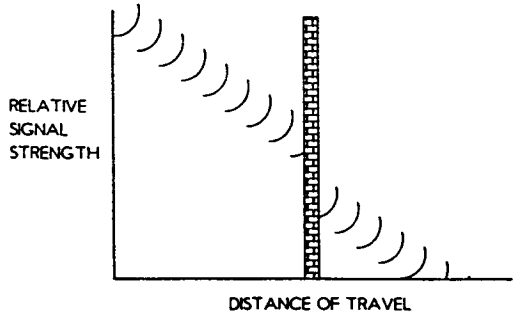


Illustration #3: When the signal passes through light concrete or brick, it loses up to 45% of its power.

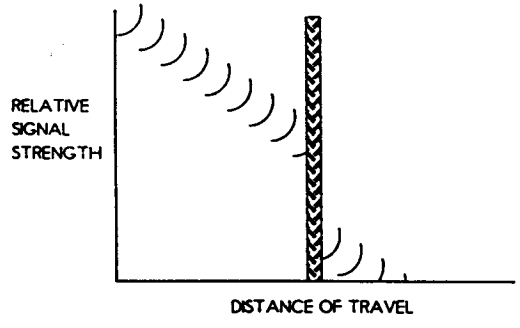


Illustration #4: When the signal passes through concrete steel reinforcement or metal lath, it loses up to 90% of its power.

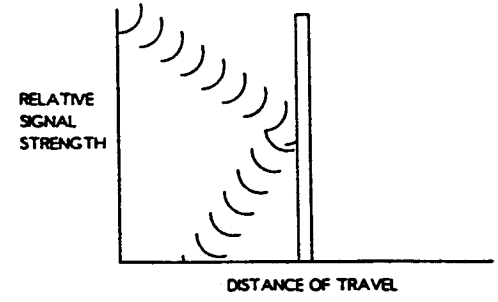


Illustration #5: When the signal comes in contact with metal such as a refrigerator, it will not pass but will deflect in another direction.

As you can see from the first illustration that even though the signal did not pass through any objects, it still lost strength as it moved farther away from its source. Notice also that as the signal passed through a medium and became attenuated, it could not travel as far as it could if it did not encounter any obstructions. RF transmitters and receivers function best when they can be placed in a "Line Of Sight" configuration.

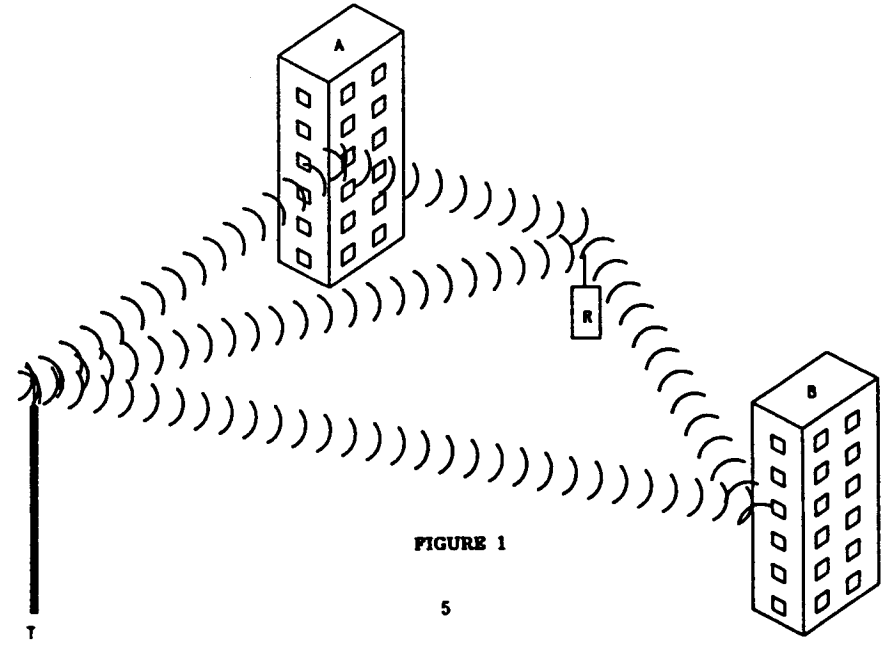


FIGURE 1

Another type of situation that RF equipment installers have to take into consideration is "Multiple Reflections". Although radio waves travel at high speeds, they still take some specific amount of time to reach their destination. Radio waves also tend to reflect off of objects that they cannot pass through. Figure 1 shows a transmitter sending out a signal and a receiver receiving the signal. The buildings are located at different distances from the receiver. Building "A's" reflection will reach the receiver before building "B's" reflection. The direct signal from the transmitters will arrive at the receiver before either reflection. Because of the difference in distance, the signals arrive out of phase as shown in Figure 2.

Figure 1 shows three signals arriving at the receiver. In reality, thousands of separate signals arrive. The net signal that the receiver decodes is an algebraic sum of ALL of the signals. This can cause the signal to be very strong or not there at all. A good example of this is driving your car through a city while listening to the radio. You can physically hear the volume increase and decrease as you drive along. Not only does this change the strength of the signal but it also can cause distortion. If the signal is badly distorted, it can cause false decoding resulting in an unreliable system.

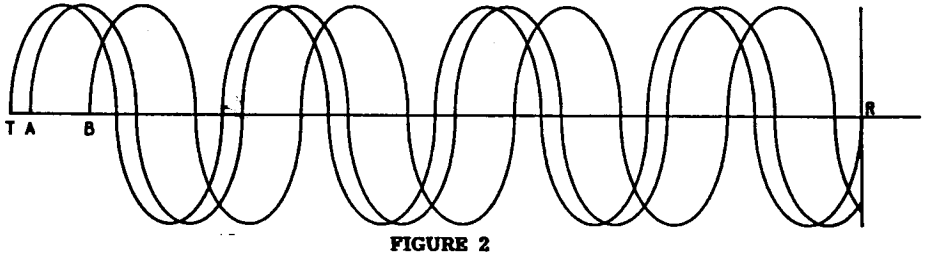


FIGURE 2

Radio waves are polarized. This means that they have both an electric and a magnetic field which are perpendicular to each others. It is the antenna that determines the polarization of a radio transmitter or a radio receiver. It is important that both the transmitters and the receiver in an RF security system are polarized in the same way. Otherwise, the receiver antenna will receive a much weaker signal than when it has the same polarization as the transmitter antenna.

In the Silent Knight RF systems, vertical polarization is being used. To have vertical polarization, you should make sure that your RF equipment is mounted in such a way that the antenna comes out vertically from either over or under the receiver or the transmitter.

In order to be able to install an RF security system in the most effective manner, it is important to understand the fundamentals of Radio Wave transmission. This manual is only a brief introduction to RF. It is recommended that you obtain a book on RF transmission and read it

carefully. It could mean the difference between success and failure when installing this RF security equipment. There are many books on radio frequency theory and use in your local library.

1.3 SELECTING INSTALLATION LOCATIONS

The first thing to look for are large sources of metal in the site. The most obvious items are:

Metal Shelving
Metallic Wall Paper
Metal Window Frames
Metal Doors
Aluminum Siding
Mirrors
Large Appliances

Smaller metal objects such as picture frames, coat hangers, and small appliances can interfere with transmission if they are close enough to the transmitter or receiver. Unfortunately, the majority of metal building materials are hidden from sight. These things would include:

Foilback insulation
Metal Studs
Plumbing
Metal Lath
Fireplace or chimney inserts

It is impossible to avoid every type of interference but with careful planning and a little patience, the job can be performed with success.

1.4 PRE-TESTING THE SITE

It is a great advantage to pre-test a site. Place all of the transmitters where you would like to install them. Tape them in place rather than permanently mounting them. By following this method, you will avoid having to repair a wall or door frame if the transmitter does not function properly from that position. For best results, the transmitters should be mounted as high as possible. Here are some other helpful hints:

DO NOT install transmitter in locations where the temperature could go below -4° F (-20° C) or exceed 140° F (+60° C).

Install the transmitters as close as possible to the receiver.

Try to keep all of the antennas in a vertical position.

Avoid placing the transmitters too close to other wiring that you may install, as this could cause signal attenuation.

Avoid mounting any of the transmitters directly on metal or foil wallpaper. If there is no other choice of location available, the transmitter should be mounted on a non conductive spacer.

Once the transmitters have been taped in place, choose a location for the receiver. DO NOT install the receiver in locations where the temperature could go below 32° (0° C) or exceed 140° F (60° C).

Locate the receiver near the center of the area which is to be covered.

Do NOT mount the receiver on metal or concrete surfaces, or on wallpaper with a mirror-like surface.

Avoid mounting the receiver near any equipment that could generate a lot of RF noise. These types of equipment include home computers, equipment that contains electric motors, television sets and lamps with dimmer controls.

Mount the receiver on the first or second floor. Do not mount it in the basement.

NOTE: Before the system can be tested, all of the EEPROMS must be programmed and the batteries must be installed.

2 SILENT KNIGHT TRANSMITTERS

2.1 MODEL 1501 SURFACE MOUNT TRANSMITTER

The 1501 is a small "Surface" mount transmitter. Its many programmable options allow it to be used with almost any type of detection device.

2.2 MODEL 1502 HAND HELD TRANSMITTER

The 1502 is a two channel hand held transmitter. This transmitter can be programmed as a "non supervised" unit, allowing it to be removed from the vicinity of the system without causing a "Trouble" condition.

2.3 MODEL 1504 RF SMOKE DETECTOR

The 1504 is an ESL smoke detector with a Silent Knight transmitter installed in the housing.

2.4 MODEL 1507 PIR TRANSMITTER

The model 1507 is a Detection Systems passive infrared detector with a Silent Knight transmitter installed in the housing.

2.5 GENERAL TRANSMITTER SPECIFICATIONS

All of the programmable options are programmed into an EEPROM using the Model 5506, 5510 or 5520/21 programmers. The actual programming will be explained in a later section.

Transmitters can be programmed for any of the 16 zones.

Each transmitter is programmed with its own ID Number. 64 ID Numbers are allowed in a system. Four of the ID Numbers are "non-supervised" for use with the 1502 hand held transmitters.

1024 different Resident Codes are available. The large number of Resident Codes reduces the possibility of unwanted interference.

Transmitters can be programmed for LEVEL 1 transmissions (12 data words) or LEVEL 2 transmissions (16 data words).

Battery status is checked every hour and each time the transmitter is activated.

A supervisory report, including sensor status and battery status, is sent every hour.

The Models 1501, and 1502 transmitters use a 6 volt Alkaline battery. It is recommended that you use Duracell 7K67 or Eveready 539 batteries or equivalent. The transmitter should not be installed in a location where the temperature could go below -4° F (-20° C) or exceed 140° F (60° C).

2.6 GENERAL TRANSMITTER OPERATION

If a transmitter is programmed for Normally Open contacts, a Closed contact will activate the transmitter. If a transmitter is programmed for Normally Closed contacts, an Open contact will activate the transmitter.

Ih this manual, a Normally Open device Will Not conduct when it is in an alarm state. A Normally Closed device Will conduct when it is in an Alarm state.

Assume that the transmitter has been programmed for 12 transmissions (LEVEL 1). When the transmitter is activated, it sends a 24 bit digital word to the receiver 12 times. It then pauses for a short time and again sends the word 12 times. It repeats the transmission in case the first one was not received. If the transmitter had been programmed for 16 transmissions (LEVEL 2), The transmitter would send the word 16 times. After a pause it sends the word 16 more times.

A restore transmission is sent 8 times with a pause then is repeated 8 times.

3 TRANSMITTER PROGRAMMING

3.1 USING THE 5506 OR 5510 PROGRAMMERS

Each transmitter requires specific information and option selections which must be programmed into the EEPROM (Electrically Erasable Programmable Read Only Memory). The EEPROM is an 8 pin Integrated Circuit Chip which can be reprogrammed over and over. The Prom Coding Forms (provided in this manual) explain each option and how to select them. Programming this information allows the user to customize the transmitters to meet their personal needs. The Model 5506 Desk Top Programmer or the Model 5510 Hand Held Programmer can be used to program the EEPROM. Refer to the operation manual of the programmer and the Prom Coding Forms to program the EEPROMs. The transmitters are shipped with the EEPROMs inserted in their sockets on the printed circuit boards. The EEPROMs must be removed and programmed before power is applied to them.

The sockets of both programmers are designed for 16-pin IC's. It is important that the EEPROM is inserted into the correct half of the programmer socket (See Figure 3 below). Pin 1 of the EEPROM should be inserted in the lower left hole of the programmer socket. When using the Model 5506 programmer, always use socket #1 to prevent damage to the EEPROM. After the EEPROM has been programmed, remove it from the programmer socket and carefully reinsert it in its socket on the PC board (see Section 3.4).

3.2 USING THE 5520 OR 5521 PROGRAMMERS

If you are using a model 5520 or 5521 desk top programmer, refer to the operation manual, Silent Knight part number 150479, for programming instructions for X2443 or X2444 EEPROMs.

NOTE: The zone number range is shown incorrectly on the 5520 and 5521 programmers. The programmers indicate the range to be 0 through 15. The correct range is 1 through 16. Therefore, if the desired zone number is 1, you must select 0 on the programmer.

3.3 EEPROM REMOVAL PROCEDURE

BE SURE THE BATTERY IS REMOVED FROM THE TRANSMITTER WHEN INSERTING OR REMOVING THE EEPROM.

To remove the EEPROM from its socket on the PC board, a flat-blade screwdriver may be used to GENTLY lever the EEPROM out of its socket.

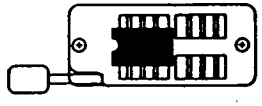


FIGURE 3

3.4 EEPROM INSERTION

To insert the EEPROM back into its socket on the PC board, CAREFULLY press it back into its socket. Pay close attention to which way the notch cut-out of the EEPROM is facing. It should be replaced on the PC board exactly as it was removed. Apply even pressure on each end of the EEPROM so that it goes in squarely. If any of the legs are accidently bent, they can be straightened by using a pair of flat-sided pliers. Keep in mind that the legs are extremely fragile and great care should be taken when straightening them.

3.5 TRANSMITTER PROGRAMMING

The following sections are a description of each option for programming the individual transmitters. Read over the options carefully. At the end of each section is the actual Prom Coding Form. When you reach the form, you will have to fill in the blanks with the option information that you want to program into the EEPROM.

3.6 ZONE NUMBERS

Zone Numbers 1 thru 16 are available when using a Model 1521 Receiver.

NOTE: As many transmitters as you wish may be assigned to a zone. The only limit is the system size of 64 transmitters per 1521 receiver.

3.7 RESPONSE TIME

You have a choice of FAST or SLOW for a response time. The FAST option requires the contacts to remain open or closed (depending on the type of contacts used) for 10 milliseconds before the transmitter will report. The SLOW option requires the contacts to remain open or closed (depending on the type of contact used) for 100 milliseconds before the transmitter will report.

3.8 CONTACT TYPE

Normally Open or Normally Closed contacts may be used.

NOTE: A transmitter programmed for N.O. contacts will report an alarm condition when the contact is closed.

3.9 TRANSMISSION TYPE

You may choose LEVEL 1 or LEVEL 2. The difference between LEVEL 2 and LEVEL 1 is the number of attempted transmissions. If a LEVEL 1 and a LEVEL 2 transmission are sent at the same time, the LEVEL 2 will override the LEVEL 1. If a transmitter is not being received properly at the receiver and the situation cannot be corrected, the LEVEL 2 option should be selected. This allows FOUR extra transmission attempts. For fire alarm detection devices, the LEVEL 2 option must be chosen.

3.10 TRANSMITTER ID

Transmitter ID Numbers can be from 0 to 63. ID Numbers 60 thru 63 are NOT supervised. They are especially suited for use with the Model 1502 hand held transmitters. Assign ID Numbers sequentially from 0 to one less than the number of supervised transmitters.

EXAMPLE 1: If 10 transmitters are to be used and they are all supervised, assign them ID Numbers 0 thru 9.

EXAMPLE 2: If 10 transmitters are to be used but one of them is NOT supervised, assign them numbers 0 thru 8 for the supervised transmitters and 60 for the "unsupervised" transmitter.

CAUTION: If you do not assign the transmitters in sequential order starting with zero, it will cause a "FAILED" indication and a "Trouble" report at the control panel. This report will then be forwarded to the central station.

3.11 RESIDENT CODE

Any Resident Code from 0 to 1023 may be used. Make sure that you program identical Resident Codes in all of the transmitters and the receiver.

3.12 MODEL 1501 PROGRAMMING

PROM CODING FORM

( ) Indicates where the information must be entered.

STEP	DATA	FUNCTION
0	1501	Indicates Model Number 1501
1	( )	Zone Number (1-16 or 1-8)
2	( )	Response Time (1 = 10 ms 0 = 100 ms)
3	( )	Contact Type (1 = N.O. 0 = N.C.)
4	( )	Transmission Type (1 = LEVEL 1; 0 = LEVEL 2)
5	( )	ID Number (0-63) (60-63 unsupervised)
6	( )	Resident Code (0-1023)

NOTE: The Model 1501 should be programmed for Normally Closed operation. (Contacts are closed when door is closed.)

3.13 MODEL 1502 PROGRAMMING

When programming the Model 1502, you must program the Zone Number, ID Number, and Resident Code. The values are given in the Prom Coding Form.

NOTE: The 1502 will activate two adjacent zones. The 1502 MUST be programmed to ODD numbered zones. The RIGHT touch switch will activate the programmed (ODD) zone and the LEFT touch switch will activate the programmed zone +1 (EVEN).

EXAMPLE: If the 1502 is programmed for Zone Number 5, the RIGHT touch switch will activate Zone 5. If the LEFT touch switch is pressed, the 1502 will activate Zone 6.

CAUTION: Be sure to program identical Resident Codes in all transmitters and the receiver.

PROM CODING FORM

STEP	DATA	FUNCTION
0	(1502)	Indicates Model Number 1502
1	( )	Zone Number (1-16 or 12-8)
2	( )	ID Number (0-63) (60-63 unsupervised)
3	( )	Resident Code (0-1023)

3.14 MODEL 1504 PROGRAMMING

When programming the Model 1504, you must program the Zone Number, ID Number and Resident Code. The values are given in the Prom Coding Form.

NOTE: As many transmitters as you wish may be assigned to a zone. The only limit is the system size of 64.

CAUTION: Be sure to program identical Resident Codes in all of the transmitters and in the receiver.

PROM CODING FORM

STEP	DATA	FUNCTION
0	1504	Indicates Model Number 1504
1	( )	Zone Number (1-16 or 1-8)
2	( )	ID Number (0-63) (60-63 unsupervised)
3	( )	Resident Code (0-1023)

3.15 MODEL 1507 PROGRAMMING

When programming the Silent Knight Model 1507, you must program the Zone Number, ID Number, and Resident Code. The values are given in the Prom Coding Form.

PROM CODING FORM

STEP	DATA	FUNCTION
0	1505	Indicates Model Number
1	( )	Zone Number (1-16 or 1-8)
2	( )	ID Number (0-63)(60-63 unsupervised)
3	( )	Resident Code (0-1023)

NOTE: In Step 0, enter 1505 even if you are using a 1507.

NOTE: As many transmitters as you wish may be assigned to a zone. The only limit is the system size of 64.

CAUTION: Be sure to program identical Resident Codes in all of the transmitters and the receiver.

4 RECEIVER GENERAL INFORMATION

4.1 MODEL 1521 SUPERVISED RF RECEIVER

Figure 4 shows the layout of the 1521 printed circuit board. The 22-pin RF receiver connector mates with a 4-foot plug-on cable assembly (P/N 130283), the other end of which can plug into a similar connector in the control panel. If more length is desired, additional 22-gauge cable can be spliced in. Wire length must not exceed 50 feet. The receiver should not be installed in a location where the temperature could go below 32° (0° C) or exceed 140° F (60° C).

The 1521 is a 64-channel, fully supervised receiver. It is capable of receiving and processing signals from any of the Silent Knight supervised transmitters mentioned earlier in this manual. The 1521 has 16 zone outputs that can be wired to most alarm control panels without an additional interface board. Test/Beep and Trouble outputs are provided to annunciate Test or Trouble conditions. The 1521 has 5 Light Emitting Diodes (LED's) to indicate transmitter status and a dual 7-segment display to indicate the transmitter ID Numbers.

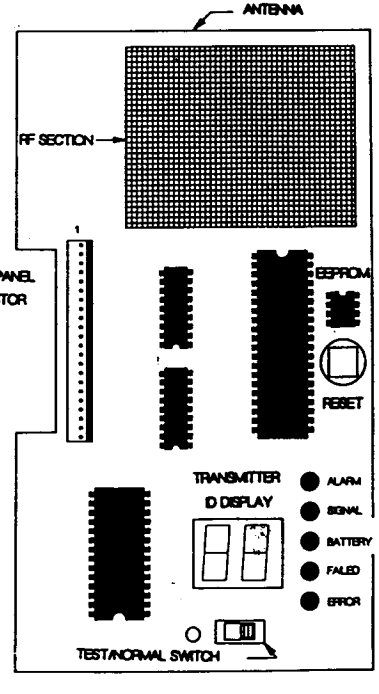


FIGURE 4
MODEL 1521 RF RECEIVER

4.2 CONTROL COMMUNICATOR PANELS

The Silent Knight receivers listed previously are designed for compatibility with the following Silent Knight Control/Communicator Panels. For compatibility with other manufacturer's equipment, call Silent Knight's Technical Support Department at 1-800-328-0103.

1. 2120 (Squire System)
2. 2420 (Squire System)
3. 2620
4. 2700 Series
5. 3320
6. 3500
7. 5251

A brief description of the interface between the Silent Knight Receivers and the Control Panels listed above, appear in the individual Control/Communicator Installation Manuals. The pertinent characteristics of each control panel are also described.

4.3 DISPLAY

ALARM LED: This LED turns ON when the displayed transmitter is in the not ready condition.

SIGNAL LED: This LED is used when in the TEST Mode (See Transmitter Test description in Section 5.1).

BATTERY LED: This LED turns on when the transmitter battery voltage is below its safe operating voltage.

FAILED LED: This LED turns ON when the displayed transmitter has failed to report during the supervision time (See Supervision Time in Section 5.4).

ERROR LED: This LED will turn ON when all of the transmitters have NOT been tested and the TEST Mode is NOT interrupted.

DUAL 7-SEGMENT DISPLAY: This displays the transmitter ID number currently being processed by the 1521 receiver.

4.4 INPUTS/OUTPUTS

INPUT POWER +8 to +18 VDC; 220ma max. at 12 VDC.

ARMED INPUT: This input will ARM the receiver when it is switched to +VDC. See the RECEIVER OPERATION section for a description of the ARMED operation.

TEST INPUT: This input puts the receiver into the TEST mode when switched to +VDC. A description of the TEST function can be found in the RECEIVER OPERATION section of this manual.

NOTE: The model 1521 provides a TEST/NORMAL switch.

ZONE OUTPUTS: The 1521 zone outputs are active low (200ma--switched to ground) during an alarm condition. The guaranteed low voltage for the outputs is 1.3 VDC. Be sure the alarm panel being used with the receiver will respond to the 1.3-VDC level.

TEST/BEEP OUTPUT: This output is active low at 100ma max. It is active for approximately 200ms every 60 seconds when a transmitter has reported a low battery or has failed. In the TEST Mode, it will be active low for about 1 second after a signal is received from the transmitter. If the receiver is in the TEST Mode for more than 5 minutes without receiving a signal from a transmitter, the output will become active. It will remain active until it receives a signal or the receiver is taken out of the TEST Mode. If an attempt is made to ARM the system while in the TEST Mode, the output will become active until the receiver is DISARMED and taken out of the TEST Mode.

TROUBLE OUTPUT: This output is active low at 100ma max. It becomes active when a transmitter reports a "Low battery" or has "Failed". The output will remain active until the condition has been corrected. Pressing the RESET switch will deactivate the output unless the condition is caused by a "Low Battery" report from one of the transmitters.

RESET SWITCH: Located inside the housing of the receiver, this switch will reset the receiver without removal of power. Full zone memory will be retained. When the receiver is switched from the TEST Mode to the NORMAL Mode of operation and all of the transmitters have not been tested, the untested transmitters will be displayed and the ERROR LED will come on. When this happens, either the receiver can be put back into the TEST Mode and testing of the transmitters can be completed, or the RESET switch can be pressed. The RESET switch will clear the untested transmitters and the receiver can operate properly in the NORMAL Mode.

4.5 MODEL 1521 PIN DESCRIPTION

DESCRIPTION	PIN #		DESCRIPTION	PIN #
Common Ground	1		Zone 6	12
+8 to +18VDC	2		Zone 7	13
Test/Beep Out	3		Zone 8	14
Trouble Out	4		Zone 9	15
Armed In	5		Zone 10	16
Test In	6		Zone 11	17
Zone 1	7		Zone 12	18
Zone 2	8		Zone 13	19
Zone 3	9		Zone 14	20
Zone 4	10		Zone 15	21
Zone 5	11		Zone 16	22

5 MODEL 1521 OPERATION

5.1 DISPLAY MODES

The receiver has two display modes when in the test mode. These are described in the following paragraph:

1. ALARM MEMORY:

When the receiver is first put into the TEST mode, the 7-segment display will indicate the transmitter ID Numbers of the last 6 transmitters to report an ALARM condition. The transmitter ID Numbers will be displayed in the order of last in - first out. The receiver will continue to display the 6 ID Numbers until a transmission is received from any of the transmitters.

2. TRANSMITTER TEST:

When a signal is received from a transmitter, the ALARM LED will come ON and the ID Number of the transmitter that sent the signal will be displayed for about one second. Next, the SIGNAL LED will come ON (the ALARM LED will go OFF) and the 7-segment display will indicate how many of the ALARM data words were correctly decoded by the receiver. After about one second, the display will turn OFF. When the violated zone is restored to its normal state the ALARM LED will come ON and the display will show the transmitter ID Number. After about one second the Signal LED will come on (the ALARM LED will turn OFF) and the display will show how many RESTORE data words were correctly decoded. When this has been displayed, all of the displays (LEDs included) will turn OFF. This is a very important troubleshooting aid. If all of the ALARM or RESTORE data words are not correctly decoded, it means that something is interfering with the transmission.

When the receiver is in the TEST mode, the zone outputs remain unchanged but they will be updated when the receiver is placed back into the NORMAL mode. This means that if a transmitter is not cleared after testing, the zone which it reports to will become active when the receiver is taken out of the TEST mode and you will not be able to ARM the system until the zone is cleared. If an attempt is made to ARM the system while in the TEST mode, the Test/Beep output will become active until the receiver is DISARMED and taken out of the TEST mode. If the receiver is left in the TEST mode for more than 5 minutes and no signals are received, the Test/Beep output will become active.

When the receiver is put back into the NORMAL mode, the 7-segment display will indicate the transmitter ID Numbers that have NOT been tested (if there are any) and the ERROR LED will come ON. At this time the receiver can either be put back into the TEST mode and testing of all the transmitters can be completed or the RESET button can be pushed to clear the displays.

5.2 TEST PROCEDURE

1. Place the receiver into the TEST mode.
2. Violate the transmitter you wish to test.

3. Read the display to see if the receiver is receiving all of the data words. This procedure may take two people if the receiver cannot be seen from the transmitter location.
4. If all of the data words do not get decoded, check for obstructions.
5. If there are no obstructions, try moving the transmitter in any direction to try and get a better transmission path.
6. If moving the transmitter does not help, it may be a situation where the transmitter is out of range. The solution for this is moving the transmitter closer to the receiver.
7. Remember to clear the transmitter after it is violated so that a RESTORE signal can be sent.
8. When you are satisfied with the transmission, clear the transmitter and proceed to the next one to be tested.

NOTE: When violating a zone, make sure that it is violated for more than 3 seconds so that the receiver does not combine the ALARM data words with the RESTORE data words. This causes a false decoding of the data words and the display will add the number of ALARM data words to the number of RESTORE data words. EXAMPLE: If the transmitter is programmed for a LEVEL 1 transmission (12 data words), the display may show that the receiver decoded 20 words because it added the 8 RESTORE data words to the 12 ALARM data words.

5.3 NORMAL OPERATION

When the receiver is in the NORMAL mode, the 7-segment display will sequentially display all of the transmitters that report an ALARM, FAILURE or LOW BATTERY. The 7-segment display will indicate the transmitter ID Number while the 5 LED's will indicate the the status of the transmitter.

When the receiver is DISARMED and an ALARM signal is received, the proper zone output WILL become active unless the receiver is in the TEST mode. It will remain active until that transmitter reports a non-alarm condition.

When the receiver is ARMED and an ALARM signal is received, the proper zone output WILL become active. It will remain WILL active for 3 minutes or until that transmitter reports a non-alarm condition, whichever comes first. If the zone output is reset by the 3 minute limit, the 7-segment display will continue to display the transmitter ID Number and the ALARM LED will be ON. The zone output is reset after 3 ALARM LED ON minutes to allow the control panel to attempt to reset. The output will become active again when the receiver is DISARMED or if another transmitter programmed to activate that zone sends an ALARM signal.

5.4 SUPERVISION TIME

This is the time interval in which all transmitters in the system must have made one complete, correct transmission to the receiver. If one or more of the transmitters have failed to do so, The TROUBLE output will become

active and the TROUBLE Test/Beep output will signal a failed transmitter(s). On a Model 1521, the FAILED LED will turn ON when the failed transmitter(s) ID Number(s) are displayed. This time interval is a programmable function.

6 PROGRAMMING THE MODEL 1521

6.1 SUPERVISION TIME

This can be programmed for 0 to 15 hours. This determines when the receiver will check to see if all supervised transmitters have reported. If programmed for 0 hours, no failure reports will be made. Recommended supervision time is two or more hours.

6.2 HIGHEST SUPERVISED TRANSMITTER NUMBER IN THE SYSTEM

The value of this number can be from 0 to 59 inclusive. Since we are looking for supervised transmitters only, 60 thru 63 cannot be used.

NOTE: If 15 transmitters are used in the system and 1 of them is a Model 1502 programmed as unsupervised (60-63), then the others are assigned the values 0 to 13. 13 MUST entered as the highest supervised transmitter ID Number.

6.3 RESIDENT CODE (0 TO 1023)

CAUTION: Be sure to program identical Resident Codes in all of the transmitters and in the receiver to be used with them.

6.4 PROM CODING FORM FOR THE 1521

STEP	DATA	FUNCTION
0	1520	Indicates Model Number.
1	( )	Not used
2	( )	Supervision Time 0 - 15 Hours
3	( )	Highest ID Number Of Supervised Transmitter 0 - 59
4	( )	Resident Code 0 - 1023

NOTE: In Step 0, enter 1520 for DATA for the Model 1521.

NOTE: If a Supervision time of 0 is selected, no transmitter supervision will take place.

7 MOUNTING INSTRUCTIONS

After the transmitters and receiver have been programmed, the EEPROMS replaced and the batteries installed, it is time to test the system. Remember to "Tape" the transmitters in their desired locations for testing purposes. Once you are satisfied that the location of all components of the system are positioned correctly, it will be time to permanently mount them.

NOTE: If a transmitter will not function in a desired location, it may take only a small movement to make it operate.

7.1 1521 MOUNTING PROCEDURE

The model 1521 can be placed near the accompanying control panel using the supplied cable. Remember not to mount the receiver on metal, such as the cabinet, or directly on concrete. If you wish to mount the receiver remotely away from the control to optimize range, the receiver may be up to 100 feet away from the control. Use a minimum of 22 gauge wire and as many conductors as needed for receiver power, supervisory functions and the number of zones that are being used. Use #8 Round Head Phillips drive screws. The following steps refer to Figure 5:

1. Drive the top screw into the wall so that the receiver will be in the desired location.
2. Press the receiver onto the top screw and slide downward until the screw is at the top of the screw slot.
3. Drive the bottom screw into the wall through the printed circuit board and bottom screw hole until it is snug.
4. Plug the cable assembly into the connector then position the cable assembly into the cable slot.
5. Insert the bottom of the cover into the slot on the bottom of the mounting piece.
6. Press the top of the cover forward and slightly downward so that the top snaps into the slot in the top of the mounting piece. CAUTION: DO NOT pinch the cable assembly.

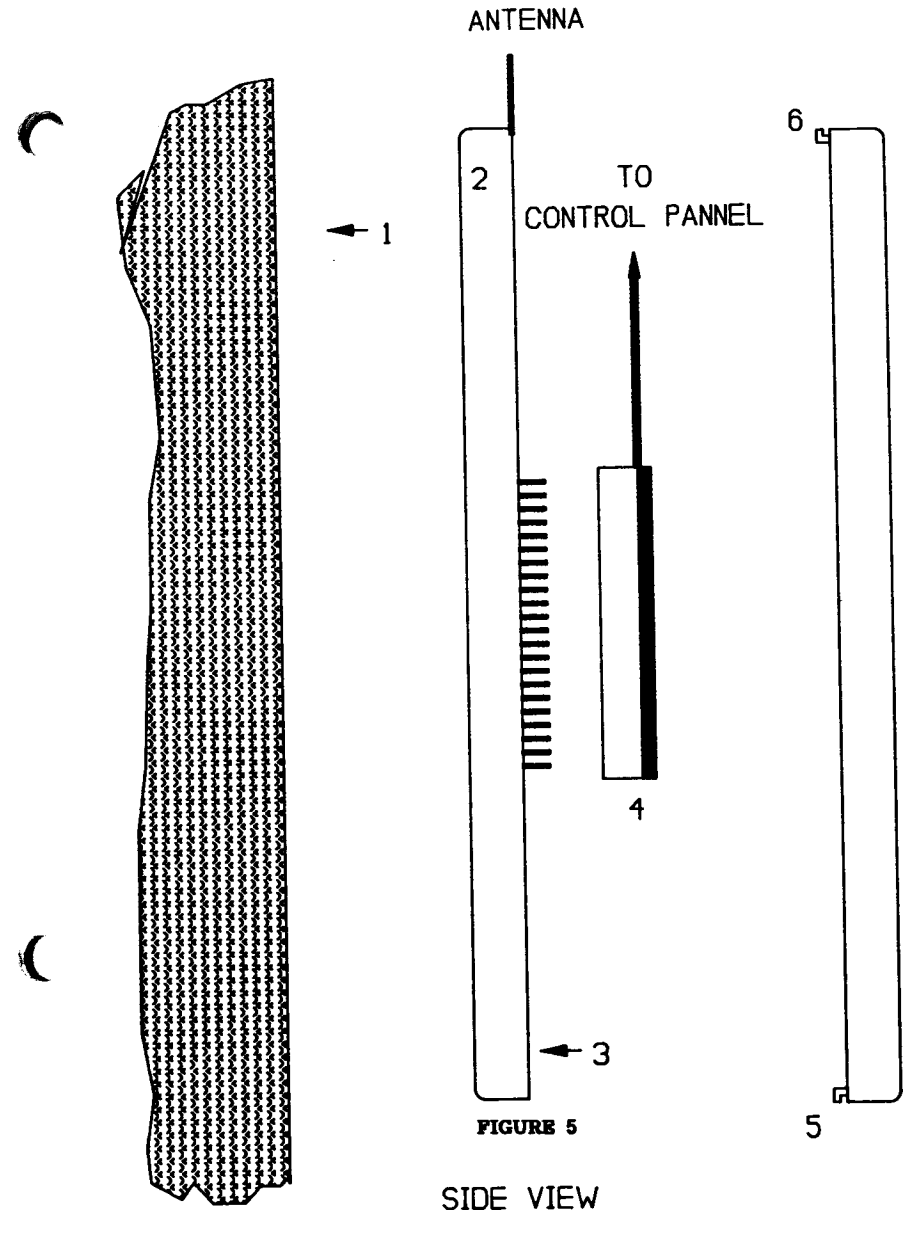


FIGURE 5

SIDE VIEW

7.2 1501 MOUNTING INSTRUCTIONS

Figure 6 depicts the wiring of Normally Open sensors to a 1501 transmitter. DO NOT use both Normally Open and Normally Closed sensors on the same transmitter. Normally Open sensors should be connected in parallel across the two terminals of the transmitter. Remember to select the Normally Open option in the EEPROM of the transmitter if you are using this type of sensor.

NOTE 1: The maximum wire length on the model 1501 loop is 10 feet.

NOTE 2: To avoid signal attenuation, route the transmitter wires through the notches in the sides of the transmitter. Do NOT let the wires pass across the printed circuit board.

Figure 7 shows the wiring of Normally Closed sensors to a 1501 transmitter. DO NOT use both Normally Closed and Normally Open sensors on the same transmitter. Normally Closed sensors should be connected in series between the two terminals of the transmitter. Remember to select the Normally Closed option in the EEPROM when using this type of sensor.

Figure 8 shows the mounting procedure for the 1501 Surface Mount Transmitter. Use #8 Flathead Phillips drive screws. The following steps refer to Figure 8. Before these steps can be followed, the battery must be removed.

1. Drive the top screw into the wall so that the transmitter will be in the desired location.
2. Place the transmitter housing on the top screw slot and slide downward until the screw head is at the top of the screw slot.
3. Drive the bottom screw into the wall through the hole in the PC board and the housing until it is snug.
4. Press the battery into place in the housing from the bottom side. Make sure that the terminals are at the top of the battery and the hook at the bottom of the battery is on the side of the housing with the notch. When inserted properly, the hook should snap into the notch of the housing.
5. Attach the sensor wires to the terminals and place the wires in the wire slots.
6. Slide the bottom of the cover under the housing until the bottom tab of the housing rests in the slot of the cover.
7. Press the top of the cover forward and slightly downward until the top tab snaps into the slot in the top of the cover.

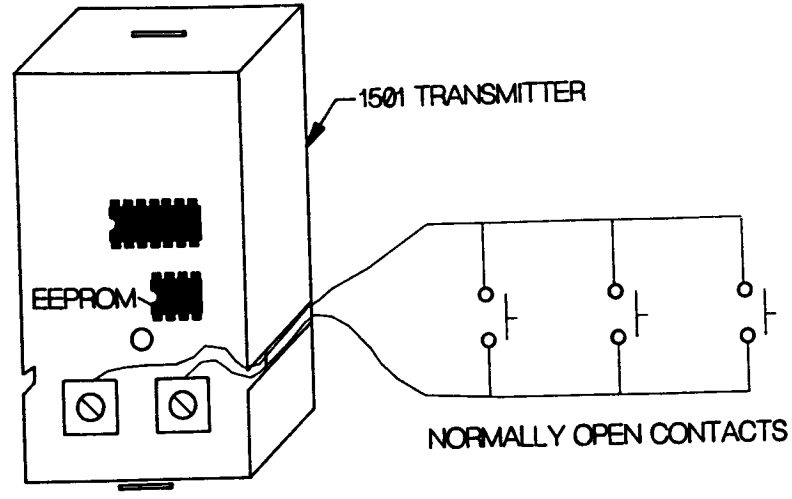


FIGURE 6

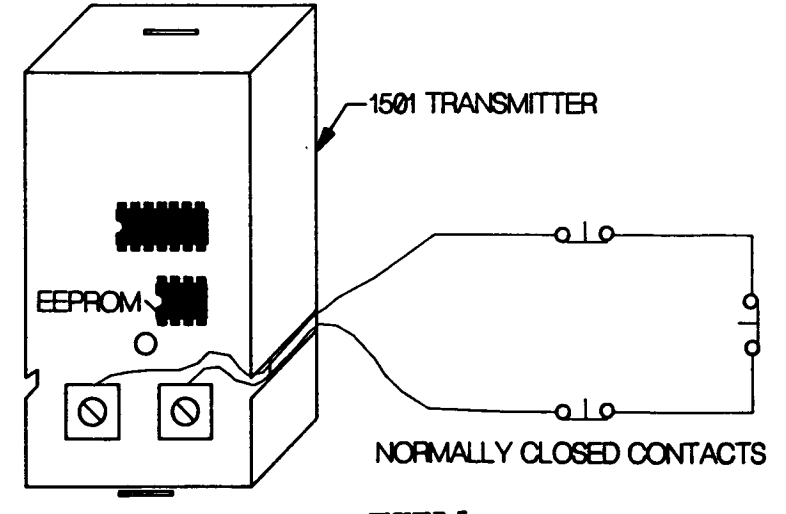


FIGURE 7

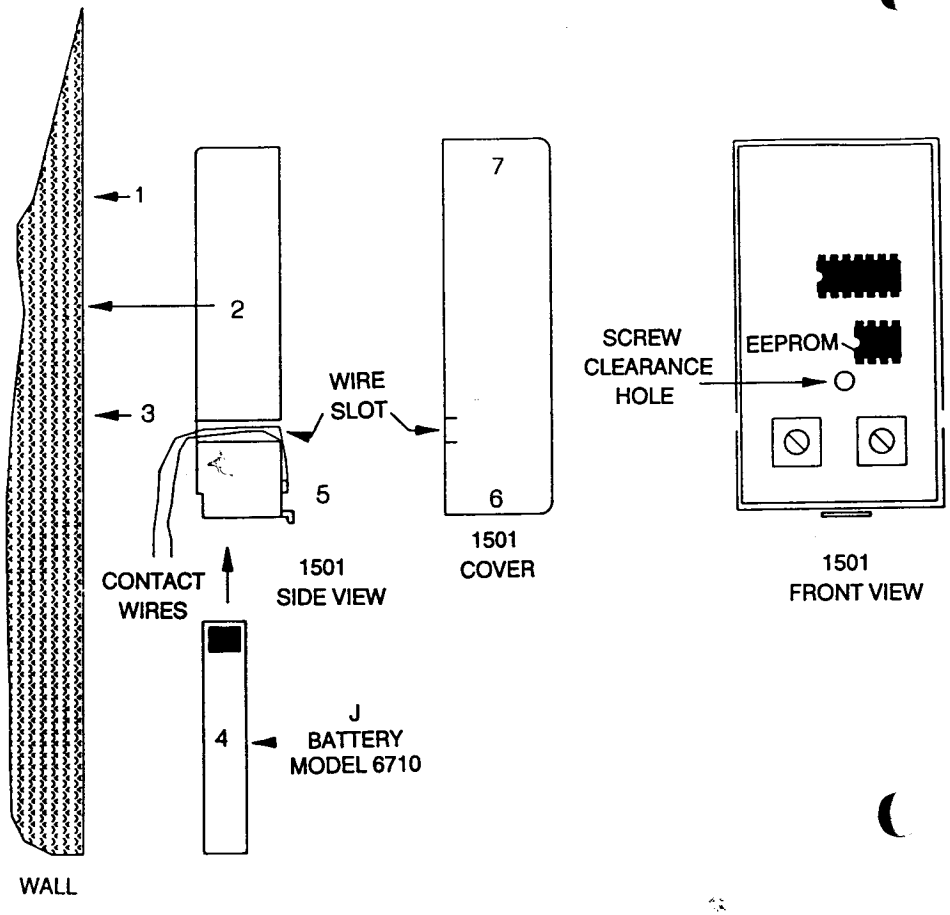


FIGURE 8

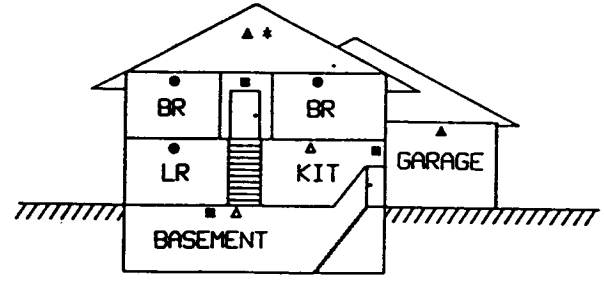
7.3 MODEL 1504 MOUNTING PROCEDURE

The ESL smoke detectors have a Model 1504 transmitter inside of the housing. The transmitters must be programmed before correct operation can take place. Figure 9 shows possible placement of smoke detectors in a typical residential setting. A smoke detector should be placed between each sleeping area and the rest of the family living unit. A smoke detector should be placed on each floor, preferably at least one near the bottom entrance to each staircase. Other areas for placement are the centers of rooms and near main exits. Additional smoke detectors may be required to achieve the desired level of protection. Refer to the National Fire Code for more detailed information concerning placement of--and number of--smoke detectors. The installation instructions are included with the smoke detector.

The 1504 transmitter and smoke detector circuit share the same battery. A "Low Battery" report from the transmitter also refers to the smoke detector battery.

7.4 MODEL 1507 MOUNTING PROCEDURE

See the manual which is supplied with the model 1507 for mounting procedures and protection pattern information



■ SMOKE DETECTORS TO MEET MINIMUM STANDARD
● SMOKE DETECTORS FOR ADDITIONAL PROTECTION
△ 135°F HEAT ACTIVATED DETECTORS
▲ 190°F HEAT ACTIVATED DETECTORS
✱ BELL LOCATION

FIGURE 9

8 TROUBLESHOOTING GUIDE

This guide is provided in order to help you to troubleshoot the RF system after it has been installed. Here are some suggestions for what you could do if you should get a call from the user of an RF system or the central station, informing you that a transmitter has failed?

1. You may start with testing of the transmitter in question. If it fails the test every time, you should investigate if there might be some obstruction in the transmission path which has been placed there after the installation was completed. If an obstruction is found, one may have to decide whether it is easier to move the obstruction or the transmitter. If it is decided that it is better to move the transmitter than the obstruction, it may only take a small movement in any direction in order to make it function.

2. If the transmitter should work intermittently, you may try to program the receiver for a longer supervision time. The receiver has to see only one good transmission when it is supervision time. Suppose the transmitter works only one out of three times. This means that in a three hour period, the transmitter has sent one good signal. If the supervision time of the receiver is set to three hours or longer, it should receive at least one good signal during this time frame.

3. Suppose that you are getting a LOW BATTERY report from the transmitter. Your first move should be to replace the battery with a new one. If you have completed this procedure, but are still receiving a low battery report, one or two things may be happening. Either the new battery was not good or you did not use an ALKALINE battery. If you do not use an ALKALINE battery, you may get a LOW BATTERY report even though you installed a new battery of another type.

Let us consider another situation which can occur. A transmitter is reporting an alarm. After the condition has been cleared, the transmitter does not report a RESTORE. This situation can happen because of the fact that a RESTORE transmission has only 8 data words whereas the ALARM transmission has 12 or 16 (depending on the transmission type). Here is what you can do in this situation.

1. If this occurs when you are installing the system, try moving the transmitter closer to the receiver. It may be a situation where the transmitter was out of the normal operating range.

2. If this occurs after the system is installed, you can check for a low battery. The battery may not be low enough to activate a LOW BATTERY report but if the transmitter is on the edge of its range, it may not be able to transmit the 8 data word RESTORE code.

3. You may have a problem with signal "Bounce". If this is suspected, try moving the antenna at different angles. This will cause the signal to be polarized at a different angle and may eliminate the "Bounce".

Environmental conditions may adversely affect the performance of the transmitters. The temperature limits were mentioned earlier in this manual. Humidity is another factor. High humidity can cause false alarms or can open contacts. Because the internal impedance of the transmitters is high, it takes very little current to activate them. If moisture builds up inside the transmitter, it may look like a closed contact to the circuit thus causing an alarm. If normally closed contacts are being used, they may open up but due to moisture the transmitter may not see the open and will not activate an alarm. This situation does not happen very often, but it is a possibility that one should keep in mind.

The range of the transmitters can be a problem in large buildings. It may be helpful to install two receivers instead of one. If this is done, they must be placed at least 25 feet apart to avoid interference. They should also be given separate Resident Codes. In other words, install the receivers as though they are two separate systems. When they have been installed, the outputs must be run in parallel to the Control Panel.

If you should encounter a situation where your PIR detectors are rapidly depleting their batteries, you should check to see if the Alarm Inhibit Delay is ON. Consult the PIR manual for instructions on turning this feature ON and OFF. For longer battery life, it should be ON. If the PIR detector is in an area of heavy traffic, it will activate every time there is movement in the area. With the Alarm Inhibit Delay ON, it can activate only once every three minutes thus lengthening the life of the battery.

A similar situation can occur with "Switch Mats". If the mat is placed in a high traffic area, it will cause the battery to rapidly deplete. This is due to the fact that every time someone steps on the mat, a transmission will be sent. This could also cause a situation where the transmitted signal could interfere with the supervisory signal. An incorrect supervision signal may be occurring in this situation.

9 TESTING TRANSMITTER SIGNAL STRENGTH

To test the signal strength of the transmitter, follow the procedure below:

1. Connect a voltmeter (set to AC) to the receiver as shown in figure 10 (for revision B1) or figure 11 (for revisions A and E).

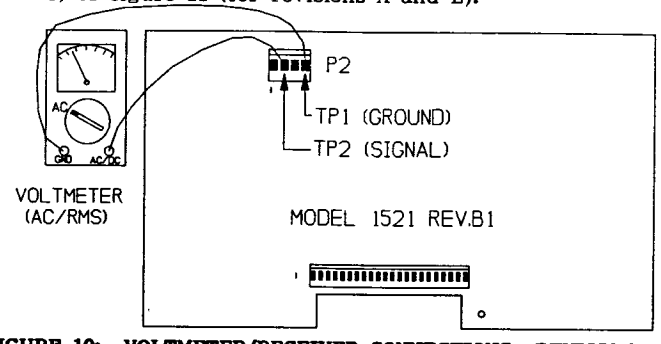


FIGURE 10: VOLTMETER/RECEIVER CONNECTIONS—REVISION B1

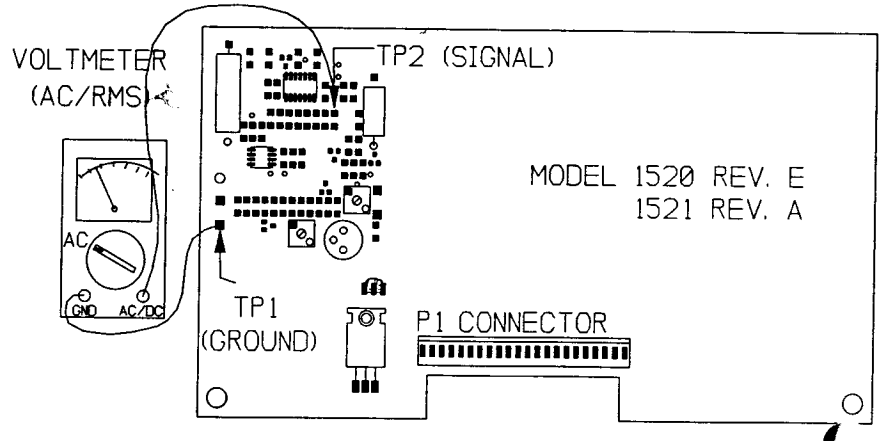


FIGURE 11: VOLTMETER/RECEIVER CONNECTIONS—REVISIONS A AND E

2. Have someone else activate the transmitter (by opening the door, tripping the PR detector, etc., depending on the type of sensor). While the transmitter is activated, watch the meter and note the maximum AC voltage.
3. Estimate the distance in feet between the transmitter and receiver.

4. On the bottom of the graph shown in figure 12, find the distance that is closest to your estimate. The curve shows the acceptable signal strength voltages for the various distances. Compare the AC voltage you noted on the meter with the voltage shown on the graph.

*NOTE: The voltages shown in figure 3 are **RMS values.***

5. If the meter voltage is less than the acceptable voltage by more than 0.05 VAC, the transmitter is weak. Try the following suggestions, then test the transmitter again, as explained in the previous steps.
   a. Replace the battery (see the troubleshooting guide, section 8 of the manual).
   b. Move the transmitter or receiver so they are closer together.
   c. If the signal strength is still weak, the transmitter may need service. Call Silent Knight Technical Service at 1-800-328-0103.

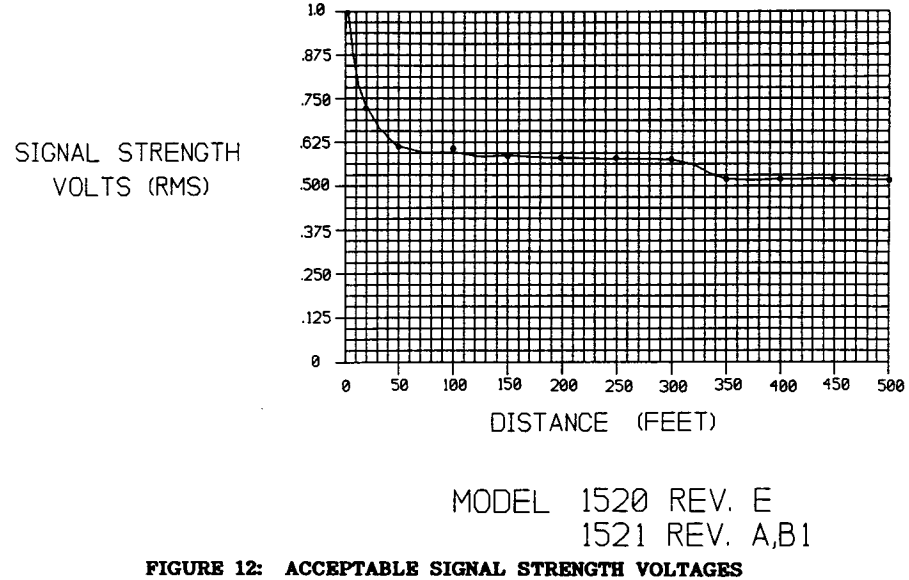


FIGURE 12: ACCEPTABLE SIGNAL STRENGTH VOLTAGES

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