WIRELESS MOTION DETECTOR MANUAL

KTPIRS3

GLOLAB
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Thank you for buying our model KTPIRS3 Wireless Motion Detector kit.

The goal of Glolab is to produce top quality electronic kits, products and components. All of our kits are designed by Glolab engineers and tested in our laboratory. Mechanical devices, prototypes and enclosures are fabricated in our precision machine shop.

Glolab Corporation has two locations in New York's Hudson Valley. Our electronics laboratory and kit packaging is located in Wappingers Falls and our machine shop is in Lagrangeville.

We think that Glolab kits are the easiest to assemble of any available. To ease assembly for both experienced and new kit builders, we package each part in individual plastic zip-lock envelopes that are labeled with the value and part number. It is not necessary to read resistor color codes or capacitor number codes while assembling the PC boards. You simply locate the part and insert it into the PC board where the corresponding part number is marked on the board. Each kit includes assembly instructions and a complete description of how it works.

In addition to our kits, we supply some special and hard to find parts for those of you who want to design and build your own projects.

Technical help is available by email from lab@glolab.com.

NOTICE: THIS DEVICE IS NOT CERTIFIED BY THE FEDERAL COMMUNICATIONS COMMISSION. IF IT IS USED IN A PRODUCT, THAT PRODUCT MUST BE SENT TO A TESTING LABORATORY AND SUBMITTED FOR FCC CERTIFICATION BEFORE IT CAN BE SOLD

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Introduction_____

Motion detectors are used mostly to turn lights on when they sense movement of people or vehicles. The detector device is often built into an outdoor flood or porch light to illuminate a driveway or porch at night making it easier to enter your house without having to leave the light on while you are away. They also add security by turning the outside light on at night when motion is detected even while you are at home.

Detectors are available that are intended for use with security systems to sound an alarm or summon police when motion is detected even during daytime but these are usually expensive and must be wired to the alarm control box. If security is your main concern, this may be a good choice.

However, it is often convenient just to know when a person is approaching your front or back door or when a vehicle enters your driveway even in daytime. If several detectors are used, you can also identify where the motion is taking place.

The Wireless Motion Detector system described here is designed to detect motion over a narrow field of less than ten degrees so that the area where motion occurs is easily identified. The motion detector includes a pyroelectric sensor, amplifier, encoder, transmitter and a battery operated power supply housed in a plastic enclosure. The enclosure can be attached to a wall or other surface using a Velcro fastener. It can be located indoors and also outdoors if it is protected from the weather with some type of housing.

*How it works*_____

Detector

Figure 1 is a schematic of the detector. PIR is a PIR325 dual element pyroelectric infrared sensor having a built-in FET amplifier. It also has an optical filter that passes infrared in the 5 to 14μm range that is most sensitive to human body radiation. As an object that emits infrared passes in front of the PIR, its output goes either more positive or more negative depending on the direction of travel. Since the output signal is very small, it is passed through two stages of amplification having a total maximum gain of about 10,000. Range is controlled by potentiometer R5 which adjusts the gain from 1000 to 10,000.

R1 and C1 filter any noise from the power that feeds the PIR and R2 is a load for the FET within the PIR. IC1 is either a Maxim MAX407 or Linear Technologies LT1495 dual micropower operational amplifier. R3, R4 and C2 set the IC1A amplifier gain and reference voltage and C3 limits its bandwidth to about 10Hz. C4 couples the output of IC1A into IC1B. R5, R6, R7 and R10 set the gain of IC1B and C5 limits its bandwidth to about 10Hz. R7 and R9 set its bias to 2.5 volts.

IC2 is either a Maxim MAX922 or a Linear Technologies LTC1440 dual micropower comparator. IC2A functions as a window comparator and also functions together with IC2B as a single shot. When no motion occurs and there is no output from the PIR, the output of IC1B at pin 7 rests at 2.5 volts. Resistive divider R11, R12 and R13 apply a bias input through R14 and R15 to pin 5 and pin 6 of IC2A. The level at pin 5 is 250MV more positive than at pin 6, forcing output pin 8 to a down level.

When motion is detected that produces a positive transition at IC1B pin 1, then pin 6 of IC2A is forced up through D2 and becomes more positive than pin 5. This causes output pin 8 to go up. If the motion produces a negative transition at IC1B pin 1 then IC2A pin 5 is forced down through D1 which also causes IC2A output pin 8 to go up.

The positive transition at IC2A pin 8 couples through C6 into IC2B, turning it on and causing its output pin 1 to go down. This down level pulls IC2A pin 5 down through D3 and latches it down until C6 discharges through R17 and, or R18. When C6 discharges below the reference voltage at pin 3, IC2B turns off and pin 1 goes up again. The circuit is now ready to respond to motion again. Program jumper PJ places a lower value R17 in parallel with R18 to reduce the time constant during testing, The C6, R15, R18 time constant is about 90 seconds without PJ and 1 second with PJ. The 90 second delay avoids rapidly repeating messages when someone remains in view of a detector, for example, when someone is standing near your front door awaiting entry. R19, R20 and R21 produce hysteresis to avoid jitter in the IC2B output during the slow discharge of C6 and they also set its reference. C7 R16 and D4 couple a narrow negative pulse into Holtek HT680 encoder IC3 to initiate a transmit sequence.

Upon being triggered by IC2B, the encoder generates three groups of bits containing data and address information and serially sends them to transmit module TM1V. The encoder addresses can be programmed by 8 position DIP switch SA positions 1, 2 ,3 and 4. These switches may be set all OFF or in any ON - OFF combination for up to 16 binary addresses so that if more than one set of detectors and receivers are used you can control which detector sends to which receiver. Each detector can also be programmed to be received by one of four data channels in a four channel receiver. Its data inputs are programmed by SA positions 5, 6, 7 and 8 to identify the detector as number 1, 2, 3 or 4. Only one of these switches should be ON.

The circuits are powered with 5 volts through reverse polarity protection diode D5 and Seiko 81250SGY low dropout micropower regulator IC4 by a 9 volt battery. Because of the micropower circuits used in this detector, standby current is only 20 microamperes which is about 100 times less than that of other motion detectors. A 9 volt alkaline battery will power this device for more than 2 years and a 9 volt lithium battery is estimated to power it for 8 years. When the battery voltage drops below 5 volts a low battery condition will be indicated by continuously repeating transmissions with no movement in front of the sensor.

Construction

PC Board

Attach the Fresnel lens inside the enclosure with its grooves facing in. Hold it in place with pieces of scotch tape along the edges. Position the lens carefully by holding it up to a light source so it is well centered over the enclosure hole. Place an O ring under the PIR to space it off the board and solder the PIR in place. This spacing ensures proper focal distance between the Fresnel lens in the enclosure cover and the PIR. Sockets are used for all of the DIP ICs. To assemble the board mount all of the small components first, then add the sockets. After all components are mounted feed the leads from a 9 volt battery connector through a hole in the battery compartment of the enclosure and solder them to the transmitter board holes marked plus V and minus V. Feed the antenna through a hole in the enclosure and attach it to the terminal block.

Testing

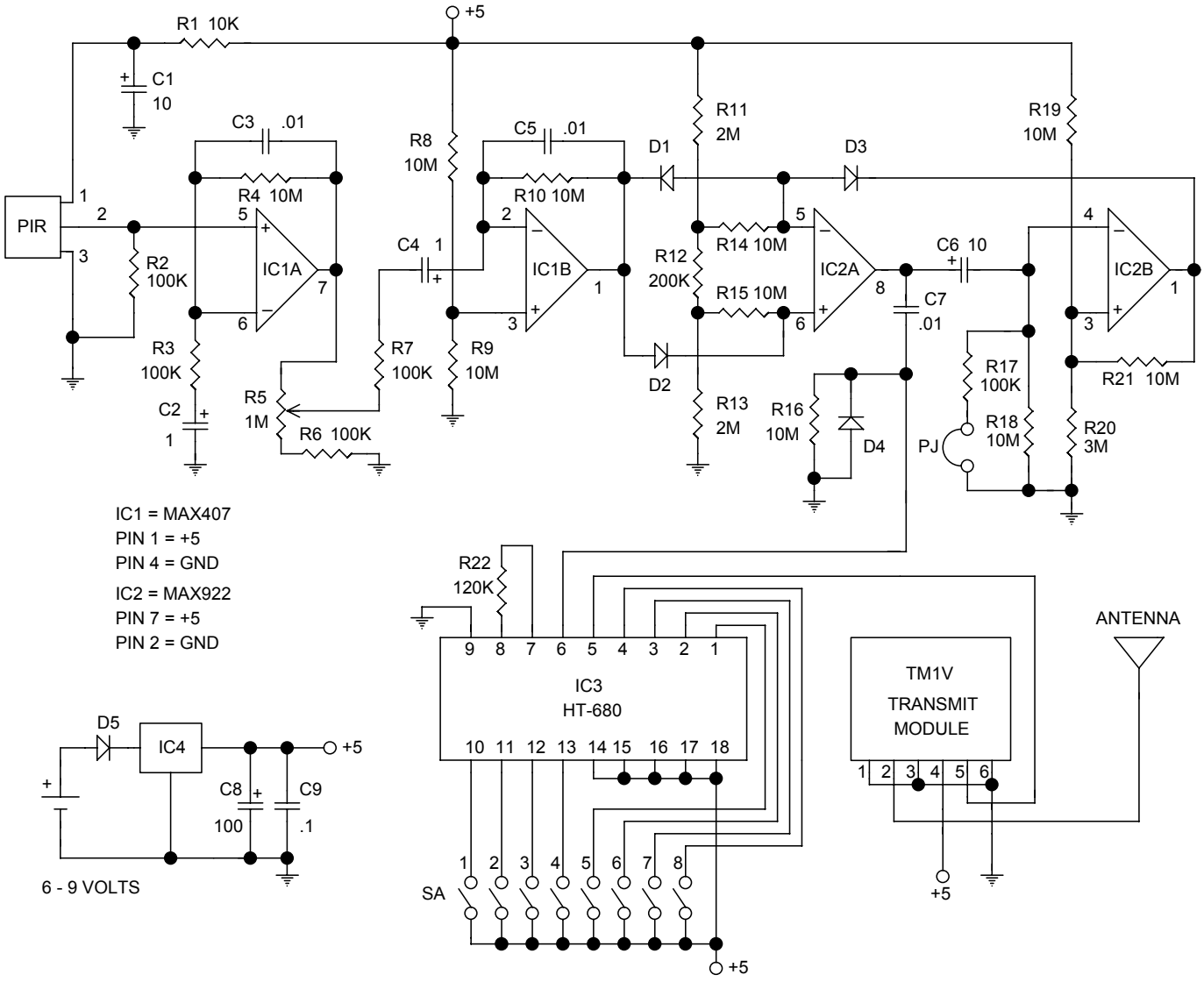
A KRETS3 event receiver having four data channels may be used to test the operation of one or more detectors. Connect a piezo buzzer to the receiver momentary terminal and to ground. Connect an LED in series with a 470 ohm resistor to receiver output terminal block position 1 and to the +12 volt terminal. Be sure to connect the long LED lead to +. Connect a normally open push button reset switch to RES and +5. Plug the receiver wall transformer into a receptacle. Set SB in the receiver for all positions OFF. After a signal is received the output latch can be reset with the push button switch.

Connect a 9 volt battery to the detector. Set address switch SA positions 1, 2, 3 and 4 OFF. Set data position 5 on to identify it as detector 1. Put program jumper PJ in place. You are now ready to detect motion and transmit data to a receiver. Repeat for any additional detectors using SA positions 6, 7 or 8 to identify each one. For additional detectors you will also need corresponding LEDs in the receiver.

Operation

Since the detector is battery operated and portable, it is ideal for temporary applications such as to warn that your cat is on the kitchen table eating the turkey that was just cooked or to signal the movement of a child without having to view a video monitor.

Infrared in the range of 8 to 14 microns cannot pass through ordinary window glass, plastic and most materials that can pass visible light. It can however, pass through with some loss in sensitivity, germanium and silicon which are completely opaque to visible light. An unprocessed reject silicon wafer makes a good infrared window for a weather resistant outdoor housing. The pyroelectric sensor is sensitive to movement across its surface in a horizontal direction only, when the antenna is vertical facing either up or down.



WIRELESS MOTION DETECTOR FIGURE 1

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PC Board Layout

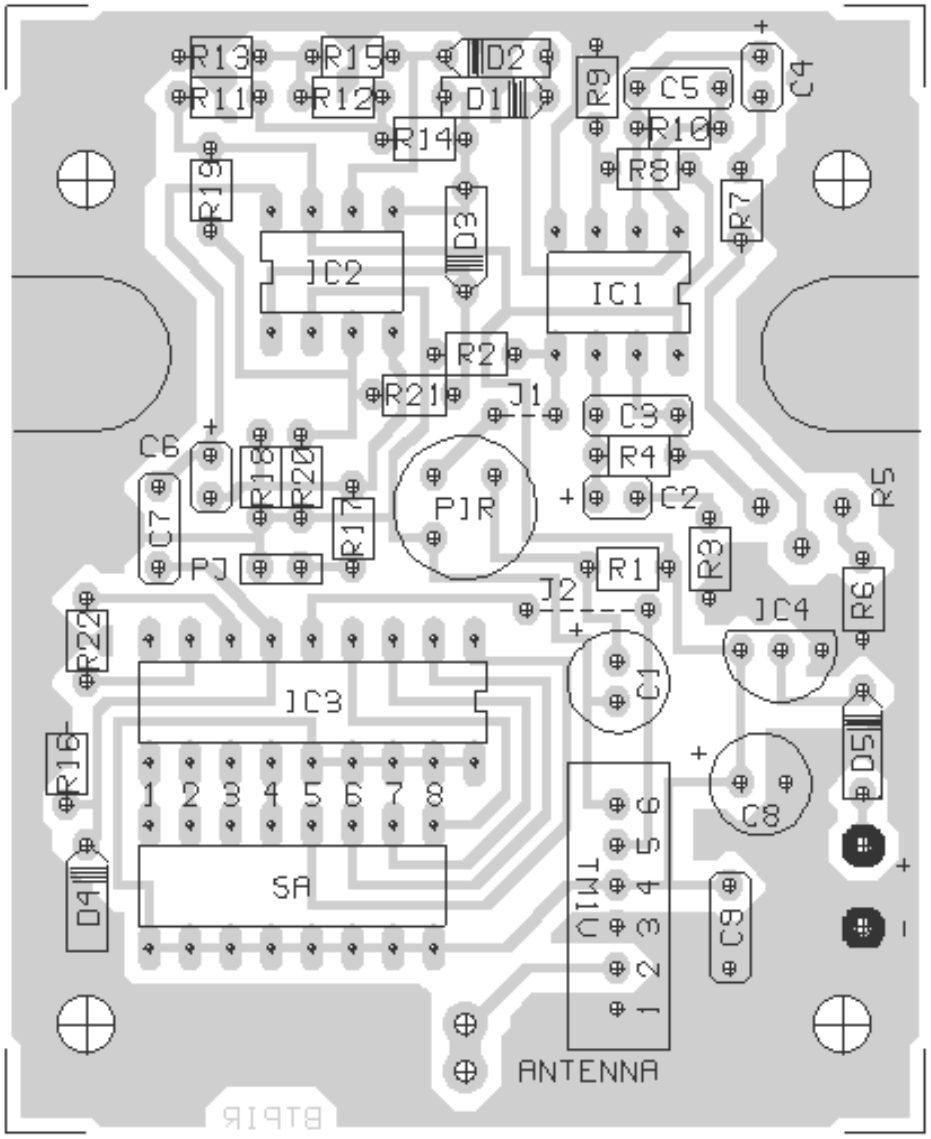

FIGURE 2

This single sided PC board requires two jumpers to complete the circuits. Install these jumpers as indicated in the layout above and on the board screening before any components are installed. Excess leads from resistors may be used as jumpers.

Parts List

Wireless Motion Detector Transmitter parts	Source	P/N
R1 - 10K 1/8 watt 5%	Mouser	299-10K
R2, R3, R6, R7, R17 - 100K 1/8 watt 5%	Mouser	299-100K
R4, R8, R9, R10, R14 R15 - 10 MEG 1/8 watt 5%	Mouser	299-10M
R16, R18, R19, R21 - 10 MEG 1/8 watt 5%	Mouser	299-10M
R20 - 3 MEG 1/8 watt 5%	Mouser	299-3M
R5 - 1 MEG potentiometer	Digi-Key	36G16
R11, R13 - 2 MEG 1/8 watt 5%	Mouser	299-2M
R12 - 200K 1/8 watt 5%	Mouser	299-200K
R22 - 390K 1/8 watt 5%	Mouser	299-390K
C1 - 10 MFD 16 volt low leakage electrolytic	Mouser	140-LLRL16V10
C2, C4 - 1 MFD 16 volt tantalum	Digi-Key	P2105
C3, C5, C7 - .01 MFD 50 metalized film	Digi-Key	P4513
C6 - 10 MFD 6.3 volt tantalum	Digi-Key	P2013
C8 -100 MFD 10 volt low leakage electrolytic	Mouser	140-LLRL10V100
C9 - .1 MFD 50 volt metalized film	Digi-Key	P4525
D1, D2, D3, D4, D5 - 1N914B diode	Mouser	583-1N914B
SA - 8 position DIP switch	Digi-Key	CKN1282
IC sockets - two 8 pin	Mouser	571-3902612
IC socket 18 pin	Mouser	571-3902615
O-ring spacer	MSC	09260092
PIR – PIR325 pyroelectric infrared sensor	Glolab	PIR325
IC1 – Maxim MAX407CPA micropower op amp	Maxim	MAX407CPA
IC2 – Maxim MAX922CPA micropower comparator	Maxim	MAX922CPA
IC3 - Holtek HT-680 encoder	Glolab	HT-680
IC4 – Seiko 81250SGY 5 volt regulator	Mouser	628-81250SGY
9 volt battery connector	Mouser	123-6004
1 position antenna terminal block	Glolab	ATB1
6.7 inch antenna wire	Glolab	WC418
Transmit module	Glolab	TM1V
Transmit circuit board to fit S211FL enclosure	Glolab	BTPIR
Infrared Fresnel lens	Glolab	FL65
Enclosure with hole for Fresnel lens	Glolab	S211FL

Digi-Key 1-800-344-3539 www.digikey.com
Mouser 1-800-346-6873 www.mouser.com
MSC Industrial Supply Co. 1.800-645-7270 www.mscdirect.com
Maxim Semiconductor www.maxim-ic.com Buy online

KTPIRS3 Assembly Instructions

Before soldering components, check to be sure that they are in the correct place and that polarity sensitive components are inserted in the correct direction. Bend resistor and diode leads close to the component body. Insert resistors, capacitors and diode and bend their leads against the board. Cut the leads off short enough so they do not short to adjacent lands but leave them long enough to retain the component on the board.

1. Insert all small components such as jumpers diodes and resistors first, being careful to insert the diodes with their cathode bands in the correct direction as shown on the PC board.

2. Insert all small capacitors.

3. Insert all IC sockets with their notch in the direction indicated on the PC board.

4. Insert DIP switch and potentiometer R5.

5. Solder all inserted components. Hold the sockets and switches against the board while soldering a few pins, then solder all remaining pins.

6. Place O ring spacer over PIR leads and insert and solder PIR in board.

7. Insert voltage regulator IC4, solder it and then cut off excess leads. IC4 should stand at least 1/8” off the board.

8. Insert antenna terminal and solder.

9. Insert module TM1V with its module side facing the edge of the board and solder. Excess leads may be cut off.

10. Insert each IC in its socket with its pin 1 indicator toward the socket notch. Handle ICs as static sensitive devices.

11. Insert the battery connector leads through a hole in the enclosure battery compartment. Insert the red lead in the board hole marked + and the black lead in the hole marked - and solder.

12. Mount the PC board in the enclosure with four #4 X 3/8” screws

13. Insert the antenna through a hole in the enclosure and into the antenna terminal.

14. attach the top enclosure with two screws provided

15. Place a 9 volt alkaline battery into the battery compartment and close the cover

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