# LamaPLC: PIR sensors

A *Passive Infrared* (**PIR**) sensor is an electronic device that detects motion by sensing changes in infrared light (radiant heat) emitted by nearby objects like people, animals, or vehicles.

*"Passive"* means it emits no energy; it only detects infrared radiation, making it suitable for applications such as security alarms, automatic lighting, and motion-activated doors.

**The HC-SR501** is a widely used, low-power Passive Infrared (PIR) motion sensor module designed to detect the movement of warm objects, such as humans or animals, by sensing changes in infrared radiation

The **HC-SR505 Mini PIR Module** is a much smaller version of the HC-SR501.

The **AM312 PIR Sensor** is another small-form-factor alternative often recommended over the HC-SR501 due to its lower power consumption and better electromagnetic interference resistance.

**Panasonic EKMB/EKMC Series** are professional-grade PIR sensors that offer superior reliability and extremely low power consumption (as low as 2 µA in standby mode) compared with generic HC-SR501 modules.

| **Feature** | **HC-SR501** | **HC-SR505** | **AM-312** | **Panasonic EKMB/EKMC Series** |
|---|---|---|---|---|
| |  |  |  |  |
| **Operating Voltage** | 4.5V - 20V DC | 4.5V - 20V DC | 2.7V - 12V DC | 2.3V - 6V (EKMB), 3V - 6V (EKMC) |
| **Quiescent Current** | ~50µA - 65µA | ~60µA | <0.1mA (~100µA) | Extremely Low (e.g., 1µA, 2µA, 6µA for EKMB; 170µA for EKMC) |
| **Detection Range** | 3m - 7m (up to 7m, adjustable) | Up to 3m | 3m - 5m | Varies greatly by model/lens (e.g., 5m, 12m, 17m options available) |
| **Detection Angle** | <140° cone angle | ~100° cone angle | ≤100° cone angle | Varies by lens (e.g., 94°x82°, 150° in one axis) |
| **Adjustable Delay** | Yes (via potentiometer, ~5s - 300s) | No (fixed ~6-12s) | No (fixed ~2s) | Varies by specific model, some are highly configurable |
| **Adjustable Sensitivity** | Yes (via potentiometer) | No | No | Varies by specific model |

| Feature | HC-SR501 | HC-SR505 | AM-312 | Panasonic EKMB/EKMC Series |
|---|---|---|---|---|
| **Trigger Mode** | Configurable (Repeatable 'H' / Non-repeatable 'L') | Repeatable only (by default) | Repeatable only (by default) | Varies by specific model |
| **Physical Size** | Standard (32x24mm module) | Mini/Small | Mini/Small (10x8mm module) | Very small, integrated components, often lensless options available |
| **Reliability/Noise** | Prone to false triggers, low quality processing | Can be triggered by temperature changes/power noise | Small, but has reports of false alarms | Superior reliability, high signal-to-noise ratio, highly shielded |
| **Cost** | Very Low | Very Low | Very Low | Higher cost (professional grade) |

For most beginner hobbyist projects, the HC-SR501 offers great versatility because of its adjustable settings, while the HC-SR505 and AM312 are excellent for size-constrained, simple applications. For professional or battery-critical applications demanding high reliability, the Panasonic EKMB/EKMC series is a superior, albeit more expensive, option.



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# HC-SR501 PIR sensor

The HC-SR501 PIR sensor module features a 3-pin connector. Because the labels on the circuit board are often hidden underneath the white Fresnel lens, it is important to orient the module correctly when identifying pins.

**Standard Pinout**

When looking at the back of the board (the side with the components and adjustment knobs) with the pins at the bottom:

- **VCC (Left/Right depending on version):** Power supply input. Most modules accept 5V to 12V DC.
- **OUT (Center):** Digital output signal. It sends 3.3V (HIGH) when motion is detected and 0V

(LOW) when idle.
- **GND (Right/Left depending on version):** Ground connection to the power supply.
- **Pro Tip:** If you are unsure, you can gently pop off the white dome lens to see the labels (VCC, OUT, GND) printed directly on the circuit board.

#### Control Adjustments

The back of the module also contains two potentiometers and a mode jumper:

- **Sensitivity Adjustment:** Changes the detection range (typically between 3m and 7m).
- **Time Delay Adjustment:** Sets how long the output stays HIGH after detection (typically 5s to 300s).
- **Trigger Jumper:**
  - **L (Single Trigger):** Output stays HIGH for the set time, then goes LOW, even if motion continues.
  - **H (Repeatable Trigger)**: Output remains HIGH as long as motion is continuous, resetting the timer with each movement.

## Arduino & HC-SR501

To interface the HC-SR501 with an Arduino, connect the sensor's OUT pin to digital pin 2, VCC to 5V, and GND to GND.

The following sketch uses the Arduino IDE Serial Monitor to display motion status and turns on the built-in LED (Pin 13) when motion is detected.

```
/*
 * HC-SR501 PIR Motion Sensor Test
 */

const int PIR_PIN = 2;    // HC-SR501 Out pin
const int LED_PIN = 13;   // Onboard LED

void setup() {
  pinMode(PIR_PIN, INPUT);
  pinMode(LED_PIN, OUTPUT);
  Serial.begin(9600);

  // Warm-up period for the PIR sensor
  Serial.println("Warming up sensor... please wait 30-60s");
  delay(30000);
  Serial.println("Sensor Active");
}

void loop() {
  int motionState = digitalRead(PIR_PIN);

  if (motionState == HIGH) {
    digitalWrite(LED_PIN, HIGH);
    Serial.println("Motion Detected!");
```

```
  } else {
    digitalWrite(LED_PIN, LOW);
    Serial.println("No motion.");
  }

  delay(500); // Small delay for serial stability
}
```

### Essential Setup Tips

- **Warm-up Delay:** The HC-SR501 requires approximately 30 to 60 seconds to calibrate to the room's infrared signature after power-on. During this time, it may trigger false positives.
- **Trigger Jumper:** For this code, set the yellow jumper on the back to H (Repeatable Trigger) so the LED stays lit as long as you keep moving.
- **Voltage Logic:** Although you power the module at 5V, the OUT pin uses 3.3V logic, which is compatible with both 5V Arduinos and 3.3V boards like the ESP32 or Raspberry Pi Pico.

## Sensor topics on lamaPLC

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| • lamaPLC project: Arduino - OLED SH1106 with AHT20/BMP280 Sensor | 2026/04/23 21:51 | bmp280, aht20, temperature, humidity, pressure, sensor, arduino, oled, sh1106, arduino code |
| • lamaPLC project: Arduino - Vibration sensors | 2026/04/15 17:21 | vibration, sensor, piezoelectric, mems, eddy-current, electrodynamic, gxfm0459, ldtm-028k, arduino, arduino code |
| • lamaPLC project: Digitales Potentiometer Board Moduls | 2026/04/11 18:29 | sensor, module, arduino code, renesas, x9c series, x9c102, x9c103, x9c104, x9c503, xdcp, digitally controlled potentiometer |
| • lamaPLC project: Sension SCD $CO^2$ measurement module | 2026/04/15 19:34 | scd30, scd40, scd41, iaq, ndir, sensor, i2c, arduino code |
| • lamaPLC: A0221AU / A02YYUW Waterproof Ultrasonic Distance Sensor with UART communication | 2026/04/23 21:52 | a0221au, a02yyuw, waterproof, ultrasonic, distance, sensor, uart, ip67, serial, sen0311, dfrobot |
| • LamaPLC: AHT10 Modul | 2026/03/22 03:14 | communication, i2c, temperature, humidity, sensor, aht, aht 10, modul |
| • LamaPLC: AHT20 / BMP280 Modul | 2026/04/23 21:52 | bmp280, aht20, adafruit, temperature, humidity, pressure, sensor, arduino, code, i2c |
| • LamaPLC: Allegro ACS758 Hall-effect linear current sensors | 2026/04/23 21:52 | cjmcu, cjmcu-758, acs758, acs758lcb-050b, acs758lcb-100b, acs758kcb-150b, acs758ecb-200b, hall-effect, current, sensor, analog, arduino, code |
| • LamaPLC: APDS - Avago ALS and proximity detection sensors with $I^2C$ communication | 2026/04/23 21:52 | avago, apds-9900, apds-9930, apds-9960, als, proximity, detection, gesture recognition, gesture, i2c, communication, sensor, arduino, code |

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| • lamaPLC: Arduino Modul: BME680 | 2026/05/12 18:40 | code, c, 2026, arduino, bme680, sensor, i2c, comunication |
| • lamaPLC: AS5600 Magnetic Induction Angle Measurement Sensor Module | 2026/05/13 00:06 | communication, i2c, as5600, as-5600, magnetic, induction, angle, sensor |
| • LamaPLC: BMP/BME Bosch Temperature/Humidity/Pressure sensors with I²C communication | 2026/04/23 21:52 | bme280, bme680, bme688, bmp180, bmp280, hw-611, hw611, bosch, temperature, humidity, pressure, sensor, arduino, i2c, communication, ai, cjmcu, volatile organic compounds, vocs, volatile sulfur compounds, vscs, iaq |
| • LamaPLC: BQ25570 / CJMCU-2557 - Texas Instruments nano-power management IC and module | 2026/04/23 21:52 | bq25570, sensor, texas instruments, nano-power management, dc-dc boost charger, mppt, solar, thermoelectric, piezoelectric, energy harvesting, eh |
| • LamaPLC: CJMCU-219/INA-219 breakout board/IC with I²C communication | 2026/04/23 21:52 | cjmcu-219, ina-219, ina219, breakout board, i2c, communication, sensor, voltage, current, arduino, code, cjmcu |
| • LamaPLC: CJMCU-3216 / AP-3216 integrated digital ambient light and proximity sensor module/IC with I²C communication | 2026/04/23 21:52 | cjmcu-3216, cjmcu, ap-3216, ap3216, ambient light, proximity, sensor, arduino, code, i2c, communication |
| • LamaPLC: CJMCU-3901/PMW-3901 compact optical flow sensor module/IC by PixArt with SPI communication | 2026/04/23 21:52 | cjmcu-3901, cjmcu, pmw3901, pmw-3901, optical flow, sensor, pixart, spi, communication, arduino, code, pmw3901mb-txqt |
| • LamaPLC: CJMCU-6701: Biosensor for measuring Galvanic Skin Response (GSR) with SPI communication | 2026/04/23 21:52 | cjmcu, cjmcu-6701, acs758, acs-758, galvanic skin response, gsr, electrodermal activity, eda, spi, communication, arduino, code, sensor, healthcare |
| • LamaPLC: CJMCU-6814 combined gas sensor module for CO, $NO_2$, $NH_3$ | 2026/04/23 21:52 | analog, cjmcu, cjmcu-6814, mics6814, mics-6814, sensor, arduino, code, carbon monoxide, co, ammonia, $nh_3$, nitrogen dioxide, $no_2$ |
| • lamaPLC: CJMCU-811 CCS811 Gas Sensor (VOCs TVOC CO2) | 2026/04/23 21:52 | cjmcu-811, ccs811, gas, sensor, vocs, tvoc, eco2, co2, arduino, air quality metal oxide, mox, i2c, micropython, rp2040-eth |
| • LamaPLC: CJMCU-8221 Analog Devices Precision instrumentation amplifier module | 2026/04/23 21:52 | cjmcu-8221, ad8221ar, analog devices, amplifier, sensor, cjmcu |
| • LamaPLC: D6T Omron Non-Contact Thermal Sensors with I²C communication | 2026/04/23 21:52 | d6t, d6t-32l, d6t-44l, d6t-8l, d6t-1a, omron, non-contact, thermal, sensor, i2c, arduino, code |
| • LamaPLC: DHT Temperature /Humidity sensors with 1-wire / I²C communication | 2026/04/23 21:52 | dht11, dht20, dht22, temperature, humidity, pressure, sensor, 1-wire, arduino, code |
| • LamaPLC: DPS Infineon Temperature/Pressure sensors with I2C communication | 2026/04/23 21:52 | dps310, infineon, temperature, pressure, sensor, arduino, i2c, communication, code |

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| • lamaPLC: DS18B20 1-Wire Digital Thermometer | 2026/04/23 21:52 | ds18b20, sensor, 1-wire, communication, arduino, thermometer, parasitic mode |
| • lamaPLC: Energy, power, current, and voltage | 2025/05/31 23:32 | i2c, i c, communication, arduino, energy, power, current, sensor, ina226 |
| • LamaPLC: ENS ScioSense Multi-gas sensors with I²C communication | 2026/04/23 21:52 | ens160, sciosense, gas-quality, i2c, communication, sensor, arduino, code, eco₂, tvoc, aqi, indoor air quality, iaq, co₂, voc |
| • lamaPLC: ENS160 + AHT21 Air Quality Sensor - CO, ECO, TVOC, Temp & Humidity Module | 2026/04/23 21:52 | arduino, ens160, aht21, air quality, sensor, co, eco, tvoc, module, aqi |
| • LamaPLC: Gas sensors | 2023/07/01 17:29 | gas, sensor, i2c, onewire, communication, mq-3, mq-4, mq-5, mq-6, mq-7, mq-8, mq-9, mq-135, gm-102b, gm-302b, gm-502b, gm-702b, alcohol, ch4, natural gas, smoke, lng, co, co2, lpg, h2, iso-butane, nox, nh3, benzene, town gas, formaldehyde, propane, humidity, temperature, voc, grv gas sens v2 |
| • LamaPLC: GM MEMS Gas-sensors | 2026/04/23 21:52 | gm-102b, gm-302b, gm-502b, gm-702b, mems, gas-quality, sensor, arduino, code, nitrogen dioxide, no₂, volatile organic compounds, voc, carbon monoxide, co, ethyl alcohol, c₂h₅ch, formaldehyde, ch₂o, alcohol, c₂h₅oh |
| • lamaPLC: GY-511 6DOF sensor module | 2026/03/22 01:44 | stmicroelectronics, lsm303dlhc, i2c, lsm303, sensor, gy-511, 6dof, pololu, module, arduino |
| • LamaPLC: HC-SR04 Ultrasonic Sensor Module | 2026/04/23 21:52 | hc-sr04, ultrasonic, sensor, arduino, code |
| • LamaPLC: HDC Texas Instruments Temperature/humidity sensors with I²C communication | 2026/04/23 21:52 | sht21, htu21, si7021, gy-21, gy-213v, hdc1080, gy-213v-hdc1080, cjmcu, cjmcu-1080, texas instruments, temperature, humidity, sensor, i2c, communication, arduino, code |
| • LamaPLC: HTU TE Connectivity temperature/humidity sensors with I²C communication | 2026/04/23 21:52 | htu, htu31d, htu21d, htu20d, sht20, htu20, sht21, htu21, si7021, gy-21, gy-213v, hdc1080, si702, gy-20, sht31, htu31, si7031, gy-31, te connectivity, temperature, humidity, i2c, communication, sensor, arduino, code |
| • LamaPLC: HX711 24-bit analog-to-digital converter (ADC) | 2026/04/11 18:28 | hx711, hx-711, analog-to-digital, adc, converter, load cell, wheatstone bridge, weight, sensor, communication, arduino, code |
| • lamaPLC: INA modules with Arduino libraries | 2026/04/23 21:52 | i2c, i c, communication, arduino, energy, power, current, monitor, sensor, ina219, gy-219, ina226, gy-216, ina228, gy-228, ina237, ina238, ina260, ina3221, ina |

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| • lamaPLC: INA226 - current/voltage/power monitor with I²C communication | 2026/04/23 21:52 | i2c, i c, communication, arduino, energy, power, current, monitor, sensor, ina226, ina219, ina |
| • lamaPLC: LTC3588 - Nanopower energy harvesting power supply IC | 2026/04/23 21:52 | communication, arduino, sensor, energy harvesting, eh, energy, ambient power |
| • LamaPLC: M01 - V0.4 Laser ranging sensor with UART communication | 2026/04/23 21:52 | distance measurement, laser, distance, sensor, m01 |
| • LamaPLC: MAX30100/MAX30102 Heart Rate Click Sensor Module | 2026/04/23 21:52 | max30102, max30100, heart rate click, sensor, communication, i2c, arduino, code |
| • lamaPLC: Max31865 RTD to Digital Converter - PT100/PT1000 Platine | 2026/04/23 21:52 | max31865, rtd, pt 100, pt 1000, temperature, spi, platinum, arduino, code, sensor, adafruit |
| • LamaPLC: MAX4466/MAX9814: Low-noise Microphone Preamplifiers | 2026/04/23 21:52 | audio, microphone, analogue audio, max4466, max9814, max 4466, max 9814, agc, preamplifiers, sensor, arduino, code |
| • LamaPLC: MH-Z19 series of NDIR $CO_2$ sensors | 2026/04/23 21:52 | mh-z19, mh-z19d, mh-z19c, mh-z19b, mh-z19e, ndir, $co_2$, sensor, winsen, uart, pwm, communication, non-dispersive infrared, infrared, ir, temperature, arduino, code, tasmota |
| • lamaPLC: MPU-6050 (HW-123, GY-521) 6-axis MotionTracking device | 2026/04/23 21:52 | mpu-6050, hw-123, gy-521, 6-axis motiontracking, dmp, temperature, sensor, mems, arduino code, arduino, accelerometer, gyroscope, tilt |
| • LamaPLC: MQ Winsen Gas-sensors | 2026/04/23 21:52 | mq, mq-2, mq-3, mq-4, mq-5, mq-6, mq-7, mq-8, mq-9, mq-131, mq-135, mq-137, winsen, gas-sensor, sensor, arduino, code, alcohol, $c_2h_5oh$, benzine gas, smoke, lpg, propane, $c_3h_8$, hydrogen, $h_2$, methane, $ch_4$, iso-butane, town gas, ammonia, $nh_3$ |
| • LamaPLC: PIR sensors | 2026/04/23 21:52 | hc-sr501, hc-sr505, am-312, ekmb ekmc, pir, motion, sensor, arduino, code |
| • LamaPLC: Pixart PAJ7620U2 Gesture recognition sensors/module with I²C communication | 2026/04/23 21:52 | paj7620u2, gy-paj7620, pixart, gesture recognition, i2c, communication, sensor, arduino, code |
| • lamaPLC: PT100 / PT1000 | 2025/09/23 18:59 | pt100, pt1000, temperature, sensor, platine, rtd |
| • lamaPLC: PTA8C04 4-channel PT100 Modbus Modul | 2026/02/14 18:42 | pta8c04, sensor, modbus, rtu, rs-485, communication, platine, um72 |
| • LamaPLC: RCWL - Microwave radar sensor | 2026/04/23 21:52 | rcwl-0516, rcwl, microwave, radar, sensor, arduino, code |
| • lamaPLC: RD-xx - Ai-Thinker Radar Module with UART communication | 2026/04/23 21:52 | radar, s3km1110, fmcw, rd-01, rd-03, rd-03d, ai-thinker, k-band, 24 ghz, sensor, distance, micro-movements |
| • lamaPLC: RP2040_ETH_Modul: Read BME 680/688 sensor data | 2026/05/12 21:06 | code, micropython, 2026, rp2040 eth, bme680, i2c, sensor, communication |
| • lamaPLC: RP2040_ETH_Modul: Read BME 680/688 sensor data and store in Modbus input registers | 2026/05/12 18:58 | code, micropython, 2026, rp2040 eth, bme680, i2c, sensor, communication |

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| • LamaPLC: SGP Sensirion TVOC/VOC sensors with I²C communication | 2026/04/15 19:41 | sgp30, sgp40, sgp41, sensirion, gas-sensor, i2c, communication, sensor, arduino, code, eco₂, voc, tvoc, indoor air quality, iaq, nox, hydrogen |
| • LamaPLC: SHT Sensirion Temperature/humidity sensor with I²C communication | 2026/04/23 21:52 | sht20, sht21, sht25, sht30, sht31, sht35, sht40, gy21, temperature, humidity, i2c, communication, sensor, arduino, code |
| • LamaPLC: Texas Instruments ADCs: Delta-sigma multi-channel Analog Converters with SPI communication | 2026/04/23 21:52 | ads111x, ads12xx, delta-sigma, converter, texas instruments, adc, spi, communication, sensor, arduino, code, ads1110, ads1112, ads1113, ads1114, ads1115, ads1118, ads1119, ads1220, ads1232, ads1234, ads1256, ads1261, ads1263, multi channel |
| • LamaPLC: TOFnnnC STMicroelectronics Time-of-Flight (ToF) sensors with I²C communication | 2026/04/23 21:52 | tof050c, vl6180, tof200c, vl53l0x, tof400c, vl53l1x, stmicroelectronics, time-of-flight, tof, i2c, communication, sensor, arduino, code |
| • LamaPLC: UICPAL Temp.humi.sensor | 2023/06/25 00:43 | simatic, s7, modbus, communication, temperature, humidity, sensor |
| • LamaPLC: VL53Lnn STMicroelectronics time-of-flight (ToF) laser-ranging sensors with I²C communication | 2026/04/23 21:52 | vl53l0x, vl53l1x, vl53l0 1xv2, gy-530, time-of-flight, tof, laser-ranging, i2c, communication, sensor, arduino, code |
| • LamaPLC: VL6180X STMicroelectronics Time-of-Flight (ToF) sensor with I²C communication | 2026/04/23 21:52 | vl6180x, stmicroelectronics, time-of-flight, tof, i2c, communication, sensor, arduino, code |
| • LamaPLC: Waveshare TOF Laser Range Sensor with UART / I²C communication | 2026/04/23 21:52 | distance measurement, laser, range, sensor, tof, waveshare |
| • lamaPLC: XGZP68xx: Silicon Pressure Sensors/Module | 2026/05/15 15:17 | communication, i2c, sensor, modul, pressure, cfsensor, xgzp68xx, xgzp6810d, xgzp6857d, xgzp6859d, xgzp6887d, xgzp6897d, xgzp6899a, piezoresistive, capacitive |
| • lamaPLC: YR-3180 - Weight sensor module with UART or Modbus communication | 2026/02/15 00:00 | communication, modbus, rtu, sensor, weight, yr-3180, hx710b, arduino, ttl, rs-485 |
| • LM393: Dual differential comparator (flame, light, sound sensors) | 2026/05/12 22:18 | communication, analog, lm393, lm-393, flame, ir, sound, hall, sensor, ky-026, hw-484, ky-037, ky-038, fc-03, hc-89, ky-024, modul |
| • Magnetic angle sensors | 2026/03/05 21:19 | magnetic angle sensor, magnetic flux, sensor, spi, i2c, pwm, communication, modul, as5047p, as5600, mt6701, mt6816, mt6835, tle5012b, amr, gmr, tmr, anisotropic magnetoresistive |
| • NT18B07: 7 Kanal RS485 Temperatur Sensor with Modbus RTU | 2026/02/14 18:49 | nt18b07, sensor, modbus, rtu, rs-485, communication, platine |
| • PT100 / PT1000 sensors | 2026/04/23 21:52 | rtd, pt100, pt1000, sensor, temperature |

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| • Radar Module RD-xx | 2026/04/23 21:52 | radar, s3km1110, fmcw, rd-03, k-band, 24 ghz, sensor, distance, micro-movements |

HC-SR501, HC-SR505, AM-312, EKMB/EKMC, PIR, motion, sensor, arduino, code

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