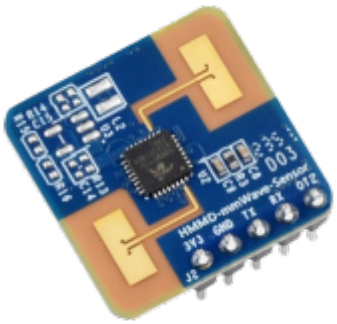
lamaPLC: RD-xx - Ai-Thinker Radar Module with UART communication

The Ai-Thinker RD-xx series comprises 24 GHz mmWave radar modules, each optimized for varying levels of human detection and tracking complexity. While all use FMCW technology, their primary differences lie in connectivity, target tracking capabilities, and power requirements.



Comparison of RD-01, RD-03, and RD-03D:

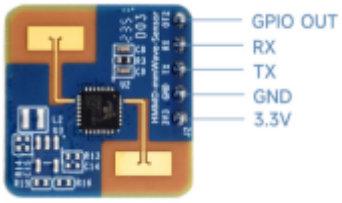
Feature	RD-01	RD-03	RD-03D
Primary Focus	Human presence + Wireless	Precise motion/presence	Multi-target trajectory tracking
Connectivity	UART, Wi-Fi, BLE 5.0	UART	UART
Detection Range	Up to 5 meters	Up to 6.5 meters	Up to 8 meters
Detection Angle	±60° (Horizontal)	±60° (Horizontal)	±60° (Azimuth), ±30° (Pitch)
Target Tracking	Single presence/motion	Single presence/motion	Up to 3 targets simultaneously
Data Output	Presence, micro-motion	Presence, micro-motion	X/Y coordinates, speed, distance
UART Baud Rate	115200 (Default)	115200 (Default)	256000 (Default)
Power Supply	3.0V – 3.6V	3.0V – 3.6V	5V (Stable)
Size	35 x 18 mm	20 x 20 mm	15 x 44 mm

Key Differentiators

- **RD-01:** The only one in this group with integrated Wi-Fi and Bluetooth (via BL602 chip). It is designed for smart home products that need to report human presence directly to a cloud or app without an external gateway.
- **RD-03:** A cost-optimized, standalone version of the RD-01 without wireless features. It offers higher bandwidth (1 GHz) for better interference resistance and is ideal for simple “occupied/unoccupied” triggers such as lighting.
- **RD-03D:** The most advanced in the series. Unlike the others, it provides a spatial map of up to three people, showing their exact positions in a room (X and Y coordinates) and their speed.

Rd-03 is an electrostatically sensitive piece of equipment; special precautions should be taken during handling.

PIN out



3V3	input power
GND	Ground
OT1	UART_TX
RX	UART_RX
OT2	Detection result output, output high level when sensing, output low level when not sensing

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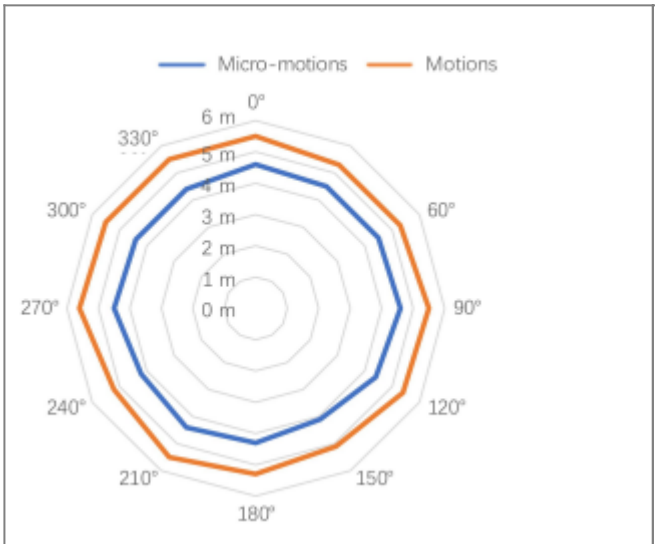
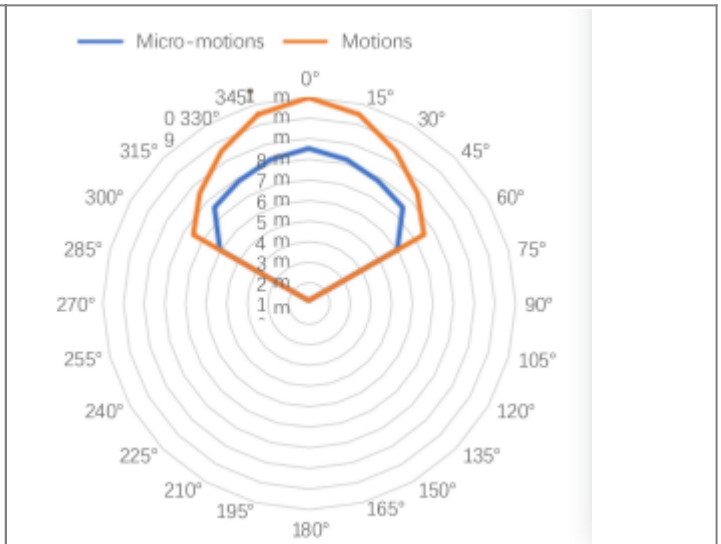
Characteristics of perception



Characteristics of a sensor installed on the ceiling, approximately 2.6 to 3 meters high.



Horizontal characteristic of a sensor mounted on a wall, approximately 1.5 to 2 meters high.

RD-03 Arduino example

To connect the Ai-Thinker RD-03 to an Arduino reliably, use a dedicated library such as RD03Radar. This library simplifies the interpretation of complex 24 GHz mmWave data packets by translating them into straightforward presence and motion indicators.

Pinout

The RD-03 requires a stable 3.0V – 3.6V power supply and communicates via UART at a default baud rate of 115200.

- VCC → Arduino 3.3V
- GND → Arduino GND
- RX → Arduino TX (e.g., Pin 17 for ESP32/Mega)
- TX → Arduino RX (e.g., Pin 16 for ESP32/Mega)

Arduino code

```
#include <RD03Radar.h>

// Use a HardwareSerial port (e.g., Serial2 on ESP32 or Serial1 on Mega)
// On Uno, you may need SoftwareSerial, but performance may be limited.
RD03Radar radar(Serial2);

void onPresenceChange(RD03PresenceState state, float distance) {
  if (state == RD03PresenceState::MOTION_DETECTED) {
    Serial.print("Motion detected at: ");
    Serial.print(distance);
    Serial.println(" cm");
  } else if (state == RD03PresenceState::STATIONARY_DETECTED) {
    Serial.println("Subject is stationary (e.g., breathing detected).");
  } else {
    Serial.println("Area is clear.");
  }
}

void setup() {
  Serial.begin(115200);

  // Set detection callback
  radar.onPresenceChange(onPresenceChange);

  // Start radar (provide RX and TX pins for ESP32)
  radar.begin(16, 17);
  Serial.println("RD-03 Radar Initialized");
}

void loop() {
  // Required to process incoming serial data
  radar.loop();
}
```

Sources

https://cdn.robotshop.com/media/A/Ait/RB-Ait-27/pdf/ai-thinker-radar-module-rd-03-datasheet.pdf

Sensor topics on lamaPLC

Page	Date	Tags
• lamaPLC project: Arduino - OLED SH1106 with AHT20/BMP280 Sensor	2026/02/12 22:14	bmp280, aht20, temperature, humidity, pressure, sensor, arduino, oled, sh1106, arduino code
• lamaPLC: A0221AU / A02YYUW Waterproof Ultrasonic Distance Sensor with UART communication	2026/02/14 22:31	a0221au, a02yyuw, waterproof, ultrasonic, distance, sensor, uart, ip67, serial, sen0311, dfrobot
• LamaPLC: AHT10 Modul	2026/03/21 19:20	communication, i2c, temperature, humidity, sensor, aht, aht 10, modul
• LamaPLC: AHT20 / BMP280 Modul	2026/02/15 20:33	bmp280, aht20, adafruit, temperature, humidity, pressure, sensor, arduino, code, i2c
• LamaPLC: Allegro ACS758 Hall-effect linear current sensors	2026/02/14 23:38	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 I²C communication	2026/02/14 22:24	avago, apds-9900, apds-9930, apds-9960, als, proximity, detection, gesture recognition, gesture, i2c, communication, sensor, arduino, code
• lamaPLC: AS5600 Magnetic Induction Angle Measurement Sensor Module	2026/03/28 22:07	communication, i2c, as5600, as-5600, magnetic, induction, angle, sensor
• LamaPLC: BMP/BME Bosch Temperature/Humidity/Pressure sensors with I²C communication	2026/02/15 20:40	bme280, bme680, bmp180, bmp280, hw-611, hw611, bosch, temperature, humidity, pressure, sensor, arduino, i2c, communication, cjmcu
• LamaPLC: BQ25570 / CJMCU-2557 - Texas Instruments nano-power management IC and module	2026/02/14 23:36	bq25570, sensor, texas instruments, nano-power management, dc-dc boost charger, mppt, solar, thermoelectric, piezoelectric
• LamaPLC: CJMCU-219/INA-219 breakout board/IC with I²C communication	2026/02/14 23:37	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	2026/02/14 22:40	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	2026/02/14 22:39	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	2026/02/14 23:39	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	2026/02/14 22:16	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)	2026/03/21 22:25	cjmcu-811, ccs811, gas, sensor, vocs, tvoc, eco2, co2, arduino, air quality metal oxide, mox, i2c
• LamaPLC: CJMCU-8221 Analog Devices Precision instrumentation amplifier module	2026/02/14 22:55	cjmcu-8221, ad8221ar, analog devices, amplifier, sensor, cjmcu
• LamaPLC: D6T Omron Non-Contact Thermal Sensors with I^2C communication	2026/02/14 18:19	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 / I^2C communication	2026/02/15 20:42	dht11, dht20, dht22, temperature, humidity, pressure, sensor, 1-wire, arduino, code
• LamaPLC: DPS Infineon Temperature/Pressure sensors with I2C communication	2026/02/14 18:11	dps310, infineon, temperature, pressure, sensor, arduino, i2c, communication, code
• lamaPLC: DS18B20 1-Wire Digital Thermometer	2026/02/15 20:44	ds18b20, sensor, 1-wire, communication, arduino, thermometer, parasitic mode
• lamaPLC: Energy, power, current, and voltage	2025/05/31 21:32	i2c, i c, communication, arduino, energy, power, current, sensor, ina226
• LamaPLC: ENS ScioSense Multi-gas sensors with I^2C communication	2026/02/14 19:29	ens160, sciosense, gas-quality, i2c, communication, sensor, arduino, code, eco_2, tvoc, aqi, indoor air quality, iaq, co_2, voc
• lamaPLC: ENS160 + AHT21 Air Quality Sensor - CO, ECO, TVOC, Temp & Humidity Module	2026/03/21 20:45	arduino, ens160, aht21, air quality, sensor, co, eco, tvoc, module, aqi
• LamaPLC: Gas sensors	2023/07/01 15:29	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	2026/02/14 22:18	gm-102b, gm-302b, gm-502b, gm-702b, mems, gas-quality, sensor, arduino, code, nitrogen dioxide, no_2, volatile organic compounds, voc, carbon monoxide, co, ethyl alcohol, c_2h_5ch, formaldehyde, ch_2o, alcohol, c_2h_5oh

• lamaPLC: GY-511 6DOF sensor module	2026/03/22 00:26	stmicroelectronics, lsm303dlhc, i2c, lsm303, sensor, gy-511, 6dof, pololu, module, arduino
• LamaPLC: HC-SR04 Ultrasonic Sensor Module	2026/02/14 22:19	hc-sr04, ultrasonic, sensor, arduino, code
• LamaPLC: HDC Texas Instruments Temperature/humidity sensors with I²C communication	2026/02/14 22:09	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	2026/02/14 21:54	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)	2026/02/15 23:59	hx711, hx-711, analog-to-digital, adc, converter, load cell, wheatstone bridge, weight, sensor, communication, arduino, code
• lamaPLC: INA modules with Arduino libraries	2026/03/28 18:02	i2c, i c, communication, arduino, energy, power, current, monitor, sensor, ina219, ina226, ina228, ina237, ina238, ina260, ina3221, ina
• lamaPLC: INA226 - current/voltage/power monitor with I²C communication	2026/02/14 23:58	i2c, i c, communication, arduino, energy, power, current, monitor, sensor, ina226, ina219, ina
• lamaPLC: LTC3588 - Nanopower energy harvesting power supply IC	2026/02/14 23:35	communication, arduino, sensor, energy harvesting, energy, ambient power
• LamaPLC: M01 - V0.4 Laser ranging sensor with UART communication	2026/02/14 22:24	distance measurement, laser, distance, sensor, m01
• LamaPLC: MAX30100/MAX30102 Heart Rate Click Sensor Module	2026/02/14 23:38	max30102, max30100, heart rate click, sensor, communication, i2c, arduino, code
• lamaPLC: Max31865 RTD to Digital Converter - PT100/PT1000 Platine	2026/02/14 17:38	max31865, rtd, pt 100, pt 1000, temperature, spi, platinum, arduino, code, sensor, adafruit
• LamaPLC: MAX4466/MAX9814: Low-noise Microphone Preamplifiers	2026/02/15 17:35	audio, microphone, analogue audio, max4466, max9814, max 4466, max 9814, agc, preamplifiers, sensor, arduino, code
• LamaPLC: MH-Z19 series of NDIR CO_2 sensors	2026/02/15 20:20	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	2026/03/22 01:24	mpu-6050, hw-123, gy-521, 6-axis motiontracking, dmp, temperature, sensor, mems, arduino code, arduino, accelerometer, gyroscope, tilt

• LamaPLC: MQ Winsen Gas-sensors	2026/02/14 21:17	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	2026/02/15 16:39	hc-sr501, hc-sr505, am-312, ekmb ekmc, pir, motion, sensor, arduino, code
• LamaPLC: Pixart PAJ7620U2 Gesture recognition sensors/module with I²C communication	2026/02/14 22:23	paj7620u2, gy-paj7620, pixart, gesture recognition, i2c, communication, sensor, arduino, code
• lamaPLC: PT100 / PT1000	2025/09/23 16:59	pt100, pt1000, temperature, sensor, platine, rtd
• lamaPLC: PTA8C04 4-channel PT100 Modbus Modul	2026/02/14 17:42	pta8c04, sensor, modbus, rtu, rs-485, communication, platine, um72
• LamaPLC: RCWL - Microwave radar sensor	2026/02/14 22:33	rcwl-0516, rcwl, microwave, radar, sensor, arduino, code
• lamaPLC: RD-xx - Ai-Thinker Radar Module with UART communication	2026/02/14 22:33	radar, s3km1110, fmcw, rd-01, rd-03, rd-03d, ai-thinker, k-band, 24 ghz, sensor, distance, micro-movements
• LamaPLC: SGP Sensirion Gas-sensors with I²C communication	2026/02/15 20:27	sgp30, sgp40, sgp41, sensirion, gas-sensor, i2c, communication, sensor, arduino, code, eco_2, voc, tvoc, indoor air quality, iaq, nox, hydrogen
• LamaPLC: SHT Sensirion Temperature/humidity sensor with I²C communication	2026/02/15 20:29	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	2026/02/15 22:34	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	2026/02/14 22:22	tof050c, vl6180, tof200c, vl53l0x, tof400c, vl53l1x, stmicroelectronics, time-of-flight, tof, i2c, communication, sensor, arduino, code
• LamaPLC: UICPAL Temp.humi.sensor	2023/06/24 22:43	simatic, s7, modbus, communication, temperature, humidity, sensor
• LamaPLC: VL53Lnn STMicroelectronics time-of-flight (ToF) laser-ranging sensors with I²C communication	2026/02/14 22:21	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	2026/02/14 22:22	vl6180x, stmicroelectronics, time-of-flight, tof, i2c, communication, sensor, arduino, code
• LamaPLC: Waveshare TOF Laser Range Sensor with UART / I²C communication	2026/02/14 22:32	distance measurement, laser, range, sensor, tof, waveshare

• lamaPLC: YR-3180 - Weight sensor module with UART or Modbus communication	2026/02/14 23:00	communication, modbus, rtu, sensor, weight, yr-3180, hx710b, arduino, ttl, rs-485
• Magnetic angle sensors	2026/03/05 20:19	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 17:49	nt18b07, sensor, modbus, rtu, rs-485, communication, platine
• PT100 / PT1000 sensors	2025/12/10 17:50	rtd, pt100, pt1000, sensor, temperature
• Radar Module RD-xx	2025/11/09 17:38	radar, s3km1110, fmcw, rd-03, k-band, 24 ghz, sensor, distance, micro-movements

radar, S3KM1110, FMCW, RD-01, RD-03, RD-03D, Ai-Thinker, K-band, 24 GHz, sensor, distance, micro-movements

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