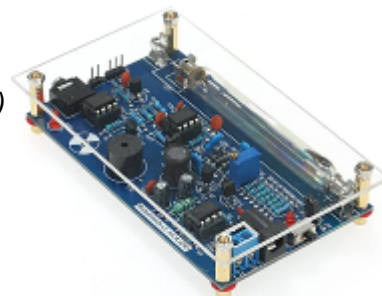


lamaPLC: RadiationD Geiger counter module and tubes

The **RadiationD-v1.1** is a popular DIY Geiger counter module for measuring ionising radiation, often paired with microcontrollers like the ESP32 or Arduino. It typically utilizes a **Miller tube** (*Geiger-Müller tube*) to detect gamma rays and some beta particles.



The RadiationD-v1.1 module's measuring limits are primarily determined by the specific Geiger-Müller (GM) tube installed on the board. Most kits use either the *J305* or *M4011* glass tubes.

⊕ Radiation Type Limits

- **Gamma (Γ):** Excellent detection. It is most accurate for Gamma rays (like those from *Cesium-137*).
- **Beta (β):** Detects high-energy (“hard”) Beta particles. Low-energy Beta may not penetrate the glass tube wall.
- **Alpha (α):** Detection is only possible with the *LND-712* tube. All other tubes have glass walls that are too thick for alpha particles to penetrate; they are either blocked by the glass or even a few centimeters of air.

RadiationD Recommended and Compatible Tubes

The RadiationD-v1.1 (also known as the CAJOE module) is highly versatile and supports most Geiger-Müller (GM) tubes that operate with an anode voltage between 350V and 500V.

Parameter	J305	J321	M4011	SBM-20	STS-5	LND-712
Material	Glass	Glass	Glass	Metal (Stainless)	Metal (Stainless)	Metal / Mica Window
Sensitivity	Moderate	Low-Moderate	Moderate	High	High	Very High
Min. energy¹ Alpha	Blocked	Blocked	Blocked	Blocked	Blocked	> 4.0 MeV
Min. energy¹ Beta	~0.3 MeV	~0.4 MeV	~0.3 MeV	~0.2 MeV	~0.2 MeV	> 0.2 MeV
Min. energy¹ Gamma	~0.02 MeV	~0.02 MeV	~0.02 MeV	~0.05 MeV	~0.05 MeV	> 0.01 MeV
Max. dose²	1,200 μ Sv/h (0.12 R/h)	1,000 μ Sv/h (0.10 R/h)	1,200 μ Sv/h (0.12 R/h)	1,440 μ Sv/h (0.14 R/h)	1,440 μ Sv/h (0.14 R/h)	2,000 μ Sv/h (0.20 R/h)
Max. counts² (CPM)	~30.000	~25.000	~30.000	~40.000	~40.000	~50.000
Alpha	No	No	No	No	No	Yes (via window)

Parameter	J305	J321	M4011	SBM-20	STS-5	LND-712
Beta	Yes (High energy)	Yes (High energy)	Yes (High energy)	Yes (Excellent)	Yes (Excellent)	Yes (Excellent)
Gamma	Yes	Yes	Yes	Yes	Yes	Yes
Dose Limit	~1.2 mSv/h	~1.0 mSv/h	~1.2 mSv/h	~1.44 mSv/h	~1.44 mSv/h	~2.0 mSv/h
Op. Voltage	350V - 450V	350V - 450V	350V - 450V	350V - 475V	350V - 475V	450V - 500V
Light Sens.	High (Needs tape)	High (Needs tape)	High (Needs tape)	None	None	None

¹: This defines the minimum energy a particle must have to “get inside” the tube.

²: This defines the maximum amount of radiation the tube can count before it becomes “choked” (Saturation).

- **Low Energy Limit:** When detecting weak radiation, such as from food or granite, the J-series glass tubes may fail to register it because the energy is too low to penetrate the glass.
- **Saturation (The Danger Zone):** When these tubes are near a high-radiation source, like an X-ray machine or a major leak, they will reach their Max CPM and stop detecting additional radiation. **A flat reading around 30,000 CPM usually indicates radiation levels are actually much higher than the display suggests.**
- **LND-712 Advantage:** This model is unique in being able to detect Alpha particles, like those from Americium in smoke detectors, as Alpha particles are very weak and cannot pass through glass or steel.

The Glass Tubes (J305, J321, M4011)



- **Light Sensitivity:** These act like solar cells. If you don't wrap them in black tape or put them in a dark box, the sun will cause thousands of “fake” counts.
- **Beta Detection:** They can only detect “hard” Beta. The glass walls are too thick for Beta particles to penetrate.
- **J305:** Excel at detecting Beta radiation, which makes them popular in medical radiology experiments. They are very fragile.
- **J321:** Concentrates on Gamma detection with improved linear response features, making it perfect for environmental security monitoring.
- **M4011:** Exhibits high sensitivity to both Beta and Gamma rays, making it ideal for scientific research and broad industrial monitoring.

The Soviet Workhorses (SBM-20, STS-5)



- **Durability:** These are metal tubes. They won't break if you drop them, and they are completely immune to light interference.
- **Size:** The STS-5 (~112mm) is longer than the SBM-20 (~108mm). Neither usually fits the standard “clips” on the RadiationD board (85-90mm) without modification or the use of wires.
- **Voltage Tuning:** These tubes love 400V. You will need to use a multimeter to adjust the P1 blue potentiometer on the RadiationD board to ensure it stays in the “plateau” range (350V-475V).
- **Connection:** These tubes use “pin” ends. Most users use fuse clips or small springs to hold them, rather than soldering directly to the tube (which can damage the seal).

The Professional Choice (LND-712)

The LND-712 is a professional-grade, American-made tube. It is rarely used by beginners because the tube alone often costs \$80-\$150, which is 5-10 times the price of the RadiationD module.



- **Alpha Detection:** This is the only tube on your list with a Mica end-window. This window is thin enough to let Alpha particles through.
- **Voltage:** It requires the higher end of the RadiationD's power range (near 500V). You must adjust the blue potentiometer (P1) while measuring the voltage with a high-impedance multimeter.
- **Usage:** To detect Alpha, you must point the “window” end directly at the source (within 1-2 cm).
- **Warning:** The Mica window is extremely fragile—touching it with a finger or a tool will destroy the tube instantly
- **Mounting:** The LND-712 is much shorter (approx. 50mm) and has a different pin configuration. It will not fit the clips. You must solder custom lead wires.
- **Use for mineral collectors:** Users hunting for “hot” rocks (Autunite, Torbernite) where Alpha emission is the primary indicator.

RadiationD and Arduino

To operate the RadiationD-v1.1 with an Arduino, connect it as an external interrupt source. Since radiation events occur randomly and very quickly, relying on a standard `digitalRead` is not dependable.

Wiring Diagram

RadiationD Pin	Arduino Pin	Note
5V	5V	Power supply from Arduino
GND	GND	Common ground
Vin (or Out)	Digital Pin 2	Must be an Interrupt Pin (D2 or D3 on Uno)

Simple RadiationD & Arduino Code

This script counts the pulses and calculates CPM (Counts Per Minute).

```
#define LOG_PERIOD 15000 // Log period in milliseconds (15 seconds)
unsigned long counts; // Variable to store pulses
unsigned long previousMillis;

void ICACHE_RAM_ATTR countPulse() {
  counts++;
}

void setup() {
  Serial.begin(9600);
  pinMode(2, INPUT);
  // RadiationD pulses LOW when radiation is detected
  attachInterrupt(digitalPinToInterrupt(2), countPulse, FALLING);
}

void loop() {
  unsigned long currentMillis = millis();
  if (currentMillis - previousMillis > LOG_PERIOD) {
    previousMillis = currentMillis;

    // Calculate CPM (Counts Per Minute)
    float cpm = counts * (60000.0 / LOG_PERIOD);

    Serial.print("CPM: ");
    Serial.println(cpm);

    counts = 0; // Reset count for next period
  }
}
```

Converting CPM to $\mu\text{Sv/h}$

To get a usable dose reading, you multiply the CPM by the conversion factor specific to your tube.

- **J305 / M4011:** $\mu\text{Sv/h} = \text{CPM} * 0.0081$
- **SBM-20:** $\mu\text{Sv/h} = \text{CPM} * 0.0057$
- **Example:** If your Arduino calculates 20 CPM with a J305 tube: $20 * 0.0081 = 0.162 \mu\text{Sv/h}$ (Normal background radiation).

I²C topics on lamaPLC

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• lamaPLC Communication: I²C	2025/09/23 21:25	i2c , i c , smbus , philips , bus , communication , arduino
• lamaPLC project: Senson SCD CO² measurement module	2026/04/15 19:34	scd30 , scd40 , scd41 , iaq , ndir , sensor , i2c , arduino code
• 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: APDS - Avago ALS and proximity detection sensors with I²C communication	2026/04/23 21:52	avago , apds-9900 , apds-9930 , apds-9960 , als , proximity , detection , gesture recognition , gesture , i2c , communication , sensor , arduino , code
• 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	2026/04/23 21:52	communication , i2c , as5600 , as-5600 , magnetic , induction , angle , sensor
• lamaPLC: Bi-Directional Logic Level Converter 3.3V ↔ 5V	2026/04/12 00:34	bi-directional , logic level converter , i2c , uart , spi
• 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: 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-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: 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: DPS Infineon Temperature/Pressure sensors with I²C communication	2026/04/23 21:52	dps310 , infineon , temperature , pressure , sensor , arduino , i2c , communication , code
• 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

<ul style="list-style-type: none"> • lamaPLC: ESP32 / ESP8266 	<p>2025/11/22 00:07</p>	<p>esp8266, esp32, esp32-c2, esp32-c3, esp32-c5, esp32-c6, esp32-c61, esp32-h2, esp32-s2, esp32-s3, esp32-p4, espressif systems, communication, ethernet, ip, wi-fi, thread, zigbee, matter, homekit, bluetooth, mqtt, adc, spi, uart, i2c, i2s, rmt, pwm, usb, usb otg, twai</p>
<ul style="list-style-type: none"> • LamaPLC: Gas sensors 	<p>2023/07/01 17:29</p>	<p>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</p>
<ul style="list-style-type: none"> • lamaPLC: GY-511 6DOF sensor module 	<p>2026/03/22 01:44</p>	<p>stmicroelectronics, lsm303dlhc, i2c, lsm303, sensor, gy-511, 6dof, pololu, module, arduino</p>
<ul style="list-style-type: none"> • LamaPLC: GY-9250 MPU-9250/6500 9-axis Attitude Sensor Board 	<p>2026/04/23 21:52</p>	<p>ak8963, gy-9250, mpu-9250, 9-axis, motion detection, magnetometer, communication, i c, i2c, spi</p>
<ul style="list-style-type: none"> • LamaPLC: HDC Texas Instruments Temperature/humidity sensors with I²C communication 	<p>2026/04/23 21:52</p>	<p>sht21, htu21, si7021, gy-21, gy-213v, hdc1080, gy-213v-hdc1080, cjmcu, cjmcu-1080, texas instruments, temperature, humidity, sensor, i2c, communication, arduino, code</p>
<ul style="list-style-type: none"> • lamaPLC: HT16K33 display controller 	<p>2026/04/23 21:51</p>	<p>i2c, 7-segment display, display, ht16k33, arduino</p>
<ul style="list-style-type: none"> • LamaPLC: HTU TE Connectivity temperature/humidity sensors with I²C communication 	<p>2026/04/23 21:52</p>	<p>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</p>
<ul style="list-style-type: none"> • lamaPLC: INA modules with Arduino libraries 	<p>2026/04/11 19:54</p>	<p>i2c, i c, communication, arduino, energy, power, current, monitor, sensor, ina219, gy-219, ina226, gy-216, ina228, gy-228, ina237, ina238, ina260, ina3221, ina</p>
<ul style="list-style-type: none"> • lamaPLC: INA226 - current/voltage/power monitor with I²C communication 	<p>2026/04/23 21:52</p>	<p>i2c, i c, communication, arduino, energy, power, current, monitor, sensor, ina226, ina219, ina</p>
<ul style="list-style-type: none"> • lamaPLC: LCD 1602/2004 with I²C communication 	<p>2026/02/14 18:27</p>	<p>communication, i2c, display, lcd, 1602, 2004, hd44780, pcf8574, pcf8574t, pcf8574at, arduino</p>
<ul style="list-style-type: none"> • LamaPLC: MAX30100/MAX30102 Heart Rate Click Sensor Module 	<p>2026/04/23 21:52</p>	<p>max30102, max30100, heart rate click, sensor, communication, i2c, arduino, code</p>
<ul style="list-style-type: none"> • lamaPLC: MCP23017 / MCP23S17 16-Bit I/O Expander with Serial Interface I²C / SPI 	<p>2026/04/23 21:52</p>	<p>communication, i2c, mcp23017, mcp23s17, spi, i o expander, serial, cjmcu-2317, cjmcu</p>

• lamaPLC: MLX90614 (GY-906) infrared non-contact thermometer	2026/05/08 00:03	communication, i2c, temperature, mlx90614, gy-906, modul, infrared, non-contact thermometer, dsp, pwm, smbus, hailege
• lamaPLC: PCF857x I/O Expander chip/modul with I ² C communication	2026/05/14 15:21	communication, i2c, pcf857x, pcf8574, pcf8574a, pcf8575, i o expander, i o extension, nxp, texas instruments
• LamaPLC: Pixart PAJ7620U2 Gesture recognition sensors/module with I ² C communication	2026/04/23 21:52	paj7620u2, gy-paj7620, pixart, gesture recognition, i2c, communication, sensor, arduino, code
• lamaPLC: RP2040_ETH_Modul: I ² C scanner	2026/05/12 16:20	code, micropython, 2026, rp2040 eth, i2c, comunication
• lamaPLC: RP2040_ETH_Modul: MLX90614 simple	2026/05/12 17:06	code, micropython, 2026, rp2040 eth, i2c, communication, mlx90614
• 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
• LamaPLC: SC16IS750 / SC16IS752: One or two serial (UART) ports from microcontroller via I ² C or SPI communication	2026/04/23 21:52	cjmcu-750, cjmcu-752, cjmcu, nxp, sc16is750, sc16is752, uart, serial, i2c, spi, modul, converter, arduino, code
• LamaPLC: SGP Sensirion TVOC/VOC sensors with I ² C 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 I ² C communication	2026/04/23 21:52	sht20, sht21, sht25, sht30, sht31, sht35, sht40, gy21, temperature, humidity, i2c, communication, sensor, arduino, code
• lamaPLC: Signal level converters	2026/02/14 23:47	pca9306, i2c, voltage, level, converter
• lamaPLC: TCA9548A (HW617); Low-Voltage 8-Channel I ² C Switch Module	2026/02/14 23:51	tca9548a, hw617, i2c, switch, communication, expansion board, arduino
• lamaPLC: TM1637 7-segment display	2026/02/14 18:26	i2c, 7-segment display, display, tm1637, arduino
• LamaPLC: TOFnnnC STMicroelectronics Time-of-Flight (ToF) sensors with I ² C communication	2026/04/23 21:52	tof050c, vl6180, tof200c, vl53l0x, tof400c, vl53l1x, stmicroelectronics, time-of-flight, tof, i2c, communication, sensor, arduino, code
• LamaPLC: VL53Lnn STMicroelectronics time-of-flight (ToF) laser-ranging sensors with I ² C 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 I ² C communication	2026/04/23 21:52	vl6180x, stmicroelectronics, time-of-flight, tof, i2c, communication, sensor, arduino, code
• 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

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- [SSH1106/SSD1306 OLED Display with I²C communication](#) 2026/02/14 18:27 [i2c](#), [oled](#), [display](#), [ssd1306](#), [sh1106](#), [ssh1106](#), [arduino](#), [cmos](#)

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