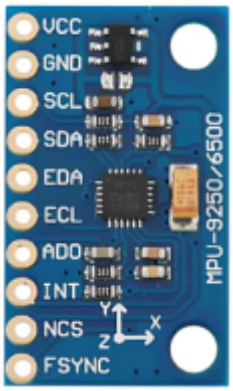
LamaPLC: GY-9250 MPU-9250/6500 9-axis Attitude Sensor Board

The MPU-9250 is among the most sophisticated compact sensors, combining an accelerometer, gyroscope, and compass. It replaces the MPU-9150, offering reduced power consumption, better gyro noise performance, and an expanded full-scale range for the compass.



This sensor features advanced capabilities like low-pass filtering, motion detection, and a programmable specialized processor. Inside, it incorporates the MPU-6500, which houses a 3-axis gyroscope and 3-axis accelerometer, and the **AK8963**, a high-performance 3-axis digital compass. The MPU-9250 employs 16-bit ADCs to digitize data from all nine axes.

Features

- **1. Nine-Axis Motion Sensing:** The GY-9250 MPU-9250 module integrates a nine-axis motion sensor with an accelerometer, gyroscope, and magnetometer, enabling accurate, comprehensive 3D motion tracking.
- **2. Wide Range and High Accuracy:** The MPU-9250 chip offers a wide range of measurement options, with gyroscopes ranging from ±250 to ±2000 °/s, accelerometers ranging from ±2 g to ±16 g, and a magnetometer range of ± 4800 uT. It provides high-resolution data output, ensuring accurate and detailed motion sensing.
- **3. Compatible Communication Protocols:** The GY-9250 module supports standard IIC and SPI communication protocols, enabling easy integration with microcontrollers and other devices. It offers flexibility and compatibility for seamless data transmission and control.
- **4. Compact Design and Lightweight:** With its compact size of 1525 mm and weighing only 2 g, this module is small and lightweight. It occupies minimal space and integrates easily into your project or design.
- **5. High-Quality and Reliable:** The GY-9250 MPU-9250 module features a high-quality build, including a gold-plated PCB and machine-soldered components, ensuring excellent quality and durability. The module's built-in 16-bit ADC delivers accurate, reliable data output.

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Specification

- *Chip used:* MPU-9250
- *Power supply:* **3-5v** (internal low dropout regulator)
- *Communication method:* standard I²C/SPI communication protocol
- *Gyroscope range:* ±250 500 1000 2000 °/s
- *Acceleration range:* ±2±4±8±16 g
- *Magnetic field range:* ±4800 uT
- *Pin pitch:* 2.54 mm
- *Module size:* 15*25 mm
- *Net weight:* 2g

MPU9250 Module Pinout

Pin Number	Pin Name	Description
1	VCC	Power Supply
2	GND	Ground Reference
3	SCL	I²C Serial Clock
4	SDA	I²C Serial Data
5	EDA	Auxiliary Serial Data
6	ECL	Auxiliary Serial Clock
7	AD0	I²C/SPI Address Select
8	INT	Interrupt
9	NCS	SPI Chip Select
10	FSYNC	Frame Synchronization

The MPU-9250 I2C address is typically **0x68** (when the AD0 pin is grounded) or **0x69** (when AD0 is pulled high), with **0x68** being the default. The internal magnetometer (*AK8963*) has a fixed I²C address of **0x0C**.

Internal Circuit Diagram for MPU9250 Module

The circuit includes a low-dropout (LDO) linear regulator that reduces the 5V supply to the 3.3V required by the MPU9250. Because of their small size and limited power dissipation, the board's LDOs cannot manage high voltages, so powering them from 5V is optimal. The module also features the necessary decoupling capacitors for the LDO.

The MPU9250 includes the required pull-up and pull-down resistors for the I²C/SPI lines, the address select, and the frame synchronization pin. Because the I²C pull-up values are high, additional external pull-ups of a lower value can be added to enhance speed. Adequate decoupling is also provided for the chip's various power pins.

Arduino & MPU9250

To use the MPU9250 module with an Arduino via the I²C interface, you can use a library like the **MPU9250_WE library** by Wolfgang Ewald.

Arduino Wiring (I²C Mode)

- VCC → Arduino 5V or 3.3V (most modules have an on-board regulator and 5V tolerant inputs).
- GND → Arduino GND.
- SCL → Arduino A5 (for Uno/Nano) or the dedicated SCL pin on other boards.
- SDA → Arduino A4 (for Uno/Nano) or the dedicated SDA pin on other boards.
- AD0: Leave unconnected or connect to GND for the default I²C address 0x68.

Basic Example Code

Install the **MPU9250_WE** library from the Arduino Library Manager (*Sketch > Include Library > Manage Libraries*) and use the following code to read acceleration, gyroscope, and magnetometer data.

```
#include <MPU9250_WE.h>
#include <Wire.h>

#define MPU9250_ADDR 0x68 // I2C address is 0x68 when AD0 pin is grounded

MPU9250_WE myMPU9250 = MPU9250_WE(MPU9250_ADDR);

void setup() {
  Serial.begin(115200);
  Wire.begin(); // Initialize I2C communication

  if (!myMPU9250.init()) { // Initialize the MPU9250 sensor
    Serial.println("MPU9250 does not respond");
    while (1); // Stop program
  } else {
    Serial.println("MPU9250 is connected");
  }

  // Set sensor ranges (optional, defaults are 2G, 250 DPS)
  myMPU9250.setAccelRange(MPU9250_ACCEL_RANGE_2G);
  myMPU9250.setGyroRange(MPU9250_GYRO_RANGE_250DPS);
  // Magnetometer range is fixed
}

void loop() {
  // Read the sensor data
  xyzFloat accel = myMPU9250.getAccelRawValues();
  xyzFloat gyro = myMPU9250.getGyroRawValues();
  xyzFloat mag = myMPU9250.getMagRawValues();
  float temp = myMPU9250.getTemperature();
```

```
  // Print the data to the Serial Monitor
  Serial.print("AccelX: "); Serial.print(accel.x); Serial.print("\t");
  Serial.print("AccelY: "); Serial.print(accel.y); Serial.print("\t");
  Serial.print("AccelZ: "); Serial.println(accel.z);

  Serial.print("GyroX: "); Serial.print(gyro.x); Serial.print("\t");
  Serial.print("GyroY: "); Serial.print(gyro.y); Serial.print("\t");
  Serial.print("GyroZ: "); Serial.println(gyro.z);

  Serial.print("MagX: "); Serial.print(mag.x); Serial.print("\t");
  Serial.print("MagY: "); Serial.print(mag.y); Serial.print("\t");
  Serial.print("MagZ: "); Serial.println(mag.z);

  Serial.print("Temperature: "); Serial.print(temp); Serial.println(" C");

  Serial.println();
  delay(200);
}
```

I²C topics on lamaPLC

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• lamaPLC Communication: 1-Wire	2025/05/31 21:56	1-wire, communication, bus, microlan, i2c, uart, usart, ds18b20
• lamaPLC Communication: I²C	2025/09/23 19:25	i2c, i c, smbus, philips, bus, communication, arduino
• 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: 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: 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-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: D6T Omron Non-Contact Thermal Sensors with I²C communication	2026/02/14 18:19	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	2026/02/14 18:11	dps310, infineon, temperature, pressure, sensor, arduino, i2c, communication, code
• 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 I²C communication	2026/02/14 19:29	ens160, sciosense, gas-quality, i2c, communication, sensor, arduino, code, eco₂, tvoc, aqi, indoor air quality, iaq, co₂, voc
• lamaPLC: ESP32 / ESP8266	2025/11/21 23:07	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
• 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: GY-511 6DOF sensor module	2026/03/22 00:26	stmicroelectronics, lsm303dlhc, i2c, lsm303, sensor, gy-511, 6dof, pololu, module, arduino
• LamaPLC: GY-9250 MPU-9250/6500 9-axis Attitude Sensor Board	2026/02/14 22:45	ak8963, gy-9250, mpu-9250, 9-axis, motion detection, magnetometer, communication, i c, i2c, spi
• 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: HT16K33 display controller	2026/02/14 17:26	i2c, 7-segment display, display, ht16k33, arduino
• 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: 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: LCD 1602/2004 with I²C communication	2026/02/14 17:27	communication, i2c, display, lcd, 1602, 2004, hd44780, pcf8574, pcf8574t, pcf8574at, arduino
• LamaPLC: MAX30100/MAX30102 Heart Rate Click Sensor Module	2026/02/14 23:38	max30102, max30100, heart rate click, sensor, communication, i2c, arduino, code
• lamaPLC: MCP23017 / MCP23S17 16-Bit I/O Expander with Serial Interface I²C / SPI	2026/02/14 22:52	communication, i2c, mcp23017, mcp23s17, spi, i o expander, serial, cjmcu-2317, cjmcu
• 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: SC16IS750 / SC16IS752: One or two serial (UART) ports from microcontroller via I²C or SPI communication	2026/02/14 22:53	cjmcu-750, cjmcu-752, cjmcu, nxp, sc16is750, sc16is752, uart, serial, i2c, spi, modul, converter, arduino, code
• LamaPLC: SGP Sensirion Gas-sensors with I²C communication	2026/02/15 20:27	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	2026/02/15 20:29	sht20, sht21, sht25, sht30, sht31, sht35, sht40, gy21, temperature, humidity, i2c, communication, sensor, arduino, code
• lamaPLC: Signal level converters	2026/02/14 22:47	pca9306, i2c, voltage, level, converter
• lamaPLC: TCA9548A (HW617); Low-Voltage 8-Channel I²C Switch Module	2026/02/14 22:51	tca9548a, hw617, i2c, switch, communication, expansion board, arduino
• lamaPLC: TM1637 7-segment display	2026/02/14 17:26	i2c, 7-segment display, display, tm1637, arduino
• 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: 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
• 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

• SSH1106/SSD1306 OLED Display with I²C communication	2026/02/14 17:27	i2c, oled, display, ssd1306, sh1106, ssh1106, arduino, cmos

AK8963, GY-9250, MPU-9250, 9-axis, motion detection, magnetometer, communication, I²C, I2C, SPI