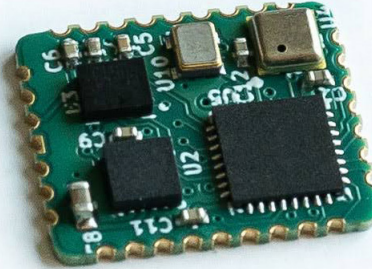
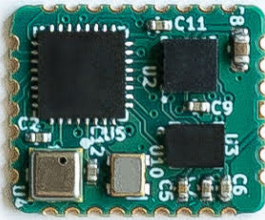




# MOTION NODE



## IMU PCB Module

**Motion Node** PCB module is a precision inertial measurement unit designed for embedding directly onto your custom PCB. Includes state of the art on-board sensor fusion, and fast output sample rate of up to 1000Hz. Datastream is accessible via UART, SPI, or USB.

Visit [www.motionnode.com](http://www.motionnode.com) for videos and more.

- ✓ Designed and manufactured in the USA
- ✓ Fast-track your embedded IMU design
- ✓ Robust, rich data stream
- ✓ Free, open source SDK

## Fast-track your embedded IMU design

### Micro-miniature PCB Size

15x15mm SMT module easily fits on your custom board

### Fast On-board Sensor Fusion

1000Hz update rate sensor fusion

### High-Quality MEMS Sensors

Durable, field tested equipment. Cutting edge sensor technology.

# Sensor data

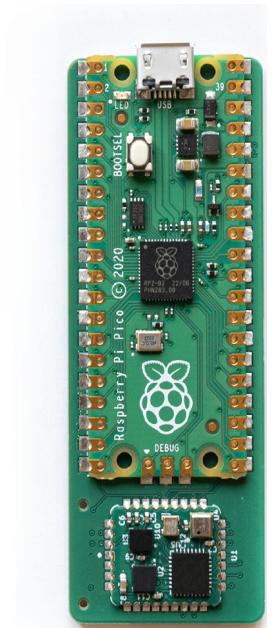
Read live measurement data from the [MotionNode PCB module](#) using SPI or UART, or USB 2.0 data transmission.

- Rotation
- Angular velocity
- Calibrated accelerometer, gyroscope, and magnetometer signals

## Embedded Developer Kit

An [embedded devkit](#) is available, which includes a MotionNode PCB module connected to a host embedded processor with USB connectivity on a PCB. Firmware examples show how to interface via UART and SPI to read IMU data.

This kit is intended for users who wish to access the IMU datastream on a host microcontroller platform, such as ARM Cortex M0+. An end application requires very little processing power on the host processor, as the MotionNode module does the heavy lifting of sensor fusion and data wrangling.

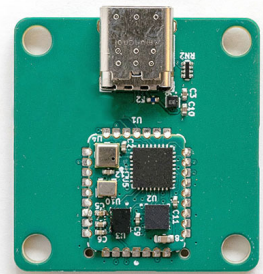


## USB Developer Kit

Choose our [USB devkit](#) if your intended application is USB connectivity for an embedded system.

The dev-kit includes a MotionNode PCB module on a PCB with a USB-C connector. Connect to any host computer (PC, Mac, Arm SBC, etc) running our MotionNode software to stream and record IMU data.

The resulting device is compatible with the [MotionNode app](#) and the [SDK](#), with the same functionality as our [MotionNode USB](#) product. Record takes and live-stream IMU data.



# Firmware Examples

Visit our github repository for SDK and firmware examples how to configure the MotionNode PCB Module and read data over SPI and UART interfaces using the embedded or USB dev-kit.

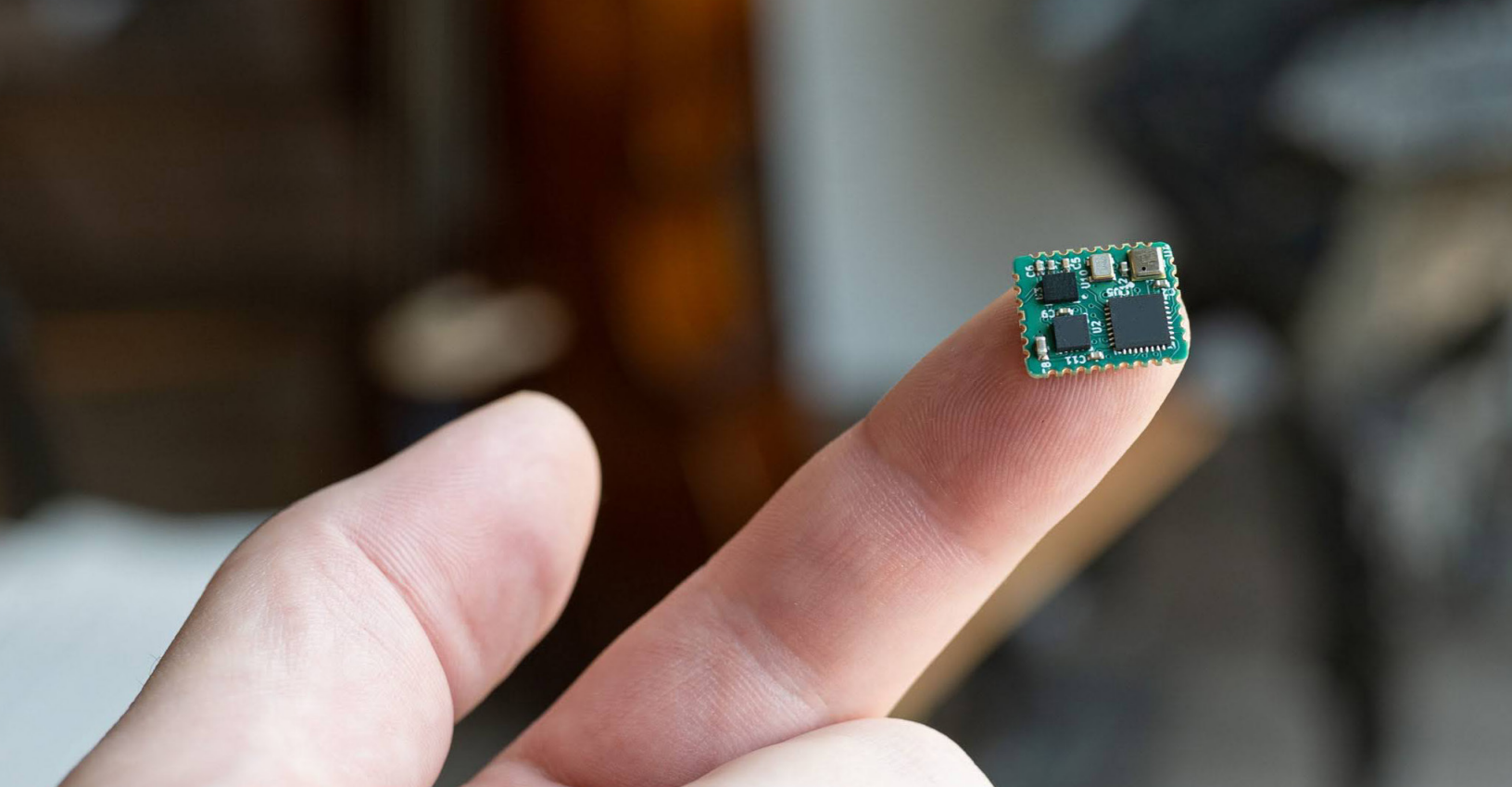
[www.github.com/motion-workshop](http://www.github.com/motion-workshop)

## Technical specs

|                                                   |                              |                               |
|---------------------------------------------------|------------------------------|-------------------------------|
| <b>Sensors</b>                                    | <b>Size</b>                  | <b>Orientation</b>            |
| 3-axis accelerometer, gyroscope, and magnetometer | 15 x 15 x 2mm                | Drift free, 3D rotation       |
|                                                   | <b>Embedded Connectivity</b> | 0.5° static accuracy          |
| <b>Sample rate</b>                                |                              | 2° dynamic accuracy           |
| 1000Hz update rate                                | SPI                          | Full 360° range for each axis |
| Selectable output data rate                       | UART (1Mbaud 8N1)            |                               |
| 100Hz to 1000Hz                                   | USB 2.0                      | <b>Latency</b>                |
|                                                   |                              | 1ms at 1000Hz                 |

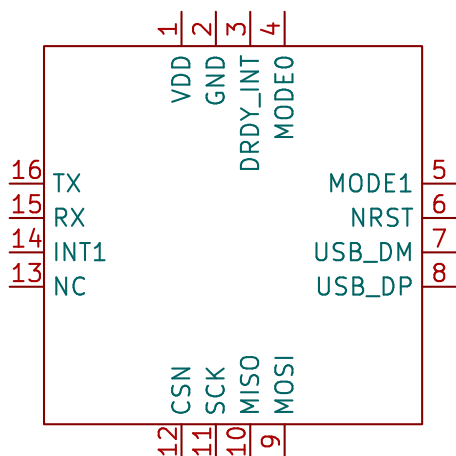
## Sensor specs

|               | Range     | Resolution      | Noise          |
|---------------|-----------|-----------------|----------------|
| Accelerometer | ±2 / 8 g  | 0.045 / 0.18 mg | 65 (µg/rt-Hz)  |
| Gyroscope     | ±2000 °/s | 0.06 °/s        | 2.8 mdps/rt-Hz |
| Magnetometer  | ±8 gauss  | 0.25 mG         | 0.4 mG RMS     |



## Technical drawings

### MotionNode PCB Module diagram



- All GPIO are 3.3V CMOS level.
- Single DC supply, 3.3-5V, max current is 25mA at 5V.
- Select data transfer interface using MODE0/1 pins.
- See the [dev-kit firmware examples](#) for more information on SPI and UART interface usage.

[MODE1, MODE0]

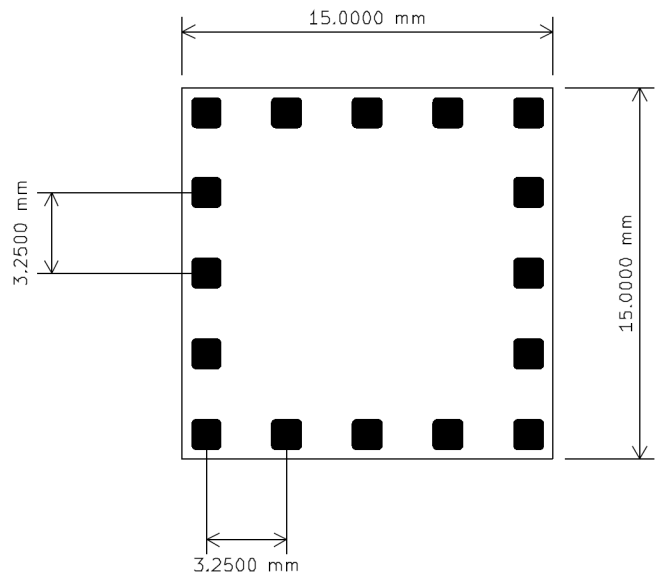
00: USB 2.0 FTDI, 1Mbps 8N1, MotionNode driver  
 01: SPI  
 10: UART, 1Mbaud 8N1, no FIFO  
 11: UART, 1Mbaud 8N1, no FIFO

# Module Pin Definitions

| Pin | Name       | Direction | Description                                  |
|-----|------------|-----------|----------------------------------------------|
| 1   | VCC_SENSOR | POWER     | power input, 3.3V to 5V                      |
| 2   | GND        | POWER     | Ground                                       |
| 3   | DRDY_INT   | Out       | Data Ready Interrupt (active high)           |
| 4   | MODE0      | In        | Mode select bit 0                            |
| 5   | MODE1      | In        | Mode select bit 1                            |
| 6   | NRST       | In        | Module reset (active low)                    |
| 7   | USB_DM     | USB       | USB 2.0 D-                                   |
| 8   | USB_DP     | USB       | USB 2.0 D+                                   |
| 9   | MOSI       | In        | SPI slave interface MOSI                     |
| 10  | MISO       | Out       | SPI slave interface MISO                     |
| 11  | SCK        | In        | SPI slave interface clock                    |
| 12  | CSN        | In        | SPI slave interface chip select (active low) |
| 13  | NC         | -         | Do not connect.                              |
| 14  | INT1       | Out       | FIFO interrupt (not currently implemented)   |
| 15  | RX         | In        | UART interface RX                            |
| 16  | TX         | Out       | UART interface TX                            |

# Module SMT land pattern

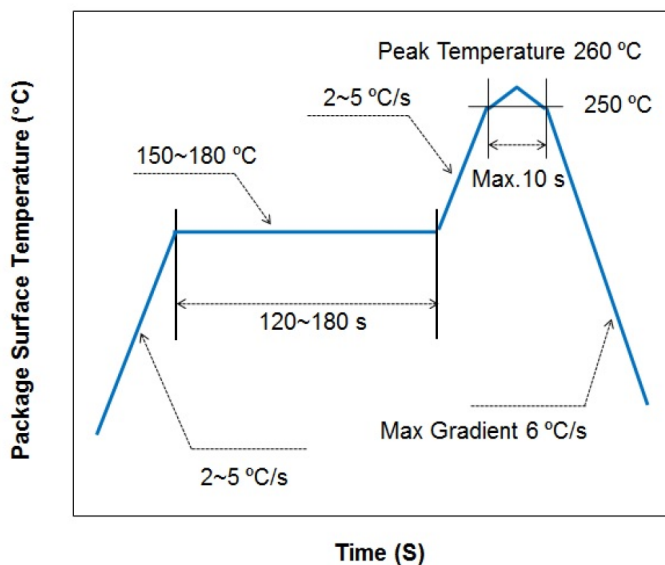
| dimension     | mm   |
|---------------|------|
| module length | 15   |
| module width  | 15   |
| pad spacing   | 3.25 |
| pad length    | 1.2  |
| pad width     | 1.2  |



16 SMT pads of 1.2x1.2mm size are placed on the bottom side of the module for SMT solder reflow. Pad spacing (pitch) is 3.25mm.

Avoid routing signals under the the module. Ground pour is acceptable but not required.

## SMT Reflow Profile



- MSL3 reflow profile for Pb free process
- The peak temperature on the sensor surface should be limited under 260°C for no more than 10 seconds.
- Reflow conditions recommended by solder paste should be followed to get the best SMT quality.
- Maximum 3 SMT cycles

# Ordering Information

**NODE-PCB-MOD**

MotionNode PCB Module

Please contact us at [info@motionnode.com](mailto:info@motionnode.com) to place an order.

## Trust our proven solution

Field tested by the best and brightest in companies, research labs, and academic institutions.



# Spec Sheet Version

Current Version: 1

| Version | Date              |
|---------|-------------------|
| 1       | February 25, 2025 |