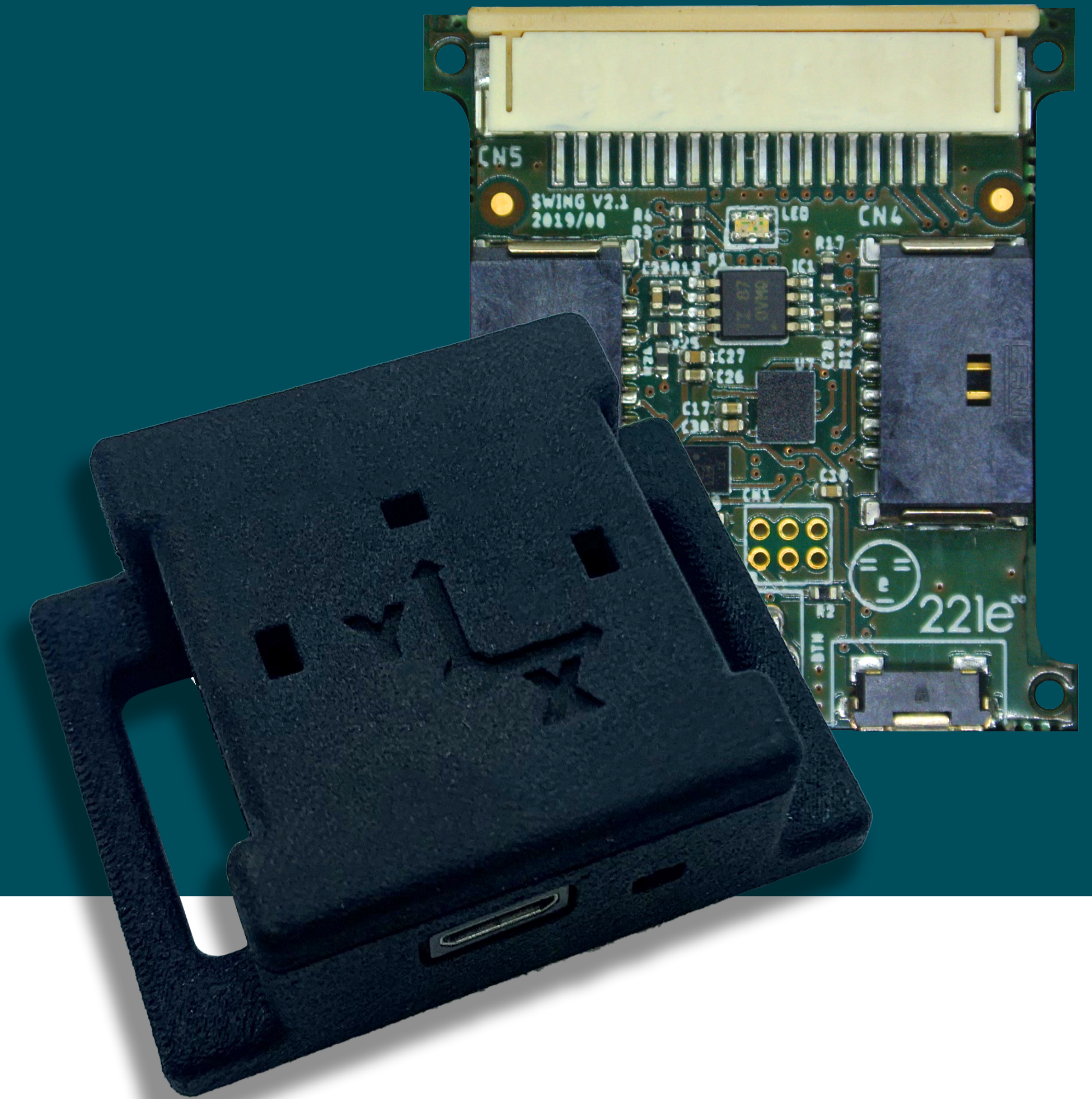


Mitch™

Research Sensor Platform

Advance Your Work With a Modular Sensor System
Trusted By World-leading Institutions

Product Code: A3b4v02



∞ General Information

Fields of Application

- Inertial Measurement Unit
- Motion tracking
- Wearable, Sport and e-Health
- Patient rehabilitation
- Time-of-Flight measurements
- Analog input measurements
- Gait Analysis
- Pressure Mapping
- Biometrics

System Description

MITCH is a state-of-the-art scalable inertial data acquisition platform that can be integrated with different sensing peripherals making it suitable for a wide range of applications. MITCH can measure acceleration, angular rate and magnetic field. The on-board connectors ease the use of our plug and play sensors for the measurement of foot pressure points (FSR membrane), distance and proximity (ToF peripheral), heart rate and pulse-oximetry (PPG peripheral). MITCH combines gyroscope, accelerometer and magnetometer into a 6+3 axis solution. With flash storage on board, wireless connectivity (Bluetooth Low Energy), high resolution real time clock, and rechargeable battery, MITCH is ideal for data logging and research in multiple settings, even out of the lab. The platform can run 221e proprietary algorithms and embedded AI software libraries to boost intelligent precision sensing to the next level.

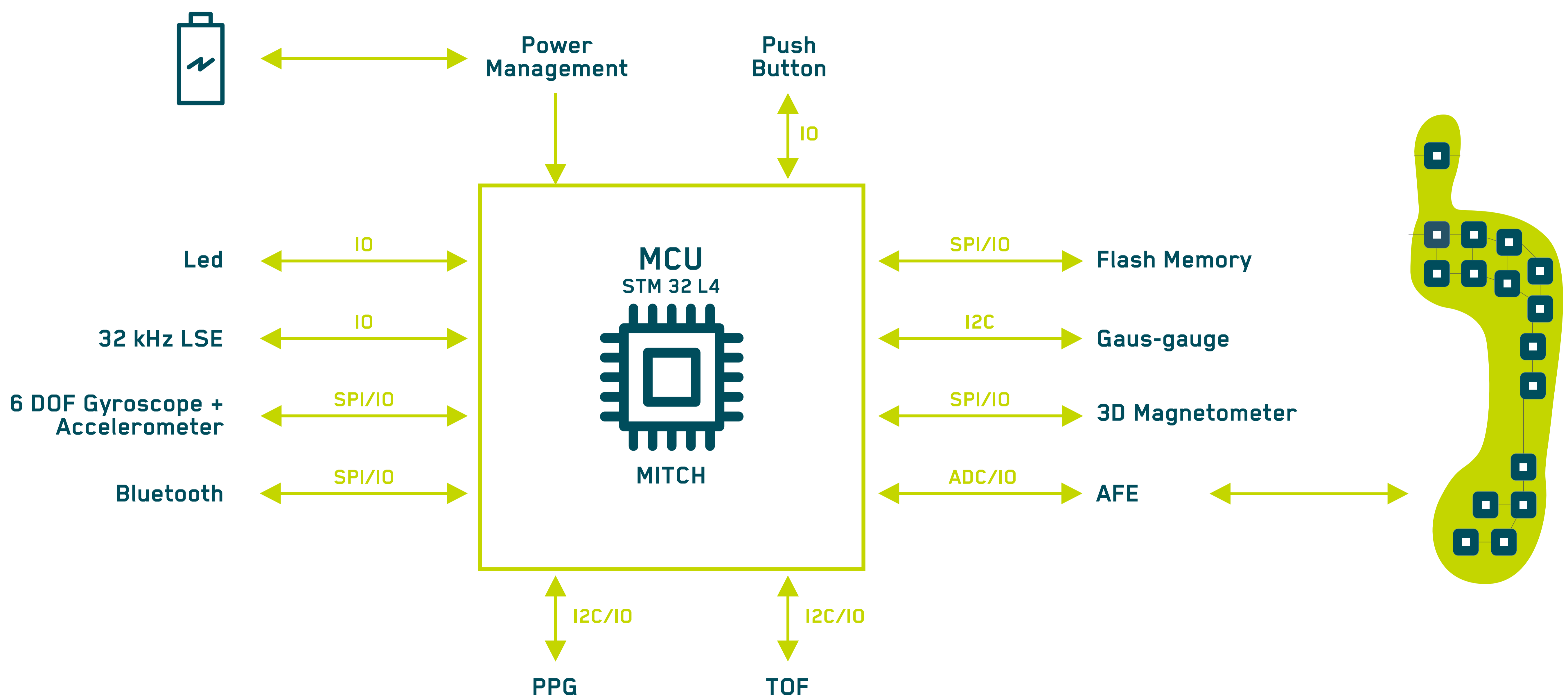
System Summary

- Inertial (accelerations/angular rate) data sampling up to 1600 Hz.
- Magnetic data sampling up to 100 Hz.
- External probe Time-of-Flight (ToF) sampling up to 50 Hz.
- External analog input sampling up to 50 Hz.
- Log of the sampled data into the user data memory up to 1000 Hz
- Bluetooth streaming of the sampled data up to 50 Hz.
- USB streaming of the sampled data up to 50 Hz.
- Battery duration ranging from 6 to 22 hours of continuous operation depending on mode chosen.
- Battery duration up to 16 months in standby.
- System recharge via USB connector. Time to full charge below 2 hrs.

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∞ Block Diagram



∞ Ordering Information

Product number	Description
221e-A3b4v02	Multipurpose Inertial Chameleon
221e-C3b1v02	YETI - FSR Insole Pressure Sensor 16 pads (Add-on)
221e-B3b1v01	TOF - Time of Flight Distance Sensor (Add-on)
221e-B3b2v01	PPG - Optical Heart Rate & SpO2 Sensor (Add-on)

∞ Contact Information

For the latest specifications, additional product information, worldwide sales, and distribution locations, as well as information about 221e:

• *Web:* www.221e.com

• *Email:* info@221e.com

• *For technical questions* support@221e.com

∞ Certification

Mitch is CE certified. CE conformity corresponds to the device being in compliance with the following European directives: ElectroMagnetic Compatibility (Directive 2014/30/EU), Radio Equipment Directive (Directive 2014/53/EU) and Safety (Low Voltage Directive 2014/35/EU). Standard compliance: EN 62368-1:2014 + A11:2017 + AC:2017; EN 62479:2010; ETSI EN 300 328 v2.2.2; EN 61000-6-3:2007 + A1:2011 + AC:2012; EN 61000-6-1:2019; ETSI EN 301 489-17 v3.2.2 draft; ETSI EN 301 489-1 v2.2.3, IEC 62133, ROHS. Bluetooth qualified module: CE, FCC, IC, TELEC certified.

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∞ System Specifications

Microcontroller

Core	→	Arm® Cortex®-M4
Frequency	→	Up to 80 MHz

Data Rate

Memory Log	→	25 / 50 / 100 / 200 / 500 / 1000 Hz
Ble Streaming	→	5 / 10 / 25 / 50 Hz

Communication Interface

Wired	→	USB 2.0, micro-USB connector
Wireless	→	Bluetooth Low Energy v4.2

Data Storage

Data Memory	→	1 Gbit
Memory Type	→	NAND Flash

Expansion Interface

Expansion Port	→	1x SPI BUS 1x I²C BUS 1x UART Up to 6x GPIOs
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User Interaction

Visual	→	Red, Green and Blue LEDs
Touch	→	Programmable Push Button
Sync	→	Synchronization pin on USB port

Embedded Software Libraries

MPE - Motion Processing Engine

MPE library enables IMU sensor fusion algorithm to estimate device orientation based on the input of linear accelerations (3-axis accelerometer) and angular velocities (3-axis gyroscope). Orientation is provided in quaternion form and it is referred to the earth gravity reference frame. The library includes logics and procedures for offset calibration of sensors, and the tuning of the internal Kalman filter.

NeuraSense

NeuraSense is a set of intelligent sensing libraries optimized for the edge. It provides real-time inertial sensor data analytics for activity tracking, man down detection, vehicle monitoring and vibration analysis.

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Sensors - Raw Data

Inertial Sensor	
ACCELEROMETER	
Measurement range	±2 / ±4 / ±8 / ±16 g
Sensitivity	0.061 / 0.122 / 0.244 / 0.488 mg/LSB
ODR	max 1600 Hz
GYROSCOPE	
Measurement range	±125 / ±250 / ±500 / ±1000 / ±2000 g
Sensitivity	4.375 / 8.75 / 17.5 / 35 / 70 mdps/LSB
ODR	max 1600 Hz
MAGNETOMETER	
Measurement range	±50 G
Sensitivity	1.5 mG/LSB
ODR	max 100 Hz

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Electrical Specification

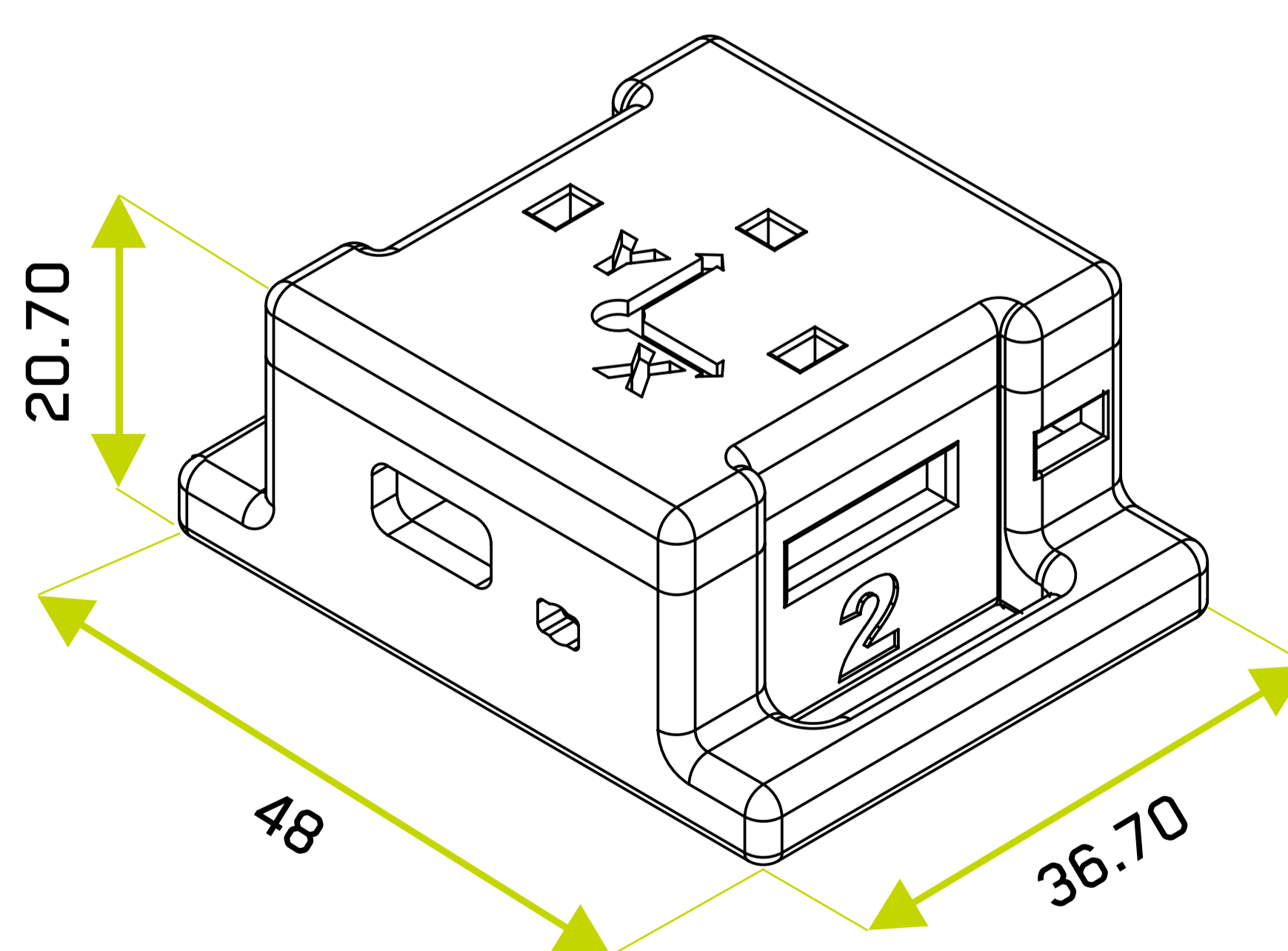
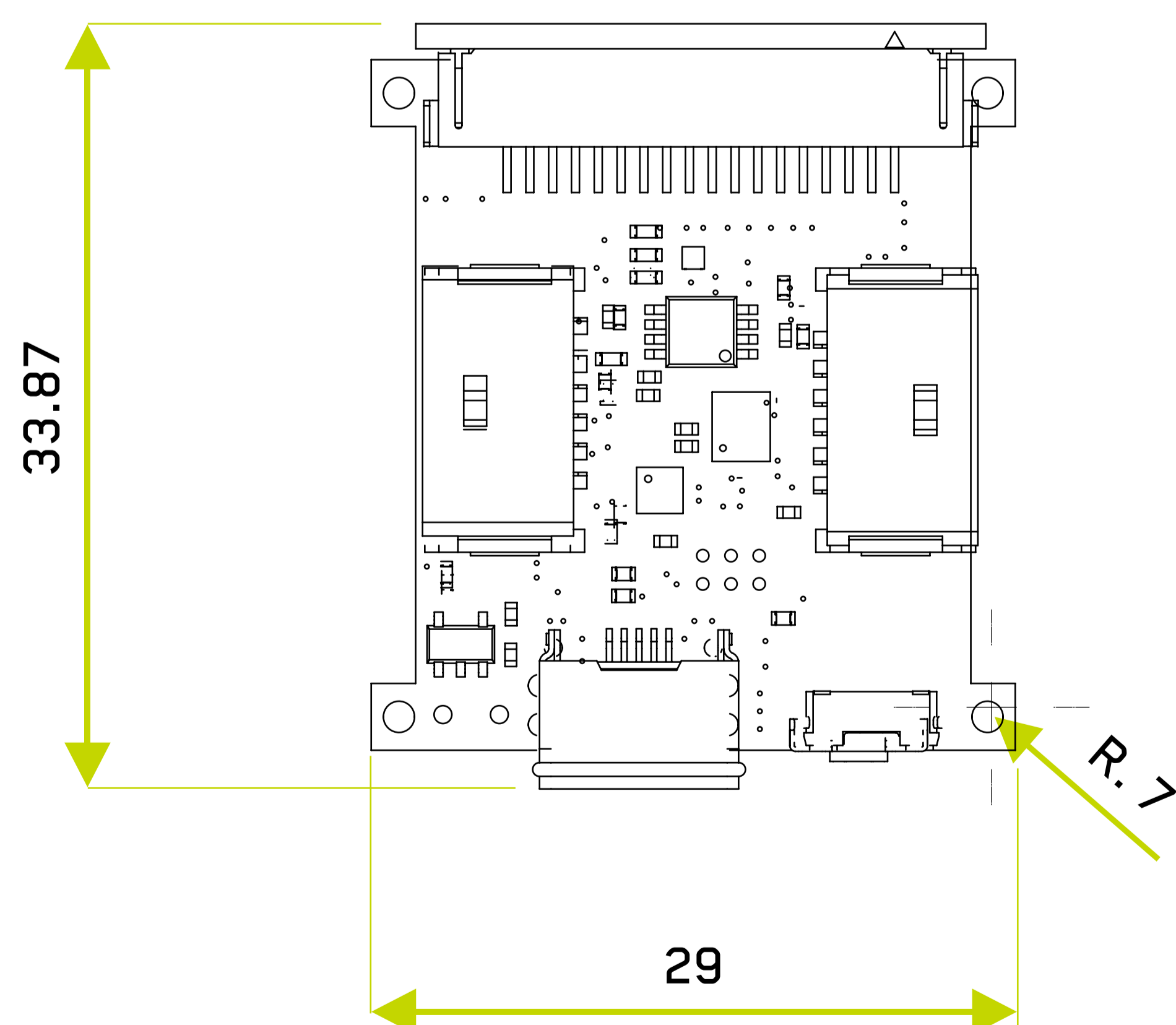
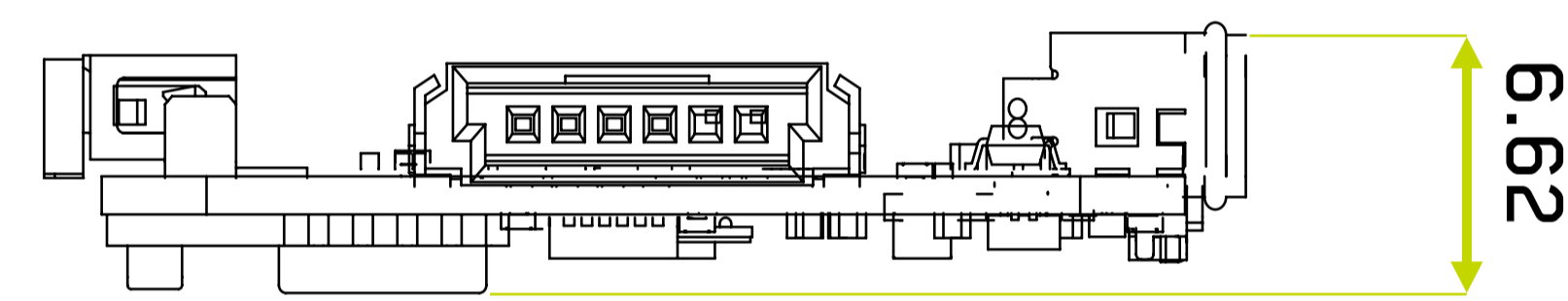
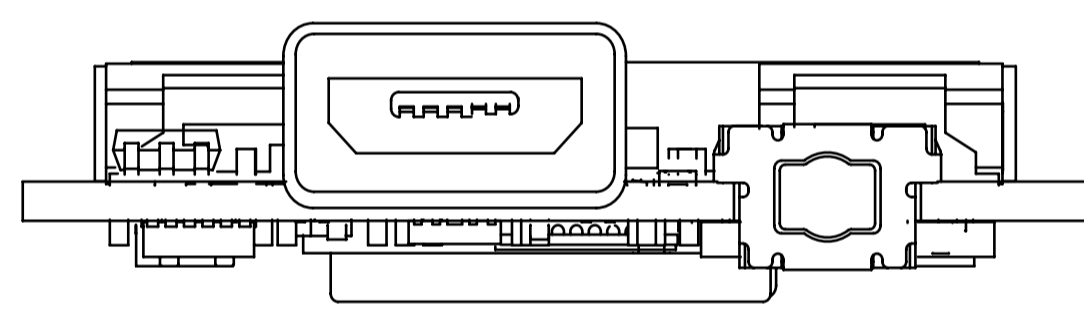
Power Supply	
BATTERY (LI-ION BATTERY)	
Core voltage	3.3 V - 4.2 V
Capacity	155 mAh
Full charge time	1.5 hr
USB	
Core voltage	5 V
Absolute Maximum Rating	
Rated voltage	5 V
Protection Circuit	
Cell protection	Over-charge, Over-discharge, Over-current detection
Input protection	Over-voltage, Reverse-voltage detection
Power Consumption	
Standby	13 μ A (up to 16 months of battery)
Log/Streaming inertial data	up to 5 mA (up to 31 hrs of battery)
Log/Streaming all data	up to 25 mA (up to 6 hrs of battery)
Temperature Range	
Minimum / Maximum	-20°C - 60 °C

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Mechanical Specification

Mechanical Dimension	
Board	29 W x 31 L x 6.7 H mm
Housing	48 W x 36.70 L x 20.70 H mm
Weight	
Board	2 gr
Housing	14 gr
Case	
Material	PLA
IP Rating	IP30



All dimension in mm.

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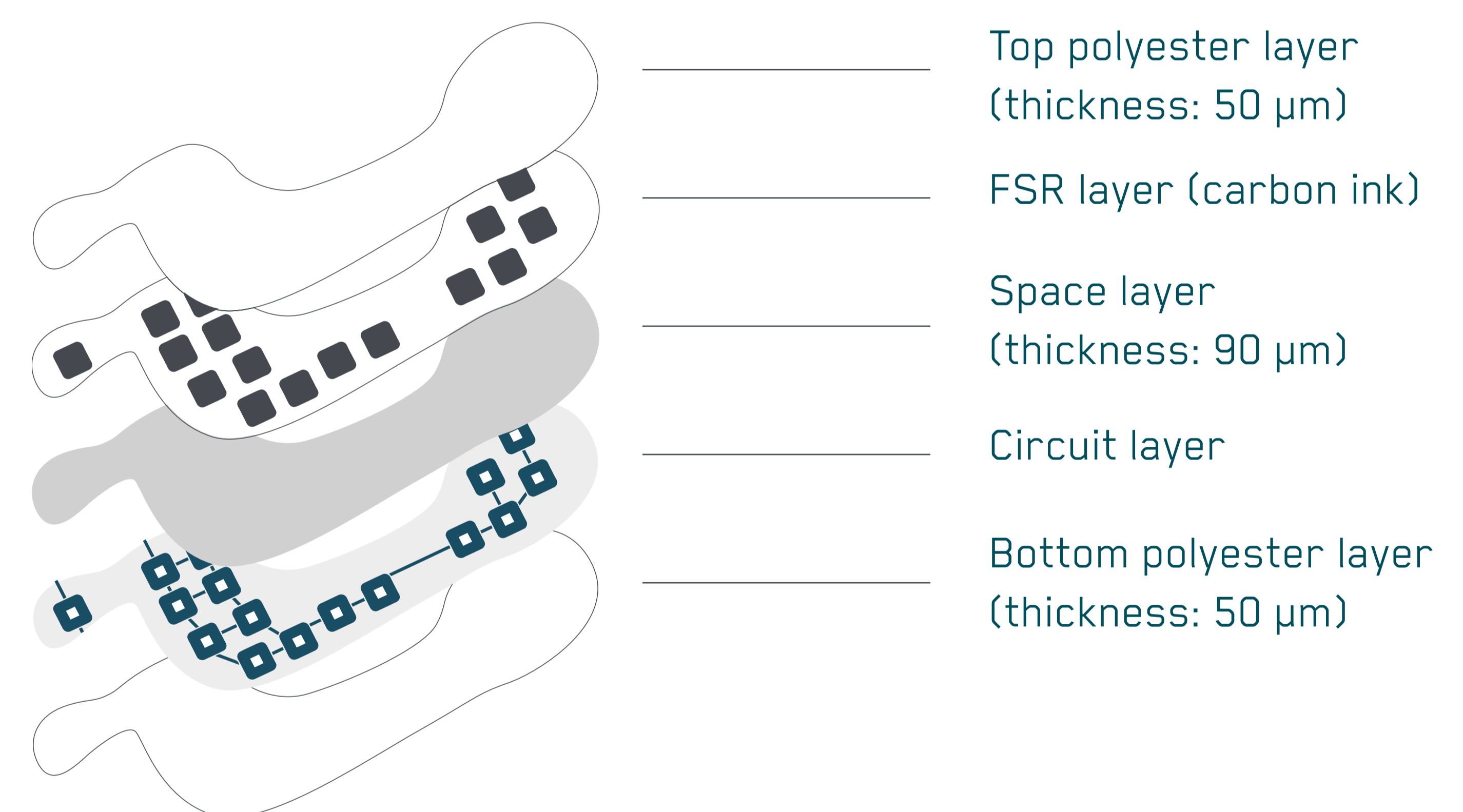
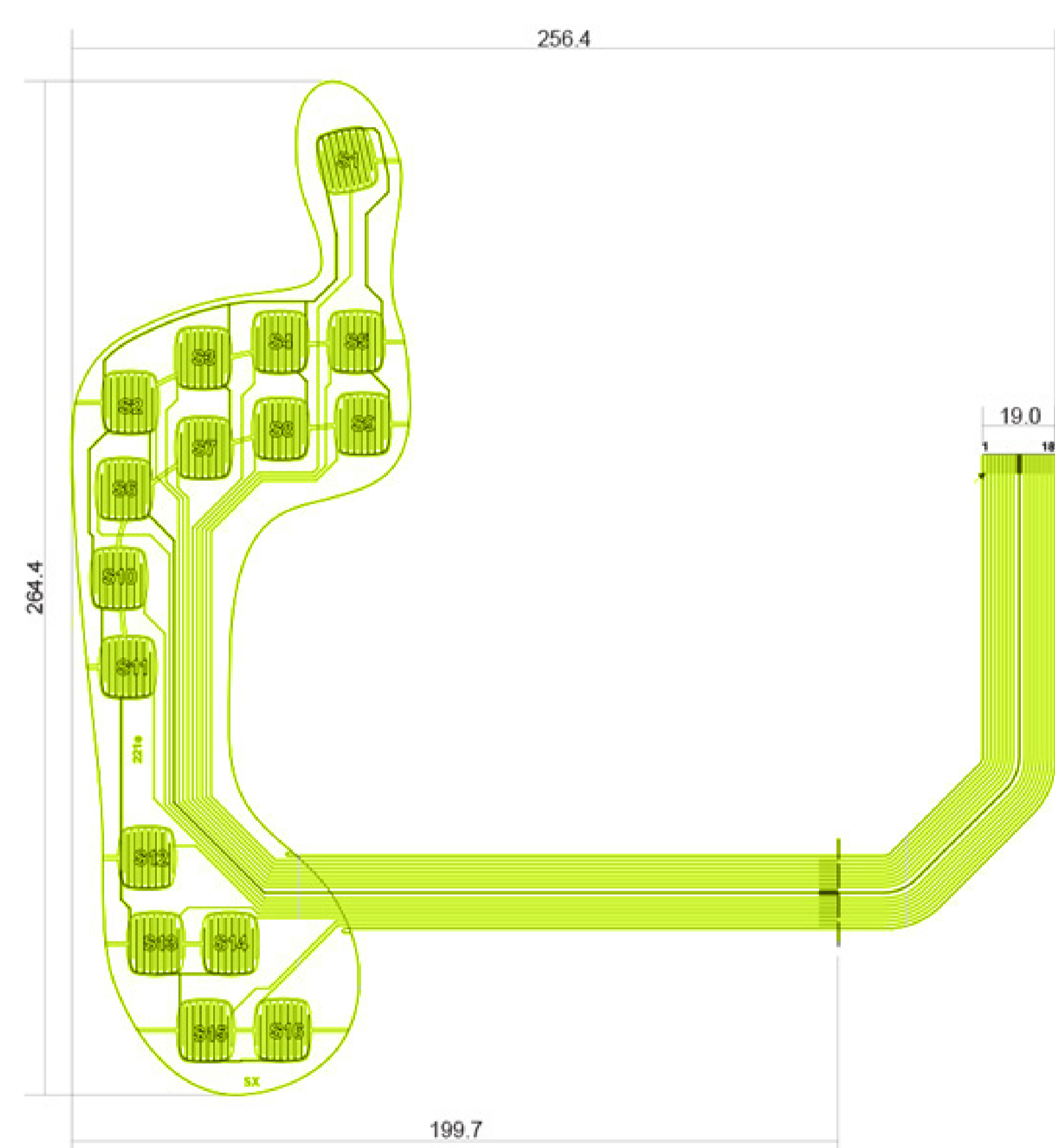
Addon Code: C3b1v02

∞ Add-on / YETI

Sensor Description

YETI is a membrane sensor for Gait Analysis designed to be a plug and play with MITCH system. It can be used for foot pressure points measurement by healthcare professionals, trainers, biomedical engineers, scientists and researchers. YETI detects and measures contact, touch, force and rate of change of an applied load. This in-shoe sensor behaves like a Force Sensing Resistor(FSR), exhibiting a resistance value inversely proportional to the amount of force applied. As the applied pressure increases, the equivalent resistance of the sensor decreases. YETI sensors are manufactured as a sandwich construction of a polyester sheet and conductive ink, for a total thickness of 240 µm. YETI features 16 measurement points carefully placed to maximize the amount of information usefull for gait and pressure mapping research. The sensor can flex and the interconnection flat cable is optimized to follow the ergonomics of the foot.

FSR Technology



Available Sizes: From 36-37 to 46-47

Technical Specification

Force-sensing resistors (FSR) pressure membrane	
Operating Temperature	-20 °C - +50 °C
Substrate	Polyester
Overall membrane thickness	240 µm
Pads' dimensions	H 16.67 mm - W 15 mm
Overall sensing area	40 cm ²
TYPICAL PERFORMANCE	
Linearity (typical)	±10 %
Repeatability (typical)	±3 %

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Faqs & Further Informations

Q:What is the duration of the user memory? For how long can I save data?

A: The internal memory dedicated to data is 1Gbit. The duration depends on the frequency of data sampling and the number of sensors sampled; a very rough estimate of the memory duration can be computed using the following equation:

$$D = \frac{1.542 \cdot 10^3}{F_s}$$

Where D is the memory duration in hours and F_s is the selected log frequency. Keep in mind that for very low sampling frequencies, it is likely that the battery will run out before the memory.

Q:Can I log and stream data at the same time?

A: No, log and stream are two different modes of the device, which is capable of handling them one at a time.

Q:How can I control the system?

A: The system can be configured and controlled via Bluetooth commands; we provide a software to seamlessly interface with the system, implementing all the functionalities in a more intuitive way. To avoid using the software on the field, a pre-configured log mode can be started with a press of the button; Bluetooth commands or the use of the software is still needed to configure this mode the first time around.

Q:How can I recharge the system?

A: You can recharge the system battery by connecting it via a standard USB cable. A full system charge will take less than 2 hours.

Q:How can I save power when I'm not using the system?

A: The system, if not connected via Bluetooth, will automatically enter standby after 30 seconds of inactivity. You can force the standby mode by pressing the button for a duration between 2 and 5 seconds. The system can be removed from the standby mode with the same button press.

Q:How long is the Bluetooth connection range?

A: The Bluetooth range greatly depends on the obstacles between the system and the host (usually a smartphone), but can reach a maximum of 30 meters. Metal objects or peoples in between the system and the host can lead to a reduction in this figure.

Q:What happens if the system runs out of memory or battery during a log?

A: If the system runs out of memory during a log, the log will be automatically terminated and the file will be available for download up to the point of interruption. If the system runs out of battery during a log, when the system is recharged, it will attempt to recover the last file: if the recovery is successful, the file will be available for download up to the point of interruption.