

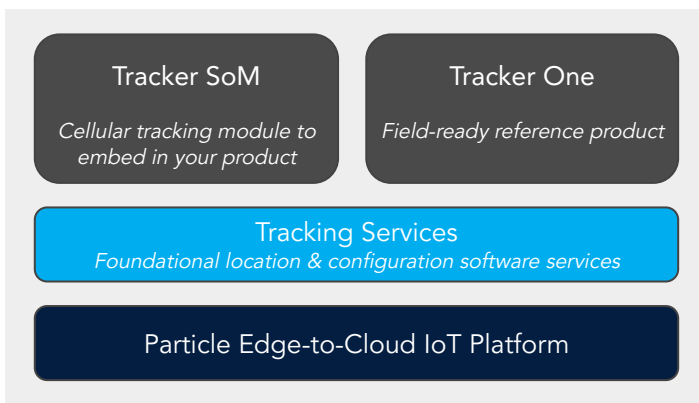
# Particle Tracking System

*Intelligent, configurable, and extensible IoT-enabled asset tracking*

In 2020, asset tracking is critical for both emerging and established industries who need real-time visibility into the state and location of their physical operations, including supply chain & logistics providers, cold chain operations, micromobility businesses such as connected scooter & eBike vendors, transportation, and general purpose high-value capital asset tracking and monitoring.

The Asset Tracking industry has historically been filled with basic “off-the-shelf” trackers with capabilities limited to location tracking and mapping. Next-generation intelligent tracking systems (either sold as “off-the-shelf” products or as technology to be embedded inside other products) allow companies to deploy more intelligent tracking systems with a wider range of both software and hardware capabilities to support more complex industry-specific use cases.

Built on the Particle Edge-to-Cloud IoT platform spanning integrated hardware, edge software, connectivity, and cloud-based management software, Particle’s Tracking System empowers customers to integrate real-time location of critical assets with other sensor data and control systems. Particle’s Tracker SoM and Tracker One can be modified, reconfigured, and reprogrammed to suit the needs of every customer, achieving the customizability of DIY systems with the speed of deployment of “off the shelf” products.



*The Particle Tracking System*

## Particle Tracking Services: The Foundation

Particle’s Tracking Services provide foundational services including open source asset tracking firmware, device management and configuration capabilities, mapping and location services, remote “over-the-air” update functionality, as well as reporting and integration management.

Track critical asset data including real-time location and temperature, historical location and temperature, battery level, and more. All data is encrypted to ensure security and GDPR compliance.

## Tracker SoM: The Heart of Your Tracking Technology

Tracker SoM is a powerful, configurable, and extensible IoT System-on-Module (SoM) that builds on Particle’s Tracking Services foundation and provides a powerful MCU, GNSS with 1.8m CEP\_50 accuracy, and advanced peripherals in a compact form factor.

Tracker SoM serves as an accelerated starting point to organizations that require a tailored tracking solution for sophisticated applications as well as a fully-certified foundation for original equipment manufacturers developing commercial products.

## Tracker One: Field-Ready Reference Product

Utilizing Particle Tracking Services and the Tracker SoM as a foundation, Tracker One is a fully-functional and field-ready tracker solution. Tracker One is fully certified, immediately deployable, and requires no additional development.

Tracker One’s hardware design and firmware are open source and can be customized to suit your unique needs or act as a reference design for a fully custom product designed by either your engineering team or by Particle Studios, our in-house development team.

## Reliable and Accurate Location Data

The onboard high-gain GNSS antenna with onboard dead-reckoning is accurate to 1.8 meters and is ready for worldwide operations with two pin-compatible versions: one for North America and one for EMEA (Europe, the Middle East, Africa, and Asia).

## Built on the Particle Edge-to-Cloud IoT Platform

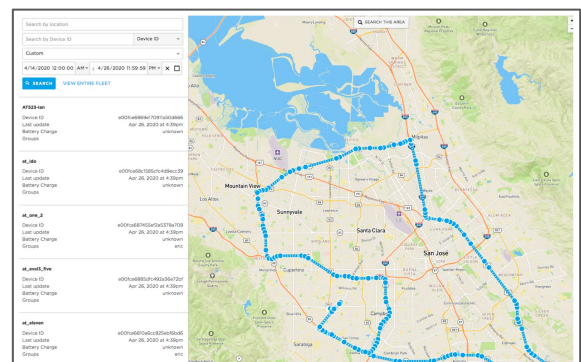
Particle’s Tracking System inherits the benefits of the Particle edge-to-cloud IoT Platform, an “all-in-one” solution spanning edge hardware, edge software (firmware), cellular connectivity, and cloud-based management software. Particle powers thousands of IoT products across a wide range of use cases with its flexible, reliable, scalable, and secure end-to-end platform.

## Configurable for Your Needs; No Ph.D Required

Particle’s configurable Open Asset Tracker Library, in combination with its configuration cloud service, means that the Tracker SoM and Tracker One can be reconfigured without writing code, empowering you to add your own sensors and report that data along with location data. Optimize the tracking system for your use case and balance critical monitoring insights with power and data consumption by configuring data publishing rates and triggers, wake on motion detection via the onboard IMU, crash detection, and customizable threshold publishing - all via the Particle Console.

## Rapid Deployment or a Custom Solution? Yes.

Launch your asset tracking capabilities today with Tracker One while developing a custom tracking solution built on the same reference design, Tracking Services and the Tracker SoM to satisfy the precise needs of your use case. Want us to customize for you? Contact our sales team for more information on Particle Studios.



*Particle Tracking Services provides an interface to monitor asset location & status, configure hardware, manage remote over-the-air updates, generate reports, & more.*

# Technical Specifications

## Asset Tracking SoM

- Highly-reliable cellular connectivity with LTE CAT M1 connectivity in North America via the Quectel BG96 and LTE CAT 1 with 3G and 2G fallback in EMEA via the Quectel EG91-X
- Power efficient connectivity with LTE CAT 1 offering a 50% improvement as compared to 3G while LTE CAT M1 offers even more power savings through Power Save Mode and eDRX
- GNSS provided by u-blox eo M8U with onboard dead-reckoning for up to 1.8m CEP50 GPS accuracy
- Wi-Fi location via onboard ESP32 with SSID scanning for third-party Wi-Fi location services
- Powerful and efficient MCU: Nordic Semiconductor nRF52840 SoC ARM Cortex-M4F 32-bit processor @64MHz with 1MB flash, 256KB RAM, and Bluetooth
- 8MB additional Flash with a Posix file system with full wear-leveling and power-safety for user storage, location logging, and backup
- PMIC & Fuel Gauge: integrated power management, LiPo charger, and battery connector
- Onboard, integrated CAN Bus controller and transceiver for fleet management and micromobility applications
- I/O Expander: 1 x SPI, 1 x I2C, 1 x UART, and up to 6 x GPIO available
- GNSS clock and battery-backed RTC clock
- Integrated Watch-Dog Timer for whole system reset should a user application require it
- Castellated form factor for ease of manufacturing and reliability
- Multi-Purpose Indicator LED
- Multi-Purpose Button

## Asset Tracking Carrier Board

- Accelerate your Asset-Tracking Implementation: ready-to-go carrier board for the Particle Asset Tracker soM
- GNSS Antenna Onboard: convenient high-gain GNSS antenna for easy access to GNSS signals
- Flexible Power Supply: easily add your asset tracker to most devices. 4.5-105V power supply copes with most power delivery systems. Also accepts 5V supply via USB-C. switched LiPo battery connector, charge LED, backup battery for GPS and battery-backed, RTC
- High-precision Thermistor: with accuracy to 1%
- Extensible: IP67-rated M8 connector includes CAN Bus, UART, GPIO, and power for simple expansion
- USB-C: for flashing, debugging and power with higher charging rates than micro-USB or for use without an internal battery
- RGB LED: for use as both a user-configurable device as well as Particle status information
- Backup Battery: for RTC and GNSS

## Asset Tracking Firmware

- Open Asset Tracker Library: complete, ready-to-use asset-tracking application enables rapid implementation and time to market
- Extensible: modular implementation with user hooks means that it is easy to add your sensors to the application and report that data along with location data
- Configurable: publish is configurable by Particle console
- GNSS parsing and uBlox control: utilizing the TinyGPS++ parser for NMEA messages and utilizes a Particle designed module for configuring u-blox GNSS
- High-Performance IMU: offers wake-on-motion so device can be asleep and wake when necessary, saving power
- Point Publish with Multiple Triggers: capable of being triggered by time, radius from previous point or the IMU (high-G (crash detection))
- Storage Location with Backfill : 8MB flash with a managed queue for offline location and data store with publish backfill
- CAN Bus Library: general-purpose CAN Bus library available for vehicle, fleet, and micro mobility purposes

## Asset Tracking Device OS

- Cellular: Highly reliable LTE CAT M1 (NA) (Quectel BG96), LTE CAT 1 with 3G, 2G fallback (EMEA)(Quectel EG91-EX). Automatic connection with rapid provisioning, secure by default
- Particle Primitives: All the usual Particle primitives, publish, subscribe, variable functions, vitals extended for location services.
- Multithreading: Device OS is being extended to provide more complete threading support, initially at the HAL layer but eventually at the Wiring layer too
- Posix File System Support: with full wear-leveling and power-safety for user storage, location logging and backup
- Persistent Takeover of Particle LED: enabling user control on a persistent basis
- RTC Support: real-time clock support enabling system synchronization
- I/O Expander support: on-board I/O expander is fully supported by Device OS so that device communication is transparent

## Tracker Services Cloud-Based Management Software

- Location Service: the Particle console offers snapshot and historical location viewing. This includes location, battery, IMU, and temperature data. Locations can be filtered by group or devices characteristics. Available via download (Sep 2020)
- Data Storage: location data is stored in the Particle cloud for analysis, reporting and retention
- Publish Configuration: publish rates and triggers can be configured from the Particle console by product or device
- Configuration on Wakeup: the asset tracker can go to sleep and be configured from settings created in the console on wakeup
- Sleep Configuration: deep sleep can be enabled or disabled. Sleep on low battery
- Configurable Crash Detection: wake on IMU, crash and threshold publishing may be configured
- Secure Database Storage: all data is stored encrypted to ensure GDPR compliance
- Particle API: is extended to provide the location and configuration services described above
- Mapbox: the asset tracker location services utilizes the highly scalable Mapbox platform for visualization, geolocation and other map-related services

## TrackerOne: Field-Ready Asset Tracking Reference Product

- Accelerate your Asset-Tracking Implementation: complete enclosed, IP67 rated, asset tracker for immediate use
- Convenient: includes the Asset Tracker SoM mounted on carrier board and installed in an IP67-rated enclosure
- Extensible: IP67-rated M8 connector includes CAN Bus, UART, GPIO, and power for simple expansion
- Flexible Power Supply: accepts 4.5-30V power supply (105V may be used if connecting power direct to the carrier board without using the M8 connector). Also accepts 5V supply via USB-C. Switched LiPo battery connector, charge LED, backup battery for GPS and RTC
- High-precision Thermistor: with accuracy to 1%
- USB-C: for flashing, debugging and power with higher charging rates than micro-USB
- RGB LED: for use as both a user-configurable device as well as Particle status information
- Backup Battery: for RTC and GNSS

## Why Particle?

### Intelligent Location Services

The location service provides an API to receive location (and in a future release, customizable user data).

Location data is stored in the Particle cloud for analysis, reporting and retention. All data is stored encrypted in a separate database for security and GDPR compliance.

### Edge-to-Cloud IoT Solution

Full edge-to-cloud tracking solution spanning edge hardware, firmware, connectivity, and cloud software.

### Flexible Configuration Services

Publish rates and triggers can be configured by product or device. Sleep modes can be configured. Deep sleep can be enabled or disabled. Sleep on low battery.

The IMU can be configured to cause wake on IMU events, high-G (crash) detection and thresholds may be set.

### No. 1 Ranked Customer Experience

Number one ranked IoT vendor in customer satisfaction (IDC Marketscape: Worldwide IoT Platforms, 2018 Vendor Assessment).

### Open, Extensible, & Configurable Firmware

The firmware provides a reference application for tracking and integrates with Particle cloud location and configuration services. The firmware provides GNSS control, parsing of GNSS messages and publishing of location data. Publish triggers include time, radius from a point or the IMU. The firmware accepts control messages from Particle configuration service, varying publish frequency and setting publish triggers.

### Developer Friendly

Active community with extensive resources and over 200,000 engineers building on Particle.