Ommo ORBIT Creates Revolutionizing Sensor User Manual

ORBIT

Product Manual

System Overview

Scope

- The Orbit Base Station is the only certified component referenced in this product manual; however, base station product functionality cannot be described without considering other system components.
- All sensors, SIUs, receivers and other Ommo Devices described in this document are pre-production, pre-certification prototype units.
- Certified Sensors & SIUs are forthcoming and will come with their own updated product manual.

Introduction

- **ORBIT** is a permanent magnet-based 3D tracking system that outputs 6 degrees-of-freedom information (position & orientation) for each sensor device within its tracking volume, with submillimeter precision and accuracy
- The sensor devices can be embedded in tools of various form factors using our standard hardware or in a custom hardware design, using our reference designs and guidelines.
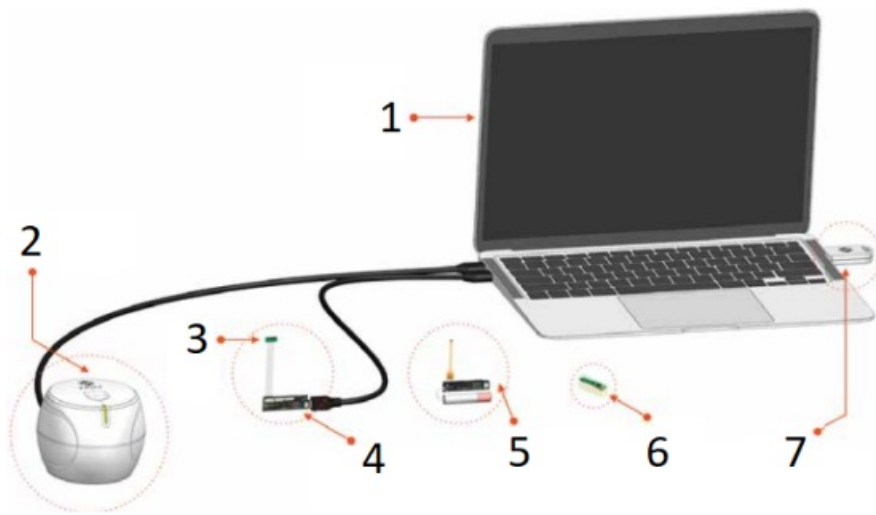
1. (3) DPU
2. (1) Base Station
3. (2) Wired Sensor Device
4. (4) Wired SIU
5. (4) Wireless SIU
6. (2) Wireless Sensor Device
7. (5) Wireless Receiver

Note: Refer to the next page for the definition of products shown above

Definition

1. **BASE STATION** is an unique magnetic signal source based on Ommo's patented permanent magnet mechanism. It is the origin of tracking coordinate system
2. **SENSOR DEVICE** consists one or more tracking units*
   2-1.**TRACKING UNIT** is a construction where a set of N sensors, such as magnetometer and inertial measurement unit, are coupled to a rigid body. Each tracking unit produces a single, independent 3D point of measurement that corresponds to one computed output
3. **DATA PROCESSING UNIT** (DPU) is a computer that runs Ommo Service process that manages and communicates with hardwares and provides the client API. DPU is supplied by customers
4. **SENSOR-DEVICE INTERFACE UNIT** (SIU) samples, synchronizes, and transmits sensor device data to the data processing unit via wired or wireless connection.
5. **WIRELESS RECEIVER** (dongle) plugs into a DPU and receives wireless data from SIU(s) which are then processed by Ommo Service. One dongle can support multiple wireless SIUs simultaneously and many dongles can be used at a time to further increase the total number of wireless devices

*Currently, all of Ommo's sensor devices have 1 tracking unit. Future products may include flexible sensor devices with multiple tracking units

Note: Refer to the "Product Guide" for more detailed information on the current product offerings at Ommo

Setup

Note: Ommo system runs on Windows 10 and above. For battery-operated computers, ensure that the power cord is plugged in for computing power.

Software

Step 1 | Download the zip file (i.e ommo_eval_sdk.zip) from your google drive folder (Ommo Pilot Software & Documentation > SDK) or directly provided by Ommo

Step 2 | Unzip the file and save it to a directory of your choice. Folder structure should look as shown below
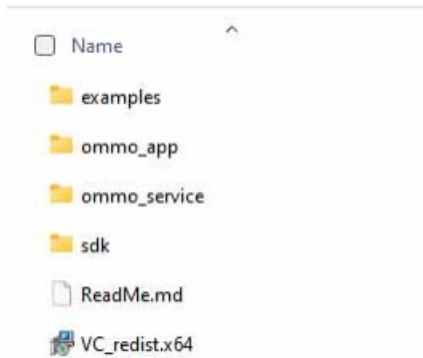
Hardware

Note: Make sure your base station is NOT sitting on ferrous metals and that the tracking space is free from large ferrous objects.

NOTE: Starting with firmware V5004, the LED behavior of the base station and SIU has changed to comply with IEC 60601-1 guideline for indicator lights. The LED behavior is explained <u>here</u>. To check the firmware version, refer to the troubleshooting/FAQ section <u>here</u>

Step 1 | Unbox the kit that includes a base station and a custom USB-C to USB-A cable

Step 2 | Plug USB-C into the **base station** and connect to the **DPU** (computer)

Note: The base station LED will show white with the firmware version starting with V5004 and will show blue with a firmware version before V5004. Refer to to the LED Behavior for the base station here

Step 3 | Connect **sensor device**(s) and **SIU**(s) to **DPU**
– Refer to the respective sensor device and sensor device interface unit (SIU) here

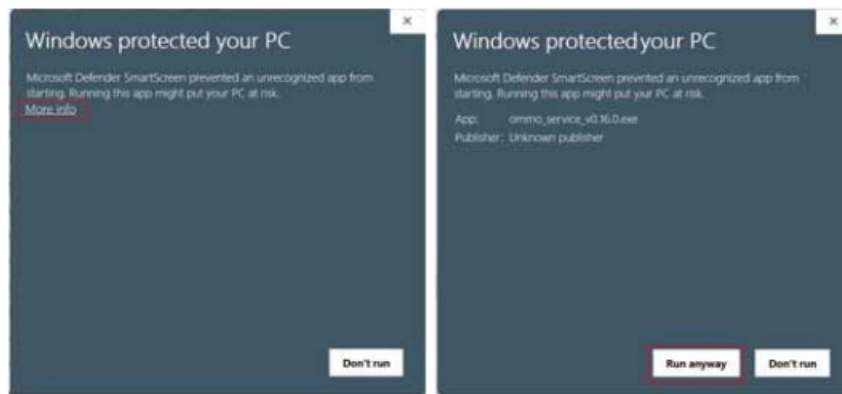**Set up is now complete. Move to the next Section "Operation" to start tracking sensor devices**

Operation

Ommo Service

Step 1 | Navigate to Ommo Service folder inside the SDK folder

Step 2 | Launch "ommo_service" application
– Use latest available version (v0.17.1 or later)
– For the first time use, the following window may pop up. Click "More Info" and "Run Anyway"

– A command window will open. Do not close the window during use

– Ommo Service will open and base station LED will turn green (for ~V5004)/blue (for V5004~) while the unit is starting and being set up
– SIU(s) and base station will stay (for ~V5004)/blue (for V5004~) until data is requested by Ommo App or client app

Note: Refer to to the LED Behavior for base station here

Ommo Service UI

You can check the list of connected and disconnected devices using the Ommo Service UI.

Step 1 | Click on the Ommo icon on the right side of the Window task bar
– If the icon is not shown, click on the arrow button to show the hidden icons

– You can see the status of Ommo Service and connected hardware devices

Step 2 | Click on "Error Details" on the Ommo Service status box to see the details of the warnings/errors on Ommo Service

Step 3 | Click on the box of the running device you want to check. and click on "Error Details" to see the details of the warning/errors on the device
In this example, you can see the detailed information about the SIU. You can also see that there's a sensor

connected on Port 2 of the SIU, with Fusion mode disabled.

**Note: If there's a critical error with the device connected, UI will show "Error" instead of "Running"**
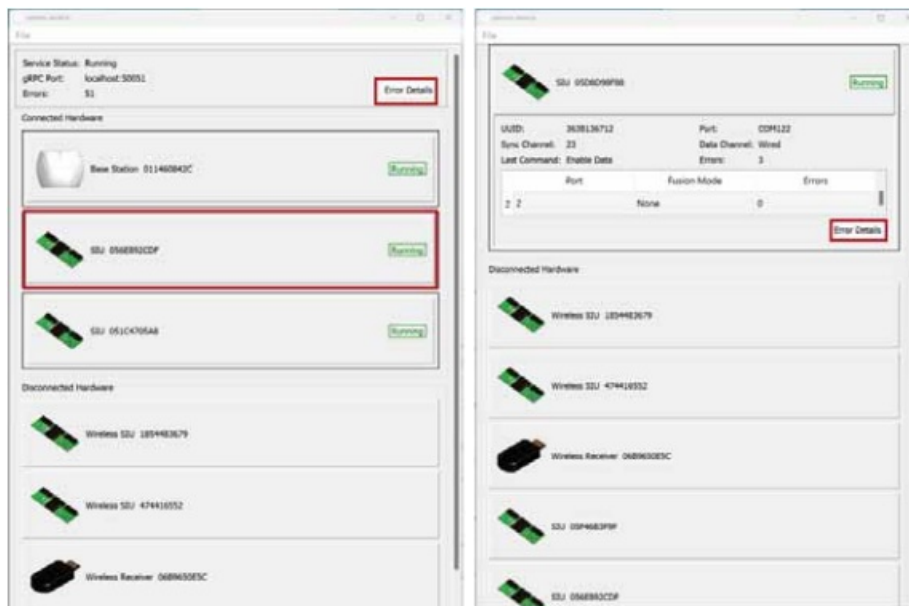
Ommo App

Step 1 | Launch Ommo App
Ommo App is an example application provided to showcase the provided ommo_sdk and to get the user up and running with displaying tracking information from the system. Do not turn off the window command window while Ommo App is running.

Note: For more detailed information on the software, refer to "Ommo App User Guide"

Once Ommo service is running, navigate to the Ommo App folder in the SDK folder and launch "ommoApp"
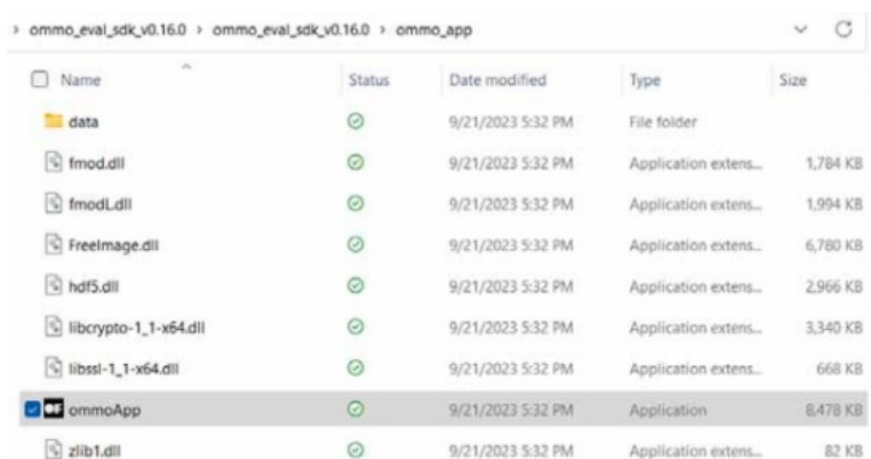
– The SIU LED may flash yellow (~v5004)/flash green (v5004~) while waiting for the base station to set up
– Once the base station has reached its operating speed:

    – the base station LED will turn white(~v5004)/green (v5004~) and start sending data to Ommo Service
    – the SIU LED should turn white(~v5004)/green (v5004) after it connects and will start sending data to Ommo Service
    – This should take less than 15 seconds

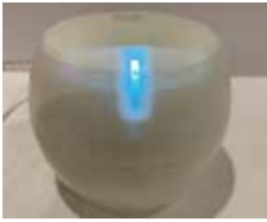**Note: Refer to table for LED Behaviors of Base Station and SIU**

3D Tracking Screen is the first screen you see on Ommo App. This screen displays all connected devices and their associated sensors' real-time position and orientation information. The red line at the top shows the currently selected sensor's information (packet rate, SIU UUID, Port, Sensor #) along with the available tracking and measurement modes.
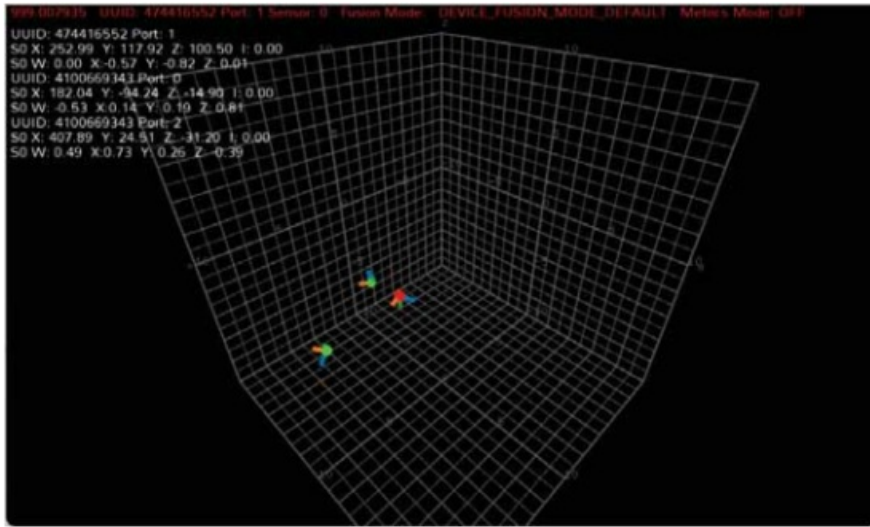
When you are done tracking, close Ommo Service and the base station will stop running and the LED will return to blue (~v5004)/white (v5004~)

NOTE: Starting with Firmware V5004, the LED behavior of the base station and SIU has changed to comply with IEC 60601-1 guideline for indicator lights. For devices with firmware before V5004, refer to pages here. To check the firmware on the device, refer to troubleshooting/FAQ guide here

Base Station LED Behavior

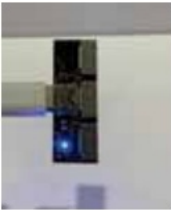| Base Station LED Behavior From V5004		Status
Green Fade		Base station has reached its operation speed and is sending data to Ommo Service
White		Idle Mode Base Station is powered on, magnet not spinning, USB Port Not Open
Dark Blue		Connected Standby Mode Base station is ready to receive commands from software. Base station will stay in this state until sensor device data has been requested by a client from the service (i.e starting Ommo App). If there is no sensor or SIUs attached, Ommo Service will not start the base station.
Purple		Base station has detected a new wireless SIU/sensor device and is working to set the device up.
Orange Flash		Error Unrecoverable firmware error/hardware fault Refer to Troubleshooting

NOTE: Pictures below do not fully capture the color of the LED. Colors look more vibrant and true to the colors listed.

SIU LED Behavior

SIU LED Firmware From V5004		Status
Green Fade		SIU is operating normally and sending data Wired SIU: LED turns from Solid Green to Green Fade. Wireless SIU: Green Fade.
White		Idle Mode SIU is powered on. Connection to base station lost/no base station found
Dark Blue		SIU is connected to Ommo Service via a wired connection and the port is opened. No data transmission at this stage (No sensors attached and set up cannot be completed; data has not been requested by Ommo App/client)
Purple		Wireless communication mode to base station SIU is setting up a wireless connection with the base station
Green Flash		No synchronization between the base station and SIU/sensor device. (No base station; base station is not running; base station synchronization signal is not received) If SIU is operating in wireless mode, losing synchronization for 0.5s will return SIU to discovery mode (Blue LED)
Orange Flash		Error Unrecoverable firmware error/hardware fault Refer to Troubleshooting

Base Station LED Behavior Prior to V5004	Status
Blue, Fade	Base station is powered on
Green, Fade	Base Station is successfully connected to Ommo Service. Base Station is in idle/set up state. Base station will stay in this state until sensor device data has been requested by a client from the service (i.e starting Ommo App). If there is no sensor or SIUs attached, service will not start the base station.
White, Fade	Base station has reached its operation speed and is sending data to Ommo Service
Yellow, Solid	Base station has detected a new wireless SIU/sensor device and is working to set the device up.
Red, Flash	Error Unrecoverable firmware error/hardware fault Refer to Troubleshooting

SIU LED Firmware Prior to V5004		Status
Blue, Fade		Discovery Mode. Connection to base station lost/no base station found; SIU is powered on and in idle state Wired: port not opened Wireless: wireless discovery to find a base station
Purple, Solid		Wireless communication mode to base station SIU is setting up wireless connection with the base station (corresponding base station LED is yellow)
White		Sending data normally Fade: wireless mode Solid: wired mode
Green, Fade		SIU is connected to Ommo Service via wired connection and port is opened. No data transmission at this stage (No sensors attached and set up cannot be completed; data has not been requested by Ommo App/client)
Yellow, Flash		No synchronization between base station and SIU/sensor device. (No base station; base station is not running; base station synchronization signal is not received) If SIU is operating in wireless mode, losing synchronization for 0.5s will return SIU back to discovery mode (blue LED)
Red, Flash	–	Error Unrecoverable firmware error/hardware fault Refer to Troubleshooting

Connecting Sensor Device and SIU

To understand which page of the guide to follow, refer to the item description included in the packing list.

There are 3 types wire connections offered by Ommo: Micro SD, Mezzanine, and JST.

The item description includes the connection. For example:

MICRO SD CONNECTION: 11528, ASM, MMC5983 **MICRO SD** 6 C WITH SHIELD TPE 1.25M
MEZZANINE CONNECTION: 12042, ASM, MMC5983 **MEZZANINE** WITH 30MM JUMPER CABLE
JST CONNECTION: 11573, ASM, MMC5983 + IMU, 8P **JST** FUSION BOARD
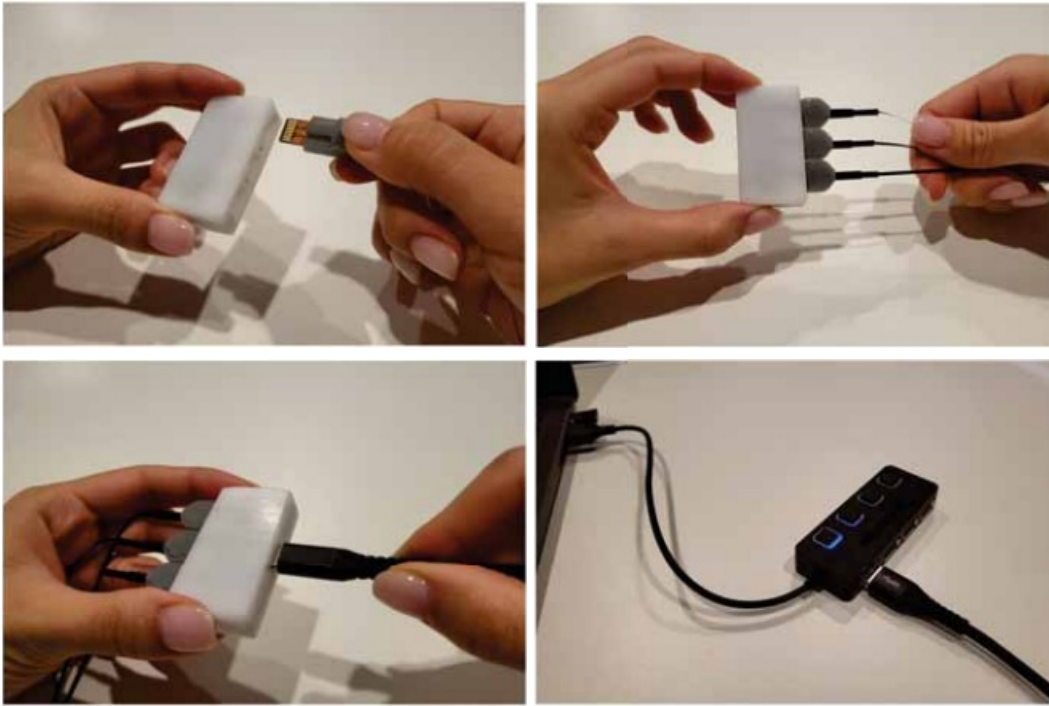
Micro SD Connection Sensors + SIU

– Plug USB-C into the SIU and connect to the DPU
– Plug a Micro SD sensor device into the SIU. Follow the guidance feature (notch) on the sensor plug board for the correct side up (Top right picture)
– Repeat the process to connect multiple sensor devices
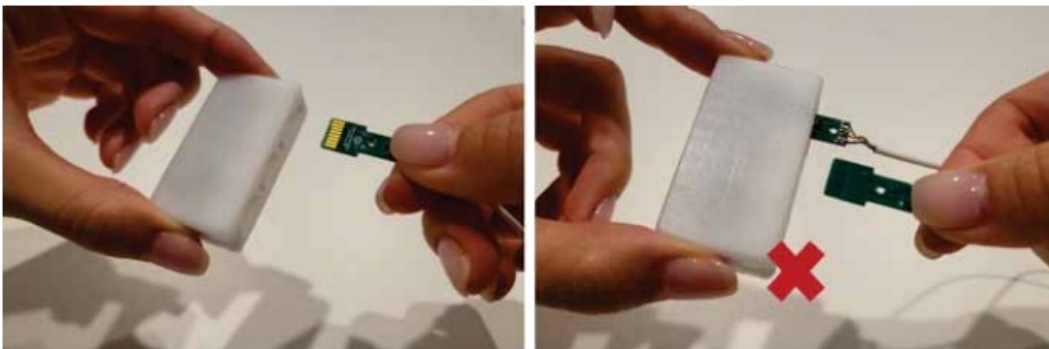
New Micro SD SIU with Universal Plug Interface
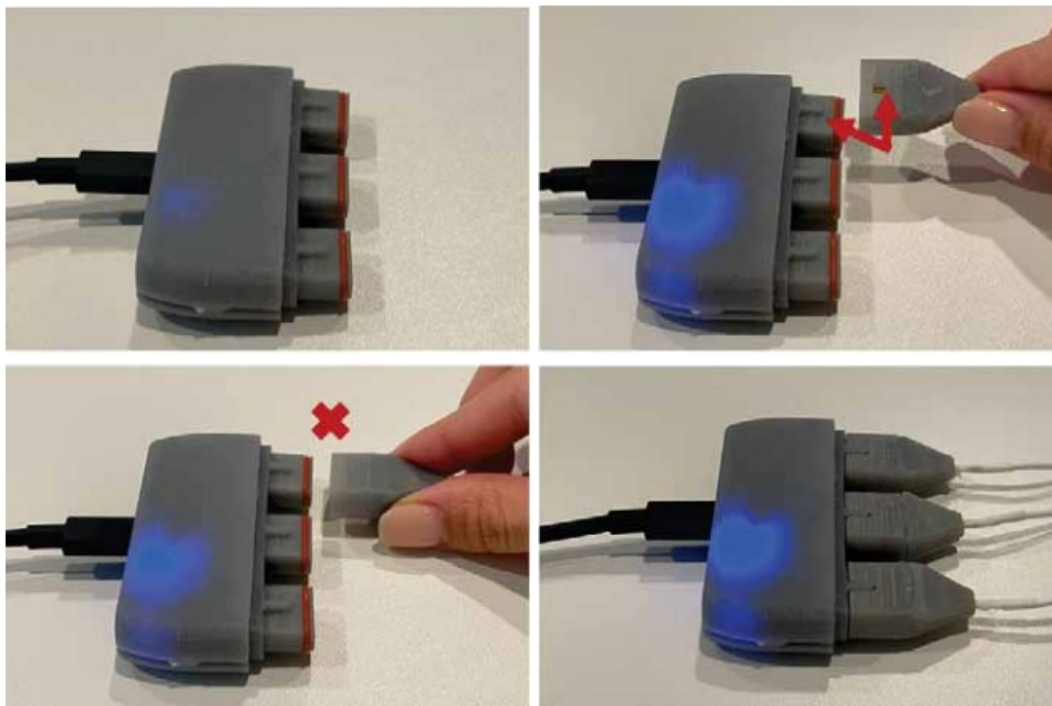
Note: Pictures above shows the device with v5002. For devices with v5004 and higher, LED will show white when plugged in and in idle mode.
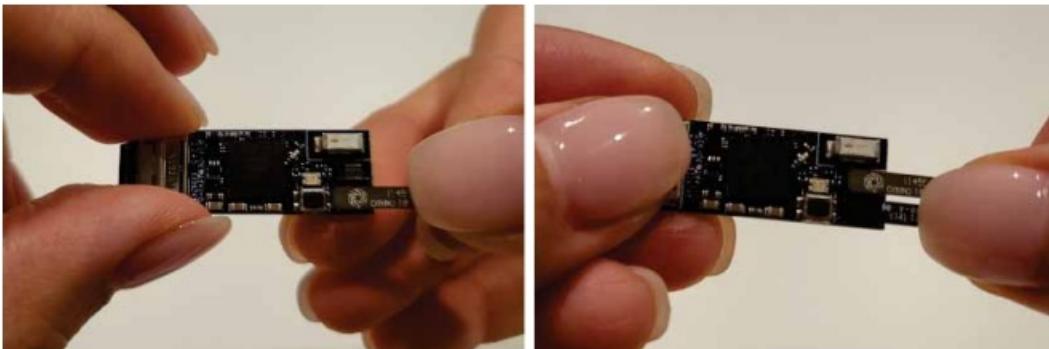
Legacy Micro SD SIU

Note: If the sensor plug board does not have housing, refer to the picture below to ensure the correct side up
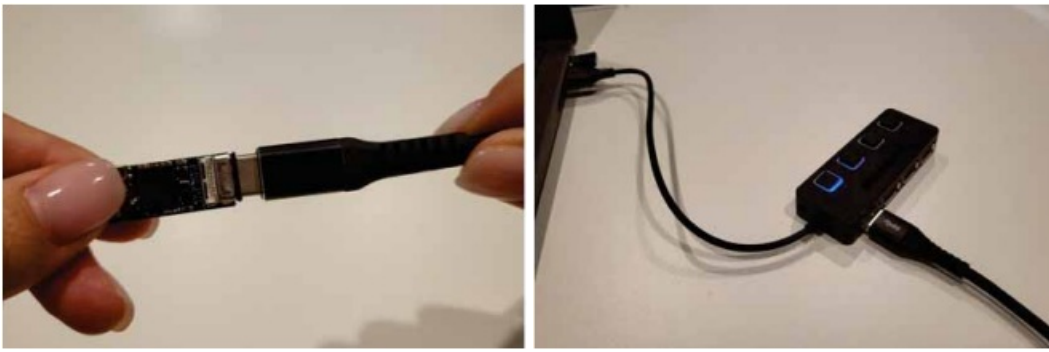

Mezzanine Connection Sensors + SIU

– Plug Mezzanine Sensor into the SIU
– Repeat the process to connect multiple sensor devices (refer to the Product Guide for the number of ports supported)
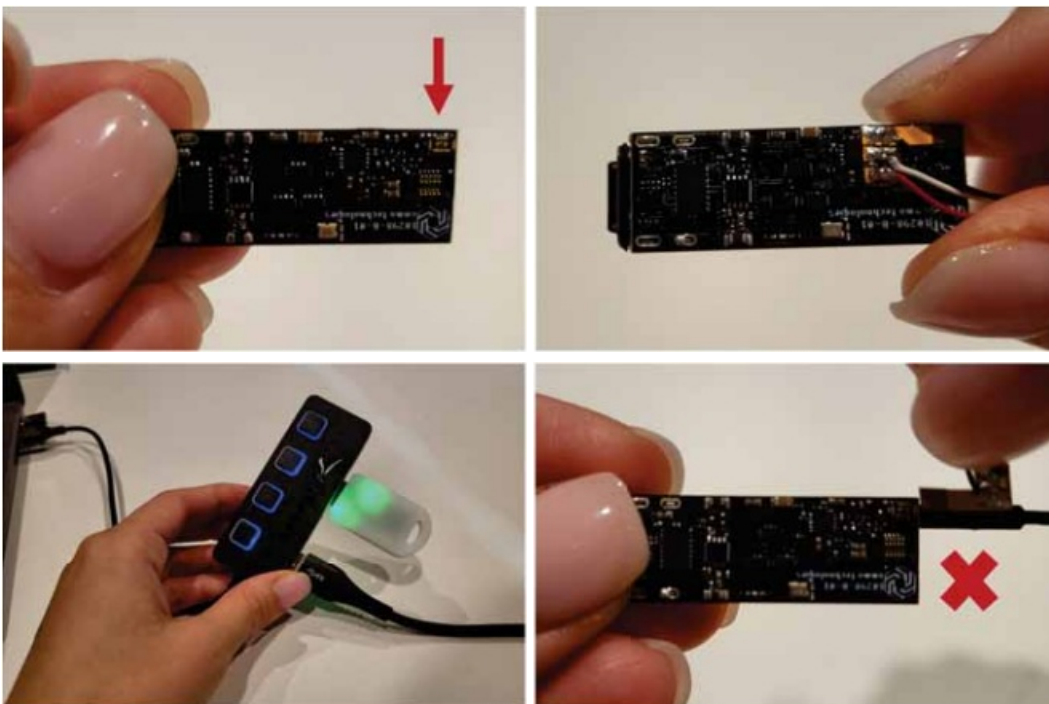

– For **wired connection** to DPU: Plug USB-C into the SIU and connect to the DPU
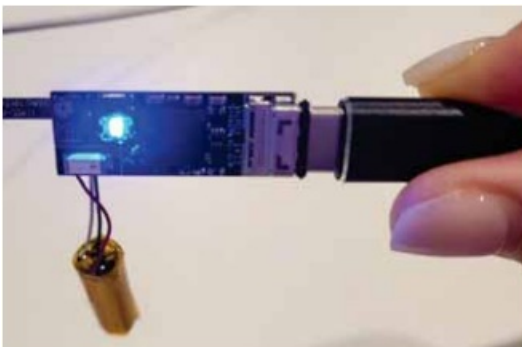
– For **wireless connection** to DPU: plug 10631 battery into the SIU and connect the 10102 Wireless Dongle to the DPU

WARNING: Battery can be plugged in both directions but MUST BE connected as shown in the top right picture. Plugging in the wrong direction can DAMAGE the device.
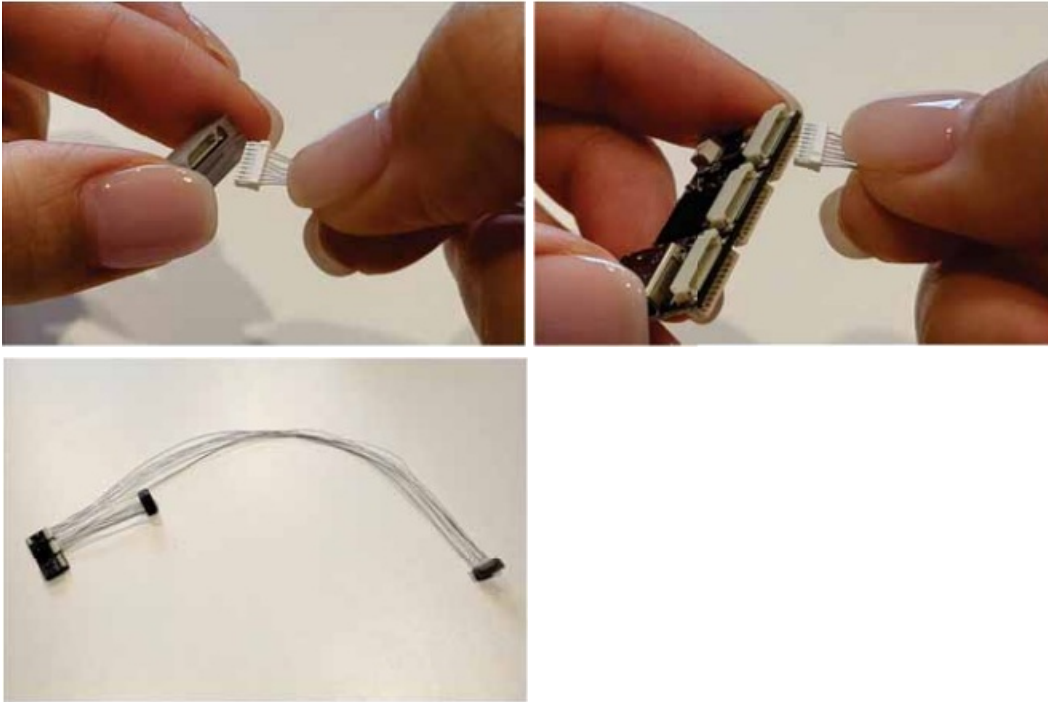

– To **charge the battery**, plug in USB-C while the battery is attached to the SIU. Currently, there's no LED behavior for charging the 10631 battery. LED will remain blue

JST Connection Sensors + SIU (Legacy Product)

– Plug a connection cable into the JST Fusion Sensor Unit

– Plug the other end of cable into the SIU
– Repeat the process to connect multiple sensors to the SIU (up to 6 sensors)

**Note: Ensure that the header is the correct side up as shown in top right**

– For **wired connection** to DPU: plug USB-C into the SIU and connect the USB cable to the DPU
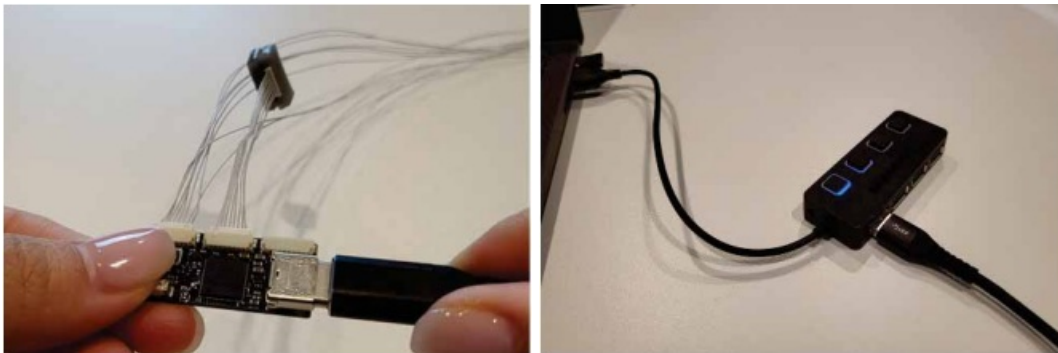
– For **wireless connection** to DPU: plug 10532 battery into the SIU and connect the 10102 Wireless Dongle to the DPU
– To **turn on** the SIU, press on the button shown below. SIU will flash blue once turned on. To   **turn off** the SIU, hold the button and the LED will turn off
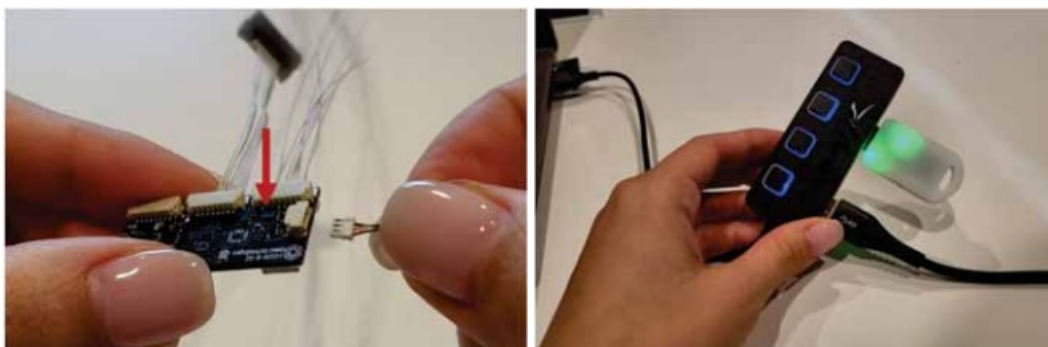
– To **disconnect the cable** from sensor device and SIU, hold on to all the wires close near the header and gently pull
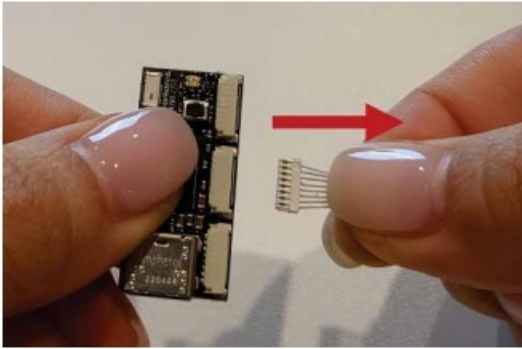

– To **charge the battery**, plug in USB-C while the battery is attached to the SIU. Currently, there's no LED behavior for charging the 10532 battery. LED will remain blue
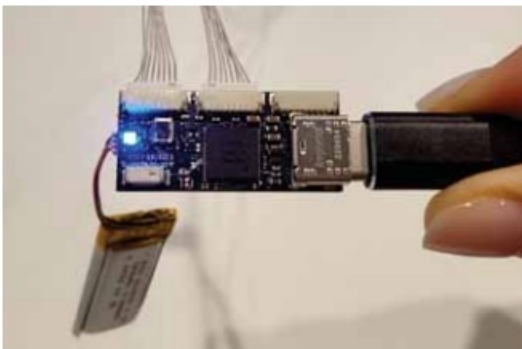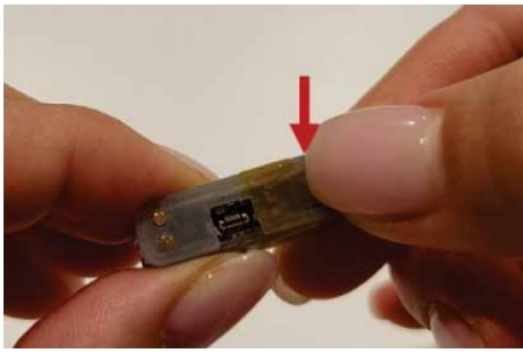

Mini Wireless

– This device has a built-in SIU and does not require a separate SIU connection
– Insert 10102 Dongle (Wireless Receiver) to the DPU
– To **turn on** the device, press the button located at the bottom of the device. The LED will turn blue
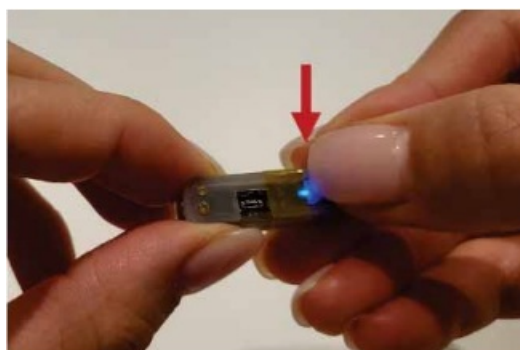

– To **turn off** the device, hold on the button until the light turns off

Note: Pictures above shows the device with v5002. For devices with v5004 and higher, LED will show white when turned on and in idle mode.

To charge the device, insert the sensor device with the two circle contacts side down into 10474 Mini Wireless Charger
– Plug in USB-C to the charger and the LED will turn blue. Once charging is complete, LED will turn green
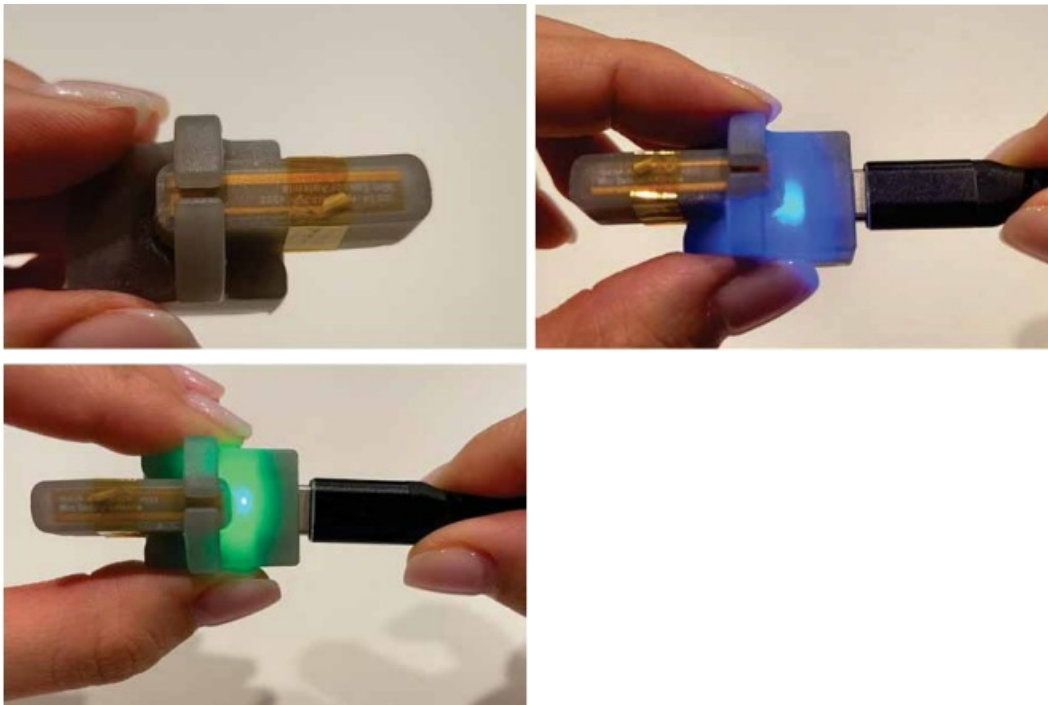
Troubleshooting/FAQs

Q1: How do I check the firmware version of my hardware?
A: Plug in the hardware devices and open Ommo Firmware Updater. At the Master Firmware Updater tab, click "Scan Hardware". This will show all the connected hardware and their firmware version. For specific details on how to use this app and update the firmware, refer to the Firmware Updater Guide. Note to update the firmware to v5004 or higher, firmware_upder v2.1.10 or higher needs to be used.
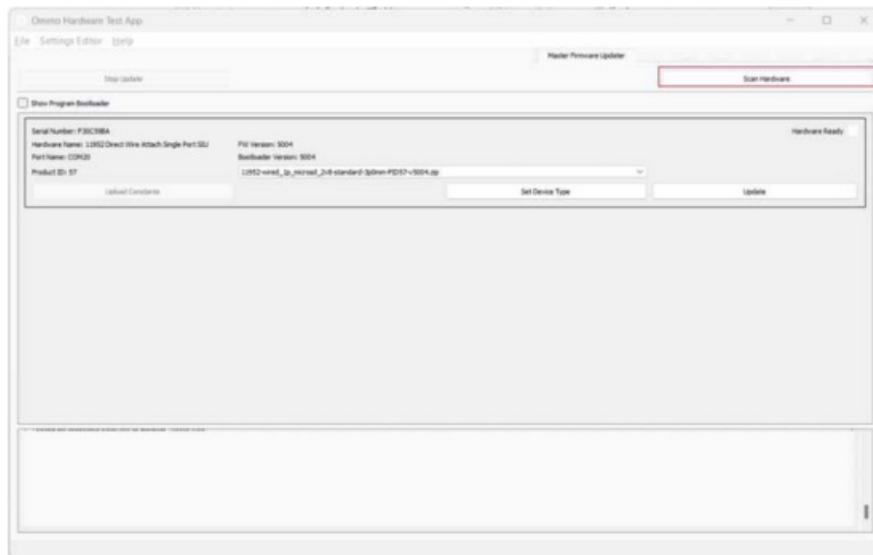
Q2: My hardware (SIU/base station) LED is flashing red (firmware lower than V5004)/orange (firmware from V5004 and on). What does this mean and what do I do?

A: Make sure your base station is **NOT sitting on ferrous metals** and that the tracking space is free from large ferrous objects.

If the hardware is away from ferror metals and the LED turned red/orange after starting Ommo Service, unplug and replug the hardware. Restart Ommo Service again and share the crash report with Ommo team for further support.

Q3: My hardware (SIU/base station) LED is fading green (firmware lower than v5004 only). My base station LED is blue and my SIU is flashing green (firmware from V5004 and on) What does this mean and what do I do?

A: Base station and SIU are both connected to Ommo App but are not actively sending data. Check to see if a sensor device is attached and present on Ommo App. Base station and SIU LED will turn white (~V5004)/green (V5004~) when they are sending data normally.
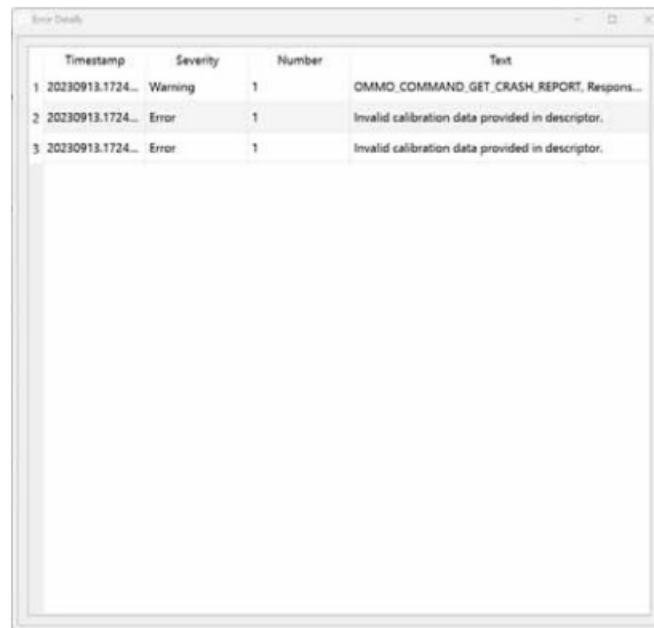
Q4: I connected sensor devices to the SIU but they are not shown on the Ommo App. How do I troubleshoot?

A: Ommo recommends using Ommo Service UI to understand the details of the error

– Check on the LED color of the base station and SIU. Their behavior is explained in a table here: Base Station and SIU

– Open up Ommo Service UI and click on the interested connected device

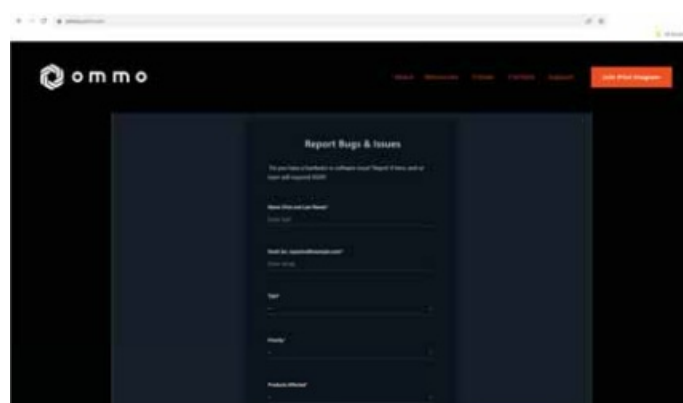– If there are errors shown, click on "Error Details"
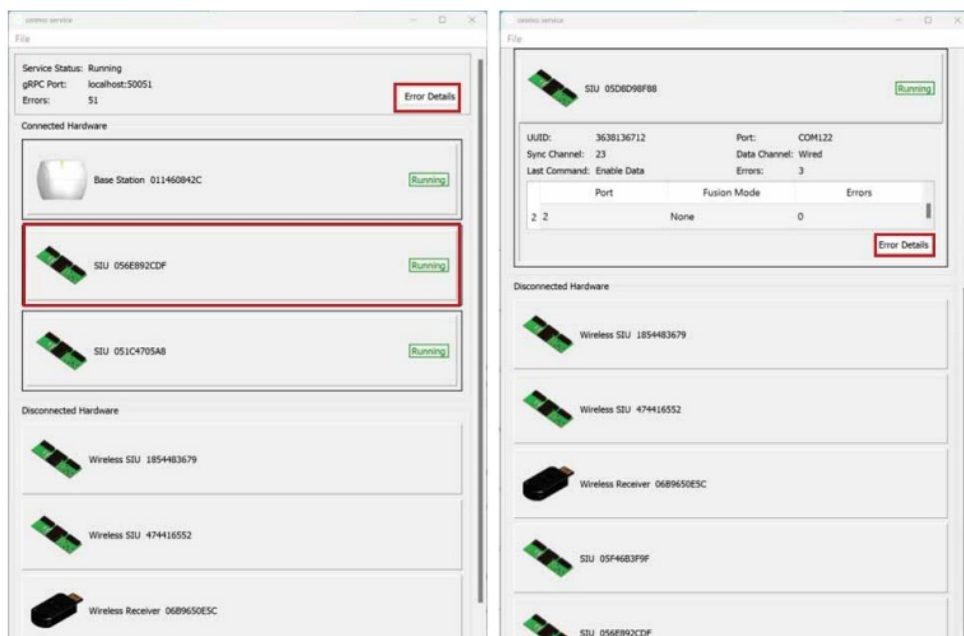
– Error details show the details of the error and when it happened.
– If the following error, " invalid calibration data provided in descriptor" is displayed, your sensor devices need to be re-calibrated/updated. Please contact Ommo team (refer to Q5 below)

Q5: My error is not listed in this guide and I need additional help. How do I contact Ommo team for support?
A: Go to **ommo.co/support** and fill out a ticket. Please share detailed description/picture/videos/screenshot of the issue you're experiencing (i.e LED behavior, error details on Ommo Service UI, service logs) to help us understand better. You can find the service log text file in the data folder in the ommo service file. (Refer to the 3rd picture below)

Disclaimers/ Legal

The Orbit Base Station and other orbit system components are not medical devices.

FCC Regulatory Compliance

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

— Reorient or relocate the receiving antenna.

— Increase the separation between the equipment and receiver.

— Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

— Consult the dealer or an experienced radio/TV technician for help.

RF Exposure Compliance

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Ommo Technologies, Inc. – Getting Started Guide

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Documents / Resources

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ORBIT Creates Revolutionizing Sensor, ORBIT, Creates Revolutionizing Sensor, Revolutionizing Sensor, Sensor

References

- **System Support — OMMO**
- **User Manual**