



# OriginIoT™ Application Kit

## USER GUIDE

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[OriginGPS.com](http://OriginGPS.com)

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## TABLE OF REVISIONS

Ver. #	Description	Author/s	Date
1.0	First Edition		May 26, 2020
1.1	Updated Table 2 in Appendix B		June 11, 2020
1.2	Added FDTI driver instructions for Windows and Mac operating systems		March 29, 2021
1.3	Updated APN command		June 16, 2021



## ABBREVIATIONS

Abbreviation	Description
APN	Access Point Network
ADC	Analog-to-Digital Converter
APK	Application Kit
DHCP	Dynamic Host Configuration Protocol
ESD	Electronic Sensitive Device
FTDI	Future Technology Devices International
GNSS	Global Navigation Satellite System
GPIO	General-Purpose Input/Output
GSM	Global System for Mobile Communications
GUI	Graphical User Interface
I2C	Inter-Integrated Circuit
IMEI	International Mobile Equipment Identity
IMS	IP Multimedia Subsystem
IoT	Internet of Things
LTE	Long-Term Evolution – a standard for wireless broadband communication for mobile devices and data terminals
OriginIoT™	Cellular IoT system to accelerate IoT product development
OriginSmart™	Web-based GUI to configure and manage OriginIoT™ systems
RF	Radio Frequency
SMA	Subminiature version A (RF connector)
SPI	Serial Peripheral Interface
UART	Universal Asynchronous Receiver Transmitter
UID	Unique Identifier



## RELATED DOCUMENTATION

#	Document Name
1	OriginIoT™ Datasheet
2	OriginSmart™ Web Specifications



## SCOPE

This document describes the features and specifications of the OriginIoT™ Application Kit.

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As long as those FW improvements have no material change on end customers, PCN may not be issued.

OriginGPS navigation products are not recommended to use in life saving or life sustaining applications.

## SAFETY INFORMATION

Improper handling and use can cause permanent damage to the product.

## ESD SENSITIVITY

This product is ESD sensitive device and must be handled with care.



## CONTACT INFORMATION

[contactus@origingps.com](mailto:contactus@origingps.com)

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## 1. GENERAL

### 1.1. Introduction

Welcome to the OriginIoT™ Application Kit (APK) User Guide. The APK is a compact development and evaluation tool for use with the OriginIoT™ system. The APK enables users to interactively configure their OriginIoT™ systems according to their project requirements. The APK enables the quick and easy configuration of the IoT module through an interactive debug console, and also enables debugging commands to be sent to the module.

The OriginIoT™ is a miniature cellular IoT system that enables the speedy development of IoT projects without writing embedded code and without knowledge of RF engineering. This guide assumes the reader has basic software and hardware knowledge.

### 1.2. Purpose and Scope

The purpose of this guide is to explain, step by step, how to use the OriginIoT™ Application Kit. It is intended to provide all the necessary information to configure and test new cellular IoT projects and development innovations. This guide includes a description of the system functions and capabilities, contingencies and alternate modes of operation, and step-by-step procedures for setting up, configuring, and using the OriginIoT™ APK.

## 2. SYSTEM OVERVIEW

### 2.1. OriginIoT™ System Description

The OriginIoT™ is a miniature cellular IoT system with a GNSS tracker and interfaces to peripheral sensors and devices. The data is transferred through cellular communication, stored in a remote server (cloud), and displayed on a Web GUI.

The system communicates through a GSM or LTE interface (2G, 3G, Cat1, CatM, or NB-IoT) through a cloud-based application.

The OriginIoT™ functions as a multi-purpose IoT sensor platform and can accommodate sensors and other peripheral devices using UART, SPI, I2C, USB, ADC, or GPIO with superior positional accuracy of a stand-alone GNSS. Data is configured over a Web interface and embedded firmware development is not required by the user. The ease and flexibility of developing a vast array of applications based on the OriginIoT™ dramatically improves time to market while minimizing the size of your IoT sensor device.

### 2.2. OriginIoT™ Application Kit Description

The OriginIoT™ Application Kit is a development and evaluation tool for use with the OriginIoT™ system. With the OriginIoT™ APK, users can see live results of the configurations of the OriginIoT™ system according to their project requirements while using a debug console.

The OriginIoT™ APK may be used for the following activities:

- Connecting the OriginIoT™ system to a server
- Testing the functionality of the add-on
- Connecting and configuring new sensors
- Debugging and configuring the OriginIoT™ system locally

## 3. GETTING STARTED

### 3.1. OriginIoT™ Application Kit Contents

The OriginIoT™ Application Kit package includes the following items:

- OriginIoT™ system
- OriginIoT™ add-on board
- GNSS antenna 12x12x4.3 mm with a W.FL connector
- Penta-band GSM antenna with a U.FL connector
- ST-LINK and FTDI USBs
- Cable from USBs to add-on board
- Cable to connect battery (not shown)
- Nano SIM card with optional data package



Figure 1. OriginIoT™ Application Kit Contents

### 3.2. Equipment Required to Set-Up

The following items are required to set up and start working with the OriginIoT™ Application Kit:

- Nano SIM card with data package
- Server:
  - ◆ **Option A:** OriginGPS provides a cloud server for evaluation purposes free of charge at: <http://18.184.85.107>. The latest IP address can be found in the latest version of this document on [our website](#).
  - ◆ **Option B:** Users can develop their own server tailored to their project's requirements based on OriginSmart™ open-source code, provided with the purchase of the OriginIoT™ system.
- PC with terminal emulator (ex. Tera Term, a free, open-source software, downloadable [here](#))
- USB power source with output 5V / 1A

### 3.3. Download the FTDI Driver

To download the FTDI driver, execute the following steps:

1. For Windows, click on the following link:

<https://www.silabs.com/developers/usb-to-uart-bridge-vcp-drivers>

For a Mac, click on the following link:

<https://www.macupdate.com/app/mac/31352/coolterm>

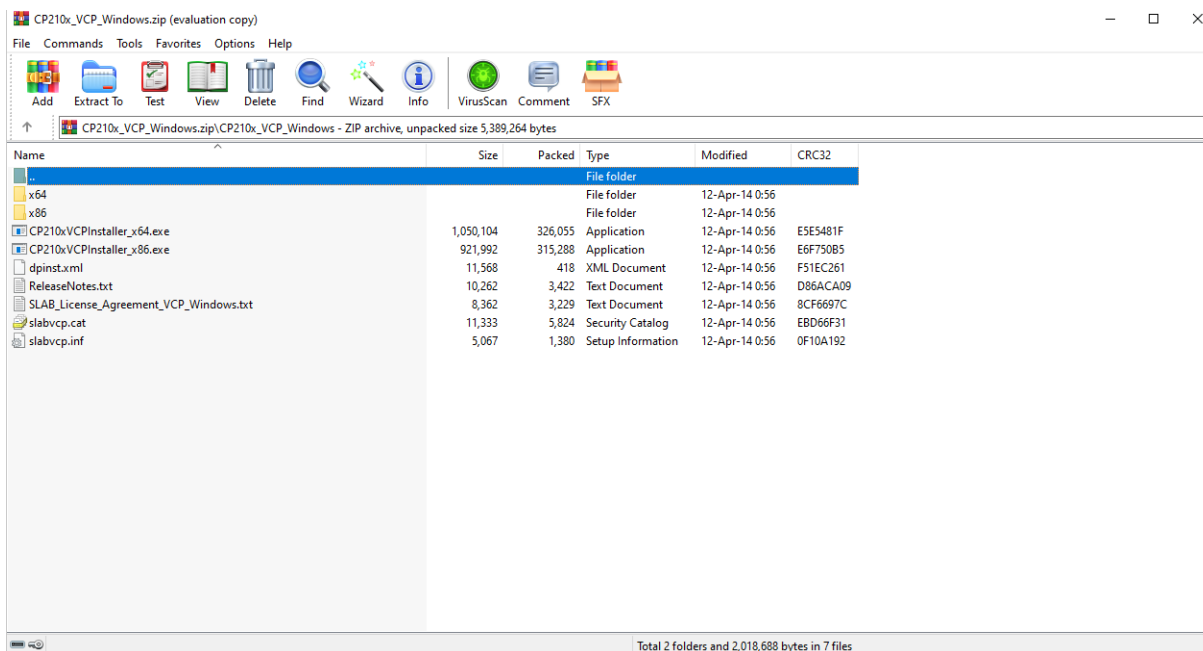


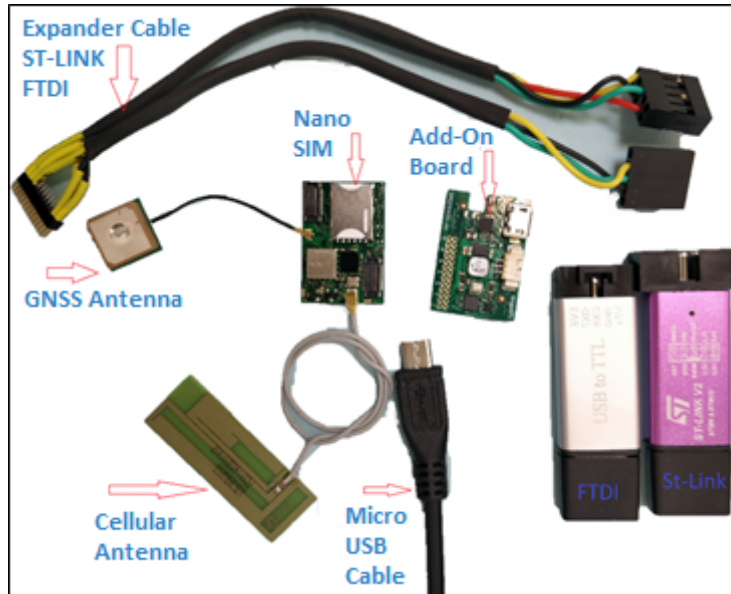
Figure 2. VCP CP210X Driver

2. Navigate to the Downloads section and select your required VCP CP210X driver installation.
3. After the ZIP file has downloaded, open the ZIP folder, and then double-click on the *CP210xVCPInstaller\_x86.exe* file.
4. Click on **YES** button to install it.
5. Restart the PC.

### 3.4. Connecting the APK to a PC

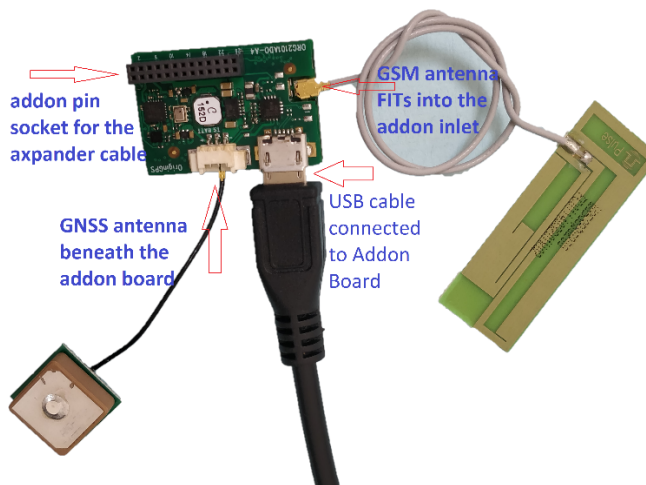
To configure the OriginIoT™ to establish a connection between the GSM/LTE network and Web server, the module using the debug port connection to the PC must be configured according to the following steps:

1. Insert a Nano SIM card to the dedicated slot on the OriginIoT™ system. This step is not required with the ORG2101-XXXX-E model, which includes an integrated, embedded SIM card.
2. Connect the GSM/LTE cellular antenna to the U.Fl connector on the OriginIoT™ (Figure 3).
3. Connect the GNSS antenna to the W.Fl connector on the OriginIoT™ (Figure 3). This step is only required when evaluating GNSS functionality.



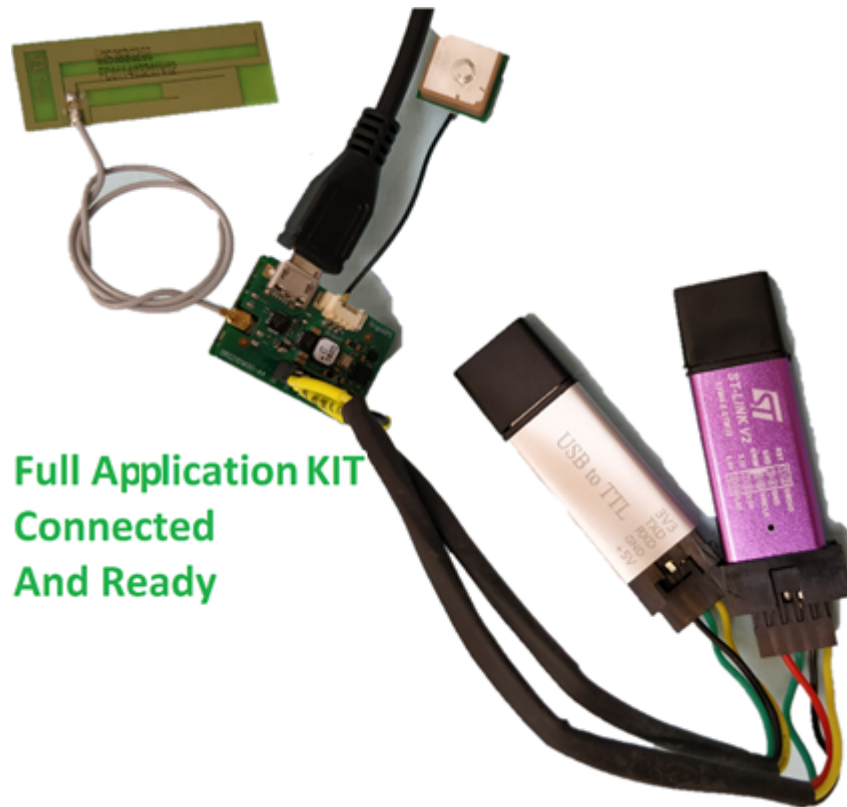
**Figure 3. Connecting the OriginIoT™ to the Antennas and SIM Card**

4. Connect the OriginIoT™ system to the add-on board using the micro-USB cable (Figure 4).



**Figure 4. Connecting the OriginIoT™ to the Add-On Board**

5. Connect the console debug USB (Figure 5)



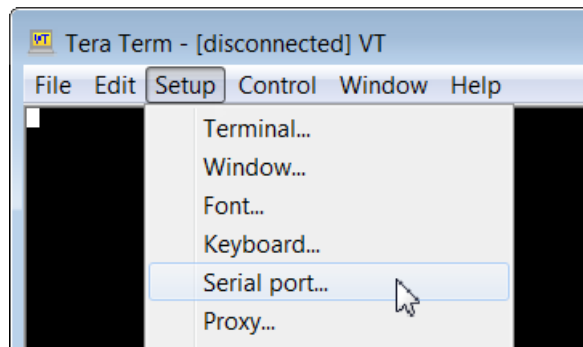
**Figure 5. Connecting the OriginIoT™ to the Console Debug USB**

6. Connect the expander cable according to
7. Figure 6. The FTDI connector is used for the debug console, whereas the ST-LINK is used for flashing the IoT module. Make sure to connect the FTDI connector to a USB port.

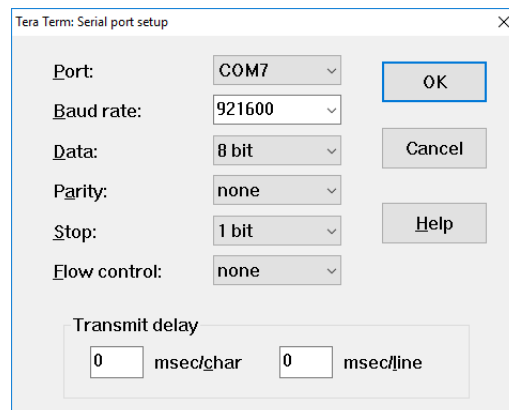


**Figure 6. OriginIoT™ Expander Cable to FTDI USB**

7. To connect to the OriginIoT™ COM port: In the Tera Term application, go to: **Setup** → **Serial Port** (Figure 7), select the relevant COM from the port drop list, and set the baud rate to 921600 bps (
8. Figure 8).
9. Click **OK**.

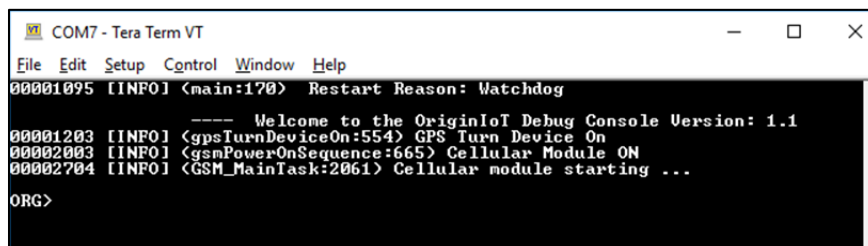


**Figure 7. Selecting the Serial Port in Tera Term**



**Figure 8. Serial Port Setup in Tera Term**

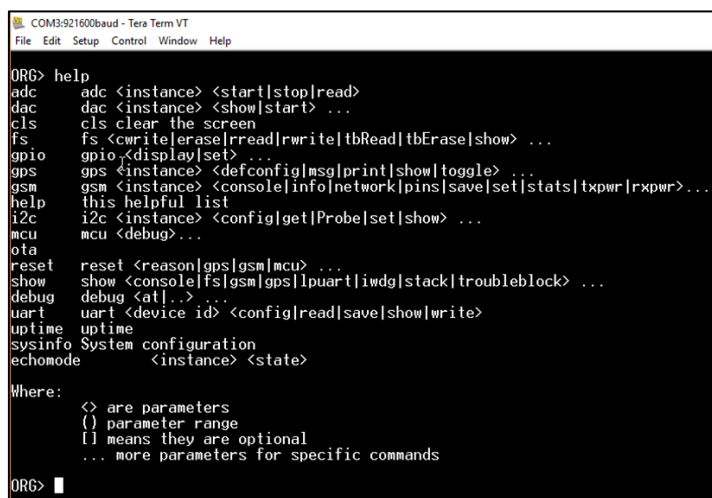
10. When the OriginIoT™ is connected to a power source, a welcome message and GSM/LTE start-up messages is displayed on your PC.
11. While the OriginIoT™ is connected to your PC, press **Enter** in the terminal, and the prompt line **ORG>** is displayed in the terminal window (Figure 9).



**Figure 9. OriginIoT™ Connected to the Debug Console**

The system may now be accessed through the debug console.

12. Enter **'help'** in the Tera Term terminal to see a list of available commands (Figure 10).



**Figure 10. OriginIoT™ Help List**

### 3.5. OriginSmart™ Tutorial

The following online tutorial will help you configure additional tasks on your OriginIoT™ system while working with the OriginSmart™ API Web app:

<https://www.youtube.com/watch?v=cT-c22z1pYQ&t=2s>

This tutorial explains how to perform the following tasks:

- Understanding the OriginSmart™ API Specifications document
- Operating the OriginIoT™ debug console
- Logging into the online development environment
- Interpreting Notify and Response messages



- Writing and sending simple Get and Set messages

## 4. CONNECTING THE ORIGINIoT™ TO A SERVER

### 4.1. Mobile Network Parameters

The OriginIoT™ can send data over a mobile network following initial cellular configuration. This task is only performed once for a specific SIM card and includes the following SIM parameters from your mobile network operator's website or your SIM card:

- **APN** – Access Point Network
- \*Username
- \*Password

\*Not required by all mobile network operators

```
ORG> gsm 0 network
00124449 [INFO] (gsmDebugShowNetwork:4935) APN           : datamobile.ag
00124470 [INFO] (gsmDebugShowNetwork:4936) Server IP      : 18.184.85.107
00124491 [INFO] (gsmDebugShowNetwork:4937) Server Port   : 31000
00124512 [INFO] (gsmDebugShowNetwork:4938) Connected    : true
00124533 [INFO] (gsmDebugShowNetwork:4940) Network IP   : 10.7.192.83
```

**Figure 11. OriginIoT™ Configuration Example**

The OriginIoT™ is preconfigured to connect to the OriginGPS evaluation server at <http://18.184.85.107>.

If you require your products to be pre-configured to a separate server and network configuration, contact us at [contactus@origingps.com](mailto:contactus@origingps.com).

Key to Figure 11:

- **APN:** SIM card provider's network.
- **Server IP:** Hostname or IP address of cloud-based application—the server to which the module connects.
- **Server Port:** Port used by a cloud application to receive messages from OriginIoT™.
- **Connected:** Set to 'true' when GSM/LTE is connected to the access portal, 'false' if otherwise.
- **Network IP:** (Shown only when connected) provided to the system by the Internet provider's Dynamic Host Configuration Protocol (DHCP) servers and is not configurable.

To set these fields, use the command:

**gsm 0 set <apn|ip|port|ims(for LTE/4G)> ...**

1. Save the changes to flash memory using the command:

**gsm 0 save**

2. Reset the MCU using this command to implement these changes:

**reset mcu**

Examples of the above commands are shown in Figure 12:

```

COM3:921600baud - Tera Term VT
File Edit Setup Control Window Help

ORG> gsm 0 network
APN          : datamobile.ag
Server IP    : 18 new ip
Server Port  : 31000
Connected    : false

ORG> gsm 0 set ims
--> ims
ORG>
ORG>
ORG> gsm 0 set ip
--> 18.184.85.40
ORG>
ORG>
ORG> gsm 0 save

ORG>
ORG>
ORG> gsm 0 network
APN          : datamobile.ag
Server IP    : 18.184.85.40
Server Port  : 31000
Connected    : false

ORG>
ORG>
ORG> gsm
Unknown command: "gsm "

ORG> reset mcu
resetting the mcu
***** Disconnecting from NW *****

=BTLD tag:
APP run*00005193 [INFO] (main:292) Restart Reason: Software

----- Welcome to the OriginIoT Debug Console Version: C.2.2
00005502 [INFO] (GPS_TurnDeviceOn:614) GPS Turn Device On
00005702 [INFO] (gpsToggleOnOffState:577) GPS gpsToggleOnOffState
00006302 [INFO] (gsmPowerOnSequence:760) Cellular Module ON
00007102 [INFO] (GPS_StartConfig:805) Need to change BuadRate after Power Reset
00007660 [INFO] (GPS_StartConfig:807) after init BuadRate for NMEA

```

Figure 12. Setting Up the OriginIoT™ Network Configuration with the Debug Console

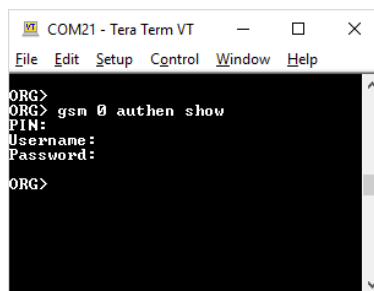
## 4.2. Editing Mobile-Network Parameters— GSM/LTE Authentication Command

You may skip this section if your SIM card does not require authentication (username and password).

To configure your SIM card, use the ‘**authen**’ command in the debug console.

To see the current configuration, use the command **gsm 0 authen show**.

The following output is displayed:



```

COM21 - Tera Term VT
File Edit Setup Control Window Help
ORG>
ORG> gsm 0 authen show
PIN:
Username:
Password:
ORG>
  
```

**Figure 13. GSM Authentication Command – Output**

The OriginIoT™ is shipped without authentication settings, so these settings are displayed as empty fields here.

The ‘**authen**’ command enables the operator to set the following fields:

- PIN (4 to 8-digit number provided with the SIM card)
- Username
- Password

**Note:** Fields that the operator does not set are shown as empty.

**To set these fields use the command:**

**gsm 0 authen enter**

The operator is then prompted for each of the fields. If a field is not required, type **Enter** to exit the field.



```

ORG>
ORG> gsm 0 authen enter
Enter PIN number:
00110655 [DEBUG] <gsmAuthenPINnum():2021>: pin: 1234
Enter UserName:
00116075 [DEBUG] <gsmAuthenUsername():2070>: Username: USER
Enter Password:
00121395 [DEBUG] <gsmAuthenPassword():2061>: password: PASS
For these credentials to be used, the operator must save and then restart the module.
ORG>
  
```

**Figure 14. Setting up Authentication Credentials**

Verify the fields are correct, then save them to flash using the following command:

**gsm 0 authen save**

The next time the system boots, these fields are used for the wireless network connectivity.

The GSM authentication process should look like the following figure (Figure 15):

```

ORG> gsm 0 authen show
PIN          :
Username     :
Password     :

ORG> gsm 0 authen enter
Enter PIN number:

00546272 [DEBUG] (gsmAuthenPINnum():3490): pin: 12
Enter UserName:

00555390 [DEBUG] (gsmAuthenUsername():3539): Username: 12
Enter PassWord:

00562350 [DEBUG] (gsmAuthenPassword():3530): password: 12345678
For these credentials to be used, the operator must save and then restart the module.

ORG> gsm 0 authen save

ORG> gsm 0 authen show
PIN          : 12
Username     : 12
Password     : 12345678

ORG> reset mcu
resetting the mcu
***** Disconnecting from NW *****

=BTLTD tag: APP run*00005193 [INF01 (main:292) Restart Reason: Software

----- Welcome to the OriginIoT Debug Console Version: C.2.2
00005502 [INF01 (GPS_TurnDeviceOn:614) GPS Turn Device On
00005702 [INF01 (gpsToggleOnOffState:577) GPS gpsToggleOnOffState
00006302 [INF01 (gsmPowerOnSequence:760) Cellular Module ON
00007102 [INF01 (GPS_StartConfig:805) Need to change BuadRate after Power Reset
00007660 [INF01 (GPS_StartConfig:807) after init BuadRate for NMEA

```

**Figure 15. GSM Authentication Process**

## 5. ORIGINSMART™ WEB APPLICATION

### 5.1. Overview

This chapter is for users who have chosen to use the OriginIoT™ evaluation server.

The OriginIoT™ Web application server is a user-friendly GUI interface for configuring and viewing the OriginIoT™ system with its associated interfaces, devices, messages, and commands. Users can execute user-created and system commands using this Web application. It is free of charge and a great starting point for development with the OriginSmart™ protocol.

### 5.2. Common Commands

Examples of configurations and commands that can be used by the OriginIoT™ can be found in the OriginSmart™ Web app under the International Mobile Equipment Identity (IMEI) 357300070607893 in the **All Devices** tab. The commands are specified in the OriginSmart™ Web Specifications.

### 5.3. User Log In

The Web application resides on Amazon Web Services at: <http://18.184.85.107>.

Figure 16 displays the Login page of the OriginSmart™ Web application.

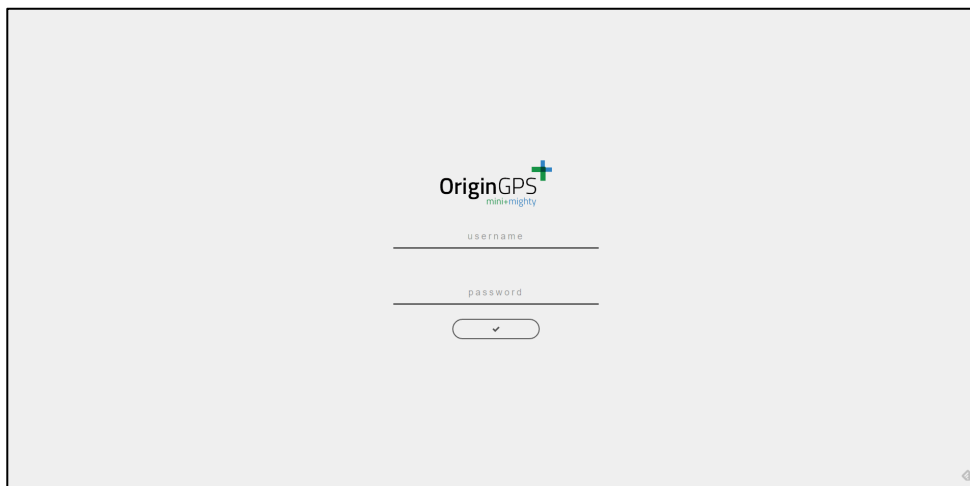


Figure 16. OriginIoT™ Web App - Login Page

Enter the credentials you received from your OriginGPS representative. To change your password, go to the **Profile** tab. To go to the **Home** tab, click the ✓ symbol.

## 5.4. Web Home Tab

Each OriginIoT™ system has an ID number associated with it in this specific server. The unique ID is associated with the system upon the system’s first registration to the server. The unique ID is linked to the system’s IMEI number. OriginGPS adds the systems purchased by a user to the user profile, and these appear once the user is logged in. Contact OriginGPS at [contactus@origingps.com](mailto:contactus@origingps.com) if your IMEI does not appear in your home tab.



Figure 17. OriginIoT™ Home Tab

To open the device details page, click on the row displaying your OriginIoT™ IMEI. A green/red link symbol in the status column indicates the connection status of the system—connected/not connected, respectively. Refresh the page to update the connectivity status displayed.

## 5.5. Module Details Tab

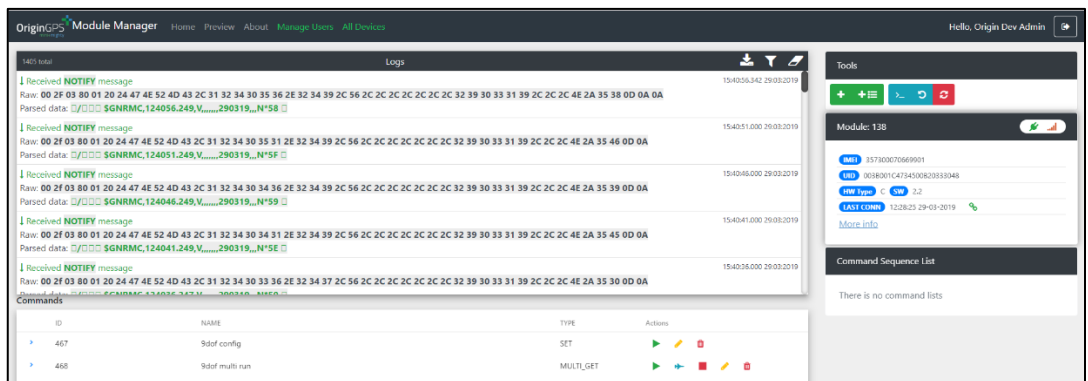


Figure 18. Module Details Tab

The following windows are displayed in the **Module Details** tab:

- **Log Window:** Displays raw data sent to/from the system. The log is saved locally for up to one hour and is deleted if the page is refreshed.
- **Commands Window:** Displays the command exchange between the system and the server. To view the command details line displaying the byte string sent to the system when executing a command, click on the command row (Figure 19). To copy the command byte string to the clipboard as a string (ex. 00 0b 80 05 04...), click on the yellow copy button (Figure 19).

ID	NAME	TYPE	Actions
227	ADXL 345 Set Measure Mode	SET	▶ ✎ 🗑️
<b>Command bytes</b> 00 0b 80 05 04 20 41 a6 2d 01 28 count src dest type ack rsp dev h dev d			
228	ADXL 345 MultiGet	MULTI_GET	▶ ⏏️ 🗑️ ✎ 🗑️

Figure 19. Command Details

Each command is displayed on a line with either three or five associated buttons, depending on the type of command. MultiGet commands have five buttons, all the rest have three. Every command has at least the following three buttons:

- ◆ **Send Command** ▶ sends a command to the IoT module, which then appears in the log window.
- ◆ **Edit** ✎ opens a new message window preloaded with data of the edited message.
- ◆ **Delete** 🗑️ removes the command from the list and from the database.

The MultiGet and MultiBuf commands have the following additional two buttons:

- ◆ **Stop** ■ terminates a multi\_GET or multi\_BUF command.
  - ◆ **Show on Widget** ➡ routes the user to the preview tab where data may be viewed in the widgets.
- **Tools Window:** Enables the user to select the following options:

- ◆ **The New Command button** + opens a message window and enables the user to add a new command.
- ◆ **The New Command List button** +≡ opens a new sequence list creation window and enables the user to add a new list of messages.
- ◆ **The Custom Command button** ⌵ enables the user to write a custom message, bypassing the new message window restrictions.



- ◆ **The Loopback button** 🔄 initiates a loopback test to confirm the link status between the system and the server. To check the connectivity status of the status, execute a loopback test by pinging the module (this test checks the connectivity of the module to the server, not the link state or status of peripheral sensors/devices). The structure of the loopback test message is depicted in the *OriginSmart™ API Specifications* document. The messages sent and received from the module appear in the log area (Figure 20). If the module has not connected to the server, a success notification message is not sent.



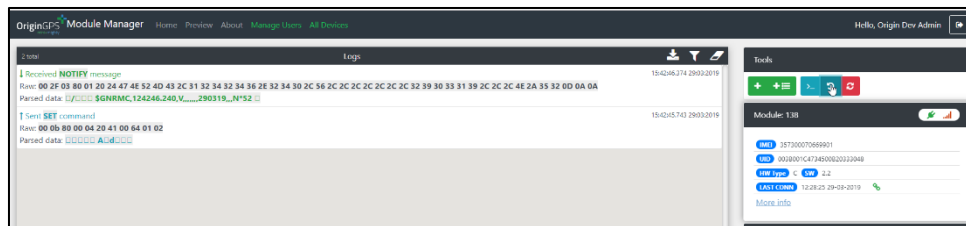


Figure 20. Loopback Message Displaying System-Server Link Status

- **Module Window:** Displays the IMEI and link state of the system, with a place holder for future hardware and software versions, last connection time, MAC address, and system serial number.
- **Command Sequence List Window:** Enables the user to edit, delete, and run a list of commands that are automatically executed one after another.

## 5.6. Common Commands

Examples of configurations and commands used by the OriginIoT™ can be found in the OriginSmart™ Web Application under the IMEI 357300070607893 in the Command window. The commands are specified in the *OriginSmart™ API Specifications* document.

## 5.7. Adding a New Command

The New Command window enables the user to easily define messages without format constraints for the inputs. Data is inserted as two characters for bytes (hexadecimal) with a space between bytes (ex. 00 1A). The count field is updated automatically according to the length of the message entered when new bytes are added/removed.

The *OriginSmart™ API Specifications* document specifies input required for Type, Source, Destination, ExpAck, ExpRsp, Device Header, and Device Data. The Result command is the actual string that is sent to the system.

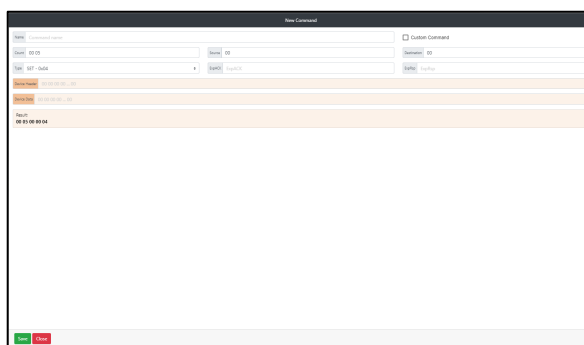


Figure 21. New Command Window

The message type MULTI\_GET opens the New Command window for streaming commands, as shown in Figure 22. Count, devices, and UIDs are determined automatically by the system in this window. To configure a new widget, click on the **Add Device** box to open a new UID table.

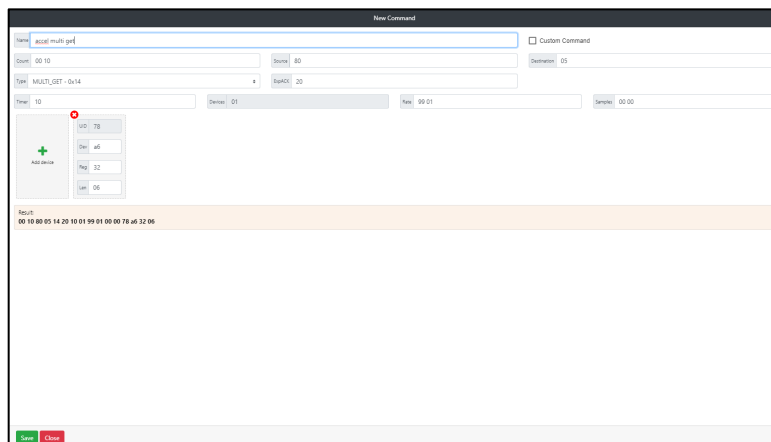



Figure 22. New Multi-GET Command Window

## 5.8. Adding a Custom Command

The user can send strings to the device with the Custom Command feature. If the command cannot be interpreted by the OriginIoT™ system, no response is issued. If the first two bytes, dedicated for message length, are not correct, the message is not sent to the system.

- To reach the Custom Command window, click on the Custom Command button  in the Tools section.
- To close the window without sending the message, click on **Close**.
- To send the message and close the window, click on **Send**.

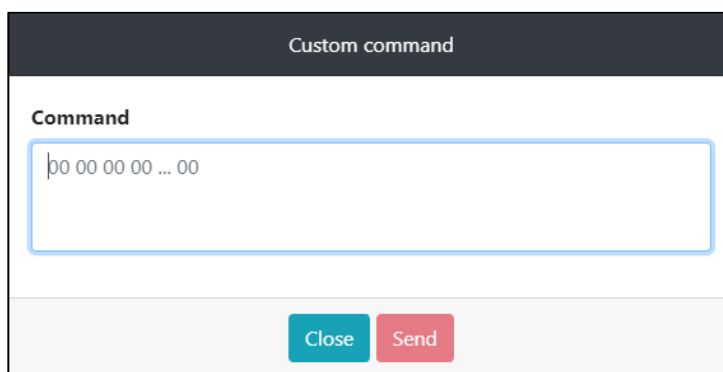


Figure 23. Custom Command Details

## 5.9. Adding a List of Commands

Command lists are used to implement a sequence of sequential commands without human intervention. With them, the user can execute a set of commands on start-up without even being present. In order to create a new command list, execute the following steps:

1. Click on the **New Command List** button.

2. Enter a title for the list under 'List Name'.
3. Click the **Is Init List?** button to make the list play upon start-up or back from sleep.
4. 'List Delay' is the amount of time to wait after registration to the network until the command list starts.
5. The commands in the New Command List are the same as those in the Command window. Click and drag the commands you want in your list in sequential order from the 'Commands' side to the 'Selected' side.
6. Click **Save** to save and **Close** to exit without saving.
7. The newly created list appears in the Command Sequence List window, with buttons enabling play, repeat, edit, and delete.
8. Figure 24 shows the implementation of adding a series of sequential commands.

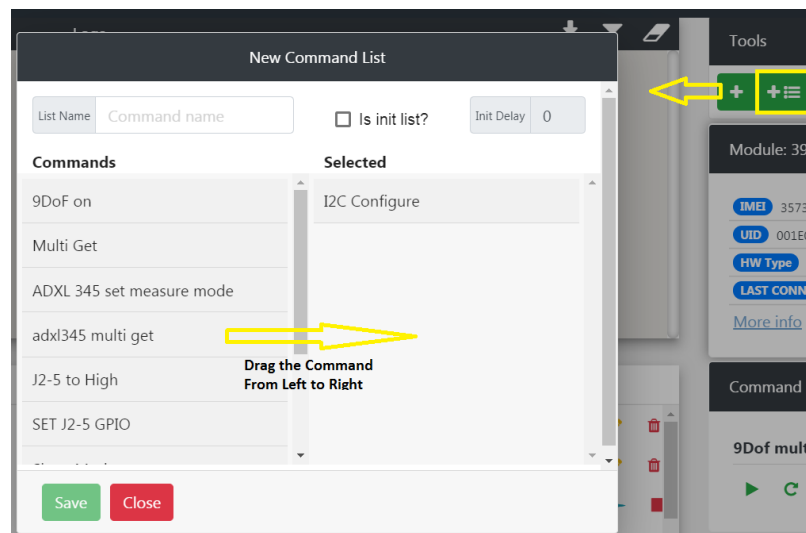


Figure 24. New Command List

## 5.10. Widget Review Tab

The **Widget Review** tab is shown in Figure 25:

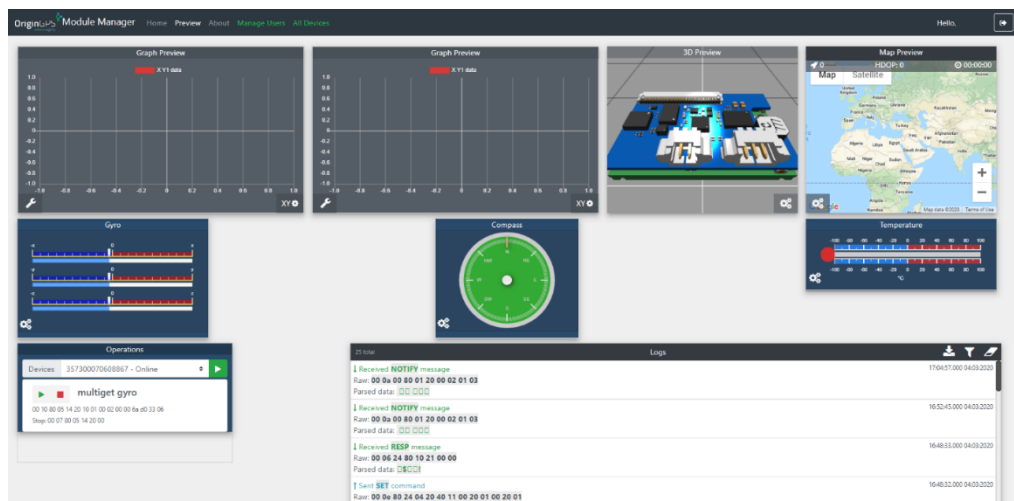


Figure 25. Widget Review Tab

OriginGPS has developed sample widgets to demonstrate the functionality of the OriginIoT™ system.

These widgets include:


- **3D Preview** of the system plus add-on assembly—controllable by an accelerometer.
- **Google maps preview**—displays GNSS locations.
- **Sensor preview**— displays temperature, compass, and gyro data.
- **Logs**— displays raw data transferred to and from the system. The log widget enables the user to filter selected messages (GNSS, Registration, Loop Back, and Multi\_Get). The log widget also enables the user to download the log data as a **.log** file.
- **Operations**—enables the user to select which device to operate according to the IMEI. Includes start/stop listening to selected device/s, start/stop Multi\_Get, and Multi\_Buf messages.

## 5.11. Widget Configuration

The **Widget Configuration** tab is shown in Figure 26.



Figure 26. Widget Configuration Window

Each widget can be configured by clicking the  button at the bottom corner of the screen. In order for the widget to present the required information, the user must first set the type of message to listen to. The field name, type, source, destination, and pattern are common to all widgets. Widgets that are planned to be used with 3-dimensional data have an invert axis function that adds a (-) sign to the raw data (this is for sensors physically oriented in a negative direction).

- **'name'**—enables the input of any string as an input.
- **'type'**—enables the selection from a drop-down menu.
- **'source'** and **'destination'**—enable the choice of the hexadecimal interface ID from which/to where your message is sent (the message you want to present with the widget).
- **'pattern'** or **'UID'**—enable the choice of which message (from a chosen interface) to listen to. The pattern should be in a hexadecimal byte string (not a string). For example, if you are selecting a \$GNRMC NMEA message, you should enter 24 47 4e 52 4d 43.

## 5.12. Profile Tab

The **Profile** tab is shown in Figure 27.

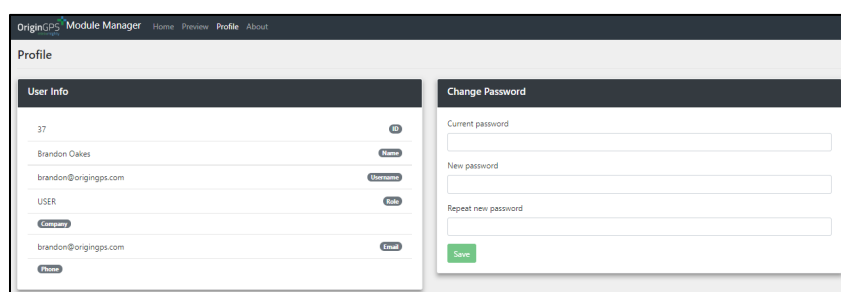


Figure 27. Profile Tab

The **Profile** tab enables the user to view ID, name, username, role (user or admin), company, email, and phone number, and to change the password.

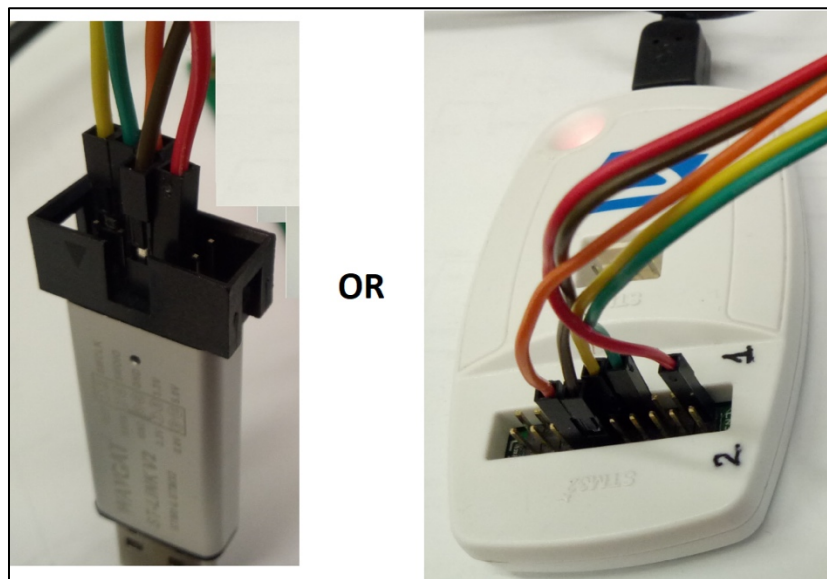


## Appendix A. System Firmware Upload (Flashing)

The OriginIoT™ Application Kit includes company proprietary OriginSmart™ firmware, designed to enable codeless configuration of the remote system without performing any firmware changes. This section explains how this firmware can be uploaded.

The equipment required for uploading the firmware includes:

- ST-Link/V2 STM8 & STM32 controller
- STM32-ST-Link Utility – [Link](#) to download application
  - ♦ There are two options for using the controller to update the firmware.
- Using the USB supplied in the APK, pictured on the left in Figure 28.
  - Note: The pin description labeled on the top of the USB connector. In the case of any discrepancies between the between the connector pins in this guide and those labeled on the USB, refer to the USB connector as the USB connector might vary from kit to kit.
- Using a standard controller ST-LINK/V2 STM8 & STM32, pictured on the right in Figure 28.



**Figure 28. Firmware Upload**

To connect the application board to the ST-LINK controller, connect wires to the J5 connector, as depicted in Table 1 and Figure 29 below.

**Table 1. Wireless Connection to Application Board**

Function	Wire Color	J5 Add-On	ST-LINK USB	ST-LINK Plug
GND	Black	Pin 2	Pin 4	Pin 14
GND	Black	Pin 4	Pin 3	Pin 12
VCC 3.3V	Red	Pin 3	Pin 7	Pin 1
SWCLK	Green	Pin 24	Pin 6	Pin 9
SWDIO	Yellow	Pin 26	Pin 2	Pin 7



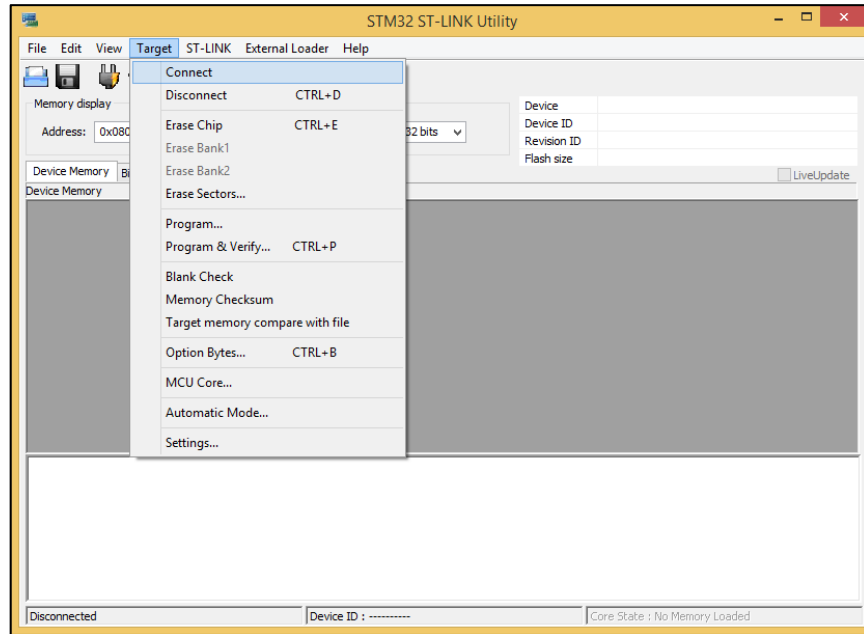
**Figure 29. Connector Pins**

To update the OriginIoT™ firmware, take the following steps:

1. Connect the OriginIoT™ to the add-on board
2. Power-on the OriginIoT™ system using the Micro USB connector
3. Connect the ST-LINK to J5, as shown in Figure 29 above
4. Connect the ST-LINK to a PC



5. Add a DLL file (missing in Windows) with the following link <https://answers.microsoft.com/en-us/windows/forum/all/missing-mfc140dll/fd263446-82bd-4fdf-8e50-a0a2c0cf8486>.
6. Open the STM32 ST-LINK Utility
7. Click **Target** → **Connect**



**Figure 30. STM32 ST-LINK Utility Window**

8. When the connection is established, the following message is shown: **'Connected via SWD'** (Figure 31).
9. If you are unable to connect, verify that the wires are correctly connected.

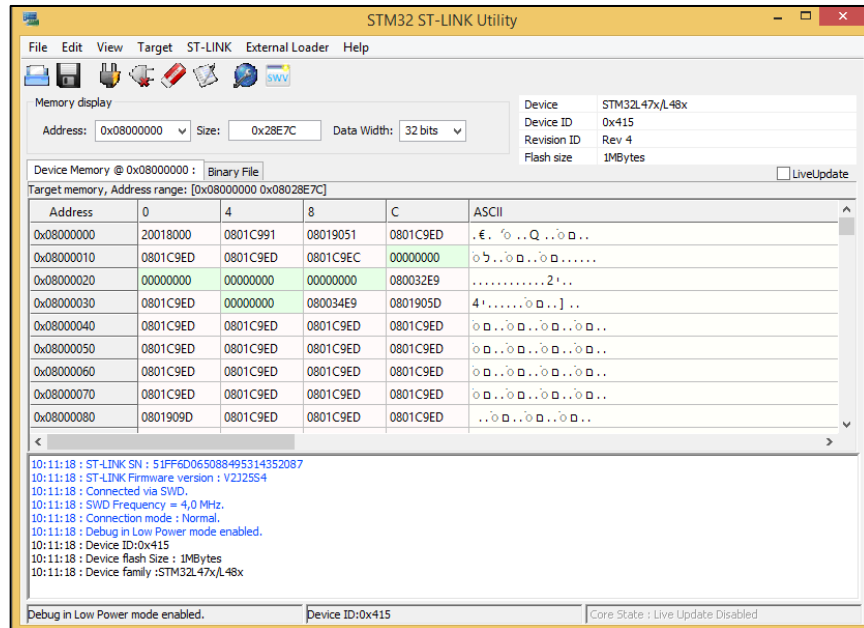


Figure 31. Connecting to System with STM32 ST-LINK Utility

9. Click on **Target** → **Program & Verify** (Figure 32).

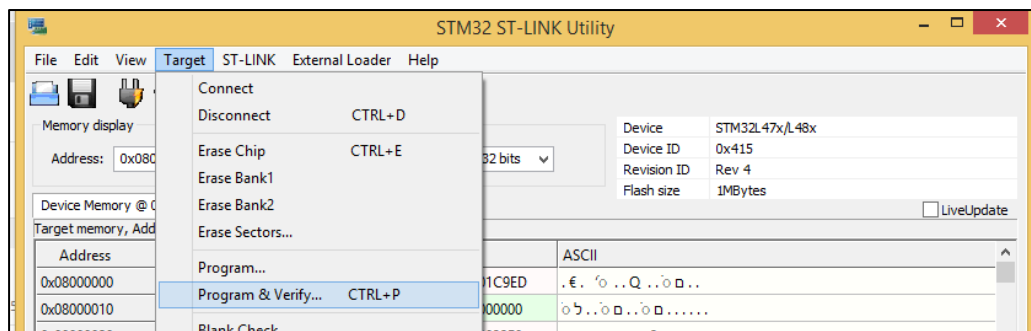


Figure 32. Program & Verify in STM32 ST-LINK Utility

10. Open the file and a dialog box opens. Select your firmware file - a **.hex** / **.bin** file.
11. After selecting your firmware file, a download window opens.
12. Click **Start**.

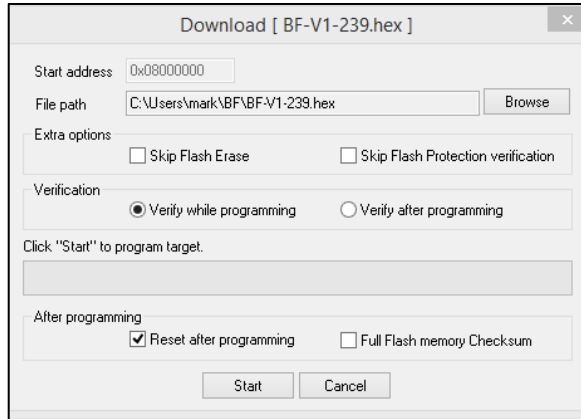


Figure 33. Download Window

- When the firmware upload is complete, a Verification...OK message is shown (Figure 34).

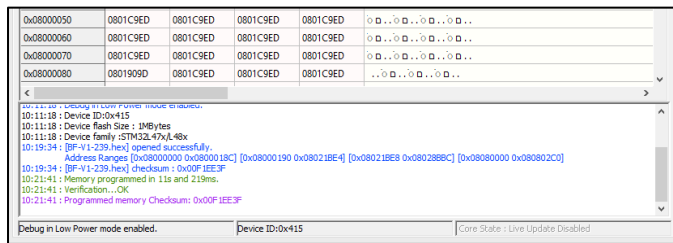


Figure 34. Successful Firmware Download Window

- To disconnect the system, click **Target** → **Disconnect**.

## Appendix B. Sensor Configuration

The add-on board contains six sensors (including the GNSS module on the OriginIoT™ system):

- GNSS module connected through the UART interface
- Temperature sensors connected through the I2C
- Accelerometer connected through the I2C
- Magnetometer connected through the I2C
- Gyroscope connected through the I2C
- Barometer connected through the I2C
- Fuel gauge for battery life through the I2C with dedicated address

All sensors, with the exception of the GNSS module, must be configured (“Committed”) on the device using an IF\_PARAM\_SET message, specified in the API spec document.

The required parameters for each peripheral device can be found in its respective datasheet. OriginIoT™ system does not restrict devices that can be connected to the module as long as they interface with I2C, UART, SPI or GPIO. Each device has parameters that are required in this step. For convenience, Table 2 below lists the parameters required to configure the devices inside the APK.

See the API datasheet for examples on how to configure and use the default sensors on the add-on board.

**Table 2. Sensor Configuration**

Device	Device P/N	IF_ID	Parameters							
UART Type Interface			Baud Rate	Flow Control	Stop Bit	Parity	Data Bits	Data Ready IF_ID	Data Over Run Action	
GPS	ORG4572	03	4800-230400	Disable	1	None	8	N/A	N/A	
I2C Type Interface			Addressing Mode	Bit Rate	Register Type	Data Ready IF_ID	Data Over Run Action	Device Address (0x)	Register Address (0x)	
Magnetometer (Ecompass)	ICM-20948	05	7-bit	400 kbps	BYTE	N/A	N/A	d0	11H	
Gyroscope	ICM-20948	05	7-bit	400 kbps	BYTE	N/A	N/A	d0	33	
Accelerometer	ICM-20948	05	7-bit	400 kbps	BYTE	N/A	N/A	d0	2d	
Temperature	ICM-20948	05	7-bit	400 kbps	BYTE	N/A	N/A	d0	39	
Barometer	BMP280	05	7-bit	400 kbps	BYTE	N/A	N/A	EC	f7	
Fuel Gauge	LC709203F	05	7-bit	400 kbps	BYTE	N/A	N/A	16*	Note**	

**Note:** \*The Fuel Gauge has a dedicated address and is not subject to change.  
 \*\*Many different registers are used to configure and receive data from the fuel gauge – see datasheet and/or API specifications for more information.