Quick Start Guide

STM32Cube function pack for IoT sensor node with telemetry and device control applications for Amazon AWS Cloud (FP-CLD-AWS1)
Hardware Description

The X-NUCLEO-IDW01M1 is a Wi-Fi evaluation board based on the SPWF01SA module, which expands the STM32 Nucleo boards. The CE, IC and FCC certified SPWF01SA module has an embedded STM32 MCU, a low-power Wi-Fi b/g/n SoC with integrated power amplifier and power management and an SMD antenna. The SPWF01SA module communicates with the STM32 Nucleo developer board host microcontroller though an USART link available on the Arduino UNO R3 connector.

Main Features:
- X-NUCLEO-IDW01M1 hosts FCC, IC and CE certified SPWF01SA module (FCC ID: VRA-SG9011203, IC: 7420A-SG9011203 and ETSI compliant)
- SPWF01SA module major characteristics:
  - Compatible with STM32 Nucleo boards
  - Equipped both with ST morpho connector and Arduino UNO R3 connectors
  - Scalable solution; it can cascade multiple boards for larger systems
  - Free development firmware library and examples, compatible with STM32Cube
  - RoHS compliant

Key Products on board

**SPWF01SA**
ST SPWF01Sx module, 802.11 b/g/n compliant

Latest info available at www.st.com X-NUCLEO-IDW01M1
X-NUCLEO-IKS01A1 Hardware Description

- The X-NUCLEO-IKS01A1 is a motion MEMS and environmental sensor evaluation board system.
- It is compatible with the Arduino UNO R3 connector layout, and is designed around ST’s latest sensors.

**Key Product on board**

**LSM6DS0:** MEMS 3D accelerometer (±2/±4/±8 g) + 3D gyroscope (±245/±500/±2000 dps)

**LIS3MDL:** MEMS 3D magnetometer (±4/±8/±12/16 gauss)

**LPS25HB:** MEMS pressure sensor, 260-1260 hPa absolute digital output barometer

**HTS221:** capacitive digital relative humidity and temperature

**DIL 24-pin:** socket available for additional MEMS adapters and other sensors (UV index)
Motion MEMS and environmental sensors expansion board

Hardware Overview (3/4)

X-NUCLEO-IKS01A2 Hardware Description

- The X-NUCLEO-IKS01A2 is a motion MEMS and environmental sensor evaluation board system.

- It is compatible with the Arduino UNO R3 connector layout, and is designed around ST’s latest sensors.

Key Product on board

**LSM6DSL**
MEMS 3D accelerometer (±2/±4/±8/±16 g) + 3D gyroscope (±125/±245/±500/±1000/±2000 dps)

**LSM303AGR**
MEMS 3D magnetometer (±50 gauss) + MEMS 3D accelerometer (±2/±4/±8/±16 g)

**LPS22HB**
MEMS pressure sensor, 260-1260 hPa absolute digital output barometer

**HTS221**
Capacitive digital relative humidity and temperature

DIL 24-pin

Socket available for additional MEMS adapters and other sensors (UV index)

Latest info available at www.st.com
X-NUCLEO-IKS01A2

** Connector for the STM32 Nucleo Board
STM32L4 Discovery Board for IoT node (B-L475E-IOT01A)

Hardware Description

The STM32L4 Discovery kit for the IoT node (B-L475E-IOT01A) allows users to develop applications with direct connection to cloud servers. The STM32L4 Discovery kit enables a wide diversity of applications by exploiting low-power multilink communication (BLE, Sub-GHz), multiway sensing (detection, environmental awareness) and ARM® Cortex®-M4 core-based STM32L4 Series features. Arduino™ Uno V3 and PMOD connectivity provide unlimited expansion capabilities with a large choice of specialized add-on boards.

Key Product on board

- Ultra-low-power STM32L4 Series MCUs based on ARM® Cortex®-M4 core with 1 Mbyte of Flash memory and 128 Kbytes of SRAM, in LQFP100 package
- Bluetooth® V4.1 module (SPBTLE-RF)
- Sub-GHz (868 or 915 MHz) low-power-programmable RF module (SPSGRF-868 or SPSGRF-915)
- Wi-Fi® module Inventek ISM43362-M3G-L44 (802.11 b/g/n compliant)
- Dynamic NFC tag based on M24SR with its printed NFC antenna
- 2 digital omnidirectional microphones (MP34DT01)
- Capacitive digital sensor for relative humidity and temperature (HTS221)
- High-performance 3-axis magnetometer (LIS3MDL), 3D accelerometer and 3D gyroscope (LSM6DSL), 260-1260 hPa absolute digital output barometer (LPS22HB), Time-of-Flight and gesture-detection sensor (VL53L0X)
- USB OTG FS with Micro-AB connector
- Expansion connectors: Arduino™ Uno V3, PMOD
- Flexible power-supply options: ST LINK USB VBUS or external sources
- On-board ST-LINK/V2-1 debugger/programmer with USB re-enumeration capability: mass storage, virtual COM port and debug port

Latest info available at www.st.com
B-L475E-IOT01A
FP-CLD-AWS1 Software Overview

FP-CLD-AWS1 Software Description

FP-CLD-AWS1 is an STM32 ODE Function Pack. Thanks to this package you can directly connect your IoT sensor node to Amazon AWS IoT, transmit sensors data and receive command from Cloud applications.

Key features

- Complete firmware to safely connect an IoT node with sensors to Amazon AWS IoT using Wi-Fi communication technology
- Middleware libraries featuring the Amazon AWS IoT software development kit, Wi-Fi, and transport-level security (mbedTLS)
- Ready-to-use binaries to connect the IoT node to a web dashboard running on Amazon AWS services for sensor data visualization and device control
- Sample implementations available for STM32L4 Discovery Kit for IoT node (B-L475E-IOT01A), or for X-NUCLEO-IKS01A2 or X-NUCLEO-IKS01A1, X-NUCLEO-IDW01M1 when connected to a NUCLEO-F401RE development board
- Easy portability across different MCU families, thanks to STM32Cube
- Free, user-friendly license terms

Overall Software Architecture

Latest info available at www.st.com

FP-CLD-AWS1
Quick Start Guide Contents

FP-CLD-AWS1: STM32Cube function pack for IoT sensor node with telemetry and device control applications for Amazon AWS Cloud
Hardware and Software overview

Setup & Demo Examples
Documents & Related Resources

STM32 Open Development Environment: Overview
• 1x Wi-Fi expansion board based on SWPF01SA module for STM32 Nucleo (X-NUCLEO-IDW01M1)
• 1x Motion MEMS and environmental sensor expansion board for STM32 Nucleo (X-NUCLEO-IKS01A2 or X-NUCLEO-IKS01A1)
• 1x STM32 Nucleo development board (NUCLEO-F401RE)
• 1x USB type A to mini-USB cable
• 1x Laptop/PC with Windows 7, 8 or above
• Wi-Fi Router or access to a Wi-Fi network
Setup & Demo Examples
HW prerequisites (2/2)

NUCLEO-F401RE

STM32 Nucleo

+ 

X-NUCLEO-IDW01M1

Wi-Fi

X-NUCLEO-IKS01A2
or X-NUCLEO-IKS01A1

Sensors

NUCLEO-IKS01A2
or NUCLEO-IKS01A1
Setup & Application Examples

HW prerequisites for B-L475E-IOT01A

- 1x B-L475E-IOT01A development board
- Laptop/PC with Windows 7, 8 or 10
- 1 x USB type A to mini-USB cable
- Wi-Fi Router or access to a Wi-Fi network
Setup & Demo Examples
SW prerequisites

- **STM32 ST-Link Utility**
  - Download and install [STSW-LINK004](http://www.st.com) from www.st.com

- **FP-CLD-AWS1**
  - Download [FP-CLD-AWS1](http://www.st.com) package from www.st.com, copy the .zip file content into a folder on your PC. The package contains binaries and source code with project files ([Keil](http://www.keil.com), [IAR](http://www.iar.com), [System Workbench](http://www.systemworkbench.com)) based on NUCLEO-F401RE and B-L475E-IOT01A.

- **Serial line monitor**, e.g. TeraTerm ([https://ttssh2.osdn.jp/](http://https://ttssh2.osdn.jp/))

- **Chrome** web browser ([https://www.google.com/chrome/](http://https://www.google.com/chrome/)); tested with Chrome version v56.0.2924.76
FP-CLD-AWS1

Get results in few minutes (1/2)

1. Go to www.st.com/stm32ode-fp

2. Select FP-CLD-AWS1

3. Download & unpack FP-CLD-AWS1

FP-CLD-AWS1 package structure:
- Docs
- BSP, HAL and Drivers
- AWS IoT SDK, Wi-Fi, FreeRTOS
- AWS IoT MQTT Client application

4. Release Notes

5. Open project examples for different IDEs

6. Build & Run the application (or use pre-compiled binaries)

7. Configure Wi-Fi and read the MAC address from the terminal

Download and install STSW-LINK004
Get Results in few minutes (2/2)

8 Go to http://st-dashboard-iot.s3-website-us-east-1.amazonaws.com

9 Register your board using MAC address as device Id

10 Download Certificate and key from dashboard

11 Update Device Cert & Key through serial terminal

12 Login to Dashboard

13 Visualize sensors data

14 Control board LED
FP-CLD-AWS1. Step by step setup in details
Launch Firmware application (1/2)

- Connect the board to your laptop using micro (for B-L475E-IOT01A) or mini (for NucleoF401RE) USB cable
FP-CLD-AWS1. Step by step setup in details
Launch Firmware application (2/2)

• Precompiled binaries are provided in folders:
  • Projects\B-L475E-IOT01\Applications\Cloud\AWS\Binary
  • Projects\STM32F401RE-Nucleo\Applications\Cloud\AWS\Binary

• Drag binary to connected board to flash the microcontroller
FP-CLD-AWS1. Step by step setup in details
Configure Serial Terminal (1/2)

• Open serial terminal then configure baud rate speed to 115200 (Setup → Serial port in TeraTerm).

![Image showing TeraTerm setup](image-url)
FP-CLD-AWS1. Step by step setup in details
Configure Serial Terminal (2/2)

- Configure New-line (Rx:AUTO/Tx:CR+LF) and enable local echo in Terminal configuration (Setup → Terminal in TeraTerm).
FP-CLD-AWS1. Step by step setup in details
Configure Wi-Fi parameters and read MAC address

• Enter SSID, PWD and security mode

• Read MAC address
FP-CLD-AWS1. Step by step setup in details

Register a new board (1/2)

- Connect to [http://st-dashboard-iot.s3-website-us-east-1.amazonaws.com](http://st-dashboard-iot.s3-website-us-east-1.amazonaws.com) and enter MAC address as Board Id to register your board.
FP-CLD-AWS1. Step by step setup in details
Register a new board (2/2)

- Once the board has been registered, a link will appear below Board Id; click on the link to download a file containing device certificate and key.
FP-CLD-AWS1. Step by step setup in details
Copy certificate and key to device (1/2)

- In serial terminal, confirm first default values for RootCA certificate, AWS IoT endpoint and device name.
FP-CLD-AWS1. Step by step setup in details

Copy certificate and key to device (2/2)

- Open certificate file in a text editor, then copy/paste device certificate and key in serial terminal when requested.
FP-CLD-AWS1. Step by step setup in details

Visualize sensors data (1/2)

- Return to [http://st-dashboard-iot.s3-website-us-east-1.amazonaws.com](http://st-dashboard-iot.s3-website-us-east-1.amazonaws.com) and enter MAC address as Board Id to login
FP-CLD-AWS1. Step by step setup in details
Visualize sensors data (2/2)

- Visualize environmental and inertial sensors data collected up to past 24 hours
FP-CLD-AWS1. Step by step setup in details

Control LED

- Use LED control section to switch on/off green LED onboard NucleoF401RE or B-L475E-IOT01A
All documents are available in the DESIGN tab of the related products webpage

FP-CLD-AWS1:
- **DB3232**: STM32Cube function pack for IoT sensor node with telemetry and device control applications for Amazon AWS Cloud – data brief
- **UM2186**: Getting started with the FP-CLD-AWS1 software package for IoT node with Wi-Fi and sensors, connected to Amazon AWS IoT cloud – user manual
- Software setup file

X-NUCLEO-IDW01M1:
- Gerber files, BOM, Schematic
- **DB2726**: Wi-Fi expansion board based on SPWF01SA module for STM32 Nucleo – data brief
- **UM1975**: Getting started with X-NUCLEO-IDW01M1 Wi-Fi expansion board based on SPWF01SA module for STM32 Nucleo – user manual

X-NUCLEO-IKS01A1:
- Gerber files, BOM, Schematic
- **DS10619**: Motion MEMS and environmental sensor expansion board for STM32 Nucleo – product specification
- **UM1820**: Getting started with motion MEMS and environmental sensor expansion board for STM32 Nucleo – user manual

X-NUCLEO-IKS01A2:
- Gerber files, BOM, Schematic
- **DB3009**: Motion MEMS and environmental sensor expansion board for STM32 Nucleo – data brief
- **UM2121**: Getting started with the X-NUCLEO-IKS01A2 motion MEMS and environmental sensor expansion board for STM32 Nucleo – user manual

B-L475E-IOT01A:
- Gerber files, BOM, Schematic
- **DB3143**: Discovery kit for IoT node, multi-channel communication with STM32L4 – data brief
- **UM2052**: Getting started with STM32 MCU Discovery Kits software development tools – user manual
- **UM2153**: Discovery kit for IoT node, multi-channel communication with STM32L4 – user manual

Consult www.st.com for the complete list
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FP-CLD-AWS1: STM32Cube function pack for IoT sensor node with telemetry and device control applications for Amazon AWS Cloud
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STM32 Open Development Environment: Overview
The STM32 Open Development Environment (ODE) consists of a set of stackable boards and a modular open SW environment designed around the STM32 microcontroller family.

STM32Cube development software

STM32 Nucleo development boards

STM32 Nucleo expansion boards (X-NUCLEO)

STM32Cube expansion software (X-CUBE)

Function Packs (FP)

www.st.com/stm32ode
STM32 Nucleo Development Boards (NUCLEO)

- A comprehensive range of affordable development boards for all the STM32 microcontroller series, with unlimited unified expansion capabilities and integrated debugger/programmer functionality.
STM32 Nucleo Expansion Boards (X-NUCLEO)

- Boards with additional functionality that can be plugged directly on top of the STM32 Nucleo development board directly or stacked on another expansion board.

Example of STM32 expansion board (X-NUCLEO-IKS01A1)
### STM32 Open Development Environment

#### Software components

<table>
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<tr>
<th>Tools &amp; IDEs</th>
<th>IAR EWARM, Keil MDK-ARM, GCC-based IDEs (e.g. Ac6 System Workbench for STM32)</th>
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<td>Hardware Abstraction</td>
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<td>Hardware</td>
<td>STM32 Nucleo expansion boards (X-NUCLEO)</td>
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<td>STM32 Nucleo developer boards</td>
</tr>
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</table>

- **STM32Cube software (CUBE)** - A set of free tools and embedded software bricks to enable fast and easy development on the STM32, including a Hardware Abstraction Layer and middleware bricks.

- **STM32Cube expansion software (X-CUBE)** - Expansion software provided free for use with the STM32 Nucleo expansion board and fully compatible with the STM32Cube software framework. It provides abstracted access to expansion board functionality through high-level APIs and sample applications.

- **Compatibility with multiple Development Environments** - The STM32 Open Development Environment is compatible with a number of IDEs including IAR EWARM, Keil MDK, and GCC-based environments. Users can choose from three IDEs from leading vendors, which are free of charge and deployed in close cooperation with ST. These include Eclipse-based IDEs such as Ac6 System Workbench for STM32 and the MDK-ARM environment.

**OPEN LICENSE MODELS:** STM32Cube software and sample applications are covered by a mix of fully open source BSD license and ST licenses with very permissive terms.

[www.st.com/stm32cube](http://www.st.com/stm32cube)

[www.st.com/x-cube](http://www.st.com/x-cube)
STM32 Open Development Environment
Building block approach

The building blocks

Sense

Connect

Translate

Move / Actuate

Power

Process

Software

Your need

Your need

Our answer

COLECT

TRANSMIT

ACCESS

CREATE

POWER

PROCESS

Inertial modules, magnetometer
Pressure, temperature, humidity
Proximity, microphone

Bluetooth LE, Sub-GHz radio
NFC, Wi-Fi, GNSS

Audio amplifier
Touch controller
Operation Amplifier

Stepper motor driver
DC & BLDC motor driver
Industrial input / output

Energy management & battery

General-purpose microcontrollers
Secure microcontrollers

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