Quick Start Guide

Motion MEMS and environmental sensor expansion board for STM32 Nucleo (X-NUCLEO-IKS01A2)
Quick Start Guide Contents

X-NUCLEO-IKS01A2: Motion MEMS and environmental sensor expansion board
  Hardware and Software overview

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STM32 Open Development Environment: Overview
Motion MEMS and environmental sensor expansion board

Hardware overview (1/3)

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 products 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**
Key features

- The X-NUCLEO-IKS01A2 is a motion MEMS and environmental sensor evaluation board system.
- All sensors are connected on a single I²C bus or could be managed by a Sensor HUB.
- Sensor I²C address selection.

- DIL24 socket (compatible with STEVAL-MKI***V* MEMS adapter boards)

* is used as a wildcard character for related part number.
Key features

- Sensor disconnection (disconnects the I²C bus as well as the power supply allowing power consumption measurements)

- Interrupt and DRDY signals from sensors could be re-directed.
X-CUBE-MEMS1 Software description

- The X-CUBE-MEMS1 software package is an expansion for STM32Cube, associated with the X-NUCLEO-IKS01A2 expansion board.
- It is compatible with NUCLEO-F401RE, NUCLEO-L053R8, NUCLEO-L152RE or NUCLEO-L476RG

Key features

- Complete middleware to build applications using temperature and humidity sensors (HTS221), pressure sensor (LPS22HB) and motion sensors (LSM303AGR and LSM6DSL)
- Easy portability across different MCU families, thanks to STM32Cube
- Sample application to transmit real-time sensor data to a PC
- PC-based application (Windows®) to log sensor data
- Low-power optimization (suitable for the STM32L0 MCU family)
- Free, user-friendly license terms

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Setup & demo examples

Hardware prerequisites

- 1x Motion MEMS and environmental sensor expansion board (X-NUCLEO-IKS01A2)
- 1x STM32 Nucleo development board (NUCLEO-F401RE or NUCLEO-L053R8 or NUCLEO-L152RE or NUCLEO-L476RG)
- Windows 8/7 - Laptop/PC
- 1 x USB type A to mini-B USB cable
Setup & demo examples
Software prerequisites

- **STSW-LINK008**: ST-LINK/V2-1 USB driver
- **STSW-LINK007**: ST-LINK/V2-1 firmware upgrade
- **X-CUBE-MEMS1**
  - Copy the .zip file content into a folder on your PC
  - The package contains source code examples (Keil, IAR, System Workbench) based on **NUCLEO-F401RE or NUCLEO-L053R8 or NUCLEO-L152RE or NUCLEO-L476RG**
X-CUBE-MEMS1 in 7 steps

Use of Sensors_DataLog GUI with precompiled BIN FW

X-CUBE-MEMS1 for NUCLEO-F401RE or NUCLEO-L053R8 or NUCLEO-L152RE or NUCLEO-L476RG

1. www.st.com/x-nucleo

2. Select X-NUCLEO-IKS01A2

3. Download & unpack X-CUBE-MEMS1

4. Download & install STM32 Nucleo ST-LINK/V2-1 USB driver STSW-LINK008

5. Download / Install / Run ST-Link FW Upgrade utility STSW-LINK007
X-CUBE-MEMS1 in 7 steps

Use of Sensors_DataLog GUI with precompiled BIN fmw

X-CUBE-MEMS1 for NUCLEO-F401RE or NUCLEO-L053R8 or NUCLEO-L152RE
or NUCLEO-L476RG

6. Drag and drop DataLog.bin for F4 or for L0 or for L1 or for L4 on Nucleo drive

6. Open Utilities Folder in the X-CUBE-MEMS1 SW package

7. ...and Run Sensors_DataLog PC GUI
X-CUBE-MEMS1 for NUCLEO-F401RE, NUCLEO-L053R8, NUCLEO-L152RE or NUCLEO-L476RG

Select COM port

Select sensor reading interval

Select sensors

Start data logging

Select graph plots

Data Log Area

Sensors_DataLog PC GUI
X-CUBE-MEMS1

Compile the DataLog FW using a supported IDE

X-CUBE-MEMS1 for NUCLEO-F401RE, NUCLEO-L053R8, NUCLEO-L152RE or NUCLEO-L476RG

1. www.st.com/x-nucleo

2. Select X-NUCLEO-IKS01A2

3. Download & unpack

4. Flash and run the project.

X-CUBE-MEMS1 package structure

- Docs
- Low-level sensor drivers
- L0 / F4 / L1 / L4 example (DataLog FW)
- PC GUI (Sensors_DataLog)

\file{\text{STM32CubeExpansion_MEMS1_V3.0.0}\Projects\Multi\Examples\IKS01A2\DataLog\EWARM\STM32F401RE-Nucleo}
X-CUBE-MEMS1 for NUCLEO-F401RE, NUCLEO-L053R8, NUCLEO-L152RE or NUCLEO-L476RG

1. Close the Sensors_DataLog GUI
2. Configure the serial line monitor (speed, LF)
3. Press the BLUE user button on STM32Nucleo
Documents & related resources

All documents are available in the DESIGN tab of the related products webpage

X-NUCLEO-IKS01A2:
- Gerber files, BOM, Schematics
- DB3009: Motion MEMS and environmental sensor expansion board for STM32 Nucleo – Data brief
- UM2121: Getting started with motion MEMS and environmental sensor expansion board for STM32 Nucleo – User manual

X-CUBE-MEMS1:
- DB2442: Motion MEMS and environmental sensor software expansion for STM32Cube – Data brief
- UM1859: Getting started with the X-CUBE-MEMS1 motion MEMS and environmental sensor software expansion for STM32Cube – User manual
- Software Setup File

Consult www.st.com for the complete list
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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.
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)

Motion MEMS sensors
Environmental sensors
DIL24 support for new devices

www.st.com/x-nucleo
STM32 Open Development Environment
Software components

• **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.

**Tools & IDEs**
- IAR EWARM, Keil MDK-ARM, GCC-based IDEs (e.g. Ac6 System Workbench for STM32)

**Applications**
- Sample applications (e.g. based on ST OpenSoftwareX)

**Middleware**
- STM32Cube middleware
- Upper level middleware (e.g. ST OpenSoftwareX)

**Hardware Abstraction**
- STM32Cube Hardware Abstraction Layer (HAL)

**Hardware**
- STM32 Nucleo expansion boards (X-NUCLEO)
- STM32 Nucleo developer boards

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
www.st.com/x-cube
STM32 Open Development Environment

Building block approach

The building blocks

Your need

Our answer

The building blocks:
- Sense: Accelerometer, gyroscope, Inertial modules, magnetometer, Pressure, temperature, humidity, Proximity, microphone
- Connect: Bluetooth LE, Sub-GHz radio, NFC, Wi-Fi, GNSS
- Translate: Audio amplifier, Touch controller, Operation Amplifier
- Move / Actuate: Stepper motor driver, DC & BLDC motor driver, Industrial input / output
- Power: Energy management & battery
- Process: General-purpose microcontrollers, Secure microcontrollers
- Software: COLLECT, TRANSMIT, ACCESS, CREATE, POWER, PROCESS

STM32 Open Development Environment

www.st.com/stm32ode