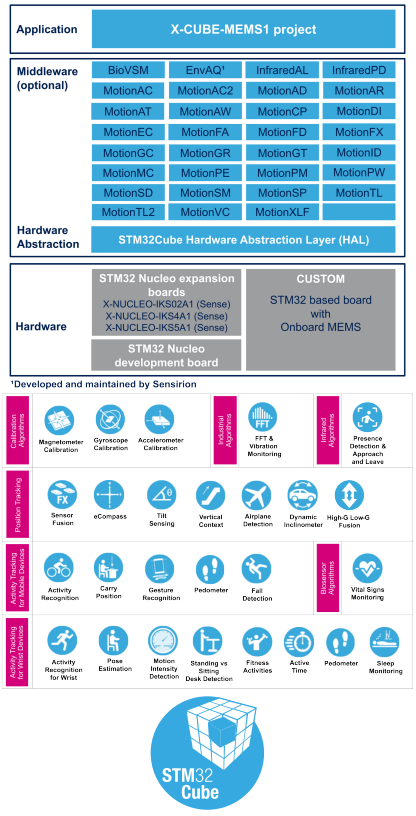
X-CUBE-MEMS1

Data brief

Sensor and motion algorithm software expansion for STM32Cube



Product summary	
Sensor and motion algorithm software expansion for STM32Cube	X-CUBE-MEMS1
Motion MEMS and environmental sensor expansion board for STM32 Nucleo	X-NUCLEO-IKS02A1/X-NUCLEO-IKS4A1/ X-NUCLEO-IKS5A1
STM32 Nucleo development board	STM32 Nucleo
Applications	Climate control/ Connectivity/ Lighting Controls/ Metering/Sensing/ Smart farming/ Tracking/Virtual - Augmented Reality

Features

- Complete software to build applications using the following sensors:
  - motion sensors: A3G4250D, AIS2DW12, AIS2IH, AIS328DQ, AIS3624DQ, ASM330LHH, ASM330LHHX, H3LIS331DL, IIS2DLPC, IIS2DULPX, IIS2ICLX, IIS2MDC, IIS3DWB, ISM303DAC, ISM330BX, ISM330DHCX, ISM330DLC, ISM330IS, ISM6HG256X, LIS2DH12, LIS2DTW12, LIS2DU12, LIS2DUX12, LIS2DUXS12, LIS2DW12, LIS2MDL, LIS3MDL, LSM303AGR, LSM6DSL, LSM6DSO, LSM6DSO32, LSM6DSO32X, LSM6DSOX, LSM6DSR, LSM6DSRX, LSM6DSV, LSM6DSV16B, LSM6DSV16BX, LSM6DSV16X, LSM6DSV32X, LSM6DSV80X, LSM6DSV320X, LSM6DSO16IS
  - pressure sensors: ILPS22QS, ILPS28QSW, LPS22CH, LPS22DF, LPS22HB, LPS22HH, LPS27HHTW, LPS28DFW, LPS33HW, LPS33K
  - infrared sensor: STHS34PF80
  - temperature and humidity sensors: HTS221, SGP40, SHT40AD1B, STTS22H, STTS751
  - audio sensor: IMP34DT05
  - biosensors: ST1VAFE6AX, ST1VAFE3BX
  - X-NUCLEO-IKS02A1 expansion board with onboard ISM330DHCX, IIS2DLPC, IIS2MDC and IMP34DT05 sensors
  - X-NUCLEO-IKS4A1 expansion board with onboard LSM6DSV16X, LSM6DSO16IS, LIS2DUXS12, LIS2MDL, LPS22DF and STTS22H sensors
  - X-NUCLEO-IKS5A1 expansion board with onboard ISM330IS, ISM6HG256X, ILPS22QS, IIS2DULPX, IIS2MDC sensors
- Several examples to show the innovative inertial and environmental sensors
- Sample application to transmit real-time sensor data to a PC
- Compatible with the MEMS-Studio graphical user interface to display sensor data and configure outputs
- Sample implementation available on the X-NUCLEO-IKS02A1/X-NUCLEO-IKS4A1 or X-NUCLEO-IKS5A1 boards connected to a NUCLEO-L073RZ, NUCLEO-L152RE, NUCLEO-F401RE or NUCLEO-U575ZI-Q development board
- Advanced motion libraries with sample applications
- Package compatible with STM32CubeMX, can be downloaded from and installed directly into STM32CubeMX
- Easy portability across different MCU families, thanks to STM32Cube
- Free, user-friendly license terms

Description

The X-CUBE-MEMS1 expansion software package for STM32Cube runs on the STM32 and includes drivers that recognize the sensors and collect temperature, humidity, pressure, and motion data. The expansion is built on STM32Cube software technology to ease portability across different STM32 microcontrollers. The software comes with a sample implementation of the drivers running on the X-NUCLEO-IKS02A1/X-NUCLEO-IKS4A1/X-NUCLEO-IKS5A1 expansion boards connected to a featured STM32 Nucleo development board. The software is also available on GitHub, where the users can signal bugs and propose new ideas through [**Issues**] and [**Pull requests**] tabs.

The software provides sample applications and advanced motion libraries: MotionAC accelerometer calibration, MotionAD airplane detection, MotionAR activity recognition, MotionAT active time, MotionAW activity recognition for wrist, MotionCP real-time carry position, MotionDI dynamic inclinometer, MotionEC real-time e-compass, MotionFA fitness activity, MotionFD real-time fall detection, MotionFX sensor fusion, MotionGC gyroscope calibration, MotionGR real-time gesture recognition, MotionGT gyroscope temperature calibration, MotionID motion intensity detection, MotionMC magnetometer calibration, MotionPE real-time pose estimation, MotionPM real-time pedometer library, MotionPW real-time pedometer for wrist, MotionSD standing vs sitting desk detection, MotionTL tilt measurement, MotionVC vertical context, InfraredAL approach and leave, InfraredPD presence and motion detection, BioVSM vital signs monitoring, MotionXLF high-g, low-g accelerometer fusion libraries.

1 Detailed description

1.1 What is STM32Cube?

STM32Cube is a combination of a full set of PC software tools and embedded software blocks running on STM32 microcontrollers and microprocessors:

- STM32CubeMX configuration tool for any STM32 device; it generates initialization C code for Cortex-M cores and the Linux device tree source for Cortex-A cores
- STM32CubeIDE integrated development environment based on open-source solutions like Eclipse or the GNU C/C++ toolchain, including compilation reporting features and advanced debug features
- STM32CubeProgrammer programming tool that provides an easy-to-use and efficient environment for reading, writing and verifying devices and external memories via a wide variety of available communication media (JTAG, SWD, UART, USB DFU, I2C, SPI, CAN, etc.)
- STM32CubeMonitor family of tools (STM32CubeMonRF, STM32CubeMonUCPD, STM32CubeMonPwr) to help developers customize their applications in real-time
- STM32Cube MCU and MPU packages specific to each STM32 series with drivers (HAL, low-layer, etc.), middleware, and lots of example code used in a wide variety of real-world use cases
- STM32Cube expansion packages for application-oriented solutions.

1.2 How does this software complement STM32Cube?

This software is based on the STM32CubeHAL hardware abstraction layer for the STM32 microcontroller.

The package extends STM32Cube by providing a board support package (BSP) for the sensor expansion board. The drivers abstract the hardware low-level details and allow the applications to access sensor data in a hardware-independent manner.

The package includes several sample applications that the developer can use to start experimenting with the code. A sample application has been developed to enable sensor data logging on a PC; a Windows PC utility (MEMS-Studio) is available on www.st.com, to allow the developer choose among various sensors available on the expansion board and set the appropriate delay/interval among consecutive data points.

Sensor data can be logged to a file selected by the user.

The package is compatible with STM32CubeMX. It can be downloaded from and installed directly into STM32CubeMX, as detailed in UM1718 (freely available on www.st.com).

Revision history

Table 1. **Document revision history**

Date	Revision	Changes
07-Nov-2014	1	First release.
19-Dec-2014	2	Modified the document title, features, and description text on the cover page. Added Section 1: Detailed description.
17-Jun-2015	3	Updated: Title on the cover page.
20-Oct-2015	4	Updated: Overall system architecture, features and description on the cover page.
21-Dec-2015	5	Updated cover image
22-Dec-2015	6	Updated How does this software complement STM32Cube?
04-Nov-2016	7	Updated cover image Updated hardware compatibility information for X-NUCLEO-IKS01A2 expansion board and associated sensors.
20-Mar-2017	8	Updated cover image, features, description and How does this software complement STM32Cube?
20-Sep-2017	9	Updated cover page image and description.
14-Nov-2017	10	Updated cover page title.
09-Jul-2018	11	Updated cover page image, features, and description.
20-Dec-2018	12	Updated cover page features and Section 1.2 How does this software complement STM32Cube?
18-Feb-2019	13	Updated cover page image. Added X-NUCLEO-IKS01A3 expansion board compatibility information.
05-Jun-2019	14	Updated cover page image, features and description.
25-Nov-2019	15	Updated cover page image, product summary table, features and description. Updated Section 1.1 What is STM32Cube?. Added X-NUCLEO-IKS02A1 expansion board compatibility information.
14-May-2020	16	Updated cover page image. Added references to MotionAD and MotionDI libraries.
23-Jul-2020	17	Updated cover page features and description. Added references to LPS33K MEMS pressure sensor and IIS2ICLX digital inclinometer.
14-Jan-2022	18	Added link to GitHub in the description.
04-Nov-2022	19	Replaced NUCLEO-L476RG with NUCLEO-U575ZI-Q.
02-Feb-2023	20	Added new sensors: LSM6DSV, LSM6DSV16B, LIS2DUX12, LIS2DUXS12 and SHT40AD1B.
27-Jul-2023	21	Updated cover image and description. Added new sensor: STHS34PF80.
17-Oct-2023	22	Added X-NUCLEO-IKS4A1 expansion board compatibility information.
05-Jul-2024	23	Updated cover image, Section Features, *Section Description and Section 1.2: How does this software complement STM32Cube?.*
15-Oct-2024	24	Updated Section Features, Section Description.
05-Feb-2025	25	Added IIS2DULPX and LSM6DSV80X to motion sensors in Section Features.
05-May-2025	26	Added BioVSM and MotionXLF into feature chart, added support for LSM6DSV320X
09-Sep-2025	27	Added X-NUCLEO-IKS5A1, updated Section Cover image and Section Product summary table with X-NUCLEO-IKS5A1 and BioVSM. Removed X-NUCLEO-IKS01A3 – updated Section Cover image, Section Product summary table, Section Features, Section Description.

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