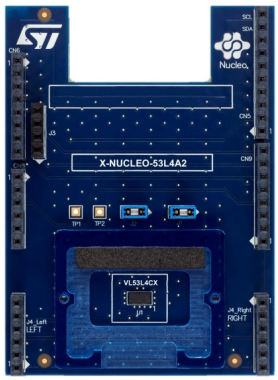
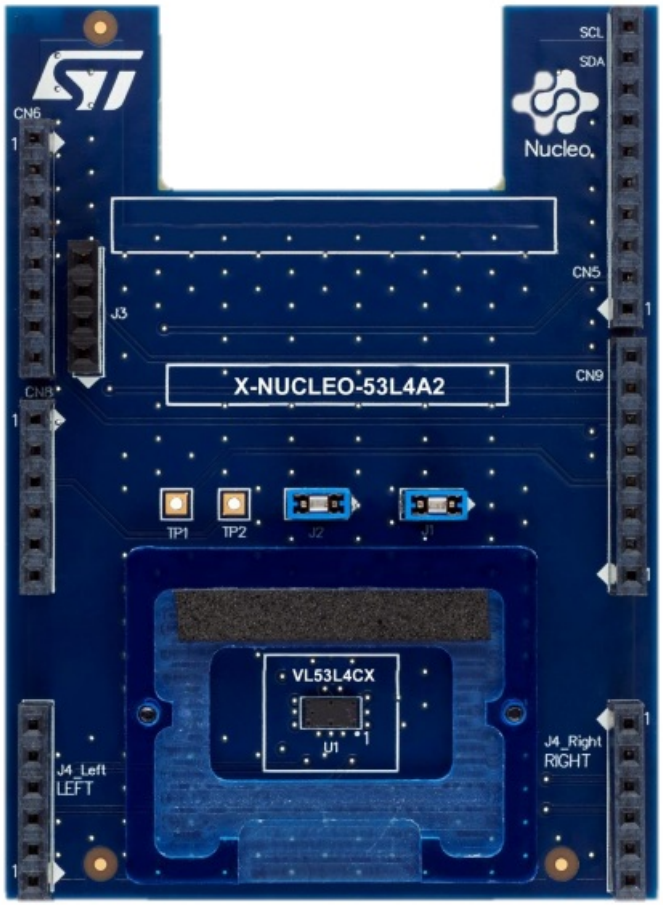


STM32 Nucleo Time Flight Sensor with Extended Range Measurement User Guide

STM32 Nucleo Time Flight Sensor with Extended Range Measurement



Time-of-Flight sensor with extended range measurement based on the VL53L4CX expansion board for STM32 Nucleo

Contents

Hardware Overview

X-NUCLEO-53L4A2 Hardware Description

- The X-NUCLEO-53L4A2 is a Time-of-Flight sensor with extended range measurement and development board

designed around the VL53L4CX sensor based on ST FlightSense™ patented technology

- The VL53L4CX communicates with the STM32 Nucleo developer board host microcontroller through an I2C link available on the Arduino UNO R3 connector.

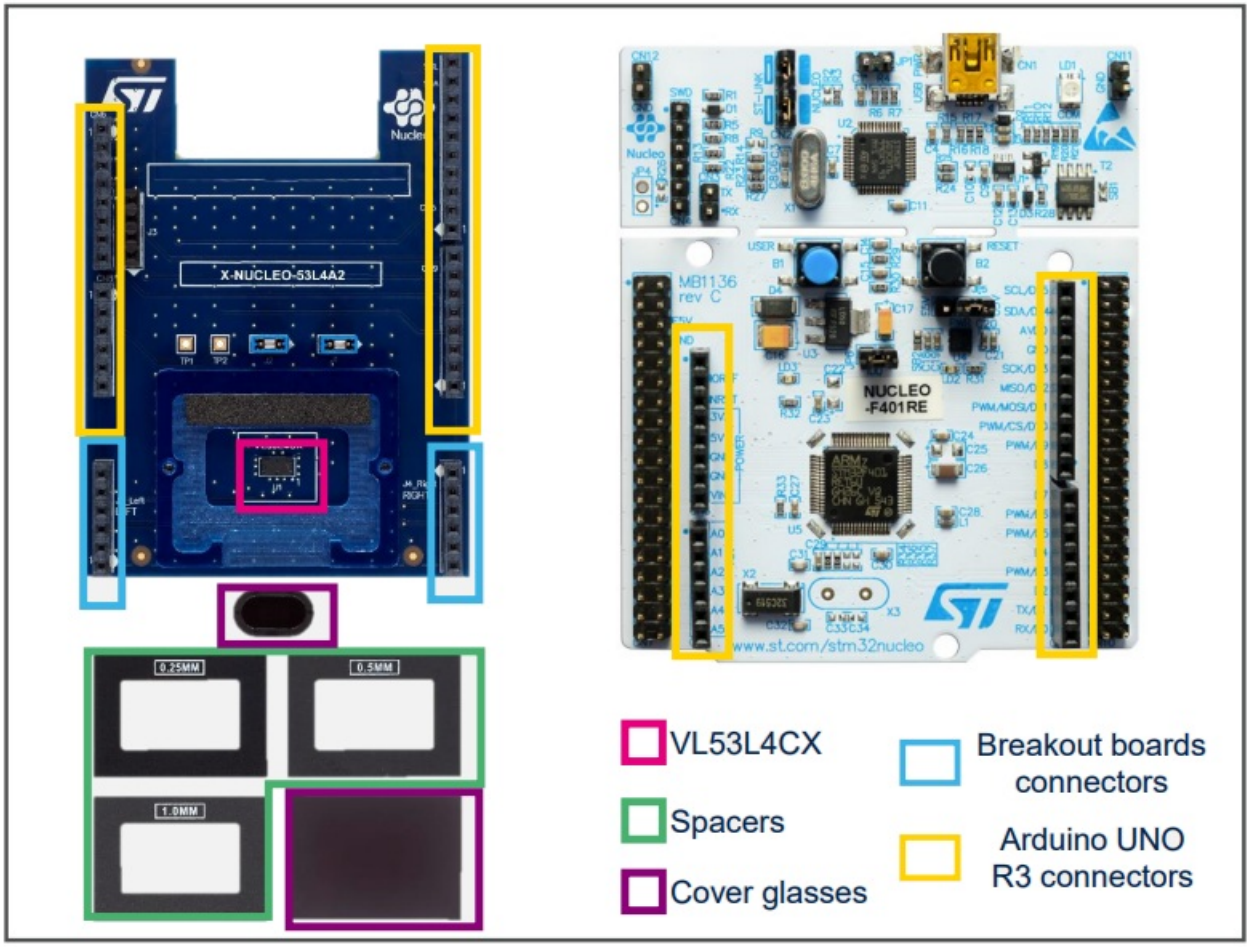
Key Products on board

VL53L4CX Time-of-Flight (ToF) Time-of-Flight sensor with extended range measurement
0.25, 0.5 and 1mm spacers to simulate air gaps, with the cover glasses

Breakout boards connectors

SATEL-VL53L4CX breakout boards can be purchased separately

Order Code: X-NUCLEO-53L4A2

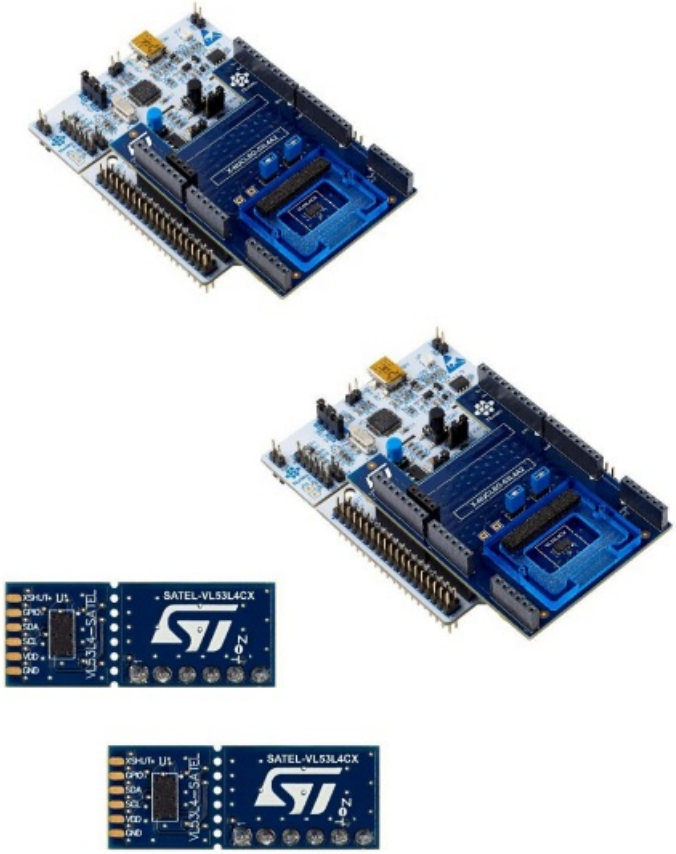


Latest info available at www.st.com
X-NUCLEO-53L4A2

- X-NUCLEO-53L4A2 expansion board
- VL53L4CX devices in custom applications can be integrated with expansion board, or external VL53L4CX breakout.
- The breakout boards are delivered separately.
- X-NUCLEO-53L4A2 is also available as a NUCLEO Pack (P-NUCLEO-53L4A2)
- The X-NUCLEO-53L4A2 expansion board can also be ordered on **www.st.com** as part of a NUCLEO Pack

with expansion board and STM32 NUCLEO board.

- Order code: P-NUCLEO-53L4A2:
  X-NUCLEO-53L4A2 expansion board and NUCLEO-F401RE full features board.
- VL53L4CX breakout boards can be ordered separately
- Order code: SATEL-VL53L4CX
- The pack carry two breakout boards



Time-of-Flight sensors Software Environment

STM32Cube Software Overview

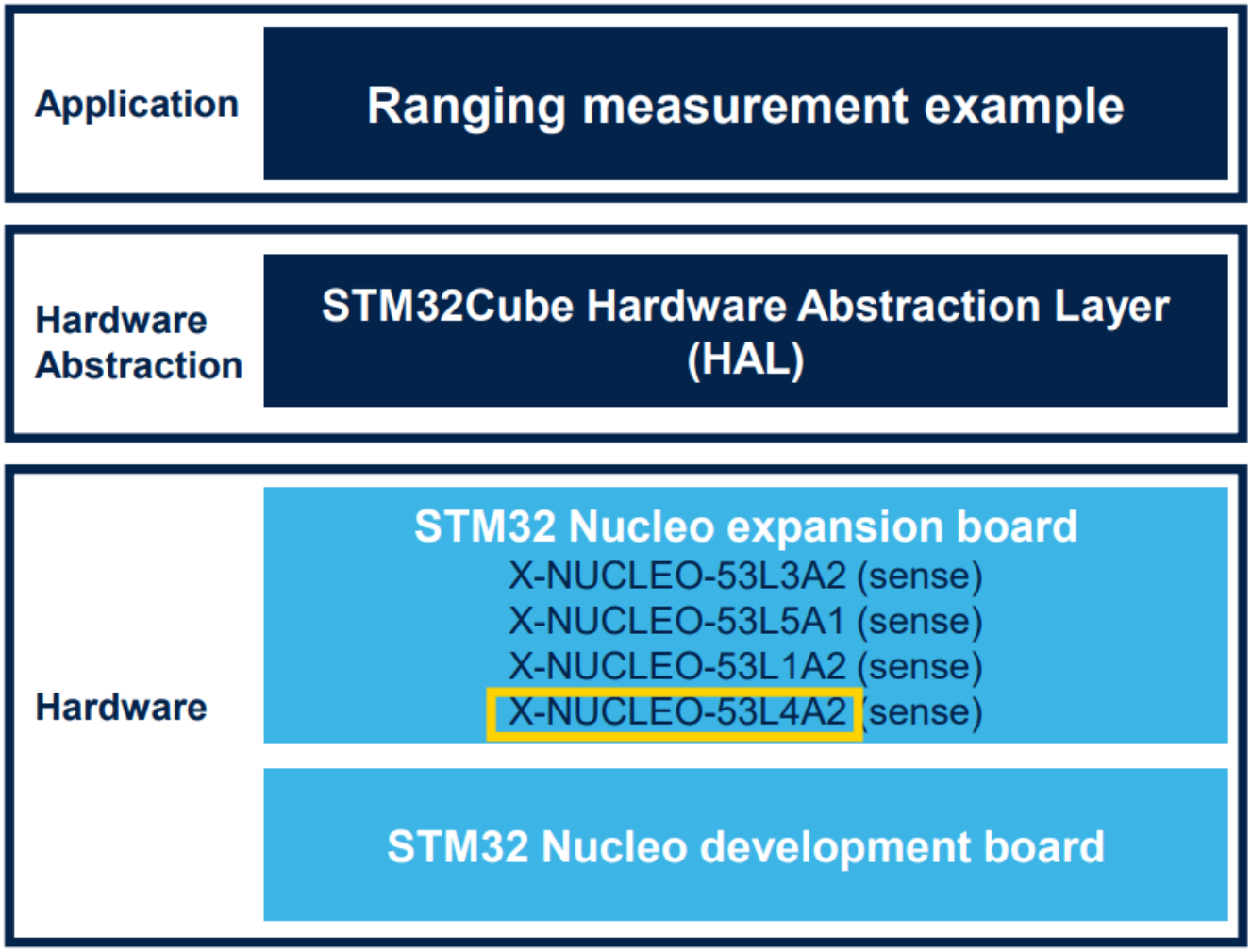
X-CUBE-TOF1 software description

- The X-CUBE-TOF1 software package is a STM32Cube expansion for the expansion boards of the Time-ofFlight product family (including the X-NUCLEO-53L4A2) for STM32. The source code is based on STM32Cube to ease portability and code sharing across different STM32 MCU families. A sample implementation is available for the STM32 Nucleo ranging sensor expansion board (X-NUCLEO-53L4A2) plugged on top of an STM32 Nucleo development board (NUCLEOF401RE or NUCLEO L476RG).

Key features

- Driver layer (VL53L4CX driver) for complete management of the VL53L4CX sensor with extended range measurement integrated in the X-NUCLEO53L4A2 expansion board.
- Easy portability across different MCU families, thanks to STM32Cube.
- Free, user-friendly license terms.

- Sample code for ranging measurement.

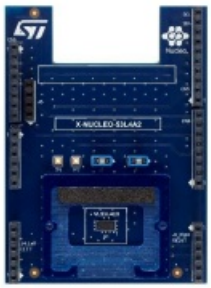


Latest SW available at www.st.com
X-CUBE-TOF1

Setup & Demo Examples

HW prerequisites

- 1x High accuracy ToF sensor expansion board based on VL53L4CX **(X-NUCLEO-53L4A2).**



X-NUCLEO-53L4A2

- 1x STM32 Nucleo development board **(NUCLEO-F401RE for example)**

NUCLEO-F401RE

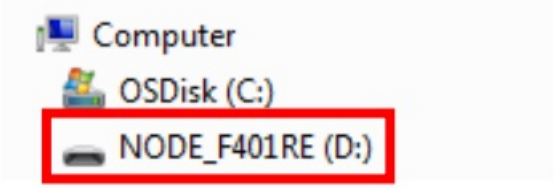
- 1x Laptop/PC with Windows
- 1x USB type A to Mini-B USB cable
- If you don't have an STM32 Nucleo development board, you can order a Nucleo pack **(P-NUCLEO-53L4A2):**

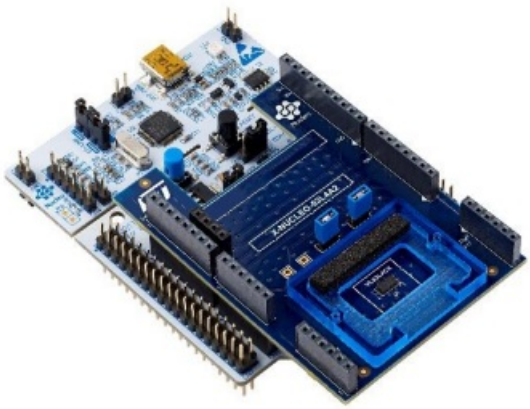
P-NUCLEO-53L4A2

- X-NUCLEO-53L4A2 expansion board and NUCLEO-F401RE full features board delivered together.
- **STSW-IMG029:** Bare driver for VL53L4CX
- **STSW-IMG030:** P-NUCLEO-53L4A2 Graphical User Interface (GUI) on Windows 7 and 10
- **STSW-IMG031:** Linux driver for VL53L4CX
- **X-CUBE-TOF1:** Time-of-Flight sensors software expansion for STM32Cube.
    - When you install the X-CUBE-TOF1 the installer install also the directory containing the example projects here for instance :
        - C:\Users\user_name\STM32Cube\Repository\Packs\STMicroelectronics\X-CUBE TOF1\4.0.0\Projects\STM32F401RENucleo\Examples\53L4A2\53L4A2_SimpleRanging.

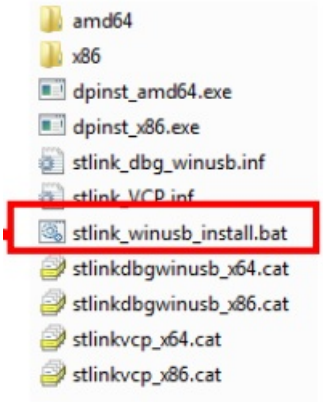
NUCLEO Kit driver installation

1. Connect the P-NUCLEO to the PC through USB
   • Wait for the board to be recognized; the drivers are installed automatically)
   • If Windows cannot install automatically the STLINK driver, please follow step 2





2. Install the PC USB port driver to detect the Nucleo board
   • Download STSW-LINK009 from www.st.com
   • Unzip and double click on “stlink_winusb_install.bat” to install the driver.

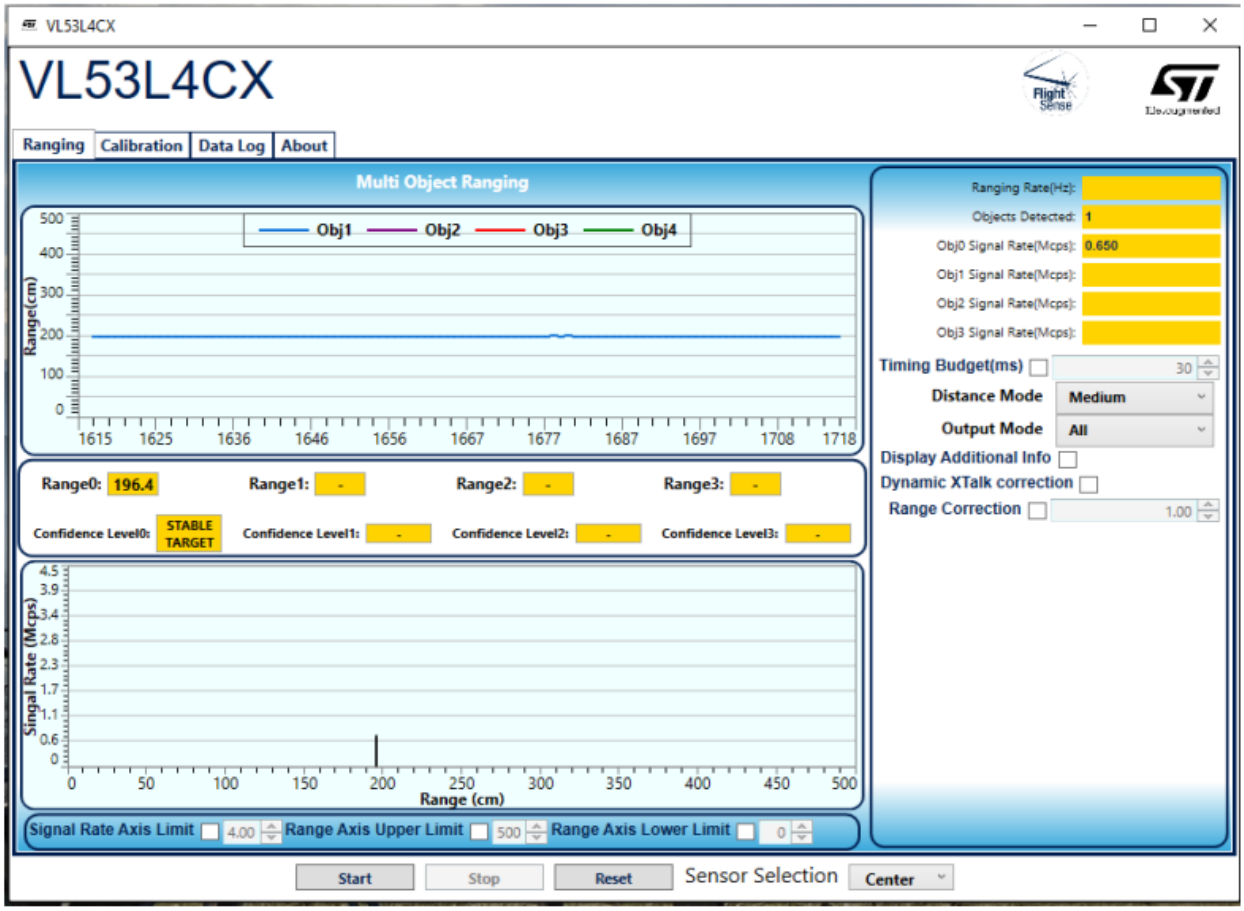


VL53L4CX GUI software installation

GUI is generally the first and easy tool to evaluate the device

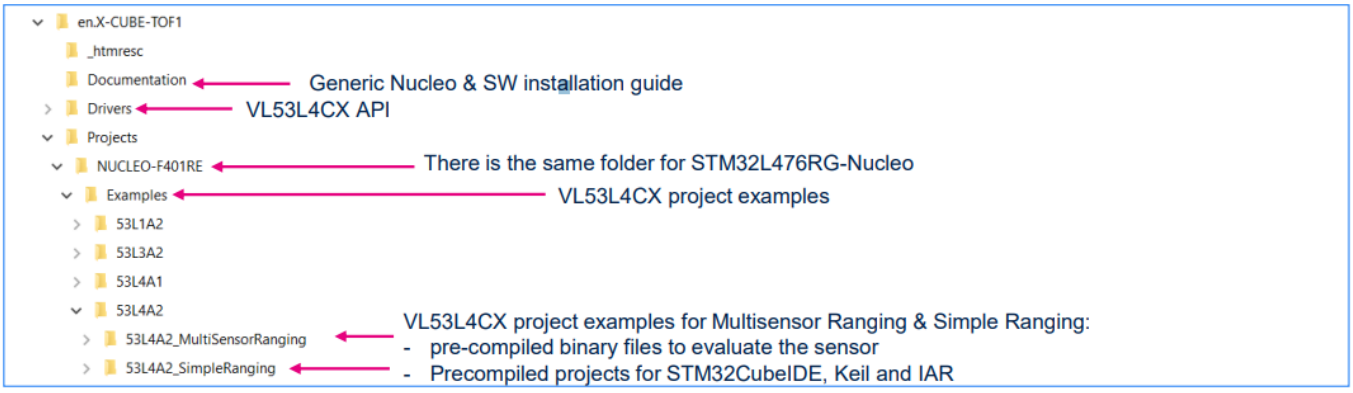
- Perform HW installation and connect the VL53L4CX expansion board + Nucleo F401RE to the PC
- Install the GUI SW for VL53L4CX Demo and configuration settings
  - **TSW-IMG030,** downloaded from **www.st.com**
  - **Run the installer with Admin privileges**

    The Graphical User Interface can:
  - Perform the offset and Xtalk calibration and visualize calibration data
  - Change key parameters of VL53L4CX
  - Display real time the data (distance, signal, ambient rate)
  - Get data logging and replay a datalog (.csv file)



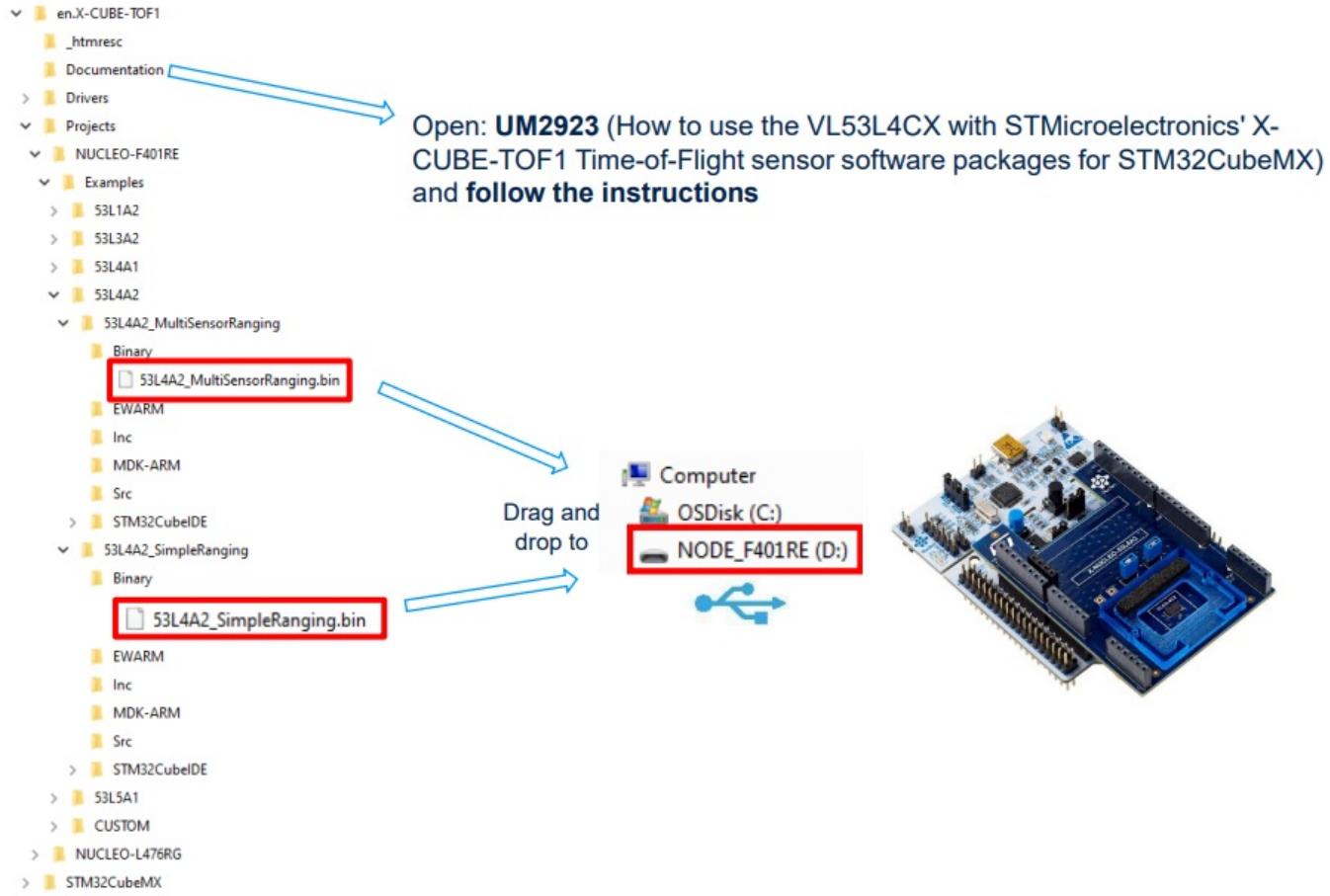
- Perform HW installation and connect the NUCLEO kit (P-NUCLEO 53L4A2) to the PC
- Install the X-CUBE-TOF1 SW package
  - **X-CUBE-TOF1 rev 4.0.0 or newer,** downloaded from www.st.com
  - The X-CUBE-TOF1 is installed through STM32CubeMx, manage software installation section.
  - Once the X-CUBE-TOF1 is installed. Go to
    - C:\Users\user_name\STM32Cube\Repository\Packs\STMicroelectronics\X-CUBE-TOF1\4.0.0- B1\Projects\STM32F401RE Nucleo\Examples\53L4A2\53L4A2_SimpleRanging

X-CUBE software package contents: API SW + SW examples



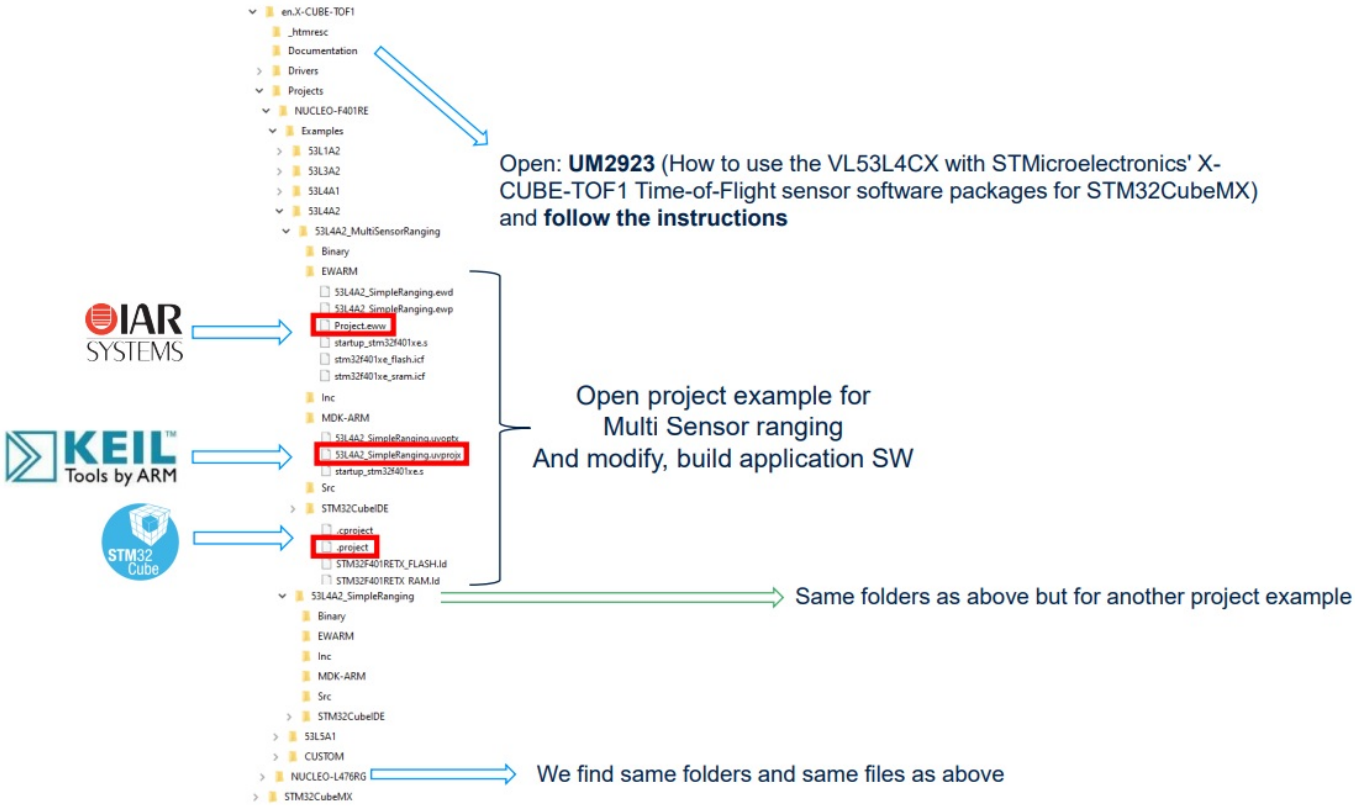
High accuracy Time-of-Flight Sensor expansion board

Evaluation code example (.bin) using X-CUBE-TOF1 and a NUCLEO Pack



VL53L4CX sensor with extended range measurement expansion board

Start programming with code examples using X-CUBE-TOF1 and a NUCLEO Pack



Documents & Related Resources

Go to https://www.st.com/en/imaging-and-photonics-solutions/VL53L4CX

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

VL53L4CX: Product Folder

- **DS13805** : Time-of-Flight sensor with extended range measurement – data sheet

X-NUCLEO-53L4A2: Product Folder

- **DB462** : Time-of-Flight sensor with extended range measurement expansion board based on VL53L4CX for STM32 Nucleo – data brief
- **X-NUCLEO-53L4A2 Quick start guide**: Time-of-Flight sensor with extended range measurement – this document
- **UM2976** : Getting started with X-NUCLEO-53L4A2 Time-of-Flight sensor with extended range measurement based on the VL53L4CX for STM32 Nucleo – user manual

P-NUCLEO-53L4A2: Product Folder

- **DBxxxx** : VL53L4CX Nucleo pack with X-NUCLEO-53L4A2 expansion board and STM32F401RE Nucleo board– data brief

SATEL-VL53L4CX: Product Folder

- **DB4632** : VL53L4CX breakout board Time-of-Flight sensor with extended range measurement – data brief

STSW-IMG029: Bare driver for VL53L4CX folder

- **DB4583** : Application Programming Interface (API) for the VL53L4CX – data brief

STSW-IMG030: Graphical User Interface (GUI) Folder

- DB4584 : P-NUCLEO-53L4A2 pack graphical user interface (GUI) – data brief
- Software setup file

X-CUBE-TOF1: Software package for STM32Cube

- **DB4449** : Time-of-Flight sensors software expansion for STM32Cube – data brief
- **UMxxxx** : Getting started with the STMicroelectronics X-CUBE-TOF1, Time-of Flight sensors, software package for STM32CubeMX – User Manual
- Software setup file

STM32 ODE Ecosystem

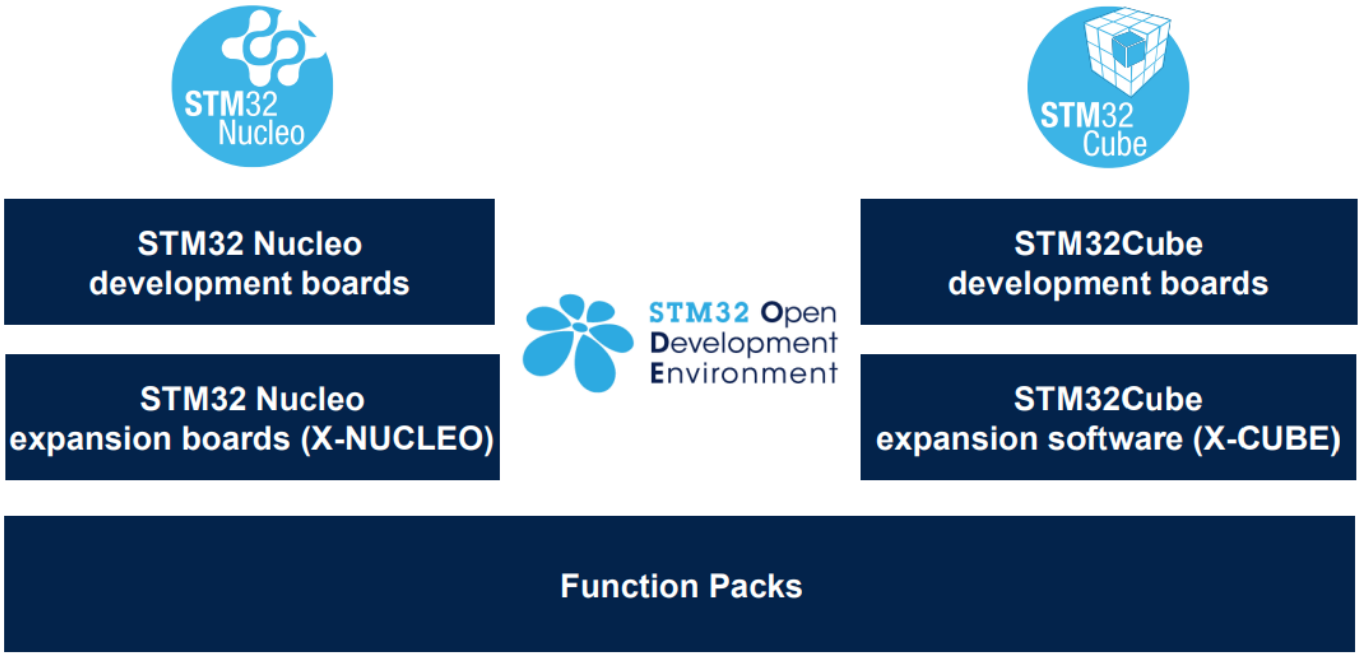
FAST, AFFORDABLE PROTOTYPING AND DEVELOPMENT

The STM32 Open Development Environment (ODE) is an open, flexible, easy and affordable way to develop innovative devices and applications based on the STM32 32-bit microcontroller family combined with other state-of-the-art ST components connected via expansion boards. It enables fast prototyping with leading-edge components that can quickly be transformed into final designs.

The STM32 ODE includes the following five elements:

- STM32 Nucleo development boards. A comprehensive range of affordable development boards for all STM32 microcontroller series, with unlimited unified expansion capability, and with integrated debugger/programmer
- STM32 Nucleo expansion boards. Boards with additional functionality to add sensing, control, connectivity, power, audio or other functions as needed. The expansion boards are plugged on top of the STM32 Nucleo development boards. More complex functionalities can be achieved by stacking additional expansion boards.
- STM32Cube software. A set of free-of-charge tools and embedded software bricks to enable fast and easy development on the STM32, including a Hardware Abstraction Layer, middleware and the STM32CubeMX PC-based configurator and code generator
- STM32Cube expansion software. Expansion software provided free of charge for use with STM32 Nucleo expansion boards, and compatible with the STM32Cube software framework
- STM32Cube Function Packs. Set of function examples for some of the most common application cases built by leveraging the modularity and interoperability of STM32 Nucleo development boards and expansions, with STM32Cube software and expansions.

The STM32 Open Development Environment is compatible with a wide range of development environments including STM32CubeIDE, IAR EWARM, Keil MDK-ARM, and GCC/LLVM-based IDEs, with the possibility to integrate the various components such as STM32CubeMX, STM32CubeProgrammer or STM32CubeMonitor.



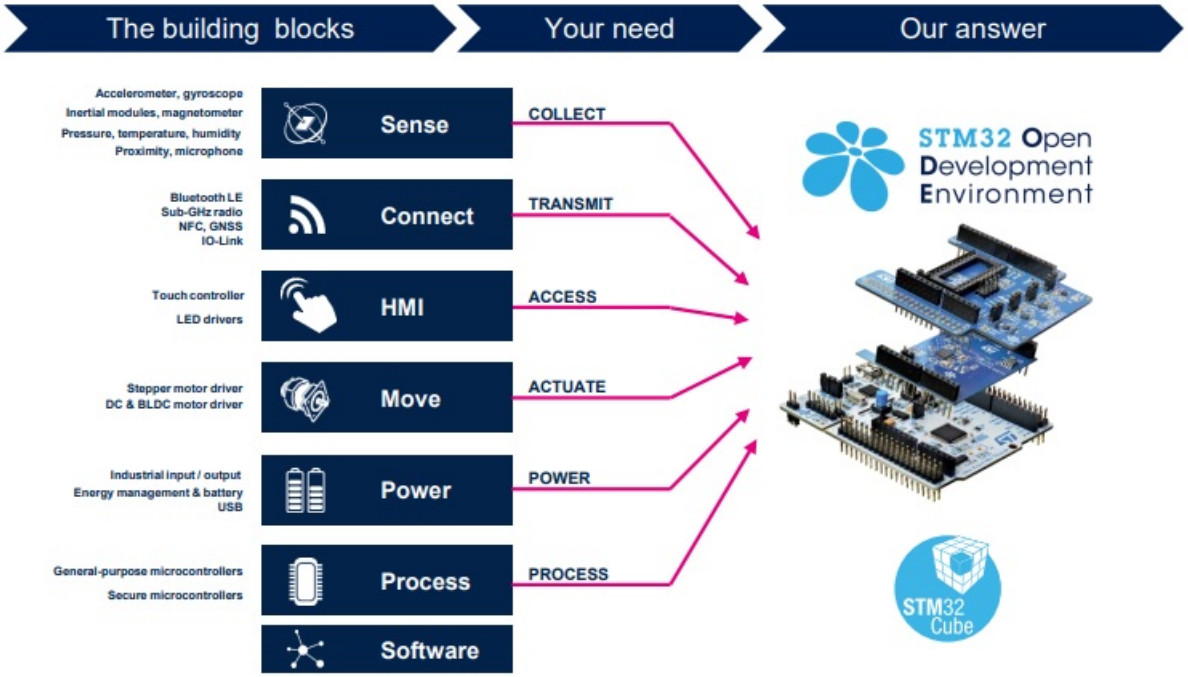
STM32 Open Development Environment: all that you need

The combination of a broad range of expandable boards based on leading-edge commercial products and modular software, from driver to application level, enables fast prototyping of ideas that can be smoothly transformed into final designs.

To start your design:

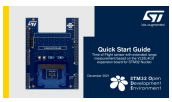
- Choose the appropriate STM32 Nucleo development board (NUCLEO) and expansion (X-NUCLEO) boards (sensors, connectivity, audio, motor control etc.) for the functionality you need.
- Select your development environment (IAR EWARM, Keil MDK and GCC/LLVM-based IDEs) and use the free STM32Cube tools and software such as STM32CubeMX, STM32CubeProgrammer, STM32CubeMonitor or STM32CubeIDE.
- Download all the necessary software to run the functionality on the selected STM32 Nucleo expansion boards.
- Compile your design and upload it to the STM32 Nucleo development board.
- Then start developing and testing your application.

Software developed on the STM32 Open Development Environment prototyping hardware can be directly used in an advanced prototyping board or in an end product design using the same commercial ST components, or components from the same family as those found on the STM32 Nucleo boards.



life.augmented

Documents / Resources

	ST STM32 Nucleo Time Flight Sensor with Extended Range Measurement [pdf] User Guide STM32 Nucleo Time Flight Sensor with Extended Range Measurement, STM32 Nucleo, Time Flight Sensor with Extended Range Measurement, Extended Range Measurement, Range Measurement

References

- STMicroelectronics: Our technology starts with you
- STM32 Open Development Environment - STMicroelectronics
- STM32 Nucleo Expansion Boards - STMicroelectronics
- STM32 Nucleo Development Boards (supports Arduino) - STMicroelectronics
- STM32 ODE Function Packs - STMicroelectronics
- STM32Cube Expansion Software - STMicroelectronics
- STM32Cube Development Software - STM32 Open Development Environment - STMicroelectronics
- VL53L4CX - Time-of-Flight sensor with extended range measurement - STMicroelectronics