Quick Start Guide

Long distance ranging ToF sensor expansion board based on VL53L1X for STM32 Nucleo (X-NUCLEO-53L1A1)
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Long distance ranging ToF sensor expansion board

Hardware Overview (1/2)

X-NUCLEO-53L1A1 Hardware Description

- The X-NUCLEO-53L1A1 is a long distance ranging sensor evaluation and development board designed around the VL53L1X sensor based on ST FlightSense™ Time-of-Flight technology.

- The VL53L1X communicates with the STM32 Nucleo developer board host microcontroller through an I²C link available on the Arduino UNO R3 connector.

Key Products on board

- VL53L1X long distance ranging and gesture detection sensor module
- 0.25, 0.5 and 1mm spacers to simulate air gaps, with the cover glass
- Cover window (made by Hornix) sample with low cross-talk ready to use / clipable on VL53L1X
- 2x VL53L1X breakout boards

Order Code: X-NUCLEO-53L1A1
• **X-NUCLEO-53L1A1 expansion board**
  - To help integrate multiple VL53L1X devices in custom applications, up to 2 external VL53L1X breakout boards can be connected to the expansion board.
  - The breakout boards are delivered with the **X-NUCLEO-53L1A1**.

• **X-NUCLEO-53L1A1 is also available as a NUCLEO Pack (P-NUCLEO-53L1A1)**
  - The X-NUCLEO-53L1A1 expansion board can also be ordered on www.st.com as part of a NUCLEO Pack with expansion board and STM32 NUCLEO board.

• **VL53L1X breakout boards can also be ordered separately**
  - Order code: **VL53L1X-SATEL**
    Two breakout boards are included.

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Remove the protective film on the VL53L1X sensor
The X-CUBE-53L1A1 software package is an STM32Cube expansion for the X-NUCLEO-53L1A1 expansion board for STM32. The source code is based on STM32Cube to ease portability and code sharing across different STM32 MCU families. An sample implementation is available for the STM32 Nucleo ranging sensor expansion board (X-NUCLEO-53L1A1) plugged on top of an STM32 Nucleo development board (NUCLEO-F401RE or NUCLEO-L476RG).

**Key features**

- Driver layer (VL53L1X API) for complete management of the VL53L1X ranging sensor integrated in the X-NUCLEO-53L1A1 expansion board.
- Easy portability across different MCU families, thanks to STM32Cube.
- Free, user-friendly license terms.
- Sample code for ranging measurement.
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HW prerequisites

• 1x Ranging sensor expansion board based on VL53L1X (X-NUCLEO-53L1A1).

• 1x STM32 Nucleo development board (NUCLEO-F401RE or NUCLEO-L476RG)

• 1x Laptop/PC with MS 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-53L1A1):
  • X-NUCLEO-53L1A1 expansion board and NUCLEO-F401RE full features board delivered together.

Remove the protective film on the VL53L1X sensor
Setup & Demo Examples

SW prerequisites

- **STSW-LINK009**: ST-LINKV2-1 USB driver
- **STSW-LINK007**: ST-LINKV2-1 firmware upgrade
- **STSW-IMG008**: P-NUCLEO-53L1A1 Graphical User Interface (GUI) on Windows 7, 8 and 10
- **X-CUBE-53L1A1**: P-NUCLEO-53L1A1 software expansion. Copy the .zip file content into a folder on your PC; the package will contain the API software driver, a simple ranging source code example (Keil, IAR, STM32 System Workbench) based on NUCLEO-F401RE or NUCLEO-L476RG for STM32Cube, and all the necessary documentation.
1. Install the PC USB port driver to detect the Nucleo board
   • Called STSW-LINK009, downloaded from www.st.com
   • Unzip, extract the docs, and install “stlink_winusb_install.bat”

1. Connect the Nucleo pack to the PC through USB
   • Wait for the board to be recognized; the drivers are installed automatically

1. Upgrade ST-link firmware
   • Called STSW-LINK007, downloaded from www.st.com
   • Unzip, extract the docs, go to “Windows” folder and install “ST-linkUpgrade.exe”
   • Launch ST-LinkUpgrade.exe, press Device Connect, then Yes

=> VL53L1X NUCLEO Kit is ready for GUI installation
GUI is generally the first step to evaluate the device

- Perform HW installation and connect the VL53L1X NUCLEO pack (X-NUCLEO-53L1A1 expansion board + STM32 Nucleo board) to the PC

- Install the GUI SW for VL53L1X Demo and configuration settings
  - Called STSW-IMG008, downloaded from www.st.com
  - Unzip, extract the docs, and install “VL53L1X_setup.exe”
  - Run the installer with Admin privileges or change default installation directory

The Graphical User Interface can:

- Perform calibration phases (offset and xTalk with cover glass)
- Change key parameters of VL53L1X
- Display real time key ranging data (distance, signal rate),
- Get data logging (.csv file)
Setup & Demo Examples

VL53L1X GUI software installation

Remove the protective film on the VL53L1X sensor
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X-CUBE-53L1A1 software installation

- Perform HW installation and connect the NUCLEO kit (P-NUCLEO-53L0A1) to the PC

- Install the X-CUBE-53L1A1 SW package
  - Called **X-CUBE-53L1A1**, downloaded from www.st.com
  - Unzip, extract the docs, and the **STM32CubeExpansion_Vx.y.z** folder directory appears

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

- **Generic Nucleo & SW installation guide**
- **VL53L1X API driver**
- **VL53L1X project examples for single sensor ranging**:
  - pre-compiled binary files to evaluate the sensor
  - STM32 IDE with projects on STM32 Workbench, Keil and IAR
VL53L1X long distance ranging ToF sensor expansion board
Evaluation code example (.bin) using X-CUBE-53L1A1 and a NUCLEO Pack

Open: UM2371 (Getting started with VL53L1X ranging sensor software expansion for STM32Cube) and follow the instructions

Load STM32 firmware (Binary code file)
VL53L1X_RangingExample_F401.bin
Or
VL53L1X_RangingExample_L476.bin

Drag and drop to NODE_F401RE (D:)

yum
VL53L1X Long distance ranging ToF sensor expansion board

Start programming with code examples using X-CUBE-53L1A1 and a NUCLEO Pack

Open project example for Single sensor ranging measurement

And

Modify, build application SW

Open: UM2371 (Getting started with VL53L1X ranging sensor software expansion for STM32Cube) and follow the instructions
Documents & Related Resources

Go to www.st.com/VL53L1X
All documents are available in the DESIGN tab of the related products webpage

VL53L1X: Product Folder
  • **DS12385**: A new generation, long distance and fast ranging sensor - [data sheet]

X-NUCLEO-53L1A1: Product Folder
  • **DB2901**: VL53L1X Time-of-Flight ranging sensor expansion board – [data brief]
  • **X-NUCLEO-53L1A1 Quick start guide**: Long distance ranging sensor expansion board - (this document)
  • **UM2359**: BOM and electrical schematic of the expansion board X-NUCLEO-53L1A1 - [user manual]

P-NUCLEO-53L1A1: Product Folder
  • **DB3477**: VL53L1X NUCLEO Pack with X-NUCLEO-53L1A1 expansion board – [data brief]

STSW-IMG008: Graphical User Interface (GUI) Folder
  • **DB3508**: P-NUCLEO-53L1A1 pack PC graphical user interface (GUI) – [data brief]
  • **Software setup file**

STSW-IMG007: Application programming Interface (VL53L1X software driver API) folder
  • **DB3510**: VL53L1X long-distance ranging sensor application programming interface (API) – [data brief]
  • **UM2356**: VL53L1X long-distance ranging sensor application programming interface (API) – [user manual]

X-CUBE-53L1A1: Software package for STM32Cube
  • **DB3523**: VL53L1X ranging and gesture detection sensor software expansion for STM32Cube – [data brief]
  • **UM2371**: Getting started with X-CUBE-53L1A1; ranging sensor software expansion for STM32Cube – [user manual]
  • **Software setup file**
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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.

Motion MEMS sensors
Environmental sensors
DIL24 support for new devices

Example of STM32 expansion board (X-NUCLEO-IKS01A1)

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; they 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
- Application examples (e.g. based on ST OpenSoftwareX)

**Middleware**
- STM32Cube middleware
- STM32Cube expansion 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

Sense

COLLECT

Connect

TRANSMIT

Translate

ACCESS

Move / Actuate

CREATE

Power

POWER

Process

PROCESS

Software

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