UM2046
User manual

Getting started with VL53L0X ranging and gesture detection sensor software expansion for STM32Cube

Introduction

STMicroelectronics has introduced various evaluation and development tools to facilitate the integration of the VL53L0X sensor in customers' applications.
The VL53L0X is a time-of-flight ranging and gesture detection sensor, based on ST patented FlightSense™ technology.

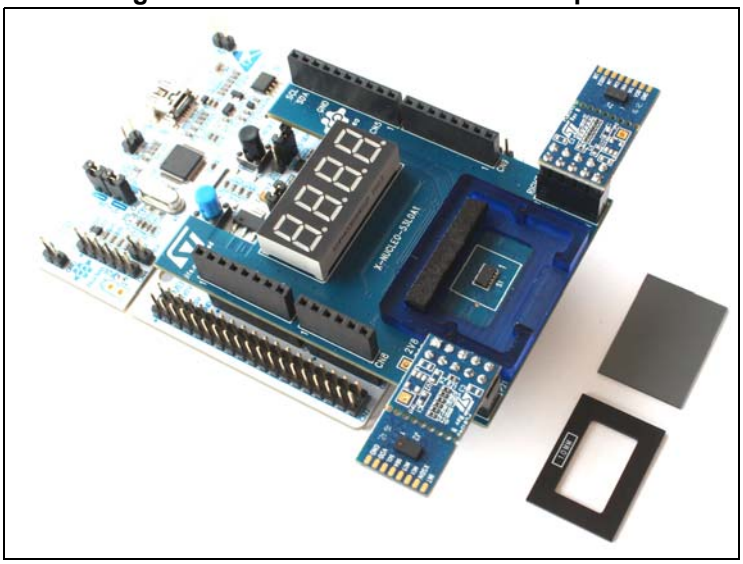
This document provides:

- Detailed information guidelines for STM32 and X-CUBE-53L0A1 firmware installation and standalone operation.
- How to download the PC graphical interface (GUI) and VL53L0 API from www.st.com.

The following evaluation devices are available:

- The P-NUCLEO-53L0A1: Includes both NUCLEO-F401RE development board and X-NUCLEO-53L0A1 expansion board.
- The X-NUCLEO-53L0A1 expansion board can be used with all STM32 Nucleo boards. It contains
  - A VL53L0X expansion board.
  - Three spacers, 0.25, 0.5 and 1mm height to simulate air gaps.
  - A cover glass
  - Two VL53L0X satellite boards
  - Two 10 pin connectors to be soldered on the VL53L0X expansion board to connect the VL53L0X satellite boards.

Figure 1. P-NUCLEO-53L0A1 Nucleo pack



Contents

1 Introduction

1.1 Document references

Table 1. Document references

Type	Description	DocID on www.st.com
Data brief	X-NUCLEO-53L0A1 - Ranging and gesture detection sensor expansion board based on VL53L0X for STM32 Nucleo	DB2901
Data brief	P-NUCLEO-53L0A1 - VL53L0X Nucleo pack with ranging, gesture detection sensor expansion board and STM32F401RE	DB2905
Data brief	X-CUBE-53L0A1 - VL53L0X Time-of-Flight (TOF) ranging and gesture detection sensor software expansion for STM32Cube	DB2902
Data brief	STSW-IMG005 - VL53L0X Time-of-Flight (TOF) ranging and gesture detection sensor application programming interface (API)	DB2903
Data brief	STSW-IMG006 - P-NUCLEO-53L0A1 pack PC graphical user interface (GUI)	DB2904
Datasheet	VL53L0X - World smallest Time-of-Flight (ToF) laser ranging sensor	DS11555
User manual	VL53L0X Time-of-Flight (TOF) laser ranging module API user manual	UM2039
User manual	X-NUCLEO-53L0A1 ranging and gesture detection sensor expansion board based on VL53L0X for STM32 Nucleo (hardware description)	UM2047

1.1.1 Hardware ordering information

Table 2. Ordering information

Ordering code	Description
P-NUCLEO-53L0A1	X-NUCLEO-53L0A1 and NUCLEO-F401RE boards
X-NUCLEO-53L0A1	VL53L0X expansion board, satellites and accessories for STM32 Nucleo board family

1.2 Hardware description

The X-NUCLEO-53L0A1 expansion board:

- Is compatible with Arduino™ UNO R3 connectors.
- Must be plugged into an STM32 Nucleo board.
- Can be superposed with all ST expansion boards (X-NUCLEO), which allows, for example, to develop VL53L0X applications with Bluetooth or Wi-Fi interface.

The STM32 Nucleo board is connected to the PC via a mini USB connector.

2 What is STM32Cube?

STMCube™ represents an original initiative by STMicroelectronics to ease developers' life by reducing development effort, time and cost. STM32Cube covers the STM32 portfolio.

Version 1.x of STM32Cube includes:

- STM32CubeMX, a graphical software configuration tool that allows the generation of C initialization code using graphical wizards
- A comprehensive embedded software platform, delivered per series (such as the STM32CubeF4 for STM32F4 series)
- STM32Cube HAL, an STM32 abstraction layer embedded software, ensuring maximized portability across the STM32 portfolio
  - A consistent set of middleware components, such as RTOS, USB, TCP/IP, graphics
  - All embedded software utilities, including a full set of examples

3 How does this software complement STM32Cube?

The proposed software is based on the STM32CubeHAL, the hardware abstraction layer for the STM32 microcontroller. The package extends STM32Cube by providing a Board Support Package (BSP) for the X-NUCLEO-53L0A1 expansion board and a VL53L0X API component (in Drivers\BSP\Components\vl53L0X directory) to program, control and get ranging values from the VL53L0X device.

Several example projects are included in the Projects\Multi\Examples\vl53L0X directory, the developer can use these examples to start experimenting with the code. These examples are ready to be compiled using Keil (MDK-ARM), IAR (EWARM) or STM32 Workbench (SW4STM32):

- **RangingWithSatellites** example features:
  - Ranging measurements displayed on 7-segment display.
  - Ranging from the VL53L0X located in the center of the expansion board, displayed in cm.
  - Or simultaneous ranging from the VL53L0X located in the center of the expansion board and from the two VL53L0X on the satellites (right and left), displayed as bar-graph.
  - Three ranging configurations: LongRange, HighSpeed and HighAccuracy that can be selected with the blue button on the STM32 Nucleo board.

One example project is included in Projects\Multi\Applications directory:

- **GestureDetect** example features:
  - Gesture detection movements displayed as characters on the 7-segment display.
  - Vertical gesture like “Tap” or horizontal gesture like “Swipe” using the VL53L0X located in the center of the expansion board.
  - Directional lateral gesture like “Swipe” able to discriminate left to right movement from right to left using the two left and right satellites.

4 VL53L0X Nucleo pack software installation

ST delivers a software suite allowing the user to discover, through standalone demonstrations and a PC graphical user interface (GUI), the VL53L0X ranging and gesture detection features.

The STM32 Nucleo board software suite is available from www.st.com, this software is compatible with all STM32 Nucleo boards.

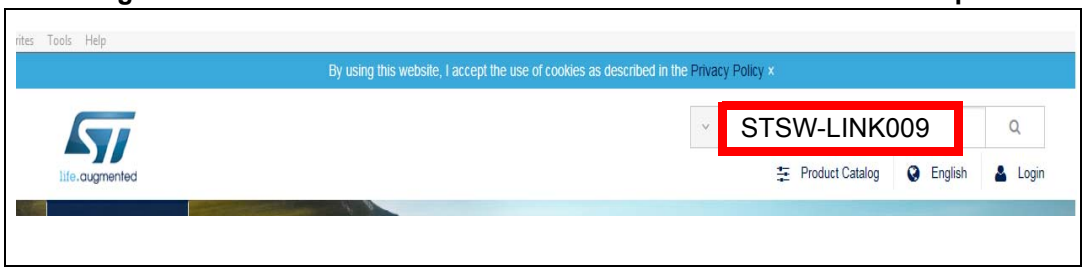
This installation software suite consists of:

- **STSW-LINK009**, ST-Link, ST-Link/V2, ST-Link/V2-1 USB driver signed for XP, Windows 7 and 8. This driver must be installed first.
- **STSW-LINK007**, ST-Link/V2-1 firmware update.
  When STSW-LINK009 and STSW-LINK007 firmware are installed the STM32 Nucleo board is configured and ready to use with a PC.

4.1 STSW-LINK009: STM32 Nucleo board Windows USB driver installation

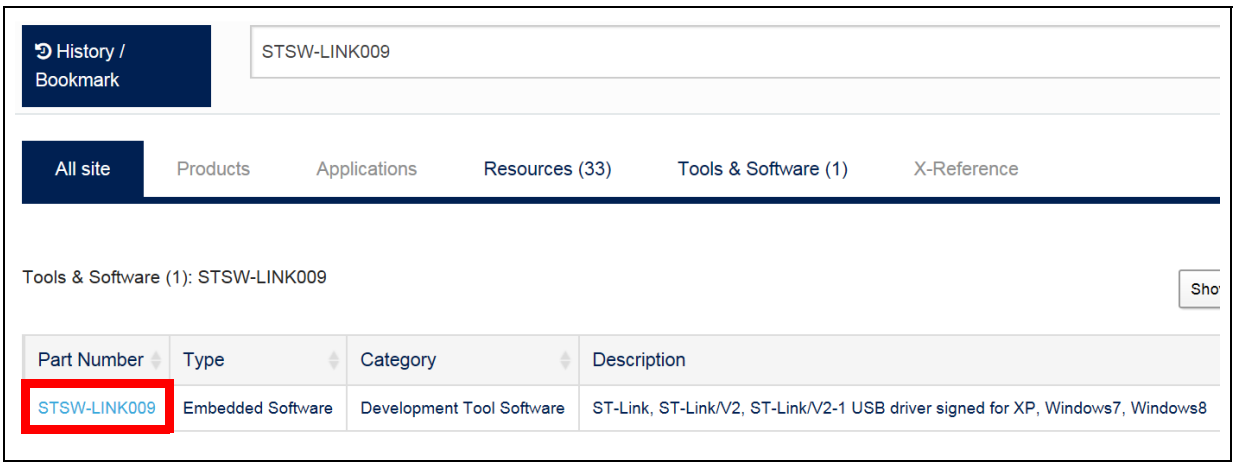
- On www.st.com home page search for “STSW-LINK009”

Figure 2. STM32 Nucleo board Windows USB driver installation - step 1



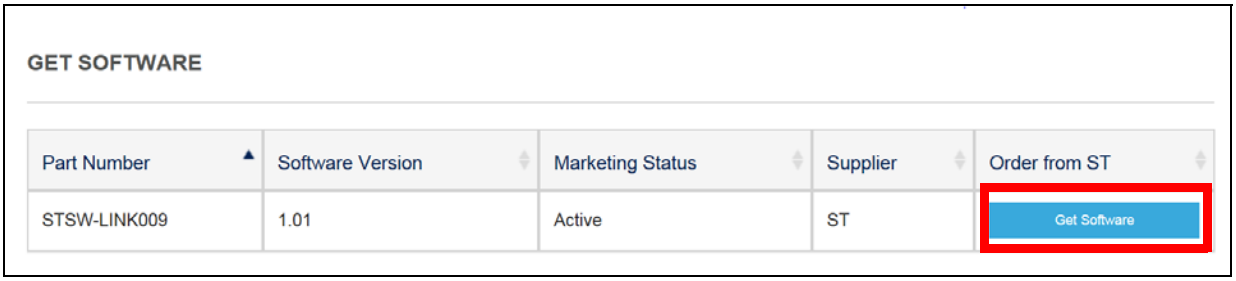
- On next page click on “STSW-LINK009”

Figure 3. STM32 Nucleo board Windows USB driver installation - step 2



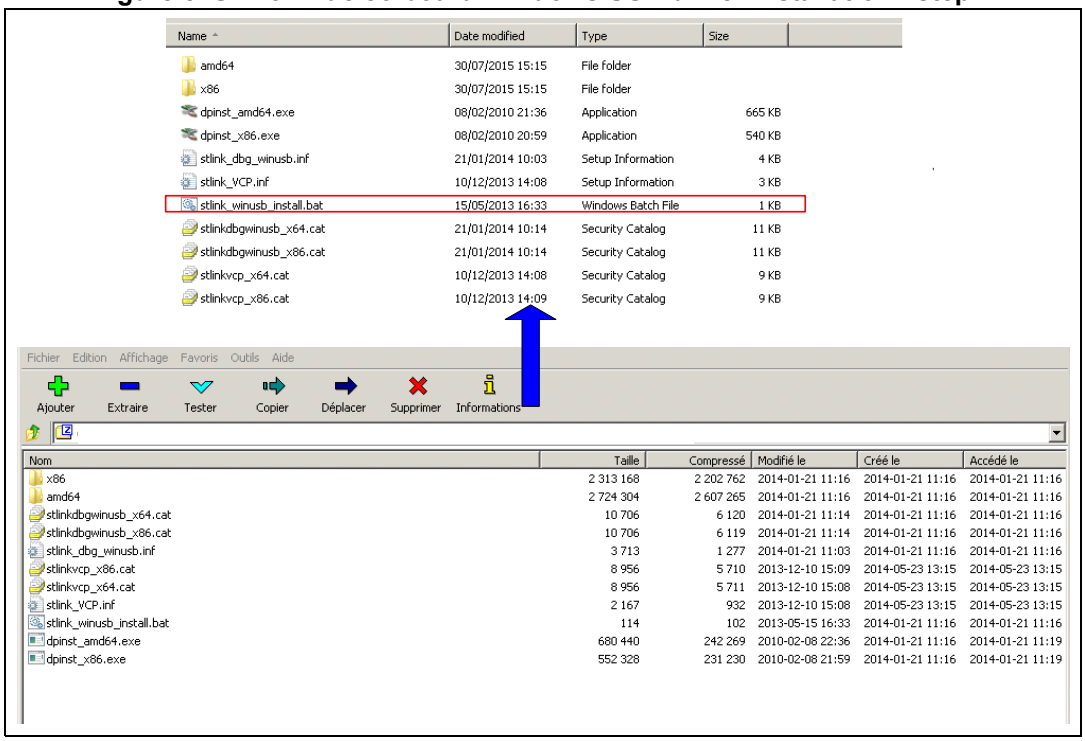
- On next page click on “Get software”

Figure 4. STM32 Nucleo board Windows USB driver installation - step 3



- Complete and sign license agreement
- From en.stsw-link009.zip, unpack the .zip file and run stlink_winusb_install.bat. This will install the necessary USB drivers to allow communications between the STM32 Nucleo board and the PC.

Figure 5. STM32 Nucleo board Windows USB driver installation - step 4

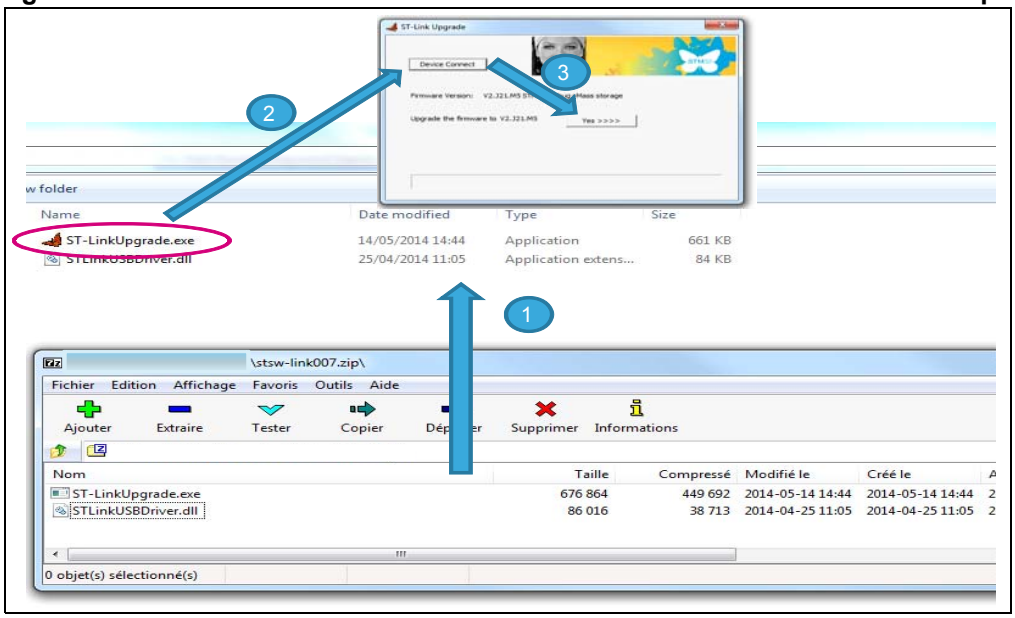


- Plug a USB cable between the PC and STM32 Nucleo board. Allow the board driver installations to complete before proceeding.

4.2 STSW-LINK007: STM32 Nucleo board PC communication driver

- On www.st.com home page search for “STSW-LINK007”
- To install STSW-LINK007 repeat the steps 1 to 3 performed for the installation of the STSW-LINK009 STM32 Nucleo board Windows USB driver installation.
- Unpack the downloaded stsw-link007.zip file and run STLinkUpgrade.exe.
- Ensure the STM32 Nucleo development board is connected via the USB port.
- Click 'device connect' on the dialogue and confirm the board has successfully connected.
- When prompted to upgrade to the latest version check that the suggested version is later than the current firmware version then, click 'YES’ to proceed.

Figure 6. STM32 Nucleo board communication driver with PC installation - step 4

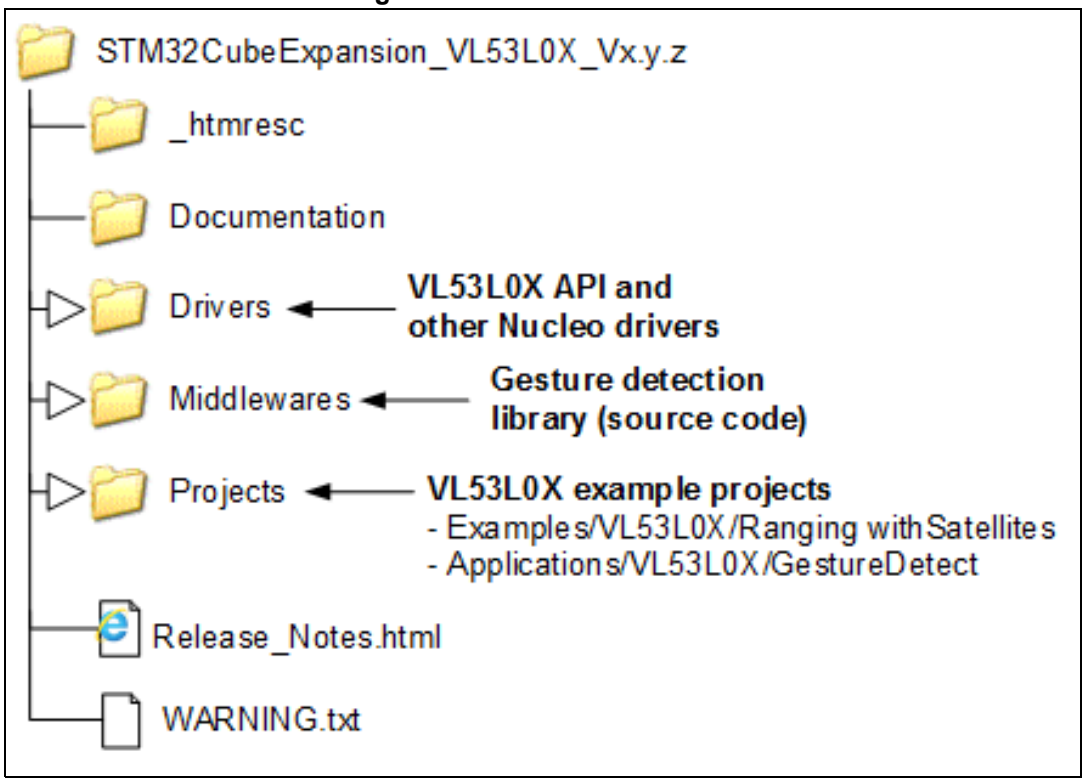


5 X-CUBE-53L0A1 installation

Starting from this software package user can:

- Run ranging and gesture detection demonstrations (see *Section 5.2: "RangingWithSatellites" demonstration* and *Section 5.3: "GestureDetect" demonstration*).
- Get data logging on PC through Virtual Com Port (Teraterm, Putty, etc...) to collect data or build simple PC GUIs (see *Section 5.2.3: Data logging*).
- Import a project in their favorite IDE (Keil, IAR or STM32 Workbench) to browse the code, (re) compile, (re) flash STM32 Nucleo board and debug (breakpoints, step into code, etc...) (see *Section 5.4: IDE installation*).

Figure 7. X-CUBE-53L0A1 files



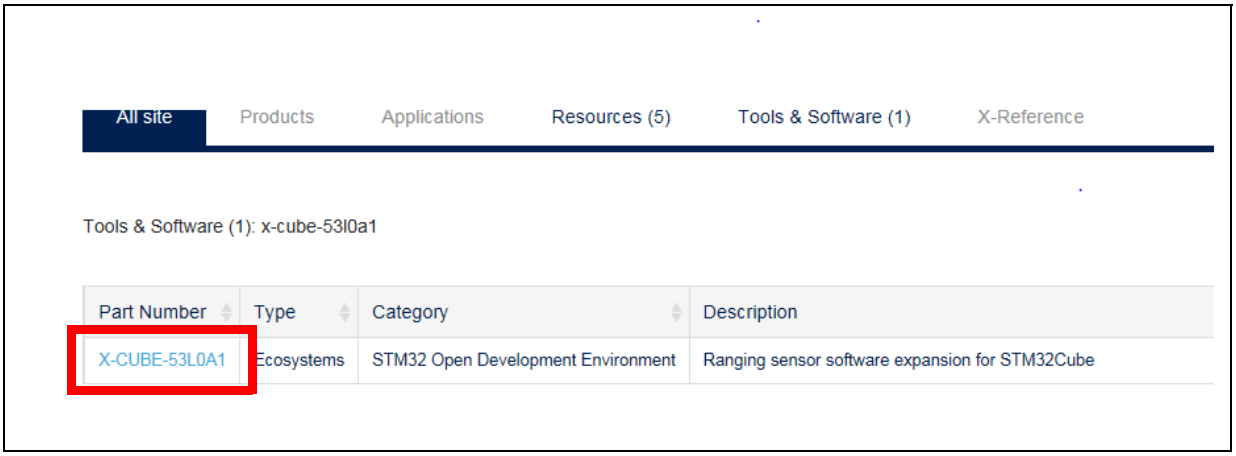
5.1 Installation of the VL53L0X standalone operation

Note: If not already done, plug VL53L0X expansion board on to STM32 Nucleo board

To install VL53L0X standalone demonstrations.

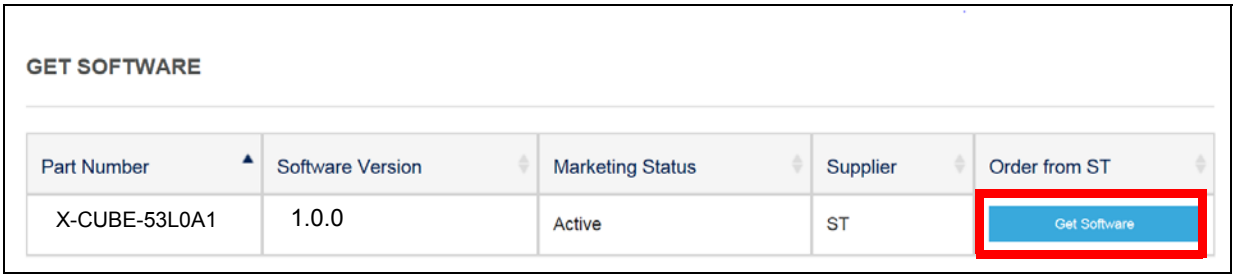
- On www.st.com home page search for "X-CUBE-53L0A1".

Figure 8. VL53L0X standalone demonstration installation - step 1



- Click on “Get software”
- Complete and sign license agreement
- then save it

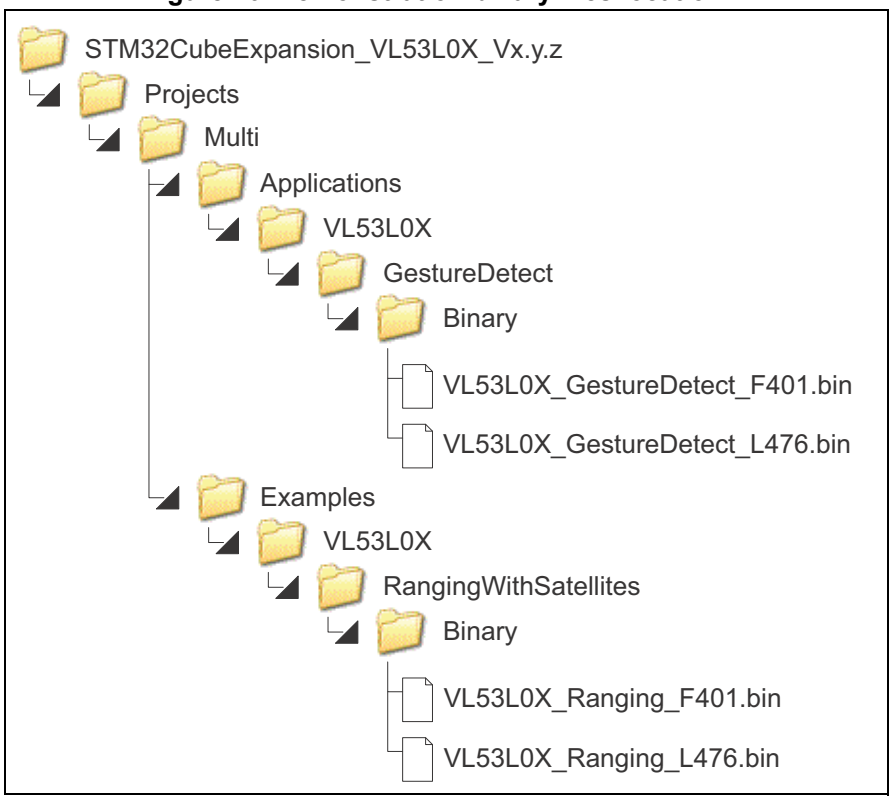
Figure 9. VL53L0X standalone demonstration installation - step 2



- Unzip the file
- The pre.compiled binary demonstration software are provided in (see *Figure 10*):
  - VL53L0X_Ranging_yyyy_bin files, are located in the directory:
    STM32CubeExpansion_VL53L0X_Vx.y.z/Projects/Multi/Examples/VL53L0X/RangingWithSatellites/Binary.
    RangingWithSatellites example features:
    - Ranging measurements displayed on 7-segment display.
    - Ranging from the VL53L0X located in the center of the expansion board, displayed in cm.
    - Simultaneous ranging from the VL53L0X located in the center of the expansion board and the two VL53L0X on the satellites (right and left), displayed as bar-graph.
    (see *Section 5.2: “RangingWithSatellites” demonstration* for detailed information)
  - VL53L0X_GestureDetect_yyyy_bin files, are located in the directory:
    STM32CubeExpansion_VL53L0X_Vx.y.z/Projects/Multi/Applications/VL53L0X/GestureDetect/Binary.
    GestureDetect example features:
    - Gesture detection movements displayed on 7-segment display as characters.
    - Vertical gesture like “Tap” or horizontal gesture like “Swipe” using the VL53L0X located in the center of the VL53L0X expansion board.
    - Directional lateral gesture like “Swipe”, from left to right or from right to left, using the two VL53L0X left and right satellites.

(see *Section 5.3: "GestureDetect" demonstration* for detailed information)

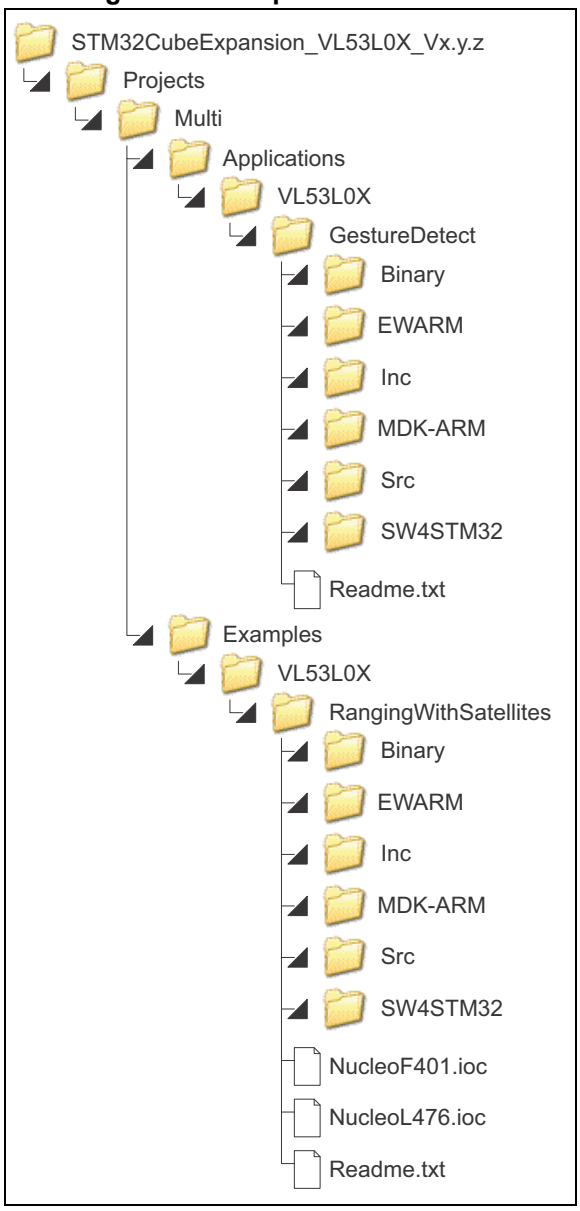
Figure 10. Demonstration binary files location[a]



a. The list above shows the examples available in the latest version of the STM32CubeExpansion_VL53L0X_Vx.y.z. More examples can be added.

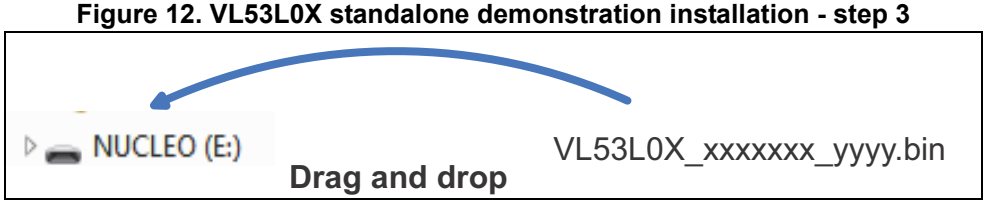
- Each example code (RangingWithSatellites and GestureDetect) can be compiled using one of the provided projects (MDK-ARM, EWARM, SW4STM32) for each STM32 Nucleo board type: L476 and F401 (see *Figure 11*).

Figure 11. Compiler file locations



To start the standalone demonstration, drag and drop the ".bin" file you want to select to the NUCLEO-F401RE or NUCLEO-L476RG STM32 Nucleo board.

Figure 12. VL53L0X standalone demonstration installation - step 3



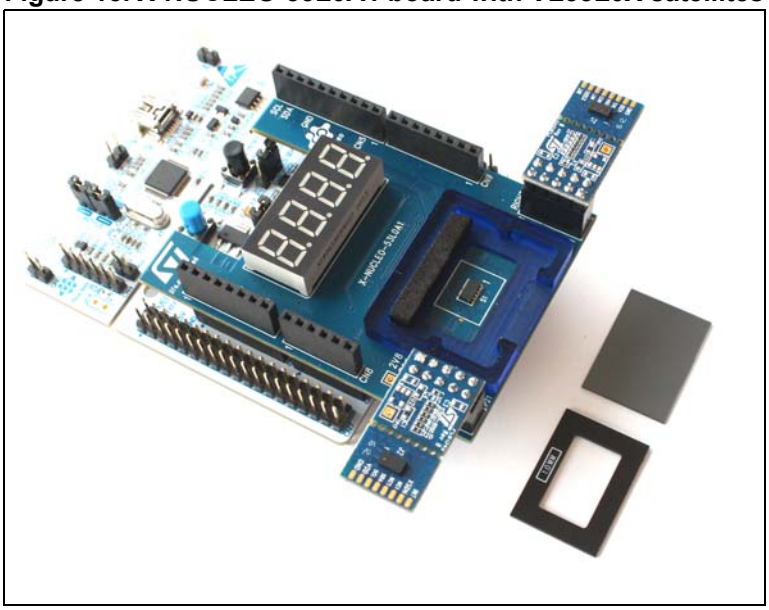
The VL53L0X Nucleo pack provides various demonstration modes for ranging and gesture detection.

These are described in more detail in the following sub-sections.

5.2 “RangingWithSatellites” demonstration

- X-NUCLEO-53L0A1 board is set as described in *Figure 13*, spacer and cover glass are optionals.

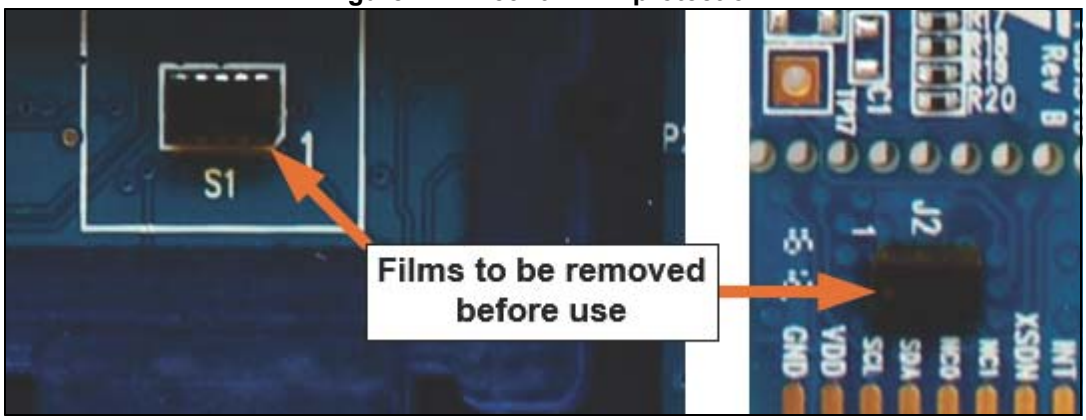
Figure 13. X-NUCLEO-53L0A1 board with VL53L0X satellites



The USB connector is plugged in the STM32 Nucleo board.

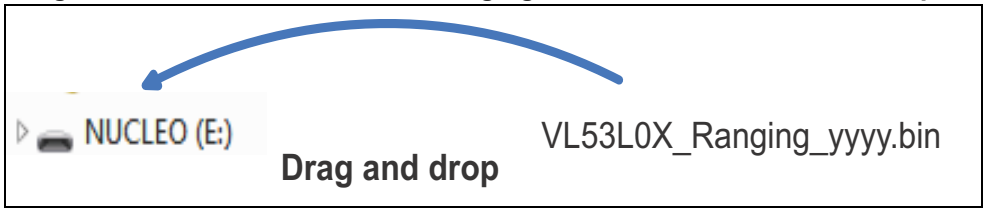
Warning: VL53L0X are protected by a film, this film must be removed before used

Figure 14. VL53L0X film protection



- Drag and drop the “VL53L0X_Ranging_yyyy.bin” file, which one will depend on whether you use a NUCLEO-F401RE or a NUCLEO-L476RG board.

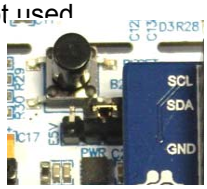
Figure 15. VL53L0X standalone RangingWithSatellites installation - step 4



5.2.1 Single device ranging mode

In single device ranging mode only the VL53L0X located in the center of the expansion board is doing ranging, the two VL53L0X on the satellites (left and right) are not used.

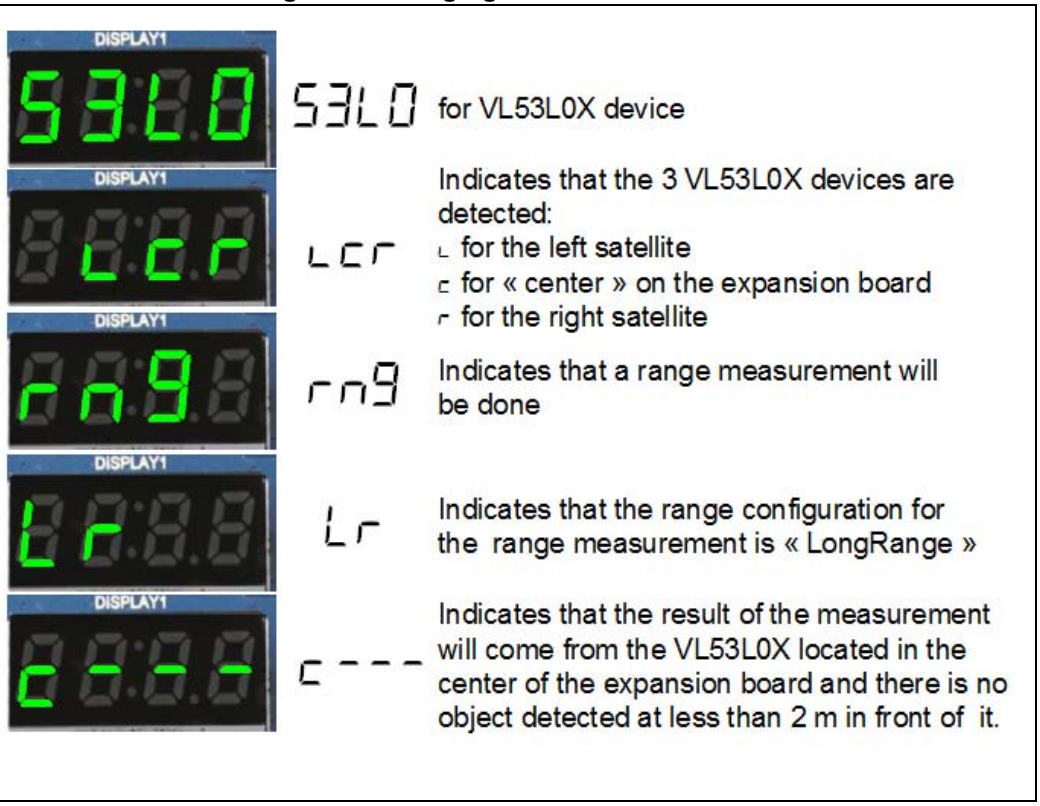
Press the black reset button on the STM32 Nucleo board and release it,



the Nucleo pack is now running in “standalone” mode, meaning no PC is required to control the Nucleo pack, USB connection is only used to power the Nucleo pack.

- When the black reset button is released, the following messages are displayed one after the other for a few seconds:

Figure 16. Ranging mode initialization



- Move your hand or any objects in front of VL53L0X and read the value of the distance between your hand, or any objects, and the VL53L0X sensor displayed in cm on the 4-digit display.

Figure 17. Ranging mode display

123c Indicates that an object is detected at 123cm from the VL53L0X sensor on the expansion board (center)

The ranging mode supports three configurations:

- LongRange
- HighSpeed
- HighAccuracy

Each time the blue button on the STM32 Nucleo board is pressed for a short period, the ranging mode is modified as described in *Figure 19*.

When the blue button is released, the range mode indicator is displayed for a few seconds before the range measurement is displayed.

Figure 18. Ranging configuration messages

rn9 Indicates that a range measurement will be done

Lr Indicates that the range configuration for the range measurement is « LongRange »

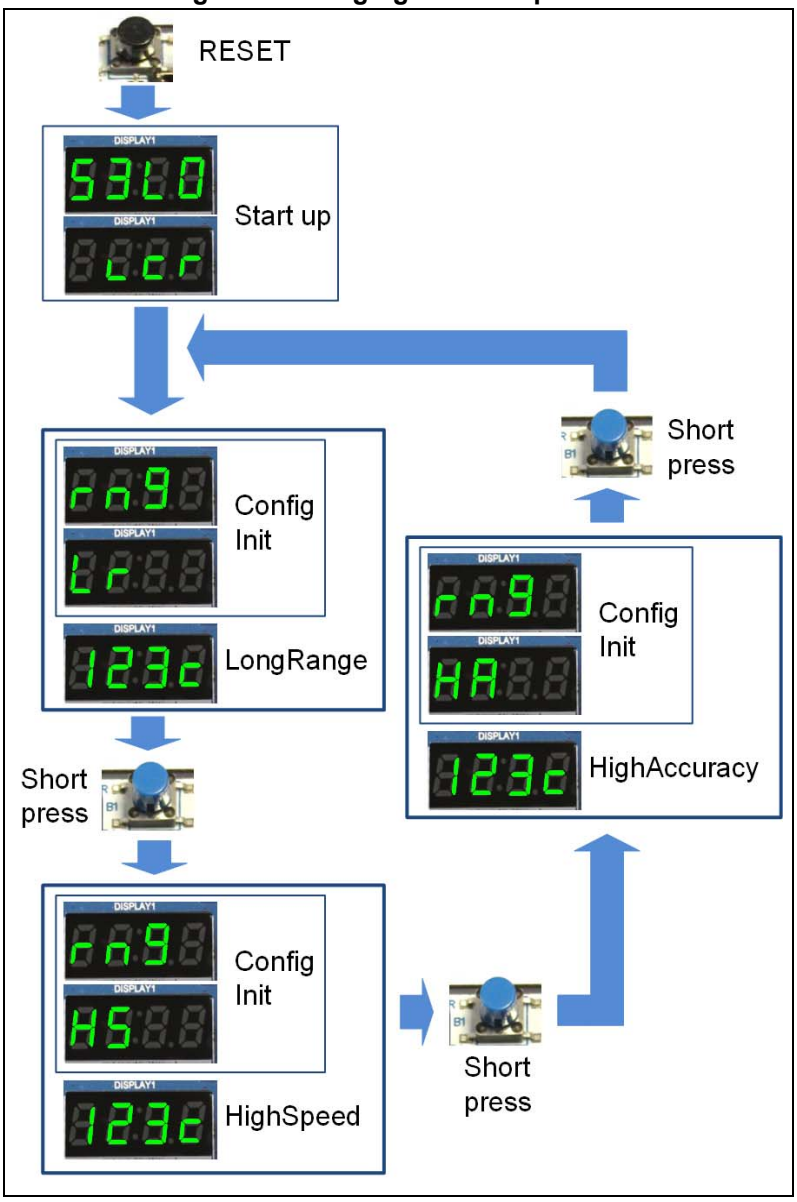
rn9 Indicates that a range measurement will be done

HS Indicates that the range configuration for the range measurement is « HighSpeed »

rn9 Indicates that a range measurement will be done

HA Indicates that the range configuration for the range measurement is « HighAccuracy »

Figure 19. Ranging mode sequencer



Note: Detailed information for these configurations is given in the VL53L0X datasheet.

5.2.2 Multi-devices ranging mode

As explained in the previous section, after a press and release of the black reset button on the STM32 Nucleo board, a ranging measurement is enable on the VL53L0X located in the center of the expansion board.

From this state a long press, more than 2s, on the blue button of the STM32 Nucleo board enable the “bar graph” mode.

To enable this mode, press the blue button on the STM32 Nucleo board and when “rb” message is displayed, release the blue button. (“rb” for release button)

Figure 20. Released button display

rb Indicates that the blue button has to be released.

When the blue button is released below message is displayed

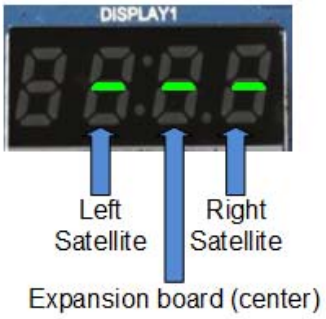
Figure 21. Bargraph display

bar Indicates that a range measurement will be displayed through bargraph.

This mode uses the three VL53L0X devices.

Each VL53L0X uses a digit and the number of bars displayed on each digit depends of the distance between each VL53L0X and the object detected (see *Figure 22*).

Figure 22. Simple gesture feature displayed



– – – Indicates that no object is detected in front of the three VL53L0X sensors

– – – Indicates that an object detected at less than 10cm in front of the three VL53L0X sensors

– – – Indicates that an object detected between 10 and 30cm in front of the three VL53L0X sensors

– – – Indicates that an object detected at more than 30cm in front of the three VL53L0X sensors

The multi-devices ranging mode supports three configurations:

- LongRange
- HighSpeed
- HighAccuracy

Each time the blue button on the STM32 Nucleo board is pressed for a short time, the configuration is modified as described in *Figure 23*.

When the blue button is released range mode indicator is displayed during a few seconds before the range measurement is displayed.

Figure 23. Multi-devices ranging mode sequence

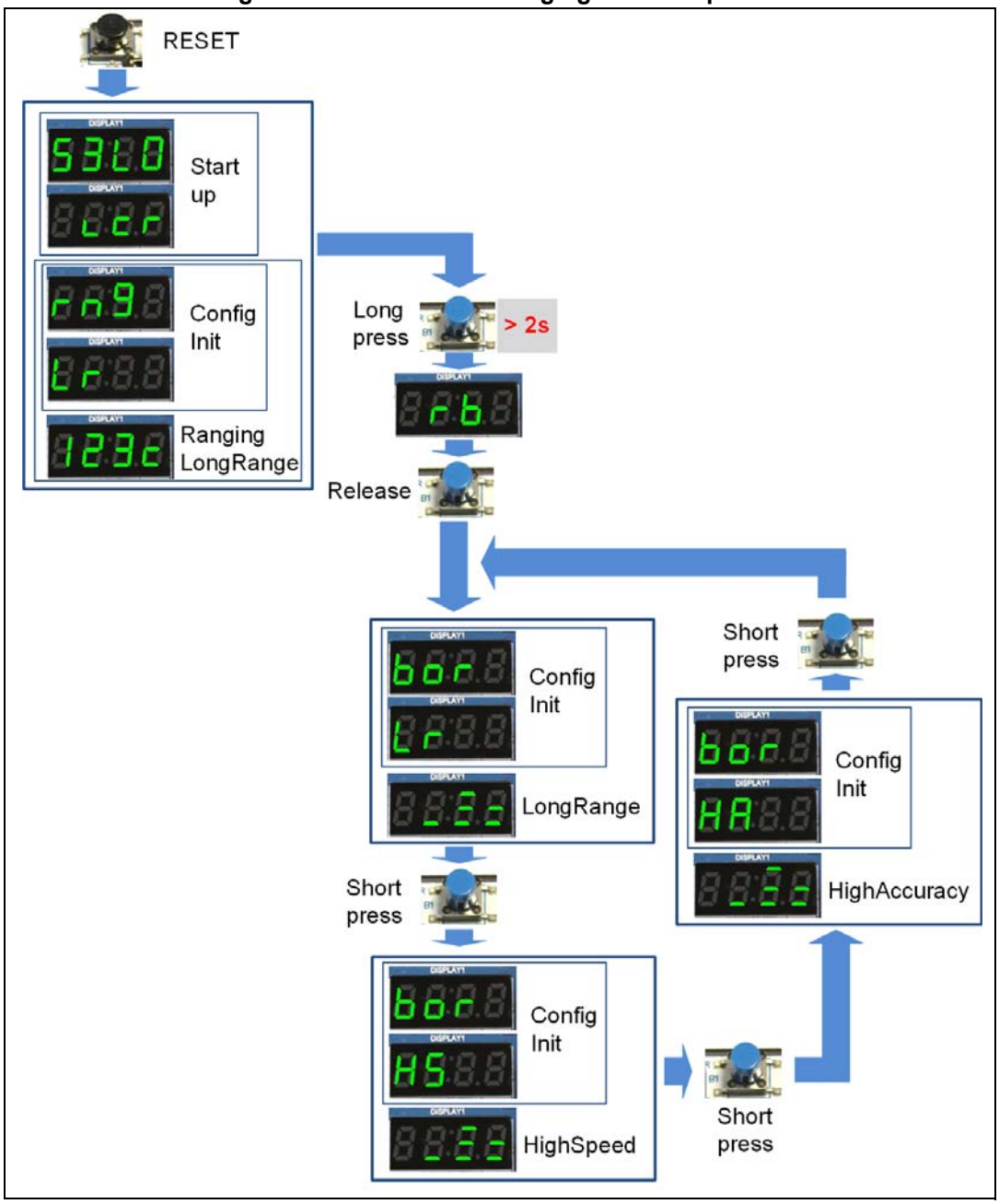
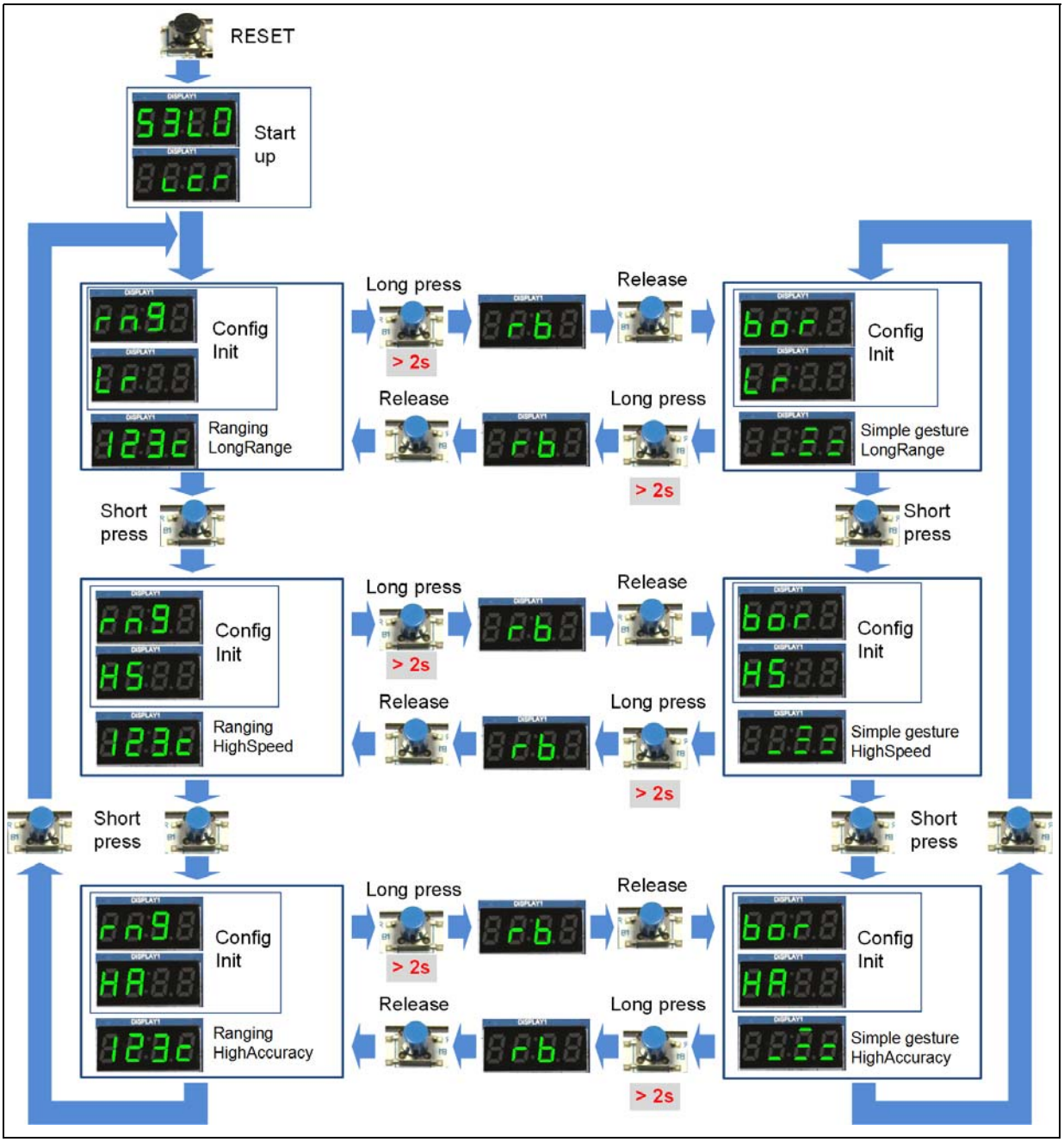


Figure 24 summarizes all possible ways to go from one state to another state using the blue button on the STM32 Nucleo board.

Figure 24. Ranging mode sequencer



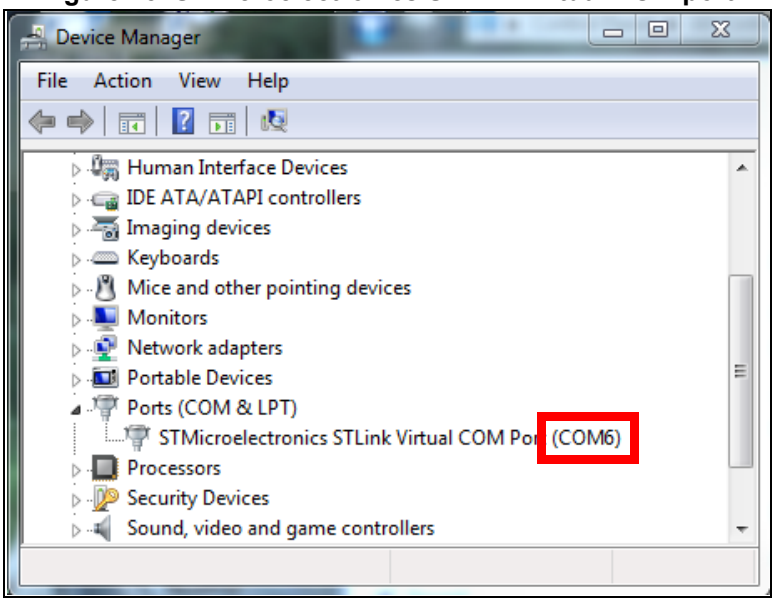
5.2.3 Data logging

Key ranging parameters can be outputted from STM32 Nucleo to the PC through serial com over USB using any terminal emulator program supporting serial connections like Tera Term, Putty, etc.

For example, Tera Term utility can be downloaded @ *http://logmett.com/tera-term-the-latest-version*

- In the Device Manager window get the COM number of the STMicroelectronics STLink Virtual COM port used by the STM32 Nucleo board.

Figure 25. STMicroelectronics STLink Virtual COM port

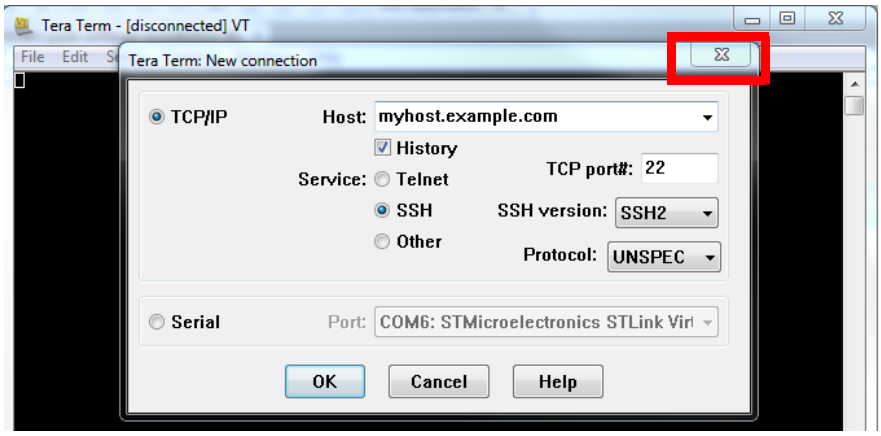


- Open the Tera Term software

Figure 26. Tera Term icon

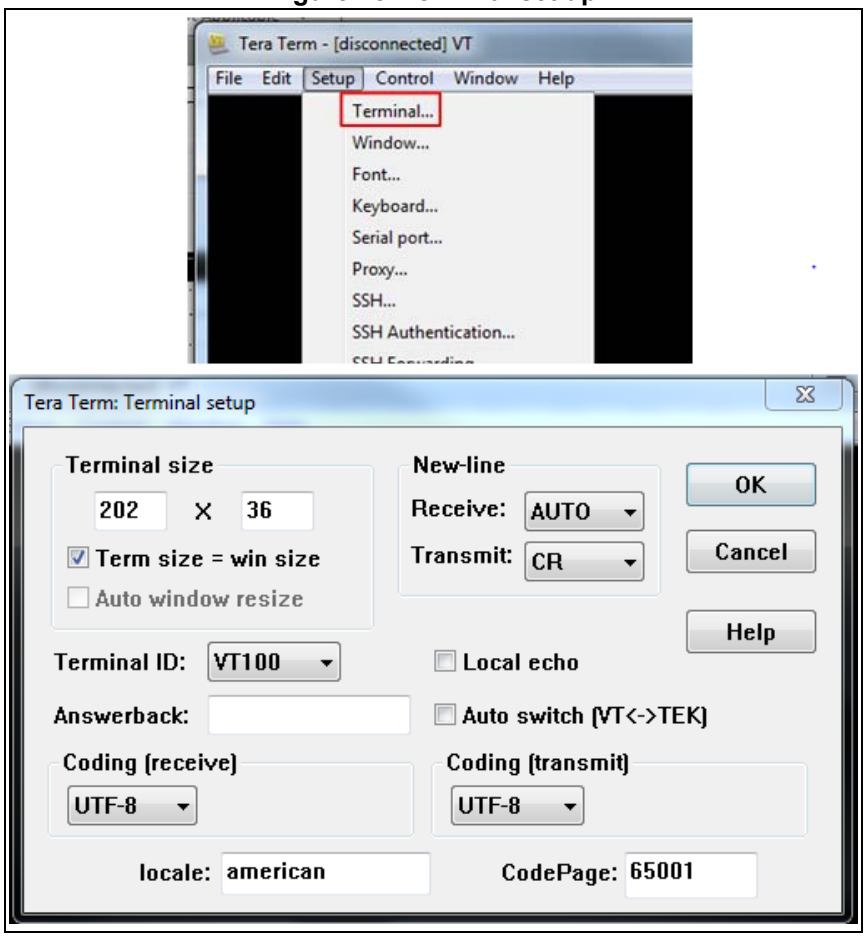
- Close the “New connection” window or tick Serial, then chose the right COM port and press OK

Figure 27. Tera Term new connection window.



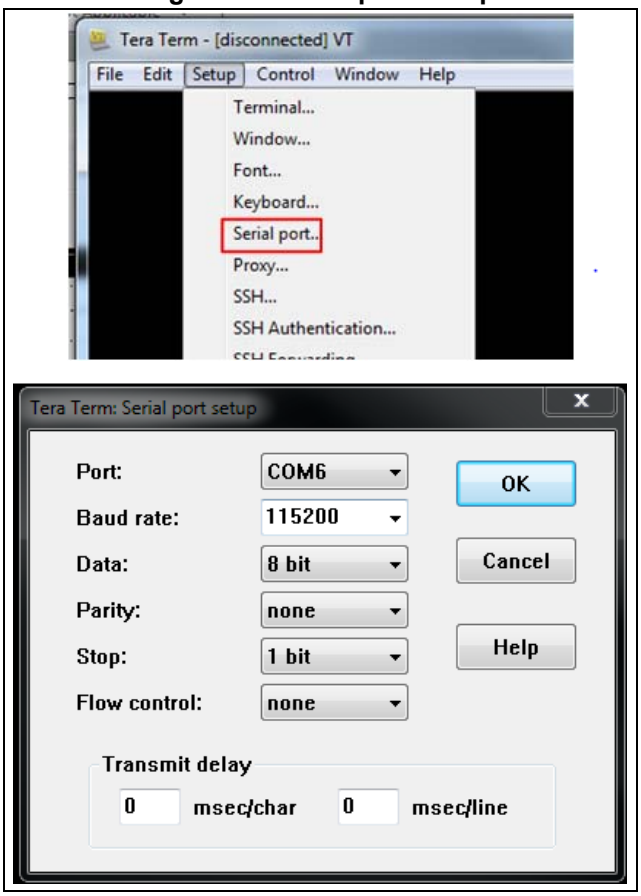
- In the Setup menu select “Terminal”, then set it as below and click on “OK”

Figure 28. Terminal set up



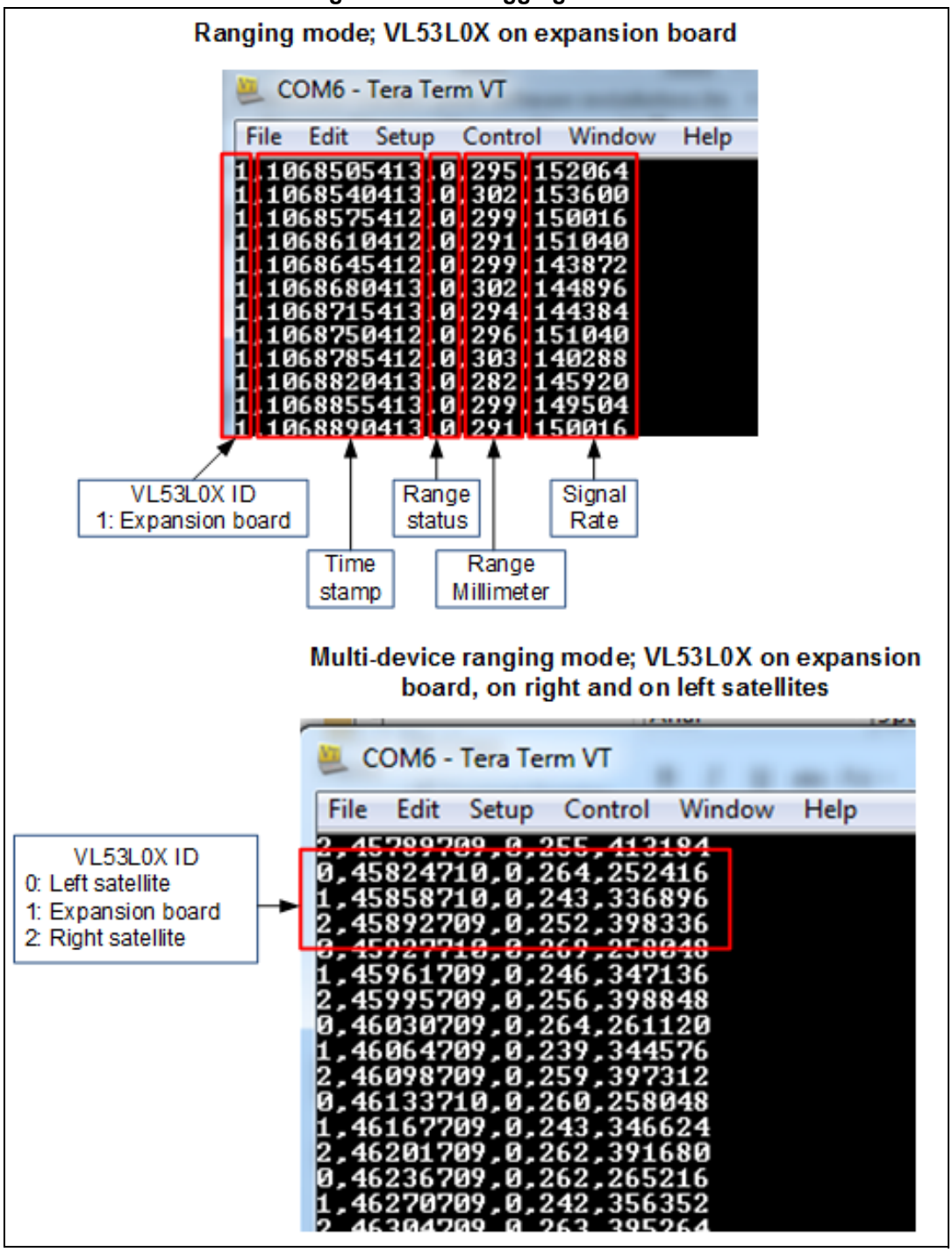
- In the Setup menu select “Serial port”, then set it as below, the Port parameter has to be filled with the STMicroelectronics STLink Virtual Com port (ex: Com6 - *Figure 25*) and click on “OK”

Figure 29. Serial port set up



- The data logging is now enabled with the format given in *Figure 30*.
  - VL53L0X ID: 0 for left satellite, 1 for expansion board (center), 2 for right satellite.
  - Time stamp in µsec: Time when ranging measuremt is returned by the VL53L0X API.
  - RangeStatus returned by VL55L0X API: Typical values are (refer to UM2039 API user manual for more details):
    - 0: Range Valid
    - 1: Sigma fail
    - 2: Signal fail
    - 3: Min range fail
    - 4: Phase fail
  - RangeMillimeter: Distance in mm returned by VL53L0X API (only valid if RangeStatus = 0).
  - Signal rate: Return rate in Mcps coded as 16.16 fixed-point value.
    - Divide the integer value by 65536.0 to get the floating point value (in Mcps).

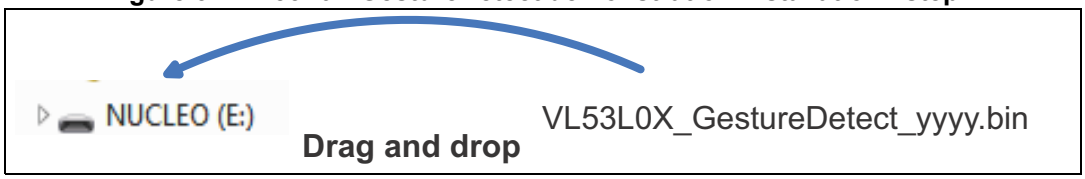
Figure 30. Data logging format

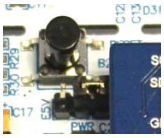


5.3 “GestureDetect” demonstration

- Drag and drop the “VL53L0X_GestureDetect_yyyy.bin” file, corresponding to the STM32 Nucleo board that you are using NUCLEO-F401RE or a NUCLEO-L476RG board.

Figure 31. VL53L0X GestureDetect demonstration installation - step 4

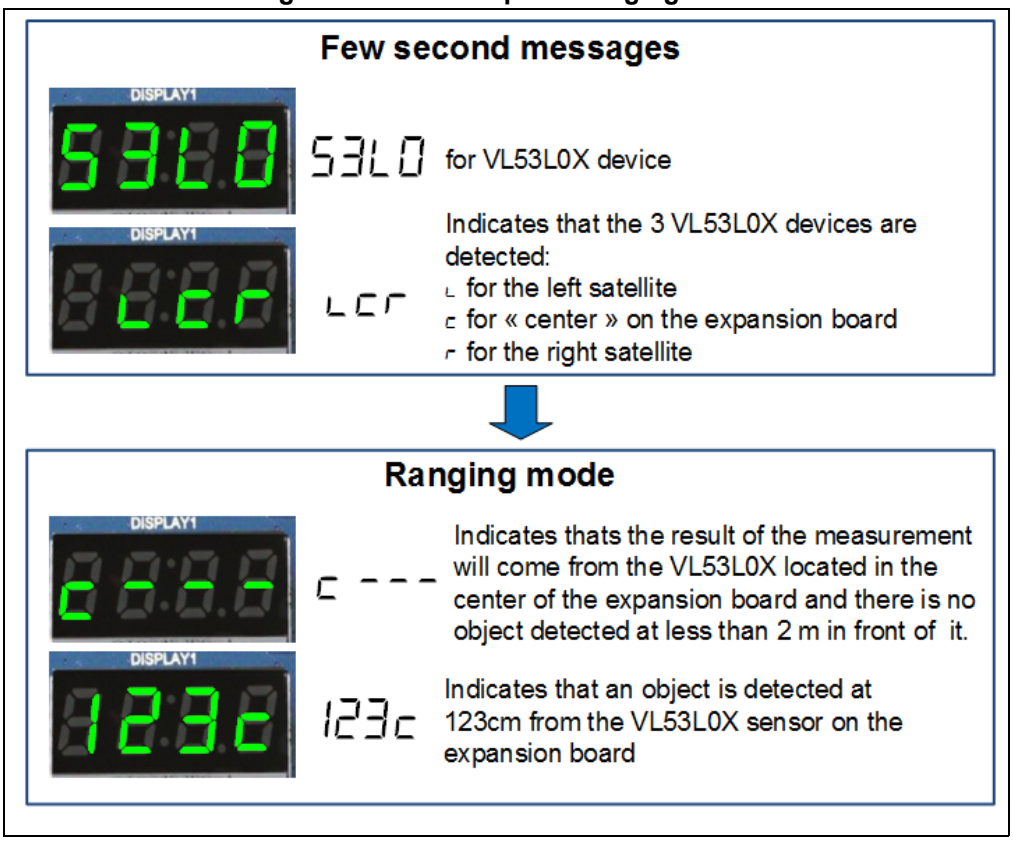


Press the black reset button on the STM32 Nucleo board and release it, 

the Nucleo pack is now running in “standalone” mode, meaning no PC is required to control the Nucleo pack, USB connection is only used to power the Nucleo pack.

- When the black reset button is released, the following messages are displayed one after the other for a few seconds and then the VL53L0X located in the center of the expansion board starts in ranging mode:

Figure 32. initial step and ranging mode



The GestureDetect VL53L0X standalone demonstration shows several features, range, swipe and tap detections.

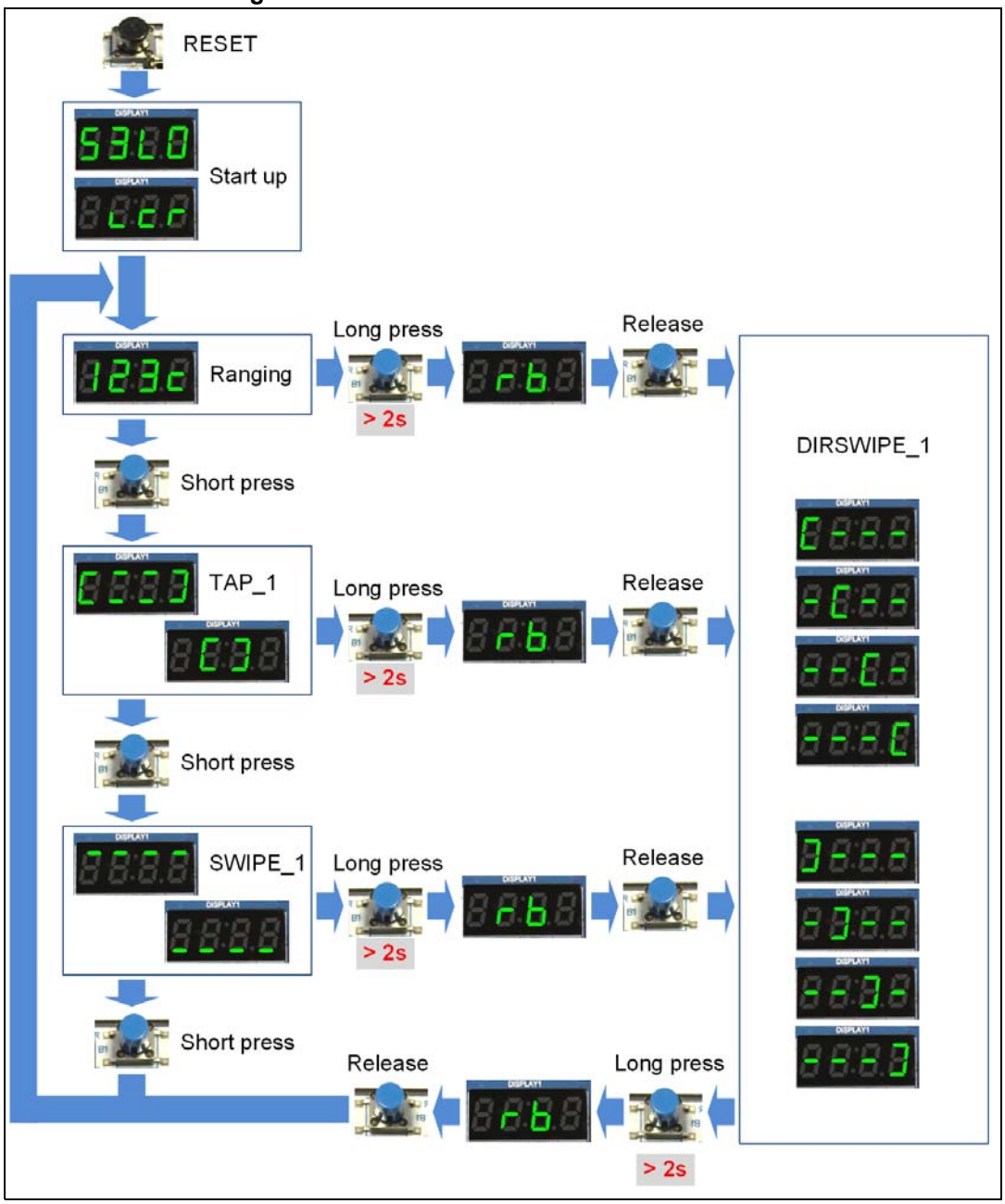
The following sections describe the three gesture detection, TAP_1, SWIPE_1 and DIRSWIPE_1 modes, *Figure 33* shows how to switch from one mode to another.

For ranging, TAP_1 and SWIPE_1 modes: The VL53L0X located in the center of the expansion board is used.

For DIRSWIPE_1 mode, theVL53L0X on the right and left satellites are used.

Note: For more details about how these gesture detection algorithms are implemented, please refer to the ToF Gesture library Doxygen documentation (in Documentations directory).

Figure 33. “GestureDetect” demonstration flow

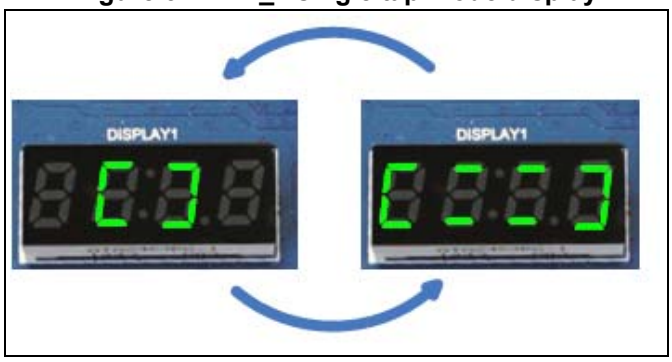


5.3.1 GestureDetect TAP_1 mode

Single Tap mode (*Figure 34*):

- Move your hand (flat) vertically (assuming sensor is tar-getting vertical direction) at a natural speed from a far distance to a close distance.
- Note that hand can either stay at close distance or be removed (vertically or horizontally) before another TAP can be done & detected.
- TAP can even be done with a single finger

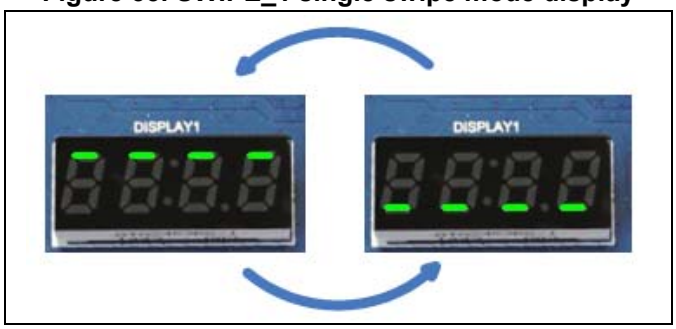
Figure 34. TAP_1 single tap mode display



5.3.2 GestureDetect SWIPE_1 mode

Single swipe mode, if you move your hand from left to right or from right to left in front of the VL53L0X on the expansion board (center) the display changes as shown in *Figure 35*.

Figure 35. SWIPE_1 single swipe mode display



5.3.3 GestureDetect DIRSWIPE_1 mode (Single directional swipe)

In this mode the left and right VL53L0X satellites are used.

At a distance more than 15cm, passing your hand over the VL53L0X devices in a circular motion as shown in *Figure 36*, *Figure 37* the message as shown in *Figure 36*, *Figure 37* are successively displayed (to mimic book page turning).

Figure 36. Hand movement, circles to right

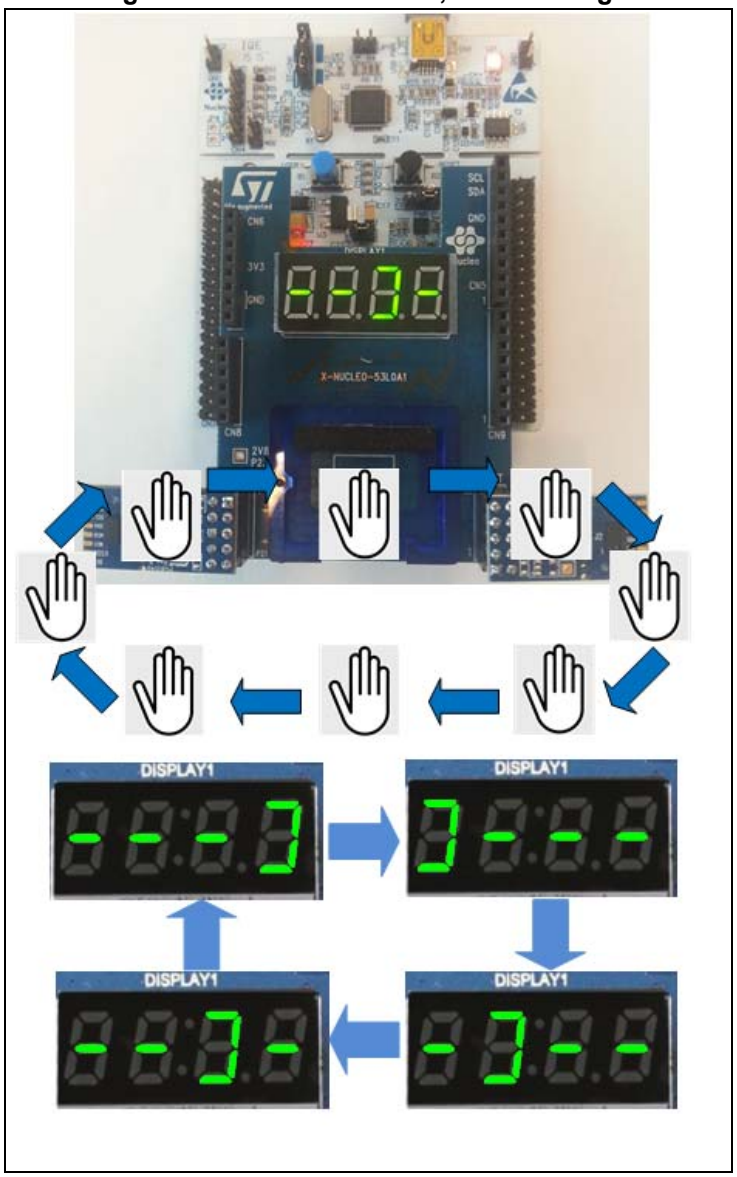
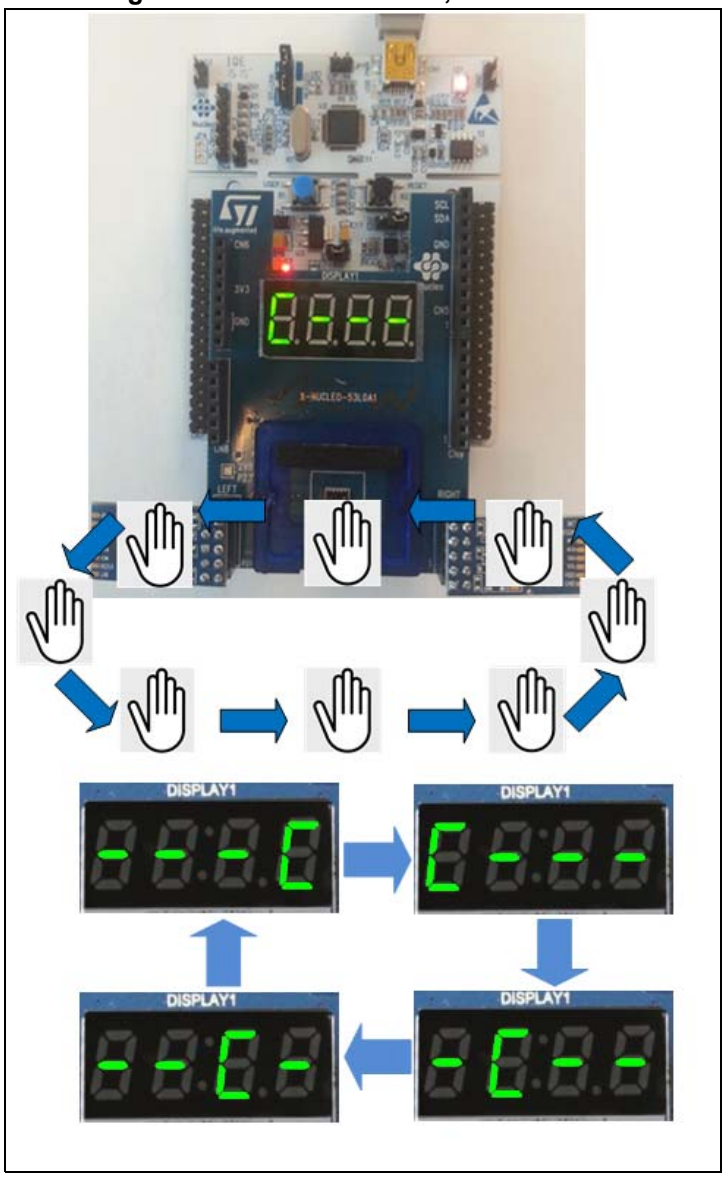


Figure 37. Hand movement, circles to left



5.4 IDE installation

Pre-configured project are available for:

- Keil: *http://www.keil.com/*
- IAR: *https://www.iar.com/*
- STM32 Workbench (Eclipse-based): *http://www.openstm32.org/HomePage*

The remainder of this section focuses on the STM32 Workbench (SW4STM32) as it is free and full featured (no code limit).

Warning: Compiling the projects with all features, including data logging, exceeds the 32kB limit of the free editions on Keil and IAR.

5.5 Install STM32 Workbench

- Go to: *http://www.openstm32.org/System+Workbench+for+STM32*
- Log in or register
- Follow the install procedure at: *http://www.openstm32.org/Installing+System+Workbench+for+STM32+with+installer?structure=Documentation*
  - Select workbench for STM32 installer (Windows 7 64 bits): install_sw4stm32_win_64bits-v1.X.exe, the latest available version.
  - JAVARE is needed, user will be redirected to the Oracle JAVA website
- The architecture version for System Workbench for STM32 must be identical to the Java architecture version (example: STW4STM32 64bits only works with JavaRE 7 (and upper) 64bits)

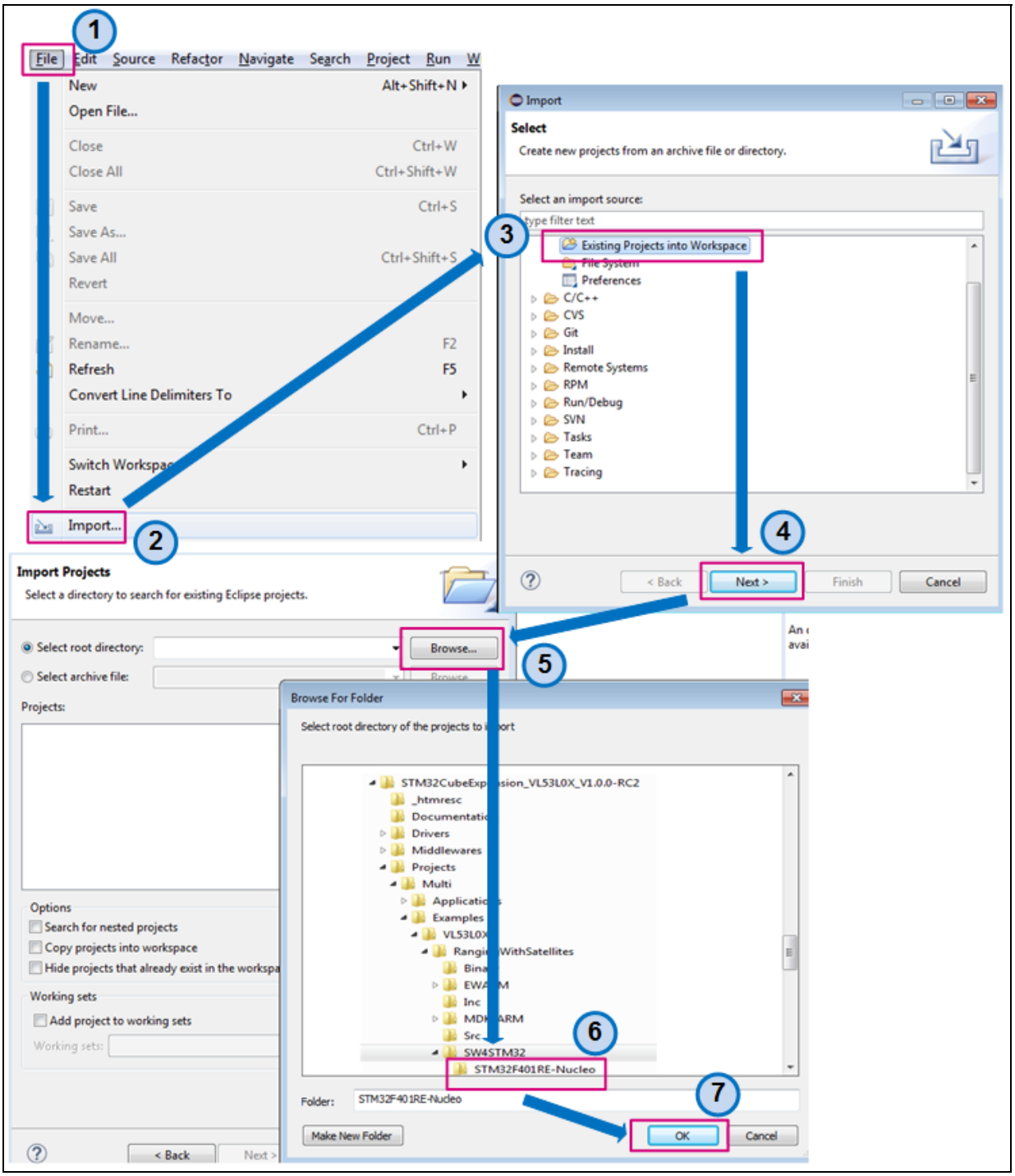
Start STM32 System Workbench

Figure 38. STM32 System Workbench icon

5.6 Import a project in STM32 Workbench

Import the project as described in *Figure 39*.

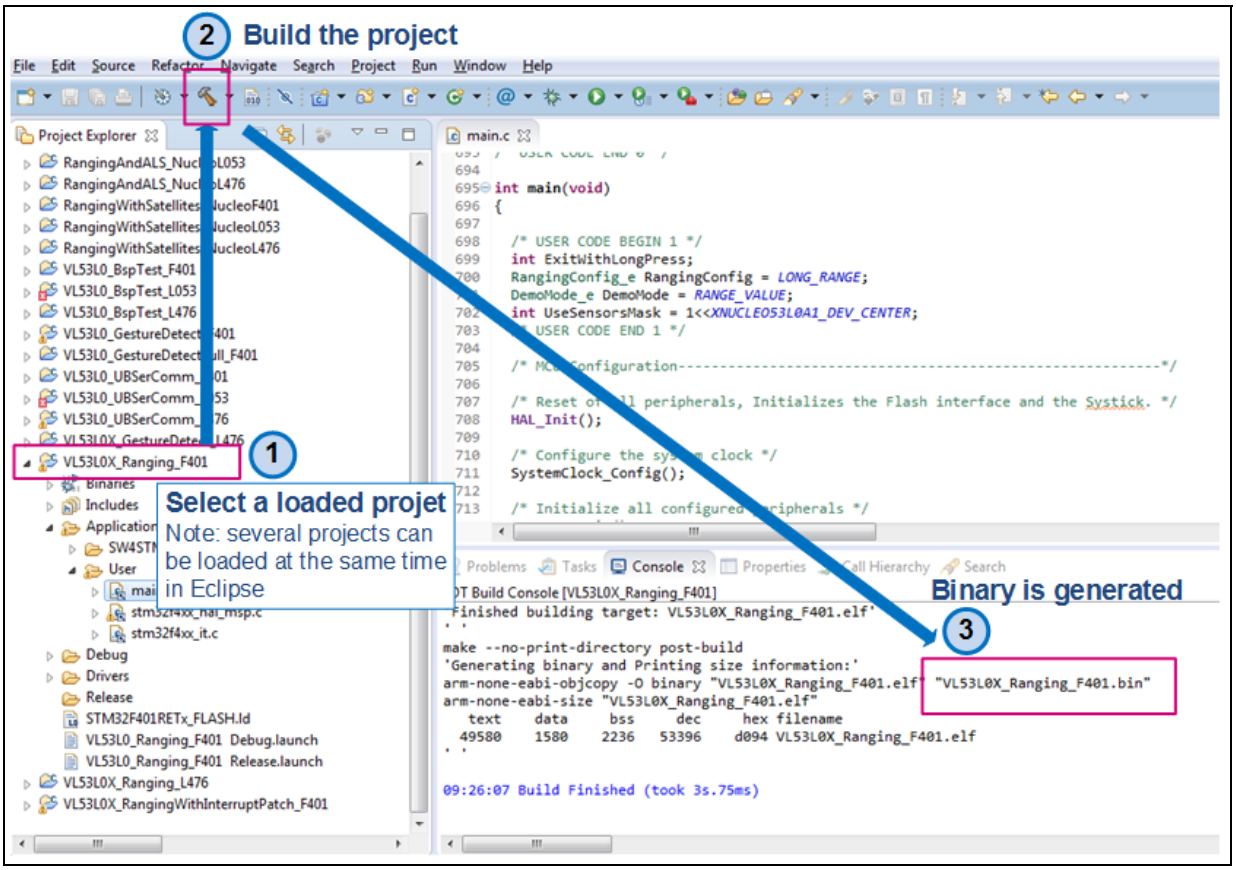
Figure 39. Import a project in STM32 System Workbench



5.7 Compile a project in STM32 Workbench

Compile the project as described in *Figure 40*.

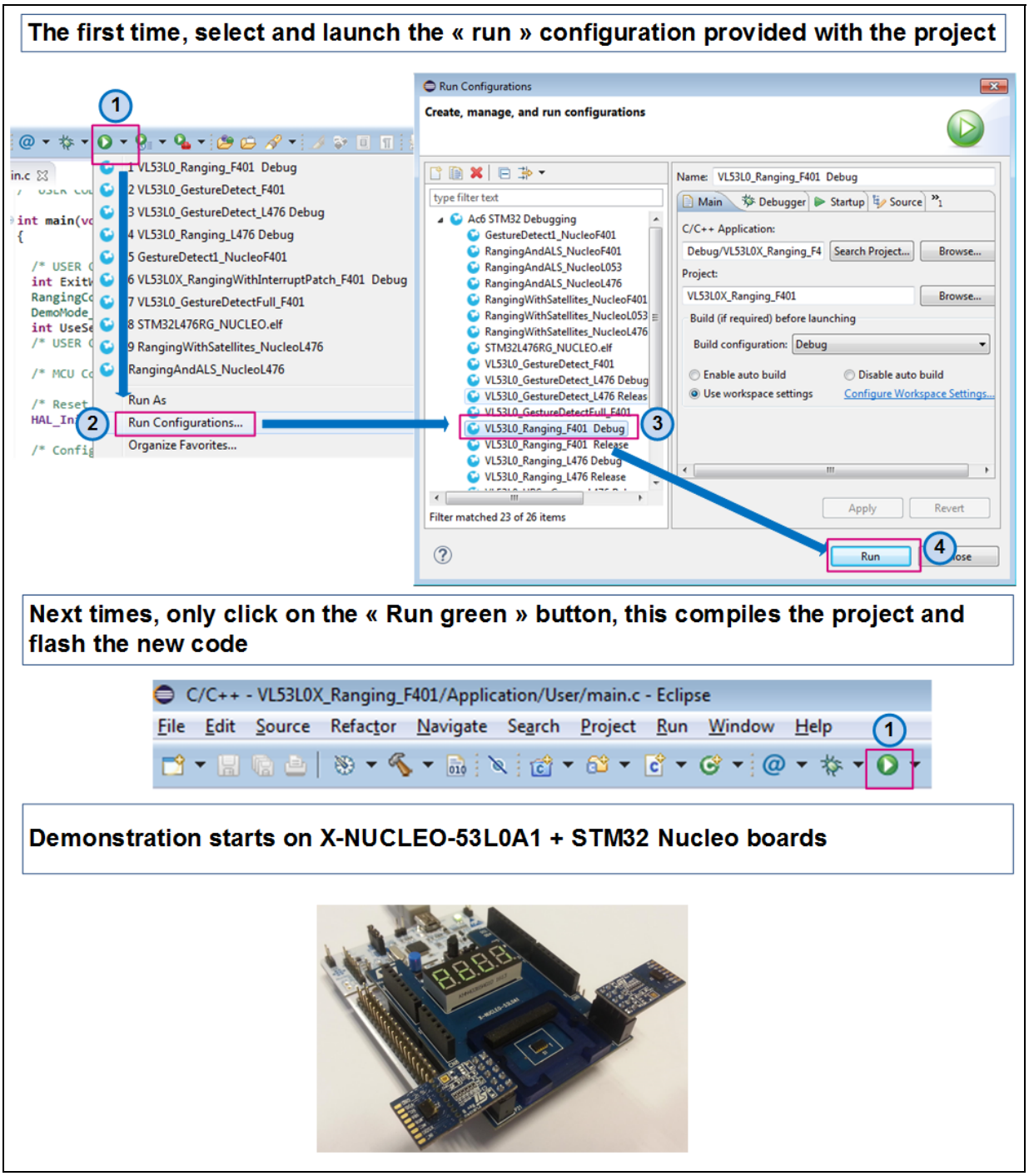
Figure 40. Compile a project in STM32 System Workbench



5.8 Flash the STM32 Nucleo board with STM32 Workbench

The procedure to flash the STM32 Nucleo board is described in *Figure 41*.

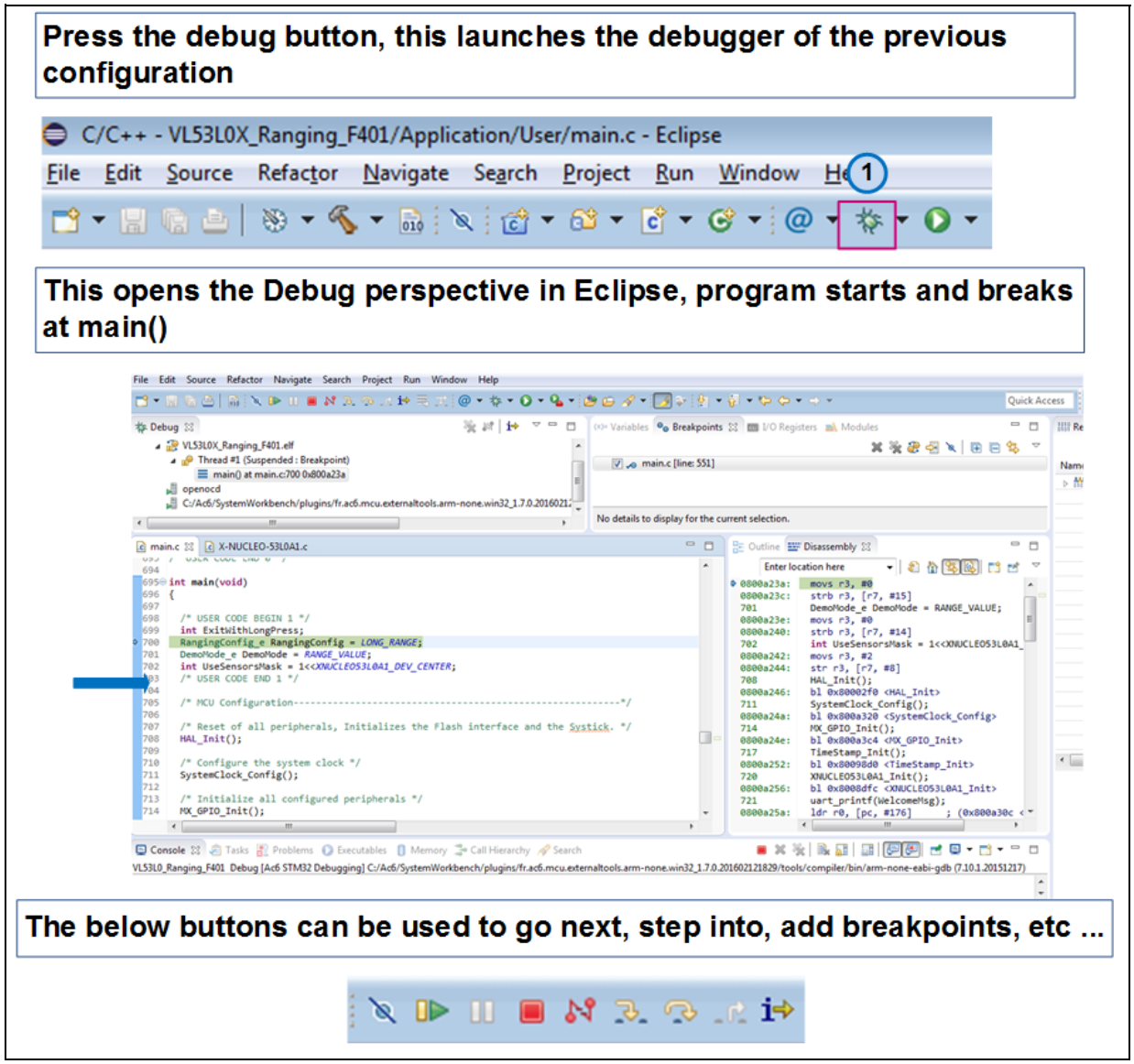
Figure 41. Flash the STM32 Nucleo board with STM32 System Workbench



5.9 Debug mode in STM32 Workbench

Debug mode is described in

Figure 42. Debug mode in STM32 System Workbench



5.10 Browse the code in STM32 Workbench

It is very convenient to discover VL53L0X API code within Eclipse using following shortcuts:

- Put the mouse cursor on any functions and do: **CTRL + “mouse left click”**
  - This opens the file containing the function implementation
- Pres: **ALT + “keyboard left arrow”**
  - To go back (up) to previous file location (undo)
- Press: **CTRL + ALT + H**
  - To open “Call hierarchy tree”: all functions calling the selected function

5.10.1 RangingWithSatellites code review

Figure 43 shows where to find in the STM32Cube software the different folders linked to the RangingWithSatellites code.

Figure 43. Folders linked to RangingWithSatellites code

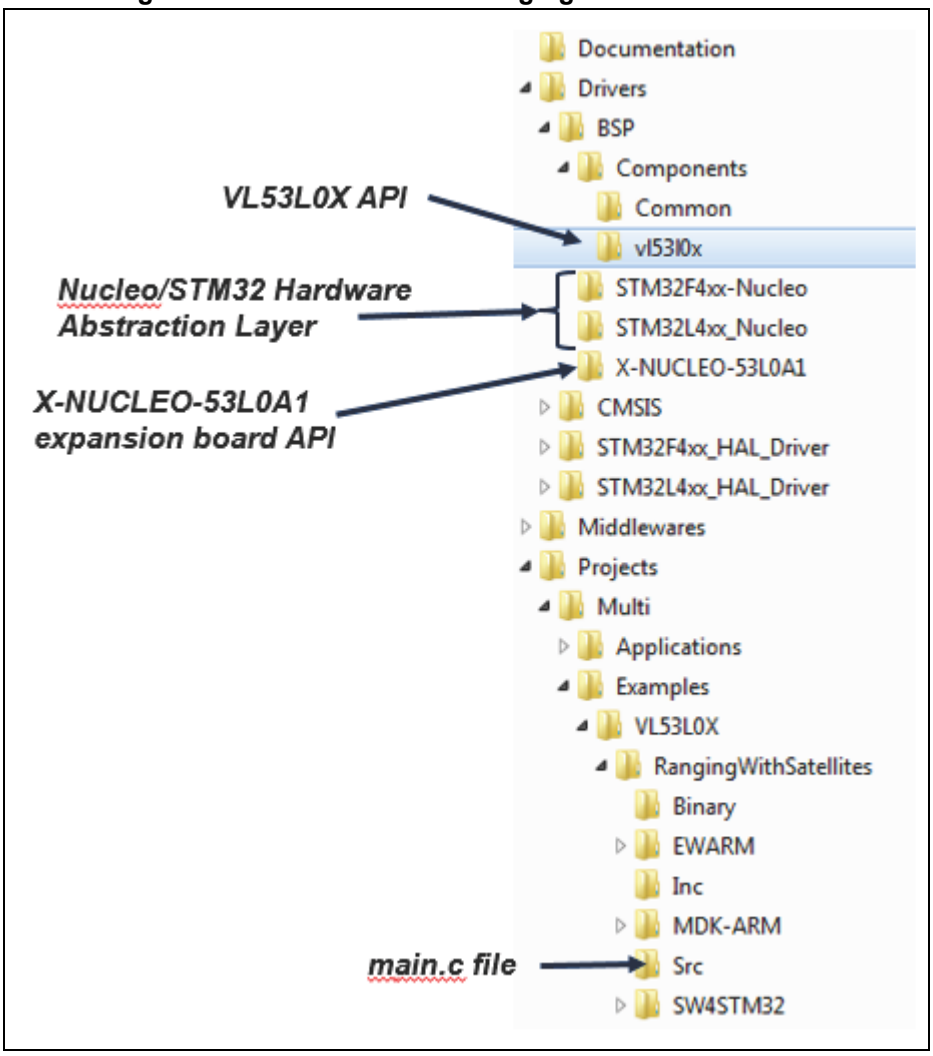


Figure 44 to *Figure 47* detail the RangingWithSatellites code.

Figure 44. RangingWithSatellites code - 1

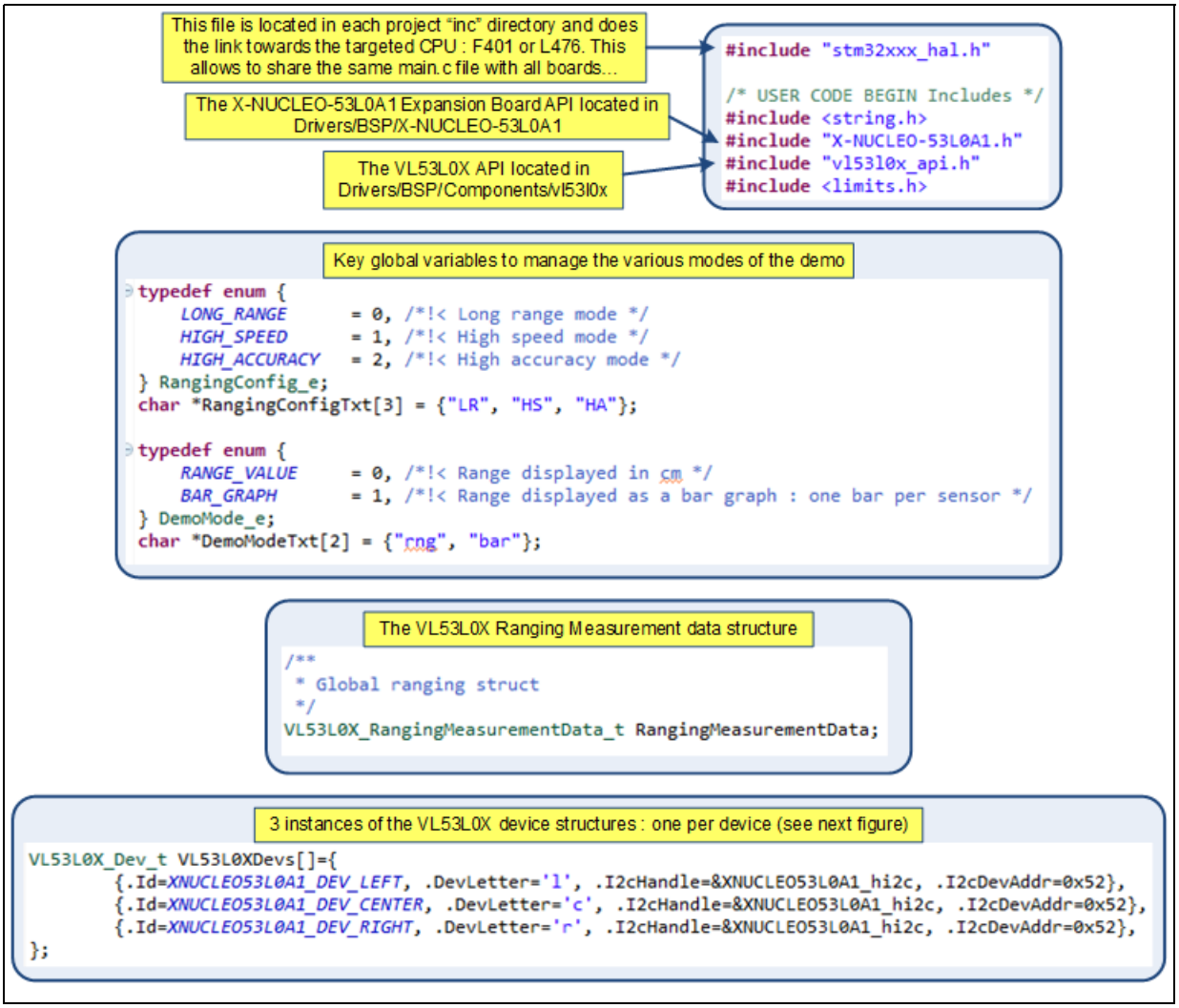


Figure 45. RangingWithSatellites code - 2

The VL53L0X device structure definition : vl53l0x_platform.h in Drivers/BSP/X-NUCLEO-53L0A1 (contains all what is needed for one sensor to range)

```
/**
 * @struct  VL53L0X_Dev_t
 * @brief    Generic PAL device type that does link between API and platform abstraction layer
 *
 */
typedef struct {
    VL53L0X_DevData_t Data;              /*!< embed ST Ewok Dev  data as "Data"*/

    /*!< user specific field */

    I2C_HandleTypeDef *I2cHandle;
    uint8_t   I2cDevAddr;

    char    DevLetter;

    int     Id;
    int     Present;
    int     Enabled;
    int     Ready;

    uint8_t   comms_type;
    uint16_t  comms_speed_khz;

    int LeakyRange;
    int LeakyFirst;
    uint8_t RangeStatus;

} VL53L0X_Dev_t;
```

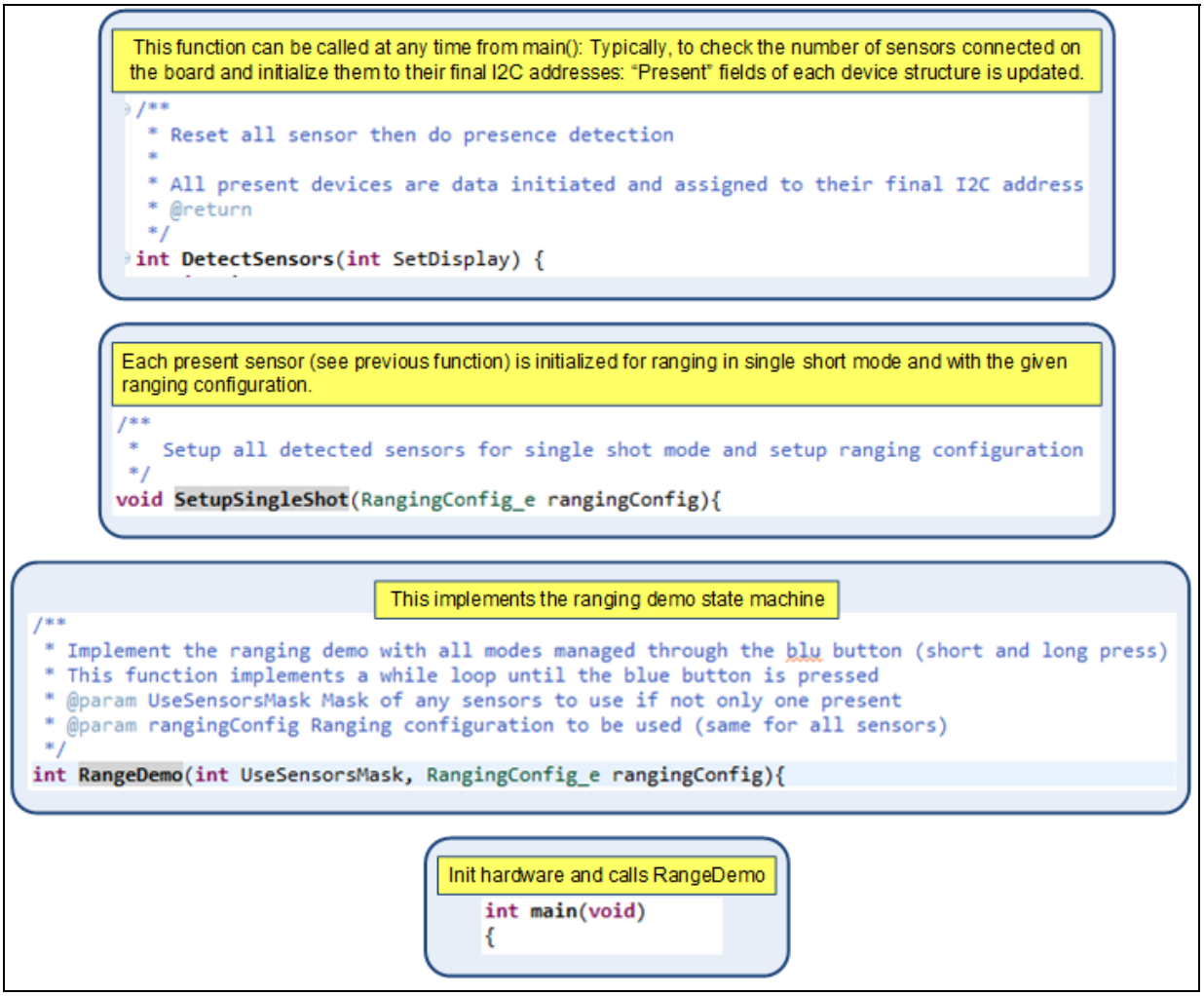
I2C address: will be different for each sensor

Sensor is detected on the board

Sensor ranging is enable

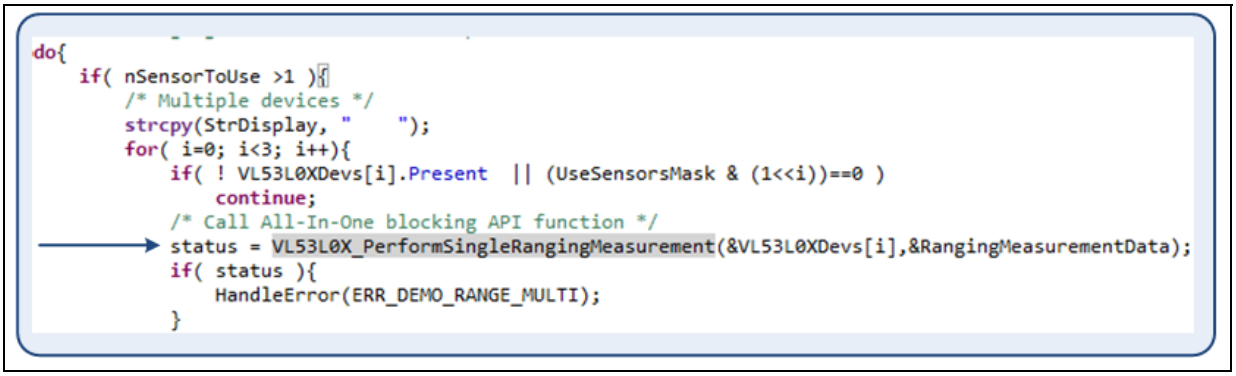
New ranging sample is ready

Figure 46. RangingWithSatellites code - 3



- Ranging operation for each enabled device is performed by the VL53L0X_PerformSingleRangingMeasurement API function, called in the RangeDemo() function.
- The above function being blocking, multi-device ranging is sequential (not simultaneous).

Figure 47. RangingWithSatellites code - 4



5.10.2 GestureDetect code review

Figure 48 shows where to find in the STM32Cube software the different folders linked to the GestureDetect code.

Figure 48. Folders linked to GestureDetect

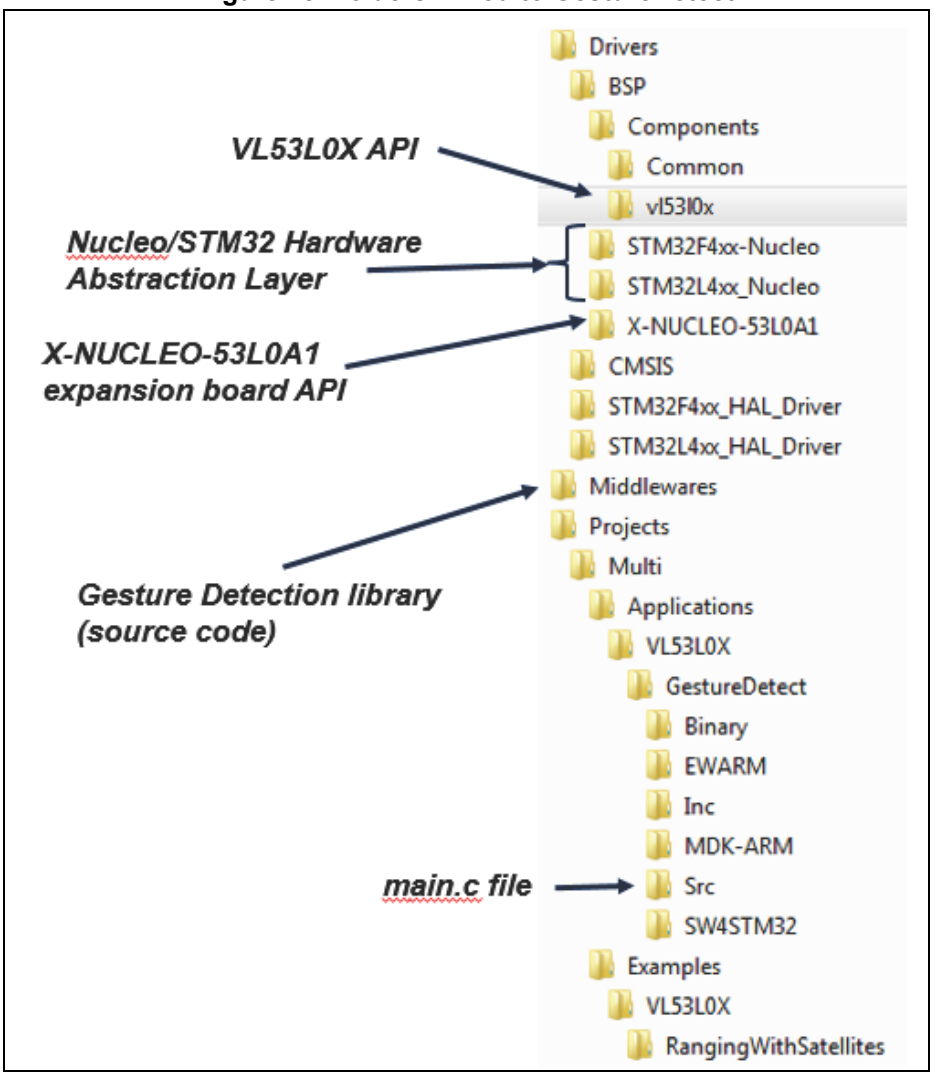


Figure 49 to *Figure 52* detail the GestureDetect code.

Figure 49. GestureDetect code - 1

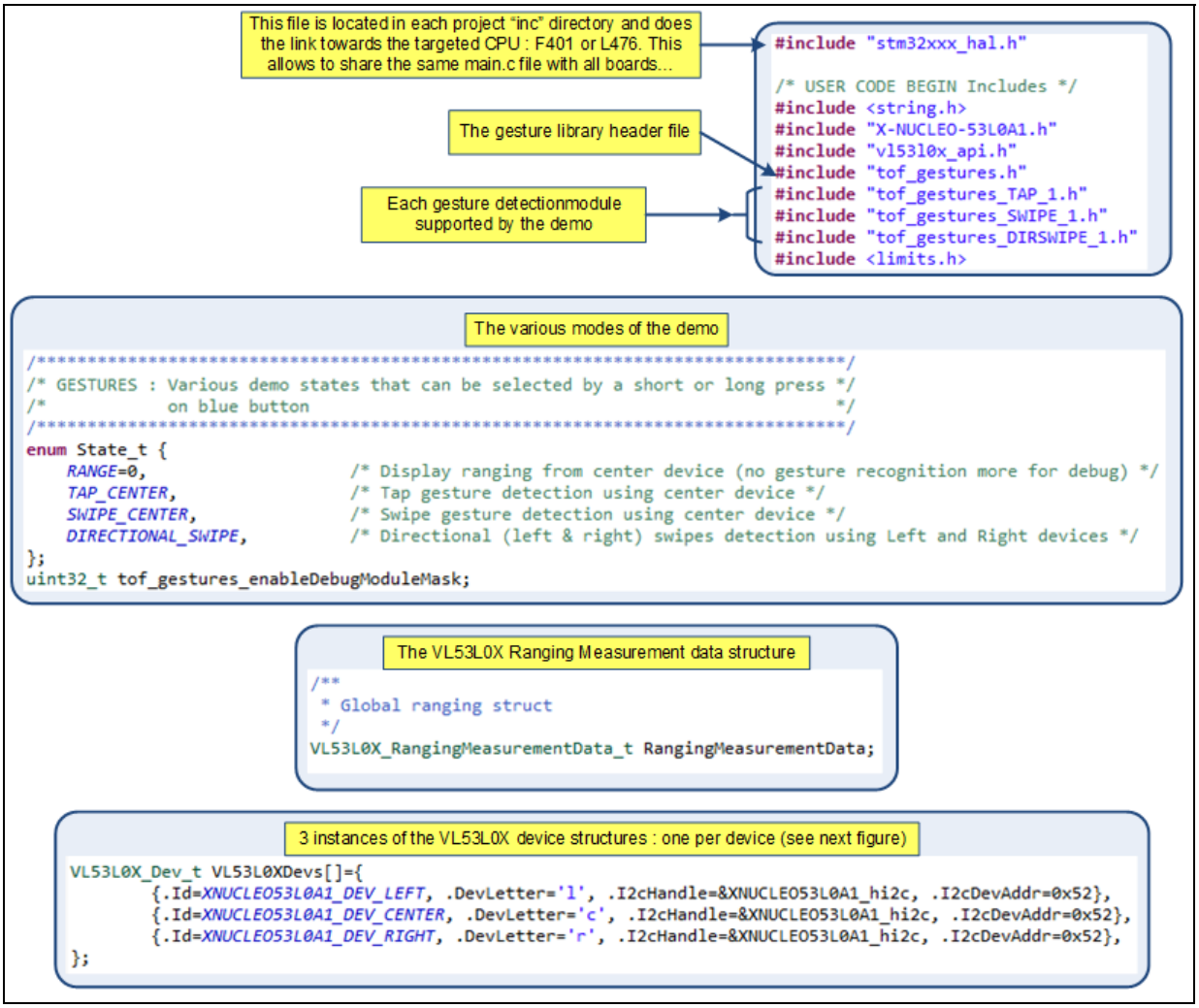


Figure 50. GestureDetect code - 2

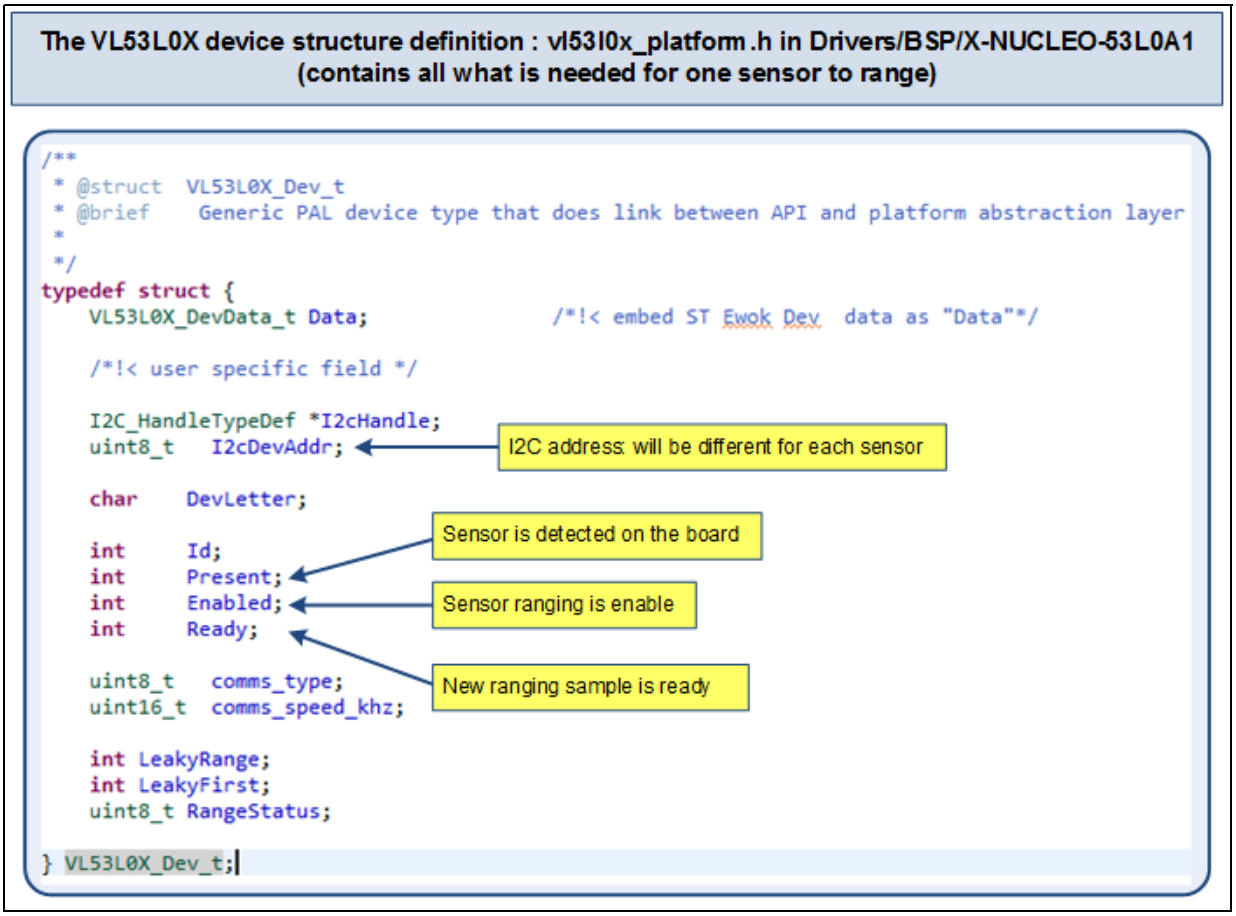
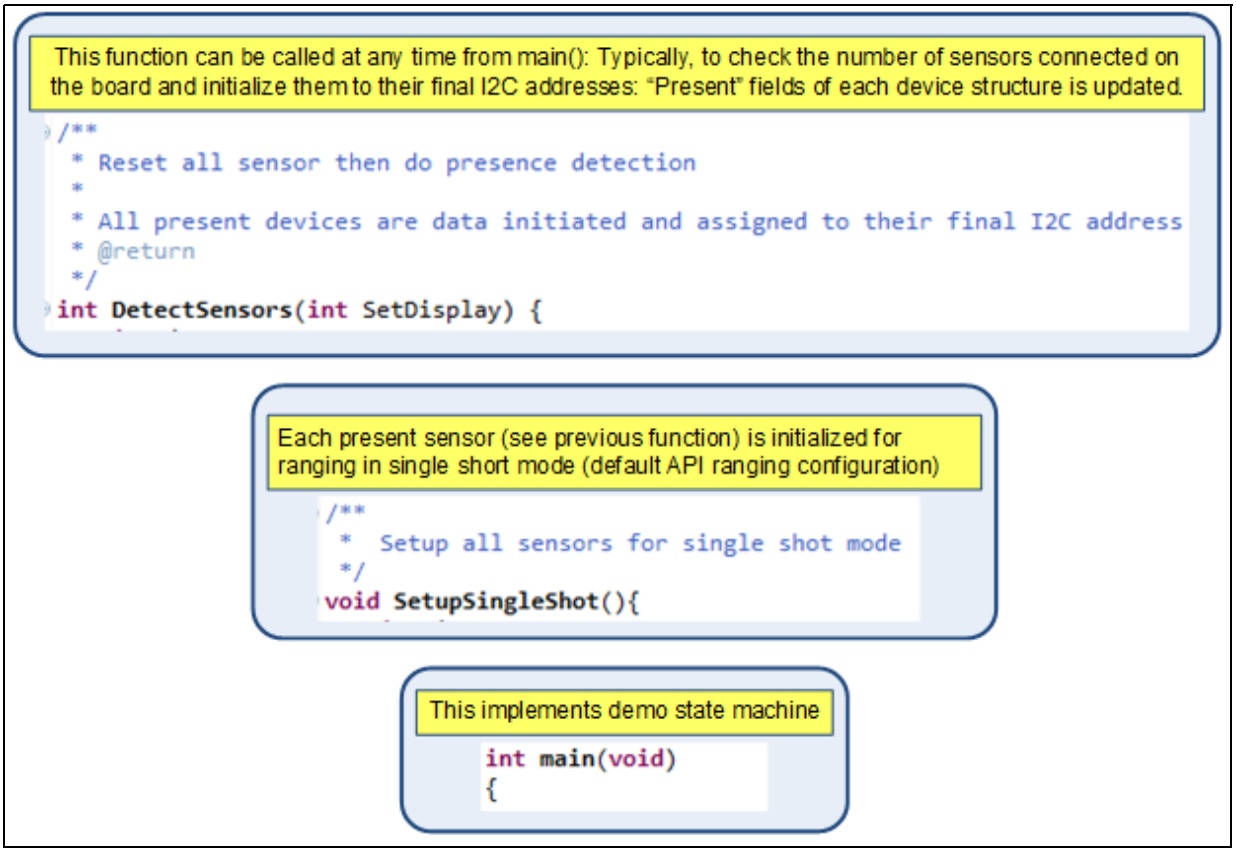
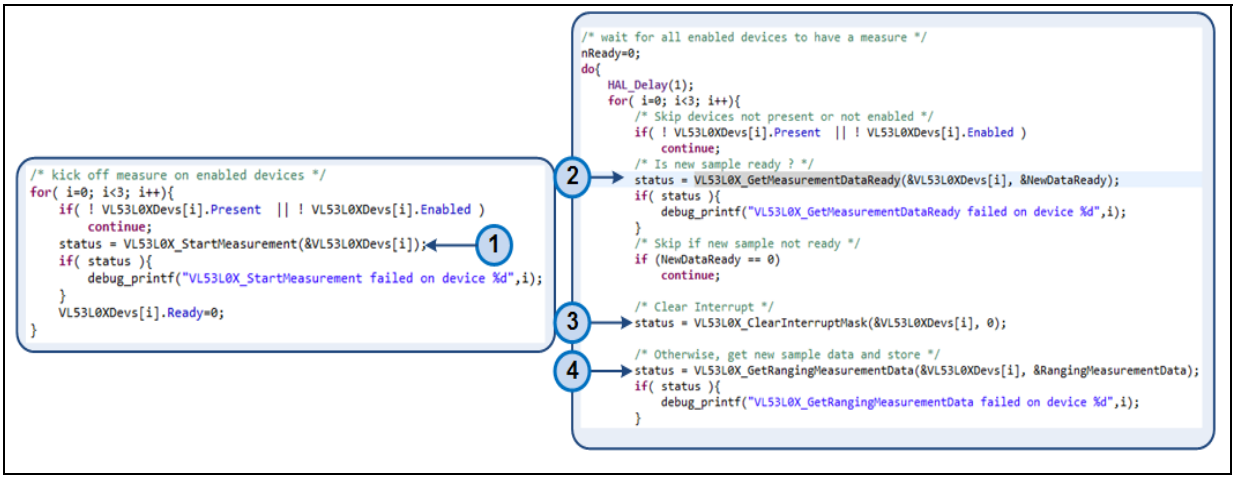


Figure 51. GestureDetect code - 3



- Ranging operation for each enabled device is performed by the VL53L0X_StartMeasurement, VL53L0X_GetMeasurementDataReady and VL53L0X_GetRangingMeasurementData API functions, called in the main() function.
- The above functions are not blocking, so multi-devices ranging is simultaneous.

Figure 52. GestureDetect code - 4



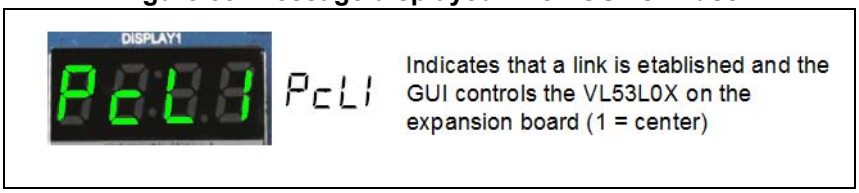
6 VL53L0X software graphical user interface (GUI)

6.1 Installation of the VL53L0X PC software graphical user interface (GUI)

The GUI shows, on the PC screen, the result of a range measurement and allows the user to discover and test the different VL53L0X settings.

Caution: As soon as the PC software runs, the VL53L0X expansion board display the message shown in *Figure 53* and values are only visible on the PC screen.

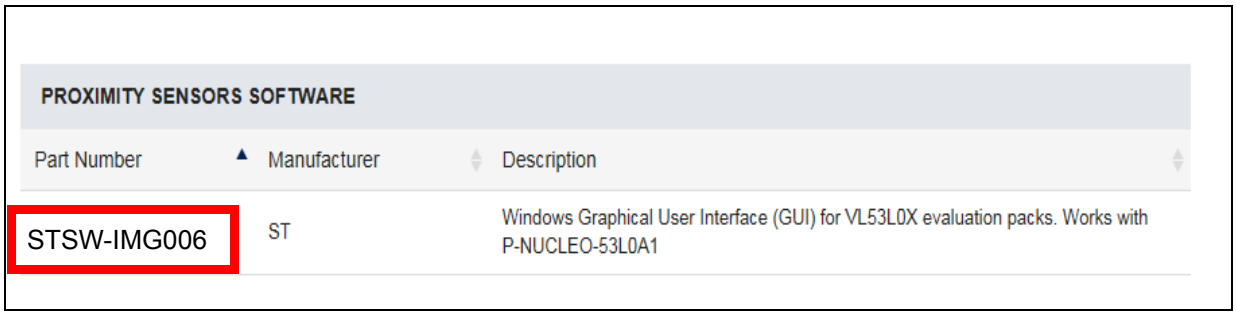
Figure 53. Message displayed when GUI is in use



To install the PC graphical user interface:

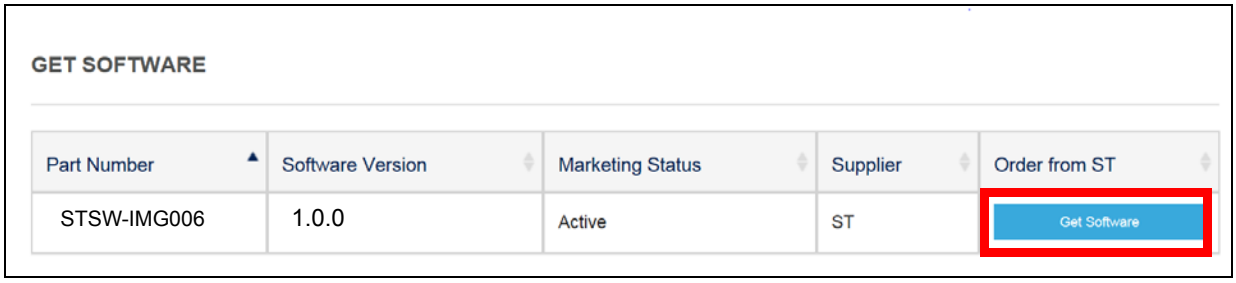
- Search for STSW-IMG006 on www.st.com.
- Click on “STSW-IMG006.

Figure 54. Installation of the VL53L0X PC software GUI - step 1



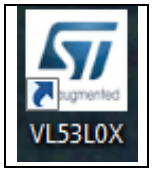
- Click on “Get software”.

Figure 55. Installation of the VL53L0X PC software GUI - step 2



- Accept license agreement.
- Then “Save” and “Run” VL53L0X_setup.exe, icon “VL53L0X” is installed on the user desktop space.

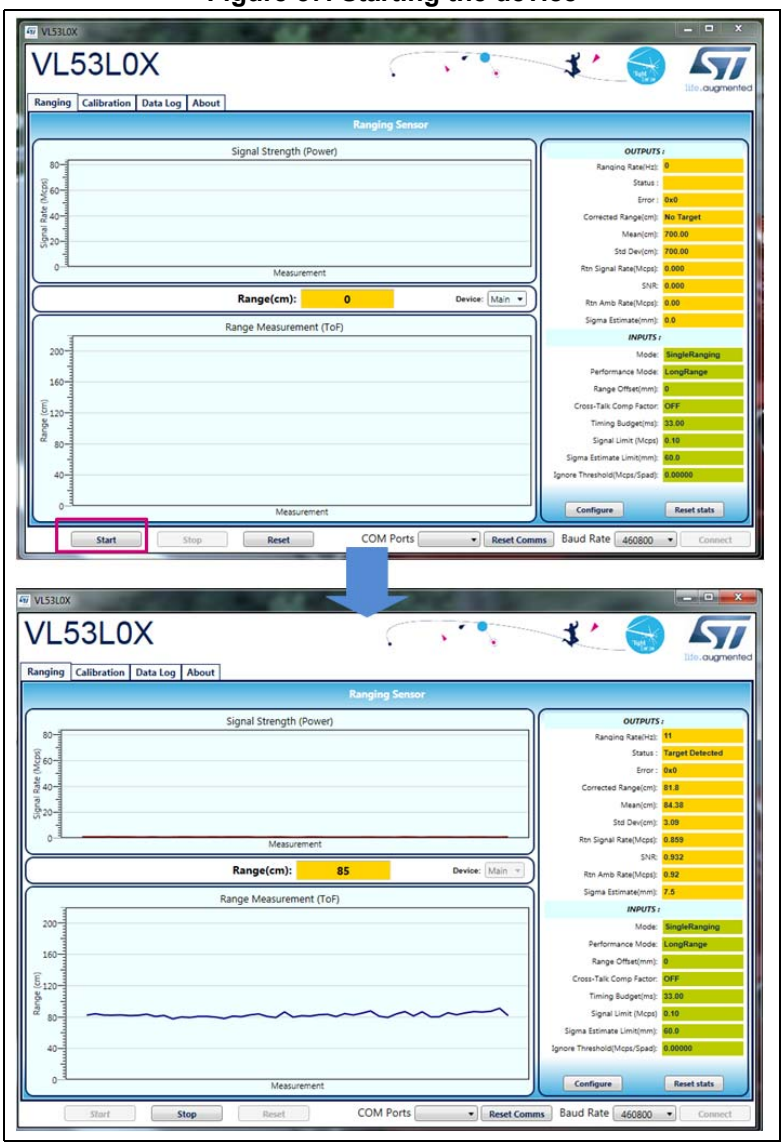
Figure 56. VL53L0X icon



- Connect STM32 Nucleo pack to an USB PC port.
- Start PC graphic user interface by clicking “VL53L0X” icon.
- Click on the Start button to start the device.

Note: The first time, GUI will program STM32 Nucleo board with FW needed to enable communication between the GUI and the STM32 Nucleo board (this could take few seconds).

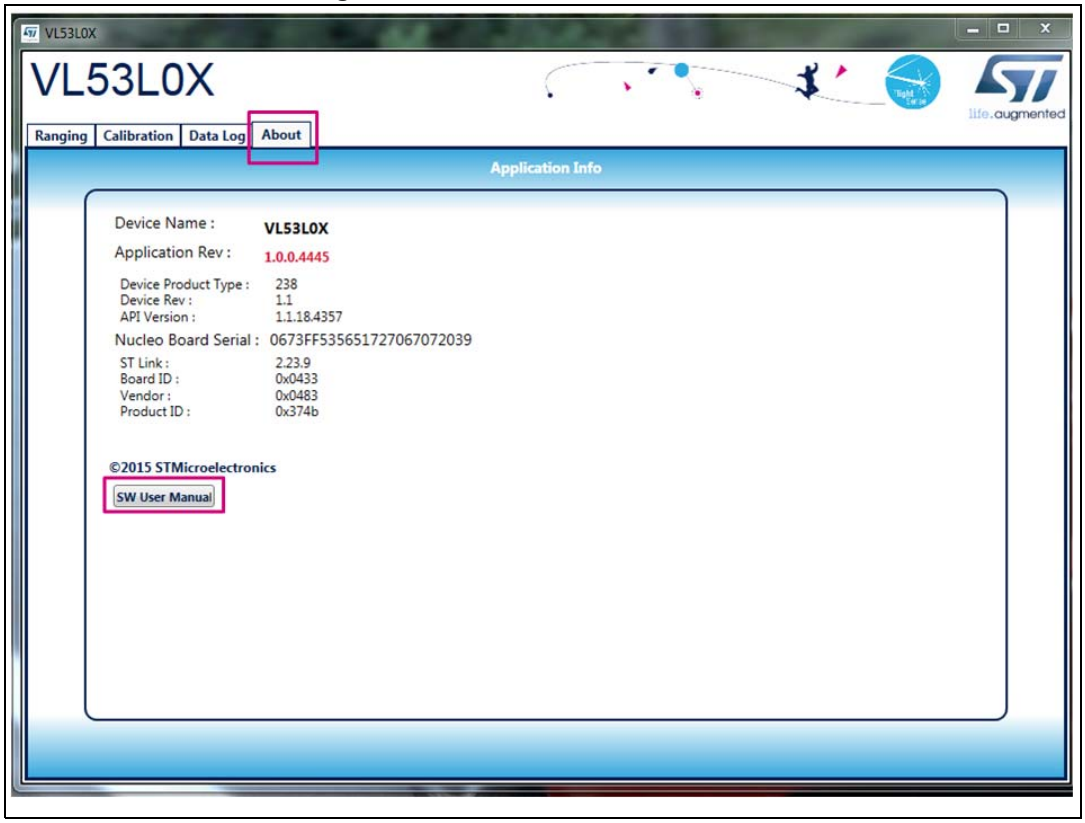
Figure 57. Starting the device



- Values are now displayed on the PC screen.

Detailed information to discover and test the different VL53L0X settings are given in the Sw user manual accessible from the “About” tab of the GUI.

Figure 58. GUI Software user manual



7 VL53L0X API

Software package containing:

- The VL53L0X API source code
- Examples running on the PC connected to the X-NUCLEO-53L0A1 and STM32 Nucleo pack.

Starting from this software package user can:

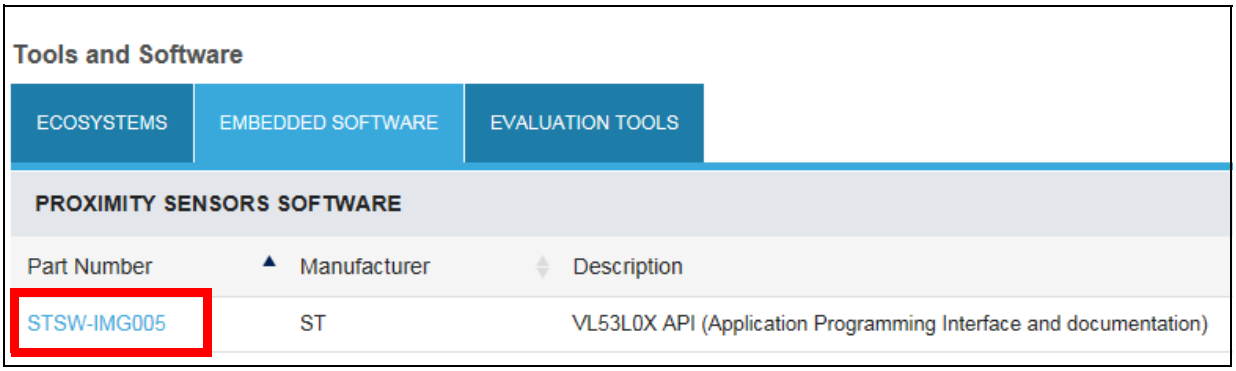
- Discover VL53L0X API
  - Browse the code.
  - read Doxygen documentation.
- Run simple .exe programs on the PC to do ranging from the VL53L0X.

7.1 Installation

To install the VL53L0X API:

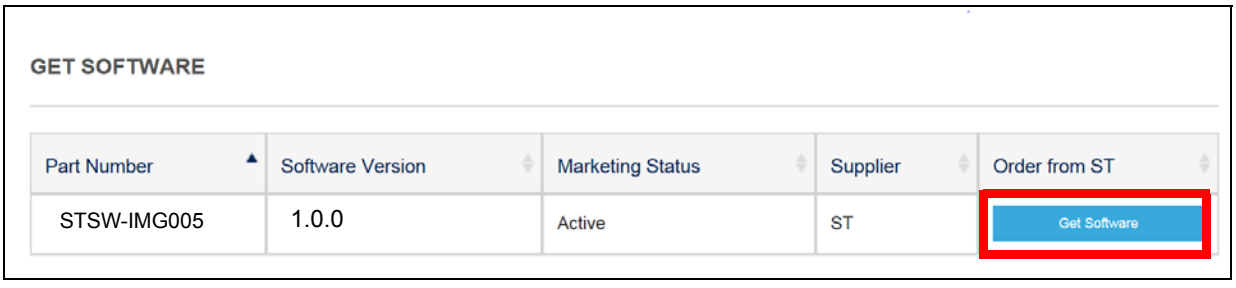
- If not already done, install STSW-LINK009 and STSW-LINK007 (see *Chapter 4: VL53L0X Nucleo pack software installation*).
- Search for STSW-IMG005 on *www.st.com*.
- Click on STSW-IMG005.

Figure 59. Installation of the VL53L0X API - step 1



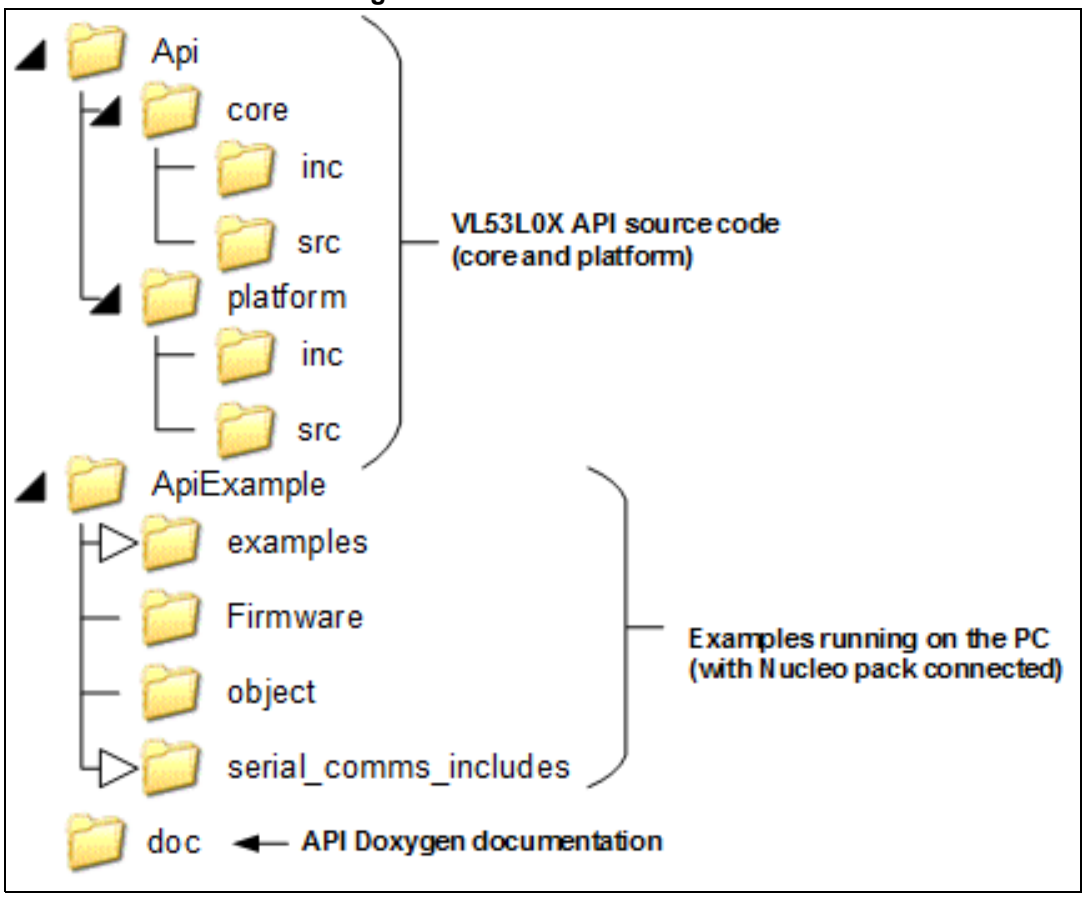
- Click on “Get software”.

Figure 60. Installation of the VL53L0X API - step 2



- Accept license agreement.
- Unzip the package

Figure 61. VL53L0X API folders



7.2 Running an example

The package contains several pre-compiled examples in APIExample\examples directory, to run an example double-click on the vl53l0x_yyyyyyy_exe you want to run.

The source code of these examples are provided in APIExample\examples\src directory.

It is possible to (re) build the .exe programs by double-clicking on the .bat files. This requires gcc compiler (https://gcc.gnu.org/) to be installed on the PC and available in the PATH.

8 Revision history

Table 3. Document revision history

Date	Revision	Changes
03-Jun-2016	1	Initial release.