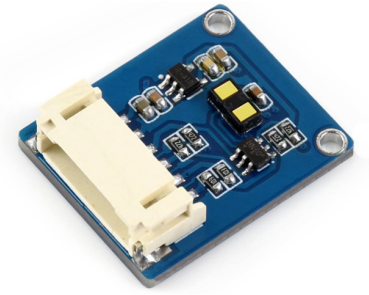


WAVESHARE VL53L1X Distance Sensor User Manual

VL53L1X Distance Sensor
User Manual

Contents

OVERVIEW

VL53L1X Distance Sensor is a Time-of-Flight (ToF) ranging module based on the VL53L1X from ST, with accurate ranging up to 4m and fast ranging frequency up to 50 Hz, it is controlled through an I2C interface and pretty low power consumption. The VL53L1X is a ToF sensor that embeds the ST's third-generation FlightSense patented technology. Compared with the second generation VL53L0X, the VL53L1X extends the ToF ranging distance up to 4m and features a fast ranging frequency up to 50 Hz. Unlike conventional ranging sensors, the VL53L1X

integrates physical infrared
filters and optics use ST's latest generation ToF technology which allows absolute distance measurement whatever the target color and reflectance, achieves better anti-interference capability.

FEATURES

- I2C communication interface, control the module on/off via IO pins
- Onboard voltage translator, compatible with 3.3V/5V operating voltage
- Comes with development resources and manual (examples for Raspberry Pi/Arduino/STM32)

SPECIFICATIONS

• Operating voltage: 3.3V/5V • Dimension: 20mm × 24mm • Mounting holes size: 2.0mm • Ranging distance: 40 ~ 4000mm • Ranging accuracy: ±5%	• Ranging time (min): 20ms (short distance mode), 3 3ms (medium/long distance mode) • Field of view: 27° • Laser wavelength: 940nm • Operating temperature: -20 ~ 80°C

PINOUTS

VCC: 3.3V/5V power input
GND: ground
SDA: I2C data pin
SCL: I2C clock pin
SHUT: shutdown control connects to IO pin
INT: interrupt output, connects to IO pin

HARDWARE

VL53L1X

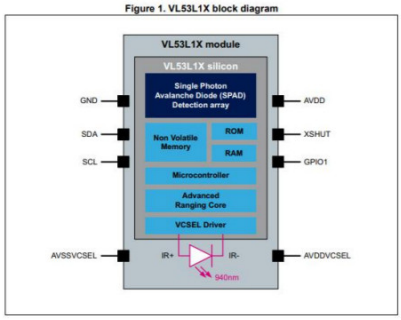
The VL53L1X is a state-of-the-art, Time-of-Flight (ToF), laser-ranging sensor, enhancing the ST FlightSense™ product family. It is the fastest miniature ToF sensor on the market with accurate ranging up to 4 m and fast ranging frequency up to 50 Hz.
Housed in a miniature and reflowable package, it integrates a SPAD receiving array, a 940 nm invisible Class1 laser emitter, physical infrared filters, and optics to achieve the best ranging performance in various ambient lighting conditions with a range of cover window options.
Unlike conventional IR sensors, the VL53L1X uses ST's latest generation ToF technology which allows absolute distance measurement whatever the target color and reflectance.
It is also possible to program the size of the ROI on the receiving array, allowing the sensor FoV to be reduced.

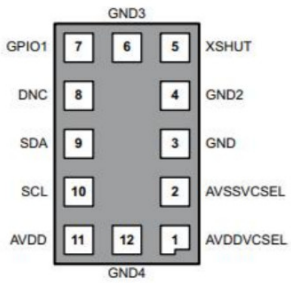
Features:

- Fully integrated miniature module
  – Size: 4.9×2.5×1.56 mm
  – Emitter: 940 nm invisible laser (Class1)
  – SPAD (single photon avalanche diode)

- receiving array with integrated lens
  – Low-power microcontroller running advanced digital firmware
- Pin-to-pin compatible with the VL53L0X FlightSense™ ranging sensor
- Fast and accurate long-distance ranging
  – Up to 400 cm distance measurement
  – Up to 50 Hz ranging frequency
- Typical full field-of-view (FoV): 27 °
- Programmable region-of-interest (ROI) size on the receiving array, allowing the sensor FoV to be reduced
- Programmable ROI position on the receiving array, providing multizone operation control from the host
- Easy integration
  – Single reflowable component
  – Can be hidden behind many cover window materials
  – Software driver and code examples for turnkey ranging
  – Single power supply (2v8)
  – I²C interface (up to 1 MHz)
  – Shutdown and interrupt pins

Pictures:





For more details, please read the datasheet.

USING DEMO CODE

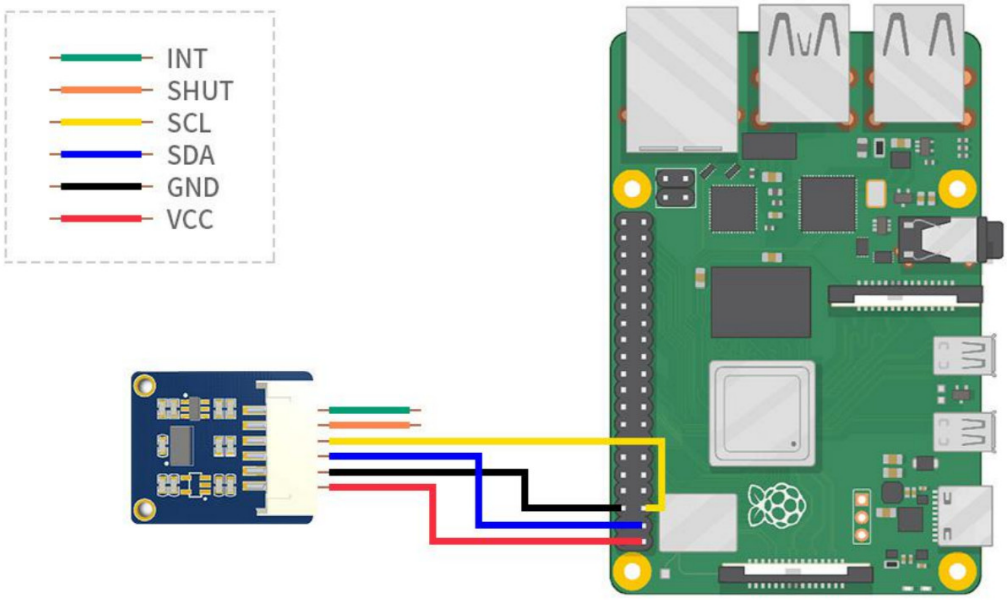
WORKING WITH RASPBERRY PI
LIBRARIES INSTALLATION

To use the demo code for Raspberry Pi, you need to install the wiringPi library first, otherwise, it cannot work properly. About how to install the library, you can visit the page:
Libraries_Installation_for_RPi#Install_WiringPi_Library

HARDWARE CONNECTION

The connection is based on Raspberry Pi

VL53L1X Distance Sensor	Raspberry Pi
VCC	3.3V
GND	GND
SDA	SDA.1
SCL	SCL.1



COMPILING AND RUNNING

1. Download the demo code on Wiki

2. Unzip and copy the Raspberry Pi code to your Pi (Recommend put on /home/pi)
3. Enter the path of the demo code and compile it: sudo make clean && sudo make

&& ./Range

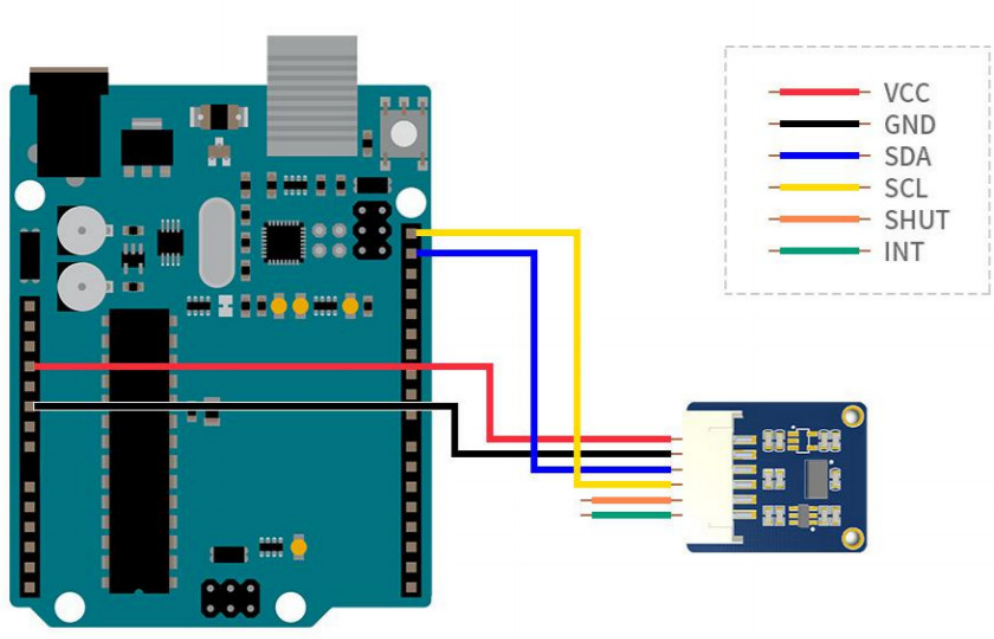
```
pi@raspberrypi:~/VL53L1XX $ sudo make clean && sudo make && ./Range
rm Range
g++ -Wall -o Range Range.cpp VL53L1X.cpp -lwiringPi
```

4. Run the code: ./Range

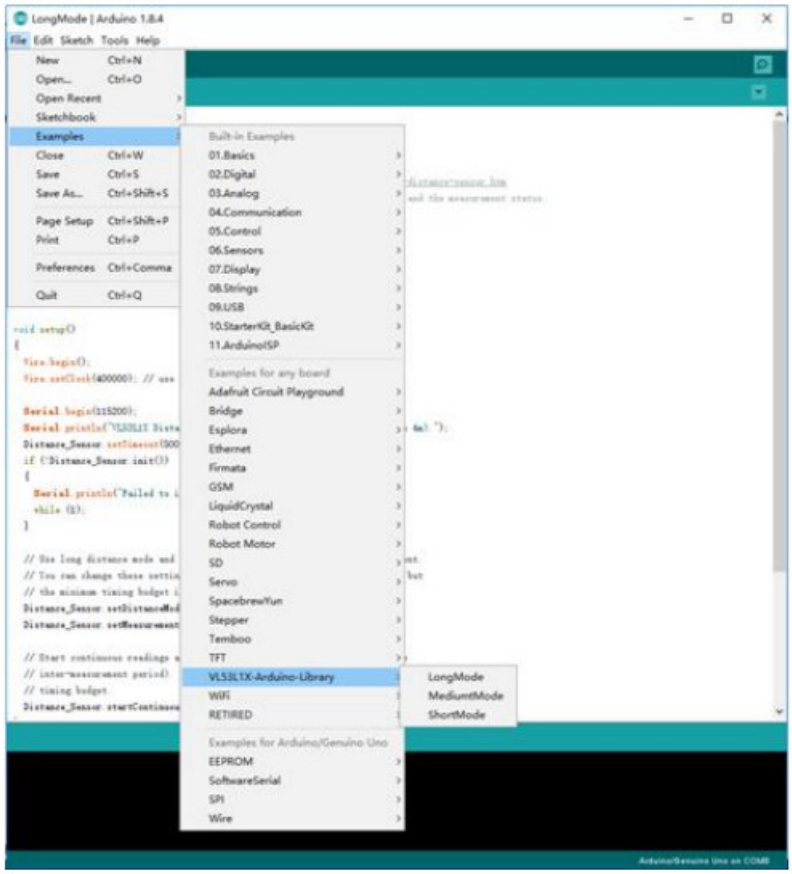
```
1 Raspberry Pi 3 Model B+
pi@raspberrypi:~/VL53L1XX $ ./Range
Distance(mm) :54
Distance(mm) :52
Distance(mm) :57
Distance(mm) :53
Distance(mm) :54
Distance(mm) :54
Distance(mm) :53
Distance(mm) :55
Distance(mm) :54
Distance(mm) :57
Distance(mm) :54
Distance(mm) :54
Distance(mm) :52
Distance(mm) :54
Distance(mm) :56
Distance(mm) :53
Distance(mm) :55
```

WORKING WITH ARDUINO
HARDWARE CONNECTION
This connection is based on Waveshare UNO PLUS

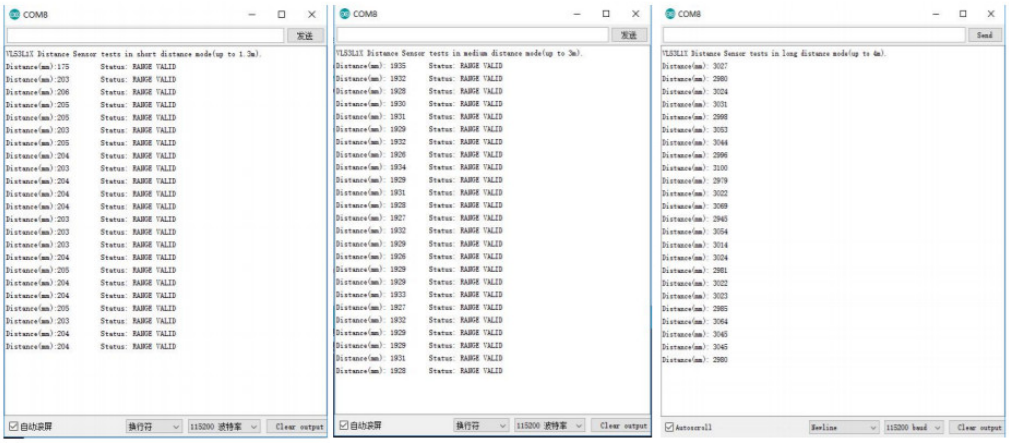
VL53L1X Distance Sensor	Arduino
VCC	3.3V
GND	GND
SDA	SDA
SCL	SCL



RUNNING CODE
Copy the VL53L1X-Arduino-Library folder which is under the Arduino demo code directory to Arduino IDE's Libraries directory which is under the installation directory of your IDE. Then Open Arduino IDE, and choose File->Examples-> VL53L1X-Arduino-Library

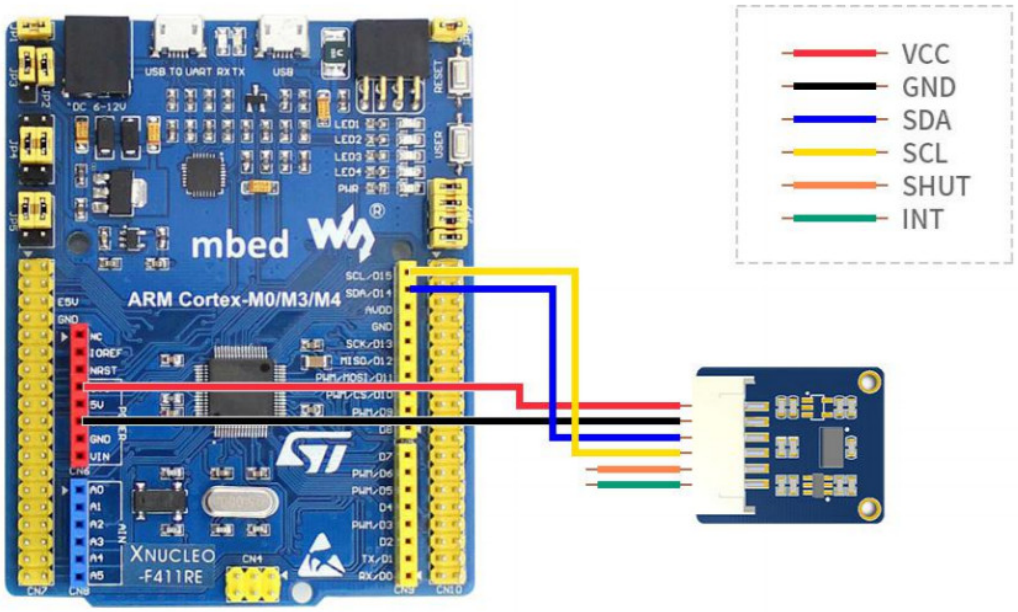


Compile and run three examples that are using Short Mode, Medium Mode, and Long Mode separately.
Short mode For short distance ranging range 0 ~ 1.3m
Medium mode For medium distance ranging range 0m ~ 3m
Long mode For long-distance ranging range 0m ~ 4m



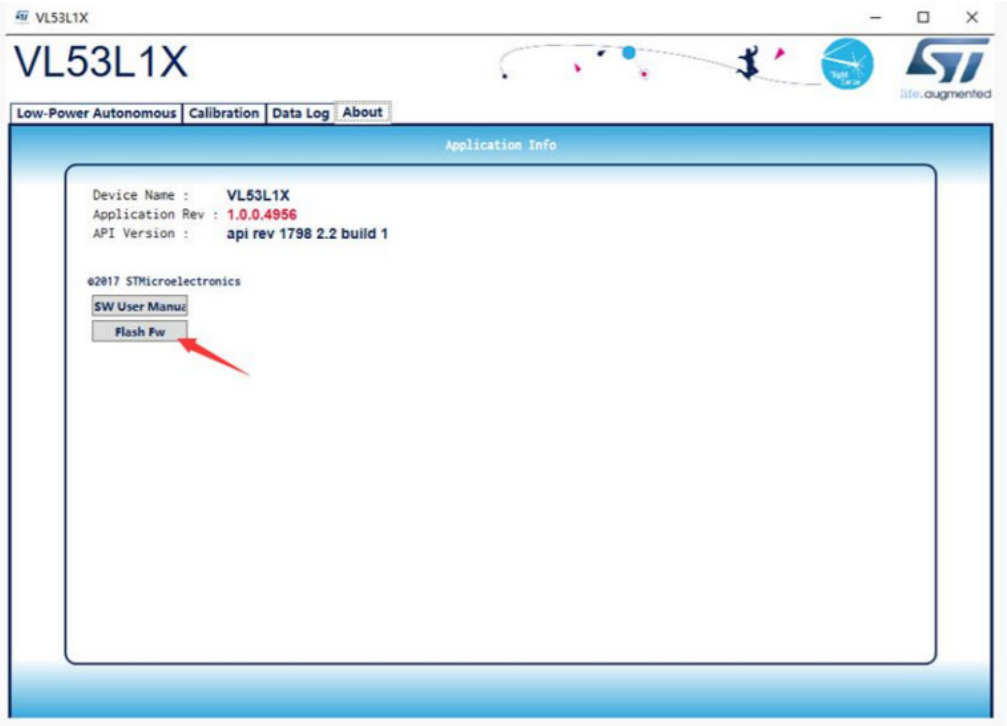
WORKING WITH STM32
HARDWARE CONNECTION
This connection is based on XNUCLEO-F411RE/NUCLEO-F401RE

VL53L1X Distance Sensor	XNUCLEO-F411RE/NUCLEO-F401RE
VCC	3.3V
GND	GND
SDA	SDA
SCL	SCL



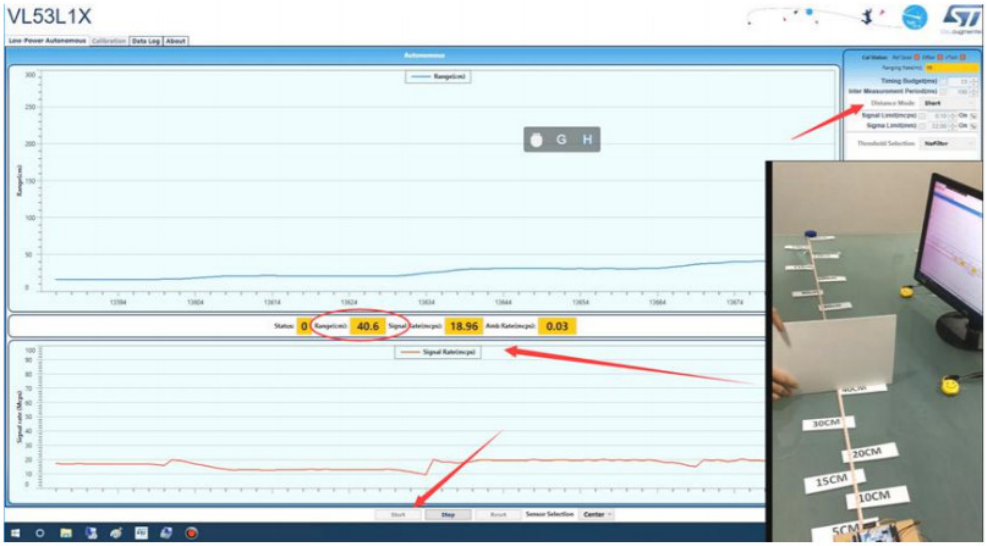
USING VL53L1X_GUI

1. Connect the sensor to NUCLEO-F401RE according to the Hardware connection
2. Install ST's VL53L1X_GUI software and run it. Open the software and write firmware to NUCLEO board: About->Flash Fw (for this example, only supports NUCLEO-F401RE)



3. Choose Low-Power Autonomous, and choose Distance Mode to Short. Click Start. The distance curve will be

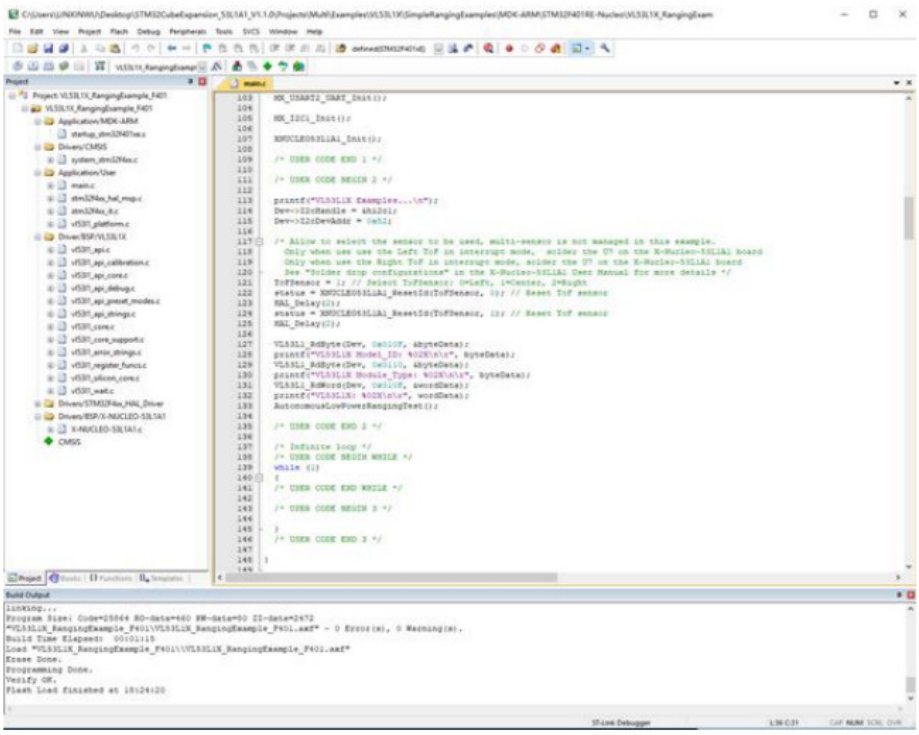
displayed on the software.



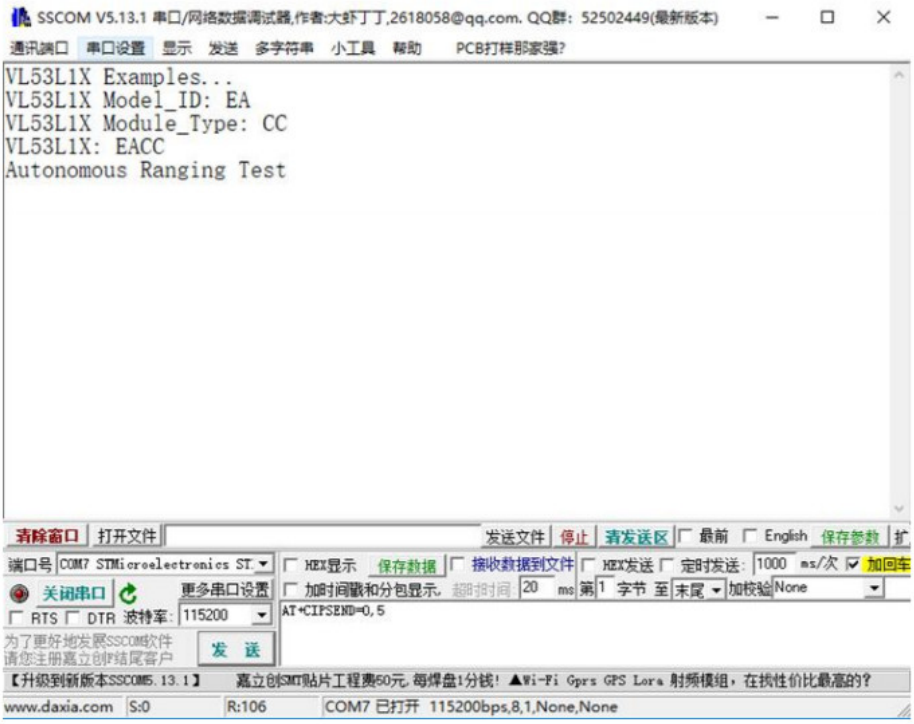
SIMPLERANGIN EXAMPLES

Connect the VL53L1X sensor to the NUCLEO-F401RE board (or the XNUCLEO-F411RE)

Open and run the example: .. \VL53L1X\SimpleRangingExamples\MDK-ARM\STM32F401RE-Nucleo

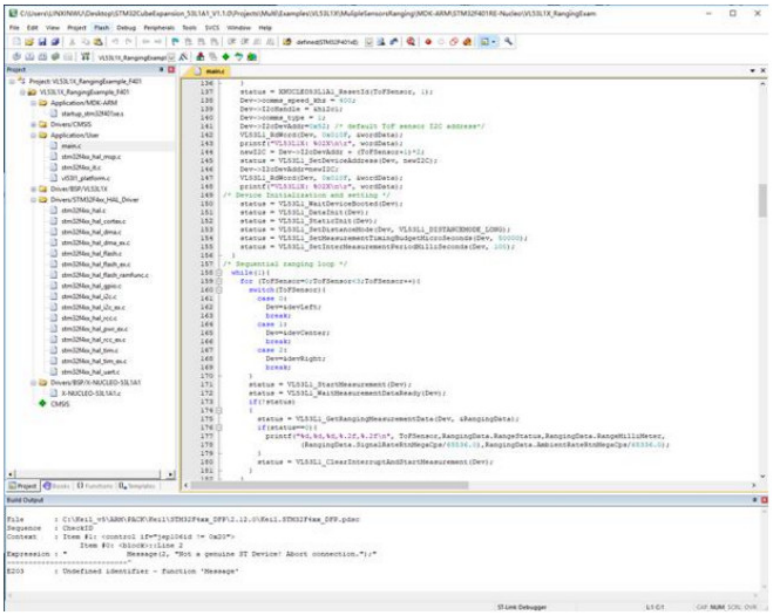


Open Serial debug assistance tool, choose the right COM, and set the baud rate to 115200. Then press the reset button.

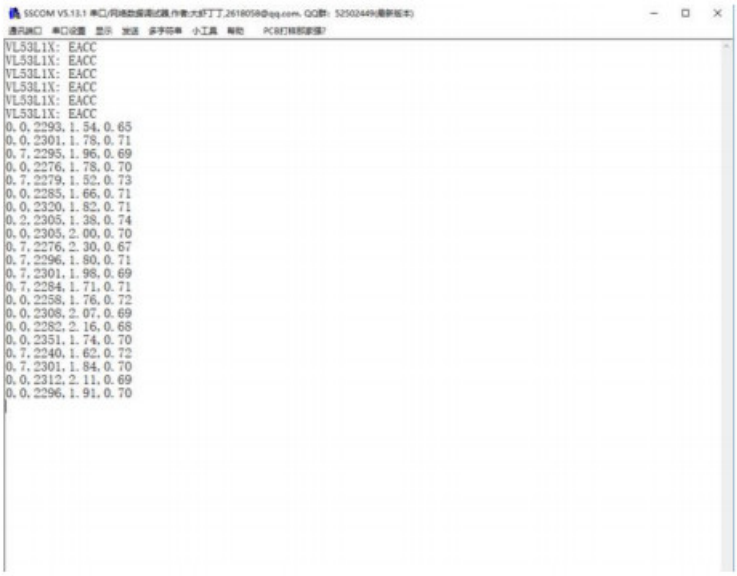


MULIPLESENSORSRANGING

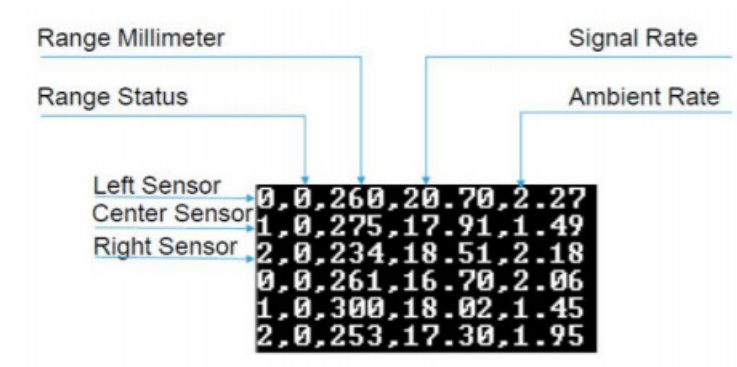
Connect the VL53L1X sensor to the NUCLEO-F401RE board (or the XNUCLEO-F411RE)
Open and run the example: ..\VL53L1X\MulipleSensorsRanging\MDK-ARM\STM32F401RE-Nucleo



Open Serial debug assistance tool, choose the right COM, and set the baud rate to 115200. Then press the reset button.



The information printed on serial;



For more information about STM32, please refer to the documents which are under the Documentation directory.

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Version: V1.0.0 Date: 2018.06.25

Documents / Resources

	WAVESHARE VL53L1X Distance Sensor [pdf] User Manual VL53L1X Distance Sensor