
Frequently asked questions on compact and normalized histograms (CNH)

Introduction

This document contains a list of frequently asked questions (FAQ) on compact, normalized histograms (CNH). Our Imaging expert replied to these questions during the [webinar about CNH](#). The questions and answers refer to the VL53L7CH and VL53L8CH products.

1 FAQ about CNHs

What is CNH?

CNH stands for compact, normalized histograms. It is STMicroelectronics' name for the output of a histogram. In terms of functionality, the product variants VL53L7CH and VL3L8CH are a superset of the VL53L7CX and VL53L8CX.

Is the CNH data normalized relative to the returned photons or the photons that are sent out?

CNH data is a measure of the return rate of the photons received by the sensor. The purpose of normalization is to remove the effects of dynamic setting changes. Such changes are applied by the ToF ranging core to optimize the histogram capture. Normalization also removes (subtracts) the ambient light level from the histogram.

Can I get raw and native histograms?

No, only the CNH histogram data is available. There is too much raw histogram data to transfer it all to the host. CNH data is preprocessed so it is normalized before sending it to the host. This removes the effect of "dynamic setting changes" that are made as part of the ranging process.

Is it possible to increase the number of bits in a histogram?

No, the CNH histogram data already uses a 5 bytes per bin format with a dynamic range larger than the underlying sensor.

Is autonomous mode available on CNH data?

Autonomous mode, as defined in the UM3183, can be used. This mode is free running, where the integration time does not need to be equal to the maximum possible at the frame rate.

Can I change the output histogram settings "on the fly"? If so, how long am I blind while this configuration change takes place?

If settings are changed on the fly, one frame of corrupt data may be generated while the new settings are being applied.

Can I create a single zone that aggregates all 64 zones?

Yes, this can be done by using the ultra lite driver (ULD) plugin: vl53lmz_plugin_cnh function vl53lmz_cnh_create_agg_map().

Can I increase the maximum frame rate to greater than 15 MHz in 8x8 mode?

No, 15 fps is the maximum frame rate for 8x8 mode (the same as for the VL53L8CX).

What is a good example of using a 4x4 instead of an 8x8 grid? In other words, is there a speed or data averaging advantage?

A 4x4 grid is useful with high frame rates, or low power operations. It is obligatory whereas a full 8x8 spatial resolution is not.

Is it possible to obtain the CNH of the VL53L5CX?

No, the CNH output is only available with the VL53L7CH and VL53L8CH products.

Are there limitations for CNH data when using an I²C?

There are no specific limitations when using an I²C. However, an SPI transfers data faster, and may be useful in some applications.

What is the ambient infrared (IR) signal usually used for?

The "noise floor" of the data within the histograms is related to the ambient light level. The ambient level can then be useful to set threshold levels when processing the histogram data.

Is it possible to mimic the first significant bin (FSB), but instead use the last significant bin?

Yes, this could be useful if you want to detect the feature that is farthest from the target.

Can I use multiple sensors to extract data for two or more CNHs?

Multiple sensors can be used. For more information, see the VL53L8CX application note AN5945.

Are calibrations applied to CNH data?

With CNH data, the signal from the cover glass crosstalk is removed. This is done based on calibration data.

2 FAQ about the VL53L7CH and VL53L8CH sensors

These sensors perform excellently indoors. However, their performance degrades significantly in the presence of natural light (at 940 nm). Do you think that meaningful data can be obtained under high ambient light conditions that would otherwise result in erroneous data without CNH?

It is application dependent whether external processing of histogram data is better than the range measurement algorithm built into the Time-of-Flight (ToF) device. The customer needs to test this in their own application environment.

When using screens in front of a sensor, is the calibration stored in the component?

A default calibration is downloaded as a part of the standard ULD device initialization process. Customer-specific calibration data must be stored within the host microcontroller unit (MCU) and downloaded to the device after the device has been initialized.

Is the sensor insulated against water, including steam and air humidity?

ST sensors are not insulated against water. The sensor should be protected with a cover glass.

Does ST intend to release a sensor with an SPI and one with a narrower angle than 20°?

The VL53L8CH supports an SPI. There are no plans for a sensor with a narrower field of view (FoV) than 20°.

I would like to integrate the ST sensor on a moving device with a reasonably high vibration. Is this combination of ST sensor and my device tolerant to vibration?

Vibration tests are done as per the JESD22-B103 standard.

Are the VL53L7CH and VL53L8CH pin-to-pin compatible?

No, they are not. They are also not pin-to-pin compatible with other VL53Lx sensors. For example, it is not possible to update a board, which has a VL53L1 sensor with a board, which has a VL53L8 sensor.

Are these high resolution sensors available in all types of housing, or just as a die?

These sensors are extremely small modules. Customers must add environmental protection around them, including an optical cover glass.

Is it possible to build some kind of 3D shape recognition system using several ToF sensors together?

Yes, it is possible. See the application note AN5945 on the VL53L8CH product page.

The sensor sends light towards the target. Can multiple sensors send light to the same location?

Multiple sensors can be used concurrently to range on the same target. Each sensor operates independently as light emissions from each are not synchronized.

Are the sensors ready for order?

Yes, they are. You can order them on st.com from the VL53L7CH and VL53L8CH product pages.

I want to order the SATEL-VL53L8 breakout board. Is it possible to order it with a VL53L8CH mounted on it?

The SATEL-VL53L8 is mounted with a VL53L8CA module. This is a noncommercial "super product" covering the VL53L8CX and VL53L8CH sensors. ST does not sell boards that specifically have the VL53L8CH product mounted on them.

3 Use cases

It seems that the histogram is able to measure material separation in fluids such as oil and water. Have you done any tests like this?

ST has not tested this.

We are using the VL53L8CH with a simple color sensor to provide auxiliary information about an occupant. We can use this color sensor with a wider field of view to wake up the ToF sensor. Are you working on any of these capabilities?

There are certain applications in which it is useful to pair a ToF sensor with an imaging camera module. ST is working with partners on such applications. For example, ST recommends that you use the STEVAL_PDETECT1. This board embeds all ST Presence sensors, including an ambient light sensor and a ToF sensor. Stay tuned!

Cup detection is an interesting application. How can I get more information about it?

Really soon. ST is planning to release such a use case. Stay tuned!

How can I use a single sensor and design a 360° mapping device?

Mount a ToF sensor on a 360° rotating mount. Then, as the mount is rotating, use some clever software to merge all the data together.

More information on use cases can be found on [st.com](https://www.st.com):

- [Multizone Time-of-Flight sensors enabling Artificial Intelligence landing page.](#)
- [VL53L7CH product page.](#)
- [VL53L8CH product page.](#)

Revision history

Table 1. Document revision history

Date	Version	Changes
20-Jun-2024	1	Initial release

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