

# Vzense DCAM800 ToF Camera User Manual





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# 1 General Information

The purpose of this document is to familiarize the customer with the correct operation of the Vzense ToF Camera. This document provides important information about the camera's features, hardware specification, safe use of the camera, and installation procedures.

## 1.1 Terms of Use

Vzense offers a 1-year-warranty for this camera.

### Warranty Information

Please do follow the following guidelines when using the Vzense camera:

#### **Do not remove the product's serial number label**

Warranty must be void, if the label is damaged or removed and the serial number can't be read from the camera's registers.

#### **Do not open the camera housing**

Do not open the housing. Touching any internal components may damage the camera.

**Prevent any objects or substances from entering the camera housing. Otherwise the camera may fail or damaged.**

#### **Avoid electromagnetic fields**

Do not use the camera near strong electromagnetic fields. Prevent from electrostatic charging.

#### **Transport in original packaging**

Transport and store the camera in its original packaging only. Do not discard the packaging.

#### **Clean with care**

If you have to clean the housing of the camera, follow the guidelines in the notice as below:

- Use a soft, dry cloth that won't generate static during cleaning;
- To remove tough stains, use a soft cloth dampened with a small amount of neutral detergent(Pure water); after that wipe dry;
- Make sure no any residual detergent after cleaning, before reconnecting the camera to power


#### **Read the manual**


Do read the manual carefully before using the camera.



## 2 Precautions

### 2.1 Safe Usage Instructions

	DANGER
	<p><b>Electric Shock Risk</b></p> <p>Non-standard and improper power supplies may result in fire and electric shock. You must confirm the camera power supply used that meets the Safety Extra Low Voltage (SELV) and Limited Power Supply (LPS) requirements.</p>

	CAUTION
	<p><b>Invisible Radiation</b></p> <p>This camera uses laser to work, improper use may damage the eye. Lasers are classified as risk group 1 (low risk) according to EN 60825 which means that the product presents no risk related to exposure limits under normal usage conditions. Eye safety is only guaranteed when the camera is used properly</p>

### 2.2 Power

If you are supplying camera power via the camera's 10-pin connector cable and the voltage is higher than 24 VDC ( $\pm 10\%$ ), the camera may get damaged. If the voltage is lower than 12V, the camera may not work as expected and you may not be able to start the camera. Use a power supply with a minimum output current of 2 A at 24V and 3A at 12V.

### 2.3 Usage

Don't try to open the camera housing. Each camera has been calibrated at the factory to achieve precise measurements. Touching internal components may damage the camera and cause calibration data lost.

Incorrect plugging in and unplugging of the camera's power cable can damage the camera. To avoid switch-on surges damaging the camera, please plug in the power cable into the camera's 10-pin connector firstly before getting power supply.



Don't try to change the position of the lens, may cause damage to the camera.  
Do store the camera carefully when not in use, in original package the best.

## 2.4 Temperature

To avoid damaging the camera and to achieve best performance, please observe the maximum and minimum housing temperatures in Section 3.1

# 3 Specifications and Requirement

## 3.1 General Specifications

Specification	Vzense DCAM800
Technology	ToF (Time-of-flight) Depth Camera
Depth Sensor Resolution and Frame rate	640 x 480(VGA)@30FPS
Output Formats	Depth & IR Map (RAW12)
Depth Sensor Field of View	H-58°
H-Horizontal, V-Vertical(degree)	V-43.84° (customizable)
Use Range	0.2m~10m (customizable)
Accuracy	<1%
Power Consumption	Average Max. 10W(Ref)
Illumination	In-door 850nm/Out-door 940nm,4 x Vcsel
Dimension(L*W*H)	84mmx65mmx70mm
Weight	400g
Power Supply	DC 12V-24V / POE+ or above
Interface	1000M Ethernet, CAN-BUS
Digital I/O (Exposure Control, Synchronization etc.)	2in/2out
Enclosure Rating	IP65
Working/Storage Temperature	-20℃-50℃/-30℃-70℃



Software	C/C++ SDK
Operation System	Windows 7/8/10, Android, Linux
Cooling	Passive, no fan
Certification	FCC/CE/FDA
Eye safety	Class 1

## 3.2 Electrical Specifications

### 3.2.1 Recommended Operating Conditions

Parameter	Symbol	Conditions	Min	Typ.	Max	Units
Supply voltage on VDD	VDD		12		24	V
Digital I/O (EXT_Trigger/ EXT_INPUT/)	Vin	Work mode	3.3		24	V
	Input impedance *			560		$\Omega$
Digital I/O Exposure_timing/ EXT_OUTPUT)	Current	OD mode			40	mA
Voltage between pin CANH and CANL	V(CANH-CANL)		-24		24	V
Operating Temperature	Ta		-20		50	°C
Operating humidity			20		80	%
Storage humidity			20		80	%
Storage temperature			-30		70	°C

\*: Please consider Vf range is about 1.3V

### 3.2.2 Power Consumption

Parameter	Conditions	Average	Max	Units
Current at near mode	250mm-1200mm @30 frame	307	455	mA
Current at far mode	800mm-4300mm @30frame	482	1011	mA
Current at xfar mode	1200mm-6300mm@15frame	508	1986	mA

Note: 12V input voltage



### 3.2.3 Absolute Maximum Ratings

This is a stress rating only and functional operation of the devices at those or any other conditions above those indicated in the operation listings of this specification is not promised. Exposure to maximum rating conditions for extended periods may affect device reliability

Parameter	Symbol	Conditions	Min	Typ.	Max	Units
Supply voltage on VDD	VDD		9		28	V
Digital I/O (EXT_Trigger/ EXT_INPUT/ Exposure_timing/ EXT_OUTPUT)	Vio	Work mode	3.3		26	V
Voltage between pin CANH and CANL	V <sub>(CANH-CANL)</sub>		-26		26	V
Operating Temperature	Ta		-20		50	°C



### 3.3 Mechanical Specifications

This drawing contains information about the dimensions and user mounting location of the ToF Camera.

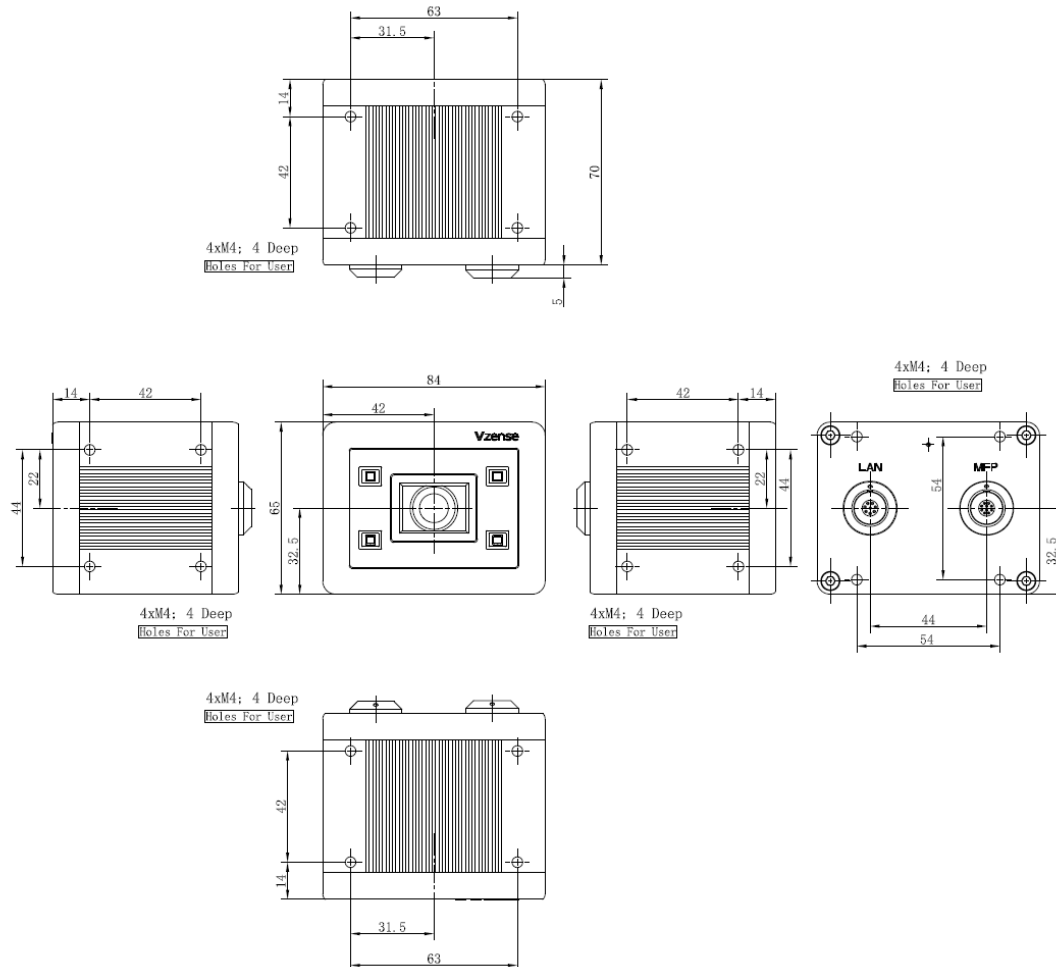


Fig. 1: ToF Camera Dimensions

Unit: mm



## 3.4 Working Condition Requirements

### 3.4.1 Hardware Requirements

#### Vzense ToF Camera

- Power Adaptor (Included in package)
- Customized Ethernet cable. Part number: VZENSE-LAN-8P-A (Included in package)

Or

- M16-10 Pin cable which provide power and interface with host. Part number: VZENSE-MFP-10P-A (Not included in package)

#### Host device with 100M/1000M Ethernet

### 3.4.2 Software Requirements

#### Operating system

- 32-bit Windows 7/10
- 64-bit Windows 7/10 (recommended)
- Linux (x86, x64)
- Android 5.0 or above

#### Vzense ToF Driver

The Vzense ToF Driver software is available for Windows, Linux and Android operating systems and includes the following:

- SDK code
- Sample code
- Software user manual

### 3.4.3 Environmental Requirements

#### Temperature and Humidity

Housing temperature during operation:	-20–50 °C
Humidity during operation:	20–80 %, relative
Storage temperature:	-30–70 °C
Storage humidity:	20–80 %, relative

#### Heat Dissipation

Users can provide sufficient heat dissipation, like mounting the camera on a substantial, thermally conductive component that can act as a heat sink. Or a fan can be used to provide an air flow over the camera.



### 3.4.4 Coordinate of the Camera System

There are two coordinate system need to be understood, one is camera coordinate system (CCS), one is world coordinate system (WCS).

CCS: CCS describe the two-dimensional data, the origin of coordinates is the optic center.

WCS: WCS describe the three-dimensional information.

The CCS data can switch to the WCS data using the camera internal parameters.

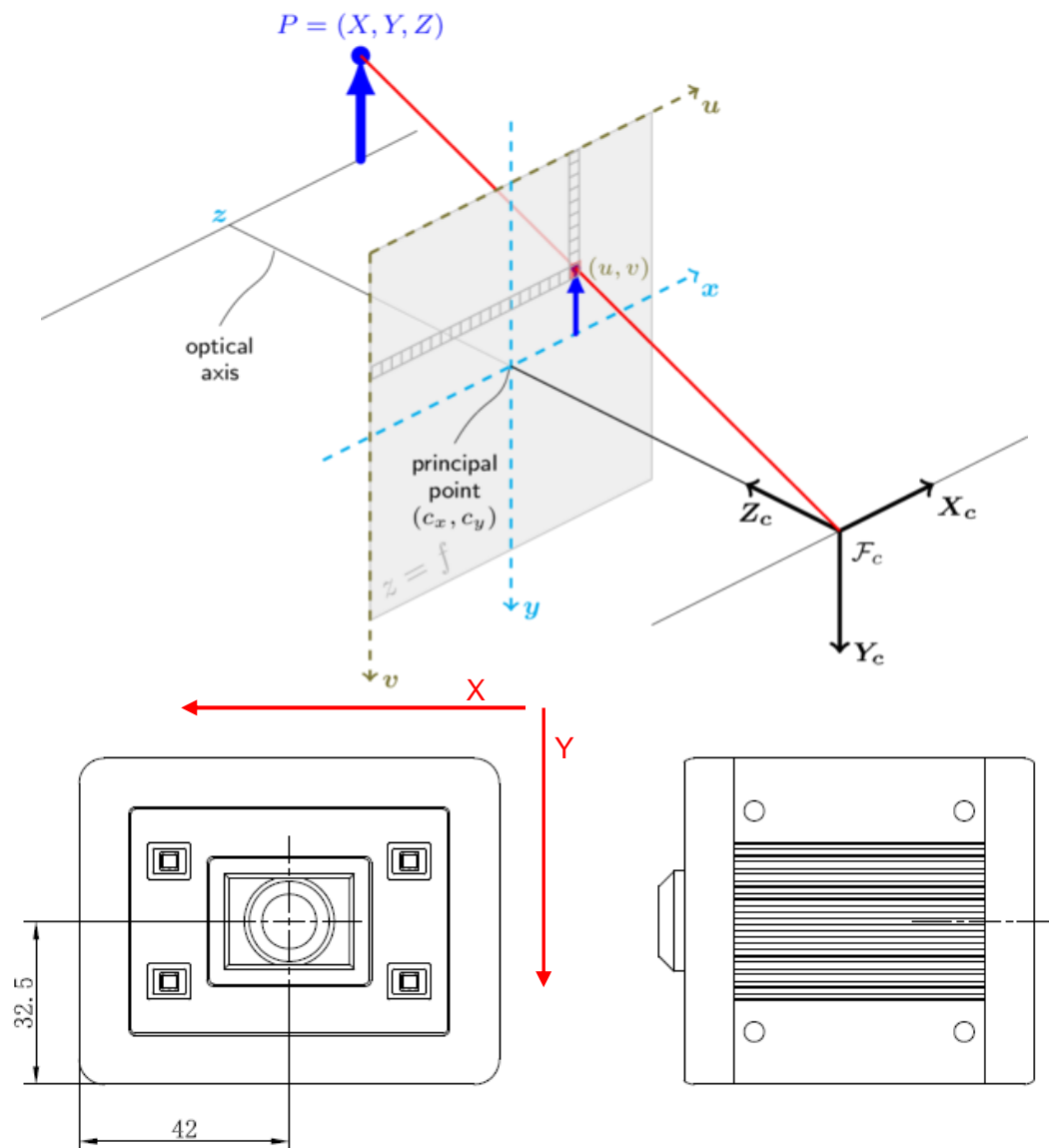


Fig. 3: Origin of the Coordinate System

Meshlab and CloudCompare tools are recommended to analyze the point cloud data saved by Vzense software or SDK method.



## 4 Interface with Host

DCAM800 ToF Camera is equipped with two M16 connectors at the back of its housing as shown in below figure.

For more information about pin assignments and connector types, see the following sections.

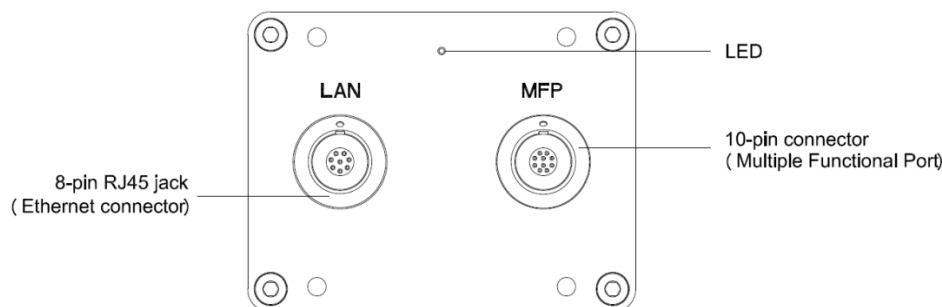


Fig. 4: Camera Connectors

### 4.1 M16-10 MFP Connector

The M16-10 MFP (Multiple functional port) connector includes the two physical input signals and two physical output signal, power supply source and CAN bus interface can also be available in this interface.

The power adaptor in package can supply power to the camera via the M16-10 MFP connector.

The optional cable VZENSE-MFP-10P-A can source all the signals in MFP connector out, the user can do more applications.

The pin assignments and pin numbering for the receptacle are as shown in below table.

The recommend detailed external signal connection ways please refer to section 3.4.and 3.4.

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The diagram shows a top-down view of a circular connector with 9 pins. The pins are numbered 1 through 9 in a circular arrangement. Pin 1 is at the bottom. Pins 2 through 9 are arranged in a circle around it. A red dot is located below the connector.

Pin	Designation
1	VCC
2	Ext_Trigger
3	GND
4	Ext_INPUT
5	CAN_H
6	Ext_OUTPUT
7	CAN_L
8	Exposure_timing
9	GND



	10	External GND
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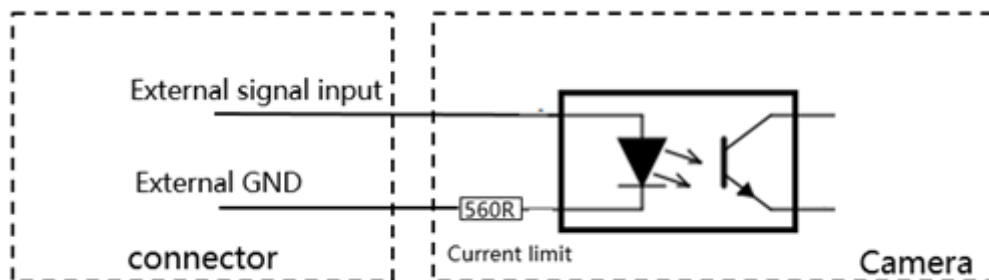
### Pin Description

Pin	Designation	Direction	Description
1	VCC	INPUT	12-24V power supply input
2	Ext_Trigger	INPUT	External trigger input (3.3V-24V)
3	GND	GND	System ground
4	Ext_INPUT	INPUT	Reserved for external input (3.3V-24V)
5	CAN_H		Positive signal of CAN BUS
6	Ext_OUTPUT	OUTPUT	Reserved for external output
7	CAN_L		Negative signal of CAN BUS
8	Exposure_timing	OUTPUT	Indicates the exposure timing
9	GND	GND	System ground
10	External GND	GND	Reference to external voltage

### Hardware Trigger Function

Hardware trigger mode is available only when the camera works at slave mode, in slave mode the camera will wait for the hardware trigger signal on Ext\_Trigger.

The EXT\_Trigger signal is opto-isolated, to driver the diodes, External input trigger signal voltage should range 3.3V-24V, moreover the signal driving capacity should be more than 60mA.

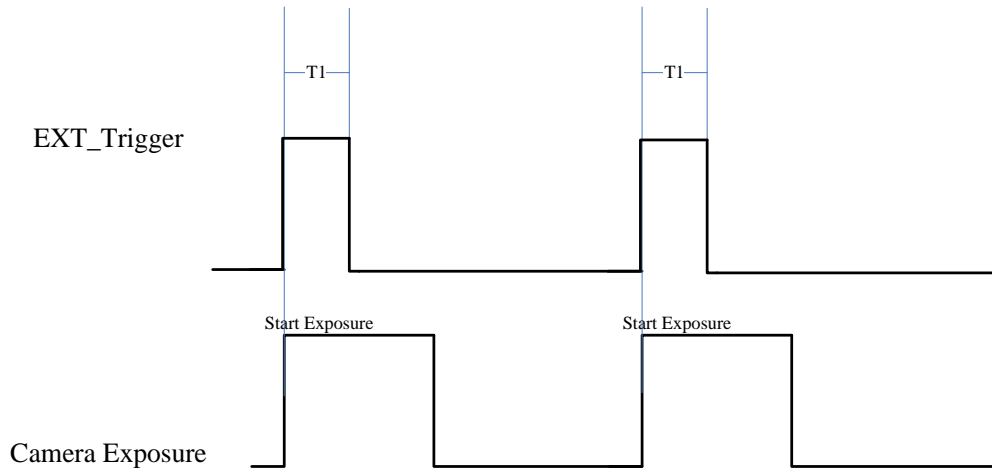


Camera input signal internal circuit

You can use input pin Ext\_Trigger to send a hardware trigger signal to the camera. The hardware trigger can be used to trigger the acquisition start. **A hardware debouncer circuit shall be considered on the EXT\_Trigger line.**

The polarity of the hardware trigger can be predefined by software command. By default, the hardware trigger is low level activated, refer to below exposure timing:



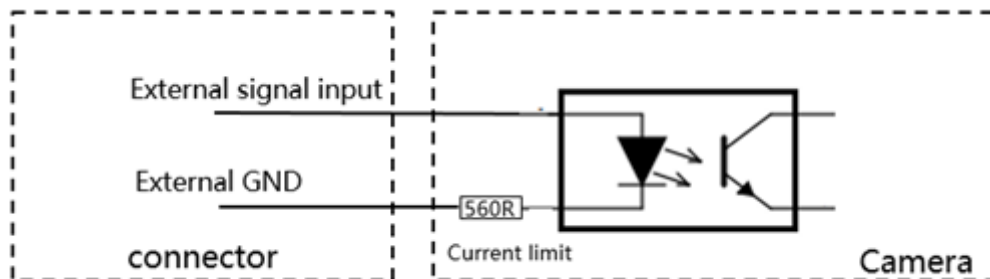


The requirement to T1 should be from 10 $\mu$ s to 1ms, a hardware debouncer circuit shall be considered on the EXT\_Trigger line.

### Reserved External INPUT Pin

An external INPUT pin, EXT\_INPUT is reserved for advanced user, it can be functional with software customization applications. NRE fee shall be charged if need us to enable this feature according to customers requirement.

The EXT\_INPUT pin is opto-isolated, to driver the diodes, External input trigger signal voltage should range 3.3V-24V, moreover the signal driving capacity should be more than 60mA.

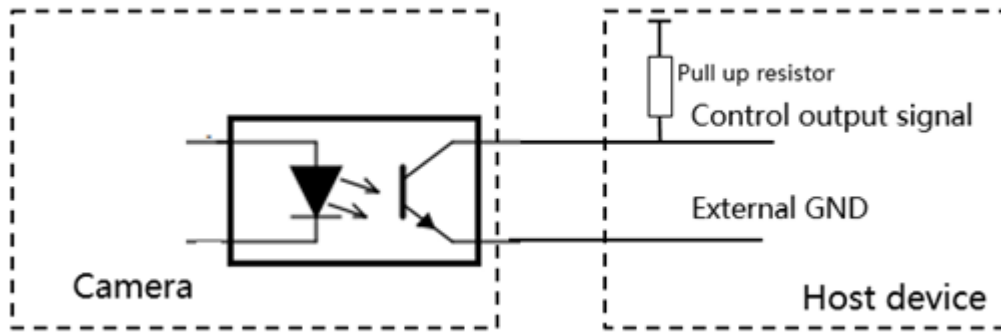


Camera input signal internal circuit

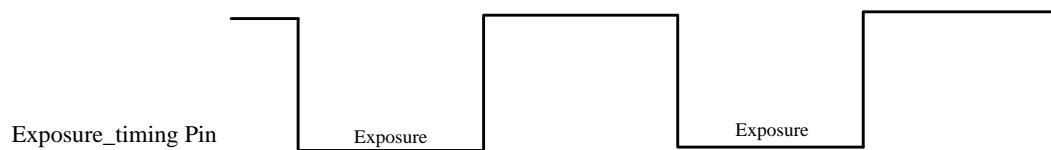
### Exposure\_timing Pin Description

This pin is an output indicates the whole exposure period of the camera, polarity can be predefined by software command. The internal circuit of this pin is open-drain, so need a pull-up resistor circuit to enable the feature. The pull up voltage must follow host system voltage level.



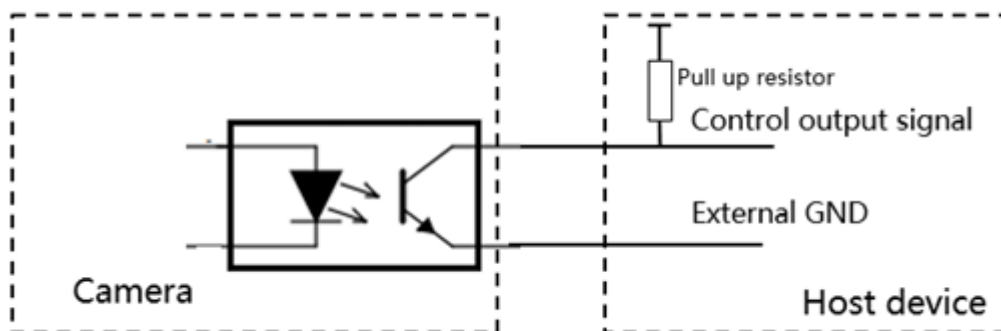


By default, the polarity is high level activated, which means a high-level signal indicates the exposure period. Please refer to below figure:



#### Reserved External OUTPUT Pin

An external OUTPUT pin, Ext\_OUTPUT is reserved for advanced user, it can be functional with software customization applications. NRE fee shall be charged if need us to enable this feature according to customers requirement.



The internal circuit of this pin is open-drain, so need a pull-up resistor circuit to enable the feature. The pull up voltage must follow host system voltage level.


## 4.2 M16-8 LAN Ethernet connector

The M16-8 LAN Ethernet connector provides 1000M Ethernet access to the camera. In addition, POE (Power over Ethernet) module is included in the camera. Users can use POE as main power supply.

The cable VZENSE-LAN-8P-A in the package shall be used if you want to get the data via M16-8 Ethernet connector. The M16-8 LAN Ethernet connector is a waterproof receptacle with the cable inserted.



### 8pin IO pin definition

	Pin	Designation	Description
	1	TD0+	Media Dependent Interface[0], positive signal of differential pair
	2	TD0-	Media Dependent Interface[0], negative signal of differential pair
	3	TD1+	Media Dependent Interface[1], positive signal of differential pair
	4	TD2+	Media Dependent Interface[2], positive signal of differential pair
	5	TD2-	Media Dependent Interface[2], negative signal of differential pair
	6	TD1-	Media Dependent Interface[1], negative signal of differential pair
	7	TD3+	Media Dependent Interface[3], positive signal of differential pair
	8	TD3-	Media Dependent Interface[3], negative signal of differential pair

### POE+ parameters description

CLASS	MINIMUM(W)	MAXIMUM Peak power(W)
IEEE802.3at IEEE802.3bt Class 4	12.5	25.5

## 4.3 LED indication

An LED locates in the back side of the camera, LED animation indicates the camera status.

The LED animation table is shown as below:

Power off:



Broadcast:



Connected:



Upgrading:



## 5 Principle of Time of Flight

### 5.1 Scope of remote sensing technology

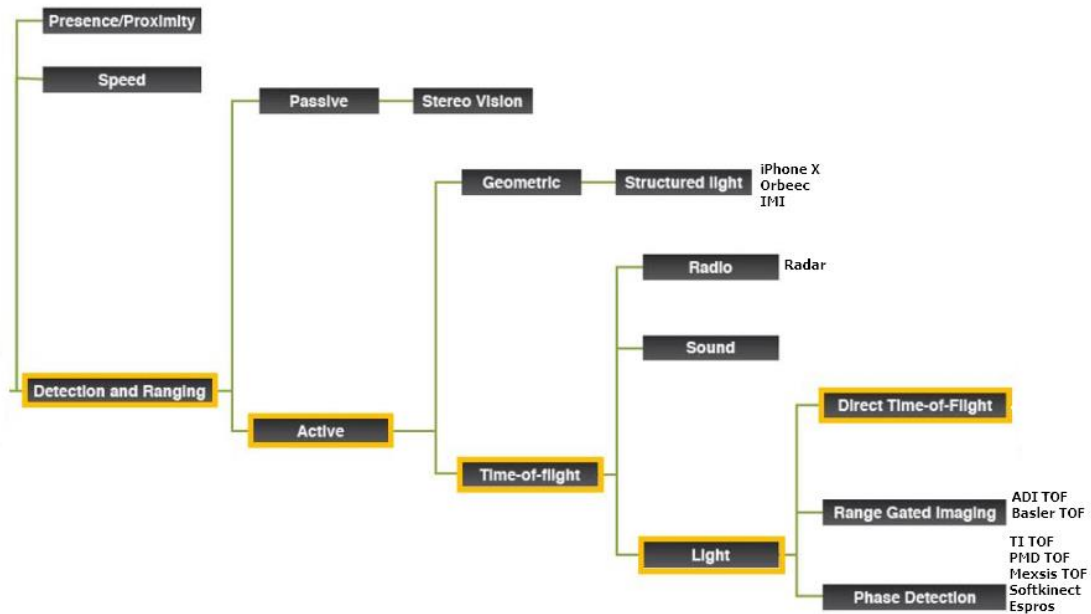
- **Presence or proximity detection**, where the absence or presence of an object in a general area is the only information that is required (e.g., for security applications). This is the simplest form of remote sensing;

- **Speed measurement**, where the exact position of an object does not need to be known but where its accurate speed is required (e.g., for law enforcement applications);

- **Detection and ranging**, where the position of an object relative to the sensor needs to be precisely and accurately determined.

This document will concentrate on technologies capable of providing a detection and ranging functionality, as it is the most complex of the three applications. From the position information, presence and speed can be retrieved so technologies capable of detection and ranging can be universally applied to all remote sensing applications.

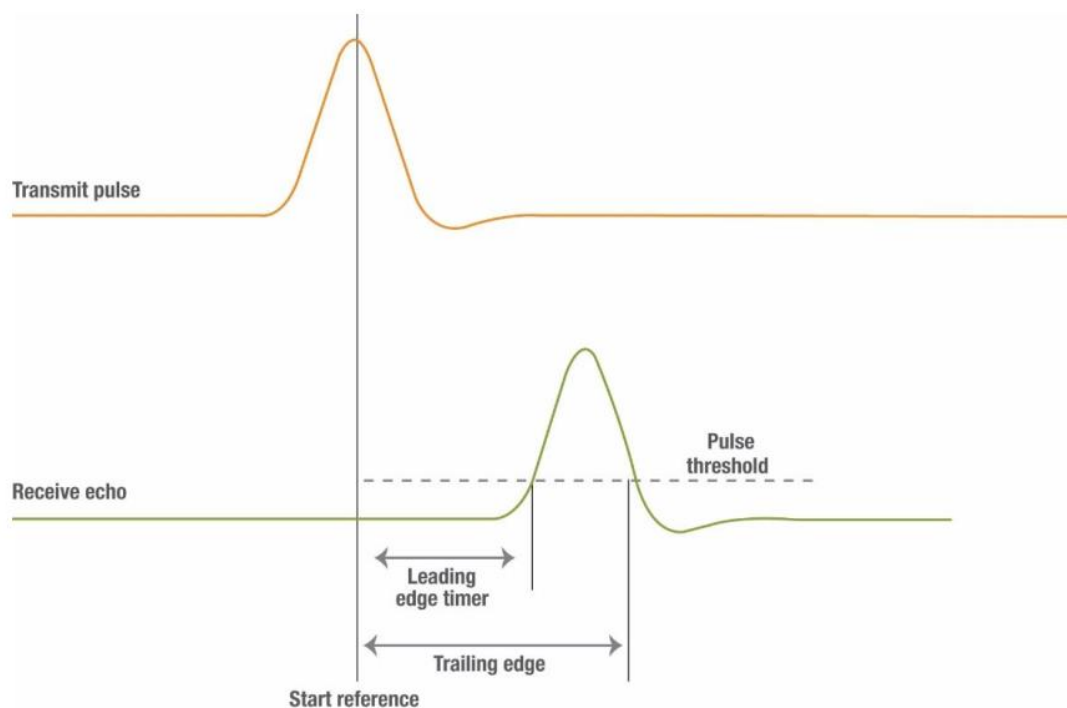




### 5.1.1 Direct Time of Flight

In the direct time-of-flight measurement method, a discrete pulse is emitted and one or several timers are used to measure the time difference between the emitted pulse and the return echo, based on threshold detection. This time difference can be directly converted to a distance, based on the following equation:

$$d = \frac{C * t}{2}$$

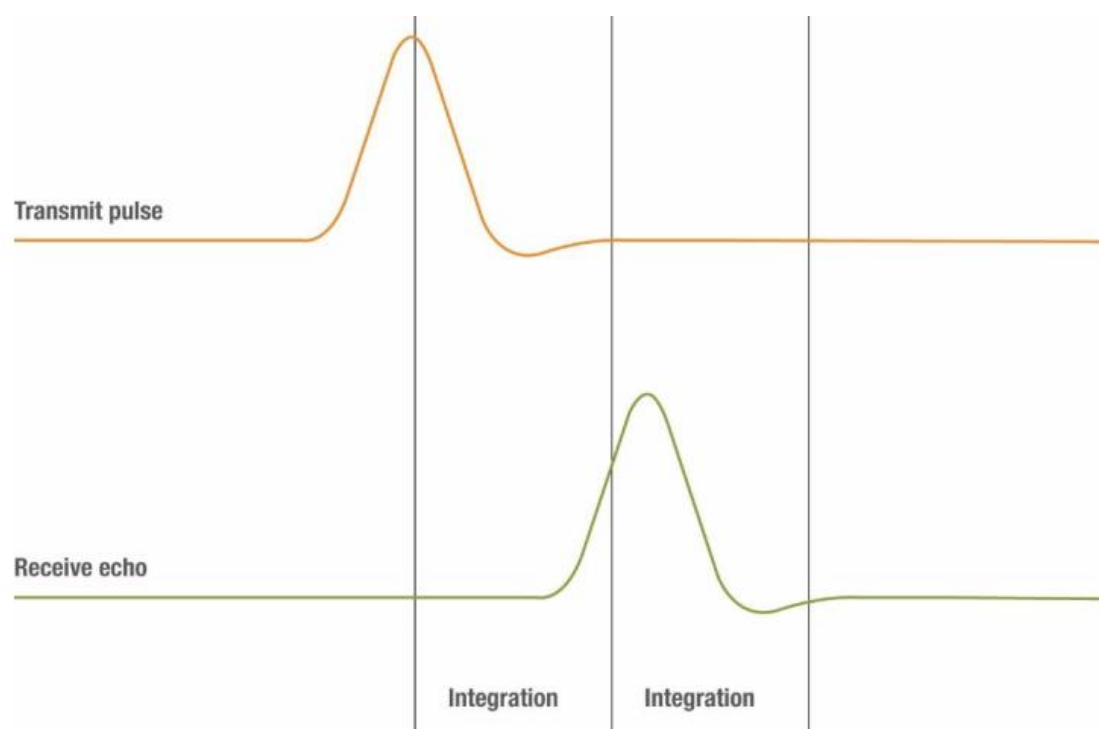




The difficulty in implementing the direct time-of-flight measurement method resides in the time intervals to be measured. In order to resolve a distance to centimeter-level accuracy, the required accuracy for the timers is 67 ps. Implemented in digital logic, this would require a 15 GHz clock speed, which is obviously not practical. Therefore, various time-to-digital conversion methods are typically used.

### 5.1.2 Range-gated Imaging ToF

Whereas direct time-of-flight relies on measurements made on the immediate value of the received signal, range-gated imaging uses signal integration methods, typically with CCD or CMOS imagers.



By measuring the energy received in successive integration intervals, it is possible to extrapolate the distance between the sensor and the measured object, based on the ratio of energy received in the different intervals.

The difficulty with range-gated imaging is that CCD and CMOS imagers have a limited dynamic range; therefore, strong ambient light can easily cause saturation and impair measurement. Furthermore, since neither the emitted and received pulses are perfect rectangle pulses, nor is the sensor perfectly linear, compensation is required and accuracy is ultimately limited.

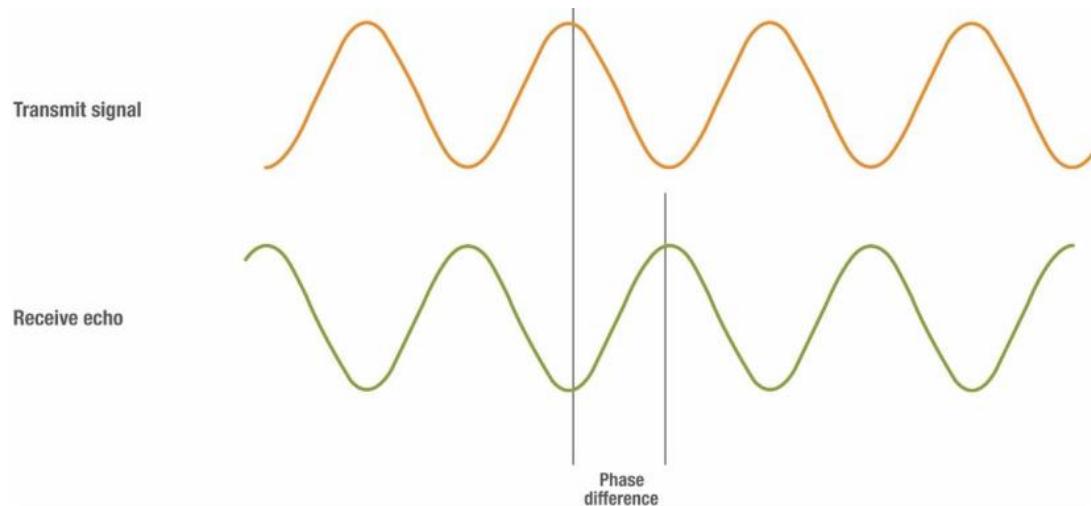
### 5.1.3 Continuous Waveform ToF

In contrast to the previous two methods, phase difference measurement relies on a modulated light source and evaluates the phase difference between the transmit



signal and the receive echo. This phase difference can be converted to a distance, using the following formula:

$$d = \frac{C * \phi}{4 * \pi * f}$$



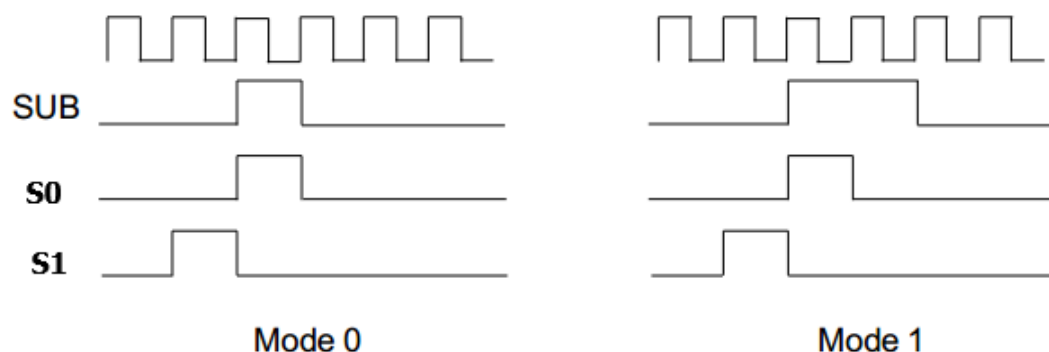
Correlation methods are typically used to measure the phase difference of the receive echo

respective to the transmit signal as well as recover the propagation delay and therefore the distance to the object to be measured.

Of course, a phase difference greater than  $2\pi$  is not resolvable; for instance,  $3\pi$  or  $5\pi$  will be measured as a  $\pi$  radian phase difference. Therefore, depending on the chosen modulation frequency, an artefacting phenomenon will occur where far-away objects will appear to be much closer than in reality.

#### 5.1.4 Vzense ToF Principle

Vzense DCAM800 product principle is based on range-gated imaging ToF solution, and the sensor inside is based on Panasonic CCD sensor MN34906.



##### ◆ Mode #0:

- 1T,
- Best LD pulse number,
- good for distance from 10cm to 3.3m



## 5.2 Noise Factors

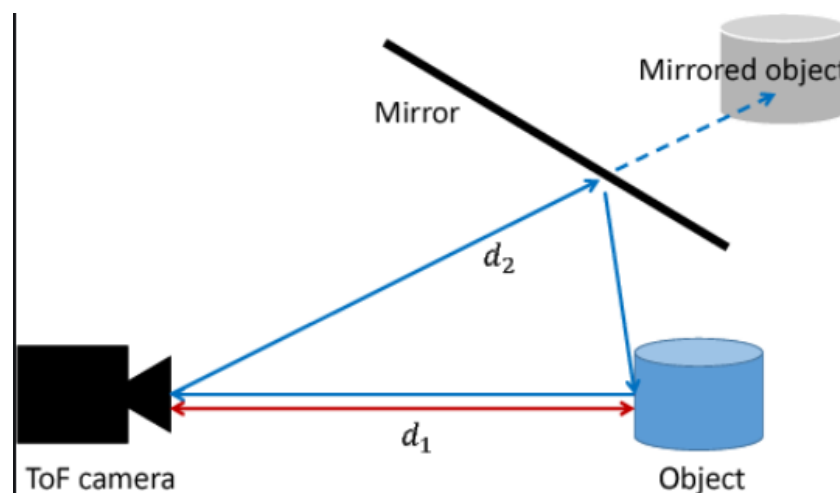
### 5.2.1 Ambient Light

Because the ToF distance measurement relies on the reflection of light sent out by the camera, any additional light, e.g. artificial light sources or sunlight, may influence the measurement results.

A strong ambient light may affect the accuracy and precision of the depth data, the Vzense DCAM 800 is suggested to in user below 50K LUX ambient light.

### 5.2.2 Multipath Propagation

Based on the principle of ToF, Multipath effect may happen when the light reflected more one once. Any light that has been reflected several times, by other objects in the camera's field of view or the environment can cause deviation to the measurement result.



To eliminate the multipath effect, you should:

1. Keep the camera working environment as clean as possible;
2. Avoid the camera be placed at concave forms environment, like corners of a room or inside of a narrow space;
3. Highly-reflective object shall be removed far away from the measurement target;

### 5.2.3 Reflectivity of the Target

Please note that different reflectivity of the target may cause measurement result deviation, objects which have 20% to 80% reflectivity to 850nm or 940nm infrared light have the best result.



## 5.2.4 Scattering Effect

Scattering light effect is a noise factor to ToF products, it is caused by multiple reflection inside the lens of camera or the cover of camera.

To eliminate the scattering light effect, you should:

1. Keep the cover glass of the camera clean;
2. Do NOT place any other cover glass in front of the camera;
3. Keep the camera working environment as clean as possible;

# 6 Installation

## 6.1 Hardware Installation

You have read and understood the warnings listed under "Precautions" on Chapter 2;

To achieve reliable distance measurements, please follow below tips:

- Better not using the camera in strong sunlight. If have to, keep the ambient light below 50k Lux.
- Do NOT place any objects in the scene that are not part of your intended target, especially mirrors or other shiny surfaces/objects.
- Maintain a stable housing temperature during operation.
- Take measures to provide cooling to camera
- Mount the camera robustly.
- All accessories are ready

### 6.1.1 Ethernet Mode Installation

In this mode, the camera transmits the required data to host by Ethernet cable, so the power adaptor shall be used.

The steps are as below:

1. Mount the camera in an appropriate fixture, e.g. a camera bracket;
2. Plug the M16-8 socket end of the Ethernet cable (VZENSE-LAN-8P-A) into the M16-8 LAN socket jack at the back of the camera, and plug the other RJ45 end into the Ethernet port of your host processor;
3. Insert the M16-10 socket of the power supply adaptor into the M16-10 MFP connector at the back of the camera;
4. Connect the adaptor to power source;

### 6.1.2 POE Mode Installation

**What is POE (Power Over Ethernet)**



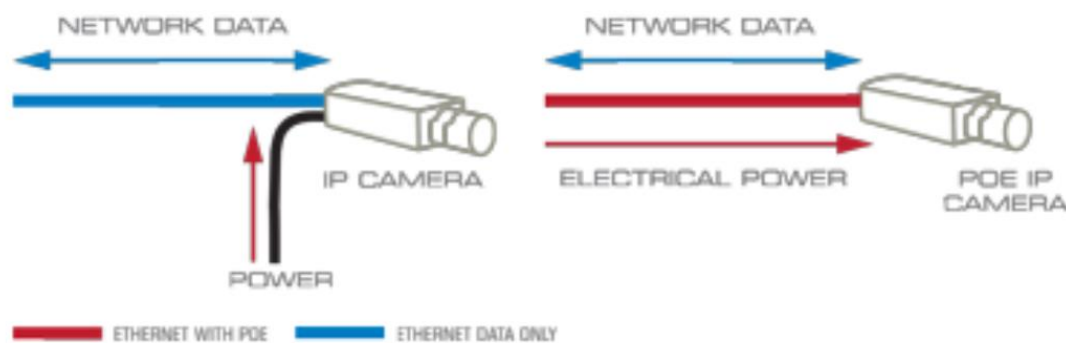
Power over Ethernet (POE) is a technology that lets network cables carry electrical power.

For example, a digital security camera normally requires two connections to be made when it is installed:

A network connection, in order to be able to communicate with video recording and display equipment.

A power connection, to deliver the electrical power the camera needs to operate.

However, if the camera is POE-enabled, only the network connection needs to be made, as it will receive its electrical power from this cable as well.



## Why Use PoE?

Specifying Power over Ethernet brings many advantages to an installation:

**Time and cost savings** - by reducing the time and expense of having electrical power cabling installed. Network cables do not require a qualified electrician to fit them, and can be located anywhere.

**Flexibility** - without being tethered to an electrical outlet, devices such as IP cameras and wireless access points can be located wherever they are needed most, and repositioned easily if required.

**Safety** - POE delivery is intelligent, and designed to protect network equipment from overload, underpowering, or incorrect installation.

**Reliability** - POE power comes from a central and universally compatible source, rather than a collection of distributed wall adapters. It can be backed-up by an uninterruptible power supply, or controlled to easily disable or reset devices.

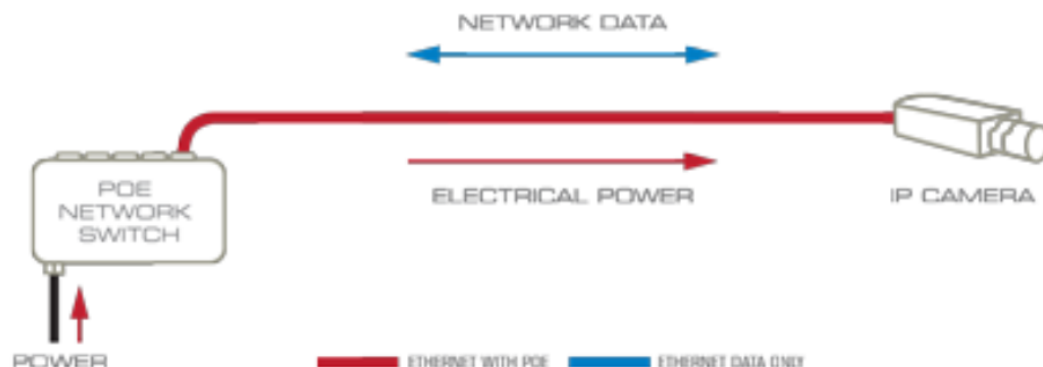
**Scalability** - having power available on the network means that installation and distribution of network connections is simple and effective

## How to Upgrade to POE



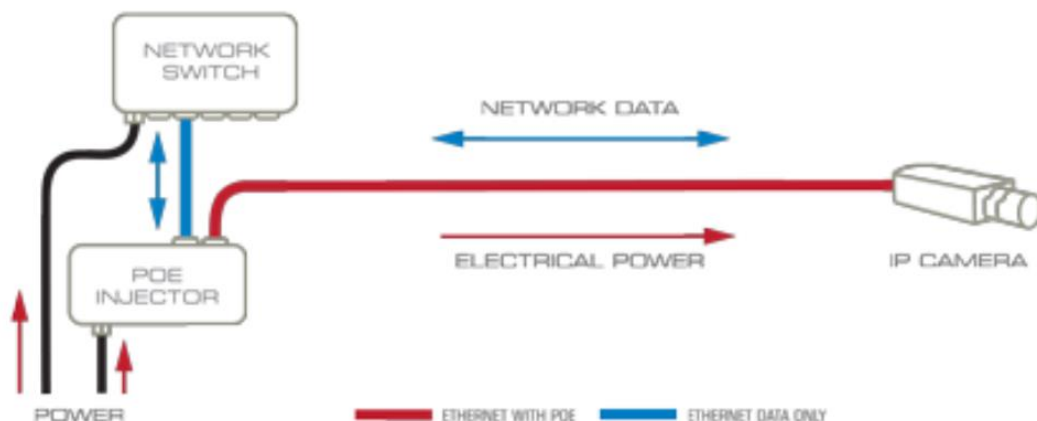
Adding POE to your network is straightforward, and there are two routes you can choose:

A **POE switch** is a network switch that has Power over Ethernet injection built-in. Simply connect other network devices to the switch as normal, and the switch will detect whether they are POE-compatible and enable power automatically. POE switches are available to suit all applications, from low-cost unmanaged edge switches with a few ports, up to complex multi-port rack-mounted units with sophisticated management.



A **midspan (or POE injector)** is used to add POE capability to regular non-POE network links. Midspans can be used to upgrade existing LAN installations to POE, and provide a versatile solution where fewer POE ports are required. Upgrading each network connection to POE is as simple as patching it through the midspan, and as with POE switches, power injection is controlled and automatic.

Midspans are available as multi-port rack-mounted units or low-cost single-port injectors.



For Vzense DCAM800 camera, the POE Switch or POE injector needs to support IEEE 802.3at-2009 standard also known as PoE+, which can provide up to 25.5W, otherwise the camera may not work well at long range mode.

We can provide optional PoE switch or PoE injector to our customers, please try to contact the sales for the quotation and more information.



### **Steps to Setup PoE Mode**

As mentioned above, a PoE switch or PoE injector shall be in use to setup the PoE;

The steps are as below:

1. Mount the camera in an appropriate fixture, e.g. a camera bracket;
2. Plug the M16-8 pin socket end of the Ethernet cable into the M16-8 LAN socket jack at the back of the camera, and plug the RJ45 end into the Ethernet port of your PoE switch or PoE injector;
3. Connect the PoE switch or PoE injector to your host processor by Ethernet cable;
4. Connect the PoE switch or PoE injector to power source;

### **6.1.3 Standalone Mode Installation**

This mode is for advanced users who require customization to the software and application, the applications can run on the processor inside the camera, and output the result data by either CAN\_BUS or EXT\_OUTPUT pin. NRE fee shall be charged if you need Vzense team to do software or application customization.

In this mode, an optional cable (VZENSE-MFP-10P-A) shall be used in this mode.



## 6.2 Software Installation





















### 6.2.1 UTool

Vzense UTool is ToF camera frame tool that can help user evaluate product. You can download it from our website:

China: <https://gitee.com/Vzense/UTool>

Oversea: <https://github.com/Vzense/UTool>

- Copy or download the application zip file and unzip it.
- Start the VzenseUTool.exe file.

	platforms	2020/2/13 11:05	文件夹	
	Upgrade	2020/2/13 11:06	文件夹	
	avcodec-57.dll	2018/2/27 10:58	应用程序扩展	21,786 KB
	avutil-55.dll	2018/2/27 10:58	应用程序扩展	678 KB
	ImgPreProcess.dll	2019/12/27 13:24	应用程序扩展	10,631 KB
	log.txt	2020/5/25 11:17	TXT 文件	173 KB
	msvcp120.dll	2018/3/13 15:45	应用程序扩展	445 KB
	msvcr120.dll	2018/3/13 15:45	应用程序扩展	949 KB
	opencv_world300.dll	2018/2/27 10:58	应用程序扩展	26,992 KB
	Qt5Core.dll	2018/5/22 18:53	应用程序扩展	4,592 KB
	Qt5Gui.dll	2017/1/19 1:55	应用程序扩展	4,804 KB
	Qt5OpenGL.dll	2017/1/19 2:00	应用程序扩展	265 KB
	Qt5Widgets.dll	2017/1/19 1:59	应用程序扩展	4,386 KB
	ReleaseNotes.txt	2019/11/1 14:42	TXT 文件	1 KB
	swresample-2.dll	2018/2/27 10:58	应用程序扩展	317 KB
	swscale-4.dll	2018/2/27 10:58	应用程序扩展	493 KB
	UTool.ini	2019/12/30 10:59	配置设置	1 KB
	version	2019/12/27 18:34	文件	1 KB
	vzense_api.dll	2020/1/13 16:04	应用程序扩展	1,059 KB
	VzenseUtool.exe	2020/5/25 9:56	应用程序	2,591 KB

### 6.2.2 Frameviewer

Frameviewer is an opensource application that can guide user how to call the SDK APIs. You can open it from the project, the SDK package have different demo code for different system.

### 6.2.3 SDK

Download it from our website:

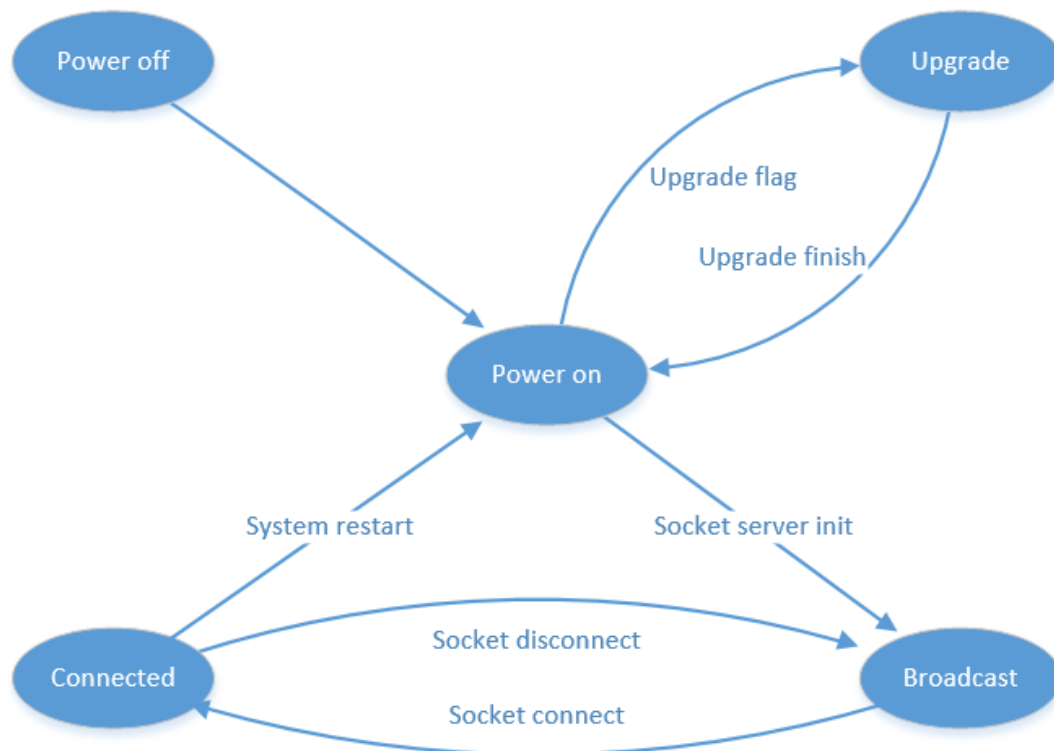
China: <https://gitee.com/Vzense>

Oversea: <https://github.com/Vzense>

Please chose the suitable version based on the product and system.



## 6.3 Product State Machine



- Power Off: product have not any power
- Power On: power up and initialize drivers and system
- Broadcast: broadcast IP address, socket do not connect
- Connected: socket connected, product can transfer image and answer host command
- Upgrade: product upgrade the firmware mode

## 6.4 Software Command Set

DCAM800 support different work mode like depth\_30, IR\_30, depth&IR\_30. Three default range: range0(0.35m~1.5m), range2(0.8m~4.4m), range5(1.2m~6.2m). User can use UTool to try the different command or can use the APIs to control the camera. The details please reference the SDK documents.

## 6.5 IP Address Configuration

You can connect the camera to the host via either direct connection or DHCP connection.



### 6.5.1 Direct Connection

Direction connection means to use the Ethernet cable connect from camera to the host directly or with a network switch which has no DHCP capability.

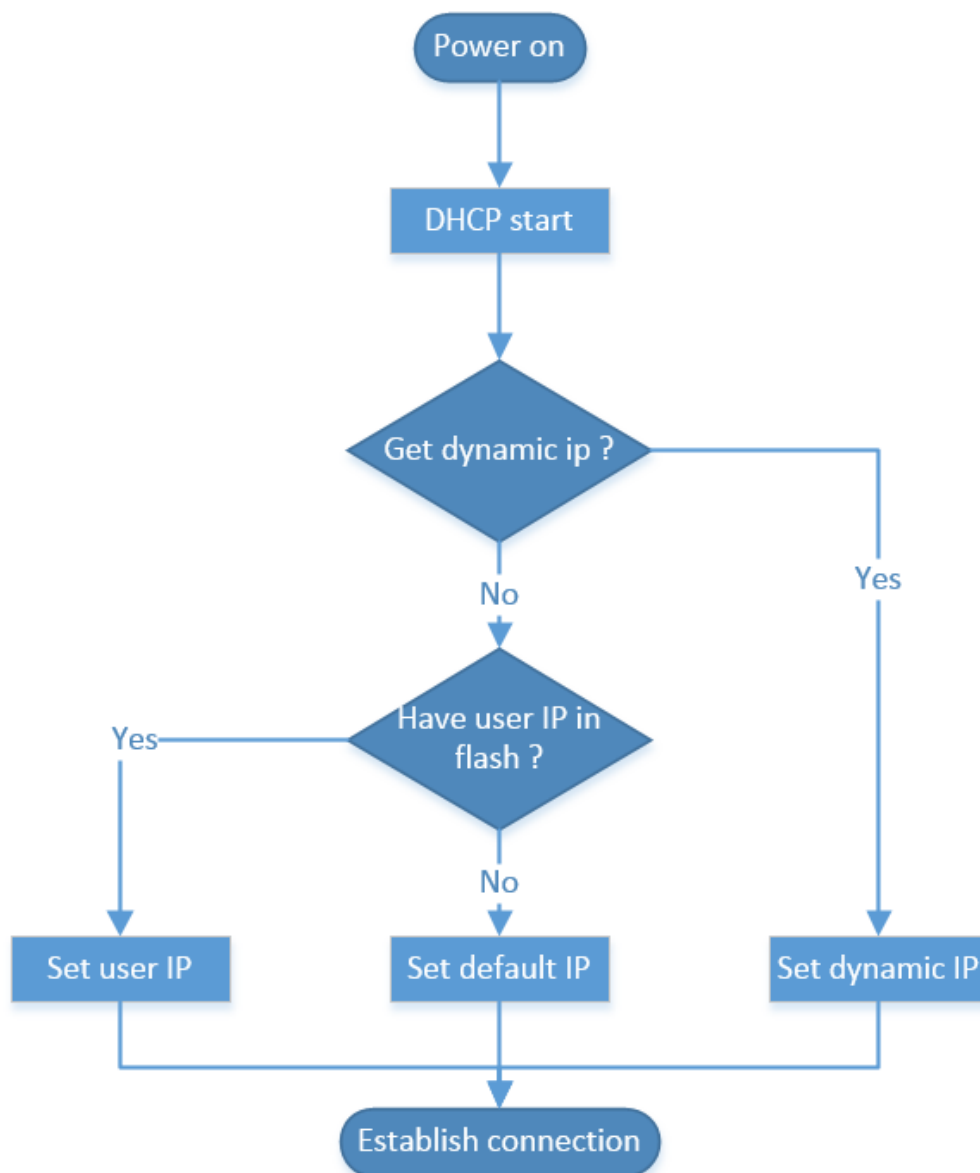
The default IP address of the camera is 192.168.1.101, subnet mask 255.255.255.0

The user can change the default IP with the tool provided by Vzense team.

The host IP has to be in the same network segment as the camera.

### 6.5.2 DHCP Connection

The camera can be allocated an IP by the network router which runs a DHCP server





## 7 Features

### 7.1 Multiple Camera Synchronization

If you need to use more than one camera in a same narrow space, multiple camera synchronization method shall be in use, to avoid the light source interference among each other.

### 7.2 Range Customization

By default, there are 3 different range modes calibrated for DCAM800, please see below table for more information:

Range number	Distance range
Range 0	0.35m~1.5m
Range 2	0.8m~4.4m
Range 5	1.2m~6.2m

Please do NOT use uncalibrated modes, the measurement data will not be guaranteed.

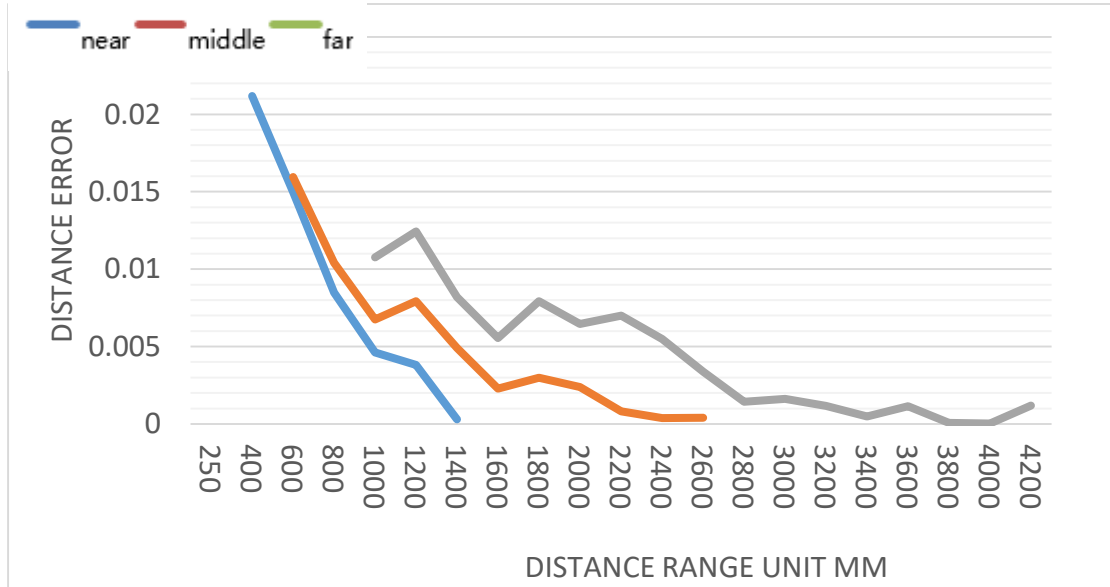
If you need other range mode requirement, you can ask Vzense team to do range customization, reasonable NRE fee will be charged.

One range mode of the Vzense DCAM800 camera can fulfill furthest distance be at most 5 times to nearest distance. For example, if the near limitation is 0.4m, then the furthest distance in this mode can reach about 2m.

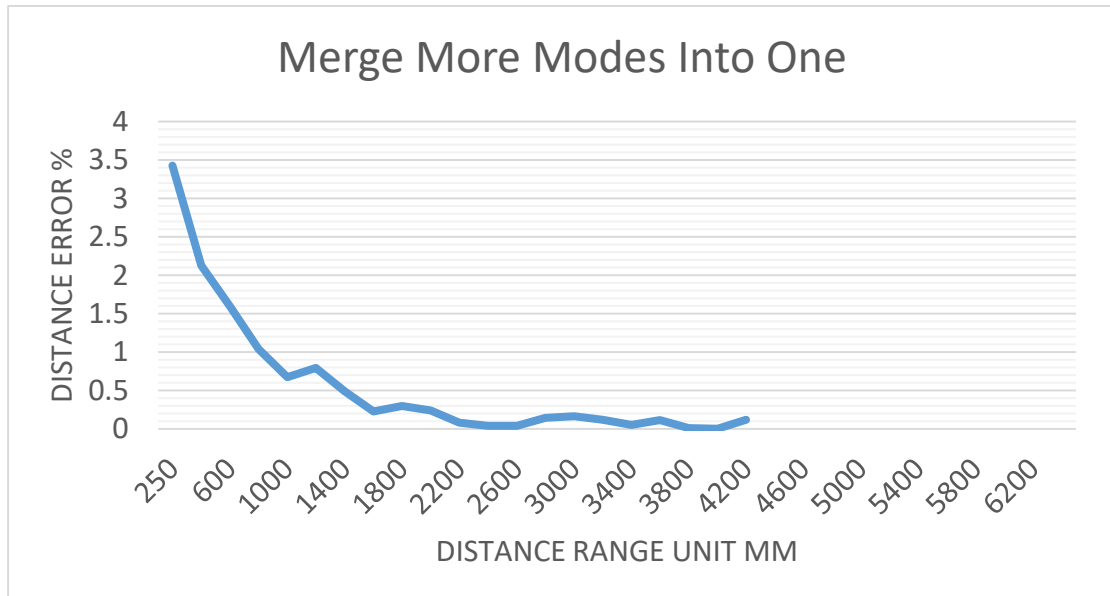
### 7.3 Wide Dynamic Range

As mentioned above, Most of the ToF based 3D sensing technology has range limitation to nearest and furthest distance, due to the sensor saturation of weak light strength to far objects. One range mode of the Vzense DCAM800 camera can fulfill furthest distance be at most 5 times to nearest distance. For example, if the near limitation is 0.4m, then the furthest distance in this mode can reach about 2m.





Wide dynamic range means that the camera can work at more than one range modes alternately, then the camera itself will combine the result into one depth frame, therefore can expand the range limitation from furthest distance to nearest distance.



This feature requires customization service for Vzense team, you can refer to Chapter 8 in this document for WDR mode experience.

## 7.4 Data Filtering

In the software SDK and UTool, we implemented data filtering to improve the depth data performance.

The filtering algorithm includes:

- Median filtering;
- Gaussian filtering;
- Bilateral filtering;



- Timing filtering;
- Flying pixel removing;

## 7.5 IR Image

Besides the depth image, Vzense DCAM800 camera can also output a VGA resolution IR image. And the IR image is strictly timing synchronized with the depth image. Pixel to pixel mapping is also strictly aligned.



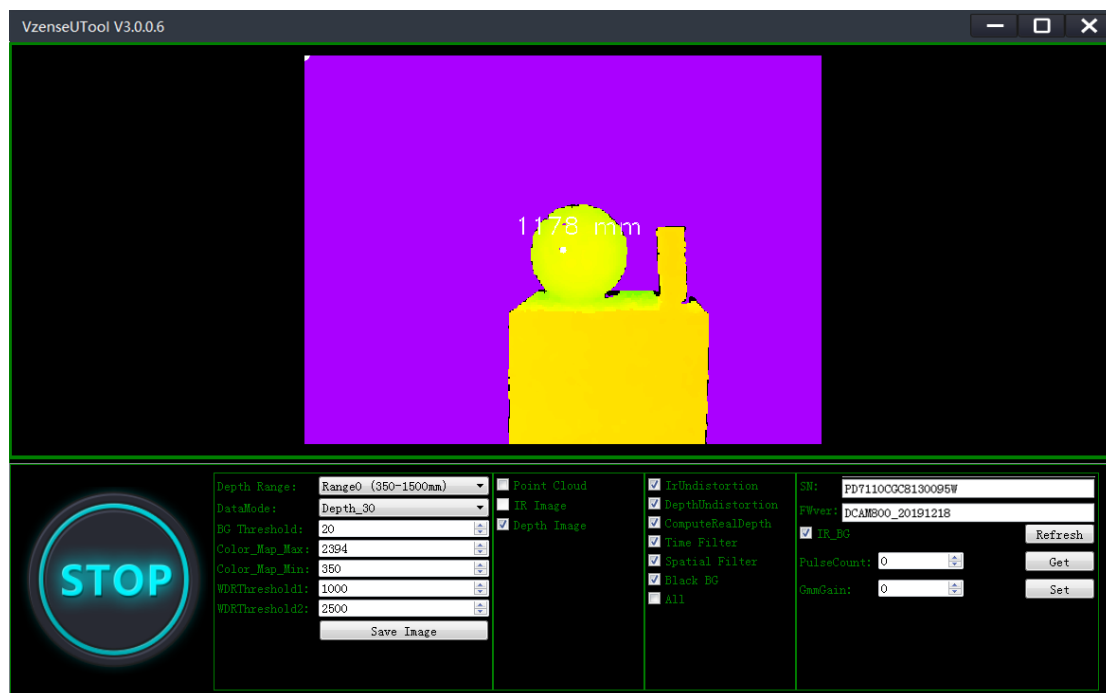


## Camera Operation on Vzense UTool

Function		Description
2D/3D image show		depth image colorize
Camera hardware information show		like SN, version
Image store		
Mode Switch	Depth 30	depth image in 30fps
	IR 30	IR image in 30fps
	Depth&IR 30	both depth and ir in 30fps
	WDR	see the detail in below
Range Change	Range 0-7	different depth detect range
Exposure parameter modify	Pulse count	laser pulse parameter
	Gamma gain	IR image gamma gain
Filters switch		different image filters
IR_BG		the background light swtich

## 7.6 Main screen

UTool have some areas for different function, for example, image area, control area, information area.



### 7.6.1 Image area

Image area is the area of showing depth image, IR image or point cloud.





## 7.6.2 Control area

Control area is working for camera control: switch mode, change detect range, 2D-3D display, filters enable or disable, pulse count or gamma gain get/set.

Depth Range: Range2 (800-4400mm)	<input checked="" type="checkbox"/> Point Cloud	<input checked="" type="checkbox"/> IrUndistortion	SN: PD7110CGC8130095W
DataMode: WDR_Depth1 (350-4400mm)	<input type="checkbox"/> IR Image	<input checked="" type="checkbox"/> DepthUndistortion	FWver: DCAM800_20191218
RG Threshold: 20	<input checked="" type="checkbox"/> Depth Image	<input checked="" type="checkbox"/> ComputeRealDepth	<input checked="" type="checkbox"/> IR_BG <input type="button" value="Refresh"/>
Color_Map_Max: 4944		<input checked="" type="checkbox"/> Time Filter	PulseCount: 400 <input type="button" value="Get"/>
Color_Map_Min: 350		<input checked="" type="checkbox"/> Spatial Filter	GammaGain: 512 <input type="button" value="Set"/>
WDRThreshold1: 1250		<input checked="" type="checkbox"/> Black BG	
WDRThreshold2: 2500		<input checked="" type="checkbox"/> All	
<input type="button" value="Save Image"/>			

## 7.6.3 Information area

Information area show some camera information like SN, firmware version.

SN:	PD7110CGC8130095W
FWver:	DCAM800_20191218

## 7.7 Connect devices

- Find devices:

SN:	PD7110CGC8130095W
FWver:	DCAM800_20191218

- Chose devices:

SN:	PD7110CGC8130095W
FWver:	DCAM800_20191218

- Connect devices:





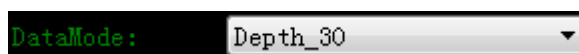
## 7.8 2D view

The display area can show different type image.

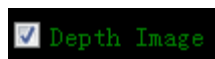


### 7.8.1 Depth Image

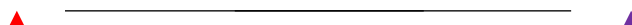
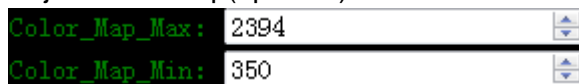
- Change mode to depth mode:



- Chose depth image show enable:



- Adjust color map(optional):





Depth Image with color map:



## 7.8.2 IR Image

- Change mode to IR mode:

DataMode: IR\_30

- Chose depth image show enable:

☒ IR Image

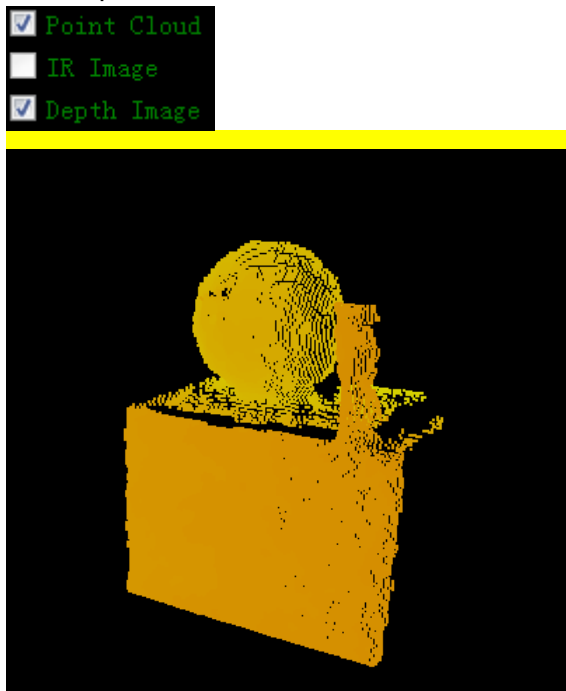


## 7.9 3D view


- Make sure depth image alive:
























- Chose point cloud show enable:



## 7.10 Save Image

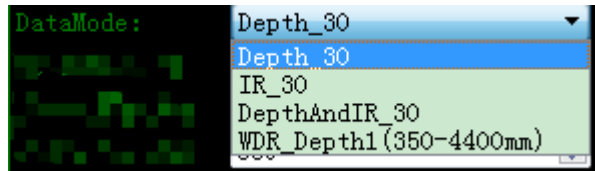
: click button will save the current showing image.  
The save image will store in “SaveImage” folder.

 platforms	2020/2/13 11:05	文件夹	
 <b>SaveImage</b>	2020/5/25 11:17	文件夹	
 Upgrade	2020/2/13 11:06	文件夹	
 avcodec-57.dll	2018/2/27 10:58	应用程序扩展	21,786 KB
 avutil-55.dll	2018/2/27 10:58	应用程序扩展	678 KB
 ImgPreProcess.dll	2019/12/27 13:24	应用程序扩展	10,631 KB
 log.txt	2020/5/25 11:17	TXT 文件	173 KB
 msvcp120.dll	2018/3/13 15:45	应用程序扩展	445 KB
 msucr120.dll	2018/3/13 15:45	应用程序扩展	949 KB
 opencv_world300.dll	2018/2/27 10:58	应用程序扩展	26,992 KB
 Qt5Core.dll	2018/5/22 18:53	应用程序扩展	4,592 KB
 Qt5Gui.dll	2017/1/19 1:55	应用程序扩展	4,804 KB
 Qt5OpenGL.dll	2017/1/19 2:00	应用程序扩展	265 KB
 Qt5Widgets.dll	2017/1/19 1:59	应用程序扩展	4,386 KB
 ReleaseNotes.txt	2019/11/1 14:42	TXT 文件	1 KB
 swresample-2.dll	2018/2/27 10:58	应用程序扩展	317 KB
 swscale-4.dll	2018/2/27 10:58	应用程序扩展	493 KB
 UTool.ini	2019/12/30 10:59	配置设置	1 KB
 version	2019/12/27 18:34	文件	1 KB
 vzense_api.dll	2020/1/13 16:04	应用程序扩展	1,059 KB
 VzenseUtool.exe	2020/5/25 9:56	应用程序	2,591 KB



## 7.11 Camera Control

### 7.11.1 Mode switch



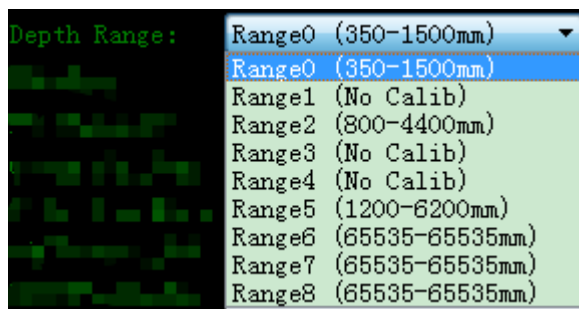
DCAM800 can support Depth\_30, IR\_30, Depth&IR\_30.

Depth\_30: depth image only in 30 fps.

IR\_30: IR image only in 30 fps.

Depth&IR\_30: depth and IR image all in 30 fps.

### 7.11.2 Range change



DCAM800 have 8 detect ranges in it, but by default, there are 3 different range modes calibrated, please see below table for more information:

Range number	Distance range
Range 0	0.35m~1.5m
Range 2	0.8m~4.4m
Range 5	1.2m~6.2m

Please do NOT use uncalibrated modes, the measurement data will not be guaranteed.

If you need other range mode requirement, you can ask Vzense team to do range customization, reasonable NRE fee will be charged.

### 7.11.3 Exposure parameter modify

Vzense ToF camera have two exposure parameters can be adjusted. There are pulse count and gamma gain.

Pulse count: laser pulse count number in one exposure cycle. Use the default value is the recommended choice. If you have some particular requirement and want to



change it, you can contract with Vzense FAE first.

Gamma gain: the IR image gamma gain value that can be adjust brightness of IR image. The maximum is 1023.

PulseCount:	400	<input type="button" value="Get"/>
GammaGain:	512	<input type="button" value="Set"/>

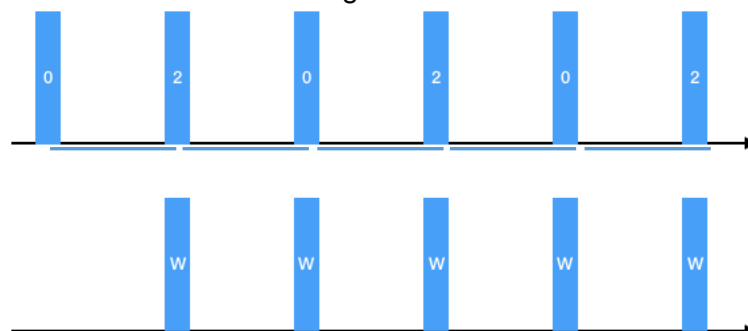
## 7.12 Filters Switch

All of these filters are the ToF image filter. The default value is the recommended choice. Unless user have more professional algorithm to make image better.

<input checked="" type="checkbox"/>	IrUndistortion
<input checked="" type="checkbox"/>	DepthUndistortion
<input checked="" type="checkbox"/>	ComputeRealDepth
<input checked="" type="checkbox"/>	Time Filter
<input checked="" type="checkbox"/>	Spatial Filter
<input checked="" type="checkbox"/>	Black BG
<input type="checkbox"/>	All

## 7.13 WDR

WDR mode can merge the multi-range image to extend the detect range. For example, if you want to get the distance from 0.35m to 4.4m, only one range mode can't cover the whole distance. Use range 0 and 2 WDR can match this requirement.



- Configure the WDR mode:

```
#WDR1`  
t1_totalRange=2  
t1_range1=0  
t1_range1Count=1  
t1_range2=2  
t1_range2Count=1  
t1_range3=0  
t1_range3Count=1  
  
t1_threshold1=1250  
t1_threshold2=2500
```

If you have some particular requirement and want to use WDR mode, you can contract with Vzense FAE first.

- Change mode to WDR mode:

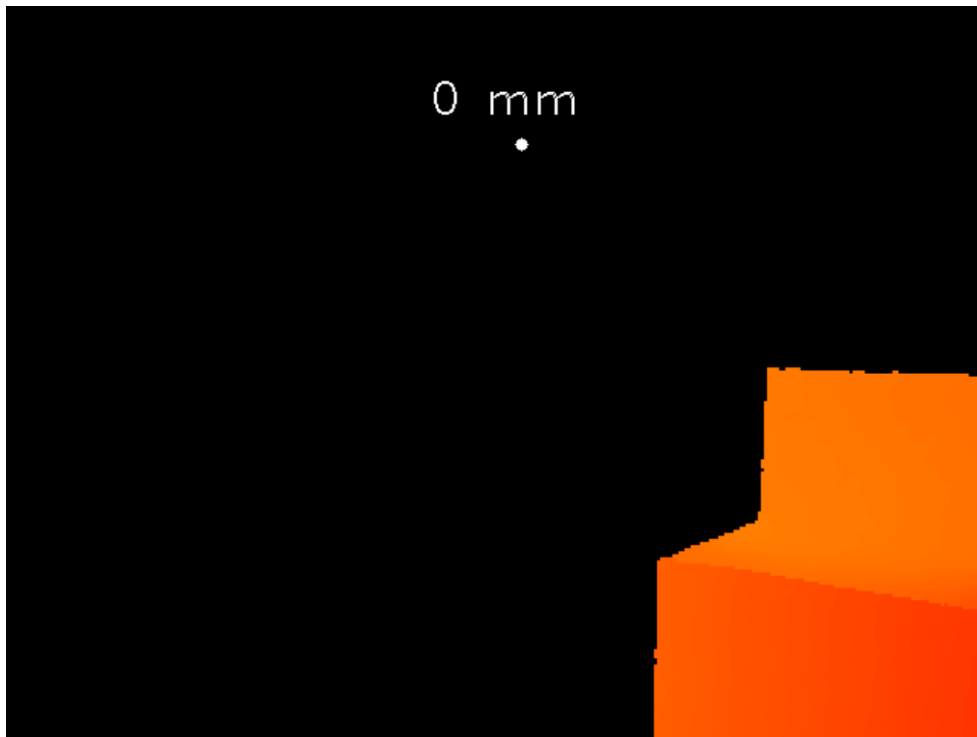


DataMode: WDR\_Depth1 (350-4400mm) ▼

- Adjust WDR merge threshold(optional):

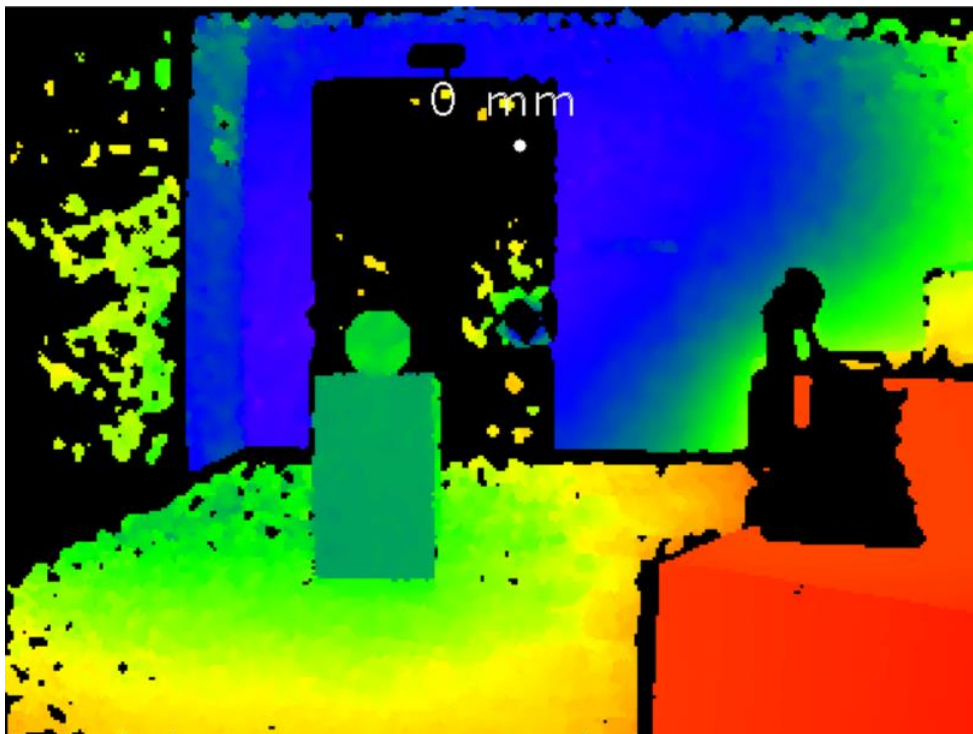
WDRThreshold1: 1250  
WDRThreshold2: 2500

Depth image in range 0:

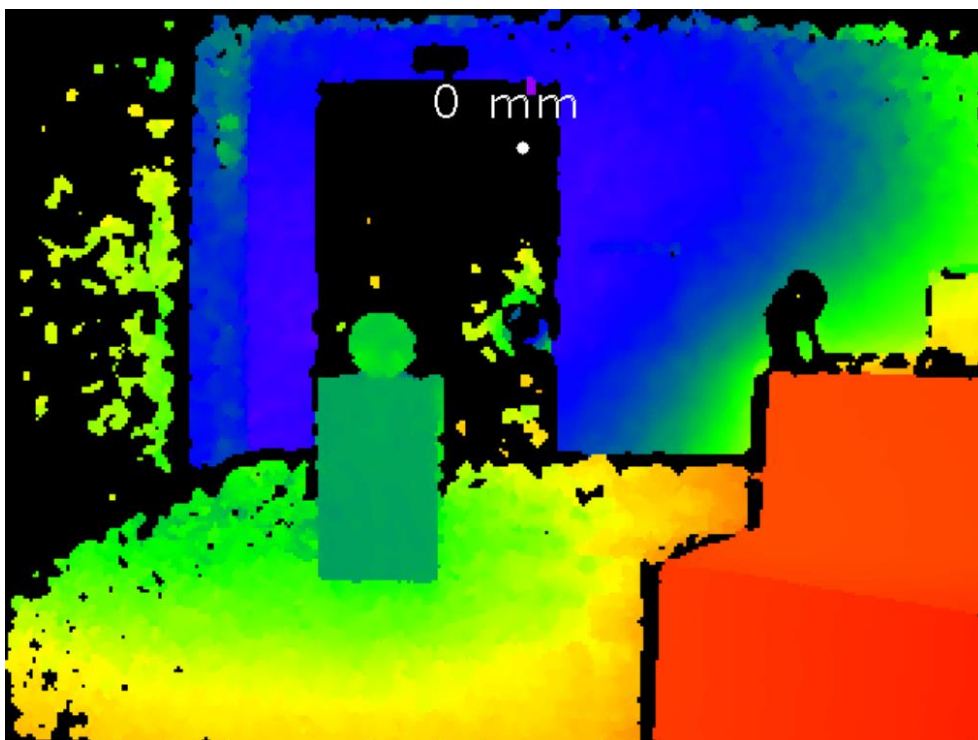


Depth image in range 2:





Merged depth image in WDR mode





## 8 DCAM800 Accessories and Package

In package item list:

Item	Part number	Description	Quantity
1	DCAM800	Vzense DCAM800 Depth Camera Module	1
2	VZENSE-DC-24V3A-A	Power adaptor, DC 24V,3A	1
3	VZENSE-LAN-M8-CABLE	M16-8 pin,5m,cate5e	1
4	User Guide	User Guide	1

You can ask Vzense to do customization to the cable or adaptor for any reason, for example extending the cable length.

Please do NOT use the accessories from other parts except Vzense Company, otherwise warranty will void.

Optional item list:

Item	Component	Description	Quantity
1	VZENSE-MFP-M10-CABLE	Multiple usage cable, M12-10 pin,3m. (Power, CAN BUS, INPUT, OUTPUT signals)	1
2	VZENSE-POE-AT-Injector	IEEE802.at standard POE+ Injector	1
3	VZENSE-POE-AT-Switch	IEEE802.at standard POE+ Switch	1

Optional items need customer to pay for.

## 9 Customization Service

Vzense team has rich experience in ToF product design and delivery, we welcome customer to send customization requirement besides the standard module. Reasonable NRE fee shall be charged depends on the requirement.

## Appendix

**ROHS Declaration**

**Eye Safety Declaration**

**Reliability Declaration**

**Revision History**