ZF-BP3-SH Face Recognition Module Specification

Version V2.0

Preface and Statement

We have done our best to ensure the accuracy of this manual. However, if you have any questions or find any mistakes, you can directly contact Kneron Holding Corporation (hereinafter refer to as the Company or Kneron) or our authorized agent, we will be very grateful.

As our company pursues constantly improving the products, the module and manual contents are subject to change without notice. Please visit our company's website (www.kneron.com) or telephone contact for the latest information.

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Revision Log

| Version	Date	Written by	Revised content
V1.0	20230303	Lincy	Create a document
V2.0	20230627	Warren	Update mechanical part

Table of Content

1. Product profile

ZF-BP3-SH refers to a 3D face recognition function module developed by Kneron, aiming to empower AI for the smart door lock industry, so as to create a more secure and reliable intelligent door lock products.

BP3-SH refers to a 3D face recognition module upgraded by Kneron on the basis of BP3-S products. The product uses 2M HD pixel dual infrared camera, and the algorithm is optimized for people with different skin colors. Through big data training, the security of the product algorithm is improved and the error rate is reduced. The accuracy optimization of the algorithm model further improves the environmental adaptability, especially improves the success rate of unlocking in a complex environment.

2. Product components

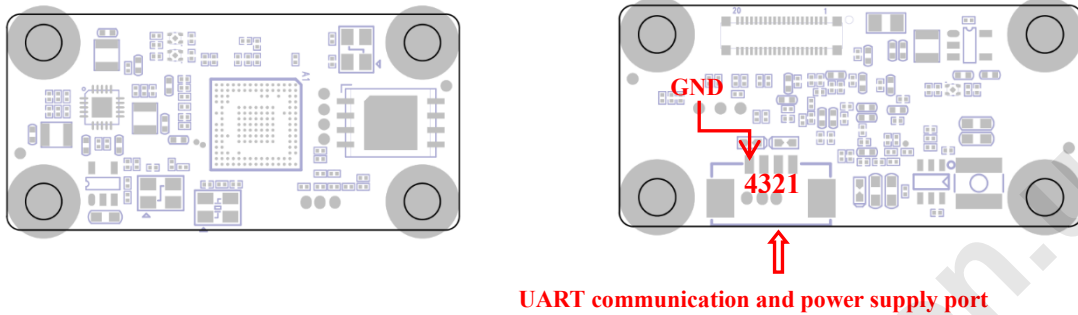**Algorithm board**
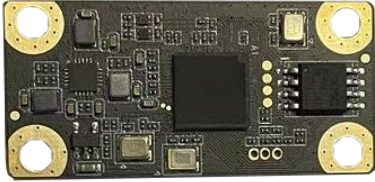
front

back

Camera components

front

back

3. Product structure and interface

3.1 algorithm board structure and interface

Algorithm plate structure diagram

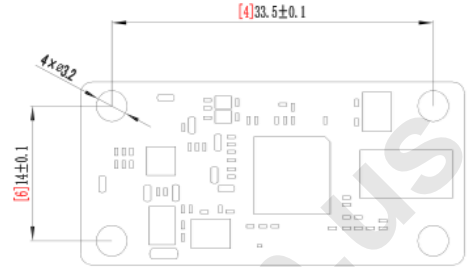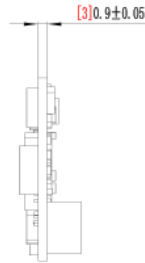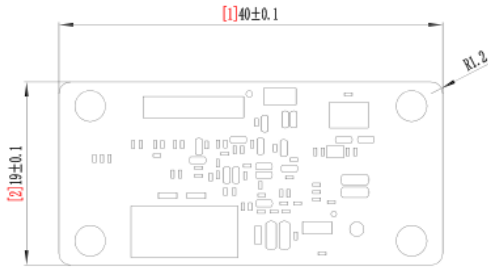Interface description, line order 1 on the righmost right:

U ART	definition	explaination
1	VCC	5-12V
2	TX	Sending, 3.3V
3	RX	Receiving, 3.3V
4	GND	the earth

Algorithm board dimension (in mm)

TOP VIEW   SIDE VIEW   BOTTOM VIEW

[1]40±0.1

[3]0.9±0.05

[4]33.5±0.1

R1.2

[2]19±0.1

4×ø3.2

[6]14±0.1

3.2 Camera component structure

Camera dimensions (in mm)

TOP VIEW   SIDE VIEW   BOTTOM VIEW

[1]40.2±0.2

[2]18±0.2

[4]0.51±0.1

(IR通光孔中心測和通光孔中心)

[3]10.9±0.2

Camera retaining bracket-front
ZF-BP2-002-1

ZAKI-FD005-V1.0-BP3

double side
electromagnetic film

[5]19±0.15

[6]14±0.15

[7]33.5±0.15

[8]40±0.15

[9] from LED light to steel sheet 5±0.2

[10] from camera to steel sheet 4.71±0.2

[11]0.13±0.05

[12]0.9±0.1

[13]33.5±0.2

[14]2-ø3.5±0.1

Camera retaining bracket-back
ZF-BP2-002-2

[15]64.65±0.2

steel sheet enhancement 0.2
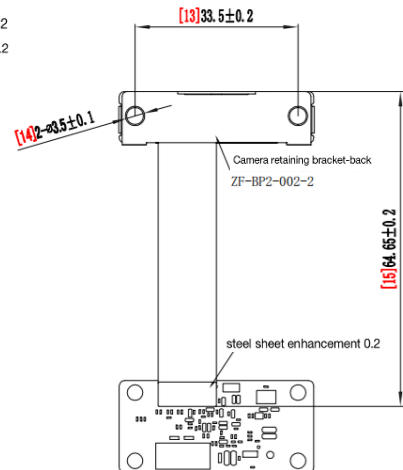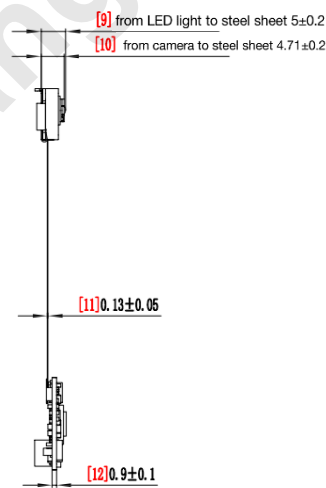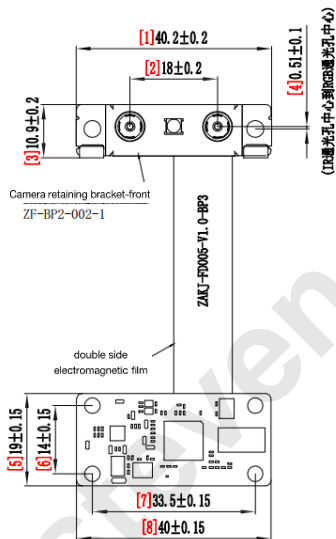
4. Specification of product

Item	Parameters
Product size	40 * 19 mm
Interface	UART
CPU	Dual core M4
NPU	Support
RAM	64MB DDR
ROM	32MB SPI NOR
Feature map	256 Bytes
Camera	Dual MIPI interface, dual IR + infrared LED
Resolution ratio	Dual 2M HD pixels
Infrared LED light	850nm
FOV	72(V)*57(H)
User capacity	100 (local registration, expanded to thousand)
Liveness detection	TAR> 98 @ FAR <1 in 100,000
Face recognition	TAR> 98 @ FAR <1 in 1 per million
FR distance	0.4 to 1 m, optimum 0.6m
FR time	≤ 1s
FR height	1.3～2m
Environment	Support for indoor / outdoor / dark / high light
Working voltage	5～12 V
Standby current	0 uA
Average power consumption	＜ 0.8 W
Working temperature	-25～60°
Storage temperature	-30～65°
Working humidity	From 10% to 95%, with no condensation

5. Interfaces and PIN definitions

Customer's AP structure   Kneron's module
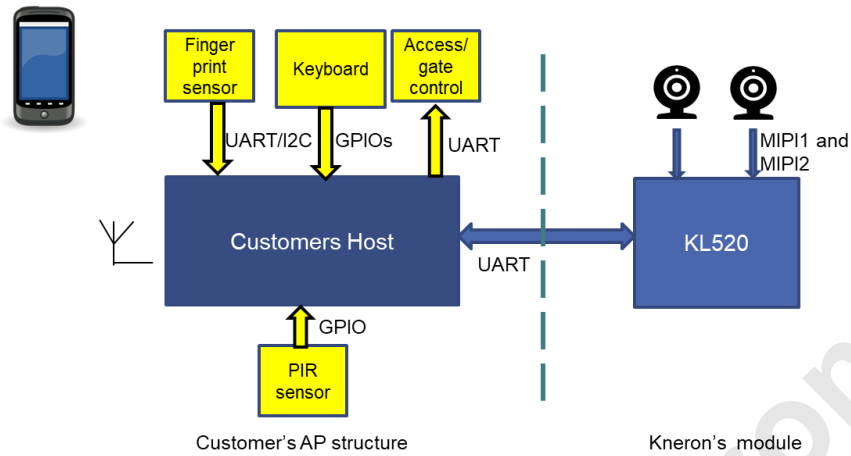
The picture above shows the basic diagram of door lock with face recognition function. The module uses two cameras and is equipped with AI algorithms, and uses a simple UART interface to interface with the master control, allowing users to simply use UART communication to obtain recognition results.

Pin number and pin define can be found in chapter3
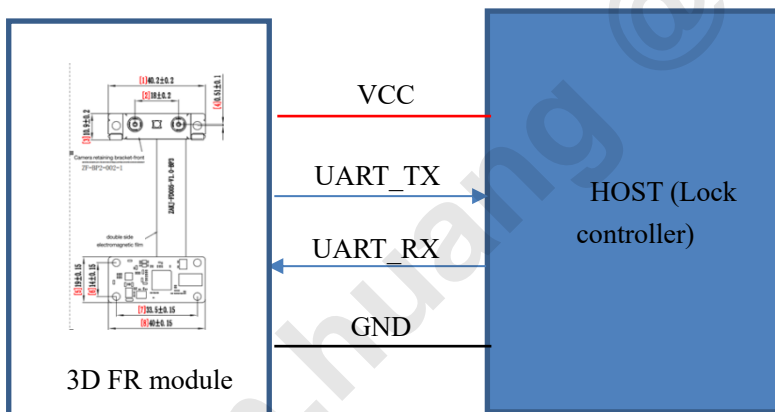
The interface between the module and the main control is defined in above figure, which is plug-plug mode. Two of the four lines are power supply lines, and the lock controller is responsible for the power supply. The power supply voltage range is 4.5-10 V, the peak power supply current is 600mA @ 5V. The other two are UART communication lines, which are connected to the module's UART communication interface.

5.1. Host IO state when entering sleep mode

When module enters sleep mode each Host IOs that connect to module should be:

● UART TX (connect to module's UART RX): high impedance or output low.

● UART RX (connect to module's UART TX): high impedance

- VCC_IN: shut down. 0V

5.2. Error handling

The UART of the module can send out the corresponding message that defined. If the module does not work properly for unknown reasons (interference, ESD, etc.), the Host can simply let the module's input power VCC, PIN 1, power down for a period of time and then power up again, it should be noted that this means that the VCC provided by the Host can be controlled. The VCC discharge time when Host is trying to power off the module should be as short as possible.

5.3. PIR sensor

If the user's project has more stringent power consumption requirements, the PIR sensor can be connected to the user's lock controller (mcu or others), which is a "proximity sensing" sensor that will send a trigger signal to the main control when it detects a person approaching. Then main controller will power on the face module to do face recognition or registration. After the face module is finished his job, the face module can be powered down again. This can reduce the standby power consumption of the face module.

6.   Notes for the enrollment

When registering, the user should keep a distance of approximately 70cm from the face module, face it, start slowly, center, left, center, right, center, up, center, down, and then finish. The user can also see the corresponding Log prompt in the corresponding programming tool.

7.   Mechanic considerations

This chapter describes the mechanic considerations of the FR module.

7.1   Angle of camera module

In order to be able to include specific human heights, please refer to bellow picture, a lock angle need to be specified. To make the calculation evaluation easier, we provide a calculator. Please refer to appendix a.
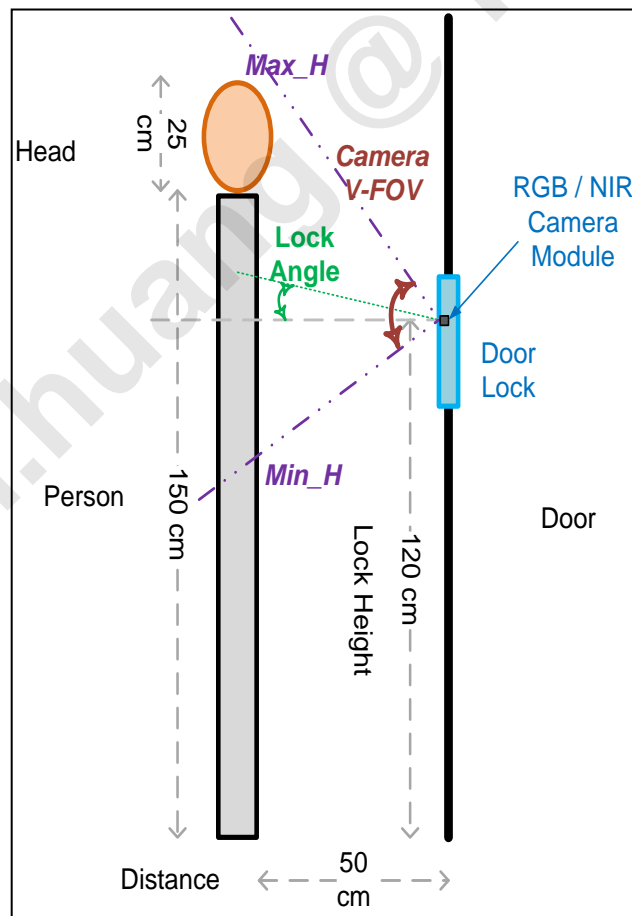

Figure- Lock angle need to be specified to fit certain human height.

Users only need to input the

1. Distance between human and door lock (default=50cm)

2. Lock Height (default=120cm)

3. Lock angle (default =25 degree)

4. V-FOV (vertical field of view) of two cameras (for ZF-BP3-SH module, V-FOV=72 degree)

In the calculator. It will output the supported human height. (by using these default values, the supported height is 115~193cm)

Distance (cm)		50		
Lock Height (cm)		120		
Lock Angle (degree)		26		
Range	V-FOV (degree)		Max_H (cm)	Min_H (cm)
Camera 1 (RGB/IR)	55.4		188	119
Camera 2 (NIR)	55.4		188	119

input

output

Figure- calculator inputs and outputs

7.2 Cover lens on top of LED and camera

There normally have two types of cover lens, PMMA and glass. Transmittance is the key. Please ensure that the light transmission is over 90% in the corresponding wavelength band, e.g. 850nm, 940nm and the visible band.

Scratch protection on the cover lens also need to be considered.

7.3 The opening window of LED

The opening window of LED need to be considered carefully. If this window too small, we will see a noisy, blurry and ringing artifacts after adding smart lock housing.
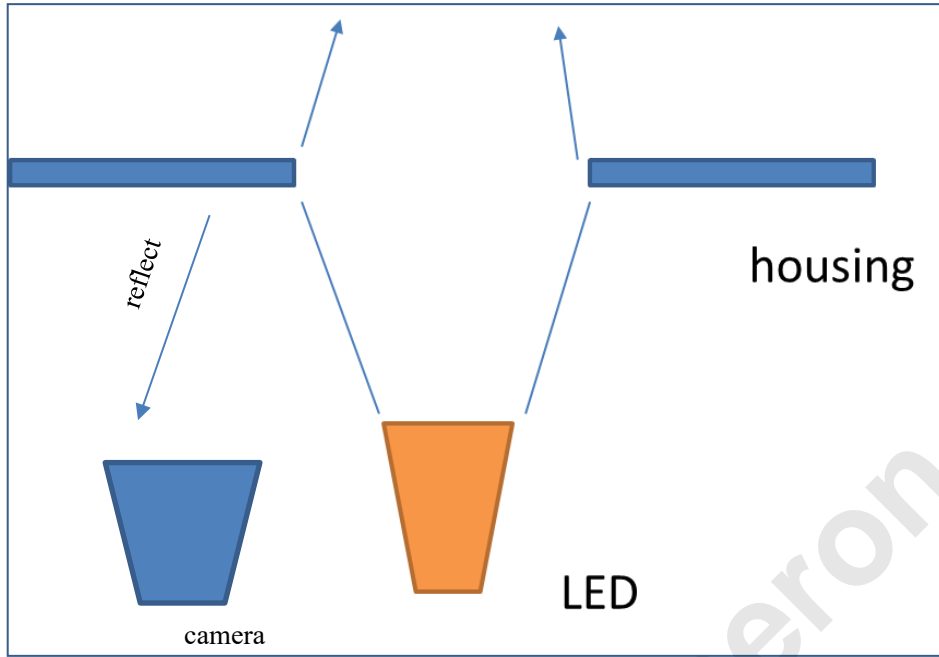
Figure – small opening would cause refraction of light

Figure – NIR images, we can see a ring if we turn on the LED

7.4   The opening window of cameras

The opening window of camera also need to be taken good care. A bad camera opening design will cause a bad image we got from camera. Some area will be blocked. Designers need to make sure cover will not block any camera visions.
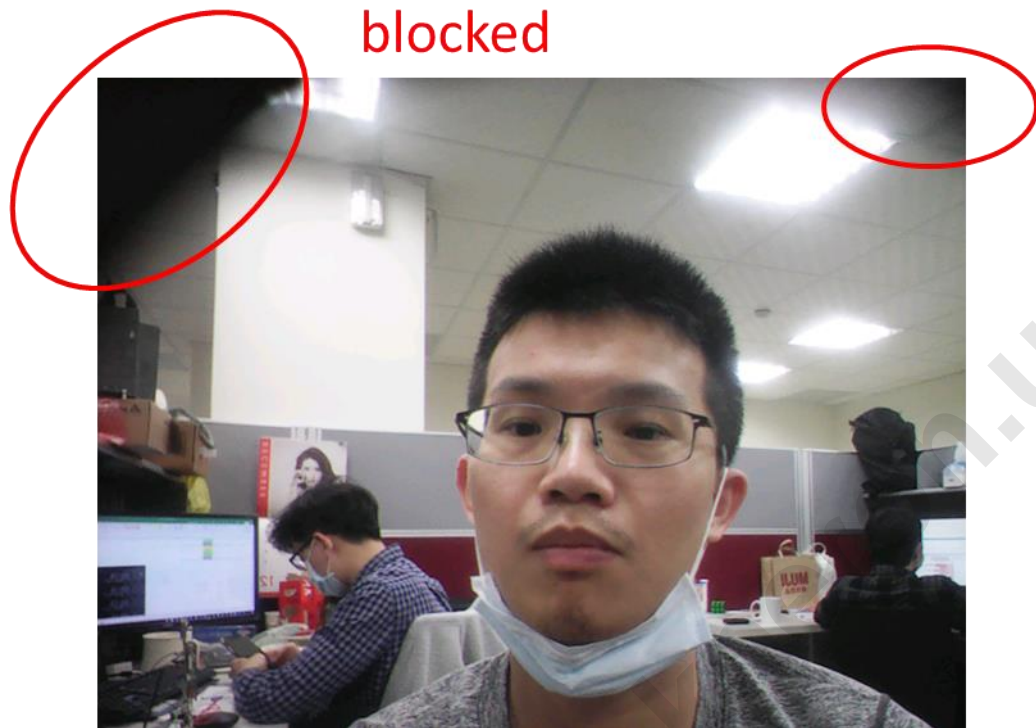
Figure – image corners are blocked.

It is important to double check images from camera when engineers finish the mechanic parts assembly.

7.5   Distance between camera module and housing/cover lens

Similar to what we described in chapter6.2 and 6.3, we want the cover to not reflect light from the LEDs and not block the view of the camera. We would like the distance between the cover and the camera to be as small as possible. Please refer to bellow picture:
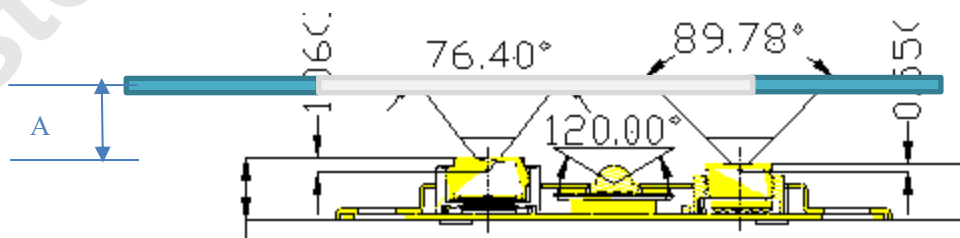

Figure - distance between camera module and cover, A, need to be as small as possible.

We would suggest the distance A should be <=0.5mm

7.6   Flat cover case

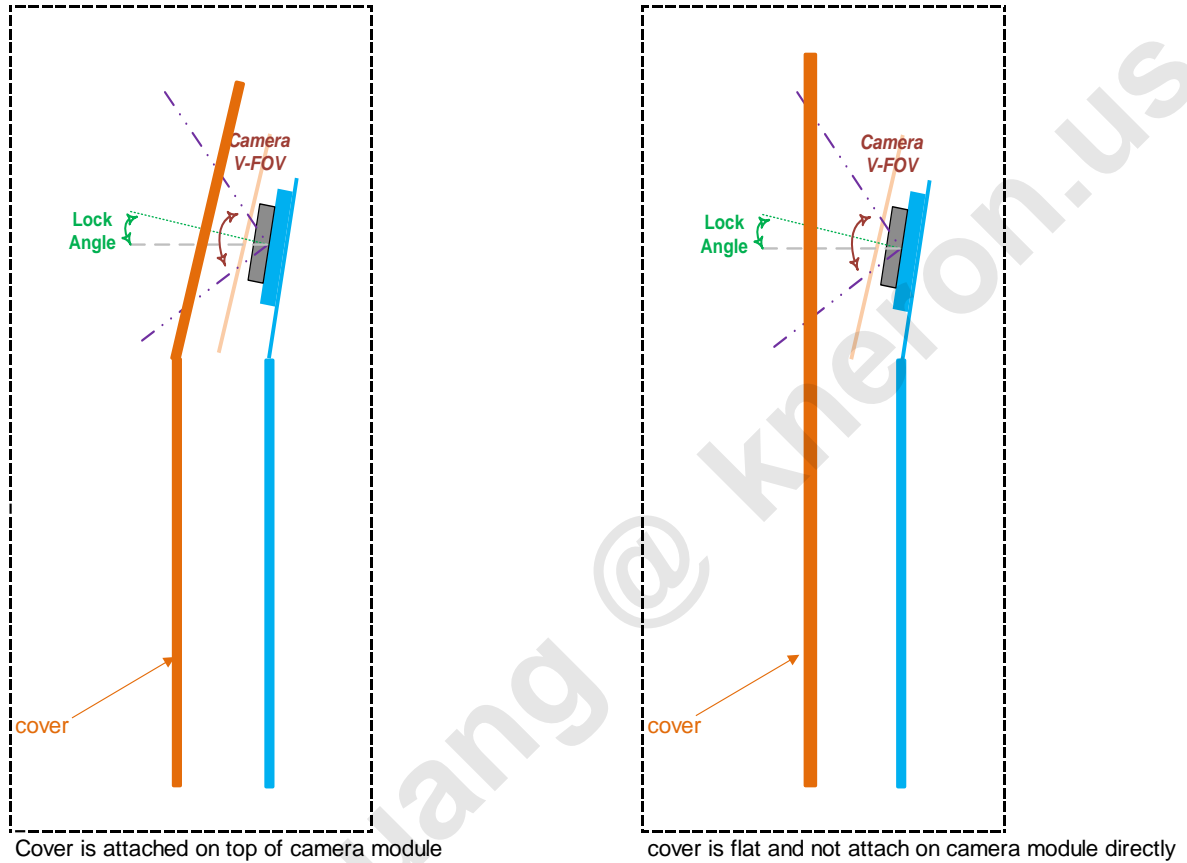For the case that the cover is flat not bended as shown in bellow picture:

Figure - the case on the right side: cover is flat, not bended.

In order to make sure it can fit to the window opening on the cover and no LED interference on the camera, we would suggest to make a conical shaped light shield. As show in below picture:
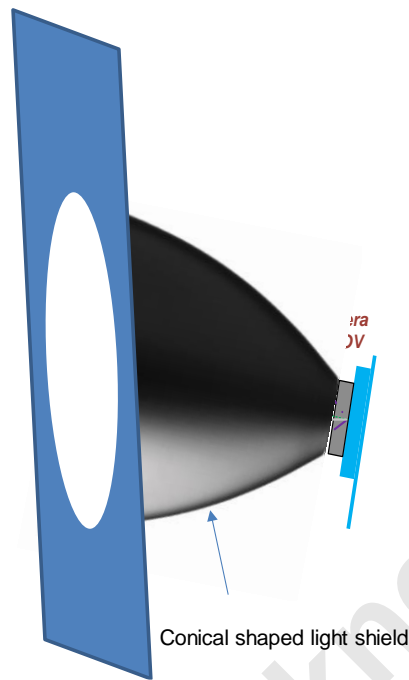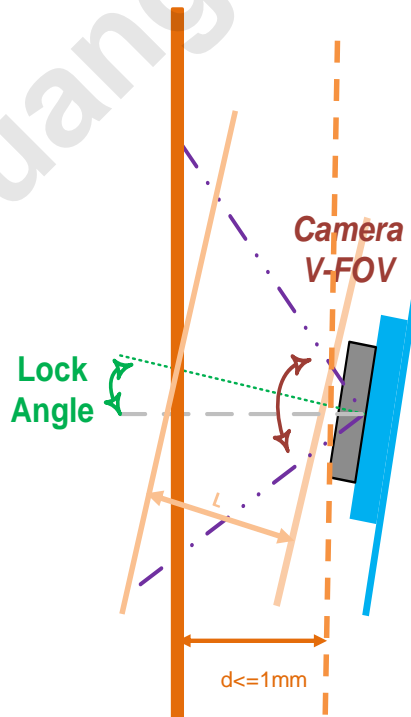
Figure -Conical shaped light shield

We would recommend that the distance between camera and cover (L) should be as small as possible. The vertical distance between cover and camera module should be smaller than 1mm. User can get lock angle from Chapter6.1.

8. Appendix

    a.   View_range_calculator.xls

9. Precautions

In order to avoid adverse accidents and damage to product performance, please comply with the following warnings and prohibitions.

9.1 Precautions for Storage

Store the product at a temperature of 22 ° C ±5 ° C and a humidity of 40%~75%. Do not be exposed to direct sunlight or heavy weight.

9.2 Precautions for Use

1) Do not rub the product with sharp blade or other sharp products;

2) Do not arbitrarily pull or bend the folding products;

3) Do not stack the product to avoid scratching the surface and causing bad appearance;

4) Please avoid using and storing this product near or exposed to organic solvents and acidic gases;

5) Please do not arbitrarily peel or tear the product;

6) Please do not touch the product directly with your hands, so please wear clean finger cover, gloves and mask before touching the product to avoid contaminating the through-light hole of the product, and please hold the product around;

7) In order to maintain the best photo effect, do not press the surface of the lens;

8) Please pay attention to ESD protection. People in contact with the camera must wear electrostatic rings.

9) Avoid strong light direct camera. It will affect the face recognition effect.

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