

Camera Monitor System

MA-E24

Instruction manual

Guangzhou modern angle Technology Co., Ltd.

Document approval				
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Date	Revised item	Reason	Version	Reviser
2023/11/19	The initial version	-	V1.0	Ken.Zhu
2024/07/15	Modify the partial content and description	Adapt to regulation requirements	V2.0	Ken.Zhu

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1. Description

1.1.Application

The MA-E24 series CMS(camera monitor system) which is developed for replacing traditional rear view mirror, we aim to provide drivers with a fluency and stable rear view vision that meets the regulations. At the same time, we also developed some adjustment function and fault warning function to improve drivers' experience, ensure drivers' driving safety. For example vision adjustment, brightness adjustment, camera failure warning, monitor failure warning, EUC failure warning and etc..

1.2.Regulation and adaptability

The MA-E24 CMS is designed according to ECE R46 and GB15084 regulation, it provide drivers with wider class II and class IV field of visions than both regulations defined. Please refer to the below figure:

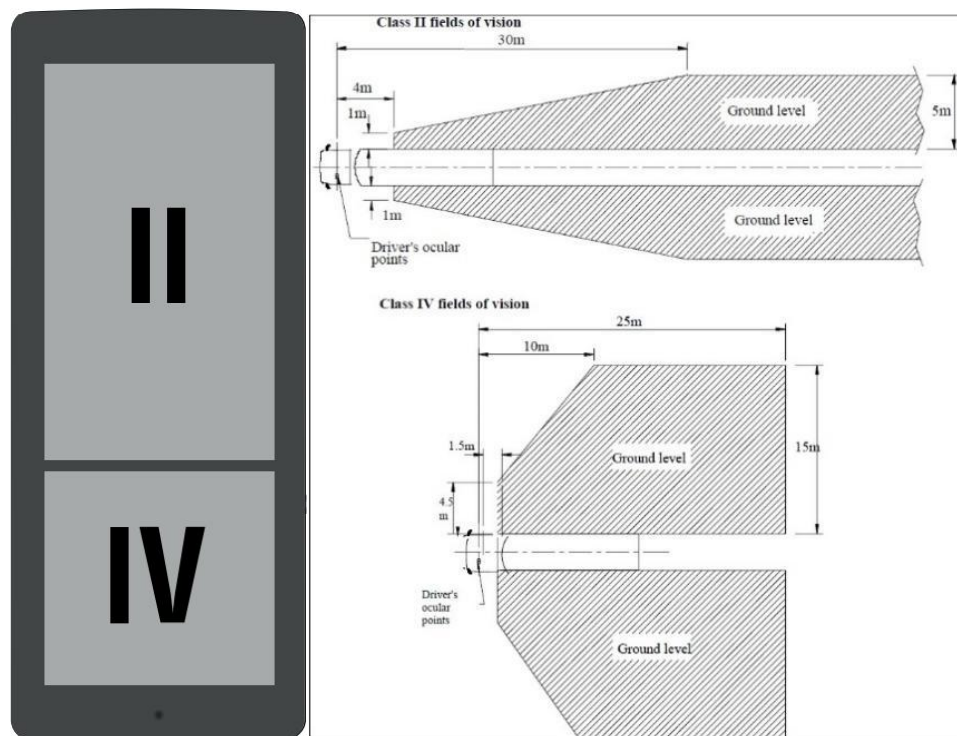


Fig.1 CMS display field of vision definition

This product and installation have been officially certified by regulations of ECE R46 and GB15084, and have obtained type approvals by regulations of R46,R10,R118 and GB15084. The product and installation also meet the standards requirement of ISO16505, ISO26262, GB/T28046, ISO16750 and GB34660.

Remarks: The CMS only with the type approval of ECE R46/GB15084 is allowed replace the traditional rear view mirror.

1.3. Safety statement

- Please note that compliance with regulations is mandatory at all times.
- To ensure safe operation, these safety statements must be read before starting to use this equipment.
- The monitor is installed in the vehicle, which may block the driver's direct vision to some extent.
- Do not open the case, as this may cause damage to the device, short circuit, or electric shock.
- Do not expose the device to extreme temperatures, which may result in distortion of the case or damage to internal components.
- Use of this system while driving is permitted only by persons who are (legally) authorized to operate the vehicle and who are deemed competent to drive the vehicle.
- Check whether the system functions normally before driving.
- In view of the decline of human adaptability, such as dazzling sunlight and other situations, sunglasses, polarizers and other appliances can be worn to adapt to the driving scene.
- sunlight or light from other intense light source upon the monitor reduces the luminance contrast which may require the driver to be particularly alert and attentive.
- possible artefact and their impact on the partial occlusion of the field of view and of the objects which may require the driver to be particularly alert and attentive.
- At night, if the driver sees a brighter light source on the monitor, not two clearly distinguishable brighter light sources need special attention, which may also be the vehicle.
- Before driving, please check whether the lens of the camera are clean. If there is dirt, please wipe it with 100% cotton cloth dipped in alcohol.

1.4. System name and version information

- (1) Name of manufacturer of camera, monitor and electronic control units: MA.
- (2) Type of camera, monitor and electronic control unit:
 - (a) CMS Class II & CMS Class IV.
 - (b) MA-E24 CMS CLASS II & MA-E24 CMS CLASS IV.
- (3) System software version: V1.90.09.
- (4) System hardware version:
 - (a) ECU: MA_CMS1123_T11_V1_0-240701.
 - (b) Screen Version: LCD_2.0.
 - (c) Camera Version: MA-CMC0181/ MA-CMC0182.
 - (d) Controller: VER: V2.0.

1.5. The same type

The MA-E24 series are designed base on the SOC+MCU architecture. In order to adapt the installation and adaption of different vehicle models, three product combinations have been formed by changing the design of the appearance and layout of the camera housing. But the software and hardware of these three product combinations are same, so these three combinations of CMS can be considered as type consistent.

Solution 1: CMS class II & class IV (with camera module)

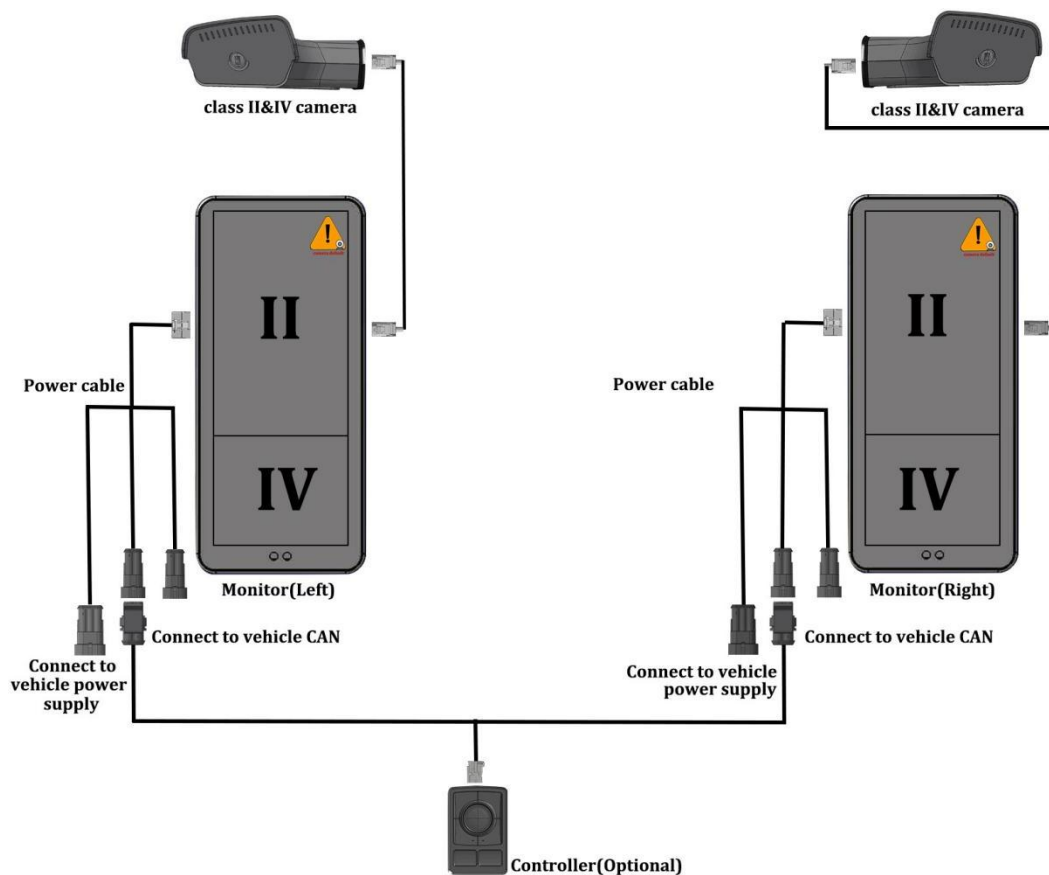


Fig.2

System configurations:

- Two 12.3-inch monitors are installed in the vehicle respectively, which can be installed on the A-pillar in the vehicle or hoisted on the roof according to the conditions;
- Two sets of camera module, each of which contains one camera, are used for the display of Class II and Class IV field of visions respectively. The camera modules are installed outside the vehicle;
- Controller is optional, it use to adjust the monitor brightness, switch the view mode, operate the heating, restore the default view, and operate the menu
- The harness includes coaxial video harness, power cable and communication harness, which connects the vehicle and two monitors, connects two monitors and two camera modules.

Solution 2: CMS class II & class IV & class V (The right class II & class IV camera module integrated class V camera)

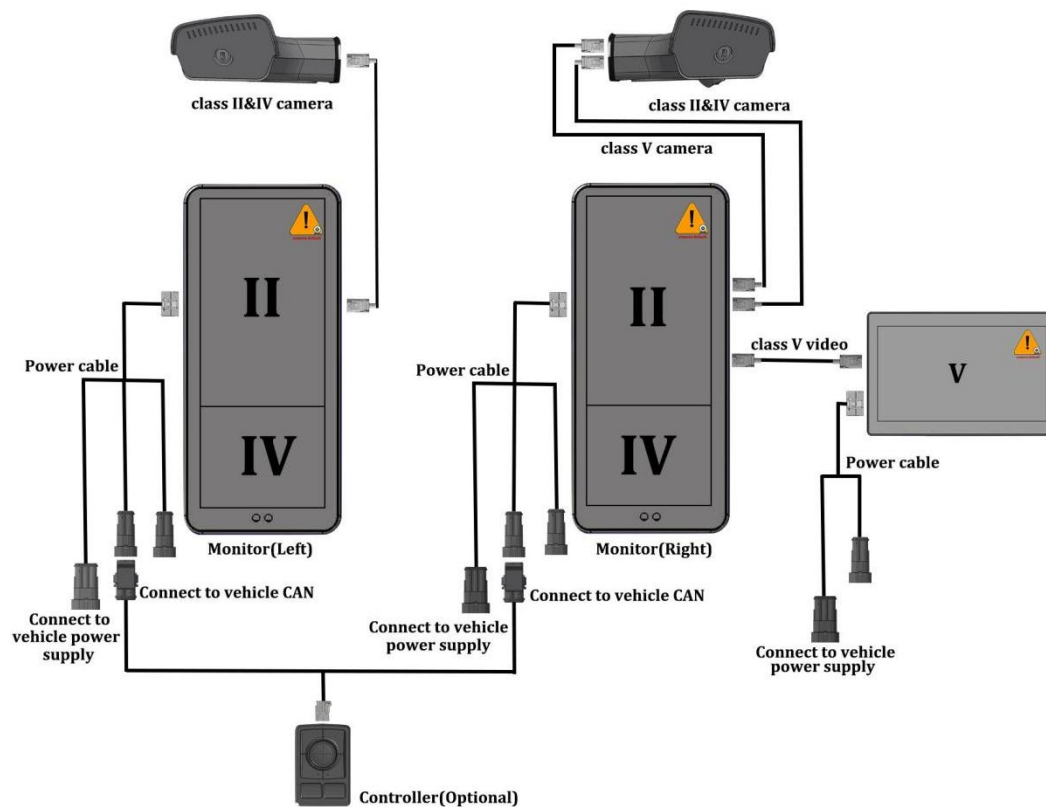


Fig.3

System configurations:

- Two 12.3-inch monitors are installed in the vehicle respectively, which can be installed on the A-pillar in the vehicle or hoisted on the roof according to the conditions;
- Two sets of camera module. The left camera module contains one camera for both class II and class IV field of visions. The right camera module contains 2 cameras, one for both class II and class IV field of visions, the other one for class V field of vision. Class V field of vision display on another 10.1-inch monitor; The camera modules are installed outside the vehicle;
- Controller is optional, it use to adjust the monitor brightness, switch the view mode, operate the heating, restore the default view, and operate the menu
- The harness includes coaxial video harness, power cable and communication harness, which connects the vehicle and two monitors, connects two monitors and two camera modules.
- This solution is applicable to left-hand drive vehicles.

Solution 3:CMS class II & class IV & class V (The right class II & class IV camera module integrated class V camera)

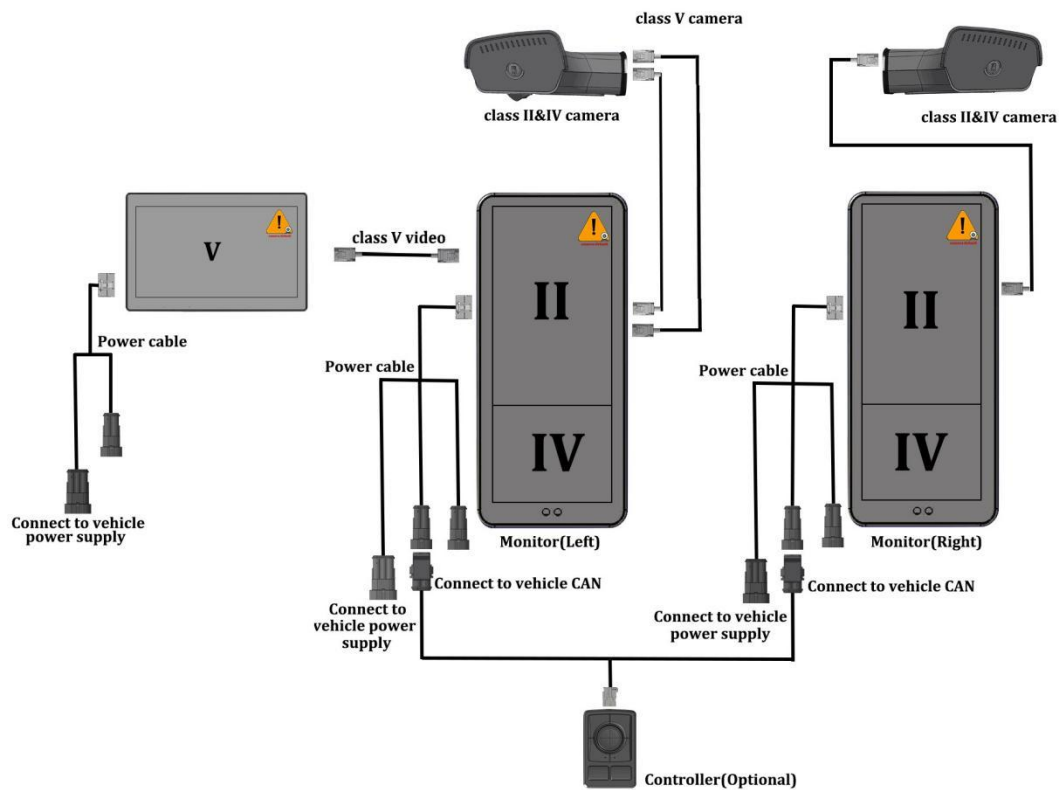


Fig.4

System configurations:

- Two 12.3-inch monitors are installed in the vehicle respectively, which can be installed on the A-pillar in the vehicle or hoisted on the roof according to the conditions;
- Two sets of camera module. The right camera module contains one camera for both class II and class IV field of visions. The left camera module contains 2 cameras, one for both class II and class IV field of visions, the other one for class V field of vision. Class V field of vision display on another 10.1-inch monitor; The camera modules are installed outside the vehicle;
- Controller is optional, it use to adjust the monitor brightness, switch the view mode, operate the heating, restore the default view, and operate the menu
- The harness includes coaxial video harness, power cable and communication harness, which connects the vehicle and two monitors, connects two monitors and two camera modules.
- This solution is applicable to right-hand drive vehicles.

2. System introduction

2.1. System parameter

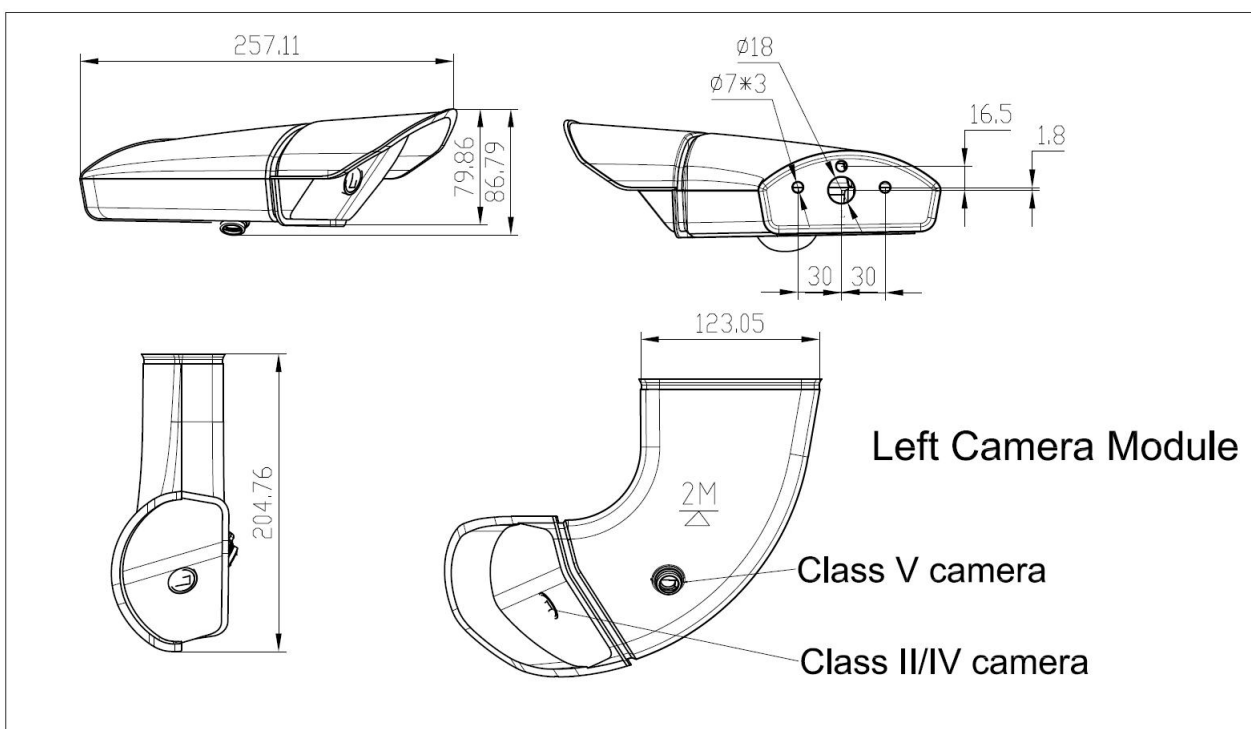
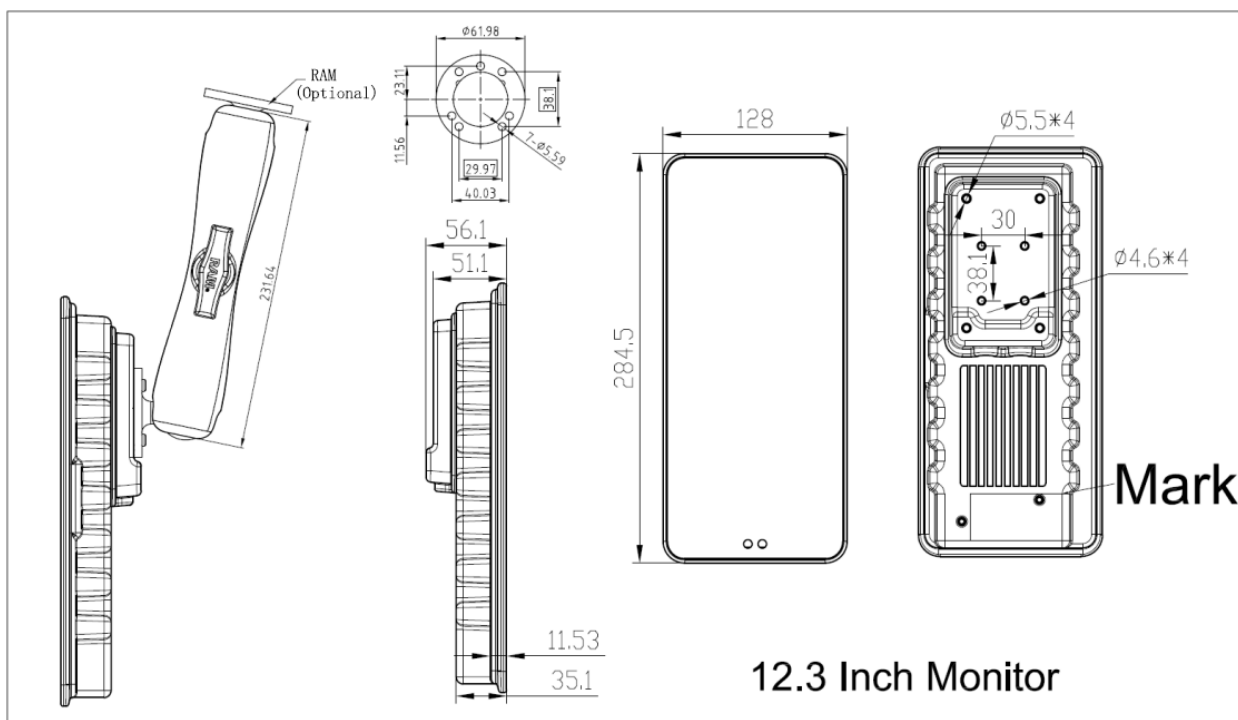
Monitor

S/N	Specification	Parameters
1	Model	MA-MOD0231
2	Technology Type	IPS TFT (NO.96.AJV01.001)
3	Resolution	1920*720
4	Diagonal size (inch)	12.3inch
5	Frame rate	60HZ
6	Luminance	1200cd/m ² (MAX.)
7	Contrast Ratio	1400
8	Brightness adjustment	Manual / automatic
9	transport protocol	LVDS
10	Response time	MAX. 20ms (+25°C)
11	Active Area	292*109.5mm
12	Operating voltage/current	+24V(9~32V)/<2A(+24VDC)
13	System latency	47ms
14	Degree of protection	IP54
15	Working Temperature	-30°C~+85°C
16	Storage Temperature	-40°C~+85°C
17	Life time	70000Hrs

Camera

S/N	Specification	Camera	
		Class II /IV	Class V
1	Sensor Type	SONY ISX031	SONY ISX031
2	Number Of Pixels	1920(H)*1536(V)	1920(H)*1536(V)
	Frame Rate	60fps	60fps
3	Image Size	1/2.42inch	1/2.42 inch
4	Unit Cell Size	3.0um(H)*3.0um(V)	3.0um(H)*3.0um(V)
5	Aperture	f/No 2.0	f/No 2.0
6	Focus Distances	3.04mm	1.31mm
7	High Dynamic Range	120dB	120dB
8	Minimum illumination	0.1Lux	0.1Lux
9	Transport protocol	POC	POC
10	Lens form	7G+1R	7G+1R
11	FOV	(H) 118°; (V) 91°	(H) 196°; (V) 160°
12	Working temperature	-40°C~+85°C	-40°C~+85°C
13	Storage temperature	-40°C~+85°C	-40°C~+85°C
14	Degree of protection	IP69K	

2.2. Drawing



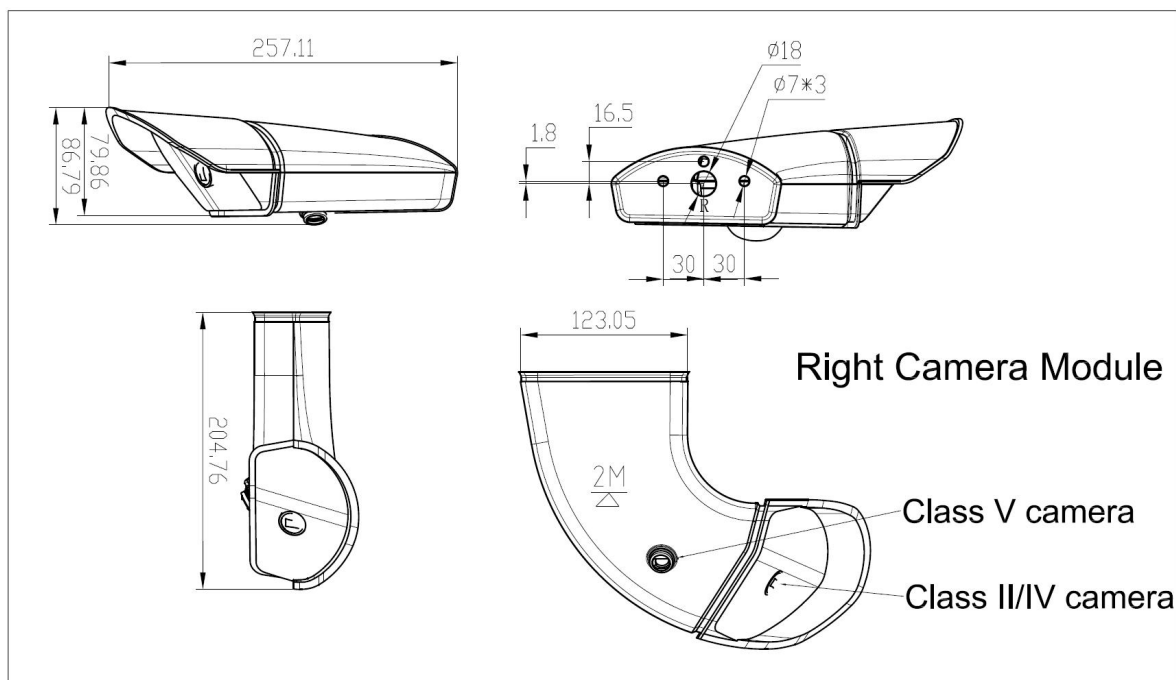


Fig.5

Controller

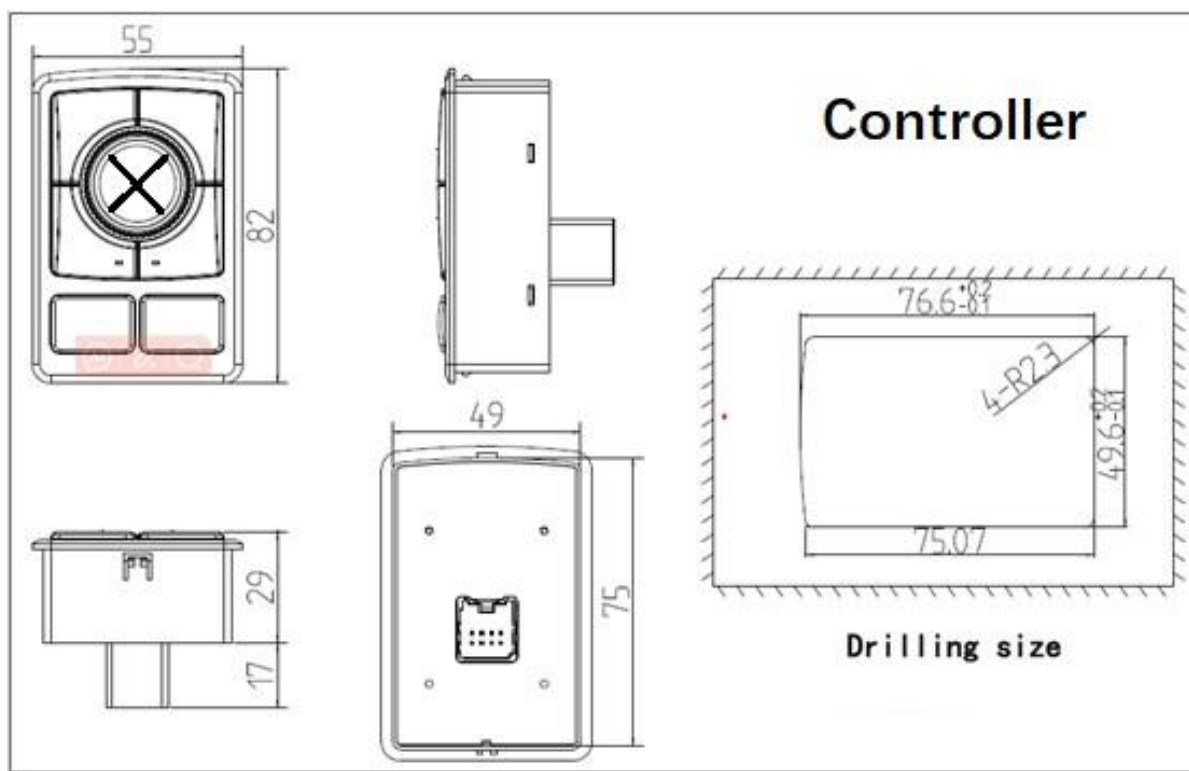


Fig. 6

3. Function introduction

3.1. Led status indicator

There is a red LED status indicator front of the monitor, which will take effect in the following cases:

- CMS reset.
- CMS camera failure.
- CMS ECU failure.
- CMS monitor fault.

3.2.Activation and deactivation

The start switch/opening the front door is used to turn the CMS on. When the key is turned off,the system will perform a controlled shutdown. After the startup switch is turned off,the system will remain on for 120 second, and display a icon . After these120 second, the system will stand by for another 300 second and can be reactivated so that the required field of vision can be obtained again within 1 second. No activation operation (starting the vehicle,opening the front door, etc.) is performed within 7 seconds, and the system shuts down 300 seconds later.

3.3.Luminance adjustment

Automatic luminance control:according to the surrounding light conditions,the light sensor is used to automatically adjust the brightness of the display to cope with different driving environments.The automatic brightness adjustment range is $1\text{cd/m}^2 \sim 1000\text{cd/m}^2$.

Manual luminance adjustment:adjust the display brightness through the buttons on the controller.

3.4.Trailer panning

Cautions: There are safety risks in adjusting the field of vision of CMS while the vehicle is in motion;

Before driving, please make sure that the CMS is not faulty and the display field of vision is correct.

3.4.1. Trigger temporary view

- When the automatic rear tracking function is turned on, the field of vision displayed on the upper part of the screen will automatically translate with the rotation angle of the steering wheel, and will only be automatically adjusted on the display screen on the inside of the vehicle turning  .The distance line displayed on the screen at this time does not represent the

correct distance and is only for reference.

- The driver can move the field of view shown in the upper part of the display screen up, down, left or right. Use the button to move the field of view. If the field of view on the display deviates from that required by the regulations, a symbol will appear on the display ◀ ▶ (Red)

3.4.2. Restore the default field of view

After the monitor displays the temporary field of view, the default field of view can be restored by the following measures:

- The default field of vision can be restored to the default state with one key through the controller's button to restore the default field of vision.
- When the vehicle starts to move forward, the display image will also exit the temporary field of view and automatically restore the default field of view state.
- After restarting the CMS, the system will automatically return to the default view.

3.5. Distance lines

The purpose of these distance lines is to determine the distance from other vehicles on the road and to help operators change lanes safely. By default, the distance line is not visible, but you can The adjustable distance line on the monitor can be moved to three corresponding positions on the rear edge of the vehicle after the CMS is installed for the first time or after the semi-trailer/trailer is replaced. As shown in Figure 8.

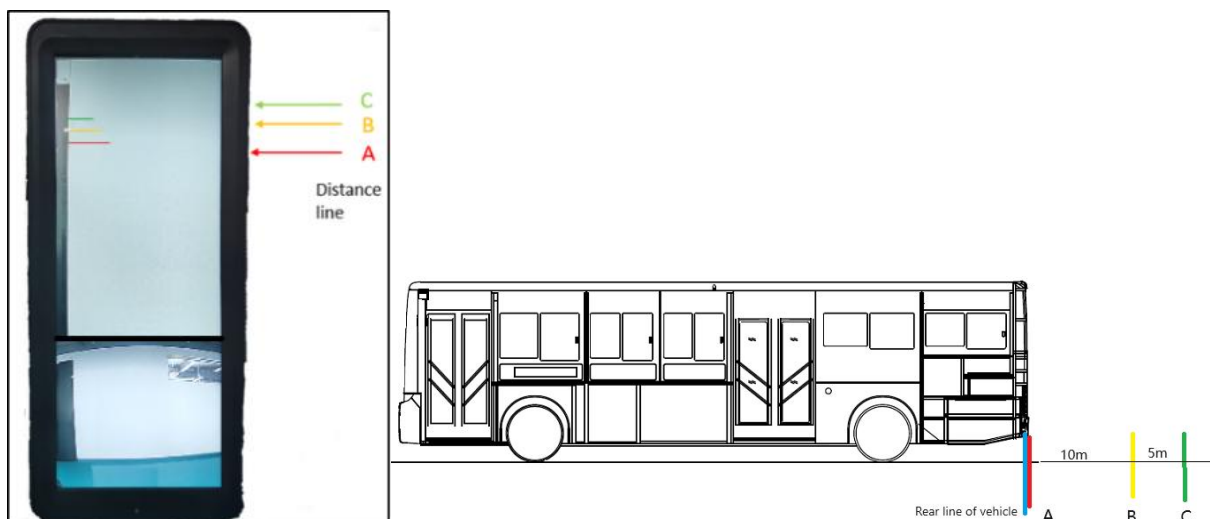


Fig. 7

4. System availability

4.1. Failure list and icons

No.	Item	Failure list	Failure Icon	remark
1	Camera failure	Failure of the camera	 Camera failure	
2		Electronic noise, reduced detail resolution	 Excessive noise	
3		Defocus of the optics, reduced detail resolution	 Optical defocus	
4	Monitor failure	Failure of monitor display, no image content is displayed	 Monitor failure	
5		Freeze of displayed monitor content, image content is not refreshed	 Monitor failure	
6		Enlarged image formation time, changing image content is blurred	 Monitor failure	
7	ECU Failure	Failure of the control unit	 ECU failure	
8		Failure in the communication between camera and control unit	 Communication failure	
9		Failure in the communication between control unit and monitor	 Communication failure	

Other icons

No.	Item	Icon	remark
1	Trailer panning icon		
2	standby mode icon		

4.2. Failure countermeasures

Measures after failure

- Before driving, please check whether the lens of the camera is clean. If there is dirt, please wipe it with 100% cotton cloth dipped in alcohol;
- Before driving, Check whether the system function is normal. In case of the following conditions, the system must be repaired before continuing to drive or stop safely as soon as possible and notify a qualified professional organization for maintenance:

The monitor is completely out;

Although the object in front of the camera is moving, the monitor shows a static image;

The image displayed in the monitor is noticeably lagging;

Distorted image on monitor;

Obvious pixel error, or disappearance of a column or row;

The contrast or color is significantly different from the actual environment;

Camera failure

- If the following conditions occur, please check the status of the CMS system at an appropriate time, assess whether it affects the continued driving, and try to restart the equipment to see if it can be solved. If it still does not work, please contact a qualified professional organization for inspection and maintenance:

The screen appears more noise or water ripple.

Abnormal communication is displayed on the screen, including the screen and ECU, camera and ECU.

5. Installation recommendation

The installation position and angle of the camera monitor system components (such as camera module and host screen) determine the vision acquisition of the system and the visual perception and experience of the driver. In the regulations, there are also requirements for the installation of the camera monitor system, so it is necessary to emphasize the correct installation of the display screen. The installation diagram of the display screen is shown in Figure 8.

Install the the left monitor on the left side of the driver's eye points, which can not block the direct line of sight defined by the regulations, and can be fine-tuned according to the actual situation. Install the right monitor on the right side of the driver's eye point, which can not block the direct line of sight defined by the regulations, and can be fine-tuned according to the actual situation.

The camera module shall be installed at least 550 mm in front of the eye points and at least 2 m above the ground, on both sides outside the cockpit.

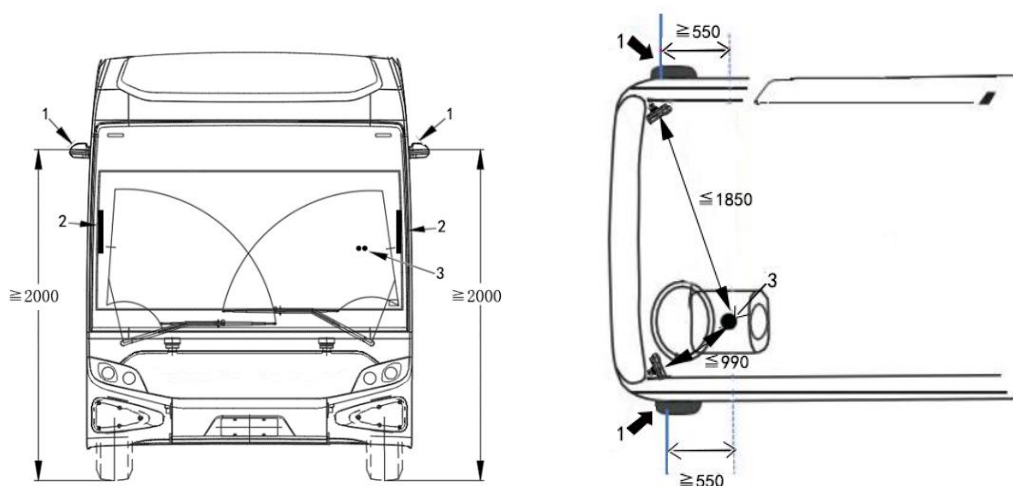


Fig. 8 :System installation diagram (1: camera; 2: monitor; 3: eye points)

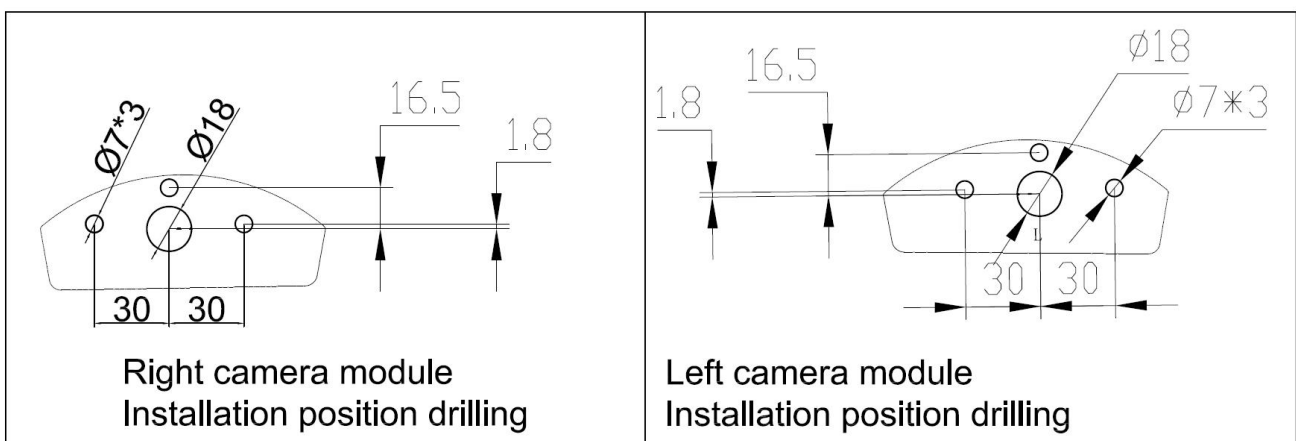
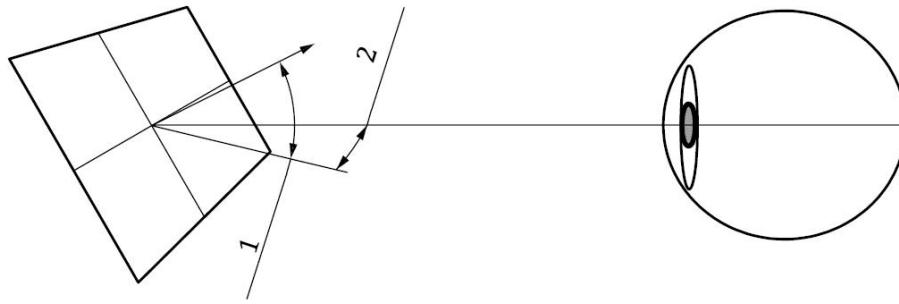


Fig. 9: camera module mounting hole

Compliance corresponding to the installation plan

**Key**

- 1 $\theta_{monitor/ver}$
 2 $\theta_{monitor/hor}$

Fig. 10: Perspective view of horizontal and vertical viewing angle

Position	CMS	Monitor size	Design Observation horizontal angle	Design Observation vertical angle	Eye point distance from monitor
Driver side	Class II	12.3"	0°	-11°	815mm(The maximum distance is 950mm)
	Class IV		0°	11°	800mm(The maximum distance is 950mm)
Passenger side	Class II	12.3"	0°	-6°	1225mm(The maximum distance is 1850mm)
	Class IV		0°	6°	1220mm(The maximum distance is 1850mm)

Table 1 Description of monitor Installation Parameters

6. Maintenance

- The mounting bolts of the monitor and camera shall be inspected quarterly;
- Camera cleaning and relevant safety instructions

Regular cleaning can ensure that the camera lens remains clean. Use high-quality, safe cleaners and soft cloths to remove dirt, debris and dirt on the lens. Automatic heating to confirm the camera lens can effectively evaporate the fog on the front of the camera lens.

Caution: Do not use aggressive chemicals or abrasive cleaners to clean this device.