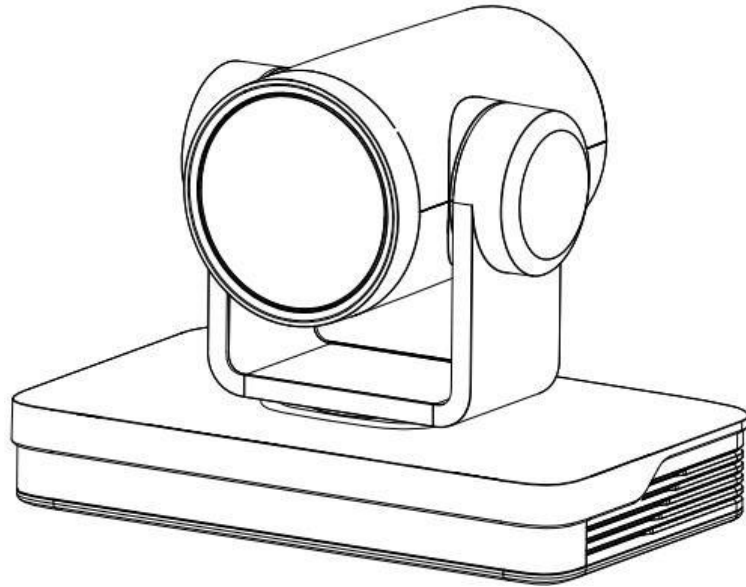
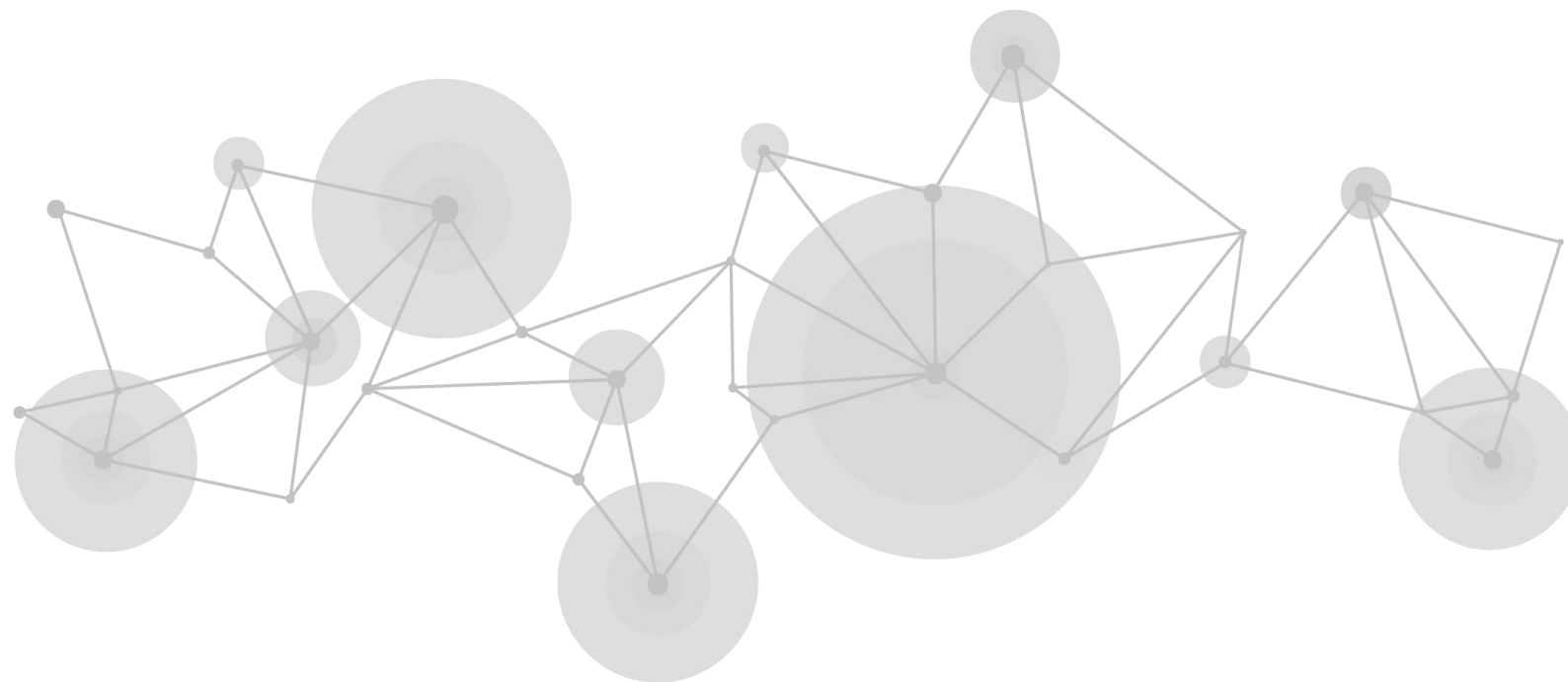


4K Ultra HD NDI Camera



RGBlink[®]

User Manual



Article No: RGB-RD-UM-4K Ultra HD NDI
Camera-E000
Version: V1.0

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Thank you for choosing our product!

This User Manual is designed to show you how to use this camera quickly and make use of all the features. Please read all directions and instructions carefully before using this product.

Declarations

FCC/Warranty

Federal Communications Commission (FCC) Statement

This camera has been tested and found to comply with the limits for a class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area may cause harmful interference, in which case the user will be responsible for correcting any interference.

Guarantee and Compensation

RGBlink provides a guarantee relating to perfect manufacturing as part of the legally stipulated terms of guarantee. On receipt, the purchaser must immediately inspect all delivered goods for damage incurred during transport, as well as for material and manufacturing faults. RGBlink must be informed immediately in writing of any complains.

The period of guarantee begins on the date of transfer of risks, in the case of special systems and software on the date of commissioning, at latest 30 days after the transfer of risks. In the event of justified notice of compliant, RGBlink can repair the fault or provide a replacement at its own discretion within an appropriate period. If this measure proves to be impossible or unsuccessful, the purchaser can demand a reduction in the purchase price or cancellation of the contract. All other claims, in particular those relating to compensation for direct or indirect damage, and also damage attributed to the operation of software as well as to other service provided by RGBlink, being a component of the system or independent service, will be deemed invalid provided the damage is not proven to be attributed to the absence of properties guaranteed in writing or due to the intent or gross negligence or part of RGBlink.

If the purchaser or a third party carries out modifications or repairs on goods delivered by RGBlink, or if the goods are handled incorrectly, in particular if the systems are commissioned operated incorrectly or if, after the transfer of risks, the goods are subject to influences not agreed upon in the contract, all guarantee claims of the purchaser will be rendered invalid. Not included in the guarantee coverage are system failures which are attributed to programs or special electronic circuitry provided by the purchaser, e.g. interfaces. Normal wear as well as normal maintenance are not subject to the guarantee provided by RGBlink either.

The environmental conditions as well as the servicing and maintenance regulations specified in this manual must be complied with by the customer.

Operators Safety Summary

The general safety information in this summary is for operating personnel.

Do Not Remove Covers or Panels

There are no user-serviceable parts within the unit. Removal of the top cover will expose dangerous voltages. To avoid personal injury, do not remove the top cover. Do not operate the unit without the cover installed.

Power Source

This product is intended to operate from a power source that will not apply more than 230 volts rms between the supply conductors or between both supply conductor and ground. A protective ground connection by way of grounding conductor in the power cord is essential for safe operation.

Grounding the Product

This product is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting to the product input or output terminals. A protective-ground connection by way of the grounding conductor in the power cord is essential for safe operation.

Use the Proper Power Cord

Use only the power cord and connector specified for your product. Use only a power cord that is in good condition.

Refer cord and connector changes to qualified service personnel.

Use the Proper Fuse

To avoid fire hazard, use only the fuse having identical type, voltage rating, and current rating characteristics. Refer fuse replacement to qualified service personnel.

Do Not Operate in Explosive Atmospheres

To avoid explosion, do not operate this product in an explosive atmosphere.

Installation Safety Summary

Safety Precautions

For all device installation procedures, please observe the following important safety and handling rules to avoid damage to yourself and the equipment.

To protect users from electric shock, ensure that the chassis connects to earth via the ground wire provided in the AC power Cord.

The AC Socket-outlet should be installed near the equipment and be easily accessible.

Unpacking and Inspection

Before opening device shipping box, inspect it for damage. If you find any damage, notify the shipping carrier immediately for all claims adjustments. As you open the box, compare its contents against the packing slip. If you find any shortages, contact your sales representative.

Once you have removed all the components from their packaging and checked that all the listed components are present, visually inspect the system to ensure there was no damage during shipping. If there is damage, notify the shipping carrier immediately for all claims adjustments.

Site Preparation

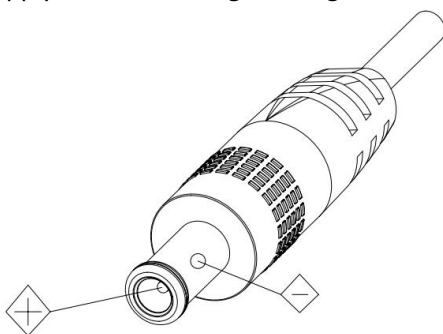
The environment in which you install your device should be clean, properly lit, free from static, and have adequate power, ventilation, and space for all components.

Electric Safety

Installation and operation must accord with electric safety standard

Polarity of power supply

The power supply of the product is DC12V, the max electrical current is 2A .Polarity of the power supply as the following drawing.



Careful of installation

Never move the camera by seizing the camera head. Don't rotate camera head by hand; otherwise, mechanical trouble will occur.

This series item must be put on the smooth desk or platform, and it can not be installed slant ways;

If the camera is installed on TV or computer, the base can be fixed by four double-sided adhesive trays.

Don't apply in corrosive liquid, as or solid environment to avoid the cover which is made up of organic material.

To make sure no obstacle in rotation range.

Never power on before installation is completed.

Don't disassemble discretionarily.

There are no parts that users can repair by themselves on this product. We are not responsible for any unauthorized modification or dismantling.

Avoid Magnetic Interference

Magnetic field under specific frequency may affect this product image; this is Class A product. Application in domestic environment may cause radio interference. Therefore, user should take corresponding measures.

Caution

If the power cord need to be extended, must only extend the cord connect to outlet 220V/110V. Do not extend the DC 12V power cord, otherwise malfunction could be caused.

Chapter 1 Your Product

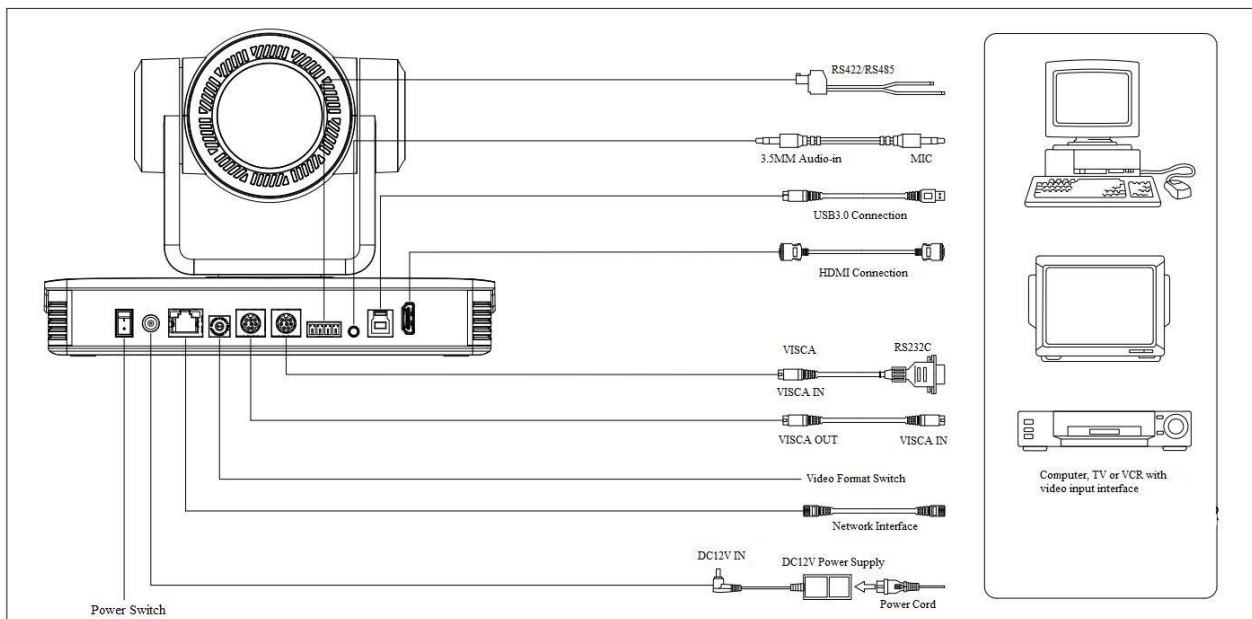
1.1 In the Box

- Power Adapter × 1
- USB3.0 Cable (U3) × 1
- IR Remote Control × 1
- Mounting Bracket × 1

1.2 Product Overview

4K Ultra HD NDI Camera is a new Ultra HD 4K camera, 12X optical zoom, 80.4° wide angle lens. It has perfect functions, superior performance and rich video output interfaces. Featuring with advanced ISP processing algorithms, offering vivid and high resolution video with a strong sense of depth and fantastic color rendition.

It features built-in Built with SONY high quality CMOS sensor, which allows it to output 4K@60fps video. It fully satisfies all scenario demand of Tele-education, Lecture Capture, Webcasting, Videoconferencing, Tele-training, Tele-medicine, Interrogation and Emergency command systems.



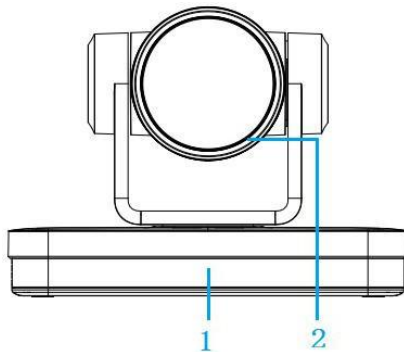
Wiring Diagram

Product Features

- **4K Ultra HD Resolution:** 1/2.5inch high quality SONY CMOS sensor. Resolution is up to 4K with frame rate up to 60fps.
- **Dual Stream Output:** USB can support the main stream and sub stream output at the same time, and can meet the needs of near-end and far-end.
- **Optical Zoom Lens:** 12X optical zoom lens and 80.4° wide angle lens.
- **Rich and perfect interfaces:** Support HDMI, USB 3.0, LAN, and output 4K audio and video at the same time.
- **Leading Auto Focus Technology:** Fast, accurate and stable auto focusing technology.
- **Low Noise and High SNR:** Super high SNR image is achieved with low noise CMOS. Advanced 2D/3D noise reduction technology further reduces the noise while ensuring high image clarity.
- **Multiple Audio/Video Compression Standards:** LAN interface supports H.264/H.265 video compression, USB3.0 interface supports MJPG, H264, YUY2, NV12, H265; support AAC, MP3 and G.711A audio compression, 8000, 16000, 32000, 44100, 48000 sampling frequency.
- **Multiple Network Protocol:** Support ONVIF, GB/T28181, RTSP, RTMP ,NDI protocols; support RTMP push mode, which can easily link with streaming media server (Wowza, FMS); support RTP multicast mode, support VISCA control protocol over Network.
- **Control Interface:** RS422 input(compatible with RS485), RS232 input/output, RS232 (cascade connection)
- **Multiple Control Protocol:** Support VISCA, PELCO-D, PELCO-P protocols; Support automatic identification protocols.

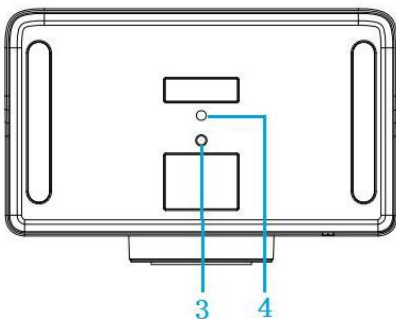
1.2.1 Interface

Front view



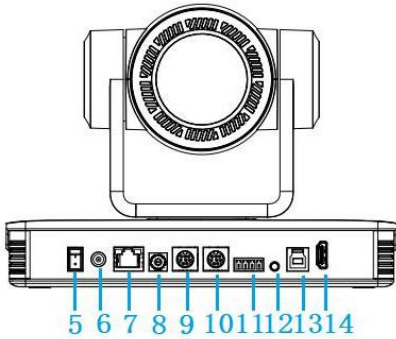
1. Remote Control Receiving Indicator
2. Camera Lens

Bottom view



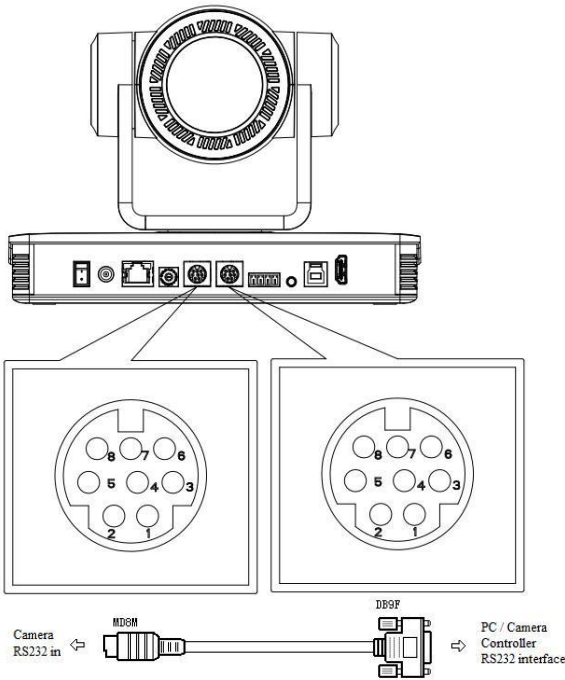
3. Tripod Screw Hole
4. Screw Hole for Tripod

Back view

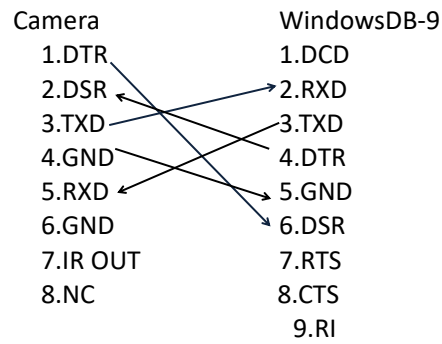


- 5. Power Switch
- 6. DC12V Input Power Supply Socket
- 7. LAN Port
- 8. Rotary DIP Switch
- 9. RS232 Control Interface (input)
- 10. RS232 Control Interface (output)
- 11. RS422/RS485 Input
- 12. Audio Input
- 13. USB 3.0 Output
- 14. HDMI Output

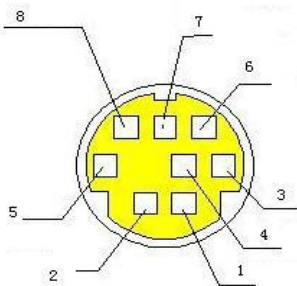
1) RS-232 Interface Definition



Connection to PC or Camera Controller

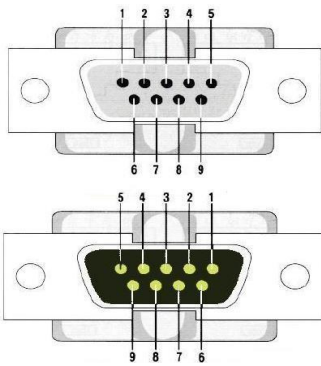


2) RS-232 Mini-DIN 8-pin Port Definition



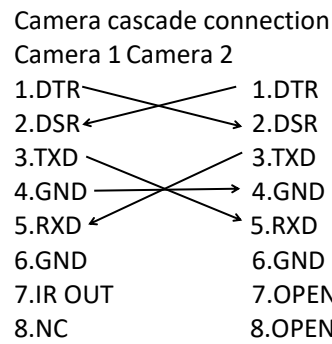
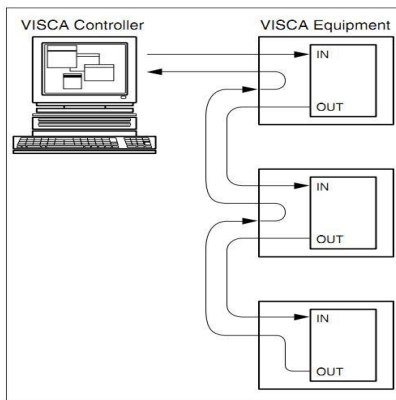
NO.	Port	Definition
1	DTR	Data Terminal Ready
2	DSR	Data Set Ready
3	TXD	Transmit Data
4	GND	Signal Ground
5	RXD	Receive Data
6	GND	Signal Ground
7	IR OUT	IR Commander Signal
8	NC	No Connection

3) RS232(DB9) Port Definition



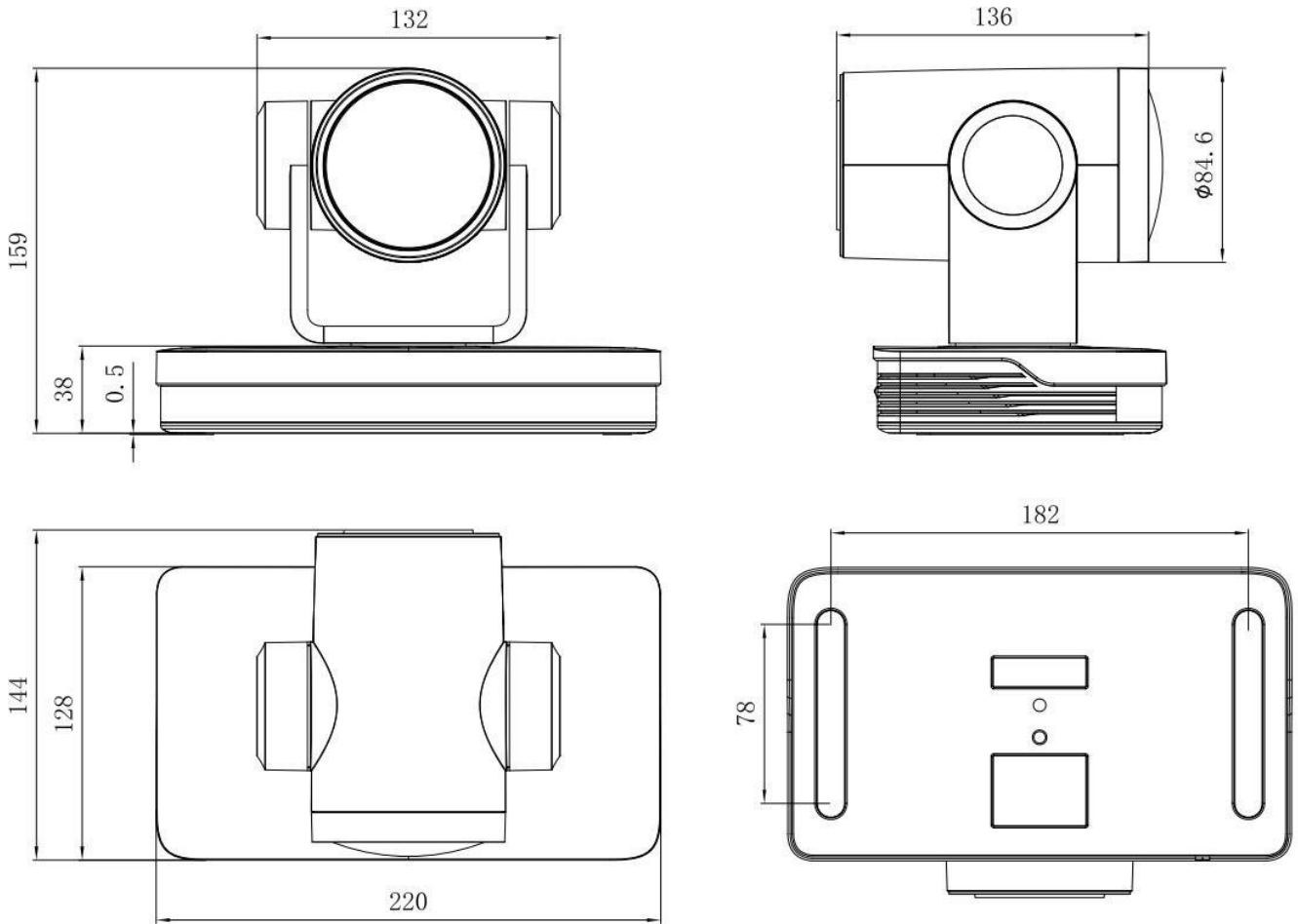
NO.	Port	Definition
1	DCD	Data Carrier Detect
2	RXD	Receive Data
3	TXD	Transmit Data
4	DTR	Data Terminal Ready
5	GND	System Ground
6	DSR	Data Set Ready
7	RTS	Request to Send
8	CTS	Clear to Send
9	RI	Ring Indicator

4) VISCA networking as shown below



1.2.2 Dimension

Ultra HD NDI Camera dimension



Chapter 2 Install Your Product

2.1 Power-on Initial Configuration

1)**Power-on:** Connect DC12V power supply adapter with power supply socket

2)**Initial Configuration:** The remote control receiving indicator flashes after power on, the pan-tilt turns left to the lowest left to the lowest, and then turns to the HOME position (both the horizontal and vertical positions are in the middle), while the movement first shrinks and then stretches. When remote control receiving indicator stops flashing, the self-checking is completed.

Notes:

1. After power on and self-checking, the camera will automatically return to the preset 0 position if it's pre-set.
2. The default address for the IR remote control is 1#. If the menu restored to factory defaults, the remote control default address will restore to 1#.

2.2 Video Output

1) **Network output**

A. Network cable connection: as shown in Figure 1.1 label 7

B. Webpage Login: open your browser and enter 192.168.5.163 (factory default) in the address bar; press Enter to enter into the login page, click on the "player is not installed, please download and install !" and follow the installation steps for installation. Then enter the user name *admin* and password *admin* (factory default); press Enter to enter into the preview page, users can carry out PTZ control, video recording, playback, configuration and other operations.

2) **HDMI Video Output**

A. HDMI video cable connection: as shown in Figure 1.1 label 14

B. Connect the camera and the monitor via HDMI video cable, and the video output is available after the camera self-test.

3) **USB3.0 Video Output**

A. USB 3.0 video cable connection: as shown in Figure 1.1 label 13

B. Connect the camera and the computer via USB3.0 video cable, open the video software and select the image device to output the video.

If the recording and broadcasting host supports LAN network control port, the concentrator can be replaced by LAN network switch.

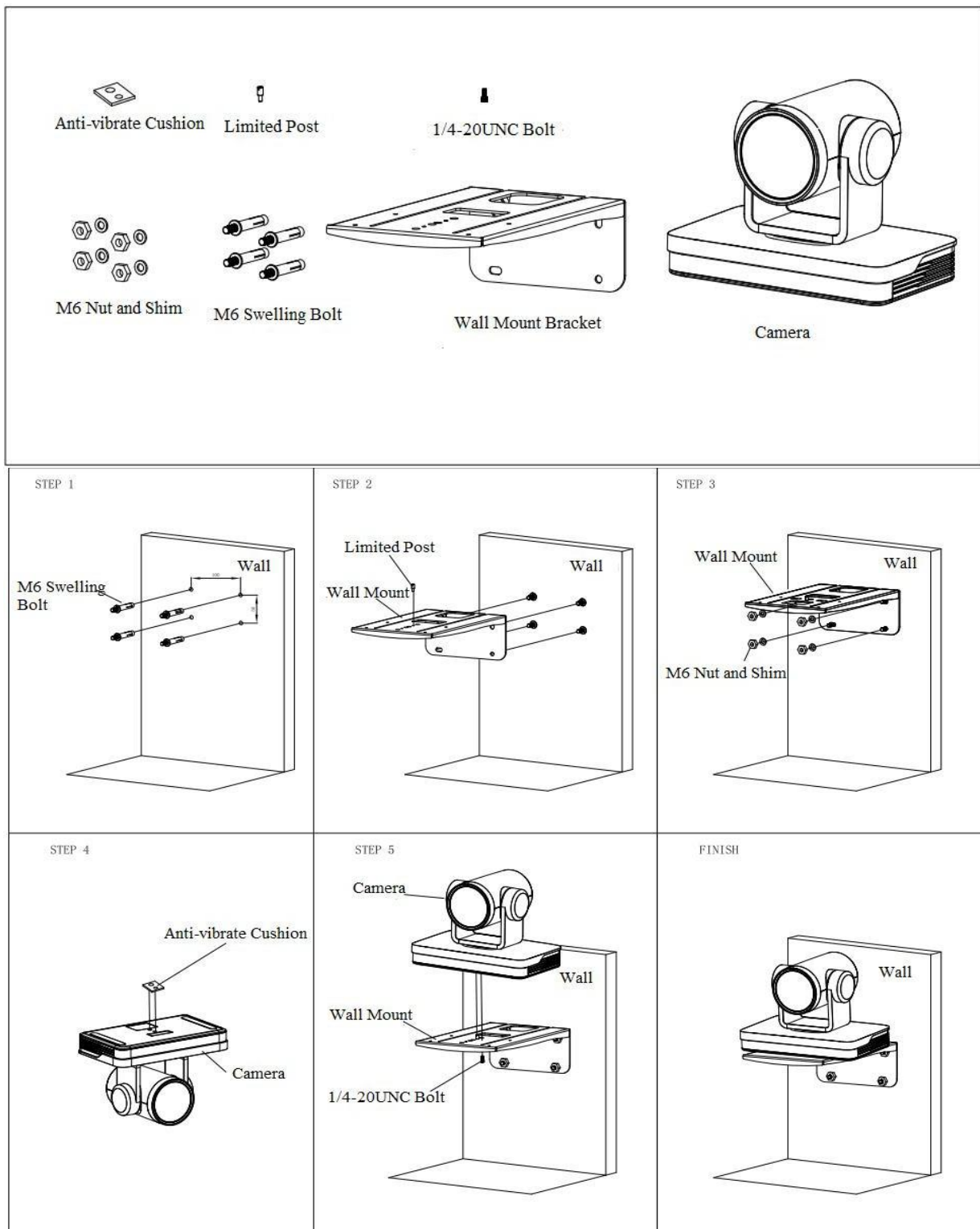
2.3 Bracket Mount

Notes:

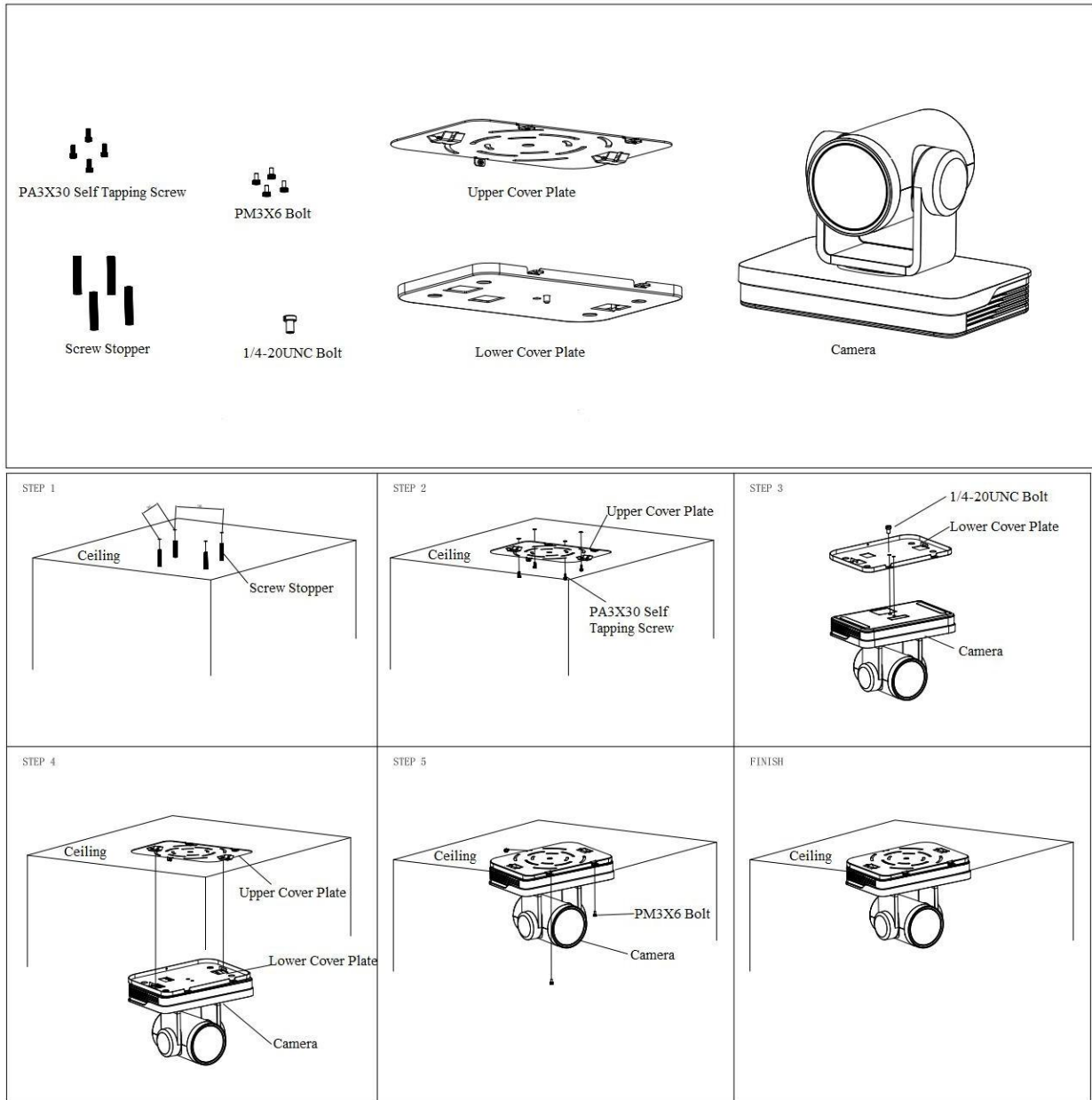
A.Ceiling or wall mounting brackets can only be mounted on template and concrete wall.

B.For safety reason, plasterboard is not recommended.

1) Wall Mounting



2) Ceiling Mounting



Chapter 3 Use Your Product

3.1 Remote Control

3.1.1 Match Code for Wireless Remote Control



One to One Code Matching:

Press the "set" and "*" keys combined for 3 seconds, LED indicator starts flashing. Camera receive the signal and power on, LED indicator will go off if code matching successfully. The camera can be controlled by this wireless remote control only after one to one code pairing. Otherwise please clear the code matching of this remote control, or use other remote control to pair with the camera again.

If one to one code matching failed, the red LED light flashes for 20 seconds and then goes off, camera will stop code match and turn on sleep mode; Press any key to wake up the camera and re-match code.

Note: After code matching successfully, please select the camera address to control it.

Clear Code:

Press the "set" and "*" keys combined for 3 seconds, LED indicator starts flashing. Camera will power off and on, the LED indicator will go off if clear code successfully.

Sleep Mode and Wake Up:

Press any key to wake up the camera from sleep mode.

3.1.2 Keys Introduction for IR Remote Control

- 1) In this manual, "press the key" means a click rather than a long-press, and a special note will be given if a long-press for more than one second is required.
- 2) When a key-combination is required, do it in sequence. For example, "【*】 + 【#】 + 【F1】" means press "【*】" first and then press "【#】" and last press "【F1】".

1. Standby Key

The camera enters standby mode if long press 3s on standby key;

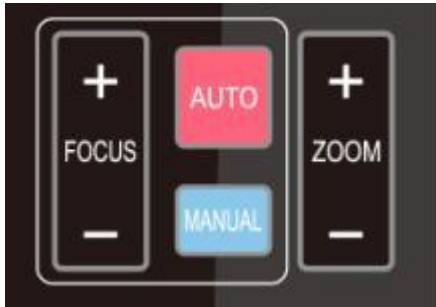
Long press 3s again on the standby key, the camera will self-check again and return to HOME position (If preset 0 position is set, the camera will return to preset 0 position).

2. Camera Selection



Select the camera address to control

3. Focus Control



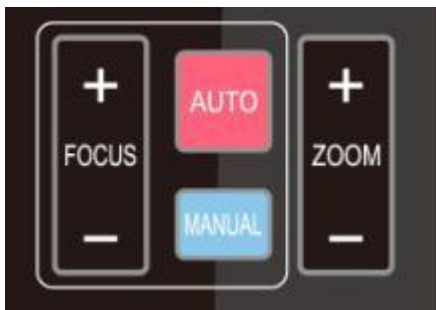
Auto: auto focus mode Manual:
manual focus mode

Focus + (near): Press **【 FOCUS + 】** key (Valid only in manual focus mode)

Focus - (far): Press **【 FOCUS - 】** key (Valid only in manual focus mode)

Press and hold the keys, the action of focus will keep continue and stop as soon as the key is released.

4. Zoom Control



ZOOM +: press **【 ZOOM + 】** key to zoom in

ZOOM - : press **【 ZOOM - 】** key to zoom out

Press and hold the keys, the action of focus will keep continue and stop as soon as the key is released.

5. Set and Clear Presets



Set Preset: press **【 SET PRESET 】** button, and then press the number key 0-9 to set preset positions.

Note: 10 presets via remote control.

Call Preset: Press a number key 0-9 directly to call a preset position.

Clear Preset: press **【 CLEAR PRESET 】** button, and then press the number key 0-9 to clear preset positions.

Note : press the **【 # 】** key three times continually to clear all presets.

6. Pan/Tilt Control



Up: press ▲ Down: press ▼
Left:press ◀ Right: press ▶
Back to middle position: press“【HOME】”

Press and hold the up/down/left/right key, the pan/tilt movements will keep running, from slow to fast, until it runs to the endpoint; stop as soon as the key is released.

7. Menu Setting



【MENU】 : Open / close the OSD menu

【HOME】 : Camera lens back to the middle position; Confirm button; Enter next menu

【↑】 【↓】 : Choose item

【←】 【→】 : Modify values

【BLC ON/OFF】 : Turn on or off the back light compensation

8. Camera Remote Address Setting



【*】 + 【#】 + 【F1】 : Camera Address No.1

【*】 + 【#】 + 【F2】 : Camera Address No. 2

【*】 + 【#】 + 【F3】 : Camera Address No. 3

【*】 + 【#】 + 【F4】 : Camera Address No. 4

9. Key Combination

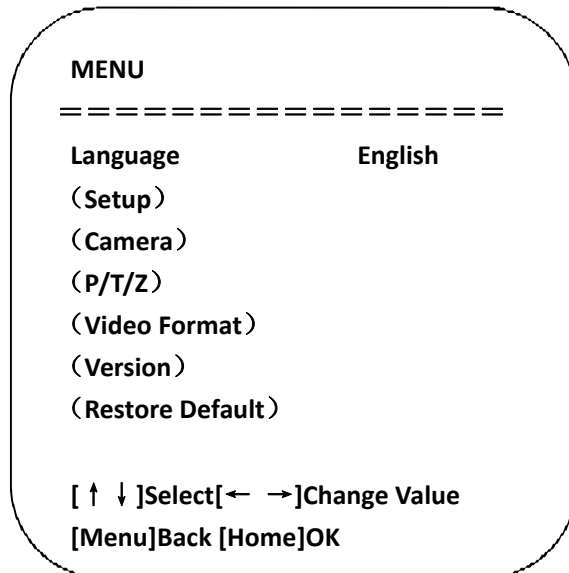


- 1) **【#】 + 【#】 + 【#】** : Clear all presets
- 2) **【*】 + 【#】 + 【6】** : Restore factory defaults
- 3) **【*】 + 【#】 + 【3】** : Menu set to Chinese
- 4) **【*】 + 【#】 + 【4】** : Menu set to English
- 5) **【*】 + 【#】 + 【9】** : Flip switch
- 6) **【*】 + 【#】 + Auto**: Enter aging mode
- 7) **【#】 + 【*】 + Auto**: Exit aging mode
- 8) **【*】 + 【#】 + Manual**: Restore the default user name, password, and IP address
- 9) **【#】 + 【#】 + 【0】** : Switch the video format to 4KP60
- 10) **【#】 + 【#】 + 【1】** : Switch the video format to 4KP50
- 11) **【#】 + 【#】 + 【2】** : Switch the video format to 4KP30
- 12) **【#】 + 【#】 + 【3】** : Switch the video format to 4KP25
- 13) **【#】 + 【#】 + 【4】** : Switch the video format to 1080P60
- 14) **【#】 + 【#】 + 【5】** : Switch the video format to 1080P50
- 15) **【#】 + 【#】 + 【6】** : Switch the video format to 1080P60
- 16) **【#】 + 【#】 + 【7】** : Switch the video format to 1080P50
- 17) **【#】 + 【#】 + 【8】** : Switch the video format to 1080P30
- 18) **【#】 + 【#】 + 【9】** : Switch the video format to 1080P25

3.2 Menu Introduction

3.2.1 Main Menu

In normal working mode, press **【MENU】** key to display the menu, using scroll arrow to point at or highlight the selected items.



Language: Language setting, Chinese / English

Setup: System parameter setting

Camera: Camera parameter setting

P/T/Z: Enter into sub menu

Version: Enter into sub menu

Restore Default: Enter into reset setting, select YES or NO to confirm

[↑↓] Select: For selecting menu

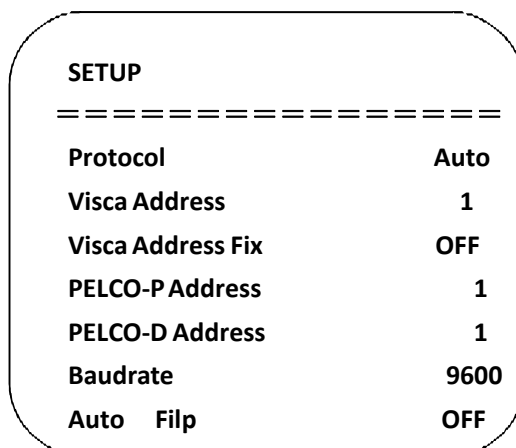
[← →] Change Value: For modifying parameters

[MENU] Back: Press [Menu] to return

[Home] OK: Press [Home] to confirm

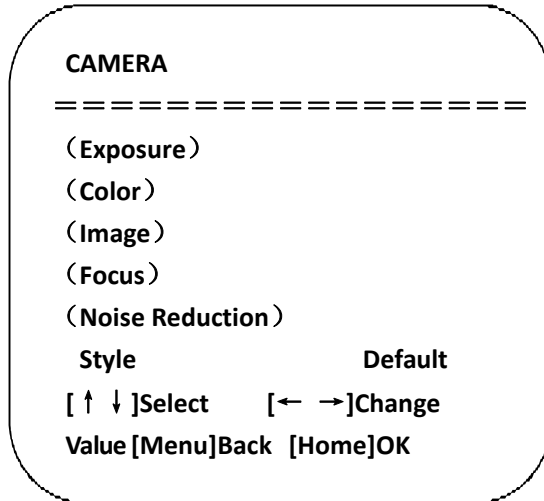
3.2.2 System Setting

Move the pointer to the (Setup) in the Main Menu, click the **【HOME】** key and enter into the (System Setting) as shown below,



Protocol: VISCA/Pelco-P/Pelco-D/Auto
Visca Address: VISCA=1~7 Pelco-P=1~255 Pelco-D=1~255
Baudrate: 2400/4800/9600/115200
Visca Address Fix: On/Off
Auto Filp: On/Off

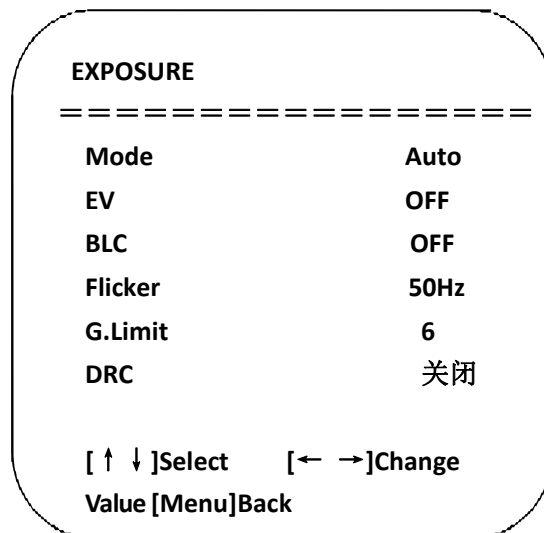
3.2.3 Camera Setting



Move the pointer to the (CAMERA) in the Main Menu, click the 【 HOME 】 key and enter the (CAMERA) as follow,.

1) Exposure Setting

Move the pointer to the (EXPOSURE) in the Main Menu, click the 【HOME】 key and enter into the (Exposure Sub menu) as shown below,

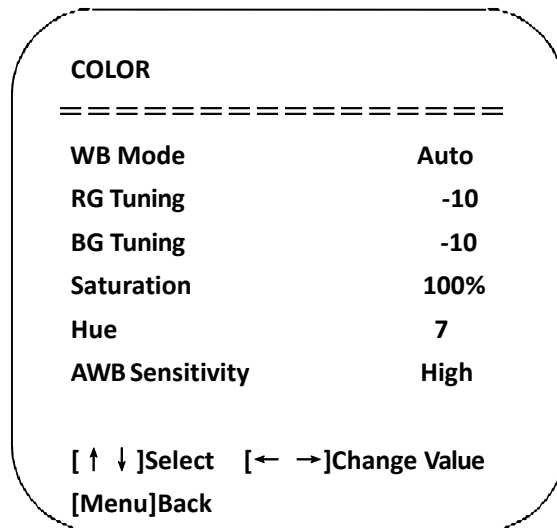


- Exposure:** Enter into Exposure setting
- Color:** Enter into color setting
- Image:** Enter into image setting
- Focus:** Enter into focus setting
- Noise Reduction:** Enter into noise reduction

Mode: Auto, Manual, Shutter priority, Iris priority and Brightness priority.
EV: On/Off (only available in auto mode)
Compensation Level: -7~7 (only available in auto mode when EV is ON)
BLC: ON/OFF for options (only available in auto mode)
Dynamic Range: 1~8, close
Anti-Flicker: OFF/50Hz/60Hz for options (only available in Auto/Iris **priority**/Brightness **priority** modes)
Gain limit: 0~15(only available in Auto/ Iris **priority** /Brightness **priority** mode)
WDR: Off, 1~8
ShutterPriority:1/25,1/30,1/50,1/60,1/90,1/100,1/120,1/180,1/250,1/350,1/500,1/1000,1/2000,1/3000,1/4000, 1/6000, 1/10000 (only available in Manual and Shutter priority mode)
IRIS Priority: OFF, F11.0, F9.6, F8.0, F6.8, F5.6, F4.8, F4.0, F3.4, F2.8, F2.4, F2.0, F1.8(only available in Manual and Iris priority mode)
Brightness: 0~23 (only available in Brightness **priority** mode)

2) Color

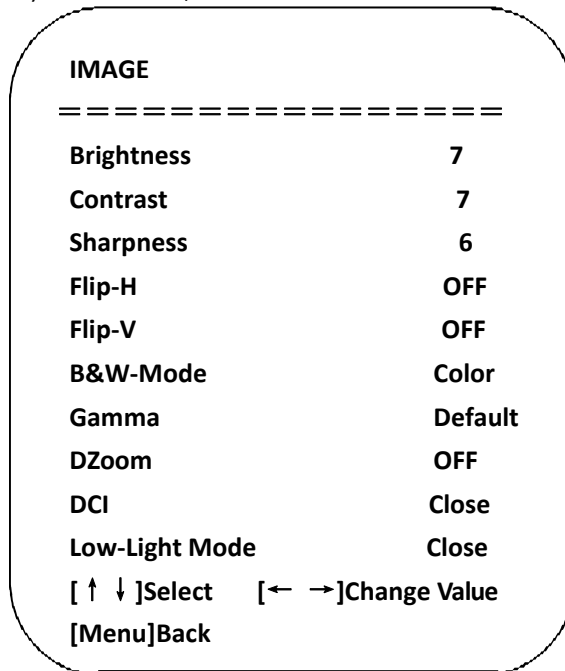
Move the pointer to the (COLOR) in the Main Menu, click the **【HOME】** and enter the (COLOR sub menu) as follow,



WB Mode: Auto, Manual, One Push, 3000K, 3500K, 4000K, 4500K, 5000K, 5500K, 6000K, 6500K,7000K
Saturation: 60%,70%,80%,90%,100%,110%,120%,130%,140%,150%,160%,170%,180%,190%,200%
Red fine-tuning: -10~10 (only available in automatic mode)
Blue fine-tunable: -10~10 (only available in automatic mode)
RED GAIN: 0~255(only available in Manual mode)
BLUE GAIN: 0~255(only available in Manual mode)
AWB Sensitivity: high/middle/low
Chroma: 0~14

3) Image

Move the pointer to the (IMAGE) in the Menu, click the **【HOME】** and enter into the (IMAGE sub menu) as follow,



Brightness: 0~14

Contrast: 0~14

Sharpness: 0~15

Flip-H: On/Off

Flip-V: On/Off

B&W Mode: color, black/white

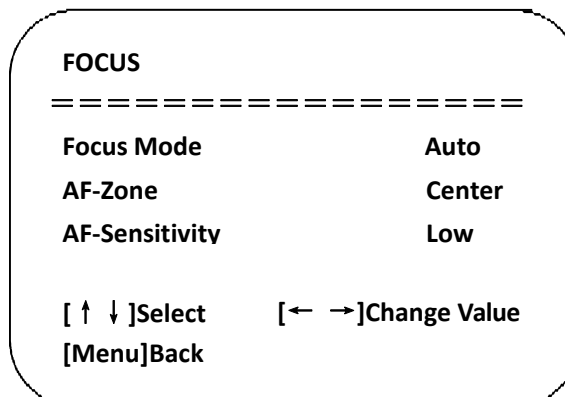
Gamma: Default/0.45/0.50/0.5/0.63

DCI: Dynamic Contrast: Off/1~8

Minimum Illumination: On/Off

4) Focus

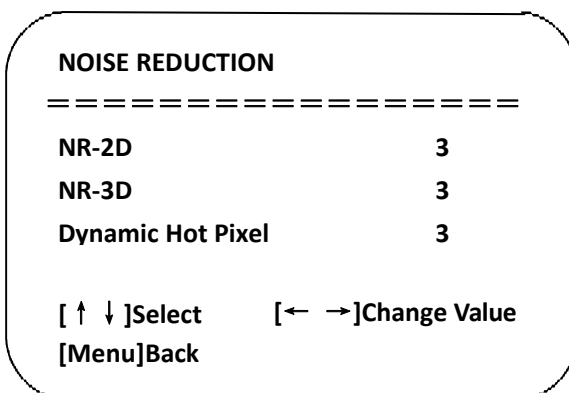
Move the pointer to the (FOCUS) in the Menu, click the **【HOME】** and enter the (FOCUS) as follow,



Focus Mode: Auto/manual
AF-Zone: Up/middle/down
AF-Sensitivity: High/middle/low

5) Noise Reduction

Move the pointer to the (NOISE REDUCTION) in the Menu, click the 【 HOME 】 and enter the (NOISE REDUCTION) as follow,



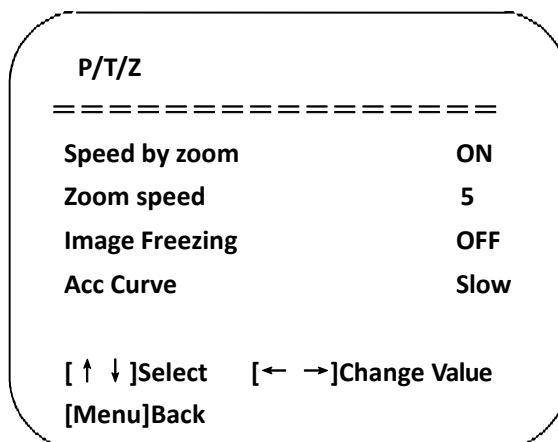
2D Noise Reduction: Auto, close, 1~7

3D Noise Reduction: Close, 1~8

Dynamic Hot Pixel: Close, 1~5

3.2.4 P/T/Z

Move the pointer to the (P/T/Z) in the Main Menu, click the 【 HOME 】 and enter the (P/T/Z) as follow,



Depth of Field: Only effective for the remote controller, On/ Off;
(When zooming in, the PT control speed by remoter will become slow)

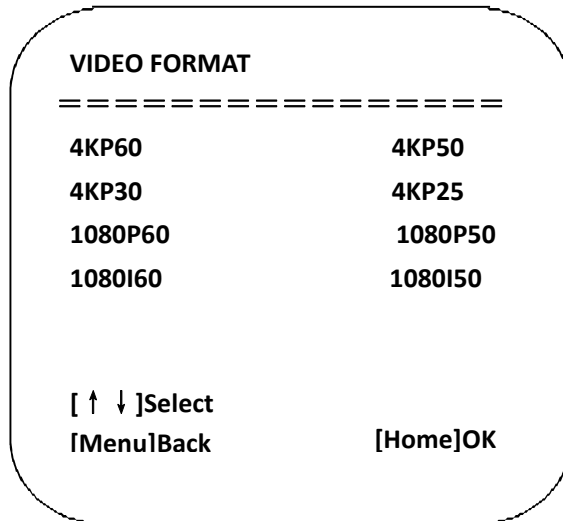
Zoom Speed: Set the zoom speed for the remote controller, 1~8

Image Freezing: On/Off

Accelerating Curve: Fast/Slow

3.2.5 Video Format

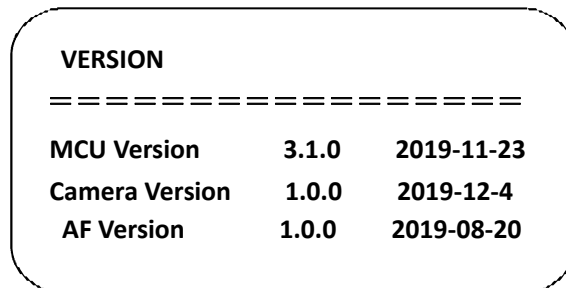
Move the pointer to the (Video Format) in the Menu, click the **【HOME】** and enter the (Video Format) as follow,



Note: Exit menu after modifying parameter to save it after powered off

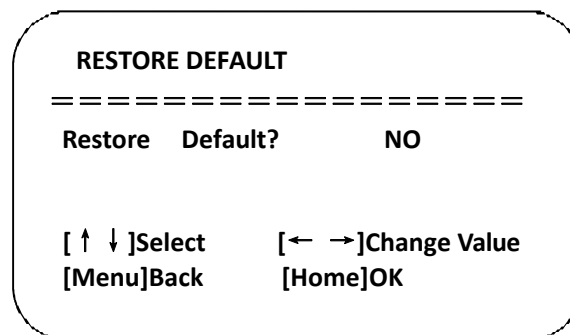
3.2.6 Version

Move the pointer to the (VERSION) in the Main Menu, click the **【HOME】** and enter the (VERSION) as follow,



3.2.7 Restore Default

Move the pointer to the (RESTORE DEFAULT) in the Main Menu, click the **【HOME】** and enter the (RESTORE DEFAULT) as follow,



Restore default: YES/NO. Color style and video format cannot be restored to factory default

Note: If the address of former remoter is not 1 but another one from 2, 3, 4, the corresponding camera address will restore to 1 when all parameters or system parameters are restored. User should change the remoter address to be 1 (press No.1 according to the camera so to get normal operation)

3.3 Network Connection

3.3.1 Connecting Mode

Direct connection: Connect the camera via network cable to external Internet access of the PC

Internet connection mode: Connect the camera to Internet by Router or Switch and user can log in the device by browser.

Note: Please do not put the power and network cable in places where can be easily touched to prevent video quality lowered by unstable signal transmission due to poor contact of cables.

The computer must have the network segment where the camera IP address belong to. The device will not be accessible if without the segment. I.E. The camera default IP address is 192.168.5.163, then segment 5 must be added in the computer. Specific steps are as below:

Firstly open the window of Local Area Connection Properties on computer, select the “Internet protocol version 4(TCP/IPv4)” as shown by picture on the left. Double click or click the property “Internet” protocol version 4 (TCP/IPv4)to enter into the Internet Protocol Version 4(TCP/IPv4) Properties window, select “Advanced” to enter into the Advanced TCP/IP Setting and add IP and subnet mask in the IP browser as picture shown below. Click the “Confirm” to finish the adding of IP segment. User can add the corresponding network segment according to the revised IP address of the camera.

Note: The IP address to be added cannot be same with that of other computers or devices. The existence of this IP address needs to be verified before adding.

To verify whether the network segment has been successfully added, click the “Start” and select “Operation” to input cmd, then click OK and open DOS command window, type ping 192.168.5.26, press Enter key to display information shown below, which means network segment adding is succeeded.

```
C:\Users\qq214>ping 192.168.5.26

Pinging 192.168.5.26 with 32 bytes of data:
Reply from 192.168.5.26: bytes=32 time<1ms TTL=128
Reply from 192.168.5.26: bytes=32 time=1ms TTL=128
Reply from 192.168.5.26: bytes=32 time<1ms TTL=128
Reply from 192.168.5.26: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.5.26:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\Users\qq214>
```

User can also to verify network connection as steps above mentioned after the finish of camera self-check. If IP is default, open DOS command window and input 192.168.5.163, then press Enter key, It will show the message as below, which means network connection is normal.

```
C:\Users\qq214>ping 192.168.5.163

Pinging 192.168.5.163 with 32 bytes of data:
Reply from 192.168.5.163: bytes=32 time=2ms TTL=64
Reply from 192.168.5.163: bytes=32 time=1ms TTL=64
Reply from 192.168.5.163: bytes=32 time<1ms TTL=64
Reply from 192.168.5.163: bytes=32 time=4ms TTL=64

Ping statistics for 192.168.5.163:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 4ms, Average = 1ms

C:\Users\qq214>_
```

3.4 IE Login

3.4.1 Web Client

1) Web Client Login

Input the IP address 192.168.5.163 of the device in the address field of browser and click Enter button to enter into Web Client login page as below picture. User can login as administrator and normal user. If login as administrator (Default User name/Password: admin), users can preview, playback, configuration and cancel in the Web Client; If login in as normal user (Default User name/Password: user1 or user2), users can only preview, playback and logout, no option for configuration.

Note: Web access support browsers: IE, 360 browsers, and other conventional browsers.

Language Selection: click Chinese/English in the upper right corner of the login page to select the language type of the web interface.

2) Download/Install Plug in

When first using IE browser to access the web conferencing camera, the login page will appear "Playback plug-in is not installed, please download and install!" Click on this message, download and install MRWebXinstall.exe, according to information prompts.

After installing the plug, enter user name and password, click and Sign (initial default user name and password: "admin", users can change the user name and password on their own after entering) into the Web client management interface.

3.4.2 Preview

After successful login into the management interface, it enter the video preview interface. In the preview screen, users can control PTZ, zoom, focus, video capture, sound, focus, full screen and set the preset position, run, delete and other operations.

You can record the video and save it on SD Card when SD Card built-in. Video can be saved on the Computer at Local.

1) Login as administrator

User name, password the default admin

PTZ control can be carried out, zoom, focus, video capture, sound, zoom, full screen and set the preset position, run, and delete; you can preview, playback, configuration, logoff.

2) Login as normal user

Default User name/password: user1 or user2

PTZ control can be carried out, zoom, focus, video capture, sound, zoom, full screen and set the preset position, run, and delete; you can preview, playback and logout.

Note : There are no configuration rights for normal user login.

3.4.3 Playback

1) Playback video files

First, please record, snapshot and save the file when previewing. Click "Playback" to enter recording file and picture files playback page, and then select the file "Video File" and click Search, and search out the video file, click Play to play the video file.

2) Playback picture files

First, please record, snapshot and save the file when previewing. Click "Playback" to enter recording file and picture files playback page, and then select the file "Image File" and click Search, and search out the video file, click Play to play the image file.

The default storage directory of local video/capture files is D:\MyIPCam\

3.4.4 Configuration

Click G to enter into the device parameters setting page

There are the following options: Local configuration, audio configuration, video configuration, network configuration, PTZ configuration, internet access configuration, system configuration, detailed description see the following table.

Menu	Explanation
Local configure	Including video preview mode, record video packing time ,record video storage route settings etc.
Audio configure	Including audio compressing format, sampling frequency, sampling precision, compressing code rate settings etc.
Video configure	Including video encoding, video parameters, character-overlapping, character size, video output setting etc.
Network configure	Including basic parameters, Ethernet, DNS, GB28181, wireless network setting etc.
System configure	Including equipment property, system time, user management, version update, reset, reboot device settings etc.

1) Local configuration

Video Preview Mode: User can choose real-time priority or fluency priority: The delay will be small when under real time priority mode and fluency will be good when under fluency priority mode. Setting based on the user need (Default value: real time normal (2), real time best (1), fluency normal (3), fluency good (4) and fluency best (5))

Recording packing time (minute): Set recording video packing time (default is 10, range from 1~120 minutes)

Recording file packaging format type: Set the video file packaging format type (default MP4, TS optional)

Recording/Snapshot file storage route: Set local recording video/snapshot file storage route. (Default D:\MyIPCam\)

Click the **Save** button to make settings effective.

2) Audio Configuration

Switch: Choose to enable the audio or not.

Compressing Format: Set audio compressing format and the device will reboot automatically after change (default MP3, AAC, G.711A optional)

Sampling Frequency: Set sampling frequency and the device will reboot automatically after change (default

44100, 8000, 16000, 32000 and 48000 optional, G.711A default 8000)

Sampling Precision: Set sampling precision (default 16bits)

Compressing Code Rate: Set audio compressing code rate (default 64bits, 32, 48, 96, 128bits optional)

Input Volume: Set the input volume (default 2, 1-10 optional)

Click "Save", it will remind "Enable has changed. Restart the device to take effect after the success of the save.", then please reboot the camera to make new setting effect.

3.4.5 Video Configuration

1) Video Encoding

Code stream: Stream: Different video output mode setting, use different streams.(Main stream, secondary stream)

Compression Format: Set the video compression format, save and reboot to take it effect (main / secondary stream default: H.264, H.265 optional)

Profile: Set Profile mode (default HP, BP, MP optional)

Video Size: Set video image resolution, save and reboot to take it effect (main stream default 1920*1080, 3840*2160, 2592*1944, 2304*1296, 1920*1080, 1280*720 optional; default secondary stream 320*180, 640*360, 320*240, 640*480, 320*180, 1280*720 optional)

Stream Rate control: Set rate control mode, save and reboot to take it effect (main / secondary stream default variable bit rate, fixed rate is for option).

Image Quality: Set the image quality, image quality can be changed only when rate control is variable bit rate,(main stream defaulted is better, secondary stream default is not good, there are best, better, good, bad, worse, worst for options).

Rate (Kb / s): Set the video bit rate (main stream default 8192b/s, 64-40960Kb/s optional; secondary stream default 512Kb/s, 64-40960Kb/s optional).

Frame rate (F/S): Set the video frame rate (main/ secondary stream default 25F/S, main stream 5-60F/S optional, secondary stream 5-30F/S optional).

Key frame interval: Set the key frame interval (main / secondary stream default 100, main stream 1-300F optional, secondary stream 1-150F optional).

Stream Name: When streaming via rtsp or rtmp, user can modify stream name. Main Stream (live/av0), secondary stream (live/av1)

Click the "Save" button to display the "saved successfully" message, then settings take effect.

2) Stream Release

Switch: To turn on/off the main / secondary stream.

Protocol: Primary / secondary stream applies RTMP protocol.

Host Port: Server port number (default 1935, 0-65535 optional)

Host Address: Server IP addresses (default 192.168.5.11)

Stream Name: Choose a different stream name (live / av0, live / av1 optional).

User: Set the user name.

Password: Set the password.

Click on the "Save" button to display the "Save successful" message, then settings take effect.

Method of obtaining RTSP: RTSP:// device IP address: 554 / live / av0 (av0 main stream; av1 secondary stream)

3) RTP Broadcasting

Main/Sub Stream:On/off

Protocol: RTP or TS

Address: Default 224.1.2.3. It can be edited.

Port: Main Stream Default Port: 4000, Sub Stream Default Port: 4002

Visit: Address comes up after setting. Eg ; rtp: //224.1.2.3:4000; udp: //@224.1.2.3:4000

4) Video Parameters

a.Focus: Focus mode, focus range, focus sensitivity can be set.

Focus Mode: Set the focus mode (the default auto, manual optional)

Focus range: Set the focus range (the default middle, the upper and lower optional)

Focus Sensitivity: Set the focus sensitivity (default is low, high, medium optional)

b.Exposure: Exposure mode, exposure compensation, back light compensation, anti-flicker, gain limit, wide dynamic, shutter speed, aperture value and brightness can be set.

Exposure Mode: Set the exposure mode (the default automatic, manual, shutter priority, aperture priority, Brightness priority optional)

Exposure compensation: Exposure compensation setting is active when it is auto status (default is off). **Exposure**

compensation value: Set the exposure compensation value, valid when it is set for auto (default 0, -7 to 7 optional).

BLC: Set back light compensation, valid when it is auto status (default is off).

Anti-flicker: Set up anti-flicker mode, valid when status of automatic, aperture or brightness priority (default 50Hz, closed, 60Hz optional).

Gain limit: Set the gain limits, auto, active when it is status of aperture or brightness priority (default 4, 0-15 optional).

Dynamic range: Set the dynamic range (default 4, 1-8 optional).

Shutter speed: Active when it is status of manual or shutter-priority (default 1/100, 1/25, 1/30, 1/50, 1/60, 1/90, 1/100, 1/120,1/180,1/250,1/350,1/500,1/1000,1/2000,1/3000,1/4000,1/6000,1/10000 optional).

Aperture value: Set the aperture value, active when it is status of manual or aperture-priority(default F1.8, closed F11, F9.6, F8.0, F6.8, F5.6, F4.8, F4.0, F3.4, F2.8, F2.4, F2.0, F1.8 optional).

Brightness: Set the brightness value, active when it is a state of brightness priority (default 7, 0-23 optional).

c.Color: White balance, saturation, color, white balance, sensitivity, color temperature, gain red and blue gain can be set.

White balance modes: Set the white balance mode (the default automatic, 3000K, 3500K, 4000K, 4500K, 5000K,5500K, 6500K, 7000K manual, One-push optional).

Note: Click the "Correction" button when selected the One-push white balance mode.

Red fine-tuning: Default -10~10 (only available in automatic mode)

Blue fine-tunable: Default -10~10 (only available in automatic mode)

Saturation: Set the saturation (default 60%, 70%, 80%, 90%, 100%, 110%, 120%, 130%, 140%, 150%, 160%, 170%, 180%, 190%, 200% optional).

Auto white balance Sensitivity: Sensitivity Auto white balance settings (default is low, high, medium optional).

Chroma: Set the chroma (default 7, 0-14 optional).

White balance sensitivity: Set the white balance sensitivity (Default setting: High, with low, middle for options)

Red Gain: Set the red gain, effective when it is manual (default 145, 0-255 optional).

Blue Gain: Sets the Blue gain, effective when it is manual (default 56, 0-255 optional).

d.Image: Brightness, contrast, sharpness, black and white mode, the gamma curve, Horizontal Flip and Vertical Flip can be set.

Brightness: Set the brightness (default 7, 0-14 optional).

Contrast: Set the contrast (default 7, 0-14 optional).

Sharpness: Set the sharpness value (default 6, 0-15 optional).

Black and white mode: Set black and white mode (default color, black/white optional).

Gamma: Gamma value setting (default, 0.45, 0.50, 0.55, 0.63 optional).

Dynamic Contrast: Set the dynamic contrast (default off, 1~8 optional)

Flip Horizontal: Set Flip Horizontal (default Off, On optional).

Flip Vertical: Set vertical flip (default Off, On optional). Electronic

Zoom: Set the electronic zoom (default Off, On optional)

a. **Noise Reduction: 2D noise reduction, 3D noise reduction and dynamic dead pixel correction available.** **2D Noise Reduction:** Set 2D noise reduction level (default 3, Auto, 1-7 and Off optional).

3D Noise Reduction: Set 3D noise reduction level (default 5, 1-8 and Off optional).

Dynamic dead pixel correction: Set Dynamic dead pixel correction (default Off, 1-5 optional).

Note: Click "Refresh" to make revision of any video parameters of a, b, c, d, e effective.

5) Character-Overlapping

Display date and time: Set whether to display the time and date (default display).

Display Title: Set whether to display the title (default display).

Font Color of Time: Set font color of time and date (default white, black, yellow, red, and blue optional).

Font Color of Title: Set font color of title (default white, black, yellow, red, and blue optional).

Moving characters: Set the display position of moving date, time and title, click on the "up, down, left, right" buttons to move the corresponding character position.

Title Content: Set title content (default CAMERA1).

Time Content: Set time content (default 1970/01/10 05:36:00)

Click on the "Save" button and display the "Save successful" message, then valid

6) Character Size

Main stream character size: Set the character size of the display, the device will restart automatically after changed and saved (default 48, 28-200 optional)

Secondary stream character size: Set the character size of the display, the device will restart automatically after changed and saved (default 48, 28-200 optional)

Click on the "Save" button to display "Parameter saved successfully" message, set to take effect

7) Video output

Output format: 3840x2160P60, 3840x2160P50, 3840x2160P30, 3840x2160P25, 1080P60, 1080P50, 1080P30, 1080P25, 1080I60, 1080I50, 720P60, 720P50

Click on the "Save" button, it will be valid when display "Save successful".

3.4.6 Network Configuration

1) Network port

Data port: Set the data port, the device will restart automatically after changed (default 3000, 0-65535 optional)

Web Port: Set Web port, the device will restart automatically after changed (default is 80, 0-65535 is optional)

Onvif Port: Set Onvif port, the device will restart automatically after changed (default 2000, 0-65535 optional)

Soap Port: Set Soap port (default 1936, 0-65535 optional)

RTMP Port: Set RTMP port (default 1935, 0-65535 optional)

RTSP Port: Set RTSP port, the device will restart automatically after changed (default 554, 0-65535 optional).

Visca Port: Set Visca port, the device will restart automatically after changed (default 3001, 0-65535 optional).

Click on the "Save" button, it will be valid when display "Save successful".

RTSP Obtaining method: rtsp: // device IP address: 554 / live / av0 (av0 main stream; av1 secondary stream)

RTMP Obtaining method: rtmp: // device IP address: 1935 / live / av0 (av0 main stream; av1 secondary stream)

2) Ethernet parameters

DHCP: Enable or disable obtain IP automatically can be set. Save changes and reboot the device to takes effect (default: OFF)

IP Address: Set the IP address, save changes and reboot the device to takes effect (default 192.168.5.163). Note: This IP address is the same with the one used to login Web page.

Subnet Mask: Set the subnet mask (default 255.255.5.0).

Default Gateway: Set the default gateway (default 0.0.0.0).

Physical Address: Set the physical address (the parameter is read-only but can not be modified).

Click on the "Save" button, it will be valid when display "Save successful". (Note: To prevent IP conflicts When modify)

3) DNS parameters

Preferred DNS server: Set the preferred DNS server. (Default 0.0.0.0).

Alternate DNS server: Alternate DNS server settings. (Default 0.0.0.0). Click on the "Save" button, it will be valid when display "Save successful".

4) GB28181

Switch: Set whether open GB28181, can check

Time Synchronization: Whether synchronization time is set, you can check

Stream Type: Stream type setting (the default main stream, secondary stream optional)

Sign effective time (in seconds): 3600 Range 5-65535

Heartbeat time (seconds): 60 Range 1-65535

Register ID: 34020000001320000001

Register User name:IPC

Register Password:12345678

Equipment ownership: Users can add their own

Administrative regions: Users can add their

own Alarm Zone: Users can add their own

Equipment installation address: Users can add their

own Local SIP Port: 5060 Range 0-65535

GB28181 Server Address: IP address of the computer

Server SIP Port: 5060 Range 0-65535

Server ID: 34020000002000000001

Click on the "Save" button, it will be valid when display "Save successful".

3.4.7 System Configuration

1) Device Properties

Device Name: Set the device name (the default Camera1, user can add their own). Device ID: Set the device ID (default 1, Read-Only).

System Language: Set the system language (default Simplified Chinese, English optional).Need to re-login after modify and save the setting.

Click on the "Save" button, it will be valid when display "Save successful".

2) System Time

Date Format: Set the date format (YYYY-MM-DD default That year - month - day, MM-DD-YYYY namely Month - Day - Year, DD-MM-YYYY date - month - year Optional).

Date separator: Set the date separator (default '/', '-', ' ' Optional).

Time Zone: Set the time zone (default East eight districts, other time zones optional).

Time Type: Set the time types (default 24 hours, optional 12 hours).

Time setting: Set time mode (to choose the computer time synchronization, NTP server time synchronization, or set manually).

Computer Time: Set the computer synchronization valid.

Update interval: Set the NTP server automatic updated time interval. Valid after setting NTP server synchronization (default one day, 2-10 days Optional).
NTP server address or domain name: Set NTP server address or domain name (default time.nits.gov). Valid after setting NTP server synchronization.
NTP Server Port: Sets the NTP server port (default 123).Valid after setting NTP server synchronization. Set the time manually, Effective when set manually.
Click on the "Save" button, it will be valid when display "Save successful".

3) User Management

Select users: Set the user type (the default administrator, Common User 1, Common User 2 optional)
User name: Set the user name (Select User Administrator default admin; select a common user1 default user1; to select a common user 2 default user2; user can modify their own)
Password: Set a password (Select User Administrator default admin; select a common user1 default user1; to select a common user 2 default user2; user can modify their own).
Password confirmation: Confirm the input passwords are the same or not.
Click on the "Save" button to display the "Save successfully" message, then the set is to take effect.

Please note the case-sensitivity of the user name and password.
If login page by a common user's name and password, one does not have configuration privileges but can only operate to preview, playback, logout.

4) Version upgrade

Users only read the version information above which is consistent with the menu version but can not modify. Different types of the machine has different information.
Update file: Click "Browse ..." installation, to select the upgrade file in the pop-up window.
Click on the "Upgrade" button, the upgrade dialog will appear, the device will reboot automatically after update successfully.
(Note: Make sure the power and network is keeping connected during the process, or the upgrade will fail)

Note: After the version upgrade is complete, you need to restore factory defaults; a. through web to restore the factory default configuration; b. through the recovery menu; c. remote control shortcut * # 6;
Choose one of the above three ways. The IP account and password of mode a are also restored to default.

5) Restore factory setting

Click on pop-up "Restore Factory Defaults" button and choose "yes" or "no", then the device will restart automatically and restore factory setting.

6) Reboot

Click on the pop-up "Reboot" button and choose "yes" or "no", then the device will restart automatically.

3.4.8 Logout

Point "Logout" pop-up "Confirmation" dialog; select "Yes" or "No", choose "Yes" to exit the current page and return to the user login interface again.

Chapter 4 Ordering Codes

4.1 Product

981-0011-10-0

RGB12X-UNDI-WH 4K Ultra HD NDI Camera

Chapter 5 Support

5.1 Contact us

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5.2 Camera Maintenance and Troubleshooting

5.2.1 Camera Maintenance

- 1) Please power off the camera and disconnect the power adapter and socket, if it's not used for a long run.
- 2) Use soft cloth or tissue to clean the camera cover.
- 3) Wipe it with a soft, dry cloth when cleaning the camera lens. Wipe it gently with a mild detergent if needed. Do not use strong or corrosive detergents to avoid scratching the lens and affecting the video quality.

5.2.2 Troubleshooting

1) No video output

- a, Check whether the camera power supply is connected, the voltage is normal, the power indicator is lit.
- b, Whether the machine could do self-inspection after restarted.
- c, Check whether the bottom of the DIP switch is the normal operating mode (see Table 2.2 and Table 2.3)
- d, Check whether the video output cable or video display is normal

2) No image sometimes

- a, Check whether the video output cable or video display is normal

3) Image dithering when zoom-in or zoom-out

- a, Check whether the camera installation position is solid
- b, Whether there is shaking machine or objects around the camera

4) Remote controller can not work

- a, Remote control address is set to 1 (if the machine is set back to the factory defaults, remote control addresses need to be back to 1 too)
- b, Check whether the battery is installed on the remote controller or low .
- c, Check the camera working mode is the normal operating mode
 - d, Check the menu whether is closed, camera control through remote controller is only available after exiting the menu. If video output from LAN, menu will not be displayed, menu will automatically exist 30s later, then it can be controlled by remote controller.

5) Serial port can not work.

- a, Check whether the camera serial device protocol, baud rate, address is consistent
- b, Check whether the control cable is connected properly
- c, Check whether the camera working mode is the normal operating mode

6) Web pages can not log in

- a, Check whether the camera is showing normally.
 - b, Check whether the network cable is connected properly (Ethernet port yellow light flashes to indicate normal network cable connection)
 - c, Check whether your computer is added the segment and the segment is consistent with the IP address of the camera
 - d, Click "Start" and select "Run" and then type "cmd" in the computer; Click "OK" then turn on a DOS command window to enter ping 192.168.5.163. Press the Enter key to appear message as follows: Description network connection is normal

```
Admin C:\Windows\system32\cmd.exe
C:\Users\Administrator>ping 192.168.5.163 64
Ping 192.168.5.163 with 32 bytes of data:
Reply from 192.168.5.163:bytes=32 times<1ms TTL=64
Reply from 192.168.5.163:bytes=32 times<1ms TTL=64
Reply from 192.168.5.163:bytes=32 times<1ms TTL=64
Reply from 192.168.5.163:bytes=32 times<1ms TTL=64
Ping statistics for 192.168.5.163
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\Users\Administrator>_
```

Chapter 6 Appendix

6.1 Specification

Connectors	Video(Output)	HDMI	1×HDMI-A	
		USB3.0	1×USB-B	
		LAN	1×RJ45	
	Audio	Input	1×3.5mm Stereo Jack	
	Communication	RS232 In/Out	2×DIN 8	
		RS422 (RS485)	1×4Pin Terminal	
Performance	Camera	Optical Zoom	12X	
		Focus	f=3.85 mm ~ 43.06 mm ±5%	
		View Angle	Horizontal: 7.59° (tele) ~ 80.4° (wide)	
			Tilt:4.6° (tele) ~ 50.0° (wide)	
		Effective Pixels	8.51m,16:9	
		Aperture	F1.8 ~ F3.56±5%	
		Minimum Illumination	0.05 lux (F1.8, AGC ON)	
		DNR	2D & 3D DNR	
		White Balance	Auto / Manual/ One Push/ Specified color temperature	
		Focus Mode	Auto / Manual/ One Push	
		Explosure Mode	Auto / Manual / Shutter Priority / Iris Priority / Whiteness Priority	
		Shutter Speed	1/25~1/10000	
		Dynamic range	OFF/ Dynamic level adjustment	
		BLC	ON/OFF	
	Video Adjustment	Brightness/Color/Saturation/Contrast/Sharpness/B/W mode/Gamma curve		
	SNR	≥50dB		
Pan-and-Tilt Parameter	Pan/Tilt	-110°~+110°/-30°- +30°		
	Rotation			
	Pan/Tilt Control Speed	0.1~100°/S ; 0.1~70°/S		
	Preset Speed/Numbers	Pan:100°/S, Tilt:70°/S; Up to 255 preset positions (10 remote control)		
Audio Compression Format	AAC,MP3,G.711A			
Video Compression Format	LAN:H.264, H.265	USB3.0: MGPG, H.264, YUY2, NV12		
Output Resolutions	HDMI	720p@50/60 1080i@50/60 1080p@25/30/50/60		
	SMPTE	2160p@25/30/50/60		
	USB 3.0			

		YUY2/NV12	320×176@25/30 640×360@25/30 640×480@25/30 960×540@25/30 1280×720@25/30 1920×1080@25/30
		MJPEG/H.264/H.265	320×176@25/30 640×360@25/30 640×480@25/30 960×540@25/30 1280×720@25/30 1920×1080@25/30 3840×2160@25/30
	Control Protocol	VISCA Pelco-D Pelco-P	
	Baud Rate(bps)	115200 9600 4800 2400bps	
	Network Protocol	RTSP RTMP ONVIF GB/T28181 NDI VISCA	
Power	Input Voltage	DC12V	
	Max Power	18W	
Environment	Temperature	-10℃～50℃	
	Humidity	20%～80%	
Physical	Weight	Net	1.7kg
	Dimension	Net	220mm×144mm×159mm

6.2 VISCA Protocol List

6.2.1 Camera Return Command

Ack/Completion Message		
	Command packet	Note
ACK	z0 41 FF	Returned when the command is accepted.
Completion	z0 51 FF	Returned when the command has been executed.

z = camera address + 8

Error Messages		
	Command packet	Note
Syntax Error	z0 60 02 FF	Returned when the command format is different or when a command with illegal command parameters is accepted
Command Not Executable	z0 61 41 FF	Returned when a command cannot be executed due to current conditions. For example, when commands controlling the focus manually are received during auto focus.

6.2.2 Camera Control Command

Command	Function	Command packet	Note
AddressSet	Broadcast	88 30 0p FF	p: Address setting
IF_Clear	Broadcast	88 01 00 01 FF	I/F Clear
CommandCancel		8x 21 FF	
CAM_Power	On	8x 01 04 00 02 FF	Power ON/OFF
	Off	8x 01 04 00 03 FF	
CAM_Zoom	Stop	8x 01 04 07 00 FF	
	Tele(Standard)	8x 01 04 07 02 FF	
	Wide(Standard)	8x 01 04 07 03 FF	

Command	Function	Command packet	Note
	Tele(Variable)	8x 01 04 07 2p FF	p = 0(low) - F(high)
	Wide(Variable)	8x 01 04 07 3p FF	
	Direct	8x 01 04 47 0p 0q 0r 0s FF	pqrs: Zoom Position
CAM_Focus	Stop	8x 01 04 08 00 FF	
	Far(Standard)	8x 01 04 08 02 FF	
	Near(Standard)	8x 01 04 08 03 FF	
	Far(Variable)	8x 01 04 08 2p FF	p = 0(low) - F(high)
	Near (Variable)	8x 01 04 08 3p FF	
	Direct	8x 01 04 48 0p 0q 0r 0s FF	pqrs: Focus Position
	Auto Focus	8x 01 04 38 02 FF	
	Manual Focus	8x 01 04 38 03 FF	
CAM_Zoom Focus	Direct	8x 01 04 47 0p 0q 0r 0s 0t 0u 0v 0w FF	pqrs: Zoom Position tuvw: Focus Position
CAM_WB	Auto	8x 01 04 35 00 FF	
	3000K	8x 01 04 35 01 FF	
	4000k	8x 01 04 35 02 FF	
	One Push mode	8x 01 04 35 03 FF	
	5000k	8x 01 04 35 04 FF	
	Manual	8x 01 04 35 05 FF	
	6500k	8x 01 04 35 06 FF	
CAM_RGain	Reset	8x 01 04 03 00 FF	Manual Control of R Gain
	Up	8x 01 04 03 02 FF	
	Down	8x 01 04 03 03 FF	
	Direct	8x 01 04 43 00 00 0p 0q FF	pq: R Gain
CAM_Bgain	Reset	8x 01 04 04 00 FF	Manual Control of B Gain
	Up	8x 01 04 04 02 FF	
	Down	8x 01 04 04 03 FF	
	Direct	8x 01 04 44 00 00 0p 0q FF	pq: B Gain
CAM_AE	Full Auto	8x 01 04 39 00 FF	Automatic Exposure mode
	Manual	8x 01 04 39 03 FF	Manual Control mode
	Shutter priority	8x 01 04 39 0A FF	Shutter Priority Automatic Exposure mode
	Iris priority	8x 01 04 39 0B FF	Iris Priority Automatic Exposure mode
	Bright	8x 01 04 39 0D FF	Bright mode
CAM_Shutter	Reset	8x 01 04 0A 00 FF	Shutter Setting
	Up	8x 01 04 0A 02 FF	
	Down	8x 01 04 0A 03 FF	
	Direct	8x 01 04 4A 00 00 0p 0q FF	pq: Shutter Position
CAM_Iris	Reset	8x 01 04 0B 00 FF	Iris Setting
	Up	8x 01 04 0B 02 FF	
	Down	8x 01 04 0B 03 FF	
	Direct	8x 01 04 4B 00 00 0p 0q FF	pq: Iris Position
CAM_Gain Limit	Gain Limit	8x 01 04 2C 0p FF	p: Gain Positon
CAM_Bright	Reset	8x 01 04 0D 00 FF	Bright Setting
	Up	8x 01 04 0D 02 FF	
	Down	8x 01 04 0D 03 FF	

Command	Function	Command packet	Note
	Direct	8x 01 04 4D 00 00 0p 0q FF	pq: Bright Positon
CAM_ExpComp	On	8x 01 04 3E 02 FF	Exposure Compensation ON/OFF
	Off	8x 01 04 3E 03 FF	
	Reset	8x 01 04 0E 00 FF	Exposure Compensation Amount Setting
	Up	8x 01 04 0E 02 FF	
	Down	8x 01 04 0E 03 FF	
		Direct	8x 01 04 4E 00 00 0p 0q FF
CAM_Back Light	On	8x 01 04 33 02 FF	Back Light Compensation
	Off	8x 01 04 33 03 FF	
CAM_WDRStrength	Reset	8x 01 04 21 00 FF	WDR Level Setting
	Up	8x 01 04 21 02 FF	
	Down	8x 01 04 21 03 FF	
	Direct	8x 01 04 51 00 00 00 0p FF	p: WDR Level Positon
CAM_NR (2D)		8x 01 04 53 0p FF	P=0-7 0:OFF
CAM_NR (3D)		8x 01 04 54 0p FF	P=0-8 0:OFF
CAM_Gamma		8x 01 04 5B 0p FF	p = 0 – 4 0: Default 1: 0.45 2: 0.50 3: 0.55 4: 0.63
CAM_Flicker	OFF	8x 01 04 23 00 FF	OFF
	50HZ	8x 01 04 23 01 FF	50HZ
	60HZ	8x 01 04 23 02 FF	60HZ
CAM_Aperture	Reset	8x 01 04 02 00 FF	Aperture Control
	Up	8x 01 04 02 02 FF	
	Down	8x 01 04 02 03 FF	
	Direct	8x 01 04 42 00 00 0p 0q FF	pq: Aperture Gain
CAM_Memory	Reset	8x 01 04 3F 00 pq FF	pq: Memory Number(=0 to 254) Corresponds to 0 to 9 on the Remote Commander
	Set	8x 01 04 3F 01 pq FF	
	Recall	8x 01 04 3F 02 pq FF	
CAM_LR_Reverse	On	8x 01 04 61 02 FF	Image Flip Horizontal ON/OFF
	Off	8x 01 04 61 03 FF	
CAM_PictureFlip	On	8x 01 04 66 02 FF	Image Flip Vertical ON/OFF
	Off	8x 01 04 66 03 FF	
CAM_ColorSaturation	Direct	8x 01 04 49 00 00 00 0p FF	P=0-E 0:60% 1:70% 2:80% 3:90% 4:100% 5:110% 6:120% 7:130% 8:140% 9:150% 10:160% 11:160% 12:180% 13:190% 14:200%
CAM_IDWrite		8x 01 04 22 0p 0q 0r 0s FF	pqrs: Camera ID (=0000 to FFFF)
SYS_Menu	ON	8x 01 04 06 06 02 FF	Turn on the menu screen
	OFF	8x 01 04 06 06 03 FF	Turn off the menu screen
IR_Receive	ON	8x 01 06 08 02 FF	IR(remote commander)receive On/Off
	OFF	8x 01 06 08 03 FF	
IR_ReceiveReturn	On	8x 01 7D 01 03 00 00 FF	IR(remote commander)receive message via the VISCA communication ON/OFF
	Off	8x 01 7D 01 13 00 00 FF	
CAM_SettingReset	Reset	8x 01 04 A0 10 FF	Reset Factory Setting
CAM_Brightness	Direct	8x 01 04 A1 00 00 0p 0q FF	pq: Brightness Position

Command	Function	Command packet	Note
CAM_Contrast	Direct	8x 01 04 A2 00 00 0p 0q FF	pq: Contrast Position
CAM_Flip	OFF	8x 01 04 A4 00 FF	Single Command For Video Flip
	Flip-H	8x 01 04 A4 01 FF	
	Flip-V	8x 01 04 A4 02 FF	
	Flip-HV	8x 01 04 A4 03 FF	
CAM_VideoSystem	Set camera video system	8x 01 06 35 00 0p FF	P: 0~E Video format 0:1080P60 8:720P30 1:1080P50 9:720P25 2:1080i60 A: 1080P59.94 3:1080i50 B: 1080i59.94 4:720P60 C: 720P59.94 5:720P50 D: 1080P29.97 6:1080P30 E: 720P29.97 7:1080P25
Pan_tiltDrive	Up	8x 01 06 01 VV WW 03 01 FF	VV: Pan speed 0x01 (low speed) to 0x18 (high speed) WW: Tilt speed 0x01 (low speed) to 0x14 (high speed) YYYY: Pan Position ZZZZ: Tilt Position
	Down	8x 01 06 01 VV WW 03 02 FF	
	Left	8x 01 06 01 VV WW 01 03 FF	
	Right	8x 01 06 01 VV WW 02 03 FF	
	Upleft	8x 01 06 01 VV WW 01 01 FF	
	Upright	8x 01 06 01 VV WW 02 01 FF	
	DownLeft	8x 01 06 01 VV WW 01 02 FF	
	DownRight	8x 01 06 01 VV WW 02 02 FF	
	Stop	8x 01 06 01 VV WW 03 03 FF	
	AbsolutePosition	8x 01 06 02 VV WW 0Y 0Y 0Y 0Y 0Z 0Z 0Z 0Z FF	
	RelativePosition	8x 01 06 03 VV WW 0Y 0Y 0Y 0Y 0Z 0Z 0Z 0Z FF	
	Home	8x 01 06 04 FF	
	Reset	8x 01 06 05 FF	
Pan-tiltLimitSet	Set	8x 01 06 07 00 0W 0Y 0Y 0Y 0Y 0Z 0Z 0Z 0Z FF	W:1 UpRight 0:DownLeft YYYY: Pan Limit Position(TBD) ZZZZ: Tilt Limit Position(TBD)
	Clear	8x 01 06 07 01 0W 07 0F 0F 0F 07 0F 0F 0F FF	

6.2.3 Inquiry Command

Command	Function	Command packet	Note
CAM_PowerInq	8x 09 04 00 FF	y0 50 02 FF	On
		y0 50 03 FF	Off(Standby)
CAM_ZoomPosInq	8x 09 04 47 FF	y0 50 0p 0q 0r 0s FF	pqrs: Zoom Position
CAM_FocusAFModelInq	8x 09 04 38 FF	y0 50 02 FF	Auto Focus
		y0 50 03 FF	Manual Focus
CAM_FocusPosInq	8x 09 04 48 FF	y0 50 0p 0q 0r 0s FF	pqrs: Focus Position
CAM_WBModelInq	8x 09 04 35 FF	y0 50 00 FF	Auto

		y0 50 01 FF	3000K
		y0 50 02 FF	4000K
		y0 50 03 FF	One Push Mode
		y0 50 04 FF	5000K
		y0 50 05 FF	Manual
		y0 50 00 FF	6500K
CAM_RGainInq	8x 09 04 43 FF	y0 50 00 00 0p 0q FF	pq: R Gain
CAM_BGainInq	8x 09 04 44 FF	y0 50 00 00 0p 0q FF	pq: B Gain
CAM_AEModeInq	8x 09 04 39 FF	y0 50 00 FF	Full Auto
		y0 50 03 FF	Manual
		y0 50 0A FF	Shutter priority
		y0 50 0B FF	Iris priority
		y0 50 0D FF	Bright
CAM_ShutterPosInq	8x 09 04 4A FF	y0 50 00 00 0p 0q FF	pq: Shutter Position
CAM_IrisPosInq	8x 09 04 4B FF	y0 50 00 00 0p 0q FF	pq: Iris Position
CAM_Gain LimitInq	8x 09 04 2C FF	y0 50 0p FF	p: Gain Positon
CAM_BrightPosInq	8x 09 04 4D FF	y0 50 00 00 0p 0q FF	pq: Bright Position
CAM_ExpCompModeInq	8x 09 04 3E FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_ExpCompPosInq	8x 09 04 4E FF	y0 50 00 00 0p 0q FF	pq: ExpComp Position
CAM_BacklightModeInq	8x 09 04 33 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_WDRStrengthInq	8x 09 04 51 FF	y0 50 00 00 00 0p FF	p: WDR Strength
CAM_NRLevel(2D) Inq	8x 09 04 53 FF	y0 50 0p FF	P: 2DNRLLevel
CAM_NRLevel(3D) Inq	8x 09 04 54 FF	y0 50 0p FF	P:3D NRLevel
CAM_FlickerModeInq	8x 09 04 55 FF	y0 50 0p FF	p: Flicker Settings(0: OFF, 1: 50Hz, 2:60Hz)
CAM_ApertureInq	8x 09 04 42 FF	y0 50 00 00 0p 0q FF	pq: Aperture Gain
CAM_PictureEffectModeInq	8x 09 04 63 FF	y0 50 00 FF	Off
		y0 50 04 FF	B&W
CAM_MemoryInq	8x 09 04 3F FF	y0 50 0p FF	p: Memory number last operated.
SYS_MenuModeInq	8x 09 06 06 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_LR_ReverseInq	8x 09 04 61 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_PictureFlipInq	8x 09 04 66 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
CAM_ColorSaturationInq	8x 09 04 49 FF	y0 50 00 00 00 0p FF	p: Color Gain setting 0h (60%) to Eh (130%)
CAM_IDInq	8x 09 04 22 FF	y0 50 0p FF	p: Gamma ID
IR_ReceiveInq	8x 09 06 08 FF	y0 50 02 FF	On
		y0 50 03 FF	Off
IR_ReceiveReturn		y0 07 7D 01 04 00 FF	Power ON/OFF
		y0 07 7D 01 04 07 FF	Zoom tele/wide
		y0 07 7D 01 04 38 FF	AF ON/OFF
		y0 07 7D 01 04 33 FF	Camera_Backlight
		y0 07 7D 01 04 3F FF	Camera_Memery
		y0 07 7D 01 06 01 FF	Pan_titleDriver
CAM_BrightnessInq	8x 09 04 A1 FF	y0 50 00 00 0p 0q FF	pq: Brightness Position
CAM_ContrastInq	8x 09 04 A2 FF	y0 50 00 00 0p 0q FF	pq: Contrast Position
CAM_FlipInq	8x 09 04 A4 FF	y0 50 00 FF	Off

		y0 50 01 FF	Flip-H
		y0 50 02 FF	Flip-V
		y0 50 03 FF	Flip-HV
CAM_GammaInq	8x 09 04 5B FF	y0 50 0p FF	p: Gamma setting
CAM_VersionInq	8x 09 00 02 FF	y0 50 ab cd mn pq rs tu vw FF	ab cd : vender ID (0220) mn pq : model ID ST (0510) 、 U2(0512)、 U3 (0513)、 HD (? ?) rs tu : ARM Version vw : reserve
VideoSystemInq	8x 09 06 23 FF	y0 50 0p FF	P: 0~E Video format 0:1080P60 8:720P30 1:1080P50 9:720P25 2:1080i60 A: 1080P59.94 3:1080i50 B: 1080i59.94 4:720P60 C: 720P59.94 5:720P50 D: 1080P29.97 6:1080P30 E: 720P29.97 7:1080P25
Pan-tiltMaxSpeedInq	8x 09 06 11 FF	y0 50 ww zz FF	ww: Pan Max Speed zz: Tilt Max Speed
Pan-tiltPosInq	8x 09 06 12 FF	y0 50 0w 0w 0w 0w 0z 0z 0z 0z FF	www: Pan Position zzzz: Tilt Position

Note:[X] in the above table indicates the camera address to be operated, **[y] = [x + 8]** .

6.3 Pelco-D Protocol Command List

Function	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
Up	0xFF	Address	0x00	0x08	Pan Speed	Tilt Speed	SUM
Down	0xFF	Address	0x00	0x10	Pan Speed	Tilt Speed	SUM
Left	0xFF	Address	0x00	0x04	Pan Speed	Tilt Speed	SUM
Right	0xFF	Address	0x00	0x02	Pan Speed	Tilt Speed	SUM
Upleft	0xFF	Address	0x00	0x0C	Pan Speed	Tilt Speed	SUM
Upright	0xFF	Address	0x00	0x0A	Pan Speed	Tilt Speed	SUM
DownLeft	0xFF	Address	0x00	0x14	Pan Speed	Tilt Speed	SUM
DownRight	0xFF	Address	0x00	0x12	Pan Speed	Tilt Speed	SUM
Zoom In	0xFF	Address	0x00	0x20	0x00	0x00	SUM
Zoom Out	0xFF	Address	0x00	0x40	0x00	0x00	SUM
Focus Far	0xFF	Address	0x00	0x80	0x00	0x00	SUM
Focus Near	0xFF	Address	0x01	0x00	0x00	0x00	SUM
Stop	0xFF	Address	0x00	0x00	0x00	0x00	SUM

Set Preset	0xFF	Address	0x00	0x03	0x00	Preset ID	SUM
Clear Preset	0xFF	Address	0x00	0x05	0x00	Preset ID	SUM
Call Preset	0xFF	Address	0x00	0x07	0x00	Preset ID	SUM
Query Pan Position	0xFF	Address	0x00	0x51	0x00	0x00	SUM
Query Pan Position Response	0xFF	Address	0x00	0x59	Value High Byte	Value Low Byte	SUM
Query Tilt Position	0xFF	Address	0x00	0x53	0x00	0x00	SUM
Query Tilt Position Response	0xFF	Address	0x00	0x5B	Value High Byte	Value Low Byte	SUM
Query Zoom Position	0xFF	Address	0x00	0x55	0x00	0x00	SUM
Query Zoom Position Response	0xFF	Address	0x00	0x5D	Value High Byte	Value Low Byte	SUM

6.4 Pelco-P Protocol Command List

Function	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8
Up	0xA0	Address	0x00	0x08	Pan Speed	Tilt Speed	0xAF	XOR
Down	0xA0	Address	0x00	0x10	Pan Speed	Tilt Speed	0xAF	XOR
Left	0xA0	Address	0x00	0x04	Pan Speed	Tilt Speed	0xAF	XOR
Right	0xA0	Address	0x00	0x02	Pan Speed	Tilt Speed	0xAF	XOR
Upleft	0xA0	Address	0x00	0x0C	Pan Speed	Tilt Speed	0xAF	XOR
Upright	0xA0	Address	0x00	0x0A	Pan Speed	Tilt Speed	0xAF	XOR
DownLeft	0xA0	Address	0x00	0x14	Pan Speed	Tilt Speed	0xAF	XOR
DownRight	0xA0	Address	0x00	0x12	Pan Speed	Tilt Speed	0xAF	XOR
Zoom In	0xA0	Address	0x00	0x20	0x00	0x00	0xAF	XOR
Zoom Out	0xA0	Address	0x00	0x40	0x00	0x00	0xAF	XOR
Stop	0xA0	Address	0x00	0x00	0x00	0x00	0xAF	XOR
Focus Far	0xA0	Address	0x01	0x00	0x00	0x00	0xAF	XOR
Focus Near	0xA0	Address	0x02	0x00	0x00	0x00	0xAF	XOR
Set Preset	0xA0	Address	0x00	0x03	0x00	Preset ID	0xAF	XOR
Clear Preset	0xA0	Address	0x00	0x05	0x00	Preset ID	0xAF	XOR
Call Preset	0xA0	Address	0x00	0x07	0x00	Preset ID	0xAF	XOR
Query Pan Position	0xA0	Address	0x00	0x51	0x00	0x00	0xAF	XOR
Query Pan Position Response	0xA0	Address	0x00	0x59	Value High Byte	Value Low Byte	0xAF	XOR
Query Tilt Position	0xA0	Address	0x00	0x53	0x00	0x00	0xAF	XOR
Query Tilt Position Response	0xA0	Address	0x00	0x5B	Value High Byte	Value Low Byte	0xAF	XOR
Query Zoom Position	0xA0	Address	0x00	0x55	0x00	0x00	0xAF	XOR
Query Zoom Position Response	0xA0	Address	0x00	0x5D	Value High Byte	Value Low Byte	0xAF	XOR

6.5 Terms & Definitions

● **RCA:** Connector used primarily in consumer AV equipment for both audio and video. The RCA connector was developed by the Radio Corporation of America.

● **BNC:** Stands for Bayonet Neill-Concelman. A cable connector used extensively in television (named for its inventors). A cylindrical bayonet connector that operates with a twist-locking motion .

● **CVBS:** CVBS or Composite video, is an analog video signal without audio. Most commonly CVBS is used for transmission of standard definition signals. In consumer applications the connector is typically RCA type, while in professional applications the connector is BNC type.

● **YPbPr:** Used to describe the colour space for progressive-scan. Otherwise known as component video.

● **VGA :** Video Graphics Array. VGA is an analog signal typically used on earlier computers. The signal is non-interlaced in modes 1, 2, and 3 and interlaced when using in mode

● **DVI:** Digital Visual Interface. The digital video connectivity standard that was developed by DDWG (Digital Display Work Group). This connection standard offers two different connectors: one with 24 pins that handles digital video signals only, and one with 29 pins that handles both digital and analog video.

● **SDI:** Serial Digital Interface. Standard definition video is carried on this 270 Mbps data transfer rate. Video pixels are characterized with a 10-bit depth and 4:2:2 color quantization. Ancillary data is included on this interface and typically includes audio or other metadata. Up to sixteen audio channels can be transmitted. Audio is organised into blocks of 4 stereo pairs. Connector is BNC.

● **HD-SDI:** high-definition serial digital interface (HD-SDI), is standardized in SMPTE 292M this provides a nominal data rate of 1.485 Gbit/s.

● **3G-SDI:** standardized in SMPTE 424M, consists of a single 2.970 Gbit/s serial link that allows replacing dual link HD-SDI.

● **6G-SDI:** standardized in SMPTE ST-2081 released in 2015, 6Gbit/s bitrate and able to support 2160p@30.

● **12G-SDI:** standardized in SMPTE ST-2082 released in 2015, 12Gbit/s bitrate and able to support 2160p@60.

● **U-SDI:** Technology for transmitting large-volume 8K signals over a single cable. a signal interface called the ultra high definition signal/data interface (U-SDI) for transmitting 4K and 8K signals using a single optical cable. The interface was standardized as the SMPTE ST 2036-4.

● **HDMI:** High Definition Multimedia Interface: An interface used for the transmission of uncompressed high definition video, up to 8 channels of audio, and control signals, over a single cable.

● **HDMI 1.3:** released on June 22 2006, and increased the maximum TMDS clock to 340 MHz (10.2 Gbit/s). Support resolution 1920 × 1080 at 120 Hz or 2560 × 1440 at 60 Hz). It added support for 10 bpc, 12 bpc, and 16 bpc color depth (30, 36, and 48 bit/px), called deep color.

● **HDMI 1.4 :** released on June 5, 2009, added support for 4096 × 2160 at 24 Hz, 3840 × 2160 at 24, 25, and 30 Hz, and 1920 × 1080 at 120 Hz. Compared to HDMI 1.3, 3 more features added which are HDMI Ethernet Channel (HEC) , audio return channel (ARC), 3D Over HDMI, a new Micro HDMI Connector, an expanded set of color spaces.

● **HDMI 2.0,** released on September 4, 2013 increases the maximum bandwidth to 18.0 Gbit/s. Other features of HDMI 2.0 include up to 32 audio channels, up to 1536 kHz audio sample frequency, the HE-AAC and DRA audio standards, improved 3D capability, and additional CEC functions.

● **HDMI 2.0a:** was released on April 8, 2015, and added support for High Dynamic Range (HDR) video with static metadata.

- **HDMI 2.0b:** was released March, 2016, support for HDR Video transport and extends the static metadata signaling to include Hybrid Log-Gamma (HLG).

- **HDMI 2.1 :** released on November 28, 2017. It adds support for higher resolutions and higher refresh rates, Dynamic HDR including 4K 120 Hz and 8K 120 Hz.

- **DisplayPort:** A VESA standard interface primarily for video, but also for audio, USB and other data. DisplayPort (orDP) is backwards compatible with HDMI, DVI and VGA.

- **DP 1.1:** was ratified on 2 April 2007, and version 1.1a was ratified on 11 January 2008. DisplayPort 1.1 allow a maximum bandwidth of 10.8 Gbit/s (8.64 Gbit/s data rate) over a standard 4-lane main link, enough to support 1920x1080@60Hz

- **DP 1.2:** introduced on 7 January 2010, effective bandwidth to 17.28 Gbit/s support increased resolutions, higher refresh rates, and greater color depth, maximum resolution 3840 × 2160@60Hz

- **DP 1.4:** publish on 1 Mar, 2016. overall transmission bandwidth 32.4 Gbit/s ,DisplayPort 1.4 adds support for Display Stream Compression 1.2 (DSC), DSC is a "visually lossless" encoding technique with up to a 3:1 compression ratio. Using DSC with HBR3 transmission rates, DisplayPort 1.4 can support 8K UHD (7680 × 4320) at 60 Hz or 4K UHD (3840 × 2160) at 120 Hz with 30 bit/px RGB color and HDR. 4K at 60 Hz 30 bit/px RGB/HDR can be achieved without the need for DSC.

- **Multi-mode Fiber:** Fibers that support many propagation paths or transverse modes are called multi-mode fibers, generally have a wider core diameter and are used for short-distance communication links and for applications where high power must be transmitted.

- **Single-mode Fiber:** Fiber that support a single mode are called single-mode fibers. Single-mode fibers are used for most communication links longer than 1,000 meters (3,300 ft).

- **SFP :** small form-factor pluggable , is a compact, hot-pluggable network interface module used for both telecommunication and data communications applications.

- **optical fiber connector:** terminates the end of an optical fiber, and enables quicker connection and disconnection than splicing. The connectors mechanically couple and align the cores of fibers so light can pass. 4 most common types of optical fiber connectors are SC, FC, LC,ST.

- **SC:(Subscriber Connector),** also known as the square connector was also created by the Japanese company – Nippon Telegraph and Telephone. SC is a push-pull coupling type of connector and has a 2.5mm diameter. Nowadays, it is used mostly in single mode fiber optic patch cords, analog, GBIC, and CATV. SC is one of the most popular options, as its simplicity in design comes along with great durability and affordable prices.

- **LC:** (Lucent Connector) is a small factor connector (uses only a 1.25mm ferrule diameter) that has a snap coupling mechanism. Because of its small dimensions, it is the perfect fit for high-density connections, XFP, SFP, and SFP+ transceivers.

- **FC :(Ferrule Connector)** is a screw type connector with a 2.5mm ferrule. FC is a round shaped threaded fiber optic connector, mostly used on Datacom, telecom, measurement equipment, single-mode laser.

- **ST:** (Straight Tip) was invented by AT&T and uses a bayonet mount along with a long spring-loaded ferrule to support the fiber.

- **USB:** Universal Serial Bus is a standard that was developed in the mid-1990s that defines cables, connectors and communication protocols. This technology is designed to allow a connection, communication and power supply for peripheral devices and computers.











- **USB 1.1:** Full-Bandwidth USB, specification was the first release to be widely adopted by the consumer market. This specification allowed for a maximum bandwidth of 12Mbps.

- **USB 2.0:** or Hi-Speed USB, specification made many improvements over USB 1.1. The main improvement was an

increase in bandwidth to a maximum of 480Mbps.

- **USB 3.2:** Super Speed USB with 3 varieties of 3.2 Gen 1(original name USB 3.0), 3.2Gen 2(original name USB 3.1), 3.2 Gen 2x2 (original name USB 3.2) with speed up to 5Gbps,10Gbps,20Gbps respectively.

USB version and connectors figure:

	Type A	Type B	Mini A	Mini B	Micro-A	Micro-B	Type C
USB 2.0							
USB 3.0							
USB 3.1& 3.2							

- **NTSC :** The colour video standard used in North America and some other parts of the world created by the National Television Standards Committee in the 1950s. NTSC utilizes an interlaced video signals.

- **PAL:** Phase Alternate Line. A television standard in which the phase of the colour carrier is alternated from line to line. It takes four full images (8 fields) for the colour-to-horizontal images (8 fields) for the colour-to-horizontal phase relationship to return to the reference point. This alternation helps cancel out phase errors. For this reason, the hue control is not needed on a PAL TV set. PAL, is widely used in needed on a PAL TV set. PAL, is widely used in Western Europe, Australia, Africa, the Middle East, and Micronesia. PAL uses 625-line, 50-field (25 fps) composite colour transmission system.

- **SMPTE:** Society of Motion image and Television Engineers. A global organization, based in the United States, that sets standards for baseband visual communications. This includes film as well as video and television standards.

- **VESA:** Video Electronics Standards Association. An organization facilitating computer graphics through standards.

- **HDCP:** High-bandwidth Digital Content Protection (HDCP) was developed by Intel Corporation an is in wide use for protection of video during transmission between devices.

- **HDBaseT:** A video standard for the transmission of uncompressed video (HDMI signals) and related features using Cat 5e/Cat6 cabling infrastructure.

- **ST2110:** A SMPTE developed standard, ST2110 describes how to send digital video over and IP networks. Video is transmitted uncompressed with audio and other data in a separate streams.

SMPTE2110 is intended principally for broadcast production and distribution facilities where quality and flexibility are more important.

- **SDVoE:** Software Defined Video over Ethernet (SDVoE) is a method for transmission, distribution and management AV signals using a TCP/IP Ethernet infrastructure for transport with low latency. SDVoE is commonly used in integration applications.

- **Dante AV:** The Dante protocol was developed for and widely adopted in audio systems for the transmission of uncompressed digital audio on IP based networks. The more recent Dante AV specification includes support for digital video.

- **NDI:** Network Device interface (NDI) is a software standard developed by NewTek to enable video-compatible

products to communicate, deliver, and receive broadcast quality video in a high quality, low latency manner that is frame-accurate and suitable for switching in a live production environment over TCP (UDP) Ethernet based networks. NDI is commonly found in broadcast applications.

●**RTMP:** Real-Time Messaging Protocol (RTMP) was initially a proprietary protocol developed by Macromedia (now Adobe) for streaming audio, video and data over the Internet, between a Flash player and a server.

●**RTSP :** The Real Time Streaming Protocol (RTSP) is a network control protocol designed for use in entertainment and communications systems to control streaming media servers. The protocol is used for establishing and controlling media sessions between end points.

●**MPEG:** Moving Picture Experts Group is a working group formed from ISO and IEC developing standards that allow audio/video digital compression and Transmission.

●**H.264:** Also known as AVC (Advanced Video Coding) or MPEG-4i is a common video compression standard. H.264 was standardized by the ITU-T Video Coding Experts Group (VCEG) together with the ISO/IEC JTC1 Moving Picture Experts Group (MPEG).

●**H.265:** Also known as **HEVC** (High Efficiency Video Coding) H.265 is the successor to the widely used H.264/AVC digital video coding standard. Developed under the auspices of ITU, resolutions up to 8192x4320 may be compressed.

●**API:** An Application Programming Interface (API) provides a predefined function which allows access capabilities and features or routines via a software or hardware, without accessing source code or understanding the details of inner working mechanism. An API call may execute a function and/or provide data feedback/report.

●**DMX512:** The communication standard developed by USITT for entertainment and digital lighting systems. The wide adoption of the Digital Multiplex (DMX) protocol has seen the protocol used for a wide range of other devices including video controllers. DMX512 is delivered over cable of 2 twisted pairs with 5pin XLR cables for connection.

●**ArtNet:** An ethernet protocol based on TCP/IP protocol stack, mainly used in entertainment/events applications. Built on the DMX512 data format, ArtNet enables multiple “universes” of DMX512 to be transmitted using ethernet networks for transport.

●**MIDI:** MIDI is the abbreviation of Musical Instrument Digital Interface. As the name indicates the protocol was developed for communication between electronic musical instruments and latterly computers. MIDI instructions are triggers or commands sent over twisted pair cables, typically using 5pin DIN connectors.

●**OSC:** The principle of Open Sound Control (OSC) protocol is for networking sound synthesizers, computers, and multimedia devices for musical performance or show control. As with XML and JSON, the OSC protocol allows sharing data. OSC is transported via UDP packets between devices connected on an Ethernet.

●**Brightness:** Usually refers to the amount or intensity of video light produced on a screen without regard to colour. Sometimes called black level.

●**Contrast Ratio:** The ratio of the high light output level divided by the low light output level. In theory, the contrast ratio of the television system should be at least 100:1, if not 300:1. In reality, there are several limitations. Well-controlled viewing conditions should yield a practical contrast ratio of 30:1 to 50:1.

●**Colour Temperature:** The colour quality, expressed in degrees Kelvin (K), of a light source. The higher the colour temperature, the bluer the light. The lower the temperature, the redder the light. Benchmark colour temperature for the A/V industry include 5000°K, 6500°K, and 9000°K.

●**Saturation:** Chroma, Chroma gain. The intensity of the colour, or the extent to which a given colour in any image is free from white. The less white in a colour, the truer the colour or the greater its saturation. Saturation is the amount of pigment in a colour, and not the intensity.

●**Gamma:**The light output of a CRT is not linear with respect to the voltage input. The difference between what you should have and what is actually output is known as gamma.

●**Frame:** In interlaced video, a frame is one complete image.A video frame is made up of two fields, or two sets of interlaced lines. In a film, a frame is one still image of a series that makes up a motion image.

●**Genlock:** Allows synchronisation of otherwise video devices. A signal generator provides a signal pulses which connected devices can reference. Also see Black Burst and Color Burst.

●**Blackburst:** The video waveform without the video elements.It includes the vertical sync, horizontal sync, and the Chroma burst information. Blackburst is used to synchronize video equipment to align the video output.

●**Colour Burst:** In colour TV systems, a burst of subcarrier frequency located on the back part of the composite video signal. This serves as a colour synchronizing signal to establish a frequency and phase reference for the Chroma signal. Colour burst is 3.58 MHz for NTSC and 4.43 MHz for PAL.

●**Colour Bars:** A standard test pattern of several basic colours (white, yellow, cyan, green, magenta, red, blue, and black) as a reference for system alignment and testing. In NTSC video, the most commonly used colour bars are the SMPTE standard colour bars. In PAL video, the most commonly used colour bars are eight full field bars. On computer monitors the most commonly used colour bars are two rows of reversed colour bars

●**Seamless Switching:** A feature found on many video switchers. This feature causes the switcher to wait until the vertical interval to switch. This avoids a glitch (temporary scrambling) which often is seen when switching between sources.

●**Scaling:** A conversion of a video or computer graphic signal from a starting resolution to a new resolution. Scaling from one resolution to another is typically done to optimize the signal for input to an image processor, transmission path or to improve its quality when presented on a particular display.

●**PIP:** Picture-In-Picture. A small image within a larger image created by scaling down one of image to make it smaller. Other forms of PIP displays include Picture-By-Picture (PBP) and Picture- With-Picture (PWP), which are commonly used with 16:9 aspect display devices. PBP and PWP image formats require a separate scaler for each video window .

●**HDR:** is a high dynamic range (HDR) technique used in imaging and photography to reproduce a greater dynamic range of luminosity than what is possible with standard digital imaging or photographic techniques. The aim is to present a similar range of luminance to that experienced through the human visual system.

●**UHD:** Standing for Ultra High Definition and comprising 4K and 8K television standards with a 16:9 ratio, UHD follows the 2K HDTV standard. A UHD 4K display has a physical resolution of 3840x2160 which is four times the area and twice both the width and height of a HDTV/FullHD (1920x1080) video signal.

●**EDID:** Extended Display Identification Data. EDID is a data structure used to communicate video display information, including native resolution and vertical interval refresh rate requirements, to a source device. The source device will then output the provided EDID data, ensuring proper video image quality.

6.6 Revision History

The table below lists the changes to the User Manual.

Format	Time	ECO#	Description	Principle
V1.0	2021-5-8	0000#	Release	Sylvia

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