# AVONIC

# Video Conference Camera USB2.0 Black

AV-CM44-VCUC

# Disclaimer, Contact and CE Marking

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## CE Marking

The Product has a CE Marking. The CE labels are placed at the bottom of the Product and on the packaging. See the respective figures below:
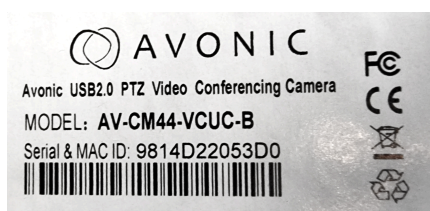


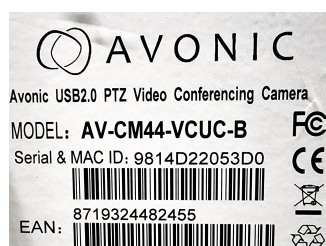*Figure 1: CE Marking (Product)*



*Figure 2: CE Marking (Packaging)*

# EU Declaration of Conformity

The Avonic Declaration of Conformity is in accordance with EN ISO/IEC 17050-1 and generated using the ProductIP compliance platform.

**Table 1: EU Declaration of Conformity**



**CE DECLARATION OF CONFORMITY**

| | |
|---|---|
| 1. Models No: | AV-CM44-VCUC-B |
| 2. Brand Name: | Avonic |
| 3. Product Name: | Video Conference Camera USB2.0 Black |
| 4. Manufacturer: | Avonic |
| | Exportweg 11a |
| | 2645ED Delfgauw |
| | The Netherlands |

3. This declaration of conformity is issued under the sole responsibility of the manufacturer

4. The object of the declaration descibed in point 1 is in conformity with the EMC2014/30/EU

| | |
|---|---|
| 5. Standards | EN 55032: 2015 |
| | EN 61000-3-2: 2014 |
| | EN 61000-3-3: 2013 |
| | EN 55024: 2010+A1: 2015 |

6. Signed for and on behalf of Avonic:

Delfgauw, 25th of April, 2019

Martijn van Bodegom,
Product Manager

# Important Information

## Liability

Avonic will NOT be held responsible for any damage or injury caused by unqualified persons carrying out these tasks, or by not following the instructions in this Manual.

## Intended Use and Non-Intended Use

### Installation

> The following applies to the *installation* of the camera:
> - The installation activities described in this Manual should ONLY be executed by experienced technicians.
> - The installation activities should NOT be executed by minors, mentally disabled persons or other persons not qualified to perform these tasks.

### Operation

> The following applies to the *operation* of the camera:
> - The operational activities described in this Manual should ONLY be executed by people with enough technical knowledge to perform the activities in a safe manner.
> - This Product is specifically developed for video conferencing / streaming via internet by companies, institutes and universities. It is NOT meant for private use in the residential area.
> - This Product should ONLY be used indoors.
> - This Product is NOT a medical device and should NOT be used as a substitute for professional medical judgment. It is NOT designed or intended for use in the diagnosis of disease or other conditions, or in the cure, mitigation, treatment, or prevention of any condition or disease. Please consult your healthcare provider prior to making any decisions related to your health.

## Important Precautions

| | |
|---|---|
| ⚠ | This Product is NOT intended for use where failure of the device could lead to death, personal injury, or severe environmental damage. |
| ⚠ | Be sure that you have COMPLETELY READ and UNDERSTOOD ALL information in this Manual before unpacking, installing and using this Product. Keep the Manual in a safe place for future reference or download it from *www.avonic.com*. |
| ⚠ | Failure to follow the SAFETY NOTES as described in this chapter could result in fire, electric shock, injury, or damage to this Product or other property. |
| ⚠ | Power this Product ONLY with the included cable and power adapter. Other adapters may not meet applicable safety standards, and could pose a risk of death or injury when connected. |

## Symbols Used in This Manual

| Symbol | Meaning | Description |
|---|---|---|
| ⚠ | Danger | Not following the instructions associated with this symbol may lead to personal injury and / or serious damage to the Product. |
| ⚠ | Electrical Shock | Not following the instructions associated with this symbol may lead to life-threatening situations and / or serious damage to the Product. |

| Symbol | Meaning | Description |
|---|---|---|
| ⚠ | Important | The information associated with this symbol requires special attention. |
| ℹ | Information | The information associated with symbol refers to a general remark or a reference to other documentation. |
| 👤 | Instruction | This symbol refers to one or more user instructions. |
| ♻ | Recycling | Specific parts of the Product can be re-used. |

## Acronyms

The following acronyms are used in this Manual:

| | |
|---|---|
| **AAE** | Aperture Auto Exposure |
| **AWB** | Aperture White Balance |
| **BLC** | Black Light Control |
| **CMOS** | Complementary Metal Oxide Semiconductor |
| **DRC** | Dynamic Range Compression |
| **EV** | Exposure Value |
| **HD** | High Definition |
| **HDMI** | High-Definition Multimedia Interface |
| **IP** | Internet Protocol |
| **MJPEG** | Motion-JPEG |
| **NR** | Noise Reduction |
| **OSD** | On-Screen Display |
| **PoE** | Power over Ethernet |
| **PTZ** | Pan / Tilt / Zoom |
| **RTMP** | Real-Time Messaging Protocol |
| **RTSP** | Real-Time Streaming Protocol |
| **SAE** | Shutter Auto Exposure |
| **SDI** | Serial Digital Interface |
| **SKU** | Stock Keeping Unit |
| **SNR** | Signal to Noise Ratio |
| **SRT** | Secure Reliable Transport |
| **UDP** | User Datagram Protocol |

# Contents

# Introduction

## Purpose of This Manual

This Manual describes the safety precautions and the instructions for safe unpackaging, installation, operation, maintenance and disposal of the Avonic CM44 camera.

> ℹ️  In this Manual the Avonic CM44 camera is referred to as the 'Product'.

## Target Audience

This Manual is developed for installation technicians who install the Product at client sites, and for IT professionals who are responsible for operating the Product.

## Document Structure

The Manual is subdivided into the following *Chapters*:

1. *Introduction*
2. *Safety*
3. *Product Overview*
4. *Unpacking*
5. *Mounting and Installation*
6. *Operation*
7. *Maintenance*
8. *Transport and Storage*
9. *Disposal and Recycling*
10. *Troubleshooting*

Additionally, it contains the following

- *Appendix A - VISCA Settings and Command List*
    - *Appendix A1 - Pelco-d Protocol and command List*
    - *Appendix A2 - Pelco-p Protocol and command List*
- *Appendix B - Dimensions*
- *Appendix C - CMOS Image Sensor Characteristics*

# Safety

This chapter contains important safety information regarding the unpacking, installation and use of the camera.

## Important Precautions

| ⚠ | This Product is NOT intended for use where failure of the device could lead to death, personal injury, or severe environmental damage. |
|---|---|
| ⚠ | Be sure that you have COMPLETELY READ and UNDERSTOOD ALL information in this Manual before unpacking, installing and using this Product. Keep the Manual in a safe place for future reference or download it from *www.avonic.com*. |
| ⚠ | Failure to follow the SAFETY NOTES as described in this chapter could result in fire, electric shock, injury, or damage to this Product or other property. |
| ⚠ | Power this Product ONLY with the included cable and power adapter. Other adapters may not meet applicable safety standards, and could pose a risk of death or injury when connected. |

## Intended Use

| ℹ | See section *Intended Use and Non-Intended Use* on page iv for details. |
|---|---|

## Handling

⚠

To prevent the risk of injury, take the following precautions when handling this Product:
- Handle the Product with care. It is made of metal, glass, and plastic and has sensitive electronic components inside.
- The Product can be damaged if dropped, burned, punctured or crushed, or if it comes into contact with liquid.
- Do not pick up and move the Product unit while a tripod is attached. The fitting may break under the weight of the tripod, which may result in injury.
- If you suspect any damage to the Product, discontinue its use, as it may cause overheating or injury.

## Mounting

⚠

To prevent the Product from falling down which may cause injuries:
- Set up this Product on a hard, stable surface or mount it to a wall or ceiling.
- ONLY use an Avonic mount for mounting to a wall or ceiling.
- Ensure the mounting construction is capable of supporting four times the weight of the Product. (See 'General Specifications > Weight product' in the Product Datasheet for the exact weight.)
- Use a safety loop or drop protection that prevents the Product from falling if the mounting construction fails.
- During installation, NEVER install a Product above a person.
- Check the installation at least once a year. An improper mounting could cause the unit to fall off, resulting in personal injury.

## Ventilation

To prevent the risk of life-threatening injury or damage to the Product or other property, caused by electric shock or fire hazard due to overheating:

- Maintain adequate ventilation by NOT installing or placing the Product unit in a bookcase, built-in cabinet or any other confined space.
- Ensure that curtains or any other material does NOT obstruct the ventilation.

## Repair

Take the following precautions if the Product should be repaired:

- Don't open this Product and don't attempt to repair it yourself. Disassembling the Product may damage it or may cause injury to you.
- If this Product is damaged, malfunctioning, or if it comes into contact with liquid, contact Avonic or an Avonic Authorized Service Provider.
- Repairs by service providers other than Avonic or an Avonic Authorized Service Provider may not involve the use of Avonic genuine parts and may affect the safety and functionality of the device. *You can find more information about repairs and service at* www.avonic.com.

## Power and Adapter

To prevent the risk of life-threatening injury or damage to the Product or other property, caused by electric shock or fire hazard:

- Power this Product ONLY with the included cable and power adapter. Other adapters may not meet the applicable safety standards. They could pose a risk of death or injury when connected.
- Do NOT use damaged cables.
- Do NOT power the Product in a moist / wet environment.
- Before you power the Product, ensure the cable is fully inserted into the power adapter.
- Plug the power adapter directly into a power outlet.
- Do NOT use the power adapter at a moist / wet location.
- Do NOT connector disconnect the power adapter with wet hands.
- Keep the Product, cable, and power adapter in a dry and well-ventilated area when in use.
- Stop using the power adapter and any cables if any of thefollowing conditions exist:
  - The power adapter plug or prongs are damaged.
  - The cable becomes frayed or otherwise damaged.
  - Thepower adapter is exposed to excessive moisture, or liquid is spilled into it.
  - The power adapter has been dropped, and its enclosure is damaged.

## Atmospheric Conditions

To prevent the risk of injury or damage to the Product or other property caused by a potentially explosive atmosphere:

- Do NOT use this Product in an area with a potentially explosive atmosphere, such as areas where the air contains high levels of flammable chemicals, vapors, or particles (such as grain, dust, or metal powders), may be hazardous.
- Exposing this Product to environments having high concentrations of industrial chemicals, including near evaporating liquified gasses such as helium, may damage or impair this Product functionality.
- Obey all signs and instructions.

# Product Overview

## Description

The Avonic AV-CM44-VCUC is a high-quality USB video conferencing PTZ camera with IP-control and a discrete design. The CM44-VCUC, with its versatile horizontal FOV of 83.7° and flexible 5x optical zoom range, is suitable for small to medium size meeting rooms.

This easy to use USB video conference camera has a plug-and-play design and can easily be controlled with the handheld IR remote. The camera has extremely silent mechanical Pan/Tilt/Zoom and can either be mounted on the wall or the ceiling.

Due to the high SNR CMOS sensor in the CM44-VCUC it's possible to obtain a pristine video quality even under low light conditions, making it ideal for every conference room. Easily create high-quality video that feels like you are together in the same room.

## Features

The Avonic CM44 camera has the following features:

**Lens**

High-quality wide-angle glass lens, 5x optical zoom and 83.7° horizontal field of view.

**Low light**

High SNR CMOS combined with digital noise reduction, the picture is clear even under low illumination (0.5 lux @ F1.8) conditions.

**Full HD 1080p30**

With 1/2.8"high-quality CMOS sensor (2.07 Megapixel) the camera has a resolution of 1920 x 1080p30 and achieves a picture of great quality.

**Output**

USB 2.0 up to 1080p30.

**Control**

Control the camera with common protocols: VISCA over IP (RJ45), Visca and Pelco-D/P (RS232/ RS485) or IR remote control (included).

**Presets**

Up to 255 presets with 0.1° accuracy.

# Unpacking

This describes the contents of a complete Product package, and instructions for safe unpacking and (if necessary) Product return.

It is subdivided into the following sections:

1. Package Contents
2. Handling Precautions
3. Unpacking the Camera
4. Return Procedure

## Package Contents

The following tables contains an overview of the package contents of the Product.

| No. | Quantity | Description | Avonic SKU |
|-----|----------|-------------|------------|
| 1 | 1 pc | PTZ Camera | AV-CM44-VCUC |
| 2 | 1 pc | Remote Control | AV-CM40-RC |
| 3 | 1 pc | USB cable type A to type A | AV-USB20-AA |
| 4 | 1 pc | Power Supply 12V/A | AV-CM40-PSU |
| 5 | 1 pc | RS-232 9-pin D-Sub female to DIN -8 male | AV-CM-RS-232 |
| 6 | 1 pc | RS-485 2-pin Phoenix Connector | AV-PHNX-2 |

Each item is visualized below and referenced by the associated number in the table above:



*Figure 3: Package Contents*

## Handling Precautions

⚠️ Always take the camera by its base and do *not* move the position of the lens manually. See below.
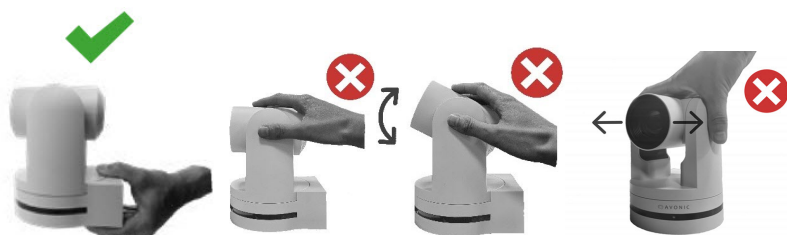


*Figure 4: Handling Precautions*

## Unpacking the Camera

Execute the following steps to unpack the camera and associated components:

1. Open the box.
2. Verify that the contents of the box exactly matches the items as described in *Package Contents*. If this is NOT the case, contact Avonic and stop here.
   The camera should be in its protective foam as follows:



*Figure 5: Camera in Foam*

3. Verify that the plastic camera bag is sealed. If this is NOT the case, contact Avonic and stop here.
4. Break the seal of the sealed camera bag.
5. Take the camera out of the bag. Be sure to follow the *Handling Precautions* on page 13 while doing so.
6. Install the camera following the steps as described in chapter *Mounting and Installation* on page 15

## Return Procedure

If, for any reason, you have to return the camera to Avonic, Execute the following steps:

1. Place the camera back in its protective foam. *Verify that the lens is in HORIZONTAL position!*
2. Place the camera with *all* of its components in the box.
3. Verify that the contents of the box *exactly* matches the items as described in *Package Contents*.
4. Contact Avonic for the Return Procedure.

# Mounting and Installation

This chapter describes the steps you have to perform to mount and install the Product in a correct and safe manner.

These steps are subdivided into the following groups, each of which is described in a separate section:

1. Mounting on Wall or Ceiling
2. Connecting the Components to the Camera
3. Connecting a Controller to a Camera

Take the following precautions to prevent the Product from falling down which may cause injuries:
- Set up this Product on a hard, stable surface, or mount it to a wall or ceiling.
- ONLY use an Avonic mount for mounting to a wall or ceiling.
- Ensure the mounting construction is capable of supporting four times the weight of the Product. (See *'General Specifications > Weight product'* in the Product Datasheet for the exact weight.)
- Use a safety loop or drop protection that prevents the Product from falling if the mounting construction fails.
- During mounting and installation, NEVER install a Product above a person.
- Check the installation at least once a year. An improper mounting could cause the unit to fall off, resulting in personal injury.

## Mounting on Wall or Ceiling

The following accessories (AV-MT200 and AV-MT250) are separately available if the client wants to mount the camera to the wall or ceiling. Contact your Avonic reseller or local distributor for purchasing details.

**Table 2: Camera Accessories**



**Wall and Ceiling mount (AV-MT200)**

SKU white: AV-MT200-W

SKU black: AV-MT200-B



**Ceiling mount (AV-MT250)**

SKU white: AV-MT250-W

SKU black: AV-MT250-B

Visit *www.avonic.com* to download instructions for mounting the camera to the wall or ceiling using the accessories AV-MT200 or AV-MT250.

# Connecting the Components to the Camera

Execute the following steps to connect the components to the camera:

1. Connect all provided components (see *Package Contents*) to the ports at the back of the camera. The figure below shows the applicable ports.

| | |
|---|---|
| <br>*Figure 6: Camera Ports* | 1. RS-485 two-wire serial communication with 2-pin Phoenix connector<br>2. System Selector (see *Using the Select Switch* )<br>3. RS-232 mini-DIN-8 IN (connect the supplied RS-232 cable)<br>4. RS-232 mini-DIN-8 OUT for daisy chaining RS-232 connection<br>5. USB2.0 Type A, UVC video output<br>6. RJ45 Ethernet connection (firmware update and Visca over IP control)<br>7. DC12V power with locking screw (connect the supplied DC PSU)<br>8. Power ON/OFF |

2. If you connected the power cable to the camera, set the power switch at the back of the camera to 'ON'.

After empowering the camera, it starts initializing by first rotating the Pan-Tilt to the maximum top right position and then to the center.

> If position preset '0' has been stored, this is the position that will be called after initialization.

The current IR-channel setting and IP Address of the camera are displayed on the *OSD Menu*. From this point onwards, the user can start controlling the camera.

# Connecting a Controller to a Camera

You can connect one or more cameras to an VISCA IP controller.

> See *https://avonic.com/en/product-categorie/controllers/* for an overview of the available controllers.

A controller gives you direct control over the most important camera settings (e.g., Pan, Tilt, Zoom, Focus, White Balance). You can access all other settings through the **OSD Menu** of the camera using the controller. The camera(s) can be connected via a serial connection to USB, RS-232, RS-485, or via a LAN Ethernet connection. Each of these options is described below.

## Connecting via USB

Execute the following steps to connect the camera to a computer (desktop) via USB.

Execute the following steps to connect the camera to a desktop or a (computer) monitor via USB2.0:

1. Connect the camera to the desktop or monitor via the USB2.0 port (see figure above).
2. Open the Windows Camera app or a third-party camera app and open the settings.
3. Select the camera, or click on the option / icon to change the camera to the camera you just connected.
4. Press the **MENU** button on the provided IR Remote Control to open the **OSD Menu.**

> See *Using the Remote Control* for more information on how to use the Remote Control.

# Serial Connecting via RS-232 or RS-485

## COM Port Settings

In default working mode, the camera can connect to a VISCA controller via a RS-232 or RS-485 serial interface. The applicable COM port settings are (where '*' stands for 'Default value'):

**RS-232**

- Baud rate: 2400/4800/9600*/115200
- Start bit: 1 bit
- Data bit: 8 bits
- Stop bit: 1 bit

**RS-485 (half-duplex mode)**

- Baud rate: 2400/4800/9600*
- Start bit: 1 bit
- Data bit: 8 bits
- Stop bit: 1 bit

> See *Appendix A - VISCA Settings and Command List* **on page 43** for the command list.

## RS-232 Interface

Connect the controller to the back of the camera via the RS-232 cables as shown in the figures below:

| No. | Function |
|-----|----------|
| 1. | DTR |
| 2. | DSR |
| 3. | TXD |
| 4. | GND |
| 5. | RXD |
| 6. | GND |
| 7. | IR OUT |
| 8. | NC |
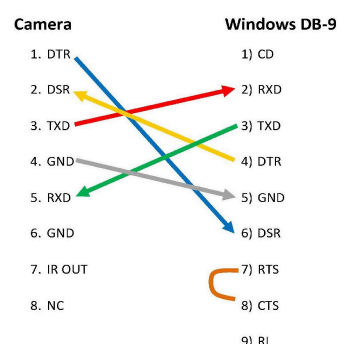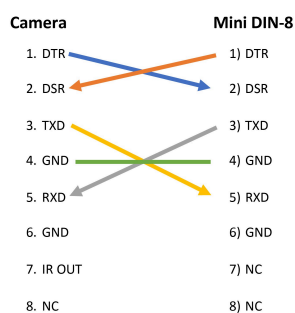
*Figure 7: RS-232 Interface (Mini DIN-8)*

| Camera | Mini DIN-8 | Camera | Windows DB-9 |
|--------|-----------|--------|--------------|
| 1. DTR | 1) DTR | 1. DTR | 1) CD |
| 2. DSR | 2) DSR | 2. DSR | 2) RXD |
| 3. TXD | 3) TXD | 3. TXD | 3) TXD |
| 4. GND | 4) GND | 4. GND | 4) DTR |
| 5. RXD | 5) RXD | 5. RXD | 5) GND |
| 6. GND | 6) GND | 6. GND | 6) DSR |
| 7. IR OUT | 7) NC | 7. IR OUT | 7) RTS |
| 8. NC | 8) NC | 8. NC | 8) CTS |
| | | | 9) RI |

*Figure 8: RS-232 Cable and Interface Connection (Mini DIN-8 and Windows DB-9)*

## RS-232 Network Connection

Execute the following steps to connect the controller to the back of the camera(s) via RS-232:

1. Make the connection using *daisy chaining* network architecture.
2. Keep in mind that the maximum cable length for RS-232 is 10-15m.
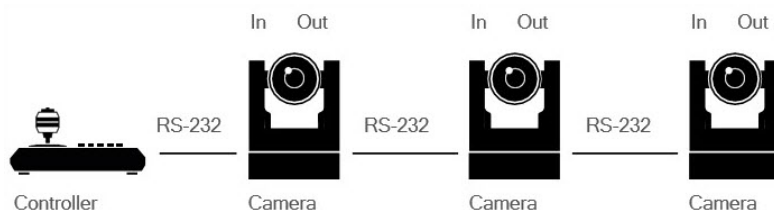
*Figure 9: RS-232 Network Connection Diagram*

## RS-485 Interface

Connect the controller to the + and - at the back of the camera via the RS-485 cables, as shown in the figure below. Note that the color of the connecting cables (red and black in the figure) may vary.
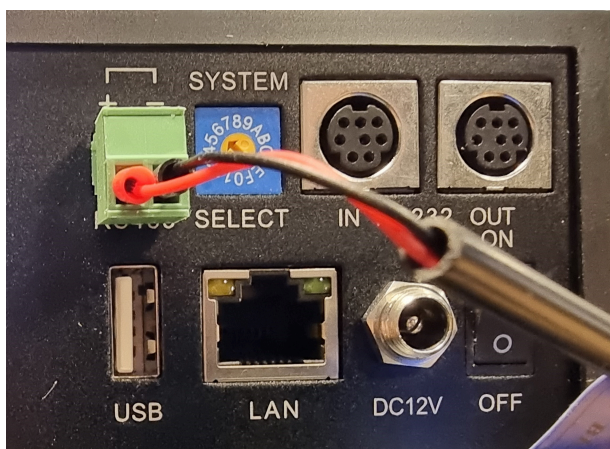

*Figure 10: RS-485 Interface*

## RS-485 Network Connection

Execute the following steps to connect multiple cameras to RS-485:

1. Attach the cameras to a 2-wire twisted pair bus (maximum length 1200m) that is terminated at both ends with a 120Ω-impedance resistor.
2. Ensure that the maximum distance from the bus t of the camera or controller is 5m. If you use only ONE camera, the impedance resistor is not needed.
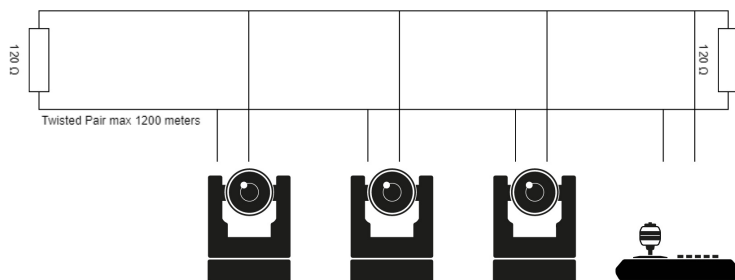

*Figure 11: RS-485 Network Connection Diagram*

# Connecting via LAN

Avonic cameras can be controlled by any device using a LAN and a standard switch.

## Settings

By default, the IP address of the camera is "192.168.5.163" with "admin" for both the username and password.

The control parameters for the CM4x cameras are as follows:

- IP Address: 192.168.5.163
- Username: admin
- Password: admin
- TCP or UDP port: 1259

## IP (Network) Connection

Execute the following steps an Avonic camera to a LAN:

1. Use a standard switch.
2. Ensure that addressing is done via IP. When using VISCA over IP, the 'x' in all the '8x' addresses is always '1', where the Visca address in a Visca over IP environment is always 1. (See *Appendix A - VISCA Settings and Command List* for more information.)
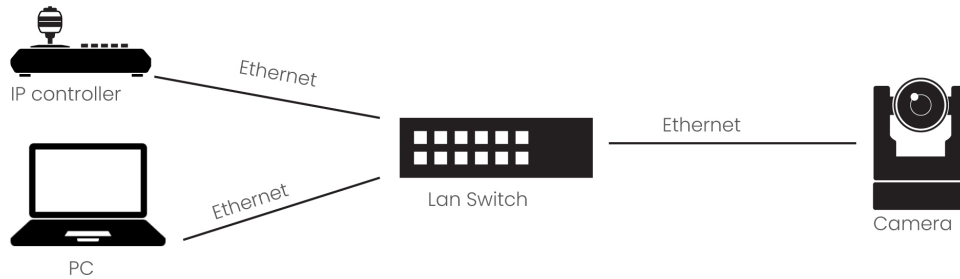


*Figure 12: IP Network Connection Diagram*

# Operation

1. WebGUI
2. Using the Remote Control
3. Other Key Combinations
4. OSD Menu
5. Using the Select Switch

## Using the Remote Control

The Product is provided with an IR Remote Control for full control of the camera and use of the OSD menu.
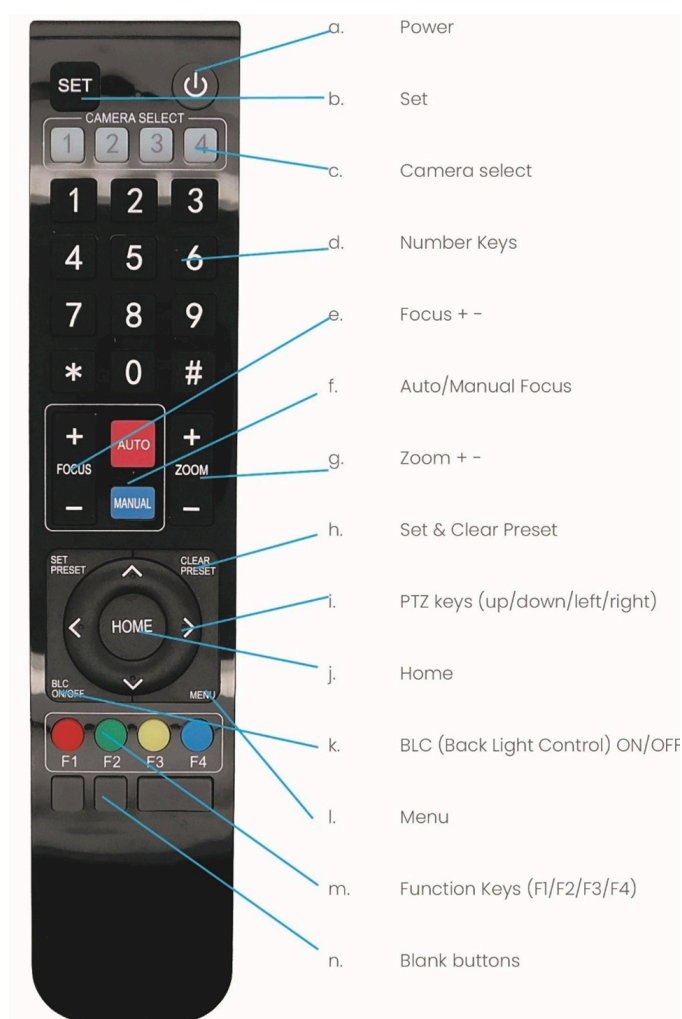


*Figure 13: Remote Control*

The various options (a. through n.) are described below.

### a. Power

1. Press the **Power** button to turn on the camera. If the position preset '0' has been stored, this will be called after initialization.
2. Press the **Power** button again to turn the camera off. It will turn to the back when turned off, this is called the "privacy mode".

### b. Set

This button has *no* function with this camera.

## c. Camera Select

Up to 4 different cameras can be controlled with one IR remote Control. You can use the **camera select** buttons [**1,2,3,4**] to select the IR channel that the remote control is using. The default camera IR channel is 1.

1. To control a camera on first use, select camera 1 (IR channel 1) on the remote control.
2. To control a second camera, you first need to change the IR channel stored in the camera from 1 to 2. Then do the following:
   a. First turn off the other cameras in the room you don't want to change, to prevent that other cameras also get changed accidentally.
   b. Select camera 1 on the remote control, because the camera is still configured tolisten to IR channel 1.
   c. Press **[*]+[#]+[F2]** to change the IR channel inside the camera to IR channel 2. The camera will confirm this on the screen.
   d. Select camera 2 on the remote control to control this camera.

Key Combinations: (Default IR address is 1)

**[*]+[#]+[F1]**      Camera Address No. 1

**[*]+[#]+[F2]**      Camera Address No. 2

**[*]+[#]+[F3]**      Camera Address No. 3

**[*]+[#]+[F4]**      Camera Address No. 4

> The Function buttons F1, F2, F3 and F4 are the colored buttons on the remote.
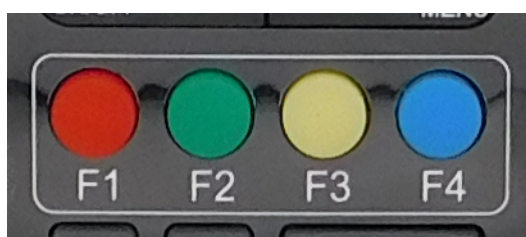


*Figure 14: Function Buttons on Remote*

## d. Number Keys

The number keys are used to call presets.

Press the number **[0-9]** of the desired preset and the camera will respond accordingly (See 'h' on how to set & clear presets).

## e. Focus + -

1. Push the button [manual focus] first before using the focus buttons.
2. Focus the camera with the [+] and [−] button.

   If the camera does not respond, check if the camera is set to auto-focus.

## f. Auto/Manual Focus

Set the camera to 'auto focus' or 'manual focus'.

If the camera is configured to 'auto focus', the buttons [Focus + -] are disabled.

If the camera is in 'manual focus' and the *Zoom* buttons are used, the camera automatically switches to 'auto focus'.

## g. Zoom + -

Zoom the camera with these buttons.

## h. Set & Clear Preset

A preset is a specific position of a camera that you save in the camera. A preset is assigned to a number from 0-9.

1. To set a preset, first point the camera in a specific directing and a specific zoom position.
2. Assign the position to a number with the button *Set Preset*.
3. You can call the preset by pressing one of the numbers 0-9 on the remote control.

| | |
|---|---|
| Set Preset: | [SET PRESET]+[<number>] |
| Call Preset: | [<number>] |
| Clear Preset: | [CLEAR PRESET]+[<number>] |

If the position preset '0' has been stored, this position will be called after initialization.

> **Use ONLY presets between 0-9 when using the Remote Control. For presets 10 or higher you need a serial or IP connection!**

## i. PTZ Keys (up/down/left/right)

Use these keys to move the camera in the desired direction.

## j. Home

Use this key to set the direction of the camera to the center position.

## k. BLC ON/OFF

Use this key to enable / disable the Back Light Control feature.

## l. Menu

1. Use the *Menu* button to open the **On Screen Display (OSD)** menu. This menu is visible on the HDMI/SDI/IP output.
2. If the menu is not in English, press **[*]+[#]+[4]** to change the Menu language into English.

## m. Function Keys (F1/F2/F3/F4)

Used to configure the IR channel of the camera. See *'c. Camera Select'* above for instructions.

## n. Blank Buttons

These buttons have NO function with this camera.

## Other Key Combinations

The following key combinations on the Remote Controller have specific functions. These are:

| Combination | Function |
|---|---|
| [*]+[#]+[4] | Menu set to English |
| [*]+[#]+[6] | Restore factory defaults |
| [*]+[#]+[9] | Flip switch (just temporary flip to view the image flipped) |
| [*]+[#]+[Auto] | Enter into the aging mode, only for quality control purposes |
| [*]+[#]+[Manual] | Restore the default username, password, and IP address |
| [#]+[#]+[#] | Clear all presets |

> The camera returns to the video output setting of the rotary dial after a reboot.

> **Use ONLY presets between 0-9 when using the Remote Control. For presets 10 or higher you need a serial or IP connection!**

## Using the Select Switch

The back of the Product is provided with a Select Switch that can be used to select a video format.

This switch is important for the video quality during video recording or streaming.

> The System Select Switch has **NO FUNCTION** in the AV-CM44-VCUC as all the output resolutions are dictated by the computer to which it has been connected.



> When the camera is turned ON, Pan-Tilt will rotate to the maximum position of top right after the camera started, then it returns to the center, the process of initialization is finished. The camera will show its current IR-channel setting and IP Address on the OSD Menu.

# OSD Menu

Each camera is provided with an **On-Screen Display (OSD) Menu**.

This is an integrated on-screen menu that can be accessed within the camera to change specific functions that effect how the camera processes an image.

The OSD Menu is visible on the USB and IP outputs.

The OSD menu can be accessed by the Remote Control or an Avonic PTZ controller.
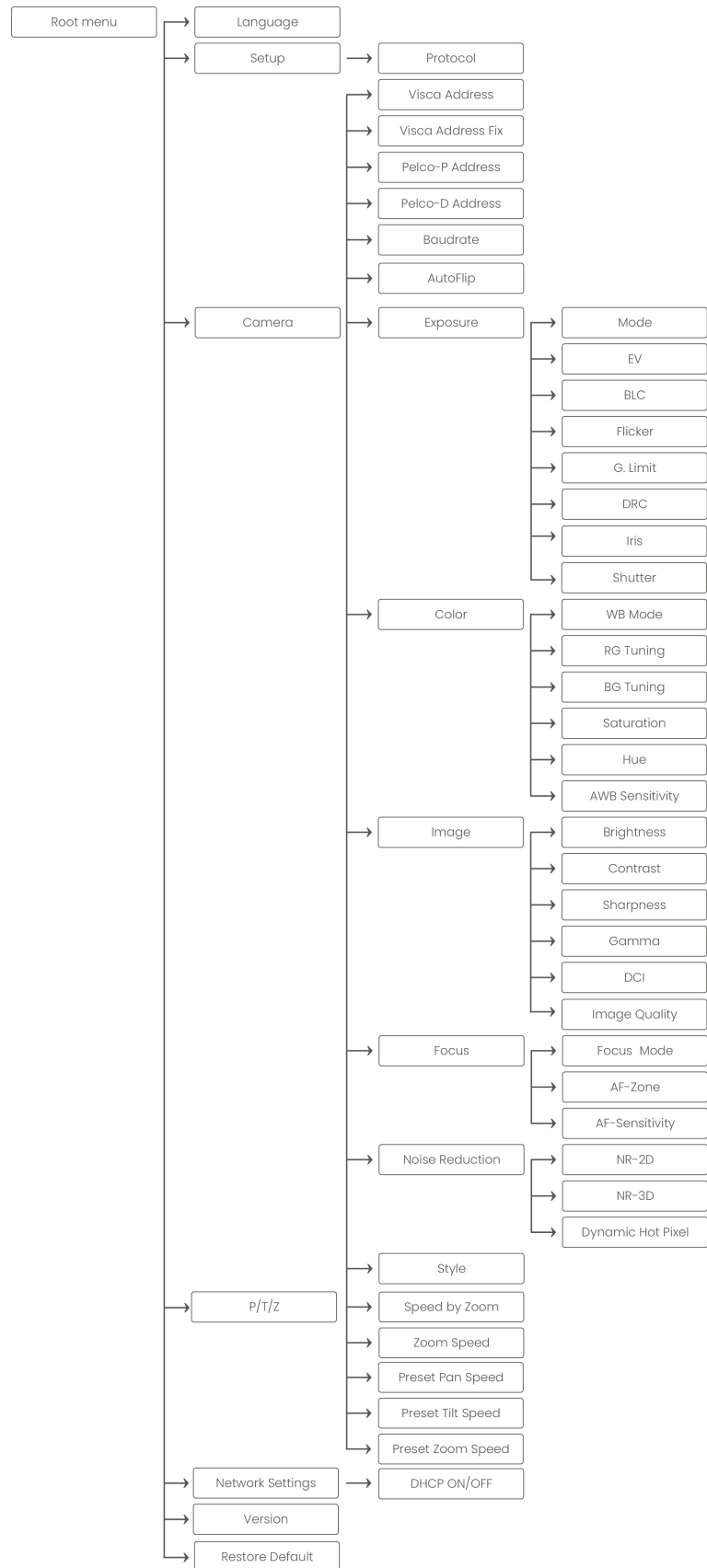


*Figure 15: OSD menu structure*

## 1. MENU

```
MENU
    ▶       Language            EN / CN
            Setup
            Camera
            P/T/Z
            Video Format
            Version
            Restore Default


    ▼▲      Select Item
    ◀▶      Change Value
[Home] Enter
[Menu] Exit
```
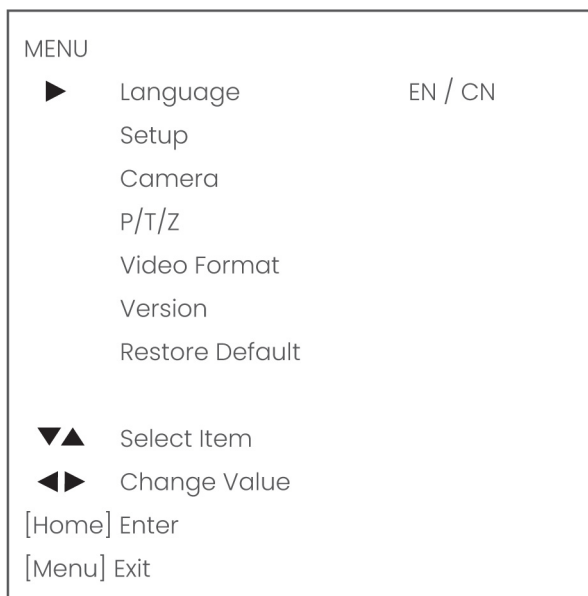
*Figure 16: OSD - MENU*

1. Press the [*MENU*] button to display the main menu on the screen.
2. Use the arrow buttons to move the cursor to the item to be set. Press the [*HOME*] button to enter the corresponding sub-menu.
3. Press [◀▶] to change settings. Press [**MENU**] again to go back.

## 2. SETUP

```
SETUP
    ▶       Protocol            AUTO / VISCA / PELCO-D / PELCO-P
            Visca Address       1 ~ 7
            Visca Address Fix   ON / OFF
            PELCO-P Address     1 ~ 255
            PELCO-D Address     1 ~ 255
            Baudrate            2400 / 4800 / 9600 / 38400 / 115200
            Autoflip            ON / OFF


    ▼▲      Select Item
    ◀▶      Change Value
[Menu] Back
```
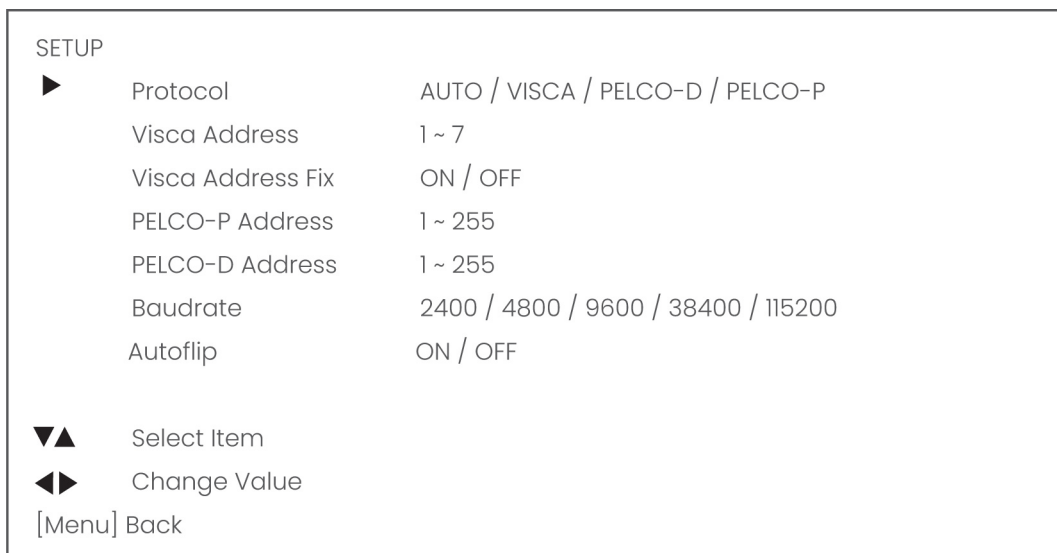
*Figure 17: OSD - SETUP*

1. Select the Protocol you want to use: Auto, VISCA, or PELCO and set the Address. If you are using you the VISCA address, you set the VISCA address. If you are using PELCO-P or D you set the PELCO address.
2. Set the Baudrate (2400 - 115200).
3. If you want to flip the picture up side down, you can set the Autoflip to "ON".

## 3. CAMERA

Under camera you can change Exposure, Color, Image, Focus, Noise Reduction and Style settings. In the now following parts these settings will be explained.

```
CAMERA

        Exposure

        Color

        Image

        Focus

        Noise Reduction

        Style                      Soft / Default / Normal / Clarity / Bright


  ▼▲    Select Item

        Change Value

[Menu] Back
```
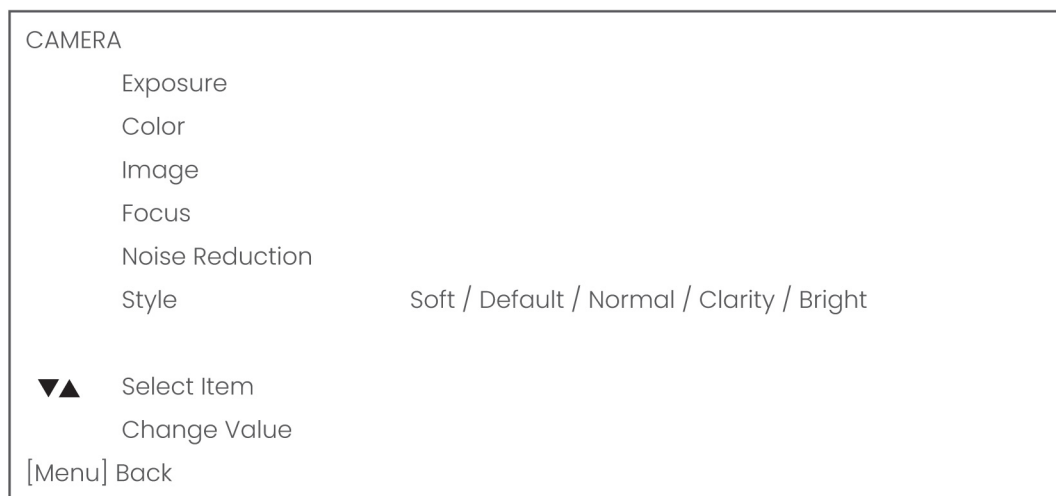
*Figure 18: OSD - CAMERA*

## 3.1 EXPOSURE

```
EXPOSURE

        Mode                       Auto / Manual / SAE / AAE / Bright

        Iris                       F11 ~ F1.8 / CLOSE

        Shutter                    1/25 ~ 1/10000

        EV                         ON / OFF

        EV Level                   -7 ~ +7

        BLC                        ON / OFF

        Flicker                    50Hz / 60Hz / OFF

        G. Limit                   0 ~ 15

        DRC                        1 ~ 8 / CLOSE


  ▼▲    Select Item

        Change Value

[Menu] Back
```
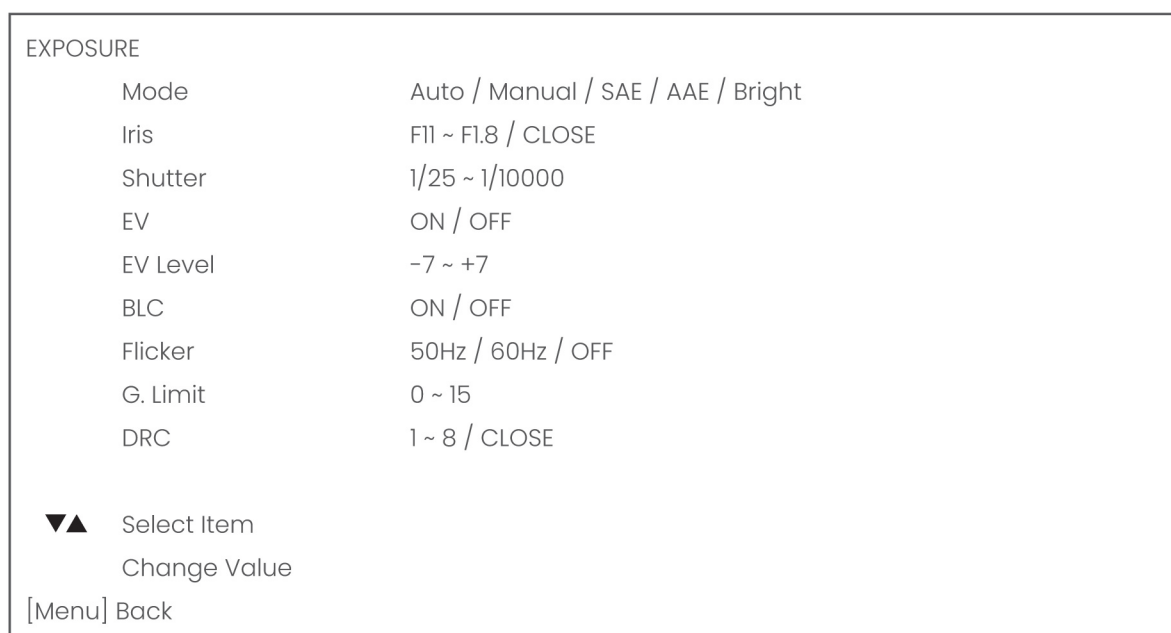
*Figure 19: OSD - EXPOSURE*

If you click in the field after the option 'mode', you will see that you have the following Exposure options: **Auto, Manual, SAE, AAE and Bright**. These options are described below.

## Auto Exposure Mode

In Automatic exposure mode, the camera determines the iris and shutter settings. There are a couple of settings to present the camera with some limits as to what it may do to the image:

### EV (Exposure Value): ON/OFF and Level

If the light conditions require this, you can create a quick adjustment to your current exposure settings without actually changing the fundamental values like iris and shutter.

> ℹ️ Remember that this is a software setting, take care to not 'overdo' the settings or the picture will become washed out bright or too dark to make out details in shadows.

### BLC (Back Light Compensation): ON/OFF

Compensate for having to film against bright lighting directly into the lens.

See the pictures below:
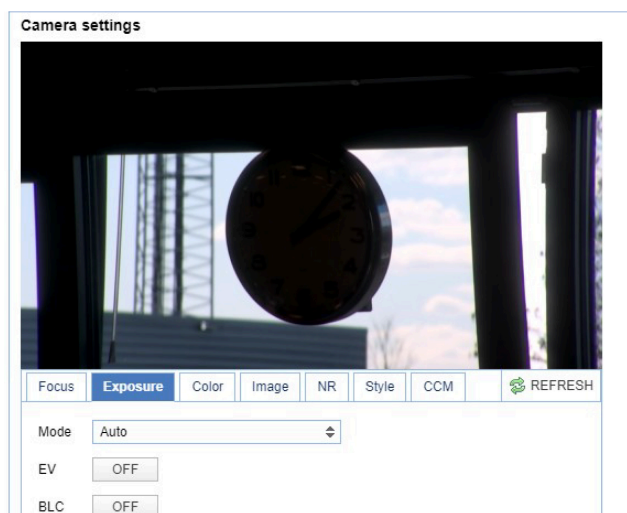


*Figure 20: WebGUI > VIDEO > Camera Settings > Auto Expo (BLC OFF)*
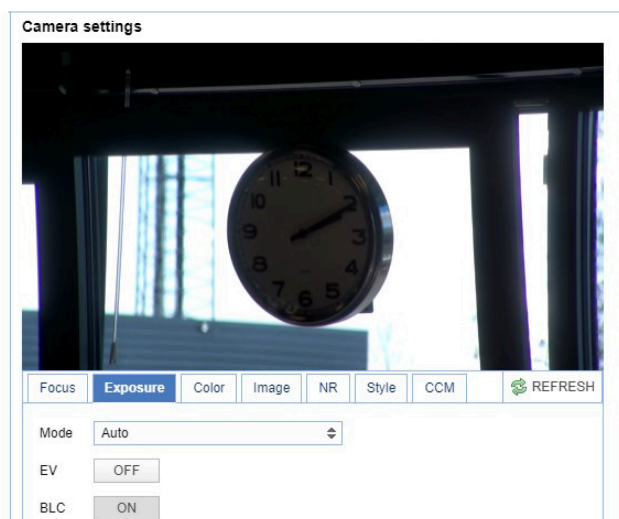


*Figure 21: WebGUI > VIDEO > Camera Settings > Auto Expo (BLC ON)*

### Flicker

Set up your camera so that it can handle the flickering of artificial lighting in the space where it is operating. The options are 50Hz, 60Hz and OFF.

### G.Limit

Gain limit is the maximum level of artificial brightness and contrast that the camera can automatically add to the image. This setting will make a significant difference to the overall picture.

> ℹ️ Make sure that this setting can add noise to the picture in dark areas and produce a washed out, greyish image. This is done for a reason.

### DRC

Dynamic Range Compression has a similar effect on the picture as the above mentioned gain limit. The DRC works by compressing the natural dynamic range of the image by taking out the darkest and lightest parts of the image. This can be a particular helpful setting when the light conditions are challenging. The differences should be clearly visible in dark parts of the image, as they will become lighter/more grey as the level of DRC increases.

## Manual Exposure Mode

In Manual exposure mode, you can manually set the shutter, Iris and DRC options.

### Shutter

The shutter setting determines the amount of time per second that the sensor is exposed. The range of the shutter speed setting is 1/25th of a second (40 milliseconds) to 1/10000th of a second (0.1 milliseconds).

If you shoot a video with a shutter time of 1/25th of a second, you can imagine that the video becomes blurry and overexposed. The faster the shutter is set to open and close, the sharper your filmed object will become. However, the amount of light that falls onto the sensor is also diminished.

> ℹ️ If you are inexperienced or if the light conditions change a lot, it's best practice to keep the camera on the automatic exposure setting.

### Iris

The Iris is a part of a lens that regulates the amount of light that passes through the lens and onto the sensor, by altering the diameter of the hole through which the light enters. The diameter of the hole is measured in *F-stop* value. A higher value lets in less light, while a lower setting lets in more light.

The Iris setting affects the length of the depth of field. The higher F-stop you use, the deeper your depth of field, and vice versa. Reason: the smaller the aperture, the more focused the light beams will be, resulting in a more focused image.

### DRC

Dynamic Range Compression has a similar effect on the picture as the above mentioned gain limit. The DRC works by compressing the natural dynamic range of the image by taking out the darkest and lightest parts of the image. This can be a particular helpful setting when the light conditions are challenging. The differences should be clearly visible in dark parts of the image, as they will become lighter/more grey as the level of DRC increases.

## SAE Mode (Shutter Auto Exposure)

In this mode, the shutter speed is user-adjustable. The camera automatically decides the best Iris F-stop value for an optimal exposure setting.

> ℹ️ Keep in mind that the shutter speed is the amount of time that each frame of the sensor has been exposed to light.

To compensate for poor lighting conditions, it is possible to adjust the *DRC (Dynamic Range Compression).*

## AAE Mode (Aperture Auto Exposure)

The camera will automatically set the shutter speed based on the Iris F-stop value (aperture) set by the user. As the camera determines the preferable shutter speed, it is possible in this mode to turn the anti flicker setting to the required 50Hz or 60Hz to eliminate the effects of a shutter functioning at 1/50th of a second, for example.

In this mode, both the Gain limit and DRC are available to compensate for challenging light conditions.

## Bright Mode

This mode is to try and create a decent image when the light conditions are exceptionally poor.

In this mode, you should keep the Bright level, Gain limit and DRC as low as possibly acceptable to avoid getting too much noise in the picture. If the level of noise in the image becomes unacceptable, you can use *noise reduction* to smooth the picture over.

## 3.2 COLOR

The color modes inside the camera are designed in such a way that the video output of the camera can match the current light conditions to produce accurate colors. There are several automatic preset modes and a manual mode to set the colors to the preference of the user.

```
COLOR
        WB Mode              Auto / 3000K / 4000K / 5000K / 6000K / 7000K / Manual / OnePush
        RG Tuning            -10 ~ 10
        BG Tuning            -10 ~ 10
        RG                   0 ~ 255
        BG                   0 ~ 255
        Saturation           60% - 200%
        Hue                  0 ~ 14
        AWB Sensitivity      Low / Middle / High


        Select Item
        Change Value
[Menu] Back
```

*Figure 22: OSD - COLOR*

The settings are listed below.

| | |
|---|---|
| **WB mode auto** | The camera continuously measures and defines the light conditions and acts accordingly. |
| | In this mode, there are some adjustments that can be made to tune the image to the preference of the user. |
| **RG Tuning** | Red Gain Tuning, increase or decrease red. |
| **BG Tuning** | Blue Gain Tuning, increase or decrease blue. |
| **RG** | Finetuning the color red. |
| **BG** | Finetuning the color blue. |
| **Saturation** | How saturated the image's colors are. 0% would produce a black and white image. |
| **Hue or tint** | The balance between green and red. 0 is green, 14 is red. |
| **AWB Sensitivity** | This setting indicates how quickly the camera responds to changing light settings. |

## 3.3 IMAGE

```
IMAGE
   ▶        Brightness              0 ~ 14
            Contrast                0 ~ 14
            Sharpness               0 ~ 15
            B&W-Mode                Color / B&W
            Gamma                   0.45 / 0.50 / 0.55 / 0.63 / Default
            DCI                     1 ~ 8 / Close
            Image Quality           0 ~ 5


   ▼▲       Select Item
   ◀▶       Change Value
[Menu] Back
```

*Figure 23: OSD - IMAGE*

These are settings that have an effect on the image post-processing. Basically, these settings are all artificial: they don't affect the optical parts of the camera itself.

The settings are listed below.

| | |
|---|---|
| **Brightness** | The amount of detail that is visible in darker areas of the image. *Be careful not to set this setting too high, as you will see that the image becomes 'milky-white'.* |
| **Contrast** | The amount of detail that is visible in lighter areas of the image. |
| **Sharpness** | Artificial contrast, be careful no to set this too high as it will create a sort of 'halo' around sharp edges of filmed objects. The setting of sharpness coincides with the setting ofnoise reduction. |
| **B&W Mode** | Black and White Mode makes the picture black and white. |
| **Gamma** | The gamma curve selection has to do with the perception of the human eye to lighter and darker. If you select a higher rate of gamma, you will see that the picture become darker, but you get also more detail. |
| **DCI** | The Dynamic Contrast affects the contrast of the picture. The higher the number, the more contrast you will get. |
| **Image Quality** | Improves the image quality by making the picture slightly more saturated. |

## 3.4 FOCUS

```
FOCUS
            Focus Mode              Auto / Manual / OnePush
            AF-Zone                 Top / Center / Bottom / All
            AF-Sensitivity          Low / Middle / High


   ▼▲       Select Item
   ◀▶       Change Value
[Menu] Back
```

*Figure 24: OSD - FOCUS*

## Focus Mode

| | |
|---|---|
| **Auto** | The camera determines the focus position by itself and will adjust to the contents of the filmed object. |
| **Manual** | The user is able to set a fixed focus position manually. This can be useful when the contents of the filmed object are not clear towards the background and the autofocus has difficulty finding the correct focusing. |
| **One-push** | The camera will focus once and will keep the focus in that position until another focus command is sent. |

## AF-Zone

This setting defines the area where the autofocus is aimed at.

## AF-sensitivity

Sets the level of speed with which the autofocus responds. This can be useful if you have people walking through the picture. If the setting is 'High', the camera will respond immediately. If the setting is 'Low' or 'Medium', the camera will not react to sudden and short changes in the picture.

> Note that in some cases the autofocus will have some difficulties to focus. We strongly recommend to focus manually to avoid autofocus issues. See also the Troubleshooting/ Image in this manual.

## 3.5 NOISE REDUCTION

```
NOISE REDUCTION

        NR-2D                   1 ~ 7 / Auto / OFF
        NR-3D                   1 ~ 8 / Auto/  OFF
        Dynamic Hot Pixel       1 ~ 5 / OFF


   ▼▲    Select Item
   ◄►    Change Value
 [Menu] Back
```

*Figure 25: OSD - NOISE REDUCTION*

Noise reduction can be used to soften the image when noise is present due to poor lighting conditions. The higher the amount of noise reduction, the softer the image will get, ultimately resulting in losing details.

Be careful when adjusting the noise reduction, as it can take away the natural 'crispness' of the image. You will lose the natural 'crispness' of the image, if you set the dynamic contrast and gain too high (this will cause more noise). Better practice is to add light to the filmed object.

The settings are as follows:

| | |
|---|---|
| **NR-2D** | Used for still-standing objects. |
| **NR-3D** | Used for moving objects. |
| **Dynamic Hot Pixel** | A dynamic hot pixel is a defective pixel which look much brighter than they should and will sometimes becomevisible due to long exposure shots of the camara at a higher rate of light sensitivity. This is often visible as sparkles in the picture. The Dynamic Hot Pixels mode corrects the pixel so that the pixel will appear as normal on the filmed picture. |

## 3.6 STYLE

```
STYLE
    ▶      Style                    Default / Normal / Clarity / Bright / Soft


    ▼▲     Select Item
    ◀▶     Change Value
[Menu] Back
```
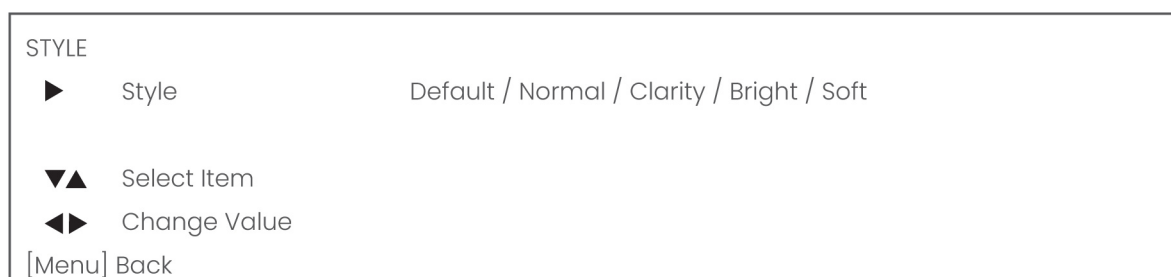
Here, you can choose the style you want, such as **Default** (standard setting), **Normal** (which makes the picture more 'natural'), **Clarity** (makes the picture more clear), **Bright** (which makes the picture more bright) and **Soft** (which softens the picture).

*Figure 26: OSD - STYLE*

## 4. PTZ

```
PTZ
          Speed by Zoom        ON / OFF
          Zoom Speed           1 ~ 8
          Preset Pan Speed     1 – 25
          Preset Tilt Speed    1 – 21
          Preset Zoom Speed    1 – 8


    ▼▲    Select Item
    ◀▶    Change Value
[Menu] Back
```
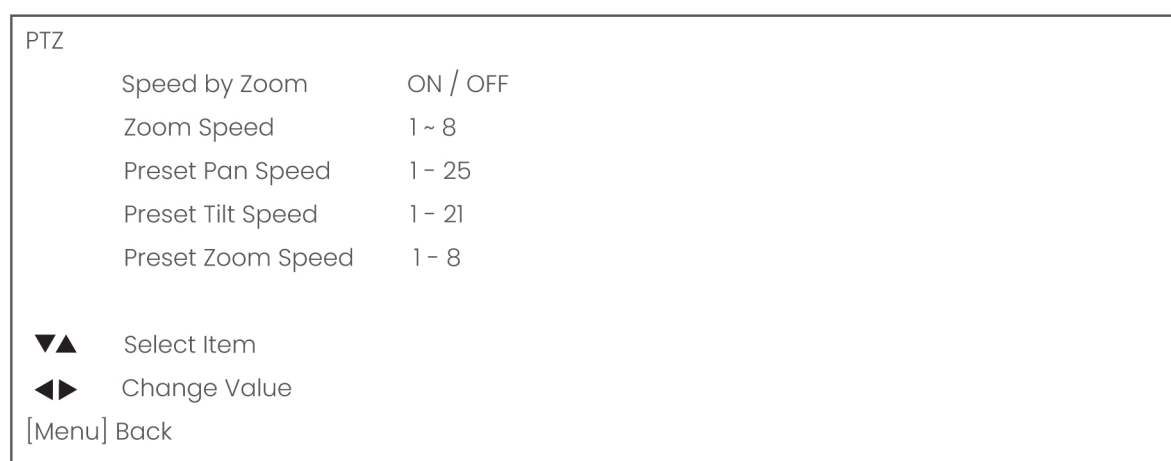
In this window, you can define various P/T/Z settings for your camera. These are:

*Figure 27: OSD - PTZ*

| | |
|---|---|
| **Speed by zoom** | This mode affects PTZ speed when the camera is zoomed in to its max. If you move the stick of your controller when this mode is disabled, it will move too fast to control it. Enabling reduces this speed in relation to the current zoom factor. |
| **Zoom Speed** | You can set the speed to which the camera will zoom in to the image. The higher the number, the faster the camera will zoom in. This works only when the remote controller is used to control the camera. |
| **Preset Pan, Tilt and Zoom Speed** | This mode affects the speed to which the camera is switching from one preset to another when you use your (remote) controller. The higher the number, the faster it will switch. |

## 6. NETWORK SETTINGS

```
      DHCP                    ON/OFF
      IP Address              xxx.xxx.xxx.xxx
[Menu] Back
```

*Figure 28: OSD - NETWORK SETTINGS*

In this section the IP-settings for the ethernet adapter can be made. You can set the DHCP to ON or OFF, or you can set the IP Address.

## 7. VERSION

```
VERSION
      MCU Version          nr      date
      Camera Version       nr      date
      AF Version           nr      date


[Menu] Back
```

*Figure 29: OSD - VERSION*

No changes can be made. This is to view the MCU, Camera and AF Version you have.

## 8. RESTORE DEFAULT

```
RESTORE DEFAULT
      Restore default?              NO / YES


  ▼▲    Select Item
  ◄►    Change Value
[Menu] Back
[Home] OK
```

*Figure 30: OSD - RESTORE DEFAULT*

Here you can restore all the settings to the factory default settings by selecting YES.

# WebGUI

You can access the camera remotely through a WebGUI where you can set basic changes to the network and system settings.

## Login



*Figure 31: WebGUI > Login*

Execute the following steps to log in to the WebGUI:

1. Open your web browser.
2. Enter the default IP address "192.168.5.163" in the URL box. The *Login* screen appears.
3. Enter "admin" for both the *User Name* and *Password*.
4. Click **LOGIN** to continue.

> If **DHCP** is enabled and no **DHCP** server is available, the camera will automatically appoint an IPv4 link-local address between **169.254.0.0** and **169.254.255.255**. The IP address is shown on the screen at start-up.

After a successful login, the WebGUI is displayed. Here, you can select various tabs that are described below.

## NETWORK

Use the tabs on the NETWORK screen to define the appropriate **Port**, **Ethernet** and **DNS** settings.

### Port Settings
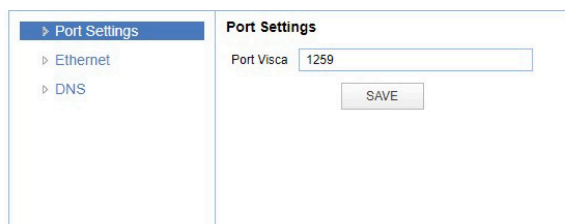


*Figure 32: WebGUI > NETWORK > Port Settings*

You can define the VISCA port for control of the camera by using the VISCA protocol.

> ⚠ **Make sure that this setting doesn't interfere with other uses and services on the same network.**

Click **SAVE** to apply your settings. A small confirmation dialogue appears in the bottom right corner.

## NETWORK - Ethernet

In this section, you can specify the IP settings for the Ethernet adapter.
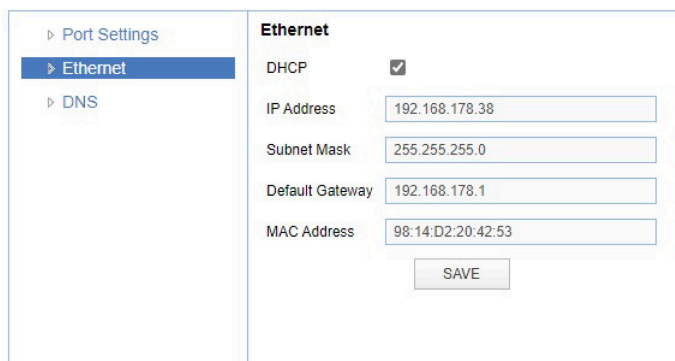


*Figure 33: WebGUI > NETWORK > Ethernet*

Execute the following steps to save your settings:

1. Click **SAVE** to apply your settings. A small confirmation dialogue appears in the bottom right corner.
2. Reboot the camera.

## NETWORK - DNS

Here, you can specify the **Preferred** and **Alternative DNS Server**.
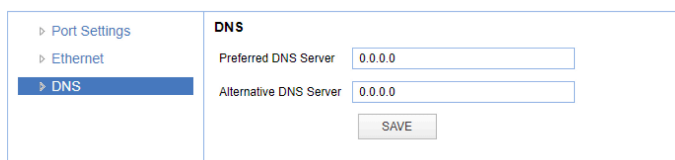


*Figure 34: WebGUI > NETWORK > DNS*

Click **SAVE** to apply your settings. A small confirmation dialogue appears in the bottom right corner.

## SYSTEM

You can use the **SYSTEM** tabs (described below) to define the desired system settings.

## User
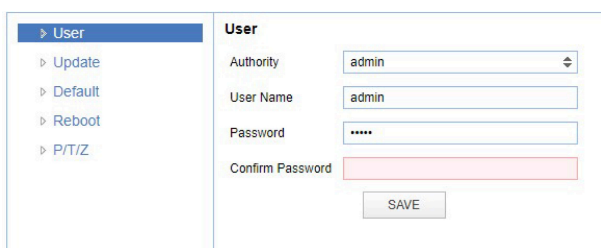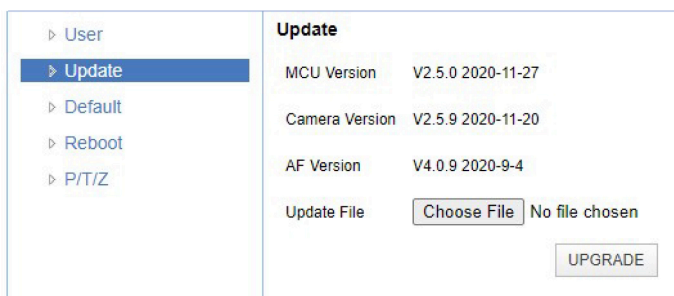


*Figure 35: WebGUI > SYSTEM > User*

You can define different users with specific permission levels and different username / passwords combinations. There are 2 levels of users: *administrators* with access to all features, and *user-1 and user-2* with access to the preview and PTZ controls.

Click **SAVE** to apply your settings. A small confirmation dialogue appears in the bottom right corner.

## Update



*Figure 36: WebGUI > SYSTEM > Update*

By default, this screen shows a readout of the current firmware versions. The *Update file* provides a firmware upgrade functionality via this screen. When the camera is done uploading and processing the update, it will automatically reboot.
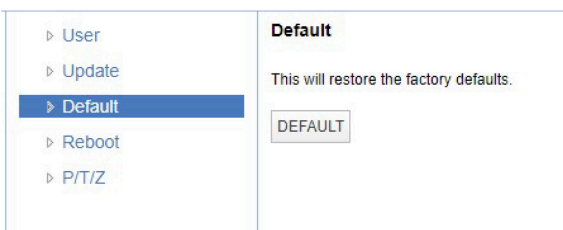
Execute the following steps to perform a firmware upgrade.

1. Click **Choose File** to select the firmware update file.
2. Click **UPGRADE** to start the firmware upgrade wizard.
3. Follow the steps in the wizard.
4. Wait until the process finishes and reboots.
5. Refresh your browser and log in again after the reboot.

## Default

If necessary, you can perform a factory reset. This restores all default settings.



*Figure 37: WebGUI > SYSTEM > Default*

Click on **This will restore the factory defaults** to perform a factory reset. When completed, the camera automatically reboots. The camera will be ready for use again after the boot cycle.

## Reboot

If necessary, you can manually perform a camera reboot.



*Figure 38: WebGUI > SYSTEM > Reboot*

Click on the button **Reboot** to reboot the camera. It will be ready for use again after the boot cycle.

# P/T/Z



*Figure 39: WebGUI > SYSTEM > P/T/Z*

In this window, you can define various P/T/Z settings for your camera. See *OSD Menu - PTZ.*

# Maintenance

## Camera Maintenance

Take the following actions to maintain the camera:

- If you will not be using the camera for a long time, turn off the power switch and disconnect the AC powercord of the AC adaptor to the outlet.
- Use a soft cloth or tissue to clean the camera cover.
- Please use the soft dry cloth to clean the lens. If the camera is very dirty, clean it with diluted neutral detergent.

**Do not use any type of solvents, which may damage the surface.**

## Usage Precautions

Take the following precautions to ensure good image quality:

- Do not film extreme bright objects for a prolonged period of time, such as sunlight, light sources, etc.
- Do not operate in unstable lighting conditions, otherwise the produced image could be less than optimal.
- Do not operate close to powerful electromagnetic radiation, such as TV or radio transmitters, etc.

# Transport and Storage

The camera must be transported in its original packaging box. Inside the box, it is recommended to wrap the camera in the original plastic bag and to place it in the protective foam.

Specific guidelines apply to the environmental temperature and humidity when operating and storing the camera.

> **See** *'Operating humidity'* **and** *'Storage temperature'* **in the provided Datasheet for the applicable values.**

# Disposal and Recycling

In general, the term 'E-Waste' applies to items of all types of electrical and electronic equipment and its parts that have been discarded by the owner as waste without the intention of re-use.

Avonic outsources the disposal and recycling of its E-Waste camera materials to the **Stichting Open**.

**See** *https://stichting-open.org/* **for more information about the disposal and recycling.**

# Troubleshooting

## General

1. Turn the camera off and on again and check if the problem persists.
2. If it does, restore to the factory default.

## Power Issues

If the camera does NOT perform a self-test and / or if the power LED is OFF:

1. Check the net power.
2. Check the power supply.
3. Check the physical power button on the back of the camera.

## Image
### No image

1. Check the power of the camera and monitor.
2. Check the quality and length of the video cable.
3. Check if the video specifications of monitor match the specifications of the camera.
4. Check if the Iris under *Exposure settings* is set to 'closed'.

### Abnormal image

1. Check the quality and length of the video cable.
2. Check the cable connections.
3. Check if the Iris under *Exposure settings* is set to 'closed'.

### Dithering or flickering image

1. Check the camera fixation and nearby vibration sources.
2. Check the *Anti-flickering* setting in the OSD.
3. Check the *Noise Reduction* settings in the OSD.

### Color issues

Check the OSD settings for exposure, white balance, color temp, Red and Bluetuning.

> When experiencing image problems, you may also check *Appendix D - CMOS Image Sensor Characteristics*.

## Autofocus Issues

- Check the autofocus (position, speed etc.) before streaming
- Check Video/Camera Settings in de WebGUI or the OSD menu (for example: if the image is too bright, too dark, or too noisy, the camera will have difficulties to focus

Check environmental conditions and the subject of focussing. The camera will have difficulties to focus in the following situations:

- Light: Strong light, low light/dark areas and backlight conditions
- Moving subjects
- Small objects before a plain or solid background
- Blurry or unsharp subjects: filming throught wet glass or dirty objects
- Distance: filming two or more different subjects, some near and some far away
- Position in the image: subject positioned in the corners of the picture
- Faces: partly hidden faces, sideways filmed faces, diagonal or up side down
- When the camera itself moves, or when the iris is narrowed down

> When you experience one or more of the above mentioned problems check also our *Appendix - CMOS characteristics*

# Control
## No self-test (PTZ cameras only) and no power LED

1. Check the net power
2. Check the power supply

## Remote Controller does not work

1. Check the power of the controller.
2. Check the RS-232 or RS-485 cable quality, length, polarity and network architecture.
3. Check the serial communication settings on the camera and controller.
4. Check the VISCA / PELCO address settings on the camera and controller.
5. Check the IP network settings on the camera and controller.

# WebGUI
## Cannot enter WebGUI

1. Check the network cable.
2. Check if the computer is connected to the same subnet as the camera.
3. Use an *incognito* window in your browser, sometimes cache issues arise when using multiple cameras that have the same default IP address
4. Reset the factory default IP settings by pressing **[*] [#] [Manual]** and **Reboot.**

## Firmware update failed

1. Check firmware file integrity, download it again.
2. Make sure you are trying to flash the UVC file for the correct color camera (ARM is generic, UVC is color-dependent).

# Appendix A - VISCA Settings and Command List

**To control the camera, in all the '8x' addresses, you have to replace the 'x' with the serial Visca address that is set in the camera.**

**When using VISCA over IP, the 'x' in all the '8x' addresses is always '1', as the unique identifier is the IP address.**

## VISCA over IP

The Avonic IP camera is implemented with a TCP server. The TCP port number is **1259** by default and can be altered in the WebGUI. Once the connection between client and server is set up, the client will be able to send PTZ commands to the server. The server then parses and executes the PTZ command.

The Avonic Camera also has an implemented UDP server. The UDP port number is fixed on **1259**. Once the connection between client and server is set up, the client will be able to send PTZ commands to the server. The server then parses and executes the PTZ command.

**Pay attention to the fact that the camera does not send back any communication via UDP!**

The VISCA over IP command list is based on the VISCA protocol. Not all VISCA commands are implemented.

The PTZ Command format is according to the definition of the VISCA protocol. The VISCA address of the camera is set to 1 by default and can be changed in the WebGUI. As all cameras are uniquely identified by their IP address, all VISCA serial addresses of the cameras that are controlled over IP do not necessarily have to be unique.

For Visca over serial proporties note that you have to replace the "1" in all the "81" addresses with the serial VISCA address set in the camera to control it.

Default settings:
- TCP port 1259
- UDP port 1259 (same port as TCP; is correct)
- VISCA address 1

# Camera Return Commands

All parameter values are in HEX.

- x = Camera Address
- y = Socket Number
- z = Camera Address + 8

| Return/complete Command | | | |
|---|---|---|---|
| **Command** | **Function** | **Command Packet** | **Comments** |
| ACK/Completion Messages | ACK | 90 4y FF<br>(y: Socket No.) | Return when the command is accepted. |
| | Completion | 90 5y FF<br>(y: Socket No.) | Return when the command has been executed. |

| Error Command | | | |
|---|---|---|---|
| **Command** | **Function** | **Command Packet** | **Comments** |
| Error Messages | Syntax Error | 90 60 02 FF | Returned when the command format is different or when a command with illegal command parameters is accepted. |
| | Command Buffer Full | 90 60 03 FF | Indicates that two sockets are already being used (executing two commands) and the command could not be accepted when received. |
| | Command Canceled | 90 6y 04 FF<br>(y: Socket No.) | Returned when a command which is being executed in a socket specified by the cancel command is canceled. The completion message for the command is not returned. |
| | No Socket | 90 6y 05 FF<br>(y: Socket No.) | Returned when no command is executed in a socket specified by the cancel command, or when an invalid socket number is specified. |
| | Command Not Executable | 90 6y 41 FF<br>(y: Execution com-mand Socket No. Inquiry command: 0) | Returned when a command cannot be executed due to currentconditions. For example, when commands controlling the focus manually are received during autofocus. |

# Camera Control Commands

All parameter values are in HEX

- x = Camera Address
- y = Socket Number
- z = Camera Address + 8

| Camera Control Commands | | | |
|---|---|---|---|
| **Command** | **Function** | **Command Packet** | **Comments** |
| Address Set | Broadcast | 88 30 01 FF | Address setting |
| CAM_Power | On | 8x 01 04 00 02 FF | Power ON |
| | Off | 8x 01 04 00 03 FF | Power OFF |
| | Reboot | 8x 0A 01 06 01 FF | Reboot |
| CAM_Zoom | Stop | 8x 01 04 07 00 FF | |
| | Tele (Standard speed) | 8x 01 04 07 02 FF | |
| | Wide (Standard speed) | 8x 01 04 07 03 FF | |
| | Tele (Variable speed) | 8x 01 04 07 2p FF | p = 0(low speed) -F(high speed) |
| | Wide (Variable speed) | 8x 01 04 07 3p FF | |
| | Direct | 8x 01 04 47 0p 0q 0r 0s FF | pqrs(0-F): Zoom Position |
| | Zoom Wide ~ Tele | 00 00 00 00 ~ 04 00 00 00 (PQRS) | |
| CAM_Focus | Stop | 8x 01 04 08 00 FF | |
| | Far (Standard speed) | 8x 01 04 08 02 FF | |
| | Near (Standard speed) | 8x 01 04 08 03 FF | |
| | Far (Variable speed) | 8x 01 04 08 2p FF | p = 0(low) - F(high) |
| | Near (Variable speed) | 8x 01 04 08 3p FF | |
| | Direct Focus Position | 8x 01 04 48 0p 0q 0r 0s FF | min p = 0, q = 0, r = 0, s = 0 max p = 0, q = 6, r = E, s =A |
| | Auto Focus | 8x 01 04 38 02 FF | AF On |
| | Manual Focus | 8x 01 04 38 03 FF | AF Off |
| | Auto/Manual | 8x 01 04 38 10 FF | AF Toggle On/Off |
| | OnePush mode | 8x 01 04 38 04 FF | |
| | OnePush trigger | 8x 01 04 18 01 FF | |
| | Focus Near ~ Far | Variable ~ 00 00 00 00 (PQRS) | pqrs: Focus Position |
| CAM_WB | Auto | 8x 01 04 35 00 FF | Normal Auto |
| | Indoor mode | 8x 01 04 35 01 FF | Indoor mode |
| | Outdoor mode | 8x 01 04 35 02 FF | Outdoor mode |
| | OnePush mode | 8x 01 04 35 03 FF | One Push WB mode |
| | Manual | 8x 01 04 35 05 FF | Manual Control mode |
| | OnePush trigger | 8x 01 04 10 05 FF | One Push WB Trigger |

## Camera Control Commands

| Command | Function | Command Packet | Comments |
|---|---|---|---|
| CAM_Bgain | Reset | 8x 01 04 04 00 FF | Manual Control of BGain |
| | 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(Manual control) |
| CAM_Iris | Reset | 8x 01 04 0B 00 FF | Iris Setting (CAM_AE isset to Iris Priority) |
| | Up | 8x 01 04 0B 02 FF | |
| | Down | 8x 01 04 0B 03 FF | |
| | Direct Iris Position | 8x 01 04 4B 00 00 0p 0q FF | min p = 0 q = 0 max p = 0, q = C |
| CAM_Gain | Reset | 8x 01 04 0C 00 FF | Gain Setting |
| | Up | 8x 01 04 0C 02 FF | |
| | Down | 8x 01 04 0C 03 FF | |
| | Direct | 8x 01 04 0C 00 00 0p 0q FF | pq: Gain Position |
| | Gain Limit | 8x 01 04 2C 0p FF | p:Gain Position |
| 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 | |
| | Direct | 8x 01 04 0D 00 00 0p 0q FF | pq: Bright Position |
| 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 | pq: ExpComp Position |
| CAM_BackLight | On | 8x 01 04 33 02 FF | Back Light Compensation On/Off |
| | Off | 8x 01 04 33 03 FF | |

## Camera Control Commands

| Command | Function | Command Packet | Comments |
|---|---|---|---|
| CAM_NR(2D)Mode | Auto | 8x 01 04 50 02 FF | NR2D Auto/Manual |
| | Manual | 8x 01 04 50 03 FF | |
| CAM_NR(2D)Level | - | 8x 01 04 53 0p FF | p: NR Setting (0: Off, level 1 to 5) |
| CAM_NR(3D)Level | - | 8x 01 04 54 0p FF | p: NR Setting (0: Off, level 1 to 8) |
| CAM_Flicker | 0/50Hz/60Hz | 8x 01 04 23 0p FF | p: Flicker Settings (0: Off, 1: 50Hz, 2: 60Hz) |
| CAM_DHotPixel | - | 8x 01 04 56 0p FF | p: Dynamic Hot PixelSetting (0: 0ff, level 1 to 6) |
| CAM_ApertureMode (sharpness) | Auto | 81 01 04 05 02 FF | Sharpness Auto |
| | Manual | 81 01 04 05 02 FF | Sharpness Manual |
| CAM_Aperture (sharpness) | 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_PictureEffect | Off | 8x 01 04 63 00 FF | Picture Effect Setting |
| | B&W | 8x 01 04 63 04 FF | |
| CAM_Memory(preset) | Reset | 8x 01 04 3F 00 pp FF | pp: Memory Number (=0 to 127) |
| | Set | 8x 01 04 3F 01 pp FF | |
| | Recall | 8x 01 04 3F 02 pp FF | |
| CAM_LR_Reverse | On | 8x 01 04 61 02 FF | Image Flip HorizontalOn/Off |
| | Off | 8x 01 04 61 03 FF | |
| CAM_PictureFlip | On | 8x 01 04 66 02 FF | Image Flip VerticalOn/Off |
| | Off | 8x 01 04 66 03 FF | |
| SYS_Menu | Off | 8x 01 06 06 03 FF | Turns the OSD menu On/Off |
| | On | 8x 01 06 06 02 FF | |
| CAM_ColorGain | Direct | 8x 01 04 49 00 00 00 0P FF | p: Color Gain setting 0h (60%) to Eh (200%) |

## Camera Control Commands

| Command | Function | Command Packet | Comments |
|---|---|---|---|
| Pan_tiltDrive | Up | 8x 01 06 01 VV WW 03 01 FF | VV: Pan speed 0x01(low speed) to 0x18 (high speed) |
| | Down | 8x 01 06 01 VV WW 03 02 FF | WW: Tilt speed 0x01(low speed) to 0x14 (high speed) |
| | Left | 8x 01 06 01 VV WW 01 03 FF | speed) |
| | Right | 8x 01 06 01 VV WW 02 03 FF | YYYY: Pan PositionZZZZ: Tilt Position |
| | 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 | |
| | Pan range: -170° ~ +170° | 0F 06 07 00 ~ 50 00 09 09 (YYYY) | |
| | Tilt range: -30° ~ +90° | 0F 0E 04 05 ~ 00 05 01 00 (ZZZZ) | |
| | Home | 8x 01 06 04 FF | |
| | Reset | 8x 01 06 05 FF | |

| Camera Control Commands | | | |
|---|---|---|---|
| **Command** | **Function** | **Command Packet** | **Comments** |
| Pan_tiltLimitSet | LimitSet | 8x 01 06 07 00 0W<br>0Y 0Y 0Y 0Y 0Z 0Z 0Z 0Z FF | W: 1 UpRight 0: Down-Left<br>YYYY: Pan Limit Position<br>ZZZZ: Tilt Position |
| | LimitClear | 8x 01 06 07 01 0W<br>07 0F 0F 0F 07 0F 0F 0F FF | |
| CAM_AFSensitivity | High | 8x 01 04 58 01 FF | AF Sensitivity High/<br>Normal/Low |
| | Normal | 8x 01 04 58 02 FF | |
| | Low | 8x 01 04 58 03 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 |
| CAM_Contrast | Direct | 8x 01 04 A2 00 00 0p 0q<br>FF | pq: Contrast Position |

## Inquiry Commands

all parameter values are in hex

- x = camera address
- y = socket number
- z = camera address + 8

| Inquiry Commands | | | |
|---|---|---|---|
| **Command** | **Function** | **Command Packet** | **Comments** |
| CAM_ZoomPosInq | 8x 09 04 47 FF | 90 50 0p 0q 0r 0s FF | pqrs: Zoom Position |
| CAM_FocusAFModeInq | 8x 09 04 38 FF | 90 50 02 FF | Auto Focus |
| | | 90 50 03 FF | Manual Focus |
| | | 90 50 04 FF | OnePush Focus |
| CAM_FocusPosInq | 8x 09 04 48 FF | 90 50 0p 0q 0r 0s FF | pqrs: Focus Position |
| CAM_WBModeInq | 8x 09 04 35 FF | 90 50 00 FF | Auto |
| | | 90 50 01 FF | Indoor mode |
| | | 90 50 02 FF | Outdoor mode |
| | | 90 50 03 FF | OnePush mode |
| | | 90 50 05 FF | Manual |
| CAM_RGainInq | 8x 09 04 43 FF | 90 50 00 00 0p 0q FF | pq: R Gain |
| CAM_BGainInq | 8x 09 04 44 FF | 90 50 00 00 0p 0q FF | pq: B Gain |
| CAM_AEModeInq | 8x 09 04 39 FF | 90 50 00 FF | Full Auto |
| | | 90 50 03 FF | Manual |
| | | 90 50 0A FF | Shutter priority |
| | | 90 50 0B FF | Iris priority |
| | | 90 50 0D FF | Bright |
| CAM_ShutterPosInq | 8x 09 04 4A FF | 90 50 00 00 0p 0q FF | pq: Shutter Position |
| CAM_IrisPosInq | 8x 09 04 4B FF | 90 50 00 00 0p 0q FF | pq: Iris Position |
| CAM_BrightPosInq | 8x 09 04 4D FF | 90 50 00 00 0p 0q FF | pq: Bright Position |
| CAM_ExpComp-ModeInq | 8x 09 04 3E FF | 90 50 02 FF | On |
| | | 90 50 03 FF | Off |
| CAM_ExpCompPosInq | 8x 09 04 4E FF | 90 50 00 00 0p 0q FF | pq: ExpComp Position |
| CAM_Backlight-ModeInq | 8x 09 04 33 FF | 90 50 02 FF | On |
| | | 90 50 03 FF | Off |
| CAM_Noise2DLevel | 8x 09 04 53 FF | 90 50 0p FF | Noise Reduction (2D) p: 0 to 5 |
| CAM_Noise3DLevel | 8x 09 04 54 FF | 90 50 0p FF | Noise Reduction (3D) p: 0 to 8 |
| CAM_FlickerModeInq | 8x 09 04 55 FF | 90 50 0p FF | p: Flicker Settings(0: OFF, 1: 50Hz, 2: 60Hz) |
| CAM_Aperture-ModeInq (Sharpness) | 8x 09 04 05 FF | 90 50 02 FF | Auto Sharpness |
| | | 90 50 03 FF | Manual Sharpness |

## Inquiry Commands

| Command | Function | Command Packet | Comments |
|---|---|---|---|
| CAM_ApertureInq(Sharpness) | 8x 09 04 42 FF | 90 50 00 00 0p 0q FF | pq: Aperture Gain |
| CAM_PictureEffectModeInq | 8x 09 04 63 FF | 90 50 02 FF | Off / Color |
| | | 90 50 04 FF | B&W |
| CAM_MemoryInq | 8x 09 04 3F FF | 90 50 0p FF | p: Memory number last operated. |
| SYS_MenuModeInq | 8x 09 06 06 FF | 90 50 02 FF | On |
| | | 90 50 03 FF | Off |
| CAM_LR_ReverseInq | 8x 09 04 61 FF | 90 50 02 FF | On |
| | | 90 50 03 FF | Off |
| CAM_PictureFlipInq | 8x 09 04 66 FF | 90 50 02 FF | On |
| | | 90 50 03 FF | Off |
| CAM_ColorGainInq | 8x 09 04 49 FF | 90 50 00 00 00 0p FF | p: Color Gain setting 0h (60%) to Eh (200%) |
| VideoSystemInq | 8x 09 06 23 FF | 90 50 00 FF | 1920x1080p60 |
| | | 90 50 01 FF | 1920x1080p50 |
| | | 90 50 02 FF | 1920x1080i60 |
| | | 90 50 03 FF | 1920x1080i50 |
| | | 90 50 04 FF | 1280x720p60 |
| | | 90 50 05 FF | 1280x720p50 |
| | | 90 50 06 FF | 1920x1080p30 |
| | | 90 50 07 FF | 1920x1080p25 |
| | | 90 50 08 FF | 1280x720p30 |
| | | 90 50 09 FF | 1280x720p25 |
| | | 90 50 0A FF | 1920x1080p59.94 |
| | | 90 50 0B FF | 1920x1080i59.94 |
| | | 90 50 0C FF | 1280x720p59.94 |
| | | 90 50 0D FF | 1920x1080p29.97 |
| | | 90 50 0E FF | 1280x720p29.97 |
| Pan-tiltMaxSpeedInq | 8x 09 06 11 FF | 90 50 ww zz FF | ww: Pan Max Speed zz: Tilt Max Speed |
| Pan-tiltPosInq | 8x 09 06 12 FF | 90 50 0w 0w 0w 0w 0z 0z 0z 0z FF | wwww: Pan Position zzzz: Tilt Position |
| CAM_GainLimitInq | 8x 09 04 2C FF | 90 50 0q FF | p: Gain Limit |
| CAM_DHotPixelInq | 8x 09 04 56 FF | 90 50 0q FF | p: Dynamic Hot PixelSetting (0: 0ff, level 1 to 6) |
| CAM_AFSensitivityInq | 8x 09 04 58 FF | 90 50 01 FF | High |
| | | 90 50 02 FF | Normal |
| | | 90 50 03 FF | Low |

| Inquiry Commands | | | |
|---|---|---|---|
| **Command** | **Function** | **Command Packet** | **Comments** |
| CAM_BrightnessInq | 8x 09 04 A1 FF | 90 50 00 00 0p 0q FF | pq: Brightness Position |
| CAM_ContrastInq | 8x 09 04 A2 FF | 90 50 00 00 0p 0q FF | pq: Contrast Position |
| CAM_FlipInq | 8x 09 04 A4 FF | 90 50 00 FF | Off |
| | | 90 50 01 FF | Flip-H |
| | | 90 50 02 FF | Flip-V |
| | | 90 50 03 FF | Flip-HV |
| CAM_IridixInq | 8x 09 04 A7 FF | 90 50 00 00 0p 0q FF | pq: Iridix Position |
| CAM_AFZone | 8x 09 04 AA FF | 90 50 00 FF | Top |
| | | 90 50 01 FF | Center |
| | | 90 50 02 FF | Bottom |
| CAM_ColorHueInq | 8x 09 04 4F FF | 90 50 00 00 00 0p FF | p: Color Hue setting 0h (−14 degrees) to Eh (+14 degrees) |
| CAM_TallyLight | Red | 81 01 7E 01 0A 00 02 03 FF | Tally Light Red ON |
| | Green | 81 01 7E 01 0A 00 03 02 FF | Tally Light Green ON |
| | Off | 81 01 7E 01 0A 00 03 03 FF | Tally Light OFF |

# Appendix A1 - Pelco-D Protocol and 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 |
| 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 |
| 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 |
| Auto Focus | 0xFF | Address | 0x00 | 0x2B | 0x00 | 0x01 | SUM |
| Manual Focus | 0xFF | Address | 0x00 | 0x2B | 0x00 | 0x02 | 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 |

# Appendix A2 - Pelco-P Protocol and 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 |
| Zoom In | 0xA0 | Address | 0x00 | 0x20 | 0x00 | 0x00 | 0xAF | XOR |
| Zoom Out | 0xA0 | Address | 0x00 | 0x40 | 0x00 | 0x00 | 0xAF | XOR |
| Focus Far | 0xA0 | Address | 0x00 | 0x80 | 0x00 | 0x00 | 0xAF | XOR |
| Focus Near | 0xA0 | Address | 0x01 | 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 |
| Auto Focus | 0xA0 | Address | 0x00 | 0x2B | 0x00 | 0x01 | 0xAF | XOR |
| Manual Focus | 0xA0 | Address | 0x00 | 0x2B | 0x00 | 0x02 | 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 |

# Appendix B - Dimensions
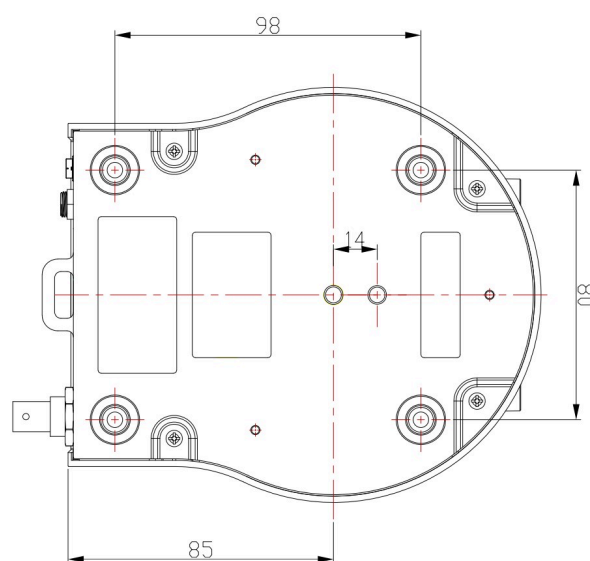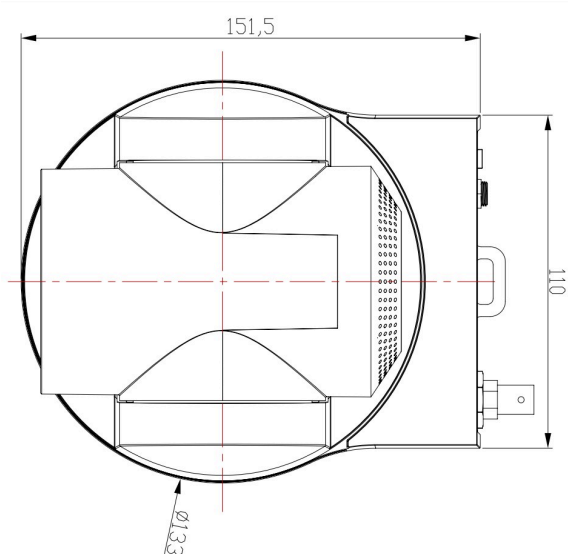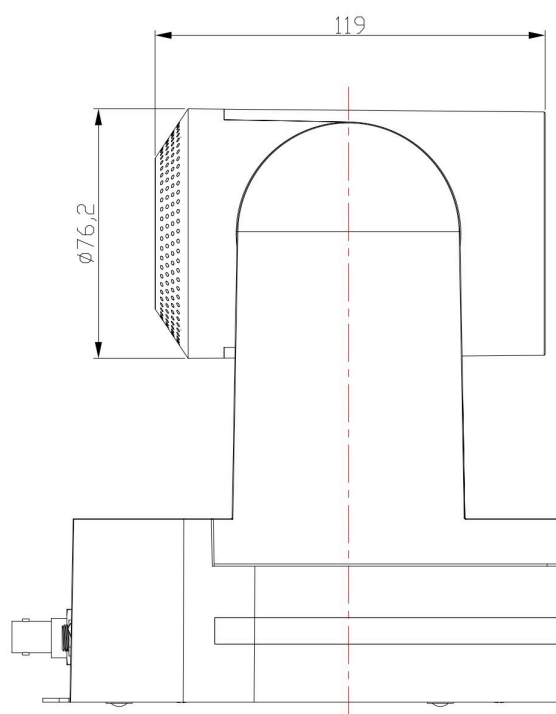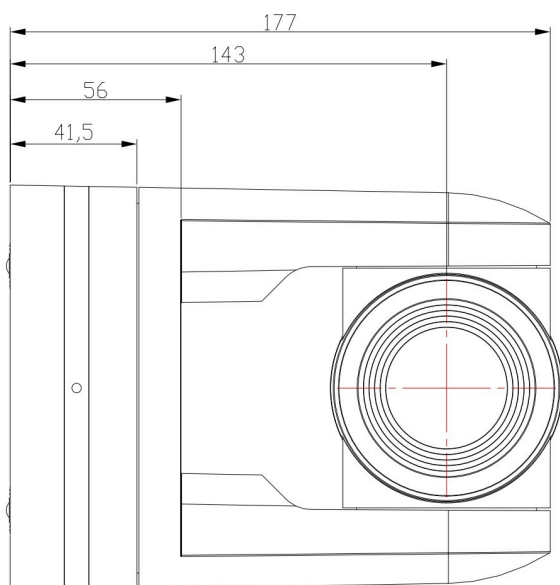
# Appendix C - CMOS Image Sensor Characteristics

## White Flecks

Although the CMOS image sensors are produced with high-precision technologies, fine white flecks may be generated on the screen in rare cases. These flecks are caused by natural and / or artificial radition, which causes a "false exposure"on the image sensor. The shape of these spots may vary from dots to lines or other —sometimes irregular— shapes.

These spots occur in random locations of the image, occur only in a single frame and are more visible in dark images. This is a principle issue of all image sensors and *is not a malfunction*.

The white flecks especially tend to be seen in the following cases:

- When operating at a high ambient temperature
- When you have raised the gain (sensitivity)

The white flecks may be reduced by turning the camera off, then on again.

## Aliasing

When fine patterns, stripes, or lines are shot, they may appear jagged or flickering. *Aliasing* refers to the effect that is produced when a signal is imperfectly reconstructed from the original signal. It occurs when a signal is not sampled at a high enough frequency to create an accurate representation.

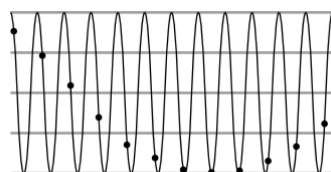This effect is shown in the following example of a *sinusoidal function*:



*Figure 40: Sinusoidal Function*

In this example, the dots represent the sampled data and the curve represents the original signal. Because there are not enough sampled data points, the resulting pattern produced by the sampled data is a poor representation of the original.

## Focal Plane

Owing to the characteristics of the pickup elements (CMOS image sensors) for reading video signals, subjects that quickly move across the screen may appear slightly skewed (i.e., tilted to the left or right, depending on the direction of camera or subject movement). Since a CMOS sensor typically captures one row at a time within approximately 1/60th or 1/50th of a second (depending on the refresh rate), it may result in a "rolling shutter" effect. In such cases, the image is skewed.

## Flash Band

If you film a strobe or quick-flashing light, brightness may differ between the upper and lower halves of the picture. See the Focal Plane explanation above for a clarification ofthis occurrence.

## Flicker

If you are recording under lighting that is produced by discharge tubes (such as fluorescent, sodium or mercury-vapor lamps), the screen may flicker, colors may vary, or horizontal stripes may appear distorted.

In such cases, set the *anti-flicker* setting to 'on'.

> **Depending on lighting types, such occurrences may not be improved with the anti-flicker setting. It is recommended to set the shutter speed to 1/100s in areas of 50 Hz power supply frequency, and to 1/60s in areas of 60 Hz power supply frequency.**

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