Pre-sales Test and Maintenance Guide to Smart Functions

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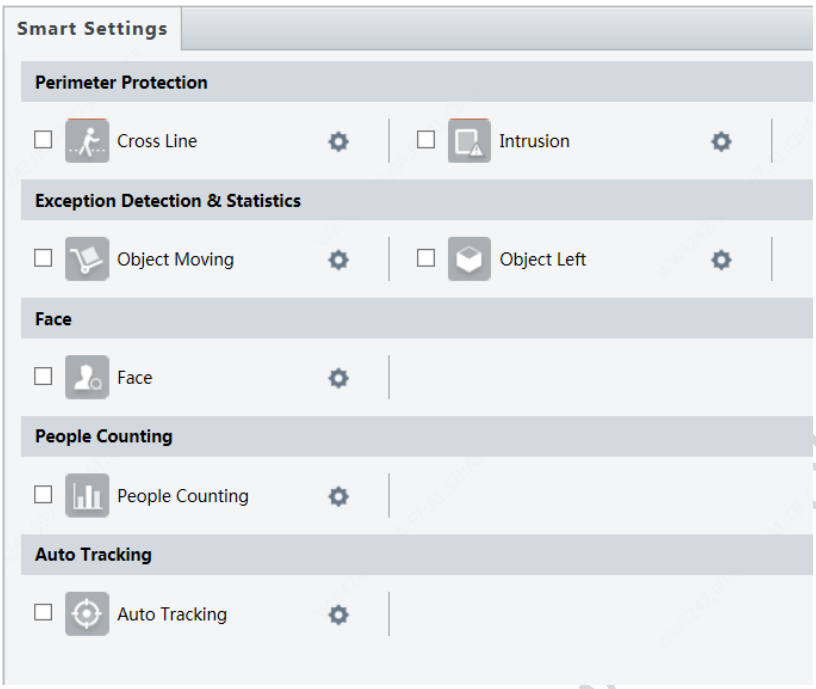
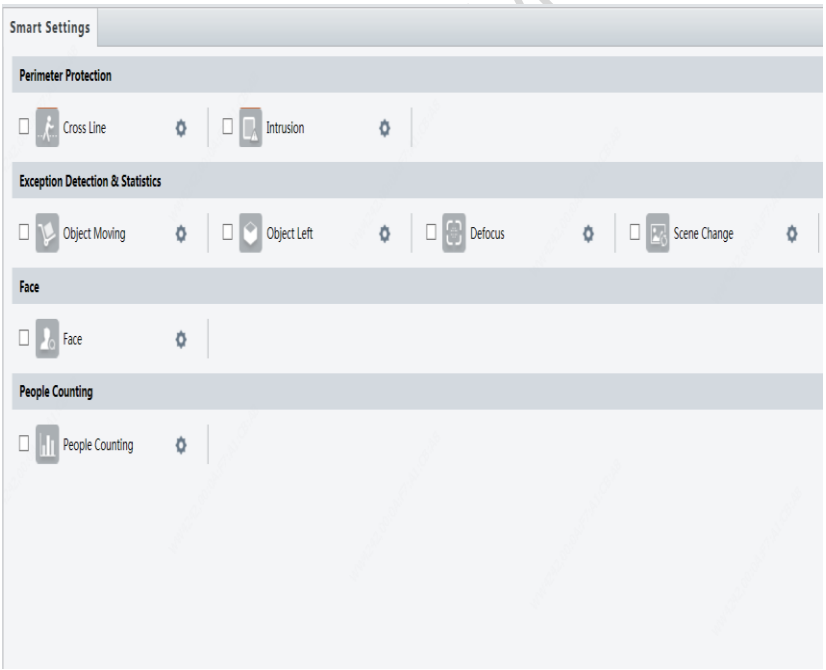
1 Introduction to Smart Functions

Smart functions are integrated in a common IPC for simple detection and analysis of specific behaviors and alarm generation correspondingly.

Smart Settings page of a dome camera:



Smart Settings page of a box camera:



Currently, smart functions can detect cross line, intrusion, object left, object moving, defocus, scene change, face, people counting, and auto tracking. Based on this service mode, relevant parameters and plans of smart functions are configured on the front end. When a rule is triggered, a packet similar to a motion detection alarm is generated and sent to the platform. Then, the corresponding action is triggered by generating an alarm on the platform or in other linkage modes. Since most smart functions work based on screen brightness differences, factors affecting the screen brightness in the scene, such as shadow, strong light, reflect light, WDR, and noises, can cause interference.

The table below lists the main factors of illumination change that can influence smart determination.

Illumination	Impact	Scene
WDR	When an object moves from a bright area to a dark area, the smart may not be able to track the object continuously or may even lose the object. In addition, objects at the junction of the bright and dark areas will have bright and dark sides.	Building edges, and places under overpasses, with water surfaces, and against entrance gates
Overexposure/ Underexposure	In an overexposure/underexposure scene, smart determination can be very difficult due to the relatively small brightness difference. In addition, the large noise in an underexposure scene can heavily impact on smart determination.	Back light, night, etc.
Quick change	The smart may incorrectly determine quickly changing illumination as an object, and quick change makes background unstable.	Tree shade, shadow, automobile lighting, and cloudy day

Table 1

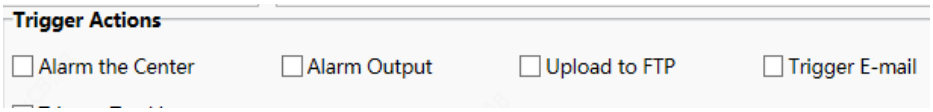



Smart services are sensitive to illumination changes and therefore it is not recommended to test the services in scenes listed in Table 1.

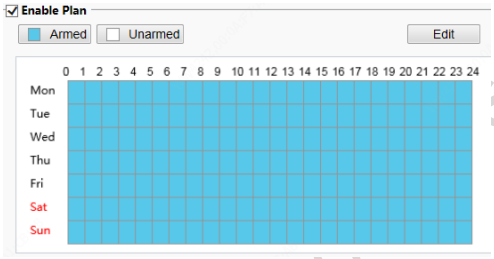
Basic concepts of smart services:

Object center point: When an object is detected, a green detection frame appears. The center of the frame is the center of the object. Algorithms use the center point to represent the object. Whether to trigger rules of tripwire, intrusion, etc. depends on whether the center point meets the preset condition and has nothing to do with the object edge. Therefore, we may see sometimes that an object has reached the rule line but no rule is triggered.

Alarm triggering: When an object triggers a rule, the corresponding action can be performed, including reporting the alarm to the center, outputting the alarm, uploading to the FTP, and email triggering. Smart items not mentioned with alarm triggering below all support these four actions.



Arming schedule: Alarms and alarm-triggered actions take effect only in the time period of an arming schedule. If no arming schedule is configured, no alarm will be reported and no action will be triggered even if an object triggers a rule.



Sensitivity: A higher sensitivity means wider conditions of rule triggering and reduces report losses, but may increase the probability of incorrect triggering.

1. People Counting

1.1 Function Introduction

Traffic statistics: A surveillance area is preset in a surveillance scene. When someone enters or leaves the area, the people entry and leaving data is recorded. For a closed space, the number of people remaining in the place can be obtained by calculating the flow at the entrance and exit. This function is applicable to entrances and exits of indoor environments, such as chain stores, exhibitions, museums, and hotels.

1.2 Installation Requirements

(1) Mounting position: The camera needs to be ceiling-mounted in front of the pedestrians walking direction, as shown in the installation diagram. The area needs to have stable illumination, avoiding impact of illumination changes caused by door opening and closing on the smart determination.

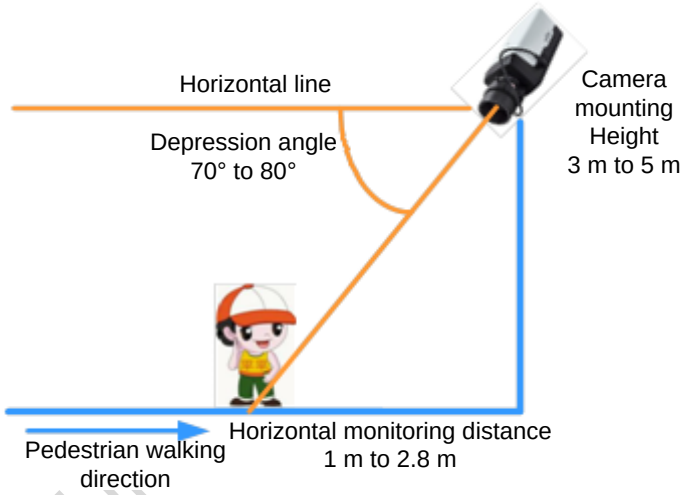
(2) Depression angle of the camera: between 70° and 80°.

(3) Horizontal distance from the box camera to the snapshot point: related to the camera installation height and depression angle.

(4) Lens selection: It is recommended that the lens focal length not be less than 4 mm. Otherwise, distortion may occur. Do not use a lens with a large focal length as well. Otherwise, the coverage range will reduce.

(5) Shoulder pixels: The detection effect is optimal when human shoulder pixels are between 120 pixels and 160 pixels (for 1080P screens; zoom accordingly for other resolutions). During the installation, adjust the camera height and lens focal length so that the shoulder pixels meet the requirement.

Installation Diagram



1.3 Scene Recommendations

(1) **Scene selection:** It is advised to apply the traffic statistics service at indoor entrances and exits of shopping malls, supermarkets, parks, and elevators, instead of in open and broad places such as roads and squares.

(2) **Illumination:** If no fill light is available in the surveillance area, it is recommended that a 50 W fluorescent lamp be installed every one meter right above the surveillance area for fill light.

(3) **Surveillance range:** The effective surveillance width ranges from 1 m to 4 m, but the actual width of the scene can be greater.

(4) **Blocking:** If a head is blocked by a hat or umbrella, the effectiveness of pedestrian detection will be reduced.

(5) **Installation angle of the camera:**

The recommended mounting height is 3 m, depression angle is 75°, and shoulder pixels are 130.

1.4 Recommended Scenes

1. Entrances and exits with sufficient illumination, fixed object tracks, single person passing by, appropriate camera mounting angle and height, and human head pixels meeting requirements

1.5 Non-recommended Scenes

1. Open and broad places, such as roads and squares
2. Scenes with a large passenger flow and multiple persons passing at the same time
3. Scenes with unfixed object tracks
4. Scenes with multiple objects close to one another, which can cause incorrect detection when they pass by at the same time
5. Scenes with people staying on the detection line because the object center changes consecutively and may trigger counting for multiple times
6. Scenes with insufficient illumination, such as nights and rainy days
7. Scenes where the camera angle and height are improper or the head pixels do not meet the requirement

Examples of non-recommended scenes

1.6 Configuration Description

Enable Passenger Flow Detection: distinguishes entry and leaving. Currently, you can set only horizontal rule lines.

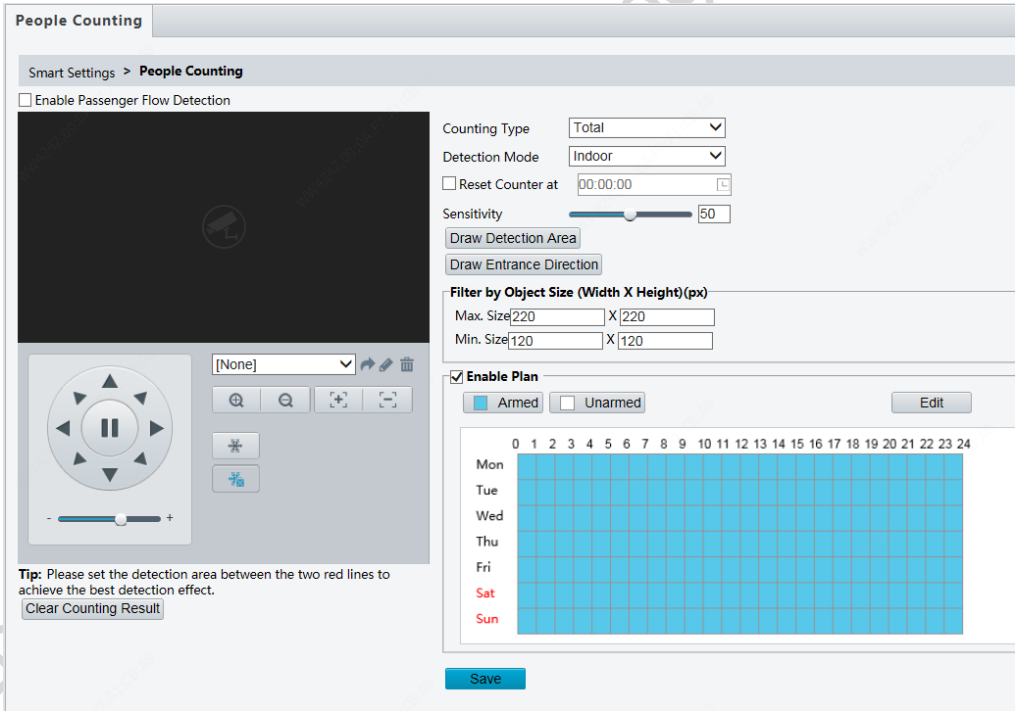
Counting Type:Total, **People Entered**, or **People Left**

Detection Mode: Indoor or **Outdoor**. The main difference lies in the algorithm classifier. You are advised to choose **Indoor** for indoor scenes.

Reset Counter at: You can set a time to clear the OSD value.

Sensitivity: indicates the ability to distinguish objects that are close to one another. A higher sensitivity indicates a stronger ability to recognize multiple objects.

Filter by Object Size: For the same object, a greater setting value of **Filter by Object Size (Width X Height)** brings a higher false alarm rate. A too small setting value brings a higher rate of missed detection. Therefore, when setting the parameters, make clear of the head size of the object to be detected.



2. Cross Line Detection

2.1 Function Introduction

This function presets detection tripwires on the video screen and selects the triggering direction. When an object reaches a tripwire in the preset direction on the screen, an alarm is generated.

2.2 Installation Requirements

(1) Avoid large objects because they may cause serious detection errors.

(2) Depression angle of the camera: at least 20° between the optical axis of the camera lens and the horizontal plane.

(3) Surveillance range: related to the focal length of the selected lens and the mounting height of the box camera. The minimum pixels of an object on a 1080P screen need to be 40 x 40 (width x height).

Theoretical calculation formu

2.3 Scene Recommendations

(1) The scenes must be fixed, that is, the camera does not move.

(2) Mounting position: The camera needs to be mounted in a place with a wide view and without back light to avoid light interference.

(3) Avoid the areas that may affect the accuracy if possible, such as areas with shaking leaves, waving shadows, or many birds.

(4) Avoid scenes with reflect lights, such as glasses, floor tiles, and lakes.

(5) Single-object scenes are recommended and multiple-object scenes are not recommended.

Recommended installation:

Height	Pixel	Angle
6	200	30
3	220	17

Note: The principles of detecting intrusion,enter area, leave area,are the same as those of cross line detection, and the scene requirements are similar. Therefore, for the installation recommendations and detection requirements of the functions, you can see those of cross line detection.

2.4 Recommended Scenes

Scenes with simple and clear backgrounds, sufficient illumination, and great difference between the object and background, and without interference and blocking


2.5 Non-recommended Scenes

1. Scenes without sufficient illumination, outdoors at night
2. Scenes with multiple objects because smart determination indexes will be affected
3. Scenes with too large or small objects or other interferences like light
4. Too noisy scenes
5. Scenes with severe blocking

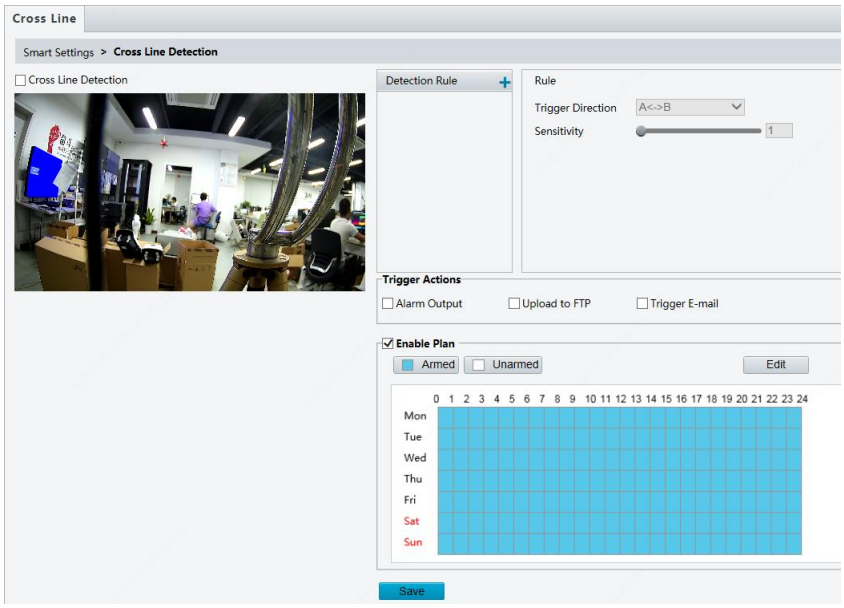
   Examples of non-recommended scenes





2.6 Configuration Description

The rule line cannot be too close to the screen edge. Single- or double-direction detection should be configured as required. The sensitivity needs to be set based on the size of the object to be detected.



Detection area: You can set up to four detection lines with independent triggering directions and sensitivities.

Trigger Direction: If an object crosses the line in the preset arrow direction, the rule is triggered. The value can be A->B, B->A, and A<->B.

Sensitivity: sets the size of the object to be detected. The value ranges from 1 to 100. A greater value indicates that a smaller object can be detected. The minimum size is 40 pixels. A smaller value indicates that a larger object can be detected.

3. Intrusion Detection

3.1 Function Introduction

This function presets surveillance areas in the scene. When an object intrudes into the areas or an originally still object leaves the areas, an alarm is generated.

3.2 Installation Requirements

For installation requirements, see those of cross line detection.

3.3 Scene Recommendations

For scene selection recommendations, see those of cross line detection.

3.4 Recommended Scenes

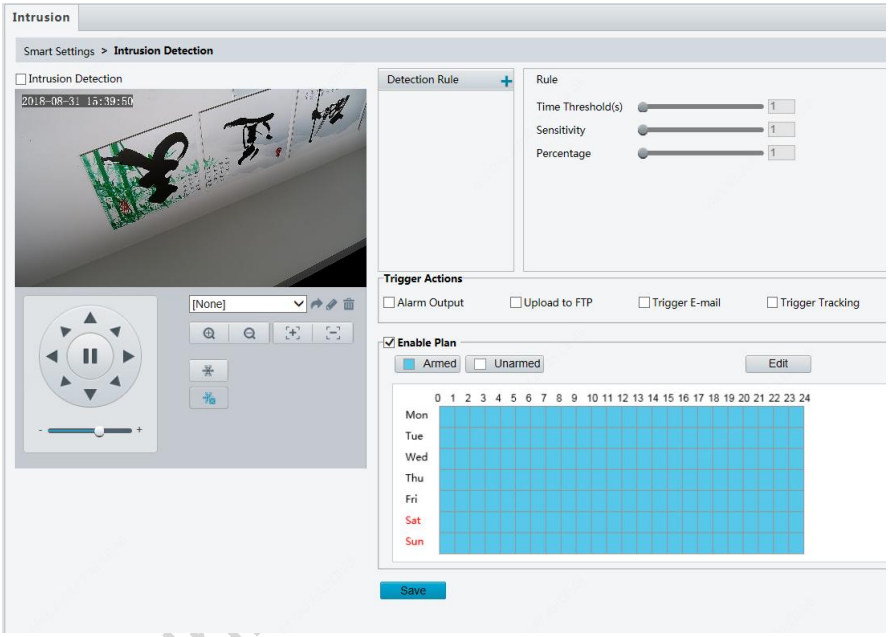
For recommended scenes, see those of cross line detection.

3.5 Non-recommended Scenes

(1) Scenes with many people and much interference, such as waving shadows, light, dark light, shaking leaves, rain and snow, and searchlight

(2) Scenes with IR, long corridors, or obstacles in front of the lens

3.6 Configuration Description



Detection areas: Up to four areas can be set with independent time thresholds, sensitivities, and percentages. The areas can be in hexagon.

Time Threshold(s): duration of an object staying in the detection area before an alarm is triggered

Percentage: ratio of the object size to the detection area

Sensitivity: determines the size of an object that can be detected. When the sensitivity is the highest, the object size is 40 pixels.

4. Object Left/Object Moving

4.1 Function Introduction

Object left presets detection areas on the screen and detects events that an object is left in an area for a certain duration. This function can prevent unscrupulous personnel from destroying important facilities, such as leaving flammable, explosive, and other dangerous goods close to the facilities. The detection of unknown carry-over can

prevent major accidents.

Object moving presets detection areas on the screen and detects events that an object is moved from an area for a certain duration. This function detects whether some required objects are moved, such as fire extinguishers, flowerpots, bags, wallets, and mobile phones. It determines whether an object in a detection area is moved from a video sequence.

4.2 Installation Requirements

(1) Mounting position: Directly above or obliquely above the object being monitored

(2) Mounting height: 2.5 m to 3.0 m recommended

(3) Surveillance range: related to the focal length of the selected lens and the mounting height of the camera. The minimum pixel requirement of an object on a 1080P image is 40 x 40 (width x height).

(4) For other installation requirements, see those of cross line detection.

4.3 Scene Recommendations

(1) Scene selection: The object left/object moving detection function is recommended for **Indoor scenes with fixed illumination**, such as exhibition halls and warehouses. It is not recommended for open scenes, such as roads and squares, complicated scenes with many people coming and going, such as stations and supermarkets, and scenes with great change, such as strong light in the morning when the task is created but no illumination in the afternoon. If the scene changes greatly, you are advised to recreate the task and detect again. Indoor scenes without great changes are recommended for detection. When a task of object left detection is created, no objects can be left in the detection area. When a task of object moving detection is created, the object to be moved must exist in the detection area.

(2) Illumination: It is recommended that the gray value change in the scene during the detection does not exceed 30 for a long time, that is, the illumination should not change greatly.

(3) This function is applicable only to single-object and clear scenes.

(4) For other scene selection recommendations, see those of cross line detection.

4.4 Recommended Scenes for Object Left Detection

For recommended scenes, see those of cross line detection.

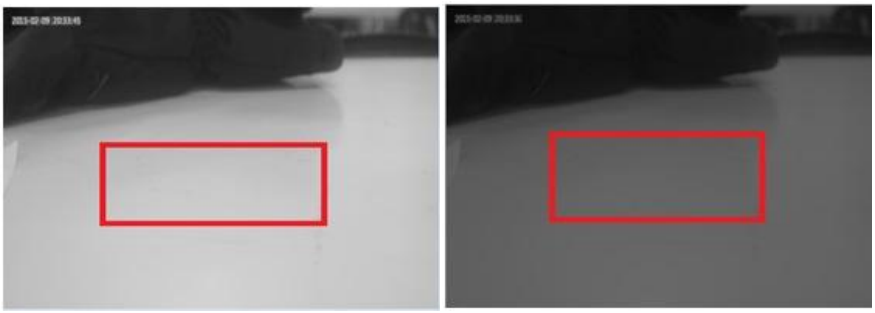
4.5 Recommended Scenes for Object Moving Detection

Scenes with great difference between the object to be detected and the background color

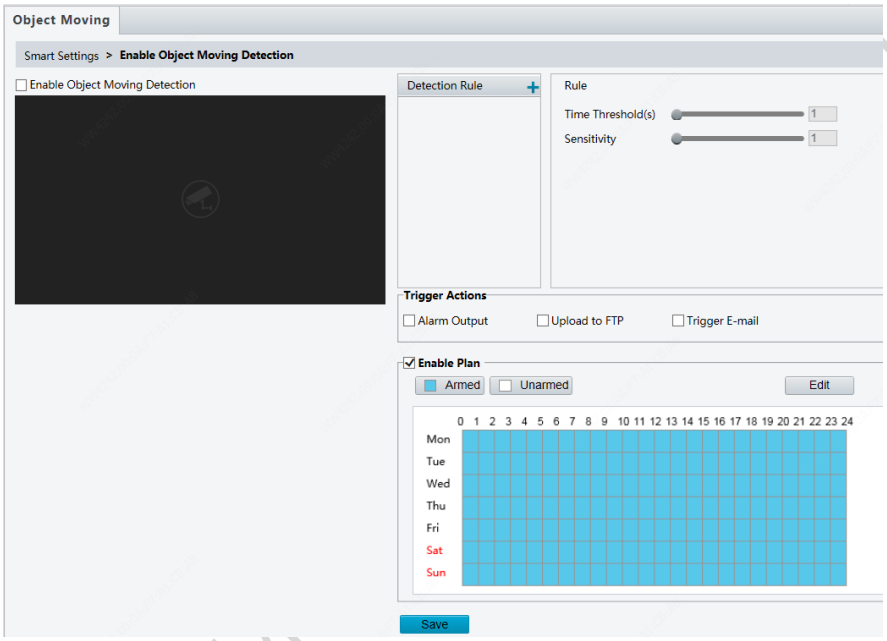
4.6 Non-recommended Scenes

(1) Scenes with adverse factors, such as too small objects, too dark images, and other interference factors in the detection area

(2) Scenes with great illumination change during the detection, that is, the brightness in the left and right pictures varies greatly In a task, the scene illumination changes greatly and the scene gray value change is greater than 30. That is, the scene is shown in the left picture for some time and then in the right picture for some time. The scene changes greatly.



4.7 Configuration Description



Detection areas: Up to four areas can be set with independent time thresholds and sensitivities.

Time Threshold(s): duration when an object can be left in a detection area.

Sensitivity: ranges from 1 to 100. A higher sensitivity means that a smaller object can be detected, and a smaller sensitivity means that a larger object can be detected.

5. Defocus

5.1 Function Introduction

This function determines whether defocus occurs on a camera and generates an alarm if so. This function calculates the image resolution. If the resolution is lower than the threshold, an alarm is generated.

5.2 Installation Requirements

See those of cross line detection.

5.3 Scene Recommendations

(1) Moving object: If a moving object occupies a large percentage of the screen, the focus detection algorithm may determine defocus incorrectly.

(2) Scene change: If the scene changes, all the scenery changes, and a determination error occurs.

(3) Illumination: Generally, sufficient and uniform illumination is the optimal ambient light. Because all artificial light sources are not able to be uniform outdoors, it is improper to perform smart tests outdoors at night.

(4) For other scene selection recommendations, see those of cross line detection.

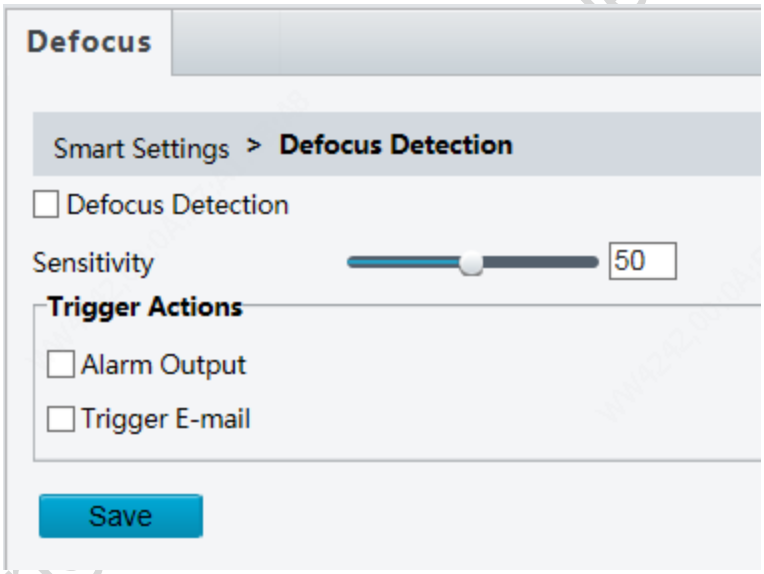
5.4 Recommended Scenes

For recommended scenes, see those of cross line detection.

5.5 Non-recommended Scenes

For non-recommended scenes, see those of cross line detection.

5.6 Configuration Description



Sensitivity: degree of controlling defocus (image clearness), ranging from 1 to 100. A smaller value indicates that defocus is more difficult to be detected, and a larger value indicates that defocus is easier to be detected.

Trigger Actions: Trigger E-mail or **Alarm Output**

6. Scene Change

6.1 Function Introduction

This function determines whether the camera surveillance scene changes and generates an alarm if so. The algorithm of this function features an image stabilizer. However, a great jitter may still be incorrectly determined as a scene change.

6.2 Installation Requirements

See those of cross line detection.

6.3 Scene Recommendations

(1) Moving object: If a moving object occupies a large percentage of the screen, the algorithm may incorrectly determine scene change.

(2) Blocking: If an obstacle, such as an electric wire and branch, exists between the device and object, determination error may occur.

(3) Illumination: Generally, sufficient and uniform illumination is the optimal ambient light. Because all artificial light sources are not able to be uniform outdoors, it is improper to perform smart tests outdoors at night.

(4) For other scene selection recommendations, see those of cross line detection.

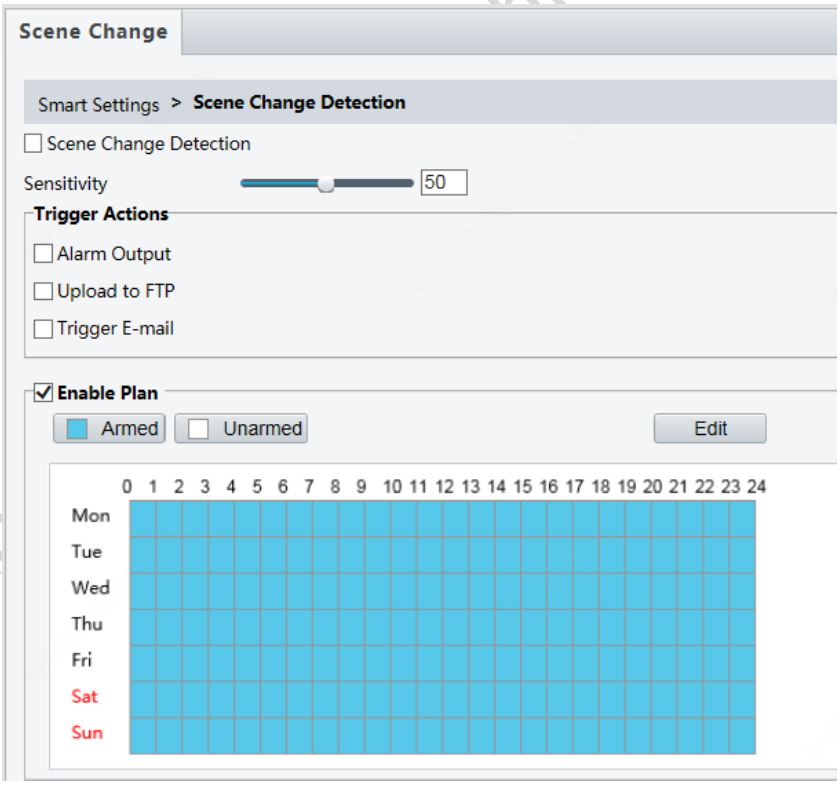
6.4 Recommended Scenes

For recommended scenes, see those of cross line detection.

6.5 Non-recommended Scenes

For non-recommended scenes, see those of cross line detection.

6.6 Configuration Description



Sensitivity: degree of detecting scene change, ranging from 1 to 100. A smaller value indicates that scene change is more difficult to be detected.

Trigger Actions:Alarm Output, **Upload to FTP**, or **Trigger E-mail**

7. Face

7.1 Function Introduction

This function first determines areas with similar colors to skins in the image and matches the areas with characteristics of human faces (by determining the similarity of the pixel brightness and darkness distribution in an area with a classifier). Only an area with matched characteristics is determined as a human face.

7.2 Installation Requirements

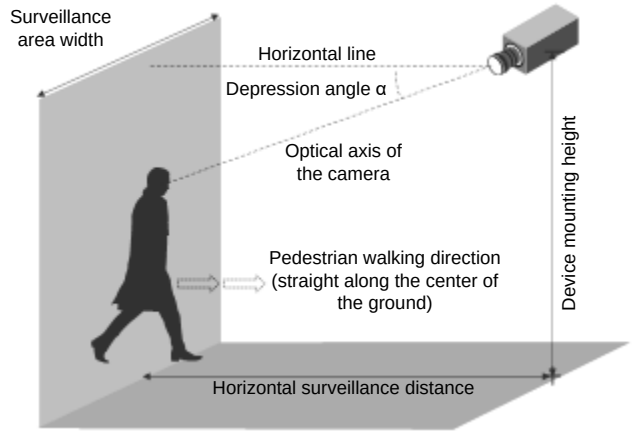
(1) Mounting height: 2.5 m to 3 m recommended

(2) Mounting position: dead against the human face with a horizontal deflection angle not greater than 30° and a downward angle not greater than 15°

(3) Depression angle of the camera: around 10° recommended

(4) Face pixels: more than 120 pixels

The installation scene is shown in the figure below.



7.3 Scene Selection

(1) **Pixel requirements**: Pixels of a human face on an image must be at least 120 pixels.

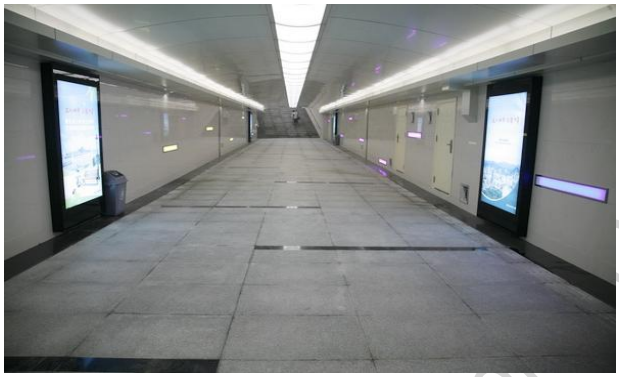
(2) **Illumination**: If no fill light is available in the surveillance area, it is recommended that a 50 W fluorescent lamp be installed every one meter right above the surveillance area for fill light.

7.4 Recommended Scenes

Scenes with face detection requirements

Scenes with uniform spotlight, such as metro entrances/exits

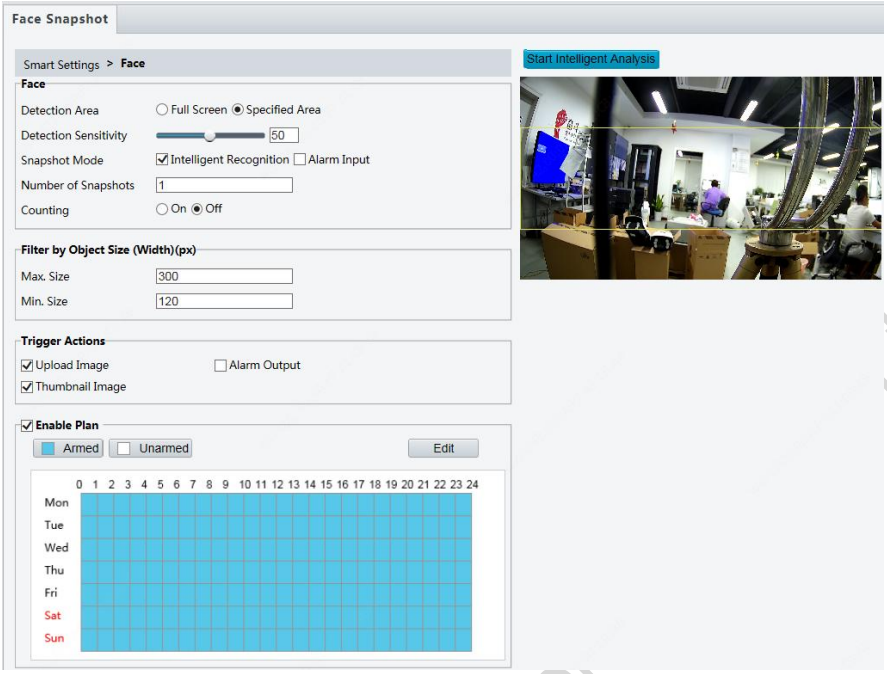
Scenes where the ambient light is uniform and sufficient and the human face size meets the minimum requirement



7.5 Non-recommended Scenes

Scenes with too large areas, too low illumination, or WDR

7.6 Configuration Description



Detection Area:Full Screen or **Specified Area**

Detection Sensitivity: determines the face detection capability. A higher sensitivity brings more accurate detection, less missed detection, more performance consumption, and more detection errors.

Snapshot Mode:Intelligent Recognition or **Alarm Input**

Number of Snapshots: number of snapshot face images

Counting: count total number of captured face images or not

Filter by Object Size: set according to the actual pixels of a human face on the image

8. Auto Tracking

8.1 Function Introduction

An object can be tracked in two modes depending on the trigger method:

Full screen smart detection: Taking a 2 mega-pixel dome camera as an example, the detection area is 1300 x 700 pixels with the center of the screen center (scaling in proportion for devices in other resolutions). The first detected moving object in the area is tracked.

Smart triggered and linked tracking: The first object that triggers a rule is tracked.

Note: It is not recommended to use auto tracking separately. Smart triggered and linked tracking is recommended for tracking services.

8.2 Installation Requirements

(1) Mounting height: between 6 m and 10 m. The recommended pole height is 6 m.

(2) Mounting position: The dome camera needs to be mounted in a place with a wide view and not applicable to indoor spaces or other confined scenes.

(3) Secure installation: After being installed, the dome camera cannot wobble when the PTZ rotates at the maximum speed.

(4) Device protection: After installing the dome camera, perform waterproof process and electric leakage prevention at the power supply and network connectors.

8.3 Scene Selection

(1) Moving objects: If many objects move in the scene, the tracked object may be lost due to the interference of surrounding objects. The tracking effect cannot be guaranteed in scenes like station squares and this function is not recommended.

(2) Blocking: Blocking is not allowed. If an object is blocked when the dome camera tracks it, tracking fails.

(3) Illumination: The tracking smart service is applicable to daytime only. Incorrect snapshot and tracking may occur under the impact of factors such as image noises, light interference, and low ambient illumination.

(4) Shadow interference: If a shadow exists in the surveillance scene and the object enters the shadow, the object may not be detected because the difference between the object and shadow is small.

(5) Weather interference: Rain and snow in rainy or snowy days and tree shaking in windy days may cause false alarms.

(6) Moving speed: This function is applicable to objects moving slowly, such as pedestrians. If an object moves fast at speed higher than 20 km/h, the dome camera cannot track the object.

(7) Detection: The object size on the image must meet the detection requirement. The recommended pixels of width x height are between 30 x 100 and 350 x 400.

(8) For other scene selection recommendations, see those of cross line detection.

8.4 Recommended Scenes

For recommended scenes, see those of cross line detection.

8.5 Non-recommended Scenes

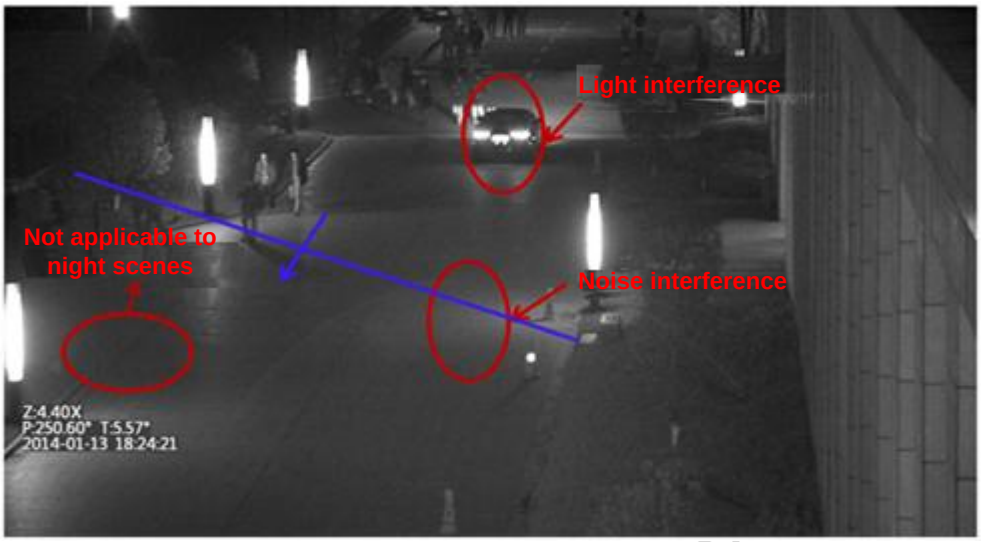
For non-recommended scenes, see those of cross line detection.

Scene 1

Scene 2

Scene 3

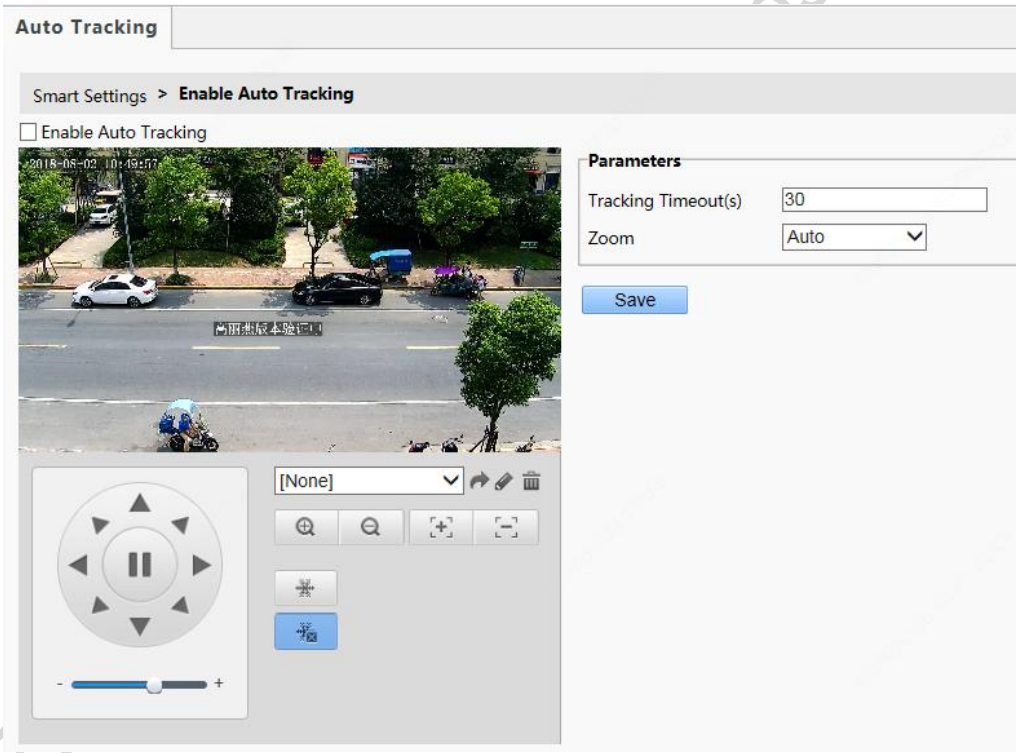
Scene 4



Scene 5

Scene 6

8.6 Configuration Description



Tracking Timeout(s): duration when the PTZ tracks an object (in the unit of second). After tracking the object for the period, the dome camera returns to the original position.

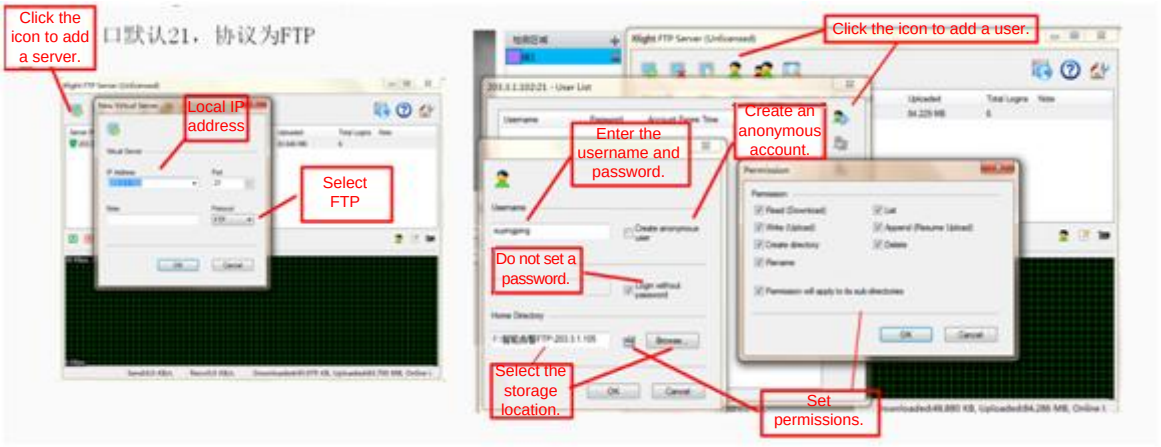
Zoom: If it is set to **Auto**, the device zooms automatically and displays the object with the height or width being 1/4 of that of the image. Whether the height or the width of the object is 1/4 of that of the image depends on whether the height or width of the object is greater. If the current zoom is used, the image will not be zoomed.

2 Appendix:

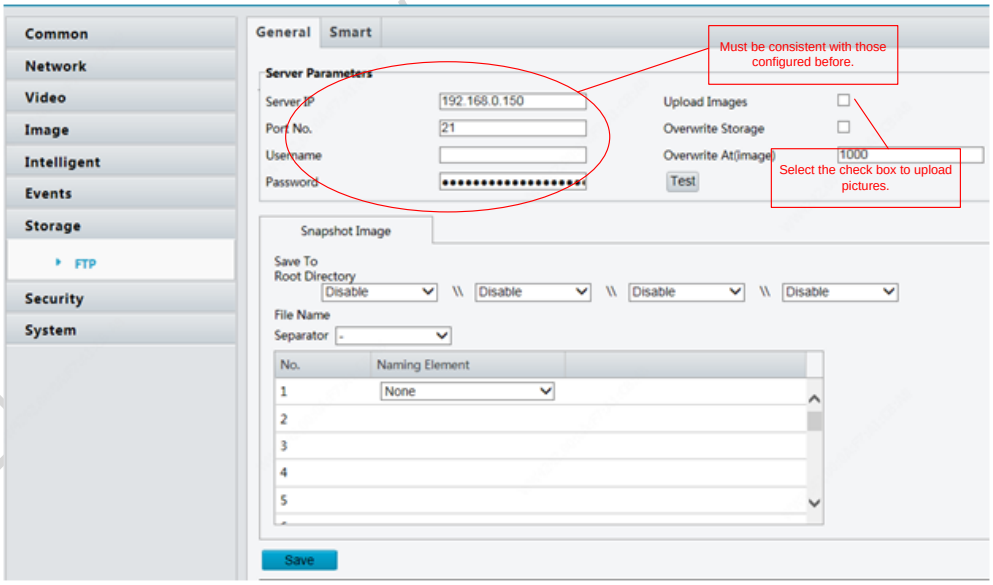
FTP Setting

1. Start Xlight and set the server address (local computer). By default, the port is 21 and the protocol is FTP.

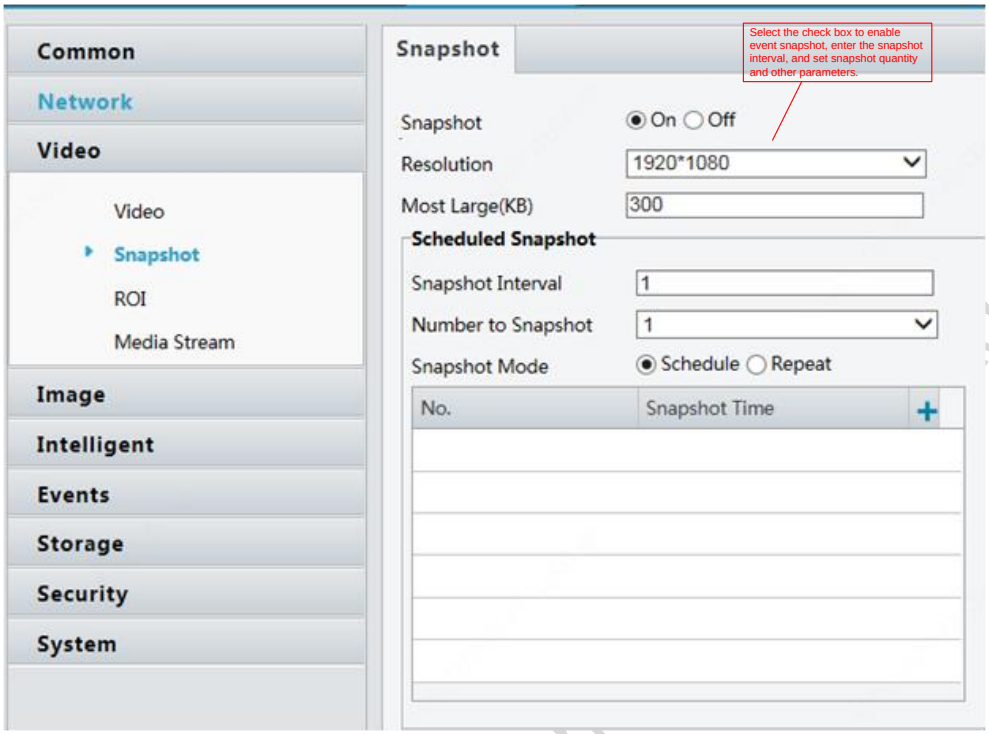
2. Double-click the computer icon and add a storage location as shown below.



3. Choose **Storage**>**FTP** on the web client and set as below. (The port number, username, and password must be consistent with those configured before.)

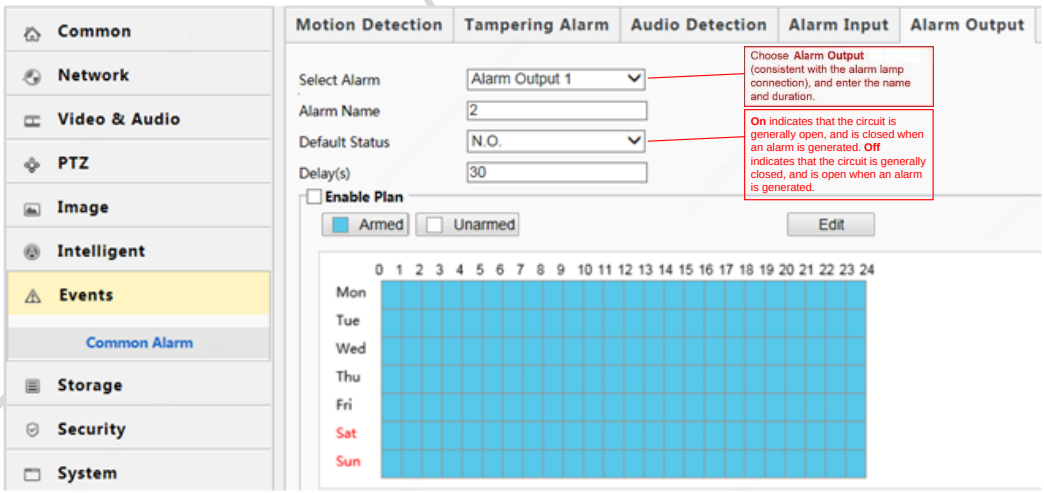


4. Choose**Audio/Video**>**Snapshot**, select **Event snapshot**, and set other parameters as required.



Alarm Output

1. Choose **Events**>**Common Alarm**>**Alarm Output**, and set as shown below.



2. Connect the alarm lamp: Connect the DC 12 V adapter, alarm lamp, and ALARM OUT at the rear of the IPC. Pay attention to the anode and cathode.

TMS Server Registration

Fill in the **Server** on the **Intelligent Server** page.