System Installation Guide

Systems for the UFO Data Acquisition Project (UFODAP)

ufodap.com

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RHOlch Systems

Disclaimer

This document is under active development and as such there may be mistakes and omissions — please watch out for these and report any you find to the developer at team.ufodap@gmail.com.

Contributions of material, suggestions and corrections are welcome.

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INTRODUCTION

A data collection system configured as part of the UFO Data Acquisition Project

(UFODAP) utilizes UFO Data Acquisition System (UFODAS) components. A UFODAS consists of several hardware and software components including cameras, cables, a Power over Ethernet (PoE) Injector and software. This document will guide you through the initial physical and software selection and setup of these components.

The basic unit of a UFODAS is a Data Acquisition Unit (DAU). There are several types of DAUs:

- Optical Tracking DAUs (OTDAU) which provides all of the functions to stream, analyze, detect and track targets in video streams from cameras

- Multi-Sensor DAUs (MSDAUs) which collect data from non-optical sensors including magnetic, gravitational, GPS and RF data

- Pan/Tilt DAU (PTDAU) which provides is a pan/tilt, payload-independent carrier for various sensors or combination of sensors such as cameras, radar and acoustic devices.

A complete UFODAS installation includes one or more DAUs and supporting components. Planning your system involves the following considerations:

- Site selection – Verification of usable viewing site lines to the intended field of view.

- If you collect data from one or more cameras, Multi-Sensor Data Acquisition Units (MSDAUs) or both.

- If you are using a camera(s), selection of the type of camera(s) for your situation -- Pan-Tilt-Zoom (PTZ) or fixed, optical field width and, if PTZ, maximum zoom.

- Equipment mounting methods – Using a tripod for temporary field studies or implementing a more permanent attachment of the equipment to a structure.

- Power source selection – Determining if AC power will be provided from a source near the installation or if the system must be self-sustaining, using, for instance, a solar/battery inverter power source.

- Communication infrastructure – Availability of local or remote routers and internet connections and whether the OTDAU or MC software will be run on one or more computers and whether those computers are local or remote.

- Communication interfaces – Cable runs, connections to routers or computers whether by cable or WiFi and IP address setup, forwarding and additional security measures. A camera could be hardwired to a local computer or router, remotely connected to a computer or router via an RF range extender or hardwired to a WiFi extender that communicates with a local router via WiFi.

- Protecting equipment from lightning-induced voltage surges.

- Software installation -- Optical Tracking Data Acquisition Unit (OTDAU) for camera data collection and Mission Control (MC) to collect data from OTDAUs and MSDAUs.

A minimal system could be nothing more than OTDAU software running on a local computer and using a USB webcam on a windowsill.

The most complex installations may utilize a combination of up to six DAUs with a total of up to 12 cameras and six MSDAUs. The six units may be widely separated with OTDAU computers remote from their associated cameras and MC running at yet another remote site. The internet connections that tie all these elements together may involve local or WiFi-connected routers and possibly a dedicated server.

UFODAS cameras may be provided mounted on a weatherproof junction box with a sealed Ethernet connector. They may be provided with a tripod mount or with mounting hardware appropriate for permanent mounting to a building, pole or tower.

A camera might be a standalone fixed-lens type or one that includes a pan/tilt/zoom capability. It might also use a PTDAU for motion control in lieu of its own P/T positioner. The PTDAU's primary function is to allow the combination of more than one such sensor so that all are directed at the same target while only one is used for tracking.

This guide shows how to implement a UFODAS system for any combination of the above selections.

PC HARDWARE SELECTION

One possible error message you may encounter while installing UFODAP software may be from the software installer noticing a very low amount of system RAM you have, e.g., 2GB.

The UFODAP User Guide specifies a minimum system of:

• Windows 10 or 11 OS on a PC Computer with Core i5 processor, 16GB memory and 2GB free disk memory. A faster computer, e.g., an i7 or i9 or with higher speed ratings may provide higher analysis frame rates and thus better tracking of faster targets. Higher-speed mass memory (HDD), especially Solid-State Disk (SSD) is desirable.

A slower PC, e.g., and i5, may work but process frame rates may be reduced, especially at higher camera resolutions.

That is also a rather slow CPU. For a comparison to a minimal i5 see:

https://versus.com/en/intel-atom-z3735f-vs-intel-core-i5-8250u

Monitor resolution is optimal for OTDAU and MC at 1920x1080. However, OTDAU will automatically scale its window size to fit the detected monitor size unless the Display option to force a particular size is enabled.

MC will be difficult to use with a resolution smaller than 1920x1080. You may find that it is convenient to use two or three monitors on your PC to better display, for example, two copies of OTDAU and MC in a triangulation setup.

There is no advantage in spending more on a computer rated for gaming since that usually includes special graphics acceleration hardware that is not used by OTDAU or MC.

CAMERA SELECTION

OTDAU software requires one camera, and optionally two, to detect and then track moving objects. It provides two types of hardware and software interface to cameras:

- USB webcams which may be external to your computer or built-in

- IP cameras by Ethernet connection through a router or directly to your computer

Two cameras may be used to track and zoom in on an object that may be first detected in a direction that is much wider than the PTZ camera's field of view (FOV). Making the initial detection using a wide-angle fixed camera and handing off continuous tracking to the PTZ camera can make best use of both their capabilities. This function of OTDAU software is referred to as Handoff.

When the general direction of interest is known, then the selection of a single camera may hinge on its FOV, shown as horizontal angle of view in the table below.

Another aspect of selection is the tradeoff between higher resolution and a PTZ function. A PTZ camera can continuously track (center) a target while zooming in which effectively increases the number of active pixels, thus compensating for its lower unzoomed resolution. However, a fixed camera will not experience the motion lag of a PTZ camera and thus does a better job at tracking faster-moving objects.

Also note the difference in light sensitivity between these cameras. In color mode, this will not be apparent during the day but may result in more granularity of the image in very dark conditions.

Near-infrared light (700-1000 nm) is beyond what the human eye can see, but most camera sensors can still detect and use it. When there is plenty of light, a day/night camera uses an IR-cut filter to block the IR light so that it doesn't distort the other colors in the image. When the camera is in night mode, the IR-cut filter is removed, thus boosting the camera's light sensitivity to 0.001 lux or lower.

Each camera may be set to a "black and white" mode by accessing its Setting menus, in Camera > Conditions > Day & Night and setting the profile to night. This removes the IR cut filter and thus enhances the camera's ability to image near IR wavelengths. If the camera has an IR illuminator, it should always be disabled by setting its Mode to off in the Illuminator menu.

Information about the Sony STARVIS sensor used by Dahua cameras may be found at:

https://www.sony-semicon.co.jp/e/products/IS/security/technology.html

See the individual data sheets for each camera, available on the ufodap.com website, for more details.

Dahua cameras tested and selected for UFODAS over competing brands and models due to:

Best price vs performance

Excellent light sensitivity and resolution

Rugged enclosures and ability to maintain water-proof rating mounted dome-up

5-year warranty

Here are some examples. Please see the UFODAP Shop for comparisons of the latest cameras offered there.

	N53AB52	DH-IPC-EBW81242N	42212TNI	50232XANR	49425XBNR
Image sensor	1/2.7-in 5MP	1/1.7-in 12MP	1/2.8-in 2MP	1/2.8-in 2MP	1/2.8-in 4MP
Sensor type	Low light CMOS	Low light CMOS	Sony STARVIS	Sony STARVIS	Low light CMOS
Microphone	yes	yes	no	no	no
Effective pixels	2592 x 1944	4000 x 3000	1920x1080	1920x1080	2560x1440
Electronic shutter speed	1/3 s to 1/100,000	1/3 s to 1/100,000	1/3 s to 1/30,000	1/3 s to 1/30,000	1/3 s to 1/30,000
Main channel resolutions	2592 x 1944	4000 x 3000	1920 x 1080	1920 x 1080	2560 x 1440
	2688 x 1520	2880 x 2880	1280 x 720	1280 x 960	2048 x 1536

	2304x1296	2880 x 2160		1280x720	1920 x 1080
	1920 x 1080	2048 x 1536		704 x 480	1280 x 960
	1280 x 960			352x240	1280 x 720
	1280 x 720				704 x 480
	704x480				352x240
	640x480				
	352x240				
Sub Stream 1 resolutions	704 x 480	704 x 576	704 x 480	704 x 480	704 x 480
		352 x 288	352 x 240	352 x 240	352 x 240
Sub Stream 2 resolutions	1280x720	1280 x 960	1280 x 720	704 x 480	1920 x 1080
		704 x 480	704 x 480		704 x 480
			352 x 240		
Color sensitivity	0.005 lux	0.001 lux	0.005 lux	0.005 lux	0.005 lux

B&W (IR) sensitivity	0.0 lux	0.01 lux	0.0005 lux	0.0005 lux	0.0005 lux
With illuminator on	N/S	0.0 lux	N/A	N/A	0.0 lux, IR on
Focal length	F1.6	F1.85	F1.6	F1.35	F1.6
Pan-Tilt-Zoom control	no	no	yes	yes	yes
Optical zoom	none	none	12x	32 x	25 x
Angle of View, Horizontal	98 deg	180 deg	58.2 - 4.2 deg	62.8 - 2.2 deg	62.8 - 2.6. deg
Angle of View, Vertical	72 deg	180 deg	N/S	36.7 - 1.3 deg	N/S
Environment	IP67	IP67	IP66	IP67	IP66
Temperature range, °C	-40 to +60	-30 to +45	-30 to +60	-40 to +60	-40 to +70
Power consumption, W	<5.4	12.9	12	16	13
N/S -- Not Specified	N/A -- Not Applicable				
** See individual camera data sheets for specification qualifiers					
-- Cameras can simultaneously stream video from both the Main and Sub stream outputs					

-- All cameras have IR cut filters that can be selected for normal color or electronically removed for IR				
-- IR sensitivity shown with IR emitter off				

In 2024 Dahua was acquired by Lumanys, a Taiwan-based company. UFODAP now uses Lumanys cameras that have similarly valuable features or better. Cameras from Uniview are also qualified, particularly for thermal infrared applications.

Camera/resolution tradeoffs

A moving target may not be slow enough or hang around long enough to be able to zoom to 32x. If you make that assumption, then you would save money using a 25x zoom camera such as the 4A425DBNR.

A higher resolution is good as well but the tradeoff there is that the higher the resolution the more data must move from camera to computer which uses more CPU resources.

If your field of view is limited to less than a fixed camera, such as the N53AB52 with an FOV of 98 degrees and max resolution of 2592x1944, then that may be good enough and cost less.

See the various cameras offered in the UFODAP Shop and the comparison table found there.

SYSTEM POWER REQUIREMENTS AND SOURCES

UFODAP cameras and the Multi-Sensor Data Acquisition Unit (MSDAU) both use Power over Ethernet (PoE) as a power source as a path for the data to a computer or router. All six of the recommended cameras are PoE compatible meaning that a single Ethernet cable provides communication signals as well as power over otherwise unused wire pairs. The single-port and 4-port power "injectors" derive approximately 56VDC from the AC line and provide it to each port. The camera then converts this voltage to lower voltages used internally.

The hardware required for that function is known as a PoE Injector or Injector/Switch.

This is a small device that is powered from a 115/230VAC, 50/60Hz source. An Ethernet cable connects a computer or router to the Injector's uplink or LAN port and another connects the Injector's PoE port to the camera or a MSDAU.

An injector may have more than one PoE port. Each port may be used to connect a camera or MSDAU up to the limit of the injector's total output power capacity. UFODAP injectors have the following capabilities:

Part No.	Description	PoE Ports	Power, Watts
OPT-POE-1-30	Planet POE-164, 10/100Mbps	1	30
OPT-POE-1-60	Planet POE-173, 10/100/1000Mbps	1	60
OPT-POE-4-60	Planet FSD-504HP, 10/100Mbps	4	60

Examples of approximate maximum power requirements for some UFODAS components are shown below. Please see current offerings in the UFODAP Shop and power ratings in their datasheets, which may be found in the Downloads tab of ufodap.com:

- 50230UNI-A 30x optical zoom camera – 23W max.

- 42212TNI 12x optical zoom camera – 12W

- NK8BR4 panoramic camera – 12W

- N53AB52 bullet camera – 6W

- MSDAU – 4W

- PowerBeam Ethernet Bridge – 8.5W

AC power for an Injector and possibly a computer may simply be from a wall-outlet in a fixed installation or from a portable source such as a DC-to-AC inverter powered by an automotive 12VDC source or from a solar/battery system.

Sizing a power source for a remote UFODAS installation is based on the total power required and run time until recharged if battery storage is included.

Thus, for example, the total system power required for a field installation that includes the panoramic camera, a 50230 camera, an MSDAU and an RF bridge to a remote router would be 47.5W. Thus, this system could run continuously with a 100W solar panel during the day and continue during the night using battery storage in the GoalZero Portable Power Station, shown below. The Power Station provides a 396WH battery and thus could sustain the 47.5W load for up to about 8 hours without recharging. Additional 33Ah batteries could be added for longer run times.

The Power Station may be recharged by plugging it into an AC outlet or charged in the field by means of a 100W (or larger) solar panel, as shown below.

OTDAU INSTALLATION AND UNINSTALLATION

UFODAS software is distributed as a typical Windows setup.exe file. The name of this file is setup-otdau-x.xx.exe where x.xx is the version number.

The file is provided by means of an invitation via email from SendOwl which includes your software license number. Download the file to any convenient location on your computer, such as:

C:\Users\<your user name>\Downloads

That is the typical default location for downloads and does not have to be explicitly selected.

To uninstall the software, open Windows Control Panel > Programs and Features.

Right click on OTDAU version x.xx (the currently installed version number) and then click uninstall.

All parts of the software and the desktop icon will then be removed from your computer. If any items remain, they may be manually deleted without harm.

To uninstall OTDAU software, go to Windows icon > Settings > Apps. Scroll down through the installed applications to find OTDAU. Click on that entry and then click Uninstall and follow the resulting prompts.

NOTE: If you want to retain the prior version of OTDAU or MC software to run instead of newer versions, then, prior to installing the new version, rename the folder

> C:\Program Files (x86)\OTDAU

To something like

> C:\Program Files (x86)\OTDAU-vx.xx

Where x.xx is the prior version number.

To use the old version, just navigate to the renamed folder and double-click the otdaux.xx.exe file. You can also set the old OTDAU vx.xx desktop icon by right clicking it and selecting browse – Browse to the associated version and change the Properties of the icon so that the old version is the "Target" file and the "Start" folder is the old folder name.

When run, OTDAU copies System and Camera files to C:\OTDAU that are not the same as any such files in the existing folders. Thus, if you had created modified or new versions with different file names, they will be retained between software version updates.
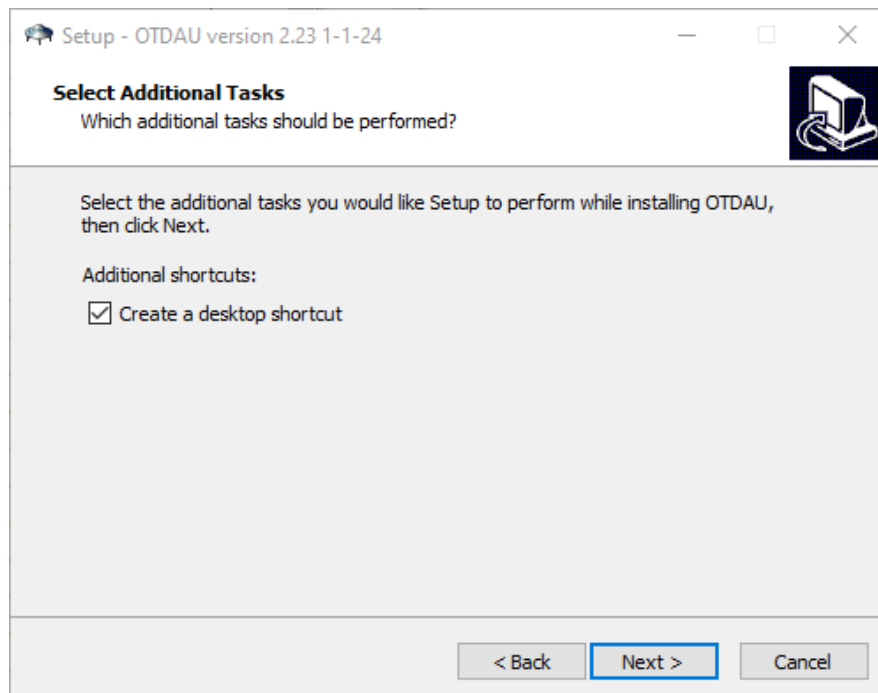
Similarly, MC copies Mission and Sensor files (MSDAUconfigs and OTDAUconfigs) to C:\MC such that user-modified versions are retained.

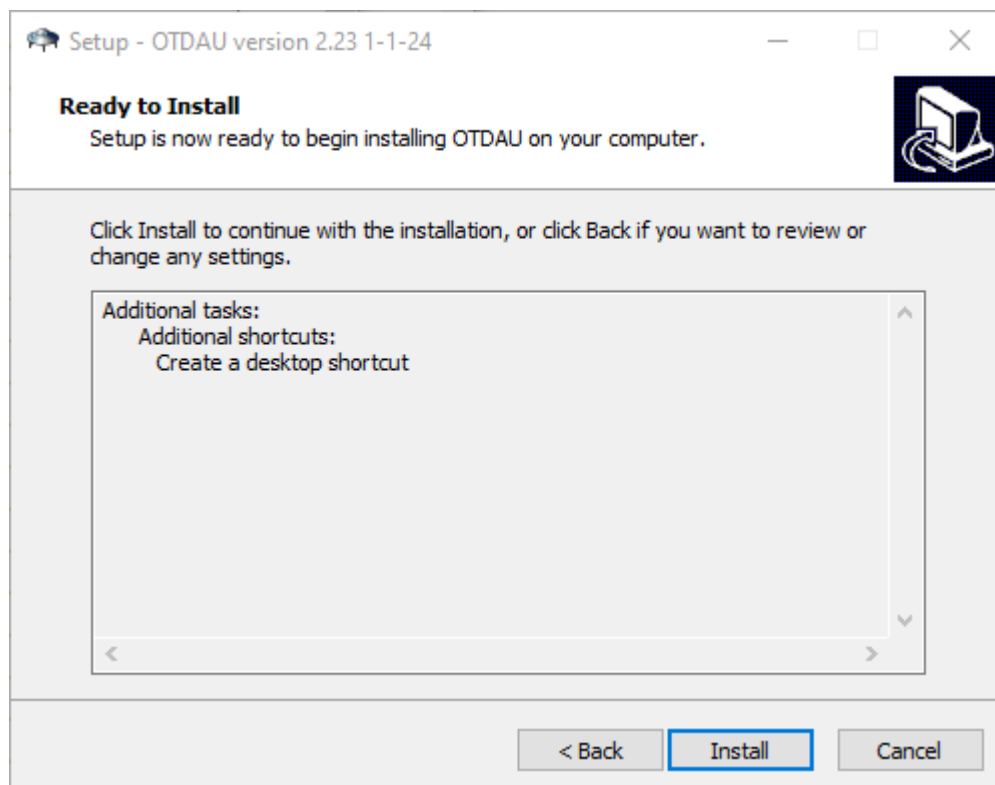Double click the setup-otdau-x.xx.exe to initiate installation.
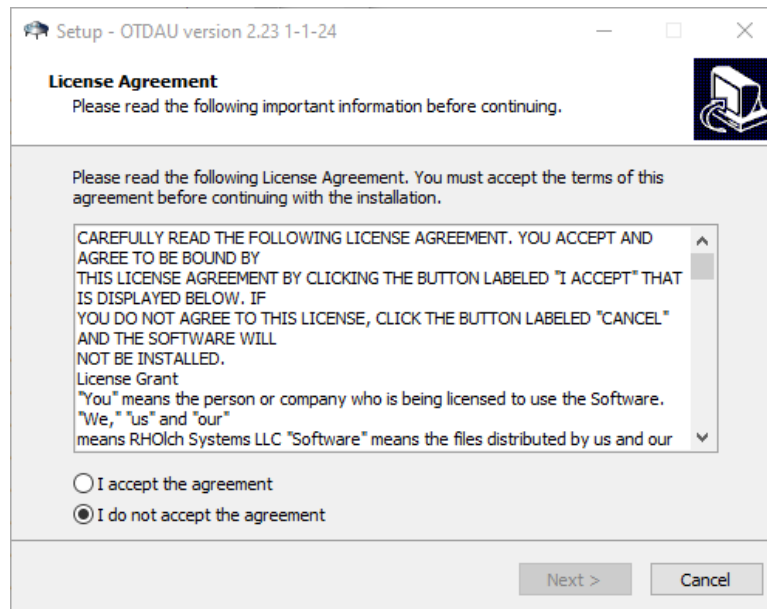
Accept the License Agreement. If not, then installation will not continue.

Select Create a desktop shortcut:

Install the software:

The OTDAU software and supporting files will then be saved to the file:

C:\Programs(x86)\OTDAU

To run OTDAU, double click on the desktop icon. This initiates the Validation process, described below.

MC INSTALLATION AND UNINSTALLATION

UFODAS software is distributed as a typical Windows setup.exe file. The name of this file is setup-mc-x.xx.exe where x.xx is the version number.

The file is provided by means of an invitation via email from SendOwl which includes your software license number. Download the file to any convenient location on your computer, such as:

C:\Users\<your user name>\Downloads

That is the typical default location for downloads and does not have to be explicitly selected.

To uninstall the software, open Windows icon > Settings > Apps.

Right click on Mission Control version x.xx (the currently installed version number) and then click uninstall.

All parts of the software and the desktop icon will then be removed from your computer. If any items remain, they may be manually deleted without harm.

To uninstall MC software, go to Windows > Settings > Apps & Features. Scroll down through the installed applications to find Mission Control. Click on that entry and then click Uninstall and follow the resulting prompts.

NOTE: If you want to retain the prior version of MC software to run instead of newer versions, then, prior to installing the new version, rename the folder
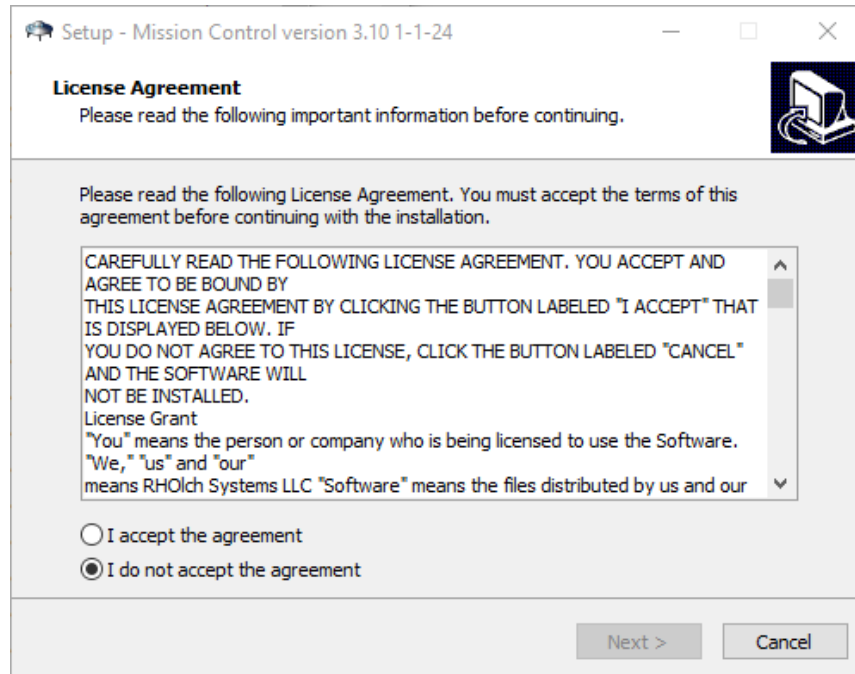
C:\Program Files (x86)\MC

To something like

C:\Program Files (x86)\MC-vx.xx

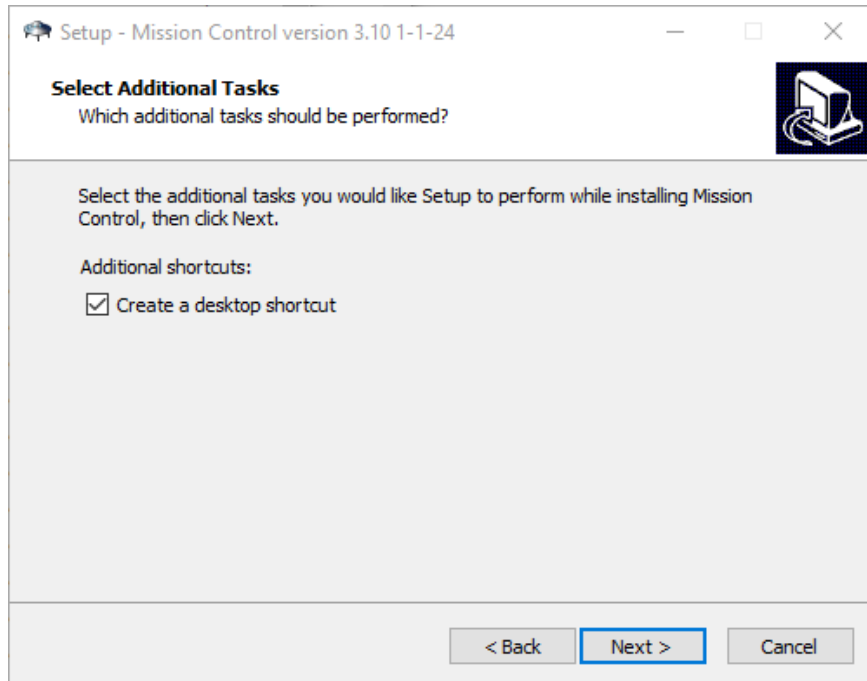Where x.xx is the prior version number.

To use the old version, just navigate to the renamed folder and double-click the otdaux.xx.exe file. You can also set the old MC vx.xx desktop icon by right clicking it and selecting browse – Browse to the associated version and change the Properties of the icon so that the old version is the "Target" file and the "Start" folder is the old folder name.

When run, MC copies Mission and Sensor files (MSDAUconfigs and OTDAUconfigs) to C:\MC such that user-modified versions are retained.
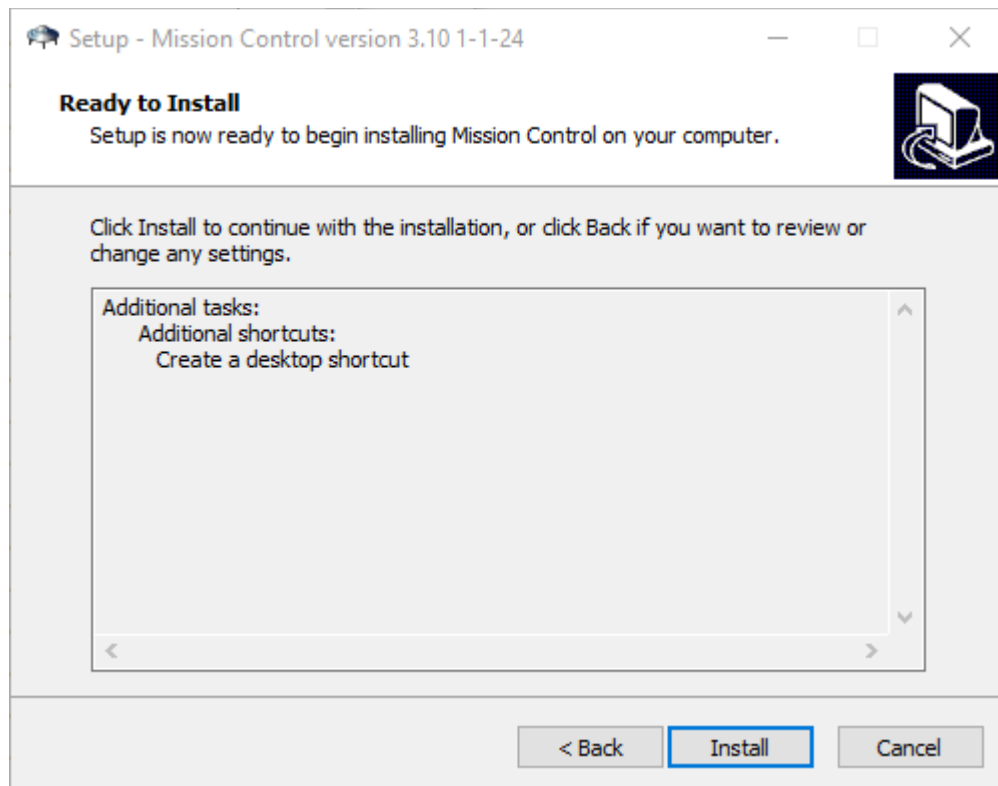
Accept the License Agreement

Select Create a desktop shortcut:

Setup - Mission Control version 3.10 1-1-24

Select Additional Tasks
Which additional tasks should be performed?

Select the additional tasks you would like Setup to perform while installing Mission Control, then click Next.

Additional shortcuts:

☑ Create a desktop shortcut

< Back   Next >   Cancel

Install the software:

To uninstall the software, open Control Panel > Programs and Features.

Right click on MC version x.xx (the currently installed version number) and then click uninstall.

All parts of the software and the desktop icon will then be removed from your computer. If any items remain, the following folder may be manually deleted without harm.

C:\Program Files (x86)\Mission Control

IF OTDAU OR MC WILL NOT START

If after installing OTDAU or MC software and clicking on the icon to run either, you get an error message with "Traceback…DLL load failed while importing…", then you may have a missing or incorrect Data Link Library (DLL) that the software relies upon for operation.

Your Windows installation may have an older version of the Visual C++ Redistributable installs Microsoft C and C++ (MSVC) runtime libraries.

You can get the latest one here:

> https://learn.microsoft.com/en-us/cpp/windows/latest-supported-vc-redist?view=msvc-170

> or

> https://visualstudio.microsoft.com/downloads/#microsoft-visual-c-redistributable-for-visual-studio-2022

Your choices of Architecture are ARM64, X86 or X64. To determine which version is correct, check the following:
1. On your PC, click the Windows symbol
2. Click the gear symbol on the right.
3. Click System
4. At the bottom, left, click About
5. Under Device specifications, see the System type. That will indicate what computer architecture your computer uses, then install the associated version.

INITIAL LICENSE VALIDATION FOR OTDAU

If this is the first time you are running OTDAU, you will see License Validation form:

Fill in your license key, including the "-" characters, provided by SendOwl in the email you received for program download.

For OTDAU, modify the camera IP, port and User Name if necessary and fill in the password. UFODAS cameras are usually provided with a default password that reflects the type of camera, such as "dahua42212", as shown below.

Your entries will be automatically saved when you click Validate or Exit.

UFODAP Software License Validation OTDAU

Enter your license key below. Upper case including "-"
Enter your camera information. Modify the defaults shown as required
For use with USB cameras only, enter "USB" for the Camera IP
Click Validate to use your license on this computer

License key: XXXX-XXXX-XXXX-XXXX

Camera IP: 192.168.1.120

Camera HTTP port (usually 80): 80

Camera User Name: admin

Camera Password: dahua42

Validation Results

Validating camera...
--- Camera information ---
 Mfgr: Dahua
 Model: NK8BR4
 S/N: 4D013E5PAG2B56C
 Hardware ID: 1.00
 Camera Local Time: 9:20:10
Selected camera is accessible
License entries have been saved

Exit to go back to OTDAU

[Validate] [Save] [Exit]

If no UFODAP IP camera is available, then OTDAU may still be used with USB cameras by entering "USB" (no quotes) instead of an IP number. This mode will also allow use with the built-in test configurations or external avi files.

If your camera ONVIF Authentication is ON (see Setting > Network > Access Platform > ONVIF), then the ONVIF Username and Password, defined in Account > ONVIF must match those used in the Camera configuration. Otherwise, if that camera is referenced in the initial Validation or during Load, then it will not validate or load correctly.

You can also edit the Validation information from the OTDAU Help > Manage license function. This is particularly helpful if you started OTDAU in USB validation mode and then want to use an IP camera.

INITIAL LICENSE VALIDATION FOR MISSION CONTROL

A completed MC validation form is shown below.

Click on Save and then Validate. The result of the attempt to validate the camera will be shown in the Validation Results box. If both the key and camera validate successfully, then click Exit to open the OTDAU GUI. If there is a validation problem, check your entries and try Validation again. If you are not able to validate your system, please contact us at team.ufodap@gmail.com to resolve the problem.

After the first time a particular computer is validated, the validation information is retained in the LicensingData.txt file in your C:\OTDAU or C:\MC folder. Thereafter, to support field use without Internet connectivity, the system is automatically validated when started with or without any connection to the Internet.

The Validation window is shown during system startup so that user can tell what is happening during periods of key and camera communication delays. The Validation window will close and OTDAU will still automatically start if validation is completed.

For some systems, incorrect validation data will be displayed the first time a new software version is invoked. Correct the data on the form and click Validate to save the correct data.

The LicensingData.txt system validation file includes a unique computer identifier. The file is created when the initial licensing information is entered and confirmed. If this file exists when the software is started and the identifier is correct, then the system will start without the need for any internet connection.

After initial validation, OTDAU does not require any Internet connection.

Some Mission Control functions do require having real-time Internet access:

- Map generation
- Weather reporting
- Aircraft displays

If no internet connection is available, MC will use validation information saved when the last successful validation was performed with a connection. MC will perform normally but will not be able to display maps, weather or aircraft data and displays warnings as appropriate. Thus, MC is usable for Missions that use any combination of OTDAUs and MSDAUs as normal otherwise.

TROUBLESHOOTING PROBLEMS WITH SYSTEM STARTUP

DATA LINK LIBRARY (DLL) PROBLEM

If after installing OTDAU or MC software and clicking on the icon to run either, you get an error message, then you may have a missing or incorrect Data Link Library (DLL) that the software relies upon for operation.

Verify that, prior to installation of the software, you have done one of the following:

- To retain an older version for future use, renamed the folder in C:\Program Files(x86) from \OTDAU or \Mission Control to something else, perhaps by adding the version number to the folder name.

- Used Windows Apps & Features to uninstall the last version. If you do that, then be sure that the remaining \OTDAU or \Mission Control folder is empty.

If that was not the problem, then your Windows installation may have an older version of the Visual C++ Redistributable installs for Microsoft C and C++ (MSVC) runtime libraries. See https://learn.microsoft.com/en-us/cpp/windows/latest-supported-vc-redist?view=msvc-170 to download and install the latest version for your computer.

Your choices of Architecture are ARM64, X86 or X64. To determine which version is correct, check the following:

1. On your PC, click the Windows symbol

2. Click the gear symbol on the right.

3. Click System

4. At the bottom, left, click About

5. Under Device specifications, see the System type. That will indicate what computer architecture your computer uses

WMI PROBLEM

If when OTDAU or MC is started, you get a WMI-related error you will need to restore your WMI repository by entering (or copy/paste) the following commands at an elevated (Admin) command prompt:

```
mofcomp %windir%\System32\wbem\cimwin32.mof
mofcomp %windir%\System32\wbem\wmiutils.mof
regsvr32 %windir%\System32\wbem\wbemcore.dll
```

Then restart the WMI service using wmimgmt.msc, started from the Windows search box.

SYSTEM INITIALIZATION FILE CREATION

When OTDAU loads and if there is no C:\OTDAU\ConfigFiles folder, then it creates one and copies all System and Camera configuration files from C:\Program Files (x86)\OTDAU to C:\OTDAU\configurations and \cameras.

If the ConfigFiles folder does exist, then the only files from Program Files that are copied are those **with names that do not exist in C:\OTDAU\configurations, \cameras and \positioners** – In this way, new versions of OTDAU can add new configurations and cameras for anyone's use. Any subsequent loading and changing of System or Camera config files are made to those in the \OTDAU\configurations, \cameras and \positioners folders. Thus, the user can make any modifications or additions desired, and they will be retained regardless of installing or running OTDAU or new OTDAU version installations.

Similarly, Mission Control preserves any C:\MC\missions, \MSDAUconfigs and \OTDAUconfigs files **with names that differ** from those in the same named folders in C:\Program Files (x86)\Mission Control.

CAMERA PREPARATION

Some cameras have a protective film over the lens or IR emitters. Remove those before use.

Dahua dome cameras are provided with a lens cover and tape to protect the pan/tilt mechanism from damage during shipping. This must be removed prior to use.

Remove the dome using the provided star wrench to unscrew the three screws that fasten the dome to the housing, as shown below.

Remove the tape and lens cover and set aside for possible shipping, perhaps for warranty repair, should that be necessary.

Replace the dome onto the camera, **taking care that the o-ring is in place** and tighten the three screws. **If the o-ring is not in place or the small rubber washer is not on each of the three mounting screws, then the dome may not be properly sealed resulting in leaks which will void the warranty.**

TRIPOD MOUNTED CAMERA SETUP

The camera is mounted on a Camera Mount as shown below.

Note that the tripod legs may be extended and spread from vertical to fully horizontal to accommodate a wide range of height and stability requirements. However, if the legs are spread too far, then the leg tips cannot grip the ground which may result in undesired spread.

For tripod mounting, open the legs enough for sufficient stability. Place the System mount on top of the tripod and start the 5/8-11 tripod screw into the mount socket. Try to align the mount in the approximate center of the tripod head. Tighten the tripod screw by hand using the handle under the screw. Adjust the tripod legs for length and spread for the required MSDAU/camera height and for good stability.

Collect the following components:

1. Camera on junction box with tripod mount and Ethernet connector.

2. Surveyor-style tripod with 5/8"-11 threaded mount.

3. Single-output, 60W injector or a four-output, 60W PoE power injector with power supply and line cord. **Note**: From the camera specifications, be sure that the output power, per port, of the injector is sufficient for your camera.

4. Ethernet 7' cable

5. Ethernet 100' or 200' all-weather cables. **Note**: The maximum length for a camera to injector cable is 100 meters or 328 feet.

6. Optional castor cups to protect the floor from the tripod tips.

Setup Procedure:

1. Open the tripod in the selected location. Remove the protective cap on the tripod threads.

2. Place the camera assembly on top of the tripod and using the knob under the tripod, screw the tripod treads into the bottom of the camera assembly. The assembly does not have to be precisely located at the center of the top of the tripod.

3. The initial height of the camera may be adjusted by spreading the tripod legs and by how far the legs are extended. To extend them, unlatch, extend/retract and re-latch. For stability, it is better to spread the legs to a wider rather than narrower stance and extend the legs if necessary to achieve a desired height.

4. To protect your carpet or flooring, optionally place a castor cup under each of the three legs.

SMALL FIXED-LENS CAMERA SETUP

If your system has one or more bullet or other fixed-lens cameras perform the following steps.

Collect the following components:

1. Camera on junction box with tripod mount and Ethernet connector.

2. Standard camera tripod with 1/4-20 threaded mount

3. 30W Injector. Small cameras may also be used with a single output, 60W injector or a four-output injector due to its higher, 60W outputs.

4. Ethernet 6' cable

5. Ethernet 100' or 200' all-weather cables. Note: The maximum length for a camera to injector cable is 100 meters or 328 feet.

Setup Procedure:

1. Open the tripod in the selected location.

2. Place the camera assembly on top of the tripod and using the knob under the tripod, screw the tripod treads into the bottom of the camera assembly.

3. The initial height of the camera may be adjusted by spreading the tripod legs and by how far the legs are extended. To extend them, unlatch, extend/retract and re-latch. For stability, it is better to spread the legs to a wider rather than narrower stance and extend the legs if necessary to achieve a desired height.

NOTE: For additional stability, the larger heavy-duty tripod may be used but with a 5/8-11 to ¼-20 adapter installed.

CAMERA MOUNTING METHODS
POLE OR CORNER MOUNTING

Installing a camera on a fixed structure such as a building or a tower requires consideration of how the camera will be attached to the structure and how its PoE connection will be made to ensure a waterproof connection.

Several junction boxes and adapters are available from ufodap.com. Please request a detailed parts list customized for your system configuration.

The brackets shown below may be attached to a camera or MSDAU mount to adapt it to a building corner or pole/tower. The stainless-steel straps are provided with the pole mount adapter. It may be convenient to use an existing vent pipe on the roof for a mount.

Note: Your installation may require attachment of the pole mount to a larger diameter pole or structural element than the standard provided straps can accommodate. In that case, you may have to purchase longer straps.
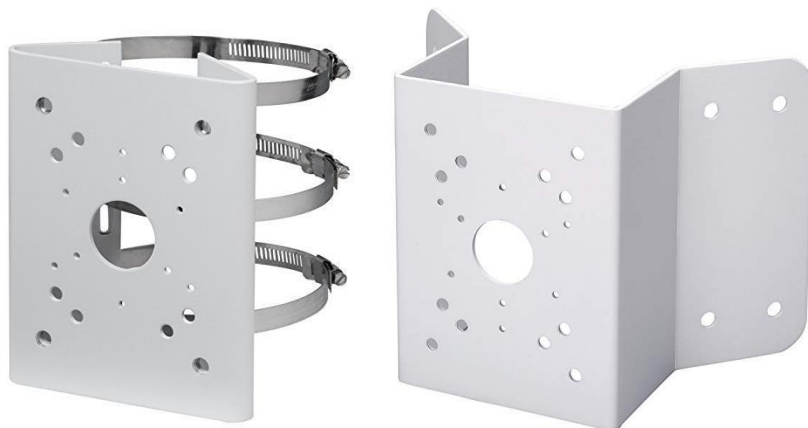
NOTE: If pole/pipe mounting, the pipe should be rigidly attached and supported to the structure such that the camera and/or MSDAU do not move in windy conditions, as shown in the example below.

The optional addition of the owl can sometimes be helpful to prevent birds from landing on the dome, leaving behind residue that can obscure the view.

Outdoor installations in environments known for potential lightning action should provide for proper surge suppression. One way to accomplish this is to use a good quality surge suppressor near the MSDAU/Camera and another at the entrance to the structure where the Ethernet cable will attach to the router. One such suppressor is shown below.
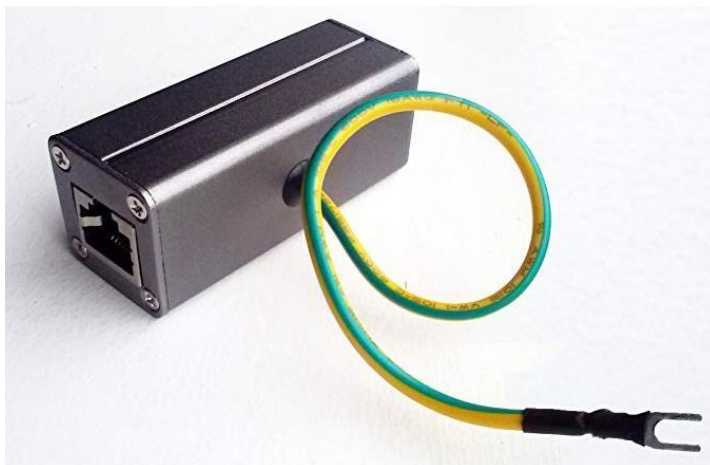
A surge suppressor is typically used with shielded Ethernet cable with the ground wire connected to the metal structure, if any, at the MSDAU/Camera end and to a good building or rod ground at the structure end. The MSDAU and Camera Mount enclosures are non-metallic and thus isolate those electronics from ground. Thus, the MSDAU or camera should not be directly tied to the mounting structure such as a metal tower. The purpose of the surge suppressors is to shunt a voltage spike induced anywhere along the Ethernet cable to ground rather than allow it to enter the outside or inside electronics.

WALL MOUNTING

Any UFODAP camera may be provided with a junction box and mounting accessories to allow it to be mounted to a vertical wall. The following steps are an example of how to mount and cable an N53AB52 fixed optics camera to a wall if no junction box-mounted Ethernet connector is provided.

The camera is provided assembled to a junction box oriented in such a way that the camera may be tilted up rather than in the usual down direction. The seal under the camera's mounting plate has been rotated to seal its side cable opening to prevent water ingress. Also, a special gland nut has been pre-installed to the box. This gland nut allows a standard Ethernet cable with RJ-45 connector to be used without field termination and

waterproofs the cable. UFODAP camera cables are sized and specified to allow this and to provide long-term use in outdoor conditions.


1. Using the Allen wrench provided, remove the three screws that attach the camera to the junction box. Do not detach the safety cable from the camera or box.

2. Install the box to the wall by using the screws provided for a wooden wall. Use the provided anchors to mount to drywall or stucco. The Ethernet connector housing also shown below, left, is not needed and may make the connection too large to fit in the box.

3. Unscrew and remove the outer gland nut shroud and insert the end of the camera cable that has no boot through the shroud and the nut into the box, as shown below.

4. Plug the cable into the Ethernet jack of the camera and dress the cables inside the box as shown:
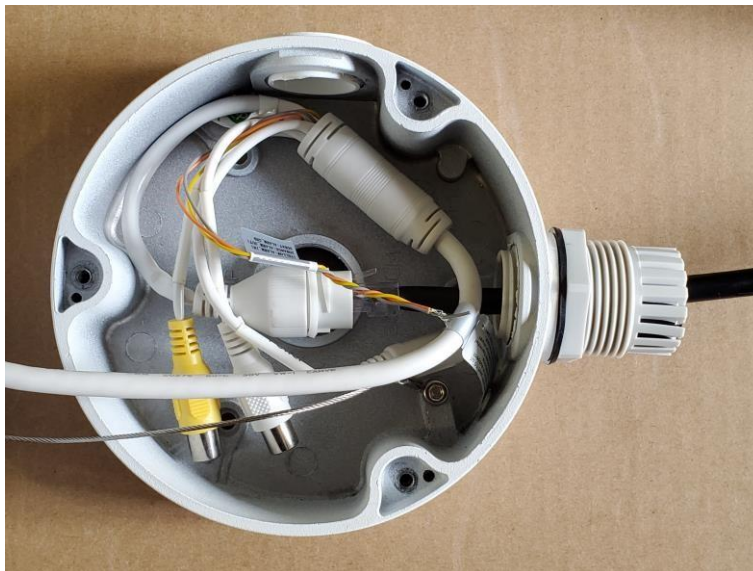
5. Reinstall the shroud to the nut and tighten the shroud by hand as much as possible. Be sure that the rubber gasket under the shroud has fully tightened against the cable.

6. Reinstall the camera mounting plate to the box using the three screws previously removed. Be sure that the orientation of the camera is as shown below so that it can be tilted up.

Note that when positioning the camera field of view, it may be both rotated and angled.

Loosen the Philips screw on the side of the camera mount. You can rotate the camera about its axis and move it left or right with a ratcheting action until it is pointing as desired. Then tighten the screw.

Typically, UFODAP camera assemblies come with all-weather Ethernet connectors in place of gland nuts. CAT6 cables purchased from UFODAP come with the mating connector shroud installed.

POLE-MOUNTED CAMERA INSTALLATION

A pole-mounted camera utilizes a junction box between the camera mount and the pole mount adapter, as shown below.

The junction box provides a waterproof transition from the camera's Ethernet connector to a box-mounted connector you use to attach the Ethernet cable.

Most installations will not require an external Ethernet connector. In those cases, the pole mount junction box will be provided with a waterproof gland nut that is sized to allow a pre-terminated cable, without a boot, to be passed through and directly connected to the camera's connector inside the box. Be sure to fully tighten the external gland nut so that the rubber gasket is tight around the cable.

MSDAU INSTALLATION

The MSDAU is designed for three methods for mounting – tripod, wall corner or pole.

An MSDAU and the passive Camera Mount share a common System Mounting Assembly. The System Mounting Assembly consists of two black plates attached to each other at a right angle. The bottom plate has a 5/8-11 threaded socket for attachment to a standard surveying-type tripod. The back plate includes four threaded holes to which either the pole mount adapter or the building corner mount adapter, shown above, may be attached.

An MSDAU mounted via the System Mounting Adapter is shown below. The mounting position shown accommodates an additional camera or other item, such as an antenna mount, on the opposite side of the plate, above the tripod threads. The MSDAU can also be mounted on the side of the plate directly above the tripod mount which may provide additional stability.
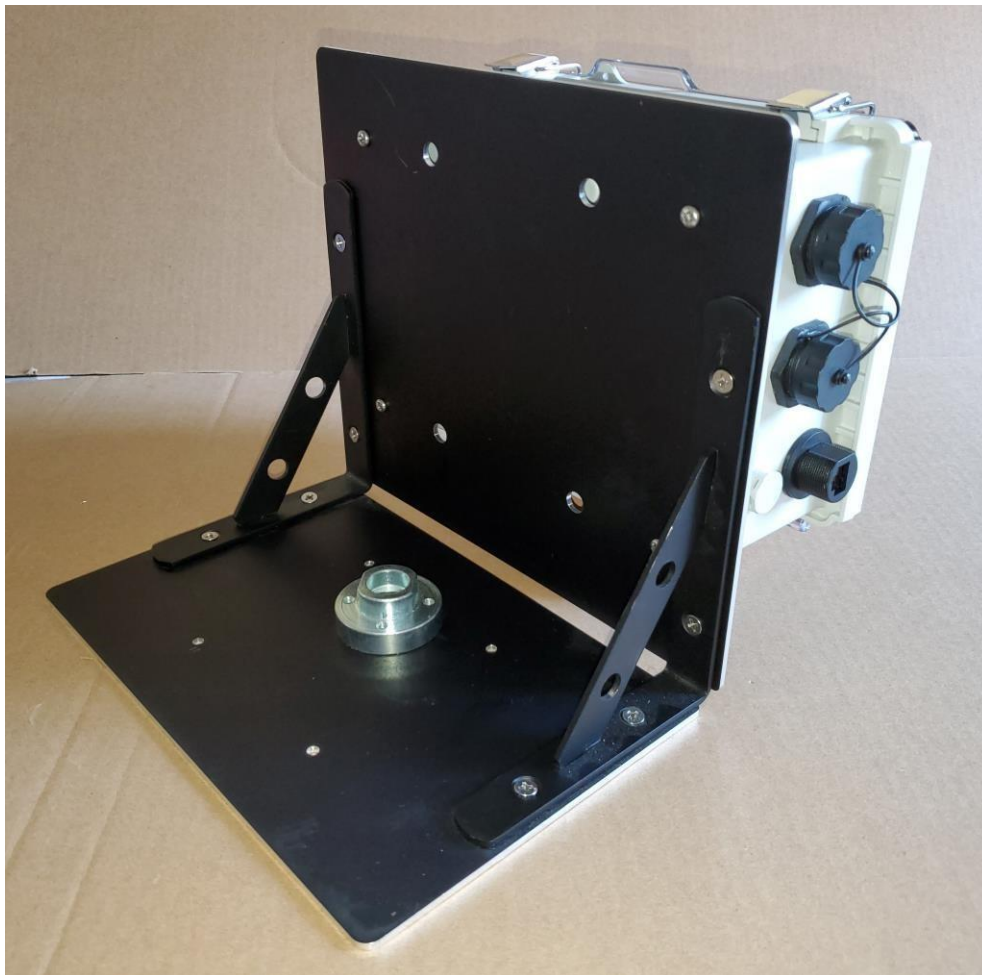
A tripod mounted MSDAU with Dahua 50230 camera and Camera Junction Box is shown below.
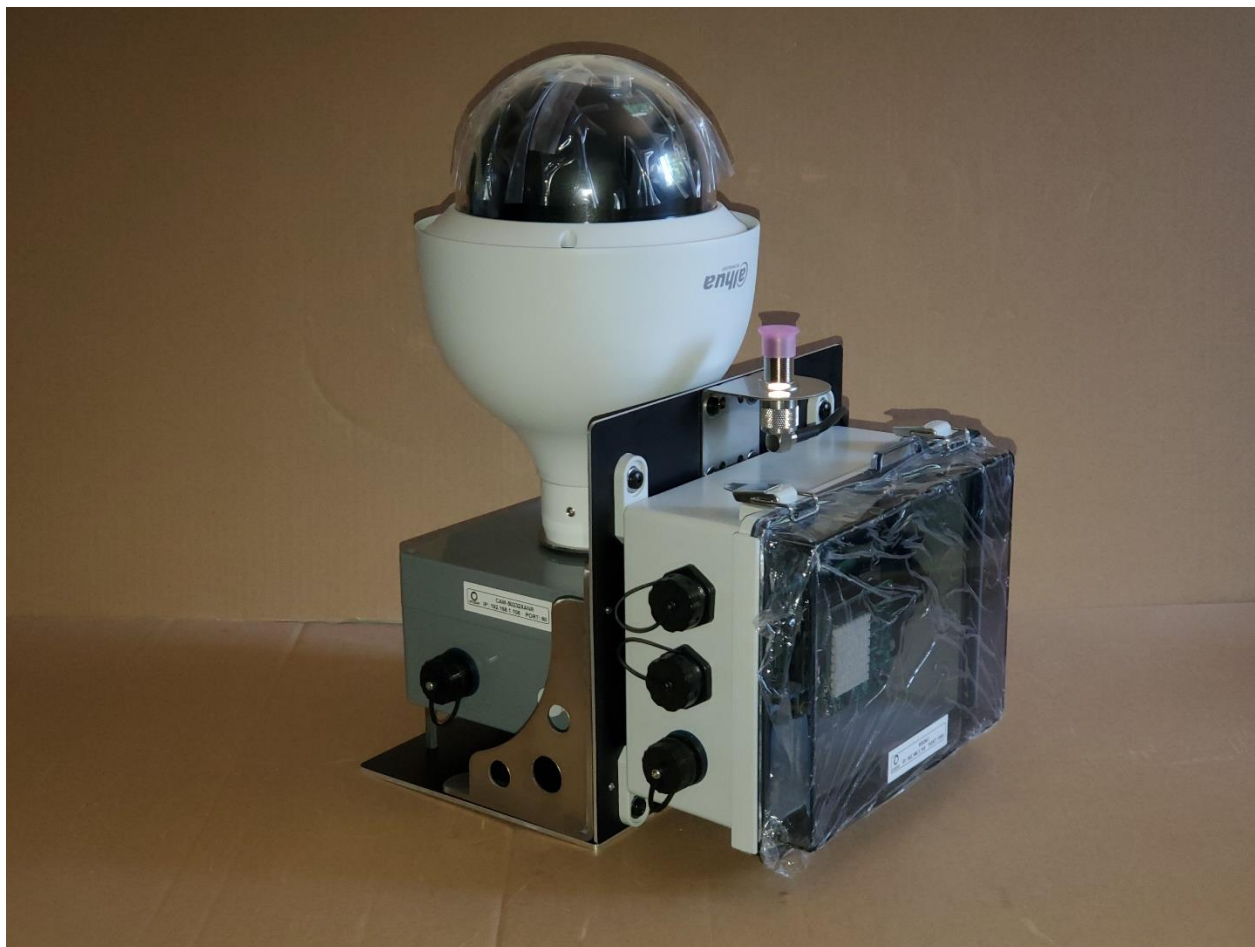
Any camera and the MSDAU are powered via their own Ethernet cable to PoE injector. In the above configuration, the camera and the MSDAU each require an Ethernet cable to an injector, usually located near a router.

In this tripod-mount configuration, refer to the use of the 5/8-11 tripod, above.

For pole or corner mounting, the MSDAU is provided with the System Mount backplate and the pole mount option, shown below.

Three stainless steel straps are provided to attach the pole mount to any vertical, rigid pipe. Be sure that the pipe is sufficiently supported so that, with the weight of the MSDAU, it does not move in the wind.

The mechanical configuration of these components is set by your order when purchased – you will not have to install or change any such configuration.

MSDAU RF ANTENNA

The MSDAU provides a standard SO-239 connector on the right side for an external antenna connection, as shown below.

The design of the antenna used will determine its optimum gain and frequency range.

A telescoping antenna, as shown below, may be directly connected to the antenna mount via a PL-259 to SMA adapter, included with the antenna.

This is typically a ¼ wave whip which is omnidirectional but has no well-defined ground plane. Its gain at any frequency is dependent on its extended length. The optimal values may be calculated using this Whip Antenna Length and Frequency Calculator:

http://www.csgnetwork.com/antennagenericfreqlencalc.html

Thus, the 6.7-to-30-inch antenna above has a range of about 187 MHz to 838 MHz but

will provide signal well below and above those values but with lower gain.

The whip antenna may be provided with an SMA to PL-259 adapter for connection to the MSDAU antenna connector.

An Ultra-Wide-Band (UWB) type antenna can provide higher gain throughout a broader spectrum of frequencies such as 1MHz to 6GHz in the case of the example below.

The various length elements are the primary antenna. Its response is omnidirectional, primarily in the horizontal plane. It includes a standard NMO ("New Motorola") screw-on mount.

The UWB antenna is provided with a mounting bracket that attaches to a standard ¼-20 screw tripod. The antenna is connected to the MSDAU via a cable with a PL-259 connector.

It may be easily unscrewed from the mount for transport and reattached when the MSDAU is set up in the field. Note that use of this antenna requires a mating NMO mount with a pin in the center. This arrangement is provided by the NMO mount with cable supplied with the UWB antenna, as shown below.

The bracket may be installed permanently with the supplied screws or attached to a standard tripod with its ¼-20 screw and the wing nut also supplied with the antenna. Adjust the angle of the tripod mount so that the antenna is in an upright orientation.

The antenna could also be mounted directly to an SO-239 connector but requires a brass threaded adapter and a center pin to insert into the SO connector. These are available from UFODAP if needed but it is recommended to use the supplied mount/cable.

1. Connect the waterproof Ethernet cable to the connector on a camera mounting box or MSDAU as shown below. To do this, start with all parts of the connector housing unscrewed. Plug the Ethernet cable connector into the box connector until the latch snaps in. Move the larger connector housing toward the connector and screw it all the way onto the box connector. Verify that the rubber cable gland is fully inserted into the back of the housing. Then move the farther (right) portion of the connector housing toward the cable box and screw it onto the connector body. Be careful not to cross-thread this connector. If it does not screw in exactly straight, then unscrew it and try again. Cables provided by UFODAP come with this backshell installed on the cable.

   To remove the connector, always loosen the back portion first to allow the connector to rotate around the cable while the front part is unscrewed from the box or MSDAU. This prevents stress on the cable where it enters the connector.

Some junction box mounts use a type of connector that allows use of a booted Ethernet cable, as shown below. Note that the rubber gland has a split that allows it to be opened and then snapped over the cable. Be sure to notice which side of the gland is intended to be inserted into the connector housing.

With both types of mating connectors, be sure to loosen the rear nut sufficient for the cable to rotate in the gland before installing or removing the connector from its mating connector so that the cable will not be twisted and stressed.

Waterproof/Dustproof Cap Cover

Lock Ring Rubber ring Elastic regulator

Rubber ring Waterproof Connector Rubber ring

M25-CAT6A Shielded Waterproof RJ45 Socket

2. Your PoE Injector passes the Ethernet signals thru it to your router while "injecting" DC power on two unused cable wire pairs to power the camera. To install it, place the PoE injector near your router. For a four-port injector, plug the injector barrel power connector into the rear of the injector. Plug the injector line cord into the injector's power supply and plug the line cord into a source of AC power. The power supply is rated for 110/240 VAC – 50/60 Hz power so if the installation is not in the US, just use an AC adapter or a different line cord in accordance with your AC power wall socket.

3. Using a second, short Ethernet cable, plug one end into the LAN connector on your PoE injector. For a 4-port injector, this is the right connector on the front of the PoE injector labeled "5 - Uplink". For a single-port injector, it is labeled "LAN". We will connect the other end in a subsequent step.

4. Route the unconnected end of a long camera cable from the camera assembly or MSDAU to the PoE injector, by some convenient route and avoiding creating a tripping hazard.

5. As shown below, plug the camera or MSDAU cable into any of the four unused ports of a four-port PoE+ injector or the "POE" port on a single port injector. This cable may be a bit stiff so bend it near the injector so that the connector goes straight into the injector socket, relieving stress on the connection.

6. There are two options for connecting the camera via the injector to your router – hardwired or by WiFi.

If the injector can be located near the router, then plug the other end of the short Ethernet cable into an unused router port.

If the camera and injector will be used in a location remote from the router and AC power is available at that location, then a WiFi Extender that includes a wired Ethernet port may be used to provide a wireless connection from the injector to the router. As shown below, plug the short cable into the Extender and the Extender into a wall outlet. Plug the injector's power cord into the AC outlet as well. The Extender should have been set up previously to communicate with the router via its manufacturer's instructions.

7. If the Extender and Injector are outside, be sure that they are protected from moisture.   The camera assembly is waterproof, but the Extender and Injector are not.

8. If the camera is only used by a computer directly connected to the router, either by an Ethernet cable or by WiFi, the software will address the camera by its native IP address and port number. For example:

UFODAP software set up defaults assume that your router's LAN address is 1912.168.1.x. If it is not, and you do not have other devices that have to use a static address in a different LAN, then you may have to change your camera's static address to match. However, it may be easier to change your router's LAN address so that camera configurations that come with the OTDAU software will work without change.

192.168.1.108 is the standard initial static IP address for all Dahua cameras as well as the address used for initial set up by UFODAP for other types of IP cameras. A second camera might be set to 192.168.1.109.

The initial default address for an MSDAU is 192.168.1.144. You can change the third and fourth numbers to match your router setup via the joystick on the internal Sense HAT board (See the User Guide for instructions). If there is more than one MSDAU on the same LAN, then the fourth number may also be increased or decreased on other MSDAUs by the following steps:

1. Open the MSDAU enclosure.

2. Press the joystick button to display the current display brightness level. Push the joystick up or down to change this value from 0 to 5. If set to 0, the display will be turned off.

3. Push the joystick right to show the value of the third octet of the IP address (e.g., 192.168.x.144). Push the joystick up or down to change this value.

4. Push the joystick right again to show the value of the fourth octet of the IP address (e.g., 144). Push the joystick up to increase or down to decrease the address by one.

4. Press the joystick again to set the address and continue normal operation

9. In addition to or instead of using a computer connected to the camera's router, the camera may also be made accessible to any computer that is not directly connected to the camera's router. That is, at a different location, no matter how remote, via the internet. To enable this, the camera's router must be set up to "port forward" the camera's IP address. Each type of router has a bit different means to do this so consult the router's documentation or obtain help. The resulting forwarded IP address and port number will be required for setup of an OTDAU software configuration for your camera.

Another somewhat simpler method to accomplish port forwarding is to use your router's UpNP feature. Enable UpNP in the router and in the camera via the camera's WEB interface.

SETTING A CAMERA IP ADDRESS

To use an IP camera with OTDAU, the camera's IPv4 address must be configured so that it is in the proper address range:

- If you are connecting the camera to a router – It would be your router's subnet Local Area Network (LAN) address.
- If you are not using a router and thus connecting directly to a computer – It would match a static address that you assign to your computer.

Routers always have a configured address that can be modified by the user. Typically, it is either 192.168.0.1 or 192.168.1.1. OTDAU software Camera configurations assume that it is 192.168.1.1. Thus, a provided configuration might have an IP address of 192.168.1.108 (the Dahua factory default value). Any statically-addressed device on a router's LAN must have an address that shares the first three parts (octets) of the LAN address – in this case, 192.168.1.x.

If your router's LAN address is 192.168.1.x then UFODAP cameras and OTDAU software will work together without modification.

If your router uses some other LAN address, then you will need to modify the IP address in the Camera configuration you want to use to have the correct LAN address using the method below.

For example, the initial OTDAU Camera configuration for a Dahua 42212 camera looks like:

Modified to work with a router LAN address of 192.168.0.1:

Notice that after changing the IP field and clicking Save, OTDAU automatically generates the correct Video URL that includes the corrected IP address.

MODIFYING YOUR CAMERA IP ADDRESS TO MATCH A LAN ADDRESS

In cases where you cannot or do not want to change your router's LAN address to match the camera's address, you will need to change the camera address. However, because these addresses are not on the same LAN, you will need to access the camera's TCP/IP address settings via the following procedure:

Disconnect the PoE injector from the router and connect it directly to the computer in place of the computer's connection to the router.

In Windows, navigate to the Network & Internet settings. Go to the Ethernet port, Change adapter options. Right click on the Ethernet port and click Properties. Select IPv4 and then Properties. Set a static address that would share the same LAN as the known camera address. For example, if your camera has the address 192.168.1.108, then change your TCP/IPv4 Properties to:

Internet Protocol Version 4 (TCP/IPv4) Properties   ✕

General

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

◯ Obtain an IP address automatically
◉ Use the following IP address:

IP address: 192 . 168 . 1 . 140
Subnet mask: 255 . 255 . 255 . 0
Default gateway: 192 . 168 . 1 . 1

◯ Obtain DNS server address automatically
◉ Use the following DNS server addresses:

Preferred DNS server: .   .
Alternate DNS server: .   .

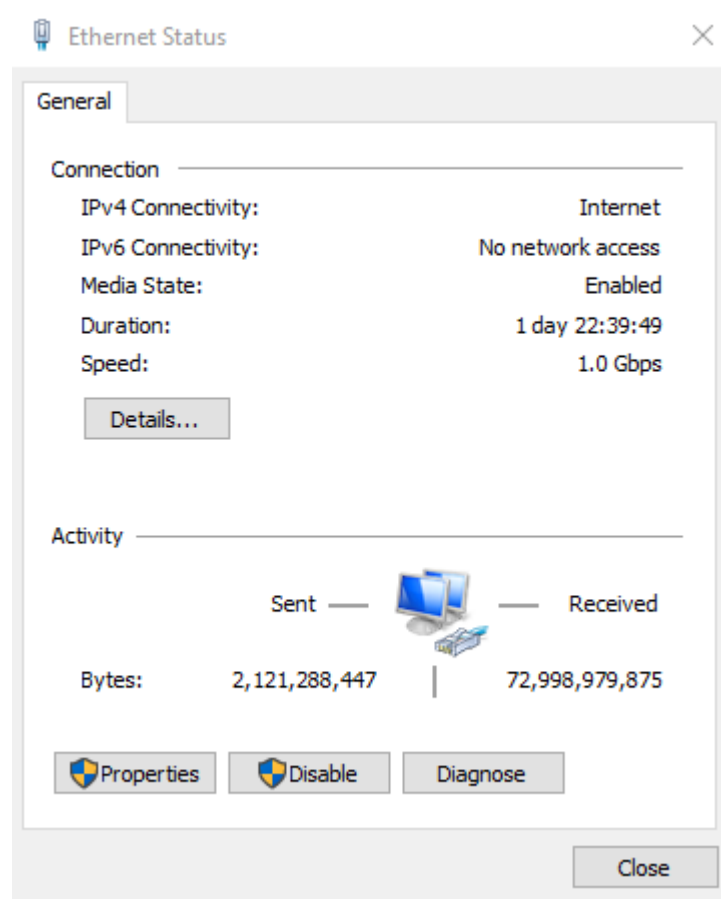☐ Validate settings upon exit   Advanced...
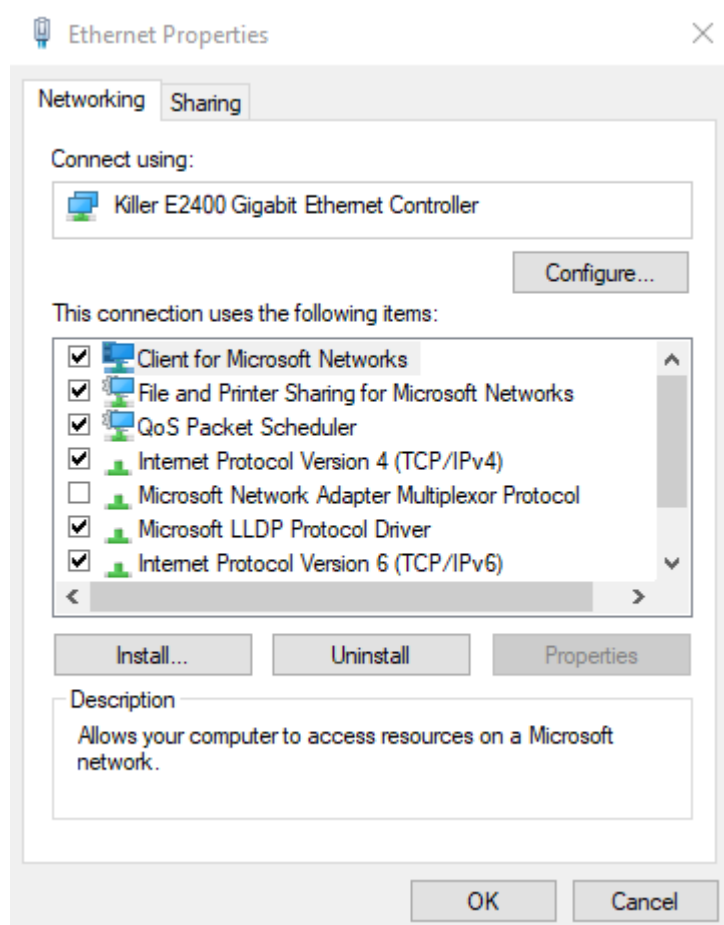
                              OK   Cancel

To set up a computer with a static (non-DHCP) address in Windows 10:

Click Windows icon > Settings (gear wheel) > Network and Internet > Change adapter options

Double click on Ethernet or Wi-Fi depending on how the computer running OTDAU communicates with your router. For example:

Click Properties:

Click on Internet Protocol Version 4 (TCP /IPv4) to highlight it and then click Properties

Change the values shown to the selections below (the IP address 37 is shown as an example but could be any value that does not conflict with a camera or DHCP-assigned address). In the example below, the DNS server addresses have been entered because the computer will be used with a router.

Click OK and Close to save this selection. Now you can use 37 as the entry for IP in your MC OTDAU configuration.

Now you should be able to run ConfigTool on the PC and access the camera's Setup menus by clicking the WEB icon on the right of the listing of your camera as found by the Tool.

Go to the Setting > Network > TCP/IP page and modify the IP Address and Default Gateway fields like so, with a Dahua camera as an example:
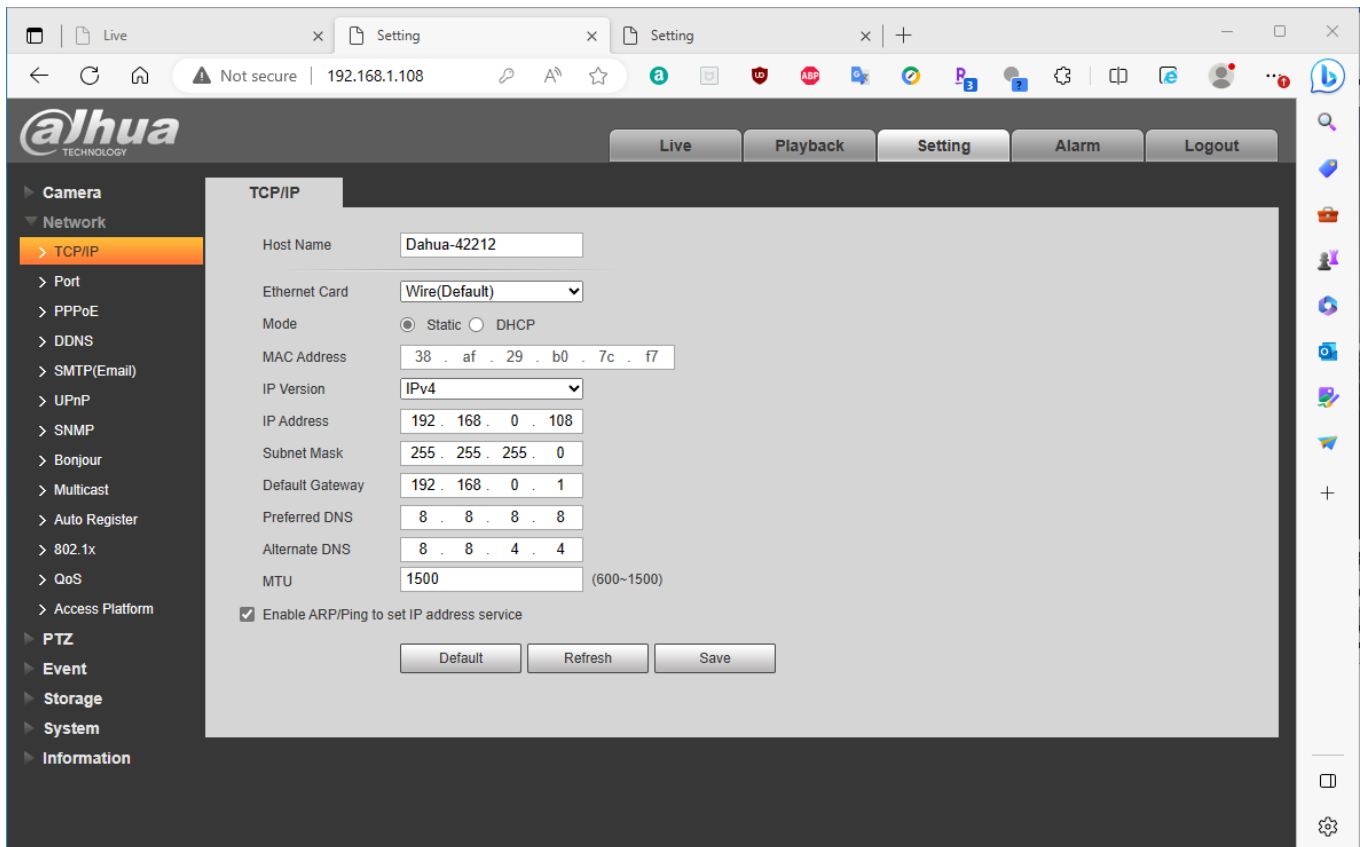
Click Save. The camera will change its address and no longer be accessible by the computer.

Go back to the computer Ethernet Properties settings and change them back to match your router's LAN address.   Select DHCP address selection if you normally use your router with your camera and computer. If not due to not using the router for field use, then leave the address as Static and do not fill in the Preferred and Alternate DNS server values as they refer to a router.

Reconnect the injector and computer to the router and reset the router (typically by removing power, waiting a short time and then powering it on again).

You should now be able to use your computer with internet access via the router normally as well as having access to the camera. OTDAU should also now be able to access the camera via the IP address that you modified to match your router LAN address.

INITIAL CAMERA AND MSDAU SETUP AND TEST

-- The camera IP address, as on the label on the unit, is 192.168.1.108, port 80. A new UFODAP camera will have all camera parameters set to values useful for OTDAU including an initial focus setting. You can review them using the Dahua software found at dahauwiki.com: "ConfigTool". Use ConfigTool to test that your camera/injector/router is functioning properly. Use it to load IE to display the camera's web page by clicking on "web" on the right of the line showing your camera. Note that the IP address implies a LAN address of 192.168.1.x. Unless you have some reason not to, it would be easiest to be sure that your router conforms to that LAN address.

-- The camera username is "admin". For a 50232XANR camera, the password is "dahua50232". The camera configurations supplied with OTDAU assume that, so it would be best not to change them and there is no security issue involved.

-- For first tests of OTDAU, try the various test configurations, such as "test-aerobatics.json". This is convenient to learn the effect of the various Tracking parameters. Then try your camera using the System configuration "dahua-50232-108-1920x1080.json".

-- The MSDAU IP address is initially 192.168.1.144. If you had a second MSDAU, it would be modified via its joystick to ...145. To test it, use the Mission Control software and select the Mission "mission-ms1.json", then click Load. To use MS with OTDAU, load your camera configuration, then select a mission such as "mission-pccam1.json". You can also use the various combinations of ms1 and pccam1 missions. NOTE: Be sure to set your PC to have a static IP address, such as that used in the given configurations: 192.168.1.140. Your PC should still be able to access the internet as with DHCP addressing.

INITIAL CAMERA CONNECTION AND TESTING

If you have any problems making your camera work with OTDAU, check the following steps:

1. Connect the PoE injector via one of the two non-PoE ports to your router
2. Verify that your router subnet address is 192.168.1.x. If not, access your router's menus to change it or follow the procedure elsewhere in this document to change the camera's IP address. **The camera's address must be on the same LAN as the router.**
3. Connect one of the PoE ports to the camera.
4. Install ConfigTool from dahuawiki.com on your PC. Run it to verify that it detects your camera and shows it as IP address 192.168.1.108.
5. In the line showing the camera in ConfigTool, start the IE browser via the "web" icon. Alternatively, open a browser, such as Chrome, and enter the IP address into the search line and press Enter.
6. The camera web page should start. Enter the login as user: admin and password: dahua50432 (or similar for other camera part numbers).
7. After a short delay, the video from the camera should appear. You can use the pan/tilt/zoom controls to move the camera image.

Your WiFi or your system firewall should not have any effect on this process. Typically, a camera that functions over a wired connection will work the same over WiFi.

SETTING UP AN INSTALLED CAMERA

Perform the following steps before you mount the camera at its permanent, perhaps inaccessible location.

Before attempting to use the camera with operational software such as OTDAU, it is wise to verify that it and the injector/router are all operating correctly. This can be accomplished by using either Dahua, Lumanys or Uniview configuration tools or a web browser.

To use Chrome:

1. Open Chrome and in the search box, type IE Tab.

2. Select the web page for the IE Tab extension. Add it to Chrome.

3. Click on this symbol found on the upper right, next to the Address bar:

4. That will open an Options and Settings page. Scroll down until you find IE Compatibility Mode and select the "IE 10 Forced Standards Mode" setting.

5. You can now close the Tab Options tab.

6. In the tab labeled "IE Tab – Chrome Web Store", on the Address line, enter your camera's IP address, such as: "192.168.1.108" and press Enter.

7. Enter Username "admin" and password you have been provided for your camera and press Enter or click Login.

To use Config Tool:
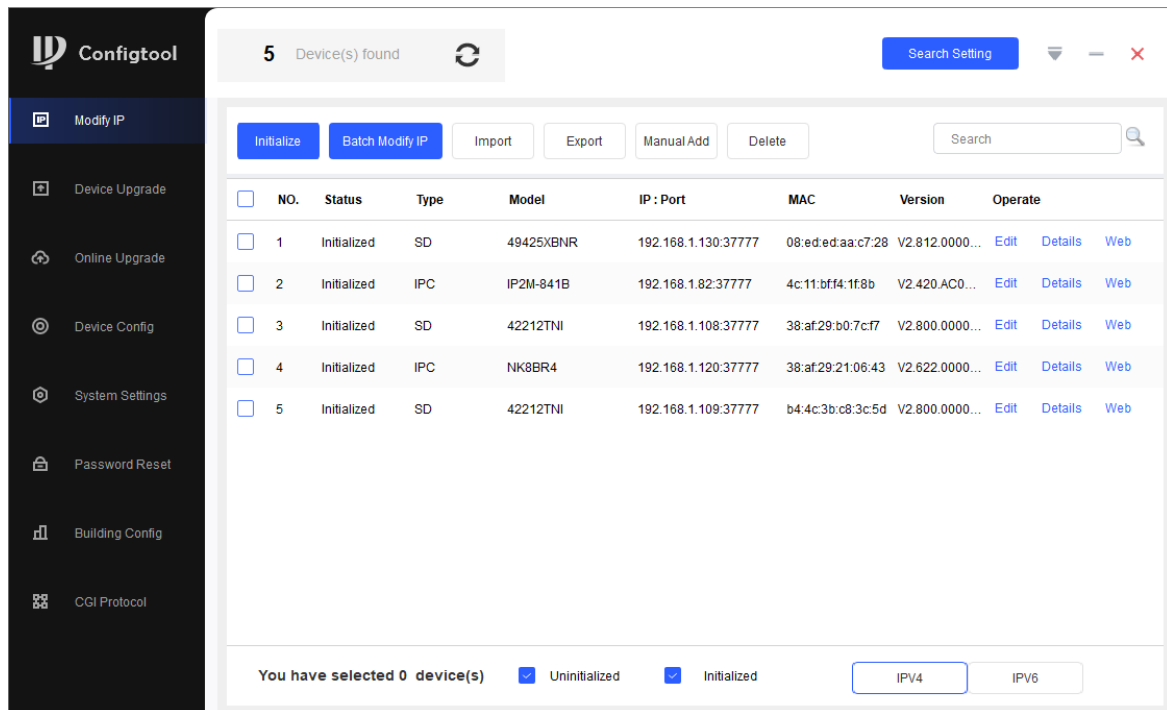

1. The Dahua Wiki has loads of information on their cameras – See the home page of dahuawiki.com.

2. Scroll down to the bottom of the home page and you will find their Config Tool. Download and install the version for your computer (Windows or Apple).

3. When you run it, it discovers and displays all Dahua IP cameras on your LAN. You can then modify the IP address if necessary.

4. Click on the WEB symbol on the right to run Internet Explorer to access the camera's Settings options.

With either method, you may see the message:

"Please click here to download and install the plug-in."

Click on that link and install the plug-in. You may then need to close the IE window and restart IE via Config Tool again. This time, you should see video from the camera and have access to all the camera's settings and manual controls.
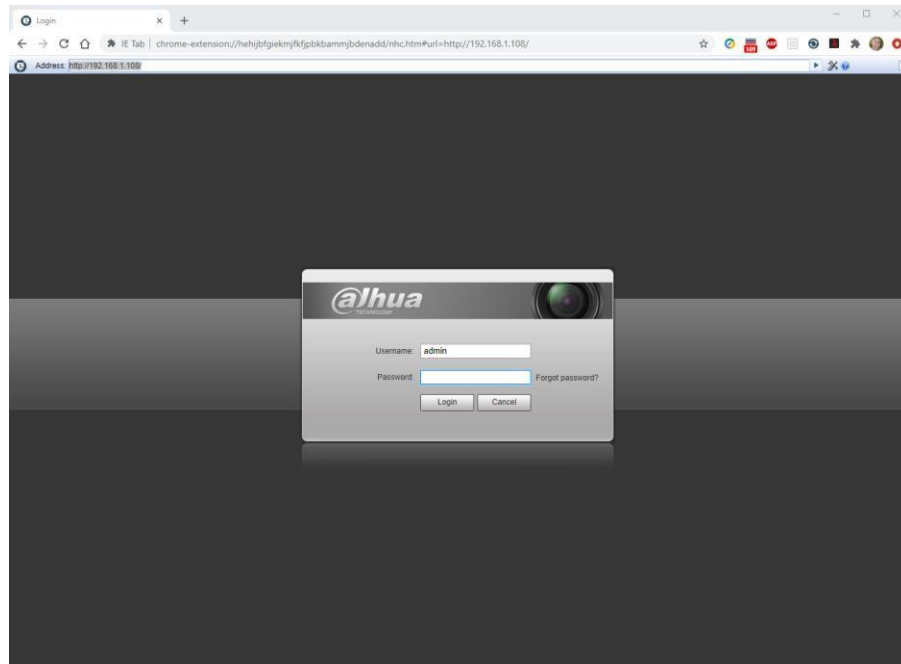
You should now have a Live view of what the camera sees and a set of PTZ controls on the right side. Check that the camera's PTZ functions are working by clicking on the various PTZ buttons to move the camera, zoom and manually adjust focus and iris settings. Follow the OTDAU User's Guide instructions for the Dahua camera to check or adjust the various camera controls via the Setting tab on the top of the display.
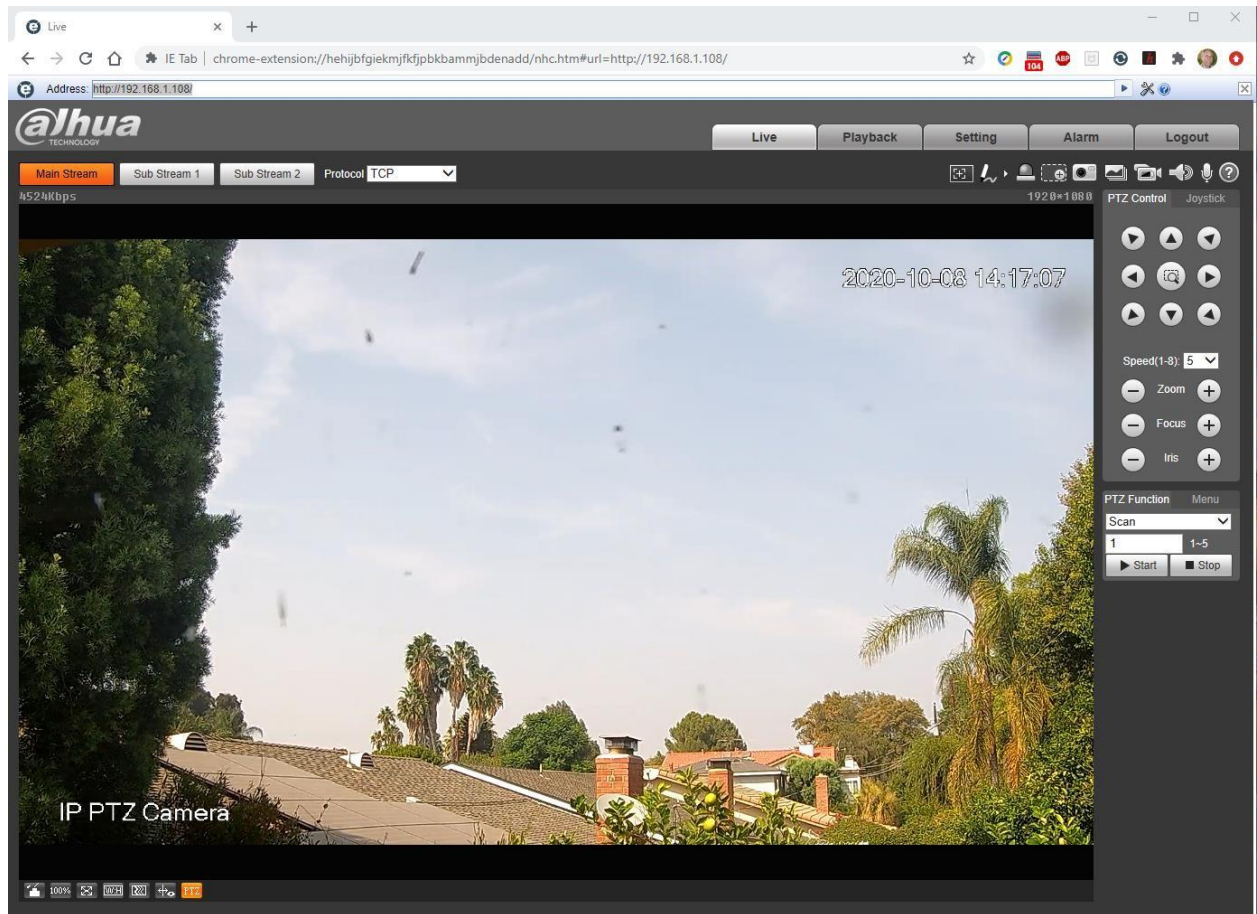
Click on the Setting tab to access all the camera's adjustments, as referenced below.

All necessary settings have already been adjusted prior to delivery of your system.   If you change any of the Network settings, then the default configurations provided with OTDAU and Mission Control software will not work and would have to also be adjusted to match.

In case you need to check or redo them, they are the factory defaults except as follows (shown for a Dahua camera but similar values should be found for other brands):

Dahua Camera Setup

Menu levels under Setting ---

Top	1	2	3	4	Value	Notes
Camera	Conditions	Conditions	Flip		180	Not for N51BD22 camera
			Picture	Profile	Normal	
			Exposure	Profile	Day	
			Backlight	Mode	Off	
			WB	Profile	Normal	
				Mode	Auto	
			Day & Night	Profile	Day	
				Mode	Color	
			Focus & Zoom	Profile	Day	
				Digital Zoom	Off	
				Zoom Speed	100	
				Mode	Manual	
				Focus Level	Auto	
				Sensitivity	High	
			Defog	Profile	Day	
				Mode	Auto	
		Profile Management	Profile Management		Normal	
	Video	Overlay	Channel Title		Enable	
					"Available"	
			Time Title		Disable	
			OSD Info	Preset	Disable	Not for N51BD22 camera
				Pattern	Disable	Not for N51BD22 camera
		ROI			Disable	
Network	TCP/IP	Host Name			<enter host name>	
		IP Address			<enter IP adds>	Restart Web Service from Chrome
	Port	HTTP Port			<enter port number>	Camera will reboot
		ONVIF	Authentication		Off	
PTZ	Function	PTZ Speed			High	Not for N51BD22 camera
System	General	Date&Time	Time Zone		<enter time zone>	
		Current Time			Sync PC	

The following section illustrates how to change these settings.

CAMERA CONFIGURATION SETTINGS

When you purchase a camera from UFODAP, all the following settings have already been implemented when the camera was tested, prior to shipment to you. The username and password were also set to match the sample configurations included with OTDAU software.

The following steps may be taken to check or change the settings. Some Setting screens may look a bit different, depending on the camera model and its software updates.

Please refer to the Dahua manual "Dahua Speed Dome Web3.0 Operation Manual" for complete instructions for camera setup operations. The latest version of this manual as of this time is 4.2.0. It may be downloaded from the Dahua Wiki at:

https://dahuawiki.com/Template:Manuals

The following screen shots were captured using Internet Explorer (IE) to setup and control Dahua 50A230 or 50230 cameras. Other Dahua cameras are similar. They show initial settings suggested for OTDAU operation. Leave all other settings per factory default.
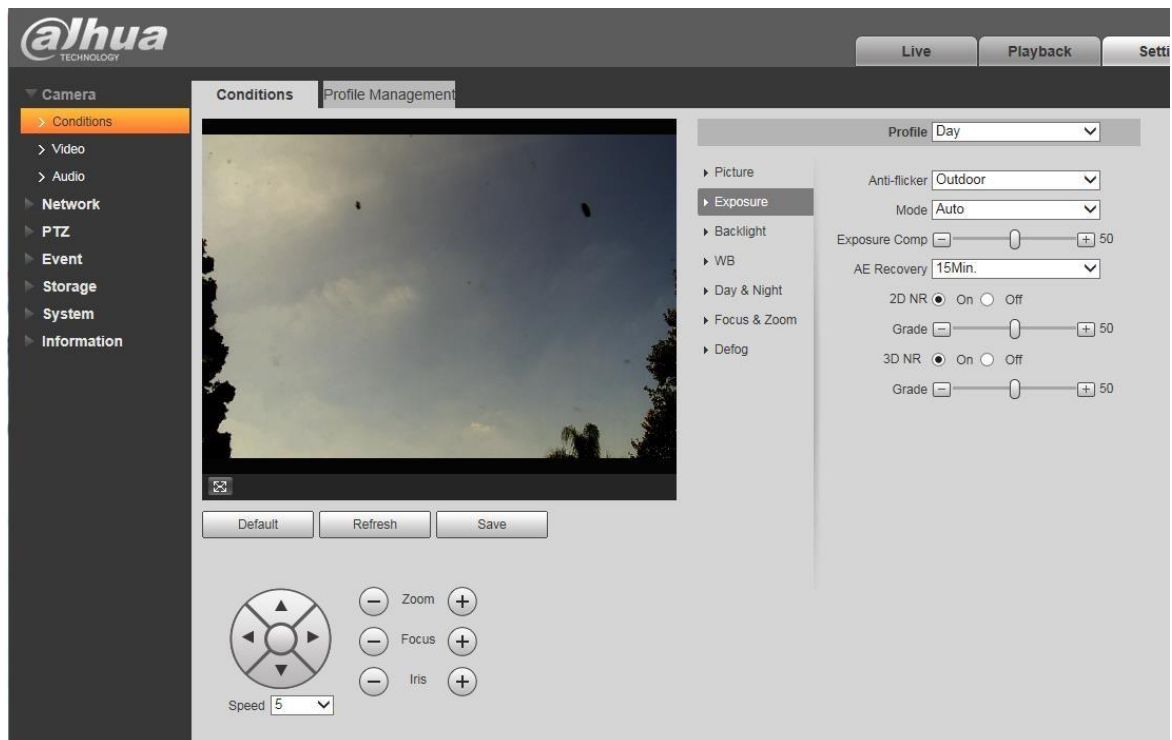
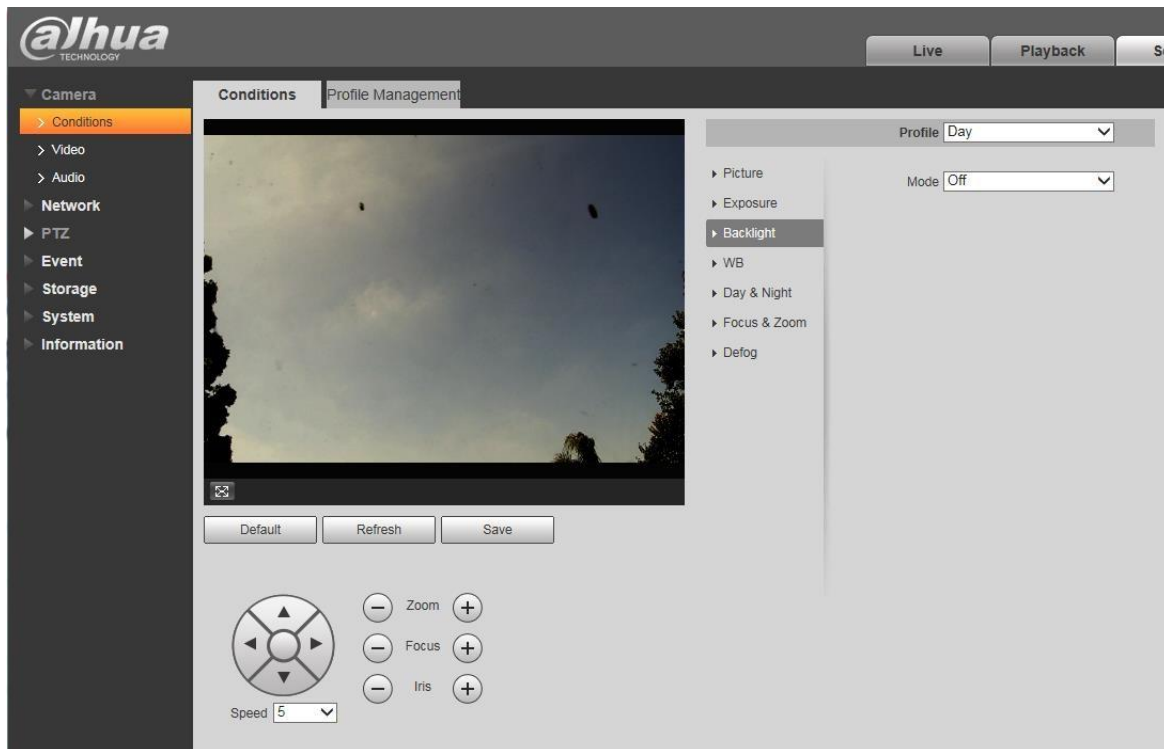**Be sure to click on Save after each setting.**
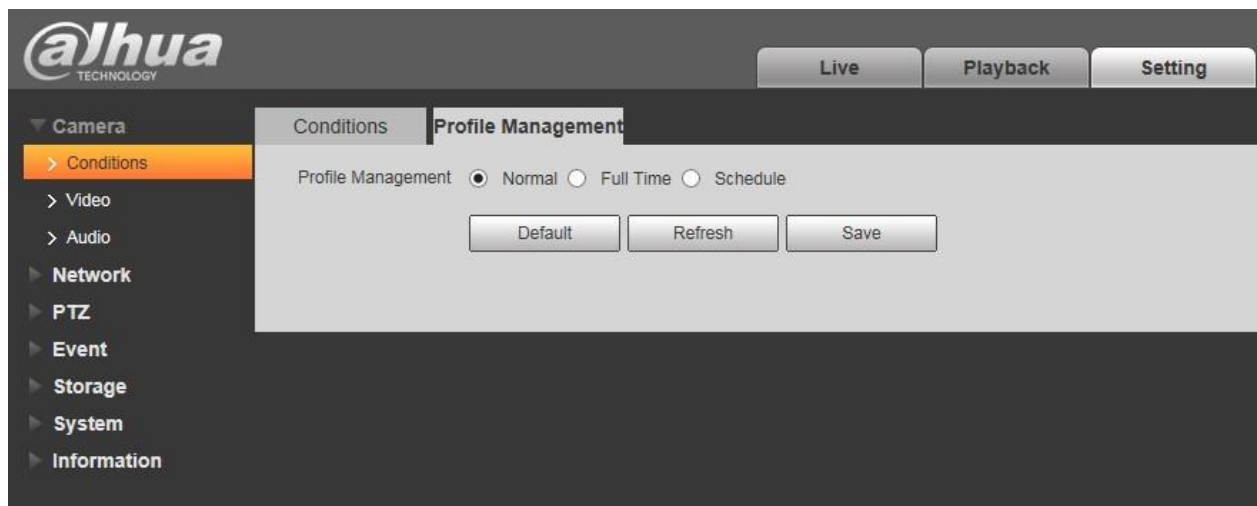
Set Profile Management to Normal. Otherwise, other settings may revert to prior values if you Save, go to Live and back to Setting > Conditions.
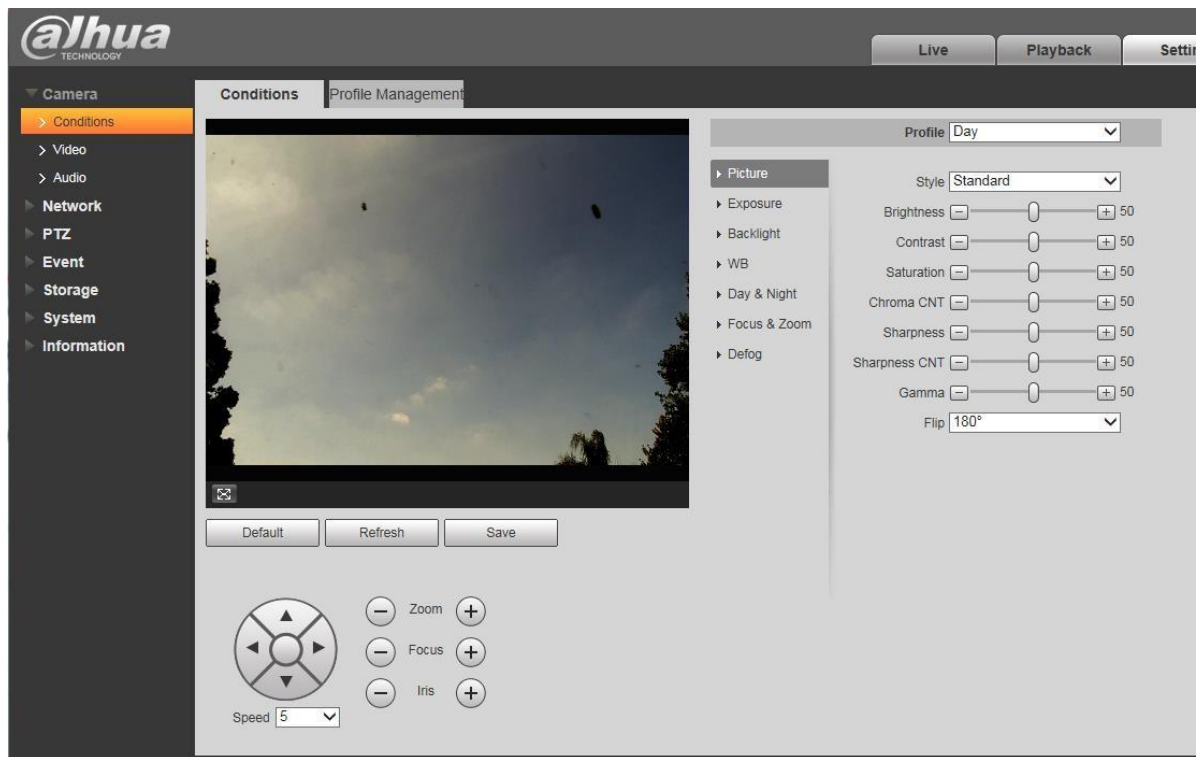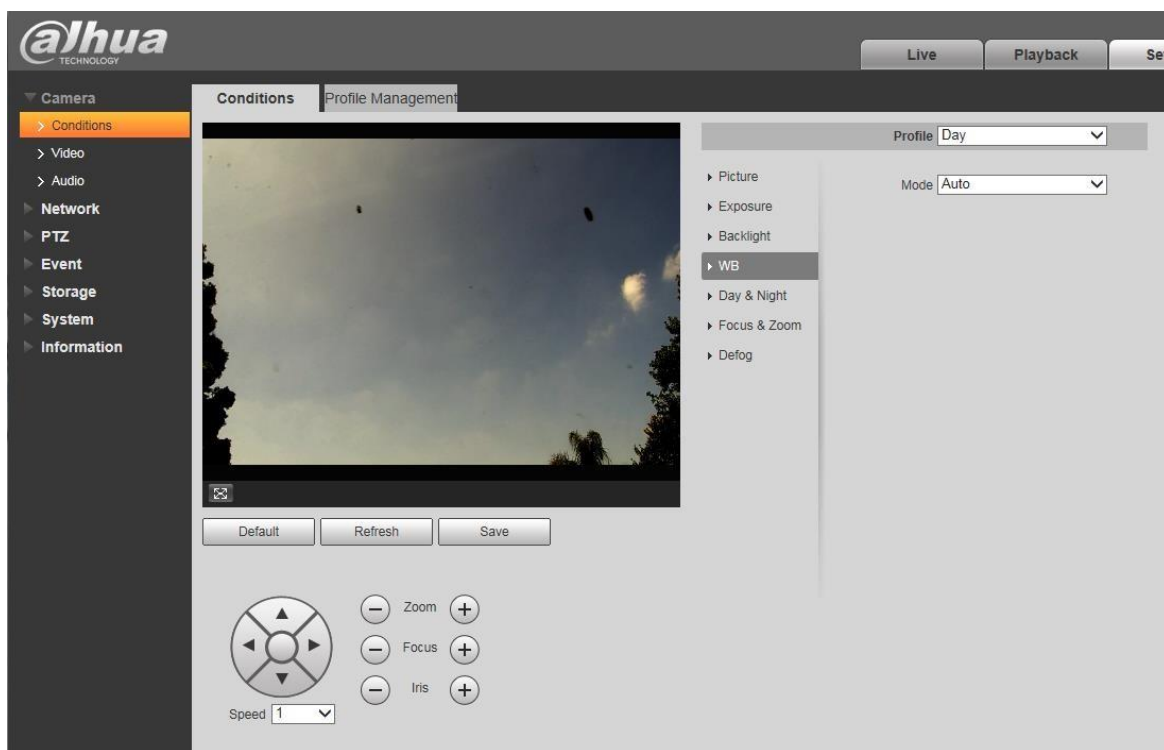
Set Picture settings to Profile Normal and leave others as shown above. Set Flip to 180 degrees.

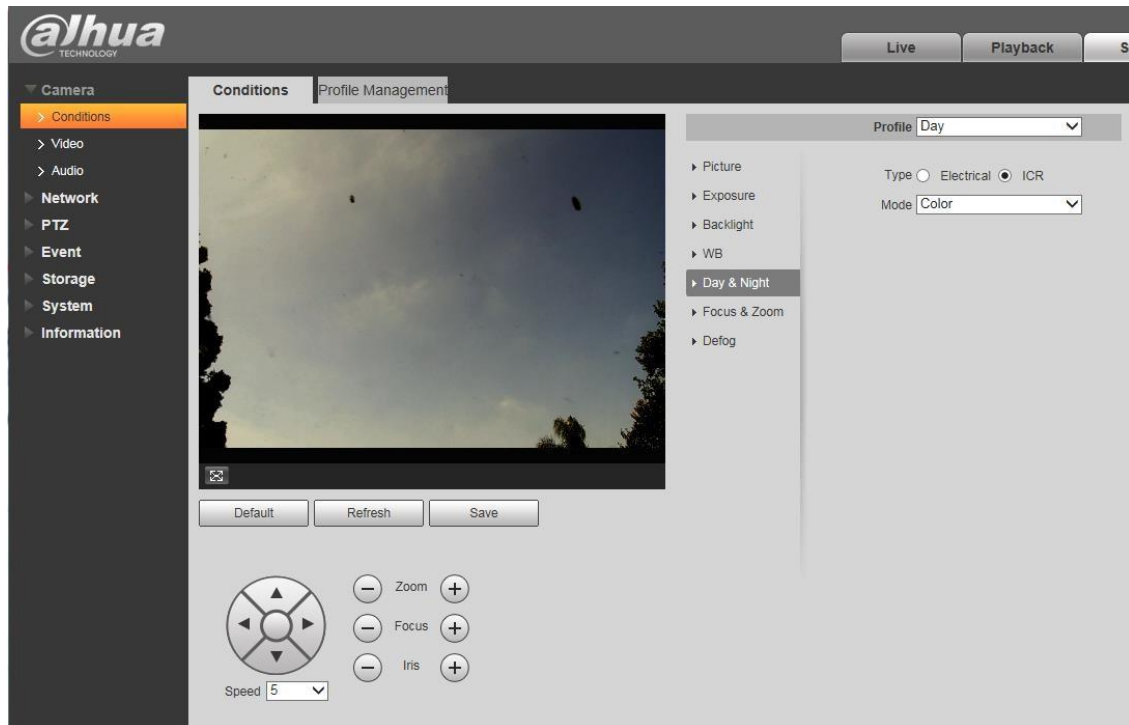Set Exposure settings as shown above.

Set Backlight Profile to Normal and Mode Off.

Set WB to Profile Normal and Mode Auto.

NOTE: Some cameras may provide better tracking performance by using noise reduction by using one of the Backlight Compensation modes, such as BLC, enabled. The 42212 camera, in particular, seems to benefit from this. For Dahua cameras that support this option, it is found in Camera > Conditions > Backlight.
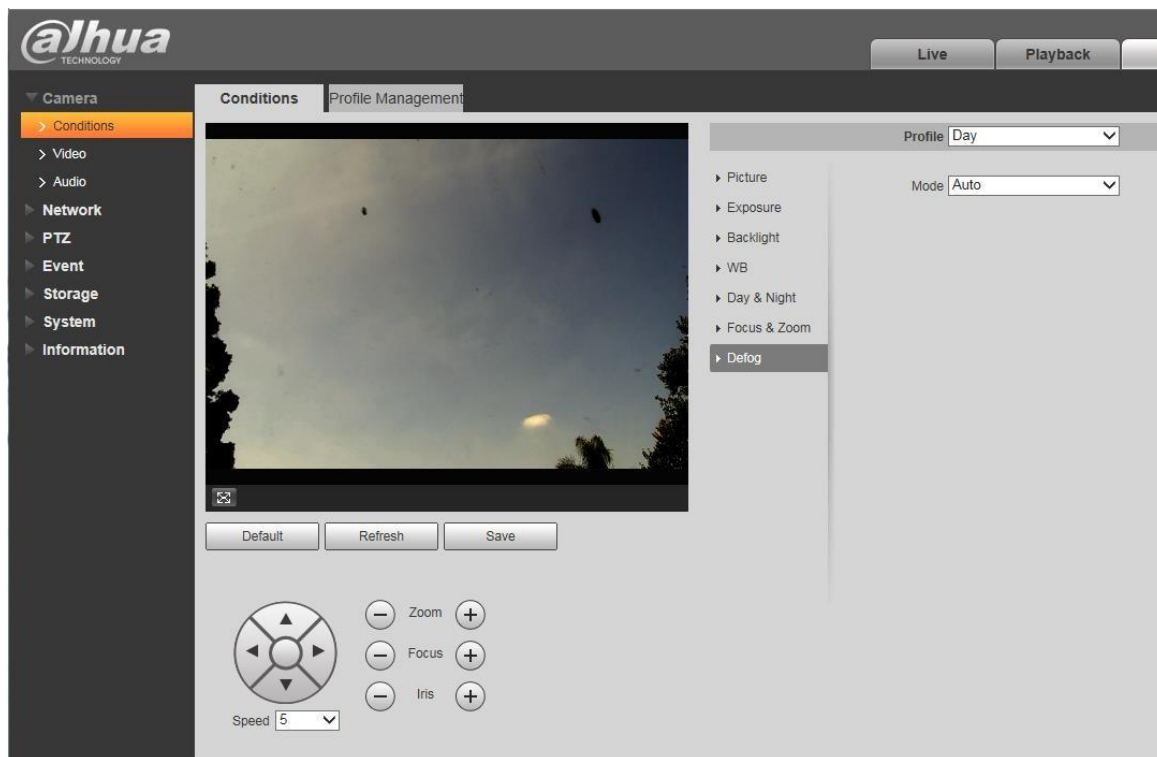
NOTE: Some USB cameras, at some resolutions, may not provide expected frame rates. See your camera's documentation for what resolutions and frame rates are available.
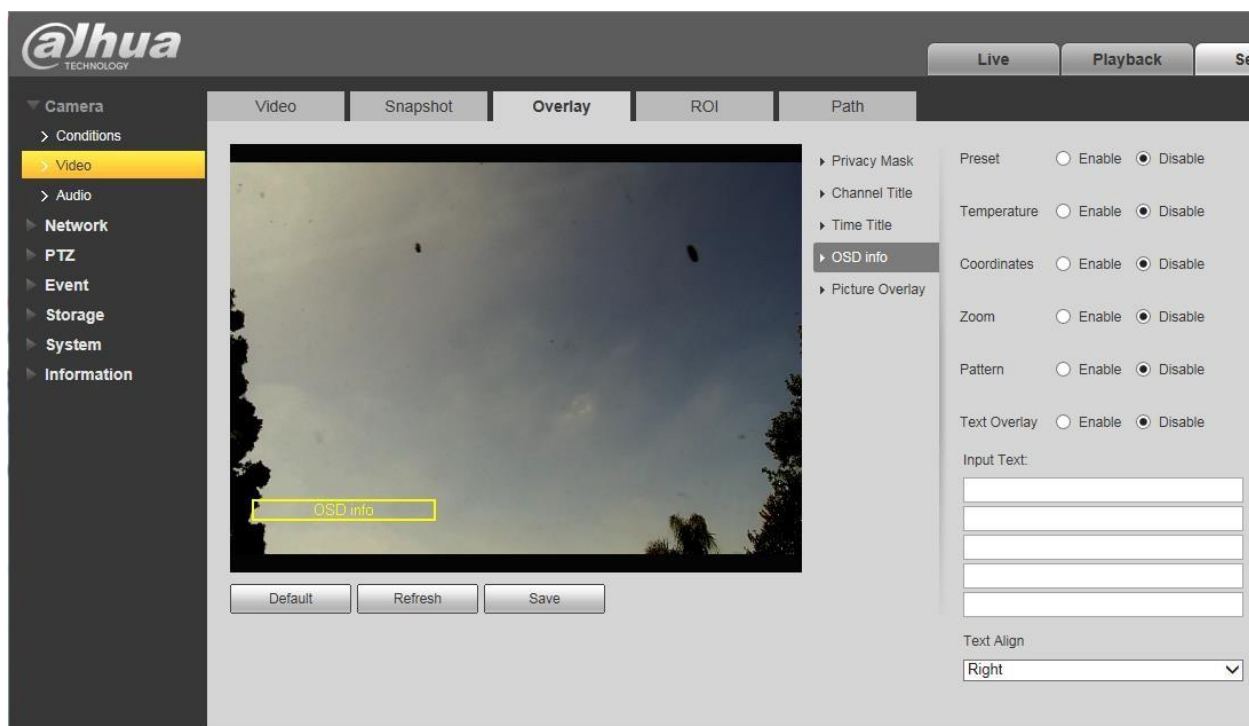

Set Day & Night settings as shown above.
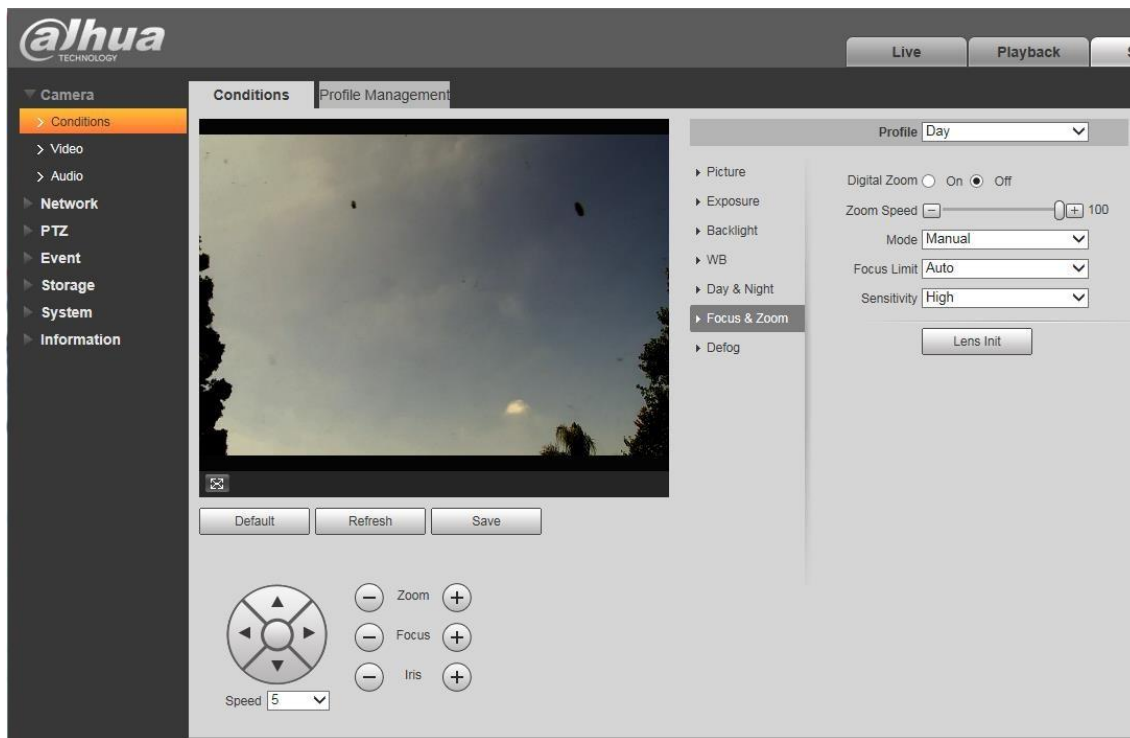
Set Focus & Zoom settings as shown above.
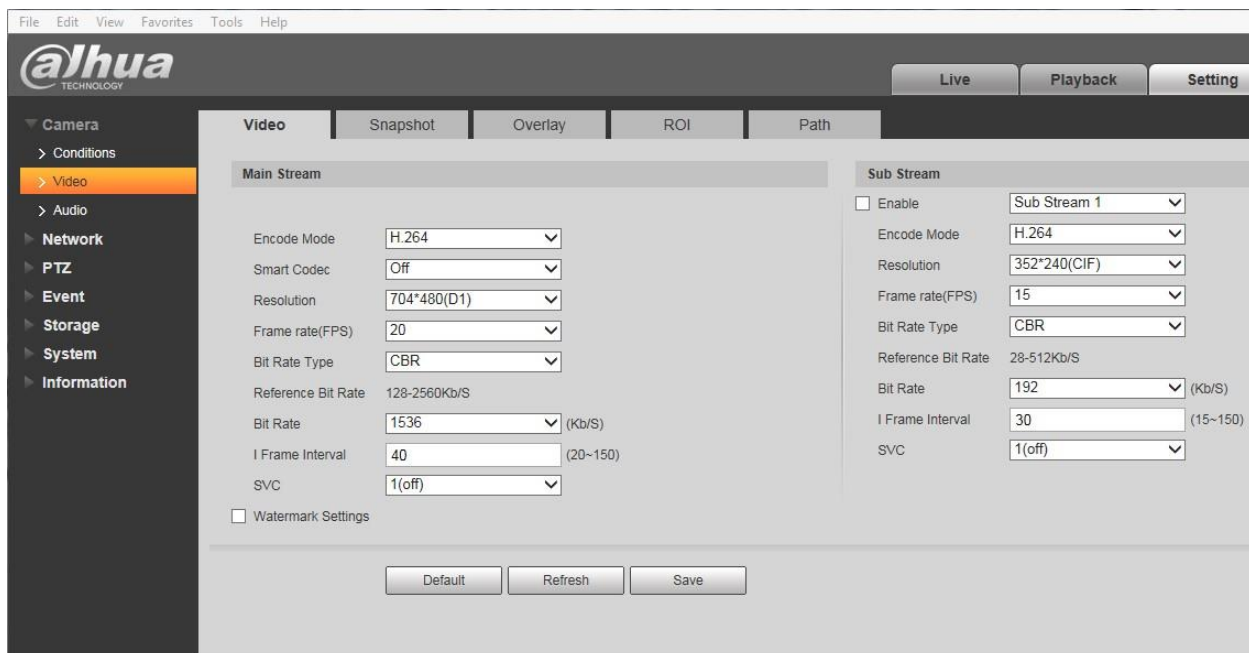
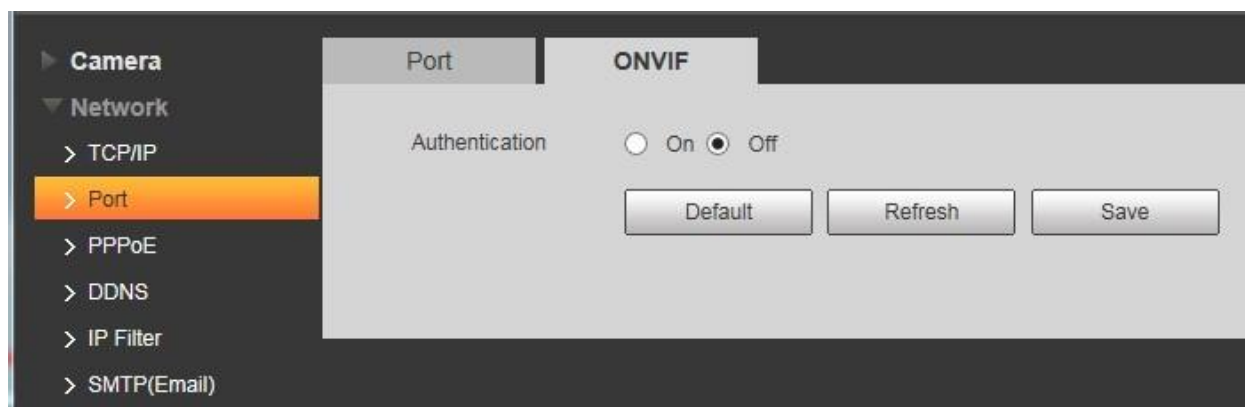Set Defog Profile to Normal and Mode to Auto.

Disable all OSD info options.

Above shows frame resolution for 704 x 480, 20 frames per second.

1280 x 720 or 1920 x 1080 at up to 30 FPS could also be selected depending on OTDAU computer capacity.

ONVIF Authentication should be set to Off for no authentication.
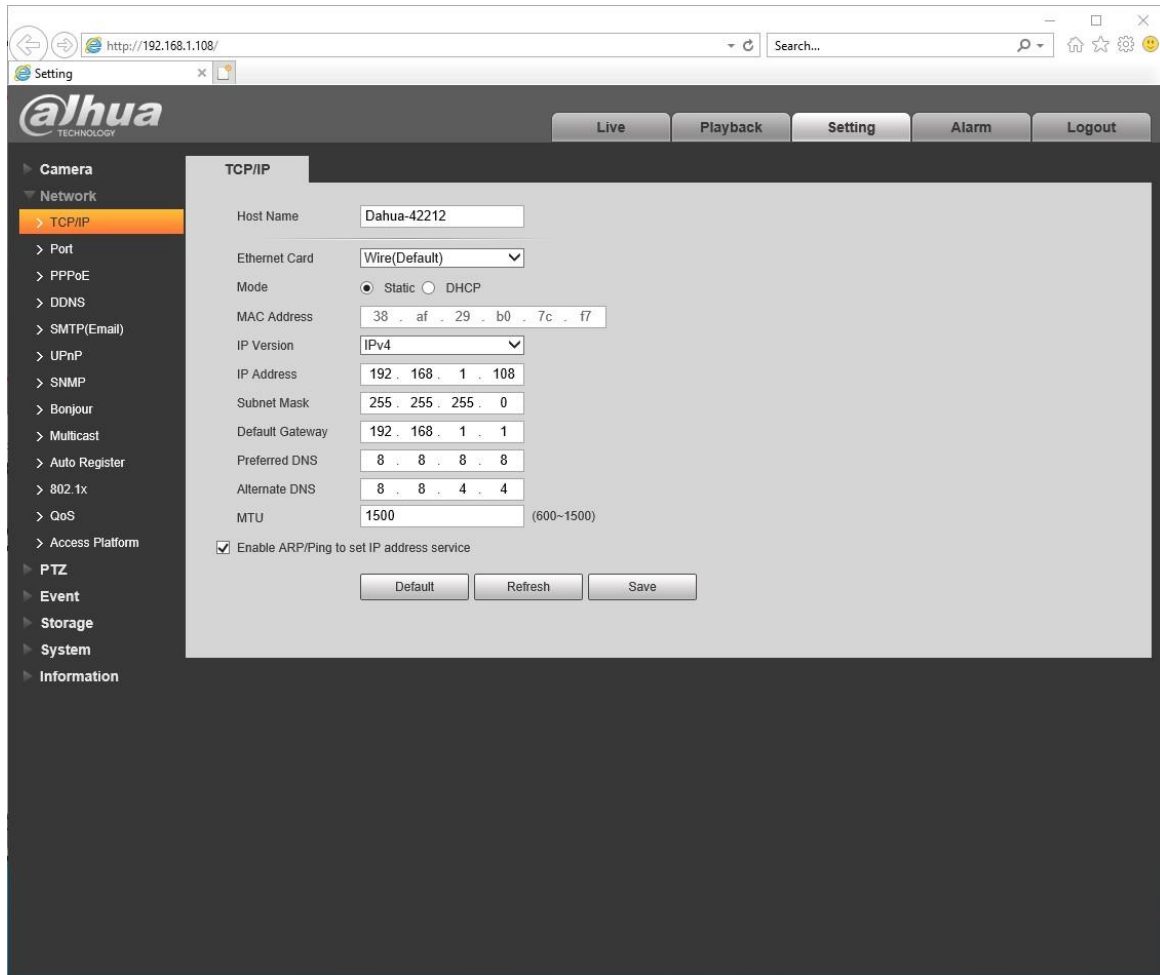

Set a Static IP address as desired. Leave the other setting as is.

192.168.1.108 is the Dahua standard default address. You can leave this as is if it does not conflict with another device address.

NOTE: If you have difficulty connecting to the camera or it seems intermittent, then you may have an address conflict. Check and correct this as follows:

1. Open your router's user interface, typically by entering the address 192.168.1.1 in the search bar of your browser.

2. Log into your router. The Username is usually "admin". The Password may be "password" unless you changed one or both. (Check your router's manual for the actual default values).

3. Check your router's subnet (IP or LAN) address. It is usually factory set to 192.168.1.1 or 192.168.0.1. For your camera(s) to be able to connect to your router, it must be on the same LAN as the router. That is, the first three parts of its address must match that of the router, e.g., 192.168.1.x. Any device on your router that has a static address, such as a camera, must match in this way. The last of the four sets of digits is the device's unique address, such as 108. If your camera and router are not on the same LAN, then correct that by changing the IP address of the router or that of the camera, as shown below. It may be easier to change the router if all your other devices use DHCP addressing (not static). When you reset the router or cycle power, it will reassign all DHCP addresses transparently and none of the example Camera configurations that are provided with OTDAU software will need to be changed.

4. Navigate to the router's DHCP settings. Change the address range used by the DHCP Server Pool to avoid assigning an address that is the same as your camera's. Do this by changing the Ending Address to some value below that of your camera(s), such as 100.

5. Click Apply to implement any changes.

Select a HTTP Port number other than the default of 80, as shown above, if the camera needs to be port-forwarded on your router. Leave it as 80 otherwise.

SETUP FOR OPERATION WITHOUT A ROUTER

You can set up an OTDAU/MC system where the camera(s) connect directly to a computer, without going through a router. This configuration may be required, for instance, when setting up a system that must operate standalone, independent of any direct internet connection.

To do this, you will need to modify the PC's IPv4 address to static instead of DHCP.

This change will place the camera(s) and the PC on a common LAN by setting the PC's IP address and that of the camera to have the same first three parts of the LAN address.

(192.168.1.x). Despite this change, the PC will still have internet access when connected to a router.

1)   Press the Windows + R keyboard shortcut to bring out the Run box.

2)   Enter "cmd" and press Enter to open a system command window.
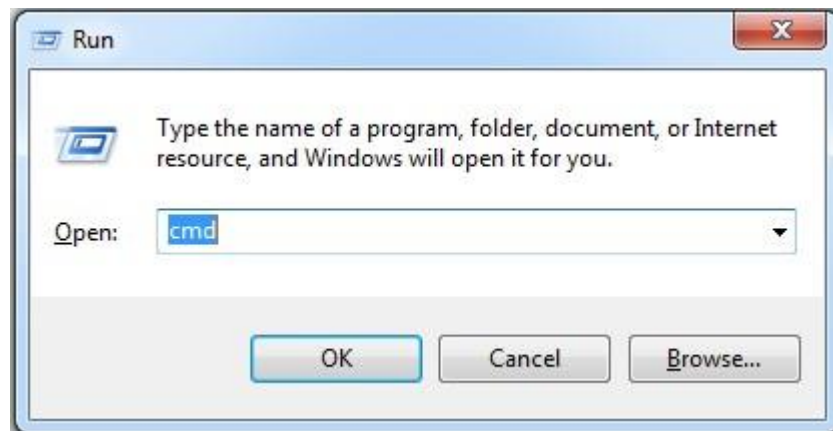
3)   Type "ipconfig" and Enter to find your computer's IPv4 address.

4) Press the Windows + R keyboard shortcut to bring out the Run box.

5) Enter "ncpa.cpl" and open the "Network Connections" window.
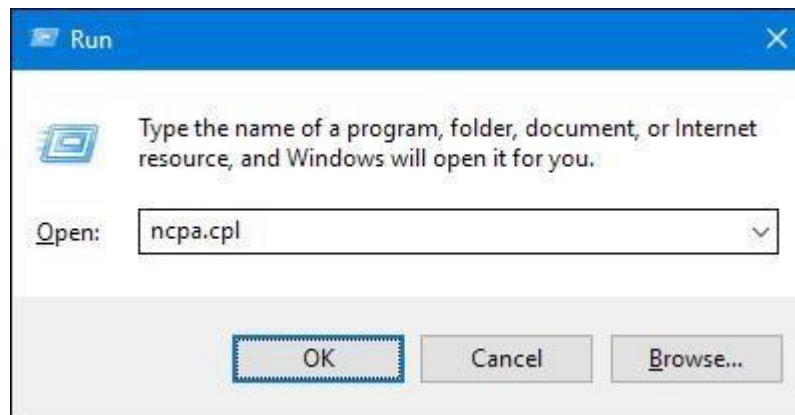
6) Right-click your computer's network adapter and select "Properties".
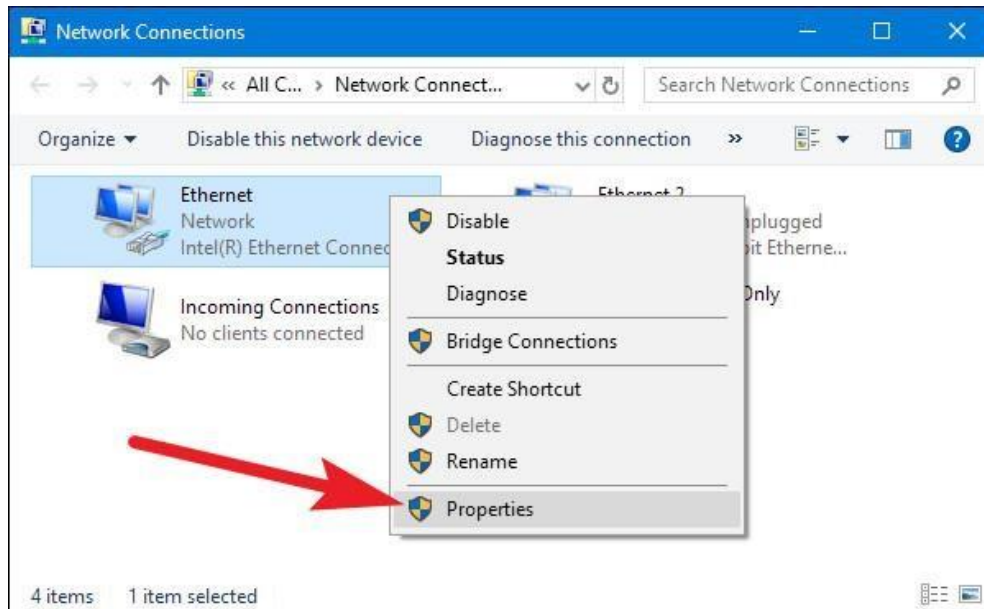
7)   Select your computer's Internet Protocol Version 4 and click "Properties".
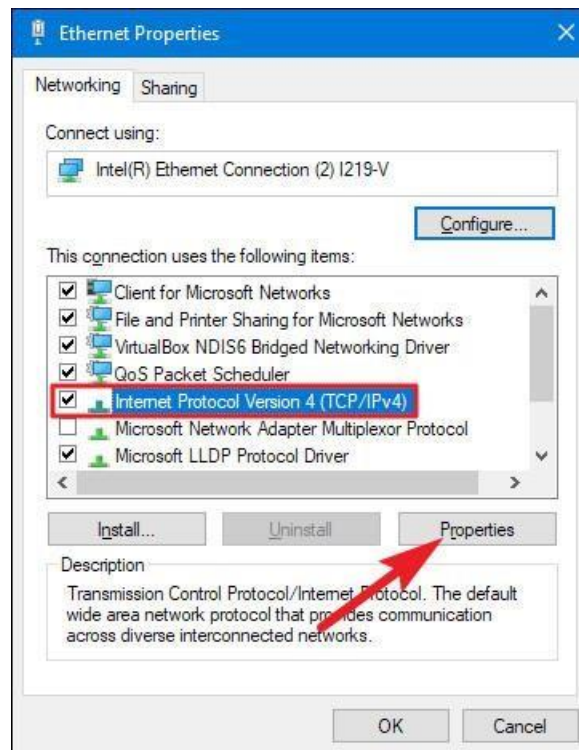
5) Select "Use the following IP address" and change the IP address to the desired IPv4 address such as 192.168.1.50 as shown in this example. **NOTE:** This address must match the one in the IP field of the OTDAU Configuration when using an instance of OTDAU with Mission Control software. If you are setting up a system for field use that will not use a router, then do not fill in the Preferred and Alternate DNS server entries.

IMPORTANT -- Use whatever means are provided by your router to:

- Change the range of addresses that the router uses for DHCP so that DHCP will use IP addresses (such as 192.168.1.xx) such that xx is always smaller than the highest DAU address. For example, setting the DHCP address range to 10 to 100.

- Verify that all your DAU IP addresses are greater than the top of the DHCP range, e.g., greater than 100.

These steps will prevent conflict between automatic assignments of addresses by your router conflicting with the static addresses of your DAUs.

NOTE: The IP address of your computer is shown above as x.x.x.140. It can be any value that does not conflict with any other statically addressed device on your computer, such as a camera. 140 is shown above because that is the default address supplied with Mission Control software in the OTDAU Configurations.

SYSTEM SETUP FOR TRIANGULATION

Triangulation of a tracked object's geolocation, altitude, speed and size requires two running copies of OTDAU, each with one or two cameras.

Triangulation calculations and display is performed by the Mission Control (MC) software. MC derives the data it needs to do that by communicating with two OTDAUs via the LAN or WAN. Each OTDAU camera is set up as described above, possibly sharing a single PoE injector/switch.

Minimum and maximum distance between such cameras is dependent on camera fields of view (FOV), the distance between them and their relative azimuths (rotation towards each other). As shown in the figure below, this distance, along with the FOV governs the minimum distance an object can be to an observer halfway between them. Anything farther will also be in view.

The answer to the question "what is the farthest object that can be seen?" is a complex function of several factors such as:

- The size of the object

- The amount of optical zoom in use

- The amount of self-illumination of the object

- The contrast ratio of the object vs the sky/background

- The resolution of the camera imager

OTDAU can trigger on and thus record an object if it has a sufficient contrast difference covering only a few pixels of the camera imager. The ability to capture this minimal image must be traded off against OTDAU settings for blur, threshold and minimum contour size that may result in false triggering from other small, weaker points of light. This situation is usually much easier at night due to elimination of the effects of clouds and foliage as well as a better contrast ratio for self-illuminated objects.

READYING THE SYSTEM FOR TRIANGULATION

Setting up two tripod-mounted systems involves the following steps:

-- Open the tripods and mount the cameras with optional MSDAUs on them. Connect an antenna to the MSDAU(s)

-- Plug one end of a CAT6 cable into each camera and MSDAU

-- Plug the other end of the cables into a common PoE injector

-- Connect a short cable from the injector to a computer or router-- Run two copies of OTDAU and one of Mission Control on the computer

-- Select per-defined configurations for the OTDAU System configuration and MC Mission. Select recording and sharing options.

-- Execute Run on each OTDAU and the MC.

Camera separation for triangulation

Camera separation vs target distance

What is the minimum required D for target acquisition at minimum range T?
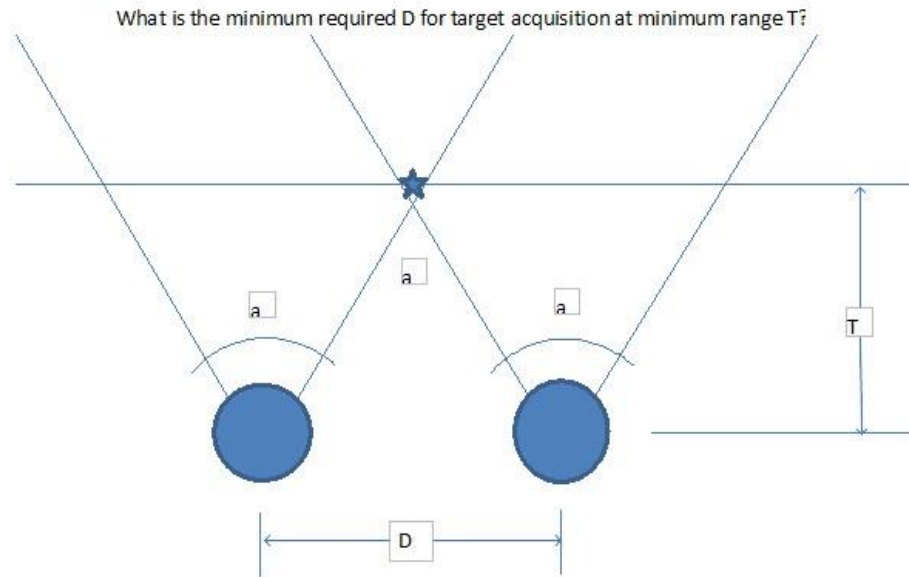
a   Horizontal Field of View of each camera
D   Distance between cameras
T   Minimum overlapping LOS distance to target

If two cameras are D feet apart then they can capture a target if it is T feet from the cameras or far

$$COS(a/2) = T / (D/2) \quad \text{-------->} \quad D = 2 * T / COS(a/2)$$

Typical fixed camera FOV

a degrees	D feet	T feet
96	2.99	1
96	29.89	10
96	298.90	100
96	2988.95	1000
96	5977.91	2000
96	8966.86	3000
96	14944.77	5000

Typical PTZ camera FOV

a degrees	D feet	T feet
60	2.31	1
60	23.09	10
60	230.94	100
60	2309.40	1000
60	4618.80	2000
60	6928.20	3000
60	11547.01	5000

For example, two 96 degree OFV cameras about 300 feet apart can see a common object as close as 100 feet

If you assume that T is 50 miles (264000 ft) and your camera FOV is 60 degrees, then the minimum distance between cameras needs to be about COS(60/2) * (264000/2) = 114315 ft or 21 miles.

So that would require remote, internet-connected cameras. Note that the wider the FOV, the closer the cameras can be to triangulate a target at a given distance.

See also the following section on maximum usable target distance.

MAXIMUM TARGET DETECTION DISTANCE

In general, the maximum altitude that a UFODAP camera might see a target would not depend on the absolute altitude, per se, but rather the size, brightness and contrast of the target.

"Seeing" might be defined as the target just covering enough pixels, with enough brightness so that the tracking settings of the OTDAU software detect it. Those settings can be as sensitive as about 3 pixels and very low contrast.

Another way one might want to quantify the ability to see a target is to specify its resolution vs distance. The following calculations reference the image resolution document listed below.

- Assume a 30' diameter target object.

- Assume the nominal 1920x1080 pixel camera image, with no zoom to start for initial target detection.

- Using the 50232XANR camera (32x zoom), focal length of 4.9 to 156mm, Sony Starvis sensor (IMX290LLR) which is 4.56mm/side.

- Rearranging the equations to get camera distance = ((pixels / (3 pixels/30')) * (focal length / chip size) = ((1920 / (3/30)) * (4.9/4.56) = 20,631 feet or 3.9mi.

Of course, after target detection, with incremental zoom while staying on target, the focal length and thus the distance greatly increases, thus putting more pixels on target. If it is bright enough, even the initial target point of light would be adequate for measurement by the Tracking Spectrometer.

Theia Technologies, a maker of lenses for security cameras like those specified for UFODAP, has published several useful guides on this subject:

Image resolution simulator and lens calculator -- https://www.theiatech.com/calculator

White papers, including "How to calculate image resolution" from which the calculations above are derived -- https://www.theiatech.com/white-papers

Camera calibration for triangulation

For MC to calculate the location, altitude, etc. of a triangulated target from the position of a target in the FOV of two cameras, the pan and tilt (azimuth and elevation) angles of each of the two cameras must be set up in advance. The setup assumes that each of two instances of OTDAU software is controlling one PTZ camera. One set of steps to accomplish this is as follows:

1. For each camera, in its instance of OTDAU software, open the Setup menu and disable the "Set Pan and Tilt offsets" option.

2. Using the manual controls, move the camera's azimuth so that it points due North.

3. Move the camera's elevation to a height such that the FOV covers the best initial target acquisition area. Note the value of EL in the Wide-Angle display.

4. In Setup Options, enter the EL value at the Elevation offset and enable Set Pan and Tilt offsets. AZ will be zeroed, and EL will be the entered value.

5. Draw an appropriate Bounding Box.

6. Do the same for the other camera, elevating it to approximately the same tilt angle as the first camera.

Notice that after closing the camera configuration and reopening by clicking Load, the camera will return to the above saved position.

Note that this setup assumes that one camera will acquire a target first and as it tracks, if the target moves to enter the bounding box of the second camera, both will track the same target and triangulation will occur.

After the above OTDAU setup, open Mission Control and select a Mission that includes both cameras, such as mission-pccam1-pscam2. After initial checkout of your triangulation configuration, you may want to add other DAUs such as MSDAUs.

Load this Mission and verify that data from both cameras are displayed. As a demonstration/test of triangulation, open the MC Setup menu and select "Enable Test Mode" (and Save). In this mode, after Run is selected, MC will display triangulation calculations using the two cameras without requiring a trigger condition. Thus, you can manually move the camera pointing angles and observe the effect on the calculation. Use the Map Display Controls to better visualize the location of the DAUs and the intersection point of the camera pointing angles.

Stop, disable Test Mode and Run again for actual triangulation use. Be sure to enable any recording options needed prior to Run.

TIPS AND TECHNIQUES

The following are some guidelines for common problems and questions UFODAP users have had while setting up or using UFODAP hardware or software or planning for a new system.

Telescope control

It should be possible to control a GoTo telescope via the OTDAU software. However, the software interface (driver) to do that has not been developed.

For that to be possible, the following conditions would have to be met:

-- Use a GoTo to WiFi interface such as the SkyFi 3 controller

(https://skysafariastronomy.com/skyfi-3-professional-astronomy-telescope-control.html) to get commands from your PC to the GoTo mount.

-- The GoTo telescope interface must be Celestron NexStar hand controller-compatible as defined in the document: NexStarCommunicationProtocolV1.2.pdf

-- You would have to provide the WiFi interface and a compatible GoTo controller (perhaps without the telescope) for software/hardware integration and testing.

-- You would need to provide some type of telescope camera that results in the image available via either a USB or Ethernet interface.

If all of that could be arranged, then UFODAP may be able to develop the driver. If so, then OTDAU would detect and track moving targets in the field of view and slew the telescope to maintain track.

MSDAU antenna functions

The UFODAP MSDAU antenna is of a type intended for scanner use and covers ultra-wideband frequencies from 1MHz to 6000MHz and does it without the band gaps found in antennas meant for similar applications. Thus, it covers all practical frequencies the SDR can receive without changing the antenna.

Its data sheet and dimensions may be found in the Downloads section of ufodap.com.

This antenna is mounted to a standard NMO (New Motorola) adapter attached to an assembly that fastens to the vertical plate that holds the MSDAU, high enough to clear the camera. Later versions include a NMO tripod mount and cable so that the antenna is a short distance from the MSDAU and does not interfere with a co-located camera.

The antenna can be simply unscrewed from the NMO mount for transport without affecting the mount or cable connections.

Initial installation issues

The Operating System (OS), under which the OTDAU and Mission Control software run must be Windows 10 or 11.

They can also run on an Apple MAC computer with a Windows emulator running on top of their iOS, although this results in rather slow performance.

Those requirements and others are listed in the beginning of the UFODAP User Guide which can be downloaded or viewed from the Downloads tab of ufodap.com.

If you have a problem initially running OTDAU, you might try the following:

1. Uninstall OTDAU

2. Delete the folder C:\Program Files (x86)\OTDAU

3. Install the new version from the download you received via SendOwl

Open OTDAU and complete the verification process either with an IP camera, if you have one, or using the USB camera option.

MSDAU mounting on a vehicle

One issue may be that the 3-DOF magnetometer (compass) in the MSDAU would be affected by the metal of the vehicle which would also shield it from fluctuating magnetic anomalies.

Thus, it may function better if mounted externally when in use. Note that the wall plate is the same as the vertical plate portion of the System Mounting assembly used for the camera tripod mount.

You could either: a) mount the plate horizontally on top of the truck (using wing nuts?), b) Use the System mount (both plates) and the 5/8-11 tripod mount on the truck (MSDAU vertical) or c) Your own L-brackets or plate to attach to the wall plate.

Bear in mind that:

- Permanently mounting cameras and other sensors on the outside of a vehicle will subject those items to dust, dirt and the elements and make them more susceptible to vandalism and theft.

- Camera data would be more easily analyzed if the camera was not in motion during data collection.

Tracking problems

If you have difficult tracking problems, please share data about those issues as follows:

-- Verify correct operation without P/T or Zoom enabled

-- Then verify if there is a problem with only P/T enabled

-- Only if that works, enable zoom

To share data on this, please send to UFODAP the avi of the Wide camera and a screenshot of the Tracking and Camera parameters used at the time.

However, one probable cause of this behavior is that the PID proportional value in the Camera parameters is set too high for your camera -- try setting it to 5 and run a test.

If that works for you, then increase it a bit with each test until you notice overshoot or hunting during tracking, then back it off.

USING A CAMERA WITH OTHER SOFTWARE AS WELL AS OTDAU AND MC AT THE SAME TIME

MC acquires triangulation-related data from the computer running the OTDAU software, not from the camera itself. Thus, the normal way this works is for OTDAU to operate the camera and pass info such as azimuth and elevation (pan and tilt) to MC.

MC also receives a reduced resolution image for display and storage from OTDAU. In any case, an IP camera stream may be viewed on several applications at once. For example, you can view and manually control an IP camera from the IE browser while OTDAU is using it. The only constraint is you would not want some other application to be sending PTZ motion commands to the same camera as OTDAU is controlling. MC and multiple instances of OTDAU can all run on the same computer or different computers since they communicate via TCP/IP within your LAN or the internet.

OTDAU can operate with any USB camera. In fact, it can use two at a time for purposes of creating a wider field of view although only one (the "Wide-angle" camera) will be used for target acquisition and tracking. OTDAU software is provided with many System configurations, each of which defines what cameras are in use among other parameters. Besides various IP cameras, it includes those for cameras on USB0, USB1 and USB2. Each System configuration calls out what Camera configurations it uses for the "Wide" and "Telephoto" cameras. Thus, there are Camera configurations for various resolutions of cameras for each USB port. You can also modify or create any needed System or Camera configuration you need.

ADDING A POE EXTENDER

-- Using the short Ethernet cable, connect the PoE injector port 5 or 6 to an unused port on your router.

-- Using any length Ethernet cable, connect any PoE injector port 1-4 to the Extender In port.

-- Using a short Ethernet cable, connect one of the Extender Out ports to MSDAU.

-- Using another short cable, connect the other Extender port to the camera.

SOFTWARE SETUP

Use the Dahua ConfigTool (for example) or a web browser to verify camera operation. When you open it, it should discover the camera. Then click the WEB icon on the right to run IE to see the camera's display. Login using admin / dahua50432.

You can then use the Setting tab to, for instance, get to the focus adjustments (Conditions > Focus & Zoom).

Start OTDAU and connect to the camera using the dahua-50432-108-1920x1080 System configuration. Verify correct operation.

Start MC and Load the mission-pccam1 mission and verify camera data is displayed.

Close the MC mission above and instead, Load the mission-ms1 mission and verify that MSDAU data is displayed. There may be some delays due to installation of a new version of MSDAU firmware.

Close that mission and Load mission-pccam1-ms1 to see both DAUs at the same time.