



DAVID

GENERIC STAND-ALONE VISION PAYLOAD

USER MANUAL

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Proprietary Notice

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OVERSIGHT

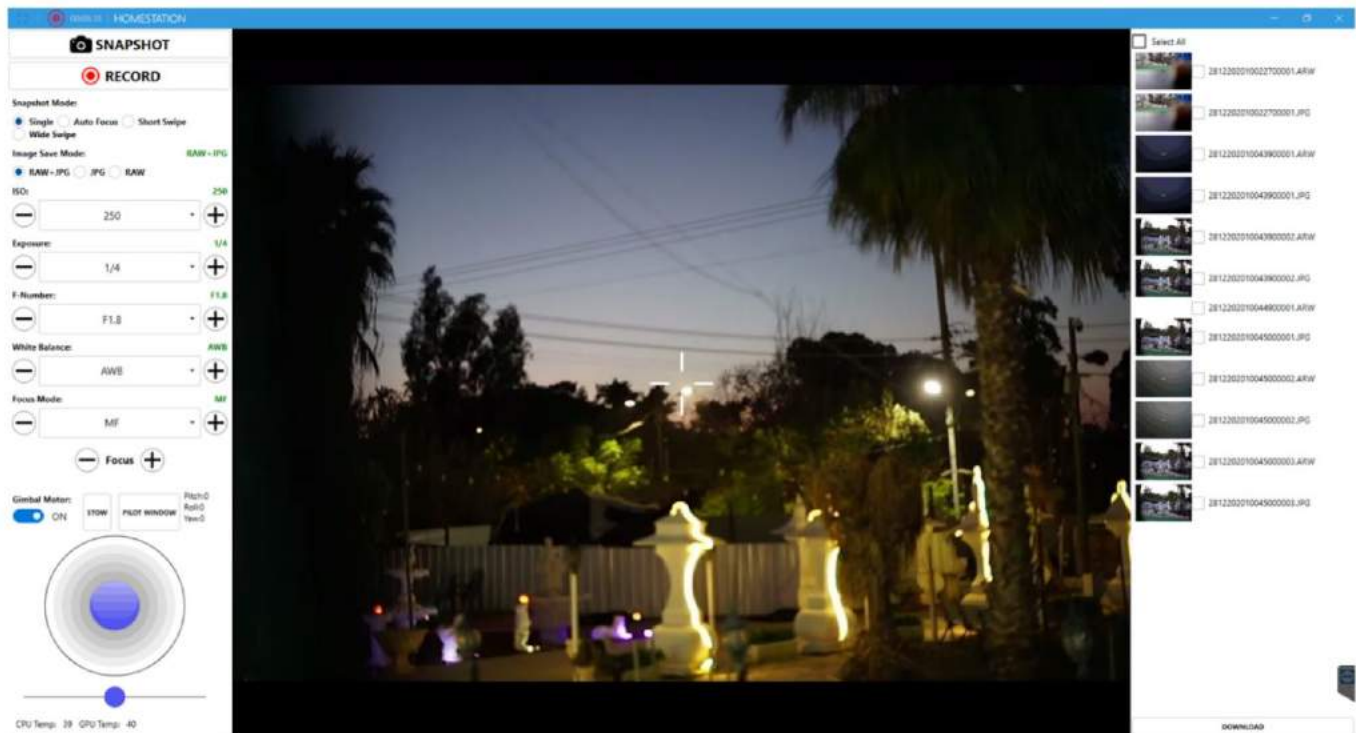
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System Description

David is a stand-alone generic vision payload based on the Gremsy T3V3, suitable for Sony $\alpha 7$ series cameras and can support a variety of lenses. David contains capabilities such as:

- Live video feed
- Full gimbal control
- Changing camera settings in real time
- Fully compatible windows based Ground Control Station (GCS)
- JPEG image data tagging (DJI style)
- Download RAW and JPEG images in real time
- The operator can choose to work with the David dedicated communication (configurable 2.2-2.4 Ghz) or work with an external one
- Mavlink based communication - Mission planning using mavlink tools (Mission planner, qground control and more)

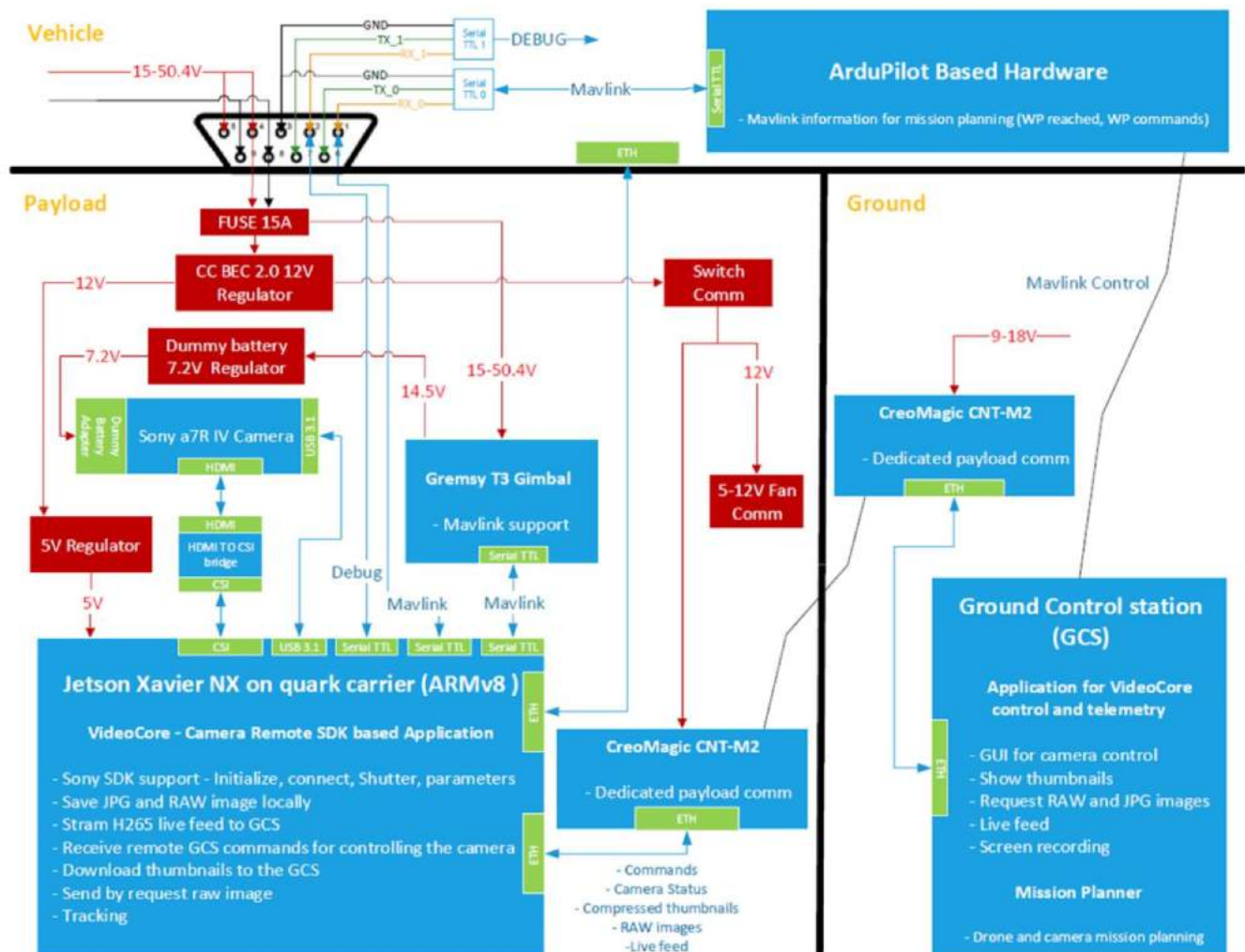


System Architecture

The system consist of several main components:

- Jetson Xavier NX on a ConnectTech Quark carrier board
- CreoMagic CN2-M2 modem
- Sony α7 series camera
- Greamsy T3V3 gimbal

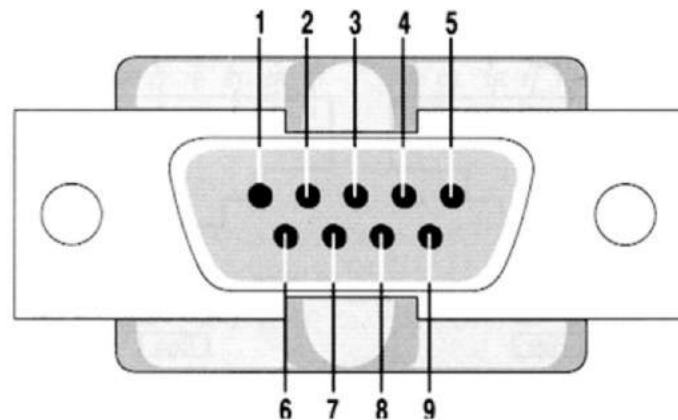
High level architecture diagram of a David system:



Pinout and switches

David has a single DB9 connector which supplies power to the Payload, communication, and DEBUG capabilities.

Be sure to secure the plug with m3x25 screws while flying.



5, 9 - VCC (15.50.4 v)

4, 8 - GND

3 - Serial communication GND

2 - Mavlink RX - UART TTL 115200, 8bit, non pariti, 1 stop bit

7 - Mavlink TX - UART TTL 115200, 8bit, non pariti, 1 stop bit

1 - DEBUG RX - UART TTL 115200, 8bit, non pariti, 1 stop bit

6 - DEBUG TX- UART TTL 115200, 8bit, non pariti, 1 stop bit

Davis has also an RF switch for the modem for 2 main reasons:

1. The modem is set to transmit in 1 Watt, **please ensure to turn off the RF switch when powering the David in a lab environment.**

2. David can also use the vehicle communication over ETH instead of it's own modem to deliver communication.

The Sony camera has a dummy battery connected to Gremsy 14.5V output on the bottom and an HDMI connector connected also at the bottom of the gimbal.

The USB type C connects to the camera and goes into the David computing unit and not through the gimbal itself.

Gimbal-Lens Calibration

Each camera and lens configuration installed on the David has a specified calibration in each axis in order to balance the gimbal.

The gimbal has also a defined range for each configuration.

If a new lens or camera from the α series is installed please update the measurements accordingly in the following table:

Camera	Lens	Pitch	Roll	Yaw	Range Pitch [deg]	Range Roll [deg]	Range Yaw [deg]
sony α 7R	50mm	1	0.8	1.9	-90 - 90	-45 - 45	-180 - 180
sony α 7R	200mm						

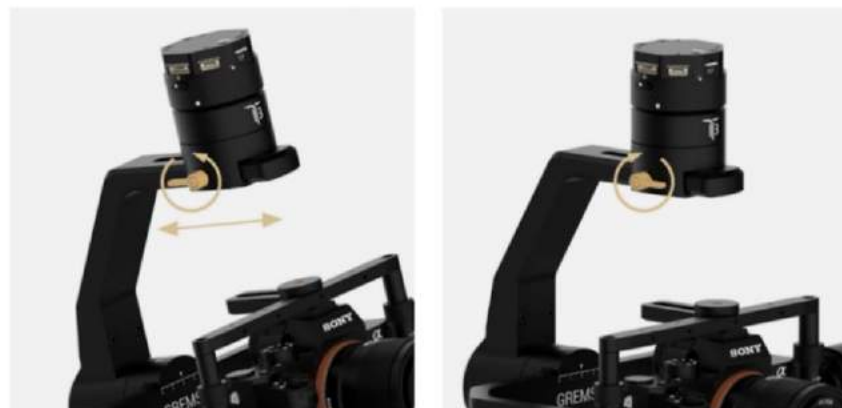
Pitch:



Roll:

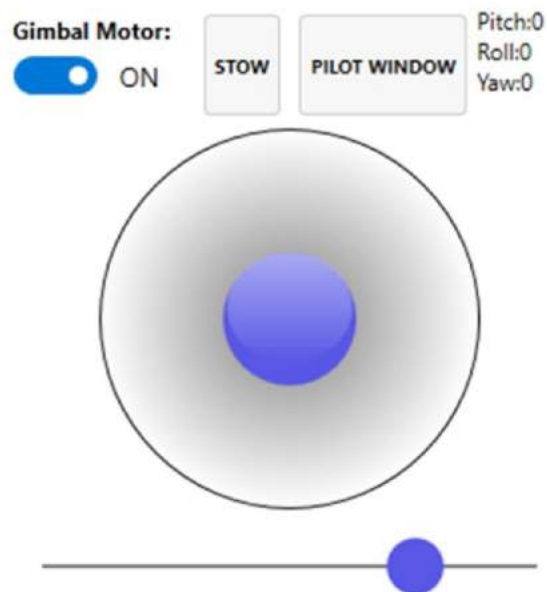


Yaw:



Gimbal Functions

David offers a full gimbal control and a live view of the gimbal position relative to its starting position.



Gimbal Motor

The gimbal motors will start in on position by default.

The operator has the option to turn off the gimbal motors and turn them on again using the GCS for a testing purpose.

Joystick control

The operator can choose to control the gimbal with a real or a virtual joystick using the "UseVirtual"=false parameter (refer to section parameters).

The joystick models that are tested and find suitable:

- Logitech f310
- XBOX controller

Virtual joystick and roll bar

The virtual joystick can be controlled on a touch screen or by a mouse and delivers a full control on the gimbal in all axes, the knob controls the pitch and yaw axes and the bar controls the roll axis.

Land and takeoff mode

While taking off and landing with an mavlink based autopilot, the camera will retract itself in order to protect the lens.

Notice: This will work only if the gimbal is in rate mode (Joystick control).

Pilot Window

Send the camera to (pitch: 0, roll: 0, yaw: 0) and stabilize it.

Stow

Send the camera to (pitch: -90, roll: 0, yaw: 0) and stabilize it.

Camera functions

Notice: Make sure that the camera dial is in M (Manual Exposure) like in the following picture:

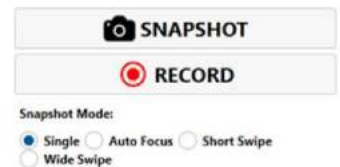


Record

Recording a XAVC S 4K video on the camera SD card.

Snapshot mode

The operator can choose snapshot mode according to the scenario.



Single

Take a quick image with a manual focus selection, in this mode the user can change the manual focus manually.

Auto focus

Take an Auto Focus image, the operator can not set manual focus in this mode.

Short and large swipe

The camera will point down and take a series of images (short-3, large-5) in a constant angle jump as defined by the "SwipeAngle" parameter (refer to the parameters section).

When finishing the swipe, the camera will point down and then go to it's last position, for example, if it was on joystick mode it will stay put.

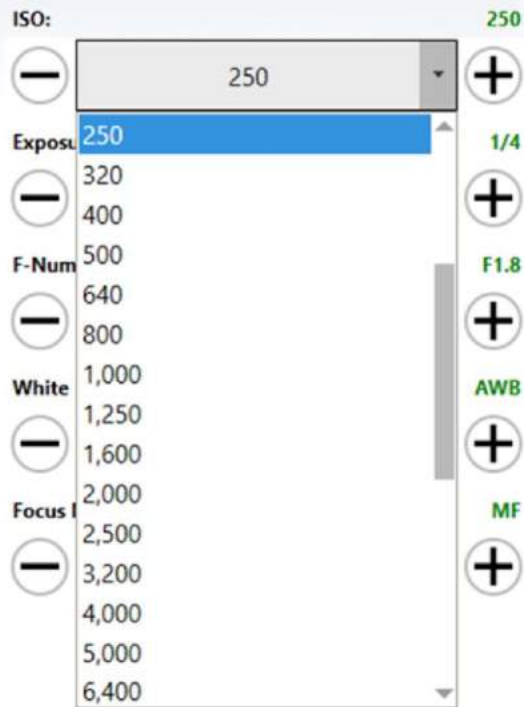
Image saver mode

The Operator can choose which kind of image to download to the David system (The camera will always save the RAW+JPEG on it's SD card).

The green indication points to the current state.



ISO



ISO: 250

Exposure: 250

F-Num: 500

White: 1,000

Focus: 2,500

250

320

400

500

640

800

1,000

1,250

1,600

2,000

2,500

3,200

4,000

5,000

6,400

250

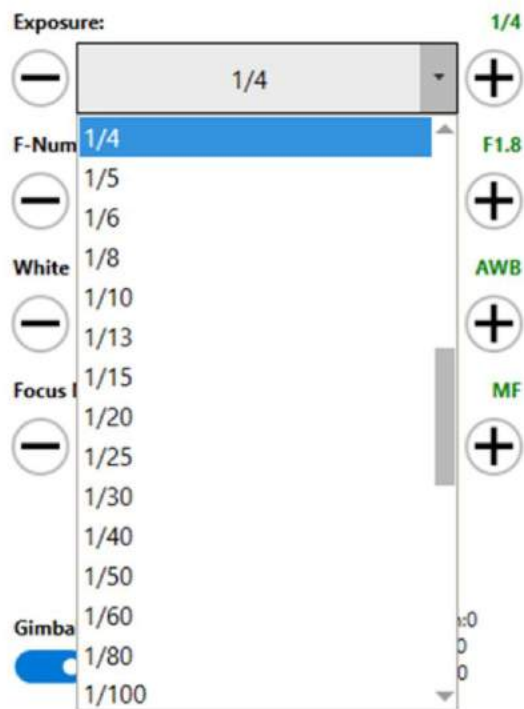
1/4

F1.8

AWB

MF

Exposure



Exposure: 1/4

F-Num: 1/4

White: 1/8

Focus: 1/15

Gimba: 1/60

1/4

1/5

1/6

1/8

1/10

1/13

1/15

1/20

1/25

1/30

1/40

1/50

1/60

1/80

1/100

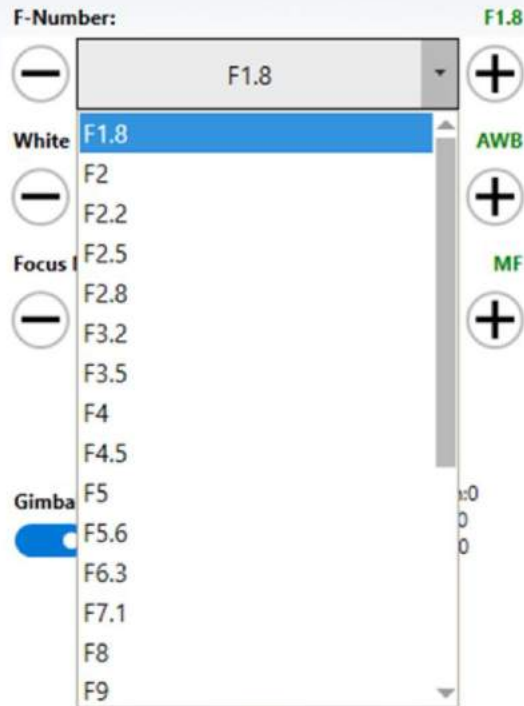
1/4

F1.8

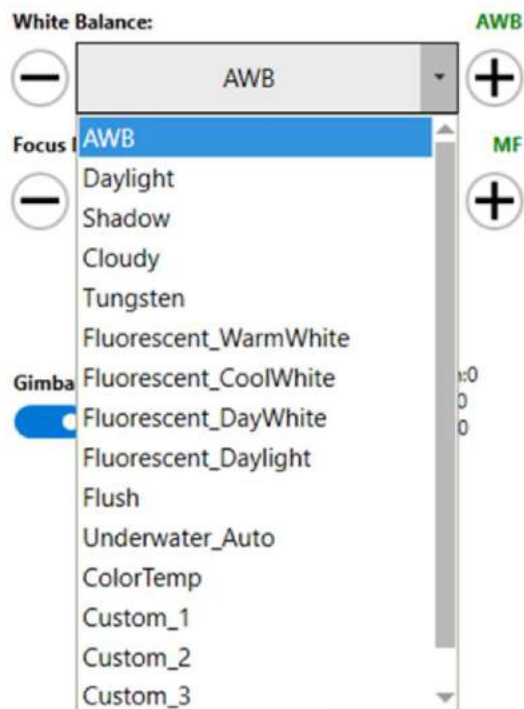
AWB

MF

F-Number



White Balance



Focus mode

The operator can select focus mode by itself, usually this is Unnecessary and we advise not to set this manually since David will choose the appropriate focus mode depending on its current shutter mode.

Manual Focus Control

while in single shutter mode the user can adjust the focus using the + and - far and near respectively.

Mission Planning and generic mavlink response

The David will respond to a generic mavlink Trigger and PointCameraHere commands:

Trigger camera by demand



Set region of interest by demand



Trigger camera in mission planning

While planning a survey make sure to choose “DO_DIGICAM_CONTROL” under “Trigger Method”



Your survey mission should look like this:



The operator has the ability to choose the shutter type by changing “Shutter Cmd” value:

- 1 - single manual focus photo:

	Command	On/Off	Zoom Position	Zoom Step	Focus Lock	Shutter Cmd	CommandID	Frame	Delete		Grad %	Angle	Dist	AZ
5	DO_DIGICAM_CONTROL	1	0	0	0	1	0	Relative	X	 	0	0	0	0

- 3 - Auto focus photo:

	Command	On/Off	Zoom Position	Zoom Step	Focus Lock	Shutter Cmd	CommandID	Frame	Delete		Grad %	Angle	Dist	AZ
23	DO_DIGICAM_CONTROL	1	0	0	0	3	0	Relative	X	 	0	0	0	0

- 5 - Short swipe

	Command	On/Off	Zoom Position	Zoom Step	Focus Lock	Shutter Cmd	CommandID	Frame	Delete		Grad %	Angle	Dist	AZ
23	DO_DIGICAM_CONTROL	1	0	0	0	5	0	Relative	X	 	0	0	0	0

- 6 - Large swipe

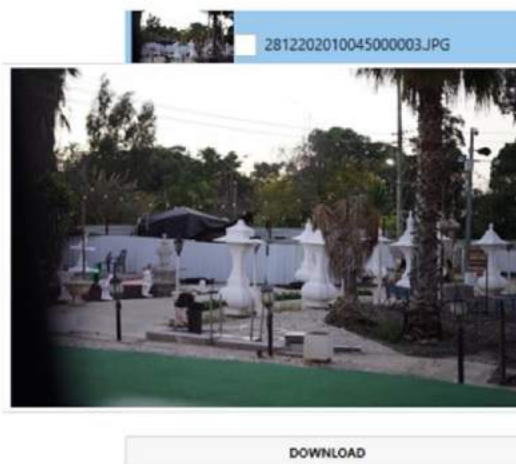
	Command	On/Off	Zoom Position	Zoom Step	Focus Lock	Shutter Cmd	CommandID	Frame	Delete		Grad %	Angle	Dist	AZ
23	DO_DIGICAM_CONTROL	1	0	0	0	6	0	Relative	X	 	0	0	0	0

Downloading images

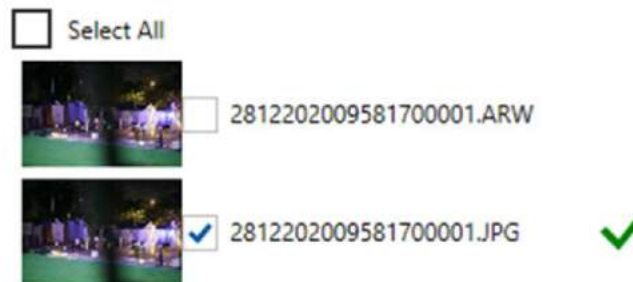
When the operator chooses to take an image it will appear on the right side after a few seconds of downloading to the compute unit of David system and tagging it with the current data. The image name consists of the current date, serial number and the appropriate file extension (JPEG or RAW).



Once the image will be ready to download a thumbnail of this image will appear, the operator can enlarge it by moving the mouse on it



The operator can choose to download the image to his local PC to a path defined by a parameter "SavePath": "C:/Users/David/Videos" (refer to section parameters). Once the image will complete download a green check mark indication will appear.



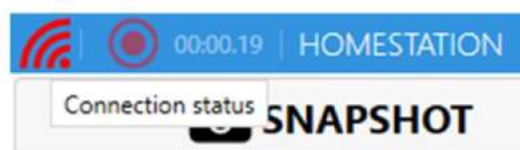
Screen recording and a link indication

David GCS has a built in screen recorder which records an .avi file type in h.264 format on a selectable path "SavePath": "C:/Users/David/Videos".

Please use a compatible player for opening the screen record like VLC.

The operator needs to change the resolution parameters for screen recording so it will fit the PC the David GCS is running on.

The link sign on the top left indicate connection status to David system



Parameters

David has a parameter file which gives the user the ability to change default camera parameters.

```
{
  "Camera": {
    "DefaultParameters": {
      "Iso": "AUTO",
      "Exposure": "1/320",
      "FocusMode": "MF",
      "FNumber": "F5.6",
      "WhiteBalance": "AWB",
      "ImageSaverMode": "JPG"
    },
    "ConnectivityTimeout": "00:00:05"
  },
  "Joystick": {
    "UseVirtual": true
  },
  "Video": {
    "SavePath": "C:/Users/galda/Videos"
  },
  "GimbalConfig": {
    "SwipeAngle": 15
  }
}
```