

NEMETODE Technical Note #02

Troubleshooting Resolution Issues

Optimising Resolution Settings when using different combinations of Cameras and Video Capture Devices

This document provides a guide on how to optimise (and in many cases maximise) the resolution of images obtained for different combinations of cameras and video capture devices when configuring them for use with SonotaCo's UFO Capture Software. In addition this document also discusses common interference issues and compression artefacts that may degrade the image. Within the [NEMETODE](#) team a common camera manufacturer (Watec) is used however there are a number of different video input devices in use that take the output from the camera and convert it to a format that can be interfaced to a computer. Irrespective of camera manufacturer, elements of this document should be of use to those interested in troubleshooting resolution issues. The recommendations are based on user experience within the NEMETODE team and on input from others. Where possible the authors have included references to the rationale behind the recommendations provided.

Video Standards

There are two primary analogue video standards in use around the world, NTSC ([National Television System Committee](#)) and PAL ([Phase Alternating Line](#)), with the primary difference being the frame rate (number of frames per second, fps). NTSC is used through North America, parts of South America, Japan and South Korea. With the exception of northern Asia and parts of Africa, who use SECAM ([Sequential Colour with Memory](#)), the rest of the world (including Europe, Australia and much of southern Asia) uses the PAL standard. Within the television industry these standards are being replaced as broadcasters switch from analogue to digital however within the CCTV industry they are still in widespread use. As the cameras that are typically used for video detection of meteors can trace their lineage back to CCTV and Machine Vision applications, a basic understanding of these standards is still required.

Cameras are typically manufactured to provide a video output that is *either* NTSC *or* PAL and switching between the two is not an available option to the user. In the days when the output from such cameras was connected directly to an analogue television set this was particularly important as some televisions, based on the part of the world in which they were intended to be used, were hardwired to only accept either an NTSC or PAL video input.

With modern meteor detection systems the video output from the camera is typically interfaced to a computer, not a television set, but the user still needs to take account of the video standard when considering the combination of Camera and Video Capture Device and when performing the initial setup. The good news is that many modern Video Capture Devices can be configured by the user to accept input from either NTSC or PAL cameras.

Details of the video standard are sometimes detailed on the exterior of the camera, if not then this information should be included in the user documentation. CCTV manufacturers however tend to use "EIA" to denote NTSC and "CCIR" to denote PAL (see Table 1).

Video Standard	CCTV Reference	Frame Rate
NTSC	EIA	29.97
PAL	CCIR	25.00

Table 1: CCTV References and Frame Rates for the two primary video standards, NTSC and PAL, which are adhered to by cameras typically used for video meteor detection.

Resolution vs. Frame Rate

For the purposes of this document the word "resolution" will refer to the number of pixels in each row or column of the image. The objective is to maximise each of these values while at the same time achieve the frame rates mandated by the NTSC / PAL standard and avoid image degradation resulting from the imposition of an unacceptable aspect ratio.

A review of the specifications for a particular camera typically contains information such as that shown in Table 2.

Model	WAT-902H2 Supreme (EIA)	WAT-902H2 Supreme (CCIR)
Pick-up element	½ inch interline transfer CCD image sensor	
Number of total pixels	811(H) x 508(V)	795(H) x 596(V)
Number of effective pixels	768(H) x 494(V)	752(H) x 582(V)
Unit cell size	8.4µm(H0 x 9.8µm(V)	8.6µm(H0 x 8.3µm(V)
Synchronising system	Internal	
Scanning system	2:1 Interlace	
Video Output	Composite Video, 1Vp-p, 75 Ohms, Unbalanced	
Resolution (H)	570 TVL (Centre)	

Table 2: Typical parameters given in the specification documentation for a camera. The highlighted values are within the scope of discussion of this document and are defined below.

The *number of effective pixels* that an image sensor or digital camera has is the count of elementary pixel sensors that contribute to the final image, as opposed to the *number of total pixels*, which includes unused or light-shielded pixels around the edges. The “H” and “V” denote horizontal and vertical respectively.

Resolution (TVL – or TV Lines) is a monochrome specification that states how many black and white lines can be seen in a given area. [This link](#) provides useful additional background information.

Scanning System: When the picture is sent to a monitor or another receiving device, each frame of the image is actually transmitted as two fields. The first field of even-numbered lines is sent and then the second field of odd-numbered lines is transmitted. The odd and even fields are offset one line apart, so when they are viewed in rapid succession they slot into one another (to create a frame) to give the illusion of the complete picture. Each frame, transmitted at the Frame Rate given in Table 1, is therefore made up of two fields hence the Field Rate is 2 x the Frame Rate. This is called interlaced video.

As previously mentioned, the video output from the camera could simply be connected to the input of a suitable (either NTSC or PAL) analogue television and an image would be visible. Modern video meteor detection systems however have the camera’s video output connected to a computer and this is accomplished through the use of an interface device. These typically take the form of a card that is inserted into one of the slots in a PC or a USB dongle (see Figure 1)



Figure 1: Different types of Video Interface device in common use by members of the NEMETODE team. To the upper left is the Osprey 210 PCI Video Capture Card. Due to its physical size this card requires a full size desktop PC and will not fit in a mid-size or “small form factor” PC chassis. To the upper right is a Climax Digital USB Video Audio Capture Device while the bottom row shows two models of EZ Capture device (discussed in the main text) with Model A on the left and B on the right.

Common Issues

Ideally one should be able to simply load the software drivers for the chosen capture device, select either NTSC or PAL, connect all the hardware then input the relevant “Number of Effective Pixels” value for your particular camera into UFO Capture. Unfortunately this does not often work and an error message “UM021: Resolution or Media type not matched” is displayed. Many users reduce the input pixel values to the widely known 640 x 480 and (because this works) accept that this is just the way it is and live with the fact that the image is cropped. Users have reported similar issues on the SonotaCo forum (see [here](#) and [here](#)).

To begin with users should be familiar with SonotaCo’s [Night Sky Observation Guide](#) (NSOG) which provides excellent troubleshooting information. Regarding NSOG Alex Pratt [2] notes:

“You’ll see that it refers to the NTSC format 720x480 at 29.97 fps and the PAL standard 720x576 at 25 fps, which is our normal setting. The NTSC settings are fine if you have an EIA camera, otherwise if you have a CCIR camera use the PAL values, to avoid cropping”.

These (and in some cases higher) values are achievable though in some cases the interface devices require some cajoling. The specific instructions that follow are for PAL cameras. Users should check their camera types and, if necessary, adopt the NTSC values given in the preceding paragraph.

Osprey 210 Video Capture Card

Out of the box and with a default software installation, the Osprey 210 Video Capture Card is able to support the following values in UFO Capture [1]:

	Resolution	Frame Rate
NTSC / EIA	640 x 480	29.97
PAL / CCIR	768 x 576	25.00

Table 3: Resolution values that can be realised when using the Osprey 210 Video Capture Card in conjunction with UFO Capture.

EZ Capture USB

The initial setup of these has been found to be problematic though Alex [2] offers the following guidance that should be read in conjunction with SonotaCo’s NSOG:

- *Step 5: After the software has been installed, connect your camera to your video capture card (or USB capture device) and switch it on. Make sure the camera is never pointed near the Sun or a very bright sky.*
- *Step 6: From the Input tab, check that the Video field contains your capture device.*
- *Step 7: In the Operation tab, click Read Settings and select the PF720x576.ufi file. In the Input tab, it should then set the size and video format to 720, 576 and 25 Fps. Select the tuner, composite or S-video input.*
- *Click Preview, and it should display the live feed from your camera in the adjacent window.*
- *This often works first time. If not, try another video input option, such as composite. On occasion the USB capture device may have been factory-set to NTSC format and fails to display. This being the case, change it to PAL format via its supplied software then retry it in UFO Capture.*
- *Step 8: If the live Preview works OK, on the Live tab press Rec. After a few seconds press RecOff.*
- *Click Replay, to select the Replay tab. The DB tab will list your captured video clips. Click on a clip name, then press ">" in the Replay tab to play the short video.*
- *Step 9: To test the auto-detection feature, click on the Live tab and click Detect. Wave your hands in front of the lens. It should detect the movement and save a short video. Replay the video clip(s) to confirm the test.*

- *Save your settings - On the Operation tab, in the Maintenance group, click Save Settings. (It should do this automatically every time UFO capture is closed, but it's best to manually save your settings after setting it up first time.)*

While this was initially found to be effective, further tests using different models of the EZ Cap devices revealed inconsistencies and Alex [2] notes:

I've just done some test with grabber models A and B. Model B didn't display anything when using the supplied EZ Grabber software, even after tweaking various settings for video input, video format and reinstalling the EZ Grabber software and drivers (although the EZ Grabber software had no problems when used with model A). Likewise, UFO Capture works with model A but would not work with model B. Windows Device Manager always showed a yellow icon against the USB device when testing model B, saying that the driver was either missing or not working properly.

Model B is manufactured by Winstars, specifically model WS-VR203P, and I installed the latest grabber and driver software from [here](#). This cleared the Device Manager problem but EZ Grabber (and UFO Capture) still failed to display the video feed.

Using [VirtualDub](#) with grabber model B I then used the Capture AVI option in VirtualDub and selected the Device, then Video - Set custom format - to select 720 x 576 resolution. This displayed the video feed with no problems. Returning to UFO Capture, and having pre-selected the PAL 720 x 576 format, under Preview I selected the grabber from the Video pick-list, chose Composite input, clicked on 'set' and selected Video Standard 'PAL_B' and the video feed burst into life. It seems that the USB dongle needed to be configured (in this case via VirtualDub) to match the PAL settings required. Perhaps it defaults to the NTSC system. It continues to work in UFO Capture after removing the grabber dongle, doing a full reboot and camera power off/on, although the EZ Grabber software still declines to talk to my grabber model B.

Nick James took Alex's guidance and developed the following workflow [3]:

- *Run VirtualDub*
- *Select File → Capture AVI... (Capture Mode will now be displayed in the title bar at the top of the dialogue window)*
- *Select Device → and select your camera*
- *Select Video → Capture filter... and then select PAL_I in the dropdown for video standard*
- *Select Video → Capture pin... and ensure the video standard is PAL_I, the frame rate is 25.00, the colour space is YUY2 and the size is 720 x 576. Click OK.*
- *Select Video → Crossbar... and select "Composite In" as the input (assuming you are using composite video).*
- *Exit VirtualDub.*
- *Run UFO capture and load the default settings file PF720x576N.ufi*
- *Connect to the camera and you should now have video in native resolution and frame-rate.*

Banding

On occasion users may notice a "banding pattern" on their image which may remain at a constant position within the frame or may slowly roll up or down the frame. It may also exhibit itself as a "squiggle" in certain regions of the image. These are classic symptoms of a ground loop issue. A ground loop occurs when there is more than one "ground" or "earth" between two pieces of equipment. As the two pieces of equipment have multiple ground paths, loops (circuits) are formed in which current can flow which in turn can lead to the banding described above.

The solution is to fit a *CCTV Ground Loop Isolator* between the camera and the video interface device. It is recommended that these are connected as close as possible to the camera though some users have

reported that in situations where the camera is located a long way from the computer, the video cable itself may be acting as an antenna and picking up local interference. In this situation they have seen better results by fitting the CCTV Ground Loop Isolator close to the PC.



Figure 2: Typical CCTV Ground Loop Isolator. Note the words “Cable” and “Equipment” embossed on the body of the device with “Cable” being the end that leads to the video capture device fitted to the PC and “Equipment” being the end that leads to the camera. Each end has a BNC connector while many cameras, cables and video interface devices have RCA connectors. Search “CCTV BNC RCA adaptor” for converters that allow all items to be connected together.

Tartan Pattern

Another artefact encountered by the team has been a tartan pattern on the composite image produced within UFO Capture. Somewhat ironically the issue was noted and resolved by David Anderson and Bill Ward respectively who both observe from ... Scotland! David notes, “*Bill had noticed the “tartan” pattern in my images and he suggested that this was a “data grid pattern” on the summed peak hold image. This pattern is an artefact generated from setting the image size at 640 x 480 when UFO Capture is expecting 720 x 576 from a PAL system. I have now adjusted this resolution and the images are a lot better*” [4].

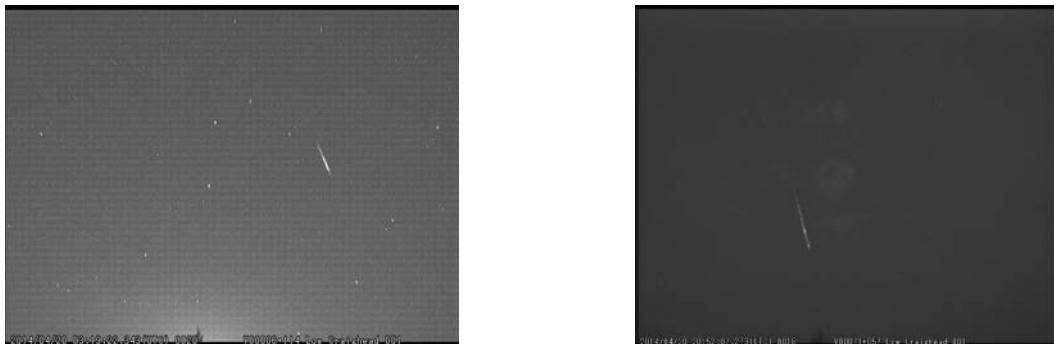


Figure 3: “Tartan” artefact (left) resolved by adjusting resolution input parameters (right).

References

- [1] William Stewart, personal experience
- [2] Alex Pratt, personal communication, May 2014
- [3] Nick James, personal communication, May 2014
- [4] David Anderson, personal communication, April 2014

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William Stewart, First Issue, Released 18th May 2015

Acknowledgements & Feedback

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If you have any questions, feedback or recommendations then please contact the author at ws@nemetode.org