NTCS User Manual

User Guide for the NTCS Mesh Node Camera

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Change History

Version	Date	Change Summary	Author
v1.0	10/04/2018	Existing Support Articles Compiled	RE

Warranty and Support

All Visual Engineering products are supplied as standard with a 12 month 'Return to Base' warranty.

Please note: Any unauthorised product disassembly, modification or the removal of tamper proof labels will void the warranty.

In the event of a suspected product failure, users should contact the Visual Engineering support team on the telephone number +44 (0) 1206 211842 or please email us at:

support@visualengineering.co.uk

Should the fault persist or if the support team are unable to resolve the fault, it may be necessary to return the equipment.

Equipment should only be returned using the RMA (Returns Management Authorisation) process. Users should contact the support team on the above number and request an RMA number.

Introduction

The NTCS provides a simple, rugged outdoor deployable method for close observation.

It integrates a DTC NETNode IP mesh radio, a high definition PTZ camera and GPS positioning into a single IP67 sealed unit.

NETNode IP radios can be combined in a fluid self-forming, self-healing mesh containing up to sixteen radios.

The NETNode radios within the mesh exchange data on a single frequency, simplifying frequency management.

The entire mesh occupies just 2.5MHz of bandwidth, 3.0, 3.5, 5.0, 6.0 and 8.0MHz bandwidths are also selectable. The NETNode radios employ the unique DTC COFDM modulation scheme and therefore offer excellent RF penetration and performance in the presence of multipath.

The integrated EV7520 HD Sony block camera offers a 30x optical zoom with and a 63.7° wide angle of view. It supports video resolutions up to 1080p output, along with exceptional low light sensitivity.

The camera's video is encoded into an IP stream via an integrated encoder, configuration including video encoding parameters is supported via a web page interface.

The pan and tilt drive trains are actuated by gearless stepper motors, reducing the operational noise to a minimum. Pan and tilt speeds are zoom factor corrected, giving fine control over the entire range of the lens.

It has absolute position feedback and therefore has the ability to self correct its actual position if external forces act upon it.

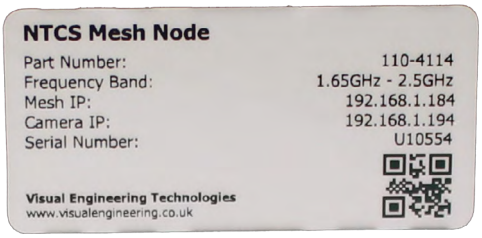
Optional on-board recording to SD card is supported, whilst GPS positioning is available via an optional add on module.

Kit Contents & Part Numbers

• 1 x NTCS Mesh Camera	110-4114
• 1 x Dual Li-Ion Battery Charger	110-8709
• 4 x Li-Ion Battery Pack (4S1P)	110-8401
• 2 x Antenna - DBA Series	110-4021
• 1 x Fischer CAT 5 Cable	110-3507
• 1 x Passive PoE Cable Set	110-8301
• 1 x Power Supply - AC/DC 15V 4.3A	110-3613
• 1 x IEC C7 Power Cord	110-3614
• 1 x PSU 12V 5A	110-8815
• 1 x IEC to UK Power Cord 2M	110-8642

IP Addresses

All default IP addresses can be found on the label on the base of the camera. This details the IP address of the Mesh radio and also the IP address of the camera's video encoder.



Connections

The NTCS has two TNC antenna connectors and two Fischer connectors (CTRL and GPS) as shown on the right.

Remove the protective caps from all connectors.

Connect the provided antennas to the TNC connectors at the required orientation. Information on antenna orientation is described in the Mounting section of this user guide.

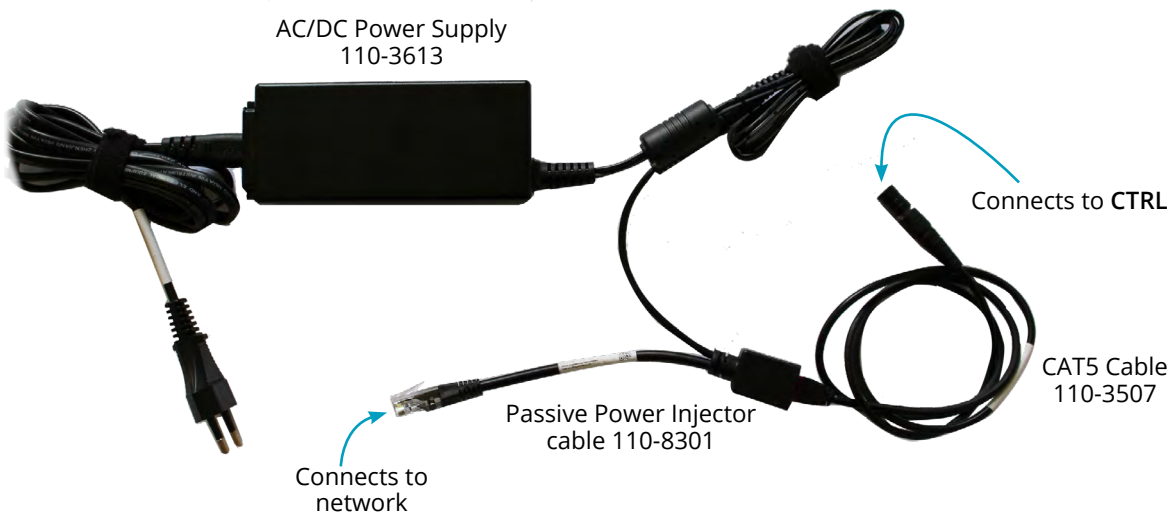
If a GPS Module (110-3510) is included in the kit this should connected to the GPS Fisher connector.

CNTRL Connector

The CNTRL connector allows the NTCS to be powered by a mains supply and direct cable connectivity.

The 15v AC/DC power supply connects to the Passive Power Injector cable (110-8301) which in turn connects to the Fischer CAT5 Cable (110-3507) as shown below.

A cable network connection can now be made once the RJ45 plug of the injector cable is connected to the local Ethernet network.



Battery Installation

The NTCS has a dual battery compartment.

It is designed such that a low battery can be swapped out during run time.

To access the battery compartment slide the battery hatch door to the right as shown here and hinge the door open.

The power level of each battery can be checked by pressing the status indicator button. The battery LED power level will display the remaining power level for that particular battery.

Rotate the central battery lock mechanism to release a battery.

Replace the battery and lock both batteries back into position by rotating the battery lock through 90°

Mesh Radio Configuration

The following web browser control interface is not required for normal operation.

Web browser control of the mesh radios should only be undertaken by users wishing to achieve the following:

- Change the system frequency
- Change the system IP addresses
- Change the Encryption key
- Understand the RF performance of the system better

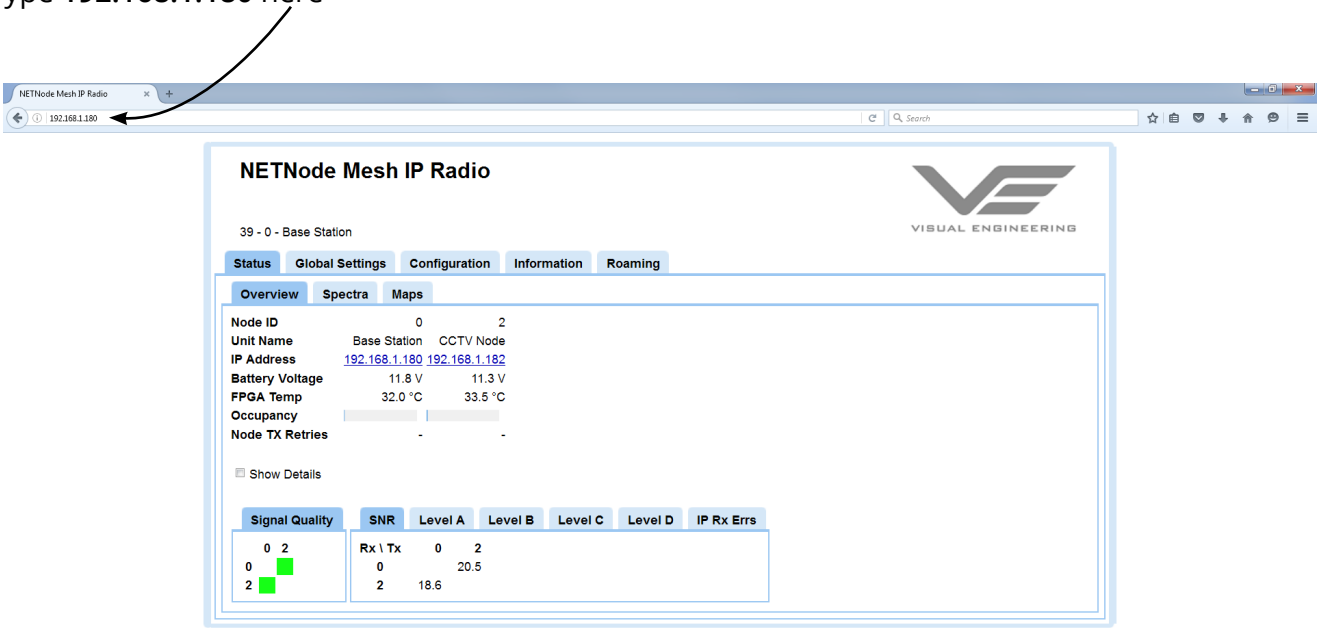
Users should be very careful when using this interface because it is entirely possible to make changes that will leave the system inoperable, requiring the system to be returned to base for repair.

Activating the Web Interface

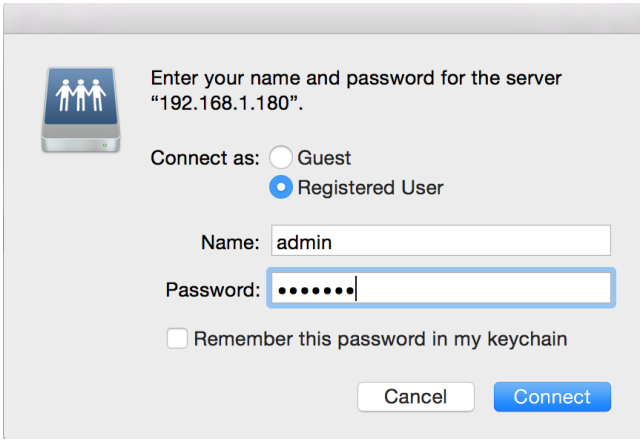
Power up the an NTCS Camera Mesh node and make a direct network cable connection.

- Open a web browser on the PC
- Type the Node IP address of the Mesh node, e.g. **192.168.1.180**
- The web browser opens the **Status** ⟶ **Overview** page following a **Login Prompt**

Type **192.168.1.180** here



Login Prompt

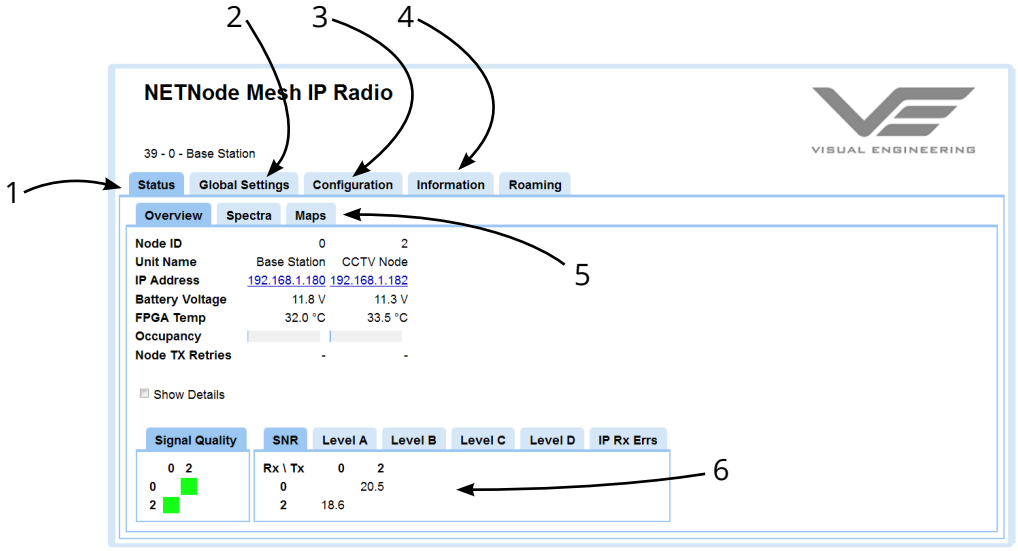


- Authentication is required to connect
- By default, the Name is **admin**
- By default the Password is **meshweb**
- Click the Connect button

Once logged in the user can begin configuring it to suit.

The Main Window

This is the main entry point for the RF configuration. The following six parameters are explained in the table that follows.

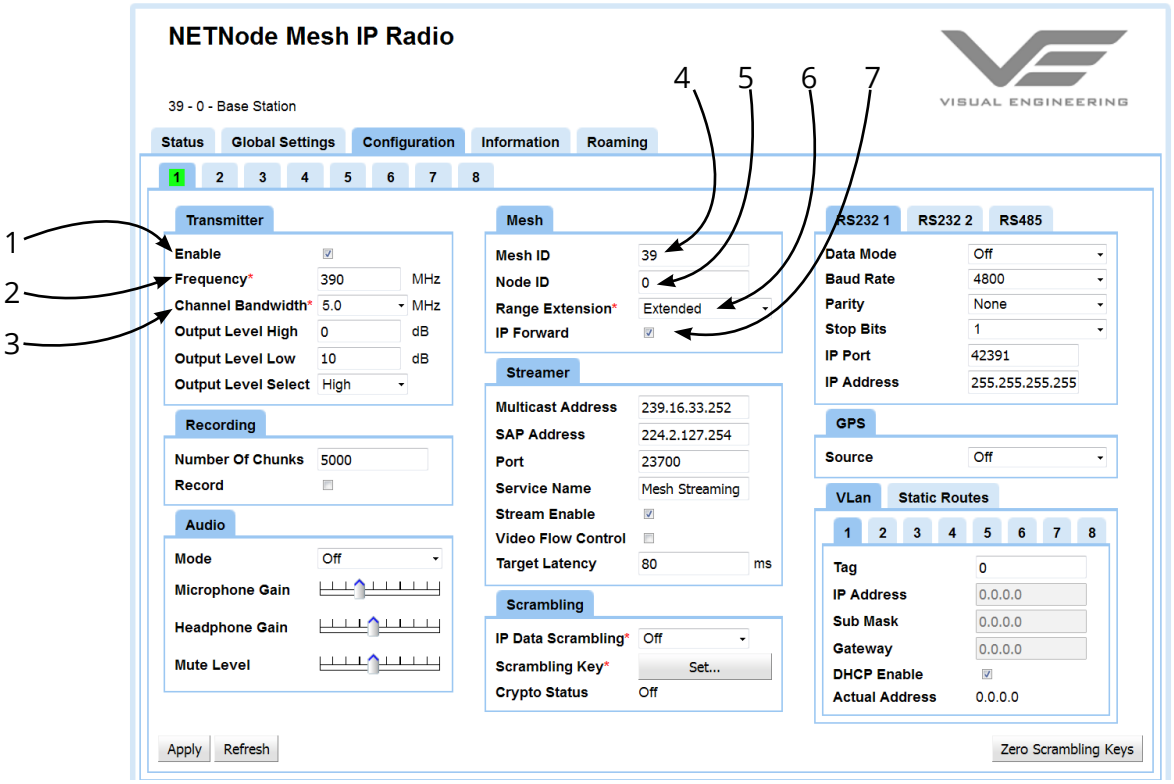


Item	Description
1	**Status tab**. Divided into Overview, Spectra and Maps sub-tabs. This displays detailed status information of received signal quality, battery and mapping information.
2	**Global Settings tab**. Divided into Main, Ethernet Ports and Interlink Mode panes. The Set Clock, Format File system, Restore Defaults and Password buttons are found here.
3	**Configuration tab**. Divided into Transmitter, Recording, Audio, Mesh, Streamer, RS232, GPS, Scrambling and VLAN panes. The Configuration tab contains the list of 8 presets. In each preset the user can specify demodulation parameters, decoding modes, and descrambling configuration.
4	**Information tab**. Contains information including software versions and unit specific data. This information is of use during a support call.
5	**Sub-Tabs**. Simply enables the user to break down information from a tab.
6	**SNR Pane**. The tabs and sub-tabs are broken down into panes of information. This particular one is all about Signal to Noise ratios, for example.

Basic Settings

This explains how to configure a Mesh so that the user can start to explore what can be done with a Mesh network.

There are only seven things to configure to form a mesh network. Choose the configuration tab and set up these seven options.

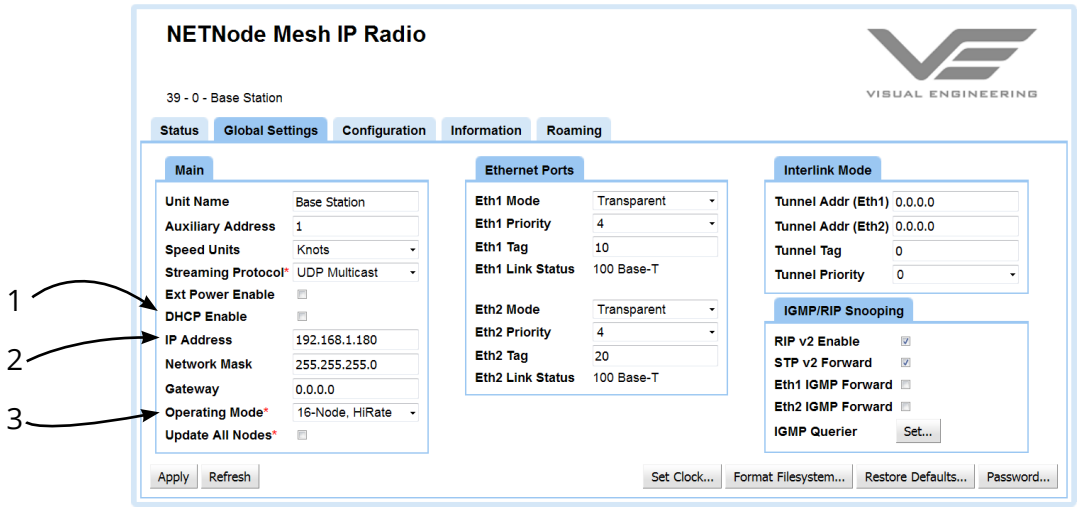


Item	Description
1 Enable	Place a check in this box to switch the transmitter on.
2 Frequency	Type in the frequency required for use in the mesh. This must be the same on all units (see configuration defaults earlier).
3 Channel Bandwidth	Select the required bandwidth to use for the mesh from the drop-down list. This must be the same on all units. This is normally set to 5MHz. Lower bandwidths will give extra range but will reduce capacity.
4 Mesh ID	Type in the required mesh ID. This must be the same on all units in the mesh network. The mesh ID tells the unit which mesh it belongs to. All nodes are defaulted to Mesh ID 101.
5 Node ID	Type in a Node ID for each node in the mesh. The node ID must be unique and can only be 0 to 11 for a twelve node mesh system. Note: A node may automatically reassign its node ID at power up if it finds a conflict with an existing node.
6 Range Extension	Select 'Extended' on all nodes for increased range of performance. This will reduce the bandwidth slightly.
7 IP Forward	Place a check in this box to switch the IP forwarding on.

Note: Remember to click the **Apply** button. This is vital to saving all your work

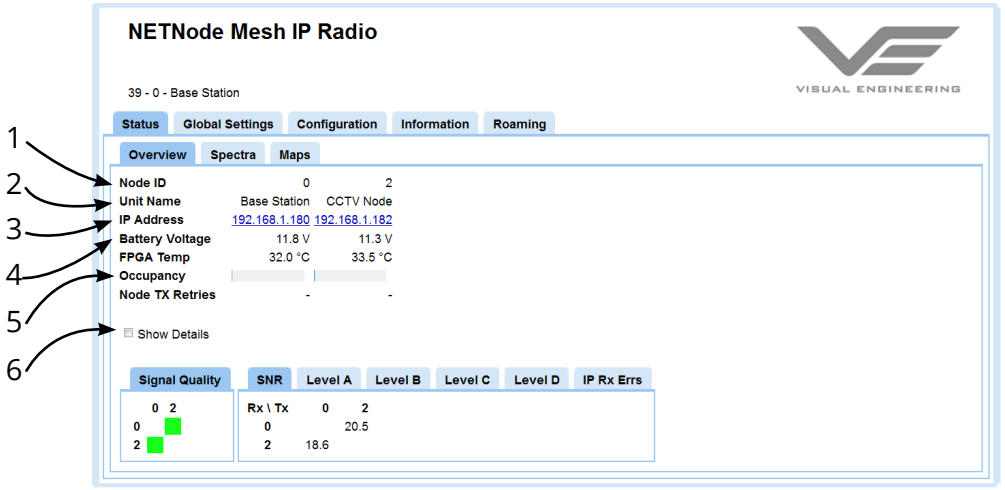
The Global Settings Tab

Global settings are applied to the unit generally and occur in all eight configurations.



Item	Description
1 DHCP Enable	Check this box if you need the Mesh node to obtain its IP address remotely from a DHCP server.
2 IP Address	Complete this box to give the Mesh node a fixed IP address when DHCP is not used, it is not used by default.
3 Operating Mode	This should be set the same for every node in the mesh and is defaulted to '16 node HiRate'.

The Status Tab

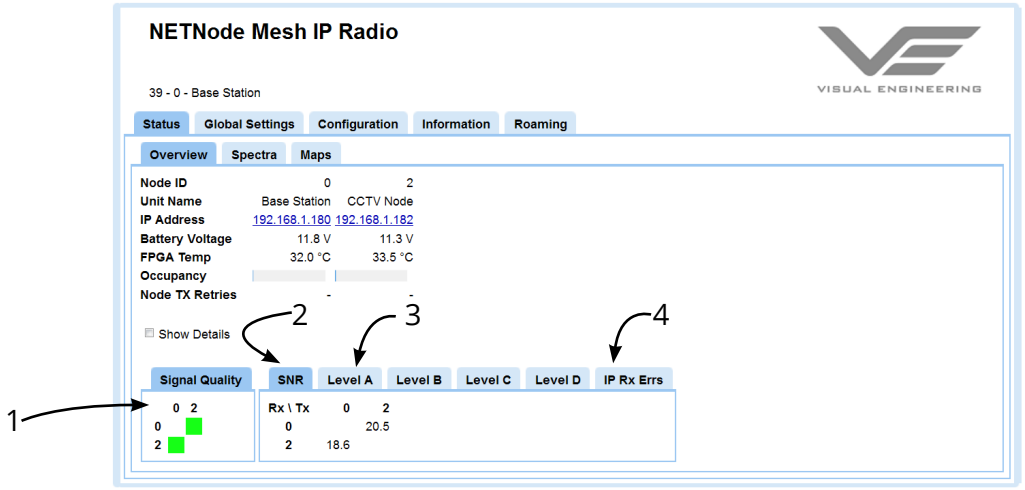


This displays detailed status information of received signal quality and enables navigation between nodes. The Status tab is divided into three sub-tabs:

- **Overview**
- **Spectra**
- **Maps**

Item	Options	Notes
1 Node ID	0 to 11 or 0 to 15	We are showing two Node IDs, 1 and 2. There could be up to sixteen nodes in a mesh, numbered 0 to 15.
2 Unit Name	You can use up to 12 alphanumeric characters for the Unit Name	The Unit Name is a friendly name to make it easier to identify each camera node. This name is assigned in the Global Settings Tab.
3 IP Address	192.168.1.180 for example	This shows the IP address of the unit that we set up in our initial configuration. Notice that it is shown as a hyper-link. If you click on one of these hyper-links the browser will switch to that node.
4 Battery Voltage	0 to 16v	This returns the current input voltage of the node. The voltage should show approximately 12v.
5 Occupancy	Blue and Orange Bars	The blue bar gives a visual indication of the volume of data generated by this node. An orange bar gives a visual indication of the volume of data passing through this node.
6 Show Details	Check box	Displays network information about IP packets etc.

The Status - Overview Tab



1. Signal Quality

This gives a simple picture of the signal quality around the mesh system. Ideally, it would have steady green boxes for all links. Naturally, mobile units will go out of range or interference will cause a unit to degrade for a while.
The clever thing is the mesh will find a new routing and heal itself when it can, so keeping your network on air.

Here's what the colours mean:

Colour	Meaning
Green	16 QAM mode – maximum data rate
Amber	QPSK mode – reduced data rate
Red	BPSK – lowest data rate passing between nodes
White	Link broken or not configured

2. SNR Pane

This pane shows the Signal to Noise Ratios for each of the nodes. Typically SNRs > 15 is very good, 8 to 14 is good, 7 or less is starting to get low.

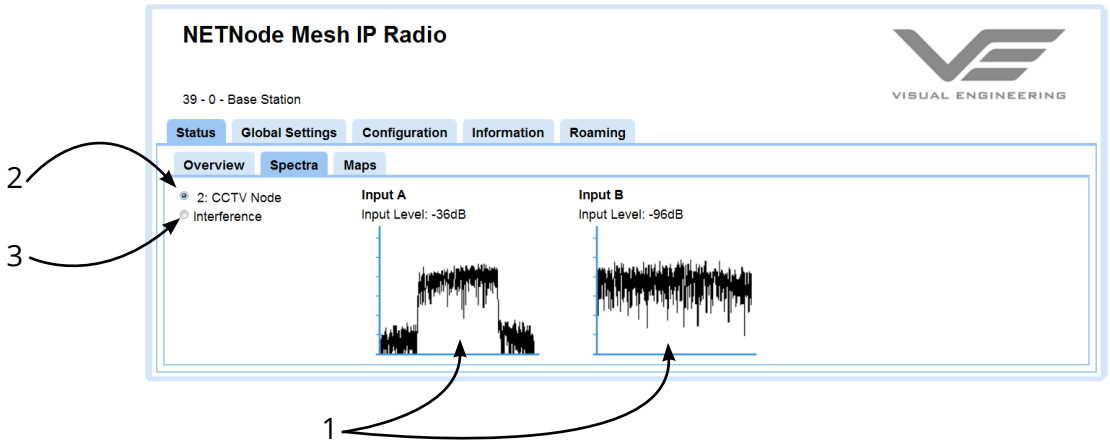
3. Level A Pane

Shows the dBm value for antenna A on a node. There are similar panes for antennas B, C and D.

4. IP RX errors Pane

This pane shows the number of IP receive errors for each node on the system.

The Status - Spectra Tab



1. The Spectra Displays

There are two displays labelled A and B which show the spectra being received on the two diversity antennas of the node that is being interrogated.
In the above example there is a valid COFDM signal being received on Input A of -36dB. The second antenna, Input B, is showing no signal. It can be assumed, therefore, that the second antenna is not connected.

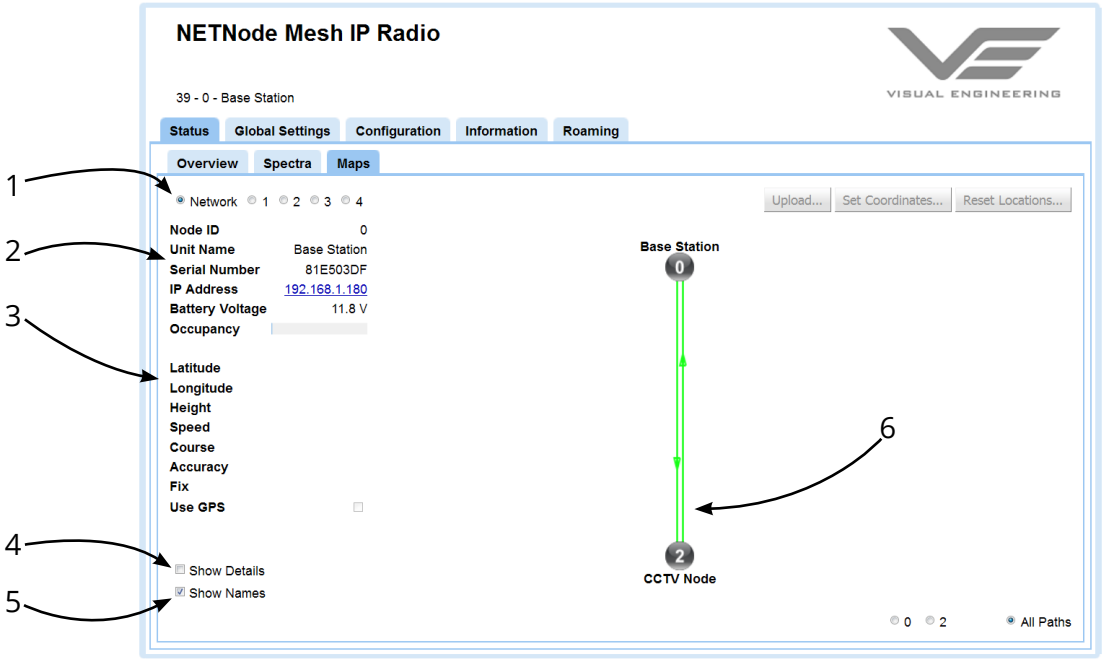
2. Node Selection

There could be several nodes transmitting on the mesh so we need to define which node we are looking at. This is done with the radio buttons on the left side of the spectra display.
In our example there is only one node on the network, the CCTV Node. This is the one that has been selected.

3. Interference

If the Interference button is selected the display shows the spectra when none of the nodes in the mesh are transmitting. This enables the user to look for interference on the system frequency that is to be used.
In an ideal clean RF environment, with no interference, the user will see a spectra for both inputs as shown above for Input B of -96dB.

The Status - Maps Tab



1. Radio Buttons

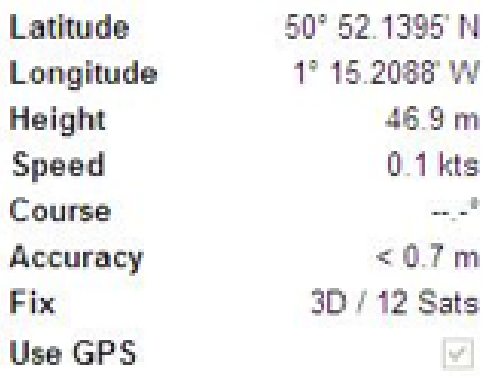
The radio buttons enable you to choose between Network and one of four map displays for the mesh. Leave it on Network for now.

Note: When you are in **Network** mode the **Upload, Set Coordinates** and **Reset Locations** buttons are greyed out.

2. Node Information

Under the radio buttons you'll see some node information about the node you are currently attached to. This was covered earlier in the Status Tab section.

3. GPS Information



If the node that we select has a GPS receiver connected and the **Use GPS** box is checked, the node can broadcast precise information about its location to other nodes or fixed assets on the mesh.

4. Show Details Checkbox

When the **Show Details** box is checked the node information is expanded to show things like TX IP Packets which are useful when diagnosing network problems.

5. Show Names

When the **Show Names** box is checked the friendly names for the nodes are shown on the network map display.

6. Display Pane

In the previous example the network display is selected. This gives a simple graphical view of the nodes in the mesh and the links between them.

Note: The buttons above the display are greyed out as they have no function when the **Network** radio button is selected.

Each node is shown as a circle with a white number. If the number turns red, then the node is temporarily congested.

If the **Show Names** box is checked, the node name is displayed.

The links between the nodes are shown as coloured lines. As each node supports bi-directional operation there are normally two lines for each link. Here is what the colours mean:

Colour	Meaning
Green	16 QAM mode – maximum data rate
Amber	QPSK mode – reduced data rate
Red	BPSK – lowest data rate passing between nodes
White	Link broken or not configured

In the previous example there are static lines but when connected to a live system these lines change as the state as the RF environment changes or nodes move about.

Changing Frequency or Encryption Key in the System

For users wishing to change the frequency channel or encryption key in the system, they must check the '**Update All Nodes**' box in the Global Settings page then press apply.

This feature ensures that all nodes are updated simultaneously. If this is not done then it is possible to leave some nodes on one channel and some on another, rendering the system inoperable.

Once the '**Update All Nodes**' tab is set, users can change the frequency or encryption key, both of which can be found in the **Configuration** page.

The VE Camera Viewer

The VE Camera Viewer is a software application used to display the video from all cameras in the system. It will auto detect any cameras that are on the network and populate a list on the left hand side of the player.

The VE Camera Viewer software can be downloaded from the VE website support page:

www.visualengineering.co.uk/supportdownload/26

Viewing Video

The VE Camera Viewer is intuitive and simple to use. Any camera on the network will be displayed in a list on the left hand side of the player. The video can be viewed by clicking the “Eye Icon” next to the camera’s name. The video panel selector can be used to select how the video panels are arranged, this is useful when several video feeds are in the system.

Video Panel Options

The top of the video panel displays information on the playback mode of the displayed video. In the above instance the video playback is a Live stream, it can also be noted that the camera is currently recording since the REC icon is shown. The power source displayed is a DC input.

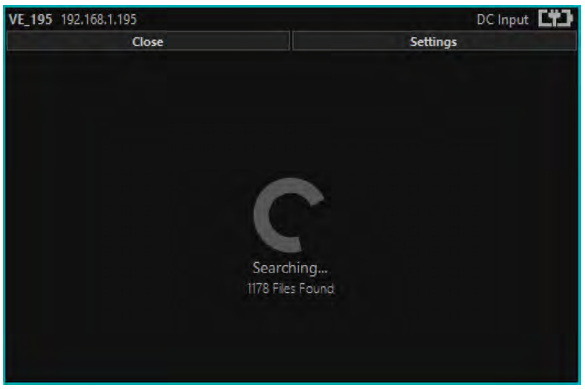
If the mouse is hovered between the video panel and the above information the player will offer the user the option to enter Settings or Play a Recording. Settings functions are not supported in the NTCS Mesh camera.

Play Recordings

Recordings will only be available if the NTCS camera is fitted with the recording option.

If the Play Recording option is highlighted and selected as shown below the player will allow the user to select a recording to playback.

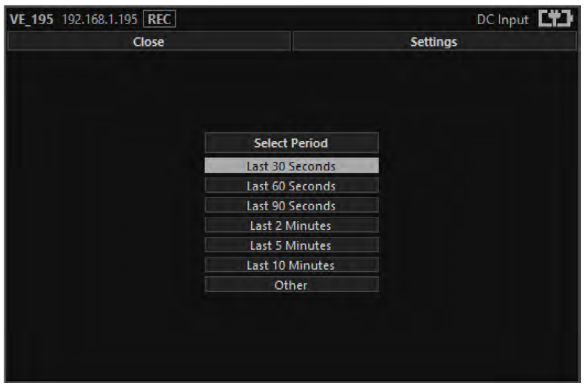
The player will find all available files that are stored on the SD card in the camera. The update screen as shown on the right will be displayed until all files are discovered.



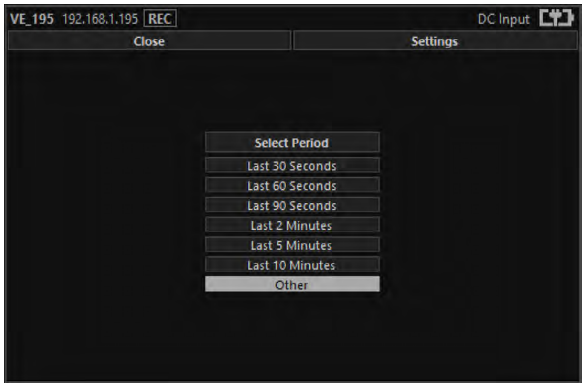
Users can then select a segment of recorded video to be played back from memory. Options are from 30 seconds to 10 minutes.

The full range of download periods is only available in advanced mode.

To access the advanced mode the user needs to hold keyboard keys “A”, “D”, and “V” then click on the padlock icon next to the Advanced User text.

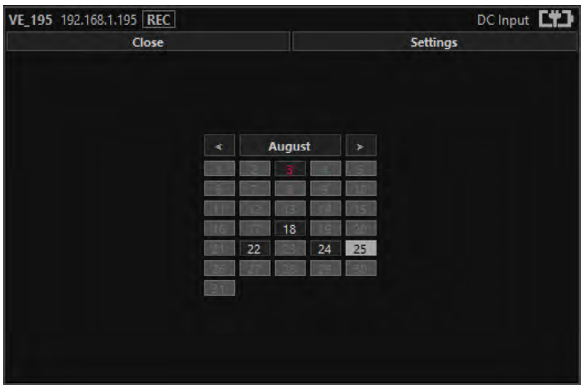


Select “Other” to choose a specific period of timed recording.



Select the required month, months that don’t hold recordings are greyed out.

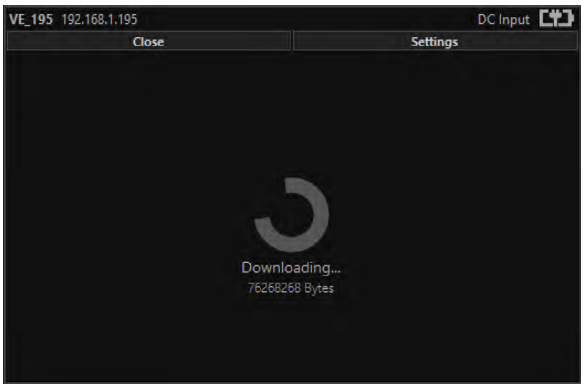
Select the required date, days that don't hold recordings are greyed out.



Select the required hour of day, hours that don't hold recordings are greyed out.

Select the required start and end time from the time dial. Press the play icon.

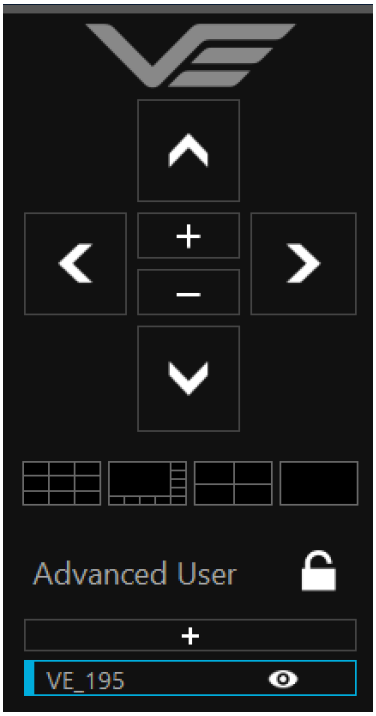
The files will then be downloaded, after which time the video recording can be viewed in the video panel.



Pan, Tilt & Zoom Control

Select a camera from the Camera List, this will cause the selected camera description being edged in blue, as shown on the right. The video panel for the camera will also be edged in blue.

- Pan Control: left & right arrows
- Tilt Control: up & down arrows
- Zoom in: + symbol
- Zoom out: - symbol



Advanced User

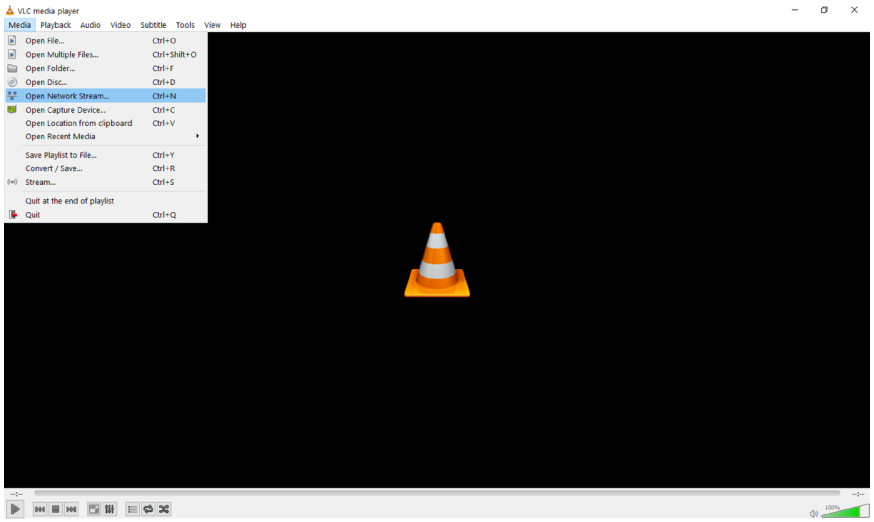
To access the advanced mode, which allows full access to the stored recordings, the user needs to hold keyboard keys "A", "D", and "V" then click on the padlock icon next to the Advanced User text.

Using **VLC to Play Streams**

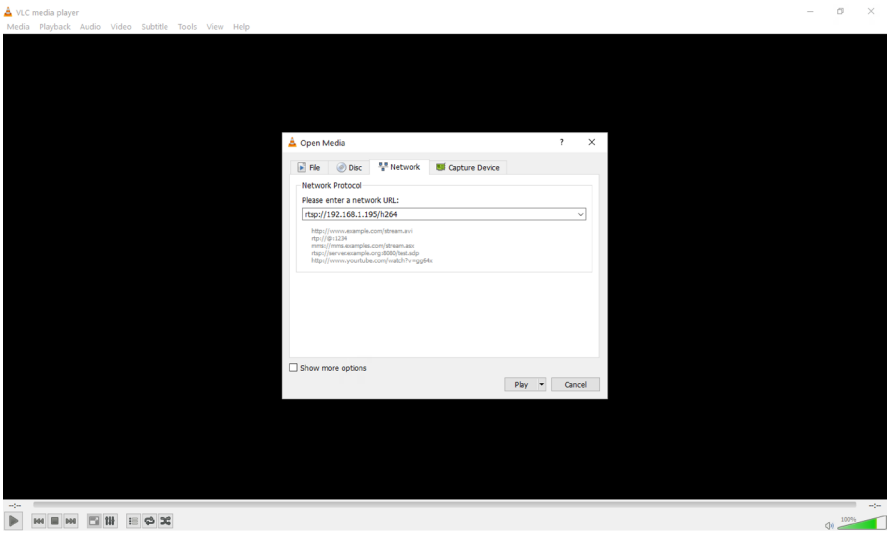
The NTCS is compatible with many players, a simple freeware player is VLC Media Player, which can be downloaded from:

http://www.videolan.org/vlc/index.en_GB.html

- Install and run the VLC Media Player application.
- From the Media menu select the 'Open Network Stream' as shown below.



- Enter the camera URL and stream type, eg: **rtsp://192.168.1.195/h264**
  The URL depends upon the IP address of the camera and the stream type, eg: h264 or jpeg. This is shown below



- Press play and the video stream will appear.

IP Video Encoder

Once the NTCS is powered and has an network connection to a PC, users can web browse to the camera's video encoder to control its functions.

The web browser allows control of the encoders parameters such as resolution, bit-rate, and network settings.

All parameters are non-volatile, meaning they will be remembered after re-powering the camera.

Users can web browse the settings using any of the standard web browsers; Firefox, Internet Explorer or Chrome.

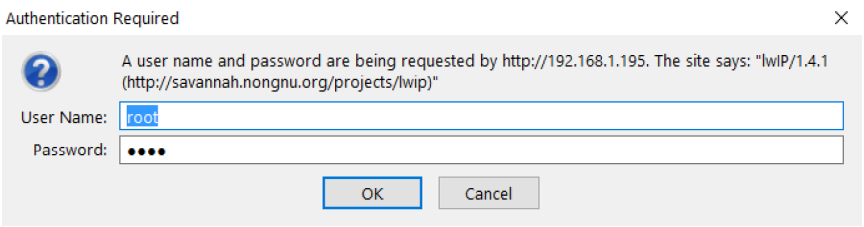
Simply type the camera's IP address into the browser's address bar, using the encoder IP address.

Video Encoder Login

On trying to establish a connection the user will be prompted for the User Name and Password, enter the following details:

Default **User Name** is:
root

Default **Password** is:
1234



Default IP Address

Encoders are have a default IP address as detailed on the label found on the base of the NTCS.

If the camera is not responding on this address it is possible that the IP address has been changed.

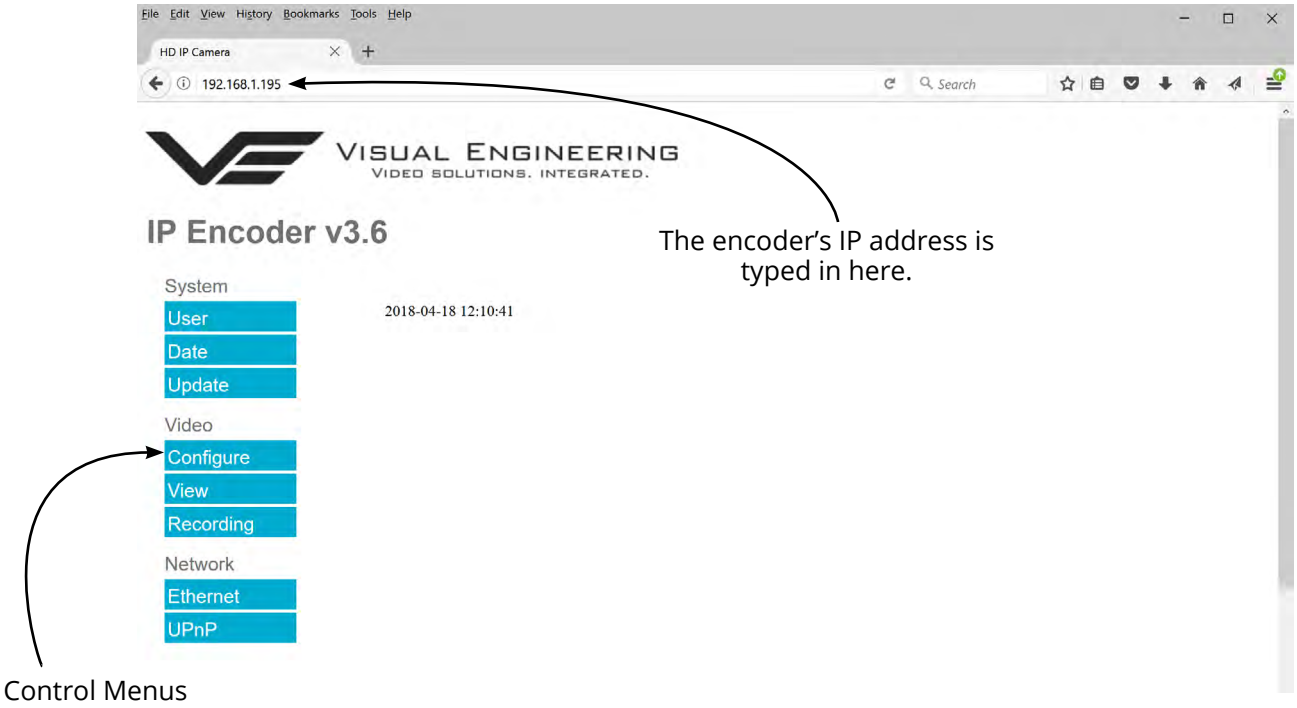
If the new IP address is unknown, the user can use the VE Camera Viewer software application to locate the IP address. This method is explained in the The VE Camera Viewer section of this user guide.

Video Encoder Control

The mechanism for configuring the H.264 encoder is its web browser interface.

The example screen below shows what is to be expected once a valid connection between the PC and NTCS has been established by typing the video encoder's IP address into the web browsers address bar. In this example it is using the IP address 192.168.1.195

On the left side of the screen are the Control Menus which allow the user to configure various encoder settings. The functions of these menus are described in the following sections.



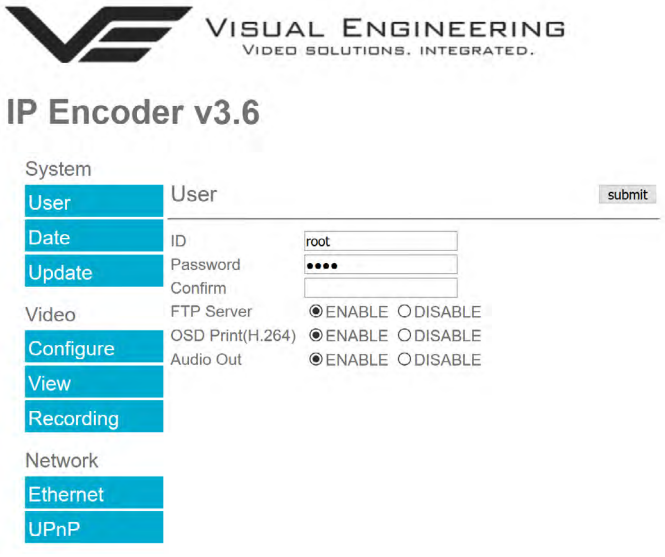
User Menu

The user menu page allows users to configure the user ID and password of the encoder. It is necessary to confirm the password to change it.

There is also the option to enable/ disable the following:

- FTP Server Connection
- OSD (On Screen Display)
- Audio Out

Changes are only enabled when the **submit** button is pressed.



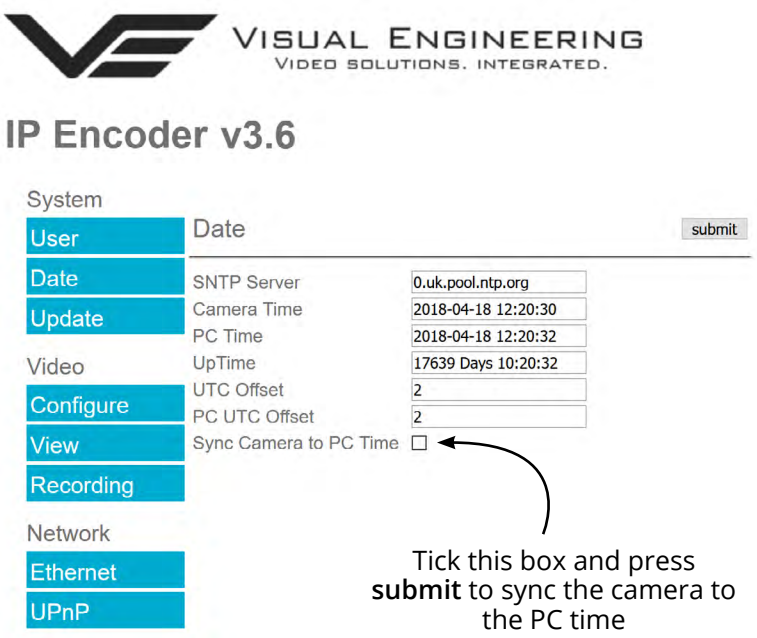
Date Menu

The date menu page allows the user to synchronise the encoder time to an SNTP server. In this instance it is necessary to have the PC connected to a network.

If a network connection is not available it is possible to synchronise the encoder to the PC time by ticking the "Sync Camera to PC Time" check box and pressing the **submit** button.

The "UTC Offset" can be altered to align the camera time with the local time zone. Changes are only enabled when the **submit** button is pressed.

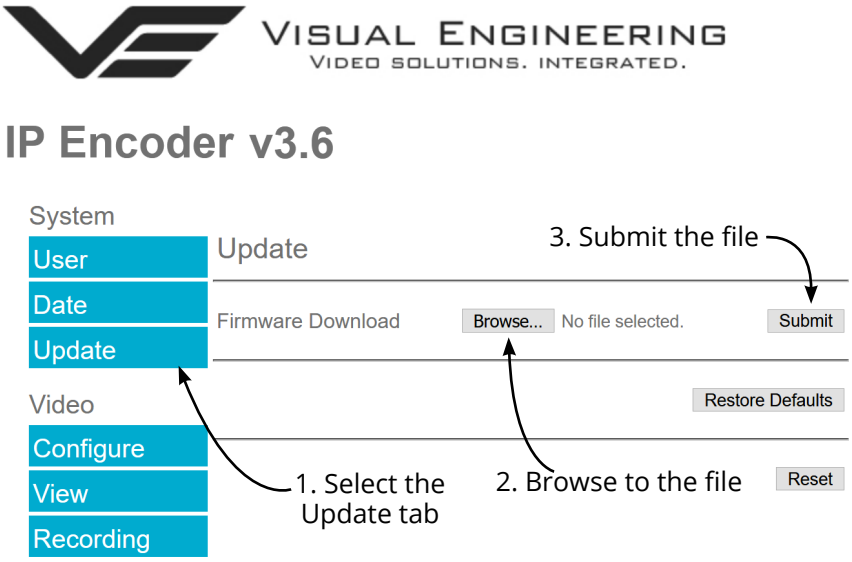
To align the camera to the actual PC time the "UTC Offset" should be made same as the value displayed in the "PC UTC Offset" field.



Update Menu

It is possible to update the firmware of the encoder. There are three steps to updating the firmware, as shown on the right.

Only update the encoder with files that have been approved by Visual Engineering.
Use of other files will render the encoder inoperable.



Following a **Submit** the camera will update the firmware and display the following text:
Programming in Progress...Do NOT remove power
Wait until the web page clears this text before trying to move away from the current web page or powering off the camera. Updates typically take approx 3 minutes to complete.

To fully ensure the upgrade has finished it is **strongly advised** to refresh the webpage and check the banner displays the new firmware version number before switching off the power.

It is also **strongly advised** that following a firmware update that the **Restore Defaults** button is pressed. This will revert the encoder back to a default start state.

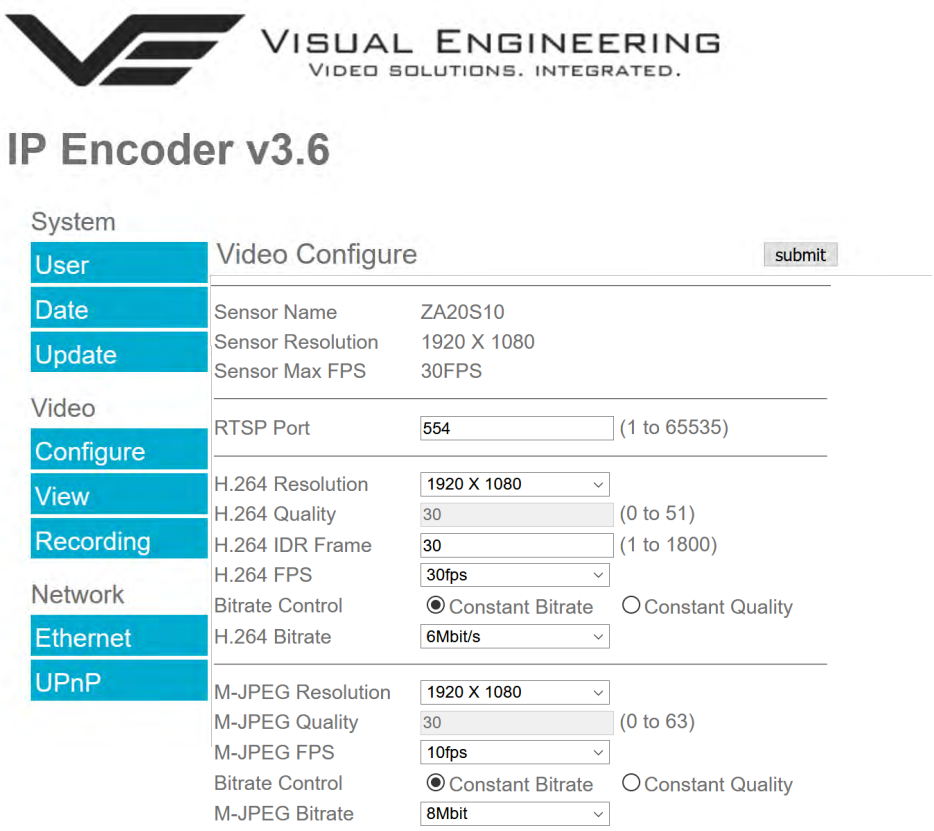
Video Menu

The Video Page is where all the IP encoder parameters are controlled.

The encoder supports two encoding formats, H.264 and MJPEG. The choice of the format is initiated by the user when the stream is enabled.

To initiate a H.264 stream from an encoder with an IP address of 192.168.1.195 the URL is:
rtsp://192.168.1.195/h264

To initiate an MJPEG stream from a encoder with an IP address of 192.168.1.195 the URL is:
rtsp://192.168.1.195/jpeg



The Video page contains parameters for each encoder type. The encoder has two fundamental modes of operation:

- **Constant Bitrate**. This is the normal mode of operation, it will output a constant bit-rate for its IP video stream.
- **Constant Quality**. In this mode the bit-rate is varied in a effort to maintain a constant quality. The target quality is set using an arbitrary number between 0 to 51, the lower the number the higher the quality. This is set in the quality field.

Other video encoder parameters include:

H.264 Resolution
The maximum resolution is 1920x1080, users can select lower resolutions if there is restricted bandwidth available for the camera's connection.

H.264 FPS (frames Per Second)
The maximum frame rate is 30fps, users may choose to select lower frame rates, thereby reducing the bandwidth required.

H.264 IDR Frame changes the I frame interval in the H.264 stream by setting the parameter, this balances the stream's quality against latency. The default value is 30.

Recommended Settings

Bit-rate Available	Resolution	Frame Rate
5-10MB/s	1920x1080	30
4-5Mb/s	1920x1080	15
3-4Mb/s	1280x720	30
2-3Mb/s	800x600	30
1-2Mb/s	800x600	15
512kb/s-1Mb/s	640x480	15
256-512kb/s	320x240	15

View Menu

Viewing the video from the encoder can be possible from the web browser by selecting the view button. Users can return to the main menu by selecting the Back button.

Recent web browser releases have stopped supporting the VLC video plug-in, as such the video will not be displayed.
In this instance view the video using either the The VE Camera Viewer or the VLC media player.

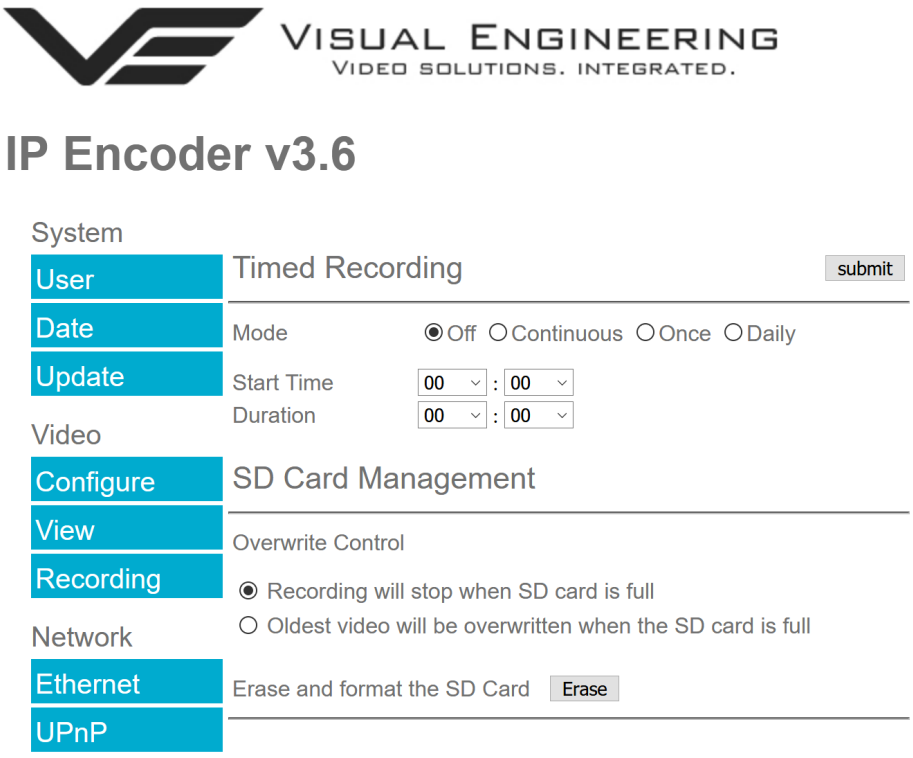
Recording Menu

Recordings will only be available if the NTCS camera is fitted with the recording option.

The integral SD Card has a capacity of 32GBytes, this offers 17 hours of continuous recording at 4Mb/s, or 34 hours at 2Mb/s etc.

If recording capacity is achieved there is a user option to either stop recording or overwrite.

The recording web page menu is shown on the right.



Timed Recordings

There are 4 options for timed recordings, these are; Off, Continuous, Once and Daily.

Off = No recording takes place.
Continuous = Recording Continuously.
Once = Record once when the start time is reached and record for the set duration.
Daily = Record daily starting when the start time is reached and record for the set duration.

SD Card Management

In the event of the SD card becoming full, there are two options for Overwrite Control. One option is to have the recordings stop when the SD card is full, or the other option is to have the oldest material to be overwritten when the SD card becomes full.

Following any changes made in the menu the user must press the **submit** button .The camera will then save the changed parameter. Wait until the camera finishes re-configuring before trying to move away from the current web page or powering off the camera.

Erase and Format

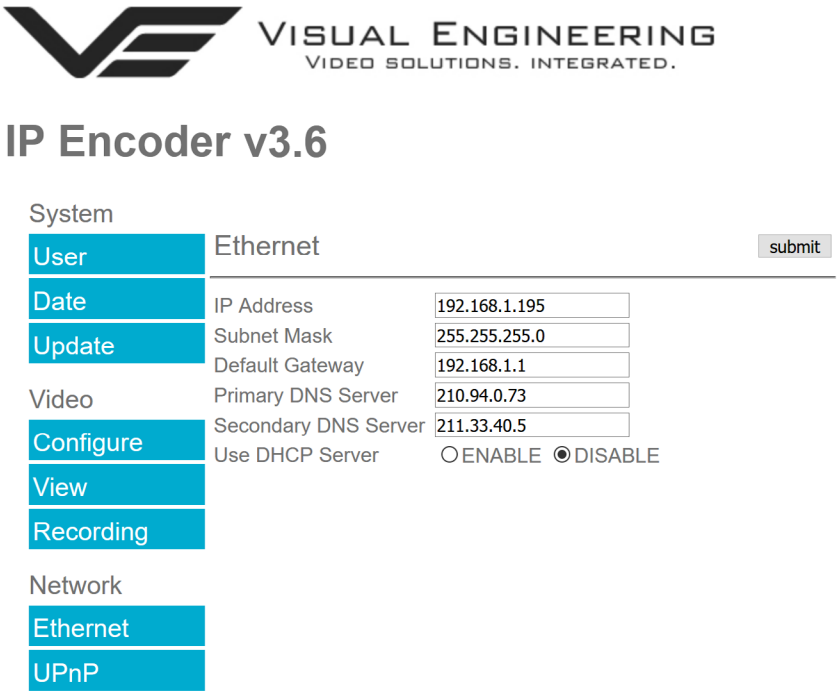
The SD card will be completely erased and formatted if the **Erase** button is used. The user will be asked to confirm that this is the intention before the SD card memory card is actually erased.

Ethernet Menu

Network parameters can be set on the encoder by selecting the Ethernet menu.

The encoder can operate with a fixed IP address, or can be allocated an IP address from the network, these modes are controlled using the DHCP button enable/disable.

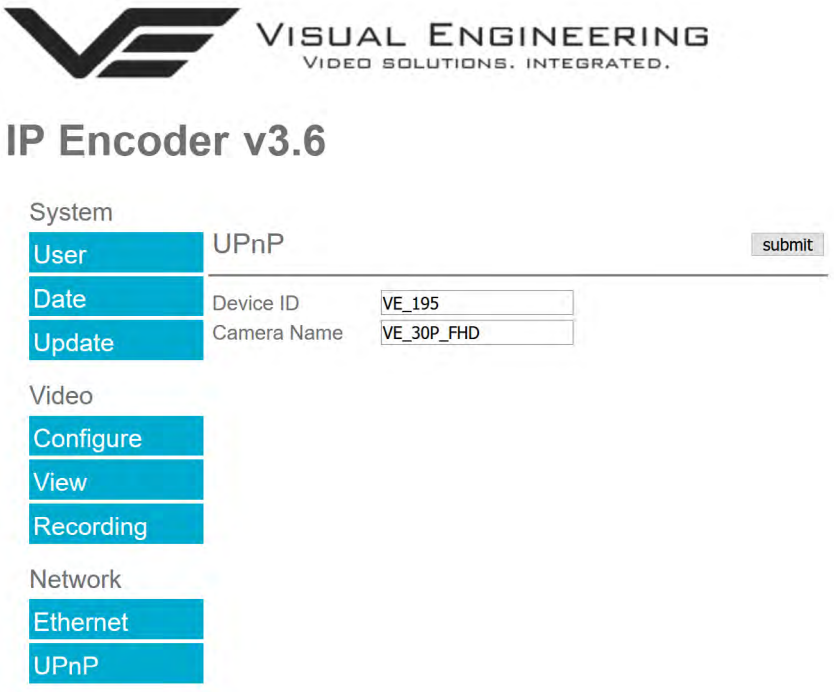
Users should press the **submit** button to enable changes.



UPnP Menu

The Universal plug and play menu allows the user to set the Device ID and Camera Name.

Users should press the **submit** button to enable changes.



Mounting

The NTCS can be mounted using the threaded holes in the base to attach it to a tripod, pole or similar structure.

It can be mounted in either orientation with the camera mounted below the antennas as shown in the pole mounted example on the left, or with the camera above the antennas as shown in the tripod mounted example on the right.

In both of these scenarios it can be seen that the antennas are positioned away from the body. This ensures that the RF path is not hindered by the battery compartment or camera casing.

The base mounting options include 3/8-16 UNC, 1/4-20 UNC threads and a circular pattern of M5 threaded holes.

Specific dimensions can be found in the Base Plate Dimensions section.

Specifications

Specifications			
Frequency	1.65GHz to 2.5GHz	**Camera Sensor**	1/2.8" Type CMOS
Channel Bandwidth	2.5, 3, 5, 6MHz	**Camera Sensitivity**	<0.05 Lux, ICR On
Modulation	COFDM 360 Carrier	**Camera Resolution**	1920 x 1080 Pixel
Data Capacity	Up to 8.8Mb/s	**Field of View**	63.7° (wide), 2.3° (tele)
RF Output Power	2 Watt	**Pan & Tilt Range**	270° Tilt, Continuous Pan
Receive Sensitivity	-98dBm	**GPS**	Optional Add On Module
Typical Range	Line of Sight 60km Light Urban 5km	**Run Time**	Up to 12 Hours
Max Nodes	16	**Weight**	3KG
Encryption	DES, Optional AES128 or AES256	**Dimensions**	295 x 117.5 x 115mm
On Board Storage	32GB	**Casing**	Aluminium
Video Streaming	RTSP over TCP or UDP	**Environmental**	IP67

Connector Pinouts

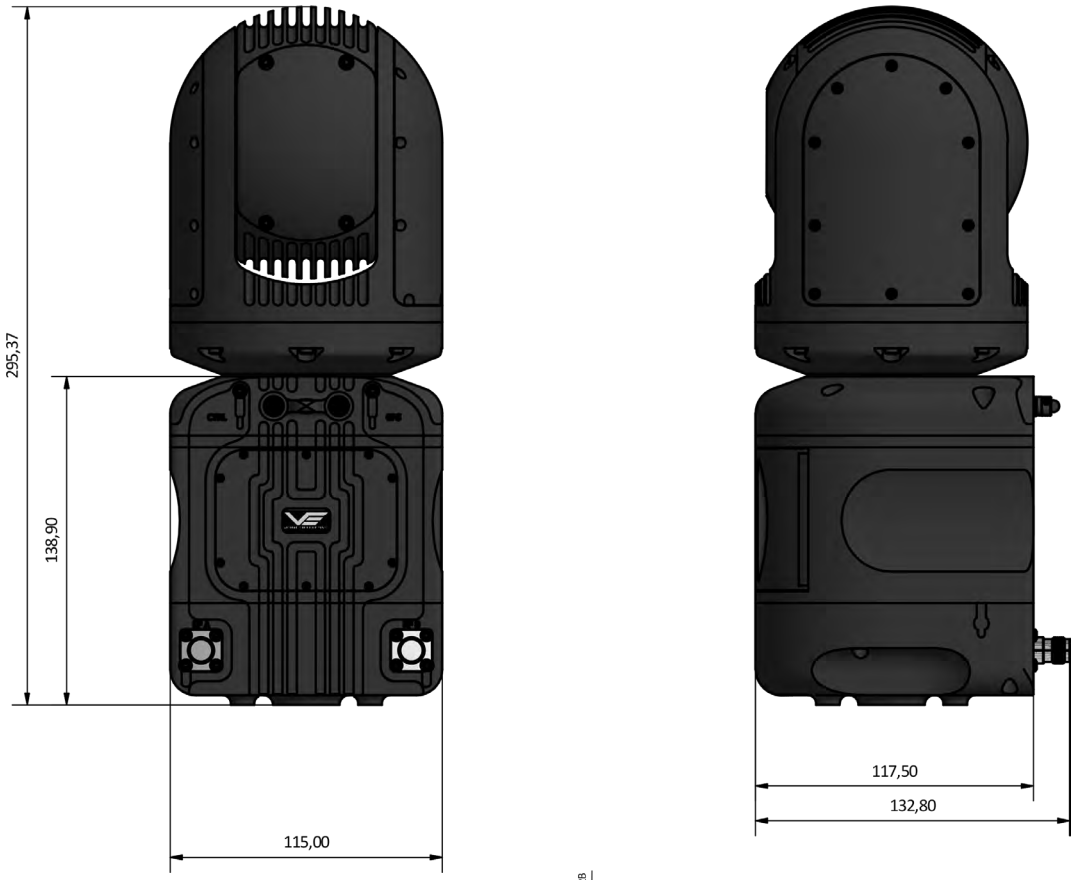
CNTRL

1. SDA
2. ETH TX-
3. ETH RX+
4. RS232 TX (data from camera) / RS485 A
5. 12V Input
6. SCL
7. ETH TX+
8. N.C
9. GND
10. ETH RX-
11. RS232 RX (data to camera) / RS485 B
12. N.C

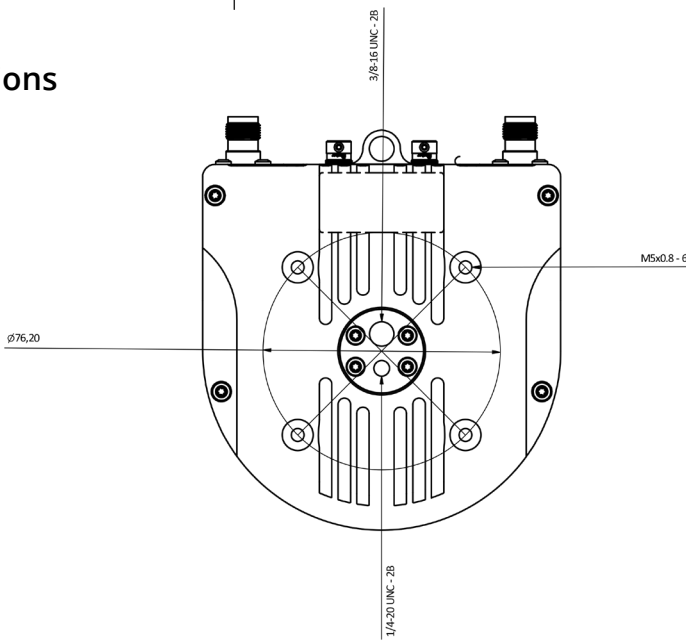
GPS

1. N.C
2. N.C
3. N.C
4. N.C
5. N.C
6. N.C
7. N.C
8. N.C
9. GND
10. N.C
11. RS232 RX (data from GPS module)
12. +5V Input

Dimensions



Base Plate Dimensions



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