vnmatrix

STREAMING ENCODER/DECODER

USER GUIDE

VN-MATRIX USER GUIDE
Part No. I458GB issue 6 (24/04/2008)

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IMPORTANT SAFETY MARKINGS

The following symbols are used throughout this User Guide to advise you of important instructions:

This symbol warns the presence of a voltage of sufficient magnitude to cause a severe or fatal electric shock. Follow the appropriate instructions carefully to avoid the risk of injury.

This symbol indicates an important instruction for the correct and safe installation, operation or maintenance of your VN-MATRIX system. Failure to comply with such instructions may result in injury to personnel or damage to the VN-MATRIX hardware.

This product conforms with the protection requirements of the EC Directive 89/336/EEC (relating to Electromagnetic Compatibility) and EC Directive 73/23/EEC (relating to Low Voltage) by application of the following standards:

EN 55022:1994 Class B; EN 55024:1994 Class B; EN60950:2000

Provided that:

- The product is used in accordance with the manufacturer's instructions.
- The product is not connected to any peripheral equipment that is not CE marked.

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UL 60950-1:2003
Information Technology Equipment Safety - Part 1: General Requirements

CSA C22.2 No. 60950-1-03
Information Technology Equipment Safety - Part 1: General Requirements

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and
(2) This device must accept any interference received, including interference that may cause undesired operation.

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SECTION 1:

Introduction

What is VN-MATRIX?

VN-MATRIX is used to distribute RGB video/graphics from a source computer (or similar graphical device) across an IP network to one or more viewing stations.

An RGB signal is captured/acquired by a VN-MATRIX unit and encoded in to a TCP or RTP data stream for transport across a local area or wide area network. Elsewhere on the network another VN-MATRIX unit can decode the stream back into an analog RGB or digital (DVI) signal, suitable for display on a wide range of display devices.

In addition to an RGB signal, the VN-MATRIX can provide cross-network transport of:

- Digital Audio (SPDIF), and
- Serial Data (RS-232).

NOTE: *Digital audio can be used to accompany a video/graphics source. VN-MATRIX cannot transport an 'audio only' signal.*

RS-232 serial data can be distributed between VN-MATRIX units unidirectionally as part of the source stream, or bi-directionally independent of any source streams. A VN-MATRIX can also be configured to accept serial remote control commands allowing simple changes to be made to system operation.

Firmware Version

This user guide is based on v3.3c firmware. You can check for newer firmware releases and user guide updates by visiting our web site at www.electrosonic.com/support.

HINT: *To check which version of firmware is currently installed, login to the web interface (see page 41) and go to the Upgrade page (see page 82).*

Extended Functionality

Support for the following extended functions has been introduced for firmware v3.0 and above:

- **Scaling** which allows up/down scaling of sources to suit the target display. By default, sources can only be displayed at their native resolution.
- **Whiteboard** which allows live text and pointer interaction between users of both the local and remote displays.
- **Recorder** which allows recording and playback of source, whiteboard and RS-232 data streams.

By default, these extended functions are disabled and can only be enabled by the purchase and installation of a special license key. Please contact your Electrosonic supplier or agent for details.

These functions are not documented in this user guide.

Functional Overview

The VN-MATRIX can be configured to operate in one of two modes:

- As an **encoder** to encode a source and stream it across a network,
- As a **decoder** to decode a VN-MATRIX data stream from a network.

Therefore, any VN-MATRIX system will comprise at least two devices, one configured as an encoder and the other as a decoder. However, multiple encoders and decoders can co-exist on the same network.

On a given network any decoder has the ability to display the source provided by any encoder.

Encoder / Source Compatibility

As an encoder the VN-MATRIX is compatible with both digital (DVI) and analog (RGB) graphics sources up to UXGA resolution (1600 x 1200 @ 60Hz, 24-bit color). See page 101 for a list of standard supported sources.

The VN-MATRIX incorporates advanced image acquisition circuitry which can auto-detect a wide range of source types without the need for any additional setup.

For specialist or non-standard source formats, user customizable source modes can be created using the Web Interface. See page 66 for further details.

HINT

The VN-MATRIX provides Analog-to-Digital or Digital-to-Analog conversion via its monitor connections. Therefore, it is possible to use a digital monitor with an analog source and vice versa.

Decoder / Display Capability

As a decoder the VN-MATRIX is compatible with both digital (DVI) and analog (RGB) graphics sources up to UXGA resolution (1600 x 1200 @ 60Hz, 24-bit color)*. See page 102 for a list of standard supported sources.

NOTE: *By default, sources are displayed at their native resolution and format. Support for source scaling existing within firmware v3.0 and above but must be enabled by a special license key.*

Control Capability

Source Control

Loop-through connections are provided on the VN-MATRIX for the source computer keyboard and mouse. Local keyboard and mouse control of the source computer is fully maintained while connected to the VN-MATRIX. In addition, keyboard and mouse functions can be remotely controlled from the viewing station.

System Setup & Configuration

Low level communications setup of the VN-MATRIX is achieved using a serial data link to the COM1 port. High level configuration is achieved via the network using the Integrated Web Management System (see below).

Integrated Web Management System

VN-MATRIX incorporates an Integrated Web Management System (Web Interface for short). This allows any VN-MATRIX unit on a network to be configured via a PC/laptop (on the same network), using a standard web browser (*e.g*. Internet Explorer, Netscape Navigator, Opera).

One VN-MATRIX unit on the network must be designated as a ‘controller’. This unit acts as a server for the Web Interface and also holds a database of all VN-MATRIX devices on the network.

Any VN-MATRIX unit, whether it is configured as an encoder or decoder, can be used as a controller.

The Web Interface includes a full on-line help system.

Remote Control

RS-232 serial data can be routed between selected VN-MATRIX units, for example to provide remote control of a source.

In addition, serial commands can be input to a VN-MATRIX and routed to the controller to allow basic control of system operation, *e.g.* to change source selection on displays, compression settings, or enabling and disabling devices.

Network Requirements

VN-MATRIX uses highly efficient compression algorithms to minimize the amount of data needed to be transported across the network.

It is, however, crucial to the effective operation of VN-MATRIX that sufficient data throughput can be achieved, especially where multiple sources are being encoded.

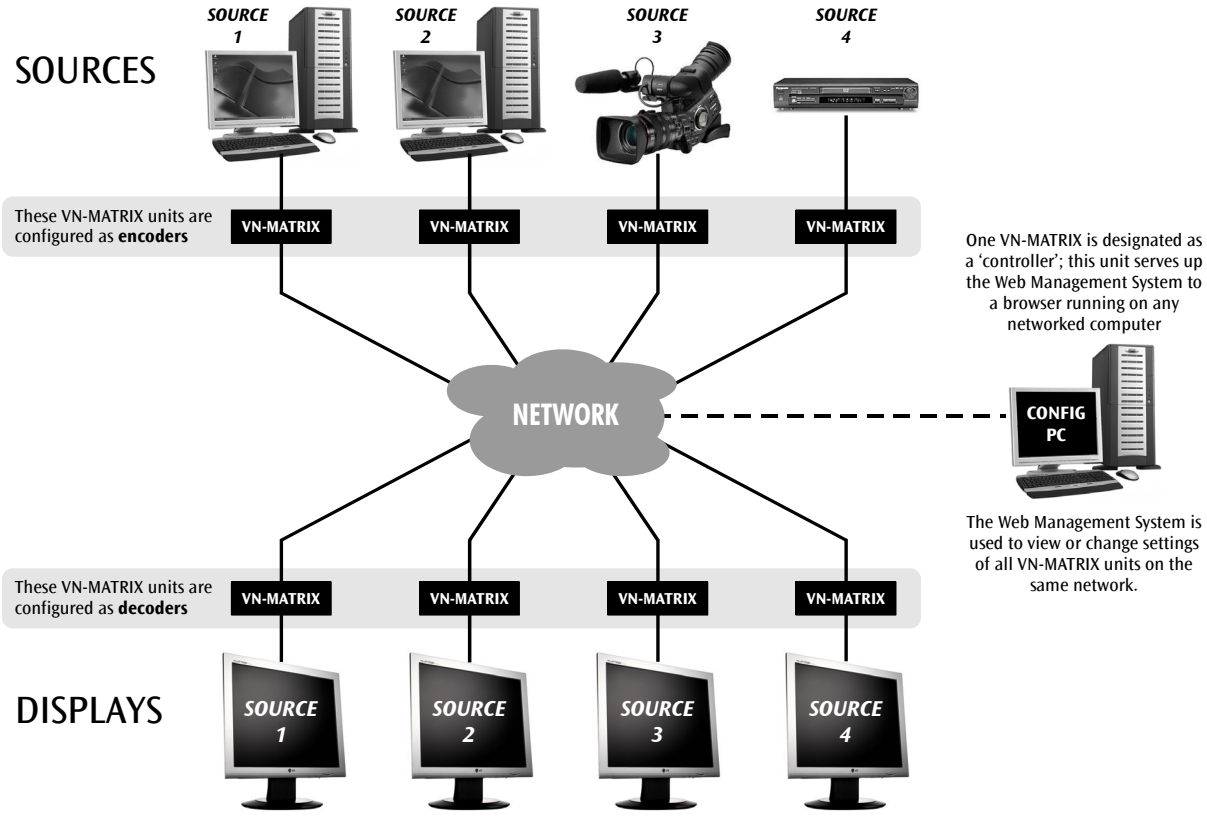
The efficiency of a network will be directly affected by the speed and configuration of each element within its infrastructure, *e.g.* switchers and routers. VN-MATRIX will achieve optimum transmission results over a dedicated 1Gbps network (Gigabit Ethernet).

For more general information on networks and network performance, please refer to Appendix B on page 128.

Example System Application

The diagram below shows an example system application utilizing eight VN-MATRIX units. Four are configured as encoders (sources) and four as decoders (displays). Each device is connected to a network.

Configuration of each device, including which source is displayed on which display, can be achieved by any PC/laptop on the same network, using the VN-MATRIX Integrated Web Management System.



In this example each of the four sources is shown separately on the four displays. Potentially however, any display can display any source.

Data Transport Methods

Source data from a VN-MATRIX Encoder can be distributed to multiple displays/encoders (one-to-many) or to a single display/decoder (point-to-point).

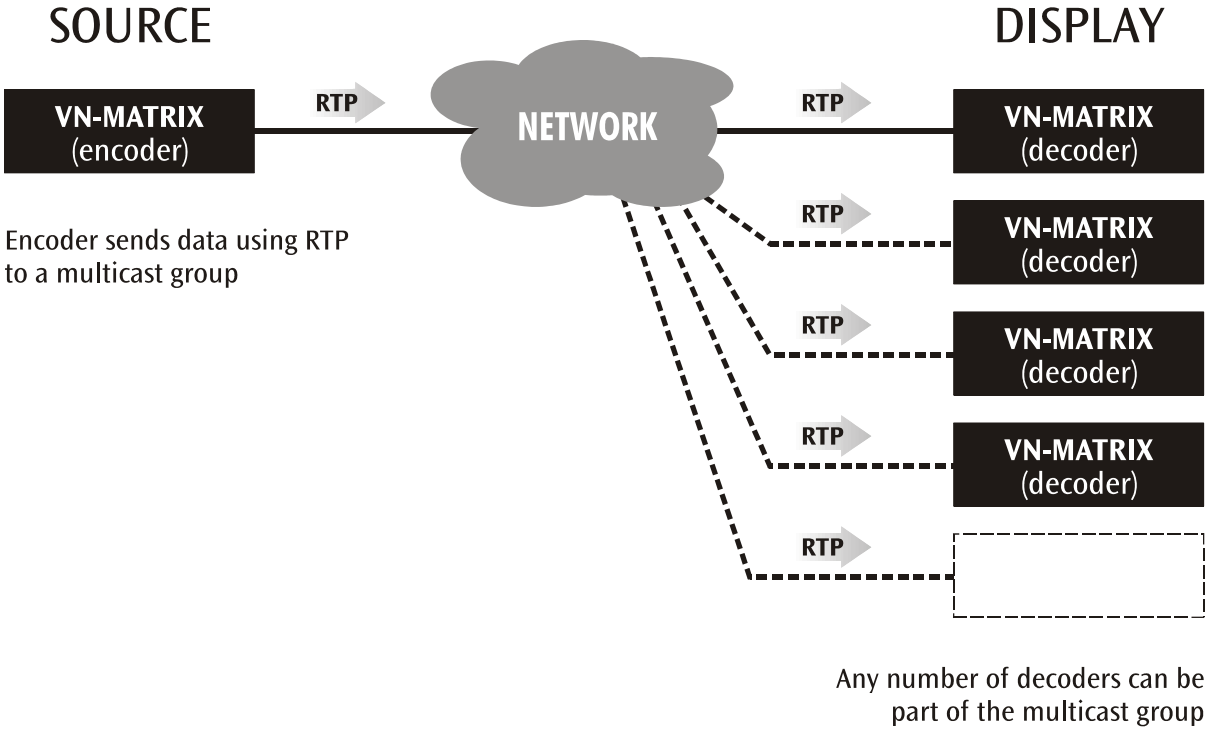
Video data is transported from the source (encoder) to the display (decoder) using one of three methods:

- Multicast RTP
- Unicast RTP
- Unicast TCP

A description of each method, together with its advantages and disadvantages, can be found on the next few pages.

Multicast RTP

This method uses a real-time variation of UDP (User Datagram Protocol), called RTP (Real Time Protocol). Multicast RTP allows a source to be displayed on any number of displays.
.



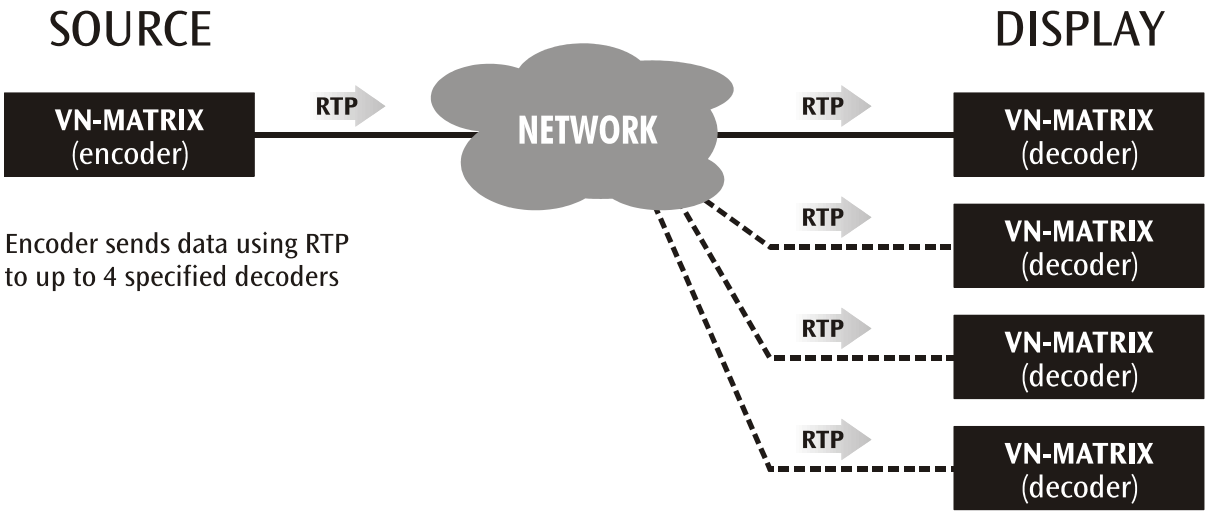
The source encoder uses RTP to send data to a multicast group. The source does not need to know the IP address of any decoders that use that source.

RTP provides very low latency which is important for video transport. Unlike other protocols, RTP packets include a time-stamp. Therefore, if packets are received in the wrong order they can easily be sorted into the correct order for display, or discarded if the time stamp is ‘out of date’.

However, because RTP is a connection-less protocol, data delivery is not guaranteed. Where data packets *are* lost (*e.g.* due to excessive network traffic) VN-MATRIX carefully manages the data stream to minimize any image disruption.

Unicast RTP

Like Multicast RTP this method uses a real-time variation of UDP protocol, called RTP. This method can be used where the network infrastructure does not support multicast traffic. Typically this should be used as a point-to-point configuration (*i.e.* single source to single display) but can be used for up to four displays.



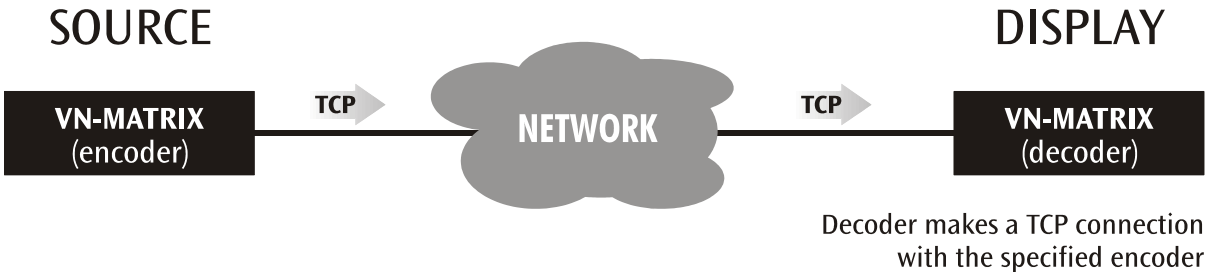
The source encoder defines the display decoder(s) that the source is available to, but the decoder chooses which source to display.

RTP provides very low latency which is important for video transport. Unlike other protocols, RTP packets include a time-stamp. Therefore, if packets are received in the wrong order they can easily be sorted into the correct order for display, or discarded if the time stamp is ‘out of date’.

However, because RTP is a connection-less protocol, data delivery is not guaranteed. Where data packets *are* lost (*e.g.* due to excessive network traffic) VN-MATRIX carefully manages the data stream to minimize any image disruption.

Unicast TCP

This method transports data using standard TCP (Transport Control Protocol) and should only ever be used for single point-to-point transfer of data.

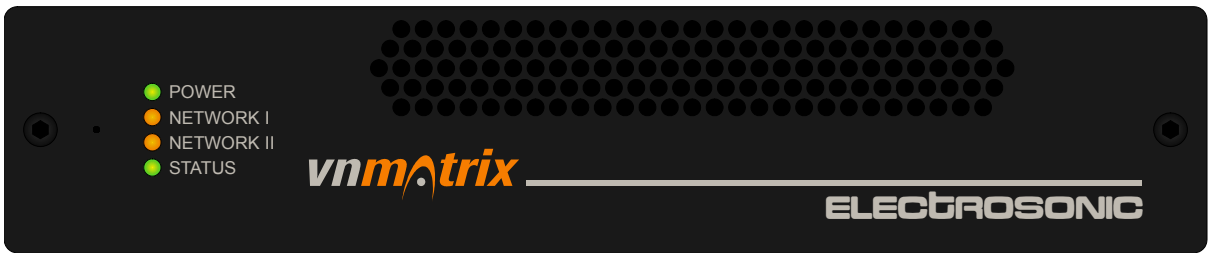


TCP is a connection-based protocol and, therefore, data is *guaranteed* to be delivered. However, in the event of excessive network traffic, delivery may be delayed which will impact on real-time performance.

The decoder defines which source to ‘connect to’. Other than defining an IP Address and source type (if required) no special source encoder setup required.

NOTE: *Multiple decoder connections are theoretically possible using this method but NOT recommended. Each additional connection will create extra loading on the encoder CPU which will ultimately result in poor display performance. In addition, multiple TCP streams carrying the same source data is an inefficient use of network bandwidth.*

Front Panel Features



Indicators

The following indicators are visible on the front of the VN-MATRIX:

Name	Color	Function
POWER	Green	*Fully Lit* – when the unit is receiving power from the 12V supply input. *Flashing* – an over temperature condition has occurred or there was a power overload/underload condition. Cycle the power off/on to reset.
NETWORK I	Orange	Indicates the status of network port I: *Fully Lit or Flashing Intermittently* – control or source data is being transmitted or received by the port. *Unlit* – no data or no network connection detected.
NETWORK II	Orange	Indicates the status of network port II: *Fully Lit or Flashing Intermittently* – control or source data is being transmitted or received by the port. *Unlit* – no data or no network connection detected.
STATUS	Green	Indicates the source status of the VN-MATRIX: **Condition** / **Encoder (source)** / **Decoder (display)** *Unlit* / No source input detected / No source being received *Flashing* / Source being streamed / Source being received *Fully Lit* / Source present but not being streamed (*e.g.* unit currently disabled or in standby mode) / n/a

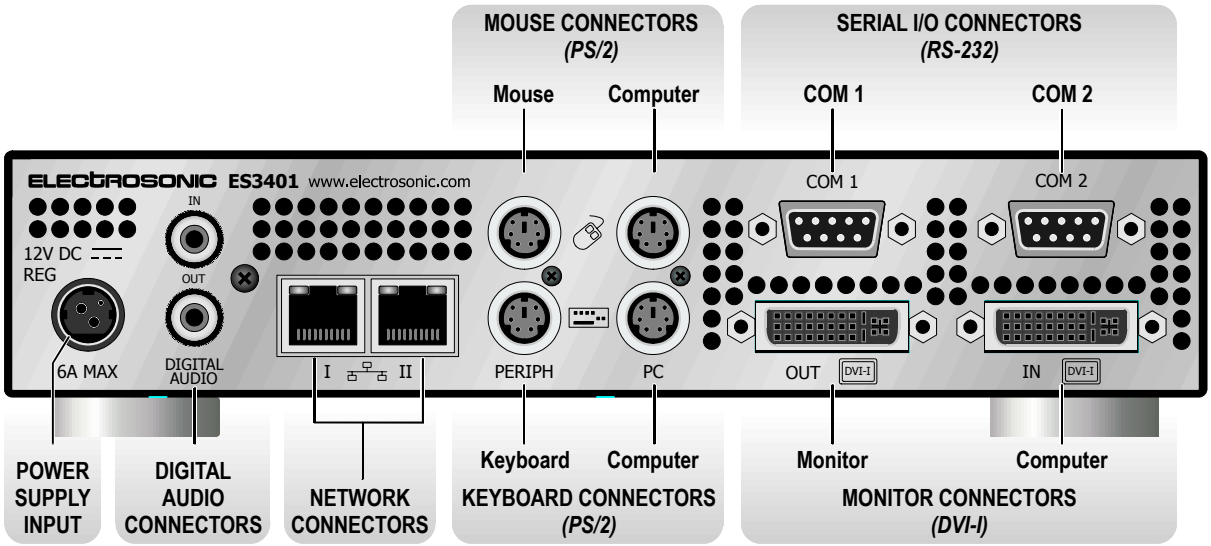
NOTE: *During the VN-MATRIX boot up period (typically 20-30 seconds) the NETWORK and STATUS indicators may light up or flash intermittently while the unit initializes.*

Reset Button

VN-MATRIX is fitted with a concealed reset button. This can be used to reboot the operating system, for example during firmware upgrade procedures.

To activate this button, insert the blade of a very small screwdriver (or similar tool) or straightened paper clip into the hole on the front panel, on the left of the indicators.

Rear Panel Features



Full details of connector types, pin-outs and specifications can be found in Section 5:Technical Data. Briefly, these are as follows:

Power Supply Input

The VN-MATRIX requires a 12V DC regulated power supply (rated at 6A) via this connector.
A suitable mains-operated power supply unit (PSU) is provided.

Network Connectors

These are used to connect the VN-MATRIX to an Ethernet network. Typically NETWORK I is used for data streaming and device configuration (using the Web Interface). NETWORK II port is reserved for future use and special applications.

Keyboard Connectors

Standard PS/2 connectors, used to connect the VN-MATRIX between the source computer and its keyboard.

Mouse Connectors

Standard PS/2 connectors, used to connect the VN-MATRIX between the source computer and its mouse.

Monitor Connectors

Standard DVI-I connectors, used to connect the VN-MATRIX between the source computer and its monitor. Compatible with both digital and analog sources – see Source Compatibility (page 11).

Serial I/O Connectors

Standard 9-pin connectors used to establish a serial data link between the VN-MATRIX and an external computer. COM1 is typically used to configure the unit via a serial link. COM2 is typically used for sending or receiving serial data across a network.

Accessories

Supplied Accessories

In addition to this User Guide, the VN-MATRIX is supplied with the following accessories. If any of these items is missing or damaged, please contact your Electrosonic dealer immediately:

Item	Qty	Re-order Code
12V Power Supply Unit (PSU)	1	ES3401-P
Mains Cord for PSU (with 3-pin 'Edison' plug) *For use in the USA.*	1	CA4291
Mains Cord for PSU (bare-ended) *For use in Europe and all other countries.*	1	CA429
Digital Monitor Cable (2 metre DVI-D to DVI-D)	1	*Digital Cable Kit:* ES3401-CD *Analog Cable Kit:* ES3401-CA
Analog Monitor Cable (2 metre 15-pin HD-type to DVI-A)	1	
DVI-A to 15-pin HD Adapter	1	
Mouse/Keyboard Cable (2 metre PS/2 to PS/2)	2	
Serial Cable (9-pin D-type to 9-pin D-type)	1	

Optional Accessories

The following optional accessories are also available for use with the VN-MATRIX – these must be ordered separately from your Electrosonic dealer:

Item	Order Code
Rack Mounting Kit (single unit) *A kit that allows a VN-MATRIX unit to be installed in a 19 inch equipment rack. Full instructions are included with the kit.*	ES3401-RM1
Rack Mounting Kit (dual unit) *A kit that allows two VN-MATRIX units to be installed, side by side, in a 19 inch equipment rack. Full instructions are included with the kit.*	ES3401-RM2
Surface Mounting Kit *A kit that allows a VN-MATRIX unit to be mounted to any convenient flat surface, e.g. under a desk. Full instructions are included with the kit.*	ES3401-SM

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SECTION 2:

Installation & Basic Setup Procedures

Choosing a Suitable Location

The VN-MATRIX is designed to be used either as a free-standing unit or (by using the optional kits available) to be mounted in a 19 inch equipment rack.

CAUTION

Whichever installation method you choose there are certain environmental requirements, detailed on page 25, which must be observed in order to ensure safe and reliable operation.

For rack-mounted applications the criteria detailed on page 26, must also be observed.

Environmental Requirements

CAUTION

The criteria on this page must be observed for all installations of the VN-MATRIX, whether free-standing or rack-mounted.

Orientation

The VN-MATRIX is designed to be used free-standing on a stable, horizontal surface. It can, however, be used in any orientation subject to the necessary ventilation requirements.

Temperature

DO NOT install or operate the VN-MATRIX in an area where the ambient temperature exceeds 35°C (95°F) or falls below 5°C (35°F).

Remember that, as with all electronic equipment, the VN-MATRIX and its associated PSU also produces heat which may affect the ambient temperature.

After the VN-MATRIX has been in use for a period of time the external casing may become slightly warm to the touch. Ensure that any adjacent surfaces will not be affected by the heat.

Ventilation

DO NOT obstruct the ventilation grilles during use. The VN-MATRIX has an integral forced-air cooling system. A fan draws air in through the grille in the front panel and expels ‘warmed’ air through the grilles in the back panel. The fan speed is controlled automatically by an internal temperature sensor. The fan may, therefore, appear to run faster as the unit warms up or if the ambient temperature is increased.

A self-resetting thermal cut-out will shutdown the VN-MATRIX if the temperature exceeds design limits.

Humidity & Water

DO NOT install or operate the VN-MATRIX in an area in which the ambient relative humidity exceeds 85% or in an area that is prone to condensation.

DO NOT install or operate the VN-MATRIX near water or in a location which may be prone to water seepage — the VN-MATRIX is not waterproof.

Rack-mount Requirements

CAUTION

For rack-mounted installations, the following criteria must be observed (in addition to the Environmental Requirements listed on page 25)

Mounting & Support

ALWAYS use the special rack-mount kits (available separately) to secure the VN-MATRIX. Full details on using the kit are included with the kit. It will be necessary to remove the four feet prior to rack mounting.

DO NOT stand other units directly on top of the VN-MATRIX when it is rack-mounted as this will place excessive strain on the mounting brackets.

Ventilation

ALWAYS ensure that the rack enclosure is adequately ventilated. Sufficient airflow must be achieved (by convection or forced-air cooling) to satisfy the ventilation requirements of **all** items of equipment installed within the rack.

No additional ventilation gap is required above or below the VN-MATRIX and adjacent surfaces or equipment.

Mains Supply

ALWAYS ensure that the mains power supply is of the correct voltage and frequency for **all** equipment within the rack, and that it has a good ground/earth connection.

Where a power strip (mains distribution batten) is used (of either a hard-wired or plug and socket type), always ensure that the current rating of both the power strip and the supply is sufficient for all equipment within the rack.

Mains Power Connection (via PSU)

The VN-MATRIX must be powered from a 12 Volt DC regulated supply. A suitable mains-operated power supply unit (PSU) is provided. The mains connection details that follow relate to the PSU.

NEVER CONNECT THE VN-MATRIX DIRECTLY TO THE MAINS.

To ensure CE compliance ALWAYS use the PSU provided.
If a backup/replacement PSU is required, always use an Electrosonic approved PSU.

Supply Requirements (for PSU)

ALWAYS observe the following instructions to ensure safe and reliable operation of the PSU.

ALWAYS ensure that the mains supply voltage is single phase only and is within the permitted range:

- 100 – 240V AC (0.45A Max.) 50 – 60Hz.

NEVER connect the PSU to a DC supply.

DO NOT allow the mains power point to be overloaded. This is particularly important to check when powering several items of equipment from a single power point (*e.g.* within rack-mounted installations).

WARNING: **THIS EQUIPMENT MUST BE GROUNDED / EARTHED.**

WARNING: To avoid the possible risk of electric shock or product damage due to condensation, ALWAYS allow the PSU to become acclimatized to ambient temperature and humidity for at least thirty minutes BEFORE switching on. This is particularly important when moving the unit from a cold to a warm location.

Mains Power Cord (for PSU)

The mains PSU is equipped with a 3-pin (male) type mains connector which requires a power cord fitted with a corresponding 3-pin IEC320 (female) connector.

Two power cords are supplied with the PSU, each having a different termination; you must use the lead appropriate for your country:

In...	Use the...	Re-order Code
USA and Canada	cord fitted with the 3-pin American-style 'Edison' plug.	CA4291
UK, Europe and all other countries	unterminated cord and fit a suitable plug as described on page 29.	CA429

WARNING: Do not allow anything to rest on the mains power cord.

Power-up Procedure

You must always ensure that the VN-MATRIX is powered-up at the same time as the source computer or slightly before.

Powering the VN-MATRIX *after* the source computer may result in the source computer not correctly detecting the mouse, keyboard and/or monitor.

Fitting a Mains Plug

If you are fitting a plug to the unterminated power cord (or replacing an existing plug), you must fit a plug that:

- is rated for use with mains voltage
- is equipped with a grounding pin/connection
- complies with any applicable National or Local electrical regulations.
- is fitted with a correctly rated fuse (applicable to UK-style plugs only – see page 30.)

WARNING: Never attempt to fit or use a plug without a ground or earth pin/connection.

Wiring Details

The wires of both mains power cords (supplied with each VN-MATRIX) are color-coded as shown in the table below; be sure to connect your plug in accordance with the following guidelines:

Connect the wire colored...	**to the plug terminal identified with...**
Brown	'L' or 'Live' or 'Line' (*or colored red or brown*)
Blue	'N' or 'Neutral' (*or colored blue or black*)
Green & Yellow	'E ' or 'E' or 'Earth' or 'Ground' (*or colored green or green & yellow*)
	WARNING *— If you are unsure of the connections, or if the markings in your plug do not match those given above, CONSULT A QUALIFIED ELECTRICIAN.*

NOTE: *The PSU is double-insulated and does not require an earth/ground connection. However, the earth cable of the mains lead must be connected in the plug.*

External Supply Protection

The mains power cord supplied with this product is rated at 10A maximum and must be protected from overload by an external fuse or circuit breaker.

Fused Plugs (UK-style)

If the power cord is fitted with a UK-style BS1363 3-pin plug (*i.e.* with provision for an internal fuse), then it must be fitted with a BS1362 ASTA approved 1 inch cartridge fuse.

This fuse must be rated at a **maximum of 10A/250V**. Since the current draw of the PSU is less than 1A, a fuse of a lower rating **not less that 3A/250V** may be used.

WARNING: Never attempt to fit a fuse or circuit breaker of a higher maximum rating than shown above.

Unfused Plugs or Hard-wired

If the power cord is fitted with an unfused plug, or is hard-wired into a power strip (mains distribution batten), then the power cord must be protected by an external fuse or circuit breaker of a rating shown in the table below:

Supply Voltage	**110V** nominal	**230V** nominal
Maximum Fuse Rating	**10A**	**10A**
Minimum Fuse Rating	**3A**	**3A**
WARNING: Never attempt to fit a fuse or circuit breaker of a higher maximum rating than shown above.		

Setup and Connection Procedure

Setting up and connecting a VN-MATRIX system is best undertaken in three stages. Briefly these are:

- **Stage 1: Network Communications Setup**
  Configure the network settings for each device using a PC/laptop and serial data link, ensuring that one device is configured as a controller. (See pages 32 to 34).

- **Stage 2: Connection**
  Connect each device to the network and connect its associated source or display equipment. (See pages 35 to 40).

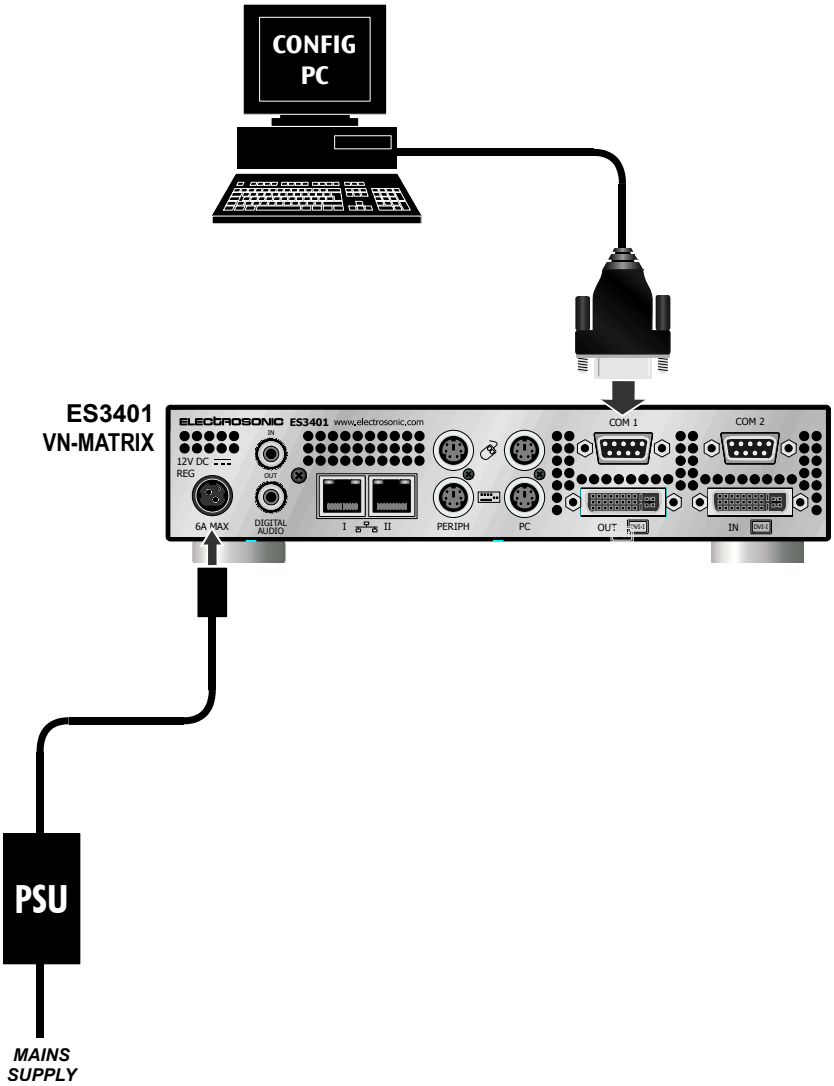
- **Stage 3: System Configuration**
  Using a PC/laptop connected to the same network to access the Web Interface (served by the controller) configure each device to be an encoder (source) or decoder (display).
  (See Section 3, page 41 onwards).

CAUTION: Do not proceed with connecting or configuring the VN-MATRIX for an existing network until you are certain you know what you are doing – incorrect connection or configuration may cause disruption to other network users.

Network Communications Setup

To establish a serial communications link…

☞ Using a null modem type serial cable, connect the serial port of a PC/laptop to the COM1 serial port on the VN-MATRIX to be configured:



☞ On the PC/laptop run a terminal emulation program such as HyperTerminal, with the following comms settings:

Baud rate:	115200
Data bits:	8
Parity:	None
Stop bits:	1
Flow control:	None

NOTE: *HyperTerminal is supplied with all Windows operating systems.*

To access the setup menus…

☞ Connect the power to the VN-MATRIX (or, if already connected, cycle the power off then on).

☞ VN-MATRIX will commence sending setup/diagnostic data which should appear in the HyperTerminal window. After a few seconds this will conclude with something like:

```
VN Matrix(R) Maintenance Console: ver3.1c

(none) login: ThorPci Init
registering plx interrupt routine = D17F89FC, -780166896
Hello kernel
thor_init_module: pre-ioremap
thor_init_module: post-ioremap
Hello kernel, this is MK registering
registering plx interrupt routine = D296BD30, 0
```

☞ Press the <enter> key: the VN-MATRIX should respond with the following login prompt:

```
VN Matrix(R) Maintenance Console: ver3.1c

192.168.0.1 login:
```

NOTE: *The login prompt will be preceded by the current IP Address of the unit.*

☞ Type **config** followed by the <enter> key.

☞ When prompted for a password type **config** followed by the <enter> key.

The following menu will then appear:

```
     Network Port 1                          Network Port 2
     ==============                          ==============
1. Boot method: static [dhcp]          11. Boot method: static [dhcp]
2.   address:       192.168.0.18      12.   address:    192.168.1.18
3.   netmask:       255.255.255.0     13.   netmask:    255.255.255.0
4.   gateway:       192.168.0.1
5.   broadcast:     192.168.0.255     15.   broadcast:  192.168.1.255
6. mtu:             1500              16. mtu:          1500
7. controller ip:   192.168.0.18
8. controller port: 5432              18. webserver port: 80
9. Exit
```

☞ Change the settings as required by typing the option number followed by the <enter> key. Then type the new value followed by the <enter> key.

For example, to change the Network Port 1 IP address to 172.28.232.16:

type **2** <enter> then type **172.28.232.16** <enter>

NOTE: *Do not include any leading zeros when typing IP addresses.*
For example, type 192.168.0.18 and not 192.168.000.018.

NOTES

- For advice on choosing IP Addresses, see Appendix A on page 126.
- For normal applications only Network Port 1 settings need to be configured.
- Option **1** and **11** are toggle action. For example, to switch between static and dchp modes simply type **1** <enter>. The currently selected mode is the option listed first. When DHCP mode is selected, options 2, 3, 4 & 5 (or 12, 13 & 14) will not be displayed.
- Remember that one (and only one) VN-MATRIX must be configured as a controller (see below). The controller IP (option **8**) must be set to the IP Address of the unit designated as the controller.
- Gateway (option **4**) is generally only required if devices are on different subnets.

To configure VN-MATRIX as a controller…

☞ Ensure the boot method for Network Port 1 is set to **static** (option **1**).

☞ Set the IP Address (option **2**) and controller IP (option **8**) to the *same* value.

To implement the new settings…

☞ Once you have made completed any changes, type **9** <enter> to exit the menu.

The VN-MATRIX will now reboot automatically to implement the new settings.

☞ If the unit does not reboot for any reason, or you want to perform a manual reboot, type **reboot** <enter> at the command prompt (or cycle the power off and on) to reboot the unit and implement the new settings.

<u>VN-MATRIX is now ready for connection to the network.</u>

Connections

Supplied Cables

A set of cables is supplied with VN-MATRIX to accommodate a variety of standard connection requirements.

The VN-MATRIX is compatible with both digital (DVI) and analog graphics signals. The unit is provided with the necessary additional cables that you may require.

Cable Description	**Source (encoder)**		**Display (decoder)**	
	Digital	**Analog**	**Digital**	**Analog**
Mouse/Keyboard Cable (PS/2 to PS/2) (2 off)	✓	✓		
Digital Monitor Cable (DVI-D to DVI-D)	✓		✓	
Analog Monitor Cable (15-pin Hi-D D-type to DVI-A)		✓		✓
DVI-A to 15-pin Hi-Density D-type Adapter		✓		✓
For Connection Diagram see page…	**37**	**38**	**39**	**40**

IMPORTANT NOTES

Disconnecting and reconnecting PS/2 cables to a computer that is already switched on may cause loss of mouse/keyboard control or cause the computer to ‘freeze’. It is recommended, therefore, that the connections are made while the computer is powered-down. See also ‘Power-up Procedure’ on page 28.

If you use a monitor cable or adapter other than that provided with the VN-MATRIX (as an encoder) you must ensure that all pins are properly interconnected, otherwise the computer graphics card or monitor may not operate correctly.

Network Connection

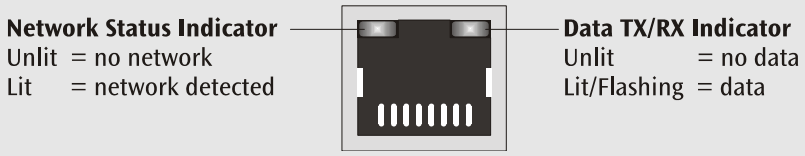
CAUTION: Do not proceed with connecting VN-MATRIX to an existing network until it is correctly configured using the procedure in Stage 1 (See pages 32 to 34). Incorrect connection or configuration may cause disruption to other network users.

Typically, the VN-MATRIX will connect to convenient network point on an existing in-house network. Use a standard CAT 5E or CAT 6 (or better) patch cable for this purpose. A patch cable is not supplied with the VN-MATRIX but is readily available in a variety of lengths from all good computer suppliers.

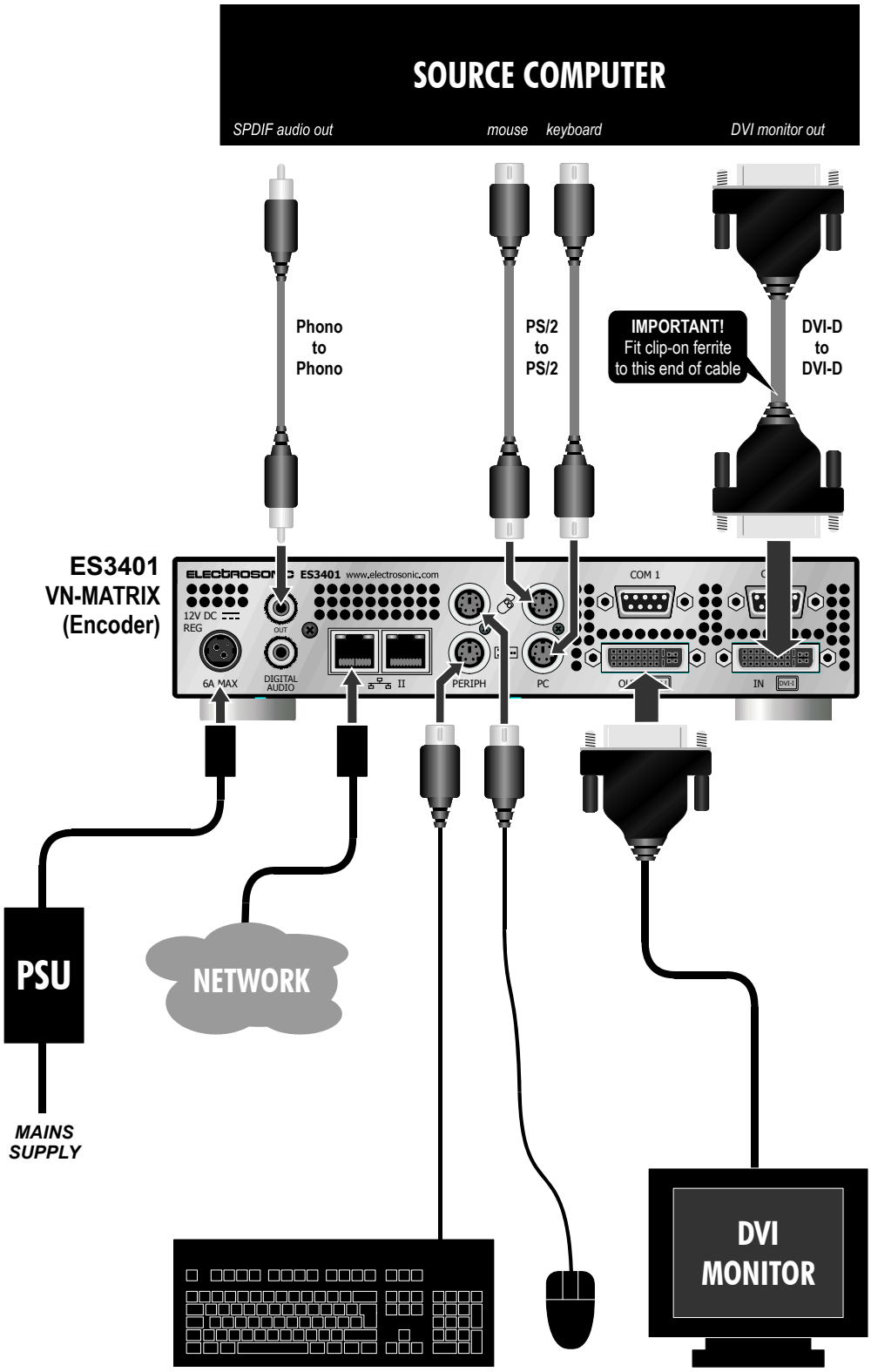
If a convenient network point is not available it will be necessary to have one installed – please consult the IT/Network Administrator or Building Facilities Manager for advice. Alternatively, the VN-MATRIX and source computer can 'share' a connection by using a switcher. Hubs are not suitable for use with VN-MATRIX as they restrict bandwidth.

For normal VN-MATRIX operation use Network Port I only.

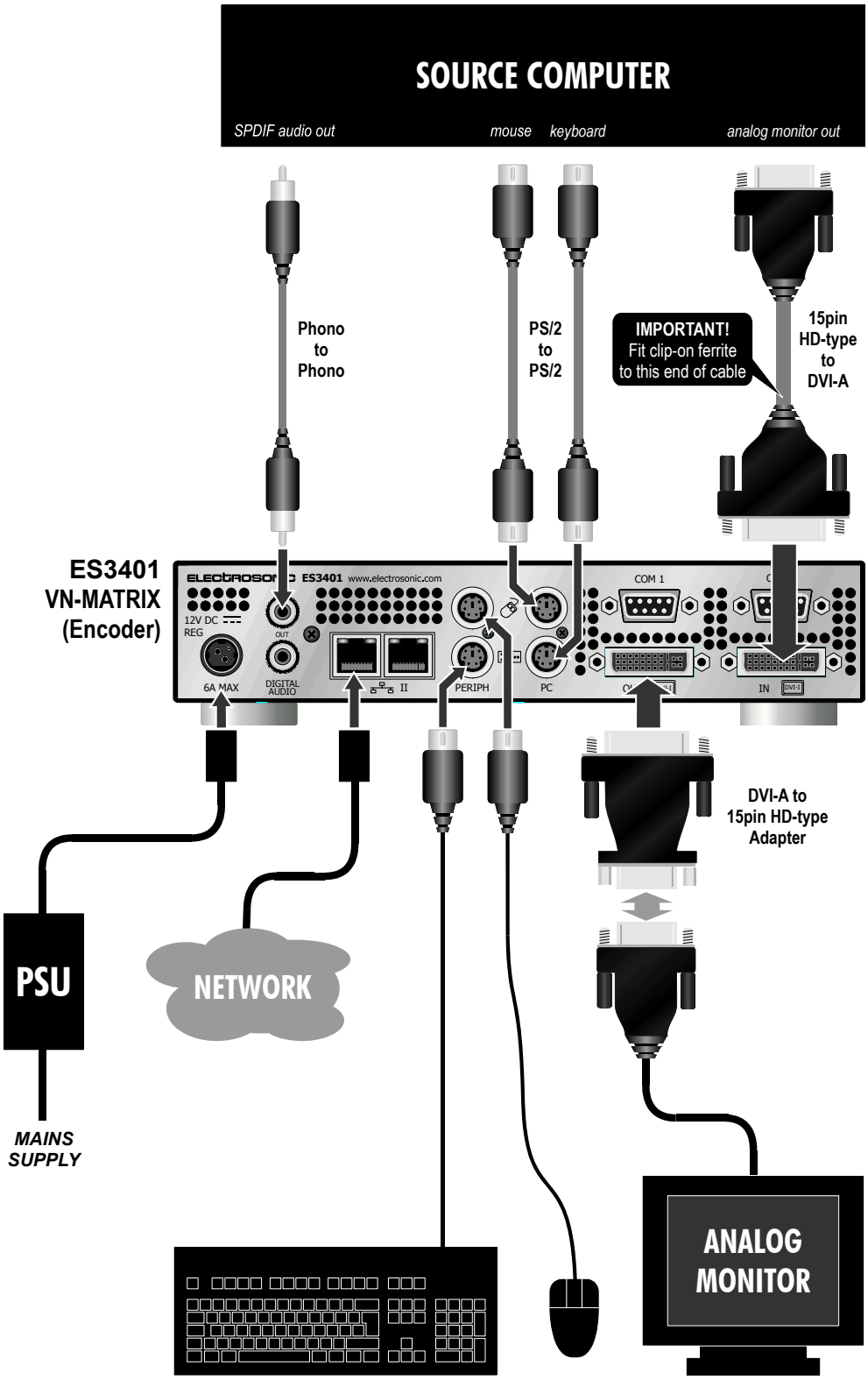
HINT: *With the VN-MATRIX powered and connected to a network the Network Status Indicator (next to the network connector) should be lit:*



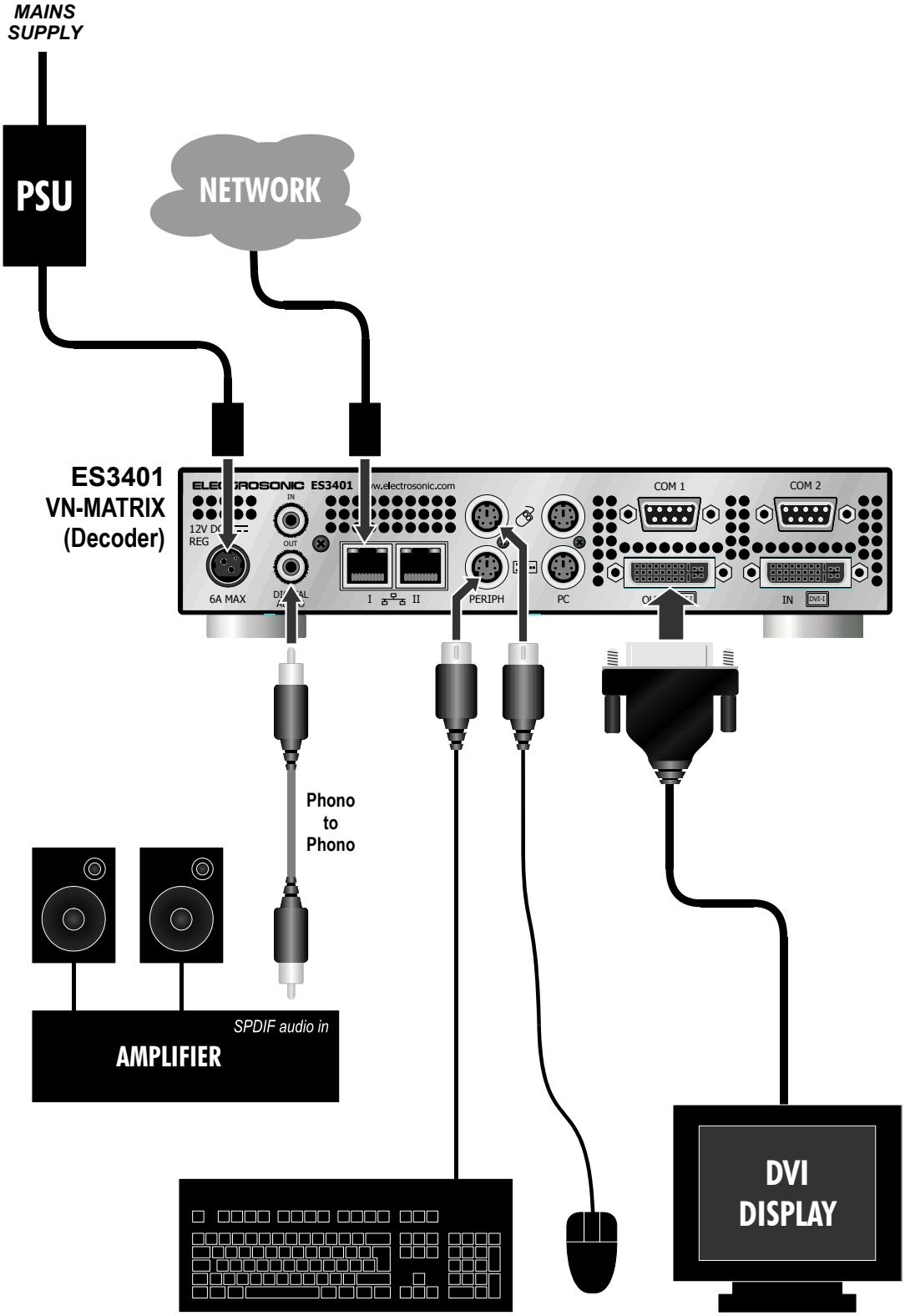
Connecting a Digital Source



Connecting an Analog Source

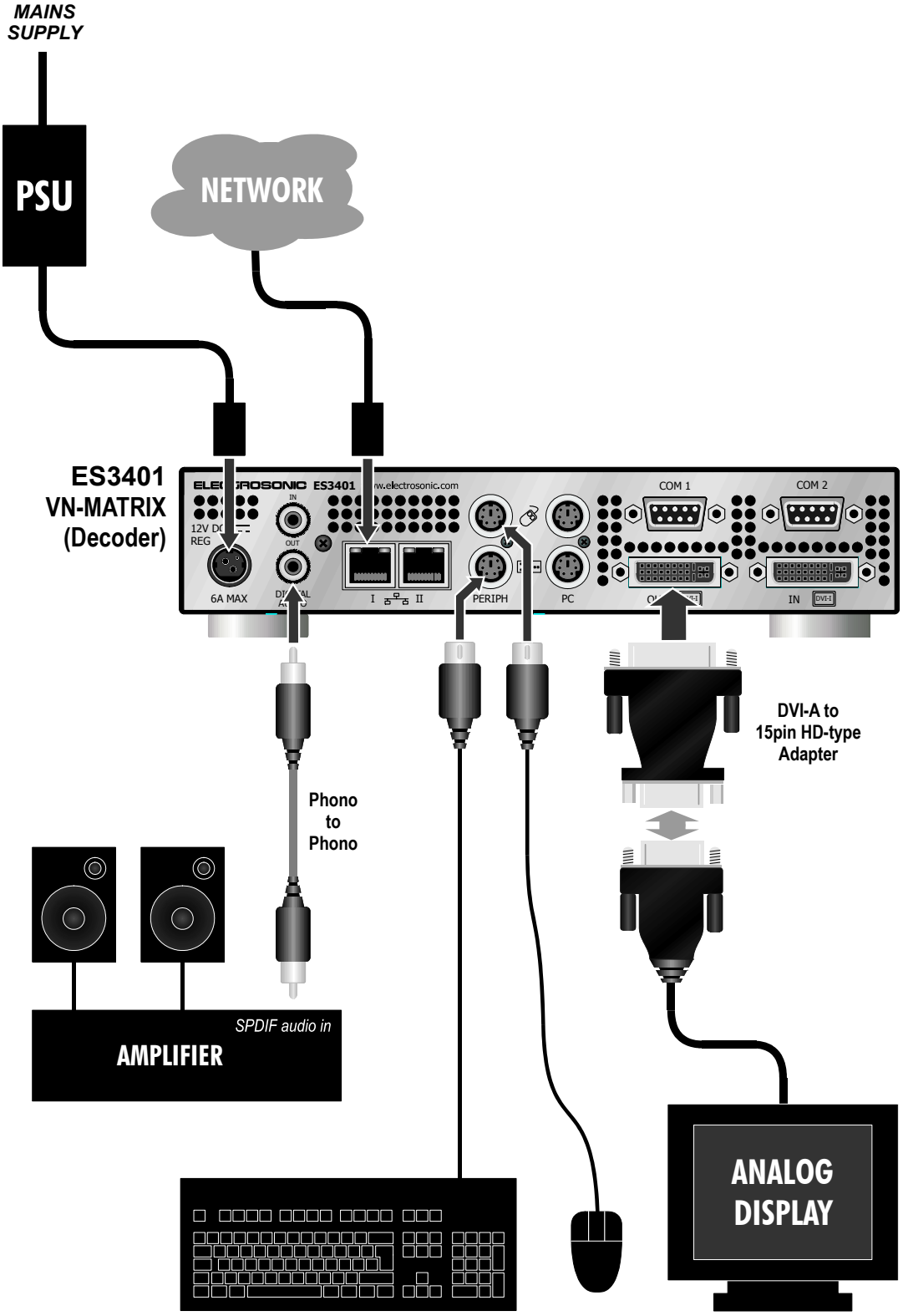


Connecting a Digital Display



NOTE: *VN-MATRIX provides both an analog and digital output signal regardless of the original source format.*

Connecting an Analog Display



NOTE: *VN-MATRIX provides both an analog and digital output signal regardless of the original source format.*

SECTION 3:

System Configuration

The VN-MATRIX Web Interface

Once all VN-MATRIX devices have been correctly set-up for (and connected to) a network, any system further configuration is achieved via the VN-MATRIX Web Interface. This comprises a number of 'pages' which provide access to various system parameters.

HINT: *This section provides step-by-step instructions for using the Web Interface and is aimed at new users of the VN-MATRIX system. Advanced users may wish to refer to the Quick Reference Guide in Section 7, pages 107 to 123.*

The Web interface is 'served up' by the VN-MATRIX device that was designated as the 'controller' during the network set-up procedure (see page 34). It can be viewed by any up-to-date web browser, running on a PC/laptop that is connected to the same network as the VN-MATRIX devices.

Suitable browsers include (but are not necessarily limited to):

- Internet Explorer (v6 and above),
- Firefox/Mozilla (v1.3 and above).
- Netscape (v6 and above), and

IMPORTANT: *Whatever browser is used, it must be configured to accept cookies and be JavaScript-enabled. For further help on configuring your browser, refer to Appendix C (page 133 onwards).*

Accessing the Web Interface

☞ Use the address box of your chosen browser to enter the following URL:

http://xxx.xxx.xxx.xxx

where xxx.xxx.xxx.xxx is the IP address of the VN-MATRIX controller.

The following page will appear in the browser:

☞ Click the text as directed to reveal the login screen:

☞ Enter the appropriate **User name** and **Password**.

VN-MATRIX has two user accounts:

- **admin** – which allows full *read/write* access to all setup parameters,
- **public** – which allows *read only* access to setup parameters.

Initially the password for both accounts is the same as the user name (*i.e.* the account name). It is recommended that these are changed once commissioning is complete (see page 81).

☞ Click the **Login** button.

If the login details are correct the **Device List** page will appear (see next page).

The Device List Page

This page lists all VN-MATRIX devices detected on the network.

NOTE: *If devices are added after this page is displayed they will not automatically appear on this list. You will need to refresh the list by clicking the* ***Device List*** *tab, or by clicking the browser Refresh/Reload button.*

Once a VN-MATRIX device has been detected and been listed on the Device List page, an entry will be displayed even if the device is subsequently disconnected. All valid devices are listed by device name and followed by their current IP address. 'Missing' devices are easily identified by the lack of an IP Address. In the above example, the last device in the list (device 620098) is not currently available (*e.g.* may be disconnected from the network or powered-down).

The current configuration status of each device is also identified by an icon:

- unconfigured
- configured as an encoder (source)
- configured as a decoder (display)

In a new system, all VN-MATRIX devices will typically be in an unconfigured state. The remainder of this section will guide you through the process of configuring each VN-MATRIX as either an encoder (source) or decoder (display).

On-line Help

On-line help is available for each page in the Web Interface by simply clicking the Help tab.

Interface Timeout & Logging Out

If the web interface is left unattended or is not used for a period of 30 minutes it will automatically logout. You can start using the interface again by re-entering your login details.

To logout of the Web Interface…

☞ Click the Logout tab on any page.

Update Button and Save Tab

Most pages in the web interface have an **Update** button and/or a **Save** tab:

Update — Clicking the **Update** button implements the settings for the current page/device but **does not save** them to the VN-MATRIX flash memory, *i.e.* if the unit is rebooted the previous settings will be used.

Save — Clicking the **Save** tab implements the settings for the current page/device and **does save** them to the VN-MATRIX flash memory.

On the **Device List** page only there is a **SaveAll** tab:

SaveAll — Clicking the **SaveAll** tab will save **all** current settings (including those that have been 'updated') for **all** VN-MATRIX units.

Configuring a VN-MATRIX as an Encoder (source)

The following procedure assumes that a valid source is connected to the VN-MATRIX.
For details on how to connect a source, see page 37 and 38.

NOTE: *This procedure provides a basic level of configuration which will be adequate for most systems. For additional 'Advanced Setup' options, see pages 62 to 74.*

❸ Check that the **Mode** field is set to **enable**.

For more information, see 'Device Mode' on page 49.

❹ Click the **Save** tab.

HINT: *To help identify this device during set-up or troubleshooting, tick the Identify box to display the device name on the local monitor (where connected).*

For more information, see 'Identify Mode' on page 49.

❺ Click the **videoPort0** icon.

The **Configure** page will appear…

❻ Check that the **Input Mode** is set to **auto**.
If not, see 'Input Mode' on page 49.

❼ Check that the **Current Mode** shows the format of the connected source.
If not, see 'Input Mode' on page 49.

HINT: *If your source or local monitor uses EDID, you may need to look at these settings.*

For more information, see 'EDID Options' on page 49.

❽ Tick the **Multicast Enable** box if RTP Multicast source streaming is required, otherwise ensure this box is unticked to enable RTP Unicast.

❾ Does the source have an audio channel?

NO…	***YES…***
Encoder setup is complete, click the Save tab. If a local monitor is connected it should now be displaying the source. If not, see 'Source Checkup on page 1058.	Turn to page 48 and follow 'Additional Setup for Audio'

❿ Repeat this procedure (from page 46, step ❶) for each encoder in the system.
To configure a VN-MATRIX device as a decoder (display), turn to page 51.

Additional Setup for Audio

❶ Click the **Device** tab to return to the **Device** page…

❷ Click the **audioPort0** icon.

The **Configure** page will appear…

❸ Check that the **Audio Status** shows a valid audio source type. If not, see page 50.

❹ Ensure that **Compression** is set to **no compression**.

For further information on this feature, see page 73.

❺ Tick the **Multicast Enable** box if RTP Multicast source streaming is required, otherwise ensure this box is unticked to enable RTP Unicast.
This must be the same as the **videoPort** setting.

❻ Encoder setup is now complete, click the Save tab.

Repeat this procedure (from page 46, step ❶) for each encoder in the system.
To configure a VN-MATRIX device as a decoder (display), turn to page 51.

Input Mode

The default and recommended input mode for a VN-MATRIX encoder is **auto**. This mode provides full detection of the applied source and automatic configuration of input parameters. It has the additional advantage that if a different source is connected at any time, the VN-MATRIX will automatically re-configure the input for the new source.

Auto mode will detect most standard video and graphic source formats. However, if the source input:

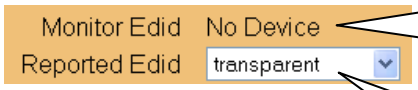
- is a non-standard format,
- is an RGsB (sync on green) or YPrPb source type,
- has a poor quality signal,
- has Macrovision® copy protection

then VN-MATRIX may not auto-detect correctly. In these cases, to achieve reliable operation, some fine-tuning may be necessary. A pre-defined or custom input mode can also be applied.

For further information, see 'Advanced Source Setup' on page 63.

EDID Options

Many modern computers and monitors are capable of using EDID (Extended Display Identification Data). This allows a computer graphics card to be 'aware' of the capabilities of the display connected to it. VN-MATRIX, when configured as an encoder, provides different options for handling EDID.



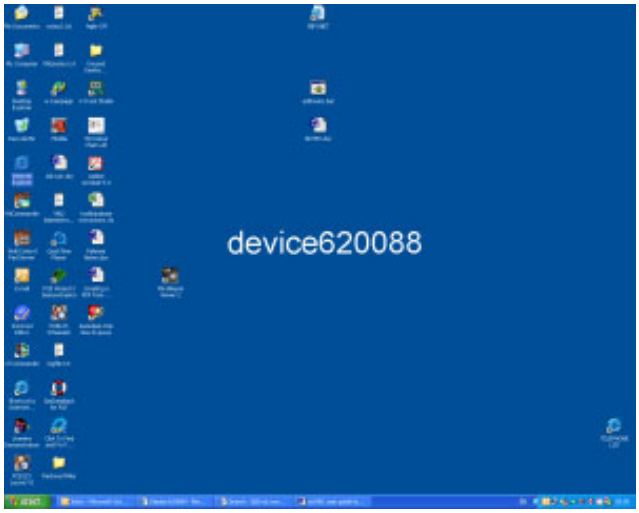
The **Monitor EDID** field shows the local monitor display type. If no local monitor is connected or the monitor does not support EDID, this will show **No Device**.

The **Reported EDID** field shows the EDID that VN-MATRIX reports back to the source device. **Transparent** mode will report the current or last connected monitor type. Alternatively, choose one of the listed display types.

Identify Mode

As an aid to setting-up a VN-MATRIX encoder in a large or complex system, use the **Identify** function to display the device name on the local monitor (if fitted).

Tick the **Identify** checkbox, then click the **update** button. The device name will appear on the local display (see example right).



NOTES

- The name will only display if a valid source is connected and has been correctly detected by VN-MATRIX.
- The name only displays on the local display output. It does not appear as part of the streamed source.

Device Mode

A VN-MATRIX encoder can be configured in three modes:

- **enable** allows the source to be streamed,
- **disable** prevents a source from being streamed,
- **standby** prevents a source from being streamed.

For normal operation, **enable** must be selected.

Audio Status

Where a valid digital audio signal is connected to the **DIGITAL AUDIO IN** connector, the type of signal will appear in the **Audio Status** field on the **Configure (audioPort)** page.

VN-MATRIX supports the auto-detection of **44100 Hz** and **48000 Hz** digital audio sources.

Advanced Setup Options

The encoder set up procedure on the preceding pages will achieve a basic level of operation which will be adequate for most normal applications.

The following advanced setup options are possible and these are detailed in Section 4:

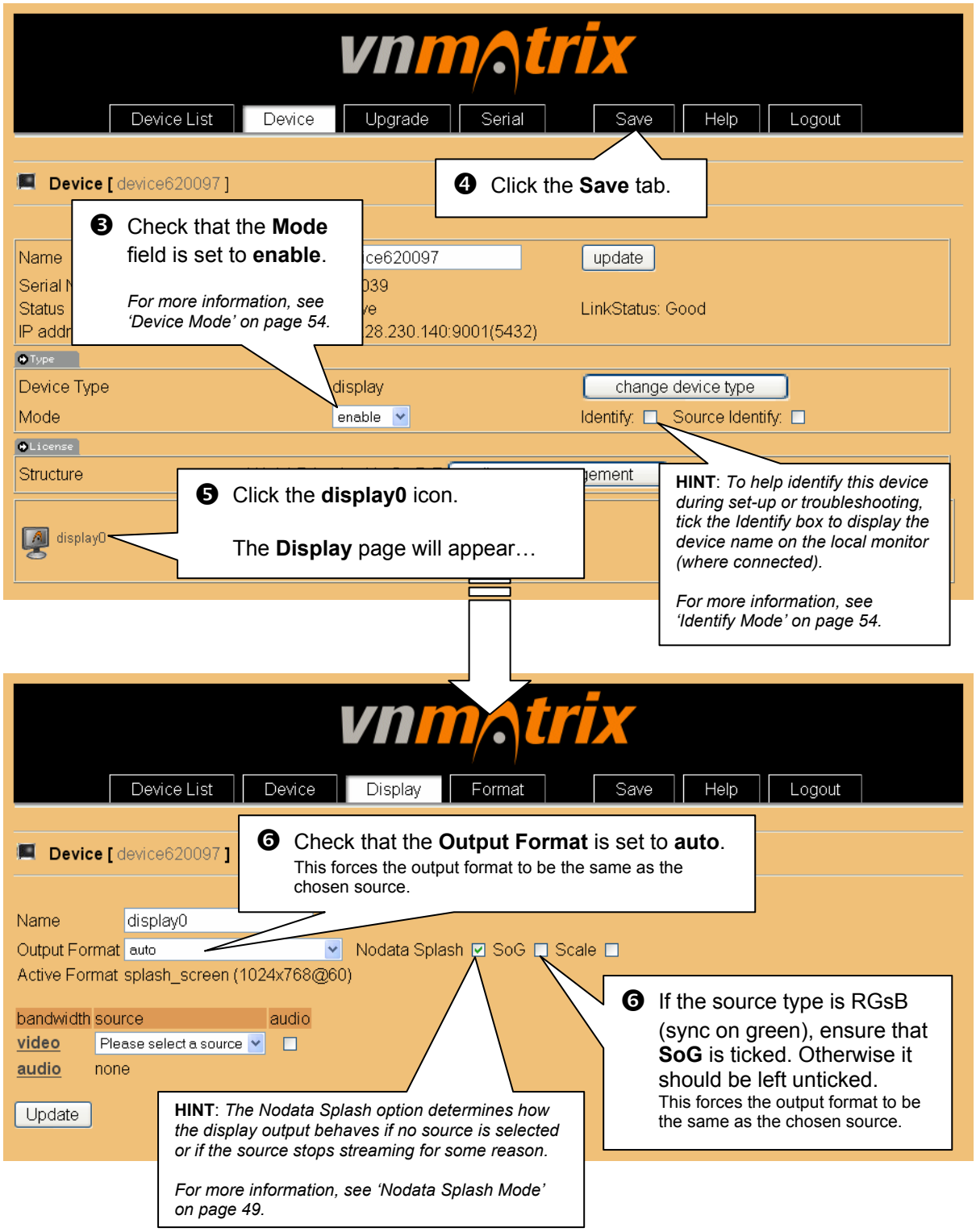
Fine-tuning of input parameters see page 65
Creation of custom input modes see page 66
Changing video compression see page 69
Managing bandwidth usage see page 72
Changing audio compression see page 73

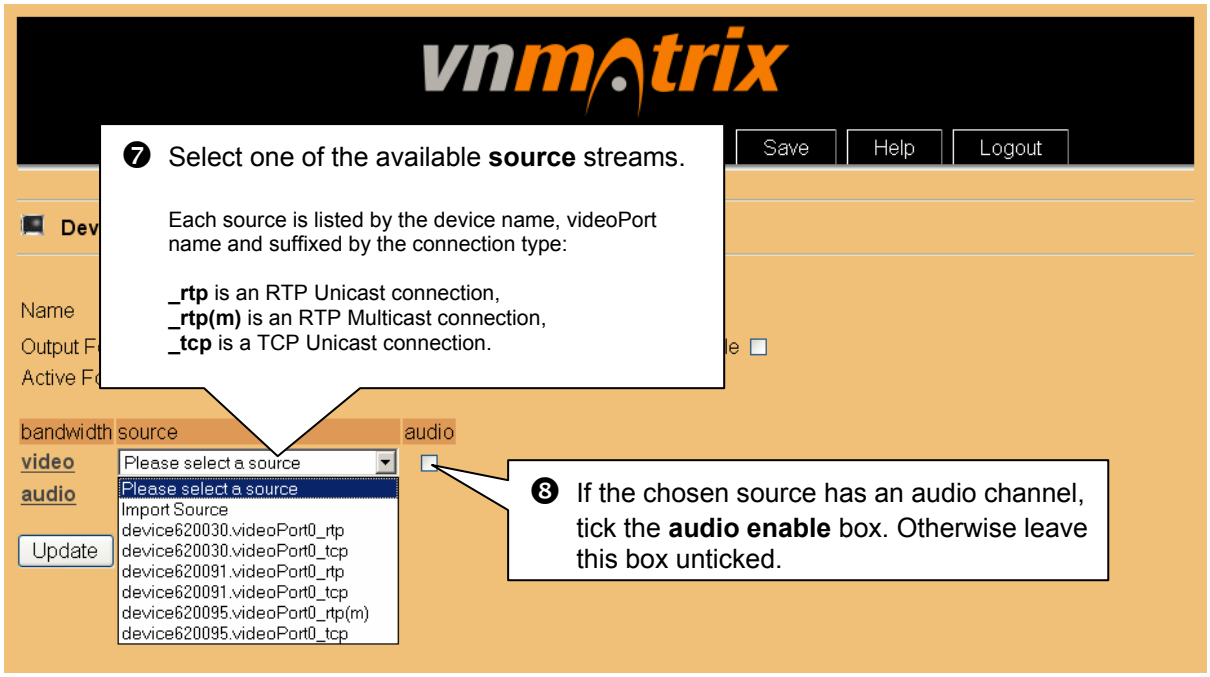
Configuring a VN-MATRIX as a Decoder (display)

The following procedure assumes that at least one VN-MATRIX encoder has been configured and is ready to stream a source (see page 46)

It is also assumed that a suitable display device is connected to the VN-MATRIX.
For details on how to connect a display, see pages 39 and 40.

NOTE: *This procedure provides a basic level of configuration which will be adequate for most systems. For additional 'Advanced Setup' options, see pages 74 to 81.*


vnmatrix
Device List
Device
Upgrade
Serial
Save
Help
Logout
Device [device620097]
❹ Click the **Save** tab.
❸ Check that the **Mode** field is set to **enable**.
For more information, see 'Device Mode' on page 54.
Name
update
Serial N
Status
LinkStatus: Good
IP addr
28.230.140:9001(5432)
Type
Device Type
display
change device type
Mode
enable
Identify:
Source Identify:
License
Structure
❺ Click the **display0** icon.
The **Display** page will appear…
display0
HINT: *To help identify this device during set-up or troubleshooting, tick the Identify box to display the device name on the local monitor (where connected).*
For more information, see 'Identify Mode' on page 54.
vnmatrix
Device List
Device
Display
Format
Save
Help
Logout
Device [device620097]
❻ Check that the **Output Format** is set to **auto**.
This forces the output format to be the same as the chosen source.
Name
display0
Output Format
auto
Nodata Splash
SoG
Scale
Active Format splash_screen (1024x768@60)
bandwidth
source
audio
video
Please select a source
audio
none
Update
HINT: *The Nodata Splash option determines how the display output behaves if no source is selected or if the source stops streaming for some reason.*
For more information, see 'Nodata Splash Mode' on page 49.
❻ If the source type is RGsB (sync on green), ensure that **SoG** is ticked. Otherwise it should be left unticked.
This forces the output format to be the same as the chosen source.



❾ Click **Update** and **Save**.

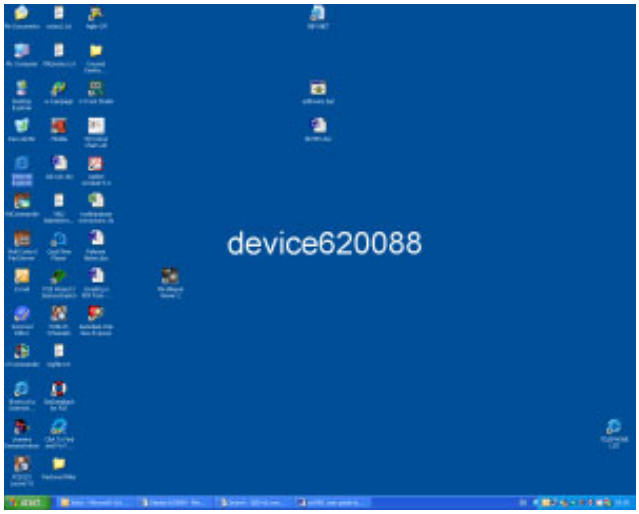
The chosen source should now appear on the output display.
If not, please refer to ‘Display Checkup’ on page 57.

Additional Information for Decoder Setup

Identify Mode

As an aid to setting-up a VN-MATRIX decoder in a large or complex system, use the **Identify** function to display the device name on the display output.

Tick the **Identify** checkbox, then click the **update** button. The device name will appear on the display (see example right).



NOTES

- The name will only display if a valid source is currently selected and being displayed.
- The name only displays on the selected output device only. It does not appear as part of the streamed source on other displays.

No Data Splash Mode

If a VN-MATRIX decoder cannot display a source (*e.g.* if no source is selected, has become disconnected or is in the wrong format), it offers two different display options.

The required option is selected using the **Nodata Splash** checkbox:

- Nodata Splash ☑
  Display a splash screen (see example right), or
- Nodata Splash ☐
  Display the last frame of valid source data (black if no data is available).

Device Mode

A VN-MATRIX decoder can be configured in three modes:

- **enable** allows the selected source to be displayed,
- **disable** prevents a source from being displayed (display is blank),
- **standby** prevents a source from being displayed (display shows 'no data' splash screen).

For normal operation, **enable** must be selected.

Advanced Setup Options

The decoder set up procedure on the preceding pages will achieve a basic level of operation which will be adequate for most normal applications.

The following advanced setup options are possible and these are detailed in Section 4:

Setting optimum playback delay see page 75
Monitoring bandwidth usage see page 76
Creation of custom output modes see page 78

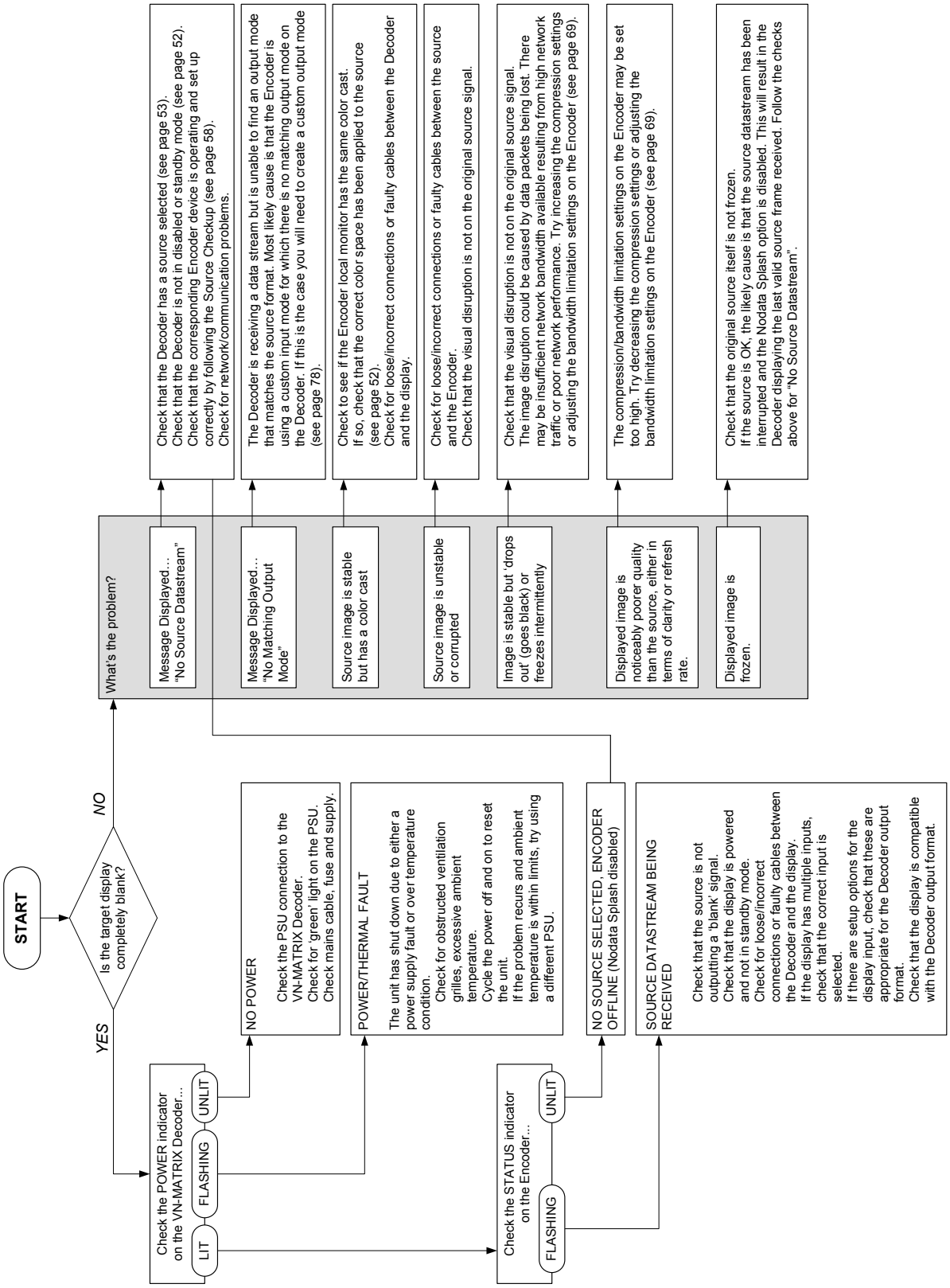
Troubleshooting

If you have followed the procedures on the preceding pages, you should by now have at least one VN-MATRIX encoder and one VN-MATRIX decoder and be able to display the source (encoder) on the display (decoder). If not, this section will help to diagnose most problems that you may encounter.

Most problems in a VN-MATRIX system will manifest themselves as some kind of disruption of the target display. Use the Display checkup (see page 57) as a starting point to trace common problems, either with the decoder/display or elsewhere in the system.

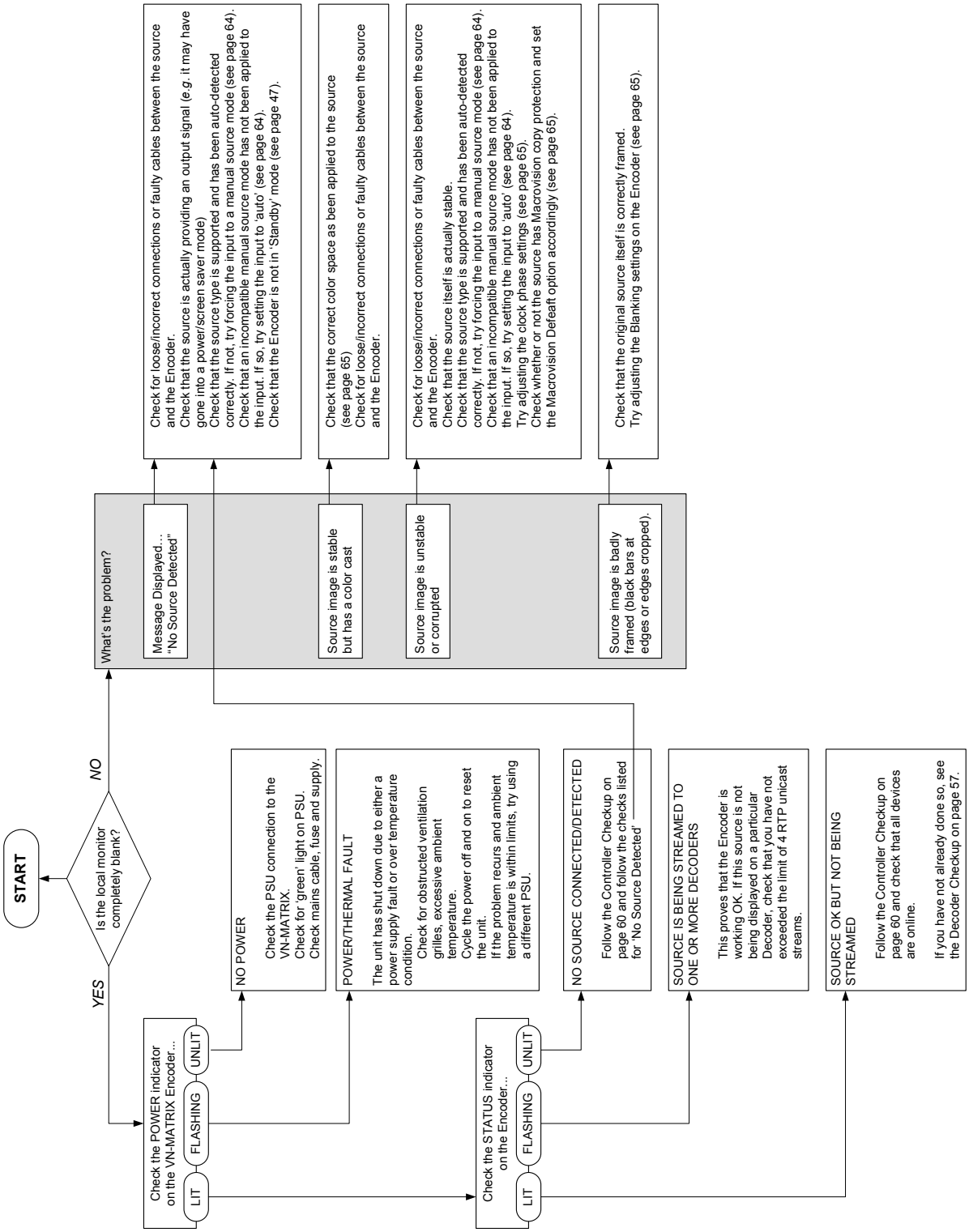
Display Checkup

Most problems in a VN-MATRIX system will manifest themselves as some kind of disruption of the target display. Use this checkup as a starting point to trace common problems, either with the decoder/display or elsewhere in the system.



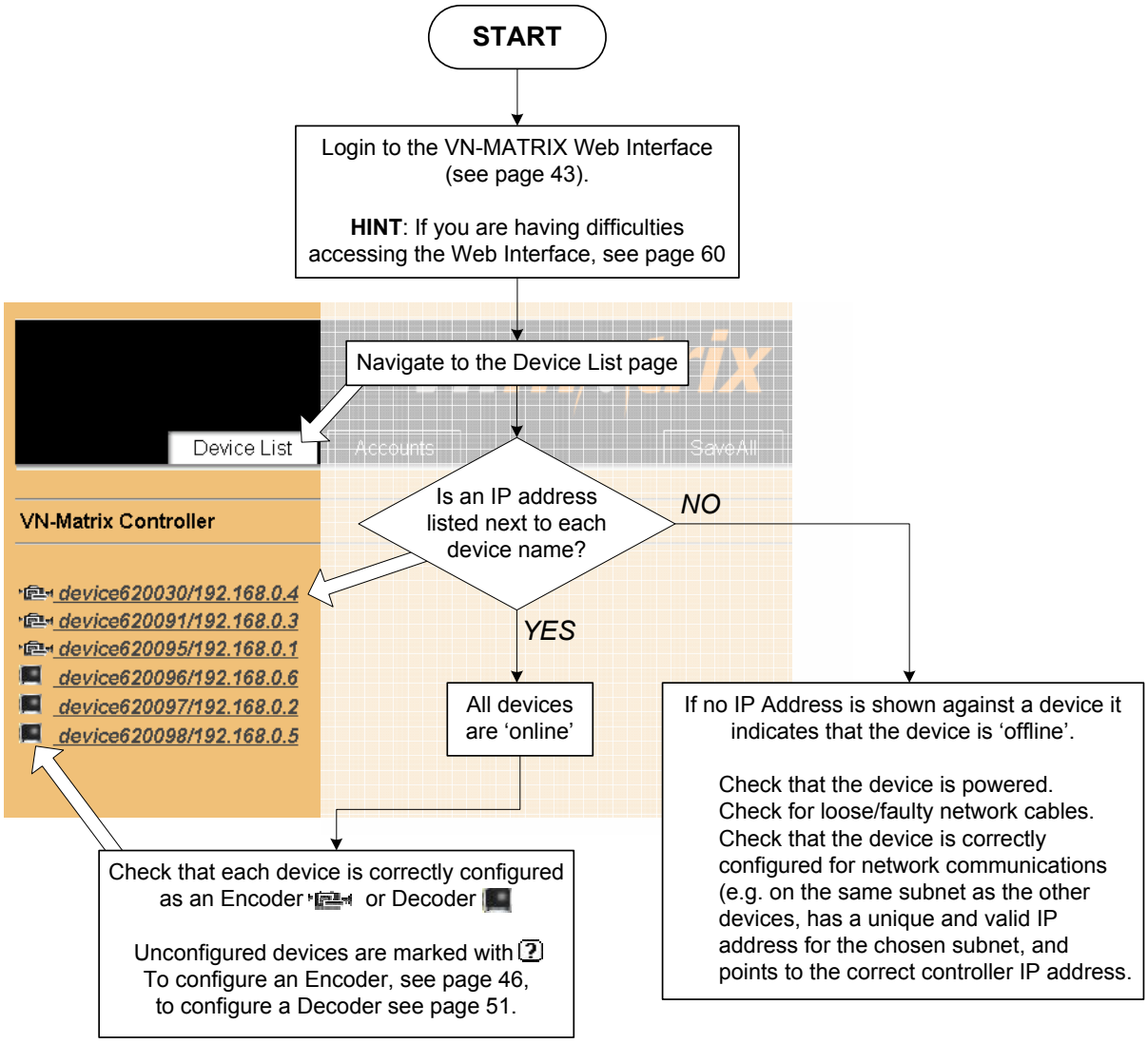
Source Checkup

When attempting to diagnosing problems with an encoder or source it is highly recommended that a local monitor is connected to the VN-MATRIX. If a monitor is not already connected as part of the system, it is suggested that one be connected temporarily.



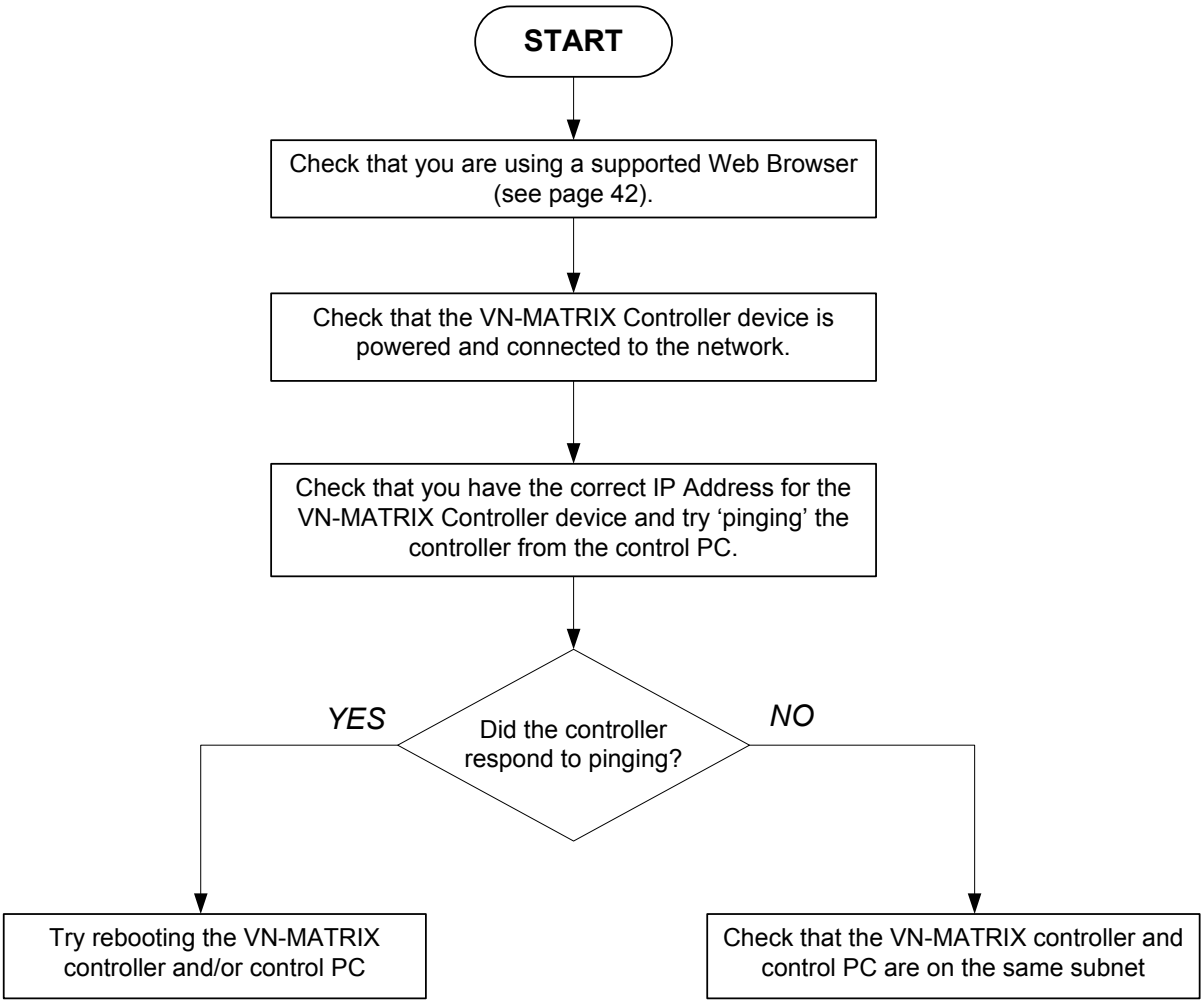
System Checkup

Follow this checkup to ensure that all VN-MATRIX devices in your system are online and correctly configured as either Encoders or Decoders.



Controller Checkup

Follow this checkup if you cannot establish contact with the VN-MATRIX controller device using the Web Browser on you control PC.



SECTION 4:

Advanced Setup Procedures

Encoder Set Up

This section provides details for advanced set up options for a VN-MATRIX encoder.

Fine-tuning of input parameters see page 65
Creation of custom input modes see page 66
Changing video compression see page 69
Managing bandwidth usage see page 72
Changing audio compression see page 73

Advanced Source Setup

For most applications it is recommended that the source input of VN-MATRIX is set to **auto** mode. This enables the device to detect the electrical/timing characteristics of the input signal and determine the exact source type. It will then invoke the appropriate input parameters for optimum processing of that source.

This also has the advantage that if the input source changes to another source type (*e.g*. if the source input is derived from a source switcher) it can change input setup 'on the fly' without any user intervention.

While the **auto** mode will work with most standard video/graphics standards, there are some circumstances, particularly with analog sources, where some additional fine-tuning may be required. For example, when the source:

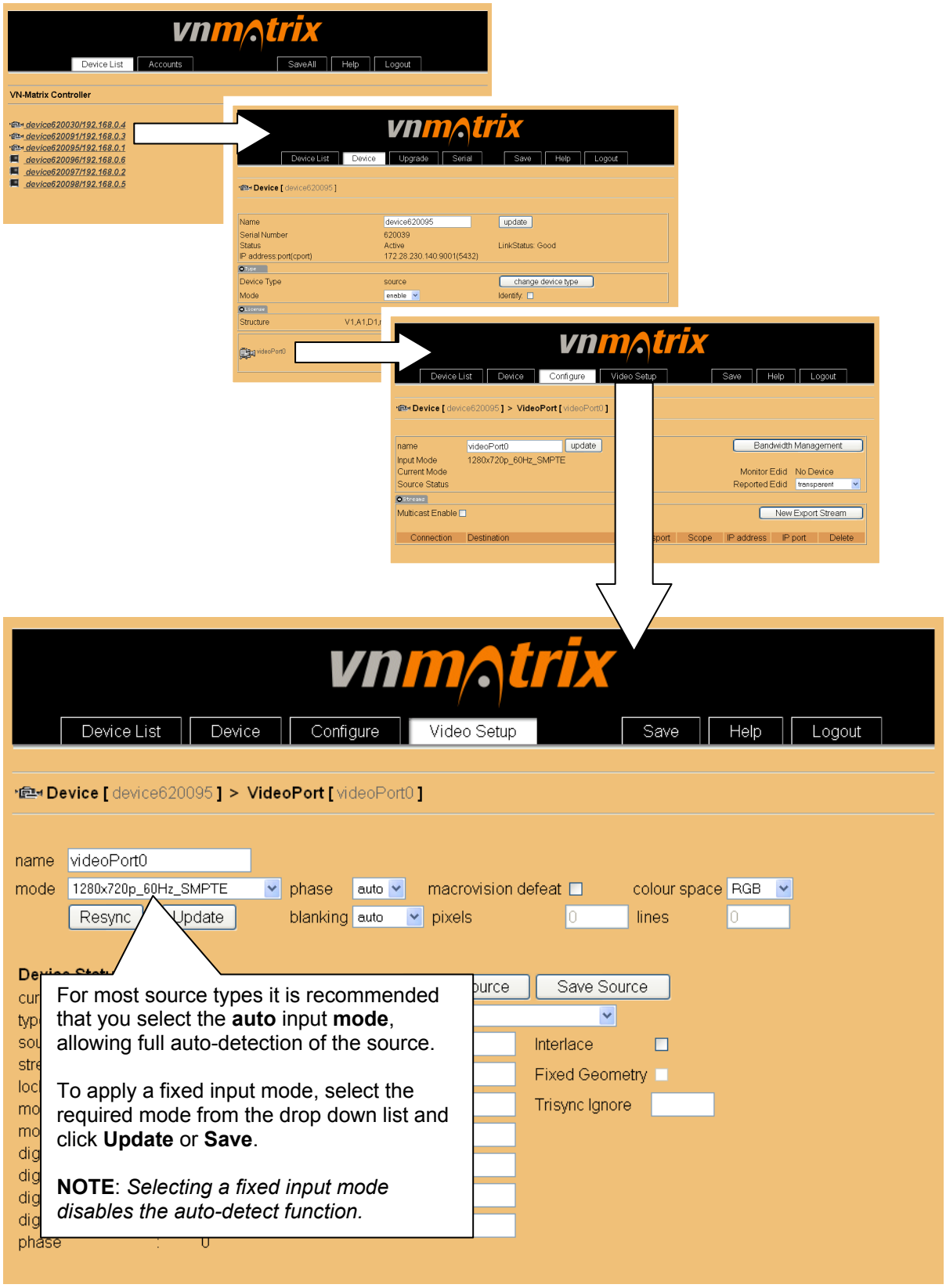
- is an RGsB (sync on green) or YPrPb source type,
- has Macrovision® copy protection,
- does not have a completely standard signal format,

In extreme circumstances, it may even be necessary to create a custom input mode. For example, when a source:

- is completely non-standard,
- has a poor quality signal.

Video Setup Page

All advanced source setup is achieved via the **Video Setup** page. This is accessed by clicking the **Video Setup** tab on the **Configure** (videoPort) page for the relevant VN-MATRIX encoder:



Fine-Tuning a Source (manual overrides)

The following adjustments are classed as manual overrides. The chosen settings are not saved as part of the current source **mode** and, once applied, will remain in force until they are changed.

Phase (Pixel Clock)

When an analog graphics signal is being digitized it is essential that each pixel is sampled as close as possible to its center in order to obtain a stable value. Sampling too close to a pixel boundary will cause unreliable data capture and result in noise or artifacts, especially between pixels of significantly different hue or intensity.

Normally **phase** is set to **auto**. This allows VN-MATRIX to automatically determine the optimum clock phase. If the auto setting proves unsatisfactory for any reason, try adjusting the **phase** manually by selecting a value between **+32** and **-32**. Positive numbers advance the clock phase relative to the start of the active line while negative numbers retard the clock phase.

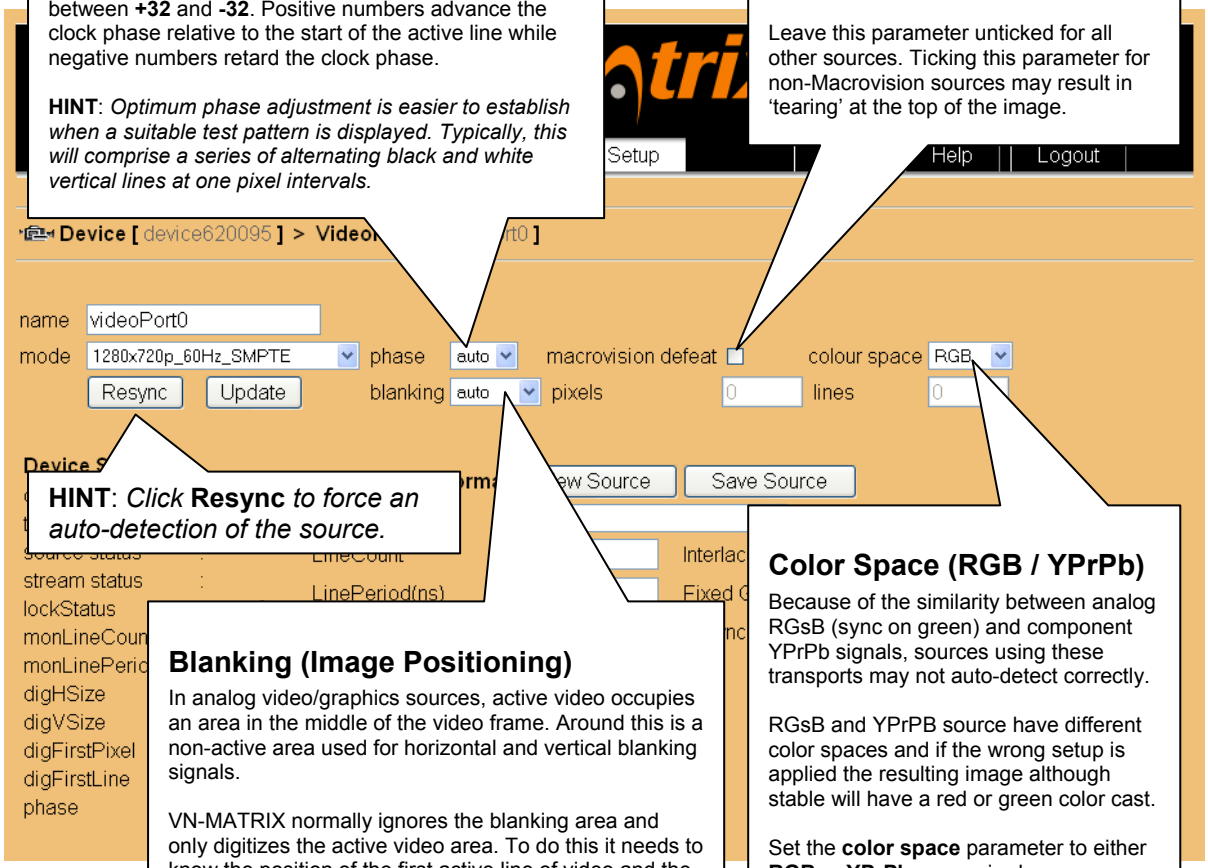
HINT: *Optimum phase adjustment is easier to establish when a suitable test pattern is displayed. Typically, this will comprise a series of alternating black and white vertical lines at one pixel intervals.*

Macrovision Defeat

Macrovision copy protection is often applied to commercially produced videos and DVDs. This adds additional sync-level pulses to the video waveform and these need to be ignored for proper auto-detection on VN-MATRIX.

If you know (or suspect) that your source material has Macrovision encoding, tick the **Macrovision defeat** option on the **Video Setup** page.

Leave this parameter unticked for all other sources. Ticking this parameter for non-Macrovision sources may result in 'tearing' at the top of the image.



HINT: *Click* **Resync** *to force an auto-detection of the source.*

Blanking (Image Positioning)

In analog video/graphics sources, active video occupies an area in the middle of the video frame. Around this is a non-active area used for horizontal and vertical blanking signals.

VN-MATRIX normally ignores the blanking area and only digitizes the active video area. To do this it needs to know the position of the first active line of video and the first active pixel on that line. This is controlled by the **blanking** parameter. This is normally set to **auto** which allows VN-MATRIX to calculate the values automatically.

If required, the calculated values for first line and first pixel can be adjusted by applying a manual offset. To do this set the blanking parameter to **manual** and type a positive or negative integer value into the **pixels** or **lines** fields as required and click **update**.

NOTE: *The offsets are made relative to the current Source Format 'digFirstPixel' and 'digFirstLine' values.*

Color Space (RGB / YPrPb)

Because of the similarity between analog RGsB (sync on green) and component YPrPb signals, sources using these transports may not auto-detect correctly.

RGsB and YPrPB source have different color spaces and if the wrong setup is applied the resulting image although stable will have a red or green color cast.

Set the **color space** parameter to either **RGB** or **YPrPb** as required.

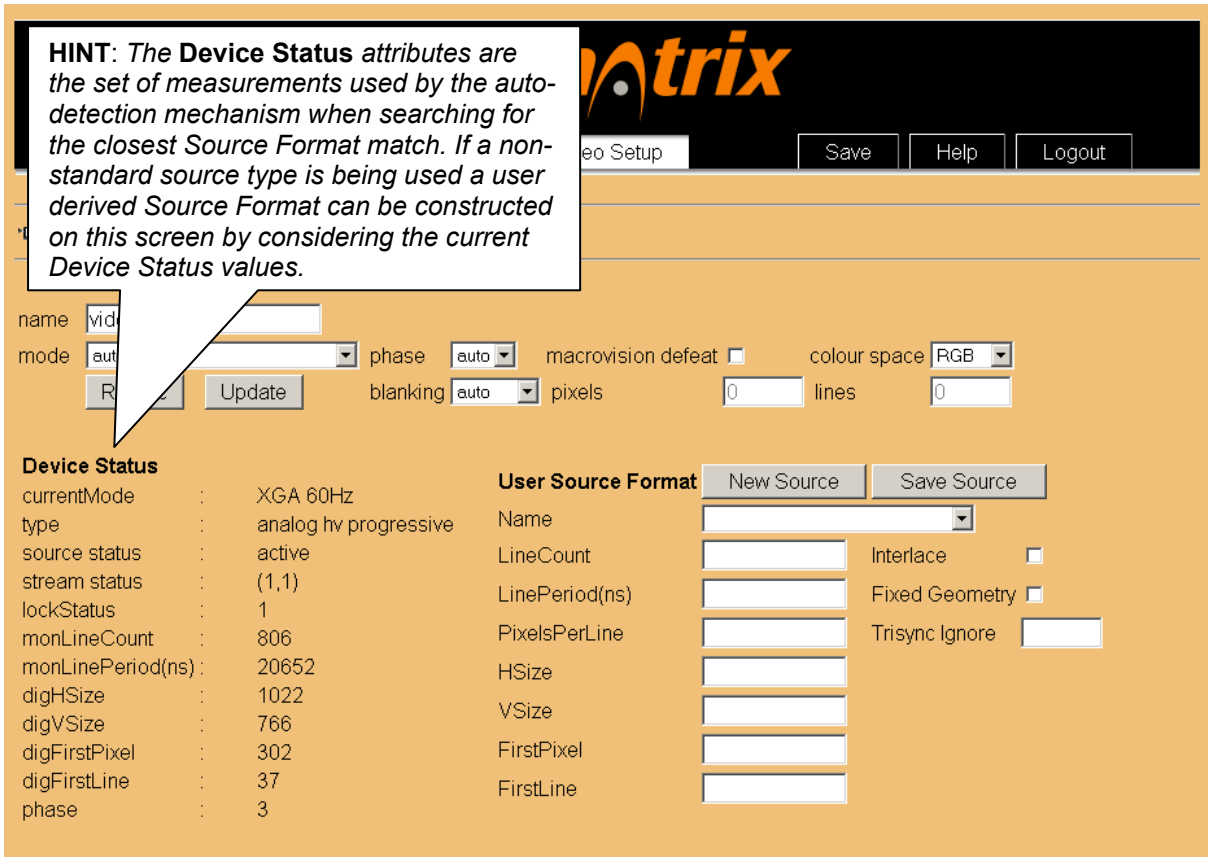
Creating a Custom Input Mode

A custom input mode allows you to specify your own values for the various input parameters, *e.g.* number of lines/pixels of active video, the start line/pixel of active video, etc.

When VN-MATRIX performs an auto-detect on a non-standard source, it will usually be able to choose an existing mode that 'best matches' the source. This will then provide the starting point for you to make adjustments and create your custom mode.

However, if VN-MATRIX cannot find a suitable mode, you will need to obtain technical data about the source to be able to enter the required input parameters.

Custom input modes are created using the Video Setup page (see page 64).

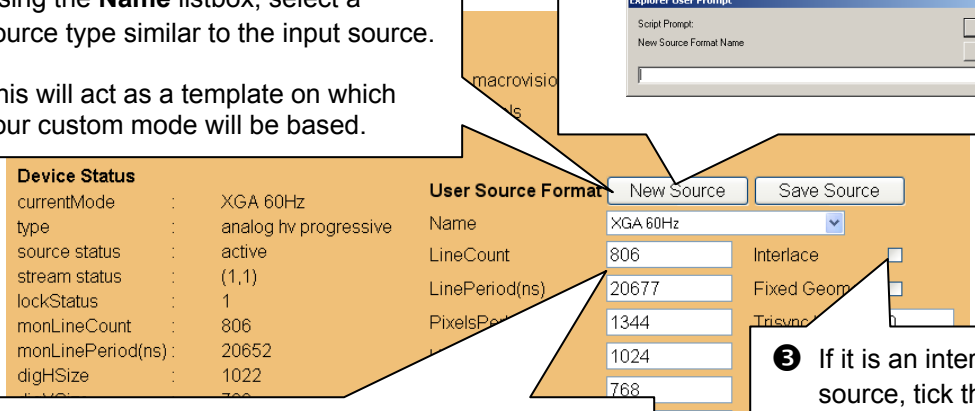


To create a Custom Source Mode…

❶ Using the **Name** listbox, select a source type similar to the input source.

This will act as a template on which your custom mode will be based.

❷ Click the **New Source** button and enter a new name for the new source type in the popup box:



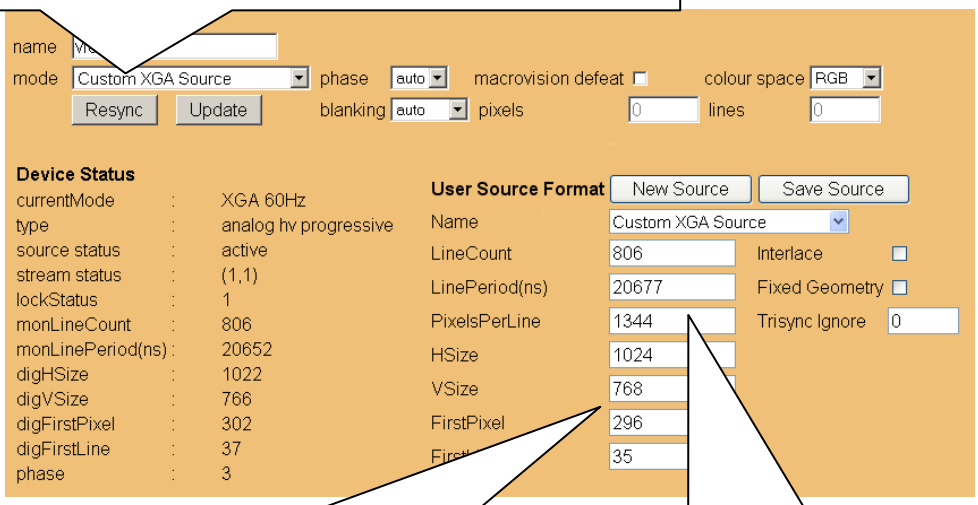
❸ If it is an interlaced source, tick the **Interlace** box. For progressive sources ensure that this box is unticked.

❹ Copy the **monLineCount** value (in the Device Status section) to the **LineCount** field.

Copy the **monLinePeriod** value (in the Device Status section) to the **LinePeriod** field.

❺ Select the new source name in the **mode** pull down. This forces auto-detection to always choose the new mode.

Click **Resync** to force the auto-detection algorithm to select your new mode.



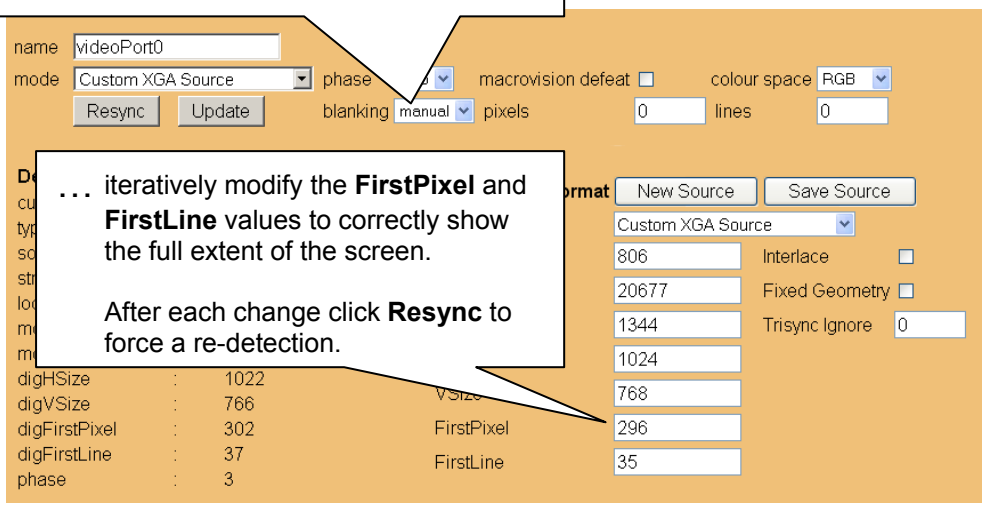
❻ If necessary, modify the **HSize** and **VSize** fields to be the same as the **digHSize** and **digVSize** measurements. These will only reflect the true source values if the screen is showing content across its full extent.

If necessary, modify the **FirstPixel** and **FirstLine** fields to be the same as the **digFirstPixel** and **digFirstLine** measurements.

❼ Iteratively modify the **PixelsPerLine** value and click the **Resync** button.

When the value is correct sampling across a line will not show any aliasing. This is best done using a moire test pattern or with a screen of fine text.

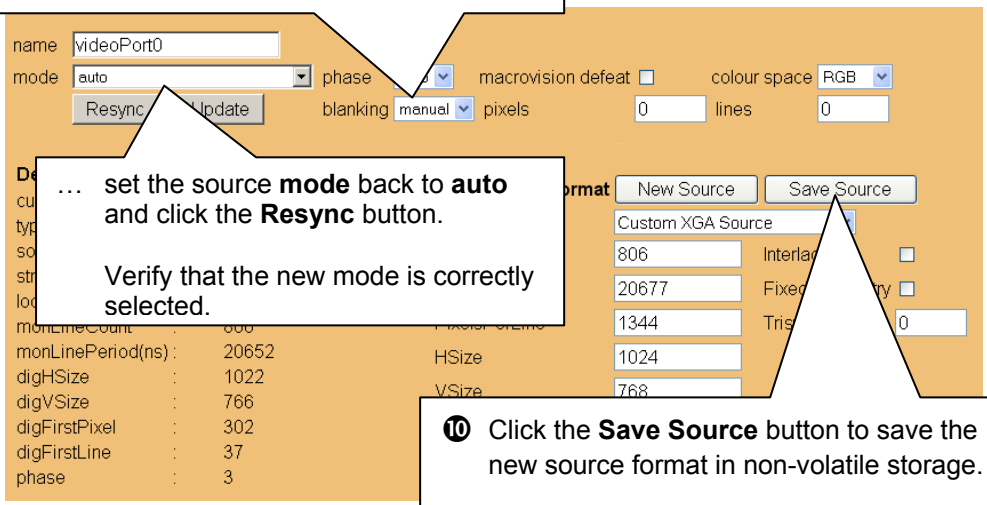
❽ Set **blanking** mode to **manual** and check that the **pixels** and **lines** values are both set to zero. Then…



… iteratively modify the **FirstPixel** and **FirstLine** values to correctly show the full extent of the screen.

After each change click **Resync** to force a re-detection.

❾ Set **blanking** mode back to **auto**. Then…



… set the source **mode** back to **auto** and click the **Resync** button.

Verify that the new mode is correctly selected.

❿ Click the **Save Source** button to save the new source format in non-volatile storage.

NOTE: *Once saved a custom source format is stored on the VN-MATRIX controller device and becomes available to all VN-MATRIX encoder devices.*

Managing Compression & Bandwidth Settings

VN-MATRIX can apply various types of compression to an input source in order to reduce the volume of source data being streamed across the network.

In addition, various parameters are provided to manage and, if necessary, limit the amount of data flow to ensure that the available network bandwidth is not exceeded.

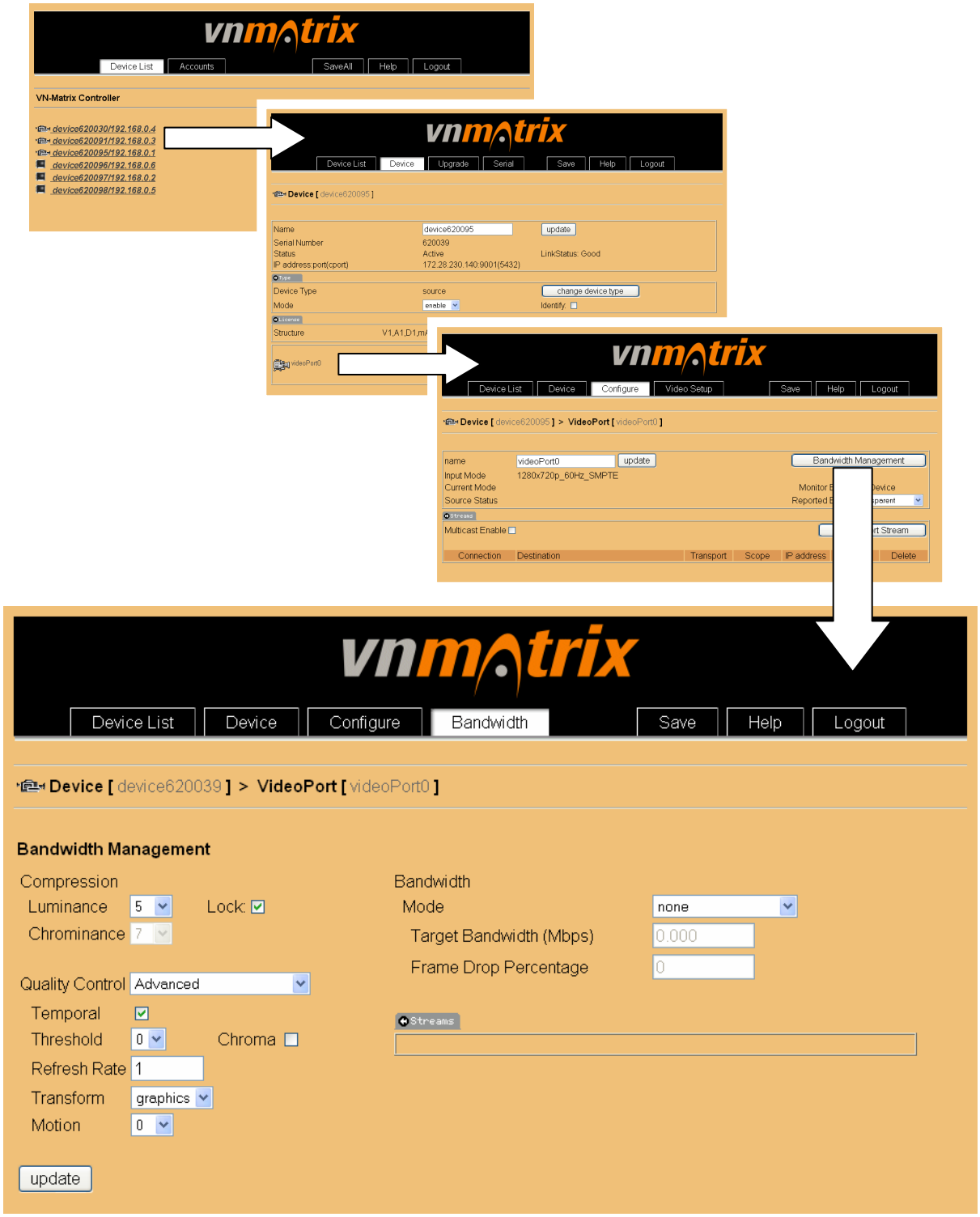
The default compression settings applied by VN-MATRIX offer a good balance between the quality of the displayed material and network bandwidth. Where network bandwidth is restricted, extra compression can be applied. Depending on the source type and content, significant reduction in streamed data can be achieved with little or no perceptible affect on image quality.

Alternatively, where network bandwidth is not an issue, compression can be removed altogether. However, in most cases, there is no real benefit in doing this due to the highly efficient compression algorithms used by VN-MATRIX.

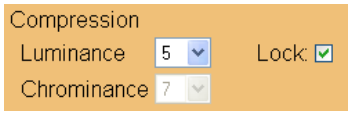
All compression and bandwidth settings are accessed via the Bandwidth Page (see page 70).

Bandwidth (source) Page

All advanced source setup is achieved via the **Bandwidth** (source) page. This is accessed by clicking the **Bandwidth Management** button on the **Configure** (videoPort) page for the relevant VN-MATRIX encoder:



Compression Settings

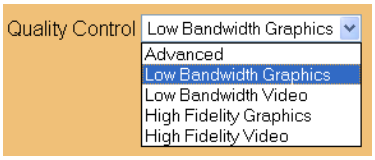


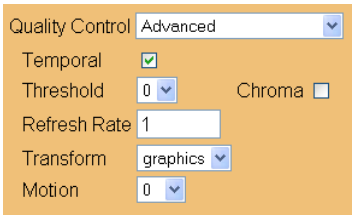
The Luminance and Chrominance settings can be individually modified (**Lock** unchecked) or they can be locked together (**Lock** checked). When locked together the Chrominance tracks the Luminance setting plus 2 stops.

The **Luminance** compression can be modified between 0 and 10, where 0 is no compression and 10 is maximum compression. The picture may look noticeably 'blocky' at higher compression values. A value of **4** is a good compromise for efficiency and visual integrity.

The **Chrominance** compression can be modified between 0 and 11, where 0 is no compression and 11 is maximum compression. Excess screen artifacts will become visible if the chrominance compression is set more than two points above the luminance setting. A value of **6** is a good compromise for efficiency and visual integrity.

Quality Control Settings





These settings control the dynamic nature of the compression system - how the system responds to changes in the source input.

Choose the preset option that best matches the type of imagery and the type of compression to be applied or choose **Advanced** and adjust the settings as follows:

Temporal compression causes areas of the screen to be refreshed only when a change between frames is detected. Enabling temporal compression can significantly reduce network bandwidth. It it best used with the screen refresh capability. For all normal operation it is suggested that temporal compression is enabled.

Threshold controls the sensitivity of the temporal change detection algorithm. A value of 0 means any screen changes will be sent. Increasing the value increases the send threshold and reduces the network bandwidth. A setting of 0 is suitable for DVI computer generated sources. Sources with more noise or video-type motion should use a setting between 1 and 4. Camera sources should always use value greater than 0.

Chroma controls whether the temporal algorithm should consider changes in the color or chrominance of the image. Enabling Chroma gives better results on digital simulation type sources, however Chroma thresholding can increase the transmit bandwidth by up to 200% so it should be disabled on bandwidth sensitive systems. It is usually not required on video/camera type sources.

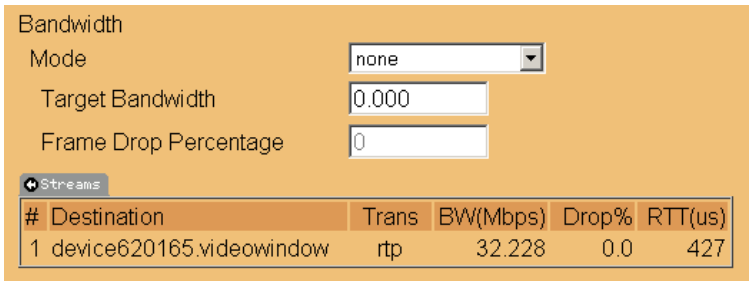
Refresh Rate controls how frequently the non-changing parts of the screen are updated in temporal compression mode. This is useful when connecting new displays to a temporally encoded source and to fill in gaps in the data when using a lossy network transport such as RTP. A value of 1 refreshes the screen in one second, a value of 0.1 refreshes the screen 10 times per second. A value of 0 disables the refresh.

The compression system supports two **Transform** types:

- **Graphics** is optimised for text and sharp lines, such as is present on most computer screens.
- **Video** is optimised for smooth tone changes such as is present in movies and other video content.

Motion compression can be modified between 0 and 15, where 0 is no additional motion compression and 15 is full motion compression. When enabled, where motion is detected on the screen that area is compressed more heavily. This reduces bandwidth at a time when the eye cannot perceive significant detail. When the motion stops the screen area is resent at the standard resolution preserving the screen integrity.

Bandwidth Management Settings



VN-MATRIX can apply various bandwidth management policies and these can be selected using the **Mode** parameter:

- **None** – no bandwidth management policy will be followed apart from the underlying compression settings.

- **Manual Frame Drop** – allows the user to specify the precise fraction of frames to drop. This doesn't manage the bandwidth at a fixed level, but does result in a smoother update given rapidly changing video content types. The percentage of frames to discard is entered into the **Frame Drop Percentage** field. For example, a value of 95 (*i.e*. 95%) will discard 19 out of every 20 frames and will therefore reduce a 60 fps video signal to 3 fps.

  NOTE: *Slowing the frame rate to around 1fps may cause the decoder to behave as if the source stream has been interrupted and it will start flashing up the 'no source' splash screen.*

- **Shared Flowrate** - the total network video traffic for all streams of this source is limited to the flowrate (in kBps) specified in the **Target Bandwidth** field. Frames are dropped if the instantaneous data rate is higher than the flowrate.

- **Peak Flowrate** - the network video-traffic for each stream of this source is limited to the flowrate (in kBps) specified in the **Target Bandwidth** field.. Frames are dropped if the instantaneous data rate is higher than the flowrate.

Flowrate control modes limit the instantaneous traffic on the network and are useful where the network pipe between source and display has limited bandwidth and drops traffic when this rate is exceeded. Non-flowrate control modes limit the average bandwidth but the instantaneous bandwidth can be high. Non-flowrate control modes are best used on a LAN where the user does not wish VN-MATRIX to consume excess bandwidth.

IMPORTANT NOTE: *The bandwidth management is applied to each source data stream separately. Thus actual bandwidth usage will be multiplied by the number of source data streams. For example, if the encoder has two Unicast RTP connections plus a TCP connection, it will actually be sending three data streams across the network.*

The **Streams** list shows network statistics for current RTP streams. For each RTP stream three values are presented: the Transmit Bandwidth (in Megabits-per-second), the packet Drop Percentage and the Round Trip delay Time (in microseconds). The Bandwidth is the true bandwidth of the source measured over the last second. All of this data may not have arrived at the destination if the link shows packets are being dropped. Most networks show a small amount of dropped traffic but when this rises above 5% it indicates the capacity of the link has probably been exceeded. A lightly loaded network will show a fairly constant RTT. When this value starts to rise or fluctuates excessively it indicates the network is congested. Usually when network capacity has just been exceeded the RTT will rise to a large value just before packets start being dropped. The link latency will rise as RTT increases.

The **Streams** box can be hidden/revealed by clicking on the arrow in the tab. When the box is hidden the auto-updating function is suppressed which reduces system load.

Audio Compression

The S/PDIF digital data bus can carry two types of data:

- 2 channel (stereo) uncompressed audio, or
- encoded digital data, typically AC-3 (Dolby Digital) format.

VN-MATRIX supports limited compression of S/PDIF audio sources. This is controlled by the **Compression** setting on the **Configure (audioPort)** page. The following compression options are available:

Compression	2 channel audio source	AC-3 audio source
no compression	24 bit native data (2975 kbps)	24 bit native data (2975 kbps)
compress 1	16 bit data, full sample rate (1517 kbps)	16 bit data, zeros run length encoded (430 kbps)
compress 2	16 bit data, 1/2 sample rate (784 kbps)	16 bit data, zeros run length encoded (430 kbps)
compress 4	16 bit data, 1/4 sample rate (418 kbps)	16 bit data, zeros run length encoded (430 kbps)

NOTE: *The native uncompressed setting passes the full 24 bit payload plus the 4 S/PDIF control bits updating on a continuous frame basis. Other modes only transmit 16 bit data and reduce the S/PDIF control bits update rate to once per second.*

Decoder Set Up

This section provides details for advanced set up options for a VN-MATRIX decoder.

Setting optimum playback delay see page 75
Monitoring bandwidth usage see page 76
Creation of custom output modes see page 78

Setting Optimum Playback Delay

During playback of a source stream, data is transported from a VN-MATRIX encoder across the network and into a buffer on the VN-MATRIX decoder. Data is then read from the buffer and output to the display. Because of the inherent time delay (latency) for data to be transported across the network, it is clearly not possible for the decoder to display the source at exactly the same instant as it is being encoded.

For this reason the VN-MATRIX decoder imposes a Playback Delay to take account of the total data transit time. It also ensures smooth playback of a source stream by equalizing the flow of data into and out of the decoder buffer.

Setting the Playback Delay too small may cause the buffer to 'underrun' (data is read from the buffer quicker than it can be written). This will result in the playback image jumping as network loading changes.

Setting the Playback Delay too large will cause excessive image latency and may, particularly on high bandwidth datastreams, cause the buffer to 'overflow' (data is written to the buffer quicker than it can be read). This will result in 'jumpy' screen updates and screen flashing.

NOTE: *When a source has both a video and audio stream, these are treated separately and can be subject to different processing delays. In many applications this will not present any noticeable issues. However, with some source material, especially where correct 'lip-sync' must be maintained, it may be necessary to set different values for the video and audio Playback Delay.*

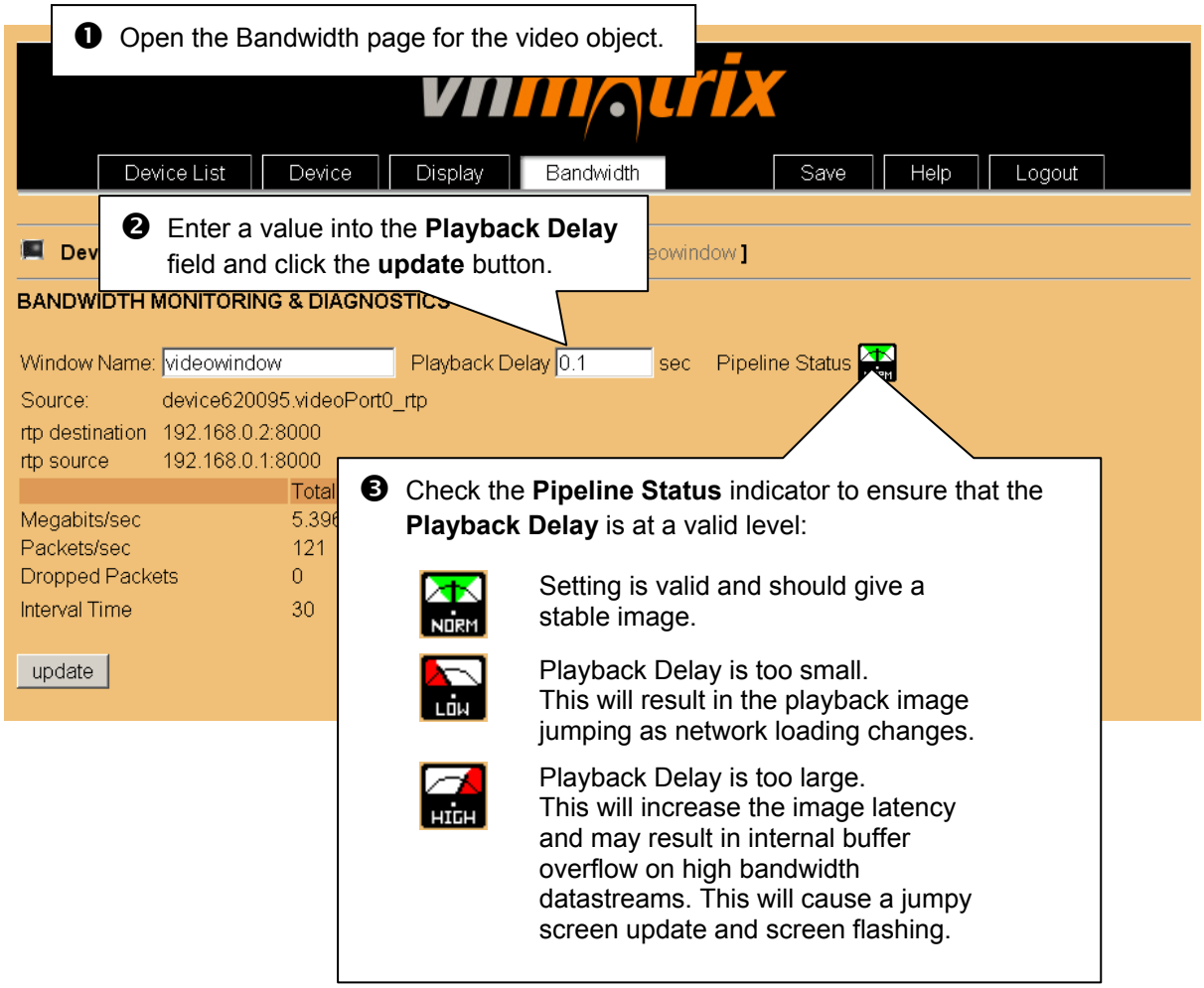
The default Playback Delay is 0.1 seconds which will be suitable for most applications and is the minimum recommended for a 30Hz source (or a 60Hz interlace source). For a 60Hz frame rate source the minimum recommended Playback Delay is 0.05 seconds.

Valid Playback Delay settings can be determined by setting values then checking the Pipeline Status Meter.

Bandwidth Monitoring Page

Playback Delay is adjusted via the Bandwidth page for the VN-MATRIX decoder. This is accessed via the video or audio hyperlink on the Display page:

Adjusting the Playback Delay



❹ If the source also has an audio stream, open the Bandwidth page for the audio object and adjust the Playback Delay in the same way.

HINT: *To achieve lip sync between video and audio streams, adjust the video playback delay first to obtain a 'normal' meter reading, and then adjust playback delay as required.*

Creating a Custom Output Mode

The **Output Format Management** screen allows the user to create bespoke video formats for displaying decoded video data streams.

There are two ways of creating bespoke video display formats:

- Clone an existing mode and modify some parameters
- Type in resolution and refresh rate values and create a CVT or GTF mode

The Cloning Method

An existing video format is cloned by selecting an existing format from the **Name** list box then clicking on **New Format**. A popup dialog will then prompt for a new name. This should be descriptive and ideally include the resolution and frame rate. Once a user video format has been created the various timing fields can be edited. New values are typed into the appropriate fields and pressed to commit the change.

The following graphic indicates the meaning of each term. Only the active video area contains visible content. The borders are normally on screen but do not show content. The two porches and the sync together define the 'screen blanking'. This is a non-visible portion of the signal inserted to give a CRT sufficient time to reset to the start of the next line/frame.

The following relationships must hold:

- **TotalPixels** = ActivePixels + LeftBorder + RightBorder + HorFrontPorch + HorSync + HorBackPorch
- **TotalLines** = ActiveLines + TopBorder + BottomBorder + VertFrontPorch + VertSync + VertBackPorch
- **PixelClock** = TotalPixels * TotalLines * FrameRate
- **Borders** (margins) are typically only used for VGA sized modes

NOTE: *It is difficult to create a video format that will be correctly interpreted by monitors without adhering quite closely to standards. If definitive timing information is not available it is suggested the following CVT/GTF approach is used.*

NOTE: *Interlace modes cannot be created by this or the CVT/GTF method at this time.*

After a suitable video format has been created and tested it can be saved to non-volatile storage by clicking on **Save Formats**. This video format will then be available after a device reset or power cycle.

Unwanted user video formats can be deleted by selecting the video format to delete and clicking on **Delete**. A **Save Formats** operation is then required to delete this format from non-volatile storage.

The CVT/GTF Method

GTF and the newer CVT are a standardized approach to creating video formats.

To select a GTF format the user must input Active Pixels, Active Lines, Frame Rate and the margins flag, then click the **GTF** button . All other fields will then be filled in with the nearest suitable GTF video format.

A CVT video format is similarly selected. However CVT also supports the reduced blanking flag. Reduced blanking allows LCD panels, which do not require as long a blanking period as CRTs, to support a higher resolution for any fixed maximum pixel clock rate.

After a suitable video format has been created and tested it can be saved to non-volatile storage by clicking on **Save Formats**. This video format will then be available after a device reset or power cycle.

Unwanted user video formats can be deleted by selecting the video format to delete and clicking on **Delete**. A **Save Formats** operation is then required to delete this format from non-volatile storage.

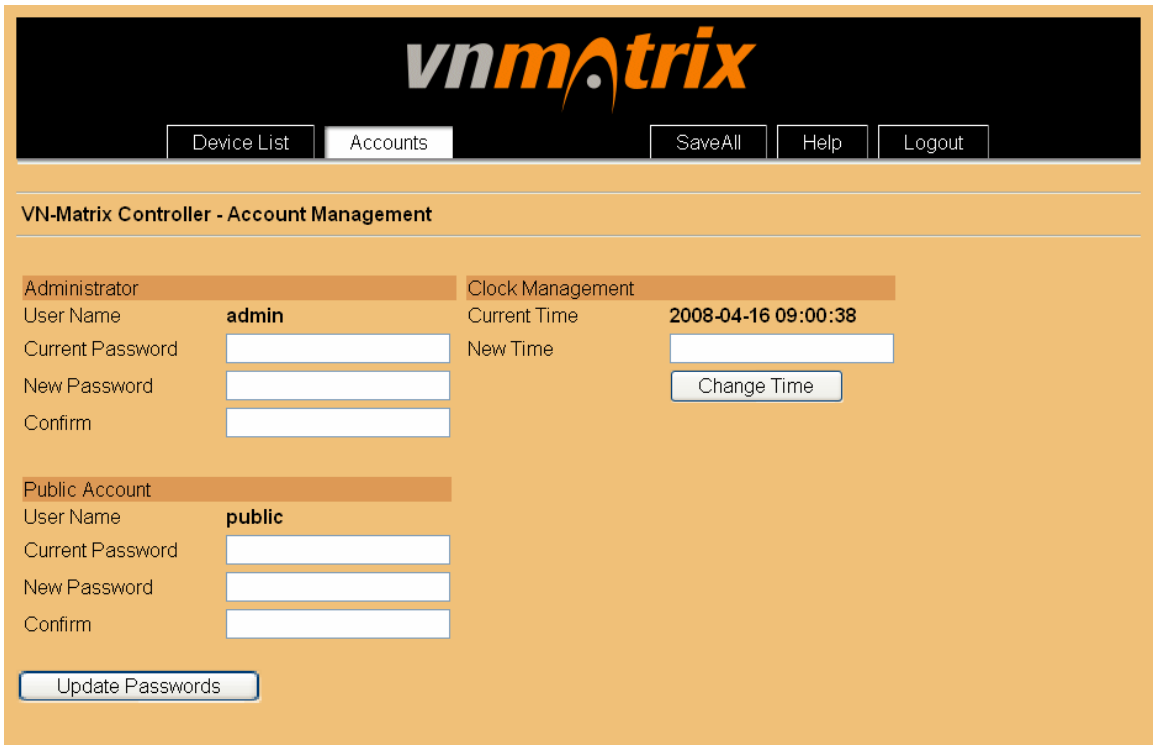
System Set Up

Changing User Login Passwords

☞ Login to the Web Interface (see page 41).

☞ From the **Device List** page click the **Accounts** tab.

The following page will appear:



VN-MATRIX has two user accounts:

- **admin** – which allows full *read/write* access to all setup parameters,
- **public** – which allows *read only* access to setup parameters.

☞ Enter the **Current Password** for the user account you want to change.

☞ Then enter the new password in both the **New Password** and **Confirm** fields.

NOTE: *The password can include letters, numbers and the underscore character, and is case-sensitive.*

☞ Click the **Update** button to save the change. The new password will be required the next time you login.

Upgrading Device Firmware

From time to time Electrosonic may issue firmware upgrades for VN-MATRIX, in order to make new functionality available. Details if the latest firmware release will be published on our website.

Upgrades are supplied in a single file, named in the format '**upgrade_ver3.3c.tar**' where 'ver3.3c' is the version number. Before you start you will need to copy the upgrade file on to the computer that you use to access the VN-MATRIX controller.

The update process is split into the following stages:

Stage	Function Summary	Performed On
UPLOAD	Copy the upgrade file from the control PC to a temporary storage area on the VN-MATRIX Controller	The VN-MATRIX Controller only
PREPARE	Unpack and copy the new firmware (from the controller) into the VN-MATRIX alternate flash memory.	Each VN-MATRIX device including the controller
ACTIVATE	Reboot the VN-MATRIX to start using the new firmware. This is a temporary mode that allows you to test the new firmware. If you encounter any problems you can 'back out' of this mode and return to the previous firmware version.	Each VN-MATRIX device including the controller
COMMIT	Reboot the VN-MATRIX to start using the new firmware permanently.	Each VN-MATRIX device including the controller

All stages of the upgrade process are carried out using the Web Interface. It is recommended that all VN-MATRIX units in the same system are upgraded to the same firmware version to ensure full compatibility.

IMPORTANT NOTES:

- *Performing the ACTIVATE function on the controller will cause the device to reboot and as a result the upgrade file (in the temporary storage are) will be erased. It is recommended, therefore, that you PREPARE **all** devices first, after which the upgrade file will no longer be needed. Then perform the ACTIVATE function on each device, commencing with the controller.*

- *The ACTIVATE function must be performed on the controller device **first**, such that the new firmware is in control of upgrading the remaining devices.*

- *When performing ACTIVATE or COMMIT on the controller, the device will reboot.*
  This will cause temporary loss of the Web Interface, since this is provided by the controller.
  Wait for 30 seconds to allow the device time to reboot, then 'refresh' the browser.

To upload the firmware file to the VN-MATRIX controller…

☞ Login to the Web Interface (see page 41).

☞ From the **Device List** page click on the VN-MATRIX controller device.

☞ From the **Device** page click the **Upgrade** tab. The **Upgrade** page will appear:

☞ Click the **Browse** button to navigate to the required upgrade file, or type the path and filename directly into the field provided.

☞ Click the **Upload** button to begin uploading the file to the VN-MATRIX controller. This may take a few minutes.

☞ Once the file is uploaded, you can begin installing it into each unit (as described on page 84) starting with the controller unit.

To install the new firmware into each VN-MATRIX unit…

IMPORTANT NOTE: *You must upgrade the VN-MATRIX controller first. Please note, however, that once you go past the READY TO ACTIVATE stage the unit will reboot and the upgrade file will be erased from the controller. It is recommended, therefore, that you get ALL devices to the READY TO ACTIVATE stage before completing the controller upgrade, otherwise you will need to upload the file again (as described on page 83).*

☞ From the **Device List** page click on the VN-MATRIX unit that you want to upgrade.

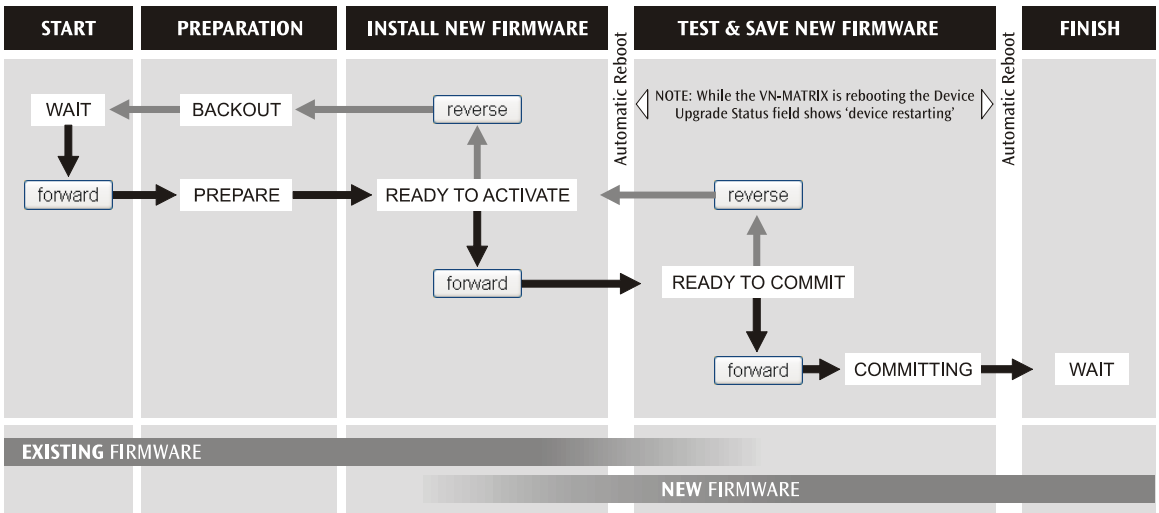
☞ From the **Device** page click the **Upgrade** tab. The **Upgrade** page will appear.

☞ Click the **Select Firmware Version** listbox and choose the new firmware file you want to install. Usually there will only be one file listed (*i.e*. the file that you uploaded using the procedure on page 83).

The remainder of the installation procedure is achieved using the **forward** and (if necessary) **reverse** buttons, to move the installation between the various stages. The current stage/status is indicated by the **Device Upgrade Status** field.

The process allows you to temporarily install and test the new firmware and, if everything is OK, you can then permanently install (commit) the new firmware. Up until the last stage it is possible to return to the existing firmware version.

The process is summarized in the following diagram:



☞ Click the **forward** button. The Device Upgrade Status field will show **PREPARE** and percentage progress. This stage may last a few minutes.

HINT: *The chosen firmware version is confirmed in the Upgrade Version field.*

☞ When **READY TO ACTIVATE** appears, click the **forward** button again.

☞ The unit will then reboot. Once rebooted the Device Upgrade Status field will show **READY TO COMMIT** and the VN-MATRIX will be using the new firmware. Test for correct operation.

☞ If everything is working correctly, click **forward** again to permanently install the new firmware. The Device Upgrade Status field will show **COMMITING** and percentage progress. This stage may last a few minutes.

*If you experience any problems, click **reverse** to return to the previous stage*.

☞ When the Device Upgrade Status field returns to **WAIT** the unit is ready for use.

Changing a Device Licence

Each VN-Matrix unit is supplied with a default level of functionality which can be upgraded by obtaining a special license key from Electrosonic.

A license key comprises two elements – a 'structure' and a 'checksum'. These are entered using the **License** page which is accessed via the **license management** button on the **Device** page:

☞ Enter the **New Structure** and **New Checksum** information exactly as supplied.

☞ Click the **Update Licence** button.

SECTION 5:

Serial Transport & Control Methods

Overview

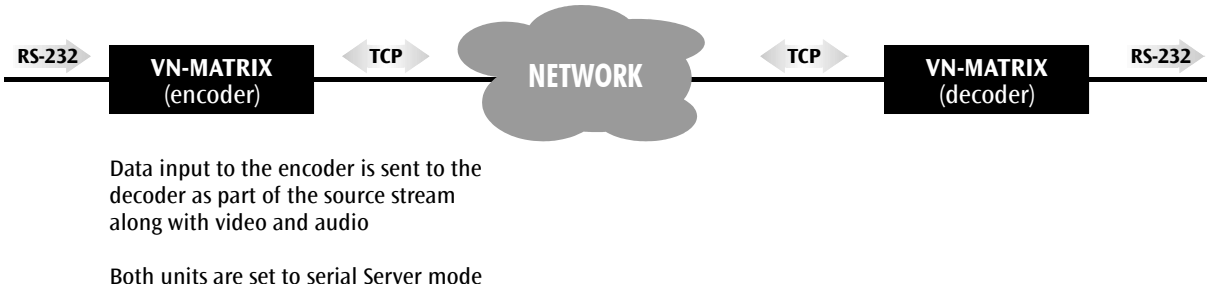
Routing of external serial (RS-232) communications can be achieved between any VN-MATRIX units on the same network.

Serial traffic can be unidirectional as part of a source stream (encoder to decoder) – Data Stream Mode - or bi-directional and independent of any source stream – Passthrough Mode.

In addition, serial commands can be sent via any VN-MATRIX device to the VN-MATRIX controller, allowing dynamic control of system parameters – Remote Control Mode.

Data Stream Mode

In this mode, data received by an encoder is transported to the decoder, along with video and audio, as part of the source stream. Data transport in this mode is unidirectional and is capable of being recorded (and played back) by VN-RECORDER.



Serial ports on each VN-MATRIX need not share a common baud rate. However, where a large amount of data is sent from a high speed to a low speed data link, some form of handshaking/flow control may be required to prevent buffer overflow on the output device. Standard flow control methods are fully supported.

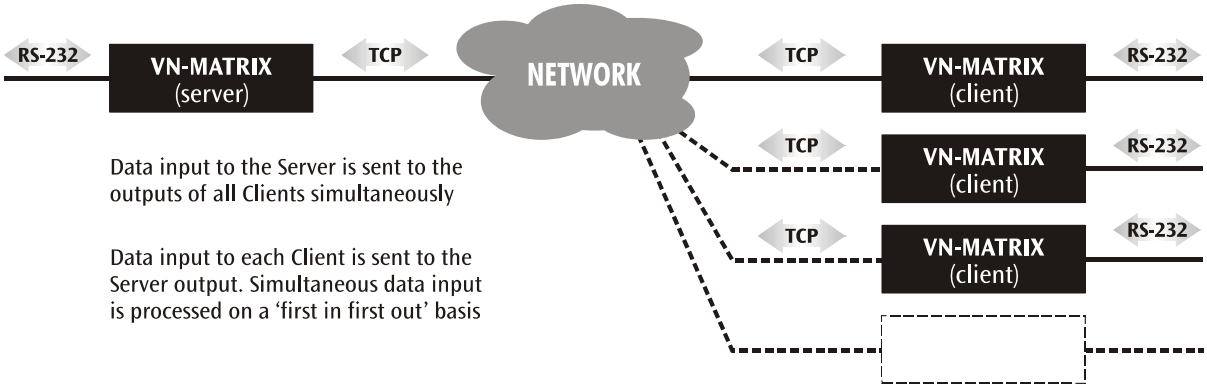
IMPORTANT: *No data will be transported until the decoder 'connects' to the encoder stream.*

To set up a serial data stream, see page 90.

Passthrough Mode

In this mode, data received by a device 'input' is transmitted using TCP/IP over the network and then converted back to serial data by a device 'output'. Data flow is fully bi-directional and totally independent of whether a VN-MATRIX is configured as an encoder or decoder.

One device within a passthrough group is designated as a server. One or more devices are then 'connected' as clients (in passthrough mode):



Serial ports on each VN-MATRIX need not share a common baud rate. However, where a large amount of data is sent from a high speed to a low speed data link, some form of handshaking/flow control may be required to prevent buffer overflow on the output device. Standard flow control methods are fully supported.

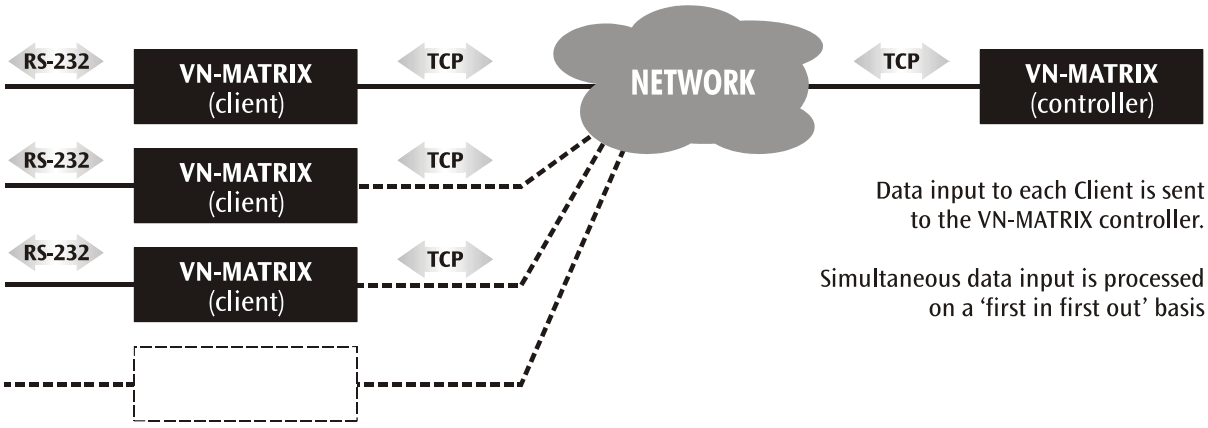
Any number of serial passthrough groups may exist on the same network.

To set up a serial passthrough group, see page 91.

Remote Control Mode

In addition to ‘passthrough’ operation outlined above, a VN-MATRIX serial input can be configured to communicate directly with the VN-MATRIX controller. This provides basic serial ‘remote control’ functionality of a VN-MATRIX system, such as display source switching. A full list of serial commands can be found on page 93.

One or more devices are designated as clients (in remote control mode). Data received by a device ‘input’ is then automatically transmitted using TCP/IP over the network to the VN-MATRIX controller:



Serial remote control functionality is totally independent of whether a VN-MATRIX is configured as an encoder or decoder.

To set up a remote control group, see page 92.

Setting-up a Serial Data Stream

☞ Login to the Web Interface (see page 41).

☞ From the **Device List** page click on the required encoder device.

☞ From the **Device** page click the **Serial** tab to display the following:

☞ Using the **mode** listbox select the **server** option.

☞ Change the other settings (*e.g.* baud rate) as required, then click the **Save** tab.

☞ Return to the **Device List** and do the same for the decoder device.

IMPORTANT: *No data will be transported until the decoder 'connects' to the encoder stream.*

Setting-up a Serial Passthrough Group

☞ Decide which VN-MATRIX unit is to be the server in the passthrough group and which will be the client(s), and connect your serial devices to the VN-MATRIX COM2 ports accordingly.

Remember, communication can only take place between server and client(s), not between clients.

☞ Login to the Web Interface (see page 41).

☞ From the **Device List** page click on the device you want to configure as the server.

☞ From the **Device** page click the **Serial** tab to display the following:

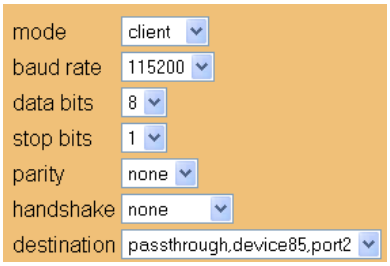
☞ Using the **mode** listbox select the **server** option.

☞ Change the other settings (*e.g.* baud rate) as required, then click the **Save** tab.

Then, for <u>each</u> client in the group…

☞ Return to the **Device List** page (by clicking on the Device List tab).

☞ Click on the device you want to configure as a client, then click the **Serial** tab.



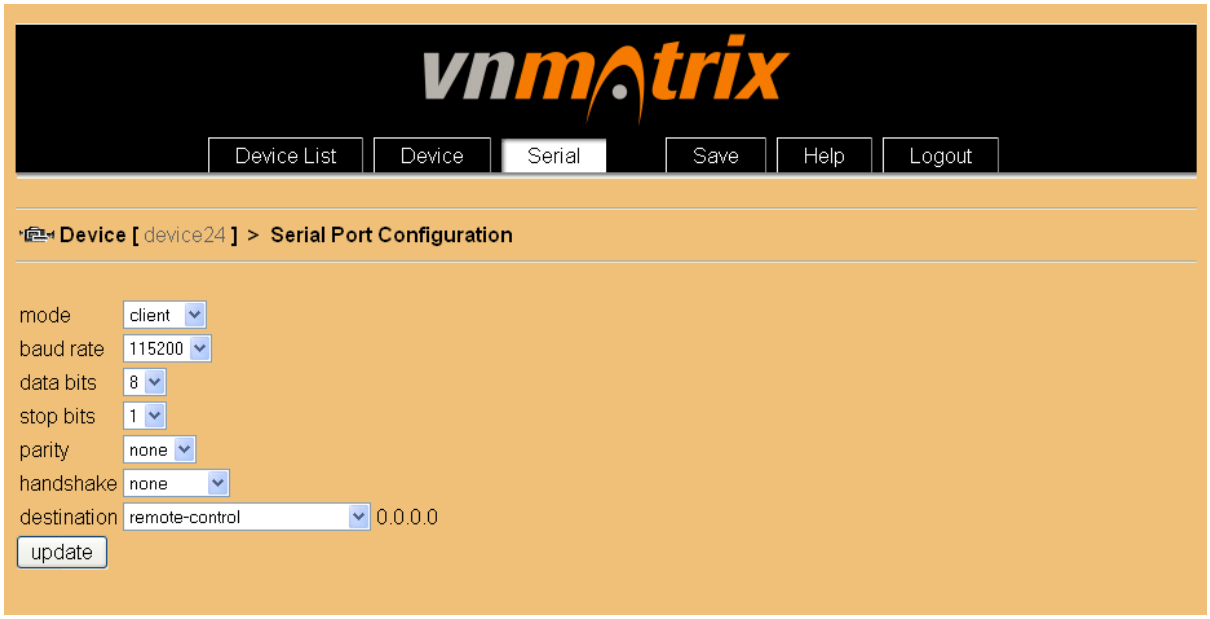
☞ Using the **mode** listbox select the **client** option (note that this will reveal the **destination** box).

☞ Using the **destination** listbox select **passthrough** for the appropriate server.

☞ Change the other settings (*e.g.* baud rate) as required, then click the **Save** tab.

Setting-up a Remote Control Group

- ☞ Decide which VN-MATRIX unit(s) will act as the remote control client(s) and connect your serial control device(s) to the VN-MATRIX COM2 port(s) accordingly.
- ☞ Login to the Web Interface (see page 41).
- ☞ From the **Device List** page click on the device you want to configure as a remote control client.
- ☞ From the **Device** page click the **Serial** tab to display the following:



- ☞ Using the **mode** listbox select the **client** option.
- ☞ Using the **destination** listbox select the **remote-control** option.
- ☞ Change the other settings (*e.g.* baud rate) as required, then click the **Save** tab.

Serial / Telnet Commands

The following commands can be used to provide basic remote control of a VN-MATRIX system.

Commands can be issued either as part of a serial remote control configuration (see page 89) or by using a Telnet application via the network (see page 106).

In either case, a control session must first be initiated by sending a valid username and password.

All commands must be terminated (actioned) with a ‘new line’ character (carriage return not required). In programs such as Telnet, this is accomplished by pressing the Enter key.

Control Session Commands

user *<username>*

Initiates a user login. To be able to change system settings you must login using the ‘admin’ user account.

EXAMPLE: **user admin**

pass *<password>*

Specifies the password for the user account. By default this will be ‘admin’ but may have been changed using the Web Interface (see page 81).

EXAMPLE: **pass admin**

exit

Terminates the current remote control session.

Device Commands

mode *<deviceid> <state>*

Changes the operating mode of the specified device.

<deviceid> is the device serial number of the device or the user-defined device name.

<state> is the required mode and can be set to:

enable – for normal operation
disable – to stop encoder source streaming or stop display output on a decoder
standby – to stop encoder source streaming or display splash screen on a decoder

EXAMPLE: **mode 16 enable**

channel *<deviceid> <window> <sourceid.videoport.protocol>*

Changes the source being displayed in a window of the specified decoder device.

<deviceid> is the device serial number of the device or the user-defined device name.

<window> is the window object number. Currently this can only be **0**.

<sourceid.videoport.protocol> is the source to be displayed, where:

source id is the serial number of the source device,
videoport is the video input number, usually set to **0**,
protocol specifies either RTP or TCP, set to **0** for RTP or **1** for TCP.

NOTE: Full stops (**.**) are required between the *sourceid, videoport* and *protocol* values.

EXAMPLE: **channel 17 0 16.0.1**

optimization *<deviceid> <videoport> <mode>*

Changes the compression transform for the specified encoder device.

<deviceid> is the device serial number of the device or the user-defined device name.

<videoport> is the video input number, usually set to **0**.

<mode> is the source transform to be used and can be set to:

video – for video sources
graphics – for graphics sources

EXAMPLE: **optimization 16 0 video**

bandwidth *<deviceid> <videoport> <bandwidth>*

Changes the target bandwidth value for the specified encoder device.

<deviceid> is the device serial number of the device or the user-defined device name.

<videoport> is the video input number, usually set to **0**.

<bandwidth> is the bandwidth value in Megabits per second.

EXAMPLE: **bandwidth 16 0 5**

Response Messages

All commands (except for **user** and **exit**) will generate an **ok** response message if the command is successfully executed.

Unrecognized commands or invalid command parameters will generate an error message in the format **fail:** followed by a brief description of the error, for example **fail: unknown command**.

SECTION 6:

Remote Keyboard & Mouse Operation

Overview

When a PC source is being viewed by a VN-MATRIX decoder, remote keyboard and mouse control of the source PC can be achieved via the decoder unit.

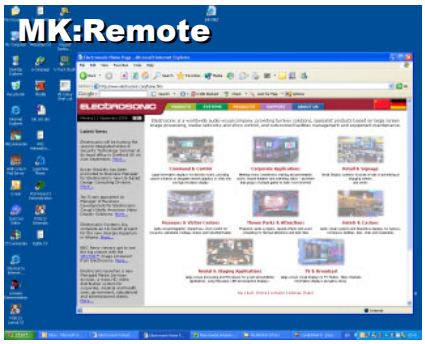
For remote keyboard and mouse functionality to be possible:

- The keyboard and mouse ports of the source PC must be fully connected to the VN-MATRIX encoder (as shown on page 37 or 38),
- A keyboard and mouse must be connected to the VN-MATRIX decoder (as shown on page 39 or 40), and
- The decoder must currently be viewing the PC source.

To initiate a remote control session…

☞ Using the keyboard attached to the VN-MATRIX decoder, press the **Scroll Lock** key twice, followed by the **F1** key.

*The **source** monitor will briefly show* **MK:Remote** *in the top left-hand corner…*



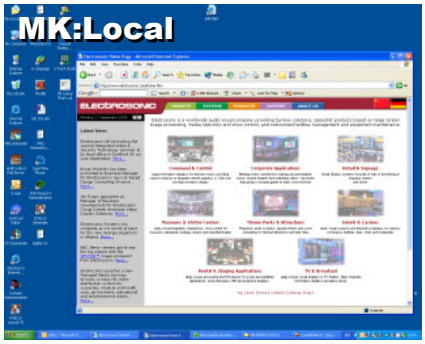
*The **display** monitor will briefly show* **MK:Forward** *in the top left-hand corner…*

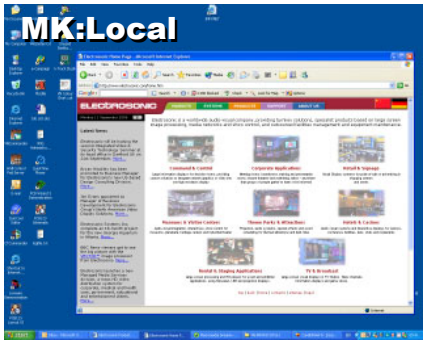
NOTE: *Local keyboard and mouse control of the source will be disabled. See below for instructions on regaining local control.*

To terminate a remote control session…

☞ Using the keyboard attached to the VN-MATRIX decoder or encoder, press the **Scroll Lock** key twice, followed by the **F2** key.

*Both the **source** monitor and **display** monitor will briefly show* **MK:Local** *in the top left-hand corner…*





SECTION 7:

Technical Data

VN-MATRIX Hardware

Mechanical Data

Overall Dimensions:	*Width:*	215mm (8.47 inches)	
	Depth:	308mm (12.17 inches)	[*including rear sockets*]
	Height:	44mm (1.74 inches)	[*excluding feet*]
		53mm (2.09 inches)	[*including feet*]
Average Weight:	1.4 kg (3.1 lbs)		

Operating Conditions

Ambient Temperature:	5°C to 35°C (41°F to 95°F).
Ambient Humidity:	85% maximum (non-condensing).
Location:	Free-standing or 19” Rack-mounting (using approved kit).
Cooling Method:	Internal fan (temperature controlled speed).

Power Supply

VN-MATRIX

Supply Voltage:	12V DC Regulated (via Mains Adapter)
Supply Current:	6A max.

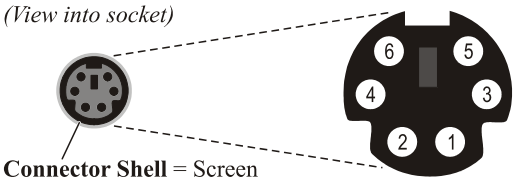
MAINS ADAPTER

Supply Voltage:	100 – 240V AC nominal.
Supply Frequency:	50 – 60 Hz nominal.
Supply Current:	0.45A maximum.
Supply Inlet Connector:	IEC320 (C14).
Supply Mating Connector:	IEC320 (C13); suitable 2m (6ft) mains cord supplied.

Connectors

Keyboard/Mouse (PS/2)

Function: Keyboard and mouse pass-through connections for source computer.
Connector Type: 6-pin mini-DIN (female)
Pin-out Details:



Pin	Function
1	Data
2	No connection
3	Ground
4	+5V supply*
5	Clock
6	No connection

** 5V on pin 4 limited to 200mA by thermal fuse.*

Mating Connector: 6-pin mini-DIN (male).
Recommended Cable: Supplied screened PS/2 cable.
Max. Cable Length: 2.95 metres (9.5 feet).

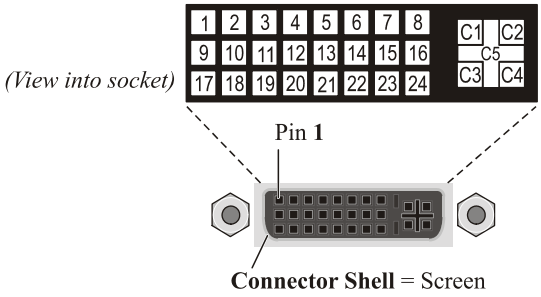
Digital Audio I/O (SPDIF IN and OUT)

Function: Input and Output/Loop-Through for digital audio.
Connector Type: RCA Phono Socket

Mating Connector: RCA Screened Phono Plug
Recommended Cable: 75Ω co-axial.
Max. Cable Length: 10 metres (32 feet)

DVI Input (IN)

Function: Digital or analog video input for encoding.
Connector Type: DVI-I (female).
Pin-out Details:



Digital Connections

Pin	Function	Pin	Function	Pin	Function
1	TMDS 2-	9	TMDS 1-	17	TMDS 0-
2	TMDS 2+	10	TMDS 1+	18	TMDS 0+
3	Ground (2/4)	11	Ground (1/3)	19	Ground (0/5)
4	*nc*	12	*nc*	20	*nc*
5	*nc*	13	*nc*	21	*nc*
6	DDC Clock	14	+5V supply*	22	Ground (Clk)
7	DDC Data	15	Ground (for 5v)	23	TMDS Clock+
8	Analog V-Sync	16	Hot Plug Detect	24	TMDS Clock-

** 5V supply is provided by VN-MATRIX and limited by 200mA polyswitch.*
All ground pins are linked internally.

Analog Connections

Pin	Function
C1	Red Signal
C2	Green Signal
C3	Blue Signal
C4	Horizontal Sync
C5	Ground

NOTE:
Analog Vertical Sync is on pin 8.

Mating Connector: DVI-D or DVI-I (male).
Recommended Cable: Supplied DVI cables.
Maximum Cable Length: 2.95 metres (9.5 feet).
Signal Type: DVI (PanelLink® TMDS).
Pixel Clock (DVI sources): Up to 162MHz.
Analog Sources: VGA 640x480 @ 60,72,75,85Hz
SVGA 800x600 @ 56,60,72,75,85Hz
XGA 1024x768 @ 60,72,75,85Hz
1152x864 @ 75Hz
SXGA 1280x1024 @ 60,75,85Hz
UXGA 1600x1200 @ 60Hz

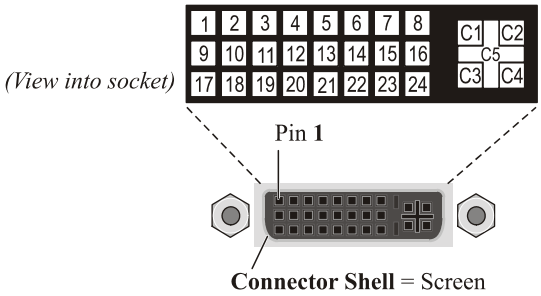
Color Depth: 24-bit maximum.
Scan Mode: Progressive.
DVI Standard: DVI 1.0
Display Data Channel Standard: DDC2B.
DDC Levels: V_{IH} = 2.4V
V_{OH} = 0.9V
$I_{LOADMAX}$ = 2mA

DVI Output (OUT)

Function: Loop-through video connection providing buffered output of the DVI IN connector.

Connector Type: DVI-I (female).

Pin-out Details:



Digital Connections

Pin	Function	Pin	Function	Pin	Function
1	TMDS 2-	9	TMDS 1-	17	TMDS 0-
2	TMDS 2+	10	TMDS 1+	18	TMDS 0+
3	Ground (2/4)	11	Ground (1/3)	19	Ground (0/5)
4	*nc*	12	*nc*	20	*nc*
5	*nc*	13	*nc*	21	*nc*
6	DDC Clock	14	+5V supply*	22	Ground (Clk)
7	DDC Data	15	Ground (for 5v)	23	TMDS Clock+
8	Analog V-Sync	16	Hot Plug Detect	24	TMDS Clock-

** 5V supply is provided by VN-MATRIX and limited by 200mA polyswitch.*
All ground pins are linked internally.

Analog Connections

Pin	Function
C1	Red Signal
C2	Green Signal
C3	Blue Signal
C4	Horizontal Sync
C5	Ground

NOTE:
Analog Vertical Sync is on pin 8.

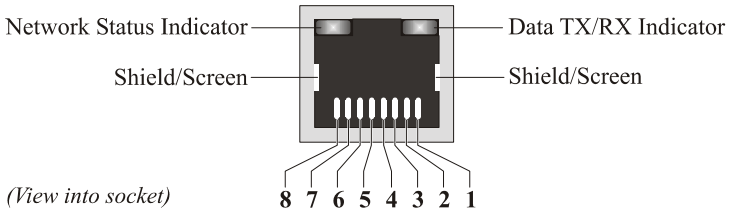
Mating Connector: DVI-D or DVI-I (male).
Recommended Cable: Supplied DVI cables.
Maximum Cable Length: 2.95 metres (9.5 feet).
Signal Type: DVI (PanelLink® TMDS).
Pixel Clock (DVI sources): Up to 162MHz.
Analog Sources: VGA 640x480 @ 60,72,75,85Hz
SVGA 800x600 @ 56,60,72,75,85Hz
XGA 1024x768 @ 60,72,75,85Hz
1152x864 @ 75Hz
SXGA 1280x1024 @ 60,75,85Hz
UXGA 1600x1200 @ 60Hz
Color Depth: 24-bit maximum.
Scan Mode: Progressive.
DVI Standard: DVI 1.0
Display Data Channel Standard: DDC2B.
DDC Levels: V_{IH} = 2.4V
V_{OH} = 0.9V
$I_{LOADMAX}$ = 2mA

Network (I and II)

Function: Two separate network ports (labeled as I and II). Port I is used for primary network connectivity (for data transport and configuration). Port II is reserved for future expansion.

Connector Type: Shielded RJ-45 Socket.

Pin-out Details:



Pin	Function	Pin	Function
1	TX_D1+ (TX+)	5	BI_D3–
2	TX_D1– (TX–)	6	RX_D2– (RX–)
3	RX_D2+ (RX+)	7	BI_D4+
4	BI_D3+	8	BI_D4–

Mating Connector: Shielded RJ-45 Plug.

Recommended Cable: CAT 5E or CAT 6 Shielded twisted pair (STP).

Max. Cable Length: 100 metres (330 feet).

Comms Standard: 10/100/1000BASE-T (Gigabit Ethernet)

Ethernet (MAC) Address: Each address is unique and in the format 00:E0:AA:10:*xx*:*yy* where *yy* is in the range 00 – FF and the same on both ports and *xx*:is a hex value in the range 00 – 0A for port I and 10 – 1B for port II.

For example: Port I: 00:E0:AA:10:00:18
Port II: 00:E0:AA:10:10:18

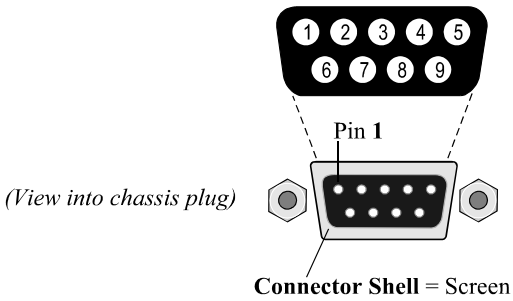
IP Address: Factory-set default is:
Port I: 192.168.0.1.
Port II: 192.168.1.12 (reserved for future use).
Both are user-definable via the serial interface.
Optional DHCP mode.

RS-232 Serial I/O (COM1 and COM2)

Function: COM1 – used for low level setup or system recovery.
COM2 – used for cross-network serial communications or serial remote control of the VN-MATRIX controller.

Connector Type: 9-pin D-type (male)

Pin-out Details:



Pin	Function	Pin	Function
1	DCD	6	DSR
2	RX (data in)	7	RTS
3	TX (data out)	8	CTS
4	DTR	9	RING
5	Ground		

Mating Connector: 9-pin D-type (female) with metal cover

Recommended Cable: 6-core plus overall screen (low capacitance), 0.22mm^2 min. per core.

Max. Cable Length: 2.95 metres (9.5 feet).

Comms Standard: RS-232.

COM1 Default Setting:

Baud:	115200
Bits:	8
Parity:	None
Stop Bits:	1
Flow Control:	None

Serial Interface – Quick Reference

COM2 Port Settings

Baud rate:	115200
Data bits:	8
Parity:	None
Stop bits:	1
Flow control:	None

Login Procedure

☞ From the Login: prompt, type **config** followed by the <enter> key.

☞ When prompted for a password type **config** followed by the <enter> key.

The following menu will then appear.

```
      Network Port 1                          Network Port 2
      ==============                          ==============
 1. Boot method: static [dhcp]          11. Boot method: static [dhcp]
 2.   address:       192.168.0.18       12.   address:    192.168.1.18
 3.   netmask:       255.255.255.0      13.   netmask:    255.255.255.0
 4.   gateway:       192.168.0.1
 5.   broadcast:     192.168.0.255      15.   broadcast:  192.168.1.255
 6. mtu:             1500               16. mtu:          1500
 7. controller ip:   192.168.0.18
 8. controller port: 5432               18. webserver port: 80
 9. Exit
```

☞ Type the menu option number required followed by the <enter> key.

☞ Where required, type the new value followed by the <enter> key.

☞ To exit the menu and return to the main command prompt type **9** <enter>

Command Options

The following commands are also supported from the main command prompt:

Exit	to logout from the session
Reboot	to force the VN-MATRIX device to restart
Ping	to test network communications with another device (see page 127).

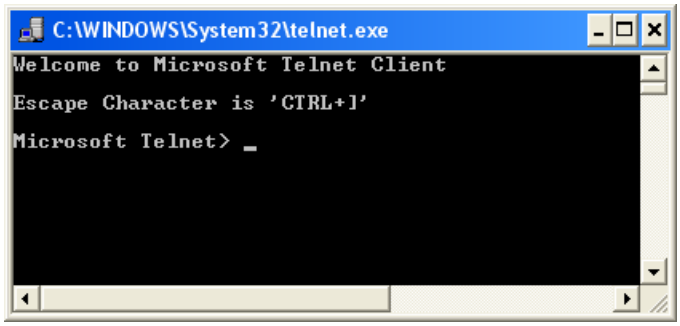
Telnet Interface – Quick Reference

Starting Telnet

☞ Click the Windows **Start** button and click on **Run**.

☞ In the **Open** box type **telnet** then press the<enter> key.

The telnet application will start in a separate window:



Login Procedure

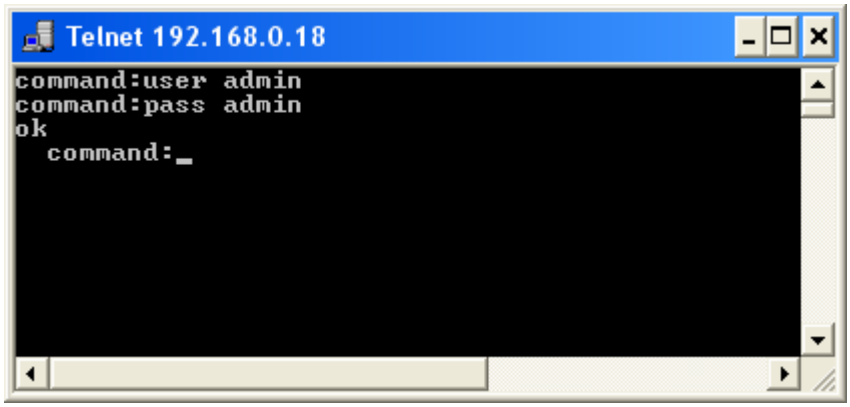
☞ At the prompt type **open** followed by the ip address of the VN-MATRIX controller and the telnet port number (9999), then press <enter>. For example:

open 192.168.0.18 9999 <enter>

☞ At the **command:** prompt type **user admin**, then press <enter>.

☞ Then type **pass** followed by a space and the appropriate password, then press <enter>.

*By default the password is **admin**, but this can be changed via the web interface, see page 81).*

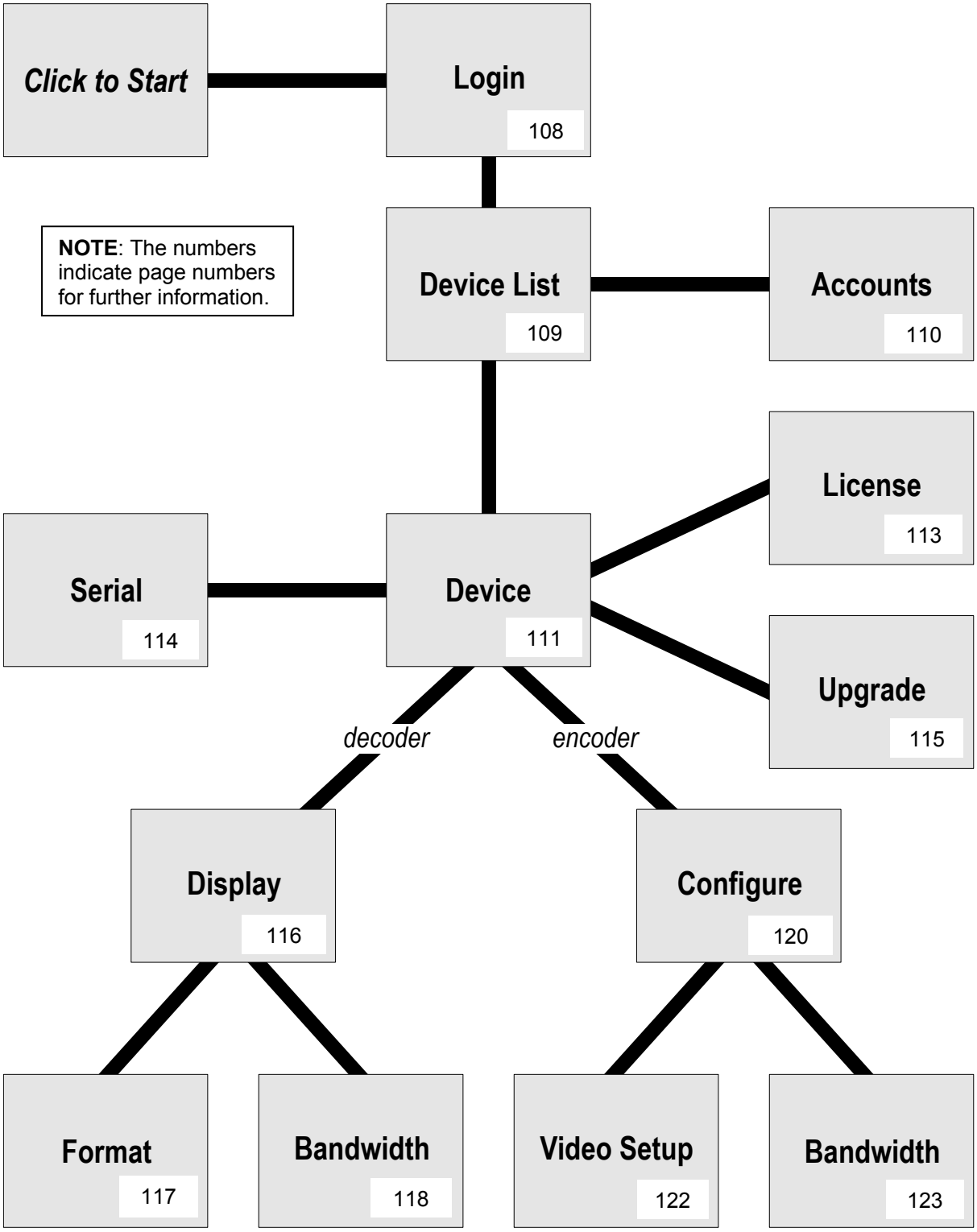


☞ Type further commands as required (see pages 93 to 95 for command options).

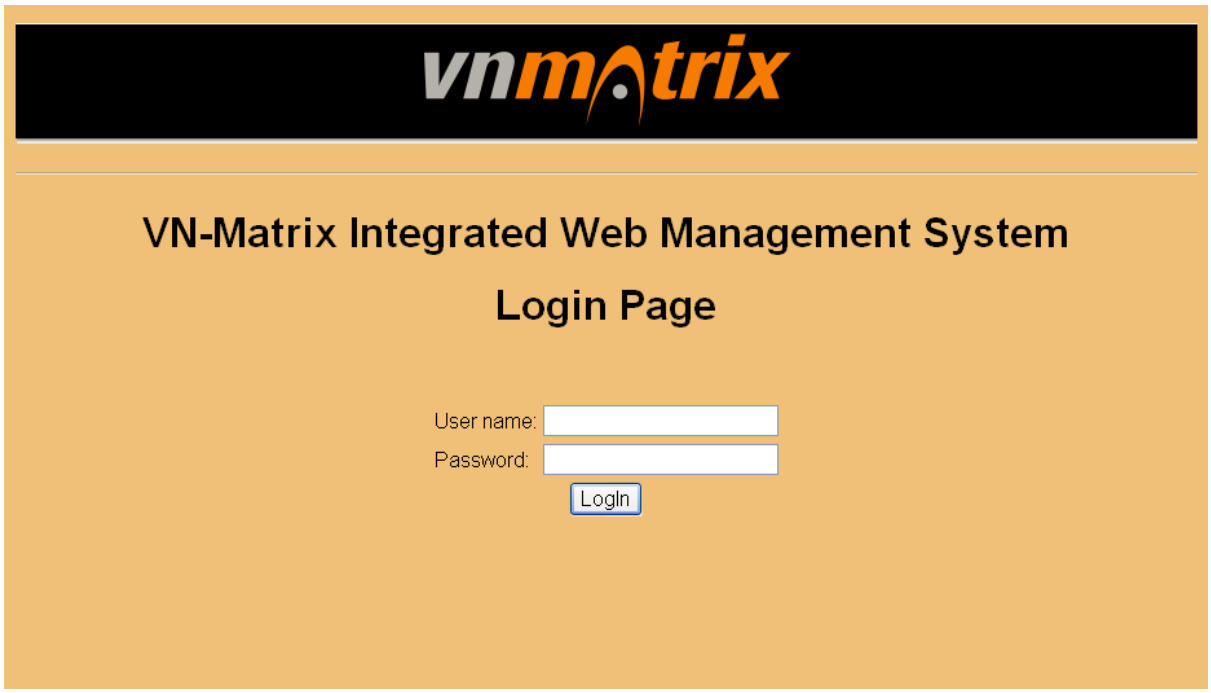
☞ To logout type **exit** followed by <enter>.

Web Interface – Quick Reference

Menu Structure



Login Page



Use this page to:

- Login to the Web Interface (see page 41)

Device List Page

Use this page to:

- Select a device to configure (click on the appropriate device link)
- Save all current device settings (click the **Save All** tab)
- Switch to the Accounts page (click the **Accounts** tab)
- Refresh the device listing (click the **Device List** tab)

The current configuration status of each device is also identified by an icon:

unconfigured

a VN-MATRIX configured as a decoder (display)

a VN-MATRIX configured as an encoder (source)

a computer configured as a VN-MATRIX Recorder

NOTE: *Once a VN-MATRIX device has been detected and been listed on the Device List, an entry will be displayed even if the device is subsequently disconnected. All valid devices are listed by device name and followed by their current IP address. 'Offline' devices (that couldn't be contacted by the controller) are easily identified by the lack of an IP Address. In the above example, 'device620098' is currently offline.*

For further information:

- Refer to the online help (click the **Help** tab)

Accounts Page

Use this page to:

- Change user account passwords (see page 81)
- Change the date and/or time on the VN-MATRIX controller (not required for normal encoder/decoder applications of VN-MATRIX)

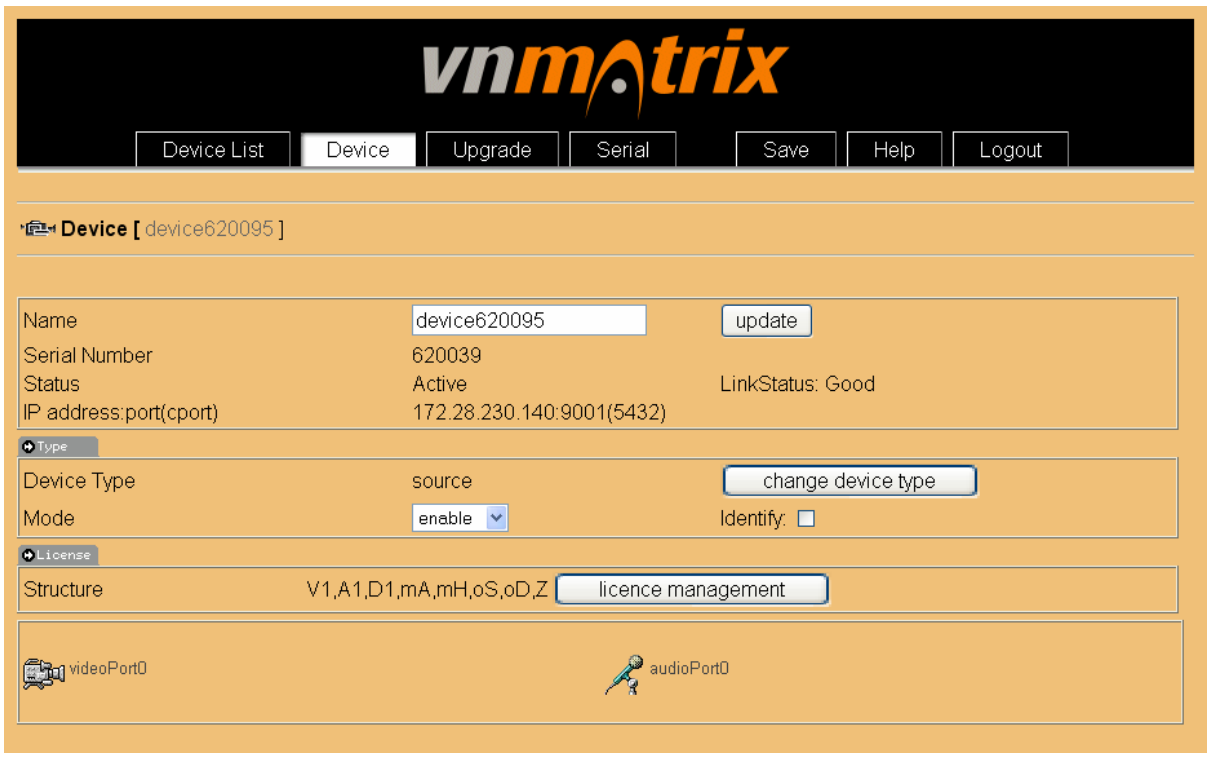
For further information:

- Refer to the online help (click the **Help** tab)

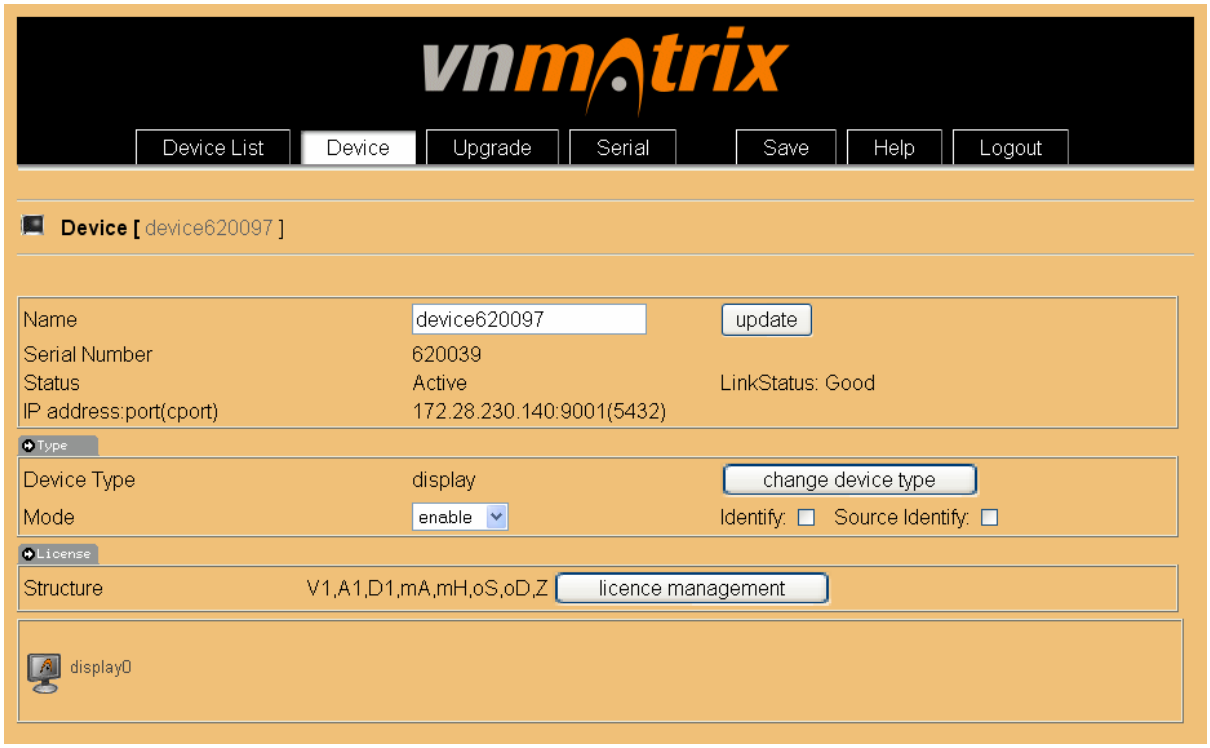
Device Page

Undefined Device Type:

Source/Encoder Device Type:



Display/Decoder Device Type:



Use this page to:

- Configure VN-MATRIX as an Encoder (see page 46)
- Configure VN-MATRIX as a Decoder (see page 51)
- Change the device type (click **change device type** button)
- Change the device name (edit the **Name** field)
- Change the device mode (edit the **Mode** field)

- Switch to configuration pages (click on **videoPort0**, **audioPort0** or **display0** links)
- Switch to Upgrade page (click the **Upgrade** tab)
- Switch to Serial configuration page (click the **Serial** tab)

For further information:

- Refer to the online help (click the **Help** tab)

License Page

Use this page to:

- Enter a new licence key to add functionality (see page 85)

For further information:

- Refer to the online help (click the **Help** tab)

Serial Page

Use this page to:

- Setup cross-network serial communications (see page 91 and 92)

For further information:

- Refer to the online help (click the **Help** tab)

Upgrade Page

Use this page to:

- Upgrade the VN-MATRIX firmware (see page 82)

For further information:

- Refer to the online help (click the **Help** tab)

Display Page

Use this page to:

- Set up the Decoder (see page 51)
- Change the Display object name (edit the **Name** field)
- Enable/disable splash screen when no source is connected (use **Nodata Splash** checkbox).
- Switch to Bandwidth Monitoring page (click on **video** or **audio** link)

For further information:

- Refer to the online help (click the **Help** tab)

Format Page

Use this page to:

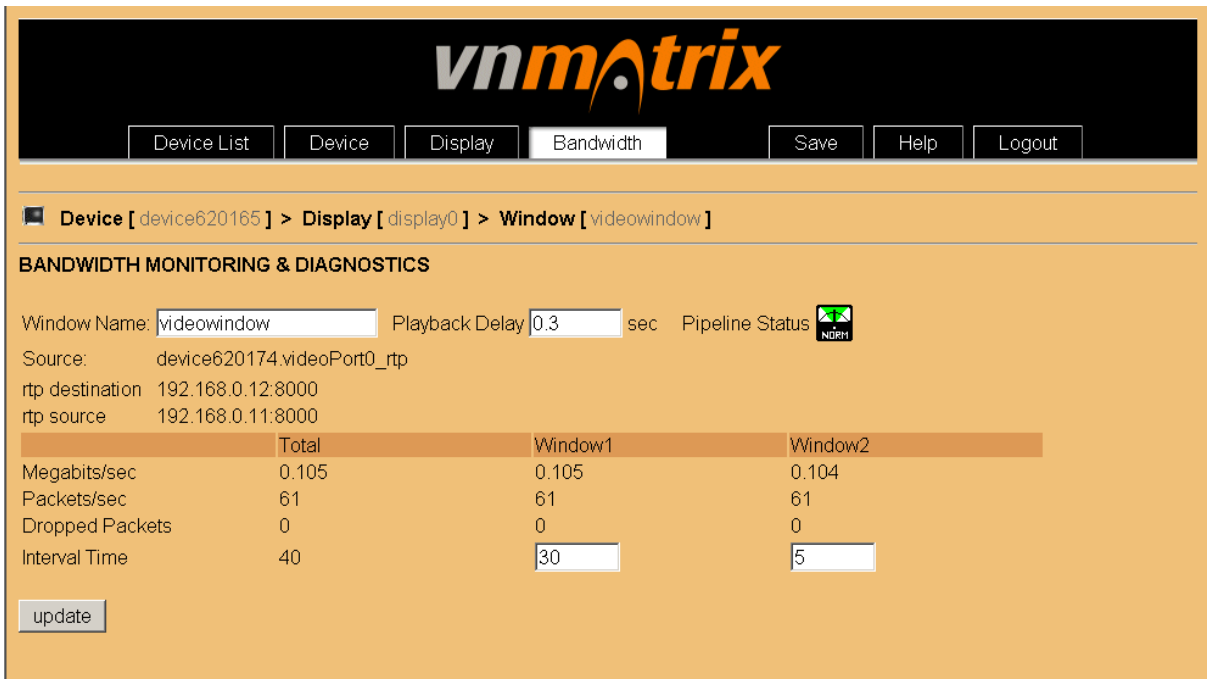
- Create custom output modes for a VN-MATRIX decoder (see page 78)

For further information:

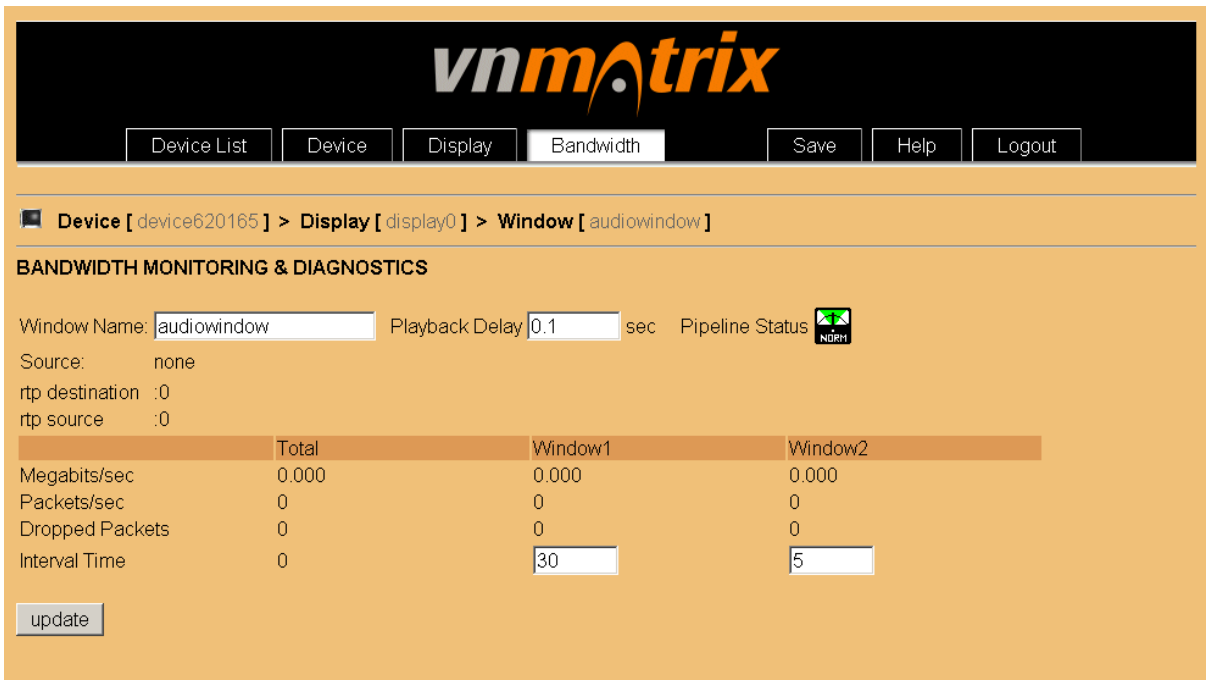
- Refer to the online help (click the **Help** tab)

Bandwidth Page (display)

Video Object Selected:



Audio Object Selected:



Use this page to:

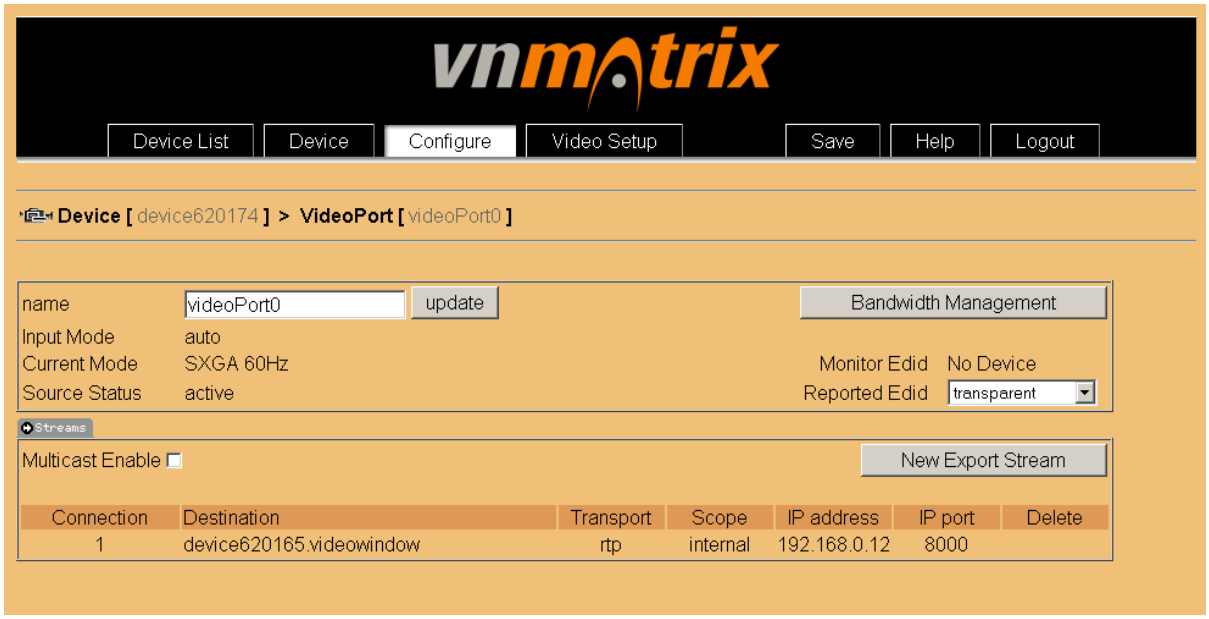
- Change the Window object name (edit the **name** field)
- Optimize Playback Delay (see page 77)
- Monitor window bandwidth and diagnostic information

For further information:

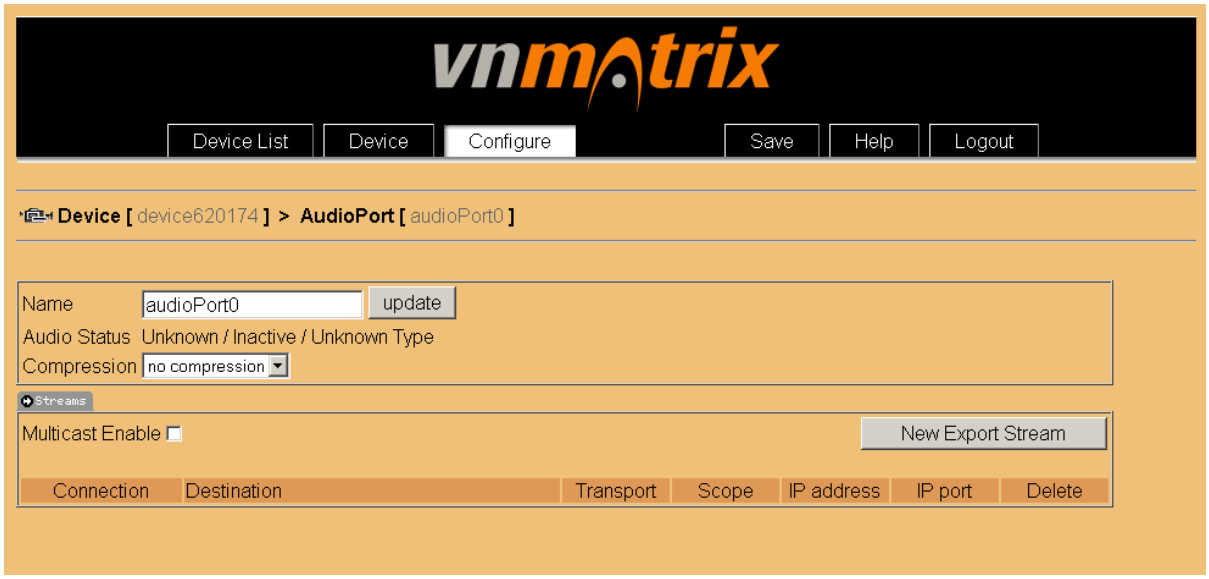
- Refer to the online help (click the **Help** tab)

Configure Page

Video Port Selected:



Audio Port Selected:



Use this page to:

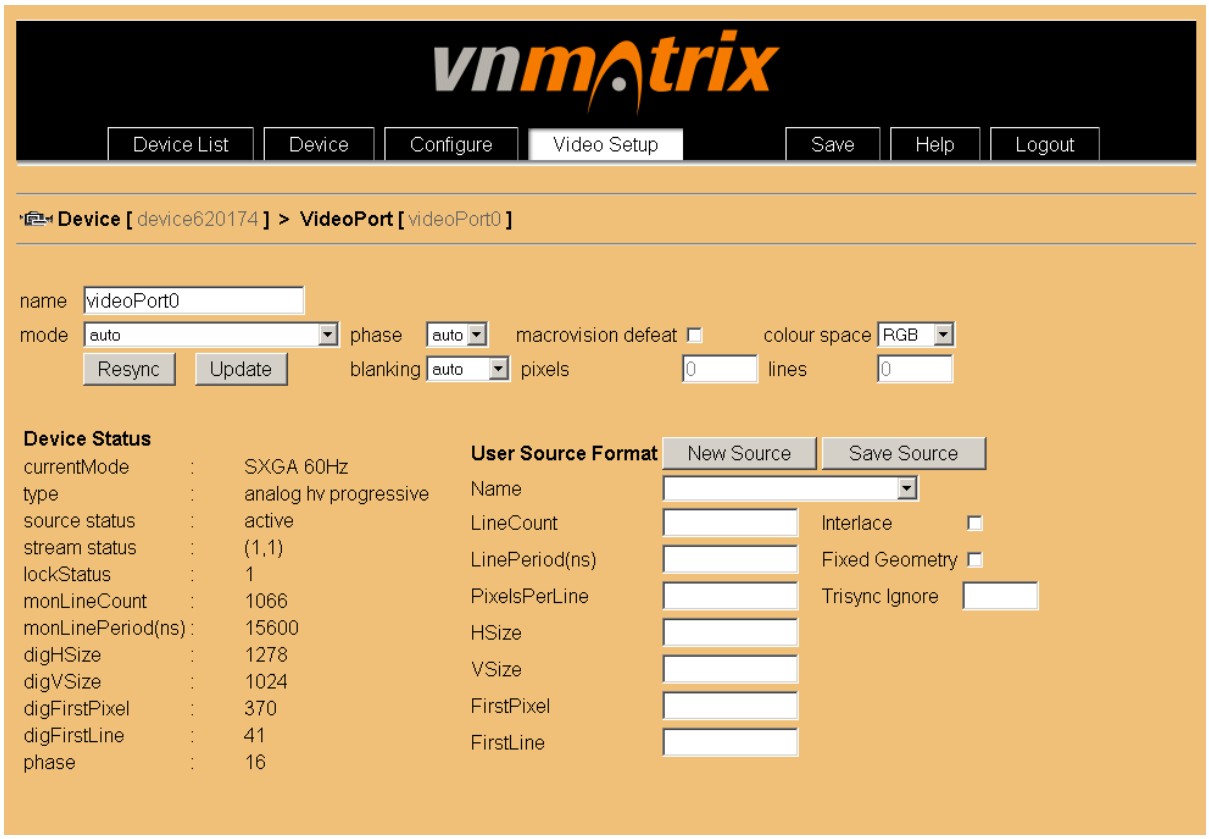
- Setup the source input for an encoder (see page 46)
- Change the videoPort object name (edit the **Name** field)
- Change the input mode (edit the **Input Mode** field)

- Switch to the Video Setup page (click the **Video Setup** tab)
- Switch to the Video Bandwidth & Compression Management page (click on the **Bandwidth Management** button)

For further information:

- Refer to the online help (click the **Help** tab)

Video Setup Page



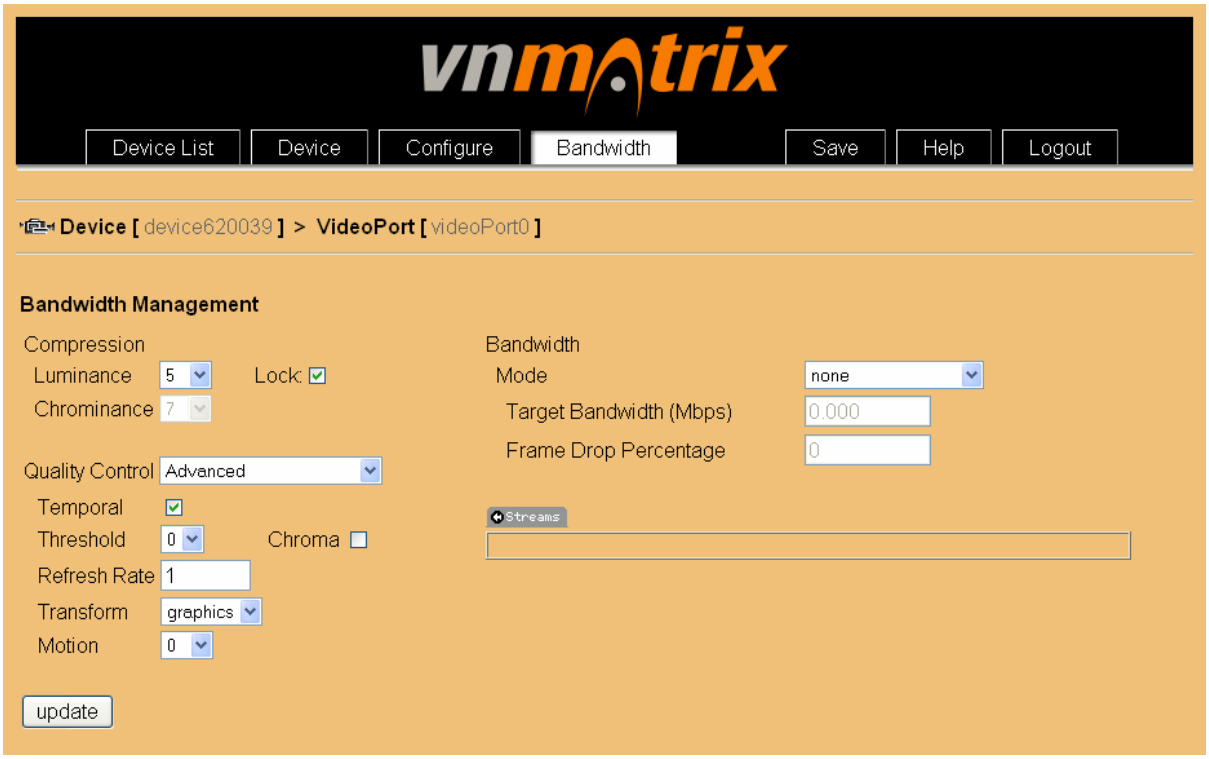
Use this page to:

- Fine-tune an auto-detected source (see page 65)
- Create or modify a source input mode (see page 66)
- View current source setup for a ‘detected’ source

For further information:

- Refer to the online help (click the **Help** tab)

Bandwidth Page (source)



Use this page to:

- Change bandwidth management and compression settings for a source (see pages 71 & 72)

For further information:

- Refer to the online help (click the **Help** tab)

APPENDIX A:

Guide to IP Addressing

What is an IP Address?

A full explanation of IP addressing is beyond the scope of this user guide. However the following details will provide you with enough information to get started.

An IP Address is a 32-bit binary number that is used to identify each device on an Ethernet network. This number is usually represented by four decimal numbers (each in the range 0 to 255) separated by dots, *e.g.* 198.123.34.240. This is called 'dotted decimal notation'.

An IP Address is divided into two parts:

- the 'network identifier', and
- the 'host identifier'.

On a given network each address must have the same network identifier value but have a unique host identifier. There are, therefore, different 'classes' of address which define:

- the range of valid addresses, and
- which parts of the address are used for the network and host identifiers.

The most common IP Address classes are:

Class Name	Valid Address Range	Identifier Arrangement*
Class A	0.0.0.1 to 127.255.255.254	NNN.HHH.HHH.HHH
Class B	128.0.0.1 to 191.255.255.254	NNN.NNN.HHH.HHH
Class C	192.0.0.1 to 223.255.255.254	NNN.NNN.NNN.HHH

*Where:NNN = Network identifier
HHH = Host identifier

Private & Public Address Ranges

Within each of the above classes are a range of addresses designated as 'private' addresses. These are addresses which should only ever be used on private local networks and intranets and cannot be accessed directly from the internet.

10.0.0.0 – 10.255.255.255
172.16.0.0 – 172.31.255.255
169.254.0.0 –169.254.255.255
192.168.0.0 – 192.168.255.255

All other addresses outside these ranges are considered 'public' addresses.

Multicast Address Range

A further range of addresses are available for multicast usage:

224.0.0.0 – 239.255.255.255

These addresses (also known as Class D addresses) are used to allow several devices to be part of the same multicast group. Each device in the group has the same multicast address and can effectively send data to all other devices in the same group simultaneously.

Choosing IP Addresses

If your VN-MATRIX units are connected via their own independent network, then follow the guidelines below for choosing your IP Addresses.

However, if you intend connecting your VN-MATRIX units to an existing network, you will need to advise the network administrator and ask them to allocate suitable addresses to you.

On an independent network you can (in theory) use just about any addresses you wish. However, it is generally recommended that you use the Class C format (*i.e.* from 192.0.0.1 up to 223.255.255.253).

Remember that there are two rules for choosing IP Addresses:

- the network identifier must be the same for each address, and
- the host identifier must be unique for each address.

Applying these rules to Class C addresses, it can be seen that the first three decimal values of your IP Addresses must all be the same, while the last value is used to uniquely identify each device.
The following is an example of a valid Class C addressing scheme:

Device	IP Address
Device 1	208.132.180.41
Device 2	208.132.180.42
Device 3	208.132.180.43

NOTE: *The host identifiers (e.g. 41, 42, and 43 in the above example) need not be sequential or in any particular order. However, it is recommended that you group the numbers for simplicity.*

The following is an example of an **invalid** Class C addressing scheme:

Device	IP Address
Device 1	208.132.180.41
Device 2	192.157.180.42
Device 3	209.100.123.43

NOTE: *These are invalid because the network identifier for each address is not the same, even though each IP Address is unique.*

You can use the Ping command from your computer to check that a device at a particular address is responding correctly (see page 127).

Subnet Mask

The Subnet Mask is another 32-bit binary number that is used to ‘mask’ certain bits of the IP Address. This provides a method of extending the number of network options for a given IP Address. It works by allowing part of the host identifier to be used as a ‘subnet identifier’. Any further explanation of this facility is not relevant here.

However, it is important that you set the correct value for the Subnet Mask. The basic values depend on the class of IP Address being used:

Class Name	Subnet Mask
Class A	255.0.0.0
Class B	255.255.0.0
Class C	255.255.255.0

Using the 'Ping' Utility to Test Communications

You can test for communications between a Windows computer and another device on the same network by using the Windows Ping utility.

☞ From the Windows Desktop of the computer, click on the **Start** button, and select **Run** from the pop-up menu.

The Run dialog box will appear.

☞ In the Open box, type in the following command:

```
ping xxx.xxx.xxx.xxx –t
```

where xxx.xxx.xxx.xxx is the IP Address of the device (*e.g.* a VN-MATRIX) that you want to test.

☞ Click on the **OK** button or press the **Enter** key.

A text window will appear showing a series of response messages; these are explained below.

☞ To stop the ping utility, press **Ctrl** + **C** on the keyboard.

HINT: *Ping can also be run from the command line of the serial interface (see page 105).*

Response Messages

When you run the Ping utility, it will display a series of response messages, which you can use to determine the state of the communications link. For example, if you have 'pinged' a device with the address 208.132.180.48, you should get a message similar to the following:

```
Reply from 208.132.180.48: bytes=32 time=2ms TTL=32
```

This is the correct response which indicates that the device at the specified address is communicating correctly. Note that the response 'time' value may vary according to network traffic.

If you get the message...

```
Request timed out.
```

...this indicates that there has been no response from the specified address. Either the processor is not receiving data from the computer or not sending data back. Check that the device is powered-up and set to the same address that you 'pinged'. Also, check that you are using the correct type of connecting cables (*i.e.* 'straight through' or 'crossover') and that they are not damaged or faulty.

If you get the message...

```
Reply from 208.132.180.48: Destination host unreachable.
```

…this indicates that the IP Address of the computer is not in the same 'class' (or subnet) as that of the device being 'pinged'. Check that the SubNet Mask on both the computer and the device are set to the same value (see page 126). Also check that both IP Address are within the correct range for the chosen class and are compatible (see page 126).

APPENDIX B:

Understanding Network Performance

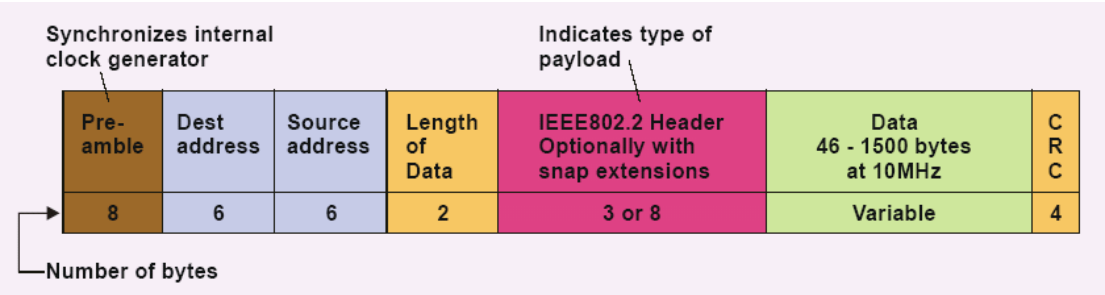
Network Characteristics

There are a number of characteristics of networks that have to be taken into account when transmitting image data.

When a conventional analog or digital video signal is sent from a source to a display, the image is transmitted in real time with negligible delay (or “latency”). The signal itself is continuous with (even in the case of a digital signal) very little redundancy in the signal (i.e. the great majority of the signal is image data, so little bandwidth is “wasted”). In general the signal is not subject to any unpredictable degradation.

Data Packets/Frames

If a digital image stream is sent across a network, it must be “packetized”. The network itself is indifferent to the nature of data, and simply treats all digital information in a standard way. Before it can be sent over a network, the data must be re-formatted into packets called “IEEE MAC frames”.



IEEE802.3 Media Access Control frame.

Some points arise from this:

- The data carried within a frame/packet is limited to the MTU (maximum transmission unit) of the network, typically 1500 bytes.
- The data must include any additional overhead arising from the protocol being used (*e.g.* UDP or TCP/IP).

The MTU is the largest physical packet size (measured in bytes) that a network can transmit. Any messages larger than the MTU are divided into smaller packets before being sent.

The introduction of Gigabit (1 Gb/s) Ethernet has allowed the introduction of “Jumbo” frames with more than 1500 data bytes. Clearly the overhead involved by limiting the number of bytes to 1500 is considerable, and using jumbo frames makes more efficient use of the network. However, the following should be noted:

- Many real world networks only operate at 100Mb/s at local level and these can NOT accept jumbo frames.
- Even many gigabit networks are not configured to accept jumbo frames. Only networks so configured can use them.
- The maximum data size of a jumbo frame is 9000 bytes; and typically jumbo frames carry 8000 data bytes.
- While network efficiency goes up with larger frames, the effect of a lost frame or packet is more serious.

Nodes, Switchers & Routers

An Ethernet Local Area Network (LAN) will have a number of nodes, and in principle all nodes can communicate with each other. The principle used is “Carrier Sense, Multiple Access/Collision Detection” or CSMA/CD. This means that when not transmitting, all nodes are listening. When a node transmits no other node attempts transmission. However, signal speed limits mean that a “collision” is possible. Such collisions are detected and the competing parties “back off” for another attempt. The principle works well for small networks, but introduces inefficiency in networks with high traffic.

Networks are in practice, therefore, constrained by the use of various switching and routing devices.

- An Ethernet **hub** simply allows nodes to be connected together and CSMA/CD applies.
- An Ethernet **switch** intelligently routes internode traffic; i.e. nodes only receive traffic addressed to them. This reduces or eliminates bus contention at the local level. A switch can also allow a node to operate duplex communication i.e. simultaneous transmit and receive.
- An Ethernet **bridge** is a two port switch used for segmenting networks or joining dissimilar media.
- An Ethernet **router** connects multiple networks, and connects to networks of other types.

Routers and switches use *routing tables* to determine how traffic is directed. These can be dynamic, in the sense that they are generated as needed by examining the traffic; but they can also be static, imposing strict rules about how traffic is directed.

This factor is of great importance in respect of transmitting image data over networks. In practice unless a network is specifically programmed to carry image data, it is likely that the data will be blocked at the first router it encounters.

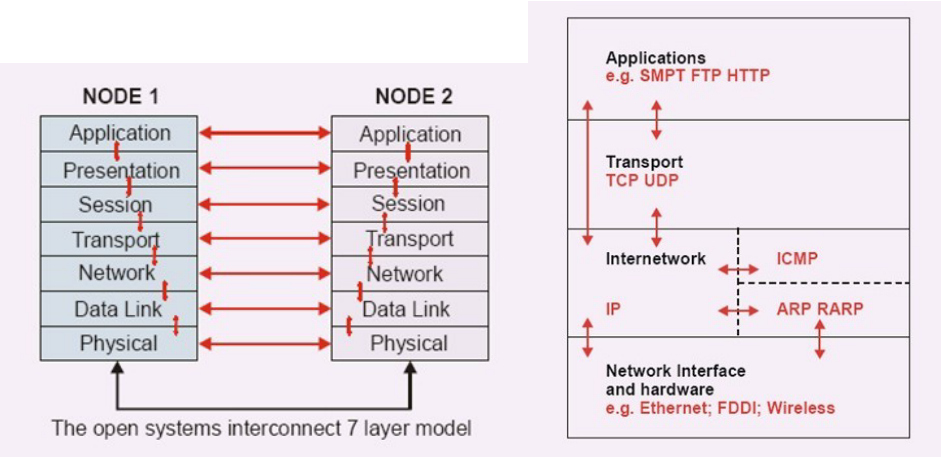
Protocols

For communication to work over networks there must be some formality about how communication is done in order to ensure inter-operability between different systems. The ISO proposed a model for this in its Open Systems Interconnection (OSI) model. It defines seven different “layers” for any intercommunication protocol, starting at the bottom with a “physical” layer (which might be Ethernet, wireless or some standard serial communications method) going to the top which is the “application” layer relating to the actual task in hand.

The OSI model is used as a reference, and while some systems follow the full model, others simplify it by combining the functions of certain layers. In particular the protocol stack which is the basis of standard Ethernet communication only has four layers, as indicated in the figure below.

The Internetwork layer combines the functions of the Data Link and Network layers of the OSI model and looks after addressing, carrying Internetwork Protocol (IP) within the MAC frame. The current version of Internetwork protocol is IPv4 which uses a 32 bit address. IPv6 with 128 bit addressing is being introduced to solve the possible problem of running out of available IP addresses and to provide certain other enhancements.

The Transport layer is possibly of most significance in respect of sending images over networks. It is here that data is formatted into *datagrams* suitable for transmission by IP. Here there are two significant protocols, User Datagram Protocol (UDP) and Transmission Control Protocol (TCP).



The OSI model (left) defines seven layers of interconnection. The system behaves as if, at each layer, there is direct connection between each node; but in fact communication is through the layers. With Ethernet and most data networks the preferred model is the TCP/IP four layer protocol stack (right).

Comparison between UDP and TCP

The two different transport layer protocols are compared in the following table:

UDP	TCP
Connectionless	Connection oriented
Datagrams must be formatted in application	Automatically generates datagrams from bitstream
Multiple applications using ports	Multiple applications using ports
Unreliable (best effort) communication	Reliable (guaranteed) communication
No flow control (must be in application if required)	Flow control (deals with out-of-order data and error corrections)
No error recovery	Error recovery
Multicast possible (one to many)	One to one only
Minimum latency	Significant latency

Clearly the most significant difference is that UDP is “best effort” and TCP is “guaranteed delivery”. TCP is used in most networks for such tasks as exchanging file information between nodes, because here absolute accuracy is required and because the delivery requirement is usually “point to point”.

The table implies several different methods of transmission, for example:

- **Broadcast** where a message goes to all nodes on the network. Must be UDP.
- **Unicast** where a message goes from one node to another. Must be TCP.
- **Multicast** where a message goes from one node to many nodes, each assigned to a multicast address group. Must be UDP.

The table has great significance in respect of transmitting images over networks. A few of the points that arise from it are as follows:

- Many if not most applications will involve the transmission of an image from one node to many nodes, *i.e.* multicast operation is required, mandating the use of UDP.
- Many if not most applications will require minimum latency, again indicating the use of UDP.
- But UDP does not provide “reliable” communication, so any application has to take into account the effect of lost data packets, out-of-order packets, and errors.
- Time critical data like video is often sent using an additional protocol called RTP (Real Time Protocol). This “time stamps” the packets and can be used to endow UDP with some measure of flow control.

These are not trivial issues. If a data bit goes missing in a dedicated digital video link like SDI the result is not catastrophic – its effect is at a single pixel level within a single video frame. If a data bit goes missing in an MPEG stream it can prevent the reconstruction of an entire group of images.

APPENDIX C:

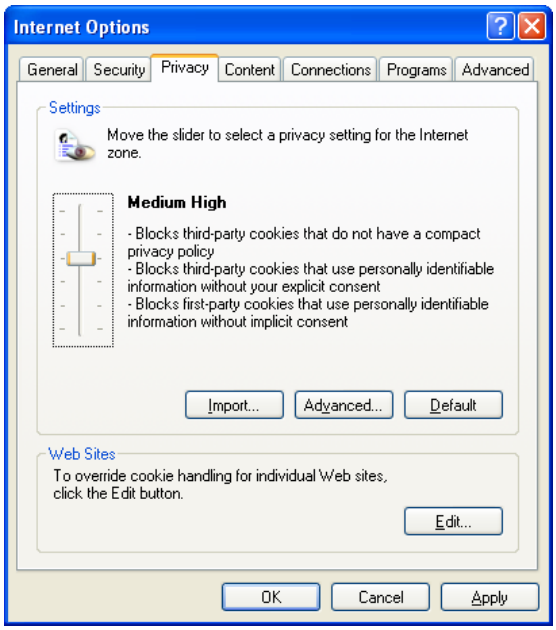
Browser Configuration

Internet Explorer (v6 or above)

☞ Open Internet Explorer and from the **Tools** menu choose **Internet Options** to open the Internet Options dialog.

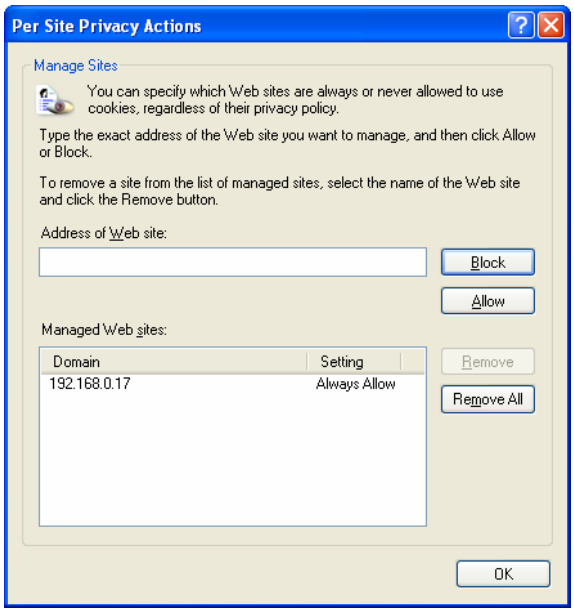
To enable cookies…

☞ Select the **Privacy** tab and, if required, adjust the slider control to set the required security level. VN-MATRIX will operate correctly up to and including **Medium High**.



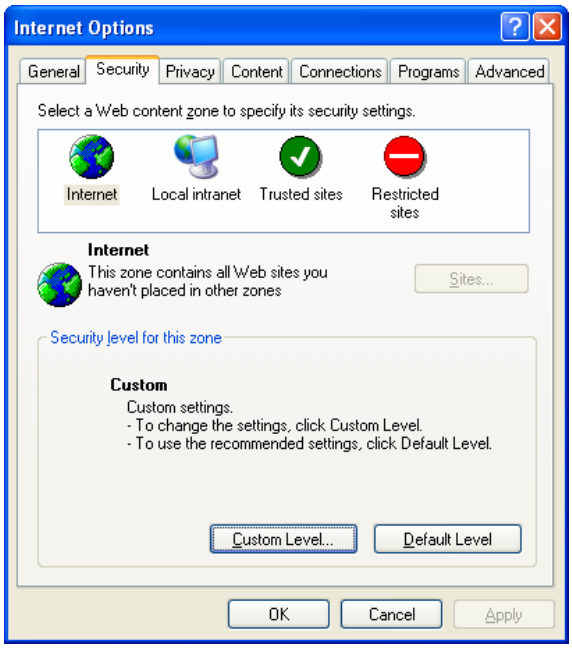
IMPORTANT: Setting the security slider to **Block all cookies** will prevent the VN-MATRIX web interface from operating.

HINT: If you need to use a **High** security level, you can click on the **Edit** button and allow the VN-MATRIX web interface to use cookies. For example:

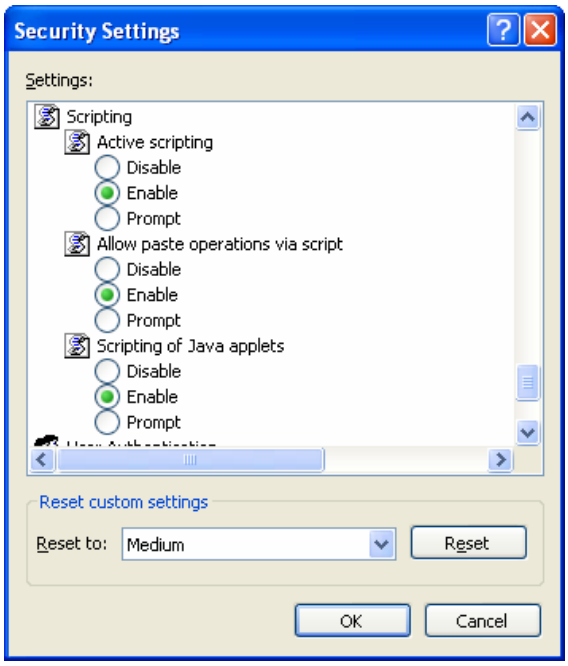


To enable JavaScript…

☞ Select the **Security** tab.



☞ Click the **Custom Level button**. The Security Settings dialog will appear:



☞ Scroll down to the **Scripting** setting and, under **Active scripting**, select **Enable**.

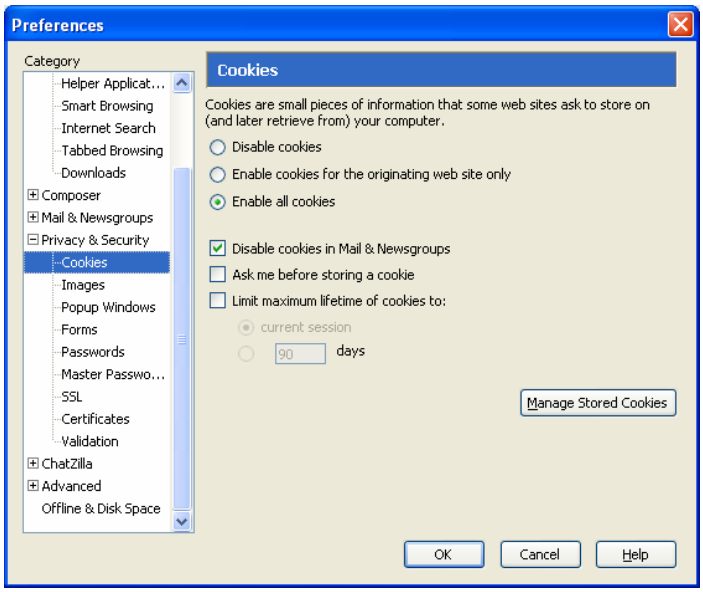
☞ Click **OK** on both dialogs to close and save the new settings.

Mozilla (v1.3 or above)

☞ Open Mozilla and from the **Edit** menu select **Preferences** to open the Preferences dialog.

To enable Cookies…

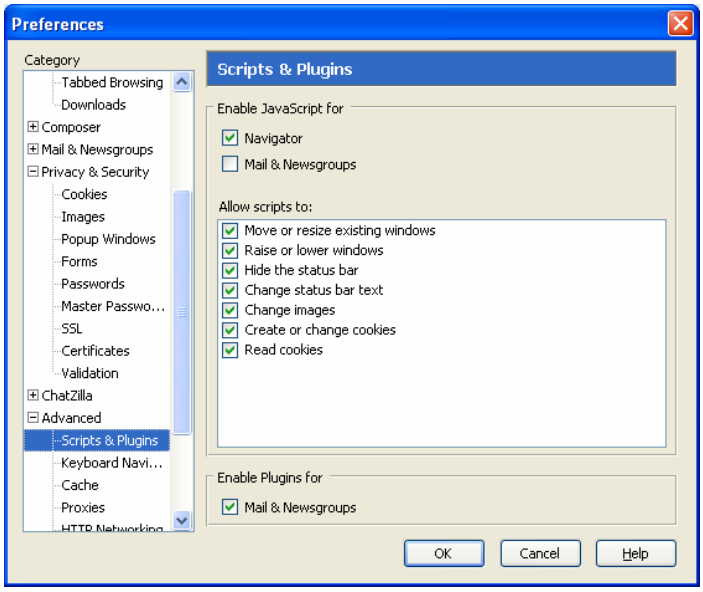
☞ Go to the **Privacy & Security** category and choose **Cookies**.



☞ Ensure that either the **Enable all cookies** or **Enable cookie for the originating web site only** option is selected.

To enable JavaScript…

☞ Go to the **Advanced** category and choose **Scripts & Plugins**.



☞ Ensure that the **Enable JavaScript for Navigator** option is selected.

☞ Click **OK** to close the dialog and save the settings.

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