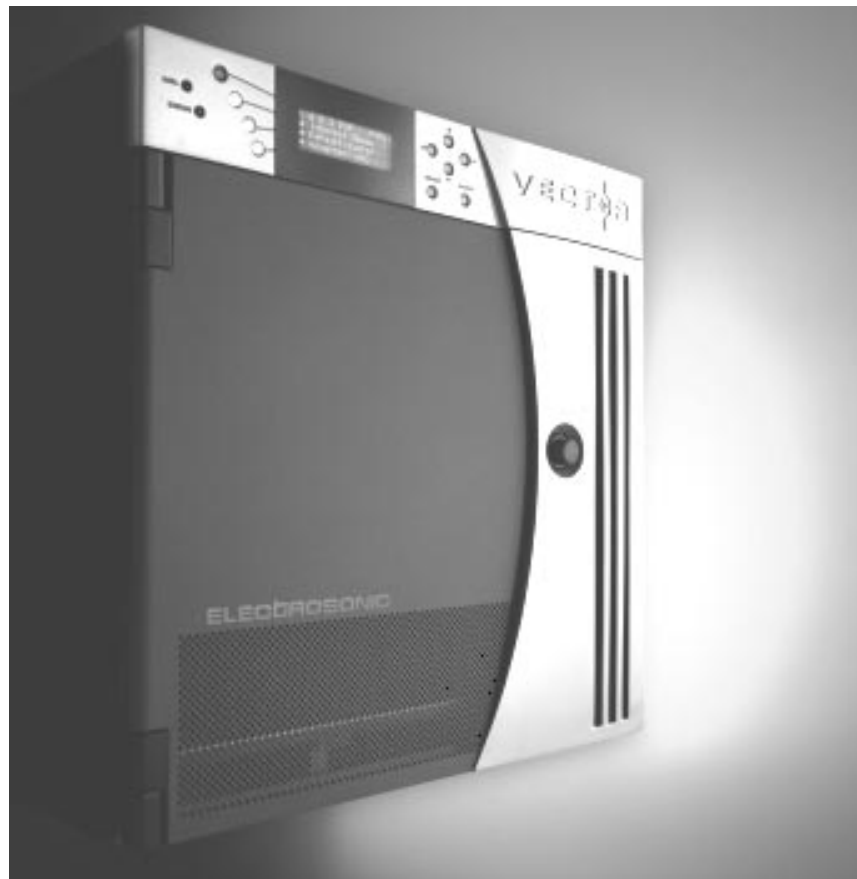


# VECTOR Principles Guide



## Contents

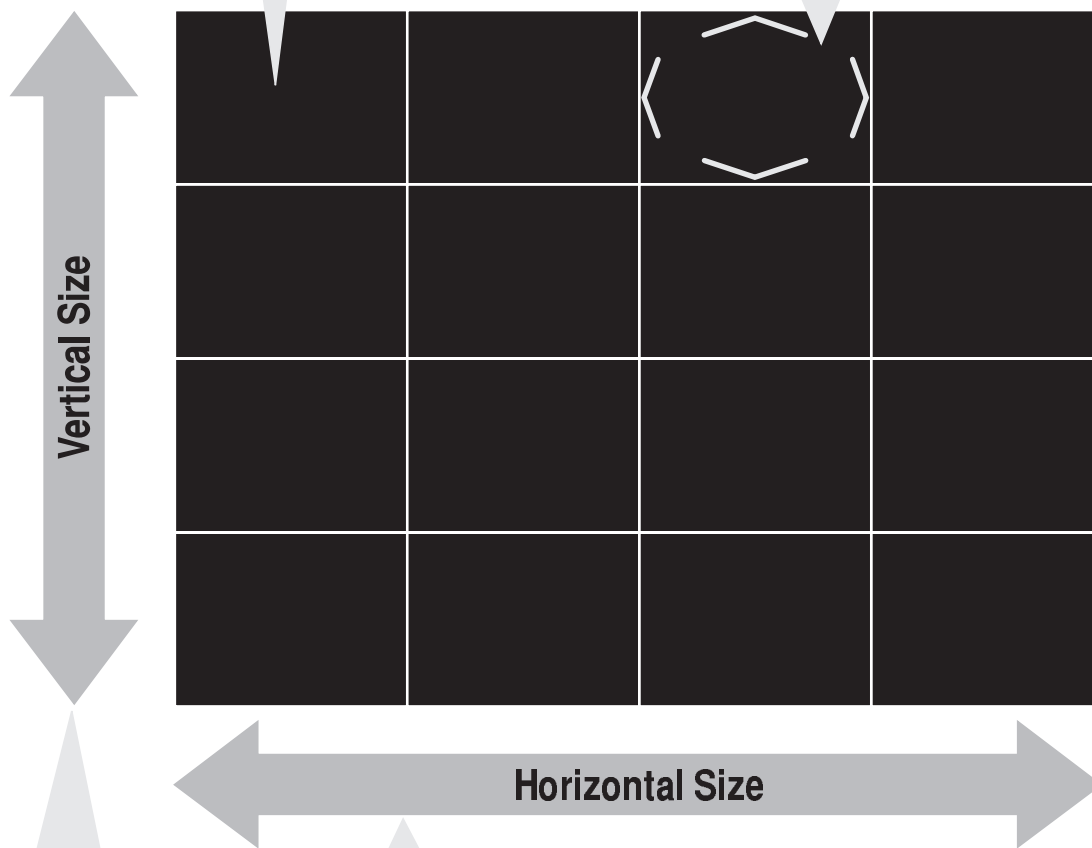
Introducing the Videowall. . . . .	2
Introducing Source Formats . . . . .	3
VECTOR System Architecture. . . . .	4
Input Card (ES5954) . . . . .	5
Input Card (ES5955) . . . . .	6
Output Card (ES5953). . . . .	7
System Manager Card (ES5952) . . . . .	8
Introducing VECTOR Windows . . . . .	9
Resizing a Source . . . . .	10
Methods of Scaling a Source. . . . .	11
What is a Convolver?. . . . .	12
Magnifications & Minifications . . . . .	13
More About VECTOR Windows. . . . .	14
Dynamic Windows . . . . .	15
What is Viewporting?. . . . .	16
Window 'Z Order' Levels . . . . .	17

# Introducing the Videowall

A videowall is constructed from a number of separate SCREENS.

Each screen or DISPLAY DEVICE is usually either a MONITOR or PROJECTION CUBE (or just CUBE for short).

The edges of each screen are called the SCREEN BORDERS or MULLIONS.



The size of a videowall is specified differently in different parts of the world. Some countries use '**width x height**' while others prefer '**height x width**'.

In this document we use the first definition. For example, when we refer to a 3x2 videowall we mean that it is 3 screens wide and 2 screens high.

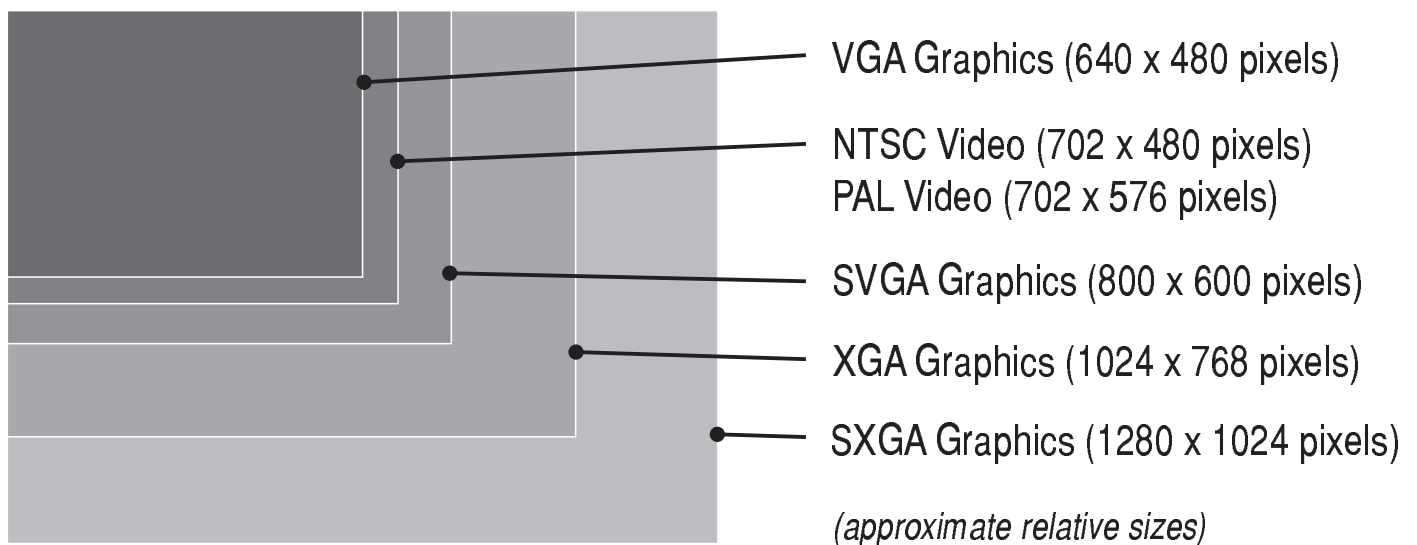
Walls are usually SQUARE (as shown above), *i.e.* they have the same number of screens horizontally as vertically, *e.g.* 3x3, 4x4, 6x6, *etc.* This format preserves the original ASPECT RATIO (*i.e.* 4:3) of a normal video image.

Other formats in common usage are 3x2 or 6x4, which gives a 2:1 'widescreen' format, or 4x3 which gives the 16:9 format used by HDTV sources.

# Introducing Source Formats

Any DIGITAL source, or an ANALOG source that has been DIGITIZED, is made up of PIXELS.

The more Pixels there are, the greater the ability to show fine detail and the greater the RESOLUTION of the source.



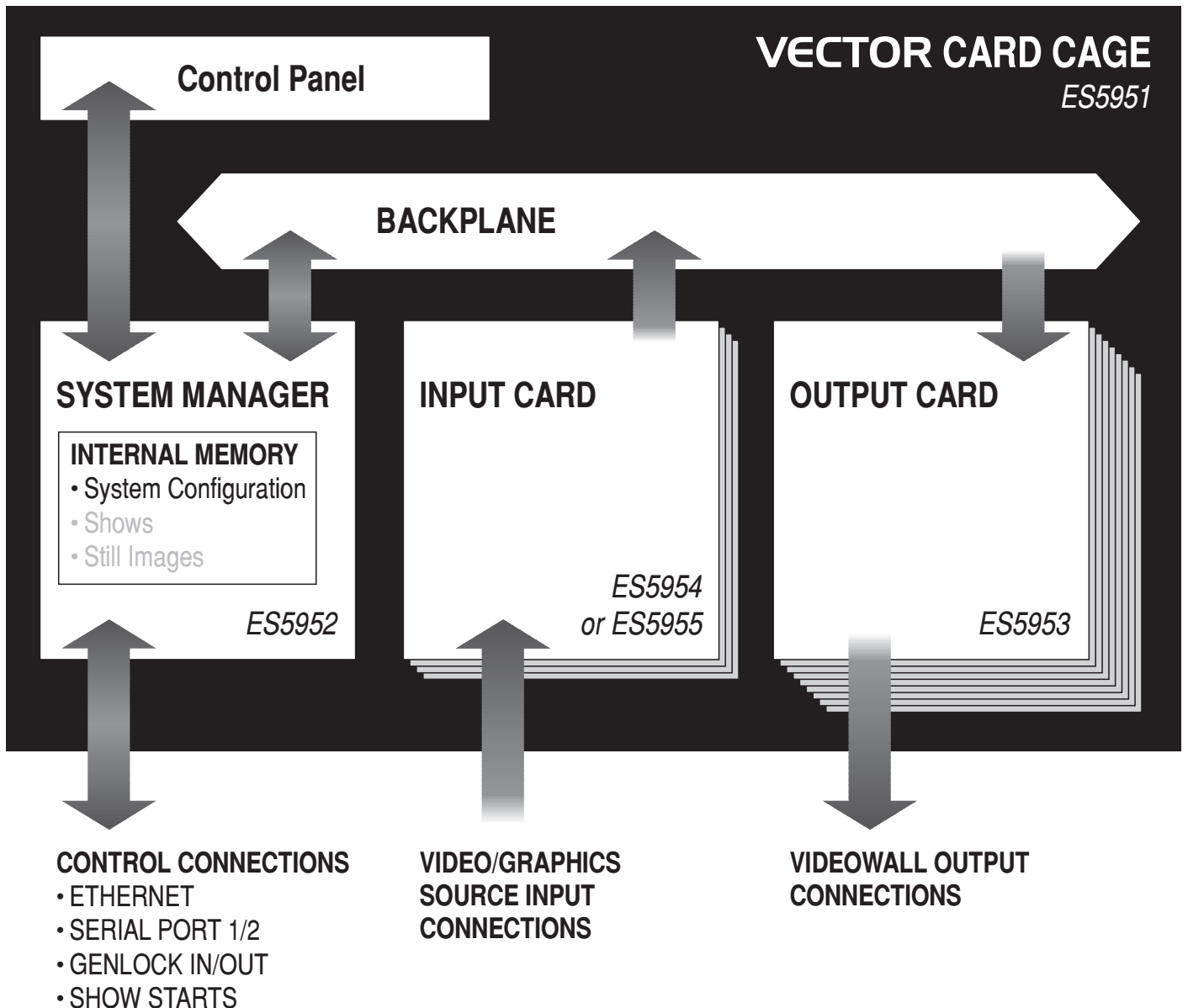
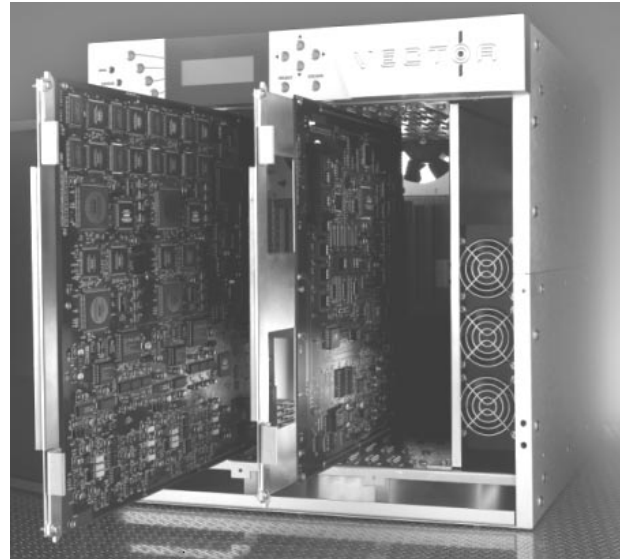
## Points to note:

- The pixel values shown in the above diagram indicate the nominal ACTIVE image area of the source. The actual active area of some sources (particularly video) may vary slightly.
- Video sources often need to be CLIPPED or CROPPED to remove any unwanted material around the edge of the video frame.
- If all pixels are of equal size, higher resolution sources appear to be larger in 'overall size'.
- Graphics pixels are generally square. However, video pixels are usually elongated vertically to ensure an overall aspect ratio of 4:3.

# VECTOR System Architecture

The VECTOR system comprises a CARD CAGE which can hold up to 13 PROCESSOR CARDS.

Each type of processor card performs a specific function within the system.



# Input Card (ES5954)

**Purpose** To convert an external ANALOG VIDEO or GRAPHICS signal into a DIGITAL format that can be used and manipulated by VECTOR.

- Features**
- Two source Inputs per card.
  - Supports a range of Video & Graphics standards.
  - Auto-Detection of standard source types.
  - Built-in timebase correction.  
*VECTOR resamples all inputs using a common timebase.  
No external source GenLock is needed.*
  - Two separate digitized outputs...
    - Unity (1:1): used for unity or magnification windows.
    - Convolved (resized): used for minification windows.
  - Supports the following C-Through Effects...
    - Digitizer Freezes,
    - Minifications (window-based)

- Usage**
- Input cards must be installed in the slots nearest the System Manager (*i.e.* slot 1 onwards).
  - A maximum of 4 x ES5954 cards (*i.e.* 8 sources) can be used per card cage.

# Input Card (ES5955)

**Purpose** To convert an external ANALOG VIDEO or GRAPHICS signal into a DIGITAL format that can be used and manipulated by VECTOR.

- Features**
- One source Input per card.
  - Supports a range of Video & Graphics standards.
  - Auto-Detection of standard source types.
  - Built-in timebase correction.  
*VECTOR resamples all inputs using a common timebase.  
No external source GenLock is needed.*
  - Two separate digitized outputs...
    - Unity (1:1): used for unity or magnification windows.
    - Convolved: used for minification windows.
  - Supports the following C-Through Effects...
    - Digitizer Freezes,
    - Minifications (window-based)

- Usage**
- Input cards must be installed in the slots nearest the System Manager (*i.e.* slot 1 onwards).
  - A maximum of 8 x ES5955 cards (*i.e.* 8 sources) per cage.

# Output Card (ES5953)

**Purpose** To generate the final videowall display, using the required source(s) and EFFECTS and to output the result as an analog signal to the DISPLAY DEVICES.

- Features**
- Four screen Outputs per card.
  - Supports a range of display formats...
    - Video, VGA or SVGA,
    - 50Hz, 59.94Hz or 60Hz,
    - Interlaced, Progressive, Frame Doubled or Line Doubled.
  - Supports the following C-Through Effects...
    - Magnifications (window and screen-based),
    - Viewporting,
    - Color Washes,
    - Screen Freezes,
    - Chroma & Luma Fades.

- Usage**
- Must be installed in the slots immediately following the the Input Cards.
  - A maximum of 9 cards (*i.e.* 36 screens) per cage.

# System Manager Card (ES5952)

**Purpose** To manage the flow of control and video data between the Input and Output Cards, and to provide a control interface between VECTOR and the 'outside world'.

- Features**
- Non-volatile memory for storage of...
    - System Configuration (e.g. wall size, source setup)
    - Internal Shows,
    - Internal Still Images.
  - Two Serial Ports (RS-232)  
*Used for ES4000 Input/Output, Low-level Diagnostics, etc.*
  - Ethernet Port (10BaseT)  
*Used for C-Through Control, Firmware Downloads, etc.*
  - GenLock Input/Output  
*Used for synchronizing multiple Card Cages.*
  - Show Start Inputs  
*Used for remote control of Internal Shows.*

- Usage**
- Must be installed in slot 0.
  - Only one System Manager Card per cage.

# Introducing VECTOR Windows

On a videowall display, a WINDOW is a **rectangular** area of **any size** that contains either a SOURCE, an INTERNAL IMAGE or a COLOR WASH.

## SOURCE

A Source is derived from the output signal of a **VIDEO** device (e.g. PAL/NTSC from a laser disc) or a **GRAPHICS** device (e.g. VGA/SVGA from a computer).

## INTERNAL IMAGE

An Internal Image is a 'single frame' or 'still image' stored as a **BITMAP** in VECTOR's memory. Internal Images can be manipulated in the same ways as any other Source.

## COLOR WASH

A Color Wash is an area filled with a solid color.

A Window can be constrained to the Screen Borders...

... or it can be FREE-SIZED, (i.e. not constrained to the screen borders).

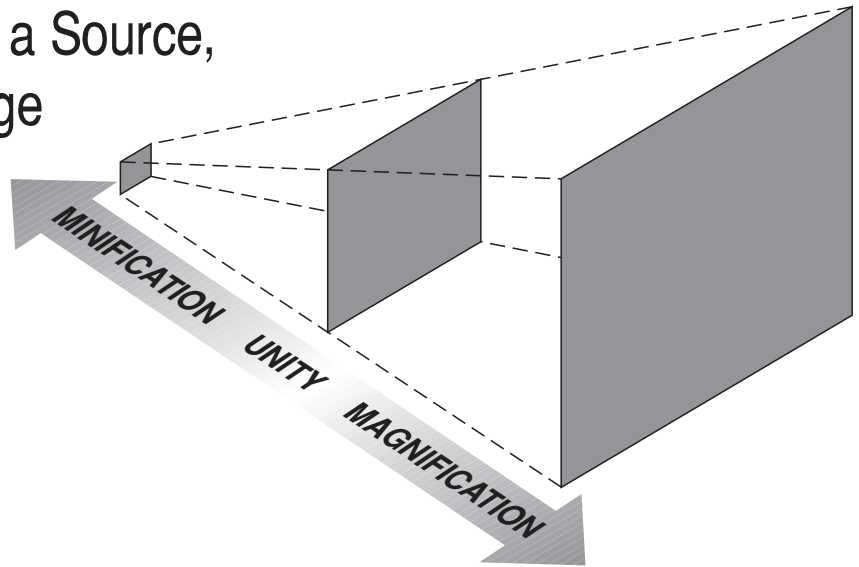


A Window can overlap the edge of the wall...

...and can be larger than the visible area of the wall.

# Resizing a Source

When a Window contains a Source, VECTOR resizes the image to fit the size and shape of the Window.



## MINIFICATION

A windowed image that is **smaller than** the size of the original source.

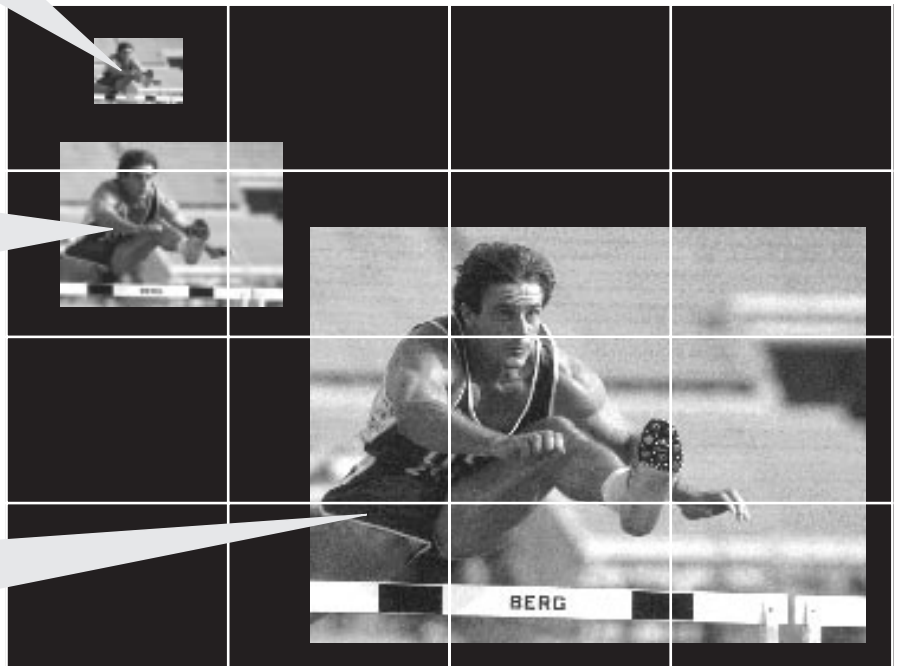
## UNITY

A windowed image that is the **same** as the original source.

The term is often incorrectly used to describe a **SINGLE** full-screen display of a source.

## MAGNIFICATION

A windowed image that is **larger than** the size of the original source.



The resized image can have the same **ASPECT RATIO** as the original source (e.g. 4:3)...



... or it can be **ANAMORPHIC**, which means that it is stretched in either the vertical or horizontal axis.

# Methods of Scaling a Source

## Pixel Repeat Method

For example, by repeating each pixel twice in both the horizontal and vertical axis, you can achieve a 2x2 magnification. In the case of an SVGA source, the number of pixels would be doubled from 800x600 to 1600x1200.

### Disadvantages:

- 'Blocky' appearance.
- Limited to integer magnifications.
- Display format must be the same as the source format.

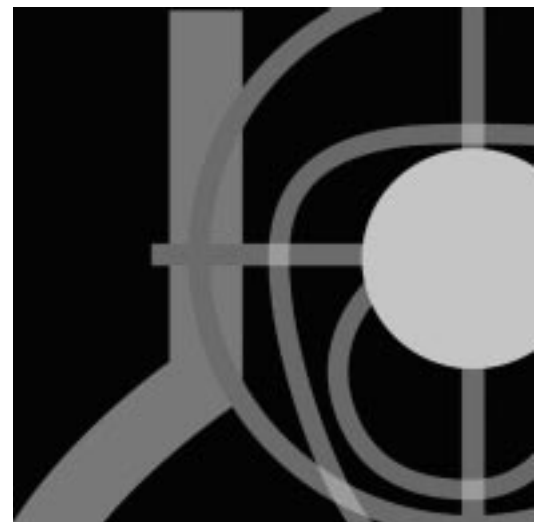


## Convolver Method

VECTOR uses a CONVOLVER to scale the source image to any size window. A convolver works by filtering every source pixel to uniquely create each display pixel.

### Advantages:

- Smooth appearance.
- Not limited to integer magnifications.
- Display format can be different to the source format.

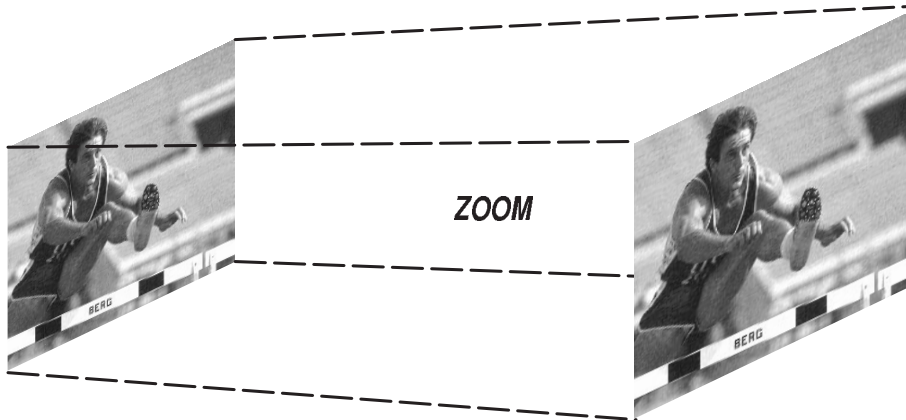


# What is a Convolver?

A CONVOLVER is digital device for scaling an image from an input format (resolution) to an output format (resolution).

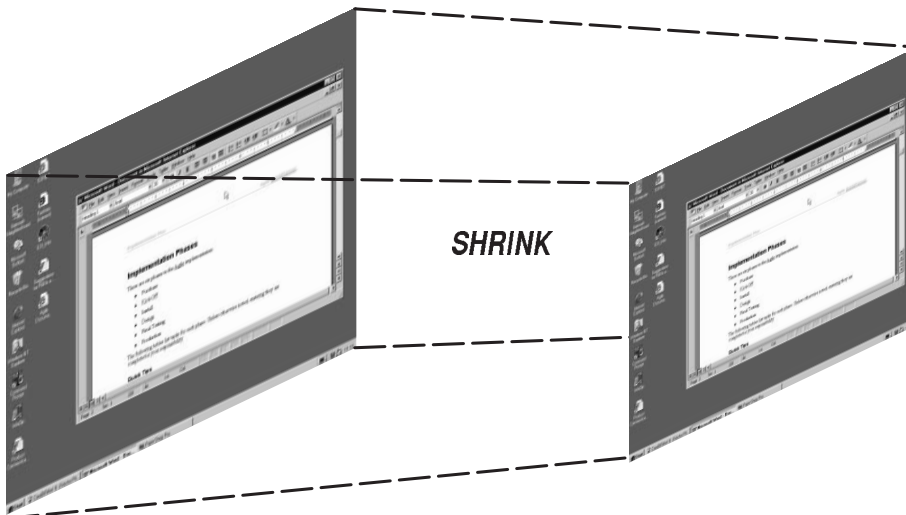
It works by filtering every source pixel to uniquely create each display pixel.

**INPUT FORMAT**  
NTSC VIDEO  
704 x 480 Pixels



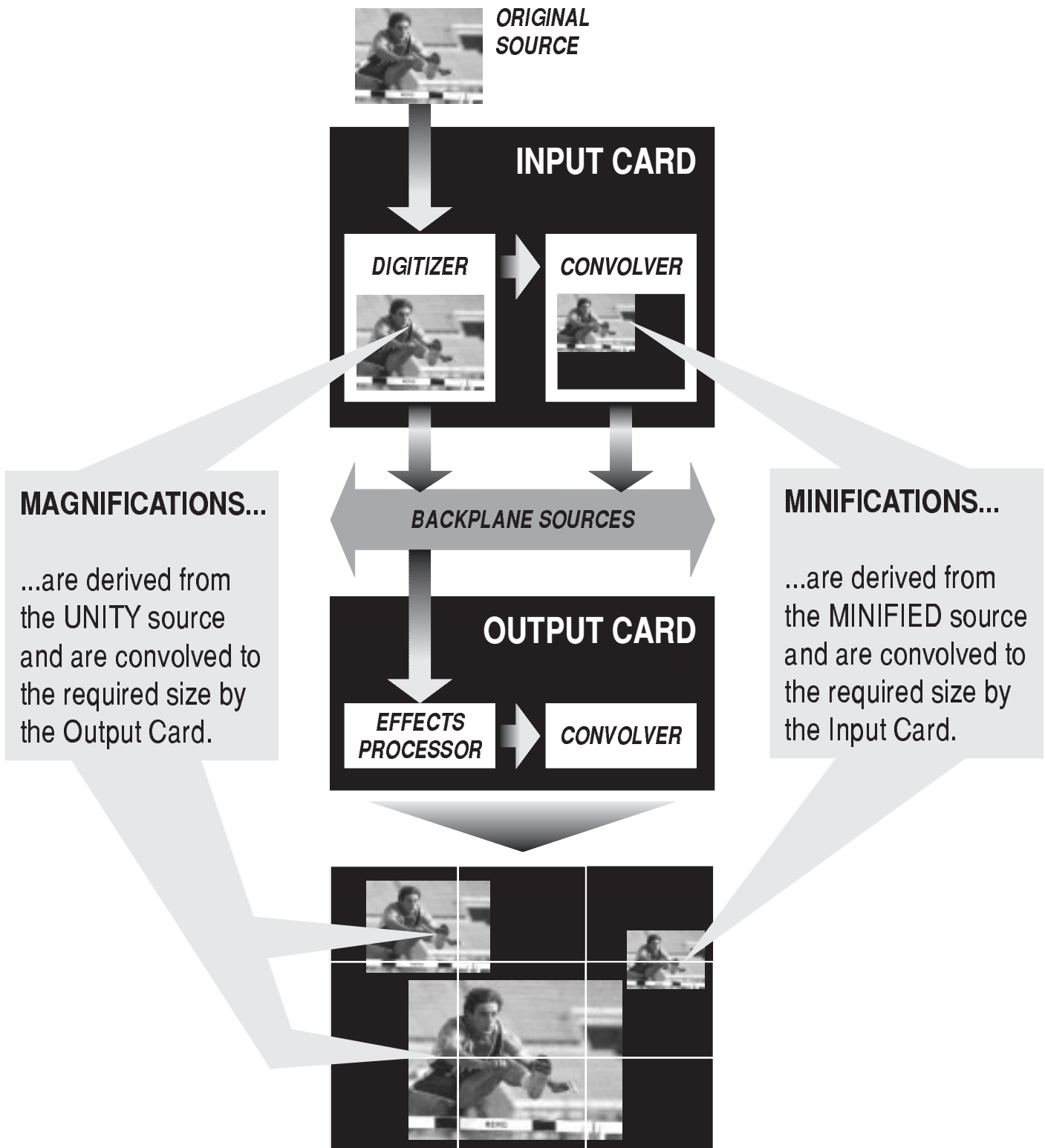
**OUTPUT FORMAT**  
SVGA  
800 x 600 Pixels

**INPUT FORMAT**  
XGA  
1024 x 768 Pixels



**OUTPUT FORMAT**  
SVGA  
800 x 600 Pixels

# Magnifications and Minifications



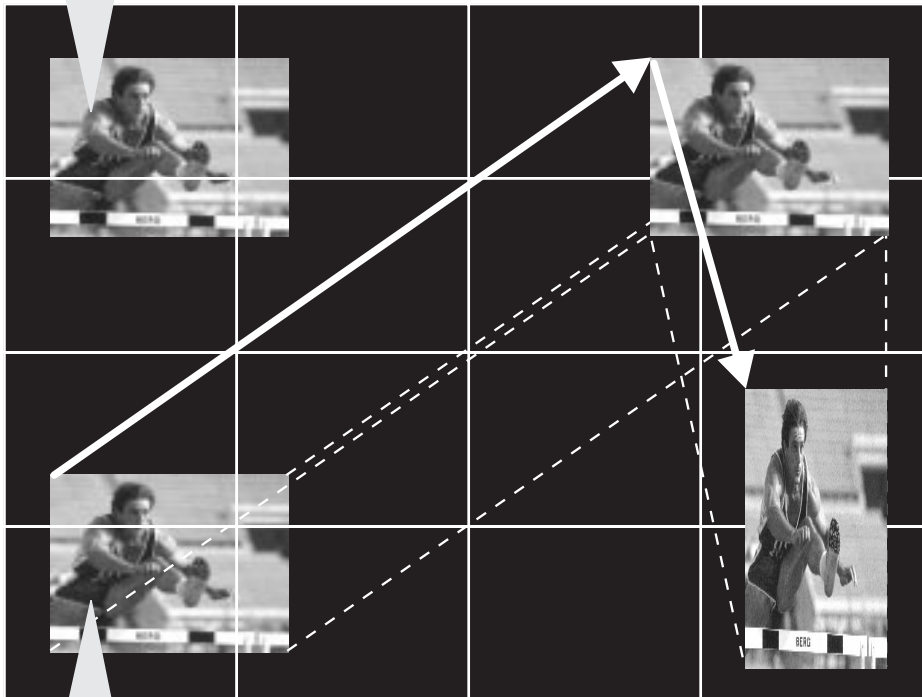
## IMPORTANT POINT...

You cannot have different size minifications of the same source on the wall at the same time. However, you can have more than one minification of the same size from the same source.

# More About VECTOR Windows

A VECTOR Window can be either STATIC or DYNAMIC...

A STATIC WINDOW stays in a fixed position and size on the videowall.



A DYNAMIC WINDOW changes its characteristics (*e.g.* position and/or size) over a period of time. These changes are called TRANSITIONS.

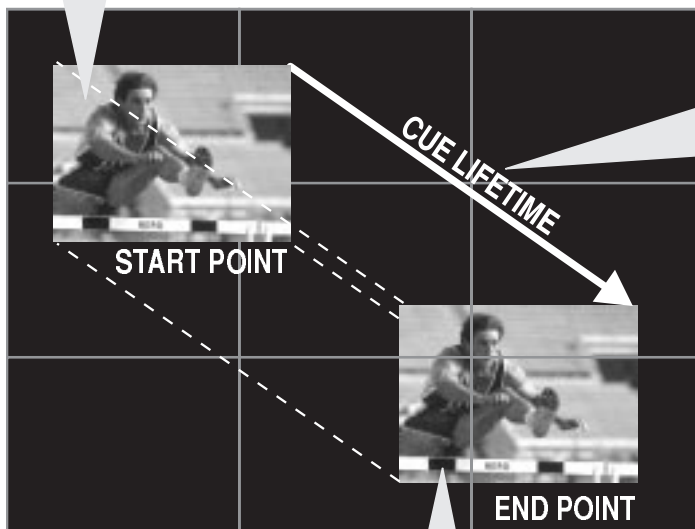
The following properties of a VECTOR Window can be affected by a Transition:

- Position
- Size/Shape
- Source Viewport
- Chroma/Luma Levels (if the window contains a source)
- Color (if the window contains a color wash)

# VECTOR Dynamic Windows

A Dynamic Window is defined with a START POINT, END POINT and a CUE LIFETIME.

The initial properties of the window are defined by the START POINT Window.



The time taken to complete the Transition is defined by the CUE LIFETIME.

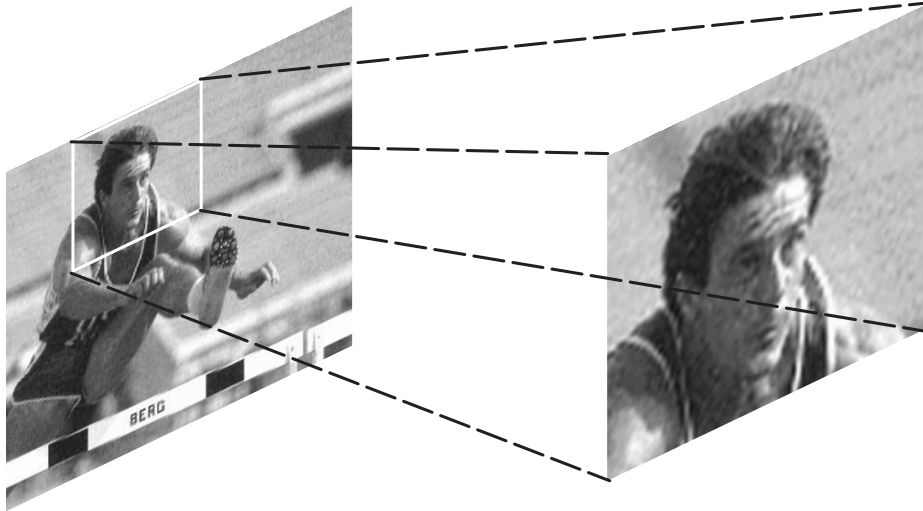
The final properties of the window (*e.g.* its final position/size, *etc.*) are defined by the END POINT Window.

You can CHAIN Dynamic Windows together to create a sequence of Transitions. This works by copying the End Point properties of one Transition to the Start Point properties of the next Dynamic Window. This can be used, for example, to create the illusion of a window 'bouncing' around the videowall.

The Start Point and End Point need not be on the videowall; windows can be made to 'slide on' and 'slide off' the wall.

# What is Viewporting?

VIEWPORTING is an Effect that allows a Window to display part of a source rather than the whole source.

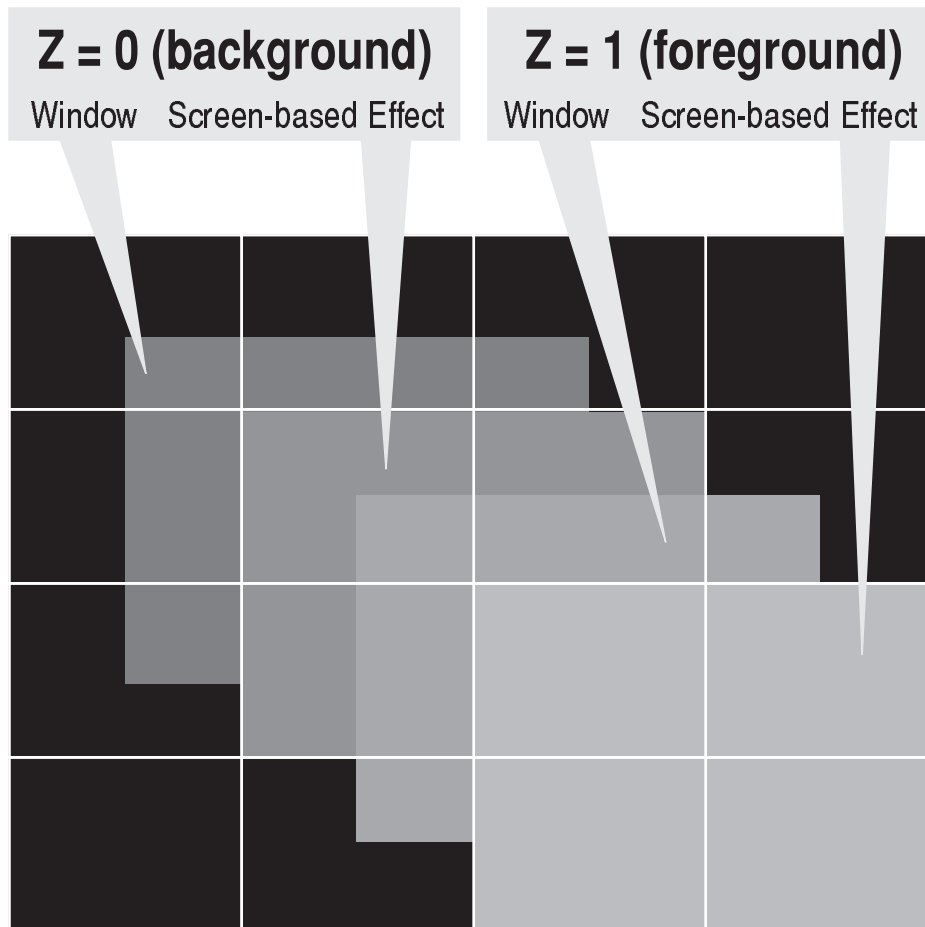


- The Viewported area can be any size or shape.
- The Viewported area is Magnified or Minified to fill the size and shape of the window.
- Each Window can show a different Viewport of the same source.
- The Viewported area can be Static or Dynamic (*i.e.* it can change size or shape between the Start and End Points of a Window)
- Viewporting can be used to crop any unwanted material from around the edge of the source, change the Aspect Ratio of the source without distorting it, create 'pan and scan' effects and to zoom in and out on the source.

**Remember...** a Source can be either Video or Graphics.

# Window 'Z Order' Levels

The Z ORDER of a Window (whether Static or Dynamic) determines if it is 'in front' or 'behind' another Window. Effects that are SCREEN-BASED (e.g. Wall Singles) always appear 'in front of' a window on a given level. There are two Z Order levels:



## IMPORTANT POINTS...

1. You can have a maximum of one Window (or part of a Window) occupying the same screen on the same Z Level at the same time. *If you try to display two or more Windows on the same Z Level, the 'newest' Window will take precedence; the 'oldest' Window will simply 'disappear' from the screen.*
2. You cannot have Screen-based Effects displayed on both Z Levels at the same time. *All Screen-based Effects currently displayed on the videowall will switch to the most recently specified Z Level.*