Content Creation

CONTENT CREATION AND RESOLUTION GUIDELINES FOR DIGITAL VIEW 300-SERIES VIDEO PLAYERS

v 1.01

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1 Introduction

Digital View 300-series Video players can play content in MPEG-1, MPEG-2, MPEG-still and JPEG formats. These industry standard formats have very broad application, from the home market to the professional user.

In principle, creating and using content is simple:

> "Just create an MPEG or JPEG, and upload it to your player (using remotetransfer.com or by copying directly to the Flash card".

In practice, though, it is necessary for a content creator to know more. What sizes are appropriate? What encoding rates? What screen sizes? What are the limitations? The key point is that to get professional results you need professional skills.

This guide explains some of the basics you need to understand in order to start developing those skills and reliably create optimal content. We recommend you have content creation taken care of by a qualified video content house, such as Digital View's Junction 7.

1.1 Introduction to formats

The file formats that can play on a Digital View DN3-based video player (such as the RemotePlayer 300 or RemoteFlyer 300) are JPEG stills, MPEG-stills, MPEG-1 and MPEG-2. These are described in this document; starting with a description of the output format.

*Important Note: This is the format the file will have on the actual player – it may **not** be the format in which you deliver your raw material to your content house: more about which later!*

The formats that Digital View Video players support are as follows:

1.1.1 JPG

This is a compressed still image format. JPEG images have a size, expressed in pixels (e.g. 1024 x 768 pixels). These are "square pixels". JPEG images have a filename that ends in .JPG (e.g. "picture5.jpg").

JPEG files must be created to match the output resolution of the Media Player. They are not re-scaled by the Media Player and are not output by the MPEG chipset, but rather by the general processor of the DV Video Player. That means you need to create JPG files as follows:

704x480 if connected to a Composite or S-Video output and set to NTSC (1)
704x576 if connected to a Composite or S-Video output and set to PAL (1)
640x480 if connected to a VGA-sized screen via the VGA or direct screen outputs (*)
800x600 if connected to a SVGA-sized screen via the VGA or direct screen outputs (*)
1024x768 if connected to a XGA-sized screen via the VGA or direct screen outputs (*)

(*) The DN3 player must be jumpered to reflect the screen size connected.

(1) NB: See also the note on JPG and pixel aspect ratios on page 11

1.1.2 MPEG Still

This is a compressed still format intended mainly for video players. Using DVSTUDIO or MPSCONVERTER, images can be converted into the mpeg still format, which will give a better look for text heavy content. Also, loading time between MPEG and MPEG-still is shorter than loading time between MPEG and JPG.

If you wish to use MPEG-still format, you should generate it at the following sizes:

MPEG STILL - PAL: 704x576 (Fullscreen Analogue Underscan)
MPEG STILL - NTSC: 704x480 (Fullscreen Analogue Underscan)

1.1.3 MPEG 1

This is a compressed video format, with audio. Compression is heavy and the quality is equivalent to what you would get from a VCD-player or a Video CD (VCD). MPEG-1 images have a filename that ends in .MPG (e.g. “video3.mpg”)

MPEG-1 format is different depending on whether it is NTSC format (used in North America and Japan) or PAL format (used in most of Europe and other areas).

PAL MPEG-1 FORMAT:

Video:	• Size: 352x288 • PAL Pixel Aspect Ratio 1.0950 (4:3) • 2 Fields Interlaced 25fps • Field order must match input file if transcoding from Quicktime or AVI
Audio:	• 44.1 kHz Stereo • Mpeg must be encoded with an audio stream, even if audio is silent.
Data Rates:	• Video: 1,120,000 bps • Audio: 224 kbps • Multiplex: 170 kbps

NTSC MPEG-1 FORMAT:

Video:	• SIZE: 352x240 • NTSC Pixel Aspect Ratio 0.9157 (4:3) • 2 fields Interlaced 25fps • Field order must match input file if transcoding from Quicktime or AVI
Audio:	• 44 kHz Stereo • Mpeg must be encoded with an audio stream, even if audio is silent.
Data Rates:	• Video: 1,119,200 bps • Audio: 224 kbps • Multiplex: 170 kbps

Notes on MPEG 1:

- The maximum data rate of the multiplexed (ie video & audio) content is 270kbps.
- Increasing screen size of MPEG 1 beyond these specifications will not make a better quality MPEG, and in most cases will make playback worse.
- Increasing data rates will also not create significantly better MPEG-1 as the format can only hold a limited amount of information.
- MPEGs must be tested on target machines: testing on a different machine, such as a PC, is no guarantee of compatibility or of quality. This is a media player, like a Video-CD or DVD player, and just as that equipment is not compatible with all PC content, nor is the DV Media Player.
- 16x9 Aspect ratios can be used but due to lack of industry standardisation of hardware, there is no guarantee that Digital View Media Players, or any other hardware, will auto-detect this flagging. Content must therefore be previewed on the player.
- Since data transfer cost is a major element of total network cost, always try MPEG-1 before concluding you must use MPEG-2, which is many times larger.

1.1.4 MPEG-2

This is a compressed video format, with audio. The quality is high: it is what you would get from a DVD-player. File size is therefore considerably greater than MPEG-1 file size. MPEG-2 images have a filename that ends in .MPG (e.g. “lipstick.mpg”)

MPEG-2 format is different depending on whether it is NTSC format (used in North America and Japan) or PAL format (used in Europe etc).

PAL MPEG-2 FORMAT:

Video:	• Video Size: 720x576 • PAL Pixel Aspect Ratio (4:3) • 2 Fields Interlaced 25fps • Field order must match input file if transcoding from Quicktime or AVI
Audio:	• 48 kHz Stereo • Mpeg must be encoded with an audio stream, even if audio is silent.
Data Rates:	• Video: 4-6 Mbps (*) • Audio: 224 kbit/s

(*) the format supports higher bit rates but these will not work reliably on DV Video Players

NTSC MPEG2 FORMAT:

Video:	• Video Size: 720x480 • NTSC Pixel Aspect Ratio (4:3) • 2 fields Interlaced 29.97fps • Field order must match input file if transcoding from Quicktime or AVI
Audio:	• 48 kHz Stereo • Mpeg must be encoded with an audio stream, even if audio is silent.
Data Rates:	• Video: 4-6 Mbits/s • Audio: 224 kbit/s

(*) the format supports higher bit rates but these will not work reliably on DV Video Players

A word about data rates:

- A good standard overall data rate is 5.5 Mbps (this is what DVD's use). Maximum data rates of up to 8 Mpbs can be reached but this is not reliable and is dependent on content and playlist complexity. 6 Mbps is the highest data rate that should be used.
- Variable bit rate encoding can be used, but a fixed rate is recommended for general use.

1.1.5 HALF D1 encoding

Digital View Media Players also support this specialised MPEG2 format. It is generally used to give MPEG2 performance, but with small file sizes. This is achieved by lowering the audio data rate and using only HALF the horizontal screen size. This has only a small effect on video files as resolution is based on the vertical scan lines in a video image. It is also useful for graphic content and video data rates can be lowered to almost MPEG1 rates. With a bit of experimentation, very good results can be achieved.

PAL example encode at:

Video:	• Video Size: 352x576 (Input size is still 720x576) • PAL Pixel Aspect Ratio (4:3) • 2 fields Interlaced 25fps • Field order must match input file if transcoding from Quicktime or AVI
Audio:	• 44.1 kHz Stereo • Mpeg must be encoded with an audio stream, even if audio is silent.
Data Rates:	• VIDEO: 2.048 Mbits/s • AUDIO: 120 kbit/s

2 Creating Content: A Brief Guide

2.1 The basics and history

Without delving into to much technical jargon and history, this is a brief guide to optimising the look of content on Digital View Media Players. This should not be seen as an exhaustive guide, but rather as a starting point for discussions with content creation experts.

2.1.1 Viewing Distance:

MPEG was created as a standardised compression scheme for domestic viewing purposes. It is designed to carry digital video signals to be viewed on video screens.

Part of the MPEG compression scheme (especially with MPEG1) is the optimal viewing distance, which is a few feet away. This is because MPEG throws away a lot of colour and static data, and optimises contrast and movement, which is what the human eye responds to. Very detailed text heavy applications would be better suited by using large Jpegs of 1024x768 on an XGA panel. However, good quality video can be achieved with only MPEG1 on a standard video monitor.

2.1.2 Text Issues:

Text should be at least 24-30pt depending on font. Serif fonts should be avoided. This is because of the relatively low resolution of video when compared to print. It is also a good idea to use drop shadows and glows when small text is used. This will help to avoid compression artifacts around small details like text.

2.1.3 Safe Area:

A border of approximately 10% of the picture area should be left free of important detail and text. This is especially important if content cannot be tested out on its delivery platform before playback. This is because different Panels / Monitors / and input-output configurations can 'blank' out the overscan area, especially if analogue video cabling is being used.

2.1.4 VGA / Non video Output:

If a Media Player is being used with an LCD, TFT or other VGA/Direct input without using a controller to process the signal, image results can vary considerably depending on the display being used. This is because the video signal is being displayed in a "raw" fashion on the screen, and has to be retimed, rescaled and colour corrected to fit. LCD and TFT do not display with *fields*, like video does, but with *frames*, updating many times faster a second than a television. Video Monitors, televisions, VHS players and plasma screens all have complex electronics in place to enhance a video signal. These processes include comb filters, scalers, colour correction and timing, image stabilisation and noise reduction. These filters are usually bypassed only when the best possible signal is being input, from an RGB SCART connector from a Playstation, for example.

The MPEG decoder chips used in Digital View's Media Players are the same ones found in many millions of DVD players and set top boxes around the world. When used with high quality component out and a high quality video screen, the results are exactly the same as a high quality DVD player would produce. Even with only a composite cable, impressive picture quality can be achieved.

Direct Drive LCD and TFT displays, on the other hand, have none of this image correction technology. In addition, the way the screen updates is also different from television and can strip away the smoothing effect of fields on text and motion graphics. If an XGA panel is being used, the video image is being scaled to twice its original size, with pixel aspect ratio conversion and colour retiming from YUV to RGB.

Even a cheap household PC has a video card to display video on the screen. To seamlessly display full screen, full motion video, this card is often an additional expense. This is why the addition of a controller card is often required to produce the best quality video image on an LCD or TFT screen.

However, VGA and Direct drive panels do produce an incredibly stable, bright and clear image. General video works very well, and Jpegs look immaculate, especially on an XGA screen with a full resolution Jpeg. There is also less colour crawl and aliasing than can be found on a composite signal.

Mixed text and graphic video content suffers the most as the encoding process has to deal with high detail that is moving, and high detail that is not. The image is then being resized to fit the screen. more often than not an XGA size panel. This results in slightly jaggier text as the anti-aliasing effects of video fields are stripped away by the LCD or TFT updating a frame at a time. Screens with static information will suffer the most. For this kind of installation particular care should be taken with text. Small high contrast text on a plain background is particularly vulnerable.

2.1.5 Creating the Best Quality MPEG

Content creation is an art.

Content purpose-made for the delivery platform is the best way to achieve optimum results. Colours, movement and safe areas all need to be optimised for the Media Player and enclosure it is playing in. Content should be encoded on software or hardware that allows elements of the encode to be tweaked to the requirements of the content. An mpeg may have to be tested many times before optimum results are achieved. There is no magic setting to produce the best results, as this depends on the content.

At the time of writing, the best quality mpeg is achieved by having broadcast quality video sourced on Digital Betacam or equivalent, or broadcast specification graphic files. The original file needs to be good: one golden rule is “rubbish in, rubbish out”.

A PAL MPEG2 File with PAL pixels running at 6 MBits/sec (up to 8 is possible, but not reliable) on a component driven LCD with a controller produces the best results.

At the present time encoding with larger than standard files, using progressive scan or square pixel encoding methods and or non-standard frame rates does not increase the picture quality of the content. The MPEG chips expect to input and output standard DVD / VCD format multiplexed MPEG2.

2.1.6 A few words about Wide screen

Everything supports 16:9. Confusion sometimes arises because some MPEG-2/DVD encoders include the option for tagging an MPEG as 16x9, so that a widescreen TV can flip between 4:3 and 16:9 modes automatically. This tagging is also used for video that is recorded at 16:9 with 16:9 pixels. [1] *Widescreen content (16:9) is just video content.* It works over any video connection. Widescreen content will not look right on a VGA screen, because XGA cannot be driven at a 16:9 shape by Digital View players.

To create widescreen content, start by *creating* it at 16:9 and then *encode* as 4:3. A 16x9 panel/ monitor/screen stretches it back out. No resolution is lost in this process because video signals contain their resolution in their height (this is measuring the scan lines that make up fields). For optimal quality on a large 16x9 or 4:3 screen, please be sure to use *component* output as much as possible: anything else will not offer optimum quality.

1 This usually applies to film, which is why DVDs advertise film as being *anamorphically enhanced*: you are simulating the use of anamorphic lenses to create the picture shape, without zooming or cropping.

2.2 Content Creation – Resolution Guide

The following section will help you create content for conversion to MPEG-1 or MPEG-2 video. This is complex, and you can be forgiven for leaving the enterprise to the experts.

2.2.1 Pixel Aspect Ratios.

Pixels on a computer end up showing a different "shape" to those on a video screen. While a CRT has "virtual pixels", an LCD you have absolute pixels. That explains why, for instance, an NTSC video (720x480) looks thin and flat on a PC-screen, but almost square on a TV, where the "virtual pixels" are higher than they are wide. Looked at another way, a TV appears to "stretch" content vertically (NTSC more so than PAL).

We recommended that content be created in *square* pixel aspect ratios in image software such as Photoshop. Animated or video content should then be resized later to the equivalent PAL or NTSC aspect ratios for export in software such as After Effects, Final Cut Pro, or Avid. This will not result in loss of data quality, as the pixels are just a different shape, rather than an actual resize. Widescreen content should be created in square pixels at full size, and then encoded at standard PAL or NTSC size. This quick guide outlines these numbers:

768x576	=	720x576 PAL
1024x576	=	720x576 PAL Widescreen
960x576 PAL	=	720x576 PAL Widescreen
720x540 NTSC	=	720x480 NTSC
864x486	=	720x480 NTSC Widescreen

Examples of JPG file creation:

- **If you create a JPG file for displaying on an NTSC video screen, create it in "square pixels" (e.g. In Photoshop) at 704x540, then scale ("squish") it (still in Photoshop) to 704x480 before uploading to the player. That way when the player "stretches" the signal vertically, it will once again look right (and a circle will be circular).**
- **If you create a JPG for displaying on an LCD screen using the player's VGA output, no scaling will be done. Simply create the JPG at the VGA resolution (e.g. 1024X768 for XGA output).**

2.2.2 "D1"

D1 refers to the digital broadcast standard. D1 is "full digital overscan" and will fill a screen to the edges. Smaller video resolutions may leave borders. This is called underscan. This disparity is caused by the difference in resolution between consumer and professional source material.

It is also a legacy from analogue equipment. Many resolutions refer to analogue or old digital editing formats based around square pixel VGA resolutions.

MPEG 1 (Video CD) resolutions are measured in multiples of 16 pixels, and match analogue underscan broadcast screen size. This is a limitation of the compression process. This is also true of MPEG stills. MPEG 2 (DVD) matches broadcast resolutions. JPEG images are measured in SQUARE pixels.

2.2.3 Content Creation – Resolution Chart

There is a lot of confusion as to what is PAL and what is NTSC standard content. For historical reasons, many different formats and sub-formats exist. Over time, standards have changed depending on what equipment you use.

The table below describes most of these standards; this is, in other words, an illustration of formats you may encounter, and what they mean and are intended for.

RESOLUTION	PIXEL SHAPE	FORMAT	USE
768 X 576	SQUARE	4:3 PAL D1	Square pixel size equivalent of D1 PAL. Used to create c content for mpeg or jpeg in a design program
720 X 540	SQUARE	4:3 NTSC D1	Square pixel size equivalent of D1 NTSC. Use to create content for MPEG or JPEG in a design program.
720 X 534	SQUARE	4:3 NTSC	Square pixel size equivalent of consumer source NTSC.
864 X 486	SQUARE	16X9 NTSC D1	Square pixel size equivalent of widescreen NTSC. create content for mpeg or jpeg in a design program
864 X 480	SQUARE	16X9 NTSC	Square pixel size equivalent of consumer source NTSC.
1024 X 576	SQUARE	16X9 PAL D1	Square pixel size equivalent of D1 PAL. Widescreen. Use to create content for mpeg or jpeg in a design program
704 X 576	SQUARE	PAL	Square NTSC underscan. often used digital editing applications using analogue video
704 X 480	SQUARE	NTSC	Square NTSC underscan. often used digital editing applications using analogue video
640 X 480	SQUARE	VGA	VGA
800 X 600	SQUARE	SVGA	SVGA
1024 X 768	SQUARE	XGA	XGA
720 X 480	NTSC	DV NTSC	DV / DVD NTSC
720 X 486	NTSC	NTSC D1	Full overscan broadcast NTSC
720 X 576	PAL	D1 PAL	Full overscan broadcast PAL
704 X 576	PAL	PAL	PAL underscan. Often used for analogue video applications.
704 X 480	NTSC	NTSC	NTSC underscan. Often used for analogue video

			applications.
352 X 288	PAL	PAL	MPEG 1 maximum size
352 X 240	NTSC	NTSC	MPEG 1 maximum size
352 X 576	PAL	PAL	Half D1, an economic dvd based format
352 X 480	NTSC	NTSC	Half D1, an economic dvd based format

2.2.4 Content Creation – Encoding Chart

If you are encoding content on a computer, the table below shows what size to create at, what size to make your content at in an editor or video software, and then what size to actually encode at.

Format	Create at	Export Video	Encode At
MPEG 1 PAL	704 X 576	352 X 288	352 X 288
MPEG 1 NTSC	704 X 540	352 X 240	352 X 240
MPEG 2 PAL	768 X 576	720 X 576 PAL	720 X 540 PAL
MPEG 2 PAL WIDE	1024 X 576	720 X 576 PAL	720 X 540 PAL
HD1 MPEG 2 PAL	768 X 576	352 X 576 PAL	352 X 576 PAL
MPEG 2 NTSC	720 X 540	720 X 480 NTSC	720 X 480 NTSC
MPEG 2 NTSC WIDE	864 X 480	720 X 480 NTSC	720 X 480 NTSC
HD1 MPEG 2 NTSC	720 X 540	352 X480 NTSC	352 X 480 NTSC
MPEG STILL PAL	704 X 576		704 X 576
MPEG STILL NTSC	704 X 480		704 X 480
JPEG STILL (PAL)	704 X 576		
JPEG STILL (NTSC)	704 X 480		
JPEG STILL (XGA)	1024 X 768		

3 Video Quality on the RP 300

3.1 Factors that determine output quality

"Good Video Output" is not simple, and often, there is no "right or wrong" answer to "how do I obtain the best quality video on my players". Video output quality depends on many factors, including:

- The type of content to be used: MPEG-1, MPEG-2, MPEG still or JPEG.
- Resolution of MPEG still and JPEG used.
- OSD (On Screen Display) required or not?
- What output method? (Direct Drive, VGA out, or Composite/S-Video?).
- Panel type or resolution of monitor.

This note describes the various ways you can derive differing video quality from the RM-DN3 Digital Video Player. You should use the method that best suits your budget, the available media, the output device, and the desired output quality.

3.2 Options to get output from RP 300

The RM-DN3 board offers three ways to get output to your display device:

1. **DIRECT DRIVE:** Direct-drive (CN11) from RM-DN3 to the TFT LCD panel.
2. **VGA:** ARGB out (CN12) from RM-DN3 to the LCD/VGA monitor
3. **COMPOSITE:** S-Video/Composite out through CNV4 from RM-DN3 to TV monitor
4. **COMPOSITE:** S-Video/Composite out through CNV1 from RM-DN3 to TV monitor

These all offer their own advantages and drawbacks, as described in the following sections.

3.3 Preferences

The optimal output path (as decribed in the previous section) will depend on what content is being used, as follows:

3.3.1 “One-to-one” JPEG:

(E.g. 640x480 JPEG, displayed on a VGA panel, or 1024x768 JPG, displayed on an XGA panel)

The best quality in order of preference is obtained by using:

(1) – (2) – (3)

where (4) does not support JPEG

Reason/notes:

1. Since not much scaling or signal conversion needs to be done by the Geode chip.
2. The signal needs to be converted down to analogue and digital through ARGB port
3. The output is in video format (720x576) and therefore needs scaling.
4. The CNV1 does not support JPEG

3.3.2 MPEG movie:

Option (4) should give best results, so the order of preference is:

(4) – (1) – (2) – (3)

Reason/notes:

(4) Video signal directly output from Sigma chip: not much signal conversion needs to be done.
(1) Digital signal directly from Geode chip: not much signal conversion needs to be done.
(2) and (3) Need much more signal conversion from Digital signal to ARGB or Composite.

3.4 Comparison

The following table shows relative quality of the various solutions, as well as the signal paths taken for the respective outputs. In general, the shorter the path, the better the quality.

	Direct-Drive / VGA out		S-Video / Composite out	
	CN11(direct-drive)	CN12(ARGB)	CNV1	CNV4
Optimal resolution for JPEG content	640x480 VGA panel 800x600 SVGA panel 1024x768 XGA panel	640x480 VGA monitor 800x600 SVGA monitor 1024x768 XGA monitor	NOT support JPEG	720x576 (PAL) 720x480 (NTSC)
Optimal resolution for MPEG still content	720x576 (PAL) 720x480 (NTSC)	720x576 (PAL) 720x480 (NTSC)	720x576 (PAL) 720x480 (NTSC)	720x576 (PAL) 720x480 (NTSC)
OSD support	Yes	Yes	No	Yes
Video quality	●●●●	●●●	●●●●●	●●●
JPEG quality	●●●●●	●●●●●	NOT support JPEG	●●●
Optimal encoding bitrate for MPEG	MPEG-1 (1 -1.5Mbit/s) MPEG-2 (5 -6Mbit/s)	MPEG-1 (1 -1.5Mbit/s) MPEG-2 (5 -6Mbit/s)	MPEG-1 (1 -1.5Mbit/s) MPEG-2 (5 -6Mbit/s)	MPEG-1 (1 -1.5Mbit/s) MPEG-2 (5 -6Mbit/s)

●●●●● Good quality
●●●● Fair quality
●●● Acceptable quality

Video on CNV1 : Sigma ->Composite -> digital -> panel
Video on CN11 : Geode ->Digital signal -> panel
Video on CN12 : Geode -> Digital signal -> ARGB -> digital -> panel
Video on CNV4 : Geode -> Digital signal -> Composite -> digital -> panel

4 Video Quality on the MV-Flash M3

4.1 Factors that determine output quality

When you going to create content for MV-Flash M3 and want to have better outout quality, you should consider the following factors:

- Resolution of JPEG used.
- Encoding bitrate

4.1.1 JPEG:

The 800x600 resolution can make your JPEG picture best fit on screen. Using JPGs with larger or smaller resolution that this may chop off the edges of the image or not fill the entire screen.

4.1.2 Encoding bitrate:

The following are the recommended encoding specifications for video content on the MV-Flash M3:

MPEG-1 specifications:

Screen size:
PAL: 352 x 288
NTSC: 352 x 240
Bit Rate: 147kBps (1.15 Mbit/s)
Audio Bit Rate: 224 Kbit/s, 44.1 kHz at 16 bits sample rate
Frame Rate: PAL: 25 Hz / NTSC: 30 Hz

MPEG-2 specifications:

Screen size (recommended):
PAL: 720 x 576
NTSC: 720 x 480
Bit Rate: 640 kBps (5 Mbit/s)
Audio Bit Rate: 224 Kbit/s, 48 kHz at 16 bits sample rate
Frame Rate: PAL: 25 Hz / NTSC: 30 Hz

5 Glossary

bps – bits per second
fps – frames per second
Hz – Hertz, measure of frequency
JPEG – the Joint Photographic Experts Group – the committee that created the standards for pictures. Also a common digital picture format.
kbps – kilobit per second (1,000 bits)
Mbps- megabit per second (1,000,000 bits)
MPEG – the Motion Picture Experts Group – the committee that created the standards for digital video. Also a series of common digital video formats.
NTSC – National Television Standards Committee (USA color TV standard)
PAL – Phase Alternating Lines (European colour TV standard)

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