FlipFactory®

SD / HD CONVERSION

UP-CONVERTING SD TO HD
DOWN-CONVERTING HD TO SD
CROSS-CONVERTING HD FORMATS
SELECTED SD CONVERSIONS

This
App Note
applies to
versions
6.1 & later

Synopsis

With the introduction of HD television, the number of video standards with widely varying image sizes, aspect ratios, and frame rates, continues to expand. The core requirement to easily convert media between SD and HD formats as an integral part of production workflows is exemplified by the growing popularity of 1080 and 720 HD formats.

FlipFactory Pro SD | HD Edition provides HD encoders and profiles which enable you to up-convert SD 4:3 to HD 16:9 in various ways and cross-convert between HD formats. FlipFactory also supports transcoding video from or to anamorphic SD formats.

In addition to the HD encoding profiles that Telestream provides in FlipFactory Pro SD | HD Edition, you can use any edition of FlipFactory to down-convert HD 16:9 to all SD 4:3 profiles. You can also encode media in HD frame sizes in QuickTime, Windows Media, MPEG-4 Apple (H.264), and Flash format, without purchasing an HD license.

FlipFactory enables you to implement flexible, reliable, automated monitor-transcode-deliver workflows to suit your HD requirements for transcoding and delivery of high-quality media.

FlipFactory Pro SD | HD Edition

FlipFactory Pro SD | HD edition provides HD 1080 interlaced and progressive and 720 progressive profiles, and wrappers as appropriate, for the following systems:

Autodesk Stone Format	Avid TransferManager Format
Final Cut Pro & QuickTime NLE	Grass Valley Profile and K2 GXF
Leitch Format	Matrox Format
MXF Stream	Omneon Server
SeaChange Format	VOD Transport Stream
EVS	H.264
IPTV Transport Stream	MediaStream
MPEG2 Program Stream	Windows Media Format

For details about these profiles, see HD Profile Formats on page 31.

This app note introduces some of the FlipFactory filters commonly used in SD/HD conversion workflows. This app note describes how you can use FlipFactory to perform SD>HD, HD>SD, HD cross-conversion, and other specialized transcoding workflows. It also provides workflow examples including image conversion diagrams, filter setups, and formulas you'll find helpful as a reference when setting up your own conversion workflows.

FlipFactory Conversion Filters

FlipFactory provides over two dozen audio and video pre-processing filters, which you can use to customize and control how FlipFactory processes media. The following filters are often enabled in up-conversion, cross-conversion, and down-conversion workflows:

Frame Mode Filter

The Frame Mode filter is used to identify your input media as progressive and interlaced video, and specify interlaced video as lower or upper field dominance. This filter should be utilized when you are processing media that is not encoded in the manner that FlipFactory processes by default (for example, VC-1).

When in doubt, always enable the Frame Mode filter. If you know the field dominance of your media and you're not sure FlipFactory uses the right default for its essence type—or if your media is progressive, always enable the filter and specify the correct field dominance or specify *progressive*. That way, you know FlipFactory will process your incoming media correctly.

Under the following conditions, you should enable the Frame Mode filter:

1. **Decoding Interlaced NTSC with Lower Field First**. If the NTSC file is lower field first, select *Interlaced Lower Field First*. The decoder processes NTSC source files as Upper Field First unless you override the setting.

2. **Decoding Interlaced PAL with Upper Field First**. If your PAL file is upper field first, select *Interlaced Upper Field First*. The decoder always processes PAL source files as Lower Field First unless you override the setting.

3. **Decoding Progressive**. If your source file is progressive, select *Progressive*. The decoder always processes NTSC and PAL source files as interlaced unless you override the setting.

For a detailed discussion of dealing effectively with variations in video interlacing field dominance, see the "FlipFactory Video Interlacing" App Note on Telestream's Web site at www.telestream.net.

Field Order Conversion Filter

Enable the Field Order Conversion filter when converting your upper field first media to output lower field first or input lower field first to output upper field first. You should also select Frame Line Shift Up or Frame Line Shift down to prevent FlipFactory from performing spatial interpolation, which may result in a softer image.

Crop Filter

The Crop filter operates on input video frames after they have been decoded to digital baseband video. Enable the Crop filter to trim the outer edges of the input image, vertically and/or horizontally. You can use the Crop filter to trim VBI, or to trim the top and bottom from a 4:3 profile input image to create a 16:9 ratio image, for example.

Mask Filter

The Mask filter operates on output video frames before they are encoded. The Mask filter masks a region which lies outside of the output image, and inside of the output rectangle. Masking causes the output image to be resized (scaled down) to fit into the masked region in each dimension: horizontal (left and right) and vertical (top and bottom). For example, you can configure the Mask

filter to compress a 4:3 output frame vertically to a 16:9 aspect ratio, then fill the region above and below the 16:9 area with black—producing letterbox format output.

Overlay Filter

The Overlay filter allows you to replace the solid color mask region with a graphic image file. The Overlay filter is often used in conjunction with the Mask Filter, with an alpha channel on the graphic image file to display the actual video frame.

MotionResolve® Filter

When up-converting interlaced SD video to HD formats, you can employ MotionResolve®, a licensed filter designed specifically to provide the highest level of visual clarity. The MotionResolve filter increases transcoding time (typically 20 to 50%). The determination of when to employ MotionResolve is best based on your visual quality requirements, suitability of input media (interlaced video with significant detail and motion), and acceptability of additional processing time.

FlipFactory's MotionResolve filter is designed specifically to improve visual clarity on interlaced video when up-converting, compared to up-converting by traditional means. The MotionResolve Filter processes interlaced video to eliminate motion-induced field conflicts and maintain detail, reduce motion artifacts, and reduce "jaggies".

Conside using MotionResolve to improve visual quality when:

- Transcoding interlaced-to-progressive media, for example,
    — HD up-conversion—525/60 (NTSC) to 720p
    — 625/50 (PAL) to Windows Media full-screen
    — 525/60 to Real full-screen
- Resizing interlaced-to-interlaced media, for example,
    — HD up-conversion (525/60 to 1080i)
    — Standards conversion (525/60 to 625/50)

Note: *For details and examples of using MotionResolve to improve visual clarity of up-converted interlaced video, see the App Note entitled "Motion Resolve Filter—Maintaining Visual Quality When Scaling Video", available on Telestream's Web site at* www.telestream.net.

Use of the MotionResolve filter is independent of any SD > HD workflow you create. You can elect to enable MotionResolve in any SD > HD workflow.

Non-Linear Resize Filter

Most often used in up-conversion workflows, the Non-Linear Resize filter enables you to customize the region of each frame where little or no resizing is performed, and allows you to adjust the progression of increased rate of resizing to achieve a high-quality transition from one ratio to another (for example, 4:3 to 16:9). For details, see Non-Linear Resizing.

Processing SD Input with In-Band VBI

When FlipFactory detects 512-line NTSC input, it presumes that there is a 480-line active region with 30 lines on top and 2 lines on bottom that comprise the VBI band. If your output profile is set to 480, 720, 1080, or 1088 pixels high and the Crop filter is *not* enabled (or enabled and set to 0), FlipFactory automatically crops the NTSC VBI band from the input.

In the case of PAL-based 608-line input, FlipFactory presumes that there is a 576-line active region with 32 lines on top that comprise the VBI band. If your output profile is set to 576, 720, 1080, or 1088 pixels high and the Crop filter is *not* enabled (or enabled and set to 0), FlipFactory automatically crops the PAL VBI band from the input.

Up-converting SD to HD

Conversion to HD formats often involves re-imaging the source at four to five times the area or greater. High-quality source video and high-quality transcoding algorithms are critical to preserve the original image and present it as acceptable HD media to the viewing audience.

Up-converted media is usually viewed on HD-capable televisions and other high-definition monitors or display systems, and tends to magnify every aspect of the image—including motion-induced artifacts, noise, and other conversion-induced artifacts. For these reasons, it is important to start with SD material that has low noise. Pre-processing to reduce noise may be required—even when starting with digital media—to meet your required output quality standards.

You can up-convert your existing assets and new SD production for HD broadcast as inserts into HD productions or as an entire program.

The following examples describe common SD to HD conversions you can perform in FlipFactory Pro SD | HD edition:

- 4:3 SD > 16:9 Full-Resolution HD Conversion

- 4:3 SD > 16:9 Full-screen HD Conversion

- Anamorphic SD > HD Up-Conversion

- Non-Linear Resizing

4:3 SD > 16:9 Full-Resolution HD Conversion

You perform full-resolution (also called *full-image* or *pillarbox*) conversion of 4:3 SD video input to 16:9 HD output when you want to preserve the entire original frame. To do this, you add curtains of equal or unequal size to the original 4:3 frame to produce a 16:9 ratio (or 14:9) HD frame.

Figure 1. Perform a full-resolution conversion 4:3 SD > 16:9 HD by adding side curtains

Decode SD letterbox format input.

Up-convert the active SD input region into the 16:9 output frame at the proper resolution.

Add curtains, then encode the full-resolution output.
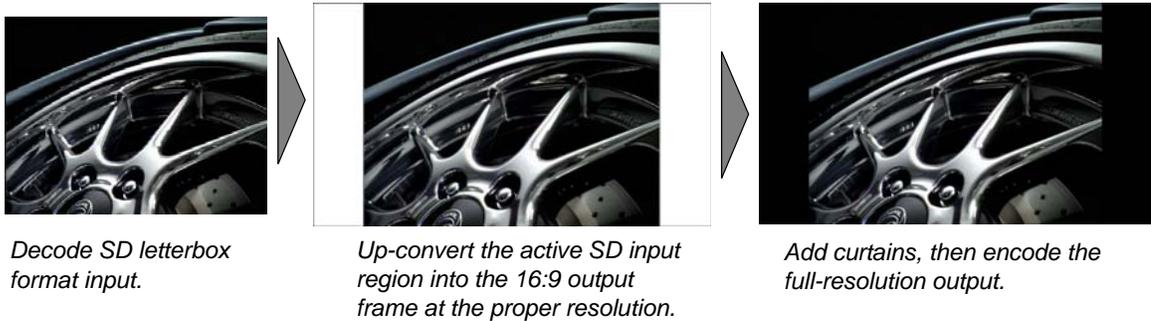
To set up a factory to convert 4:3 SD into full-resolution HD video, perform these tasks:

1. Make a new HD factory and name it appropriately.

2. Create a product in your factory with an HD profile. For example, VOD Transport Stream.

3. Select a 1080 interlaced or progressive profile or a 720 progressive profile, and frame rate, video rate, and GOP structure.

4. For interlaced profiles, select the output field order.

5. Make other settings in the codec editor panel as required.

6. Add a Mask filter to supply side curtains on each side of the image.

7. Set up monitors, destinations, and notifies as required.

Figure 2. Use the Mask Filter to add side curtains
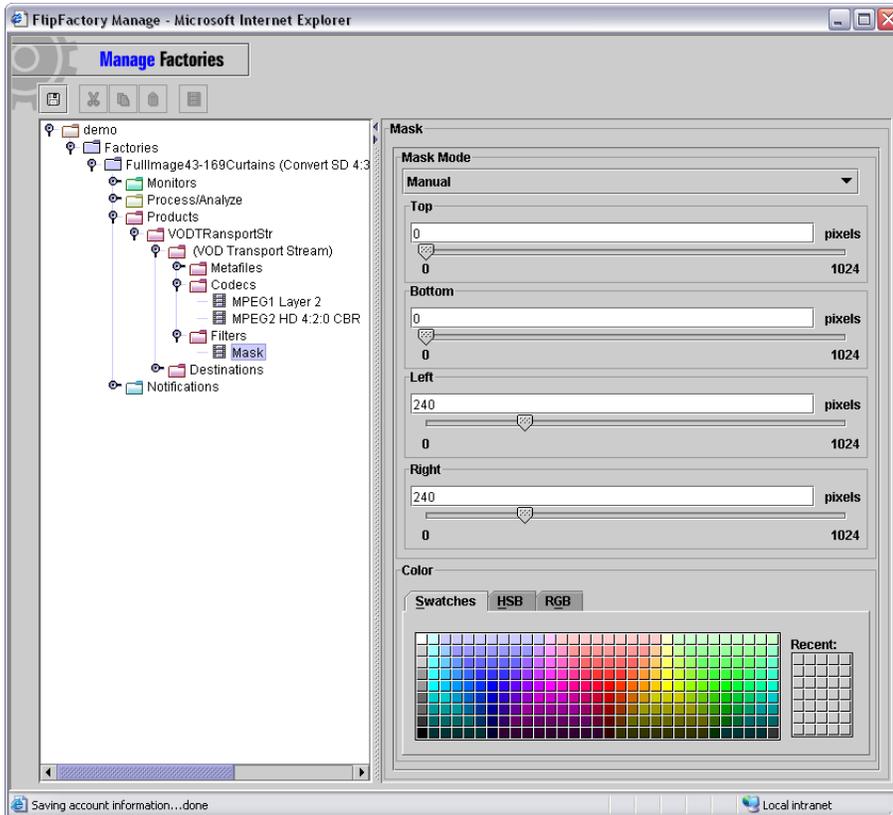
You can set up the Mask filter for use with 1080 or 720 HD profiles, based on the formula:

Total Curtain Width = HD Profile Width - Output Active Region Width

Because the rescaled HD image will be either 720 or 1080 pixels (lines) high, you can calculate the rescaled image width and curtain requirements as follows:

1. Calculate the horizontal dimension of the active region in the new image when up-converted to meet the height requirement of your HD profile in 4:3 format. In the case of 1080: 4/3 X 1080 = 1440. In the case of 720: 4/3 XX 720 = 960.

2. Next, subtract the active region width from the HD profile width.

    Continuing the example, the width of 1080 HD is 1920. 1920 - 1440 = 480.
    The width of 720 HD is 1280. 1280 - 960 = 320.

3. Divide the total curtain width in half to calculate each curtain width when split evenly.

     In this example, 320 / 2 = 160.

Note: *If your input NTSC or PAL video has inband VBI, FlipFactory will automatically crop it for you unless you enable the Crop filter and set the values a value other than 0. In most cases, you can ignore VBI lines when performing these calculations.*

For all 1080 output, total curtain width is 480; even-sized left and right curtains are 240 pixels wide. For all 720 output, total curtain width is 320; even-sized left and right curtains are 160 pixels wide.

Encoding 1080 Profiles. For 1080 profiles, configure the Mask filter by selecting Manual, then setting the Left and Right settings to 240 (or adjust accordingly to total 480 pixels).

Figure 3. Converting 4:3 SD frames to 16:9 HD 1080 full-resolution frames with side curtains
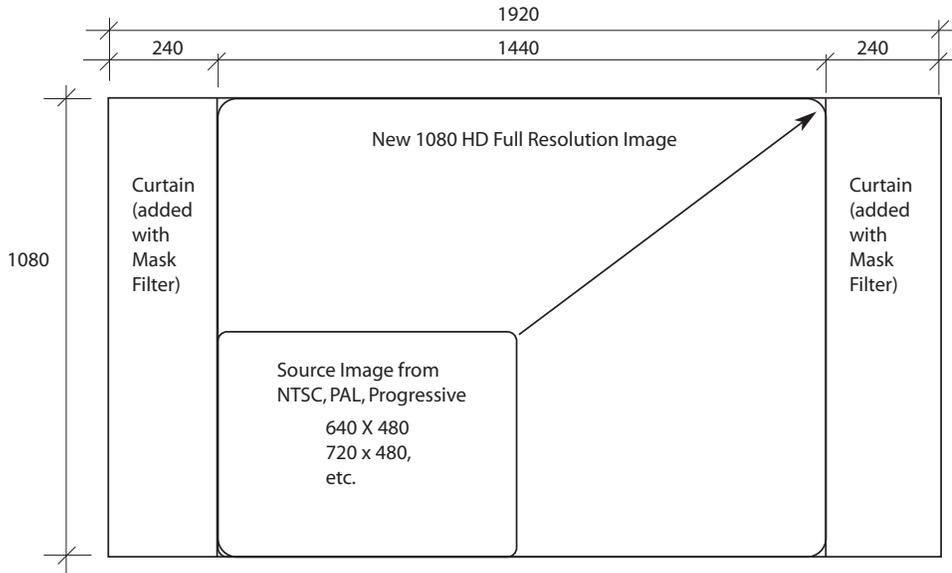
Encoding 720 Profiles. For 720 profiles, configure the Mask filter by selecting Manual, then setting the Left and Right settings to 160 (or adjust accordingly to total 320 pixels).

Figure 4. Converting 4:3 SD frames to 16:9 HD 720 full-resolution frames with side curtains
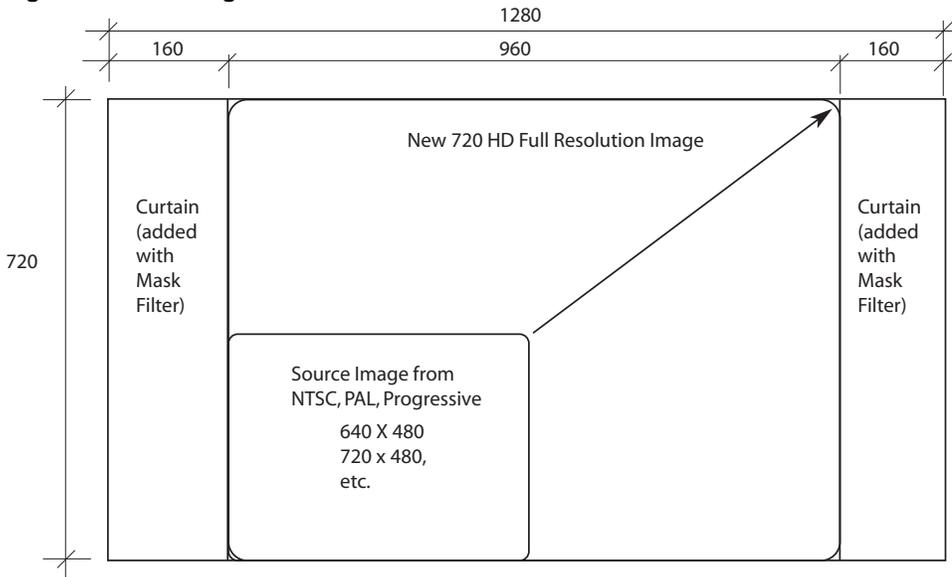
4:3 SD > 16:9 Full-screen HD Conversion

You perform a full-screen (sometimes referred to as *zoom*) conversion of 4:3 format SD video to 16:9 format HD video when you want to display the original frame on the full-screen of an HD monitor without using side curtains. When performing a full-screen conversion, you lose a vertical portion of the frame; textual or other graphic elements at the top or bottom are lost.

To up-convert full-screen, you crop 2 bands of equal or unequal size from the top and/or bottom of the original 4:3 frame to produce a 16:9 ratio (or 14:9) HD frame. You should split the loss from the top and bottom evenly or unevenly to preserve the most important part of the image. Because you are enabling the Crop filter, if your input video has inband VBI, you need to manually account for the cropping of VBI lines in your calculations.

Performing a full-screen up-convert results in more pixel generation than when performing a full-resolution conversion, so the frame has less clarity when compared to the same source converted via the full-resolution method. You can optionally employ the MotionResolve filter to improve clarity (in either case).

Figure 5. Perform full-screen conversion 4:3 SD >16:9 HD by cropping a portion of the frame

Decode SD letterbox format input.

Crop the top and bottom per the Crop filter configuration to create a 16:9 frame.

Up-convert to fill the output HD profile image dimensions, then encode the full-resolution output.
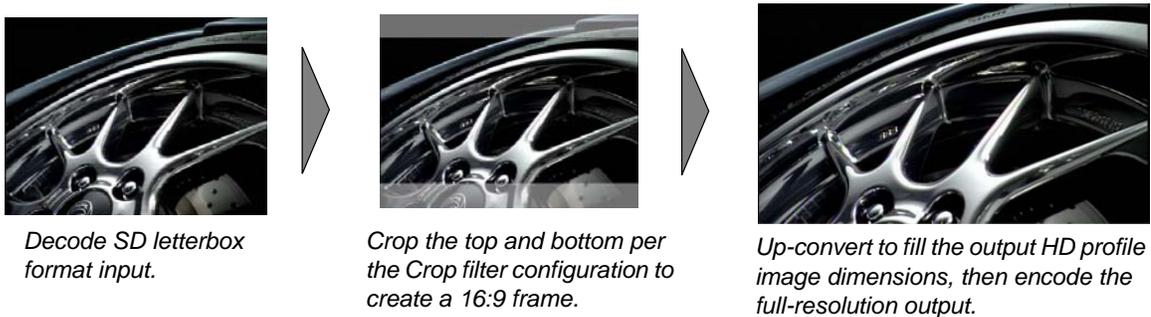
To set up a factory to convert 4:3 SD video into full-screen HD video, perform these tasks:

1. Make a new HD factory and name it appropriately.

2. Create a product in your factory with an HD profile. For example, VOD Transport Stream.

3. Select a 1080 interlace or progressive profile or a 720 progressive profile, and frame rate, video rate, GOP structure.

4. For interlaced profiles, select the output field order.

5. Make other settings in the codec editor panel as required.

6. Add a Crop filter to crop content from the top and bottom of the image.

7. Set up monitors, destinations, and notifies as required.

Figure 6. Use the Crop filter to trim pixels to achieve 16:9 format
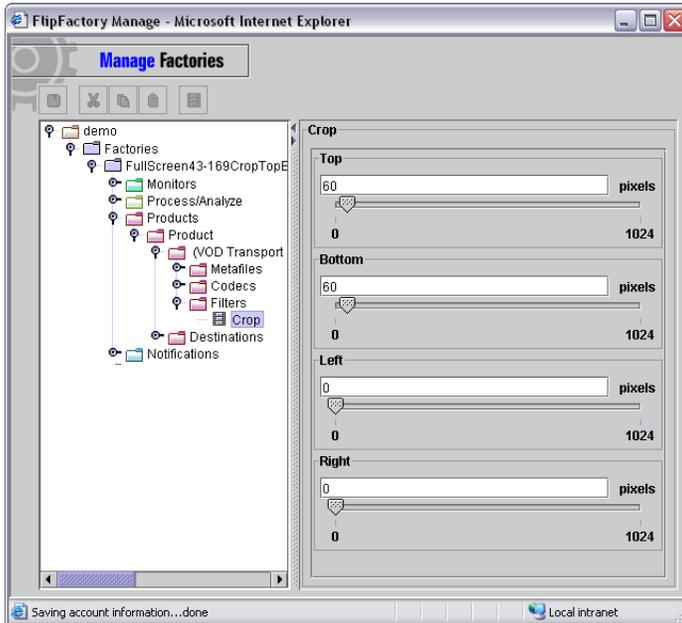
The 16:9 ratio is calculated as 4/3 X 4/3. Therefore, 3/4 of the height of the SD output is available to receive the input active 16:9 region. Conversely, 1/4 of the height must be cropped; typically 1/8 from the top and 1/8 from the bottom.

Total Crop Height Formula. Configure the Crop filter by setting the top and bottom setting to values that equal the total pixels to crop based on your input frame size, using this formula:

Total Crop Height = SD Height - (SD Height X 3/4)

1. Calculate the height of the SD image in 16:9 aspect ratio by multiplying the SD height by 4/3.

    For example, a 480 high SD frame x 3/4 = 360, the height of the SD image in 16:9 format.

2. Subtract any inband the SD image height in 16:9 format from the SD height to determine the total crop height.

    For example, the SD height is 480, so 480 - 360 = 120 (the total crop height).

3. Divide the total crop height by two (or unevenly) to determine top and bottom crop dimensions.
    In this example, the top and bottom crop is each 60 pixels high.

4. If input is 512 NTSC with inband VBI, add 30 to the top crop dimension and 2 to the bottom crop dimension. If input is 508 PAL with inband VBI, add 32 to the top crop dimension.

    Notice that the size of the encoded HD image is immaterial. The cropping is performed on the input to achieve a source image in the same aspect ratio as the up-converted image, to achieve the best possible output.

    Also note that the width of the SD input is also immaterial. SD formats are always 4:3, because in both PAL and NTSC the pixels are not square, and inband VBI may be present.

You can set up the Crop filter for use with various SD formats, as follows:

Figure 7. HD Full-screen conversion from 640 X 480 SD cropped top and bottom

New HD Full Screen Image

60

Crop region

Original 640 x 480 Image

480 360

60

Crop region
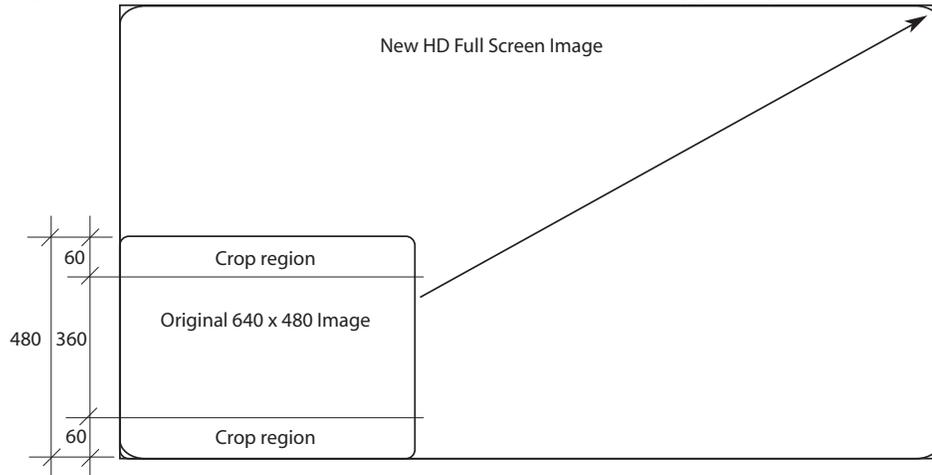
When encoding 640 X 480 or 720 X 480 SD source, FlipFactory crops the 4:3 SD image to 360 (to achieve the 16:9 aspect ratio), then enlarges the image to an HD frame for the selected profile.

Figure 8. HD Full-screen conversion from 720 X 512 In-Band VBI cropped top and bottom

New HD Full Screen Image

Original 720 x 512 Image

Top VBI Band   30

90   Crop Region   60

512 360   Cropped Source Region

Bottom VBI Band (2)

62   Crop Region   60
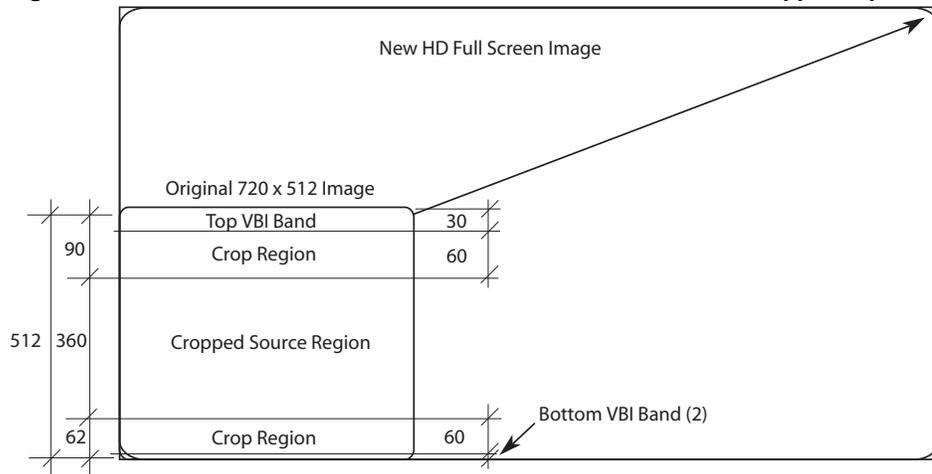
When encoding 720 X 512 SD source with inband VBI, FlipFactory crops the 4:3 SD image to 720 X 360 (to achieve 16:9 aspect ratio), then enlarges the image to the HD frame for the profile you selected.

Anamorphic SD > HD Up-Conversion

You perform anamorphic SD > HD up-conversion when you want to produce HD profile media from anamorphic SD source media without cropping any of the frame, or introducing pillars.

During the anamorphic SD > HD up-conversion process, FlipFactory up-converts each anamorphic SD 4:3 frame to achieve each new HD 16:9 frame. Because the source is 16:9 format in a 4:3 frame, the entire image is preserved–no cropping or curtains are necessary.

To set up a factory to convert anamorphic SD video into 720 or 1080 HD video, perform these tasks:

1. Make a new HD factory and name it appropriately.

2. Create a product with a 720 or 1080 HD profile. For example, VOD Transport Stream.

3. Set your bit rate, GOP structure, and select a suitable video profile.

4. Make other settings in the codec editor panel as required.

5. Set up monitors, destinations, and notifies as required.

Figure 9. Anamorphic SD conversion > 720 | 1080 HD
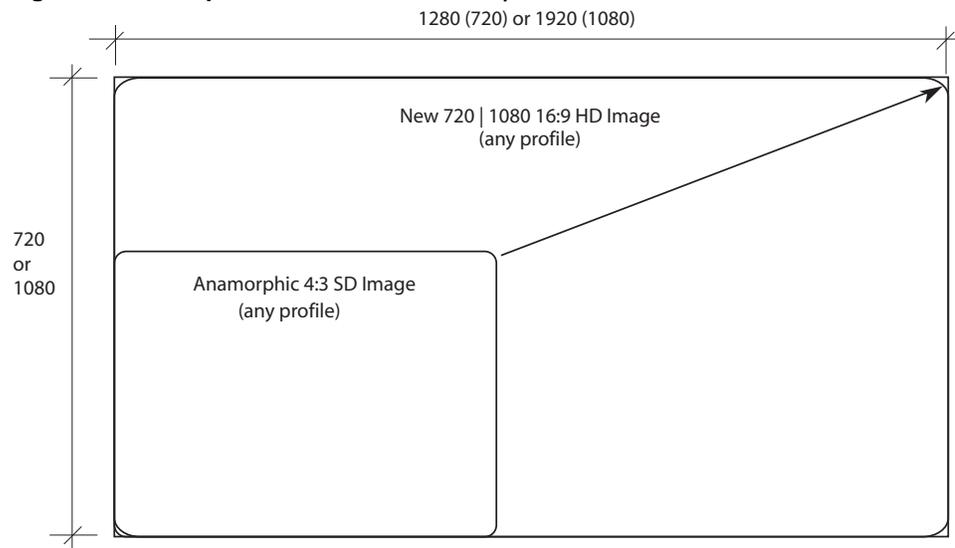
When encoding 720 or 1080 HD from anamorphic SD, FlipFactory simply creates a new image of the 16:9 HD frame. If in-band VBI is present (and no crop filtering is being performed), FlipFactory automatically crops the default VBI lines in NTSC and PAL.

Non-Linear Resizing

You should select non-linear (or wide zoom mode) resizing when you want to produce HD format content from SD source material, without resorting to providing pillars or uniformly distorting the entire frame. (Or other output that is not of the same ratio as the input).

The primary goal of non-linear resizing is to preserve the aspect ratio as best you can for the content; typically in the center of the screen where the action—and thus the focus of the viewer—is concentrated. The further from the center, the greater the distortion, in slowly-increasing amounts, out to the edge of the frame.

During the non-linear resizing process in an HD upconvert factory, FlipFactory up-converts each SD 4:3 frame to achieve each new HD 16:9 frame. Because the entire source is distorted into 16:9 format from a 4:3 frame, the entire image is preserved—no cropping or curtains are necessary.

To set up a factory to convert SD video using non-linear resizing techniques into 720 or 1080 HD video, perform these tasks:

1. Make a new HD factory and name it appropriately.

2. Create a product in your factory with an HD profile. For example, VOD Transport Stream.

3. Select an HD codec, and set the bit rate, GOP structure, and select a suitable video profile. Make other settings in the codec editor panel as required.

4. Enable the Non-Linear Resize filter and configure it:

Figure 10. Configuring the Non-Linear Resize Filter
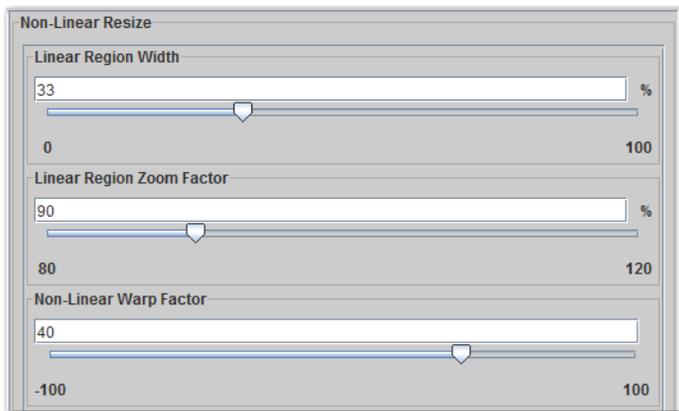
You can configure the filter to specify what percent of the frame (from the vertical and horizontal center) is resized linearly (typically, 33%). You can also specify how much to zoom the linear region, and the degree to which you warp the remaining (non-linear) region of the frame.

The best practice when utilizing the non-linear resize frame is to set up a set of steps, then run them against a common clip and review the output for best results.

Down-converting HD to SD

Media shot in HD is ideal for producing high-quality SD output. With 5 to 6 times the resolution of SD, HD provides a highly-oversampled source from which to encode SD broadcast productions.

1080i/p and 720p HD formats can be easily translated into SD formats supported by FlipFactory, with excellent visual quality and clarity. You can perform HD down-conversion to SD formats in any edition of FlipFactory. The HD Edition of FlipFactory is not required for these types of workflows.

This topic describes common HD to SD conversions you can perform with FlipFactory:

- 16:9 HD > 4:3 Full-screen SD Conversion
- 16:9 HD > 4:3 SD Letterbox Conversion
- Anamorphic HD > SD Down-conversion

16:9 HD > 4:3 Full-screen SD Conversion

You perform full-screen (often called *4:3* or *center-cut*) down-conversion of 16:9 format HD video to 4:3 format SD video, to produce output for playout on SD televisions. In these workflows, you crop vertical segments of equal or unequal size from one or both sides of the original 16:9 image, removing content from the edge or edges of the frame. You can pan and scan to split the side crops unevenly to preserve the important part of the image.

To down-convert full-screen, you crop 2 bands of equal or unequal size from the left and/or right of the original 16:9 frame to produce a 4:3 ratio, reduced SD frame.

Figure 11. Full-screen Conversion 16:9 > 4:3 SAMPLE

Decode HD 16:9 input.   *Crop the left and right to leave a 4:3 ratio active region.*   *Down-convert to fill the SD profile image dimensions.*
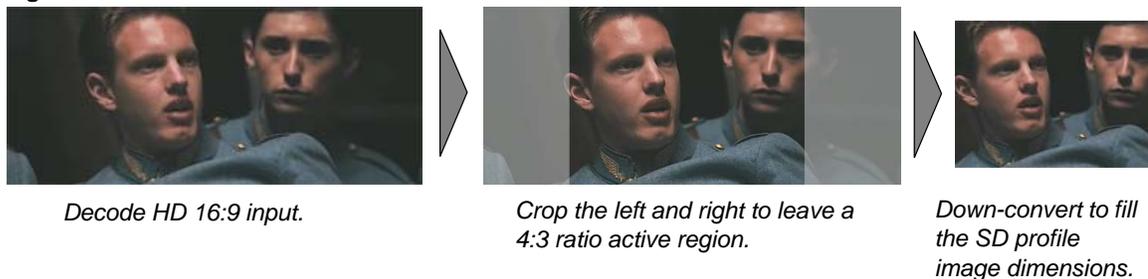
To set up a factory to convert HD 16:9 video into 4:3 SD full-screen video, perform these tasks:

1. Make a new SD factory and name it appropriately.

2. Create a product in your factory with an SD profile. For example, MPEG2 Program Stream, and configure it for your workflow and output requirements

3. Set your bit rate, GOP structure, and select a suitable video profile.

4. Make other settings in the codec editor panel as required.

5. Add a Crop filter to trim pixels from either/each side of the image and configure it.

6. Set up monitors, destinations, and notifies as required.

Figure 12. Use the Crop filter to remove content from the top and bottom of input frame
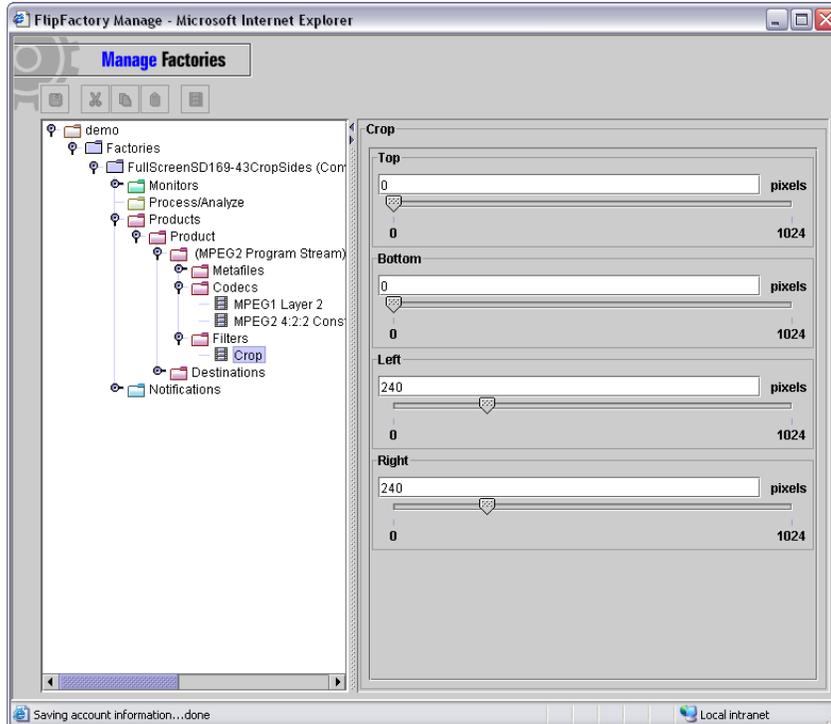
You can set up the Crop filter for use when down-converting HD 1080 or 720 HD profiles to SD 4:3, based on the formula:

Total Crop Width = HD Profile Width - (HD Profile Width X 3/4)

1. Calculate the 4:3 image width of the HD image by dividing the HD profile width of the input by 3/4 to make an HD image in 4:3 format.

   Using 1080 HD as an example: 3/4 X 1920 = 1440.

2. Subtract this value from the HD profile width to determine the total crop width value.

   Continuing the example, 1920 - 140 = 480.

3. Divide the total crop width as necessary to provide crop region dimensions.

   In this example, an even left and right cropped region is 240 pixels wide.

Encoding from 1080 Profiles. For 1080 profile source media, configure the Crop filter by setting the Left and Right settings to 240 (or adjust accordingly to total 480 pixels).

Figure 13. 1080 HD input is cropped on both sides
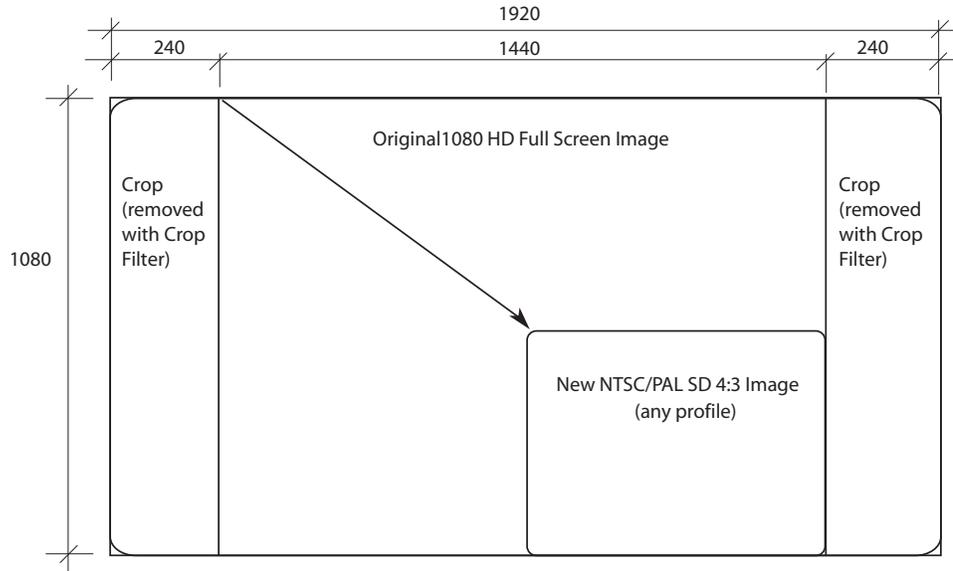
When encoding SD from 1080 profiles, FlipFactory creates a 4:3 aspect ratio image of the 16:9 HD frame by cropping 480 pixels from the width (usually in two 240 pixel panels, one on each side), to arrive at the total image size of 1440 x 1080 before down-sampling to the SD profile.

Encoding from 720 Profiles. For 720 source, configure the Crop filter by setting the Top and Bottom settings to 160 (or adjust accordingly to total 320 pixels).

Figure 14. Full-screen conversion 720 HD > 4:3 SD cropped both sides
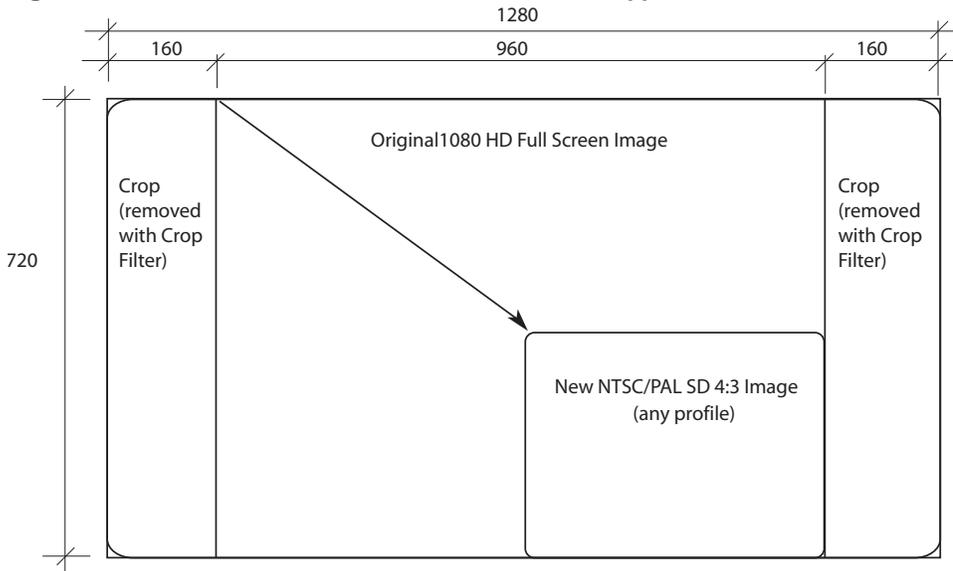
When encoding SD from 720 profiles, FlipFactory creates a 4:3 aspect ratio image of the 16:9 HD frame, by cropping 320 pixels from the width (usually in two 160 pixel panels, one on each side), to arrive at the total image size of 960 x 720 before downsampling to the SD profile.

16:9 HD > 4:3 SD Letterbox Conversion

You perform letterbox (or *16:9*) conversion of 16:9 format HD video to 4:3 for playout on SD televisions to preserve the entire 16:9 frame in letterbox format. To perform this conversion, you add bars (typically of equal size) to the top and bottom of the original 16:9 image.

Figure 15. Letterbox Conversion 16:9 HD > 4:3 SD

Decode HD 16:9 input.

down-convert to fill the SD profile image dimensions.

Fill the mask region and encode the video.
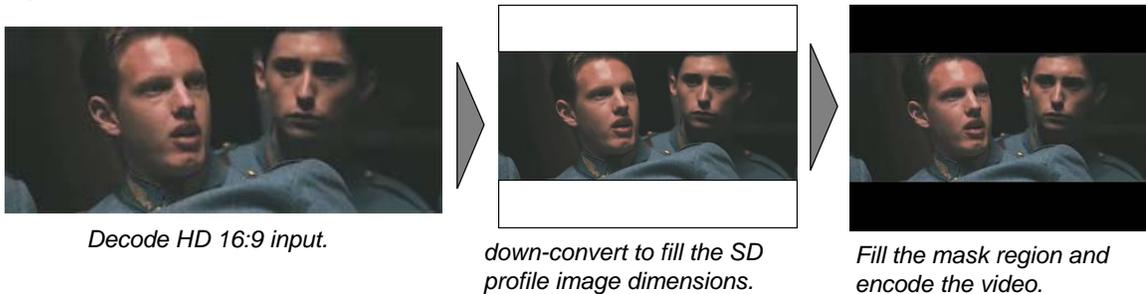
To set up a factory to convert HD 16:9 video into 4:3 SD letterbox video, perform these tasks:

1. Make a new SD factory and name it appropriately.

2. Create a product in your factory with an SD profile. For example, MPEG2 Program Stream.

3. Set your bit rate, GOP structure, and select a suitable video profile.

4. Make other settings in the codec editor panel as required.

5. Add a Mask filter to pad top and bottom, and select Letterbox in 16:9 or 14:9 format.

6. Set up monitors, destinations, and notifies as required.

The 16:9 ratio is calculated as 4/3 X 4/3. Therefore, 1/4 of the height of the SD output is excess and 3/4 is available to receive the input active 16:9 region. Therefore, 1/4 of the height must be masked; typically 1/8 at the top and 1/8 at the bottom.

In situations where the preset Letterbox settings in the Mask filter are not adequate, you can calculate the dimensions based on the formula:

> **Total Bar Height = SD Profile Height - (SD Profile Height X 3/4)**

1. Multiply the SD profile height by 3/4 to calculate the height of the encoded SD image in the 16:9 ratio.

    In the example of 480: 480 X 3/4 = 360.

2. Subtract the result from the SD profile height to calculate the total bar height.

    Continuing the example: 480 - 360 = 120.

3. Divide the total bar height by 2 to determine the height of top and bottom bars.

    In this example, the bars are 60 and 60, which total 120.

    All NTSC (480 high) SD profiles require a total letterbox bar height of 120; top and bottom even bars are 60 pixels each.

    All PAL (576 high) SD profiles require a total letterbox bar height of 144; top and bottom even bars are 77 pixels each.

You can set up the Mask filter for use when down-converting 1080 or 720 HD profiles to SD 4:3 profiles, as follows:

Figure 16. Use the Mask Filter to add top and bottom panels
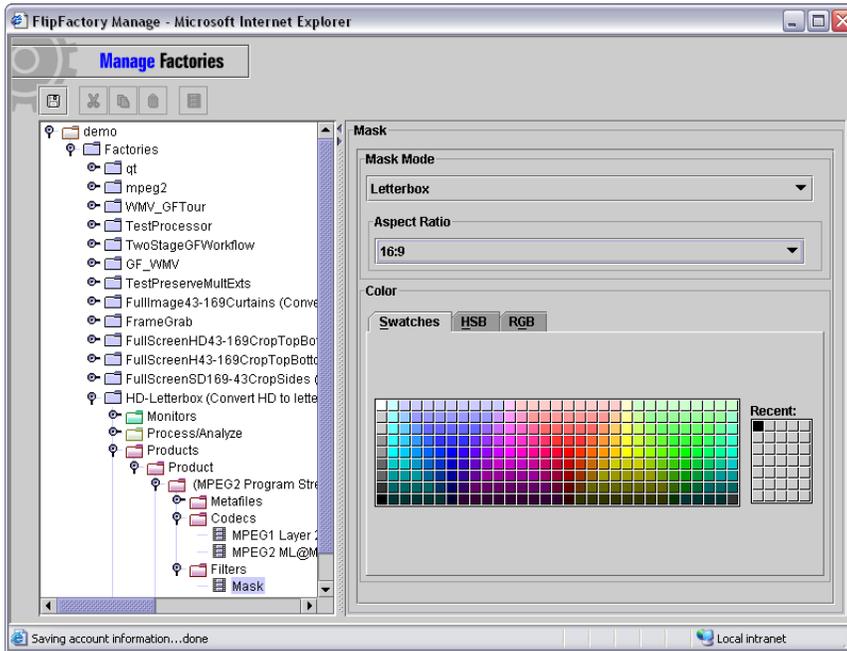
Encoding 4:3 Letterbox format from HD Profiles. For HD profile sources, configure the Mask filter by selecting Letterbox 16:9 or 14:9, or in special circumstances, by selecting Manual, and setting the Top and Bottom settings based on your calculated top and bottom curtain dimensions.

Figure 17. HD 16:9 conversion > 4:3 SD in Letterbox format
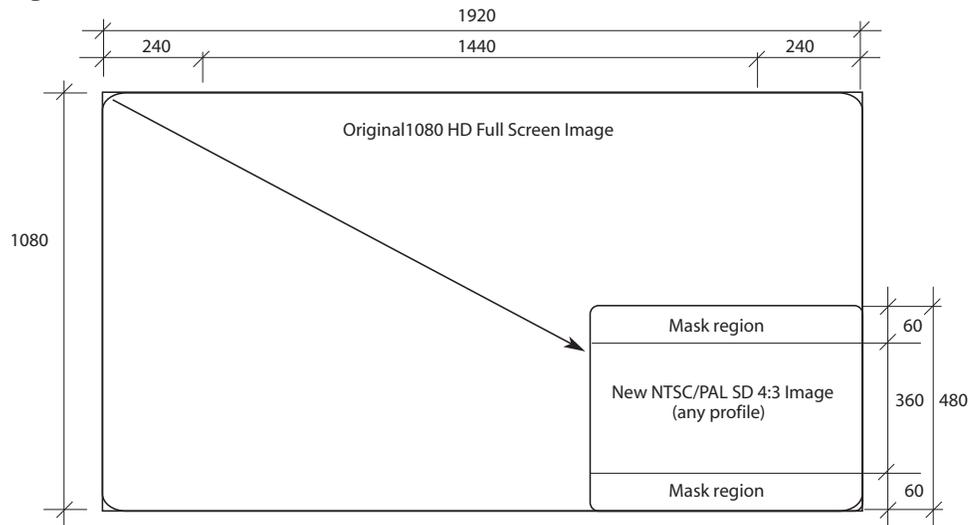
When encoding SD from 1080 (Figure 14) or 720 HD profiles, FlipFactory creates a 4:3 aspect ratio image of the 16:9 HD frame, by cropping 480 pixels from the width (usually in two 240 pixel panels, one on each side), to arrive at the total image size of 1440 x 1080 before downsampling to the SD profile.

Anamorphic HD > SD Down-conversion

You perform HD > Anamorphic SD down-conversion when you want to produce Anamorphic SD format content from HD source.

FlipFactory down-converts each HD 16:9 frame to achieve each new anamorphic SD 4:3 frame. Because the output retains the 16:9 format in a 4:3 frame, the entire image is preserved—no cropping or curtains are necessary.

To set up a factory to convert 720 or 1080 HD video into anamorphic SD, perform these tasks:

1. Make a new SD factory and name it appropriately.

2. Create a product with an SD profile. For example, an MPEG2 Program or System Stream.

3. Set your bit rate, GOP structure, and select a suitable video profile.

4. Make other settings in the codec editor panel as required.

Figure 18. 720 | 1080 HD > Anamorphic SD conversion
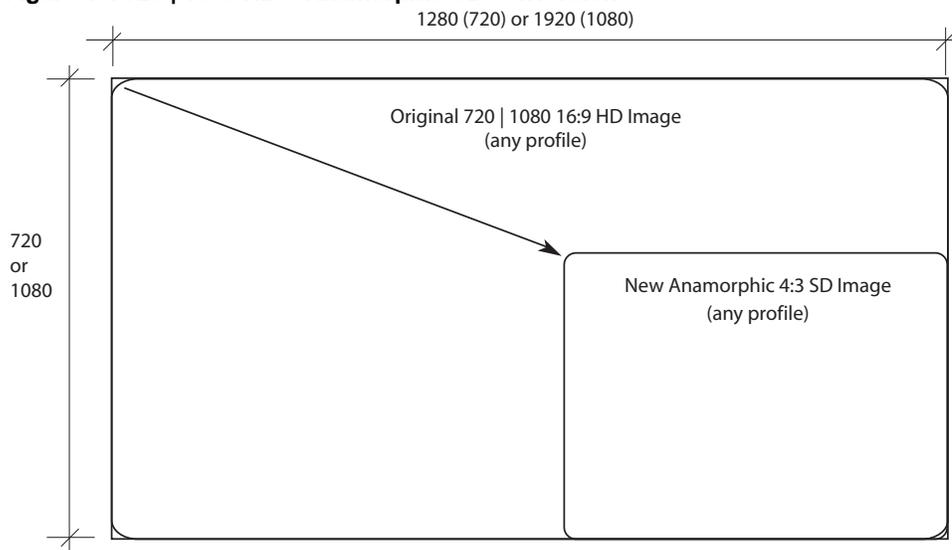
When encoding anamorphic SD from 720 or 1080 HD, FlipFactory simply creates a down-sampled output image of the input 4:3 SD frame.

Cross-converting HD Formats

Digital television standards permit wide variations in HD formats, in both 1080 and 720 profiles. FlipFactory Pro SD | HD excels at cross-conversion of HD formats, where the visual quality of encoded images is critical.

Figure 19. Converting 720 > 1080 and 1080 > 720 HD Formats

Using FlipFactory Pro SD | HD, 1080 and 720 HD formats can easily be cross converted to meet production requirements. This section describes two common HD cross-conversions you can perform with FlipFactory Pro SD | HD edition:

- 720 HD > 1080 HD Up-conversion
- 1080 HD > 720 HD Down-conversion

720 HD > 1080 HD Up-conversion

You perform 720 HD > 1080i or 1080p HD up-conversion when you want to inject 1080 source programs, spots, or other segments into a 1080 HD broadcast channel.

FlipFactory automatically up-converts each source 720 frame to achieve each new 1080 frame. The conversion is performed automatically because FlipFactory knows the dimension of the input frame is different from the dimension of the output frame, and automatically resizes the content for the new frame.

To set up a factory to convert 720 HD video into 1080 HD video, perform these tasks:

1. Make a new HD factory and name it appropriately.

2. Create a product with a 1080 HD profile. For example, a VOD Transport Stream.

3. Set your bit rate, GOP structure, and select a suitable video profile.

4. Make other settings in the codec editor panel as required

5. Optionally, enable the Temporal Interpolation filter and select Nearest Neighbor Temporal Interpolation to control how fields are generated from the progressive source.

6. Set up monitors, destinations, and notifies as required.

Figure 20. HD conversion 720 HD > 1080 HD
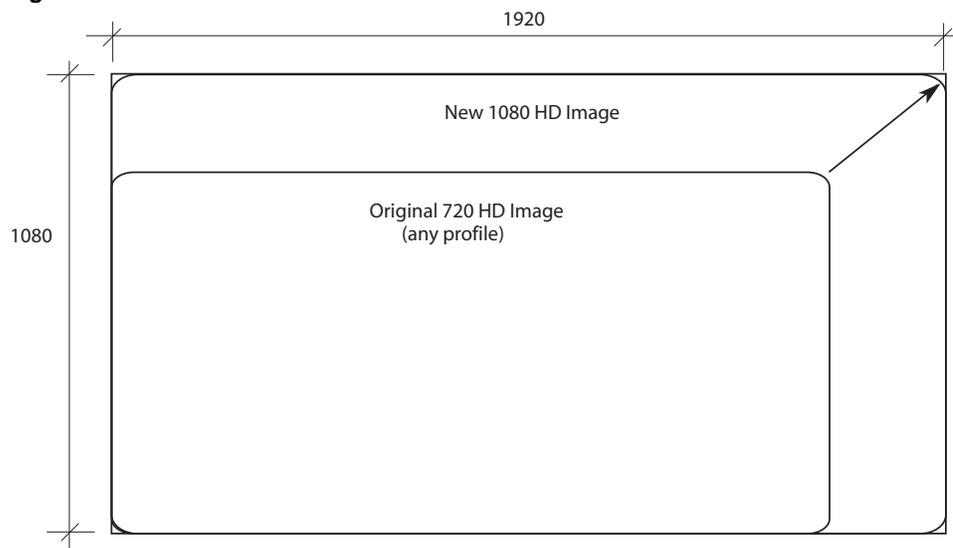
When encoding 1080 HD from 720 HD, FlipFactory creates a new image of the 16:9 HD frame.

1080 HD > 720 HD Down-conversion

You perform 1080i or 1080p HD > 720p HD down-conversion when you want to inject 1080 source programs, spots, or other segments into a 720 HD broadcast channel.

FlipFactory down-converts each source 1080 frame to achieve each new 720 frame.

To set up a factory to convert 1080 HD video into 720 HD video, perform these tasks:

1. Make a new HD factory and name it appropriately.

2. Create a product in your factory with a 720 HD profile. For example, a VOD Transport Stream.

3. Set your bit rate, GOP structure, and select a suitable video profile.

4. Telestream recommends enabling the MotionResolve filter when converting interlaced to progressive even when down-converting, to improve visual clarity.

5. Make other settings in the codec editor panel as required.

6. Set up monitors, destinations, and notifies as required.

Figure 21. HD conversion 1080 HD > 720 HD

When encoding 720 HD from 1080 HD profiles, FlipFactory creates a new image of the 16:9 HD frame.

Cross-converting SD Formats

FlipFactory's core value in the broadcast world has been its ability to easily convert from one video essence or file format to another. As the target devices for media viewing expand to HD televisions, mobile phones, MP3 players, and other devices beyond basic television, FlipFactory's feature set grows to meet your media conversion challenges.

This section describes selected SD cross-conversions to meet requirements for specific workflows and target viewing devices, and to highlight FlipFactory tools and techniques you can employ in novel ways to solve unique conversion problems:

- Letterbox SD > 4:3 Anamorphic SD Conversion for HD Television Playout
- Letterbox SD > Full-screen SD Conversion
- SD > Anamorphic SD Conversion

Letterbox SD > 4:3 Anamorphic SD Conversion for HD Television Playout

This example demonstrates how to convert Letterbox SD source to 4:3 anamorphic SD MPEG2 output. The purpose of this output is to provide anamorphic SD video for playout on HD televisions that will scale the video to 16:9 for proper aspect ratio viewing.

In this case, you crop top and bottom segments of equal or unequal size from the original letterbox image, depending on the SD input profile. You then configure your factory to encode the 16:9 SD content into anamorphic 4:3 SD output to preserve the full-screen.

Figure 22. Letterbox SD > Full-screen 4:3 Anamorphic Conversion Process

Decode SD letterbox format input.   *Crop input to remove letterbox top and bottom mask regions.*   *Encode SD as 4:3 anamorphic full-screen.*

To set up a factory to convert SD letterbox video to 4:3 SD anamorphic video, perform these tasks:

1. Make a new SD factory and name it appropriately.

2. Create a product with an SD profile. For example, MPEG2 640 Program Stream.

3. Set your bit rate, GOP structure, and select a suitable video profile.

4. Make other settings in the codec editor panel as required.

5. Add a Crop filter to trim pixels from the top and bottom of the input video.

6. Set up monitors, destinations, and notifies as required.

Figure 23. Use the Crop filter to trim pixels from top and bottom of input frames
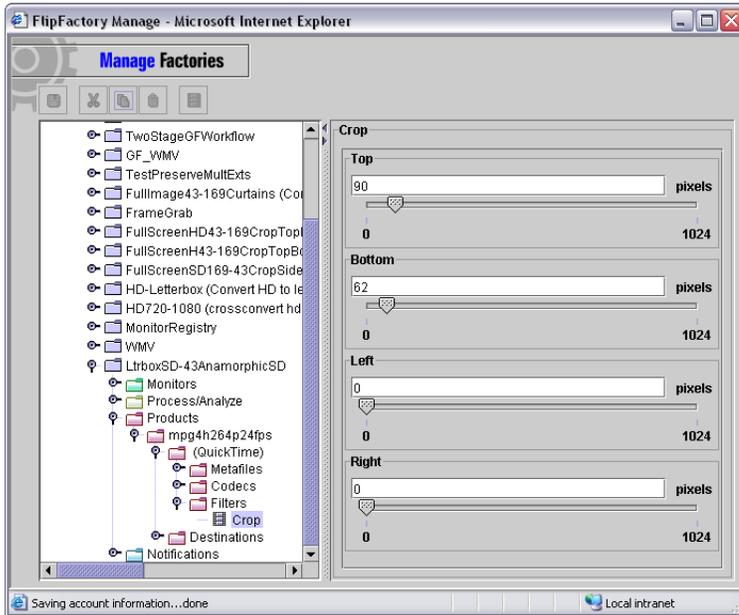
Set up the Crop filter for SD letterbox to full-screen SD 4:3 anamorphic, based on the formula:

Total Crop Height = SD Input Height - (Active Region Height X 3/4)

1. Calculate the total amount to crop from letterbox SD input by multiplying the SD active region height by 3/4.

    Using 720 X 512 SD VBI as an example: (512-32) x 3/4 = 360.

2. Subtract this value from the SD input height to determine the total crop height value.

    Continuing the example, 480 - 360 = 120.

3. If the input does not have inband VBI, divide evenly to produce top and bottom values.

4. If input is NTSC and contains inband VBI, add 30 top the top dimension and 2 to the bottom. If input is PAL, add 32 to the top dimension.

    In this example, an even top and bottom crop height is 60 pixels high. Because the input is NTSC and has inband VBI, add 30 to the top value: 90; and 2 to the bottom value: 62.

TABLE 1. Top and Bottom Crop Dimensions for Letterbox to Full-Height SD Video

Profile	Total Crop	Top Crop	Bottom Crop
NTSC 720 x 512 (inband VBI)	152	90	62
NTSC 720 x 480	120	60	60
NTSC 704 x 480	120	60	60
NTSC 640 x 480 (progressive)	120	60	60
NTSC 544 x 480	120	60	60
NTSC 528 x 480	120	60	60
NTSC 352 x 480	120	60	60
PAL 720 x 608 (inband VBI)	176	109	77
PAL 720 x 576	144	77	77
PAL 704 x 576	144	77	77
PAL 544 x 576	144	77	77
PAL 352 x 576	144	77	77

Encoding SD Anamorphic from Letterbox SD. For any 480 high source, configure the Crop filter by setting the Top and Bottom settings to 60.

Figure 24. Letterbox SD input is cropped top and bottom
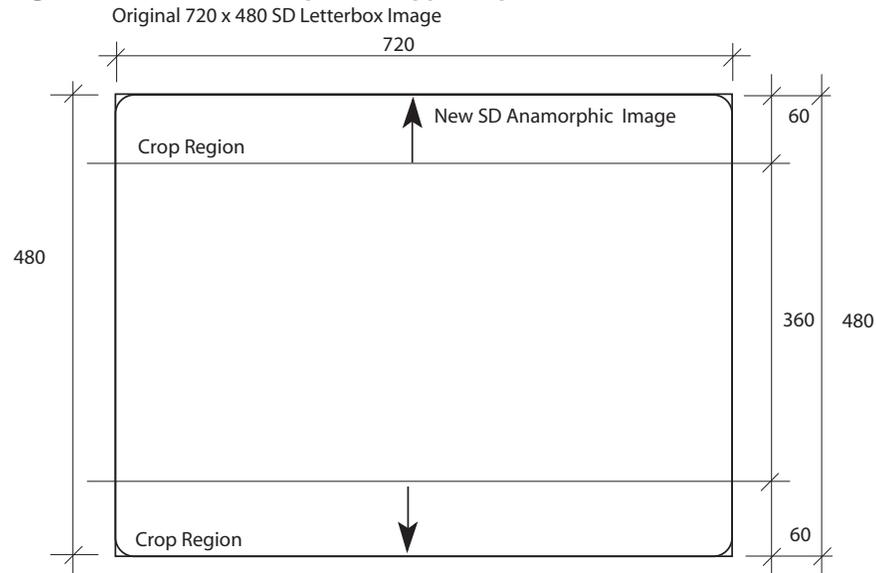
Original 720 x 480 SD Letterbox Image

720

New SD Anamorphic Image

60

Crop Region

480

360   480

Crop Region

60

When encoding SD Anamorphic from Letterbox SD, FlipFactory creates a 16:9 aspect ratio image in a 4:3 SD frame, by cropping the appropriate pixels from the top and bottom (varies by profile and depends on presence of inband VBI, to encode a new image size of the selected SD profile.

Letterbox SD > Full-screen SD Conversion

This example demonstrates how to convert Letterbox SD source to full-screen SD output, where the active region is trimmed to a 4:3 aspect ratio so that the active region completely fills the SD output image.

To perform this type of conversion, crop top and bottom segments from the original letterbox image. You also center-cut the 16:9 image—cropping even or uneven left and right regions—to form the 4:3 active region. You then encode the remaining full-screen video into a 4:3 SD profile.

Figure 25. Letterbox SD > Full-screen SD Conversion Process

Decode SD letterbox format input.

Crop input to remove letterbox top and bottom mask regions, plus left and right curtains to create a 4:3 ratio active region.

Encode SD as full-screen.

To set up a factory to convert SD letterbox video to 4:3 full-screen video, perform these tasks:

1. Make a new SD factory and name it appropriately.

2. Create a product in your factory with an SD profile. For example, MPEG2 Program Stream.

3. Set your bit rate, GOP structure, and select a suitable video profile.

4. Make other settings in the codec editor panel as required.

5. Add a Crop filter to trim pixels from the top and bottom, and left and right of the input video.

6. Set up monitors, destinations, and notifies as required.

Figure 26. Use the Crop filter to trim pixels from all 4 sides of input frames
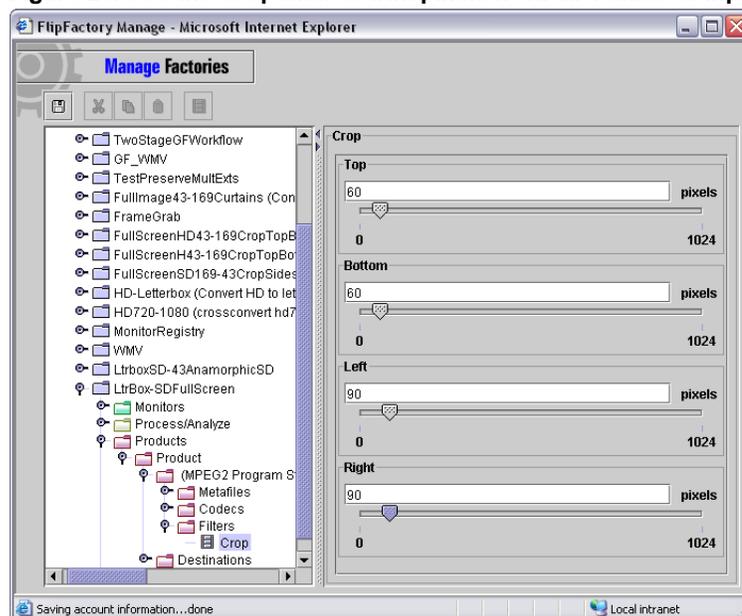
Set up the Crop filter for use when converting SD letterbox input to full-screen SD 4:3 output, based on two formulas. The total crop height formula (Page 10) calculates the height, with common crop dimensions listed in Table 2, below.

Calculate the width using the same formula used for cropping HD when down-converting to 4:3 full-screen video:

Total Crop Width = Profile Width - (Profile Width X 3/4)

1. Calculate the 4:3 image width of the image by dividing the profile width of the input by 3/4 to make an image in 4:3 format.

   Using 720 x 480 as an example: 720 x 3/4 = 540.

2. Subtract this value from the profile width to determine the total crop width value.

   Continuing the example, 720 - 540 = 180.

3. Divide the total crop width as necessary to provide curtain dimensions.

   In this example, an even left and right curtain is 180 pixels wide.

   Inband VBI input is treated the same as other video; the presence of extra vertical pixels is immaterial when calculating side curtains to crop.

TABLE 2. Top and Bottom Crop Dimensions for Letterbox to Full-Height SD Video

Profile	Total Crop	Top Crop	Bottom Crop
NTSC 720 x 512 (inband VBI)	180	90	90
NTSC 720 x 480	180	90	90
NTSC 704 x 480	176	88	88
NTSC 544 x 480	136	68	68
NTSC 528 x 480	132	66	66
NTSC 352 x 480	88	44	44
PAL 720 x 608 (inband VBI)	180	90	90
PAL 720 x 576	180	90	90
PAL 704 x 576	176	88	88
PAL 544 x 576	136	68	68
PAL 352 x 576	88	44	44

Encoding SD Anamorphic from Letterbox SD. For any 480 high source, configure the Crop filter by setting the Top and Bottom settings to 60.

Figure 27. Letterbox SD input is cropped top and bottom
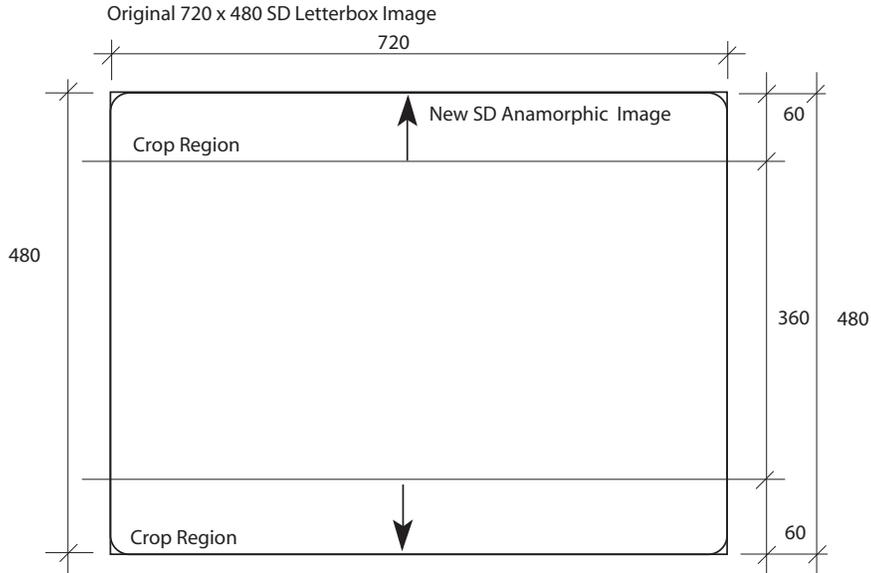
Original 720 x 480 SD Letterbox Image

720

New SD Anamorphic Image

Crop Region

480

60

360 480

Crop Region

60

When encoding SD Anamorphic from Letterbox SD, FlipFactory creates a 16:9 aspect ratio image in a 4:3 SD frame, by cropping the appropriate pixels from the top and bottom (varies by profile and depends on presence of VBI, to encode a new total image size of the selected SD profile.

SD > Anamorphic SD Conversion

This example demonstrates how to convert standard SD source to anamorphic SD output, for playback in 16:9 format in real time, on HD-capable monitors, displaying the image in its original aspect ratio.

To perform this type of conversion, you add mask rectangles to the left and right regions of the original 4:3 output frame. FlipFactory then anamorphically fits the 4:3 input image active region into the area inside (or *between*) the new mask curtains, then applies the curtains with the color you specify, and encodes the new output frame.

Figure 28. SD > Anamorphic SD Conversion Process

Decode SD format input.   *Add a left and right mask region to the output frame using the Mask filter.*   *Re-render the 4:3 SD frame anamorphically, place it between the masks, and encode the new frame.*
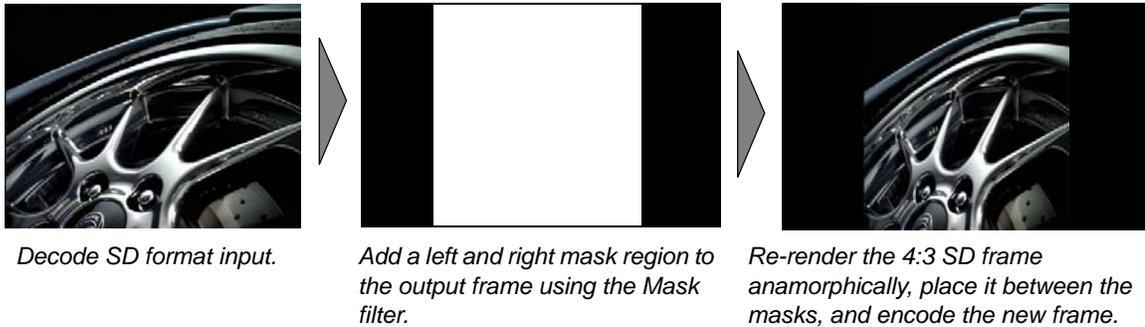
To set up a factory to convert SD video to anamorphic SD video, perform these tasks:

1. Make a new SD factory and name it appropriately.

2. Create a product in your factory with an SD profile. For example, MPEG2 Program Stream.

3. Set your bit rate, GOP structure, and select a suitable video profile.

4. Make other settings in the codec editor panel as required.

5. Add a Mask filter to supply side curtains on each side of the image.

6. Set up monitors, destinations, and notifies as required.

Figure 29. Use the Mask Filter to add side curtains
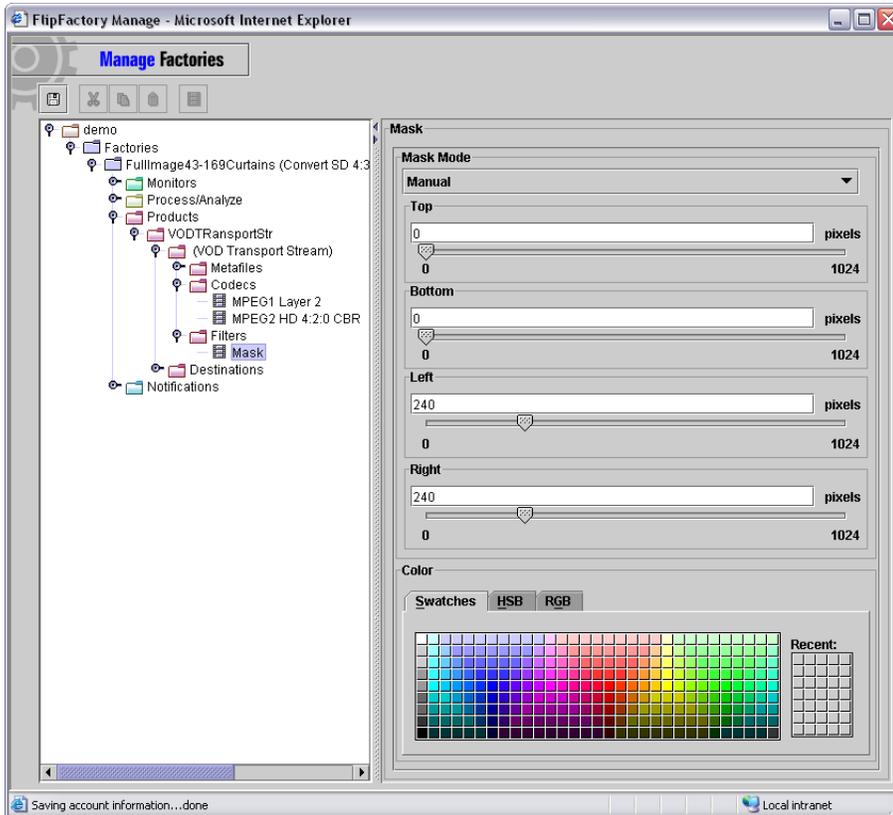
You can set up the Mask filter to supply side curtains, based on the formula:

Total Curtain Width = SD Profile Width - (SD Profile Width X 3/4)

Because the rescaled HD image will be either 720 or 1080 pixels (lines) high, you can calculate the rescaled image width and curtain requirements as follows:

1. Calculate the horizontal dimension of the active region in the new image when up-converted to meet the height requirement of your HD profile in 4:3 format.

    In the case of 1080: 4/3 X 1080 = 1440.

    In the case of 720: 4/3 XX 720 = 960.

2. Next, subtract the active region width from the HD profile width.

    Continuing the example, the width of 1080 HD is 1920. 1920 - 1440 = 480.

    The width of 720 HD is 1280. 1280 - 960 = 320.

3. Divide the total curtain width in half to calculate each curtain width when split evenly.

    In this example, 320 / 2 = 160.

Note: *If your input NTSC or PAL video has inband VBI, FlipFactory will automatically crop it for you unless you enable the Crop filter and set the values a value other than 0. In most cases, you can ignore VBI lines when performing these calculations.*

For all 1080 profile output, total curtain width is 480; even left and right curtains are 240 pixels wide.

For all 720 profile output, total curtain width is 320; even left and right curtains are 160 pixels wide.

HD Profile Formats

Telestream provides the following formats with HD profiles in FlipFactory Pro SD | HD edition:

- Autodesk Stone Format (following)
- EVS (Page 31)
- Grass Valley Profile & K2 GXF (Page 32)
- Leitch Format (Page 33)
- MediaStream (Page 34)
- MXF Stream (Page 34)
- SeaChange BML Format (Page 35)
- Windows Media Format (Page 37)

- Avid TransferManager Format (following)
- Final Cut Pro & QuickTime NLE (following)
- IPTV Transport Stream (Page 33)
- Matrox Format (Page 33)
- MPEG2 Program Stream (Page 34)
- Omneon Server (Page 35)
- VOD Transport Stream (Page 36)
-

TABLE 3. Autodesk Stone Format

Codec	Profile
Raw Video and Audio	**Audio**: 2, 4, 6, 8 channel @ 8-48kHZ, selectable **Video**: HD 720 (1280 x 720): 24p, 25p, 30p, 50p, 60p HD 1080 (1440 x 1080): 50i, 60i, 24p, 25p, 30p

TABLE 4. Avid TransferManager Format

Codec	Profile
Avid DNxHD	**Audio**: 2, 4, 6, 8 channel @ 48kHZ **Video**: Frame Rate: 24 to 60 FPS, selectable HD 720p (1280 x 720): 145, 220 mb/sec HD 1080p (1920 x 1080): 36, 145, 220 mb/sec HD 1080i (1920 x 1080): 145, 220 mb/sec HD 1440i (1440 x 1080): 145 mb/sec

TABLE 5. EVS

EVS JPEG-M	Profile
	Audio: 4 ch. 48kHZ, 24 bit **Video**: HD 720 60p (1768 x 720) HD 720 60p (960 x 720) HD 720 60p (1024 x 720) HD 720 60p (1280 x 720) XT[2] Only HD 1080 50i | 60i (960 x 1080) HD 1080 50i | 60i (1152 x 1080) HD 1080 50i | 60i (1280 x 1080) HD 1080 50i | 60i (1152 x 1080) HD 1080 50 | 60i (1372 x 1080) HD 1080 50i | 60i (1440 x 1080) HD 1080 50i (1920 x 1080) XT[2] Only Max Bitrate: 1-200mb/sec, selectable

TABLE 6. Final Cut Pro and QuickTime NLE

Codec	Profile
DVCPRO HD	**Audio**: 2, 4, 8 ch. audio @ 48kHZ, 16 | 24 bit **Video**: HD 720 50p | 60p (1280 x 720) HD 1080 50i | 60i (1920 x 1080) Optional timecode track
DVCPRO HD Direct Convert	
HDV	**Audio**: 2, 4, 8 ch.l audio @ 48kHZ, 16 | 24 bit, optional Big Endian audio format **Video**: HD 720 30p (1280 x 720) HD 1080 50i | 60i (1440 x 1080) Optional timecode track
HDV Direct Convert	
DNxHD	**Audio**: 8 ch. @ 48kHZ, 16 | 24 bit, optional Big Endian audio format **Video**: HD 720p (1280 x 720): 23.976, 24, 25, 29.97, 30, 50, 59.94, 60 HD 1080p (1440 x 1080): 23.976, 24, 25, 29.97, 30, 50, 59.94, 60 HD 1080i (1440 x 1080): 25, 29.97, 30 User-selectable quality level, time code track

TABLE 7. Grass Valley Profile and K2 GXF

Codec	Profile
MPEG2 HD 4:2:0 and 4:2:2 VBR	**Audio**: 2|4|6|8 ch. uncompr. audio, 16 | 24 bit **Video**: HD 720p (1280 x 720) NTSC or PAL HD 1080i (1920 x 1080) NTSC or PAL Selectable bit rate (14 to 80 mb/sec), GOP structure Opt. SOM/EOM, VANC Preservation, Source Time Code, 16:9 display
MPEG2 HD 4:2:0 and 4:2:2 CB	**Audio**: 2|4|6|8 ch. uncompr. audio, 16| 24 bit. **Video**: HD 720p (1280 x0 720) NTSC or PAL HD 1080i (1920 x 1080) NTSC or PAL Selectable bit rate (20 to 100 mb/sec), GOP structure Opt. SOM/EOM, VANC Preservation, Source Time Code, 16:9 display

TABLE 8. IPTV Transport Stream

Codec	Profile
H.264 Main Profile	**Audio**: Up to 4 audio streams of MPEG1 Layer 2, Dolby 5.1/AC3 or AAC, user-configurable **Video**: User-selectable frame width (352-1280), frame height (240-720) NTSC | PAL, interlaced or progressive Selectable total or video bit rate (512kb to 8mb/sec) Selectable Program Map Table PID and Video PID, Transport ID, Program Number, Bandwidth Reservation, PMT Stream Ordering
H.264 High Profile	**Audio:** Up to 4 audio streams of MPEG1 Layer 2, Dolby 5.1/AC3 or AAC, user-configurable **Video**: Selectable frame width (352-1920), height (240-1080) NTSC | PAL, interlaced or progressive Selectable total or video bit rate (512kb to 8mb/sec) Selectable Program Map Table PID & Video PID, Transport ID, Program Number, Bandwidth Reservation, PMT Stream Ordering

TABLE 9. Leitch Format

Codec	Profile
MPEG2 HD 4:2:0 & 4:2:2 VBR	**Audio**: 2|4|6|8 ch. uncompr. 16 bit audio **Video**: HD 720 50|60p (1280 x 720) HD 108050|60i (1920 x 1080) Selectable bit rate (14-50 mb/sec), GOP structure, Opt. Source Time Code, Leitch Header V1, Link Filename
MPEG2 HD 4:2:0 & 4:2:2 CBR	**Audio**: 2|4|6|8 ch. uncompr. 16 bit audio **Video**: HD 720p (1280 x0 720) NTSC or PAL HD 1080i (1920 x 1080) NTSC or PAL Selectable bit rate (14-50 mb/sec), GOP structure, Opt. Source Time Code, Leitch Header V1, Link Filename

TABLE 10. Matrox Format

Codec	Profile
MPEG2 HD CBR	**Audio**: 1|2|4 ch. 48kHZ, 1 or 2 channels per file **Video**: HD 1080i (1920 x 1080) NTSC or PAL Selectable bit rate (59.9996-79.9996 mb/sec) I-Frame Optional reference clip, interlaced field order

TABLE 11. MediaStream

Codec	Profile
MPEG2 Program Stream HD 4:2:0 | 4:2:2 VBR	**Video**: HD 720 50 | 60p (1280 x 720) HD 1080 50 | 60i (1920 x 1080) Selectable bit rate (8-30 mbps), GOP structure, MPEG EIA 608 Closed Captioning, DAL2 Media, Timecode (Header), VBI Insertion

TABLE 12. MPEG2 Program Stream

Codec	Profile
MPEG2 HD 4:2:0 & 4:2:2 VBR	**Audio**: MPEG1 Layer 2 **Video**: HD 720 24 | 25 | 30 | 50 | 60p (1280 x 720) HD 1080 50 | 60i (1920 x 1080) HD 1080 24 | 25 | 30p (1920 x 1080) Selectable bit rate (8-30 mbps), GOP structure, interlaced field order, Opt. close caption insertion
MPEG2 HD 4:2:0 & 4:2:2 CBR	**Audio**: MPEG1 Layer 2 **Video**: HD 720 24 | 25 | 30 | 50 | 60p (1280 x 720) HD 1080 50 | 60i (1920 x 1080) HD 1080 24 | 25 | 30p (1920 x 1080) Selectable bit rate (8-60 mbps), GOP structure, aspect ratio, interlaced field order, Opt. close caption insertion

TABLE 13. MXF Stream Format

Codec	Profile
Sony XDCAM HD	**Audio**: 4|8 ch. 48kHZ, 16|24 bit **Video**: HD 1080 50|60i (1920 x 1080) @ 17.5|25|35 mb/sec HD 1080 24|25|30p (1920 x 1080) @ 17.5|25|35 mb/sec Selectable GOP Structure, interlaced field order

TABLE 14. Omneon Server

Codec	Profile
MPEG2 HD 4:2:0 & 4:2:2 VBR	**Audio**: AIFF | WAV **Video**: HD 720 50 | 60p (1280 x 720) HD 1080 50 | 60i (1920 x 1080) Output File Type: QuickTime Reference Movie, Quick-Time Self-contained Movie, MXF Self-contained Movie (Op1a) Selectable bit rate (8-60 mb/sec), GOP structure, Omneon user data, interlaced field order, timecode.
MPEG2 HD 4:2:0 & 4:2:2 CBR	**Audio**: AIFF | WAV **Video**: HD 720 50 | 60p (1280 x 720) HD 1080 50 | 60i (1920 x 1080) Output File Type: QuickTime Reference Movie, Quick-Time Self-contained Movie, MXF Self-contained Movie (Op1a) Selectable bit rate (800kb-1006mb/sec), GOP structure, Omneon user data, interlacd field order, timecode.
ON MPEG2 Direct Convert	

TABLE 15. SeaChange Format

Codec	Profile
SeaChange BML: MPEG2 HD 4:2:0 & 4:2:2 VBR	**Audio**: MPEG1 Layer 2, MPEG1 Layer 2 Direct, AES in various profiles **Video**: HD 720 50 | 60p (1280 x 720) HD 1080 50 | 60i (1920 x 1080) HD 1080 50 | 60i (1440 x 1080) - 6000 Series Selectable bit rate (14-50 mbps), GOP structure, Private Data version, interlaced field order, timecode.
SeaChange BML: MPEG2 HD 4:2:0 & 4:2:2 CBR	**Audio**: MPEG1 Layer 2, MPEG1 Layer 2 Direct, AES in various profiles **Video**: HD 720 50 | 60p (1280 x 720) HD 1080 50 | 60i (1920 x 1080) HD 1080 50 | 60i (1440 x 1080) - 6000 Series Selectable bit rate (20-50 mb/sec), GOP structure, Private Data version, interlaced field order, timecode.

TABLE 16. VOD Transport Stream

Codec	Profile
Movie MPEG2 HD 4:2:0 & 4:2:2 VOD Stream	**Audio**: MPEG1 Layer 2, Dolby 5.1/AC3, AES Max 4 streams configurable, with profiles, bit rates, fully configurable **Video**: HD 720 24 | 25 | 30 | 50 | 60p (1280 x 720) HD 1080 50 | 60i (1920 x 1080) HD 1080 24 | 25 | 30p (1920 x 1080) Selectable bit rate (512kb-60mb/sec), GOP structure & configuration, interlace field order, Program Map Table & Video PIDs, aspect ratio.
Movie ATSC VOD Stream	**Audio**: MPEG1 Layer 2, Dolby 5.1/AC3 Audio, AES Audio Selectable sample rates, mono & stereo profiles **Video**: HD 720 24 | 25 | 30 | 50 | 60p (1280 x 720) HD 1080 50 | 60i (1920 x 1080) HD 1080 24 | 25 | 30p (1920 x 1080) 20mb/sec bit rate Selectable GOP structure, interlace field order, motion estimation, Program Map Table & Video PID, transport ID and Program Number, ATSC PSIP table insertion, Closed Caption, max. PCR interval, bandwidth reservation, MPT Stream ordering, aspect ratio.
Video MPEG2 HD 4:2:0 & 4:2:2 CBR	**Video**: HD 720 24 | 25 | 30 | 50 | 60p (1280 x 720) HD 1080 50 | 60i (1920 x 1080) HD 1080 24 | 25 | 30p (1920 x 1080) Selectable bit rate (512kb-60mb/sec), GOP structure, interlace field order, motion estimation, Program Map Table & Video PID, transport ID & Program Number, ATSC PSIP table insertion, Closed Caption, max. PCR interval, bandwidth reservation, MPT Stream ordering, aspect ratio
VOD Direct Convert	

TABLE 17. Windows Media Format

Codec	Profile
Single Rate CBR (HTTP/Download) WMV 7,8,9 | ISO MPEG-4 V1	**Audio:** WMA 7, 8, 9, Windows Audio V9 Voice, WMA V9 Pro, selectable profiles, languages **Video**: Selectable frame width (80-2000), height (60 x 2000) Selectable video rate (4 mb/sec to 20 mb/sec) Selectable frame rate (1-72 fps), keyframe, quality Opt buffer window size, aspact ratio, two-pass encoding, timecode, closed caption, IPV SpectreView, index opt. Windows Media DRM
Multiple Rate (Windows Media Server)	**Audio:** WMA 7, 8, 9, Windows Audio V9 Voice, WMA V9 Pro, selectable profiles, languages **Video**: Selectable frame width (80-2000), height (60 x 2000) Up to 5 video streams, individually configurable opt. Windows Media DRM
Single Rate VBR WMV 7,8,9	**Audio:** WMA 7, 8, 9, WMA V9 Pro, selectable profiles, languages **Video**: Selectable frame width (80-2000), height (60 x 2000) Selectable video rate (4 mb/sec to 20 mb/sec) Selectable frame rate (1-72 fps) opt. Windows Media DRM
Multiple Rate/Size (Windows Media 9 Server)	**Video**: Selectable frame width (80-2000), height (60 x 2000) Up to 5 video WMV9 streams, individually configurable Opt. Windows Media DRM

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The software will operate in substantial conformance with its specifications as set forth in the applicable product user's guide/published specifications/product description. Telestream does not warrant that operation of the software will be uninterrupted or error-free, will meet your requirements, or that software errors will be corrected. Telestream's sole liability under Section 1 of this Limited Warranty shall be to use reasonable commercial efforts to bring the Software's performance into substantial conformance with the specifications in the applicable product user's guide/ published specifications/product description.

FlipFactory has been designed for professionals skilled in the art of digital media transformation and workflow automation, to facilitate the automation of complex media operations and workflow that require a multitude of input and output media formats, delivery to numerous types of media devices and file systems, and notification of media systems including broadcast automation systems and media asset management systems.

The FlipFactory architecture and user interface is designed to provide maximum flexibility in the setup and configuration of these complex media transformations and workflow. In providing this high degree of flexibility, it is possible for media transformation and workflow processes to be configured that are impractical, likely to result in unexpected or unintended results, or beyond the limits of FlipFactory to perform satisfactorily. Additionally, FlipFactory may be executed on a platform that lacks the performance or capacity to perform the media transformations and workflow you've configured, which is your responsibility to specify. Telestream has chosen to implement FlipFactory to provide the greatest flexibility without limiting its functionality to only those transformations and workflow that are known with certainty to be within its performance capabilities, including those limits imposed by the platform upon which you have installed FlipFactory.

Therefore, you acknowledge that you may create transformations and workflow that are impractical or beyond your FlipFactory installation's limits, and Telestream does not warrant that each transformation or workflow you specify or use will complete without error.

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