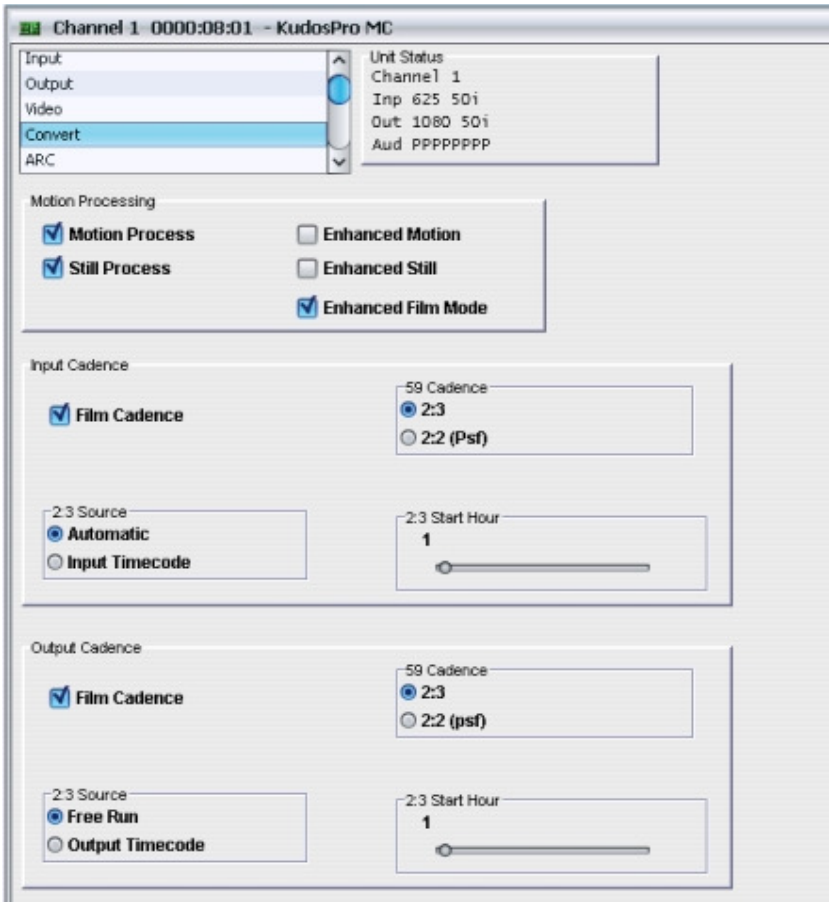
APPLICATION NOTE

KudosPro - Application note # 7
Film Mode



Overview

The KudosPro Film Mode provides a set of solutions to enable optimized conversion of film originated content. Film originated content may be transported by standards supporting the original film frame rate, such as 1080 23.98p. Film originated content may also be packed into interlaced standards using a rule based method to map source frames to interlaced fields. In this case the interlaced standard's content is described as having a film cadence.

In order to perform high quality conversion of film originated content, the cadence must be identified and used to adapt the interpolation process. The KudosPro Film Mode also permit the synthesis of film cadence in the output.

The KudosPro Film Mode features include:

- Applying a 2:3 cadence when converting 23.98 psf to 59.94Hz.
- 2:3 detection and removal when converting 59.94 2:3 to 23.98 psf
- Maintain 2:3 cadence when up-converting 59.98 2:3 content.
- Maintain 2:3 cadence when down-converting 59.98 2:3 content.
- Control 2:3 cadence with respect to time-code.

Film Mode Interface

The menu for the Film Mode is found in the channel menu, under 'Convert', as shown in Figure 1.

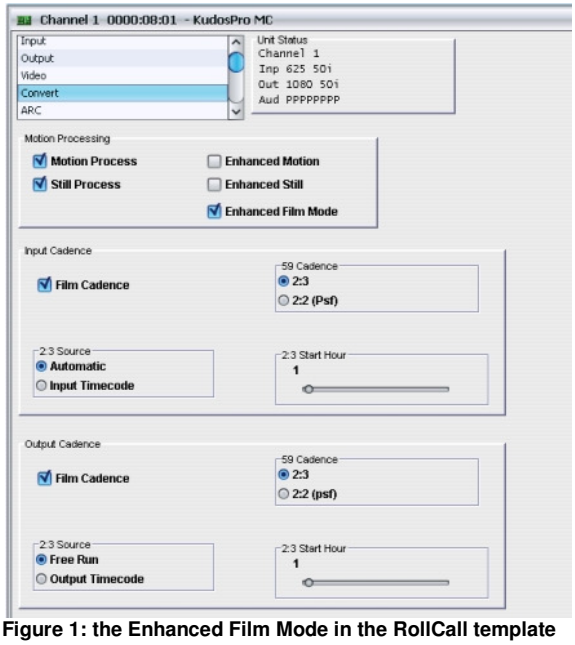


Figure 1: the Enhanced Film Mode in the RollCall template

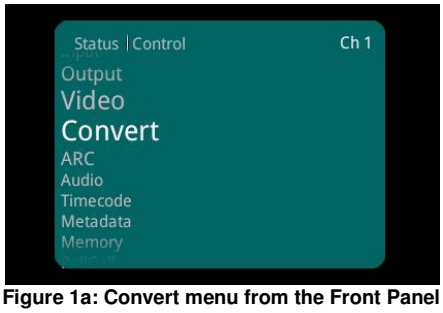


Figure 1a: Convert menu from the Front Panel

Note that the Film Mode feature is relevant to each video channel. So in the case of an MC2000 which has two video channels, each channel can be independently configured with regard to the Film Mode feature.

Enhanced Film Mode

The 'Enhanced Film Mode' sets a sharp conversion aperture suited to filmic content.

Figure 2: Enabling the Enhanced Film Mode via RollCall

Figure 2a: Enabling the Enhanced Film Mode via Front Panel

For content that is not exclusively filmic, or where there are inconsistencies with the input cadence, this mode may create higher visibility of artifacts.

Note that this mode is only relevant for film originated content where the cadence is carried in an interlaced format. In circumstances where the film originated content is carried in a progressive format, the 'Enhanced Film mode' setting is irrelevant.

Input Cadence

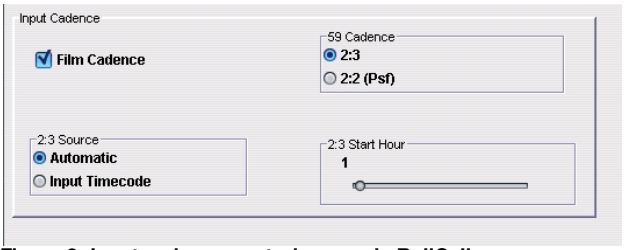


Figure 3: Input cadence control menu via RollCall.

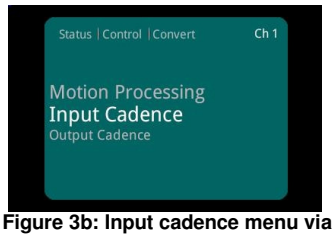


Figure 3b: Input cadence menu via the Front Panel

The 'Input Cadence' menu allows the user to define any cadence associated with the input video.

Film Cadence

If the input content is film originated, or simulates film originated content, the 'Film Cadence' box should be ticked.

Figure 4: Enabling Input Cadence via RollCall

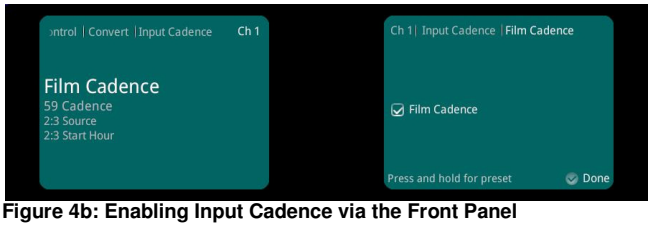


Figure 4b: Enabling Input Cadence via the Front Panel

59 Cadence

If the input is film originated and its frame rate is 59.94Hz, then the Cadence should be defined as either 2:3 or 2:2 (psf), by selecting the appropriate option.

Figure 5: 59.94Hz Cadence select via RollCall

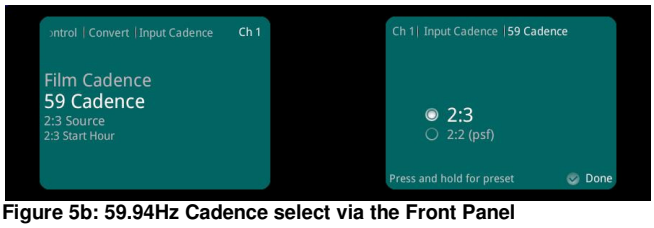


Figure 5b: 59.94Hz Cadence select via the Front Panel

2:3 Source

This control allows the user to choose if the input cadence detection is Automatic or defined by Timecode.

Figure 6: 2:3 source control via RollCall

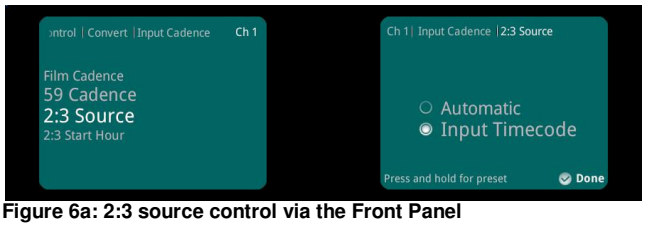


Figure 6a: 2:3 source control via the Front Panel

When set to 'Automatic' the input cadence will be determined by the cadence detection circuit. This feature is useful when the source material contains mixed cadences.

When set to 'Input Timecode', the user defines the relationship between timecode and the 2:3 sequence. This feature is useful when the source material contains known continuous 2:3. This setting removes any uncertainty that may be associated by use of the sequence detector (Automatic Mode).

2:3 Start Hour

This control allows the user to define the position in timecode when the 2:3 sequence begins. The assumption is made that the start of the 2:3 sequence is aligned with the start of program, and under normal working practices, that the start of program is coincident with a integer hour value.

This control is only active when '2:3 Source' is set to 'Input Timecode'.

Figure 7: Defining the 2:3 start time via RollCall

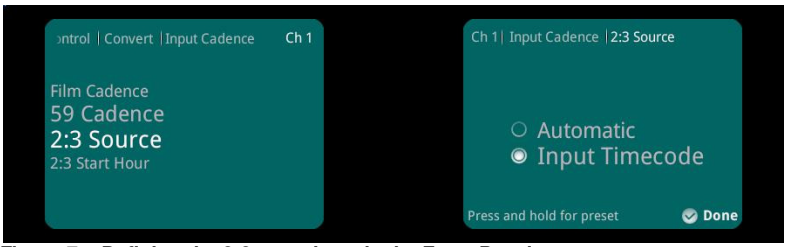


Figure 7a: Defining the 2:3 start time via the Front Panel

Output Cadence

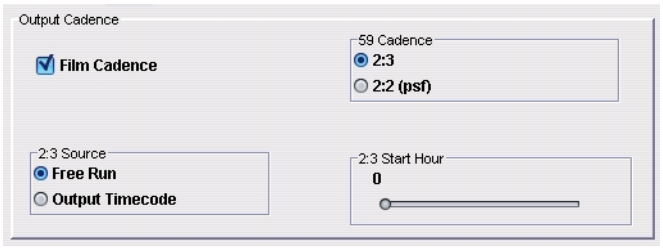


Figure 8: Output Cadence menu, via RollCall.

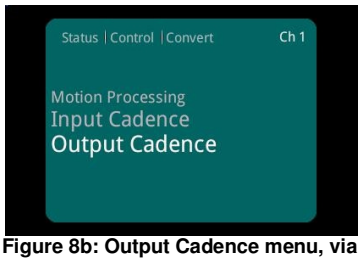


Figure 8b: Output Cadence menu, via the Front Panel

The 'Output Cadence' menu allows the user to define the required cadence of the output video.

Film Cadence

If the output content is required to have a film cadence associated with it, the 'Film Cadence' box should be ticked.

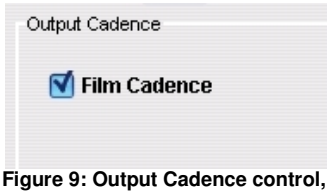


Figure 9: Output Cadence control, via RollCall

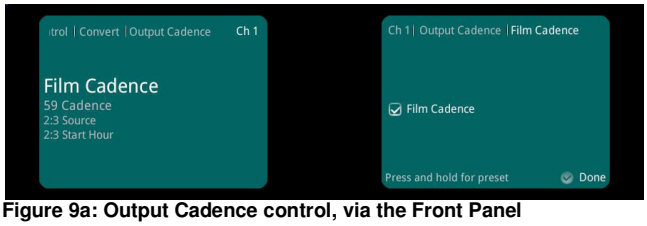


Figure 9a: Output Cadence control, via the Front Panel

59 Cadence

If the output is to have a Film Cadence associated with it and its frame rate is 59.94Hz, then the Cadence should be defined as either 2:3 or 2:2 (psf), by selecting the appropriate option.

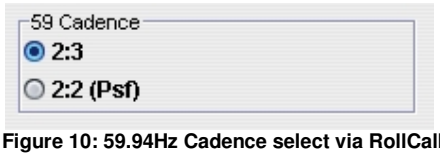


Figure 10: 59.94Hz Cadence select via RollCall

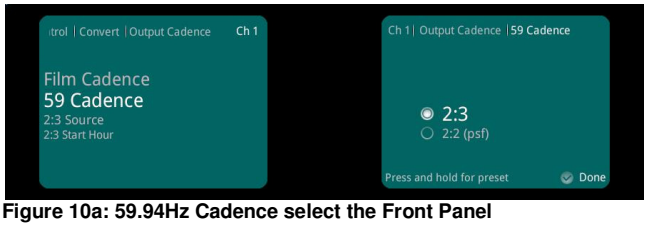


Figure 10a: 59.94Hz Cadence select the Front Panel

2:3 Source

In circumstances where the output is defined as 59.94 2:3, this control allows the user to decide if they wish to control the starting point of the 2:3 sequence with respect to timecode.

Figure 11: 2:3 source sequence configured as 'Free Run' via RollCall

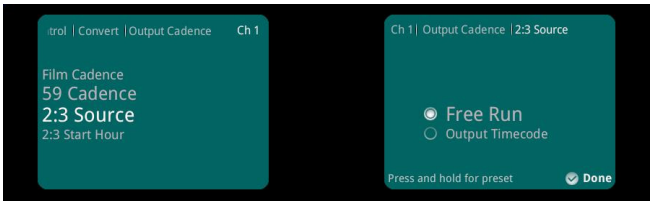


Figure 11b: 2:3 source sequence configured as 'Free Run' via the Front Panel

When set to 'Free Run' the output 2:3 cadence starting point is not defined. The output will have continuous 2:3, but may vary from conversion to conversion.

When set to 'Output Timecode', the user defines the point where the 2:3 sequence starts relative to timecode.

2:3 Start Hour

This control allows the user to define the starting position of the 2:3 sequence with respect to timecode. A start time integer hour value may be selected.

This control is only active when '2:3 Source' is set to 'Output Timecode'.

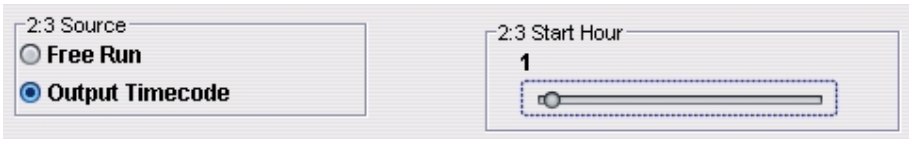


Figure 12: Defining the output 2:3 start time, via RollCall

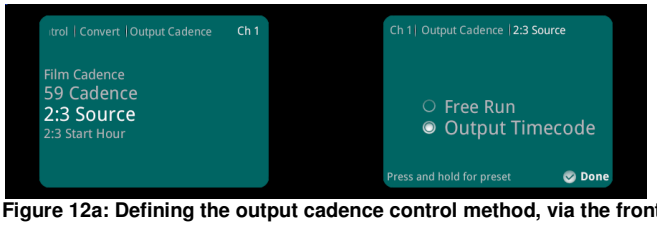


Figure 12a: Defining the output cadence control method, via the front Panel

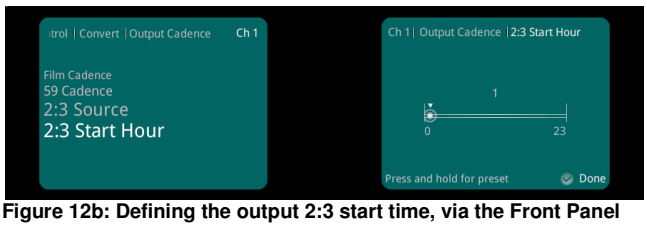


Figure 12b: Defining the output 2:3 start time, via the Front Panel

Working examples:

1. 1080/23.98 PsF to 1080/59.94 2:3 using MC2000

In this example the requirement is to convert a 1080/23 PsF source to 1080/59.94, where the output has a 2:3 Film Cadence associated with it.

The following procedure will configure channel 1 (MC2000 has two channels) to convert the input as per the requirements.

Procedure:

1.1 Go to the Channel 1 menu and select 'Output'. Then select the output standard to be 1080/59i.

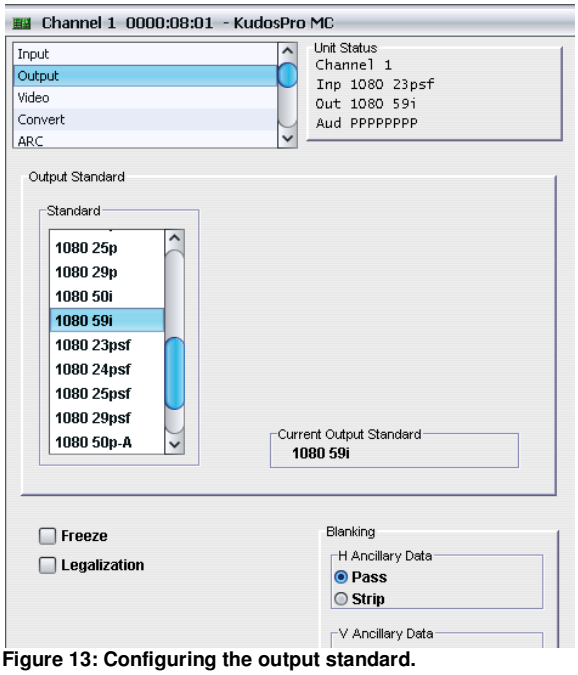


Figure 13: Configuring the output standard.

1.2 In the 'Channel 1' menu, select 'Convert':

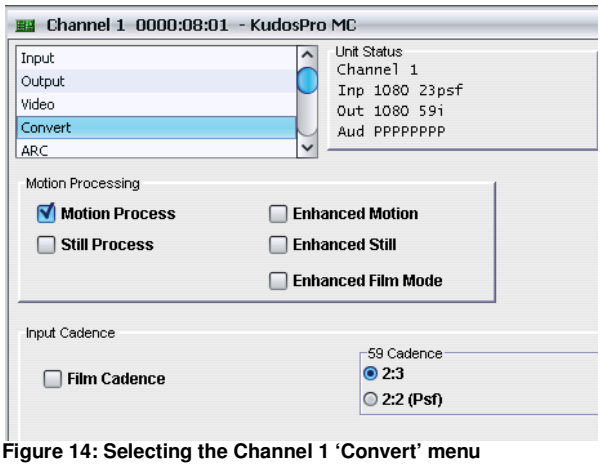


Figure 14: Selecting the Channel 1 'Convert' menu

1.3 In the menu now displayed, select ‘Enhanced Film Mode’.

Note: selecting ‘Enhanced Film Mode’ is optional. If selected, a sharper conversion aperture suited to Filmic content will be configured. Since this conversion is Filmic, it is recommended that this setting is selected. However, a User may decide not to select it, in which case a normal video aperture will be configured. This will not affect the ability of the MC2000 to perform the conversion requirement of adding a 2:3 cadence, as per the requirements.

Figure 15: Selecting ‘Enhanced Film Mode’

1.4 In the ‘Input Cadence’ submenu note the ‘Film Cadence’ tick box. Since the input standard is 1080/23.98PsF there is no ambiguity of the input standard. Being 23.98 it will be treated as having a Film Cadence regardless of the ‘Film cadence’ setting. In this case, the setting of ‘Film Cadence’ is irrelevant.

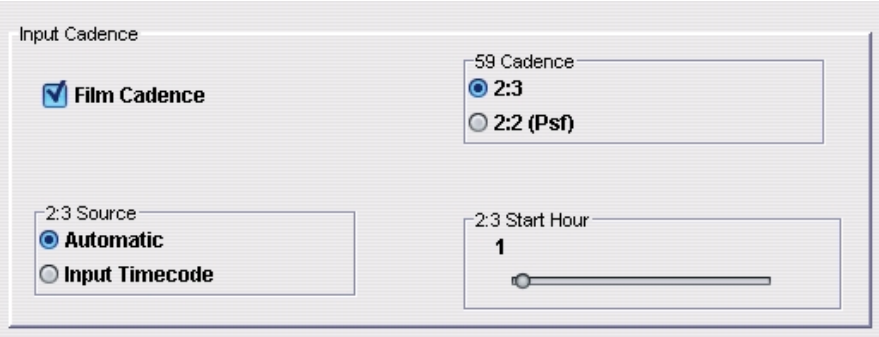


Figure 16: Configuring the input with respect to film cadence.

Note that in this example, that the input is 1080/23.98 PsF. The other settings in this submenu relating to 59.94 2:3 will be ignored.

1.5 In the ‘Output Cadence’ submenu, select the ‘Film Cadence’ tick box.

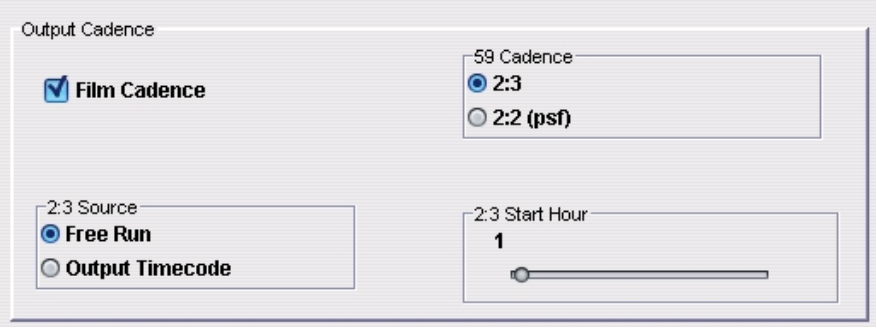


Figure 17: Configuring the Output Film cadence

Also confirm that the ’59 Cadence’ control is set to 2:3 (2:3 is the default setting).

In this example, it has not been specified that the 2:3 sequence should be configured with respect to timecode. The 2:3 source has been set to ‘Free-run’.

The MC2000 has now been configured as per the requirement.

2. 1080/59i 2:3 to 1080/23.98 PsF

In this example the requirement is to convert a 1080/59.94 source to 1080/23 PsF, where the output has a 2:2 (PsF) Film Cadence associated with it.

The following procedure will configure channel 1 (MC2000 has two channels) to convert the input as per the requirements.

Procedure:

2.1 Go to the Channel 1 menu and select 'Output'. Then select the output standard to be 1080/23 PsF.

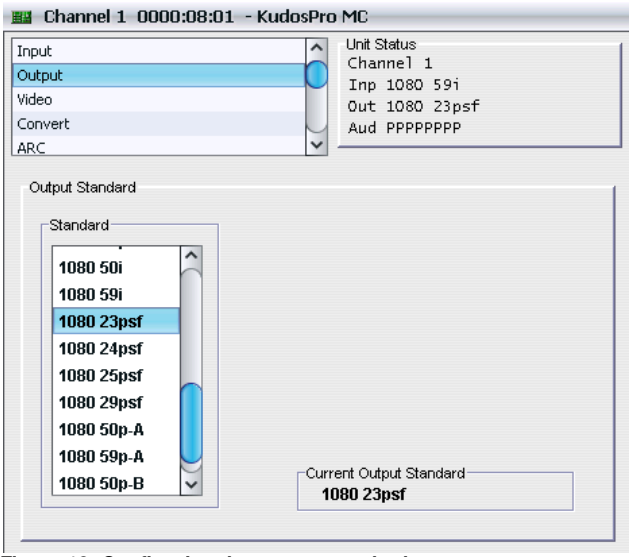


Figure 18: Configuring the output standard.

2.2 In the 'Channel 1' menu, select 'Convert':

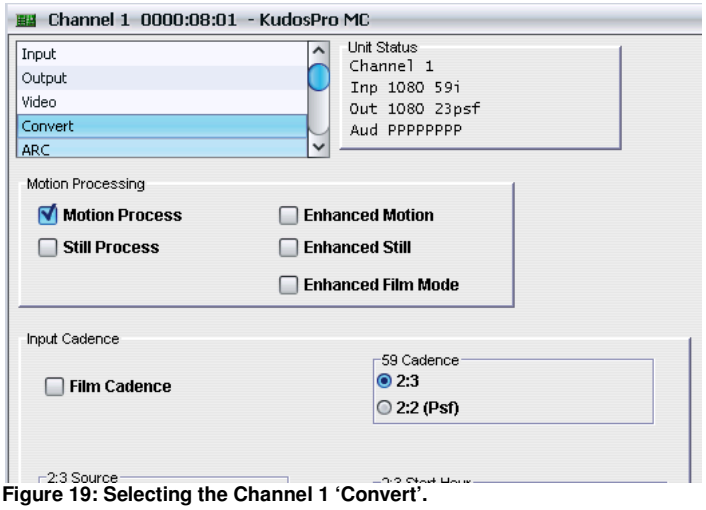


Figure 19: Selecting the Channel 1 'Convert'.

2.3 In the menu now displayed, select ‘Enhanced Film Mode’.

Figure 20: Selecting ‘Enhanced Film Mode’

2.4 In the ‘Input Cadence’ submenu, select the following:

- ‘Film Cadence’: tick box.
- 59 Cadence: confirm 2:3 selected (default setting).
- 2:3 Source: confirm set to ‘Automatic’ (default setting)

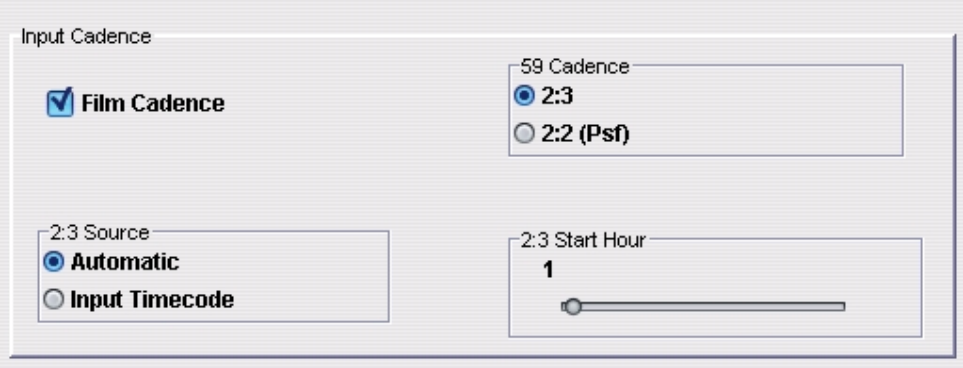


Figure 21: Configuring the ‘Input Cadence’ menu

Since the incoming source has a 2:3 cadence associated with it, the ’59 Cadence’ setting is ‘2:3’. By setting this, the User is telling the KudosPro that the input is 59.98 2:3.

By setting the 2:3 source to ‘Automatic’, the Input sequence detector will lock on to the incoming 2:3 sequence. In these circumstances, the ‘2:3 start Hour’ setting is ignored.

2.5 In this example, The ‘Output Cadence’ menu does not need to be configured. The output standard has already been configured to be 1080/23.98 PsF, so setting ‘Film Cadence’ is not required, although it does not matter if it is ticked. All other settings in this menu relate to circumstances when the output is 59.94Hz, so in this example these controls will be ignored.

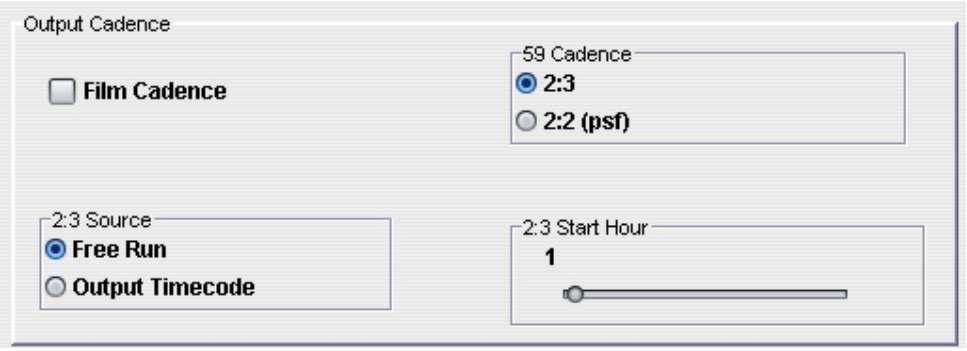


Figure 22: Output Cadence Menu.

The MC2000 has now been configured as per the requirement.

3. 720/23.98P to 720/59 2:3

The source is Film Originated.

For this example, there is a requirement that the output 2:3 Cadence should start exactly at the 1 hour mark.

To achieve this conversion, a 2:3 Cadence will be added

Note – since the input and output standards are progressive, the 2:3 sequence process will repeat complete progressive frames. If a 2:3 Cadence is added to a 23.98 source, by definition the output will be 720/59P. KudosPro cannot make 720/29 2:3. This would be a very difficult process to achieve and would involve interpolation. The result would not be pleasing to the eye.

The following procedure will configure channel 1 (MC2000 has two channels) to convert the input as per the requirements.

Procedure:

3.1 Go to the 'Channel 1' menu and select 'Output'. Then select the output standard to be 525/59i:

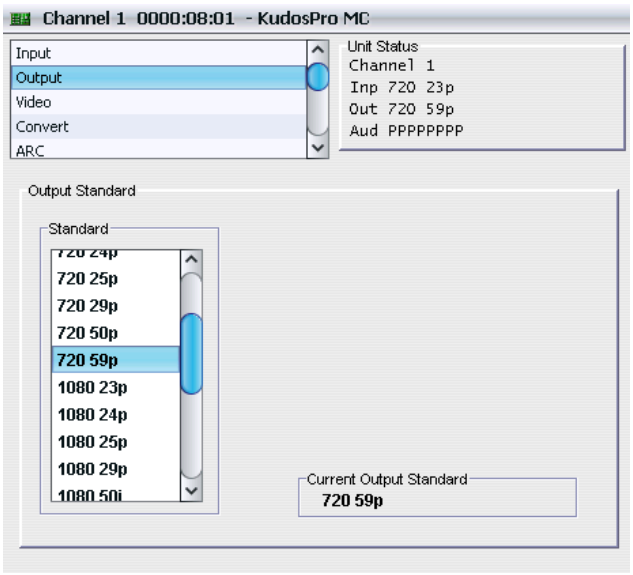


Figure 23: Configure Output standard

3.2 In the 'Channel 1' menu, select 'Convert':

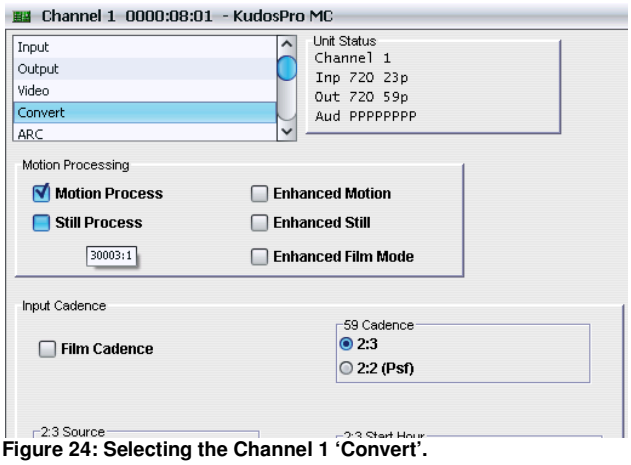


Figure 24: Selecting the Channel 1 'Convert'.

3.3 In the menu now displayed, note that the 'Enhanced Film Mode' setting is only applicable to interlaced sources.

Figure 25: Selecting 'Enhanced Film Mode'

Since the source is Progressive, the setting of the 'Enhanced Film Mode' is irrelevant.

3.4 As in 'Working example 1' above, because the input is 23.98 PsF, it can only be Filmic therefore there is no requirement to set the Input 'Film Cadence' tick box.

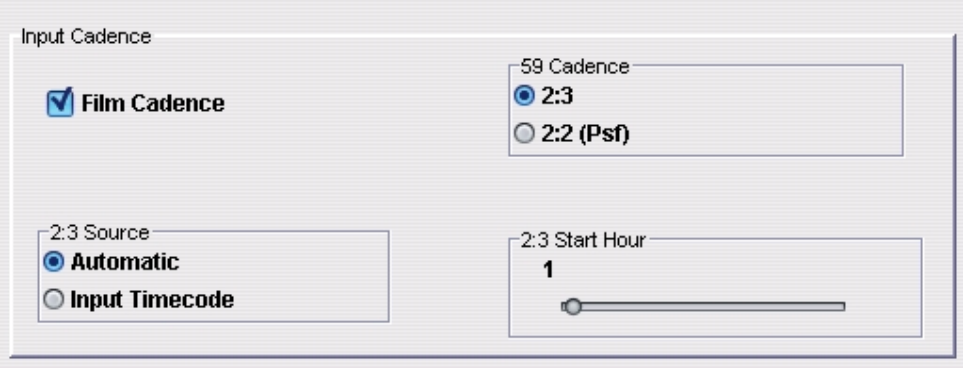


Figure 26: Input 'Film Cadence'.

Note that in this example, that the input is 720/23.98 PsF. The other settings in this submenu relating to 59.94 2:3 will be ignored.

3.5 In the 'Output Cadence' submenu, select the 'Film Cadence' tick box.

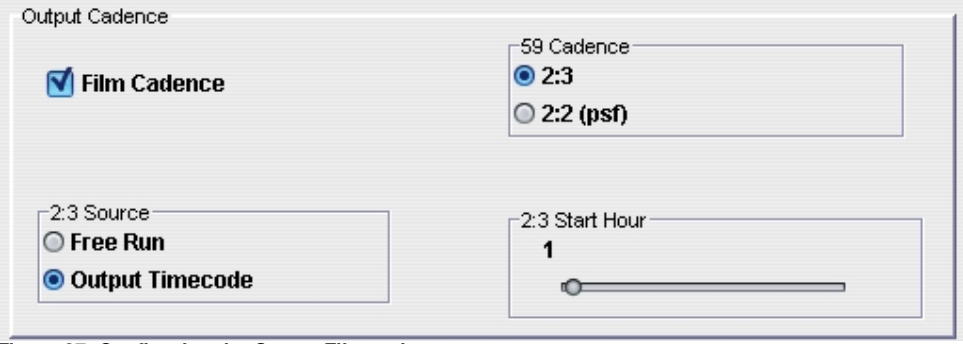


Figure 27: Configuring the Output Film cadence

Also confirm that:

- the '59 Cadence' control is set to 2:3 (2:3 is the default setting).
- the '2:3 Source' is set to 'Output timecode'
- the '2:3 Start Hour' is set to '1'.

The MC2000 has now been configured as per the requirement.

4. 1080/25 PsF to 1080/23 PsF

To achieve this conversion, the KudosPro must use an interpolation process. The preferred interpolation process is 'Motion Estimation'. However, a User could decide that a linear process is preferable. This is for the User to decide. It is not a case of there being a right or wrong way to do the conversion.

4.1 Go to the Channel 1 menu and select 'Output'. Then select the output standard to be 1080/23 PsF.

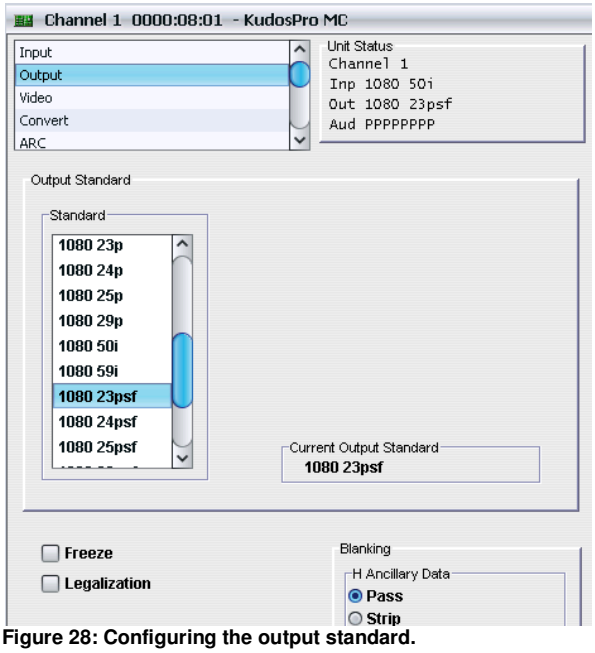


Figure 28: Configuring the output standard.

4.2 In the 'Channel 1' menu, select 'Convert':

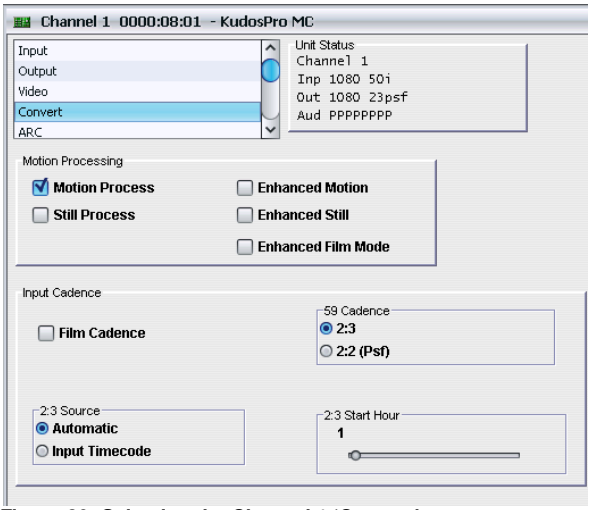


Figure 29: Selecting the Channel 1 'Convert'.

Confirm 'Motion Process' is selected. This will set the interpolation process to be 'Motion estimated'.

4.3 In the menu now displayed, select ‘Enhanced Film Mode’.

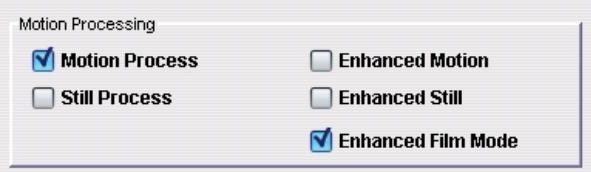


Figure 25: Selecting ‘Enhanced Film Mode’

Since the source is Film Originated, it is recommended that the ‘Enhanced Film Mode’ be enabled.

4.4 In the ‘Input Cadence’ submenu, select ‘Film Cadence’

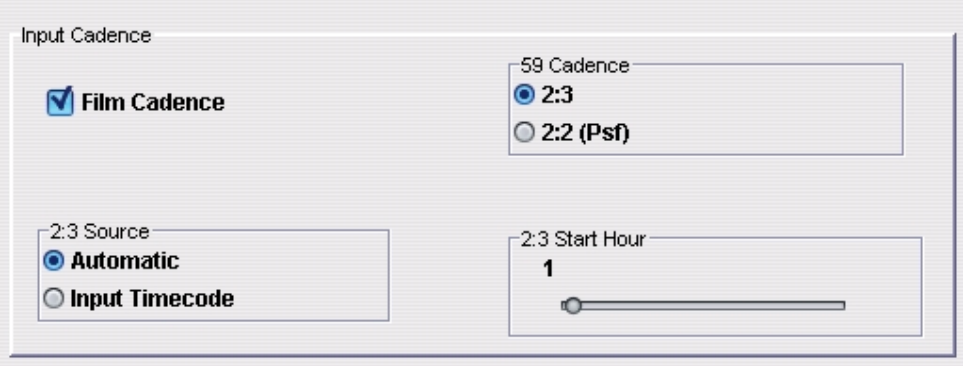


Figure 26: Select ‘Film Cadence’.

Note: since the input, in this example, is 1080/25 PsF, it should be understood that the line structure of this standard is identical to 1080/50i. This means that it is more difficult for the standards detect circuit to identify a 1080/PsF source. By setting the ‘Film Cadence’ tick box, the input standards detector will identify the input as PsF and there will be no ambiguity associated with detecting 1080/25 PsF.

4.5 In this example, as with example 2 above, the ‘Output Cadence’ menu does not need to be configured. The output standard has already been configured to be 1080/23.98 PsF, so setting ‘Film Cadence’ is irrelevant. All other settings in this menu relate to circumstances when the output is 59.94Hz, so in this example these controls will be ignored.

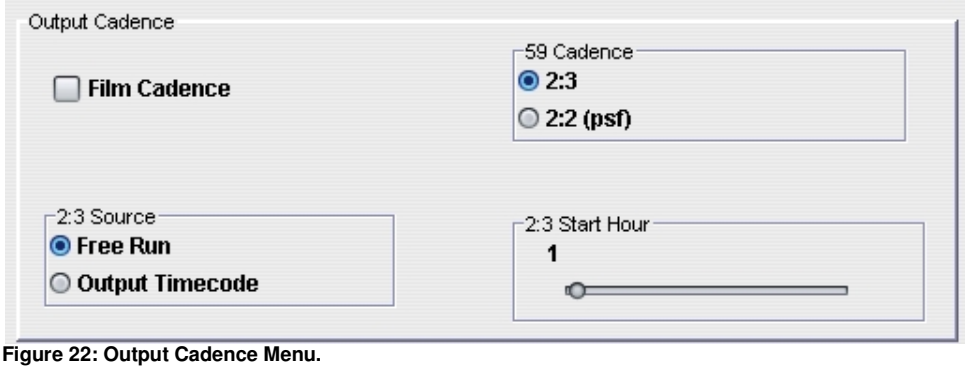


Figure 22: Output Cadence Menu.

The MC2000 has now been configured as per the requirement.