3G FUSION | Option

Dolby® Digital™ / Digital Plus™ Encoder Option (+ENCDA ... ENCDD)

Manual Supplement

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OPT-SW-F3GENCD-MS (V1.3)

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Option

Overview

This manual supplement provides descriptions and operating instruction for the **+ENCD** (Dolby® Encode) Option available as an option on new Cobalt® FUSION3G® (9900-Series) cards, and as a purchased field-installed licensable feature upload.

Note: This option can be ordered to provide up to four independent Dolby® Digital/ Digital Plus™ encoders per card (ordered as **+ENCDA** thru **+ENCDD**). See the table below for basic configuration information and important considerations.

Dolby® Digital Modes Accommodation

Description	+ENCDA	+ENCDB	+ENCDC	+ENCDD
Dual 3/2L Digital + Dual 2/0	3/2L	3/2L	—	—
3/2L + Dual 2/0	3/2L	—	2/0	2/0
Dual 3/2L + 2/0	3/2L	3/2L	2/0	—
Quad 2/0	2/0	2/0	2/0	2/0

Dolby® Digital Plus™ Modes Accommodation

	+ENCDA	+ENCDB	+ENCDC	+ENCDD
3/2L	3/2L	—	—	—
3/2L + Dual 2/0	3/2	2/0	2/0	
Quad 2/0	2/0	2/0	2/0	2/0

Mixed Dolby® Digital / Digital Plus™ Modes Accommodation

	+ENCDA	+ENCDB	+ENCDC	+ENCDD
3/2L Digital Plus + Dual 2/0 Digital / Digital Plus	3/2L	2/0	2/0	—
Dual 3/2L Digital + Dual 2/0 Digital / Digital Plus	3/2L	—	—	—
3/2L + Dual 2/0	3/2	2/0	2/0	
Dual 3/2L	3/2L	3/2L	—	—

Note: 1. Encoding modes shown above represent greatest channel count for a given encoder. All encoders can be set for lower modes as desired (examples: any listing above indicating “3/2L” can be set for “2/0”; any listing above indicating “2/0” can be set for “1.0”).

2. Unshaded cells above indicate allowable modes specified for proper unrestricted operation. Shaded cells indicate combinations which may not produce encoded pairs in all instances. This is a function of available processing resources and is influenced by selected bit rates and program material complexity. In the event selected encoding is not available, the encoder displays a message to that effect. This is described in further detail in the operating section that follows.

3. Encoders **ENCDA** and **ENCDB** are full encoders, and can be set for any of several Dolby encoding modes. Encoders **ENCDC** and **ENCDD** are limited to 2/0 (or lower) encoding.

+ENCD Option Functional Description

(See Figure 1.) The Dolby® encoders receive up to six audio channels (**ENCDC**, **ENCDD** stereo only) from the internal bus and/or optional audio DSP (upmixed and/or loudness-processed) channels and produces up to four discrete encoded Dolby® pairs. Individual internally generated metadata can be user-defined using the encoder controls, or external metadata from SMPTE 2020, serial, or optional on-card Dolby decoder can be used. Each encoder can be set to use its own individually defined internal metadata, or use global external metadata. The encoded pair can be sent from the card as embedded audio or over discrete AES-3id connections as a SMPTE 337M-formatted non-PCM signal.

Note: The Dolby® encoders can receive PCM audio inputs from any combination of internal bus or Audio DSP outputs. The resulting encoded pairs can be sent only to embedded or AES card audio outputs.

Input Audio Mapping. Any audio input supported by the card can serve as audio inputs for the Dolby® encoders. The encoder selects from these sources which can be user mapped to encoder inputs **Dolby 1** thru **Dolby 6**.

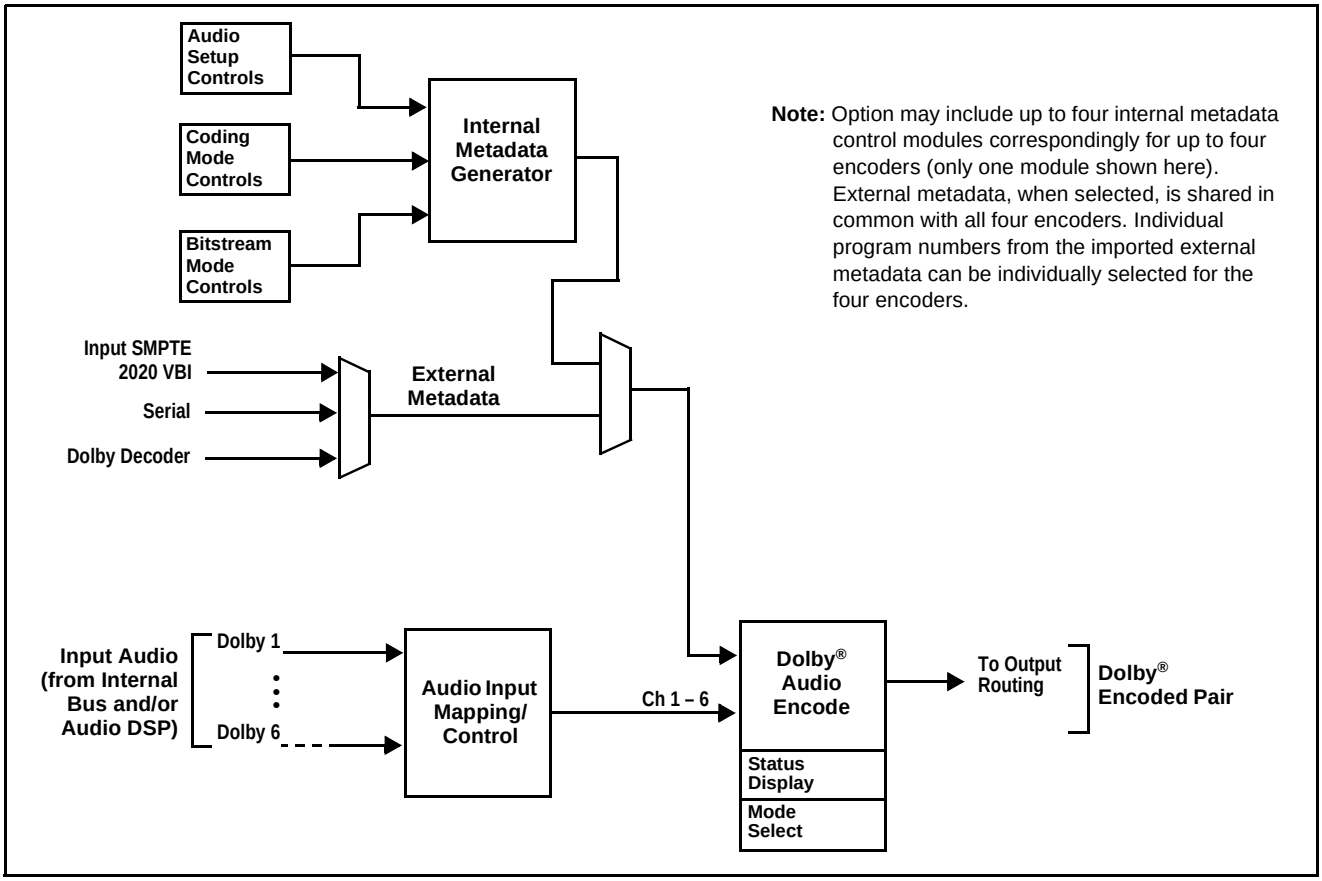


Figure 1 Dolby® Encoder Functional Block Diagram

Internal Metadata Generator. The internal metadata generator provides full audio setup, program coding, and bitstream definition controls, allowing user-generated metadata for providing Dolby® encoding without any external metatdata being required.

Full audio production controls are provided in general conformance with ATSC A/52B definitions.

Dolby® Audio Encode. In accordance with the selected metadata, the Dolby® audio encode function receives the audio inputs **Dolby 1- 6** from the internal bus and/or Audio DSP and provides the Dolby® encoded SMPTE 337M pair. The encoded pairs are available as a source for an embedded channel pairs, and as sources for AES output pairs (allowing the encoded pair to be available over a discrete AES-3id port).

The encoded AC-3 data rate can be selected from multiple choices with associated audio quality trade-offs.

Uploading Option Feature (Field Upgrade Only)

Note: • If your FUSION3G® card was purchased with the option(s) covered here, this procedure is not required for your card. If you have purchased this feature to be field-installed on an existing card, perform the upload procedure here to upload the feature key file sent by Cobalt, and to activate the feature on your card.

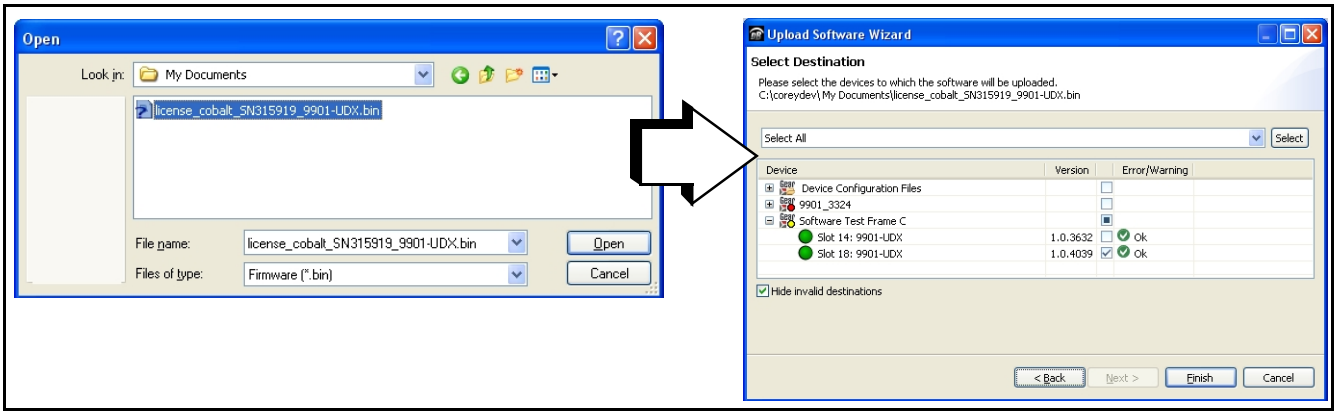
• To order features and obtain a license key, contact Cobalt® sales at sales@cobaltdigital.com or at the contact information on the cover of this supplement. Please provide the Serial Number of your card (displayed in the Card Info pane) when contacting us for your feature key. Typically, a feature key file is bound to the card's serial number and will only work with that card. Please indicate if upgrades are needed for more than one card.

Activate licensable feature as described below.

1. Cobalt typically supplies a .bin file (by e-mail; file size < 10kB) that activates the licensable feature. Download this file to a convenient location on the PC connected to the card's frame.

Note: During this procedure, the card will go offline while the feature is installed. Make certain card is not carrying OTA signal.

2. In DashBoard for the card being upgraded click the **Upload** button and browse to the feature license file (in the example below, license_cobalt_SN315909_9901-UDX.bin).



3. Select the file, click **Open** and then follow the prompts. With intended card selected ("Slot 18 UDX-9901" in example above), click **Finish**. When the card comes back online, the feature appears in the DashBoard controls and is ready for use.

Note: Applying the licensable feature has no effect on prior settings. All control settings and drop-down selections are retained.

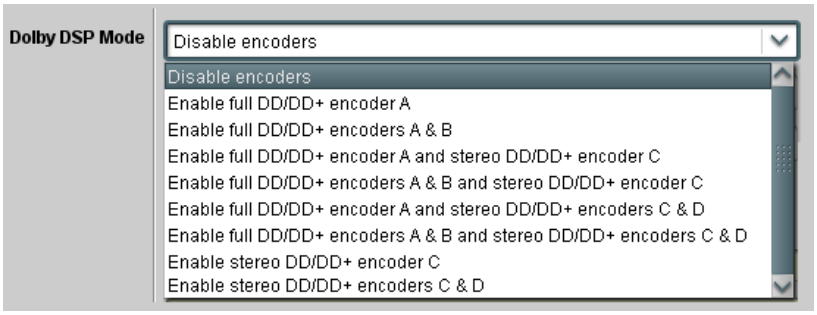
Note: Added features, when first appearing after installation, are set to their factory default states. For features having a direct impact on the output signal, all controls are initially set to disabled or null.

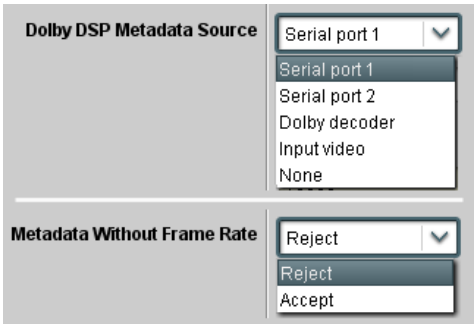
Dolby Encoder Controls and Examples

Table 1 individually lists and describes Dolby encoder controls available using DashBoard™ for cards equipped with the **+ENCD** option.

Note: Although not essential for setting up Dolby encoded audio, it is recommended to consider the small audio delay induced in the encoding. After setup is done, refer to Compensating for Dolby Encoding Audio Delays, p. 17 to remove this delay.

Table 1 +ENCD Option Control List and Descriptions

<table>
<tr><td> 
</td><td>Encoder sub-tab provides global setup and status monitoring for the up to four Dolby encoders.</td></tr>
<tr><td colspan="2">Encoder Global Controls – The following controls are used as a group control for all encoders.</td></tr>
<tr><td>• Encoding Mode</td><td>Selects the encoding modes for the up to four encoders as shown below.</td></tr>
<tr><td colspan="2"> 

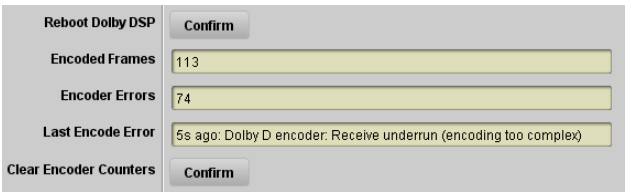
Note: The drop-down allows the maximum combination of encoding choices available. Choices shown in this example depict full +ENCDA thru +ENCDD licensing (as further example, a license for only +ENCDA and +ENCDB will only show choices related to encoders A and B). Also see the Note on page 1 regarding important restrictions.</td></tr>
<tr><td>• External Metadata Select
 
</td><td>When external metadata is to be used, Dolby DSP Metadata Source selects the external metadata source used by the encoders from the choices shown.
Note: • If external metadata is to be used, also set other controls on the Metadata Routing and Embedding tab as intended.
• If internal metadata is to be used, setting this control is not required.

Accepts or rejects external metadata marked as “0 frame rate”. When set for Reject and metadata is received without compatible frame rate, external metadata is blocked.
Note: For typical use, this control should always be set to the default Reject setting.</td></tr>
</table>

Table 1 +ENCD Option Control List and Descriptions — continued

(continued)

- **Dolby DSP Status/Reset Controls**



Provides reboot (restart) and encoding status displays. Where an encoder error display is present, also indicates global encoder error.

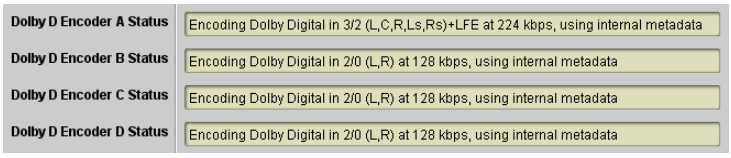
Note: • Encoding errors are typically caused by setting the encoders to conditions not specifically authorized, resulting in encoding complexity exceeding DSP capacity (see Note on pg. 1). Note that Dolby Digital Plus, while resulting in a more efficient data stream, typically requires greater processing capacity.

• Encoding errors are also displayed on the card's Card Info pane and overall DashBoard card status indicator (indicator changes from green to red).

- **Encoding Info and Status Display**

Displays encoding status summary for up to four encoders.

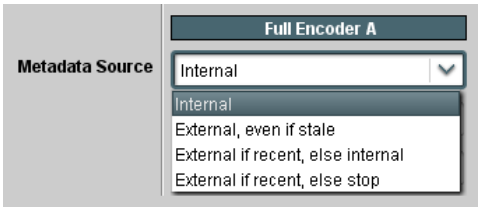
- Example below shows all four encoders properly encoding as per selected encoding.
- Installed encoders that are not enabled are shown as **Ready to encode**.
- Encoders experiencing errors are displayed with the cause for error (e.g., "Receive underrun (encoding too complex)").



Encoder Individual Controls – The following controls appear individually for each of the up to four encoders.

Note: Encoder B thru **Encoder D** have controls identical to those shown here for **Encoder A**.

- **Int/Ext Metadata Source Select**



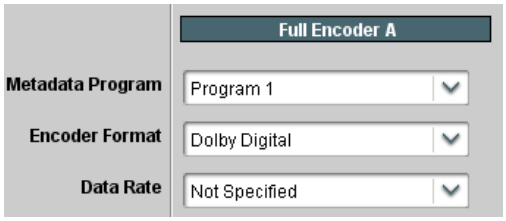
For up to four encoders, individually selects internal metadata or selects external metadata with the failover choices shown.

Note: If external metadata choice is selected as source, intended physical source (SMPTE 2020 de-mux from SDI, serial, or decoder (where available)) must be appropriately selected. See **External Metadata Select** on previous page for more information.

Table 1 +ENCD Option Control List and Descriptions — continued

(continued)

• Encoding Select Controls

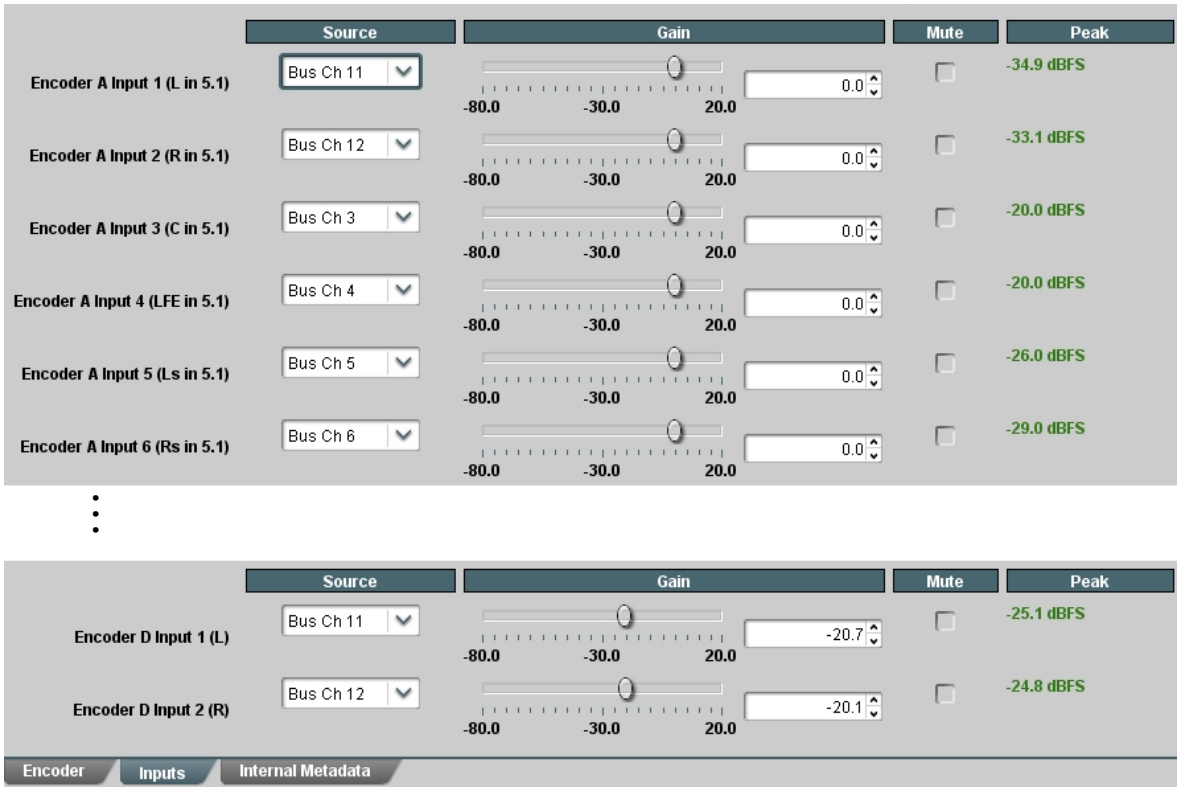


- **Metadata Program** selects Dolby E program when external metadata is being used (from on-card decoder (where available) or external SMPTE 2020 or serial source).
- **Encoder Format** selects either Dolby Digital or Digital Plus when using internal or external metadata.
- **Data Rate** selects encoding data rate from standards rates of 32 kbps to 640 kbps.

Note: • "Not Specified" setting provides default data rates for mode being encoded. For 3/2L, this is 224 kbps; for 2/0, this is 128 kbps.

• Data Rate setting here preempts any related setting contained in received external metadata.

Inputs sub-tab provides source routing and gain controls for the 6 input channels supported in 3/2L encoding and stereo channels supported in 2/0 encoding for each of the up to four encoders.



Individual input source routing controls are provided for each of the up to four encoders. These controls are described in detail on the following pages.

Table 1 +ENCD Option Control List and Descriptions — continued

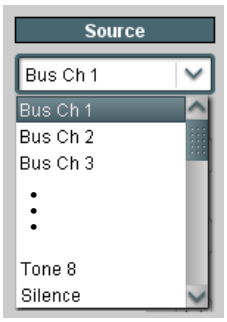
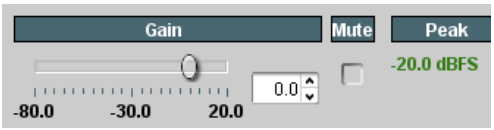
	**(continued)**
Note: **Encoder B** thru **Encoder D** have controls similar to those shown here for **Encoder A**. (Encoders **C** and **D** only have two channels per encoder but otherwise function identically to those shown here.)	
• **Source Select** 	Selects the input channel mapping. Drop-down lists for encoder inputs **Input 1** thru **Input 6** can be independently sourced from any the following sources: • **Bus 1 thru Bus 16:** Routes card bus channels (which transport input embedded, discrete AES, and/or analog inputs through the card). • **Upmix (L, R, C, LFE, Ls, RS) (only with Upmixing option):** Routes card DSP-generated upmixed channels to Dolby® encoder input channel. • **LP3/2L, LP2 Sources (only with Loudness Processor option):** Routes DSP loudness processed 3/2L or stereo sources to Dolby® encoder input channel. • **Tone 1 thru Tone 8:** Routes card internal tone generator sources to Dolby® encoder input channel. • **Silence:** Routes silence to Dolby® encoder input channel.
• **Gain / Mute Control** 	Provides relative gain (in dB) control and peak level display for corresponding encoder input. Also provides a channel **Mute** control. (-80 to +20 dB range in 0.1 dB steps; unity = 0.0 dB)

Table 1 +ENCD Option Control List and Descriptions — continued

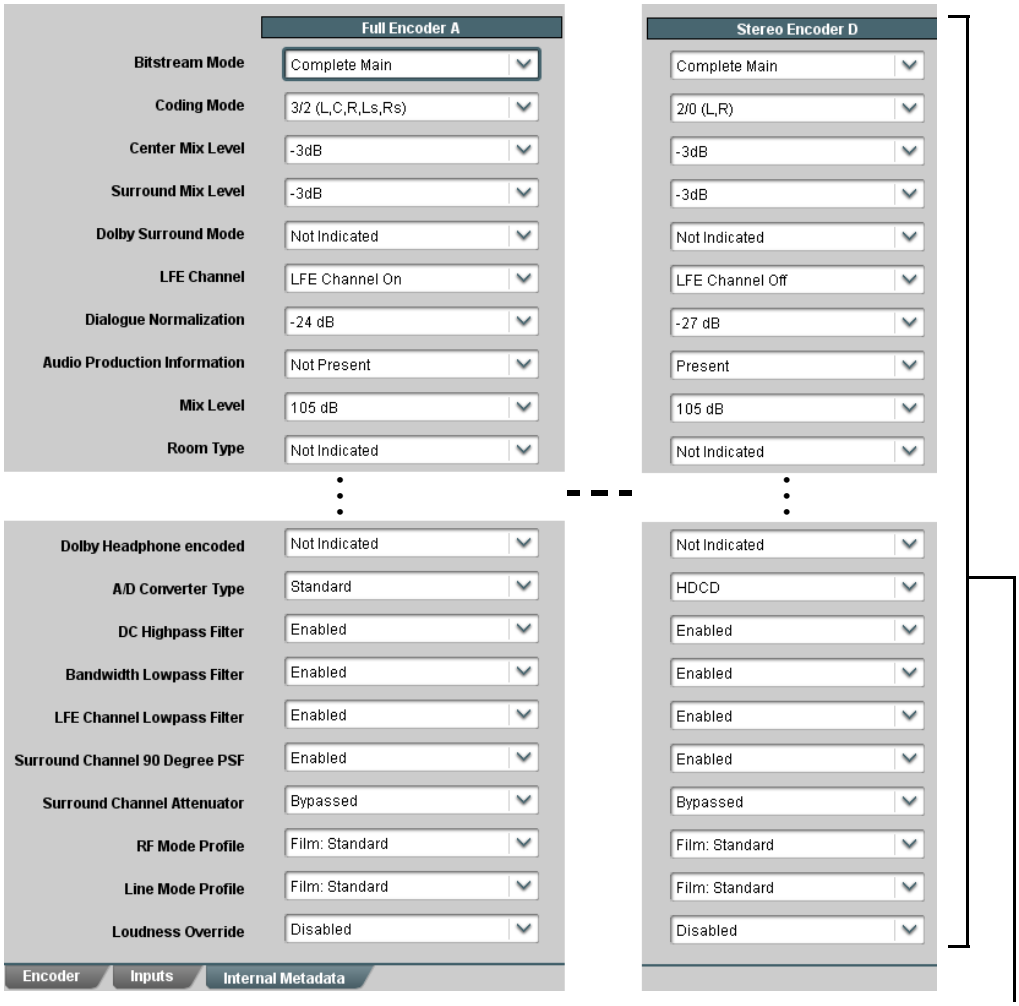
Internal Metadata sub-tab provides individual internal metadata audio production and bitstream controls for the up to four encoders.

Note: • Information provided here is intended as an overview of the screen. Displayed parameters are per ATSC A/52B definitions. Refer to ATSC A/52B for detailed descriptions and background.

• Default settings provide typically accepted parametric settings for each Audio Coding Mode. If settings are changed, note that settings performed here have a profound effect on program material technical and aesthetic aspects. Setup should **only** be performed by authorized personnel.

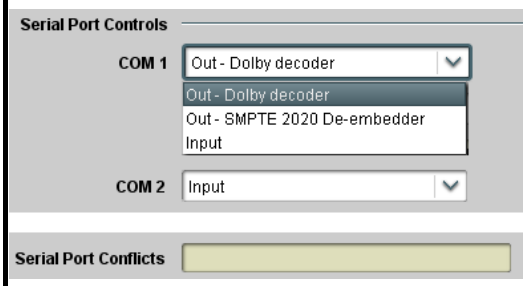
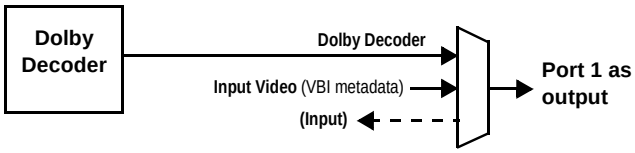
• Although Stereo Encoders C and D have Coding Mode drop-downs that have settings greater than 2/0, settings greater than 2/0 automatically revert to 2/0 if settings exceeding 2/0 are attempted.

Note: **(USA)** ATSC A/85 and the CALM Act (H.R. 1084/S. 2847) requires that when real-time loudness processing is applied using a fixed target loudness of -24 LKFS, downstream AC-3 encoding must correspondingly use a fixed dialnorm value of -24. The default target loudness (as set by the loudness processor Master Output Gain Control at default setting of 0.0) is -24 LKFS.



For internally generated metadata, individual audio production parametric settings and bitstream information controls allow individual setup for the up to four encoders. Drop-down lists provide on/off settings or selection from a range of appropriate choices in general conformance with Dolby® Digital (AC-3) and Digital Plus encoding and ATSC A/52B practices.

Table 1 +ENCD Option Control List and Descriptions — continued

<table>
<tr><td>COM and Metadata Routing</td><td>Provides input and output support of Dolby metadata routing between the Dolby decoder and serial/video interfaces.</td></tr>
<tr><td colspan="2">Note: • “Dolby Decoder” drop-down choice for this function appear only on cards equipped with an optional Dolby decoder.
• After familiarizing yourself with the controls described here, see the following page for an example showing interrelated use of these controls.</td></tr>
<tr><td>• Serial Port Selectors
 
</td><td>For serial ports 1 and 2, selects the source for metadata to be exported (outputed) from the card over a port as shown from the choices listed to the left and shown below. (None selection frees the port to be used as an input.)
 

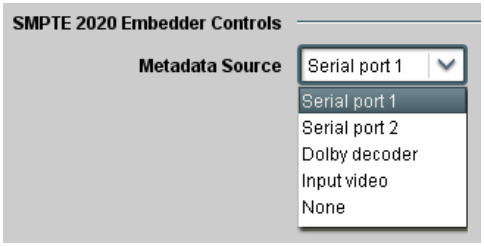
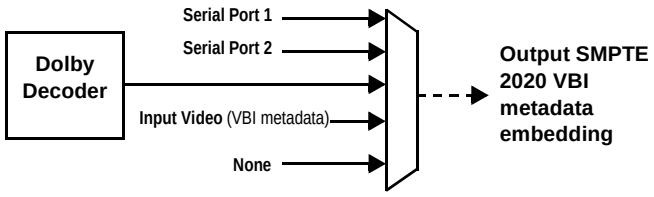
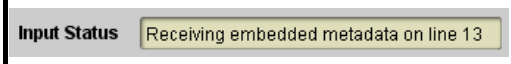
Note: If settings here and described below attempt to set a given port as both an output and an input, Serial Ports Conflicts status display indicates conflict (e.g., “Port 1 configured as both input and output”.)</td></tr>
<tr><td>• VBI SMPTE 2020 Embedding Source Selector
 
</td><td>For VBI embedding at the card SDI output, selects the source of metadata to be exported (outputed) from the card from the choices listed to the left and shown below.
 
</td></tr>
<tr><td>• SDI Input VBI Metadata Status Display
 
</td><td>Indicates if Dolby metadata is present on input SDI VBI, as well as VBI line number. (If no metadata present, displays “Not Present”.)</td></tr>
</table>

Table 1 +ENCD Option Control List and Descriptions — continued

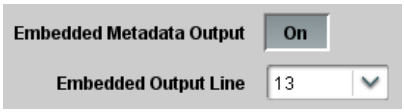
COM and Metadata Routing	(continued)
• **Metadata Embedding**  	**Embedded Metadata Output** enables SMPTE 2020-1 metadata embedding in the SDI video output, as selected using controls described above. Embedded Output Line allows selection of SMPTE 2020-1 metadata line location within the VANC space for re-inserted Dolby® metadata. (Range is 9 thru 41) **Note:** • Although the output line drop-down will allow any choice within the 9 thru 41 range, the actual range is automatically clamped (limited to) certain ranges to prevent inadvertent conflict with active picture area depending on video format. • The card does not check for conflicts on a given line number. Make certain the selected line is available and carrying no other data unless existing metadata is to be intentionally overwritten. Typically, when encoding is active it is recommended that any metadata not specifically related to that being used by the encoder be removed (or replaced with metadata being used by the encoder), and also that the line number be set to overwrite obsolete input VBI metadata. Also, the encoded pair carries the up to date metadata within the encoded pair stream. Removing or replacing obsolete metadata avoids any ambiguity of having different metadata packets on multiple lines, or metadata that is not related to the encoding being performed.

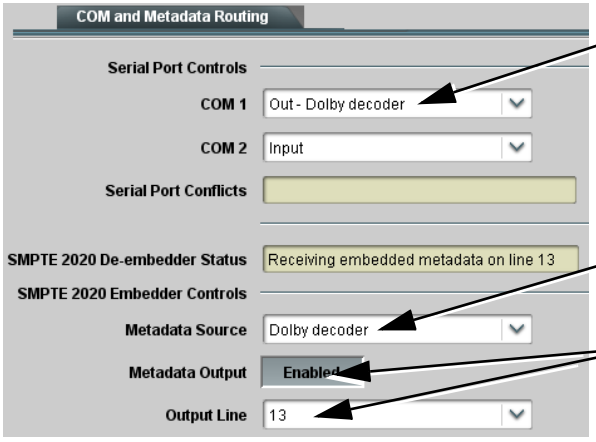
Table 1 +ENCD Option Control List and Descriptions — continued

Metadata Routing and Embedding	(continued)

Metadata Routing Example

In this example, the on-card Dolby decoder is to receive and decode Dolby E3/2L. The baseband outputs are then to be fed to the on-card Dolby Digital encoder, which in turn is set to encode the six audio channels as Dolby Digital Plus 3/2L using metadata from the decoder. Additionally, the decoder metadata is to be outputed from the card over Serial Port A as well as on the SDI output (SMPTE 2020 VBI on line 13).

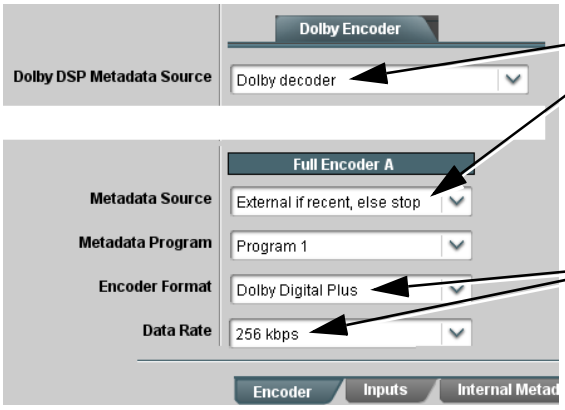
Note that this setup uses metadata **directly** from the decoder. In setups like this where external metadata is to directly control an encoder, intermediate processing elements (such as upmixing or loudness processing) **should not** be inserted in the baseband audio path between the decoder and encoder ("Baseband 3/2L audio" in the example below); if intermediate processing elements are included, metadata values from the decoder will not be in agreement with the baseband audio fed to the encoder.



Decoder metadata is exported (outputed) from the card on Serial Port A

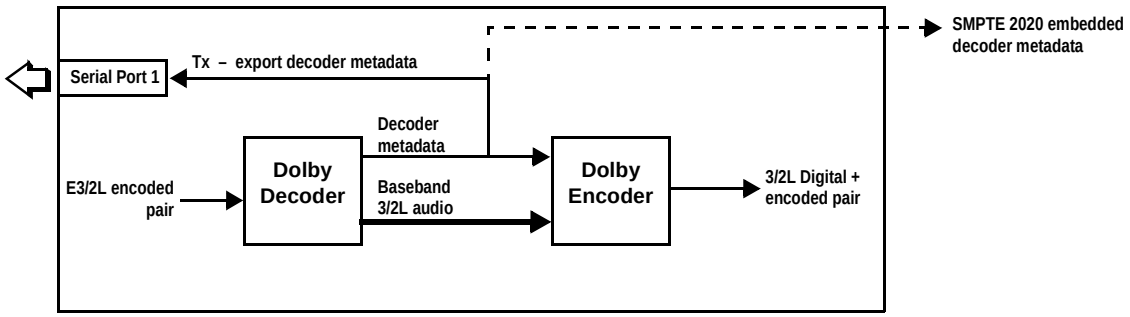
If desired, Decoder can serve as the metadata source for SMPTE 2020 SDI output embedding.

SMPTE 2020 SDI output metadata embedding is enabled and set for VBI line 13



The encoder is set to use external metadata (in this case, on-card decoder metadata as set on the Encoder **Dolby DSP Metadata Source** selector)

On the on-card Dolby encoder, Format and Rate are set for Dolby Digital Plus and Rate as desired



Dolby® E Decode-to-Digital Plus Re-Encode for Emission Example

Note: This example includes descriptions of the on-card Dolby Decoder (option **+DEC**). This option is **not** part of option +ENCD.

The example here shows how to use the same-card Dolby decoder and encoder controls and audio routing controls for four-language program material support to:

- Receive and decode Dolby E 4x2 containing four-language stereo programming:
  Language A = pair 1
  Language B = pair 3
  Language C = pair 4
  Language D = pair 2
- Apply the decoded Dolby E feed to the four same-card Dolby Digital encoders (**ENCD-A** thru **ENCD-D**).
- Use the multi-program external metadata sourced from the decoded E 4x2 stream to independently direct the four Dolby Digital re-encoded streams.
- Output the Dolby Digital encoded pairs on Emb Ch 1/2 thru Ch 7/8.

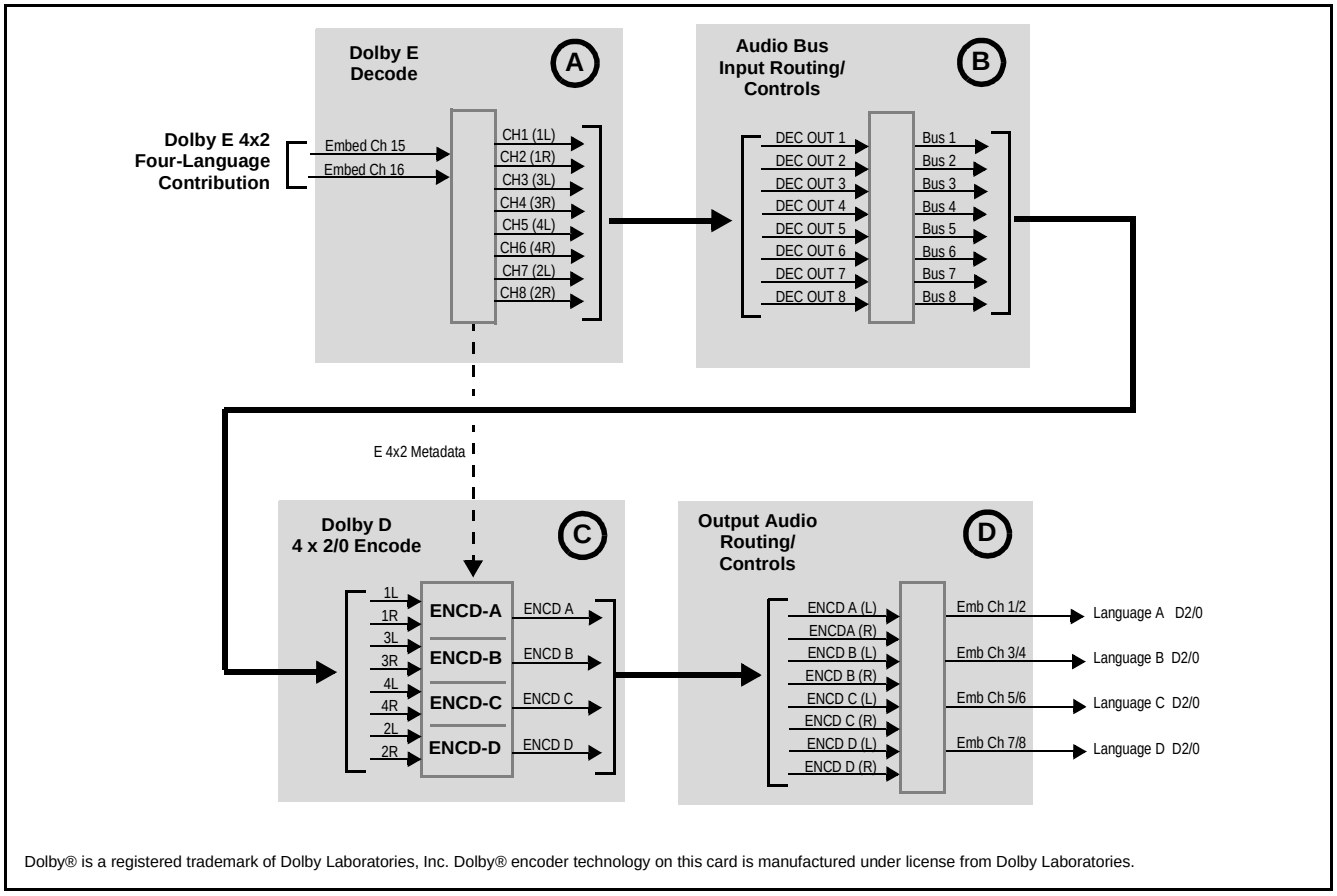


Figure 2 Example Routing and Dolby Re-Encode Processing (Sheet 1 of 4)

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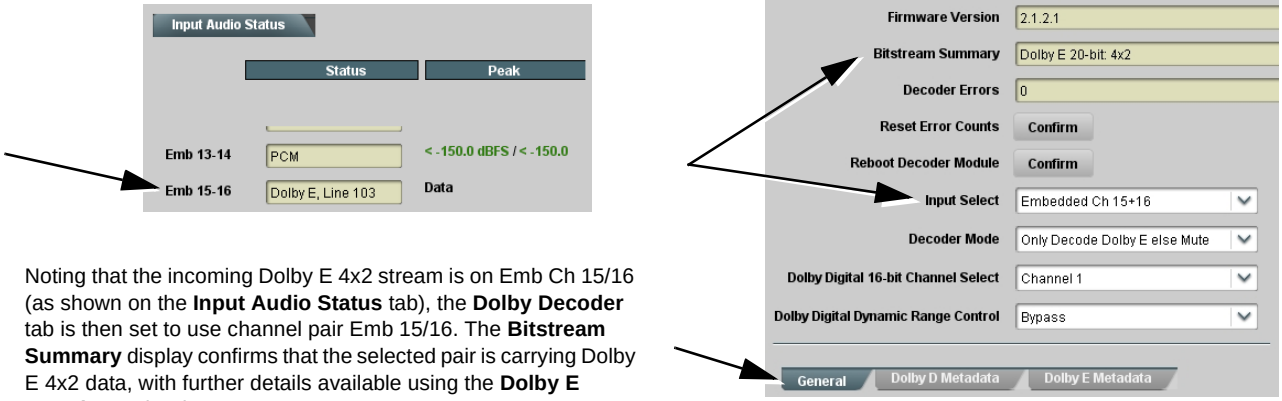
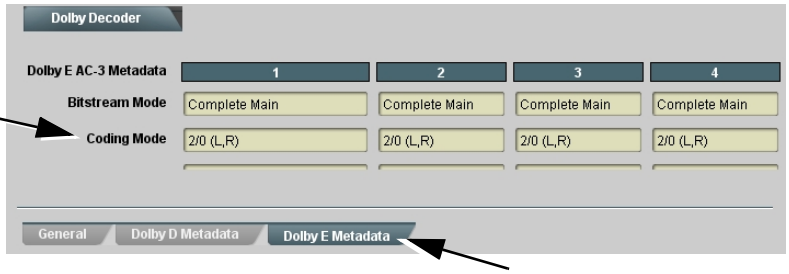


Noting that the incoming Dolby E 4x2 stream is on Emb Ch 15/16 (as shown on the **Input Audio Status** tab), the **Dolby Decoder** tab is then set to use channel pair Emb 15/16. The **Bitstream Summary** display confirms that the selected pair is carrying Dolby E 4x2 data, with further details available using the **Dolby E Metadata** sub-tab.

In this example, the Dolby E Metadata tab confirms four, 2/0 channel encoding.



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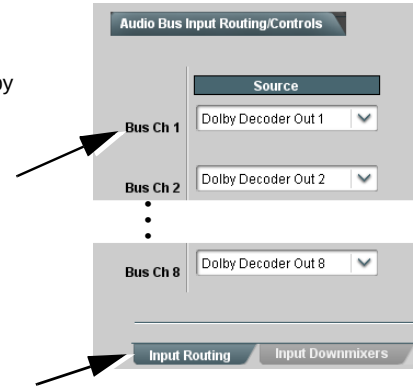
Next, on the **Audio Bus Input Routing/Controls** tab, the eight resulting decoded Dolby channels for the four decoded pairs are routed on the card bus.



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On the **Dolby Digital Encoder** tab / **Encoder** sub-tab, for this example **DSP Mode** is set to use all four encoders. (Note that the mode displayed here for encoders A and B only indicates the maximum setting; actual mode is a function of other settings or from external metadata).

Since this example is to use **external** metadata from the on-card Dolby decoder, the **Metadata Source** selector is then set to **Dolby Decoder**. This metadata will determine the encoding modes for all four encoders.

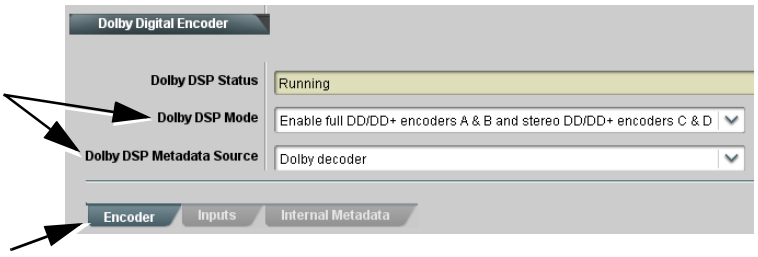
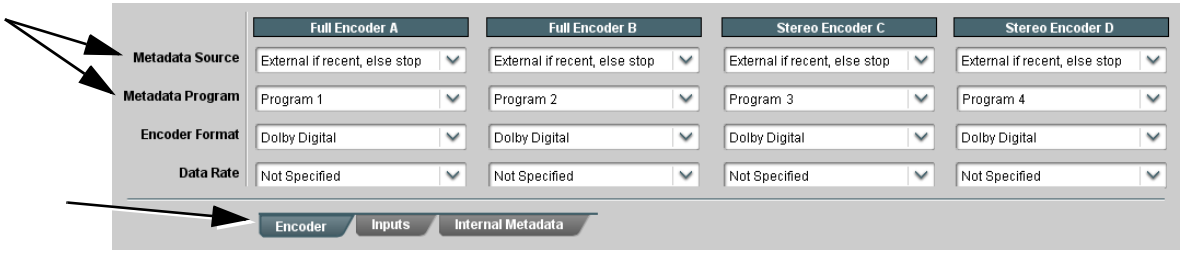


Figure 2 Example Routing and Dolby Re-Encode Processing (Sheet 2 of 4)

On the **Encoder** sub-tab, now each of the four encoders A thru D can be set to use external metadata, along with the individual program numbers associated with the encoding programs therein. In this example, Programs 1 thru 4 are to determine the settings for the four pairs carried on this stream. As such, the four encoders here are set to respectively use Programs 1 thru 4.

The Data Rate setting of Not Specified results in the default encoding rate for the selected mode (see Dolby Encoder, p. 5 for more information).



The **Input** sub-tab is selected to route audio to the encoder inputs. Because the Dolby decoded channels were routed onto Bus Ch 1 thru Bus Ch 8 earlier, these four stereo pairs are now routed directed to the four stereo pair inputs on encoders A thru D as shown here.

Note: Encoders A and B have 3/2L-channel input routing selectors. When these encoders are used for less than six channels, set the selectors for unused inputs to Silence.

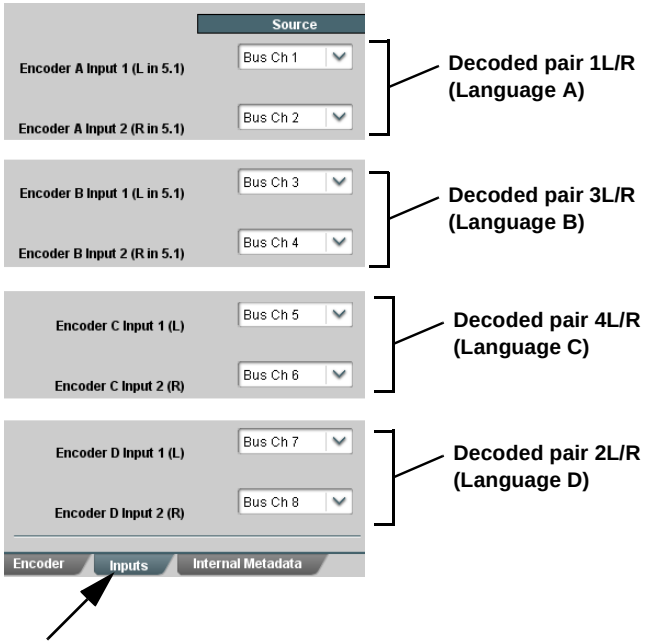


Figure 2 Example Routing and Dolby Re-Encode Processing (Sheet 3 of 4)

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The four Dolby Digital 2/0 encoded pairs (used for Langauge A thru Language D) can now be outputted from the card. In this example, these channels will be outputted over embedded audio.

On the **Output Audio Routing/Controls** tab, Emb Ch 1 thru Ch 8 are set to carry the four Dolby Digital 2/0 encoded pairs as shown here.

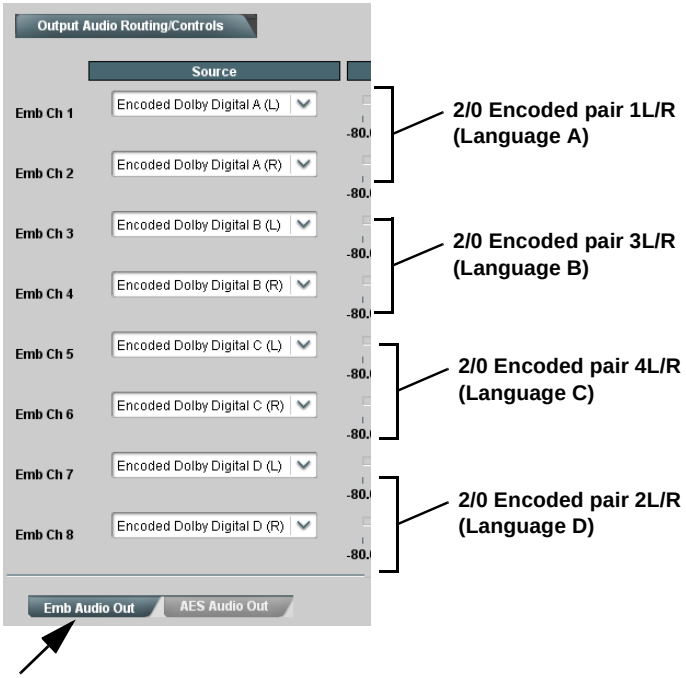


Figure 2 Example Routing and Dolby Re-Encode Processing (Sheet 4 of 4)

Compensating for Dolby Encoding Audio Delays

Because of the significant DSP functions required to develop a Dolby encoded stream an audio delay results which, if not compensated for, can be noticeable when played out on the decoded receiving end. Table 2 lists the **+ENCD** encoder processing delays for various AC-3 modes when carrying an HD signal.

Table 2 Dolby Encoding Delays for Various AC-3 / E-AC-3 Modes

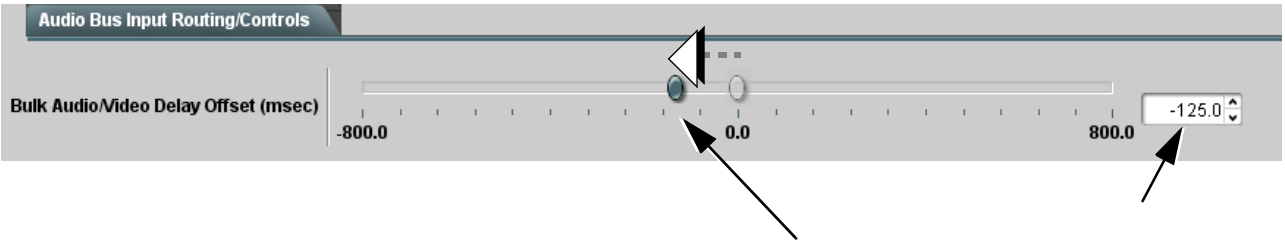
AC-3 Mode	Delay (msec)	AC-3 Mode	Delay (msec)
3/2L	125	2/1	98
1/0	98	3/1	98
2/0	98	2/2	125
3/0	98		

E-AC-3 Mode	Delay (msec)	E-AC-3 Mode	Delay (msec)
3/2L	145	2/1	118
1/0	118	3/1	118
2/0	118	2/2	145
3/0	118		

These delays can be nulled (compensated for) by delaying video and advancing the input audio timing to remove the delay as shown in the example on the next page.

In this example, a card-generated AC-3 3/2L encoded pair is being routed onto the output video. Per Table 2, it is noted that a 125 msec delay will be induced.

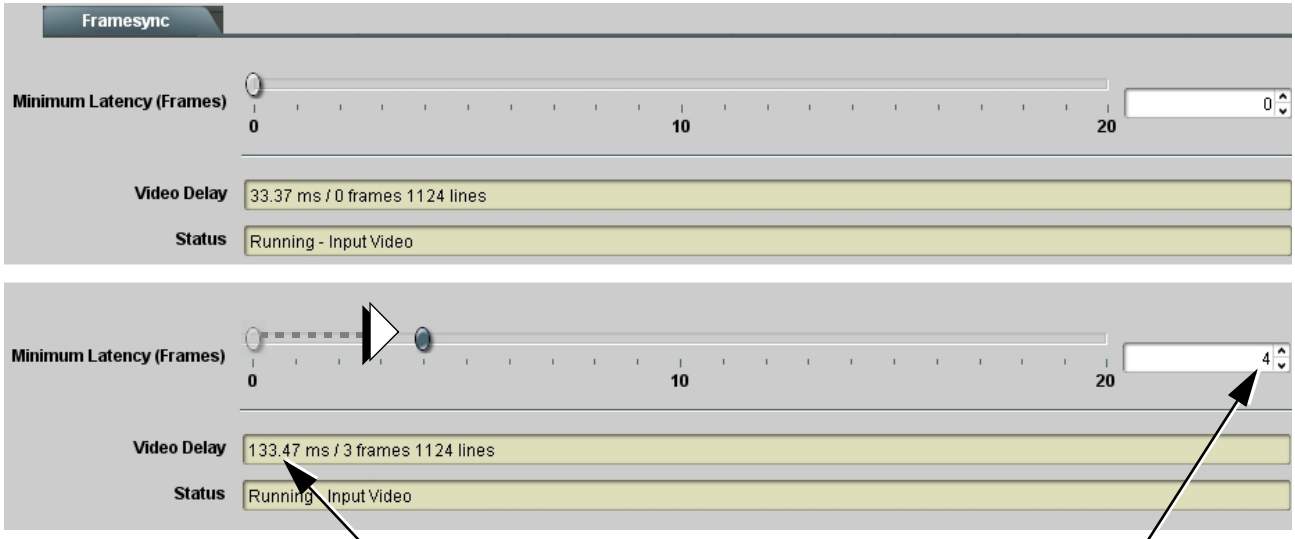
To compensate for this 125 msec delay, the input audio to be applied to the encoder is **advanced** by this amount using the card **Audio/Video Delay Offset** control on the **Audio Bus Input Routing/Controls** tab. (Note that either the Bulk control or individual per-channel delay controls can be used.)



Audio is **advanced** ahead of video by 125 msec

To accommodate the 125 msec audio advance, a similar amount of video must be buffered in the card memory.

Viewing the **Framesync** tab and noting that the default latent delay in this example is appr. 33 msec, more video must be added to the latency. As such, the **Minimum Latency** control setting is increased to buffer at least 125 msec of video. (It is recommended to "round up", as shown in this example where appr. 133 msec of video is now buffered.)



Additional video latency (memory buffering) is **added** to accommodate the 125 msec audio advance

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