



# **Dolby Professional Reference Decoder DP580**

**Product specification**

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## **Dolby Laboratories, Inc.**

1275 Market Street  
San Francisco, CA 94103-1410 USA  
Telephone 415-558-0200  
Fax 415-863-1373  
<http://www.dolby.com>

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# 1 Introduction

The Dolby Professional Reference Decoder DP580 is a real-time audio decoder and monitoring tool that supports Dolby codecs, including the latest immersive audio technologies. It provides reference information to manufacturers who are testing equipment, and broadcasters who are managing quality control.

- [Overview](#)
- [Workflow](#)
- [Technical benefits](#)
- [Business benefits](#)

## 1.1 Overview

The DP580 is a powerful and versatile tool for audio testing and quality control.

It enables you to monitor audio along multiple points of the broadcast chain. It provides detailed analysis of Dolby audio streams and provides real-time feedback, making it ideal for broadcast trials, manufacturers' test environments, and live broadcast monitoring.

The DP580 performs decoding, monitoring, and comprehensive validation of Dolby audio codecs, including:

- Dolby Digital Plus, Dolby E
- The technologies that support Dolby Atmos audio:
  - Dolby AC-4
  - Dolby ED2
  - Dolby Digital Plus with Dolby Atmos content

It is a key element of the live Dolby Atmos toolkit, which also includes the Dolby Object Authoring Tool DP590, and the Dolby Audio Encoder DP591. The toolkit assists broadcasters, live audio mixers, and engineers in the adoption and delivery of immersive audio for live events.

## 1.2 Workflow

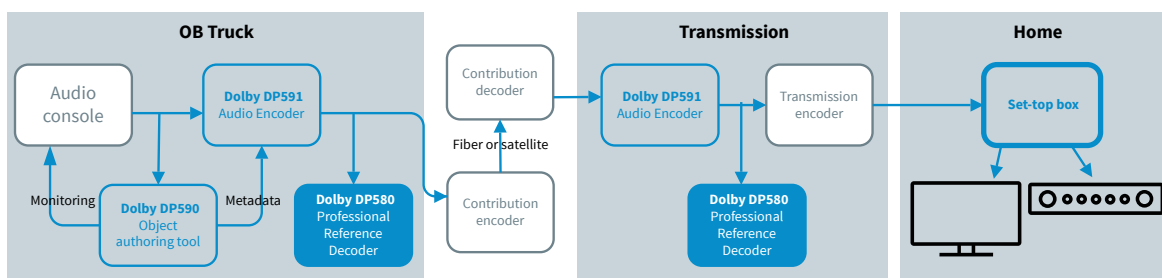
The versatile DP580 fits into any production or test environment.

It enables the audio engineer to:

- Test the integration of Dolby technologies in products and workflows.
- Provide real-time live broadcast quality control (QC) monitoring of Dolby audio content at multiple points along the broadcast chain.
- Implement monitoring when and where it is needed in a given workflow, from initial content creation testing to troubleshooting of specific issues.

### Live broadcast workflow

The DP580 monitors the contribution and transmission of Dolby Atmos content at any point in the workflow, as shown in the following simplified diagram.



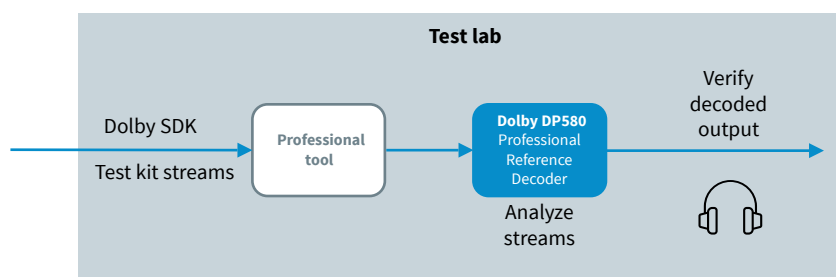
In the outside broadcast (OB) truck, the DP580 ingests PCM audio, Dolby ED2, or Dolby Digital Plus with Dolby Atmos content over SDI and renders the audio and video over its outputs for monitoring purposes.

In the headend, the DP580 supports monitoring of Dolby technologies over multiple inputs.

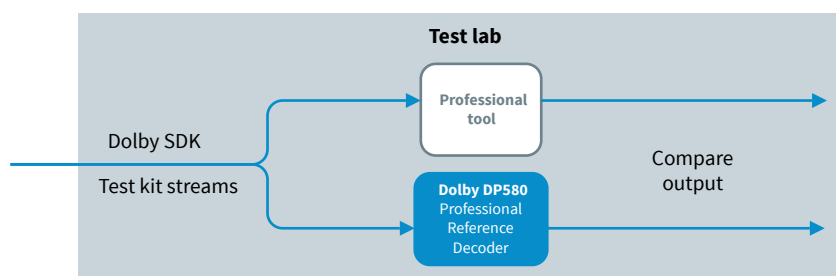
## Manufacturer test workflow

The DP580 plays an integral role in the development of products that support Dolby technologies.

In the test lab, the DP580 monitors the output from the product under test.



Here it serves as a reference decoder for comparison of product performance.



## 1.3 Technical benefits

The DP580 delivers proven technology to broadcast providers.

- It supports monitoring, display, and logging of all audio-related metadata.
- It measures program loudness using the ITU-R BS.1770-4 (with or without Dialogue Intelligence), or EBU R 128 loudness recommendations, to help you ensure regulatory compliance.
- It supports HDMI inputs to provide emulation of Dolby Atmos consumer devices, such as TVs, A/V receivers, and sound bars.

- It supports error detection and information logging to aid in troubleshooting audio stream problems.
- It supports a consumer emulation mode for Dolby Digital Plus with Dolby Atmos content decoders to be used by manufacturers of consumer audio/video receivers (AVRs) and sound bars.
- It provides a web-based user interface for easy selection and monitoring of the unique downmixing capabilities, listening modes, and compression modes of Dolby technologies.
- The front-panel interface provides basic setup and monitoring capability, including a headphone output for confidence monitoring.

## 1.4 Business benefits

The adoption of the Dolby DP580 makes business sense.

- It delivers proven monitoring capabilities for Dolby audio technologies. It provides consistent monitoring of both legacy channel-based audio, as well as new immersive audio capabilities.
- It provides support for OB truck and headend operations to implement a single system and process for monitoring across the entire delivery chain.
- It supports emulation of consumer playback devices for legacy stereo and 5.1 surround sound, as well as for immersive audio. This ensures a quality consumer experience regardless of how the consumer experiences the content.

## 2 Device description

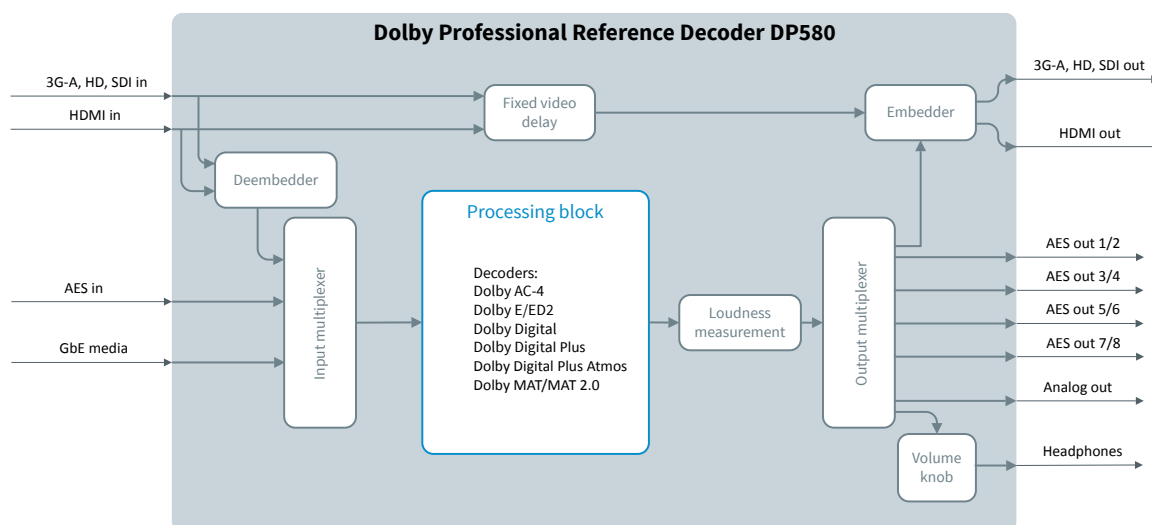
The DP580 supports multiple input and output types. It decodes and monitors the Dolby audio formats needed for Dolby Atmos workflows.

- [Dolby DP580 block diagram](#)
- [Operating environment](#)
- [General features](#)
- [Audio monitoring features](#)
- [DP580 front panel](#)
- [DP580 rear panel](#)

### 2.1 Dolby DP580 block diagram

The block diagram illustrates the audio processing flow through the DP580.

*Figure 1: DP580 block diagram*



### 2.2 Operating environment

The DP580 operates in stand-alone mode, under the control of a web GUI provided by an internal HTTP server over an IP connection to the command port.

The UI provides full control of the device system settings, decoding and monitoring services, software updates, and event logs. It includes a user's guide, available from the UI main menu.

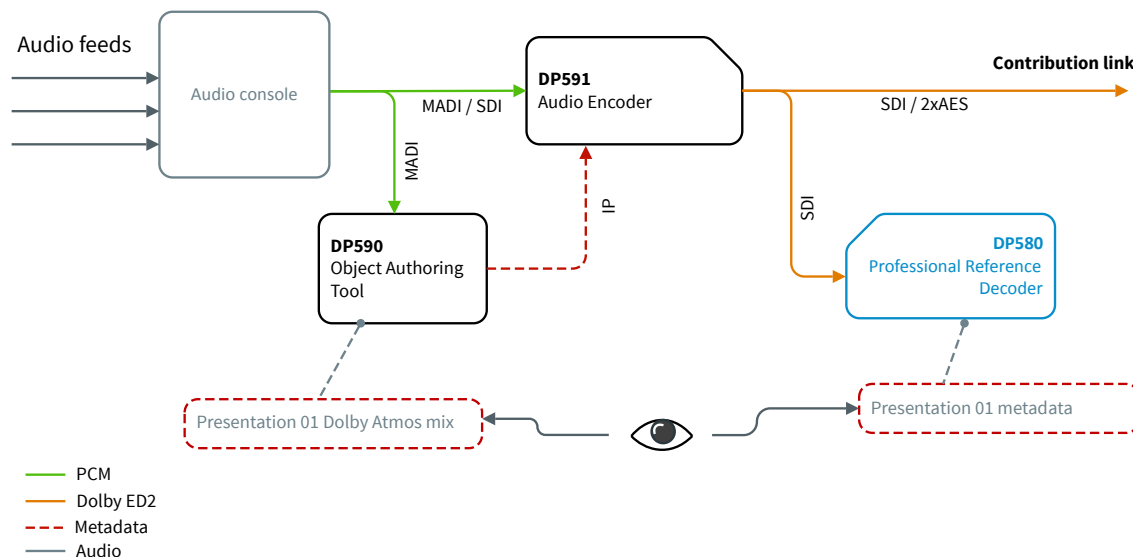
The device provides status and monitoring feedback through LEDs and indicators on the front panel, as well as graphical LEDs, audio meters, loudness meters, and event logs in the UI. The front panel provides controls for setting the device IP address, and displays a description of the input being decoded.

You can employ the DP580 at any point in a broadcast production chain or test environment. The device supports multiple input formats, making it easily adaptable to any workflow. Place a DP580 in as many locations as you require verification and monitoring of audio content.



For example, assume an audio engineer sets up a live program with Dolby Atmos content. He locates the three live Dolby Atmos toolkit devices in the OB truck. He uses the Dolby Object Authoring Tool DP590 to create the audio objects and presentations of the program. The Dolby Audio Encoder DP591 encodes the presentations. The Dolby Professional Reference Decoder DP580 decodes the stream and displays its contents.

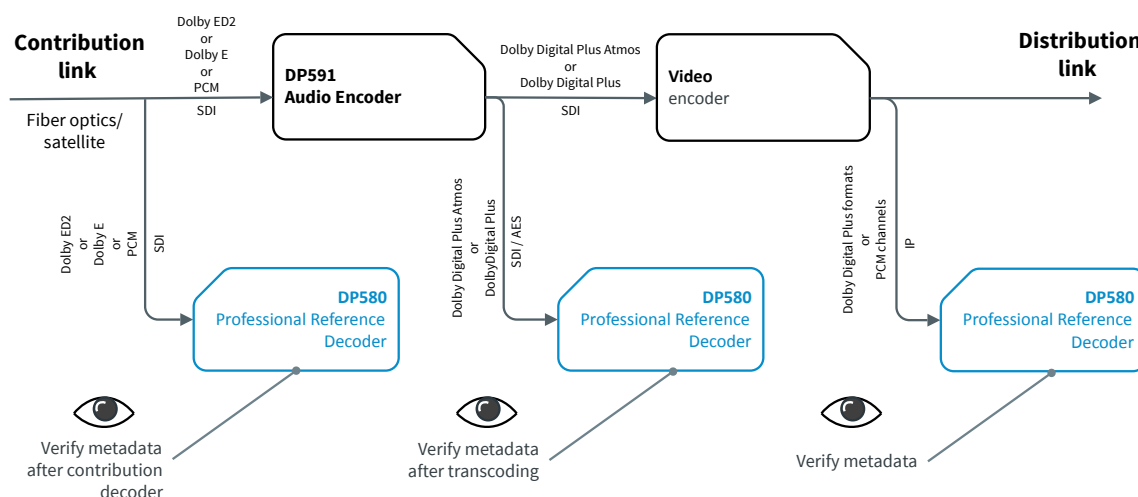
**Figure 2: Monitoring Dolby Atmos content creation in the OB truck**



The engineer compares the presentation in the authoring session to the encoded output (Dolby ED2 or Dolby Digital Plus with Dolby Atmos content) to verify that it carries the metadata and elements intended. He can check the output in real time, and make adjustments to the authoring or encoding settings as needed.

In the broadcast center, there are multiple points at which monitoring the integrity of the program is important to ensure that content has not been lost or corrupted (for example, after the contribution decoder has received the program, after transcoding from one format to another, after reembedding the transcoded program, after reauthoring, and so on). Monitoring at any or all of these stages provides a high level of quality control right up to the final distribution of content.

**Figure 3: Monitoring Dolby Atmos in the broadcast center**



Once the content workflow is established, the role of the DP580 is to monitor the program as it is broadcast, helping you to ensure continuous, quality service. For this confidence monitoring, you deploy the DP580 devices necessary to cover the key points in the broadcast chain.

## 2.3 General features

The DP580 performs comprehensive audio analysis for Dolby codecs. The device components support this function.

The following tables provide a summary of the DP580 features.

### Hardware

Feature	Description
Chassis	<ul style="list-style-type: none"> <li>• Single rack unit (1 U rackmount).</li> <li>• Mounts in Electronic Industries Alliance (EIA) standard rack.</li> <li>• AC power supply.</li> <li>• Temperature-controlled fan provides front-to-rear air flow.</li> </ul>
Local control panel	<ul style="list-style-type: none"> <li>• Four-line, 20-character (easy-to-read FSTN LCD) display.</li> <li>• Six-button (LED backlit) keypad.</li> <li>• Four multicolor (red, yellow, green) status LEDs.</li> </ul>

### Software

Feature	Description
Operating system	<ul style="list-style-type: none"> <li>• Ubuntu (Linux).</li> </ul>
Control	<ul style="list-style-type: none"> <li>• From a web client GUI.</li> <li>• Front-panel control for configuring network settings.</li> </ul>
Upgrades	<ul style="list-style-type: none"> <li>• From the GUI. (See the user's guide for instructions.)</li> </ul>
NTP	<ul style="list-style-type: none"> <li>• Supports configuration of one main and one backup NTP server.</li> </ul>

### Input

Feature	Description
AES	One female 75Ω BNC unbalanced connector. This input supports: <ul style="list-style-type: none"> <li>• Signal levels per AES3-4-2009</li> </ul>
SDI	One autodetecting female 75Ω BNC unbalanced connector. This input supports: <ul style="list-style-type: none"> <li>• 1.5 Gbps HD-SDI (SMPTE 292M-2012)</li> <li>• 3 Gbps HD-SDI (SMPTE 424M-2012) Level A</li> </ul>
Gigabit Ethernet	<ul style="list-style-type: none"> <li>• One 1000Base-T Ethernet RJ-45 connector command port.</li> <li>• One 1000Base-T Ethernet RJ-45 connector media port.</li> </ul>

Feature	Description
HDMI	<ul style="list-style-type: none"> <li>One HDMI 1.4 B female connector.</li> </ul>
USB	<ul style="list-style-type: none"> <li>Rear panel: Two to four USB 2.0 (480 Mbps) ports, depending on hardware version</li> <li>Front panel: Two USB 2.0 (480 Mbps) ports</li> </ul>

## Output

Feature	Description
AES	<p>Four female 75Ω HD-BNC unbalanced connectors. These outputs support:</p> <ul style="list-style-type: none"> <li>Signal levels per AES3-4-2009</li> </ul>
SDI	<p>One autodetecting female 75Ω BNC unbalanced connector. This output supports:</p> <ul style="list-style-type: none"> <li>1.5 Gbps HD-SDI (SMPTE 292M-2012)</li> <li>3 Gbps HD-SDI (SMPTE 424M-2012) Level A</li> </ul>
HDMI	<ul style="list-style-type: none"> <li>One HDMI 1.4 B female connector.</li> </ul>
Multichannel analog	<p>One female multichannel analog DB25-connector. It requires a male 25-pin D-connector that is compliant to the TASCAM pinout standard. This output supports:</p> <ul style="list-style-type: none"> <li>Signal levels per AES3-4-2009</li> </ul>
Headphones	<ul style="list-style-type: none"> <li>One 6.35 mm (1/4-inch) standard stereo headphone jack for confidence monitoring.</li> </ul>

## Audio support

Feature	Description
Input	<ul style="list-style-type: none"> <li>PCM audio at 48 kHz:               <ul style="list-style-type: none"> <li>Eight channels over HDMI (also supports 192 kHz)</li> <li>Up to 16 channels over SDI</li> <li>Two channels over AES input</li> </ul> </li> <li>20-bit Dolby E over SDI or AES</li> <li>20-bit Dolby ED2 over SDI</li> <li>Dolby Digital over all inputs</li> <li>Dolby Digital Plus over all inputs:               <ul style="list-style-type: none"> <li>2.0</li> <li>5.1, 5.1.2, 5.1.4</li> <li>7.1, 7.1.2, 7.1.4</li> </ul> </li> <li>Dolby MAT, Dolby MAT 2.0 over HDMI</li> <li>Dolby AC-4 over SDI, AES, and IP:               <ul style="list-style-type: none"> <li>2.0</li> <li>5.1, 5.1.2</li> </ul> </li> </ul>
Output	<ul style="list-style-type: none"> <li>PCM audio at 48 kHz:               <ul style="list-style-type: none"> <li>Eight channels over HDMI (also supports 192 kHz)</li> <li>Up to 16 channels over SDI</li> <li>Two channels per AES output</li> </ul> </li> <li>Dolby Digital Plus over SDI or HDMI:               <ul style="list-style-type: none"> <li>2.0</li> <li>5.1, 5.1.2, 5.1.4</li> <li>7.1, 7.1.2, 7.1.4</li> </ul> </li> </ul>
Pass-through	<ul style="list-style-type: none"> <li>Dolby Digital Plus over HDMI output</li> <li>Dolby Digital or Dolby Digital Plus over SDI output (only when input is HDMI)</li> </ul>
Metadata	<ul style="list-style-type: none"> <li>Displays metadata for Dolby codecs</li> </ul>

## Video support

Feature	Description
Input	<ul style="list-style-type: none"> <li>H.262, H.264, H.265 (up to 1080p 60 fps only) over IP</li> <li>HD-SDI and 3G-SDI Level A video over SDI</li> <li>Up to 1080p 59.94/50 fps over HDMI</li> </ul>

## Device monitoring

Feature	Description
Logs	<ul style="list-style-type: none"> <li>Event logs record changes in input or processing status, and error states.</li> <li>System logs record device status and processing details for review by Dolby technical support.</li> <li>Available in the UI and for download.</li> </ul>

## 2.4 Audio monitoring features

The DP580 performs analysis and validation for Dolby codecs that support Dolby Atmos workflows.

### Audio monitoring

Feature	Description
HDMI sink verification	<ul style="list-style-type: none"> <li>The DP580 provides device status on downstream HDMI sink devices and reports the EDID configurations from those devices.</li> </ul>
EDID emulation	<ul style="list-style-type: none"> <li>Configurable (user-defined) EDID settings enable the DP580 to emulate the capabilities of a broad range of HDMI sink devices.</li> </ul>
Audio meter	<ul style="list-style-type: none"> <li>The UI displays real-time audio meters with audio levels for channel modes up to 7.1.4.</li> <li>Meter refresh rate is 30 times per second.</li> </ul>
Loudness meters	<ul style="list-style-type: none"> <li>Supports measurement according to broadcast standard recommendations: <ul style="list-style-type: none"> <li>ARIB</li> <li>ATSC</li> <li>EBU R 128</li> <li>Free TV</li> </ul> </li> <li>Applies measurement algorithm ITU-R BS.1770-4 with or without Dialogue Intelligence.</li> <li>User-defined speech threshold percentage.</li> <li>Real-time loudness meters display metrics in the UI for: <ul style="list-style-type: none"> <li>Dialogue normalization value (<code>diaInorm</code>)</li> <li>Short ungated (ATSC: ten seconds, EBU: three seconds)</li> <li>Integrated level gated</li> <li>True peak</li> </ul> </li> <li>Meter refresh rate is every 0.5 seconds.</li> </ul>
Metadata	<ul style="list-style-type: none"> <li>Displays metadata values carried in the audio stream. Available metadata parameters depend on the Dolby codec.</li> </ul>

Feature	Description
Confidence monitoring	<ul style="list-style-type: none"> <li>Multichannel analog output supports routing to speakers.</li> <li>Headphone jack supports output to headset.</li> <li>Audio and loudness meters display levels in real time.</li> </ul>
Logs	<ul style="list-style-type: none"> <li>Event logs record user configuration actions, input audio format, changes in input or processing status, and error states.</li> <li>Loudness logs capture loudness metrics sampled 120 times per minute over a user-defined time range.</li> <li>Available in the UI and for download.</li> </ul>

## 2.5 DP580 front panel

The front panel provides device control and status information.



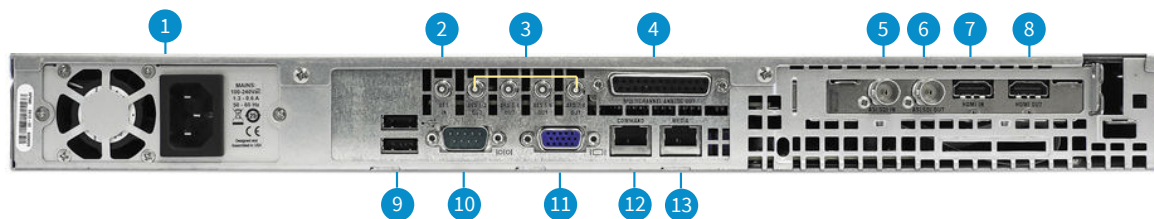
Item	Interface	Description
1	Input LED	<ul style="list-style-type: none"> <li>Green: Active input signal.</li> <li>Red: No active input signal.</li> </ul>
2	Audio LED	<ul style="list-style-type: none"> <li>Green: Audio data is detected on the input, and no errors have occurred in the last five seconds.</li> <li>Red: Red for five seconds indicates that there are cyclic redundancy check (CRC) or Pa errors detected.</li> <li>Off: No audio data is detected on the input.</li> </ul>
3	Video LED	<ul style="list-style-type: none"> <li>Green: Video data is detected on the selected input, and no errors have occurred in the last five seconds.</li> <li>Red: A video processing error has occurred.</li> <li>Off: No video data is detected on the selected input.</li> </ul>
4	Error LED	<ul style="list-style-type: none"> <li>Red: Red for five seconds indicates an audio or video decoding error.</li> </ul>
5	Control screen	<ul style="list-style-type: none"> <li>Displays the bitstream source, program and PID, codec, channel pair, channel configuration and bit rate, and loudness level.</li> <li>From the menu, you can set/view device IP addresses.</li> </ul>
6	Navigation keys	<ul style="list-style-type: none"> <li>Used to navigate through the device menu, and to set the device IP addresses and loudness measurement.</li> </ul>
7	Volume control knob	<ul style="list-style-type: none"> <li>Provides external volume control for the headphones. This control is tied to the master volume control in the device UI, and changes to one will affect the other.</li> </ul>

Item	Interface	Description
8	Headphone jack	<ul style="list-style-type: none"> <li>One 6.35 mm (1/4-inch) standard stereo headphone jack for confidence monitoring.</li> </ul>
9	Dim button	<ul style="list-style-type: none"> <li>Not used.</li> </ul>
10	Two USB 2.0 ports	<ul style="list-style-type: none"> <li>Used to load firmware upgrades.</li> </ul>
11	Power button	<ul style="list-style-type: none"> <li>Powers up the unit. Use at the end of the initial installation, and for shutting down or power cycling the device.</li> <li>Short press: The OS shuts down correctly, closing processes and saving open files.</li> <li>Long press: Forces power down of the system. Nothing is saved, and data may be lost.</li> </ul>
12	Reset button	<ul style="list-style-type: none"> <li>Physical reset of the device. No data is saved.</li> </ul>
13	Over-temperature indicator	<ul style="list-style-type: none"> <li>Solid red: Indicates that the unit temperature is higher than the recommended range for safe operation. Ensure that the unit front and rear air vents are not blocked, and that the ambient room temperature meets device environmental specifications.</li> <li>Flashing red: Indicates fan failure.</li> </ul>

## 2.6 DP580 rear panel

The DP580 rear panel gives access to the input and output connections, and to the power supply.

*Figure 4: DP580 rear panel*



Item	Interface	Description/use
1	AC power supply	One AC power supply, 100 and 240 VAC, 50–60 Hz, and 350 W, with temperature controlled fans.
2	AES input port	<p>One female 75Ω BNC unbalanced connector. This input supports:</p> <ul style="list-style-type: none"> <li>Signal levels per AES3-4-2009</li> </ul> <p>This port receives:</p> <ul style="list-style-type: none"> <li>PCM audio</li> <li>Dolby Digital</li> <li>Dolby Digital Plus</li> <li>Dolby Digital Plus with Dolby Atmos content</li> <li>Dolby E</li> <li>Dolby AC-4</li> </ul>

Item	Interface	Description/use
3	AES output port	<p>Four female 75Ω HD-BNC unbalanced connectors. These outputs support:</p> <ul style="list-style-type: none"> <li>• Signal levels per AES3-4-2009</li> </ul> <p>This port outputs up to eight channels of decoded PCM audio.</p>
4	Multichannel Analog output port	<p>One female multichannel analog DB25-connector. It requires a male 25-pin D-connector that is compliant to the TASCAM pinout standard. This output supports:</p> <ul style="list-style-type: none"> <li>• Signal levels per AES3-4-2009</li> </ul> <p>This port outputs up to eight analog channels.</p>
5	SDI input port	<p>One autodetecting female 75Ω BNC unbalanced connector. This input supports:</p> <ul style="list-style-type: none"> <li>• 1.5 Gbps HD-SDI (SMPTE 292M-2012)</li> <li>• 3 Gbps HD-SDI (SMPTE 424M-2012) Level A</li> </ul> <p>This port receives HD-SDI and 3G-SDI Level A video with up to eight embedded SDI audio pairs of:</p> <ul style="list-style-type: none"> <li>• PCM audio</li> <li>• Dolby Digital</li> <li>• Dolby Digital Plus</li> <li>• Dolby Digital Plus with Dolby Atmos content</li> <li>• Dolby E</li> <li>• Dolby ED2</li> <li>• Dolby AC-4</li> </ul>
6	SDI output port	<p>One autodetecting female 75Ω BNC unbalanced connector. This output supports:</p> <ul style="list-style-type: none"> <li>• 1.5 Gbps HD-SDI (SMPTE 292M-2012)</li> <li>• 3 Gbps HD-SDI (SMPTE 424M-2012) Level A</li> </ul> <p>This port outputs HD-SDI Level A video with up to eight embedded SDI audio pairs of:</p> <ul style="list-style-type: none"> <li>• Decoded PCM audio</li> <li>• Compressed audio as pass-through, when input is over HDMI</li> </ul>
7	HDMI input port	<p>One HDMI 1.4 B female connector. This port receives uncompressed video (up to 1080p 60 fps), with up to eight channels of PCM audio or compressed audio.</p>
8	HDMI output port	<p>One HDMI 1.4 B female connector. This port sends uncompressed video (up to 1080p 60 fps), with up to eight channels of PCM audio or compressed audio.</p>
9	USB 2.0 ports	<p>Two to four USB 2.0 (480 Mbps) ports, depending on the hardware version. These ports are used for USB firmware upgrades.</p>
10	Serial port	This port is not in use.
11	VGA video port	This port is not in use.



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Item	Interface	Description/use
12	GbE command port	One RJ-45 connector for 1000Base-T Ethernet. This port provides access for device control through a web-based user interface.
13	GbE media port	One RJ-45 connector for 1000Base-T Ethernet. This port receives an IP transport stream with compressed video and compressed audio/PCM on multiple PIDs.

---

## 3 Use cases

These example use cases highlight the monitoring functions of the DP580 for broadcasters who are implementing Dolby Atmos content in their live production workflows, and for professional tool developers whose products support Dolby technologies.

- [Dolby ED2 contribution format](#)
- [Dolby distribution formats](#)
- [Professional tools development](#)

### 3.1 Dolby ED2 contribution format

This use case illustrates the workflow for creating, encoding, and monitoring the Dolby ED2 contribution format that supports Dolby Atmos content.

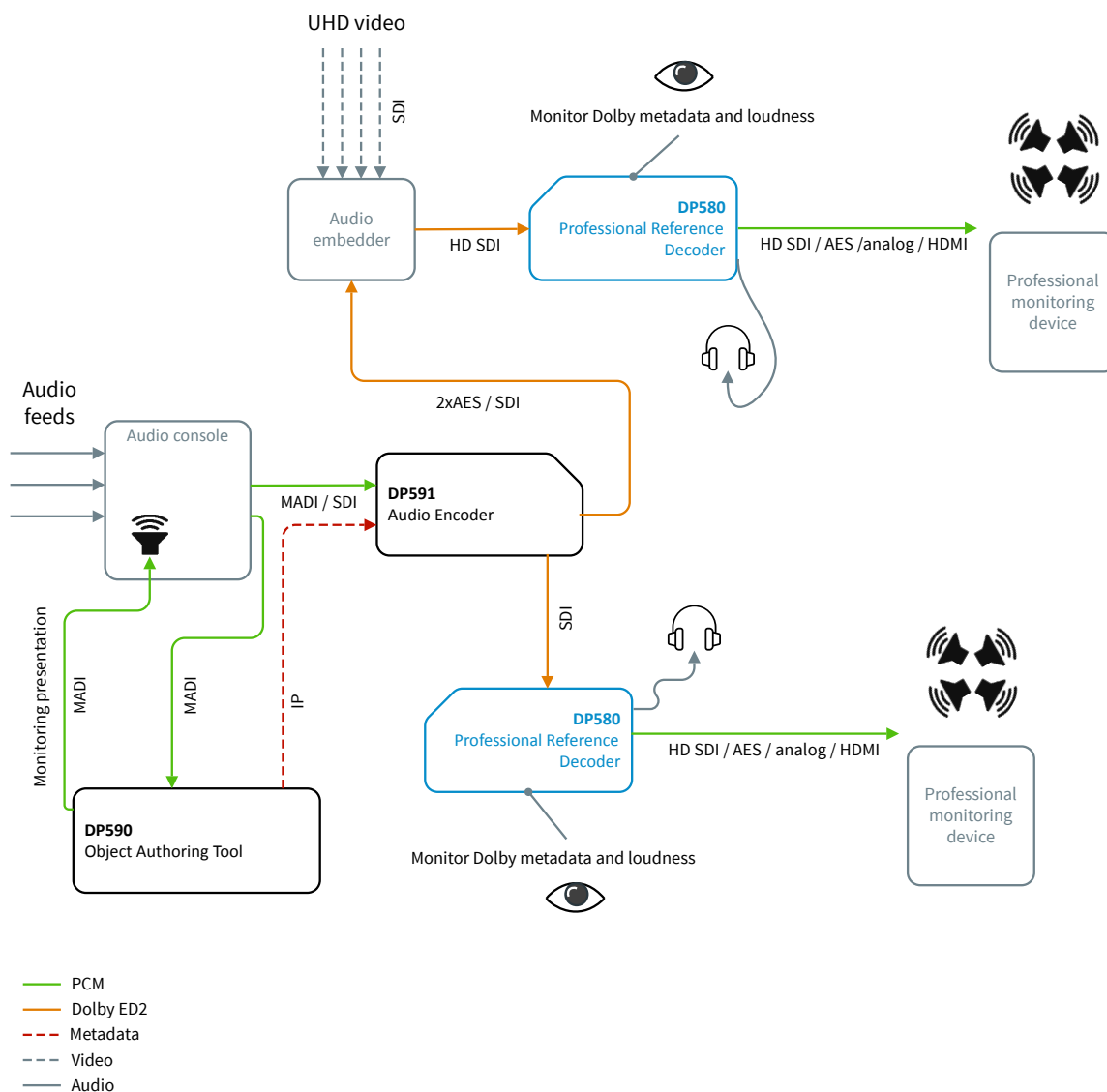
Live broadcast workflows that are incorporating Dolby Atmos audio need to encode the immersive audio to a format that they can transmit efficiently to the broadcast center.

Dolby ED2 is a contribution format that builds on Dolby E. It supports the extended metadata requirements of Dolby Atmos. Like Dolby E, it is video frame aligned. It is a mezzanine format, not intended for distribution to home devices. It is typically grouped in two pairs to carry 16 channels of 20-bit audio plus metadata.

The content creator uses the Dolby DP590 to define the immersive audio, and the Dolby DP591 to encode it. He uses the DP580 to monitor and verify the encoded Dolby ED2 streams.

Once he is satisfied with the immersive content, it is ready for the live broadcast. During a live event, he monitors the audio using the DP580 and other monitoring tools.

Figure 5: Monitoring Dolby ED2



In this example, the engineer uses one DP580 device to monitor the Dolby ED2 after encoding, and another DP580 to monitor after reembedding the audio with the UHD video.

The metadata carried in the Dolby ED2 bitstream defines individual presentations of the audio. The DP580 is the only device that can decode each individual presentation.

To ensure that no audio artifacts or errors are present, the audio mixer uses the DP580 to perform the following tasks:

- Monitor the metadata carried in the Dolby ED2 bitstream.
- Monitor individual presentations defined by the metadata. He switches between presentations to:
  - Listen to the headphone output
  - Monitor the loudness level
  - Ensure that all of the audio elements are present
  - Monitor the DP580 audio meters

He may choose to feed the decoded PCM to a different professional monitoring tool, to perform a similar channel check to what he customarily does for other content.

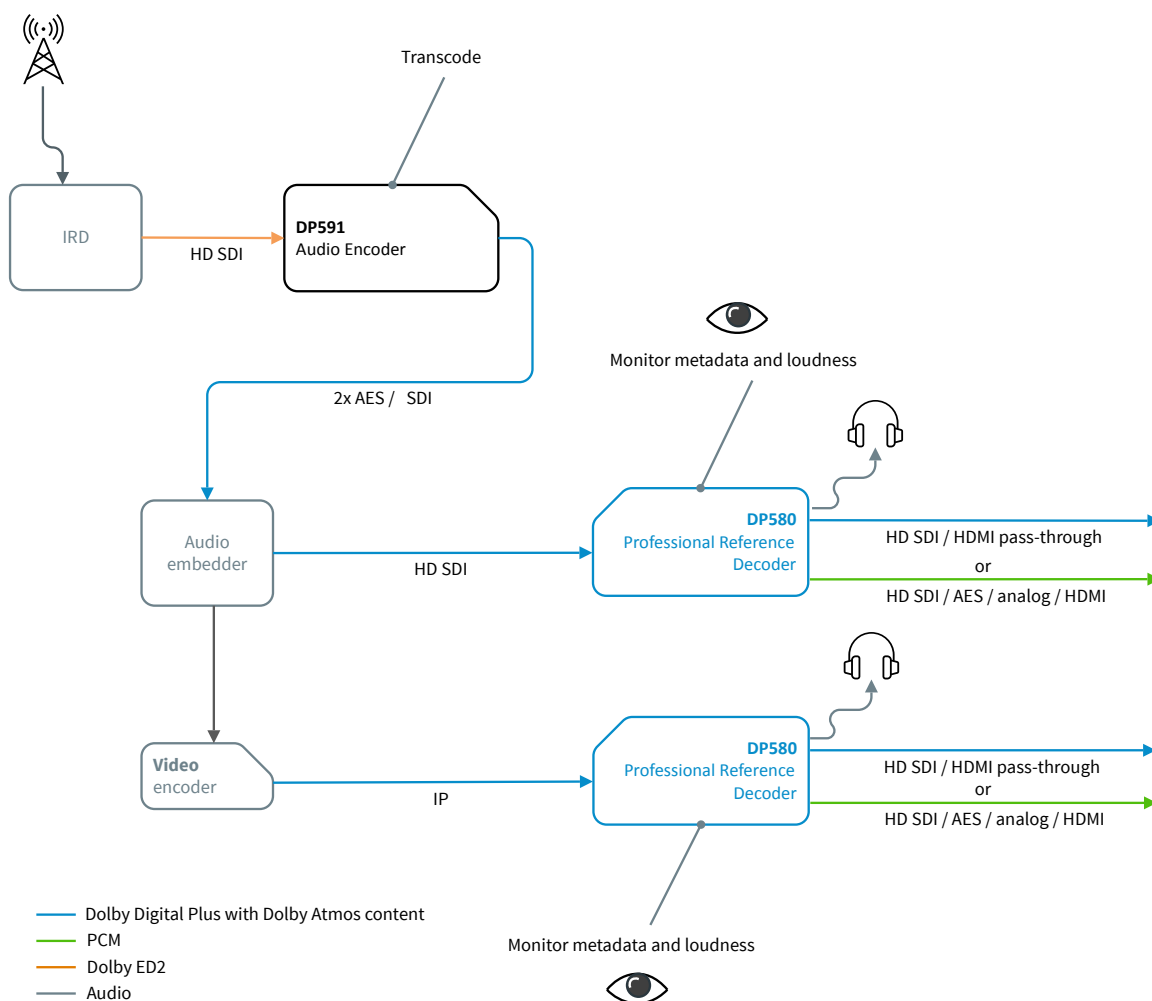
He tracks any errors by downloading the DP580 event log.

## 3.2 Dolby distribution formats

This use case illustrates the workflow for processing and monitoring the Dolby Digital Plus distribution formats.

Live broadcast workflows that are incorporating immersive audio can distribute the audio using either Dolby Digital Plus with Dolby Atmos content or Dolby AC-4. Dolby Digital Plus with Dolby Atmos content is an extension to the existing Dolby Digital Plus format, which supports metadata for up to 16 audio objects. It can carry one audio presentation. Dolby AC-4 is Dolby's newest codec. It supports immersive audio, among many other features, and can carry multiple presentations of the audio content.

**Figure 6: Monitoring distribution formats**



In this example, the Dolby ED2 arrives at the broadcast center where the Dolby DP591 Audio Encoder transcodes it to Dolby Digital Plus with Dolby Atmos content.

The engineer uses one DP580 to monitor the Dolby Digital Plus with Dolby Atmos content after reembedding the audio, and another DP580 to monitor the audio after reencoding the video.

When transcoding the Dolby ED2, the user chose the presentation to be included in the Dolby Digital Plus with Dolby Atmos content stream. For this presentation, the engineer can:

- Monitor the loudness level
- Ensure that all of the audio elements are present in the presentation

- Render the content to a different speaker system to evaluate the end-user experience
- Monitor the DP580 meters

Additionally, he can use the DP580 pass-through mode to pass through the compressed audio and feed it to a Dolby Atmos AVR for listening purposes.

He tracks any errors by downloading the DP580 event log.

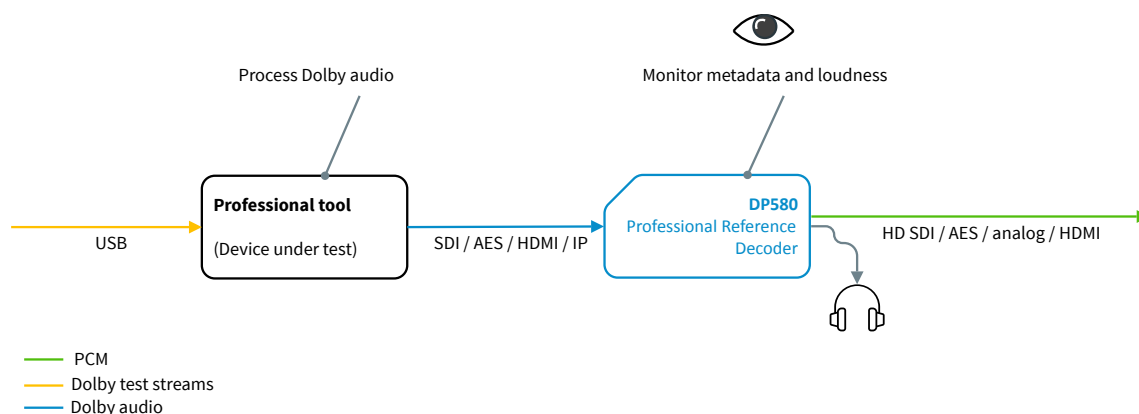
### 3.3 Professional tools development

This use case illustrates the workflow of a professional tool developer using the Dolby system development kit to integrate Dolby technologies in his products.

#### Generating Dolby content

This product outputs Dolby audio bitstreams, so the developer uses the DP580 to verify that the output generated by the professional tool matches the behavior defined in the Dolby test kit.

*Figure 7: Verifying professional tool output*



In this example, the developer uses test streams provided by the Dolby test kit. He loads the test streams to the professional tool through the USB port. He connects the output to the DP580. The DP580 outputs can connect to speakers, TVs, or other monitoring devices.

He initiates playback of the Dolby test streams on the professional tool. The DP580 decodes the streams, and the developer monitors the following:

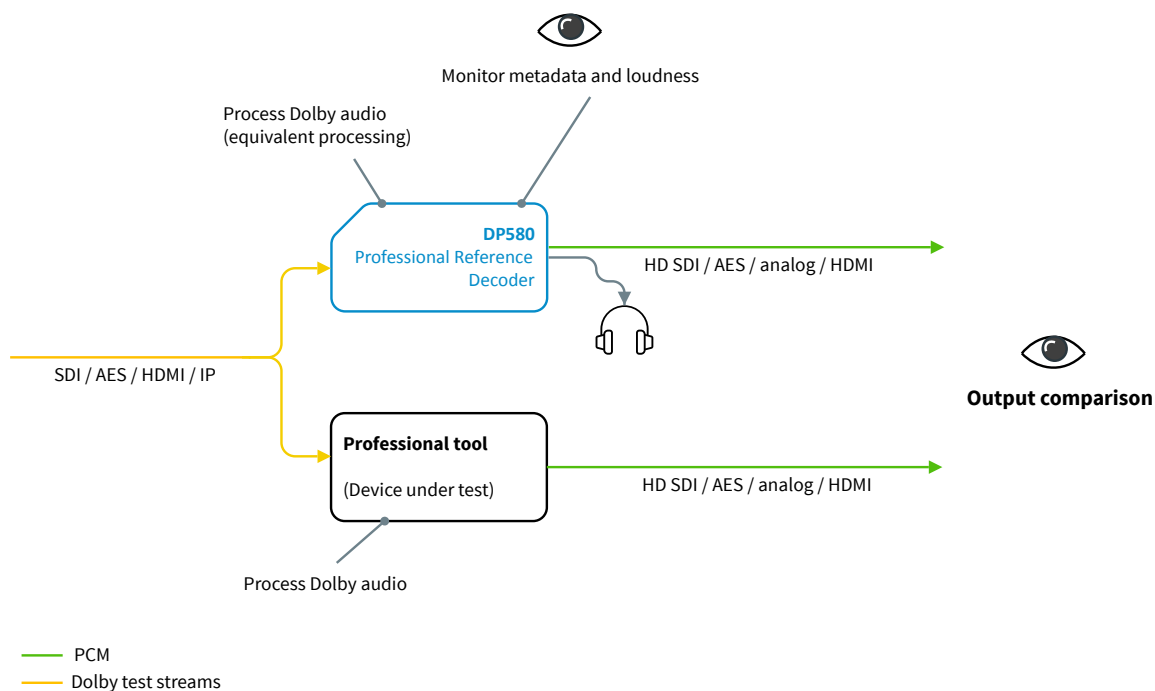
- Video and audio output from the DP580 to ensure that no artifacts are present
- Metadata properties of the audio stream to ensure they are properly configured
- A/V sync using a pop/flash stream as part of the listening test, to ensure that synchronization is maintained

He downloads the DP580 error log to track the performance issues.

#### Supporting Dolby content

This product receives Dolby audio and decodes it. The developer uses the DP580 to perform the same decoding task, and compares the results.

**Figure 8: Using the DP580 as a reference tool**



In this example, the developer loads the test kit streams to both his professional tool and the DP580. He monitors and compares the following settings for each device to ensure they are correct and equivalent:

- Metadata properties of the audio stream
- Loudness levels
- Audio analog and digital output

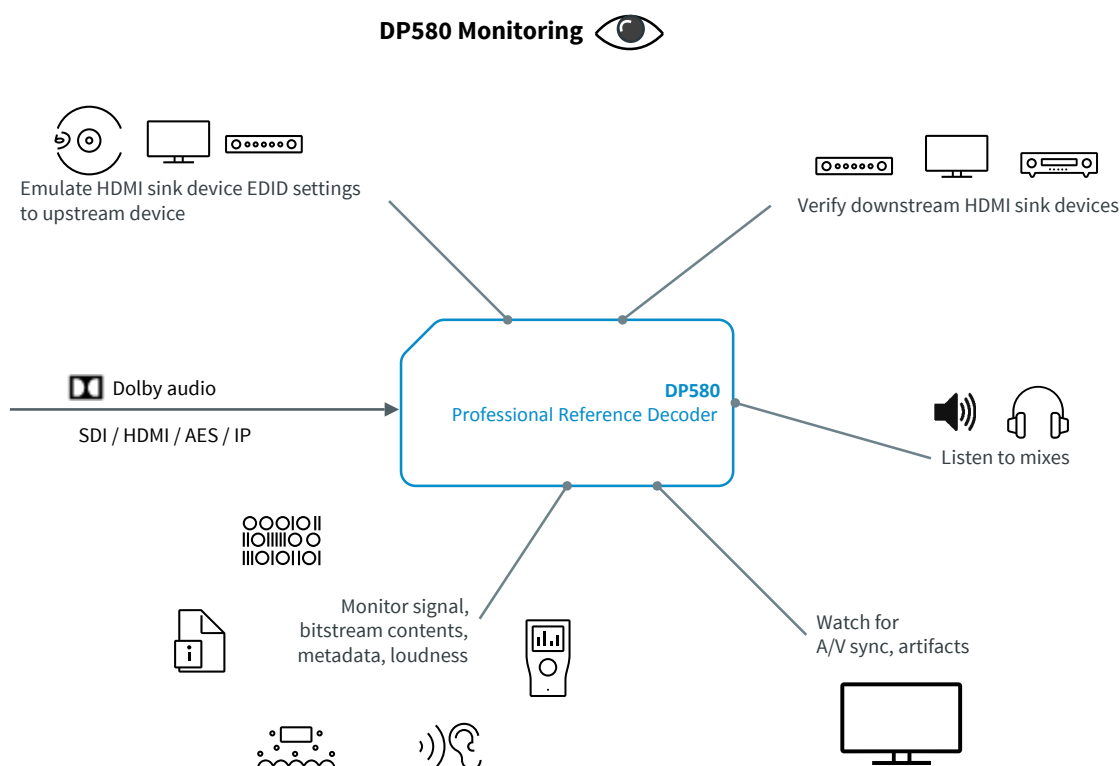
## 4 Audio monitoring

The DP580 is designed to enable all types of monitoring tasks, from decoding the compressed audio stream to verify that is valid and error-free, to facilitating testing with a wide variety of playback devices.

- [Introduction](#)
- [Decoding options](#)
- [Metadata monitoring](#)
- [Loudness monitoring](#)
- [HDMI sink emulation and testing](#)

### 4.1 Introduction

Each monitoring session has a different goal. To achieve that goal, you may need to perform a number of different tasks, from observing the audio metadata, applying downmix or upmix for a listening test, testing with other equipment, emulating a particular device or speaker configuration, and so on.



Dolby technologies are designed to provide the best possible listening experience on a variety of end-user playback devices and speaker configurations. They support a rich set of parameters that provide a great deal of flexibility to the sound mixer when creating or adapting audio content. The DP580 decoders support all relevant options for each Dolby codec, enabling you to simulate the listening experience that you want to test.

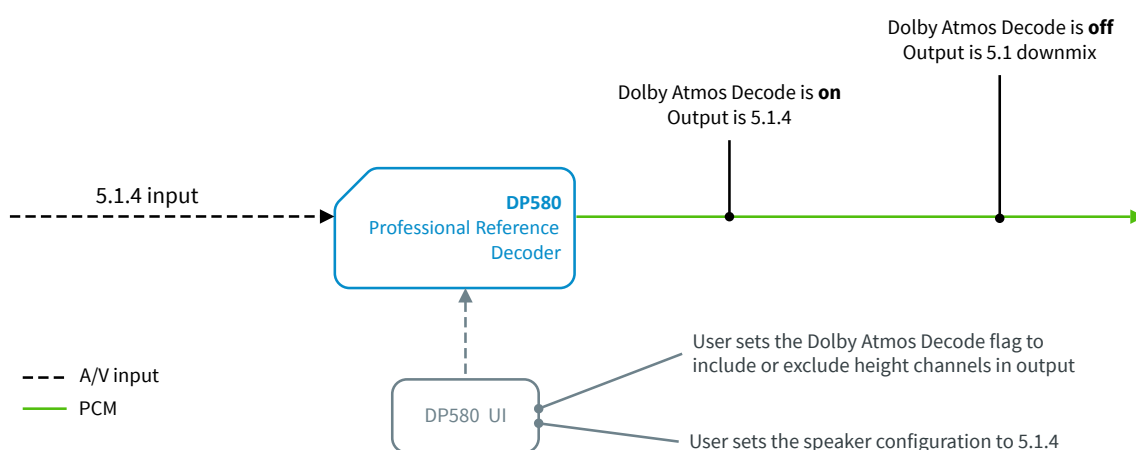
## 4.2 Decoding options

Monitoring begins with decoding the audio. Based on his testing goals, the user chooses what type of rendering he wants the decoder to perform in order to obtain the output he wants to monitor. The DP580 provides a number of decoding options to produce the desired audio mix and environment.

### 4.2.1 Dolby Atmos decode

For Dolby Atmos content, the user chooses whether or not the device renders the Dolby Atmos height channel information to the output. This determines how the decoder fills the channel output for the desired speaker configuration.

*Figure 9: Rendering height channels*



In this example, the input carries 5.1.4, and the speaker configuration is 5.1.4. The user sets the flag to include or exclude the height channels with the following results:

- Include: Output is 5.1.4.
- Exclude: Output is 5.1.

Using this option the DP580 can emulate the behavior of devices that support Dolby Atmos and those that do not.

It does not affect downmixing. When downmixing, the device downmixes all channels from the input, including the height channels.

### 4.2.2 Speaker configuration

For decoding all input types, the user chooses the speaker configuration he wants to reproduce.

The decoder can render the input to the following speaker configurations, where the third number indicates height speakers.

Channels	Speaker configuration
2.0	L, R
5.1	L, R, C, LFE, Ls, Rs
7.1	L, R, C, LFE, Ls, Rs, Lrs, Rrs
5.1.2	L, R, C, LFE, Ls, Rs, Ltm, Rtm

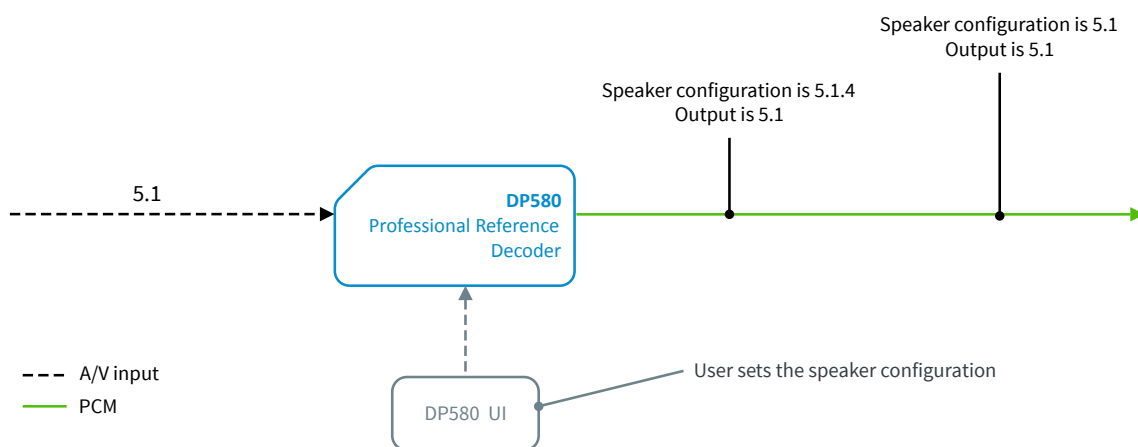


Channels	Speaker configuration
5.1.4	L, R, C, LFE, Ls, Rs, Ltf, Rrf, Ltr, Rtr
7.1.2	L, R, C, LFE, Ls, Rs, Lrs, Rrs, Ltm, Rtm
7.1.4	L, R, C, LFE, Ls, Rs, Lrs, Rrs, Ltf, Rrf, Ltr, Rtr

Setting the speaker configuration dictates how the decoder uses the available input channels, and how it performs upmixing or downmixing when those options are enabled.

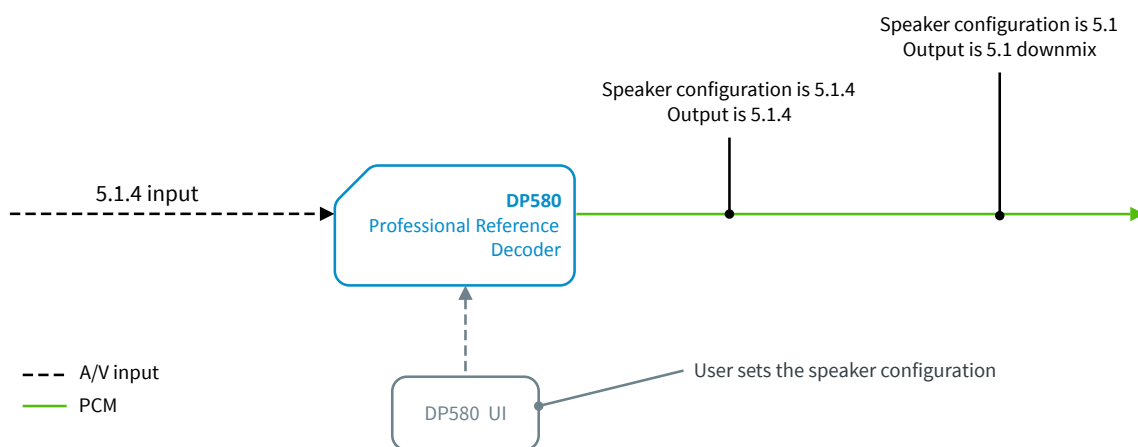
By default, the decoder fills only the output channels that have corresponding input. In this example, the input carries 5.1. If the speaker configuration is set to 5.1.4, the output will be 5.1, with silence on the other channels.

**Figure 10: Speaker configuration example with 5.1 input**



By default, the decoder downmixes the input if it carries more channels than indicated in the speaker configuration setting. In this example, the input carries 5.1.4. If the speaker configuration is 5.1, the device downmixes the height channel information to 5.1 output.

**Figure 11: Speaker configuration example with 5.1.4 input**



### 4.2.3 Downmixing to stereo

The decoder provides controls for setting stereo downmixing behavior.

These settings apply to the headphone output, and when the speaker configuration is set to 2.0, they apply to the output from all interfaces.

- Auto: The decoder uses the information in the input bitstream metadata to determine downmixing settings.

- LtRt: Left total/Right total. The decoder uses an equation that is Dolby Pro Logic II compatible.
- LoRo: Left only/Right only.

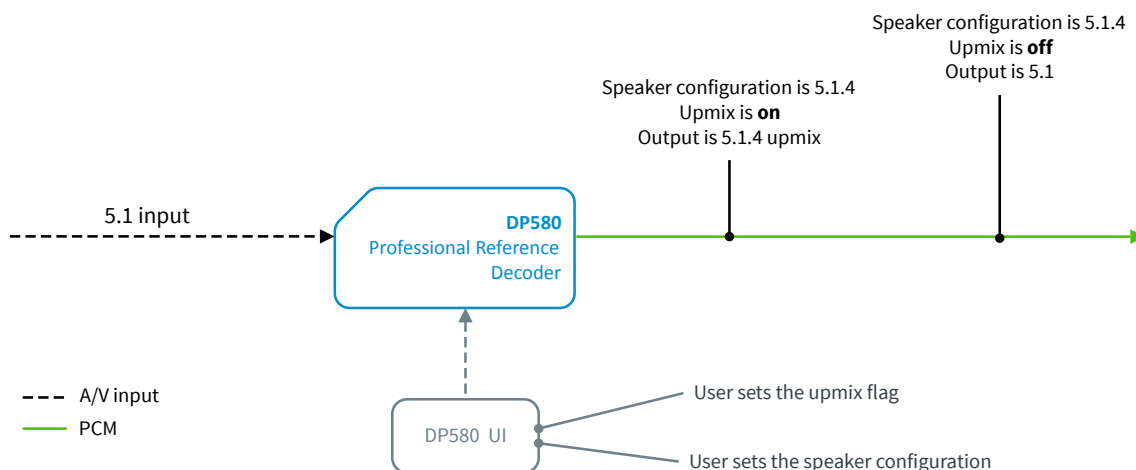
This option requires input that is 5.1 or greater. The device behavior and output depends on the speaker configuration.

Speaker configuration	Decoder behavior
2.0	Applies stereo downmix for output to all interfaces.
5.1 7.1	Applies stereo downmix to headphone output only. The other interfaces carry 5.1 or 7.1 output, depending on the input.
5.1.2	Applies stereo downmix to headphone output only.
5.1.4 7.1.2 7.1.4	If the input carries height channels, the device uses a virtualization algorithm to produce the stereo downmix for the headphone output. In this case, it ignores the user-defined options (Auto, Lt/Rt, Lo/Ro). Virtualization gives an illusion of 3D space on just two channels.  The other interfaces carry 5.1.2, 5.1.4, 7.1.2, 7.1.4 output, depending on the input.

## 4.2.4 Upmixing

The decoder can upmix 2.0, 5.1, or 7.1 input to the target speaker configuration, including height channels (5.1.2, 5.1.4, 7.1.2, or 7.1.4).

*Figure 12: Upmixing*



In this example, the input is 5.1 and the speaker configuration is 5.1.4. The user sets the upmixing flag with the following results:

- Enabled: The output is 5.1.4.
- Disabled: The output is 5.1.

## 4.2.5 Mixing main and associated audio services

For IP input, the device supports dual PID audio mixing (receiver-mix audio), where it mixes an associated audio service into the main audio service.

The device provides two methods for enabling associated service mixing.

### Method One

On the input selection page:

- Select both the main audio stream and the associated audio service, and enable mixing.

You identify the streams by their PIDs. It is not necessary to match any audio descriptor metadata.

### Method Two

On the input selection page:

- Select the main audio stream.

On the decoder configuration page:

- Enable associated audio service mixing.
- Choose an associated service type.

This option requires that the associated audio stream be identified in the `supplementary_audio_descriptor` field in the PMT, and in the `editorial_classification` field in the supplementary audio descriptor, as defined in ETSI EN 300 468, section 6.4.10. The device discovers the audio stream with the matching `editorial_classification` value, and mixes it with the main audio stream.

- Choose where the decoder extracts the mixing metadata.

When mixing a main and an associated audio service, the decoder can apply mixing metadata that is specified in the transport stream container or in the coded bitstream (codec specific). The device supports the transport stream mixing metadata as defined in the `AD_descriptor` in ETSI TS 101 154 (table E.1). It contains five elements: fade, pan, gain center, gain front, and gain surround.

Alternatively, the DP580 can extract and use the mixing metadata from Dolby AC-4 bitstreams (Dolby AC-4 only, no other codecs). This Dolby AC-4 mixing metadata is defined in ETSI 103 190-1, section 6.2.16.2. The `extended_metadata` contains four elements: `scale_main`, `scale_main_center`, `scale_main_front`, and `mono_pan_associated`.

## 4.2.6 Bass management

The decoder supports a bass management system that enables the user to control cutoff and boost levels.

Processing bitstreams that contain Dolby Atmos content causes increased complexity and risk of overload with traditional bass management systems. Specifically, bass buildup can occur as bass is summed by amplitude, as when an object is panning between speakers.

For example, when an object pans from the left speaker position to the center speaker position, bass buildup (which is caused by the summation of the low-frequency information) can occur when the object is located directly between the left and center speakers.

To solve this problem, Dolby has developed a special bass management system. The DP580 implements this system as Bass Extraction Mode. It enables the user to specify the cutoff frequencies for height and nonheight speakers. All frequencies below these cutoff values are filtered out, summed, and routed to the LFE speaker by the bass management module.

Optionally, the LFE signal can be boosted by an additional 10 dB. The system extracts the low-frequency content postrendering and routes this (along with the optional LFE boost of 10 dB) to the LFE channel.

## 4.2.7 Dolby Digital and Dolby Digital Plus dynamic range control

For Dolby Digital and Dolby Digital Plus decoding, the DP580 provides controls to emulate the behavior of AVRs that apply compression.

The user chooses a compression mode:

- None
- Line
- RF

For Line Mode, you can enable different amounts of compression for high level signals and low level signals.

Partial compression is achieved by multiplying the `dynrng` value by a scale factor from 1.0 to 0.0. A scale factor of 1.0 equals full compression. A scale factor of 0.0 equals no compression. A fractional scale factor (such as 0.5) results in partial compression, with a linear change in the scale factor resulting in a linear change in the amount of compression applied.

## 4.2.8 Dolby AC-4

For Dolby AC-4 decoding, the DP580 provides settings specific to this codec.

To monitor audio dialogue quality at various levels, you can set dialogue enhancement levels to audibly boost or attenuate the decoded bitstream dialogue content.

Dynamic compression mode for Dolby AC-4 is oriented to target devices. You can choose to emulate the compression mode for:

- Home Theater
- Flat-panel TV
- Portable Speakers
- Portable Headphones

You can set the reference level for the selected mode.

## 4.3 Metadata monitoring

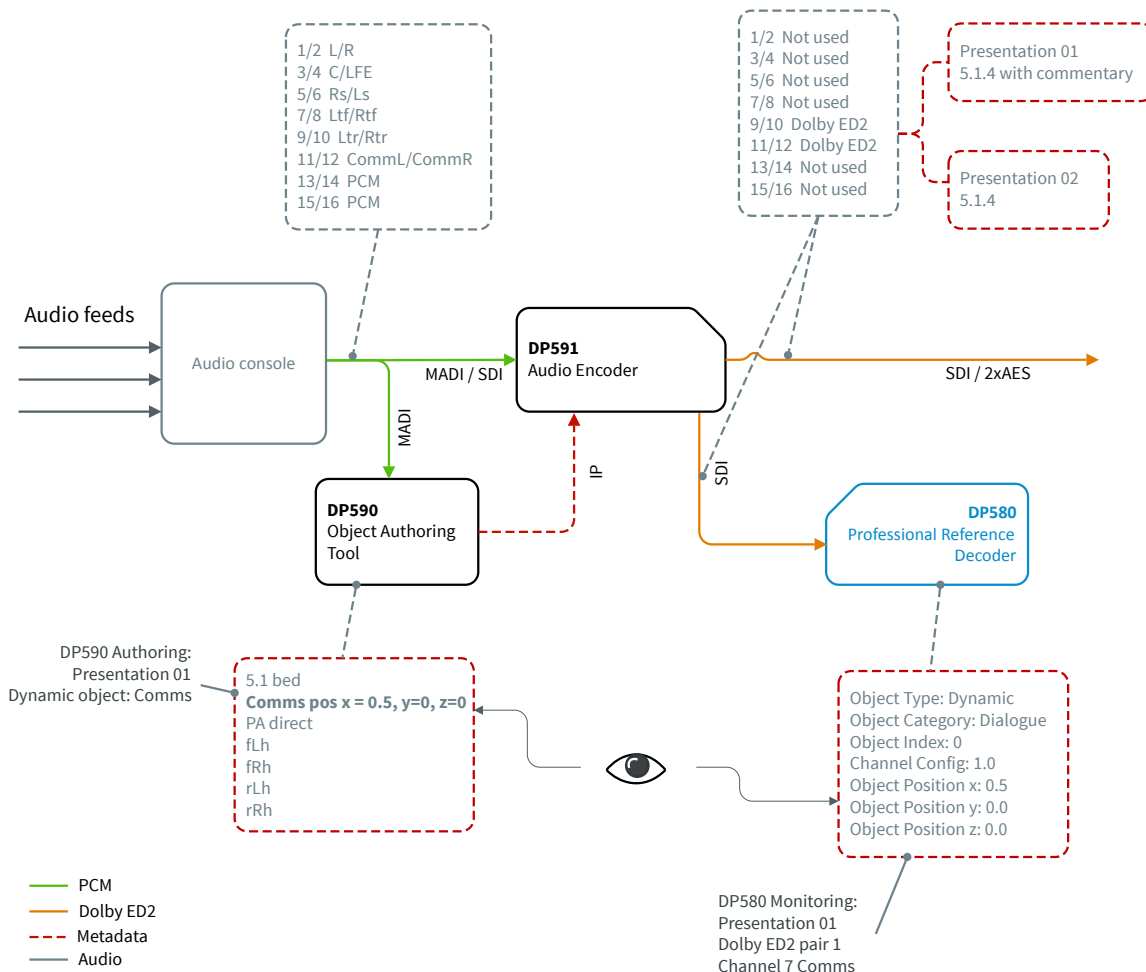
The DP580 decodes Dolby codecs, and exposes the relevant metadata parameters for monitoring.

All of the Dolby technologies rely on metadata to support the rich feature set that consumers rely on. Moreover, the metadata included for each codec supports customization of audio settings. Verifying metadata parameters plays an important part in content creation, and in troubleshooting audio issues.

The UI displays metadata parameters for the audio stream that the device is actively decoding. It reads the values in real time as it decodes the audio frames. This varies for each codec.

For the content creator, the DP580 is a powerful tool for testing a new configuration. In this example, we see the case of live Dolby Atmos content authoring. By using the devices from the live Dolby Atmos toolkit together, you can compare the output settings even as you are authoring the content. In this way, you ensure that you have correctly configured the settings, and they are being correctly encoded and decoded.

Figure 13: Checking the Dolby Atmos height object coordinates metadata



For troubleshooting, the ability to compare metadata parameters at various points in the production chain helps you to pinpoint where changes are being introduced, or parameters are getting dropped.

## 4.4 Loudness monitoring

To ensure compliance with the loudness-level regulations, it is necessary for broadcasters to measure loudness levels at many points within the production workflow. The DP580 provides loudness measurement on all decoded output.

To perform loudness estimation, the DP580 decodes the bitstream to 5.1 (irrespective of the speaker configuration setting) and applies no postprocessing (such as bass management or dynamic range control).

The device provides users a great deal of control over how loudness is measured during monitoring. The following table lists the settings users can make for a given monitoring session.

Loudness measurement control	Options
The broadcast standard recommendations for the region under test	<ul style="list-style-type: none"> <li>• ATSC</li> <li>• ARIB</li> <li>• EBU R 128</li> <li>• Free TV</li> </ul>

Loudness measurement control	Options
Measurement algorithm	ITU-R BS.1770-4 with or without Dialogue Intelligence
Speech threshold setting	0 to 100% This setting indicates at what speech level the device should switch from performing loudness measurement using level gating to using speech gating. This setting applies only for measurements with Dialogue Intelligence.

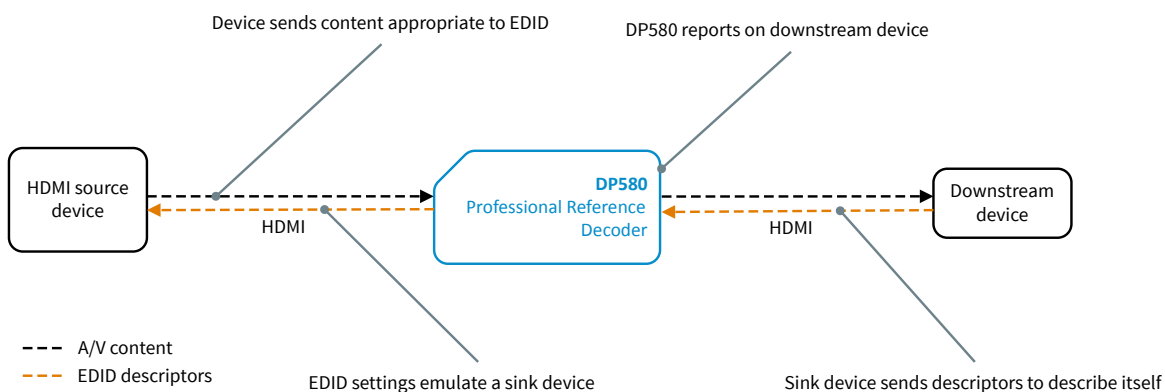
The following table shows the different loudness measurements that you can monitor from the UI and the device front panel. You can choose two parameters to monitor at the same time.

Parameter	Description
dialnorm	An AC-3 metadata parameter, numerically equal to the absolute value of the dialogue level, carried in the AC-3 bitstream
Short ungated	A ten-second sliding window measurement, as per ITU-R BS.1770 (ATSC: ten seconds, EBU: three seconds)
Integrated level gated	A cumulative loudness value measured according to ITU-R BS.1770-4
True peak	The peak value, oversampled four times, as calculated per ITU-R BS.1770-4

## 4.5 HDMI sink emulation and testing

The DP580 provides support for monitoring HDMI-compliant source devices (upstream devices), as well as HDMI compatible sink devices (downstream devices).

*Figure 14: HDMI source and sink device monitoring*



### EDID emulation

An HDMI-compatible device uses the EDID to communicate its capabilities to an upstream source device. The source device then transmits content that conforms to those capabilities.

The DP580 provides EDID emulation, allowing content creators to test a source device to ensure that it is sending the correct content. You connect the source device to the DP580 HDMI input port and set emulation parameters to indicate:

- The number of channels

- The Dolby audio formats

The DP580 sends these parameters to the source device in the EDID format.

The DP580 shows the contents of the HDMI input, allowing you to confirm that the upstream device is able to comply with the EDID configuration settings. You can examine the metadata of the input stream and determine whether your product is processing the audio correctly.

## **HDMI sink device monitoring**

The DP580 reports the capabilities of a downstream sink device when it is connected to the HDMI output port.

In this way, you can verify if the device is responsive and see its support for the following parameters:

- The number of PCM channels
- Supported codecs
- Supported speakers

## 5 Audio processing

The DP580 processes the input audio according to the active decoding and monitoring selections, and the type of input it receives.

- [Input selection](#)
- [Output behavior](#)
- [Switching behavior](#)
- [A/V sync](#)
- [Latency](#)

### 5.1 Input selection

In order to support monitoring in a variety of environments, the DP580 accepts audio and video input over SDI, HDMI, or IP and audio over AES input.

The DP580 processes one audio program at a time. The user chooses the input source, and the DP580 autodetects the audio content, or in the case of IP input, it discovers the audio program in the selected transport stream.

When you select the stream you want to monitor, the device displays all available information about the stream, including metadata values.

The DP580 supports the following input audio formats per input interface. For each input type, the device presents options appropriate to the input format and the audio content it carries.

If the input is Dolby AC-4 or Dolby ED2 and it carries multiple audio presentations, you can select which presentation to monitor.

#### HDMI input

- Dolby Digital 2.0, 5.1
- Dolby Digital Plus 2.0, 5.1, 7.1, 5.1.2, 5.1.4, 7.1.2, 7.1.4
- Dolby MAT/Dolby MAT 2.0
- PCM 8 channels (up to 16 channels with Dolby MAT)

The device deembeds the PCM/compressed audio from the video and displays input format. For example:

HDMI - Dolby Digital Plus

3/2 448 kbps

For PCM audio carried in the Dolby MAT container, the device does not display specific metadata.

#### SDI input

- PCM (up to 16 channels)
- Dolby Digital
- Dolby Digital Plus 2.0, 5.1, 7.1, 5.1.2, 5.1.4, 7.1.2, 7.1.4
- Dolby E



- Dolby ED2
- Dolby AC-4 2.0, 5.1, 5.1.2

The device deembeds the PCM/compressed audio from the video and displays the input channel pairs with a description of the content. For example:

Group 1 Ch 1/2 - Dolby Digital Plus

## AES input

- Dolby Digital 2.0, 5.1
- Dolby Digital Plus 2.0, 5.1, 7.1, 5.1.2, 5.1.4, 7.1.2, 7.1.4
- Dolby E
- Dolby AC-4 2.0, 5.1, 5.1.2

The device displays a description of the input content. For example:

AES Input - Dolby Digital Plus

## IP input

- Dolby Digital 2.0, 5.1
- Dolby Digital Plus 2.0, 5.1, 7.1, 5.1.2, 5.1.4, 7.1.2, 7.1.4
- Dolby AC-4 2.0, 5.1, 5.1.2

The device stores program source stream information as "bookmarks." You can create multiple bookmarks and choose between them when selecting an IP source. For example:

- Bookmark: 2018\_Winter\_olympics, multicast, 227.12.34.56, port 3131
- Bookmark: World\_cup\_comm\_french, multicast, 228.12.34.56, port 3232

To monitor IP input, you select a bookmark source. The device discovers the programs carried in the transport stream, and lists them in the UI. The device lists the streams within each program by PID and identifies the contents. For example:

Program 1

PID 482 Dolby Digital Plus

## 5.2 Output behavior

When receiving input, the DP580 always produces output. The default output from the decoder is decoded PCM audio. Pass-through processing is available for some input/output combinations.

### Decoded output

The device supports the following input/output routing:

Figure 15: Supported outputs for HDMI input

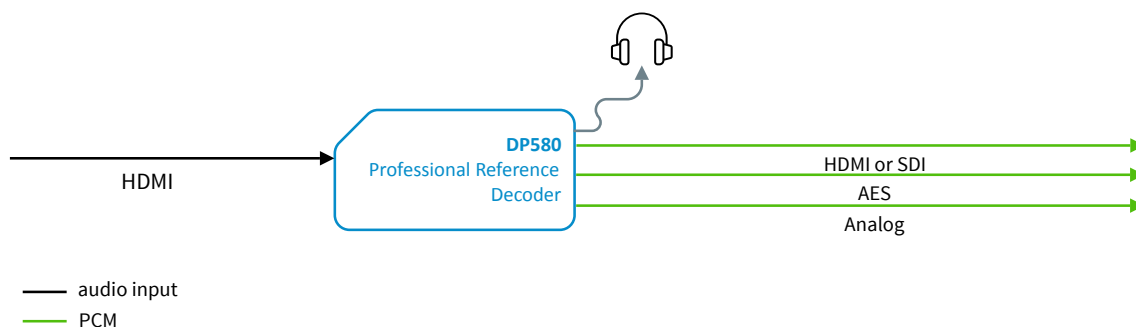
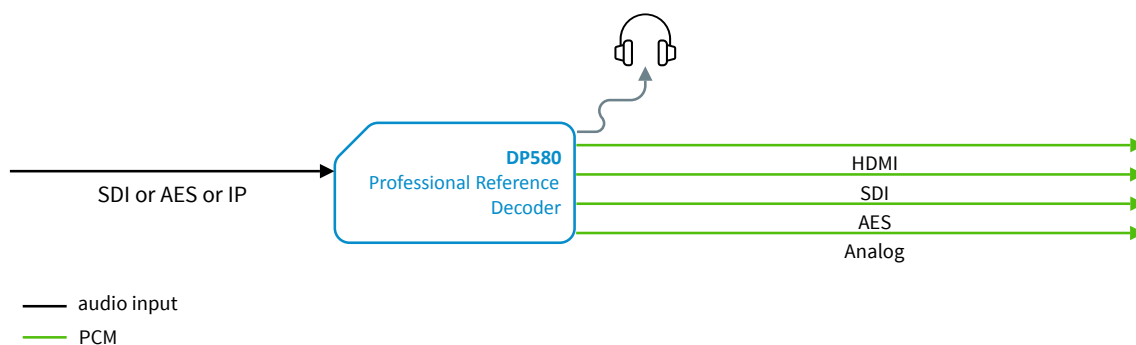


Figure 16: Supported outputs for SDI, AES, IP input



The output channel mapping depends on the interface.

Output	Channels	Mapping
HDMI	8	2.0 L, R 5.1 L, R, LFE, C, Ls, Rs 7.1 L, R, LFE, C, Ls, Rs, Lrs, Rrs
SDI	Up to 16	Fixed channel mapping: L, R, C, LFE, Ls, Rs, Lrs, Rrs, Ltf, Rtf, Ltm, Rtm, Ltr, Rtr, PCM, PCM (See the examples in the following table.)
Headphones	2	Choose either stereo or a single channel.
AES	8	You can distribute 16 channels of input across 8 channels AES and 8 channels analog output.
Analog	8	

For SDI output the device implements fixed channel mapping, as listed in the following table.

SDI channels	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16
5.1	L/R	C/LFE	Ls/Rs	-/-	-/-	-/-	-/-	-/-
5.1.2	L/R	C/LFE	Ls/Rs	-/-	-/-	Ltm/Rtm	-/-	-/-
5.1.4	L/R	C/LFE	Ls/Rs	-/-	Ltf/Rtf	-/-	Ltr/Rtr	-/-
7.1	L/R	C/LFE	Ls/Rs	Lrs/Rrs	-/-	-/-	-/-	-/-
7.1.2	L/R	C/LFE	Ls/Rs	Lrs/Rrs	-/-	Ltm/Rtm	-/-	-/-
7.1.4	L/R	C/LFE	Ls/Rs	Lrs/Rrs	Ltf/Rtf	-/-	Ltr/Rtr	-/-

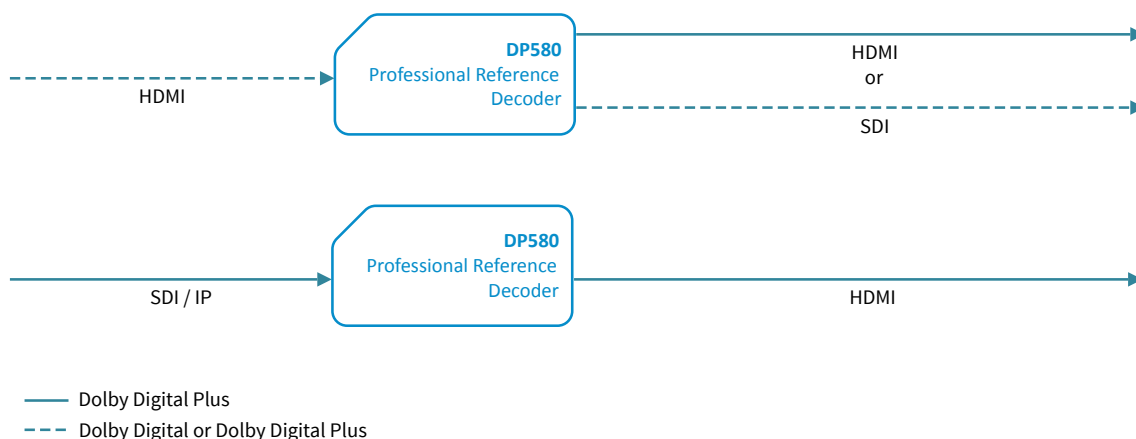
## Pass-through output

It may be desirable to use the DP580 to analyze the input stream, but rather than outputting PCM, to output the audio in its compressed form. The device supports pass-through for some

codecs and input/output routing. When you designate pass-through output, the device does not output decoded PCM over any interface.

The device supports the following pass-through routing.

**Figure 17: Pass-through routing**



When HDMI input is passed through to SDI output, the output video is black.

## 5.3 Switching behavior

Switching refers to how the decoder handles the transition from decoding one program to another, without introducing audible glitches, pops, or silence.

The DP580 handles switching as follows:

- When the input the device receives changes from one input interface to another, the device restarts audio processing.
- When switching between audio content on the same input interface, or from one audio stream to another within the same program in a transport stream, the device performs a fade-out/fade-in transition.

## 5.4 A/V sync

The DP580 maintains audio/video synchronization on the HDMI and SDI outputs within a range of -5 to +15 ms.

## 5.5 Latency

Latency refers to the delay between when an audio signal enters a system and when it emerges from the system. To maintain synchronization, the same delay must apply to the video feed. Dolby provides latency metrics for DP580 audio decoding.

The DP580 ensures equal audio and video latency when processing. If the audio is delayed by  $n$  frames, the video is delayed by a corresponding number of frames.

The following tables list the latency measurements for DP580 audio processing. These values represent the delay that needs to be applied to the video feed when reembedding the audio.

These measurements represent AES output.

## Decode Dolby ED2 to PCM audio

Video format	SDI input Delay (ms)
720p 50 fps	240
720p 59.94 fps	204
1080i 25 fps	483
1080i 29.97 fps	403
1080p 25 fps	483
1080p 29.97 fps	403
1080p 50 fps	240
1080p 59.94 fps	204

## Decode Dolby Digital Plus with Dolby Atmos content to PCM audio

Video format	SDI input Delay (ms)	HDMI input Delay (ms)
720p 50 fps	231	244
720p 59.94 fps	191	205
1080i 25 fps	471	483
1080i 29.97 fps	391	403
1080p 25 fps	470	482
1080p 29.97 fps	392	405
1080p 50 fps	230	244
1080p 59.94 fps	191	205

## Process PCM audio to PCM audio

AES input Delay (ms)
512

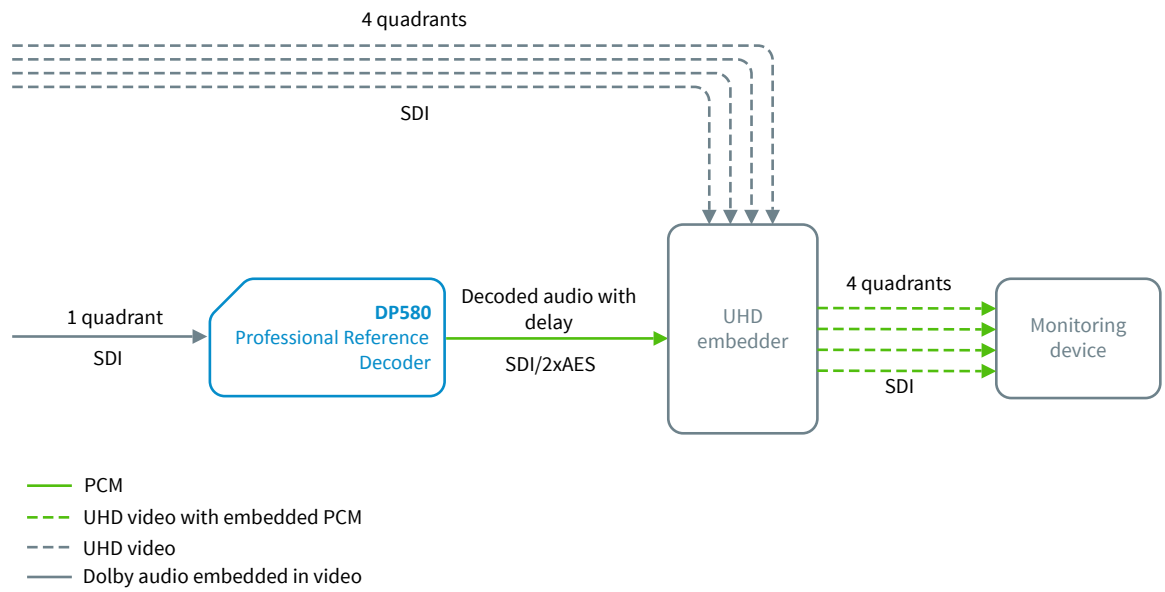
## Delay for 4K UHD video over 3G-SDI

When processing 4K UHD video over 3G-SDI, the decoder ingests only the first video quadrant that is carrying the audio. The DP580 processes the audio, applying the correct delay to the video (one quadrant).

The production workflow must apply the same delay to the other three video quadrants. This function is typically performed by the UHD embedder. Although many operators prefer to keep the video feed on a separate path and reembed the encoded audio, synchronizing these three quadrants to the DP580 output video is a reliable way to generate the signal.

In this figure, the DP580 applies delay to one UHD video quadrant, and the embedder delays video to align with the audio.

**Figure 18: DP580 delays audio, embedder delays video**



## 6 Device monitoring

The DP580 provides real-time status information, error monitoring, and event logs.

- [LEDs and display screen](#)
- [Event and system log descriptions](#)

The device provides real-time feedback about device status and processing operations using the LEDs on the front panel and on the UI.

The device maintains a downloadable event log that tracks changes, audio processing status, errors, and device status.

It also keeps system logs to track system processes. Dolby technicians may request these logs for troubleshooting purposes.

### 6.1 LEDs and display screen

The DP580 front-panel LED indicators show whether the device is receiving input, whether the input contains audio, and whether it contains video. In addition to the front-panel LEDs, the UI shows graphical LEDs that indicate the same information.

When monitoring the device visually, you can use the LED indicators to quickly identify a problem on the input, and follow up by checking the event logs.

The front panel also has an indicator light showing the temperature status of the device itself. If the device is overheating, you can take measures to correct the ventilation.

The front-panel display screen shows the status of the current processing, and some information about the bitstream. For example, it shows the source input type, the audio type, the loudness measurement, and so on. The information will vary according to the input type and audio format.

This gives the user a quick reference for confidence monitoring.

### 6.2 Event and system log descriptions

The DP580 logs provide a record of unit operations and behavior.

#### Event logs

The device generates an event log entry for every change in input or processing status, and every error state. This provides a picture of the device operation, and is very useful for monitoring and troubleshooting. You can download the .csv log files from the UI.

Each logged event includes:

- Date
- Level (type of log information):
  - General information
  - Warnings (marked in yellow)
  - Errors (marked in red)

- Category
- Input type
- Message

The device stores the event log locally. To prevent overrunning the disk space, the logs remain available until one of the following conditions occurs:

- The number of log entries exceeds one million.
- A log entry is older than two months.

A periodic backup of the event log will ensure that you retain this information.

## **System logs**

System logs include detailed technical information about the DP580 unit processes. In the event of a system failure, users must send the logs to Dolby Laboratories for analysis and support.

## 7 Hardware specification

The Dolby Professional Reference Decoder DP580 is designed to meet certain hardware specifications and meets a variety of compliance standards.

- [Physical specifications](#)
- [Environmental specifications](#)
- [Compliance](#)

### 7.1 Physical specifications

The DP580 occupies one rack unit and is mountable in an EIA-310 standard rack.

Dimensions	1 U rackmount: 44 × 483 × 394 mm (1.75 × 19 × 15.5 inches)
Net weight	6.5 kg (14.5 lb)

### 7.2 Environmental specifications

The DP580 meets a variety of environmental specifications.

#### Power

Input voltage range	100–240 VAC
Input frequency range	50–60 Hz, autosensing
Power consumption	350 W

#### Temperature and humidity

Cooling	Front-to-rear airflow temperature-controlled fans
Operating temperature	10°C–35°C (50°F–95°F)
Operating humidity	5%–90% relative humidity (noncondensing)

### 7.3 Compliance

The DP580 complies with the regulatory standards governing electronic equipment in North America and Europe.

#### Safety

EN 60950-1:2006/A11:2009/A1:2010/A12:2011/A2:2013

#### EMC

EN 55032:2012/AC:2013	(Emission)
EN 61000-3-2:2006/A2:2009	(Power line harmonics)
EN 61000-3-3:2008	(Power line flicker)



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EN 55024:2010	(Immunity)
EN 61000-4-2:2009	(Electrostatic discharge)
EN 61000-4-3:2006/A2:2010	(Electromagnetic field)
EN 61000-4-4:2012	(Electrical fast transient)
EN 61000-4-5:2006	(Surge)
EN 61000-4-6:2009	(Radio frequency common mode)
EN 61000-4-11:2004	(Mains voltage dip/fluctuation)

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## European Union directives

Safety	2014/35/EU
EMC	2014/30/EU
RoHS	2011/65/EU

# Glossary

**3G-SDI**

3 Gbps high-definition serial digital interface.

**AES**

Audio Engineering Society. An international organization that promotes advances in audio and disseminates new knowledge and research.

**AVR**

Audio/video receiver. An audio amplifier and audio/video (A/V) switching combination device for a home theater. It contains inputs for all of the audio and video sources and outputs to one or more sets of speakers and one or more monitors or TVs.

**CRC**

Cyclic redundancy check.

**dialnorm**

Dialogue normalization value.

**dual PID**

Dual PID. Within a transport stream, the main and associated audio are identifiable by distinct packet identifiers (PIDs) as separate elementary streams.

**dynamic range control**

An audio compression metadata parameter applied to audio to limit the dynamic range.

**EBU**

European Broadcasting Union. An alliance of public service media entities, based mainly in Europe.

**EDID**

Extended Display Identification Data. A data structure, standardized by the Video Electronics Standards Association, which enables a sink device to inform the host device about its identity and capabilities.

**ETSI**

European Telecommunications Standards Institute.

**GUI**

Graphical user interface.

**HD**

High definition.

**HDMI**

High-Definition Multimedia Interface. A high-speed, high-capacity format for transferring digital information and the specific hardware interface for the format.

**HDMI sink**

A consumer device with a display (such as a TV) that receives content by means of HDMI from a source device for playback.

**HD-SDI**

High-definition serial digital interface.

**IP**

Internet Protocol.

**IP address**

Internet Protocol address. A numerical identifier assigned to a device that is a member of a network that uses the IP for communication.

**ITU**

International Telecommunication Union.

**kbps**

Kilobits per second.

**MADI**

Multichannel Audio Digital Interface. A communications protocol for an interface that carries multiple channels of digital audio, defined by the Audio Engineering Society. Also known as AES10.

**NTP**

Network Time Protocol. A network protocol for clock synchronization on computers.

**Pa**

The name of a start-of-frame marker defined in SMPTE 337-2008.

**PCM**

Pulse code modulation. A method that is used to convert analog signals into digital, binary, coded pulses by sampling the analog signal, quantizing each sample independently, and converting the resulting quantized values into a digital signal.

**PMT**

Program Map Table. A table within an MPEG-2 transport stream that defines the set of elementary streams associated with a specific program.

**SDI**

Serial digital interface.

**SMPTE**

Society of Motion Picture and Television Engineers.

**STB**

Set-top box.

**UI**

User interface.

**USB**

Universal Serial Bus. A standard that defines the cables, connectors, and communications protocols used in connections between computers and electronic devices.