Dolby Vision CMU

User Manual

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1 Introduction

The Dolby Vision Content Mapping Unit (CMU) is an external processing box provided by Dolby that enables the following Dolby Vision functionality:

- Enables the GUI and controls for Dolby Vision in a Dolby Vision-enabled color grading or mastering system
- Contains the master database for Dolby Vision Mastering Monitors and output Target displays
- Real-time Content Mapping (CM) processing

The CMU performs the content mapping function from content with embedded Dolby Vision metadata through a SDI interface for a selected target display. The applications enabled with Dolby Vision must also communicate with the CMU via a network; either connected directly or as part of a larger house network. This traffic is minimal and generally only occurs at startup or project initialization time. The following CMU setup procedure shows how to setup and test the network and briefly describes SDI connectivity.

Alternatively, you can send content with embedded Dolby Vision metadata through HDMI tunneling for quality control.

Note:
- HDMI tunneling with a consumer TV should not be used for mastering.
- HDMI tunneling output only supports HD resolution. This signal will be upscaled in the TV.

The following diagram shows the most common configuration for the CMU in an operating environment.

![Dolby Vision CMU workflow diagram](image)

**Figure 1: Dolby Vision CMU workflow diagram**

For support and questions, send a detailed email to: dolbyvisionmastering@dolby.com
2 Setup

2.1 Initial connectivity

The CMU is a head-less box designed to reside in a rack in the server room with no GUI explicitly running. This is only an issue when the network has not been configured to work for the environment in which it is installed. Therefore, it is advisable to setup the machine with a VGA monitor and USB keyboard before you begin operations.

Follow these steps to connect to the network.

1. Unbox the CMU and connect power, making sure there is sufficient ventilation top and bottom.
2. For SDI connection, locate the included mini-SDI-to-SDI cable harness that connects the CMU to the color grading or mastering system.
3. For connecting a display to the CMU, either use the included mini-SDI-to-SDI cable harness to connect to a reference monitor or the included mini-HDMI cable to a Dolby Vision TV.
4. Connect a network cable to the first port (nearest the USB ports) and plug it into the switch or other networking infrastructure in which the color grading or mastering system is also connected to.
5. Plug a USB keyboard into a USB slot. You do not need a mouse, as there is no graphical user interface.
6. Connect a monitor to the VGA port. Do not connect the monitor to the graphics card.
7. Plug in the power cable and turn on the machine; all the services will automatically start.

The following figures show the front and back of the Dolby Vision CMU.

Figure 2: Dolby Vision CMU front panel

Figure 3: Dolby Vision CMU rear panel
2.2 Network setup

Configure the default network for DHCP. If the installation site has a DHCP server, it automatically negotiates an address. However, many networks either use static DHCP, or manually assigned addresses. In these environments, it is necessary to assign a static IP address.

Once you have determined the type of network to use, log in to the CMU using the following user name and password:

   User name: admin
   Password: Dolby1234!

2.2.1 DHCP network configuration

For a DHCP network, make sure that the CMU has connected and successfully obtained an IP address. To obtain the IP address, run the following command once logged in:

/sbin/ifconfig

Example Output:

[admin@dlb-cmu-06 ~]$ ifconfig

enp5s0f0:  flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
    inet 10.204.189.27  netmask 255.255.192.0  broadcast 10.204.191.255
    inet6 fe80::ec4:7aff:fe02:8196  prefixlen 64  scopeid 0x20<link>
    ether 0c:c4:7a:02:81:96  txqueuelen 1000  (Ethernet)
    RX packets 606  bytes 60305 (58.8 KiB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 126  bytes 20113 (19.6 KiB)
    TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
    device memory 0xfb220000-fb240000

Note: It may take 30 to 60 seconds to bind to a DHCP server if the DHCP servers have churn processing turned on.

2.2.2 Static DHCP network configuration

For a static DHCP network in which the network addresses are served based on the MAC address, log in and run the following command to display the CMU’s MAC address:

/sbin/ifconfig

There may be multiple network devices on the CMU. Depending on the physical setup, the MAC address you want should be attached to network device enp5s0f0 or en0 depending on the CMU’s generation. Provide this MAC address the networking administrator. Once the MAC address is entered to their
system, simply reboot, and make sure the network automatically picked up as occurs in a normal DHCP network.

2.2.3 Static IP address configuration

The most complicated setup configuring for a static IP address. Contact your Linux administrator to setup the CMU for a static IP configuration.

2.2.4 Network verification

After configuring the network settings on the CMU, access the built-in web application by opening a web browser on Chrome, Firefox or Safari on a computer that is connected to the same network.

Navigate to the CMU IP address you assigned for the CMU to display the CMU web page. For future access, create a bookmark. It is useful to check the SDI status and other log pages during operation.

2.3 Single Card AJA Kona 4 setup for 2K/HD

The CMU with a single AJA Kona 4 SDI card is compatible with a dual-link 1.5G HDSDI, single-link 3G Level A/B SDI or quad-link 3G Level A/B SDI, depending on the hardware configuration of the CMU. The CMU automatically configures the output SDI interface to match the input SDI interface. If needed, the CMU can be set to force a 3G SDI output, even if the input SDI is dual-link HDSDI, see the CMU Configuration page.

Additionally, the CMU with Kona 4 supports HDMI output to a Dolby Vision television. We recommend that you use 3G connectivity, because of the reduced wiring necessary. Additionally, there are fewer timing and VPID identification issues when using 3G connectivity. The CMU is designed to process 12-bit RGB 4:4:4 content; therefore, the supported frame rates are only those in which a 4:4:4 RGB signal can be displayed (23.976, 24, 25, 29.976, 30 are all possible). The CMU examines the input signal and adapts based on the VPID and connection state it detects on the wire. If the application does not output a VPID, it assumes 24fps 4:4:4 RGB 12-bit.

![Figure 4: Single AJA Kona 4 interfaces](image)
2.3.1 Single-link 3G Level A/B Setup

2.3.1.1 SDI output

Use the following SDI configuration to connect using single-link 3G SDI. See Figure 4 for SDI connector configuration.

- SDI 1 = input from application
- SDI 3 = output to target monitor
- SDI 2, 4 = not used

2.3.1.2 HDMI output

Use the following HDMI configuration to connect using single-link 3G SDI. See Figure 4 for SDI connector configuration.

- HDMI = output to Dolby Vision television
- SDI 1 = input from application
- SDI 2, 3, 4 = not used

2.3.2 Dual-link 1.5G HDSDI Setup

2.3.2.1 SDI output

Use the following SDI configuration to connect using dual-link 1.5G HDSDI. See Figure 4 for the SDI connector configuration.

- SDI 1 = A side of dual-link input from application
- SDI 2 = B side of dual-link input from application
- SDI 3 = A side of dual-link output to target monitor
- SDI 4 = B side of dual-link output to target monitor

2.3.2.2 HDMI output

Use the following HDMI configuration to connect using dual-link 1.5G HDSDI. See Figure 4 for the SDI connector configuration.

- HDMI = output to Dolby Vision television
- SDI 1 = A side of dual-link input from application
- SDI 2 = B side of dual-link input from application
- SDI 3, 4 = not used
2.4 Single Card AJA Corvid 88 SDI setup for 2K/HD/4K/UHD

The CMU with a single AJA Corvid 88 SDI card is compatible with dual-link 1.5G HDSDI, single-link 3G Level A/B and quad-link 3G Level A/B.

![AJA Corvid 88 SDI interfaces](image)

**Figure 5: AJA Corvid 88 SDI interfaces**

NOTE: The Corvid 88 does not support HDMI tunneling as there is no HDMI interface using this card.

2.4.1 Single-link 3G Level A/B Setup

Use the following SDI configuration to connect using single-link 3G SDI. See Figure 5 for SDI connector configuration.

- SDI 1 = input from application
- SDI 5 = output to target monitor
- SDI 2, 3, 4, 6, 7, 8 = not used

2.4.2 Dual-link 1.5G HDSDI Setup

Use the following SDI configuration to connect using dual-link 1.5G HDSDI. See Figure 5 for SDI connector configuration.

- SDI 1 = A side of dual-link input from application
- SDI 2 = B side of dual-link input from application
- SDI 5 = A side of dual-link output to target monitor
- SDI 6 = B side of dual-link output to target monitor
- SDI 3, 4, 7, 8 = not used

2.4.3 Quad-link 1.5G/3G Level A/B Setup

Use the following SDI configuration to connect using single-link 3G SDI. See Figure 5 for SDI connector configuration.

- SDI 1, 2, 3, 4 = input from application
- SDI 5, 6, 7, 8 = output to target monitor
2.4.3.1 Quad-link HD Split-Quadrant Configuration for Corvid 88

The following diagram shows the SDI HD Split-Quadrant window configuration for the Corvid 88.

![Corvid 88 SDI HD Split-Quadrant window configuration](image)

**Figure 6 Corvid 88 SDI HD Split-Quadrant window configuration**

2.5 Dual Card AJA Kona 4 setup for HD/2K/UHD/4K

The CMU with dual AJA Kona 4 SDI cards is compatible with dual-link 1.5G HDSDI, single-link 3G Level A/B and quad-link 3G Level A/B. The cards are configured individually as primary and secondary. The Primary AJA Kona 4 card is always the input and the Secondary AJA Kona 4 card is always the output.

Usually, the bottom card is the Primary SDI card (input) and the top card is the Secondary SDI card (output) but this is not always the case. If the source device cannot communicate with the CMU or there is no video output, try switching between cards.

Additionally, the CMU with Kona 4 supports HDMI output to a Dolby Vision television.

The following sections describes the various SDI configurations.
2.5.1 Single-link 3G Level A/B Setup

2.5.1.1 SDI

Use the following SDI configuration to connect using single-link 3G SDI. See Figure 7 for connector configuration.

Primary Card SDI 1 = input from application
Primary Card SDI 2, 3, 4 = not used
Secondary Card SDI 1 = output to target monitor
Secondary Card SDI 2, 3, 4 = not used

2.5.1.2 HDMI

Use the following HDMI configuration to connect using single-link 3G SDI. See Figure 7 for connector configuration.

Primary Card SDI 1 = input from application
Primary Card SDI 2, 3, 4 = not used
Secondary HDMI = output to Dolby Vision television
Secondary Card SDI 1, 2, 3, 4 = not used
2.5.2 Dual-link 1.5G HDSDI Setup

2.5.2.1 SDI

Use the following SDI configuration to connect using dual-link 1.5G HDSDI. See Figure 7 for connector configuration.

- Primary Card SDI 1 = A side of dual-link input from application
- Primary Card SDI 2 = B side of dual-link input from application
- Secondary Card SDI 1 = A side of dual-link output to target monitor
- Secondary Card SDI 2 = B side of dual-link output to target monitor
- Primary Card SDI 3, 4 = not used
- Secondary Card SDI 3, 4 = not used

2.5.2.2 HDMI

Use the following HDMI configuration to connect using dual-link 1.5G HDSDI. See Figure 7 for connector configuration.

- Primary Card SDI 1 = A side of dual-link input from application
- Primary Card SDI 2 = B side of dual-link input from application
- Primary Card SDI 3, 4 = not used
- Secondary Card HDMI = output to Dolby Vision television
- Secondary Card SDI 1, 2, 3, 4 = not used

2.5.3 Quad-link SDI Level A/B Setup

2.5.3.1 SDI

Use the following SDI configuration to connect using quad-link SDI. See Figure 5 for connector configuration.

- Primary Card SDI 1, 2, 3, 4 = input from application
- Secondary Card SDI 5, 6, 7, 8 = output to target monitor

2.5.3.2 HDMI

Use the following HDMI configuration to connect using quad-link SDI. See Figure 5 for connector configuration.

NOTE: HDMI tunneling output will be HD resolution. This signal will be upscaled in the TV.

- Primary Card SDI 1, 2, 3, 4 = input from application
- Secondary Card HDMI = output to a Dolby Vision television
- Secondary Card SDI 5, 6, 7, 8 = not used
2.5.4 Quad-link HD Split-Quadrant Configuration for Dual Kona 4

The following diagram shows the SDI HD Split-Quadrant window configuration for dual Kona 4s.

![Diagram of Quad-link HD Split-Quadrant Configuration for Dual Kona 4]

2.6 Signal verification

Once the application is running and providing a signal to the CMU with the embedded Dolby Vision metadata, connect to the CMU’s web page, and check the status information. If everything is working correctly, the host application populates the user interface menus with available displays for targeting, and the status is Processing Normally. If another status appears, it may mean further debugging is necessary.

See Troubleshooting for further information.
3 License activation

The CMU requires a valid license to function and enable certain Dolby Vision features that are supported on partner tools that support Dolby Vision workflows. Without a valid license, the CMU does not communicate to a connected third-party tool, and will not perform the Content Mapping functions.

To activate the CMU, you must install a valid license. Contact your sales or support person at Dolby Laboratories to submit the CMU’s required HostID and to receive a valid license to activate the CMU.

Once you receive a valid license, install it on the CMU. The license is only valid for a single CMU, and cannot be transferred to other CMU machines. If there are multiple CMUs in the facility, each CMU requires a unique license.

Follow the steps in the following sections for license activation.

3.1 Licensing status

When the CMU license is not installed, or has expired, the CMU stops processing and displays the video with the No license message. The CMU home screen displays the following message:

Process State: No Dolby Vision CMU License

Figure 8 CMU Home page, no license
3.2 Obtaining the CMU HostID

On the Licensing tab of the CMU, copy the HostID information, send it to Dolby along with your company and contact information to receive a license.

![CMU License page - no license](image)

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3.3 Installing the CMU license

To install the license file, select **Upload License File** and install the `license.bin` file you received from Dolby. Once the license file is installed, the CMU is active and the web page displays the license expiration date.

![Figure 10 CMU License page - valid license](image)

Figure 10 CMU License page - valid license
4 CMU Operation

The CMU has a web page user interface that can be accessed using most web browsers that are connected on the same network. See Web browser support for supported browsers. In a web browser enter or navigate to the CMU web application IP address. The CMU web application provides valuable information, such as Operation Status, Configuration Status and troubleshooting logs.

4.1 CMU Home page

The Home Page displays the operational status of the CMU and provides some basic controls.

![CMU Home page](image)

Figure 11: CMU Home page
The Home menu displays the operational status for the CMU. It also includes options to view the Process State, Active Profile, software version, and input and output format.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process State</td>
<td>Appears if the application and CMU are communicating, and if and metadata is transported through SDI.</td>
</tr>
<tr>
<td>Active Profile</td>
<td>Displays the selected active profile. The active profile renders to the target display.</td>
</tr>
<tr>
<td>Input</td>
<td>Displays the video input format sent by the application.</td>
</tr>
<tr>
<td>Output</td>
<td>Displays the video output format sent out by the CMU.</td>
</tr>
</tbody>
</table>

When the CMU is functioning correctly, the Process State is, **Processing normally** and no error messages should appear. If there is an issue, an error message appears and that can help when troubleshooting. For more information, see [Troubleshooting](#).

These are following controls are available for the CMU. When using the CMU to create or playback Dolby Vision content, set the CMU to **Normal** mode.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>The normal CMU operating mode.</td>
</tr>
<tr>
<td>Pass-Thru</td>
<td>Enables the signal from the application to pass through the CMU to the connected target display without Content Mapping processing.</td>
</tr>
<tr>
<td>Black-Out</td>
<td>Outputs a full-screen black frame to the target display.</td>
</tr>
<tr>
<td>Bars</td>
<td>Forces the CMU to output a colorbar test pattern.</td>
</tr>
<tr>
<td>Ramp</td>
<td>Forces the CMU to output a ramp test pattern.</td>
</tr>
<tr>
<td>Restart</td>
<td>Restarts the SDI capture card.</td>
</tr>
<tr>
<td>Refresh</td>
<td>Refreshes the CMU status information.</td>
</tr>
</tbody>
</table>
4.2 CMU Configuration page

Use this page to configure the CMU Unique ID, Machine Name, Video Input and Output configuration. When setting the source output for HD or UHD resolutions, the user will need to manually set the appropriate resolution on the CMU webpage.

When setting up multiple CMUs on a network, each CMU requires a unique ID Number and Name to avoid machine conflicts and easily identify each CMU. Use this configuration page to set the CMU’s unique ID and Name.

![CMU Configuration page](image)

Figure 12: CMU Configuration page
Edit the following parameters for each CMU.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>Enter a new CMU Identification number. 1-4 are valid; only use when connecting to multiple CMUs.</td>
</tr>
<tr>
<td>New Name</td>
<td>Enter a unique CMU machine name to identify the CMU if there are multiple CMUs on the network.</td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td></td>
</tr>
<tr>
<td>HD/2K</td>
<td>Configures the CMU for HD video resolutions.</td>
</tr>
<tr>
<td>UHD/4K</td>
<td>Configures the CMU for UHD video resolutions.</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td></td>
</tr>
<tr>
<td>SDI</td>
<td>Sends the image through SDI (default).</td>
</tr>
<tr>
<td>HDMI tunneling</td>
<td>Sends the image through HDMI to a Dolby Vision television</td>
</tr>
<tr>
<td>L5 ON/OFF</td>
<td>Enables or disables sending the active area metadata (Level 5) to the connected Dolby Vision TV. NOTE: Disabling this function will cause the letterboxed areas in the TV to lift when positive lift trim is applied.</td>
</tr>
</tbody>
</table>

NOTE: The CMU does not support simultaneous HDMI and SDI video output.
4.3 CMU Log page

The CMU Log page displays any CMU configuration updates, warnings, or errors. Use this page for debugging purposes. Use the Download field to select the date range for the logs you want to download. The default download period is one week prior from the current date.

![Figure 13: CMU Log page](image)

4.4 CMU user manual

To view the manual at any time, select the Manual tab on the top bar and it will display the PDF user manual.

![Figure 14: CMU User manual](image)
5 Troubleshooting

5.1 Error messages that can be displayed on the CMU Home page

<table>
<thead>
<tr>
<th>Error Message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing Normally:</td>
<td>The system is connected to the application and working properly.</td>
</tr>
<tr>
<td>No Dolby Vision CMU License:</td>
<td>The CMU license is missing or expired.</td>
</tr>
<tr>
<td>Unexpected CMU Input:</td>
<td>The CMU is only compatible with RGB input signal format. Confirm the application is outputting in RGB format and not YCbCr or XYZ formats.</td>
</tr>
<tr>
<td>No metadata:</td>
<td>The application is not sending Dolby Vision metadata over SDI. Confirm the application and project are configured properly to work in Dolby Vision. Also check the SDI is routed correctly from the application to the CMU. The video output will also display the No metadata error message.</td>
</tr>
<tr>
<td>Invalid L1 Metadata:</td>
<td>The application may have corrupted Dolby Vision metadata. Rerun Analysis on the application for the shot.</td>
</tr>
</tbody>
</table>

5.2 Web browser support

The CMU web UI supports most popular web browsers, such as Chrome, Safari and Firefox. You must enable JavaScript to ensure that the CMU web UI functions correctly.
5.2.1 Enabling JavaScript in Safari

Navigate to Preferences > Security and enable JavaScript.

5.2.2 Enabling JavaScript in Chrome

Navigate to Preferences > Show Advanced Settings > Privacy > Content Settings and select, Allow all sites to run JavaScript.
6 Specifications

The CMU has the following specifications.

- **Chassis Type** - 1RU Rackmount
- **Dimensions**
  - 17.2 inch (W) x 28.2 inch (D) x 1.7 inch (H)
  - 437 mm (W) x 716 mm (D) x 43 mm (H)
- **Weight**
  - 42 lbs / 19.1 kg
- **Power**
  - 100VAC ~ 240VAC, 50/60Hz, 1200W Max
  - 300W Nominal, 1400W Max
# 7 Format and signal compatibility

<table>
<thead>
<tr>
<th>SDI interface</th>
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