codex

TECHNICAL BULLETIN

RECORDING IN HD STEREO 3D

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1.   Codex Onboard Recorder – Stereo 3D Recording

The "Codex Onboard Recorder Getting Started Guide" concisely covers most functions of the Codex Onboard recorder, including how to use the remote handset to interact with the menu system. The "...Getting Started..." document can be downloaded from the Support section of the Codex website (http://www.codexdigital.com).

2.   Shooting stereo High Definition video

This document describes how to configure the Codex Onboard recorder to record stereo images from a pair of High Definition video cameras.

We assume the following hardware/software versions:

• Codex Onboard recorder, software 2011-r1-2902 [released 21 Apr 2011]

Note: To view the software version on a Codex Onboard recorder, use the remote handset to navigate to the "SETUP->System" page. The version number will be shown at the top of the screen. If the Codex needs to be updated, installation packages and instructions can be found at http://www.codexdigital.com/software

3.   Camera cabling and configuration

The Codex Onboard recorder has 4x BNC ports for video input which are labelled "1", "2", "3", and "4".

Inputs "1" and "2" should be used for the LEFT eye camera.

Inputs "3" and "4" should be used for the RIGHT eye camera.

Both cameras must be configured to the same video format and frame rate.

It is essential that the video outputs of the camera are in genlock sync, so that each image pair (one image from each camera) arrives at the recorder at the same time instant.

Video sync is usually achieved by providing a common genlock signal to both cameras, from which the cameras can synchronise their shutters and video outputs.

The HD-SDI cabling requirements depend on the chosen video format (and capabilities of the camera):

3.1 Single link 1.5Gb

Single link 1.5Gb supports YCbCr 4:2:2 rasters.
1: LEFT eye 4:2:2
2: ---- *Not Connected*
3: RIGHT eye 4:2:2
4: ---- *Not Connected*

3.2 Dual link 1.5Gb

Dual link 1.5Gb supports RGB 4:4:4 rasters, and double-speed 4:2:2.
The Onboard recorder will automatically swap the A and B links is they are misconnected. If the cables are misconnected a warning message will be shown on the user interface.

1: LEFT eye link A
2: LEFT eye link B
3: RIGHT eye link A
4: RIGHT eye link B

3.3 Single link 3Gb

Identical capabilities to Dual link 1.5Gb, but with the advantage of only requiring a single cable.

1: LEFT eye 3Gb
2: ---- *Not Connected*
3: RIGHT eye 3Gb
4: ---- *Not Connected*

4.   Menu parameters for Codex Onboard recorder
2011.r1.2902

The majority of menu settings on the Codex Onboard recorder can be set at the start of a shoot and left as-is for the duration of the project. We will cover these menu items first, then move on to the settings that a camera crew might interact with on a day-to-day basis.

4.1 A brief reminder of how to enter the SETUP menu using the remote handset

Press the **[ARROW]** button. The root menu "Back │ Play │ Setup │ Storage" will be displayed at the bottom of the screen.

Press the **[Setup]** button. The list of all setup pages will be displayed. You can scroll through the page titles using the rotary dial. Press the centre button of the rotary dial to select a particular setup page.

4.2 Before a shoot: Project-wide settings

Menu: SETUP->PROJECT ("PROJECT SETUP")
The "PROJECT SETUP" menu allows you to set global metadata fields that are applied to recorded clips. When a recording is made, the current values of these fields are associated with the new clip. The default field values are shown below (most are blank).

Production: **CODEX**
Production Company:
Unit:
Director:
DP:
Location:
Codex Operator:

The "Production" metadata field is the only significant field. Here you should enter the name of your production (usually in UPPERcase). MXF file deliverables will use this to set the Avid Bin name.

Menu: SETUP->SOURCE ("SOURCE SETUP")
The Source ID field allows you to assign a unique identifier to the camera pair. This is usually a single uppercase letter, the default value being "A".
It is important that each Onboard on a production uses a different "Source ID", so that Editorial can differentiate between footage from the different stereo rigs.

Source Name: [**A** optional custom label for the stereo rig]
Source ID: **A**

For stereo recordings it is **critical** that each video channel is given a unique channel identifier. It is typical to use the channel identifiers "L" and "R".

After a clip has been recorded these channel identifiers can be used to augment the roll names of file deliverables. For example, a 2-channel video clip with the roll name "A001" could be presented as two image sequences; left eye mapping to roll name "A001L" and right eye to "A001R".

Codex Digital Lab and **Transfer Station for Mac OS X** products employ the Codex Virtual File System (VFS) to present clips on a Datapack as image/movie files for use in Post Production. VFS configuration and usage is outside the scope of this document, but needless to say the channel identifiers are *vital* to creating sensible file deliverables from stereo clips.

Channel ID V1: **L**
Channel ID V2: **R**

Note that the value of the "SETUP->VIDEO->Channels" menu item dictates how many "Channel ID V?" fields are shown on this page. In the case of stereo recording this option should be set to "2", and it is then possible to define two channel identifiers.

Menu: SETUP->SLATE ("SLATE SETUP")
This menu defines the naming conventions for a production. These rules are usually decided in advance of a shoot, in consultation with Editorial and Post Production departments. Expert users may choose to customise these rules, but the default rules have been carefully crafted to be suitable for the vast majority of shoots and are suitable for both 2D and S3D shooting.

Shot Naming Rule: "**{Scene}-{Take}_{r}**"
Roll Naming Rule: "**{SourceId}{Diskpack}**"

When creating a roll on a Datapack, it is common practice to name it with 3 numerical digits, e.g. "001" for the first roll. When the default Roll Naming Rule is used the {Diskpack} name is prepended by the {SourceId} metadata, resulting in roll names like "A001".

Menu: SETUP->GPI ("GPI SETUP")
Set "Record Trigger" to "SDI" if you wish to trigger recording directly from a camera, to "GPI" if you wish to use a custom electrical trigger (e.g. Preston control), or "None" if you intend to use the RECORD/STOP buttons on the recorder to start/stop recording. Note that the only camera that supports SDI triggering is the ARRI Alexa. The video feed from the LEFT eye camera is monitored for SDI trigger signals.

Note: the "Hold" button on the Control Panel should be engaged when using the SDI record trigger from ARRI Alexa, otherwise the "Stop" button will still be active during recording.

Record Trigger: **SDI** or **GPI** or **None**

The other menu items are specific to "GPI" triggering:

GPI Polarity: **Low** or **High**
GPI Type: **Latching** or **Momentary**
GPO Polarity: **Low** or **High**

These should describe the type of electrical GPI trigger that is being used. These items are ignored if "Record Trigger" is set to "None" or "SDI".

Menu: SETUP->SYSTEM ("SYSTEM SETUP")
The Codex Onboard has an ethernet port which allows it to be connected to standard computer network infrastructure. The network IP configuration can be set here:

IP: **10.82.95.101**
Mask: **255.255.255.0**
Gateway: **10.82.95.1**
DNS: **INVALID**

It is necessary to configure the network port if you wish to use the remote user interface (UI) software to control the Codex Onboard recorder. The software is currently available for Mac OSX and Windows, but its use is outside the scope of this document.

The "System control" setting determines whether remote UI software is allowed to take control of the recorder. This can be set to "Locked" to prevent a network user from taking control of the recorder.

System control: **Unlocked**

The next three settings determine the brightness level of the Codex light rings and the remote handset's LCD display. The user can pick a level in the range 0 (dim/off) to 15 (bright), and the default level is 12.

Screen contrast: **12**
Control ring bright: **12**
Main ring bright: **12**

If the Onboard recorder receives power from the Alexa's 24V regulated RS power output, then there is no benefit in enabling a shutdown voltage level:

Shutdown volts: **Disabled**

4.3 During a shoot: Video/Audio/Timecode settings

Here we describe the menu pages that are likely to be used on a day-to-day basis during a shoot; VIDEO, AUDIO, and TIMECODE.

Menu: SETUP->VIDEO ("VIDEO SETUP")
The Codex Onboard supports many SMPTE standard HD video formats. The following list is not exhaustive, but features the most frequently used formats:

Single link 1.5Gb formats:
    1280x720p 4:2:2@[50.00, 59.94, 60.00]
    1920x1080sF 4:2:2@[23.98, 24.00, 25.00, 29.97, 30.00]
    1920x1080p 4:2:2@[23.98, 24.00, 25.00, 29.97, 30.00]

Dual link 1.5Gb / Single link 3Gb formats:
    1920x1080sF 4:4:4@[23.98, 24.00, 25.00, 29.97, 30.00]
    1920x1080p 4:4:4@[23.98, 24.00, 25.00, 29.97, 30.00]
    1920x1080sF 4:2:2@[47.95, 48.00, 50.00, 59.94, 60.00]
    1920x1080p 4:2:2@[47.95, 48.00, 50.00, 59.94, 60.00]

In addition to these "standard" formats, the proprietary ARRI MScope, ARRI D-21 High Speed are also supported for stereo recording. Discussion of these proprietary formats is outside the scope of this document.

The user should set the "Format" field first, which causes the "Storage", "Fps", and "Quality" options to be limited to supported values.

Format: **1280x720p, 1920x1080i, 1920x1080sF, 1920x1080p, ARRI MS-1440p, ARRI D21-1080p**
Storage: **10-bit 4:2:2, 10-bit 4:4:4, 12-bit 4:4:4**
Fps: **23.98, 24.00, 25.00, 29.97, 30.00, 47.95, 48.00, 50.00, 59.94, 60.00**
Quality: **1:1** [uncompressed], **3:1** [wavelet compression], **4:1** [wavelet compression]

Channels: **2** [for stereo recording]

Aspect: **Square** [for spherical lenses], **x1.33** [for anamorphic video lenses]

Some cameras support variframe flags over the HD-SDI outputs, which makes it possible to record non-SMPTE HD speeds such a 27fps. When shooting variframe you must ensure that:

• The camera actually supports Variframe recording.
• The Onboard recorder's "**SETUP->VIDEO->Variframe**" setting is set to "**On**". The Codex Onboard supports Panasonic, ARRI, and Sony flagging protocols. The protocol is automatically detected.

- Audio capture on the Onboard recorder is disabled when in variframe recording mode, so It is good practice to set the Onboard recorder's variframe setting to "**Off**" when shooting at standard HD frame rates (23.98, 24.00, 25.00, 29.97, 30.00, 47.95, 48.00, 50.00, 59.94, 60.00).
- Variframe: **Off** or **On**

Remaining settings:
Input: **Default** [for 1.5Gb video sources], **3G** [for 3Gb video sources]
Output: **4:2:2** [forces both monitoring video outputs to be 4:2:2 single link], **3G** [3Gb video pass-through for use with 3Gb video sources]
Play Sync: [Choose a genlock source for playback. Default setting: **Internal**]

Menu: SETUP->TIMECODE ("TIMECODE SETUP")
Select the timecode source to use for all video channels. Note that HD VANC timecode is read from the LEFT camera and applied to all channels.
TC source: **HD VANC, LTC, TCG**
AUX source: **None, HD VANC UB, LTC UB, TCG UB**

Metadata: **None**
Fix TC break: **Yes** [to automatically repair bad timecode tracks]

It is possible to define the delay present in the video and timecode inputs. These settings define how many image or timecode samples should be discarded from the beginning of a captured clip in order that they sync with the audio input.

Video delay: **None**, [1, 2, 3, 4] frames
TC delay: **None**, [1, 2, 3, 4] frames

Menu: SETUP->AUDIO ("AUDIO SETUP")
Configure the audio settings to your projects' requirements. The Onboard recorder supports:

- Up to 8 channels of embedded digital audio (HD AiV)
- Up to 4 channels of AES digital audio
- Up to 2 channels of analog line-level audio

Input: AES, HD AiV, **Line**
Channels: **None**, 1, 2, 4, 6, 8 [Number of channels. Set to "None" if no audio is required]
Input Level: [22, **18**, 15, 12, 8] dBu [Only applicable to analog sources]
AES SRC: **On**, Off [Only applicable to AES sources, and should be "On" if the audio feed is not genlocked to the video]
Bits: **24**

If no audio is to be recorded to the Onboard recorder then the user should disable audio capture by setting "Channels" to "None". None of the other items in the AUDIO menu have any effect when audio is disabled. Note that audio input is ignored if "**SETUP->VIDEO->Variframe**" = "**On**".

4.4 During a shoot: Playback settings

When on the TRANSPORT screen (for E-E, PLAYback or REC), the "Options" button is available on the left-most button under the screen.

Menu: TRANSPORT->Options ("TRANSPORT OPTIONS")
The following are sensible defaults:

LUT: **<off>**
Volume: **15**
Play loop: **Repeat**
Play range: **All**
Play rate: **Default**, 23.98, 24.00, ...
Play chans:
    All [play both video channels at the same time. Left eye plays to output #1, right eye to #2]
    Single video [play one video channel at a time through HD-SDI output #1. Press the STOP button on the control handset to toggle between video channels]
TC source: **TC**
TC type: **Standard**

Note: it is possible to force a particular playback rate. It is typical to set this to 23.98 or 24.00 for most film productions, so that off-speed/varispeed clips are always played back at the intended projection rate.

Off-speed playback is only supported for uncompressed (1:1) clips. Wavelet recordings always play back at the original capture rate.

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