![CE Labs logo]

CE250 Technical MANUAL
Ultra-High-Definition Media Player

Version – 1.0.2

Please visit our web site at www.celabs.com for information on more Digital Signage products.

Table of Contents

IMPORTANT SAFETY INSTRUCTIONS

1. Read these instructions.
2. Keep these instructions.
3. Heed all warnings.
4. Follow all instructions.
5. Do not use this apparatus near water.
6. Clean only with dry cloth.
7. Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
8. Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that product heat.
9. Do not defeat the purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider that the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong is provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
10. Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where the exit from the apparatus.
11. Only use the attachments/accessories specified by the manufacturer.
12. Use only with the cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.
13. Unplug this apparatus during lightning storms or when unused for long periods of time.
14. Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way such as power supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.

S3125A

Figure 17 DU– Portable cart warning

WARNING: **To Reduce the Risk of Fire or Electric Shock, Do Not Expose This Apparatus to Rain or Moisture**

CAUTION: **To reduce the risk of electric shock, do not remove cover or back. No user serviceable parts inside. Refer servicing to qualified personnel.**

Chapter 1 – INTRODUCTION

Introduction to the CE250 UHD Media Player

The CE250 is a high-quality advertising / display solution that allows users to play SD, HD and UHD content from internal memory, USB, or streamed from an Internet connection. It has an extremely effective performance versus cost ratio and provides a great return on investment.

The CE250 is a commercial grade, application specific graphics processor, specifically designed for driving digital signage. The compact size allows for installation behind the screens. The die cast aluminum chassis is rugged and great at dissipating heat to keep the unit cool. The player may be provisioned with a large variety of 3rd party applications via the CE Sync Control System. This will automatically load the app specified at time of order. One of the available applications is Crusade. This application allows us to quickly create custom application scripts to control many aspects of the player operation.

Package Contents

The box should contain the following items:

- CE250 Media Player
- 12 Volt DC Universal Input Power Supply
- IR Remote control
- 2 AAA batteries
- 1 Wi-Fi Antenna
- 1 HDMI Cable

NOTE:

We try to include the latest up to date information, but this document will require periodic updates. We recommend you check at our web site, www.celabs.com, for the latest information available.

Chapter 2 – INSTALLATION

Detailed Player View
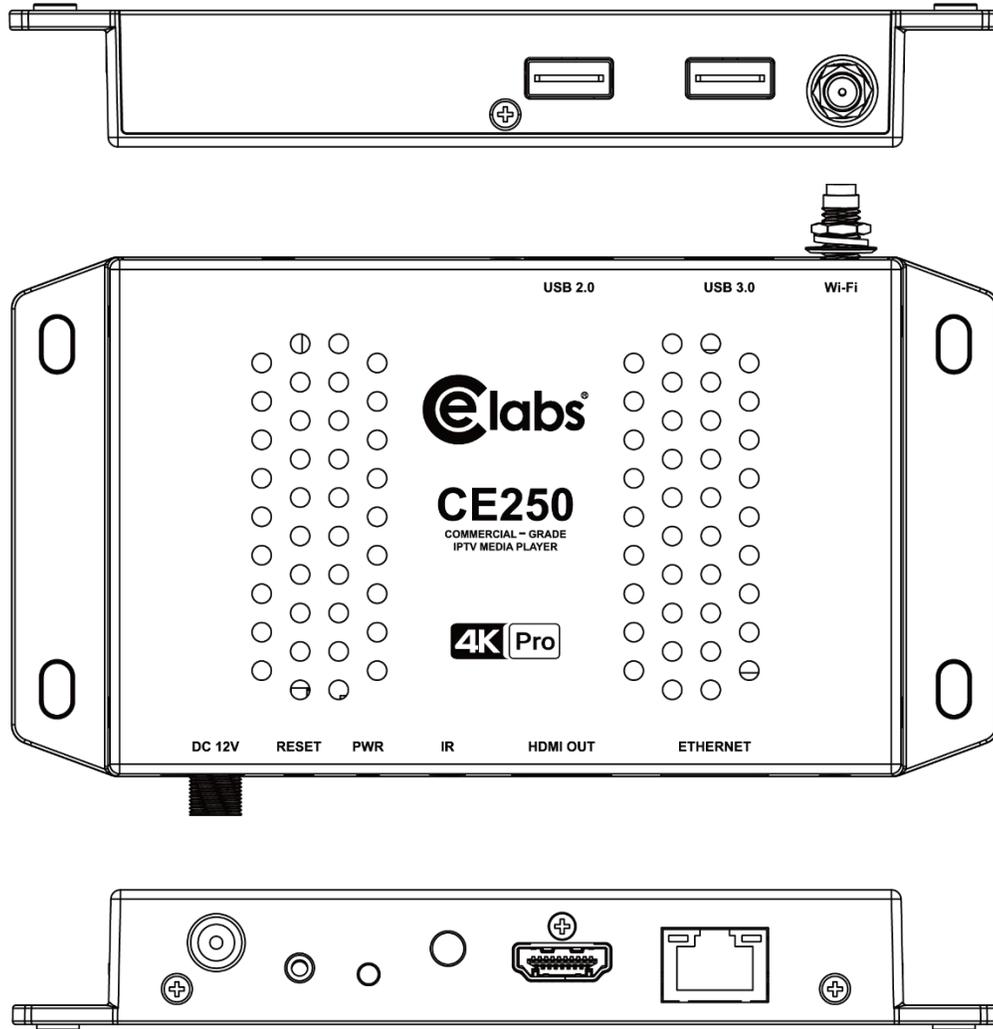
If you require a GPIO interface, consider the CE440 model.

CE250 Connections

The CE250 can drive a wide variety of displays at up to 2160P resolution at bit rates up to 50 Mbps. Depending upon your application, connect the following cables to operate the unit.

- **Display cable** – The preferred connection between the CE250 and the display monitor is a high-quality HDMI cable of no longer than 15 feet. Depending on the application, plug in the cable from the media player to the display, switch, or first distribution amplifier.

  Note: Video output resolution has been pre-set at the factory for automatic negotiations. The media player should select the highest resolution reported available from the Display. The output and resolution can be specified at time of order and pre-set to your requirements.

- **Power –** The CE250 uses a 12VDC, 1.5A or 2A power supply. Total power consumption is approximately 6 Watts which leaves a large reserve in the power supply. Insert the power supply 12 VDC plug into the CE250 power jack and screw it down snugly. Insert the AC Plug of the power supply into an electrical outlet. The power LED will be illuminated red then green, and the unit will boot up within 1 minute.

- **Ethernet –** If this is a networked installation, connect the Ethernet Port to a Switch or Router via an Ethernet cable. The unit will automatically obtain an IP address if unit's DHCP is selected as ON and there is a DHCP server somewhere on the local subnet. A static IP may be set if desired.

- **IR Remote Control –** Use the included remote to complete the Out of Box experience or enter Advanced settings.

- **IR Receiver –** There is an internal IR receiver on the front of the CE250. This is for use with the included IR remote control.

- **Wi-Fi Antenna Jack–** The CE250 includes an internal Wi-Fi module and uses an external antenna. For best performance, orient the external antenna in the same direction as the Wi-Fi router antenna.

- **Reset–** In order to reset the CE250, disconnect the power supply from the AC output for about 10 seconds, then re-apply power. There is also a dedicated RESET jack (2.5mm) that allows an external reset button with a 2.5mm plug harness to be remotely located in case the media player is installed in an inaccessible location. The RESET button should be normally open with momentary contacts.

Mounting

The media player should be installed in a well-ventilated air-conditioned space for best operation. The overall dimensions of the units are 3.2" x 4.8" (6.0" including mounting ears) x 0.85". It is recommended to reserve 3 inches to the rear of the unit for routing cables. The mounting dimensions given below are measured from center to center of the mounting holes. The mounting holes will accommodate a #6 screw.


The unit has ventilation holes all along the top. These should remain uncovered during operation. There are no ventilation openings on the bottom of the chassis, so it may be attached directly to a shelf or monitor.

Initial Startup Procedure

Once the unit has been mounted and configured with the appropriate cabling, connect the power supply to a suitable AC outlet. Verify that the locking ring is snug on the player DC jack. The power LED will illuminate. The media player may take about 30 seconds to fully boot to the operational state depending upon the startup configuration.

Chapter 3 – CE250 OPERATION
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Out of Box Experience

The first time the media player is powered on, you will see the Welcome screen that will guide you through the player setup.
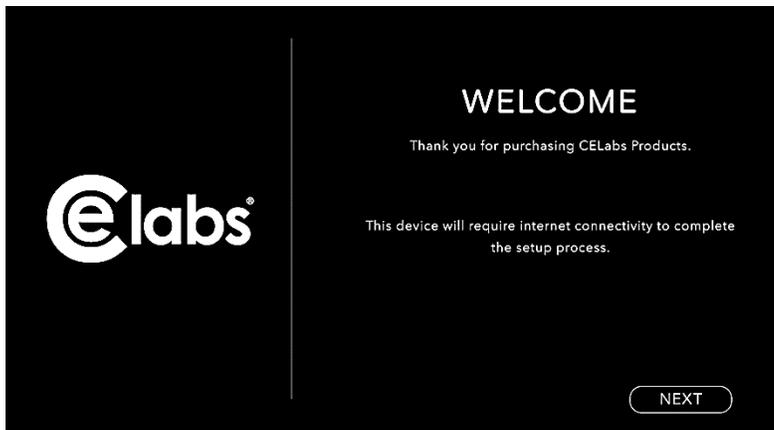
Select the preferred language.
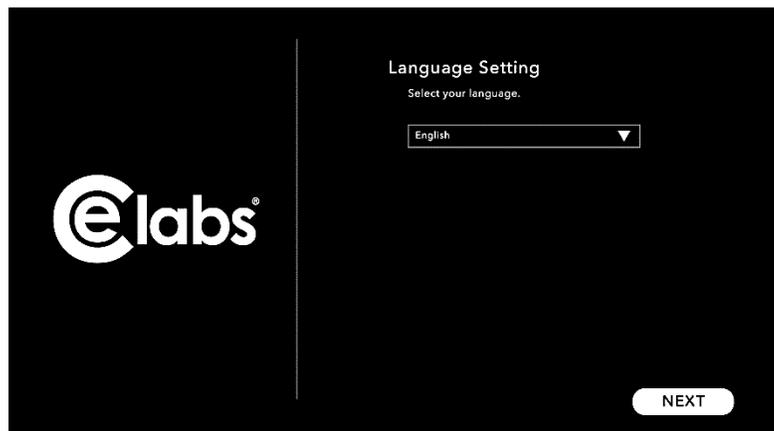
Select your local Time Zone.

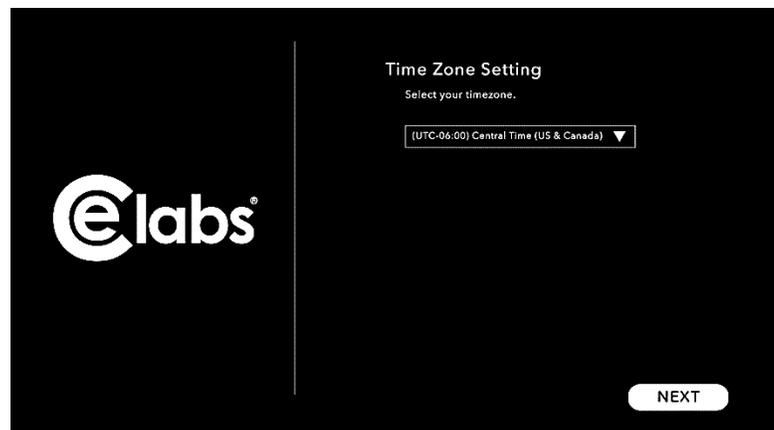Configure your preferred Network settings. The unit is shipped with Ethernet port ON and DHCP enabled. The Ethernet port may also be configured to use Static IP addressing. All fields must be populated for a successful save. If the Ethernet cable is not connected, the Network Data Fields will be blank.

If you wish to use Wi-Fi, it is recommended to turn OFF the Ethernet port and then proceed to the wireless setup page. Unplug the Ethernet cable if it is not being used. Select the desired wireless provider from the list on screen. Enter the password and save it.

Upon completing the Network set up, press next and the player will download the necessary files to provision the unit according to the factory sales order.

Once the downloads are done and applications are installed, you will see the Setup Complete page.

To activate your product warranty, please scan the QR code or go to the website indicated on screen and complete the required information.
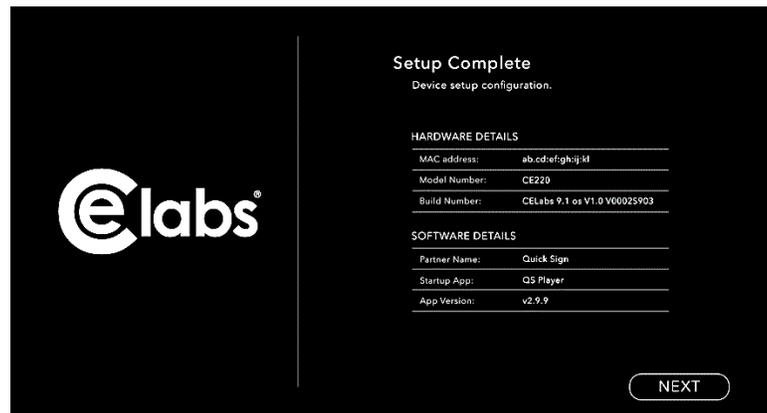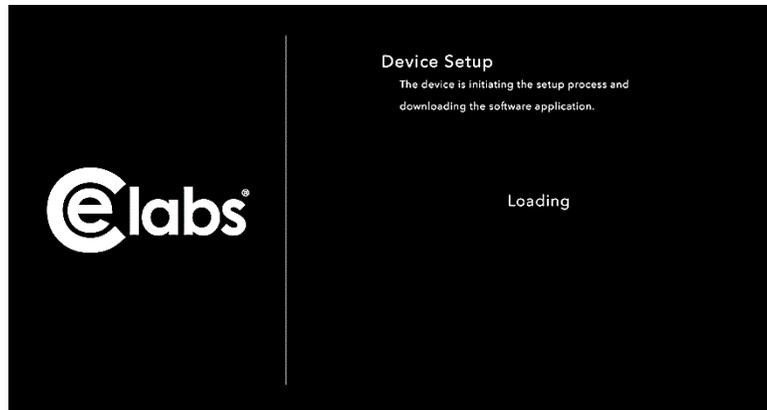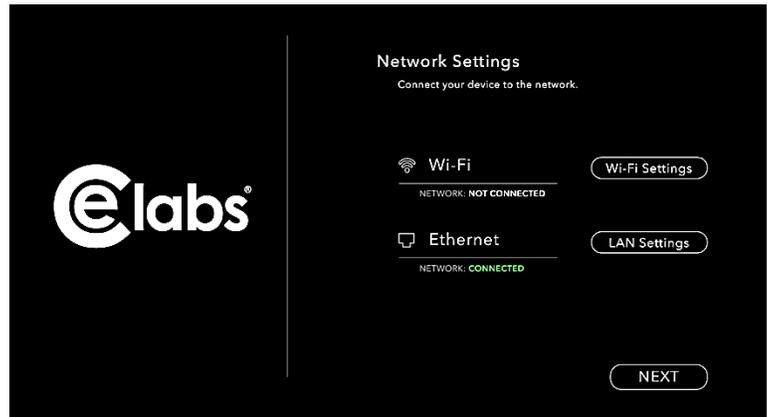
Activating Your Device:

After attaching the needed connections, follow the Out of the Box on-screen instructions to complete the setup process. Scan the QR code at the end to activate your warranty.
1.   Connect device to power outlet.
2.   Connect device to a screen using HDMI.
3.   Configure Language & Time.
4.   Configure Network Connection Parameters.
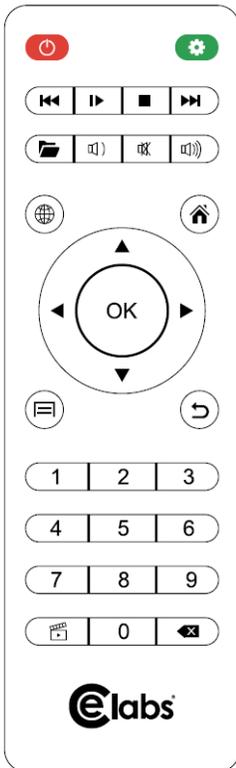5.   Activate the player.
6.   Register your product.

Your Content Management System Partner application will be downloaded in the background and automatically startup ready for you to use your new device.

Advanced Settings: Network / Video Resolution / Audio Mode

Enter CESync Admin Mode / Advanced settings using a mouse or remote.

- ▪   Mouse: Right click one time to exit app. Click the Left mouse button 3 times.

- ▪   Remote: Press Return button ↺ and select OK three times.
- •   Enter Access code (5555)

* If an application is running, it will be necessary to press RETURN ↺ on the remote or right click the mouse to exit the app. Then you will see a dark screen with CE labs logo in the upper left corner.

CESync Admin Mode

Enter PIN below

Hint default is 5555

CONFIRM

CESync Admin Mode

Go to Set tings
Device info
Register
Display Set tings

- •   **Go to Settings** – Access to general Android settings including Network- Ethernet or Wi-Fi.
- •   **Device Info** – MAC Address, Model #, and Software Details
- •   **Register** – Activate your player warranty with the supplied QR code.
- •   **Display Settings** – Controls for Video Resolution, Audio settings, etc.

Ethernet Configuration

The CE250 may be used on a network with DHCP supplied IP addresses or with Static IP addresses. Configure the CE250 appropriately for your network in the Android Settings menu accessible from the CE Sync Admin Mode page. If there is no Ethernet cable connected, the network information fields may be blank until you connect an Ethernet cable. Also, all parameters must be completed before saving the configuration. If you leave a field blank, the IP information will not be saved. Static IP configuration can be entered on this page. Check with your IT department for compatible address information.

Wi-Fi Configuration

Wi-Fi is configured under the same network page on the Admin page. If Wi-Fi is enabled, you must turn off the Ethernet port for the best performance. In some cases, it may be necessary to remove the Ethernet cable to allow Wi-Fi to be used.

The CE250 can drive a wide variety of displays at up to 4K resolution at bit rates up to 50 Mb/S. Maximum peak excursions in excess of 100Mb/S are acceptable if the external media is capable of supporting this data transfer rate. Internal flash memory storage will support this rate natively. Once connected, powered on, and fully booted, the unit is ready to use. The CE250 can be configured with different applications to perform different functions.

The unit will play this content until instructed to play something else. If no startup item has been defined, the screen may only show the CE labs logo and then a black screen. The player works well with a variety of media files at high bit rates, but please adhere to the media creation standards described later in this document.

The media player can play content from many sources:

- Real Time Source
  - Web Page
  - Ethernet RTP / UDP IP Stream

- Local Storage Source
  - External USB Drive (optional)
  - Internal 16GB flash memory

The CE250 may be used as a stand-alone UHD / High-Definition source (once content is loaded on the internal storage device) or greater versatility is allowed when the player is connected to a network. The primary focus of the CE250 is media playback and control device that is part of a network of media players. The network interface is a powerful tool in managing from one to thousands of players.

Video Resolution / Audio Output

Video Resolution and Audio output configuration are configured by selecting the "Settings / Display / HDMI / Resolution" icon. The output resolution may be set to a fixed value or use AUTO to allow the CE250 resolution to be determined by the EDID information from the connected display.

Audio output may be configured under "Settings / Display / HDMI / Audio Device" for AUTO, DECODE, or HDMI Bitstream. If you are using EAC3, DTS or Dolby ATMOS encoded files, the Audio Device must be set to HDMI Bitstream to support this format. The DTS or Dolby ATMOS will not be decoded locally but pass through the HDMI output for decoding on an external device.

Any audio stream decoded from PCM, or stereo Digital + will be output as stereo audio and the volume is controllable from the media player. The higher-level formats that are passed through will not be decoded and volume must be controlled externally on the display or soundbar.

CE250 SPECIFICATIONS

FEATURES
4K UHD HDMI 2.0 Output
Quad Core Processor w/Dual GPU
4GB DDR4 RAM
16GB Internal Memory
Gigabit Ethernet
Internal Wi-Fi w/ External Antenna
Real Time Clock
HTML5 Full Support
HDR 10 & HLG
CESync Software
Commercial-Grade for Optimized 24/7 play operation
Connect interactive devices (USB)
IP Streaming: play streaming media
Live Feeds: Live data, Live Text, MRSS, Twitter, Flickr, etc.
Mosaic Mode: multiple video zones
Supports Custom Interactive Kiosks Applications

VIDEO / PICTURE CODEC
VP9 Profile-2 up to 4Kx2K@60fps
H.265 HEVC MP-10@L5.1 up to 4Kx2K@60fps
AVS2-P2 Profile up to 4Kx2K@60fps
H.264 AVC HP@L5.1 up to 4Kx2K@30fps
MPEG-4 ASP@L5 up to 1080P@60fps (ISO-14496)
VC-1 SP/MP/AP up to 1080P@60fps
MPEG-2 MP/HL up to 1080P@60fps (ISO-13818)
MPEG-1 MP/HL up to 1080P@60fps (ISO-11172)
RealVideo 8/9/10 up to 1080P@60fps
Multiple language and multiple format sub-title video support
Image Formats: TIFF, JPEG, GIF, PNG, WEBVTT, RokuBif, WebP

VIDEO FORMATS
MP4 (mp4, m4a, m4v, f4v, f4a, m4b, m4r, f4b, mov)
MOV, WEBM, MKV, FLV, AVI, HDV, MXF, AVCHD, LXF, VOB
3GP (3gp, 3gp2, 3g2, 3gpp, 3gpp2), OGG (ogg, oga, ogv, ogx)
MPEG-TS, MPEG-2 PS, MPEG-2 TS
MPG, MP2, MPEG, MPE, MPV

AUDIO FORMATS
MP3, AAC, AC3, EAC3, WMA, RM, FLAC, OGG, PCM Decoding
DTS and Dolby Atmos(passthrough)

I/O PORTS
HDMI 2.0 Output Transmitter
Gigabit Ethernet
Locking Coaxial Power Jack, 12Vdc
SMA Jack for Wi-Fi Antenna
USB 3.0 Type
USB 2.0 Type
External Reset Jack, 2.5mm
Internal IR Receiver
LED Indicators for Power, Status, LAN

NETWORK
Integrated 802.3 10/100/1000M Ethernet MAC with RGMII interface.
IP, TCP, UDP, ICMP, ARP, DHCP, HTTP, RTP, RTSP, NTP, DNS

ACCESSORIES
Power Adapter, 100-240Vac 50/60Hz, 12Vdc/1500mA, EL VI, UL
IR Remote w/2 AAA Batteries
1 Wi-Fi Antenna
HDMI 2.0 High Speed Cable
Rubber mounting feet (may be removed for screw attachment)

MISCELLANEOUS
Dimensions (H) 0.85", (W) 6.0", (D) 3.2" / 21 x 150 x 81 mm
Weight 0.6 lbs. / 0.27 kg
Operating Temp & Humidity 0-40C, 80% Max Rel. Humidity
Includes Rubber Standoff Feet
Integrated Mounting Brackets
Low Profile Design
Rugged (Industrial) Cast Aluminum Chassis

OPTIONAL FEATURES (Add-On)
Application Pre-Load via CE Sync MDM

Troubleshooting Tips:

The CE250 has been configured at the factory. After boot-up, if no video appears, please check the following:

- Is the connected monitor capable of UHD? The CE250 may be set to a resolution too high for the monitor.

- Verify that the TV/Monitor is ON and set to the correct input.

- Is the green LED on? If not, please check the power connection. Also check the switch on any power strip into which the unit may be plugged. Be patient as the unit starts from boot up, this may take almost 1 minute.

- Reboot the unit by disconnecting and reapplying the power connector.

- If the green LED is ON, but there is no video, please check all the video cables and make sure that they are connected properly to the first distribution amplifier or to the correct input on the TV. Check to see that the HDMI cable is firmly seated in the HDMI OUT port of the media player.

- Has content been assigned to this player via the control software?

I cannot communicate over the network.

- Verify that the Ethernet cable is securely connected at both ends.

- Verify that both Ethernet connector LEDs are lighted to indicate presence of signal and activity.

- Use the remote control to browse to player network setup. Verify that DHCP is turned on and do a "Save and Exit". Now go to the info screen on the OSD and record the IP address. Verify this address is within the Sub-Net range required on your network.

- Your computer firewall may be blocking the needed ports. Try to communicate with the firewall temporarily disabled.

- If your network is managed by an IT department, check with them to make certain the Switch port is provisioned.

The video is playing, but it stops or stutters occasionally.

- This can occur if the video content bit rate exceeds the capability of the unit. As a rule, you are safe up to 100 Mb/S per second. At bit rates over 100 Mb/S, extended spikes in bit rate may exceed buffer storage and lead to visual artifacts on screen.
- Verify the source file plays well on your PC. Download the content again in case it was corrupted.

My Video Files do not play properly.

- The player runs on a version of the Android operating system. Try to avoid unusual punctuation marks in file names as this could cause unexpected behavior.
- Verify that the file is encoded properly. See the CE250 Media Encoding guide for more information.

Wi-Fi communications are intermittent.

- There may be another access point on the same carrier. Try changing the desired access point to another carrier.
- Try using an alternate access point that is closer to the CE250.
- Verify antenna on the CE250 is securely fastened.
- Turn OFF the Ethernet port in SETTINGS to allow the best Wi-Fi performance.

Preferred Network Configuration for Digital Signage Applications

The CE Labs Digital Signage Media Players communicate via network connection across the Internet. The following list shows how to connect a player in order of preference.

- **Hard wired ETHERNET.** Connections should be direct to a network router or a minimum number of switches. In a managed network, the ETHERNET port must be configured to support standard Internet traffic. Network must support DHCP and DNS.
- **Wi-Fi Access** The CE Labs player supports IEEE 802.11 a/b/g/n/ac Wi-Fi compliant wireless routers. Wi-Fi network should be secured with SSID and Password. There is an external antenna that must be installed for best performance. The Wi-Fi router must be physically located within a reasonable distance to support nominal signal strength. Player is designed to work with Wi-Fi networks that broadcast the available SSID.

  - *Do Not use open, non-secured networks. This is a security hazard.*
  - *Proxy login on a browser page is Not supported.*

- *Note: The CE labs signage player will communicate with the Cloud control system with a very low bandwidth connection to convey status and control information. If there is a content update, the network connection will be used to transfer data to be stored locally on the player. Any content packages containing a web site or stream URL will maintain a continuous connection to display URL based information on screen.*
- **External Wi-Fi to ETHERNET adapter.** Should the installation location not allow 3rd party devices to join their network, they may provide an external adapter that is configured and locked down to their Wi-Fi network. This device should provide a standard ETHERNET port to interface with the CE Labs player.
- **Phone Hotspot** This is not recommended as a long-term solution. The player needs continuous visibility to the Cloud control system to fully utilize the status and monitoring aspects of the system.

Wi-Fi access to a local network that does not broadcast their SSID

1. Contact the IT department and acquire the appropriate system SSID and Password. Since the player scan will not detect this network, the installer must ensure the player proximity is close enough to the router.
2. Install batteries in the signage player IR remote and locate the Green Settings button at the top.
3. Reboot the CE Labs CE series player. You will see a stationary CE Labs logo and then there will be a CE Labs logo with a moving bar animation at the bottom. While the animation is in motion, press the Green Settings button on the IR remote. This will bring up an alternative Android menu.
4. Navigate to the Network and Internet. Select "Add new network".
5. Enter the provided SSID and Password information. Punctuation and capitalization is key.
6. Once network is confirmed, press the back button on the remote to return to the Out of Box Experience and proceed through the normal steps. You should see a green check mark on the Wi-Fi option.

Warranty

CE labs, LLC. warrants this product to be free from defects in material and workmanship, under normal use and service, for a period of three years from the purchase date by the original purchaser. If this product is defective or malfunctions, CE labs, LLC. will replace or repair this unit (at our option) within a reasonable time. No expressed or implied warranty is made for any defects or damage caused by immersion or exposure to liquids, abuse, neglect, improper operation of unit, harsh environmental stresses (lightning or ESD), excess wear and tear and or defects resulting from unauthorized disassembly and or modification.

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CE labs, LLC
1357 N. Glenville Drive
Richardson, TX 75081
Attn: Open-Source Licensing Administrator

CE250 Standard Media Encoding Guide

Description:
The purpose of this document is to provide information on encoding media for the CE labs CE250 players. The CE250 supports several formats: Windows Media 9, MPEG-4 part 10 (h.264), MPEG-2, and HEVC. Windows Media 9 can take the form of a WMV/WMA or VC-1. MPEG-2 or -4 can take the form of a program stream or transport stream. HDR10 playback is supported.

Video Decoding Format Support   .
*HEVC/h.265, Main and Main10 Profile   up to 3840x2160 @ 60FPS
*MPEG2, Main Profile,   up to 3840x2160 @ 24FPS
*MPEG4.2 ASP@L5   up to 1920x1080 @ 60FPS
*MPEG4.10 (H.264) MP@L4.0   up to 3840x2160 @ 24FPS
  While the player supports much higher bit rates, it is best to average 50Mb/s or less to allow for peak excursions.

Audio Decoding Format Support   .
*MPEG1 Layers I and II   *MPEG4 AAC-LC 5.1
*WMA   *FLAC
*AC3 / E-AC3   *MP3
*WAV   Dolby ATMOS pass-thru is supported on HDMI Bitstream output.

For optimum 4K playback, we suggest using the HEVC codec in a MP4 container, which is specified below.

Best Format Recommendation:

CE250 Video/Audio Encoding Settings for HEVC (h.265 Codec)

Video Settings:
File Format (Container):   MP4
Frame rate: 23.97 or 29.97
Codec: h.265, Main (Main10 Profile)
Max Resolution: 3840 x 2160
Color-Space: YUV420pl10le, 4:2:0 (bt709)
Aspect Ratio (DAR):   16:9
CU Size: 64
GOP: No open frames (Very Important to reduce possible stutter)
Bit Depth: 10 bit color (minimizes color gradient transition banding)
Bit rate: Variable bit rate = Target: 30 - 40 Mb/s - Maximum: 60 Mb/S (Maintain a minimum of 500 Kb/s).
                          For minimum file size, a target bit rate of 15Mb/s may be desirable.
                          If using a fixed bit rate, 20 Mb/s produces an excellent picture with manageable file sizes.

Audio Settings:
Codec: AAC (Mpeg 4)
Output Channels: Stereo
Frequency: 44.1 kHz or 48 kHz
Bit rate: 192 kbps
Volume level: Target: -12 dB
        Note: Frame rate and frequency will need to be the same as the source video being encoded

Suggested programs for encoding content:
The primary use of the CE250 will be playback of 4K video media. Good results have been achieved in using "ffmpeg" for encoding HEVC 4K files to use with this player. When processing compressed files, use a CRF factor of 20 or smaller.

Note: All media processing should be performed at a minimum of 10 bits. Truncating color depth to 8 bits to reduce file size can cause objectionable bands to become visible in areas of gradient color transitions. If 8-bit color is mandatory, use less aggressive compression.

Browser Layer Design Guidelines

1. This browser is standards-compliant and should correctly interpret all but the most exotic CSS and JavaScript syntax.

2. Try keeping the total uncompressed size of images including those that are not visible at the moment or downloaded using JavaScript under 2 MB. Avoid complicated page structures (deeply nested tables, etc.), and keep formatting simple.

3. Avoid resizing images in HTML, CSS or JavaScript by specifying width and height. This will increase memory usage. Specifying width/height is OK only if the dimensions are exactly equal to the natural dimensions of the image.

4. When designing dynamic effects, keep in mind performance limitations. We found that moving large bitmaps or text across the screen (marquee) may slow page response. However, image and text rotators seem to work fine.

5. When manipulating objects (especially images) in JavaScript, release the buffer (MyImg.src="") or make sure that the object goes out of scope when no longer needed. Some techniques, like preloading images one at a time in image rotators shortly before use and releasing shortly afterwards may be helpful.

6. When developing playlists, allow enough time to load websites, especially when video is being played concurrently. When navigating from one web page to another web page, allow some time for the previous page to unload. For large, complicated pages both loading and unloading may take several seconds each. Recommended time between page changes is 10 minutes depending on the complexity of the page being displayed.

7. Page dimensions should not exceed displayed dimensions (typically 3840x2160, 1920x1080, 1366x768, etc.).

8. Pages should be developed specifically for the CE250 family as the browser limitations make displaying generic web pages unpredictable.

9. When using active JavaScript, try not to change to other pages. As the JavaScript is running and is asynchronous to running playlists, information may be loaded/unloaded at any time; therefore, a playlist should not change the actively displayed web page. This can however be handled in JavaScript since it controls loading/unloading of objects, etc.

10. When using a multilayer display, video bandwidth may need to be reduced. The recommendation currently is H.264 running at 40Mbps or lower.

11. When spawning a Video, or picture from the Browser JavaScript always use "?internal=1" as an option in the video execution line.

12. Macromedia Flash and QuickTime Movie are **not** supported.