DIGITAL SMART ENCODER
MODEL HD491

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Section 1: Introduction

Product Description

The 491-series Smart Encoder is a next-generation digital closed captioning solution designed to streamline and integrate the Line 21/HD-VANC encoding process into one powerful box. The HD491 revolutionizes closed caption encoding with the introduction of our **CCMatch™** timing module (*Page 33*) which eliminates latency between captions and audio in program video output. All 491 encoders ship with the iCap™ internet captioning package; other software, including CCPlay™, XDS Xpress™, and custom packages, are available separately and can be installed in the field at any time. In addition to its new features, the 491 includes the same industry-standard closed caption and XDS data entry functions as previous Smart Encoder generations, available through two serial ports and a dial-up modem.

Selected Features

▪ Relay-bypassed master video and auxiliary video paths

▪ Exclusive **CCMatch™** timing option

▪ Encodes caption data sourced from previously encoded video sources, two RS232 serial ports, or a dial-up modem (one included, second modem optional)

▪ Includes iCap™ software for secure real-time internet-based captioning without dial-up phone lines or external audio couplers.

▪ HD491 encodes CEA-708 standard closed captioning from native 708 or legacy 608 (SD) sources

▪ Caption relocation from configurable GPI triggers

▪ Ships network ready, with advanced Startup Settings editor and debugging terminal available over an intuitive web browser interface

▪ Flash updates and fast file transfers through front panel USB port.

▪ Full command set back-compatibility with 470 Smart Encoder III, 530 Smart Encoder IV, and 480 Smart Encoder V.

Section 2: Installation

Front Panel

| | | Insert On | Insert On / |
| LCD Display | Control Pad | LED | Bypass |

SMART ENCODER
MODEL HD490

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USB Port   Power On LED   Power Switch
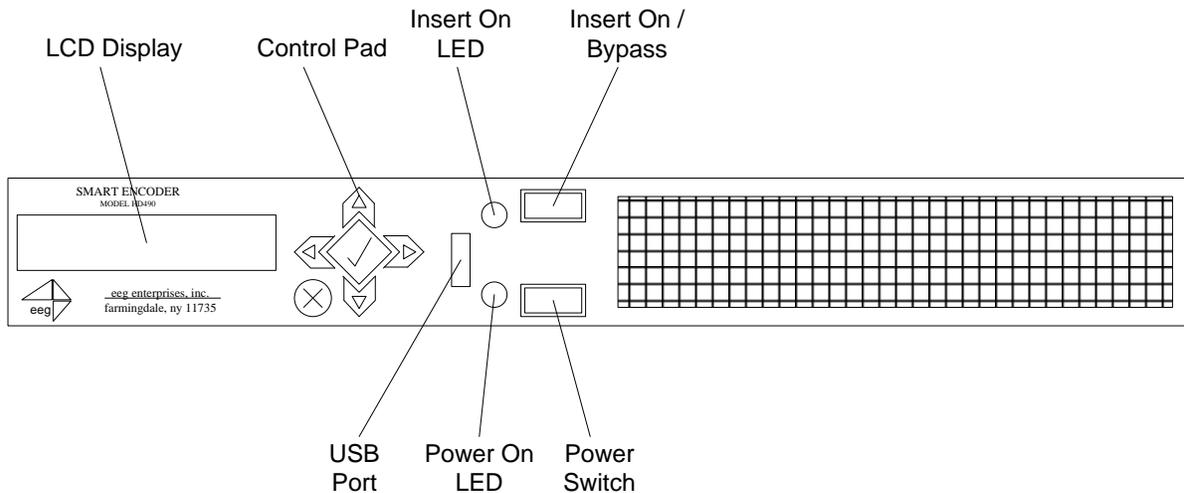
Power Switch   This is the on/off switch for the unit. When the unit is powered on, pushing the button once will provide a slower shutdown while all tasks are terminated cleanly. Holding the button down will provide an immediate shutdown.

Power On LED   The Power On LED will light steady green when the unit is powered on.

Insert On   Toggles the Encoder between active operations and Relay Bypass mode. In Relay Bypass mode, the signal at the master video input is routed directly through to the master video output, while the signal at the auxiliary video input is routed directly through to the auxiliary video output. Video output 2 is inactive.

Insert On LED   The Insert On LED will light green when the unit is in active operating mode. The LED will turn off when the Encoder is in Relay Bypass mode.

LCD Screen   The LCD Screen provides access to the unit's front panel configuration menu. On the HD491, status information is displayed when the menu is not in use.

Control Pad   The Control Pad provides menu navigation for the front panel configuration menus. The control pad buttons are: **ENTER** (marked by a check), **CANCEL** (marked by an 'X'), **LEFT, RIGHT, UP,** and **DOWN.**

USB Port   The front panel USB port provides firmware upgrade capability via a flash memory device. For instructions on upgrading the firmware, see page 8. Additional USB ports are available on the rear panel of the unit.

Rear Panel
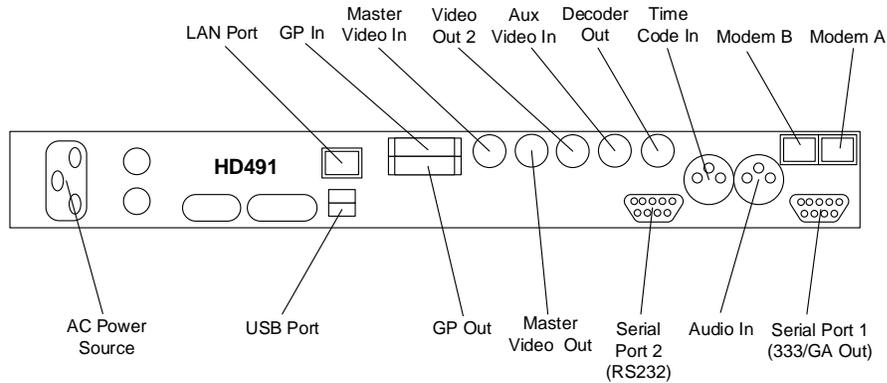
Primary AC Power   AC power input, 120 – 240 V, 50-60 Hz tolerant. Connect to the unit's AC power source.

Master Video In   Input for program video source. HD491 can use HD-SDI (SMPTE 292M) or SD-SDI (SMPTE 259M).

Master Video Out   Relay-bypass protected primary video output.

Video Out 2   Non relay-bypass protected copy of the primary video output signal.

Video Out 3   Non relay-bypass protected copy of the primary video output signal.

Aux Video In   The Aux Video In can be used as a source of caption data when connected to a captioned HD-SDI or SD-SDI video source. Caption data from the Aux Video In will be up-converted or down-converted as necessary for encoding on to the Master Video signal. If caption data is present at both the Master Video In and the Aux Video In, the signal with HD data will take precedence.

Modem   Standard phone jack data port. Connect to a phone line to enable dial-up captioning. Modem A is installed in all 491 units; Modem B is an add-on option.

Serial Ports   491 Encoders have two serial data ports. For HD491, port 1 is a 708 caption data output port to be connected to an ATSC encoder captioning port (see page 22) and port 2 is an RS232/RS422 port for caption data input. For more detailed descriptions of RS232/422 operation and configuration, see pages 37 and 44.

LAN
Connect the 491 Encoder to your local network to access web-based configuration and use network features such as iCap™. The encoder will be reachable on your network using the static IP address set in the front panel configuration menu.

GP In & Out
Two blocks of 8 GPI input switches and 8 GPO output notifications. Switch functions vary based on software configurations. For the default GPI functionality, see page 39; for the default GPO functionality, see page 41.

Time Code In
Balanced audio input for LTC time code. The HD495 can also read VITC data embedded in the master SD video signal; this feature is not available on the HD491.

Audio In
Balanced audio input for program companion audio in analog, AES digital format, or embedded audio. If using AES digital audio, an AES pair of PCM encoded audio at 48kHz should be used. The iCap™ module uses the audio stream selected from the front panel for encrypted IP transmission to a remote captioner's iCap™ client. For more details on iCap™ audio, see the front panel "Audio Setup" menu, or the HD491 iCap™ Software Manual.

Section 3: Encoder Operation

Front Panel Menus

The front panel LCD screen and Control Pad are used to configure encoder settings and networking, perform flash updates, and access many add-on software features installed in the unit. The interface is organized in a series of hierarchical menus; use the **LEFT** and **RIGHT** keys to scroll between menu options and the **ENTER** or **DOWN** keys to select options or enter sub-menus. Press the **CANCEL** key from any menu screen to return to the top of the menu hierarchy.

In the HD491, when the front panel menu is inactive, the display will revert to a status screen. The top line shows the availability and format of the video signals at the Master and Aux Video Inputs in the left and right corners, respectively. The bottom line shows the current data sources for the primary and secondary HD caption Services. Press any key on the Control Pad to return to the top-level menu from the status screen.

System Setup Menu

LCD Display

The LCD Display menu contains display options for the front panel LCD screen.

- **LCD Contrast** sets the contrast level of the display screen. The value ranges from 0 (lightest) to 20 (darkest). Use the **UP** and **DOWN** keys to make changes, which will take effect on the screen immediately. When you are finished making changes, use the **ENTER** key to exit the menu and save changes, or the **CANCEL** key to exit the menu and reject changes.

- **LCD Backlight** sets the brightness level of the display screen's backlighting. The value ranges from 0 (darkest) to 50 (brightest). Use the **UP** and **DOWN** keys to make changes, which will take effect on the screen immediately. When you are finished making changes, use the **ENTER** key to exit the menu and save changes or the **CANCEL** key to exit the menu and reject changes.

L21 Pedestal

Turns the Line 21 Pedestal feature on and off. Use the **UP** and **DOWN** buttons to select 'On' or 'Off' and **ENTER** or **CANCEL** to exit.

Version   View the current versions of hardware, firmware, and all software modules installed on the unit. Use the **UP** and **DOWN** buttons to scroll through the list and **ENTER** or **CANCEL** to exit.

Network Configuration

The Network Configuration menu contains the IP address and subnet mask that the Encoder will use when connected to a local network.

- **IP Address** selects the network address that the unit will request on your LAN. Use the **LEFT** and **RIGHT** keys to move the cursor between digits and the **UP** and **DOWN** keys to change the selected digit. When you are finished making changes, use the **ENTER** key to exit the menu and save changes or the **CANCEL** key to exit the menu and reject changes.

- **Subnet Mask** should be set to match the bit mask used on your LAN.

- **Gateway** should be set to the address of the computer or device that the unit will use to communicate outside of your local network, when applicable.

Firmware Update   The Firmware Update utility provides a fast, simple, and convenient way to upgrade your Encoder to the latest version of the EEG firmware or add additional software modules. Begin by downloading a firmware update file from the EEG website and transferring the file to any standard USB memory device. Insert the memory stick into the front panel USB port, navigate to the Update option in the System Setup menu, and press **ENTER**. The update utility will find the installation file on the memory device, display the revision number, and prompt you to continue. Press **ENTER** to proceed and install the new firmware, or **CANCEL** to end the utility. A message will appear on the LCD screen when the update utility has finished. **Do NOT remove the memory device while the update utility is running.** When the update utility is finished, the new firmware has been installed. Some updates will require a power-cycle before they take effect; in this case, the Encoder will power down automatically once the update is complete.

In HD491 versions 2.3.8 and up, updates can also be applied over your LAN on the HD491 Web Configuration page.

SD/HD Encode   SD/HD Encode allows you to use the aux path to simultaneously encode matching captions to a synchronized source of SD Video. This feature is off by default – to activate, select 'SD/HD Encode' by using the **UP** and **DOWN** buttons to scroll through the list. Set SD/HD Encode to "On" and press **ENTER** to save your selection or **CANCEL** to exit.

*SD/HD Encode option should **NOT** be used simultaneously with CCMatch activated in external delay mode. Doing so will produce undesirable results.*

Utilities

Test Captions   The Test Caption menu allows you to enable a stream of caption text on a single 608 channel of your choosing.

- **Enable** starts the stream of captions on the selected channel, which is CC1 by default. To enable test captions use the **UP** and **DOWN** keys to select **ON**. To disable test captions select **OFF**. Use the **ENTER** key to apply the changes. The test captions will stop if any other port (i.e. 232, modem or Linux virtual port) enters caption mode on the same channel and automatically change Enable to **OFF**.

- **Set Channel** allows you to select which 608 channel the test caption stream will be appear on. The default channel is CC1. TO select a different channel use the **UP** and **DOWN** keys to select a different channel and press the **ENTER** key to apply the change.

Capture VANC   Captures VANC data of the selected DID/SDID from the Master video input and loads it onto a USB storage device. Use the **UP** and **DOWN** keys to select the desired DID/SDID and insert a USB device into the box. Press **ENTER** to begin downloading the VANC data or **CANCEL** to exit. To stop capturing VANC data press any front panel key. Depending on the size and type of memory device used, there may be a momentary delay before the device is detected. If you see "Failed: Insert USB Disk", wait a few seconds and try again.

Capture All VANC   Captures VANC data of the selected DID/SDID from the Master video input and loads it onto a USB storage device. Use the **UP** and **DOWN** keys to select the desired DID/SDID and insert a USB device into the box. Press **ENTER** to begin downloading the VANC data or **CANCEL** to exit. To stop capturing VANC data press any front panel key. Depending on the size and type of memory device used, there may be a momentary delay before the device is detected. If you see "Failed: Insert USB Disk", wait a few seconds and try again.

Force Regen   Manually returns the encoder to upstream "Regeneration" mode (see page 18). This command can be used to resume passing of upstream caption data whenever it is being blocked by locally input caption data. Any captioners or devices inserting local data will be removed from caption mode immediately.

Audio Setup Menu

Input Select   Selects whether the input audio format is analog, AES digital or embedded audio. Use the **LEFT** and **RIGHT** keys to select the correct format, then press **ENTER** to exit and apply changes or **CANCEL** to exit and cancel changes. The HD491 does not currently support direct input of Dolby® E or other compressed audio signals.

Peak Level   Dynamically displays the peak signal level at the audio input. A warning message will be displayed when clipping is detected at the input. For optimal sound quality, the peak level bar should reach at least 60% across the screen, but should never display "Clipping!"

Scale Audio   Adjusts the audio input level without adjusting the output level of your source. The built-in digital input trim can boost or cut the audio input level up by as much as 12 dB.

Audio Group   Selects the SDI embedded audio channel group that the iCap™ mix is sourced from. Up to 4 channel groups can be carried on an SDI signal, though most commonly Group 1 carries the primary audio program. *Applies only when embedded audio input is selected.*

Audio Mix   Selects whether the iCap™ mix is being created from a Stereo or Surround channel group. Choose "Stereo" to select a mix of the left and right channels (1 & 2 or 3 & 4 within the selected Audio Group, according to the Stereo Channel setting), or "Surround" to select a mix of the left, right, and center channels (1, 2 & 3 within the selected Audio Group). *Applies only when embedded audio input is selected.*

Stereo Channel   Selects whether the iCap™ stereo mix is being created from channels 1 & 2 or channels 3 & 4 within the selected Audio Group. *Applies only when embedded audio input and stereo audio mix are selected.*

Web Configuration

The Web Configuration interface enables you to access configurations and log files for your 491 applications from any computer on your local network. Several web applications are installed at the factory for all HD491 encoders: a Startup Setting editor, a web-based serial-emulation Terminal for entering Smart Encoder commands, a documentation library, and the iCap™ application.

To use Web Configuration, first connect the Ethernet connector on the rear panel of the HD491 to your local network. Then, use the front panel LCD and button pad to give the encoder a valid IP address and subnet mask for your network by navigating to **System Setup | Network Setup | IP Address** and **System Setup | Network Setup | Subnet Mask.**

Once you have set up the front panel IP settings, you can leave your encoder and open up a web browser on any PC on the same local network. Navigate to the IP address that you configured on the encoder's front panel; for example, type **192.168.1.15** into the address bar of the browser if that is the address you entered into the front panel. If you cannot navigate to the page in your web browser, check with your network administrator that the IP Address and Subnet Mask you entered on the encoder front panel are valid parameters for your network, since individual settings vary.

Once the page has loaded, you will see a list on the top panel of the different web applications installed on your encoder. Click any of these links to navigate to the page for that application.

Update

The Update page enables you to load and apply a software update to the HD491 through the web interface. First, download the update file to your local computer. Then, from the Update page, select 'Choose File' to navigate to the update file path, and 'Upload' to apply the update. Follow any on-screen instructions to complete the update, and note that some updates may require a reboot to take effect.

Product Info

The Product Info page contains the Documentation subpage at the top and the Licensing subpage on the lower half of the page

The Documentation subpage contains PDF files of the HD491 manual as well as software manuals for any installed modules. These files can be downloaded or viewed in your web browser with a PDF reader such as Adobe Acrobat Reader.

The Licensing subpage displays the status of the caption module, the unit's serial number and provides a way to enable the caption module with a valid license key if it is not currently enabled. If your captioning is not enabled and you would like to enable it, please contact an EEG Sales Representative at sales@eegent.com for a license upgrade. Once you have received your new license key, simply enter it into the input box and click the 'Submit' button. A message box should appear informing you that the upgrade was successful and your captioning will now be enabled.

Terminal

The Terminal page gives you access to a Smart Encoder command terminal that emulates the serial port interface to the encoder. You can enter any of the commands detailed in this manual into the Web Terminal, just as you would through a serial port terminal, using <CTRL+A> and <CTRL+C>.

The Terminal page also has a feature that saves the past twenty-five commands and responses from the web terminal, which can be seen by clicking on the 'View History' button below the active web terminal. This feature is useful for recalling past commands even after you navigate away from the Terminal page or reset your HD491. To hide the history window, click on the 'Hide History' button located between the active web terminal and the open history window.

Smart Encoder Command Terminal
Version 1.4

```
Welcome to the Smart Encoder Command Terminal

Type a Smart Encoder command and hit enter.
- Type commands using [CTRL+A] and [CTRL+C]
- An asterisk signifies the end of a successful request
- 'El' is returned if an unknown or unsupported command is used


  >^A?
  EEG Model HD491, Unit ID: 7777, Ver: 1.30v2
  *
  >
```

View History
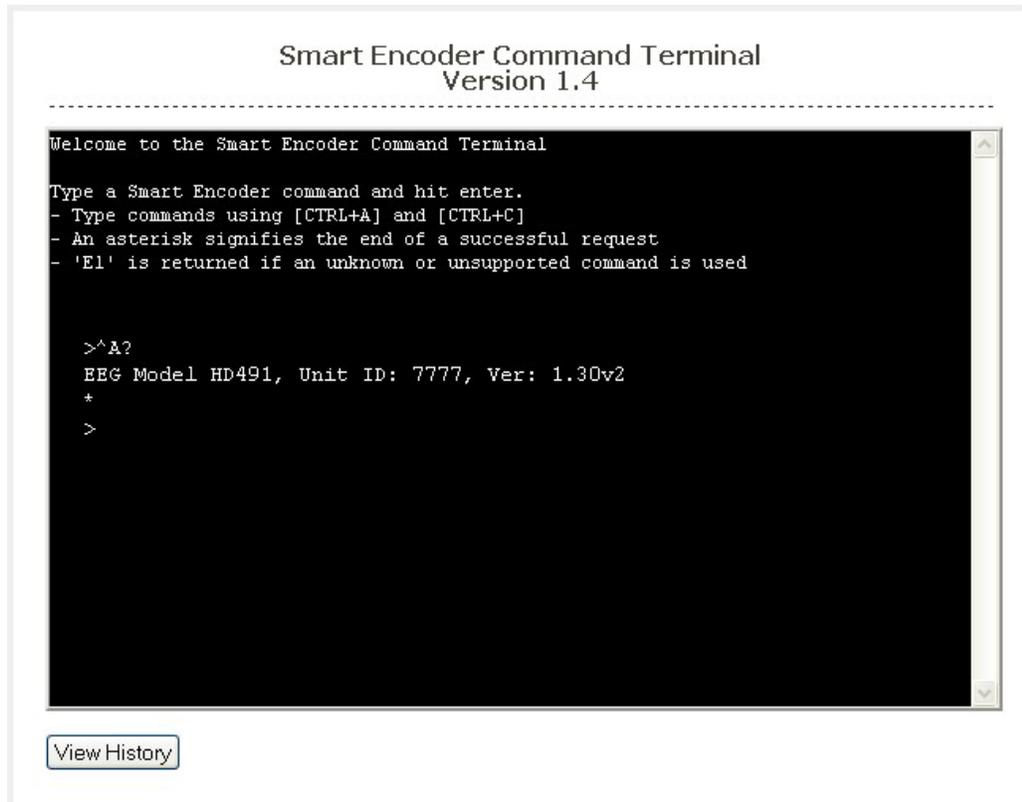
Alarms

The Alarms page allows you to set the timeout interval for each of the GPI alarms listed in the table. The table shows the GPI Output, the function of the alarm and gives a brief description of the alarm, followed by an input box where you can set the time interval in seconds. To apply any changes made to the time interval click the 'Save Changes' button.

Startup Settings

The Startup Settings Editor enables entry of Smart Encoder commands that will be run every time the encoder starts up. Use Startup Settings whenever you want a setting to be "sticky"; settings entered through the Web Terminal or the serial port only are not sticky and will revert to defaults when the encoder is power-cycled.

To use the Startup Settings editor, type any Smart Encoder command into the command box. Omit the <CTRL+A> character entirely- this character is implied at the beginning of each line. To add additional commands, press the '+' button and more lines will appear.

When you have entered commands for all the settings that you want to make sticky, click Update Startup Settings. The configuration changes will take the next time the encoder starts up.

The 'Description' field provides a human-readable description for future reference for many commonly used startup commands.

iCap™

Every HD491 unit ships with ready-to-use iCap™ software. The iCap™ software is turned off by default. To begin using the iCap™ software, enter your encoder's unique iCap™ account login on the configuration page, press 'Apply', and then press 'Start'.

iCap™ account logins can be obtained by contacting EEG Sales or Technical Support, and are now free with each HD491 unit.

For complete information on using iCap™ on the HD491, refer to the iCap™ manual which can be found in the 'Manuals' section on the configuration web pages.

Logs

The Logs tab on the HD491 web page will show daily event logs for installed modules, including iCap™ and XDS/PSIP network insertion.

Optional Modules

A wide variety of optional modules are available for the HD491 platform. Some of the most popular are pre-installed on new units, though some pre-installed modules still require a license key to activate. See Section 4 for an up-to-date list of available modules.

Local Caption Entry

This section covers methods for inputting closed captioning data into your 491 Encoder using the serial ports or dial-up modem. The same commands can for caption entry and settings can also be entered to the HD491 Web Terminal

Data Port Settings

The serial data input ports (labeled 'P2' only for HD491) are factory configured to use the RS232 protocol at 1200 baud, 7 data bits, and Odd parity. To change these settings, see page 37. The dial-up modem is set to operate at 2400 baud, but will also operate at 1200 baud without explicit reconfiguration.

The Encoder controls the flow of data from input ports to the processing queue using XON/XOFF handshaking protocol. XOFF will be sent when the queue is over ¾ full. When the queue clears to ¼ full, XON will be sent. The XON and XOFF characters are sent with a parity bit determined by the parity setting of the port they are sent through. Hardware handshaking is not supported and must be disabled when connecting the Encoder.

To communicate through the serial data ports, connect the port to a PC serial port with a standard 9-pin connector, and begin entering data through a serial communications application such as HyperTerminal on Windows. If you have trouble communicating using HyperTerminal, always check to make sure that the settings in the Port Settings menu in HyperTerminal match the settings for the Encoder port you are connected to.

Smart Encoder Command Format

The 491-series Encoders maintain full compatibility with the industry standard EEG Smart Encoder command set for closed caption data entry. All Smart Encoder control commands begin with a leading control code of <CTRL+A>, also represented by the ASCII hex code 01. A Smart Encoder control command must end with a carriage return; use the <ENTER> key on a keyboard or 0D in ASCII hex. Note that both the <CTRL+A> and <ENTER> characters are usually non-printing in serial port communication programs.

In HD491 Versions 1.19 and above, you can use the Web Terminal interchangeably with the serial port interface. Instead of entering <CTRL+A> at the beginning of commands, use '@'.

In this manual, Encoder commands will be distinguished from other text by use of a bold font. The parameters for each command will be listed in italics. Optional parameters will be listed within square brackets.

To check the operation of your communications setup, try typing **<CTRL+A>?<ENTER>**. If your setup is working correctly, the Encoder will respond with its model name, firmware version, and serial number.

Local Entry Modes

Caption data entered into the Encoder must be associated with a particular Line 21 Data Channel, NTSC field, or HD caption Service. The table below identifies the commonly used NTSC (SD) Line 21 data channels.

Data Channel	Description
CC1	Primary language Closed Captioning in Field 1
CC2	Secondary language Closed Captioning in Field 1
CC3	Secondary language Closed Captioning in Field 2
T1, T2	Field 1 Text services, including Interactive TV URLs
XDS	Extended Data Services such as Program Rating, Type and Length. Appears in Field 2.

In HD captioning, Services are designated instead of Channels. Service 1 is assigned for primary language captioning, and Service 2 is assigned for secondary language captioning. When 608 data is up-converted to create 708 data, CC1 data is assigned to Service 1, and CC3 data is assigned to Service 2. Text and XDS data is preserved in 608 down-compatibility bytes, but is not up-converted.

The Local Entry Modes described in this section are used for local insertion of data into caption channels only; see the next two sections of the manual for modes to insert Text or XDS data.

Regeneration Mode

Appears on front panel display as REGEN. Upstream regeneration is used whenever no other local entry mode is enabled for a caption channel. The Encoder's default Regeneration action is to regenerate the caption data recovered from the HD video input. If no upstream HD captioning is present, caption data from the SD video input will be used instead.

The default Regeneration response is configurable by using the commands listed in this section, and also by setting the Force 608 Up-conversion GPI switch (see page 39).

Regenerate Upstream VANC   **<CTRL+A>!** *[ON/OFF]* **<ENTER>**

Instructs the Encoder to either detect and potentially regenerate (default) or ignore incoming VANC data from the HD video input. If the encoder is set to ignore upstream VANC data, output signals will include only caption data recovered and regenerated from the SD video input. Use **OFF** to ignore upstream VANC caption data, and **ON** to resume detecting upstream VANC caption data.

Ignore Upstream L21 Channel   **<CTRL+A>6** *Channel* **<ENTER>**
Return Upstream L21 Channel   **<CTRL+A>7** *Channel* **<ENTER>**

Instructs the Encoder to ignore incoming caption data corresponding to the specified CEA-608 style caption channel.

- **Channel** sets the incoming Line 21 channel to be turned off. This parameter may be set for any NTSC Caption or Text channel (i.e. CC1, T1, etc). Upstream XDS data cannot be turned off with this command.

Begin PassThru Mode   **<CTRL+A>3 [*Pairing*] [*Field*] <ENTER>**
End PassThru Mode   **<CTRL+C>**

Displayed as PTHRU. When a port enters the command to begin PassThru for a field, caption data received through that port will replace upstream caption data for that field. PassThru mode is for use with complete CEA-608 formatted data streams, including control and formatting codes, such as would be provided by captioning software packages. If PassThru is engaged but no valid data is being entered, pairs of null data bytes (80h 80h) will be inserted into output signals. When PassThru mode is ended, the field will return to upstream Regeneration.

- **Field** specifies which NTSC field the locally entered caption data is intended for. Field 1 (enter as F1) is for primary language captioning and text, and Field 2 (F2) is for secondary language captioning and text. The parameter defaults to Field 1.

- **Pairing** can be set using integer values from 1 to 4 corresponding to differing levels of control code processing. The table below describes the available levels. If the parameter is not set, the default for field 1 is level 4, and the default for field 2 is level 2.

Control Code Pairing Settings	
1	All incoming data is passed. Control byte pairs will not be automatically aligned, which may lead to missed codes.
2	Field 2 default. Control pairs are identified and delayed if necessary for correct alignment.
3	Control pairs are corrected for proper alignment and doubled in Field 1.
4	Field 1 default. Control pairs are corrected for proper alignment, doubled in Field 1, and non-Line 21 codes are omitted.

Begin RealTime Mode: **<CTRL+A>2 [*Channel*] [*Rollup*] [b*Base*] <ENTER>**
End RealTime Mode: **<CTRL+C>**

Displayed as RTCAP. When a port enters the command to begin RealTime mode, text entered through that port will be encoded into a rollup caption display and replace upstream caption data for the specified channel. The 491 Encoder will automatically create all necessary control and formatting codes. When RealTime mode is ended, the channel will return to upstream Regeneration.

Data entered in RealTime must be in ASCII text format with a carriage return (0Dh or <ENTER>) at the end of each line of data. Because a line of data is processed only upon receipt of a carriage return, text may be edited by use of a backspace (08h or <BACKSPACE>) at any time before the carriage return.

The input text may be formatted to fit on 32 character lines by sending a carriage return at word boundaries approaching the 32 character limit. If sufficient data to fill a line is not available within a reasonable amount of time, a carriage return should be sent to ensure timeliness for the queued data.

- **Channel** specifies which NTSC caption channel the ASCII data that will be entered is intended for. Enter CC1 for primary language captioning or CC3 for secondary language captioning. If no parameter is entered, CC1 will be assumed.

- **Rollup** sets the number of rows in the rollup caption display that will be created. Possible values are 2, 3, and 4. If no setting is entered, 3 will be assumed.

- **Base** sets the row from which the caption display will begin rolling up. The parameter value must be entered with a leading "b". Possible values range from b2 (top of the screen) to b15 (bottom of the screen). The default value is b15. Always set the Base value at least as large as the number of rows in the rollup display, or else the uppermost row(s) of the display will not be visible.

HD Output Types

The HD491 is capable of outputting HD caption data in three different ways. HD VANC Insertion implements SMPTE 334M-style encoding of the caption data on to the output video signal. HD Serial Output puts the caption data out onto P1 instead, for connection directly into an ATSC encoder. HD Serial Output can be configured to use either the SMPTE-333M or the Grand Alliance protocol.

HD VANC Insertion

In HD VANC Insertion, the Encoder inserts its CEA-708B caption output data into the vertical ancillary space of the Master HD video source, using SMPTE 334M protocol. The newly captioned HD video signal appears at the HD-SDI video outputs on the rear panel.

VANC Insertion is the Encoder's default HD output type and will be in effect unless the P1 port has been set to the Grand Alliance mode. In the default mode, the encoder will automatically switch to SMPTE 333M mode if P1 is connected to an ATSC encoder supporting the SMPTE 333M protocol. The Encoder will return to VANC insertion mode if the device supporting SMPTE 333M is disconnected. VANC insertion can also be disabled by typing **<CTRL+A># OFF <ENTER>**. If insertion is disabled through this command, it must be re-enabled using **<CTRL+A># ON <ENTER>**. The command to return to VANC insertion from another mode, with automatic SMPTE 333M detection on P1, or to change the VANC line on which insertion takes place is **<CTRL+A>f 334 [*Line*] <ENTER>**. To enter VANC Insertion mode without automatic 333 detection, use **<CTRL+A>f vanc [*Line*] <ENTER>**. This will allow P1 to be used as a general purpose serial input port.

The **Line** parameter sets the VANC line on which caption data will be inserted into the HD video signal. Non-captioning VANC data packets on that line will be preserved. The following table lists the valid VANC insertion lines for the most common HD video formats. The Encoder's default insertion line is line 9, which is valid for all formats. Entering 0 as the Line parameter will set insertion for the first available VANC line, using the order listed in the table below for each format. In interlaced formats, caption data will only be inserted once per frame, in the first field.

Format	VANC Insertion Lines
24Psf	1124, 1125, 1-20
720p	746-750, 1-25
1080i	561, 562, 1-20
1080p	1122–1125, 1-41

333 Serial Output

In 333 serial output, the Encoder sends its 708 caption output to a serial output queue to wait for transport to an ATSC encoder supporting the SMPTE 333M protocol. 333 is a "pull" protocol; a properly configured ATSC encoder will send synchronization requests (SYNs) to the caption encoder, which then sends data chunks from the output queue to serial port P1. For complete information about the protocol, refer to the SMPTE 333M specification.

To set the Encoder for 333 serial output, simply connect P1 to the captioning port of a SMPTE 333M ATSC encoder. When the Encoder begins receiving SYNs, it will automatically enter the 333 output mode. P1 is default-configured on startup for the proper communications settings to listen for 333 (38400 Baud, 8 data bits, no parity, and one stop bit). To set the Encoder for 333 output manually, and set P1 to the proper listening settings, use **<CTRL+A>f 333 <ENTER>**.

GA Serial Output

In GA serial output, the Encoder sends its 708 caption output to a serial output queue for transport to an ATSC encoder supporting Grand Alliance (GA) protocol. Grand Alliance is a "push" protocol; the caption encoder sends data out through P1 as it becomes available, and the ATSC encoder synchronizes the data upon reception. The Grand Alliance transport protocol in use by EEG equipment is described on *Page 45*.

Since the caption encoder initiates data transfer with a Grand Alliance ATSC encoder, GA output must be begun manually. The command to set the Encoder for GA output is **<CTRL+A>f ga <ENTER>**. This command will begin the GA serial output and set P1 for the proper communications rate (19200 Baud, 8 data bits, no parity, and one stop bit).

Note that, each time the HD491 is power cycled, the default startup behavior is to return to the HD VANC Insertion mode. If a SMPTE 333M ATSC encoder is connected to P1, 333 serial output will begin as soon as SYNs are received. If GA serial output is the desired mode on each startup, the GA output command can be stored in Startup Settings used the web-based Startup Settings Editor. If the command is stored in the startup settings, GA output will automatically begin each time the Encoder is power cycled.
When either serial output mode is active, no VANC caption data will appear on the HD video output.

XDS Insertion

Extended Data Services (XDS) is an NTSC Field 2 data channel that provides information to viewers about the program that is being aired. XDS is used to transmit FCC-mandated program ratings to allow viewer V-chip filtering. XDS is a part of the CEA-608 standard for SD broadcasts, and should be included in the 608 compatibility bytes of CEA-708 compliant HD broadcasts.

The 491 Encoder includes all of the XDS functionality of the broadcast industry's leading XDS solution, the EN470 Smart Encoder III. XDS data packets can be loaded into the Encoder's queue with one simple command, and be held for any specified time period. Each individual packet type can be independently set for upstream or local priority, and permanent packets can be stored in Non Volatile Memory and inserted automatically whenever the Encoder is operating.

Packets are inserted into output video signals using EEG's proprietary Stochastic Scheduling Algorithm. The Stochastic Scheduling Algorithm is a finely tuned solution to the Field 2 bandwidth limitations that cause difficulties in XDS packet transmission. A Priority level is automatically assigned to each packet based on its XDS Class and Type. The Stochastic Scheduling Algorithm ensures both that high priority packets like V-chip data and program names are transmitted frequently enough to be instantly accessible for new viewers, and that lower priority packets are guaranteed to be inserted periodically, and not preempted completely.

As per CEA-608B specifications, all available Field 2 space is filled, rescheduling and regeneration are automatically performed on all upstream packets, and packet continuations are applied when necessary. Additionally, upstream XDS program packets will continue to transmit for five minutes after any non-clearing upstream interruption, such as a commercial break or undesired outage.

Enable XDS Entry   **<CTRL+A>O XDS O <ENTER>**

This command must be entered to enable a port for XDS input. A port must be enabled for XDS input in order to accept XDS data and control commands. The character repeated in the command is a capital o and not a zero.

Set Active Port   <CTRL+A>O *Px* XDS O <ENTER>

> Used to request or yield Active status. The 'Px' argument specifies the port that XDS activity will be set to, i.e. P1. Port P3 can set the Active status of any port. The other ports can only request active status for itself and so does not need to enter the Px parameter. Active status can only be obtained if the port has been authorized in the Permission List.
>
> Only one port can be active for each Data Type at a time. If another port is already active the E1 error message will be returned. If the command is entered with the override parameter O, the port entering the command will become active in place of the previous active port.

Load XDS Packet   <CTRL+A>P *Packet Duration Content* [*Priority*] <ENTER>

> Creates an XDS packet and loads it into the XDS queue. The Encoder will begin inserting the packet immediately.
>
> - **Packet** sets the XDS Class and Type of the packet that will be created. If a new packet is loaded with the same Packet ID as an existing packet in the queue, the pre-existing packet will be deleted; if the new packet is a Program Name or Program ID packet, all program-specific packets will be deleted from the queue. A packet loaded into the Encoder with the Load XDS Packet command has local priority; in output signals, it will replace all upstream packets of the same Class and Type.
>
>   The Packet parameter should be entered as Class immediately followed by Type in the way shown in the table below. Leading zeroes may be omitted.
>
>   The Class and Type of a few of the most commonly used XDS packets are shown in the following table; for a complete list refer to CEA-608B.

Class/Type	Content	Class/Type	Content
0102	Current Program Length	0501	Network Name
0103	Current Program Name	0502	Station ID (Call Letters)
0105	Current Program Rating	0504	TSID

- **Duration** sets the transmission duration of the newly created packet. When a packet's duration period expires, it will be deleted from the XDS queue. A duration setting of –1 will cause the packet to be inserted until it is deleted by a future command. An integer setting (i.e. 100) will be interpreted as the number of times to output the packet before deleting it. An Elapsed Time setting (i.e. 00.45.00), will cause the packet to be inserted for that length of time, beginning when the command is entered, and then deleted.

- **Content** sets the information content of the packet. Content can be entered in ASCII text enclosed in curly braces, { }, or in ASCII Hex notation. If you enter data in ASCII hex mode, you must only use ASCII hex characters between 0x20 and 0x7f. A checksum need not be enclosed, as the Encoder will calculate it automatically before insertion.

- **Priority** is an optional parameter that allows the output priority of a packet to be customized. The parameter should not be used for standardized, commonly used packets, which the Encoder automatically assigns appropriate priorities. The parameter is useful for custom, user-defined packets. The default priority for packets that the encoder does not recognize is 115, which corresponds to a fairly low priority. A typical high priority value is 30. A packet's numerical priority is inversely proportional to the frequency with which it is inserted.

Two sample XDS entries follow.

<CTRL+A>P 103 –1 {Evening News} <ENTER> will load and begin insertion for a current program name packet reading "Evening News." The packet will be output until a new packet is entered.

<CTRL+A>P 105 00.30.00 4844 <ENTER> will load and begin insertion for a current program rating packet of TV-PG. The packet will be inserted for the next thirty minutes. Refer to CEA-608B for a listing of hex codes for other possible program ratings.

Load Default XDS Packet   **<CTRL+A>P L***Packet Duration Content* [*Holdoff*] **<ENTER>**

Loads an Upstream Priority XDS packet. This is called a "default" packet because it will be output only when no XDS packet of the specified Class and Type is present in the incoming video signal. When an upstream packet is discontinued without a replacement or a Clear packet (two Space characters), the Encoder will continue insertion of the discontinued packet for a time-out period of 5 minutes to ensure continuity during commercial breaks or replacement delays. The default packet will then be transmitted until the upstream packet is replaced.

The Packet, Duration, and Content parameters are the same as for the local priority Load XDS Packet command explained on the previous page, except the Packet Class/Type must be entered with a leading "L".

- **Holdoff** sets the number of seconds after which the default packet will begin transmission once the five minute upstream time-out period expires. The default is zero.

Example: **<CTRL+A>P L105 –1 4840 <ENTER>** will create a default program rating packet of None. This packet will be inserted beginning 5 minutes after an interruption in upstream program rating data, and will continue to be transmitted indefinitely until upstream data resumes.

Load NVM XDS packet   **<CTRL+A>w <CTRL+A>P** *Packet* **-1** *Content* **<ENTER>**

Stores an XDS packet in Non Volatile Memory. The stored packet will be loaded into the XDS queue every time the Encoder starts up, and will be inserted indefinitely unless cancelled. The packet will not initially be sent to the queue until the Encoder is rebooted.

NVM storage is suggested for packets like Network Name, Station ID, and TSID that do not need to be updated, or for default packets. To change or delete an item in NVM, see page 32. Note also that only P3 may write to the NVM.

Example: **<CTRL+A>w <CTRL+A>P 502 –1 {WEEG} <ENTER>** stores a Station ID packet reading "WEEG" in NVM. Once the Encoder has been rebooted, this packet will be sent indefinitely whenever the Encoder is on.

Report XDS Queue   **<CTRL+A>e [***Packet***] <ENTER>**

Reports the contents and settings for the packet of the specified Class/Type loaded in the XDS queue. An asterisk after the packet ID indicates that max time-based preemptive priority has been set. If the Packet parameter is omitted, the entire XDS queue will be displayed. The following information is displayed:
- **ID** is the packet's Class and Type. Default packets are displayed with a leading "L".

- **Format** and **Ending** describe the packet's duration. A Format value of RE indicates an indefinite or integer duration, and a value of EL indicates an Elapsed Time duration. Ending displays the duration value.

- **Priority** displays the packet's Priority rating. Packets with smaller numerical priorities go out more frequently than packets with larger numerical priorities, with an approximately inverse proportional relationship between numerical Priority and insertion frequency.

- **Frames** displays the number of frames the packet occupies. Larger packets take up more frames and more bandwidth.

- **Source** indicates whether the packet is locally inserted (Loc) or upstream regenerated (Up).

A report on an individual packet includes the packet's hex byte representation, decoded content for common packets, and checksum in addition to the above information.

Delete XDS Packet   **<CTRL+A>P** *Packet* **<ENTER>**

Deletes the packet of the specified Class and Type from the XDS queue. If the packet is a Program Name or Program ID packet, all other program-specific packets will also be deleted, and the Encoder will insert a Clear packet for downstream databases and decoders.

Delete XDS Queue   **<CTRL+A>L -all <ENTER>**

Deletes all packets in the XDS queue. Packets loaded from NVM will be removed from the queue but will remain in NVM storage.

Block Upstream XDS   **<CTRL+A>T -*Class*00 <ENTER>**
End Blocking   **<CTRL+A>T *Class*00 <ENTER>**

Blocks all incoming packets of the specified Class. Entering **all** instead of *Class*00 as the parameter will cause all upstream packets to be blocked. Omitting the Class parameter will cause the block/pass status for each Class to be reported.

Example: **<CTRL+A>T –0100 <ENTER>** blocks all upstream XDS packets in the Current Program Class. **<CTRL+A>T 0100 <ENTER>** will resume normal XDS operation.

URL and Text Encoding

The Smart Encoder handles URL and Text Encoding, like XDS, as an output from memory function, rather than a real time flow function. The Encoder can store up to 24 separate text messages and interactive television URLs in RAM storage indefinitely. Messages in storage may be transmitted in any sequence and repeated any number of times in either Field 1 text channel. However, both channels cannot use the same message simultaneously. Once insertion of a message begins, upstream data on that Text channel is blocked until the locally inserted message is completed. The URL insertion protocol operates in T2 and is fully compliant with CEA-608B specifications.

Begin Message Input   <CTRL+A>0 *Title* [*Channel*] [*Repeat*] [*K/D*] [*O/H*] [*N/L*] <ENTER>
End Message Input   <CTRL+C>

To load a new message, enter the Begin Message Input command. The character following <CTRL+A> in the Begin command is a zero. The Encoder should respond with ">" as a prompt at the beginning of the message and at the beginning of each new line. Enter the message text, ending each line with a carriage return (0Dh or <ENTER>). For URL insertion, be certain to observe the format defined in CEA-608B, which includes specific ordering, punctuation, and a checksum. When the message is finished, enter a final carriage return, and then the End Message Input command.

To insert a transmission delay within the message, insert the command **<CTRL+B>** *Delay* at the desired point, setting Delay equal to the length of the desired delay in seconds.

- **Title** sets the title of the message. The title will be used to identify the message for future use.

- **Channel** sets the Text Channel queue (T1 or T2) into which the message will be inserted. T1 is the default.

- **Repeat** sets the integer number of times that the message will be repeated when it arrives in the queue. All messages in the queue are cycled, and any message that has not reached its Repeat count returns to the end of the queue line after it is inserted. The default setting is infinite repeat (listed as FFFF in a status display).

- **K/D** specifies whether the article is to be Kept in memory or Deleted once it exits the queue. The default setting is Delete.

- **O/H** instructs the Encoder to either Output the article to the appropriate channel queue immediately or to Hold it in memory for future use. Immediate output is the default setting.

- **N/L** specifies whether the message is to be placed Next in line or Last in line when it is sent to an output queue. The default setting is Last.

Example: **<CTRL+A>0 EEG_URL T2 3 D O N <ENTER>**
EEG on the Web <ENTER>
<http://www.eeg.tv>[t:p][C510]<ENTER> <CTRL+C> will create a two line message that displays and identifies a URL address. The use of brackets, attributes, and checksum is per CEA-608B specification. The message will be placed next in the T2 output queue, inserted 3 times, and then deleted.

Output Message   **<CTRL+A>1** *Title* [*Channel*] [*Repeat*] [*K/D*] [*O/H*] [*N/L*] **<ENTER>**

Places a previously stored message into the appropriate text channel output queue. Any parameters that are not specified will retain the values the message was last stored with. The character following <CTRL+A> in the command is a one. If O/H is set to H, the message will not be output, and this command can be used to change the messages' parameters.

Remove Message from Queue   **<CTRL+A>4** *Title* [*K/D*] **<ENTER>**

Removes all instances of the specified message from the output queue. If the last K/D parameter associated with the message is D, the message will also be deleted from memory. If the message is being output as this command is received, the current repetition will be allowed to finish.

Display Message Status   **<CTRL+A>9** [*Channel*] **<ENTER>**

Displays the names and settings of the messages currently associated with the specified Channel. If the Channel parameter is omitted, displays the names and setting of all saved messages.

Begin Set Output Queue   **<CTRL+A>8** [*Channel*] **<ENTER>**
End Set Output Queue   **<CTRL+C>**

To set the message output queue for a Channel, first enter the Begin Set Output Queue command. T1 is the default channel. A prompt reading ">" should appear. Enter the desired Messages, delineated by carriage returns, in the desired order of insertion. When the list is completed, enter the End Set Output Queue command. A message that is associated with a different channel cannot be added to the queue.

Display Output Queue   **<CTRL+A>B <ENTER>**

Displays the contents of both text channel output queues.

Section 4: Exclusive CCMatch™ Feature

Overview

The EEG HD491 Smart Encoder introduces the addition of our CCMatch™ syncing module that allows broadcasters to reduce or eliminate latency between captions and audio in their program video output. In CCMatch™ mode, the HD491 intelligently detects whether the caption input is post-produced or real-time, and synchronizes captions accordingly with the output video and audio.

Additionally, captioners using iCap™ receive program audio that is advanced with respect to the unit's program video output, thereby minimizing caption latency. Captions from commercial and promotional segments are protected from being overwritten by real-time caption input.

Configuration

CCMatch™ may be used in either of the following 2 scenarios:

CCMatch™ Scenario 1:

Scenario 1 allows the video/audio delay AND synching process to take place *entirely* within the HD491 resulting in an output of delayed video/audio with appropriately synchronized captions. This scenario requires only one master video/audio input (See Figure 1).

Figure 1: Workflow for HD491 Smart Encoder with CCMatch™ option enabled
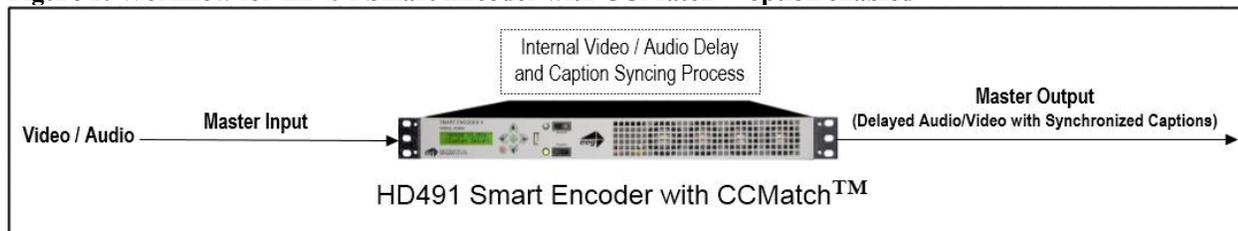
CCMatch™ Scenario 2:

Scenario 2 allows CCMatch™ to be used in tandem with an externally delayed video/audio input (See Figure 2). This Scenario would be ideal if you are looking to make use of an existing delay source, for instance, an intentional broadcast delay for censoring live material. Unlike Scenario 1, this option requires that the HD491 have two input video feeds – both a Master and Auxiliary. The video on the Master input should be a delayed copy of the same video being fed on the Auxiliary input. The delay of the Master in respect to the Auxiliary approximates the anticipated delay of real-time captioning and CCMatch™ re-times the captions according to this delay (The Master output of the HD491 will contain the same video delay present in the Master input).

Figure 2: Workflow for HD491 Smart Encoder with external delay and CCMatch™ option enabled
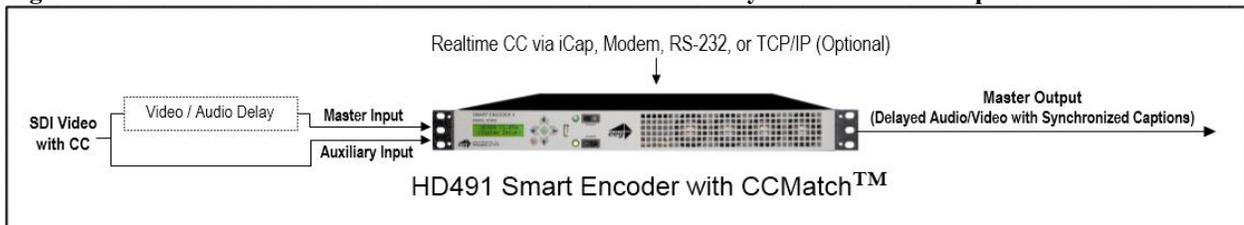
Enabling CCMatch™ Mode

Enabling CCMatch™ mode requires configuration through the HD491's front-panel LCD menu.

- Browse to the **System Setup** menu, and choose the **CCMatch** option.
- You will then be provided with two submenu options **Delay Source** and **Delay Length**.
- **Delay Source** requires you to choose either *Internal* or *External* – choose according to the scenario being used (*Internal for Scenario 1, and External for Scenario 2*).
- **Delay Length** requires the input of a numeric value from 0.0 to 10.0 seconds (in increments of 0.1 seconds). Enter the length of the desired delay as follows:

    o For CCMatch™ **Scenario 1**: Enter the number of seconds you would like CCMatch™ to delay input and synchronize captions according to.

    o For CCMatch™ **Scenario 2** - enter the number of seconds of delay present in your Master video input, with respect to the Auxiliary input (*the number of seconds entered must match the delayed input*).

For each scenario, the delay is likely to be between 3 and 8 seconds, consisting of a transcription delay of approximately 3 seconds, and an audio transmission delay that can be nearly as low as zero, or as high as 5 seconds, depending on the means of audio delivery to the captioner.
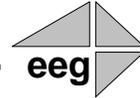
Section 5: Applications

The 491-series Smart Encoder platform is designed to support standard, semi-custom, and custom EEG software solutions for a wide variety of VBI and VANC data handling applications. These applications take advantage of the HD491's enhanced processing power, fast network connectivity, simple browser-based configuration, and custom software decoder platform to create powerful single-box solutions in any encoding environment. Some of the most popular modules are pre-installed on new units, though some pre-installed modules still require a license key to activate. Others require a software update. For information, technical specs, or pricing on any of the below modules, or to inquire about customization, please contact support@eegent.com or sales@eegent.com.

iCap™ Secure Internet Captioning

The EEG iCap™ system is a real-time IP-based captioning system designed exclusively for use with the 491-series Smart Encoder platform. With iCap™, the 491 Encoder and a single LAN connection replaces both an older encoder used with a dial-up modem line, and an external audio coupler with an additional phone line, while improving system security, quality of service, logging, and monitoring. iCap™ also greatly simplifies encoding jobs with multiple captioners and/or multiple encoders by creating dynamically networked, password-protected groups of Encoders and enabled captioners with real-time status reporting to participants and administrators.

The block diagram on the next page shows the basic cloud architecture of the iCap™ system. Each Encoder logs in to a secure remote connection server with its unique ID key and password automatically on startup. Once the Encoder is authenticated into the system, remote captioners can use the Encoder's access code to connect through a dedicated high-speed relay network. The captioners receive an encrypted audio stream and caption monitoring from the HD491, and status messages from any other encoders or captioners in the group. All connections to each Encoder, and the start and stop times for any captioner sending data, are logged by the servers and accessible through a secure administrative website. iCap™ provides high quality, low latency audio to captioners for improved transcription accuracy, and automatic status and arbitration messages eliminate common problems with loss of service due to dial-up modem preemption or lock-out.
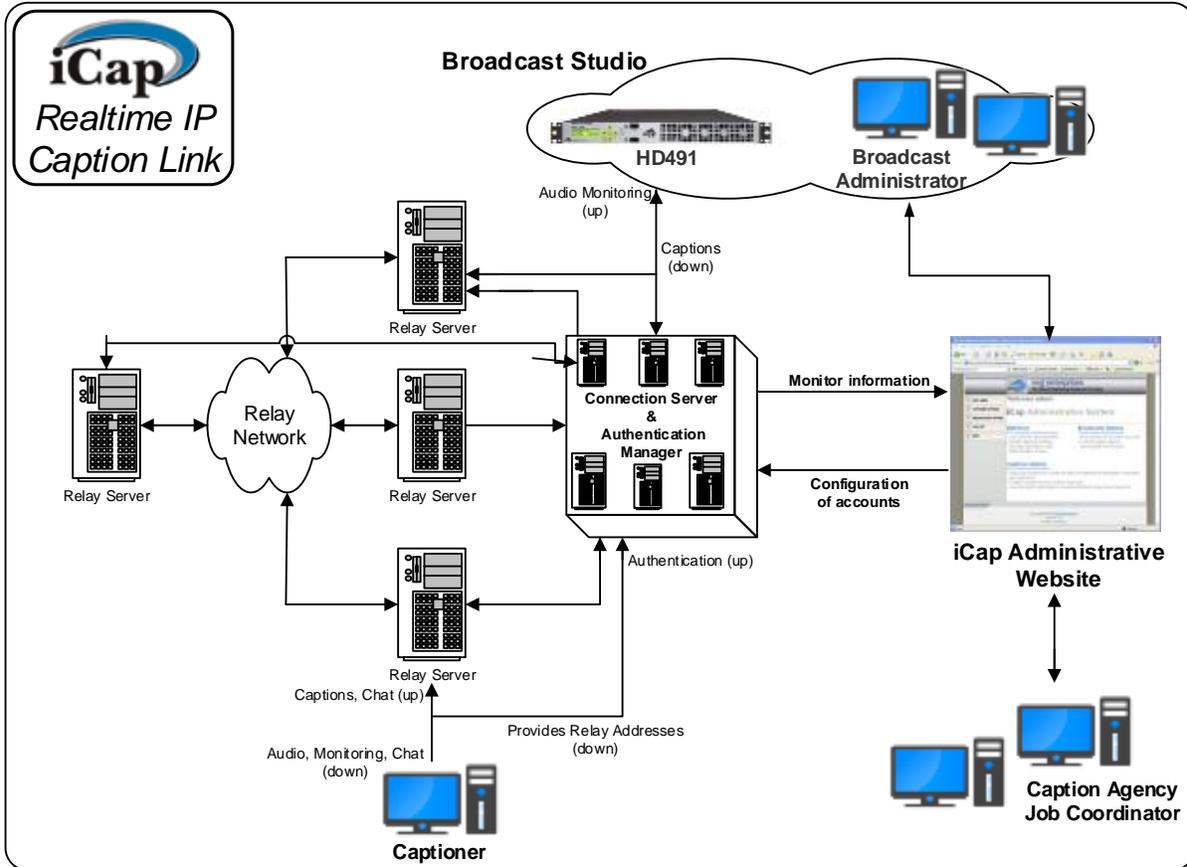
Refer to the iCap™ manual in the 'Manuals' section on the HD491 configuration page for complete details about getting started with iCap™.

Selected Other Modules

AFD	Advanced AFD preset insertion, code swapping, and control
CCArchive	Stream captions and audio to a CCArchive collection server
CCPlay	Play-out of caption files synced to time code or a schedule
CCRecord	Record caption files from pass-through data
Clone	Multi-encoder daisy-chaining through TCP/IP or RS-232
ComCC	Ethernet-based dial-up backup system for iCap installations
NAS/BAS	Server-based affiliate communications systems
NTP	Network time synchronization
SCTE104	Digital Program Insertion cues, precursor to SCTE-35 data
XDS	Server-based scheduling of program-specific XDS data

eeg
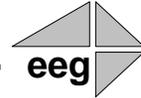
Section 6: Additional Features

Set Clock   **<CTRL+A>c** *Time* **[***Zone***] [***DST***] <ENTER>**

Sets the Encoder's internal clock and stores the settings in Non-Volatile Memory. If no parameters are entered, returns current settings. This information is only used for the optional generation of the Time of Day XDS packet.

- **Time** is the local time on a 24-hour clock, in the format HH:MM:SS.

- **Zone** is the local time zone, expressed by the number of hours local time differs from UTC time. For example, Eastern Standard Time would be entered as 5. If the parameter is omitted, current setting will be retained.

- **DST** sets the Daylight Savings Time status and can be entered as ON or OFF. If the parameter is omitted, current setting will be retained.

Set Date   **<CTRL+A>d** *Date* **<ENTER>**

Sets the Encoder's internal clock for the date and stores the settings in Non-Volatile Memory. If no parameters are entered, returns current settings. This information is only used for the optional generation of the Date XDS packet.

The Date parameter must be entered in the form *MM/DD/YY W* where MM is the month (01-12), DD is the date (01-31), YY is the year (00-99) and W is the day of the week (1-7, with 1 representing Sunday).

Serial Port Configuration

Change Baud Rate   **<CTRL+A>I** *Baud Bits Parity* **<ENTER>**

The Change Baud Rate command can be used to change the communication parameters of any serial data port. Any changes in these settings take effect immediately; you will need to begin using the new settings to continue using the port after entering this command.

- **Baud** sets the new baud rate for the port. Supported rates are 1200, 2400, 4800, and 9600.

- **Bits** sets the number of data bits. Choose either 7 or 8.

- **Parity** sets the parity bit. Choose either o for odd, e for even, or n for none.

Data Port Pin Assignments

Serial ports 1 and 2 use 9-pin DB9 connectors with the following pin assignments:

Pin	DB9 Adapter
1	
2	Tx
3	Rx
4	
5	Ground
6-9	

These ports can be connected directly to a standard PC serial port with a 9-pin, three wire straight serial cable. A "null modem" cable MAY NOT be used for this purpose since it will reverse the connections of pins 2 and 3.

GPIO Connector Pin Numbering

The GPIO pins are located on the two 16-pin connectors on the rear panel of the HD491. The top connector is used for the GPI switches and the bottom is used for the GPO switches, with the pins numbered in the following manner on each connector:

15	13	11	9	7	5	3	1
16	14	12	10	8	6	4	2

GPI Pin Assignments

The GPIs use the upper 16-pin connector, which mates to a female IDC-16 connector. The pin assignments are given in the table below:

Pin(s)	Input
1,3,5,7,9,11,13,15	Ground
2	GPI-A
4	GPI-B
6	GPI-C
8	GPI-D
10	GPI-E
12	GPI-F
14	GPI-G
16	GPI-H

GPO Pin Assignments

The GPOs use the lower 16-pin connector, which mates to a female IDC-16 connector. The pin assignments are given in the table below:

Pins	Output
1,2	1
3,4	2
5,6	3
7,8	4
9,10	5
11,12	6
13,14	7
15,16	8

GPI Switch Functions

Each GPI Switch is activated when closed (connected to ground), and inactive when open (left floating). The default GPI function mappings are defined as follows:

GPI-A: Force 608 Up-conversion
Activating this function causes upconverted 608 caption data from the SD video input to be encoded onto the HD video outputs, even in the presence of upstream captioning on the HD input. Locally input data will still override the upstream 608 data, but all upstream VANC caption data will be ignored.

GPI-B: Modem Lockout
Activating this function disables the dial-up modem for data input. The modem will still answer calls, but users will not be able to enter caption data. If a modem user is entering data, and then this switch is closed, the modem user will be cut off from entering more data

GPI-C: Port 2 Lockout
Activating this function disables P2 for data input. Users connected to P2 will not be able to enter any caption data, and if a user is inputting data and then the switch is closed, the serial port user will be cut off from entering more data.

GPI-D: Force Regeneration
Activating this function causes all locally input caption data to be ignored. Upstream caption data will be regenerated as if no local caption modes were active.

GPI-E through GPI-H: No functionality currently defined

The GPI switches can also be manually configured to perform caption display relocation. Caption displays can be remapped to avoid either the top rows or bottom rows of the television screen to avoid blocking emergency information, news crawls, or other important graphics. These functions provide compliance with FCC requirements that emergency alert information be visible to closed caption viewers.

Configure GPI Switches <CTRL+A>R *GPI-A GPI-B GPI-C GPI-D* <ENTER>

Each of the four parameters assigns a function to the respective GPI switch. Each parameter should be set to either – (subtract sign), to indicate that the switch should perform its default function, or a two character string that will create a new caption relocation function. The first character of a caption relocation function should be either **t** to protect an area at the top of the screen by bumping captions down, or **b** to protect an area at the bottom of the screen by bumping captions up. The second character should be an integer between 2 and 4, indicating the number of SD captioning rows that should be protected (HD captions will avoid an approximately equivalent portion of the screen). Once a caption remapping function has been created, simply close the corresponding GPI switch to activate it.

Example: **<CTRL+A>R – b3 t2 - <ENTER>** assigns the second GPI switch to bump captions up from the bottom 3 SD rows and the third switch to bump captions down from the top 2 SD rows, and leaves the first and fourth switches to perform their default operations.

GPO Switch Functions

Each GPO consists of a pair of pins, forming a switch that is CLOSED when the output is ON, and OPEN when the output is OFF. The default GPO function mappings are defined as follows:

GPO-3: iCap™ Server Connection
If iCap™ is active on your HD491, checking **Monitor connection on GPO-3** on the iCap™ configuration page will cause GPO-3 to close when your encoder has a valid connection to an iCap™ server, and open when iCap™ is not connected.

GPO-4: CC1/S1 Activity
If iCap™ is active on your HD491, checking **Monitor S1 activity on GPO-4** on the iCap™ configuration page will cause GPO-4 to close when your encoder is receiving real-time caption data for CC1/S1 through iCap™, and open when the iCap™ connection is idle.

Other GPOs: No functionality currently defined

Encoder Status Commands

Report Identification   <CTRL+A>? <ENTER>

Returns the Encoder's model, serial number, and firmware version.

Report Port Activity   <CTRL+A>O <ENTER>

Returns a table displaying which ports last entered data for each data type. The port that last entered data for each data type is marked with an A in the table. The data types are primary language captioning (CF1), secondary language captioning (CF2), primary text services (TF1), secondary text services (TF2), and XDS.

Modem Status   <CTRL+A>+ [*Modem*] <ENTER>

Returns the status of the specified modem as either On Hook or Off Hook. The Modem parameter need not be entered to view the status of MA, the built in dial up modem.

Recovery Status   <CTRL+A>A <ENTER>

Returns the data recovery status of each Line 21 channel for incoming SDI video. ON indicates that data on the channel is being recovered and processed. OFF indicates that the channel has been turned off (see page 19) and incoming data is being ignored.

SD Video Presence   <CTRL+A>b <ENTER>

Reports either Video Present or No Video Present to indicate whether or not the Encoder is receiving an SDI video signal.

Report Switch Setting   <CTRL+A>S <ENTER>

Returns the current setting of the front panel INSERT ON bypass switch.

Report Battery Level   <CTRL+A>Y <ENTER>

Returns the status of the battery that maintains the Encoder's Non-Volatile Memory. GOOD will be returned for a properly functioning battery. BAD will be returned for a battery in need of replacement.

Monitor Line 21   **<CTRL+A>5 [*Channel*] [*I/O*] <ENTER>**
End Monitoring   **<CTRL+C>**

Monitors and displays the CEA-608B caption data encoded in the specified channel. The I/O parameter determines whether the incoming (enter as I) or outgoing (O) data is monitored. The default settings are incoming and CC1.

Appendices

Appendix A: RS422 Configuration

Serial data ports P1 and P2 are individually configurable for RS422 operation. RS422 can be used for greater signal integrity over longer distances.

To reconfigure for RS422:

1. Unscrew and remove the top panel of the Encoder.

2. Locate the adjacent 3-pin selection headers labeled JP3 (sets P1) and JP5 (sets P2) on the EEG video board. If you are looking at the board with the rear panel of the Encoder facing towards you, pin 1 is the left-most pin on the header.

3. The serial ports will be set for RS232 if the jumpers on the selectors connect pins 1 & 2. They will be set for RS422 if the jumpers connect pins 2 & 3. Always adjust the jumper setting in tandem.

Appendix B: Grand Alliance Interface Protocol

The following table describes the Data Packet Structure used by EEG equipment to send caption data to Grand Alliance protocol ATSC encoders. This protocol has been proven compatible with encoders from all major manufacturers supporting GA protocol.

Byte	Name	Value	Meaning
0	SOH	0x01	ASCII SOH, start of packet
1	Type	0x41	ASCII "A", ATVCC data
		0x31	ASCII "1", NTSC field 1 data
		0x32	ASCII "2", NTSC field 2 data
2	Count	5+n	Packet size, in bytes, including header and trailer bytes.
3	Data 1		
4	Data 2		CEA-708 data bytes.
2+n	Data n		
3+n	Checksum	\<varies\>	1 byte checksum. The sum of all bytes in the packet must be zero, modulo 256.
4+n	EOT	0x04	ASCII EOT, end of packet

Notes:

1. The maximum packet size is 128 (0x80).

2. Because the packet size (Count) includes the header and trailer bytes, the minimum valid count is 5. This corresponds to a packet with zero data bytes.

3. This packet structure is applied only to the data for the closed caption serial stream input to the ATSC encoder. Outgoing bytes in the ATSC stream follow the CEA-708B standard.

Appendix C: Smart Encoder Command List

Local Entry Modes
  <u>Regeneration Mode:</u>

Regenerate Upstream VANC	**<CTRL+A>! [ON/OFF] <ENTER>**
Ignore Upstream Caption Channel	**<CTRL+A>6 Channel <ENTER>**
Return Upstream Caption Channel	**<CTRL+A>7 Channel <ENTER>**
Begin PassThru Mode	**<CTRL+A>3 [Pairing] [Field] <ENTER>**
End PassThru Mode	**<CTRL+C>**
Begin RealTime Mode	**<CTRL+A>2 [Channel] [Rollup] [bBase] <ENTER>**
End RealTime Mode	**<CTRL+C>**

HD Output Types
  <u>HD VANC Insertion:</u>

VANC Insertion Disabled	**<CTRL+A># OFF <ENTER>**
VANC Insertion Enabled	**<CTRL+A># ON <ENTER>**
VANC Line Change	**<CTRL+A>f 334 [Line] <ENTER>**
VANC No 333 Detection	**<CTRL+A>f vanc [Line] <ENTER>**

<u>333 Serial Output:</u>

333 Output Manual configure	**<CTRL+A>f 333 <ENTER>.**

<u>GA Serial Output:</u>

GA Serial Output	**<CTRL+A>f ga <ENTER>.**

XDS Insertion
  <u>XDS Entry:</u>

Enable XDS Entry	**<CTRL+A>O XDS O <ENTER>**
Load XDS Packet	**<CTRL+A>P Packet Duration Content [Priority] <ENTER>**
Sample XDS entries	**<CTRL+A>P 103 –1 {Evening News} <ENTER>**
	<CTRL+A>P 105 00.30.00 4844 <ENTER>

  <u>XDS Packet:</u>

Load Default XDS Packet	**<CTRL+A>P LPacket Duration Content [Holdoff] <ENTER>**
Sample XDS entries	**<CTRL+A>P L105 –1 4840 <ENTER>**
Load NVM XDS packet	**<CTRL+A>w <CTRL+A>P Packet -1 Content <ENTER>**
Report XDS Queue	**<CTRL+A>e [Packet] <ENTER>**
Delete XDS Packet	**<CTRL+A>P Packet <ENTER>**
Block Upstream XDS	**<CTRL+A>T -Class00 <ENTER>**
End Blocking	**<CTRL+A>T Class00 <ENTER>**
End Blocking Example	**<CTRL+A>T –0100 <ENTER>**

URL Encoding

<u>Message Input:</u>

Begin Message Input	**<CTRL+A>0 Title [Channel] [Repeat] [K/D] [O/H] [N/L] <ENTER>**
End Message Input	**<CTRL+C>**
Transmission delay	**<CTRL+B> Delay (delay in seconds)**
Message Input Example	**<CTRL+A>0 EEG_URL T2 3 D O N <ENTER>**
	EEG on the Web <ENTER>
	<http://www.eeg.tv>[t:p][C510]<ENTER>
	<CTRL+C>
Output Message	**<CTRL+A>1 Title [Channel] [Repeat] [K/D] [O/H] [N/L] <ENTER>**
Remove Message from Queue	**<CTRL+A>4 Title [K/D] <ENTER>**
Display Message Status	**<CTRL+A>9 [Channel] <ENTER>**
Begin Set Output Queue	**<CTRL+A>8 [Channel] <ENTER>**
End Set Output Queue	**<CTRL+C>**
Display Output Queue	**<CTRL+A>B <ENTER>**

Additional Features

<u>NVM Command (Non-Volatile Memory):</u>

New NVM Command	**<CTRL+A>w Port [List] Command <ENTER>**
New NVM Command Example	**<CTRL+A>w MA <CTRL+A>O XDS O <ENTER>**
List NVM Commands	**<CTRL+A>x <ENTER>**
Delete NVM Command	**<CTRL+A>w List <ENTER>**

Date and Time

Set Clock	**<CTRL+A>c Time [Zone] [DST] <ENTER>**
Set Date	**<CTRL+A>d Date <ENTER>**

Prom Configurations

List PROM Messages	**<CTRL+A>J <ENTER>**

Serial Port Configuration

Change Baud Rate	**<CTRL+A>I Baud Bits Parity <ENTER>**
Configure GPI Switches	**<CTRL+A>R switch1 switch2 switch3 switch4 <ENTER>**
GPI Switches Example	**<CTRL+A>R – b3 t2 - <ENTER>**

Encoder Status Commands

<u>Status Commands:</u>

Report Identification	**<CTRL+A>? <ENTER>**
Report Port Activity	**<CTRL+A>O <ENTER>**
Modem Status	**<CTRL+A>+ [Modem] <ENTER>**
Recovery Status	**<CTRL+A>A <ENTER>**
SD Video Presence	**<CTRL+A>b <ENTER>**
Report Switch Setting	**<CTRL+A>S <ENTER>**
Report Battery Level	**<CTRL+A>Y <ENTER>**
Monitor Line 21	**<CTRL+A>5 [Channel] [I/O] <ENTER>**
End Monitoring	**<CTRL+C>**
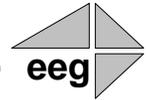
491 Specifications

HD491 HD-SDI Video Inputs

Number of Inputs 2
Connector .... BNC per IEC 169-8
Format .... 1.485 Gbits/s SMPTE 292M (1080i, 720p, 480p, 24psf) or 270 Mb/s SD
Input Level .... 800 mV p-p ± 10%
Input Impedance .... 75 Ohms
Equalization .... Automatic up to 100m @ 1.5 Gb/s with Belden 1694 or equivalent

HD491 HD-SDI Video Outputs

Number of Outputs 3
Output 1 .... Master (relay bypass protected)
Output 2 .... Master copy
Output 3 .... Auxiliary (relay bypass protected)
Connector .... BNC per IEC 169-8
Output Level .... 800 mV p-p ± 10%
Output Impedance .... 75 Ohms
DC Offset .... 0V ± 0.5V
Rise/Fall Time .... 200 pS nominal
Overshoot .... < 10% of amplitude
Wide Band Jitter .... < 0.2 UI

DATA PORTS

LAN .... RJ45 connector, 10/100/1000 Base T TCP/IP
USB .... Three standard USB ports, one on front panel and two on rear
Serial Ports .... Two serial DB-9 jacks, Selectable RS232C / RS422.
Serial Data Input Format .... 7 data bits, odd parity, 1 stop bit, settable between 1200-38400 baud
Modem .... Two RJ-11 telephone jacks (2nd modem optional), 1200/2400 baud
GPI/GPO .... Two ports which each mate to female IDC-16 connectors, Switches rated
.... to 1A / 30 VDC

AUDIO PORTS

Port 1 .... LTC time code input
Port 2 .... Program audio input for streaming audio applications
Connector .... Female XLR
Format .... Balanced analog or AES balanced 110-ohm digital

FRONT PANEL

Display .... Back-lit LCD display with six-button keypad and navigable menus for unit
.... configuration
Power .... Unit power switch with LED indicator
Insert On .... Encoder bypass switch with LED indicator

PHYSICAL

Dimensions .... 19" rack mount x 1 RU x 25" deep

ELECTRICAL

Power .... 115/230V AC 50/60Hz