

UPC-28C

UPC-28C Two Audio Channel Plus Closed Captioning Infrared Emitter & Accessories.

INSTRUCTION MANUAL

One Year Limited Warranty



USL, Inc. warrants that each product manufactured by it will be free from defects in material and workmanship under normal usage for a period of one (1) year after its purchase new from an authorized dealer. Our obligation under this warranty is limited to repairing or replacing any product or component which we are satisfied does not conform with the foregoing warranty and which is returned to our factory, freight paid, or serviced by one of our authorized contractors. The foregoing warranty is exclusive and in lieu of all other warranties, whether expressed or implied. Such warranty shall not apply to any product or component (A) repaired or altered by anyone other than USL, Inc. or an authorized service contractor; (B) tampered with or altered in any way or subjected to misuse, negligence or accident or (C) which has been improperly connected installed or adjusted other than in accordance with USL, Inc.'s instruction.

The UPC-28C consists of: IRC-28C Emitter Panel, IRP-20 DC Power Pack, and Mounting Brackets. The IRC-28C is UL listed for compliance with IEC 60065 audio/video and similar electronic apparatus. UL file E307263

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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 produce heat.

9) Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong are 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 they exit from the apparatus.

11) Only use 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.

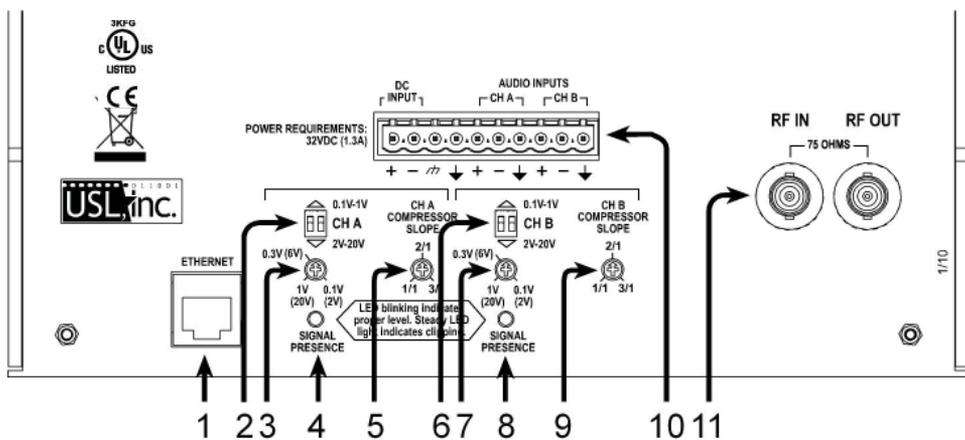
14) Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.

WARNING

To reduce the risk of fire or electric shock, do not expose this appliance to rain or moisture.

Introduction

The IRC-28C transmits two channels of audio plus closed captioning data over infrared. Channel A is transmitted at 2.3MHz. Channel B is transmitted at 2.8MHz. Both carriers are frequency modulated. Channel A is normally used to carry the Hearing Impaired audio, while channel B is normally used to carry the Visually Impaired - Narrative audio.



1. Ethernet Connector
2. and 6. Input audio level range switches for channels A & B.
With both switch keys in the “up” position, the input range is 0.1 to 1.0 Volts RMS. In the down position, the range is 2 to 20 Volts RMS.
3. and 7. Input audio level adjustments for channels A & B.
4. and 8. LED audio level indicators for channels A & B.
5. and 9. Compressor slope adjustments for channels A & B.
Increasing compressor slope improves intelligibility of low level dialog.
10. Main Connector; consisting of the following:
 - a. Pins 1 & 2: DC Power Input Terminals.
Connects to the DC terminals of the 32VDC Power Pack supplied with the IRC-28C. Red wire connects to + terminal (pin 1) connection.
 - b. Pin 3: Chassis Ground Terminal.
The DC power supply connects the AC safety ground to its negative output. No connection is required to this terminal.
 - c. Pin 4: Audio System Ground.

Connect to shield of shielded-pair input cable.

- d. Pin 5 & 6, 8 & 9: Channel A & B Audio Input Terminals.

Channel A is modulated on a 2.3MHz FM carrier. Channel B is modulated on a 2.8 MHz FM carrier. Either or both channels are transmitted by the IR panel. Balanced, differential input. One side of each may be grounded for unbalanced sources. Ground at source is recommended.

- e. Pin 7 & 10: Audio system ground

11. BNC RF Connectors.

RF connectors provide connection to additional emitter panels in multi-panel installations. (see page 12)

Introduction to SMPTE Captioning

The Society of Motion Picture and Television Engineers has established several standards that are used to provide closed captioning in digital cinema. These include:

- **SMPTE 428-7**, which describes the XML (extensible markup language) structure of “timed text” files that are used for subtitles and captions.
- **SMPTE 428-10**, which constrains SMPTE 428-7 for closed captions. These constraints limit the timed text file such that the captions can be displayed on commonly used displays. These constraints deal with the number of lines in a caption, the number of characters in a line, disallow multiple captions at the same time, etc.
- **SMPTE 430-10**, which describes the Auxiliary Content Synchronization Protocol. This protocol provides synchronization information to Auxiliary Content Servers (such as the IRC-28C) that handle captioning, seat shakers, lightning strobes, and other auxiliary content that may be played back in synchronization with the projected image. The IRC-28C initiates a connection over Ethernet to the Digital Cinema Server (DCS). The DCS then tells the IRC-28C where various files required for caption playback are located, tells the IRC-28C when playback is started and stopped, and provides timeline information to the IRC-28C to synchronize the captions with the audio and image.
- **SMPTE 430-11**, which describes the Auxiliary Content Resource Presentation List. This file, created by the DCS, contains a list of the auxiliary resources (such as captions), the time in playout this resource is to be used, and the language of the resource. Using the Auxiliary Content Synchronization Protocol, the DCS tells the IRC-28C where this file is located. The IRC-28C fetches and parses this file. The IRC-28C then uses the information in this file to determine the location, language, and time of use of each of the caption (timed text) files. The IRC-28C then fetches and parses the timed text files and sends them to the displays at the proper time.

UPC-28 Installation

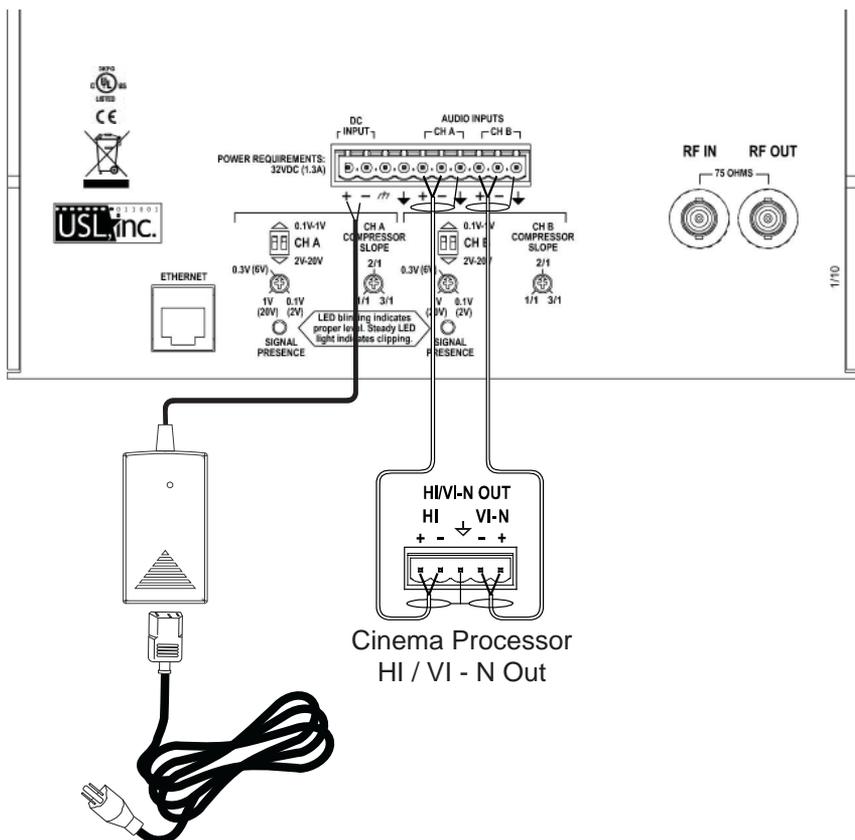
Unpack the carton and verify that all materials are present.

There should be:

- One system manual
- One IRC-28C Emitter Panel
- One IRP-20 DC Power Pack
- One Mounting Bracket composed of 1 ea. IRBS-20 & IRBE-20
- Two 10-32 x 5/8 machine screws for attaching the emitter panel to the mounting bracket.

You will need to supply the following materials:

- A small jeweler's type flat blade screwdriver or trim pot alignment tool for adjusting the input audio levels.
- A medium flat blade screwdriver for attaching the mounting bracket.
- Shielded, two conductor audio cable for connection of the IRC-28C to the program source.
- Eighteen gauge or larger; two conductor "zip" cord to connect the DC power pack to the emitter panel.
- Tools and hardware to attach the mounting bracket to the wall
- One IRH-230 receiver.
- One CCR-100 Closed Captioning Receiver.
- Laptop computer.
- CAT 5 Cable



Initial Audio Configuration and Test

It is easier to configure and test the IRC-28C before it is installed. The configuration and test procedures are listed below.

1. Connect the power supply to the IRC-28C. Note the + and - terminal marking near the terminal strip. Connect the positive (red) wire to the positive terminal.
2. Connect the HI audio to the channel A terminals of the IRC-28C. Connect the VI-N audio to the channel B terminals. Two conductor shielded twisted pair cable is suggested for each audio channel. Connect the two conductors to the + and - terminals of the appropriate channel. Connect the shield to the adjacent ground terminal. If an audio source is unbalanced, connect the - lead to the shield at the audio source.
3. Run programming with HI and VI-N audio. Set the compression slope to 2:1. Adjust the appropriate DIP switches and input level controls to cause the audio level LEDs to flash during normal programming, but not stay lit continuously. Try listening to each channel on IR headphones. If necessary, adjust compression to bring up low levels or reduce noise.

Closed Caption Configuration

The system is configured using a web browser on a laptop computer. Connect the laptop to the IRC-28C using a crossover Ethernet cable. A straight through cable may be used on many laptops, but a crossover will work with all laptops. Set the laptop IP address to 169.254.1.123 with a subnet mask of 255.255.0.0. Open a web browser and go to http://169.254.1.1 . A page similar to that below should appear.

USL Caption Encoder v110209

Please select desired caption language

Language Stream 0	Captions	Debug
Language Stream 1	Captions	Debug
Language Stream 2	Captions	Debug

[System Configuration](#)

Last RPL URL = . Click link to see RPL.

[Telnet to port 10001](#) on this device to see a streaming log.

Click "System Configuration" to get to the configuration screen. You will be prompted for a username and password. The username is admin and the password is ultra. A configuration screen similar to that below should appear.

USL Caption Encoder v110209 Configuration Page

[Home Page](#) | [Status Page](#) | [Update Firmware Page](#)

DCS Configuration

DCS IP Address:

Timeline Offset 0

Positive values make captions earlier

DCS Caption Protocol:

ACS Reboot on Lease Terminate:

Caption Output Configuration

IR Caption Carrier:

RS232 Output:

No RS232 output on IRC-28C.

Offline Text

Delay before Offline Text: seconds

Enter text to be displayed (up to 3 lines)
when no captions available (output mode off):

Caption Language Priority

Select the priority with which caption languages will be selected. The first three languages available on a particular show will be available to users. Do not select the same language more than once. Unused priorities can be set to unassigned

-
-
-
-
-
-
-
-
-
-

Auditorium Data

Theater Name:

Theater Number:

Screen Number:

AES Source:

ProcessorType:

HI System:

VI-N System:

Comments:

Network Configuration

MAC Address: 00:23:A3:02:FF:FF

USL Caption Encoder v110209

Host Name:

IP Address:

Gateway:

Subnet Mask:

Primary DNS:

Secondary DNS:

After hitting Save, you will need to put the new IP address in your browser if you changed the IP address.

Change Password

To change the configuration page password, enter the new password twice, then click on Save New Password.

Starting on the left side of the screen, configure the system using these steps:

1. Set the DCS IP address. This is the Digital Cinema Server IP address the IRC-28C will use to get data from the DCS.
2. Set the timeline offset to 0 Edit Units. If desired, this can be changed to make captions earlier or later. A positive number makes captions appear earlier.
3. Set the caption protocol to SMPTE. The Doremi protocol is also supported, but Doremi also supports the SMPTE protocol.
4. Set ACS Reboot on Lease Terminate to “no”. On rare occasions, it may be necessary to set this to yes. If you find the IRC-28C must be rebooted between shows, set this to yes.
5. Set the IR Caption Carrier to “On Connect to DCS.” This will shut down the caption carrier when the DCS is shut down.
6. Set the delay before offline text. This is the number of seconds after playout stops that the offline text appears.
7. Set the offline text. This text appears on caption displays after playout stops. This is typically a welcome message. The text can be up to 3 lines of up to 32 characters each.
8. Select language priorities. As discussed above, the Auxiliary Resource Presentation List includes the language of each resource. The IRC-28C supports the display of up to three languages on IR receivers. The IRC-28C searches the Auxiliary Resource Presentation List for the languages in the language priority list. If the first language in the priority list is not found, the Auxiliary Resource Presentation List is searched for the next language, etc. Languages are assigned to IR data streams and web streams according to priorities selected here. The first language found is assigned to stream 0 (language 1). Do NOT include the same language in more than one priority position. If the Auxiliary Resource Presentation List does not include language attributes for the caption files, the captions will be sent to stream 0. If the Auxiliary Resource Presentation List has language attributes for the caption files, but the attributes are not standard (for example “English” instead of “en”), the first three languages found will be used. The system will search for nonstandard language attributes only if standard language codes were not found.
9. Once caption configuration settings have been made, click on the save button in the bottom of that field to save the settings.
10. If desired, user data that is not used but is displayed can be set and saved.
11. If desired, the admin password can be set and saved. The password has to be entered in both fields, then Save New Password pressed.
12. Moving to the right side of the screen, set the IP address, gateway,

and subnet mask for the IRC-28C. If desired, a netbios hostname can also be set. Since DNS is not used by the IRC-28C, these fields can be left unchanged.

13. Once the network configuration has been entered, press Save IP Config and Reboot. The IRC-28C will reboot at the new IP address.

14. Connect the IRC-28C to your DCS control network.

15. Reconfigure your laptop for the DCS control network and connect it.

16. You should be able to point the web browser to the new IRC-28C IP address and see the opening screen.

Closed Caption System Operation

When captioned content is played, the IRC-28C should send captions to the display(s) at the appropriate time. The IRC-28C tells the DCS that it is ready to start playback when all assigned languages have data ready for transmission. If a movie only has captions for one language, the DCS is told that the IRC-28C is ready when language 1 (stream 0) is ready.

Restore Button

To restore the IRC-28C to its original state (original firmware, original IP address settings, etc.), use a paper clip to hold down the restore button while powering up the IRC-28C.

The Restore Button is visible through a vent hole on the bottom right of the IRC-28C, when viewed from the front of the plastic side of the IRC-28C

System Status Page

A System Status page is available from the selections at the top of the configuration page. This page shows the last 10 log entries. However, the streaming log, described below, is more useful.

Update Firmware Page

An Update Firmware page is available from the selections at the top of the configuration page. Use this page to load new firmware into the IRC-28C. When the update is complete, a blank page will appear on the browser. Enter the IP address of the IRC-28C in the browser URL field to reconnect to the IRC-28C and verify that the version number has changed to the new version. All user configuration is saved through a firmware update.

Mounting the IRC-28C

Attach the supplied mounting bracket to the wall surface and use the supplied screws to attach the bracket to the emitter. Allow free airflow around the emitter and be sure to have at least four inches clearance from all surfaces, preferably more. The rear panel is used as a heat sink and must be allowed to dissipate heat. The emitter will cover up to 6,500 square feet (77 x 84 feet). The emitter is typically mounted near the projector window. The panel should be “aimed” towards the screen. This typically results in the panel being vertical and parallel to the rear wall of the auditorium. Aiming the panel towards the screen provides additional auditorium coverage from screen reflection.

Note that if the DC power cable needs to be extended, wire sizes in the table below are recommended. In addition, **be very careful to maintain the voltage polarity.**

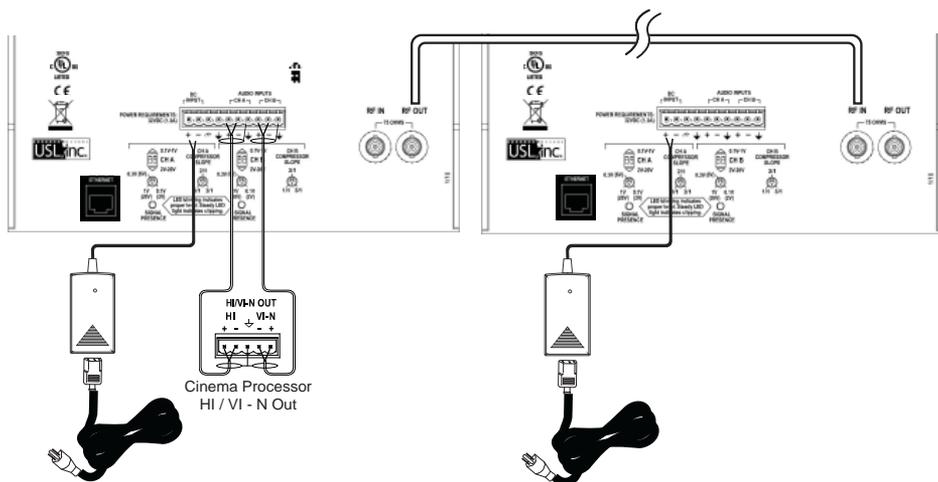
Length (feet)	AWG	Length (meters)	mm ²
60	18	20	0.82
100	16	30	1.31
150	14	50	2.08
200	12	60	3.31

Extend the audio Ethernet and DC power wiring as required.

CAUTION: The rear panel may get quite warm to the touch. This is normal.

Installation Using Two UPC-28Cs

Two or more IRC-28C panels may be cascaded to provide adequate coverage for a very large auditorium. In such a case, one IRC-28C panel becomes the master source with normal audio input(s), level settings and Ethernet connection. An RF feed from the master panel is carried by a 75 ohm coaxial cable (RG-59/U or similar) to the first slave panel (RF Out of the master drives RF In of the slave). The first slave panel then drives the second slave panel, etc. Each panel must be driven by its own power supply. When a channel on the master panel shuts down due to lack of audio, transmission of that channel also ceases on all slave panels. The full power of the master and slave panels is devoted to active audio and captioning channels. If no channels are active, all transmissions cease, saving power and increasing the IR LED life.



Mount additional slave panels adjacent to the master panel. Long coaxial cable runs may introduce sufficient phase delay to cause signals to cancel instead of add. IRC-28 panels may be slaves to an IRC-28C master. If IRC-28C panels are used as slaves, make sure IR caption carrier is set to "off" on slave panels.

TROUBLESHOOTING

Finding The Box

At times, it can be difficult to determine the IP address of the IRC-28C. You can use the Ethernet Discoverer on the USL website to determine the IP address of the IRC-28C. Clicking on the text line for the caption encoder in the Ethernet Discoverer window will open a web browser pointing to that IP address. If the IP address is on the same subnet as your computer, you should see the opening page of the caption encoder.

Streaming Log

The IRC-28C makes a streaming log available on TCP port 10001. You may view this log using telnet, a terminal program such as Tera Term, or by using the PCMan Firefox extension. If the IP address of the IRC-28C is 192.168.1.158, a telnet command to view the streaming log would be “telnet 192.168.1.158 10001”. With the PCMan Firefox extension, it’s possible to just click the “Telnet to port 10001 on this device to see a streaming log.” link on the IRC-28C home page to view the log. A typical streaming log screen from within Firefox is below.

```

0x0000 192.168.1.33 connected to TCP
0x0000 TCP connected to 192.168.1.189:4170
0x0003 Announce DCS: Dolby ShowStore
0x0003 Announce
0x000f Connecting to http://192.168.1.189:80/auxresources/resourcepresentationli
st.xml
0x000f Disconnected from http://192.168.1.189:80/auxresources/resourcepresentati
onlist.xml
0x000f Got 5541 bytes from http://192.168.1.189:80/auxresources/resourcepresenta
tionlist.xml after deleting duplicate spaces
0x0017 RPL /ResourcePresentationList found
0x0017 Searching RPL for languages
0x0097 Stream 0 assigned language: en-us - English (United States)
0x0197 Stream 1 assigned language: es - Spanish
0x0197 Skipping RPL ResourceType MainSubtitle
0x0187 RPL Parsed OK. RplPlayOutID=0x00000000.
0x0187 Rssi
0x01c7 Found /SubtitleReel... Parsing file.
0x05c7 PacketFifo 0 contains 2107 bytai
0x05c7 Found /SubtitleReel... Parsing file.

```

Basic DCS Test

You can verify whether the DCS supports SMPTE captioning by using a laptop to connect to the Content Synchronization Port. Disconnect the IRC-28C from the network. Set your laptop to the IP address of the IRC-28C. Use Tera Term or telnet to connect to the DCS on port 4170. For example, the command “telnet 192.168.1.189 4170” (assuming the DCS IP address is 192.168.1.189) should connect, dump some garbage that normally includes the model of the DCS. If the laptop cannot connect to the DCS on port 4170, there may be networking, DCS configuration, or DCS software issues.

Viewing an RPL

If captions do not run, it is possible that the content does not have captions or the DCS is unable to decrypt the captions. Click the “Last RPL URL” link on the IRC-28C main page. You should see the Auxiliary Resource Presentation List supplied by the DCS. A portion of a typical RPL is shown below.

Note that some servers do not include the IP address in the RPL URL (they use a relative instead of absolute URL). If the IP address does not appear in the RPL link on the IRC-28C home page, click the RPL URL link, then type the DCS IP address in front of the URL in the browser URL field.

```

<as2:ResourcePresentationList PlaylistID="458545505">
-<ReelResources EditRate="24.1" ReelID="urn:umid:ca68e10-c31-4654-828f-7a45e9791b9" TimelineOffset="0">
-<ReelResource IntrinsicDuration="5635" Duration="5443" EntryPoint="192" Language="es" Resource Type="MainSubtitle" Id="urn:umid:a6da592a-7670-46aa-b098-281e100cd64b">
-<ResourceFile>
  http://192.168.1.189/anxresources/anxresource0/a6da592a-7670-46aa-b098-281e100cd64b.xml
</ResourceFile>
</ReelResource>
-<ReelResource IntrinsicDuration="5635" Duration="5443" EntryPoint="0" Language="en-us" Resource Type="ClosedCaption" Id="urn:umid:23067cd8-7f08-4444-a408-690c79f64d4d">
-<ResourceFile>
  http://192.168.1.189/anxresources/anxresource1/23067cd8-7f08-4444-a408-690c79f64d4d.xml
</ResourceFile>
</ReelResource>
-<ReelResource IntrinsicDuration="5635" Duration="5443" EntryPoint="0" Language="es" Resource Type="ClosedCaption" Id="urn:umid:72f49ebc-8d46-4a6c-b3ba-ca4174f00802">
-<ResourceFile>
  http://192.168.1.189/anxresources/anxresource2/72f49ebc-8d46-4a6c-b3ba-ca4174f00802.xml
</ResourceFile>
</ReelResource>
-<ReelResources EditRate="24.1" ReelID="urn:umid:b1e8092-f222-423a-a391-f334654b9bb9" TimelineOffset="5443">
-<ReelResource IntrinsicDuration="2365" Duration="2173" EntryPoint="0" Language="es" Resource Type="MainSubtitle" Id="urn:umid:8e19d246-a76d-49ae-b6b2-9303e1a35a86">
-<ResourceFile>
  http://192.168.1.189/anxresources/anxresource3/8e19d246-a76d-49ae-b6b2-9303e1a35a86.xml
</ResourceFile>
</ReelResource>
-<ReelResource IntrinsicDuration="2365" Duration="2173" EntryPoint="0" Language="es" Resource Type="ClosedCaption" Id="urn:umid:83ed7b89-1773-45c8-8e69-75abcf1721d9">
-<ResourceFile>
  http://192.168.1.189/anxresources/anxresource4/83ed7b89-1773-45c8-8e69-75abcf1721d9.xml
</ResourceFile>
</ReelResource>
-<ReelResource IntrinsicDuration="2365" Duration="2173" EntryPoint="0" Language="en-us" Resource Type="ClosedCaption" Id="urn:umid:d319d68d-01f1-4548-9c8c-959d949b6f64">
-<ResourceFile>
  http://192.168.1.189/anxresources/anxresource5/d319d68d-01f1-4548-9c8c-959d949b6f64.xml
</ResourceFile>
</ReelResource>

```

In the above RPL fragment, there is a ReelResources element for each reel of the movie. Within each ReelResources element are one or more ReelResource elements. The IRC-28C looks for a ReelResource with ResourceType of Closed-Caption. Note the Language attribute within the ReelResource. Here “en-us” and “es” are shown. If captions are only provided in one language, the Language attribute is optional. Further note that within each ReelResource element is a ResourceFile element. This contains the URL of the timed text file holding the captions. If a ResourceFile is not present, either the movie is not captioned or the DCS was unable to decrypt the captions.

You can also copy the ResourceFile URL into a web browser to see the actual caption file.

Viewing Caption Data

The IRC-28C main page includes links to real time captions for each of the three language streams. When the IRC-28C identifies languages in an RPL, the language codes and their stream assignments are shown in the table at the top of the main page.

Please select desired caption language

Language Stream 0	en-us Captions	en-us Debug
Language Stream 1	es Captions	es Debug
Language Stream 2	Captions	Debug

```

What brings you to
the land of the gatekeepers?
TimelinePID=0x4d5309d4
FrameNum=3153
Current Caption TimeIn=3106
Current Caption TimeOut=3211
Next Caption PID=0x4d5309d4
Next Caption TimeIn[0]=3240
Next Caption TimeOut[0]=3300
SystemStatus=0x6487
RplFifoBytes=0
CaptionFifoBytes[0]=1209
    
```

After clicking on a debug link, the caption text is shown at the top of the screen. Below that is the Program ID of the content currently playing, as reported by the DCS in the Content Synchronization Protocol timeline update message. The FrameNum is the edit unit currently being displayed. This is generated by a clock in the IRC-28C that is synchronized with the DCS using the Content Synchronization Protocol. The Current Caption TimeIn and TimeOut show the edit unit (or frame) number when the caption should appear and when it should disappear. These numbers are calculated from data in the RPL and the timed text files. The playout ID, TimeIn, and TimeOut for the next caption to be displayed are shown next.

The SystemStatus is a hexadecimal number indicating the overall system status. The bit assignments in the SystemStatus word are shown below.

- 0 Connected to server
- 1 Announce request received
- 2 Lease active
- 3 Fetching RPL
- 4 Parsing RPL
- 5 Fetching timed text
- 6 Parsing timed text
- 7 Stream 0 assigned
- 8 Stream 1 assigned
- 9 Stream 2 assigned
- 10 Language 0 captions ready
- 11 Language 1 captions ready
- 12 Language 2 captions ready
- 13 Caption transfer (toggles every time a caption is transferred into the transmit buffer)
- 14 Output mode enabled

In the sample screen capture, 0x6487 is binary 0110 0100 1000 0111. This is decoded as:

We are connected to the DCS.
An announce request has been received from the DCS
The lease with the DCS is active.
We are not currently fetching an RPL.
We are not currently parsing an RPL.
We are not currently fetching a timed text (caption) file.
We are not currently parsing a timed text file.
Stream 0 is assigned (we have data for language 1).
Stream 1 is not assigned.
Stream 2 is not assigned.
Language stream 0 captions are ready.
Language stream 1 captions are not ready (there is no second language).
Language stream 2 captions are not ready (there is no third language)
Bit 13 will toggle as each caption is displayed.
Output mode is enabled (the DCS is playing content).

RpIFifoBytes shows much data is in the RPL buffer. As an RPL is parsed, the resulting "RPL records" are put in the RPL FIFO. Each record contains information on another file the IRC-28C needs to fetch and parse.

CaptionFifoBytes shows how much caption data we are holding that has not yet been shown. CaptionFifoBytes will increase as timed text files are parsed, then decrease as the captions are played.



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