HDCC-708MULTI-OG2

(CEA-608/CEA-708 Closed Caption/Subtitle Card for the openGear™ Platform)

Multi-Purpose, HD/SD-SDI Closed Caption Card: Inserter, Decoder, Bridge, Monitor, and Transcoder

Configuration Guide

Firmware Version: V2.46
Software Version: V0.56

Part Number 821154, Revision B

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Last Update

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CHAPTER 1
Functionality and I/O Paths

Introduction

Overview

This chapter describes the basic captioning functions that you can perfrom using your Wohler HDCC-708MULTI-OG2 product.

Topics

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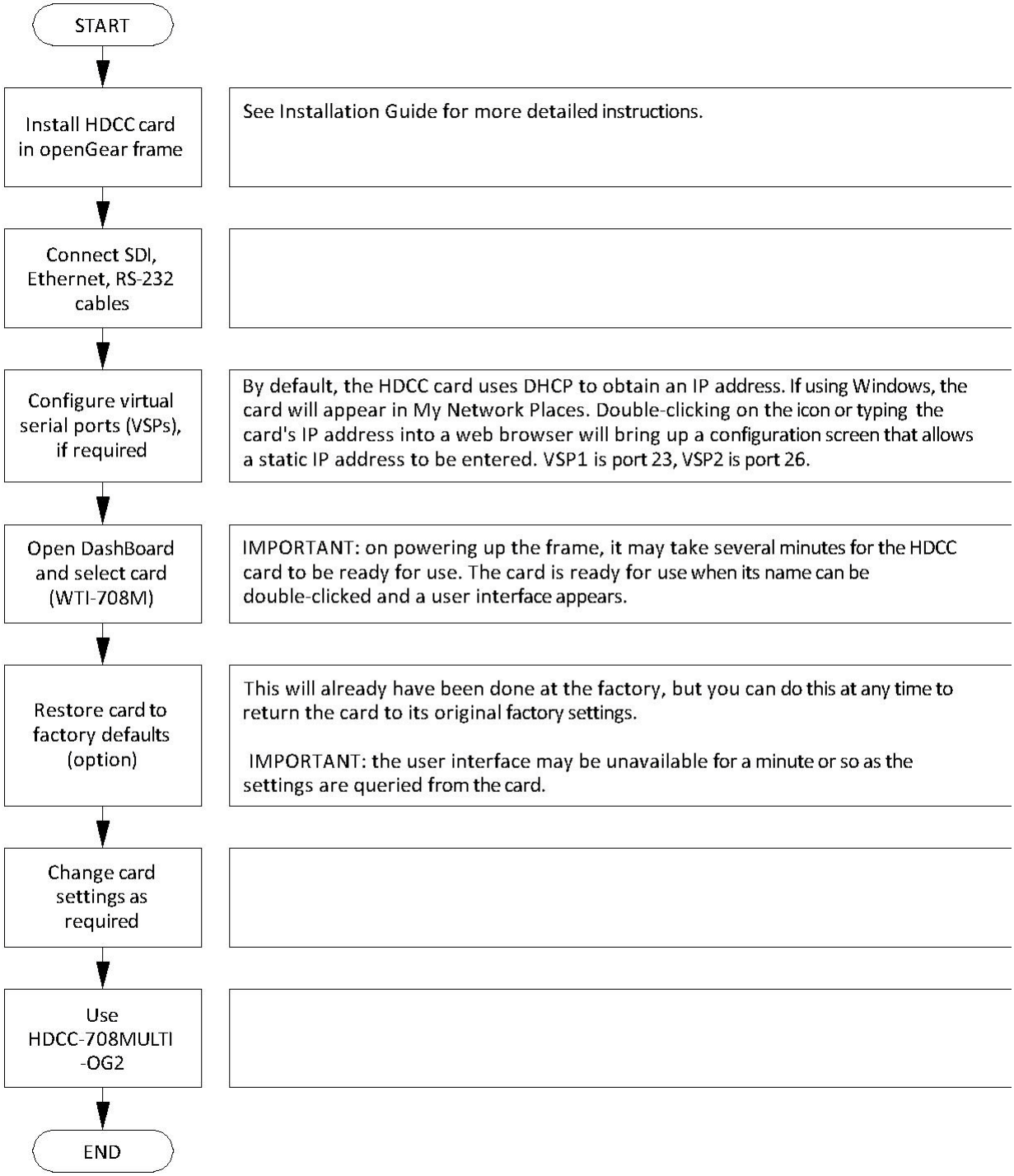
Quick Start Guide

If you are already familiar with Wohler's HDCC product line, this page may be all you need to get it installed and up and running.



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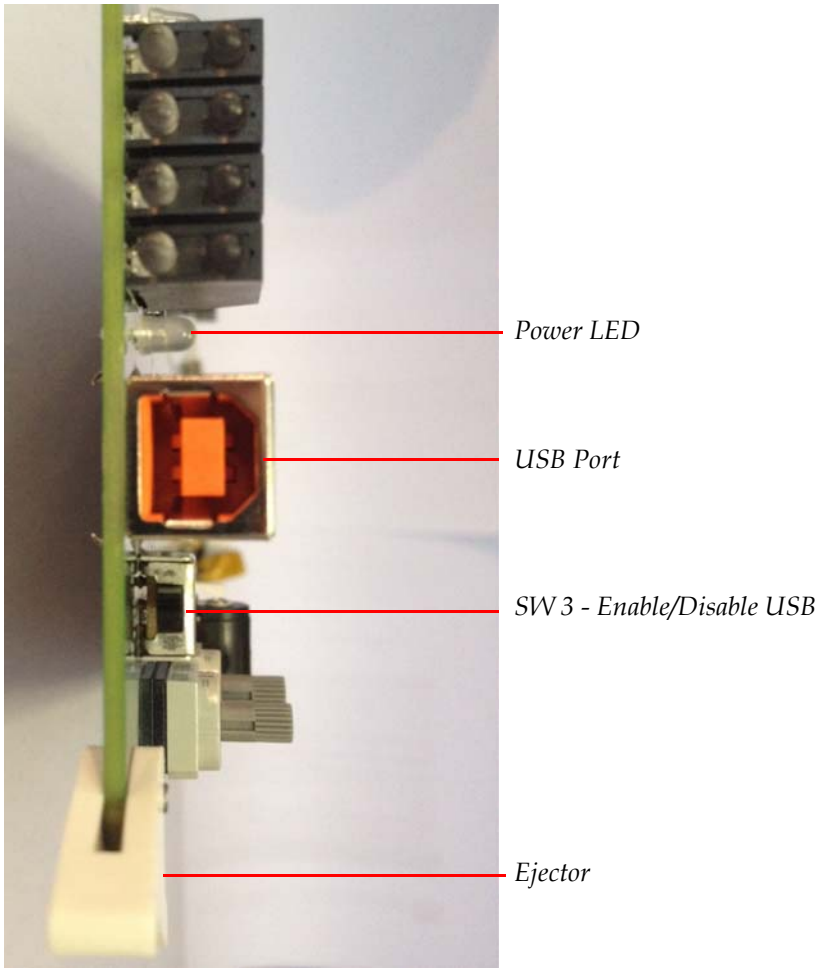
Installation and Front Panel

Refer to the *Installation Guide* (Part Number 821150) for installation information and configuring the Ethernet port as a virtual serial port.

Figure 1–1 HDCC Front Panel



Note: The general purpose input and/or output (GPI/O) functions and pin-outs are described in Connector Pin Assignments on page 33.

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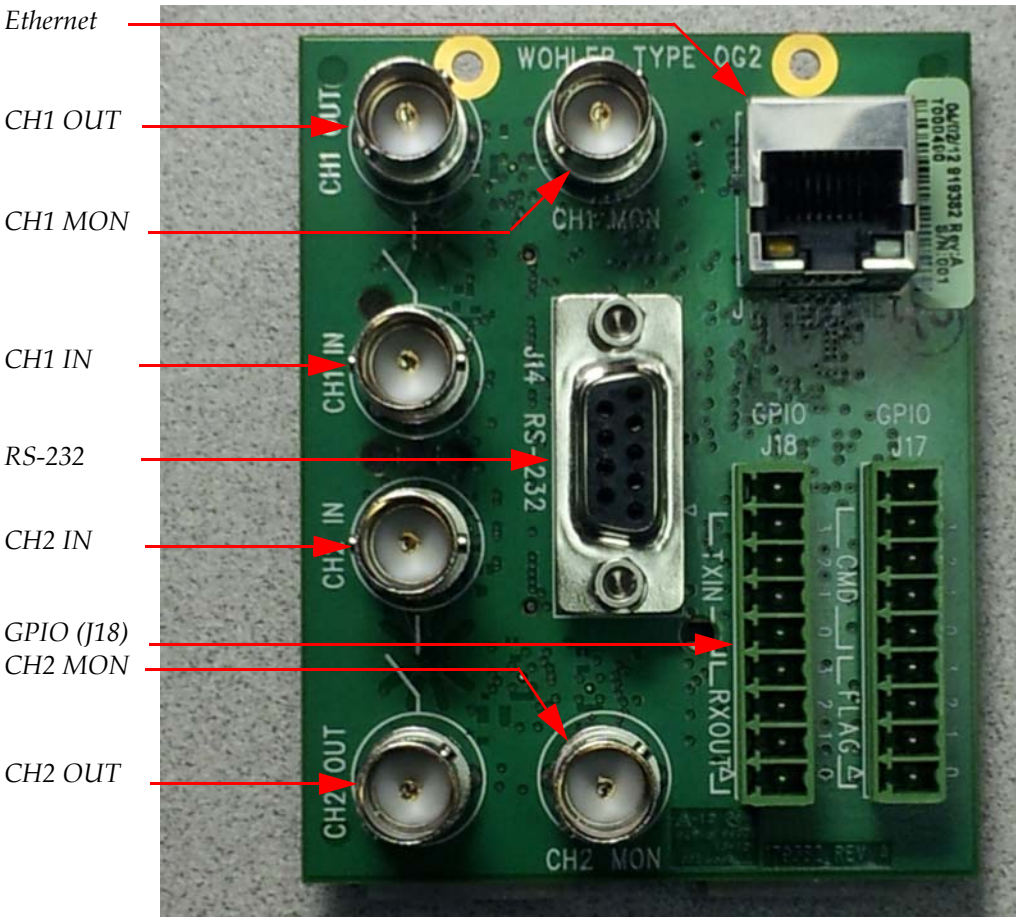
Figure 1–2 OG2 Rear Panel



Basic Functionality

Inputs and Outputs

The Wohler HDCC-708MULTI-OG2 is a system for encoding closed captions on a video stream.

Figure 1–3 shows the input and output configuration of the HDCC-708MULTI-OG2. The inputs are **CH1 IN** and **CH2 IN** and the outputs are **CH1 OUT** and **CH2 OUT**. The monitoring outputs (**CH1 MON** and **CH2 MON**) allow duplicates of the regular outputs to be sent to a monitor for display with burned-in captions to show how the captions will look on a viewer's screen.

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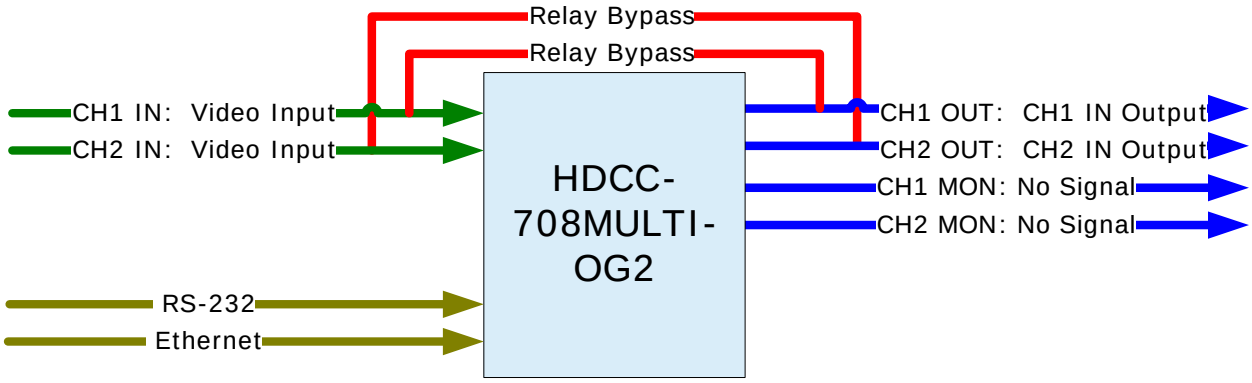
To prevent the loss of the broadcast signal in the event of power failure, the inputs are bypassed via a relay to each output, ensuring the signal will always pass through the card.

Figure 1–3 I/O Functionality - No Power



Processes

Encoding

The HDCC-708MULTI-OG2 can receive caption data from either the RS-232 port or one of two available Ethernet virtual serial ports, and embed it into the input video stream. The monitoring output channel allows the encoding to be visually confirmed by displaying the video with captions overlaid. Moreover, you can simultaneouly encode Channels 1 and 2 from either the same source or a different one.

Decoding

Decoding is the process of extracting closed caption text data from an SDI video stream, interpreting it, and making it available in human-readable form. For example, if a video/audio stream with embedded caption data is supplied to **CH1 IN** or **CH2 IN**, the caption text is decoded and supplied through a serial and/or Ethernet connection to a host PC for display. Note that the closed captioned text is not removed from the input video stream.

Monitoring

The HDCC-708MULTI-OG2 provides two output ports (**CH1 MON and CH2 MON**) to verify the captions on the video stream.

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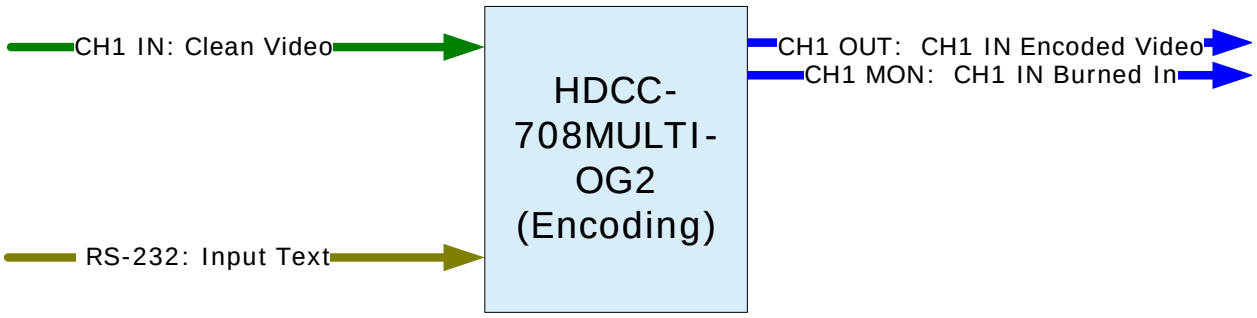
Bridging/Transcoding

As a bridge, the HDCC-708MULTI-OG2 can decode the captions from the input video stream on one channel and encode them onto the video stream of the second channel. If one channel is HD and the other SD, the card will automatically reformat the caption data for the destination frame rate (transcode).

Encoding

The following example shows the connections necessary to encode user-supplied caption data onto the video stream. See Figure 1–4 below.

Figure 1–4 Encoding Setup



Example: The caption data supplied on RS-232 is encoded onto the video stream supplied at **CH1 IN** and output to **CH1 OUT** and **CH1 MON**. Our example uses only channel for simplicity; but you can easily duplicate the results on the second channel using similar inputs.

Connections	
Port	**Data**
CH1 IN	SMPTE HD/SD-SDI video stream with no captions present.
CH1 OUT	SMPTE HD/SD-SDI video stream with user-supplied captions encoded.
CH1 MON	SMPTE HD/SD-SDID video stream with "burned-in" captions to monitor.

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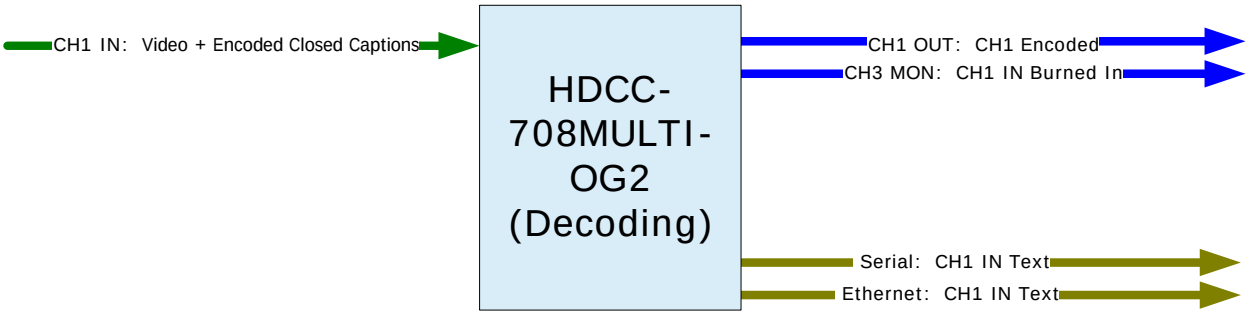
Connections	
Port	**Data**
RS-232	**Input**: Closed caption input data, Grand Alliance/ SMPTE333/CDP format. **Output**: None.
Ethernet	None.

Decoding

Like encoding, a signal that comes in on **CH1 IN** goes out on **CH1 OUT**. In decoding, however, the embedded text is captured and output to the Ethernet port and the RS-232 port. See Figure 1–5 below.

Figure 1–5 Decoding Setup



Example: The caption data supplied on **CH1 IN** is copied to both the **Ethernet** and **RS-232** output ports. Our example uses only channel for simplicity; but you can easily duplicate the results on the second channel using similar inputs.

Connections	
Port	**Data**
CH1 IN	SMPTE HD/SD-SDI video stream with captions present.
CH1 OUT	SMPTE HD/SD-SDI video stream with closed captions present (same as **CH1 IN**).
CH1 MON	SMPTE HD/SD-SDID video stream with "burned-in" captions to monitor.

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Connections	
Port	**Data**
RS-232	**Input**: None. **Output**: Captions from **CH1 IN**.
Ethernet	**Input**: None. **Output**: Captions from **CH1 IN**.

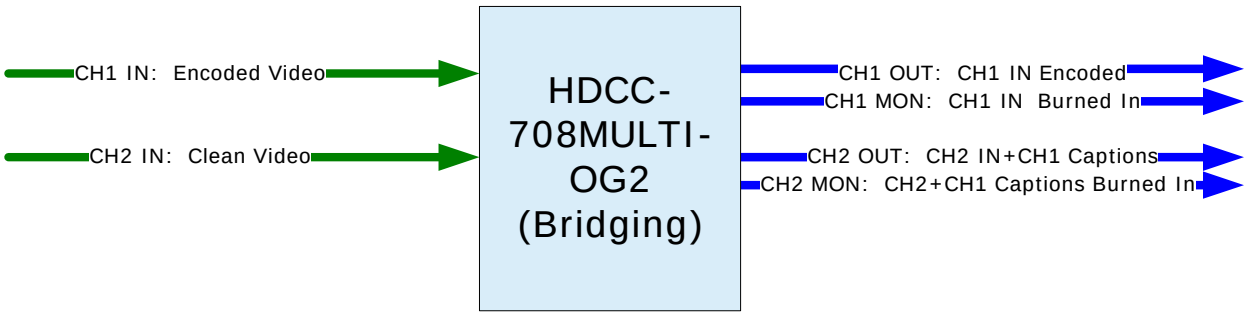
Bridging

The following example shows the connections necessary to bridge captions; that is, to copy the captions from one video stream onto another.

Note: It is not necessary to match the resolutions and/or refresh rates when using multiple inputs, with one exception: the target video frame rate must match or be faster than the source video frame rate.

For example, you can bridge and transcode from a SD-50Hz to a HD-60Hz signal but not the other way around.

Figure 1–6 Bridging Setup (CH1 → CH2)



Example: This example demonstrates decoding. Captions from video provided at **CH1 IN** are copied to video provided at **CH2 IN**. **CH1 OUT** is unmodified copy of **CH1 IN**. **CH2 OUT** is **CH2 IN** encoded with captions from **CH1 IN**.

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Connections	
Port	**Data**
CH1 IN	SMPTE HD/SD-SDI video stream with captions present.
CH2 IN	SMPTE HD/SD-SDI video stream.
CH1 OUT	SMPTE HD/SD-SDI video stream, unmodified from **CH1 IN**.
CH2 OUT	SMPTE HD/SD-SDI video stream from **CH2 IN**, but with captions from **CH1 IN** encoded.
CH1 MON	SMPTE HD/SD-SDI video stream with "burned-in" captions to monitor.
CH2 MON	SMPTE HD/SD-SDI video stream with "burned-in" captions to monitor.
RS-232	**Input**: None. **Output**: Decoded caption data from incoming stream, SMPTE333 or raw.
Ethernet	None.

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CHAPTER 2
Using DashBoard

Introduction

Overview

This chapter explains how to download, install, set up, and use the DashBoard Control System™ (the PC graphic user interface, from here on referred to as *DashBoard*) to configure your HDCC card.

Topics

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Starting DashBoard

The operations of the HDCC card are controlled by the settings of internal registers, which are easily and intuitively configured with DashBoard.

1. Make sure your openGear™ frame is installed, the HDCC card is installed within it, and DashBoard has been installed on a PC that is networked to the frame (see the Installation Guide).

2. Power up the frame to initialize the HDCC card's interface.

   Note: Depending on the frame contents, the card may take several minutes to be ready.

3. Open the DashBoard application by double-clicking the desktop icon or selecting it from the Start menu.

4. When the application opens, it will discover any openGear frames on the network and display them in the left side window of the main screen (Figure 2–1 below) the DashBoard tree. Clicking on the frame's entry in this window will show cards that are installed within it.

Figure 2–1 DashBoard Tree

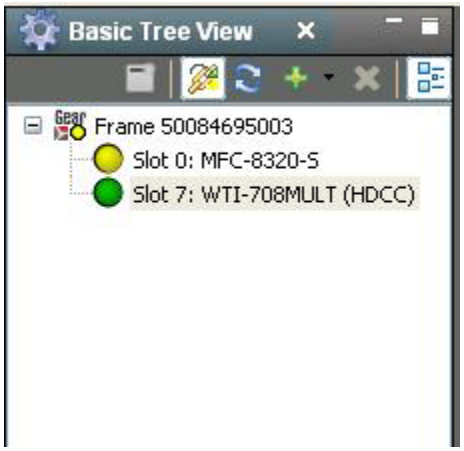

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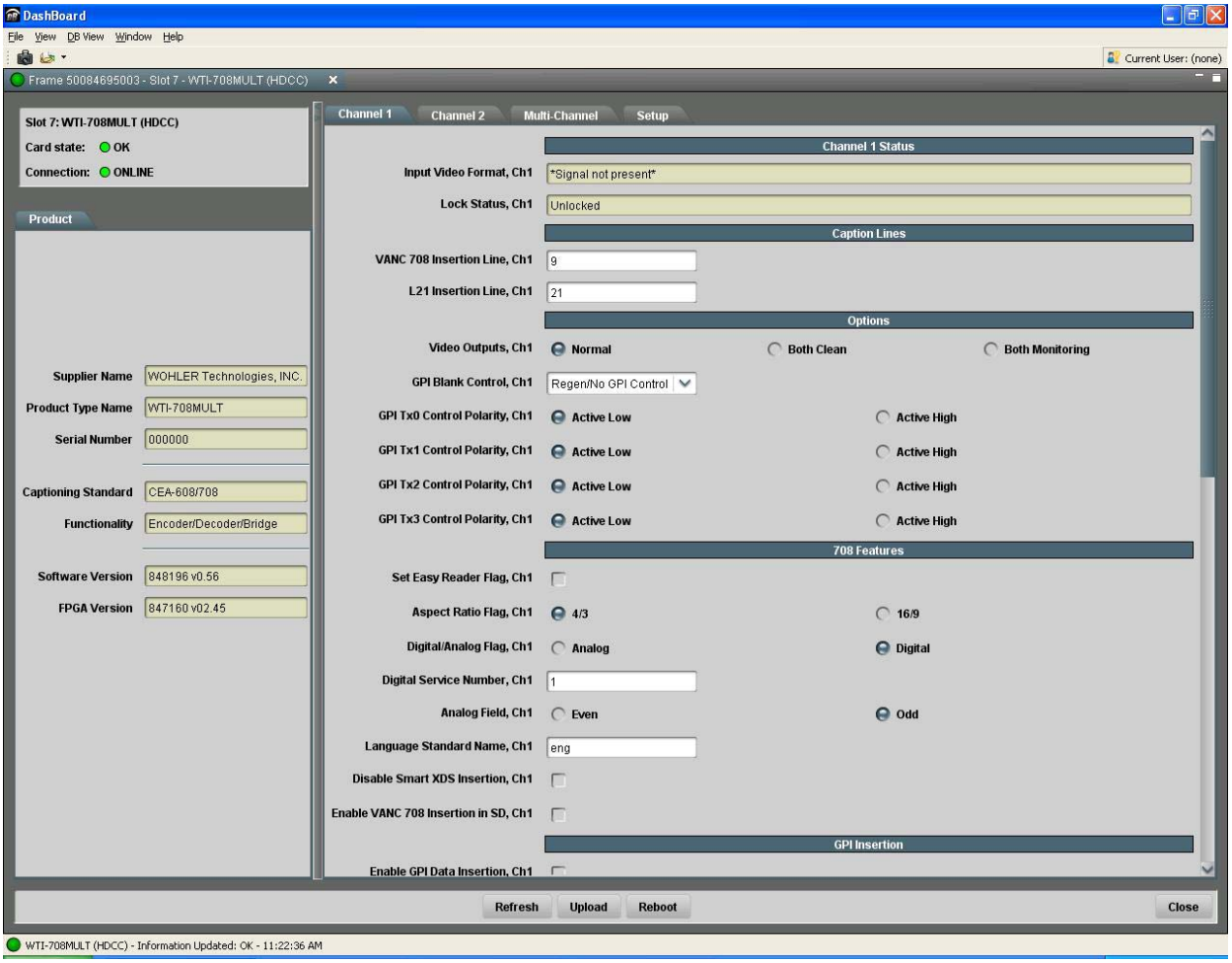
Figure 2–2 DashBoard Main Screen (Top)



Note: The Wohler HDCC-708MULTI-OG2 card will appear as **WTI-708M (HDCC)** in the list of cards installed in the frame.

5. Double-click on the HDCC card in the list of cards and the user interface will appear in the main screen.

6. If everything is in order, the **Card state** and **Connection** indicators in the left frame of the window will be green and product information will appear in the Product submenu (see Figure 2–3 below).

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Figure 2–3 Product Information Pane

Figure 2–3 shows some product details about the HDCC that may be helpful at a future date, including the software and FPGA firmware part numbers and revisions.

If you have a two channel card, you will see both a **Channel 1** and **Channel 2** menu tabs in the right-side frame; if you have a single channel card, you'll only see **Channel 1**. The next section discusses how to configure a channel. The **Setup** menu allows you to configure the routing of the HDCC's serial ports and is discussed in a later section.

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Figure 2–4 Channels 1 and 2 (Top)

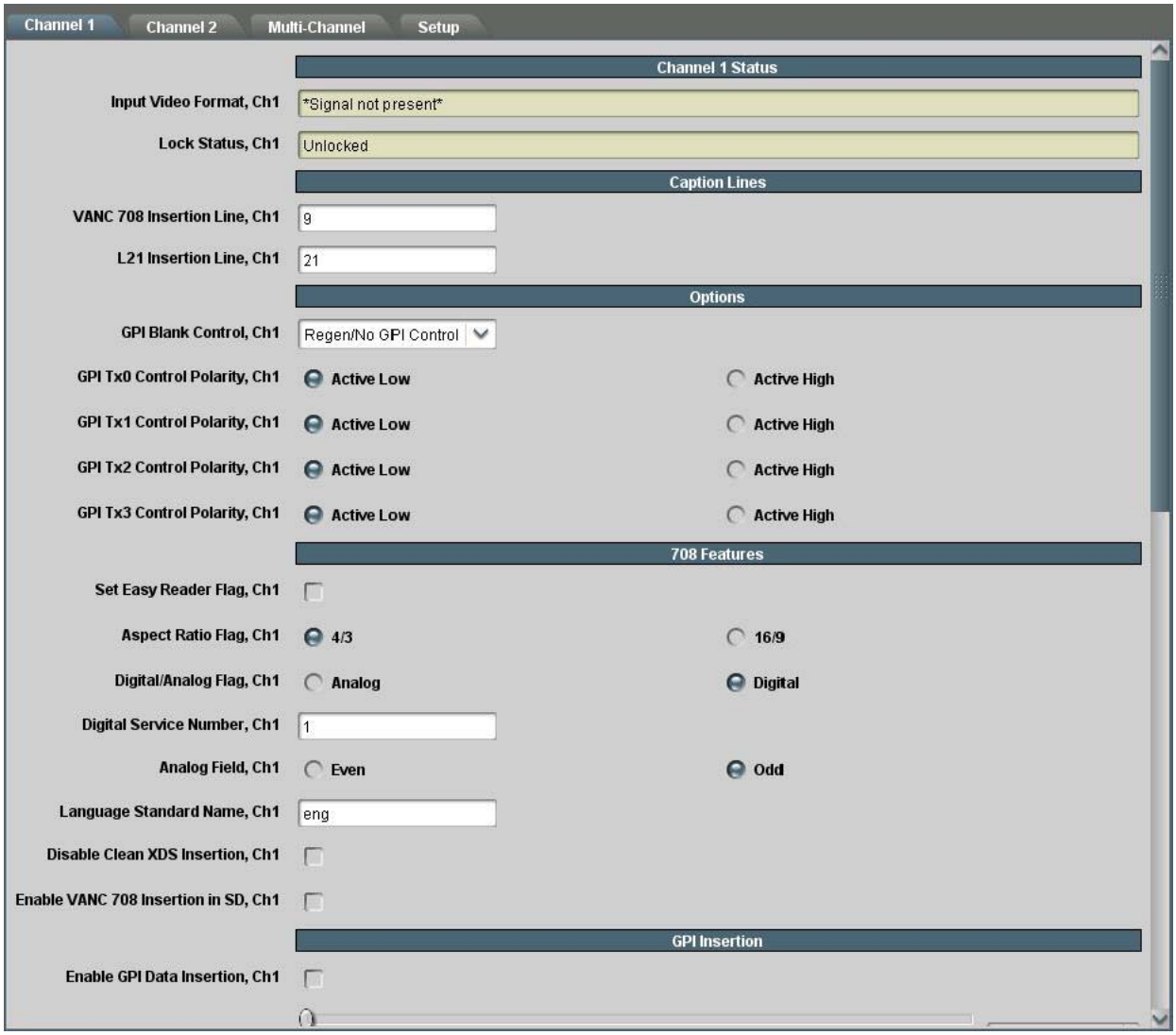

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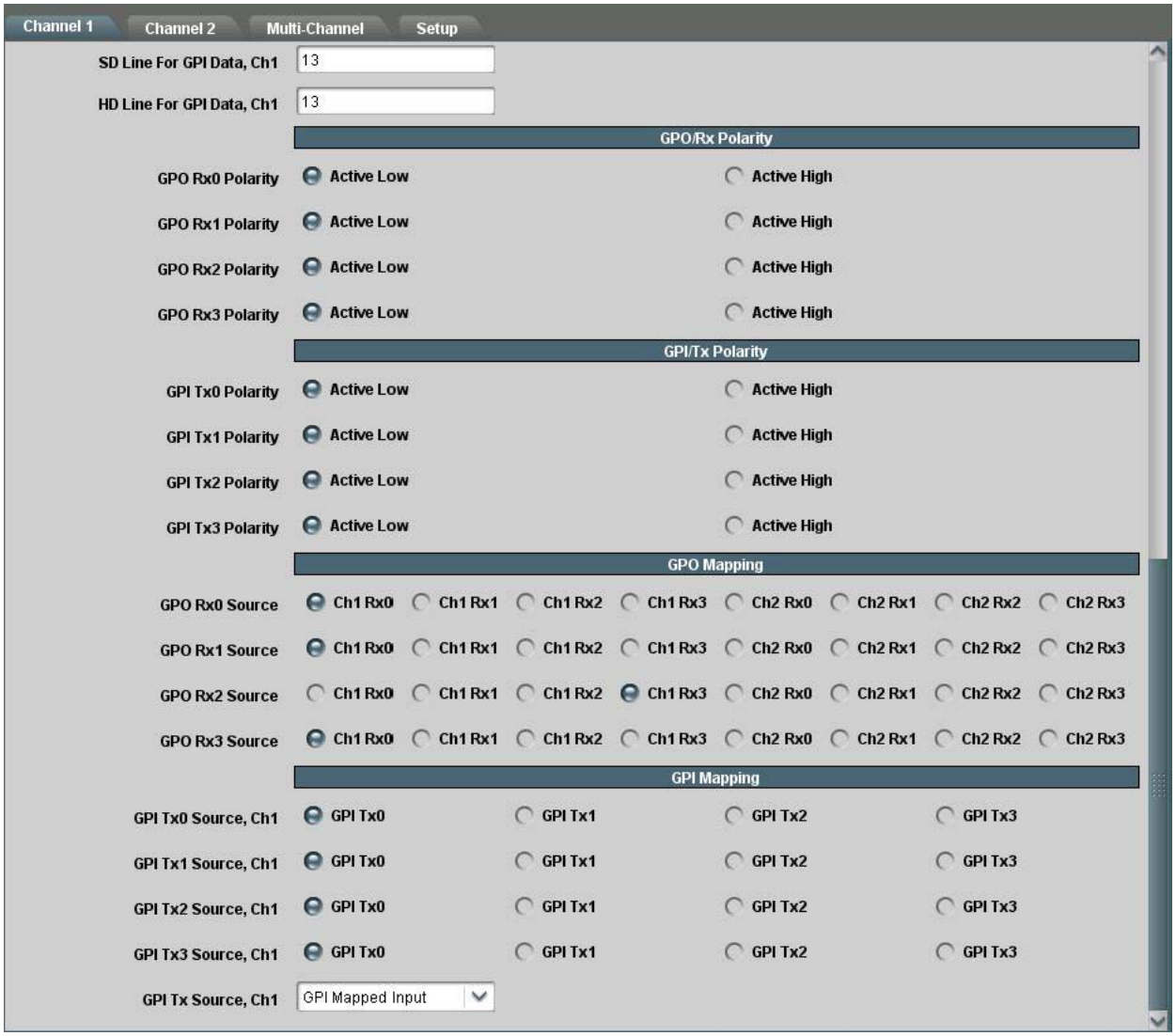
Figure 2–5 Channels 1 and 2 (Bottom)



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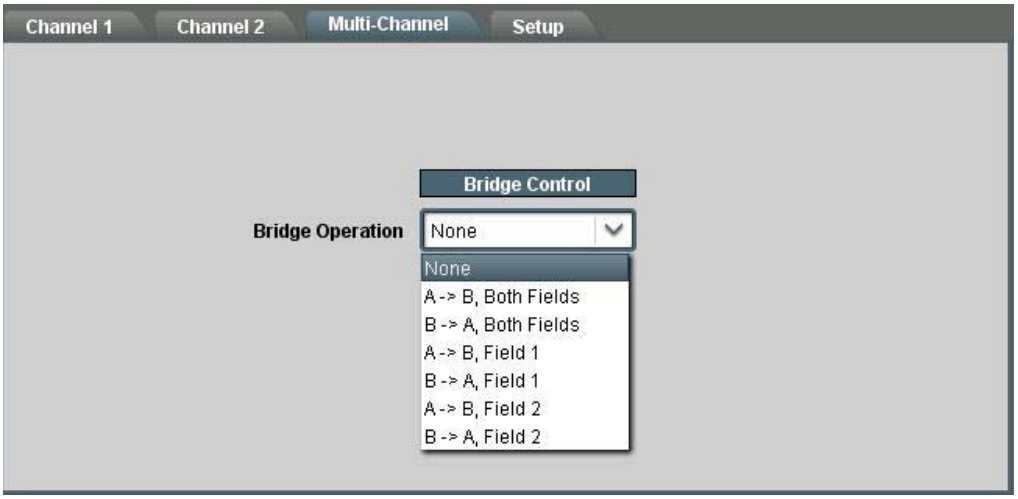
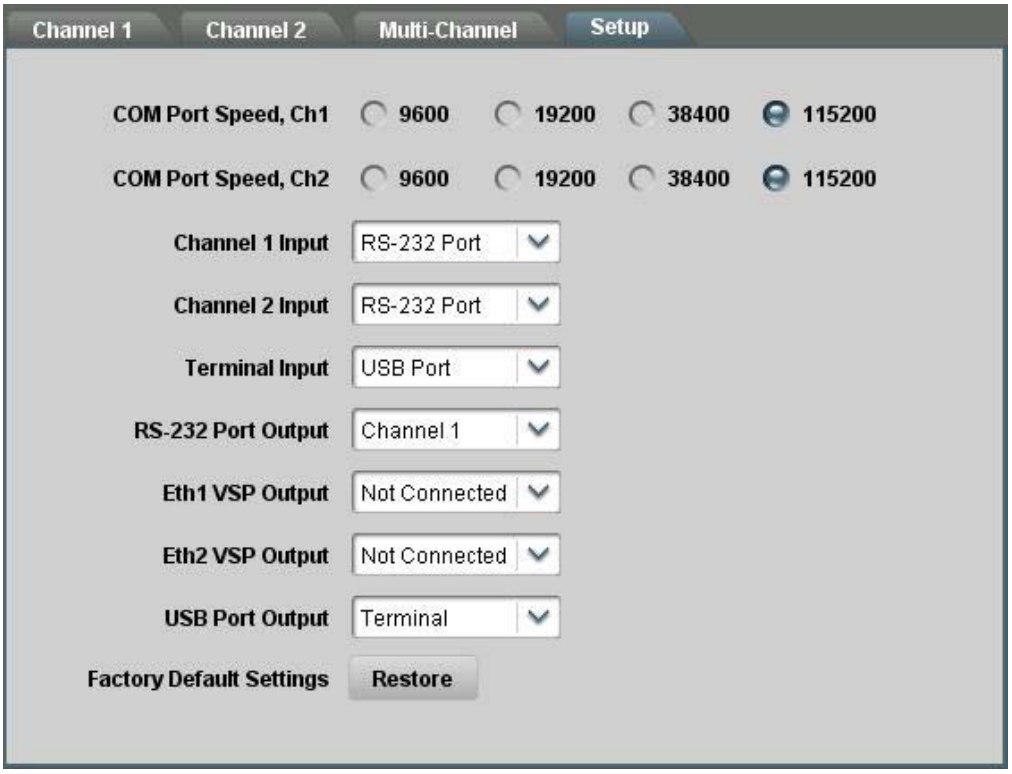
Multi-Channel

Figure 2–6 Multi-Channel Selection



Setup

Figure 2–7 System Setup



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Configuring a Channel

Click the channel tab in DashBoard and change the settings in the Channel 1 submenu (see Figure 2–4 on page 15) to customize your configuration. Repeat the steps for Channel 2.

You'll notice that the submenu is divided into sections, each with a heading that describes the features below. Let's review each section.

Channel 1/2 Status

None of these fields are user-editable; they reflect the state of the input video channel as it is measured.

- **Input Video Format**: The video format (resolution, frame rate) of the incoming signal
- **Lock Status**: Whether the hardware has locked onto an incoming video signal

Caption Lines

- **VANC 708 Insertion Line**: The video line for HD video formats on which captions are present or will be placed.
- **L21 Insertion Line**: The video line for SD video formats on which captions are present or will be placed.

Table 2–1 Caption Lines

Specification	HD Line	SD Line
Domain Range	7 to 25	6 to 25
Channel 1 Register	0x00	0x02
Channel 2 Register	0x20	0x22

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Options

- **Video Outputs**
  - Normal: **CHx OUT** output is clean and **CHx MON** ouput has burned-in captions.
  - Both clean
  - Both monitoring (burned-in)
- **GPI Blank Control**: Specifies how GPI control of caption blanking works:
  - No GPI Control: No GPI stimulus will blank captions.
  - GP1..GP4: Determines which GPI blanks captions.
- **GPI Tx Control Polarities (0..3)**: Controls how GPI inputs are interpreted:
  - Active Low: External switch closure to ground activates.
  - Active High: External switch open activates.

Table 2–2 Output Control

Specification	GPI Blank Control	GPI Command Polarities
Channel 1 Register	0x11: Bits 0..3	0x11: Bits 4..7
Channel 2 Register	0x31: Bits 0..3	0x31: Bits 4..7

708 Features

Note: The register information is presented for reference and is **not** essential for DashBoard operation.

Note: Where two registers are listed, the first is for Channel 1 and the second is for Channel 2.

- **Set Easy Reader Flag**: Click check box to set this flag during transmission. For more information, Refer to Registers 03h in Appendix A.
- **Aspect Ratio**: Click either 4:3 or 16:9 to set this flag during transmission. For more information, Refer to Registers 03h/23h in Appendix A.

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- **Digital/Analog**: If the closed captions are in a digital format, click **Digital**; if analog, click **Analog**. For more information refer to Registers 04h/24h in Appendix A.
- **Digital Service Number**: Enter a number from 1 to 63 inclusive. For more information refer to Registers 04h/24h in Appendix A.
- **Analog Field**: Click either **Even** (for Field 1) or **Odd** (for Field 2). For more information refer to Registers 04h/24h in Appendix A.
- **Disable Clean XDS Insertion**: For more information refer to Register 08h/28h in Appendix A.
- **Enable VANC 708 Insertion in SD**: For more information refer to Register 08h/28h in Appendix A.

GPI Insertion

- **Enable GPI Data Insertion**: Controls whether data provided on the GPI inputs of the card will be encoded on the video signal.

Table 2–3 Enable GPI Data Insertion

Specification	Enable GPI Insertion
Channel 1 Register	0x12: Bit 7
Channel 2 Register	0x32: Bit 7

- **Insertion Timeout**: Click and drag the slider to select the number of seconds for the timeout. For more information refer to Registers 12h/32h in Appendix A.
- **Insertion Mode**: For more information refer to Registers 12h/32h in Appendix A.
- **Custom Apology Message**: Type in the apology message you want to display on the screen when no captions are available.
- **SD Line for GPI Data**: Specifies the line on which the GPI data will be encoded when the signal is SD. For more information refer to Registers 0Ah/2Ah in Appendix A.
- **HD Line for GPI Data**: Specifies on which line the GPI data will be encoded when the signal is HD. For more information refer to Registers 0Bh/2Bh in Appendix A.

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Table 2–4 GPI Data Insertion Lines

Specification	HD Line for GPI Data	SD Line for GPI Data
Domain Range	7 to 25	6 to 22
Channel 1 Register	0x0B	0x0A
Channel 2 Register	0x2B	0x2A

GPO/Rx Polarity

GPO Rx Polarities: Specifies how GPO output of received data will be presented:

- **Active High**: The output voltage is high if the bit is set.
- **Active Low**: The output voltage is low if the bit is set.

Table 2–5 GPO/Rx Polarity

Specification	GPO/Rx Polarity
Channel 1 Register	0x0F: Bits 0..3
Channel 2 Register	0x2F: Bits 0..3

GPI/Tx Polarity

GPI Tx Polarities: Specifies how GPI input of received data will be interpreted:

- **Active High**: The output voltage is high if the bit is set.
- **Active Low**: The output voltage is low if the bit is set.

Table 2–6 GPI/Tx Polarity

Specification	GPI/Tx Polarity
Channel 1 Register	0x0F: Bits 4..7
Channel 2 Register	0x2F: Bits 4..7

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GPO Mapping

GPO Rx (0..3) Sources: Each video signal can have four bits of GPI/O data encoded. This controls how the bits from each channel are mapped to the four outputs (for the OG2 model) or the two outputs (for the OG1 model) on the card.

Table 2–7 GPO Mapping

Specification	GPO Mapping
Channel 1 Register	0x4E
Channel 2 Register	0x4F

GPI Mapping

GPI Tx Sources: These control how the inputs presented at the four (for the OG2 model) or two (for the OG1 model) GP inputs will be encoded on the video channels.

Table 2–8 GPI Mapping

Specification	GPI Mapping
Channel 1 Register	0x13
Channel 2 Register	0x33

Common Controls

At the bottom of the screen (no matter which tab is selected) you can perform two systemic functions.

- **Upload**: Not currently used.
- **Refresh**: Clicking this button causes the card to re-query all the settings. A screen indicating that the card is busy will appear while the system is refreshing.
- **Reboot**: Clicking this button causes the card to reboot. A screen indicating that the card is busy will appear while the system is rebooting.

The Setup Tab

The **Setup** tab allows you to set the Com port speed for both channels and reload the factory default settings.

- **Com Port Speed, Ch 1/2**: Click either 9600, 19200, 38400, or 115200.

Important: If a virtual serial port is connected (for encoding or decoding) the baud rate **must** be 115200.

- **Factory Default Settings**: Clicking the **Restore** button displays a confirmation dialog and then allows you to reload all the factory default settings of the card.

How Do I...?

In this section we provide a list of questers and answers to help you set up and use your new HDCC product as efficiently as possible.

How do I decode captions on Channel 1 and output the data on the RS-232 port?

Situation: You have an incoming video stream on Channel 1 and want to decode the captions on it and output the data through the RS-232 port.

Preparation: Make sure an SDI cable with a valid captioned video stream is connected to input **CH1 IN**, the card/frame is powered and operational, and a serial cable is connected to the **RS-232** port, hooked to a PC with a terminal/decoding program.

Process:

1. In the **Setup** menu, set the **RS-232 Port Output** to "Channel 1" and the **COM Port Speed, Ch1** to the baud rate used by your terminal program. No other output should be set to "RS-232."

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2. Enter the video line for the captions on the **VANC 708 Insertion line, CH1** (if 708) or **L21 Insertion Line**.

Decoded caption data should be output from the **RS-232** port.

How do I decode captions on Channel 2 and output the data on the Ethernet virtual serial port Eth1 VSP (port 23)?

Situation: You have an incoming video stream on Channel 2 and want to decode the captions on it and output the data through virtual serial port **Eth1 VSP**.

Preparation: Make sure an SDI cable with a valid captioned video stream is connected to input **CH2 IN**, the card/frame is powered and operational, an Ethernet cable connects the HDCC card to your computer network, and that you have established an Ethernet virtual serial port (see the Installation Guide for instructions on doing this).

Process:

1. In the **Setup** menu, set the **Eth1 VSP Output** to "Channel 2" and the **Channel 2 COM Port Speed, Ch2** to 115.2k. The baud rate for a channel must always be set to 115.2k when an Ethernet virtual serial port is connected to it; however, your PC's terminal emulator can still set the baud rate to any desired setting in the range 9,600 to 115.2k. No other output should be set to "Eth1 VSP."

2. Enter the video line for the captions on the **VANC 708 Insertion line, CH2** (if 708) or **L21 Insertion Line, CH2** (if 608).

Decoded caption data should be output from the **Eth1 VSP** port.

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How do I decode captions on either channel using ANY port?

Situation: You want to generalize decoding process.

Preparation: A cable with a valid captioned video stream must be connected to the channel you'll use for decoding (if you'd like, you can use both channels for simultaneous decoding of two different video streams), the card/frame must be powered and operational, and you must have at least one of the following:

- A serial cable connected to the **RS-232** port;
- An Ethernet cable connecting to your network and one or two virtual serial ports configured; or
- A USB cable connected to the **USB** connector on the front edge of the board.

Any of these three connectivity methods can be used to output decoded data.

Process:

1. In the **Setup** menu, set the output of your chosen connectivity method to the channel you wish to decode (e.g., **Eth2 VSP Output** set to "Channel 1") and make sure no other outputs are set to that same connectivity method.
2. Enter the video line for the captions on the **VANC 708 Insertion line, CHx** (if 708) or **L21 Insertion Line, CHx** (if 608).

Decoded caption data should be output from your selected connectivity method.

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How do I encode captions on Channel 1 using the RS-232 port?

Situation: You have an incoming video stream on Channel 1 and you want to encode captions on it using data supplied by **RS-232**.

Preparation: Make sure a cable with a video stream is connected to **CH1 IN** input, the card/frame is powered and operational, and a serial cable is connected from your caption generator to the card's **RS-232** port.

Process:

1. In the **Setup** menu, set the **Channel 1** input to "RS-232" and the **COM Port Speed, CH1** to the baud rate used by your captioning system.

2. In the **Channel 1** menu, in the **Caption Lines** section, set the **VANC 708 Insertion Line, CH1** (if signal is HD) or **L21 Insertion Line, CH1** (if SD) to the video line to which you want the captions encoded.

Caption data supplied on **RS-232** will be encoded on the video stream coming out of **CH1 OUT**.

How do I encode captions on Channel 1 using a Virtual Serial port?

Situation: You have an incoming video stream on Channel 1 and you want to encode captions on it using data supplied by virtual serial port **Eth1 VSP**.

Preparations: Make sure a cable with a video stream is connected to **CH1 IN** input, the card/frame is powered and operational, an Ethernet cable connects the HDCC card to your network, and that you have established an Ethernet virtual serial port (see the Installation Guide for instructions on doing this).

Process:

1. In the **Setup** menu, set the **Channel 1** input to "Eth1 VSP" and the **COM Port Speed, Ch1** to 115.2k. The baud rate for a channel must always be set to 115.2k when an Ethernet virtual serial port is

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connected to it; however, your captioning system can still set the baud rate to any desired setting in the range 9,600 to 115.2k.

2. In the **Channel 1** menu, in the **Caption Lines** section, set the **VANC 708 Insertion Line, CH1** (if signal is HD) or **L21 Insertion Line, CH1** (if SD) to the video line to which you want the captions encoded.

Caption data supplied on **Eth1 VSP** will be encoded on the video stream coming out of **CH1 OUT**.

How do I encode captions on EITHER channel using ANY port?

Situation: You want to generalize the process of encoding.

Preparation: Make sure a cable with a video stream is connected to your selected channel (or signals to both channels, if you'd like to encode two streams simultaneously), the card/frame is powered and operational, and you have at least one of the following:

- A serial cable connected to the **RS-232** port;
- An Ethernet cable connecting to your network and one or two virtual serial ports configured; or
- A USB cable connected to the **USB** connector on the front edge of the board.

Any of these 3 connectivity methods can be used to output decoded data.

Process:

1. In the **Setup** menu, set your selected channel's input to your preferred connectivity method and set the **COM Port Speed** for that channel as required. Remember, the baud rate for a channel must always be set to 115.2k when an Ethernet virtual serial port is connected to it.

2. In the **Channel** menu (for the channel you want to configure), in the **Caption Lines** section, set the **VANC 708 Insertion Line, CHx** (if signal is HD) or **L21 Insertion Line, CHx** (if SD) to the video line to which you want the captions encoded.

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Caption data supplied by your chosen connectivity method will be encoded on the video stream coming out of the output for your selected channel.

How do I bridge captions from Channel 1 to Channel 2?

Situation: You have captions on one video stream and want to bridge them to another video stream.

Preparation: Connect a cable with the captioned video stream to **CH1 IN**, a cable with the destination video stream to **CH2 IN**, and a cable to **CH2 OUT** for the destination stream with captions bridged.

Important: the destination video frame rate must be greater than or equal to the source video frame rate. For example, captions from a 50Hz source signal can be bridged to a 60Hz destination signal, but not vice versa.

1. In the **Multi-Channel** menu, select either "A->B, Both Fields" (captions on both odd and even fields), "A->B Field 1" (captions on odd fields), or "A->B Field 2" (captions on even fields) from the **Bridge Operation** pull-down menu.

2. You must configure Channel 1 so that the captions are read from the correct video line. In the **Channel 1** menu, enter the video line containing the caption data in either the **VANC 708 Insertion Line, Ch1** (if CEA-708) or the **L21 Insertion Line, Ch1** (if CEA-608).

3. You must configure Channel 2 so that the captions are written to the correct video line. In the **Channel 2** menu, enter the video line containing the caption data in either the **VANC 708 Insertion Line, Ch2** (if CEA-708) or the **L21 Insertion Line, Ch2** (if CEA-608).

4. **CH2 OUT** will output **CH2 IN** video with captions from **CH1 IN**.

5. Set **Bridge Operation** back to "None" when complete.

Note: Bridging can go in either direction. Select one of the "B->A" options in the **Bridge Operation** menu to bridge captions from **CH2 IN** to **CH1 OUT**.

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How do I set general purpose transmission bits on Channel 1?

Situation: You want to set general purpose transmission bits on a video stream to cue downstream equipment, etc.

Preparation: Connect a switch-closing circuit for the **TXIN0-3** pins on connector **J18**. Provide a video input on **CH1 IN** and a video output on **CH1 OUT**.

Process:

1. Check the **Enable GPI Data Insertion, Ch1** checkbox on the **Channel 1** menu.

2. If you want encoding to time out (and revert to passing received data), select an interval using the **Insertion Timeout Ch1** slider in the **Channel 1** menu.

3. Select the insertion mode using the **Insert Mode, Ch1** drop-down list:

   - "Normal" means encoding will time out after the interval selected in step 2.
   - "Permanent, Field 0" will keep the input data present on the odd.
   - "Permanent, Field 1" will keep the input data present on the even field.
   - "Permanent, Both" will keep the input data present on both fields.

4. Enter a video line for the data in **SD Line for GPI Data, Ch1 textbox** (for SD video signals) and in **HD Line for GPI Data, Ch1 textbox** (for HD video signals).

5. The polarity of the input-active high—(a high input means "1") or active low (a low input means "1")—can be set for each of the TXIN0-3 inputs with the controls in the GPI/Tx Polarity section. For example, if GPI Tx0 Polarity is set to "Active Low," then a low input (switch closed) on the TXIN0 pin will correspond to a set ("1") bit in the transmission stream.

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6. The mapping of the TXIN0-3 bits to the transmitted bits can be set with the controls in the **GPI Mapping** section.

7. If **GPI Tx Source, Ch1** is set to "GPI Mapped Input," the transmitted bits will be as assigned by the TXIN0-3 inputs. If pass-through of existing data bits is desired, select "GPI Input OR GPI Rx."

8. Transmitted bits will now be encoded on Channel 1 according to the inputs you provide and the settings you've chosen.

How do I receive general purpose transmission bits on Channel 1?

Situation: You are receiving a video stream with transmission bits encoded upon it and you want to drive the outputs on the GPIO connector based on their values.

Preparation: Connect your video input to CH1 IN. Sense (or provide output circuit for) RXOUT0-3 outputs on J18 connector.

Process:

1. Enter a video line for the data in **SD Line for GPI Data, Ch1 textbox** (for SD video signals) and in **HD Line for GPI Data, Ch1 textbox** (for HD video signals).

2. The polarity of the output-active high—(a high output means a "1" in the transmission stream) or active low (a low output means "1")—can be set for each of the RXOUT0-3 outputs with the controls in the GPO/Rx Polarity section. For example, if GPO Rx0 Polarity is set to "Active Low," then a high transmission bit will correspond to a low output on the RXOUT0 pin.

3. The mapping of the RXOUT0-3 pins to the received bits can be set with the controls in the GPO Mapping section.

   Note: Received bits from either/both video channels can be used to drive the RXOUT0-3 outputs.

4. Received bits will now be represented on the RXOUT0-3 pins of J18 according to the received data bits and the settings you've chosen.

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CHAPTER 3
Using the General Purpose Inputs/Outputs

Introduction

Overview

This chapter describes the functionality of the GPI/O connectors on the adaptors.

Topics

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Functionality

The GPI interface allows the user to encode contact closure triggers into a HD or SD video stream frame accurately. The encoded data uses a proprietary algorithm designed to withstand severe degradation and prevent false triggering or releasing of GPIs. Error checking information is embedded within the GPI data stream which accomplishes this task and is far more advanced than simple CRC.

Typical triggers that users can encode from automation include (but are not limited to:

- ARC switching
- Commercial cue triggers (more accurate than the antiquated cue tone system)
- Machine control
- Regional commercial insertion cards

Typically the GPI data is encoded on Line 13 for both the HD-SDI signals and the SD-SDI signals. However, the HDCC is flexible enough to allow you to assign the lines on which you want the GPI data. See Register Reference on page 36 for details.

You can also use the GPI interface to control other operational aspects of the card.

Figure 3–1 on page 25 illustrates the GPI/O signal flow through the HDCC. For our purposes, a GPI is an input signal to the HDCC card supplied by the user through the physical GPI/O port that can activate certain modes in the HDCC card, and/or can be encoded onto the outgoing SDI video stream to notify downstream equipment of some condition, event, or command. A GPO is a signal the HDCC card receives on the incoming SDI video stream that is output to the physical GPI/O port to signify some condition, event, or command generated by upstream equipment.

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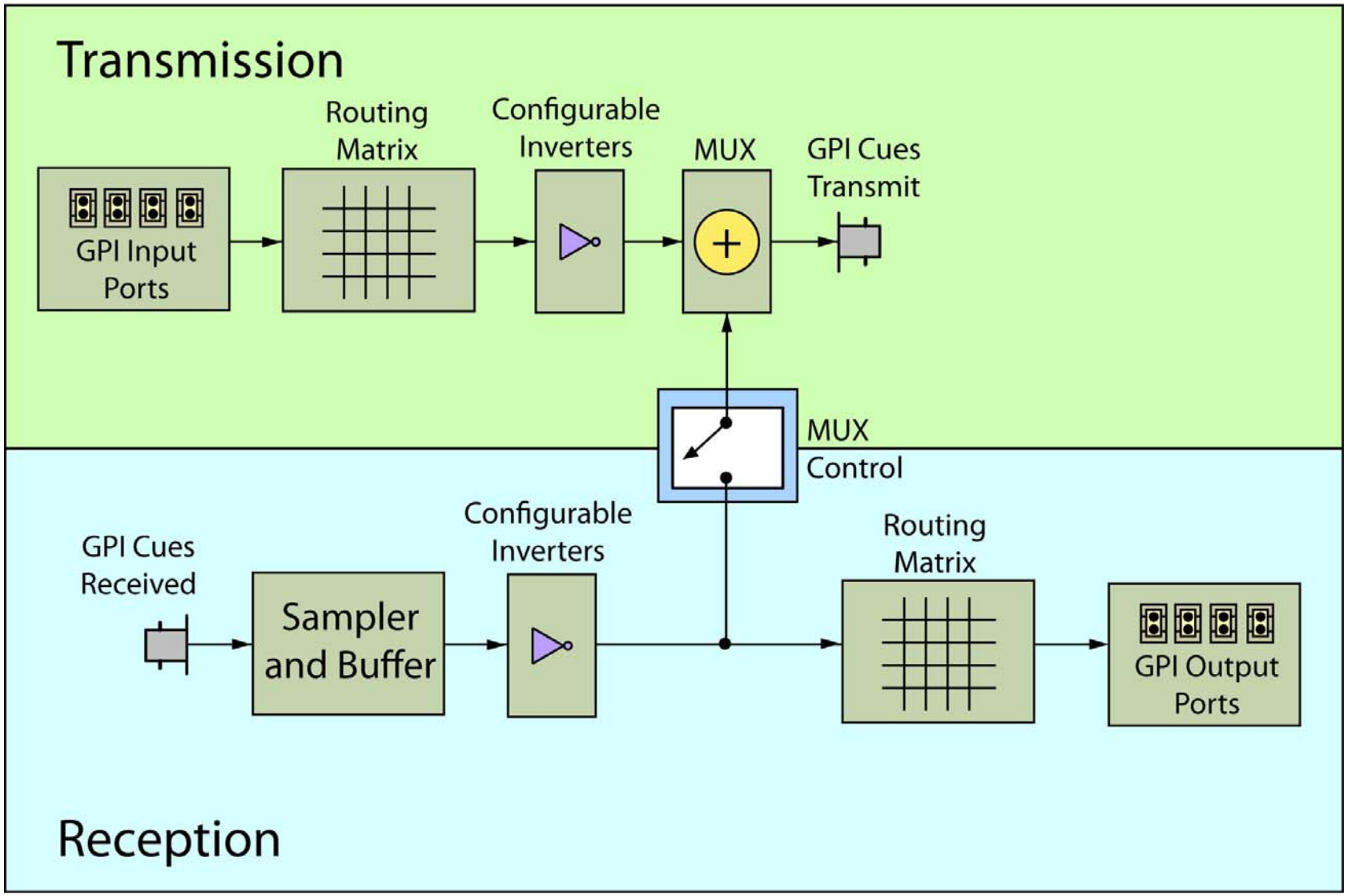
Figure 3–1 GPI/O Functional Diagram



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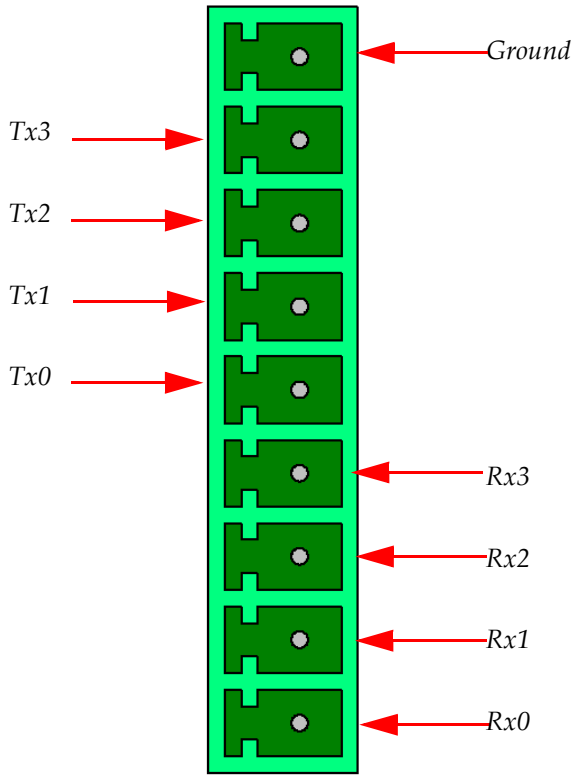
GPI/O Connector

Connector J18 on the rear panel provides general purpose input and output.

Figure 3–2 J18 Phoenix Connector Diagram



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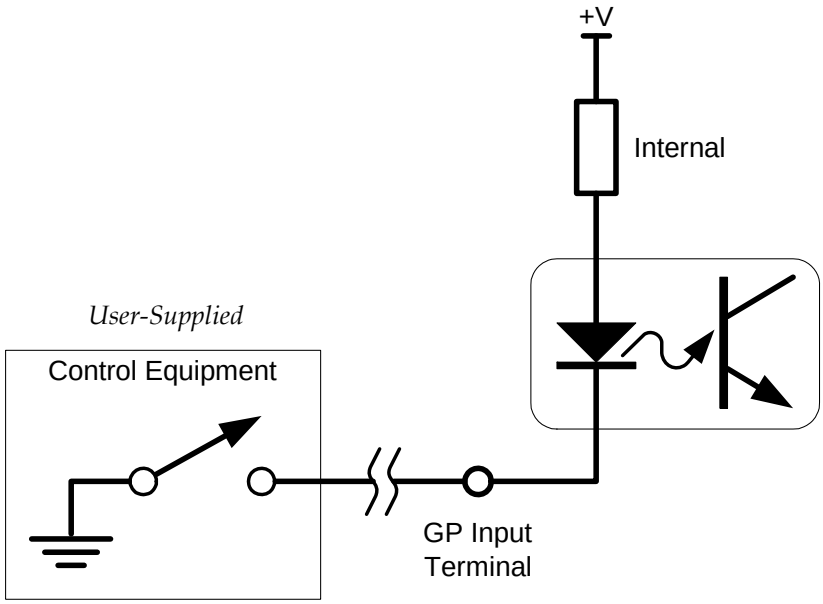
GPIs

The GP inputs are designed to be asserted by switching the closures to ground. Asserting a GP input will result in that input state being encoded on the appropriate line of the video signal or the required function being activated.

Figure 3–3 Input Diagram



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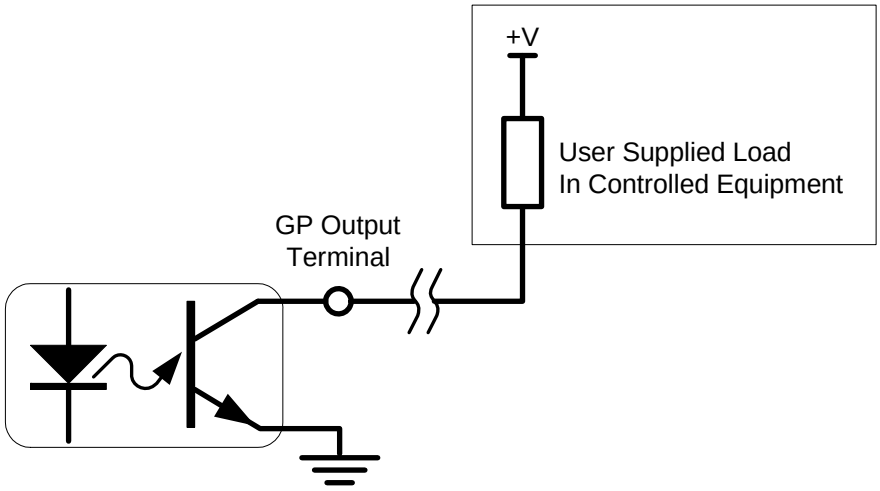
GPOs

If the incoming SDI data stream contains GP data on the appropriate line of the video signal, the corresponding GP output on the card can be activated. The GP output is asserted when its voltage is high.

Important: The GP outputs are optically isolated and "open collector" so the user must provide the appropriate pull-up resistor for each GP output. See Figure 3–4 below.

The HDCC-708MULTI-OG2 provides four GPOs. (See Connector Pin Assignments on page 33 in Chapter 4 for connectivity.)

Figure 3–4 Output Diagram



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GPI/O Polarities

You can control the polarities of the encoded GPIs, both at the receiving stage (Rx) and at the encoding stage (Tx).

GPI Encoded Polarity (Rx)

Channel	Register	Bit(s)	Values
1	0Fh	0 through 3	See Table 3–1 below.
2	2Fh	0 through 3	

The polarity settings are listed in Table 3–1 below.

Table 3–1 GPI Assertion Polarity

Bits	GPI	Active Low (default)	Active High
0	GPI-0	0	1
1	GPI-1	0	1
2	GPI-2	0	1
3	GPI-3	0	1

GPI Encoded Polarity (Tx)

Channel	Register	Bit(s)	Values
1	0Fh	4 through 7	See Table 3–2 below.
2	2Fh	4 through 7	

You can set the polarity of the GPI as encoded on the data stream as shown in Table 3–2 below.

Table 3–2 Register 0Fh and 2Fh: Bits 4 through 7

Bits	GPI	Active Low (default)	Active High
4	GPI-0	0	1
5	GPI-1	0	1
6	GPI-2	0	1
7	GPI-3	0	1

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Enabling/Disabling GPI Transmission

Channel	Register	Bit(s)	Values
1	12h	7	0=Disable 1=Enable
2	22h	7	

The HDCC can be configured to enable or disable transmission of GPI data by setting bit 7 of register 12h for Channel A, or 32h for Channel B.

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CHAPTER 4
Specifications and Pin-Outs

Introduction

Overview

This chapter lists the specifications of the HDCC-708MULTI-OG2 and provides the pin-outs for its connectors.

Topics

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Specifications

Table 4–1 Physical Specifications

Specification	Value
Dimensions (H x W x D)	Card: 3″ x 12.75″x 0.5″ (76.2 mm x 323.85 mm x 12.7 mm)
	Rear Panel: 2.5″ (W) x 3.5″ (H) x 1.5″ (D) (63.5 mm x 88.9 mm x 38.1 mm)
Shipping Weight (combined)	1 lbs (.45 kg)
Space Requirements	2 RU
Supplied Accessories	Rear panel adaptor
Power Requirements	Receives power from frame
Power Consumption	Approximately 10 W

Table 4–2 Technical Specifications

Specification	Value
Inputs	2 SD/HD-SDI autosensing on BNC 4 GPI (on Phoenix connector J18)
Outputs	2 HD/SD-SDI Closed Captioned (BNC) 2 HD/SD-SDI Open Captioned (BNC) 4 GPO (on Phoenix connector J18)
Inputs/Outputs	1 Ethernet (RJ-45) 10/100 TX 1RS-232 (DB-9)
Frame compatibility	openGear
Available functions	• Closed Caption OSD Monitoring • HD/SD Closed Caption Encoding/Inserting • HD/SD Closed Caption Decoding/Analyzing • HD/SD Closed Caption Bridging and Transcoding • GPI Encoding and Decoding
Available communication protocols	• GrandAlliance • SMPTE333 • CDP
Supported closed caption specifications	CEA-608, CEA-708 both encapsulated 608 and native 708

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Connector Pin Assignments

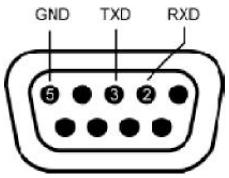
Table 4–3 J18 Pin-Out Assignments

Pin	Label	Interface
1	Ground	
2	TX3 (GPI-3)	Open Collector (Emitter to Ground)
3	TX2 (GPI-2)	
4	TX1 (GPI-1)	
5	TX0 (GPI-0)	
6	RX3 (GPO-3)	Active Low
7	RX2 (GPO-2)	
8	RX1 (GPO-1)	
9	RX0 (GPO-0)	

Table 4–4 RS-232 DB-9 Pin-Out Assignments

Pin	Label	Function
2	TXD	RS-232 Tx Data
3	RXD	RS-232 Rx Data
5	Common GND	GND

Figure 4–1 RS-232 DE-9 Pin-Out



Technical Functional Overview

Figure 4–2 on page 34 illustrates the design of the HDCC.

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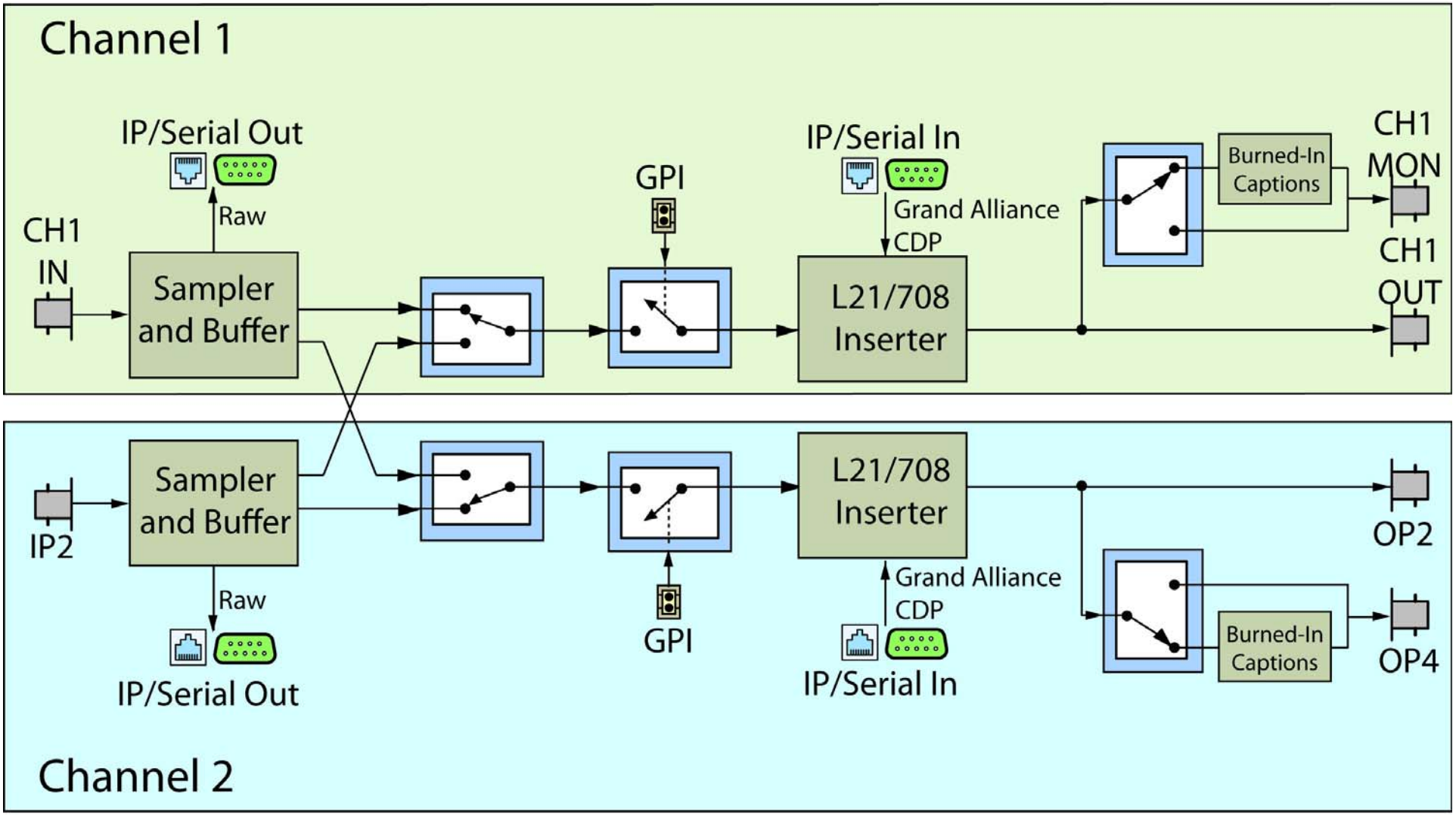
Figure 4–2 HDCC-708MULTI-OG2 Block Diagram



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APPENDIX A
Engineering Registers

Introduction

Overview

This chapter explains how to access the engineering registers to configure the HDCC card for your particular system.

Topics

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Accessing the Engineering Menu

To access the Engineering Menu, refer to the *Hardware Installation Guide* (part number 821150).

Register Reference

WARNING! If a register is not listed in Table A–1 below, do not modify it. Do so will cause unpredictable results.

Table A–1 Register Table Summary

Channel		Description
1	2	
00h	20h	HD Line for CEA-708 Insertion
01h	21h	Not Used
02h	22h	SD Line for CEA-608 Insertion, Extraction, and Monitoring
03f	23h	708 Features (1)
04h	24h	708 Features (2)
05h	25h	708 Language Code (1st Letter)
06h	26h	708 Language Code (2nd Letter)
07h	27h	708 Language Code (3rd Letter)
08h	28h	Transmission Features
09h	29h	Horizontal Timing Offset for GPI SD Insertion Line (Reserved)
0Ah	2Ah	SD Line for GPI Data Insertion and Decoding
0Bh	2Bh	HD Line for GPI Data Insertion and Decoding
0Ch	2Ch	Not Used
0Dh	2Dh	Not Used
0Eh		GPI LED Settings
0Fh	2Fh	GPI Rx/Tx Polarity Control
10h	30h	Special Features 2
11h	31h	Regen/Blank Control With External GPI
12h	32h	GPI Data Insertion Control and Encoder Timeout
13h	33h	GPI Mapping for Tx
14h	34h	GPI Mapping for Per-Field Blank Control (Reserved)
15h	35h	Not Used
16h	36h	Not Used
17h	37h	Not Used

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Table A–1 Register Table Summary

Channel 1	Channel 2	Description
18h	38h	Not Used
19h	39h	Not Used
1Ah	3Ah	Not Used
1Bh	3Bh	Not Used
1Ch	3Ch	Not Used
1Dh	3Dh	Decoded Channel on Monitor Output (CC1, CC2, etc.)
1Eh	3Eh	Not Used
1Fh	3Fh	Not Used
4Dh		Timing Offset—Do Not Change
4Eh		GPO 1 and 2 Mapping
4Fh		GPO 3 and 4 Mapping

Table A–2 Register Settings with Descriptions, Domains, and Defaults

<table>
<tr><th>CH1 Reg #</th><th>CH2 Reg #</th><th>Description</th><th>Default</th></tr>
<tr><td>00h</td><td>20h</td><td>HD Line for CEA-708 Insertion
Min: 07 – Max: 19</td><td>09h</td></tr>
<tr><td>01h</td><td>21h</td><td>Not Used</td><td></td></tr>
<tr><td>02h</td><td>22h</td><td>SD Line for CEA-608 Insertion, Extraction, and Monitoring
Min: 06 – Max: 16</td><td>15h</td></tr>
<tr><td>03h</td><td>23h</td><td>708 Services Features (1)
Min: N/A – Max: N/A
<table>
<tr><th>Bit(s)</th><th>Function</th></tr>
<tr><td>7</td><td>Aspect Ratio Flag
0 = 4:3
1 = 16:9</td></tr>
<tr><td>6</td><td>Easy Reader Flag
0 = Easy reader flag not set
1 = Easy reader flag set</td></tr>
</table></td><td>00h</td></tr>
</table>

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Table A–2 Register Settings with Descriptions, Domains, and Defaults (Continued)

<table>
<tr><th>CH1 Reg #</th><th>CH2 Reg #</th><th>Description</th><th>Default</th></tr>
<tr><td>04h</td><td>24h</td><td>708 Service Features (2)
Min: N/A – Max: N/A
<table><tr><th>Bit(s)</th><th>Function</th></tr><tr><td>7</td><td>Digital/Analog Flag
0 = Analog
1 = Digital</td></tr><tr><td>6:0</td><td>Service Number (if Bit 7=1):
000 0001
.
.
.
111 1111</td></tr><tr><td>0</td><td>Field Number (if Bit 7=0):
0 = Field 1
1 = Field 2</td></tr></table></td><td>81h</td></tr>
<tr><td>05h</td><td>25h</td><td>708 Language Code (1st Letter)
Min: “a” 61h – Max: “z” 7Ah</td><td>“e” 65h</td></tr>
<tr><td>06h</td><td>26h</td><td>708 Language Code (2nd Letter)
Min: “a” 61h – Max: “z” 7Ah</td><td>“n” 6Eh</td></tr>
<tr><td>07h</td><td>27h</td><td>708 Language Code (3rd Letter)
Min: “a” 61h – Max: “z” 7Ah</td><td>“g” 67h</td></tr>
</table>

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Table A–2 Register Settings with Descriptions, Domains, and Defaults (Continued)

<table>
<tr><th>CH1 Reg #</th><th>CH2 Reg #</th><th>Description</th><th>Default</th></tr>
<tr><td>08h</td><td>28h</td><td>Transmission Features
Min: N/A – Max: N/A
<table>
<tr><th>Bit(s)</th><th>Function</th></tr>
<tr><td>7</td><td>Enable SMPTE 333 Protocol
(Not Yet Used)
0 = Disabled
1 = Enabled</td></tr>
<tr><td>6:5</td><td>Com Port Speed
00 = 9600 baud
01 = 19200 baud
10 = 38400 baud
11 = 115200 baud</td></tr>
<tr><td>4:3</td><td>Not Used</td></tr>
<tr><td>2</td><td>Enable VANC 608/708 Insertion in SD
0 = Normal
1 = Insert</td></tr>
<tr><td>1</td><td>Enable “Smart XDS” Insertion Feature
0 = Normal: Smart XDS Insertion Feature Enabled
1 = Smart XDS Feature Disabled</td></tr>
<tr><td>0</td><td>Disable VANC 608/708 Insertion in HD
0 = Normal: Insertion Enabled
1 = Insertion Disabled</td></tr>
</table></td><td>00h</td></tr>
<tr><td>09h</td><td>29h</td><td>Reserved—Do Not Change</td><td>–</td></tr>
<tr><td>0Ah</td><td>2Ah</td><td>SD Line for GPI Data
Min: 06h – Max: 16h</td><td>0Dh</td></tr>
<tr><td>0Bh</td><td>2Bh</td><td>HD Line for GPI Data
Min: 07h – Max: 19h</td><td>0Dh</td></tr>
<tr><td>0Ch</td><td>2Ch</td><td>Not Used</td><td>–</td></tr>
<tr><td>0Dh</td><td>2Dh</td><td>Not Used</td><td>–</td></tr>
</table>

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Table A–2 Register Settings with Descriptions, Domains, and Defaults (Continued)

<table>
<tr><th>CH1 Reg #</th><th>CH2 Reg #</th><th>Description</th><th>Default</th></tr>
<tr><td>0Eh</td><td></td><td>
GPI LED Settings
Min: N/A – Max: N/A
<table>
<tr><th>Bits</th><th>Function</th></tr>
<tr><td>0:3</td><td>
<table>
<tr><th colspan="2">GPI 4</th></tr>
<tr><th>LED</th><th>Description</th></tr>
<tr><td>0000</td><td>GPI Rx Ch 1 on LEDs 0 to 3
GPI Rx Ch 2 on LEDs 4 to 7</td></tr>
<tr><td>0001</td><td>GPI Rx Ch 1 OR GPI-In 0 to 3 on LEDs 0 to 3
GPI Rx Ch 2 OR GPI-In 0 to 3 on LEDs 4 to 7</td></tr>
<tr><td>0010</td><td>GPI Rx Ch 1 on LEDs 0 to 3
GPI Rx Ch 2 OR GPI-In 0 to 3 on LEDs 4 to 7</td></tr>
<tr><td>0011</td><td>GPI Rx Ch 1 on LEDs 0 to 3
GPI Rx Ch 2 OR GPI-In 0 to 3 on LEDs 4 to 7</td></tr>
<tr><td>0100</td><td>GPI Tx Ch 1 on LEDs 0 to 3
GPI Tx Ch 2 on LEDs 4 to 7</td></tr>
<tr><td>Else</td><td>Show status on LEDs 0 to 3. See tables below.</td></tr>
</table>
<table>
<tr><th>LED</th><th>LED 4 Description</th></tr>
<tr><td>0</td><td>Interleaved Mode</td></tr>
<tr><td>1</td><td>Progressive Mode</td></tr>
</table>
<table>
<tr><th rowspan="2">Description</th><th colspan="3">LED</th></tr>
<tr><th>1</th><th>2</th><th>3</th></tr>
<tr><td>576 (PAL)</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>480 (NTSC)</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>720</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>1035</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>Not Used</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>1080</td><td>1</td><td>1</td><td>0</td></tr>
</table>
</td></tr>
<tr><td>4:7</td><td>Not Used</td></tr>
</table>
</td><td>00h</td></tr>
</table>

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Table A–2 Register Settings with Descriptions, Domains, and Defaults (Continued)

<table>
<tr><th>CH1 Reg #</th><th>CH2 Reg #</th><th>Description</th><th>Default</th></tr>
<tr><td>0Fh</td><td>2Fh</td><td>GPI Tx/Rx Polarity
Min: N/A – Max: N/A
<table><tr><th>Bit(s)</th><th>Type</th><th>Function</th></tr><tr><td>0</td><td>GPI Rx 0</td><td rowspan="8">0 = Normal (Active Low)
1 = Inverted (Active High)</td></tr><tr><td>1</td><td>GPI Rx 1</td></tr><tr><td>2</td><td>GPI Rx 2</td></tr><tr><td>3</td><td>GPI Rx 3</td></tr><tr><td>4</td><td>GPI Tx 0</td></tr><tr><td>5</td><td>GPI Tx 1</td></tr><tr><td>6</td><td>GPI Tx 2</td></tr><tr><td>7</td><td>GPI Tx 3</td></tr></table></td><td>00h</td></tr>
<tr><td>10h</td><td>30h</td><td>Special Features—2
Min: N/A – Max: N/A
This register controls miscellaneous functions on the card including the video outputs.
<table><tr><th>Bit(s)</th><th>Function</th></tr><tr><td>3:4[a]</td><td>Video Output Mode:
00 = Normal
01 = Both outputs set to monitoring
10 = Both outputs are clean
11 = Not Used</td></tr><tr><td>5</td><td>GPI Tx Source:
0 = GPI mapped input (See Registers 13h and 33h.)
1 = GPI mapped input ORed with GPI Rx</td></tr></table>a Normal (default) = Monitoring O/Ps are 3 and 4; Clean O/Ps are 1 and 2
Monitoring = Burned-in captions on all O/Ps
Clean = No burned-in captions on any O/Ps</td><td>00h</td></tr>
</table>

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Table A–2 Register Settings with Descriptions, Domains, and Defaults (Continued)

<table>
<tr><th>CH1 Reg #</th><th>CH2 Reg #</th><th>Description</th><th>Default</th></tr>
<tr><td>11h</td><td>31h</td><td>
Regen/Blank Control with External GPI
Min: N/A – Max: N/A
<table>
<tr><th>Bit(s)</th><th>Value</th><th>Blank Controlled by...</th></tr>
<tr><td rowspan="5">0:3</td><td>0000</td><td>GPI Control (Regen Operation)</td></tr>
<tr><td>0001</td><td>External GPI 0</td></tr>
<tr><td>0010</td><td>External GPI 1</td></tr>
<tr><td>0011</td><td>External GPI 2</td></tr>
<tr><td>0100</td><td>External GPI 3</td></tr>
</table>
<table>
<tr><th>Bit(s)</th><th>Polarity Control</th><th>Function</th></tr>
<tr><td>4</td><td>GPI 0</td><td rowspan="4">0 = Normal (Active Low)
1 = Inverted (Active High)</td></tr>
<tr><td>5</td><td>GPI 1</td></tr>
<tr><td>6</td><td>GPI 2</td></tr>
<tr><td>7</td><td>GPI 3</td></tr>
</table>
</td><td>00h</td></tr>
</table>

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Table A–2 Register Settings with Descriptions, Domains, and Defaults (Continued)

<table>
<tr><th>CH1 Reg #</th><th>CH2 Reg #</th><th>Description</th><th>Default</th></tr>
<tr><td>12h</td><td>32h</td><td>GPI Insertion Control and Insert Mode Timeout
Min: N/A – Max: N/A

<table>
<tr><th>Bit(s)</th><th>Function</th></tr>
<tr><td>0:3</td><td>Insert Mode Time Out
(0.5 second intervals):
0000 = 0 seconds
0001 = 0.5 seconds
0010 = 1.0 seconds
.
.
.
1111 = 7.5 seconds</td></tr>
<tr><td>4:5</td><td>Time Out
00 = Normal (Automatic Fall Back to Regen Mode After Timeout)
01 = Permanent Insert Mode in Field 0
10 = Permanent Insert Mode in Field 1
11 = Permanent Insert Mode in Both Fields</td></tr>
<tr><td>6</td><td>Not Used</td></tr>
<tr><td>7</td><td>GPI Data Insertion
0 = Off
1 = On</td></tr>
</table></td><td>12h</td></tr>
<tr><td>13h</td><td>33h</td><td>GPI Mapping for Tx
Min: N/A – Max: N/A

<table>
<tr><th>Bit(s)</th><th>GPI Tx Source</th><th>Function</th></tr>
<tr><td>0:1</td><td>0</td><td rowspan="5">External GPIs:
00 = GPI 0
01 = GPI 1
10 = GPI 2
11 = GPI 3</td></tr>
<tr><td>2:3</td><td>1</td></tr>
<tr><td>4:5</td><td>2</td></tr>
<tr><td rowspan="2">6:7</td><td rowspan="2">3</td></tr>
</table></td><td>E4h</td></tr>
</table>

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Table A–2 Register Settings with Descriptions, Domains, and Defaults (Continued)

CH1 Reg #	CH2 Reg #	Description	Default
14h	34h	Not Used	–
15h	35h	Not Used	–
16h	36h	Not Used	–
17h	37h	Not Used	–
18h	38h	Not Used	–
19h	39h	Not Used	–
1Ah	3Ah	Not Used	–
1Bh	3Bh	Not Used	–
1Ch	3Ch	Not Used	–
1Dh	3Dh	**Decoded Channel on Monitor Output** *Min: 00h – Max: 03h* 0 = CC1 1 = CC2 2 = CC3 3 = CC4	00h
1Eh	3Eh	Not Used	–
1Fh	3Fh	Not Used	–
4Dh		**Timing Offset** – Do Not Change *Min: N/A – Max: N/A*	06h

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Table A–2 Register Settings with Descriptions, Domains, and Defaults (Continued)

<table>
<tr><th>CH1 Reg #</th><th>CH2 Reg #</th><th>Description</th><th>Default</th></tr>
<tr><td>4Eh</td><td></td><td>GPO 0 and 1 Source
Min: N/A – Max: N/A

<table>
<tr><th>Bit(s)</th><th>Function</th></tr>
<tr><td>0:3</td><td>GPO 0 Source
0000 = Ch 1 GPI Rx 0
0001 = Ch 1 GPI Rx 1
0010 = Ch 1 GPI Rx 2
0011 = Ch 1 GPI Rx 3
0100 = Ch 2 GPI Rx 0
0101 = Ch 2 GPI Rx 1
0110 = Ch 2 GPI Rx 2
0111 = Ch 2 GPI Rx 3</td></tr>
<tr><td>4:7</td><td>GPO 1 Source
0000 = Ch 1 GPI Rx 0
0001 = Ch 1 GPI Rx 1
0010 = Ch 1 GPI Rx 2
0011 = Ch 1 GPI Rx 3
0100 = Ch 2 GPI Rx 0
0101 = Ch 2 GPI Rx 1
0110 = Ch 2 GPI Rx 2
0111 = Ch 2 GPI Rx 3</td></tr>
</table></td><td>10h</td></tr>
</table>

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Table A–2 Register Settings with Descriptions, Domains, and Defaults (Continued)

<table>
<tr><th>CH1 Reg #</th><th>CH2 Reg #</th><th>Description</th><th>Default</th></tr>
<tr><td colspan="2">4Fh</td><td>GPO 2 and 3 Source
Min: N/A – Max: N/A
<table>
<tr><th>Bit(s)</th><th>Function</th></tr>
<tr><td>0:3</td><td>GPO 2 Source
0000 = Ch 1 GPI Rx 0
0001 = Ch 1 GPI Rx 1
0010 = Ch 1 GPI Rx 2
0011 = Ch 1 GPI Rx 3
0100 = Ch 2 GPI Rx 0
0101 = Ch 2 GPI Rx 1
0110 = Ch 2 GPI Rx 2
0111 = Ch 2 GPI Rx 3</td></tr>
<tr><td>4:7</td><td>GPO 3 Source
0000 = Ch 1 GPI Rx 0
0001 = Ch 1 GPI Rx 1
0010 = Ch 1 GPI Rx 2
0011 = Ch 1 GPI Rx 3
0100 = Ch 2 GPI Rx 0
0101 = Ch 2 GPI Rx 1
0110 = Ch 2 GPI Rx 2
0111 = Ch 2 GPI Rx 3</td></tr>
</table></td><td>00h</td></tr>
</table>

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