HDCC-OP47TX

(WST/OP-47 Insertion Card)

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

Configuration Guide

Software Version: V2.40
PIC Code Version: V1.11

Part Number 821139, Revision A

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CHAPTER 1
Setting the Switches

Introduction

Overview

Thank you for purchasing Wohler's HDCC card, a product that provides a variety of closed captioning functions. This chapter explains how to install, set up, and use your card.

Important: Thorough the whole manual, the term of "closed captions" or "captions" refers to WST and OP-47 encoded captions, and is not related whatsoever with North American Closed-Captions service (a.k.a. "CC") and specifications.

These closed captions may also be referred to as "subtitles," as it is the common usage in Europe.

Topics

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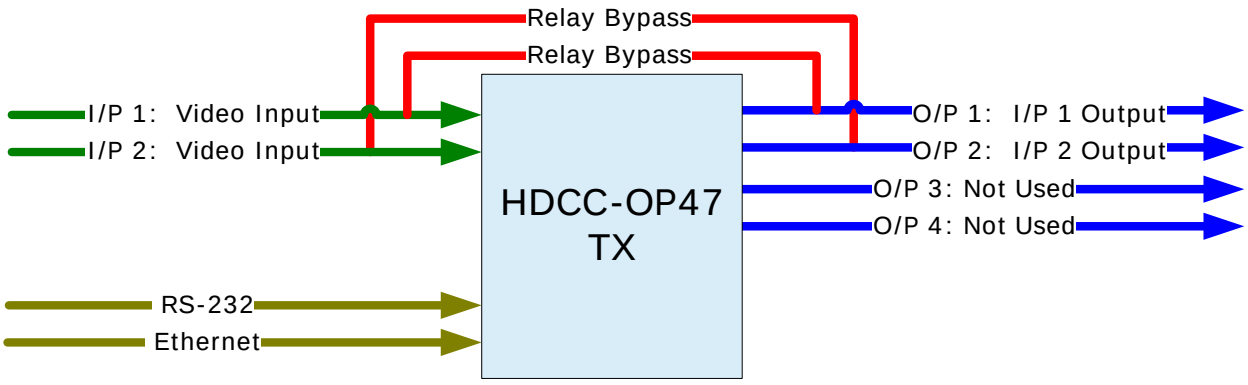
Basic Functionality

Inputs and Outputs

Figure 1–1 illustrates the basic inputs and outputs of the HDCC. In the event of a power failure, or when the system is powered down, the bypass relays engage and the outputs on O/P 1 and O/P 2 are identical to the input signals on I/P 1 and I/P 2 respectively.

Figure 1–1 I/O Functionality - No Power



Note: For Figure 1–1 above through Figure 1–6 on page 8, the illustrations depict either a Codan or Evertz rear panel adapter. The IRT has two RS-232 ports and no Ethernet port.

Processes

Encoding

Encoding allows the broadcaster to embed, or encode, caption text from a separate source into the video/audio stream. For example, the video/audio stream would come in on I/P 1, and the caption data would come in on the serial port from a PC on which an operator keys in the text of the caption data.

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Bridging / Transcoding

Bridging is the process of extracting captions data from one SDI data stream and inserting it into another. For example, a video stream with embedded text would come in on I/P 1 and a clean video stream would come in on I/P 2. In this scenario, the HDCC card would copy the caption text data coming in on I/P 1 and embed it into the video stream of I/P 2. Note that the caption text is not removed from the source input video stream. If the two signals are different, say SD and HD, then this scenario also exemplifies transcoding.

Ethernet and Serial Communications Summary

Figure 1–2 illustrates the direction of communications between the input channels (I/P 1 and I/P 2, aka Channel A and Channel B) and the serial and Ethernet ports, depending on the settings of SW1.

Figure 1–2 Serial and Ethernet Communications for SW1 Settings)

Encoding ←

SW 1	Channels	Ports
0	A ← Serial B ← Ethernet	
1	A ← Serial B → Ethernet	
2	A → Serial B ← Ethernet	
E	Register Settings	Serial 38400 baud
F	Register Settings	Ethernet 38400 baud

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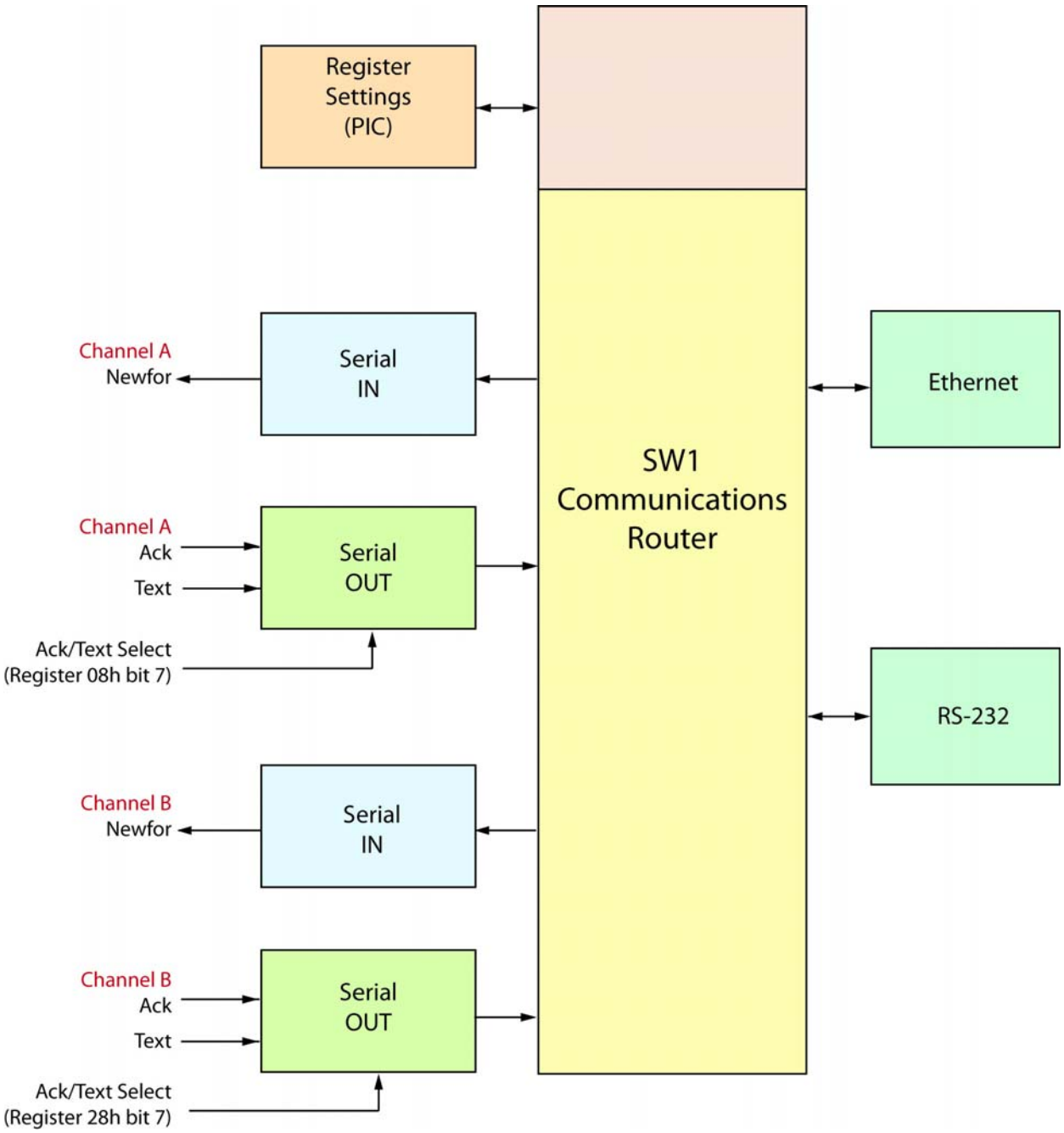
Communications Paths

Figure 1–3 below illustrates the serial and Ethernet communication as it relates to the Ack/Nak settings in Registers 08h and 28h.

Figure 1–3 Serial and Ethernet Communications Relative to Ack/Nak Settigns



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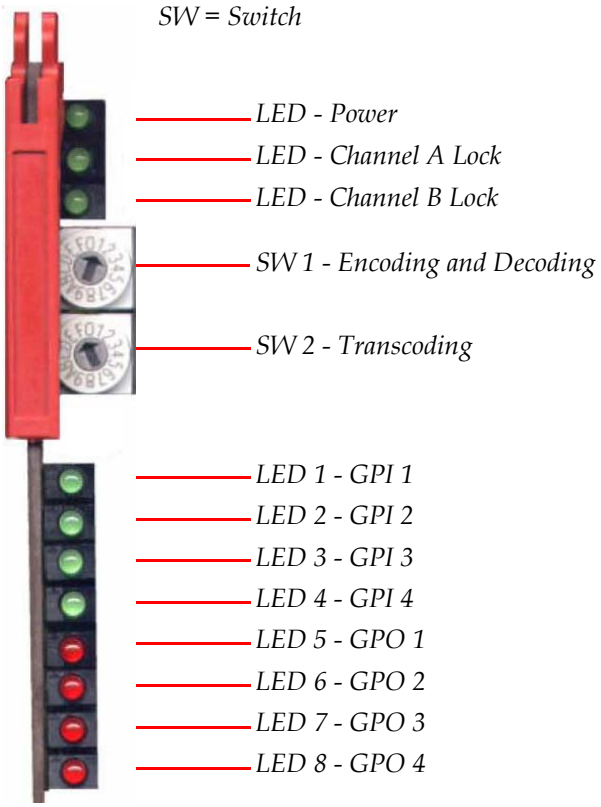
Using the Card

Using the HDCC card amounts to little more than setting the switches, attaching the I/O cables, and connecting a PC through either an Ethernet or a serial port to encode or analyze. (But a PC connection is not needed for bridging.)

Figure 1–4 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 57.

Refer to Register 0Eh for LED assignments: Figure 2–3 on page 21 and Table 2–4 on page 17.

- **Switch 1 (SW 1)** controls whether the card is set to **encoding** (settings 0 through 2), **encoding and decoding** (settings 3 through 7) or **decoding** (settings 8 or 9). This is the communications router.
- **Switch 2 (SW 2)** controls whether the card performs the **bridging** and **transcoding** functions (settings 1 or 2).

Also refer to Figure 1–2 on page 3.

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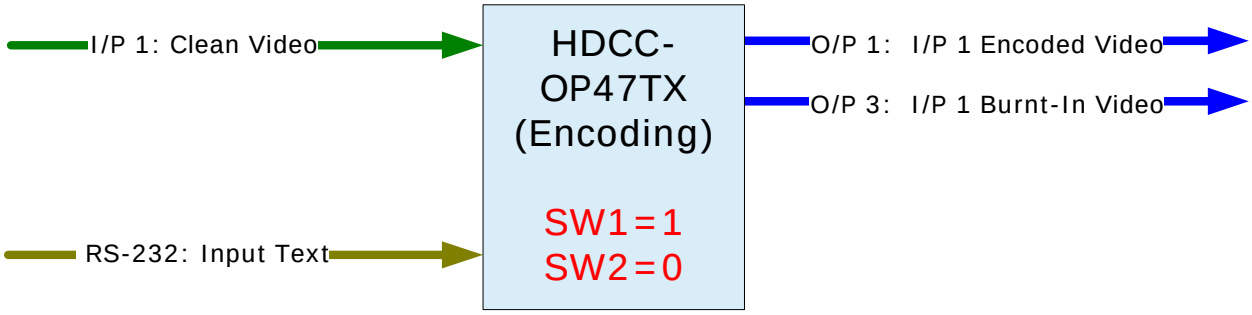
Encoding Only

When encoding, a signal that comes in on I/P 1 goes out on the odd-numbered outputs, and a signal that comes in on I/P 2 goes out on the even-numbered outputs. See Figure 1–5 below.

Figure 1–5 Typical Scenario for Encoding



Example: This simple example demonstrates the encoding feature.

I/P 1: Input clean video stream.

I/P 2: NC

O/P 1: Output video stream with encoded closed captions.

O/P 2: NC

O/P 3: NC.

O/P 4: NC

Serial: Closed caption data input.

Ethernet: NC

1. Connect a clean video source to I/P 1.
2. Connect an output cable to O/P 1.
3. Connect a data source for closed captioned text to the RS-232 port.

Note: To use the Ethernet port as a virtual serial port, refer to Appendix A of the *Installation Guide* (PN 821135) to download, install, and configure the Ethernet connectivity application.

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4. Set SW 1 according to the port through which you will insert the closed caption text. For our example, set SW 1 to 1. See Table 1–1 below a list of additional options.

Table 1–1 Switch 1 Settings - Encoding

SW 1	Insert Text From
0	Inserts captions on I/P 1 from the RS-232 port. Inserts captions on I/P 2 from the Ethernet port.
1	Inserts captions on I/P 1 and on I/P 2 from the RS-232 port.
2	Inserts captions on I/P 1 and on I/P 2 from the Ethernet port.

5. Set SW 2 to 0.

6. Launch the closed caption text insertion application and verify that you have connected to the HDCC using the correct com port at the correct baud rate.

7. Begin sending text from your closed caption text insertion application.

Providing the HDCC card is locked on an video signal, as soon as it receives closed caption data, it will immediately encode this closed caption data into the output video streams O/P1 and O/P 3.

Note: You can repeat the previous steps 1 through 4 (using I/P 2, O/P 2, and O/P 4 in Steps 1 through 5 respectively) to encode a second video stream with either the same or a different text source/communications port since the HDCC is a dual-channel card. Moreover, the signals need not be synchronous.

Important: If you have difficulty getting the correct results on the ouput connectors/ports, you may need to modify some of the register settings to fit your particular installation. Refer to Chapter 2: Setting the Engineering Registers on page 11 for more information.

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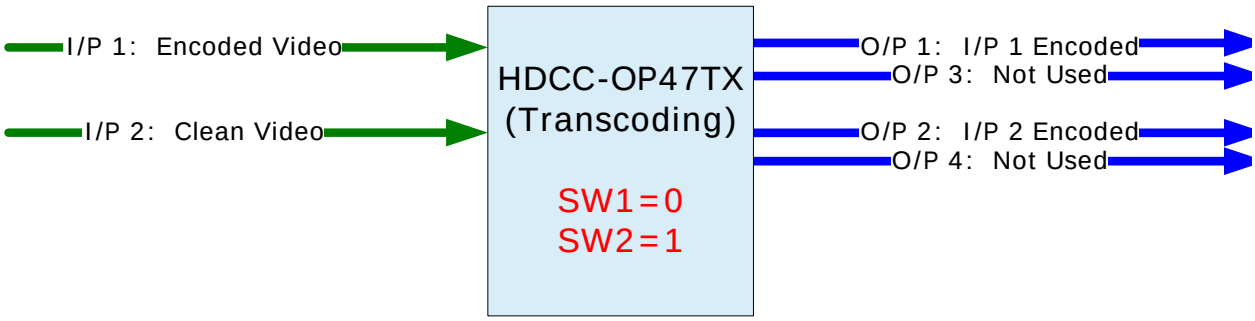
Bridging

Bridging means that encoded closed captions are copied from one video stream to the other, *transcoding* them on-the-fly if the two video streams are of a different format.

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

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

Figure 1–6 I/O Functionality - Transcoding



1. Connect the encoded video signal to I/P 1.
2. Connect the clean video signals to I/P 2.
3. Connect the output cables to O/P 1 and O/P 2.
4. (Optional) Connect monitor cables to O/P 3 and/or O/P 4.
5. For our example, set SW 2 to 1. Set SW 1 to 0.

As soon as the HDCC card is locked on the two video signals, it should begin to bridge and if necessary transcode closed caption data from channel A (I/P 1) to channel B (O/P 2 and O/P 4).

Important: If you have difficulty getting the correct results on the ouput connectors/ports, you may need to modify some of the register settings to fit your particular installation. Refer to Chapter 2: Setting the Engineering Registers on page 11 for more information.

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Connecting to the Card

To perform this procedure you will need:

- A PC or laptop with a serial port and/or Ethernet port
- One or both of the following:
  - A serial cable (connected from the serial port of the PC to the serial port on the HDCC). Refer to Accessing the Configuration on page 19 for more information.
  - An Ethernet cable (connected to the Ethernet ports of the HDCC card and the PC).

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CHAPTER 2
Setting the Engineering Registers

Introduction

Overview

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

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Accessing the Configuration

The card has a number of registers to allow easy configuration of various card parameters that can be accessed from both the RS-232 interface and the Ethernet interface.

Note: An active SDI (SD or HD) signal connected to one of the input interfaces (I/P 1 or I/P 2) is required to activate the Ethernet port.

To access the configuration registers:

1. Determine whether you want to access the engineering menu from the Ethernet port or from the RS-232 port.

2. Depending how you will access the menu, turn SW 1 to either E or F according to Table 2–1 below.

Table 2–1 Switch 1 Settings - Encoding

SW 1	Insert Text From
E	Access engineering menu through RS232 port.
F	Access engineering menu through Ethernet port.

3. Connect the serial or Ethernet cable from the host computer's port to the port on the rear panel adaptor.

   Note: IRT adaptors do not provide an Ethernet port.

4. Launch your **HDCCRegEdit** program.

5. Verify that your communications settings are 38400, n, 8, 1.

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Modifying the Register Settings

Table 2–2 Register Table Summary

Channel 1	Channel 2	Description	Encoding	EU Default	AUST Default
00	20	HD-Field 1 OP-47 Insertion Line	Hex	0A	0C
01	21	HD-Field 2 OP-47 Insertion Line	Hex	0A	0C
02	22	SD-Field 1 WST Insertion Line	Hex	0A	15
03	23	SD-Field 2 WST Insertion Line	Hex	0A	15
04	24	Default Newfor Magazine Number	Hamming	15 (00)	15 (00)
05	25	Default Newfor Page Number	BCD	88	01
06	26	Not Used			
07	27	Not Used			
08	28	Default Newfor Languages and Transmission	Figure 2–1	00	18
09	29	Horizontal Timing Offset for GPI SD Line	Hex	Reserved	
0A	2A	SD Line Number for GPI Data	Hex	0D	13
0B	2B	HD Line Number for GPI Data	Hex	0D	09
0C	2C	Special Features 1	Figure 2–2	00	00
0D	2D	Horizontal Timing Offset for WST SD Line	Hex	1E	1E
0E	2E	Block Regeneration and GPI LED Settings	Figure 2–3	00	00
0F	2F	GPI Rx/Tx Polarity Control	Figure 2–4	00	00
10	30	Special Features 2	Figure 2–5	80	00
11	31	External GPI Bypass Control	Figure 2–6	00	00
12	32	Enabled GPI Insertion and Timeout Control	Figure 2–7	0F	0F
13	33	GPI Mapping for Tx	Figure 2–8	E4	E4
14	34	GPI Mapping for Feature Control	Figure 2–9	E4	E4
15	35	Time Filler Page Number	Hex	FF	FF
16	36	Time Filler Subcode Bottom 2 Digits	Hex	7E	7F
17	37	Terminator Page Number	Hex	FF	EE
18	38	Terminator Subcode Bottom 2 Digits	Hex	7E	7F
19	39 to FD	Reserved for future use			
FE		GPO 1 and 2 Mapping	Figure 2–10	10	10
FF		GPO 3 and 4 Mapping	Figure 2–11	32	32

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Table 2–3 Register Settings 00h to 07h and 20h to 27h

Ch 1 Reg #	Ch 2 Reg #	Description	EU Default	AUST Default
00	20	**HD OP-47 Insertion Line, Field 1** *Min: 07 – Max: 19* Sets the actual Field-1 line number that the OP47 data will be inserted. The OP47 data is inserted into the HD-VANC. The HD-HANC is not manipulated. Note: Since the OP47 data overwrites any existing data in the VANC, verify that no other data is already present on this line.	0A	0C
01	21	**HD OP-47 Insertion Line, Field 2** *Min: 07 – Max: 19* Sets the actual Field-2 line number that the OP47 data will be inserted. The OP47 data is inserted into the HD-VANC. The HD-HANC is not manipulated. Note: Since the OP47 data overwrites any existing data in the VANC, verify that no other data is already present on this line.	0A	0C
02	22	**SD WST Insertion Line, Field 1** *Min: 06 – Max: 16* Sets the actual Field-1 line number that the WST data will be inserted. The WST Subtitle Line complies with EBU ETS-300-706 Level 1 specifications. Note: Since the WST data overwrites any existing data in the VBI, verify that no other data is already present on this line.	0A	15
03	23	**SD WST Insertion Line, Field 2** *Min: 06 – Max: 16* Sets the actual Field-2 line number that the WST data will be inserted. The WST Subtitle Line complies with EBU ETS-300-706 Level 1 specifications. Note: Since the WST data overwrites any existing data in the VBI, verify that no other data is already present on this line.	0A	15

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Table 2–3 Register Settings 00h to 07h and 20h to 27h

Ch 1 Reg #	Ch 2 Reg #	Description	EU Default	AUST Default
04	24	**Default Newfor Magazine Number** *Min: 15 (00) – Max: 2F (07)* (*Hamming Encoded* Refer to Table 2–15 on page 39.) Used by the caption inserter only, this register value sets the default magazine number that will be used when inserting subtitles on either a HD or SD video stream in the event that the system fails to receive the appropriate command to change the magazine number. *Note: Interacts with Register 0C*	15 (00)	15 (00)
05	25	**Default Newfor Page Number** *Min: 00 – Max: 99* *(BCD Encoded)* Sets the default page number that will be used when inserting subtitles on either a HD or SD video stream in the event that the system fails to receive the appropriate command to change the page number. *Note: Interacts with Register 0C*	88	01

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Figure 2–1 Registers 08h to 28h

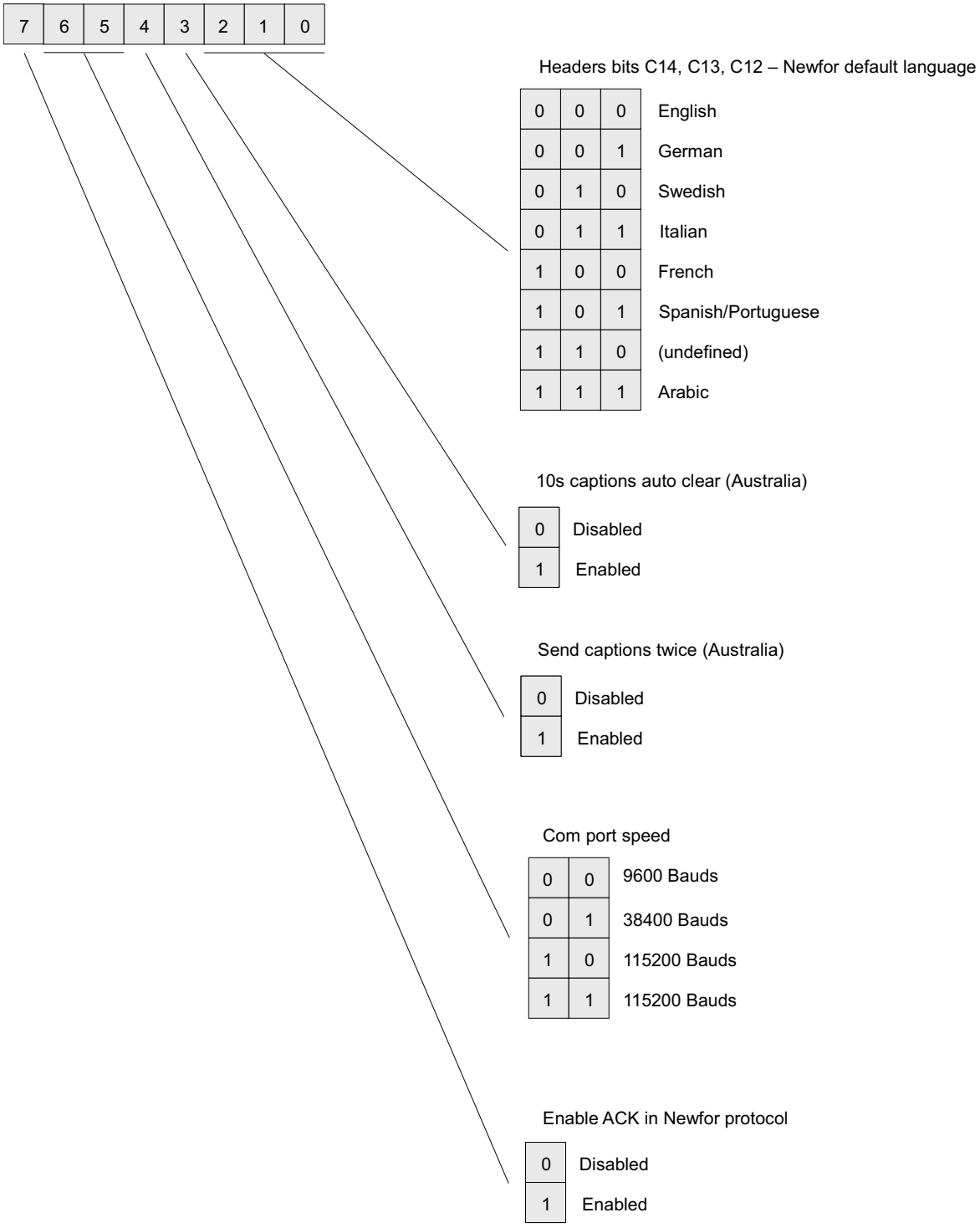

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Table 2–4 Register Settings 08h to 0Bh and 28h to 2Bh

<table>
<tr><th>Ch 1 Reg #</th><th>Ch 2 Reg #</th><th>Description</th><th>EU Default</th><th>AUST Default</th></tr>
<tr><td>08</td><td>28</td><td>Default Newfor Languages and Transmission Features
Min: N/A – Max: N/A
Set Newfor protocol options, as well as some subtitle transmission options. Also sets the default language that will be specified when inserting subtitles on either a HD or SD video stream in the event that the system fails to receive the appropriate command to set the required language.
<table>
<tr><th>Bit(s)</th><th>Function</th></tr>
<tr><td>7</td><td>ACK/NAK support for Newfor standard:
0 = Disabled
1 = Enabled</td></tr>
<tr><td>6:5</td><td>Baud Rate for Newfor Protocol:
00 = 9600
01 = 38400
1x = 115200</td></tr>
<tr><td>4</td><td>Send Caption Twice: (Australia)
0 = Disabled
1 = Enabled</td></tr>
<tr><td>3</td><td>10-Second Caption Clear: (Australia)
0 = Disabled
1 = Enabled</td></tr>
<tr><td>2:0</td><td>Newfor Default Language:
000 = English
001 = German
010 = Swedish
011 = Italian
100 = French
101 = Spanish/Portuguese
110 = Undefined
111 = Arabic</td></tr>
</table></td><td>00</td><td>18</td></tr>
</table>

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Table 2–4 Register Settings 08h to 0Bh and 28h to 2Bh

Ch 1 Reg #	Ch 2 Reg #	Description	EU Default	AUST Default
09	29	**Horizontal Timing Offset for GPI SD Line** *Min: N/A – Max: N/A*	Reserved	
0A	2A	**SD Line Number for GPI Data** *Min: 06 – Max: 16* Sets the line number that will be used when inserting and decoding GPIs from an SD video stream. Note: Since the GPI data overwrites any existing data in the VBI, verify that no other data is already present on this line. **WARNING**: Do not use the same line number that is used for caption insertion as this data will overwite.	0D	13
0B	2B	**HD Line Number for GPI Data** *Min: 07 – Max: 19* (Value in hex: Default 09h = Line 9) Sets the line number that will be used when inserting and decoding GPI from an HD video stream. Note: Since the GPI data overwrites any existing data in the VANC, verify that no other data is already present on this line. **WARNING**: Do not use the same line number that is used for caption insertion as this data will overwite.	0D	09

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Figure 2–2 Registers 0Ch to 2Ch

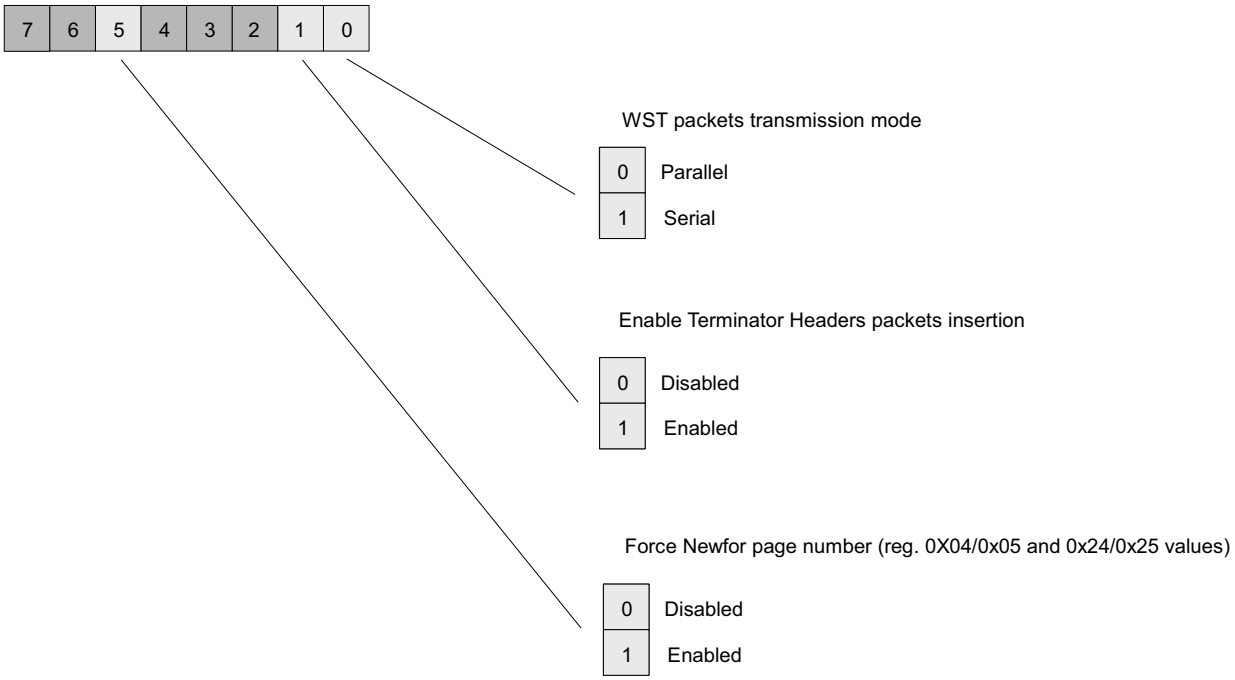

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Table 2–5 Register Settings 0Ch to 0Dh and 2Ch to 2Dh

<table>
<tr><th>Ch 1 Reg #</th><th>Ch 2 Reg #</th><th>Description</th><th>EU Default</th><th>AUST Default</th></tr>
<tr><td>0C</td><td>2C</td><td>Special Features 1
Min: N/A – Max: N/A
This register is used to set some subtitles transmission options. And also to force the default page number that will be specified when inserting subtitles on either a HD or SD video stream even though the system receives the appropriate command to set the subtitles page number.
<table><tr><th>Bit(s)</th><th>Function</th></tr><tr><td>7:6</td><td>Unused</td></tr><tr><td>5</td><td>Force Newfor Page Number (Register values: 04h/24h and 05h/25h):
0 = Disabled
1 = Enabled</td></tr><tr><td>4:2</td><td>Unused</td></tr><tr><td>1</td><td>Enable Terminaor Headers Packets Insertion:
0 = Disabled
1 = Enabled</td></tr><tr><td>0</td><td>WST Packets Transmission Mode:
0 = Parallel
1 = Serial</td></tr></table></td><td>00</td><td>00</td></tr>
<tr><td>0D</td><td>2D</td><td>Horizontal Timing Offset for WST SD Lines
Min: 00 – Max: FF</td><td>1E</td><td>1E</td></tr>
</table>

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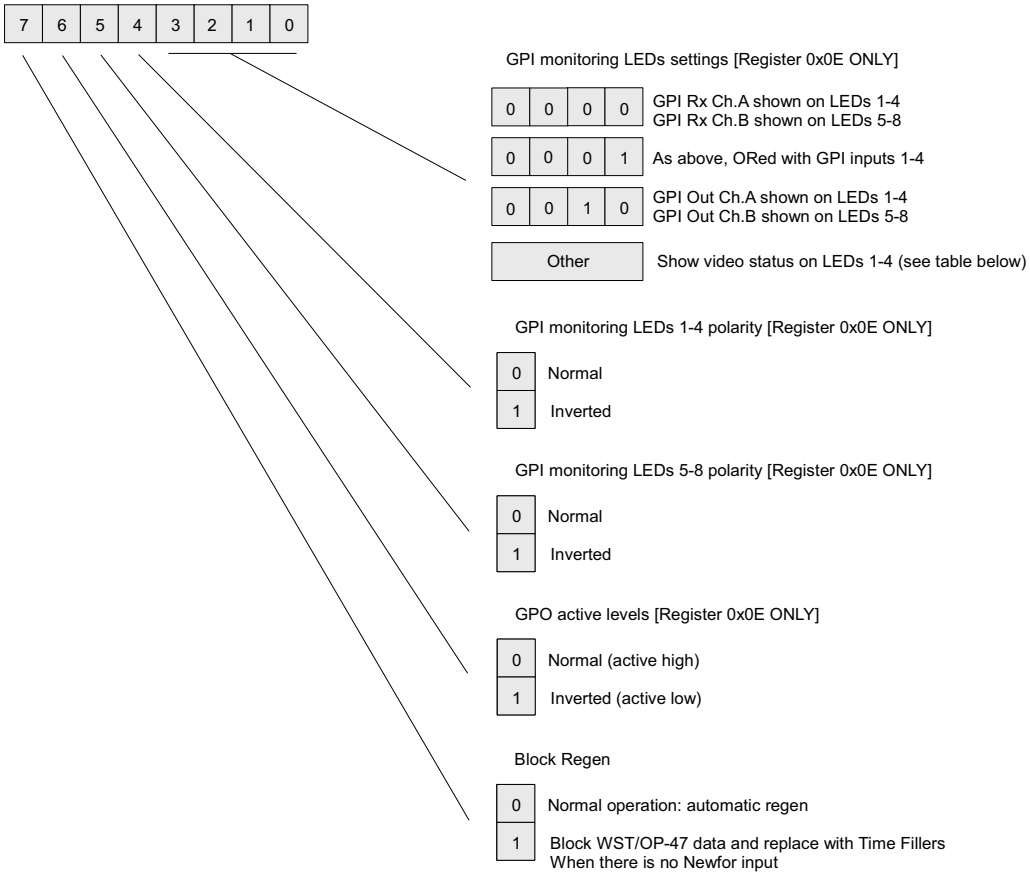
Figure 2–3 Registers 0Eh and 2Eh



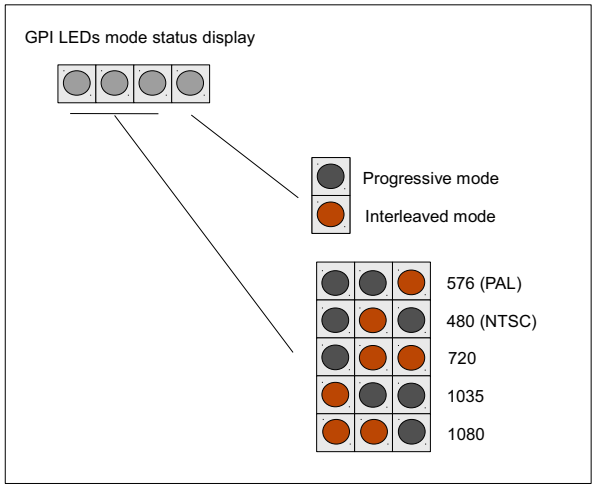


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Table 2–6 Register Settings 0Eh and 2Eh

<table>
<tr><th>Ch 1 Reg #</th><th>Ch 2 Reg #</th><th>Description</th><th>EU Default</th><th>AUST Default</th></tr>
<tr><td>0E</td><td>2E</td><td>
Block Regeneration and GPI LED Settings
Min: N/A – Max: N/A

This register is used to control miscellaneous functions on the card including the front status LED's.

<table>
<tr><th>Bit(s)</th><th>Function</th></tr>
<tr><td>7</td><td>Block Regeneration:
0 = Normal operation: automatic regeneration.
1 = Block OP-47/WST data and replace with time fillers when no Newfor input is available.</td></tr>
<tr><td>6:4</td><td>Bits 6 through 4 apply to Register 0Eh only

<table>
<tr><th>Bit</th><th>Description</th><th>Values</th></tr>
<tr><td>6</td><td>Physical GPO Active Levels (Register 0Eh only)</td><td rowspan="3">0=Normal (active high
1=Inverted (active low</td></tr>
<tr><td>5</td><td>GPI Monitoring LEDs 5 to 8 Polarity</td></tr>
<tr><td>4</td><td>GPI Monitoring LEDs 1 to 4 Polarity</td></tr>
</table>
</td></tr>
<tr><td>3:0</td><td>LED Mode Selection:
0000 = GPI Rx Ch. A shown on LEDs 1 thru 4 (Register 03h) and GPI Rx Ch. B shown on LEDs 5 to 8 (Register 2Eh)
0001 = As above, ORed with GPIs 1 to 4
0010 = GPI Tx Ch. A shown on LEDs 1 to 4 (Register 0Eh) and GPI Tx Ch. B shown on LEDs 5 to 8 (Register 2Eh).
0011 = Engineering status display
All other values = Show status on LEDs 1 to 4 as shown below

<table>
<tr><th colspan="2">GPI 4</th></tr>
<tr><th>LED</th><th>Description</th></tr>
<tr><td>On</td><td>Interleaved Mode</td></tr>
<tr><td>Off</td><td>Progressive Mode</td></tr>
</table>

<table>
<tr><th rowspan="2">Description</th><th colspan="3">GPI LED</th></tr>
<tr><th>1</th><th>2</th><th>3</th></tr>
<tr><td>576 (PAL)</td><td>Off</td><td>Off</td><td>On</td></tr>
<tr><td>480 (NTSC)</td><td>Off</td><td>On</td><td>Off</td></tr>
<tr><td>720</td><td>Off</td><td>On</td><td>On</td></tr>
<tr><td>1035</td><td>On</td><td>Off</td><td>Off</td></tr>
<tr><td>1080</td><td>On</td><td>Off</td><td>On</td></tr>
</table>
</td></tr>
</table>
</td><td>00</td><td>00</td></tr>
</table>

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Figure 2–4 Registers 0Fh and 2Fh

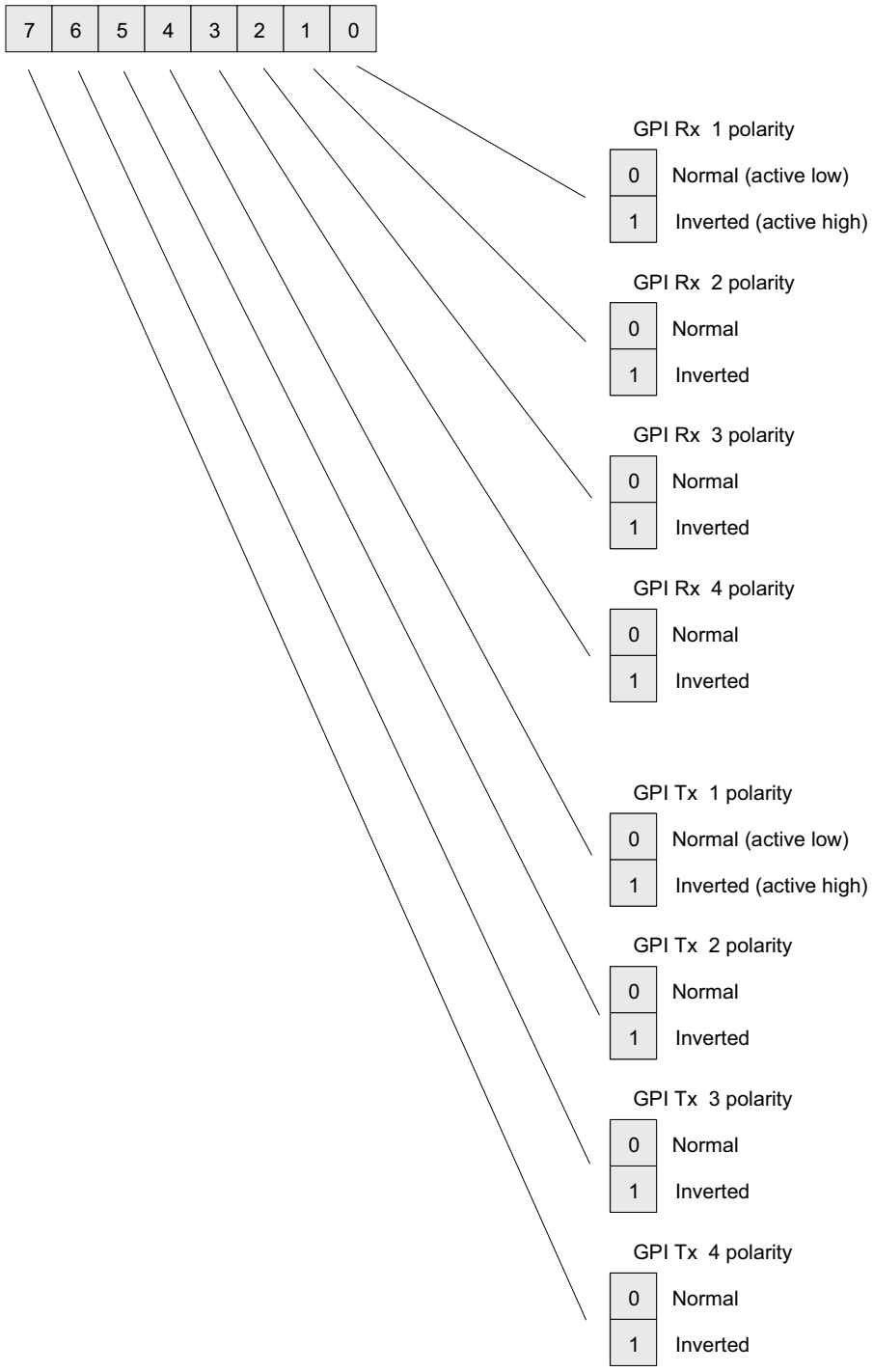

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Table 2–7 Register Settings 0Fh and 2Fh

<table>
<tr><th>Ch 1 Reg #</th><th>Ch 2 Reg #</th><th>Description</th><th>EU Default</th><th>AUST Default</th></tr>
<tr><td>0F</td><td>2F</td><td>GPI Rx nd Tx Polarity Control
Min: N/A – Max: N/A
(See GPI Encoded Polarity (Tx) on page 47 for details.) Controls the polarity of the Rx and Tx GPIs for the card.
<table>
<tr><th>Bit(s)</th><th>Type</th><th>Function</th></tr>
<tr><td>7
6
5
4</td><td>Tx Input</td><td>0 = Normal (Active Low)
1 = Inverted (Active High)</td></tr>
<tr><td>3
2
1
0</td><td>Rx Output</td><td>0 = Normal (Active Low)
1 = Inverted (Active High)</td></tr>
</table></td><td>00</td><td>00</td></tr>
</table>

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Figure 2–5 Registers 10h and 30h

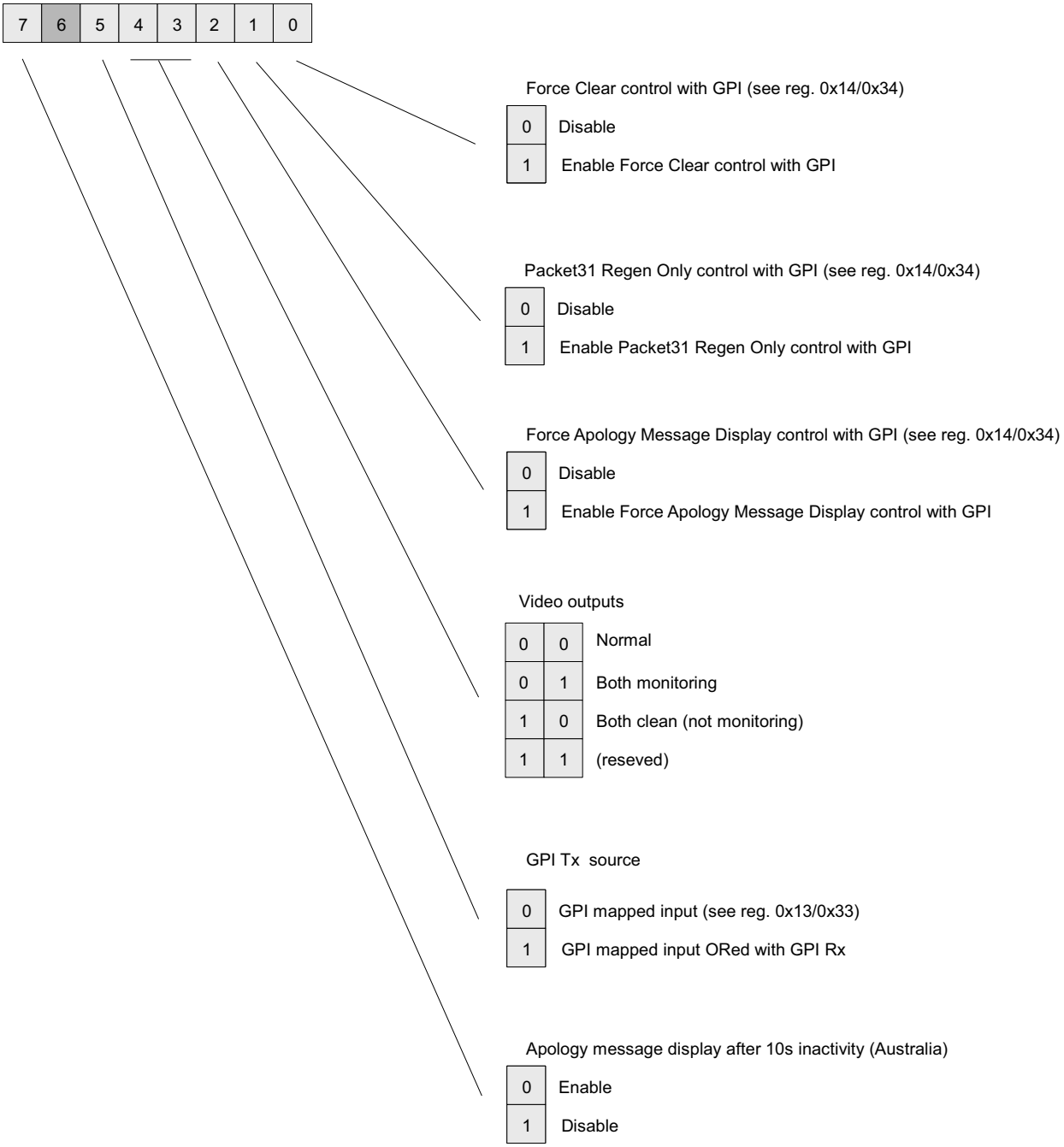

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Table 2–8 Register Settings 10h and 30h

<table>
<tr><th>Ch 1 Reg #</th><th>Ch 2 Reg #</th><th>Description</th><th>EU Default</th><th>AUST Default</th></tr>
<tr><td>10</td><td>30</td><td>
Special Function Register—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>7</td><td>Aplogy Message Display After 10 sec Inactivity:
0 = Enable 1 = Disable</td></tr>
<tr><td>6</td><td>Reserved: Set to 0</td></tr>
<tr><td>5</td><td>GPI Tx Source
0 = GPI mapped input (see Registers 13h/33h)
1=GPI mapped input ORed with GPI Rx</td></tr>
<tr><td>4[a]:3</td><td>Video Output s:
00 = Normal
01 = Both outputs set to monitoring
10 = Both outputs are clean
11 = Not Used</td></tr>
<tr><td>2</td><td>Force Apology Message Display Control with GPI (See 14h/34h).
0 = Enable 1 = Disable</td></tr>
<tr><td>1</td><td>Packet 31 Regen Only control with GPI (See 14h/34h).
0 = Enable 1 = Disable</td></tr>
<tr><td>0</td><td>Force clear control with GPI (See 14h/34h):
0 = Enable 1 = Disable</td></tr>
</table>
a Normal (default) = Monitoring O/Ps are 3 and 4; Clean O/Ps are 1 and 2
Monitoring = Burnt-in captions on all O/Ps
Clean = No burnt-in captions on any O/Ps
</td><td>80</td><td>00</td></tr>
</table>

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Figure 2–6 Registers 11h and 31h

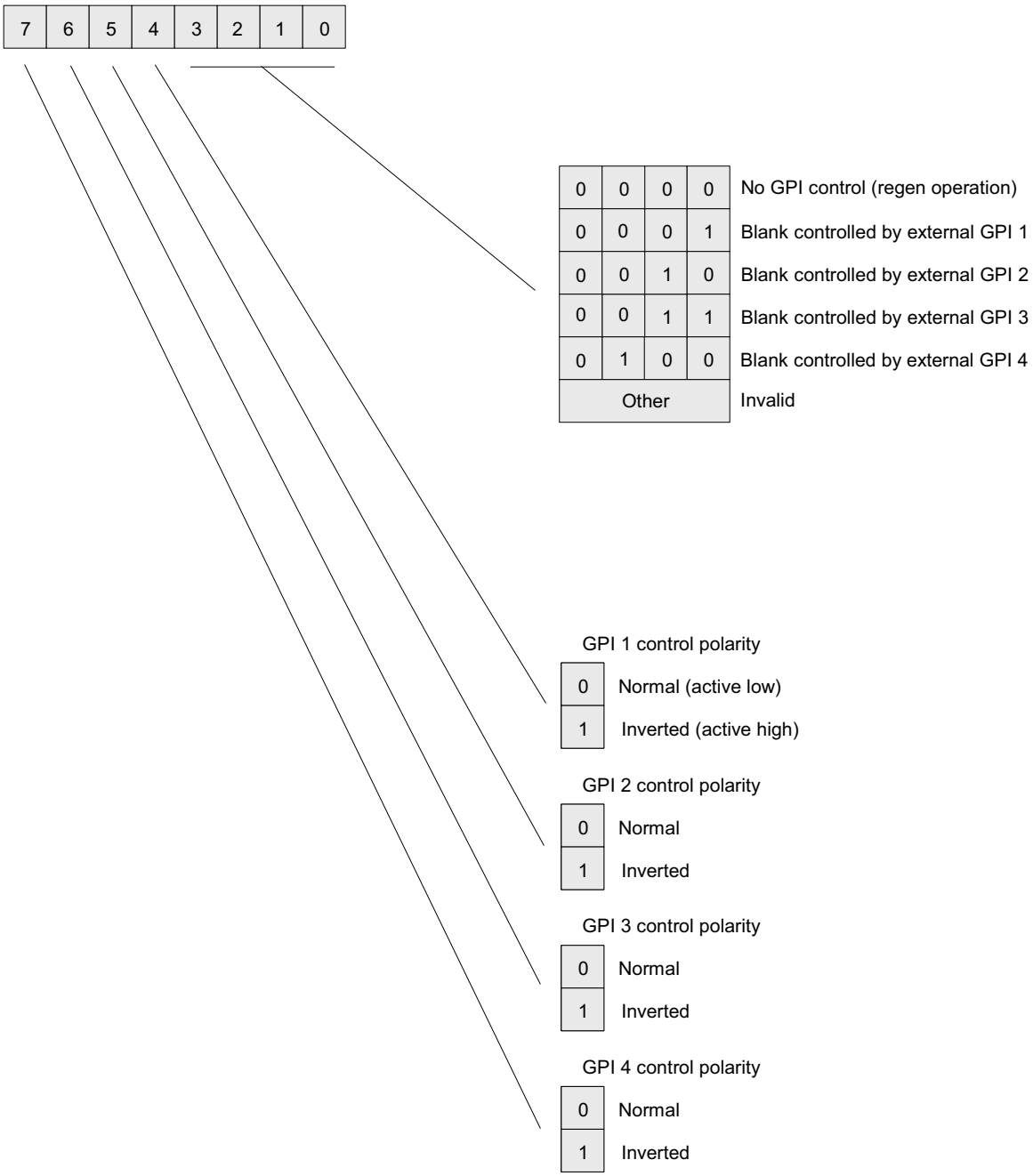

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Table 2–9 Register Settings 11h and 31h

<table>
<tr><th>Ch 1 Reg #</th><th>Ch 2 Reg #</th><th>Description</th><th>EU Default</th><th>AUST Default</th></tr>
<tr><td>11</td><td>31</td><td>Bypass Control with External GPI
Min: N/A – Max: N/A
This register assigns a GPI to inhibit the 'regen' operation of subtitle streams already encoded in I/P1 (or I/P2 respectively). When on, the GPI controls whether the incoming subtitles are regenerated or blanked. Special care needs to be taken to assure the GPI selected has not been already assigned to another task.
<table><tr><th>Bit(s)</th><th>Function</th></tr><tr><td>4
5
6
7</td><td>GPI:
0 = Active Low
1 = Active High</td></tr><tr><td>3:0</td><td>GPI Polarity:
0000 = No GPI control: normal regen operation
0001 = GPI 1
0010 = GPI 2
0011 = GPI 3
0100 = GPI 4
All other values = invalid</td></tr></table></td><td>00</td><td>00</td></tr>
</table>

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Figure 2–7 Registers 12h and 32h

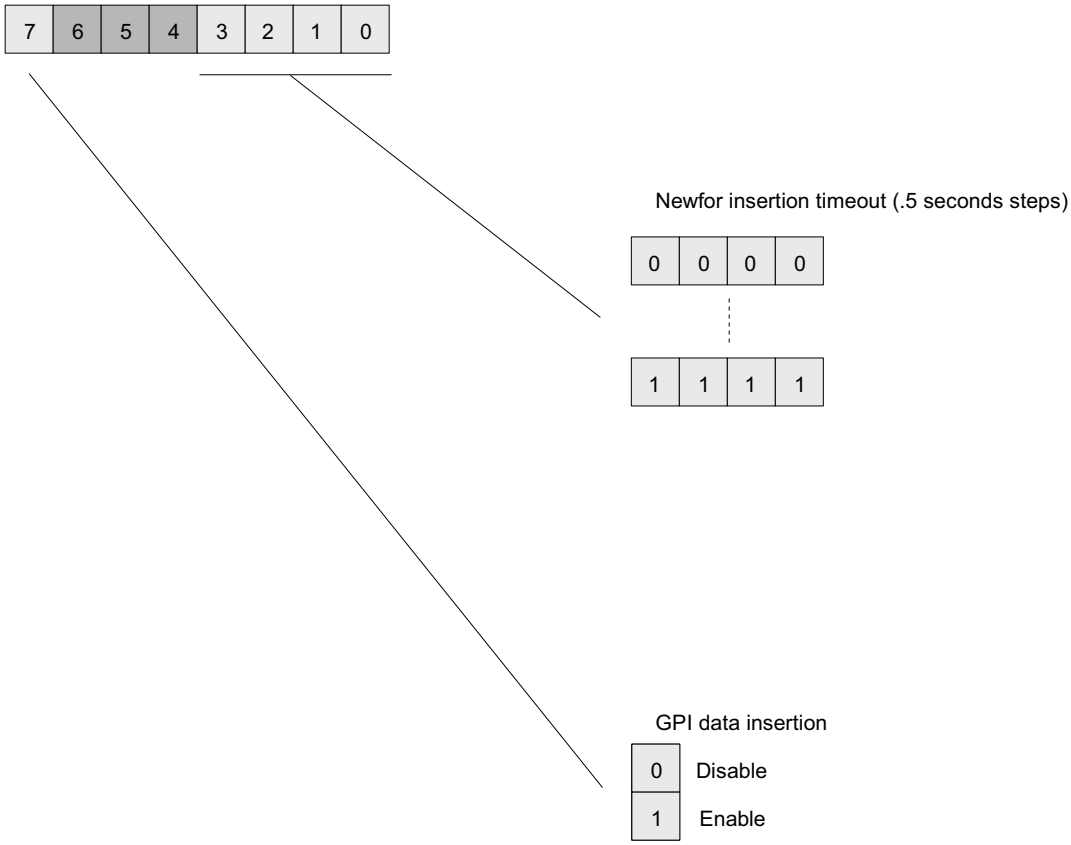

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Table 2–10 Register Settings 12h and 32h

<table>
<tr><th>Ch 1 Reg #</th><th>Ch 2 Reg #</th><th>Description</th><th>EU Default</th><th>AUST Default</th></tr>
<tr><td>12</td><td>32</td><td>GPI Data Insertion Control and Newfor Insertion Timeout
Min: N/A – Max: N/A
Bit 7 enables the insertion of GPI data into the video stream.
Bits 0 thru 3 control the timeout settings for subtitle insertion. These bits set the changeover time between loss of Newfor data and the pass-through of input captions when present. If a valid teletext header is present on the input and the timeout has been reached then the card will select this data to be passed through after the timeout has expired. The timeout is reset on the detection of Newfor data.
<table>
<tr><th>Bit(s)</th><th>Function</th></tr>
<tr><td>7</td><td>GPI Insertion:
0 = Off
1 = On</td></tr>
<tr><td>6:4</td><td>Reserved: Set to 0</td></tr>
<tr><td>3:0</td><td>Time Out:
0000 = No timeout (immediate changeover)
0001 = 0.5 second
0010 = 1.0 second
...
1110 = 7.0 seconds
1111 = 7.5seconds</td></tr>
</table></td><td>0F</td><td>0F</td></tr>
</table>

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Figure 2–8 Registers 13h and 33h

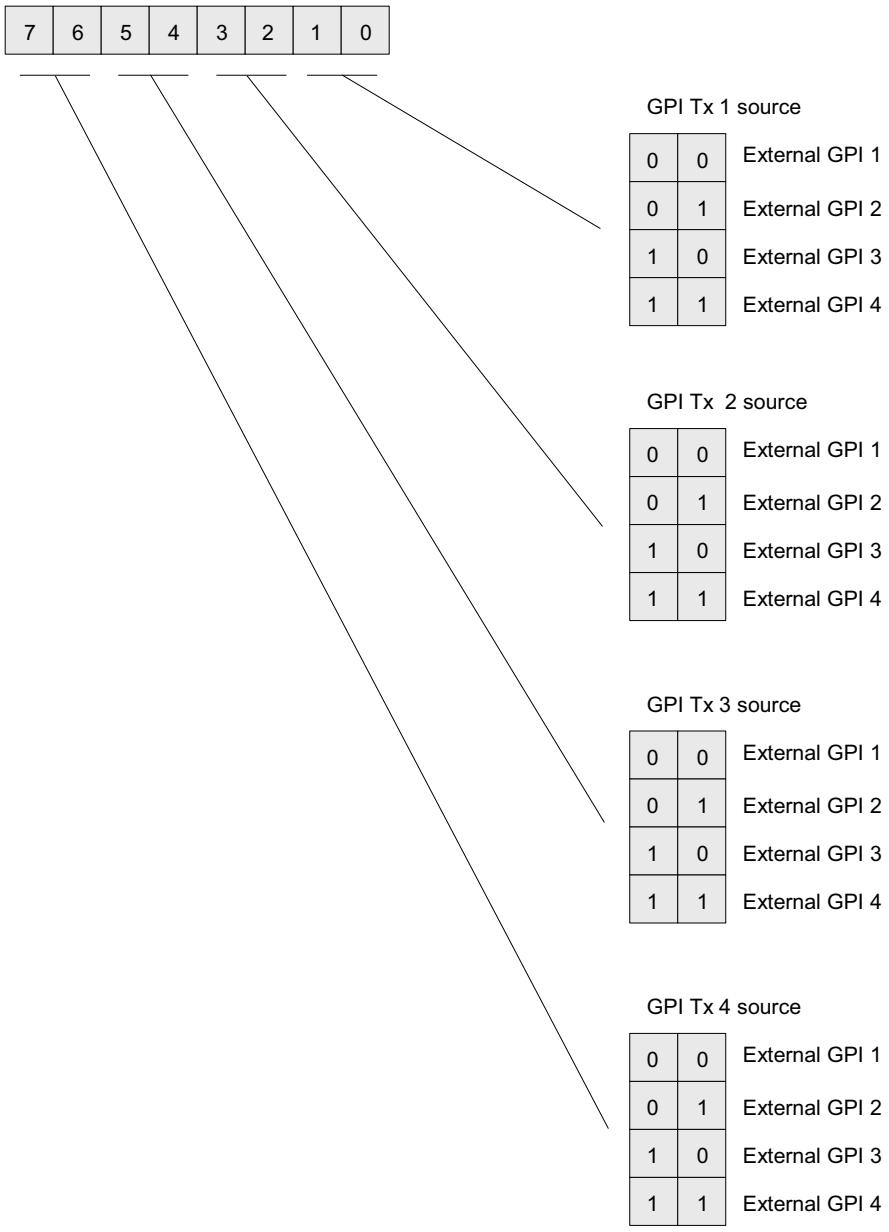

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Table 2–11 Register Settings 11h to 1Fh and 31h to 3Fh

<table>
<tr><th>Ch 1 Reg #</th><th>Ch 2 Reg #</th><th>Description</th><th>EU Default</th><th>AUST Default</th></tr>
<tr><td>13</td><td>33</td><td>GPI Mapping for Tx
Min: N/A – Max: N/A
This register allows you assign physical GPIs to any of the four virtual GPIs transmitted by the card. The card transmits four GPIs but in some instances, users may need to re-map the actual GPIs sent in any of these four placeholders.
<table>
<tr><th>Bit(s)</th><th>Internal GPI</th><th>Function</th></tr>
<tr><td>7:6</td><td>4</td><td rowspan="4">External GPIs:
00 = GPI 1
01 = GPI 2
10 = GPI 3
11 = GPI 4</td></tr>
<tr><td>5:4</td><td>3</td></tr>
<tr><td>3:2</td><td>2</td></tr>
<tr><td>1:0</td><td>1</td></tr>
</table></td><td>E4</td><td>E4</td></tr>
</table>

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Figure 2–9 Registers 14h and 34h

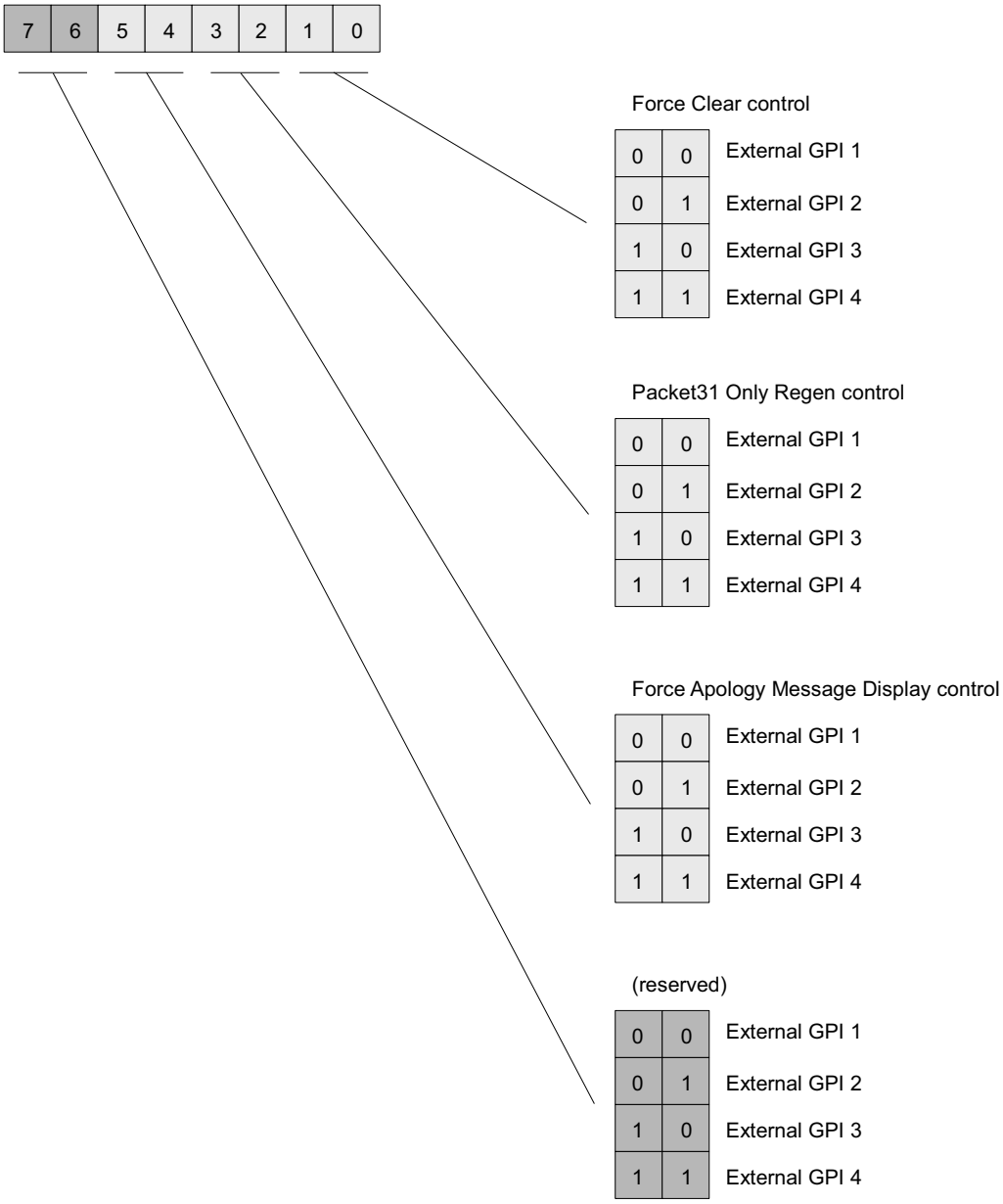

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Table 2–12 Register Settings 14h to 19h and 34h to FDh

<table>
<tr><th>Ch 1 Reg #</th><th>Ch 2 Reg #</th><th>Description</th><th>EU Default</th><th>AUST Default</th></tr>
<tr><td>14</td><td>34</td><td>GPI Mapping for Feature Control
Min: N/A – Max: N/A
This register determines how the GPI are routed to perform special functions.
<table><tr><th>Bit(s)</th><th>Function</th></tr><tr><td>7:6</td><td>Reserved</td></tr><tr><td>5:4</td><td>Force Apology Message Display Control:
00 = GPI 1 01 = GPI 2
10 = GPI 3 11 = GPI 4</td></tr><tr><td>3:2</td><td>Controls the GPI used to activate the "Packet31 only regen" operation.:
00 = GPI 1 01 = GPI 2
10 = GPI 3 11 = GPI 4</td></tr><tr><td>1:0</td><td>Controls the GPI used to force the card to immediately send an on-air "Clear Subtitle" command.
00 = GPI 1 01 = GPI 2
10 = GPI 3 11 = GPI 4</td></tr></table></td><td>E4</td><td>E4</td></tr>
<tr><td>15</td><td>35</td><td>Time Filler Page Number
Min: 00 – Max: FF</td><td>FF</td><td>FF</td></tr>
<tr><td>16</td><td>36</td><td>Time Filler Subcode Bottom 2 Digits
Min: 00 – Max: 7E</td><td>7E</td><td>7F</td></tr>
<tr><td>17</td><td>37</td><td>Terminator Page Number
Min: 00 – Max: FF</td><td>FF</td><td>EE</td></tr>
<tr><td>18</td><td>38</td><td>Terminator Subcode Bottom 2 Digits
Min: 00 – Max: 7F</td><td>7E</td><td>7F</td></tr>
<tr><td>19</td><td>39 thru FD</td><td colspan="3">Reserved: Do Not Change</td></tr>
</table>

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Figure 2–10 Register FEh

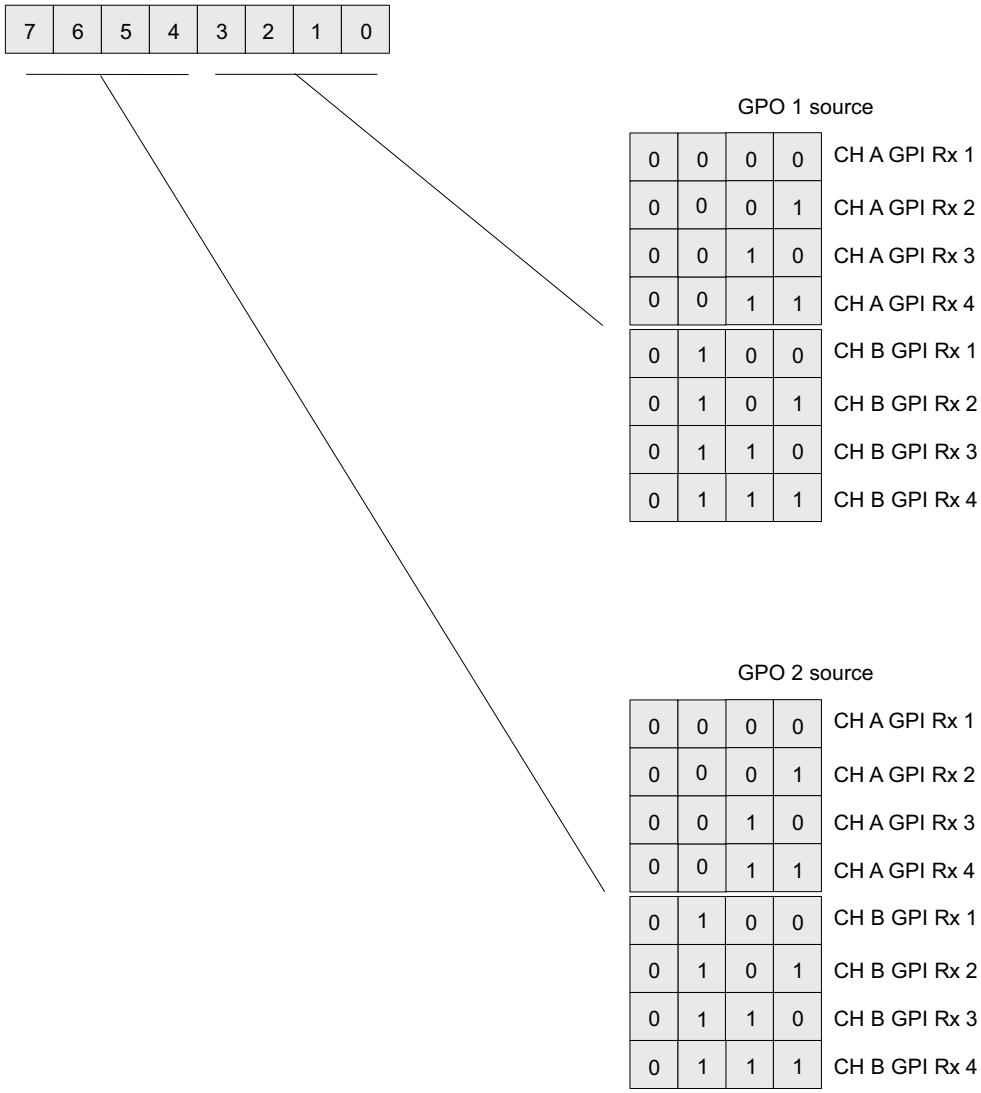

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Table 2–13 Register Setting FEh - Both Channels

<table>
<tr><th>Description</th><th>Default</th></tr>
<tr><td>GPO 1 and 2 Source
Min: N/A – Max: N/A
<table>
<tr><th>Bit(s)</th><th>Function</th></tr>
<tr><td>0:3</td><td>GPO 1 Source
0000 = Ch A GPI Rx 1
0001 = Ch A GPI Rx 2
0010 = Ch A GPI Rx 3
0011 = Ch A GPI Rx 4
0100 = Ch B GPI Rx 1
0101 = Ch B GPI Rx 2
0110 = Ch B GPI Rx 3
0111 = Ch B GPI Rx 4</td></tr>
<tr><td>4:7</td><td>GPO2 Source
0000 = Ch A GPI Rx 1
0001 = Ch A GPI Rx 2
0010 = Ch A GPI Rx 3
0011 = Ch A GPI Rx 4
0100 = Ch B GPI Rx 1
0101 = Ch B GPI Rx 2
0110 = Ch B GPI Rx 3
0111 = Ch B GPI Rx 4</td></tr>
</table></td><td>10h</td></tr>
</table>

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Figure 2–11 Register FFh

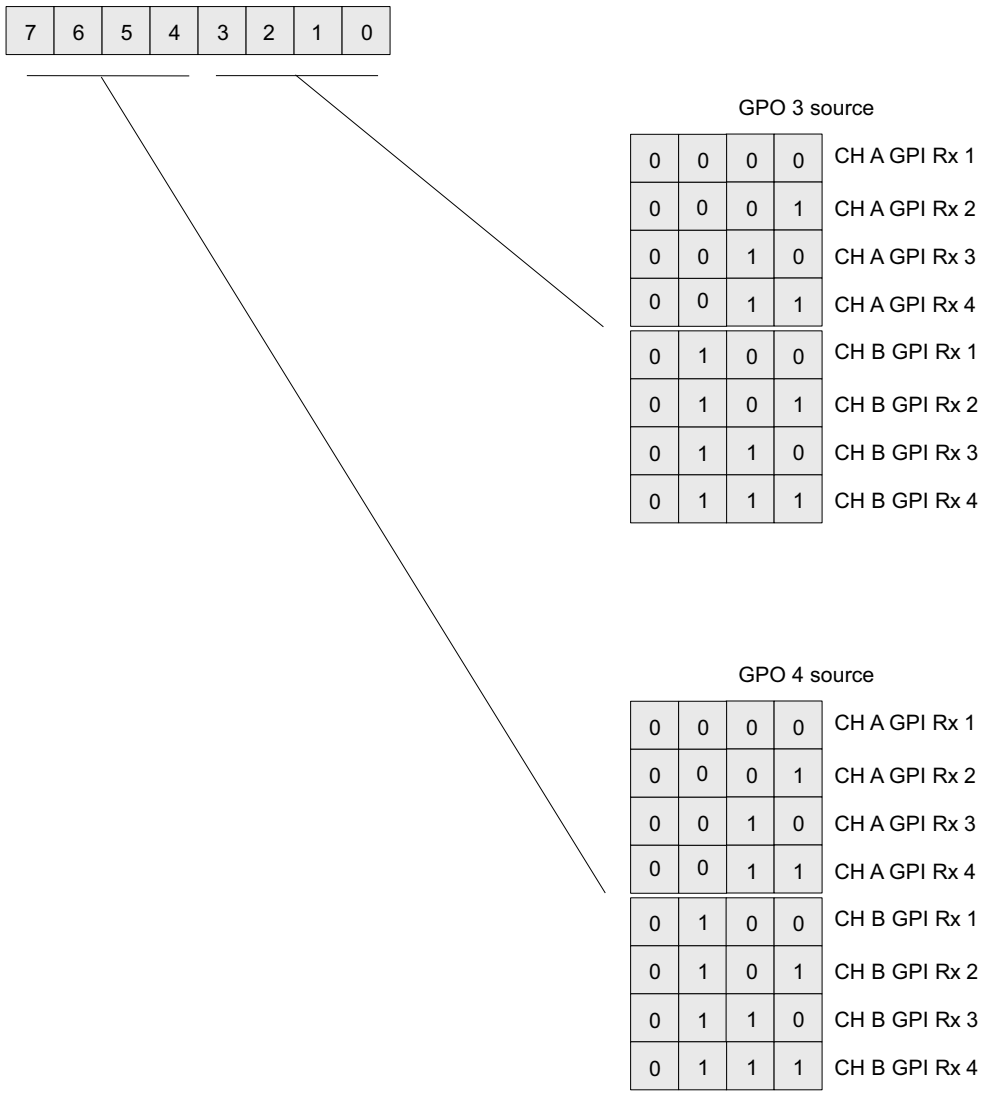

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Table 2–14 Register Setting Descriptions - Both Channels

<table>
<tr><th>Description</th><th>Default</th></tr>
<tr><td>GPO 3 and 4 Source
Min: N/A – Max: N/A

<table>
<tr><th>Bit(s)</th><th>Function</th></tr>
<tr><td>0:3</td><td>GPO 3 Source
0000 = Ch A GPI Rx 1
0001 = Ch A GPI Rx 2
0010 = Ch A GPI Rx 3
0011 = Ch A GPI Rx 4
0100 = Ch B GPI Rx 1
0101 = Ch B GPI Rx 2
0110 = Ch B GPI Rx 3
0111 = Ch B GPI Rx 4</td></tr>
<tr><td>4:7</td><td>GPO 4 Source
0000 = Ch A GPI Rx 1
0001 = Ch A GPI Rx 2
0010 = Ch A GPI Rx 3
0011 = Ch A GPI Rx 4
0100 = Ch B GPI Rx 1
0101 = Ch B GPI Rx 2
0110 = Ch B GPI Rx 3
0111 = Ch B GPI Rx 4</td></tr>
</table>
</td><td>32h</td></tr>
</table>

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For all registers with hamming encoding, the following table defines those codes.

Table 2–15 Hamming Codes

Byte	Encoding
0	15
1	02
2	49
3	5E
4	64
5	73
6	38
7	2F
8	D0
9	C7
A	8C
B	9B
C	A1
D	B6
E	FD
F	EA

Magazine and Page Number Settings

The magazine has a range of 1 through 8. Since only a 3-bit value is allowed to represent the magazine, Magazine 8 is represented by 0 and values 1 through 7 represent Magazines 1 through 7 respectively.

The page number is a BCD number between 00h and 99h.

Example: So to insert captions on Magazine 8, Page 88 by default, set the following registers (See Table 2–4 on page 17 for details.):

- Register 06h = 15h (Magazine 8 Hamming Encoded)
- Register 07h = 88h

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You should also set Registers 08h and 09h for the decoder.

Note: Do not try to convert 88 into a hexadecimal number—it's already in BCD format.

Note Sending a PAGE 999 command via the Newfor protocol will restore the inserter to the default magazine and page.

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CHAPTER 3
Using the General Purpose Inputs/Outputs

Introduction

Overview

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

Topics

Topics	Page
Introduction	41
Functionality	42
Alternate Uses	45
Encloded GPI Polarities	47

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Functionality

The GPI interface allows the user to encode up to four 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 or other antiquated encoding techniques.

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

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

Typically the GPI data is encoded on Line 9 of the HD-SDI signal and on line 19 of the SD-SDI signal. However, the HDCC is flexible enough to allow you to assign the lines on which you want the GPI data. See Modifying the Register Settings on page 20 for details.

You can also use the GPI interface to control other operational aspects of the card. (See Alternate Uses on page 45.)

Figure 3–1 on page 43 illustrates the GPI-I/O signal flow through the HDCC. For our purposes, a GPI-input (often called a GPI) is an input signal to the HDCC card supplied by the user through the physical GPI-I/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 GPI-output (often called a GPO) is a signal the HDCC card receives on the incoming SDI video stream that is output to the physical GPI-I/O port to signify some condition, event, or command generated by upstream equipment.

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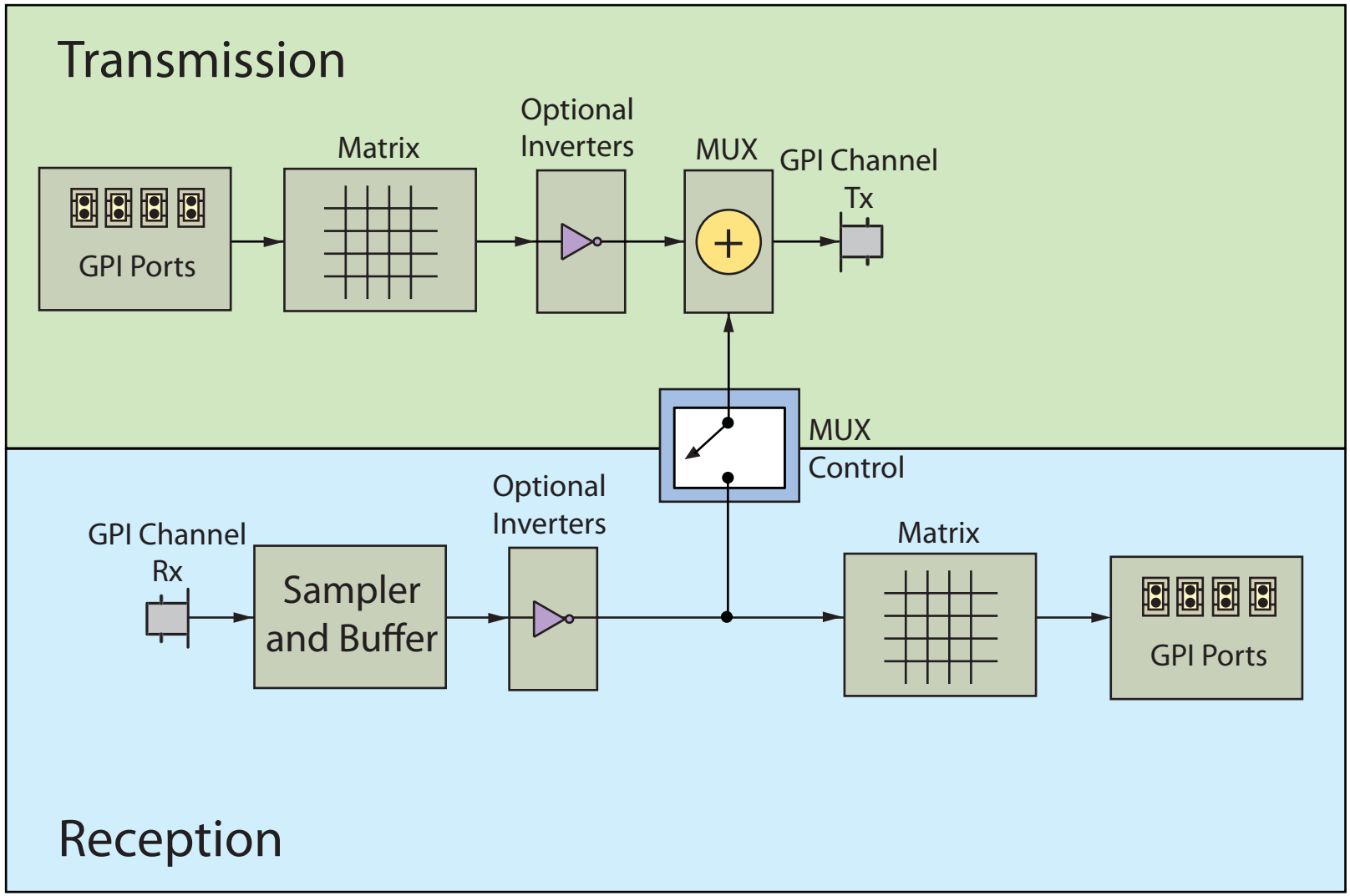
Figure 3–1 GPI/O Functional Diagram



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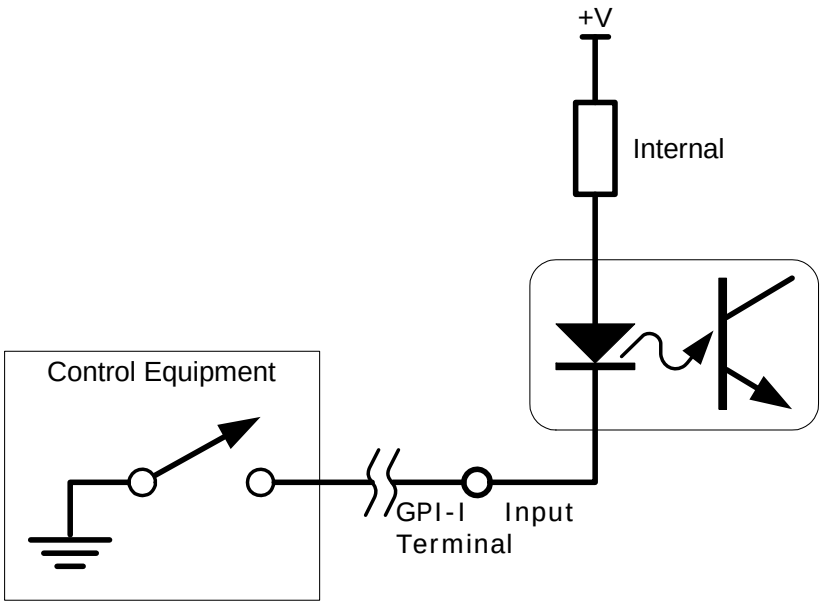
GPI-Inputs

The GPI-inputs are designed to be asserted by switching the closures to ground. Asserting a GPI-input will result in that input state being encoded on the configured line of the video signal.

Figure 3–2 Input Diagram



GPI-Outputs

If the incoming SDI data stream contains GPI data on the configured line of the video signal, the GPI-outputs on the card will be asserted according to the received GPI data. The GPI-output is asserted when its voltage is high. .

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

The HDCC provides four GPI-outputs. (See Connector Pin Assignments on page 57 in Chapter 4 for connectivity.)

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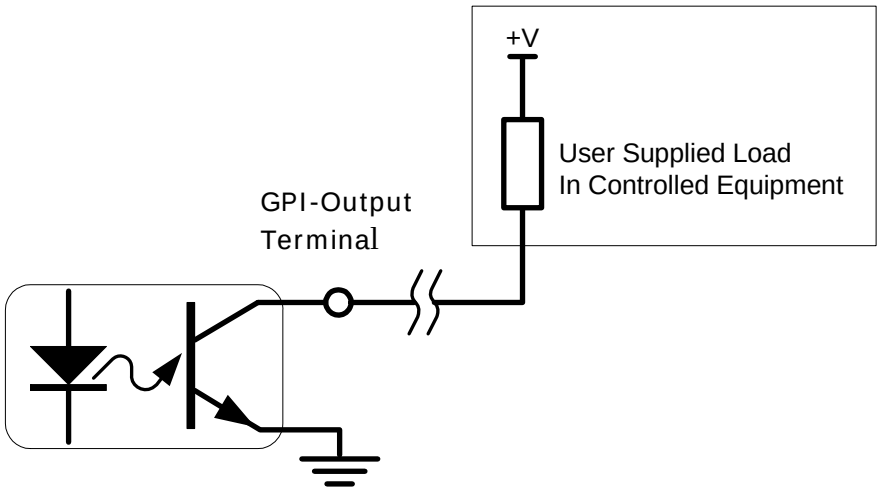
Figure 3–3 Output Diagram



Alternate Uses

In addition to the standard functionality, the GPI-inputs can be re-assigned to perform specific pre-defined tasks.

WARNING! EXERCISE EXTREME CAUTION when modifying register values. Improper configuration of the registers can cause the HDCC to behave in unexpected ways.

These functions include:

- Block regen operation (prevent subtitles to pass through the card)
- Force broadcasting of a "Subtitle Clear" command
- Force broadcasting on an apology message subtitle

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Force Clear

Refer to Registers 14 and 24 (Figure 2–9 on page 33) for more information.

Table 3–1 Force Clear

Channel	Register	Bit(s)	Values
A	10h	0	0=Normal
			1 = GPI-I: Force clear
B	30h	0	0=Normal
			1 = GPI-I: Force clear

When asserted GPI-I will cause a closed caption clear command to be inserted into the video stream. Refer to page 34 for Register 14h/34h values that determine which GPI-I is used.

Force Apology Message

When asserted, a GPI-I will display a message indicating that no captions are available to be inserted into the video stream. Refer to Force Apology Message Display Control: on page 34 for Register 14h values that determine which GPI-I is used.

Table 3–2 Force Clear

Channel	Register	Bit(s)	Values
A	10h	3	0=Normal
			1 = GPI-I: Force clear
B	30h	3	0=Normal
			1 = GPI-I: Force clear

Inhibit Captions

A GPI-I can be assigned to inhibit the 'regen' operation of subtitle streams already encoded in I/P1 or I/P2: the GPI-I controls whether the incoming subtitles are regenerated or blanked. The bits set determine which GPI-I is used to inhibit the regen operation, as shown in Table 3–3 on page 47.

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Table 3–3 Inhibit Captions

Channel	Register	Bits 3:0	Result
A	11h	0000	No Control (default)
		0001	GPI-I-1 inhibit regen
		0010	GPI-I-2 inhibit regen
		0011	GPI-I-3 inhibit regen
		0100	GPI-I-4 inhibit regen
		Else	Invalid
B	31h	0000	No Control (default)
		0001	GPI-I-1 inhibit regen
		0010	GPI-I-2 inhibit regen
		0011	GPI-I-3 inhibit regen
		0100	GPI-I-4 inhibit regen
		Else	Invalid

Encloded GPI Polarities

You can control the polarities of the GPI-I/Os, both as asserted and as encoded.

GPI Encoded Polarity (Tx)

Table 3–4 GPI Encoded Polarity (Tx)

Channel	Register	Bit(s)	Values
A	0Fh	4 through 7	See Table 3–5 below.
B	2Fh	4 through 7	

You can set the polarity of the GPI as encoded on the data stream as shown in Table 3–5 below.

Table 3–5 Register 0Fh and 2Fh: Bits 4 through 7

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

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GPI Received Polarity (Rx)

Table 3–6 GPO Received Polarity (Rx)

Channel	Register	Bit(s)
A	0Fh	3:0
B	2Fh	3:0

You can set the polarity of the GPI-O as received on the data stream as shown in Table 3–7 below.

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

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

Physical GPI-O Active Level

Register 0Eh sets the active level polarity of the physical GPI-O ports.

Table 3–8 Physical GPO Active Level

Channels	Register	Bit(s)	Values
Both	0Eh	6	0=Normal (Active High) 1=Inverted (Active Low

Enabling/Disabling GPI Transmission

Table 3–9 Enabling/Disabling GPI Transmission

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

The HDCC can be configured to disable transmission of GPI data by setting the bit 7 of registers 12h/22h.

Important: The lower four bits (bits 0 through 3) of Register 12h and 22h are used for setting the automatic automatic changeover timeout; be careful not to inadvertently modify these bits when changing the value of this register.

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CHAPTER 4
Features and Specifications

Introduction

Overview

This chapter explains the features of the HDCC closed caption card and details all of the specifications.

Topics

Topics	Page
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Advanced Operation	54
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Technical Functional Overview	59

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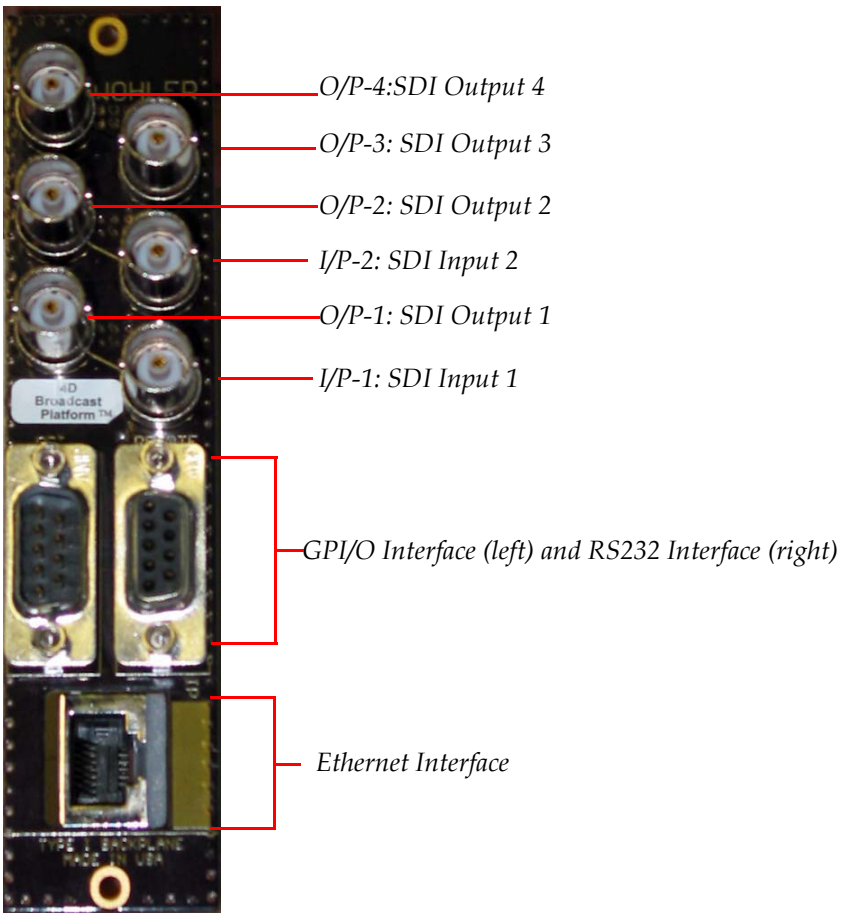
Features

Description

Hardware

The image and call outs in Figure 4–1 provide a reference for the detailed interface descriptions provided below.

Figure 4–1 Codan Adaptor and Interface Layout



BNC Interfaces

- **I/P-1 and I/P-2:** These interfaces (Channel A and Channel B, respectively) accept SDI channel inputs that conform to the SMPTE 259M standard for SD and SMPTE 292M standard for HD.

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- **O/P 1 and O/P 2:** These SDI outputs provide encoded caption data. They are relay bypassed on power failure, card removal, or card failure.

- **O/P 3 and O/P 4:** These SDI outputs (Channel A and Channel B, respectively) provide encoded caption data as well as an open caption display of the encoded data. The open caption display is fed from the final output stage of the card.

GPI Interface

Four GPI-inputs and four GPI-outputs are provided for products that use the GPI-I/O functionality. All GPI-I/Os are opto-coupled through the card.

Serial and Ethernet Interfaces

The serial and Ethernet interface (100BT) is used to input Newfor data into the card when used as a subtitle inserter and as a monitoring port when used as a closed caption analyzer.

Software

The HDCC is a dual-channel card that delivers captions text and performs a variety of other tasks related to captioning. The card receives Newfor caption data through an RS-232 serial port and/or an ethernet port. The four functions of the card are:

- HD/SD Caption Encoding/Inserting

- HD/SD Caption Bridging and Transcoding

- GPI Encoding

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Functionality

The HD/SD Caption Inserter (Encoding)

The HD caption inserter can be used to encode two independent HD-SDI sources with unique subtitle data, or two independent HD-SDI sources with identical data where the signal is intended to be used for different markets. The two signals do not need to be synchronous.

The HD/SD Bridge and Transcoder (Briding and Transcoding)

The SD/HD bridge copies encoded subtitle data from one video channel to the other, transcoding it if required (SD to HD or HD to SD).

Connectivity

Interfaces

A serial port (RS-232) and an ethernet interface (adaptor-dependent) are provided to insert subtitle data. Either interface can be used to control one or both channels of the card as required. subtitling workstations that use the Newfor protocols can be connected to the card through either interface to allow the encoding of subtitles. The Ethernet interface allows you to control the card from virtually any location within the facility as long as you have a network connection.

Newfor Protocol

Newfor is a protocol used by a number of caption workstations to create subtitle data. The subtitle inserter takes the Newfor data input and converts it into the required data. The subtitle inserter then inserts the converted data and also inserts the appropriate “Dummy Header/ Time Filler” packets required for a usable transmission.

Data Insertion

Each channel of the card has two clean outputs that carry the encoded subtitle data, one of which is protected by a bypass relay.

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Automatic Regen / Insert Changeover

The subtitle inserter automatically switches back from insert to regen mode, depending on the subtitle data being delivered to the serial and/or Ethernet interfaces. This automatic changeover timeout is configurable,and can be forced to either mode, independantly for Field 1 or Field 2.

Automatic Subtitle Page Clearing

The subtitles inserter is continually monitoring, through the Ethernet port or the RS-232 port, the Newfor source for valid caption data. Once the time out period has expired, the card looks for pre-existing data at its video input. If no data is present after a 10s timeout, the card automatically inserts packets with the "PAGE CLEAR" flag every 10 seconds.

GPI Interfaces

Four optically isolated GPI-Is and four optically isolated GPI-Os are available to control some of the card's features, including inserting and extracting GPI data in the VBI or HD-VANC.

Supported Formats

The HDCC supports the following video formats:

- 460i60
- 576i50
- 720p (all field rates)
- 1035i (all field rates)
- 1080p (all field rates)

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Advanced Operation

User Controls

Table 4–1 below lists all the values for SW 1.

Table 4–1 Switch 1 Communications Settings[a]

Setting	Function
0	Insert subtitles on Channel A from the serial port and on Channel B from the ethernet port. No decoding.
1	Insert subtitles on Channel A and Channel B from the serial port. No decoding.
2	Insert subtitles on both Channel A and Channel B from the ethernet port. No decoding.
4 thru D	Not used
E	Access configuration through serial port
F	Access configuration through Ethernet port

a See also Figure 1–2 on page 3.

Table 4–2 below lists the valid settings for SW 2.

Table 4–2 Switch 2 Communications Settings

Setting	Function
0	Normal Operation
1	Copy subtitles from Channel A to Channel B
2	Copy subtitles from Channel B to Channel A
3 thru F	Not used

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Status Indicators

Table 4–3 below describes the LED status indicators on the front of the HDCC card..

Table 4–3 Front Panel Status Indicators

LED #	Label	Color	Function
Power		Green	Lights to indicate that the card is receiving power.
SDI I/P		Green	Confirms that a valid serial digital input is present. This LED will light only when the signal is present and locked. If the signal input fails or is not stable, the LED will flash at a 1 Hz rate.
SDI O/P		Green	Confirms that a valid serial digital input is present. This LED will light only when the signal is present and locked. If the signal input fails or is not stable, the LED will flash at a 1 Hz rate.
LED 1	GPI-I-1	Green	Refer to Register 0Eh—See Register 0Eh ONLY —Register 2Eh Not Used on page 23 and Table 2–6 on page 22 for details.
LED 2	GPI-I-2		
LED 3	GPI-I-3		
LED 4	GPI-I-4		
LED 5	GPI-O-1	Red	
LED 6	GPI-O-2		
LED 7	GPI-O-3		
LED 8	GPI-O-4		

Specifications

Table 4–4 Physical Specifications

Specification	Value
Dimensions (H x W x D)	4″ x 8.7″x .5″ (101.60 mm x 220.98 mm x 127.00 mm)
Shipping Weight	1 lbs (.45 kg)
Space Requirements	3 RU
Supplied Accessories	Rear panel adaptor for user-specified frame

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Table 4–4 Physical Specifications

Specification	Value
Power Requirements	Receives power from frame
Power Consumption	Approximately 10 W

Table 4–5 Technical Specifications

Specification	Value
Inputs	2 SD/HD-SDI autosensing on BNC 4 GPI-I (DB-9) (on 10-pin header on the Evertz rear panel adaptor)
Outputs	2 HD/SD-SDI Subtitle (BNC) 2 HD/SD-SDI Open Captioned (BNC) 4 GPI-O (DB-9) (on 10-pin header on the Evertz rear panel adaptor)
Inputs/Outputs	Ethernet (RJ-45) (not available on the IRT rear panel adaptor) 1 RS-232 (DB-9) (on Codan and IRT rear panel adaptors) 1 RS-232 (10-pin header on the Evertz rear panel adaptor)
Frame compatibility	• Codan • Evertz • IRT
Available functions	• HD/SD Caption Encoding/Inserting • HD/SD Caption Bridging and Transcoding • GPI Encoding
Available protocols	OP-47/WST
Available languages	• English • German • Swedish • Italian • French • Spanish • Arabic

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Connector Pin Assignments

Table 4–6 GPI DB-9 Pin-Out Assignments (Codan and IRT Adaptors)

Pin	Label	Interface
1	Common GND	GND
2	GPI-O-4	Open Collector (Emitter to Ground)
3	GPI-O-3	
4	GPI-O-2	
5	GPI-O-1	
6	GPI-I-4	Active Low
7	GPI-I-3	
8	GPI-I-2	
9	GPI-I-1	

Figure 4–2 GPI DB-9 Male Pin-Out

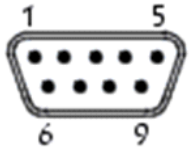

Table 4–7 RS-232 DB-9 Pin-Out Assignments (Codan and IRT Adaptors)

Pin	Label	Function
1	N.C.	Not Connected
2	TXD	RS-232 Tx Data
3	RXD	RS-232 Rx Data
4	Not Connected	
5	Common GND	GND
6	The IRT adaptor has the second serial port available on pins 6 and 7. See Table 4–10 on page 59.	
7		
8		

Figure 4–3 RS-232 DB-9 Pin-Out

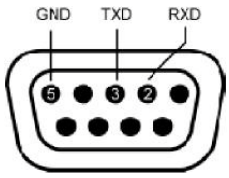

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Table 4–8 14-Pin Header Assignments - RS-232 and GPI (Evertz Adaptor)

Pin	Label	Interface
1	GPI-O-1	Open Collector
2	GPI-I-1	Active Low
3	GPI-O-2	Open Collector
4	GPI-I-2	Active Low
5	GPI-O-3	Open Collector
6	GPI-I-3	Active Low
7	GPI-O-4	Open Collector
8	GPI-I-4	Active Low
9	RS-232 Rx	RS-232 Rx Data
10	RS-232 Tx	RS-232 Tx Data
11	Common GND	Reference Ground
12		
13		
14		

Figure 4–4 14-Pin Header Assignments

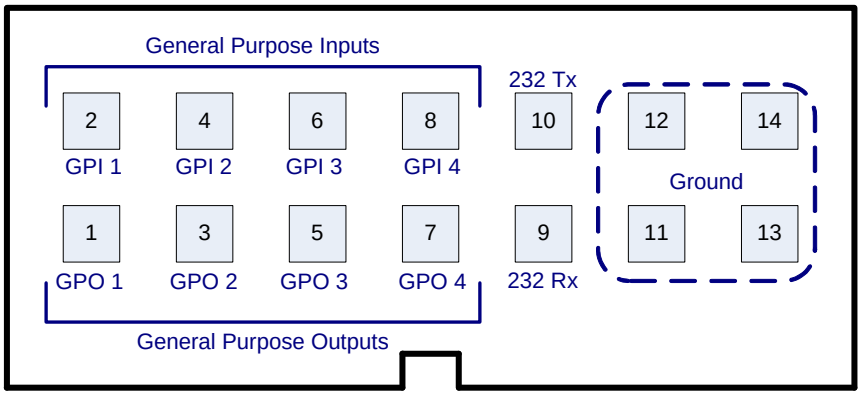

Table 4–9 DB9F Cable Connector (Codan and IRT Adaptors)

Pin	HDCC (DB9-F) to PC (DB9-M)
1	Do Not Connect.
2	Pin 2
3	Pin 3
4	Do Not Connect.
5	Pin 5

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Table 4–9 DB9F Cable Connector (Codan and IRT Adaptors) (Continued)

Pin	HDCC (DB9-F) to PC (DB9-M)
6	Do Not Connect.
7	
8	
9	

Note: Table 4–10 and Table 4–11 below provide the pin-out for the cable connecting the HDCC-200 to the PC. A straight serial cable (not a null modem cable) will also work.

IMPORTANT: Pins 1, 4, 6, 7, 8, and 9 MUST NOT be connected.

Table 4–10 HDCC (IRT) to PC Interface RS-232 #1

HDCC (IRT) DB-9F		PC DB-9M	
Pin	Description	Pin	Description
2	Tx D1	2	Rx D
3	Rx D1	3	Tx D
5	GND	5	GND
1, 4, 8, and 9: NC		1, 4, 6, 7, 8, and 9: NC	

Table 4–11 HDCC (IRT) to PC Interface RS-232 #2

HDCC (IRT) DB-9F		PC DB-9M	
Pin	Description	Pin	Description
7	TxD2	2	Rx D
6	RxD2	3	Tx D
5	GND	5	GND
1, 4, 8, and 9: NC		1, 4, 6, 7, 8, and 9: NC	

Technical Functional Overview

Figure 4–5 illustrates the design of the OP47TX.

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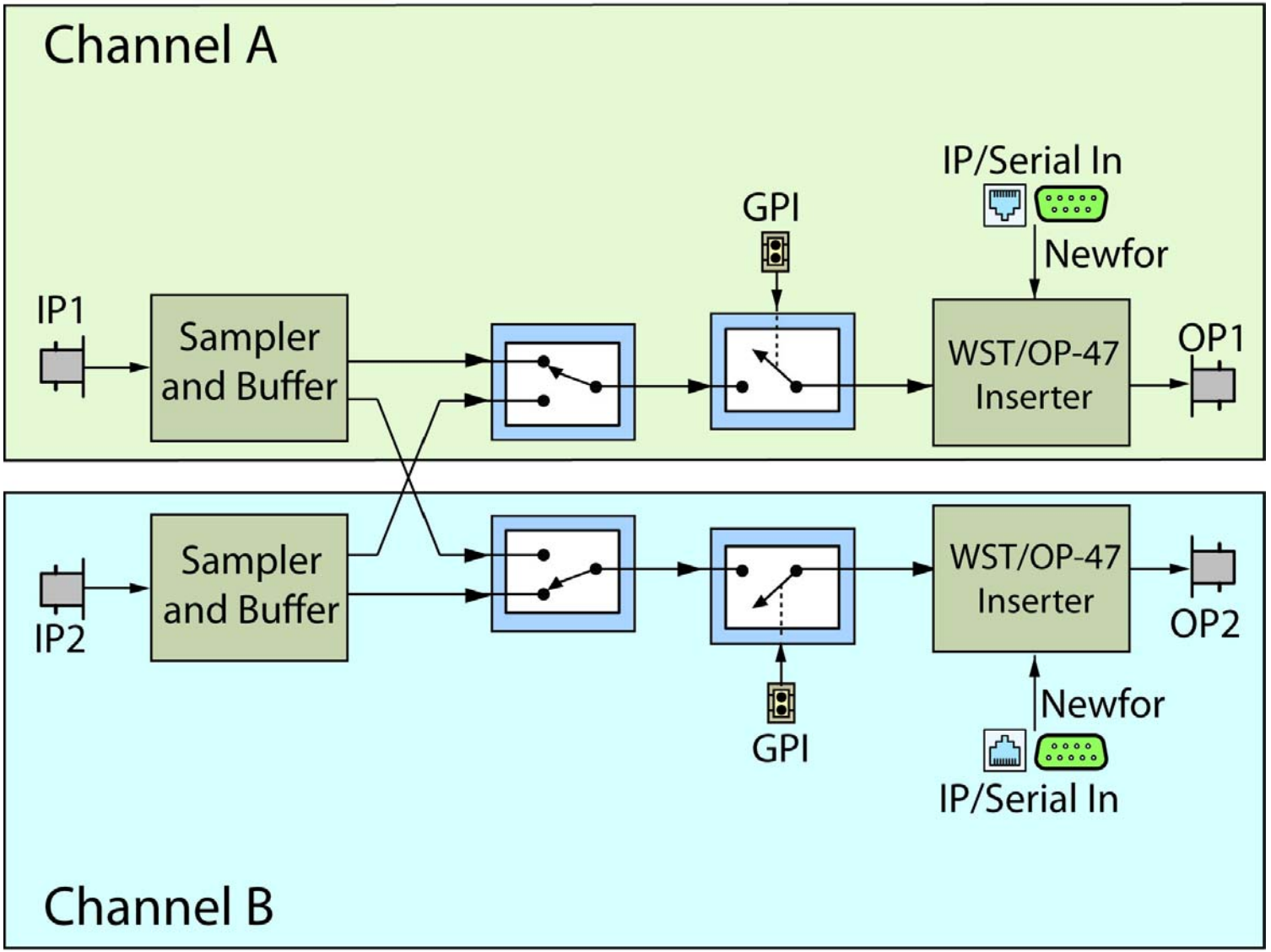
Figure 4–5 HDCC Block Diagram



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