## Figures

## Tables

## REVISION HISTORY

| REVISION | DESCRIPTION | DATE |
|---|---|---|
| 1.0 | Original Version | Jan 00 |
| 1.1 | Features added for software version 1.1<br>–Pulldown controlled by Ancillary Timecode if present<br>–2.4:1 aspect ratio markers added<br>–DIP switch and GPI reassignment for encoded Aspect ratio marker control | Mar 00 |
| 1.2 | Features added for software version 1.3<br>–GPI5 autosenses one of two functions – 6Hz Pulse or Pulldown Disable Closure<br>–Frame marked by 6 Hz pulse on GPI5, RP188 or Film ANC Timecode will become the A frame on the output<br>–Phase of A frame Output aligned to frame following input A Frame candidate. | Oct 00 |

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# 1. OVERVIEW

The 7732PFT-HD Progressive Format Translator converts 1.5 Gb/s HDTV video in the 1080p/24sF format to 1080i/60 digital video, thus allowing these signals to be viewed at a higher video refresh which eliminates the annoying 24 Hz flicker. The 7732PFT-HD inserts extra fields to create a 3:2 pulldown of the picture content to increase the video frame rate from 24 to 30.

When an input video feed of 1080p/24sF is detected, a 3:2 pulldown of the picture is inserted resulting in a 1080i/60 output. Determination of the output sequence of the fields is determined from a 6 Hz input pulse on GPI5, or from ancillary time code if it is present. DIP switches allow the user to determine how the output pulldown aligns to the 6 Hz input or ancillary timecode. If an input video feed of 1080i/60 or any other format is detected, it is simply passed through. When the 3:2 pulldown mode is turned off with a DIP switch or GPI input, the output video remains the same as the input video. An output tally indicates when the 3:2 pulldown mode is active and may be used to control external audio delay devices. Figure 1 shows the process of creating the 3:2 pulldown from the progressive video input with the DIP switches set to the default position.

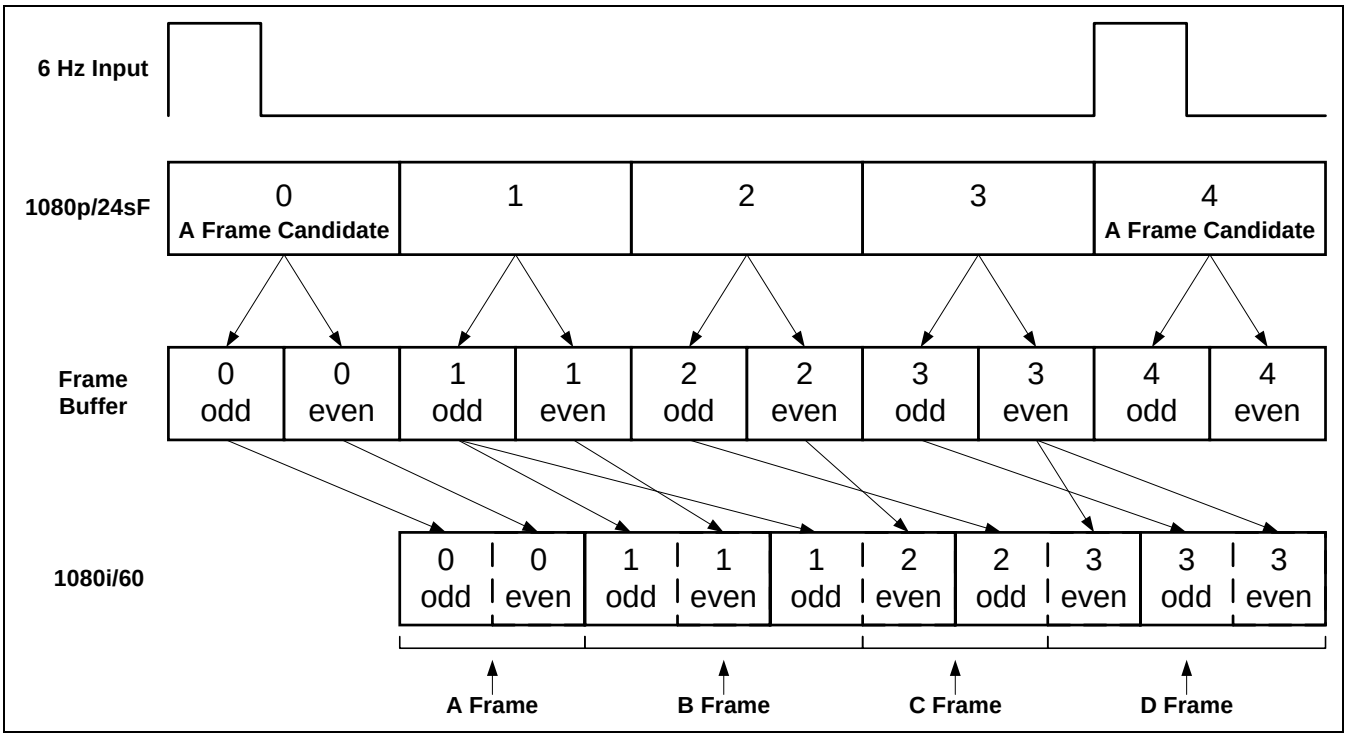


**Figure 1: 3:2 Pulldown Creation**

The user has the option of adding markers that show the extents of a 4:3 or 2.4:1 aspect ratio area in the center of the HD 16:9 image.

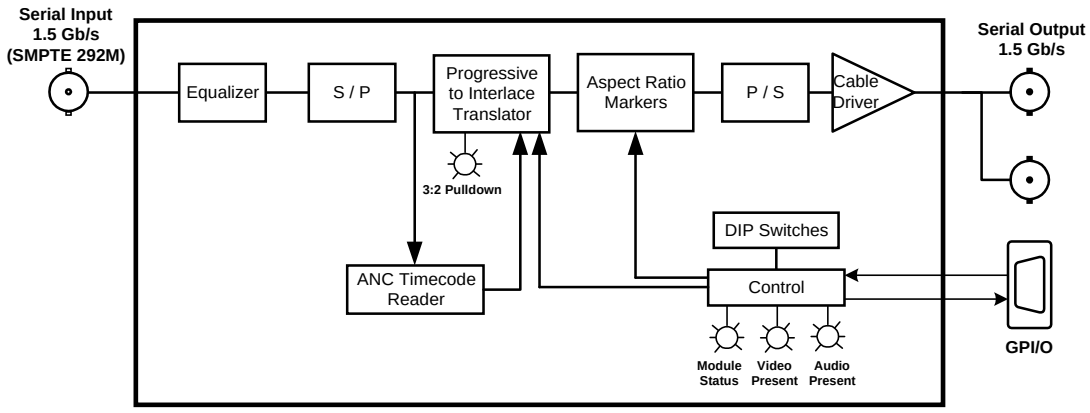


**Figure 2: 7732PFT-HD Block Diagram**

**Features:**

- Automatic detection of 1080p/24sF or 1080i/60 video input
- Pulldown of output set from 6 Hz pulse input or incoming ANC time code.
- DIP switch selection of A frame cadence
- Front panel LEDs indicate video signal presence, 3:2 pulldown insertion and module fault.
- 4:3 and 2.4:1 aspect ratio markers
- GPI Inputs control 3:2 pulldown and aspect ratio markers
- Tally output indicates 3:2 pulldown insertion active

# 2. INSTALLATION

The 7732PFT-HD module comes with a companion rear plate that has 3 BNC connectors and a female 15 pin high density D connector. For information on mounting the rear plate and inserting the module into the frame see section 3 of the 7700FR chapter.

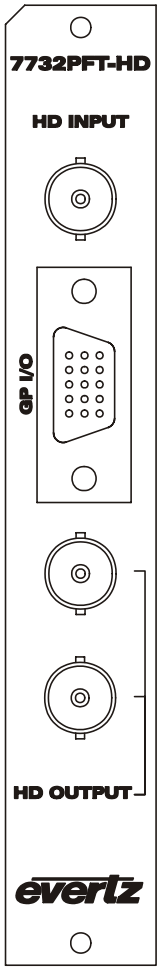


**Figure 3: 7732PFT-HD Rear Panel**

## 2.1. HD VIDEO INPUTS AND OUTPUTS

**HD INPUT** Input BNC connector for 10-bit serial digital video signals compatible with the SMPTE 292M standard.

**HD OUTPUT** There are two BNC connectors with reclocked serial component video outputs, compatible with the SMPTE 292M standard. When 3:2 Pulldown mode is active, these outputs contain the 1080p/24sF input video converted to 1080i/60. When 3:2 pulldown mode is not active the input video is passed through to the output.

## 2.2. GENERAL PURPOSE INPUTS AND OUTPUTS

The following is the pinout of the female HD DB-15 connector labeled **GPI/O**

| DB-15 | Name | Description |
|---|---|---|
| 1 | COMGND | RS 232 & GPI Ground |
| 2 | Tx | RS-232 TxD output (Future Use) |
| 3 | GPI 5 | 6 Hz Pulse & Pulldown Disable GPI Input |
| 4 | | not used |
| 5 | | not used |
| 6 | Rx | RS-232 RxD input (Future Use) |
| 7 | CTS | RS-232 CTS output (Future Use) |
| 8 | GPI 4 | Aspect Ratio Markers GPI Input |
| 9 | | not used |
| 10 | GP +5 | General Purpose +5Volts Supply |
| 11 | RTS | RS-232 RTS input (Future Use) |
| 12 | GPI 6 | Aspect Ratio Markers GPI Input |
| 13 | GPO 7 | Pulldown Mode Active Tally Output |
| 14 | | not used |
| 15 | Vext | Ext. Voltage Input to GPIO Circuitry |

**Table 1: GPI/O DB 15 Connector Pinout**

Figure 4 shows a schematic diagram of the GPIO circuitry. The user can connect GP+5V supplied from the frame into the Vext pin to provide power to the GPIO opto-isolator circuitry. In this configuration the user can activate GPIs simply by connecting the GPI input pins to Ground (see Figure 5). This can be done with a button, switch, relay or an open collector transistor. In this configuration the GPOs will be internally pulled up to 5 volts. (See Figure 7) Five volts is available to the user to be used for driving external circuitry. Care must be taken to limit the load to 0.5W so there is no affect on the power supply source on the module.

Alternately, the user can connect an external power source for the opto-isolator circuitry. The Vext voltage must be greater than the voltage supplied to GPI by at least 5v. Figure 6 and Figure 8 show how to wire the GPIs and GPOs from an external power supply.

**Warning: Do not connect GP+5V from one module to another module's GP+5V.**

The pulldown tally output is active low with an internal pull up (10k Ohm) resistor to the Vext pin. When active, the output will go low and is able to sink up to 10mA. When inactive, the signal will go high (to the voltage applied to the Vext pin). Do not attempt to source more than 100μA from the output.

The COM port signals are standard RS-232 with hardware flow control. The directions of the signals are indicated in the above table. The COM port is reserved for future use.

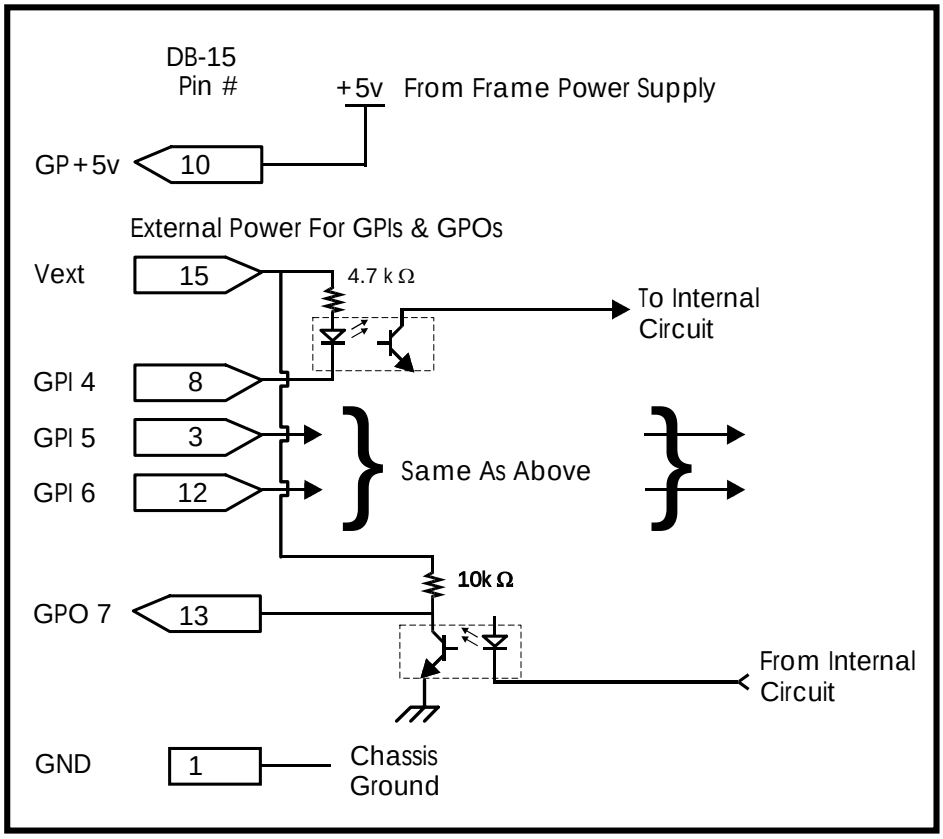


**Figure 4: GPIO Opto Isolator Circuitry**

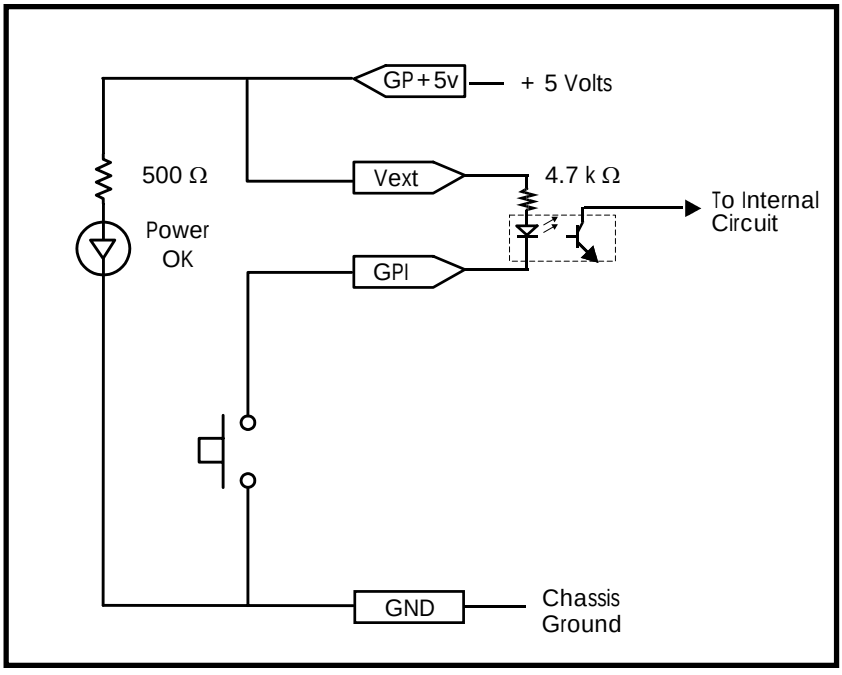


**Figure 5: Powering the General Purpose Input Opto Isolators from the Module**

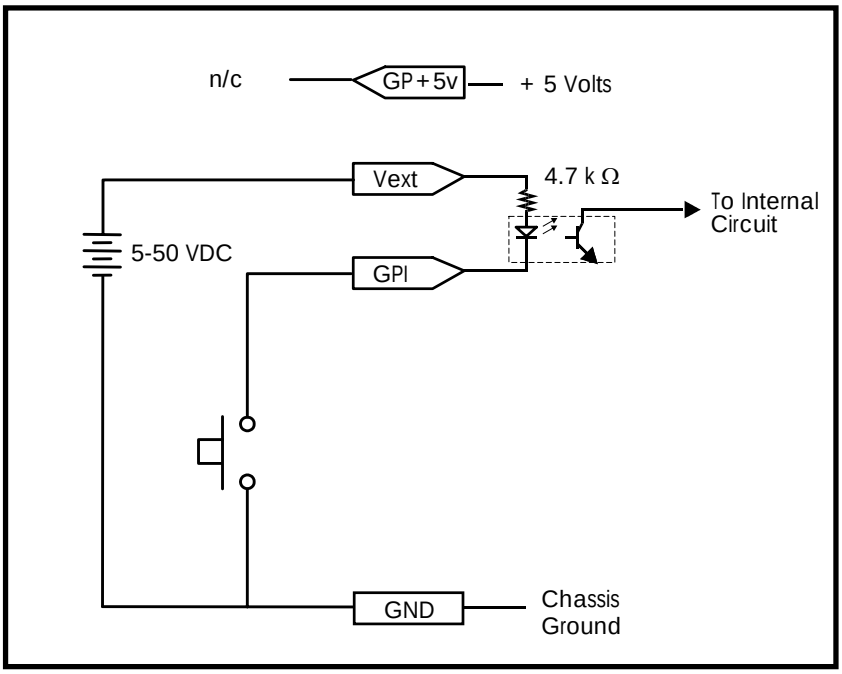


**Figure 6: Powering the General Purpose Input Opto Isolators from an External Power Supply**

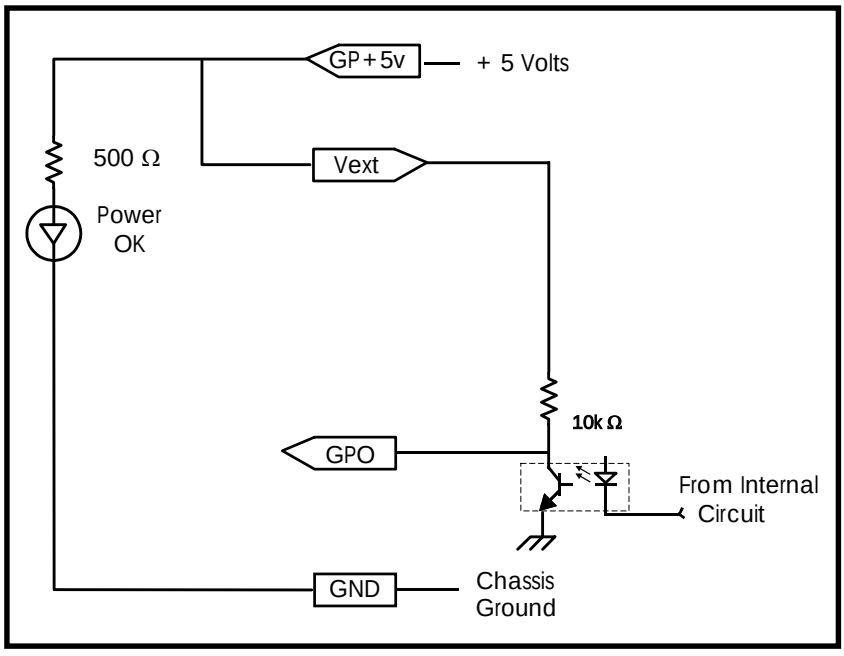


**Figure 7: Powering the General Purpose Output Opto Isolators from the Module**

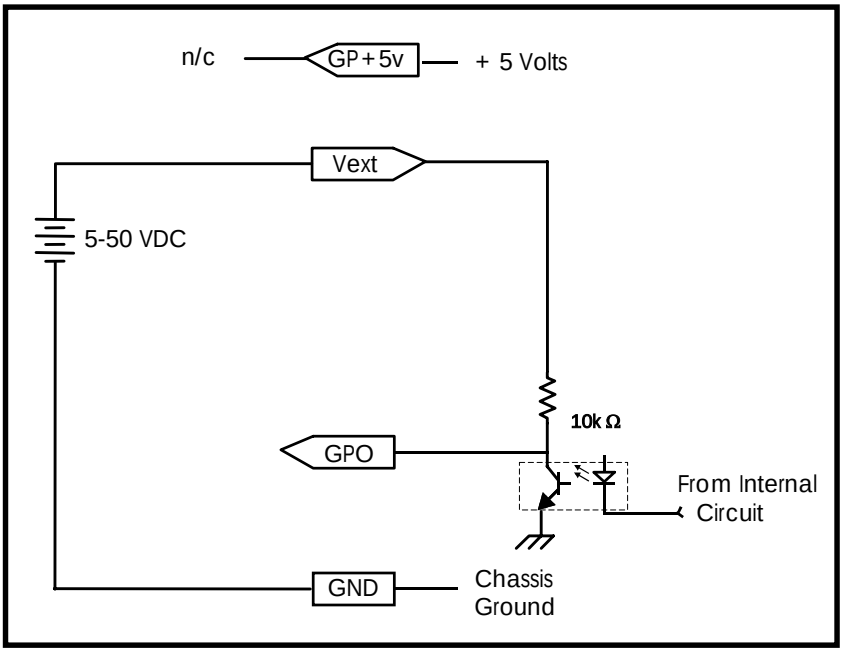


**Figure 8: Powering the General Purpose Output Opto Isolators from an External Power Supply**

# 3. SPECIFICATIONS

## 3.1. SERIAL VIDEO INPUT

**Standard:** 1.485 Gb/sec SMPTE 292M – 3:2 pulldown inserted with video standards shown in Table 2. Other video formats are passed through unchanged.
**Connector:** 1 BNC per IEC 169-8
**Equalization:** Automatic to 130m @ 1.5Gb/s with Belden 1694 or equivalent cable

| Common Name | Pixels / Active Lines | Frame Rate | Progressive /Interlace | SMPTE Standard |
|---|---|---|---|---|
| 1080p/24sF | 1920 x 1080 | 24 | P (sF) | RP211 |
| 1080p/23.98sF | 1920 x 1080 | 23.98 (24/1.001) | P (sF) | RP211 |

**Table 2: Video Input Formats**

### 3.2. HD SERIAL VIDEO OUTPUTS

**Number of Outputs:** 2
**Connectors:** BNC per IEC 169-8
**Signal Level:** 800mV nominal
**DC Offset:** 0V ±0.5V
**Rise and Fall Time:** 200ps nominal
**Overshoot:** <10% of amplitude
**Wide Band Jitter:** < 0.15 UI

### 3.3. GENERAL PURPOSE IN/OUT

**Inputs:** GPI4 & GPI6: Activate Aspect Ratio Markers when pulled low
GPI5: Disable Pulldown mode when pulled low
Pulldown control input when 6 Hz pulse applied
**Output:** GPO7: Low when pulldown mode is active
**Type:** Opto-isolated, active low with internal pull-ups to Vext pin.
**Connector:** Female High Density DB-15
**Signal Level:** +5V nominal when Vext connected to + 5volt output

### 3.4. ELECTRICAL

**Voltage:** + 12VDC
**Power:** 6 Watts.
**EMI/RFI:** Complies with FCC regulations for class A devices.
Complies with EU EMC directive.

### 3.5. PHYSICAL

**7700 or 7701 frame mounting:**
**Number of slots:** 1

**Stand Alone Enclosure:**
**Dimensions:** 14 " L x 4.5 " W x 1.9 " H
(355 mm L x 114 mm W x 48 mm H)
**Weight:** approx. 1.5 lbs. (0.7 Kg)

## 4. STATUS LEDS

### 4.1. MODULE STATUS LEDS

**MODULE OK** This Green LED will be On when the module is operating properly

**LOCAL FAULT** This Red LED makes it easy to identify one module in a frame that is missing an essential input or has another fault.

The LED will blink on and off if the microprocessor is not running.

The LED will be on solid when input video is missing or there is a fault in the module power supply.

**VIDEO PRESENT** This Green LED will be On when there is a valid video signal present at the module input.

**PULLDOWN** This Green LED will be On when 3:2 pulldown is being added to the input video.

**AUDIO PRESENT** This Green LED is reserved for future use and will be always Off.

## 5. CARD EDGE CONTROLS

The 7732PFT-HD is equipped with an 8 position DIP switch to allow the user to select various functions. All positions are assigned sequentially such that the DIP switch 1 is located at the top of the DIP switch (farthest from the card ejector). Table 3 gives an overview of the DIP switch functions. Sections 5.1 to 5.2 show the assigned DIP switch functions. The On position is down, or closest to the printed circuit board.

| DIP Switch | Function |
|---|---|
| 1 | Reserved for future use |
| 2 | |
| 3 | Pulldown Disable Control |
| 4 | Aspect Ratio Marker Control |
| 5 | |
| 6 | ANC Timecode Selection |
| 7 | A Frame Alignment Control |
| 8 | |

**Table 3: DIP Switch Functions**

## 5.2. CONTROLLING THE ASPECT RATIO MARKERS

DIP switches 4 and 5 control which one of the three aspect ratio markers will be enabled.

| DIP 5 | DIP 4 | FUNCTION | DESCRIPTION |
|---|---|---|---|
| Off (default) | Off (default) | GPI4 & 6 | Which markers will be On is determined by the GPI4 and GPI6 inputs – see Table 5. |
| Off | On | 4:3 Prod | The 4:3 Production aperture markers will be On all the time. The 4:3 aspect ratio is measured with respect to production aperture and results in a set of vertical lines 1440 pixels apart. |
| On | Off | 4:3 Clean | The 4:3 Clean aperture markers will be On all the time. The 4:3 aspect ratio is measured with respect to clean aperture and results in a set of vertical lines 1416 pixels apart. |
| On | On | 2.4:1 | The 2.4:1 aperture markers will be On all the time. The 2.4:1 aspect ratio is measured with respect to production aperture and results in a set of horizontal lines 800 lines apart. |

**Table 4: Aspect Ratio Marker Switch Settings**

When DIP switches 4 and 5 are Off the GPI4 and GPI6 inputs determine which one of the aspect ratio markers is on.

| GPI 6 | GPI 4 | FUNCTION | DESCRIPTION |
|---|---|---|---|
| High | High | Off | Aspect Ratio markers Off |
| High | Low | 4:3 Prod | The 4:3 Production aperture markers will be On. |
| Low | High | 4:3 Clean | The 4:3 Clean aperture markers will be On. |
| Low | Low | 2.4:1 | The 2.4:1 aperture markers will be On. |

**Table 5: Aspect Ratio Marker GPI Controls**

## 5.3. CONTROLLING THE 3:2 PULLDOWN SEQUENCE

When an input video feed of 1080p/24sF is detected, the 7732PFT-HD inserts extra fields to create a 3:2 pulldown of the picture content to increase the video frame rate from 24 to 30. Determination of the output sequence of the fields is determined from a 6 Hz input pulse on GPI5, or from ancillary time code if it is present. The pulldown can also be disabled, resulting in the 1080p/24sF being clocked through to the output. Figure 1 shows how the extra fields are added to make the pulldown output.

### 5.3.1. Disabling the 3:2 Pulldown

GPI5 (pin 3 on the GPI/O connector) is a dual functioned input. When it is connected to a steady level (high or low) it acts as a pulldown disable control. When a 6 Hz pulse sequence is applied to the GPI5 pin, then the 6 Hz pulse will control the cadence of the pulldown output. DIP switch 3 provides a method of disabling the 3:2 pulldown on the output video from the card edge controls.

| DIP 3 | FUNCTION | DESCRIPTION |
|---|---|---|
| Off (default) | Use GPI5 Level Control | 1080p/24sF input video will be converted to 1080i/60 when the GPI 5 input is open.<br>1080p/24sF input video will be passed through unchanged when the GPI 5 input is closed to ground.<br>1080i/60 and all other HD input video formats will always be passed through regardless of the GPI 5 input.<br>When a 6 Hz pulse applied to GPI5, pulldown will be enabled. |
| On | Pulldown Disable | All input video formats will be passed through regardless of the GPI 5 input. |

**Table 6: 3:2 Pulldown Switch Settings**

### 5.3.2. Controlling Where the 3:2 Pulldown A frame Occurs

The A frame of the pulldown sequence of the output video is set according to the following priority scheme.

1. 6 Hz pulse applied to the GPI5 input
2. RP188 ancillary timecode or the film ancillary data packet on the incoming video
3. If none of these are present, the pulldown sequence is established randomly at power up.

A 1/30$^{th}$ second wide active high pulse occurring 6 times per second applied to GPI5 will normally identify the input frame that will become an A frame at the output (called the *A frame candidate*). This 6 Hz pulse must be coincident with the start of an input frame and can be generated using the Evertz 7700SRG-HD Slave Reference Generator module. The output of the *A frame candidate* frame will start at the beginning of the next input frame and will consist of two video fields.

In the absence of a 6 Hz input video timecode derived from ancillary data present on the video input can be used to control the pulldown cadence. DIP switch 6 determines if the timecode will be derived from RP188 ANC timecode or the Film ancillary data packet (generated by the Evertz HD9025TR Film Footage Encoder). Input video frames with frame numbers divisible evenly by 4 will normally identify the input frame that will become an A frame at the output (the *A frame candidate*). The output of the *A frame candidate* frame will start at the beginning of the next input frame and will consist of two video fields.

| DIP 6 | FUNCTION | DESCRIPTION |
|---|---|---|
| Off (default) | RP188 | Use RP188 ANC timecode to derive pulldown sequence if 6 Hz pulse missing. |
| On | Film ANC | Use Film ANC packet to derive pulldown sequence if 6 Hz pulse missing. |

**Table 7: Aspect Ratio Marker Intensity Switch Settings**

DIP switches 7 and 8 allow the user to select other frames as the *A frame candidate*. Figure 9 shows how the DIP switches define the A frame when the 6 Hz pulse is present. Figure 10 shows how the DIP switches define the A frame when 6 Hz pulse is missing and the Ancillary data is used to control the 3:2 pulldown.

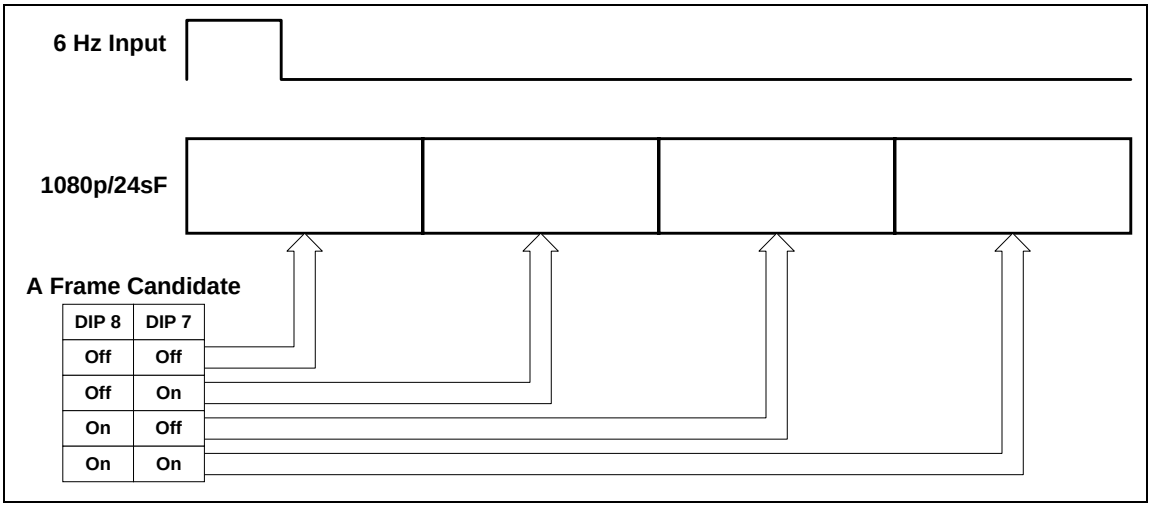


**Figure 9: 6 Hz Pulldown Sequence A Frame Alignment**

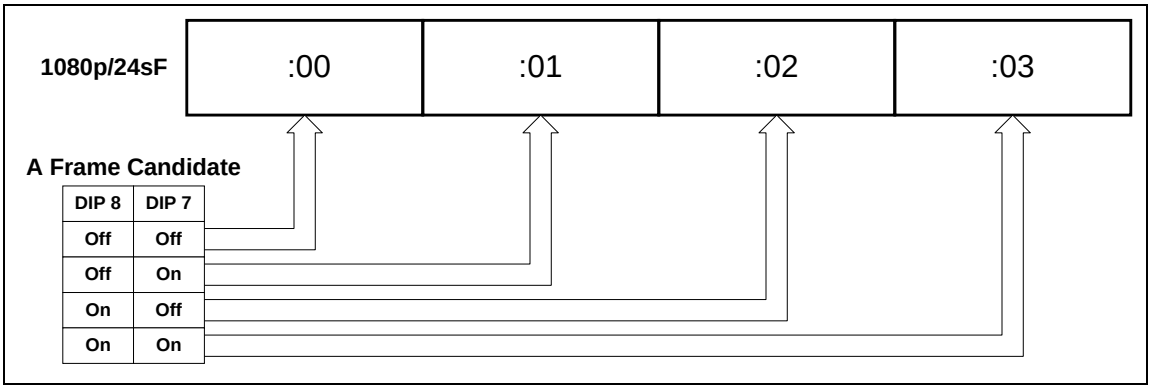


**Figure 10: ANC Data Pulldown Sequence A Frame Alignment**

# 6. JUMPERS

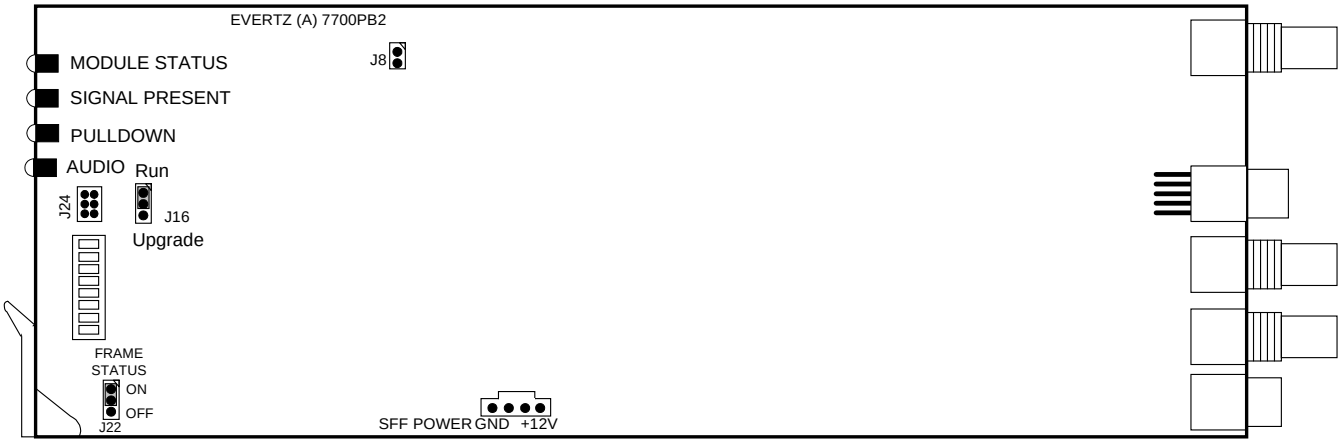


**Figure 11 : Location of Jumpers on 7700PB2 Boards**

## 6.1. SELECTING WHETHER LOCAL FAULTS WILL BE MONITORED BY THE GLOBAL FRAME STATUS

**FRAME STATUS** The FRAME STATUS jumper located at the front of the module determines whether local faults (as shown by the Local Fault indicator) will be connected to the 7700FR frame's global status bus.

To monitor faults on this module with the frame status indicators (on the PS FRAME STATUS LED's and on the Frame's Fault Tally output) install this jumper in the On position. (Default) When this jumper is installed in the Off position, local faults on this module will not be monitored.

## 6.2. CONFIGURING THE MODULE FOR FIRMWARE UPGRADES

**UPGRADE** The UPGRADE jumper J16 located at the front of the module is used when firmware upgrades are being done to the module. For normal operation it should be installed in the *RUN* position. See the *Upgrading Firmware* section of this manual for more information.

To upgrade the firmware in the module unit pull it out of the frame. Move Jumper J16 into the *UPGRADE* position. Install the Upgrade cable provided (located in the vinyl pouch in the front of this manual) onto header J24 at the card edge. Re-install the module into the frame. Run the upgrade as described in the *Upgrading Firmware* section of this manual. Once the upgrade is completed, remove the module from the frame, move J16 into the *RUN* position, remove the upgrade cable and re-install the module. The module is now ready for normal operation.

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