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REVISION HISTORY

REVISION	DESCRIPTION	DATE
1.0	Released Version	January 2005

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1. OVERVIEW

The PKG7771MFC-HD, HDTV Compression Codec encodes one SMPTE 292M (1.485Gb/s) serial digital video signal with up to four stereo AES channels of embedded or separate audio, into one 270Mb/s SDTi (SMPTE305M) compliant output stream. Automatic detection and support of 1080i/59.94, 1080p/29.97sF, 1080p/23.97sF, 1035i/59.94, and 720P/59.94 video formats is provided.

The PKG7771MFC-HD is composed of two sets of cards, the PKG7771MFC and the 7771MFCD-C.

The PKG7771MFC-HD occupies four card slots and is housed in the standard Evertz 3RU frame that holds up to 15 modules.

Features:

- Industry proven HDCAM video compression for origination quality video
- Supports 1080i/59.94, 1080p/29.97sF, 1080p/23.98sF 1035i/59.94, and 720P/59.94 formats
- Automatic detection of 720/1035/1080/ active lines
- Accepts up to four channels of embedded or separate AES audio
- No compression applied to AES audio streams
- SMPTE 305M compliant 270Mb/s output stream
- Error correction and EDH insertion on SDTi output
- Fully hot swappable from front of frame

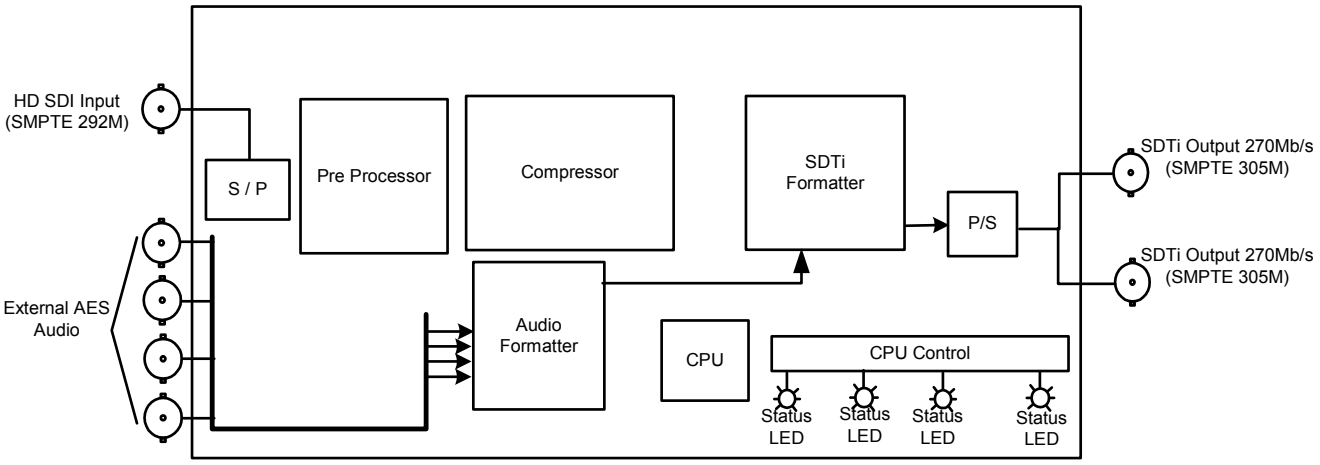

Figure 1: PKG7771MFC-HD Block Diagram

2. INSTALLATION

The PKG7771MFC-HD comes with a companion rear plate that has nine BNC connectors, occupying four slots in the 7700FR frame. For information on mounting the rear plate and inserting the module into the frame see the 7700FR chapter Section 3.

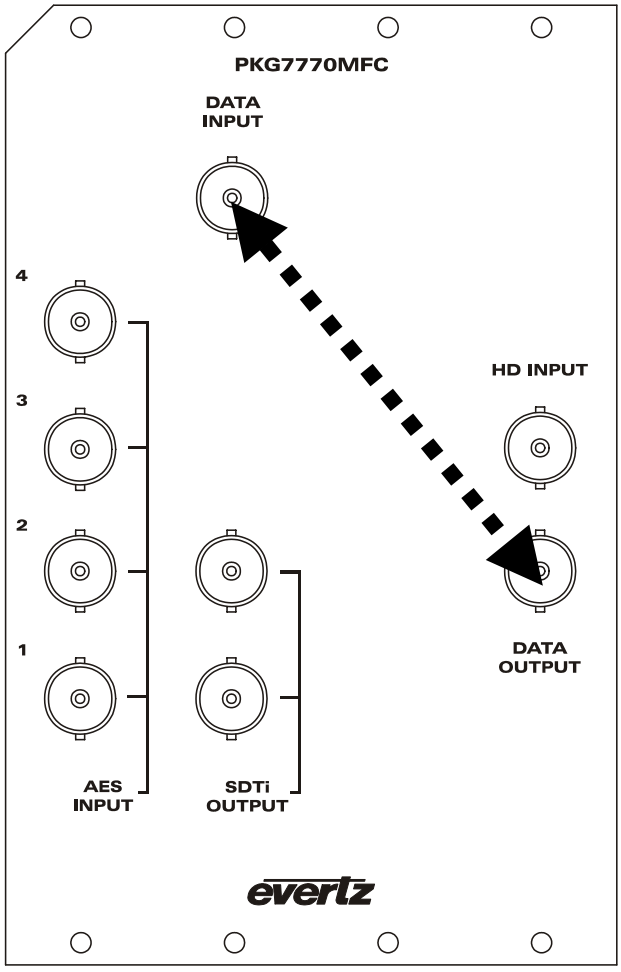

Figure 2: PKG7771MFC-HD Rear Panel

2.1. VIDEO CONNECTIONS

Connect a source of HD serial component video, compatible with the SMPTE 292M standard, to the BNC labeled **HD INPUT**. See Table 1 for a list of the video formats supported. Compressed video output, compatible with the SMPTE 259M and SMPTE 305M standards, is available on the **SDTi OUTPUT** BNCs.

2.2. DATA CONNECTIONS

The PKG7771MFC-HD requires an external BNC jumper in order to transfer the Video/Audio DATA from the PKG7771MFC card to the 7771MFCD-C card. See Figure 2 dotted line as reference. Connect the DATA OUTPUT BNC from the PKG7771MFC to the DATA INPUT BNC of the 7771MFCD-C.

2.3. AUDIO CONNECTIONS

The PKG7771MFC-HD has the ability to embed up to 4 AES audio streams (8 channels) into 2 groups on the compressed video output. No compression is applied to the AES audio streams. The audio source can be either embedded audio on the HD video input or AES audio connected to the 4 BNCs labeled **AES INPUT**. Selection of the audio source is done by DIP switch (see section 5.1).

3. SPECIFICATIONS

3.1. HD SERIAL VIDEO INPUT

Standard: 1.485 Gb/sec SMPTE 292M – standards supported are shown in Table 1.
Connector: 1 BNC per IEC 169-8
Equalization: Automatic to 125m @ 1.5Gb/s with Belden 1694 or equivalent cable

HD Input					SDTi Output	Genlock Type
Common Name	Pixels / Active Lines	Frame Rate	Progressive /Interlace	SMPTE Standard		
720p/59.94	1280 x 720	29.97	P	296M	525/29.97	NTSC
1080i/59.94	1920 x 1080	29.97	I	274M	525/29.97	NTSC
1080p/29.97sF	1920 x 1080	29.97	P (sF)	274M	525/29.97	NTSC
1080p/23.98sF	1920 x 1080	23.98	P (sF)	274M	525/23.98	---
1035i/59.94	1920 x 1035	29.97	I	260M	525/29.97	NTSC

Table 1: Video Input Formats

3.2. AES AUDIO INPUTS:

Standard: SMPTE 276M, single ended AES, Dolby E
Number of Inputs: 4
Signal Level: 1V p-p ±0.1V
Connector: BNC per IEC 60169-8 Amendment 2
Sampling Rate: 48khz
Impedance: 75Ω balanced
Resolution: 24-bit

3.3. SDTI VIDEO OUTPUT:

Standard: SMPTE 259M-C (270Mb/s)
SMPTE 305M
Number of Outputs: 2
Connector: BNC per IEC 60169-8 Amendment 2
Signal Level: 800mV nominal
DC Offset: 0V ±0.5V
Rise and Fall Time: 740ps nominal
Overshoot: <10% of amplitude
Wide Band Jitter: <0.2UI
Embedded VANC: One 20-bit group as per SMPTE337M
Embedded Audio: Two 24-bit groups as per SMPTE 272M-A embedded audio on HD input

3.4. SYSTEM DELAY (COMPRESS + DECOMPRESS):

Video: 9 Frames
Audio: 9 Frames

3.5. ELECTRICAL:

Voltage:	+12VDC
Power:	16 Watts
EMI/RFI	Complies with FCC Part 15 Class A EU EMC Directive

3.6. PHYSICAL:

7700 frame mounting:	4 slots

3.7. ORDERING INFORMATION:

PKG7771MFC-HD	Multi-Format HDTV (720p/1035i/1080i) to 270Mb/s SDTi Compression CODEC Package

3.8. ORDERING OPTIONS:

Rear Plate must be specified at time of order
Eg: Model + 3RU

Rear Plate Suffix
+3RU 3RU Rear Plate for use with 7700FR-C Multiframe

3.9. ENCLOSURES:

7700FR-C 3RU Multiframe which holds 15 modules

4. STATUS INDICATORS AND DISPLAYS

The PKG7771MFC-HD has 12 LED Status indicators and a 4 digit alphanumeric display on the front card edge to show operational status of the card at a glance. Figure 3 shows the location of the LED's display and card edge DIP switches.

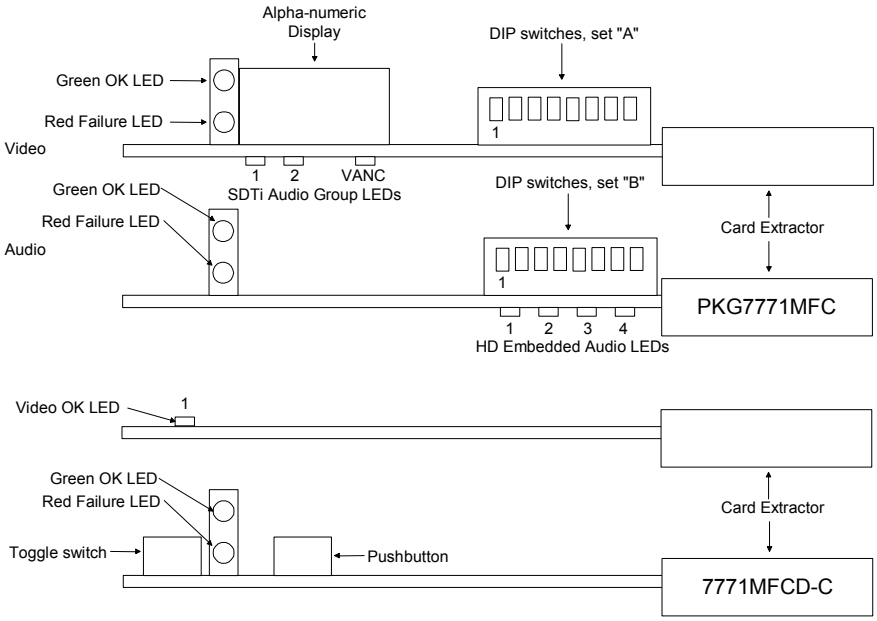

Figure 3: LED and Switch Locations

4.1. PKG7771MFC STATUS AND INDICATOR LEDS

4.1.1. Module Status LEDs

Two large LED's on the front of the bottom board indicate the general health of the module

LOCAL FAULT: This Red LED indicates poor module health and will be On during the absence of valid Data and Audio input or if a local input power fault exists on the bottom board (i.e.: a blown fuse). The LOCAL FAULT indication can also be reported to the frame through the FRAME STATUS jumper on the bottom board.

MODULE OK: This Green LED indicates good module health. It will be On when a valid audio signal is present, and board power is good.

Two large LED's on the front of the top board indicate the presence of video to the module. DIP switches 1 to 3 on the top board are used to select the video standard (see section 5.4). The alphanumeric display will show the video standard in use (see section 4.1.4).

VIDEO FAULT: This Red LED will be On during the absence of valid video input of the selected standard or if a local input power fault exists on the top board (i.e.: a blown fuse). This condition can also be reported to the frame through the FRAME STATUS jumper on the top board.

VIDEO OK: This Green LED will be On when a valid video signal of the selected standard is present.

4.1.2. AES Audio Present LEDs

There are four small LED's on the back side of the top board that indicate the presence of AES audio on the AES inputs.

AES 1 PRESENT: This Green LED indicates the presence of a valid signal on the AES 1 input.

AES 2 PRESENT: This Green LED indicates the presence of a valid signal on the AES 2 input.

AES 3 PRESENT: This Green LED indicates the presence of a valid signal on the AES 3 input.

AES 4 PRESENT: This Green LED indicates the presence of a valid signal on the AES 4 input.

4.1.3. HD Input Embedded Audio Present LEDs

There are four small LED's on the backside of the bottom board that indicate the presence of embedded audio on the incoming HD video.

GROUP 1 PRESENT: This Green LED indicates the presence of Group 1 embedded audio.

GROUP 2 PRESENT: This Green LED indicates the presence of Group 2 embedded audio

GROUP 3 PRESENT: This Green LED indicates the presence of Group 3 embedded audio

GROUP 4 PRESENT: This Green LED indicates the presence of Group 4 embedded audio

4.1.4. DOT-MATRIX DISPLAY

The 4-digit alphanumeric display located on the card edge of the top board is used to display the video standard in use. If manual video standard selection is set (DIP switch 1 On) then the display will always display the selected standard. If auto standard selection is set (DIP switch 1 Off) the alphanumeric display will read AUTO until a valid input standard is detected. When valid input video is detected the detected standard will be displayed. The following messages will be displayed.

AUTO	Auto video standard selected, and no video present
59	1080i/59.94 or 1080p/29.97sF
720	720p/59.94
35	1035i/59.94
23	1080p/23.98sF

4.2. 7771MFCD-C STATUS AND INDICATOR LEDS

4.2.1. Module Status LEDs

Two large LED's on the front of the bottom board for the 7771MFCD-C indicate the general health of the module. See Figure 3: LED and Switch Locations

LOCAL FAULT: This Red LED indicates poor module health and will be On during the absence of valid video and embedded audio in group 1 or group 2 of the HD-SDI input or if a local input power fault exists on the bottom board (i.e.: a blown fuse).

MODULE OK: This Green LED indicates good module health. It will be On when both audio groups 1 and 2 are present, and board power is good.

4.2.2. Video Present LED

The Green LED on the top board of the 7771MFCD-C module is on when valid video is received from the HD-SDI Input. See Figure 3: LED and Switch Locations

5. CARD EDGE CONTROLS

The PKG7771MFC-HD is equipped with two 8 position DIP switches to allow the user to select various functions. The DIP switch on the bottom card (SET B) is used to control the embedding of audio on the SDTi output. The DIP switch on the top card (SET A) is used to set the input video standard. All positions are assigned sequentially such that the first position is located at the top of the DIP switch (farthest from to the card ejector). The On (closed) position is down, or closest to the printed circuit board. The Off (open) position is up, or farthest from the printed circuit board.

Table 2 and Table 3 give an overview of the DIP switch functions. Sections 5.1 to 5.5 give detailed descriptions of each of the DIP switch functions.

DIP Switch	Function
1	Group 1 source select
2	Group 1 mapping from input embedded groups
3	
4	Group 2 source select
5	Group 2 mapping from input embedded groups
6	
7	Group 2 enable/disable
8	Auto/manual audio selection

Table 2: Bottom Board DIP Switch Functions (SET B)

DIP Switch	Function
1	Auto/Manual video format selection
2	Video standard selection
3	
4	20/24 Bit audio transport select
5	No function
6	AES Input 1 and 2 sample rate converter enable/disable
7	AES Input 3 and 4 sample rate converter enable/disable
8	Audio transport enable/disable

Table 3: Top Board DIP Switch Functions (SET A)

5.1. SELECTING THE AUDIO GROUP THAT WILL BE EMBEDDED (SET B)

The SMPTE 276M standard permits up to 4 groups of 4 audio channels to be embedded into the 270 Mb/s video bit stream. DIP switch 1 on the bottom board controls whether the source for audio group 1 will be the AES inputs or the audio embedded on the HD input. When DIP switch 1 is set for the HD embedded audio source, DIP switches 2 and 3 are used to select which group on the HD input will be placed into group 1 on the output according to Table 4.

DIP 1	DIP 2	DIP 3	Audio Group 1 Source
Off	---	---	AES inputs 1 and 2
On	Off	Off	HD Input group 1
On	Off	On	HD Input group 2
On	On	Off	HD Input group 3
On	On	On	HD Input group 4

Table 4: Audio Group 1 Source Selection Switch Settings

DIP switch 4 on the bottom board controls whether the source for audio group 2 will be the AES inputs or the audio embedded on the HD input. When DIP switch 4 is set for the HD embedded audio source, DIP switches 5 and 6 are used to select which group on the HD input will be placed into group 1 on the output according to Table 5.

DIP 4	DIP 5	DIP 6	Audio Group 2 Source
Off	---	---	AES inputs 3 and 4
On	Off	Off	HD Input group 1
On	Off	On	HD Input group 2
On	On	Off	HD Input group 3
On	On	On	HD Input group 4

Table 5: Audio Group 2 Source Selection Switch Settings

5.2. ENABLING/DISABLING TRANSPORT OF THE SECOND AUDIO GROUP (SET B)

DIP switch 7 on the bottom board controls whether the second audio group is embedded in the output SDTi stream. If the switch is On the second group is embedded. When DIP switch 7 is Off only the first audio group is embedded in the SDTi output.

DIP 7	Group 2 Embedder Enable
Off	Disabled
On	Enabled

Table 6: Group 2 Enable/Disable Switch Settings

5.3. AUTO/MANUAL AUDIO TRANSPORT SELECTION (SET B)

DIP switch 8 on the bottom board controls the determination of the audio groups that will be embedded in the SDTi output. When DIP switch 8 is On the audio group embedded is manually determined by DIP switches 1 to 7 on the bottom board.

When DIP switch 8 on the bottom board is Off the audio groups embedded are automatically determined in the following manner.

- If there is audio embedded in the incoming HD video the first two groups found will be transported (starting at group 1 searching up to group 4).
- If there is only one group present in the incoming HD video stream then only one group will be transported.
- If there is no embedded audio in the incoming HD video stream then the external AES inputs will be used as the audio source.
- If there is also no input signal to the AES inputs and no embedded audio in the incoming HD video stream there will not be any audio groups embedded in the SDTi stream.

DIP 8	Manual/Auto Audio Selection
Off	Manual audio transport selection
On	Automatic audio transport selection

Table 7: Manual/Auto Audio Transport Selection Switch Settings

5.4. SELECTING THE INPUT VIDEO STANDARD (SET A)

DIP switches 1 to 3 on the top card control the selection of the input video format. DIP switch 1 selects whether the input video format will be automatically detected or set using DIP switches 2 and 3. When set to the manual mode, the PKG7771MFC-HD compressor will lock on faster to the input video.

DIP 1	DIP 2	DIP 3	Video Standard
Off	---	---	Auto
On	Off	Off	1080p/23.98sF
On	Off	On	1035i/59.94
On	On	Off	720P/59.94
On	On	On	1080i/59.94 or 1080p/29.97sF

Table 8: Video Standard Switch Settings

5.5. 20/24 BIT AUDIO SELECTION (SET A)

DIP switch 4 on the top card selects whether the PKG7771MFC embeds 20 bit or 24 bit audio into the SDTi bitstream. When 24 bit audio is beind embedded the Extended data packets are used and this will comsume more of the available HANC data space (see section 6).

DIP 4	20/24 Bit Audio Resolution
Off	20 Bit Audio
On	24 Bit Audio

Table 9: Audio Resolution Select Switch Settings

5.6. AES INPUT SAMPLE RATE CONVERTER ENABLE/DISABLE (SET A)

DIP switch 6 and 7 on the top card disable the sample rate converters on the AES inputs.

DIP 6	DIP 7	AES input sample rate converter
Off	Off	AES inputs 1, 2, 3 and 4 enabled
On	Off	AES input 1 and 2 disabled AES inputs 3 and 4 enabled
Off	On	AES input 1 and 2 enabled AES inputs 3 and 4 disabled
On	On	AES inputs 1, 2, 3 and 4 disabled

Table 10: AES Input Sample Rate Converter Enable/Disable Switch Settings

5.7. AUDIO TRANSPORT ENABLE/DISABLE (SET A)

DIP switch 8 on the top card enables or disables embedding of any Audio packets found in the input HD video to the output SDTi stream.

DIP 8	Audio Transport
Off	Disabled
On	Enabled

Table 11: Audio Transport Switch Settings

6. HANC SPACE IN THE SDTI STREAM

The HANC space in the SDTi output of the 7771CS is almost entirely used when all features of the card are enabled. This section details that usage so that coupled with the controls detailed in section 5 the user can configure the card for best utilization for their needs. With all features turned on the following list details the mapping of data into HANC space of the SDTi stream.

SDTi header	53 words
Group 1 audio 20 bit packet	55 words
Group 1 audio extended packet	15 words
Group 2 audio 20 bit packet	55 words
Group 2 audio extended packet	15 words
Group 3 audio 20 bit packet (VANC data)	55 words

For a total of 248 words. This is true for all lines except for the EDH line, the switch line and the protect lines. The EDH line, switch lines and protect lines contain no audio data. It is possible to turn off audio group 2 (see section 5.2). Whether group 2 is enabled or not the extended audio packets can also be disabled (see section 5.5). This gives the user flexibility for to turn off features that are not needed to free up HANC space for embedding other data to the output of this card.

7. VANC TRANSPORT OPERATION

The PKG7771MFC-HD card is capable of transporting VANC data in a form that can be used by the PKG7771MFD-HD card. Since VANC is not normally transported on HDCAM this feature is only available when the PKG7771MFC-HD is used with the PKG7771MFD-HD. The VANC data is transported over the SDTi stream as a 20 bit audio group. Data is formatted into two AES streams as per SMPTE337. These two AES streams are then embedded as group three audio in the SDTi stream. It is possible to disable this feature to free up room in the HANC space of the SDTi stream. See section 6 for a description of how the HANC space is utilized in the SDTi stream and Section 5 for DIP switch settings to enable/disable this feature.

VANC data is transported on a field by field basis. The PKG7771MFC-HD accumulates data over the vertical interval of a field. The vertical interval starts when the V bit changes to a one to the point where the V bit changes to a zero. The PKG7771MFC-HD will store all ANC data packets it finds in this interval that have a data ID of 61, 62, 40-5f, and c0-df up to the limit of it's field buffer. The VANC data field buffer is 4K words deep. Once this much data has been buffered any remaining ANC data in the field will be dropped. At the end of each vertical interval period the VANC data buffer is processed into AES data to be embedded into the SDTi output. VANC data buffers are delayed in the 7771CS to compensate for the video processing delays in both the PKG7771MFC-HD card and the PKG7771MFD-HD card. The result is that the data appears in the same field in the output after decompression as it did on the input before compression.

8. JUMPERS

Several jumpers, located at the front of the module are used to preset various operating modes. Figure 4, Figure 5, and Figure 6 show the location of the jumpers on the bottom and top boards respectively.

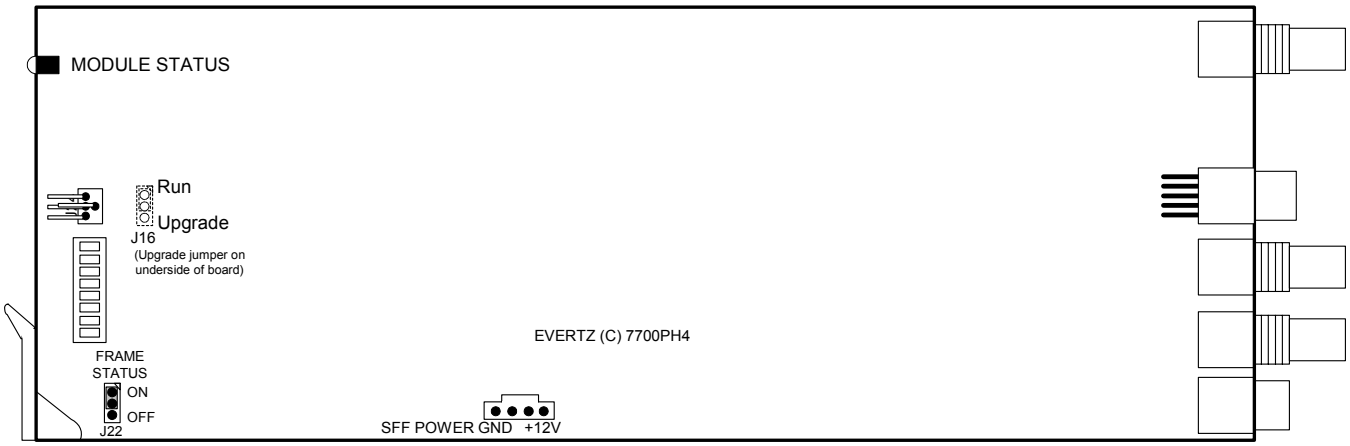

Figure 4: Location of Jumpers Bottom Board (PKG7771MFC)

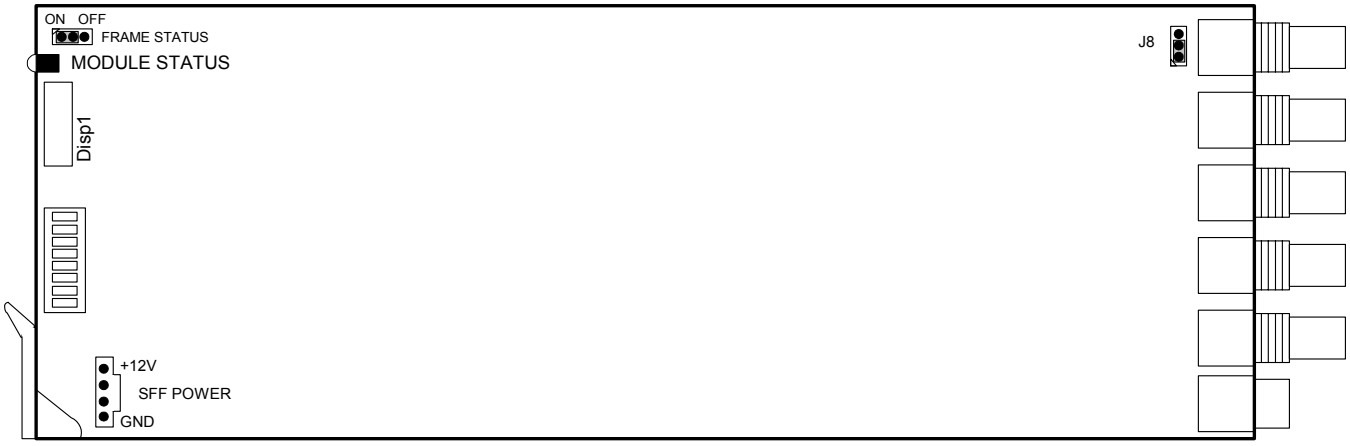

Figure 5: Location of Jumpers Top Board (PKG7771MFC)

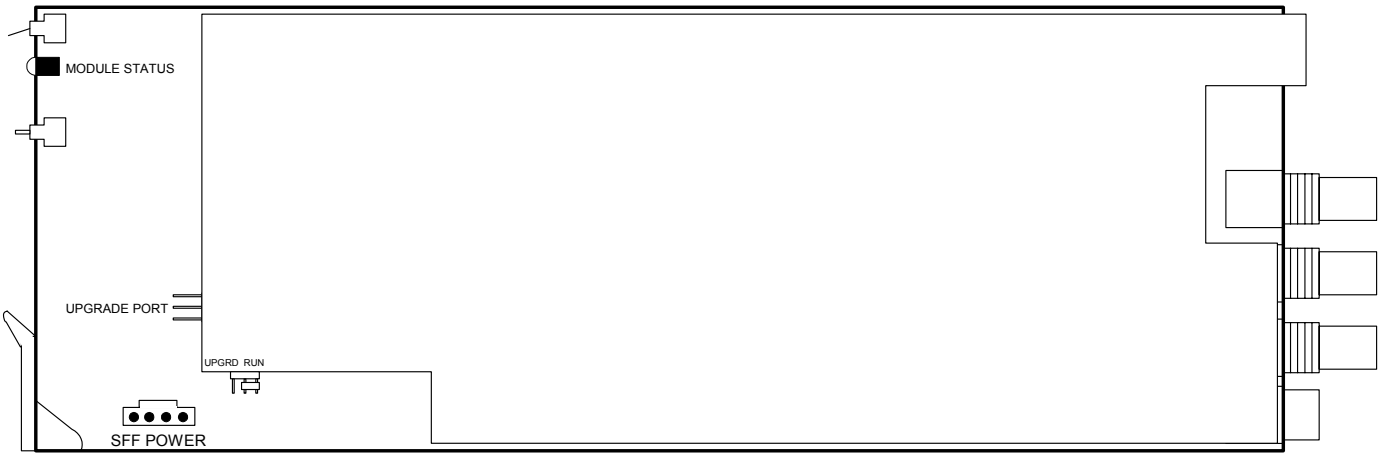

Figure 6 Location of Jumpers (7771MFCD-C)

8.1. SELECTING WHETHER LOCAL FAULTS ON THE BOTTOM BOARD WILL BE MONITORED BY THE GLOBAL FRAME STATUS

The FRAME STATUS jumper J4 on the bottom board determines whether local faults (as shown by the Local Fault indicator) on the bottom board will be connected to the 7700FR frame's global status bus.

FRAME STATUS To monitor faults on this module with the frame status indicators (on the Power Supply 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.

8.2. SELECTING WHETHER LOCAL FAULTS ON THE TOP BOARD WILL BE MONITORED BY THE GLOBAL FRAME STATUS

The FRAME STATUS jumper J4 on the top board determines whether local faults (as shown by the Local Fault indicator) on the top board will be connected to the 7700FR frame's global status bus.

FRAME STATUS To monitor faults on this module with the frame status indicators (on the Power Supply 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.

8.3. CONFIGURING THE PKG7771MFC-MODULE FOR FIRMWARE UPGRADES

The UPGRADE jumper J16 is installed on the underside of the bottom board.

UPGRADE The UPGRADE jumper J16 on the bottom board 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* chapter of this manual for more information.

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

8.4. CONFIGURING THE 7771MFCD-C MODULE FOR FIRMWARE UPGRADES

The UPGRADE jumper J15 is installed on the underside of the 7771MFCD top board.

UPGRADE The UPGRADE jumper J15 on the top board 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* chapter of this manual for more information.

To upgrade the firmware in the module unit pull it out of the frame. Move the UPGRADE jumper into the *UPGD* position. Install the Upgrade cable provided (located in the vinyl pouch in the front of this manual) onto the SERIAL header 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 the UPGRADE jumper 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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