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# REVISION HISTORY

| REVISION | DESCRIPTION | DATE |
|---|---|---|
| 1.0 | Original Version | Oct 2001 |
| 1.1 | Added Warning for Balanced Audio Shielding | Aug 2003 |
| 1.2 | Added –B Rear Plate Drawing; updated overview, features, specs | Feb 2010 |

# 1. OVERVIEW

The 7720ADC-A4 is a high-quality, 24-bit, analog to digital audio converter which provides digital conversion of 4 balanced analog audio channels and provides 2 unbalanced (or balanced from the 7720ADC-A4-B) AES/EBU channels out.

The sampling clock may free run at 48KHz or may be locked to either a DARS (Digital Audio Reference Signal) reference or composite video reference. Level control is provided via a card edge toggle switch. The input gain level can be read out from a card edge display for convenience. The full scale digital signal can be calibrated to accommodate peak levels ranging from 8dBu to 27dBu with 0.5dB resolution.

The audio ADC features a card edge VU meter for quick confidence monitoring. Four separate level indicators are provided via bar graphs for quick validation of audio program material.

**Features**

- Auto detect composite video or DARS on the reference input
- 24-bit, high-quality analog to digital audio conversion
- Support for 4 channels of analog audio (2 AES/EBU)
- Local card edge display and control of input gain
- 0dBFS programmable from 8dBu to 27dBu
- A card edge display provides a 4 channel bar graph type level indicator display for confidence monitoring
- VistaLINK® capable for remote monitoring via SNMP (using VistaLINK® PRO) when installed in 7800FR frame with a 7700FC VistaLINK® Frame Controller

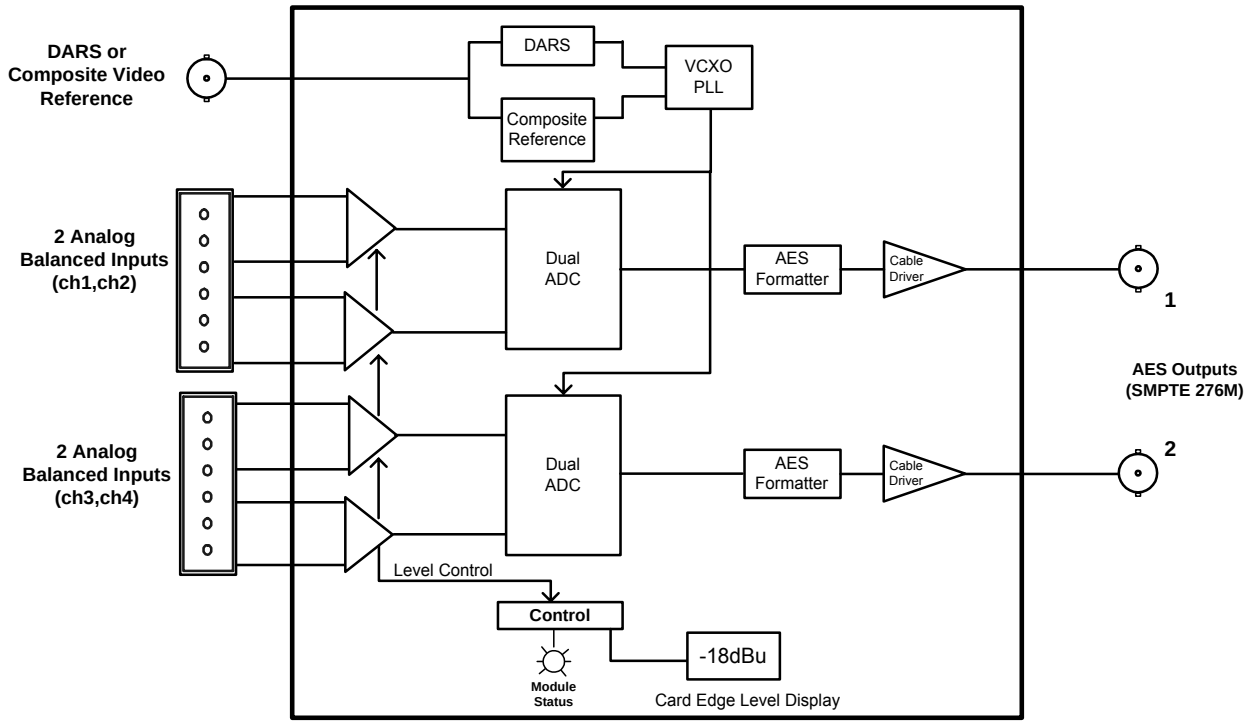


**Figure 1-1: 7720ADC-A4 Block Diagram**

# 2. INSTALLATION

The 7720ADC-A4 modules each come with a companion rear plate that has 3 BNC connectors and two 6 pin terminal strips. For information on mounting the rear plate and inserting the module into the frame see section 3 of the 7700FR chapter.

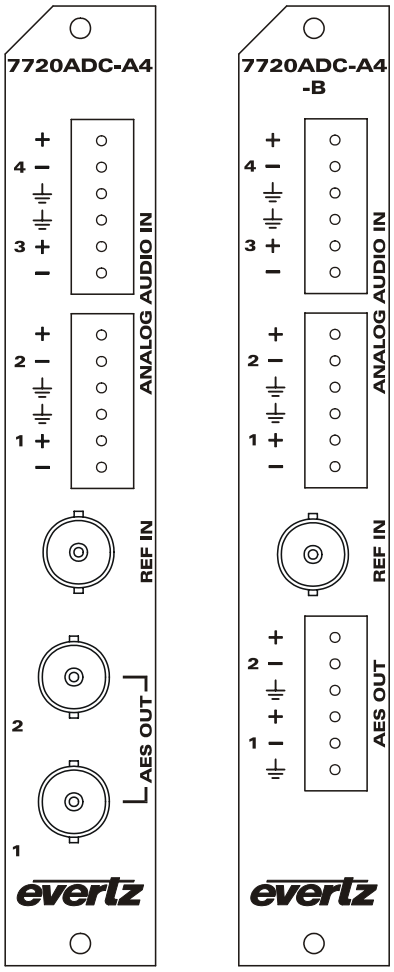


**Figure 2-1: 7720ADC-A4 and 7720ADC-A4-B Rear Panels**

## 2.1. ANALOG AUDIO CONNECTIONS

The 7720ADC-A4 has two 6 pin terminal blocks containing balanced analog audio inputs. The audio cables can be secured into the removable portion of the terminal strips using a small screwdriver. The removable part of the terminal strip is then inserted into the rear panel.

**Caution should be exercised when connecting the cable shield to the "shield ground" as this input only has a limited tolerance for any arising ground loop currents.**

**When using 7720ADC-A4, the shield should be connected at one end of the cable only. Which end of the cable shield should be grounded, source or destination, is a matter of local practice / preference? For an authoritative guide to cable shield connections, please refer to Rane Note 151 ("Grounding and Shielding Audio Devices", http://www.rane.com/pdf/note151.pdf). For the purposes of interpreting this very thorough application note, be advised that 7720ADC-A4 connector pin "shield ground" is internally connected to "signal ground" (not "chassis ground").**

**Shield ground loop currents may arise, if the source equipment "shield ground" potential is significantly different from 7720ADC-A4 local power ground and the shield is grounded at both ends. The card can tolerate about 0.5A of any resulting ground loop current. Exceeding this limit risks causing catastrophic failure of the card.**

## 2.2. AES AUDIO CONNECTIONS

The 7720ADC-A4 has two BNC connectors for outputting unbalanced AES signals compatible with the SMPTE 276M standard. The AES IN 1 output will come from the Analog Audio 1 and 2 inputs and the AES IN 2 output will come from the Analog Audio 3 and 4 inputs.

## 2.3. AES REFERENCE CONNECTIONS

**REF IN:** Composite video or DARS reference input. This input is high impedance and must be terminated externally.

# 3. SPECIFICATIONS

## 3.1. ANALOG AUDIO INPUT

| | |
|---|---|
| **Number of Inputs:** | 4 |
| **Type:** | Balanced analog audio |
| **Connector:** | Removable terminal strip |
| **Input Impedance:** | 10k Ω minimum (differential) |
| **Sampling Frequency:** | 48kHz synchronous locked to reference<br>48 kHz ± 50 ppm free run if no reference |
| **Signal Level:** | 0dB FS =>8dBu to 27dBu (programmable via 0dB/+6dB jumper and card edge fine gain with -10dB to +10dB range) |
| **Level Control Range:** | ± 10dB |
| **Frequency Response:** | ± 0.1dB (20Hz to 20kHz) |
| **SNR:** | 100dB with input at -1dBFS |
| **THD+N:** | < 0.001% (>100dB) @ 20Hz to 20kHz, -1 dB FS |
| **CMRR:** | >100dB @ 1kHz |
| **Crosstalk:** | < -100dB at 20Hz-20kHz |
| **Interchannel Phase Error:** | < 1°, 20Hz to 20kHz |

## 3.2. AES AUDIO OUTPUTS

| | |
|---|---|
| **Number of Outputs:** | 2 |
| **Standard:** | SMPTE 276M, unbalanced AES |
| **Connectors:** | BNC per IEC 61169-8 Annex A |
| **Sampling Rate**: | 48 kHz, synchronous with reference if applied |
| **Impedance:** | 75 Ω unbalanced |
| **Resolution:** | 24 bits |
| **Input/Output Delay:** | 0.87ms |

## 3.3. REFERENCE INPUT

| | |
|---|---|
| **Standard:** | NTSC (SMPTE 170M), PAL (ITU624-4), DARS |
| **Number of Inputs:** | 1 |
| **Connector:** | BNC per IEC 61169-8 Annex A |
| **Signal Level:** | |
| **Video:** | **Max:** 2Vp-p video<br>**Min:** Sync level 150mV |
| **DARS:** | SMPTE 276M, 1Vp-p |
| **Frequency Lock Range:** | ±100ppm from nominal |
| **Input Impedance:** | High impedance – external termination required. |
| **Return Loss:** | >25dB to 10MHz (with external 75Ω termination) |

## 3.4. ELECTRICAL

| | |
|---|---|
| **Voltage:** | + 12VDC |
| **Power:** | 10 watts |
| **EMI/RFI:** | Complies with FCC Part 15, class A and 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<br>(355 mm L x 114 mm W x 48 mm H) |
| **Weight:** | approx. 1.5 lbs. (0.7 Kg) |

# 4. STATUS INDICATORS

The 7720ADC-A4 has 2 LED Status indicators and a 4 digit alphanumeric display on the front card edge to show operational status of the card at a glance. The card edge pushbutton is used to select various displays on the alphanumeric display. The location of the status LEDs is shown in Figure 6-1.

## 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 there is a fault in the module power supply.

## 4.2. DOT-MATRIX DISPLAY

Additional signal and status monitoring is provided via the 4-digit dot-matrix display located on the card edge. The rotary switch position determines what is displayed on the dot matrix display. When it is set to position 0, the input audio levels are shown using bar graphs on the display. Pushing the toggle switch up when the rotary switch is in position 0 will orient the display vertically; pushing the toggle switch down will orient the display horizontally. When it is set from 1 to 4 the gain level for each of the channels will be displayed, and can be set using the toggle switch (see section 5.1.1).

### 4.2.1. Audio Level Bar Graphs

When the rotary switch is set to position 0, each section of the dot matrix display shows a bar graph representation of the level for one of the audio channels. Channel 1 is shown on the left (top) section and channel 4 is shown on the right (bottom) section. Each section of the display is comprised of a 5 x 5 array of dots. Diagonal rows of dots represent one of 9 different signal levels as shown below.

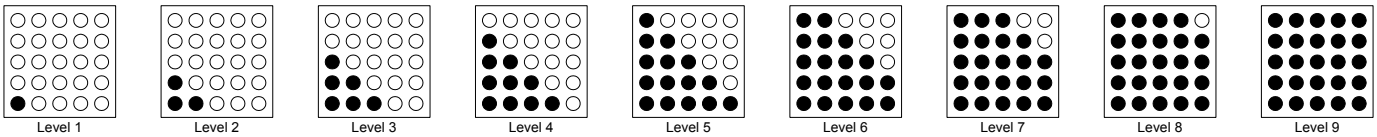


**Figure 4-1: Bar Graph Displays**

The signal levels shown in Table 4-1 are nominally in dBFS units. Table 4-1 also shows the levels in dBu when the gain is set to 0 dB (see section 5.1.1) and the level jumpers are set so that 24 dBu = 0 dBFS (see section 6.2). The ballistics of the bar graph displays follow the AES/EBU guidelines and have the attack time constant set to 0 seconds, and the decay time constant set to 1.5 seconds / 20 dB.

| Bar Graph Level | dBFS | dBu |
|---|---|---|
| Level 1 | -60 | -36 |
| Level 2 | -36 | -12 |
| Level 3 | -30 | -6 |
| Level 4 | -24 | 0 |
| Level 5 | -21 | 3 |
| Level 6 | -18 | 6 |
| Level 7 | -15 | 9 |
| Level 8 | -12 | 12 |
| Level 9 | -6 | 18 |

**Table 4-1: Bar Graph Levels**

# 5. CARD EDGE CONTROLS

On the card edge there is a toggle switch and a ten position rotary switch that are used to choose what will be displayed on the dot matrix display, and to set the gain for each of the analog channels.

## 5.1. AUDIO LEVELS, HEADROOM, CLIPPING AND THE BAR GRAPHS

This section contains notes to understand how the 7720ADC-A4 relates analog audio levels, digital audio levels, and the displayed bar graph levels.

Before you can calibrate the audio analog to digital converter, you must know a couple of system issues specific to your application. What is your analog reference level and how much headroom do you want to have in the digital audio signal? By adding these two values together, you will get the analog input level that will just begin to saturate the digital world (This is the highest level that can be represented without distortion with the digital numbers). This level is called 0dB FS (FS stands for "full scale"). For instance, if your analog program reference level is 4dBu and you want 20dB of headroom in the "digital world", then 0dB FS will correspond to an analog level of 24dBu. Once the audio input level is calibrated, when you apply a 4dBu analog signal, the digital level will be –20dB FS.

The AES output audio and the bar graphs are all based on the digital quantized signal. The card edge bar graph display is scaled to 0dB FS.

### 5.1.1. Input Audio Level Calibration

The analog audio input circuitry has two gain control stages before the audio is digitized. Eight Jumpers located near the rear of the 7720ADC-A4 module are used to set a coarse gain level. (See Figure 6-1 for location of jumpers) When the jumpers are not installed, the input range is optimized for when peak audio levels are up to 24dBu. When the jumpers are installed, best performance is achieved when input peak levels are below 18dBu.

The toggle switch and rotary switch on the card edge of the 7720ADC-A4 allow independent ±10dB audio level control of all four channels. To set the gain of one of the audio channels, select the channel number using the rotary switch. The corresponding channel number will be displayed on the dot matrix display. Alternately, the current gain setting for the selected channel will be displayed. To increase the gain, push the toggle switch up (toward the dot matrix display). To decrease the gain, push the toggle switch down. The gain is adjusted in increments of 0.5 dBu, and will be shown on the dot matrix display. To adjust the gain for other channels first select the channel using the rotary switch then adjust the level using the toggle switch. When you are finished setting the gain levels, return the rotary switch to position 0.

The following is an example calibration procedure:

1. Take your analog program reference level and add the amount of desired headroom in the digital signal (SMPTE standard is 20dB). If this number is greater than 18dBu, then remove the 8 jumpers near the rear of the 7720ADC-A4 module. If the number is less than 18dBu, then install the 8 jumpers. (see Figure 6-1 for location of jumpers)
2. Apply an analog audio signal of the level calculated above.
3. Monitor the output AES audio with appropriate level measuring equipment.
4. Adjust the card edge level controls (described above) so that the digital level just starts to clip.
5. Verify the settings by applying program reference level audio signals. The bar graphs should read a level that is below 0dB FS by the desired headroom level.

# 6. JUMPERS

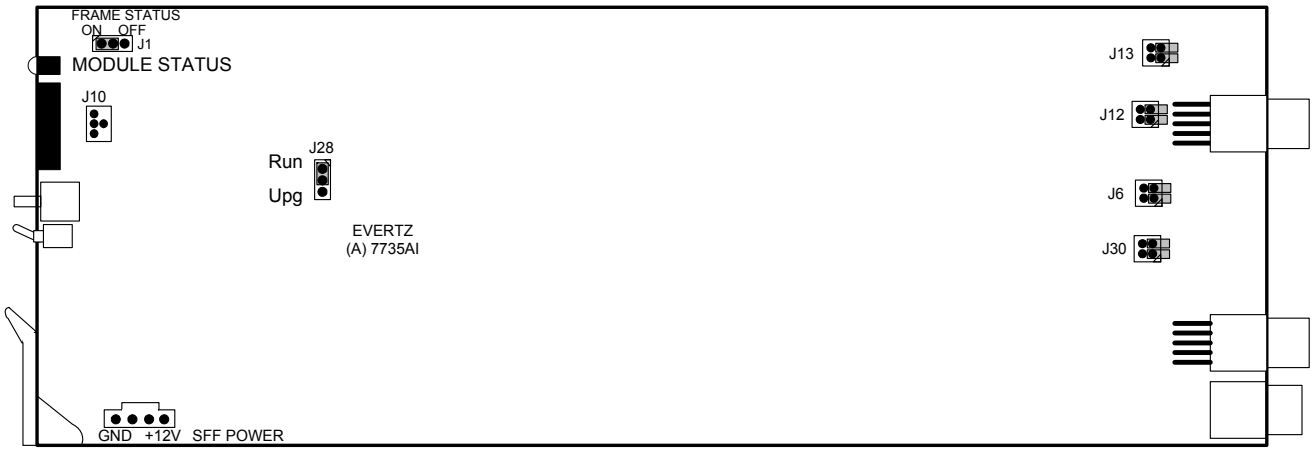


**Figure 6-1: Location of Jumpers**

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

**FRAME STATUS:** The FRAME STATUS jumper J1 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 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.

## 6.2. SETTING THE COARSE ANALOG INPUT GAIN RANGE

**J13, J12, J6, J30:** Eight Jumpers located near the rear of the 7720ADC-A4 module are used to set a coarse gain level.

When the jumpers are not installed (or installed so that only one side is connected), the input range is optimized for when peak audio levels reach up to 24dBu. (Default)

When the jumpers are installed, best performance is achieved when input peak levels are below 18dBu.

## 6.3. CONFIGURING THE MODULE FOR FIRMWARE UPGRADES

**UPGRADE:** The UPGRADE jumper J28 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* chapter in the front of the manual binder for more information.

To upgrade the firmware in the module unit pull it out of the frame. Move Jumper J28 into the *UPGRD* position. Install the Upgrade cable provided (located in the vinyl pouch in the front of this manual binder) onto header J10 at the card edge. Re-install the module into the frame. Run the upgrade as described in the *Upgrading Firmware* chapter in the front of the manual binder. Once the upgrade is complete, remove the module from the frame, move J28 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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