DDA & DSA SERIES

AES/EBU DIGITAL AUDIO DISTRIBUTION AMPLIFIERS

OPERATING AND MAINTENANCE MANUAL

DESCRIPTION

The DDA Series of Digital Audio Distribution Amplifiers are designed to regenerate, isolate and distribute digital audio data formatted in accordance with specifications AES3-1992 and IEC 958. This is commonly called AES/EBU formatting.

The DSA Series operates much the same as the DDA Series; however, the DSA Series does not include the full featured display front panel and does not provide re-clocking of the digital input signal. The non-reclocking feature is essential when distributing Dolby E encoded AES signals and other clocked signals that should not be re-clocked.

DDAxxx-XLR and DSAxxx-XLR models use XLR connectors and operate from and drive a 110-ohm balanced shielded twisted pair distribution system per AES3-1992.

DDAxxx-BNC and DSAxxx-BNC models use BNC connectors and operate from and drive single-ended 75-ohm coaxial cable per AES-3id-1995 and are designed to integrate easily into video facilities.

S/PDIF (consumer) formatted digital audio data differs primarily in the use of consumer type "RCA" audio connectors in an unbalanced 75 ohm system and can be handled by a DDAxxx-BNC with use of an RCA to BNC input cable.

S/PDIF digital audio can be connected directly to a DSA106-RCA unit.

FEATURES

- Accepts sample rates from 27 to 96kHz
- Displays standard sample rates of 32, 44.1, 48, 88.2, 96 kHz (DDA only)
- Status and error LEDs show clock lock and data validity (DDA only)
- Adjustable input equalizers compensate for very long cable runs (DDA only)
- Data is relocked and regenerated before low-jitter transmission (DDA only)
- Loop thru transformer balanced and isolated inputs
- Switchable input termination resistors
- Individual, transformer balanced and isolated 110 ohm XLR outputs (-XLR only)
- Individual isolated 75-ohm BNC outputs (-BNC only)
- Single or dual inputs
- Up to 12 XLR or 24 BNC outputs
- Quiet, internal linear power supplies
- Attractive, 1RU package

DESCRIPTION

INPUTS

Incoming AES/EBU formatted digital audio data is applied to input transformers T8 (T9 for second input channel of dual unit). Both XLR and BNC inputs are balanced and DC isolated from ground. Input blocking capacitors C22 (C24) prevent accidental DC inputs from saturating (and perhaps damaging) the input transformers. Input termination resistors R25 (R26) at 75 ohms for BNC (and SP/DIF) inputs or 110 ohms for XLR inputs can be switched in or out of the circuit with rear panel DIP switches S1a (S1b). Inputs should always be terminated unless they are looped thru to another device or DDA input. The last device or input should always terminate the line.

INPUT EQUALIZERS

The input signals feed cable equalizer circuits U3 (U4) and associated components. Input equalization should only be necessary for extremely long input cable lengths and should only be used if proven to be necessary. The equalizers are adjustable with front panel multi-turn trimpots R63 (R66) so that only the minimum amount of boost required to compensate for excess cable roll-off can be added without over-equalization, which can degrade noise margins. See adjustment instructions in the INSTALLATION section. If input equalization is not required and you want to protect yourself from random control diddlers, you may disable the equalizers by removing jumpers E4 (E5).

RECEIVERS

(Note that DSA Series units do not re-clock and provide no front panel status information. The following section applies to DDA Series units only.)

The equalized AES/EBU data stream is applied to the receiver circuit U8 (U17) that is a Crystal Semiconductor CS8414 96kHz Digital Audio Receiver IC. The CS8414 receives the data, recovers the clock and synchronization signals and separates the audio and digital data. The audio data may be 16 to 24 bits at sample rates from 27 to 96 kHz.

Frame sync (FSYNC), Serial Clock (SCK), Serial audio data (SDATA), Channel status (C), User channel data (U), and data validity information (VERF) are passed directly to the transmitter IC for reformatting into the output data stream. VERF is an OR'ing of the validity information from the incoming data (V) with an internal error flag (ERF) that detects serious transmission errors such as parity errors, bi-phase coding violations and an out-of-lock PLL receiver. VERF then becomes the transmitted validity bit (V) and can be used by downstream error correction devices to interpolate through errors.

Received frequency information is encoded on U8 (U17) pins F0, F1 and F2 and is decoded by U14 (U19) into two BCD digits for display. Error information is encoded on pins E0, E1 and E2. It is decoded by 3 to 8 line decoder U20 (U22) and sent to the front panel display LEDs.

DISPLAYS

(Note that DSA Series units do not re-clock and provide no front panel status information. The following section applies to DDA Series units only.)

The two most significant digits of the sample rate are decoded by U1 AND U4 and displayed if the sample rate is within +/- 4% of a standard rate. Since only two digits are displayed, readouts of 32, 44, 48, 88 and 96 correspond to actual sampling rates within four percent of 32.0, 44.1, 48.0, 88.2 and 96kHz. The displays are blanked if the detected frequency is out of range.

Data and transmission errors are displayed in priority order of no lock, BI-PHASE Coding errors, PARITY errors and CRC errors. The no-lock signal is inverted and lights when the clock recovery PLL is in LOCK. The VALIDITY indicator shows that the previous received sample was valid when transmitted from the source device. NO ERROR is the absence of any of the other errors and is good. The SET indicator, used to tune the equalizer adjustment, lights when the received data eye opening is greater than half a bit period and the recovered clock is within range.

TRANSMITTERS

The Frame sync (FSYNC), Serial Clock (SCK), Serial audio data (SDATA), Channel status (C), User channel data (U), and data Validity information (VERF) are passed directly to the transmitters U9 (U18) for reformatting into the AES/EBU output data stream TXPA (TXPB). The transmitters are Crystal Semiconductor CS8404A devices capable of operation from 27 to 96kHz equivalent sample rates. The transmitters operate in a transparent mode, which allows the transmitter block structure (Channel Status, User and Validity bits) to be slaved to the block structure of the receiver. In the transparent mode the propagation delay of data through the CS8404A is set so that the total propagation delay from the receiver inputs to the transmitter outputs is exactly three sample intervals, which is less than 100 microseconds even at the lowest sample rate.

OUTPUT DRIVERS

DDAxxx-XLR and DSAxxx-XLR units use the balanced, 110-ohm, transformer coupled outputs and XLR type connectors shown on the referenced schematics. DDAxxx-BNC and DSAxxx-BNC units use the alternative 75-ohm unbalanced outputs to BNC coax connectors shown on the same schematics. The XLR outputs are in full compliance with specification AES3-1992 and the BNC outputs are in accordance with the recommendations of AES-3id-1995. RS-422 differential line drivers U1 and U2 (U5 and U6) provide a balanced drive for XLR outputs of 8Vp-p, open circuit through 110-ohm source resistance to yield 4Vp-p when loaded by a 110-ohm load. XLR outputs are transformer coupled for ground isolation. Each side of the differential line driver output is used to separately drive a 75-ohm capacitor coupled BNC output. Each BNC output provides 4Vp-p open circuit thru 75 ohms for a loaded output of 2Vp-p. Although the two sides of a differential line driver are out of phase with each other there is no phase difference in the recovered audio since the AES/EBU digital data is defined only by the presence or absence of transitions. It makes no difference whether those transitions are hi to low or low to hi.

REFERENCE OSCILLATORS AND POWER SUPPLIES

U10 generates a 6 MHz reference frequency input to U8 (U17) for determining the incoming frame (sample) rate. The oscillator is counted down in U11, 12, 15 and 16 to provide a synchronized display reset pulse every 3 seconds. U21 generates a precision 2.5VDC reference for the equalizer circuit. U7 and U13 provide regulated and quiet +/-5VDC for all circuits. Power transformer primary windings are paralleled for 115VAC or wired in series for 230VAC. Jumpers E1 allows field modification if necessary.

INSTALLATION

LOCATION

To avoid addition of jitter (timing variations) to the digital bitstream, which could cause noise and distortion in the recovered audio, avoid locating the DDA or DSA in close proximity to a high energy, high frequency switching type power supply or a power amplifier that utilizes a switching supply. If possible, do not power both devices from the same AC power line.

Expensive components start to die at internal temperatures above 70°C (158°F). We recommend that you maintain rack temperatures below 50°C (122°F) to prevent excessive internal temperature buildup. This is another good reason not to mount the DDA or DSA directly above that 500W power amplifier. Don't force the DDA to support the weight of 28 coax or 16 XLR cables (especially when you drop that 500W power amplifier on the cable bundle), support the cables.

POWER

If it is necessary to convert a unit wired for 115VAC to 230VAC operation, unplug the unit from the power source, remove the four cover mounting screws and locate the E1 jumpers next to the power transformer. Clip the jumpers 1-2 and 3-4 (don't unsolder), jumper from 2-3 carefully soldering together the free ends of 2-3 previously clipped. This procedure is recommended to avoid soldering damage to the multi-layer PC board.

WIRING

XLR types require special controlled impedance, 110 ohm, low loss, foil shielded, twisted pair cables. Standard audio cable is not recommended except for runs of only a few feet. Belden and most other cable manufacturers offer special digital audio cabling for this application. With equalization, cable runs of 300 meters (about 1000 feet) should be achievable. BNC types use 75-ohm coax (RG59). Select a cable for losses less than 20dB at 12MHz (for data rates up to 96kHz) at the maximum distance you require. Runs up to 1000 meters should be readily achievable with low loss coax.

INPUT CABLE EQUALIZATION

If there is an unusually long (more than a few hundred feet) cable connection between a particular AES/EBU data source and the DDA or DSA, it may be necessary to equalize the cable response. Equalization would be indicated if it is not possible to lock onto a known good signal source and obtain a stable reading of the DDA input sample rate as evidenced by the front panel indicators.

(The following procedure uses the front panel displays of the DDA to verify correct operation. Note that DSA units have no front panel display; therefore, Input Cable Equalization adjustment should be performed with a known-good AES tester connected to any of the DSA unit's outputs.)

1. Apply a known good AES/EBU digital signal with sample rate of 96, 88.2, 48, 44.1, or 32 kHz to the source end of the cable. (You can validate the source by temporarily co-locating the DDA with the signal source, connecting them together with a short cable and noting that all red LEDs are off, all green LEDs are on and the correct sample rate is steadily displayed.)

2. The factory default setting for the front panel equalizer control(s) is fully counterclockwise. With a small screwdriver, slowly turn it clockwise, pausing after each half turn for three seconds to allow the displays to update. Note the first position at which all red LEDs are off, all green LEDs are on and the sample rate is displayed steadily.

3. Continue to turn the control clockwise, counting turns, until the conditions of 2 above are no longer obtained.

4. Turn the control counterclockwise by half the number of turns counted in 3. above. This is the optimum setting for the installed cable length and sample rate.

SPECIFICATIONS

INPUTS

Connectors:	XLR female or BNC, DC isolated from chassis. Input connector pairs paralleled for loop-thru.
Level:	200mVp-p minimum
Impedance:	Transformer isolated, capacitor coupled, balanced and floating, XLR inputs 110 ohms, and BNC and RCA inputs 75 ohms. Terminating resistors may be switched in or out on rear panel.
Cable Length:	300m of 110-ohm cable, 1000 m of 75 ohm coax (with equalizer)
Equalizer:	Multi-turn panel control, adjust using DSA panel indicators
Sample Rates:	Accepts 27kHz to >100kHz
DDA Clock:	Regenerated from input signal with dual-mode PLL Clock Jitter <3nanoseconds peak-to-peak at 96kHz sample rate
DSA Clock:	Non-regenerated. Input clock is passed directly to outputs.

OUTPUTS

Connectors:	XLR male, 6 or 12; BNC chassis mount, 12 or 24
Levels:	XLR, 4Vp-p loaded at 110 ohms. BNC, 2Vp-p loaded at 75 ohms, RCA, 0.5Vp-p loaded at 75 ohms
Impedances:	XLR: 110 ohms, balanced, transformer isolated and capacitor coupled
BNC:	75 ohms, unbalanced, capacitor coupled
Output Jitter:	<3 nanoseconds peak to peak at 96kHz sample rate
Output Delay:	Three frames (sample intervals) at the sample rate

INDICATORS (DDA only)

Sample Rate:	Numeric readout of first two digits of 32, 44.1, 48, 88.2, 96kHz rates if within +/-4%. Out of range blanks display
Received Signal:	Status: NO ERROR, LOCK, VALIDITY, and all Green for normal operation
Error:	PARITY, CRC, BIPHASE, normally OFF, Red for error
Cable Equalizer:	SET indicator, lit Green for normal operation
Power:	Lit RED for ON
POWER	Internal supply, 115/230VAC+/-10%, 50/60Hz, 10VA, IEC320 3 pin connector.
SIZE	1 RU, 19”(48.3cm) W X 1 ¾”(4.5cm) H X 7”(19.1cm) D
WEIGHT	10lbs (4kg)
MODELS:	DDA106-XLR (1X6) DDA112-BNC (1X12) DDA112-XLR (1X12) DDA124-BNC (1X24) DDA212-XLR (Dual 1X6) DDA224-BNC (Dual 1X12) DSA106-BNC (1X6) DSA106-XLR (1X6) DSA112-BNC (1X12) DSA112-XLR (1X12) DSA124-BNC (1X24) DSA212-XLR (Dual 1X6) DSA224-BNC (Dual 1X12)