



# DA1000

## DISTRIBUTION AMPLIFIER

### OPERATING AND MAINTENANCE MANUAL



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## DESCRIPTION

The DA1000 is a 1X8 Analog Audio Distribution amplifier. A single balanced bridging input is level-regulated via a front panel level control and the signal is sent to eight balanced differential outputs and a front panel mounted headphone jack. Power, Signal Present and Output Clipping indicators are located on the front panel.

The ICs developed primarily for the instrumentation market had many shortcomings when used in high quality audio applications. The lack of audio related specifications, crossover distortion, high noise for low source impedances, limited output capability and limited gain bandwidth product forced many compromises when used in audio systems. High ratio input transformers, output boost stages and multiple stage designs were all used to compensate for op amp deficiencies and in turn added additional response and distortion problems of their own.

Walter Jung, in a definitive series of articles, analyzed and defined slew rate induced distortion mechanisms, tested many commonly available ICs and correlated various distortion tests with subjective (listening) criteria. A very significant result of his efforts was the identification of an IC originally developed for the European professional audio market which has almost ideal characteristics for audio use and in particular provides a high slew rate capability of 13 volts/microsecond, virtually eliminating slew induced Transient Intermodulation Distortion. By contrast the old standard 741-op amp has a slew rate of only .6V/microsecond.

This op amp is now available from several U.S. Manufacturers in single and dual versions and forms the basis for the DA1000. This chip incorporates an input stage designed for excellent noise performance with a wide range of source impedances, thus eliminating the necessity for input step up transformers. An output stage capable of driving 600 ohm loads directly to +22dBm with total freedom from crossover distortion, high inherent linearity, 100dB open loop gain and 50 MHz gain bandwidth product make this an ideal device for highest quality audio. The absence of Transient Intermodulation Distortion may be detected by the smooth effortless high frequency output capability, the absence of the harsh, raspy sound typical of IC amplifiers driven to full output at high frequencies and the freedom from increasing harmonic distortion vs. frequency. As used, a minimum of 40dB of loop gain is available for 100:1 distortion reduction even at 20kHz. All program audio stages in the Distribution Amplifiers use this unique device in its dual version (NE5533).

## INPUT

Input audio feeds a unity gain balanced differential input buffer stage (A1), which presents 30,000-ohm bridging impedance to the source. The inputs are protected from over voltage signals by clipping diodes (CR4-CR7). Dual bypass capacitors (C7, C29 and C8, C39) protect the inputs against common mode RFI pickup. A balance potentiometer (R9) allows setting a precise null for common mode hum inputs.

## **SIGNAL PRESENT INDICATOR**

The second half of A1 monitors the voltage at the output of the input buffer IC. The green Signal Present LED on the front panel will light for audio inputs over -30dBm. The LED will normally flicker with applied program material to tell you that all is well. (Happiness is a green LED.)

## **OUTPUTS**

Audio from the input buffer is AC coupled to the front panel level adjust potentiometer. This control adjusts the level of all outputs. If you are afflicted with lurking knob twiddlers, the knob can be removed leaving a somewhat less inviting screwdriver adjustment. If removing the knob doesn't cure the problem, put your DA out of reach by sticking it to the ceiling using the supplied suction cup feet.

The pot output is applied to the non-inverting input of the HI (in-phase) output stage driver IC (A2-1). The IC supplies the first 10 mA of output current directly and then the complementary Class B output booster transistors (Q1 and Q2) take over. The unique, wide bandwidth, high slew rate circuit design provides effective class AB operation with minimal crossover distortion from a power output stage operating true Class B with zero quiescent power dissipation.

The HI output bus is applied to the inverting input of A2-2 in a unity gain, phase inverting configuration and boosted by Q3 and Q4 to form the LO output bus.

The HI and LO output buses are split into nine individual outputs (eight rear and one front panel jack) through 150 ohm build-out resistances. All outputs will tolerate short circuits across the output or to ground without damage. Up to two outputs can be shorted with no significant reduction in headroom. Needless to say, this is NOT the recommended mode of operation. Do not drive single-ended (one side grounded) loads from both HI and LO outputs together. Drive single ended loads from either the HI or LO outputs to ground. Up to 18 single-ended 600-ohm output loads may be simultaneously driven.

The build-out resistors are split and heavily bypassed to prevent RF pickup on the output lines from affecting operation of the DA. These bypasses will place a very heavy load on the outputs under sustained sine wave operation above 20kHz and such operation may over-dissipate the 47 ohm build-out resistors—don't do it!

## **OUTPUT CLIPPING INDICATOR**

The differential input voltage of HI output driver IC (A2-1) is monitored by A3. The differential voltage is under a few millivolts under linear operation; however, if the output is driven to clipping, the differential voltage rapidly increases and is amplified to

light the yellow OUTPUT CLIPPING LED. Conserve power—try not to light the yellow LED.

## **HEADPHONE OUTPUT**

The front panel headphone jack provides a ninth output with its own set of build-out resistors. The phone jack is a convenient metering point, an auxiliary output or headphone output. The jack is wired primarily to drive stereo headphones with an in-phase mono signal; consequently tip (red) and ring (blue) are wired together and to the HI output, and the sleeve connection (white) is wired to the LO output. To use a standard tip-ring-sleeve patchcord output, rewire the jack terminals by removing the blue wire from the ring terminal, moving the white wire to the ring connection (and grounding the sleeve terminal to the top shield foil of the P.C. board).

## **POWER SUPPLY**

The DA1000's internal power supply incorporates a couple of unique regulating devices called zener diodes. In contrast to most fancy IC regulators, these devices will live through most line transients and simultaneously protect your expensive circuitry. As further insurance, a varistor suppresser is placed across the power transformer secondary.

## **INSTALLATION**

### **MOUNTING**

Your DA1000 may be desk mounted on its non-slip suction cups. Rack mount system 21075-501 mounts one or two units in one rack. A 1/2RU Filler Panel, Part Number 21098-501, may be used to tidy up the installation.

### **WIRING**

The attached line cord contains a three wire grounded plug. The third wire ground can cause a ground loop with your facility ground. If you are sure your facility ground will provide adequate protection to personnel in case of an AC line short to chassis, a 3-to-2 AC adapter can be used to isolate the power line ground. We recommend that the adapter be removed and the power line ground reconnected prior to any service work requiring removal of the facility ground from the chassis.

The four-inch silver bearing copper strap, which you are, of course, using for your facility ground is not going to fit around the #6 chassis ground screw on the rear panel. Run the strap to within a few inches of the chassis and jump to the chassis ground with shield braid.

Audio inputs and outputs should be connected using the rear panel labels as a guide. HI outputs are all in phase with each other and in phase with the HI inputs. Fanning strips are provided so that our ears won't be burning in the middle of the night while you are trying to wrap wires around tiny barrier strip screws. The fanning strips are Kulka part number 649A22 and extras are available from our Parts and Accessories Department.

To allow maximum flexibility in grounding in high RF environments, the circuit grounds are isolated from case ground. For normal operation, add a ground jumper from the barrier strip ground terminal closest to the inputs to the chassis ground screw.

## **CAUTION**

The balanced differential outputs have active drivers for both HI and LO output terminals. **DO NOT GROUND either HI or LO terminals.** To drive an unbalanced (one side grounded) load, connect it between HI and GND terminals and let the LO terminal float. Two separate 600 ohm unbalanced loads can be driven from each output without interaction by connecting one between HI and GND and the other between LO and GND. The two loads thus driven will be out of phase with each other.

## **MAINTENANCE NOTES**

Power supply voltages are + and - 20 VDC nominal. Maximum allowable voltages are  $\pm 22$  VDC (limited by IC). If zeners are replaced, remove ICs and check output voltage before plugging ICs back into the circuit. Remove power when inserting or removing ICs.

IC output DC voltages (no signal conditions) should measure  $0\text{VDC} \pm .5$  VDC. Significant deviation indicates an IC or circuit problem. Measurable DC difference between HI and LO amplifier inputs (other than due to meter loading) indicates IC failure.

If hit by lightning, replace A1 through A3.

## **MODIFICATIONS**

### **230 VAC OPERATION**

Your DA1000 is wired for 115 VAC 50/60 Hz operation unless otherwise requested at the time of ordering. It can be modified for 230 VAC use by removing the power transformer primary jumpers J1 and J3 and inserting a jumper in the J2 holes.

## **GAIN**

To increase gain by 10dB, change R13 to 680 ohms and increase C15 to 68  $\mu\text{F}$ .

## TECHNICAL SPECIFICATIONS

<b>OUTPUT CLIPPING LEVEL</b>	+24dBm @ 600 ohms load
<b>DISTORTION</b>	.2% maximum THD, 20-20kHz @ +24dBm output and input levels to +24dBm
<b>FREQUENCY RESPONSE</b>	±.25dB, 20 to 20kHz; -3dB at 100 kHz
<b>OUTPUT NOISE</b>	-70dBm maximum @ 20kHz measurement bandwidth, 600 ohm source impedance and max gain
<b>HUM REJECTION</b>	80dB for common mode hum
<b>INPUT IMPEDANCE</b>	Balanced differential inputs, 30,000 ohms bridging. +24dBm maximum input level
<b>GAIN</b>	26dB, front panel adjustable
<b>OUTPUT ISOLATION</b>	70dB minimum at 1 kHz, any output to any other output; unit will tolerate up to two shorted outputs with no reduction in headroom
<b>POWER</b>	115VAC, 47-63 Hz 230VAC, 47-63 Hz with internal wiring change
<b>SIZE</b>	8.5" (21.6cm) W x 1.75" (4.4cm) H x 7" (17.8cm) D
<b>WEIGHT</b>	2.5 lbs. (1.1kg) Net, 4 lbs. (1.8kg) Shipping
<b>MOUNTING</b>	Suction feet for non-slip desk mounting Rack mount system P/N 21075-501 mounts up to two units in one rack 1/2RU Filler Panel P/N 21098-501

## One Year Limited Warranty

ATI warrants this product to be free from defects in materials and workmanship to its original owner for a period of one year from date of purchase. ATI will repair or replace such product or part thereof, which upon inspection by ATI, is found to be defective in materials or workmanship.

The Proper Return Authorization Number must be obtained from ATI in advance of return. Contact ATI at 856-626-3480 or email [sales@atiaudio.com](mailto:sales@atiaudio.com) to receive the number and instructions for return of your unit.

A written statement providing the name, address, daytime telephone number and email address of the original owner, together with receipt from the original purchase, and a brief description of any claimed defects, must accompany all returns. Parts or product for which replacement is made shall become the property of ATI.

The customer shall be responsible for costs of transportation and insurance to the factory of ATI, and shall be required to prepay such costs.

ATI shall use reasonable efforts to repair or replace any product covered by this limited warranty within thirty days of receipt. In the event repair or replacement shall require more than thirty days, ATI shall notify the customer accordingly. ATI reserves the right to replace any product that has been discontinued from its product line with a new product of comparable value and function.

This warranty shall be void in the event a covered product has been damaged, or failure is caused by or attributable to acts of God, abuse, accident, misuse, improper or abnormal usage, failure to follow instructions, improper installation or maintenance, alteration, or lightning, power fluctuations and other incidental or environmental conditions. Further, product malfunction or deterioration due to normal wear is not covered by this warranty.

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This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.

ATI reserves the right to modify or discontinue, without prior notice to you, any model or style product.

If warranty problems arise, or if you need assistance in using your product contact us.