



**SUM100**  
**LINE/SUM/LINE AMPLIFIER**  
OPERATING AND MAINTENANCE MANUAL



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## **DESCRIPTION**

The SUM100 Summing Amplifier is an inexpensive, high performance amplifier that is designed as a line level stereo to mono summing amplifier. It is also useful as a gain block, and as an impedance converter and summing for IHF (RCA type) signals.

The inputs provide balanced 40Kohm bridging impedance for line levels up to +24dBm. The high input impedance allows the SUM100 inputs to also bridge -10dBu (hi-fi, RCA plug) lines without loading.

Front panel, screwdriver adjust, full range gain controls provide 26dB gain at full clockwise rotation, unity gain at twelve o'clock and a smooth audio taper to full off. The output driver is a servo controlled, ground-sensing circuit, which will supply over +24dBm to 600 ohm balanced loads and +20dBu to high impedance, unbalanced loads. The SUM100 uses rugged XLR type input and output connectors.

Loop-through DC connectors allow several NANOAMPS to share a single external 24VDC power supply. Battery packs and DC-DC converters for portable use are also available.

Up to three amplifiers will mount side-by-side in only one rack unit using the available rack mounting kits. NANOAMPS may also be neatly stacked or mounted side by- side on your desk with the available angled desk mounting kits.

## **CIRCUIT DESCRIPTION**

### **INPUT STAGES**

The balanced input stages of the SUM100 Line Amplifier utilize a FET input LF347 quad op-amp in a clean, quiet inverting instrumentation amplifier configuration. Input levels up to +24dBm will be handled without clipping, excess levels cause only clean clipping without hang-up or phase reversal. Equal -6dB gains from both HI and LO inputs allow unbalanced sources to be easily accommodated. Bridging impedance is a high 40Kohms with good CMR. Linear panel adjust trim pots for both left and right signals are designed to be operated at their 12 o'clock position for maximum resolution.

### **SUMMING AMPLIFIER**

Left and right signals are combined in an active summing network (A1B) which yields unity gain for each individual signal, three dB gain (RMS summation) for program audio signals and six dB gain for correlated inputs.

## **GAIN STAGE**

A low noise NE5532 section (A1A) provides 26dB maximum gain. A linear control is used in a unique circuit configuration to provide a wide range logarithmic MASTER gain control characteristic in a variable gain stage with optimum noise performance. Output noise at unity gain is low enough to allow performance to exceed 16-bit digital dynamic range even at -10dBu nominal output. Unity overall gain is achieved at approximately 12 o'clock pot position.

## **LINE OUTPUT**

The balanced output stage of the SUM100 utilizes a unique active balanced output driver IC, the Analog Devices SSM2142, that senses whether the connected load is balanced and floating or is unbalanced due to either side being grounded. A balanced output load will be driven with equal and antiphase levels on the HI and LO output lines.

An unbalanced (one side grounded) load will cause the driver IC to shut off the signal output to the grounded side of the load and double the output level applied to the other side, thus maintaining equal output to either type of load. The output stage provides 6dB gain and will drive loads of 600 ohms and higher. Nominal output is +4dBm with clipping at +24dBm (12.28Vrms) into 600 ohm balanced loads for 20dB nominal headroom. Maximum output is reduced to +20dBu (7.8Vrms) when driving an unbalanced load since the full output swing of only one driver is available. This still provides a very comfortable 30dB of headroom above the typical -10dBu nominal unbalanced signal.

## **POWER SUPPLY**

The SUM100 requires 24 to 30VDC and are designed to share a common external 24VDC "Wall Wart" type power supply. A pair of loop-thru DC connectors on the rear of each module permits several units to be daisy-chained with P/N20602-1 DC power cables to a single power supply. The WA100-1 and WA100-2 (230VAC) are 400Ma supplies. The SUM100 draws 70mA. Any combination of amplifiers, which add up to less than the supply rating, can be powered by a single supply.

## **INSTALLATION**

### **UNPACKING**

Inspect the equipment. If there is any visible damage to the unit or to the box it came in, contact the factory but do not return anything to ATI without prior authorization and shipping instructions. It may be necessary to have the shipping company inspect the unit and the box at your location. Count the pieces! Don't throw out the boxes and packing material until you are sure you have everything that is coming to you. The amplifiers are normally shipped with a WA100-1 120VAC power supply. An optional WA100-2 230VAC supply and 20602-1 DC Loop-Thru Cable, to share the supply of another amplifier, is available.

Rack and desk mounting hardware may be packed in with the unit even though ordered separately. Power supplies may either be included with the unit or shipped in their own box.

### **MOUNTING**

Single desk mounting kits consist of a pair of angled base plates that mount under the lower front and rear cover screws of a single unit, to raise and to tilt it for easy use. In addition, one or more sets of vertical stacking plates, mounting to the upper front and rear cover screws of the bottom unit, allow multiple units to be stacked. Several units can be desk mounted side-by-side and even stacked side-by-side using horizontal joiner kits together with mounting base and stacker kits. P/N20617-501 is the angled base kit. P/N20617-502 is the base plus one stacker kit (two high). P/N20617-503 is the base plus two stackers (three high). P/N20617-504 is the stacker kit by itself and P/N20604-504 is a horizontal joiner kit.

Rack mount system 21075-501 mounts three units in one rack.

### **WIRING**

#### **AUDIO CONNECTIONS**

Balanced XLR type inputs and outputs are wired per figure 1 with pins 2 as HI and pins 3 as LOW. Pin 1 is the cable shield and ground connection. Pin 1 is grounded as shipped but may be floated to interrupt a hum producing ground loop by opening the unit and clipping out the GND LIFT jumpers. Unbalanced lines use pin 2 as HI and ground pins 3 and 1.

Active balanced outputs and inputs require a reference ground connection to the source or receiving device for proper operation. This ground can be provided by the rack frame or a studio buss connection if it is not carried through by the output cable shield.

## GROUNDING

Operation in high RF broadcast environments requires special attention to grounding and shielding. The chassis **must** be grounded directly to a good, low impedance studio ground system. Input and output connections must be properly shielded and free of ground loops. It may even be necessary to add shielding to the DC input leads to avoid RF pickup.

## POWER DISTRIBUTION

Multiple amplifiers sharing a single wall-wart power supply should be looped through each other using the DC interconnect cables P/N20602-1. Hum and noise performance of the units can be degraded by poor DC ground connections between units sharing a common supply, use of the recommended rack and desk mounting kits will assure a good ground connection between units by firmly strapping their chassis together.

**CAUTION!** The outer shell of the DC interconnect cables is positive relative to the chassis. Do not allow a DC cable plugged into a powered unit to hang loose where it might short against the chassis or rack frame.

## OPTIONS

### 230VAC

The WA100-2 tabletop power supply accepts 230VAC/50-60Hz via an IEC320 male 3 pin AC input connector. User supplies a matching line cord for the local power system.

## BATTERY OPERATION

Alkaline battery packs (BBU100-1) and 24VDC converters for operation from 12V belt pack or automotive batteries (DC100-1) power modules are available.

## MAINTENANCE

There is no routine maintenance required. If you have a problem, check panel LED indicators to assure that the units have DC power, eliminate by substitution input and output cables, connectors, downstream devices, DC interconnect cables and Wall Wart power supplies.

## **POWER SUPPLY LEVELS**

The recommended loaded DC input voltage range is 24VDC minimum to 32VDC maximum over the full range of AC line voltage tolerances. The audio circuits continue to work with reduced headroom below 24VDC. Momentary surges up to 36VDC will cause some increased internal heating, but above 36VDC may cause IC failure.

## **OPERATING POINTS**

An internal reference voltage equal to 1/2 the supply voltage is generated. All audio stage IC inputs and outputs should show a DC level equal to this voltage when measured with a high impedance meter. Audio inputs and outputs are capacitor coupled and ground referenced.

## **MODIFICATIONS**

### **ADDITIONAL GAIN**

If more gain is required for a particular application, increase the values of R25 (left) and R34 (right). 20K ohms adds 6dB, 30K ohms adds 10dB, 62K adds 16dB, 100K adds 20dB. A corresponding decrease in the input clipping level will result.

## PERFORMANCE SPECIFICATIONS

<b>Gain:</b>	28dB maximum, 0dB at 12 o'clock pot position
<b>Nominal Levels:</b>	+4dBu in, +4dBm out to 600 ohm balanced load
<b>Peak Levels:</b>	+24dBu in, +24 dBm out to 600 ohm balanced load
<b>Noise 20kHz B.W.:</b>	-90dBm maximum output
<b>Harmonic Distortion:</b>	.02% Max at Peak Level 20Hz to 20 kHz .005% max at Nominal Level
<b>Frequency Response:</b>	+.25dB, 20 to 20,000Hz
<b>Crosstalk:</b>	70dB minimum at 10kHz
<b>Input Impedance:</b>	Balanced, 40kohm bridging
<b>Output Impedance:</b>	Balanced, 40 ohms maximum Zs
<b>Dimensions:</b>	1.5" (3.8cm) H by 5.5" (14cm) W by 5.75" (14.6cm) D
<b>Weight:</b>	1.5 lb. (0.7kg) Net
<b>Connectors:</b>	XLR (balanced input/outputs)
<b>Power:</b>	24VDC @ .07A, connector sleeve is positive
<b>Power Supplies:</b>	All units require 24VDC power supply; 120VAC unit is supplied. NanoAmps can share a single supply using DC Loop-Thru Cable P/N 20602-1. Do not exceed rated supply current
<b>WA100-1 (Standard):</b>	Wall mount power supply (UL), 24VDC @ .4 amp, 120 VAC/60 Hz
<b>WA100-2 (Optional):</b>	Tabletop power supply, 24VDC @ .4 amp, 230 VAC/50-60 Hz with IEC 320 male 3 pin AC input connector. User supplies matching AC line cord for local power system.
<b>BBU100-1:</b>	Battery Pack unit houses four 9V alkaline batteries (batteries not included). Four to six-hour life
<b>DC100-1:</b>	DC to DC converter powers several units from 12VDC mobile and belt pack batteries. Supplies 24VDC @ .2amp maximum
<b>20602-1:</b>	DC power cable assembly for looping the DC power between NanoAmps
<b>DESK MOUNT KITS:</b>	20617-501 Angled Desk Mount Base 20617-502 Angled Desk Mount Base and One Stacker (2 units high) 20617-503 Angled Desk Mount Base and Two Stackers (3 units high) 20617-504 Stacker (2 units high) 20617-505 Horizontal joiners for 2 units (side by side)
<b>21075-501:</b>	Rack mount system mounts three units in one 1RU 19-inch rack space
<b>21097-501:</b>	1/3 RU Filler Panel for 21075-501