9303 / 9505
Installation & Operation

Hafler®

trans•nova

MADE IN THE USA

PROFESSIONAL POWER AMPLIFIER

NOTICE - IMPORTANT SAFETY INFORMATION

CAUTION

RISK OF ELECTRIC SHOCK
DO NOT OPEN

WARNING: TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS EQUIPMENT TO RAIN OR MOISTURE.

The lightning flash with arrowhead symbol within an equilateral triangle is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure, that may be of sufficient magnitude to constitute a risk of electric shock to persons.

The exclamation point within an equilateral triangle is intended to alert the user of the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

1. **READ INSTRUCTIONS**
   All the safety and operating instructions of your Hafler equipment should be read before power is applied to the equipment.

2. **RETAIN OWNER'S MANUAL**
   These safety and operating instructions should be retained for future reference.

3. **HEED WARNINGS**
   All warnings on the equipment and in the operating instructions are important and should be followed.

4. **FOLLOW INSTRUCTIONS**
   All operating and use instructions are important and should be followed.

5. **HEAT**
   The equipment should be kept away from areas of high temperature, i.e., heater vents, radiators, stoves/ovens, fireplaces, etc.

6. **VENTILATION**
   The equipment should be used in an area suitable for proper ventilation. Care should be taken not to impede airflow in and around the cabinet. Do not mount on a carpeted shelf or in a sealed enclosure. Allow for proper clearance above the equipment.

7. **WATER AND MOISTURE**
   The equipment should not be used in or around water, such as a bathtub, sink, or swimming area. Also, the equipment should not be used in areas prone to flooding, such as a basement.

8. **POWER SOURCES**
   The equipment should be connected only to a power source of the same voltage and frequency as that listed on the rear panel above the power cord entry point.

9. **POWER CORD PROTECTION**
   Power cords should be arranged so they do not interfere with the movement of objects in the room: people, fan blades, utility carts, etc. Also, care should be taken that the cord is not pinched or cut, and placed so it is not in danger of being pinched or cut, as in under a rug, around a tight corner, etc.

10. **POWER CORD GROUNDING**
    The power supply cord is of a three wire grounded type, designed to reduce the risk of electric shock sustained from a live cabinet. It is assumed to be of suitable length for most uses of the equipment. The use of extension cords and power strips is discouraged unless they are of suitable rating to deliver the required total current for safe operation of all connected equipment. Furthermore, extension cords or power strips must provide the same three wire grounded connection. It is important that the blades of the equipment's plug be able to fully insert into the mating receptacle. Never remove the round grounding pin on the plug in an attempt to mate to a two wire ungrounded receptacle: use a grounding adaptor with the grounding tab or wire suitably connected to earth ground.

11. **NON-USE PERIODS**
    During periods of extended non-use, the power cord should be unplugged from the power source.

12. **CLEANING**
    The equipment should be cleaned only as detailed in the operating instructions.

13. **OBJECT AND LIQUID ENTRY**
    Care should be taken so that objects and/or liquids, such as cleaning fluids or beverages, are not spilled into the enclosure of the equipment.

14. **DAMAGE REQUIRING SERVICE**
    Hafler equipment should be serviced by qualified service personnel when:

    A. The power supply cord or plug has been damaged, or

    B. Objects have fallen, or liquid has been spilled into the equipment, or

    C. The equipment has been exposed to rain, or

    D. The equipment does not appear to operate normally or exhibits a marked change in performance, or

    E. The equipment has been dropped, or the enclosure has been damaged.

15. **SERVICING**
    The user should not attempt to service the equipment beyond that which is described in the operating instructions. All other service should be referred to qualified service personnel.

16. **CARTS AND STANDS**
    The equipment should be used with carts or stands only of sufficient strength and stability for the use intended.

    An equipment and cart combination should be moved with care. Quick stops and starts, excessive force, and uneven surfaces may cause the equipment and cart combination to topple.

PERFORMANCE SPECIFICATIONS

9303/9505

Full Power Bandwidth:	0.15Hz to 300kHz
Signal-to-Noise:	>100dB "A" Weighted
Slew Rate:	150 V/µs
CMRR:	75dB at 1kHz
Gain:	+29dB max.

9303

Power Rating:	150 wpc @8 Ω, 225 wpc @ 4Ω, 450 Watts mono @ 8Ω
Distortion:	0.07% THD 20-20Hz, Typically 0.005% THD 1kHz, at rated power into 8Ω
Damping Factor:	800 (to 1kHz); 80 (to 20kHz); 20 (to 100kHz) into 8Ω
Input Sensitivity Range:	1.22 Vrms for 150W into 8Ω, 1.06Vrms for 225W into 4Ω
Dimensions:	19"W x 12-1/2"D x 3-1/2"H (excluding feet)
Weight:	36 lbs. (16.4kg)
Power Consumption:	Quiescent, 84 VA; at rated power, 612 VA (150W into 8Ω, both channels driven)

9505

Power Rating:	250 wpc @8 Ω, 375 wpc @ 4Ω, 750 Watts mono @ 8Ω
Distortion:	0.1% THD 20-20Hz, Typically 0.005% THD 1kHz, at rated power into 8Ω
Damping Factor:	1000 (to 1kHz); 100 (to 20kHz); 20 (to 100kHz) into 8Ω
Input Sensitivity Range:	1.58 Vrms for 250W into 8Ω, 1.37Vrms for 375W into 4Ω
Dimensions:	19"W x 12-1/2"D x 5-1/4"H (excluding feet)
Weight:	50 lbs. (22.7kg)
Power Consumption:	Quiescent, 132 VA; at rated power, 1020 VA (250W into 8Ω, both channels driven)

TABLE OF CONTENTS

INTRODUCTION

The Hafler 9303 and 9505 are two channel professional power amplifiers. Passive cooling with large heatsinks is used for low mechanical noise. Our patented **trans•*nova*** circuit topology and MOSFET output stage ensures trouble free, long term operation and is backed by our seven year warranty.

This manual contains information on using the 9303 and 9505 amplifiers. It is organized into three main sections. **“Installation”** covers the location and connection of the amplifier in the system. Like many precision components careful attention to the initial setup can yield dividends in higher performance and trouble-free use. **“Operation”** covers the controls and features of the amplifiers and how to use them to get the best effect. The **“Technical Information”** section contains information on the circuit implementation and the schematic diagram and parts list. We strongly urge reading over the Installation and Operation portions of this manual before putting the amplifier into service.

The circuitry used in the 9303 and 9505 is the latest refinement of our **trans•*nova*** (TRANSconductance NOdal Voltage Amplifier, US Patent 4,467,288) circuit. The 9303 and 9505 utilize our proprietary DIABLO (patent application in progress) transconductance driver stage which combines the linearity of Class A operation with the current headroom of a Class B system. When used in combination with the robust output stage used with these models, DIABLO yields lower high frequency distortion without the sonic penalties associated with increasing the negative feedback.

The 9303 and 9505 have fully differential inputs for use in balanced line systems. The balanced input terminals work with either 1/4" TRS phone or XLR plugs. Gold-plated RCA phono jacks are available for use with unbalanced source components. The output terminals are gold-plated binding posts, spaced on 3/4" centers for use with dual banana plugs. For high power applications, the amplifier can run in bridged mono for double the output voltage. Using state-of-the-art surface mount assembly equipment in our manufacturing facility ensures consistency and reliability.

INSTALLATION

LOCATION

The 9303 and 9505 can produce considerable heat in normal operation so the primary consideration when determining a location for the amplifiers is to allow for adequate ventilation. The large heatsinks provide unrestricted airflow, but care must be taken to keep the slots in the bottom panel and top cover clear, as well. If the amplifier is mounted in an equipment rack, make sure adjacent equipment does not impede cool air flow through the amplifier bottom and out the top. The attached feet provide sufficient clearance for the bottom when the amplifier is resting on a hard surface. Inadequate ventilation can shorten component life, especially when other equipment raises the ambient air temperature, so a circulating fan should be considered in tight quarters. The power transformer can generate a substantial magnetic field, so caution should be exercised in the placement of low level components such as a tape deck, mixer or mic preamp to avoid inducing noise in the low level circuitry.

AC LINE

The 9303 and 9505 operate from a 120 volt, 60Hz AC power line. Connection is made by an IEC Type 320, grounded line cord. For safety considerations only a properly grounded (earthed) receptacle should be used. If a grounded circuit is not available do not break off the ground pin; use the proper adapter plug for a two wire receptacle. Located inside the amplifier is the line fuse which interrupts the power to the amplifier. If this fuse blows replace it only with the same type and rating fuse. The correct replacement fuse value is included in the parts list in the “Technical Information” section of this manual. If the replacement fuse blows, this is an indication of a fault with the amplifier. Servicing should be performed only by a qualified technician.

INPUT

The 9303 and 9505 have input jacks for both balanced and unbalanced input signals. The unbalanced inputs use conventional RCA phono jacks. When using the RCA inputs, the rear panel BALANCED/UNBALANCED switch must be set to the UNBALANCED position. The balanced input jacks are dual function connectors which accept 1/4" TRS (Rip Ring Sleeve) phone or XLR plugs. Set the BALANCED/UNBALANCED switch to the BALANCED Position to use these jacks. The connector pin-out is printed on the rear panel of the amp.

Balanced Input: 1/4" Tip Ring Sleeve

The 1/4" balanced input jack is connected according to conventional usage with the Tip high (+), Ring return (–) and the Sleeve ground shield.

Balanced Input: XLR

The XLR balanced input jack is connected according to the IEC International Standard, with pin 2 high (+), pin 3 return (–) and pin 1 ground shield. When preparing to use the amplifier, check the output configuration of the source unit to maintain the proper signal polarity.

Unbalanced Input

Many popular mixers use unbalanced RCA phono jacks for the monitor outputs. For short cable runs RCA audio patch cable can be used without any system performance penalty. Check the mixer specs for the maximum cable length it will drive. Make sure the BALANCED/UNBALANCED switch is set for UNBALANCED operation.

Unbalanced Source with Balanced Input

Better noise rejection for long cable runs can be achieved by using a twisted pair balanced cable from the unbalanced source. At the source end of the cable, connect an RCA plug with the return (–) wire and shield connected to the ground shell of the plug. Wire the plug at the amplifier end of the cable the same as for the regular balanced input connection.

OUTPUT CONNECTIONS

The speaker output connectors are dual binding posts. These binding posts will directly accept 12 AWG wire or banana plugs and are spaced on 3/4" centers to accept dual banana plugs.

MONOPHONIC USE

For systems with high power requirements, the amplifiers can be configured for single channel bridged mono operation. To bridge the amplifier, set the rear panel STEREO/MONO switch to the Mono position; use only the left channel input, and connect the speaker to the red output binding posts. When the amplifier is bridged, the output is floating. Any speaker which requires a common ground from the amplifier output cannot be used in this application. Since a bridged amplifier shares the load between the two channels, the amplifier will effectively drive half of the load. Therefore, for bridged mono operation we recommend using an eight ohm load as the minimum impedance.

OPERATION

POWER SWITCH

The POWER switch is located on the front panel of the amplifier. An internal lamp indicates when it is turned on. Standard practice is to turn the amplifier on last and off first when switching components individually to prevent sending damaging transients, generated in the source components, to the speakers. It is possible to leave the power switch in the on position and switch the amplifier remotely through a power distribution block or preamp switched outlet. When doing so make sure the switch is rated for the current required by the amplifier.

BALANCED/UNBALANCED INPUT SWITCH

The BALANCED/UNBALANCED switch configures the input grounding when using the RCA phono input jacks. In the UNBALANCED position the balanced differential input return (–) port is grounded inside the amplifier. This prevents noise pickup or unstable amplifier operation caused by the open input. In the BALANCED position the differential amplifier inputs are connected to the hot (+) and (–) incoming signal connectors.

GROUND SWITCH

Ground loops are characterized by a hum or buzz in the system and are caused by a voltage potential difference between two points in a ground circuit. Ground loops are aggravated when multiple paths exist for a given circuit. Mounting components in a rack with metal rails may introduce ground loops between associated equipment, because the rails can establish an additional ground path. The CHASSIS/FLOAT switch allows you to select the amplifier grounding scheme for best system compatibility. With the switch in the CHASSIS position all signal grounds are referred to the chassis and power line ground. In the FLOAT position the signal ground is decoupled from the chassis. The position of the switch is determined by the overall noise in the system; choose the position which gives the lowest hum.

MONO SWITCH

Conventional two-channel stereo operation is obtained with the STEREO/MONO switch in the STEREO position. For high powered single channel use, set the switch to MONO and use the left channel input and the RED binding posts only for the output. For thermal considerations we do not recommend using less than an eight ohm load on the amplifier when running it in mono. When the switch is set in the mono position the left channel (+) and (–) inputs are connected to the right channel in reversed polarity, which inverts the right channel output.

LOAD FAULT PROTECTION

Because of the self-protecting properties and fault tolerance of the lateral MOSFETs used in the 9303 and 9505, elaborate voltage and current limiting protection schemes are not necessary. To prevent damage to the amplifier from a fault in the loudspeaker load, the power supply B+ and B– rails are fused. Check these fuses if the sound is garbled or there is no output. The fuses should not blow under normal use and a blown fuse is usually an indication of a fault. The fault could be a bad connection, a problem with the speaker or a short in the speaker line. **Disconnect power to the amplifier before removing the cover**.

WARM UP

In order to achieve the best sonic performance from the amplifier, we recommend letting it warm up for 1 hour before beginning any critical listening. The amplifier will not deliver its full potential sound quality before this time has passed.

CLEANING AND MAINTENANCE

There is no requirement for regular maintenance on the electronic components of the amplifier. If the case becomes soiled it can be cleaned using a soft cloth and a mild detergent, such as spray window or glass cleaner. If the amplifier is located in a particularly dusty environment cleaning the inside with compressed air or vacuuming every 18 to 24 months is sufficient.

SCHEMATIC DIAGRAM

NOTES: Unless specified otherwise

1. All resistors in ohms
2. All capacitors in microfarads
3. Component Designators:
   1-99: Left Channel
   101-199: Right Channel
   201-299: Common Parts
   301-399: Chassis/Power Supply
4. Left Channel Only Shown
5. Stereo/Mono Switch Shown in Stereo
6. Balanced/Unbalanced Switch Shown in Balanced Position
7. Chassis/Float Ground Switch Shown in Float Position

PC BOARD LAYOUT

PARTS LIST

DESIGNATOR	VALUE	PART #
ALL RESISTORS IN OHMS		
R1, R101	47.5k, 1/4W, 1%	RM/4-4752C
R2, R102	47.5k, 1/4W, 1%	RM/4-4752C
R3, R103	1k, 1/4W, 5%	RM/4-102C
R4, R104	1k, 1/4W, 5%	RM/4-102C
R5, R105	2.2M, 1/4W, 5%	RM/4-225C
R6, R106	100, 1/4W, 5%	RM/4-101C
R7, R107	22k, 1/4W, 5%	RM/4-223C
R8, R108	100, 1/4W, 5%	RM/4-101C
R9, R109	100, 1/4W, 5%	RM/4-101C
R10, R110	332, 1/4W, 1%	RM/4-3320C
R11, R111	100, 1/4W, 5%	RM/4-101C
R12, R112	332, 1/4W, 1%	RM/4-3320C
R13, R113	22.1, 1/4W, 1%	RM/4-0221C
R14, R114	22.1, 1/4W, 1%	RM/4-0221C
R15, R115	22.1, 1/4W, 1%	RM/4-0221C
R16, R116	22.1, 1/4W, 1%	RM/4-0221C
R17, R117	1k, 1/4W, 5%	RM/4-102C
R18, R118	28k, 1/4W, 1%	RM/4-2802-03
R19, R119	909, 1/4W, 1%	RM/4-9090C
R20, R120	100, 1/4W, 5%	RM/4-101C
R21, R121	332, 1/4W, 1%	RM/4-3320C
R22, R122	475, 1/4W, 1%	RM/4-4750C
R23, R123	332, 1/4W, 1%	RM/4-3320C
R24, R124	56, 1/4W, 5%	RM/4-560C
R25, R125	56, 1/4W, 5%	RM/4-560C
R26, R126	3.32k, 1/4W, 1%	RM/4-3321C
R27, R127	2k, 1/4W, 5%	RM/4-202C
R28, R128	10k, 1/4W, 5%	RM/4-103C
R29, R129	100, 1/4W, 5%	RM/4-101C
R30, R130	1k, 1/4W, 5%	RM/4-102C
R31, R131	100, 1/4W, 5%	RM/4-101C
R32, R132	100, 1/4W, 5%	RM/4-101C
R33, R133	2k, 1/4W, 5%	RM/4-202C
R34, R134	1k, 1/4W, 5%	RM/4-102C
R35, R135	1k, 1/4W, 5%	RM/4-102C
R36, R136	1k, 1/4W, 5%	RM/4-102C
R37, R137	100, 1/4W, 5%	RM/4-101C
R38, R138	1k, 1/4W, 5%	RM/4-102C
R39, R139	100, 1/4W, 5%	RM/4-101C
R40, R140	28k, 1/4W, 5%	RM/2802-03
R41, R141	100, 1/4W, 5%	RM/4-101C
R42, R142	100, 1/4W, 5%	RM/4-101C
R43, R143	1k, 1/4W, 5%	RM/4-102C
R44, R144	47.5, 1/4W, 1%	RM/4-0475C
R45, R145	1k, 1/4W, 5%	RM/4-102C
R46, R146	100, 1/4W, 5%	RM/4-101C
R47, R147	100, 1/4W, 5%	RM/4-101C
R48, R148	47.5, 1/4W, 1%	RM/4-0475C
R49, R149	475, 1/4W, 1%	RM/4-4750C
R50, R150	475, 1/4W, 1%	RM/4-4750C
R51, R151	475, 1/4W, 1%	RM/4-4750C
R52, 152	475, 1/4W, 1%	RM/4-4750C
R53, R153	56.2k, 1/4W, 1%	RMP/4-5622-03
R54, R154	220, 1/4W, 5%	RM/4-221C
R55, R155	220, 1/4W, 5%	RM/4-221C
R56, R156	220, 1/4W, 5%	RM/4-221C
R57, R157	220, 1/4W, 5%	RM/4-221C
R58, R158	0, 1/4W, 1%	RM/4-000C
R202	3.92k, 1/4W, 1%	RM/4-3921C
R203	3.92k, 1/4W, 1%	RM/4-3921C
R205	22k, 1/4W, 1%	RM/4-223C
R206	22k, 1/4W, 1%	RM/4-223C
R207	22k, 1/4W, 1%	RM/4-223C
R208	22k, 1/4W, 1%	RM/4-223C
R209	604k, 1/4W, 1%	RM/4-6043C
R210	470k, 1/4W, 4%	RM/4-474C
R211	1k, 1/4W, 5%	RM/4-102C
R212	1k, 1/4W, 5%	RM/4-102C

DESIGNATOR	VALUE	PART #
R213	220, 1/4W, 5%	RM/4-221C
R214	220, 1/4W, 5%	RM/4-221C
R215	10k, 1/4W, 5%	RM/4-103C
P1, P101	200, Trim Pot	RVH-201
P2, P202	200 Trim Pot	RVH-201
D1, D101	BAV99L	SS-260SM
D2, D102	BAV99L	SS-260SM
D3, D103	BAV99L	SS-260SM
D4, D104	BAV99L	SS-260SM
D5, D105	BAV99L	SS-260SM
D6, D106	BAV99L	SS-260SM
D7, D107	BAV99L	SS-260SM
D201	1N5245B 15V	SS-212
D202	BAV99L	SS-260SM
D203	1N5245B 15V	SS-212
D204	1N5245B 15V	SS-212
U1, U101	NPDS5566	SS-0865
U9, U109	NPDS5566	SS-0865
U201	TL072CD	SS-143SM
U202	LM337	SS-240-056
U203	LM317	SS-240-056
C1, C101	330pF, 500V	CM-331-024
C2, C102	330pF, 500V	CM-331-024
C3, C103	0.47µF, 50V	CYV-474
C4, C104	0.1µF, 50V	CYV-104-024
C5, C105	100µF, 50V	CER-107C-024
C6, C106	0.1µF, 50V	CYV-104-024
C7, C107	100µF, 50V	CER-107C-024
C8, C108	0.1µF, 50V	CYV-104-024
C9, C109	0.1µF, 50V	CYV-104-024
C10, C110	7pF, 500V	CM-070-024
C11, C111	100pF, 500V	CM-101-024
C12, C112	100pF, 500V	CM-101-024
C13, C113	0.047µF, 50V	CYV-473-024
C14, C114	22pF, 500V	CM-220-024
C15, C115	680pF, 500V	CM-681-024
C16, C116	47pF, 500V	CM-470-024
C17, C117	4.7µF, 160V	CPP-475MC
C18, C118	4.7µF, 160V	CPP-475MC
C19, C119	20,000µF, 100V	CER-209E
C20, C120	20,000µF, 100V	CER-209E
C21	0.01µF, 1000V	CD-103/20-024
C201, 202	0.1µF, 50V	CDS-104CCDB
C203	1000µF, 50V	CER-108C-024
C204	1000µF, 50V	CER-108C-024
C205	0.1µF, 50V	CYV-104-024
C206	0.1µF, 50V	CYV-104-024
C207	100µF, 50V	CER-107C-024
C208	100µF, 50V	CER-107C-024
C209	10µF, 50V	CER-106C-024
C210	4.7µF, 160V	CTR-475A-024
C211	4.7µF, 160V	CTR-475A-024
C215	0.01µF, 1600V	CD-103A-024
SW1	DPDT Switch	SW-0280
SW2	DPDT Switch	SW-0280
SW3	DPDT Switch	SW-0280
S201	Power Switch	SWH-152B
TS-201	Inrush Limiter	SSH-618
Q2, Q102	MMBT5088L	SS-0114
Q3, Q103	MMBT5088L	SS-0114
Q4, Q104	MMBT5088L	SS-0114
Q5, Q105	MMBT5087L	SS-0115
Q6, Q106	MMBT5088L	SS-0114
Q7, Q107	MMBT5087L	SS-0115

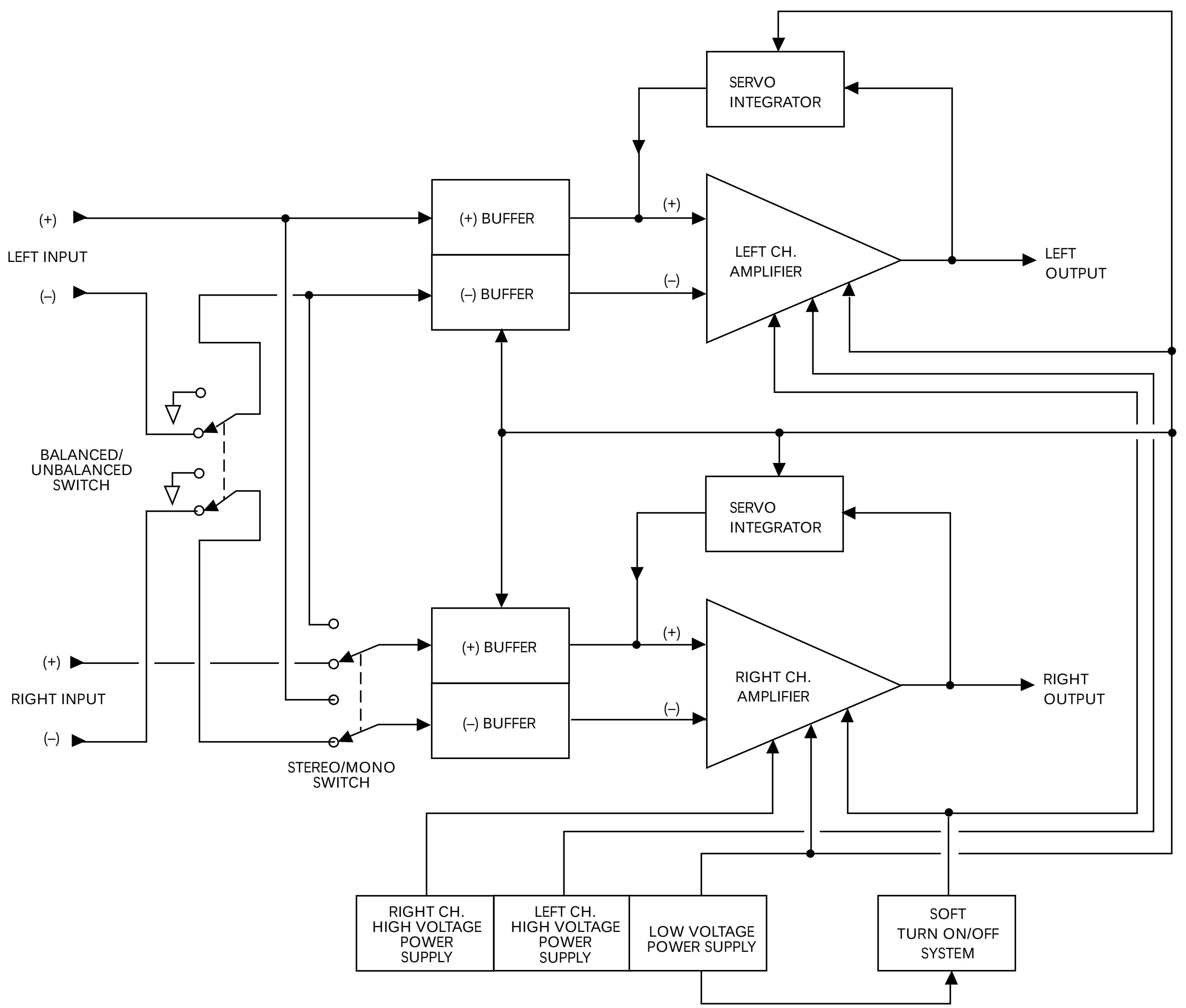
DESIGNATOR	VALUE	PART #
Q8, Q108	MMBT5087L	SS-0115
Q10, Q110	MMBT5088L	SS-0114
Q11, Q111	MMBT5087L	SS-0115
Q12, Q112	MMBT5088L	SS-0114
Q13, Q113	MMBT5087L	SS-0115
Q14, Q114	MPS-A56	SS-101A
Q15, Q115	MPS-A56	SS-101A
Q16, Q116	MPS-A06	SS-102A
Q17, Q117	MPS-A06	SS-102A
Q45, Q145	2SK1058	SSH-741T
Q46 Q146	2SK1058	SSH-741T
Q47, Q147	2SK1058	SSH-741T
Q48, Q148	2SK1058	SSH-741T
Q49, Q149	2SJ162	SSH-740T
Q50, Q150	2SJ162	SSH-740T
Q51, Q151	2SJ162	SSH-740T
Q52, Q152	2SJ162	SSH-740T
Q201	MMBT5087L	SS-0115
Q202	MMBT5088L	SS-0114
Q203	MMBT5088L	SS-0114
F1, F101	AGC 10A Fuse	FS-010
F2, F102	AGC 10A Fuse	FS-010
F201	15A Slo/Blo	FS-015SB
F203, F204	2.5A Fast Mini	FS-0390

DESIGNATOR	VALUE	PART #
BR201	Bridge Rectifier	SS-222
BR301	Bridge Rectifier	SSH-609
BR-302	Bridge Rectifier	SSH-609
	IEC Connector	CC-0918
	IEC Line Cord	FA-0209
	Dual Binding Post	CC-0867
	MOSFET Insulator	HWH-442

9303 Differences

	IEC Line Cord	FAH-146
C19, C119	15000µf, 75V	CER-159ES
C20, C120	15000µf, 75V	CER-159ES
F201	10A, Slo/Blo	FS-010SM
	Not Used	
Q47, Q147	2SK/1058	
Q50, Q150	2SJ/162	

9303 / 9505 Functional Block Diagram



THEORY AND OPERATION OF trans• *nova*

The (TRANSconductance NOdal Voltage Amplifier) principle is based on our 1984 U.S. Patent 4,467,288. This patent describes the advantages of audio power amplifiers in which a MOSFET output stage is connected in a grounded source configuration. In this connection the output stage has its full voltage gain of typically 20dB (ten times), instead of the usual 1dB loss of voltage follower designs.

It is an inevitable result of electrical physics that this output with gain inherently increases the power gain (for the same bandwidth) of the output stage by typically ten times over the conventional follower connection, using exactly the same MOSFET devices.

The output stage is thus now ten times less wasteful of its incoming drive power. The driver stage can now be of a low voltage (±24 volts) nature and be designed along the same principles always used in high quality preamplifiers: Class A operation, high linearity, and wide bandwidth. A topology utilizing an output stage with gain yields a much simpler, shorter total signal path than that of the usual high voltage driver designs. The number of serial stages is reduced from five or more, to only three.

But all of the above does not make an amplifier trans• *nova*. The output stage is further refined into a trans-impedance stage (current-to-voltage converter), to achieve extremely short loop (fast) negative feedback. The output stage is driven cooperatively by a transconductance stage (voltage-to-current converter).

The 9303and 9505are the most sophisticated amplifiers we have yet developed utilizing the basic trans• *nova* principle. And, although the measured specifications are very good, the numbers do not describe the realistic sound of the amplifiers.

CIRCUIT IMPLEMENTATION

Earlier models of amplifiers we have offered using the trans• *nova* topology have earned the reputation for clean, natural sounding reproduction. A conservative, purist design approach was used to avoid compromising the desirable characteristics of the trans• *nova* circuits. Circuit innovation was not prevented by this conservatism; as is evident in the discoveries which resulted in development of the DIABLO circuitry to be discussed shortly, and the novel balanced input system.

Many “balanced” amplifiers are merely conventional unbalanced designs with a Balanced-to-Unbalanced converter (usually IC op-amp based) preceding the power amplifier. The 9303 and 9505, however, are true differential input power amplifiers. Each (+) and (–) input port has been buffered to allow direct signal access to the differential amplifier, without conversion to unbalanced form. Deactivating the Balanced Mode is accomplished via a rear panel switch that grounds the (–) inputs, effectively converting the amplifier to unbalanced operation.

The input stage is a JFET differential amplifier. This circuit configuration results in excellent front end headroom and extremely low intermodulation effects. The ultra low noise characteristic of the JFETs virtually eliminates noise “mixing” (intermodulation) with the music signal, reducing discordant product frequencies known as “noise grain” or “noise fuzz.” A servo integrator has been employed to establish minimal DC offset. This circuit monitors the DC offset at the output of the amplifier, and injects an equal but opposite DC voltage into the (+) port of the differential input, thereby cancelling the offset. This method eliminates the need for a sonically degrading electrolytic capacitor in the audio path, and provides superior subsonic frequency response.

The final output stage utilizes lateral MOSFETs; four pairs are used for each channel in the 9505 and three pairs in the 9303. These devices, unlike conventional bipolar transistors do not exhibit “thermal runaway.” Thermal runaway is a phenomenon whereby a transistor heats up as it draws more current, which causes it to get hotter, and conduct more current, and so on until the device self destructs. Since the MOSFETs are inherently self protecting, no sonically degrading, complex circuitry is required to monitor and protect the devices. The lateral MOSFETs also have a linear input to output transfer function. Their connection in circuits and their operating characteristics are very similar to vacuum tubes, which is perhaps responsible for their widely recognized sonic trait of being “musical” and non-fatiguing.

Operation of the transconductance stage is a major factor in the reproduction quality of the amplifier. The number of MOSFETs used at the output stage of the 9303 and 9505 imposes sufficient capacitive load on the transconductance stage that if a conventional Class A stage were used (having intrinsically a 2:1 limit on peak-to-quiescent current) it would begin to show “stress” at the higher audio frequencies. The newly perfected DIABLO driver system (**D**ynamically **I**nvariant **A**-**B** **L**inear **O**peration; patent application in progress) satisfies the current headroom requirement by smoothly and continuously varying the current transfer ratios of the two transconductance paths, under the control of the signal current itself. This implementation allows the current transfer ratio of one path to be smoothly and continuously reduced to zero while the other is smoothly and continuously increased by a factor of two. What is remarkably new here is that when this normally-limiting 2:1 value is reached there is now about 14dB of additional, perfectly linear current headroom left to drive the MOSFETs! The result is a dramatic decrease in high-frequency distortion combined with higher ultrasonic stability – the “Holy Grail” of amplifier design.

The power supply utilizes a UI style transformer with a separate primary for each channel. The transformer has a separate secondary for each channel high voltage power supply, each feeding a conventional split full wave bridge rectifier. High voltage power supply capacitance is 20,000µF per rail for each channel for the 9505 and 5,000 for the 9303. The third transformer secondary feeds a regulated supply for the input stage and driver circuitry. Low voltage power supply capacitance is 1,000µF per rail, with additional decoupling for each channel.

CALIBRATION

Common Mode Rejection:

The input common mode null is adjusted by the trim pot R1 (R101 for the left channel). The CMRR should be greater than 75dB below rated output. If the CMRR requires adjustment, feed the amplifier input with a common mode signal and adjust R1. **Disconnect the power to the amplifier before removing the cover.** Use a sinewave generator set to 1 volt output at 1kHz. Connect the generator signal output to the tip and ring of a 1/4" plug and ground to the sleeve. Plug this into the amplifier input. Connect an AC voltmeter to the amplifier output binding posts. Adjust R1 to give the lowest voltage output from the amplifier. For a temporary adjustment when a signal generator and voltmeter are not available, use an FM tuner and tune it to an unused station as your signal source, and connect the output to the amplifier as described above. Connect the amplifier output to a small full range speaker and adjust R1 for the lowest output from the speaker.

Bias:

The bias control establishes the quiescent Class AB output current of the amplifier. The bias should not need readjustment from the factory setting; however, if the amplifier is repaired and output devices have been changed, or if the two channels of the amplifier do not run at the same temperature, calibrating the bias is necessary. **Disconnect the power to the amplifier before removing the cover.** To adjust the bias, disconnect the input and speakers and remove the B+ fuse for that channel. Connect an amp meter across the now vacant fuse clips and adjust R45 (R145 for the left channel) to get a current reading of 300mA for the 9303, 400mA for the 9505.

SERVICE POLICY AND LIMITED WARRANTY

If you encounter any difficulty or have any question concerning your 9303 and 9505 Amplifier, please call our Technical Support Department weekdays, 8:00 a.m. to 3:30 p.m., Mountain Standard Time, at 800-795-2385.

Should you have any doubts as to whether the amplifier is malfunctioning and requires service, please call us before sending it in for repair. All units being returned (regardless of warranty status) must receive a Return Authorization (RA) number. In addition, we can offer troubleshooting assistance that may simplify or even eliminate the need for factory service.

The Hafler 9303 and 9505 Amplifiers are warranted to the original owner (non-transferrable) for seven years from the date of purchase, including parts, labor, and return shipping costs within the Continental United States, Alaska, and Hawaii. This warranty applies only to products sold in the United States Of America.

For warranties outside the U.S.A., please contact your local agent.

It is the owner's responsibility to pay shipping (preferably United Parcel Service, UPS) to the factory: collect shipments will not be accepted. Units under warranty should be accompanied by a copy of the dated Bill Of Sale. Use the original carton and all packing material, with the RA number clearly marked on the outside of the package. Be sure to include a return address, the RA number, a daytime telephone number, and a brief description of the difficulty, including whether it occurs continuously or intermittently.

This warranty gives you specific legal rights. You may also have other rights which may vary from state to state.

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