Precision Industrial Amplifiers

Technical Manual

LVC5050

Power Supply Amplifier

LVC5050
Power Supply Amplifier

Technical Manual

2507 Warren St. Elkhart IN 46516 U.S.A.
Phone: (574) 295-9495
Fax: (574) 295-9496
E-Mail: Sales@aetechron.com
www.aetechron.com

Limited One-Year Warranty

SUMMARY OF WARRANTY
AE TECHRON**,** of Elkhart, Indiana (Warrantor) warrants to you, the ORIGINAL COMMERCIAL PURCHASER ONLY of each NEW ***AE TECHRON*** product, for a period of one (1) year from the date of purchase, by the original purchaser (warranty period) that the product is free of defects in materials or workmanship and will meet or exceed all advertised specifications for such a product. This warranty does not extend to any subsequent purchaser or user, and automatically terminates upon your sale or other disposition of our product.

ITEMS EXCLUDED FROM WARRANTY
We are not responsible for product failure caused by misuse, accident or neglect. This warranty does not extend to any product on which the serial number has been defaced, altered, or removed. It does not cover damage to loads or any other products or accessories resulting from ***AETECHRON*** product failure. It does not cover defects or damage caused by the use of unauthorized modifications, accessories, parts, or service.

WHAT WE WILL DO
We will remedy, at our sole discretion, any defect in materials or workmanship by repair, replacement, or refund. If a refund is elected, you must make the defective or malfunctioning component available to us free and clear of all liens or other encumbrances. The refund will be equal to the actual purchase price, not including interest, insurance, closing costs, and other finance charges less a reasonable depreciation on the product from the date of original purchase. Warranty work can only be performed at our authorized service centers or at our factory. Expenses in remedying the defect will be borne by ***AE TECHRON***, including one-way surface freight shipping costs within the United States. (Purchaser must bear the expense of shipping the product between any foreign country and the port of entry in the United States and all taxes, duties, and other customs fees for such foreign shipments.)

HOW TO OBTAIN WARRANTY SERVICE
When you notify us of your need for warranty service, we will give you an authorization to return the product for service. All components must be shipped in a factory pack or equivalent which, if needed, may be obtained from us for a nominal charge. Corrective actions will be taken within a reasonable time of the date of receipt of the defective product by us. If the repairs made by us are not satisfactory, notify us immediately.
,

DISCLAIMER OF CONSEQUENTIAL AND INCIDENTAL DAMAGES
You are not entitled to recover from us any consequential or incidental damages resulting from any defect in our product. This includes any damage to another product or products resulting from such a defect.

WARRANTY ALTERATIONS
No person has the authority to enlarge, amend, or modify this warranty. The warranty is not extended by the length of time for which you are deprived of the use of this product. Repairs and replacement parts provided under the terms of this warranty shall carry only the unexpired portion of this warranty.

DESIGN CHANGES
We reserve the right to change the design of any product from time to time without notice and with no obligation to make corresponding changes in products previously manufactured.

LEGAL REMEDIES OF PURCHASER
There is no warranty which extends beyond the terms hereof. This written warranty is given in lieu of any oral or implied warranties not contained herein. We disclaim all implied warranties, including, without limitation, any warranties of merchantability or fitness for a particular purpose. No action to enforce this Warranty shall be commenced later than ninety (90) days after expiration of the warranty period.

AE TECHRON Customer Service Department
2507 Warren St. Elkhart IN 46516-0000 U.S.A.
(574) 295-9495

Introducing the Model LVC 5050

The ***AE TECHRON*** **Model LVC 5050** amplifier is one of the most reliable, powerful, and cost-effective amplifiers ever made. Its innovative design and construction has enabled the **LVC 5050** to pack unprecedented power levels into 5 1/4 inches of vertical rack space. Its patented electronic circuitry provides years of rugged reliability and performance. Its outstanding features include:

- 5000 watts minimum rms series-mono output power into a 4-ohm load, with very low harmonic (<0.05%) and intermodulation (<0.05%) distortion and low noise (105 dB below rated output).
- Patented *Variable Impedance* power supply technology, combined with the latest semiconductor technology and computer control, provide complete circuitry protection and high efficiency.
- Strong physical construction and customizable input plug-in modules help to ensure that this amp will last for decades.

Revision Control

Revision	Date
0 (Initial Release)	July 2002
A Conversion to CD format	December 2006

Page Number	Revision Number

Contents

1

Pre- Installation

This section describes safety conventions used within this document and provides essential information about the **Model LVC 5050** amplifier. Review this material before installing or operating the amplifier.

AE TECHRON is committed to continuous product improvement. Technical progress may result in minor variations between this manual and a particular unit. Any significant changes or customizations will be reflected in revisions of this manual. Customers are encouraged to promptly add any additional information, about their particular unit, to this manual.

1.1 Safety Conventions

The **LVC 5050** amplifier is a highly sophisticated instrument. Accordingly, this document provides full information on the amplifier including service procedures. Safety should be your primary concern as you use this product and follow these procedures.

Special hazard alert instructions appear throughout this manual. Note the following examples:

DANGER

DANGER represents the most severe hazard alert. Extreme bodily harm or death **will** occur if these guidelines are not followed. Note the explanation of the hazard and instructions for avoiding it.

WARNING

WARNING alerts you to hazards which **could** result in severe injury or death. Note the explanation of the hazard and the instructions for avoiding it.

CAUTION

CAUTION indicates hazards which could result in potential personal injury or equipment or property damage. Once again, note the explanation of the hazard and the instructions for avoiding it.

NOTE: A Note represents information, which needs special emphasis but does not represent a hazard.

1.2. Product Design

1. 2. 1 General Description

The ***AE TECHRON* Model LVC 5050** is a dual channel power supply amplifier designed for use in the most demanding high power systems. It can deliver up to 2,500 watts per channel into 2-ohm loads or 5,000 watts bridged into a single 4-ohm load. It accomplishes this with extremely low harmonic and intermodulation distortion and low noise.

All this power is concentrated into a 5-inch rack mount package. From the front panel, you can control and monitor the input signals.

- A push button power switch activates an **AMBER "ON"** indicator.
- GREEN LED indicator show when the amplifier is in OVERLOAD.
- Dual color (**RED** and **GREEN**) LED indicators show current limit and load current.

On the back panel:

- Input is connected using bare wires.
- Loads connect to a unique output block, which combines heavy duty binding bolts and dual banana connectors.
- A detachable cover on the output block protects against accidental short circuits and dangerous electrical shock.

Other features include the ability to:.

- Switch from Dual mode to Bridge Mono or Parallel Mono mode with a 3-position slide switch.
- Select three different gain values for either channel with two more 3-position slide switches.

The **LVC 5050** uses the latest technology and miniaturized design to provide the highest power and value for its size, weight and price. Its patented-grounded bridge- circuitry offers many advantages over conventional designs. In Dual mode, the amplifier's separate **Variable Impedance (VZ)** power supplies for each channel provide the best power matching to your load. Three special modes control how and when the supplies shift impedance. Dynamic thermal protection provides years of reliability. Forced air from two fans provides cooling.

All ***AE TECHRON*** amplifiers are tested at the factory to assure operation at full efficiency upon delivery. Custom configurations are available, as well as full system implementations.

1.2.2 Specifications

Specifications are for units in Dual mode driving both channels into 8-ohm loads, (26 dB = 20 times voltage gain) and operating from 120 VAC, unless otherwise specified.

> “Standard 1 kHz Power" refers to maximum average power in watts at 1 kHz with 0.1% THD.
>
> “Full Bandwidth Power" refers to maximum average power in watts from 20 Hz to 20 kHz with 0.1% THD.

Performance

Frequency Response: ± 0.1 dB from 20 Hz to 20 kHz at 1 watt.

Phase Response: ±10° from 10 Hz to 20 kHz at 1 watt.

Signal to Noise Ratio: At 26-dB gain, better than 105 dB (A-weighted) below full output.

Total Harmonic Distortion (THD): <0.05% from 20 Hz to 1 kHz, increasing linearly to 0.1% at 20 kHz at full output.

I. M. Distortion: <0.05% from 410 milliwatts to full output at 26-dB gain, with an 8-ohm load.

Slew Rate: >30 V per microsecond.

Power

Output Power: The following are typical for standard 1 kHz power from units configured for 120 VAC, 60 Hz power. See Section 1.2.3 for 100 and 240 VAC output power specifications, into a resistive load.

Two Channel (Per Channel):

	40 mSec			**5 Minute**			**Continuous**		
Ohms	**Watts**	**Volts**	**Amps**	**Watts**	**Volts**	**Amps**	**Watts**	**Volts**	**Amps**
2	2505	71	35	2152	65.6	33	800	40	20
4	1940	88	22	1802	84.9	21	576	48	12
8	1270	101	12	1250	100	13	1205	98.2	12
16	702	106	7	702	106	7	702	106	7

Bridge Mono:

	40 mSec			**5 Minute**			**Continuous**		
Ohms	Watts	Volts	Amps	Watts	Volts	Amps	Watts	Volts	Amps
4	5320	146	36						
8	3003	155	19	3260	161.5	20	3003	155	19
16	2036	180	11	2048	181	11	2036	180	11

Parallel Mono:

	40m Sec			**5 Minute**			**Continuous**		
Ohms	Watts	Volts	Amps	Watts	Volts	Amps	Watts	Volts	Amps
1	5230	73	73				1740		
2	4045	90	45						
4	2670	103	26	2480	99.6	25	2416	98.3	25
8	1378	105	13	1378	105	13	1324	102.9	13
16				909	120.6	8	906	120.4	8

Load Impedance: Rated for 16, 8, 4, 2-ohm use. Safe with all types of loads, even reactive ones.

Required AC Mains: 60 Hz, 120VAC with 30A service. Convertible to 100/ 200/208/230/240VAC at 50/60 Hz.

Maximum Load: 250 Volts RMS, no load conditions.

Controls

Front Panel: A push "On/Off" power switch; also, a signal level control for each channel.

Back Panel: A 3-position switch selects Dual, Bridge-Mono, or Parallel-Mono mode. A 3-position switch selects 20, 70, or 140 voltage gain for each channel.

Internal: Switches behind the front grill allow selection of normal VZ operation, lock to low voltage only, lock to high voltage only, and lock to low voltage under ODEP conditions.

Indicators

A push button power switch activates an **AMBER "ON"** indicator.

Dual brightness indicator—dim indicates signal presence, bright indicates amplifier is in OVERLOAD.

Dual color (**RED** and **GREEN**) LED indicators show current limit and load current.

Input/Output

Input Impedance: Greater than 10 K ohms, balanced, and 5 K ohms, unbalanced.

Output Impedance: Less than 10 milliohms is series with less than 2 microhenries.

Connectors

Inputs: Euro-style screw terminals will accept up to 16 gauge bare wire.

Outputs: Unique output bus with dual banana jacks on 3/4 inch centers, and high current ring or spade lug barrier connectors.

AC Line: NEMA TT30P, 3-wire, 120V, 30A grounded connector (for 120V AC units).

Construction

Black splatter-coat steel chassis with specially designed flow-through front to rear ventilation system with computer-controlled forced air-cooling.

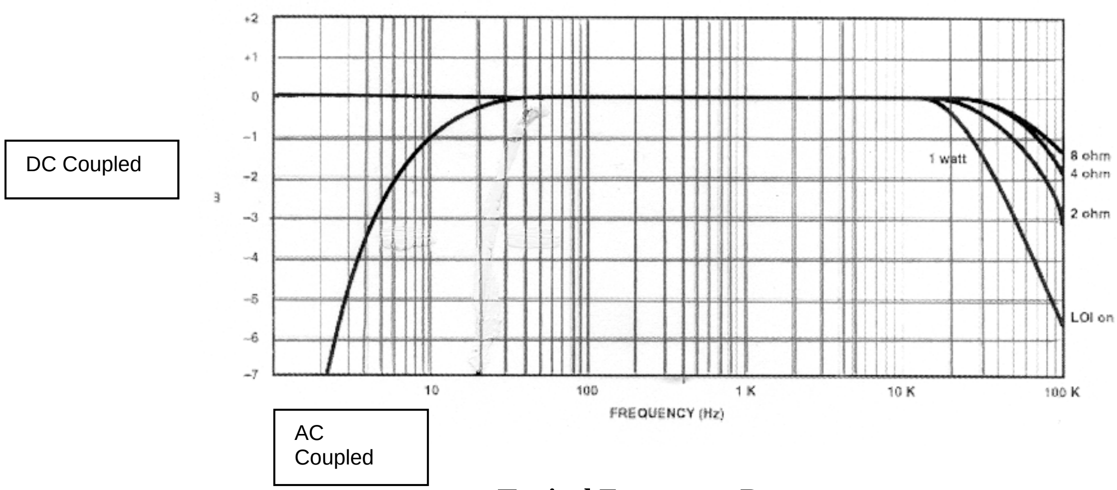
Dimensions: 19 inch (48.3 cm) wide, 5.25 inch (13.3 cm) high, 16 inch (40.3 cm) deep behind front mounting surface, and 2.875 inches (7.3 cm) in front of the mounting surface.

NOTE: Allow 4 inches in back for adequate airflow.

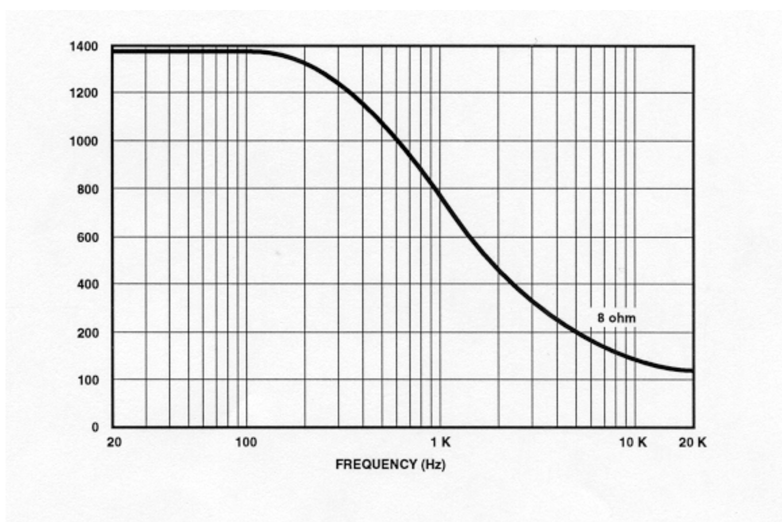
Weight: 77 lbs. (35.2 kg) net, 88 lbs. (40.2 kg) shipping weight.

Mounting: Standard BIA 310 front-panel rack mount with supports for supplemental rear corner mounting.

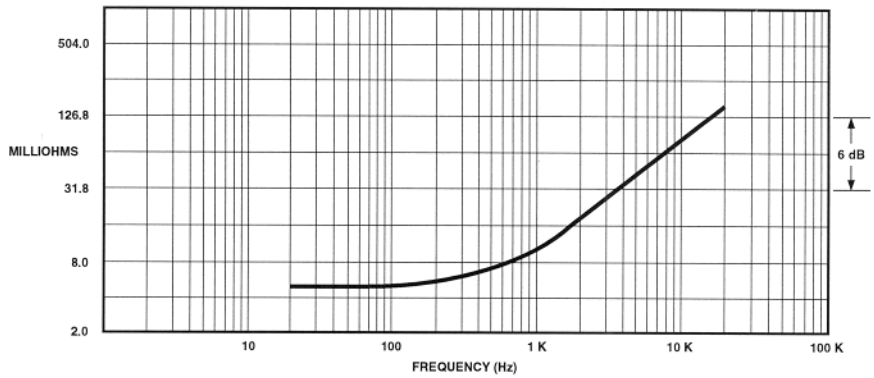
1.2.3 Performance Graphs



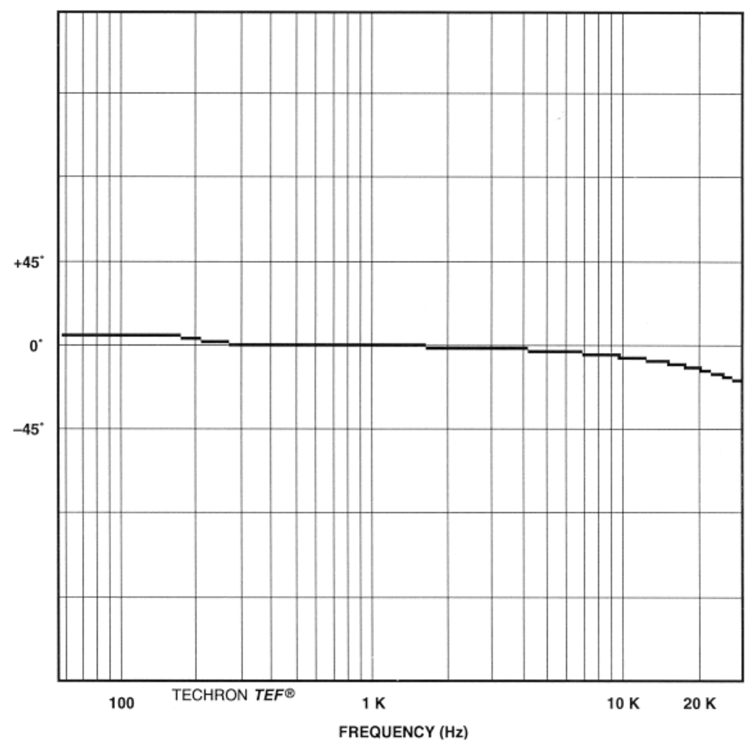
Typical Frequency Response



Typical Dampening Factor



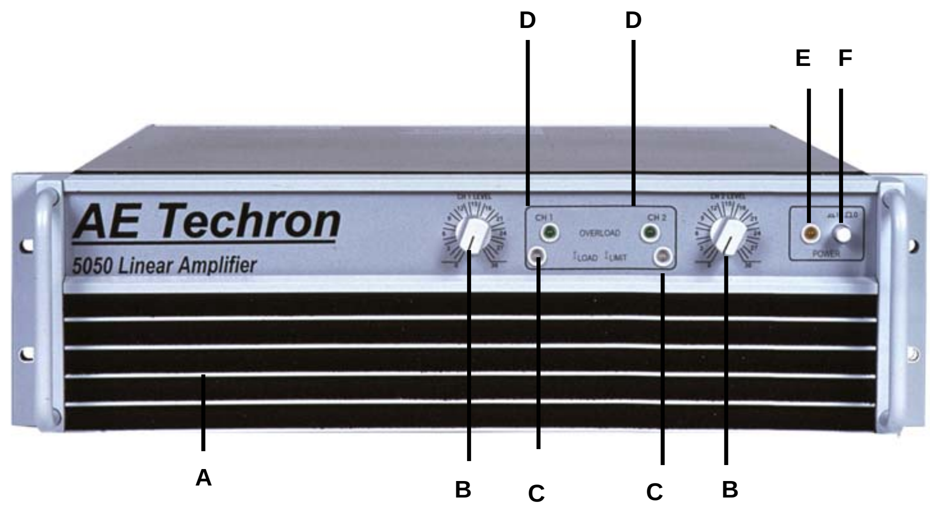
Typical Output Impedance



Typical Phase Response

1.2.4 Front Panel Functions

The following illustration, with captioned call-outs, provides a visual location of the **LVC 5050** front panel functions.



A. Dust Filters

The dust filters remove large particles from the air drawn in by the cooling fans. Check the filters regularly to prevent clogging. The filter elements can be easily removed for cleaning by gently pulling them away from the front panel.

B. Level Control

The output level for each channel is set with these controls. Each control has 31 detents for precise adjustment.

C. I_{Load}/I_{Limit} Indicators

The flow of current to the load and the maximum current limit of the amplifier are monitored by these two-color indicators. The $\mathbf{I}_{Load}/\mathbf{I}_{Limit}$ indicators glow green to show that load current is flowing and turn off when there is no significant load current. The $\mathbf{I}_{Load}/\mathbf{I}_{Limit}$ indicators turn red if the amplifier has reached its maximum output current capacity.

D. Overload Indicators

When a large input signal causes an input overload or output clipping, these green indicators flash *brightly* with a 0.1 second hold, otherwise, they indicate the presence of a distortion-free signal.

E. Power Indicator

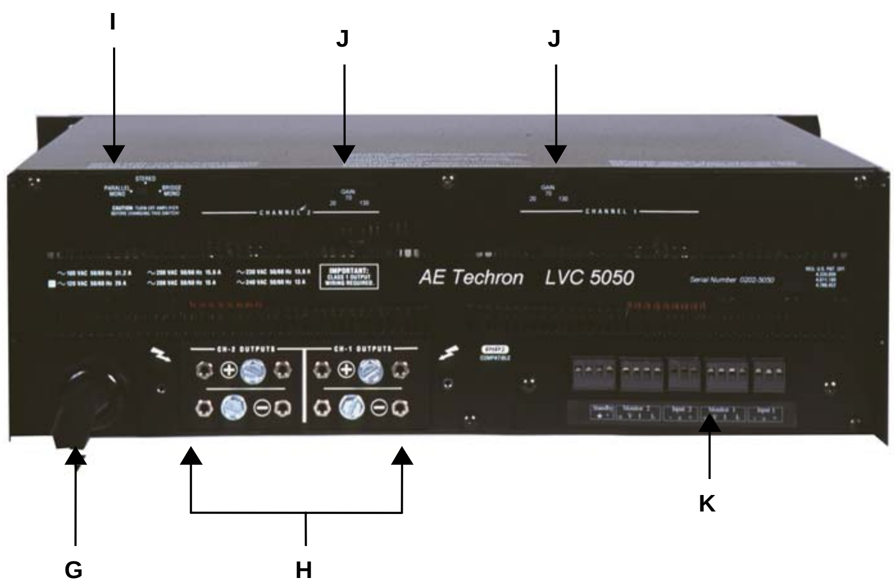
This amber indicator lights when the amplifier is connected to AC power and turned "On".

F. Power Switch

This push button is used to turn the amplifier "On" and "Off". When turned on, the output is muted for about four seconds to protect your system from start-up transients.

1.2.5 Back Panel

The following illustration, with captioned call-outs, provides a visual location of the **LVC 5050** back panel functions.



G. Power Cord

Units set up for 100 to 120 VAC have a 10 AWG, 30 amp line cord, while units set up for 200 to 240 VAC have a 12 AWG, 20 amp line cord. North American units set up for 120 VAC, 60 Hz power are shipped with a grounded 125 volt, 30 amp NEMA TT30P plug; units shipped outside North America are provided without a plug.

H. Output Connectors

This high-current output block is provided for output connection. Its connectors accept banana plugs, spade lugs or bare wire. There is a detachable output cover (not shown) used to protect against accidental short circuits and dangerous electrical shock.

I. Parallel Mono/ Stereo/ Bridge Mono

This switch is used to select one of three- output modes; Parallel Mono, Stereo or Bridge Mono.

WARNING

The amplifier should be "Off" for at least 10 seconds before changing this switch

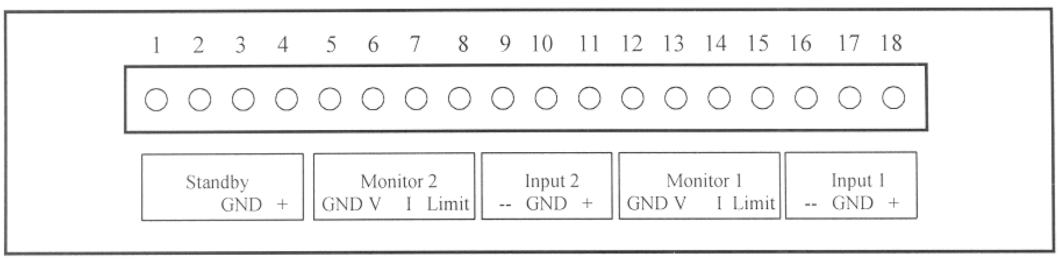
J. Gain Switches

These three-position switches are used to select a voltage gain of 20,70 or 140 times for each channel.

K. Input Plug-in Module

The versatility of plug-in modules make it easy to customize the input, and other functions of the amplifier, to your needs.

1.2.6 Details of the Plug In Module



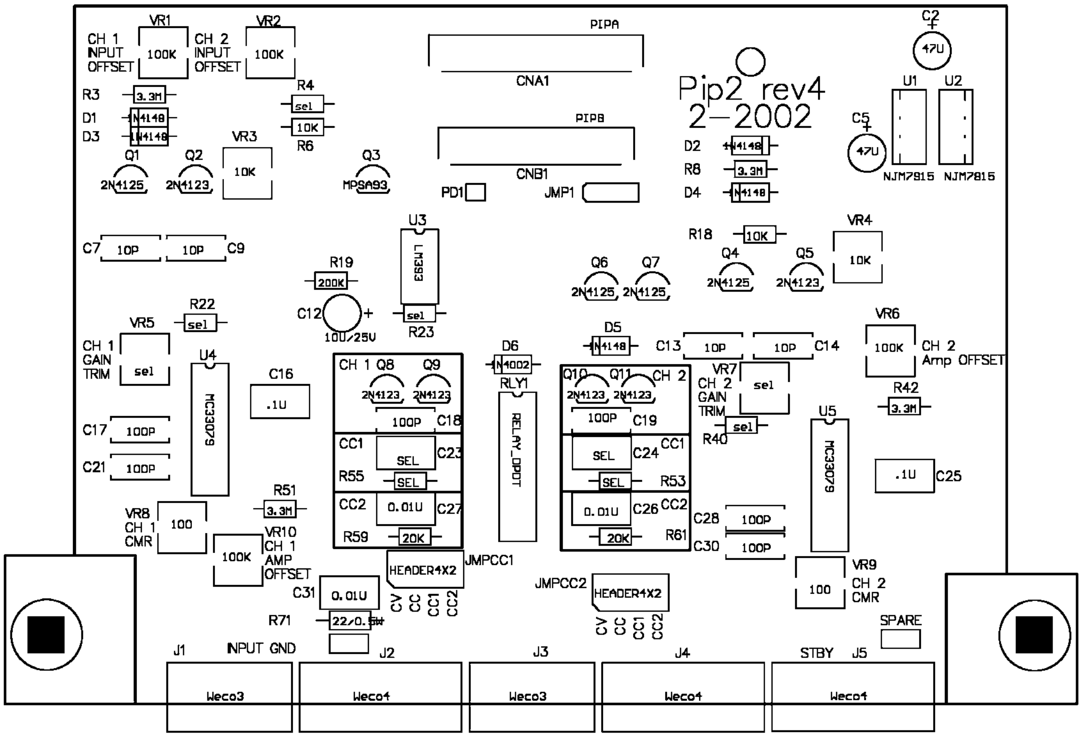
LVC 5050 Plug-In Module

Description of the Plug-In Module:

Pin	**Function**
1,2,	Available for additional features
3,4	Standby, When Pins 3 and 4 are shorted output section of amplifier forced into standby.
5	Ground pin for use with pins 6, 7, and 8
6	Voltage monitor, will have 1/20th of voltage at output of Channel 2. Pin 6 is inactive when amplifier is used in either mono mode.
7	Current monitor, will have 1 volt for every 4 amps of current at output of Channel 2, pin is inactive when amplifier is used in either mono mode.
8	When in Constant Current -mode provides a user definable maximum current, when in Constant Voltage mode provides a user definable maximum voltage for Channel 2. Uses control voltages of 0 - +8 VDC. Pin is inactive when amplifier is used in either mono mode.
9-11	Balanced input for Channel 2. Pins 9 or 11 can be connected to Pin 10 if an unbalanced input is desired. Pins 9 and 11 are not active when amplifier is used in either mono mode.
12	Ground pin for use with pins 13, 14, and 15.
13	Voltage monitor, will have 1/20th of voltage at output of Channel 1, when operated in 2 channel or Parallel Mono mode and 1/40th of the voltage when operated in Bridged Mono mode. Pin 13 is active in all modes of operation.

Pin	Function (continued)
14	Current monitor, will have 1 volt for every 4 amps of current at output of Channel 1, when operated in 2 channel or Bridge Mono mode. When operated in Parallel Mono mode 1 volt for every 6 amps of output current. Pin 14 is active in all modes of operation.
15	When in Constant Current mode provides a user definable maximum current, when in Constant Voltage mode provides a user definable maximum voltage for Channel 1. Uses control voltages of 0 - +8VDC. Pin 15 is active in all modes of operation.
16-18	Balanced input for Channel 1. Pins 16 or 18 can be connected to Pin 17 if an unbalanced input is desired. Pins 16 and 18 are active in all modes of operation.

1.2.7 The CCPIP Input Card



Component Side View of the CCPIP Input Card

Channel One Controls

VR8 Adjusts common mode rejection for balanced input on channel 1.

VR1 Adjusts DC offset of Channel 1 of input card (measured at Pin 7 of U4)

VR3 Adjusts the Channel 1 soft clip circuit
~15V (CW) No Clip
~8V (Center Minimum Clip)
0V (CCW) Max. Clip

VR10 Adjusts DC offset of Channel 1 of amplifier (measured at output of amplifier). Should be adjusted if gain of amplifier is changed.

JMPCC1

CV - Puts Channel 1 in Constant Voltage Mode
CC - Puts Channel 1 in Constant Current Mode
(CC or CV must be jumped for channel to operate)

CC1 - Constant Current compensation 1 for Channel 1 connects C 23 and R55

CC2 - Constant Current compensation 2 for Channel 1 connects C27 and R59

Input Card Continued…

NOTE: C 18 - In parallel with compensation controls stability when in Constant Current Mode

__**Channel 2 Controls:**__

VR9 Adjusts common mode rejection for balanced input on channel 2

VR2 Adjusts DC offset of Channel 2 of input card (measured at Pin 7 of U3)

VR6 Adjusts DC offset of Channel 2 of amplifier (measured at output of amplifier). Should be adjusted if gain of amplifier is changed.

JMPCC2

CV - Puts Channel 2 in Constant Voltage Mode
CC - Puts Channel 2 in Constant Current Mode
(CC or CV must be jumped for channel to operate)

CC1 - Constant Current compensation 1 for Channel 2 connects C24 and R53

CC2 - Constant Current compensation 2 for Channel 2 connects C26 and R61

NOTE: C19 - In parallel with compensation controls stability when in Constant Current Mode

1.3 Ground Loop Removal

Hum and noise problems caused by ground loops are one of the most common problems that plague power amplifier systems.

Theoretically, ground loops will never occur if one and only one ground path is allowed between the **LVC 5050,** the signal source and the load. The input and output grounds of the amplifier should not be externally joined since this external ground path will form a loop with the internal ground path. The output ground is connected to the chassis on the rear connector panel, allowing the chassis mounting to be a possible source of ground loops. If other devices attached to the amplifier inputs and outputs are mounted in an electrically common rack and are likewise internally chassis-ground joined, ground loops may be formed. When this occurs, isolate the most appropriate units from the rack so a loop is not formed.

Another source of ground loop trouble is the third wire of the AC mains connector. Only one piece of equipment in a system should connect this terminal to the system's signal ground.

Unintentional feedback of output signals into input signal lines can result in system oscillations, or gain errors.

Input signals should never be supplied to the amplifier via the current carrying output common lead. Supply the input signal to the amplifier via its own independent ground lead, one not connected to the output signal ground.

1.4 Controlled Current Compensation

The following is a guideline for compensating amplifiers in the controlled current mode. Constant voltage mode does not require compensation. For this procedure, use C 104 and R109. Jumper JMP is in the CC position.

a) Calculate the approximate value of the resistor using the following formula:

Rc = 20,000 x 3.14 x L x BW

- **Rc** is compensation resistance in ohms.
- **L** is load inductance in henries.
- **BW** is bandwidth in hertz.

b) Calculate the approximate value of the capacitor using the following formula:

Cc = L/R x Rc

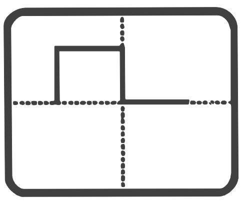
- **Cc** is compensation capacitance farads.
- **L** is load inductance in henries.
- **R** is resistance of load in ohms.
- **Rc** is compensation resistance in ohms.

c) Find the optimum values of the resistor and the capacitor by using an RC decade box:

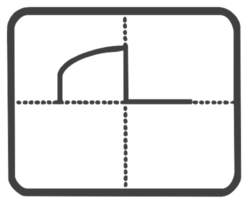
1. Use a short pair of twisted wires to connect the box to the main board.
2. Dial in the calculated values.
3. Connect load to output at "output" and 'sampled common" terminals.
4. Input square wave at highest frequency used in application with generator set for minimum amplitude.
5. Connect oscilloscope to current monitor with ground.
6. Enable the amplifier from Standby to Ready and observe oscilloscope.
7. If the system is stable (no oscillations), increase generator amplitude to a workable level and go to step 11.
8. If the system oscillates, switch to Standby and try different compensation values.
9. If the system still oscillates, increase the value of the capacitor by factors of three until stable.
10. After refining further the values of the R and C, find the optimum values of R109 and C104, by adjusting according to the observed oscilloscope waveform illustrated on the facing page.
11. After the optimum values have been found, remove the RC decade box and install components with values shown on the decade box. *Slight adjustment of values may be needed due to use of decade box.*

NOTE: In multiple amplifier systems, expect to decrease the value of R109 in series systems (by 1/2 for 2 units), and increase the value (double for 2 units) in parallel systems.

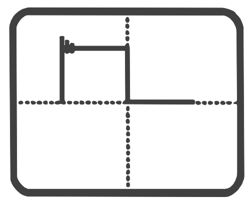
Compensation Waveforms:



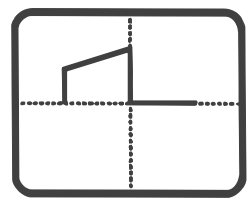
Box 1



Box 2



Box 3



Box 4

From Left to Right:

Box 1: Optimum Compensation

Box 2: Increase R109

Box 3 Decrease R109

Box 4: Increase C104

This Page Intentionally Left Blank

2

Installation

This section describes general guidelines for installing the **Model LVC 5050** amplifier with special emphasis on system installations.

2.1 Unpacking

Every ***AE TECHRON*** **Model LVC 5050** is carefully inspected and tested prior to leaving the factory. Carefully unpack and inspect the unit for damage in shipment. Besides the amplifier, you should find this manual and mounting hardware in the package.

1) Inspect the crating for **ANY** signs of damage.
   a.) Make written notes of any damage for future reference.
   b.) If damage is found notify the transportation company immediately
   c.) Save the shipping carton and packing materials as evidence of damage for the shipper's inspection.
   d.) If severe damage is apparent, **DO NOT** proceed until a representative of the shipping company is present.
2) Uncrate/unpack the amplifier
3) Save the packing materials for later use in transporting **or** shipping the unit.

AE TECHRON will cooperate fully in the case of any shipping damage investigation. In any event, replacement-packing materials are available from ***AE TECHRON***.

NOTE: Never ship this unit without proper packaging.

2.2 Mounting

The **LVC 5050** is designed for standard 19-inch (48.3 cm) rack mounting and "stack" mounting without a cabinet. For optimum cooling and rack support, multiple units should be stacked directly on top of each other.

WARNING

To reduce the risk of *ELECTRIC SHOCK* or FIRE HAZARD, DO NOT expose the LVC5050 to rain or moisture.

CAUTION

Always support the back of the unit. Provide extra support if the unit will be transported.

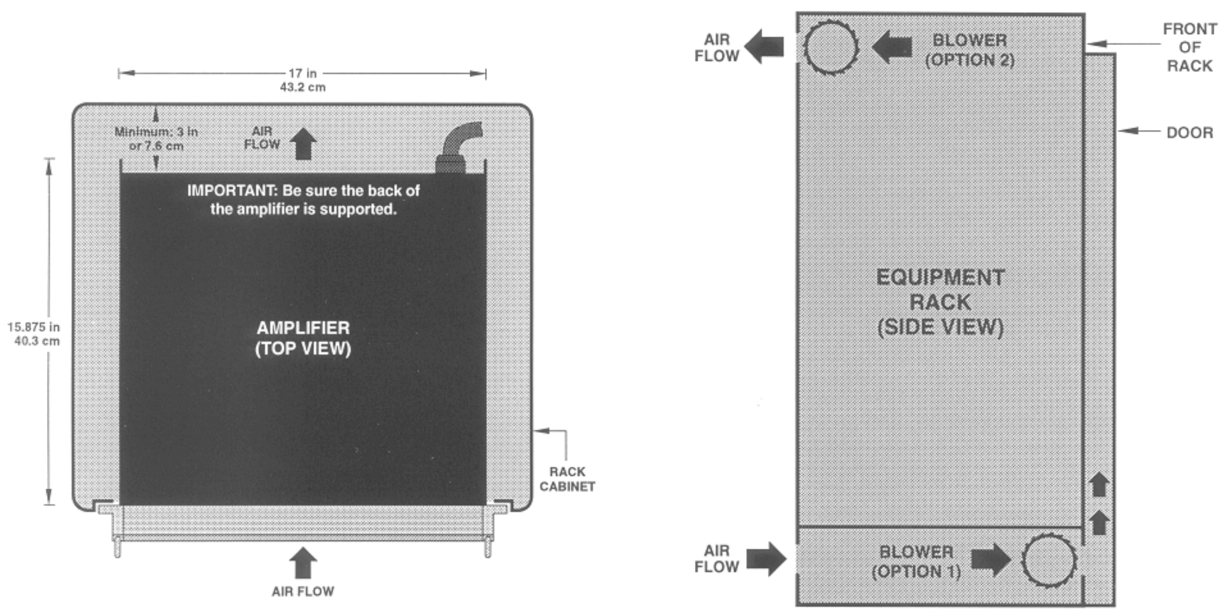
Mounting Dimensions

2.3 Cooling

NEVER block the air vents in the front or back of the amplifier. These amplifiers **DO NOT** need to be mounted with space between them. If you must leave open spaces in a rack for any reason, close them with blank panels or poor airflow will result. Allow for airflow of at least 75 cubic feet (2.1 cubic meters) per minute per unit. Additional airflow may be required when driving low-impedance loads at consistently high output levels.

NOTE: Refer to Section 3 Applications for detailed information on thermal dissipation.

When mounting the amplifier in a rack cabinet, the back wall of the rack should be at least 3 inches (7.6 cm) away from the back of the amplifier chassis as shown below.



Rack Cabinet Cooling

If your rack has a door that could block airflow to the amplifier's air intakes, you must provide adequate airflow by installing a grille in the door or by pressurizing the air behind the door. Wire grilles are recommended over perforated panels because they tend to cause less air restriction. A good choice for pressurizing the air behind the rack cabinet door is to mount a "squirrel cage" blower inside the rack (Option 1 above).

Cooling Continued…

At the bottom of the rack, mount the blower so it blows outside air into the space between the door and front of the amplifiers, pressurizing the “chimney" behind the door. This blower should not blow air into or take air out of the space behind the amplifiers. For racks without a door, you can evacuate the rack by mounting the blower at the top of the rack so that air inside the cabinet is drawn out the back (Option 2 previous page).

If the air supply is unusually dusty, you might want to pre-filter it using commercial furnace filters to prevent rapid loading of the unit's own air filters. When needed, the unit's filters can be cleaned with mild dish detergent and water. You may want to allow at least two additional inches of depth for cables and connectors extending out from the back.

⚠ CAUTION

DO NOT Install the **LVC 5050** in a small sealed chamber of any kind. Improper operation and overheating will result.

2.4 Making Connections

Before beginning the installation of your amplifier, please check the following:

✓ Remove all power from the unit. Do not have the AC cord plugged in.
✓ Turn input level control down (fully counter clockwise).

The input and output jacks are located on the back panel. Use care in making connections, selecting signal sources, and matching loads. During hookup take the following precautions:

1. **Use only shielded cable on inputs.** The higher the density of the shield (the outer conductor), the better the cable. Spiral wrapped shield is not recommended.

2. **The output wire and connectors should be heavy enough** to carry the intended current to the load.

3. **Use good quality connectors** with proper strain relief.

    - • Do not use connectors that have any tendency to short circuit.
    - • Do not use connectors that can be plugged into AC power receptacles.

4. **Keep unbalanced input cables as short as possible.** Avoid lengths greater than 10 feet.

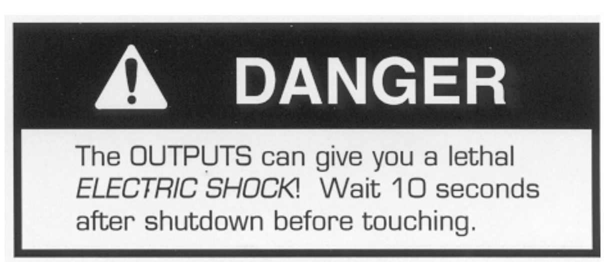
5. **Do not run signal** (input) **cables together with high level wiring** such as load (output) wires or AC cords (lowers most hum and noise).

6. **Do not short the ground lead of an output cable to the input signal ground.** Oscillations may result.

7. **Operate the amplifier from proper AC current.** Supply voltage must be 50 to 60 Hz and no more than 10% above or below the selected line voltage. Failure to comply with these frequency limits may damage the unit and result in unreliable operation.

8. **Never connect the output to a power supply output, battery, or power main.** These connections will cause serious damage to the amplifier.

9. **Do not permit unqualified personnel to tamper with circuitry.** Do not make unauthorized circuit modifications. Serious damage to the amplifier and/or safety hazards may result.



2.4.1 Dual Channel Hookup

In Dual mode, installation is very intuitive: input channel 1 feeds output channel 1, and input channel 2 feeds output channel 2. To activate Dual mode:

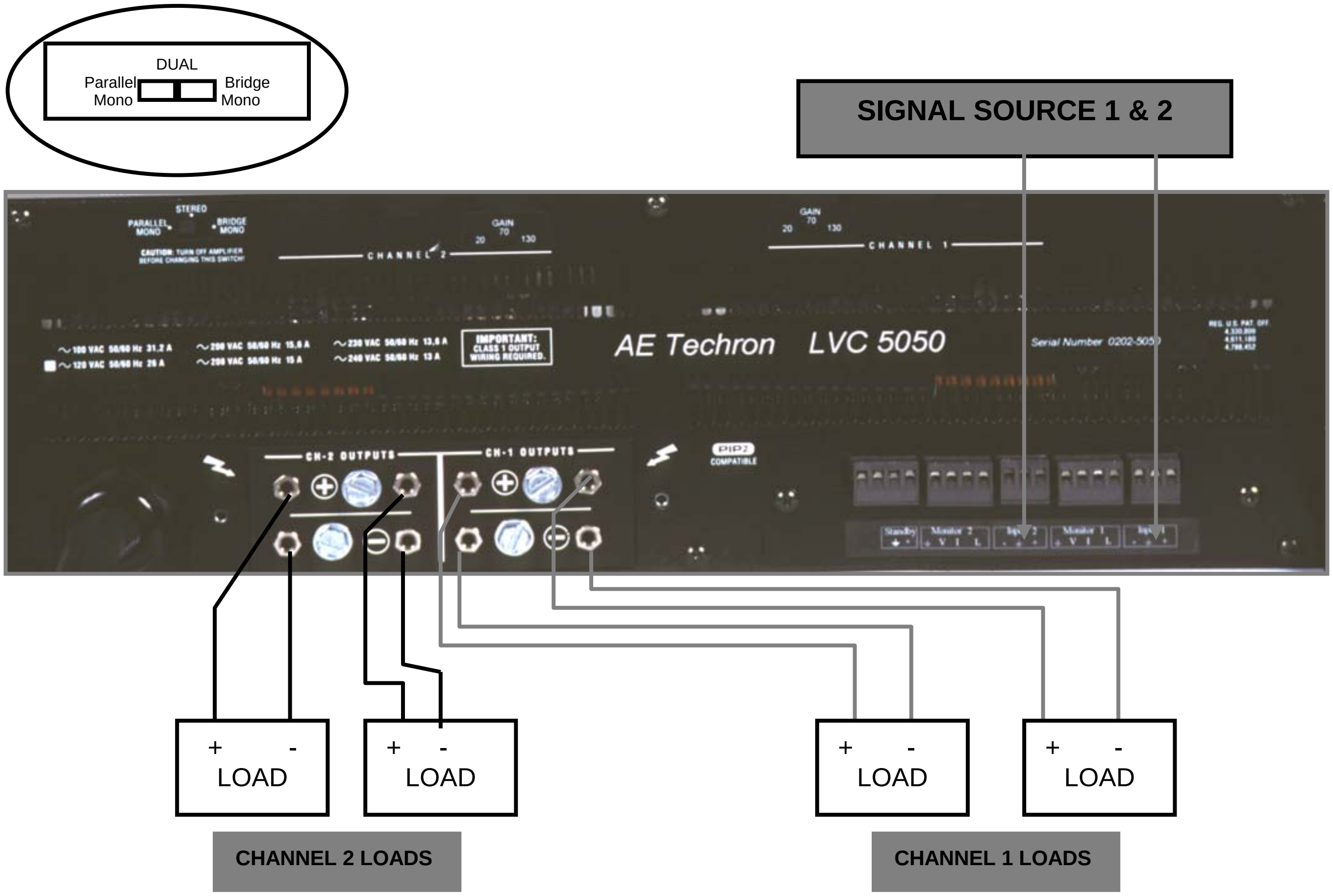
1. Turn off the amplifier
2. Wait 10 seconds for the power supply to discharge
3. Slide the Dual/Mono switch to the center position
4. Connect the output wiring as shown below.

The high-current output block has three sets of output connectors per channel so multiple loads can be easily connected. Two sets accept banana plugs, while the third set accepts spade lugs or bare wire. Observe correct load polarity and be very careful not to short the two outputs.

⚠ CAUTION

In Dual mode never parallel the outputs or parallel them with the output of another amplifier.

DUAL MODE


DUAL
Parallel Mono
Bridge Mono
SIGNAL SOURCE 1 & 2
AE Techron LVC 5050
CHANNEL 2
CHANNEL 1
CH-2 OUTPUTS
CH-1 OUTPUTS
+ - LOAD
+ - LOAD
+ - LOAD
+ - LOAD
CHANNEL 2 LOADS
CHANNEL 1 LOADS

2.4.2 Bridge-Mono Hookup

Bridge-Mono mode is intended for driving loads with a total impedance of 4 ohms or more (see Section 2.4.3 if the load is less than 4 ohms). Installing the amplifier in Bridge-Mono mode is very different from the other modes and requires special attention.

To activate Bridge-Mono mode:

1. Turn the amplifier off

2. Wait at least 10 seconds

3. Slide the Dual/Mono switch to the right (as you face the back of the amplifier).

NOTE: Both outputs receive the signal from the channel 1 input with the output of channel 2 inverted so it can be bridged with the channel 1 output.

AND

NOTE: The channel 2 input and level control are disconnected in Bridge Mono mode. A signal-feeding channel 2 will have no effect on the output.

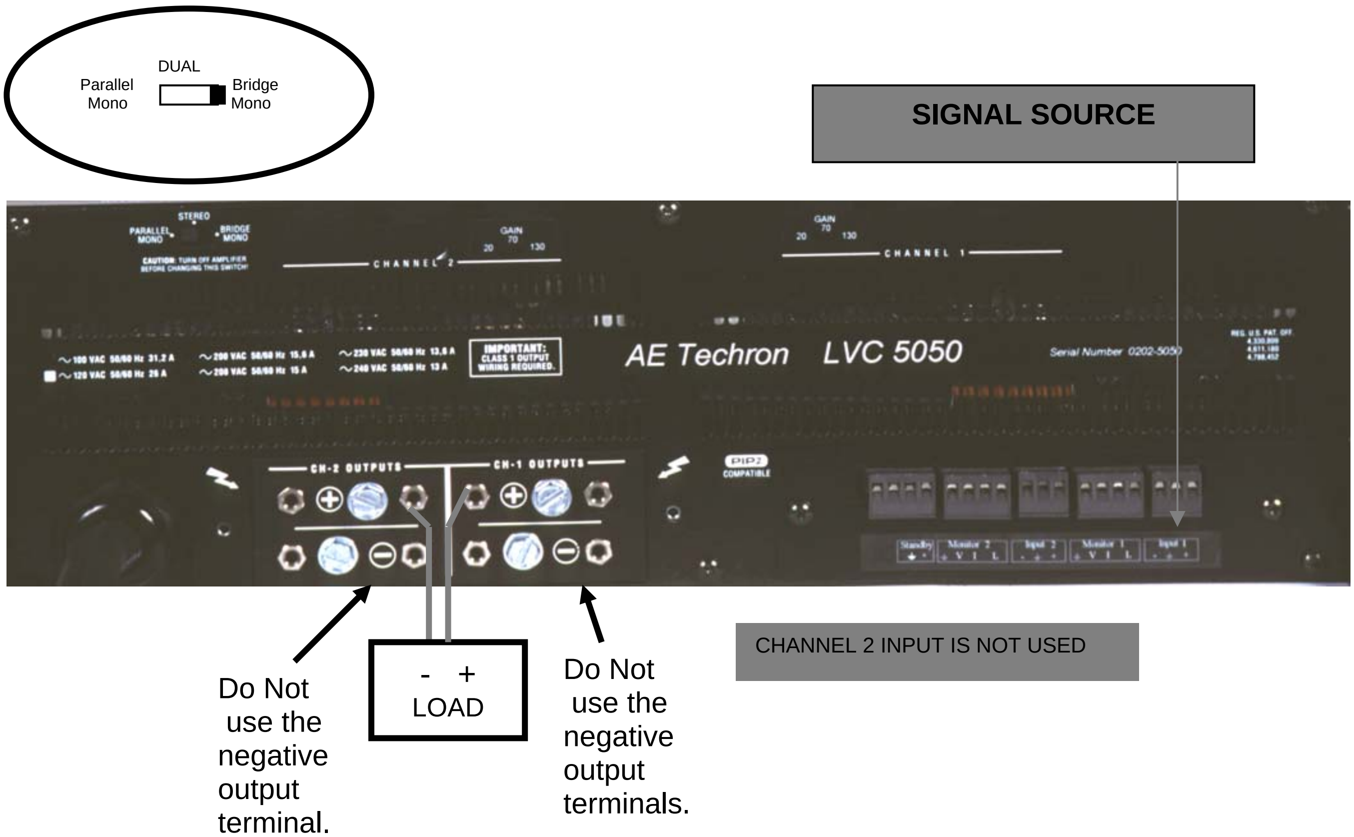
4. Connect the load across the channel 1 and 2 positive (+) terminals

5. Attach the positive lead from the load to channel 1.

6. Attach the negative lead from the load to channel 2.

The negative (-) terminals are not used and should not be shorted. In addition, the connected load must be floating referenced to ground.

Bridge Mono Hookup



2.4.3 Parallel-Mono Hookup

Parallel-Mono mode is intended for driving loads with a total impedance of less than 4 ohms (see Section 2.4.2 if the load is 4 ohms or greater). Installing the amplifier in Parallel-Mono mode is very different from the other modes and requires special attention.

To activate Parallel-Mono mode:

1. Turn off the amplifier

2. Wait at least 10 seconds

3. Slide the Dual/Mono switch to the left (as you face the back panel).

4. Connect the input signal to channel 1, and do not use the channel 2 input

Both outputs will now receive the signal from the channel 1 input.

NOTE: The channel 2 input and level control are disconnected in Parallel-Mono mode. A signal-feeding channel 2 will have no effect on the output.

To complete connections:

5. Install a jumper wire between the positive (+) outputs of channel 1 and 2 that is at least 14 gauge in size.

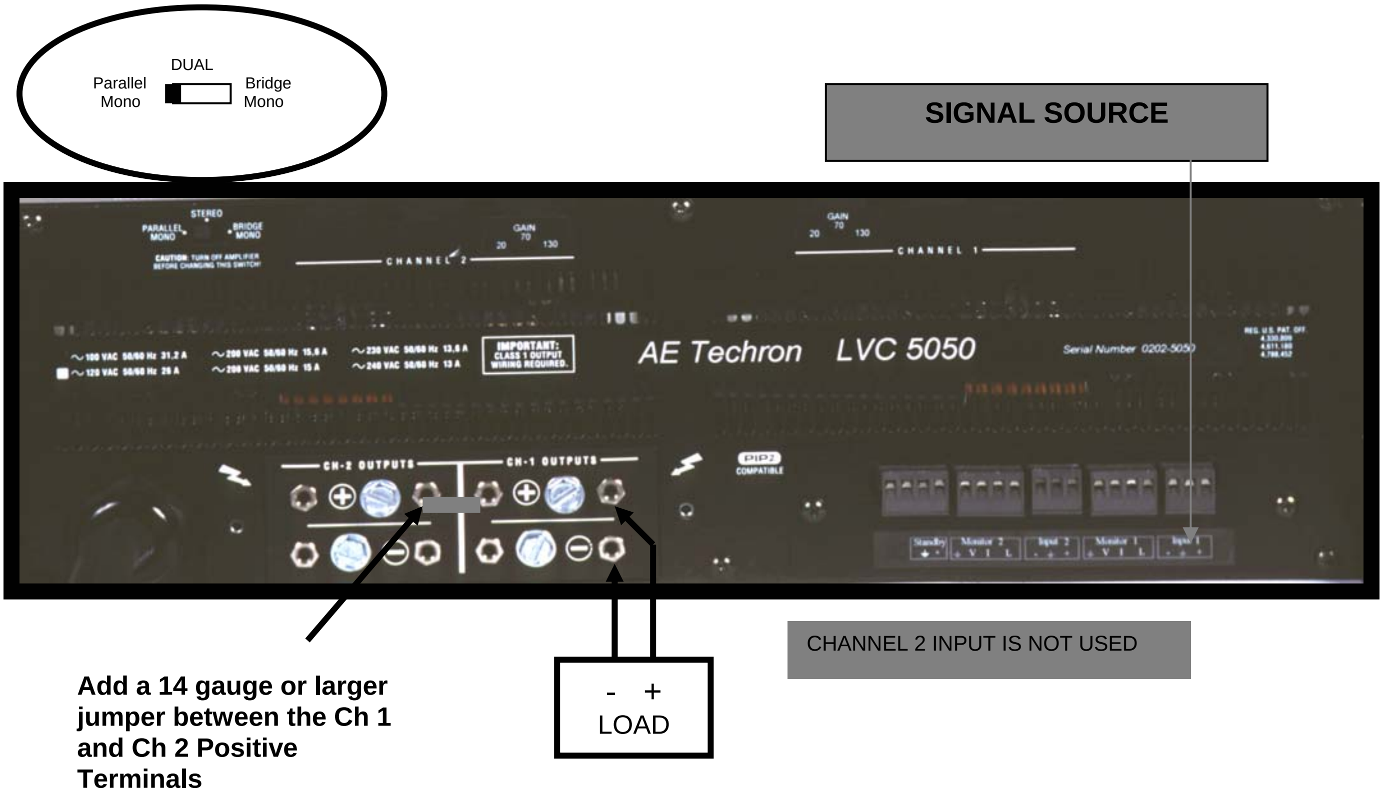
6. Connect the load to the output of channel 1 as shown below.

7. Connect positive (+) lead from the load to the positive (+) channel 1 terminal

8. Connect the negative (-) lead from the load to the negative (-) channel 1 terminal.

NOTE: Remember to remove the jumper between the positive output terminals before changing to Bridge-Mono or Dual modes (improper operation will result if you don't).

Parallel Mono



2.4.4 Connecting Power

The **LVC 5050** uses a 3-wire (grounded) AC line system. At times, the third wire ground may introduce a ground loop into the system.

Each **LVC 5050** is supplied from the factory with an appropriate AC cord.

- Units set up for 100 to 120 VAC operation is shipped with 10 AWG, 30 amp line cords.
- Units set up for 200 to 240 VAC operation is shipped with 12 AWG, 20 amp line cords.
- North American units set up for 120 VAC, 60 Hz operation are provided with a 125 volt, 30 amp NEMA TT30P plug.
- Units destined for other parts of the world are provided without a plug.

Whenever possible, connect the power cord to an isolated power circuit with adequate current (see Section 3 *Applications* for detailed information on current draw).

Excessive line voltages of more than 11% above the amplifier's rated line voltage will activate the overvoltage protection circuitry. For example, do not exceed a line voltage of 133 VAC for units set up for 120 VAC operation.

All specifications in this manual were measured using 120 VAC, 60 Hz power mains unless otherwise noted. Specifications are derived using a peak main voltage equal to the true peak of a 120 V RMS sine wave with all available channels fully loaded. Performance variations can occur at other AC main voltages and line frequencies. In addition, line regulation problems will directly affect the output power available from the amplifier.

A qualified technician can set up your amplifier for different AC main voltages and frequencies by changing the power supply connections on the control board inside the amplifier. The proper procedures are outlined inside the top cover of the amplifier and in this manual in Section 3 *Applications.*

WARNING

ELECTRIC SHOCK **hazard exists with covers removed. Only qualified technicians should do voltage conversion.**

Although this amplifier is rated for operation at 100 and 120 VAC, it is more efficient at 200, 208, 230 or 240 VAC. At these higher voltages, less power is converted to thermal energy in the AC cord and slightly more power is available at low frequencies.

3

Applications

This section describes the uses of the ***AE TECHRON*** **Model LVC 5050** amplifier, its capabilities, and various associated system configurations. Review this material before attempting to change the amplifier.

3.1 Introduction

This section is included for customers who may need to customize the **LVC 5050** for a new application. For these users, this section provides general theory and guidance.

This section assumes significant competence on your part in terms of amplifier systems, electronic components, and generally sound electronic working practices. You are encouraged to contact ***AE TECHRON*** for assistance with any modification or configuration of the **LVC 5050**.

WARNING

Except as recommended in this manual, do not attempt to change the circuitry of the amplifier. This could invalidate the warranty, damage the equipment, or harm the operator.

3.2 Amplifier Capability

Model LVC 5050 is a well-built power supply amplifier. It is capable of delivering precision power levels in a wide range of demands and with a variety of loads. When demands exceed the limits, there are several ways to increase amplifier's capability. If these special operating modes are still unable to meet power requirements, contact ***AE TECHRON*** and/or consider using an ***AE TECHRON*** model or models with higher power handling capacity.

The **LVC 5050** has three main operating modes; Dual, Bridge-Mono, and Parallel-Mono. The Dual mode is considered standard with the Mono modes used in special applications.

There are a number of precautions, which should be taken when operating the amplifier in either mono mode.

- ✓ The variable impedance mode switches for each channel must be set the same.
- ✓ The input must be to channel 1 only
- ✓ The input to channel 2 and controls for channel 2 are NOT defeated in either mono mode, therefor no connection to channel 2 may be made in either mono mode.
- ✓ The channel 2 level control should be turned down (counter clockwise) fully in either mono mode.

NOTE: Gain Switch for channel 2 makes no difference.

3.2.1 Bridge-Mono Applications

Bridge-Mono is intended for loads of 4 ohms or greater. The feedback loop for channel 1 also drives the input to channel 2 in this mono mode. The input to channel 2 is, however, inverted. This causes the output of channel 2 to be of equal magnitude and opposite polarity (for double voltage output). The output of the amplifier is balanced, and channel hot output is connected to load hot (+), channel 2 hot output is connected to load return (-).

3.2.2 Parallel-Mono Application

Parallel mono is intended for loads less than 4 ohms (as low as 1 ohm) in a monaural amplifier configuration. The channel 1 and 2 amplifier hot outputs must be shorted by an external shorting buss (10 AWG or larger). The amplifier output to the load(s) is taken from either channel's hot output to load hot, and either channel's negative output to the load return (-). The shorting buss must be removed prior to changing from parallel mono to either other mode.

3.2.3 Variable Impedance Mode Application

The Variable Impedance (VZ) mode switches are located inside the amplifier behind the top dust filter on the front panel. To access these switches, remove the top filter element (see illustration below).

WARNING

Always turn the power to the unit "OFF" before changing any of these switches.

Each switch has four settings (from left to right):

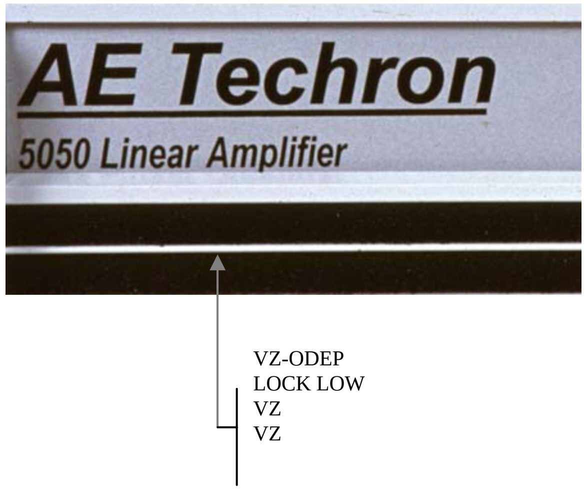
1. **VZ-ODEP**
2. **Lock Low**
3. **VZ**
4. **VZ.**

NOTE:The third and fourth positions are identical.

The amplifier is shipped from the factory with the switches set to 'VZ". To make changes:

1. Remove the top filter element
2. Locate the switch position label on the grille below each switch.
3. Reach through the grille opening with a long narrow nonconductive object like a plastic pen. The switches are about 1.75 inches (4.5 cm) behind the grille. They are easy to locate with the aid of a flashlight.
4. Locate the switch for channel 1 on the left side, and the switch for channel 2 on the right.

Variable Impedance Mode Application Continued…



The VZ (Variable Impedance) mode causes the power supplies to automatically shift between high-current and low-current modes of operation as operating conditions change. Normally, the power supplies operate in the high-current (low-impedance) mode for maximum thermal efficiency. When voltage demand reaches highs levels, the supplies quickly shift into high- voltage (high-impedance) mode. Because voltage and current requirements vary with the output level and frequency content of the source signals, the power supplies are designed to be able to continually switch between the two modes as needed with no degradation to the signal.

NOTE: VZ-ODEP stands for *Variable Impedance-Output Device Emulation Protection,* which is a combination of the names given to our patented protection circuitry.

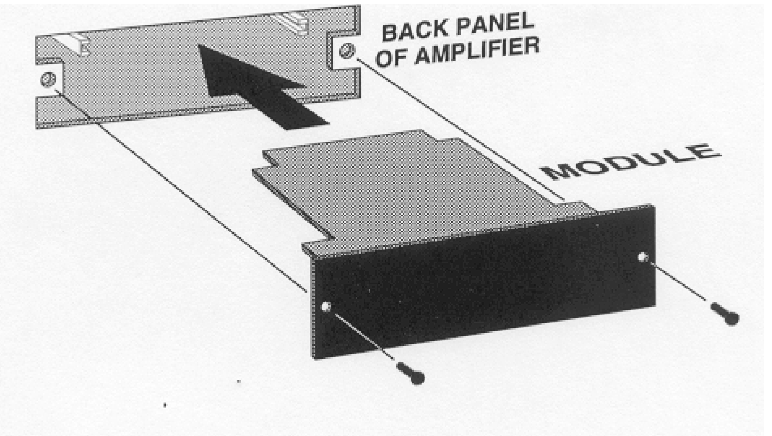
The VZ-ODEP mode is very similar to VZ mode. The only difference is that the power supplies are forced into high-current mode just before activating the amplifier's limiting circuitry. This reduces excessive stress on the output transistors, and effectively increases the thermal performance of the amplifier.

NOTE: When limiting begins, the OVERLOAD circuitry will see that the input waveform does not match the output waveform, and an error signal is generated.

The Lock Low mode locks the power supplies into the high-current mode for low-impedance loads. This may be desirable when driving high-frequency transducers that must be protected from too much voltage, or when driving loads with very low impedances.

3.3 Plug-In Modules

This is an excellent way to customize the amplifier for different applications in a relatively short amount of time. The **LVC 5050** amplifiers are equipped with an input module inside the back panel. The modules install easily as shown below.



Installing an Input Module

3.4 AC Power Applications

This section provides detailed information about power drawn from the AC mains and heat dissipation by the amplifier. Also, this section shows how to change the amplifier to operate from a different AC voltage and/or frequency.

3.4.1 AC Power Draw and Thermal Dissipation

The amount of power and current drawn, and the amount of heat produced under various conditions are presented here. These calculations are intended to provide a realistic and reliable depiction of the amplifier. The following assumptions were made:

- The amplifier's available channels are loaded, and full, standard 1 kHz power is being delivered.
- Quiescent power draw is 90 watts.
- Quiescent heat dissipation equals 105 btu/hr at 90 watts.

Here are the equations used to calculate the data presented on the following page:

$$\text{AC Mains Power Draw (watts)} = \frac{\text{Standard 1 kHz power with both channels driven (watts)} \times \text{Duty Cycle}}{\text{Amplifier Efficiency}} + \text{Quiescent Power Draw (90 watts)}$$

The quiescent power draw of 90 watts is typical, and assumes the cooling fans are <u>not </u>running.

$$\text{Thermal Dissipation (Btu/Hr)} = \left[(1 - \text{Power to Loads}) + \text{Quiescent Power Draw (90 watts)} \right] \times 3.415$$

or

$$\text{Thermal Dissipation (btu/hr)} = \left(\frac{\text{Standard 1 kHz power each channel (watts)} \times \text{Duty Cycle} \times \text{Amplifier Inefficiency}}{\text{Amplifier Efficiency}} + \text{Quiescent Power Draw (90 watts)} \right) \times 3.415$$

The constant 3.415 converts watts to btu/hr. Thermal dissipation in btu is divided by the constant 3.968 to get kcal. To convert the power draw in watts to current draw in amperes, use the following equation:

$$\text{Current Draw (amperes)} = \frac{\text{AC Mains Power Draw (watts)}}{\text{AC Mains Voltage} \times \text{Power Factor (.83)}}$$

AC Power Draw and Thermal Dissipation Continued…

The current draw values shown below depend on the AC mains voltage (power draw and thermal dissipation are typical for any AC mains voltage).

	LOAD														
	8 Ohm Dual / 4 Ohm Parallel-Mono					4 Ohm Dual / 8 Ohm Series-Mono / 2 Ohm Parallel-Mono									
Duty Cycle	AC Mains Power Draw	Current Draw (Amps)		Thermal Dissipation		AC Mains Power Draw	Current Draw (Amps)		Thermal Dissipation		AC Mains Power Draw	Current Draw (Amps)		Thermal Dissipation	
		100-120 V	220-240 V	btu/hr	kcal/hr		100-120 V	220-240 V	btu/hr	kcal/hr		100-120 V	220-240 V	btu/hr	kcal/hr
50%	1,715	20.7	9.4	1,420	360	2,590	31.2	14.2	2,015	510	3,215	38.7	17.6	2,440	615
40%	1,390	16.7	7.6	1,195	300	2,090	25.2	11.4	1,675	420	2,590	31.2	14.2	2,015	510
30%	1,065	12.8	5.8	975	245	1,590	19.2	8.7	1,330	335	1,965	23.7	10.8	1,590	400
20%	740	8.9	4.1	750	190	1,090	13.1	6.0	990	250	1,340	16.1	7.3	1,160	295
10%	415	5.0	2.3	530	135	590	7.1	3.2	650	165	715	8.6	3.9	735	185

Power Draw, Current Draw, and Thermal Dissipation

3.4.2 AC Power Conversion

The **LVC 5050** power amplifier may easily be converted to a variety of AC mains voltages and may operate at 50 or 60 Hz. Complete directions to accomplish line voltage and/or frequency changes are found on a label placed under the top cover of the unit. For convenience this information is duplicated here and on the following page. Wiring lists and instructions are below with a graphic of the unit showing physical wire locations on the following page.

INSTRUCTIONS

CAUTION

Because there is a risk of electric shock, only a qualified technician should change the line voltage configuration.

1. Turn the amplifier off and disconnect it from the AC power source. (The enable switch alone does not remove lethal voltage from the line cord.)
2. Wait at least 1 0 seconds before proceeding.

Instructions Continued…

3. Drain any remaining energy from the power supplies by shorting them as follows: Touch a 100 ohm, 10 watt resistor across terminals Al and A2 and across terminals Bl and B2 as shown in the illustration. The resistor should be held across the terminals for 10 seconds. **Be careful-the resistor can become hot.**

4. Locate the Control Board. It is the circuit board closest to the front of the amplifier. It contains numerous power supply connections, which set the voltage, and one jumper block, which sets the frequency.

5. Use the information in the table at left to connect the color-coded wiring harness correctly for the desired voltage.

6. Configure each wire group one at a time so the wires are not confused. **Do not mix wires between groups.** This step may require you to cut one or more tie wraps. If you do, replace them to make sure no loose wires are able to prevent the fans from rotating.

7. Locate the frequency jumper (JP1) and set it for either 60 Hz (left) or 50 Hz (right).

8. Double check that all connections are correct and replace the top cover.

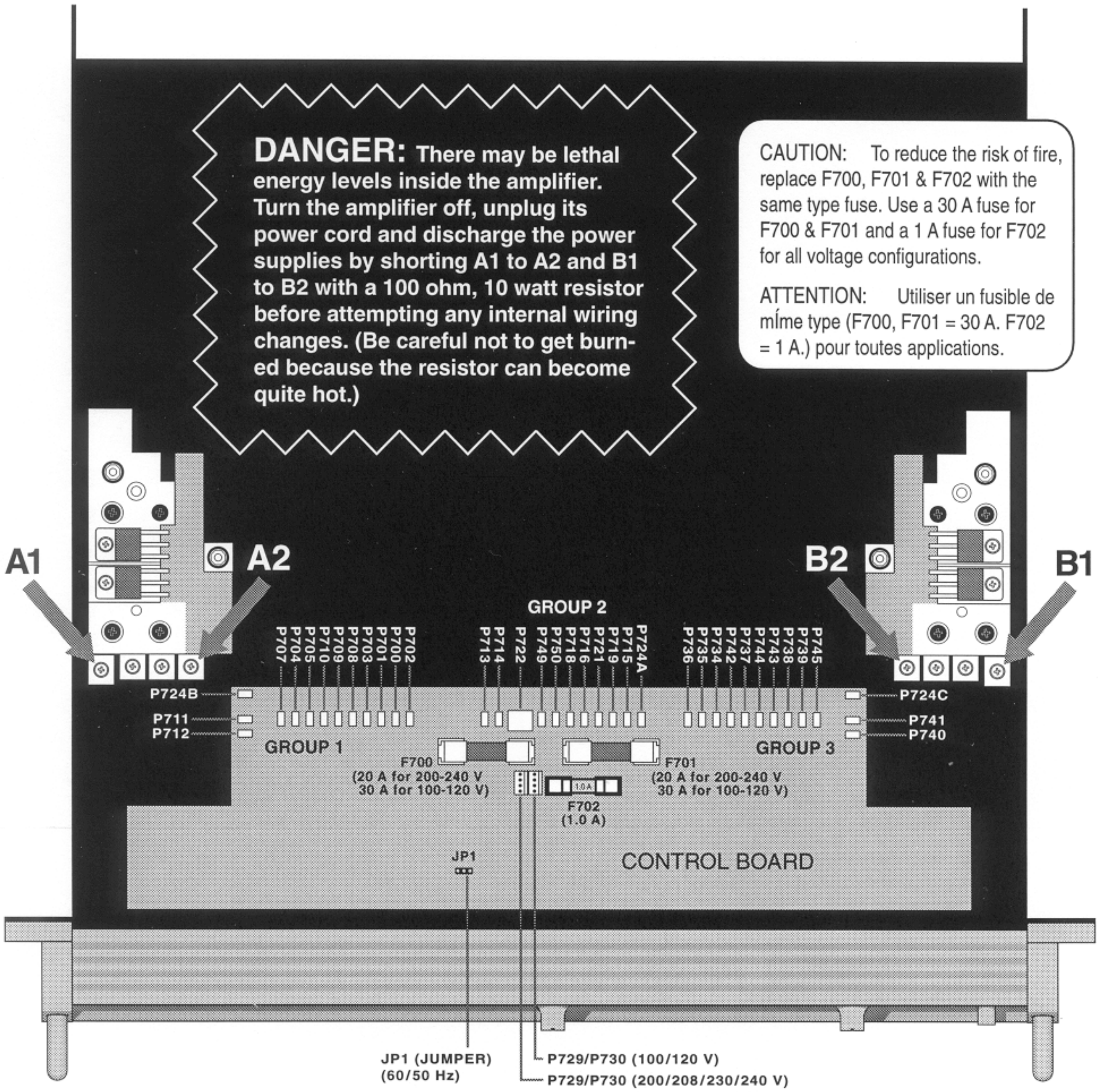
NOTE:

*Wire colors marked with a single asterisk connect to the power cord.

**The connector numbers are listed in clockwise order from left to right as you face the front of the amplifier.

***Connection P729 and P730 are combined on a single four-pin connector. It mates to a l20V connector, for 100 or 120 V operation, or a 240V connector for 200, 208, 230 or 240V.

	Control Board Wiring for Different AC Voltages						
	NO.**	100 V	120 V	200 V	208 V	230 V	240 V
GROUP 1	P712	BLK	BLK	BLK	BLK	BLK	BLK
	P711	WHT	WHT	--NONE--	--NONE--	--NONE--	--NONE--
	P724B	BLU*	BLU*	BLU*	BLU*	BLU*	BLU*
	P707	BLK/GRN	BLK/YEL	BLK/GRN	BLK/GRN	BLK/YEL	BLK/YEL
	P704	--NONE--	--NONE--	BLK/YEL	BLK/YEL	WHT	WHT
	P705	--NONE--	--NONE--	WHT	WHT	BLK/GRN	BLK/GRN
	P710	WHT/GRN	WHT/YEL	WHT/RED	WHT/YEL	WHT/YEL	WHT/YEL
	P709	WHT/RED	WHT/RED	WHT/GRN	WHT/GRN	WHT/GRN	WHT/RED
	P708	WHT/YEL	WHT/GRN	WHT/YEL	WHT/RED	WHT/RED	WHT/GRN
	P703	BLK/YEL	BLK/GRN	--NONE--	--NONE--	--NONE--	--NONE--
	P701	GRY	GRY	GRY	GRY	GRY	GRY
	P700	GRY	GRY	GRY	GRY	GRY	GRY
	P702	GRN/YEL	GRN/YEL	GRN/YEL	GRN/YEL	GRN/YEL	GRN/YEL
GROUP 2	P713	BLK/YEL	BLK/GRN	--NONE--	--NONE--	--NONE--	--NONE--
	P714	WHT/YEL	WHT/GRN	WHT/YEL	WHT/RED	WHT/RED	WHT/GRN
	P722	BRN*	BRN*	BRN*	BRN*	BRN*	BRN*
	P749	WHT/RED	WHT/RED	WHT/GRN	WHT/GRN	WHT/GRN	WHT/RED
	P750	WHT/GRN	WHT/YEL	WHT/RED	WHT/YEL	WHT/YEL	WHT/YEL
	P718	--NONE--	--NONE--	WHT	WHT	BLK/GRN	BLK/GRN
	P716	--NONE--	--NONE--	BLK/YEL	BLK/YEL	WHT	WHT
	P721	BLK/GRN	BLK/YEL	BLK/GRN	BLK/GRN	BLK/YEL	BLK/YEL
	P719	BLK	BLK	BLK	BLK	BLK	BLK
	P715	WHT	WHT	--NONE--	--NONE--	--NONE--	--NONE--
	P724A	BLU*	BLU*	BLU*	BLU*	BLU*	BLU*
GROUP 3	P736	GRN/YEL	GRN/YEL	GRN/YEL	GRN/YEL	GRN/YEL	GRN/YEL
	P735	GRY	GRY	GRY	GRY	GRY	GRY
	P734	GRY	GRY	GRY	GRY	GRY	GRY
	P742	BLK/YEL	BLK/GRN	--NONE--	--NONE--	--NONE--	--NONE--
	P737	WHT/YEL	WHT/GRN	WHT/YEL	WHT/RED	WHT/RED	WHT/GRN
	P744	WHT/RED	WHT/RED	WHT/GRN	WHT/GRN	WHT/GRN	WHT/RED
	P743	WHT/GRN	WHT/YEL	WHT/RED	WHT/YEL	WHT/YEL	WHT/YEL
	P738	--NONE--	--NONE--	WHT	WHT	BLK/GRN	BLK/GRN
	P739	--NONE--	--NONE--	BLK/YEL	BLK/YEL	WHT	WHT
	P745	BLK/GRN	BLK/YEL	BLK/GRN	BLK/GRN	BLK/YEL	BLK/YEL
	P724C	BLU*	BLU*	BLU*	BLU*	BLU*	BLU*
	P741	WHT	WHT	--NONE--	--NONE--	--NONE--	--NONE--
	P740	BLK	BLK	BLK	BLK	BLK	BLK
	P729*** P730***	120 V Position		240 V Position			
FUSE	F700 F701	30 Amp Fuse (100-120 V Conf.)		20 Amp Fuse (200-240 V Configuration)			
	F702	1.0 Amp Fuse (All Voltage Configurations)					



DANGER: There may be lethal energy levels inside the amplifier. Turn the amplifier off, unplug its power cord and discharge the power supplies by shorting A1 to A2 and B1 to B2 with a 100 ohm, 10 watt resistor before attempting any internal wiring changes. (Be careful not to get burned because the resistor can become quite hot.)
CAUTION: To reduce the risk of fire, replace F700, F701 & F702 with the same type fuse. Use a 30 A fuse for F700 & F701 and a 1 A fuse for F702 for all voltage configurations.
ATTENTION: Utiliser un fusible de mÍme type (F700, F701 = 30 A. F702 = 1 A.) pour toutes applications.
A1
A2
B2
B1
GROUP 2
P707
P704
P705
P710
P709
P708
P703
P701
P700
P702
P713
P714
P722
P749
P750
P718
P716
P721
P719
P715
P724A
P736
P735
P734
P742
P737
P744
P743
P738
P739
P745
P724B
P711
P712
P724C
P741
P740
GROUP 1
GROUP 3
F700
(20 A for 200-240 V
30 A for 100-120 V)
F701
(20 A for 200-240 V
30 A for 100-120 V)
F702
(1.0 A)
JP1
CONTROL BOARD
JP1 (JUMPER)
(60/50 Hz)
P729/P730 (100/120 V)
P729/P730 (200/208/230/240 V)

4

Principles of Operation

This section discusses the principles upon which the ***AE TECHRON*** **Model LVC 5050** amplifier functions.

4.1 Overview

Your ***AE TECHRON*** variable impedance amplifier incorporates several new technological advancements including low-stress output stages, real-time computer simulation of output transistor conditions, an advanced heat diffuser embodiment, a modular system for signal input and processing, and the articulated *variable* impedance power supplies.

Custom protection circuitry limits temperature and current to safe levels while making the amplifier highly reliable and tolerant of faults. Unlike many lesser amplifiers, it can operate at its voltage and current limits without self-destructing.

Real-time computer simulation is used to create an analogue of the junction temperature of the output transistors (hereafter referred to as the “output devices"). Current is limited only when the device temperature becomes excessive and just by the minimum amount necessary. This patented approach is called ODEP or Output Device Emulation Protection. It maximizes the available output power and eliminates overheating, the major cause of output device failure.

The amplifier is protected from all common hazards that plague high power amplifiers including shorted, open or mismatched loads, overloaded power supplies, excessive temperature, chain-destruction phenomena, input overload damage and high frequency blowups. The unit protects loads from turn-on and turn-off transients. The amplifier is also protected from internal faults.

The patented four-quadrant topology used in the grounded output stages is called the *grounded bridge. The grounded bridge* topology takes full advantage of the power supplies delivering peak-to-peak voltages to the load that are twice the voltage seen by the output devices and twice the voltage generated by the power supplies.

The *grounded bridge* topology is ground-referenced. Because the required current exceeds the limits of presently available components, composite output devices are constructed to function as gigantic NPN and PNP devices. Each output stage has two composite NPN and two composite PNP devices.

Overview Continued…

The devices connected to the load are referred to as "high-side NPN and PNP" and the devices connected to ground are referred to as "low-side NPN and PNP”. Positive current is delivered to the load by increasing conductance simultaneously in the high-side NPN and low-side PNP stage, while decreasing conductance of the high-side PNP and low-side NPN in synchrony.

The two channels may be used together to double the voltage (Bridge-Mono) or the current (Parallel-Mono) presented to the load. This feature gives the user flexibility in maximizing the power available to the load.

Our thermal diffusers (heat sinks) are fabricated from custom, machined aluminum extrusion stock that provides an extremely high ratio of area to weight. All power devices are mounted directly to massive heat spreaders that are electrically alive. Electrifying the heat spreaders improves thermal performance by eliminating the insulating interface underneath the power devices.

4.2 Variable Impedance [VZ] Power

VZ means variable impedance. It is the name of ***AE TECHRON'S*** patented articulated power supply technology. This technology is what makes it possible to pack such tremendous power into ***AE TECHRON'S*** variable impedance amplifiers.

4.2.1 Background

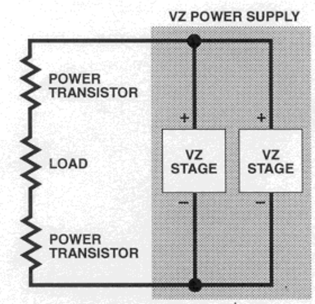
A power supply must be large enough to handle the maximum voltage and current necessary for the amplifier to drive its maximum rated power into a specified load. In the process of fulfilling this requirement, conventional power supply designs produce lots of heat, are heavy, and take up precious real estate. And it's no secret that heat is one of a power amplifiers worst enemies.

According to Ohm's Law, the bigger the power supply, the more heat the power transistors must dissipate. Also, the lower the resistance of the power transistors, the more voltage you can deliver to the load. But when you lower the resistance of the transistors, you increase the current passing through them, and again increase the amount of heat they must dissipate.

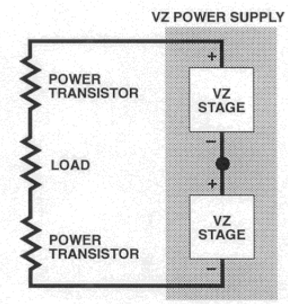
4.2.2 The VZ Supply

An articulated power supply like *variable* impedance avoids much of this problem by reducing the voltage applied to the transistors when less voltage is needed. Reducing the voltage reduces the heat, so the amplifier runs cooler and more power can be packed in safely.

The *variable* impedance supply is divided into two parts to better match the voltage and current requirements of the power transistors. When the voltage requirements are not high, it operates in a *parallel* mode (shown below) to produce less voltage and more current. When the voltage requirements are high, VZ supplies switch to a *series* mode (shown below) which produces higher voltage and less current.

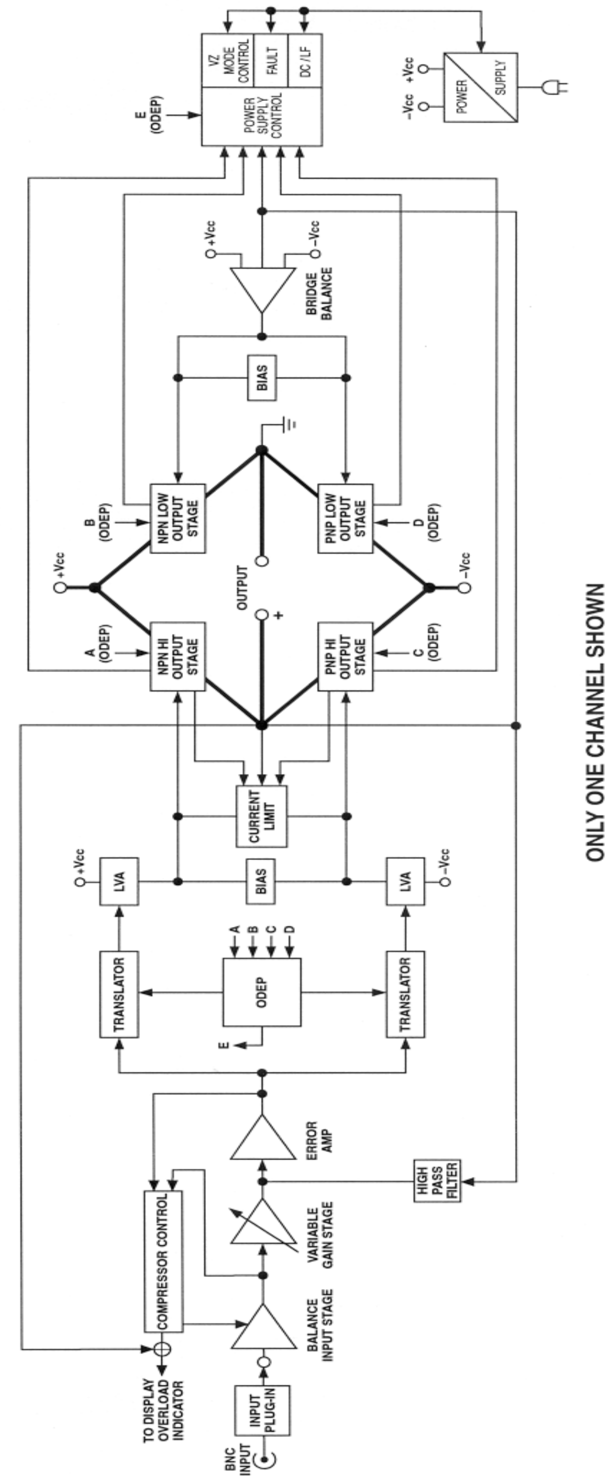


Parallel High-Current Mode



Series High-Voltage Mode

Sensing circuitry watches the voltage of the signal to determine when to switch *variable* impedance modes. The switching circuitry is designed to prevent switching distortion to yield the highest possible dynamic transfer function and the best power matching to your load.



Model LVC 5050 Circuitry Block Diagram

4.3 Circuit Theory

For a clearer understanding of the circuits discussed refer to the schematics in the back of the manual.

Each channel is powered by its own transformer, T1OO or T200. The secondary of T1OO is full wave rectified by DB1OO and DBlOl and filtered by large computer grade capacitors (C810 and C812 for channel 1). The transformers are protected against catastrophic failure by fuses F700 and F701 and thermally protected by internal self-resetting switches.

Both channels share T1, a low-voltage transformer. The output of T1 is rectified by diodes D709 through D714 providing an unregulated 24 volts. Monolithic regulators U715 and U716 provide the regulated ±15 volts. TI is protected by fuse F702.

4.3.1 Dual Operation

For simplicity, the discussion of dual operation will refer to one channel only. Mono operation will be discussed later. Please refer to the block diagram on the previous page and the schematics in the back of this manual.

The input signal at the BNC connector passes directly through the input module into the balanced input stage (U1OOA). When the compressor is enabled, the compressor control circuit (UlOl, U102 and U103) causes a reduction in gain of the balanced input stage at the onset of clipping in the output stage. The compressor is also activated any time the first stage is about to be overdriven. The compressor control circuit also sends signals to the display module to indicate input overload.

The variable gain stage (U1OOB) sets the input sensitivity. Switch S100 is used to select 20, 70, 140-voltage gain for standard 1 kHz power. From there, variable resistor (Rl2O) controls the gain.

The 'error" amplifier (UlO5) is the heart of the unit. It is located in the main feedback loop and controls the performance of the amplifier. The error amp amplifies the difference ('error") between the output signal and the input signal, and drives the voltage translator stage to compensate for these differences.

The output of the error amplifier is then sent to the signal translators (U106, U107, Q101, Q102, Q113 and Q114). This stage translates the ground-referenced output of the error amplifier to a VCC-referenced signal to drive the last voltage amplifiers. The translators output drive is controlled by the ODEP circuit via Q101, Q102, Q113 and Q114.

The output of the signal translators next goes to the Last Voltage Amplifiers or LVAs (Q501, Q502, Q503, Q507, Q508 and Q509) located on the output module. The output of the LVA stage is limited by D514 through D517 so that there is maximum current to feed the predriver transistors and the slew limit capacitors (C506 and C507) yielding a constant slew rate.

Dual Operation Continued…

The output stage consists of the predrivers (Q504 and Q510), the drivers (Q511 and Q512), and the outputs (Q513 through Q518, Q536 and Q537). These devices are configured as emitter-follower stages to supply current gain to the output of the amplifier.

The bias servos (Q533 and Q505) are thermally coupled to the heat sinks and set the quiescent current point for the output stage to lower the distortion in the crossover region of the output signal.

The bridge-balance circuit (U5O3) receives a signal from the output of the amplifier and differences it with the signal at the VCC supplies. The bridge-balance circuit then develops a voltage to drive the bridge-balanced output stage. This results in the VCC supply having exactly one half of the output voltage added to their quiescent voltage. Q529 and Q530 along with R556 set the quiescent current point for the bridge-balance output stage.

The protection mechanisms that affect the signal path are implemented to protect the amplifier under real-world conditions. These conditions are high instantaneous current, excessive temperature, and operation of the output devices outside safe conditions.

The instantaneous current limiter (Q534, Q535, Q540 and Q541) has two distinct limiting points. The current limit is nominally set to 55 amps and will switch to 32 amps when the V., voltage exceeds a predetermined level. When the output current exceeds the set limit, drive is removed from the LVA stage, thus limiting the output current to a safe level. To further protect the output stages, a specially developed ODEP circuit is used (U112, U113, U114, U116 and U117). It produces an analog output proportional to the always-changing safe operating area of the output transistors. This output controls the translator stage and the low-side predriver stage, removing any further drive that may exceed the safe operating area of the output stages.

Thermal sensors U500 and U501 give the ODEP circuits vital information on the operating temperature of the heat sink on which the output devices are mounted.

Should the amplifier fail in such a way that would result in DC (caused by excessive current or voltage) across the output terminals, the DC/low-frequency protection circuit (UI09C and U109D) senses this on the negative feedback loop and shuts down the power supply and all drive to the output stage until the DC is removed. If an output device fails, the fault circuit (U115, Q105, Q106, Q108 and Q109) detects the common-mode current in the output devices and removes power from the channel until it can be repaired.

The High Pass Filter circuit (UlO4) senses the output signal and does a double integration, feeding the resultant “error" signal to the error amplifier to correct for any net DC in the output.

Additional protection is provided by the overvoltage protection circuit (U707D), which monitors the incoming line voltage and shuts down both power supplies in the case of excessive line voltage.

The VZ-ODEP control circuit (U110) monitors both the Vcc and the output signal. When the output signal comes to within a DV of the Vcc (as determined by the output voltage and current demands), the control circuit tells the supply to switch into high-voltage mode. The supply is then latched in this mode for a minimum of 50 microseconds by U703, with U711 providing protection for the FETS. The FETs (Q810, Q811 and Q812) and the steering diodes (D810 and D811) provide the two modes of the power supply.

The VZ mode switch (S700) has four positions, which control how the articulated supply functions (two of the four switch positions are identical because there are only three VZ modes)

- In the "VZ" position, the supply will automatically change as needed depending on the signal demands.
- In the “'Lock Low" position, the supply stays in high-current mode and cannot switch into high-voltage mode.
- In the “VZ-ODEP" position, the supply operates as it would in the 'VZ" position unless the ODEP limit is reached.

If the *ODEP* limit is reached, the supply will be locked into high-current mode to lower the thermal dissipation of the output devices until it is cools enough to return to normal "VZ" operation.

The fan control circuit (U713, U707B, U712 and Q706) uses the *ODEP* thermal information to control the speed of the fan. The summation of the *ODEP* signal and the heat sink temperature is used to determine its speed.

In order to reduce the turn-on current needed by the power transformers, a “soft start" circuit is provided (U701B, U701A, U111, U700 and Q701) which limits the maximum start-up current to less than 22 peak amps per channel with 120 VAC mains. The primary voltage is ramped up to the full voltage, then relay K700 closes across triac Q701 for normal operation.

4.3.2 Bridge-Mono Operation

By setting the back panel Dual/Mono switch to Bridge-Mono, the user can convert the amplifier into a bridged mono amplifier. With a signal applied to the channel 1 input and the load connected between the positive output terminals of channel 1 and channel 2, twice the voltage output of a single channel is achieved.

The channel 1 output feeds the channel 2-error amp (U205). Because there is a net inversion, the channel 2 output is out of polarity with channel 1. This produces twice as much voltage across the load. Each of the channel's protection mechanisms work independently and both *Overvoltage* indicators are operational.

4.3.3 Parallel-Mono Operation

With the Dual/Mono switch set to Parallel-Mono, the output of channel 2 is paralleled with that of channel 1. A suitable jumper capable of handling high current must be installed to gain the benefits of this operating mode. The jumper should be connected across a positive output terminal from each channel.

The signal path for channel 1 is the same as for dual operation. The signal for channel 2 is fed from the same source as for channel 1 and is paralleled at the input to the error amplifier (UI05 and U205). A signal from the current sense circuit is also sent to the channel 2 error amplifier giving channel 2 an electronic ballasting resistor to better match the two outputs. In Parallel- Mono mode, twice the current of one channel alone can be obtained. Each of the channel's protection mechanisms work independently if a fault occurs and both Overload indicators are operational.

4.3.4 Terminator

The terminator module provides a high-frequency load to the amplifier in order to maintain stability. It includes a current sense circuit (U750) which is used for the I_{Load}/I_{Limit} display and in the Parallel-Mono mode.

4.3.5 Display Mode

On the display module there are five indicators.

1. The amber Enable LED shows that the low-voltage supply is enabled.
2. The green Overload LED is driven by Q502 from the output signal and flashes with the output signal at normal brilliance.
3. When the amplifier reaches early clipping, the LED driven by Q504 will flash brighter indicating an Overload event.
4. The two-color I_{Load}/I_{Limit} LED flashes green when U500, U501 and Q505 see output current.
5. It turns red when the amplifier's maximum current output is achieved.

5

Service Information

This amplifier has sophisticated circuitry, which should only be serviced by a fully trained technician.

5.1 Qualified Service

AE TECHRON will provide service to the original purchaser of each new ***AE TECHRON*** **LVC 5050** for a period of one (1) year from the date of purchase if all conditions of the warranty have been met. When you notify us of your need for warranty service, we will give you an authorization to return the product for service.

DANGER

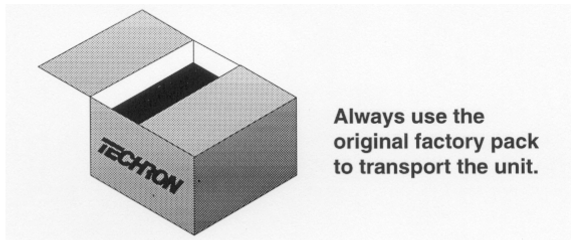
To prevent electric shock, do not remove covers. No user serviceable parts inside. Refer servicing to a qualified technician.

Warranty work can only be performed at our authorized service centers or at our factory. Expenses in remedying the defect will be borne by ***AE TECHRON***, including one-way surface freight shipping costs within the United States. (Purchaser must bear the expense of shipping the product between any foreign country and the port of entry in the United States and all taxes, duties, and other customs fees for such foreign shipments.)

5. 1. 1 Authorized Service Center Service

Service may be obtained from an authorized service center. (Contact ***AE TECHRON*** for a list of authorized service centers.) To obtain service, simply present the bill of sale as proof of purchase along with the defective unit to an authorized service center. They will handle the necessary paperwork and repair. Remember to transport your unit in the original factory pack.

5.1.2 Factory Service
To obtain factory service, write a letter describing as fully as you can the problem and send it along with your proof of purchase and the defective unit. For warranty service, we will pay for ground shipping back to you if you are within the continental United States. After repair and thorough testing the factory will return your serviced unit via truck. Please contact us if other arrangements are required.



5.2.2 Shipping Instructions
1. When sending an ***AE TECHRON*** product to the factory for service, be sure to write a letter describing the problem and reason for service and enclose it inside your unit's shipping pack.

2. To assure the safe transportation of your unit to the factory, ship it in an original factory-packing container. If you don't have one, call or write ***AE TECHRON'S*** Parts Department. With the exception of polyurethane or wooden crates, any other packing material will not be sufficient to withstand the stress of shipping. Do not use loose, small size packing materials.

3. Do not ship the unit in any kind of cabinet (wood or metal). Ignoring this warning may result in extensive damage to the unit and the cabinet. Accessories are not needed-do not send the instruction manual, cables or other hardware.

4. If you have any questions, please call or write the ***AE TECHRON*** Technical Support Group:

   Phone: (574) 295-9495
   FAX: (574) 295-9596
   E-Mail: Sales@aetechron.com

5. Shipments to ***AE TECHRON*** should be made as described below:

AE TECHRON
Precision Industrial Amplifiers
2507 Warren Street
Elkhart, Indiana 46516 U.S.A.