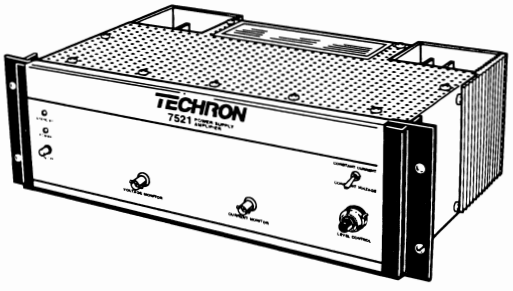
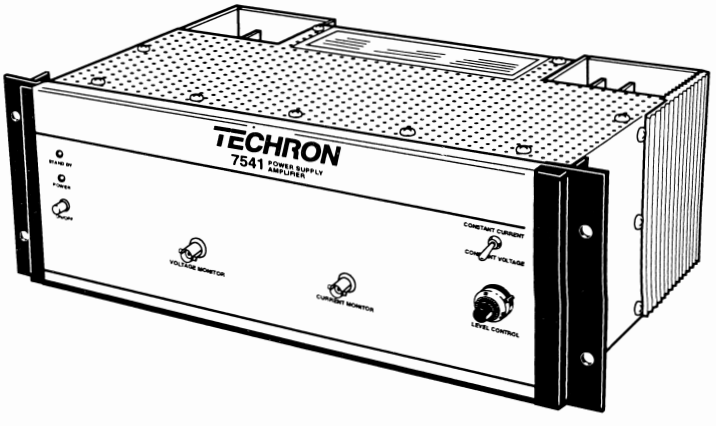
TECHRON®

A Division of Crown International, Inc.

Operator's Manual





TEC7521 & TEC7541

Power Supply Amplifiers

102678-1

About models TEC7521 & TEC7541 and this manual

Models TEC7521 and TEC7541 are single-channel amplifiers with selectable controlled voltage or controlled current output. Features of the amplifiers include:

- Front panel mounted current and voltage monitor jacks and precision 10-turn input attenuator.
- Designed to survive input overloads, continuous operation under demanding conditions and improper output connections–including shorted and improper loads.
- Front panel indicators for rapid assessment of amplifier status.
- The amplifiers install into a standard 19" rack. TEC7521 occupies 3U or rack space; TEC7541 occupies a 4U space. Aluminum construction for minimum weight and maximum cooling.
- Shipped ready to operate from 100, 120, 200, 220, or 240 volt ac mains at 50–60 Hz.

This manual covers basic operation for Techron amplifier models TEC7521 and TEC7541. It is written for electronic technicians and engineers that need to incorporate the amplifiers into their systems. It does not contain service information.

Custom versions of models TEC7521 and TEC7541 may have a different model designation, for example DC7521 or CC7541. Versions other than the basic models may have supplemental information included with this manual.

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Revision Control

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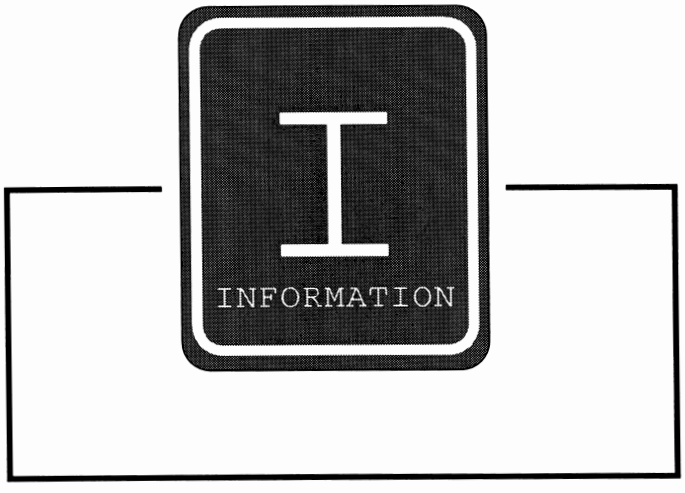
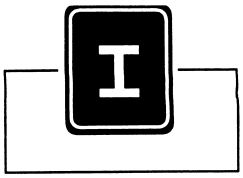


Section 1—Preinstallation

This section describes safety conventions used within this document and provides essential information about the TEC7521/TEC7541 amplifier. Review this material before installing or operating the amplifier.



1.1 Safety Conventions

The TEC7521/TEC7541 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

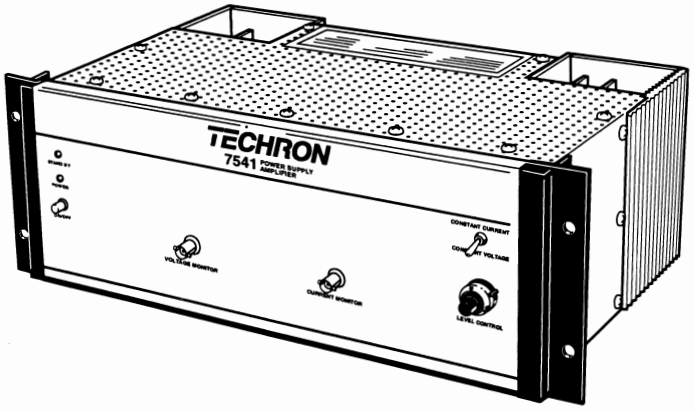
WARNING alerts you to hazards which **could** result in severe injury or death. Note the explanation of the hazard and the instructions for avoiding it.

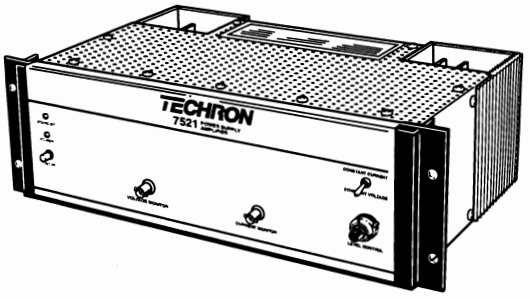
⚠ CAUTION

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 Description





1.2.1 General Description

Both *TECHRON*® Models TEC7521 and TEC7541 are single channel power supply amplifiers designed for use in the most demanding high power systems. They provide precision amplification of frequencies from dc to 20 kHz, with extremely low harmonic and intermodulation distortion and low noise. The major difference between the two models, besides physical size, is output power—288 watts rms for the TEC7521, and 559 watts rms for the TEC7541.

From the front panel, select and monitor either Controlled (Constant) Current or Controlled (Constant) Voltage mode. A push button power switch activates a green ON indicator. An amber LED indicates when the amplifier is in STANDBY. Control volume with a precision multi-turn potentiometer.

On the back panel, connect input to a BNC or to a 3–terminal barrier block. Connect output to a 3–terminal barrier block. Isolate chassis ground from electrical ground with the jumper on a 2–terminal barrier block. The grounds are connected internally with a resistance of 2.7 ohms. Massive black anodized heat sinks thermally joined to the chassis enable the entire amplifier to function as a heat sink. Forced air from two fans provide cooling.

The output transistors operate in the AB + B configuration in which quiescent current is carried by the driver stages until the output transistors are summoned by a large current demand. Output transistors are tested by Techron to verify their safe operating area. Dependable V-I current limiting provides protection against damage from shorted and low impedance loads, as well as damage from overloaded power supplies, input overload, and high frequency overloads. Dynamic thermal protection automatically switches in and out of standby operation to help minimize interupted service.

The TEC7521 & TEC7541 come complete with user's manual, four mounting screws, and four nylon washers. They are rack mountable in a standard 19-inch (48.3 cm) enclosure. All 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. General Specifications

Power Requirements: Requires 50-60 Hz AC with selectable taps for 100, 120, 200, 220, and 240V ± 10% operation. The **TEC7521** draws 750 watts max. at full output with as much as 6.25 amperes of current. The **TEC7541** draws 1200 watts max. at full output with as much as 10 amperes of current.

Power Supply: Heavy duty transformer with massive computer-grade filter capacitors. Two regulated supplies for complete isolation and stability.

Controls: Push-button on/off power switch; Precision multi-turn input level control; Controlled Current/Controlled Voltage mode locking toggle switch.

Turn-On: Four-second delay minimizes spurious signals and transients.

Displays:

- Green LED - POWER
- Amber LED - STANDBY

Connectors:

- AC line: three-wire (grounded) male connector.
- Fuse: Back panel, slotted, screw-in fuse holder.
- Input: BNC connector; 3–terminal barrier block.
- Output: 3–terminal barrier block.
- Output Monitors: BNC connectors (front panel).
- Ground Lift: 2–terminal barrier block with removable shorting strap.

Amplifier Output Protection: Short, mismatch, and open circuit proof. Limiting is instantaneous with no flyback pulses, thumps, cutouts, or premature limiting transients and other signals in Controlled Voltage mode.

Overall Protection: AC line fused. Thermal switch in control logic protects against overheating caused by insufficient ventilation. Controlled slewing rate voltage amplifiers protect overall amplifier against RF burnouts. Input overload protection is through internal resistance at inputs.

Heat Sink: Massive black-anodized heat sinks are thermally joined to the chassis, using the entire amplifier as a heat sink.

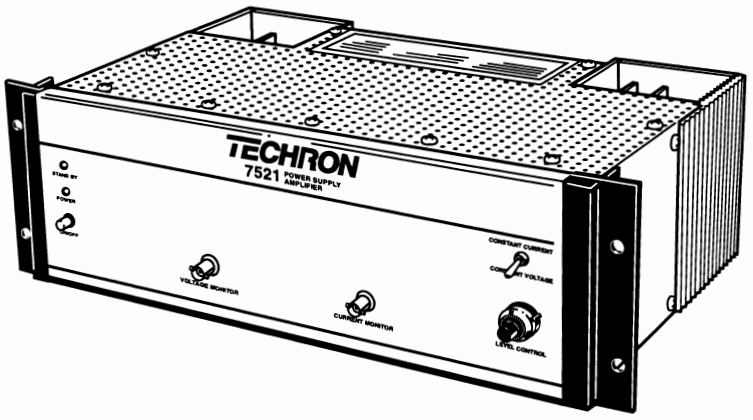
Chassis: All-aluminum construction for maximum heat conduction and minimum weight. Powder coated aluminum front panel, zinc die cast rack mounting brackets.

Dimensions: Standard rack mount 19 in. wide x 5.25 in.high x 10.25 in. deep from front panel mounting surface (48.3cm x 13.3 cm x 25.7 cm) for Model TEC7521; 19 in. wide x 7 in. high x 10.25 in. deep from front panel mounting surface. (48.3cm x 17.8cm x 26cm) for Model TEC7541.

Weight: 28 pounds (13 kg) for Model TEC7521; 58 pounds (26 kg) for Model TEC7541 net weight.

CE Requirements: Installation Class II (Overvoltage Category). Output will exceed 42.5 volts.

Pollution Degree 2: No pollution or only dry, non-conductive pollution occurs.



1.2.3 7521 Performance Specifications

(These specifications apply to Controlled Voltage mode only.)

Voltage Gain: 20.6 ± 2% or 26.3 ± 0.3 dB at maximum gain

Maximum Input: At 1kHz, (Maximum output, not clipping): No load, 1.6 volts rms; 2 ohm load, 1.3 volts rms

Output Signal: Unbalanced

Hum and Noise: (DC -100 kHz): less than 0.22 millivolts

Input Impedance: 20 kohm, ± 1% (balanced input)

Phase Response: (Output lags the input, 2 Ω resistive load). Less than 1 degree at 100 Hz; less than 2 degrees at 1 kHz; less than 13 degrees at 10 kHz; less than 60 degrees at 50 kHz.

Power Bandwidth: 144 watts rms into a 2 ohm load at the 3 dB down point over the range of 50 Hz to 25 kHz. The available power output over the range of 25 kHz to 35 kHz is approximately 75 watts rms.

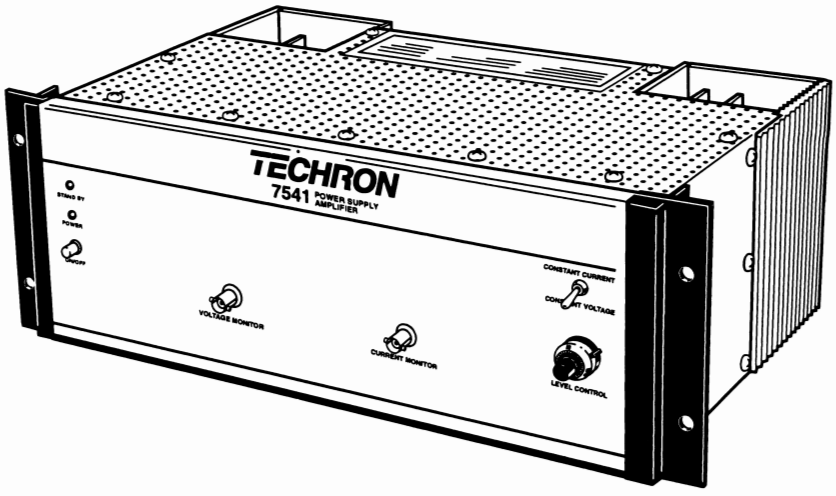
Frequency Response: DC to 35 kHz

Continuous Output Power: 288 watts into a 2 ohm load. (Sustained output power for 30 minutes with a 1 kHz sinewave input signal.)

Intermodulation Distortion: Less than 0.05% at (-40) dB of full output power.

Slewing Rate: 14volts per microsecond (no load).

Output Impedance: Less than 30 mΩ at 1kHz and less than 300 mΩ at 20 kHz



1.2.4 7541 Performance Specifications

(These specifications apply to Controlled Voltage mode only.)

Voltage Gain: 20.6 ± 2% or 26.3 ± 0.3 dB at maximum gain

Maximum Input: At 1kHz, (Maximum output, not clipping): No load, 2.2 volts rms; 2 ohm load, 1.7 volts rms

Output Signal: Unbalanced

Hum and Noise: Less than 0.22 millivolts (DC–100 kHz)

Input Impedance: 20 kohm, ± 1% (balanced input)

Phase Response: (Output lags the input, 2 Ω resistive load). Less than 1 degree at 100 Hz; less than 2 degrees at 1 kHz; less than 13 degrees at 10 kHz; less than 55 degrees at 50 kHz

Power Bandwidth: 273 watts rms into a 2 ohm load at the 3 dB down point over the range of 50 Hz to 25 kHz. The available power output over the range of 25 kHz to 35 kHz is approximately 175 watts rms.

Frequency Response: DC to 35 kHz

Continuous Output Power: 546 watts rms into a 2 ohm load. (Sustained output power for 30 minutes with a 1 kHz sinewave input signal.)

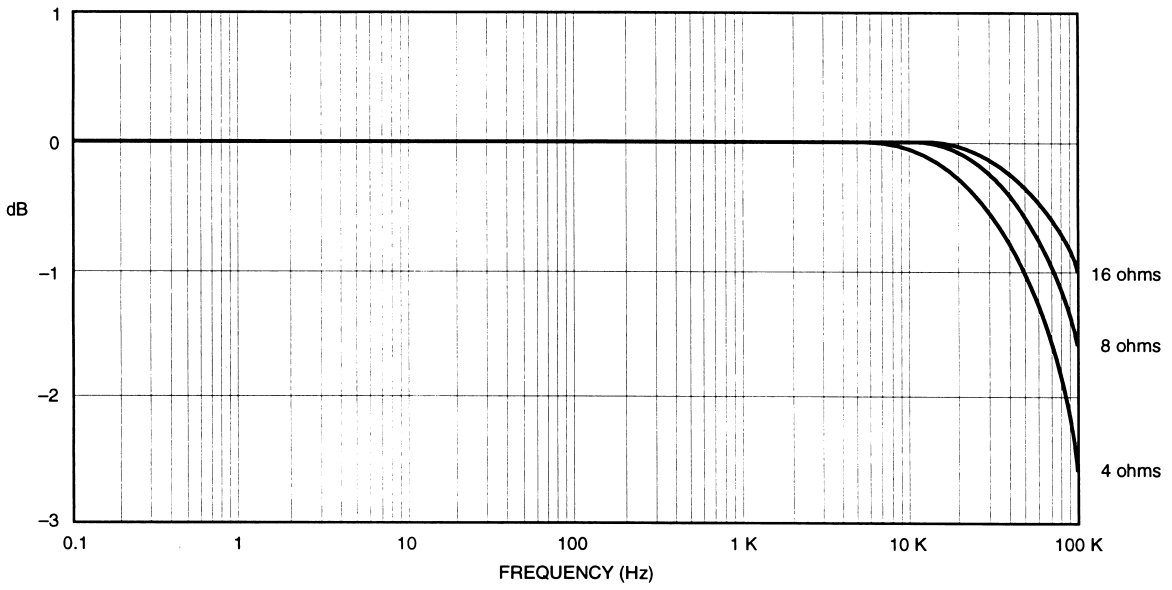
Intermodulation Distortion: Less than 0.05% at (-40) dB of full output power

Slewing Rate: 21 volts per microsecond (no load)

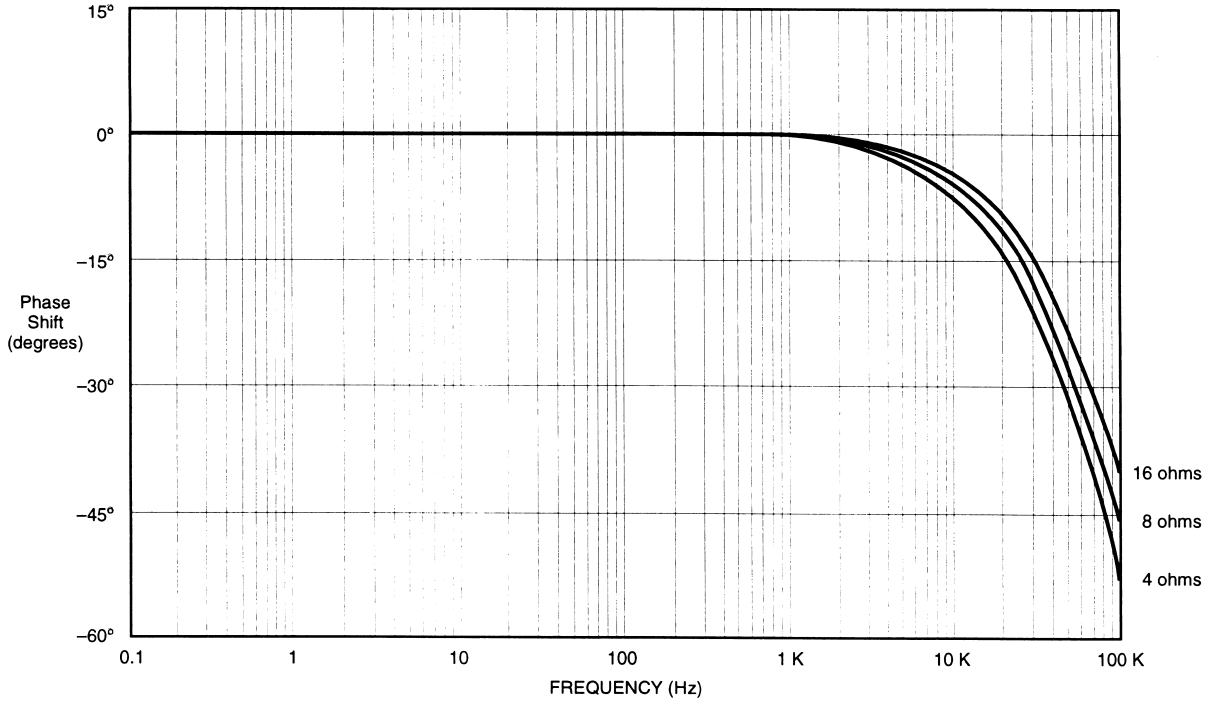
Output Impedance: Less than 30 mΩ at 1kHz and less than 300 mΩ at 20 kHz

1.2.5 Performance Graphs

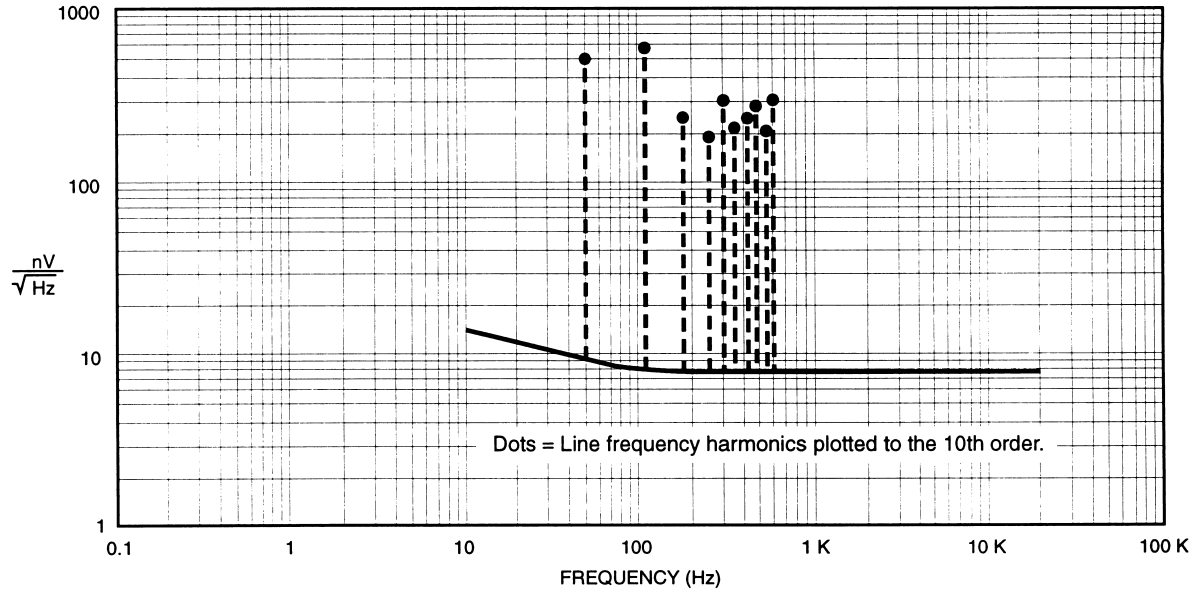
The graphs on the following pages show the performance of Model TEC7521 and/or Model TEC7541 in the Constant Voltage mode only.



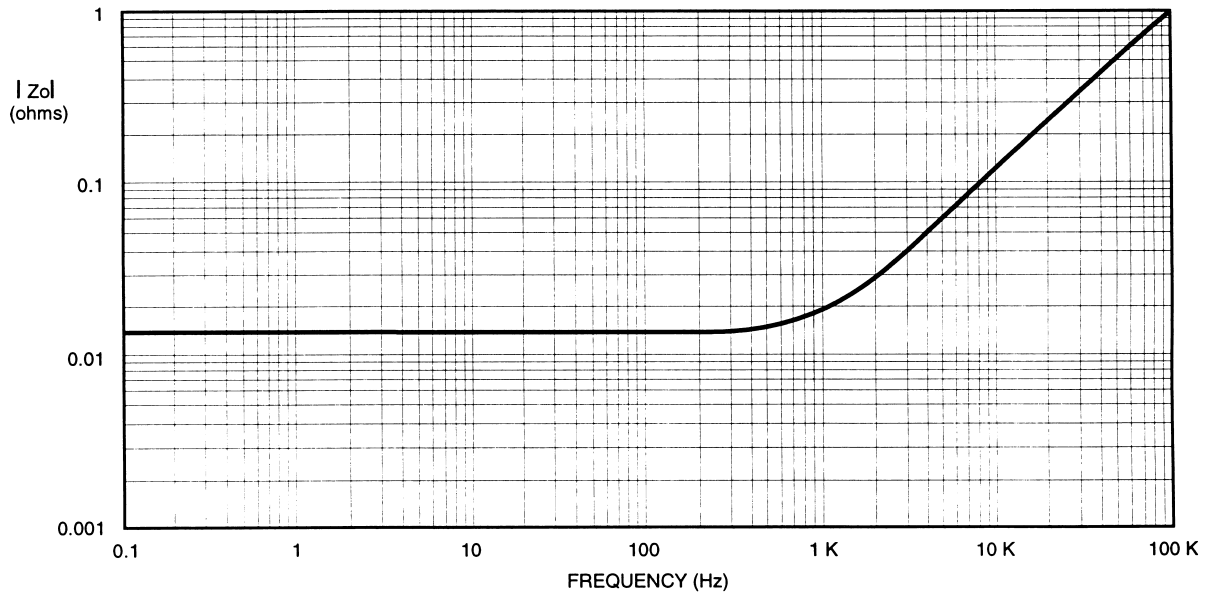
TEC7521/TEC7541 Nominal Frequency Responce



TEC7521/TEC7541 Nominal Phase Responce



TEC7521/TEC7541 Nominal Noise Spectrum



TEC7521/TEC7541 Nominal Output Impedance

1.2.6 User Interface

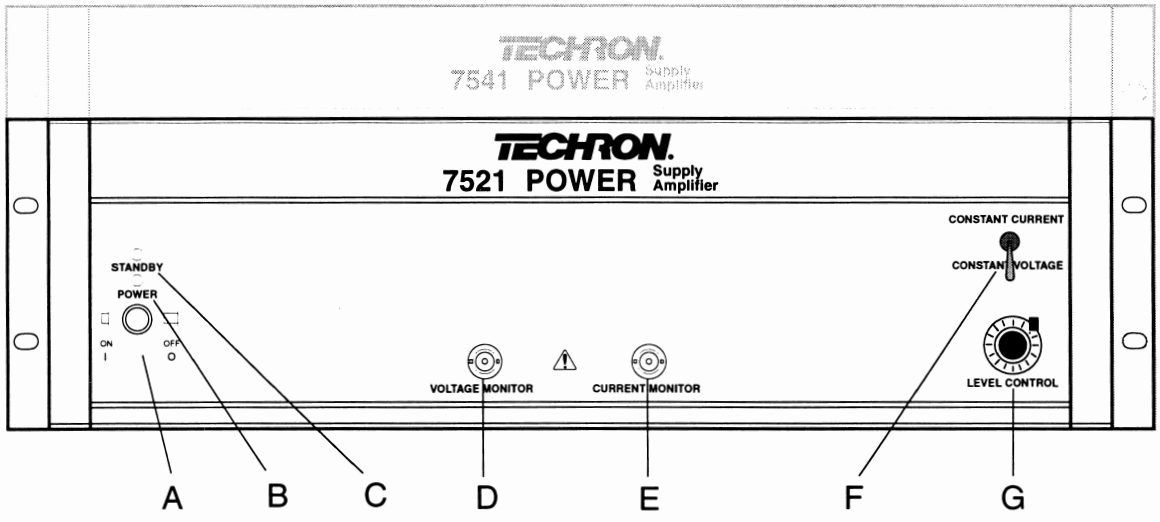
During actual amplifier operation, the TEC7521/TEC7541 interface is quite simple and straightforward. There are only three controls on the front panel—a push-button ON/OFF switch, a locking toggle switch for selecting controlled current or controlled voltage operation, and a precision level control. Two LEDs, a green power indicator and an amber standby indicator, on the front panel keep you informed of amplifier status. Monitor either the output voltage or output current through the BNC connectors.

On the back panel, choose between a BNC or a 3–terminal barrier block for easy input connection. A 3–terminal barrier block provides connection for output lines. A 2–terminal barrier block allows you to lift the chassis ground from the electrical ground. A 3–wire AC cord and an accessible fuse holder allow you to connect power and change fuses easily.

For location and operation of the amplifier's functions refer to the following two pages.

1.2.6.1 Front Panel Functions

The following illustration, showing the TEC7541 behind the TEC7521, has captioned call-outs providing a visual location of the TEC7521/TEC7541 front panel functions. Both amplifiers have the same functions in basically the same locations.



A. Power Switch
This push-button ON/OFF switch controls power to the amplifier.

B. Power Indicator
A green LED illuminates when the amplifier is ON.

C. Standby Indicator
This amber indicator illuminates when the amplifier is in STANDBY, as when the amplifier is overheating or during the 4–second turn-on delay.

D. Voltage Monitor
This BNC connector test point is used to monitor the amplifier output voltage directly. *Do not connect Loads of less than 1 M Ω here.*

E. Current Monitor
This BNC connector test point is used to monitor the amplifier output current. The Current Monitor is calibrated for 10 A per volt. The amplifier is compensated for a load of 4 Ω in series with 500 µHy at 1 kHz in CC (Controlled Current) mode. No compensation needed in CV (Controlled Voltage) mode.

F. CC/CV Switch
The Controlled (Constant) Current/Controlled (Constant) Voltage selector switch is a locking toggle switch. To use, gently pull the toggle handle out then switch to the desired position and release.

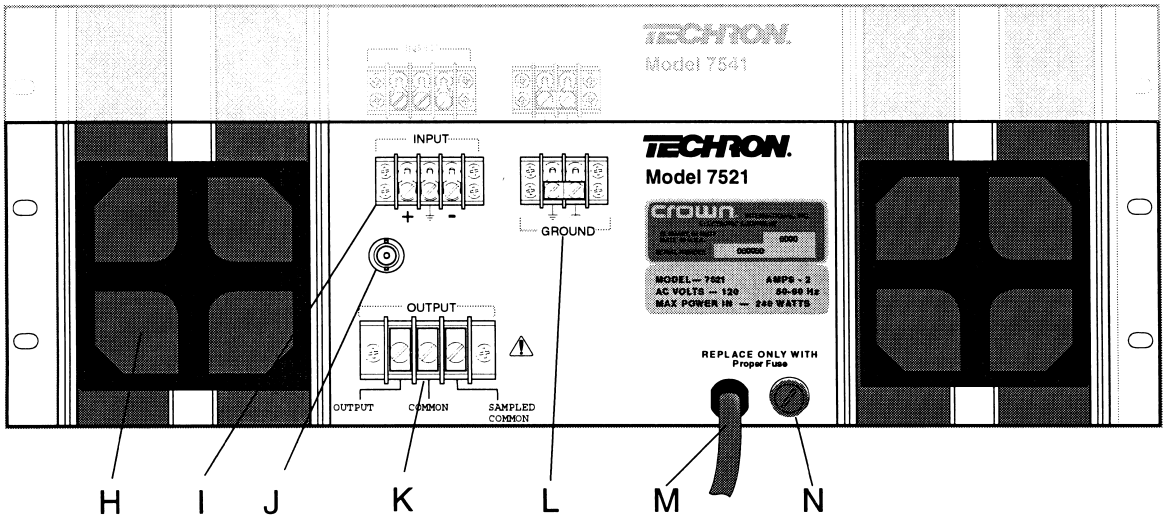
G. Level Control
The input level control is a precision multi-turn locking potentiometer. To secure the desired level against change, lock it in place with the lever on the side of the knob.

⚠ CAUTION

Do not operate Controlled Current mode without taking the precautions described in Section 3.3.6.

1.2.6.2 Back Panel Functions

The following illustration, showing the TEC7541 behind the TEC7521, has captioned call-outs providing a visual location of the TEC7521/TEC7541 back panel functions. Both amplifiers have the same functions in basically the same locations.



H. Cooling Fan
In addition to the thick aluminum heat sinks, electrical whisper fans insure adiquate cooling of the amplifier.

I. Barrier Block Input
This input option saves you a connector and is more perminate. Do not use the BNC input when using this one.

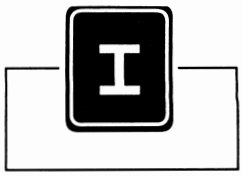
J. BNC Input
This input option allows quick change and complete shielding. Do not use the Barrier Block input when using this one.

K. Output Barrier Block
Connect output lines from the load to this 3–terminal barrier block. When operating in the Controlled Current mode, use only the **Output** terminal and the **Sampled Common** terminal for driving the load.

L. Ground Lift
The chassis ground can be lifted from the electrical ground by removing the shorting strap from this 2–terminal barrier block. The grounds are connected internally by 2.7 Ω.

M. Power Cord
Power connection is through a standard 3–wire AC cord and plug.

N. Fuse
A slotted, screw-in fuse holder makes easy access to the AC line fuse. Model TEC7521 uses a 6.25 A for 100-120 VAC, and a 3 A for 200-240 VAC. Model TEC7541 uses a 10 A for 100-120 VAC, a 5 A for 200-220 VAC, and 4 A for 240 VAC.



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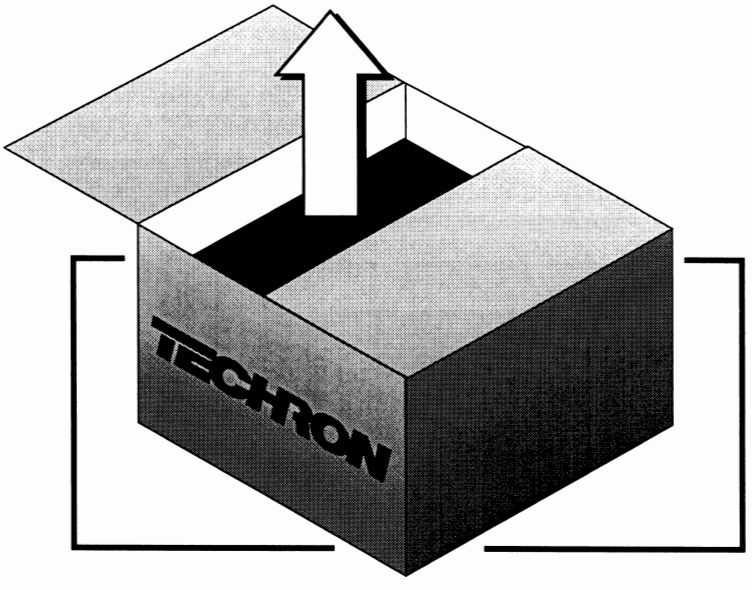
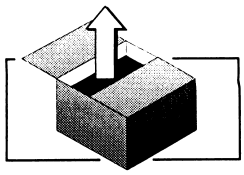


Section 2—Installation

This section provides general guidelines for installing the Model TEC7521/TEC7541 amplifier with special emphasis on system installations.



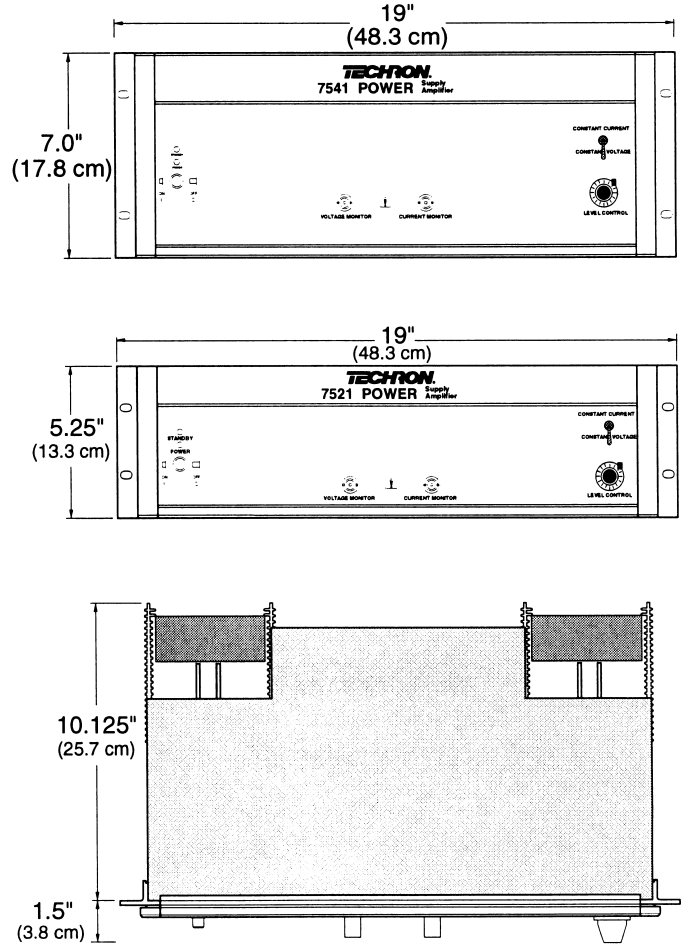
2.1 Unpacking

Every TECHRON Model TEC7521/TEC7541 is carefully inspected and tested prior to leaving the factory. Carefully unpack and inspect the unit for damage in shipment. If damage is found notify the transportation company immediately. Save the shipping carton and packing materials as evidence of damage for the shipper's inspection. TECHRON will cooperate fully in the case of any shipping damage investigation. In any event, save the packing materials for later use in transporting or shipping the unit.

The amplifier is not portable and will require the assistance of another individual or equipment to unpack, move, mount, and unmount.

2.2 Mounting

The Model TEC7521/TEC7541 mounts in a standard 19-inch rack. The illustration below shows the only mounting difference between the two amplifiers. The TEC7541 is higher than the TEC7521. You may want to allow at least two additional inches of depth for cables and connectors extending out from the back. Maintain ambient temperature of 50°–99° F within the cabinet through adequate ventilation.



Mounting Dimensions

⚠ WARNING

To reduce the risk of *ELECTRIC SHOCK* or FIRE HAZARD, do NOT expose the TEC7521/TEC7541 to rain or moisture.

⚠ CAUTION

Do not install TEC7521/TEC7541 in a small sealed chamber of any kind. Improper operation and overheating will result.

2.3 Making Connections

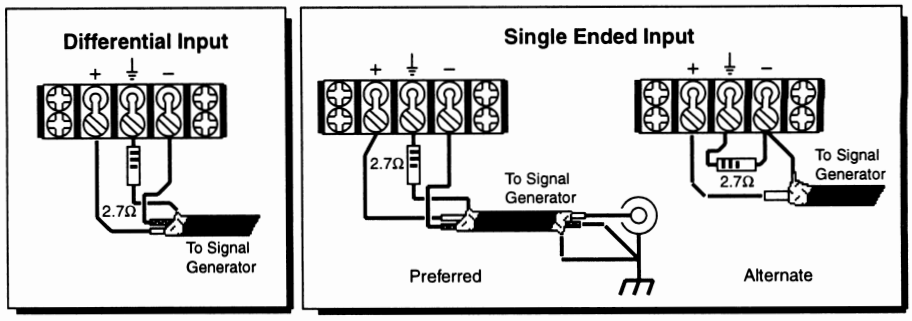
Before beginning the installation of your amplifier, please note the following:

- ❑ 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:

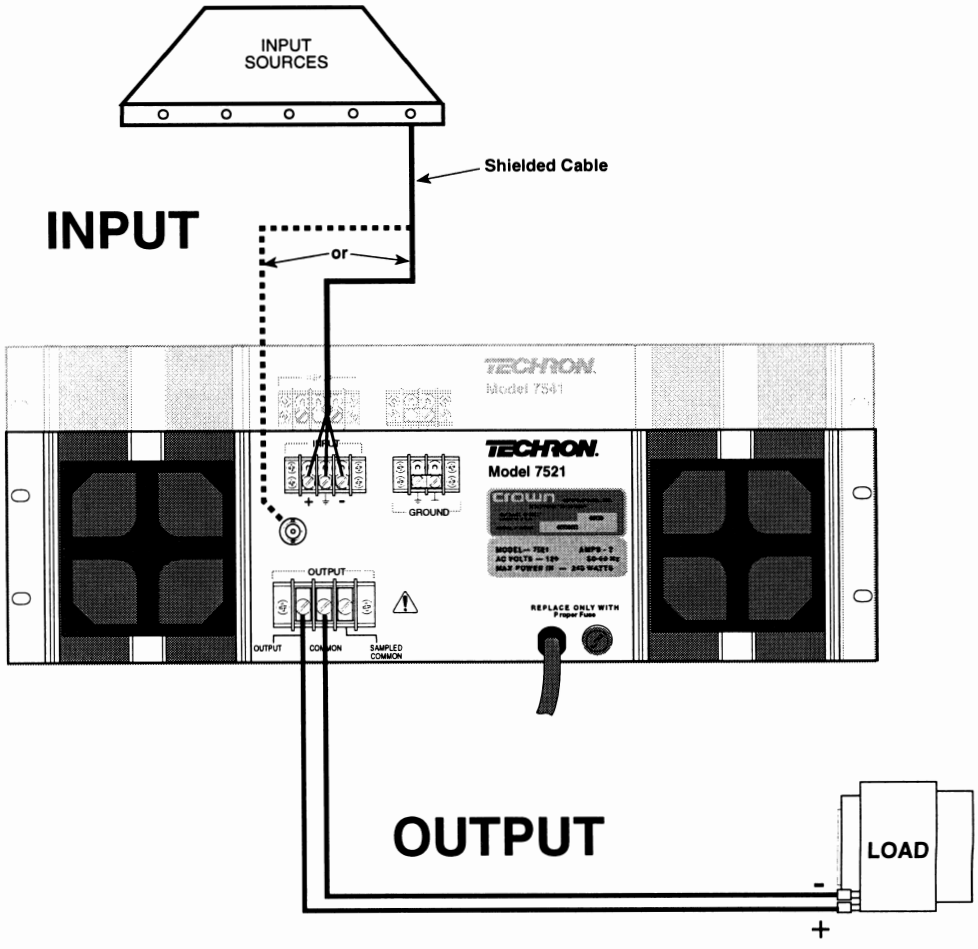
1. **Use only shielded cable on inputs.** The higher the density of the shield (the outer conductor), the better the cable. Spiral wrapped shield is not recommended.
2. **Use only one input option at a time.** Use one or the other, but not both, type of connectors.
3. **The output wire and connectors should be heavy enough** to carry the intended current to the load.
4. **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.
5. **Keep unbalanced input cables as short as possible**—avoid lengths greater than 10 feet.
6. **Do not run signal** (input) **cables together with high level wiring** such as load (output) wires or AC cords (this helps avoid most hum and noise).
7. **Do not short the ground lead of an output cable to the input signal ground**. Oscillations may result.
8. **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 will result in unreliable operation.
9. **Never connect the output to a power supply output, battery, or power main**. These connections will cause serious damage to the amplifier.
10. **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.
11. **Do not short the COMMON output terminal to the SAMPLED COMMON output terminal.** Unreliable operation will result.

12. **Input connection** can be either differential or single ended. See the illustrations below for recommended connections.



2.3.1 Controlled Voltage Hookup

To put the amplifier in Controlled Voltage mode, move the locking toggle switch on the front panel to the Controlled Voltage postion. The illustration below shows the hookup to input options and output connection to the load.



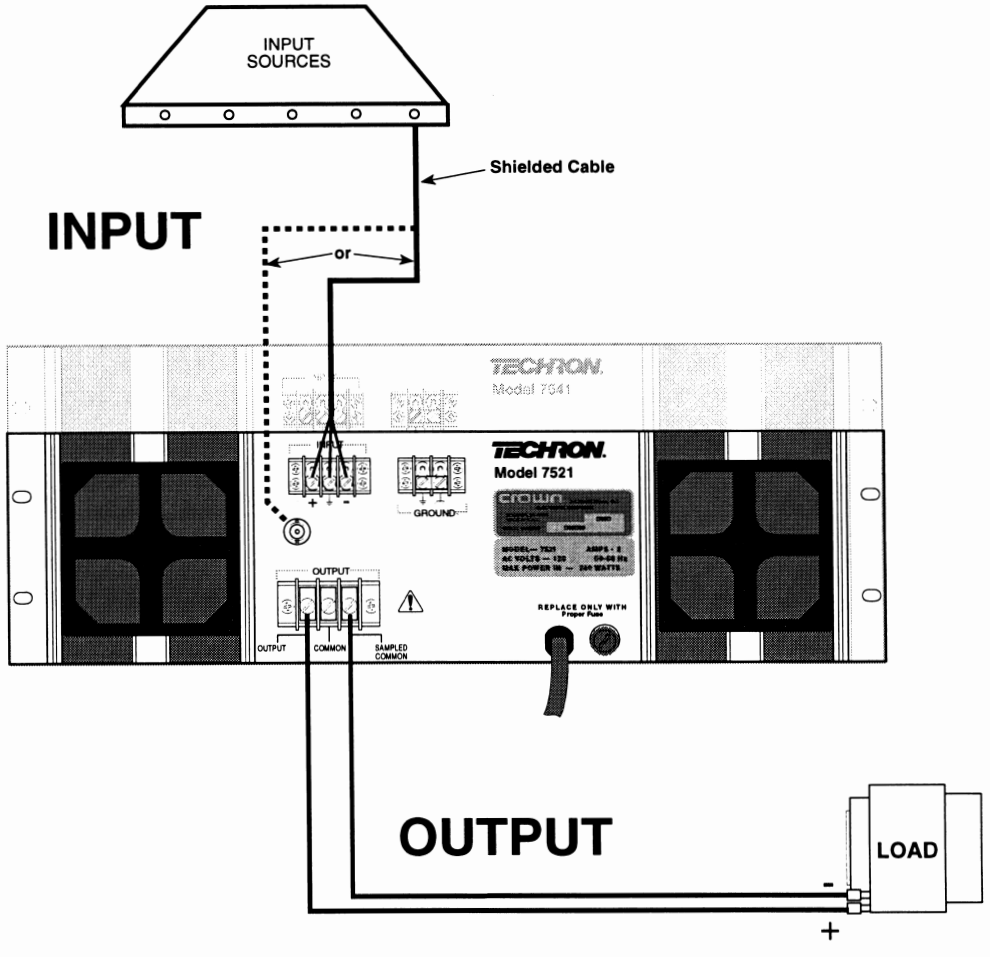
Controlled Voltage Hookup

2.3.2 Controlled Current Hookup

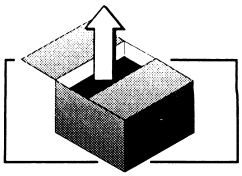
Connect Controlled Current output to the OUTPUT and SAMPLED COMMON barrier block terminals only. Do not use the COMMON terminal in Controlled Current mode. Place the front panel toggle switch in the Controlled Current mode. Follow the illustration below for input and output connections.

⚠ CAUTION

The Controlled Current mode is a special mode of operation which requires careful attention to details, otherwise, damage will occur to equipment. Read Section 3 before operating in the CC mode.



Controlled Current Hookup



2.3.3 Connecting Power

The TEC7521/TEC7541 uses a 3-wire (grounded) AC line system. At times, the third wire ground may introduce a ground loop into the system. If a ground loop is present, lift the chassis ground from the circuit ground by removing the ground strap from the 2–terminal barrier block on the back panel.

The AC power source must be between 50-60 Hz. The AC line voltage must be within ± 10%, otherwise improper operation may result. The serial tag on the back panel indicates the voltage for which the amplifier is connected. Model TEC7521/TEC7541 may operate from five different AC voltages; they are 100, 120, 200, 220 and 240 volts. To convert from one voltage to another, follow these instructions:

⚠ DANGER

The risk of potentially lethal *ELECTRIC SHOCK* exists when covers are removed! Disconnect AC power and discharge the power supply capacitors before service.

Only a competent technician should attempt to convert from one voltage to another. Follow these instructions thoroughly.

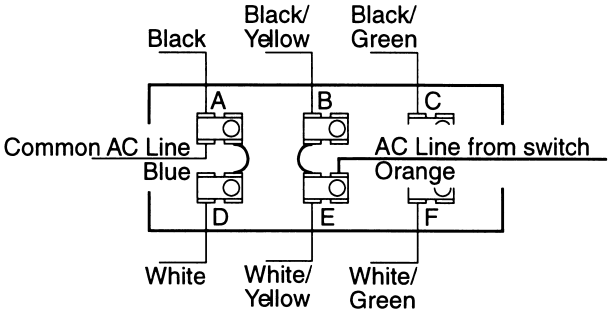
1. Turn the amplifier off and disconnect it from any power source.
2. Remove the top and bottom covers.
3. If the unit has been in recent use, discharge the large power capacitors by placing a 10 ohm, 5 watt resistor across each capacitor terminal to ground. USE EXTREME CAUTION while handling the resistor.
4. Locate the diagram in the illustration on the next page that corresponds to the desired voltage. Move the orange AC wire and orange jumpers to match the diagram.
5. Carefully check all connections and reinstall the top and bottom covers on the amplifier.
6. Check to be sure the proper fuse is installed in the back panel. Install the correct one if necessary:

(Use a type 3 AG, 250 V, slow blow fuse)

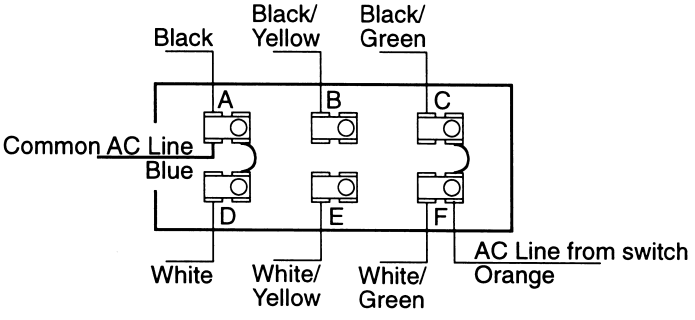
Model TEC7521 uses: 6.25 ampere for 100-120 volt ac operation
3 ampere for 200-240 volt ac operation.

Model TEC7541 uses: 10 ampere for 100-120 volt ac operation
5 ampere for 200-220 volt ac operation.
4 ampere for 240 volt ac operation.

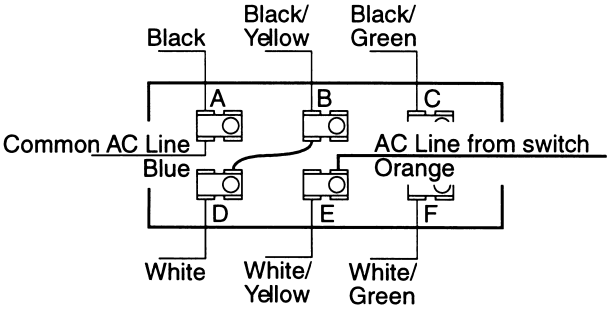
100 Volts AC



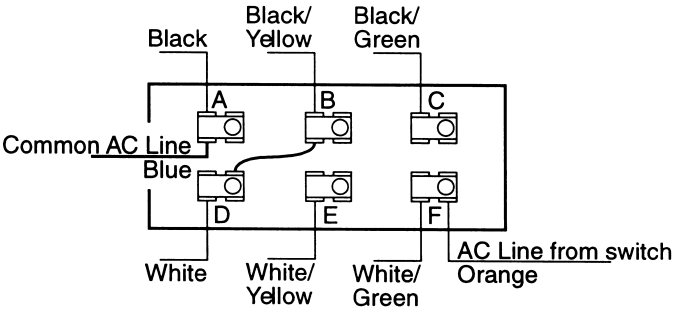
120 Volts AC



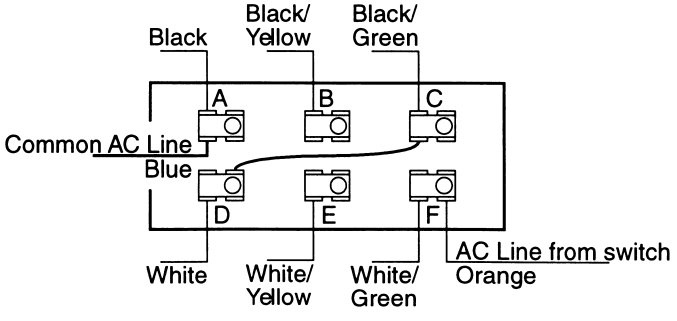
200 Volts AC



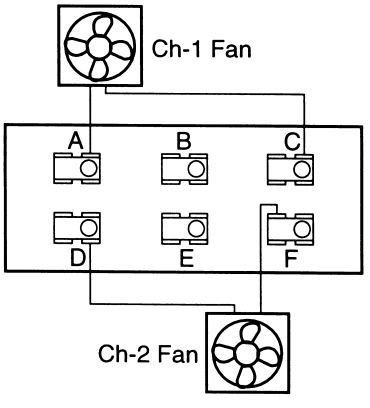
220 Volts AC



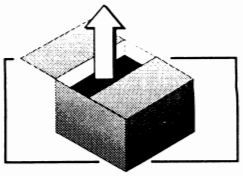
240 Volts AC



The fan connections always remain as shown below.



Internal AC Voltage Conversion Connections



2.4 Load Protection

The most common method of load protection is a fuse in series with the load. A single fuse may be used, or multiple fuses may be used in the case of multiple phase loads. Ordinary fuses will help prevent damage due to a prolonged overload. To protect against large transients, use high-speed instrument fuses such as little fuse 361000 in series. If the load is susceptible to damage by overheating, use a fuse or circuit breaker having the same slow thermal response as the load, for example, a slow-blow fuse.

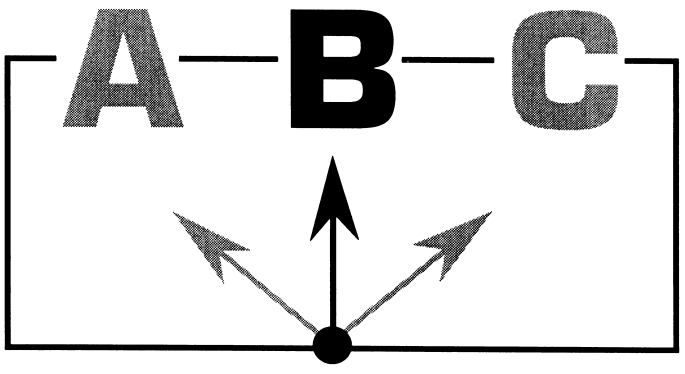
⚠ CAUTION

Whenever an OVERLOAD condition is known to be present, take the following steps as applicable to protect amplifier and load: 1. Reduce or limit input level. 2. Disconnect load from amplifier.

Each power section is independently protected against excessive internal operating temperatures. This circuitry will place the unit in the STANDBY mode in case of overheating. When sufficient cooling has taken place, operation resumes automatically.

While operating in Controlled Voltage mode, the TEC7521/TEC7541 is well protected against hazards common to high power amplifiers, including shorted, open, or mismatched loads, overloaded power supplies, excessive temperature, input overload damage, and high frequency overload damage.

> ***Note:*** A relatively simple internal wiring procedure is available for activating the low frequency interrupt circuit. Contact TECHRON Technical Service Department for information on this modification.



Section 3—Applications

This section describes the uses of the Techron Model TEC7521/TEC7541 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 TEC7521/TEC7541 for a new application. For these users, this section provides general theory and guidance.

This section assumes competence on your part in terms of amplifier systems, electronic components, and generally sound electronic working practices. You are encouraged to contact Techron Application Engineering for assistance with any modification or configuration of the TEC7521/TEC7541.

⚠ 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 TEC7521/TEC7541 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 your need is to have the output voltage waveform to be like the input waveform, then operate the amplifier in the Controlled Voltage mode. If you want the output current waveform to be like the input waveform, then operate in the Controlled Current mode.

If these special operating modes are still unable to meet the needed power capability, contact TECHRON engineering, and/or consider using a Techron model or models with higher power handling capacity.

3.2.1 Controlled Voltage Mode

The wide bandwidth, and extra protection of the Controlled Voltage mode is selected for reliably driving voltage dependent loads.

The amplifier provides full protection circuitry that automatically shuts the unit down (Standby) when short circuit or overheating conditions exist. Normal operation will resume immediately when the excessive demand, heat, or other problem is removed. There is never any danger to the amplifier when protection circuitry is activated.

Either the SAMPLED COMMON output terminal or the COMMON terminal can be used in this mode along with the OUTPUT terminal. The Current Monitor output on the front panel will not function if the SAMPLED COMMON terminal is not used.

3.2.2 Controlled Current Mode

When your application depends on control from current flowing through an inductive load, then use the Controlled Current mode. Since current control is very dependent on load characteristics, you must compensate the amplifier to your particular load, unless you use the standard load of 4 Ω in series with 500 µHy for which the amplifier is compensated at the factory. See sections 3.2.2.1 and 3.2.2.2 below for the compensation procedures.

⚠ CAUTION

Because of the wide range of current control applications certain precautions must be taken when operating in the Controlled Current mode:

1. Always have some type of DC path in the load. Don't use blocking capacitors. Damage to the amplifier will occur if the load is open!
2. All specifications are dependent on load characteristics and can change accordingly.
3. The bandwidth is not as high as in Controlled Voltage mode, again dependent on your load, around 10 kHz.
4. Use only the OUTPUT and SAMPLED COMMON output terminals.
5. If oscillations occur, turn the amplifier OFF immediately.
6. Do not short circuit the output in Controlled Current mode.
7. Never operate the amplifier without a proper load.

⚠ CAUTION

Damage to the amplifier and/or load could result from improper compensation! Follow the procedures below if you change loads.

3.2.2.1 Model TEC7521 Compensation Procedure

The following is a guideline for compensating the amplifier in the Controlled Current mode. Controlled Voltage mode requires no compensation. The compensation components C5, C6, and R16 are located on the Current Control circuit board which is mounted on the inside of the back panel. Refer to the illustration on the following page for component location.

The compensation component values for the standard load of 4 Ω in series with 500 µHy shipped from the factory for the TEC7521 is: C5 = open, C6 = .01 µf, R16 = 100 kΩ. To find new values for a different load:

A. Calculate the approximate value of R16 using the following formula:

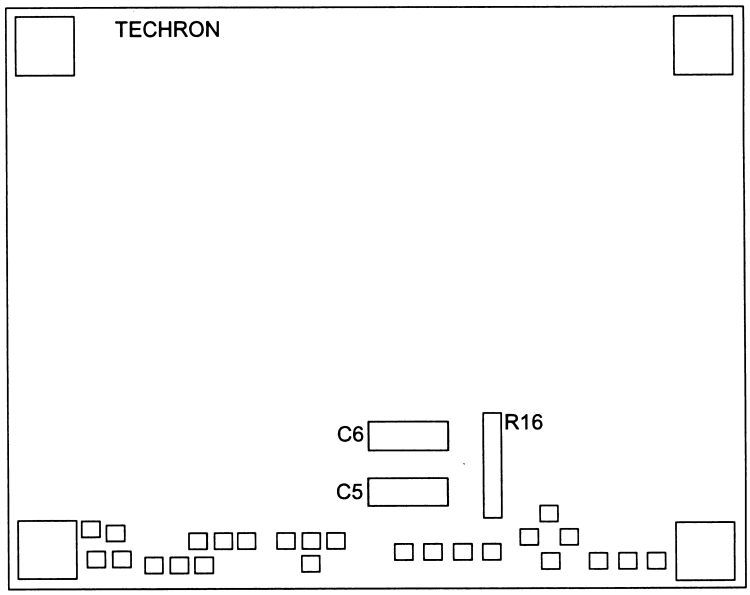
$$Rc = 15{,}708 \times L \times BW$$

Rc — compensation resistance in ohms.
L — load inductance in henries.
BW — bandwidth in hertz.

B. Calculate the approximate value of C6 using the following formula:

$$Cc = \frac{1}{(R + .033) \times 15{,}707 \times BW}$$

Cc — compensation capacitance in farads.
R — resistance of the load in ohms.
BW — bandwidth in hertz.

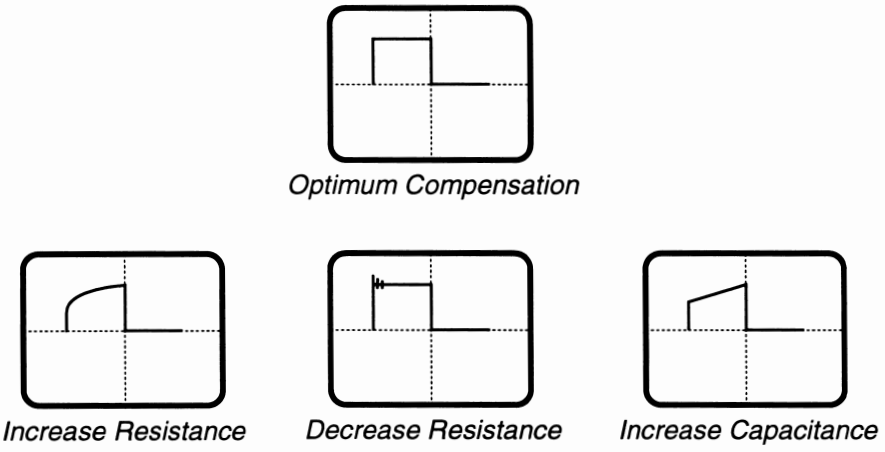


Controlled Current Circuit Board

C. Further refine the compensation values using an RC (Resistor and Capacitor substitution) decade box by following these steps:

1. Use a short pair of twisted wires to connect the RC box in the place of R16 and C6 with the resistor and capacitor wired in series .
2. Dial in the calculated values on the RC decade box.
3. Connect your load to OUTPUT and SAMPLED COMMON terminals.
4. Input a square wave at the highest frequency used in the application with the generator set for minimum amplitude.
5. Connect an oscilloscope to the Current Monitor on the front panel.
6. Turn the amplifier ON. If there are no oscillations, increase the generator amplitude to a workable level and go to step 9.
7. If the system oscillates, turn the amplifier OFF and try other compensation values on the decade box until stability is achieved.
8. Model TEC7541 may require increasing the value of C5 by a factor of three starting with 47 pf. This will decrease the bandwidth of the system; however, it will make the system more stable and allow you to refine the compensation values. After finding more suitable values for R16 and C6, remove or decrease the value of C5 to allow an acceptable bandwidth and stability. Leave C5 open for the TEC7521.

9. To find the optimum values of R16 and C6, adjust the observed oscilloscope waveform from the Current Monitor output according to the waveforms shown in the illustration below.



Waveforms For Adjusting Compensation Values

10. After the optimum values have been found, remove the RC box and install components with those discovered values. The values may have to be adjusted slightly due to the inherent errors in an RC box.

3.2.2.2 Model TEC7541 Compensation

The compensation procedure for the Model TEC7541 is the same as for the Model TEC7521 in the previous section (3.2.2.1) except for the following:

A. Calculate the approximate value of R16 using the following formula:

$$Rc = 20{,}000 \times 3.14 \times L \times BW$$

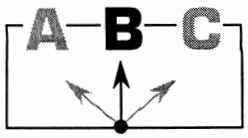
Rc — compensation resistance in ohms.
L — load inductance in henries.
BW — bandwidth in hertz.

B. Calculate the approximate value of C6 using the following formula:

$$Cc = \frac{L}{R \times Rc}$$

Cc — compensation capacitance in farads.
R — resistance of the load in ohms.
BW — bandwidth in hertz.

C. C5 is installed as 47 pf from the factory.



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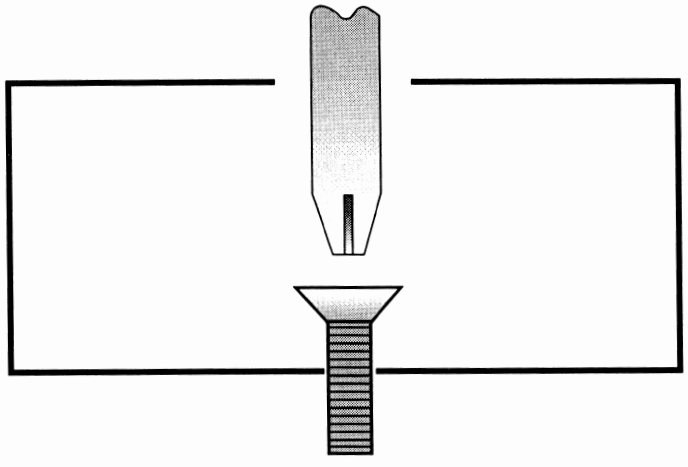
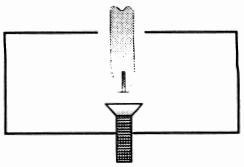


Section 4—Maintenance

This section contains information on maintenance for the amplifier. The only user-maintainable parts are the fuses and the air filters. All internal service should be done only by a qualified technician.



4.1 Periodic Maintenance

Models TEC7521 and TEC7541 require only that the fan filters be cleaned every six months or as needed. No other service needs to be scheduled.

4.2 Replacing Fuse

⚠ WARNING

Always turn power OFF when changing fuses. Always use the correct fuse size. Using other fuse sizes may be hazardous to you or the amplifier.

If a fuse blows, follow these steps:

1. Turn off power, and remove the power cord plug from the power outlet.
2. Twist open the fuse holder.
3. Remove the blown fuse from the fuse holder, and replace it with an appropriate new fuse:

(Use a type 3 AG, 250 volt, slow blow fuse)

Model TEC7521 uses:	6.25 ampere for 100-120 volt ac operation 3 ampere for 200-240 volt ac operation.
Model TEC7541 uses:	10 ampere for 100-120 volt ac operation 5 ampere for 200-220 volt ac operation. 4 ampere for 240 volt ac operation.

4. Reinsert the fuse holder.
5. Reinsert the cord plug into the power outlet, and place power on.

4.3 Cleaning Air Intake Filters

Model TEC7521/41 has two cooling fans. The fans are located on the heat sinks at the back of the amplifier. Covering the air intakes are dust filters. Check these filters periodically and clean as needed. To remove a filter follow the steps below:

1. Turn off power, and remove the power cord plug from the power outlet.
2. Loosen the four screws at the corners of the plastic filter cover, then remove the two top screws.

3. Remove the filter cover and the filter from the amplifier.
4. Clean the filter with mild dishwashing detergent and warm water.
5. Rinse thoroughly and allow to air dry before reinstalling.
6. Install the filter and plastic cover by reversing steps 1 through 3.
7. Reinsert the cord plug into the power outlet, and place power back on.

4.4 Servicing Internal Parts

⚠ WARNING

TO PREVENT ELECTRIC SHOCK DO **NOT** REMOVE COVER PANELS. NO USER SERVICEABLE PARTS ARE INSIDE. REFER SERVICING TO A QUALIFIED TECHNICIAN.

This unit contains high-voltage conductors and sophisticated internal circuitry that should only be serviced by a fully trained factory-qualified technician.

The unit *must* be shipped to Techron in the original factory pack to prevent physical damage to the amplifier. If you don't have the original shipping container, contact Techron, and a replacement will be sent promptly.

Shipments should be sent by an appropriate parcel delivery system. You must bear the expense of all taxes, duties, and customs fees when transporting the unit.

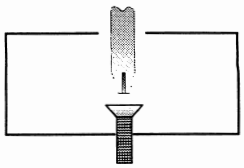
The factory will return the unit via UPS ground where available. Expedited air services are also an option.

Enclose a letter explaining the nature of the problem and what service you would like. Include your return shipping address and telephone number.

Ship the unit to the following address:

Techron
Customer Service Department
1718 West Mishawaka Road
Elkhart, IN 46517–4095
U.S.A.

Phone: 219–294–8315
Fax: 219–294–8125
e-mail: service-techron@crownintl.com



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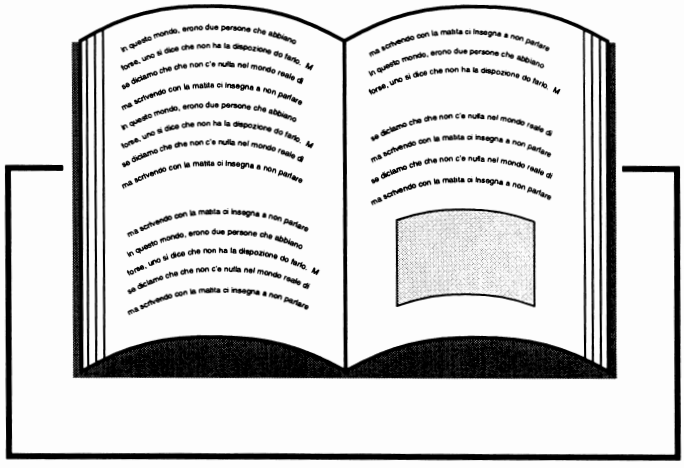


Section 5—Principles of Operation

This section discusses the principles upon which the Model TEC7521/TEC7541 amplifier functions.

5.1 General Information

This section describes basic circuit principles for models TEC 7521 and TEC 7541. It is not service information and should not be used as such. Always refer servicing matters to the Techron factory or a qualified service center.

Model 7521/7541 is composed of five separate areas. The areas are:

- Input and current control
- Power Section
- Control and Logic
- Power Supply
- Indicators

Refer to the block diagram at the end of this section. While the diagram shows only overall signal flow, the main feedback loop and the current control loop, there is sufficient detail to illustrate the function of each circuit.

Only one power section is shown for simplicity; operation of both power sections is identical.

5.2 Input and current control

The input signal is connected to the amplifier at either one of two connectors on the back panel. Either the barrier block or the BNC connection can be used to connect input signal to the amplifier. As shipped from the manufacturer, the BNC connector is connected to the non-inverting input of the amplifier. The input signal from the back panel then drives the input buffer amplifier.

The input buffer amplifier is an active differential op-amp stage with gain fixed by precision resistors. In addition to providing isolation and high common mode rejection, the buffer amplifier converts differential input signals to an unbalanced signal. The 10-turn precision potentiometer between the input buffer and the current control amplifier provides level control to vary the input signal level.

The current control amplifier serves two purposes. First, when S1 is in the CV (constant voltage) position, the current control amplifier is a unity gain amplifier. Second, when S1 is in the CC (constant current) mode, the load current of the amplifier is compared to the desired current waveform coming from the input buffer amplifier. The output of the current control amplifier is the voltage signal required to produced the desired output current in reactive loads. C5, C6 and R16 comprise the principle compensation network which serves to control the open loop gain of the closed-loop controlled current system. The output of the current control amplifier drives the inputs to the two power sections which are discussed in a following section.

The load current of the amplifier is sensed by a single high wattage resistor. The voltage developed across this resistor is amplified by the current amplifier and is used by the current control amplifier

The current monitor output is routed to the front panel BNC jack. This output is isolated from capacitive loads by a series resistor.

5.3 Power Section

Two identical power sections operate in parallel to provide voltage and current amplification for the amplifier. Discussion here is limited to one power section.

The input signal is fed to the main amplifier of both power sections from the current control amplifier.

The first active stage in the power section is the main amplifier stage which is constructed around a low-noise op-amp. The maximum gain of the amplifier is fixed in the main amplifier stage with precision resistors R_a and R_b. The voltage gain of the power sections are trimmed to match each other with a gain balance potentiometer. The input bias compensation stage compensates for dc drift in the main amplifier stage with a temperature-controlled circuit.

The gated switches at the output of the main amplifier stage provide a method to control the signal path through the amplifier. The control and logic stage (discussed in the next section) sets the state of the gated switches.

The signal translator stage, combined with the push-pull last voltage amplifier, form the voltage amplifier section of the amplifier. No voltage amplification is performed beyond these stages.

Current amplification circuitry consists of three stages: the predriver, the driver and the output transistors. Connected to output stage is the protection circuitry which is activated when a predetermined amount of voltage and/or current is drawn across the output stage sense resistors. This protection signal is then fed back to the limiting circuit which limits any increase in the bias servo voltage to the power transistors.

The output stages drive the load through an LCR output terminator network. This network provides isolation from the load and a consistent high frequency load for the amplifier. The outputs from both power sections are combined at the back panel through ballast resistors. The load is connect to the amplifier at a back panel barrier block strip.

The combined outputs of the two power sections are fed to the front panel BNC voltage monitor via a resistor.

5.4 Control and logic stage

The control and logic stage opens the gated switches when activated by any one of three circuits: turn-on delay, low frequency interrupt and thermal protection.

Turn-on delay— After the amplifier is turned on, the turn-on delay keeps the amplifier in a muted condition for four seconds. By keeping the gated switches open, the load connected to the output is protected from dc transients while the various power supplies and other circuits become stable. The turn-on delay circuit consists of an RC circuit controlling a relay.

Low frequency interrupt—The low frequency interrupt protects loads by muting the amplifier when it senses an output signal that is less than 2 Hz and greater than 10 volts.

> ***Note:*** Model 7521/7541 is shipped with the low frequency interrupt disabled. To enable this feature, contact the Techron service department.

When the low frequency interrupt circuit is activated, the signal to the output stage is muted and the low frequency interrupt will not sense the low frequency signal at the output. This will allow the amplifier to become enabled after the four-second, turn-on delay cycle is complete. This process will continue as long as low frequency is present at the output of the amplifier.

Thermal Protection—This circuit prevents damage to the output transistors and heat sink materials by shutting down the amplifier if it becomes too hot. Semiconductor thermal sensors are mounted on each of the output stage heat sinks and convert the temperature of the heat sinks to calibrated voltages. When the voltage from either heat sink exceeds a preset threshold, the control and logic circuit opens the gated switches. To prevent erratic switching, hysteresis is built into the thermal protection circuit.

5.5 Power Supply

The power supply is constructed around a single power transformer. The transformer has dual primary windings with voltage taps to provide the correct operating voltage for 100, 120, 200, 220, or 240 volt operation. The main dc supplies are a full-wave capacitor input type with a heavy duty bridge rectifier mounted on the chassis for maximum heat sinking.

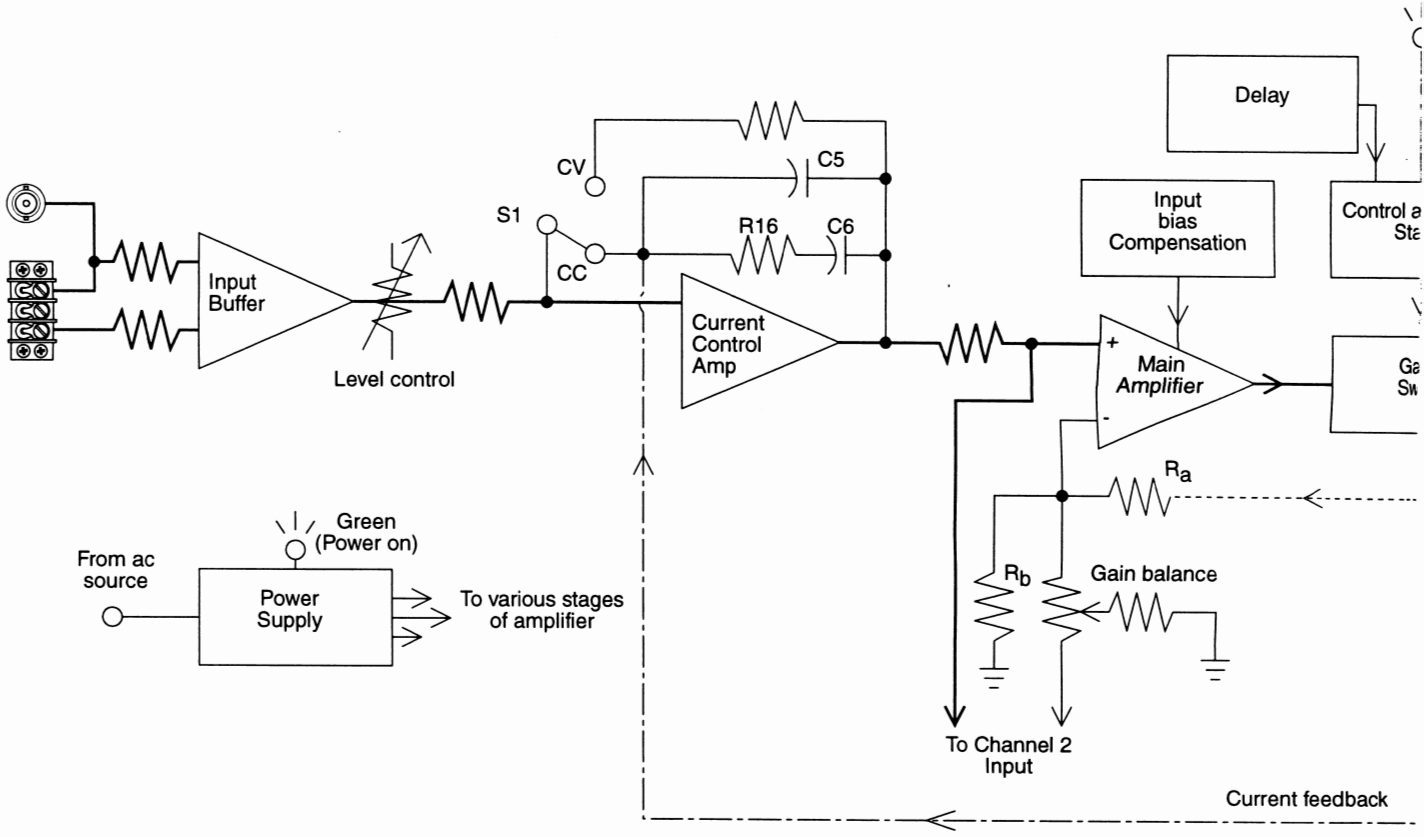
Zener diodes regulate the power supplies for the main amplifier, thermal protection and other low potential circuits. Separate Zener diodes regulate the power for the temperature compensated bias current source, along with the biasing of the push-pull signal translator stage to eliminate distortion and noise caused by line voltage variations.

A single fuse protects the primary windings of the transformer.

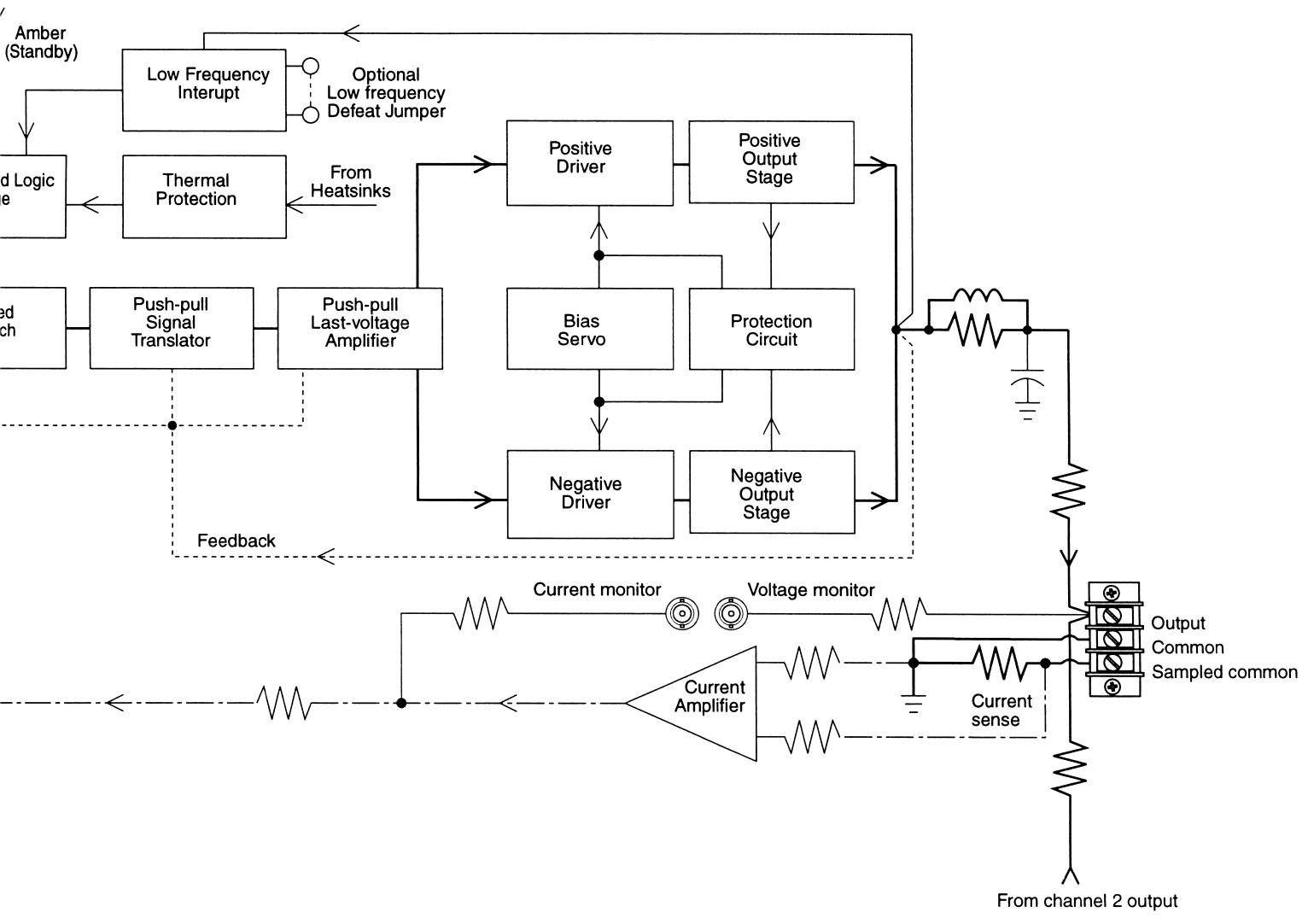
5.6 Indicators

The green power indicator LED is powered by the high potential supplies for the output stage.

The control and logic stage illuminates the amber standby LED while the gated switches are open and the amplifier is muted.



Block Diagram for



EC7521 and TEC7541