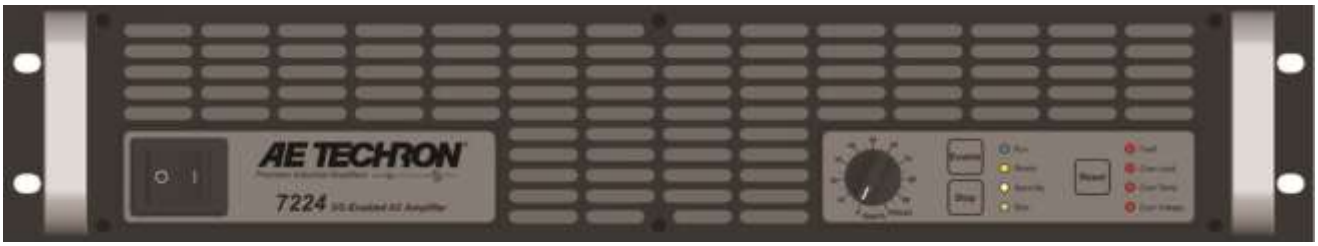
AE TECHRON®

Precision Industrial Amplifiers



7224

Quick Start Guide

Single-Channel Industrial Amplifier for Demanding, High-Power Systems

574.295.9495 | www.AETechron.com
2507 Warren Street, Elkhart, IN 46516

Limited One-Year Warranty

SUMMARY OF WARRANTY

AE TECHRON INC., of Elkhart, Indiana (Warrantor) warrants to you, the ORIGINAL COMMERCIAL PURCHASER ONLY of each NEW **AE TECHRON INC.** 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 **AE TECHRON INC.** 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 INC.,** 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.)

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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. We will take corrective actions within a reasonable time of the date of receipt of the defective product. 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 that 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.

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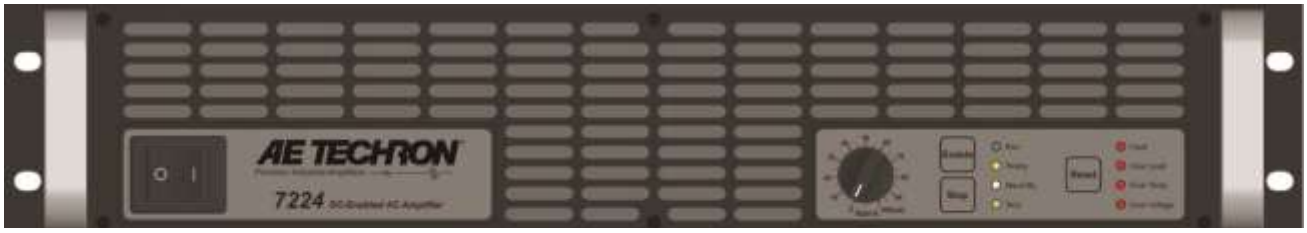


Figure 1.1 - 7224 Front Panel

Introduction

Congratulations on your purchase of the 7224 AE Techron power amplifier—one of the most precise power amplifiers ever produced for industrial applications and testing. The 7224 amplifiers are built and tested to the most stringent quality standards for long life and outstanding performance. The AE Techron brand is known throughout the world for its robust precision amplifiers as well as its product service and support.

Features

The 7224 is a single-channel linear amplifier designed for use in demanding applications requiring low noise, low distortion, and accurate power amplification from DC to 300 kHz. They feature:

- Internal assemblies designed with minimal external wiring and connectors for added endurance and reliability.
- Efficient design and light weight chassis materials allow amplifier to occupy only 2U height, and weigh only 41 lbs.
- Standard SIM (Specialized Input Module) features unbalanced BNC, balanced Phoenix-type 3-pin input, and 25-pin Interlock – I/O connectors.
- Optional SIM modules are available or can be created to provide additional features for unique applications.
- Generous cooling permits longer run times at higher duty cycles.
- Robust, linear power supply results in extremely low noise; bi-level switch design limits heat dissipation to output devices.
- Convenient front-panel display/control pad features sealed switches for reliability; a sealed gain control and a power switch that doubles as a breaker are also located on the front panel for easy access.

Amplifier Setup

The 7224 amplifiers are precision instruments that can be dangerous if not handled properly. Lethal voltages are present in both the AC input supply and the output of these amplifiers. For this reason, safety should be your primary concern when you setup and operate this amplifier.

Safety First

Throughout this manual special emphasis is placed on good safety practices. The following graphics are used to highlight certain topics which require extra precaution.

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 injury or equipment or property damage. Once again, note the explanation of the hazard and the instructions for avoiding it.

Unpacking

All amplifiers are tested and inspected for damage before leaving the factory. Carefully unpack and inspect the amplifier for damage. Please note any damage for future reference and notify the shipping company immediately if damage is found.

Also, please save the shipping carton and materials as evidence of damage and/or for returning the amplifier for repair.

Along with any additional accessories purchased by the customer, all 7224 amplifiers ship with the following:

7224 Amplifier
Toolkit (contains one #2 Phillips screwdriver and four rubber feet)
Power Cord
7224 Quick Start Guide

CAUTION

Do not operate the amplifier in a small sealed chamber of any kind. Improper operation and overheating will result.

Installation

The 7224 amplifiers are packaged in a rugged powder-coated aluminum chassis. This chassis is 2U (rack units) tall, and has rack “ears” on each side of the front panel for mounting to a standard EIA (Electronic Industries Association) rack. Use standard rack mounting hardware to mount the amplifier. Use nylon washers if you wish to protect the powder-coat finish on the front of the amplifier. Optionally, the amplifier can be placed on a bench top; please keep in mind that the protective powder-coating can be scratched when placed on other equipment or on a bench top, especially when there is dirt present. To protect the finish, a set of rubber feet is included in the toolkit that can be installed on the bottom of the amplifier.

Allow ample space on the sides and especially the back of the amplifier for heated air to escape. The amplifier should be mounted in a rack that is adequately ventilated and not sealed. Likewise, the front of the amplifier should be unobstructed to allow cool air to enter the amplifier.

WARNING

ELECTRIC SHOCK HAZARD.
Output potentials can be lethal. Make connections only with AC power OFF and input signals removed.

Connecting the Load

Before connecting the amplifier, make sure the AC power cord is unplugged.

Connection to the output of the amplifier is to a 3-position terminal strip with #8 screws. Wires terminated with a #8 ring terminals, tinned wires up to 10GA in size, or bus bars with 0.18 in. (4.6 mm) holes are recommended when connecting to the output terminals. Connect the load across the terminals marked “OUTPUT” (positive) and “COM” (negative/ground). The third terminal, “CHASSIS GROUND” can be connected to an external ground point such as the rack chassis.

Figure 2.1 – 7224 Back Panel

NOTE: The 7224 amplifier comes with a factory-installed resistor connecting the terminals marked “COM and “CHASSIS GROUND” (see Figure 2.2). This resistor should NOT be removed. **WARNING: Removing this resistor can cause dangerous output and/or damage to the load.**

Always use the appropriate wire size and insulation for the maximum current and voltage expected at the output. Never connect the output of the amplifier to any other model amplifier, power supply, signal source, or other inappropriate load; fire can result.

Figure 2.2 – Close-up of Output Terminals

Connecting the Input Signal

The signal is connected to the amplifier through a “SIM (Specialized Input Module) Card” (see Figure 2.3). Many SIM configurations are possible, but the most common are the “SIM BNC” (basic inputs), and “SIM Optoc” (for connecting multiple amplifiers in series or parallel configurations). Connectors can include balanced type (Phoenix, twinax, etc.) or unbalanced type (BNC, screw terminals, etc.) or other connectors specified by the customer. Input cables should be high quality and shielded for minimal noise and possible feedback.

Connecting the Interlock I/O Connector (optional)

The SIM card also provides a 25-pin Interlock I/O Connector for use in applications requiring remote control and monitoring of the amplifier and multi-amplifier systems. See the inside back cover of this manual for I/O Connector pin-outs and functions. For additional information about remote applications, please contact AE Techron or visit the AE Techron website at www.aetechron.com.

Figure 2.3 – Close-up of SIM Card

Connecting the AC Supply

The power cord connects to a standard 20 amp 3-pin IEC-type male connector on the back panel (see Figure 2.4). Make sure the Breaker/Switch on the front panel is switched to the OFF (O) position. Make sure the power cord is inserted and seated fully into the IEC connector by moving it slightly back and forth and up and

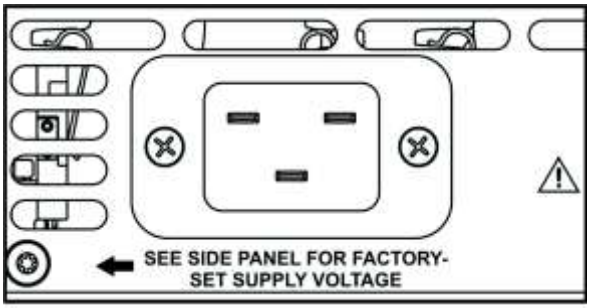


Figure 2.4 – Close-up of AC Mains Outlet

down while pushing in. The power cord is relatively stiff and should be routed so that there is no excessive force pulling to the sides or up or down that would stress the pins or internal connections. Tighten the cord strain relief screw to lock the power cord in place.

Review the factory-set supply voltage and amplifier configuration detailed on the label placed on the side of the amplifier (see Figure 2.5). This configuration can be changed by the user. See Chapter 4: "Advanced Configuration" (page 11) for more information.

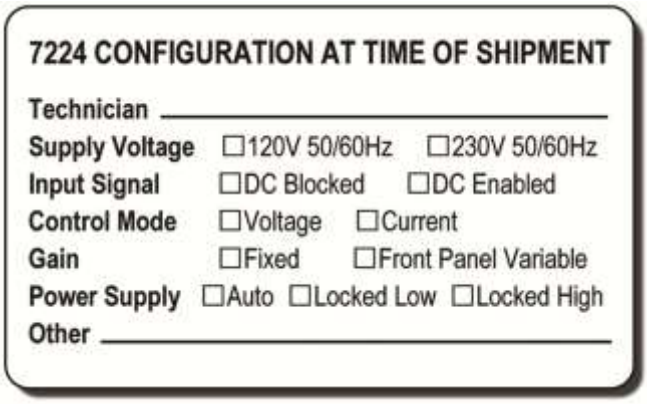


Figure 2.5 – Sample of Configuration Settings Label

Amplifier Operation

Front-Panel Controls

This section provides an overview of Front-Panel controls and indicators found on the 7224.
The Front Panel contains the following:

1. Breaker/Switch – Left Side
2. Gain Control – Right Side
3. Push Buttons – Right Side
4. Indicators – Right Side

Figure 3.1 – Breaker Switch

Breaker Switch

The Power Switch controls the AC mains power to the amplifier.

O – Off
I – On

The Power Switch also serves as a Breaker. When the Breaker is tripped, the Power Switch moves to a neutral position between On and Off. To reset the Breaker, turn the amplifier Off (O) and then turn it back On (I).

Figure 3.2 – Gain Control, Push Buttons and Indicators

Gain Control

The Gain Control Knob increases/decreases the gain from 0 – 100% of the overall Gain (factory default Gain is 20).

Push Buttons

There are three Push Buttons on the 7224.

- Enable – puts the amplifier in Run/Ready mode.
- Stop – puts the amplifier in Standby/Stop mode.
- Reset – returns the amplifier to a Run/Ready mode or Standby/Stop mode, depending on the fault condition.

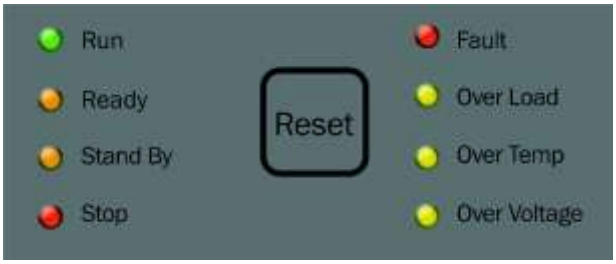


Figure 3.3 - Indicators

Front-Panel Indicators

Four Main Status Indicators located on the front panel monitor and indicate the internal conditions of the amplifier.

- **Run (green) –** This indicates that the unit will amplify the input signal. The amplifier will only pass a signal when the Run Indicator is lit.
- **Ready (orange) –** This indicates that all fault status modes are in ready condition. Ready mode is initiated by: (1) the Enable push button, or (2) when the amplifier powers up in Enable mode (see page 13).
- **Standby (orange) –** This indicates that the amplifier is in Standby mode. When in Standby mode, the Low-Voltage Transformer is energized but the High-Voltage Transformers are not.
- **Stop (red) –** This indicates that the unit is Stop Mode. Stop Mode is initiated by: (1) the Stop push button, (2) a fault condition, or (3) when the amplifier powers up in Stop Mode (see page 13).

Four Fault Status Indicators located on the amplifier front panel monitor and indicate the fault conditions of the amplifier. All fault conditions will put the amplifier in Stop Mode.

- **Fault (red) –** This indicates that a fault condition has occurred. Usually the Fault indicator lights up along with one or more of the following fault condition indicators. The Fault indicator may light up by itself; if this happens, see page 21 for troubleshooting help.
- **OverLoad (yellow) –** This indicates that the output of the amplifier could not follow the input signal.
- **OverTemp (yellow) –** The amplifier monitors the temperature inside the High-Voltage Transformers, Low-Voltage Transformer and in the Output Stage Heat Sinks. The OverTemp indicator will be lit when the temperature sensors detect a condition that would damage the amplifier. Please see page 20 for troubleshooting information.
- **OverVoltage (yellow) –** This indicates that the AC mains voltage is more than 10% of nominal. Either the AC mains must be brought down to the nominal value or the three internal transformers need to be rewired (see page 20).

Advanced Configuration

The 7224 amplifier was designed to offer exceptional versatility in operation. You can choose from a range of field-configurable options, including:

- Operate as a stand-alone amplifier or as part of a multiple-amplifier system.
- Operate with variable gain control or at a fixed gain setting of 20.
- Select Controlled-Current or Controlled-Voltage modes of operation.
- Trigger Standby Mode when specified fault conditions occur during operation.
- Select the Standby Mode state at power-up, or go immediately to the Ready state at power-up.
- Configure for use in high voltage applications, high current applications, or for applications requiring mid-level amounts of both voltage and current.

Your 7224 amplifier has been pre-configured to your specifications before shipping from the factory. These initial settings are detailed on your 7224 Proof of Performance sheet and on a label located on the side of the amplifier.

If you need to make changes to your amplifier's configuration, please follow the instructions contained in this chapter.

WARNING

Do not attempt to access the Main Board while amplifier is running. Turn the amplifier off and disconnect the AC Mains before removing amplifier front panel.

CAUTION

After turning the amplifier off, let the unit sit for 3-5 minutes before removing the front panel. This will allow the electrical charge in the Power Supply capacitors to discharge.

Configuration Access Panel

The 7224 amplifier contains an Access Panel built into the top cover. Most configuration settings can be made through this Access Panel. For your convenience, a #2 Phillips screwdriver is provided in your Toolkit for use in this procedure.

IMPORTANT: Before removing the Access Panel, make sure the amplifier is turned off for at least 3-5 minutes and the AC mains are disconnected.

1. Locate the Access Panel as shown in Figure 4.1. Make sure that all 8 screws are accessible. Remove the unit from its rack, if necessary.
2. Using a #2 Phillips screwdriver (provided), remove the 8 screws located on the top and side of the amplifier.
3. Remove the Access Panel and set it aside.

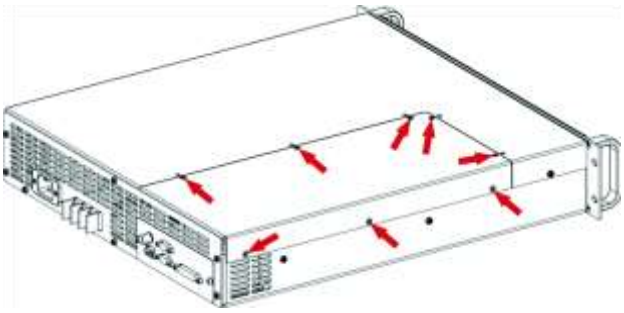


Figure 4.1 – Access Panel Screw Locations

Configuration Settings Located on the Main Board

The following custom settings can be made via jumper settings on the Main Board, which is located inside the Access Panel compartment, as shown in Figure 4.2.

1. Master/Slave setting for stand-alone or multiple-amplifier systems.
2. Variable or Fixed Gain setting.
3. Controlled Current/Controlled Voltage setting.
4. Compensation setting to select RC network when operating in Controlled Current mode.
5. Standby Mode/Ready Mode setting for selection of power-up state.
6. Stop Mode on OverTemp setting to trigger Stop Mode when amplifier senses an OverTemperature state.
7. Stop Mode on OverLoad setting to trigger Stop Mode when amplifier senses an OverLoad state.

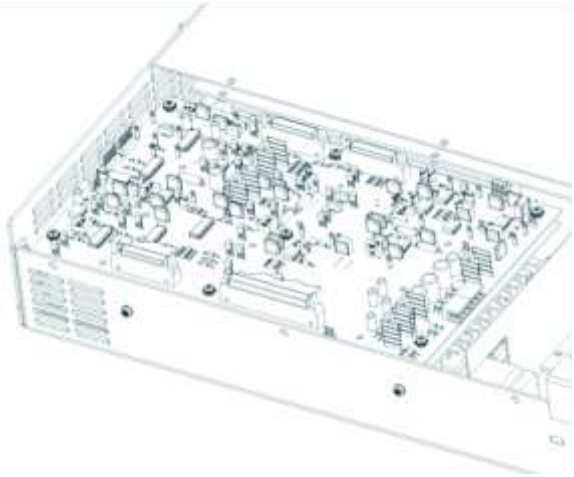


Figure 4.2 – Main Board Location inside Access Panel

Master/Slave Setting

To enable the 7224 amplifier for use as a single amplifier or as the Master amplifier in a multi-amplifier system, set jumpers **P1** and **P2** in the **Master** position (jumpers across top two pins of each set). To enable the 7224 amplifier for use as a Slave amplifier in a multi-amplifier system, set jumpers **P1** and **P2** in the **Slave** position (jumpers across bottom two pins of each set). **See Figure 4.3.**

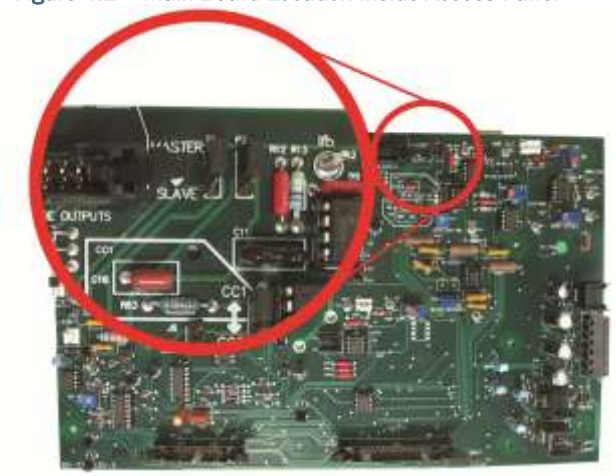


Figure 4.3 - Master / Slave Setting

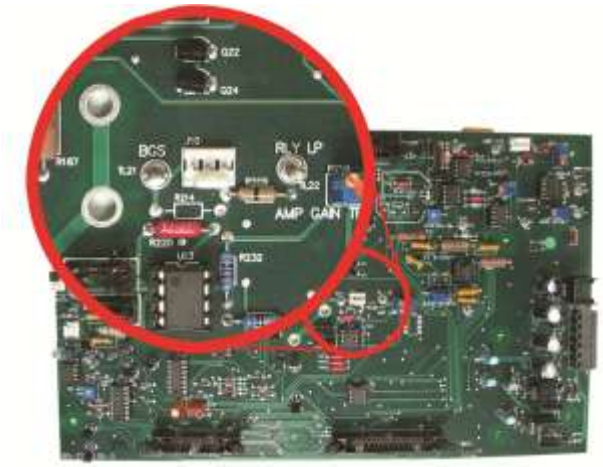


Figure 4.4 - Gain Trim Control

Fixed Gain/Variable Gain Setting

The 7224 amplifier ships with an enabled Gain Control knob (located on the amplifier front panel). To disable the **Variable Gain** control and set for a **Fixed Gain** of 20, locate and unplug the red connector from jumper **J10.** Then place a **jumper on the left two pins** at that location**. See Figure 4.4.**

Controlled Voltage/Controlled Current Setting
To allow the 7224 amplifier's **output voltage** to be controlled by its input voltage signal, place jumper **J4** in the **Right** position. To allow the 7224 amplifier's **output current** to be controlled by its input voltage signal, place jumper **J4** in the **Left** position. **See Figure 4.5.**

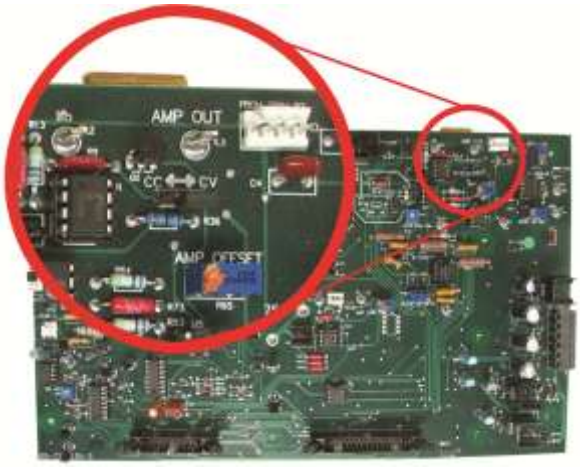


Figure 4.5 - Controlled Voltage / Controlled Current Setting

CAUTION

In Controlled-Current Mode, the load is part of the amplifier circuit, and the relationship of the load to the amplifier is critical. For proper and safe operation in Controlled-Current mode, you must observe the following guidelines:

1. **Properly attach a load before operating the amplifier.**
2. **DO NOT use a blocking capacitor.** The load must have a DC path.
3. **Never leave the load open.** If you feel the load must be fused, which could lead to a potential open circuit, please contact AE Techron Application Engineering department.
4. **Check to make sure the load has some inductive component.**
5. **Provide appropriate Compensation for the load.**
6. **If oscillation occurs, turn off the amplifier immediately.**

Failure to follow these guidelines may result in damage to the amplifier or load.

Compensation Setting (Controlled Current Mode)
When the 7224 amplifier is used in Controlled Current mode, the current control loop is tuned with one of two available RC networks. Place jumper **J5** in the **Up** position to select **CC1** network. Place jumper **J5** in the **Down** position to select **CC2** network. **See Figure 4.6.**

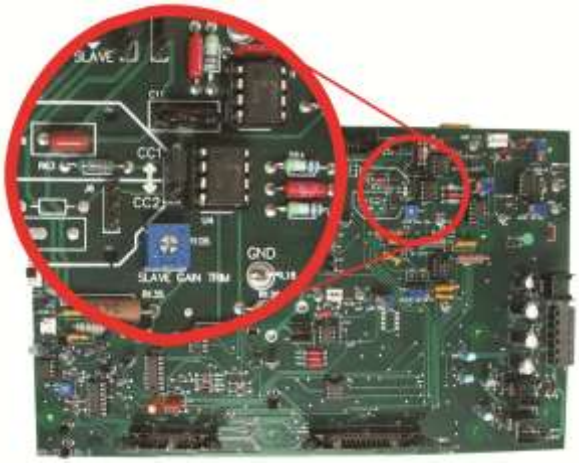


Figure 4.6 – Compensation Setting

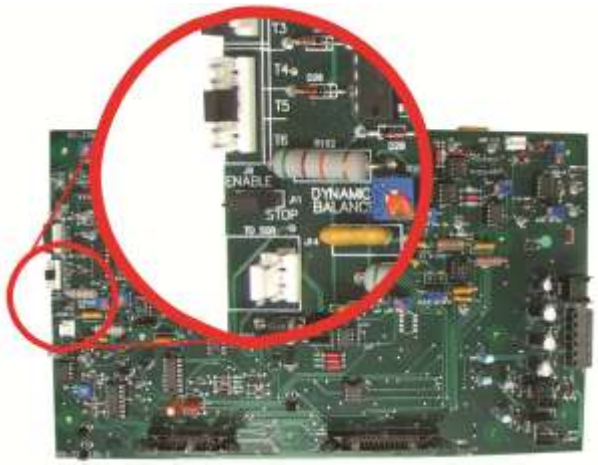


Figure 4.7 – Ready Mode/Standby Mode Power Up Setting

Ready Mode/Standby Mode Power-up Setting
The 7224 amplifier will power-up to **Ready Mode** on Power-up when jumper **J11** is in the **Left** position (default setting). To cause the 7224 amplifier to enter Standby Mode on Power-up, place jumper **J11** in the **Right** position. **See Figure 4.7.**

Stop Mode on OverTemp Setting

When enabled, the 7224 amplifier will move into Stop Mode when it senses any activation of the **OverTemperature circuit.** The amplifier will remain in Stop Mode until the Reset switch on the front panel is pushed or a Reset signal is received on the Interlock – I/O Connector. Once reset, the amplifier will return to Ready/Run (operational) Mode. To enable **Stop Mode on OverTemp**, place the jumper across the two pins labeled **J12. See Figure 4.8.**

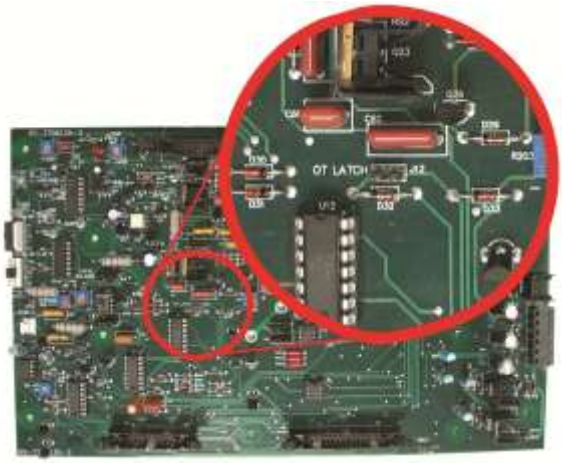


Figure 4.8 – Stop Mode on OverTemp Setting

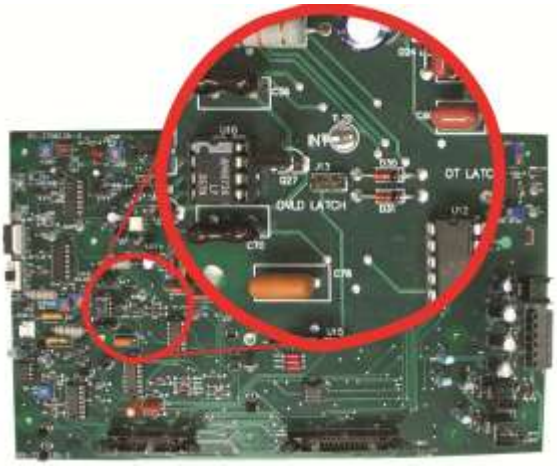


Figure 4.9– Stop Mode on OverLoad Setting

Stop Mode on OverLoad Setting

When enabled, the 7224 amplifier will move into Stop Mode when it senses an activation of **the IOC (Input/Output Comparator) Distortion Alert circuit.** The IOC Distortion Alert circuit continuously compares the input waveform to the output waveform. When a distortion of more than 0.5% occurs, the IOC circuit will activate. The amplifier will remain in Stop Mode until the Reset switch on the front panel is pushed or a Reset signal is received on the Interlock – I/O Connector. Once reset, the amplifier will return to Ready/Run (operational) Mode. To enable **Stop Mode on OverLoad,** place the jumper across the two pins labeled **J13. See Figure 4.9.**

Configuration Settings Located on the Power Supply Board

The following custom settings can be made via plug-in connectors located on the Power Supply Board:

- Amplifier Voltage Potential setting (high current or high voltage)
- Bi-Level Power Supply setting

To access the Power Supply Board, follow the instructions on page 12 to open the Configuration Access Panel. The Power Supply Board is located to the right of the Main Board, as shown in **Figure 4.10.**

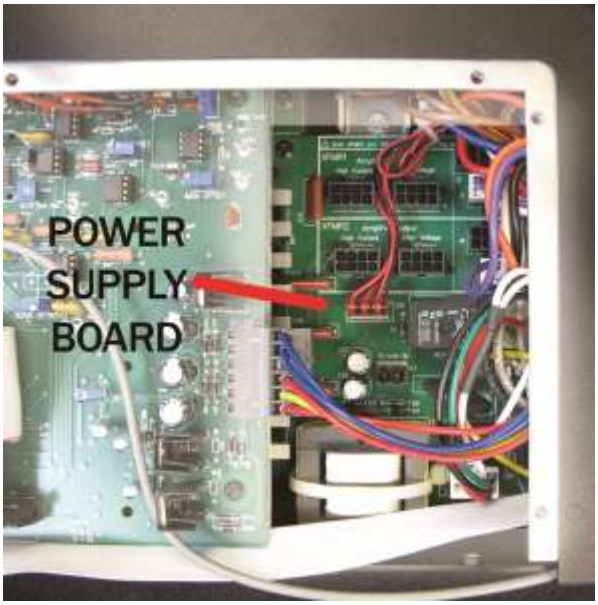


Figure 4.10– Accessing the Power Supply Board

Changing Amplifier Voltage Potential

The 7224 can be configured for High Current (90V) or High Voltage (180V) operation via user-selectable plugs on the Power Supply Board.

For general guidelines in selecting the best setting for your requirements, see page 17.

1. Locate the two XFMR sections (left of Line Voltage sections) **(see Figure 4.11).**

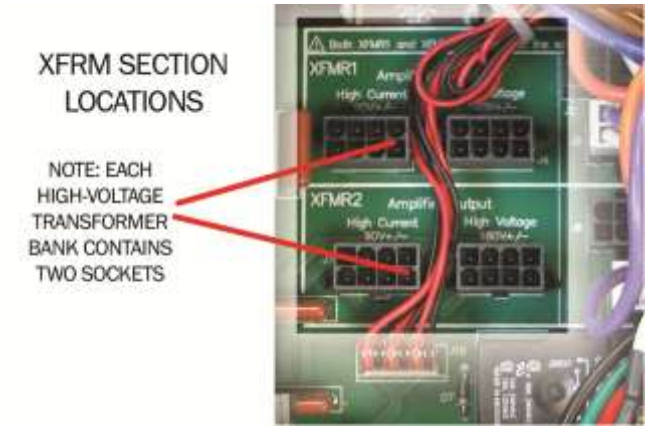


Figure 4.11– Location of Amplifier Voltage Output Sockets

2. For High Current (90V) Output **(see Figure 4.12).**

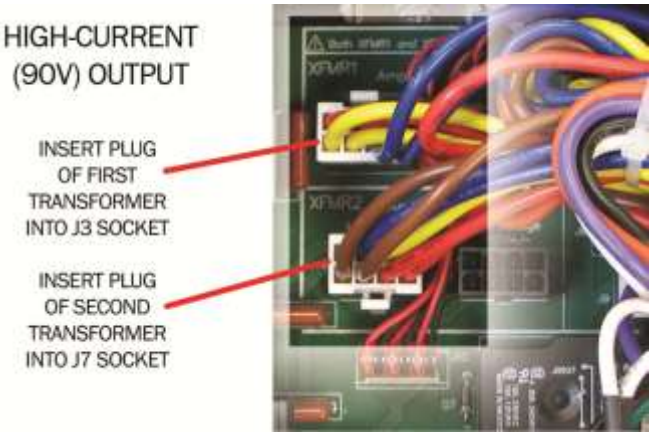


Figure 4.12– Location of Amplifier Voltage Output Sockets

3. For High Voltage (180V) Output **(see Figure 4.13).**

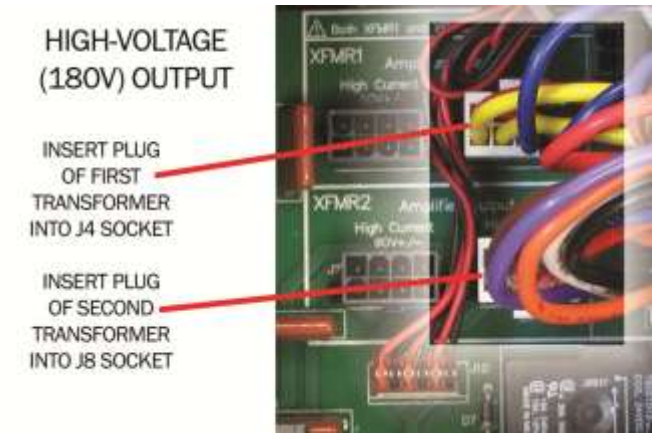


Figure 4.13– Location of Amplifier Voltage Output Sockets

Changing Bi-Level Power Supply Function

The 7224 offers three Bi-Level switch settings: Automatic, High, or Low. The user can select between settings via a switch on the Power Supply Board.

For general guidelines in selecting the best setting for your requirements, see the following section, **"Selecting the Best Voltage Potential and Bi-Level Power Switch Settings for Your Application".**

Figure 4.14– Bi-Level Power Switch Location

To access and change the Bi-Level Power Switch, follow these steps:

1. Locate the SIM Input Card on the right side of the rear panel of the amplifier.
2. Using a #2 Phillips screwdriver (provided), remove the 2 screws located at the edges of the SIM card.
3. Keeping the ribbon cable attached, remove the SIM card from the amplifier until it is completely clear from the card bay.
4. Locate Bi-Level Power Switch, S1, a black, three-position switch at the rear of the card bay. (See Figure 4.14.)
5. Move Black switch to desired setting. If necessary, use a pointed, non-metallic object (such as a pen) to help in moving the switch.
   a. Automatic – Left
   b. Low – Middle
   c. High – Right

Selecting the Best Voltage Potential and Bi-Level Power Switch Settings for Your Application

The output of the amplifier will be determined by the combination of settings used for both Voltage Potential and Bi-Level Power Switch.

OUTPUT VOLTAGE		
Bi-Level Switch Setting	Voltage Potential Setting	
	90	180
Auto	45 - 90	90 - 180
High	90	180
Low	45	90

Use the following general guidelines to select the best combination of settings to fit your requirements:

OUTPUT	LOAD		Settings
	Continuous	Pulse	
High Voltage	16, 8 ohm	16, 8, 4 ohm	180V Auto
Mid-Level	4, 2 ohm	2, 1 ohm	90V Auto
High Current	1, 0.5 ohm	0.75 – 0.25 ohm	90V Low

Also see the “Specifications” section on page 23 for more information.

Amplifier Signal Flow

Input Signals

The input signal is routed from the SIM (Specialized Input Module) on the back panel to the Mainboard. From there, the signal is amplified through low noise operational amplifier gain stages, compensation networks, and current limiting/ODEP and then final gain stage to the Output board. At the Output board, the signal is sent through predrivers, output stage drivers, then to the Output stage whose topology is a full-complimentary, full-bridge, AB+B mode transistor design. Amplifier control and status is handled by logic circuits tied to the Display/Control board on the front panel. Protection is provided by current limiting circuits and special junction temperature simulation circuits using thermal feedback from the main heat sinks on the Output board

AC Mains Power

Power to the amplifier is connected through a 20 amp IEC-type inlet connector with an integral EMI filter network on the back panel. AC mains power is first routed through the front panel switch/breaker, then to the Power Supply board. From there, the AC mains are distributed to the main power transformers, and then from the transformers back through the Power Supply board to the Main board.

The Power Supply board allows for easy configuration of primary and secondary voltages (see page 15 for more information.) The Power Supply board also performs the “bi-level” function. This allows the power supply rails to the Output section to increase or decrease depending on demand and keeps the voltage dropped across the outputs to a minimum, thereby decreasing heat dissipation.

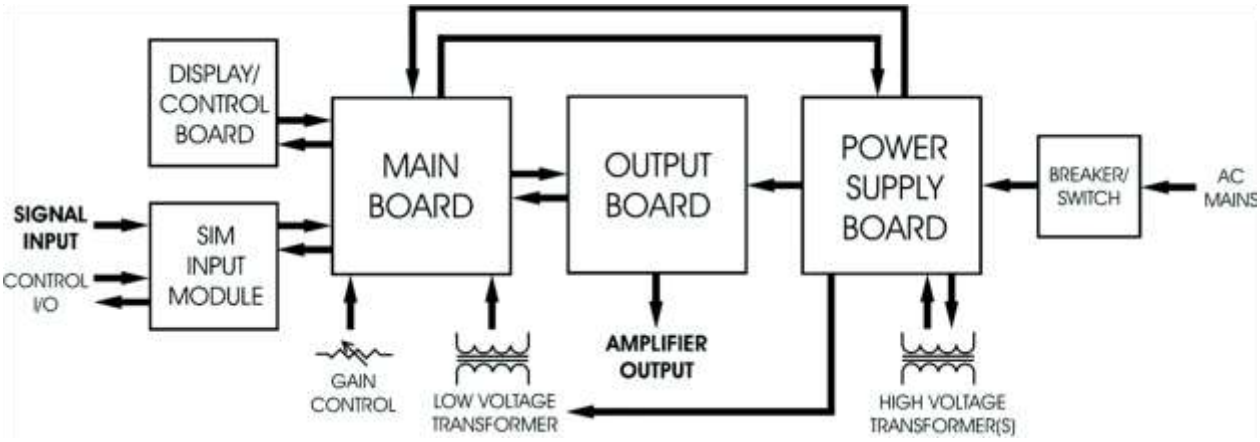


Figure 5.1– Board-Level Functional Block Diagram

Troubleshooting

Introduction & Precautions

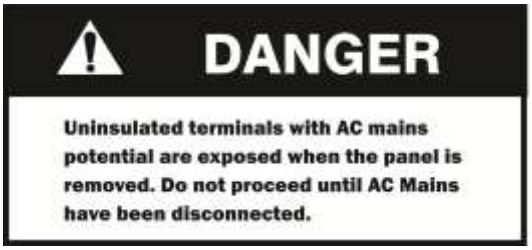
This section provides a set of procedures for identifying and correcting problems with the 7224 amplifier. Rather than providing an exhaustive and detailed list of troubleshooting specifications, this section aims to provide a set of shortcuts intended to get an inoperative amplifier back in service as quickly as possible.

The procedures outlined in this section are directed toward an experienced electronic technician; it assumes that the technician has knowledge of typical electronic repair and test procedures.

Please be aware that the 7224 will undergo frequent engineering updates. As a result, modules and electronic assemblies may not be interchangeable between units. Particularly, the Main board undergoes periodic engineering modifications that may make interchangeability between units impossible.

Visual Inspection

Before attempting to troubleshoot the amplifier while it is operating, please take time to complete a visual inspection of the internal components of the amplifier.



1. To perform a Visual Inspection, first turn the Breaker/Switch to the Off (O) position.
2. Disconnect the AC mains plug from the amplifier.
3. Wait three to five minutes for the Power Supply capacitors to discharge. You can verify the capacitor discharge by connecting a voltmeter across +Vcc and –Vcc test points on the main board **(see Figure 6.1).** Verify a reading of less than 50 volts before proceeding.
4. Inspect the amplifier's internal components. Check the following:
5. Inspect modules for charring, breaks, deformation or other signs of physical damage.
6. Look for any foreign objects lodged inside the unit.
7. Inspect the entire lengths of wires and ribbon cables for breaks or other physical damage.
8. If there is any physical damage to the amplifier, please return it to AE Techron for repair.

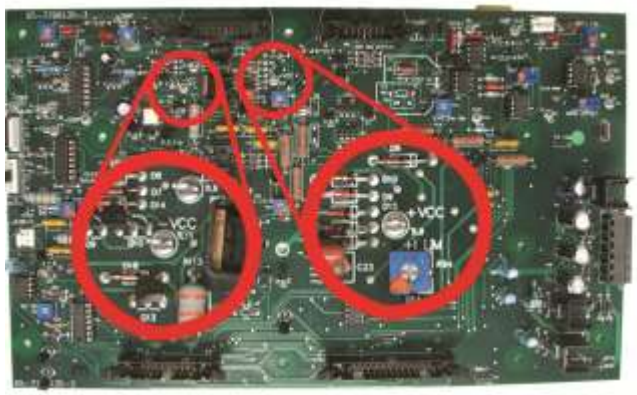


Figure 6.1– +Vcc and –Vcc Test Point Locations

No Signal

Missing Output signal may be caused by one of the following:

1. Master/Slave Jumpers are set to the Slave (down) position. The amplifier should only be configured for Slave mode if it is in a multi-amplifier system; otherwise it should be set for Master mode. See page 12 for more information.

2. Signal is not connected to any inputs on the SIM card. See page 7.

No LEDs Illuminated or No Fans

If none of the LEDs on the Display Panel are illuminated and/or the fans are inoperative, check the following:

1. The AC mains are not connected or not on (see page 8).
2. Front Panel Breaker/Switch has been tripped. Reset by turning the unit Off (O) and then On.
3. Fuse F1 is open.

To Inspect Fuse F1 follow these steps:

1. Turn Off (O) the amplifier and disconnect the AC mains.
2. Remove Access Panel (see page 11).
3. Locate Fuse F1 **(see Figure 6.2).** Remove fuse and inspect. Replace if necessary.

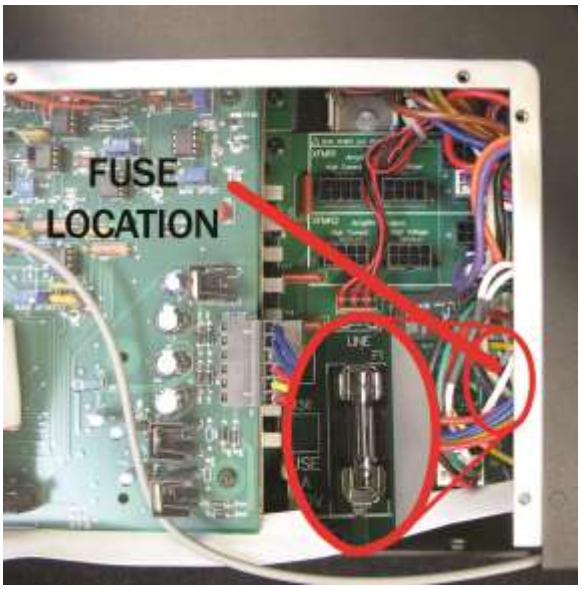


Figure 6.2 - Fuse Cover location

OverVoltage Warning Message

The amplifier will protect itself from AC mains voltage that is 10% above the voltage indicated on the back panel. If the AC mains voltage is more than 10% above the operating voltage, reduce the AC mains voltage to the proper level. When the line voltage condition is corrected, the amplifier will automatically reset unless the amplifier has been configured to enter Stop Mode on OverLoad. For information about releasing the amplifier from Stop Mode on OverLoad and on changing the Stop Mode on OverLoad setting, see page 14.

Standby LED Remains Illuminated

The Standby indicator may remain illuminated under three conditions:

1. If the output wells or power transformer have overheated. If overheating is the problem, see the following topic **("Amplifier Overheats").**
2. If both the Standby and Ready LEDs remain illuminated and the Interlock I/O Cable is being used, the amplifier is being held in Remote Standby Mode by another device **(see Figure 6.3).** For more information on 7224 Remote Operation, please visit the AE Techron website at www.aetechron.com.
3. If the connection to the Interlock – I/O Connector or other input/output connection isn't fully secure. Check all wiring and connections.

Figure 6.3 - Interlock I/O Connector

Amplifier Overheats (Over-Temperature Fault Condition)

There are two possible reasons why the 7224 amplifier is overheating:

1. Excessive Power Requirements
2. Inadequate Airflow

Excessive Power Requirements

An amplifier will overheat if the required power exceeds the amplifier's capabilities. High duty cycles and low-impedance loads are especially prone to cause overheating. To see if excess power requirements are causing overheating, check the following:

1. The application's power requirements fall within the specifications of the amplifier. Amplifier specifications can be found on page 23.
2. Faulty output connections and load.
3. Undesired DC offset at the Output and Input signal.

If the amplifier chronically overheats with suitable power/load conditions, then the amplifier may not be receiving adequate airflow. To check for adequate airflow, proceed with the following step:

Check for Inadequate Airflow

1. Check air filters. Over time they can become dirty and worn out. It is a good idea to clean the air filters periodically with a mild detergent and water.
2. Visually inspect fans to assure correct operation while amplifier is On (I).

Any inoperative, visibly slow, or reverse-spinning fan should be replaced. Please see page 22 for Factory Service information.

An OverTemp condition places the amplifier in Standby mode. If the OverTemp pulse is extremely short, as in the case of defective wiring or switches, the OverTemp pulse may be too brief to observe.

CAUTION

Shut off the signal source before resetting the amplifier. Try resetting the Fault condition only once. If the Fault condition does not clear after one reset, STOP. Contact AE Techron Support for further assistance. Repeated resetting can damage the amplifier.

Resetting After OverTemp

To reset the amplifier after an OverTemp has occurred, make sure fans are running, then remove the input signal from the amplifier. Allow the fans to run for five minutes, and then push the Reset button to reset the amplifier.

Fault LED is Illuminated

The 7224 contains protection circuitry which disables the amplifier if an output stage is behaving abnormally. This usually indicates an output transistor has shorted.

To clear the Fault condition, follow these steps:

1. Turn off the signal source.
2. Turn off the AC mains.
3. Turn AC mains power back on. If the Fault LED doesn't illuminate again, turn the signal source on.
4. If the Fault LED is still illuminated and the Fault condition doesn't clear, return the amplifier for Factory Service.

Factory Service

If the troubleshooting procedures are unsuccessful, the amplifier may need to be returned for Factory Service. All units under warranty will be serviced free of charge (customer is responsible for one-way shipping charges as well as any custom fees, duties, and/or taxes). Please review the Warranty at the beginning of this manual for more information.

All service units must be given Return Authorization by AE Techron, Inc. before being returned. Return Authorizations can be requested on our website or by contacting our Customer Service Department.

Please take extra care when packaging your amplifier for repair. It should be returned in its original packaging or a suitable alternative. Replacement packaging materials can be purchased for a nominal fee.

Please send all service units to the following address and be sure to include your Return Authorization Number on the box.

AE Techron, Inc.
Attn: Service Department / RMA#
2507 Warren Street
Elkhart, IN 46516

Specifications

Frequency, Phase and Noise Performance (Controlled Voltage Mode)

Small Signal Frequency Response:
DC - 300 kHz +0.0 to -1.0 dB

8 ohm Power Response:
± 140 Vpk DC to 60 kHz
± 50 Vpk DC to 180 kHz
± 30 Vpk DC to 300 kHz

Slew Rate:
75 V/µSec

Unit to Unit Phase Error:
± 0.1 degrees at 60 Hz

Residual Noise:
10 Hz to 300 kHz: 950 µV (0.95 mV)
10 Hz to 80 kHz: 300 µV (0.3 mV)

Signal-to-Noise Ratio:
10 Hz - 30 kHz: –113 dB
10 Hz - 80 kHz: –106.6 dB
10 Hz - 300 kHz: –99.9 dB

THD:
DC - 30 kHz less than 0.1%

Output Offset:
Less than 5 mV, field adjustable to less than 1 mV

Output Impedance:
28 mOhm in Series with 1 µH

Phase Response:
± 5 degrees (10 Hz - 10 kHz)

Input Characteristics

Balanced with ground:
Three terminal barrier block connector 20 k ohm differential

Unbalanced:
BNC connector, 10 k ohm single ended
Fixed or variable gain

Max Input Voltage:
± 10 V balanced or unbalanced

Common Mode Rejection Range:
–58 dB with 5V input

Display, Control, Status, I/O

Front Panel LED Displays indicate:
Ready, Standby, Fault, Over Temp, Over Voltage, Overload

Soft Touch Switches for:
Run, Stop, Reset

Gain Control, when enabled:
Voltage gain adjustable from 20 to 0

On/Off Breaker

Back Panel Power Connection:
25 Amp IEC (with retention latch)

Signal Output:
+/Common/Sampled Common

Signal Input:
User Selectable BNC or Barrier Strip Balanced

Communication Capabilities

Current Monitor: ± 1 V / 5 A ± 1%
Voltage Monitor: ± 1 V / 20 V ± 1%
Input Signal Monitor: ± 1 V / 2 V ± 1%

Reporting:
System Fault, Over Temp, Over Voltage, Over Load

Control:
Force to Standby, Reset after a fault

Multiple Unit Configuration

Series Operation:
Total Voltage (1, 2, 3, or 4-7224's): 150 V_{pk}, 300 V_{pk}, 450 V_{pk} or 600 V_{pk}; Increased slew rate up to 200 V/µSec

Parallel Operation:
Total Current (1, 2, 3, or 4-7224's):
50 A_{pk}, 100 A_{pk}, 150 A_{pk} or 200 A_{pk}

Physical Characteristics

Chassis:

The Amplifier is designed for stand alone or rack mounted operation. The Chassis is black aluminum with a powder coat finish. The unit occupies two EIA 19-inch-wide units.

Weight:

41 lbs (18.6 kg), **Shipping:** 51 lbs (23.2 kg)

AC Power:

Single phase, 120 VAC, 60 Hz, 20 amp service (220-240 VAC, 50-60 Hz, 10 amp model available)

Operating Temperature:

10°C to 50°C (50°F to 122°F), Maximum Output Power de-rated above 30°C (86°F).)

Humidity:

70% or less, non-condensing

Cooling:

Forced air-cooling from front to back through removable filters.

Airflow:

180 CFM

Dimensions:

19 in. x 22.75 in. x 3.5 in. (48.3 cm x 57.8 cm x 8.9 cm). Unit occupies 2 - EIA 19-inch wide rack units.

Protection

Over/Under Voltage:

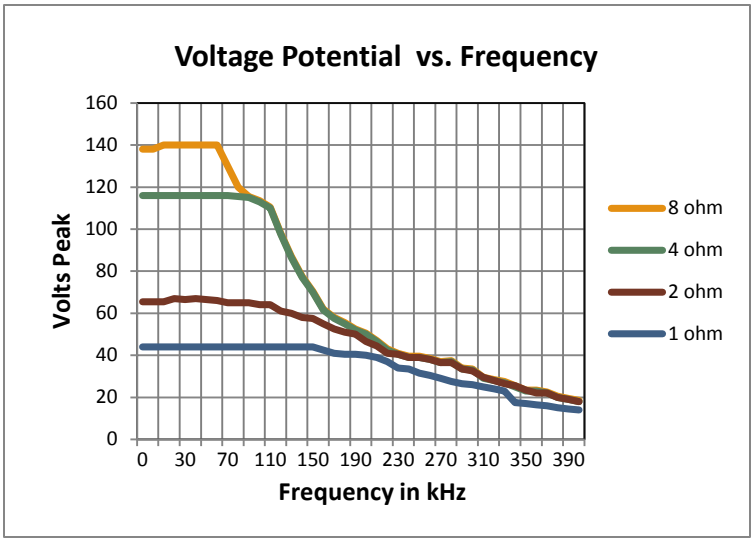
± 10% from specified supply voltage amplifier is forced to Standby

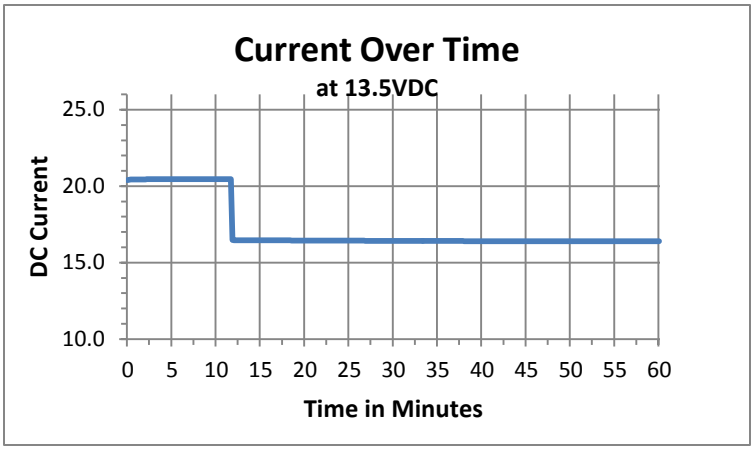
Over Current:

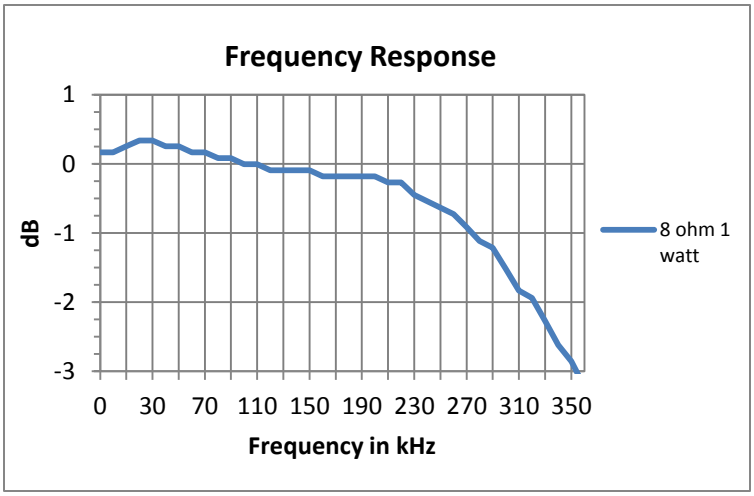
Breaker protection on both main power and low voltage supplies

Over Temperature:

Separate Output transistor, heat sink, and transformer temperature monitoring and protection







AC Specifications - *High Voltage Mode*

	PEAK OUTPUT						RMS OUTPUT				
	40mSec Pulse, 20% Duty Cycle		5 Minute, 100% Duty Cycle		1 Hour, 100% Duty Cycle		5 Minute, 100% Duty Cycle		1 Hour, 100% Duty Cycle		
Ohms	Volts	Amps	Volts	Amps	Volts	Amps	Volts	Amps	Volts	Amps	Watts
16	158	10	158	10	158	10	112	7	112	7	774
8	154	19	136	16	136	16	96	12	96	12	1108
4	124	31	108	26	61	15	76	18	43	10	442
2	98	49									

AC Specifications - *Mid-Level Mode*

	PEAK OUTPUT						RMS OUTPUT				
	40mSec Pulse, 20% Duty Cycle		5 Minute, 100% Duty Cycle		1 Hour, 100% Duty Cycle		5 Minute, 100% Duty Cycle		1 Hour, 100% Duty Cycle		
Ohms	Volts	Amps	Volts	Amps	Volts	Amps	Volts	Amps	Volts	Amps	Watts
4	72	18	69	16	69	16	49	12	49	12	566
2	61	30	57	26	57	26	40	19	40	19	746
1	47	47	43	40	21	21	30	28	15	15	220
0.5	26	52									

AC Specifications - *High Current Mode*

	PEAK OUTPUT						RMS OUTPUT				
	40mSec Pulse, 20% Duty Cycle		5 Minute, 100% Duty Cycle		1 Hour, 100% Duty Cycle		5 Minute, 100% Duty Cycle		1 Hour, 100% Duty Cycle		
Ohms	Volts	Amps	Volts	Amps	Volts	Amps	Volts	Amps	Volts	Amps	Watts
1			29	29	29	29	21	21	21	21	420
0.75			26	34	26	34	18	24	18	24	442
0.5			23	45	23	45	16	32	16	32	511
0.25											

DC Specifications

Low Voltage
High Current

	5 Min	1 Hr
Volts DC	Amps DC	Amps DC
24.0	26	20
13.5	20	16
3.0*	25	25

**A 120VAC only special configuration.*

SIM : Interlock I/O Connector Pinouts and Functions

Pin #	Function	Description	Signal Levels
1	Amplifier Output	Used for driving slave amplifiers, monitoring amplifier output voltage	Can be greater than ± 200Vpeak. NOTE: Wired to amplifier output, resistor limit (5.6 ohm, ¼W).
2	Sampled Common	Used for driving slave amplifiers (Reference), Controlled Current or Controlled Voltage	Amplifier External Reference, 5Vpeak max from Common
3	Input, 1+	High Level Input, Slave Input, Unity gain, aka "Non-inverting Input"	Can accept output of "Amplifier Output", ±200Vpeak, or Sample Common.
4	Interlock	Multiple amplifier interlock, status, remote off	Status; 0—8Vdc amplifier to standby, 12—15Vdc amplifier(s) in "Run" state. When connected to interlock common amplifier(s) will be forced to standby. To interlock multiple amplifiers (sharing the same sample common power connections) connect Interlock together (daisy chain).
5	Amp Ready	Used for OPTOC, individual amplifier status (Not optocoupled)	To drive customer optocoupler, –1.2V at 6mA to Interlock Common.
6	I MON +	Non-inverted Current Monitor Output; **7548/7796:** 1V/20A unbalanced, 2V/20A balanced, not isolated; **7224:** 1V/5A unbalanced, 2V/5A balanced, not isolated.	Low voltage output; **7548/7796:** ±200Apeak output = ±10Vpeak, unbalanced; ±20Vpeak, balanced. **7224:** ±50Apeak output = ±10Vpeak, unbalanced; ±20Vpeak, balanced.
7	Current Sum 1 (+)	Current monitor summing + input for slave 1 ,"Parallel, Controlled Current" applications only	Accepts input from I MON – slave output.
8	Current Sum 2 (+)	Current monitor summing + input for slave 2, "Parallel, Controlled Current" applications only	Accepts input from I MON – slave output.
9	Current Sum 3 (+)	Current monitor summing + input for slave 3, "Parallel, Controlled Current" applications only	Accepts input from I MON – slave output.
10	Sample Common	Amplifier Reference, used for OverTemp, Overload, Run and OverVoltage outputs	Amplifier External Reference.
11	Overtemp + Out	Amplifier status, amp ready reports if a "Power Transformers or "Output Wells" is "Over Temp", Amplifier will be forced to standby	Pulls to ground must be used with internal –24V supply. Can run an optocoupler.
12	Run + Out	Amplifier status, amp ready reports amplifier is in the "Run" state	Pulls to ground must be used with internal –24V supply. Can run an optocoupler.
13	–24V	Power from amplifier for external logic, Optical Isolating Module (OPTOC)	–24Vdc, 30mA
14	Common	Used for driving slave amplifiers, Controlled Voltage only	Amplifier Internal Reference.
15	Input, 1 –	High Level Input, Slave Input, Unity gain, aka "Inverting Input"	Can accept output of "Amplifier Output", ±200Vpeak, or Sample Common.
16	+24V	Power from amplifier for external logic, Optical Isolating Module (OPTOC)	24Vdc, 30mA.
17	Interlock Common	Used for OPTOC module and external status, remote on/ off.	Amplifier External Reference.
18	Spare	No function	
19	I MON –	Inverted Current Monitor Output; **7548/7796:** 1V/20A unbalanced, 2V/20A balanced, not isolated; **7224:** 1V/5A unbalanced and 2V/5A balanced, not isolated.	Low voltage output; **7548/7796:** ±200Apeak output = ±10Vpeak, unbalanced; ±20Vpeak, balanced; **7224:** ±50Apeak output = ±10Vpeak, unbalanced; ±20Vpeak, balanced.
20	Current Sum 1(–)	Current monitor summing – input for slave 1, "Parallel, Controlled Current" applications only	Accepts input from I MON + slave output.
21	Current Sum 2(–)	Current monitor summing – input for slave 2, "Parallel, Controlled Current" applications only	Accepts input from I MON + slave output.
22	Current Sum 3(–)	Current monitor summing – input for slave 3, "Parallel, Controlled Current" applications only	Accepts input from I MON + slave output.
23	Overload Out	Amplifier status, amp ready reports "Overload" status, indicates voltage limit, current limit, or distorted output	Pulls to ground must be used with internal –24V supply. Can run an optocoupler.
24	Overvoltage Out	Amplifier status, amp ready reports AC Line Over Voltage	Pulls to ground must be used with internal –24V supply. Can run an optocoupler.
25	Reset	Remote Reset, restores operation after "OverloadLatch" or "OverTemp"	Requires –15Vdc to reset amplifier