AE TECHRON®
Precision Industrial Amplifiers

7548/7796

Operator's Manual

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

APPLIES TO UNITS WITH MAINBOARD PART NUMBER 65-7796135-3

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.)

HOW TO OBTAIN WARRANTY SERVICE

When you notify us of your need for warranty service, we will give you an authorization to return the product for service. All components must be shipped in a factory pack or equivalent which, if needed, may be obtained from us for a nominal charge. 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.

AE TECHRON INC.
Customer Service Department
2507 Warren St. Elkhart, IN, 46516, U.S.A.
(574) 295-9495
www.aetechron.com

DECLARATION OF CONFORMITY

Technical Construction File Route

Issued By: AE Techron, Inc.
2507 Warrant Street
Elkhart, IN 46516

For Compliance Questions Only: Larry Shank
574-295-9495
lshank@aetechron.com

Equipment Type: Industrial Power Amplifiers
Model Name: 7548

EMC Standards:

EN 61326-1: 2006 Electrical Equipment for Measurement, Control and Laboratory use:
EMC Requirements

EN 55011: 2007 + A2: 2007 Industrial, Scientific and Medical (ISM) Radio-frequency Equipment:
Radio Disturbance Characteristics
Limits and Methods of Measurement

EN 61000-3-2: 2006 Electromagnetic Compatibility (EMC) Part 3: Limits:
Limits for Harmonic Current Emissions (equipment input current up to and including 16A per phase)

EN 61000-3-3: 2008 Electromagnetic Compatibility (EMC) Part 3: Limits:
Limitation of Voltage Changes, Voltage Fluctuations and Flicker in Public Low-voltage Supply Systems,
for equipment with rated current up to and including 16A per phase and not subject to conditional connection

EN 61000-4-2: 1995 + A1: 1998 + A2: 2001: Electromagnetic Compatibility (EMC) Part 4: Testing and Measurement Techniques:
Electrostatic Discharge Immunity Test

EN 61000-4-3: 2006: Electromagnetic Compatibility (EMC) Part 4: Testing and Measurement Techniques:
Radiated Radio-frequency Electromagnetic Field Immunity Test

EN 61000-4-4: 2004: Electromagnetic Compatibility (EMC) Part 4: Testing and Measurement Techniques:
Electrical Fast Transient/Burst Immunity Test

EN 61000-4-5: 2006: Electromagnetic Compatibility (EMC) Part 4: Testing and Measurement Techniques:
Surge Immunity Test

EN 61000-4-6: 2007: Electromagnetic Compatibility (EMC) Part 4: Testing and Measurement Techniques:
Immunity to Conducted Disturbances Induced by Radio Frequency Field

EN 61000-4-8: 1994 + A1: 2001: Electromagnetic Compatibility (EMC) Part 4: Testing and Measurement Techniques:
Power Frequency Magnetic Field Immunity Test

EN 61000-4-11: 2004: Electromagnetic Compatibility (EMC) Part 4: Testing and Measurement Techniques:
Voltage Dips, Short Interruptions and Voltage Variations Immunity Test

Safety Standard:

BSEN61010-1:2001 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use

I certify that the product identified above conforms to the requirements of the EMC Council Directive 2004/108/EC, and the Low Voltage Directive 2006/95/EC.

Signed: 

Larry Shank
President

Date of Issue: April 15, 2011

DECLARATION OF CONFORMITY

Technical Construction File Route

Issued By: AE Techron, Inc.
2507 Warrant Street
Elkhart, IN 46516

For Compliance Questions Only: Larry Shank
574-295-9495
lshank@aetechron.com

Equipment Type: Industrial Power Amplifiers
Model Name: 7796

EMC Standards:

EN 61326-1: 2006 Electrical Equipment for Measurement, Control and Laboratory use:
EMC Requirements

EN 55011: 2007 + A2: 2007 Industrial, Scientific and Medical (ISM) Radio-frequency Equipment:
Radio Disturbance Characteristics
Limits and Methods of Measurement

EN 61000-3-2: 2006 Electromagnetic Compatibility (EMC) Part 3: Limits:
Limits for Harmonic Current Emissions (equipment input current up to and including 16A per phase)

EN 61000-3-3: 2008 Electromagnetic Compatibility (EMC) Part 3: Limits:
Limitation of Voltage Changes, Voltage Fluctuations and Flicker in Public Low-voltage Supply Systems,
for equipment with rated current up to and including 16A per phase and not subject to conditional connection

EN 61000-4-2: 1995 + A1: 1998 + A2: 2001: Electromagnetic Compatibility (EMC) Part 4: Testing and Measurement Techniques:
Electrostatic Discharge Immunity Test

EN 61000-4-3: 2006: Electromagnetic Compatibility (EMC) Part 4: Testing and Measurement Techniques:
Radiated Radio-frequency Electromagnetic Field Immunity Test

EN 61000-4-4: 2004: Electromagnetic Compatibility (EMC) Part 4: Testing and Measurement Techniques:
Electrical Fast Transient/Burst Immunity Test

EN 61000-4-5: 2006: Electromagnetic Compatibility (EMC) Part 4: Testing and Measurement Techniques:
Surge Immunity Test

EN 61000-4-6: 2007: Electromagnetic Compatibility (EMC) Part 4: Testing and Measurement Techniques:
Immunity to Conducted Disturbances Induced by Radio Frequency Field

EN 61000-4-8: 1994 + A1: 2001: Electromagnetic Compatibility (EMC) Part 4: Testing and Measurement Techniques:
Power Frequency Magnetic Field Immunity Test

EN 61000-4-11: 2004: Electromagnetic Compatibility (EMC) Part 4: Testing and Measurement Techniques:
Voltage Dips, Short Interruptions and Voltage Variations Immunity Test

Safety Standard:

BSEN61010-1:2001 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use

I certify that the product identified above conforms to the requirements of the EMC Council Directive 2004/108/EC, and the Low Voltage Directive 2006/95/EC.

Signed: 

Larry Shank
President

Date of Issue: April 15, 2011

Table of Contents

1 Introduction 7
1.1 Features 7
2 Amplifier Setup 8
2.1 Safety First 8
2.2 Unpacking 8
2.3 Installation 8
2.4 Connecting the Load 9
2.5 Connecting the Input Signal 10
2.6 Connecting the AC Supply 11
2.7 Start-up Procedure 12
3 Amplifier Operation 12
3.1 Front-Panel Controls 12
3.2 Back-Panel Controls and Connectors 15
4 Advanced Configuration 16
4.1 Factory Defaults 16
4.2 Accessing the Main Board 16
4.3 Configuration Settings Located on the Main Board 16
4.4 Adjusting the Bi-Level Power Supply Switch 19
5 Applications 20
5.1 Remote Status and Control using the SIM Interlock I/O Connector 20
5.2 Controlled Current Operation 23
5.3 Multi-amplifier Systems 28
6 Maintenance 29
6.1 Clean Amplifier Filter and Grills 29
7 Troubleshooting 29
7.1 Introduction & Precautions 29
7.2 Visual Inspection 30
7.3 No Signal 30
7.4 No LEDs Illuminated or No Fans 30
7.5 OverVoltage Warning Message 31
7.6 Standby LED Remains Illuminated 31
7.7 Amplifier Overheats (Over-Temperature Fault Condition) 31
7.8 Fault LED is Illuminated 32
7.9 Factory Service 33
8 Specifications 34
8.1 Performance (Controlled Voltage Mode) 34
8.2 Input Characteristics 34
8.3 Display, Control, Status, I/O 34
8.4 Communication Capabilities 35
8.5 Protection 35
8.6 Physical Characteristics 35
8.7 Charts 36

List of Figures

Figure 1.1 – 7548 Front Panel 7
Figure 2.1 – Rack "Ears" for mounting into a standard rack 8
Figure 2.2 – 7796 Back Panel 9
Figure 2.3 – Closeup of output terminal resistor 10
Figure 2.4 – Controlled Voltage Hook-up 10
Figure 2.5 – Specialized Input Module ("SIM") card 10
Figure 2.6 – Wiring for Unbalanced or Balanced Input Connector 11
Figure 2.7 – 208V 3-phase AC Mains wiring 11
Figure 2.8 – 380/400/415V 3-phase AC Mains wiring 11
Figure 3.1 – Stop Button 12
Figure 3.2 – Enable Button 12
Figure 3.3 – Reset Button 12
Figure 3.4 – Navigation Buttons 13
Figure 3.5 – Peak and RMS Voltage and Peak and RMS Current 13
Figure 3.6 – Peak and RMS Voltage 13
Figure 3.7 – Peak and RMS Current 13
Figure 3.8 – RMS Voltage and Peak Current 13
Figure 3.9 – RMS Current and Peak Voltage 13
Figure 3.10 – RMS Current and RMS Voltage 13
Figure 3.11 – Peak Voltage and Peak Current 13
Figure 3.12 – Main Status Indicators 14
Figure 3.13 – Fault Status Indicator 14
Figure 3.14 – Overload Fault LCD Display 14
Figure 3.15 – Over-Temperature Fault LCD Display 14
Figure 3.16 – Over-Voltage (high-line) Fault LCD Display 15
Figure 3.17 – Output Device Fault LCD Display 15
Figure 3.18 – Back-Panel Controls and Connectors 15
Figure 4.1 – Master / Slave Setting 17
Figure 4.2 – Gain Trim Control 17
Figure 4.3 – Controlled Voltage / Controlled Current Setting 17
Figure 4.4 – Compensation Setting 18
Figure 4.5 – Ready Mode/Standby Mode Power-up Setting 18
Figure 4.6 – Stop Mode on OverTemp Setting 18
Figure 4.7 – Stop Mode on OverLoad Setting 18
Figure 4.8 – Bi-Level Power Supply Switch Location 19
Figure 5.1 – Remote Status and Control Pinouts 20
Figure 5.2 – Remote Enable/Standby 20
Figure 5.3 – Remote Status and Reset Schematic 21
Figure 5.4 – Remote Voltage Monitoring Schematic 22
Figure 5.5 – Remote Current Monitoring Schematic 23
Figure 5.6 – Remote Current Monitoring Schematic, Alternate Method 23
Figure 5.7 – Input to Output Comparison, Controlled-Voltage Operation 24
Figure 5.8 – Input to Output Comparison, Controlled-Current Operation 24
Figure 5.9 – Factory-installed default RC network 25
Figure 5.10 – Custom Compensation Location 27
Figure 5.11 – Compensation Effects on Waveform 28
Figure 5.12 – Square Wave Showing a Decrease in R is Required 28
Figure 5.13 – Square Wave Showing an Increase in R is Required 28
Figure 5.14 – Square Wave Showing an Increase in C is Required 28
Figure 7.1 – +Vcc and-Vcc test point locations 29
Figure 7.2 – Amplifier Cover removed for inspection 30
Figure 7.3 – Fuse Cover location 30
Figure 7.4 – Interlock I/O Connector 31
Figure 7.5 – +TEMP and–TEMP test point locations 32
Figure 8.1 – 7548 Voltage vs. Frequency 36
Figure 8.2 – 7796 Voltage vs. Frequency 36
Figure 8.3 – 7548 DC Power Test 36
Figure 8.4 – 7796 DC Power Test 36
Figure 8.5 – 7548 Frequency Response 36
Figure 8.6 – 7796 Temperature Over Time 36

Figure 1.1 - 7548 Front Panel

1 Introduction

Congratulations on your purchase of the 7548/7796 AE Techron power amplifier—a single-channel industrial amplifier designed for use in the most demanding high-power systems. The 7548/7796 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.

1.1 Features

The 7548/7796, when operated in Controlled Voltage mode, provides precision amplification at frequencies from DC to 50 kHz at full power and DC to 100 kHz+ at reduced power, with low harmonic and intermodulation distortion and low noise. The 7548/7796 operates on 208-volt (optional 400-volt), 3-phase AC mains. Other features include:

- DC-enabled, four-quadrant, linear amplifier.
- 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.
- Built-in protection circuitry safely provides for sustained, full-power output. Full protection includes:
    - Over-Voltage
    - Over-Temperature
    - Temperature monitor of heat-sinks, transformers and output transistors
    - Immediate protection and fast recovery in the event of overheating.
- Generous, front-to-back cooling allows tight rack mounting without the need for air spaces and permits longer run times at higher duty cycles.
- Switching, bi-level power supply adapts to meet demands for high voltage or high current.
- Convenient, multi-function front-panel LCD display provides peak and RMS values for voltage and current measured directly from the output of the amplifier. Status indicators, and sealed navigation and input buttons, are also conveniently located on the front panel.

2 Amplifier Setup

The 7548/7796 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.

2.1 Safety First

Throughout this manual special emphasis is placed on good safety practices. The following graphics are used to highlight certain topics that 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 instruction for avoiding it.

WARNING

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

CAUTION

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

2.2 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 7548/7796 amplifiers ship with the following:

1. 7548 or 7796 Amplifier
2. NEMA connector for power cord
3. 7548/7796 Operator's Manual and Quick Start

Figure 2.1 – Rack "Ears" for mounting into a standard rack

2.3 Installation

The 7548/7796 amplifiers have 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.

NOTE: The 7548 weighs approximately 103 pounds and the 7796 weighs approximately 153 pounds. Be sure this weight is properly supported using all the screw locations.

When mounting the amplifier in a rack cabinet, the sidewalls of the rack must be at least 2 inches away from the chassis on both sides.

WARNING

Never attempt to lift the amplifier without assistance. Crushing bodily injury can result if care is not taken during installation. Cabinets may overturn if not secured.

CAUTION

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

Allow for hot air discharge through the amplifier's rear grill. If your cabinet has a rear door, you must provide adequate airflow through the door. Provide a source of cool air for fan intakes. If the rack is crowded or rack ventilation is poor, use a vent tube to the outside of the rack. Cooling capacity required is 300 ft3/min. total per amp.

When operating the MODEL 7548/7796 in a dusty environment, use commercial furnace filters, or equivalent, to prevent rapid clogging of the filters on the amplifier.

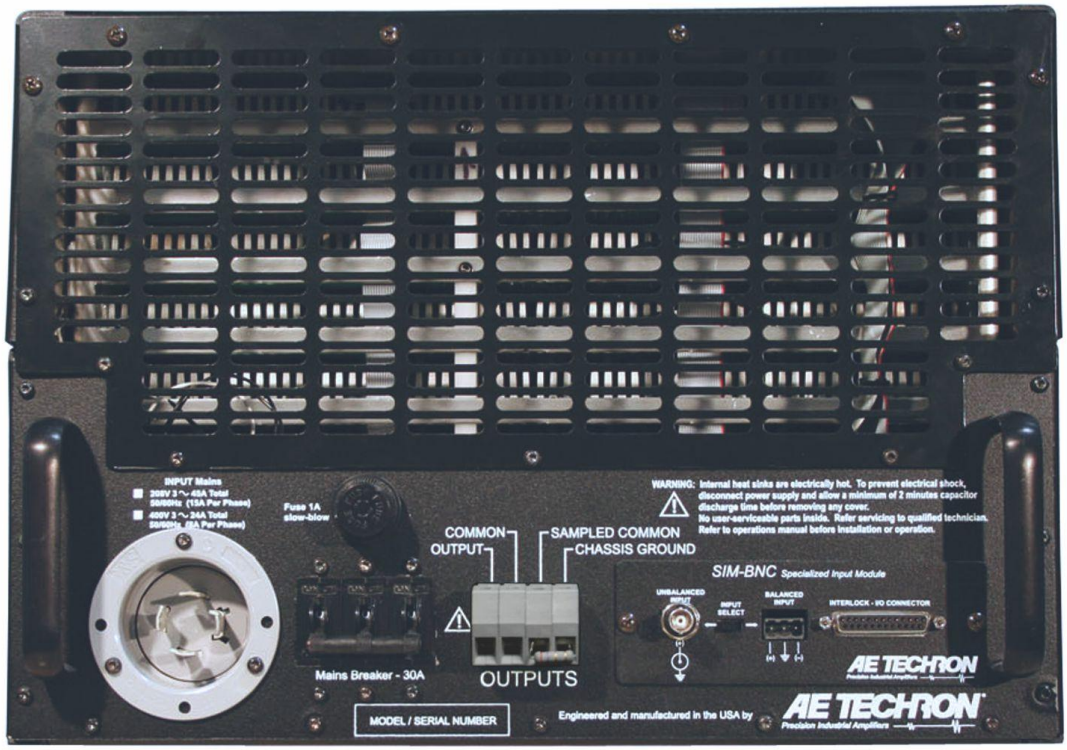

Figure 2.2 – 7796 Back Panel

2.4 Connecting the Load

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

WARNING

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

This section describes output wiring to the load when using the default amplifier configuration: Single (or Master) amplifier operated in Controlled Voltage mode. The 7548/7796 amplifier also can be field-adjusted for operation in Controlled Current mode or for operation as a Slave amplifier in a multi-amplifier system. These alternate configurations may require special output wiring and/or additional components.

If your application requires Controlled Current and/or Slave operation, change the default settings on the main board (located behind the amplifier front panel) before connecting the amplifier. (See **Section 4,**

Advanced Configuration, for more information.) Also, visit the AE Techron website at **www.aetechron.com** for additional information on these advanced configurations.

Connection to the output of the amplifier is to a four-position terminal barrier block (accepts up to #4 AWG wire). 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.

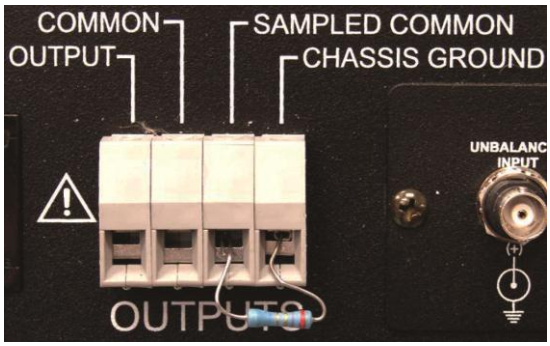

Figure 2.3 – Closeup of output terminal resistor

NOTE: The 7548/7796 amplifier comes with a factory-installed resistor connecting the terminals marked "SAMPLED COMMON" and "CHASSIS GROUND" (see **Figure 2.3**). This resistor should NOT be removed. **WARNING: Removing this resistor can cause dangerous output and/or damage to the load unless configuring multiple amplifiers in series. See www.aetechron.com for more information on these advanced configurations.**

2.4.1 Connecting the Outputs

Locate the four-position terminal barrier block labeled OUTPUTS on the amplifier back panel. See **Figure 2.4.**

Connect the negative terminal of the load to the **SAMPLED COMMON** terminal.

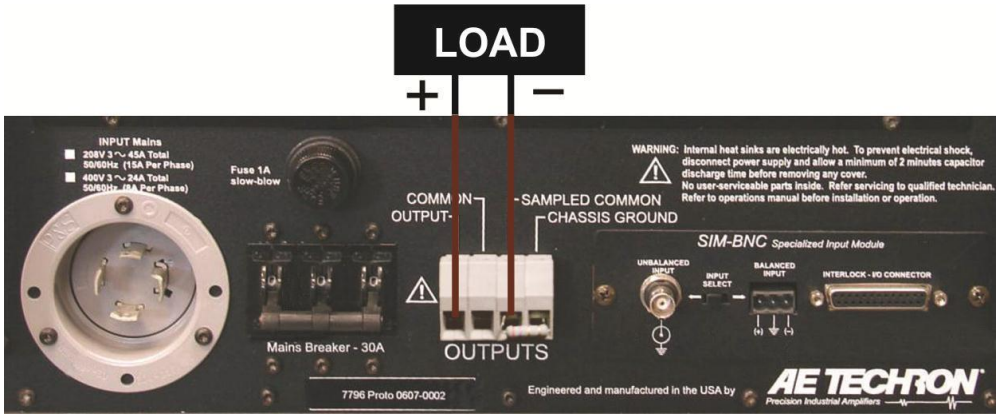

Figure 2.4 - Controlled Voltage Hook-up

NOTE: Alternately, the COMMON terminal may be used when operating in Controlled-Voltage mode; however, the integrated current monitor will not function if the COMMON terminal is used, since it depends on feedback from the Sampled Common terminal. For operation in Controlled-Current, mode, the SAMPLED COMMON terminal must be used.

Connect the load's positive terminal to the amplifier's **OUTPUT** terminal.

2.5 Connecting the Input Signal

Input connectors can be found on the "SIM (Specialized Input Module) Card" located on the amplifier back panel (see **Figure 2.5**). The standard SIM card includes both an Unbalanced Input BNC jack and a Balanced Input "Weco" terminal block connector, an Input Select switch, and an Interlock – I/O Connector. **See Section 4, Advanced Configuration,** for information on using the Interlock – I/O Connector.

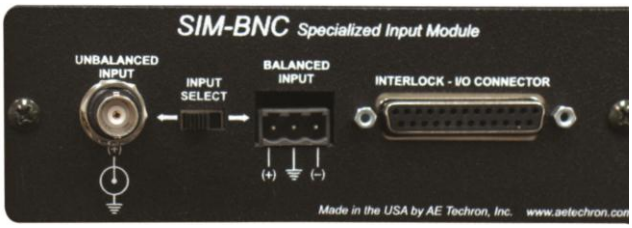

Figure 2.5 – Specialized Input Module ("SIM") card

Position the **Input Select** switch to the left to select the Unbalanced Input connector and to the right to select the Balanced Input connector. Note that **when the Input Select switch is in the right position, both Unbalanced and Balanced Input connectors are enabled.**

IMPORTANT: The Input Select switch also functions as a Ground Lift switch for the Unbalanced Input connector. If circulating currents/ground loops/60-Hz Hum occur when using the Unbalanced Input, move the Input Select switch to the right to lift the ground on the connector.

Connect your input signal to the amplifier's unbalanced or balanced input connector as shown in **Figure 2.6.** Use cables that are high quality and shielded to minimize noise and to guard against possible feedback.

Figure 2.6 – Wiring for Unbalanced or Balanced Input Connector

2.6 Connecting the AC Supply

The 7548/7796 amplifier requires 3-phase wiring. Always operate the 7548/7796 amplifier from proper AC mains. The 3-phase, 47 - 60 Hz voltage must be 208 VAC (or optionally 400 VAC) with no more than 10% variance above or below the line voltage. The amplifier will not operate properly outside these limits.

DANGER

The risk of lethal ELECTRICAL SHOCK exists when connection AC mains! Disconnect the source before connecting AC power wires to the connector.

The 7548/7796 amplifier includes a NEMA style locking AC connector as standard equipment. Connect the amplifier to the proper 3-phase AC mains with this connector. See **Figures 2.7** and **2.8** for proper AC Mains wiring. The connector then plugs into the 7548/7796 amplifier.

X = LINE 1
Y = LINE 2
Z = LINE 3
G = GROUND
(green/green with yellow stripe)
NOTE: Ground pin is L-shaped

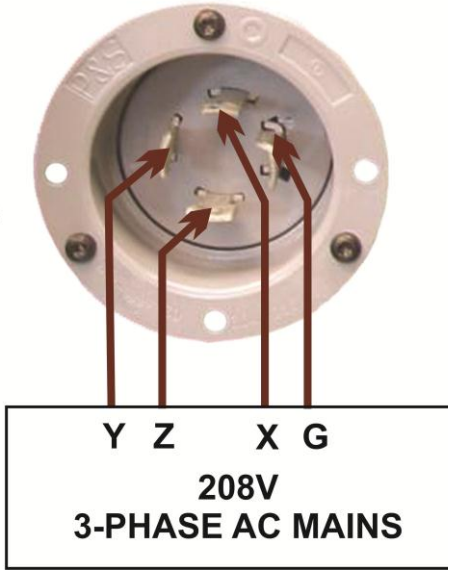

Figure 2.7 – 208V 3-phase AC Mains wiring

X = LINE 1
Y = LINE 2
Z = LINE 3
W = NEUTRAL
(white/gray)
G = GROUND
(green/green with yellow stripe)
NOTE: Neutral pin is L-shaped

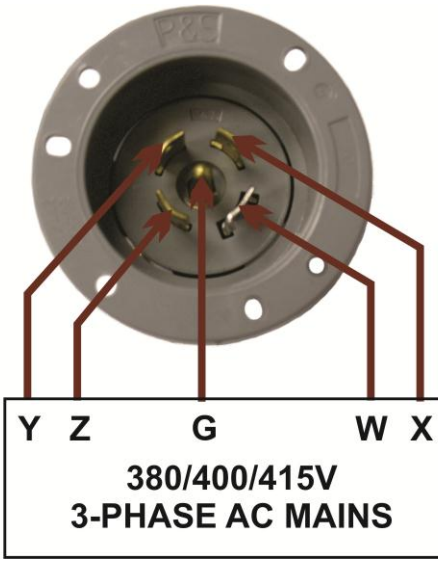

Figure 2.8 – 380/400/415V 3-phase AC Mains wiring

2.7 Start-up Procedure

1. Turn down the level of your signal source.
2. Check to make sure the AC Mains Switch/Circuit Breaker is in the off position (DOWN).
3. Apply AC power to the amplifier.
4. Move the AC Mains Switch/Circuit Breaker to the on position (UP) to turn the amplifier ON. Wait for the yellow READY and green RUN LEDs to illuminate.
5. Adjust the level of your input signal source to achieve the desired output level.
6. Use the Navigation Buttons to navigate through the various voltage and current measurement functions on the LCD display.

3 Amplifier Operation

3.1 Front-Panel Controls

This section provides an overview of Front-Panel controls and indicators found on the 7548/7796.
The Front Panel contains the following:

1. Input Buttons
2. Navigation Buttons
3. Multi-function LCD Display
4. LED Status Indicators

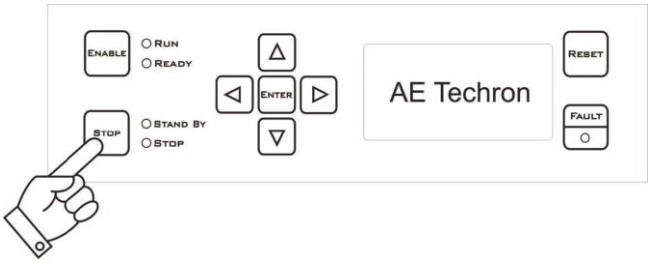

Figure 3.1 - Stop Button

3.1.1 Input Buttons

Stop Button
The Stop button (**Figure 3.1**) forces the amplifier into the Standby mode. In this mode, power on two legs of the three phase mains input power is interrupted by internal solid state relays. To completely disconnect the AC Mains, use the Breaker Switch located on the back panel of the amplifier.

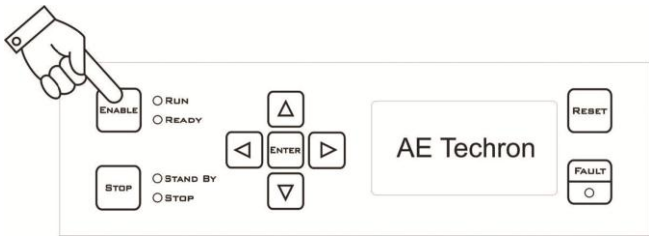

Figure 3.2 - Enable Button

Enable Button
The Enable button (**Figure 3.2**) moves the amplifier from Standby mode and into Run mode.

NOTE: Some factors, such as Interlock signal, may prevent the amplifier from moving into Run mode automatically when the Enable button is pressed.

The amplifier must move into Run mode in order to pass signal.

Reset Button
The Reset button (**Figure 3.3**) brings the amplifier out of a Standby mode caused by a Fault condition and moves it into Run mode.

NOTE: Some factors, such as Interlock signal, may prevent the amplifier from moving into Run mode automatically when the Reset button is pressed.

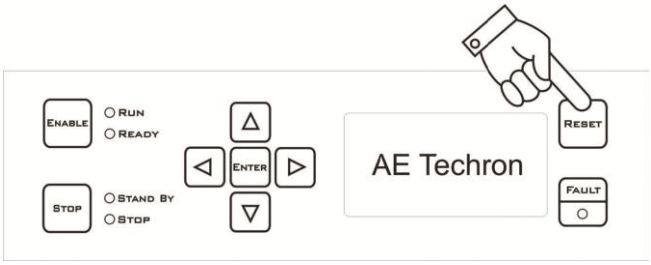

Figure 3.3 - Reset Button

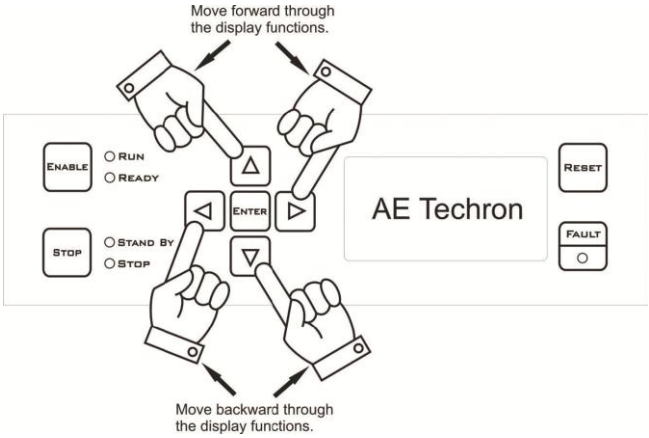

Figure 3.4 - Navigation Buttons

3.1.2 Navigation Buttons

The Navigation buttons (**Figure 3.4**) provide four arrow keys to allow navigation through the different voltage and current measurement functions on the LCD display.

Enter Button

The Enter button has been provided for future expansion and has no function at this time.

3.1.3 Multi-Function LCD Display

The multi-function LCD display provides peak and RMS values for voltage and current measured directly from the amplifier output. The LCD display also gives details and prescribed corrective actions in the event of a fault condition.

Figures 3.5 through 3.11 illustrate the available measurement function displays.

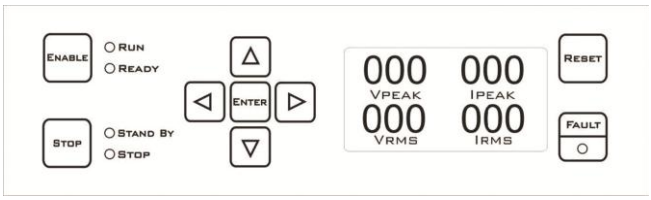

Figure 3.5 - Peak and RMS Voltage and Peak and RMS Current

Figure 3.6 - Peak and RMS Voltage

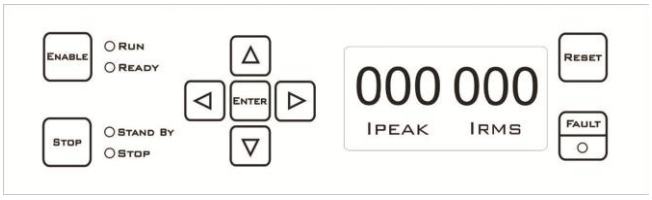

Figure 3.7 - Peak and RMS Current

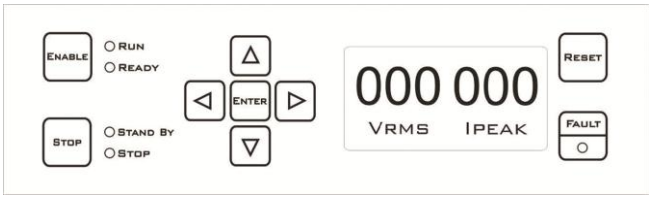

Figure 3.8 - RMS Voltage and Peak Current

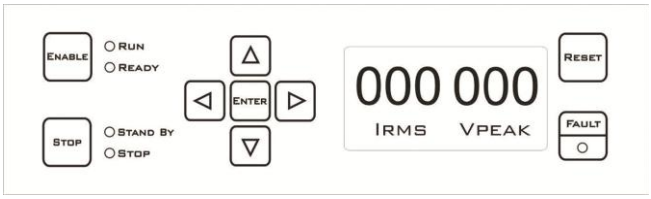

Figure 3.9 - RMS Current and Peak Voltage

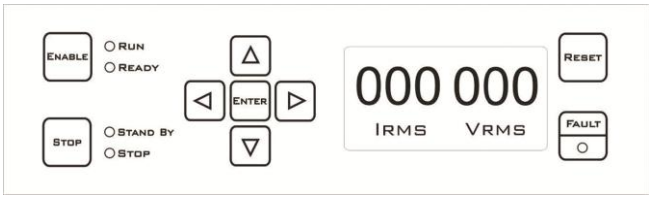

Figure 3.10 - RMS Current and RMS Voltage

Figure 3.11 - Peak Voltage and Peak Current

3.1.4 Status Indicators

Main Status Indicators

Four Main Status Indicators located on the front panel monitor and indicate the internal conditions of the amplifier. **(See Figure 3.12.)**

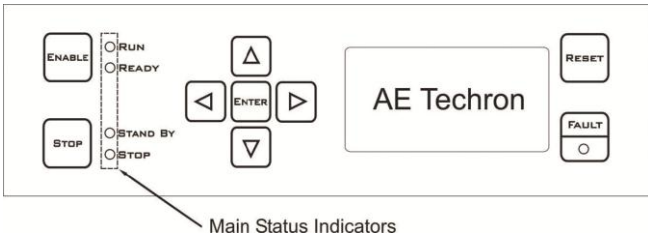

Figure 3.12 - Main Status Indicators

- **Stop (red) –** This indicates that the unit is in Stop Mode. Stop Mode is initiated by the Stop push button.
- **Standby (yellow) –** This indicates that the amplifier is in Standby mode. When in Standby mode, the low-voltage supply is energized but the high-voltage main power supply is not. The Standby indicator goes out when the amplifier goes into the Run mode.
- **Ready (yellow) –** This indicates that the amplifier is in the Ready mode. This indicator comes on only when all fault status modes are in ready condition.
- **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.

Fault Status Indicator and LCD Displays

The Fault Status Indicator (**Figure 3.13**) is a red LED located on the amplifier front panel. When the Fault Status LED is lit, it indicates that the amplifier was forced into Standby mode by a fault condition. The root cause of the fault condition and corrective actions are displayed on the LCD display.

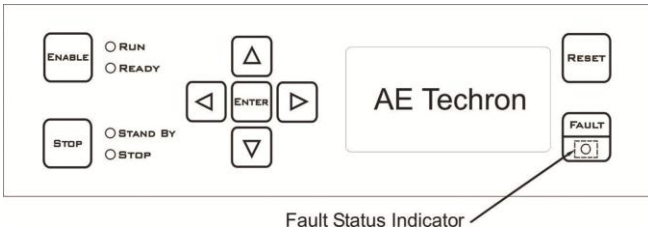

Figure 3.13 - Fault Status Indicator

The following list details the possible Fault conditions and the prescribed remedies:

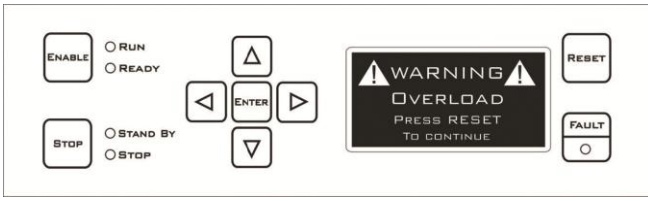

Figure 3.14 – Overload Fault LCD Display

- **Overload Fault –** An Overload fault condition is caused by amplifier output clipping. The condition may be set to "latching" on the main board, in which case the Reset button will have to be pressed to bring it out of the fault condition or "non-latching" which is self-resetting.

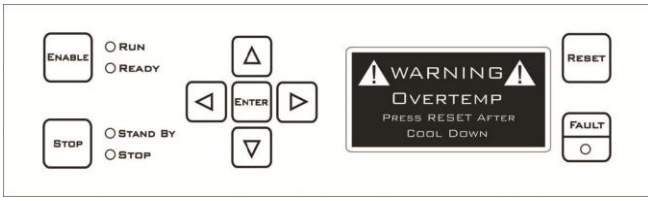

Figure 3.15 – Over-Temperature Fault LCD Display

- **Over-Temperature Fault –** An Over-Temperature fault condition is caused by the output transistor heat sinks getting too hot. After allowing the amplifier to cool, press the Reset button to bring the amplifier out of this fault condition.
- **Over-Voltage (high-line) Fault –** An Over-Voltage fault condition is caused by the three phase line supply voltage exceeding

110% of the rated line voltage. Reduce the input voltage and press the Reset button to bring the amplifier out of this fault condition.

- **Output Device Fault –** An Output Device fault condition is caused by an output transistor failing, amplifier instability, undesired oscillation, or the flyback protection bridge is shorted. Factory service is usually required when this fault condition occurs.

Figures 3.14 through 3.17 illustrate the possible Fault Status LCD displays.

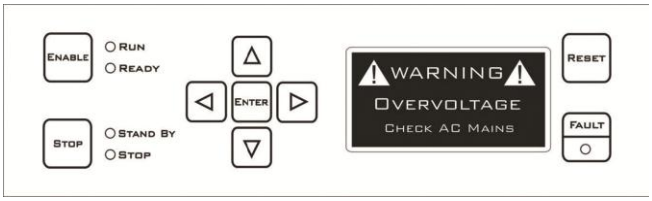

Figure 3.16 – Over-Voltage (high-line) Fault LCD Display

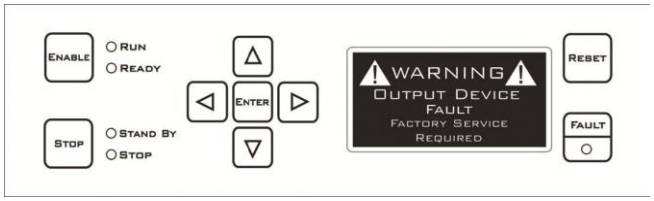

Figure 3.17 – Output Device Fault LCD Display

3.2 Back-Panel Controls and Connectors

This section provides an overview of Back-Panel controls and connectors found on the

Figure 3.18 – Back-Panel Controls and Connectors

7548/7796. Please refer to **Figure 3.18** for visual locations.

A. **AC Power Connector -** This is a NEMA style twist lock, 4 pin (208V) or 5-pin (400V), three-phase connector. See page **Error! Bookmark not defined.** for terminal connections.
B. **Low-Voltage Fuse -** This is a 1A slow blow type 600-volt rated fuse.
C. **AC Mains Switch/Circuit Breaker -** This dual function power switch and circuit breaker opens all legs of the AC mains. The rating is 20A (7548) or 30A (7796) for 208 volts.
D. **Output Terminal Block -** Connect output lines from the load to this 4-terminal block. It accepts up to #4 AWG wire. Drive the load in the Controlled Current mode using the OUTPUT terminal and the SAMPLED COMMON terminal only.
E. **BNC Input Connector -** This input option provides a standard unbalanced input.
F. **Input Selector Switch -** This switch selects which input connector is active, the BNC or Phoenix®.
G. **Phoenix® Input Connector -** This input option provides a balanced input.
H. **Interlock Connector -** This 25-pin, D-sub connector is used for interlocking and combining functions in a system of multiple amplifiers. It can also be used for remote control and monitoring applications (see **Section 5, Applications**).

4 Advanced Configuration

The 7548/7796 amplifier was designed to offer exceptional power and versatility in operation. You can choose from a range of field-configurable options, including:

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.

- Operate as a stand-alone amplifier or as part of a multiple-amplifier system.
- Trim the overall gain of the amplifier.
- Select Controlled-Current or Controlled-Voltage modes of operation.
- Adjust the Compensation for Controlled-Current mode of operation.
- Standby Mode/Ready Mode setting for selection of power-up state.
- Stop Mode on OverTemp setting to trigger Stop Mode when amplifier senses an OverTemperature stat.
- Stop Mode on OverLoad setting to trigger Stop Mode when amplifier senses an OverLoad state.

4.1 Factory Defaults

Your 7548/7796 amplifier has been configured to operate to the following factory defaults:

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.

- Controlled-Voltage mode
- Master/ Single mode
- CC1 Compensation network
- Power-Up into Ready mode
- Stop Mode on OverTemp disabled
- Stop Mode on OverLoad disabled

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

4.2 Accessing the Main Board

The 7548/7796 amplifier Main Board can be accessed by removing the amplifier front panel.

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

1. Turn the power to the amplifier "OFF".
2. Remove the four hex-head screws, located along the left and right edges of the amplifier front panel.
3. Remove the front cover by pulling straight towards you.

4.3 Configuration Settings Located on the Main Board

The following custom settings can be made via settings on the Main Board, which is located behind the amplifier front panel.

4.3.1 Master/Slave Setting

The 7548/7796 amplifier can be configured for operation within a multi-amplifier system, with up to four amplifiers configured for series or parallel operation. To enable the 7548/7796 amplifier for use as a Slave amplifier in a multi-amplifier system, adjust the jumper settings on **Jumpers P1 and P2** by placing **BOTH** jumpers in the **DOWN** position (lower pair of pins). To enable the 7548/7796 amplifier for use as a single amplifier or as the Master amplifier in a multi-amplifier system, adjust the jumper settings on **Jumpers P1 and P2** by placing **BOTH** jumpers in the **UP** position (upper pair of pins). **See Figure 4.1.**

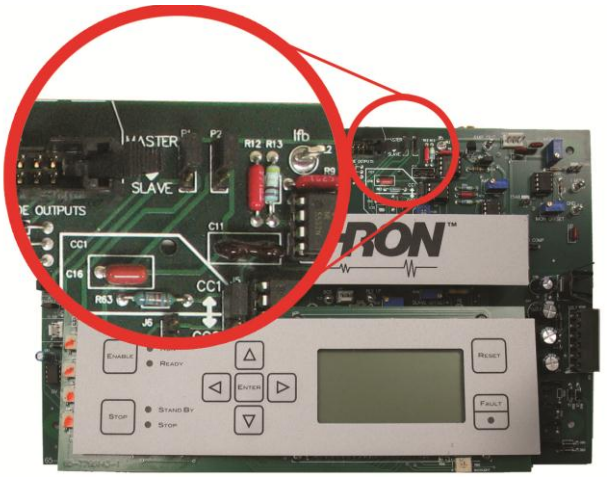

Figure 4.1 - Master / Slave Setting

For information on input and output wiring for7548/7796 multi-amplifier applications, please contact AE Techron.

4.3.2 Gain Trim Control

The 7548/7796 amplifier allows control of gain via a multi-turn potentiometer (**R210**). **R232** resistor sets the coarse gain and **R247** sets the range or sensitivity of R210. **See Figure 4.2.**

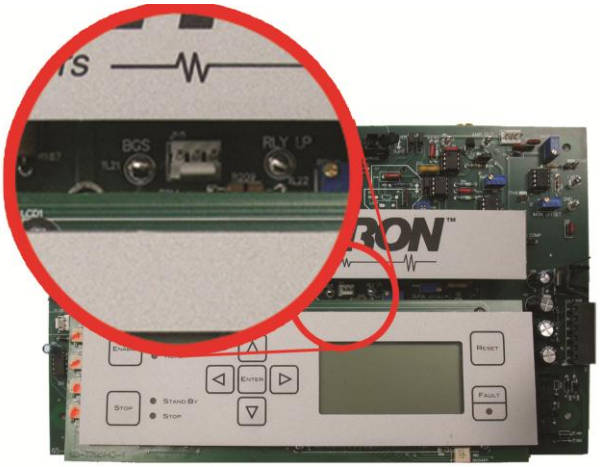

Figure 4.2 - Gain Trim Control

4.3.3 Controlled Voltage/Controlled Current Setting

To allow the 7548/7796 amplifier's output voltage to be controlled by its input voltage signal (CV mode), place jumper **J4** in the **RIGHT** position (right pair of pins). To allow the 7548/7796 amplifier's output current to be controlled by its input voltage signal (CC mode), place jumper **J4** in the **LEFT** position (left pair of pins). **See Figure 4.3.**

CAUTION

Because the load in CC mode is part of the amplifier circuit, the relationship of the load to the amplifier is critical. For proper and safe current mode of operation, you must observe the following guidelines:

1. **Properly attach a load before operating the amplifier.** Use only Outputs and Sampled Common terminals. DO NOT use the Common terminal.
2. **DO NOT use a blocking capacitor.** The load much 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 that the load has some inductive component.**
5. **Compensate, appropriately, for the load.**
6. **Turn off the amplifier immediately if oscillation occurs.**

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

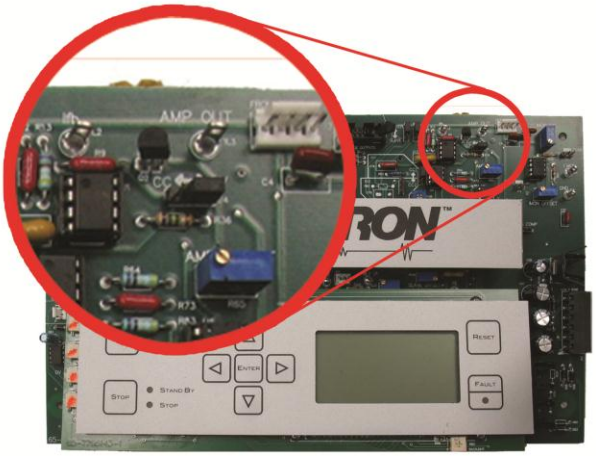

Figure 4.3 - Controlled Voltage / Controlled Current Setting

4.3.4 Compensation Setting (Controlled Current Mode)

When the 7548/7796 amplifier is used in Controlled Current (CC) mode, the current control loop is tuned with one of two available RC networks: CC1 (R63 and C16) or CC2 (R82 and C25). Place jumper **J5** in the **UP** position to select the **CC1 network** (factory default). Place jumper **J5** in the **DOWN** position to select the **CC2 network. See Figure 4.4.**

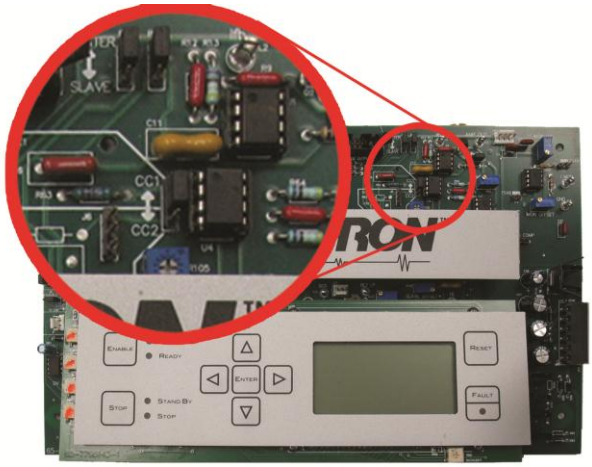

Figure 4.4 - Compensation Setting

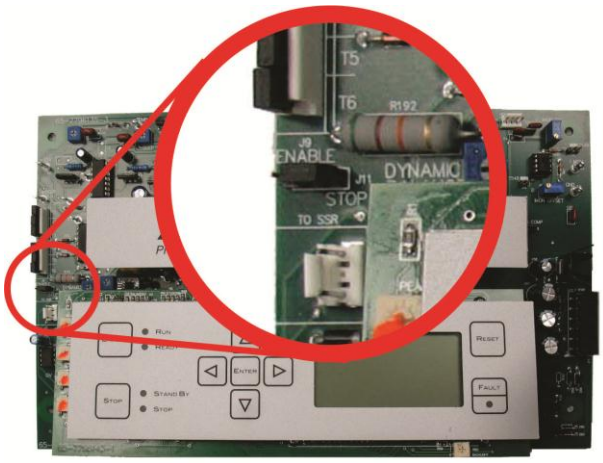

Figure 4.5 – Ready Mode/Standby Mode Power-up Setting

4.3.5 Ready Mode/Standby Mode Power-up Setting

The 7548/7796 amplifier will bypass Standby Mode and cycle directly to **Ready Mode** on power-up when jumper **J11** is in the **Left** position. To set the amplifier to power-up to **Standby Mode,** place jumper **J11** in the **Right** position. **See Figure 4.5.**

4.3.6 Stop Mode on OverTemp Setting

When enabled, the 7548/7796 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

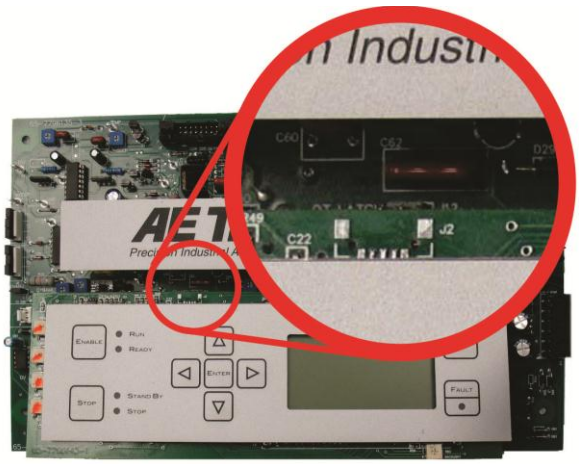

Figure 4.6 – Stop Mode on OverTemp Setting

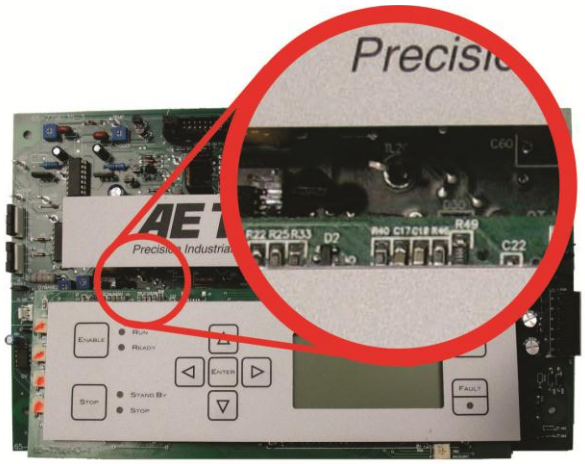

Figure 4.7 – Stop Mode on OverLoad Setting

Ready/Run (operational) Mode. To enable **Stop Mode on OverTemp,** place the jumper across the two pins labeled **J12. See Figure 4.6.**

4.3.7 Stop Mode on OverLoad Setting

When enabled, the 7548/7796 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 4.7.**

4.4 Adjusting the Bi-Level Power Supply Switch

The 7548/7796 amplifier offers three Bi-Level switch settings: Automatic, High, or Low. The user can select between settings via a switch on the Power Supply Board. The Power Supply Board is a horizontal board located below the main and display boards. To access the Bi-Level Power Supply Switch, follow the directions in **Section 4.2, Accessing the Main Board.** Locate the Bi-level Power Supply Switch as shown in **Figure 4.8.**

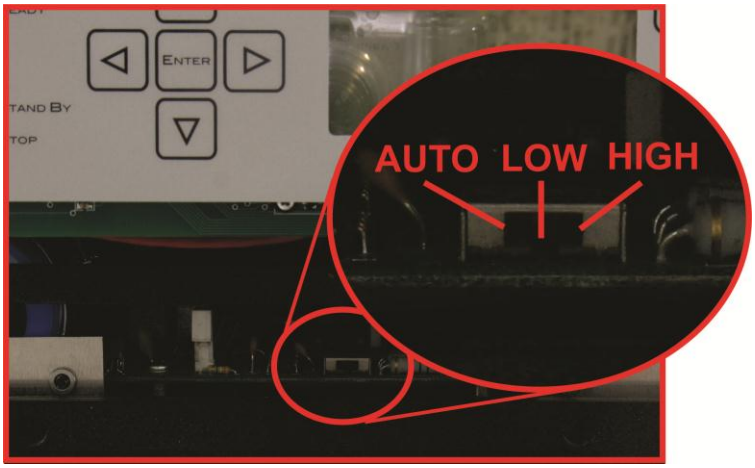

Figure 4.8 – Bi-Level Power Supply Switch Location

- **AUTO** (left position) – power supply will switch depending on voltage requirements. (Factory-default Setting)
- **LOCKED LOW** (center position) – power supply will remain in low-voltage mode.
- **LOCKED HIGH** (right position) – power supply will remain in high-voltage mode.

5 Applications

5.1 Remote Status and Control using the SIM Interlock I/O Connector

The procedures outlined in this section assume competence on the part of the reader in terms of amplifier systems, electronic components, and good electronic safety and working practices.

AE Techron 7548 and 7796 amplifiers come with a SIM-BNC input module that also contains a female, 25-pin D-Sub connector. This connector can be used to provide remote control and monitoring of the amplifier.

The information provided here will instruct you in the wiring of several control and status applications including:

- Over-temperature status
- Run status
- Overload status
- Overvoltage status
- Reset after Over-temperature or Overload error
- Voltage monitor
- Current monitor

Figure 5.1 maps the pins used for these applications.

For a detailed chart of all DB-25 pinouts, see **Appendix 1.**

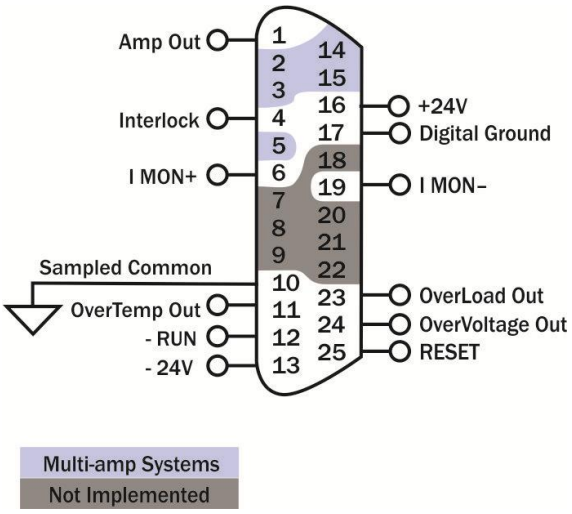

Figure 5.1 – Remote Status and Control Pinouts

5.1.1 Remote Enable / Standby

Using the SIM-BNC Interlock connector located on the back panel of the amplifier, you can remotely Enable the amplifier and/or place the unit in Standby mode.

Remote Enable/Standby
Purpose: Use a switch or optocoupler to remotely disable the amplifier and place it in Standby mode. Also, return the amplifier from Standby mode to the Run condition.
Method: Short PIN 4 of amplifier to Digital Ground (PIN 17) using a dry contact switch or optocoupler. In multi-amp applications, a switch can be used for Parallel systems, but an optocoupler must be used for Series systems. Multiple amplifiers (sharing the same Sampled Common power connections) can be simultaneously forced to Standby by daisy-chaining Interlock (PIN 4) across amps.
When Interlock (PIN 4) is shorted to Digital Ground (PIN 17), amplifier is placed in Standby mode. When switch is open, amplifier is released to the Run condition. See **Figure 5.2.**
Signal Type: DC
Level when Asserted: 0 to 8 V
Level when Deasserted: 10 to 15 V

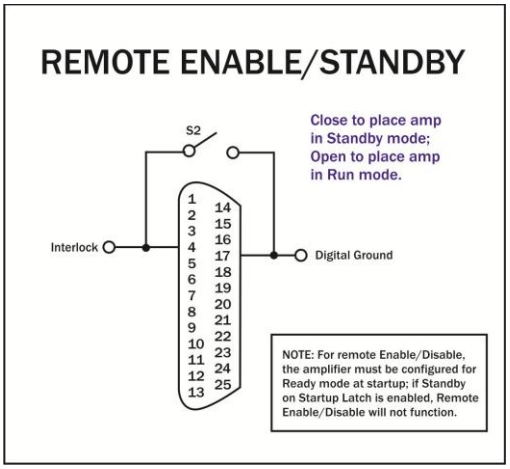

Figure 5.2 – Remote Enable/Standby

IMPORTANT: The amplifier must be configured for Ready mode at startup (factory default) or the Run button must be pressed at the amplifier front panel at startup. The Remote Enable/Standby circuit will not function if the Startup to Standby Latch has been activated on the amplifier.

5.1.2 Remote Amplifier Status and Reset

The SIM Interlock I/O Connector can be used to create a circuit to monitor remotely one or more amplifier conditions, including Run status, Over-temperature, Overload and Overvoltage. The circuit can also be constructed to allow remote reset of the amplifier when it is forced to Standby by Over-temperature or Over-load conditions.

Use a male, 25-pin D-Sub connector and high-quality wire to build the circuit. **Figure 5.3** schematic details the circuit and components required for all status and reset functions.

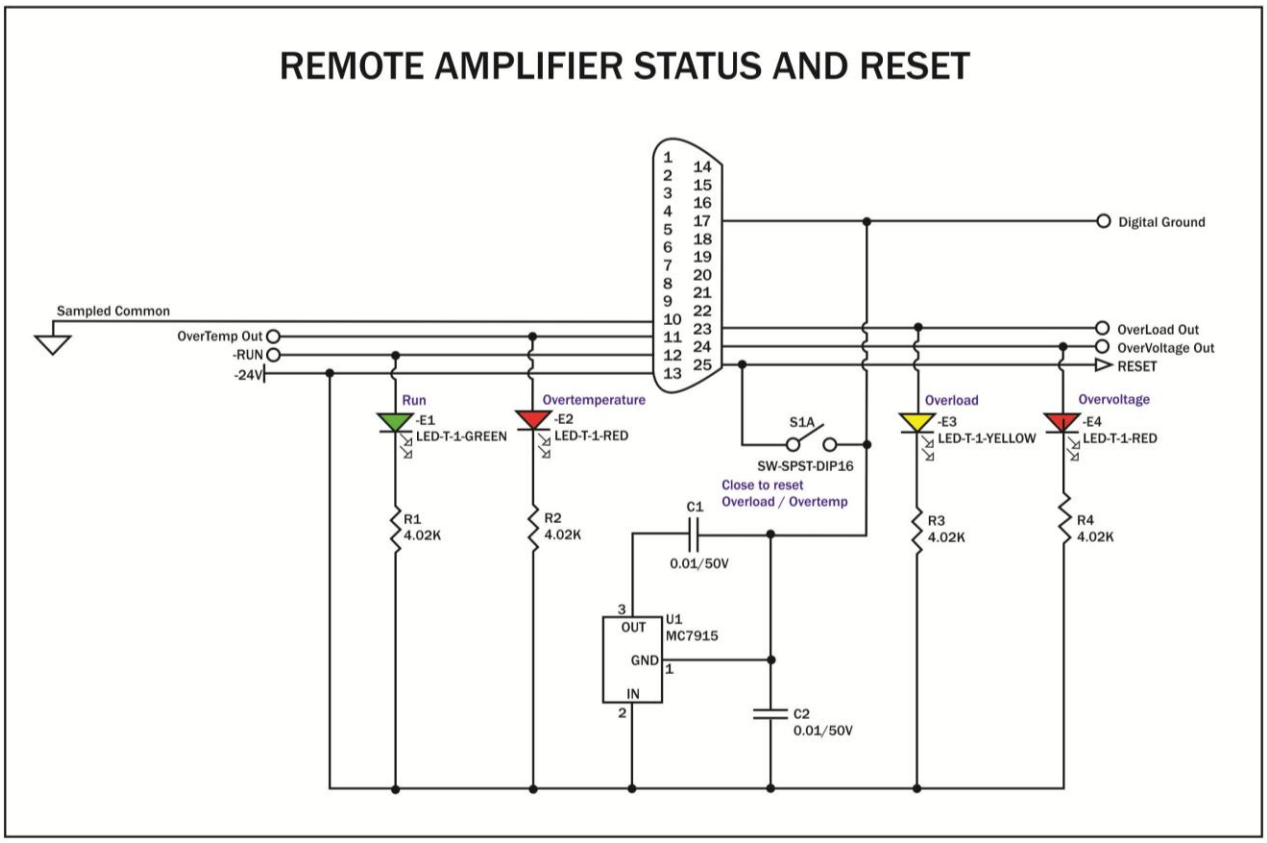

Figure 5.3 – Remote Status and Reset Schematic

Remote Signal of Over Temperature Condition
Purpose: LED, when lit, signals Over Temperature condition.
Method: Use a 6mA series resistor of 4.02 Kohm for LED or OPTO, tie OverTemp Out (PIN 11) to -24V source (PIN 16).
Signal Type: DC
Level when Asserted: –24V
Level when Deasserted: 0V
Note: When amp is normal, this pin is pulled to –24V through a 47.5K-ohm resistor; when amp is in OverTemp state, transistor Q37 turns on and sources chassis ground as an output. Do not exceed 20 milliamps.

OverTemp condition will force amp to Standby (default) or to Stop (when Stop Mode on OverTemp option is enabled). If in Standby, amp will automatically move to Run when temperature cools to operating levels. If in Stop, Reset must be triggered via front-panel Reset button or remote Amplifier Reset.

Remote Signal of Run Condition
Purpose: LED, when lit, signals Run state.
Method: Use a 6mA series resistor of 4.02K-ohm for LED or OPTO, tie Run (PIN 12) to –24V source (PIN 16).
Signal Type: DC
Level when Asserted: –24V
Level when Deasserted: 0V

Remote Signal of OverLoad Condition
Purpose: LED, when lit, signals Overload condition.
Method: Use a 6mA series resistor of 4.02K-ohm for LED or OPTO, tie OverLoad Out (PIN 23) to –24V source (PIN 16).
Signal Type: DC
Level when Asserted: –24V
Level when Deasserted: 0V
Note: When amp is normal, this pin is pulled to –24V through a 47.5K-ohm resistor; when amp is in Overload state, transistor Q36 turns on and sources chassis ground as an output. Do not exceed 20 milliamps.

OverLoad condition will force amp to Standby (default) or to Stop (when Stop Mode on OverTemp option is enabled). If in Standby, amp will automatically move to Run when overload is remedied. If in Stop, Reset must be triggered via front-panel Reset button or remote Amplifier Reset.

Remote Signal of OverVoltage Condition
Purpose: LED, when lit, signals Overvoltage condition.
Method: Use a 6mA series resistor of 4.02K-ohm for LED or OPTO, tie OverVoltage Out (PIN 24) to –24V source (PIN 16).
Signal Type: DC
Level when Asserted: –24V
Level when Deasserted: 0V
Note: When amp is normal, this pin is pulled to –24V through a 47.5K-ohm resistor; when amp is in Overvoltage state, transistor Q29 turns on and sources chassis ground as an output. Do not exceed 20 milliamps.

Reset from Standby or Stop
Purpose: Switch, when thrown, returns amp to Ready/Run condition after Over-temperature or Overload conditions.
Method: Use a dry-contact switch, voltage regulator (MC7915), and two 0.01/50V capacitors; wire the circuit as shown (above). Assert 15V for at least 100 ms to clear the error condition.
Signal Type: DC
Level when Asserted: –15V
Level when Deasserted: 0V
Note: Tie to PIN 13 (–24V dc) and create a –15V dc source; <2mA required for reset. Connect the –15V dc source to PIN 25 (Reset) through a 1K buffer resistor to reset.

5.1.3 Remote Monitoring of Voltage and Current

Using the SIM-BNC Interlock connector located on the back panel of the amplifier, you can remotely monitor both voltage and current output.

Use a male, 25-pin D-Sub connector and high-quality wire to build the desired circuits.

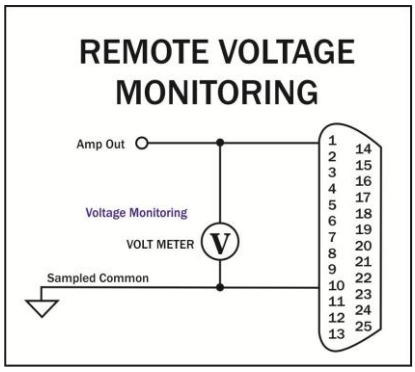

Figure 5.4 – Remote Voltage Monitoring Schematic

Remote Monitoring of Voltage Output
Purpose: Use a voltage meter to monitor output voltage.

Method: Connect a voltage meter to monitor the output voltage being produced by the amplifier. Connect across PIN 1 (Amp Out) and PIN 10 (Sampled Common). **See Figure 5.4.**
Signal Type: AC or DC
Level when Asserted: Can be greater than +/–200Vpeak
Level when Deasserted: 0V
Note: Used for monitoring amplifier output voltage; driving slave amplifiers in multi-amp systems. Wired to amplifier output. Do not connect to any impedance of less than 10K ohm. High voltage output possible. Use appropriate safety precautions.

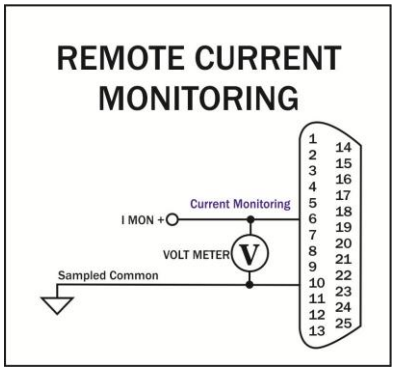

Figure 5.5 – Remote Current Monitoring Schematic

Remote Monitoring of Current Output
Purpose: Use a voltage meter to monitor output current.
Method: Connect a voltage meter to monitor the output current being produced by the amplifier. Connect across PIN 6 (I MON+) and PIN 10 (Sampled Common). See **Figure 5.5.**
Signal Type: DC
Level when Asserted: 7212/7224: 5A/V; 7548/7796: 20A/V
Level when Deasserted: 0V

Remote Monitoring of Current Output - Alternate Method
Purpose: Use a voltage meter to monitor output current when output is not balanced.
Method: Connect a voltage meter to monitor the output current being produced by the amplifier. Connect across PIN 6 (IMON+) and PIN 19 (IMON-). See **Figure 5.6.**
Signal Type: AC
Level when Asserted: 7212/7224: 2.5A/V; 7548/7796: 10A/V
Level when Deasserted: 0V
CAUTION: To avoid ground loops, isolation from ground must be provided. Use of a differential probe is recommended.

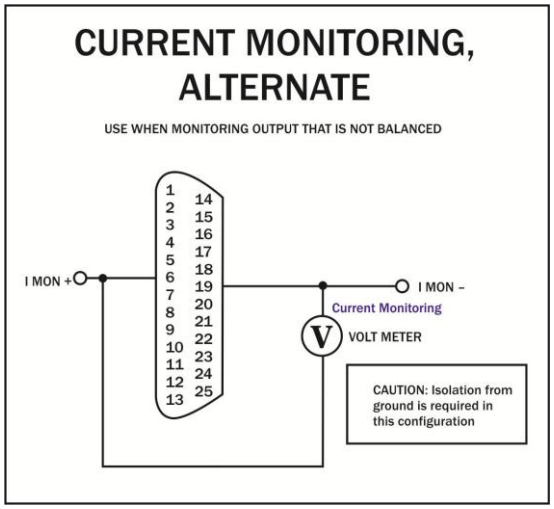

Figure 5.6 – Remote Current Monitoring Schematic, Alternate Method

Remote Monitoring of Run/Standby Status
Purpose: Use a voltage meter to monitor Run/Standby state of the amplifier.
Method: Connect a voltage meter to monitor the circuit voltage. Connect across PIN 4 (Interlock) and PIN 10 (Sampled Common). See **Figure 5.7.**
Signal Type: DC
Level when Asserted: >10V (amplifier in Run state)
Level when Deasserted: <10V (amplifier in Standby state)
NOTE: The circuit has a 100K pull-up resistor; make sure the monitor function has sufficient impedance to avoid accidentally influencing status.

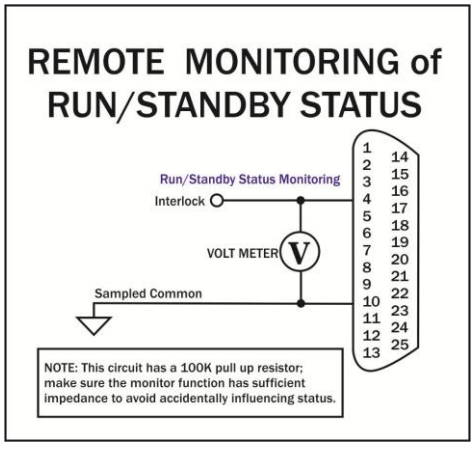

Figure 5.7 – Remote Run/Standby Status Monitoring Schematic

5.2 Controlled Current Operation

The procedures outlined in this section assume competence on the part of the reader in terms of amplifier systems, electronic components, and good electronic safety and working practices.

5.2.1 Controlled-Voltage vs. Controlled-Current Modes of Operation

AE Techron 7548/7796 amplifiers can be field-configured to operate as **Voltage Amplifiers** (Voltage-Controlled Voltage Source) or as **Transconductance Amplifiers** (Voltage-Controlled Current Source). The mode selection is made via a jumper setting located on the amplifier main board. See **Section 4, Advanced Configuration.**

When configured as a **Controlled-Voltage** source (voltage amplifier), the amplifier will provide an output voltage that is constant and proportional to the control (input) voltage. If the load's impedance changes, the amplifier will seek to maintain this ratio of input to output voltage by increasing or decreasing the current it produces, as long as it is within the amplifier's ability to create the required current. Use this mode if you want the output voltage waveform to be like the input waveform.

Conversely, when configured as a **Controlled-Current** source (transconductance amplifier), the amplifier will provide an output current that is constant and proportional to the control (input) voltage. If the load's impedance changes, the amplifier will seek to maintain this transconductance (ratio of input voltage to output current) by increasing or decreasing the voltage it produces, as long as it is within the amplifier's ability to create the required voltage. Use this mode if you want the output current waveform to be like the input waveform.

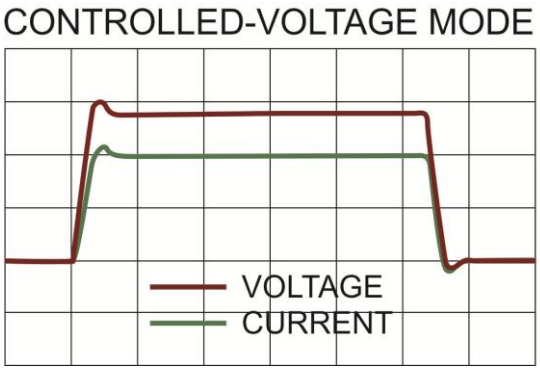

Figure 5.7 – Input to Output Comparison, Controlled-Voltage Operation

Safety and Operation Considerations for Controlled Current Operation

When an AE Techron amplifier is configured as a Controlled Current source, care needs to be exercised in its operation. **Any voltage controlled current source should never be turned on without a load, (with some impedance, real or effective) connected to its output terminals.** When asked to operate in this way, any current source (including an AE Techron amplifier) will increase its output voltage in an attempt to drive the requested current into the load. In an open-circuit condition, creating current flow will be impossible. The current source will increase its output voltage until it reaches its voltage limit. This is a potentially dangerous condition for both the AE Techron amplifier and for any user who might come in contact with the amplifier output terminals.

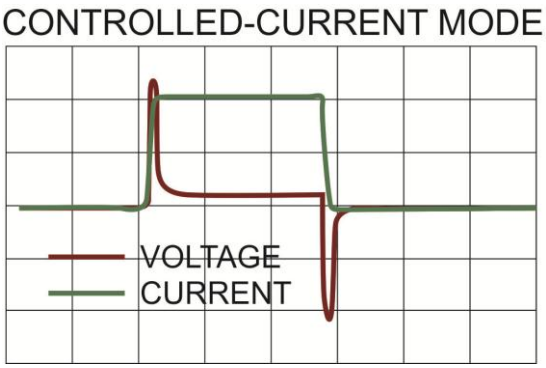

Figure 5.8 – Input to Output Comparison, Controlled-Current Operation

When operating in Controlled Current (CC) mode, a compensation circuit is required to ensure accurate output current. Since the load is a critical circuit component in CC mode, the inductive and resistive values of the load will determine the required compensation values. While the factory-default compensation setting will be sufficient for some applications, the compensation setting may also be adjusted in the field. The following section describes methods for determining and setting proper compensation when operating in Controlled-Current mode.

5.2.2 Controlling Compensation for CC Operation

AE Techron 7548/7796 amplifiers can be configured for either Controlled Voltage (CV) or Controlled Current (CC) mode of operation. When operating the amplifier in Controlled Voltage (CV) mode, compensation is not required. However, when operating in Controlled Current (CC) mode, the amplifier load becomes an integral part of the system. In order to ensure system stability and to control available bandwidth, compensation via an RC network is required for CC operation. The following steps will allow you to compensate your amplifier for operation in CC mode safely and effectively.

STEP 1: Check Amplifier Operation in CV mode.

We recommend that you power-up and enable the amplifier in Controlled Voltage mode without attaching a load before configuring your amplifier for Controlled Current operation. This will allow you to verify that the input signal and the amplifier are operating correctly.

Once this initial check is completed, power down the amplifier and access the amplifier main board to place the amplifier in CC mode. (Refer to **Section 4, Advanced Configuration**.)

One of two compensation settings can be selected via jumpers on the main board: CC1 which enables the factory-installed RC network (see Figure 1), or CC2 which allows installation of a custom RC network.

STEP 2: Determine Required Compensation.

When operating an amplifier in Controlled Current mode, the load becomes an integral part of the system. In order to determine the required compensation for your load, begin by consulting the following table to determine the approximate compensation capacitance (C) required based on the inductance of your load:

	Load Inductance (L)		
	<200 microHenries	> 200 microHenries to < 1 milliHenry	>1 milliHenry
Compensation Capacitance (Cc)	0.001 microfarad	0.01 microfarad	0.1 microfarad

NOTE: Load Resistance (R) is assumed to be <5 ohms.

STEP 3: Determine if Default or Custom Compensation is Required.

If your load inductance is between 200 microHenries and 1 milliHenry, and your load resistance is less than 5 ohms, then you can likely use the default compensation provided by the amplifier's factory-installed RC network. To select the factory-default compensation, please see **STEP 4** below.

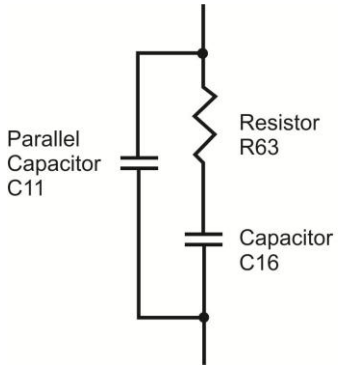

Figure 5.9 – Factory-installed default RC network

If your load inductance falls outside of the mid-range, or if your load resistance is greater than 5 ohms, then you must calculate your required compensation. If, after calculating your required compensation, you determine that the default compensation will be insufficient for your load, then you will need to enable and install a custom RC network. See **STEP 6** below.

STEP 4: Enabling Your Compensation Setting.

AE Techron 7000 Series amplifiers can be enabled with one of two compensation settings: default RC network or custom RC network. The required network can be selected via jumpers on the main board. CC1 enables the default (factory-installed) RC network, while CC2 allows installation of a custom RC network. **Figure 5.9** describes the default RC circuit.

To select CC1, place jumper J5 in the UP position; to select CC2, place jumper J5 in the DOWN position. (For jumper location, see **Section 4, Advanced Configuration**.)

IMPORTANT: If CC2 is selected, you must calculate the compensation requirements for your custom RC network and install the network on your amplifier main board before operating the amplifier in CC mode.

STEP 5: (Optional) Verify Suitability of Default Compensation (CC1)
If desired, the following values of the components contained in the default RC network can be used with the formulas provided in **STEP 6** below to verify the suitability of the default compensation for your uses.

Pins Jumped	Compensation Resistor	Compensation Capacitor	Parallel Capacitor
1 & 2 UP	R63 68 K-ohms	C16 0.047 microfarad	C11 47 picofarad

STEP 6: Installing an RC Network for Custom Compensation
If the default RC network does not provide suitable compensation for your intended load, you will need to install a custom RC network that is matched to your load. This network will require two components (a resistor (R) and a capacitor (C)) to be installed on the main board. To calculate the approximate values required for each component, use the fomulas provided below.

COMPENSATION FORMULAS:

To find the value for the resistor (Rc) in the RC network: **Rc = 20,000 x 3.14 x L x BW**
where:
Rc is compensation resistance in ohms.
L is load inductance in henries.
BW is bandwidth in hertz.

To find the value for the capacitor (Cc) in the RC network: **Cc = L/ (R x Rc)**
where:
Cc is compensation capacitance in farads.
L is load inductance in henries.
R is resistance of load in ohms.
Rc is compensation resistance in ohms.

STEP 7: Optimizing the Compensation Values.
Once an approximate Rc and Cc have been computed, these values will need to be evaluated. To do this, install components with the required values in the main board at locations R82 and C25 as shown in **Figure 5.10.**

Remember the load you are connecting is a part of the system and the amplifier should not be turned on without the load being connected.

After installing the components, check to ensure that jumper J5 is correctly installed (see **STEP 4**), then power up the amplifier without signal input.

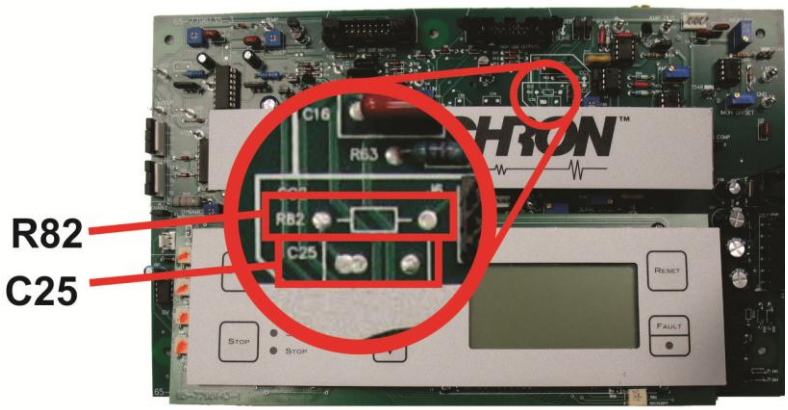

Figure 5.10 – Custom Compensation Location

To begin testing, input a square wave with a frequency of 100 Hz to 1 kHz, or a squared pulse at a low level (typically 0.25 to 2.0 volts). A limited-rise-time, repetitive pulse of low duty cycle is preferred.

Observe the output current through a current monitor or current probe. Look for clean transition edges. The presence of ringing or rounding on the transition edges indicates compensation problems. (See **Figure 5.11**.)

If a change in compensation is necessary, an adjustment to the resistor component of the Compensation circuit is probably required.

If the output current waveform is ringing, the circuit is underdamped: You have too much gain and should lower the resistance (see **Figure 5.12**).

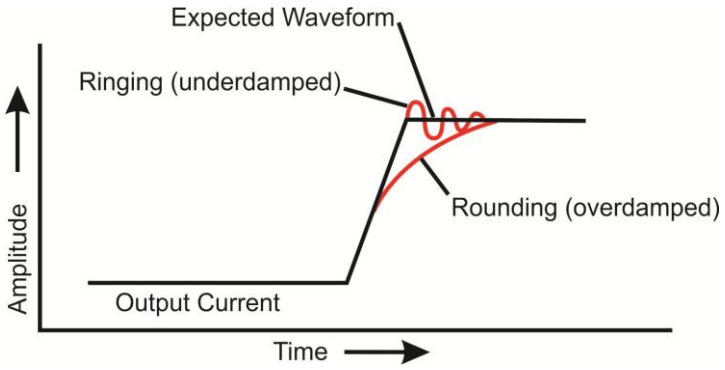

Figure 5.11 – Compensation Effects on Waveform

If the output current waveform is rounded, the circuit is overdamped: You have too little gain and should increase resistance (see Figure **5.13**).

If the output current waveform is neither underdamped or overdamped, but the top of the squarewave is not level, then you should instead increase the capacitor value (see **Figure 5.14**).

When making adjustments:
Resistor: Increase or decrease resistance values in increments of +/- 10%.
Capacitor: Incrementally increase capacitor values by a factor of 2 or 3.

After final adjustments have been made to the circuit, the final waveform for your planned application should be tested to confirm the amplifier's compensation setting.

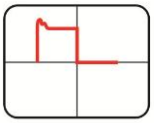

Figure 5.12 – Square Wave Showing a Decrease in R is Required

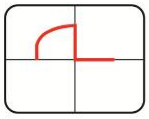

Figure 5.13 – Square Wave Showing an Increase in R is Required

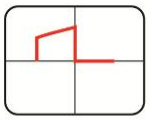

Figure 5.14 – Square Wave Showing an Increase in C is Required

NOTE:

- If possible, use 1% metal film resistors. AE Techron discourages installation of potentiometers in the resistor location of the compensation circuit because this can decrease stability and may increase inductance.
- The parallel capacitor in the RC network serves to increase stability but can be removed, if it is not required for system stability. If the parallel capacitor is used, it will usually decrease the value of resistance needed.
- In multiple amplifier systems, expect to decrease the value of R63 in series systems by 1/2.

5.3 Multi-amplifier Systems

AE Techron 7548 and 7796 amplifiers may be paired with matching 7548 or 7796 amplifiers to increase voltage or current. Because the internal circuitry of 7548/7796 amplifiers is not connected to chassis ground, these amplifiers are well suited for use in series or parallel with other 7548 or 7796 amplifiers.

Up to four 7548/7796 amplifiers may be configured in series or parallel, and configurations with more amplifiers may be possible, depending on the application. Please contact AE Techron Application Support for information on 7548/7796 Multi-Amp Systems.

6 Maintenance

Simple maintenance can be performed by the user to help keep the equipment operational. The following routine maintenance is designed to prevent problems before they occur. See **Section 7, Troubleshooting,** for recommendations for restoring the equipment to operation after an error condition has occurred.

Preventative maintenance is recommended after the first 250 hours of operation, and every three months or 250 hours thereafter. If the equipment environment is dirty or dusty, preventative maintenance should be performed more frequently.

6.1 Clean Amplifier Filter and Grills

6.1.1 Tools Required

The recommended equipment and supplies needed to perform the functions required for this task are described below.

- Vacuum cleaner
- Damp cloth (use water only or a mild soap diluted in water)

CAUTION

Before you begin, make sure your amplifier is disconnected from the power source, with power switch in the OFF position and all level controls turned completely down (counter-clockwise).

To ensure adequate cooling and maximum efficiency of the internal cooling fans, the amplifier's front and rear grills should be cleaned periodically. To clean the amplifier grills and filter, complete the following steps:

1. Turn completely down (counter-clockwise) all level controls and turn the amplifier OFF. Disconnect the amplifier from its power source.
2. Using a vacuum cleaner, vacuum the front ventilation grill, including the filter behind the grill, and the back ventilation exit grill.
3. Using a damp cloth, clean the front and rear ventilation grills. Dry with a clean cloth or allow to air dry. **IMPORTANT: Grills should be completely dry before plugging in or restarting amplifier.**

7 Troubleshooting

7.1 Introduction & Precautions

This section provides a set of procedures for identifying and correcting problems with the 7548/7796 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 towards an experienced electronic technician; it

DANGER

Uninsulated terminals with AC mains potential are exposed when the panel is removed. Do not proceed until AC Mains have been disconnected.

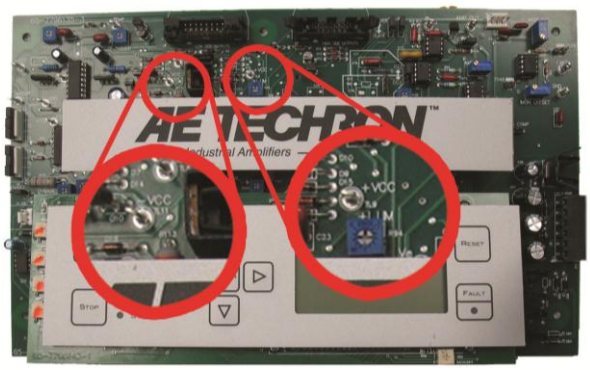

Figure 7.1 - +Vcc and-Vcc test point locations

assumes that the technician has knowledge of typical electronic repair and test procedures.

Please be aware that the 7548/7796 amplifiers 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.

7.2 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.

Figure 7.2 - Amplifier Cover removed for inspection

1. To perform a Visual Inspection, first turn OFF the power at the rear circuit breaker.
2. Disconnect the AC mains plug from the amplifier.
3. Wait three to five minutes for the Power Supply capacitors to discharge.
4. Remove the 16 single screws from the top cover.
5. You can verify the capacitor discharge by connecting a voltmeter across +Vcc and –Vcc test points on the main board (**see Figure 7.1**). Verify a reading of less than 5 volts before proceeding.
6. Inspect the amplifier's internal components (**see Figure 7.2**). Check the following:
7. Inspect modules for charring, breaks, deformation or other signs of physical damage.
8. Look for any foreign objects lodged inside the unit.
9. Inspect the entire lengths of wires and ribbon cables for breaks or other physical damage.
10. If there is any physical damage to the amplifier, please return it to AE Techron for repair.

7.3 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 17 for more information.
2. Signal is not connected to any inputs on the SIM card. See page 10.

7.4 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 11).
2. Back-panel circuit breaker is not in the UP position.
3. Fuse F1 is open.

To Inspect Fuse F1 follow these steps:

1. Turn OFF the amplifier and disconnect the AC mains.
2. Locate Fuse Cover on the amplifier back panel (**see Figure 7.3**). Remove Fuse Cover.

Figure 7.3 - Fuse Cover location

3. Remove fuse and inspect. Replace if necessary.

7.5 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.

7.6 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 7.4**). For more information on Remote Operation, see **Section 5, Applications.**
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 7.4 - Interlock I/O Connector

7.7 Amplifier Overheats (Over-Temperature Fault Condition)

There are two possible reasons why the 7548/7796 amplifier is overheating:

1. Excessive Power Requirements
2. Inadequate Airflow

7.7.1 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 in **Section 8, Specifications.**
2. Faulty output connections and load.
3. Undesired DC offset at the Output and Input signal.

Monitoring Heat Sink Temperature

When running the amplifier in very difficult conditions, monitoring the amplifier's heat sink temperatures can be very instructive. The 7548/7796 amplifier has convenient points for monitoring heat sink temperatures located on the main circuit board. See **Figure 7.5.**

Connect across **+TEMP** and **GND** to monitor the heat sinks responsible for positive voltages; connect across **–TEMP** and **GND** to monitor the heat sinks responsible for negative voltages.

When running typical sine-type wave forms, readings at both monitor points should be similar. A deviation can be an indication of a DC offset that is causing one side of the amplifier to work harder than the other.

To convert the monitor point voltage readings to degrees Celsius:

Temperature in degrees Celsius = (V x 100) – 273

V = Voltage at Pin (ex. 3.73)

V x 100 = Degrees Kelvin (ex. 373.0)

–273 = Degrees Celsius (ex. 100°C)

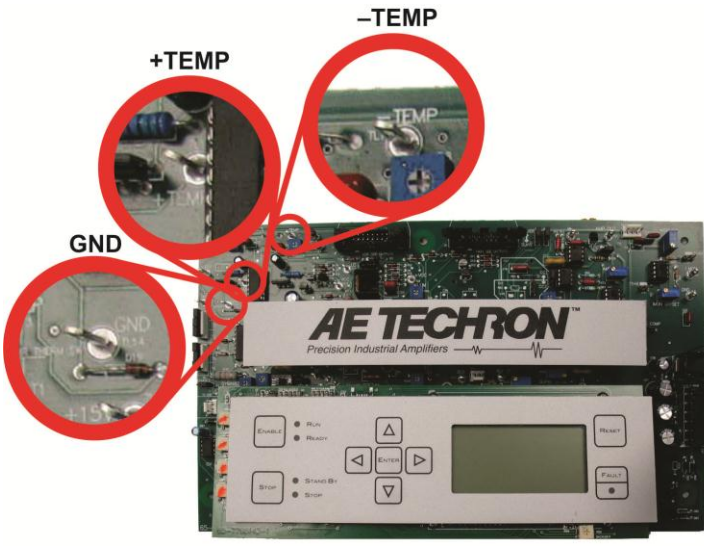

Figure 7.5 - +TEMP and–TEMP test point locations

It is recommended for most applications that long-term amplifier heat sink temperatures be limited to 100-120°C.

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:

7.7.2 Check for Inadequate Airflow

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.

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.

7.7.3 Resetting After OverTemp

To reset the amplifier after an OverTemp has occurred, make sure fans are running, and 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.

7.8 Fault LED is Illuminated

The 7548/7796 contains protection circuitry that 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.

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.

4. If the Fault LED is still illuminated and the Fault condition doesn't clear, return the amplifier for Factory Service.

7.9 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

8 Specifications

8.1 Performance (Controlled Voltage Mode)

Note: Testing performed at 208V/415V AC. The 7548/7796 amplifiers can operate from 400V AC ±10%. Since these amplifiers have an unregulated power supply, low line conditions may slightly affect the maximum voltage potential.

7548P/7796P accuracy was measured when driven into a 10 ohm load with between 0.1VDC and 6VDC or between 0.2V AC and 5V AC presented at its inputs.

Frequency Response:
DC – 30 kHz, +0.1, –0.5 dB

8 ohm Power Response:
7548:
DC-40 kHz: ± 180 Vpk
DC-50 kHz: ± 150 Vpk
DC-150 kHz:± 50 Vpk
DC-200 kHz: ± 25 Vpk

7796:
DC-50 kHz: ± 150 Vpk
DC-150 kHz: ± 50 Vpk
DC-200 kHz: ± 25 Vpk

Maximum Continuous Output Power:
7548: 3300 watts RMS
7796: 6600 watts RMS

Slew Rate:
41 V/µSec

Phase Response (10 Hz – 10 kHz):
7548: ± 5 degrees
7796: ±8.3 degrees

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

Output Offset:
7548/7796: Less than 5 mV, field adjustable to less than 1 mV
7548P/7796P: Less than 200 µV

Output Offset Current:
Less than 10 milliamperes DC

DC Drift:
7548/7796: ±1.5 mV
7548P/7796P: ± 400 µV (from cold to maximum operating temperature); ±200 µV (after 20 minutes of operation)

Residual Noise:
Unfiltered: Less than 75 µV
Filtered (400 Hz – 30 kHz):
Less than 55 µV

THD:
DC - 30 kHz less than 0.1%

8.2 Input Characteristics

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

Unbalanced:
BNC connector, 10 k ohm single ended

Gain:
Voltage Mode: 20 volts/volt
Current Mode: 20 amperes/volt

Gain Linearity (over input signal, from 0.2V to 5V):
7548/7796: 0.1%
7548P/7796P:
DC: 0.0125%
AC: 0.030%

Max Input Voltage:
± 10 V balanced or unbalanced

Input Impedance:
20 kOhm differential

Input Sensitivity:
3.0V input for 3800W output into 1 ohm (adjustable)

Common Mode Rejection Range:
± 11 VDC maximum
Common Mode Rejection Ratio:
70 dB

8.3 Display, Control, Status, I/O

Front Panel
LED Displays Indicate:
Run, Ready, Standby, Stop, and Fault conditions in the output stage

LCD Display:
Lists type of fault condition and gives suggested corrective action

Soft-Touch Switches for:
Run (Enable), Stop, Reset

User Configurable:
LCD display can be configured for up to four simultaneous displays reporting one, two or all

four of the following: Voltage Peak, Voltage RMS, Current Peak, and Current RMS

Back Panel

Power Connection:

NEMA-style locking receptacle; matching AC connector also included

Signal Output:

4-position terminal barrier block

Signal Input:

User-selectable Unbalanced BNC or Balanced Barrier Strip

Interlock Connector:

25-pin D-sub connector used for amplifier control and status applications; also used in multi-amplifier applications

8.4 Communication Capabilities

Current Monitor: ± 1V / 20A ±1%

Voltage Monitor: ± 1V / 1V ±1%

Reporting:

System Fault, OverTemp, Over Voltage, Overload

Control:

Force to Standby; Reset after a fault

8.5 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

8.6 Physical Characteristics

Chassis:

Black powder-coat chassis with all aluminum construction; designed for stand-alone or rack-mounted operation. The amplifier occupies five (7548) or seven (7796) EIA 19-inch-wide rack units.

Weight:

7548: 103 lbs (46 kg), **Typical Shipping:** 115 lbs (52.2 kg)
7796: 153 lbs (69 kg), **Typical Shipping:** 168 lbs (76.2 kg)

AC Power:

A toggle switch circuit breaker opens all legs of the AC mains on excess current demand.
7548: Three-phase, 208 VAC (±10%), 47-60 Hz, 20A AC service (400 VAC (±10%), 15A version available).
7796: Three-phase, 208 VAC, 47-60 Hz, 30A AC service (400 VAC, 20A version 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 via four (7548) or six (7796) 100 ft3/min. fans. No space is required between rack-mounted amplifiers. Air filters are removable from the rear via one fastener per side and may be eliminated if cabinet filtration is provided.

Dimensions:

7548: 19" x 22.8" x 8.75" (48.3 cm x 57.9 cm x 22.2 cm). Unit occupies 5 - EIA 19-inch wide rack units.
7796: 19" x 22.8" x 12.25" (48.3 cm x 57.9 cm x 31.1 cm). Unit occupies 7 - EIA 19-inch wide rack units.

8.7 Charts

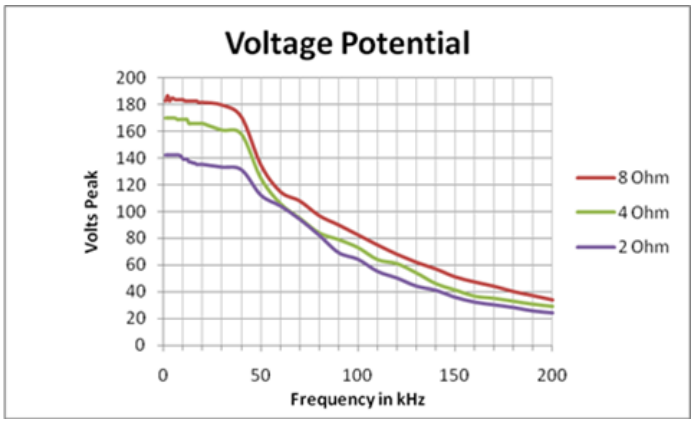

Figure 8.1 – 7548 Voltage vs. Frequency

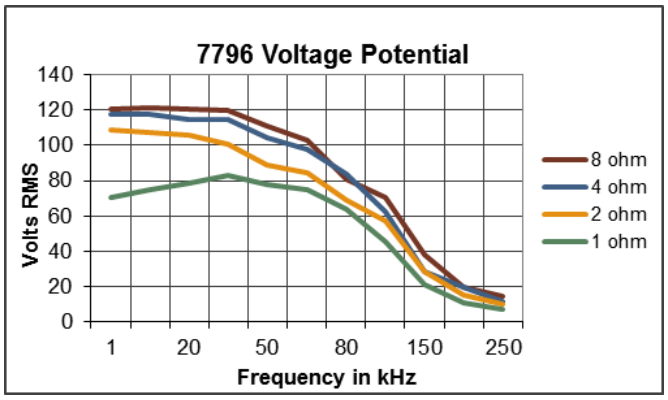

Figure 8.2 – 7796 Voltage vs. Frequency

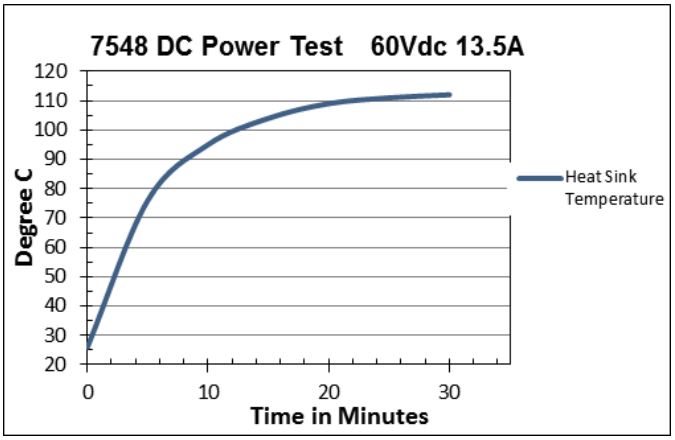

Figure 8.3 – 7548 DC Power Test

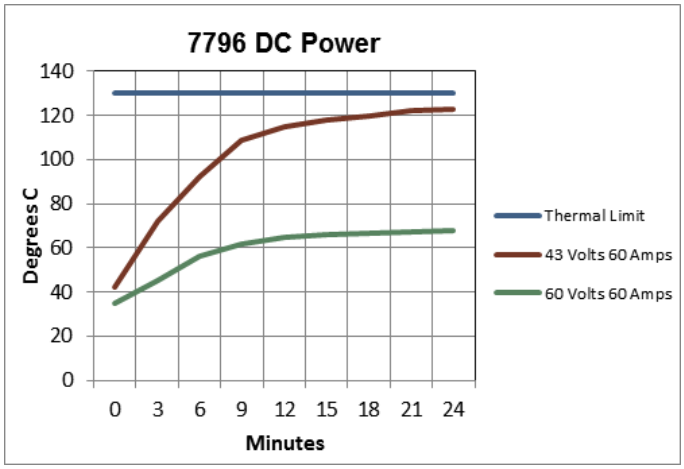

Figure 8.4 – 7796 DC Power Test

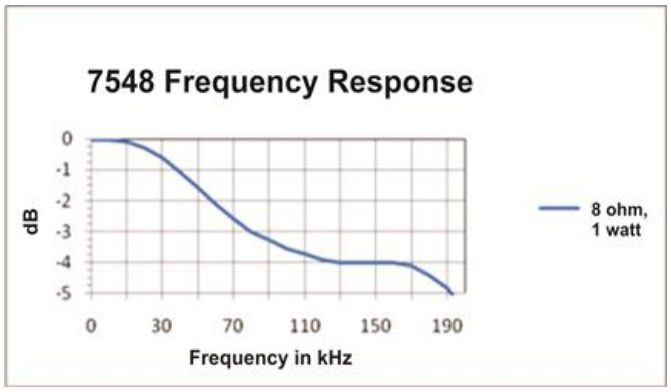

Figure 8.5 – 7548 Frequency Response

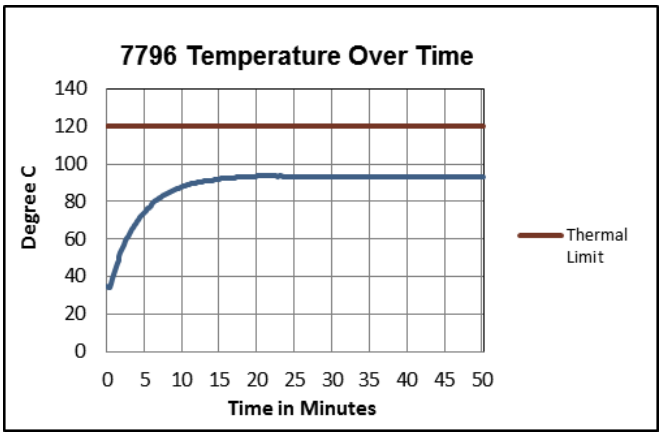

Figure 8.6 – 7796 Temperature Over Time

7548 - 40 mS Pulse Power Rating, 20% Duty Cycle

Load, Ohms	Voltage RMS	Amps RMS	Watts RMS	Voltage Peak	Amps Peak	Watts Peak
open	142	*	*	200	0	*
16	*	*	*	195	12	*
8	*	*	*	183	23	*
4	*	*	*	165	41	*
2	103.5	49	5072	150	75	11250
1.5	91	60.4	5496	134	90	11970
1	78.4	72	5645	116	105	12180
0.5	43	77	3311	66	112	7392

*Note: Performance levels typical up to 20 kHz frequency levels. Above 20 kHz, slew rate may affect performance, reducing maximum voltage, current and power output. *Not tested.*

7548 – 5 minute Continuous Power Rating, 100% Duty Cycle

Load, Ohms	Voltage RMS	Amps RMS	Voltage Peak	Amps Peak
open	141	0	200	0
16	138	8	195	12
8	129	16	183	23
4	117	29	165	41
2	0	0	*	*

*Note: Performance levels typical up to 20 kHz frequency levels. Above 20 kHz, slew rate may affect performance, reducing maximum voltage, current and power output. *Not tested.*

7548 - 1 Hour Continuous Power Rating, 100% Duty Cycle

Load, Ohms	Voltage RMS	Amps RMS	Watts RMS	Voltage Peak	Amps Peak	Watts Peak
open	141	0	0	200	0	0
16	138	8	1170	195	12	2340
8	129	16	2104	183	23	4209
4	117	29	3381	165	41	6765
2	61	30	1848	86	43	3698
1	53	53	2809	75	75	5625
0.5	Not Recommended					

Note: Performance levels typical up to 20 kHz frequency levels. Above 20 kHz, slew rate may affect performance, reducing maximum voltage, current and power output.

7796 – 40 mS Pulse Power Rating, 30% Duty Cycle

Load, Ohms	Voltage RMS	Amps RMS	Watts RMS	Voltage Peak	Amps Peak	Watts Peak
None	128	*	*	181	0	*
16	*	*	*	159	12	*
8	*	*	*	159	19	*
4	*	*	*	158	39	*
2	111	56	6146	157	79	12403
1.5	105	70	7304	148	99	14652
1	99	99	9803	140	140	19600
0.5	74	148	10,952	106	209	22154
0.25	*	*	*	53	209	*

*Note: Performance levels typical up to 20 kHz frequency levels. Above 20 kHz, slew rate may affect performance, reducing maximum voltage, current and power output. *Not tested.*

7796 – 5 minute Continuous Power Rating, 100% Duty Cycle

Load, Ohms	Voltage RMS	Amps RMS	Voltage Peak	Amps Peak
open	128	0	181	0
16	112	7	159	10
8	109	13	154	19
4	107	27	152	38
2	0	0	*	*

*Note: Performance levels typical up to 20 kHz frequency levels. Above 20 kHz, slew rate may affect performance, reducing maximum voltage, current and power output. *Not tested.*

7796 – 1 Hour Continuous Power Rating, 100% Duty Cycle

Load, Ohms	Voltage RMS	Amps RMS	Watts RMS	Voltage Peak	Amps Peak	Watts Peak
None	128	0	0	181	0	0
16	112	7	795	159	10	1590
8	109	13	1463	154	19	2923
4	107	27	2887	152	38	5776
2	100	50	5004	141	71	10011
1.5	50	50	2509	71	71	5020
1	50	50	2509	71	71	*
0.5	45	90	3999	63	127	*

*Note: Performance levels typical up to 20 kHz frequency levels. Above 20 kHz, slew rate may affect performance, reducing maximum voltage, current and power output. *Not tested.*

APPENDIX A: SIM - Interlock I/O Connector Pinouts and Functions

Pin #	Function	Description	Type	Level Asserted	Level Deasserted	Notes	Applications
1	Amplifier Output	Used for driving slave amplifiers, monitoring amplifier output voltage	AC or DC	Can be greater than ±200V peak	0V	Used for monitoring amplifier output voltage; driving slave amplifiers in multi-amp systems. Wired to amplifier output. Do not connect to any impedance of less than 10K ohm.	**Voltage Monitoring:** Connect a voltage meter to monitor the output voltage being produced by the amplifier. Connect across PIN 1 (Amp Out) and PIN 10 (Sampled Common).
2	Sampled Common	Load connected here for Current sense	AC or DC	Up to 5V peak	0V	Used for driving slave amplifiers in multi-amp systems, controlled voltage or controlled current mode.	**Driving Slave Amplifiers:** Amplifier External Reference, 5V peak maximum from PIN 14 (Common).
3	+1 IN	Differential Slave input	AC or DC	Can be greater than ±200V peak	0V	Only used in multiple amplifier configurations - Series mode.	Can accept output of PIN 1 (Amplifier Output) OR PIN 2 (Sampled Common) from Master device when in Slave mode.
4	Interlock	Amplifier Interlock input	DC	0V to 8V	10V to 15V	When asserted, forces to Standby; when deasserted, allows Run. IMPORTANT: amplifiers must be configured for Ready mode at startup (factory default) or the Run button must be pressed at the amplifier front panel at startup.	**Multi-amplifier Systems Simultaneous Remote to Standby:** Short PIN 4 of Master amplifier to Digital Ground (PIN 17) using dry contact switch or optocoupler. Switch can be used for multi-amps paralleled; must use optocoupler for multi-amps in series. Multiple amplifiers (sharing the same sampled common power connections) can be simultaneously forced to Standby by daisy-chaining Interlock (PIN 4) across amps. When closed, places amplifiers simultaneously in Standby.
5	Amp Ready	Ready output of amplifier	DC	0V	–14V	Normally reserved for OPTOC use; do not recommend for normal customer use. Line has series resistor and unloaded will go from 0V (not ready) to -15V (ready), with an OPTOC BNC card the signal will go from 0V (not ready) to -1.2Vdc (ready)	**Not recommended for normal customer use.**
6	I MON +	Differential Current Monitor +	AC or DC	**7212/7224:** 5A/V **7548/7796:** 20A/V		Output current produced per voltage detect.	**Current Monitoring:** Connect a voltage meter to monitor the output current being produced by the amplifier. For unbalanced, for each 1V detected, current output is 5A (7212/7224) or 20A (7548/7796).
7	I SUM1+	Multiple Amplifier Summing, Amplifier 1	AC or DC			Planned for use in multiple amplifier configurations - paralleled and running Controlled Current Mode.	**Not currently used.**
8	I SUM2+	Multiple Amplifier Summing, Amplifier 2	AC or DC			Planned for use in multiple amplifier configurations - paralleled and running Controlled Current Mode.	**Not currently used.**
9	I SUM3+	Multiple Amplifier Summing, Amplifier 3	AC or DC			Planned for use in multiple amplifier configurations - paralleled and running Controlled Current Mode.	**Not currently used.**

10	Sampled Common	Amp Analog Ground				Amplifier External Reference.	Used in status reporting applications. See OverTemp (PIN 11), Run (PIN 12), Overload (PIN 23), and OverVoltage (PIN 24).
11	OverTemp Out	Over-temperature output	DC	–24V	0V	When amp is normal, this pin is pulled to –24V through a 47.5K-ohm resistor; when amp is in OverTemp state, transistor Q37 turns on and sources chassis ground as an output. Do not exceed 20 milliamps.	**Remote Signal of Over-Temperature Condition:** LED, when lit, signals Over Temperature condition. Use a 6 mA series resistor of 4.02K-ohm for LED or OPTO, tie to –24V source (PIN 16).
12	Run	Amplifier Run output	DC	–24V	0V	When amp is in Standby mode, this pin is pulled to –24V through a 10-ohm resistor in series with two solid-state relays; when amp is in Run mode, transistor Q34 turns on and sources chassis ground as an output, energizing Mains Relays. VOUT is typically –0.03V dc. Do not apply load to ground as this could enable Relays.	**Remote Signal of Run Condition:** LED, when lit, signals Run state. Use a 6mA series resistor of 4.02K-ohm for LED or OPTO, tie to –24V source (PIN 16).
13	–24V	–24V Power Output	DC			–24V dc, 30 mA	Internally tied for use in status reporting applications. See OverTemp (PIN 11), Run (PIN 12), Overload (PIN 23), and OverVoltage (PIN 24).
14	Common	Ground before Sense Resistors				This can be used as an amp internal reference but if a load is attached to this pin, current cannot be sensed on that amplifier.	Possibly series amplifiers will not need current reporting on the High side amp, since its current will be same as Master.
15	–1 IN	Differential Slave Input	AC or DC	Up to 200V peak	0V	Only used in multiple amplifier configurations, Series mode.	Can accept output of PIN 1 (Amplifier Output) OR PIN 2 (Sampled Common) from Master device when in Slave mode.
16	+24V	+24V Power Output	DC			+24V dc, 30 mA.	Used in status reporting applications. See OverTemp (PIN 11), Run (PIN 12), Overload (PIN 23), and OverVoltage (PIN 24).
17	Digital Ground	Digital circuitry ground - Interlock Common	DC	0V	0V	Used with PIN 25 (Reset) for Remote Reset from Standby or Stop after Error. Used with PIN 4 (Interlock) for simultaneous remote to Standby of all amps in a multi-amplifier system.	Used with PIN 25 for Remote Reset after error. Used with PIN 4 for Remote to Standby in multiple amplifier systems.
18	Spare	No function					Currently not used.
19	I MON –	Differential Current Monitor –	AC or DC	**7212/7224:** 5A/V **7548/7796:** 20A/V		Inverted I MON+ (PIN 6). Output current produced per voltage detect.	Current Monitoring: Connect a voltage meter to monitor the output current being produced by the amplifier. For each 1V detected, current output is 5A (7212/7224) or 20A (7548/7796).
20	I SUM1–	Multiple Amplifier Summing, Amplifier 1	DC			Planned for use in multiple amplifier configurations - paralleled and running Controlled Current Mode	Currently not used.
21	I SUM2–	Multiple Amplifier Summing, Amplifier 2	DC			Planned for use in multiple amplifier configurations - paralleled and running Controlled Current Mode	Currently not used.
22	I SUM3–	Multiple Amplifier Summing, Amplifier 3	DC			Planned for use in multiple amplifier configurations - paralleled and running Controlled Current Mode	Currently not used.

23	OverLoad Out	Overload output	DC	–24V	0V	When amp is normal, this pin is pulled to –24V through a 47.5K-ohm resistor; when amp is in Overload state, transistor Q36 turns on and sources chassis ground as an output. Do not exceed 20 milliamps.	**Remote Signal of Overload Condition:** LED, when lit, signals Overload condition. Use a 6mA series resistor of 4.02K-ohm for LED or OPTO, tie to –24V source (PIN 16).
24	OverVoltage Out	Overvoltage output	DC	–24V	0V	When amp is normal, this pin is pulled to –24V through a 47.5K-ohm resistor; when amp is in Overvoltage state, transistor Q29 turns on and sources chassis ground as an output. Do not exceed 20 milliamps.	**Remote Signal of Overvoltage Condition:** LED, when lit, signals Overvoltage condition. Use a 6mA series resistor of 4.02K-ohm for LED or OPTO, tie to –24V source (PIN 16).
25	Reset	Reset	DC	–15V	0V	Tie to PIN 13 (–24V dc) and create a –15V dc source; <2mA required for reset. Connect the –15V dc source to PIN 25 (Reset) through a 1K buffer resistor to reset.	**Reset from Standby or Stop:** Use a dry contact switch and voltage regulator to return amp to Ready/Run condition after Over-temperature or Overload conditions. Assert –15V for at least 100 ms to clear error condition. **NOTE: Do not hold low.**

Gray shaded areas indicate pin not used / feature not implemented.

Blue shaded areas indicate used only in multi-amplifier systems.