Amplifier / BDA

Setup and Operation Manual

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Triad RF Systems, Inc.

www.triadrf.com

Notice

Triad RF Systems reserves the right to make changes to its products or discontinue any of its products or offerings without notice.

Triad warrants the performance of its products to the specifications applicable at the time of sale in accordance with Triad's standard warranty.

Revision History

Version	Date	Changes	Author
1.0	1/12/17	Initial Release	Dean Handrinos

Contents

1. Overview

This document provides general set up and operating instructions for Triad RF Systems' commercial off the shelf (COTS) Power Amplifier (PA) and Bi-Directional Amplifier (BDA) product line.

The instructions provided here will require a copy of the product's specification sheet, which can be obtained from our website at www.triadrf.com.

Certain custom-designed products may have been supplied with a different set of operating manuals or interface control documents. In those cases, the recommendations of the documents supplied supersede the ones contained in this manual.

For any additional information, or to suggest any clarifications / additions to this document, please contact support@triadrf.com

⚠ **Notes that accompany the warning symbol denote instructions and guidelines that must be followed. Failure to follow these guidelines may result in damage to the amplifier that is not covered by Triad's product warranty.**

2. System Considerations

2.1 Power Supply Voltage

Consult the product's specification sheet carefully. The supply voltage provided should fall within the voltage range listed in the product's specification sheet. Many of our products employ internal DC-DC conversion to accept a wide range of input voltages, but some do not.

In addition, most products contain an over / under voltage protection circuit that will shut the amplifier down if voltage limits are exceeded

⚠ **Over / under voltage conditions outside of the range listed on the specification sheet should be avoided, even if the protection feature is present.**

2.1 Power Supply Current Rating

Consult the amplifier's spec sheet for the quiescent and operating current draw of the PA/BDA.

A good general guideline (if system size / weight allows) is to select a power supply that can supply 1.2x the maximum expected current draw of the amplifier when implemented in your system.

Most units' operating current draw increases with an increase in drive power (and corresponding RF output power). Newer specification sheets contain a plot of current draw vs. RF output power. If your system does not intend to operate the amplifier at its maximum rated output power, refer to the plots provided to size an appropriate power supply.

When DC power is supplied to the unit, there will be an inrush current drawn as some internal components charge up (e.g. bypass capacitors, internal DC-DC converter filters). Refer to the spec sheet of the amplifier for a plot of inrush current, which is provided with most units.

Contact support@triadrf.comif you have followed the above guidelines, but experience a power supply going into over-current protection mode during amplifier power-up. Applications engineering can provide some additional guidance on managing inrush current without having to resort to using a larger power supply.

2.2 Cable Harness and Supply Wiring

Every Triad amplifier is available with a pre-wired connector harness. The part number is CBLXX where XX is a 2 digit number – the appropriate cable P/N is listed on the product spec sheet. Cable harnesses can be purchased from Triad, or a drawing of the harness can be emailed upon request if self-assembly of the harness is preferred. Contact support@triadrf.com for a drawing set.

⚠ **Whether using a Triad-supplied harness or building your own, make note of the number of +VDC and GND wires. If there are multiple wires assigned to +VDC and GND, they must ALL be used to ensure that the current is shared properly across the connector pins.**

⚠ **Amplifiers with signal input / output pins (e.g. TTL on/off, TTL Tx / Rx controls, temp sensor outputs) will have an extra wire on the harness designated signal ground (SGND). This has been provided as a low current ground return for use with these pins. An amplifier operating at high current draw (or a BDA switching quickly from Rx to Tx) may create a voltage drop across the main power supply ground pins. Not using the signal ground as a return for amp signal connections may result in measurement errors for outputs and undesired noise on input connections.**

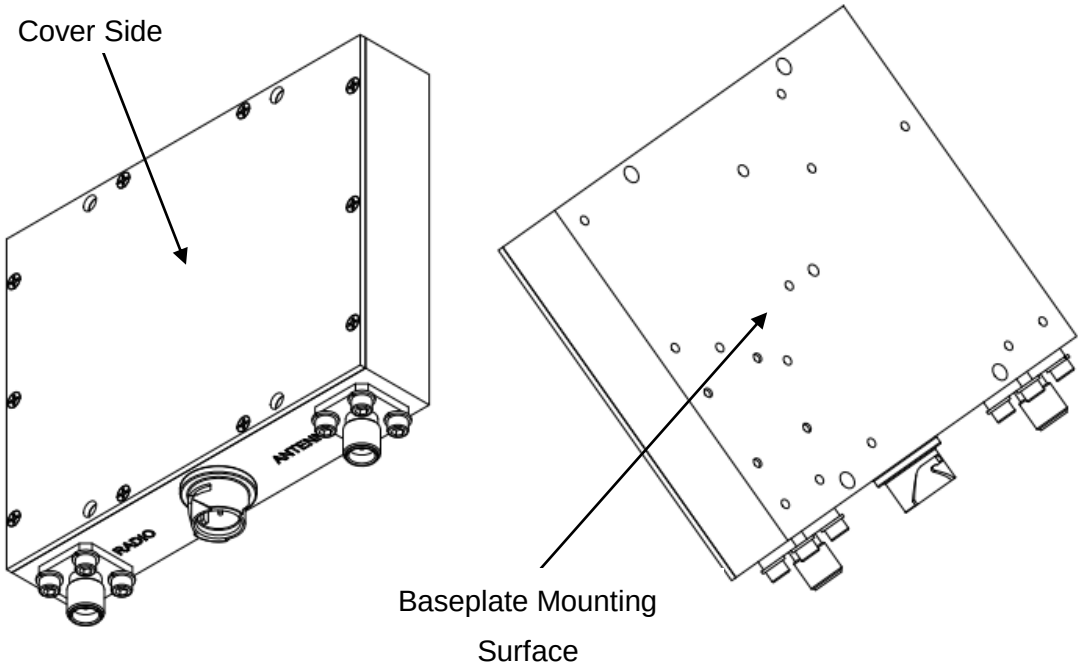
⚠ **Triad-supplied cable harnesses are typically offered with 12” wire lead lengths. If building your own harness whose leads are longer than this, be careful to take into account the inductance and voltage drop along the wire. Using wire leads that have smaller gauge wire and longer length than 12” may cause an unsafe drop in supply voltage at the amplifier power pins. The wires’ length can also exhibit an inductance – when the amplifier is switched on and off this inductance can cause voltage spikes and drop-outs that could cause damage to the amplifier.**

2.3 Heatsinking

2.3.1 General Information

For most applications, appropriate heatsinking is required on all PA and BDA products that have not been ordered with the heatsink option, or that are not units with integrated cooling.

All amplifiers should be conduction cooled through their baseplate mounting surface. The baseplate mounting surface on nearly all Triad products is the surface opposite the module's cover. See the figure below for clarification



Triad can provide detailed information regarding heat dissipation across a unit's baseplate surface if that is required for your specific heat-sinking implementation.

During operation, the baseplate temperature must not exceed the operating temp range listed in the spec sheet.

Some products have an over-temperature protection feature built in, which will automatically shut off the amplifier if it exceeds a certain baseplate temperature.

⚠ **Amplifiers with the over-temp protection feature will automatically turn the amplifier back on when it has cooled down to about 10 degrees below the over-temp trip point. Take this behavior into consideration during system design and integration.**

⚠ **Some products do not feature over-temperature protection – consult the spec sheet carefully to verify. Failure to keep the PA within its safe baseplate operating temperature range may cause damage not covered by the warranty.**

2.3.2 System-Supplied Heatsinking

If the amplifier is going to be installed into a system that has the heatsinking built in (e.g. internal system heatsinks or cold plates), ensure that the following guidelines are followed:

- The heatsink surface that the amplifier's baseplate is going to be mounted to should be milled, skim cut, and / or polished to a smooth finish.
- The heatsink surface must be clean and free of any objects that will interfere with proper interfacing with the amplifier baseplate.
- Use all of the mounting screw holes provided on the amplifier housing to affix it to the heatsink. Some of these screw holes have been specifically located near heat generating parts and are critical for correct heat transfer.
- A thermal interface material (TIM) must be used between the amplifier baseplate and the heatsink surface. Examples of appropriate materials include Laird T-

GON 800, Tennmax GP5000, and Dow-Corning 340 Thermal Grease. T-GON sheets can be purchased through Triad if needed.

- If using a TIM that is in sheet form, ensure that the sheet is cut to a size that completely covers the amplifier baseplate.
- If using thermal grease, follow the application instructions carefully.

⚠ **Failure to follow the above guidelines could lead to an amplifier overheating.**

3. Amplifier Set-Up

3.1 RF Connections

Before making any RF connections, inspect both the connectors on the amplifier and your system's connectors. Ensure both connector interfaces are clean and free of damage, dirt, or foreign objects.

Use a calibrated wrench to tighten SMA / N connectors to the appropriate torque when installing the amplifier in your system.

For amplifiers that feature snap in connectors (such as SMP or MMCX), ensure that the connector is aligned correctly and that a positive tactile click is felt when installing it.

3.1.1 SSPA Connections

SSPAs will have their input and output RF connections labelled "RF IN" and "RF OUT", respectively. Connect an antenna or an appropriate 50 Ohm load to the RF OUT port and the radio / RF stimulus to the RF IN port.

3.1.2 BDA Connections

BDAs will have their input and output RF connections labelled “RADIO” and “ANTENNA”, respectively. Connect an antenna or an appropriate 50 Ohm load to the ANTENNA port and the radio / RF stimulus to the RADIO port.

⚠ **Before turning on the SSPA / BDA, ensure that the RF input power to the amplifier is set appropriately. This will avoid amplifier damage, or damage to system components downstream from the amplifier.**

⚠ **Triad RF products are unconditionally stable and can operate into an open circuit up to a certain power output level. Refer to the specification sheet for those limits. However, it is good practice to avoid operating the amplifier into an open circuit for an extended period of time.**

3.2 DC / Control Connections

Inspect both the wire harness and connector on the amplifier for damage or debris, then connect either the Triad-supplied or self-assembled mating connector. Ensure that the connector orientation is correct and that any locking features (tabs, captive screws) are used.

Consult the section of the product’s specification sheet listing the connector pins, types, and voltage levels in or out of them. Ensure that they are connected to the appropriate circuitry in the system.

⚠ **Take care to note which pins are inputs and which are outputs for the product you are working with, along with their safe voltage ranges. Applying a voltage to an output pin, or applying an incorrect voltage to an input pin may result in damage to the amplifier.**