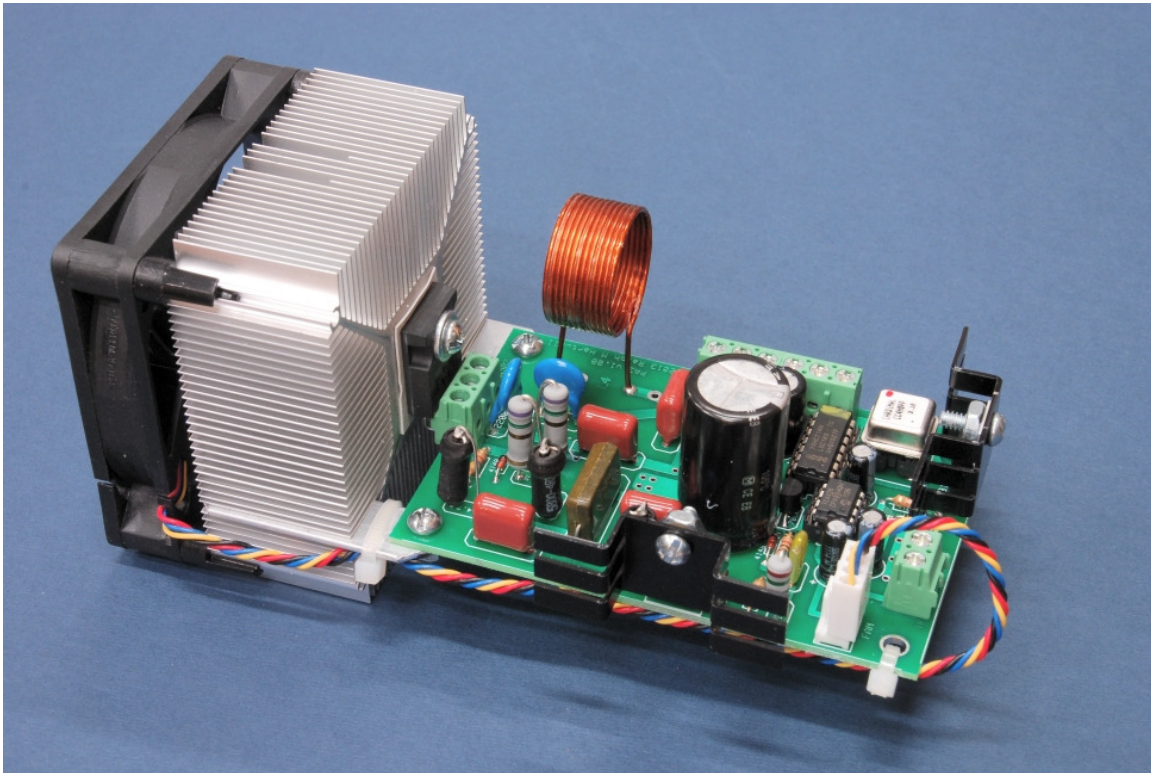


The Spectrotek PA3 Amplifier

Technical Specifications as of 17 December 2013

The PA3 amplifier has been designed to allow researchers who already have an accurate signal generator which will supply adjustable square waves to construct their own high power plasma tube system. During operation, the PA3 requires nothing more than a modulation frequency input from an external signal generator and a source of DC power.

The modulation signal source may be a stand-alone frequency generator such as a UDB1108S, an F-series generator such as an F165, a GB-4000, or even a sine wave output signal generator. Modulation frequencies between 4 Hz and 400,000 Hz may be used with the PA3.



The Spectrotek model PA3 plasma tube system amplifier.

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PA3 Technical Specifications:

DC Power Supply Input:

- For the power amplifier stage: +15 to +190 volts DC at a maximum current of 3.0 amperes; nominal operating current less than 2.1 amperes, depending on output power level and modulation duty cycle.
- For the modulation signal processor, the driver stage and the heat sink fan: +18 to +22 volts DC at a maximum current of 750 mA at a 100% duty cycle modulation rate.

Input Impedance:

- Approximately 5000 Ohms, AC coupled.

Input Drive Signal Requirements:

- TTL level (0 to +5 volts) duty cycle modulated square wave from an external frequency generator.
- Modulation frequency range with square wave input: 4 Hz to 400,000 Hz for a duty cycle range of 1% to 100%.
- Sine wave of 2.5 to 7.0 volts peak-to-peak (VPP) from an external frequency generator. The voltage level of the sine wave adjusts the duty cycle of the PA3 output.
- Modulation frequency range with sine wave input: 4 Hz to 400,000 Hz for a duty cycle range of approximately 20% to 58%.
- The modulation input of the PA3 is AC coupled, so it will ignore any DC offset voltage on the modulation input signal; however any DC offset voltage must be limited to a maximum of +/- 10 volts.

Carrier Operating Frequency:

- 2.9 to 3.5 MHz. Operation outside of this frequency range may cause damage to the PA3. The suggested operating frequency is 3.1 or 3.3 MHz.
- The PA3 is furnished with a 3.10 MHz oscillator, but customer selected frequencies may be specified at the time of order.
- The carrier frequency of the PA3 may be quickly changed by plugging in a different frequency oscillator module.

RF Power Output:

- Up to 500 watts peak power or 250 watts average power into a 50-ohm dummy load when the carrier is modulated by a 50% duty cycle square wave with frequencies from 1 to 400,000 Hz.
- When the PA3 is operated at a peak power level of 300 watts or less, the PA3 may be operated at any duty cycle between 0 to 100%.
- The power output of the PA3 may be adjusted by varying the DC voltage supplied to the PA3.
- To avoid possible damage to the PA3, when driving plasma tubes with modulation frequencies above 40 KHz, the DC power supply voltage to the PA3 should be limited to the maximum values as shown in the data below.

Modulation Signal Voltage Levels:

Note that the PA3 amplifier turns ON when the input drive signal goes in the positive direction, and turns OFF when the input drive signal goes in the negative direction. In the absence of any input signal, the PA3 will turn completely OFF.

Operation of the PA3 with a square wave modulation signal:

A minimum of 2.25 volts-peak-to-peak is required to trigger the PA3. Ideally, the drive signal should be a square wave TTL signal, which has a voltage swing of 0 to +5 Volts.

Modulation Duty Cycle vs. Frequency with a square wave modulation signal:

For a duty cycle of 1% to 50%:	1 Hz to 400 KHz
For a duty cycle of 1% to 89%:	2 Hz to 400 KHz
For a duty cycle of 1% to 98%:	3 Hz to 400 KHz
For a duty cycle of 1% to 99%:	4 Hz to 400 KHz

Operation of the PA3 with a sine wave modulation signal:

A minimum of 2.5 volts-peak-to-peak is required to trigger the PA3 when using sine waves. The maximum allowable sine wave voltage input should be limited to no more than 7.0 volts-peak-to-peak to prevent possible damage to the input circuit of the PA3. When using sine waves, the duty cycle of the modulated output of the PA3 will be limited to the range of 20% to 58%.

Modulation Duty Cycle percent vs. voltage with a sine wave modulation signal:

2.5 VPP for 20% duty cycle (Minimum duty cycle % possible with sine waves).
3.12 VPP for 37% duty cycle (for Maximum Sidebands).
5.0 VPP for 50% duty cycle (for Normal Operation).
5.58 VPP for 58% duty cycle (Clipping of input signal occurs above this level).

The maximum recommended modulation frequency when using the PA3 is 400 KHz. By reducing the high voltage DC applied to the amplifier stage of the PA3 by 25%, modulation frequencies of up to 650 KHz may be utilized at reduced output power.

Note that there is a risk of destroying the STW20NK50D at high modulation frequencies and high power levels.

Although the modulator circuits of the PA3 will work up to 6 MHz, when the modulation frequency exceeds 1/2 of the carrier frequency of 3.10 MHz, or 1.55 MHz, the resulting modulation sidebands “turn over,” and begin dropping in frequency as the modulating frequency begins to approach the carrier frequency. Thus there is no point in using a modulation frequency exceeding 1.55 MHz.

CAUTION: When the modulation frequency begins to exceed about 400 KHz, excessive RF voltages will be developed in the PA3’s tank circuit and the LC31 coupler. These voltages may cause the STW20NK50Z MOSFET in the PA3 to fail.

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