PA100W

RF Power Amplifier

Owner's Manual

SpinCore Technologies, Inc.
http://www.spincore.com

Congratulations and *thank you* for choosing a design from SpinCore Technologies, Inc.

We appreciate your business!

At SpinCore we try to fully support the needs of our customers. If you are in need of assistance, please contact us and we will strive to provide the necessary support.

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I. Precautions

Working with RF power amplifiers can be dangerous and even fatal if not handled properly. Output voltages can reach values greater than 200 V peak-to-peak and can be fatal. Follow these steps to avoid damaging the amplifier or inflicting serious injuries.

Connecting & Disconnecting Power Amplifiers

When connecting the power amplifier, follow these steps to avoid damaging the amplifier or inflicting serious injuries.

1. Apply the load to the amplifier (make sure a load is ALWAYS present when working with power amplifiers).
2. Apply the DC power to the amplifier.
3. Apply the RF input to the amplifier.

Repeat the steps in reverse order when disconnecting the amplifier.

Power Considerations

Make sure the following considerations have been made before applying power to the amplifier.

1. Be sure your load can appropriately dissipate the maximum power being applied by the amplifier.
2. When applying an RF signal, work with low duty cycles to limit the power being dissipated. The duty cycle ratio should be below 1% for safe operation.

II. PA100W – 100 W Power Amplifier Module

1. Overview

The PA100W RF power amplifier comes in a very compact broadband module delivering 100 Watts RMS (200 Watts PEP, Peak Envelope Power) into a 50-ohm load. It has a frequency range of 10 MHz to 100 MHz and is powered by a DC +24 to +28 V power supply (with the negative terminal grounded). The PA100W has standard female SMA jacks for RF input and output, and a screw terminal block for the DC power input. The PA100W typically operates in Class AB. The rise and fall time of the RF pulse output is approximately 200 ns.

The product comes with blanking circuitry – the blanking circuitry keeps the PA100W blanked (turned off) until a TTL input (logical high) is applied. The blanking circuitry helps to conserve power, keeps the amplifier cool under typical operating conditions, and provides noise reduction during the reception of NMR signals. To enable (deblank) the power amplifier, a TTL pulse (logical high) needs to be applied to the control circuitry.

The PA100W power amplifier module measures 3.15" x 2.54" x 2.33" (80 x 65 x 59 mm). It can be delivered as a module (with the blanking circuitry) or in various enclosures - see the "Configuration Options" section later in this document for more information.

2. Specifications

DC Electrical Specifications

Table 1: Electrical specifications for the PA100W RF power amplifier.

Parameter	Specification	Units
Max DC Input Voltage	28	V (DC)
Max RF input power	2.3	W
Max. continuous RF output power*	100	W (RMS)
TTL De-blanking Voltage	3.3	V

***NOTE: Operating at this power level requires an adequate heat dissipation and an appropriate rated power supply.**

RF Specifications

Table 2: Input power necessary to achieve 100 Watts output power at a given frequency when the power amplifier is supplied by a 28 V DC source.

Frequency	Input Power (Watts RMS)
10 MHz	0.64
20 MHz	0.86
30 MHz	1.02
40 MHz	1.08
50 MHz	1.02
60 MHz	1.02
70 MHz	0.98
80 MHz	1.12
90 MHz	0.90
100 MHz	1.56

Table 2 shows data for the PA100W when supplied by +28 V. The PA100W is capable of outputs greater than 100 W - however, it is important not to exceed the input power parameters for the specific operating frequency (Table 2) to avoid damaging the module. Also note that if the power amplifier is supplied by a +24 V DC source the gain is reduced and a maximum value of approximately 150 W PEP can be achieved.

3. PA100W RF Module with De-blanking Circuitry

This configuration does not have any enclosure for the PA100W RF module. It includes the de-blanking circuitry mounted on top of the power amplifier to enable it when a TTL pulse is applied to the control input pin. The module with no enclosure is shown below in Figure 1.

Figure 1: PA100W RF power amplifier module – no enclosure.

RF Input and Output Connectors

When connecting the PA100W RF power amplifier module, the RF signal source should be connected to the SMA jack on the left hand side (top view) of the circuit (RF in). The SMA jack on the right hand side (top view) is the RF output from the power amplifier (RF out). See Figure 2, on the next page, for details.

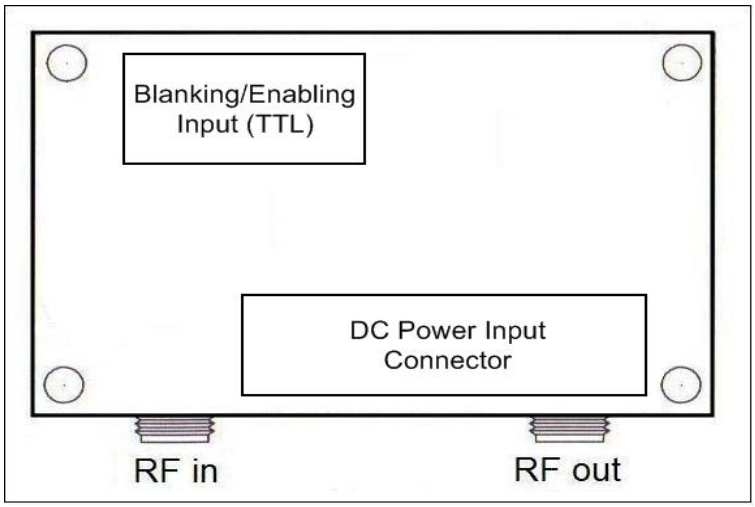

Figure 2: Top view of the PA100W power amplifier module depicting connectors. RF in and RF out are SMA jack connectors, Input TTL is an IDC connector and the input DC power connector is a screw terminal block.

TTL Control Input Connector

The PA100W power amplifier module has a 10-pin shrouded male IDC connector, pin diagram shown in Figure 3, which supplies the input TTL control signal. The control signal is pin 8 on the IDC header and the corresponding ground is pin 7. The input is terminated by a 100-ohm load and requires an external source capable of outputting at least 10 mA. The TTL requirements for the deblanking control input are standard low voltage TTL values of 3.3V for a logical high, 0V for logical low. A logical high signal is required to deblank (enable) the PA100W. In testing, the TTL deblanking pulse is typically applied 300 us prior to the application of the RF pulse. The end of the deblanking signal coincides with the end of the RF pulse. See Figure 3 below for details.

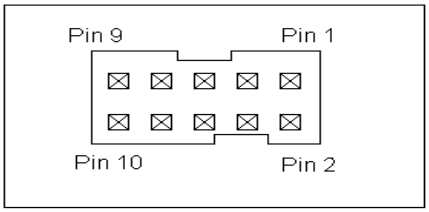

Figure 3: 10-pin IDC connector (Digi-Key part A33159-ND). Mates with Digi-Key part HKC10H-ND or similar.

The timing diagram of a typical application of PA100W with the deblanking pulse applied prior to the RF pulse is presented in Figure 4, below. The top trace is the deblanking signal, the trace below represents the input signal, and the bottom trace is the RF output. In the lower panel, an expanded view of the RF output pulse is depicted. At lower operating frequencies the output will be progressively less sinusoidal. At these frequencies a filter will have to be used to obtain a sinusoidal output. When working with short RF pulses, on the order of 1 us or so, triggering the oscilloscope on the falling edge of the deblanking pulse will help with identifying and capturing the RF pulse on the scope.

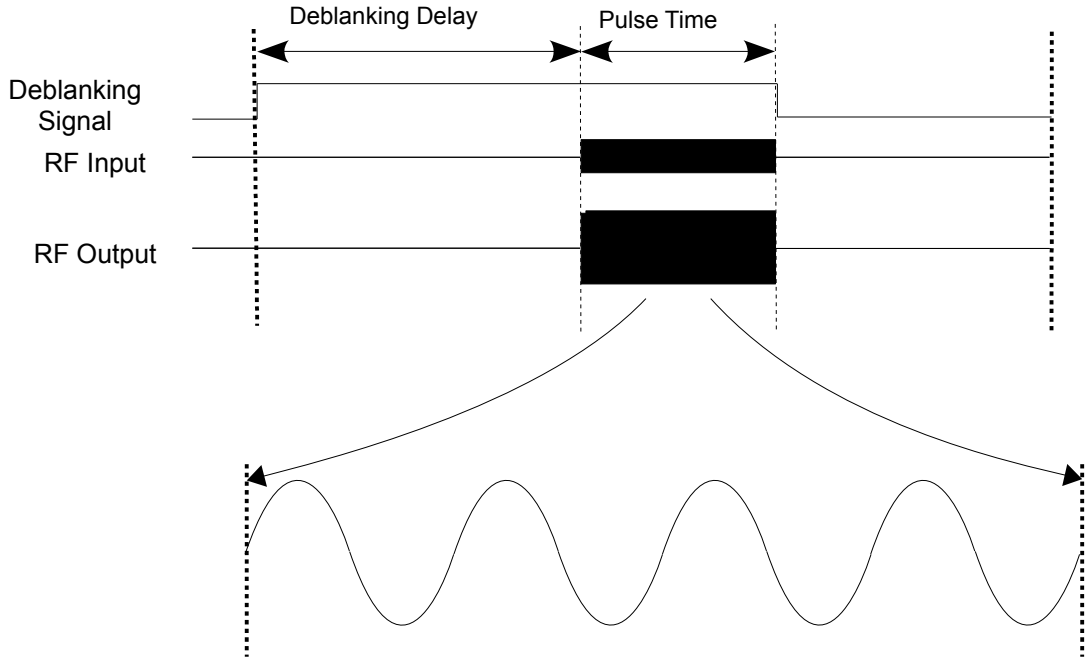

Figure 4: Representation of the deblanking and RF input and output signals to the PA100W.

DC Power Input Connector

The PA100W RF power amplifier module has a 5-pin screw-terminal input power connector. The pin arrangements for this connector are shown below in Figure 5 (top view).

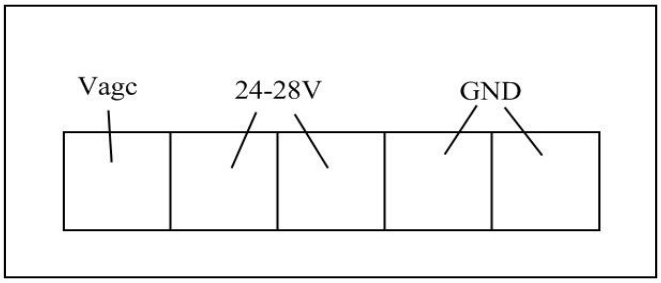

Figure 5: Top view of the 5-position power input connector (Molex part 38720-6305).

4. PA100W RF Module Enclosure Options

The PA100W RF power amplifier can be delivered in various enclosures which protect the RF power amplifier module and include an AC/DC power supply and internal RF cables. Configurations "1" and "2" below have power inputs of 90V-264V AC. All enclosures have the RF input/output signals provided on external BNC connectors. The TTL inputs are routed through female DB-9 input connectors., see Figure 6 below for the pinout. The active TTL signal needs to be connected to pin 4, with the corresponding ground line connected to pin 8. Available enclosure configurations are listed on the next page.

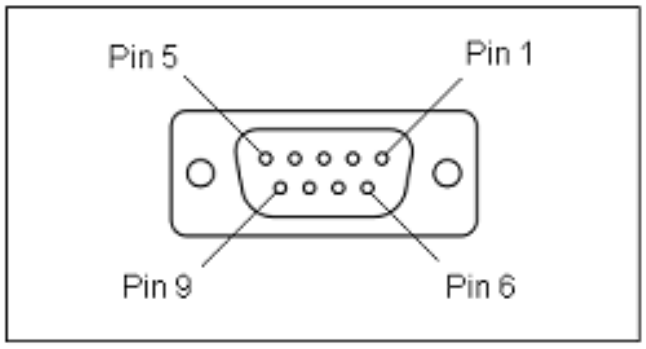

Figure 6: DB-9 Female Connector Pinout

1) PA100W module enclosed in a single bay enclosure with an integrated +24 V power supply – Figure 7

Single bay enclosure additional specifications include:

- Excellent EMI/RFI shielding that meets FCC & CE regulations.
- Built-in 4 x 4 cm quiet cooling fan.
- High quality 50 Watt AC input switching power supply.
- Dimensions are approximately 10.25” x 7.75” x 2.25” (26 x 19.5 x 6 cm).

NOTE: Since +24 V is used inside of the enclosure, both the output level and the maximum duty cycle are reduced

Figure 7: PA100W RF power amplifier – single bay enclosure.

2) PA100W module enclosed in a dual bay enclosure with an integrated +24 V power supply – Figure 8

Dual bay enclosure additional specifications include:

- Metal body to provide effective heat dissipation with streamlined plastic front panel.
- Built-in quiet 8x8 cm cooling fan.
- 80W universal AC switching power supply.

NOTE: Since +24 V is used inside of the enclosure, both the output level and the maximum duty cycle are reduced

Figure 8: PA100W RF power amplifier - enclosed in dual bay enclosure

Back Panel Connections (Figure 9):

- AC (C14) socket for power.
- RF In – BNC input signal connection to amplifier (not to exceed 1W).
- RF Out – BNC output signal connection to load.
- TTL In – DB9 connector used for de-blanking.
    - Pin 4 (of the female DB9 connector) – Connected to de-blanking signal
    - Pin 8 (of the female DB9 connector) – Connected to Ground

Figure 9: PA100W RF power amplifier – back panel connections

3) PA100W module fully enclosed in a rack-mount enclosure

(A**vailable upon request, please contact SpinCore directly for your custom quote)**
Rack-mount enclosure additional specifications include:

- Industrial steel 4U rack-mount enclosure.
- High quality quiet +24 V switching power supply.
- Built-in 12 x 12 cm quiet cooling fan.
- Dimensions are approximately 17.7” x 17.3” x 7” (45 x 44 x 18 cm)

Figure 10: PA100W RF power amplifier – rack-mount enclosure with integrated power supply

5. Typical Set-Up For NMR Experiments

Figure 11 below shows a typical connection diagram in which the PA100W is used with SpinCore's iSpin-NMR system to run NMR experiments. Note: It is not necessary to use iSpin-NMR with the PA100W.

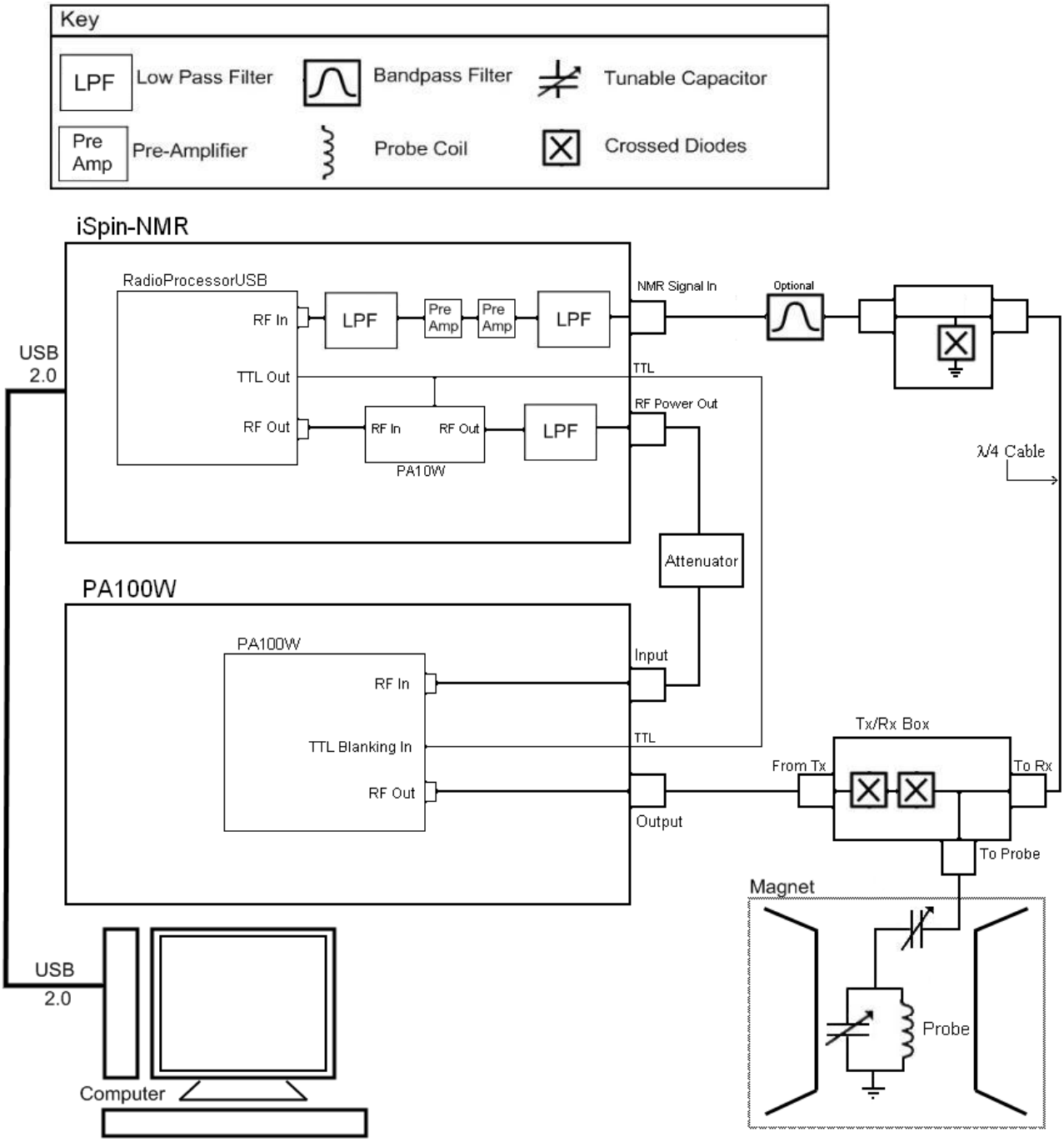

Figure 11: A typical NMR setup with iSpin-NMR, and PA100W with enclosure. Note: It is not necessary to use iSpin-NMR with the PA100W.

III. Related Products and Accessories

1. Power amplifiers with alternative power levels are also available in 10 Watts, 15 Watts, and 75 Watts. For more information, please visit http://www.spincore.com/products/RFPA/

2. iSpin-NMR, The Complete, Simple, Intuitive, Effective and Portable NMR System. For more information, please visit http://spincore.com/products/iSpinNMR/

3. SpinCore RadioProcessor: A complete single-card solution for RF pulse generation and acquisition, the. For more information, please visit http://www.spincore.com/products/RadioProcessor/

4. If you require a custom power level, please inquire with SpinCore Technologies through our contact form, which is available at http://www.spincore.com/contact.shtml

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V. Document Information

Please contact SpinCore for revision history.