

**rfc 2-315**

**rfc 2-417**

**rfc 3-312**

# Owner's Manual

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**rf**concept<sup>™</sup>



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Write the unit model and serial numbers here:

Model Number \_\_\_\_\_

Serial Number \_\_\_\_\_

Purchase Date \_\_\_\_\_

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# rfc 2-315, rfc 2-417, and rfc 3-312

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Thank you for buying an rfc concepts amplifier. The amplifiers listed above (covered in this "combined" manual) represent the "fourth generation" of solid state power amplifiers built for radio amateurs. Features include "state of the art" GaAsFet preamp, variable SSB delay, "High SWR" protection, excessive temperature protection, and automatic or external keying. These amplifiers are designed to be used with FM transceivers; however, they can often be used in SSB and CW modes effectively.

## Warning

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High power output means high heat sink temperatures. Keep the heat sink clear of any obstructions to provide adequate ventilation.

If your radio puts out more than the maximum power listed below you should use an amplifier designed to accept that higher power.

Unit	Maximum amplifier input power from your radio
2-315	50 watts
2-417	50 watts
3-312	40 watts

## Installation

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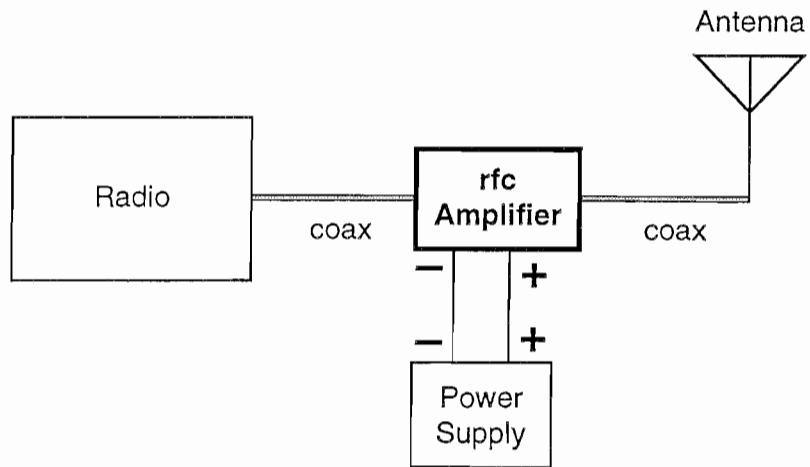
The power amplifier is connected between the radio and the antenna.

**POWER:** Heavy gauge wire should be used to connect the amplifier to the battery or power supply. For medium distances use #10 wire (American Wire Gauge (AWG)) and for longer distances use #8 wire.

**ANTENNA:** To connect the amplifier to the antenna, RG-8A/U or equivalent coax is recommended. For best performance, the antenna should be adjusted for an SWR of less than 2:1.

**RADIO:** To connect the amplifier to the radio, RG-8A/U or equivalent coax is recommended.

**LOCATION:** The amplifier should be placed to allow for maximum ventilation around the heat sink.



# Specifications

	2-315	2-417	3-312
Frequency Range	143-149 MHz		220-225 MHz
Power			
Input Range	5 W to 50 W	200 mW to 50 W	200 mW to 40 W
Output*	150 W (30 W in) 170 W (40 W in)	170 W (45 W in)	120 W (30 W in)
Maximum input	50 Watts		35-40 Watts
Duty Cycle	Less than 50%, not rated for repeater use		
Mode	FM		
GaAsFet Preamp			
Noise Figure	1 dB nominal		1.25 dB nominal
Gain	18 dB nominal		
SWR Protection	Automatic shutdown with approximately 3:1 SWR		
Temperature Protection	175 degrees F (79.4 degrees C)		
Keying	1. Automatic – RF sensing 2. External – Ground or Plus 3-12 Vdc at J3 (user option) unit supplied with “plus voltage” keying		
Input-Output Impedance	50 Ohms		
Voltage Requirements	13.8 Vdc		
Current Requirement	22 Amps		20 Amps
Fuse	35 Amp		
Size	11.5" x 6" x 3" (29.2 cm x 15.25 cm x 7.6 cm)		
Weight	5 lbs. (2.27 kg)		

\* output may vary by  $\pm 0.75$  dB

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# Operation

With the amplifier installed, power from your radio will be boosted as follows:

Unit	input from Radio	output of amplifier
2-315	30 Watts	150 Watts or more
	40 Watts	170 Watts or more
2-417	45 Watts	170 Watts or more
3-312	25-30 Watts	120 Watts or more

With the amplifier turned on, power amplification is automatic. Adequate power from the radio will automatically key the amplifier. When keyed the "TX" LED will light. If the pre-amplifier is also turned on or operated without the power amplifier turned on, it too will be automatically switched into or out of the signal path. This automatic keying is best suited for FM operation. If SSB or CW operation is desired, it is highly recommended that external keying be used. See the External Keying section.

The GaAsFet receiver preamp will improve weak copy of marginal signals. With the pre-amp on and the station in receive mode, signals from the antenna are boosted by the preamplifier and then applied to the receiver input. As above the preamplifier is switched out of the circuit when the power amplifier is keyed.

## Fault Conditions

The amplifier has a special circuit that senses return power (SWR) from the antenna. If return power exceeds approximately 30 watts, the amplifier automatically shuts off. In this case the SWR LED turns on and the TX LED turns off. To reset the amplifier, turn the power on-off switch off for 5 seconds and then back on. **WARNING:** If this occurs be sure the antenna system is properly matched before operating the amplifier again.

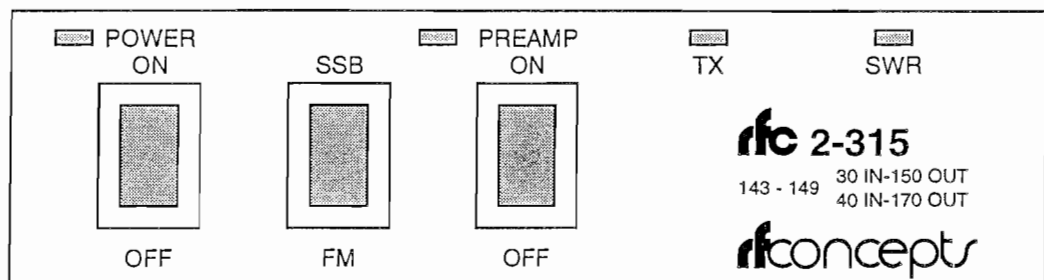
If the heat sink temperature exceeds 175 degrees F (79.4 degrees C), the internal thermostat will open, shutting down the power amplifier. The "TX" LED will go out. The thermostat will automatically reset when the heat sink cools down.

## Functions

The functions of the amplifier are controlled by the three front panel switches.

### POWER:

This switch activates the power amplifier section, and resets the SWR protection circuit.



### FM-SSB:

This switch changes the dropout delay. In FM, the amplifier has a fast dropout when the carrier is removed. In SSB, this dropout is delayed, so the relays do not "chatter" while on SSB. See "Delay Adjust".

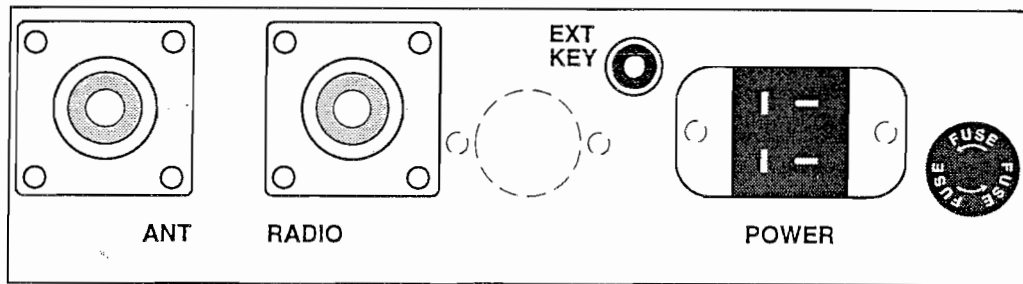
**PREAMP:** This switch turns the GaAsFet preamp on. It can be used even when the power amp section is off.

April 12, 1995

rfc 2-315, 2-417, 3-312

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## Rear Panel Connections



**ANT:** Antenna connection.

**RADIO:** Coax connector for input from the transmitter or transceiver.

**CUTOUT:** The dotted outline is a cutout for installation of a remote control jack. Contact your dealer or Kantronics to purchase the optional *Internal Remote Control Jack* kit.

**PHONO JACK:** This jack (marked "EXT KEY" in diagram above) is the external keying input. By changing a jumper inside the amplifier, keying may be accomplished by either a ground or a positive voltage of +3 to +15 at 1 mA or less. See "External Keying". **NOTE:** the unit is factory set for "plus voltage" keying.

**4 PIN "JONES":** Power is supplied through this connector. Allows quick removal of the amplifier, if needed.

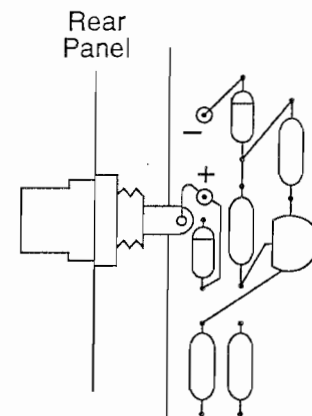
**FUSE:** A 35 Amp fuse provides protection in case of an internal short circuit.

## Internal Connections and Adjustments

**DELAY ADJUSTMENT:** "SSB delay" can be varied by changing the potentiometer accessible through the hole in the cover on the left side of the unit.

**EXTERNAL KEYING:** The amplifier is designed to allow for either positive or negative (ground) keying. The amplifier is factory set for "plus voltage" keying. Most transmitters do not provide a "ground" during transmit, but do have a positive voltage available at their back panel. Consult your radio instruction manual to locate this voltage. Keying is applied to the phono jack on the back panel.

To change the amplifier from "plus" keying to "ground" keying you must remove the cover and move the wire connected to the phono jack from the "+" pad to the "-" pad.



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# Circuit Description

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## Keying Circuit

When the power switch, S2, is "off" the radio signal passes straight through, without amplification. When S2 is "on", a small amount of RF is detected by D3 and D4, causing Q2 to activate relay, Ry1. This switches the amplifier into operation. In order to keep the relay from "chattering" when using SSB, the FM-SSB switch, S1, increases the dropout delay time by switching in C5. The combination of C5 and R5 sets the dropout delay time of Ry1.

J3 can be connected to D1 or D2. When connected to D1 a ground at J3 turns on Q1, applying a positive voltage to Q2, keying Ry1. When connected to D2, a positive voltage will turn on Q2, keying Ry1.

The receive preamp is controlled by Q4 and Ry2. When S3 is "on", Q4 is turned on through R14 + R15, actuating Ry2. This connects the preamp into the signal path.

When a keying voltage is applied to Q2, its collector switches the junction of R14 + R15 to ground. This turns off Q4, switching the preamp off.

## Protection Circuitry

**SWR Detector:** The output trace passes by a "micro-strip" coupler which senses if the SWR is too high. A high SWR produces a voltage that is detected and actuates the protection circuit. If the antenna SWR is approximately 3:1 or greater, D18 provides a voltage to the gate of the SCR, Q3. Q3 then conducts, turning on Q5 which lights LED, D12, as well as turning on Q6. Q6 grounds the bases of Q2 and Q4 through D8 and D11, unkeying the amplifier and/or the preamp. S2 must be switched off to reset the circuit.

**Over Temperature Protection:** If the heat sink exceeds 175 degrees F (79.4 degrees C), the thermostat, T1 opens, disconnecting the power to Ry1, turning off the amplifier section.

## Preamp

When S3 actuates Ry2, the incoming signal (from antenna) is routed to the preamp.

Diodes D13 and D14 prevent large input signals from damaging Q8.

C17 and L5 are tuned to 2 meters in the 2-315 and 2-417 and provide matching to Q8. (C17 and L5 are tuned to 220 MHz in the 3-312 and provide matching to Q8.) Q8 is a Gallium arsenide field-effect transistor (GaAsFet). It amplifies the signal with a minimal addition of its own noise. The signal then goes to Q7. Q7 acts as a buffer amplifier, providing additional frequency selectivity. R17 plus R18 provide a constant matching impedance for Q7, as well as for the station receiver.

## Power Amplifier 2-315 and 2-417

The signal from the radio passes through C18, Ry1a and C20 where it is divided equally and drives Q9 and Q10. There it is amplified to 85 Watts, in each transistor.

C47 and C48 combine this into 170 Watts, which then goes to the filter, C52, L13 and FL1, to remove any harmonics, before it is connected to the antenna.

Q9 and Q10 have a resistor, capacitor and coil, connected from collector to base. This provides stability at low frequencies.

Bias is applied through L7 and L8 and adjusted by R26 and R30. The bias voltage is switched on when Ry1 is activated.

C402 is adjusted for best input match and C49 is set for maximum output. C49 should be set 1/8 turn clockwise from maximum power output for best amplifier efficiency.

## Power Amplifier 3-312

The signal from the radio passes through C18 and Ry1a to C21 and C22 where it is divided equally and goes to Q9 and Q10. There it is amplified to 60 Watts, in each transistor.

C47 and C48 combine this into 120 Watts, which then goes to the filter, C52, L13 and C53 to remove any harmonics, before it is connected to the antenna.

Q9 and Q10 have a resistor, capacitor and coil, connected from collector to base. This provides stability at low frequencies.

Bias is applied through L7 and L8 and adjusted by R26 and R30. The bias voltage is switched on when Ry1 is activated.

C302 is adjusted for best input match and C49 is set for maximum output. C49 should be set 1/8 turn clockwise from maximum power output for best amplifier efficiency.



TROUBLESHOOTING FLOW CHART FOR : 2-317, 2-315, & 2-417

NOTE: This chart only covers a general area of problems that could occur. If your problem is not listed, please consult with one of our service technicians.

