

rfc 2-23  
rfc 3-22  
rfc 4-32

# Owner's Manual





a division of Kantronics Co., Inc.

Kantronics/rfconcepts  
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Bulletin Board (913) 842-4678 300 - 14,400 (MNP, V.32BIS) N,8,1

Write the unit model and serial numbers here:

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

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

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

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## rfc 2-23, rfc 3-22, and rfc 4-32

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Thank you for buying an rfconcepts 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, SSB delay, pin diode protection, and automatic 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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During normal operation the "TX" LED will light when the power amplifier is activated. If an "open" antenna connection exists (antenna not connected) prolonged application of power could damage the power transistor. See warranty. Check your antenna by listening before operating the power portion of the amplifier.

## Installation

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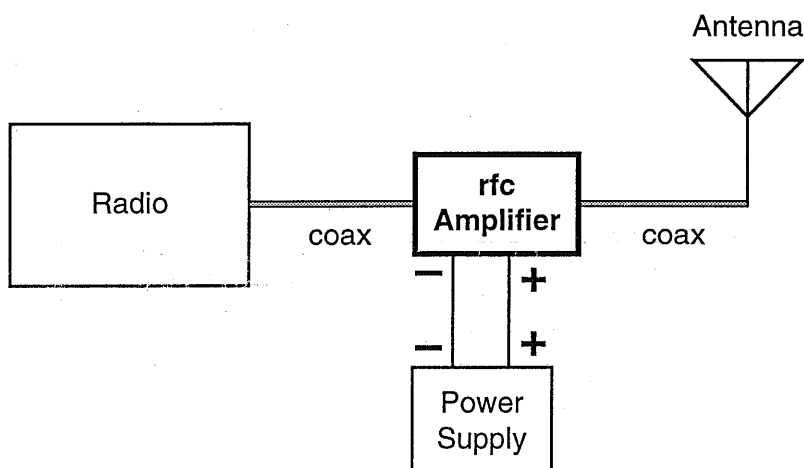
The power amplifier is connected between the radio and the antenna.

**POWER:** Heavy gauge wire should be used to connect the amplifier to the battery or power supply. For medium distances use #14 wire (American Wire Gauge (AWG)) and for longer distances use #12 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

	<b>2-23</b>	<b>3-22</b>	<b>4-32</b>
Frequency Range	143-149 MHz	220-225 MHz	440-450 MHz*
Power	200 mW to 5 W		
Input Range	200 mW to 5 W		
Output**	30 W (2 W in)	20 W (2 W in)	20 W (3 W in)
Maximum input	5 Watts		
Duty Cycle	Less than 50%, not rated for repeater use		
Mode	FM		
GaAsFet Preamp			
Noise Figure (nominal)	0.75 to 1.5 dB	1 to 2 dB	1.75 dB
Gain (nominal)	15 dB		12 dB
Keying	Automatic – RF sensing		
Input-Output Impedance	50 Ohms		
Voltage Requirements	13.8 Vdc		
Current Requirement	4 Amps		
Fuse	7 Amp		
Size	6.5" x 3.5" x 2" (16.5 cm x 8.89 cm x 5.08 cm)		
Weight	2 lbs. (0.9 kg)		

\* Tunable from 420 to 450 MHz

\*\* output may vary by  $\pm 1.0$  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
2-23	2 Watts	30 Watts or more
3-22	2 Watts	30 Watts or more
4-32	3 Watts	20 Watts or more

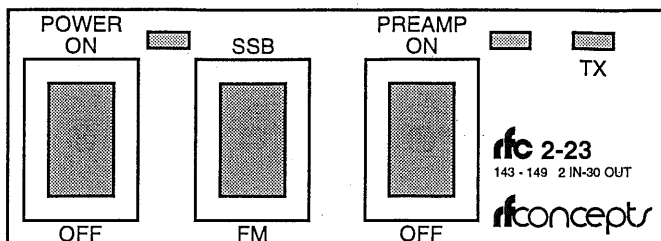
The preamp utilizes the latest GaAsFet technology. It has a low noise figure and 15 dB gain. The preamp should be used to improve the "copy" of weak and marginal signals. However, in areas that have strong signals the added gain may overload your receiver. In this case, the preamp should not be used.

When either the power amplifier or the preamp are "on" they automatically switch in and out of the circuit by sensing the RF from the radio. The "TX" LED will light during transmit.

# Functions

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



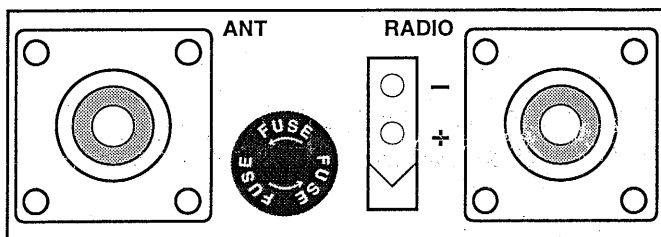
**POWER:** This switch activates the power amplifier section.

**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.

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

# Rear Panel Connections

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**ANT:** Antenna connection. Looking from the back, this is the left-hand coax connector.  
**CAUTION:** Do not connect your transceiver to the amplifier “ANT” port. Damage to amp could occur.

**FUSE:** A 7 Amp fuse provides protection in case of an internal short circuit.

**2 PIN MOLEX:** Power is supplied through this connector. Allows quick removal of the amplifier, if needed.

**RADIO:** Coax connector for input from the transmitter or transceiver. Looking from the back it is the right-hand coax connector.

# Circuit Description rfc 2-23 and rfc 3-22

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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 D2 and D3, causing Q1 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 R2 sets the dropout delay time of Ry1.

The receive preamp is controlled by Q2 and Ry2. When S3 is "on", Q2 is turned on through R6 + R7, actuating Ry2. This connects the preamp into the signal path.

When a keying voltage is applied to Q1, its collector switches the junction of R6 + R7 to ground. This turns off Q2, switching the preamp off.

## Protection Circuitry

**PIN DIODE LIMITERS:** Diodes D10 and D11 are PIN diodes. When RF power is applied, these diodes shunt momentarily coupled power to ground to protect the FET preamp.

## Preamp

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

C13 and L102 are tuned to provide matching to Q3. Q3 is a Gallium arsenide field-effect transistor (GaAsFet). It amplifies the signal with a minimal addition of its own noise. L101, C11, and C10 are tuned and match Q3 to R9. R9 + R10 provide a constant matching impedance for Q3, as well as for the station receiver.

No adjustment of the preamp should be tried, without the use of proper noise figure equipment.

## Power Amplifier

The signal from the radio passes through C1, Ry1a and C16 to Q5, where it is amplified to 30 Watts. The signal then goes to Ry1b and the filter, C105, L103, F11, L104, and C106 to remove any harmonics, before it is connected to the antenna.

Q5 has a resistor, capacitor and coil, connected from collector to base, which provides stability at low frequencies.

Bias is applied through L3 and is adjusted by R14. The bias voltage is switched on when Ry1 is activated.

The input tuning, for Q5, is adjusted by C18. It is set for minimum input SWR.

Output tuning is set by C21. C21 is adjusted for maximum power output.

# Circuit Description rfc 4-32

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## Keying Circuit

When S2 and S3 are off, transmit and receive signals pass straight through the amplifier, without amplification. To activate the transmit section, S2 is turned on. This supplies voltage to Ry1 through D4.

During transmit a small amount of signal is coupled through R1, C2 to D1 and D2. The resultant positive voltage is applied to the base of Q1. Q1 then activates Ry1, switching the contacts of Ry1b to Ry2, thus switching in the amplifier section and lighting the TX LED.

To activate the preamp, S3 connects the +13.6 to Ry1a, which is connected to Ry3. Ry3 switches in the preamp.

When the transmitter is keyed, Q1 activates Ry1 opening the circuit between S3 and Ry3, therefore switching out the preamp.

D3 and D4 allow independent operation of transmit and receive sections.

## Preamp

When S3 actuates Ry3, the incoming signal (from antenna) is routed to the preamp.

Diode D11 and D12 prevent large input signals from damaging Q2. C13 and L2 are tuned to 440 and provide matching to Q2.

Q2 is a Gallium arsenide field-effect transistor (GaAsFet). It amplifies the signal with a minimal addition of its own noise.

L1 and C1 tune the drain of Q2 to 440 MHz. The signal is coupled through C8 to D9 and D10, which protect Q2 from large signals.

No adjustment of the preamp should be tried, without the use of proper noise figure equipment.

## Power Amplifier

The 3 watt signal from the radio passes through C1, Ry2a and C17 to Q5, where it is amplified to 20 Watts. The signal then goes to Ry2b to be connected to the antenna.

Q5 has a resistor, capacitor and coil connected from collector to base, which provides stability at low frequencies.

Bias is applied through L3 and is adjusted by R15. The bias voltage is switched on when Ry1b is activated.

The input tuning, for Q5, is adjusted by C18. It is set for minimum input SWR.

Output tuning is set by C29. C29 is adjusted for maximum power output.

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KANTRONICS CO., INC.  
**LIMITED WARRANTY**

Effective December 1, 1992

To be sure you will receive notice of future updates, new product information and prompt warranty service, please take a moment to fill in the Kantronics/rfconcepts Warranty Registration card **COMPLETELY** and return it along with a copy of proof of purchase (to establish purchase date) to Kantronics Co., Inc., 1202 East 23rd Street, Lawrence, Kansas 66046 USA. **Return of the Warranty Registration card and proof of purchase is a pre-condition to warranty coverage.**

**1. WARRANTY.** Kantronics Co., Inc. ("Kantronics") warrants to the first consumer purchaser ("you"), for the Applicable Warranty Period (as described below), that the Applicable Product (as described below) will be free from defects in material and workmanship.

**2. REMEDY.** Kantronics agrees that, for any Applicable Product found by Kantronics to be in violation of the warranty of Section 1 hereof within the Applicable Warranty Period, it will, at its option, repair or replace the defective Applicable Product at no charge to you, excluding in-bound shipping charges.

**3. EXCLUSIVE REMEDY.** Repair or replacement of the Applicable Product, as provided herein, is the sole remedy available to you against Kantronics, and in no event will Kantronics be responsible for any other liability or damages or for incidental, special, or consequential damages, regardless of whether purported liability is predicated upon negligence, strict tort, contract, or other products liability theory and whether or not Kantronics is warned about the possibility of such liability or damages. **SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.**

**4. DISCLAIMER.** This Limited Warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for Kantronics any other liability in connection with the sale of its products. **KANTRONICS SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTY OF MERCHANTABILITY AND IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE FOR ANY APPLICABLE PRODUCT. IF, HOWEVER, YOU ARE A CONSUMER WITHIN THE MEANING OF 15 U.S.C. § 2301(3), THE ABOVE DISCLAIMER OF IMPLIED WARRANTIES IS EFFECTIVE ONLY FOR PERIODS OUTSIDE THE APPLICABLE WARRANTY PERIOD. SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.**

**5. APPLICABLE PRODUCTS AND PERIODS.** Kantronics products are of two types – (1) hardware units and (2) firmware and software for operation of these units, whether incorporated into the units themselves or separate from the units as adjuncts or accessories to the units. Hardware units and the media containing firmware, software and documentation are sold to the consumer purchaser and become property of the purchaser. Firmware and software are licensed for use by the consumer purchaser in return for a fee included in the purchase price of the units and do not become the property of the consumer. (See separate License Agreement provided with these products). The products to which the warranty of Section 1 hereof applies (herein "Applicable Products") and the periods during which the warranty shall apply to such products (herein, "Applicable Warranty Period") are as follows:

Applicable Products:

**UNITS:**

KAM, KPC-2, KPC-3, KPC-4, Data Engine, DVR2-2, D4-10, KTU, rfc 2/70, rfc 2/70G, rfc 2/70H, rfc 2-23, rfc 2-217, rfc 2-117, rfc 2-317, rfc 2-417, rfc 4-32, rfc 4-110, rfc 4-310, rfc 3-22, rfc 3-211, rfc 3-112, rfc 3-312

Applicable Warranty Period:

One (1) year from date of purchase.



## ACCESSORIES:

Anemometer, Rain Gauge, Temperature Sensor (for KTU units)

### Applicable Warranty Period:

Sixty (60) days from date of purchase.

DE1200 modem, DE19K2/9K6 modem, DE Jumper Board, MSK modem, Watchdog Timer

### Applicable Warranty Period:

One (1) year from date of purchase.

## MEDIA:

EPROMS, diskettes, video or audio cassettes, manuals (however bound), specification and other supplemental pages or any other media on which firmware, software or documentation are supplied

### Applicable Warranty Period:

Thirty (30) days from date of purchase.

**6. EXCLUSIONS.** This Limited Warranty does not apply to the cosmetic appearance of the Applicable Product; to broken or cracked cabinets; to any accessory not supplied by Kantronics which is used with the Applicable Product; to any product that has been subject to misuse abuse or overvoltage; to any product that has been modified by non-Kantronics personnel unless specifically authorized in writing by Kantronics; or to any product damaged or impaired by shipping (whether or not caused by poor packaging), neglect, accident, wiring not installed by Kantronics, improper parameter settings which are cleared by performing a hard reset, or use in violation of instructions furnished by Kantronics or of generally accepted industry practice. Kantronics does not warrant that the functions contained in any software will meet your requirements or achieve your intended results; or that operation of any software will be uninterrupted or error-free or without effect upon other software used with it. Responsibility for the selection of the hardware and software program to achieve your intended results rests with you.

**7. REMEDY PROCEDURE.** Should you need to make a warranty claim, first contact the dealer from whom you purchased the product. If the dealer is unable to assist you, contact Kantronics Co., Inc., by mail at 1202 East 23rd Street, Lawrence, Kansas 66046 USA; by fax at 913-842-2021; or by phone at our Customer Support number 913-842-4476. Contact us prior to returning an Applicable Product to receive a Return Authorization Number. (As a practical matter, problems can often be solved in such a manner without the product having to be returned to Kantronics for repair or replacement.)

Return of any Applicable Product for the enforcement of rights under this Limited Warranty shall be at your expense. Any product returned for warranty service which Kantronics determines to be without defect or not covered by this Limited Warranty shall be subject to a minimum charge of one-half hour labor rate and the product will be returned to you at your sole expense. Please note, no warranty service will be provided until Kantronics has been furnished with your Warranty Registration card and copy of proof of purchase establishing purchase date.

**8. NON-ASSIGNMENT.** This Limited Warranty is not assignable by you. Any attempt to assign or transfer any of the rights, duties, or obligations hereof is void.

**9. OTHER RIGHTS.** This Limited Warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction.

## Return/Repair Procedures

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Consult the limited warranty policy in this manual for the service provisions offered by Kantronics at no charge. This warranty is considered to be in force only when the customer has submitted a completed warranty registration within 10 days of purchase, and when the stipulations of the warranty have been met. Violations of warranty clauses will automatically void the warranty and service or repairs will be charged to the owner.

Service outside the warranty will be charged at the cost of parts, labor, and return shipping. Units returned for service without a Return Authorization number will be subject to a minimum charge of 1/2 hour labor plus shipping and handling. Contact the Service Department (913-842-4476) to obtain a Return Authorization number. Repaired units will be returned via UPS C.O.D. These C.O.D. charges can be avoided by including your VISA or MasterCard number with your unit to be repaired. Shipping and repair may then be charged.

When service or repairs appear necessary, it may be wise to call or write Kantronics to determine if the problem can be solved without returning the unit.

When calling, report the product name and ask for the Amateur Radio Service Department. Should you find it necessary to call for assistance, please have the unit name and serial number available. (The serial number is found on the rear panel.)

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The Service Department telephone hours are 9 am - noon and  
2 pm - 5 pm Central Time 913-842-4476, Monday through Friday.

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Returns to the factory for refund or exchange are strictly regulated. Any return for refund or exchange must be approved by the service department.

## International Support

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Kantronics honors the provisions of our Limited Warranty on units owned world-wide. In some countries, dealers may be required to provide more liberal support. (See Limited Warranty in the manual for your unit.)

In case of a problem with your unit, first review all connection and set-up instructions as well as any troubleshooting information provided in the manual of the Kantronics unit and of any other units you are using with it. Oftentimes problems are the result of incorrect connections or incorrect parameter settings.

If you cannot solve the problem, contact the dealer from whom you purchased the unit. If you did not purchase from a dealer or the dealer is unable to assist, contact Kantronics to determine whether the unit must be returned for service.

International Department  
Kantronics Co., Inc.  
1202 E. 23rd Street  
Lawrence, KS 66046-5099  
Fax 913-842-2031  
Telephone 913-842-7745

Information Needed to Advise on Problems with Kantronics Products

All units:

1. The name of the unit, serial number, date of purchase and whether or not warranty registration has been completed.

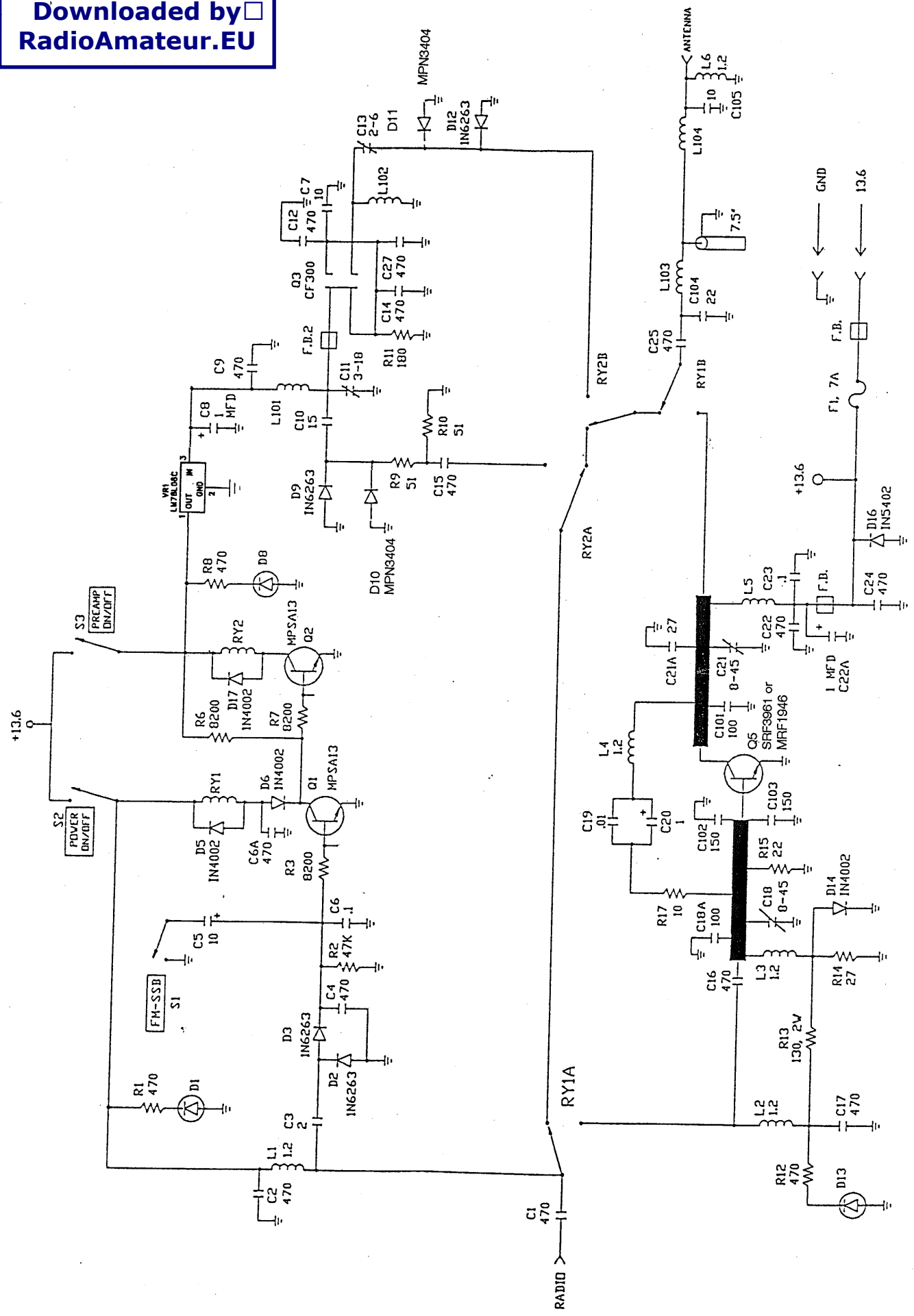
2. A clear description of the circumstances under which the problem occurs. Does it *always* happen under the circumstances described or only occasionally?

Packet radio equipment or software:

3. Provide all the information displayed when "Version" is entered at the "cmd:" prompt.
4. The type of computer, software, and radio you are using.
5. Information on the mode you are using, what your radio, computer, etc., are doing when the problem occurs.
6. A copy of your autoexec.bat and config.sys files and a list of the parameters shown at the DISPLAY command, if possible.

If the problem cannot be solved and the unit must be returned to us for service, please observe the steps outlined below. It will save both you, the customer, and Kantronics unnecessary difficulties and expense.

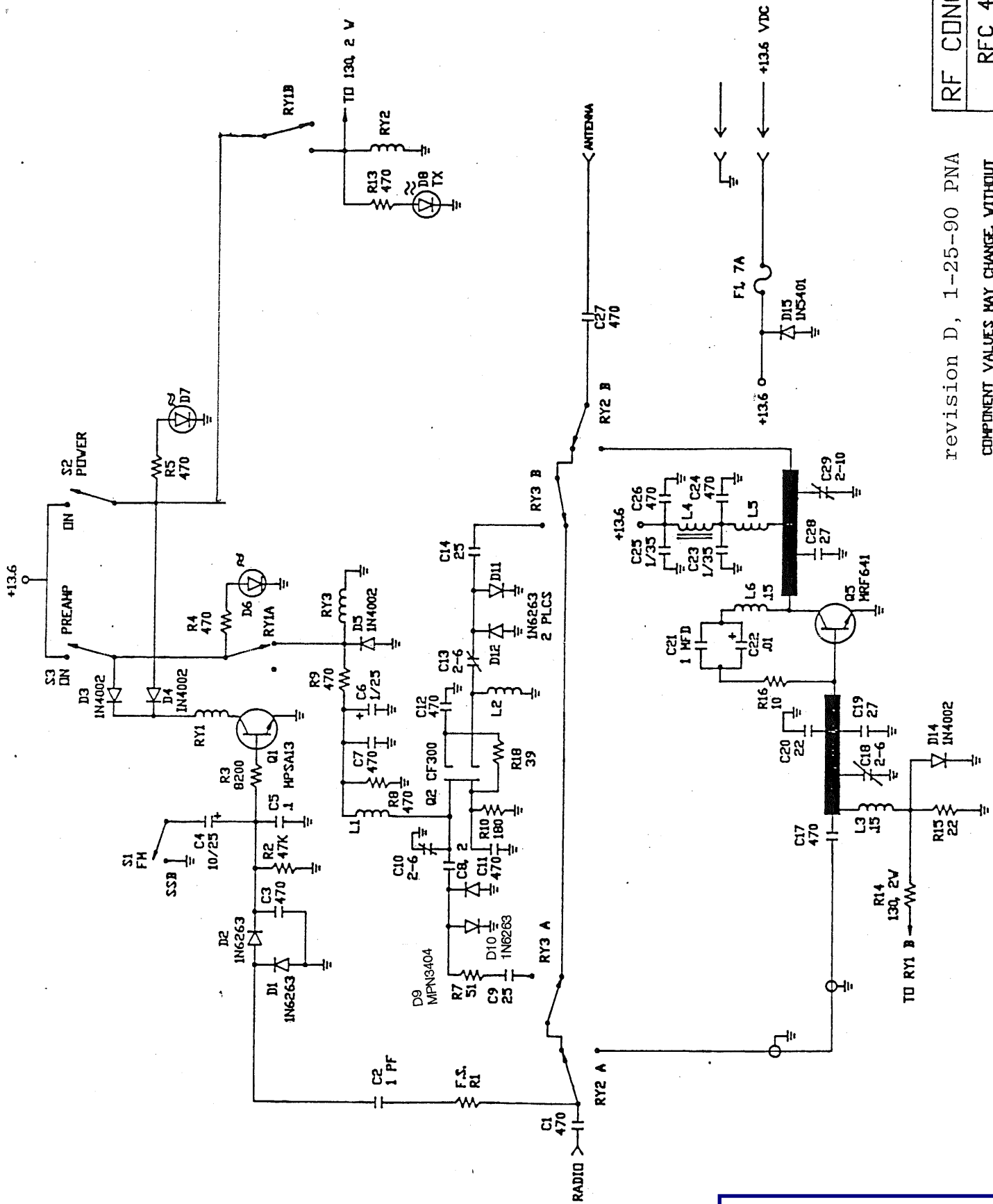
1. All returns must be shipped to the factory at 1202 East 23rd Street, Lawrence, KS 66046-5099 USA. Attn: International Department.
2. All expenses of returning item(s) to Kantronics/rfconcepts must be paid by you, including any duty/entry fees, whether the return is for warranty or non-warranty repair.
3. Usually, the best way to return item(s) to us is by mail. However, if you wish to use one of the courier services such as DHL, Federal Express, etc., be sure to use **DOOR-TO-DOOR** service. If you use one of these services, a commercial invoice may be required. Please check with your carrier before shipping.
4. Include in the description of the item(s) on the paperwork (whether postal or courier) the words:  
"U.S. GOODS RETURNED FOR REPAIR/REPLACEMENT."  
An *additional* description of "Amateur radio peripheral equipment", or "Data communications equipment", would be helpful. It would also be helpful (but not required) to include the code number 9801.00.1035 which tells U.S. Customs agents that the package contains "U.S. goods returned without improvement/enhancement". However, if the words "U.S. goods returned for repair/replacement" are on the paperwork, the number is not really necessary.
5. Provide a value for customs purposes. This is usually the value of the item(s) in their current condition. A \$0 value is not acceptable for U.S. Customs.
6. Inside the package, with the item(s), include:
  - a fax number (if available) in case we need to contact you
  - a correct and full address for return
  - method of payment to be used for any charges (if MasterCard or VISA, include expiration date).
  - a brief description of the problem (see information needed above)
  - a reference to any conversations with the technical/sales staff about the problem.
7. For warranty repairs, we will pay the shipping charges to return the item(s) to you via **air parcel post**. If you wish return by courier service, include your account number. To be eligible for repair under warranty, we must have a record that you sent your Warranty Registration card and proof of purchase to Kantronics/rfconcepts, and the item(s) must still be within the warranty period at the time the return is authorized.
8. For non-warranty repairs, you must pay the return shipping charges.



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RF CONCEPTS	
DRAWN BY	DATE
C. NAI DMFY	12/2/96
RFC 2-23	





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