QRO HF-2000 LINEAR AMPLIFIER
INSTRUCTION MANUAL

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SPECIFICATIONS

Band Coverage:	160, 80, 40, 20, 17, and 15 (12 & 10 export only) meter amateur bands. 12 & 10 meter also useable in USA with proof of license and user modification.
Drive Power Required:	120 Watts Typical
Maximum Output Power:	1,500 Watts SSB, 1250 Watts CW, 800 Watts RTTY, FM, SSTV
Duty Cycle:	100% SSB Continuous Voice Modulation 80% CW 50% RTTY, FM, SSTV. Continuous Carrier (Dead Key) 15 minute time limit at 800 watts with auxiliary cooling
Automatic Limiting Control (ALC):	0 to -20 Volts negative going, adjustable from Front Panel
Harmonic Suppression:	2nd at least -45 db; 3rd - 10th at least -50db
Keying:	Requires contact closure or sink of +12 VDC @ 80 ma, or +12 VDC on XMT
Input Impedance:	50 ohms unbalanced
Output Impedance:	50 ohms unbalanced with SWR 2:1 or less
Tube Requirement (2):	3-500Z, 3-500ZG, 3-500C
Power Line Requirement:	120 VAC, 50/60 Hz at 20 amperes maximum 240 VAC, 50/60 Hz at 10 amperes maximum
Front Panel: **(See Front Panel Pictorial)**	Multimeter (Plate Voltage, Plate Current, Power Output SSB Watts, Relative ALC) Grid Current Meter Multimeter Function Switch Transmit LED Indicator Power LED Indicator Power On/Off Switch Tune & Load Controls with 6-1 Reduction Drives Bandswitch
Rear Panel: **(See Rear Panel Pictorial)**	RF Input (SO-239) RF Output (SO-239) Transmit Keying Line (RCA Phono Socket) or +12 V Supplied by Transceiver on Transmit (RCA Phono Socket) ALC Output (RCA Phono Socket) Tuned Input Adjustments (160, 80, 40, 20, 17, 15, 12, and 10 meters) Ground Post Fuses (two 20 ampere for 100/120 VAC)
Dimensions:	18w x 15d x 8-1/2h (Inches) 45.7w x 38.1d x 21.6h (Centimeters)
Net Weight:	76 lbs. or 34.5 kgs.

WARRANTY

The HF-2000 is warranted against defects in material and workmanship for a period of two years for the original date of sale. This warranty does not cover the 3-500 triode which carries a separate warranty issued buy its manufacturer. Please check the warranty card which comes with the tube. During the warranty period, QRO Technologies, Inc. will repair or replace the amplifier at our option if it is defective in any way in material and workmanship. The warranty does not cover any defects resulting from improper use by the buyer or inadequate maintenance. In such cases the repair will be billed at prevailing service rates.

For warranty service or repair, the amplifier must be returned to the factory for authorized service. The buyer shall prepay shipping and insurance charges, QRO Technologies, Inc. will pay shipping and insurance charges to return the amplifier to the buyer. Please call the factory at 1-419-551-9354 for shipping instructions. Make sure when returning the amplifier you have insured the instrument for the full replacement cost. QRO Technologies, Inc. is not liable for any damage incurred during return shipments.

PROPRIETARY NOTICE

This instruction manual, schematic diagrams, and technical data herein disclosed, are proprietary to QRO Technologies, Inc. and shall not, without express written permission of QRO Technologies, Inc. be used, in whole or part to solicit quotations from a competitive source or used for manufacturing by anyone other than QRO Technologies, Inc. The information herein has been developed at private expense, and may only be used for operation and maintenance reference purposes or for purposes of engineering evaluation and incorporation into technical specifications and other documents which specify procurement of products from QRO Technologies, Inc. This amplifier is covered by copyrights both in the United States of America and throughout the world.

ALWAYS THINK SAFETY

THIS LINEAR AMPLIFIER DESCRIBED IN THIS MANUAL CONTAINS VOLTAGE HAZARDOUS TO HUMAN LIFE AND SAFETY WHICH IS CAPABLE OF INFLICTING PERSONAL INJURY. NEVER OPERATE THE AMPLIFIER WITH THE TOP COVER REMOVED AND THE TOP COVER SAFETY SWITCH DEFEATED. BEFORE REMOVING THE TOP COVER MAKE SURE THE AC LINE POWER CORD HAS BEEN DISCONNECTED FROM THE AC POWER SOURCE. ALLOW A MINIMUM OF 5 MINUTES TO ELAPSE BEFORE REMOVING THE TOP COVER AFTER POWER HAS BEEN REMOVED. THIS IS NECESSARY TO ALLOW THE PLATE VOLTAGE FILTER CAPACITORS TO BLEED DOWN TO A SAFE LEVEL.

If this amplifier is to be powered from the AC line (mains) through an autotransformer (such as a Variac or equivalent) ensure that the common connector is connected to the neutral (earth pole) of the power supply.

Before operating this unit ensure that the protection conductor (green wire) is connected to the ground (earth) protective conductor of the power outlet. Do not defeat the protective features of the third protective conductor in the power cord by using a two conductor extension cord or a three-prong/two-prong adapter.

Before operating this unit:

1. Ensure that the instrument is configured to operate on the voltage available at the power source. (See Installation Section)

2. Ensure that the proper fuses are in place in the amplifier's AC line fuse holders located on the rear panel.

3. Ensure that all other devices connected to or in proximity to this amplifier are properly grounded or connected to the protective third-wire earth ground.

If at any time the amplifier shows visible damage, has sustained stress, emits a foul smell, fails to operate satisfactorily, it should not be used until its performance has been checked by qualified service personnel.

UNPACKING AND INSPECTION

The amplifier is shipped in three cartons: amplifier, transformer, tube. Before unpacking each carton, check the exterior of the shipping carton for any sign of damage. All irregularities should be noted. Unpack and remove each component carefully from its carton, preserving the factory packaging as much as possible. Inspect each component for any noticeable defect or damage. Notify QRO Technologies if any defect or damage is apparent.

TRANSFORMER AND TUBE INSTALLATION

Before performing any of the following installation procedures, make sure that the amplifier has not been plugged into the AC supply line.

The Amplifier is shipped with the tubes and transformer each shipped in a separate carton. As part of the installation process, you must install the tube and transformer. You will need the following tools:

1. Phillips Screwdriver
2. Awl or suitable hole alignment tool
3. Adjustable wrench

Remove the Amplifier's top cover by removing the nine 6-32 x 3/8 Phillips Head machine screws and their associated flat washers. The sides of the top cover may bend outward when the screws are removed. This is normal, and they will return when you replace the screws and washers.

TRANSFORMER: Remove the transformer from its shipping carton. You will notice three connectors on the ends of the transformer leads. The one connector is for the primary leads, the larger connector is for the secondary leads, and the smallest is for the tube heaters. Position the amplifier so the front panel is facing you. Position the transformer so the primary leads are on your right and the secondary leads are on your left.The amplifier's transformer compartment should be on the right side. Observe there are matching primary and secondary leads coming from the amplifier. The primary leads originate on the back panel, and there are three black leads and three white leads. The nine secondary leads originate from the center divider panel. The primary and secondary leads of the transformer and amplifier have matching "mate & lock" connectors. Place the transformer into the transformer compartment with the secondary leads on the left and the primary leads on the right. The transformer's four mounting holes should align with the four mounting slots on the amplifier's bottom panel. Secure the transformer with four ¼-20 hex nuts and four ¼-20 x 5/8 mounting screws. Connect the primary and secondary "Mate & Lock" connectors together. Each connector is indexed so they connect only one way, and you will hear a distinctive click when the are correctly mated. **Make sure the primary & secondary leads coming from the transformer do not obstruct or prevent the free movement of the cooling fan. Make a check of all chassis wiring around the transformer to make sure no wiring has been pinched by the transformer's mounting plate. Correct any observed problems.**

TUBE: The tube sockets are located on the left side of the amplifier. They have five contacts which match the five pins on the 3-500 triode. ***Insert the tube into the socket making sure that the pins align with the socket contacts. If the tube pins and socket contacts are not aligned, the amplifier will not function properly and damage to the tube may result.*** After you have properly inserted the tube into its socket, connect the parasitic suppressor choke coming from the top of the plate choke to the plate connector screw located on the top of the tube.

LINE VOLTAGE SELECTION POWER POWER BLOCK WIRING
Note: Standard Factory Wiring 240 VAC

Before performing any of the following installation procedures, make sure that the amplifier has not been plugged into the AC supply line.

Refer to the four Power Block Wiring Diagrams while reading this section. Locate the Line Voltage Power Block. It is located inside the just above the AC line Cord, and it contains 6 screw connection termials. It also has black and white leads connected to it.

120 VAC: Two wire jumpers (J1 & J2) are connected to terminals. J1 is connected to terminals 1 & 4. J2 is connected to terminals 2 & 5. If there is a white wire connected to left side of terminal 6, remove it an connect it to left side of terminal 5. Also, if there is a black wire connected to the left side of terminal 3, remove it and connect it to the left side of terminal 2. Remove the small black wire connected to the right side of terminal 3 and connect it to the right side of terminal 2. Make sure all screws are tightened.

240 VAC: One wire jumper (J1) is connected to terminals. If a second Jumper was previously connected to the terminal block, you make discard it. J1 is connected to terminals 2 & 4. If there is a white wire connected to left side of terminal 6, remove it an connect it to left side of terminal 5. Also, if there is a black wire connected to the left side of terminal 3, remove it and connect it to the left side of terminal 2. Remove the small black wire connected to the right side of terminal 3 and connect it to the right side of terminal 2. Make sure all screws are tightened.

You are now ready to replace the amplifier's top cover. **The hot air exhaust holes should be located on the top left and the cooling air entry holes should be on the right side.** Align the mounting holes with the corresponding threaded inserts located on the chassis. You may also need to use an alignment tool such as an awl. You may need to lightly tap the top cover into place with your hand. The left and right sides of the top cover may need to be pushed inward as you place the mounting screws into place. Replace the nine 6-32 x 3/8 mounting screws and washers. Partially tighten each screw. When all nine screws have bee inserted, tighten all the screws. **Double check to make sure that the cooling air entry holes are on the right side, and the hot exhaust air exit holes are located on the top left directly over the tube.**

RESHIPMENT INSTRUCTIONS

Use the original packaging if it is necessary to return the amplifier, transformer, or tube to QRO for servicing. The original shipping carton and the interior corner pads are designed to provide the necessary support for safe shipment or reshipment. If the original carton along with the internal packaging is not available, contact the factory and a new carton will be shipped to you at a nominal cost. Always insure the package for the full replacement value and ship via UPS ground service. **QRO Technologies, Inc. will not be responsible for any damage or loss during return shipment.**

INTRODUCTION

The QRO Model HF-2000 Linear Amplifier is a completely self-contained, grounded grid, linear amplifier. It is designed to operate at 1,500 watts PEP output on SSB, 1250 watts on CW, and 800 watts on such high duty cycle emissions as RTTY, SSTV, and FM. The HF-2000 is designed to be used with any HF amateur transceiver. A broad-band tuned input circuit for each band feeds the 3-500 triode tubes which are connected in a grounded grid configuration. An ALC circuit develops negative voltage that can be fed back to the transceiver to reduce its gain when the amplifier is over-driven. The antenna transmit-receive (T/R) relay is normally actuated by relay contacts, or an electronic switch, in the transceiver to place the amplifier in the transmit mode.

LOCATION

Do not operate the Amplifier in excessively warm locations or near heating vents or radiators. Be sure air can circulate freely around and through the Amplifier cabinet, and can provide an unobstructed air inlet for the internal cooling fan. Do not place any books, magazines, manuals, or equipment that will impede the free flow of air near the sides and the hot air exhaust holes located on the top of the cabinet. The internal fan allows an air flow of approximately 50 CFM. Do not use an external auxiliary cooling fan with less than 50 CFM capacity. The exhaust air becomes quite warm at high power levels. Do not position any heat-sensitive objects in the exhaust airflow path.

AC LINE POWER CONSIDERATIONS

Before operating the amplifier, verify that the AC Voltage Power Block located inside the amplifier has been wired correctly for the local AC supply you will be using. See the Voltage Power Block Wiring Diagram for the correct wiring. **Make sure the AC line cord has been disconnected and filter capacitors have no charge on them before removing the top cover.**

Verify that the rating of the line fuses located in the rear panel fuse holders is suitable for the AC line voltage you will be using. The fuse should be the ceramic cartridge So-Blo type. The rating should be either of the following:

120/240 VAC 20 Ampere

Use only AC power outlets having a protective ground for connection to the amplifier. **DO NOT USE** 2 conductor extension cords or 3 prong to 2 prong adapters that do not provide a protective ground connection. Connection of the power cord to the power outlet must be made in accordance with the following standard color code:

	American	**European**
Live	Black	Brown
Neutral	White	Blue
Ground (Earth)	Green	Green/Yellow

Use the following NEMA plug configurations according to the corresponding AC line voltage:

100/110 VAC 20 Ampere 5-15P
200/240 VAC 10 Ampere 6-15P or 6-20P

Due to the power involved, this Amplifier should have its own 240 VAC electric service line. This line should have three 12-gauge conductors, and 10 ampere fuses in each "hot" wire. If a single 240 VAC line serves the entire station, make an effort to connect your equipment so the load is balanced between the two "hot" wires. If you have only 120 VAC available, use a separate line made up of 10 gauge conductors and 20 ampere fuses in each leg of the circuit. **DO NOT** use this Amplifier at it full ratings on a regular house wiring circuit, as the ratings of the wire will almost certainly be exceeded. Avoid excessively long runs of wire between your service entrance and the Amplifier. A heavy flow of current in such a line results in a voltage drop which can affect the performance of your equipment. The plug on the power cord of your Amplifier, if wired for 120 VAC operation, is for standard 120 VAC outlets (NEMA 5-15P). If the Amplifier is wired for 240 VAC operation, no plug is supplied with the line cord. Use a plug that matches your 240 VAC receptacle (NEMA 6-15P or 6-20P). Your power connection must conform to section 210-21 (b) of the National Electric Code, which reads, in part:

"Receptacles connected to circuits having different voltage, frequencies, or types of current (AC or DC) on the same premises shall be of such circuits are not interchangeable."

When you install a new plug, make sure it is connected according to your local electrical code. Keep in mind that the green line cord wire is connected to the Amplifier chassis.

ANTENNA

The output circuit of the Amplifier is designed to be connected to an unbalanced transmission line that has a 50 ohm characteristic impedance. Lines of other characteristic impedance may be used providing the SWR (standing-wave-ratio) does not exceed 2:1. In addition, the built-in wattmeter is only accurate at 50 ohms. The RF OUT connector is a UHF type SO-239. You will need a mating PL-259 plug for your transmission line. Use coaxial cables like RG-8U, RF-11U, or similar types, for the transmission line. Due to the power level, the smaller types RG-58U, RG-8X, and RG59/U are not recommended. The "A.R.R.L. Antenna Book" includes comprehensive reference work on transmission lines and antennas. Other similar handbooks for the radio amateur are offered for sale and can often be found in a public library.

GROUNDING

Connect a good earth or water pipe ground to the ground post on the rear of the Amplifier. Use the heaviest and shortest connection possible. Before you use a water pipe ground, inspect the connections around your water meter and make sure that no plastic or rubber hose connections are used. These connections interrupt the continuity to the water supply line. Install a jumper around any insulating water connectors you may find. Use heavy copper wire and pipe clamps. It is best to ground all equipment to one point at the operating position and then ground this point as described above.

EQUIPMENT INTERCONNECTIONS

Interconnection between the Amplifier and a typical transceiver is shown in the "Interconnection Diagram" located inside your transceiver owners manual. Many brands of equipment usually follow the same general pattern. Please refer to this diagram plus the amplifier's Rear Panel Pictorial while reading the following:

RF IN: Connect this socket to the RF output connector of your transceiver.

RF OUT: Connect this socket to the cable coming from your antenna.

Note: Use shielded cable, such as audio-type cable, for the following connections.

KEY XMT: Connect this socket to the Relay socket or keying contact on your transceiver. This connector requires contacts that are normally open in the receive mode and closed in the transmit mode. ***This contact sinks +12 VDC to ground at 80 mA.***

+15 V XMT: If your transceiver has a provision for + VDC on transmit for keying external devices, such as linear amplifiers, connect this socket to the appropriate socket on your transceiver

Note: If your transceiver has neither of the above keying methods, you will have to use some other means. For instance, you could use a shorted RCA phono plug by placing it in the Key XMT socket. Then, you would have to manually turn off and on the Operate/Standby switch located on the front panel.

ALC OUTPUT Connect this socket to the ALC input of your transceiver. A 0 to 20 V negative ALC voltage is present at this socket. Refer to your transceiver manual for proper connection information. Whenever the Amplifier is overdriven, the ALC circuitry creates a negative voltage that is fed back to the transceiver to reduce its gain and help prevent "flat-topping". Protective circuitry of this nature is a valuable circuit element, but it is not a substitute for proper adjustment of the transceiver drive.

SAFETY INTERLOCK SWITCH

While the Amplifier's top cover is in place, the interlock switch closes to allow AC line voltage to reach the power transformer. When the top cover is removed, the interlock switch opens and disconnects the line voltage. This does not discharge the bank of power supply filter capacitors. Be sure to allow the filter capacitors to discharge before you touch anything inside the Amplifier. You can select the High Voltage function of the Multi-meter to check the high voltage potential.

DRIVING POWER

This Amplifier is designed to operate at full ratings when it is driven by a transceiver that has approximately 100- 120 watts of RF output. You can use a transceiver that has lower output power, but the Amplifier's output will be less. If you use a transceiver that delivers more than 100 watts, carefully adjust the driving power to avoid "overdrive" and the creation of spurious signals, which create needless interference to other operators. **IMPORTANT:** In no case should you advance the power output control of your transceiver beyond the point where the Amplifier's power output indication ceases to increase. If you turn the control past this point, nonlinear operation may occur.

TUBE

It is not abnormal for the tube to show a dull red color. But if the plate shows a bright orange or yellow color, immediately investigate the tuning and drive conditions and make any necessary corrections. After prolonged operation, let the Amplifier run for several minutes without drive applied so the fan will cool the tubes before you turn the Amplifier off.

READING THE METERS

Refer to Front Panel Pictorial while you read the following information:

Multi-meter: The Multi-meter switch on the front panel of the Amplifier selects the right-hand meter functions. Read the meter scale which corresponds to the setting of the Multi-meter switch as shown in Table A.

Grid Meter: The left-hand meter always indicates grid current between 0 and 300 milliamperes. Each Division indicates 10 milliamperes.

Table A

Multimeter Switch Position	Measures	Scale Indication
Plate Voltage (PV)	Plate Voltage	Center scale indicates 0 to 7000 volts (normal operating range is 3900 to 4300 volts) Each division represents 250 volts.
Plate Current (IP)	Plate Current	Top meter scale indicates 0 to 1400 milliamperes. Each division represents 40 milliamperes.
Power Output (PO)	Peak SSB Watts	Bottom meter scale indicates 0 to 2000 **(SSB) voice peak only** watts**. Does not measure average or RMS power**
ALC	ALC Detector	Indicates relative ALC Output

TUNE-UP PROCEDURE

Please refer to the Front Panel Pictorial while reading the following. The current and voltage figures given in this section are approximate. Actual indications will vary at each installation with such factors as line voltage, transceiver drive, and load impedance. The following procedure for tuning the Amplifier should only take a few seconds after you go through it a few times. Note the Tune control position and the Load control position so you can preset it the next time you use a particular band and frequency. For your convenience, the following chart shows typical settings:

TUNE-UP TABLE (50 Ohm Resistive Load with 240 VAC Line Voltage)

Freq (Mhz)	Band	Drive	Tune Control	Load Control	Plate Voltage	Plate Current	Grid Current	Power Output
1.80	**160**							
1.90	**160**							
3.55	**80**							
3.90	**80**							
7.20	**40**							
14.20	**20**							
18.10	**17**							
21.30	**15**							
24.90	**12**							
28.50	**10**							
28.70	**10**							

CW, RTTY, SSTV, Procedure

Make sure you have the Amplifier connected as described in the Equipment Interconnections Section. ***IMPORTANT: Before you proceed, make sure you have a dummy load or an appropriate antenna is connected to the Amplifier RF Output connector.***

1. Preset the Amplifier controls as follows:

On/Off	Off
Operate/Standby	Standby
Multimeter	PV
ALC Adjust	Minimum (Fully counter clockwise)

2. Plug the line cord into a proper AC outlet.

3. Set the On/Off switch to On. The meter lamps should light and the fan should run. The red power indicator LED should also be lite. The 0 to 7000 V scale on the Multi-meter should indicate approximately 3900 - 4300 volts.

4. Make sure your transceiver has been turned on and its drive level control has been set to minimum.

5. Turn the Band Switch to the same band as you have selected on the transceiver. Then preset the Tune Control and the Load Control to the positions indicated in the above chart for the band you have selected.

6. With the transceiver drive still at minimum, set the Multi-meter Switch to Plate Current (IP). The 0 to 1400 ma scale should indicate zero. Now set the Operate/Standby switch to the Operate position.

7. Key the transceiver (with no drive applied) and observe the plate current on the 0 to 1400 ma scale. The plate current should read approximately 100 ma more or less.

8. Apply only enough drive to obtain 50 ma of **grid current** and no more than 400 ma of **plate current**. Now tune the Tune Control for maximum grid current. Un-key the transceiver. NOTE: It is normal for the plate current to dip (be reduced) when you have maximum grid current. **If the grid current goes over 200 ma, immediately reduce the drive.**

9. Again key your transceiver and observe the peak RF watts on your wattmeter. Adjust the Tune Control and Load Control for maximum output on your wattmeter. This is accomplished by going back and forth between each control.

10. Increase the transceiver drive until you obtain 250 ma of grid current. Now readjust the Tune Control and Load Control for maximum output. The grid current should decrease.

11. Increase the transceiver drive for 200 ma of grid current. Then readjust the Tune Control and Load Control for maximum output power. The output should now be around 1200 watts with 100 watts of transceiver drive power.

12. Apply only enough drive to indicate either 1200 watts of output power, or 160-200 ma of grid current. Repeak the Tune Control and Load Control. Note: The grid current, plate current. and output power must not exceed the following limits:

Grid current	220 ma
Plate current	800 ma
Output Power	1200 watts

13. **When you operate in CW, reduce the drive power until the output power is 1200 watts more or less. Also when operating RTTY or SSTV, reduce the drive power until the output power is 800 watts more or less. The amplifier will be loaded heavy for normal operation.**

The Amplifier is now fully loaded for operation on CW, RTTY, or SSTV.

SSB Procedure: Tune up the Amplifier as described for CW operation.

USING THE FRONT PANEL ALC CONTROL TO ADJUST AMPLIFIER OUTPUT POWER.

You may want to utilize an alternative to adjusting the drive power at the transceiver. The Front Panel ALC Adjustment Control allows you to adjust the ALC for the amount of output power you desire. Using this procedure, you would set the ALC Control to minimum (fully counter-clockwise). Tune the amplifier for maximum output. Then advance the ALC Control (clockwise) for the amount of output power you want. The ALC circuit of the amplifier supplies negative feedback voltage to the transceiver which reduces the amount of drive coming into the amplifier. **Only use this feature after your Amplifier has been properly tuned.**

TUNED INPUT ADJUSTMENTS

Please refer to the Rear Panel Pictorial while reading the following.

Your Amplifier's tuned input circuits have been factory preset for the optimum match. However before your initial operation, you may want to check the tuned input circuits for each band to see if it has the proper match. A nominal match will show no more than 10 watts reflected with 100 watts of drive applied. ***NOTE: DUE TO THE LARGE BANDWIDTH ON 80 METERS, THE SWR ON THE ABOVE 3.950 MHZ IS HIGH. YOU MAY HAVE TO USE YOUR TRANSCEIVER'S ANTENNA TUNER FOR A BETTER MATCH.***

To check the tuned input match, follow the following procedure:

1. Place a wattmeter in line between the transceiver and the Amplifier which reads reflected RF power.

2. Select one of the HF bands on your transceiver, and then select the corresponding band on the amplifier.

3. Place the amplifier in the Operate mode, and tune the amplifier according to the tune up procedure.

4. Observe the reflect power between the transceiver and the amplifier. If it exceeds 5 watts, adjust the corresponding mica trimmer capacitor located on the rear panel. This trimmer capacitor is located through the corresponding rear panel access hole in the area marked Tuned Input Adjustments. Use only a non-conductive flat blade adjustment tool.

5. Advance the mica trimmer capacitor's adjustment screw either clockwise or counter-clockwise and observe the reflected power indication on the watt meter. Adjust for minimum reflected power.

6. Repeat this procedure for each band.

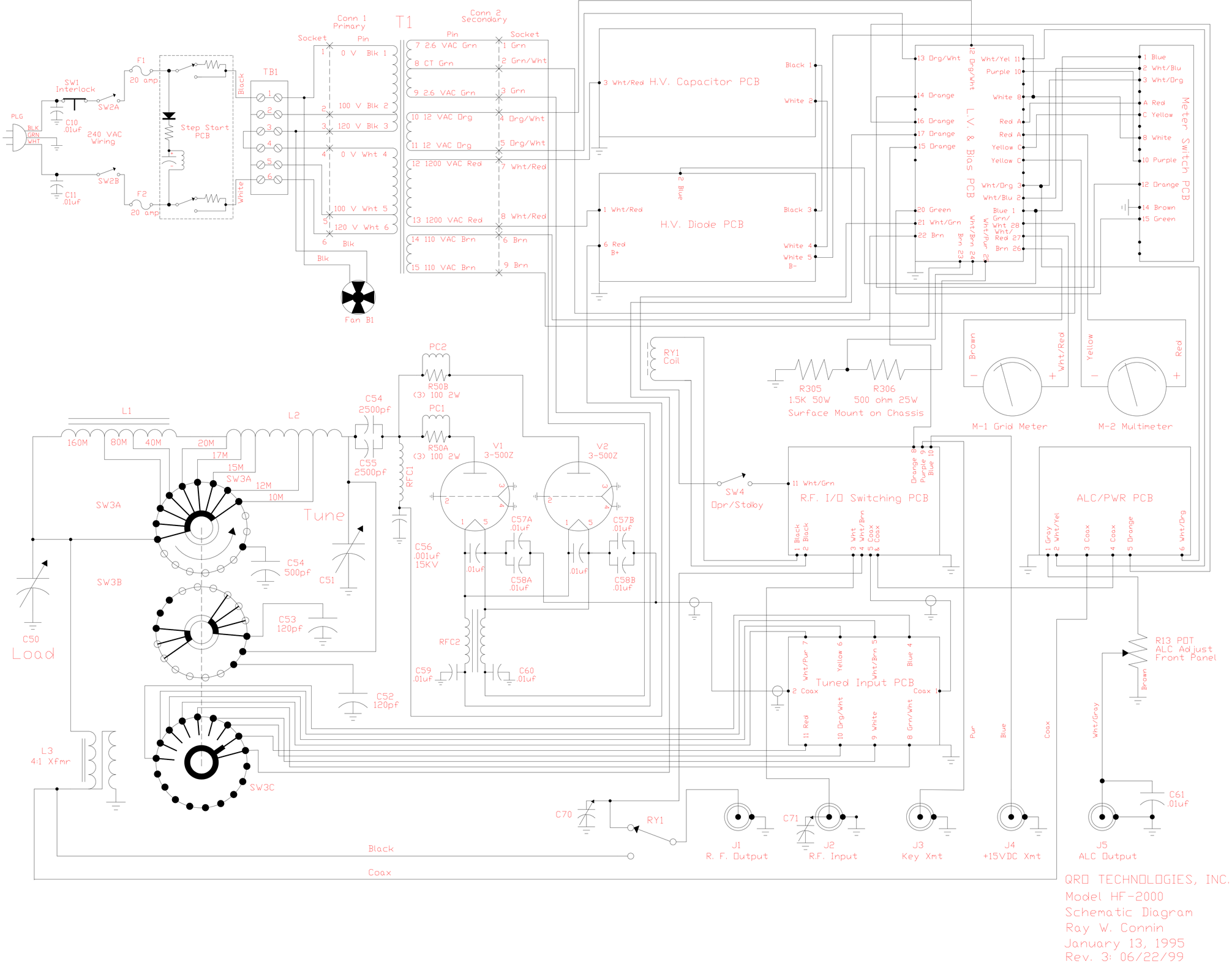
PERIODIC MAINTENANCE

Make sure the Amplifier has been disconnected for the AC power source and the high voltage filter capacitors have bleed down to zero.

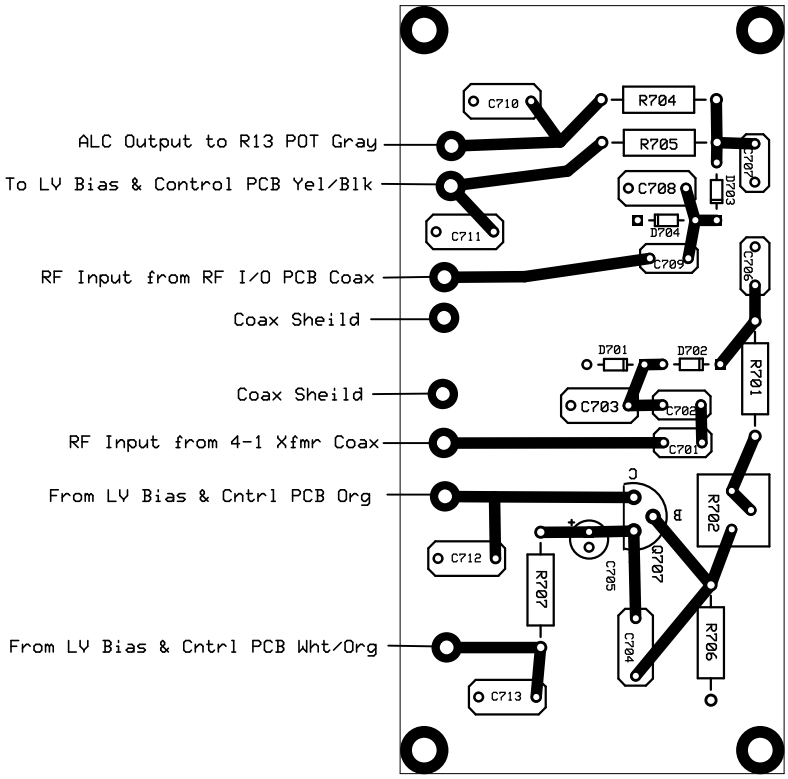
Remove the top cover from the Amplifier at least once a year and remove the dust. Dust accumulation can help cause the variable capacitors to arc between plates. Use the blower connection on a vacuum cleaner or a soft bristle brush. Also, remove the tube from its socket and check to see if any tarnish buildup has developed on the tube socket contacts. If so, use a Q Tip and Tarn-X solution, and clean each of the socket contacts.

SCHEMATICS, PCB LAYOUTS, AND PARTS LISTS

Schematic Diagrams, PCB Layouts, and Parts Lists can be downloaded from our website http://www.qrotec.com.



QRO TECHNOLOGIES, INC.
Model HF-2000
Schematic Diagram
Ray W. Connin
January 13, 1995
Rev. 3: 06/22/99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To LV Bias & Control PCB Yel/Blk
RF Input from RF I/O PCB Coax
Coax Sheild
Coax Sheild
RF Input from 4-1 Xfmr Coax
From LV Bias & Cntrl PCB Org
From LV Bias & Cntrl PCB Wht/Org
C710
R704
R705
C707
D703
C708
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C709
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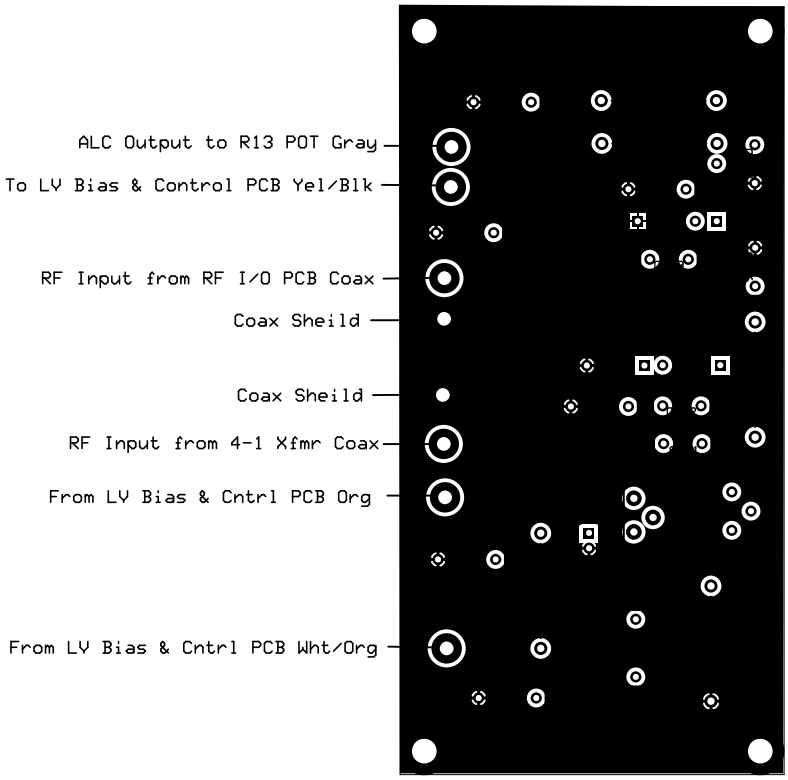
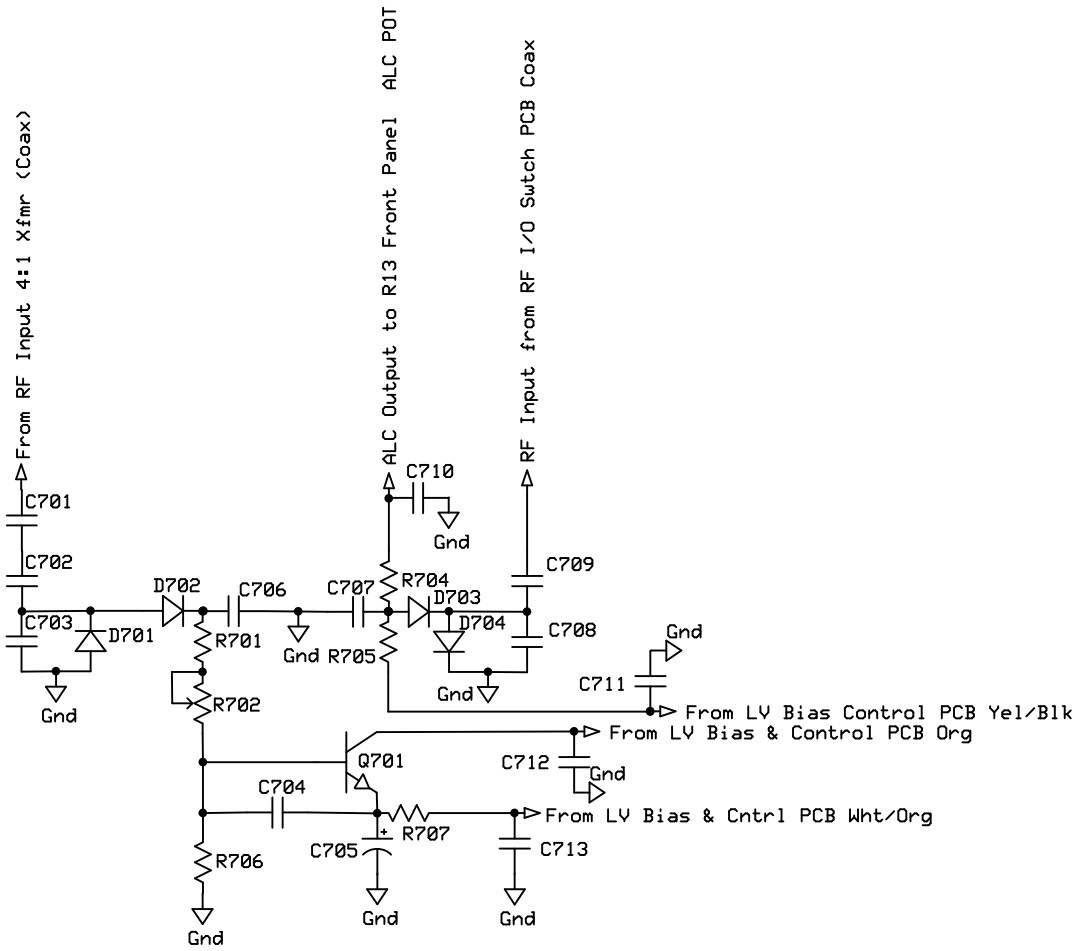
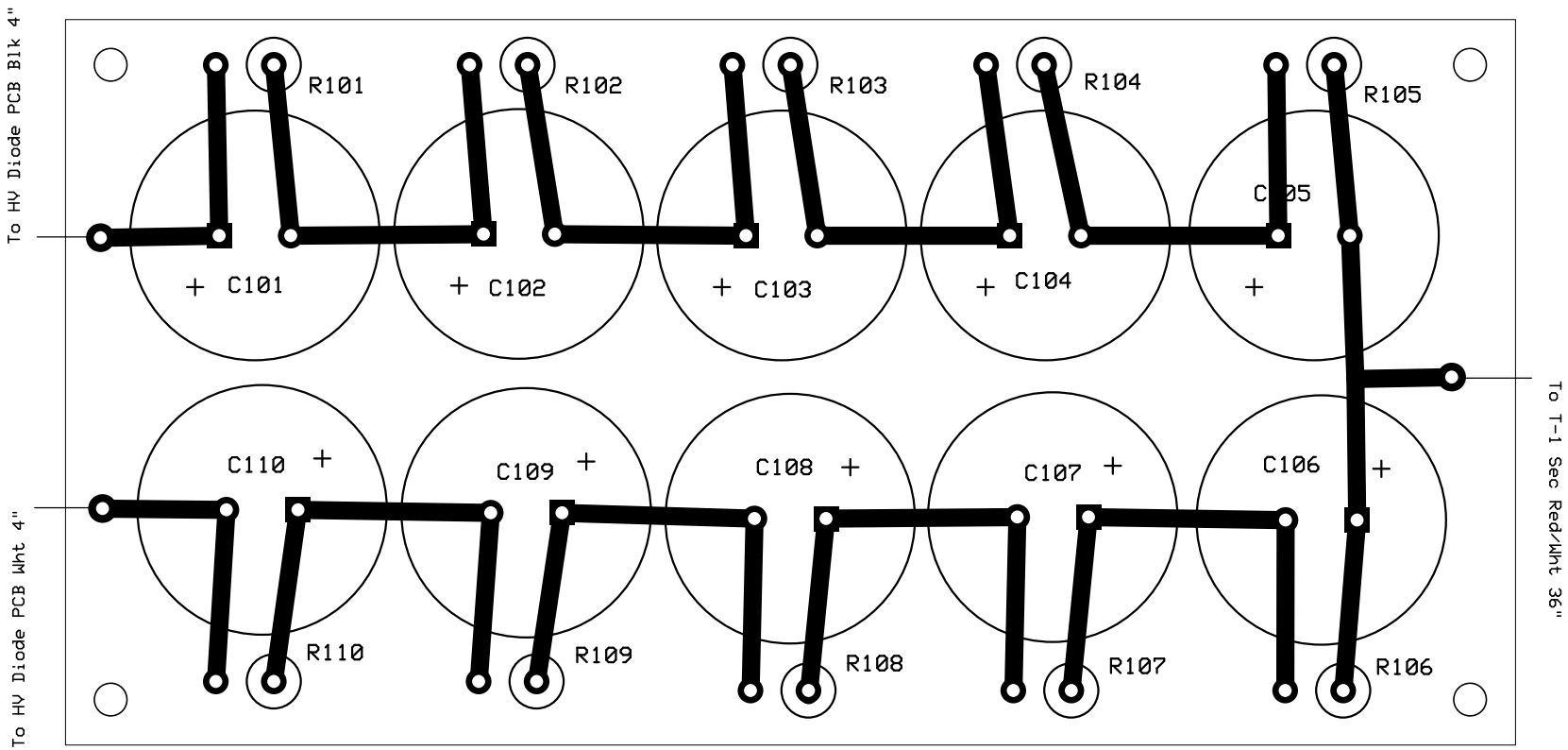

ALC Output to R13 POT Gray
To LV Bias & Control PCB Yel/Blk
RF Input from RF I/O PCB Coax
Coax Sheild
Coax Sheild
RF Input from 4-1 Xfmr Coax
From LV Bias & Cntrl PCB Org
From LV Bias & Cntrl PCB Wht/Org



QRO Technologies, Inc.		
ALC/Power PCB HF-2000		
Ray W. Connin	Rev 2.0 04/26/2011	Part No. 06108


To HV Diode PCB Blk 4"
To HV Diode PCB Wht 4"
To T-1 Sec Red/Wht 36"
R101
R102
R103
R104
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C101
C102
C103
C104
C105
C110
C109
C108
C107
C106
R110
R109
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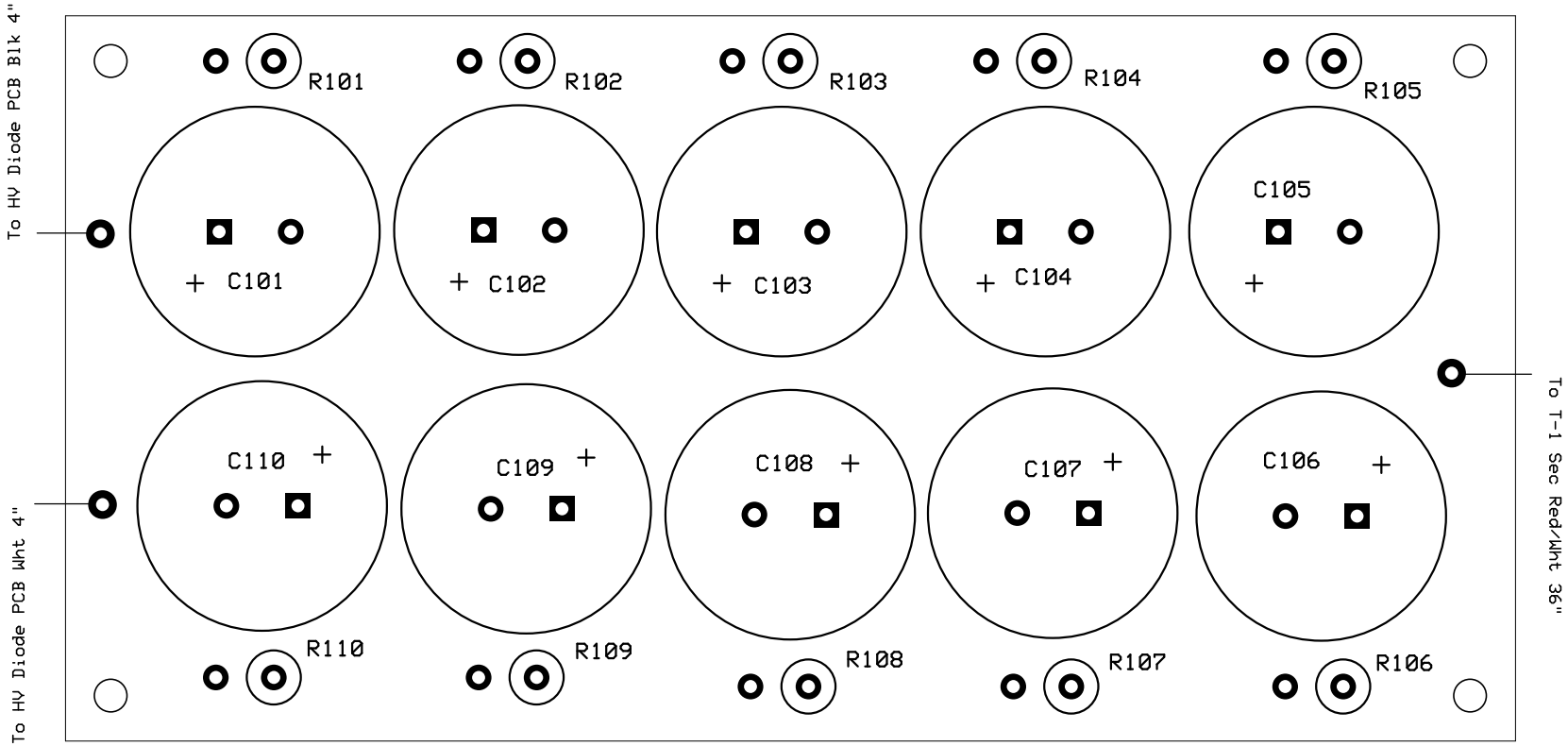
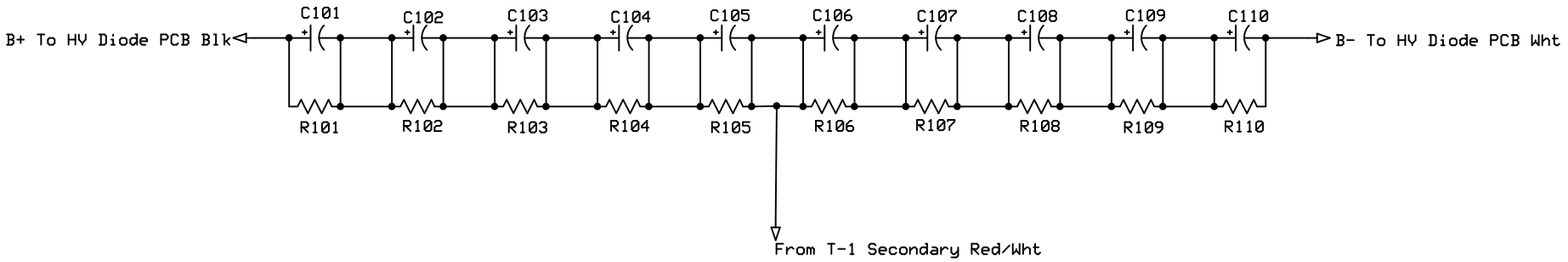
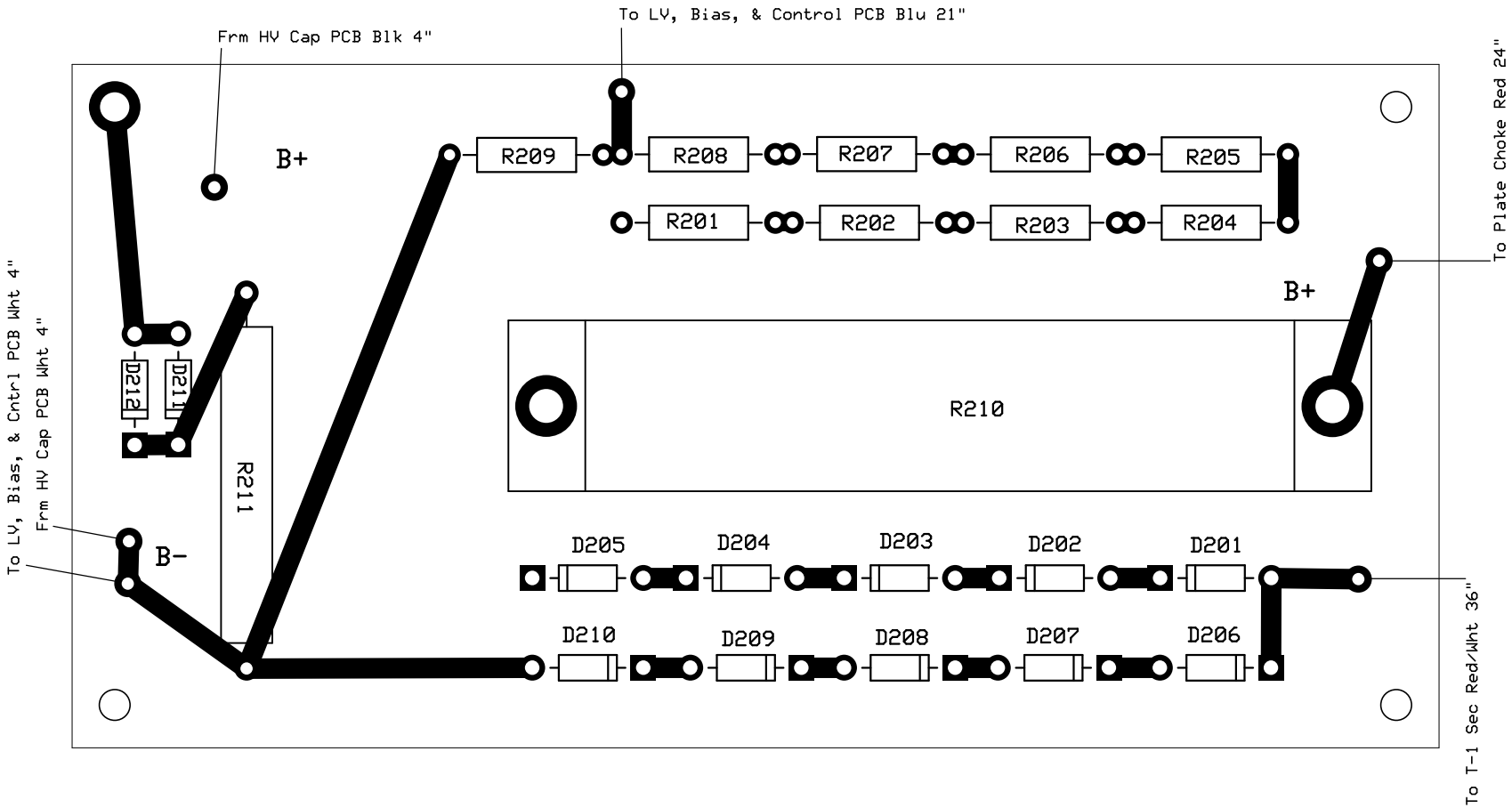
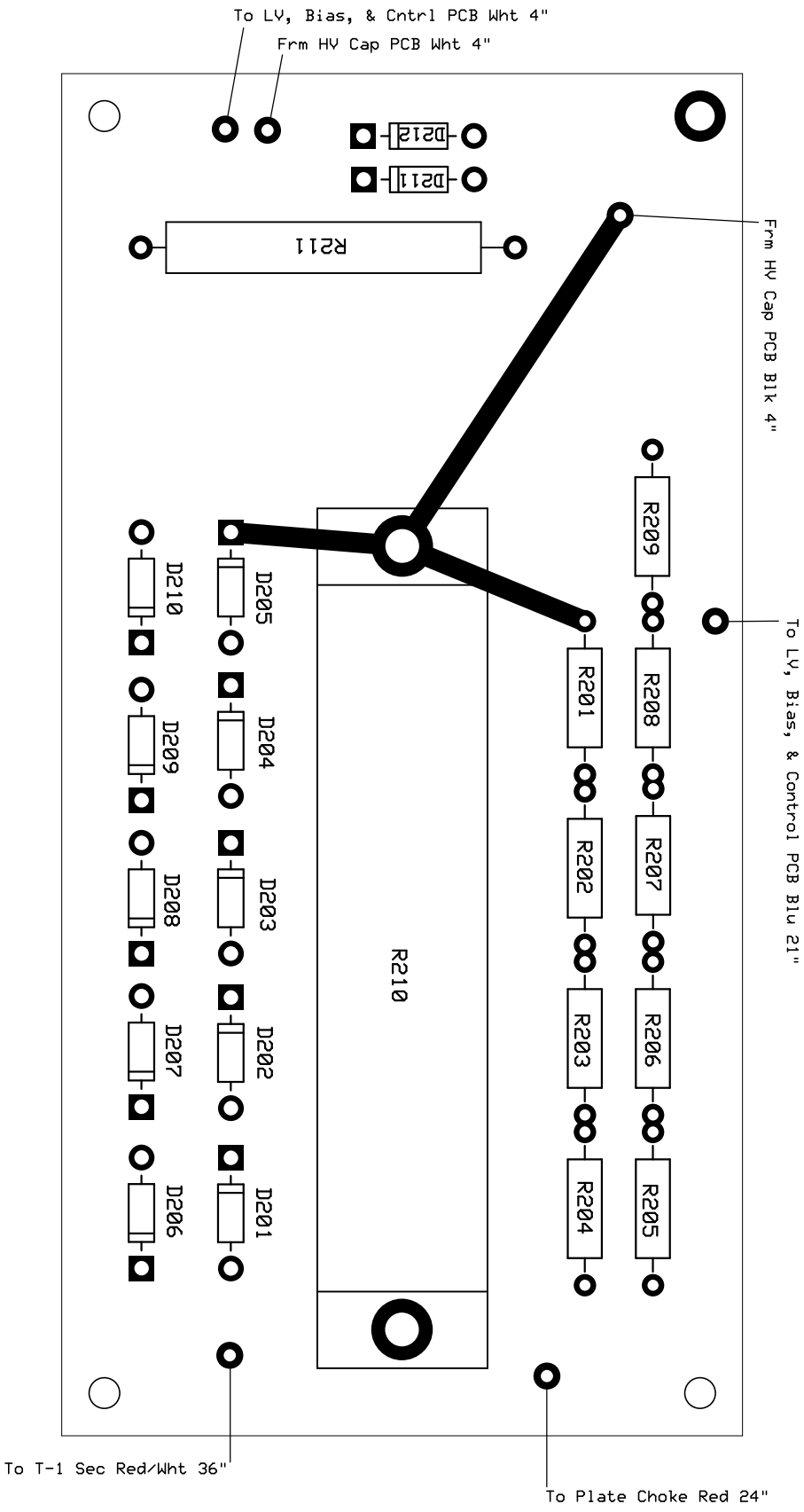
R107
R106

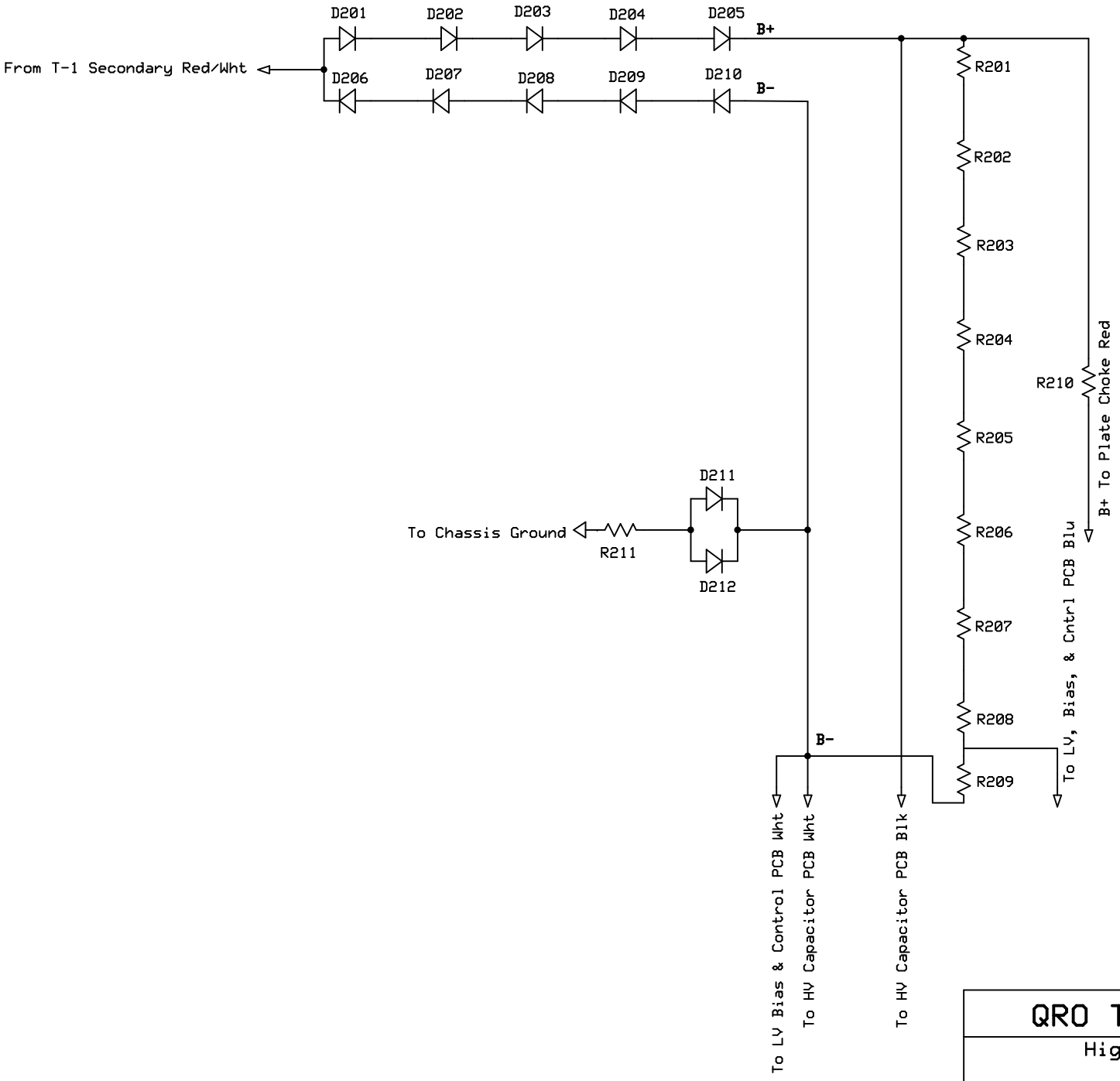

To HV Diode PCB Blk 4"
To HV Diode PCB Wht 4"
To T-1 Sec Red/Wht 36"
R101
R102
R103
R104
R105
C101
C102
C103
C104
C105
C110
C109
C108
C107
C106
R110
R109
R108
R107
R106



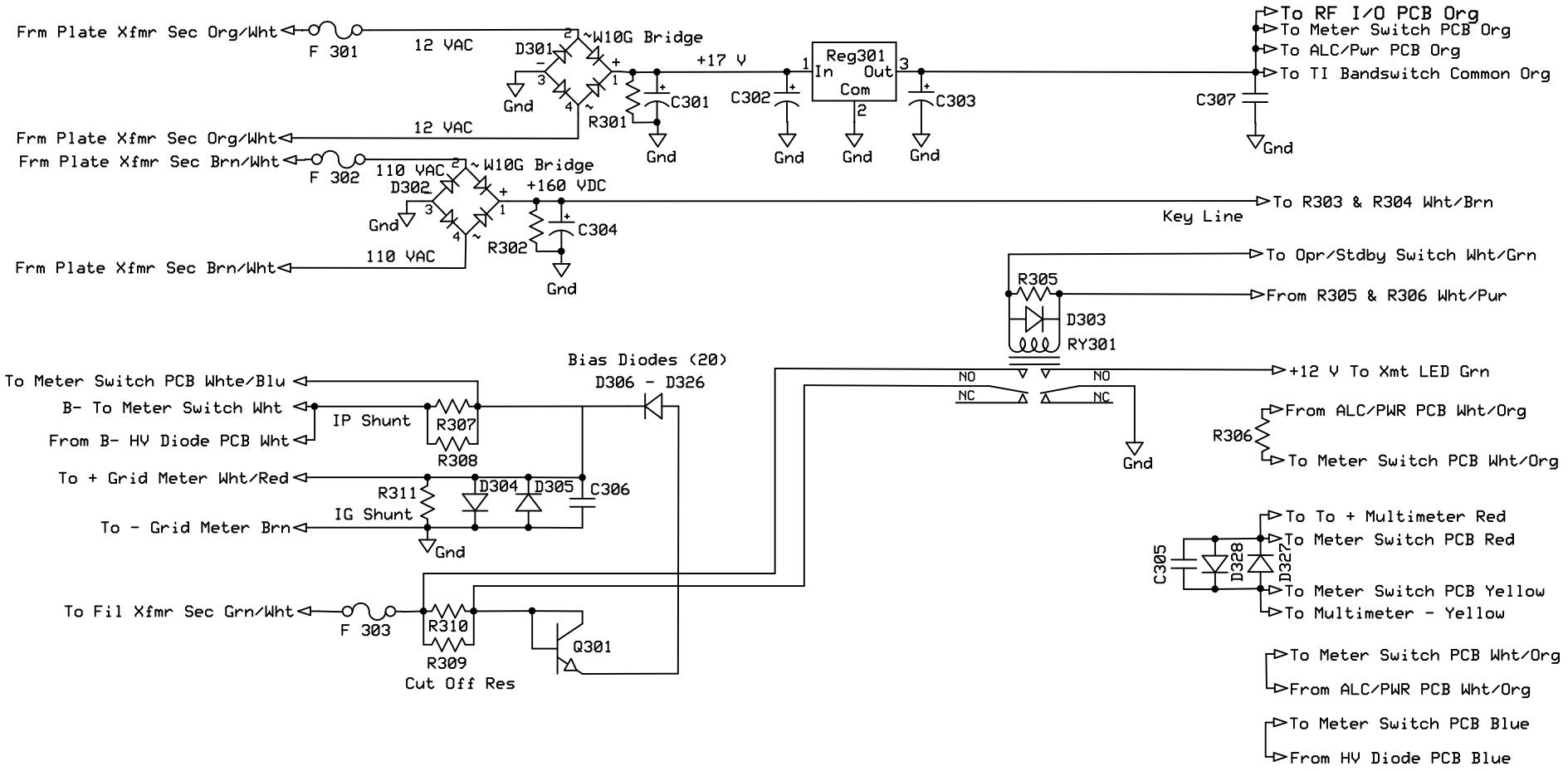
QRO Technologies, Inc.		
High Voltage Capacitor PCB HF-2000		
Ray W. Connin	Rev 2.0 04/22/2011	Part No. 06104


Frm HV Cap PCB Blk 4"
To LV, Bias, & Control PCB Blu 21"
To Plate Choke Red 24"
To LV, Bias, & Cntrl PCB Wht 4"
Frm HV Cap PCB Wht 4"
To T-1 Sec Red/Wht 36"
B+
B+
B-
R209
R208
R207
R206
R205
R201
R202
R203
R204
R210
R211
D212
D211
D205
D204
D203
D202
D201
D210
D209
D208
D207
D206

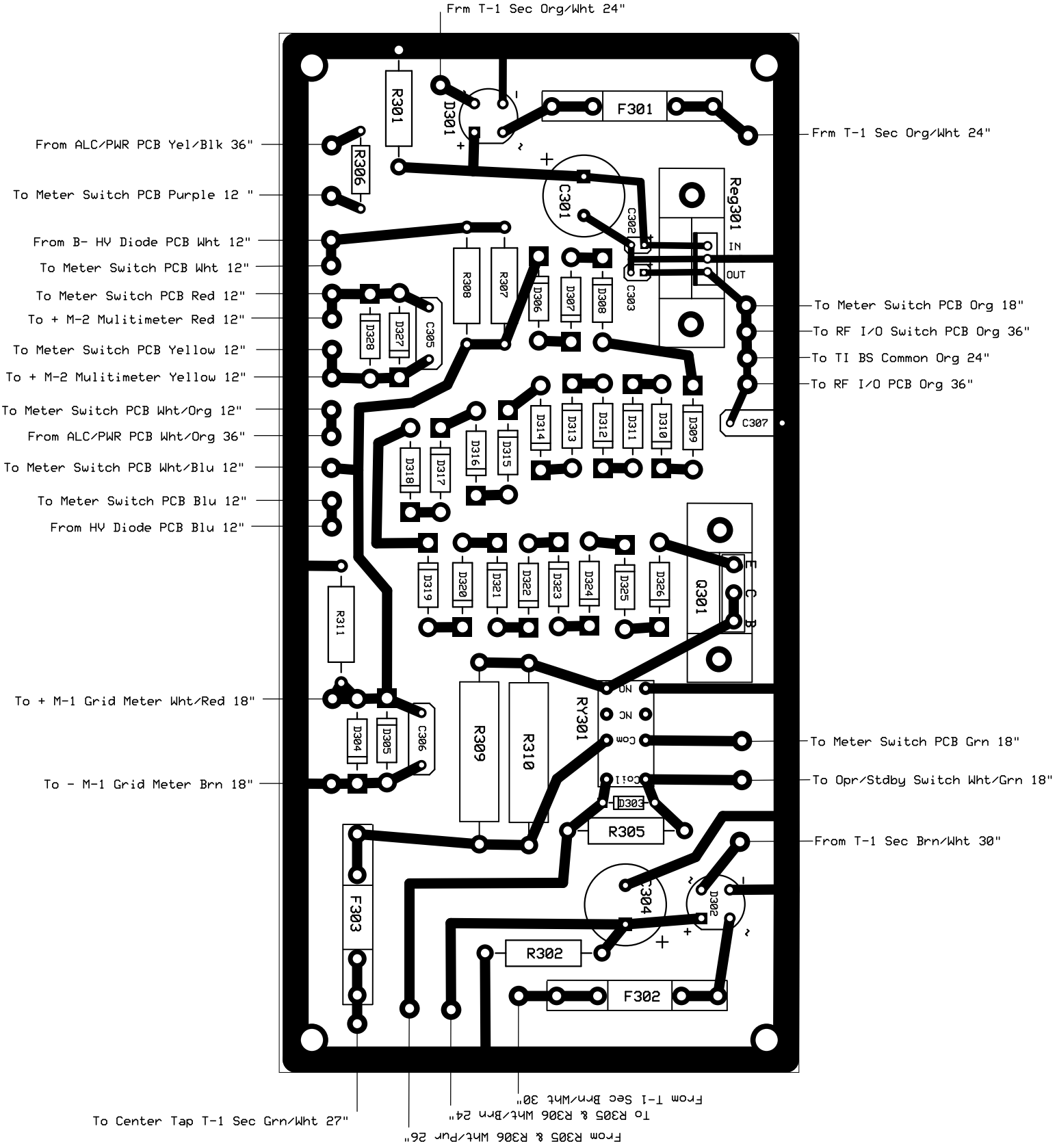

To LV, Bias, & Cntrl PCB Wht 4"
Frm HV Cap PCB Wht 4"
D212
D211
R211
Frm HV Cap PCB Blk 4"
R209
R208
R207
R206
R205
R201
R202
R203
R204
To LV, Bias, & Control PCB Blu 21"
R210
D210
D209
D208
D207
D206
D205
D204
D203
D202
D201
To T-1 Sec Red/Wht 36"
To Plate Choke Red 24"

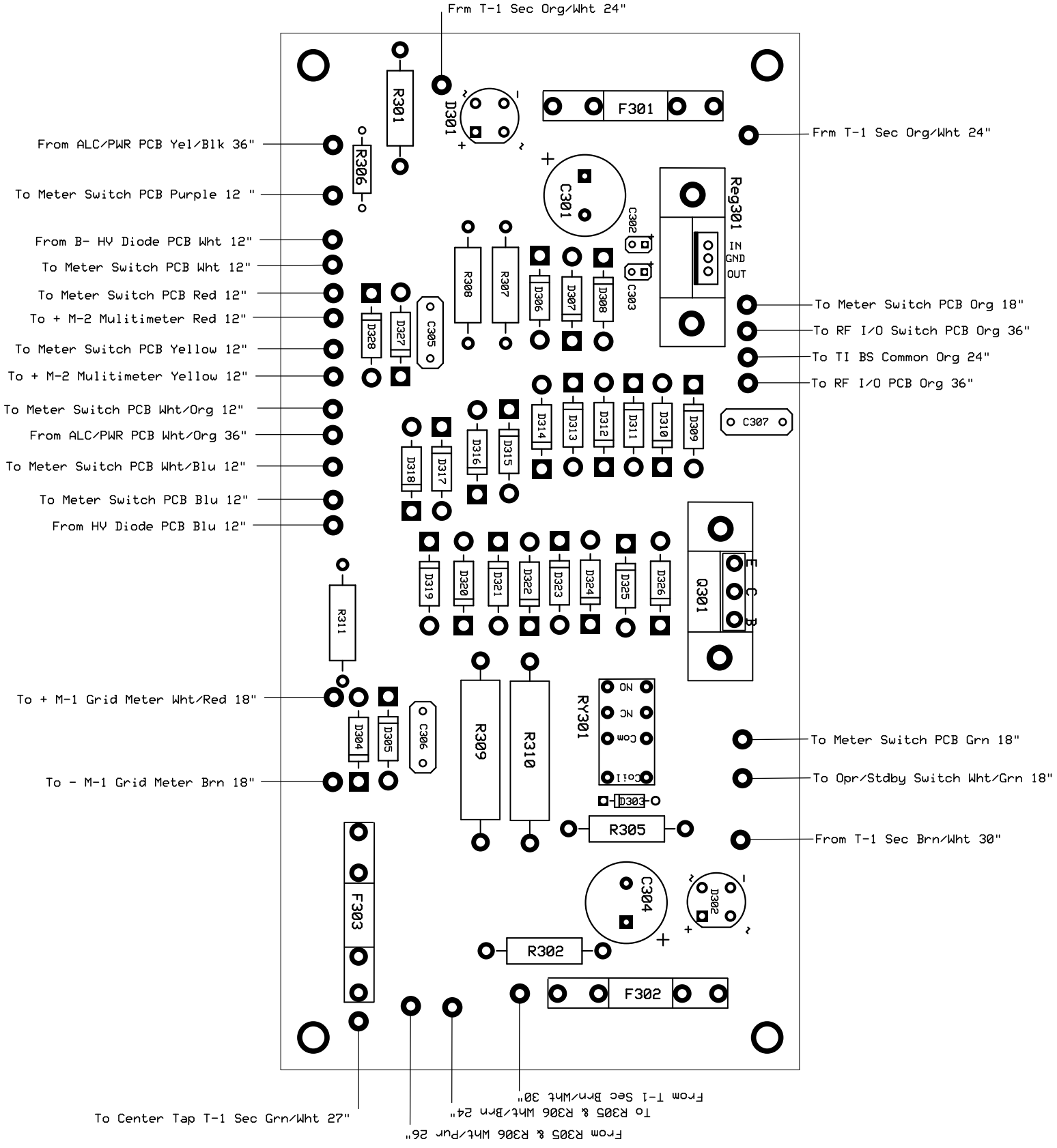


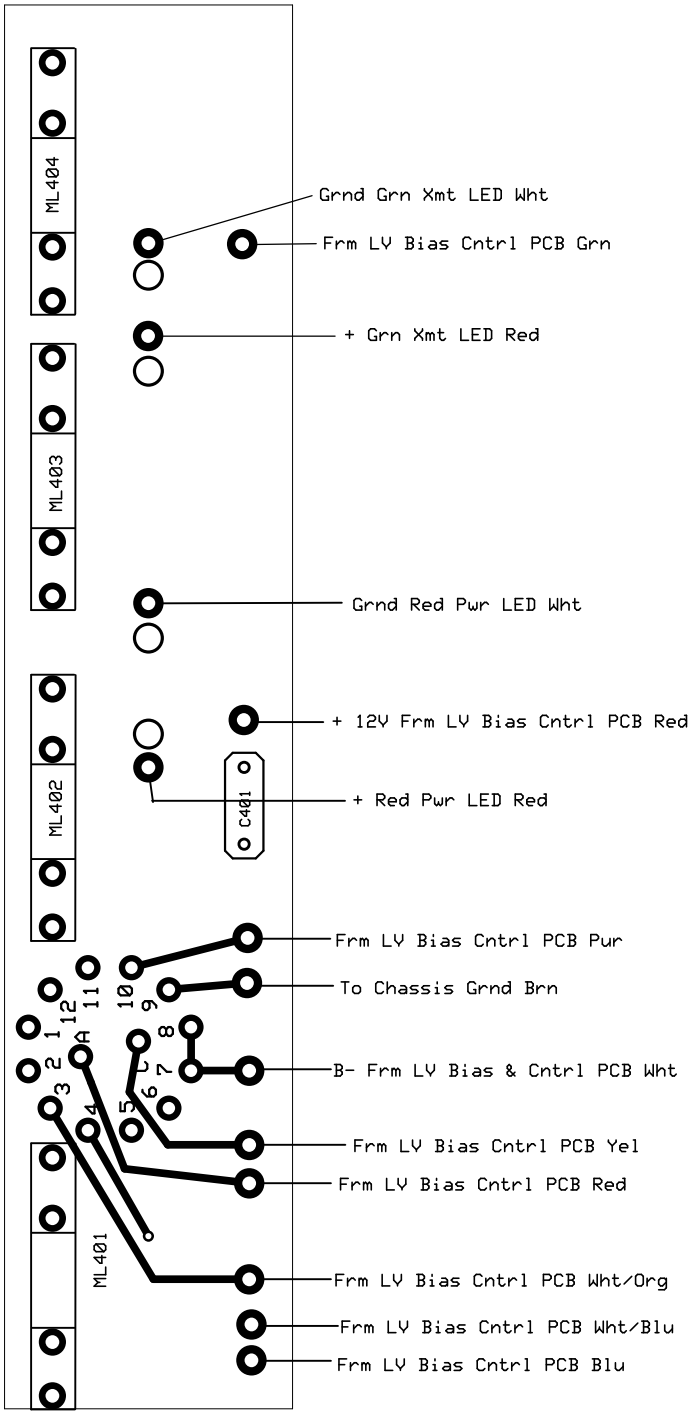
QRO Technologies, Inc.		
High Voltage Diode PCB HF-2000		
Ray W. Connin	Rev 2.0 05/01/2011	Part No. 06105

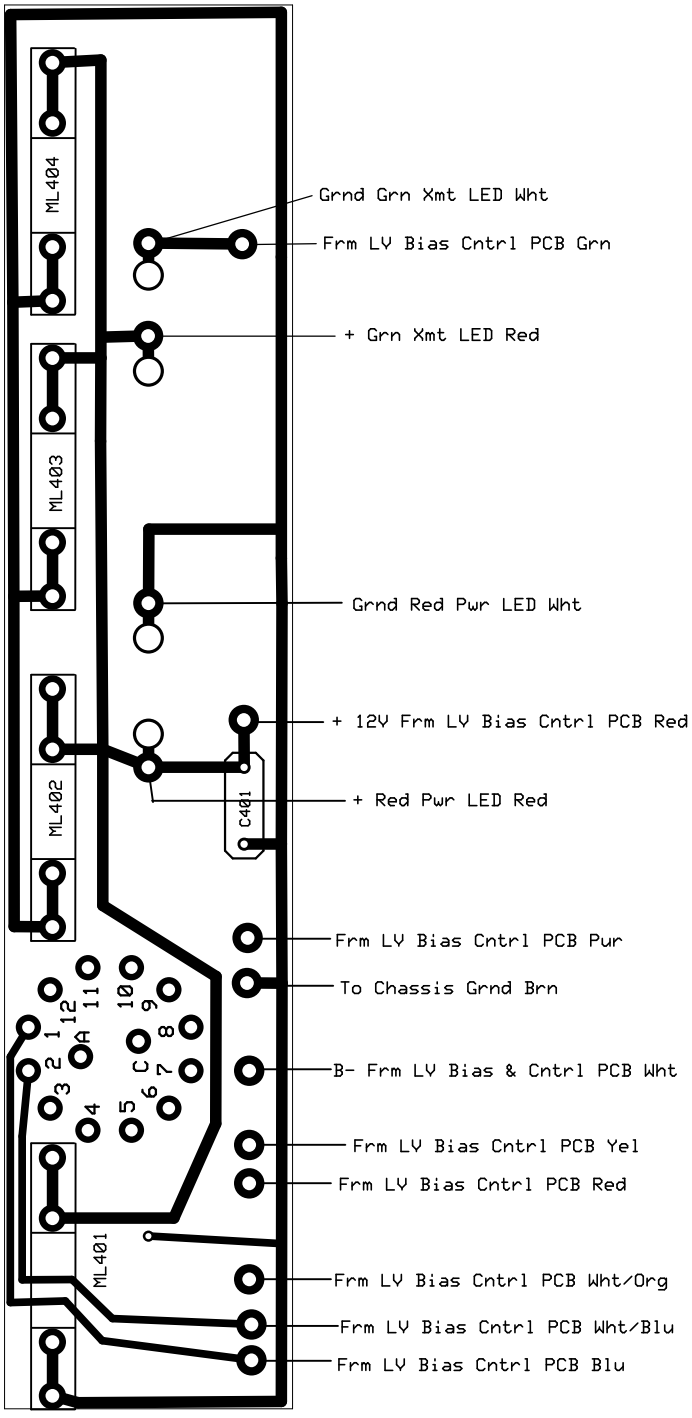


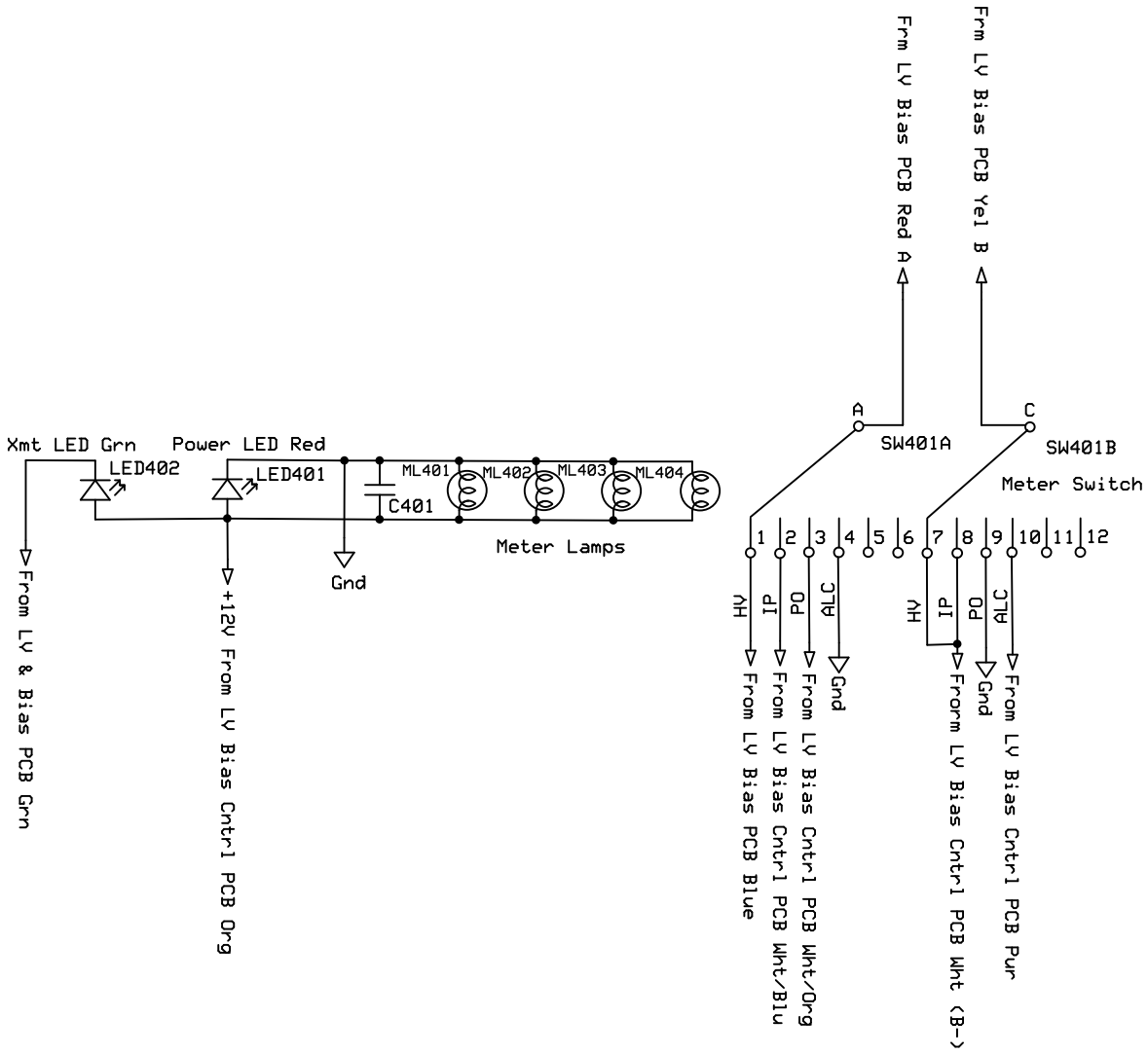
QRO Technologies, Inc.		
Low Voltage, Bias, & Control PCB HF-2000		
Ray W. Connin	Rev 8.0 04/22/2011	Part No. 06106


Frm T-1 Sec Org/Wht 24"
From ALC/PWR PCB Yel/Blk 36"
To Meter Switch PCB Purple 12 "
From B- HV Diode PCB Wht 12"
To Meter Switch PCB Wht 12"
To Meter Switch PCB Red 12"
To + M-2 Mulitimeter Red 12"
To Meter Switch PCB Yellow 12"
To + M-2 Mulitimeter Yellow 12"
To Meter Switch PCB Wht/Org 12"
From ALC/PWR PCB Wht/Org 36"
To Meter Switch PCB Wht/Blu 12"
To Meter Switch PCB Blu 12"
From HV Diode PCB Blu 12"
To + M-1 Grid Meter Wht/Red 18"
To - M-1 Grid Meter Brn 18"
Frm T-1 Sec Org/Wht 24"
To Meter Switch PCB Org 18"
To RF I/O Switch PCB Org 36"
To TI BS Common Org 24"
To RF I/O PCB Org 36"
To Meter Switch PCB Grn 18"
To Opr/Stdby Switch Wht/Grn 18"
From T-1 Sec Brn/Wht 30"
To Center Tap T-1 Sec Grn/Wht 27"
From R305 & R306 Wht/Pur 26"
To R305 & R306 Wht/Brn 24"
From T-1 Sec Brn/Wht 30"
R301
D301
F301
R306
C301
C302
C303
Reg301
IN
OUT
R308
R307
D306
D307
D308
D328
D327
C305
D314
D313
D312
D311
D310
D309
C307
D316
D315
D318
D317
D319
D320
D321
D322
D323
D324
D325
D326
Q301
E
C
B
R311
RY301
NO
NC
Com
Coil
D303
R309
R310
D304
D305
C306
R305
F303
C304
D302
R302
F302

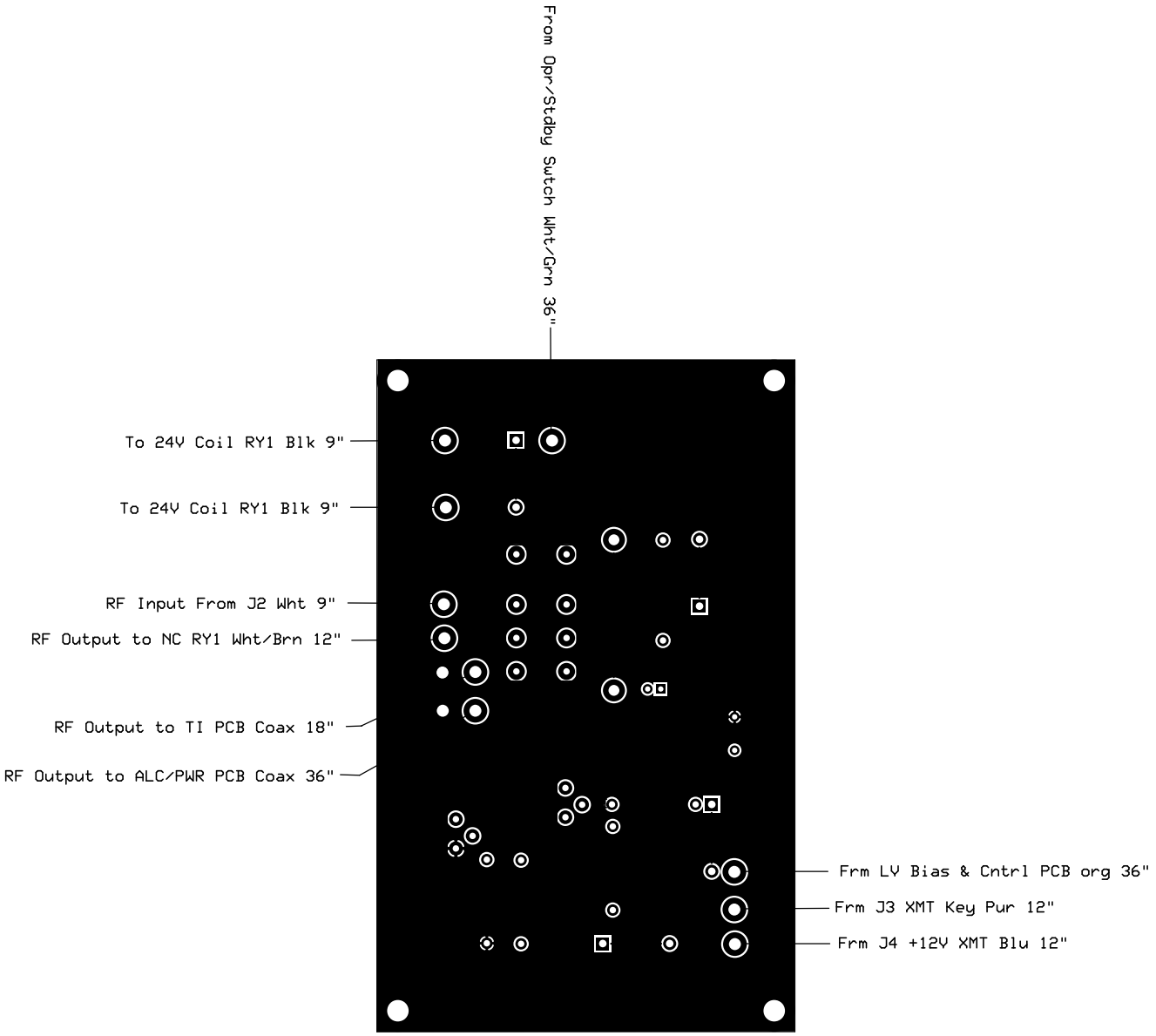

Frm T-1 Sec Org/Wht 24"
From ALC/PWR PCB Yel/Blk 36"
To Meter Switch PCB Purple 12 "
From B- HV Diode PCB Wht 12"
To Meter Switch PCB Wht 12"
To Meter Switch PCB Red 12"
To + M-2 Mulitimeter Red 12"
To Meter Switch PCB Yellow 12"
To + M-2 Mulitimeter Yellow 12"
To Meter Switch PCB Wht/Org 12"
From ALC/PWR PCB Wht/Org 36"
To Meter Switch PCB Wht/Blu 12"
To Meter Switch PCB Blu 12"
From HV Diode PCB Blu 12"
To + M-1 Grid Meter Wht/Red 18"
To - M-1 Grid Meter Brn 18"
To Center Tap T-1 Sec Grn/Wht 27"
From R305 & R306 Wht/Pur 26"
To R305 & R306 Wht/Brn 24"
From T-1 Sec Brn/Wht 30"
Frm T-1 Sec Org/Wht 24"
To Meter Switch PCB Org 18"
To RF I/O Switch PCB Org 36"
To TI BS Common Org 24"
To RF I/O PCB Org 36"
To Meter Switch PCB Grn 18"
To Opr/Stdby Switch Wht/Grn 18"
From T-1 Sec Brn/Wht 30"
R301
D301
F301
R306
C301
C302
C303
Reg301
IN
GND
OUT
R308
R307
D306
D307
D308
D328
D327
C305
D314
D313
D312
D311
D310
D309
C307
D318
D317
D316
D315
D319
D320
D321
D322
D323
D324
D325
D326
Q301
E
C
B
R311
C306
D304
D305
R309
R310
RY301
NO
NC
Com
Coil
D303
R305
C304
D302
R302
F303
F302

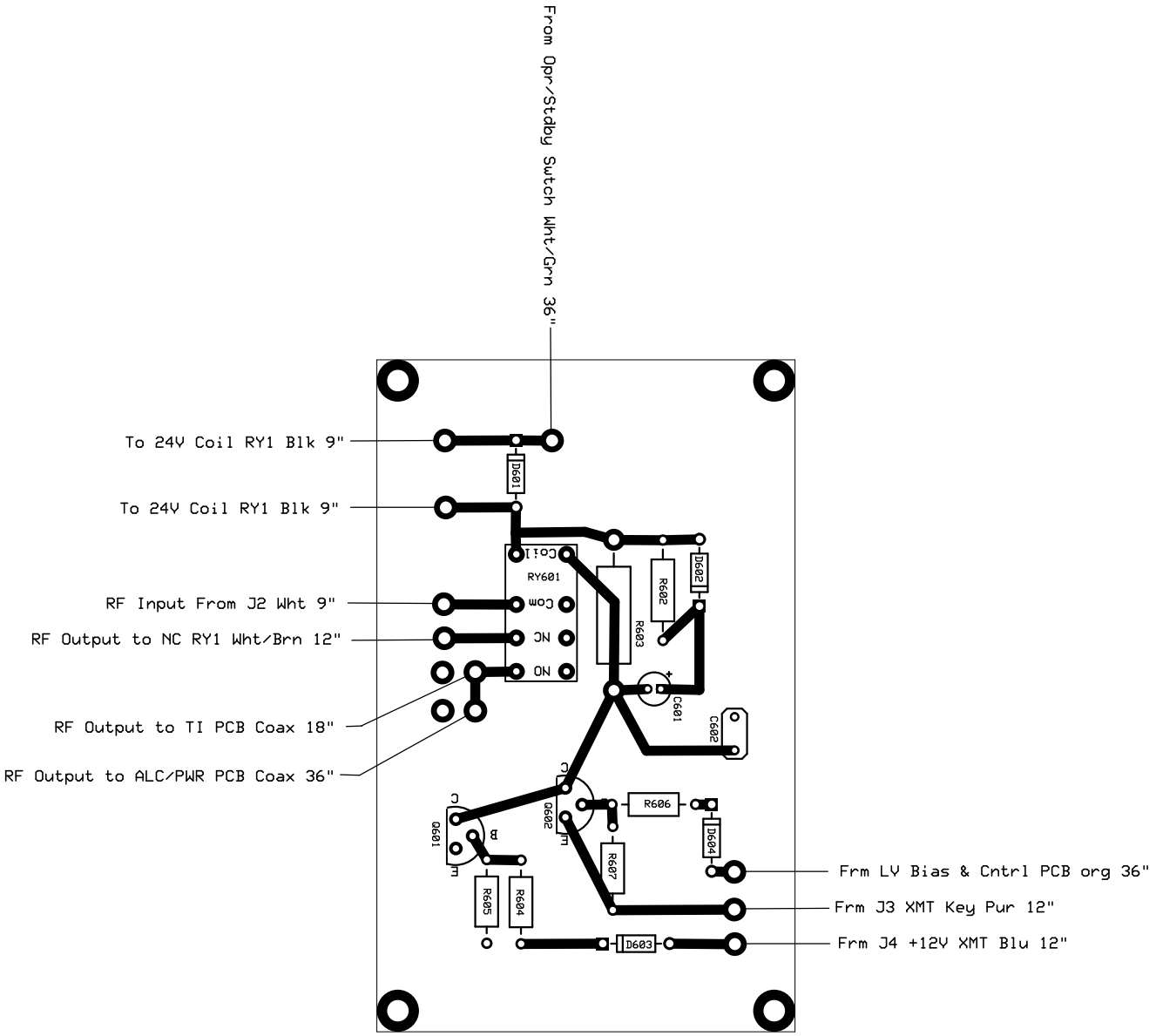

ML404
ML403
ML402
ML401
C401
Grnd Grn Xmt LED Wht
Frm LV Bias Cntrl PCB Grn
+ Grn Xmt LED Red
Grnd Red Pwr LED Wht
+ 12V Frm LV Bias Cntrl PCB Red
+ Red Pwr LED Red
Frm LV Bias Cntrl PCB Pur
To Chassis Grnd Brn
B- Frm LV Bias & Cntrl PCB Wht
Frm LV Bias Cntrl PCB Yel
Frm LV Bias Cntrl PCB Red
Frm LV Bias Cntrl PCB Wht/Org
Frm LV Bias Cntrl PCB Wht/Blu
Frm LV Bias Cntrl PCB Blu

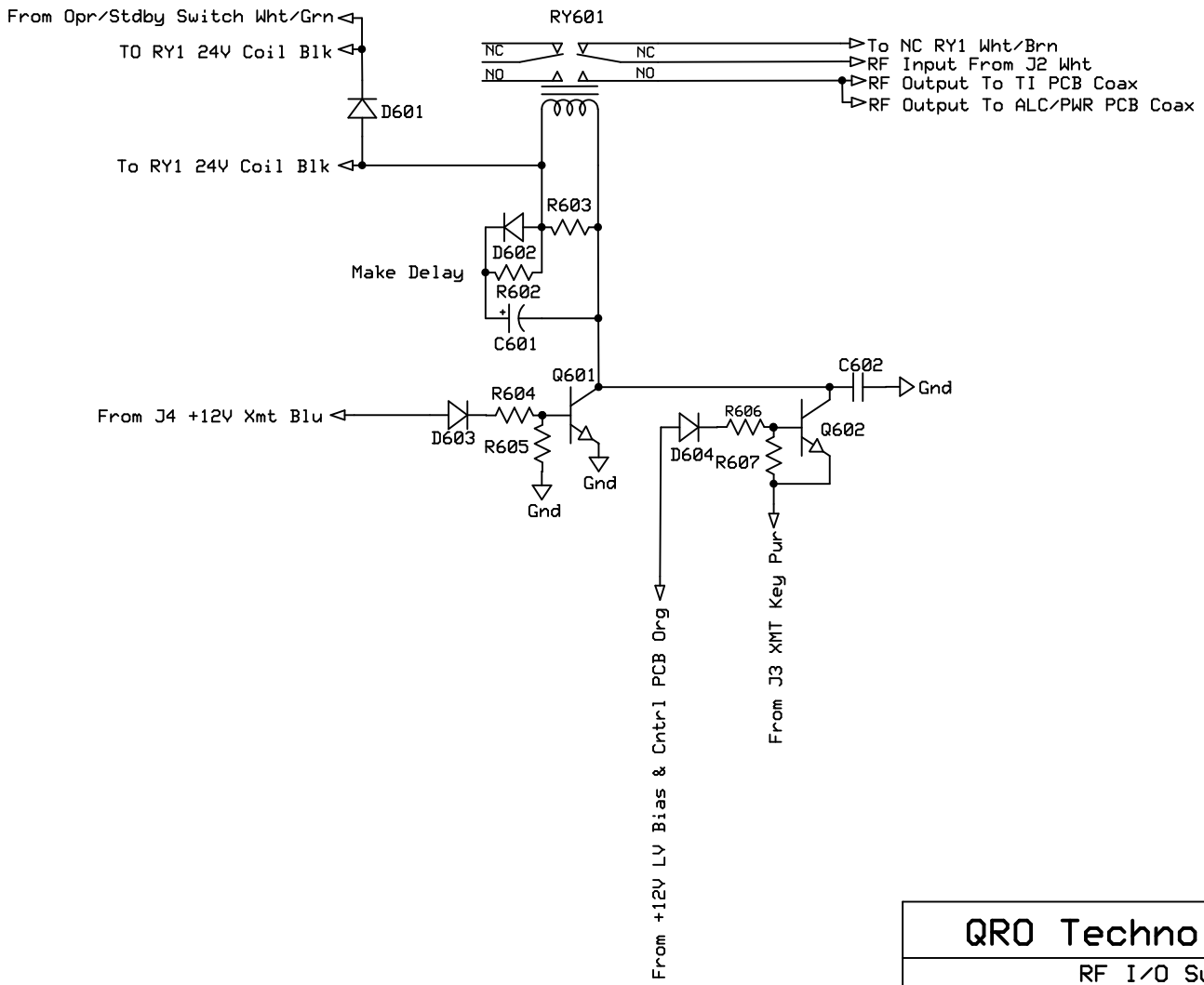

ML404
ML403
ML402
ML401
C401
Grnd Grn Xmt LED Wht
Frm LV Bias Cntrl PCB Grn
+ Grn Xmt LED Red
Grnd Red Pwr LED Wht
+ 12V Frm LV Bias Cntrl PCB Red
+ Red Pwr LED Red
Frm LV Bias Cntrl PCB Pur
To Chassis Grnd Brn
B- Frm LV Bias & Cntrl PCB Wht
Frm LV Bias Cntrl PCB Yel
Frm LV Bias Cntrl PCB Red
Frm LV Bias Cntrl PCB Wht/Org
Frm LV Bias Cntrl PCB Wht/Blu
Frm LV Bias Cntrl PCB Blu



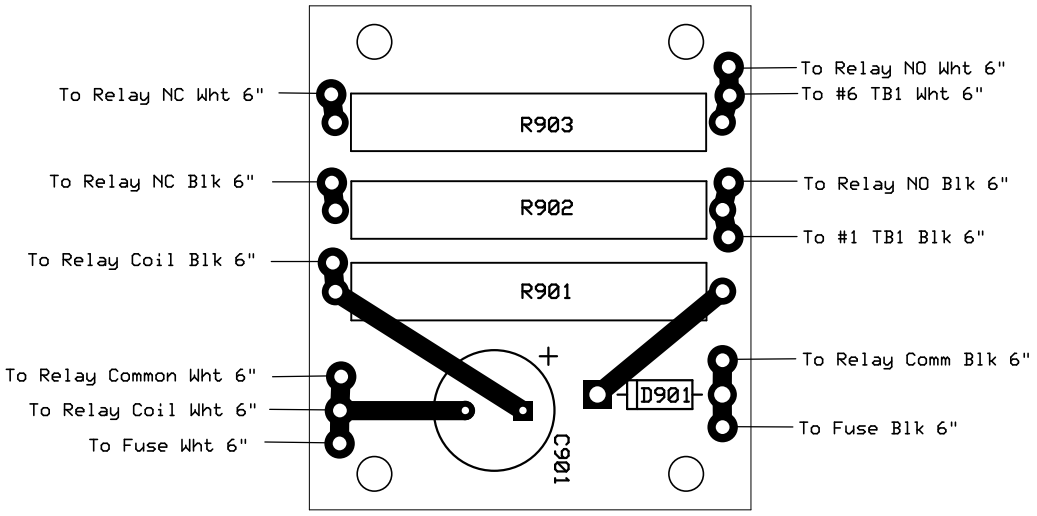
QRO Technologies, Inc.		
Meter Switch PCB HF-2000		
Ray W. Connin	Rev 1.0 04/26/2011	Part No. 06107

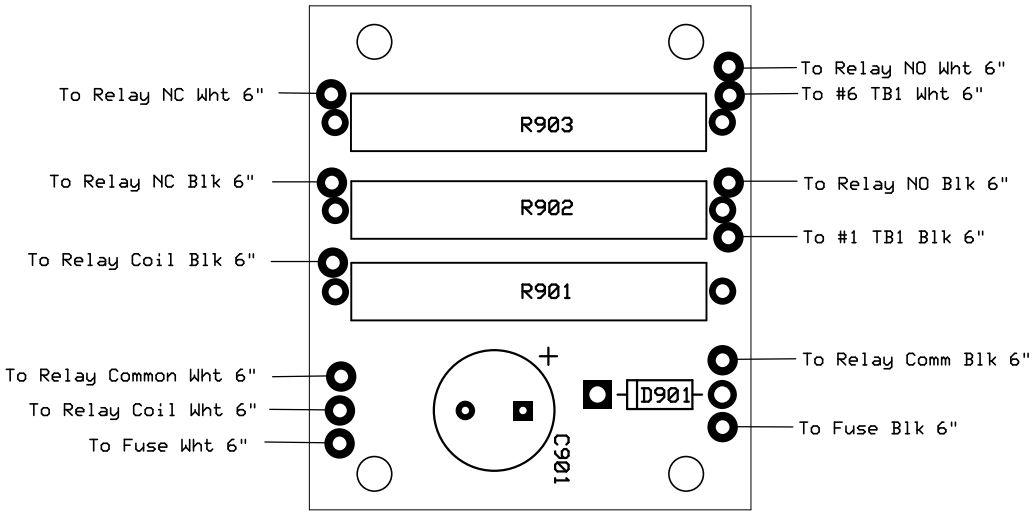

From Opr/Stdby Swtch Wht/Grn 36"
To 24V Coil RY1 Blk 9"
To 24V Coil RY1 Blk 9"
RF Input From J2 Wht 9"
RF Output to NC RY1 Wht/Brn 12"
RF Output to TI PCB Coax 18"
RF Output to ALC/PWR PCB Coax 36"
Frm LV Bias & Cntrl PCB org 36"
Frm J3 XMT Key Pur 12"
Frm J4 +12V XMT Blu 12"

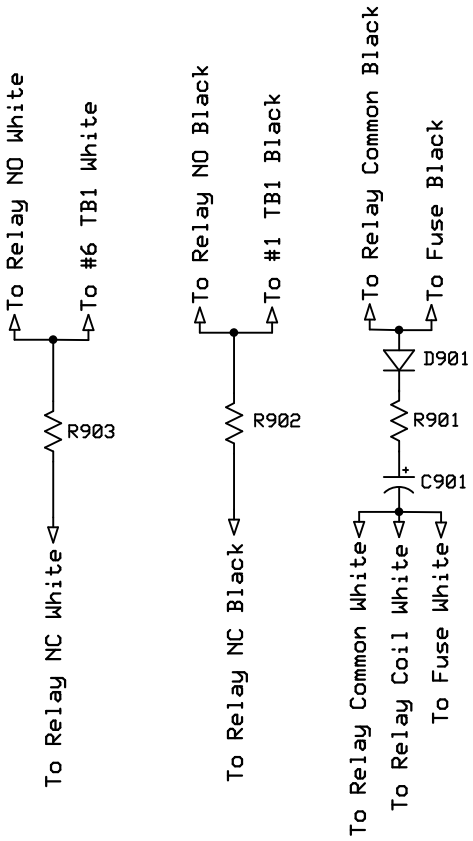

From Opr/Stdby Swtch Wht/Grn 36"
To 24V Coil RY1 Blk 9"
To 24V Coil RY1 Blk 9"
RF Input From J2 Wht 9"
RF Output to NC RY1 Wht/Brn 12"
RF Output to TI PCB Coax 18"
RF Output to ALC/PWR PCB Coax 36"
Frm LV Bias & Cntrl PCB org 36"
Frm J3 XMT Key Pur 12"
Frm J4 +12V XMT Blu 12"
D601
Coil
RY601
Com
NC
NO
R602
D602
R603
C601
C602
Q602
R606
D604
R607
Q601
R605
R604
D603



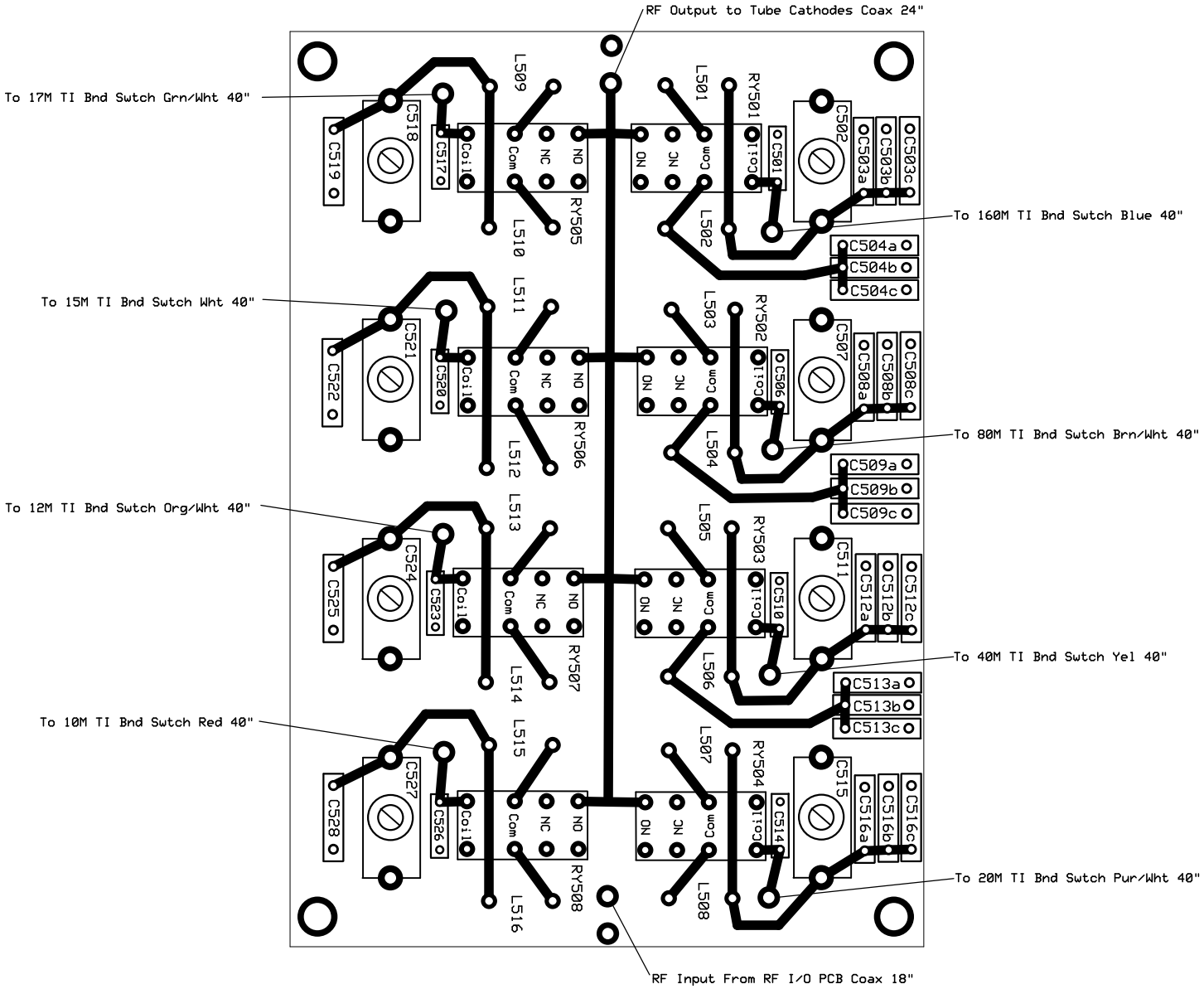
QRO Technologies, Inc.		
RF I/O Switching PCB HF-2000		
Ray W. Connin	Rev 4.0 05/08/2011	Part No. 06102

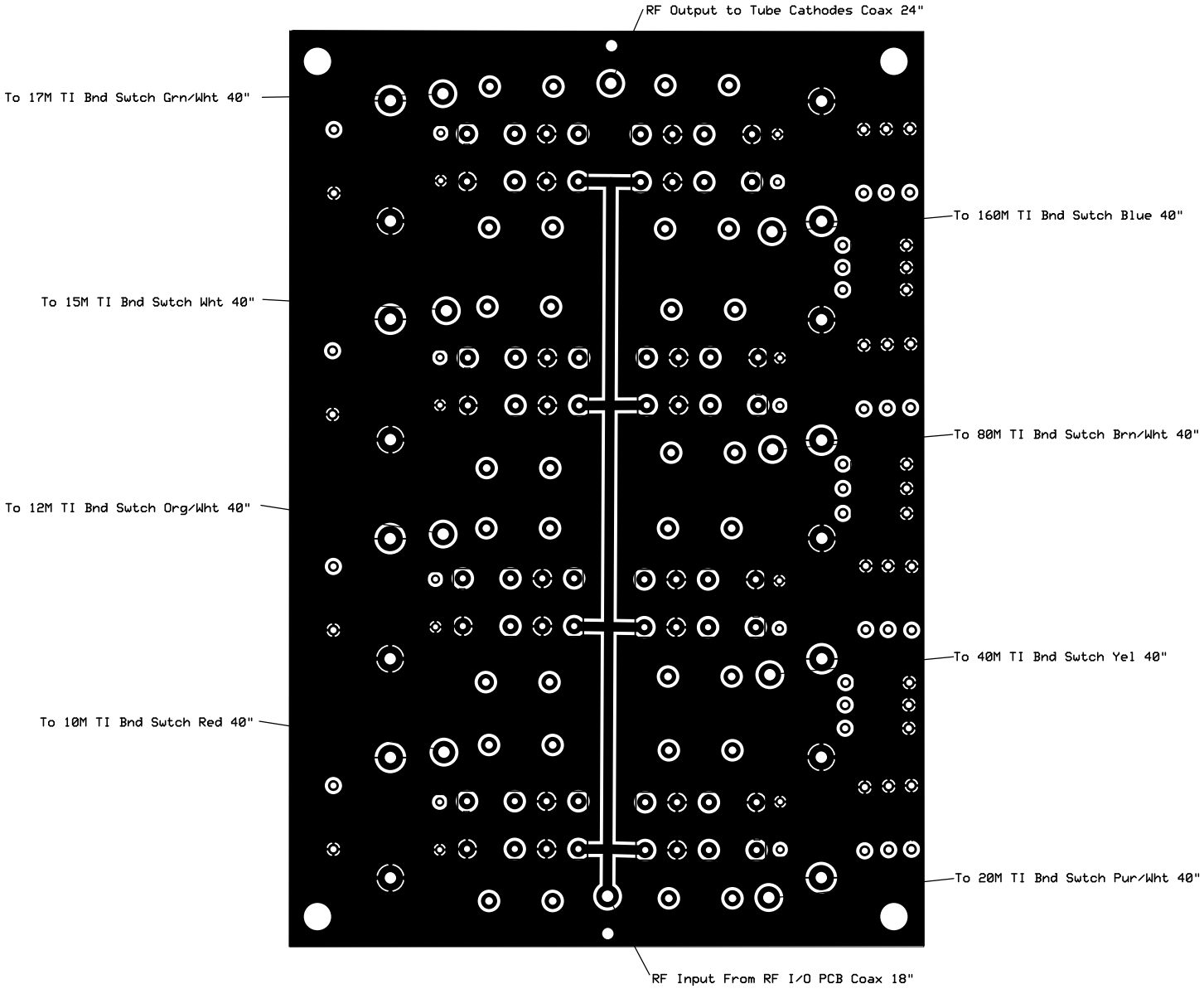

To Relay NC Wht 6"
To Relay NC Blk 6"
To Relay Coil Blk 6"
To Relay Common Wht 6"
To Relay Coil Wht 6"
To Fuse Wht 6"
R903
R902
R901
C901
D901
To Relay NO Wht 6"
To #6 TB1 Wht 6"
To Relay NO Blk 6"
To #1 TB1 Blk 6"
To Relay Comm Blk 6"
To Fuse Blk 6"

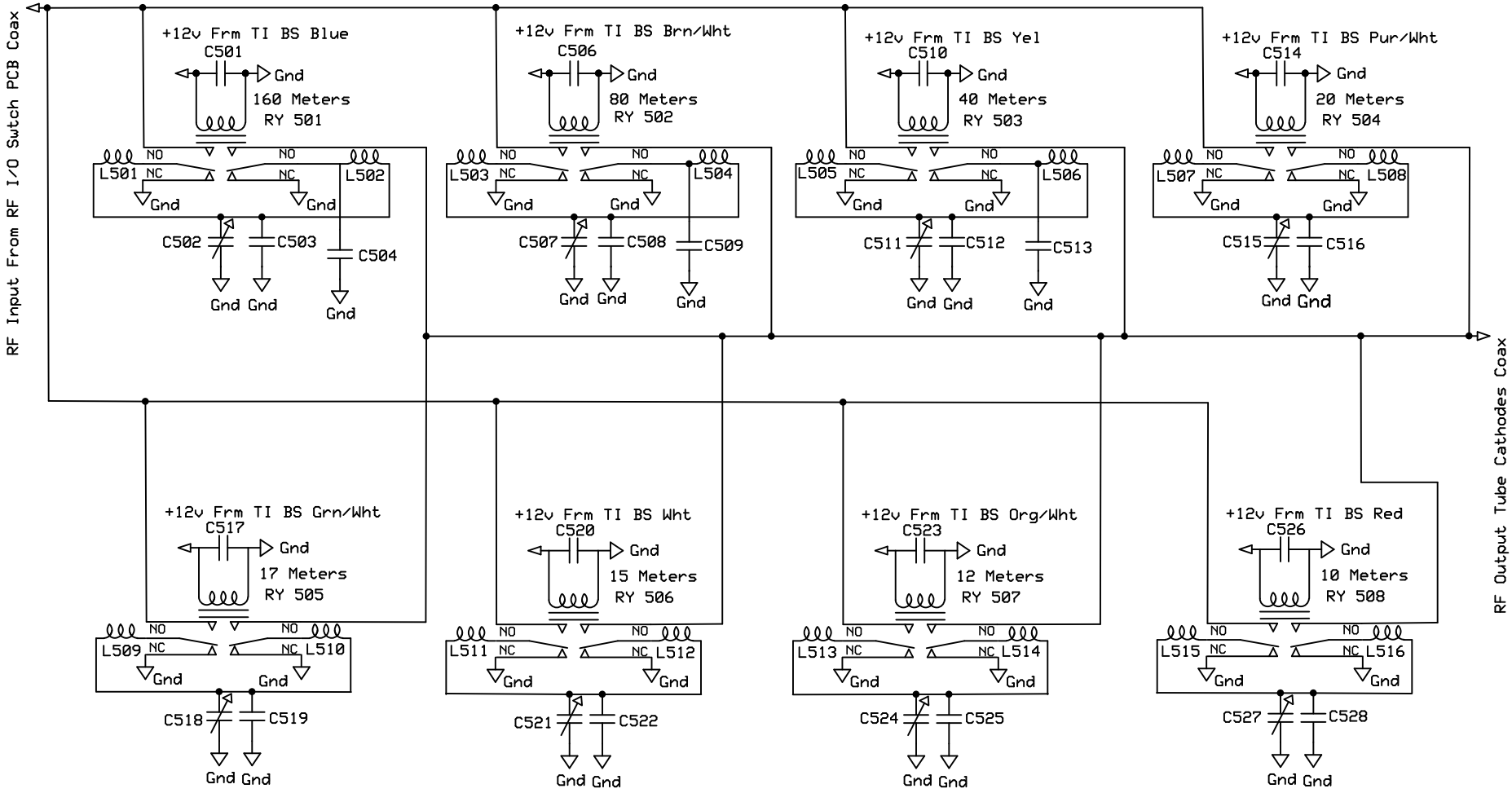

To Relay NC Wht 6"
To Relay NC Blk 6"
To Relay Coil Blk 6"
To Relay Common Wht 6"
To Relay Coil Wht 6"
To Fuse Wht 6"
R903
R902
R901
C901
D901
To Relay NO Wht 6"
To #6 TB1 Wht 6"
To Relay NO Blk 6"
To #1 TB1 Blk 6"
To Relay Comm Blk 6"
To Fuse Blk 6"



QRO Technologies, Inc.		
Step Start PCB HF-2000		
Ray W. Connin	Rev 4.0 05/15/2011	Part No. 06126


RF Output to Tube Cathodes Coax 24"
To 17M TI Bnd Swtch Grn/Wht 40"
To 160M TI Bnd Swtch Blue 40"
To 15M TI Bnd Swtch Wht 40"
To 80M TI Bnd Swtch Brn/Wht 40"
To 12M TI Bnd Swtch Org/Wht 40"
To 40M TI Bnd Swtch Yel 40"
To 10M TI Bnd Swtch Red 40"
To 20M TI Bnd Swtch Pur/Wht 40"
RF Input From RF I/O PCB Coax 18"
L509
L501
RY501
C502
C503a
C503b
C503c
C518
C519
C517
Coil
Com
NC
NO
RY505
L510
ON
NC
Com
C501
L502
C504a
C504b
C504c
L511
L503
RY502
C507
C508a
C508b
C508c
C521
C522
C520
C506
L504
C509a
C509b
C509c
L513
L505
RY503
C511
C512a
C512b
C512c
C524
C525
C523
C510
L506
C513a
C513b
C513c
L515
L507
RY504
C515
C516a
C516b
C516c
C527
C528
C526
C514
L508
L514
RY507
L512
RY506
L516
RY508


RF Output to Tube Cathodes Coax 24"
To 17M TI Bnd Swtch Grn/Wht 40"
To 160M TI Bnd Swtch Blue 40"
To 15M TI Bnd Swtch Wht 40"
To 80M TI Bnd Swtch Brn/Wht 40"
To 12M TI Bnd Swtch Org/Wht 40"
To 40M TI Bnd Swtch Yel 40"
To 10M TI Bnd Swtch Red 40"
To 20M TI Bnd Swtch Pur/Wht 40"
RF Input From RF I/O PCB Coax 18"



QRO Technologies, Inc.		
Tuned Input PCB HF-2000		
Ray W. Connin	Rev 5.0 05/15/2011	Part No. 06103