QRO HF-3KDX LINEAR AMPLIFIER
INSTRUCTION MANUAL

QRO TECHNOLOGIES, INC
1117 West High Street
Bryan, OH 43506 USA
Tel or Text: (419) 551-9354
E-mail: kb8vu@qrotec.com
Internet: http://www.qrotec.com

PUBLICATION DATE: September 2012

SPECIFICATIONS

Band Coverage:	160, 80, 40, 20, 15, and 10 (export only) meter amateur bands. 10 meter also useable in USA with proof of license and user modification.
WARC Band Coverage:	The HF-3KDX has not been designed to operate on the WARC Bands. This occurs because there are not enough bandswitch positions to accommodate these bands. You will get some amplification on 17 & 12 meters using the 15 and 10 meter band positions. However, you will not get amplification on 30 meters.
Drive Power Required:	50 to 80 watts nominal for rated output
Maximum Output Power:	1,500 watts peak all modes including SSB, CW, and continuous carrier or modulated carrier. Carrier operation (RTTY,FM, or SSTV) for more than 30 minutes requires use of auxiliary cooling
Power Gain:	Nominally 14 db
Automatic Limiting Control (ALC):	0 to -20 Volts negative going, adjustable from Front Panel
Harmonic Suppression:	Meets F.C.C. Requirements
Keying:	Requires relay contact closure or sink of 80 ma @ 12 VDC or +15 VDC on transmit supplied by transceiver
Input Impedance:	50 ohms unbalanced, VSWR <1.5:1
Output Impedance:	50 ohms unbalanced with SWR 2:1 or less
Tube Requirement (1):	8877/3CX1500 Triode
Power Line Requirement:	220/240 VAC, 60 Hz at 25 amperes maximum
Front Panel:	Multimeter Plate Voltage & Plate Current Screen 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 Fan High/Fan Low Switch Grid Trip Fault Switch
Rear Panel: **(See Rear Panel Pictorial)**	RF Input (SO-239) RF Output (SO-239) Transmit Keying Line (RCA Phono Socket) +15 V Supplied by Transceiver on Transmit (RCA Phono Socket) ALC Output (RCA Phono Socket) Ground Post Fuses (two 20 ampere for 220/240 VAC)
Dimensions:	19-3/4"W X 16-1/2"D X 9"H
Net Weight:	80 lbs. (Chassis 36 lbs. plus Transformer 44 lbs.)

TABLE OF CONTENTS

Warranty	4
Proprietary Notice	4
Safety Notification	5
Unpacking & Inspection	6
Reshipment Instructions	6
Top Cover Removal	6
Transformer & Tube Installation	6, 7
Introduction	7
Location	7
AC Power Line Considerations	7, 8
Antenna	8
Grounding	8
Equipment Interconnections	9
Safety Interlock Switch	9
Driving Power	9, 10
Tube Precaution	10
Reading the Meters	10
Front Panel Switches & Controls	10, 11
Initial Power Up	11
Tune-Up Procedure	12, 13
Using the ALC Adjust Control	14
Periodic Maintenance	14
Troubleshooting Chart	14, 15
Schematics, PCB Layouts, Parts Lists	16

WARRANTY

The HF-3KDX 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 8877/3CX1500 tube which carries a separate one year warranty issued by the tube manufacturer/distributor.*** 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, printed circuit board layouts, 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.

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, plate 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. ***It is a good idea to keep all the shipping cartons and materials in the event the amplifier needs to be reshipped.***

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.**

TOP & BOTTOM COVER REMOVAL

Remove the Amplifier's top cover by removing the fifteen 6-32 x 3/8 Phillips Head machine screws and their associated flat washers.

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.

As part of the installation process, you must install the tube and transformer.

PLATE TRANSFORMER: Remove the plate transformer from its shipping carton. You will notice two indexed connectors. Position the transformer so the connector with the red leads is on the left and the connector with the black and white leads is on the right side when viewed from the front of the amplifier. Carefully place the plate transformer into the power supply compartment cavity between the blower and the front panel meters. Align the transformer with the chassis mounting holes and secure it to the chassis with four 1/4-20 x 5/8 mounting screws and nuts. Locate the two amplifier's matching index connectors. Connect the two matching connectors. There is only one way the two connectors can go together. When the two connectors are locked together, you should hear a snap sound.

TUBE: The tube socket is located on the left side of the amplifier. The tube socket has seven contacts which match the seven pins on the 8877/3CX1500 Triode. Remove the tube form its shipping carton, and insert the tube into the socket making sure that the pins align with the socket contacts. The tube should seat without too much pressure applied. If you have to use a lot of pressure, you most likely have the wrong pin alignment. If the tube pins and socket contacts are not aligned, the amplifier will not function properly and damage to the tube may result. Once the

tube has been properly seated in its socket, slip the anode connector coming from the plate choke over the tube anode.

REINSTALL TOP & BOTTOM COVER.

Reinstall the top and bottom painted covers. Each cover has slotted holes to help with proper alignment. Use the fifteen 6-32 x 3/8 Phillips Head machine screws and their associated flat washers.

INTRODUCTION

The QRO Model HF-2500DX Linear Amplifier is a completely self-contained, grounded grid linear amplifier. It is designed to at 1,500 watts peak all modes including SSB, CW, and continuous or modulated carrier (e.g., RTTY, FM, SSTV). ***Continuous or modulated carrier operation for more than 30 minutes at or near maximum rated output power requires use of auxiliary cooling.*** The HF-3KDX is designed to be used with any transceiver which can deliver adjustable output power from 0 to 100 watts. A tuned input circuit feeds the tube which is 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 overdriven. 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

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 fuses should be the ceramic cartridge slo-blow type. The rating should be 20 - 25 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 configuration: 200/240 VAC 20 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 20 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. **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. 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.

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 and RG59/U are not recommended.

The "A.R.R.L. Antenna Book" is readily available and 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 owner's 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 T/R relay socket 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 +15 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

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 Multimeter 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 60 – 100 watts of RF output. 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 ceases to increase. If you turn the control past this point, nonlinear operation may occur.

TUBE PRECAUTION

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 directly below the two panel meters 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.

Table A

Multi-meter Switch Position	Measures	Scale Indication
Plate Voltage (PV)	Plate Voltage	Bottom scale indicates 0 to 7.0 KV (normal operating range is 3.0 – 4.0 KV volts) Each division represents .2 KV (200 volts).
Plate Current (PC)	Plate Current	Top meter scale indicates 0 to 1.4 amperes. Each division represents .4 amperes (400 milliamperes).

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

FRONT PANEL SWITCHES & CONTROLS

On/Off Switch: Rocker type switch which turn the amplifier on or off

Operate/Standby Switch: Rocker type switch used to place the amplifier in a transmit mode

Fan High/Low Switch: Rocker type switch which control blower speed

ALC Control: Varies the negative feedback voltage to your transceiver. A clockwise rotation increases this voltage which reduces the drive power delivered to the amplifier from the transceiver. The ALC line between the transceiver and the amplifier must be properly connected for this feature to operate.

Fault Light/Switch: If you amplifier is operated in such a manner to produce excessive grid current, a protection circuit will place the amplifier in a standby mode. A red light will light in the fault switch. The amplifier can be reset into a transmit mode by pushing the red switch. A successful reset will be indicated when the fault light turns off.

Tune Control: A 6-1 vernier drive control used to adjust the input capacitor of the pi output tank circuit during tune up. 0 - 100 logging scales provide a means to record your tune up settings for future reference.

Load Control: A 6-1 vernier drive control used to adjust the output capacitor of the pi output tank circuit during tune up. 0 - 100 logging scales provide a means to record your tune up settings for future reference.

Band Selector Switch: Selects the desired band of operation

Red LED: When lit, the amplifier has been turned on, and it has gone through its warm up cycle.

Green LED: When lit, the amplifier has been keyed and amplifying the power supplied by the transceiver.

INITIAL POWER UP

Preset the amplifier's front panel controls as follows:

On/Off	Off
Operate/Standby	Standby
Multi-meter	PV (Plate Voltage)
Fan	Fan High
ALC Adjust	Full counter clockwise
Tune Control	Zero
Load Control	Zero
Band	Desired Band

Turn the amplifier on by placing the On/Off switch in the on position. The meter lights and blower should immediately come on. The amplifier is now in its three minute warm up cycle. During this warm--up period, check for the following readings:

Grid Current:	Zero
PV (Plate Voltage):	4.0 KV
PC (Plate Current):	Zero

OBSERVE THE PLATE CURRENT (IP) DURING THE WARM-UP PERIOD. IF IT STARTS TO RISE, IMMEDIATELY TURN THE AMPLIFIER OFF. THE PLATE CURRENT SHOLD NOT RISE DURING THE WARM-UP PERIOD. CALL QRO TECHNOLOGIES FOR INSTRUCTIONS.

Place your transceiver in the CW mode or any mode that will provide a continuous carrier for tune-up. **At this time make sure that your transceivers output power level has been set to zero.**

TUNE UP PROCEDURE

Before making any tune up procedures, make sure your amplifier is connected to an appropriate load capable of handing at least 1,500 watts of power. Failure to do so may result is serious damage to your amplifier.

When the three minute warm-up cycle has been completed, the red power light will turn on. The amplifier is now ready for tune up. At this point, place your transceiver in the SSB mode with the microphone gain at zero. Put the amplifier's Operate/Standby switch in the operate position. Key your transceiver and you should notice the green transmit LED on the amplifier lite. You should also hear the amplifier's internal relays latch. With the transceiver keyed and the amplifier's Multi-meter switch in the PC position, observe the plate current (PC). ***It should be in the neighborhood of .200 amperes more or less***. Un-key your transceiver, and place the amplifier in the standby mode.

TUNEUP OBJECTIVE: The objective of the tune-up procedure is to bring the amplifier to resonance by adjusting the tune & load controls desired maximum output power.

1. Place your transceiver in CW mode, and set its output power level to 60 watts.

2. Select your desired band using the amplifier’s bandswitch.

3. Put the Multi-meter switch in the PC position.

4. Place the amplifier in the operate position.

5. Set the Tune Control to 0.

6. Set the Load Control to 50 for 160 thru 40 meters. Set the Load Control to 30 for 20 thru 10 meters.

7. Key your transceiver and advance the Tune Control clockwise looking for a dip in the plate current. Note: If the amplifier faults rotate the load control counterclockwise, and reset the Fault Switch. If the amplifier still faults, turn to load control counterclockwise some more.

8. Continue advancing the Tune Control clockwise until the dip in plate current reverses and starts to rise.

9. Adjust the Loading Control for maximum output power.

10. Redip the plate current using the Tune Control and readjust for maximum power using the Load Control. Repeat this step as needed.

The amplifier should now be tuned for maximum output power with 60 watts of input power. If you desire lower or higher output power decrease or increase input power and retune for maximum desired output power.

LOADING AMPLIFIER HEAVY: One technique for operating an amplifier at various output power levels is to load it “heavy”. This procedure requires you to tune the amplifier for the maximum output power you desire. Then, simply reduce your input drive power to the desired output power level. If you wish to change your output power, simply increase or decrease your input drive power to the new level of output power desired.

To facilitate your initial tune up, we have included a tune up chart. These settings and readings are into a 50 ohm dummy load. Your actual reading may vary do to any reactance in your antenna. Record your settings for future reference. You can control the power level of your voice peaks on SSB by advancing the ALC Control clockwise assuming you have the ALC line connected between your transceiver and amplifier.

TUNE-UP TABLE

Frequency (MHZ)	Power Input	Tune	Load	Grid Current	(PC) Plate Current	Power Output
1.80						
1.90						
3.60						
3.90						
7.20						
14.20						
21.30						
28.50						

WARC BAND OPERATION: The HF-3KDX has not been designed to operate on the WARC Bands. This occurs because there are not enough bandswitch positions to accommodate these bands. You can get some amplification on 17 & 12 meters. You will have to use your transceiver’s internal antenna tuner .This will get you a proper input match to the amplifier. Also, you will have to set the bandswitch to 15 meters for 17 meter operation or set the bandswitch to 10 meters for 12 meter operation. However, you will not get amplification on 30 meters.

A Word About Wattmeters: The most reliable and accurate Wattmeters are either the Bird or Coaxial Dynamics thru feed. Wattmeters which use a ferrite core for r.f. sampling can be unreliable at high power levels. If you are using such a wattmeter and you observe an output level less than 1,500 watts for the values listed above, your wattmeter is probably not giving you an accurate reading.

Input SWR: The input SWR has been set for at least 1.5:1 on each band. You can make slight adjustments using the tuned input access holes to adjust the mica trimmer capacitors for each band.

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.**

PERIODIC MAINTENANCE

Before you do any maintenance, make sure the amplifier has been disconnected for the A.C. 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 any dust accumulation on the blades of the blower. Any large accumulation of dust on the blades will impede proper cooling air to the tube.

TROUBLESHOOTING CHART

The following charts lists specific difficulties that could occur in your Linear Amplifier. Several possible causes may be listed for each difficulty. Refer to the Printed Circuit Board diagrams (PCB) and the Schematic Diagrams to locate and identify the parts listed in this chart. If a particular part is mentioned as a possible cause, check that part and other components connected to it to see if they are defective. **AS ALWAYS, BE SURE THE AMPLIFIER POWER CORD HAS BEEN REMOVED FROM THE AC LINE RECEPTACLE AND THE HIGH VOLTAGE FILTER CAPACITORS HAVE BLED DOWN TO ZERO VOLTS BEFORE REMOVING THE TOP COVER FOR YOUR INSPECTION.**

DIFFICULTY	POSSIBLE CAUSE
No AC power	1. Fuse F1 or F2 rear panel 2. Jumpers missing on Terminal Block TB1 3. Transformer T1 4. On/Off Switch SW2A or SW2B 5. Interlock Safety Switch SW1 6. Solid State Relays SR1 or SR2 or related circuitry
Multi-meter inoperative in High Voltage Function	1. Resistors R101 – R 109 High Voltage Diode PCB 2. Multi-meter Switch SW1 Meter Switch PCB 3. M-1 Multi-meter 4. Transformer T-1 Secondary

	5. Component failure on HV Diode or HV Capacitor PCB
Multi-meter inoperative in Plate Current Function	1. Resistors R310 & R311 LV & Bias PCB 2. Switch SW1 Meter Switch PCB 3. M-1 Multi-meter 4. F305 1-1/2 Ampere Fuse
Plate idle current over 200 mA	1. Components on LV & Bias PCB a. Zener Diodes ZD301 b. Relay K4
Plate Current does not read zero in standby mode	1. Components on LV & Bias PCB a. Q303 Transistor b. Diodes D309 – D324 c. Relay RY304 d. Resistors R308 & R309
No Plate idle current	1. Components on LV & Bias PCB a. Fuse 305 1-1/2 Ampere b. Diodes D309 – D324 c. Relay RY304 d. Resistors R308 & R309
Meter Lamps do not light	1. Components on LV & Bias PCB a. Fuse F301, F302 b. Bridge Rectifier D301 c. Reg 301 2. Meter Lamps PL1 - PL4 Meter Switch
Amplifier will not key when transceiver is keyed to transmit	1. Components on LV & Bias PCB a. Fuse F301, F304 b. Bridge Rectifier D303 2. Operate Standby SW5 Front Panel
ALC Inoperative	1. Improper connection between transceiver and amplifier 2. POT R13 (ALC Adjust) on front panel
No RF Output	1. Improper connections between transceiver, amplifier, and antenna 2.Transceiver and amplifier are set to different bands
Grid Trip Circuit Inoperative	1. Defective Trip Reset Switch SW6 2. Components on LV & Bias PCB
Red Power LED not functioning	1. +12 VDC supply located on LV & Bias PCB 2. LED defective
Three minute warm-up cycle not functioning	Components on LV & Bias PCB 1. U701 555 Timer and related components 2. Transistor Q301

240 VAC Wiring

Plug: BLK, GRN, WHT

F1 20 Amp — SW1 Interlock — SR1 Solid State Relay (SW2A) — J-1 — TB1

F2 20 Amp — SR2 Solid State Relay (SW2B) — J-1 — TB1

C10 .01uf, C11 .01uf

SW4: Blu, Yel

R307A 100 Ohm 50W Chassis Mount — R307B 100 Ohm 50W Chassis Mount: Blk

B-1 Blower: C64, C65

TB2: Black

T1 Plate Xfmr

Conn 1 Primary: 1 0 V Blk; 2 100 V Blk; 3 120 V Blk; 4 0 V Wht; 5 100 V Wht; 6 120 V Wht

Conn 2 Secondary: Red 7; Red 8

3.0 KV @ 1.4 Amp ICAS

Red/White

T-2 FILAMENT XFMR

Sec 5 V @ 10 A

1 0 V BLK — GRN 3; GRN/YEL 4 Green/White; GRN 5 — 2 115 V BLK

High Voltage Capacitor PCB

R101 R102 R103 R104 R105

C101 C102 C103 C104 C105

C110 C109 C108 C107 C106

R110 R109 R108 R107 R106

To B+ HV Diode PCB Blk

B+ To HV Diode PCB Wht

High Voltage Diode PCB

R109

R110

To B+ HV Caps PCB Black

B+ To HV Caps PCB White

B+ To HV Bias PCB White & Meter Switch PCB

B+ To Plate Choke Red

LV Bias & Control PCB

T 301

T 302

Black; Green/White; White

Wht/Org; Org; Red; Org/Wht; Grn; Pur/Wht; Wht/Grn; Brn; Brn/Wht

Meter Switch PCB

PWR LED; XMT LED

White; Brown; White/Blue; Yellow/Black; Wht/Org; Grn; Red; Wht/Grn; Org; Org/Wht

Tuned Input, RF Switching, ALC PCB

L1 160 M — L2 — 20 M, 15 M, 10 M, 40 M, 80 M

SW3C: 160 M Load Pad, Common Load Cap

SW3B: 160 Tune Pad, 80 Tune Pad, Common Tune Cap

SW3A: 20 M, 15 M, 10 M, 40 M, 80 M, 160 M

C50 Load — C51 Tune — C52 — C54 2500pf — C55 2500pf — C56 .001uf 15KV — C57 .01uf — C58 .01uf — C70

RFC1

L3 4-1 XFMR

V1 8877/3CX1500

J6 RF Input

Yel; Blu/Wht; Wht/Red; Wht; Pur/Wht; Common Org/Wht; Wht/Brn; Blk; Blk; Wht/Blu; Pur; Blu; Org; Org/Wht; Org/Wht; Wht/Grn; Wht/Gry; Red; Green; Green; White; Yellow/Black; Red/White; Red/White; Red; Red; Red/White; Red/White; Wht/Grn; Org; Org/Wht; Wht/Grn; Org; Org/Wht

RY1 Vacuum Output Relay

J1 R.F. Output

J2 R.F. Input

C71

J3 Key Xmt

C61

J4 +15V XMT

C62

R13 ALC POT

J5 ALC Output

C63

SW5 Opr/Stdby

Wht/Red; Red; Red; Yel; Wht/Red; Brn; Wht/Org; Pur/Wht; Brn/Wht; Brn

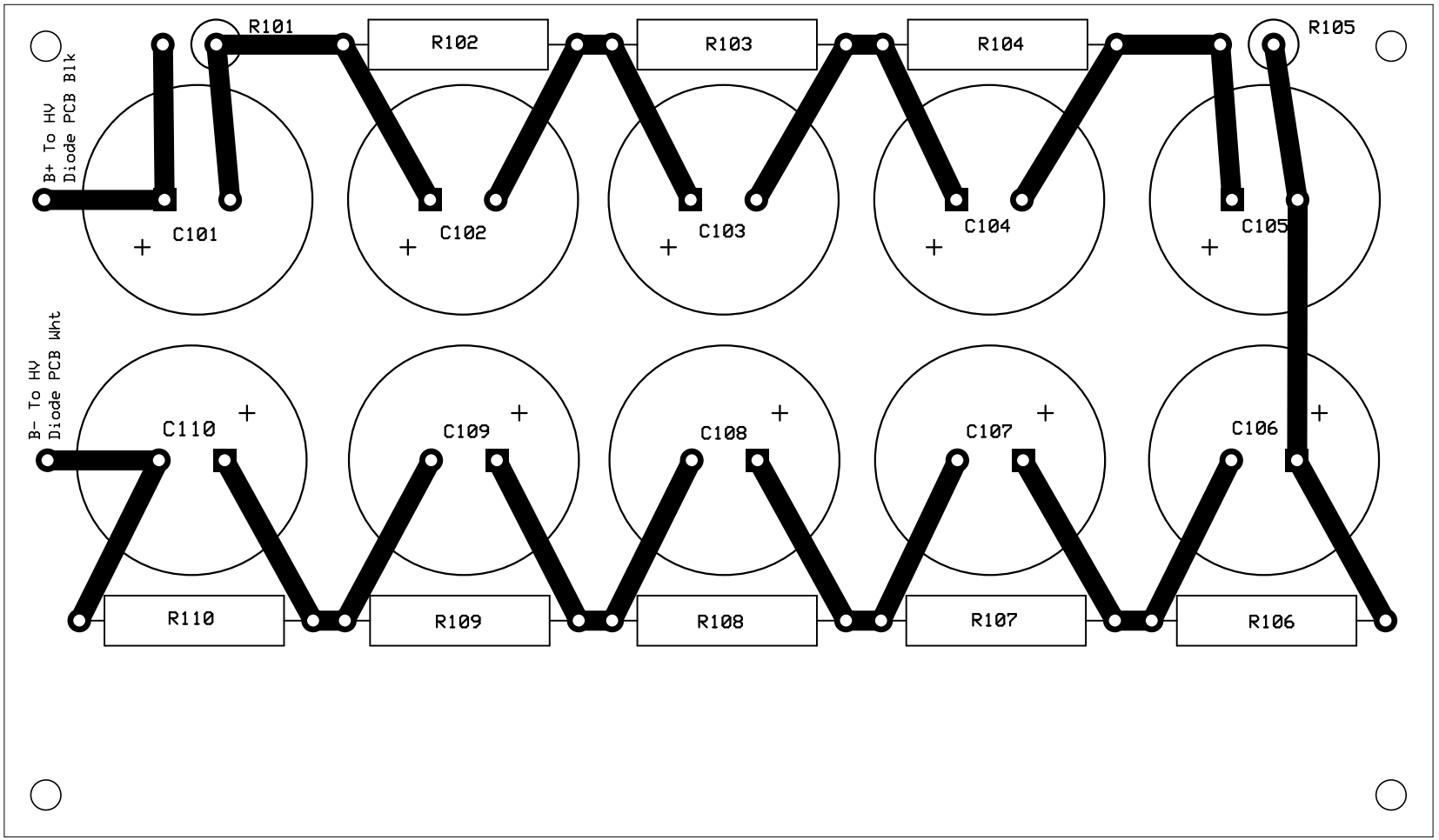
M-1 PV & PC

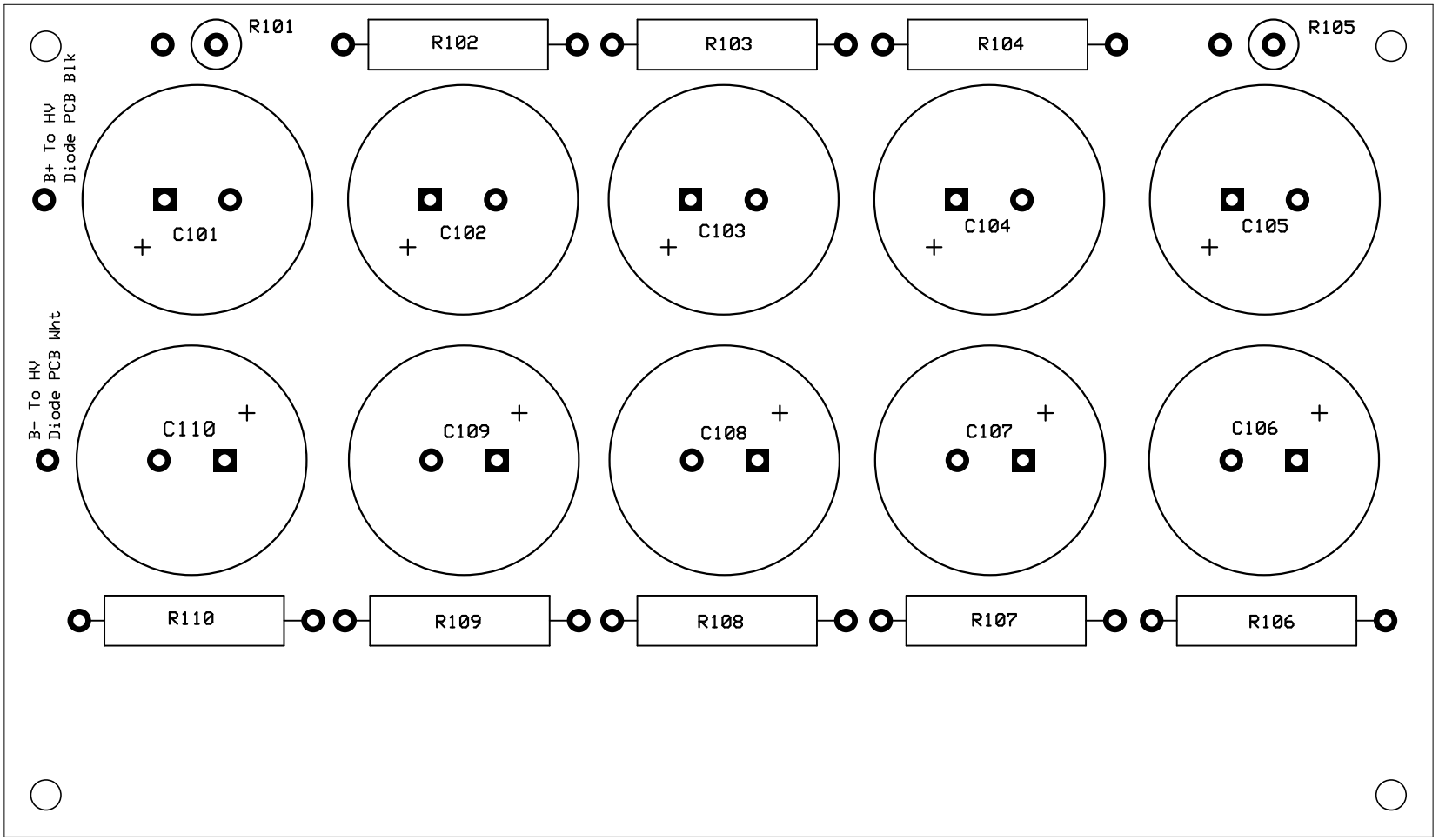
M-2 Grid Meter

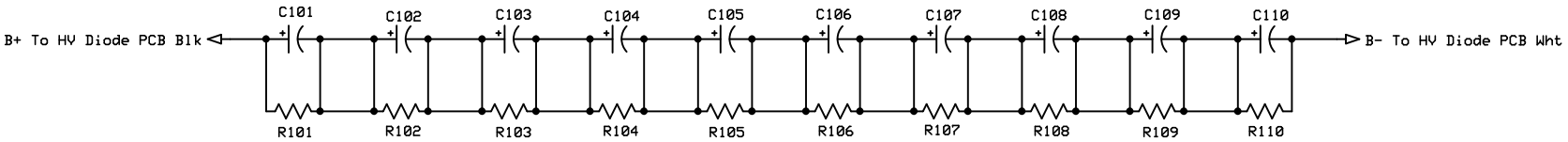
SW6 Grid Trip Reset

GTL1 Grid Trip Pilot Light

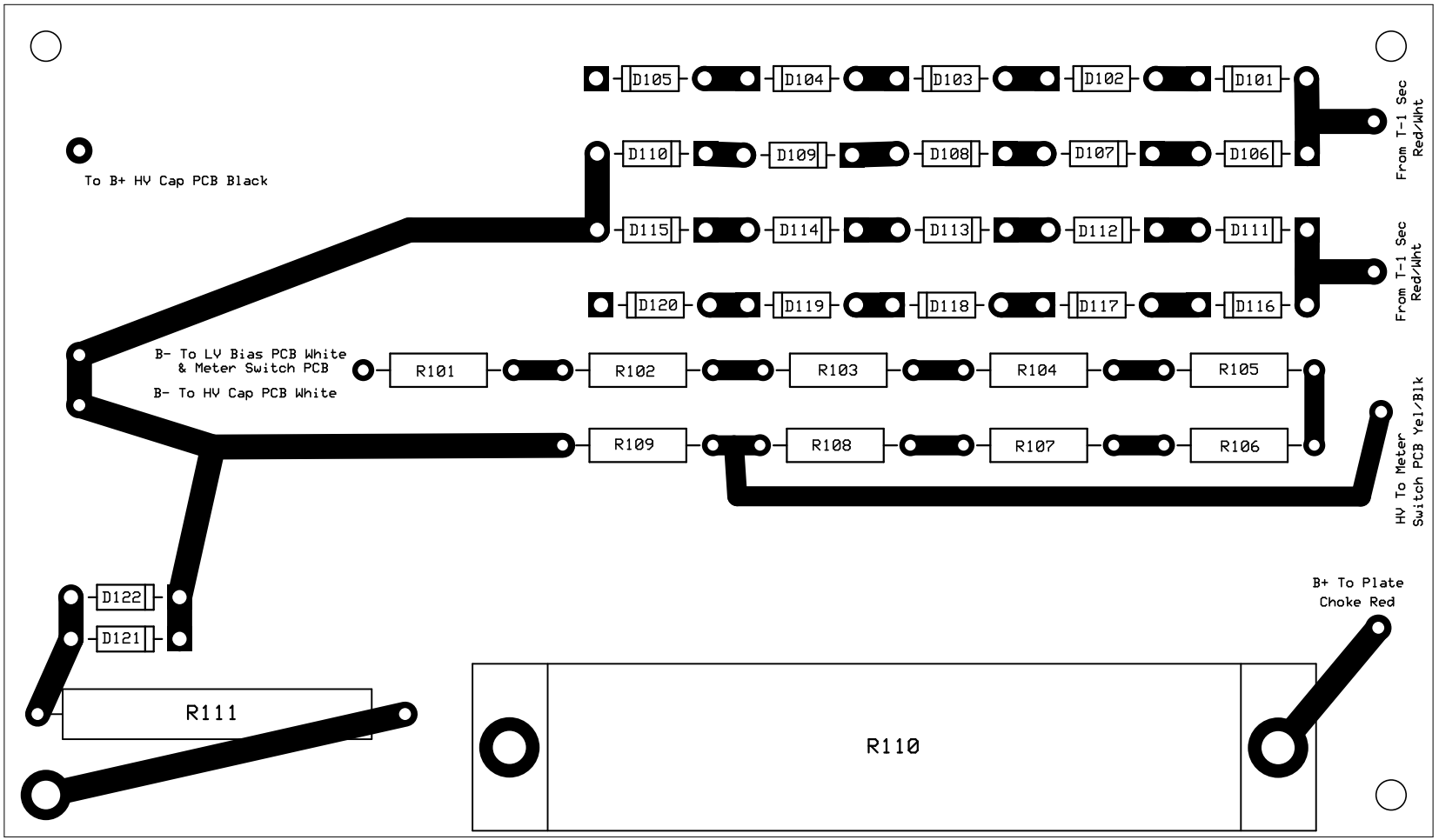
QRO Technologies, Inc.
HF-3KDX (8877/3CX1500) Linear Amplifier
General Schematic Diagram
Designed & Drawn by: Ray W. Connin
August 14, 2012

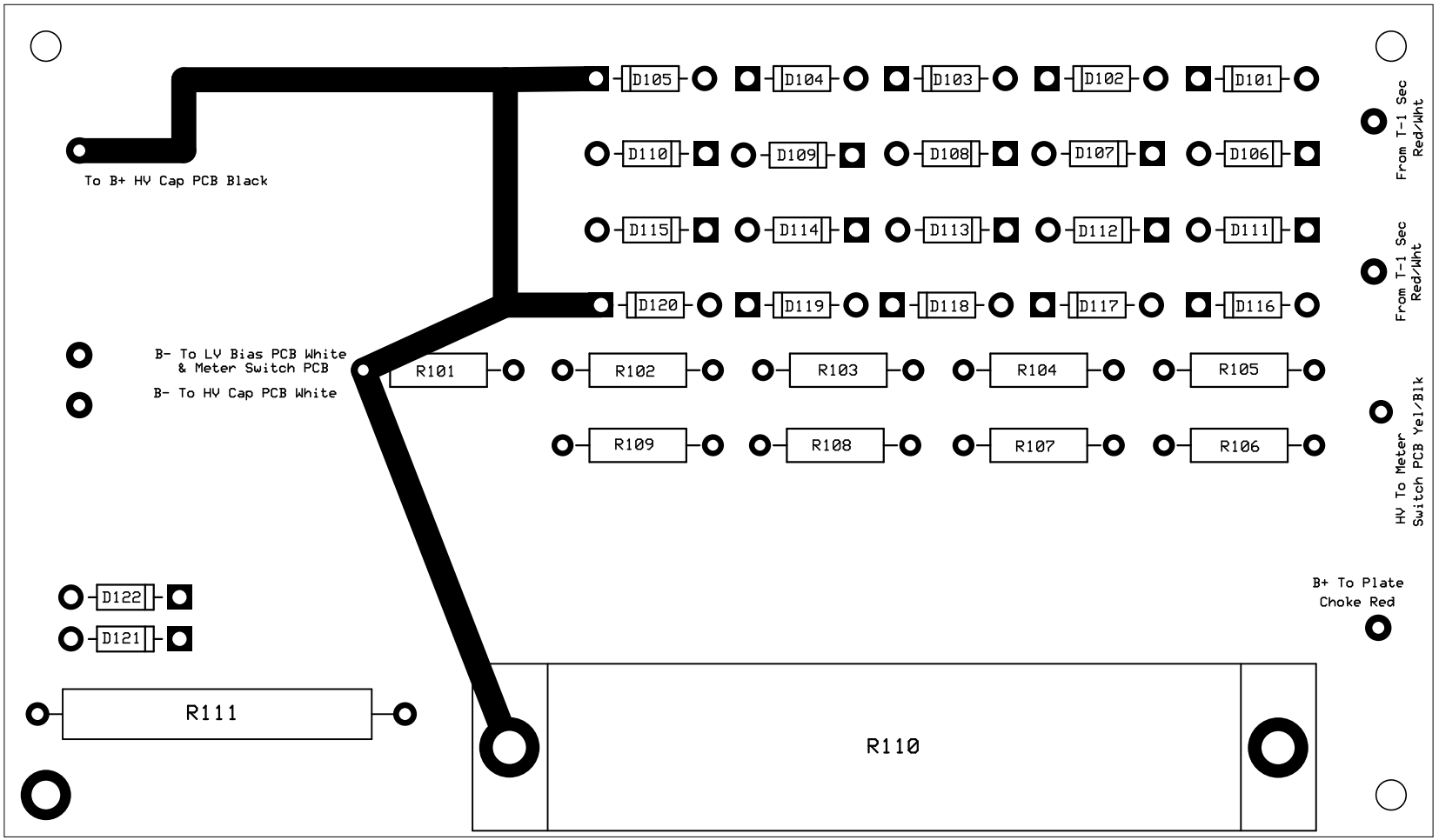

B+ To HV
Diode PCB Blk
B- To HV
Diode PCB Wht
R101
R102
R103
R104
R105
C101
C102
C103
C104
C105
C110
C109
C108
C107
C106
R110
R109
R108
R107
R106

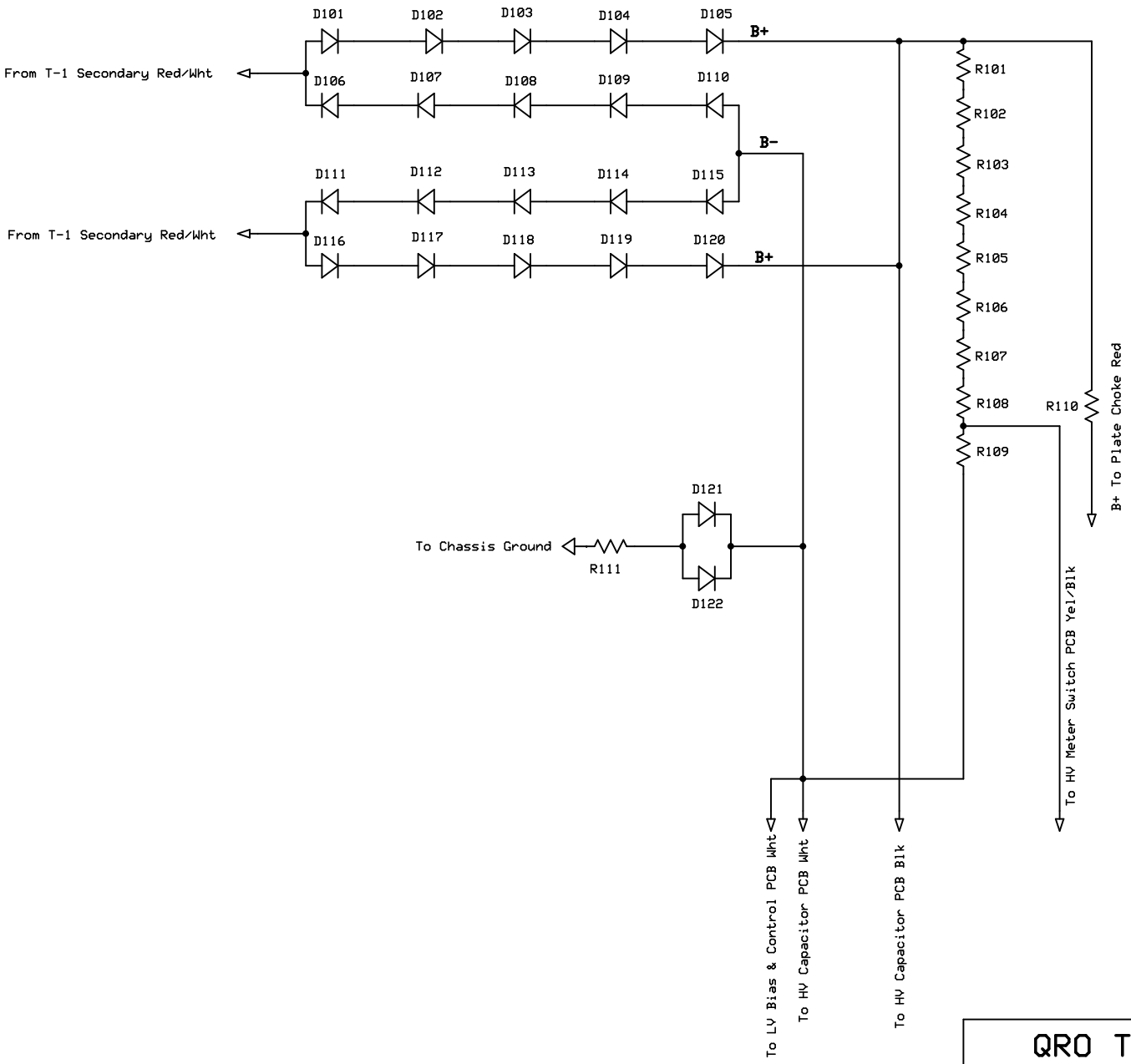

R101
R102
R103
R104
R105
B+ To HV
Diode PCB Blk
C101
C102
C103
C104
C105
B- To HV
Diode PCB Wht
C110
C109
C108
C107
C106
R110
R109
R108
R107
R106



QRO Technologies, Inc.		
High Voltage Capacitor PCB HF-3KDX (3CX1500)		
Ray W. Connin	Rev 1.0 11/7/2010	Part No. 06135


D105
D104
D103
D102
D101
D110
D109
D108
D107
D106
D115
D114
D113
D112
D111
D120
D119
D118
D117
D116
From T-1 Sec
Red/Wht
From T-1 Sec
Red/Wht
To B+ HV Cap PCB Black
B- To LV Bias PCB White
& Meter Switch PCB
B- To HV Cap PCB White
R101
R102
R103
R104
R105
R109
R108
R107
R106
HV To Meter
Switch PCB Yel/Blk
B+ To Plate
Choke Red
D122
D121
R111
R110


D105
D104
D103
D102
D101
D110
D109
D108
D107
D106
D115
D114
D113
D112
D111
D120
D119
D118
D117
D116
To B+ HV Cap PCB Black
From T-1 Sec
Red/Wht
From T-1 Sec
Red/Wht
B- To LV Bias PCB White
& Meter Switch PCB
B- To HV Cap PCB White
R101
R102
R103
R104
R105
R109
R108
R107
R106
HV To Meter
Switch PCB Yel/Blk
B+ To Plate
Choke Red
D122
D121
R111
R110



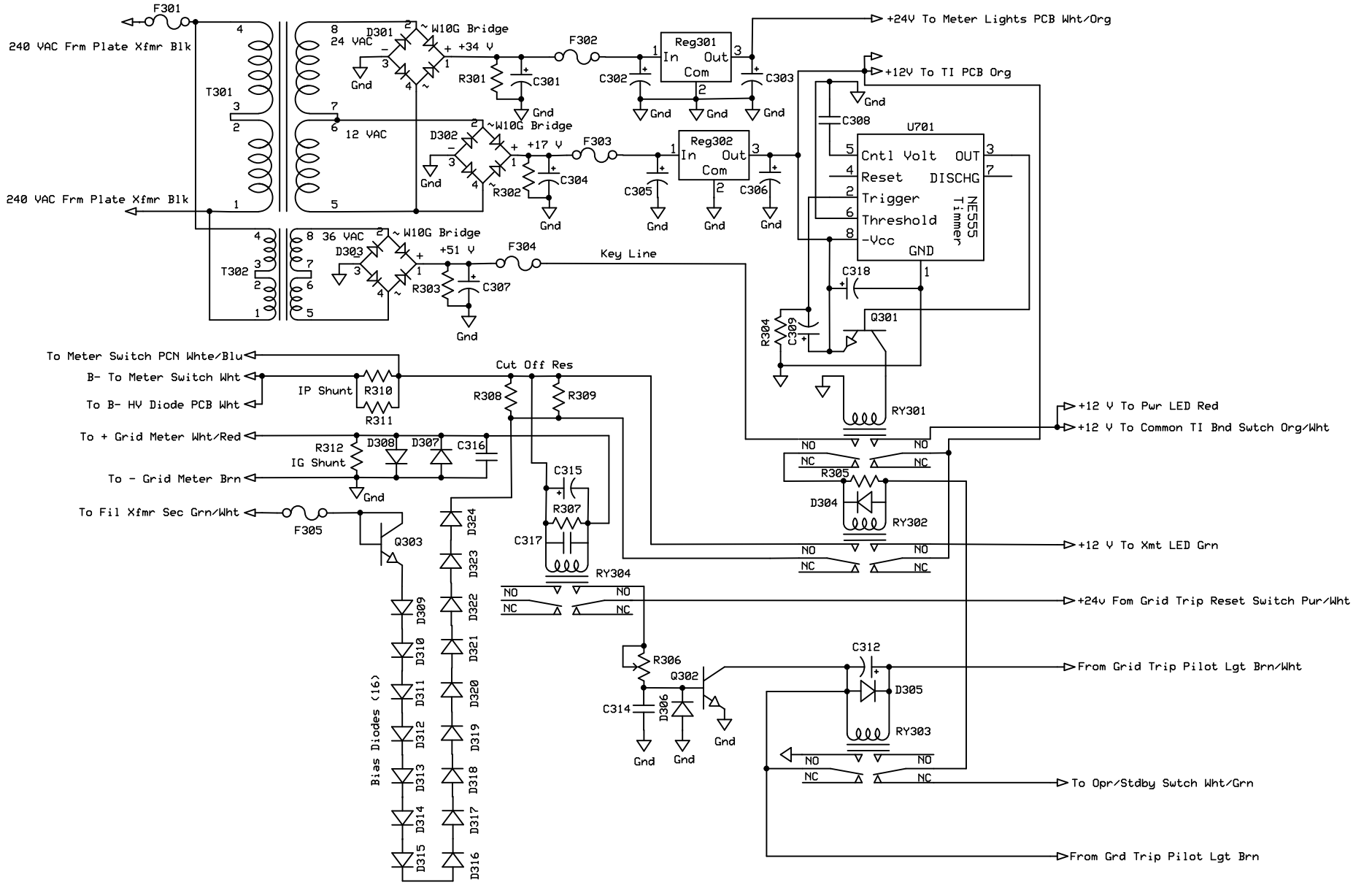
QRO Technologies, Inc.		
High Voltage Diode PCB HF-3KDX (3CX1500)		
Ray W. Connin	Rev 4.0 08/01/2012	Part No. 06136

HF-3KDX High Voltage Capacitor PCB Parts List
August 18, 2012

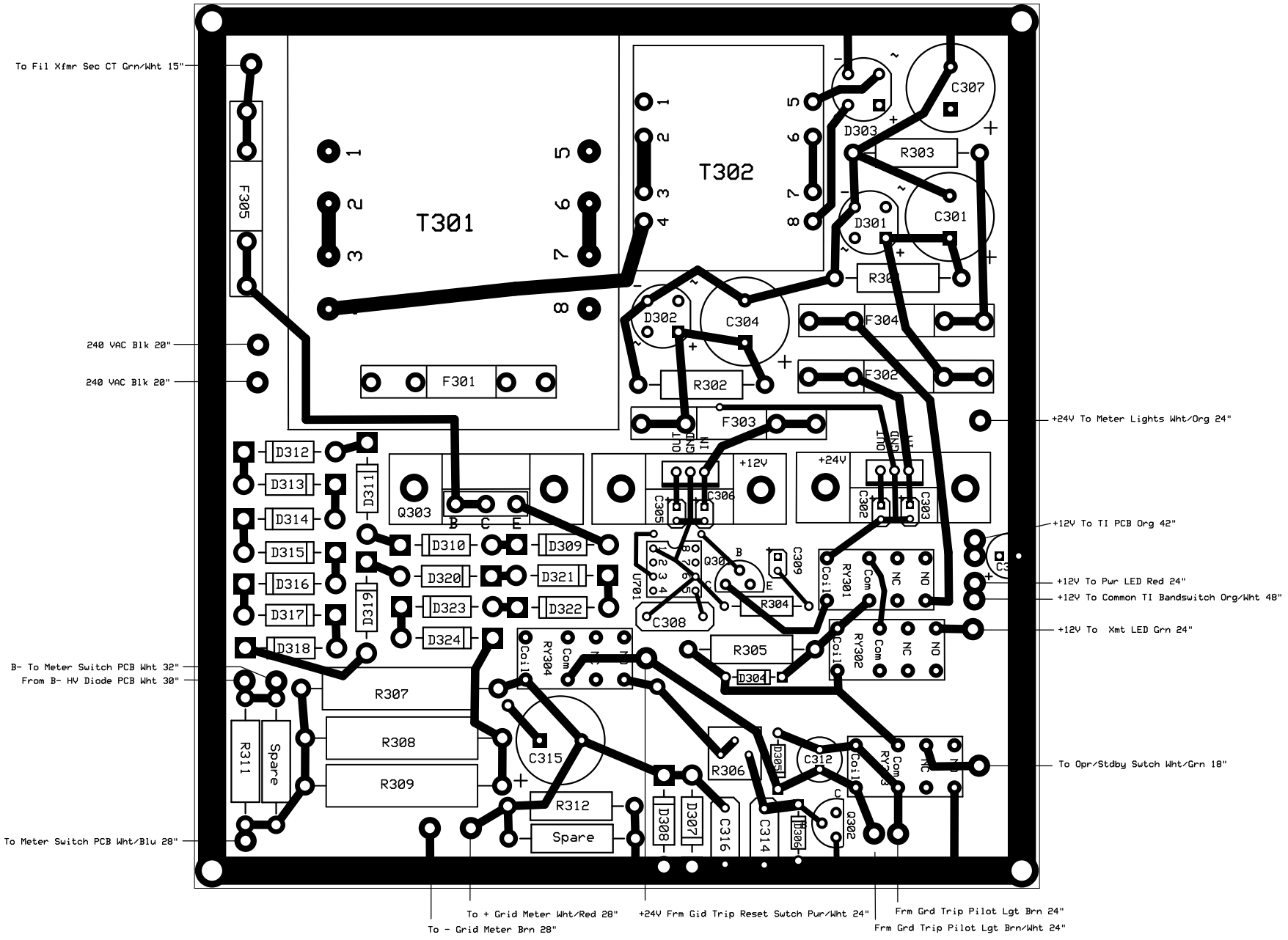
C101	470 uf 450V	Digikey 10170-ND
C102	470 uf 450V	Digikey 10170-ND
C103	470 uf 450V	Digikey 10170-ND
C104	470 uf 450V	Digikey 10170-ND
C105	470 uf 450V	Digikey 10170-ND
C106	470 uf 450V	Digikey 10170-ND
C107	470 uf 450V	Digikey 10170-ND
C108	470 uf 450V	Digikey 10170-ND
C109	470 uf 450V	Digikey 10170-ND
C110	470 uf 450V	Digikey 10170-ND
R101	51 K 50 W	Mouser 286-51KRC
R102	51 K 50 W	Mouser 286-51KRC
R103	51 K 50 W	Mouser 286-51KRC
R104	51 K 50 W	Mouser 286-51KRC
R105	51 K 50 W	Mouser 286-51KRC
R106	51 K 50 W	Mouser 286-51KRC
R107	51 K 50 W	Mouser 286-51KRC
R108	51 K 50 W	Mouser 286-51KRC
R109	51 K 50 W	Mouser 286-51KRC
R110	51 K 50 W	Mouser 286-51KRC

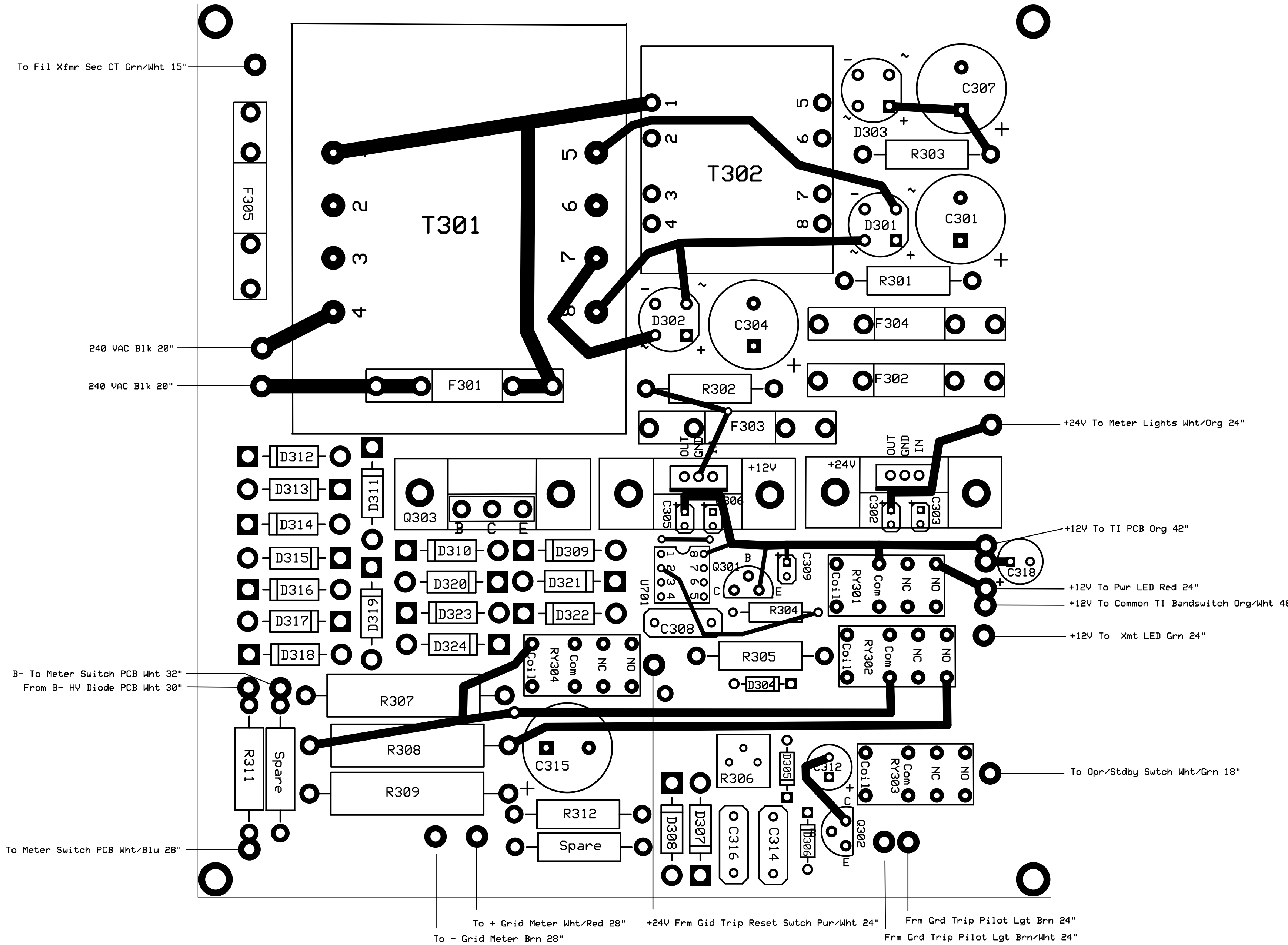
HF-3KDX High Voltage Diode PCB Parts List
August 18, 2012

D101	1N5408G	Newark 42K2941
D102	1N5408G	Newark 42K2941
D103	1N5408G	Newark 42F2941
D104	1N5408G	Newark 42K2941
D105	1N5408G	Newark 42K2941
D106	1N5408G	Newark 42K2941
D107	1N5408G	Newark 42K2941
D108	1N5408G	Newark 42K2941
D109	1N5408G	Newark 42K2941
D110	1N5408G	Newark 42K2941
D111	1N5408G	Newark 42K2941
D112	1N5408G	Newark 42K2941
D113	1N5408G	Newark 42K2941
D114	1N5408G	Newark 42K2941
D115	1N5408G	Newark 42K2941
D116	1N5408G	Newark 42K2941
D117	1N5408G	Newark 42K2941
D118	1N5408G	Newark 42K2941
D119	1N5408G	Newark 42K2941
D120	1N5408G	Newark 42K2941
D121	1N5408G	Newark 42K2941
D122	1N5408G	Newark 42K2941
R101	300K 3 Watt	Mouser 283-300KRC
R102	1.0 Meg 3 Watt	Mouser 283-1.0MRC
R103	1.0 Meg 3 Watt	Mouser 283-1.0MRC
R104	1.0 Meg 3 Watt	Mouser 283-1.0MRC
R105	1.0 Meg 3 Watt	Mouser 283-1.0MRC
R106	1.0 Meg 3 Watt	Mouser 283-1.0MRC
R107	1.0 Meg 3 Watt	Mouser 283-1.0MRC
R108	1.0 Meg 3 Watt	Mouser 283-1.0MRC
R109	47 K 3 Watt	Mouser 283-47KRC
R110	50 Ohm 100W	US Resistor
R111	1 K Ohm 10 W	Newark 41K9215



QRO Technologies, Inc.		
LV Bias & Control PCB HF-3KDX (3CX1500)		
Ray W. Connin	Rev 5.0 11/04/2012	Part No. 06137


To Fil Xfmr Sec CT Grn/Wht 15"
240 VAC Blk 20"
240 VAC Blk 20"
B- To Meter Switch PCB Wht 32"
From B- HV Diode PCB Wht 30"
To Meter Switch PCB Wht/Blu 28"
To - Grid Meter Brn 28"
To + Grid Meter Wht/Red 28"
+24V Frm Gid Trip Reset Swtch Pur/Wht 24"
Frm Grd Trip Pilot Lgt Brn 24"
Frm Grd Trip Pilot Lgt Brn/Wht 24"
+24V To Meter Lights Wht/Org 24"
+12V To TI PCB Org 42"
+12V To Pwr LED Red 24"
+12V To Common TI Bandswitch Org/Wht 48"
+12V To Xmt LED Grn 24"
To Opr/Stdby Swtch Wht/Grn 18"
T301
T302
F305
F301
F303
F304
F302
D312
D313
D314
D315
D316
D317
D318
D311
D319
D310
D309
D320
D321
D323
D322
D324
Q303
B
C
E
C305
C306
+12V
+24V
OUT
GND
IN
C302
C303
U701
Q301
C309
R304
C308
RY301
Coil
Com
NC
NO
RY304
R305
D304
RY302
R307
R308
R309
R311
Spare
C315
R312
Spare
R306
D305
C312
C316
C314
D306
Q302
D308
D307
R303
D303
C307
D301
C301
R301
D302
C304
R302

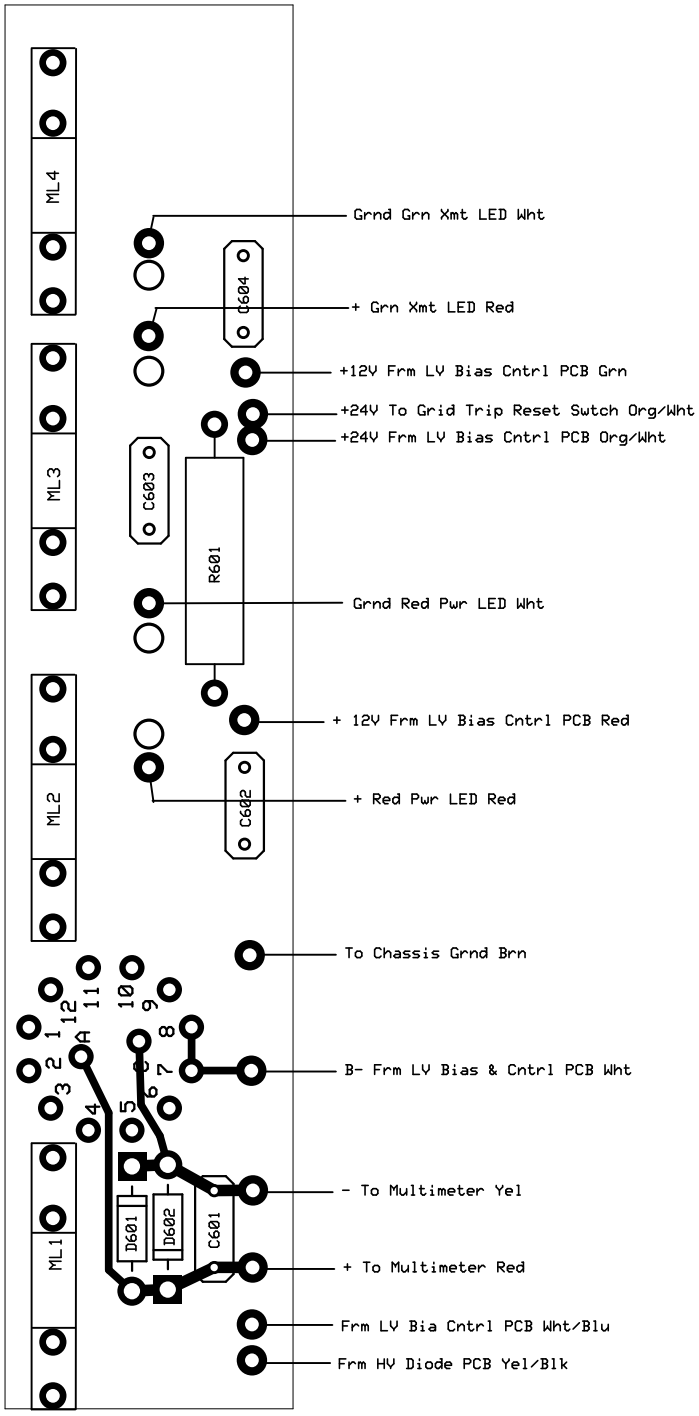

To Fil Xfmr Sec CT Grn/Wht 15"
240 VAC Blk 20"
240 VAC Blk 20"
B- To Meter Switch PCB Wht 32"
From B- HV Diode PCB Wht 30"
To Meter Switch PCB Wht/Blu 28"
To + Grid Meter Wht/Red 28"
To - Grid Meter Brn 28"
+24V Frm Gid Trip Reset Sutch Pur/Wht 24"
Frm Grd Trip Pilot Lgt Brn 24"
Frm Grd Trip Pilot Lgt Brn/Wht 24"
+24V To Meter Lights Wht/Org 24"
+12V To TI PCB Org 42"
+12V To Pwr LED Red 24"
+12V To Common TI Bandswitch Org/Wht 48"
+12V To Xmt LED Grn 24"
To Opr/Stdby Swtch Wht/Grn 18"
T301
T302
F301
F302
F303
F304
F305
C301
C304
C307
C308
C315
C316
C314
C318
D301
D302
D303
Q301
Q302
Q303
U701
R301
R302
R303
R304
R305
R306
R307
R308
R309
R311
R312
Spare
RY301
RY302
RY303
RY304
+12V
+24V

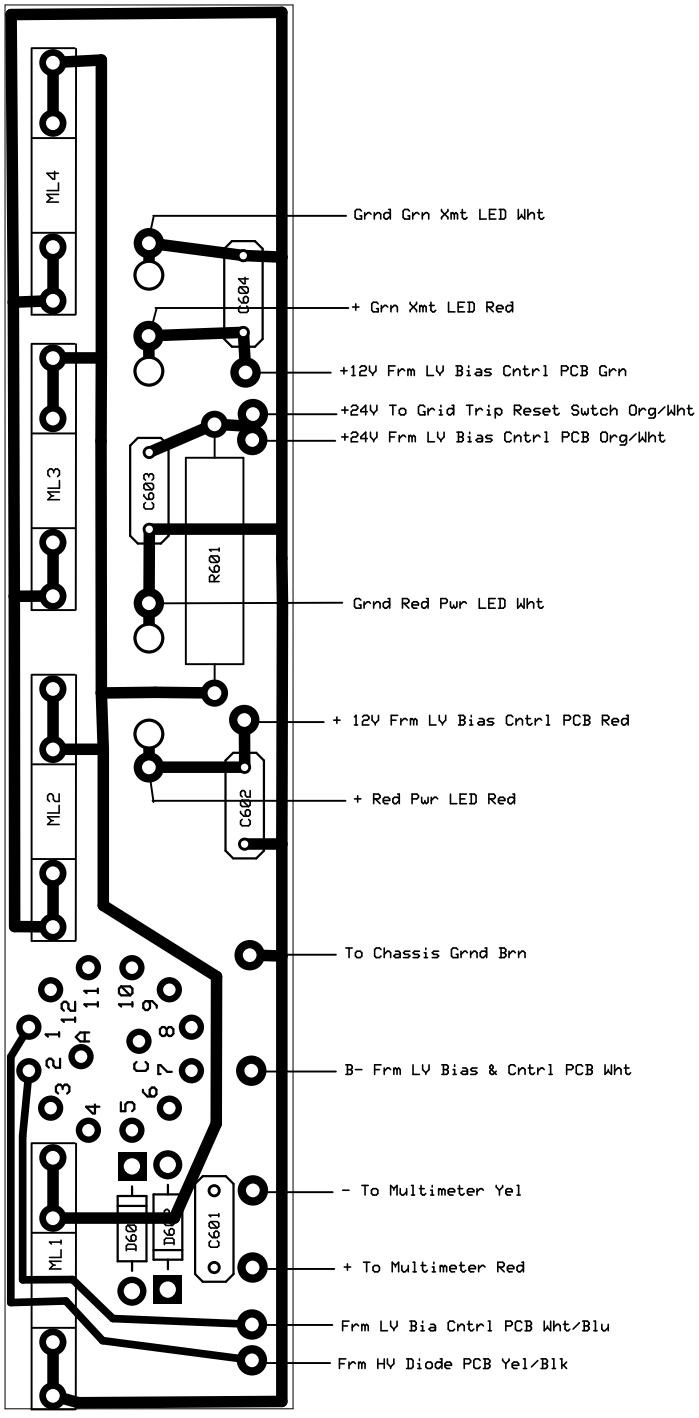
HF-3KDX Low Voltage, Bias, & Control PCB Parts List
November 4, 2012

C301	2200uf 50V	Digi-Key P5187-ND
C302	2.2uf 35V Tan	Digi-Key 478-1871-ND
C303	2.2uf 35V Tan	Digi-Key 478-1871-ND
C304	2200uf 50V	Digi-Key P5187-ND
C305	2.2uf 35V Tan	Digi-Key 478-1871-ND
C306	2.2uf 35V Tan	Digi-Key 478-1871-ND
C307	1000uf 63V	Digi-Key P5586-ND
C308	.01uf 1KV	Mouser 75-562R5GAS10
C309	15uf 16V Tan	Digi-Key P2039-ND
C312	100uf 50V	Digi-Key P5182-ND
C314	.01uf 1KV	Mouser 75-562R5GAS10
C315	1000uf 63V	Digi-Key P5586-ND
C316	.01uf 1KV	Mouser 75-562R5GAS10
C317	.01uf 1KV	Mouser 75-562R5GAS10
C318	100uf 50V	Digi-Key P5182-ND
D301	W10G Bridge	Newark 625-W10G-E4
D302	W10G Bridge	Newark 625-W10G-E4
D303	W10G Bridge	Newark 625-W10G-E4
D304	1N4001	Mouser 583-1N4001-B
D305	1N4001	Mouser 583-1N4001-B
D306	1N4001	Mouser 583-1N4001-B
D307	1N5408G	Newark 42K2941
D308	1N5408G	Newark 42K2941
D309	1N5408G	Newark 42K2941
D310	1N5408G	Newark 42K2941

D311	1N5408G	Newark 42K2941
D312	1N5408G	Newark 42K2941
D313	1N5408G	Newark 42K2941
D314	1N5408G	Newark 42K2941
D315	1N5408G	Newark 42K2941
D316	1N5408G	Newark 42K2941
D317	1N5408G	Newark 42K2941
D318	1N5408G	Newark 42K2941
D319	1N5408G	Newark 42K2941
D320	1N5408G	Newark 42K2941
D321	1N5408G	Newark 42K2941
D322	1N5408G	Newark 42K2941
D323	1N5408G	Newark 42K2941
D324	1N5408G	Newark 42K2941
F301	2 Amp Slo Blo	Mouser 504-MDL-2
F302	1/2 Amp Slo Blo	Mouser 504-MDL-1/2
F303	1 Amp Slo Blo	Mouser 504-MDA-1
F304	1/2 Amp Slo Blo	Mouser 504-MDL-1/2
F305	1-1/2 Amp Fast Acting	Mouser 504-AGC-1 1/2
Q301	2N4123	Mouser 333-2N4123
Q302	MPSA42	Newark 610-MPSA42
Q303	TIP33C	Newark TIP 33C
R301	2.0K 2W	Mouser 282-2.0K-RC
R302	1K 2W	Mouser 282-1.0K-RC
R303	5.1K 2W	Mouser 282-5.1K-RC
R304	10 Meg 1/2 W	Mouser 293-10M-RC
R305	330 Ohm 3W	Mouser 283-330-RC

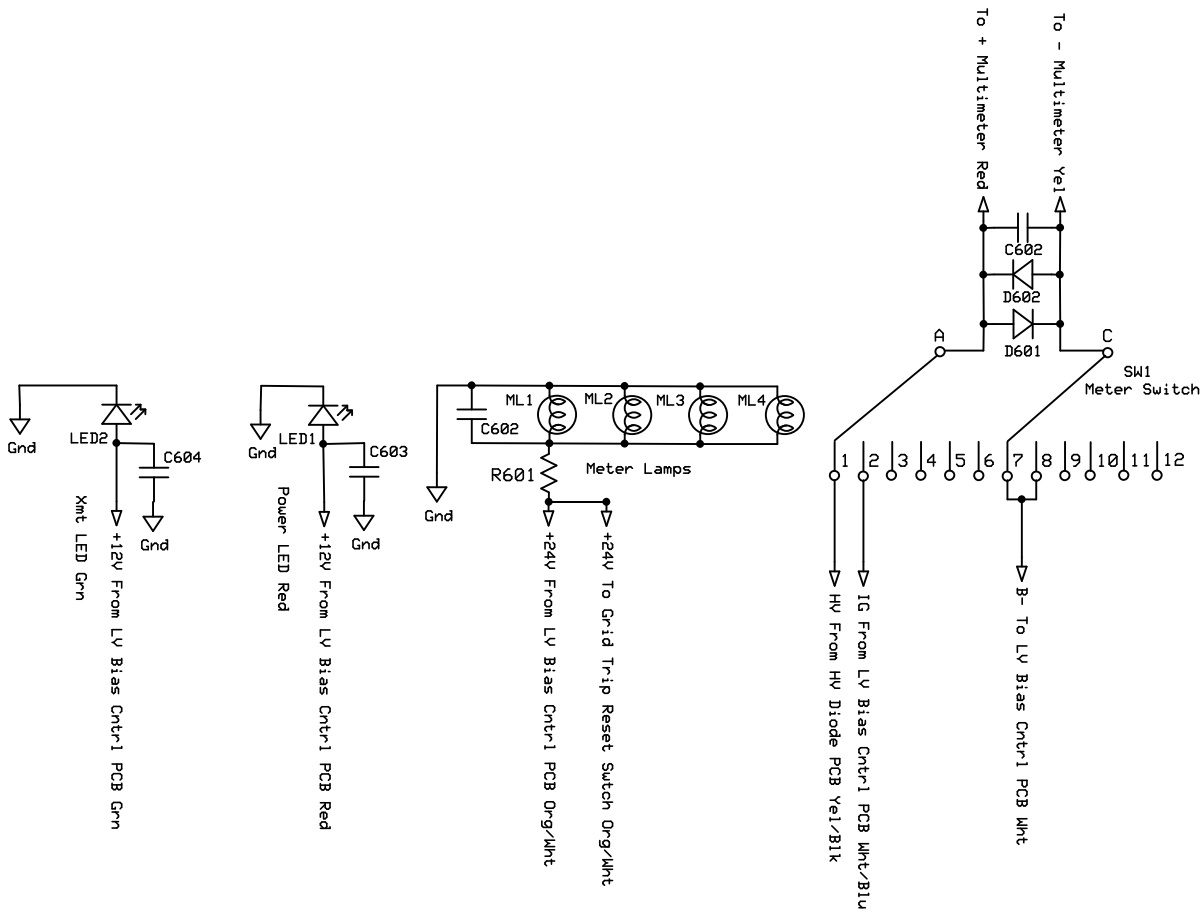
R306	100K POT	Newark 652-3386P-1-104LF
R307	33 Ohm 5W Grid Trip	Mouser 286--33-RC
R308	22K 5W	Mouser 286-22K-RC
R309	22K 5W	Mouser 286-22K-RC
R310	.030 Ohm 3W	Mouser 71-LVR03R0300FE12
R311	Spare	
R312	.15 Ohm 3W	Mouser 588-43F-0.15
Reg30	24V Reg MC78M24CTG	Newark 42K1213
Reg302	12V Reg UA78M12CKC	Newark 45J1434
RY301	Timer Relay 12V Coil	Newark 36K1941
RY302	Bias & LED Relay 12V Coil	Newark 36K1941
RY303	Grid Trip Reset Relay 24V Coil	Mouser 653-G5V-2-DC24
RY304	Grid Trip Relay 12V Coil	Newark 36K1941
T301	Xfmr 24V/12V Sec	Mouser 533-FS24-1500
T302	36V Sec	Mouser 553-FS36-170
U701	NE555N Timer	Digi-Key 497-1963-5-ND


ML4
ML3
ML2
ML1
C604
C603
R601
C602
C601
D601
D602
Grnd Grn Xmt LED Wht
+ Grn Xmt LED Red
+12V Frm LV Bias Cntrl PCB Grn
+24V To Grid Trip Reset Swtch Org/Wht
+24V Frm LV Bias Cntrl PCB Org/Wht
Grnd Red Pwr LED Wht
+ 12V Frm LV Bias Cntrl PCB Red
+ Red Pwr LED Red
To Chassis Grnd Brn
B- Frm LV Bias & Cntrl PCB Wht
- To Multimeter Yel
+ To Multimeter Red
Frm LV Bia Cntrl PCB Wht/Blu
Frm HV Diode PCB Yel/Blk

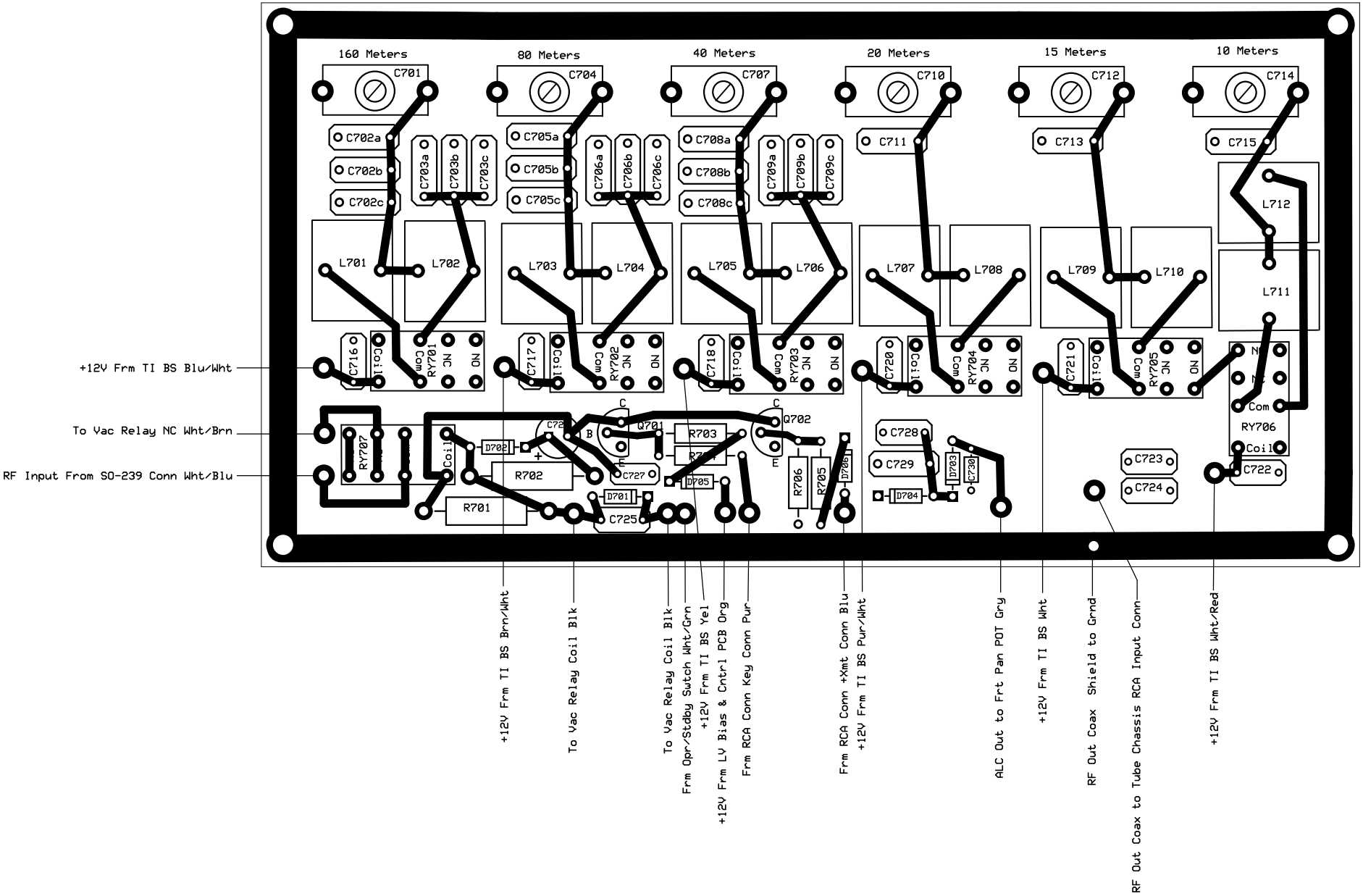

ML4
ML3
ML2
ML1
C604
C603
R601
C602
C601
D601
D602
Grnd Grn Xmt LED Wht
+ Grn Xmt LED Red
+12V Frm LV Bias Cntrl PCB Grn
+24V To Grid Trip Reset Swtch Org/Wht
+24V Frm LV Bias Cntrl PCB Org/Wht
Grnd Red Pwr LED Wht
+ 12V Frm LV Bias Cntrl PCB Red
+ Red Pwr LED Red
To Chassis Grnd Brn
B- Frm LV Bias & Cntrl PCB Wht
- To Multimeter Yel
+ To Multimeter Red
Frm LV Bia Cntrl PCB Wht/Blu
Frm HV Diode PCB Yel/Blk

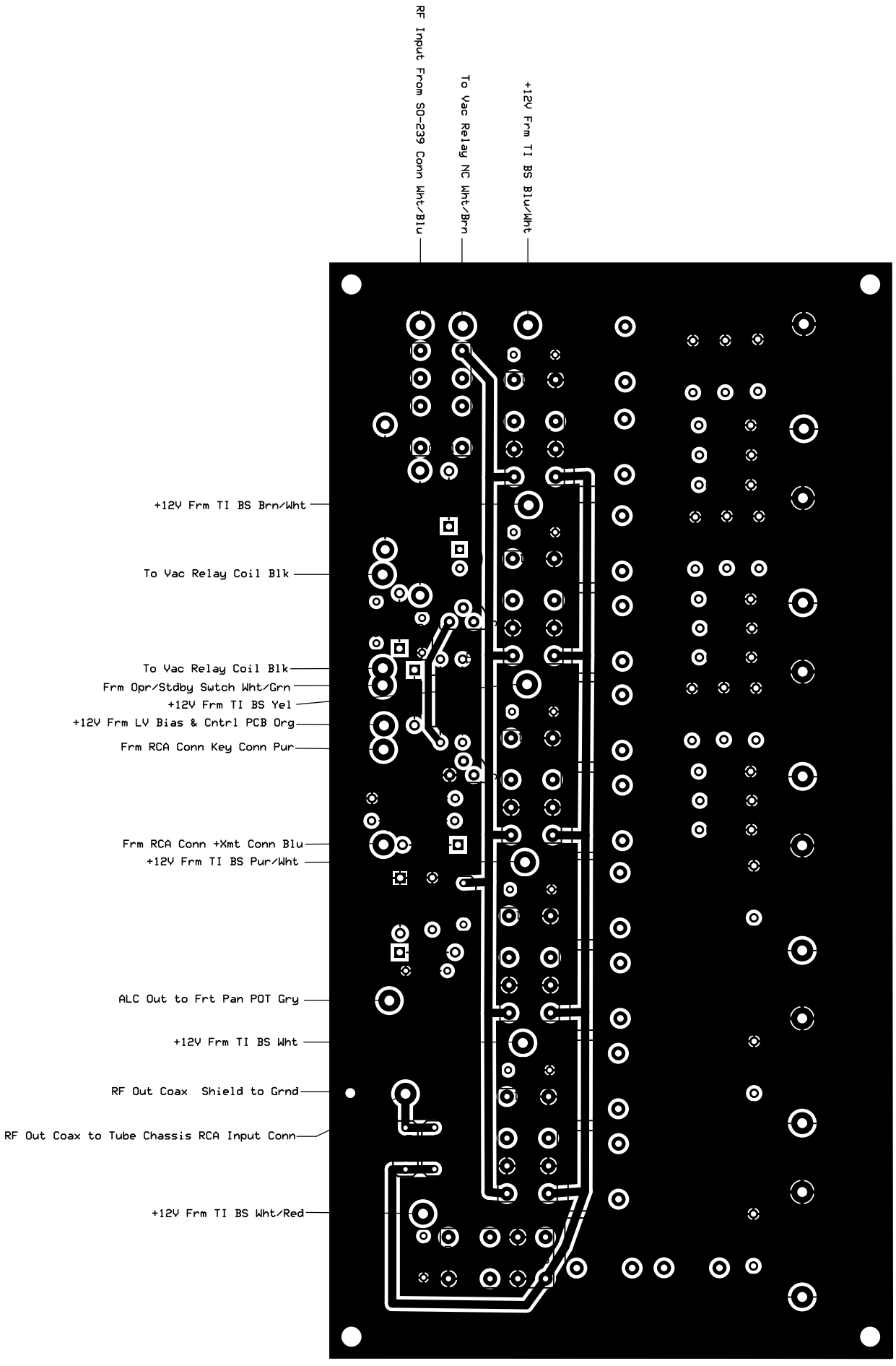
HF-3KDX Meter Switch PCB Parts List
August 18, 2012

C602 .	.01uf 1K	Mouser 75-562R5GAS10
C603	.01uf 1K	Mouser 75-562R5GAS10
C604	.01uf 1K	Mouser 75-562R5GAS10
D601	1N5408G	Newark 42K2941
D602	1N5408G	Newark 42K2941
LED1		Newark 93F3487
LED2		Newark 93F3488
ML1		Mouser 560-GF780
ML2		Mouser 560-GF780
ML3		Mouser 560-GF780
ML4		Mouser 560-GF780
R601	33 Ohm 5W	Mouser 286-33-RC
SW1		Mouser 611-A20615RNCQ



QRO Technologies, Inc.		
Meter Switch PCB HF-3KDX (3CX1500)		
Ray W. Connin	Rev 2.0 04/12/2011	Part No. 06139

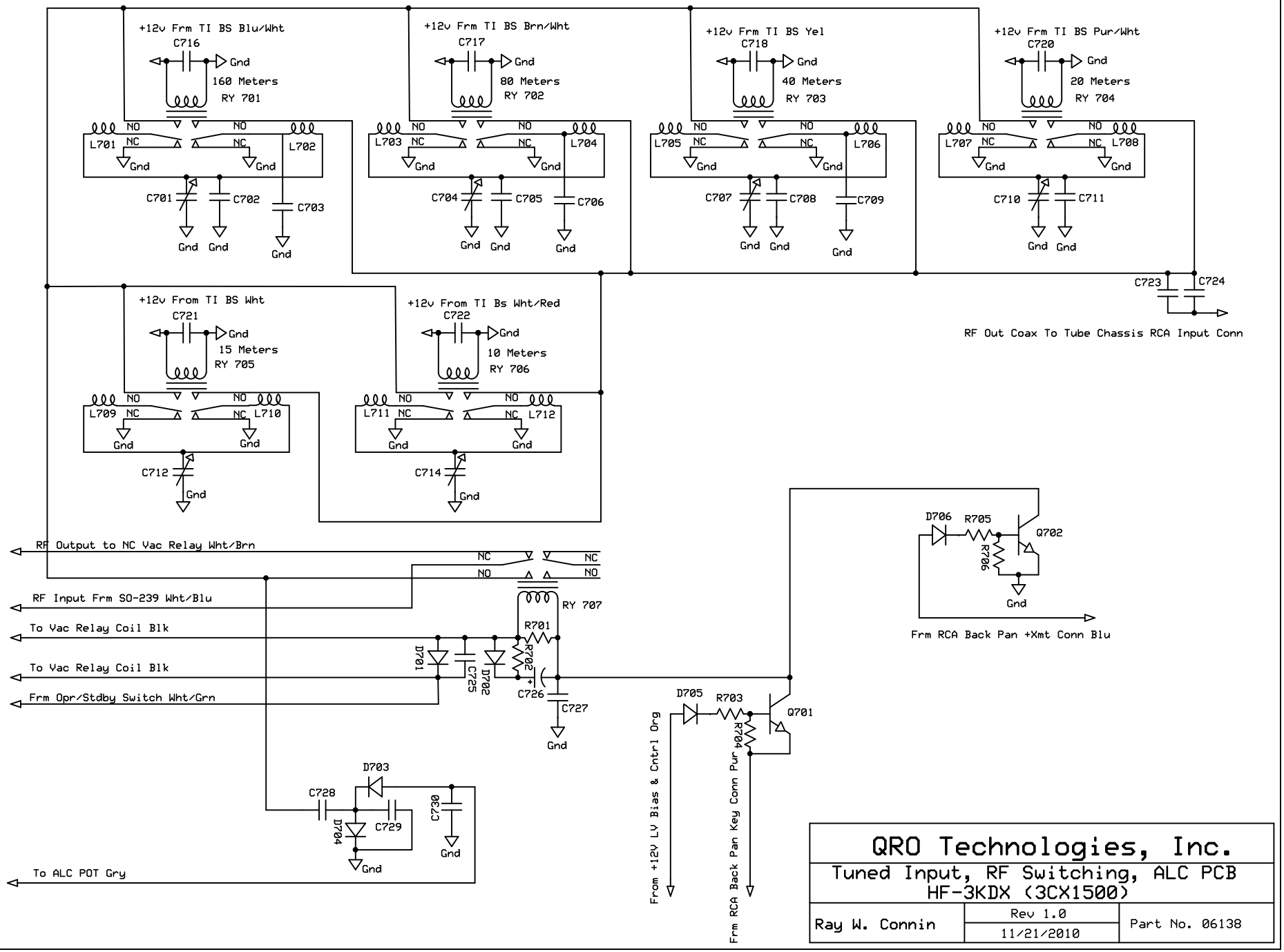

160 Meters
80 Meters
40 Meters
20 Meters
15 Meters
10 Meters
C701
C704
C707
C710
C712
C714
C702a
C702b
C702c
C703a
C703b
C703c
C705a
C705b
C705c
C706a
C706b
C706c
C708a
C708b
C708c
C709a
C709b
C709c
C711
C713
C715
L701
L702
L703
L704
L705
L706
L707
L708
L709
L710
L711
L712
C716
C717
C718
C720
C721
RY701
RY702
RY703
RY704
RY705
RY706
Coil
Com
NC
NO
Q701
Q702
R701
R702
R703
R705
R706
C725
C727
C728
C729
C722
C723
C724
D701
D702
D703
D704
D705
D706
+12V Frm TI BS Blu/Wht
To Vac Relay NC Wht/Brn
RF Input From SO-239 Conn Wht/Blu
+12V Frm TI BS Brn/Wht
To Vac Relay Coil Blk
To Vac Relay Coil Blk
Frm Opr/Stdby Swtch Wht/Grn
+12V Frm TI BS Yel
+12V Frm LV Bias & Cntrl PCB Org
Frm RCA Conn Key Conn Pur
Frm RCA Conn +Xmt Conn Blu
+12V Frm TI BS Pur/Wht
ALC Out to Frt Pan POT Gry
+12V Frm TI BS Wht
RF Out Coax Shield to Grnd
RF Out Coax to Tube Chassis RCA Input Conn
+12V Frm TI BS Wht/Red


RF Input From SO-239 Conn Wht/Blu
To Vac Relay NC Wht/Brn
+12V Frm TI BS Blu/Wht
+12V Frm TI BS Brn/Wht
To Vac Relay Coil Blk
To Vac Relay Coil Blk
Frm Opr/Stdby Swtch Wht/Grn
+12V Frm TI BS Yel
+12V Frm LV Bias & Cntrl PCB Org
Frm RCA Conn Key Conn Pur
Frm RCA Conn +Xmt Conn Blu
+12V Frm TI BS Pur/Wht
ALC Out to Frt Pan POT Gry
+12V Frm TI BS Wht
RF Out Coax Shield to Grnd
RF Out Coax to Tube Chassis RCA Input Conn
+12V Frm TI BS Wht/Red

HF-3KDX Tuned Input PCB Parts List
August 18, 2012

C701		Arco CO424
C702	2500pf Mica	
C703	2500pf Mica	
C704		Arco CO424
C705	1390pf Mica	
C706	1390pf Mica	
C707		Arco CO424
C708	390pf Mica	
C709	160pf Mica	
C710		Arco CO424
C711	100pf Mica	
C712		Arco CO424
C714		Arco CO424
C716	.01uf	Mouser 75-562R5GAS10
C717	.01uf	Mouser 75-562R5GAS10
C718	.01uf	Mouser 75-562R5GAS10
C720	.01uf	Mouser 75-562R5GAS10
C721	.01uf	Mouser 75-562R5GAS10
C722	.01uf	Mouser 75-562R5GAS10
C723	.01uf	Mouser 75-562R5GAS10
C724	.01uf	Mouser 75-562R5GAS10
C725	.01uf	Mouser 75-562R5GAS10
C726	1uf 50V	Digi-Key P5563-ND
C727	3900uf	Mouser 140-500P5-392K-RC
C728	68pf Mica	Mouser 598215500V68
C729	330pf Mica	598215500V330
C730	.01uf Axial	Digi-Key 1103PHCF-ND
D701	1N4001	Mouser 583-1N4001-B
D702	1N4001	Mouser 583-1N4001-B
D703	1N4148	Mouser 78-1N4148
D704	1N4148	Mouser 78-1N4148
D705	1N4001	Mouser 583-iN4001-B
D706	1N4001	Mouser 583-1N4001-B
L701		
L702		
L703		

L704		
L705		
L706		
L707		
L708		
L709		
L710		
L711		
L712		
Q701	MPSA42	Newark 610-MPSA42
Q702	MPSA42	Newark 610-MPSA42
R701	330 3W	Mouser 283-330-RC
R702	100 Ohm 3W	Mouser 282-100-RC
R703	1K 2W	Mouser 282-1K-RC
R704	1K 2W	Mouser 282-1K-RC
R705	1K 2W	Mouser 282--1K-RC
R706	1K 2W	Mouser 282-1K-RC
RY 701		Newark 37K1941
RY 702		Newark 36K1941
RY 703		Newark 36K1941
RY 704		Newark 36K1941
RY 705		Newark 36K1941
RY 706		Newark 36K1941
RY 707		Newark 36K1941



QRO Technologies, Inc.

Tuned Input, RF Switching, ALC PCB
HF-3KDX (3CX1500)

Ray W. Connin	Rev 1.0 11/21/2010	Part No. 06138