

DZKIT

ASSEMBLY MANUAL



SIENNA XL
HF+6 TRANSCEIVER

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YOUR DZKIT 1-YEAR LIMITED WARRANTY

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This warranty applies only to the first owner of the product and is not extended to subsequent owners.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

THE DZ COMPANY, LLC
6151 PANORAMIC DR..
LOVELAND, CO 80537

Assembly

Of the



Sienna XL HF+6 Transceiver

DZ COMPANY
LOVELAND, COLORADO

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8/1/2026

Sienna XL

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INTRODUCTION

The Sienna XL transceiver represents a revolution in amateur radio. Now you can start with a high performance QRP transceiver, and then add a 10W Amp and 250W Amp as your desires or budget allow.

The integrated QRP Labs QMX+ Software Defined Radio (SDR) assures top-notch state-of-the-art features, such as:

- Controlled Envelope SSB (which effectively doubles the average “talk power”)
- Polar Modulation (which uses AM and Phase Modulation in the QMX+ final amplifier to produce SSB so that it produces less heat)
- USB connectivity to the configuration menu (which Sienna XL brings to the rear panel)
- Integrated digital modes

The power-on/off circuitry in the Sienna XL senses the input voltage and won't allow turn-on if it's too high or low, and is fuse protected against too much current. The on/off switch is also sensed to allow staged turn-on and turn-off, allowing the QMX+ and Sienna XL to save current settings prior to shutting off the power.

Sienna XL is a study in duality:

- dual keying (manual and paddle inputs available at the same time on both the front and rear panel)
- Dual 10dB preamps and an 10dB attenuator to add that extra signal boost in poor band conditions.
- dual audio (headphones and speakers available at the same time)
- dual receive (front panel access to the audio from an external secondary receiver)
- dual backlit simulated analog meters, which give the rig a nice glow that harkens back to the early days of radio when all radios glowed. Sienna XL's color touch meter display allows you to simply touch the meter faces and select the ones you want, such as Forward Power on the left meter and an S-Meter on the right.
- Dual microprocessors, plus one in the QMX+

Sienna XL can be built in several combinations. This manual is thus a complete assembly manual for the fully loaded Sienna XL. As you upgrade your Sienna XL, you can still use this one manual as a complete assembly reference.

Thanks for trusting in DZKit to provide not only unique electronic products, but to give you hours of building fun too.



General Assembly Notes

1. Most screws in this kit are Phillips Panhead Machine Screws. For simplicity, we refer to them simply as “screws” unless a different style is used. These may be stainless steel or zinc-plated steel.
2. Almost all sheet metal parts are attached to each other using 6-32 x 1/4” screws that are inserted into captive fasteners that have been pressed into the sheet metal. These screws have a locking compound on them to keep them from vibrating loose.
3. Most PC boards attach to the sheet metal using 6-32 x 1/4” screws with attached lock-washers (“SEMS” screws) but there are some exceptions, which are explained in the steps.
4. As you tighten a screw, it is very important that you do not strip the threads. All screws should fasten smoothly. If a screw appears to be very hard to fasten, something else is probably wrong—a cable could be in the way, you are trying to use the wrong size screw or something else is wrong. DO NOT FORCE SCREWS! Instead, inspect the assembly carefully and try to see why you are having difficulty. Screws with locking compound on them are normally a little harder to fasten.
5. A PC within arms reach of your workbench is useful in helping you locate the parts on the boards. Available for download from our web site are the PCB layout files for all boards (without traces). To find the location of a part, simply install and run the “ExpressPCB” program (free download from www.expresspcb.com) and open the board you wish to work on. Press “Ctrl-F” to find a part, and then enter it in the box that pops up (e.g., “R1”, without the quotes). The program will show you exactly where that part is located. Take a few minutes to familiarize yourself with this program before beginning construction. You can also find parts manually by just looking for the part on the silkscreen, but on the denser boards, this can take a long time. We highly recommend using ExpressPCB to locate parts.
6. All references to left and right, front and back are with the chassis in an orientation such that the front of the radio faces you. The large openings on the bottom of the chassis are to the right, with the folded sides of the chassis pointed up.
7. Each circuit part has its own component number (R1, L4, Q3,



etc.). R1 on one assembly will not be the same as R1 on a different assembly, so be sure you are looking at the right set of parts when comparing part numbers with the printed parts list. Check off each part at the beginning of each section to make sure all the parts are there. If you find any missing, give us a call or email us and we will rush a replacement to you.

8. Most electronic kits that are returned for service have poor soldering jobs. **Please** take a moment to familiarize yourself with proper soldering technique. And do not, under **ANY** circumstances, use corrosive ("acid-core") solder! That will void your warranty and render your kit inoperative. Also be sure to avoid the use of products that may be called solder but are really glue (e.g., LePage's Liquid Solder, nothing more than metallic-grey colored airplane glue).
9. Soldering should only be done in an area with good ventilation and with a properly heated soldering iron.
10. Resistors are identified by their values in Ohms, Kiloohms (K) or Megohms (M) and by color codes. Your kit uses resis-

tors of several types. Axial leaded resistors have color coded bands on them. For 5% resistors, the first two bands represent the numeric value and the third band represents a multiplier, which is a power of 10. Thus, a 56 Ohm resistor is Green-Blue-Black. A 10K0hm resistor is Brown-Black-Orange, and so on. The fourth band is the tolerance – no band represents 20%, a silver band 10%, and a gold band 5%. Your Sienna uses mostly one percent or better resistors, which have 4 bands for the value. A 4.75K resistor is Yellow-Violet-Green-Brown. We have placed resistors of given types in individual bags for you, but should they get mixed and you have trouble reading the color code, we recommend an inexpensive volt-ohmmeter be used to check the values. A fluorescent light is also useful to "bring out" the colors, and a magnifying glass is also handy.

11. Capacitors are identified by their type – disk, polystyrene, polypropylene, electrolytic, trimmer, etc.) and capacitance values are in microfarads (μF) or picoFarads (pF). Polarized types have the



Most kit builders find it helpful to separate the parts into categories for quick identification. Muffin tins and cardboard egg cartons serve this purpose admirably.



positive pin marked on the silkscreen and also have a square pad.

12. Inductors are represented either by their inductance in nanoHenries (nH), microHenries (uH), milliHenries (mH) or by the number of turns in the coil if you are doing the winding.

13. Diodes are marked with a band on the cathode end. The PC boards have a bar silkscreened across one side of the component outline and a square pad which identifies the cathode.

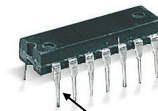
14. Transistors have either a tab or a flat side that you can match to the silkscreened component outline. Most transistors will need to have their leads "sprung" a little to fit in the holes. Do so carefully to avoid breaking the leads off.

15. ICs have a notch, beveled side and/or a dot representing the side containing pin 1. When you hold an IC with the notch or the beveled side up, pin 1 is in the upper left corner. The silkscreened outlines on the board all have notches and pin 1 also has a square pad.

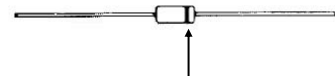
16. To insert an IC, rest the IC on its side on a hard surface. Slowly roll the entire chip so that all the leads on that side are bent inward at once and the same distance. Do about half what appears to be required. Check the leads against the socket or PCB and then roll the other side inward the same way.

It is CRITICAL that you mount polarized parts correctly! Double check your work to be sure that all such parts match the photos. See Detail 1.

IC-pin 1 (SMT part)



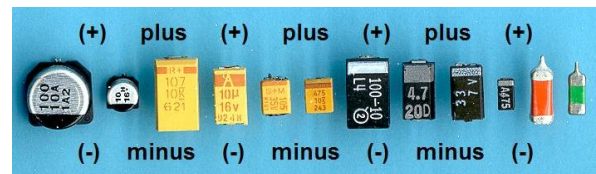
IC - pin 1 (through-hole part)



Diode - band on cathode



Transistor - Flat side



Electrolytic capacitors - negative side

Detail 1. Identifying polarity of diodes, transistors, ICs and polarized capacitors.



Abbreviations and definitions of terms used in this manual:

PC = Personal Computer

PCB = Printed Circuit Board

PH = Panhead

FH = Flathead

M/S = Machine Screw (typically 2-56, 4-40, 6-32 and 10-32 sizes)

P/L = Patch lock (locking compound added to threads)

PCB-mt = Printed Circuit Board mounting

AMP MTA = Tyco Electronics connector with .1" or .156" pin spacing

IDC = Insulation Displacement Connector (MTA connectors are IDC type)

Ribbon cable = Flat, gray cable with connectors on each end

Header = PCB-mounted connector

A word about what lies ahead...

This manual is designed to allow you to build confidence in your kit-building ability as you go along. You start by building the chassis and then building and installing the DC power distribution circuitry, which is among the simplest of all the circuitry. You will then be able to turn on the power and measure some voltages. This will give you confidence that the kit-building is progressing normally. You will also be able to use a PC to help you locate parts on the boards using the PCB layout files that we have included.

The project continues with building and/or integration of the Motherboard, Tx Audio, Rx Audio and Front Panel circuit boards and integration with the pre-assembled controller board. At that point, you will be able to experiment with the front panel controls and/or the remote control functions. Once all that works, you will install the assembled QMX+ transceiver. If you purchased the base Sienna XL model, which is a QRP model, you're done! If you purchased the 10W Amp, you will then install the 10W Amp board along with the 250W-rated Low Pass Filter (LPF) board, which also contains the SWR meter and main antenna T/R reed relay. If you bought the 250W Amp, you will then build and install that board and add a Low Power LPF board to the output of the 10W Amp, so that clean RF power is fed into the 250W Amp. So let's get started!

NOTE: If you would prefer to build all the boards first, you may go directly to the Appendices and do so.



Kit-Building Procedures

The steps involved in building a kit are listed below. Be sure to follow them and you will have a lot of fun building, testing and using your kit.

1. **Check off parts as loaded.** Each board kit contains a list of parts used on that board. We have checked off each part on the right side of the page as it is inserted in the bag. As you remove a part from the bag and load it on the board, cross out its “reference designator” (e.g., “R1”) on the left side of the page. Our method of bagging parts is different from all other kit vendors and will make the task much faster and less error prone. If you are missing any parts, call or email us and we’ll rush replacements immediately.
2. **Parts have been pre-sorted.** Do not remove parts from the bags until called for, to avoid mixing parts up (especially resistors).
3. **Find a picture online.** The parts lists are also included on a flash drive that is shipped with your kit. Almost every part has a hyperlink to the vendor. Make sure you are connected to the Internet, and click the part to get a picture and information about it.
4. **Pay attention to soldering techniques.** Keep your soldering iron clean by using a wet sponge, use appropriate heat and maintain heat long enough to make good solder joints. Solder problems are the number one cause of problems when building kits, so do it right!
5. **Some boards have been pre-loaded with surface mount parts.** Be careful not to flex these boards to avoid having parts snap off.
6. **Take your time!** We know you want to get it done and start using it, but doing it wrong will only delay that moment. Before you start, set up a ventilated, static-free work area with enough room to build the kit. Prepare parts bins and get the tools you will need. If you’re tired, take a break. Enjoy building your kit!
7. **Make sure that you are loading the part that’s called for in the right place.** Once loaded, it can be hard to find a misloaded part. Be especially careful to load polarized parts (connectors, ICs, diodes, electrolytic capacitors) in the right direction.
8. **Once you’ve done a step, put a checkmark inside the parentheses in this manual.** This helps you remember where you left off when you build in stages.
9. **After you have assembled a circuit board, take a moment (just one) to marvel at your handiwork, then spend a few more minutes critiquing it!** Check for solder bridges, unsoldered or insufficiently soldered connections, solder blobs (especially on insulated magnet wire used on toroids), loose screws and electronic parts, reversed polarized components, etc. Sometimes it helps to have a friend check your work.



Safety First!

Your safety is of utmost importance to us. Please read this information before you get started, and remember these rules as you continue building and testing your Sienna XL.

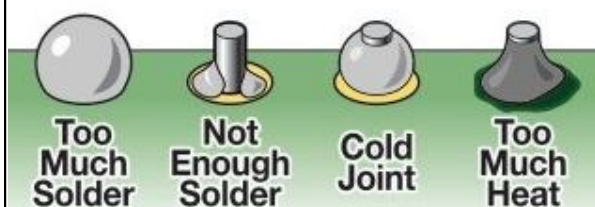
1. **Always have a healthy respect for electricity.** While the voltages present inside the Sienna XL are not lethal, high currents are available (up to 10 Amps when the 250 Watt amplifier is used). Use a power supply with overcurrent foldback or crowbar protection so that in case of high currents the supply will shut down. Set the output current only as high as necessary for a given step.
2. **When measuring voltages inside electronic equipment,** it is generally a good idea to use only one hand, wear rubber-soled shoes and avoid areas with standing water. However, remember that slightly humid environments can prevent static electricity that could damage the electronic parts! Use a humidifier in dry climates.
3. **Do not work on powered electronics by yourself** if at all possible. Have a parent, spouse or friend nearby. If you must work alone, keep a telephone handy in the event you run into problems.
4. **Soldering irons are hot.** They can burn your skin and cause damage to workbenches and carpets. We recommend you use one with an automatic shutoff in case you forget to turn it off when you are done.
5. **Do not work on electronic projects when you are tired.** We know you want to finish it, but accidents are more likely when you are tired. Take breaks! Be careful!
6. **Use proper ventilation in your work area.** Solder contains tin and lead (or tin and silver), and solder fumes should not be allowed to “hover” near your work. Open a door or window, use a fan, and be cognizant of the potential dangers.
7. **When clipping leads, use eye protection** and/or be sure to direct the flying leads down into a nearby trash can. As you gain experience clipping component leads, you will learn how to clip them so that they fall harmlessly away from the board.
8. **Be careful not to cut yourself** when handling sharp objects such as connectors and sheet metal. Keep some tissues, bandages and antibiotic ointment nearby in the event of an injury.
9. **Use common sense** in dealing with unfamiliar things. If you don't understand something, call us or ask a friend for help.



SOLDERING INSTRUCTIONS

Poor soldering accounts for almost all kit building problems. The photographs below show examples of the most common types of bad solder connections and a good one. If you locate any of these bad solder connections in your kit, correct them as described. Study this section carefully before you start building your kit.

Solder joint problems. Solution: Remove solder with a wick or solder sucker (see below), and re-heat the connection, touching the iron to both the component lead and the pad at the same time.



Use a good quality, variable temperature soldering iron with a conical, narrow tip, and set the temperature to 800 degrees F. We provide 10' of recommended solder in each kit. Keep the sponge damp and wipe the tip on the sponge before each solder step.



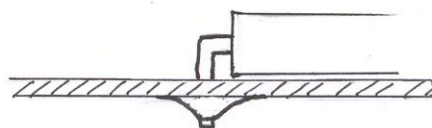
Solder bridge.



Solder that stretches from one trace or pad to another creates a short circuit. Solution: Hold the board upside down and reheat the area. The excess solder will flow down the soldering iron. Another solution is to use a “solder sucker” or solder wick to remove excess solder. Solder suckers work well one or two times on a given connection. After that, they can lift pads off the board.



Good solder connections. A good solder connection looks like this. Solder flows evenly onto both the part and the PC board or chassis component. It is shiny and even, not lumpy and dull. Component leads that are properly soldered can not be moved in the hole. The component lies flat on the board.





STATIC PRECAUTIONS

Many of the components in your kit can be damaged by exposure to static electricity. Please read this page to familiarize yourself with the causes of and solutions to this problem.

When the climate is dry, you can generate thousands of volts simply by walking across a carpet. When you then touch a metal object you can feel the effects of this as you draw a spark! That same spark, often too small to see or feel, can destroy sensitive electronic components. You **MUST** take precautions when working with electronics to prevent damage.

The best solution is to outfit your workbench with anti-static devices – floormats, grounded soldering irons, and workmats with grounded wriststraps. If these are not practical for you, the very least you should do is to discharge yourself to ground after you sit down and before you touch any electronic items, by touching a grounded object such as the corner of a wall.

In a dry environment, simply standing up after sitting in a non-grounded chair can also charge you with electricity. If you stand up to stretch, for example, be sure to re-ground yourself before getting back to work. Don't wear insulated sole shoes and avoid nylon, wool or other

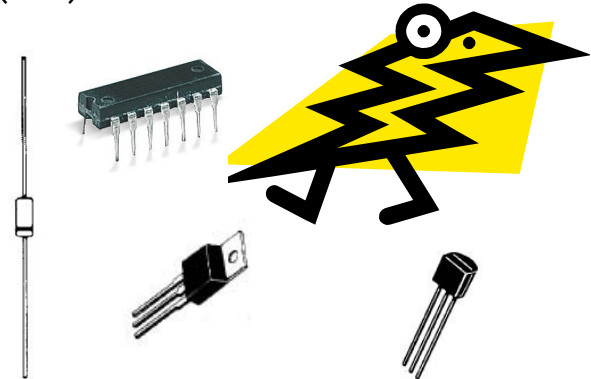
static-producing material in your clothing.

If your work area floor is carpeted, spray fabric softener on it using a hand spray bottle. Fabric softener is conductive and will bleed away carpet static for a few hours.

Don't use a plastic table unless you have a grounded workmat on it. Use a wood or metal table if possible.

Cats are notorious for inducing static into your work area. Don't allow them anywhere near your workbench!

All electronic components are susceptible to static, but semiconductors and assembled boards containing semiconductors are the most prone to damage. These include diodes (including light-emitting diodes [LEDs]), transistors and integrated circuits (ICs).



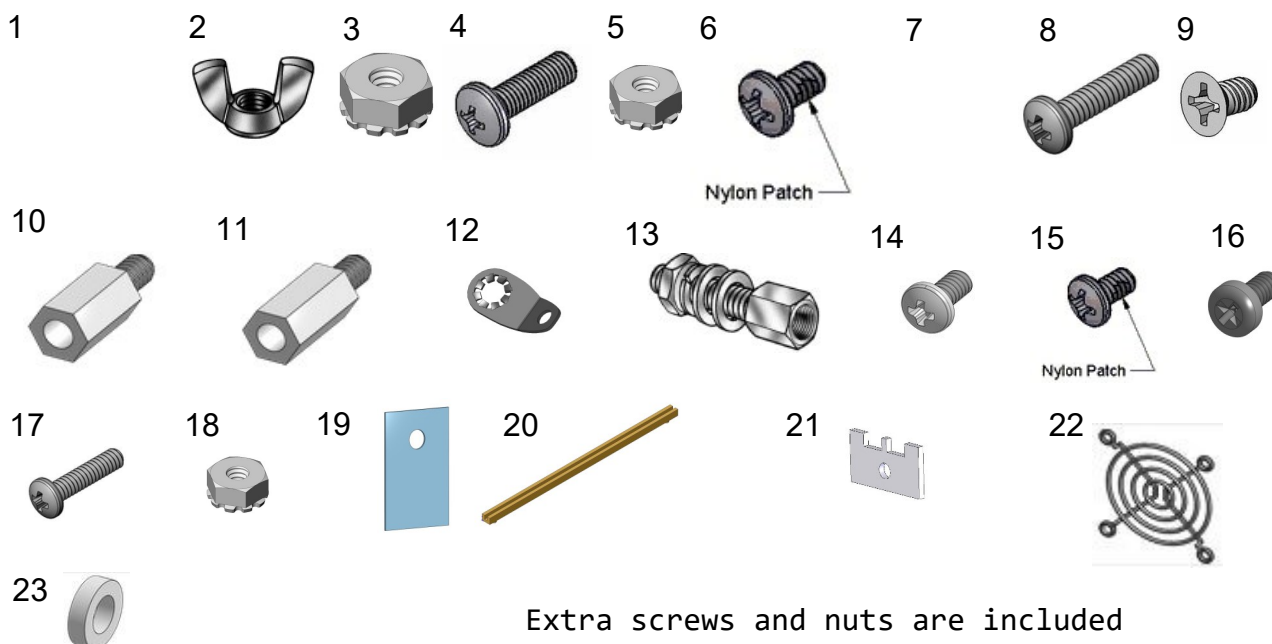
You are a walking lightning bolt! Be careful!



Your Sienna XL build experience starts now! First, verify that you have all the chassis parts shown below.

Chassis Parts

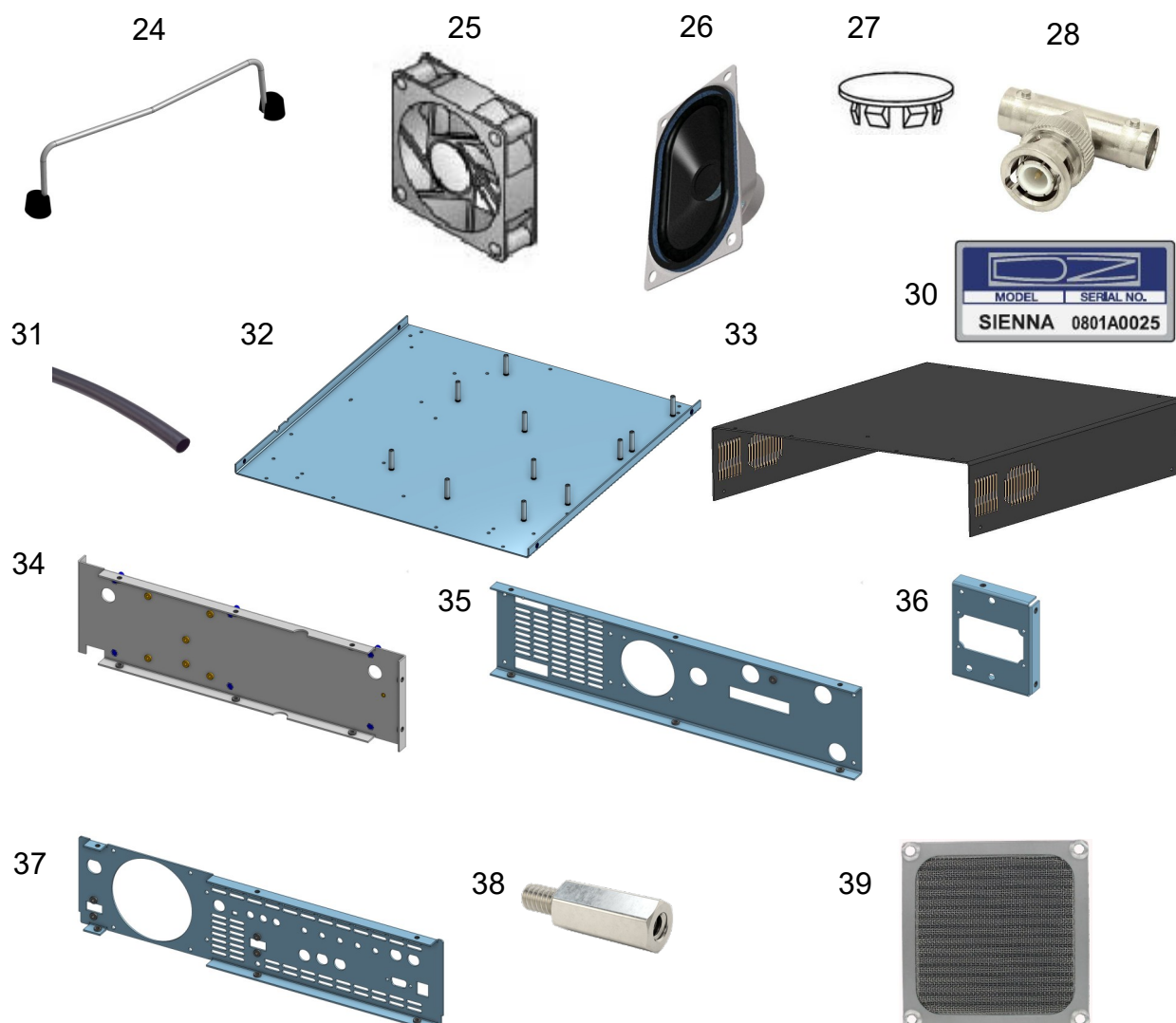
Item	Description	Quantity
1	Hardware #10 Flat Washer 1/2in OD, .05in Thick Zinc-Plated Steel	2
2	Hardware 10-32 Wing Nut Zinc-Plated Steel	1
3	Hardware 10-32 KEPS Nut SS	1
4	Hardware 10-32 x 5/8in PH Phillips M/S SS	1
5	Hardware 6-32 KEPS Nut SS	10
6	Hardware 6-32 x 1/4in PH Phillips M/S SS P/L	32
7	Hardware 6-32 x 1/4in PH Phillips M/S SEMS SS	15
8	Hardware 6-32 x 1/2in PH Phillips M/S SEMS SS	6
9	Hardware 6-32 x 1/4in FH 100 degree Phillips Black SS M/S	19
10	Hardware 6-32 x 7/16in Hex M/F Spacer SS	8
11	Hardware 6-32 x 1/2in Hex M/F Spacer SS	10
12	Hardware #6 internal tooth lockwasher with solder lug	1
13	Hardware 4-40 x 5/16in Jackscrew, washer, lockwasher, nut	2
14	Hardware 4-40 x 1/4in PH Phillips M/S Polycarbonate	2
15	Hardware 4-40 x 1/4in PH Phillips M/S SS P/L	4
16	Hardware 4-40 x 1/4in PH Phillips M/S SS	10
17	Hardware 4-40 x 1/2in PH Phillips M/S SS	3
18	Hardware 4-40 KEPS Nut SS	15
19	Hardware Insulator with adhesive back for TO-220	4
20	Hardware PCB card guide 6in plastic	1
21	Hardware Anderson Powerpole mounting clamp	2 sets
22	Hardware 60mm metal finger guard	1
23	Hardware #6 fiber washer	8



Extra screws and nuts are included



24	Hardware Feet with mtg HW and front tilt bail	823	1
25	Fan 12VDC 60mm x 25mm brushless (2-pin connector added)	592	1
26	Speaker 4 ohm 3W 200Hz-20kHz	686	2
27	Hardware - Hole plug, Nylon 5/8"	269	1
28	Hardware RF adapter BNC tee (FMF)		1
30	Sienna XL serial number sticker	745	1
31	Heatshrink tubing - 1/8"	292	6"
32	Chassis	910	1
33	Top Cover	911	1
34	Long Bracket	912	1
35	Front Bracket	914	1
36	Speaker bracket	915	2
37	Rear Panel	916	1
38	Hardware 4-40 x 7/16" Hex M/F Spacer 3/16 Hex size SS		3
39	Hardware fan guard and filter for 92mm fan		1





Chassis Interconnects

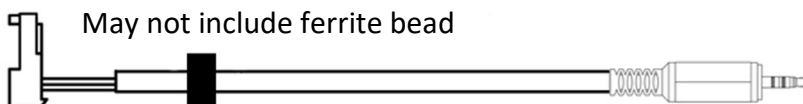


CA-APP DC power input

2-pin



S0105-00101	AUDIO RXAUDIO-LSPKR	14"
S0105-00102	AUDIO RXAUDIO-RSPKR	5"



May not include ferrite bead

3-pin	S0105-00136	CTL TXAUDIO-XCV_PTT	8"
3-pin	S0105-00137	DATA RXAUDIO-XCV-AUX_EAR	8"
4-pin	S0105-00141	AUDIO TXAUDIO-XCV_MIC_KEY	12"



4-pin

4-pin

S0105-00142	PWR MB-XCV
-------------	-------------------



18"

S0105-00125	PWR DCD14V-10W
-------------	-----------------------



S0105-00122	PWR DCD-ONOFF
-------------	----------------------

5-pin, 20"



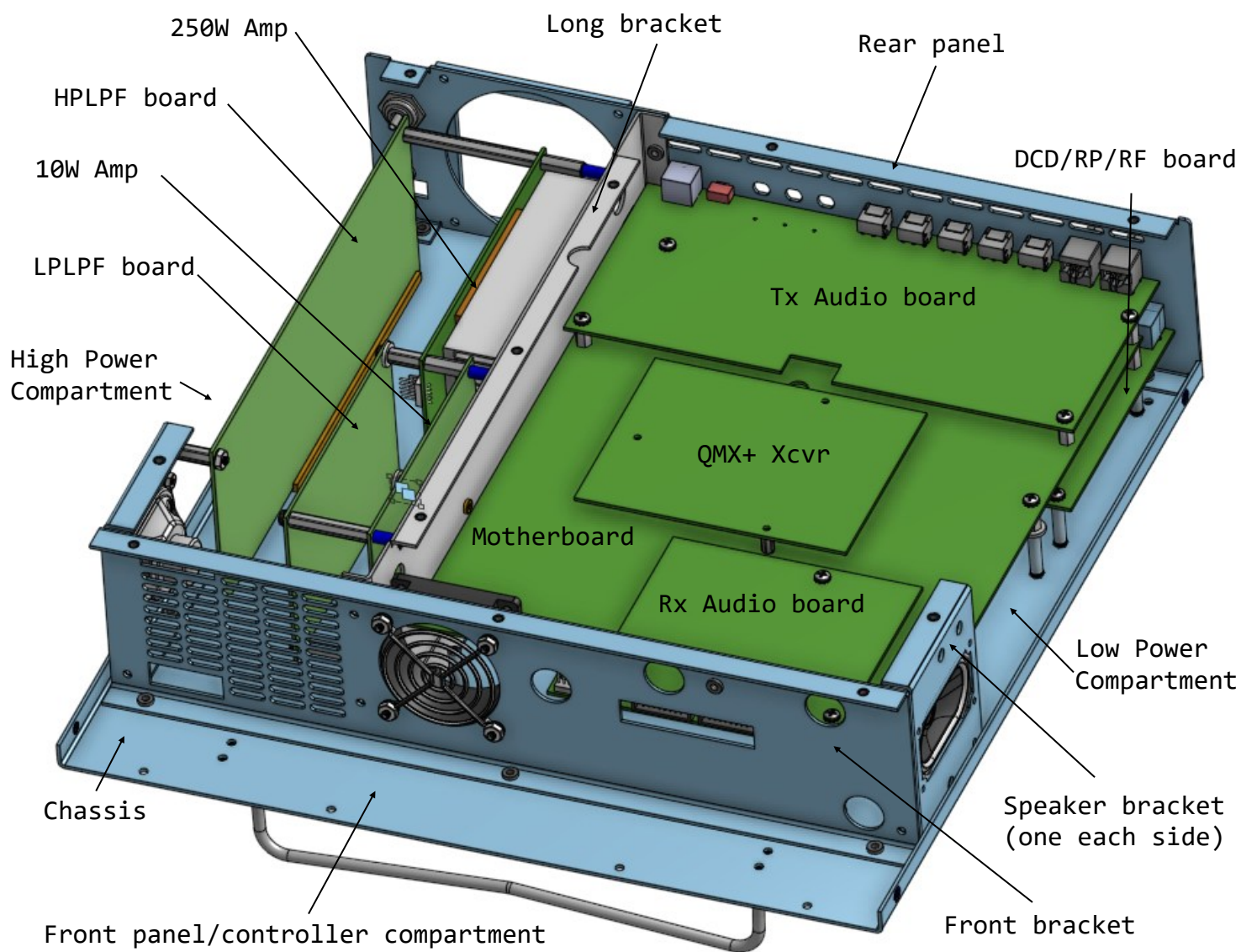
12"

S0105-00145	DATA XCVUSB-TXAUDIO
-------------	----------------------------



10"

S0105-00149	RF XCVANT-TXAUDIO_XVT
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General chassis layout



STEP-BY-STEP ASSEMBLY: Chassis, DC Power

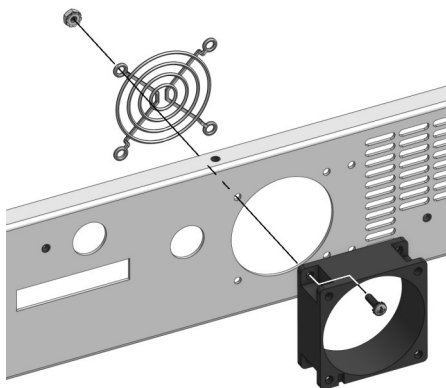


IMPORTANT! Use screws without built-in lockwashers to fasten chassis parts to each other. (Some have Nylon patches.) For simplicity, these are referred to as “screws” in the steps.

Use SEMS screws (screws with built-in lockwashers) ONLY for attaching circuit boards to standoffs and where instructed.

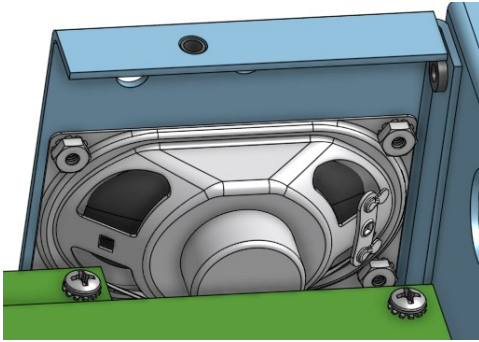
Refer to the “General chassis layout” drawing on page 16.

- () Place the chassis bottom on the pieces of stiff foam included in the packing materials. Push a 6" plastic board guide into the holes in the high-power compartment. Use a small hammer to fully seat the guide if necessary.
- () Attach the fan to the back side of the front bracket with four 6-32 x 1/2" SEMS screws, a metal finger guard and four 6-32 KEPS nuts. (Hint: use a 5/16" socket wrench on 6-32 KEPS nuts.) Make sure the airflow arrow on the fan points away from the sheet metal, with the power cable on the bottom facing the back of the radio. See below.
- () Locate left speaker cable S0105-00101 (AUDIO RXAUDIO-LSPKR). Twist the wires about 2 turns per inch if they are not already twisted.
- () Cut two pieces of heatshrink tubing to 1/2" and slide one piece over one end of each wire.
- () Solder the red wire to + and the black wire to - on one loudspeaker. Then slide the heatshrink over the connection and apply heat to shrink the tubing over both connections. (A heat gun is preferable, but you can also use your soldering iron for this.)
- () Locate right speaker cable S0105-00102 (AUDIO RXAUDIO-RSPKR). Repeat the above procedure for the left loudspeaker.
- () Attach either speaker to one of the speaker brackets using four 4-40 x 1/4" screws and 4-40 KEPS nuts. The screws attach to the outside of the bracket and the nuts attach to the screws on the speaker

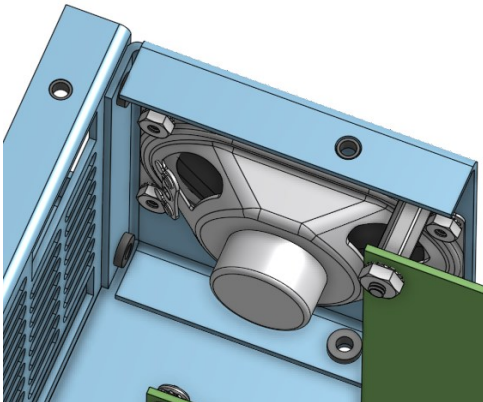




side. Position the terminals such that they point towards the flange on the bracket (i.e., not the open unfolded side). See drawing below.



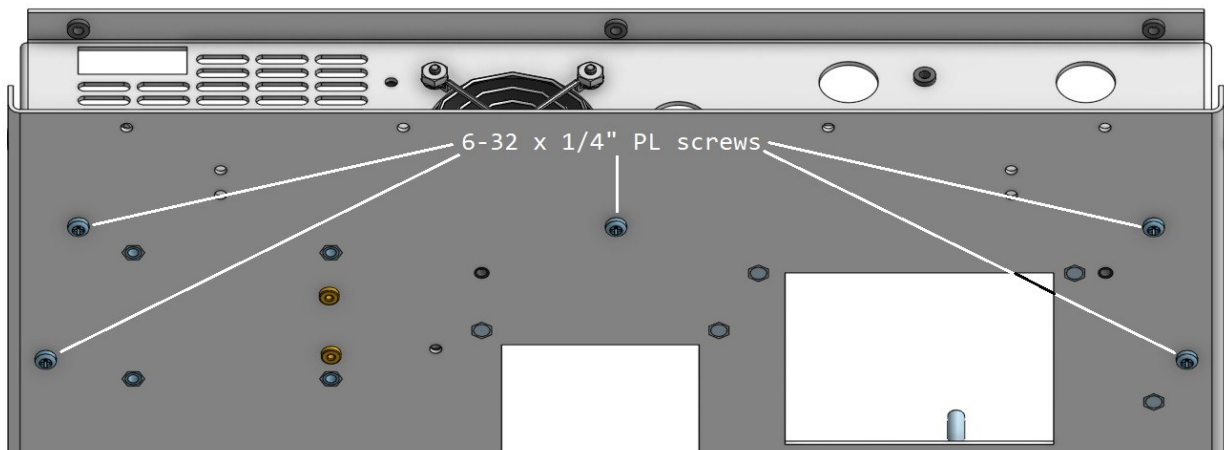
- () Repeat the previous step for the other speaker. See drawing below.



- () Attach the front bracket to the chassis bottom using

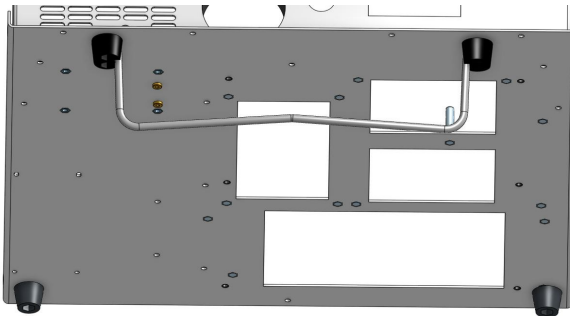
three 6-32 x 1/4" PL screws as shown below. (Note: "PL" refers to the Nylon patch compound that is on the threads. **Do not use the screws with attached lock-washers, called "SEMS".**) See below.

- () Attach the speaker bracket that has the speaker with the longer cable to the LEFT side of the chassis. Secure it to the front bracket and the chassis using three 6-32 x 1/4" PL screws.
- () Attach the speaker bracket that has the speaker with the shorter cable to the RIGHT side of the chassis. Secure it to the front bracket and the chassis using three 6-32 x 1/4" PL screws.
- () Route the left speaker cable under the fan and into the low power compartment.
- () Locate the "tilt bail" with mounting hardware. Follow mounting instructions provided with the bail. Refer to

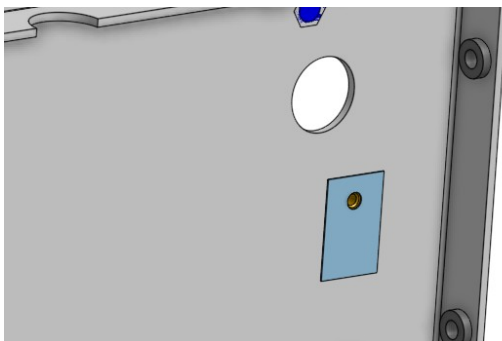




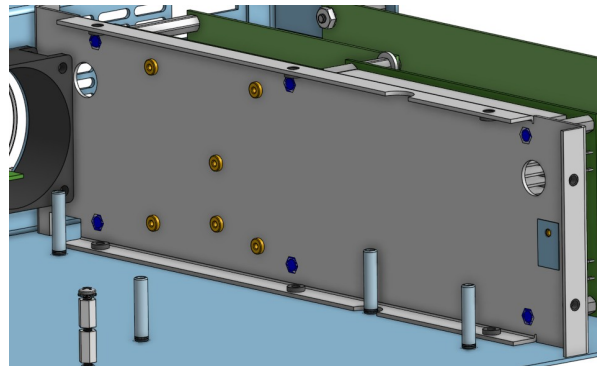
the drawing below for mounting locations of the front feet (with bail) and rear feet.



- () Locate the long bracket. Affix an adhesive-backed insulator ("Thermalsil") over the small hole toward the back, on the side that does NOT have a captive nut. Align the hole in the insulator with the hole in the bracket and make sure the insulator extends toward the bottom of the bracket.



- () Position the long bracket on the left side of the fan as viewed from the front. Attach the long bracket to the front bracket using two 6-32 x 1/4" PL screws and a #6 solder lug, and to the bottom chassis using three 6-32 x 1/4" PL screws. See below.

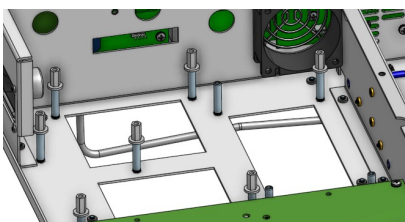


- () Build the DCD/RP/RF Board (see Appendix A). Test the power section (DCD) as described, finish building the board as described in Appendix A, then return here to continue assembly.
- () Re-install the DCD/RP/RF board as first done in the appendix, using two 6-32 x 1/4" SEMS screws and two 6-32 x 1/2" hex M/F standoffs. Re-attach the power transistor to the long bracket using a 4-40 x 1/4" polycarbonate (plastic, non-conductive) screw.
- () Locate on/off switch cable S0105-00122 (PWR DCD-ONOFF). Disconnect the on/off switch by pressing down on the latch and pulling the black connectors apart. Set the side

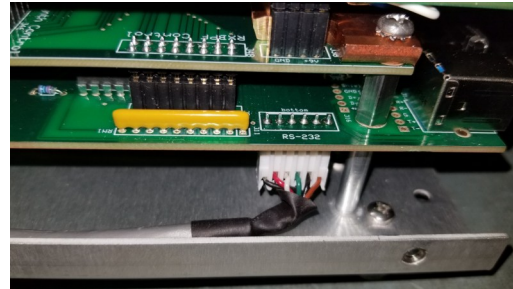


containing the on/off switch aside.

- () Route the remainder of the on/off switch cable from J20 (On/off sw) on the bottom side of the DCD/RP/RF board, along the chassis bottom, and through the notch in the bottom front of the long bracket, near the fan, into the high power compartment, then through the top rectangular hole in the front bracket and into the controller compartment.
- () Locate cable S0105-00125 (PWR DCD14V-10W). Attach the lug on the red wire to the screw terminal marked +14V on the DCD/RP/RF board. Attach the lug on the black wire to the GND screw terminal. Pass the cable along the long bracket then through the notch at the bottom front (under the fan) and into the high power compartment. Wrap the red lead with electrical tape.
- () Insert a 1/16" fiber washer and 6-32 x 1/2" hex M/F standoff into the seven 1" standoffs in the low power compartment shown below. Tighten them securely, but be careful not to crack the fiber washers. Three standoffs do not have fiber washers.



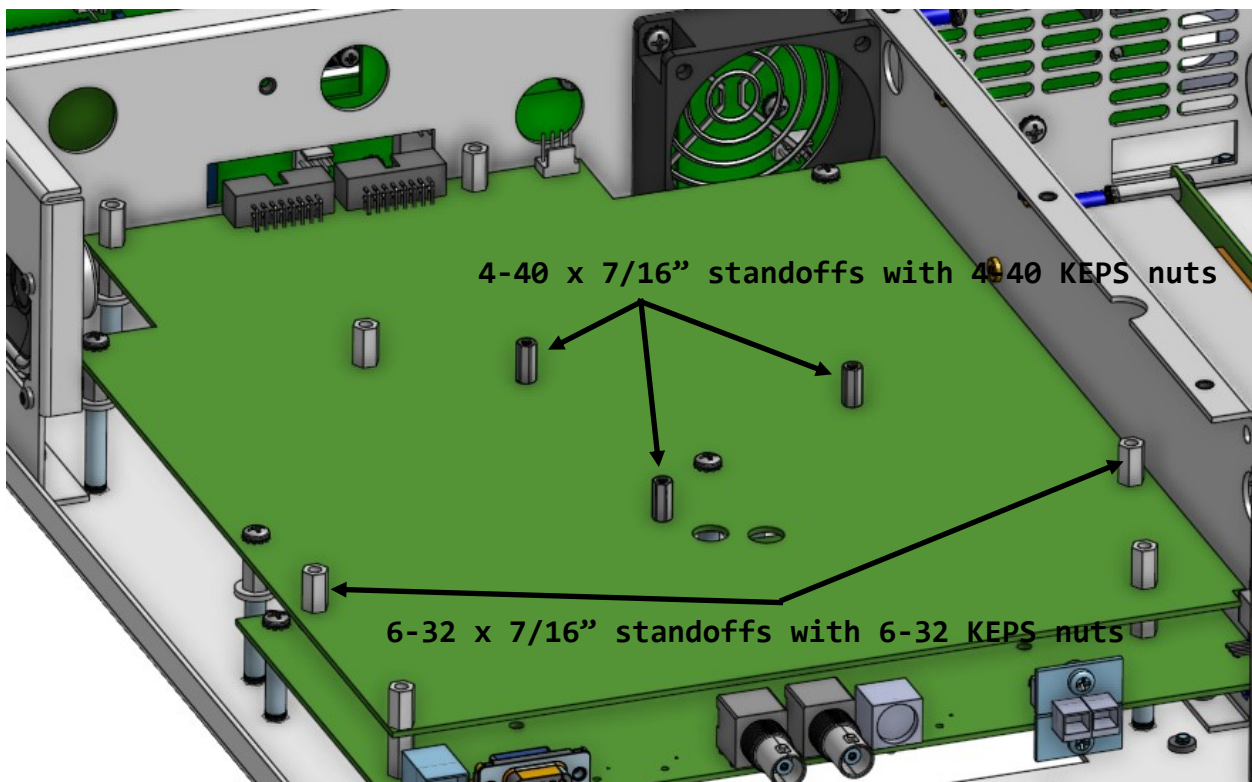
- () Insert the RS-232 control cable (S0105-00115 – DATA CONT-DCD SERIAL) into J11 on the bottom of the DCD/RP/RF board.



- () Route the cable along the bottom right side of the chassis, under the right speaker and into the round opening on the bottom of the front bracket.



- () Check to make sure you used nine 1/2"-long standoffs on the top side of the DCD/RP/RF board and on top of the 1/16" Nylon spacers. They are easily mistaken for 7/16" standoffs.
- () Build the Motherboard (see Appendix B).
- () Insert two 6-32 x 7/16" hex M/F standoffs to the top of the board. Secure them with 6-32 KEPS nuts on the bottom. See next page.
- () Insert three 4-40 x 7/16" hex M/F standoffs to the top of



Location of standoffs and screws on top side of Motherboard.

the board. Secure them with 4-40 KEPS nuts on the bottom. Also see drawing above.

- () Carefully position the motherboard over the DCD/RP/RF board so that all connectors and mounting holes line up and the board is not crooked. View the position of the board from the side to make sure the visible connectors line up. Once it looks properly aligned, push down firmly to seat it against the standoffs.

- () Using a flashlight, examine as many connectors as possible between the bottom of the Motherboard and the DCD/RP/RF

board. Make sure there are no bent pins. If you discover some bent pins, carefully remove the board, straighten the pins, and try again.

- () Secure the Motherboard to the DCD/RP/RF board and the other standoffs using five 6-32 x 7/16" hex M/F standoffs and four 6-32 SEMS screws as shown above.



STEP-BY-STEP ASSEMBLY - Front Panel Integration

Refer to detailed assembly drawings and parts list on pages 26-30 for the following steps.

- () Locate the front panel kit.
- () Build the two front panel boards. See Appendix C.
- () Sort the mounting hardware.
- () Make sure that the rotary switch that is mounted to the front panel board has had its tab bent 90 degrees as described in Appendix C.
- () Attach the two front panel boards to the back side of the front panel sheet metal using nine 6-32 x 1/4" SEMS screws and eight 6-32 x 7/16" Hex M/F spacers where noted. Do NOT use PL screws for attaching circuit boards.
- () Push and release all buttons to make sure they do not stick when pressed. If they do, loosen the mounting screws, reposition the board and try again.
- () Wash your hands to remove grease and dirt before handling the front panel overlay and displays.
- () Discharge any static electricity by touching a grounded metal object.
- () Open the display boxes and remove the displays from their antistatic bags. Remove the protective plastic sheet from each display. Handle the display by the edges to keep the glass as clean as possible.
- () Set the two displays on the small standoffs on the front panel sheet metal so that the text reads correctly left to right when the panel is viewed from the back and the display openings in the sheet metal are toward the top. Both displays are the same, so either one can be mounted in either space. Use four 4-40 x 3/16" SEMS screws for the outer display and three for the inner display. Use a 4-40 x 9/16" Hex M/F spacer instead of a screw where shown. Tighten securely but do not overtighten to avoid damaging the display boards.
- () Make sure there are no nuts attached to the controls that pass through the front panel sheet metal. If there are, remove them.
- () Remove the backing from the polycarbonate overlay (front panel sticker). Holding it carefully over the front of the sheet metal, lower it into place, wiggling it slight-



ly to get a feel for the clearance around the buttons as you do so. Once it is in place, apply pressure, using your fingers, to stick it securely to the sheet metal part. Push firmly to the sides to remove any air bubbles. *This is a critical step, so take time to do it right.*

- () Remove the lockwasher and nut from each of the rotary pulse generators (rpg) (tuning controls) and insert each rpg in the large holes beneath the displays. Make sure the tab locks into the small rectangular hole.
- () Fasten the RPGs to the front panel using the lockwashers and nuts. Tighten securely using a small wrench, but do not overtighten to avoid cracking the overlay. Be careful not to scratch the overlay while tightening the nuts.
- () Locate the nut and lockwasher that you previously removed from the rotary switch when you assembled the front panel circuit board. Attach them to the switch and tighten. Do not overtighten to avoid cracking the overlay.
- () Remove the controller board from its anti-static bag. Handle carefully to avoid static discharge that could

damage this board.

- () Place the controller board over the connectors on the front panel boards and push down firmly, making sure the connectors are lined up. Apply pressure to one side, then other, then the middle to avoid flexing the circuit board.
- () Fasten the controller to the standoffs using eight 6-32 x 1/4" SEMS screws and one 4-40 x 3/16" SEMS screw (see drawings).

Refer to the pictures on pages 31-32 for help identifying cables.

- () Locate gray ribbon cable S0105-00116 (DATA CONT-TXAUDIO). Insert one end into the bottom of two 16-pin connectors, J2 (Tx Audio), on the Controller board. Fold the cable downward, then again at right angles such that it runs along the front of the front bracket. Fold the other end at right angles and insert it into the **left** right-angle connector J11 (Tx Audio Ctrl from Controller) on the motherboard.
- () Insert one end of the other gray ribbon cable S0105-00117 (DATA CONT-RXAUDIO) into the top 16-pin connector, J15 (Rx Audio), on the Controller



STEP-BY-STEP ASSEMBLY - Front Panel Integration

board. Fold the cable downward, then again at right angles such that it runs along the front of the front bracket in front of the other ribbon cable. Fold the other end at right angles and insert it into the **right** right-angle connector J4 (RX Audio Ctrl from Controller) on the motherboard.

- () Make sure the two ribbon cables are not positioned right up against the fan guard, which would block airflow.
- () Locate the stereo minijack to 3-pin connector S0105-00103 (**AUDIO** RXAUDIO-HP). Remove the knurled nut and save it. Pass the minijack through the front panel hole on the far left side with a headphone symbol next to it. Reattach the nut and tighten securely using the minijack tool. Dress the cable neatly along the top of the cables in the controller compartment. Pass the other end through the left of the top two round holes on the right side of the front bracket.
- () Locate cable S0105-00112 (**CTL** CONT-MIC). Remove the nut and lockwasher. Insert the 6-pin connector and stereo cable through the mic hole in the bottom left of the front pan-

el. Pass the mic audio cable through the lockwasher and then the nut and then do the same for the 6-pin connector. Tighten the nut on the back side of the panel using a small wrench.

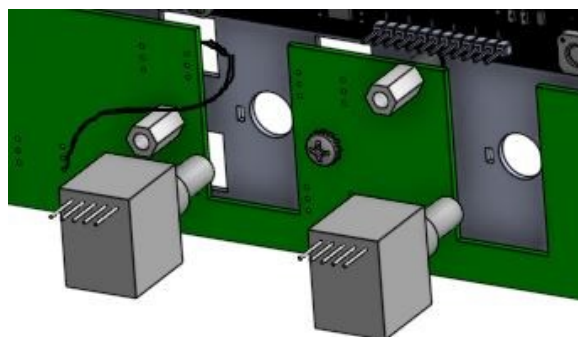
- () Solder the free black wire on the mic cable to the solder lug that you earlier installed on the bottom screw holding the long bracket to the front bracket.
- () Attach the 6-pin connector at the end of the mic cable to J20 (Mic In) on the controller board.
- () Locate cable S0105-00105 (**AUDIO** CONT-RXAUDIO_ST). Connect one end to J11 (ST/QMXIO) on the Controller board. Route the cable through the round opening on the upper right side of the front bracket.
- () Connect the free end of the 6-pin connector on S0105-00115 (**DATA** CONT-DCD_SERIAL) to J4 (RS232C) on the Controller board.
- () Locate cable S0105-00123 (**PWR** MB-CONT). Connect one end to J1 (Power) on the Controller board. Run the other end through the left round hole on the top right side of the



front bracket and into the low-power compartment. Connect the other end to J10 (DC Power to Controller) on the motherboard.

- () Locate 5-pin 17" rear panel key cable S0105-00109 (CTL CONT-TXAUDIO_KEY). Connect one end to J3 on the controller board. Run the other end through the bottom right hole in the front bracket. It will be connected to the Tx Audio board in a later step.
- () Locate the two 2" display power/control cables S0105-00111 (CTL CONT-DISP). Connect one end of each one to J25 and J22 and the other ends of each to the display power connectors.
- () Locate gray ribbon cable S0105-00119 (DATA CONT_DISP). Attach one end to J25 (GPO) on the controller board. Attach the other end to the mating connector on the end of the rightmost display.
- () Locate two cables S0105-00110 (CTL CONT_RPG). Attach one end of one of the cables to J12 and the other cable to J13 on the controller board. Attach the other ends of each cable to the two RPGs (tuning controls). Make sure the cables exit the connectors on the RPGs facing the circuit board. Refer to the detail picture on page 32.

- () Locate cable S0105-00108 (CTL CONT-FPKEY). Remove the knurled nuts from both minijacks. Insert the minijack with three connections into the right hole at the bottom right of the front panel (labeled "Paddles"). Insert the other minijack into the hole labeled "Manual". Attach the knurled nuts to the



connectors and tighten them using pliers, being careful not to scratch the Lexan panel. Attach the other end of the cable to J32 (FP Key) on the controller board.

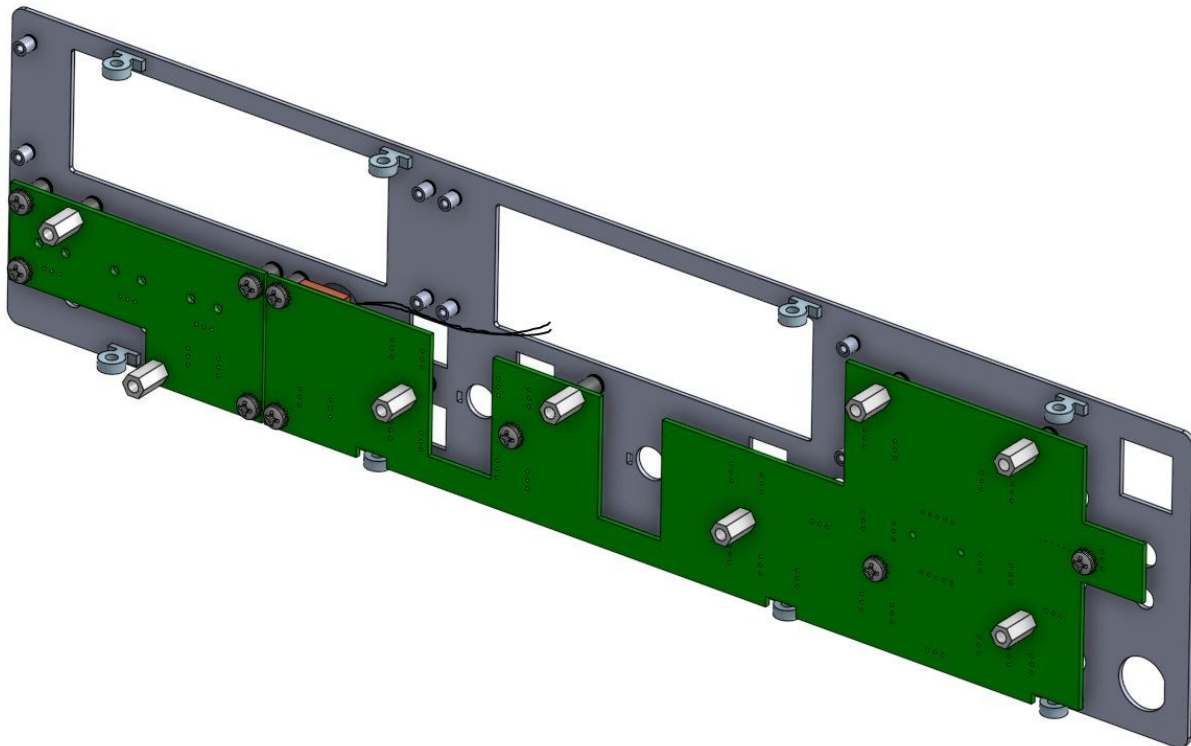
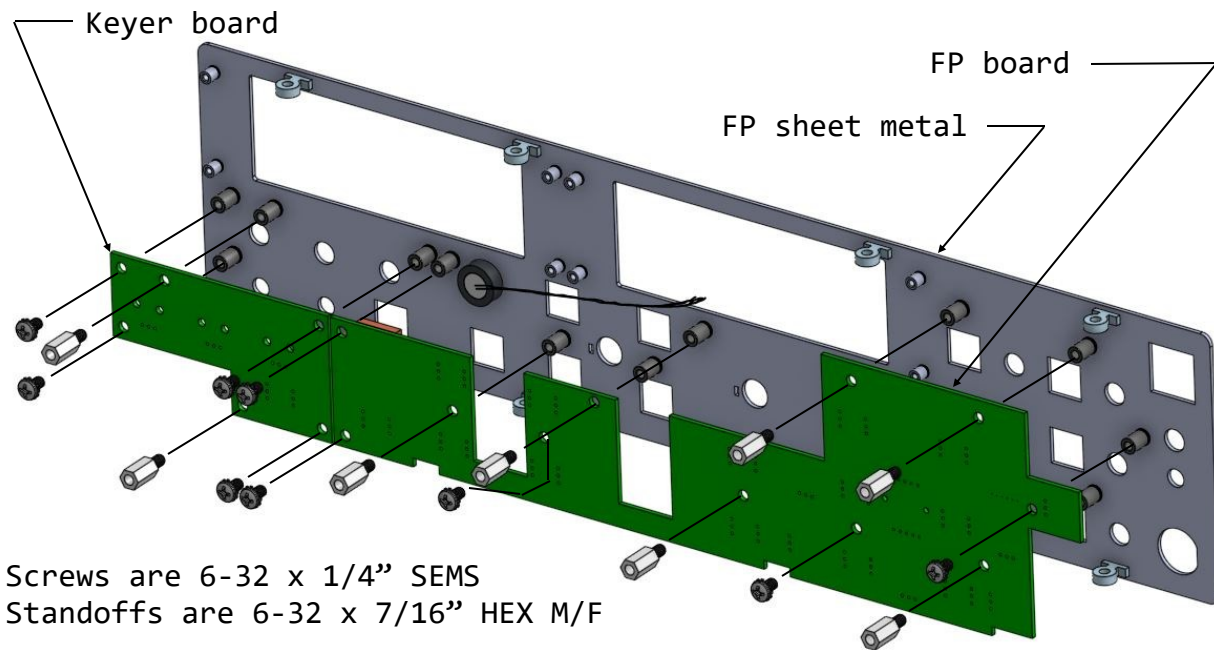
- () Temporarily attach the front panel assembly to the chassis bottom using two 6-32 x 1/4" PL screws. (Four are used when assembly is complete - these just hold it down while you work on other things.)



Front Panel Integration

Hardware

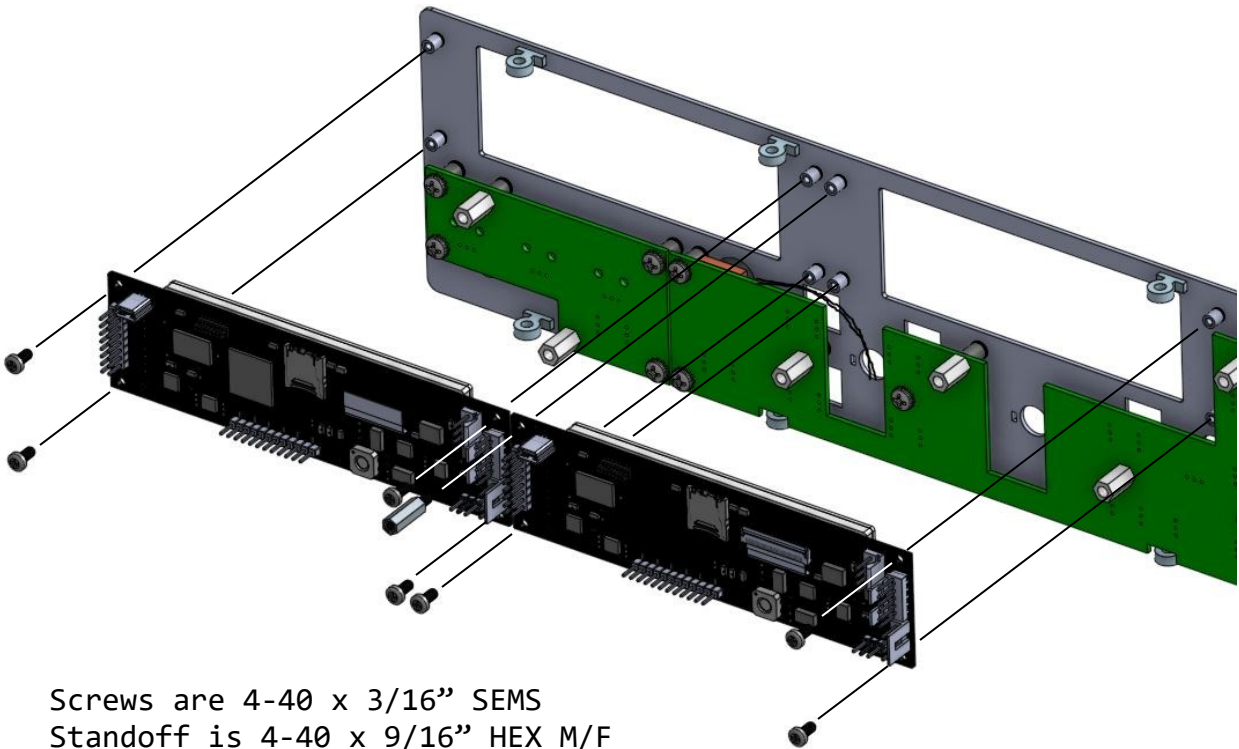
Description	Quantity
Encoder optical RPG 5V 2-bit Gray code 128ppr 1/4in shaft w/nut	2
Knob - .9in dia matte finish no dial pointer	1
Knob 1.75in dia glossy finish finger dimple no indicator line	1
Knob .5in dia matte finish indicator line top/side	12
Hardware 6-32 x 1/4in PH Phillips M/S SS SEMS	17
Hardware 6-32 x 7/16in Hex M/F Spacer SS	8
Hardware 6-32 KEPS Nut SS	2
Hardware 4-40 x 9/16in Hex M/F Spacer SS	1
Hardware 4-40 x 3/16in PH Philips M/S SS SEMS	8
Tool hex-key .05in	1
Tool hex-key 1/16in	1
Tool hex-key 5/64in	1
Tool Knurled nut fastener 6mm	1
Front Panel sheet metal	1
Lexan overlay	1
Display Color graphics 480 x 116 I2C 5V	2
Controller board - Assembled and Tested	1



Front panel circuit board mounting

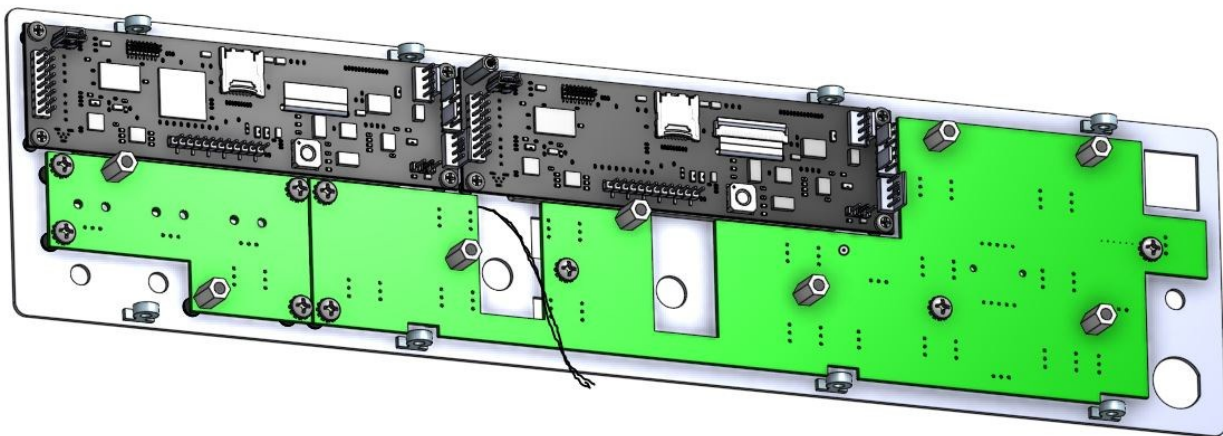


STEP-BY-STEP ASSEMBLY - Front Panel Integration

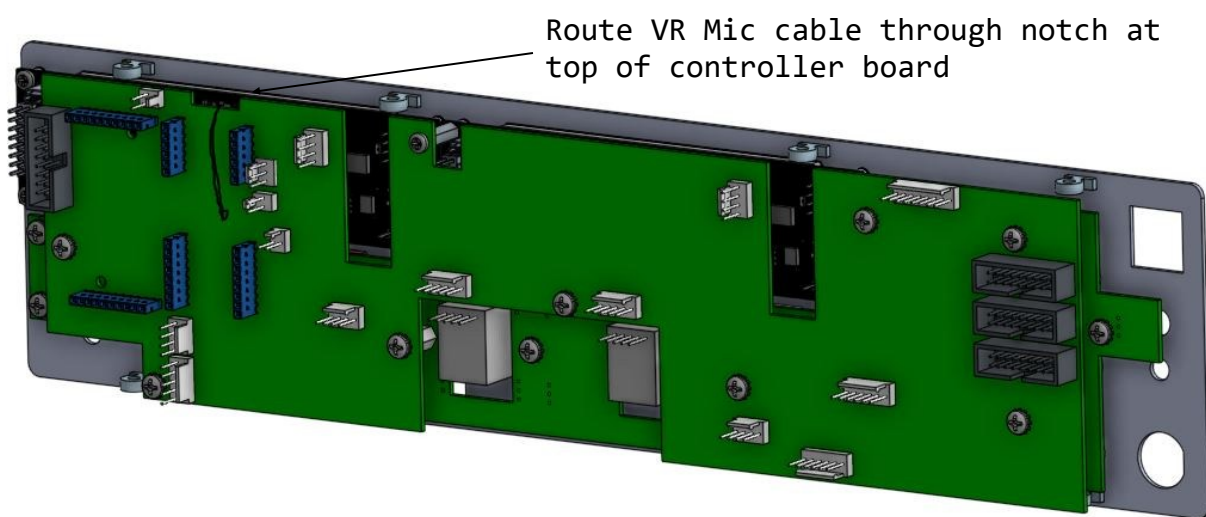
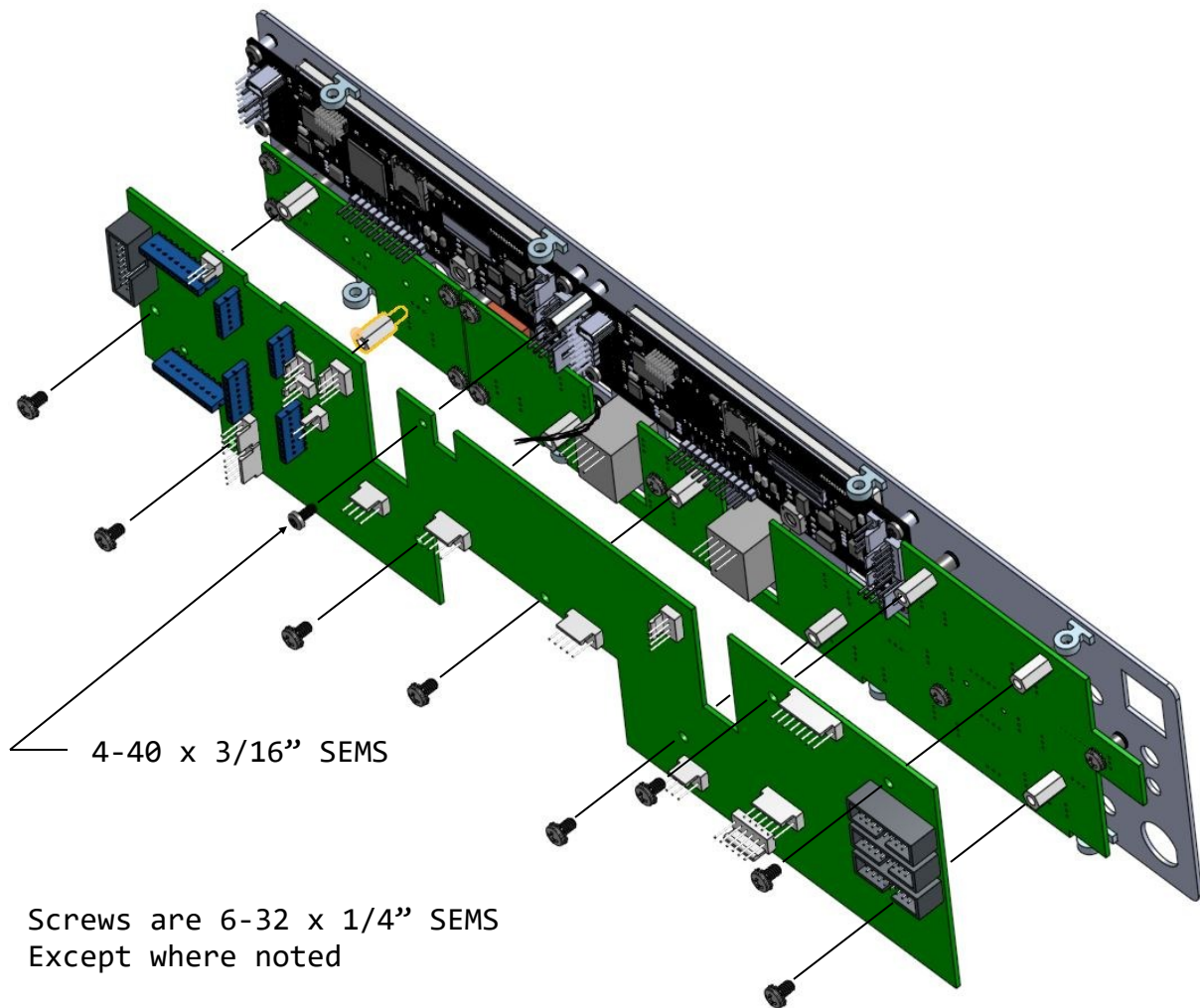


Screws are 4-40 x 3/16" SEMS
Standoff is 4-40 x 9/16" HEX M/F

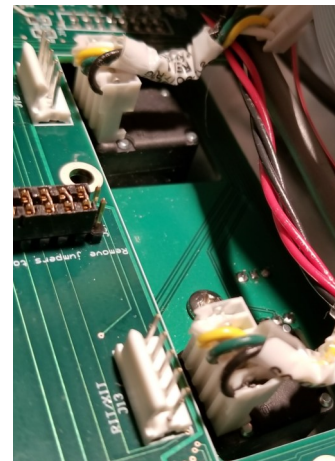
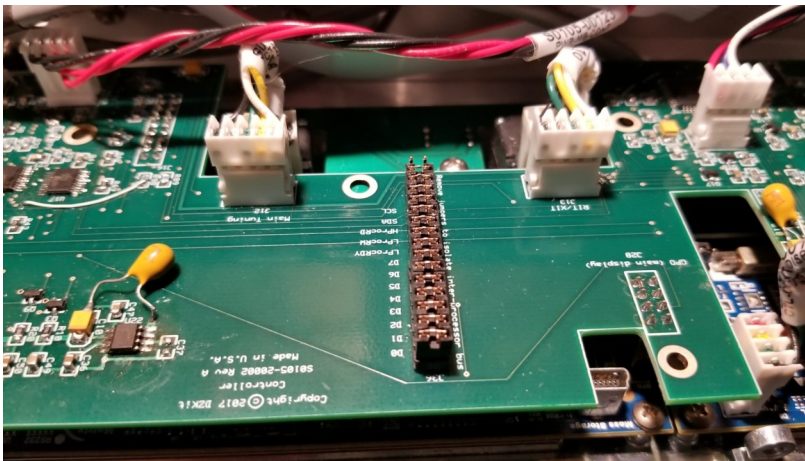
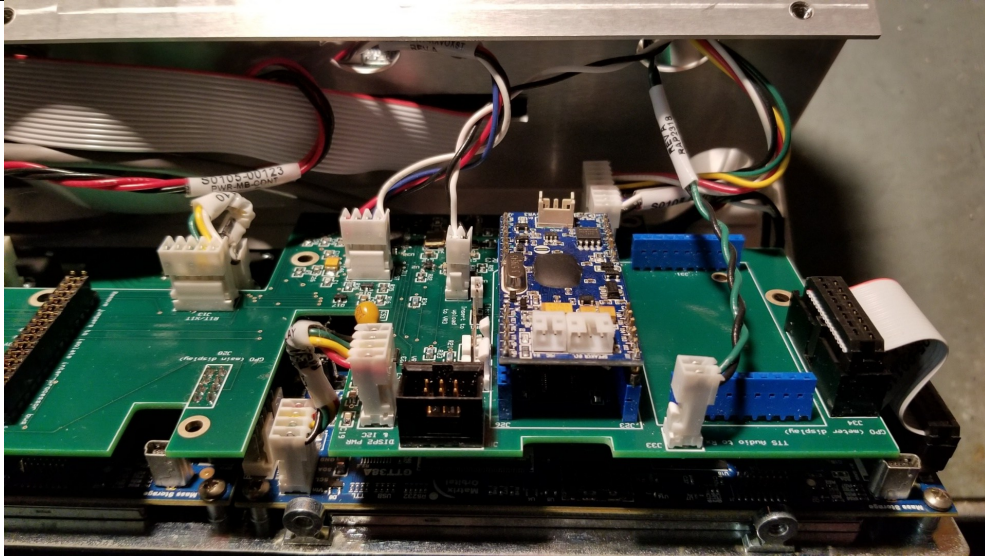
Display mounting



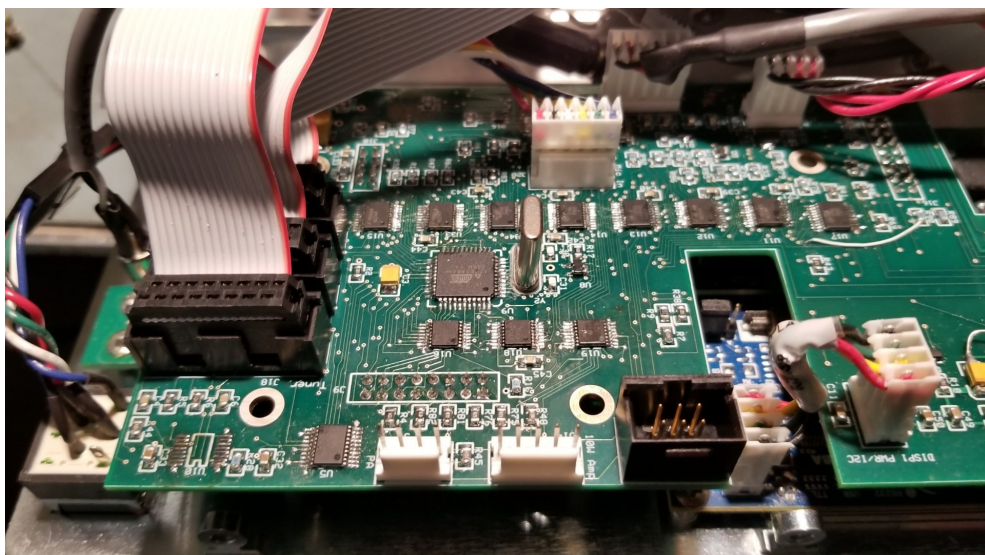
Front panel circuit board and display mounting



Controller board mounting



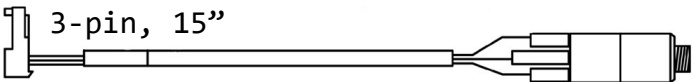
RPG connector detail



Controller board cables



Front Panel Interconnects



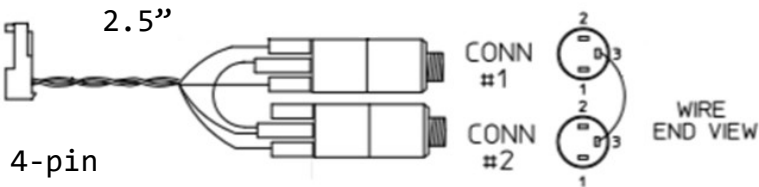
S0105-00103	AUDIO RXAUDIO-HP
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Stereo minijack
appearance may vary

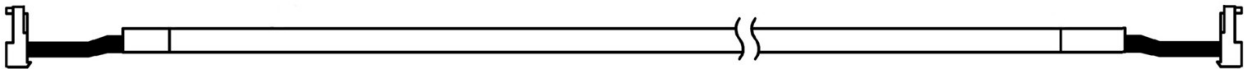


S0105-00105	AUDIO CONT-RXAUDIO_ST
S0105-00109	AUDIO CONT-TXAUDIO_KEY
S0105-00110	CTL CONT-RPG
S0105-00111	CTL CONT-DISP
S0105-00123	PWR MB-CONT

4-pin, 6.5”
5-pin, 17”
5-pin, 2” qty 2
4-pin, 2” qty 2
4-pin, 9”



S0105-00108	CTL-CONT-FPKEY
-------------	----------------

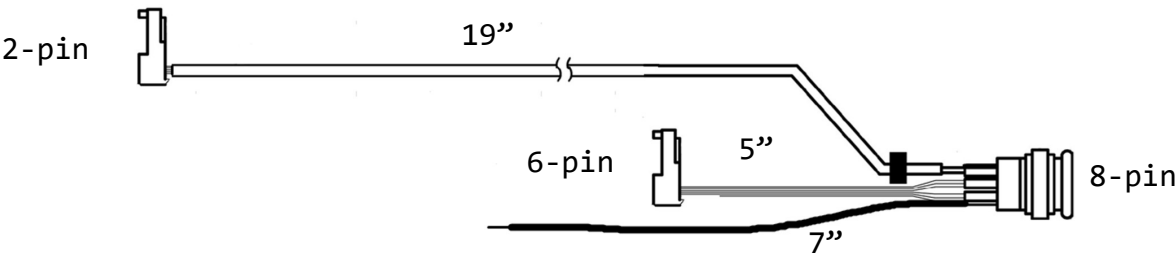


S0105-00115	DATA CONT-DCD_SERIAL
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6-pin, 24”



Front Panel Interconnects, continued



S0105-00112	CTL CONT-MIC
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S0105-00116	DATA CONT-TXAUDIO	16-pin, 12"
S0105-00117	DATA CONT-RXAUDIO	16-pin, 12"
S0105-00119	DATA CONT-DISPLAY	16-pin, 2"



STEP-BY-STEP ASSEMBLY - Initial Tests

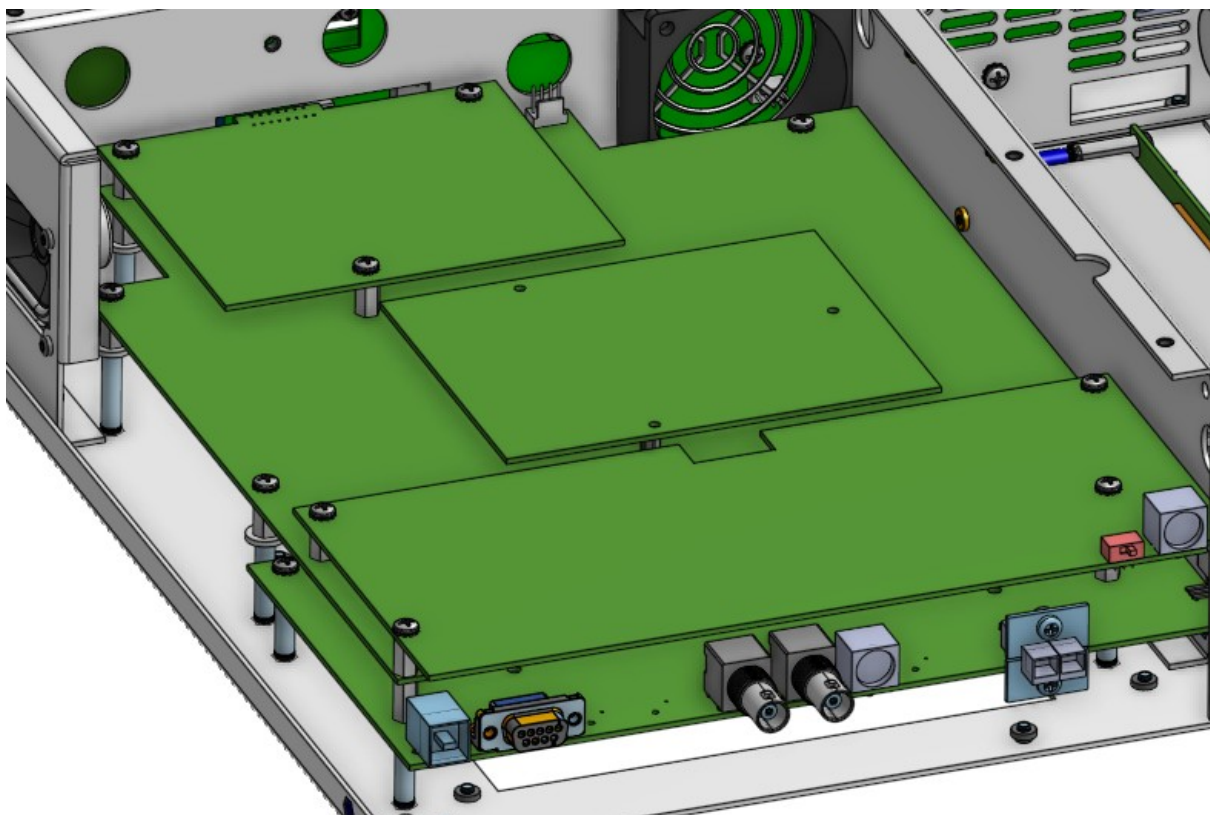
- () Attach knobs to the front panel controls. The small knobs have indicators. For the pots, turn the control all the way counter-clockwise (left) and place the knob so that the pointer is at the 7:00 position (slightly left of straight down). For the switch, use the 12:00 (straight up) position. Tighten the set screws using the hex wrenches provided. The small knobs use .05", the medium knob uses 5/64" and the large tuning knob uses a 1/16" hex key.
- () Insert the on/off switch into the square opening in the upper left corner of the front panel. Orientation is not important. Re-attach the black connector to the free end of the on/off cable that you placed in the compartment earlier.
- () Turn on the radio by applying 11-15VDC power to the APP connectors on the back panel and pushing the on/off switch.
- () The front panel pushbuttons should light up briefly and then go out. Both displays should show the DZ logo for a few seconds, then come up with the main display at 14 MHz and the meter displays showing Forward Power and S-Meter. If the right display is dark, don't panic! The brightness of the meter display defaults to 0. Push the Menu button, then rotate the large knob until the "Brightness" line is highlighted. Use the small knob to change it to 255. Press Menu again to exit. Refer to the User's manual for detailed information on use of the menu.
- () Push all buttons one at a time and note the response. The LEDs inside the buttons should light when you push the button. Turn the controls to observe their responses. At this point, since you have not yet installed the QMX+ transceiver, many of the front panel controls will not seem to do anything. That's OK. As long as it lights up and some buttons respond, you can be sure that the controller and front panel boards are working.
- () Touch the meter face anywhere and verify that you can select other meters from the menu showing in the display.
- () Turn off the power and remove the DC inputs.
- () Discharge any static that has built up by touching something metallic.



STEP-BY-STEP ASSEMBLY - Tx/Rx Audio/QMX+ Integration

Refer to the drawing below for board placement.

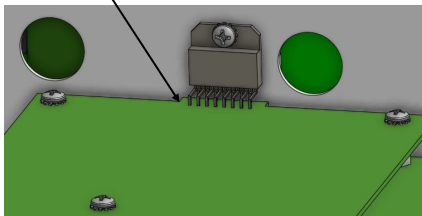
- () Remove the TxAudio board from its antistatic bag.
- () Place the board on the rear section of the motherboard, carefully lining up the connectors and the mounting holes. Push down firmly to seat the board in the connectors. Secure the board to the standoffs using four 6-32 x 1/4" SEMS screws.
- () Locate the QMX+ board. If you have not yet assembled it, do so according to the QRP Labs instructions. Line up its mounting holes as shown below. Secure it to the standoffs using three 4-40 x 1/4" SEMS screws. Leave the QMX+ front panel in place.
- () Remove the Rx Audio board from its antistatic bag. Remove the loose audio amplifier IC that is packed with it.
- () Place the board on the front section of the motherboard, carefully lining up the connectors and the mounting holes. Push down firmly to seat the board in the connectors. Secure the board to the standoffs using three 6-32 x 1/4" SEMS screws.



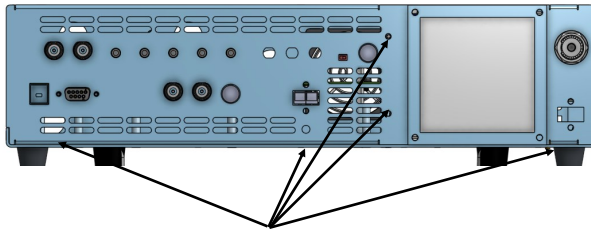


- () Insert the audio amplifier IC into the board at the holes marked "U6". Line up the mounting hole with the hole on the front bracket and secure the part with a 6-32 x 1/4" SEMS screw.

- () Solder the leads from the top of the board.



- () Locate the rear panel sheet metal. Wiggle it over the connectors until it is flush with the chassis. Secure it with 6-32 x 1/4" PL screws, three places on the bottom and two where the long bracket touches it. See below.



6-32 x 1/4" PL screws

- () Insert a 5/8" Nylon hole plug in the "Antenna" hole at the far right of the rear panel
- () Attach the Anderson Powerpole mounting bracket to the 48V opening beneath the antenna. Secure it with two 6-32 x 1/4" PL screws. (The APP con-

nector is installed only if you have the 250W option.)

- () Route the cable that is wired to the headphone jack (**AUDIO** RXAUDIO-HP) through an opening in the front bracket and connect it to J6 (Phones) on the Rx Audio board.

- () Locate the cable that is connected to J11 (**AUDIO** CONT-RXAUDIO-ST) on the Controller board. Connect the other end to J12 (ST G SRX STX) on the Rx Audio board.

- () Route the left speaker cable along the bottom of the chassis, beneath the fan, and plug the connector into J5 (SPKR-L) on the Rx Audio board.

- () Route the right speaker cable along the top of the Rx Audio board and plug the connector into J4 (SPKR-R) on the Rx Audio board.

- () Locate the 2-pin microphone cable coming from the front panel cable **CTL** CONT-MIC. Route it into the low power compartment along the top of the boards, next to the long bracket, and plug the connector into J6 (Mic In) on the Tx Audio board.

- () Locate cable S0105-00136 (**CTL** TXAUDIO-XCV_PTT). Connect this cable from J11 (PTT) on the Tx Audio board to the



QMX+ rear panel connector labeled PTT. The QMX+ rear panel is not present, but it looks like this viewed from its rear panel:



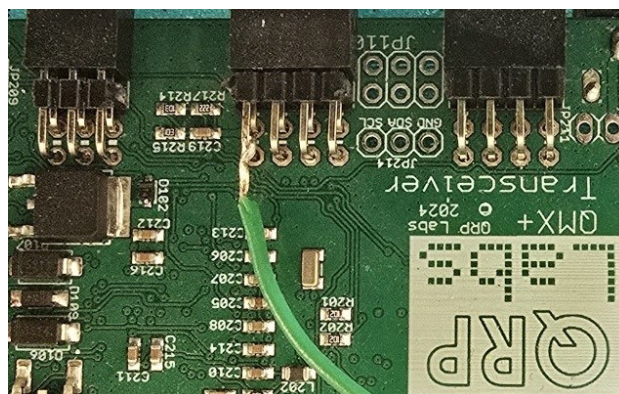
- () Locate cable S0105-00137 (**DATA** RX_AUDIO-XCV-AUX_EAR). There are two of these cables. Connect one from J2 (QMX+ Aux) on the Rx Audio board to the “Aux” jack on the QMX+ rear panel.
- () Connect the other S0105-00137 cable from J1 (QMX+ Ear) on the Rx Audio board to the “Ear” jack on the QMX+ front panel.



- () Locate cable S0105-00141 (**AUDIO**-TXAUDIO-XCV_MIC_KEY). Connect this cable from J5 (Mic/Key) on the Tx Audio board to the QMX+ front panel Mic/Paddle jack.
- () Locate cable S0105-00145 (**DATA** XCVUSB-TXAUDIO). Connect this cable from the USB connector on the QMX+ rear panel to J18 (USB 2.0) on the Tx Audio board.
- () Attach the male side of the BNC Tee adapter to the RF output of the QMX+ rear pan-

el.

- () Locate cable S0105-00149 (**RF** XCVANT-TXAUDIO). Connect the BNC end to the side of the BNC tee that faces the rear of the radio. Connect the other end to J21 (XCVR IN) on the Tx Audio board.
- () Locate the shielded microphone cable that was previously routed into the low power compartment. Plug the 2-pin MTA connector onto J6 (Mic In) on the Tx Audio board.
- () Locate cable S0105-00142 (**PWR** MB-XCV). Connect this cable from J1 (DC power to QMX+) on the Motherboard to the DC power jack on the QMX+ rear panel. Solder the end of the loose wire to a connector on the QMX+ as shown below:





STEP-BY-STEP ASSEMBLY - QMX+ Tests

- () Verify that all connections are solid, screws are tightened, and no loose wires are touching the board. If all appears good, you're ready to try the rig!
- () As you did during test of the DCD/RF/RF board, push CA-APP connector onto the APP connectors on Sienna XL so that red goes to red and black to black. Connect the other end to a power supply, with red going to the positive output and black to the ground or negative side.
- () Apply 11-15VDC power to the rear panel DC power connector and press the on/off switch on the front of your Sienna XL. The green light should come on, and the QMX+ front panel should light up.
- () Verify that the QMX+ front panel is lit up.
- () Adjust the main tuning control, and verify that the Sienna XL display and the QMX+ display show the same information as to frequency and mode (USB, CW, etc.)
- () To change modes on Sienna, press the Menu button, then rotate the main tuning knob until the mode is highlighted. Use the small knob to change the mode, then exit the menu by pressing the Menu button again. Make sure the QMX+ changes modes to agree.
- () Connect an antenna to the Antenna BNC connector on the Sienna XL rear panel. (Don't use the Transverter output which is adjacent to the antenna jack.)
- () Consult the User's manual for detailed info on how to operate the radio.
- () Remove the two cables from the front of the QMX+, then remove the QMX+ front panel and re-insert the two cables.
- () If you have not purchased the 10W or 250W options, attach the cover to the chassis using 17 6-32 x 1/4" black oxide screws.
- () Attach the serial number sticker to any convenient place on the rear panel.

The completes assembly of the QRP version of the Sienna XL.

If you have purchased the 10W option, proceed to the next page.



STEP-BY-STEP ASSEMBLY - 10W Option Integration

The 10W option consists of five parts:

1. 10W Amp board. This is an amplifier for the QMX+. It also adds solid state T/R switching, low-pass filter control and high temperature detection, which causes the large fan to run faster when the board gets hot.
2. High Power Low Pass Filter board. This board has 7 banks of low-pass filters capable of
3. Large fan
4. Mounting hardware
5. Interconnect cables

handling the full 250W power. Although the 10W amp does not need to use such large filters, this board also has the forward and reflected power detection and Transmit/Receive switching. When you add the 250W option, this board is re-connected to the high power amp, and a lower power filter board is added to the 10W amp.



10W Option Integration

Cables



S0105-00113	CTL CONT-10W	6-pin, 6"
S0105-00139	PWR 10W-HPLPF	4-pin, 15"
S0105-00140	DATA HPLPF-CONT_RFPWR	4-pin, 15"
S0105-00144	CTL TXAUDIO-10W	8-pin, 15"
S0105-00150	CTL 10W-HPLPF	8-pin, 8"



S0105-00134	RF 10W-HPLPF	6"
S0105-00129	RF HPLPF-DCD_MAINANT	12"
S0105-00130	RF XCVR-10W	6"
S0105-00148	RF DCD-10W_SELANT	15"



10W Option Integration

Hardware bag

Item	Description	Quantity
1	Hardware 4-40 x 3/8" PH Phillips M/S SS patchlock	4
2	Hardware 4-40 x 3/16" PH Phillips M/S ext tooth lockwasher SS	2
3	Hardware 6-32 x 1/4in PH Phillips M/S ext tooth lockwasher SS	5
4	Hardware 6-32 x 1 1/4" PH Phillips M/S SS	4
5	Hardware 6-32 x 1/4in PH Phillips M/S SS P/L	1
6	Hardware 6-32 KEPS Nut SS	6
7	Hardware 6-32 x 3/4" Hex M/F Spacer SS	1
8	Hardware 6-32 x 1" Hex M/F Spacer SS	1
9	Hardware 6-32 x 2 1/2" Hex M/F Spacer SS	1
10	Hardware #6 fiber washer	1
11	Sienna XL Copper heat spreader S0105-00013	1
12	Fan 92x92x25.4mm 12VDC with 2-pin MTA attached	1
13	Connector RF SO-239 bulkhead rear mount	1





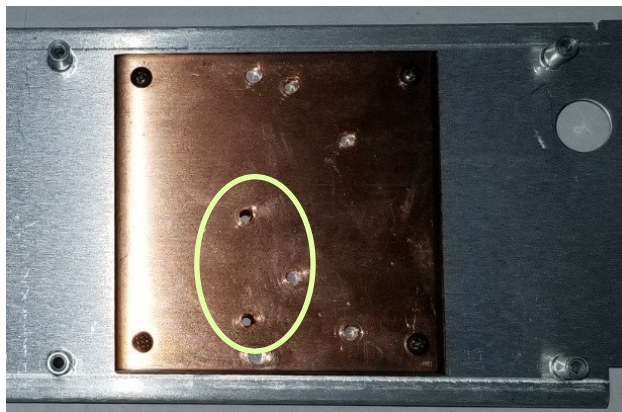
STEP-BY-STEP ASSEMBLY - 10W Option Integration

- () Discharge any static that has built up by touching something metallic away from your workspace.
- () Remove the 4 KEPS nuts and 6-32 x 1/4" screws holding in the fan guard/filter.
- () Attach the large fan to the back panel with the cable facing down and inward. Make sure the airflow arrows embossed on the fan point toward the back. Insert four 6-32 x 1 1/4" screws through the corner holes in the fan guard/filter, then through the chassis and into the fan. Secure them using four 6-32 KEPS nuts:



- () Locate the copper heat spreader.
- () Using fine grit sandpaper, remove any oxidation from the copper heat spreader in the middle area where the power transistors will go (circled area in photo below).
- () Attach the copper heat spreader to the front side of the long bracket, in the high

power compartment as shown below, using four 4-40 x 3/8" P/L screws.

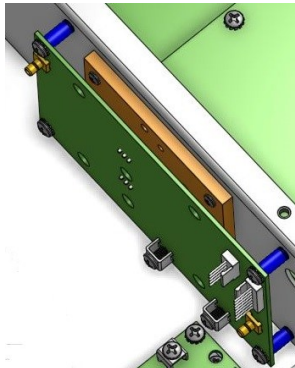


- () Build the 10W Amp board. See Appendix D.
- () Build the High Power Low Pass Filter (HPLPF) board. See Appendix E.
- () Place the 10W Amp board over the four standoffs on the long bracket directly over the copper heat spreader. Position it so that the power transistor mounting holes align with those on the copper heat spreader, with the screw terminals towards the bottom.
- () Loosely attach the board to the standoffs using four 6-32 x 1/4" SEMS screws in the corners of the board.
- () Attach the two power transistors to the copper heat spreader using two 4-40 x

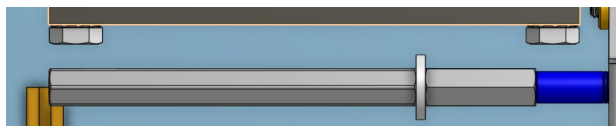


STEP-BY-STEP ASSEMBLY - 10W Option Integration

3/16" SEMS screws. You may have to wiggle the board slightly to get the screws to align properly.



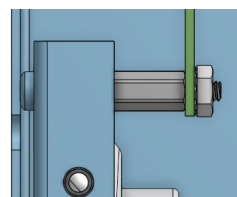
- () Solder the power transistors to the board.
- () Tighten all six screws.
- () Attach a 6-32 x 3/4" Hex M/F spacer to the top left stand-off for the 250W Amp (which is not yet installed). Tighten it securely. See below.
- () Place a #6 fiber washer on the 3/4" spacer you just installed, then fasten the 6-32 x 2 1/2" Hex M/F spacer to it. Tighten securely, but be careful not to crush the fiber washer. See below.



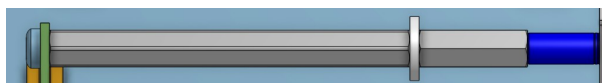
- () Attach a 6-32 x 1" Hex M/F spacer to the speaker bracket

above the left speaker using a 6-32 x 1/4" P/L screw.

- () Insert the HPLPF assembly into the board guide on the bottom of the chassis and slide it back until the top rear mounting hole lines up with the long standoff for the 250W amp.
- () Attach the HPLPF board to the right (1") standoff using a 6-32 KEPS nut.



- () Attach the HPLPF board to the left (2 1/2") standoff using a 6-32 x 1/4" SEMS screw.



- () Connect the BNC connector on cable S0105-00130 (RF XCVANT-10WI) to the BNC tee that is attached to the QMX+ antenna jack. Route the cable through the hole in the long bracket that is next to the small fan and connect it to J1 (XCVR Ant) on the 10W Amp board.
- () Locate cable S0105-00134 (RF 10WO-HPLPFI). Connect one end to J2 (RF Out) on the 10W Amp board. Connect the other end



STEP-BY-STEP ASSEMBLY - 10W Option Integration

onto J5 (RF In) on back side of the the HPLPF board.

- () Locate cable S0105-00129 (RF HPLPF-DCD_MAINANT). Connect one end to J4 (To DCD) on the back of the HPLPF board. Route the cable along the chassis and up through the opening in the long bracket next to the large fan. Push the other end through the hole in the motherboard marked "Main Ant from 250W LPF" and then into the DCD/RP/RF board.
- () Locate cable S0105-00113 (CTL CONT-10W). Connect one end to J4 (From Controller) on the 10W amp. Route the cable through the rectangular opening at the top left side of the front bracket. Connect the other end to J7 (10W Amp) on the controller board.
- () Locate cable S0105-00125 (PWR DCD14V-10W). One end should already be attached to the DCD/RP/RF board. Remove the electrical tape from the red wire. Remove the screws from the 10W Amp's screw terminal lugs, pass the screws through the lugs on the two wires and then re-fasten the screws into the terminal lugs—red to V+, black to GND.
- () Locate cable S0105-00139 (PWR 10W-HPLPF). Connect one end to J9 (To LPF) on the 10W Amp board. Route this cable down, then around to the front side of the HPLPF board, along the chassis. Connect the other end to J1 (VRLY From 10W Amp) on the HPLPF board. Do not plug it into J3 (FWD/REF), which is the same size connector.
- () Locate cable S0105-00147 (CTL LPLPF-HPLPF). Connect this cable from J2 (To LPF) on the 10W Amp board to J2 (Relay ctl from 10W) on the HPLPF board.
- () Locate cable S0105-00140 (DATA HPLPF-CONT_RFPWR). Connect one end to J3 (FWD/REF) on the HPLPF board. Route this cable down, then around to the front side of the HPLPF board, along the chassis and up and into the controller compartment. Connect that end to J14 (HPLPF FWD/REF PWR) on the Controller board.
- () Locate cable S0105-00144 (CTL TXAUDIO-10W). Connect one end to J4 (10W Amp Control) on the Tx Audio board. Route this cable along the long bracket and into the round hole near the top front. Connect the other end to J7 (From Tx Audio) on the 10W



STEP-BY-STEP ASSEMBLY - 10W Option Integration

Amp board.

- () Locate cable S0105-00148 (RF DCD-10W_SELANT). Connect one end to J6 (Selected Antenna from DCD) on the 10W Amp board. Route this cable through the hole in the top front of the long bracket and insert it into the opening on the Motherboard labeled "Selected Ant to 10W amp". Insert and down into the connector on the DCD/RP/RF board.
- () Connect the cable attached to the large fan to J3 (Fan) on the 10W Amp board.
- () Remove the 5/8" hole plug from the antenna connector opening on the rear panel. Insert the S0-239 connector in that opening, then fasten it securely using the included lockwasher and nut.
- () Solder the 3" insulated wire between the pad labeled "RF Out" on the HPLPF board and the S0-239 connector.
- () Apply power to the rig and turn it on.
- () Set menu options as follows:
 - * CW mode
 - * 20M band-14.000 MHz
 - * Relative RF Power (menu)
 - * 10W Amp (menu)
 - * RF Power: min
 - * Left meter: Fwd power
 - * Right meter: Refl power
- () Connect a key to the front or rear panel Manual Key jacks.
- () Attach an external RF power meter and a 50 ohm dummy load to the S0-239 antenna connector.
- () Press the key and observe that the "transmit path" shown on the left display turns red and that the QMX+ goes into transmit mode.
- () Adjust the RF power control for 10W as read on the external power meter.
- () Adjust the FWD PWR pot on the rear end of the HPLPF board so that the left meter reads 10W.
- () Unkey the rig.
- () If you have an additional dummy load, place two of them in parallel to create a 25 ohm load (SWR = 2:1). Key the rig, and adjust the REFL PWR pot so that it reads 1.1W.
- () Change the menu setting for Power control to "Absolute".
- () If you have purchased the 250W amplifier, proceed to the next section. Otherwise, attach the cover to the chassis using 17 6-32 x 1/4" black oxide screws.

This completes assembly of your Sienna XL up to the 10W option.

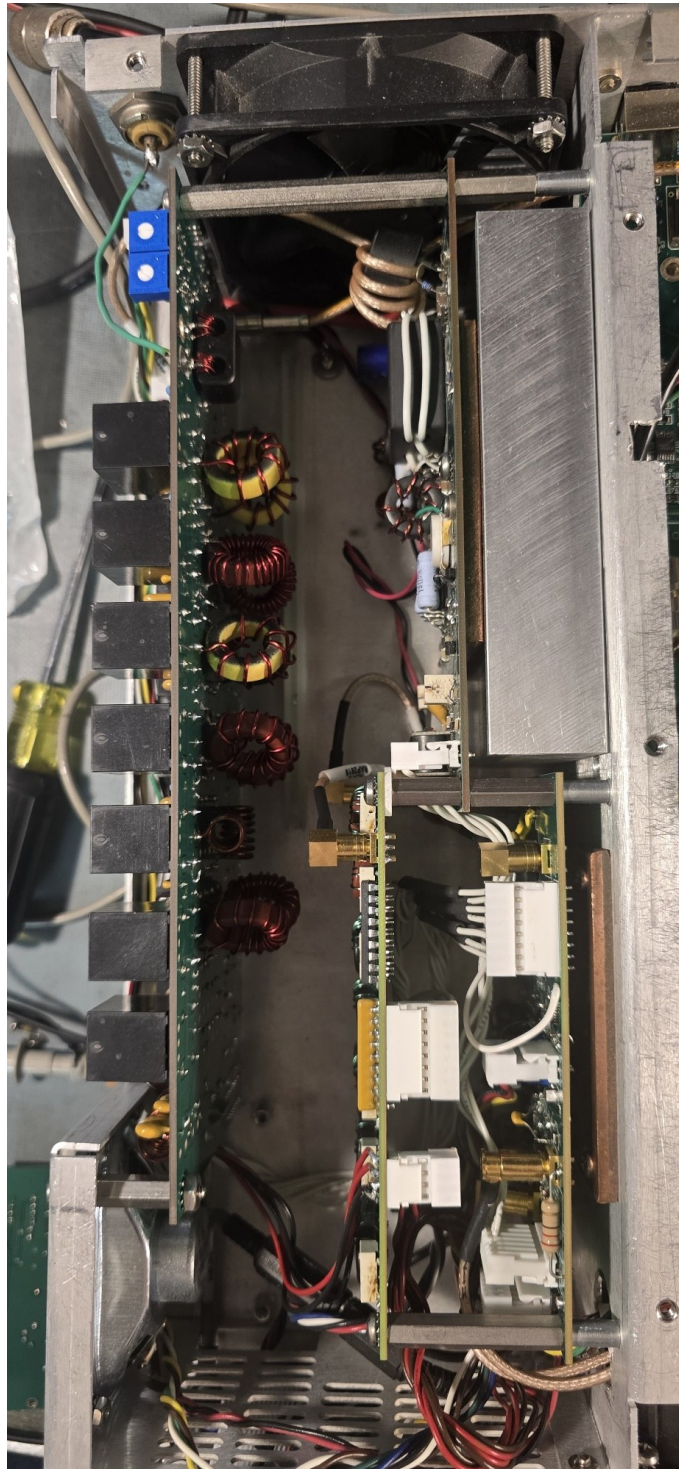


250W Option Integration

The 250W Option has four parts:

- 1. 250W Amp*
- 2. 10W Low Pass Filters (LPLPF)*
- 3. Mounting Hardware*
- 4. Cables*

Note: The 10W option used the HPLPF board because of its built-in power meter. When adding the 250W Amp, it is necessary to add a low power LPF board ("LPLPF") to the output of the 10W Amp, so that it drives the 250W Amp without harmonics. The 250W Amp is then routed to the HPLPF board. Some control cables must also be rearranged. This is explained in detail below.



High power compartment board/heatsink/fan mounting



250W Amp Integration

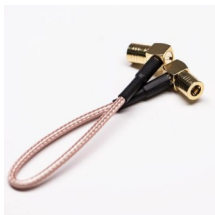
Cables



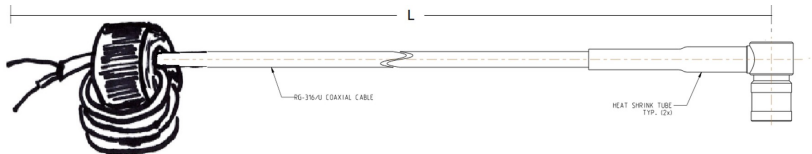
S0105-00114	CTL 10W-250W	5-pin, 6"
S0105-00138	PWR 10W-LPLPF	4-pin, 6"
S0105-00146	CTL 10W-LPLPF	8-pin, 6"
S0105-00147	CTL LPLPF-HPLPF	8-pin, 8"



CA-APP



S0105-00131	RF_LPLPFO-250WI & 10WO-LPLPFI	4", qty 2
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S0105-00132	RF_250WO-HPLPFI	6"
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250W Amp Integration

Hardware Bag

Item	Description	Quantity
1	Hardware 6-32 x 1/4in PH Phillips M/S SEMS SS	2
2	Hardware 6-32 x 5/8" Hex M/F Spacer SS	2
3	Hardware 6-32 x 3/4" Hex M/F Spacer SS	3
4	Hardware 6-32 x 1 1/2in Hex M/F Spacer SS	2
5	Hardware #6 fiber washer	1
6	Heatshrink tubing	6"

1

2



3



4



5



6





STEP-BY-STEP ASSEMBLY - 250W Option Integration

() Build the 250W Amp. See Appendix F.

() Build the 10W LPF, also called the Low Power LPF (LPLPF). See Appendix G.

Refer to the picture on page 45. Position the chassis with the front to your right, so that you are facing the long bracket.

() Remove the 6-32 x 1/4" screws holding the HPLPF board to the chassis near the speaker, and to the 2 1/2" spacer near the fan.

() Remove the four 6-32 x 1/4" screws in the corners of the 10W Amp. Do not remove the screws holding the power transistors to the copper heat spreader.

() Insert a 6-32 x 1 1/2" Hex M/F spacer into the mounting holes on the right side of the 10W Amp and tighten them securely.

() Insert two 6-32 x 3/4" Hex M/F spacers into the mounting holes on the left side of the 10W Amp and tighten them securely.

() Remove and save the 6-32 x 2 1/2" spacer and fiber washer from the left side of the long bracket, near the fan.

() Place the 250W Amp assembly into the chassis and secure it from the bottom of the chassis with two 6-32 x 1/4" P/L screws. The screws go into the heatsink. Leave them loose until the heatsink is fastened to the long bracket.

() Secure the 250W Amp to the standoffs using two 6-32 x 5/8" standoffs on the right side and the 6-32 x 2 1/2" standoff on the top left (closest to the fan).

() Secure the bottom left mounting hole to the 3/4" standoff using a 6-32 x 1/4" SEMS screw.

() Locate cable S0105-00132, which was soldered to the 250W Amp board during assembly. Solder the free wires to the pins labeled RF In and GND on the HPLPF board. Since this is a balanced cable, it technically doesn't matter which wire goes to the ground pad, but it is customary to connect the shield to the GND pad and the center conductor to the RF In pad.

() Disconnect RF cable S0105-00134 going from the 10W Amp RF Output to the HPLPF. This cable is no longer used and can be added to your junk drawer.



STEP-BY-STEP ASSEMBLY - 250W Option Integration

Note: Hold the LPLPF board while working with the cables on the 10W Amp and LPLPF boards.

- () Locate RF cables S0105-00131. (There are two of these cables.) Using one, connect one end to J8 (RF Out) on the 10W Amp. Route it down and to the left of the 10W Amp. Connect the other end to J1 (RF IN) at the bottom left of the LPLPF board.
- () Connect one end of the other cable S0105-00131 to J1 (RF In) on the 250W Amp board. Connect the other end to connector J6 (RF Out) on the LPLPF board.
- () Remove the 8-pin cable from J2 on the 10W Amp board and re-connect it to J5 on the front of the LPLPF board.
- () Locate cable S0105-00146 (CTL 10W-LPLPF). Connect one end to J2 (To LPF) on the 10W Amp board and the other end to J4 (From 10W Amp) on the back side of the LPLPF board. Loop the cable down into the space between the boards.
- () Remove the 4-pin cable from J9 (To LPF) on the 10W Amp board and re-connect it to J6 on the front of the LPLPF board.
- () Locate cable S0105-00138 (PWR 10W-LPLPF). Connect one end to J9 (To LPF) on the 10W Amp board and the other end to J3 (From 10W Amp) on the back side of the 10W LPF board. Loop the cable down into the space between the boards.
- () Connect 5-pin cable S0105-00114 (CTL 10W-250W) from J5 (To 250W Amp) on the 10W amp board to J2 (From 10W Amp) on the 250W Amp board.
- () Attach the LPLPF board to its standoffs using four 6-32 x 1/4" SEMS screws. Use the fiber washer you removed from the other side on one of the spacers on the top right side of the 250W Amp. Use another fiber washer on the bottom right. See photo on page 45.
- () Attach the 6-32 x 2 1/2" Hex M/F spacer to the top left side of the 250W Amp board.
- () Attach the HPLPF to the 2 1/2" spacer using a 6-32 x 1/4" SEMS screw.
- () Reattach the spacer on the top right side of the HPLPF board to the chassis above the speaker using the screw you removed earlier.



STEP-BY-STEP ASSEMBLY - Final Integration/Test

- () Locate cable CA-APP. Cut 3" off each end, discarding the middle section. Strip and tin the red and black wires. Place a piece of heatshrink tubing over each wire on one end. Solder the wires together (red to red, black to black) and let them cool. Place the heatshrink over the joints. Heat until the tubing is secure. Make sure no strands of wire are exposed.
- () Temporarily remove the Anderson Powerpole mounting clamps below the antenna jack. Place the cable end with Anderson Powerpole connectors into the opening and re-secure it with the mounting clamps. Attach the lug with the red wire to the terminal marked +48V on the 250W Amp board. Attach the lug with the black wire to the GND lug. Route the cable such that it doesn't touch the fan.
- () Apply power to the rig and turn it on.
- () Set menu options as follows:
 - * CW mode
 - * 20M band-14.000 MHz
 - * Relative RF Power (menu)
 - * 250W Amp (menu)
 - * RF Power: min
 - * Left meter: Fwd power
 - * Right meter: Refl power
- () Connect a key to the front or rear panel Manual Key jacks.
- () Attach an external RF power meter and a 50 ohm dummy load to the S0-239 antenna connector.
- () Press the key and observe that the "transmit path" shown on the left display turns red and that the QMX+ goes into transmit mode.
- () Adjust the RF power control for 100W as read on the external power meter.
- () Adjust the FWD PWR pot on the rear end of the HPLPF board so that the left meter reads 100W.
- () Unkey the rig.
- () If you have an additional dummy load, place two of them in parallel to create a 25 ohm load (SWR = 2:1). Key the rig, and adjust the REFL PWR pot so that it reads 11.1W.
- () Change the menu setting for Power control to "Absolute".
- () Attach the cover to the chassis using 17 6-32 x 1/4" black oxide screws.

This completes assembly of your Sienna XL.



Appendix A: DCD/RF/RF Board

The DCD/RF/RF board brings DC power into the radio, detects whether it is between 11 and 15V or greater than 46V and switches the voltage to the appropriate circuits. If 48V is present, it is routed to the 48-to-14V DC-DC converter, which converts the 48V to 14V and brings it back to the DCD/RF/RF board for distribution to the rest of the radio. The 48V is only used to power the 250W power amplifier. If the radio is configured as a receiver or a 10W transceiver, the 11-15V input voltage is used as-is to power the radio, although it will also work with 48V applied.

This board is built in two stages. The DC power detection (DCD) circuitry is built first and tested. The rear panel (RP) and RF (radio frequency) preamps and attenuator and the attached BPF (bandpass filters) are assembled next. That portion of the board cannot be tested until the motherboard and controller boards are installed.

The parts list for the board is included in the board kit bag. If you have a question about which part is which, use the electronic version of this parts list, provided on the included flash drive, and click the “Vendor P/N”. This will take you to the web site that has information about that part, including a picture. Should you ever need replacement parts, this is a great way to do it. In most cases, you can order any quantity of parts directly from the vendor. (Of course, if we made a mistake in kitting the parts, you can get a replacement from us free.)

This board contains some pre-loaded SMT parts.



STEP-BY-STEP ASSEMBLY-DCD/RP/RF Board

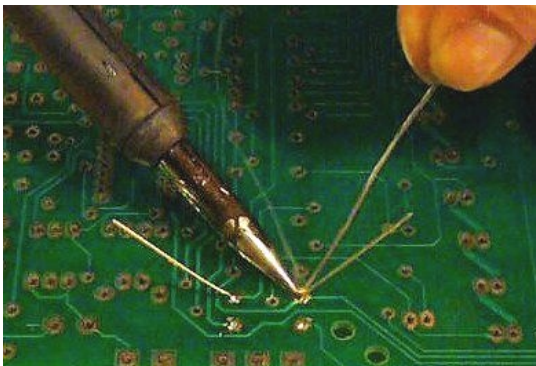
Please read all notes on this page before proceeding:

1. Check off each part on the parts list as you load it.

2. Load about 20 components at a time. Apply solder to them on the back side of the board, then clip the excess leads using wire cutters.

3. To load resistors, hold a resistor over the holes to see where the leads need to be bent. Bend them sharply using your fingernails. After you do a couple of these, you will understand how far apart to bend the leads.

4. When inserting parts, bend the leads over 90 degrees on the back side of the board to hold them in place. For IC's, if they are loose, just bend one lead in each corner.



5. Make sure all parts lie flat on the board. If they don't, re-heat them while pushing down.

6. Resistors have been pre-sorted to make it unnecessary to read color codes or to measure their values with an Ohmmeter. You can measure them if you want to.

7. Small transistors with the black plastic bodies will need to have their leads "sprung" slightly as they are inserted. Make sure the flat side lines up with the silkscreen.

8. The resistor pack, RN1, must be inserted with the side with the black dot going into the square pad.

9. When loading integrated circuits, make sure pin 1 is placed in the square pad. The text printed on the body of the part should read correctly left to right when pin 1 is in the square pad. There is also typically a notch or a bar along that end.

10. Diodes are mounted so that the side with the band goes in the square pad.

11. Relays K4-K8 are marked with a bar on one side. Match this to the bar on the silkscreen.

12. To solder SMT relays, place a little solder on one pad and place the relay on the pads so that all pins line up with a pad. Melt the solder on the one pad to hold the relay in place, then do the other pins.

() I have read all of the above.



DCD/RP/RF Board

Reference Designator	Description	Bag
	Blank board RP Preload	0
C15,C28,C33,C35	Capacitor 10pF MLCC radial 100V C0G 5%	1
C46	Capacitor 10uF aluminum electrolytic radial 25V 20%	1
C1,C2	Capacitor 100uF aluminum electrolytic radial 25V 20%	1
D1,D2	Diode Schottky rectifier 1N5711 70V 15mA axial DO-35	1
F1	Fuse 250mA Picofuse axial	1
F2	Fuse 7A resettable PTC	1
R12,R19	Resistor 10 ohm 1/8W metal film axial 1%	1
R56	Resistor 300 ohm 2W metal oxide small axial 5%	1
R35,R36	Resistor 10K ohm 1/4W metal film axial 1%	1
RFC1	Inductor 1mH axial axial 5%	1
RN1	Resistor 9-el array 10K bussed 10-pin	1
T1,T2	5T bifilar FT37-43	1
V1,V2	Gas Discharge Tube	1
W1, W2	PCB-mt screw terminal	1
	Wire 26 AWG green magnet wire (feet)	1
	Wire 24 AWG red magnet wire (feet)	1
C19	Capacitor 33pF MLCC radial 100V C0G 5%	2
D3,D4,D5,D6,D7,D8,D9,D10	Diode 1N4007B rectifier 1000V 1A DO-41	2
R7,R13,R20,R23,R24,R25,R26,R27,R28,R29,R30	Resistor 27 ohm 1/8W metal film axial 1%	2
C17	Capacitor 47pF MLCC radial 100V C0G 5%	3
C49	Capacitor 100uF aluminum electrolytic radial 63V 20%	3
D11	Diode Zener 1N5231B 5.1 Volt 0.5 W DO-35 5%	3
R14,R21,R52	Resistor 51 ohm 1/8W metal film axial 1%	3
C14,C16,C18,C20	Capacitor 120pF MLCC radial 100V C0G 5%	4
D12,D16	Diode Zener 1N5246B 16 Volt 0.5 W DO-35 5%	4
R11,R18,R43,R44,R45,R46,R47,R65	Resistor 100 ohm 1/8W metal film axial 1%	4
C36,C37,C38,C39,C40	Capacitor 150pF MLCC radial 100V C0G 5%	5
R59	Resistor 523 ohm 1/8W metal film axial 1%	5
D13	Diode rectifier 1N5404 axial 400V 3A DO-201AD	5



DCD/RP/RF Board

Reference Designator	Description	Bag
C7,C8,C9,C10,C55,C56	Capacitor 1000pF MLCC radial 100V C0G 5%	6
R10,R17	Resistor 680 ohm 1/8W metal film axial 1%	6
D15	Diode TVS 15V	6
C11,C12,C13	Capacitor 1800pF MLCC radial 50V C0G 5%	7
R2,R4,R5,R15,R22,R41,R42,R53, R54,R61,R64,R66,R67	Resistor 1K ohm 1/8W metal film axial 1%	7
D17	Diode Zener 1N5223B 2.7V 1/2W DO-35 5%	7
C26,C27,C30,C32,C41,C43	Capacitor .01uF MLCC radial 50V X7R 10%	8
R9,R16,R60	Resistor 3.3K ohm 1/8W metal film axial 1%	8
C42	Capacitor .047uF MLCC 100V X7R 10%	9
R1,R8,R31,R32,R33,R34,R37,R38, R39,R40,R48,R49,R50,R51, R55,R57,R58	Resistor 10K ohm 1/8W metal film axial 1%	9
C3,C4,C5,C6,C21,C22,C23,C24, C25,C29,C31,C34,C44,C45,C47, C50,C51,C52,C53,C54,C57,C58,	Capacitor .1uF MLCC 50V radial X7R 5%	10
R62	Resistor 22K ohm 1/8W metal film axial 1%	10
U4	IC 74HC00 quad 2-input nand gate 14-pin DIP	10
K1,K2,K3	Relay sealed Form-A 1A 12V SMT low profile	11
K4,K5,K6,K7,K8	Relay 1A DPDT low signal sealed 12V coil pcb-mount	11
U10	IC LM339 quad comparator 36V 14-pin DIP	11
Q1,Q2,Q3,Q4,Q5,Q6,Q7,Q8,Q9, Q10,Q11,Q12,Q13,Q15,Q16,Q17	Transistor 2N7000 MOSFET N-ch 60V TO-92	11
R3,R6,R63	Resistor 100K ohm 1/8W metal film axial 1%	11
Q18,Q19	Transistor 2N6428 NPN RF 40V	12
Q14	Transistor IRF4905PBF MOSFET Power P-Ch 55V 74A TO-220AB	12
T3	Transformer 4:1 6-pin DIP	12
U5	IC 7406 hex OC HV inverter 14-pin DIP	12
U3	IC 74HC138 3:8 decoder 16-pin DIP	12
U1,U2	IC 74HC374 Octal tri-state flip-flop 20-pin DIP	12
J8,J14	Connector 4-pin 2-row female .1in vert pcb_mount gold	13
J1,J2,J4	Connector MCX PC-Mt	13
J7	Connector 8-pin 2-row female .1in vert pc-mount gold	13
J3,J5	Connector 16-pin 2-row female .1in vert pc-mount gold	13
J6,J9,J10	Connector BNC 50 ohm r/a pcb-mount	13
J12	Connector 9-pin D-Sub female r/a pcb-mount	13
J15	Connector USB 3.0 Type B PC-mt	13
J13	Connector 8-pin mini-DIN r/a PCB	13
J18	Hardware Anderson Powerpole connector - red	13
J19	Hardware Anderson Powerpole connector - black	13
P18,P19	Hardware Anderson Powerpole contact right angle PCB mount 30A	13
J20	Connector 5-pin friction lock header straight post tin	13
J11	Connector 6-pin friction lock header straight post tin	13
JP1	Connector 3-pin header vert tin (for jumper)	13
JS1	Jumper 2-pin tin	13



STEP-BY-STEP ASSEMBLY-DCD Section

- () Load and solder ONLY the following parts. Use the Express PCB layout to help you find these parts. Note that J20 mounts on the BOTTOM side of the board. Match the thick side of the connector to the silkscreen (which is shown on the top side). The pins should be visible from the edge of the board.

Reference designator	Description	Bag
C1, C2	Capacitor 100uF/25V electrolytic	1
C46	Capacitor 10uF/25V electrolytic	1
F2	Fuse 7A resettable	1
R56	Resistor 300 ohm 2W	1
R35,R36	Resistor 10K ohm 1/4W	1
C49	Capacitor 100uF/63V electrolytic	3
D11	Diode Zener 1N5231B-5.1	3
D12,D16	Diode Zener 1N5246B-16V	4
R65	Resistor 100 ohm 1/8W	4
D13	Diode 1N5404	5
R59	Resistor 523 ohm 1/8W	5
D15	Diode 15V TVS	6
D17	Diode Zener 1N5223B-2.7V	7
R5,R53,R54,R61,R64, R66,R67	Resistor 1K ohm 1/8W	7
C43	Capacitor .01uF ceramic	8
R60	Resistor 3.3K ohm 1/8W	8
R37,R38,R39,R48, R49,R55,R57,R58	Resistor 10K ohm 1/8W	9
C42	Capacitor .047uF ceramic	10
R62	Resistor 22K ohm 1/8W	10
C44,C45,C47,C50, C57,C58,C59	Capacitor .1uF ceramic	11
R63	Resistor 100K ohm 1/8W	11
U10	IC Comparator LM339	11
J7	Connector 8-pin 2-row female	12
J20	Connector 5-p MTA (mount on bottom)	12
Q3,Q4,Q15,Q16,Q17	Transistor MOSFET 2N7000	14

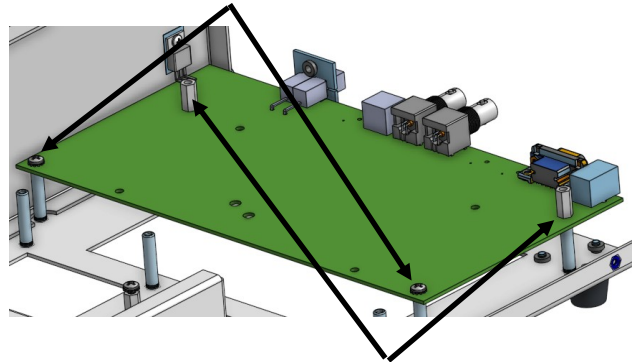


- () Insert a screw terminal (bag 1) into the pads marked +14V. It will require a lot of heat, so be careful not to burn your fingers or your work surface. Hold it flat against the board with a tool (awl, pencil, etc.) Apply solder to one pin from the top until it does not move, then turn the board over and solder the other pins. Finish by soldering the pin you started with.
- () Repeat the above step using the other screw terminal and insert it into the GND pads.
- () Insert the right-angle pins P18 and P19 (Bag 12) into the red and black Anderson Power-pole (APP) connector bodies (J18 and J19) as shown below. Be sure to push hard so that the ends snap into place past the metal tab. Slide the red and black connectors together and place the pins in the holes so that the bodies line up with the silkscreen. Make sure the body colors line up with the silkscreen marked "Black" and "Red". Solder the connector assembly in place.



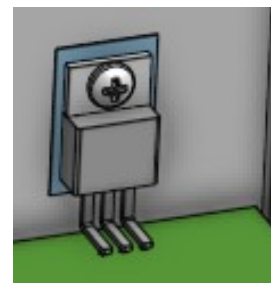
- () Inspect your work. Look for shorted pads, unsoldered parts, backwards parts, etc. Fix any defects.
- () Attach the DCD/RF/RF board to the chassis bottom as shown below, using:

* two 6-32 x 1/4" SEMS screws



* two 6-32 x 1/2" hex M/F standoffs.

- () Insert power transistor Q14 into the board so that the mounting holes line up with the captive nut in the long bracket. Bend the leads in an "S" pattern as shown below so that there is no strain on the leads. Mount the transistor to the long bracket using a 4-40 x 1/4" polycarbonate screw.



- () Solder the transistor leads to the board from the top.



- () Connect the on/off switch cable S0105-00122 (PWR DCD-ONOFF) to J20. The switch and cable can sit loosely on the chassis.
- () The CA-APP cable that is supplied has Anderson Power Pole connectors on one end. Push the connector onto the APP connectors on Sienna XL so that red goes to red and black to black. Connect the other end to a power supply, with red going to the positive output and black to the ground or negative side.
- () Apply 11-15VDC power to the rear panel DC power connector and press the on/off switch.
- () If you have an adjustable supply, Lower the voltage slowly. As the voltage reaches about 11V, the LED should turn red. At about 10V it should turn off. Now raise the voltage to 12V. The green light should again appear and stay on as you raise the supply voltage to 15V.
- () With the LED on (red or green), measure the voltage between the left and right screw terminals. It should read the voltage that your power supply is set to.
- () Measure the voltage from the positive side of C48 to ground. It should read 4.9V to 5.1V.
- () Turn off the power switch.

- () Remove the on/off switch cable from the DCD/RP/RF board.
- () Remove the polycarbonate screw holding in the power transistor and the mounting hardware.
- () Remove the DCD/RP/RF board from the chassis.

If you encountered any problems in the above steps, please check your work and try again. If you cannot get it to power up, contact DZKit Support.

- () Re-read the notes on page 53.
- () Load all remaining parts starting with bag 1 and continuing through bag 18, **except Bag 13 (connectors) and toroids T1 and T2 (bag 1)**. Use ExpressPCB to locate the parts. Continue to cross out reference designators as they are done.

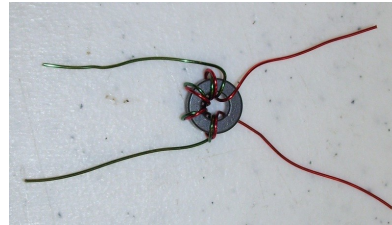
Read before loading connectors:

1. ***Double check top/bottom and male/female for every connector as you load it. They are difficult to remove after installation. The board silkscreen is marked "bottom" for every connector that must be mounted on the bottom.***
2. The white, multi-pin, single row connectors must be mounted with the thick part of the body loaded on the side with the thicker silkscreen. These mount on the bottom of this



board. You have already mounted J20. Mount J11 (RS-232) in the same manner, so that you can see the pins from the edge of the board.

3. Be careful not to melt the body of connectors that are physically close to each other.
 4. Although the 4, 8 and 16-pin 2-row connector locations are marked with a square pad, it does not matter how those connectors are inserted.
 5. Some pins require more heat than other parts because they are connected to the ground plane.
- () Load and solder all remaining connectors (bag 13).
- () Insert the 2-pin jumper JS1 on the right two pins of JP1 marked "5V Int".
- () Wind toroids as follows:
Twist 6" of red and green magnet wire together (one 6" twisted pair for each toroid), then wrap 5 turns through one toroid and 5 turns through the other toroid. Space the twisted pairs evenly around each toroid. Spread the leads so that two green leads are on one side and two red leads are on the other side as shown below.



- () Pull the red leads through the side marked "Pri" and the green leads through the side marked "Sec". Then apply solder.

Note: It will take a lot of heat for an extended period to melt the enamel and allow the solder to adhere to the wire. Solder may "blob" on the pad and wire. Don't worry about this. When the lead looks soldered, clip excess lead lengths. Next, use a "solder sucker" to remove the solder, then re-solder the leads. This assures that the leads are actually soldered.

Another way to solder the toroids is to insert the unsoldered leads into the board, clip the excess lead lengths, then remove the toroids and remove the enamel from the leads using a soldering iron or a wire stripper (very carefully, so as not to break the wire), then reinsert the toroid and solder the leads.

- () Use an Ohmmeter or other continuity tester on the traces connected to the toroid's leads to assure that the resistance is close to zero. If not, reheat the connections and re-measure.

This completes assembly of the DCD/RP/RF Board.

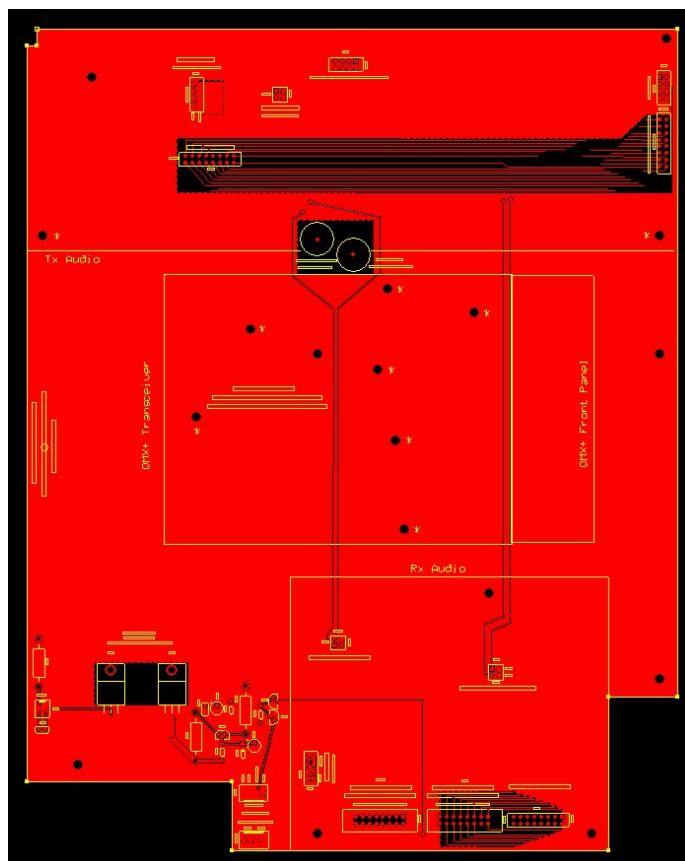




Appendix B: Motherboard

The motherboard routes inputs and outputs between boards in the low-power compartment. Since its left front corner is right behind a fan and thus able to be cooled well, it also contains circuitry in that area of the board that converts the input voltage (11-15VDC) to a regulated 9VDC which is used as a main DC voltage for the controller and QMX+. It also routes the 11-14VDC input voltage to the fan, RxAudio and TxAudio boards. This method of power distribution distributes the heat more evenly around the radio, keeping any one spot from getting too warm. Control signals from the controller to all boards in the low power compartment are also routed through the motherboard.

The parts list is on the next page. If you have a question about which part is which, use the electronic version of the parts list, provided on the included flash drive, and click the “Vendor P/N”. This will take you to the web site that has information about that part, including a picture. Should you ever need replacement parts, this is a great way to do it. In most cases, you can order any quantity of parts directly from the vendor. (Of course, if we made a mistake in kitting the parts, you can get a replacement from us free.)





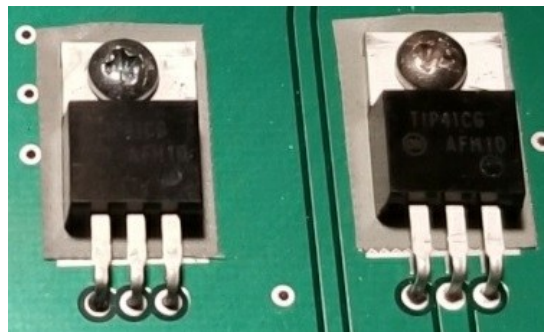
S0105-40001 Motherboard Board Kit			
Reference Designator(s)	Description	Bag	Notes
Bag 0: S0105-40001	Blank Board Motherboard	0	
Bag 1: S0105-40101			
C3,C4	Capacitor 10uF aluminum electrolytic radial 25V 20%	1	
C1	Capacitor .047uF MLCC 100V X7R 10%	1	
C2	Capacitor 1uF MLCC 50V X7R 10%	1	
D1	Diode Zener 1N5239B 9.1V 1/2W DO-35 5%	1	
Q1,Q2	Transistor TIP41C NPN Power 100V 6A TO-220	1	
Q3	Transistor 2N3906 PNP GP 40V TO-92	1	
R1	Resistor 47 Ohm 1W	1	
R2,R5	Resistor 100 ohm metal film axial 2W 5%	1	
R3,R4	Resistor 1K ohm 1/8W metal film axial 1%	1	
Q4,Q5	Transistor 2N7000 MOSFET N-ch 60V TO-92	1	
	Hardware 4-40 x 1/4in PH Phillips M/S SS	1	
	Hardware 4-40 KEPS nut SS	1	
	Hardware Insulator with adhesive back for TO-220	1	
Bag 2: S0105-40201			
J3,J14,J15	Connector 4-pin 2-row female .1in vert pcb_mount gold	2	top
J6,J7,J8,J9	Connector 8-pin 2-row female .1in vert pc-mount gold	2	top
J5,J12	Connector 16-pin 2-row female .1in vert pc-mount gold	2	top
J13	Connector 16-pin 2-row male vert pcb-mount gold	2	bottom
J4,J11	Connector 16-pin 2-row header shrouded r/a low profile	2	top
J1,J10	Connector 4-pin friction lock header .1in straight post tin	2	top
J2	Connector 2-pin friction lock header .1in straight post tin	2	top
R6	Resistor 10K ohm 1/8W metal film axial 1%	2	

Motherboard – bottom view. See page 45 for top view.



STEP-BY-STEP ASSEMBLY-Motherboard

- () Load and solder all parts in bag 1 **except Q1 and Q2**. Note that D1 must be installed with the banded side in the square pad. The electrolytic capacitors must be inserted with the longer lead (+) in to the square pad. Clip the leads on the bottom of the board after soldering.
- () Remove the adhesive-backed insulators from their backing and affix them to the board so that the mounting holes line up and the insulator covers the rectangular area with no solder mask.
- () Lay Q1 on the board so that the mounting hole lines up with the hole in the board. Note the location where the leads will fit into their holes. Bend the leads down and insert the part into the board. Insert a 4-40 x 1/4" screw into Q1's mounting hole, through the board and tighten it with a 4-40 KEPS nut on the bottom. Note that there are no shoulder washers needed here. Solder the leads and clip excess on the bottom.
- () Repeat the above step with Q2.



- () Load and install all connectors (Bag 2).

Notes:

1. Make absolutely sure you are mounting the connectors on the correct side of the board. They are very hard to remove later! The board silkscreen is marked "top" or "bottom" for every connector. J13 mounts on the bottom.
2. Make sure you load the correct connector in the correct spot. All top-mounted connectors except the right-angle shrouded connectors on the very front edge of the board and the white AMP MTA connectors are female. Both of the ones on the bottom are 2-row, gold-plated, male connectors.
3. The right-angle connectors must be mounted such that the pins face outward toward the edge of the board.
4. ***It is very important*** that the connectors be mounted flush with the board and that they



STEP-BY-STEP ASSEMBLY-Motherboard

are not crooked. You will be attaching boards with many mating connectors to this board, and it is essential that the pins line up to avoid bending them. You almost need three hands – one to hold the part, one to hold the solder, and one to hold the soldering iron! The best way to do this is to hold the board vertically, insert a connector and solder one pin, without worrying about whether it is aligned perfectly. Then turn the board flat and use one finger to push on the connector while re-heating that one pin. Check to make sure the part is flat and straight, then solder the other pins.

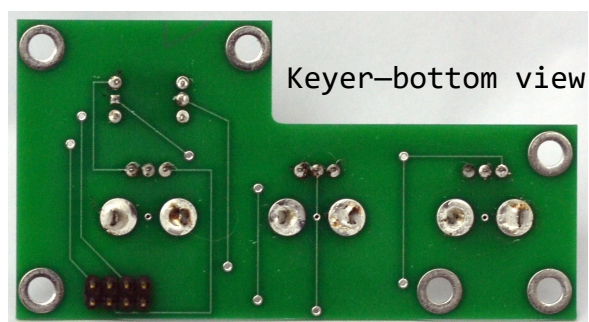
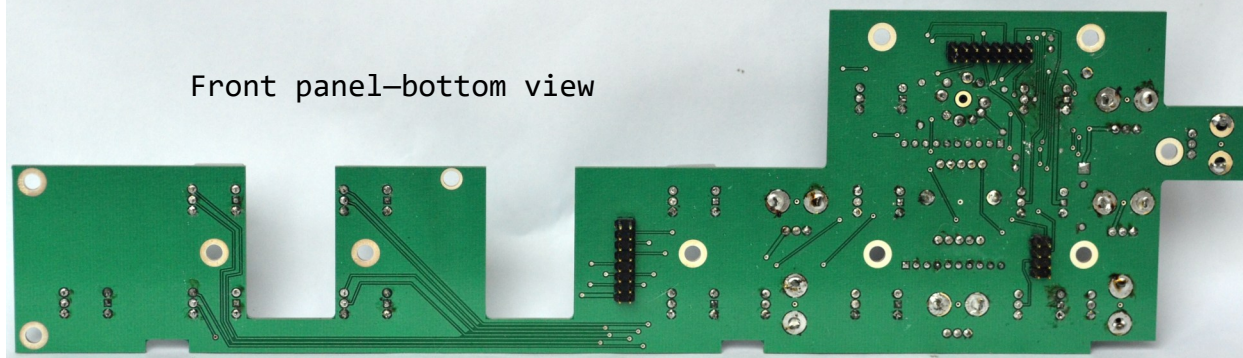
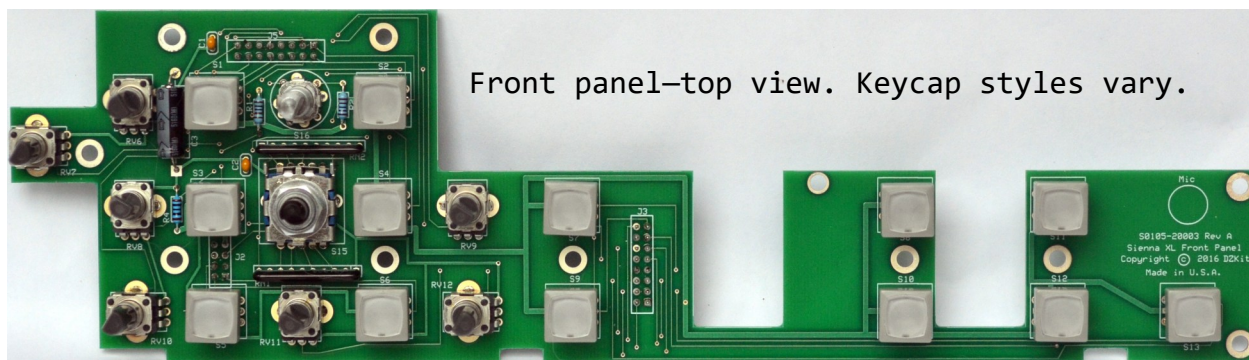
This completes assembly of the Motherboard.



Appendix C—Front Panel Boards

The Front Panel boards make up a “fly-by-wire” circuit. Potentiometers and switches generate voltages that are fed into two microprocessors, and the firmware inside the processors determines how to control the relevant portion of the radio. There is one exception – the sidetone volume is directly connected to the output of the sidetone oscillator.

The parts lists for the boards are included in this manual. If you have a question about which part is which, use the electronic version of this parts list, provided on the included flash drive, and click the “Vendor P/N”. This will take you to the web site that has information about that part, including a picture. Should you ever need replacement parts, this is a great way to do it. In most cases, you can order any quantity of parts directly from the vendor. (Of course, if we made a mistake in kitting the parts, you can get a replacement from us free.)





Appendix C—Front Panel Boards

S0105-40003 - Front Panel Board Kit - Bag 1	
Reference Designator(s)	Description
R4	Resistor 100 ohm 1/4W metal film axial 1%
C3	Capacitor 100uF aluminum electrolytic axial 25V 20%
C1,C2	Capacitor .1uF MLCC 50V radial X7R 5%
RV6,RV7,RV8,RV9,RV10, RV11,RV12	Resistor potentiometer 9MM 10K 1/20W Linear taper 20% vert
S15	Switch rotary 1-pole 8-pos vert pc-mount
S16	Encoder 9mm 15ppr 30 detents with switch vert pc-mount
RN1,RN2	Resistor array 1K ohm isolated 10-pin 2% SIP

S0105-40003 - Front Panel Board Kit - Bag 2	
Reference Designator(s)	Description
S1-S13	Switch pushbutton
SK1-SK13	Keycap
J2	FP board - Connector 8-pin 2-row male vert pcb-mount gold-plated
J3,J5	Connector 16-pin 2-row male vert pcb-mount gold-plated
R1,R2	Resistor 1K ohm 1/4W metal film axial 1%

S0105-40004 - Keyer Board Kit - Bag 1	
Reference Designator(s)	Description
J1	Keyer board - Connector 8-pin 2-row male vert pcb-mount gold-plated
RV1,RV2,RV3	Resistor potentiometer 9MM 10K 1/20W Linear taper 20% vert
S1	Switch pushbutton
SK1	Keycap
	Keyer Board Blank - S0105-20004



STEP-BY-STEP ASSEMBLY-Front Panel Board

Except for connectors, all parts mount on the silkscreened side of the board.

Load the Front Panel board:

- () Load and solder the two MLCC capacitors (Bag 1) at C1 and C2. Clip the leads.
- () Load and solder the 100uF electrolytic capacitor C3 (Bag 1). The positive side has an indentation in the body and goes in the hole with the square pad. Clip the leads.
- () Load and solder the two resistor networks (Bag 1). These are symmetric, so orientation does not matter, but it is good practice to put the dotted side in pin 1, the square pad.
- () Load and solder the 100 ohm resistor (Bag 1) at R4. Clip the leads.
- () Load and solder the two 1K ohm resistors (Bag 2) at R1 and R2. Clip the leads.
- () Load and solder all rotary pots (Bag 1). Make sure they lie flush on the board.
- () Load and solder the rotary encoder (Bag 1). Straighten any bent pins. It can only be inserted one way.
- () Bend the small tab on the 8-position rotary switch (Bag 1) 90 degrees. *Remove and save the lockwasher and nut.* Load and solder the switch. It can only be inserted one way.
- () Mount all connectors (Bag 2) to the **back** of the board. Make sure they are flat against the bottom side of the board.
- () If shipped in a separate bag, snap the plastic keycaps onto the switches. Be sure to line up the tabs on the keycaps with the notches on the switches.
- () Insert the pushbutton switches into the front panel board one at a time. **(See note on next page.)** Solder each one before doing the next one.

IMPORTANT: The text on the back of the switch faces UP. There is a "+" symbol next to the middle pin on one side and a "-" symbol on the middle pin on the other side of the switch. The "+" side goes to the square pad.

Tip: solder one pin while holding the board vertically, then lay it on a flat surface and heat that pin back up while you seat the switch on the board.



Load the Keyer board:

- () Mount the connector to the **back** of the board as described above.
- () Load and solder the three rotary pots as described above.
- () Mount the pushbutton switch as described above.

This completes assembly of the Front Panel boards.



Appendix D: 10W Amp Board

The 10W Amp Board takes a low-level RF signal from the QMX+ and amplifies it, producing up to 20W (less on AM). It's called a 10W stage because it is not necessary for it to produce 20W to drive the 250W amp to full rated power, but it is capable of the higher power to provide margin on all bands. A pair of RD16HHF MOSFET power transistors operated in push-pull produce a clean output with very low even-harmonic content. Odd harmonics are attenuated by the HPLPF or 10W LPF board (LPF = Low Pass Filters).

A Hall-Effect sensor (U3) measures drain current and passes it to the controller. The output of a temperature sensing circuit (U2) is logically "or'd" with a similar circuit on the 250W amp to provide a signal that switches the large fan to high speed if the temperature rises past a reference level on either board. This circuit also provides for a short duration full-speed mode right after the unit is turned on (via R26 and C36), to overcome rotational inertia and guarantee that the fan starts, then the speed is lowered to idle to reduce audible noise.

Another important circuit on this board is the T/R switch (MOSFET Q1). This circuit feeds the antenna signal through to the QMX+ when the unit is in Receive mode (Control signal LTxE_nB is high). In this state, the selected antenna – Rx Antenna or Main – is fed to Q1 and then to the QMX+ when Q1 is on. When Q1 is off, the QMX+ transmit power is prevented from being passed into the receive antenna circuits on the DCD/RF board.

This board also decodes 3 bits from the Tx Audio board that are then fed to the LPF board (LPLPF or HPLPF) to select one of 7 filters.

If you have a question about which part is which, use the electronic version of this parts list, provided on the included flash drive, and click the "Vendor P/N". This will take you to the web site that has information about that part, including a picture. Should you ever need replacement parts, this is a great way to do it. In most cases, you can order any quantity of parts directly from the vendor. (Of course, if we made a mistake in kitting the parts, you can get a replacement from us free.)



10W Amp Parts

HW Bag

Description	Vendor P/N	Stock bin	Qty
Hardware 4-40 x 3/8" PH Phillips M/S SS patchlock	96562A108	834	4
Hardware 4-40 x 3/16" PH Phillips M/S ext tooth lockwasher SS	95345A422	643	2
Hardware 6-32 x 1/4in PH Phillips M/S ext tooth lockwasher SS	95345A458	644	5
Hardware 6-32 x 1 1/4" PH Phillips M/S SS	91772A155	462	4
Hardware 6-32 x 1" Hex M/F Spacer SS	91075A446	Tbd	1
Hardware 6-32 x 2 1/2" Hex M/F Spacer SS	91075A008	Tbd	1
Hardware 6-32 x 3/4" Hex M/F Spacer SS	91075A444	832	1
Hardware 6-32 KEPS Nut SS	96278A007	464	1
Hardware #6 fiber washer	93493A349	Tbd	1
Fan 92x92x25.4mm 12VDC with 2-pin MTA attached	108-AUB0912VH-CX09	824	1
Sienna XL Copper heat spreader S0105-00013	S0105-00013	917	1

Circuit Bag 0: PC Bd Blank S0105-20009

S0105-40009 10W Amp - Bag 1

Reference Designator(s)	Description	Stock bin	Qty
J1,J6,J8	Connector MCX PC-Mt	Tbd	3
J3	Connector 2-pin friction lock header .1in straight post tin	172	1
J9	Connector 4-pin friction lock header .1in straight post tin	88	1
J5	Connector 5-pin friction lock header .1in straight post tin	369	1
J2	Connector 8-pin friction lock header straight post tin	79	2
J4,J7	Connector 6-pin friction lock header straight post tin	371	2
Q8,Q9	Transistor RD16HHF1 16W 12V RF Power MOSFET	806	2
W1,W2	Terminal pcb-mount 6-32 screw 15A	293	2
T2	Binocular core ferrite 43 material	847	1
T3	RF400-0 No winding, type 43	841	1
RFC2,RFC3,RFC4, T1	FT37-43 toroid (2 cores each, 2T each). One core for T1	59	7
RV1,RV2	Resistor 10K ohm 1/2W trimpot 1-turn side-adjust	169B	2
TH1	Thermistor 10K 1/2W radial NTC	215	1
D1	Diode 1N914 signal 100V 300mA DO-35	50	1
R7,R9,R21	Resistor 0 ohm metal film 1/4W	356-0	3
R11,R12	Resistor 2.7 ohm metal film axial 1/6W	356-2.7	2
R23	Resistor 47 Ohm 1W 2512 Thick Film 5%	804	1
	Wire 20 AWG solid yellow insulated wire	739	5"
	Wire 22 AWG red magnet wire	720	15"
	Wire 24 AWG red magnet wire	721	10"
	Wire 24 AWG green magnet wire	724	10"



10W Amp Parts, continued

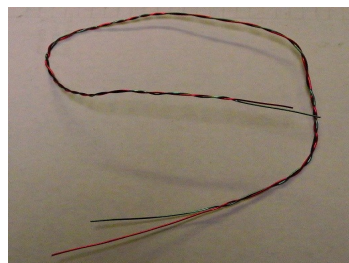
Reference Designator(s)	Description	Stock bin	Qty	Bag
C30	Capacitor 120pF ceramic 1210 50V C0G 5%	814	1	2
C2,C7,C12,C13,C27,C38	Capacitor 1000pF MLCC radial 50V 5%	836	6	2
C18,C21,C26,C33	Capacitor .01uF MLCC radial 50V X7R 10%	575D	4	2
C3,C4,C5,C6,C9,C11,C14, C15,C16,C17,C19,C20, C22,C23,C24,C25,C32,C34, C37,C39,C40,C41	Capacitor .1uF MLCC radial 50V X7R 10%	232	22	2
C8	Capacitor .47uF MLCC radial 50V Z5U 20%	575F	1	2
C1	Capacitor 1uF 50V MLCC radial 10%	813	1	2
C10,C35	Capacitor 10uF 50V MLCC radial 10%	Tbd	2	2
C28,C29,C31,C36	Capacitor 47uF 25V Tantalum "D" 10%	191L	4	2
Q1,Q2,Q3,Q4,Q5,Q6	Transistor 2N7000 MOSFET N-ch 60V TO-92	227	6	2
RFC6	10uH shielded 1008 300mA (can use 1008 or 1210)	848	1	2
R13,R14	Resistor 51 ohm 1/8W metal film axial 1%	356-51	2	2
Q7	Transistor 2N3906 PNP GP 40V 200mA TO-92	48	1	3
U2	IC LM393D Dual comparator 8-pin SOIC	545	1	3
U5	IC 74HC238 3-8 Line decoder non-inverting 16-pin DIP	873	1	3
R8,R10,R15	Resistor 680 ohm 1/8W metal film axial 1%	356-680	2	3
U1,U4	IC 78L05 voltage regulator 5.0V 100mA TO-92	55	2	4
U3	IC ACS722 Hall Effect Sensor 10A DC SOIC	780	1	4
RFC1, RFC5	47uH shielded 1008 300mA	355A-47uH -HICUR	2	4
R17,R20	Resistor 1K ohm 1/8W metal film axial 1%	356-1K	3	4
R2,R19,R24	Resistor 3.3K ohm 1/8W metal film axial 1%	356-3.3K	3	5
R3,R4,R5,R6,R18,R22,R25	Resistor 10K ohm 1/8W metal film axial 1%	356-10K	7	6
R16,R26	Resistor 220K ohm 1/8W metal film axial 1%	356-200K	2	7



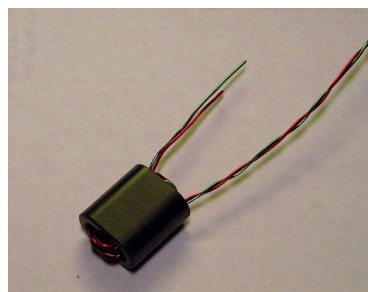
STEP-BY-STEP ASSEMBLY-10W Amp Board

All parts mount on the top (silkscreened) side of the board except TH1, Q3 and Q4. Refer to the photo on page xx.

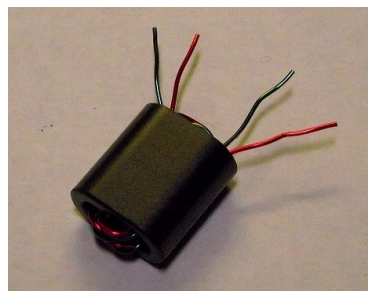
- () Load and solder all white “AMP MTA” connectors (bag 1), J2-J5, J7 and J9. Be sure the silkscreened “bar” matches the thick portion on the back of the connector.
 - () Load and solder the RF jacks, J1, J6 and J8 (bag 1).
 - () Load and solder Q1-Q6 (bag 2). The center lead may have to be sprung out slightly. Make sure the flat side matches the silkscreen. Clip excess lead lengths. These are MOSFETs, so be very careful not to expose them to static.
 - () Load and solder Q7 (bag 3), the PNP transistor in the same manner as the other transistors.
 - () Load the two screw terminals marked V+ and GND. These will require a lot of heat. Solder one pin while using a tool to keep the part flat on the board, then solder all pins. Be careful not to burn your fingers!
 - () Load and solder trimpots RV1 and RV2. Clip excess lead lengths.
- () Insert thermistor TH1 *from the bottom of the board*. Leave enough lead length to rotate the part 90 degrees under the board. It will be placed such that it touches the copper heat spreader. Solder the leads and clip excess on top.
 - () Locate the 24 gauge red and green magnet wire and twist together as shown, using about 4 turns per inch.



- () Using the twisted pair, wind four turns into the binocular (two-hole) core.



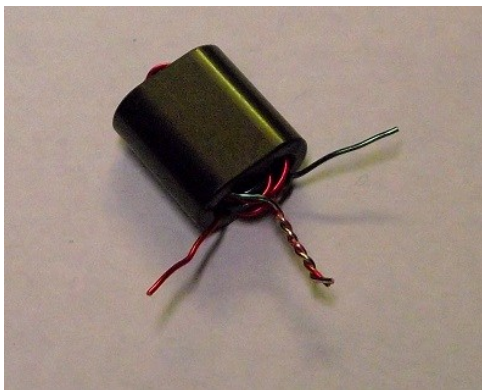
- () Dress leads as shown below.



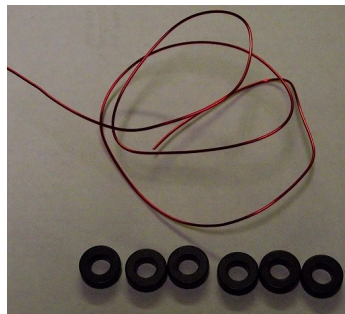


STEP-BY-STEP ASSEMBLY-10W PA Board

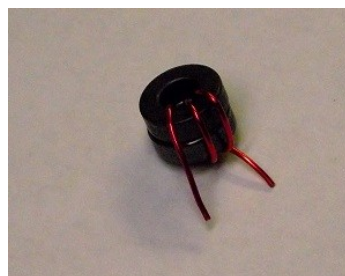
- () Strip insulation with a knife, being careful not to nick the wire, and twist a red and green wire (one from each side) into a center pair.



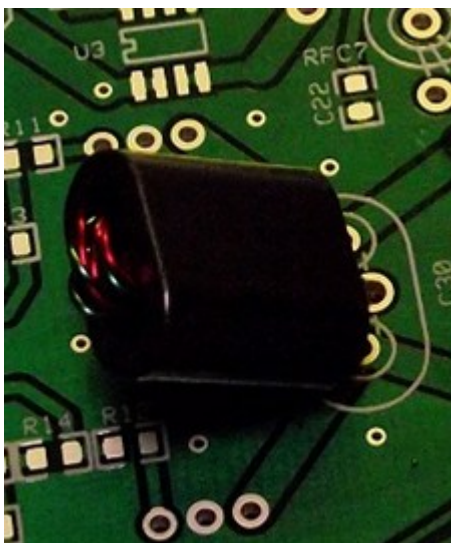
- () Locate 6 toroidal cores.



- () Wind 3 turns around two cores as shown below:

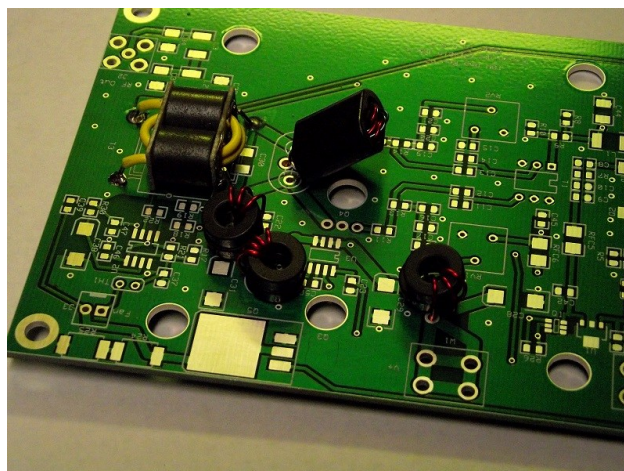


- () Install into PCB at "T2" on the silkscreen. Leave a little slack in mounting so the core can be folded over.



- () Make three inductors as shown above.

- () Strip the ends of the wire, being careful not to nick the wire. Solder at RFC2, RFC3 and RFC4.



- () Locate 22 gauge red magnet wire, about 15" long. Cut into three equal pieces.



STEP-BY-STEP ASSEMBLY-10W PA Board

Note: T3's core has two different sides. The left picture is of the primary side and the right of the secondary side.

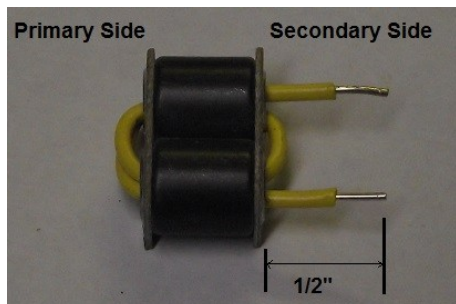
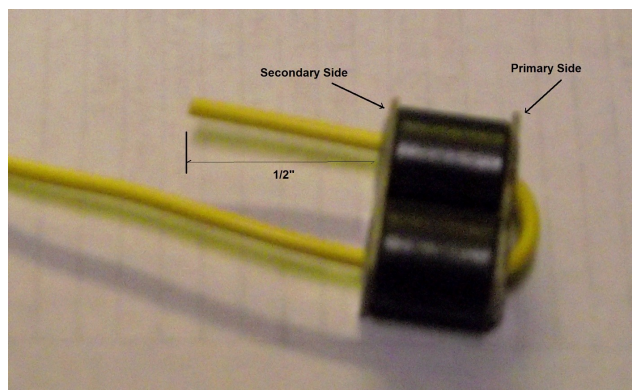


T3 Primary

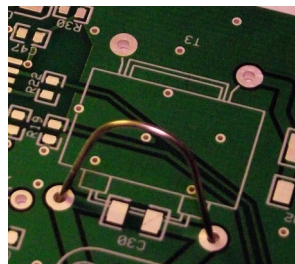


T3 Secondary

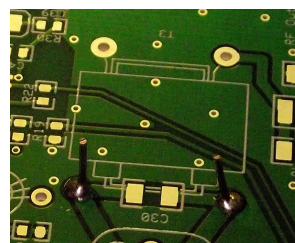
- () Using the 5" length of 20 gauge solid insulated wire, start the winding so 1/2" extends out of the secondary side of the core as shown below. Continue with two full turns and trim excess. Retain leftover wire for next step.



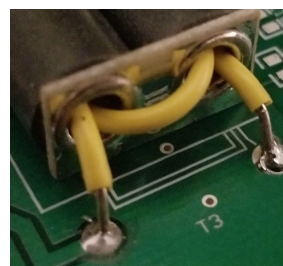
- () Strip insulation from leftover wire and install in the board as shown forming a loop about 1" tall. Solder in place.



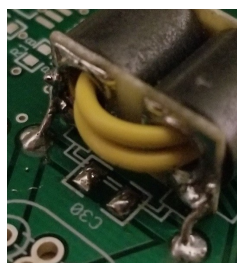
- () Cut the loop to leave two 1/4" tall stubs.



- () Mount T3 as shown below, and solder the leads.



- () Solder the wire stubs to the two primary tubes, being careful not to melt the insulation on the wire.





STEP-BY-STEP ASSEMBLY-10W Amp Board

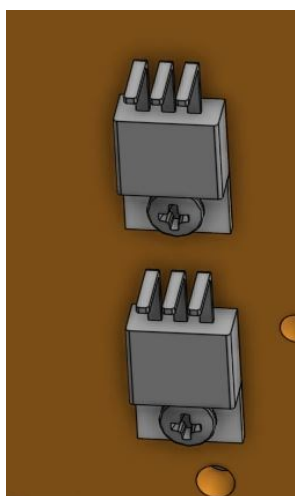
Note: In the following steps, clip excess lead lengths on the bottom of the board after soldering them. It is ok to wait until you have loaded several parts before clipping all of them at once.

- () Load and solder diode D1. The side with the band goes in the square pad.
- () Locate the 0 ohm resistors (bag 1). Since there are three identical resistors, they should be easy to identify compared to the two 2.7 ohm resistors, but you may want to measure them with an Ohmmeter. They will read less than 1 ohm. Load and solder these resistors.
- () Load and solder the 2.7 ohm resistors, R11 and R12 (bag 1).
- () Load and solder the SMT resistor, R23 (bag 1). First apply solder to one pad, then place the part and re-heat the solder. Once that side is done, solder the other side.
- () Load and solder SMT capacitor C30, just as you did R23.
- () Load and solder SMT electrolytic capacitors C31 and C36 as you did with R23. Make sure the side with the stripe goes on the side that has angled corners on the silkscreen.
- () Load and solder the rest of the capacitors (bag 1). They can be identified by the codes printed on them:
 - 1000pF: 102
 - .01uF: 103
 - .1uF: 104
 - .47uF: 474
 - 1 uF: 105
 - 10 uF: 106
- () Load the remaining resistors, one bag at a time.
- () Load RFC1, RFC5 (bag 4) and RFC6 (bag 2) in the same manner as the other SMT parts. Orientation does not matter.
- () Load IC U2 (bag 3). This is an SMT part. Solder one pad, then place the part on it and heat it up. Once it is in place, solder the remaining pins. Be sure the dot lines up with the silkscreened marking (a notch in the silkscreened outline).
- () Repeat the above step for IC U3.
- () Load and solder IC U5. Be sure the notch lines up with the silkscreen.
- () Load regulator IC's U1 and U4. They look just like the transistors and mount the same way.
- () Bend the leads of transistors Q8 and Q9 as shown below (shown as they will appear



STEP-BY-STEP ASSEMBLY-10W Amp Board

when mounted to the copper heat spreader during amp integration) and insert them into the holes on the circuit board. Tack one pin on each transistor in with solder, just enough to keep them from falling out. They will be attached to the copper heat spreader during Amp integration.



This completes assembly of the 10W Amp Board.



Appendix E—High Power Low Pass Filter (HPLPF)

The High Power Low Pass Filter board takes either a 10W signal from the 10W Amp or a 250W signal from the 250W amp, and runs the signal through one of seven low pass filters to remove harmonics and other spurs from the desired signal. It also houses the Transmit/Receive high speed reed relay and Forward and Reverse Power detection circuit, which is used to calculate VSWR. This board also routes the main antenna signal to the receiver during Receive mode.

If you have a question about which part is which, use the electronic version of the parts list, provided on the included flash drive, and click the “Vendor P/N”. This will take you to the web site that has information about that part, including a picture. Should you ever need replacement parts, this is a great way to do it. In most cases, you can order any quantity of parts directly from the vendor. (Of course, if we made a mistake in kitting the parts, you can get a replacement from us free.)



Appendix E—High Power Low Pass Filter (HPLPF)

Reference Designator(s)	Description	Stock bin	Quantity	Bag
	Blank Board - LPF	763A	1	0
CG2A,,CG6A	7pF Silver Mica	353-15-7pF	2	1
CG4A,CG4B,CD5B,CC4B	10pF	353-15-10pF	4	1
CF2B	12pF	353-15-12pF	1	1
CE2	22pF	353-15-22pF	1	1
CG5A	27pF	353-15-27pF	1	1
CD2	33pF	353-15-33pF	1	1
CF4B,CG1A,CG7A	36pF	353-15-36pF	3	1
CG3A	47pF	353-15-47pF	1	1
CE4	51pF	353-15-51pF	1	1
CC2A	56pF	353-15-56pF	1	1
CF1,CF5,CE5	91pF	353-15-91pF	3	1
CB2,CD4	100pF	353-15-100pF	2	1
CE1,CD5A	120pF	353-15-120pF	2	1
CC4A	150pF	353-15-150pF	1	1
CD1,CE3,CF3	180pF	353-15-180pF	3	1
CA2	220pF	353-15-220pF	1	1
CC5	240pF	353-15-240pF	1	1
CB4,CC1	300pF	353-15-300pF	2	1
CD3	330pF	353-15-330pF	1	1
CB5	430pF	353-15-430pF	1	1
CB1,CC3	560pF	353-19-560pF	2	1
CA4	620pF	353-19-620pF	1	1
CA5	910pf	353-19-910pF	1	1
CB3	1000pF	353-19-1000pF	1	1
CA1	1200pF	353-19-1200pF	1	1
CA3	2200pF	353-19-2200pF	1	1

Reference Designator	Description	Stock bin	Qty	Bag
C17,C19	Capacitor 1000pF 50V radial C0G 5%	836	2	2
C5,C6,C7,C8,C9, C10,C11,C12,C13,C14, C15,C16,C18,C20,C21, C22,C23,C25,C41	Capacitor .01uF MLCC radial 50V X7R 10%	575D	19	2
C43	Capacitor .01uF MLCC radial 500V X7R 10%	386	1	2
C27-C33	Capacitor .047uF MLCC 100V X7R 10%	576H	7	2
C1	Capacitor 100uF aluminum electrolytic radial 25V 20%	57	1	2
D1,D2	Diode Schottky rectifier 1N5711 70V 15mA axial DO-35	226	2	2



Appendix E—High Power Low Pass Filter (HPLPF)

Reference Designator	Description	Stock bin	Qty	Bag
D3,D4	Diode Zener 1N4733A 5.1V 1W DO-41 5%	223	2	3
J4	Connector MCX PC-Mt		1	3
J1,J3	Connector 4-pin friction lock header .1in straight post tin	88	2	3
J2	Connector 8-pin friction lock header straight post tin	79	1	3
K1-K14	Relay SPDT 10A 12VDC coil	825	14	4
K15	Relay Sensata D1 Vacuum reed SPDT		1	4
L1,L2,L3,L4,L5,L6	28T, 24T, 19T, 17T (#20), 14T (#18)		6	5
L7,L8,L9,L10	12T,10T, 10T, 9T (#18)		4	5
L11	7T #16 ID .35"		1	5
L12	3T #16 ID .33"		1	5
L13	5T #16 ID .312"		1	5
L14	4T #16 ID .33"		1	5
L15	5T #16 ID .312"		1	5
Q1,Q2	Transistor 2N7000 MOSFET N-ch 60V TO-92	227	2	6
R4,R5,R6,R7	Resistor 100 Ohm 2W 5% axial Metal Film	805	4	6
R16-R29	Resistor 51 ohm 1/4W metal film axial 1%		14	6
R10,R11	Resistor 15K ohm 1/8W metal film axial 1%	356-15K	4	6
R1,R2,R3,R8,R9	Resistor 10K ohm 1/8W metal film axial 1%	356-10K	5	7
RFC1-RFC7	Inductor 100uH 1812 5%	355B-100uH	7	7
RN1	Resistor 9-el array 10K bussed 10-pin	78	1	7
RV1,RV2	Resistor 100K ohm 1/2W trimpot 1-turn side-adjust		2	7
T1	Transformer, dual core, 17T #28 x 2, 1T #20 x 2		1	7
U2	IC ULN2803 relay driver 8-el w/diodes 18-pin DIP	392	1	7
U1	IC LMC6482AIN dual op-amp rail to rail DIP	653	1	7



STEP-BY-STEP ASSEMBLY-HPLPF Board

Parts are mounted on both sides of this board. Assume they mount on the top side unless described otherwise. Refer to the pictures on the previous page. Clip leads after soldering.

- () **Locate Bag 1.** Load (do not solder) all silver mica capacitors on the top side of the board. Bend the leads to hold them in. *It is essential that these be loaded correctly so take time and double check your work.* Use Express-PCB to help you find the location of the part. Silver mica capacitors are marked with the actual value in picoFarads (pF), making them easy to identify. Once all parts are inserted and verified, solder them.

- () **Locate Bag 2.** Load all parts From this bag as follows:

Note: All small capacitors have a code printed on them:

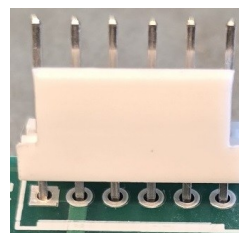
102: 1000pF
103: 0.01 uF (Note that C43 is much larger than the others)
473: 0.047uF

- () Load and solder 100uF electrolytic capacitor C1. Be sure to insert the longer lead into the hole with the square pad (also marked with a “+” on the silkscreen).

- () Load and solder 1N5711 diodes D1 and D2 with the banded side in the hole with a square pad.

- () **Locate bag 3.** Load all parts From this bag as follows:

- () Load and solder 1N4733A diodes D3 and D4 with the banded side in the hole with a square pad.
- () Load RF Connectors J4 and J5 on the bottom side of the circuit board, and solder the pins on the top.
- () Load and solder connectors J1, J2 and J3. Make sure the tall side matches the silkscreen:



- () **Locate bag 6.** Load all parts From this bag as follows:

- () Load and solder transistors Q1 and Q2. The center lead will need to be sprung out slightly. Make sure the flat side of the transistor matches the silkscreen:





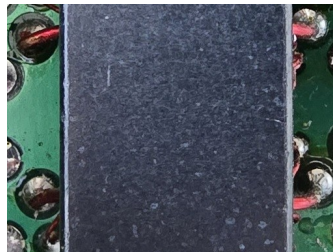
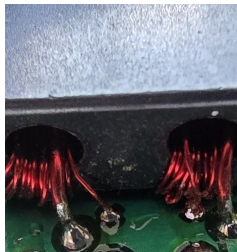
STEP-BY-STEP ASSEMBLY-HPLPF Board

- () Load and solder 100 ohm 2W resistors R4, R5, R6, R7.
- () Load and solder 51 ohm 1/4W resistors R16 through R29.
- () Load and solder 15K 1/8W resistors R10 and R11.
- () **Locate bag 7.**
 - () Load and solder 10K 1/8W resistors R1, R2, R3, R8, and R9.
 - () Load and solder resistor network RN1. Make sure the side with the dot is inserted into the hole with the square pad.
 - () Load and solder 100K ohm trim pots RV1 and RV2. They will only go in one way.
 - () Apply a small amount of solder to one of the two pads for each of the parts marked RFC1-RFC7. Place a 100uH RF choke on the pads and heat it until it melts. Remove the soldering iron and let it cool. Then apply solder to the other side.
 - () Load and solder the two ICs, U1 and U2. Be careful to insert pin 1 in the hole with the square pad. Refer to the introduction in this manual for help identifying pin 1 on through-hole IC's.
- Important! In the next steps, you will be cutting magnet wire and winding transformers and toroids. Be sure to use the right size wire! Sizes increase with decreasing AWG number, so 20AWG wire is thicker than 28AWG wire. See photos on next page.*
 - () Wind dual core ferrite T1 as follows:
 - () Cut the 28 AWG magnet wire in half, making two pieces, each 26" long.
 - () Wind 17 turns of red 28 AWG magnet wire in one hole.
 - () Wind 17 turns of red 28 AWG magnet wire in the other hole.
 - () Insert the transformer at T1 *on the bottom of the board*. Pull the wires tightly in the four holes and clip the leads on the top side of the board. Remove the transformer, tin the leads, then re-insert it and solder all four leads.
 - () Cut the 20 AWG magnet wire into two 1 1/3" segments.
 - () Insert one wire through one hole in the transformer and solder it as shown below.
 - () Repeat the previous step



STEP-BY-STEP ASSEMBLY-HPLPF Board

with another of the two pieces of magnet wire.



- () Cut the 20 AWG magnet wire into four lengths of 31", 26", 21", and 19".
- () Wind the specified lengths of wire through a T80-2 toroid (red/gray) as noted:
 - L1: 28 turns using 31" wire
 - L2: 24 turns using 26" wire
 - L3: 19 turns using 21" wire
 - L4: 17 turns using 19" wire

Note that the inductors are silkscreened on the top of the board, so locate them using the silkscreen, but insert them from the bottom, and solder the leads on the top.

- () Insert L1, clip the leads, then remove it and tin the ends of the leads. Re-insert the toroid and solder it.
- () Repeat the previous step for L2, L3 and L4.
- () Cut the 20 AWG magnet wire into two pieces, 16" and 14".

- () Wind the specified lengths of wire through a T80-2 toroid (red/gray) as noted:

L5: 14 turns using 16" wire
L6: 12 turns using 14" wire

- () Insert L5, clip the leads, then remove it and tin the ends of the leads. Re-insert the toroid and solder it.

- () Repeat the previous step for L6.

- () Cut the 20 AWG magnet wire into four lengths of 14", 11", 11" and 10".

- () Wind the specified lengths of wire through four T80-6 toroids (yellow/gray) as noted:

L7: 12 turns using 14" wire
L8: 10 turns using 11" wire
L9: 10 turns using 11" wire
L10: 9 turns using 10" wire

- () Insert L7, clip the leads, then remove it and tin the ends of the leads. Re-insert the toroid and solder it.

- () Repeat the previous step for L8, L9 and L10.

- () Cut the 20 AWG magnet wire into five lengths: 9", 9", 7", 7" and 6".

- () Create an "air-wound" coil,



STEP-BY-STEP ASSEMBLY-HPLPF Board

7 turns, such that the diameter is approximately 0.35". Use a wooden dowel if you have one, or just measure it with a ruler. The gap between turns should be about 1/16". Insert this on the **bottom** side of the board at L11.

() Place a #6 fiber washer over the threads on the 2 1/2" spacer. Attach a 3/4" spacer to the other side of the fiber washer. This will be adjusted when the board is integrated into the chassis.

This completes assembly of the HPLPF board.

() Repeat the previous step for L12, also using 7 turns.

() Repeat the previous step for L13 and L15, using 5 turns. Mount these on the **top** side of the board.

() Repeat the previous step for L14, using 4 turns.

() **Locate Bag 4.** Load and solder all relays. They can only be inserted one way.

() **Locate the Hardware Bag.**

() Insert a 6-32 x 1" spacer into the top right corner mounting hole from the top of the board and secure it to the bottom of the board using a 6-32 KEPS nut.

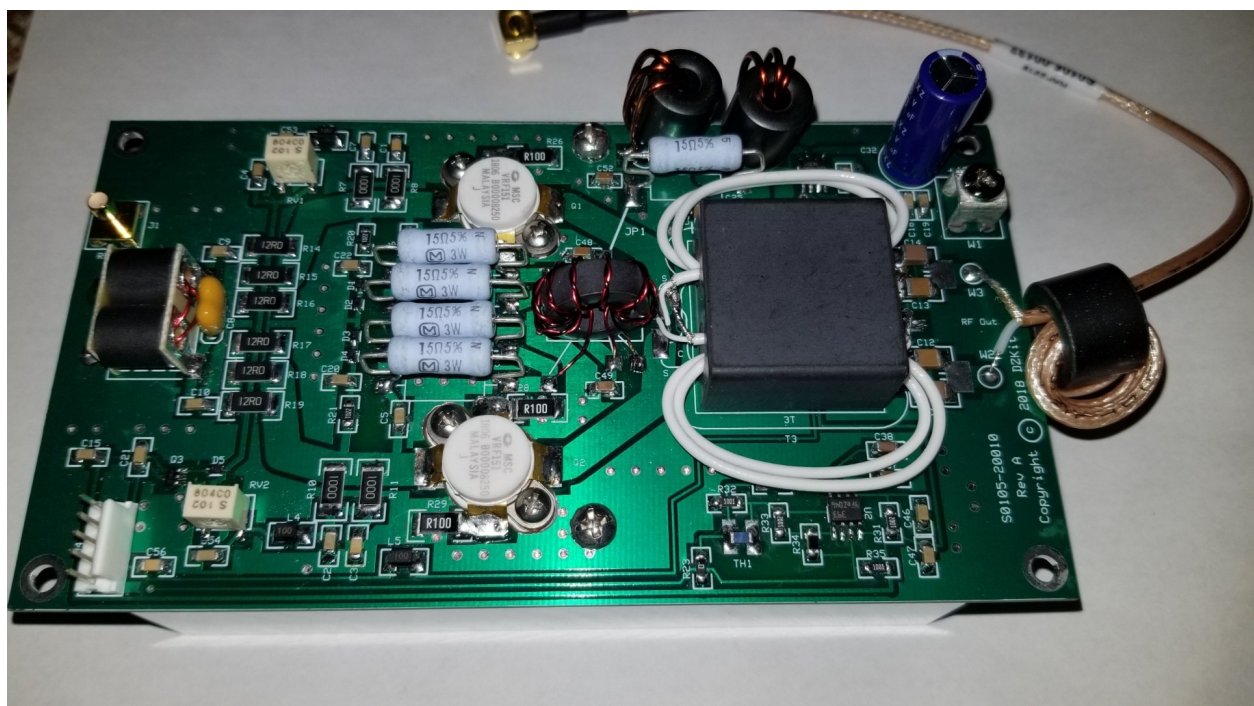
() Insert a 6-32 x 2 1/2" spacer into the top left corner mounting hole from the bottom of the board and secure it using a 6-32 x 1/4" SEMS screw on top.



Appendix F: 250W PA Board

The 250W PA Board takes a 10W RF signal from the LPLPF Board and amplifies it, producing up to 250W (less on AM). A pair of Microsemi VRF151 MOSFET power transistors running at 48VDC and operated in push-pull produce a clean output with very low even-harmonic content. Odd harmonics are attenuated with LC filters on the HPLPF board. A Hall-Effect sensor (U3) measures drain current and passes it to the controller. A temperature sensor circuit (U2) provides a signal to the 10W Amp that switches the large fan to high speed if the temperature rises past a reference level.

The parts list for the board is included on the next page. If you have a question about which part is which, use the electronic version of this parts list, provided on the included flash drive, and click the "Vendor P/N". This will take you to the web site that has information about that part, including a picture. Should you ever need replacement parts, this is a great way to do it. In most cases, you can order any quantity of parts directly from the vendor. (Of course, if we made a mistake in kitting the parts, you can get a replacement from us free.)





250W Amp Parts

Description	Stock bin	Quantity	Bag
250W PA Board Blank - S0105-20010	761A	1	1
Hardware 6-32 x 1/4in PH Phillips M/S ext tooth lockwasher SS	644	2	1
Hardware 6-32 x 1/2in PH Phillips M/S ext tooth lockwasher SS	828	2	1
Hardware 6-32 x 3/4in Hex M/F Spacer SS	832	4	1
Hardware 4-40 x 1/2in PH Phillips M/S SS no P/L	831	4	1
Hardware 6-32 x 5/8in Hex M/F Spacer SS		2	1
Hardware 6-32 x 3/4in Hex M/F Spacer SS		4	1
Hardware 6-32 x 1 1/2in Hex M/F Spacer SS		2	1
Hardware 6-32 KEPS Nut SS	464	6	1
Chemical silicon grease Wakefield 4g tube	167	1	1
Chemical ASI388 RTV silicon adhesive	810	1	1
Sienna XL Copper heat spreader - amp S0105-00013	917	1	1
Custom 250W Heatsink w/tapped holes - S0105-00012	920	1	1

S0105-30010 250W Amp Board - Preload

Reference Designator(s)	Description	Stock bin	Quantity
D1,D2,D3,D4	Diode 1N4148WS SOD-323-2	839	4
Q3	MMBT3906	315	1



250W Amp Parts

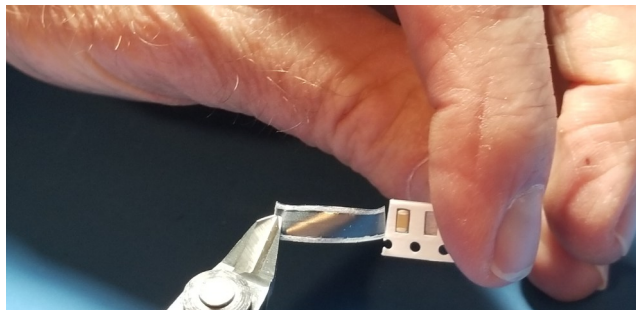
S0105-40010 250W Amp Board Kit				
Reference Designator(s)	Description	Stock bin	Qty	Bag
J1	Connector SMB PC-Mt	407	1	2
J2	Connector 5-pin friction lock header straight post tin	369	1	2
L1,L2	3T #16 on BN43-2402 - F/R 2643480102	840	2	2
T1	2T #22 on RF400-0 No winding, type 43	841	1	2
T2	8T #24 bifilar, 1T #22 on F/R 5961004901	842	1	2
T3	3T*2 25 Ohm coax on F/R 2861010002	843	1	2
W1	6-32 screw terminal	293	1	2
	Wire Coaxial cable 25 ohm (feet)	738	2	2
	Wire 16 AWG red magnet wire 10"	711	10"	2
	Wire 22 AWG red magnet wire 5"	720	0.5	2
	Wire 24 AWG red magnet wire 8"	721	0.7	2
	Wire 24 AWG green magnet wire 8"	724	0.7	2
C8	Capacitor 100pF silver mica radial 500V 5%	353-10-100pF	1	3
C27	Capacitor 1000pF MLCC 1206 200V X7R 10%	295-1206-1000pF	1	3
C32	Capacitor 220uF 63V Aluminum electrolytic 20% radial	799	1	3
L3,L4,L5	Inductor 10uH 150mA Shielded 1210 5%	355A-10uH	3	3
R23	Resistor 0 Ohm 250mW 1206	308-1206-0	1	3
RV1,RV2	Resistor 10K ohm 1/2W trimpot 1-turn side-adjust	169B	2	3
TH1	Thermistor 10K 1/2W radial NTC	215	1	3
C51,C52	Capacitor 0.47uF MLCC 1206 100V X7R 5%	295-1206-.47uF	2	4
R1	Resistor 49.9 Ohm 250mW 1206 1%	308-1206-49.9	1	4
R9,R31,R33	Resistor 10K Ohm 250mW 1206 1%	308-1206-10K	3	4
Q1,Q2	Transistor Microsemi VRF151 RF MOSFET 16A 22dB Matched pair	837	1	4
U2	IC LM393D Dual comparator 8-pin SOIC	545	1	4
C37	Capacitor 10uF MLCC 1206 16V X7R 10%	295-1206-10uF	1	5
C11,C14	Capacitor 0.01uF MLCC 1812 1000V C0G 5%	295-1812-.01uF	2	5
C1,C3,C26,C56	Capacitor 0.01uF MLCC 1206 200V X7R 10%	295-1206-.01uF	4	5
C2,C4,C5,C6,C7,C9,C10,C15,C16,C17,C18,C19,C20,C21,C22,C24,C25,C35,C46,C47,	Capacitor 0.01uF MLCC 1206 200V X7R 10%	295-1206-.1uF	23	5
R26,R27,R28,R29	Resistor 0.1 Ohm 500mW 1206 1%	309-2512-0.1	4	5
R2,R3,R4,R5,R6	Resistor 15 ohm 3W metal oxide axial 5%	555	5	5
R14,R15,R16,R17,R18,R19	Resistor 12 Ohm 2W 2512 1%	309-2512-12	6	5
U1	IC ACS722 Hall Effect Sensor 20A DC	845	1	5
C38	Capacitor 22uF MLCC 1206 10V X7R 10%	295-1206-22uF	1	6
C48,C49	Capacitor 0.22uF MLCC 1206 100V X7T 10%	295-1206-.22uF	2	6
R30	Resistor 200K Ohm 250mW 1206 1%	308-1206-200K	1	6
R32,R35	Resistor 4.7K Ohm 250mW 1206 1%	308-1206-4.7K	2	6
R7,R8,R10,R11	Resistor 100 Ohm 1W 2512 1%	309-2512-100	4	6
C12,C13	Capacitor 0.33uF MLCC 1812 250V X7R 10%	295-1812-.33uF	2	7
R34	Resistor 1M Ohm 300mW 1206 1%	308-1206-1M	1	7
R12,R13,R20,R21	Resistor 2.2K Ohm 250mW 1206 1%	308-1206-2.2K	4	7



STEP-BY-STEP ASSEMBLY-250W Amp Board

All parts mount on the silk-screened side of the board. Refer to the photos on the previous page.

***IMPORTANT Note:** Most parts on this board are surface mount technology (SMT) types. They are large and easy to solder, but they can be hard to find if they flick away from the tape they are shipped in. The correct way to handle these parts is to remove them from the tape one at a time. Peel the clear plastic from the top of the tape one part at a time, being careful not to flex the tape. Turn the tape over close to your work surface and let the part fall out. Then, for the smaller parts, use tweezers to place them on the pads. See picture below.*



it in place with tweezers, pencil or other tool and solder the one pad you added solder to earlier. When it is soldered, apply solder to the other pad.

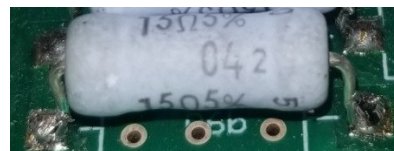
Note: Capacitors look alike and have no markings on them, so it's important to remove capacitors from their tape one at a time. Do not empty these parts into other containers. The bags have been carefully filled with tapes of different numbers of parts to make them easy to find. For example, in bag 6, C38 is the only capacitor that is on a tape with only one part. The other capacitors in this bag (C48, C49) are on a tape with two parts. Resistors are easier to identify because they are marked with their part value, but these are also bagged so the tapes have different quantities.

() Apply a small amount of solder to the pads on ONE side of every SMT component on the board. (You may miss some, but you can add solder later when you actually solder the part on its pads.)

() Load all SMT capacitors (Bag 3-C27 and all capacitors from bags 4, 5, 6 and 7.) As you place a part on its pads, hold

() Load all **SMT** resistors from bags 3, 4, 5, 6 and 7 (Do not load R2-R6).

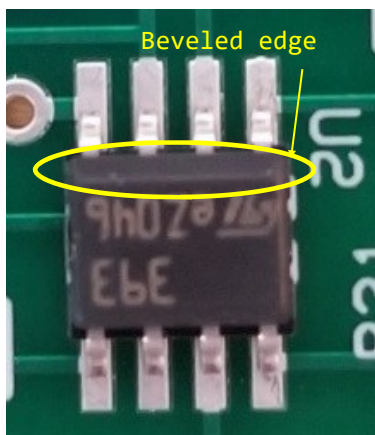
() Bend the leads of 3 Watt resistors R2-R6 so they form an "S" shape. Mount them one quarter inch above the board. Apply a generous amount of solder to both sides to make sure these parts are firmly anchored to the board.





STEP-BY-STEP ASSEMBLY-250W Amp Board

- () Load and solder Trimpots RV1 and RV2 (Bag 3). (longer) lead in the square pad. Clip excess leads.
- () Load and solder inductors L3, L4 and L5 (bag 3)
- () Load and solder thermistor TH1 (bag 4).
- () Load and solder U2, an 8-pin "SOIC" SMT comparator marked "393" (Bag 4). As with the other parts, apply a small amount of solder to one pad, place the part on the board, and solder that pin. Then solder the other pins. Be careful to position pin 1 where shown:



- () Load and solder U1, an 8-pin SOIC current sensor marked "ACS722" (Bag 5).
- () Load and solder C32 (Bag 3). This is a large electrolytic capacitor with the negative lead marked on the side of the capacitor. Mount this capacitor with the positive

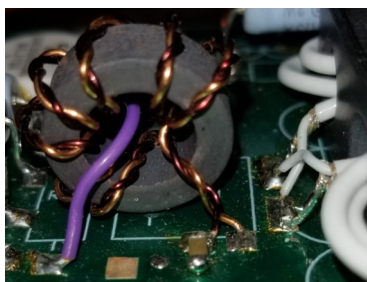
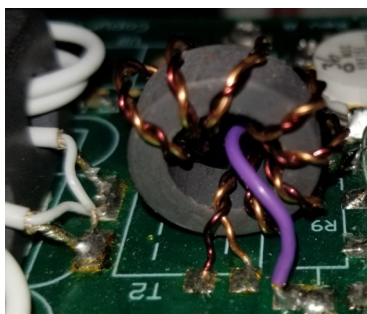
- () Load and solder W1 (Bag 2). This is a screw terminal. It will require a lot of heat to solder properly. Be careful not to burn your fingers. Solder one lead first with the part lying flat on the board, then solder the other leads.
- () Load and solder connector J1 (Bag 2), an RF "SMB" connector. Orientation does not matter.
- () Load and solder connector J2 (Bag 2). Make sure the side with the tab lines up with the bar on the silkscreen.
- () Load and solder capacitor C8 (Bag 3). Clip excess leads.
- () Cut the 16 AWG magnet wire in half. Wind 3 turns of 16 AWG magnet wire around each of the two cylindrical toroids. Strip and tin the leads, then solder the leads to the top of the board at locations marked L1 and L2. Keep the height of the toroids as low as possible.



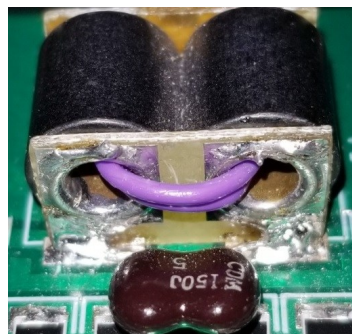
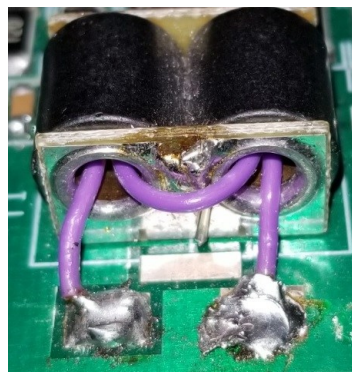


STEP-BY-STEP ASSEMBLY-250W Amp Board

- () Twist the 8" lengths of red and green 24 AWG magnet wire about 8 turns per inch. Wind the twisted wires 8 turns around the toroid. Place the toroid at the location marked T2 on the silkscreen. Strip 1/8" off the ends and tin them. Solder the four wires as shown below. Clip excess lead lengths.



small dual-core toroid and solder the leads as shown below.



- () Cut a 1 1/2" length of red 22 AWG magnet wire. Strip 1/8" off the ends, and tin them. Pass the wire through the center of toroid T2 and solder the leads as shown in the previous step.
- () Strip 1/8" off the ends of the remaining red 22 AWG magnet wire and tin the ends. Wind the wire through the
- () Cut the coaxial cable into two lengths of 10" each. Strip the insulation back 1/2" on each end. Strip the center conductor to a length of 1/8". Twist the braid so that it forms a lead and tin it. Wind each side of the large dual-core toroid with three turns. Solder the leads as shown below. Note that the center conductors cross each



STEP-BY-STEP ASSEMBLY-250W Amp Board

other on the side closest to T2. Solder the two braids to each other.



power transistors so that they fit on the pads, while making sure the metal bottoms continue to touch the copper heat spreader. Remove the transistors.

- () Cut the top off of the tube of heatsink compound. Smear a liberal amount on the bottom (metal side) of each of the two power transistors (Q1, Q2). This is very messy grease. Avoid getting it on your fingers or clothing.

- () Attach the copper heat spreader to the large aluminum heatsink and circuit board using two 6-32 x 3/4" SEMS screws in the middle two mounting holes at the top and bottom of the circuit board as shown in the top view at right:



- () Place the transistors into their holes, making sure the angled tab (Drain) is on the pad marked with a "D" on the board. Insert two 4-40 x 1/2" screws into the mounting holes of each transistor, through the copper spreader and into the aluminum heatsink. Tighten these screws.
- () Solder all four leads of each transistor to the board.

Make sure the tapped mounting holes in the side of the large heatsink face down. J4 should be near the top.

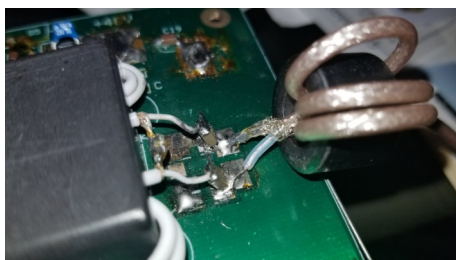
- () Test fit the power transistors (Q1, Q2) into the large holes in the board so that the metal bottoms touch the copper heat spreader firmly.
- () Bend the leads of the two





STEP-BY-STEP ASSEMBLY-250W Amp Board

- () Solder the two free leads of cable RF_250WOUT-LPF (S0105-00132) to the points labeled W2 and W3 as shown below. It does not matter which lead goes to which pad.



- () Squeeze a small amount of adhesive from the ASI 388 RTV tube around the sides of the large output transformer and all other toroids on the board.

NOTE: 388 RTV is special non-conductive adhesive that is intended for electronic circuits. Once it sets, it is very difficult to remove, so you may wish to wait until you have tested the transmitter before fastening loose parts. You can also use this adhesive on toroids throughout the radio to prevent them from moving.

This completes assembly of the 250W PA Board.



Appendix G—10W LPF Board

The 10W LPF board has seven low pass filters on it to cover all amateur bands from 160M through 6M. The filter selection is done by a decoder on the 10W Amp board, which receives the encoded bits from the Tx Audio board. This board also serves an interconnect to pass the same control information and power to the High Power Low Pass Filter (HPLPF) board. The only difference between the 10W LPF and the HPLPF filters is the power handling ability. The HPLPF board also has a power meter on it to measure actual transmitted power.



Appendix G—10W LPF Board

S0105-40011 10W_LPF Board Kit Rev A		1047	
Reference Designator(s)	Description	Quantity	Bag
	Blank Board	1	0
J1,J2	Connector MCX PC-Mt	2	1
J3,J6	Connector 4-pin friction lock header .1in straight post tin	2	1
J4,J5	Connector 8-pin friction lock header straight post tin	2	1
K1-K14	Relay sealed Form-A 1A 12V SMT low profile	14.0	1
U1	IC ULN2803 relay driver 8-el w/diodes 18-pin DIP	1	1
RN1	Resistor 7-el array 10K bussed 8-pin	1	1
L1-L4	Toroid T50-2	4	2
L5-L14	Toroid T50-10	11	2
	Wire 24 AWG red magnet wire (feet) - solderable polyester	15	2
C32,C34	Capacitor 6.8pF MLCC radial 100V C0G 0.5pF	2	3
C27	Capacitor 12pF MLCC radial 100V C0G 5%	1	3
C22,C33	Capacitor 22pF MLCC radial 50V C0G 5%	2	3
C37	Capacitor 27pF MLCC radial 50V C0G 5%	1	3
C17	Capacitor 33pF MLCC radial 100V C0G 5%	1	3
C28,C35,C38	Capacitor 36pF MLCC radial 100V C0G %	3	3
C36	Capacitor 47pF MLCC radial 100V C0G 5%	1	3
C23	Capacitor 51pF MLCC radial 100V C0G 5%	1	3
C12	Capacitor 56pF MLCC radial 100V C0G 5%	1	3
C26,C31	Capacitor 91pF MLCC radial 50V C0G 2%	2	3
C7,C18,C29	Capacitor 100pF MLCC radial 50V C0G 5%	3	3
C21,C24	Capacitor 120pF MLCC radial 100V C0G 5%	2	3
C13	Capacitor 150pF MLCC radial 100V C0G 5%	1	3
C19	Capacitor 180pF MLCC radial 100V C0G 5%	1	3
C30	Capacitor 200pF MLCC radial 50V C0G 2%	1	3
C2,C25	Capacitor 220pF MLCC radial 50V X7R 10%	2	3
C16	Capacitor 240pF MLCC radial 50V C0G 5%	1	3
C8,C14	Capacitor 300pF MLCC radial 100V C0G 5%	2	3
C20	Capacitor 330pF MLCC radial 100V C0G 5%	1	3
C11	Capacitor 430pF MLCC radial 250V C0G 1%	1	3
C15	Capacitor 560pF MLCC radial 100V C0G 5%	1	3
C3	Capacitor 620pF MLCC radial 500V C0G 5%	1	3
C6	Capacitor 910pF MLCC radial 250V C0G 1%	1	3
C10	Capacitor 1000pF MLCC radial 100V C0G 5%	1	3
C4	Capacitor 1200pF MLCC radial 100V C0G 5%	1	3
C5	Capacitor 2200pF MLCC radial 100V C0G 5%	1	3
C1	Capacitor 22uF tant "B" 16V 20%	1	3

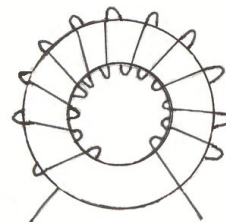


STEP-BY-STEP ASSEMBLY– 10W LPF Board

Note: All parts mount on the top side of the board EXCEPT J3 and J4. Since there is no silkscreening on the bottom of the board, use the front side as a guide. The tall “bar” on the connectors should be lined up with the top of the board.

Relays and capacitor C1 are SMT parts. To solder these, solder one pad, then place the part on the board so that all the pins line up with the pads, then hold the part down while re-heating that one solder connection. Once done, the part will not move while you solder the other pins.

- () Load and solder all through-hole capacitors. Part values are encoded on the parts. For example, 6.8pF is 689. 150pF is 151. Clip excess leads.
- () Load and solder SMT electrolytic capacitor C1. Make sure the side with the band lines up with the angled side of the silkscreen.
- () Load and solder all SMT relays.
- () Load and solder resistor network RN1. Pin 1 is marked with a dot on the part. This goes in the square pad.
- () Load and solder IC U1. Make sure pin 1 goes into the square pad.
- () Load and solder all connectors. Be sure J3 and J4 are mounted on the back.
- () Wind toroids as described below. It is best to do these one at a time or place them in an egg carton or muffin tin so you don't have to count windings after you are done:
 - L1-L4 are T50-2 (red)
 - L1: 20 turns
 - L2: 18 turns
 - L3: 14 turns
 - L4: 13 turns
 - L5-L14 are T50-10 (black)
 - L5: 13 turns
 - L6: 12 turns
 - L7: 10 turns
 - L8, L9: 9 turns
 - L10: 8 turns
 - L11, L12: 6 turns
 - L13, L15: 5 turns
 - L14: 4 turns



Example toroid winding (12 turns)

Each time the wire passes through the core counts as one turn.



STEP-BY-STEP ASSEMBLY– 10W LPF Board

- () Insert each toroid into the pads and clip the leads. Then remove them, one at a time, and tin the ends with solder. This can take a while since you are melting the coating. Make sure your soldering iron is hot! Once tinned, re-insert and solder them.

This completes assembly of the 10W LPF board.

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