Munin 2 General Construction Information

If you are accomplished at Surface Mount Construction you can probably just skip over the first part of this document.

General:

- Depending upon your eyesight you may need different types of magnification for SMT assembly. If you are farsighted you definitely will require some magnification to solder the components. If you have near perfect vision or are nearsighted [like me] you can just put your head in a position that is in focus and use the world's most perfect lens – your eyes. In any case to read the tiny print or inspect solder joints there will still be a need to find appropriate magnification for the task.

- You will also need a very bright light to illuminate the work surface – no shadows if at all possible. I use a flexible swing arm desk lamp with a 40 Watt flood lamp that can be positioned a foot or so above the work surface.

- The work surface should be white, and I just use couple of 8½ x 11" sheets of paper. You might consider using an inexpensive cookie sheet that has raised edges [to catch stray parts] with the paper on top to eliminate reflections until you know what to expect.

- Only work with one part at a time and only remove 4 or 5 parts for placement at a time, even if there are a large quantity of the same part to place.

- You will have to determine the technique that works best for your assembly. I generally place the parts on the PCB with hemostats and use a dental pick to get the part in final position. When soldering heat one pad [not ground] and feed in a bit of solder. Usually the part will center itself on the heated pad. Continue on with other placed parts and then return and reheat and use the dental pick to slide into final location or flatten tombstone parts. Finish by soldering the other side (or pins) and check for proper joints. With multi lead parts, like SOIC's do the same thing with one lead and then make sure the part is positioned properly on all of the pads, before soldering more leads.

Soldering Tools:

- A soldering iron is a necessity. Many recommend an expensive heat station with all types of features. My choice for over 30 years is a Weller WR-40P [40 Watt] Iron with a ST6 tip [I still have and use the original purchase and tip]. You should also have a stand like the PH25 or PH60 with the sponge holder. I also use a switch and 1N4007 in series with the iron [half wave power] so it can idle with out getting the tip full of crud. This works as good or better than any variable control system or station that I have ever used. [The only exception was an extremely expensive hot air station used with solder paste for fine pitch parts, primarily for their repair and removal.]

- It is imperative that the tip is ***always*** bright and clean for the best solder joint. To accomplish this you will need a Kleen-tip sponge and tray or some fine steel wool I prefer the sponge, that is kept damp, as it preserves the tip. If there is black scale on the tip, it will not conduct the heat properly to the component and PCB and most likely will result in a big solder ball. Wipe the tip on the sponge, before and after each joint.

- For solder, I recommend a 60/40 Tin/Lead with a mild rosin core flux or one of the similarly proportioned alternatives. If you can get a small diameter spool in 0.025" diameter or less it will work better than the common 0.032" or larger sizes. Forget about the lead free RoHS stuff if you want good reliable joints at home.

- You will also need some Solder Wick in different sizes to clean up excess solder or to desolder. A solder sucker bulb or a desoldering pump [like the Weller 7874B] is also useful.

- Finally you should have an assortment of stainless steel dental picks, tweezers and hemostats to maneuver and hold onto parts. Dental picks are also useful to clean out through hole solder joints when removing parts.

- You will also need some single edge razor blades or a hobby knife to separate the parts from the machine tape.

- Harbor Freight in the USA has an extensive collection of useful tools for electronics and SMT including assortments of dental picks, tweezers, hemostats, hobby knifes and razor blades. Their 3x Clip on Magnifier #66825 and Micro Flush Cutter #90708 are hard to beat.

Preliminary Activities:

There are Part Pick Sheets with color coded cross referenced Component Referenced Drawings for Munin. You should start by putting the parts on the Pick Sheets so that you can verify that you have the right parts associated with the correct reference numbers. And, that you have all of the parts.

There are 4 parts that require some extra work **BEFORE** you start assembling the rest of the PCB.

1. Heatsink: If you plan to attach the heatsink to a chassis or another enclosure you will need to drill and tap the required holes before attaching the heatsink to the PCB. The heatsink already has sixteen 4-40 holes on the bottom to attach the PCB only.

2. Source Flange Connection Strips: There are four [4] thin strips of Copper to provide the ground connections on T1 & T2 in the parts kit [0.0431" x 15/16" x 7/32"]. You need to carefully drill or punch a clearance hole [0.1285" or #30 Drill] for the 4-40 screws in the geometric center of each strip. Be careful if

drilling to not deform the flatness of the strips. Consider using a hand drill, Pin Vise or a low speed on a drill press. The geometric center can easily be found by scribing an X on each part from corner to corner.

3. Copper Heat Spreader: The Spreader requires drilling ten (10) holes for 4-40 screws that will be used to mounting the spreader to the heatsink and the RD100HHF1 transistors. Refer to the Spreader drill drawing "Heat_Spreader_Drill_Drawing_06092113.pdf" and note the Spreader is 0.25" thick not 3/16". You will need a #30 [0.1285"] drill and a countersink for the six mounting holes. Be careful not to mar or scratch the finish on the Copper surfaces that interface to the heatsink or the transistors, as that will degrade the efficiency of the heatsinks.

4. Power Terminals [MH11 & MH12]: Before starting assembly on the PCB, take two [2] of the #8 Flat Brass Washers and solder them to the bottom side of the PCB at the Power Terminals [MH11 & MH12]. Center each washer on its respective Bottom Side pad of the Power Terminal. After the PCB is attached to the heatsink the bottom side will no longer be accessible. Detailed assembly described below.

   If you are going to use the Powerpole contacts do not attach the washers until you are sure the connectors will fit through the Brass washers. Or attach them later when you install the contacts.

Construction:

Start with the Component Reference Drawings on page 4 and insert the capacitors first. Just follow the page numbers and the pick sheet color-coding for each set of parts. It is best to place all of the smaller parts first and place the higher parts at the end.

Set the four [4] Trimmer pots [R37, 38, 39 & 40] initially to have near maximum value when installed on the PCB. After soldering, check with an Ohmmeter to be sure they all are at or near maximum resistance. This keeps the amplifier Transistors from drawing too much current before they have been properly adjusted for linear operation.

The Torroids and Transformers can be wound before or after the parts are placed on the PCB.

All of the Torroids are wound in the clockwise direction. Even though there are not very many turns to wind on any of the torroids you may find that, due to the #18 ga wire, it is better to wind half of each winding from the center to each end.

Note: For the Bifilar wound coils you should strip some insulation off of both ends of only one of the wires [or color code with nail polish] so you can easily identify the ends of both wires after the coil is wound and select the correct ends to connect together [if you forget, use an ohmmeter to find correct ends and to verify]. Twist the wires so that the pitch is 3 to 4 turns per inch.

1. Take the length of wire required for the coil and bend into a “U” shape and drop the torroid onto the “U”.

2. Keep the ends of the wire together and form the wire closely to the torroid form at the bottom of the “U”.

3. With the wires vertical at the 12 o’clock position take the wire from the rear of the torroid and wind the required turns clockwise through the front of the donut hole.

4. Try to form the wire to closely conform to the torroid core as close as possible, with out kinking the wire.

5. When you finish the first side, take the remaining half of the wire and wind the remaining turns through the rear side of the torroid.

The binocular cores are wound in a similar fashion by first making a “U” with the wire and placing the core on the “U” with a wire through each hole, which is a full turn. Finish the winding by alternatively feeding each free end through the core until the required number of full turns are obtained.

Winding Data Summary

Ref	Core	Primary	Secondary
L2	BN-43-302	4 Turns of #22 ga [8”]	1 Twisted Bifilar Turn of #22 ga [2 x 3”]
L3	FT-82-43	8 Twisted Bifilar Turns of #18 ga [2 x 13.75”]	1 Turn #18 ga
L4	BN-61-002	See Separate Instruction Sheet. 1 Turn made from Coax shield.	See Separate Instruction Sheet. 4 Turns 18 ga Stranded Teflon Covered Wire
L5	RF800-43	1 Twisted Bifilar Turn of #22 ga [2 x 4”]	Part of core
L8	FT-50-43	8 Turns #18 ga [12”]	none

For winding L4 see the separate winding instruction sheet.

Solder all of the inductors and transformers to the PCB in their correct positions.

Assemble the hardware for the power terminals:

Place the #8 Internal tooth SST Lockwasher on the #8 Brass Screw and insert through the PCB from the bottom side.

1. Place a #8 Brass Flat Washer over the screw, on the top side of the PCB. Followed by a #8 SST Split Lockwasher and a #8 Brass Nut.

2. Use a slotted screwdriver to **hold** the Brass Screw with the slot facing to the outside of the PCB while you tighten the Brass Nut to completely compress the Split-ring SST Lockwasher on top of the top Brass Washer.

3. Repeat for the second power terminal.

If you have chosen to install PowerPole connectors, consider wrapping a few turns of #30 bare wire around the bottom side of the pin to help fill the void of the hole. Be certain you have the PowerPole contacts oriented correctly before soldering.

Attach any remaining parts before assembling the 4 RF Power Transistors.

Heat Spreader:

The Copper heat spreader is attached to the heatsink with six [6] 4-40 flathead SST screws. Place a ***thin*** coating of thermal grease on the bottom of the heat spreader before attaching to the heatsink. Make sure that T1 & T2 clearance holes are over the tapped holes in the heatsink. The screw heads should be as flush as possible. DO NOT over tighten the screws.
Note: The purpose of the thermal grease is to fill any air holes or gaps between the spreader and the heatsink with a thermally conductive material that is a better conductor of heat than the air. If it is too thick it will reduce the effectiveness of the heat spreader and the heatsink.

Attach the four [4] 4-40 x ¼“ aluminum spacers to the heatsink in the corners.

T3 & T4 [RD16HHF1 TO220 style]

- The leads of T3 & T4 need to be bent upward, away from the mounting plate and heatsink. Turn the PCB over and place the transistors flat on the bottom side of their respective locations, so you can see the approximate distance required before the leads must be bent upward 90 degrees.

- Next place the transistors with the bent leads on the heatsink and loosely attach each one with a 4-40 screw. You will need a 3/32” Allen wrench for the screws.

- With the PCB in its normal position, slide the PCB onto the leads of T3 & T4. Make sure the 4 corner mounting holes of the PCB and the transistor leads will be correctly aligned when assembled. Dissasemble and rebend the leads if required. Recheck again if you move the leads. When you are sure everything is correct, put a thin coat of thermal grease on the bottom of T3 & T4 and again loosely attach to the heatsink with 4-40 Cap Screws, Split Ring Lock Washer and Flat Washer hardware. Do not solder to PCB until T1 & T2 have been mounted.

- You can now attach the PCB to the heatsink by sliding it over the leads of T3 & T4 and attaching the mounting hardware to the four corner mounting spacers.

[Note: If you have not inserted the spacers do not tighten the corner screws too tight.

The heat spreader thickness affects the distance from the bottom of the RD100HHF1 mounting flange and the spacers required to support the board on the 4 mounting corners. It is necessary to keep the top of the mounting flange of the RD100HHF1 at the same level as the top of the PCB so that the thin 0.1mm Gate and Drain leads in addition to the two copper straps used to attach the Source flange are not unduly stressed during installation. From a pure mathematical analysis, without tolerance considerations, a spacer of 0.114" would be required to keep the PCB aligned with the bottom of the contacts of T3 & T4 when using a ¼" Heat Spreader.

Due to an unfortunate miscommunication the Spreader hardware was set up using a 3/16" Spreader but the actual Spreader is ¼" thick.

Currently the best solution may be to try and find an appropriate 3/8" spacer and remove 0.10" to 0.12" with a file.

Refer to "Mounting_The_RD100HHF1.pdf" for some additional information.]

- After the board is aligned you may tighten the screws for T3 & T4.

T1 & T2 [RD100HHF1 flange mounting]

1. Place a thin coating of thermal grease on the bottom of each device.

2. Place each part through the PCB slot and down on the heat spreader with the Drain, pin 1 [with 45° cut tab] facing the end of the PCB with the power connections.
3. Make sure the slots on the ends line up with the mounting holes in the spreader and the heatsink.

4. Place the Source grounding straps over each end of the transistor and insert the Socket Cap Screws with a lock washer and a flat washer through the grounding strap hole and loosely snug up the screws.

5. It is important that the tabs for the Drain and Gate lie flat on the PCB with out mechanical stress on the rest of the transistor package. It is also necessary to have all 6 ends of the tabs and ground straps aligned over their PCB contacts before soldering. If the leads and PCB are not in the same plane add shims between the four corner mounting spacers and the PCB to keep the parts flat and aligned before soldering.

6. When everything is properly aligned solder all 12 tabs.

7. Now solder the 6 leads on T3 & T4.

8. Finally tighten all of the Cap Screws with a 3/32" Allen wrench.