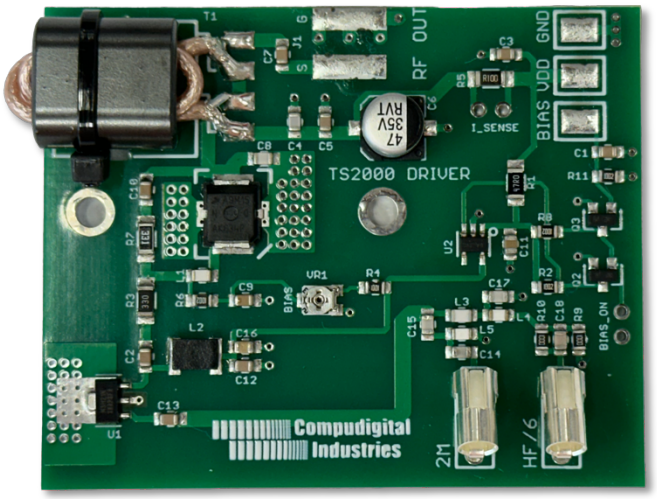
Compudigital Industries®

Updated June 1, 2024

TS-2000 Driver Replacement Board Instructions

The TS-2000 is an amazing radio that covers from 160M to UHF. One of the weaknesses is the PA driver transisitors that provide drive for the final transistors. The failure of these transistors is evidenced by no output power on HF and VHF bands. The UHF driver and PA are completely separate.



The TS-2000 original driver consists of 3 transistors. Q2 is a 2SK1971 N-Channel MOS FETdriver (Mitsubishi RDC6HHF1) and Q3 & Q4 are 2SC1972-26 MOSFET Drivers (Mitsubishi RD16HHF1). When these drivers fail, they are impossible to obtain. And when you can find them on Ebay or other sources, they are normally counterfeit or do not meet the specifications of the original parts.

So we designed up a new driver board that replaces all 3 of the original MOSFETS. Our new board uses one LDMOS driver that is very much over qualified to handle the job. The system is a direct replacement and becomes the new driver for both the 2 Meter and HF/6M bands. And the tracking is amazing! You will notice that the power output signal levels track very closely with the settings in the menu on the radio.

Every driver board has been fully tested and aligned at our lab before being packed and ready to ship. Installation is very straightforward although there is some minor soldering required. Soldering the coax output cable to the main board can be a bit tricky so we suggest that someone with soldering skills and a steady hand to make those connections.

Unpacking the kit:

You should have the following components:

- *1 ea. Compudigital TS-2000 Driver replacement board*
- *1 ea. Short length of coax*
- *1 ea. Tube of heat sink compound*
- *2 ea. 3mm screws and heat spreader*
- *This instruction manual*

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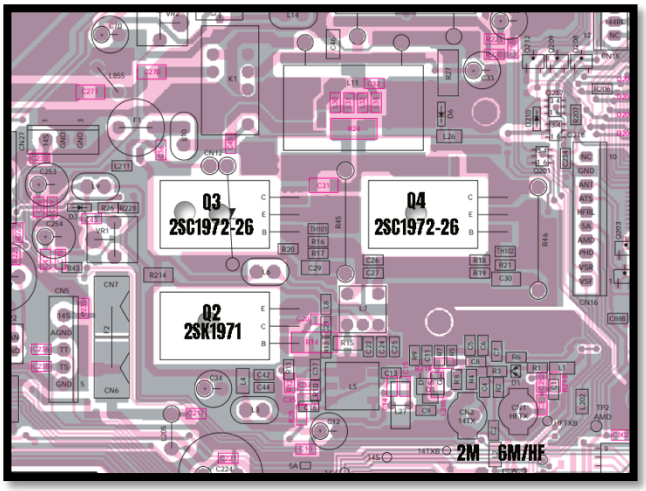
RF Connections



The RF driver connections are simple on this new driver board. First, the RF signal from the pre-driver circuitry plugs into 2 TMP connectors marked 2M and HF/6. When you remove these 2 connectors from the original board, make sure you mark which cable came from the 2M socket, and which one came from the HF/6 socket. They will plug into the sockets that are marked the same way on the new LDMOS Driver board.

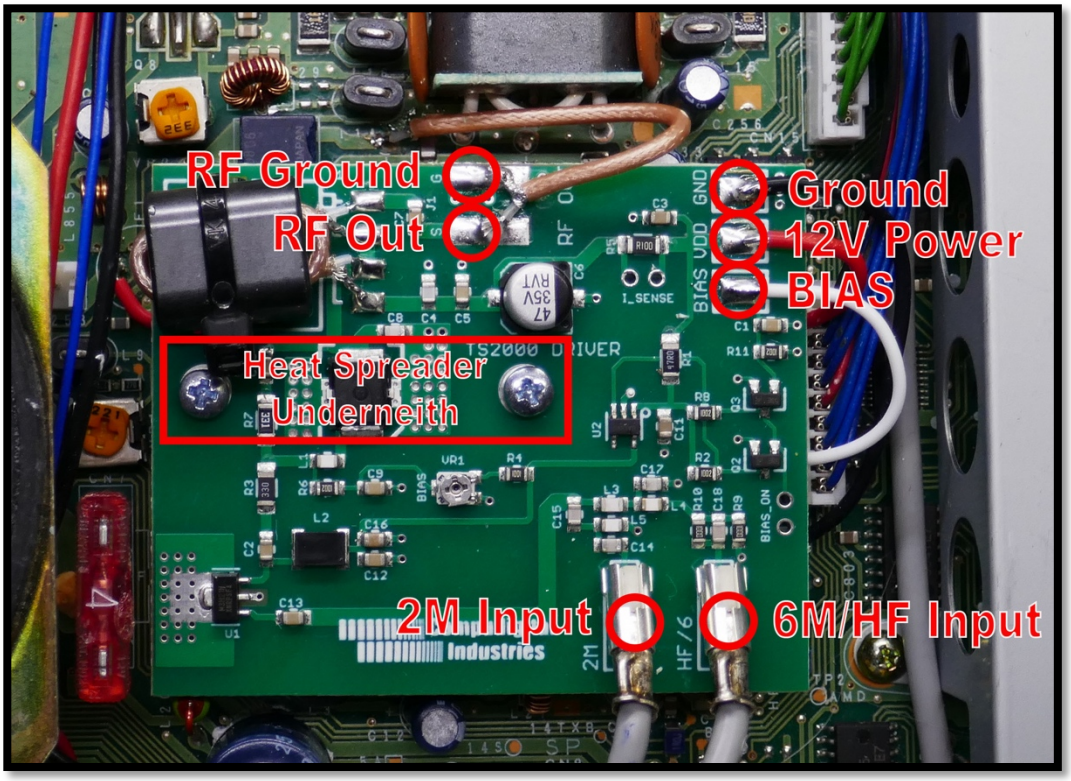
Power, Bias & Ground Connections

The other connections on the board are Power(12V) Bias, and Ground.

Summary of Board connections include the following:

- 2M Drive input (TMP connector)
- HF/6 Drive input (TMP connector)
- Bias (White)
- VDD (+) (voltage to power the board) (Red)
- GND (Ground or G) (Black)
- RF OUT (Signal) Supplied Coaxial cable center conductor
- RF Ground - Shield

CAUTION – Please do not change the VR1 Bias control on the new board. This potentiometer is set at our factory and changing it will damage the LDMOS chip on the new board.

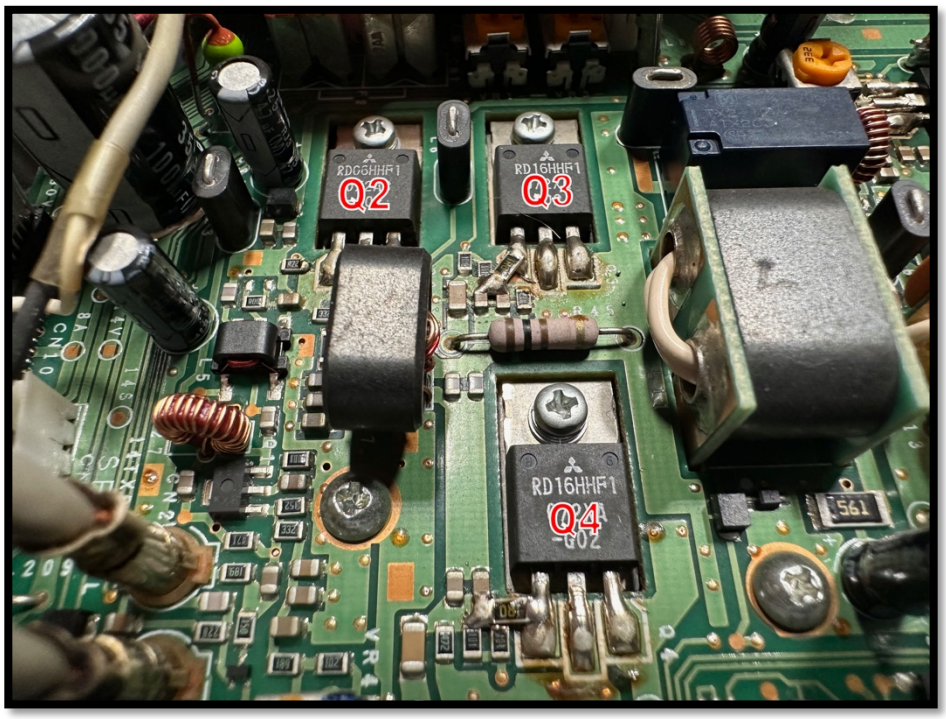


We supply 2 screws that are used to secure the board to the threaded holes where Q3 & Q4 were originally mounted. The enclosed heat spreader goes directly under the new board. Each board is pre-wired with 3 wires: White, Red, and Black. You solder both ends of the RF output cable to both the new driver board and to the input to the final board.

Let's get ready! - Disassembly procedure

- Be sure to remove power from the radio before starting this upgrade
- Remove the top cover of the TS-2000, save the screws and put the cover aside.
- Remove the interior metal cover as well and set it aside

Next you want to remove all 3 of the existing driver transistors Q2, Q3, and Q4. All 3 are TO-220 cased drivers. The easiest way to remove these is to cut all 3 of the leads right at the case of each of the 3 devices. Be sure to use a low temp soldering iron. After that, you can remove the screw from the case, and remove the transistor. Finally, use a solder removal tool to unsolder the remaining leads from the PC Board.



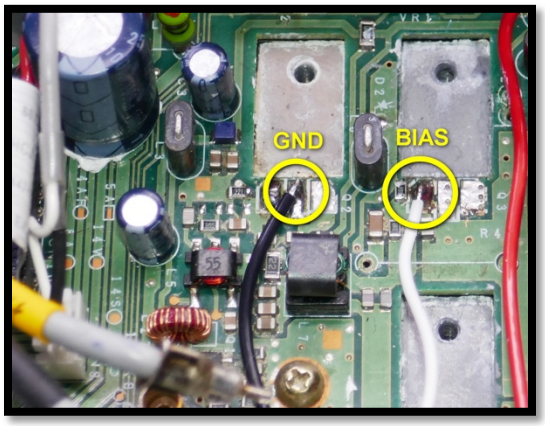
Be sure you don't overheat the transistor pads because the copper traces will lift off the circuit board if they get too hot.

Once you have all of the solder removed from the pads, you are ready to hookup 3 lines: Power, Ground, and Bias.

The Ground (Black) connection is connected to the center pin of where Q2 was located.

The White BIAS cable is connected to the left pin of where Q3 was located (see picture to the right).

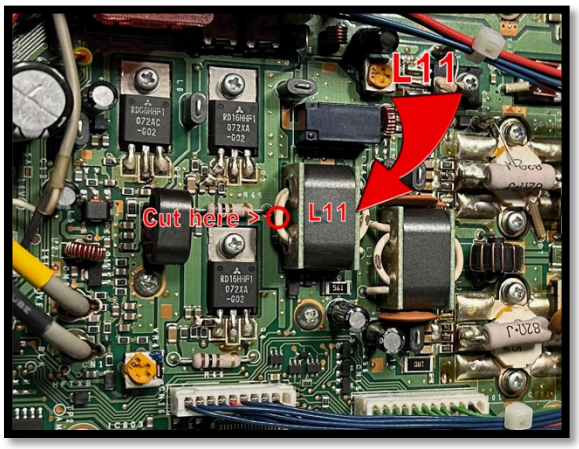
The power connection (Red wire) is soldered



directly to the fuse holder (4A) on the side next to the small potentiometer.

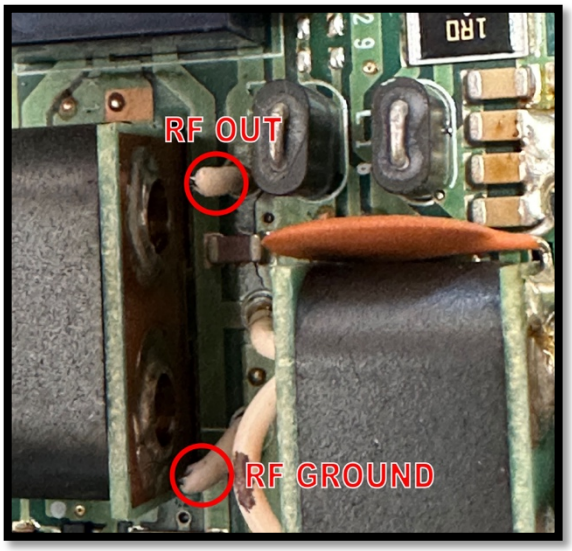
RF OUTPUT Connection
The last connection is the RF output connection. If you look at the connections image, you will see that the RF output consists of 2 pads: RF Ground and RF Out.

Transformer cable removal
Next, we are going to remove the cable from the driver output matching transformer (L11). You will see that there are 2 connections that the transformer feeds, the output (Ground) connection and the output (RF) connection. In the end, L11 is no longer used. We have removed the cable that was used inside L11 to make the connections to RF output and Ground.

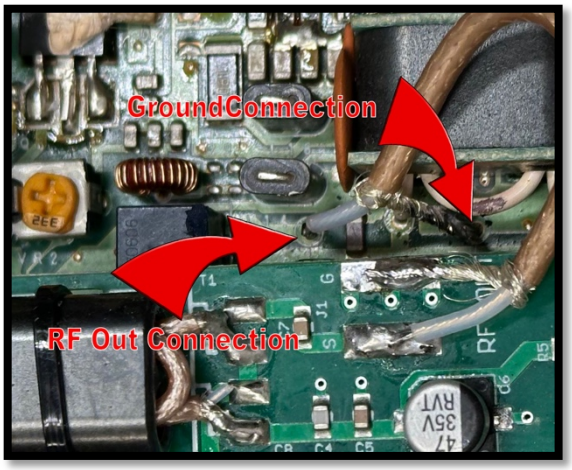


The RF Output from the driver board will be connected to the side that connects to the relay as shown in the image. The RF Ground side connects to Ground as shown. This is a tight area to work in, so you have to be a bit careful not to disturb other components in the area.

To prepare for the RF connection, we are going to cut both white wires going through L11, and pull them through the transformer and out the other side. (See the images to the right)



You want to leave these 2 white wires (RF Ground and RF Out) coming from the main board physically longer than you see them in this picture. The idea is to connect the RF OUT (Center Conductor) to the upper wire and the RF Ground (Shield) to the lower wire. These 2 connections are the output from the new driver board going into the input of the Finals. Again, this area is a bit tight so just use caution when working around these components. However you decide to connect them, it is a good idea to use heat shrink tubing on the RF out line.



Trying to connect the RF output directly to the main board would be a major task. Soldering to the wires that come up from the main board is the easiest way to make these connections. Looking at the image to the right, the Red arrows show you where each connection goes. RF Out on the left and Ground on the right.

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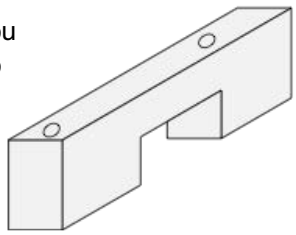
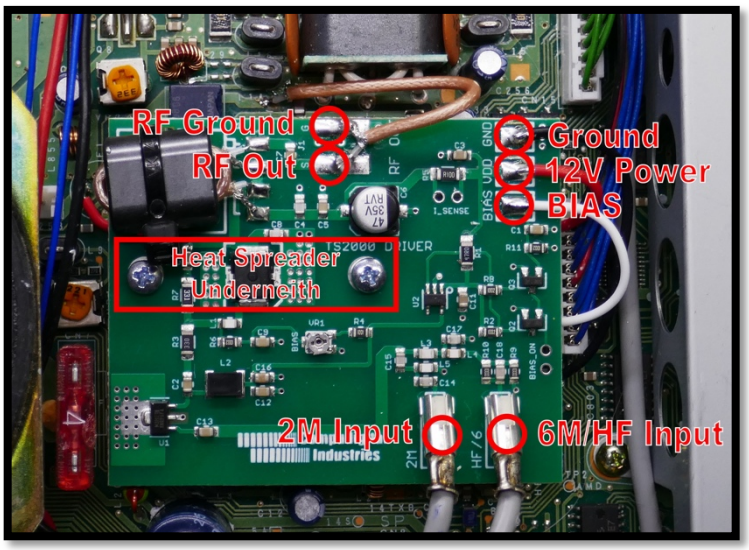
Heat spreader

The Heat Spreader is designed to take the heat off the bottom of the new driver board and distribute it to 2 of the 3 pads that were originally occupied by Q3 and Q4. After you have all of the connections completed, apply a small amount of heat sink compound to the Q3 and Q4 pads, place the heat spreader right over where Q3 and Q4 were removed and place the new driver board on top. But make sure you also put a small amount of heat sink compound on the top of the heat spreader, between the spreader and the board. Secure with the 2 supplied screws. You want these screws snug but not too tight.



Connection Summary

The connections are just as you see them on the right. The 2M input to the board is on the left, and the 6M/HF input is on the right. The Ground wire (Black), 12V Power (Red) and the BIAS (White) lines connect as shown in the images above.



And finally, the RF Output connections (RF Ground and RF Out) connect from the new driver board to the Main PA board as previously shown.

You can test the driver with the covers removed. The power output level should be about 100 watts on 160 meters through 6M. 2M output should be 100 watts or sometimes less. One thing we have noticed is that how you connect the coax output cable can affect 2 meters.

This new board does not affect UHF. UHF signals are driven and amplified in this radio using circuitry other than through this upgrade board. If you have an issue with UHF output levels, the trouble will be found in a different location.

As a matter of reference, this driver board has about 20db of gain and we test it with a signal level of about -9.5 dbm and the output normally runs at about 1 watt.

CAUTION – The is a potentiometer in the middle of the driver board (VR1). This is set by our team here and please DO NOT ADJUST this pot. A mis-adjustment will damage the output stage.