K9HZ FRONT PANEL BOARDS
BUILD INSTRUCTIONS for PCB V12.6
November 14, 2023

Background Information:

The K9HZ Front Panel board-set replaces the existing interface from the T41 Main Board to the front panel switches and encoders. It works with all versions of the T41 Main Boards (V010/ V011/ V012). This concept was originally designed and implemented by John Melton, G0ORX, to replace the switch panel matrix for a more robust operation of the T41 front panel controls.

To work, T41 encoders are disconnected from the T41 Main Board and reconnected to the Front Panel board connectors. A single 10-pin IDC cable connects the Front Panel board-set to the Main Board using the Tune/Filter connector that is repurposed in software for I2C control. The Volume/Fast-Tune connection on the Main Board is not used and can be repurposed by the user for other hardware experimentation and add-ons (Note that there is no reason to place this connector on the Main Board if the connections will not be used). Note that the holes in the boards and switch mounting positions are identical to the original T41 Switch Matrix Board.

The Front Panel Board-set uses two MCP23017 programmable in/out line expanders (at I2C addresses 00H and 01H in V12.5, and selectable in the ranges of 0-7H with board versions V12.6 and later) with 16 lines each. Connections are made to each of the eighteen front panel switches, the momentary push switches on the four encoders, the two directional encoder outputs for each of the four encoders, and two remaining lines used for output to LED connections for the users use. Routines for this enhancement is built into the standard T41 software and is enabled by selecting Front Panel option the T41 Software build.

The Front Panel board-set works perfectly with the K9HZ Encoder boards to easily and cheaply connect the encoders to the T41, yet remains flexible with respect to encoder placement.

Inventory and Prework

Before you begin, inventory your parts against the latest BOM to make sure you have everything you need to complete the *Front Panel Boards* build. The complete BOM is given in Tables 1 and 2.   V012.5 boards have a fixed I2C address at 0H (U1) and 1H (U2). V012.6 boards have pads to select the I2C addresses between 0-7H. Select the I2C addresses such that they are different from other I2C devices on the I2C bus (If you don't know, select 0H for U1 and 1H for U2. That is, all center pads for J4, J5, J6, J8, and J9 to GND, and J7 to 3.3V).

All of the IDC male connectors except the "IDC Box" connectors can be snipped from one long IDC row of pins.

Four M3 6mm x 6mm, four M3 nylon nuts, and 4 nylon M3 x 6mm screws were shipped with your Front Panel board order to use as spacers between the two boards when connecting them together.

Building the Boards

With a medium heat soldering iron (30-40W), begin the assembly of the PA board in this order:

1. Solder on the sides of the boards shown in Figure 1. Printing is on the top sides of the boards.
2. Solder the 18 tactical switches to the top side. Set the board aside.
3. Solder the two MCP23017's onto the Electronics Board taking care to locate pin one correctly. Refer to the Datasheet if there is any question about which pin is number one. This is done easily by tinning pin one with solder, heating that solder, and locating the IC with a forceps. Solder the pin on the opposite corner. Then, flood the rest of the pins with solder with a gentle swipe of the soldering iron up the edge of each side of the part. If you get solder bridges, simply use some solder wick to carefully remove the extra solder.
4. If you have a V012.56 Electronics board, select the proper I2C addresses for the MCP23017's as discussed in the above section.
5. Solder all capacitors and resistors in their appropriate locations as screened on the board.
6. Solder the three 10-pin box connectors onto the board.
7. Finally, solder the IDC two-pin male connectors to the board. These are the connections for two LEDs that you can use for various tasks like "TX", "RX", or anything else you find useful.
8. Place the nylon standoffs in the corners of the back side of the Electronics Board and secure them with nuts on the front.
9. Place the Switch Board back-to-back on the Electronics Board. Temporarily put two screws into the spacers from the front side of the Switch Board.
10. IF the J1 (20 pin connectors on both boards) line up perfectly, then remove the screws and place the 20-pin male IDC header between the two boards. The V012.6 boards line up perfectly.
11. If the holes are offset a little such that the IDC header won't work, put the remaining two screws into the corner spacers and use bus wire to connect the holes from the boards together. V012.5 boards must be done this way. See Figure 2.
12. The boards are now complete and can be mounted in the radio.
13. Plug the connector from encoders 1/2 into the correct connector on the Electronics Board.

14. Plug the connector from encoders 3/4 into the connector marked as such on the Electronics board.
15. Make a cable to connect the Front Panel boards to the T41 Main Board Tune/Filter connector (Front Panel on the V012 Main Board). See Figure 3.
16. Make sure to enable the Front Panel Board in the software and recompile.

Tables and Figures

Table 1. Electronics Board BOM

Number	Mouser Part Number	Description	Quantity	Board Designator	Other
1	80-C0402C103K5RAC	0.01uF 50V 1206 SMD Capacitor	2	C!, C2	
2	652-CR1206FX-2201ELF	2.2K Ohm 1206 SMD Resistor	4	R1, R2,R3,R4	
3	652-CR1206JW-331ELF	300 Ohm 1206 SMD Resistor	2	R5, R6	
3	579-MCP23017-E/SO	MCP23017SO SOIC-28	2	U1, U2	
4		IDC 1x20 Male Headder	1	J1	TaydaElectronics.com
5		IDC 1x2 Male Headder	2	J2, J3	TaydaElectronics.com
6		Soldered Jumpers	6	J4, J5, J6, J7, J8, J9 Encoders_1/2, Encoders_3/4,	Buss wire
7		IDC 2x5 Male Box Headder	3	Front_Panel	TaydaElectronics.com

Table 2. Switch Board BOM

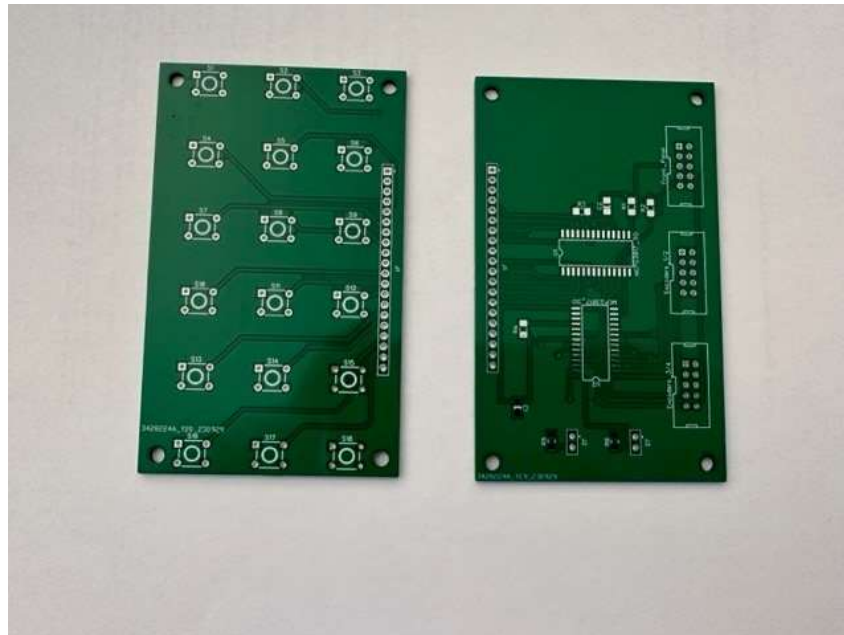| Number	Mouser Part Number	Description	Quantity
1	179-TS026690BK260LCR	6x6x9mm Tactile PB Switch	18

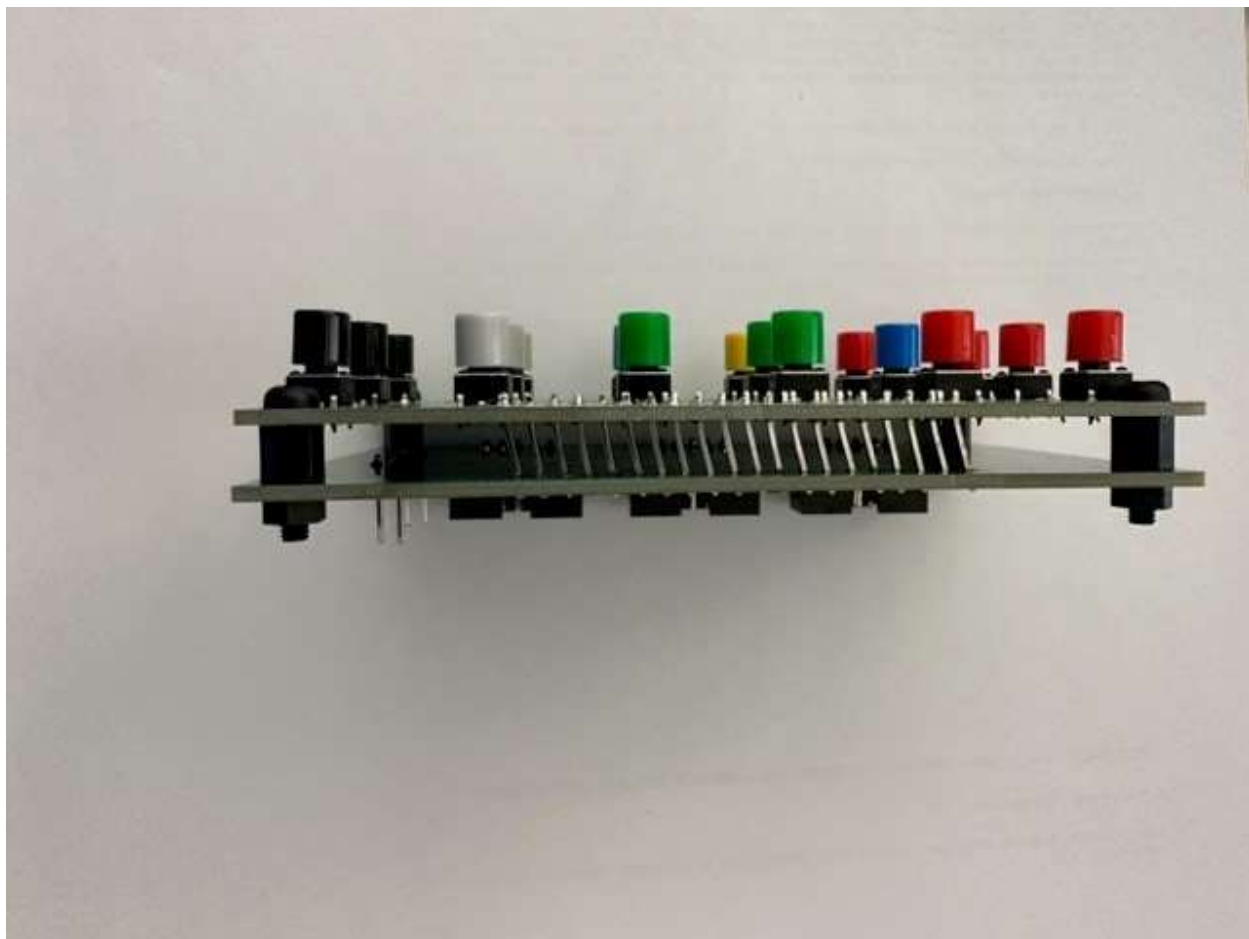**Figure 1. The Front Panel Board Set – Top Sides.**
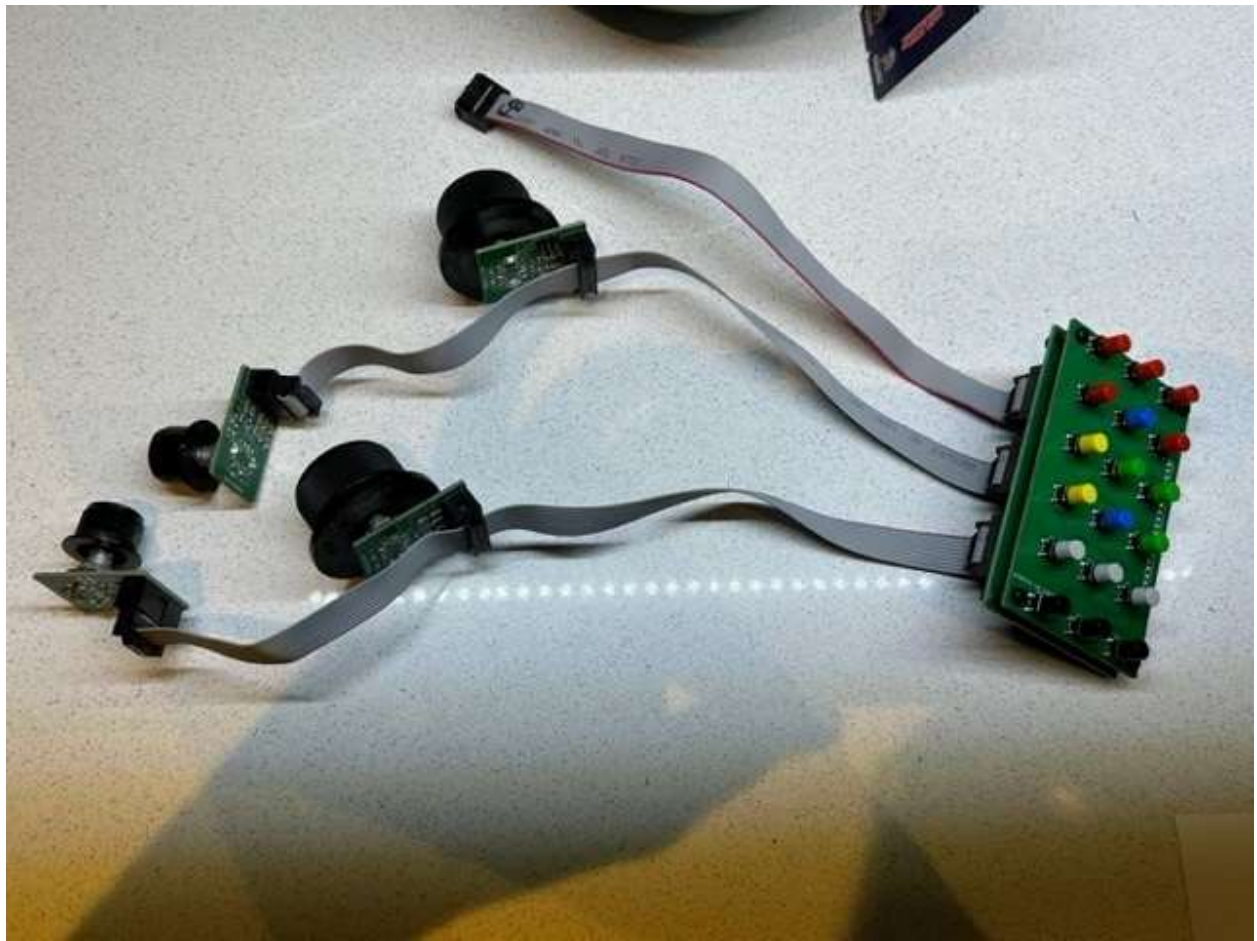
Figure 2. Boards Together. Note Slight Pin Offset in V012.5.

Figure 3. Completed Front Panel Board.