By Paul Hewitt, WD7S

Improved Amplifier Interfacing for the Yaesu Mark V FT-1000MP

A simple interface circuit to increase the flexibility of using this popular transceiver with multiple accessories including the FTV-1000 and FT-920.

While reviewing the owner's manual for my new Mark V FT-1000MP and FTV-1000 6 meter transverter, I found that the transceiver supplies only one HIGH SPEED KEY line for break-in (QSK) capable amplifiers. Although the voltage and current limits on this key line are quite low, they would be fine for my homebrew auto-tune HF amplifier and the four port sequencer I use for controlling my 50 MHz amplifier and mast mounted preamp. Unfortunately, there was no easy way to switch the key line between the two when I changed bands.

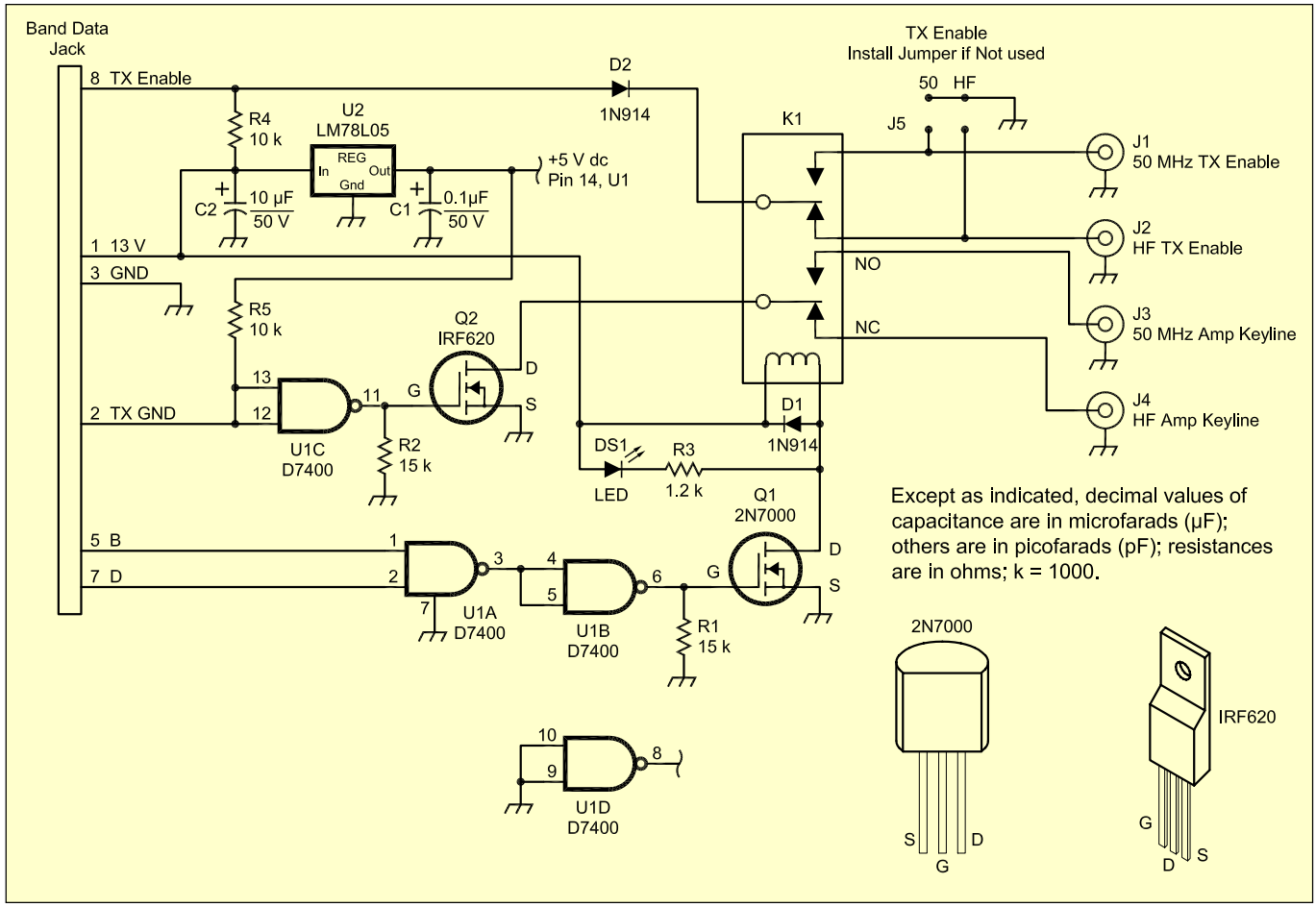

Figure 1—Schematic of the keying interface. All resistors are ¼ W. Part numbers are Mouser unless otherwise specified. Mouser Electronics, 1000 N Main St, Mansfield, TX 76064; tel 800-346-6873; local 817-804-3888; www.mouser.com/; sales@mouser.com.

J1-J4—RCA phono jacks, panel mount.
J5—0.100" snap header stock.
K1—DPDT relay, 12 V dc (Mouser 526-R40-11D2-12).
Q1—2N7000 (Mouser 625-2N7000.
Q2—IRF620 (Mouser 511-IRF620.
U1—M74HC00B1 quad NAND gate, DIP 14 package (Mouser 511-M74HC00).
U2—LM78L05, 5 V regulator, TO-92 package.
Misc—LMB CR-321-P enclosure (Mouser 537-CR321).

Another problem arose when I decided to use the transceiver's TX ENABLE line with the sequencer. This enable or handshake line holds off the transceiver's RF until it is grounded by the sequencer, but it also must stay grounded for my HF amplifier. Again, there is no easy way to switch the line between a high state for sequencer usage and a low state for the HF amp. This TX ENABLE line simplifies the use of the sequencer by not having to use a foot switch or cut into the microphone cable PTT line, a big help in minimizing my station's large nest of wires. Certain QSK amplifiers, such as those of Acom and Ten-Tec, also use this TX ENABLE line. Although a double pole, double throw switch could solve these problems, I didn't want to have to remember yet another switch while changing bands.

Table 1
Pinout of the BAND DATA jack

Pin	*Function*
1	+13 Vdc
2	TX GND
3	GND
4	DATA A
5	DATA B
6	DATA C
7	DATA D
8	TX ENABLE

This interface provides automatic steering for the TX GROUND and TX ENABLE lines between HF and 50 MHz amplifiers, or sequencers. It requires no outside voltage source and connects directly to the transceiver or transverter BAND DATA jack. The circuit allows the TX ENABLE line to be user configured as either high or low for HF and 50 MHz. The circuit also contains a high-speed buffer for the AMPLIFIER KEY line that is capable of controlling 200 V at 1 A. This voltage/current rating should make the interface safely compatible with any commercial or homebrew amplifier using a positive voltage at the TX GROUND jack.

The Circuit

A search of the Internet yielded several examples of automatic antenna and filter switching schemes using the binary coded decimal (BCD) information available at the BAND DATA jack on the transceiver or transverter. Unfortunately none supported the 50 MHz band position. I also found several AMPLIFIER KEY line buffers available but none that perform automated switching of the key line or that support the use of the TX ENABLE line.

Table 2
BCD band data and decimal equivalent

Band (MHz)	*D*	*C*	*B*	*A*	*Decimal*
50	1	0	1	0	10
28	1	0	0	1	9
24	1	0	0	0	8
21	0	1	1	1	7
18	0	1	1	0	6
14	0	1	0	1	5
10	0	1	0	0	4
7	0	0	1	1	3
3.5	0	0	1	0	2
1.8	0	0	0	1	1

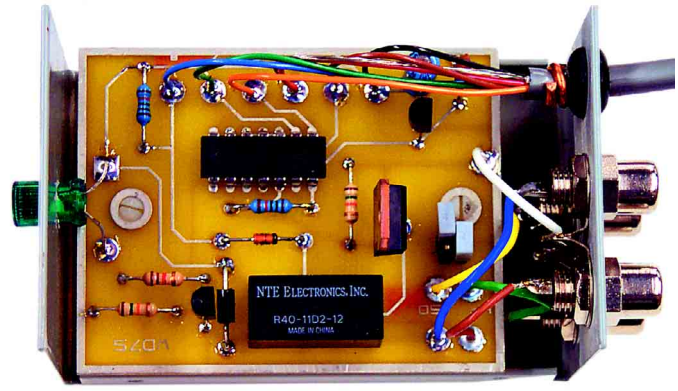

Figure 2—Completed PC board mounted in its enclosure.

A careful look at the pinout for the BAND DATA jack in Table 1 shows that everything needed for amplifier interfacing is available there. This jack is normally used for interfacing to Yaesu's automatic HF and 50 MHz solid state amplifiers. Table 2 shows the BCD data information used by the Yaesu amplifier for selecting the various bands. My needs required that I only had to decode the 50 MHz band selection to operate a DPDT relay. As can be seen in Table 2, the 50 MHz band is assigned the binary number 10. Although the automatic antenna switching examples I found used 1 of 10 (0-9) BCD decoders, they were useless for decoding the BCD number 10 assigned to 50 MHz band selection. Since no other numbers above 10 are output at the band data jack, it is possible to use an AND gate connected to the B and D data pins to detect 50 MHz operation.

Figure 1 shows the schematic of the amplifier interface. A search of my junk box yielded no AND gates but did yield some 74HC00 quad NAND gates. Recalling some digital basics, I knew I could configure two NAND gates as one AND gate, and U1 of Figure 1 is configured this way. Only when both inputs of U1A are high (50 MHz) will pin 6 of U1B also be high. This turns on MOSFET Q1, which grounds the low end of K1's coil and lights LED DS1. The LED was added for confirmation of operation only and may be omitted. Diode D1 is included to protect Q1 from the relay coil's reverse voltage spike. With K1 energized,

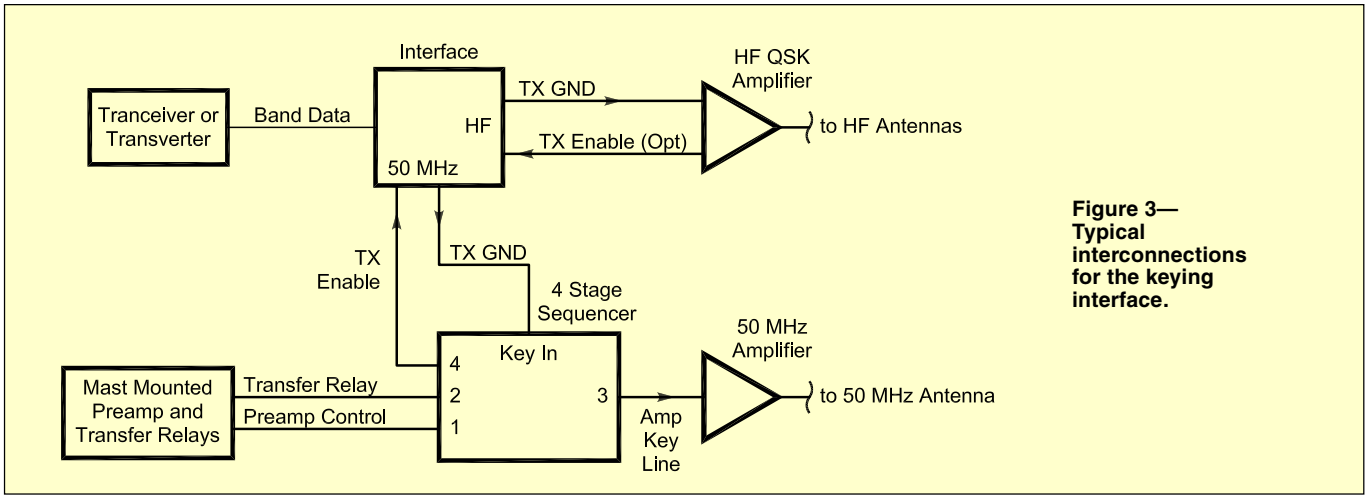

Figure 3—Typical interconnections for the keying interface.

the TX ENABLE and TX GROUND lines are connected (steered) to the 50 MHz RCA jacks at the rear of the enclosure. During HF operation the relay is de-energized and the TX ENABLE and TX GROUND lines are connected to the HF RCA jacks.

I decided to add some buffering to the transceiver's low current TX GROUND line in case I ever wanted to use another QSK amplifier with higher current or voltage keying requirements. One of the spare NAND gates, U1C, is configured as an inverter and used to turn on MOSFET Q2 when the gate's input is pulled low by the transceiver TX GROUND line. The inverter's input pull-up resistor, R5, limits current on the TX GROUND line to less than 1.0 mA. The IRF620 N-channel MOSFET I chose as the buffer switch has a 200 Vdc drain-to-source maximum rating. When biased on with the 5 Vdc supplied by the inverter, it will handle 1 A of current without heat sinking.

The TX ENABLE line has D2 in series with it to keep unwanted voltage out of the transceiver in case the wrong plug is inadvertently inserted into one of the TX ENABLE jacks. The interface allows for user-configured use of the TX ENABLE line for either HF or 50 MHz operation. This was included for those amplifiers that use a handshake line for full-break-in QSK. Either the HF or 50 MHz TX ENABLE line use can be enabled or disabled by 0.1 inch jumpers on the PC board. Resistor R4 is used to "pull up" the TX ENABLE line and must be in place to activate the TX ENABLE line operation by the transceiver.

Operating voltage for K1 is obtained from the 13 Vdc pin on the BAND DATA jack. The 13 Vdc supply is also routed to U2, a low current 5 V regulator that supplies regulated 5 Vdc to U1.

Construction

The entire circuit was built on a 2.0 × 2.65 inch PC board[1] as shown in Figure 2. The simplicity of this circuit makes perfboard construction an attractive alternative. The PC board is enclosed in a 1.5 × 2 × 3.25 inch (HWD) painted enclosure. The entire board could be mounted within the sequencer or in any other convenient location. Panel-mount RCA phono jacks are used for all connections to the amplifier and sequencer. The connection to the transceiver uses six-conductor shielded alarm wire with an eight-pin DIN plug matching the BAND DATA jack. If shielded wire is not used, be sure to add ferrite beads to all BAND DATA lines. Be sure to use the correct DIN plug to prevent damaging the transceiver's jack. A standard eight-pin DIN plug has a different pin pattern than the one used by Yaesu and *cannot* be substituted.

[1]Bare PC boards are available from the author for $5 plus $1.50 postage.

Operation

Operation of the interface is straightforward and completely transparent once set up. Figure 3 illustrates typical interconnections between amplifiers and the sequencer. Consult your HF amplifier's QSK documentation to determine if the TX ENABLE line is needed for your amplifier. If it is not needed, be sure to disable it by installing the corresponding jumper to ground on the PC board. Be sure to use shielded lines for all interconnections.

Although the interface was designed for the Mark V FT-1000MP to FTV-1000, the interface will also work with the FT-920 HF and 6 meter transceiver, as its BAND DATA jack is identical.

Paul Hewitt, WD7S, has been an electronics experimenter since age 8 and has always enjoyed it. He became licensed about 16 years ago when time finally allowed it. Paul owns and operates a construction company that specializes in custom beachfront homes. You may contact Paul at PO Box 1735, Bandon, OR 97411; **wd7s@worldnet.att.net**.