

# Technical Description of the Kenwood Tuner Interface

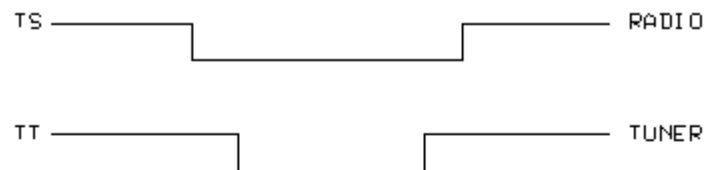
By AA4PB

Kenwood HF transceivers such as the TS-50 have a 6-pin tuner interface connector. If a tuner is connected when the radio is first turned on, it senses the type of tuner attached and configures the interface protocol accordingly. If no tuner is attached then the radio's tune function is disabled. There are two bi-directional TTL level (0 and +5 Volts) lines that provide the communications between the radio and the tuner. These are called TS (Tune Start) and TT (Tune Terminate). These lines are pulled up to +5 Volts by resistors in the radio. Either the radio or the tuner can pull the lines to ground with an open-collector driver.

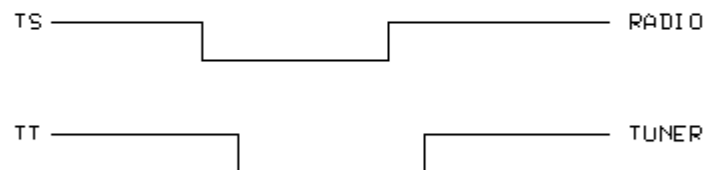
The Kenwood AT-50 tuner uses a serial data communications with commands sent from the radio to the tuner on the TS line and commands from the tuner to the radio on the TT line. Kenwood has been unwilling to release the exact protocol and commands. One would assume that there would be a tune command from the radio, a bypass command from the radio, and a match-found command from the tuner. It might be possible to reverse-engineer the commands by monitoring the ascii data flow on the TS and TT lines while operating an AT-50.

The Kenwood At-300 uses a bi-directional hand-shaking protocol on the TS and TT lines. During power-up, the radio momentarily pulls the TS line low and looks for the tuner to respond by immediately pulling the TS line low. If this occurs then the firmware in the radio is initialized in the AT-300 mode and the following timing diagrams are followed.

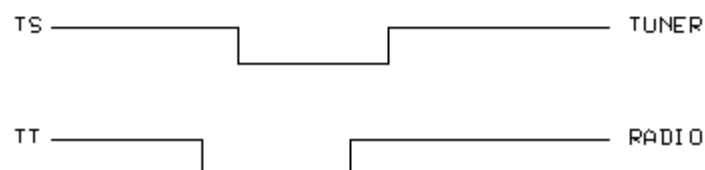
Normal Tuning



Failed or Cancelled Tuning



Bypass Request



The two traces in each of the three examples represent the voltage present on the TS and TT lines (zero or +5 Volts). The indicator to the right of the trace indicates whether the radio or the tuner is controlling the line. Most of this information was taken from the Kenwood AT-300 Maintenance Manual.

### **Normal Tuning**

In the first timing diagram, the operator has momentarily pressed the tune command and the radio is signaling the tuner to begin by pulling the TS line low (zero volts). The tuner responds by pulling the TT line low a short time later. The radio responds to the low TT line by outputting a 10 Watt CW tune signal. As soon as the tuner finds an appropriate match for the antenna, it releases the TT line back high (+5 Volts). The radio responds by terminating the CW tune signal and then releases the TS line back high. The tuning cycle is now complete.

### **Failed or Canceled Tuning**

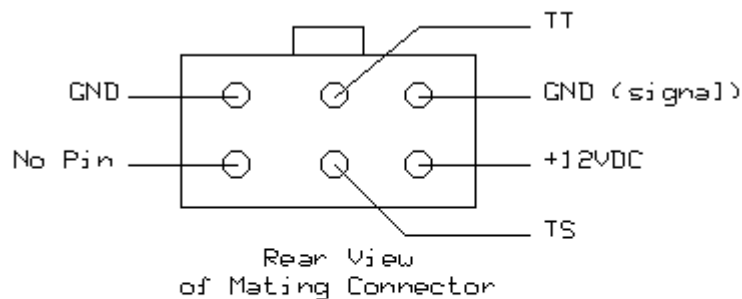
The second timing diagram shows what happens if the operator cancels a tune in progress by pushing the tune button or the radio times out after 15 seconds of tune signal because the tuner is unable to find an appropriate match. To begin, the operator momentarily presses the tune button and the radio pulls the TS line low. A short time later the tuner responds by pulling the TT line low and the radio transmits the CW tune signal. At that point the radio starts a 15 second timer. If time expires or the operator presses the tune button again before the tuner has found a match then the radio releases the TS line back high. The tuner then releases the TT line back high and places itself in bypass (antenna connected directly to the radio).

### **Bypass Request**

The third timing diagram shows what happens when the operator presses and holds the tune button for 2 seconds to place the tuner in bypass. This is the one case where the radio controls the TT line and the tuner controls the TS line (they are both bi-directional, open-collector controlled lines). The radio pulls the TT line low to signal the tuner to enter the bypass mode. The tuner acknowledges by pulling the TS line low. The radio then releases the TS line. The tuner goes into bypass and releases the TT line. No tune signal is transmitted by the radio.

### **Hardware Connections**

The Kenwood tuner interface utilizes a 6-pin connector as shown below. Note that this view is of the rear of the connector on the end of the cable that plugs into the radio. Information on the JST connector and distributors can be found at <http://www.jst.com>



- Required JST Connector components
- 1 Each, ELP-06V Plug Housing
  - 5 Each, JST SLF-01T-P1.3E Socket Contact

### **A Quick and Dirty Tune Function**

The tune button on the Kenwood radios can be made to function by simply placing a 1K, 1/4-Watt resistor between the TS and TT lines. Momentarily pressing the tune button will cause the radio to transmit the 10-Watt CW tune signal until the operator presses the tune button a second time to cancel the tune. Please note that the resistor must be in place when the radio is first turned on in order to fool it into thinking there is a tuner attached. This simple method can be used to provide a manually controlled tune function. The easiest way to fully implement the full Kenwood tuner protocol, including bypass, will be to develop an interface with a PIC microcontroller.