SDE® LCD Upgrade for the Model 1254 Receiver

The SDE modification kit for Ten-Tec's 1254 Shortwave Receiver brings to this radio new operational features, and adds a USB interface supporting CAT control and radio firmware updates.

The use of the radio with the upgrade kit has been kept similar to that of the original design as provided by Ten-Tec and described in their original manual. A major change with the kit is a new two line by twenty character LCD display. The top line on the display shows the current VFO frequency and detector mode used in direct tuning. The bottom line shows the frequency stored in the currently indexed memory channel. Depending on the radio state, VFO or Memory, the two lines can interchange position. The top line of the display always shows the currently tuned radio frequency and mode. The lower right hand portion of the display is reserved for a signal strength meter. Each bar shown on the meter represents one S unit.

Operating Instructions

The radio's controls consist of a **VOLUME** and **CLARIFIER** control, main **TUNE** knob, and the **MODE**, **MW** (memory write), **V/M** (VFO/memory), and **SPEED** keys.

Tuning the radio frequency is accomplish by either direct entry using the main tuner control knob, or by recalling one of 64 (M01 to M64) stored memory channels. The radio operates in one of two states, VFO and Memory.

VFO State

When in the VFO state rotating the **TUNE** control knob changes the frequency by the currently set step size. The current frequency and mode, and the letters VFO are displayed the top line.

Tuning Steps

Selecting the step size is done through a menu setting. To enter the step setting menu press the **SPEED** key while in the VFO state. The current frequency step will be displayed. Rotating the tuning knob will increase or decrease through the available tuning steps from a low of 10 Hz to a high of 100000 Hz. Turn the tuning knob to find the step size. Press the **SPEED** key again to retain this new step setting. If the step is 100 kHz the **FAST** LED will turn on when you exit the menu.

Detector Mode

The radio has two operating modes: AM and SSB. When in the VFO state the **MODE** key is used to cycle between the two modes.

Memory State

Switching between the VFO and Memory state is done by pressing the **V/M** key. When the key is pressed the memory channel, shown on line two of the display, is swapped with the VFO data from the top line. Turning the **TUNE** knob then steps through the channels and tunes the radio to the stored frequencies (and detector modes) saved in each channel. Pressing the **V/M** key again restores the frequency and mode of the VFO state that is preserved and shown on the bottom line. Another way to exit from the memory state is to press the **MW** key. The radio will return to the VFO tuning state, but at the frequency that is currently in the accessed memory channel.

Memory Write

Pressing the **MW** key while in the VFO state brings up a memory channel pointer. Rotate the tuning knob to select any of the 64 available channels. Press **MW** again to write the current frequency and receiver mode to that channel. Before the key is pressed again, the write can be canceled by pressing any key other than **MW**.

Firmware Updates

For flash updates to the radio's processor chip, a PIC18F25K50, a bootloader program is also available for download. All firmware revisions in Intel Hex format are available for download.

Extended Sub-2500 Khz Tuning Steps

The original hardware design of the Ten-Tec Model 1254 receiver uses an older Motorola Integer-N PLL chip. It's R register is set to a fixed value to divide the radio's 3.58 MHz reference oscillator to 2500 Hz. The N register in this chip is only 16 bits wide. Because of this limited number of bits available for tuning the VCO frequency over a 30 MHz range, and because the feedback filters used in the VCO circuits are optimized for the intended 2.5 Khz steps, sub 2500 Hz step frequencies cannot be *directly* programmed into the radio's PLL.

To get around these hardware limitations the firmware in the SDE upgrade kits uses a new type of fast "Factoring-RN" algorithm to obtain a desired VCO frequency. Both the N *and* R registers are free to take on any value to tune the radio. While N can be any value R must be restricted to a narrow range around the designed feedback filter center frequency to satisfy the sideband noise and stability of the PLL. Exact factors or fuzzy solutions can be found for 98% of requested frequencies and for all frequencies that are an exact multiple of 2500 Hz.

Throughout the tuning range when one of the very few unsolvable small step frequencies are encountered the PLL is not changed from the previously tuned frequency. This is denoted on the LCD with a superscript x before the *x*VFO indicator to show that the number shown on the display has not actually been tuned. If you wish to tune this frequency you can either go to a smaller tuning step size and tune close to the desired missing frequency, or just use the existing **CLARIFIER** control which now has a vastly ample range to shift the receiver to the desired exact frequency.

Note that displayed frequencies that are not tuned are blocked from being saved to a memory channel. In addition these frequencies are also blocked from being saved to flash memory when the radio is powered down, therefore they are not recalled on the next powerup.

Powerdown Behavior while Plugged into a Powered USB Connection

With the radio powered off the processor on the LCD display board can continue to be powered by an active USB connection. The current firmware revision allows the front display processor to continue to operate and thus communicate with the USB connection; however, the backlight will be turned off and the main radio board will be completely powered down. When the radio is again powered up the current frequency and mode is loaded into the main radio board and the backlight is turned on.

Programmer's Reference Guide

The upgrade kit adds support for external computer control using a USB interface. Virtual COM ports for emulation of UART serial ports are not used. The port communicates using USB bulk transfer protocol to the WinUSB driver built into Windows, or LibUSB on other computers.

A free Windows CAT control program is available for download from the SDE website. Also available are the C structures and enumerations, PID and VIN, as well as code samples for those wishing to write their own programs to communicate with the radio.