Initial Power-Up Tests

The signal generator will not function properly until the blank EEPROM has been programmed with a set of default values. The CPU will accomplish this task if the RxTx control line is held grounded during power up.

The steps marked with an asterisk (*) can be performed before the DDS board is attached to the CPU board.

* Turn the LCD display potentiometer (R7) fully counterclockwise to ensure the display will be visible at power-up.

* Apply power to the signal generator, using a power supply in the 9 to 12 volt range. The following sequence of displays should appear (though the frequency shown is random and depends on whatever may have already been in the EEPROM).

* If the displays above appear (could be a different frequency) then the CPU and display are functioning properly. *It is possible that your chosen R7 potentiometer might function backwards, such that full* **clockwise** *rotation is needed.* If no display is seen in the previous step, rotate R7 through its full range to find the setting for clearest character display.

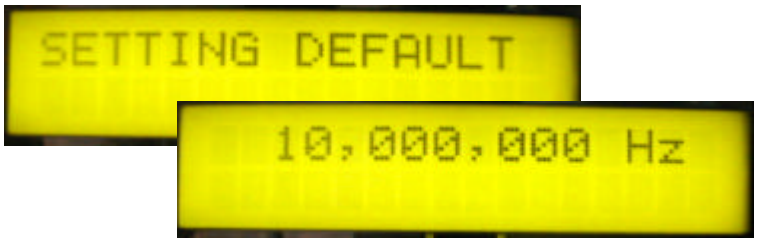
* Turn off the power.

* Place a shorting jumper between JP1-3 (RxTx) and either JP1-1 or JP1-11 (GND). Alternatively, if the pushbutton switches are already installed, press and hold the RxTx control switch.

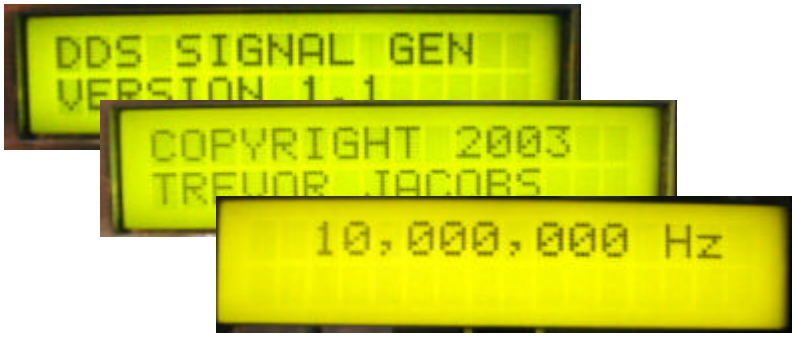
* Reapply power, while RxTx is held grounded, either by switch or jumper. The display should indicate that the CPU is about the program the default values.

* Release the RxTx pushbutton, or remove the shorting jumper on JP1-3 (RxTx). The display should prompt as shown below

* Tap the TS pushbutton, or **momentarily** short JP1-2 (TS) to either JP1-1 or JP1-11 (GND). The display should first indicate that the defaults are being written, and then revert to the newly written default power-up frequency (memory 0).



* Turn off the power. Wait a few seconds and turn on the power again. The following sequence of displays should appear.



*If the rotary encoder is attached, turn it a few steps in either direction. The displayed frequency should change in steps of 100 Hz. Clockwise rotation should increase the frequency. If not, reverse the connections to JP3-2 and JP3-3.

The remaining steps require that the DDS board be connected to the CPU board. If a receiver covering 10 MHz is available, connect a short wire to the receiver antenna terminal and loosely couple (do not electrically connect) the other end to the output of the signal generator. Just placing the end of the wire near the low pass filter elements (L1 & L2) should be sufficient.

*The frequency **stability** of the signal generator depends on the stability of the 120 MHz clock oscillator. But the control program in the CPU can compensate for **inaccuracy** of the 120 MHz clock. To accomplish this task the DDS chip is instructed to generate what should be a 10 MHz signal. The operator can then make any necessary adjustments needed to make the DDS output actually be 10 MHz. When the CPU is informed that the adjustments are complete, a permanent correction factor is written into EEPROM. Thereafter the signal generator should be within a very few Hz of correct frequency over the entire 1 Hz to 40 MHz range. To calibrate the signal generator, perform the following steps.*

Note: Even if you are not yet prepared to actually calibrate the signal generator you still must perform these steps and "pretend" to calibrate it. Otherwise the output frequency may be nowhere even close to the displayed frequency. Even a "pretend" calibration should get you within a few hundred Hz.

With the power turned off, place a shorting jumper between JP1-2 (TS) and either JP1-1 or JP1-11 (GND). If the control pushbuttons are already connected, press and hold the TS button.

Turn the power on while TS is being held grounded. The display should indicate that the calibration mode is being entered.

Release the TS pushbutton, or remove the shorting jumper from JP1-2 (TS).

At this point the signal generator should be producing ***what it thinks*** is a 10 MHz signal. It should be audible in a receiver tuned near 10 MHz, but is probably a few tens or even hundreds of Hz in error.

Turning the encoder will now raise or lower the DDS frequency in extremely small increments, about 0.03 Hz per step. If WWV can be received at 10 MHz, set the receiver to AM mode, connect an antenna, and tune in the WWV signal, while still coupling a wire from the receiver antenna input to the DDS output. The beat note between the DDS signal and WWV should be detectable.

Adjust the frequency until it is as close as possible to exactly 10 MHz. Rotate the encoder until zero beat is reached. Note that it may take many, many revolutions of the encoder if the frequency must be moved more than a few Hz. Remember that 20 to thirty steps are required for each 1 Hz change! It is possible to set the DDS within a fraction of a Hz of zero beat.

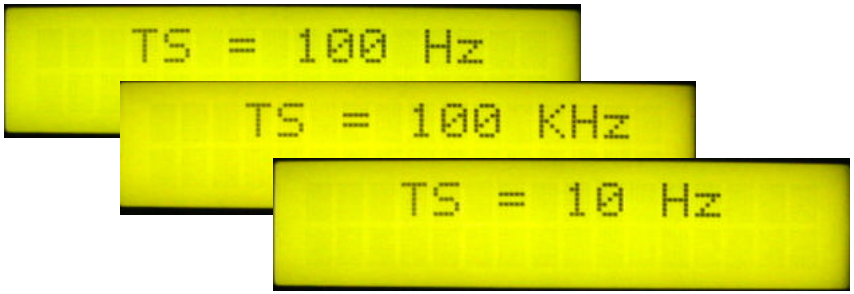
Tap the TS pushbutton, or momentarily short JP1-2 (TS) to either JP1-1 or JP1-11 (GND). The display should prompt to confirm that the frequency adjustment is complete

Once again, tap the TS pushbutton, or momentarily short JP1-2 (TS) to either JP1-1 or JP1-11 (GND). The display should revert to the power-up frequency (memory 0), which at this time should be 10 MHz. And the output of the DDS should now be almost exactly that frequency

Turn off the power. This completes the initial checkout of the DDS signal generator.

KG6CYN DDS Signal Generator
Operating Instructions

Setting the frequency step.
Press and hold the TS button. The display will show the currently selected step size. While continuing to hold the TS button, rotate the encoder to select a step size of from 1 Hz to 1 MHz.



Displaying memory contents
Press the RxTx button for about one second and release. This brings up the menu selection mode. Then first mode displayed is

Tap the TS button to enter the memory read mode. The display will show the contents of memory 0. Rotate the encoder to display the contents of other memory locations. Note that the power-on default setting performed in the initial check out wrote 10 MHz into all the memory locations. If a display of "??,???,??? Hz" appears, that means the EEPROM is still blank and the power-up default settings need to be performed.

To make the frequency in a memory location the actual operating frequency of the signal generator, tap the TS button again. The display will prompt for a confirmation.

Tap TS again to change the operating frequency to the memory frequency, **OR** tap RxTx to exit the menu without changing the operating frequency.

Storing a frequency in memory
First dial in the desired frequency using the encoder and/or changing the step size. Then enter the menu mode by pressing and holding the RxTx button. Rotate the encoder to select the "Store to Memory" mode.

Rotate the encoder to select the desired memory location. The display will show the current contents of each selected memory.

When the desired memory location is displayed, tap the TS button. A request for confirmation will be displayed.

Tap TS to store the operating frequency into memory, **OR**, tap RxTx to exit the menu without storing anything.

Split Mode

The signal generator can be operated in split mode, producing separate receive and transmit frequencies. The split mode is entered by grounding JP1-4 (SPLIT). This pin would normally be connected to a panel-mounted toggle switch. When the signal generator is operating in the split mode the display will show two frequencies, identified with a "T" and "R."

One of the identifiers (T or R) will be displayed in upper case, the other in lower case. The one in upper case is the frequency which can be controlled by the encoder.

Tap the RxTx button to select whether the receive (R) or transmit (T) frequency is to be under encoder control.

Receive Offset Frequency

The signal generator can operate with a programmed receive offset frequency. Whenever the unit is in receive mode (JP4-5 Open) the actual output frequency will be the displayed frequency PLUS the programmed offset.

To store a receive offset, first dial in the desired amount of offset while in the normal operating mode. For instance, suppose the desired amount of offset is to be 2.5 MHz…..

Put the signal generator into the split mode by closing the Split switch (grounding JP1-4 SPLIT),

and tap the RxTx button to make the transmit frequency adjustable.

Now press and hold RxTx to enter the menu mode, and rotate the encoder to select …

Tap the TS button. The confirmation prompt will appear.

Tap TS once again to execute the command, OR, tap RxTx to exit without storing the offset.

In the example at hand, if the 2.5 MHz offset had been stored and the signal generator were then set to

The actual frequency produced by the DDS device would be

(11.5 MHz) + (2.5 MHz) = 14.0 MHz

This can be verifies by listening on a receiver tuned to 14 MHz.

Checking the Receive Offset Setting

Press and hold RxTx and enter the menu mode, select

and then tap TS. The stored value of the receive offset will be dsipalyed for a few seconds, whereupon the unit will automatically exit the menu mode.

Cancelling Receive Offset

Press and hold RxTx and enter the menu mode, select

and tap TS. The confirmation prompt will appear.

Tap TS to execute the command, OR, tap RxTx to exit the menu mode without clearing the offset value.

CW Offset

The signal generator can be programmed to apply a frequency offset between the receive and transmit frequencies, even when not in the split mode. The offset direction can be positive or negative, selectable with the TS button.

Programming the CW offset is similar to programming the receive offset. First dial in the desired offset increment, for instance 800 Hz…

Put the signal generator in split mode by closing the SPLIT switch, and then make the transmit frequency the one under control by the encoder by tapping RxTx.

Now enter the menu mode by pressing and holding RxTx, and select

Tap TS to select this menu option. If the message below is displayed, it means you have not properly set the offset amount while in SPLIT mode.

If the offset amount is ready to be saved the confirmation prompt will be displayed.

Tap TS to execute the command, OR, tap RxTx to exit the menu mode without saving the CW offset.

Displaying CW offset

Press and hold RxTx to enter the menu mode. Rotate the encoder to select SHOW CW OFFSET, and then tap TS.

The offset amount will be momentarily displayed, and then the unit will automatically exit the menu mode.

When the signal generator is in the normal (non-menu) mode, the direction of the CW offset is indicated by a plus or minus sign in the right corner of the display. Tapping TS toggles between plus, minus, or no offset.

Firmware Version

The current firmware version can be displayed by entering the menu mode (press and hold RxTx) and selecting

And then tapping TS.