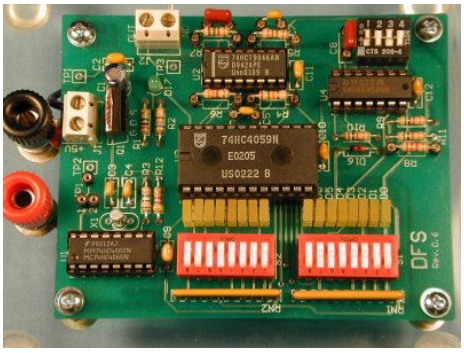
DFS at a Glance …

A Short-Wave HF synthesizer circuit is at the heart of the DFS module. The circuit is built around a VFO section controlled by a crystal oscillator, a pre-scaling divider, and a PLL circuit. This circuit is fundamentally very similar to the ones used in all present-day frequency-synthesized receivers and transmitters with digital tuners. Actual Short-Wave broadcast frequencies between the 120m – 11m bands can all be synthesized with the DFS circuit.

DFS module is also available as a "**Challenge**" version where the students can be assigned to complete the circuit design to determine the values of passive components mounted on single-pin sockets that control key functional parameters. The background material for these design steps is provided in the user manual and the data sheets.

DFS Module



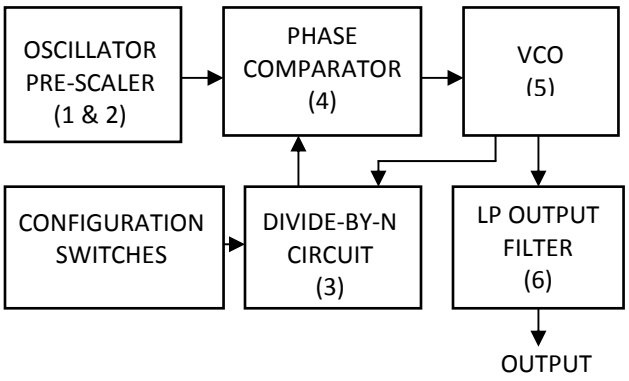
Learning outcomes

- The concept and fundamentals of frequency synthesis.
- Working with a PLL and Voltage-Controlled Oscillator circuit.
- The relationship between the reference frequency and synthesized frequencies
- Configuring a Divide-By-N integrated circuit
- Working with crystal oscillators and prescaler circuits

Circuit Description

The DFS circuit can be analyzed as being composed of six sections: Oscillator (1) and the Prescaler (2) section generates the reference signal, A divide-by-N circuit (3) with auto power-up reset facilities divides the signal from the VCO and feeds it to the PLL circuit made up of the phase comparator (4) and the VCO (5) circuit. Phase comparator compares the reference and the feedback signals and controls the frequency of the VCO to minimize the difference between the two signals. The LP Output filter (6) removes the noise on the output signal for a cleaner waveform

Block Diagram



Suggested Experiment Outline

1. Determine the oscillator and prescaler settings
2. Determine the crystal and prescaler config jumpers
3. Confirm and measure the prescaler output
4. Determine the divide-by-n and mode selector switch settings
5. Determine the PLL and VCO configuration and settings
6. Measure and confirm the VCO and PLL circuit operation
7. Measure and confirm the final output signal frequency
8. Generate and measure various frequencies in the Short-Wave HF band

Ordering Information

DFS Lab Module DFS-LM-010
DFS Challenge Module DFS-CM-010

Notes

The DFS lab experiment requires the use of a frequency counter capable of measuring up to 20 MHz signals. If such a piece of equipment is not available in the lab, the instructor might consider doing the Unistep DFM (Digital Frequency Meter) lab experiment before DFS. DFM experiment is based on a 65 MHz, 5-Digit frequency counter that would be more than adequate for the DFS lab.

NOTES