

Theory of operation

The wireless clock is based on microcontroller. The microcontroller is controlling the movement of the hands of the clock through a gear box. The gearbox outputs a signal of the hands position to the microcontroller. The microcontroller uses this signal to make sure it displays the correct time.

The clock receives the correct time through RF communication. Any time it receives time, it also transmits the correct time to other clocks. For that purpose the clock includes a transceiver. The microcontroller uses this transceiver to receive and transmit messages in frequency hopping technology in the 915-928 Mhz frequency range. The transceiver is connected to 2 antennas, one for transmit and one for receive. These are internal antennas printed on the print.

The clock transmits the same time message in 51 different frequencies. It stays 10 mili-seconds in every channel before it hops to the next channel but it transmits only 6.64 mili-seconds during this time. After 51 different frequencies it transmits another 9 messages starting at the first frequency. In worst case the clock transmits the time message every 1 minute. The all transmission endure 600 mili-seconds. Which mean, in worst case it stays 13.3 mili-seconds at the same frequency during 1 minute.

The clock is available in battery operated, 110V or 24V power input. The 110V and 24V wireless analog series receives and transmits time every minute, as opposed to the battery-operated version which receives and transmits time every four (4) hours. The clock is designed to consume very little energy. For that the microcontroller controls the frequency of its operation by a selector which gives the option to select 32.768 khz (low frequency) or 4 Mhz (high frequency).

The clock includes 2 push buttons. One of them allows the user to drive the clock into receive or transmit mode (since most of the time the clock is not open for communication). The other one allows the user to drive the clock into debug mode.

Exercise software

Since the clock transmits only every one minute we made special software for testing the clock. This software allows the user to select one of 10 modes by pushing the push button. Here are the modes:

1. continuous transmission at lowest frequency (without modulation)
2. continuous transmission at middle frequency (without modulation)
3. continuous transmission at highest frequency (without modulation)
4. continuous transmission at middle frequency (with modulation)
5. continuous transmission at lowest frequency (with modulation)
6. continuous transmission at highest frequency (with modulation)
7. continuous reception at lowest frequency
8. continuous reception at middle frequency
9. continuous reception at highest frequency
10. Normal frequency hopping with modulation

The modulation was done with time message.