

Figure 1: This is WSJT-X software operating in the FT8 mode. Stations highlighted in green are looking for contacts by calling CQ. The fuzzy yellow and red rectangles appear in the waterfall display and represent individual FT8 signals. The frequency, date, and time appear below the “Band Activity” window.

Discover the Excitement of FT8

One of the most popular operating modes in amateur radio today doesn’t involve talking into a microphone or tapping on a Morse code key. Instead, it is one of ham radio’s many *digital modes* (a form of communication between computer-equipped stations), and it offers extraordinary performance. When used with outdoor antennas, it’s possible to make contacts throughout the world. Even hams with indoor antennas, such as wire antennas installed in attics, can use this mode to make contacts spanning oceans and continents.

The mode is known as FT8, and it is provided by a free software application called WSJT-X that’s available for Windows, Mac OS, and Linux. WSJT-X allows amateurs to operate not only FT8, but other digital modes as well. You can see FT8 in action in Figure 1.

No Conversations, Just Contacts

FT8 communicates only enough information for the exchange to qualify as a contact according to the rules of contests and awards. The exchange consists of call signs, signal reports, and station locations in the form of *grid squares* (for more about Maidenhead grid squares, see arrl.org/grid-squares, which includes a link to a grid square locator tool).

FT8 has several advantages:

- **Objective Signal Reports.** *Signal reports* give you a true sense of how well your signal is being received. This is critical when testing antennas or seeing how well your signal is being heard around the world. The software automatically makes a signal-to-noise measurement and generates a report. Signal strength is expressed in dB (decibels). For example, a -25 dB signal is quite weak, while a +4 dB signal is strong.
- **High Performance.** Even a minimal station, such as someone transmitting 5 watts to an attic antenna, can make large numbers of contacts, including contacts with stations in other countries.
- **Valid Award Contacts.** FT8 contacts count toward nearly all awards, including the coveted ARRL DX Century Club (DXCC) award.
- **Speed.** It is possible to complete an FT8 contact in less than 90 seconds.

Walking Through an FT8 Contact

FT8 exchanges usually, though not always, follow a strict sequence. Here is an example of what you might see (in bold), and what each line means (in *italics*). Note that when there is an exchange between two stations, the transmitting station's call sign is the one on the right.

CQ WB8IMY FN31

WB8IMY sends CQ from grid square FN31.

WB8IMY N1NAS EN72

N1NAS replies and tells WB8IMY that he is in grid square EN72.

N1NAS WB8IMY -11

WB8IMY replies to N1NAS with a signal report, indicating that N1NAS's signal is -11 dB.

WB8IMY N1NAS R-15

N1NAS acknowledges the signal report from WB8IMY with an "R" (for "Roger"), followed by a signal report indicating that WB8IMY's signal is -15 dB.

N1NAS WB8IMY RRR

WB8IMY sends "RRR," which means "Roger, Roger, Roger." Everything has been received and the exchange is complete.

WB8IMY N1NAS 73

N1NAS sends 73 — best wishes.

N1NAS WB8IMY 73

WB8IMY sends 73 as well. The contact has ended.

An increasing number of transceivers have built-in interfaces. If you are lucky enough to own one of these radios, all you'll need is a USB cable to connect the radio directly to the computer. Figure 3 shows the three most popular ways to connect a computer to a transceiver for digital operating.

Finally, you will need to download and install WSJT-X from physics.princeton.edu/pulsar/k1jt/wsjt.html.

Setting up your station equipment and software for FT8 isn't complicated, but that discussion is beyond the scope of this article. Read the WSJT-X user manual, which you'll find at the software download site. It's also a good idea to invest in the new third edition of ARRL's *Get On the Air with HF Digital*. This book offers valuable advice not only for operating FT8, but other digital modes as well. It will be available soon at your favorite amateur radio dealer, or at the ARRL online store (home.arrl.org/action/Shop/Store).



Learn more about FT8 in the ARRL book *Get On the Air with HF Digital*.

Eavesdropping on FT8

Switch your radio to upper sideband (USB) and try tuning to one of the frequencies shown in Table 1. These are the so-called FT8 "watering holes" where operators gather to make contacts. If conditions are favorable, you'll hear trilling, musical tones that last about 13 seconds with a couple of seconds of silence in between. That's an FT8 signal, and it will likely be the only type of digital signal you'll hear at this frequency.

If your computer is running WSJT-X software set for the FT8 mode, you may see a window on your monitor with fuzzy yellow or red rectangles moving from top to bottom against a dark background (see the top third of Figure 1). That window is known as a *waterfall display* (think of a stream of water flowing over the top of a ledge and falling to the bottom), and each rectangle represents an FT8 signal.

Table 1
FT8 Frequencies
All frequencies are upper sideband (USB)

Band (METERS)	Frequency (MHZ)
160	1.840
80	3.573
40	7.074
30	10.136
20	14.074
17	18.100
15	21.074
12	24.915
10	28.074
6	50.313

Figure 2: The RigBlaster Advantage is an example of a deluxe interface.

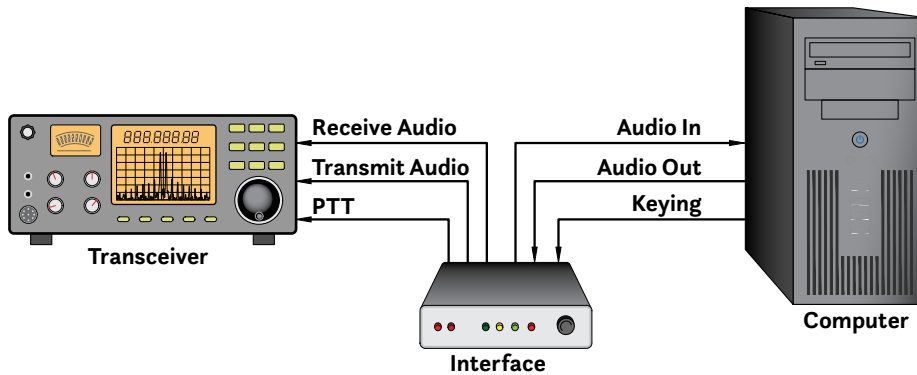
Station Hardware and Software

To explore FT8, you'll need an SSB transceiver that is capable of operating on the high frequency bands, 160 through 10 meters. If your transceiver includes 6 meters, that's a bonus — you'll find FT8 activity there as well.

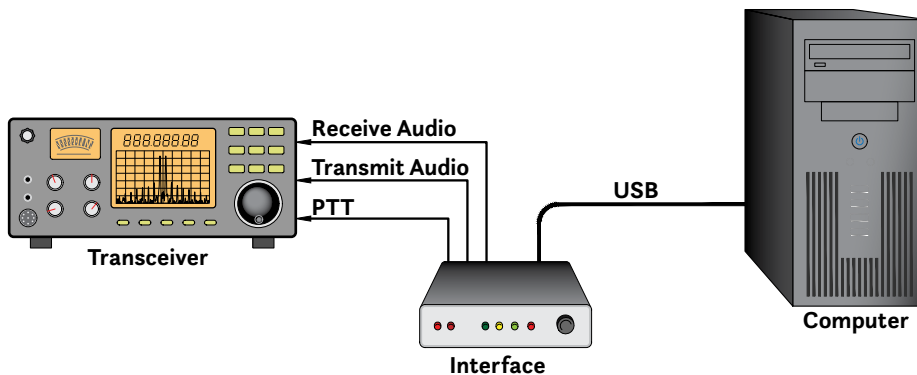
You'll also need a computer and a way to connect the computer to your radio. Many amateurs use devices known as *sound card interfaces* to perform this connection task. Interfaces can range in cost from about \$100 to \$400, depending on the model you choose, such as the one shown in Figure 2. You'll find them advertised in ARRL publications and at ham radio dealer websites.



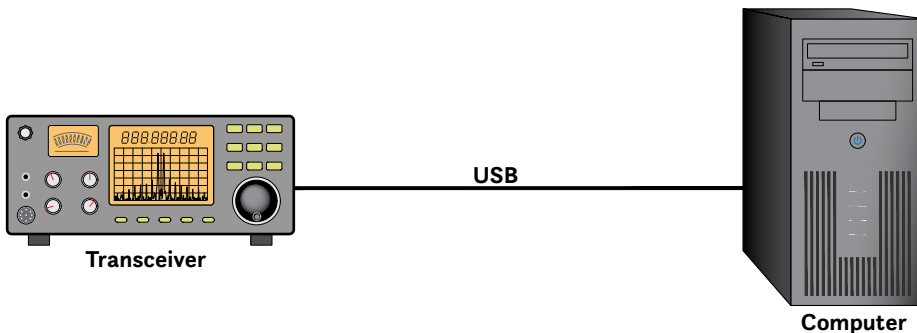
Figure 3:
Three of the most common configurations for interfacing your transceiver with your computer.



The most common setup for many years was based on an interface that took transmit and receive audio from the computer's sound card, along with transmit/receive keying from one of the computer's COM ports and passed everything to the transceiver in a way that kept the signal lines isolated. This type of interface is increasingly uncommon.



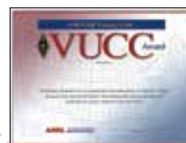
Many of the interfaces available at the time this article was written are USB devices. A single USB cable plugs into the computer. Not only is the computer's sound card not used, the interface contains its own sound device. In turn, the interface supplies transmit audio to the radio, processes receive audio from the radio and handles transmit/receive keying.



The future will likely see the disappearance of the interface entirely as transceivers incorporate their own computer interfacing. Today, several moderate- to higher-priced radios have added this feature.

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If you make FT8 contacts with stations in 100 separate grid squares on 6 meters, you'll qualify for the ARRL VHF/UHF Century Club (VUCC) award.



The ARRL DX Century Club (DXCC) award can be yours for contacting at least 100 eligible countries using FT8.

Timing is Everything

If you are seeing FT8 signals in your WSJT-X waterfall, but the software can't seem to decode their information, there is a good chance that your computer clock needs a little adjustment. The WSJT-X software depends on time synchronization to know when to expect data signals to be present, and to respond accordingly. Your computer clock doesn't need to match the clocks of other stations exactly, but it must be synchronized within less than 2 seconds — the closer the better.

Fortunately, Windows has built-in time calibration that synchronizes automatically with time sources via the internet. In many instances, however, the synchronization doesn't take place as often as it should and, as a result, Windows time may vary by a second or so after just a few days.

You can "force" Windows to synchronize. In Windows 10, for example, open Control Panel and click on "Time & Language." In the "Date & Time" screen, you will see a "switch" labeled "Set Time Automatically." Slide the switch to the OFF position, wait a few seconds, and then slide the switch back to the ON position. This will force Windows to synchronize itself. You don't necessarily need to do this before every operating session, but it doesn't hurt.

A more convenient alternative is the free time-synchronizing application *Dimension 4*, which you can download at thinkman.com/dimension4/. Install the application and set it up so that it loads and runs constantly in the background whenever you start your computer.

FT8 is for Technicians, Too!

If you hold a Technician license, you can enjoy FT8 on 10 meters. As you'll see in Table 1, the FT8 hot spot on 10 meters is at 28.074 MHz. Even when the band seems devoid of signals, you can almost always find some FT8 activity at this frequency. And when conditions improve during *band openings* — times when signals are heard at greater distances — you'll see and hear FT8 signals from all over the world.

As solar activity intensifies in the coming years of Solar Cycle 25, you'll be guaranteed to find plenty of FT8 activity on 10 meters during daylight hours. There are amateurs with indoor antennas who have used FT8 to earn their initial ARRL DXCC award on 10 meters alone! The award requires contacts with 100 separate DX countries (also known as *entities*). Collecting this many contacts can take a substantial amount of time (even years for some operators), but when 10 meters is cooperative, you can use FT8 to rack up that many contacts in a matter of weeks or months.

And don't forget that as a Technician you also have access to the 6-meter band. Many HF transceivers include 6 meters, and all you need is a basic wire antenna to have a blast on this band. FT8 operators hang out at 50.313 MHz. This frequency may be silent much of the time, but when the band opens, get ready! You'll be making FT8 contacts over hundreds, and even thousands of miles. Many of these contacts may count toward your ARRL VHF/UHF Century Club (VUCC) award — the most prestigious VHF/UHF award in amateur radio.