

Introduction to Digital Modes and Operation

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This is intended to be a mini manual on operating the digital modes. It is not intended to be all inclusive, as my experience is limited.

I have broken down digital modes into several categories. For simplicity we will first consider two categories: 1) Sound card, and 2) TNC.

Sound Card Modes – Setup These modes are the easiest to start to use as you just need a PC with a sound card. You do need to hook up your sound card input and output to the speaker output and microphone audio input of your HF or VHF transceiver. Thus with some ingenuity one can use some older radios. Newer radios have a semi standard “digital” port. This is much easier to connect to. If your radio uses the common 6 pin mini DIN connector you can get a cord with a connector already on it for a couple of bucks by purchasing a mouse extension cord at Altex Computer.

Your radio may require additional audio isolation to prevent hum and ground loops when connecting it to your sound card. Radio Shack sells audio isolation transformers that can be used. There are example circuit diagrams for various homebrew interfaces on the Internet. This one site by WM2U is a very good reference: <http://www.qsl.net/wm2u/interface.html> . If you want to purchase an interface ready made Buxcom has one called the Rascal that works well and is quite affordable.

Once you have your PC connected to your transceiver you can install the software. MixW is very popular. It is \$50, but it does many modes. Some programs do only one mode but are considered better than other programs, such as MMTTY for RTTY, and Digipan for PSK31. Since these are free you might as well start with these.

Once the software is loaded you need to decide if you want to control your radio by your PC. For modern HF transceivers I highly recommend that you do this. You will need to make another cable to connect your radio’s com port to either a serial port or USB port on your PC. “Rig Control” is a great advantage. If you see a signal on your computer’s panoramic spectrum screen, you can simply point and click on the signal on the screen and the program will change your transceiver to the correct frequency.

Sound Card Modes – Types There are many different sound card modes. Many are relatively new, but some are about 75 years old. Yes RTTY used to require either large mechanical machines or specialized computer equipment, but now you can run it better than ever using an inexpensive sound card. This is a list of the most common sound card modes.

- 1) RTTY (Radio Teletype) for HF - This is one of the older digital modes. It shifts a signal between two tones instead of turning a single tone on and off like CW. Its

speed is about 45 characters per second. It is not error correcting. It has been extremely popular for contesting for many years. It is still used for DXing.

- 2) PSK31 for HF – This is a popular newer mode. Its speed is 31 characters per second. It is just fast enough for rag chewing for a decent typist, and that is what it is mostly used for. It is not error correcting. This is usually the first digital mode that a ham starts out with. It is very easy to use.
- 3) MT63, and Olivia both for HF – These two modes are very popular with MARS. It uses passive error correction where they imbed the same characters in several places in the transmission. Because of this it can take over 8 or more seconds for your transceiver to stop transmitting after you stop typing. Both of these modes are quite reliable and capable of producing perfect copy when you can not even hear the signal in the noise. MARS uses voice for giving instructions during a net, but they pass all traffic by MT63. This speeds up a voice net by about 4 to 1.

TNC Modes – Setup These modes require an additional piece of equipment: called a Terminal Node Controller (TNC). For now we will just say that they are specialized electronic computing devices that are installed between the transceiver and the PC. They process the data from the PC and convert it to audio digital modulation that is fed into the audio input of the transceiver. Of course the receive process is opposite to this. A TNC-X is a TNC based on a PIC chip. It and can do several modes and costs only \$48. Used Timewave/AEA PK232s, and Kantronics TNCs can usually be purchased for about \$100 to \$125. An SCS TNC can cost over \$1200. Each of these devices has different capabilities. Also there are different software programs to consider.

TNC Modes – Types

- 1) Winlink 2000 VHF packet. This is usually run over 2 meters. VHF Packet was very popular in the 1980s and 90s. Hams used it like a wireless Internet to reach bulletin boards, email, DX clusters, etc. When the Internet exploded, packet all but disappeared. However, Winlink 2000 was developed with Emcomm in mind. Imagine having to send an encrypted casualty list from the Red Cross to the EOC. With Winlink 2000 you send an email from your PC to your 2 meter transceiver, which is uploaded to a RMS (Remote Message Server) station that is connected to the Internet. Your email is then deposited on the Internet, and at the same time your emails are downloaded from the RMS to your location via the 2 meter link.
 - a. Airmail Software – Think of this software as an email program. It will accept Timewave/AEA, Kantronics, SGC and other TNCs. It will not accept a TNC-X modem. Using Airmail is extremely easy.
 - b. Paclink Software – With this software package you can use Outlook Express as your email program and your emails will be deposited in a Paclink post office. When you click “send” your emails will be sent to the RMS via 2 meters and your incoming emails will go into Outlook Express. In addition this software supports the TNC-X. Its disadvantages are that the Paclink software is harder to manage and install, and it requires a third piece of software called the AGW Packet engine. Still it is not a bad option if you only have a TNC-X modem.

- 2) Winlink 2000 **HF** Pactor. First let me explain that in a large disaster the Internet is usually not available for at least 100 miles. In that case a VHF packet RMS will be worthless without an Internet connection. The greatest communication need will be to get email in and out of a disaster area that could be 200 or more miles wide and totally without the Internet. Well if you think that connecting to an RMS 1500 miles away say in Chicago or New York City to exchange email would be a solution, you are absolutely correct, and HF Pactor can do this. You connect an HF Pactor capable modem between your PC and HF transceiver. Airmail is the default software program for this setup so we will discuss the other options.
- a. Pactor I – Pactor I can be used with an old PK232 or Kantronics TNC if they have the proper firmware upgrades. Kantronics no longer sells firmware upgrades for their older TNCs so that can make an older TNC useless. If one is lucky they can pick up a PK232 with the Pactor I compatible firmware for \$50 to \$100. However, fewer and fewer HF RMSs are accepting Pactor I connects as this mode is so slow that it can hog the RMS. At least it works and could be a lifesaver in a real emergency, but emails should be text format and small.
 - b. Pactor III – Pactor III is up to 36 times faster than Pactor I. Most serious Emcomm groups only use this mode. The down side is that Pactor III is owned by SCS and their modems start at about \$1000. In a real disaster, Pactor III will likely be heavily used by hams to get information in and out of a disaster area. The CC EOC and Driscoll Children's Hospital have Pactor III modems. Certain MARS members who will deploy in an emergency also have them.

Winlink 2000 – Winmor for HF

I mention this separately because it is a relatively new mode that promises to put practical Emcomm within the reach of most hams. Hams have been working for years to develop a sound card mode that had better utility than Pactor I, and also did not require an expensive SCS TNC.. Winmor is well on the way to realizing this goal. It is said to be about the speed of Pactor II which is of course between Pactor I and III in speed. That is amazing considering all the processing work is done within the PC and sound card, and that an expensive TNC is not required. Winmor is being tested now and used by many hams. Anyone can download a copy and test it. Hopefully it will prove to be effective and become a valuable tool for the ham in an Emcomm role.

If you have any questions regarding digital modes you can send me an email at: steven (atsign) pituch (dotsign) net.