INTRODUCTION TO DIGITAL

Radio, hardware, software

1. Radio. On the HF bands, you'll commonly hear PSK31 70 kilohertz up from the bottom of the band (e.g., 7070 kHz, 14070 kHz) and other popular forms a few kilohertz up from there. Most digital is sent with the radio in UPPER side band. Any transmitter/receiver/transceiver that can do upper side band will work. Very recent transceivers may have some sort of digital conversion hardware (perhaps a sound card device) built in, and may have a "digital" or other mode option (consult your owner's manual). I've done plenty of digital conversations using a Heathkit SB-102 – a vacuum tube transceiver!

2 Hardware. For regular digital peer-to-peer (typical live ham conversation) communications, all you have to do is get the audio tones generated by your software package into your mic circuit, and you have to get the received warbles and tones, into the computer somehow. This can literally be done successfully by using the soundcard capabilities of your computer, and holding your radio speaker near your computer microphone, and your computer speaker near your radio microphone! Plenty of contacts have been made this way! Of course, you're operating in the DIGITAL/CW portions of the band, so you must keep all other sounds (your voice, for example) SILENCED if you're using acoustic coupling! An improvement is to use two potentiometers (volume controls) and appropriate shielded cables and connectors to make those connections. You can now talk in the shack again! You can either use VOX or hit the PTT switch yourself. A further improvement is to use a commercial interface device such as the Tigertronics Signalink-USB (where the "USB" refers to plugging into a computer USB port, not "upper side band").

When you want to do error-corrected communications such as WINLINK, you have to accommodate very fast transmit/receive switching to allow the "Acknowledge" and "NAK" back-and-forth communications that these systems do, so having either a serial-port-driven PTT control (as simple as a single transistor switch) or the built-in systems of a commmercial device such as the Tigertronics Signalink. Latency in the latter case will be well under 100 milliseconds. WINLINK using soundcard modes ("WINMOR") requires a transmit-to-receive latency under 250 milliseconds.

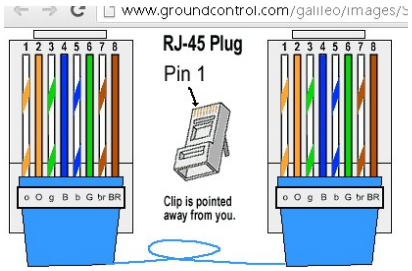
If you are using VHF transceivers – and easy way to learn digital – be sure to turn off any "squelch tail elimination" options that would increase your delay in transmit-to-receive transistions.

Wiring:. This is in theory a simple operation. You have to get the audio from your transceiver to the audio input of either your computer, or of the Signalink. You have to get push to talk wiring (most transcievers need this wire grounded in order to start transmitting) connected. You have to get audio output from the computer or Signalink into the microphone circuitry of your transceiver.

In practice, this can be daunting, because there are not one but two points of variability: the Signalink includes JUMPERS on its circuit board to determine which pins of the RJ45 (think Cat 5 network cable) get which signals – and then you have to get the appropriate connections to your transeiver. You can make your own mic and audio cables, but some people prefer to use commercially premade cables, so Tigertronics markets many different cables for various transeivers, all with RJ45's on one end to connect to their Signalink – but they differ on which pins which signals come out on, requiring different jumper settings internally....what a prescription for confusion!

I have a suggestion for people who are in any way able to make their own cables to their radios, or who

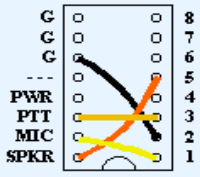
are able to modify a set of cables they bought....if you adopt a standard set of jumpers in your Signalink, you may be able in an emergency, to easily deal with someone else's setup in our group. The set of connections that I suggest are the ones that work with the commercial cable that fits the Baofeng inexpensive transceivers, as wellas many others:



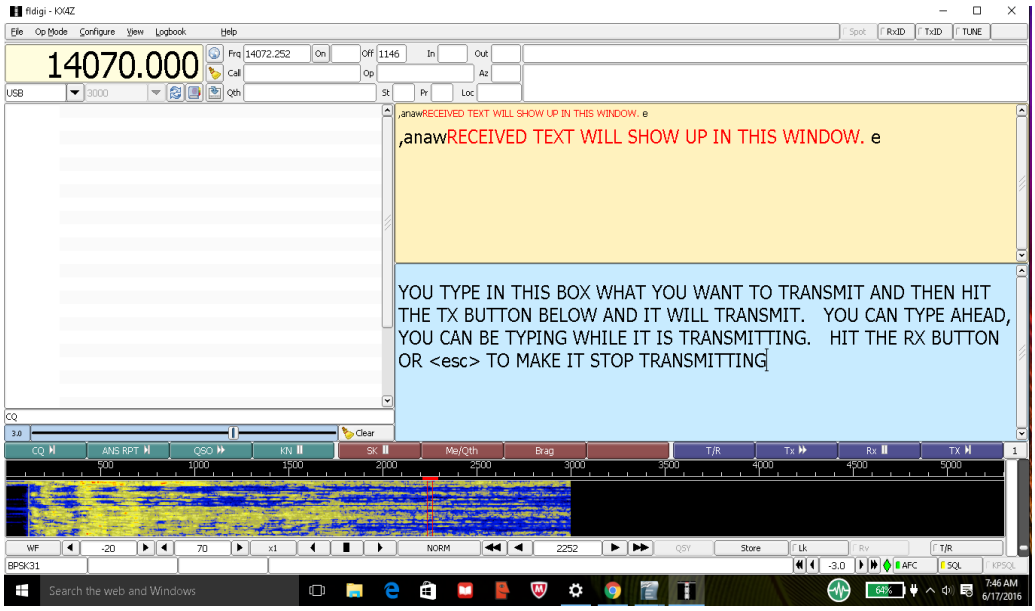
Microphone --- Pin 1 (orange white)
Ground --- Pin 2 (orange
PTT --- Pin 3 (white green)
Ground ---- Pine 4 (blue)
Receiver Audio --- Pin 5 ((white blue)

Jumpers:

6-pin Mini DIN Data Port Connector (use SLUSB6PM, S

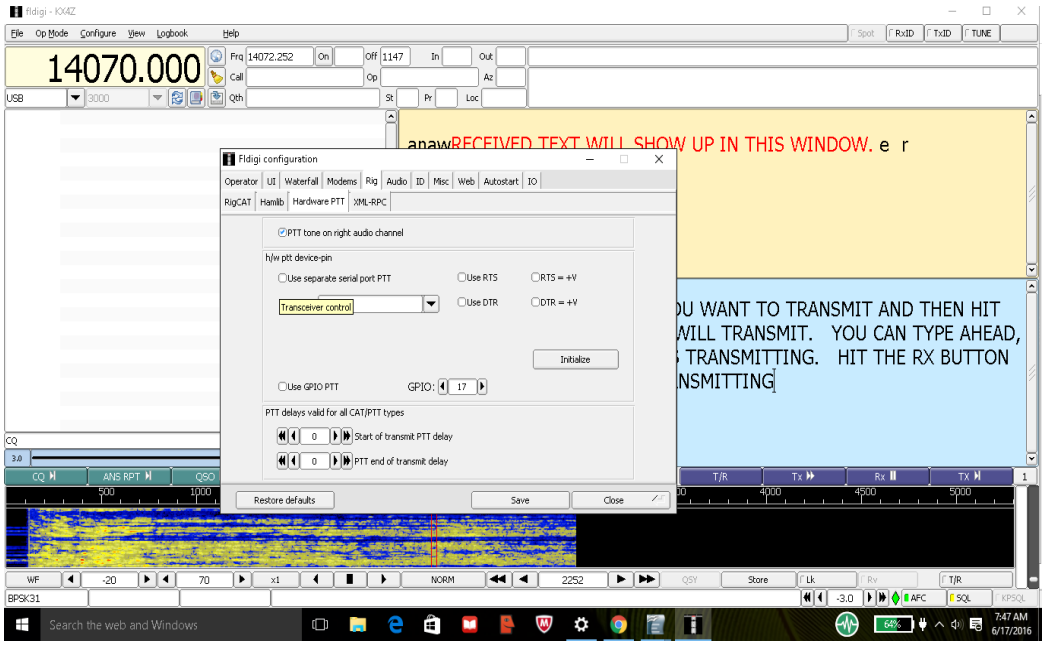
JP-1	Pin-out	Radio Models	No
	Pin 1 – Data In Pin 2 – Ground Pin 3 – PTT Pin 4 – 9600 Out Pin 5 – 1200 Out Pin 6 – Squelch	FT-100/100D FT-817/817ND FT-450** FT-840** FT-847** FT-857/897 FT-950** FT-991 FT-1500M FT-7100/7800R FT-7900R FT-8100 FT-8500 FT-8800R/8900R FTDX-1200 FTDX-3000 FTM-100DR## FTM-350** FTM-400## VX-1700	Fo un au the (9 so pr ma ** rep ve ma wi kn is the sir pr ** ra No

3. Software. People can dip their toes into digital very easily with FLDIGI free software, which can perform a dizzying array of digital protocols, including the popular PSK31, MT63 and others. You're most likely going to start with PSK31. A problem with all this digital stuff is that you generally need to recognize the sounds of different modes and select the proper one. There are some automated ways to identify the type of protocol, and FLDIGI has those built in



– but they are not that useful and you'll do better by simply listening to some of the sounds recorded on internet educational pages. FLDIGI is an extremely versatile software, and as such it has a very wide array of configuration options. Here are the most important:

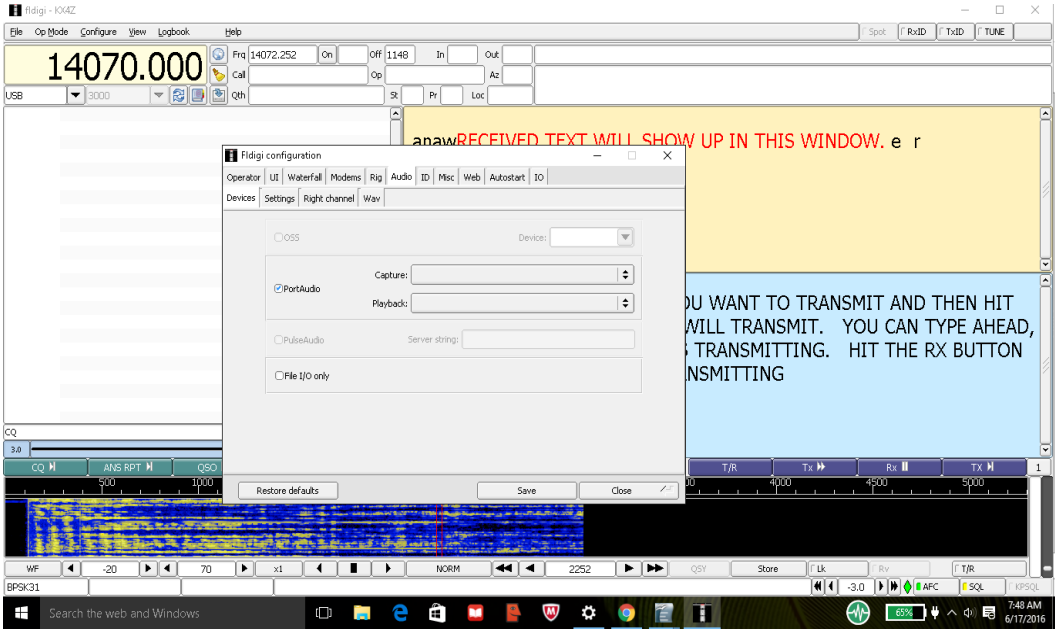
CONFIGURE | RIG CONTROL:



For Signalink devices, a continuous tone is sent on the RIGHT channel of theaudio system which activates circuitry to invoke the Push To Talk. Your audio volume on the computer right channel needs to be at 100% If you are using some form of serial port controlled push to talk, you will need to configure it here.

Be aware that the “frequency” displayed in the upper left hand corner of FLDIGI will not be accurate unless you have frequency controlled electronically from your rig (another configuration step in FLDIGI)

CONFIGURE | SOUND CARD



For Signalink, you will want to choose both for input and output-- SOMETHING that has “USB” in its name – the giveaway that the device is your Signalink device. You can ONLY have ONE signalink on a given computer, so don't try using 2 for some reason....

OPERATION

There are many help texts available for FLDIGI. Here are some tips:

1. On PSK31 and RTTY, you can see ALL the conversations happening at the same time (within your receiver bandwidth) on the left pane. You can click on any conversation and the system will automatically put your audio on the correct frequency.
2. You can get the system to report frequencies in AUDIO frequencies, which is better for you if you don't have electronic frequency control. To get your actual frequency, add the audio to your “dial” frequency.
3. You can also click within the waterfall (fft display) to position your audio tones.
4. If you have an offset between your transmitted and received tuning (this is generally not desirable, but is a fact of life for some older rigs) there is a way to offset for it within the configurations.
5. You can use FLDIGI to send and receive CW. Pick the approximate speed you want to use and enter in the box down at the lower left. The system will “follow” received text within a reasonable variance from your chosen speed.
6. There are actually FOUR “soft key” rows. Default configuration shows you only 1. You can adjust this.
7. The “soft keys” are editable. There are “fields” like in a database that you can insert into these.
8. The TUNE button at the upper right is very hellpful if you need a steady tone to tune your antenna or rig. If you can't find it to turn it off, hit the ESCape key on your computer.
9. If the screen FREEZES, that means you have RFI that is getting into your computer, typically through the USB port from the Signalink.

RFI

If you have RF running on your wires – usually because you have an imbalance and there are currents running on the OUTSIDE of your coax, which means they are running thorugh ALL the wires connected to your radio....then you are likely to have things freeze or not work properly. Try to avoid this with baluns or RF-isolators in the coax line, and with ferrites over signal wires. With larger ferrites, you can actually put a couple turns of the signal wire through the ferrite.