

Interconnecting Transceivers and Computers for WinLink

Introduction

- Setting up and configuring WinLink with a computer and ham radio transceiver can be difficult...planning ahead can help simplify.
- Provide options for how to connect your WinLink system.
 - Concentrates on TNCs, sound cards, and interfaces.
- This presentation makes the following assumptions:
 - Your computer Operating System is Windows 8 or newer (not in a virtual machine).
 - You have or will be buying an FM <u>mobile</u> or FM-capable <u>base</u> ham transceiver to use for your WinLink Express station.

An Example Packet Station



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Definitions

- VOX: Voice Actuated Switch.
- PTT: Push To Talk.
- TNC: Terminal Node Controller.
- Sound Card: Transforms digital information into audio signals.
- Hardware: Comprised of Silicon, Metal, Plastic and other materials, and has some processing capability.
- Packet/APRS/AX.25: On-air, encoded message protocols.

- Software: Commands written in a computer language that enable controlling hardware and/or other software.
- Baud: Short for baudot. Similar to "bits per second". Bandwidth.
- CAT: Computer Aided Transceiver. Used to control a ham radio.
- CI-V: An interface, common with ICOM equipment, enabling computer control.

Definitions

- Modulation: A signal added to a carrier frequency to transfer data on the airwaves.
- Deviation: The amount of signal level change (frequency shift in FM) when a carrier is modulated.
- Over-Deviation: Too much modulation. Causes distorted signals that can consume too much bandwidth.
- Interface: A device with input & output ports for inter-connecting things. For ham radio, a transceiver and a computer.

- Line-level (signal): A low voltage signal, expected in low-power devices like headphones or for transmitting signals on a small copper wire.
- Speaker Level (signal): A powered electrical signal, usually in the range of 1 to 1000s of watts, for carrying audio from an amplifier to a speaker. High voltage and currents are present.
- Packet Radio: In ham radio, a set of technologies that enables computers to communicate via ham radio. A computer connects to a TNC or via an interface to the transceiver, to send and receive packet messages.



1:Fm W7EFR-10 To BEACON <ui len="31" pid="F0" r=""> [20:08:42R] [+++] winink 2000 RMS Packet Server 1:Fm W7EFR-11 To ID <ui len="22" pid="F0" r=""> [20:08:42R] [+++] Network Node (COUGAR)</ui></ui>
/inlink 2000 RMS Packet Server :Fm W7EFR-1 To ID <ui len="22" pid="F0" r=""> [20:08:42R] [+++] letwork Node (COUGAR)</ui>
etwork Node (CDUGAR)
yCall DestCall Status Sent pkts Sent bytes Rovd pkts Rovd bytes Rovd FC CPS TX CPS RX Direction



Terminal Node Controllers

a.k.a. Tee Enn Sees

Terminal Node Controller / Modem

- Controls push-to-talk.
- Encodes computer bits into ham-radio-ready tones.
- Decodes packets from ham radio for use by a computer.
- Often \$200 or more.
- 1200 baud is common.
 - Higher speeds are less common and much more expensive.
- Connections to base/mobile are generally serial and audio cables.
 - There are ways to connect an HT to a TNC with some cable splicing.
- Manufacturers: Kantronics; AEA; MJF; SCS...
 - Alinco, Kenwood, and others can have a built-in or available add-on TNC.

Hardware TNC's

- A hardware TNC is, essentially, a modem.
 - Remember the America On-line "dial up" days?
 - Very similar hardware and command sets.
 - TNCs add encoding/decoding capability for protocols like AX.25, PACTOR, others.
- Kantronics and SCS are popular brands.
- Tend to be expensive.
- Not very user-friendly in terms of configuration.
- Cabling required between TNC and:
 - Transceiver
 - Computer
- Requires additional power source.





Software Terminal Node Controllers

- A software TNC encodes and decodes APRS and/or Packet transmissions for use "on the air", and controls push-to-talk.
- Some are as challenging to set up as a hardware TNC, others much easier.
- Most are absolutely free...unlike hardware.
 - DireWolf
 - Packet Engine Pro
 - AGW Packet Engine
 - UZ7HO
 - ...others
- Run on Windows, or Linux/Unix variants.
- There is growing evidence that Software TNC performance can outpace hardware [see DireWolf references at end of this deck].





Sound Cards

Computer Sound Cards

- Usually live INSIDE of your computer.
- External soundcards exist:
 - Webcams with microphones have sound cards built-in to them.
 - USB Microphones for recording/podcasting.
 - USB Sound dongles w/ Microphone and Headphone ports.
- Some computers do NOT have a sound card at all!
 - For example, some Raspberry Pi models.
 - To get a soundcard, purchase an external USB Dongle.
- For ham radio use:
 - Use an external Sound Card Interface if possible, like a USB Dongle.

Audio Interfaces and Sound Cards

- Enables connecting computer audio IN & OUT to other devices.
- IS NOT a TNC -- just handles audio in & out.
 - Sometimes includes PTT control.
 - If not: Add a serial, CAT, or CI-V control connection that will operate PTT.
- Usually quite simple.
 - SignaLink USB can be difficult due to its jumper settings and small wires.
- Examples:
 - Masters Communications RA-30.
 - SignaLink USB.
 - Home-brew interfaces.
 - CM-108/119 based USB Dongles.



Soundcards and Software TNCs

- Your computer handles all the busy work:
 - Whichever software TNC is in use to Encode & Decode packets and time push-to-talk operation;
 - Usually a waterfall or otherwise on-screen, live display of activity.
- Absolute speed (300, 1200, 9600 baud) is determined by:
 - The software TNC, and
 - The Interfaces between the computer, soundcard, and transceiver, and
 - The transceiver's features and filters.



Image 1 of 4 Next »



Interfacing Rigs and PCs

Interface Types

Audio Interface

- Computer Audio OUT -> Transceiver Microphone/Data IN
- Transceiver Audio OUT -> Computer Microphone IN
- A PTT mechanism:
 - Either VOX or a High/Low signal.
- Devices:
 - Home-brew interface; older SignaLink; RPi "Hats".

USB Interface

- Data + audio connection between Transceiver and Computer.
- Includes PTT functionality.
- Requires Software Download:
 - "USB Audio Codec"
- Devices:
 - SignaLink USB; DRA-30; Rigblaster;
 - Transceiver with built-in USB TNC

Interface Considerations



Microphone and Speaker Jacks

- Line levels might require lowering volumes or adding resistors to a circuit.
- Connecting the wrong mic connectors could "let out the smoke".
- Audio out might not be on mic jack!
- Either make your own cables or pay fees for pre-built ones.
 - Requires work/searching.

"Data" Connectors

- Data-IN, Data-Out, PTT.
- Usually 6-pin Mini-DIN.
 - Yaesu has 5p, 9p, etc.
 - Same in the end.
- Low-level audio.
- Include audio In + Out.
- No DC power pins.
- Pretty much standard...
 - Compared to mic connectors.

That's A Lot To Learn.

Tell Me What I Need to interconnect everything!

Which Interface Should I Use? (example)

TNC Type I Have/Will Have		What you'll need to do
 Ask yourself the following questions: 		 Steps to take.
		 Things to be aware of.
• Q2		• Advice.
• Etc		
 Conditional statement -> 	This	slide shows how the
	next	several slides will be
	laid	out.

Hardware TNC

- Ask yourself the following questions "Does my transceiver have..."
 - 6-pin mini-DIN or DATA/Packet jack?
 - Serial 9-pin connector?
 - Built-in TNC?
 - USB Connector?
- If NO to ALL, then ightarrow

You will need a cable to interface the TNC to the Transceiver's Mic and Speaker ports:

- Buy from manufacturer or 3rd party.
- Make your own.
- Beware:
 - Mic and audio levels could be fiddly to set properly.
 - Mic jack might have 9v or 12v present – don't short it!
 - ICOM and some other transceivers need a capacitor added to interface.

<u>Built-in TNC</u>

- Does my transceiver have a:
 - USB Jack
- If YES then →

- Download and install the appropriate software drivers from the manufacturer.
 - This will create a USB Audio Codec (or similar) audio device.
- Set the necessary menu items to ENABLE internal TNC.
- Note:
 - APRS good, packet could be limited to small/short messages.
 - Could be complex menu settings or other challenges.

Built-in TNC

- Does my transceiver have a:
 - 9-pin Serial or coaxial-type connector.
- If YES then ightarrow

- Acquire the computer connection/serial cable from manufacturer or 3rd party.
- Set menu items to ENABLE internal TNC.
- Set menu items to enable computer connection.
- Beware:
 - APRS good, packet could be limited to small/short messages.
 - There could be other complex menu settings or other challenges.

Expansion TNC

- The TNC board was added, internally, to the transceiver.
- Note: Alinco DR-*35 series.

- Make or purchase a cable that connects your computer audio to the serial "data" port only.
- Configure any necessary Menu items in the transceiver.
- Note: Requires installation by you or someone else.

Software TNC

- Does my transceiver have a:
 - 9-pin Serial "Data" or "Computer" jack?
- If YES then →

- Use an interface with custom cable that connects a computer USB/Serial cable to the 9-pin jack:
 - SignaLink USB with adapter cable for your rig's mic jack and possibly speaker output.
 - RigBlaster with adapter cable for your rig's mic jack and possibly speaker output.
- Download a software TNC:
 - Direwolf, UZ7HO
 - Future: VARA & VARA FM

Software TNC

- Does my transceiver have a:
 - Built-in TNC?
- If YES then →

- Set proper menu items to DISABLE the internal TNC.
- Purchase/make custom cable to connect PC to Transceiver directly or do without WinLink.
- Read through the manual and search the internet for help.
- Download a software TNC:
 - Direwolf, UZ7HO
 - Future: VARA & VARA FM

Software TNC

- Does my transceiver have a:
 - 6-pin "Data" or "Accessory" jack?
- If YES then →

- Use an interface that comes with the 6-pin mini DIN plug:
 - SignaLink USB SLCAB6PM -or-
 - RigBlaster USB -or-
 - Masters Comms DRA-30 -or-
 - Home-brew Interface using computer built-in soundcard and serial-port RTS/DTR for PTT.
- Download a software TNC:
 - Direwolf, UZ7HO
 - Future: VARA & VARA FM

Software TNC

- Does my transceiver have a:
 - USB Jack
- If YES then →

- Download the appropriate driver software from the manufacturer.
 - This will create a USB Audio Codec (or similar) audio device.
- Install driver and set menu items to disable internal TNC.
- Download a software TNC:
 - Direwolf, UZ7HO
 - Future: VARA & VARA FM

Speeds

What Speed?

Baud, bps, and Bandwidth

- Baud: Standardized system measuring how often a signal changes, per second.
- bps: Bits per Second
 - A raw count of how many bits are transferred on the medium, every second.
 - Slightly different than Baud, but close enough where this presentation will use the terms interchangeably.
- Bandwidth: Represents how much information is transferred at each moment in time.
 - High-level modulation into a microphone will cause wider transmitted signals on the air, possibly over-deviating (more on that later).

Speed, Control, and Modulation

- Speed:
 - Higher-speed digital transmissions require more bandwidth.
- Control:
 - Part of every communication requires Control Messages that manage the connection but cause the "connection speed" to seem slower.
 - More Control messages = longer packet connection sessions.
- Modulation:
 - 300 & 1200 baud packet communications use Audio Frequency Shift Keying .
 - 9600 baud uses a binary method, usually G3RUH.

What Speed?

<u>1200 Baud</u>

- VHF/UHF FM air "speeds" are usually 1200 baud:
 - HF: 300 baud or less.
 - VHF, UHF, SHF support higher speeds!
 - 9600 APRS and Packet are less common.*
- NEMCo EOCs use 1200 baud.
 - Using hardware TNCs.
 - Short messages go fast!
 - Large messages...not so much.
 - Busy airwaves? Messages get backed up due to failed connections!

<u>9600 Baud</u>

- There is a growing community of 9600 baud users around here.
- Averages about 4x faster than 1200.
 - All things being equal.
- Supports shorter traffic sessions.
 - Which enables more users on-air.
- Takes a bit more effort to set up.
 - Not all transceivers can support it.
 - Transceivers lacking "Data" ports are pretty much stuck with slower speeds.
- Newer rigs can be set to 9600 and be useful on either 1200 or 9600 baud.

The Future

- VARA and VARA FM:
 - Updated in Nov 2020!
 - Paid (faster); Free (slower).
 - NOT AX.25 Packet nor APRS.
 - Works with WinLink Express!
- Narrow Mode:
 - Approximately 1200 baud but can go faster.
- Wide Mode:
 - Meets or exceeds 9600 baud!
 - Can slow-down per conditions.

- VARA: Smarter than packet.
 - Varies speed between stations to get best throughput per conditions.
- Very few VARA RMS stations out there.
 - More are needed.
 - The more NEMCo RACES learns about new technologies like this, the more WE can help the community by adding capable stations.
 - NEMCo could leverage this technology (licensed or free) to take advantage of its capabilities.



Ports and Plugs and Cables

Oh my!

What Is This 6-pin Mini DIN Port?

- "Standardized"...
 - ...but not STANDARDIZED.
- MOST manufacturers follow same pinout as shown \rightarrow
 - GND: Ground between rig and soundcard/interface/TNC
 - Data In a.k.a. "Mic"
 - Data Out 1200 a.k.a. "Speaker"
 - (Low-voltage signal, not spkr level).
 - Data Out 9600 a.k.a. Discriminator
 - Set packet menu to "9600".
 - Connect TNC or Interface to 9600 pin.

6-Pin Mini-DIN "Packet"/"Data" Connector **PinOut Diagrams**



"Data Out 1200" (Receive Audio)

(Transmit Audio)

Looking into Female Panel Jack (Soldering end of Male Plug)



Network and Phone Cables

- Every ham transceiver is a little different.
 - Especially with microphone cables the pinouts vary widely.
- Mic audio and PTT signals are often carried on 6- or 8-conductor cables for hand microphones.
 - Sometimes a voltage is there too: Lighted hand-mic or to power mic element.
 - **Be careful!** Shorting or improper use could damage your transceiver, soundcard, interface, or computer.
- 8-pin cables with RJ-45 plugs are often used for remote-head connections on mobile rigs.
 - Not needed for interconnecting rigs, radios, and computers.



Many Other Jacks and Plugs

- Vintage Base stations, HF-only transceivers, mobile FM or mobile all-mode rigs, all have a myriad of jacks and plugs.
- TigerTronics has a LONG listing of the various types of jacks and plugs used on many ham transceivers.



Various Serial Cables & Plugs

Multiple cables might be necessary to connect transceivers to a soundcard and computer, or interface and TNC:

- Packet + Audio + PTT:
 - USB
 - DB 9
 - 5-pin "MIDI" Plugs
- Computer + Audio:
 - DB 9
 - RS-232

- Mic and Headphone audio:
 - Stereo and Mono coaxial 1/8"
- Multi-pin "Computer" or "Packet" ports:
 - Found on the back of some rigs.
 - Check the manual for your transceiver to find out which one(s) it has and what it is for!

Various Serial Cables & Plugs

Putting Things Together:

- An HT will pretty much require stereo and/or mono 1/8" audio patch cables to connect to a TNC or a soundcard like SignaLink USB.
- A mobile rig is more likely to have a 6pin mini-DIN or 9-pin Serial connection, simplifying connection to soundcard or TNC.
- Most newer HF/VHF/UHF base stations will have 6p and/or 9pin DIN connectors, and/or a USB connector for internal soundcard use.

- Older mobile and HF/VHF/UHF base stations:
 - 9-pin serial or other manufacturerspecific plugs that can be used for connecting a TNC or soundcard.
 - Others will require 6- or 8-pin modular plug (mic) and 1/8" audio jumpers (Speaker/headphone) to connect to a soundcard.
- Review what you have (or are going to purchase) and search the user manual to identify the available connectors on your rig, so you can figure out what cabling is necessary for a TNC or Soundcard.

Final Comments About Software vs. Hardware TNC's

Hardware TNC vs. Software + Interface

<u>Hardware</u>

- Limited to built-in speeds (300, 300/1200, 1200/9600).
- Some rigs have maddening menu system selections to enable the internal TNC.
- Limited "cache" memory.
 - If memory overflows the TNC might stop functioning and will need to be reset to get sessions running again.
- Stuck with built-in protocols.
 - Unable to leverage newer protocols like VARA or the myriad modes available in a program like FLDigi.

Software

- Flexible speed settings.
 - Limited mostly by your rig or interface.
- Medium to steep learning curve for configuration:
 - DireWolf: Steep
 - UZ7HO: Medium
- Documented evidence of better performance than hardware TNCs.
- Able to utilize newer protocols.
 - VARA!
 - FLDigi modes!
 - ARDOP!
 - Others!

XTuning Your Equipment for Packet

This is a complex topic: Dials, buttons, software settings, connections, components... etc. The following slides will attempt to get you started tuning your packet station for best performance. With experience, and talking with others, you will find the best settings for your system, which won't be the same as my settings.

Tools to help you tune your system

- GET A FRIEND TO HELP.
 - Preferably with their own transceiver, or better: A working packet system.
- Read the manuals of the components you already have/will purchase.
- Have an operating WinLink station to use as a test-partner system.
- Use an SDR Receiver to view the output/transmission of your system.
- Use a software Level Meter like Darkwood Designs' Audio Level Meters.
- WinLink Express Help menu and WinLink support group.

- The Interface between your computer and transceiver carries the received audio and transmit audio, and most likely a PTT signal.
 - Use good/quality components.
 - Avoid transformers if high speed packet is needed.
 - SignaLink uses transformers (1200 limit); RA-40 does not (9600+).
 - Utilize good components to prevent PTT problems between rig and computer.
 - SignaLink uses a relay (good); RA-40 uses a transistor-based switch (better).
 - SignaLink has a Delay knob that will cause connection problems (PTT delay).
 - SignaLink and others have dials and buttons on the front. Learn what these are for. Experiment with different settings and observe the results with your on-air friend.

- Windows has an audio mixer with levels that should be set.
 - Speaker: Have your on-air friend listen to your signal to find best setting.
 - Mic: Try different settings and watch the software TNC for clues:
 - Waterfall colors/shades.
 - On-screen indicators e.g.: "Input volume too high" message; A meter "in the red".
- Make sure your USB Sound Device:
 - IS set in the soft TNC as the Mic/Spk devices.
 - Is NOT set as Windows "Default".
- Turn off Windows Sounds.



- Move the Sliders:
 - Speaker controls Transmit volume.
 - Microphone controls Receive sensitivity.
- Waterfall can show mic input intensity.



Sound

Playback Recording Sounds Communications

Select a playback device below to modify its settings:



Speakers 2- USB Audio Device Default Communications Device

Speakers Properties



Tuning Your System: A Windows Gotcha!

- Microsoft introduced a new feature in a recent update to Win 10.
 - Upgrading Windows 8.0 or 8.1 to Windows 10, or
 - Updating Windows 10 installation after a long time without updates...
 - When you run your software TNC or try to configure the Mic to use the USB Audio device, an error will appear stating there was an error, and the TNC will not function.
- To fix:
 - Close software TNC and any apps using Microphone/Soundcard.
 - Open: System -> Sound -> Microphone Privacy Settings
 - Select/Enable: "Allow access to the microphone on this device."
 - Restart software TNC and select the Microphone.

- Software TNCs have a lot of very techie-sounding configuration items:
 - Network Port; AX.25; TXDelay; BPF Width; Add RX; Filters...etc
- Generally, the default TNC/Protocol settings are fine.
 - For example: UZ7HO SoundModem => Modems:
 - 1200 baud: Select "AFSK AX25 1200bd" (this is the default 1200 baud mode).
 - 9600: FSK G3RUH 9600bd (default 9600 baud).
- During initial tuning:
 - Settings like TXDelay, BitsRecovery (etc), TX Twist... can be left default.
 - Don't change these unless you know what you are doing or expert advice to change them.
 - Assess performance by monitoring:
 - Waterfall; Oscilloscope; on-air signal by ear; SDR Receiver; Session Logs.

PTT timing is important

- It tells the rig when to start transmitting.
 - If PTT is too slow or releases too quickly it will cause session errors.
- The setting for your transceiver will probably be different than mine.
 - Experiment with different timings (with the help of another ham) to discover what timing makes the most positive impact to your traffic session.
- The SignaLink "Delay" knob should be turned down all the way counter-clockwise (about 7 o'clock effectively "off").

- If you connected your Sound Card using a 9-pin serial port or a 6-pin Mini-DIN connector:
 - You shouldn't have to make any microphone or speaker adjustments.
 - Rear-connectors bypass volume adjustments, and usually mic gain controls.
 - If 1200 baud: Squelch to zero unless monitoring by ear simultaneously.
 - Disconnect the hand mic some rigs don't mute the hand-mic when in "data" mode.
- If you connected your Sound Card to the speaker and microphone jacks:
 - Reduce the Squelch to zero (usually fully counter clock-wise).
 - Adjust speaker/headset volume (knob) until waterfall shows static.
 - Transmit a test tone from the TNC software (for example: UZ7HO Tune button), then:
 - Adjust microphone gain menu/knob Have another ham listen to signal or use tools to check deviation.
- Common Problems:
 - Rig knobs/levels set to zero or "off".
 - Windows Sound Mixer adjustments have not been made.
 - SignaLink or Soundcard adjustments have not been made.

Making Choices

Revision: 12/18/2020

Look at the transceiver(s) you already own

- Discover what type(s) of connectors/ports are on it.
 - Audio in/out; microphone; 6-pin Mini DIN; 9-pin Serial.
- Read the manual to find out if it has a TNC built-in or not.
 - Built-in: Might be limited and/or challenging to configure.
 - Not built-in? Don't already have a TNC? These are good reasons to go with a Software TNC like UZ7HO or DireWolf.
- Does it support 9600 baud?
 - Check if menu system has a 1200/9600 setting.
 - If it does support 9600 AND it has a 6-pin Mini DIN connector it is a great candidate!
- Does it have a built-in Soundcard?
 - Great, find the USB cable and download the custom drivers from the manufacturer.
 - Research setup in the manual, online forums, and other hams for more info.

Thinking of buying a new transceiver soon?

- Discover what type(s) of connectors/ports are on it.
 - Audio in/out; microphone; 6-pin Mini DIN; 9-pin Serial.
- Read the manual to find out if it has a TNC built-in or not.
 - Built-in: Might be limited and/or challenging to configure.
 - Not built-in? Don't already have a TNC? These are good reasons to go with a Software TNC like UZ7HO or DireWolf.
- Does it support 9600 baud?
 - Check if menu system has a 1200/9600 setting.
 - If it does support 9600 AND it has a 6-pin Mini DIN connector it is a great candidate!
- Does it have a built-in SoundCard?
 - You'll need a USB cable and to download the custom drivers from the manufacturer.
 - Research setup in the manual, online forums, and other hams for more info.

Are you interested in electronics?

- Get a project soundcard like the DRA-30 or DINAH.
- Build your own soundcard + PTT interface.
- TNC: UZ7HO Soundmodem or DireWolf.

Hitin, Low Zout example
2=2.225
INO
3hik 725500
po out
Shik - IONF - 103 fikg or m
L
Gain = -3dBv
Bandwidth # 15/kHz



Do you like fiddling with computer technologies?

- Advanced setups might include a "remote" wi-fi connected Raspberry Pi with a DRA-30 soundcard and DireWolf (for Linux).
- Your Windows PC can run WinLink Express and connect to the remote Raspberry PI via a network protocol called "KISS". WinLink Express knows how to talk to "KISS nodes" and will tell the Raspberry PI how to connect and transfer messages.

Look at your computer/laptop

- Is it new enough to run at least Windows 8 (or Windows 10)?
- Can you install a UZ7HO or DireWolf software TNC on it? Try and see.
- Does it have audio in/out?
 - Do you have a little extra cash to buy a sound card + connector cables?
 - Do you have time to build them?
- No Windows computer?
 - Go to WinLink forums and search for solutions.
 - Try G8BPQ software to build a WinLink-capable "Node".
 - Fairly difficult/advanced setup.
 - NOT a full replacement for WinLink Express.
 - Provides basic message create/send/receive.
 - NO ability to create or fully utilize WinLink Forms.

Do you want to keep up with newer, more capable technologies?

- Invest in equipment that supports 9600 baud if you don't already have it.
- Build/buy complete RA-30 board (supports 1200 & 9600 baud).
 - FYI: Masters Communications has *several* RA- boards besides the '30.
- Build a homebrew interface using only resistors, capacitors, and a transistor or opto-coupler.
 - Don't use audio transformers; they don't have bandwidth for 9600+ baud.
- Consider investing in:
 - HSMM (high speed multimedia radio). Not very popular around here.
 - Better => HamWAN. Strong support and active community.
 - Can interop with Packet, APRS, TelNet, etc.

		ls a		Requirements						
Device	Hardware TNC	Software TNC	Soundcard Interface	Computer Connector	Recommended XCVR Connector	Other Needs	Transcevier Special Configuration	РТТ	Best For	Packet/ WinLink
									APRS, 1200 baud	
SignaLink USB	No	No	Yes	USB	6-pin mini DIN	Software TNC	Enable Packet/D Mode	VOX	Packet	Easy*
DINAH	No	No	Vec	LISB	5-pip mipi DIN	Software TNC	Enable Parket/D Mode	Automatic	APRS &	Intermediate
DINAH	NO	NU	Tes	038	0-pin min bin	Soltware Inc	Linable Facket/D Mode	Automatic	APRS,	interneurate
TARPN	Yes	No	No	USB	6-pin mini DIN	Raspberry Pi	Enable Packet/D Mode	Automatic	1200 baud Packet	Intermediate
Kenwood TH-D74A	Yes	No	Yes	Bluetooth -or- USB	n/a	Driver download	Lots in Menu system	Automatic	APRS	Difficult
Kenwood TM-D710	Internal	No	No	Serial 9-pin, USB	Kenwood Serial Cable	None	Enable Internal TNC Set Packet/APRS Mode Set 1200/9600	Automatic	APRS	Intermediate
Kantronics Packet				DSUB-25 >			(Menu if 6pin Mini		APRS &	
Communicator 3+	Yes	No	No	Serial or USB	Serial 9-pin	12v Power	DIN)	Automatic	Packet	Simple
RigBlaster Plug & Play	No	No	Yes	USB	6-pin mini DIN -or- Adapter cable	Opt: Rig Control Cable	Enable Packet/D Mode	VOX/CAT	APRS & Packet	?
Byonics TinyTracker	Yes	No	No	Serial 9-pin	6-pin mini DIN	None	Enable Packet/D Mode	Automatic	APRS	Difficult
PiTNC (12k/9k6)	Yes	No	No	Network	6-pin mini DIN	None	Enable Packet/D Mode	Automatic	APRS	Prebuilt: Intermediate
Alinco DR-135/235/435	No	No	No	Serial 9-pin	Microphone Jack	Software TNC Soundcard Interface	Menu System	Automatic	APRS	Easy to Hard
Alinco TNC Card	Add-on	No	No	Serial 9-pin	Microphone Jack	•	Menu System	Automatic	APRS & Packet	Intermediate
Masters Comm DRA-*	No	No	Yes	USB	6-pin mini DIN	Software TNC	Enable Packet/D Mode	Automatic	APRS & Packet	Kit: Intermediate Prebuilt: Easy
Homo brow Interface	No	No	Vac	Social O pip	6 nin mini DIN	Software TNC	Faable Packet/D Mede	Automatic	Poth	Intermediate
nome-brew Interface	NO	INO	res	Serial 9-pin	o-pin mini Din	Software INC	chable Packet/D Mode	Automatic	both	intermediate+
Syba SD-CM-UAUD	No	No	Ves	LISB	6-nin mini DIN	Software TNC	Enable Packet/D Mode	Automatic	Both	Intermediate+

Putting It All Together

Typical Packet Setups

- You've seen a bunch of information about packet station setup, but what do they look like?
- There are too many combinations of Packet/WinLink station setups to address here:
 - More transceiver makes/models/capabilities.
 - Packet/WinLink with an HT.
 - RMS Gateway stations.
 - Packet/WinLink stations NOT using Windows.
- The myriad of transceivers make cabling a challenge for many:
 - The simple answer is always: Buy a pre-made cable for your specific interface needs.
- Other uses besides packet exist in these setups: APRS; VARA; HF and FM digital modes
- ALL of the following setups can do "Packet P2P" and "Packet WinLink".
 - The most important modes for NEMCo RACES right now.
 - Few of them can do *everything*.
 - One of them is probably a close fit for you (Remember the "What Do I Choose?" section).

TYPICAL HARDWARE TNC SETUP

Capabilities: APRS, Packet/WinLink, 300/1200 baud (possibly 9600), KA-NODE, and Digipeating*.

Drawbacks: You are locked-in to TNC's built-in protocols; Digipeating NOT possible while using WinLink; Pricey; 9600 baud modem very expensive.

TRANSCEIVER	HAM INTERFACE	HARDWARE TNC	COMPUTER INTERFACE	COMPUTER
Has 6-pin mini-DIN "Data" jack.	Connects "Data" port to TNC "Radio" port.	9-pin Serial connector marked"Radio".9-pin Serial connector marked"Computer".	USB to Serial (9-pin connector) cable connects TNC to computer. TNC will appear as a new COM Port in Windows.	Windows 8/10 Computer with WinLink Express installed. Has USB port used to "talk" to the TNC. WinLink Express can be setup to talk "Kantronics" and will do all the setup for you.

SOFTWARE TNC SETUP: RA-40 and DIREWOLF

Capabilities: APRS, Packet/WinLink, 300/1200/2400/4800/9600 baud (maybe more), FX.25, Digipeating, VARA & VARA FM, and much more.

Drawbacks: Make/buy cable between Soundcard and Transceiver; Configuring DIREWOLF and WinLink Packet is slightly more difficult.

TRANSCEIVER	SOUNDCARD	COMPUTER	SOFTWARE TNC	WINLINK EXPRESS
			<pre>Biglemer Hole apple Level - 3(02/16) Level</pre>	Constrained Constrain
Transceiver:	Interface:	Windows 8/10 Computer	Configure DIREWOLF to use "C-	Configure Packet WinLink to
Has 6-pin mini-DIN "Data"	"RA 40" soundcard.	with WinLink Express	Media USB" for Speaker and Mic,	use KISS, Normal mode,
jack.	Build or buy a cable 6-pin	installed.	and CM118 for PTT.	"TCP" Serial Port, the IP
	"Data" port on one end and	RA40 appears as a "USB	Enable "KISS" protocol.	Address and TCP Port of the
	9-pin Serial plug on the other.	Audio Codec" in	FLDigi and other apps can	Software TNC, and keep the
	Use a standard USB-B // USB-	Windows.	directly use the RA40 USB	speed set to 1200 Baud.
	A patch cable to connect to		Soundcard.	
	computer's USB port.			

SOFTWARE TNC SETUP: SignaLink USB and UZ7HO SoundModem

Capabilities: APRS, Packet/WinLink, 300/1200/2400/4800 baud (9600 very hard), Digipeating*, VARA & VARA FM, and much more.

Drawbacks: SignaLink USB will limit packet/APRS speeds; small wires (or \$\$ for a jumper) necessary to configure audio and PTT.

	Signalad' (55	Hese.		Construction of the second secon
Transceiver:	Interface:	Windows 8/10	Configure UZ7HO	Configure Packet WinLink
Has 6-pin mini-DIN "Data"	SignaLink USB.	Computer with WinLink	SoundModem to use "USB	to use KISS, Normal mode,
jack.	Build or buy a cable 6-pin "Data"	Express installed.	Audio Codec" for Speaker and	and "TCP" Serial Port.
	port on one end and 8-pin	SignaLink USB appears	Mic.	Click Browse and find the
	Modular plug on the other.	as a "USB Audio Codec"	Enable "KISS" protocol.	UZ7HO SoundModem
	Use a standard USB-B // USB-A	in Windows.	FLDigi and other apps can	program so WinLink
	patch cable to connect to		directly use the SignaLink USB	automatically launches it
	computer's USB port.	2	Soundcard.	for you.

BUILT-IN TNC SETUP

Capabilities: APRS (natively), Packet/WinLink, 1200/9600*, Digipeating*, Frequency Control*

Drawbacks: Frequency Control not available while using WinLink Express; Must "tune" WinLink Express so it doesn't cause the internal TNC to reset; cannot do other modes like VARA; Cannot use more complex programs like FLDigi.

			WinLink Express Bit Stilling: Switch to Part 0-Per Session Connection torps: WTEP-12 Vs The torp: Machaet Velocity/99 Sesp		
Transceiver: An 8-pin "COM" jack allows using the internal Packet TNC. Set Data Band. Set Packet Speed to 1200 or 9600 (based on purpose). Enable internal Packet TNC.	Interface: Programming Cables (Kenwood, Valley Enterprises, RT Systems, or homebrew). Plug the 8 pin accessory plug in the back of the head unit of the D710 labeled COM (NOT in the main body, that is the programming port). You plug the USB side into the PC. [Quoted from K6OLI].	Windows 8/10 Computer with WinLink Express installed.	Start a Winlink Packet or Packet P2P session. Pick the D710 from the dropdown menu. Pick the correct Serial Port for your USB cable. Change the Maximum frames to 2. Click OK. Pick a frequency and you are off to the races. [Quoted from K6OLI].		

Revision: 1/12/2021

Microphone and Speaker Interface Setup

Capabilities: APRS, Packet/WinLink, 300/1200 baud (9600 unlikely), Digipeating*, VARA/VARA FM.

Limitations: Must be interested in electronics and/or making cables to build home brew interface; SignaLink will limit speeds to 1200 baud and has fiddly wirejumpers/\$ jumper-block configuration; DIREWOLF slightly more complex to configure than UZ7HO SoundModem.

			<text><text><text></text></text></text>	Bit Setting Batt Start Start Start Start Dati Setting Batt WDFR-12 Va
Transceiver:	SignaLink USB Interface:	Windows 8/10	Configure Software TNC	Configure Packet WinLink to use KISS,
Microphone jack (6-pin	Purchase the necessary cable as	Computer with WinLink	(DIREWOLF or UZ7HO	Normal mode, "TCP" Serial Port, the
Modular) and EXT SP	recommended by TigerTronics and	Express installed.	SoundModem):	IP Address and TCP Port of the
Speaker jack (mono	set the jumper pins as directed.	SignaLink USB appears	Audio: Audio CODEC.	Software TNC.
coaxial 1/8").		as a "USB Audio Codec"	PTT: VOX	Set speed to 1200 Baud.
No Data, COM, or		in Windows.	Enable KISS.	
Serial ports to bypass				Feature: WinLink can "auto launch"
speaker and	Home-brew Interface:	Windows 8/10	Configure Software TNC	UZ7HO, DIREWOLF, or VARA when
microphone audio	Build and test your circuitry.	Computer with WinLink	(DIREWOLF or UZ7HO	opening a Packet Session! Click
paths.	Use RJ-11 for the mic jack, a 1/8"	Express installed.	SoundModem):	Browse and find the TNC App and
	mono for the speaker jack on the	Laptop built-in	Audio: Built-in soundcard	select "Automatically launch" in the
	transceiver.	soundcard will be used.	PTT: Serial Port.	WinLink configuration window.
	Use a 9-pin serial port (and a USB		Enable KISS.	
	Serial Adapter) to connect to your			
	computer.			

Keep In Mind...

- This can all seem overwhelming and complex.
 - Once your system is up and running it can be fun!
- Be sure to learn about what you already have:
 - Transceiver manual(s).
 - Hardware TNC manual(s).
 - Your computer.

- ♥ What is Winlink? The Types, Paths and Modes of a Radio-Based Global Messaging System By Rick Frost, K4REF 20:03
- Review information that is already out there:
 - WinLink.org
 - YouTube "Winlink" for K4REF videos
 - WinLink Groups.io
- You are part of a team of volunteers with many skills.
 - Talk with your team members and learn about their installations or what they plan to do.
 - Ask questions and get help!
 - Participate in seminars and drills.

That's it! Simple right? ;-)

Ask your questions and I'll add/update information to this presentation.

A Quick Side Trek re: APRS v. Packet

<u>APRS</u>

- Fairly busy 1200 baud channel (144.390).
- 9600 baud... open! Ready for you!
 - 440.800 MHz simplex.
 - LOTS of open bandwidth.
 - Can be a simple way to test your system's 9600 baud setup.
 - GPS tracking capability.
 - Pretty cool Text-message style messaging.
 - Interesting integrations with Weather Stations, WinLink, and Text messaging.

Packet

- MANY channels available for packet or 'digital' use.
- Can be busy during drills or events.
 - This is due to number of users and slow transmission speeds.
 - Congestion causes failures/timeouts.
- Using 9600 baud should help reduce congestion and improve efficacy of packet communications!
 - Shorter distance range though.
 - Harder to get configured right.

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Resources

- https://www.febo.com/packet/layer-one/transmit.html
- https://www.soundcardpacket.org/
- http://uz7.ho.ua/packetradio.htm
- https://github.com/wb2osz/direwolf/tree/1.6
- https://winlink.org/sites/default/files/RMSE_FORMS/quick_setup_gui de_for_winlink_sound_card_packet_for_vhfuhf_on_windows_v1.2.pdf
- https://rigexpert.com/products/interfaces/
- http://www.trinityos.com/HAM/CentosDigitalModes/RPi/rpi4setup.html

More Resources

- https://hamprojects.info/dinah/#cmtoc_anchor_id_0
- http://audiosystemsgroup.com/HamInterfacing.pdf
- https://www.masterscommunications.com/products/radioadapter/dra/vara-primer.html
- https://www.qsl.net/wm2u/interface.html
- Go to QRZ.com, login, and look up W4PHS (Phil Sherrod).
- YouTube: K4REF (Lots of somewhat dated but mostly relevant WinLink videos).
- https://winlink.org/ClientSoftware

More Resources

- https://github.com/wb2osz/direwolf/blob/1.6/doc/WA8LMF-TNC-Test-CD-Results.pdf
- https://ham.stackexchange.com/
- https://www.tigertronics.com/sl_wirebm.htm
- https://www.darkwooddesigns.co.uk/pc2/meters.html
- https://kantronics.com/wp-content/uploads/2018/10/KPC-3Plus-Manual-RevH.pdf
- https://www.arednmesh.org/content/kenwood-tm-d710g-andwinlink

More Resources

- https://www.yaesu.com
- https://www.icomamerica.com/en/amateur
- https://www.kenwood.com/usa/com/amateur
- http://www.ka1mda.org/ham/homebrew/sound/ver1.gif