Remote Operation of your Amateur Radio Station

What works NOW?

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These slides, and more, are at my website k6ufo.com


K3/0 RemoteRig

FlexRadio Systems

Maestro™

Win PC runs digitals

FlexRadio Systems *MAESTRO* è la nuova console di controllo per i ricetrasmettitori della serie 6000 che permette l'uso immediato dell'apparato senza bisogno del PC, tramite connessione alla rete LAN anche WiFi, oppure direttamente all'apparato.

There are various reasons *why** I want a remote station...

Operate when away from home, antenna restrictions, moving into assisted-living, no longer able to do antenna work, share a station with others, multi-op contesting, use a good hill-top location, use a low-noise location, operate from the office, hotel, living room...

...but what is the current way to build a remote station?

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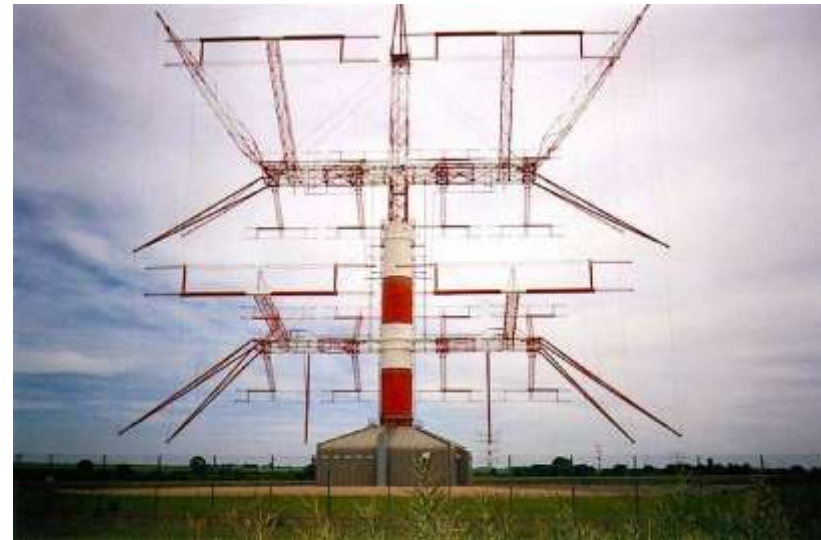
Using other people's stations is one easy approach, a good learning experience, and a backup solution.

Receive-only sites on the internet: websdr.org   kiwisdr.com/public rx.linkfanel.net …

Receive AND Transmit: you may need to register, provide a copy of your license, join a club, pay dues or dollars. Look for:

- A friend or club station already setup for remote access, especially FlexRadio-based station. Many contest stations have remote operators.

  In the Feb 2023 ARRL DX CW contest, 15% of Multi-op entries checked "Remote."

- RemoteHams.com has many shared stations and club stations globally.

- RemoteHamRadio.com $20/month or $99/year, plus airtime billed at $0.05 to $1.25 per minute. Very capable stations in USA, Puerto Rico, Haiti and Croatia. Free stations for licensed youth age 25 and younger.

- BeLoud.us A newer commercial operation. USA, Bonaire and Spain.

Remote operators need to be properly licensed for the location of the transmitter. Always follow the rules of the regulatory authority. Must use callsign approp for transmitter location. Transmitter location is the location for LoTW, contest operation, and award chasing.

But how to setup your own station for remote use?

It depends on what you want to do:

Modes: Voice, Digital, CW? CW by keyboard only, or key or paddle?

How much equipment will you haul around with you?

Fast connect? On in seconds from a phone? Longer for extras.

Dual use? Station to be used at home AND remotely, or dedicated to remote? Do you need a human operator position at station?

How much re-configuration to go from local to remote use?

Is the station easily accessible, Is anyone on-site?

Are you willing to keep a PC on-line at the remote station (useful), or does everything have to be extended across the internet (difficult)?

Recommendation: Start simple, gain experience, then expand or change. Different solutions have different advantages/problems.

VE3VEE

Four Basic Needs for Remote Operation

1. Audio In/Out to radio: MIC/SPKR, Line In/Out, **audio over USB**, or over Ethernet. Just like being set up for digital modes (FT8).

2. Radio Control: Radio with a **serial port, CAT, CI-V, USB control,** or over Ethernet. To set Freq., Mode, PTT, CW keying… just like a contest logger keying your radio.

3. Station Control: AC power outlets, antenna switch, rotators, tuners, amplifiers, ... Equipment must be highly **automatic**, or have PC control, or over-the-web control. **Automate and Simplify** your station where possible.

4. "Good" Internet service: …

... **Basic Needs for Remote Operation**

4. "Good" Internet service:

Speed: Download <u>and</u> Upload speeds over 1 Mbps for audio and radio control. (more for waterfalls, and even more for webcams).

Low latency/delay. High latency makes timing difficult for PTT and VOX control and pileup control.
+ Under 50ms is **good**,
- 100ms **okay** (USA W6 to W1),
- over 150ms **difficult** (USA W6 to Europe).

Low packet loss, low jitter, low variation: causes audio and control dropout. "Wired" internet usually good.
+ DSL/cable/fiber = good
- Satellite internet = bad
- Wireless internet provider, or WiFi connected can be good.
? Starlink has frequent dropouts "for a few seconds, every dozen minutes." Getting better as more satellites launched.

Two "simple" ways to Implement Remote Access

1. <u>Software Programs</u> designed to control remote radios.

2. <u>Remote Desktop</u> Software designed to control a remote computer. (and VPNs)

1. <u>Software Programs</u> designed to control remote radios.

RemoteHams.com is both a free software Program (RCForb) and a community of users & stations. You can use the server software to offer up your own station for remote use. See, QST Magazine, April 2017, p30: "DIY Remote Radio Now" by K5PA, and k5pa.com

ICOM's RS-BA-1 IP Remote Control software. $160.
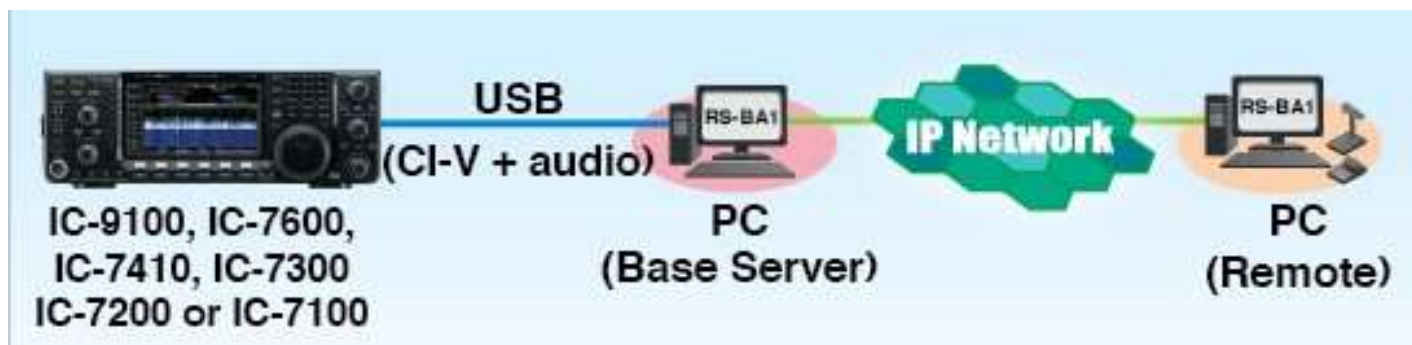
For ICOM radios, see also: Win4Icom Suite (VA2FSQ), or wfview.org

See also: RemoteTX.net, N4PY Software, <u>Win4K3Suite Server</u>, Ham Radio Deluxe, Kenwood ARCP-590, TRX-Manager, DF3CB software, RigPi (MFJ-1234B)…

Warning: Can be hard to <u>also</u> connect to your logging program since "serial port is already in use." You may have to log manual/un-connected.

2. <u>Remote Desktop</u> Software designed to control a remote computer.

Set up the shack PC to control the station. Use any software - even if it doesn't have any "remote" ability: WSJT-X, N1MM+, DXLab, ...

Then, use <u>remote desktop software</u> to "connect-in" to the shack PC. You "see" the shack desktop, and control the station, <u>just like being at the shack PC</u>.

There are many good free "remote desktop" programs (also called VNC):
Chrome Remote Desktop,
<u>AnyDesk</u>, Windows Remote Desktop,
TeamViewer(license problems?),
Splashtop,, …
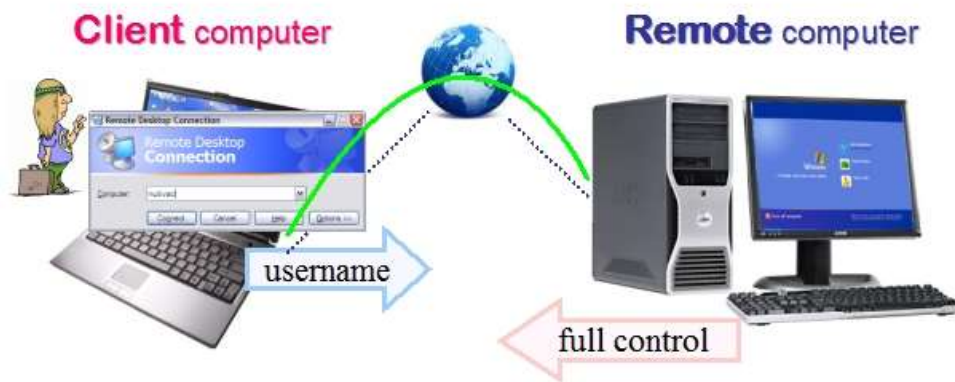
+ Use any ham software on the shack PC.
+ Audio decoding for FT8 is best at the station.
+ CW generation is best at the station.
- Audio transfer to op may need special attention.
- Needs higher internet speed to duplicate the display.

*make sure your VNC includes two-way audio, or you'll have to add SW like Skype, Mumble, RemAud, … which adds complexity.

Similar to Remote Desktop, is to install a
VPN (Virtual Private Network)
between the operator and the station.

Makes it look like the operator computer and station computer are <u>on the same LAN</u>. Setup a VPN server on the station computer. Then use a VPN client to "connect in" to your station and devices on the LAN or connected to the station computer.

You can use Windows "built-in" VPN, or install SoftEther software on both operator computer and station computer. (SoftEther recommended, it passes UDP broadcast packets. Hams also like OpenVPN, Tailscale and ZeroTier.)

Many VPNs focus on privacy and encryption – but our use is for "remote access".

Remote Access VPN

VPN Client — the local site
VPN Server — the remote site

+ Operator can use any logging software.
- Audio transfer to op may need special attention
- Needs higher internet speed to handle all LAN traffic.
- Can lead down complex IT/network rabbit holes.
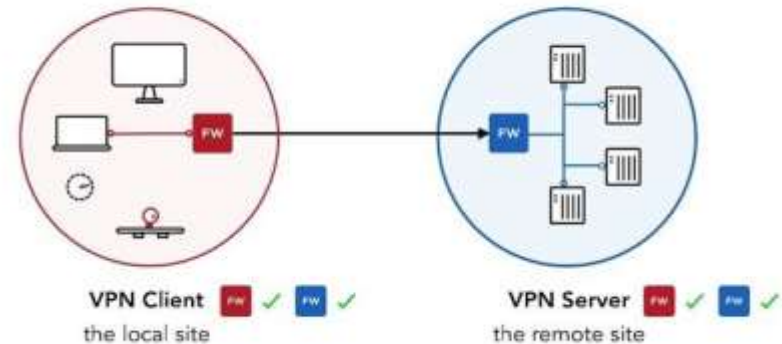
Two ways to Implement Remote Access with <u>Knobs and Buttons</u>!

3. Microbit RemoteRig boxes + 2nd front panel.

4. FlexRadio SmartLink software + Maestro front panel.

These cost more in time and money, but can have <u>real knobs</u>!

Pandemic "supply-chain problems" have made Microbit hardware and Flex Maestro front panel **out-of-stock** for many months. If you want these, start looking ...

3. Microbit RemoteRig and a Control Panel
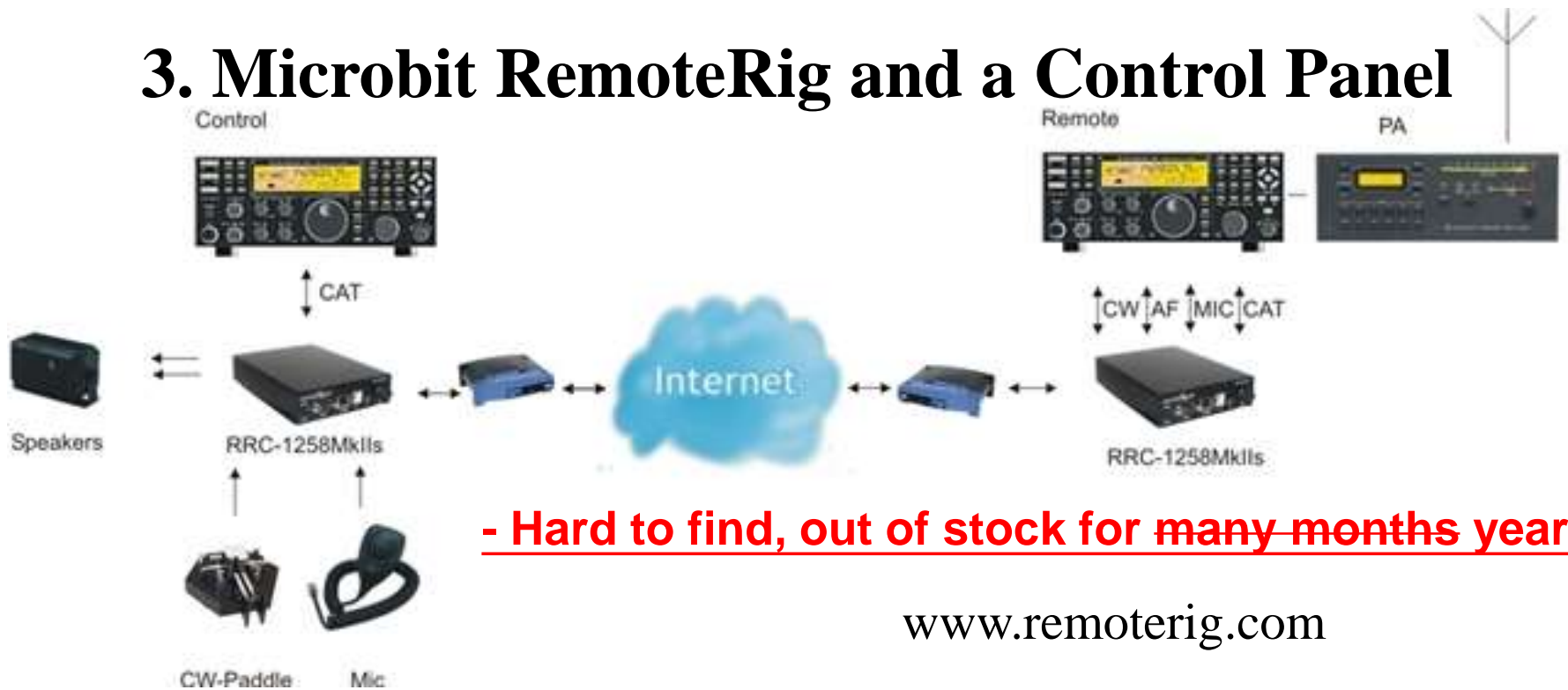
- Hard to find, out of stock for ~~many months~~ years.

www.remoterig.com

Use a pair of RemoteRig "modems" to send audio and control across internet. Use with any radio for audio/keying/CAT control. Can also support detached front panels (TS-480), "control heads" (Elecraft K3/0-Mini), "twin" radios, a PC program or an Android App. Provides a serial port for your logging SW. These have been a "gold standard" for years with K3 radios, but K3 and K3/0 are discontinued. Boxes hard to find.

+ No shack or remote PC needed. Very reliable once working. Real knobs.
+ Good CW keying from computer or paddle or straight key. Widely used for good CV
+ Good PTT support, including hand switch or foot switch.
- Expensive? ($500 a pair, plus a $700 control head or 2nd radio)
- May be hard to configure the 1st time. Get help from a current user/expert.

4. FlexRadio and a Maestro control panel

All FlexRadios are controlled from a software program (SmartSDR) locally or remotely. A "Maestro" control panel can also be used locally or remotely. (WiFi or wired) There are also tablet and smartphone Apps. Provides "virtual serial ports" for your logging SW.

+ Good support, one vendor.
+ No shack PC required.
+ Real Knobs.
+ CW keying from computer XOR paddle or key. Some latency issues.
+ Widely used.
+ Nice Spectrum Display.
- Expensive? $2k radio and $1k Maestro
- **Maestro out of stock until "spring."** Interim knob solution: FlexControl knob.

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Operating CW to a remote transmitter has some unique issues.

+ Generating CW at the transmitter generates good CW.
1. Use the transmitter's internal keyer, or
2. Use a shack PC at the transmitter to generate keying, or
3. Use a Winkeyer at the transmitter to generate keying.

- Sending CW keying across the internet can cause poor CW.
1. Microbit RemoteRig box has settings to adjust to prevent problems, and has a local sidetone for operator.
2. Flexradio Maestro is able to send CW across internet, and has local sidetone, but cannot do both computer keying and paddle keying at same time.

"Local sidetone" is needed to allow paddle keying by an operator.
         A remote sidetone returned from a remote transmitter is okay for TX monitoring, but is too delayed for an operator to perform paddle keying.

You can use "linked winkeyers" called Wkremote, one at operator and one at transmitter. Or, RemoteKeyerInterface@groups.io also offers a solution for getting an operator paddle signal safely across the internet to a Flexradio.

What are the REAL problems?

Station Control: **The control of "everything else"**: AC power outlets, antenna switching, rotators, tuners, amplifiers, RX-only antennas, watt meters, …

Simplify your station, make your station as **automatic** as possible, then solve remaining issues. Look for devices that are "**automatic**" or "**computer-controlled**"(needs a PC in shack). (Trust, but verify…)

Eliminate things that require you to manually switch, plug, adjust or reset.

No!

Yes!
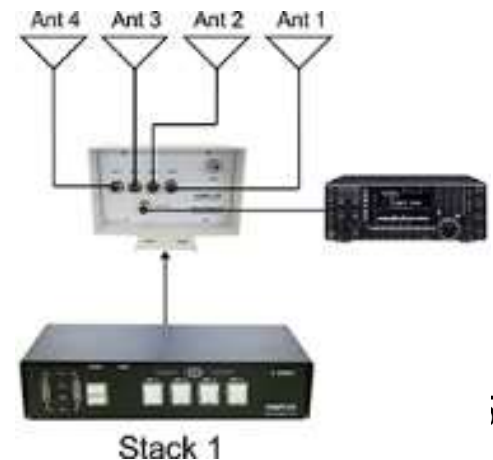
There are solutions to the REAL problems:

AC Power switching: Smart Plug $25, or DLI Web Power Switch $190

Antenna switching: The radio's ANT 1/2 button, or a band decoder & coax switches like microHam Station Master, HamPlus, Hamation, KK1L, Amplitec, homebrew, …

Rotators: Control box has serial or USB port, then use logging SW's rotator control, or YO3DMU's PstRotatorAz, or Green Heron software.

Tuners and amplifiers: If manual tune, use on one band switched-in by antenna switch. If auto-tune: use anywhere. Use in Automatic-mode or with control SW on shack PC, or over internet if remote-capable. Acom, Flexradio Power Genius, Elecraft KPA-1500, …

Other devices can be controlled by the shack PC or a RaspberryPi and relay boards (Denkovi, Sainsmart or KMtronic) or controlled across the internet with a serial port extender or "web relay" or a smart plug switch. Flexihub software, virtual serial ports, .16

Example: Operator Screen for a Remote Station, using separate apps on a remote desktop.

Example 2: Operator Screen for a Remote Station, using Node Red software.

Example 3: Operator Screen for a Remote Station, on RHR using web browser

Remember our Question: …
...but what is the current way to build a remote station?

Q1: Can the station be fully operated by the shack PC?
A1: Use either "Simple" method: Software Programs or Remote Desktop.

Q2: Is an Icom radio already in place?
A2: Try the Icom RS-BA-1 software, or Win4Icom Suite software (VA2FSQ) or wfview.org software.

Q3: Is an Elecraft K3 already in place?
A3: Search for RemoteRig boxes, and borrow/use a second K3 or K3/0 as the control head. Alternative, look at Win4K3Suite (VA2FSQ) software.

Q4: Is a Flexradio already in place?
A4: Flexradio software already supports remote operation. Just configure and operate. It may be hard to find a Maestro control head. FlexControl knob available.

You may find some limits on changing antennas, retuning amp, paddle CW, etc…
You may be able to work around some with checklist/procedures or an on-site assistant. Solving every last problem may not be cost-effective for your initial testing. Gain experience, then decide what to change or improve.

"Internet Extender" solutions like Remote Desktop and VPN are available, powerful, and use "mainstream" internet technology.

BUT, they can be complicated, have quirks, and often need additional software for acceptable audio delay and CW keying.

Putting together in an efficient, reliable and affordable remote solution is the challenge - just like putting together any effective Amateur Radio station.

The goal of "remote" setups is to get more operators and stations on the air, for more hours of operating, contesting and DXing, - which leads to more fun for the operators, and for the stations on the other end of the contacts. Win-win!

Thank you!   *Questions?*

Remote Elecraft K4

Elecraft has demonstrated a "Virtual K4" software program on a tablet controlling a K4.

They also plan a K4/0 control head to have a K4 "front panel" control a remote K4. Probably late in 2023.

Elecraft has released the software specification to stream the waterfall to other programs, like N1MM+, DXLabs, Win4K4Suite, N4PY, …

Other Good Resources

Excellent YouTube videos by:

VE6WZ - e.g.,"The control setup at VE6WZ"

FlexRadioSystems VA3MW - e.g.,"Setting up my First HF Remote Station"