

# PACIFICON<sup>SM</sup> 2023

ARRL Pacific Division Ham Radio Convention

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## Remote Operation of Your Ham Radio Station

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These slides, and more, are at my website [k6ufo.com](http://k6ufo.com)



FlexRadio Systems<sup>®</sup>  
Software Defined Radios

Maestro<sup>™</sup>

Win PC runs digitals

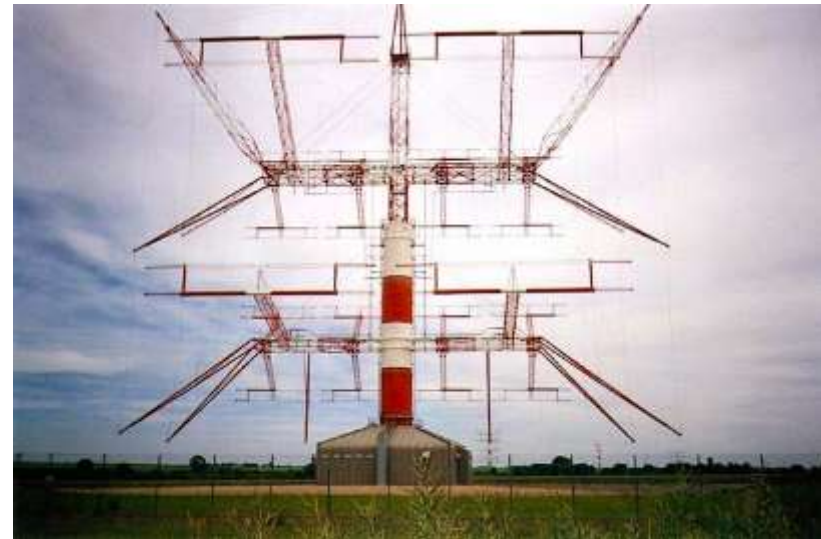
FlexRadio Systems **MAESTRO** è la nuova console di controllo per i ricetrasmittitori della serie 8000 che permette l'uso immediato dell'apparato senza bisogno del PC, tramite connessione alla rete LAN anche WiFi, oppure direttamente all'apparato.

The advertisement for FlexRadio Systems Maestro features a blue background. At the top, the FlexRadio Systems logo is displayed. Below it, a FlexRadio K3/0 radio is shown on the left, a FlexRadio 8000 series radio is in the center, and a laptop displaying the Maestro software interface is on the right. The word 'Maestro' is written in a large, elegant font at the bottom left. To the right of the laptop, the text 'Win PC runs digitals' is written. At the very bottom, a small red box contains the text 'FlexRadio Systems MAESTRO è la nuova console di controllo per i ricetrasmittitori della serie 8000 che permette l'uso immediato dell'apparato senza bisogno del PC, tramite connessione alla rete LAN anche WiFi, oppure direttamente all'apparato.'

## ***Reasons to 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 how to build a remote station?***



# Using other people's stations is available, a good learning experience, and a backup solution.

Receive-only sites on the internet: [websdr.org](http://websdr.org) [kiwisdr.com/public](http://kiwisdr.com/public) [rx.linkfanel.net](http://rx.linkfanel.net) and others.... Good for SWL, signal monitoring, ...

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](http://RemoteHams.com) has many shared stations and club stations globally.
- [RemoteHamRadio.com](http://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.

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

# But how to setup your own station for remote use?

There is no One Perfect Solution. It depends on what you want to do:

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

How much equipment will you haul around with you? Just a smartphone or tablet? Or extra control head? extra displays?

Fast connect? On in seconds from a phone? Or 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? Will you re-configure every day before leaving to work?

Is the station easily accessible (in the garage), or is it a trip to the hills?

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

How much remote “reset” ability do you need? Is anyone on-site?

**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: e.g., audio over USB.** Just like being set up for digital modes (FT8).



**2. Radio Control:** Radio with a **serial port, CAT, CI-V, USB control**, or Ethernet. Just like using a contest logging program with 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: ...**

#### 4. “Good” Internet service to the location of your transmitter equipment. (Do not select a remote site without Low Delay and Reliable internet service!)

**Speed:** Download and Upload speeds over 1 Mbps for audio and radio control. (more for waterfalls, and even more for webcams). This is low speed in today’s streaming world.

**Low Delay/Low Latency/Low Ping Time:** High delay is difficult for tuning and PTT timing.

+ 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 like DSL/cable/fiber = good

- Wireless internet provider, 5G Home Internet, or WiFi service can be good or bad.

- Starlink has frequent dropouts, but getting better as more satellites launched. Was used by recent expeditions to Pacific islands VP6A Ducie and E51D North Cook Is.

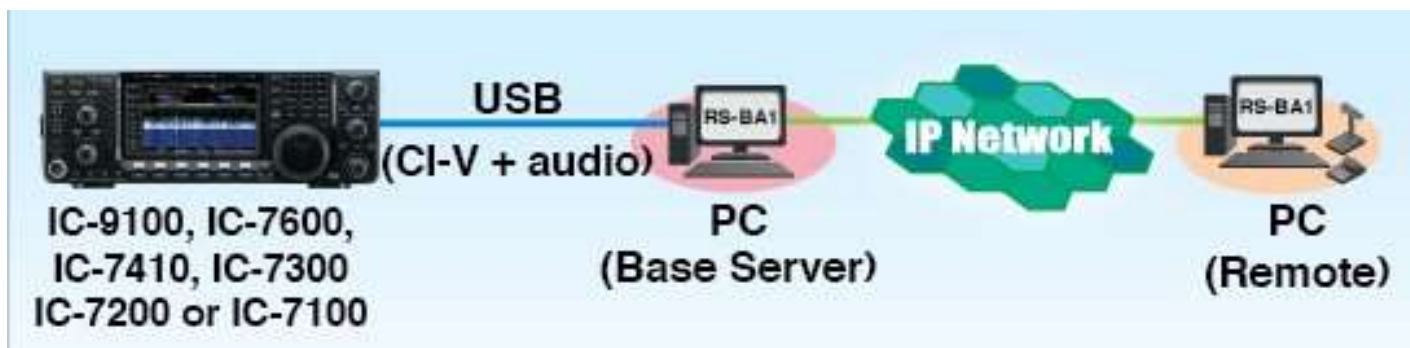
- Satellite internet (Geosync) = bad HughesNet or ViaSat has delay too long.

There are issues whether your service provides Port Forwarding, not CGNAT, Fixed IP addresses,... Most can be overcome with VPN, if the service is Low Delay, and Reliable.

# 1. Software Programs 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](http://k5pa.com)

ICOM’s RS-BA-1 IP Remote Control software. \$160.



For ICOM radios, see also: Win4Icom Suite (VA2FSQ), or [wfview.org](http://wfview.org)

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

**Warning:** You can spend a lot of time on this path, that may not meet your goals.

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

## 2. Remote Desktop Software designed to control a remote computer.

Set up the shack PC to control the station. Use any software - it doesn't have to have "remote" knowledge: WSJT-X, N1MM+, DXLab, N3FJP, ...

Then, use remote desktop software to "connect-in" to the shack PC. You "see" the shack desktop, and control the station, just like being at the shack PC. (with delay).

There are many good free "remote desktop" programs (also called VNC):

Chrome Remote Desktop,

AnyDesk,

Windows Remote Desktop,

TeamViewer (will nag you for license),

Splashtop,, ...

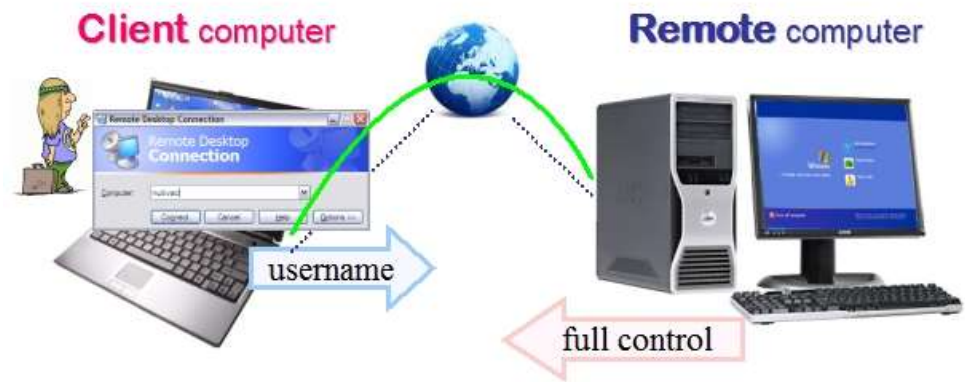
+ Use any ham software on the shack PC.

+ Audio decoding for FT8 is best at the station.

+ CW generation is best at the station.

- Audio transfer 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.

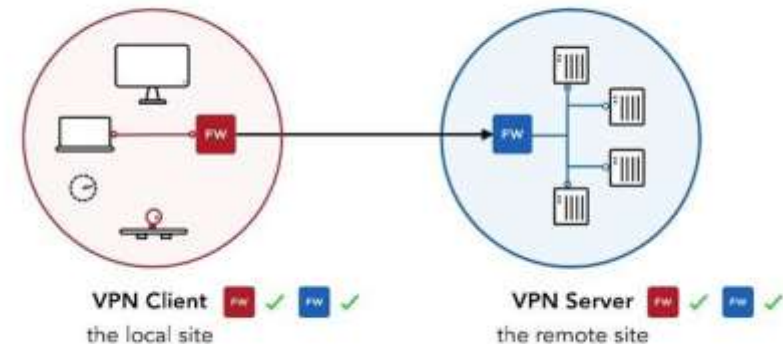
VPN makes it look like the operator's computer and station's computer are on the same LAN. Setup a VPN server on the station computer. Then use a VPN client to "connect in" to your station and use the radio and devices on the LAN or connected to the station computer.

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".

- + Operator can use any logging software.
- Audio transfer may need special attention.
- Needs higher internet speed to handle all LAN traffic.
- Can lead down complex IT/network rabbit holes.

Remote Access VPN



# With Knobs and Buttons! Microbit RemoteRig



**- Hard to find, No USA distributor, No online webstore, out of stock for many months years.**

[www.remoterig.com](http://www.remoterig.com)

Use a pair of RemoteRig “modems” to send audio and control signals across internet. These have been a “gold standard” for years with Elecraft K3 radios. Hard to find.

- + No shack or remote PC needed (but useful). Very reliable once working. Real knobs.
- + Good CW keying from computer or paddle or straight key. Widely used for good CW.
- + Good PTT support, including hand switch or foot switch. (Switch is far better than VOX)
- Expensive? (\$500 a pair, plus a \$700 control head or a 2<sup>nd</sup> radio)
- May be hard to configure the first time. Get help from a current user/expert.

# With Knobs and Buttons! FlexRadio and a Maestro



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.

- + Support from one vendor.
- + No shack PC required (but useful).
- + Real Knobs.
- + CW keying from computer or paddle or key. Some latency issues.
- + Widely used.
- + Nice Spectrum Display.
- Expensive? \$2k radio and \$1k Maestro
- **Maestro out of stock until Q4...**
- **Some SW Updates have problems.**

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FlexRadio Systems **MAESTRO** è un moderno e funzionale pannello radio dotato di schermo touch, pulsanti e manopole, connessioni per microfono e tasto/paddle con il quale usare l'apparato senza rinunciare alla operatività tradizionale di una qualsiasi apparecchiatura radio, oltre che a permetterne la remotizzazione in qualsiasi punto coperto dalla vostra rete LAN.

# 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.
  2. Use a shack PC at the transmitter to generate keying.
  3. Use a Winkeyer at the transmitter to generate keying.
  
- Sending “keyboard CW” as text to the transmitter is usually okay.
- Sending CW paddle keying across the internet can have problems. (Microbit RemoteRig and Flexradio are designed to address this.)
  
- A **Local sidetone** is needed to allow straight key or 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.

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, ...

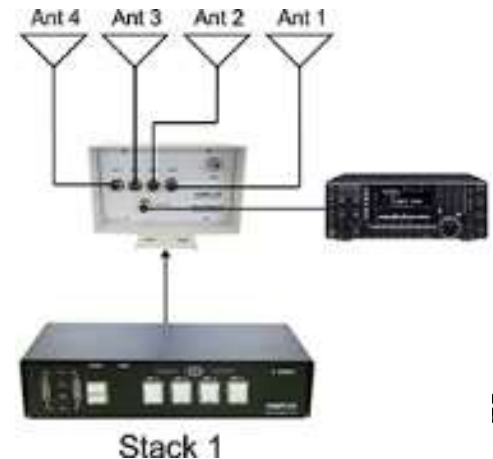
**Simplify** your station, make your station as automatic as possible, then solve remaining issues. Look for devices that are “automatic” or “computer-controlled”(needs a PC in shack). (Trust, but verify...)

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

**No!**



**Yes!**



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

**• TOWER TWO**  
4 Element SteppIR @ 75 feet under 40m Moxon @ 85°. Same rotor, "CoRotating"  
  
*Note -- the actual heading for antennas is 15 degrees Clockwise from the indicated heading.*

**• TOWER ONE**  
10/15/20 Meter Monobanders on 1 Mast @ 90 - 105 feet "CoRotating"  
Fixed 20m Monobander @ Europe  
For EU STACK rotate to 65 degrees and select M2 BOTH

**ShackLAB-4 Control Center V4.4**  
Setup Window View Help  
160 80 75 60 40 30  
20 17 15 12 10 6  
Radio 1 Auto Band Radio 2  
Multi Presets RX Master  
Main Antennas Shared Apex Loop  
WRT RT FLIP

**T2: SteppIR, 40m SteppIR Controller**  
Setup Calibrate Radio View  
To SteppIR: 21.175 From SteppIR: 14.075  
Bands: 80 40 20 17 15 12 10 6  
Auto Home Manual Radio 180 Auto

**T2: SteppIR, 40m RadioTracker - Begin...**  
Communication Setup Tracker Map View Help  
Mode: Manual Tracking SP P  
Az: 66 92  
BD: 0 90 ANT: 1 STOP

**T2: 10/15/20 M2 RadioTracker - Begin...**  
Communication Setup Tracker Map View Help  
Mode: Manual Tracking SP P  
Az: 124 53  
BD: 0 90 ANT: 1 STOP

**Alpha 9500 Remote - Amp Firmware Version: 3.03**  
File View Options  
BAND: 1.8 3.5 7 10 14 18 21 24 28  
SEGMENT: 1 2 3 4 5  
MEMORY: SAVE RCL DEF 1 2 AUTO  
TUNE: 47 54 LOAD  
ANTENNA SELECT: 1 2 3 4  
EF Power LW: 0 0.1 0.3 0.8 1.0 1.5 2.5  
SWR: 1 1.5 2 3 +10  
Grid Current mA: 0 50 100 150  
Plate Current Aneps: 0 1.0 1.5  
Plate Voltage kV: 0 1 2 3 4  
Gain: 10 30 50  
ALPHA 9500 MICROPROCESSOR CONTROLLED HF LINEAR AMPLIFIER  
OPER STBY ON ON/OFF  
AMP ANT SEL

Line Voltage: 231.8V +5V: 5.06V -12V: -12.2V Connection Status: ■  
Tap: +12V: 0V +40V: 0V Fault:  
Temperature: 61.70F +24V: 0V

**Before selecting or QSYing SteppIR make sure no one is using it!**

**IMPORTANT OPERATING PROCEDURES**  
1. For 160M there is an autotuner in place which will allow operation from 1800-1900. Before your first TX and if you QSY more than 15kc from your last TX freq you need to let autotuner adjust. **Put AMP in STBY, TX low power CW or FSK signal for 2-3 seconds**, then can put AMP in OPER and switch radio mode if needed.

WPX SSB IP-Addresses  
KT7E-MASTER 10.0.26.7  
KT7E-RUN1 10.0.26.2  
KT7E-RUN2 10.0.26.3  
K7RF-JON 10.0.26.10  
K7ZO-SCOTT 10.0.26.6  
KR7X-HANK 10.0.26.8  
K7MK-JIM 10.0.26.5  
NK7U2-JOE 10.0.26.4 (Note the "NK7U2" part)

## Example 2: Operator Screen for a Remote Station, using Node Red software to provide a consistent look.



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

The screenshot displays the operator interface for a remote station (W7Tacoma) accessed via a web browser. The interface is divided into several sections:

- Top Panel:** Shows the station name "W7Tacoma" and various status indicators. Below this is a spectrum display showing signal activity across a frequency range from 14.025 to 14.035 MHz. Two specific frequencies are highlighted: 14.031.000 and 14.032.120.
- Map Section:** A world map showing signal paths (great circles) between the station and other locations. The station is located in the Pacific Northwest of the United States.
- Frequency Control Panels:** Two panels are visible, one for each frequency. Each panel includes:
  - Frequency display (e.g., 14.031.000)
  - Mode selection (CW, SSB, etc.)
  - Power and mode settings (e.g., NR OFF, NB OFF, ANF OFF, BW 0.4 kHz, Vol 70%, Stereo, AGC Fast)
  - Additional controls like +32 dB, DAX 1, Split, RX Ant, and Remove.
- Bottom Panel:** A log table showing recent activity. The table has columns for UTC, DX, DE, Freq, Band, Mode, Country, Note, Band, Mode, and Slot.

UTC	DX	DE	Freq	Band	Mode	Country	Note	Band	Mode	Slot
Apr 5 17:50	W7TUON	K8CAE	14.277.000	20m	SSB	United States	POTA K-6385	15	15	15
Apr 5 17:48	KC0D50	K8CAE	14.273.000	20m	SSB	United States	POTA K-1595 FM18	15	15	15



Summary: ... ***how to build a remote station:***

Use other people's stations as a learning experience.

**Recommendation: Start simple, gain experience, then expand or change.**

Different solutions have different advantages/problems.

**Do not select a remote site without Low Delay and Reliable internet service!**

Consider a remote desktop or VPN to use your home station from elsewhere.

**The real problems are control of “everything else”:** AC power outlets, antenna switching, rotators, tuners, ...

**Remember the goal: get a transmitter on the air, for more hours of operating.**

Not... learn to program or solve network problems...

Other resources: Excellent YouTube videos by:

VE6WZ - e.g., “The control setup at VE6WZ”

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

- “How To Build A HF Remote Station with Mike VA3MW”