# GETTING STARTED USING RASPBERRY P IN THE SHACK (PART 2)

Jack Weaver – AA5VZ

I love this hobby! Where else can you sit in a hotel room in Pittsburgh PA and enjoy a digital QSO on a laptop with a fellow Ham in France, using your transmitter & antenna in Texas via a Raspberry Pi computer connected to the internet? A strange thing to consider one's own signals passing overhead on their way to Europe and back!

December, 2017

# INTRODUCTION

#### The Raspberry Pi Alternative for WSJT-X

Turn an inexpensive microcomputer into a digital communication machine.

#### Thomas Kocourek, N4FWD

In the "Eclectic Technology" column in the April 2017 issue of QST, Chuck Kelly, W9MDO/VE1MDO, described a portable option for running WSJT-X digital mode software with a Raspberry Pi 3 microcomputer and a miniature LCD touchscreen. In this article, Thomas Kocourek, N4FWD, presents a similar solution, but with the emphasis on using the Pi as a dedicated home station computer for JT65, JT9, and WSPR — Ed.

As we slide into the oncoming solar minimum, it's no surprise that we're seeing an uptick in popularity for digital modes, such as JT65 and JT9, as well as the WSPR digital beacon mode. JT65 and JT9 can support contacts on the HF bands under conditions that would render other modes unusable. And for those interested in HF propagation studies, WSPR is ideal.

All three modes are available in the free WSJT-X software package, created by Dr. Joe Taylor, K1JT. In addition to



The author's station, with his Raspberry Pi 3 microcomputer at lower left, in its transparent case.

around your ham shack. However, here is a list for those starting from scratch: • A Raspberry Pi 3 microcomputer. For beginners, I strongly recommend a "kit," such as those offered by CanaKit (see Amazon and other sources),

because these packages include almost everything you'll need, often including a case and power supply. Prices range your monitor. Considering the small size of the Raspberry Pi, I'd recommend a lightweight cable to keep everything mechanically stable.

 A USB "A-B" style cable. This cable will link your Raspberry Pi to your interface or transceiver.

 A keyboard and mouse. To keep cabling to a minimum, I recommend a

# WHERE IT ALL STARTED

QST Article, July 2017 Thomas Kocourek, N4FWD

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# CURRENT ACTIVITY

- ► FT-8 Digital Mode
- ► Raspberry Pi-4
- ► Kenwood TS-590
- ► USB Direct Audio Interface
- Wireless Keyboard/Mouse
- ►>250 QSOs from Dec thru March



...



### GETTING STARTED...

#### MOVING FORWARD

- Assemble a Raspberry Pi-4 Workstation
- Load the base Operating System (O/S)
- Install and Configure Ham Radio Apps
- Interface the Pi with your Station
- **Get on the Air!**



# RECOMMENDED READING

- **WSJT-X User Guide Available On-Line**
- https://physics.princeton.edu/pulsar/k1jt/wsjtxdoc/wsjtx-main-2.3.1\_en.html#NEW\_FEATURES
- **FL-Digi User Guide Available On-Line**
- http://www.w1hkj.com/FldigiHelp-3.21/html/index.html

# ... OFF WE GO!



## PART 1 (REVIEW)

- Procured a Pi-4 kit
- Assembled the components
- Assembled a Pi-4 work-station
- Installed NOOBS
- Installed/Updated the O/S
- Backed up our System SD Card(s)
- > Allowed time for familiarization



## PART 1 (REVIEW)

- Recommended add'l tools and free software to format and back up SD cards and System Files (see below)
- <u>https://www.sdcard.org/</u>
- Download / Install "SD Memory Card Formatter for Windows"
- https://sourceforge.net/projects/etcher. mirror/
- Download / Install "Etcher"





## PART 2 (TODAY)

- Install WSJT-X (FT-8, JT-65, and others)
- Supplemental Addition Install FL-Digi (PSK-31, etc) TBD
- Interface the Pi-4 to your Radio
  - Audio Sound Card
  - Direct (USB)
- Configure the Interface
- Configure WSJT-X App
- Configure your Radio
- Get on the Air
- Have Fun!



Install WSJT-X (for FT-8, JT-65, and others)



> Open the Web Browser



- Type in the following:
- https://physics.princeton.edu/pulsar/ k1jt/wsjtx.html



WSPR SimJT

References

Support

Program Development

WSJT-X implements communication protocols or "modes" called FST4, FST4W, FT4, FT8, JT4, JT9, JT65, Q65, MSK144, and WSPR, as well as one called Echo for detecting and the Moon. These modes were all designed for making reliable, confirmed QSOs under extreme weak-signal conditions.

JT4, JT9, and JT65 use nearly identical message structure and source encoding (the efficient compression of standard messages used for minimal QSOs). They use timed 60-secc and JT65 were designed for EME ("moonbounce") on the VHF/UHF/microwave bands. JT9 is optimized for the MF, and HF bands. It is about 2 dB more sensitive than JT65 while (available in WSJT-X 2.4.0 and later) offers submodes with a wide range of T/R sequence lengths and tone spacings.

FT4 and FT8 are operationally similar but use T/R cycles only 7.5 and 15 s long, respectively. MSK144 is designed for Meteor Scatter on the VHF bands. These modes offer enha nonstandard callsigns and some popular contests.

FST4 and FST4W are designed particularly for the LF and MF bands. On these bands their fundamental sensitivities are better than other WSJT-X modes with the same sequence I rates of information throughput. FST4 is optimized for two-way QSOs, while FST4W is for quasi-beacon transmissions of WSPR-style messages. FST4 and FST4W do not require the phase locking of modes like EbNaut.

As described more fully on its own page, WSPR mode implements a protocol designed for probing potential propagation paths with low-power transmissions. WSPR is fully implement "band-hopping".

#### Latest General Availability (GA) release: WSJT-X 2.3.1

WSJT-X 2.3 provides a number of features and capabilities that are new since version 2.2. A list can be found in the WSJT-X 2.3 User Guide here. The first several sections at the program changes since the GA release of WSJT-X 2.2.

Upgrading from a previous version will be straightforward. There is no need to uninstall or move any files. If you want to make sure to have the latest list of default working frequen click in the Working Frequencies list, and select Reset.

Documentation: The WSJT-X 2.3 User Guide is available online. This document should always be your first source for help. Use your browser's search facility to find a keywor

	Enalish	(v2.3)	- html
•	English	(v2.3)	- pdf

- German (v2.3) (OE1EQW)
  Swedish (v1.9) (SM7VRZ)
- French (v2.0) (ON4CN)
- <u>Norwegian (v2.2)</u> (LA6VQ) Italian (v2.0) (IZ8EEI)
- Russian (v2.1) (RA3TOX)

#### **INSTALL WSJT-X**

This takes you to the WSJT-X Web-Page



WSJT-X is licensed under the terms of Version 3 of the GNU General Public License (GPL). Development of this software is a cooperative project to which many amateur radio ope please have the courtesy to let us know about it. If you find bugs or make improvements to the code, please report them to us in a timely fashion.

Build and installation instructions are in the INSTALL file inside the tarball.

Source code for WSJT-X 2.3.1: wsjtx-2.3.1.tgz

#### Candidate release: WSJT-X 2.4.0-rc4

Candidate releases are intended for beta testers: individuals interested in testing the program's new features and providing feedback to the WSJT Development Team. This is the th introduces a new digital mode called Q65 designed for minimal two-way QSOs over especially difficult propagation paths including EME and most types of scatter. Be sure to read [ Send bug reports and feedback to wsj1-devel@lists.sourceforge.net. You will need to subscribe to the list in order to post there.

#### Installation packages for WSJT-X 2.4.0-rc4

#### Windows:

Installation instructions for Windows can be found here in the User Guide.

- Version 2.4.0-rc4: wsjtx-2.4.0-rc4-win32.exe. (32-bit Windows 7 or later).
  Version 2.4.0-rc4: wsjtx-2.4.0-rc4-win64.exe. (64-bit Windows 7 or later).
- Linux:

#### INSTALL WSJT-X

Scroll down the page and stop at the Linux package list for versions 2.3.1 an be found <u>here</u> in the User Guide. Download the package file a ckages.)

LTS, ... (32-bit): <u>wsjtx 2.3.1 i386.deb</u> LTS, ... (64-bit): <u>wsjtx 2.3.1 amd64.deb</u> . (32-bit): <u>wsjtx-2.3.1 i686.rpm</u> . (64-bit): ter, ARMv6, ... <u>wsjtx 2.3.1 armhf.deb</u> ter, arm64 (64-bit): 2.3.1 armhf.deb

to install properly on Linux distributions with required dependencie

1 2.3.1 can be found <u>here</u> in the User Guide.

0.13 and newer: wsjtx-2.3.1-Darwin.dmg

- From the 2.3.1 version list select:
- "wsjtx\_2.3.1\_armhf.deb"

WSJT-X is licensed under the terms of Version 3 of the GNU General F please have the courtesy to let us know about it. If you find bugs or ma

Build and installation instructions are in the INSTALL file inside the tarb.

Source code for WSJT-X 2.3.1: wsjtx-2.3.1.tgz

#### Candidate release: WSJT-X 2.4.0-rc4



- Observe message at bottom left corner of screen
- Select "KEEP"



 To continue the installation, click on this item at bottom left corner of screen



- The following message box will appear.
- Click the "Install" button.
- This will initiate the download of the selected file from the WSJT-X web-site to the "Downloads" directory of the Raspberry Pi.



- If you see this message box, it is asking you for your pi password.
- Type-in: raspberry
- Then click "OK"
- This should allow the file download to continue

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<b>J General Public Licens</b>	e (GPL). Developmen	nt of this software is a	in a timely fas	hion.

Success – the files are downloading...

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86.rpm 86.64.rpm			
armhf.deb		Cancel	Close

And being assembled into a package folder in the Downloads directory



To verify the files downloaded successfully select File Manager on the Menu Bar.



> Open the "Downloads" Folder



- If you see the wsjtx\_2.3.1\_armhf\_deb zipped folder in the Downloads file, the package download was successful.
- At this point you are ready to load the wsjtx software onto your device.
- Close "X" out of this screen and...
- Read on...



- Click this icon on the Menu Bar to enter desktop Terminal Mode.
- From the "Terminal" screen you will type in and enter specific commands to load the "wsjt-x" program onto your raspberry pi 4 device.



- The following prompt will be displayed on your screen.
- This indicates you are currently in the "raspberry pi": root directory.
- The directory holding the wsjtx folder is named, "Downloads" (which you just saw in an earlier slide).
- The "CD" command will be used to "change directory" to the one specified next.



- Type the following EXACTLY as shown and press Enter:
- cd Downloads
- Note: Be sure the word "Downloads" is capitalized as this is how the name of the directory is actually spelled. If you use all lower case, you will get an error message.



- The screen prompt is now coming from the "Downloads" directory.
- Proceed to the next slide...



- Type the following EXACTLY as shown and press Enter:
- sudo dpkg –i wsjtx\_2.3.1\_armhf.deb

#### File Edit Tabs Help

#### pi@raspberrypi:~ \$ cd Downloads

pi@raspberrypi:~/Downloads \$ sudo dpkg -i wsjtx\_2.3.1\_armhf.deb (Reading database ... 163803 files and directories currently installed.), Preparing to unpack wsjtx\_2.3.1\_armhf.deb ... Unpacking wsjtx (2.3.1) over (2.3.1) ... Setting up wsjtx (2.3.1) ...

Processing triggers for gnome-menus (3.31.4-3) ... Processing triggers for desktop-file-utils (0.23-4) ... Processing triggers for mime-support (3.62) ... Processing triggers for man-db (2.8.5-2) ...

#### pi@raspberrypi:~/Downloads \$

### INSTALL WSJT-X

> The screen will display all the processes occurring as the command is executed. When the process has completed you will see a new command prompt as shown.

Next slide...

#### @raspberrypi: ~/Download

#### File Edit Tabs Help

pi@raspberrypi:~ \$ cd Downloads pi@raspberrypi:~/Downloads \$ sudo dpkg -i wsjtx\_2.3.1\_armhf.deb (Reading database ... 163803 files and directories currently installed.) Preparing to unpack wsjtx\_2.3.1\_armhf.deb ... Unpacking wsjtx (2.3.1) over (2.3.1) ... Setting up wsjtx (2.3.1) ... Processing triggers for gnome-menus (3.31.4-3) ... Processing triggers for desktop-file-utils (0.23-4) ... Processing triggers for mime-support (3.62) ... Processing triggers for man-db (2.8.5-2) ... pi@raspberrypi:~/Downloads \$ sudo apt-get --fix-broken install

- After the command prompt type in the following EXACTLY as shown, then press ENTER.
- sudo apt-get --fix-broken install
- > Next slide...

pi@raspberrypi: ~/Downloads

File Edit Tabs Help

#### pi@raspberrypi:~ \$ cd Downloads

pi@raspberrypi:~/Downloads \$ sudo dpkg -i wsjtx\_2.3.1\_armhf.deb (Reading database ... 163803 files and directories currently insta Preparing to unpack wsjtx\_2.3.1\_armhf.deb ... Unpacking wsjtx (2.3.1) over (2.3.1) ... Setting up wsjtx (2.3.1) ... Processing triggers for gnome-menus (3.31.4-3) ... Processing triggers for desktop-file-utils (0.23-4) ... Processing triggers for mime-support (3.62) ... Processing triggers for man-db (2.8.5-2) ... pi@raspberrypi:~/Downloads \$ sudo apt-get --fix-broken install Reading package lists... Done Building dependency tree Reading state information... Done 0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded. pi@raspberrypi:~/Downloads \$ \_\_\_\_\_\_Y

- Again, the screen will display the resulting processes as each one is executed by the command you entered.
- When the command has been fully executed a new command prompt will be presented.
- > We're almost done.
- > Next slide...

#### @raspberrypi: ~/Downloads

#### File Edit Tabs Help

#### pi@raspberrypi:~ \$ cd Downloads

pi@raspberrypi:~/Downloads \$ sudo dpkg -i wsjtx\_2.3.1\_armhf.deb (Reading database ... 163803 files and directories currently installed.) Preparing to unpack wsjtx\_2.3.1\_armhf.deb ... Unpacking wsjtx (2.3.1) over (2.3.1) ... Setting up wsjtx (2.3.1) ... Processing triggers for gnome-menus (3.31.4-3) ... Processing triggers for desktop-file-utils (0.23-4) ... Processing triggers for mime-support (3.62) ... Processing triggers for man-db (2.8.5-2) ... pi@raspberrypi:~/Downloads \$ sudo apt-get --fix-broken install Reading package lists... Done Building dependency tree Reading state information... Done 0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded. pi@raspberrypi:~/Downloads \$ sudo dpkg -i wsjtx\_2.3.1\_armhf.deb

- Lastly, type in the following command line EXACTLY as shown, and press ENTER:
- sudo dpkg –i wsjtx\_2.3.1\_armhf.deb

#### pi@raspberrypi; ~/Download

#### File Edit Tabs Help

pi@raspberrypi:~/Downloads \$ sudo dpkg -i wsjtx\_2.3.1\_armhf.deb (Reading database ... 163803 files and directories currently installed.) Preparing to unpack wsjtx\_2.3.1\_armhf.deb ... Unpacking wsjtx (2.3.1) over (2.3.1) ... Setting up wsjtx (2.3.1) ... Processing triggers for gnome-menus (3.31.4-3) ... Processing triggers for desktop-file-utils (0.23-4) ... Processing triggers for mime-support (3.62) ... Processing triggers for man-db (2.8.5-2) ... pi@raspberrypi:~/Downloads \$ sudo apt-get --fix-broken install Reading package lists... Done Building dependency tree Reading state information... Done 0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded. pi@raspberrypi:~/Downloads \$ sudo dpkg -i wsjtx\_2.3.1\_armhf.deb (Reading database ... 163803 files and directories currently installed.) Preparing to unpack wsjtx\_2.3.1\_armhf.deb ... Unpacking wsitx (2.3.1) over (2.3.1) ... Setting up wsjtx (2.3.1) ... Processing triggers for gnome-menus (3.31.4-3) ... Processing triggers for desktop-file-utils (0.23-4) ... Processing triggers for mime-support (3.62) ... Processing triggers for man-db (2.8.5-2) ... pi@raspberrypi:~/Downloads \$

- When all command processes have been executed the screen (once again) will display a new command prompt.
- At this point, you are done inputting terminal commands.
- Next slide...

@raspberrypi: ~/Downloads

sudo dpkg -i wsjtx\_2.3.1\_armhf.deb files and directories currently installed.) 8.1\_armhf.deb ... (2.3.1) ...

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- You can now "X" or close out of Terminal Mode.
- WSJT-X should now be available on your device, ready to choose from the menu screen.
- ► Let's verify...
- ► Next slide...


Open the Applications Menu



- Select the "Sounds & Video" bar
- You should now to see the "wsjtx" menu option.
- This is where you will start up the program to use FT8 and other digital modes with your radio



Click on the "wsjtx" icon.



- The WSJT-X program should open.
- ► If it does, CONGRATULATIONS!
- This would be a great time to logoff, shut down and back up your SD Card.
- > Take a break...You deserve it!
- ► We'll return later...







- Install WSJT-X (FT-8, JT-65, and others)
- Interface the Pi-4 to your Radio
  - Audio Sound Card
  - Direct (USB)
- Configure the Apps
- Configure your radio
- ► Get on the Air
- ► Have Fun!



- Top diagram
- Very common with older radios
- Uses a USB Sound Card Interface
  - Tx/Rx Audio + PTT connections to radio
  - USB Audio Connection to Rpi-4
- Example: Kenwood TS-940
- \*\*\*\*\*\*
- **Bottom diagram**

- Newer radios provide this type of connectivity
  - > No Sound Card Interface Device
  - ▶ USB Direct Connection / Pi to R
- **Example: Kenwood TS-590**



- Numerous products available by various manufacturers.
  - Tigertronics SignaLink
  - West Mountain Radio
  - Rig Expert
  - MFJ
  - others
- I currently use Tigertronics SignaLink USB which will be used for descriptive purposes here.



- Refer to device User Manual
- https://www.tigertronics.com/slusbmain.htm
- USB:
- Connects to USB on R-Pi
- RADIO:
- Connects to Mic or ACC plug on radio
- SPKR:
- Connects to Ext. Spkr. or Audio Out on Radio



- Refer to device User Manual
- https://www.tigertronics.com/slusbmain.htm
- Depending on the type of interface used it may be necessary to configure internal jumpers or add a jumper plug that conforms to the type of cable and radio you are using.
- This is the configuration I use for my Kenwood TS-940 radio.



# CONFIGURE THE RADIO FOR WSJT-X

- Decide on an interface method
- **Top diagram**:
- Very common with older radios
- Uses a USB Sound Card Interface
  - Tx/Rx Audio + PTT connections to radio
    - Uses Mic and Spkr. Connectors
    - or ACC connector
  - USB Audio Connection to Rpi-4
- **Ex: Kenwood TS-940**
- **Bottom diagram**:
- Newer radios provide this type of connectivity
  - No Sound Card Interface Device
  - ▶ USB Direct Connection / Pi to Radio
- Ex: Kenwood TS-590, Icom IC-7300





- Refer to Instruction Manual for the Radio You are Using
- Connect USB Sound Card "Radio" Cable to Radio's MIC Input
- Connect USB Sound Card SPKR Cable to Radio's EXT SPKR
- Alt. Method Connect USB Sound Card to your Radio's ACC connector using appropriate cable
- On Radio, ensure VOX is enabled
- Use TX and RX Controls on USB Sound Card in conjunction with microphone and speaker settings on your radio to establish "optimum" audio levels. This is a bit of a balancing act.

CONFIGURE A RADIO FOR FT8 USING SOUND CARD INTERFACE



- Typical settings for modern radios follow...
- Refer to Instruction Manual for the Radio You are Using
- Connect USB Cable from Rpi-4 to Radio USB Port
- **Go to MENU settings**
- Set Audio Input Line Selection to "USB"



- Refer to Instruction Manual for the Radio You are Using
- Set a USB INPUT LEVEL value for Data Communications



- Refer to Instruction Manual for the Radio You are Using
- Set a USB OUTPUT LEVEL value for Data Communications



- Refer to Instruction Manual for the Radio You are Using
- Set a USB VOX level for Data Communications use



- Refer to Instruction Manual for the Radio You are Using
- Set the correct BAUD RATE for the radio USB Port



- Refer to Instruction Manual for the radio you are using.
- Be sure selected frequency for FT8 on radio and on the R-Pi WSJT-X control panel correspond.



- Connect Radio to R-Pi using appropriate Interface
- Use Dummy Load during initial configuration and testing
- **Turn on Radio**
- Start Up the Raspberry Pi
- Power Up the Sound Card Interface (if used)
- Open WSJT-X program
- Waterfall and Control Screens overlap.

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	20m ( 14.0	076 000	Tx ren/1st	Hold Tx Freq	Gen	erate Std Msgs	Next Now	Pwr	and the local data
	DX Call	DX Grid	Tx 100 Hz				O Tx <u>1</u>		
	80	$\rightarrow$					O Tx 2		
	-60		RX 400 HZ						
	-40 Lookup	Add	Report - 15						
1000	-20								- Andrews
	t <sub>o</sub> 202	1 Apr 04				•	0 Ix <u>5</u>		
	0 dB	:34:15					• Tx <u>6</u>		
	Receivin JT65					15/60		WD:5m	
						THE SECTION			

- Position windows accordingly for now.
- Program initially starts in JT65 mode, 14.076Mhz displayed.

	00 800 		1200	14					
	File Configurations	WSJT-X w Mode Depde S	v2.3.1 by K1JT ave Tools He	, G4WJS, and Ip	K9AN			~ ^	×
	8	d Activity			F	x Frequency			-
	UTC dB DT Freq	Message		UTC dB D	T Freq	Message			-
art 0 Hz Palette Adji Avg 5 Default			Î						ļ
	CQ only Log QSO	Stop Monitor	<u>E</u> rase	Decode E	nable Tx	<u>H</u> alt Tx	<u>T</u> une	Men	us
	20m • 14.0 [80 60 40 20 0 0 0 14.0 DX Call Lookup 2021 21:	74 000 Tx ev Tx 150 DX Grid A Rx 480 Repor Add Auto Add Auto	ven/1st Hold 0 Hz V D Hz t-15 Seq Call	1 Tx Freq K	Gener	ate Std Msgs	Next	Now P Tx <u>1</u> Tx <u>2</u> Tx <u>3</u> Tx <u>4</u> Tx <u>5</u> Tx <u>6</u>	
	Rece ng FT8					14/15		WD:6n	n

- Change operating mode by clicking "Mode" on menu tab, then select "FT8" from the dropdown list.
- Control screen is now set to FT-8 mode with corresponding frequency (14.074 MHz) for the band indicated (20m).
- Once set, program will always reopen to the mode and band used last.

	WSJT-X - Wide Gr 500 1 1 1 1	aph 800 1000	0 1200	~ ^ ×				
	File Configurati	ons View Mode De Band Activity	WSJT-X v2.3.1 by K ecode Save Tools	1JT, G4WJS, a Help	nd K9AN Rx F	Frequency	~ ^ ×	
Start 0 Hz Palette Adji N Avg 5 Default	UTC dB DT	Freq Message	Î	UTC dB	DT Freq Me	ssage	ĺ	
	CQ only LC 40m • -80 -60 -40 -20 -0 0 dB	SO         Stop           7.074         000           .call         DX Grid           Lookup         Add           2021         Apr 04           21:41:20         Add	Monitor Erase Tx even/1st Tx 1500 Hz ↓ Rx 480 Hz ↓ Report -15 ↓ ✓ Auto Seq	Decode	Enable Tx Generate	Halt Tx Iun Std Msgs Next O O O O O O O O O O O O	e Menus Now Tx 1 Tx 2 Tx 3 Tx 4 Tx 5 Tx 6	
	Receiving	FT8				5/15	WD:6m	

- To change the WSJT operating band, click on the band selection arrow and select the desired operating frequency from the list.
- The new operating band and corresponding operational frequency will be indicated.
- NOTE: You must <u>separately</u> adjust the controls on your radio to transmit and receive on the band and mode operating frequency you plan to use. The configuration settings discussed here are the "matching" modes and frequencies the WSJT program uses to operate and log your F-3 contacts.
- Advanced rig control features are available within WSJT but will not be attempted here.

Control 200	400 600		
		Settings	~ ^ X
~		General Radio Audio Tx Macros Reporting Frequencies Colors Advanced	
ns/Pixel 2 📫 Start 0 H	Iz 📮 Palette Adjust	Station Details	
lit 2500 Hz 🗧 N Avg 5	🗧 Digipan 🗸	Cr My Call: PPNSSS My Grid: EM12 AutoGrid IAPJ Region: All	•
		Ives the soperation for type 2 compound callsign holdered Tar call in Tx3	
		Display	
		Start new period decodes at top Font	Tune
		Blank line between decoding periods         Decoded Text F	ont
		Display dista <u>n</u> ce in miles	
		✓ Ix messages to Rx frequency window	
and the age	and an	Show DXCC, grid, and worked-before status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show principal prefix instead of country in the status Show prefix instead of c	
		Behavior	
		Monitor off at startup Enable VHF and submode features	
		Allow 1x frequency changes while transmittin	
		Disable The first sending 79	• Ix <u>6</u>
		Calling CQ forces Call 1st	
		Alternate F1-F6 bindings Tx watchdog: 6 minute	es :
		CW ID after 73 Periodic CW ID Interval:	0
		Cancel	OK

- Download and Consult the WSJT-X program manual for detailed instructions.
- > Open the WSJT-X program.
- Under the File Menu go to Settings
- Note: Click OK in each tab window to save settings for the selected tab.
- Under the General Tab enter your Call Sign and Grid location (EM12 in DFW area).
- In the "Behavior" section click the box, "Double-click on call sets Tx enable".
- Under the Radio Tab select None for Rig and VOX for PTT method.
- Under the Audio Tab select an applicable audio source for Input and Output.
  - For straight USB connection or SignaLink USB Sound Card I re sysdefault:CARD =CODEC for both.
- Under Colors Tab select colors you want to use to display various information.
- Under Advanced Tab select Two-pass Decoding

Cana	Se	ttings	× ^ ×	1	
Rig:		Frequencies Colors Adv	Poll Interval: 1 s		~ ^ X
CAT Se St	control rial Port: //dev/ttyAMA0 erial Port Parameters	PTT Method • VOX • CAT	○ <u>D</u> TR ○ R <u>T</u> S		
Start 0 Hz     Palette Adju       N Avg 5     Default	Baud Rate: 4800 • Data Bits • Default () Seven () Eight	Port: /dev/ttyAMA0 Transmit Audio Source O Rear/Data	• Eront/Mic	Tune	Menus
	Stop Bits ● Default ○ On <u>e</u> ○ T <u>w</u> o	Mode None OUS	BO Data/P <u>k</u> t	Vext No	
	Handshake • Default <u>N</u> one • XON/XOFF <u>H</u> ardware	Split Operation None     Rig	g 🔿 Fake It	0 D	< <u>2</u> < <u>3</u>
	Force Control Lines DTR: RTS:	Test CAT	Test PTT	т от т	<u>4</u> <u>5</u> <u>6</u>
					WD:6m
A second second		In the second	Cancel OK		

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WSJT-X - Wide Graph	VSJT-X v2.3.1 by K  ■Settings  (SJT-X - Wide Graph  800  1000  1200  14  4  4  4  4  4  4  4  4  4  4  4  4		
	Settings	~ ^ >	< * ^ ×
	General <u>R</u> adio Audio Tx <u>M</u> acros Reporting Frequencies Colors Advanced	1	
s/Pixel 2 Start 0 Hz Palette Adjus it 2500 Hz N Avg 5 Digipan	Sounder d Input: sysdefault:CARD=CODEC Output: sysdefault:CARD=CODEC Save Directory	• Mono • • Mono •	
	Location: /home/pi/.local/share/WSJT-X/save AzEl Directory Location: /home/pi/.local/share/WSJT-X Remember power settings by band	S <u>e</u> lect Select	Tune     Menus       s     Next       O     Tx 1       O     Tx 2
	☐ Iransmit ☐ Iune		<ul> <li>Tx <u>3</u></li> <li>Tx <u>4</u></li> <li>Tx <u>5</u></li> <li>Tx <u>6</u></li> <li>Ts <u>6</u></li> </ul>
	C	Cancel OK	

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·	/SJT-X - Wide Graph	~ ^ X				and the owner of the	No. of Concession, Name
400 60	0 800	1000 1200 14	H.				
		Settings		× ^ >		¥ .	~ X
	Genera <u>l R</u> adio A <u>u</u> dio Tx <u>M</u> a	acros Reportin <u>g</u> Frequencies Colors A	dvanced		1		
	Decode Highlightling						-
Start 0 Hz     Polotto Adiu	✓ My Call in message [f/	/g unset]		Î			-
	New Continent [T/g uns	[f/g upset]					
N Avg 5 Default	New CO Zone [f/g unset	ti t					
	✓ New CQ Zone on Band [1	f/q unset]					
	New ITU Zone [f/g unse	et]			Tuno	Mo.	2110
	New ITU Zone on Band [	[f/g unset]			Tune		nus
	✓ New DXCC [f/g unset]				evt	Now	Pwr
	New DXCC on Band [f/g	unset]			EXL	14044	(p) - 10 - 10 - 10
	New Grid [f/g unset]					Tx <u>1</u>	- Alterative
	New Grid on Band [f/g	unset]				Ty 2	
	New Call [f/g unset]					147	-
	New Call on Band [7/g	Unset]				Tx <u>3</u>	
	Lorw user [b/g unser]			•		Ty A	1
and the second se		Reset Highlighting				EVI	and the second
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and the second second	Only grid Fields sought				•	Tx <u>6</u>	•
	Include extra WAE entitie	es					
	Logbook of the World Liser Va	lidation				WD;6	om
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and the second se	USEIS COV THE URL.	https://iotw.ani.org/iotw-user-activity.csv	Fe	CHNOW			
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- Under Advanced Tab select Two-pass Decoding

JTX - Wide Graph	WSJT-X v2.3.1 by K ⊐Settings WSJT-X - Wide Graph 00 800 1000	1200 14			
Start 0 Hz Palette Adju N Avg 5 Default	General <u>Radio</u> <u>Audio</u> Tx <u>Macros</u> Reporting         JT65 VHF/UHF/Microwave decoding parameter         Random erasure patterns:       6         Angrowting treading level:       0         Image: Two-pass decoding         Image: Two-pass decoding         Image: Two-pass decoding         Image: Special operating activity:         Generating activity: <th>ettings Frequencies Colors Advance s Miscellaneous Degrade S/N of .wav file: Receiver bandwidth: Tx delay: Tone spacing X 2 Waterfall spectra O Low sidelobes 4, FT8, and MSK144 messages messages RTTY</th> <th><ul> <li>&lt; &lt; </li> <li>&lt; &lt; </li> <li>&lt; <th>v ∧ x      Iune</th><th></th></li></ul></th>	ettings Frequencies Colors Advance s Miscellaneous Degrade S/N of .wav file: Receiver bandwidth: Tx delay: Tone spacing X 2 Waterfall spectra O Low sidelobes 4, FT8, and MSK144 messages messages RTTY	<ul> <li>&lt; &lt; </li> <li>&lt; &lt; </li> <li>&lt; <th>v ∧ x      Iune</th><th></th></li></ul>	v ∧ x      Iune	
			Cancel OK		

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			Band	Activity						RxI	Frequency			
UTC	dB	DT	Freq	Message	1		UTC	dB	DT	Freq	Mess	age		
14600	-11	0.1	733 ~	YB8RVI	N9MR EN71	^								
14600	-17	0.1	782 ~	CQ WB8J	UI EN81 U									
14600	-15	0.2	833 ~	YBSRVI	K4HEB EL98									
4600	-12	0.9	1087 ~	JHUINE W	ATC 72									
4600	-10	0.1	1210 ~	CO NA J	ALEOD DMGE N									
4600	-10	0.2	1378 ~	VRODUT	NEVEN FM76									
4600	-17	-0.2	1541 ~	CO KOST	TEN65 U									
4600	-7	0.3	1618 ~	KB4LHP	CM2TU +00									
4600	6	0.1	2152 ~	YB9FAO	ADSFD RR73									
	100	0.000	100000000000000000000000000000000000000											
4600	-18	0.1	1512 ~	W1WWB K	6RCS R-15									
.4600 .4600	-18 -15	-0.3	1512 ~ 2164 ~	W1WWB K NK1I W4	6RCS R-15 BTA RR73	~	Darada		Epoblo 7	~				
.4600 .4600 CQ only	-18 -15	0.1 -0.3	1512 ~ 2164 ~	WIWWB K NKII W4	6RCS R-15 BTA RR73		Decode		Enable T	īx	Halt Tx	Τι	JNE	Men
.4600 .4600 CQ only m	-18 -15	0.1 -0.3	1512 ~ 2164 ~ st	WIWWB K NKII W4	6RCS R-15 BTA RR73		Decode d Tx Freq		Enable T Ger	îx	Halt Tx td Msgs	Next	Ine	Meni Pv
.4600 .4600 CQ only m	-18 -15	0.1 -0.3 g QSO	1512 ~ 2164 ~ st 7.07 DX Call	WIWWB K NKII W4 op Ma 1 000 DX Grid	6RCS R-15 BTA RR73	[	Decode d Tx Freq		Enable T Ger KC3HLT	Tx herate S AA5VZ	Halt Tx td Msgs EM12	Next	Now	Meni Pv
L4600 L4600 CQ only m	-18 -15	0.1 -0.3	1512 ~ 2164 ~ st 7.07 DX Call C3HLT	WIWWB K NKII W4	6RCS R-15 BTA RR73	[	Decode d Tx Freq	/3//2/1	Enable T Ger KC3HLT	x herate S AA5VZ AA5VZ	Halt Tx td Msgs EM12 -15	 Νext 	Now Tx 1 Tx 2	Menu Pv
.4600 .4600 CQ only m -60 -60	-18 -15	0.1 -0.3	1512 ~ 2164 ~ St 7.07 DX Call (C3HLT Az: 96	wiwwe k NKII W4	6RCS R-15 BTA RR73		Decode d Tx Freq	(3)/2/1	Enable T Ger KC3HLT KC3HLT	x herate S AA5VZ AA5VZ AA5VZ	Halt Tx td Msgs EM12 -15 R-15	Next	Now Tx 1 Tx 2 Tx 3	Pv
.4600 .4600 CQ only n -60 -40	-18 -15	0.1 -0.3	1512 ~ 2164 ~ St 7.07 DX Call (C3HLT Az: 96 .ookup	WIWWB K NKII W4	6RCS R-15 BTA RR73	Hol	Decode d Tx Freq l 1st	(3)/2/1	Enable T Ger KC3HLT KC3HLT KC3HLT	AA5VZ AA5VZ AA5VZ AA5VZ	Halt Tx td Msgs EM12 -15 R-15 RR73	Т. Next О О О	Now Tx 1 Tx 2 Tx 3 Tx 4	Meni Pv
4600 4600 CQ only n -60 -40 -20	-18 -15	0.1 -0.3	1512 ~ 2164 ~ st 7.07 DX Call CC3HLT Az: 96 .ookup 2021	WIWWB K NKII W4	6RCS R-15 BTA RR73	Hol	Decode d Tx Freq l 1st	(3/2/1)	Enable T Ger KC3HLT KC3HLT KC3HLT KC3HLT	x AA5VZ AA5VZ AA5VZ AA5VZ AA5VZ	Halt Tx td Msgs EM12 -15 R-15 RR73 73 ~	Next O O O O O O O O O O O O O O O O O O O	Now Tx 1 Tx 2 Tx 3 Tx 4 Tx 5	Pv

- Download and Consult the WSJT-X program manual for detailed instructions.
- Connect Radio to an Antenna
- Ensure Radio, Raspberry Pi and Interface (if used) are all powered "ON".
- Open the WSJT-X program.
- Ensure Radio is tuned to the FT8 base frequency for the band you will be using, and that the WSJT-X band frequency and mode selection indications match. In this case we are using 40m (7.074.000 Myz).
- If everything is connected and configured correctly, you should be able to see activity in the "Band Activity" window.
- If activity is indicated on the screen, proceed to test the transmit functions. (Next slide).

				Ŷ
able Tx	Halt Tx	Tu	ine	Menus
Generate	e Std Msgs	Next	Now	Pwr
AMI AA5V2	Z EM12	0	Tx 1	
			-	-

- The buttons shown will be used to test the Transmit feature of the Raspberry Pi, Interface and Radio connections.
- Proceed to next slide...

	3 - 7 - 9 - 20 - 40 - 60 dB - 25 - 50 - 100 W 2 - 3 - 00 W 2 - 3 - 00 W 2 - 3 - 00 W	3 DATA	AGC OFF
3/2/1	Enable Tx Hult Tx Ture Menus Generate Std Msgs Next tone On/Off N9AMI AA5VZ EM12 O Tx 1 N9AMI AA5VZ -15 O Tx 2 N9AMI AA5VZ R73 O Tx 4		
	CQ AA5VZ EM12   Tx 6  Enable Tx Halt Tx	T	
5 — 50	100W M.CH M.CH Generate Std Msgs	ansmittir	ng immediatel
A	T>T I I I I I I I I I I I I I I I I I I	] 0 [	Tx 1
	N9AMI AA5VZ -15	] 0 [	Tx 2
	PF B LSB/USB	] 0 [	Tx 3
2	7 CW/FSK	] 0 [	Tx 4
3.5	B FM-N N9AMI AA5VZ 73 V	] 0	Tx 5
14			

# "ON-AIR" TEST

- IMPORTANT: Use a Dummy Load when performing this test so as to NOT interfere with ongoing Amateur Radio communications.
- **Test "Transmit" mode:**

enu

- Click the "Tune" Button
- Radio should enter "TRANSMIT" mode.
- Click "Tune" Button again (or Halt Tx)
- > Radio returns to "RECEIVE" mode

			Band	Activity						Rx F	requency			
UTC	dB	DT	Freq	Message			UTC	dB	DT 1	Freq	Mess	age		
14600	-11	0.1	733 ~	YB8RVI N CO WB8JI	N9MR EN71 UT EN81 I	^ [								
4600	-15	0.2	833 ~	YB8RVI J	K4HEB EL98									
14600	-12	0.9	1087 ~	JHOINE (	CO6SRS FL02									
14600	-18	0.1	1137 ~	K9ZW KW4	4IG 73									
14600	-10	0.2	1219 ~	CQ NA JZ	AlEOD PM96 7	7;								
14600	-4	0.1	1378 ~	YB8RVI N	N8XKA EM79									
4600	-17	-0.2	1541 ~	CQ K9ST	r en65 u	I								
4600	-7	0.3	1618 ~	KB4LHP (	CM2IU +00									
4600	6	0.1	2152 ~	YB9FAO A	AD8FD RR73									
4600	-18	0 1	1 5 1 9											
14600	-15	-0.3	2164 ~	NK11 W4	6RCS R-15 BTA RR73	v.						1		
CQ only	-15	-0.3	2164 ~	WIWWB Ki NKII W4	6RCS R-15 BTA RR73		Decode		Enable T	x	Halt Tx	Τι	ine	Men
L4600 CQ only m	-15	-0.3	2164 ~ 51 7.07	op Mc	6RCS R-15 BTA RR73		Decode		Enable T Gen	x erate St	Halt Tx td Msgs	Next	ine	Men Pi
.4600 CQ only m	-15	-0.3	2164 ~ 5t 7.07	op Mc	6RCS R-15 BTA RR73	,	Decode old Tx Freq		Enable T Gen KC3HLT	x erate St AA5VZ (	Halt Tx td Msgs EM12	Next	Now Tx 1	Men Pi
CQ only m	-15	-0.3	2164 ~ st 7.07 DX Call (C3HLT	op Mc	6RCS R-15 BTA RR73	 _ но	Decode old Tx Freq	/3//2/1	Enable T Gen KC3HLT KC3HLT	x erate Si AA5VZ f AA5VZ -	Halt Tx td Msgs EM12 -15	] Next ] О ] О	ne Now Tx 1 Tx 2	Meni Pv
CQ only m -60	-15	-0.3	2164 ~ 2164 ~ <b>7.07</b> DX Call (C3HLT Az: 96	op Ma op Ma 1 000 DX Grid EM51 764 km	6RCS R-15 BTA RR73		Decode old Tx Freq	/3//2/1	Enable T Gen KC3HLT KC3HLT KC3HLT	x AA5VZ I AA5VZ I AA5VZ I	Halt Tx td Msgs EM12 -15 R-15	Tu   Next   O   O	Now Tx 1 Tx 2 Tx 3	☑ Meni Pv
CQ only m -60 -40	-15	-0.3	2164 ~ 2164 ~ 7.07 Dx Call (C3HLT Az: 96 .ookup	op Mc A 000 DX Grid EM51 764 km Add	6RCS R-15 BTA RR73	,	Decode old Tx Freq all 1st	/3//2/1	Enable T Ger KC3HLT KC3HLT KC3HLT	x AA5VZ I AA5VZ I AA5VZ I AA5VZ I	Halt Tx td Msgs EM12 -15 R-15 RR73	Ти Next О О О	Now Tx 1 Tx 2 Tx 3 Tx 4	Men Pi
4 600 CQ only n -60 -40 -20	-15	-0.3	2164 ~ 2164 ~ 7.07 DX Call (C3HLT Az: 96 .ookup 2021	op Mc 4 000 DX Grid EM51 764 km Add Apr 07	6RCS R-15 BTA RR73	на   _ на	Decode old Tx Freq all 1st	(3)/2/1	Enable T Gen KC3HLT KC3HLT KC3HLT KC3HLT	x AA5VZ AA5VZ AA5VZ AA5VZ AA5VZ	Halt Tx td Msgs =M12 -15 R-15 R-73 73 ~	] Ти Next ] О ] О ] О ] О	Now Tx 1 Tx 2 Tx 3 Tx 4 Tx 5	Men Pi

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- Ensure Radio, Raspberry Pi and Interface (if used) are all powered "ON".
- Open the WSJT-X program.
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- If everything is connected and configured correctly, you should be able to see activity in the "Band Activity" window.

124200 - <	-15 0.1 1	415 ~ CQ	AEODC E	
CQ only	Log QSO	Stop	Monito	
40m ~	2 😐 🔤	7.074 00	0 <b>0</b>	
E.	DX	Call D	X Grid	
-80	NQ			

- Consult the WSJT-X program manual for detailed instructions.
- On the WSJT-X Dashboard, "check" the box "CQ only".

# GET ON THE AIR



## GET ON THE AIR...

- Only stations calling "CQ" will be displayed in the "Band Activity" window.
- "Double-click" on the callsign you wish to call.
- The "Yellow" line indicates the message you are transmitting to the station you selected.

			WSJ	T-X - Wide Graph				
				1500			2000	
51 0 6	1	WS	JT-X v2.3.1 by K	1JT, G4WJS, and K9AN			``	
File Conligui	ations view iviou	e Decode Save	Tools Help		5.5			
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120315 -5 ( 120315 -12 ( 120315 17	0.2 1082 ~ CQ KF9K 0.0 2658 ~ CQ WA4P	V EN52 TZ EM65		120332 Tx 1082 120345 -4 0.1 1082 120400 Tx 1082	2 ~ KF9KV AA5VZ EM12 2 ~ AA5VZ KF9KV +02			
120315 -17 ( 120345 -4 ( 120345 -14 (	).1 2730 ~ CQ XE2J ).1 961 ~ CQ KIOE ).1 2731 ~ CO XE2J	A DL96 B EM88 X DL96		120400 TX 1002 120415 -2 0.1 1082 120430 Tx 1082	2 ~ AA5VZ KF9KV AA5VZ R-04 2 ~ AA5VZ KF9KV RR73 2 ~ KF9KV AA5VZ 73			
120415 -9 ( 120415 -8 -0	).3 2017 ~ CO N7UV ).2 1191 ~ CO CO7O	H DN17 C FL11						
120415 -6 ( 120415 -10 (	).1 2731 ~ CQ XE2J ).0 2683 ~ CQ WA4P	X DL96 TZ EM65						
120415 -17 -0	).3 1955 ~ CQ W7CD	CN87						
CQ only	Log <u>Q</u> SO	top <u>Monitor</u>	<u>E</u> rase	<u>D</u> ecode E <u>n</u> a	able Tx <u>H</u> alt Tx	<u>T</u> une	<b></b>	Menus
40m 🗸 🧲	7.07	74 000	🗹 Tx even/1st	🗌 Hold Tx Freq 🥌	Generate Std Msgs	Next	Now	Pwr
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-40			Report -2		KF9KV AA5VZ R-02		Tx <u>3</u>	-
-20		Add 🖌 Auto Seq		Call 1st	KF9KV AA5VZ RRR	0	Tx <u>4</u>	
L <sub>0</sub>	2021	May 19			KF9KV AA5VZ 73	• 0	Tx <u>5</u>	-
62 dB	12:	04:45			CQ AA5VZ EM12	۲	Tx <u>6</u>	- A-A
Dessiving				l l	0/15		14/	
	Last IX.	AF SILV AASVZ 73 TT			0/10	_	VV	
	Start 0 Hz	Palette Adius	st 🗹 Flatten	Ref Spec				Spec 30 %

## GET ON THE AIR... HAVE FUN!

- Consult the WSJT-X program manual for detailed instructions.
- The "Yellow" line indicates the message you are transmitting to the station you selected.
- The subsequent "Red" line indicates station called heard you and is calling you back.
- The remaining messages cycle automatically until the QSO is completed (when both stations have sent "73" in their message.
- At this point you can log the QS and work another station.
- ► YOU DID IT! CONGRATULATIONS!

				WSJ	JT-X - Wide Graph					
00			1000		1500			2000		
	0 (	11 A.C. A.C.	W:	SJT-X v2.3.1 by K	1JT, G4WJS, and K9AN			~	~ ^ X	7005
File	Configura	tions view Mode	Decode Save	I OOIS HEIP						
TU UT	TC dB D	Band A T Freg Message	ctivity		UTC dB DT Free	KX Frequency Message	_	_	_	
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ſ		Forteall	DX Grid	Tx 1082 Hz		KF9KV AA5VZ EM12		Tx <u>1</u>		
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	0	2021	May 19			CO 445VZ FM12	•	Tx 6		
62	dB	12.0	74.43					11/ 0		Valta of a AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
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Bin	<mark>s/Pixel 2</mark> it 2500 Hz	Start 0 Hz	Palette Adju	ust	Ref Spec				Spec	30 %

## LOGGING THE QSO

- Consult the WSJT-X program manual for detailed instructions.
- Click on the "LOG QSO" Button

				WS.	JT-X - Wide Graph							۰.
WSJT-X, v2.3.1 by K_ and K9AN - Log QSO 👻 🔺 🗙		1000			1500	1500				2500	2500	- 7
ick OK to confirm the following QSO:		10000 - 2000	-	201		All and a second second		Sara		255		
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	-60	KF9KV	EN52	Rx 1082 Hz		KF9KV AA5VZ -02		Tx <u>2</u>	T			
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#### LOGGING THE QSO

- Consult the WSJT-X program manual for detailed instructions.
- Basic Information about the QSO is already pre-populated on the form.
- Enter additional information you want to record such as station power or any other comments
- Click the "OK" Button
- That's all there is to it.
- Congratulations!



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## GETTING STARTED...

#### MOVING FORWARD

- Assemble a Raspberry Pi-4 Workstation
- Load the base Operating System (O/S)
- Install and Configure Ham Radio Apps
- Interface the Pi with your Station
- **Get on the Air!**
1. Link to configure WSJT-X for operation with Icom IC-7300 https://www.k0pir.us/icom-7300-wsjt-x-ft8-easy-way/

2. WSJT-X Home Page

3. <u>https://www.tigertronics.com/slusbmain.htm</u>

4. www.google.com

5. <u>www.youtube.com</u>

## REFERENCES

## QUESTIONS OR TESTIMONIALS?

## GETTING STARTED USING RASPBERRY P IN THE SHACK (PART 2)

Jack Weaver – AA5VZ