HB9HCI FT8--Box

DIY-Kit
Easy approach to
to modern, digital communication
FT8 (or FT4)

Developed and tested under tough SOTA applications

by HB9HCI, Andreas

Further information at

http://ft8--box.hb9hci.support

Thanks to Dave GM0HVS
for the English translation

Version 2.2.4.en

Mar. 2021

0 Quickstart guide

0.1 Things you can't find out by playing

(This part should be read by experts who consider reading instructions a waste of time.)

The assembly of the FT8-box should not be a problem. Make sure that VCC (red) and GND (black) are crossed on the GPS cable!

The FT8 box contains a Raspbery Pi 3B - a compromise between power consumption and speed - which is set up as an access point (AP)

AP-address:	***10.3.141.1***	
SID:	**FT8--Box**	
Password:	***FT8--Box***	(also applies to all passwords on the Raspi)
Login:	**wsjtx**	(also applies to all passwords on the Raspi)

Auf diese AP-Adresse wird mit VNC[1] vom Smartphone, iPhone (oder PC) zugegriffen. Wenn zusätzlich durch ein Ethernet-Kabel (RJ45) Verbindung zum Internet hergestellt ist (Shack-Betrieb), synchronisiert sich die FT8--Box über einen NTP-Timeserver. Im Portabel-Betrieb (kein Internet verfügbar) wird diese Synchronisation über den GPS-Unit geliefert, wenn das fehlschlägt, kann man einen SNTP-Server auf dem Smartphone bzw. NTP-Server auf dem iPhone starten. (Installation Time Server App[2] über Google Play, Installation von NTP TimeSYNC[3] über App).

This AP address is accessed with VNC[1] from Smartphone, iPhone (or PC). If an Ethernet cable (RJ45) is also used to connect to the Internet (Shack mode), the FT8-box synchronizes via an NTP time server. In portable mode (no internet available) this synchronization is provided by the GPS unit, if this fails, you can start an SNTP server on the smartphone or NTP server on the iPhone. (Install Time Server App[2] via Google Play, install NTP TimeSYNC[3] via App Store).

Using this AP address (entered into the browser via VNC) the AP-IP settings can be changed (caution!!!). The AP address also runs an FTP server, so that you can access the files from outside.

In addition to using AP access, client access to an existing network is possible (set WiFi in the top right corner). This allows you to create a HotSpot on the summit with your smartphone and use it to control the FT8 box. The smartphone can then connect to the Internet (note the IP address for VNC connection at first setup, when you are still at home)

The SD card is permanently bound to the Raspi board via a hardware code. It will not run on another Raspi. (Copying the SD card for another Raspi will cause a crash during boot).

If you get stuck, read the manual or look at the Trouble Shooting section.

Contents

Distribution **HB9HCI FT8--Box**: Lutz-Elektronics, Erschwillerstr. 246, CH 4247 Grindel
https://www.lutz-electronics.ch/

Further information about **HB9HCI FT8--Box**: https://ft8--box.hb9hci.support/

1 About FT8--Box de HB9HCI

1.1 Overview

The FT8--Boxis a simple way to use your transceiver to encode/decode FT8-Signals. It consists of a RaspberryPi3B computer, Soundstick USB soundcard and a GPS receiver. Your Smartphone or tablet is used as the input device to control the RasPi.

In this manual you will find a description of the FT8--Box Kit and an introduction to the use of the FT8--Box. In particular how to use the WSJT-X program to successfully make SOTA contacts with FT-8.

1.2 Function

The FT8--Box contains a Raspi 3B[4], which runs the Rasbian[5] operating system (a Linux derivative). WSJT-X[6], the actual FT8 program, runs under the Rasbian OS. The FT8 protocol requires synchronization with UTC (world time). The FT8--Box gets the time from the Internet, when the Ethernet interface is connected to the Internet, from the connected GPS, if it gets a fix, or from the smartphone/iPhone.

The FT8--Box creates its own WiFi **FT8--Box** as access point, over which the display device (Android/iPhone smartphone or tablet) connects to the FT8--Box.

If the FT8-box is connected to the Internet via the Ethernet cable, the box can also be used for other purposes: for instance, it can serve as an access point for a domestic guest wifi.

1.3 Requirements

- FT8--Box DIY-Kit
- USB-power supply (5V/0.5A) for the FT8--Box
- Smartphone/Tablet (Android) or iPhone/iPad (iOS) as display.
- Transceiver

During setup, internet access is required to install two utility programs on the display device.

1.4 Setup

Before use the following steps need to be completed:

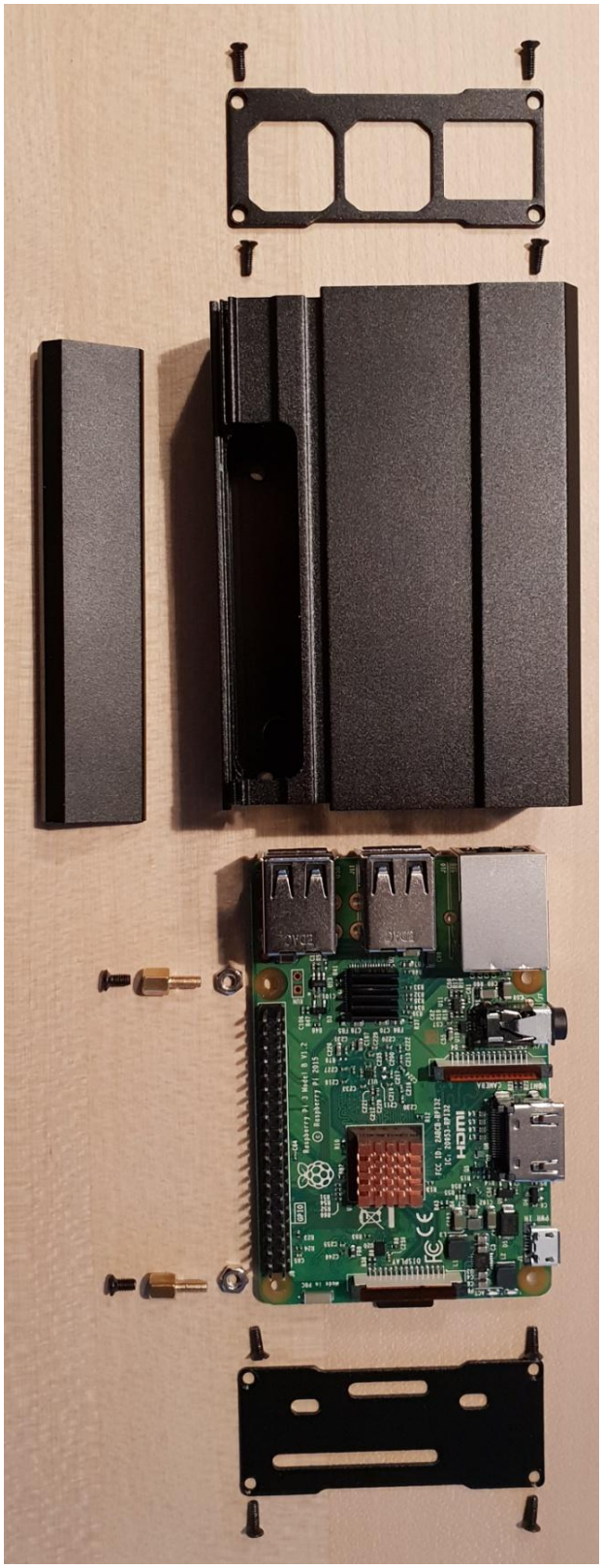
- Assemble the Box (=>2 Assembling)
- Installation of a virtual screen on the Smartphone/iPhone (VNC) (=>3.2 Settings)
- Setup time synchronisation (=>4 Time Synchronisation)
- Setup WSJT-X software and connection to radio (=>5 Initial Set Up of FT8--Box)

When using the FT8-Box the required steps are :

- Connect tranceiver to FT8 box
- Switch on
- Synchronize time
- Start FT8 program
- Make FT8-QSO's

2 Assembly of the FT8--Box

The assembly is done from top to bottom as shown in the adjacent figure:



The upper face is screwed to the housing with 4 cross-head screws. (Thick edge to the bottom of the housing.)

The cover plate (shown left) is pushed into the housing from below.

The two hexagonal spacers are inserted into the board from the rear (solder side) next to the connector strip and fixed with the two nuts.

Glue the three heat sinks onto the matching chips. The flat one with the Raspi logo goes on the chip on the bottom of the board.

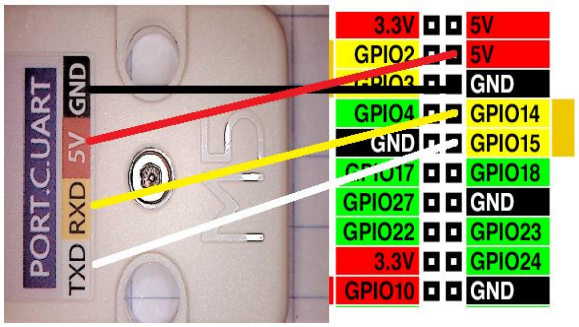
The PCB is inserted into the housing so that the spacers are aligned with the holes in the bottom of the housing. Make sure that the sockets (4xUSB, RJ45) on the board are in the corresponding housing cutouts.

Fasten the board to the bottom of the housing with the two cross-head screws.

Put the cable for GPS (see 2.1 Installation GPS Unit) through the lower front face (through the long slot) and fix it with the 4 cross-head screws. (Fit SD card into the corresponding slot).

2.1 Installation GPS-Unit

When installing the GPS unit, first insert the cable through the slot of the lower panel. To do this, insert the plug across the slot. (yes it does fit with a bit of pressure)

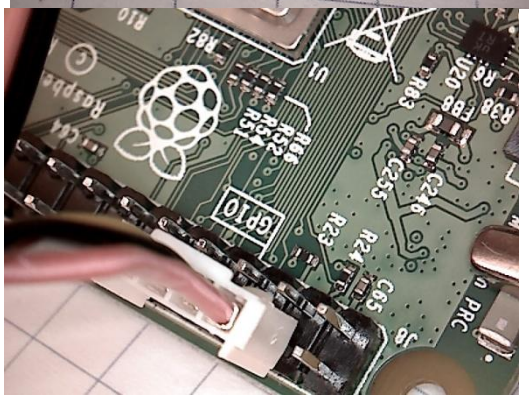


Unfortunately the supply lines (5V,GND) of the GPS unit must be crossed to match the pin assignment of the Raspi:

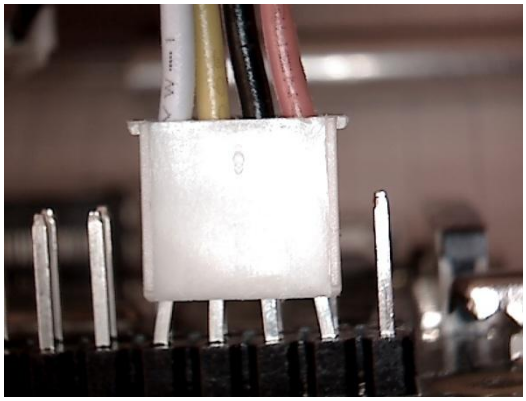
Lift the plastic spring with a pin and then pull out the black and the red wire. (See picture).

(Thanks Tom, HB9BRH, for the tip with the pin)

Then insert the two metal contacts (swapped over) back into the corresponding holes of the plastic plug. (see picture).



Unfortunately, the grid spacing of the connector strip and the GPS unit connector is different, but with a little bit of bending, a proper contact is achieved.



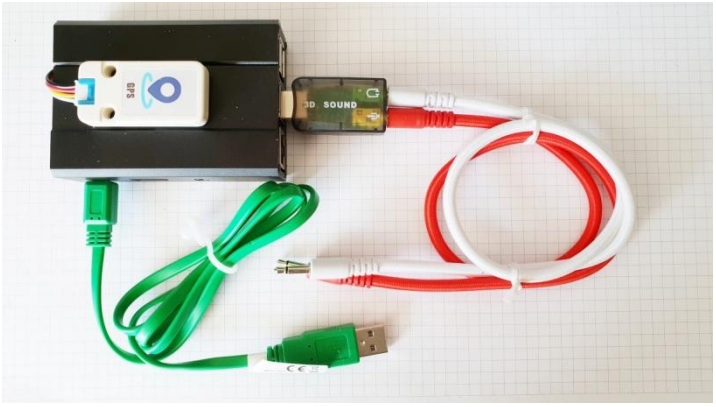
Finally stick the GPS unit to the housing with the enclosed double-sided adhesive patch.

Important:

The 1st pin on the Raspi socked is not connected!
The outer line of the socked is used. (see picture).

3 FT--8 Box Access Settings

3.1 Accesspoint



The FT8--Box is connected to a 5V USB power source using the supplied USB cable (next to the video socket - see picture). (Consumption approx. 200mA) For portable use (SOTA) accupacks[7] have proven to be the best choice. The chosen Raspi version (3B) is a compromise between speed and power consumption.

As soon as voltage is applied, the FT8-box boots and offers its own WiFi network: **FT8--Box**. This network is password protected.
Password: **FT8--Box** (note: 2 minus signs!) This network the uses the address 10.3.141.1, and allows three different methods of access:

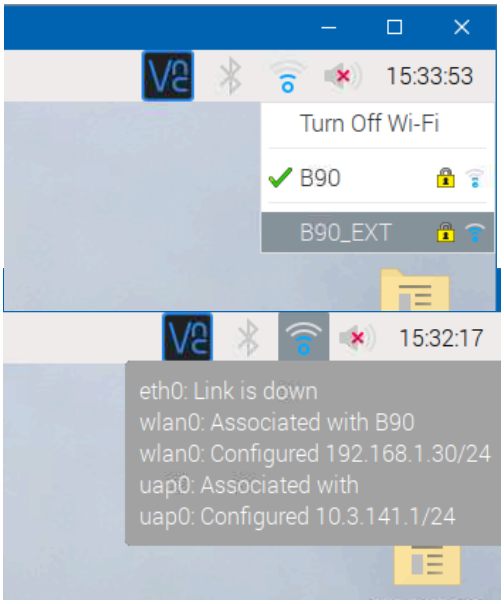
VNC: Terminal access is available with the help of a VNC program (to be installed). On the Tablet/Smartphone/iPhone/PC the virtual screen of the FT8--Box appears as own window

FTP: The URL **ftp://10.3.141.1** provides access to the file system of the FT8--Box.

HTTPS: With the URL **https://10.3.141.1** the settings of the access point of the FT8--Box can be changed. (Be careful if you do make changes: you can block your access to the FT8--Box. In this case you have to connect a keyboard and mouse to the free USB ports and a (real) screen to the HDMI socket).

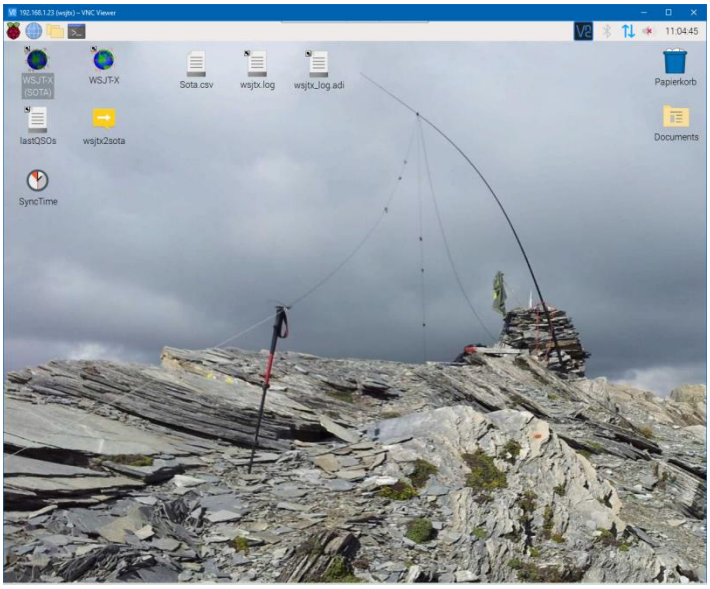
3.2 Access via WiFI Home-Net/HotSpot

(Experimental) Instead of using AP FT8--Boxwifi access, you can use your own home WiFi network or the hotspot of your smartphone to access the Raspi system. To do so, you first have to establish a connection via the AP with VNC. The host network must already be running. Now this network is selected as another network in the upper right corner and provided with the corresponding network password. To remember the set address move the mouse over the WiFi icon, then the IP address in the host network will appear as tooltip. This address you need to establish the VNC connection.



3.3 Establishing a connection to the FT8--Box

A VNC app must be installed on the device that is the display and control for the FT8 box. See: VNC-Installation



To establish a connection to the FT8--box, the access point address **10.3.141.1** must be entered in VNC. (via HotSpot see below)
Login: **wsjtx**
Password: **FT8--Box**

It is advisable to save this access (login, password) so that you do not have to enter it again each time.

The start screen of the FT8-box will open. On the top left is the menu button (Raspberry). The FT8--Box programs are in the HAM-Radio folder.

The mouse operation of the VNC program takes some practice on Smart- and iPhone, because the mouse pointer is not directly under the finger like on a touch-screen, but moves parallel to the finger. But this has the advantage that you can easily see where the mouse pointer is. The operation is described in the VNC program itself and here[8]. The mouse keys and the keyboard become accessible if you tap with the FINGER (not with the mouse pointer) into the header of the VNC program. (See also footnote[1])

3.4 Synchronisation

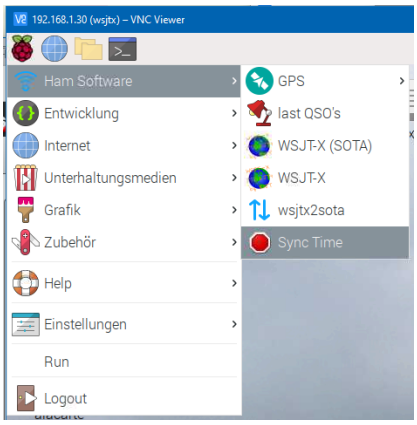
The Raspi does not contain a real time clock: when it boots, the internal (software) clock starts at 0:00. Since the FT8 protocol works with strict time slots (a new slot starts every 15s), the system must be synchronized with UTC (world time). There are 3 options in order of preference:

- The FT8--Box synchronizes with the GPS-receiver outdoors. (4.1)
- The FT8--box is connected directly to the Internet via the Ethernet interface. Then the clock is automatically set to UTC with the help of an NTP server via the Internet. (4.2)
- Using your VNC connected device to receive a GPS time signal (4.3 Android Setup or 4.4 iPhone Setup)

- If there is a GPS signal to your Android device then the time can be taken from this device via an SNTP server. See: 4.3 Setup SNTP-Server
- If a connection with an iPhone/iPad is established, the time is taken from the NTP server running there. See: 4.4 Setup NTP-Server

  As soon as the connection is established, the time query must be triggered. This can be done with a double click on the **SyncTime**-Icon or by clicking on the corresponding menu line

  (see figure right).



The SyncTime app acknowledges success:

or failure: Most of the time you have forgotten join the **FT8--Box** Net.

The other common error is that you did not start the app (or in case of Android, did not start the server additionally).

If the synchronization is successful, you can start the FT8 program (**WSJTX**)...

4 Time Synchronisation

FT4/FT8 (and other modes) require the real-time clock to be synchronized with UTC, as the individual time slots in which the data is transmitted start every 15 sec (FT8) or 7.5 sec (FT4) after the full UTC minute. This means that transmission takes place in 4 slots for FT8 (twice to and fro) and in 8 slots FT4 (four times to and fro).

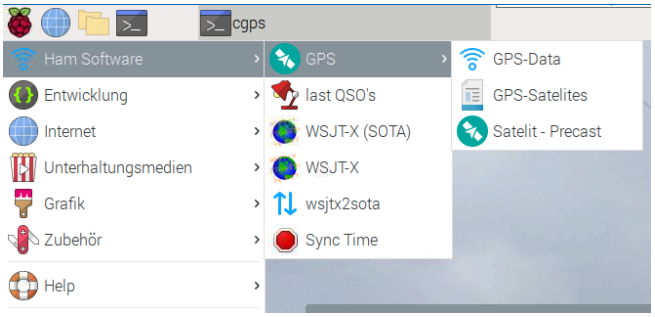
The accuracy of this synchronization is shown in **WSJTX** in the **DT** (DeltaTime) column. If the deviation is greater than +/ 2 sec, decoding will fail. Therefore it is important to make sure that the internal clock is as close to UTC as possible. (The time zone does not play a role in this).

The Raspi does not contain a real time clock: when it boots, the internal (software) clock starts at 0:00. Since FT8--Box V2.0, there are 3 different methods to perform time synchronization.

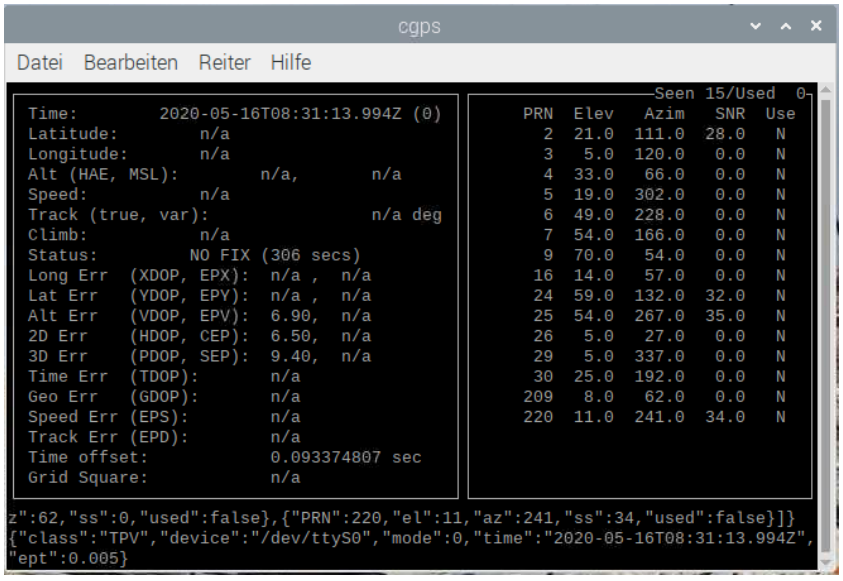
- The FT8--Box synchronizes with the GPS-receiver outdoors. (4.1)
- The FT8--box is connected directly to the Internet via the Ethernet interface. Then the clock is automatically set to UTC with the help of an NTP server via the Internet. (4.2)
- Using your VNC connected device to receive a GPS time signal (4.3 Android Setup or 4.4 iPhone Setup)

4.1 GPS-Receiver

Outdoors, this synchronization is performed automatically. As soon as the GPS receiver has calculated a fix (valid coordinates), it starts flashing bluish. The software clock in the FT8--Box will then be readjusted automatically. (It can take up to 5 min. until a fix)



The reception of GPS signals can be displayed with the app **GPS-Data** (FT8--Box: **Menu**=>**Ham Software** => **GPS** => **GPS-Data**). If there is no reception for more than 5 minutes: Start SyncTime on the FT8--Box.



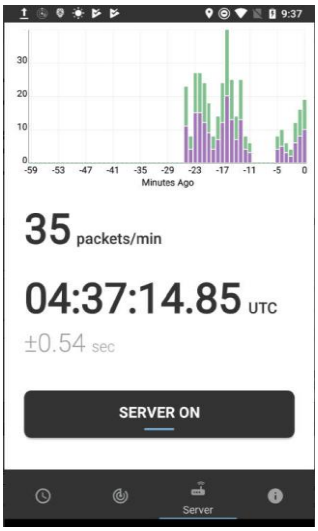
Alternatively start **WSJTX (SOTA)**. This will show when you have a valid fix and locate the nearest SOTA summit. This data is then immediately entered into the **WSJTX** program.

Here you select the next summit (in the picture: „Gempen“, which here is still 4.6 km away in direction NW (38°), 760m high, 1 SOTA point but 0 bonus points for activation).

4.2 NTP-Server with Ethernet-Connection to Internet

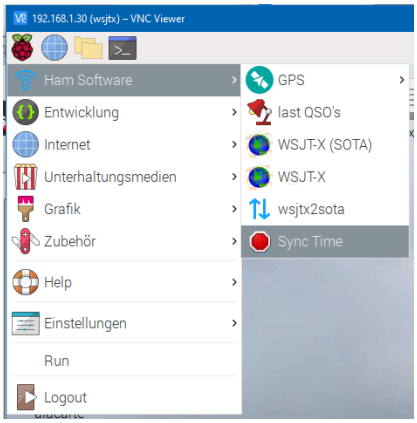
The clock is automatically synchronized via NTP, when connected to the internet via the RJ45 socket. (Shack mode)

4.3 Android-SNTP Server Setup



From Google Play download and install the TimeServer[9]. This app reads the time from the GPS signal, which only works when GPS satellites are received by the smartphone (outdoors). An SNTP server is integrated into the app, which must also be started.

There is a radio button: **NTP-Server auto-start** (start NTP server automatically). You should select this option so you can save yourself this additional step in future. Then it is sufficient to start the TimeServer app only.



As soon as the connection is established, the time query must be triggered. This can be done with a double click on the **SyncTime**-Icon or by clicking on the corresponding menu line

(see figure right).

The SyncTime app acknowledges success:

or failure: Most of the time you have forgotten join the **FT8--Box** Net.

The other common error is that you did not start the app (or in case of Android, did not start the server additionally).

If the synchronization is successful, you can start the FT8 program (**WSJTX**).

The process looks like this:

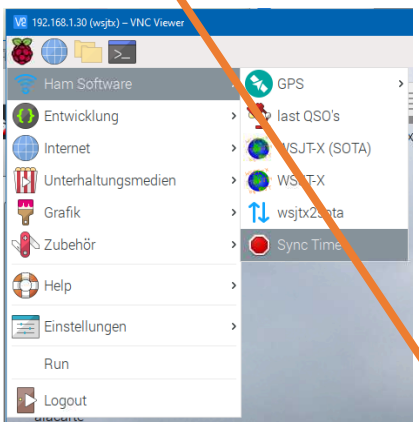
- Login your Smartphone into **FT8--Box** Wifi
- Start **TimeServer**-App. (If necessary, start the NTP server additional.)
- Start VNC-App
- In VNC-App **SyncTime** via **Menu=>Ham-Radio** or double click 

and wait for results
- Start FT8-Program **wsjtx** via Icon or **Menu**=>**Ham-Radio**

4.4 Setup iOS-NTP-Server (iPhone/iPad)

Download and install the NTP Time Sync from the App Store. If you get it! **It seems, that the chinise company has removed this app from the appstore.**

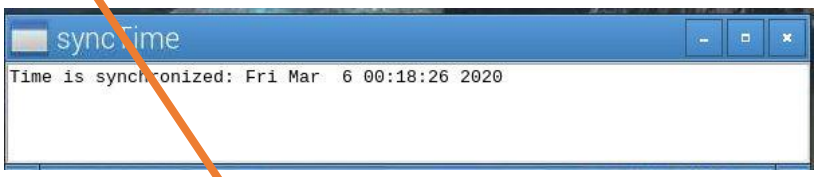
This app was apparently developed for Siemens S7 controllers, but it does its job fine.



As soon as the connection is established, the time query must be triggered. This can be done with a double click on the **SyncTime**-Icon or by clicking on the corresponding menu line

(see figure right).

The SyncTime app acknowledges success:



or failure: Most of the time you have forgotten join the **FT8--Box** Net.

The other common error is that you did not start the app (or in case of Android, did not start the server additionally).

If the synchronization is successful, you can start the FT8 program (**WSJTX**).

Procedure for starting the FT8 program:

- Login: iPhone/iPad into **FT8--Box** Wifi-net.
- Start **NTP Time Sync**.
- Start **VNC**-App (IP-address **10.3.141.1**, Login: **wsjtx** Password **FT8--Box**
- In **VNC**-App **SyncTime** via **Menu**=>**Ham-Radio** or double click on the icon and wait for receipt
- On iPhone bring **NTP Time Sync** to the foreground. wait 10s, then back to **VNC** app
- Start FT8-Programm **wsjtx** via Icon or via **Menu**=>**Ham-Radio**.

5 Initial Set Up of FT8--Box

5.1 FT8--Box and Transceiver Connections

- Plug the sound stick into the USB socket and connect the transceiver (if not sending the sound via USB line):

FT8--Box Connection	Transceiver Connection
Microphone	Headphones
Headphones	Microphone

- if applicable, connect the rig control for the transceiver to the USB socket

After the time is successfully synchronized (4), start two programs on the FT8--Box:

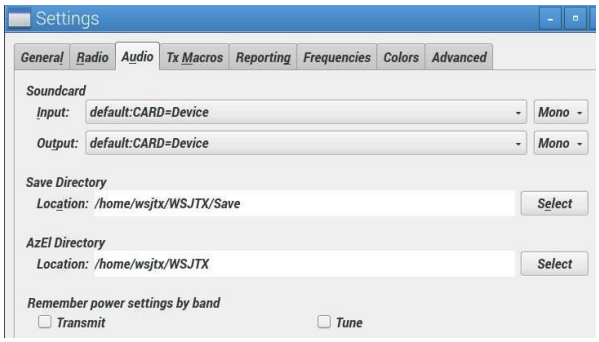
- **LastQSO's.** This program reads the **WSJT-X** log every 10s and displays the last QSO's with comment field (for SOTA: Summit identifier) (top right on the desktop)

- FT8 program: **WSJT-X**. Start using the Menu Entry **Menu=>Ham-Radio** or by double clicking on the corresponding icon.

5.2 Settings in WSJT-X

The following settings are important for the FT8--Box to work. For a full description of the software look at the WSJT-X manual[6] or https://www.g4ifb.com/FT8_Hinson_tips_for_HF_DXers.pdf[11].

5.2.1 Audio



First, the sound card is auto-detected. If this does not happen, there will be some error messages. In this case, click on the Audio tab under **File=>Settings**. The two upper fields must be filled in. Usually the setting "Default" works; otherwise have a play.

(If "Default" doesn't work, often line 2 is used for receiving and the last line for sending. More information about individual transceivers can be found on the WebSite https://ft8--box.hb9hci.support .)

5.2.2. Radio

Settings for the tab, **Radio** (**File** => **Settings**), depend on,

- Is the Transceiver driven by the FT8--Box (via USB)
- Is the Transceiver driven by VOX and Microphone

5.2.2.1 Transceiver driven by FT8--Box

If the transceiver allows an additional USB connection (with an appropriate cable), use this connection. This connection requires setting a **serial port** and **baud rate**. The baud rate is usually configured in the transceiver. You have to enter this setting in the tab **Radio**. (The other serial settings may have to be adjusted). If you use rig control in your shack, look at the configuration on your shack computer.

The **serial port** is **/dev/ttyUSB0**. Under Rig you select your transceiver. **PTT Method** is "**CAT**". In the transceiver, switch off VOX . (If you forget this, the transceiver gets out of sync, because it would be controlled by **CAT** as well as by VOX)

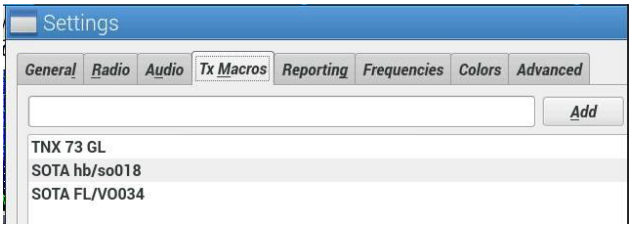
Data/Pkt is the recommended **Mode**: The transceiver will then use the appropriate filter settings. (If Data/Pkt is not an option/suitable on your transceiver then use SSB, e.g. because the filter bandwidth cannot be set in Data-Mode (as with the FT991). Note: FT-8 uses USB on all bands).

Split operation allows you to set whether the transmitter should be adjusted by 500Hz for low sounds, so that any band passages in the audio are bypassed. Recommendation **Fake It** setting

5.2.2.2 Transeiver driven via VOX

If the transceiver cannot be computer controlled, or you want to use the VOX control, set the **PTT Method** to **VOX**. In addition the transmitter must also have VOX "on" (with corresponding settings for the threshold, which triggers VOX and switch to transmit). The transmitter is then controlled by the microphone signal. To adjust these settings on the transmitter, there is a **Tune** button on the main WSJTX window: the program will continue to transmit a tone until **Tune** is pressed again. When using the VOX control, be careful not to use a stereo cable for the microphone line, as transmitter microphones usually have a PTT button that uses the second channel of the cable. (If necessary, set PTT to "off" in the transmitter).

5.2.3 Settings for SOTA



An identification for the summit must be transmitted for SOTA operation, so it is recommended to prepare a macro with the corresponding entry. As FT8 uses transmits a maximum of 15 characters per time slot, the identifier has to be shortened a bit. This entry is made automatically when starting with **WSJTX (SOTA)**.

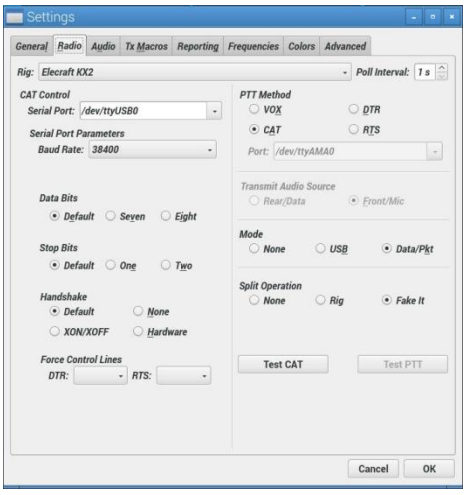
5.2.4 Colour-Setting

In the **Colors** Tab you can set the colors. Compared to the standard settings I changed the active QSO's (received QSO's) to blue for better readability. Here you can configure your own colours.

5.2.5.General Settings

In the tab **General** some basic settings are preconfigured. Here you have to enter the callsign **My Call** (don't forget to change to the corresponding country code e.g. G to GM) and the current position (**My Grid**). A detailed description of the individual fields is available here.

5.3 Settings - Transceiver



Since there are different types of transceivers, only the basic settings can be described here:The audio cable from the phone output of the receiver to the input of the soundstick should be a mono cable or must be shielded, otherwise HF radiates into the soundstick and distorts the transmitted audio signal.

- For the audio cable into the microphone input of the transmitter, a Tiptop Audio Stackable[10] (not included) is recommended, so that you can check the audio signal sent by the soundstick for purity (interference by HF) with an earphone. Attention: The 2nd audio channel (stereo) is used for PTT with some transceivers. With the

supplied mono cable this should not be a problem. For stereo lines, switch off PTT if necessary)

- If the transceiver has a **DATA** setting, make sure that no shaping filter is effective (no PSK, RTTY etc). The filter settings should allow a bandwidth between 0.5 and 3KHz.
- The modulation level should be set so that the full (QRP) transmit power is delivered but no overmodulation occurs. (Check the transmitted signal with a receiver) Set the SoundStick's output signal to max (right slider in the **WSJT-X** main window) to make this line as low impedance as possible. Adjustments are made using **Tune** in the **WSJT-X** main window, where a continuous tone is sent.
- If the transceiver is controlled via a USB line (**CAT** control), set the VOX control to "off" for safety reasons, so that both controls do not interfere with each other.
- If TX control is to be performed without a USB connection to the transceiver, the VOX setting must be set so that the transceiver only goes on air when there is a signal at the microphone input. (Adjust using **Tune** (in the main window of **WSJT-X**)).
- Adjust the output signal of the receiver so that the receive bar (on the left side of the **WSJT-X** main window) remains in the green area. (Do not overlaod.)
- Do not forget: Before first transmission, adjust the automatic tuner (ATU) - if available - to the antenna.

6 Use

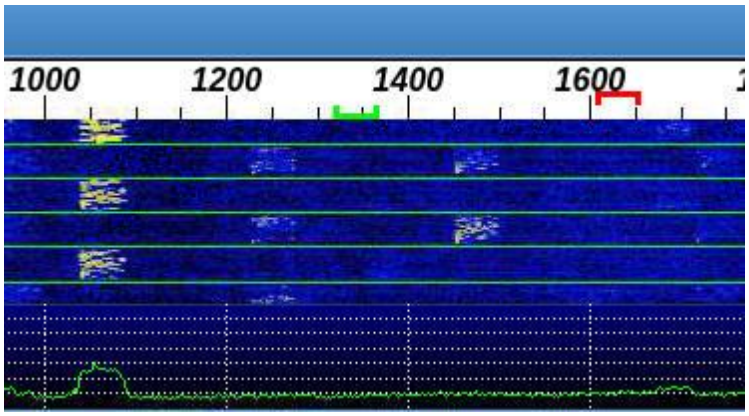
6.1 Requirements

- The virtual screen (**VNC**) should be installed and set as described in 3.3.
- Time synchronization should be completed as described in 4.
- The settings for WSJT-X should be as 5.2.
- The transceiver should be set as described in 5.3.

6.2 Start FT8

Double-click on the **WSJTX** icon or via **Menu** => **Ham Radio** => **WSJTX** to start the FT8 program. Two windows will open. The split, window shows the spectrogram of the input signal in the bottom and above a waterfall display. The other window is the WSJT-X main window.

6.2.1 Waterfall Display



It is important that the green horizontal lines are located at the start or end points of the vertical colored bars. If this is not the case, the time synchronization is not correct and no signals are decoded (left list box remains empty). In this case repeat time synchronization (4).

The waterfall allows you to view the activity on the band. Keep an eye on this waterfall window, because the free frequencies (blue/black) are visible here. In the header of this window is a frequency scale. If you move the mouse pointer there, it changes into a small cross. (with **VNC** under Windows the pointer does not change) A **<shift>+mouse** click sets the transmit frequency to the frequency located under the cross (red mark). The green mark (selected by a single mouse click) shows the receive frequency selected for the receive list field (on the right of the WSJTX main window). However, all frequencies are decoded. The remaining frequencies are displayed in the left receive list field of the **WSJTX** main window.

The waterfall window has a **Control** radio button in the upper left corner. With the sliders that now appear below the window you can adjust the settings for waterfall and spectrum.

6.2.2 Main window WSJT-X

It consists of different parts:

- List window **Band Activity**. which shows all decoded operations on the band. 6.2.2.1
- list window **Rx Frequency**, which decodes my transmitting activity (and the receiving frequency selected in the waterfall window). 6.2.2.2
- Button bar in the middle, with which individual functions are triggered. 6.2.2.3
- parameter part, displaying time, band, receive level and data of the selected QSO partner. 6.6.2.4
- QSO-Text 6.6.2.2

6.2.2.1 Band Activity

This contains a list of decoded signals with the following meaning:

UTC: World Time

dB: Received signal strength in dB (noise ratio)

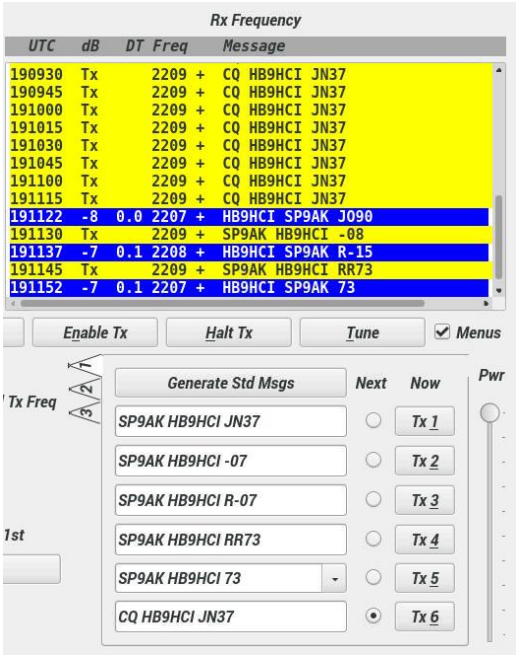
DT: Deviation from the Raspi time in s. These values should be on average < +/- 0.5s. If the values are significantly larger, the time synchronization is poor. (See 4)

Freq: Frequency of received signal in audio spectrum (position on waterfall scale)

Message: The decoded text appears here. The colors are defined under **File** => **Settings** in the **Colors** tab (5.2.4). The display of the country code is set in **File** => **Settings** Tab **General**. If the box **CQ only** is checked, only the CQ calls are listed here. Under **Menu** => **Decode** => **Enable IP**, **WSJTX** can estimate the callsign from previous connections. This saves some computing time.

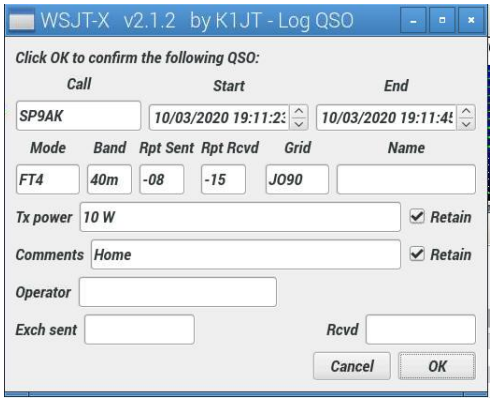
The decoding of the signals is very CPU-intensive. So if there are many stations on the band, the decoding will take a lot of time. In such a case I switch the decoding to **normal** or **fast**. (**Menu** => **Decode**). Otherwise the received line is decoded only after the transmission of a response has already started. This is probably (with patient QSO partners) no problem, but it leads to the fact that the whole QSO takes a little longer.

6.2.2.2 Rx Frequency



In this list my QSO is shown. (transmissions in yellow, reception in blue).

After some CQ calls SP9AK answers here and gives its coordinates (JO90). My answer contains the reception strength of SP9AK (-8dB). He answers with the reception strength of my signal (-15dB). I answer him with RR73. This is the end of the QSO and it is recorded in the log.



Below the list are the individual lines that can be sent by me. The second last line has a special meaning: Here I can choose if I want to send a special text. This is where I would enter identification of the SOTA summit. This can be selected from the pull-down menu. (Setup: 5.2.3)

For the simple transfer of the QSO's into the SOTA database the program **wsjtx2sota** (as icon on the desktop or via **Menu** => **Ham-Radio** => **wsjtx2sota**) converts the wsjtx-log into a suitable SOTA.csv-file. To make sure that this works without errors, the corresponding Summit-identifier must be in the field **Comments** in the log, e.g. HB/BL-002

With the radio buttons under **Next** you can select the next send step. Normally you will mainly select **Tx6** for a new CQ call. But also for the transmission of the Summit identification (**TX5**) a selection can be necessary, which the program switches off the transmitter by itself after a logged QSO (Enable becomes grey) and jumps to TX6. If one clicks on a button under **Now**, the current transmission process is aborted and the clicked line is transmitted. (This may be necessary if the remote station can't get out of a loop and is sending the same line all the time.)

By clicking on a line in the left list **Band Activity** you can also answer a CQ call. (If your callsign has no additions (no country code for international calls nor /p for portable) you can speed up the transmission by double clicking on the topmost radio button of **Next**, then this line is skipped for the QSO.

The **+** in the **Rx Frequency** window (between **Freq** and **Message**) is an indication of the mode used: **+**: FT4 **~**: FT8

6.2.2.3 Toolbar

At the centre of the **WSJT-X** main window are the following buttons:

CQ only: only CQ calling stations are displayed in the left list box.

Log QSO: window for the log entries

Stop Monitor: Switch monitoring (decoding) on/off

Erase: single click deletes left list, double click deletes right list

Decode: triggers the (re)decoding of the last lines

Enable Tx: after logging a QSO the station is disabled. This is to prevent stations from working without operator intervention (as robots). Important: Each time the log window is opened, the station must be enabled again. In contrast to **Stop Tx**, **Enable Tx** executes the last command to the end.

Halt Tx: current transmission is cancelled.

Tune: to adjust the station, a continuous tone is generated until Tune is pressed again.

Menus: with a check mark in this field the menu line in the header of the window is hidden. As a result, more lines are displayed in the list boxes.

6.2.2.4 Remaining fields

The remaining fields provide information about the QSO partner, the time of origin, the selected band and some settings for sending and receiving, which will be described in detail here.

The pull-down Frequency menu allows the band to be selected. If the transceiver is connected, this selection is also passed on to the transceiver. The frequency corresponding to the selected mode (FT8/FT4 etc.) appears in the upper black display. If there is a connection to the transceiver, the circle is marked with a green S, otherwise it is red.

Below the frequency display, the last station called and its locator are displayed. Below that we see the bearing (for antenna alignment) and the distance.

With the option field **Tx even/1st** you can choose whether you want to transmit in the even time slots (0s/30s) or in the odd (15s/45s). The QSO partners are divided into two (disjunctive) groups. At even times you can reach one group, at odd times you can reach the other group..

Hold Tx Freq: either you transmit on the frequency of your QSO partner, which has the advantage that he keeps the frequency "free" and immediately sees that someone answers on his frequency, but your own station is disabeld if the called one answers another station, or you select **Hold Tx Freq** and always transmit on the same (with the mouse in the upper window selected) frequency. This has the advantage that your own station is not disabled if the called station is still being called by another station.

With **Auto Seq** the line sequence on the right hand side is automatically run through.

With **Call 1st** the progam will respond to the first station that answers to a CQ call.

The status bar displays,

- whether transmission or reception is in progress,
- which profile is selected,
- which decoding method (**Mode**) is used
- which line was just sent

6.3 Backup and Log-File Upload

6.3.1 Backup

Hint: after a first configuration of the FT8--Box the SD-Card should be get a backup.

With Win32DiskImager you can copy the SD-Image direct to your PC-harddisk. (Start Win32Diskimager with Adminstrator rights.

6.3.2 Log-File Upload

Move your log-files to your PC via ftp (see 3.1). Best way: connect the FT8--Box with an Ethernet cable to your machine. The connet IP-address can be found via a WiFi-connection to the FT8--Box: Click on the blue VMC icon in the headerline: Now the IP-Adress of your machine is displayed. Connect from the browser of your machine via ftp://<IP-address> and you get access to the ADIF and LOG files on the desktop.

6.3.3 SOTA csv Upload

Reformat **wsjtx.log** with **wsjtx2log** in a csv formatted file. Upload this csv file into the SOTA database with the Raspi-browser (blue world icon in the headline).

6.3.4 WSJT-X update

Go to https://physics.princeton.edu/pulsar/k1jt/wsjtx.html and download

- Raspberry Pi OS Buster, ARMv6, ... : wsjtx_x.x.x_armhf.deb

With x.x.x as actual version no. With dobble click on the .deb file installation starts.

If your FT8--Box version is <= V2.2.2 you have to install also the us_locale. See: https://wsjtx.groups.io/g/main/message/21461 (be aware, there is a typo on that website. Use `sudo dpkg-reconfigure locales` in a terminal window.

7 Further information …

For the practical operating technology I recommend my WebSite

http://FT--8Box.HB9HCI.Support

with further hints, videos and explanations.

I gained Mountain Goat award (1000 SOTA points) using only FT8-QSO's in just 5 months. The idea for this box was born after I had worn out two Windows tablets. A snowstorm on Le Honeck, FL/VO-002 meant the 2nd tablet was toast. So, it was clear: I don't want any cables on the display unit! Now the realisation of the FT8--Box began. After all, it had to withstand snow, ice and rain. Some of the supply electronics were destroyed and sometimes a Raspi board was even torn away - this of course on top of the summit! (0 points). This was how the current solution turned out. It is not waterproof. But it should not fail with isolated splashes.

Now I wish you a great deal of success: the proof of the pudding is in the eating. It takes some time to get used to, but then it's a pretty safe way to get QSO's even under bad conditions.

Vy 73 de HB9HCI, Andreas

8 Trouble Shooting (Risiko-Management)

Problem	Solution	Description
Assembly		
Missing parts	Connect to HB9HCI.support	
Teile dit not fit	read manual	2
Parts still do not fit	Connect to HB9HCI.support	
Start FT8--Box		
LEDs on the FT8--Box remain dark	Power supply has an error: • Is the (small) USB plug in the side of the box? • Is the other end of this cable connected to a USB power supply? Is the power supply supplying enough power? (5V/200mA)	5.1
FT8--Box does not provide WLan Acesspoint	• Check that the smartphone/iPhone displays **FT8--Box** as WLan network • Check that the LED's on the User Box blink from time to time • Has the IP been adjusted by software? (Undo setting)	
VNC		
No VNC viewer found on the smartphone/iPhone	Has the App VNC-Viewer been downloaded and installed on the smart-phone/iPhone?	
VNC viewer starts, but no FT8 box is visible	If the smartphone/iPhone is in the • FT8--Box Wlan booked in? • No FT8--Box network to be found (see above) • Log into FT8--Box - Network (Password: FT8--Box) • Restart your smartphone	3.2
VNC comes with security prompt	Acknowledge query. (No security is required for the connection)	
VNC asks for server	Log on to the server (**FT8--Box**) with Login: **wsjtx** Password **FT8--Box**	3.2
VNC cannot be used	The operation of VNC takes some getting used to. The mouse works parallel shifted like a trackpad. To call up the keyboard or mouse buttons by tapping on the head bar with your finger, then an additional menu appears, with which you can use a keyboard and mouse buttons (as a translucent overlay)	5.1 see also OnBoard help on the Device
VNC keyboard cannot be made to disappear	Tap the back arrow at the bottom of the baseboard (VNC menu in the header can only be displayed without keyboard)	
FT8--Box screen suddenly disappears	Smartphone/iPhone has started screen saver The WLan connection has been interrupted: The distance between the smartphone/iPhone is so large that the connec-	

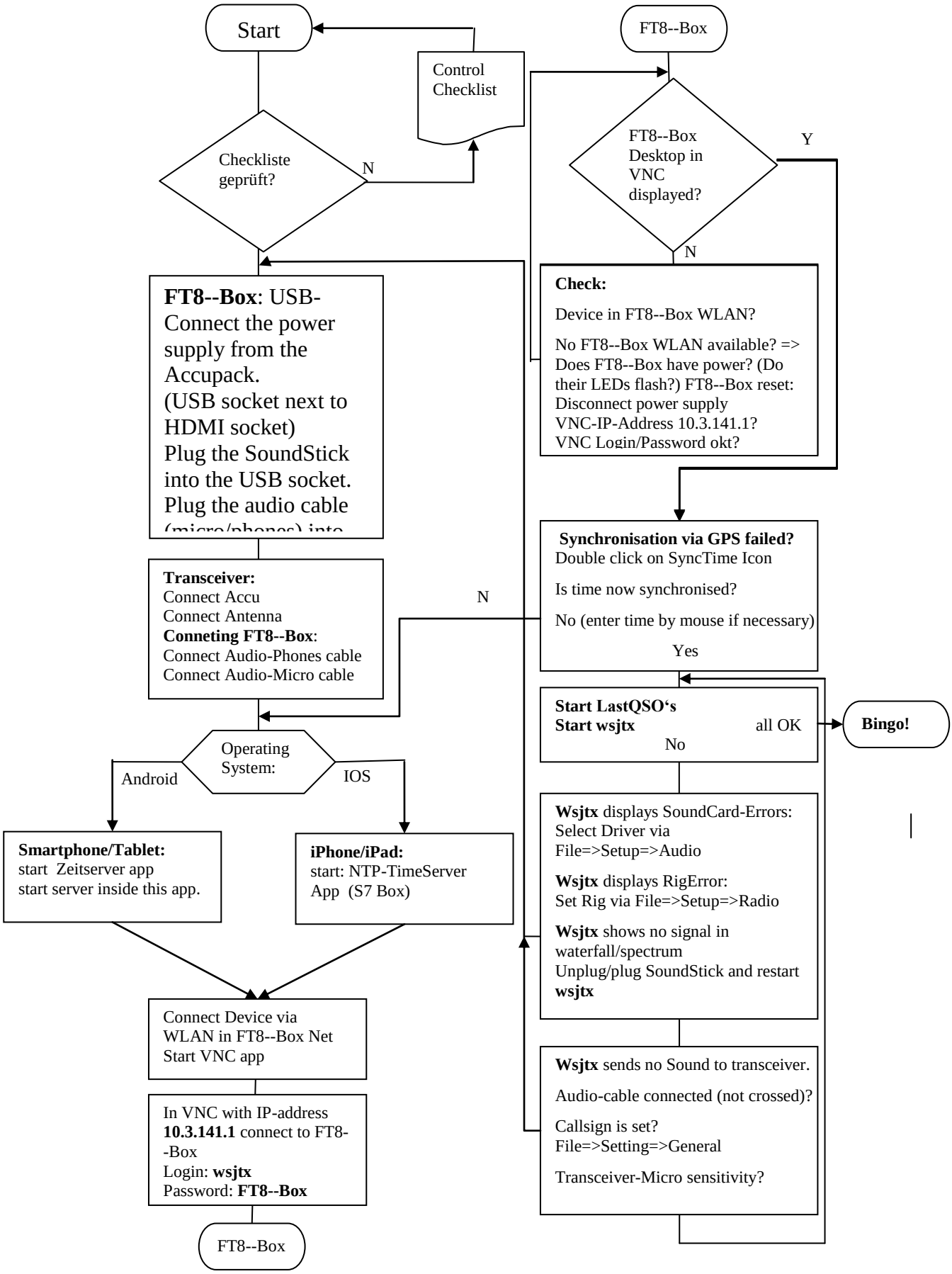
	tion is interrupted: reduce the distance and re-register. An Ethernet cable has been plugged into the FT8 box. (Not every smartphone/iPhone can tolerate this) Plug, unplug again and reboot.	
Einstellungen in der FT8--Box		
The clock in the FT8 box (top right of the screen) shows wrong time	FT8--Box synchronisieren Durch das Internet: Über Ethernet-Stecker (RJ45) verbindung mit dem Internet herstellen. (Synchronisation dauert einen Moment) Über das Smartphone: • Ggf. App installieren. • Starten und für GPS-Empfang sorgen. • In der App Zeitserver starten. Über das iPhone: ○ App installieren und starten. Anschliessend die Synchronistation mit **SyncTime** (Doppelclick auf Icon) auf der FT8--Box durchführen. Synchronise FT8--Box Through the Internet: • Connect to the Internet via Ethernet (RJ45) connectors. (Synchronisation takes a moment) Via the smartphone: • If necessary, install the App Zeitserver. • Start and ensure GPS reception. • Start the Time Server app. Via the iPhone: • Install and start the NTP-Time Sync app. Then synchronise with **SyncTime** (double click on icon) on the FT8 box. with GPS-Stick[4]	4
Synchronisation with **SyncTime** fails.	Program **SyncTime** cannot find a time server: Is the time server started in the Zeitserver app on Android? Does the smartphone have GPS reception? Is the NTP time server started on the iPhone and in the foreground?	4
wsjtx does not open.	Possibly another instance of **wsjtx** is already running. Acknowledge error message with **No**	
Error in Sound Output/Input	Soundcard is not selected in Setup. **File** => Open **Setup** Tab **Audio** and adjust Soundcard. (If no Soundcard is displayed, remove the SoundStick from the USB socket and insert it again and restart **wsjtx**).	
Rig Control Error	Click on **Ok** and select the correct rig. Make sure that there is a USB connection to the rig. If necessary restart **wsjtx**. Next to the frequency selection must be a green **S**. The adjustment of the transceiver	

	is a bit "fiddly" the first time: • PTT set to off. • VOX set to off. • Receiving bandwidth >3KHz • Displayed frequency is USB • Sound signal in the micro input should not over-drive the transceiver. (Check signal with a 2nd re-ceiver). • Sound signal from the phone output should be in **WSJT-X** at 30dB (reception bar at bottom left). (If overdriven the sound stick may become defective!)	
In **Band Activity** nothing is decoded	Check that the synchronisation has worked. (Horizontal green lines in the waterfall window must be between the signals) Re-establish synchronisation.	
No FT8 signals appear in spectrum and waterfall despite connection to trans-ceiver .	Insert the connecting cable correctly between Transceiver Soundstick Sound out (Phones) <-----> Sound in Sound in (Micro) <-----> Sound out Is the correct frequency adjusted? Can signals be heard at all when the phone plug is discon-nected?	

9 Checkliste (SOTA)

- ☐ Tranceiver
- ☐ Accu for Transceiver
- ☐ Antenna
- ☐ FT8--Box with GPS-Unit
- ☐ USB-supply cable
- ☐ Accupack with 5V USB power supply
- ☐ Audio-cable Microphone (if sound is not transferred via USB)
- ☐ Audio-cable phones (if sound is not transferred via USB)
- ☐ SoundStick ((if sound is not transferred via USB)
- ☐ USB-cable for Rig-control (optional)
- ☐ Earplug (optional)
- ☐ Audio-double plug for earphones to check the transmitted signal (optional)

10 Flowchart



[1] VNC: https://www.realvnc.com/en/connect/download/viewer/

[2] Time Server App: https://timeserver.app/

[3] NTP TimeSYNC: https://www.deepaso.com/app/tr/1089074515

[4] Raspi 3B: https://en.wikipedia.org/wiki/Raspberry_Pi

[5] Raspbian: https://en.wikipedia.org/wiki/Raspbian

[6] WSJT-X: https://physics.princeton.edu/pulsar/K1JT/wsjtx.html
WSJT-X can handle a wide range of modern digital modulation techniques (e.g. FT4, which runs on the same protocol as FT8 but at twice the speed).

[7] Tests with DC-DC voltage converters have shown that chirping is then superimposed on the reception. (However, this need not be a hindrance.) With a 12/5 V DC converter you can then save the battery pack. However, an accupack is also sufficient when the battery in the smartphone is running low.

[8] https://play.google.com/store/apps/details?id=com.realvnc.viewer.android

[9] TimeServer: https://play.google.com/store/apps/details?id=app.timeserver&hl=en

[10] Tiptop Audio Stackable z.B.: https://www.schneidersladen.de/de/tiptop-audio-stackcable-55cm-yellow.html

[11] https://www.g4ifb.com/FT8_Hinson_tips_for_HF_DXers.pdf