

DX FT8 Software Set Up and User Guide for WB2CBA / W5BAA Project 1/3/2025

This document is written to guide the user in setting up and using the project firmware.

Step 1:

Download and review the STM32F746 User Guide found here:

https://www.st.com/resource/en/user_manual/um1907-discovery-kit-for-stm32f7-series-with-stm32f746ng-mcu-stmicroelectronics.pdf

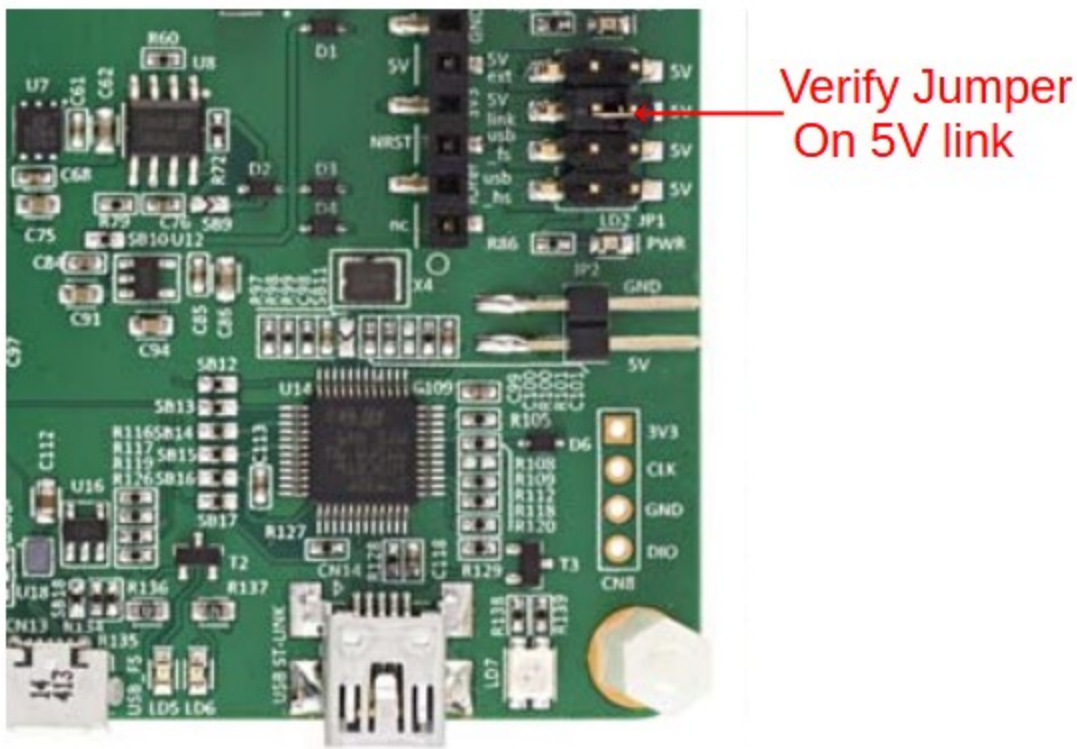
Step 2:

Download and install “STM32 ST-Link” utility found here:

<https://www.st.com/en/development-tools/stsw-link004.html>

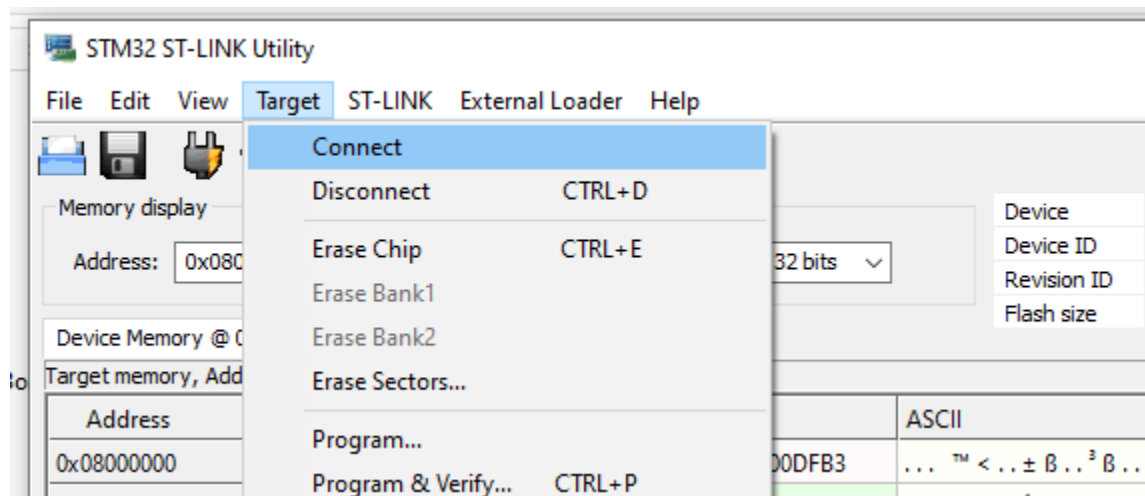
Step 3:

Make sure that a jumper is installed on JP1 on the 5V link usb pins as shown below:

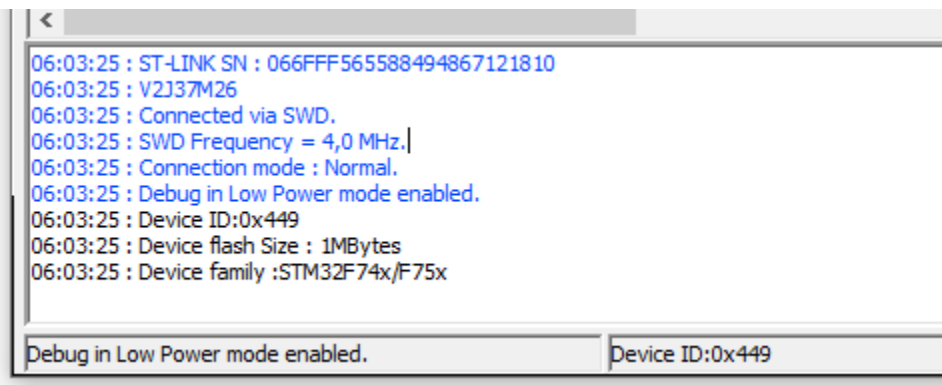


Here is a note on how to use ST-Link Utility to program the firmware on your Disco Board.

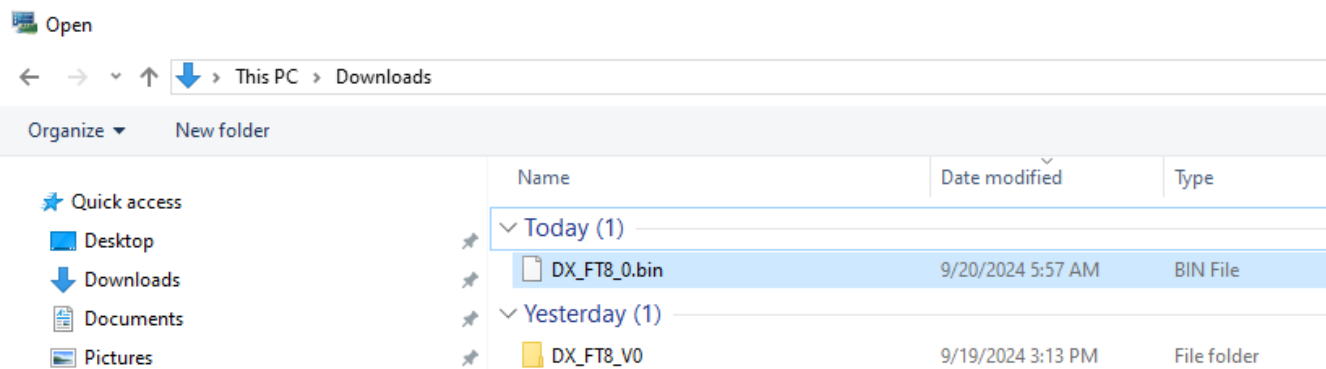
After connecting the Disco Board to your computer start the STM32 ST-Link Utility and then select the Target Tab and then select the Connect Option as shown below:



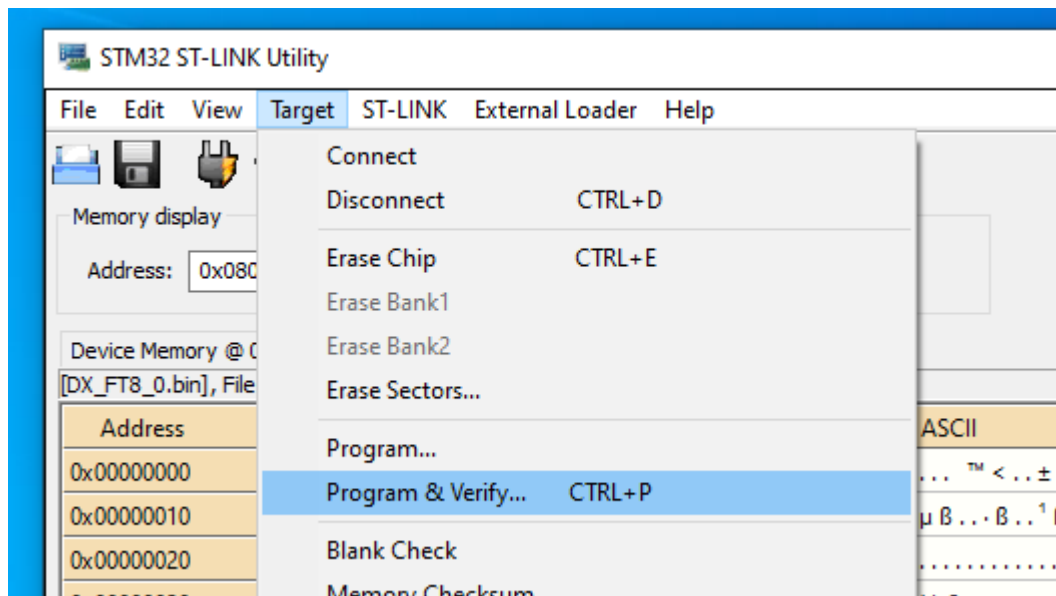
If all goes well you will confirmation of the Disco Board Connection as below:



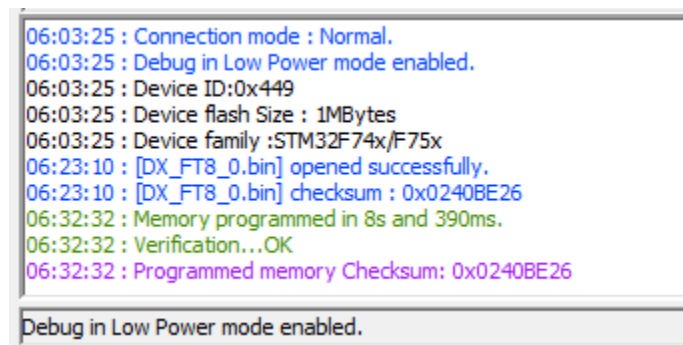
Next, using the File Tab select the Open File Option to select the DX_FT8_0.bin file that you have downloaded to your machine.



Next, using the Target Tab Select the Program & Verify Option.



When the programming is completed you will see the confirmation note shown below:

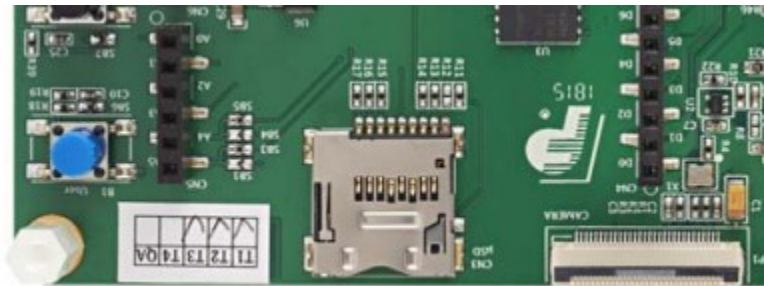


Step 4:

Format an SD Card and then create and save a file labeled “StationData.txt” which includes your Call Sign and Maidenhead Locator. Here is an example of what my station data file contains:

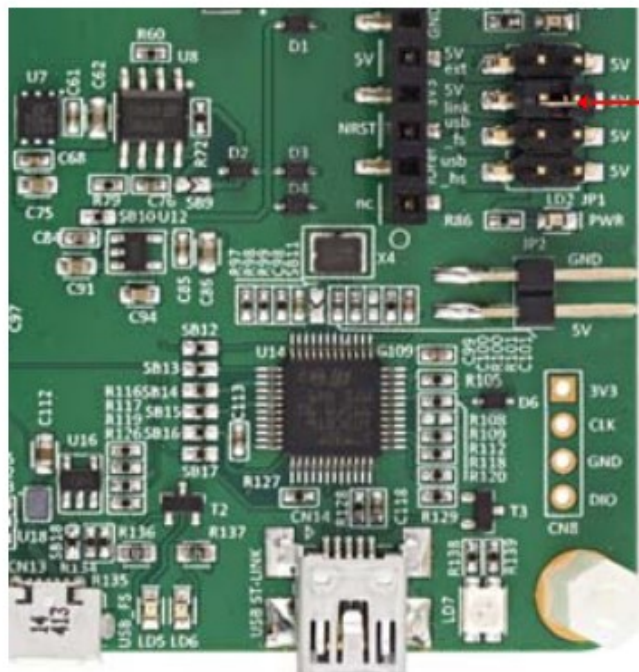
W5BAA:EM00

After creating the file on the SD Card, insert the SD Card in the SD Card Connector as shown below:

**Step 5:**

After reviewing Barb’s Notes on preparing and connecting the DX_FT8 board to the Disco Board make the required connections between the Audio IQ output of the DX_FT8 board then IQ (Line) Audio input of the Disco board.

Next, move the jumper on J1 to the 5V ext pins.



Move Jumper
To 5V ext

Step 6:

Follow Barb's instructions for setting up the input power options for the DX_FT8 board and power up the board and connect an antenna. Here us what you should see.



When you touch the Tune Button you will see the following display.



Very Important Note: The DX FT8 Firmware V1.8 Will Work With 5 Band and 7 Band Boards!

The 7 Band Boards include a Discrete Input Pin Tied to Ground.

Existing 5 Band Boards do not such a Discrete Input Pin Tied to Ground.

On Boot Up the firmware checks Discrete Input Pin to determine the board type.

The screen shot below shows the connected Board to be a 7 Band Board.



FT8 Operations Display Legend

When you first set up your unit the Real Time Clock (RTC) Date and Time will probably read as 00:00:00 or be blank. You may set the RTC Date and Time by using the Tune screen.

Clr: Touch to clear FT8 Traffic Display, momentary touch.

QSO: Touch to change FT8 Mode from QSO to Beacon, bi state touch

Tune: Touch to bring up TUNE Screen, bi state touch

Rcv: No Touch, indicates either Receive or Transmit Operation

Fixd: Touch to turn on transmit on Target's received (Rcvd) frequency, bi state touch

Sync: Touch to Synchronize FT8 Reception With Rest of World, turns from RED to BLUE on Sync

G-: Touch to reduce Receiver Gain by 1 dB.

G+: Touch to increase Receiver Gain by 1 dB.

F-: Touch to reduce transmit audio frequency by 6.25 Hz

F+: Touch to increase transmit audio frequency by 6.25 Hz

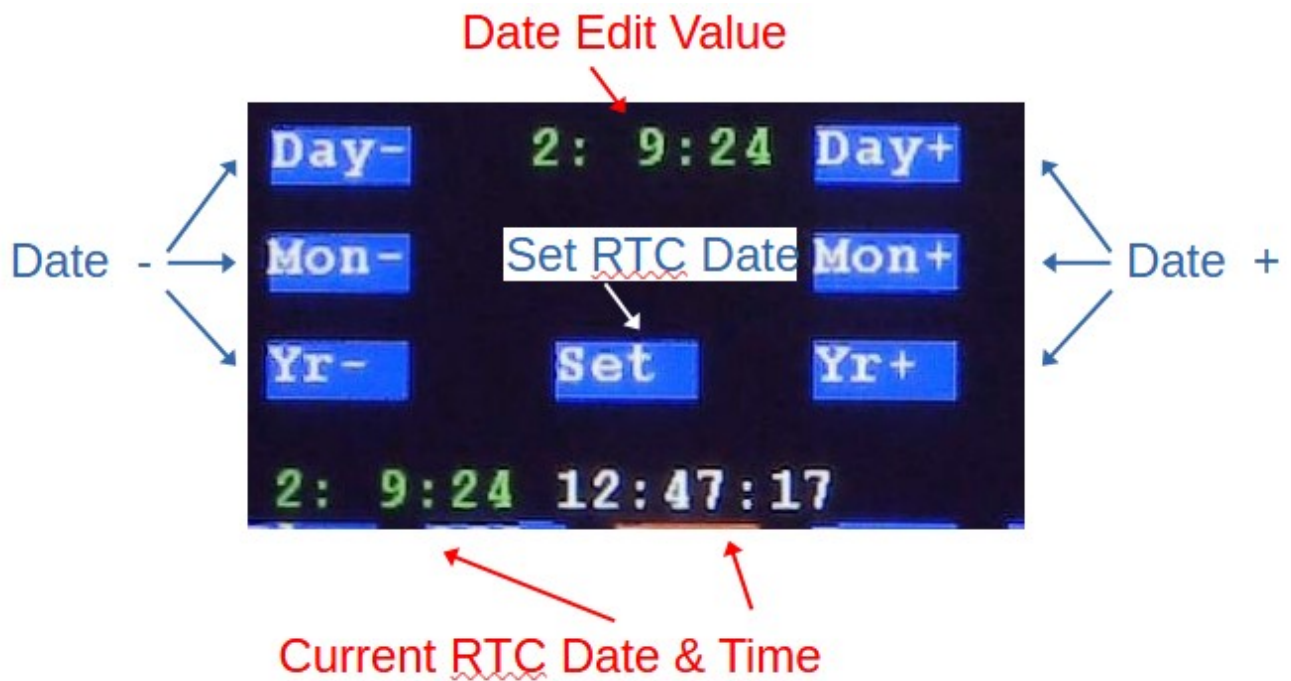
Tune Screen Data and Touch Button Legend

When you touch the **Tune Button** the unit goes into the Tune mode and additional data items and buttons will be presented as shown below:

Date / Time Edit Buttons



Date Edit Buttons



Band & Frequency Buttons



Time Synchronization With the FT8 World

In the world of FT8 time synchronization is vital. After various attempts such as using GPS Time or pure manual synchronization a more friendly semi automatic method has been developed.

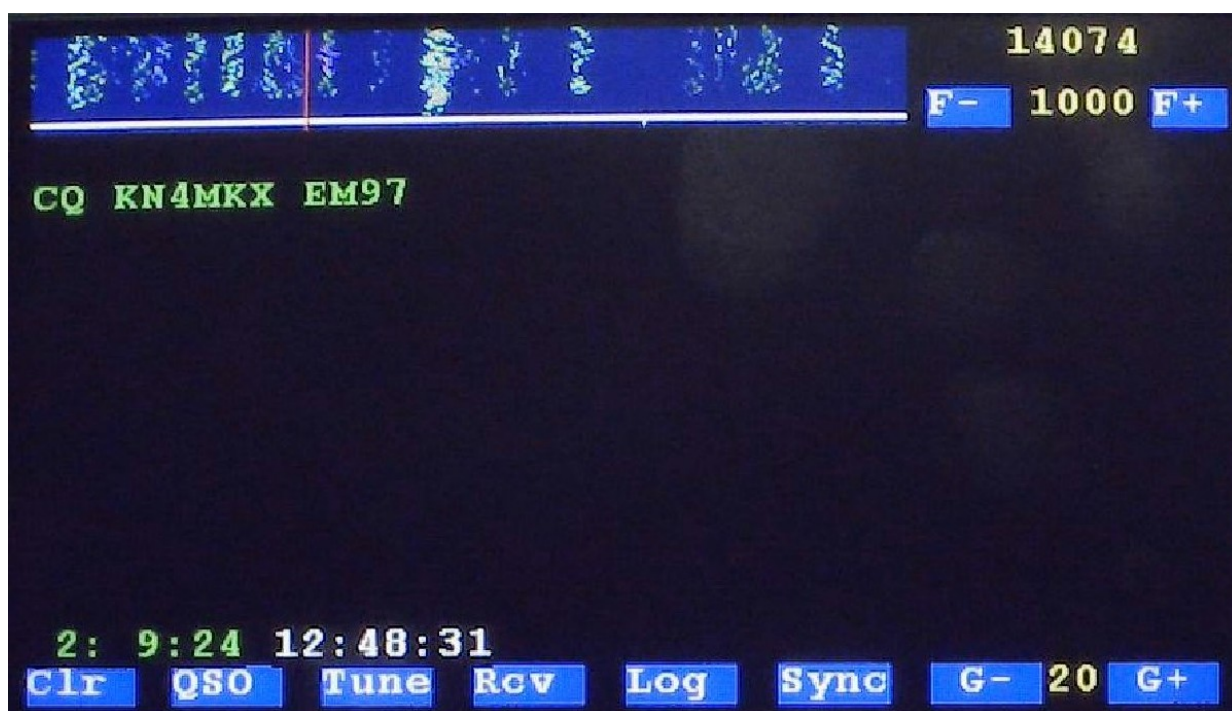
With this version of hardware the FT8 signals displayed on the waterfall are quite crisp and there is a very distinct band of no received signals at the end of each FT8 slot as shown below:



If you have noisy conditions and there is white snow at the end of the FT8 slot, use the G- button shown above until there is a distinct lull in signals at the end of the FT8 slot. Then, press the Sync button and wait.



The software searches for the lull in FT8 traffic and then sets the synchronization and the Sync Button turns BLUE and FT8 messages are decoded.



DX FT8 V1.8 Cheat Sheet Page 1: Boot Up Page

DX_FT8
Revision Levels

DX_FT8 Board Type Detected:
5 Band or 7 Band

Your Station Data Which
You Entered On SD Card



DX FT8 V1.8 Cheat Sheet Page 2: Operating Page

The screenshot shows the DX FT8 V1.8 Operating Page interface. The top section displays a waterfall view with a purple line indicating the current frequency. Below this, the main display area shows decoded FT8 messages in green and red text. At the bottom, there is a status bar with various indicators and controls.

Labels and Functions:

- Touch Waterfall To Move Offset Frequency**: Points to the waterfall view at the top.
- Offset Cursor**: Points to the purple line in the waterfall view.
- Time Sync Line**: Points to the vertical line in the waterfall view.
- Base Xmit Frequency**: Points to the frequency value 14074.
- FT8 Offset Frequency**: Points to the frequency value 1500.
- Decoded FT8 Messages**: Points to the green text "CQ POTA W6ZD EL96" and "WA3SCW N5HHS RR73".
- Touch Message To Call K8USN**: Points to the green text "CQ K8USN EM90".
- RTC Time**: Points to the time display "18:11:24".
- RTC Date**: Points to the date display "14:41:07".
- Touch To Adjust Offset Frequency**: Points to the "F-" and "F+" buttons.
- Sent / Received Message Log**: Points to the red text "AB5EO W5BAA EM00" and "W5BAA AB5EO -06".
- Clr: Touch To Clear Message Log**: Points to the "Clr" button.
- QSO: Touch For Beacon Mode**: Points to the "QSO" button.
- Beacon: Touch For QSO Mode**: Points to the "Beacon" button.
- Tune: Touch To Open Tune Page**: Points to the "Tune" button.
- Rcv: Receive Indicator**: Points to the "Rcv" button.
- Xmit: Xmit Indicator**: Points to the "Xmit" button.
- Fixd: Set Xmit Freq To Offset Frequency In QSO Mode Only**: Points to the "Fixd" button.
- Rcvd: Set Xmit Freq To Target Frequency In QSO Mode Only**: Points to the "Rcvd" button.
- Sync: Touch To Time Sync**: Points to the "Sync" button.
- Sync: Wait For Auto Sync**: Points to the "Sync" button.
- G- G+: Touch To Adjust Gain**: Points to the "G-" and "G+" buttons.

DX FT8 V1.8 Cheat Sheet Page 3: Tune Page

The screenshot shows the 'Tune' page of the DX FT8 V1.8 software. The interface is dark-themed with various buttons and text elements. Labels with arrows point to specific features:

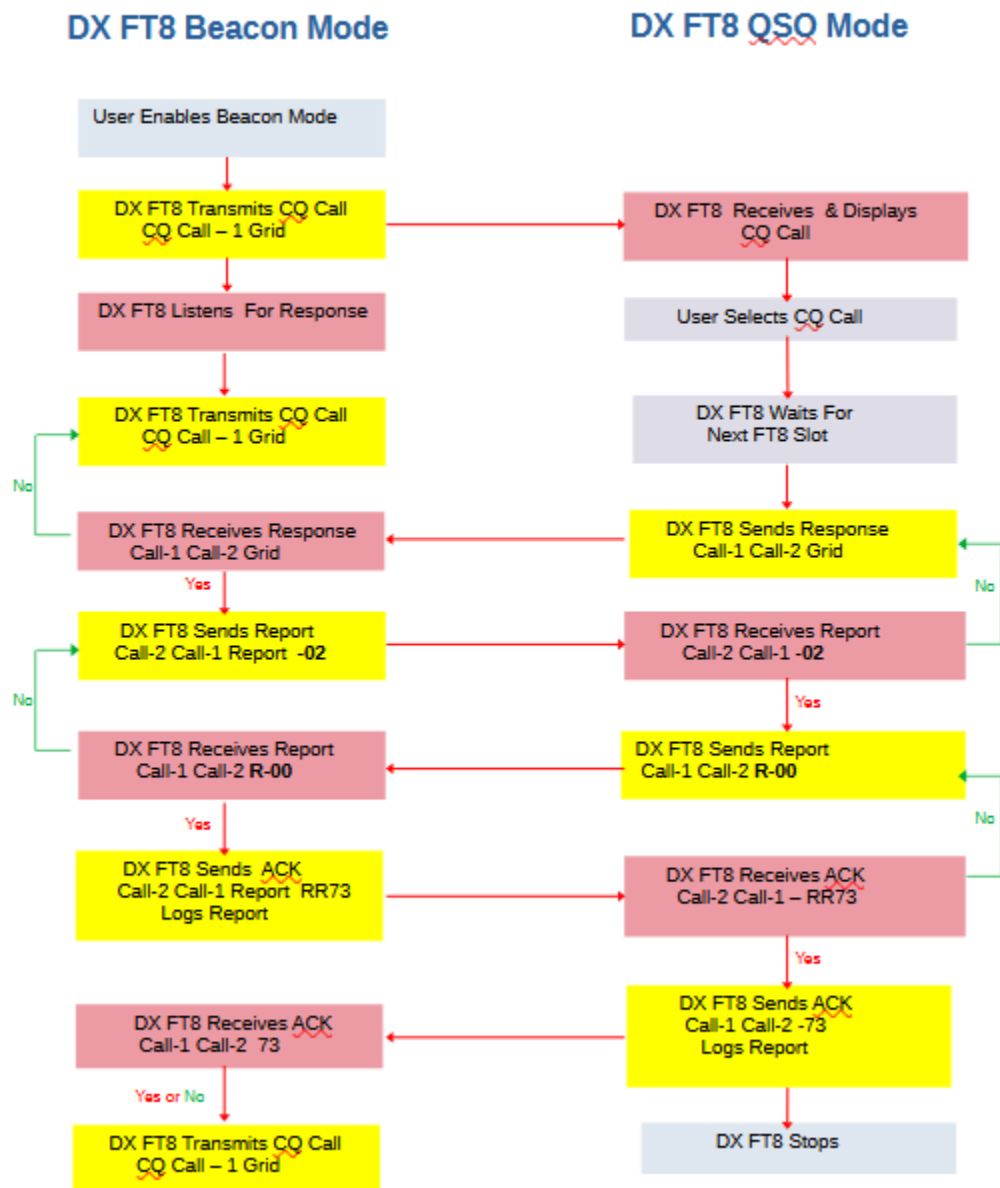
- RTC Edit Time**: Points to the top center area where the current time is displayed.
- Touch To Lower Band**: Points to the 'F-' button.
- Current Band Frequency**: Points to the '14074' frequency display.
- Touch To Raise Band**: Points to the 'F+' button.
- Edit RTC Hour - / +**: Points to the 'Hr-' button.
- Edit RTC Minutes - / +**: Points to the 'Min-' button.
- Edit RTC Seconds - / +**: Points to the 'Sec-' button.
- Touch To Set RTC Time**: Points to the 'Set' button in the RTC section.
- Edit RTC Day - / +**: Points to the 'Day-' button.
- Edit RTC Month - /**: Points to the 'Mon-' button.
- Edit RTC Year - / +**: Points to the 'Yr-' button.
- Touch To Set RTC Date**: Points to the 'Set' button in the RTC date section.
- Band-**: Points to the 'Band-' button.
- New Band Frequency**: Points to the '14074' frequency display.
- Touch To Set & Save Band**: Points to the 'Save' button.
- Xmit: Touch To Transmit**: Points to the 'Xmit' button.
- Xmit: Touch To Receive**: Points to the 'Xmit' button.
- Tune: Touch To Close Tune Page**: Points to the 'Tune' button in the bottom bar.
- RTC Edit Date**: Points to the '18:11:24' date display.

The interface includes buttons for 'Hr-', 'Min-', 'Sec-', 'Day-', 'Mon-', 'Yr-', 'Set', 'Band-', 'Save', 'Xmit', 'Clr', 'QSO', 'Tune', 'Nov', 'Fixd', 'Sync', 'G-', '20', and 'G+'. The current time is '13:48:12' and the current date is '18:11:24'.

DX FT8 Operation Flow Chart

The flow chart shown below illustrates the operation of both the QSO Mode and Beacon Mode of operation. The detail of the operations has been developed by recording and analyzing actual “On The Air FT8 Traffic”.

DX FT8 Auto Sequence Process Operation



FT8 Contact Logging

DX FT8 automatically logs FT8 Contacts as they are made. Contact entries are made when the firmware sends either a “RR73 Message” or a “73 Message”.

DX FT8 Log Files are written in the ADIF Format and may be viewed in ADIFMaster as shown below: Log Files are stored on the SD Card and have the filename of the current RTC Date, for example “20250103.adif”.

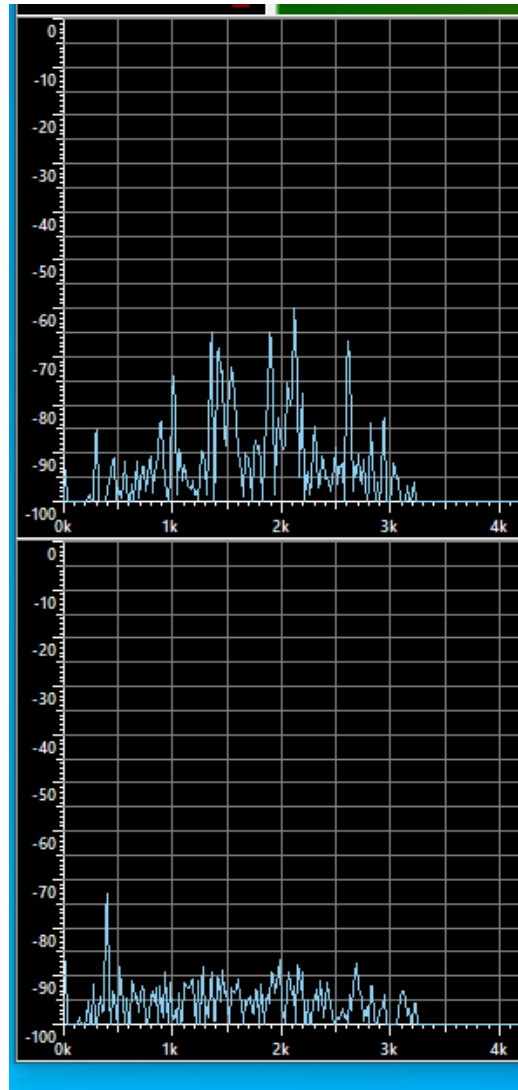
The ADIFMaster Application may be downloaded from this site: <https://www.adif.org/>

▲ ADIFMaster - G:\20250102.adif

#	CALL	GRIDSQUARE	MODE	QSO_DATE	TIME_ON	FREQ	STATION_CALLSIGN	MY_GRIDSQUARE	RST_SENT	RST_RCVD	TX_PWR
1	KC9YTT	EN40	FT8	20250102	004000	14.075	W5BAA	EM00	-3	-5	0.5
2	KC9ZTY	EN53	FT8	20250102	004300	14.075	W5BAA	EM00	1	-5	0.5
3	KD9SZQ	EN54	FT8	20250102	004630	14.075	W5BAA	EM00	-6	-8	0.5
4	KE9SX	EN80	FT8	20250102	005600	14.075	W5BAA	EM00	0	-11	0.5
5	KK4TCE	FM18	FT8	20250102	010530	14.075	W5BAA	EM00	0	-3	0.5
6	KD9JZD	EM69	FT8	20250102	010530	14.075	W5BAA	EM00	-1	-2	0.5
7	AB8YF		FT8	20250102	012900	14.075	W5BAA	EM00	-3	-8	0.5
8	W6KCV	DM03	FT8	20250102	021430	14.075	W5BAA	EM00	-3	-13	0.5
9	N7VAZ	DM09	FT8	20250102	033130	14.075	W5BAA	EM00	-13	-16	0.5
10	N6GEE	CM88	FT8	20250102	033330	14.075	W5BAA	EM00	-6	-18	0.5
11	N7TND		FT8	20250102	152430	14.075	W5BAA	EM00	-4	-11	0.5
12	KG5HXR	EM26	FT8	20250102	165444	14.075	W5BAA	EM00	-7	12	0.5
13	KB4DFK	EM86	FT8	20250102	172259	14.075	W5BAA	EM00	-3	5	0.5
14	AA7JB	DM41	FT8	20250102	194744	14.075	W5BAA	EM00	-1	0	0.5
15	AB5GC	EM48	FT8	20250102	210144	14.075	W5BAA	EM00	0	-17	0.5
16	KB4KFT	EM73	FT8	20250102	233514	14.075	W5BAA	EM00	-3	-12	0.5
17	W4MAB	DM79	FT8	20250102	235044	14.075	W5BAA	EM00	-3	-19	0.5
18	W3JRW	FM18	FT8	20250102	235544	14.075	W5BAA	EM00	0	-17	0.5

Monitoring Receiver Audio Output

The demodulated signal audio output may be observed via the Green 3.5 mm stereo audio jack, CN10. The top audio spectrum is the received Upper Sideband Audio and the bottom spectrum is the Lower Sideband Audio. Please note the excellent unwanted sideband suppression from DX FT8 board.



A nice tool for observing the audio output is an application called “Goldwave” which may be found here: <https://goldwave.com/>

Extra Benefits

One of the key benefits of the STM32F746 board that has significantly contributed to the success of the DX FT8 project are the ARDUINO connectors shown below. All signals except for the IQ Audio signals required for this project are made thru these connectors. Also the required power connections are made thru these connectors.

Table 5. ARDUINO® connectors (CN4, CN5, CN6 and CN7)

Left connectors						Right connectors				
CN No.	Pin No.	Pin name	STM32 pin	Function		Function	STM32 pin	Pin name	Pin No.	CN No.
						I2C1_SCL	PB8	D15	10	CN7 digital
						I2C1_SDA	PB9	D14	9	
						AVDD	-	AREF	8	
						Ground	-	GND	7	
CN6 power	1	NC	-	-		SPI2_SCK	PI1	D13	6	
	2	IOREF	-	3.3V Ref		SPI2_MISO	PB14	D12	5	
	3	RESET	NRST	RESET		TIM12_CH2, SPI2_MOSI	PB15	D11	4	
	4	+3V3	-	3.3V input/output		TIM1_CH1	PA8	D10	3	
	5	+5V	-	5V output		TIM2_CH1	PA15	D9	2	
	6	GND	-	Ground		-	PI2	D8	1	
	7	GND	-	Ground		-				
-					-	PI3	D7	8	CN4 digital	
					TIM12_CH1	PH6	D6	7		
CN5 analog	1	A0	PA0	ADC3_IN0	TIM5_CH4, SPI2_NSS	PI0	D5	6		
	2	A1	PF10	ADC3_IN8	-	PG7	D4	5		
	3	A2	PF9	ADC3_IN7	TIM3_CH1	PB4	D3	4		
	4	A3	PF8	ADC3_IN6	-	PG6	D2	3		
	5	A4	PF7 or PB ⁽¹⁾	ADC3_IN5 (PF7) or I2C1_SDA (PB9)	USART6_TX	PC6	D1	2		
	6	A5	PF6 or PB8 ⁽¹⁾	ADC3_IN4 (PC0) or I2C1_SCL (PB8)	USART6_RX	PC7	D0	1		

1. Refer to [Table 12](#) for details.