**********KW4KD decoder**********

draft draft draft you are welcome to add/ correct this draft

****

First Time Use Initialization:

After a .bin load or reload, see this paragraph, found on page 2 of this document, for first time startup

The Stock Screen and LED:

LED response to variable tone:

initial default center frequency 750 Hz
green - center frequency+/-25 Hz
red - below center frequency
blue - above center frequency
white - when volume is excessive
no light – no usable tone received
example of user action to led response:
cw pitch of ic 718 was preset to 700 – changed it to 750 hz for the decoder
a test source with variable and identified oscillator tone, volume and speed is useful in understanding the decoder response

Display:

top 80% reserved for decoding
no reaction to touch input
bottom 20% of the screen- information and selection of options
stylus that came with the screen is good tool for screen picks- if misplaced, a none metal object with a blunt point can be used
reaction to touch input is active- use the stylus
lower left information area - 4 modes:
1. 16/3.5 (Speed)/ (“dit” to “dah” ratio)
2. 60/180/60 (time in ms of dit/dah/space)
3. 750hz (incoming tone freq, or locked mode center frequency)
4. 5.0/1 (signal to noise ratio*)

Clear Button - 2 functions
1. quick tap – clear screen & WPM reset to 15wpm

2. press and hold- go to settings/options screen
   See “Setup Screen” below for more detail

Center Button – selects 4 decoding modes
1. Norm – good for 95% of senders
2. Bug1- sender style 1
3. Bug2 - sender style 2
4. Bug3 – sender w/ “cootie” style fist

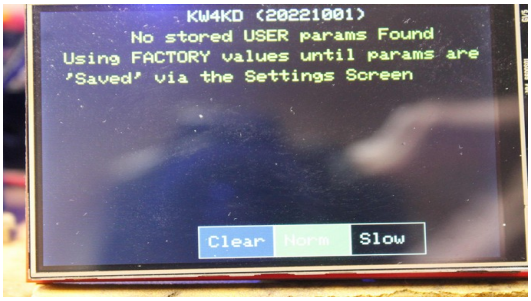
Right Button – (sample interval) 2 modes
1. Slow – 2x data points taken – repeat tap for fast
   Use this setting for routine decoding
2. Fast – 1x data points taken -
   Disadvantage – Stronger signal needed to detect a valid tone
   Advantage - 2x improvement in timing (Tone vs No Tone)
   Use this setting with high speed code, or Senders using “cootie” keys

*not functional in the current version

First Time Use Initiation:

This section describes, in a general way, the first time the decoder is started

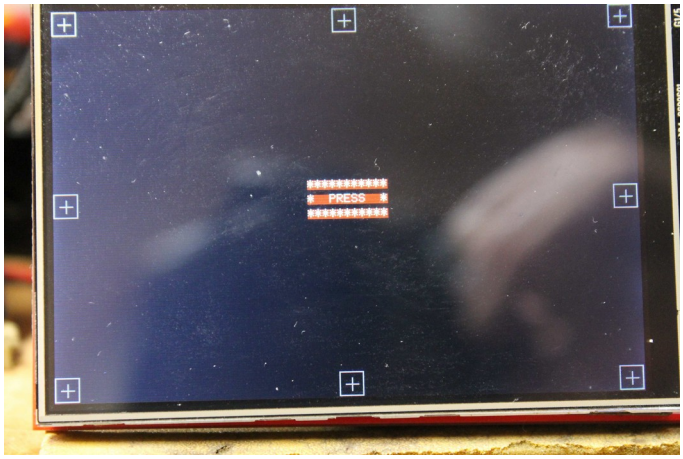
screens:



Start Screen: Will automatically advance to the following screen

Screen1: Instructions - very small font; Touch anywhere to advance

Note: Ignore text, “Report can be pasted from USB Serial”



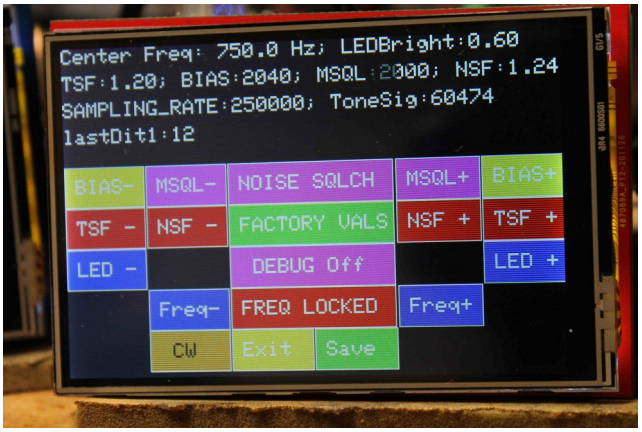
Screen2: Calibration screen; eight touch points [+] to a screen – touch stylus to mark/calibrate the active point.

Note: app may have you repeat this process twice

After completion of calibration, the program will return to the normal “decode” screen (shown on 1st page)

Long press “Clear” button to take you to the Setting/options screen, and press “Save” to store your touch screen calibration parameters.

Setup Screen



In the setup mode, the user can adjust, & save, the following parameters:

1. Bias (+/-) ; value to subtract from ADC sample to remove the microphone's DC offset
2. MSQL(+/-); Squelch value to use when tone detector is operating in MAN SQLCH mode
3. TSF(+/-); “Tone Scale Factor”; Not Functional in the current version.
4. NSF(+/-); “Noise Scale Factor”; speaker dependent; Adjust for best tone detection.
5. LED(+/-); Sets LED’s maximum brightness.
6. Freq(+/-); Tone detect Frequency; Manually change the tone detect center frequency; Use only when in the "FREQ LOCKED" Tone mode.
7. Squelch Mode (NOISE SQLCH / MAN SQLCH); no explanation needed
8. Factory Vals; return decoder to sketch’s default values.
9. Debug Mode (OFF / Plot / Decode); When not OFF, use the Arduino IDE plot /serial monitor tools, via USB serial connection.
10. Tone mode (AUTO Tune / FREQ LOCKED)

The setup screen has three additional buttons:

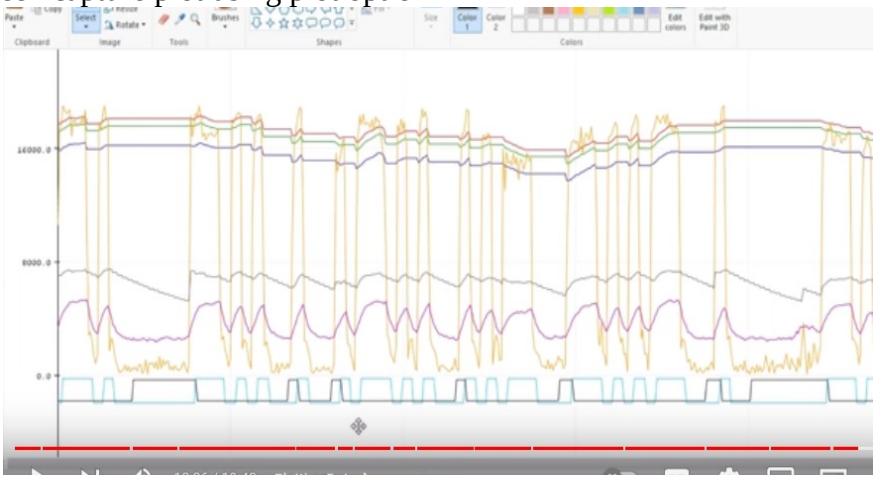
1. Program Select – 5 choices
2. Exit (leave the Setup mode; return to selected Program choice)
3. Save (Store the current settings to Flash memory)

Inside the Decoder- 3 programs running:

1. time based interrupt - tone sensing- based on Goertzel algorithm, and MPU's onboard ADC to digitize incoming analog signal
2. hardware interrupt- logic of how to class low to high transition as a "dit" or "dah"
3. parsing process and screen management loop

Arduino IDE interface

plot option under tool menu
usb serial port to access
screen capture plot using plot option



traces

above zero line:

1- orange- magnitude of the virtual algorithm
2-3-4- red green blue- low- high center frequency component
5- purple – noise magnitude
6- gray – current squelch value

below zero line

aqua – key state – high key closed
black – letter break timing group- interpret dits and dahs groups

Supplemental Notes:

Handling special cases when answering a CQ when using the decoder:

1. The OP may answer you with exact zero beat- not a special case
2. The OP may answer high or low to your calling frequency- special case
   - the OPs signal may be close to your frequency and dominating and decoder will follow to the signal without changing your transmit frequency- nothing required
   - the Ops signal may be weak yet you need decoder help to read it

it is not good form to move your main VFO A to his off frequency because the OP is listening for you where he last heard you when he goes back to you

solutions to change the receive frequency without changing the transmit frequency:

- some receivers have a second VFO B that is an improved RIT function
- the remaining receivers are likely to have a RIT shift that changes the receive frequency without changing the transmit frequency

both of these solutions may require some radio operator practice to use quickly

If you have concerns about the performance of the sound input circuit that you have supplied for mic input- Use the bottom left button (the program select button) to select the "FFT" program. And then to launch the FFT program, touch the "Exit" button. It will take it a few seconds to settle down. But if there is any incoming signal, the FFT view will show it.
If audio presence shows a peak on the FFT graph and the sound supplied is at the volume and tone you expect to be recognized - then your input circuit is working properly.

Users of the KW4KD Decoder are encouraged to add their improvements to this document and re-save it in place. Log your change below. Contact the developer if you feel your change needs his attention.

Document Change Log-
Format: call sign, date, brief (25 words max) description of change.
KI4EZC, 10/8/2022 Created Original Document
Kw4kd, 10/9/2022, minor edits & inserted info related to setup/options screen
KI4EZC, 10/9/2022, Added Handling special cases