Sound card data modes and NBEMS

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Agenda

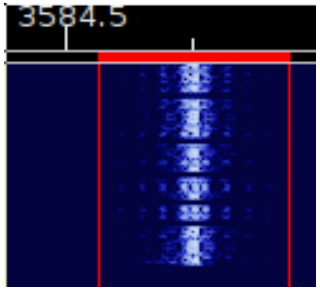
- Overview of available digital modes
- Applications to auxiliary communications
- Hardware
- Software
- Demo

Audio samples

- Audio samples for the modes mentioned in the following slides can be found here:
  - Modes supported by fldigi: http://www.w1hkj.com/FldigiHelp-3.21/Modes/index.htm
  - Additional audio samples: http://wb8nut.com/digital/

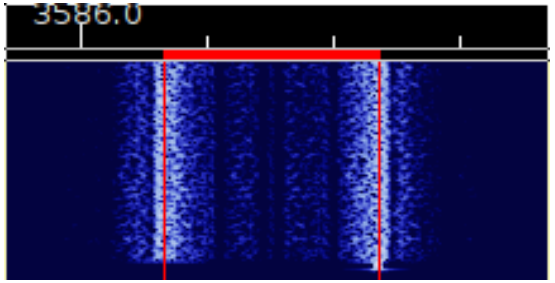
Original digital modes

- CW
  - On-Off keying of the carrier
  - Very narrow bandwidth
  - No error correction



Original digital modes

- RTTY
  - Frequency Shift Keying, typically 170 Hz shift
  - 100% duty cycle
  - As fast as 20 wpm CW
  - Still popular for contesting
  - No error correction
  - Requires:
    - FSK radio and keying circuit or…
    - AFSK using sound card



Hardware decoder modes

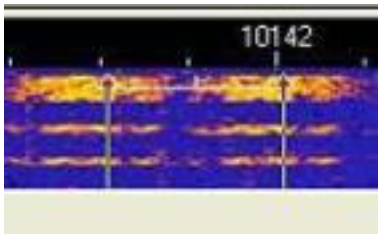
- AX.25 Packet
  - Error detection, retransmit until it's correct (ARQ)
  - Store and Forward, digipeaters
  - 1200 baud common, 19,200 baud max
  - Dedicated TNC or sound card packet engine
  - Used on HF (300 baud), VHF (1200 baud), or UHF (9600+ baud)
  - APRS uses Packet

Hardware decoder modes

- AMTOR (aka SITOR)
  - Specialized form of RTTY
    - FSK at 100 baud
  - Error detection and correction, ARQ
  - Hardware or software
  - No longer popular

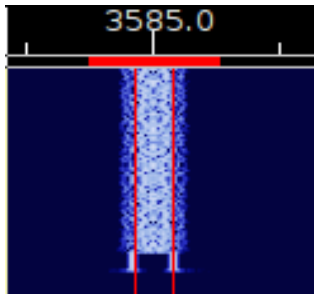
Hardware decoder modes

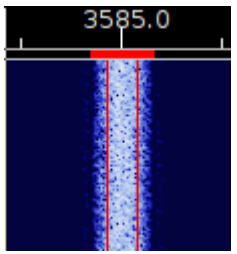
- PACTOR I/II/III
  - Combination of Packet and AMTOR
  - Error correction, ARQ
  - Can send large files in difficult conditions
  - Hardware only, PACTOR I can be RX w/ software
  - PACTOR II and III are proprietary
- Clover
  - PSK, full duplex
  - Proprietary



Sound card modes

- BPSK 31, 63, 125
  - Binary phase shift keying
  - No error correction
  - BPSK-31 (aka PSK-31) is popular for keyboard-to-keyboard QSOs
- QPSK 31, 63, 125
  - Quad phase shift keying

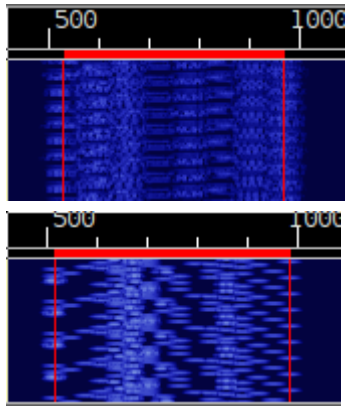




Sound card modes

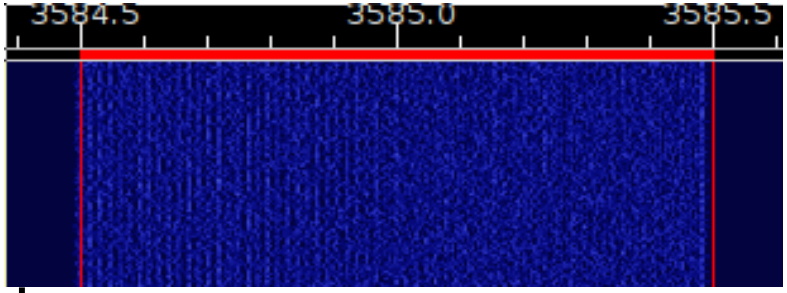
- Olivia MFSK
  - Olivia X / Y, X=number of tones, Y=bandwidth
  - Usable with very weak signals
  - Forward Error Correction
  - Olivia 8/500

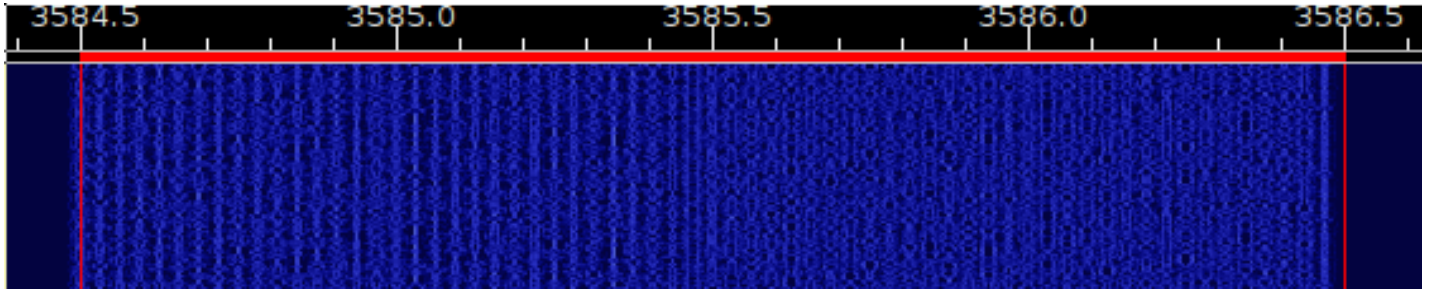
    Olivia 16/500



Sound card modes

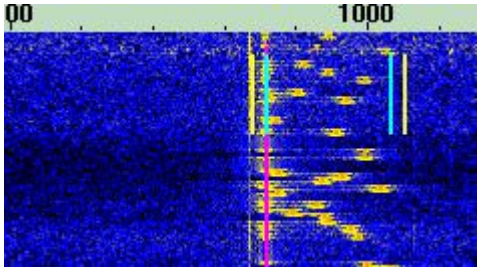
- MT63
  - Fast, noise resistant
  - PSK
  - 500 Hz, 1000 Hz, or 2000 Hz
  - Forward Error Correction
  - MT63-2KL takes about 1 minute per kb





Sound card modes

- JT65
  JT9
  - Very weak signal
    - Good for moon bounce or low-profile antennas
  - Very slow data rate
    - Exchange callsign and location, not much else



WinLink

- World-wide message (e-mail) system that uses radio and the Internet
- Hub and spoke system of Radio Message Servers (RMS) and Common Message Servers (CMS)
  - Users connect to an RMS
  - RMS's connect to a CMS
- AX.25 Packet on VHF/UHF
- Pactor I/II/III or WinMor on HF
  - WinMor—non-proprietary sound card mode

Auxiliary Communications Applications

- Served agencies have an increasing need for accurate data communications
  - Roster of evacuees
  - Lists of medications
  - Complicated directions to a site
- Error correcting modes a plus
- Must be easy to configure in the field
- We need to provide more than just voice comms from a ham with a handheld radio.

Narrow Band Emergency Message System (NBEMS)

- Keep it cheap
- Keep it simple
- Use open source software
- Don’t depend on infrastructure (repeaters, digipeaters, Internet)
- Make it fun
- Any computer, any radio.

Narrow Band Emergency Message System (NBEMS)

- Uses several programs developed by W1HJK
  - fldigi – general purpose data engine
  - flmsg – messages handling, ARRL Radiograms, ICS forms, weather reports
  - flarq/flwrap – file transfer, file compression
  - flamp – multi-cast file transfer
- Public License, i.e. free
- Windows, Linux, Mac versions

What hardware?

- Radio
- Antenna
- Power supply
- Computer (Windows, Linux, Mac)
- Sound card interface
  - On VHF/UHF, can use audio coupling.

Sound Card Interface Requirements

- Rx audio from radio to computer sound card
- Tx audio from computer sound card to radio
  - Both Rx and Tx need good audio isolation
  - Easy level adjustments a plus
- PTT
  - VOX will work
  - Hardware keying better
- Built-in USB sound card
  - Use computer's sound card at your own risk.

Sound Card Interface Options

- Homebrew
- BuxComm Rascal GLX ($80)
- MFJ-1204 ($100)
- Tigertronics SignaLink USB ($120)
- West Mountain Radio RIGblaster Advantage ($200)
- ZLP Electronics various models ($50-240)
- Microham Digikeyer II ($329)
- Timewave Navigator ($375).

Radios with built-in sound cards

- Icom
  - IC-7100
  - IC-7200
  - IC-7300
  - IC-7600
- Kenwood
  - TS-590
- Yaesu
  - FT-991A.

How to configure hardware?

- Build or buy a cable to connect sound card interface to radio
- Configure sound card interface
  - Set jumpers
- Install drivers
- Connect USB cable
- Check Windows Device Manager for COM port assignment.

How to configure radio?

- Upper Sideband (USB) for most digital modes
- Receive
  - Turn off noise reduction, notch filter, noise blanker
  - Fast AGC
  - Use IF bandwidth adjustment with caution
- Transmit
  - Turn off compression
  - Turn off equalization
  - Adjust sound card level and mic gain for minimum ALC action
  - Medium power.

Acoustic interface

- No sound card interface needed
- Use any radio
- Hold radio speaker to computer mic
- Hold radio mic to computer speaker
- Manual PTT
- Works well on VHF/UHF FM
  - Even through repeaters
- Use MT63-2KL mode.

fldigi

- fldigi=Fast, Light, Digital
- Uses sound card to decode received signals and encode transmitted signals
- Keys radio (if supported by interface)
- Old, slow computers work fine
- Designed for keyboad-to-keyboard comms
- Macros eliminate repetitive typing.

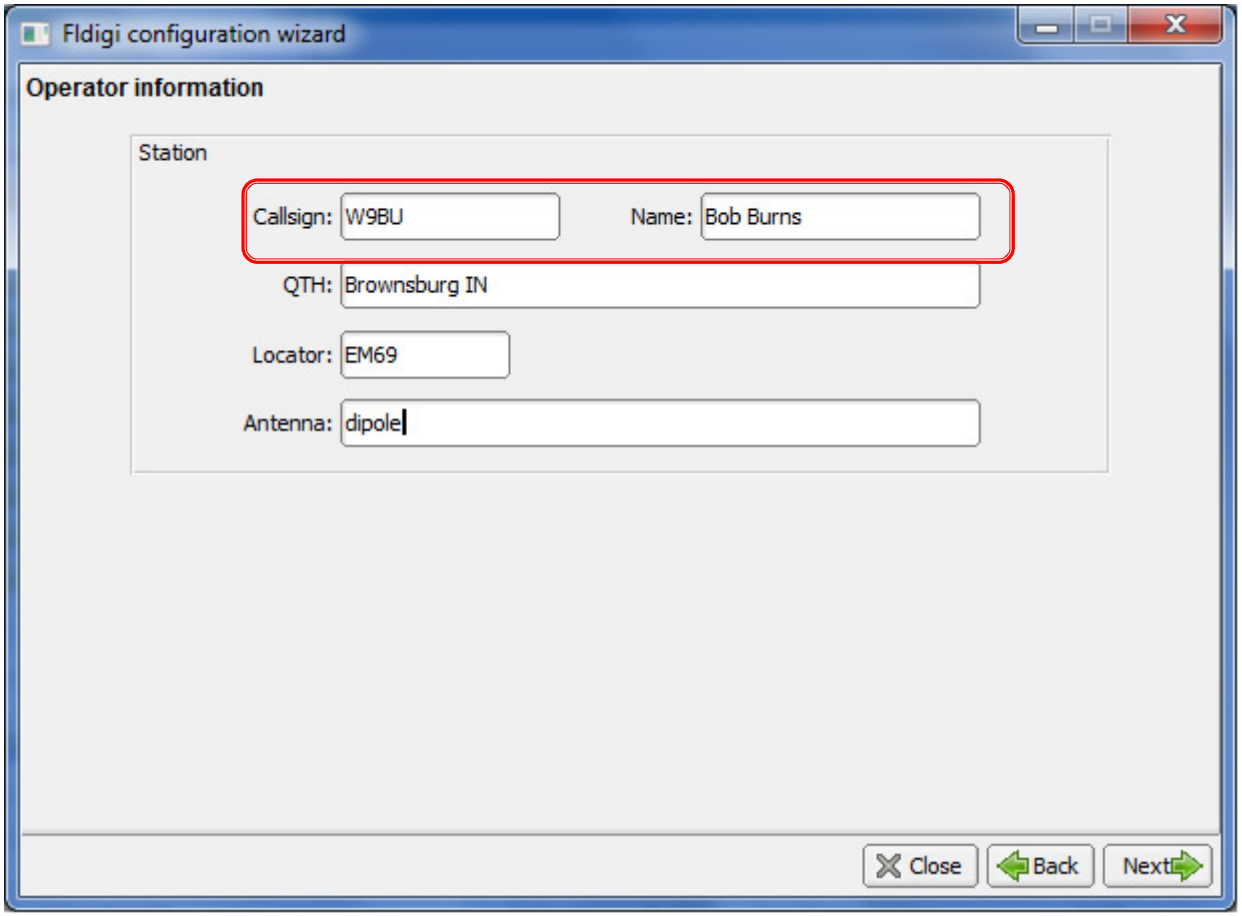
flmsg

- Built-in templates for common message formats:
  - ARRL Radiograms
  - ICS forms
  - Custom templates
- Uses check-sums to ensure accuracy
  - Sending station computes check-sum for sent message and inserts check-sum into message
  - Receiving station computes check-sum for received message and compares to sent check-sum
  - If check-sums match, error-free message
  - If check-sums don't match, resend message
- flmsg can automatically open received messages.

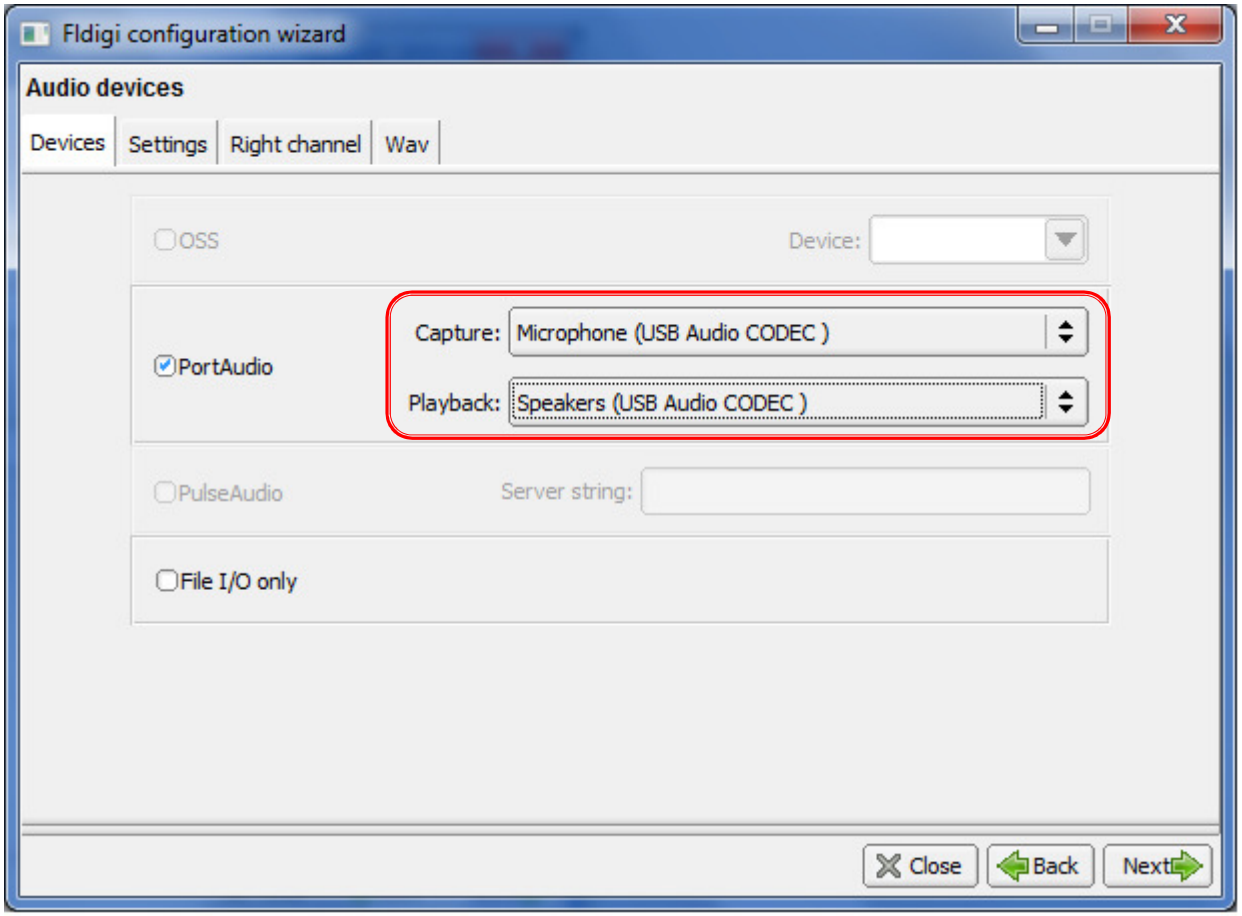
How to configure software?

- Download and install fldigi
  - Configure settings
- Download and install flmsg
  - Configure settings.

fldigi set-up wizard—Operator info

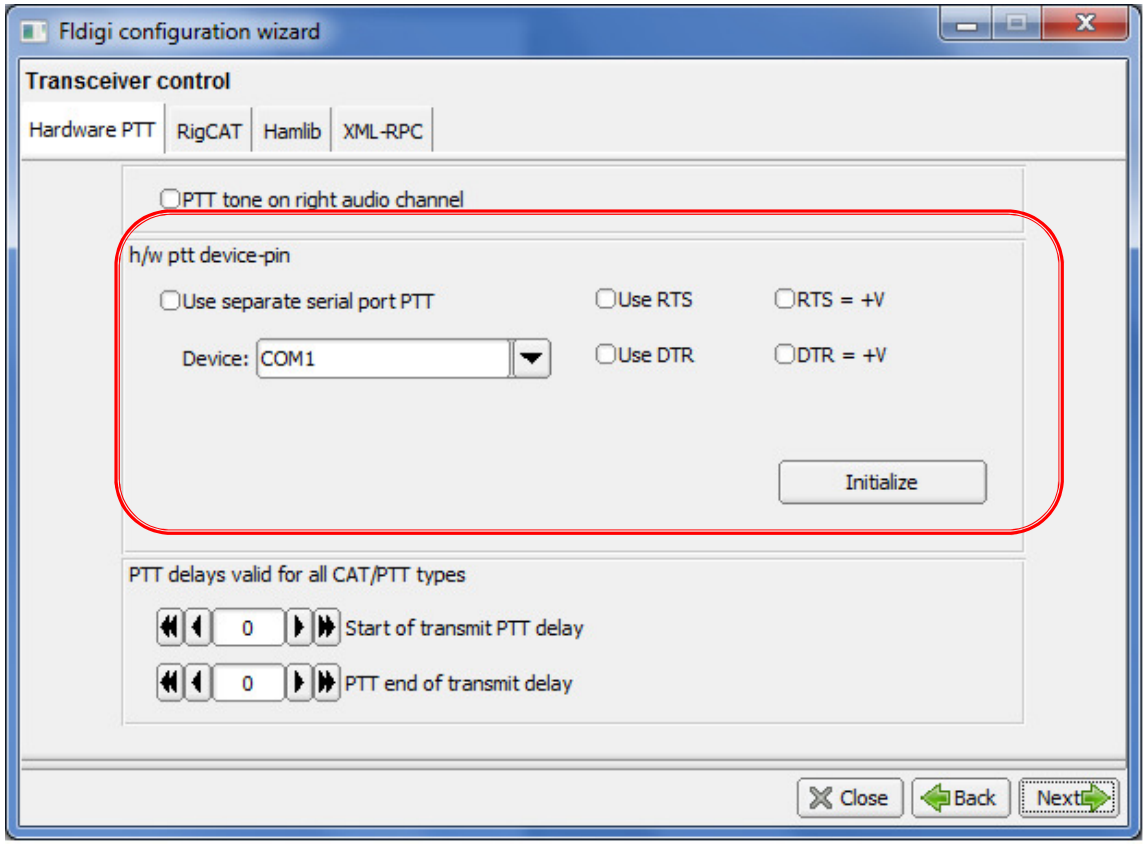


fldigi set-up wizard—Audio devices



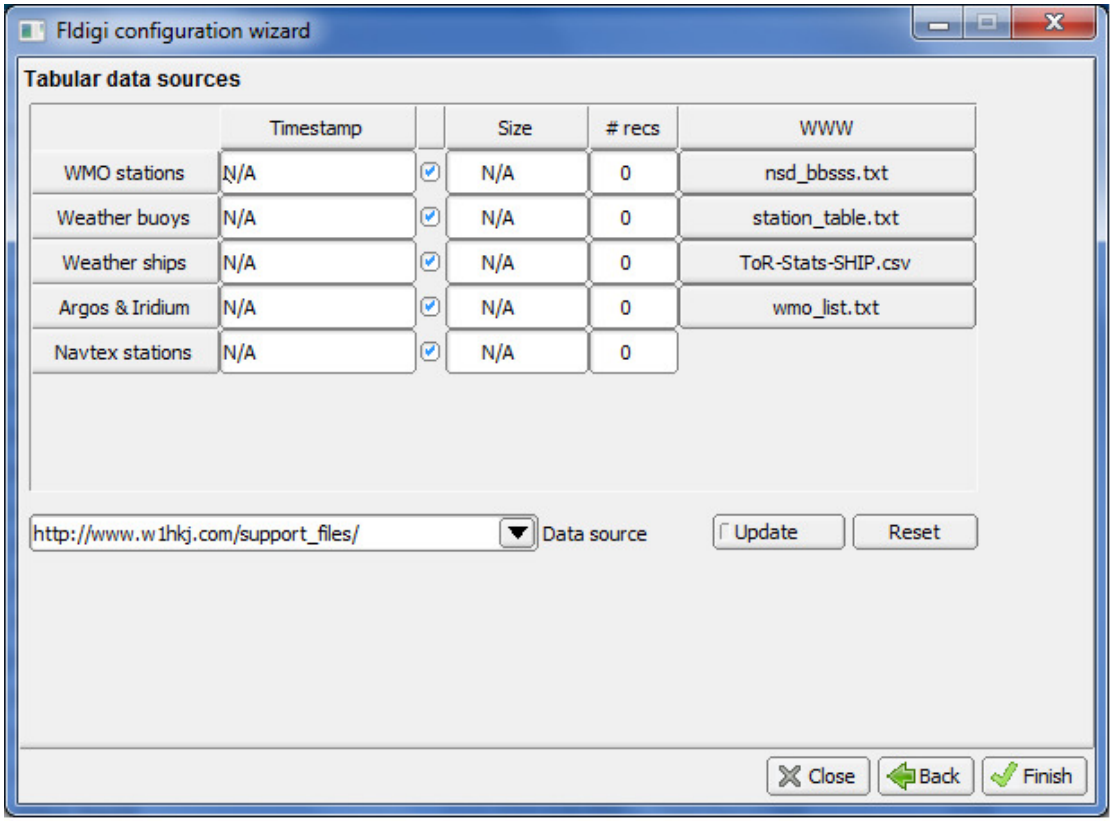
fldigi set-up wizard—Transceiver

(only if your sound card interface has transceiver control)

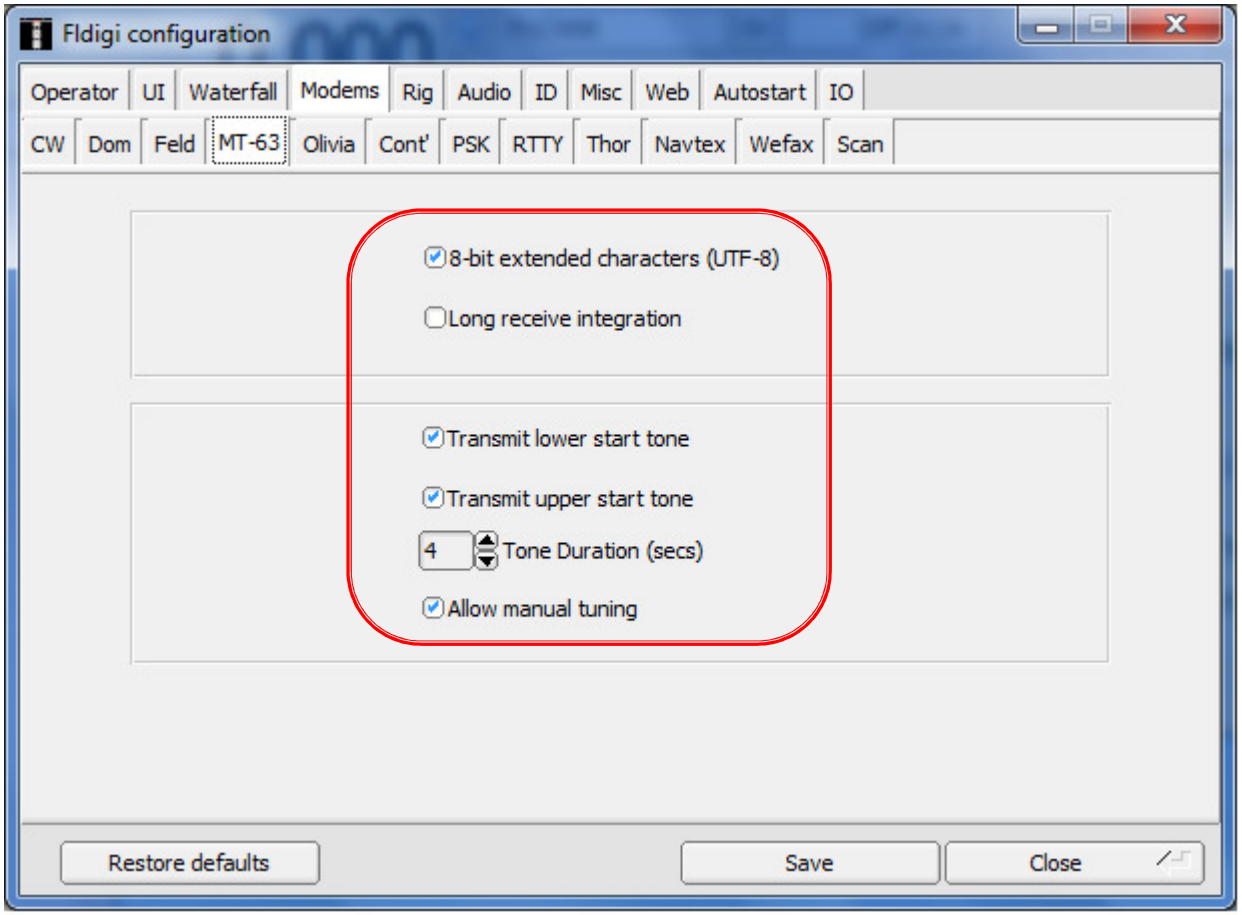


fldigi set-up wizard—Tabular data

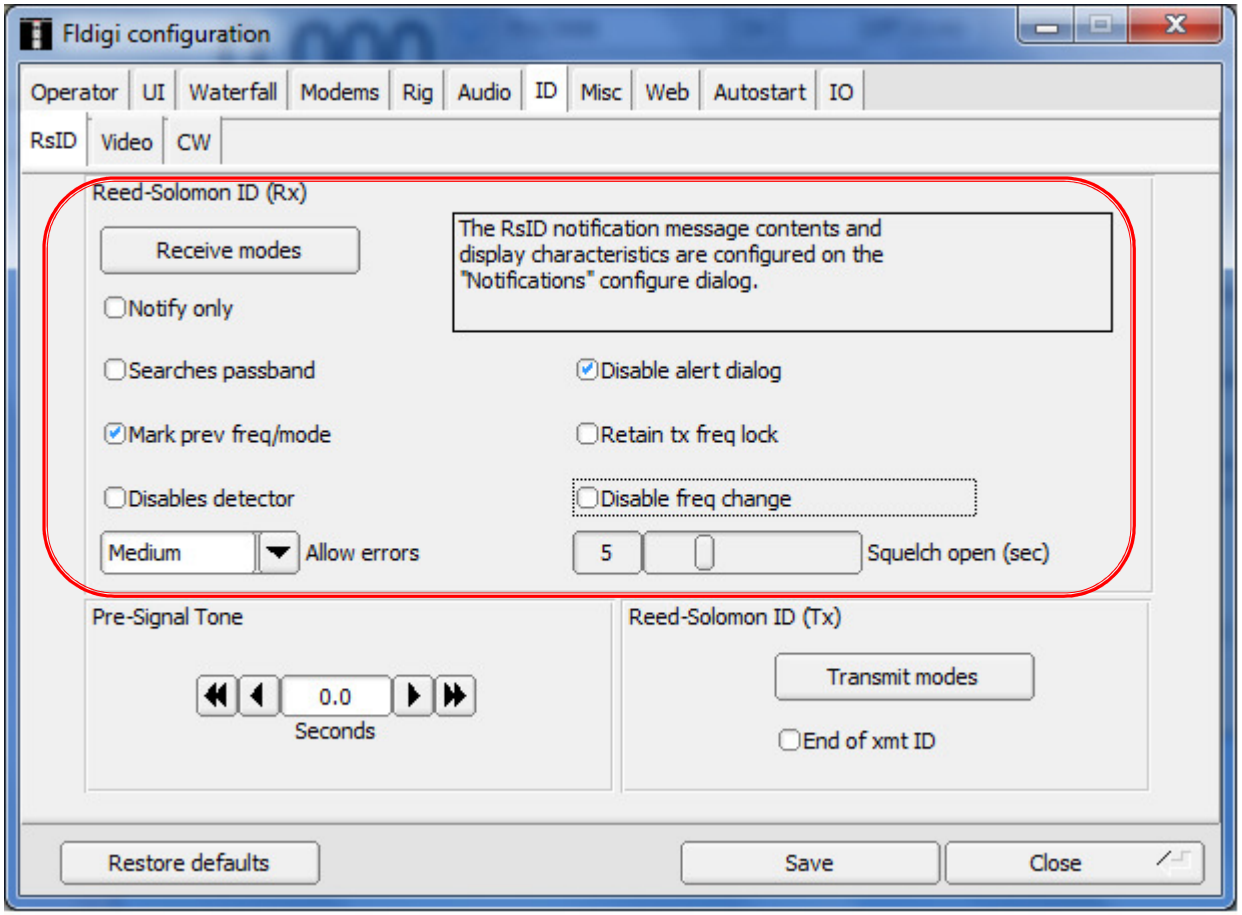
(not necessary for NBEMS)



fldigi addl set-up—Modems—MT63



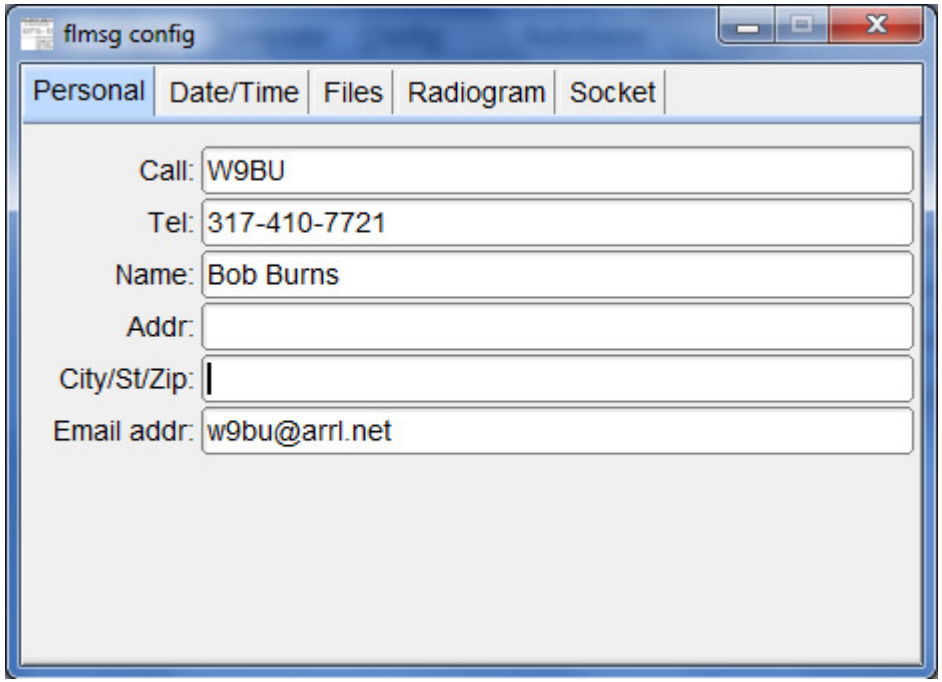
fldigi addl set-up—RSID



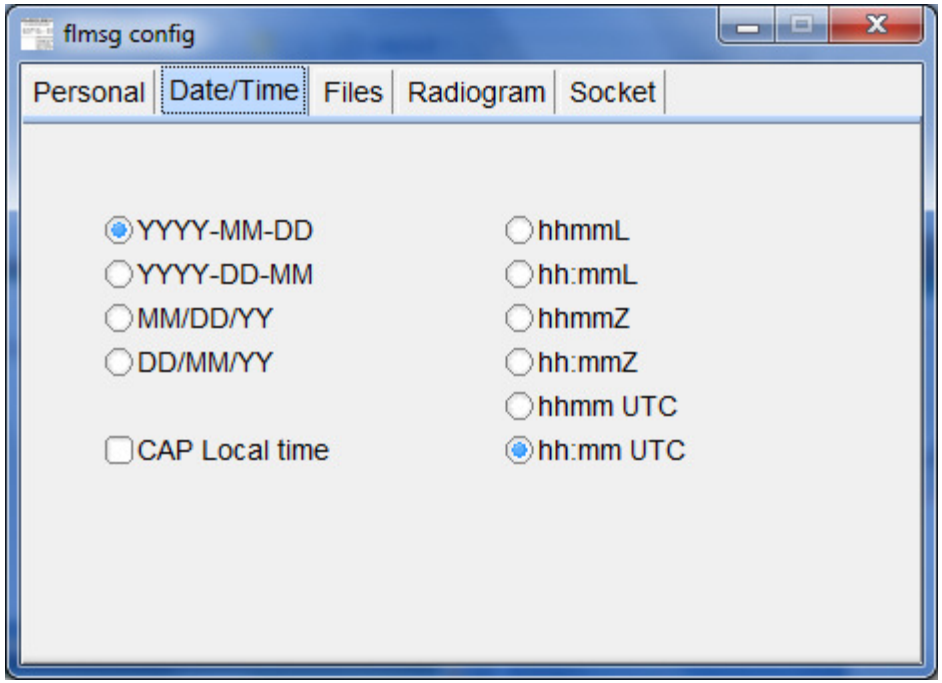
fldigi addl set-up—RSID enable

- Enable RxID on main window
- Enable TxID on main window

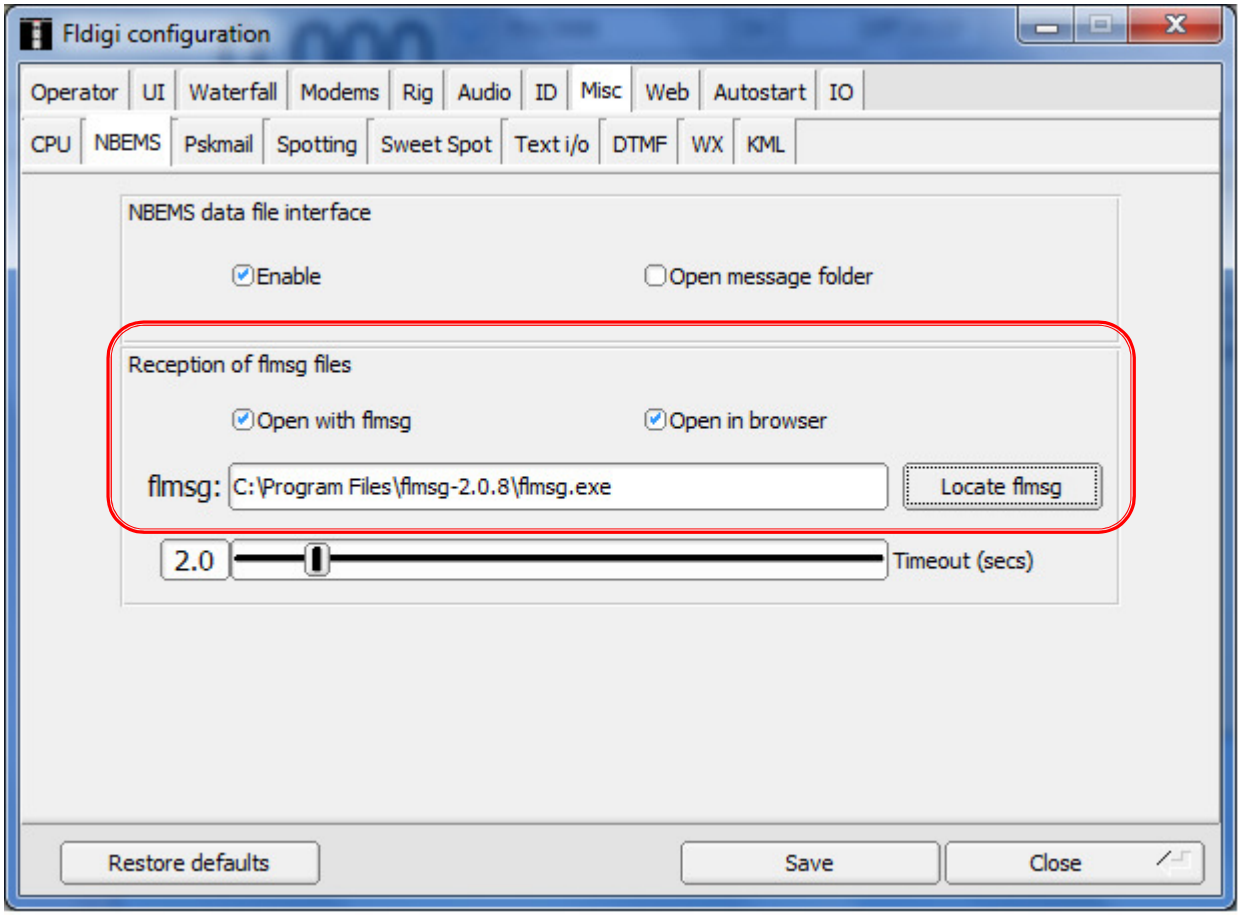
flmsg set-up—Personal



flmsg set-up—Date/Time



Configure fldigi for NBEMS



Advanced topics

- Using flarq/flwrap for file transfer
  - Binary files
- Using flamp for multi-casting
- Sound card calibration
- Packet for local VHF/UHF
  - OutpostPMM
- Promote local activity.

Practice, practice, practice

- Check into nets
  - IN DTN, 3.5840 +1 kHz, Mon-Fri 9:00am, Olivia 8/500 *
  - MI DTN, 3.5830 MHz +1 kHz, Tue/Thu/Sat 8:00pm, Olivia 8/500 *
  - KY DN, 3.5850 MHz +1 kHz, Wed 8:30pm, BPSK-31 *
  - OHDEN, 3.585 MHz +1 kHz, Tue 7:45pm, Olivia 8/500 *
  - PA NBEMS Net, 3.5835 MHz +1 kHz, Sun 10:00am, Olivia 8/500
  - PA NBEMS Net, 7.0730 MHz +1 kHz, Sun 11:00am, Olivia 8/500
  - US East NBEMS Net, 7.0360 MHz +1.5 kHz, Wed 7:00pm, Olivia 8/500

* May use other modes

On-line resources

- tigertronics.com
- w1hkj.com
- arrl.org/nbems
- FSD-218
  - arrl.org/files/file/Public%2520Service/fsd218.pdf
- wpaares.org/html/nbems.html
- youtube.com/user/davekle38sp
- youtube.com/user/K4REF
- oliviamode.com
- wb8nut.com/digital

Demo

- Using two stations on 80m with dummy loads and sound card interfaces
  - Establish communications
  - One station sends message
  - Other station sends reply
- Using two stations on 2m with antennas, one station using acoustic coupling
  - One station sends message
  - Other station sends reply