



SAINT LOUIS COUNTY ARES® DIGITAL OPERATIONS MANUAL NBEMS SUPPLEMENT

*Peter B. Brisbine, NØMTH
Assistant Emergency Coordinator – Digital Operations
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BACKGROUND

It is the intention of this plan to provide guidelines for training and usage of amateur radio volunteer communicators. The Saint Louis County ARES® organization recognizes the role of the Radio Amateur to government agencies as auxiliary communications links during times of emergency. It is also the intention of this plan to provide for adequate training and preparation of Saint Louis County ARES® operators to assist with the needs of the Saint Louis County ARES® Emergency Coordinator.

The Assistant Emergency Coordinator – Digital Operations shall establish the training and operational standards for new Saint Louis County ARES® volunteers and ensures that all new Saint Louis County ARES® digital operators are provided with the tools and training for digital communications to support the needs of the Saint Louis County ARES® Emergency Coordinator. The Digital Coordinator shall ensure that all digital operators within Saint Louis County have adequate training available and regular exercises so that the Saint Louis County area as a whole maintains a high degree of readiness.

OBJECTIVE

The Objectives below reflect the same Objectives that are defined in the Missouri Section ARES® Emergency Operations Plan – Digital Addendum located online at: <http://ares-mo.org/plans>.

- To provide an advanced high speed digital packet network for emergency service communications
- To provide training as required
- To use standard hardware, firmware, and software configuration(s)
- To be easy to set up and expand
- To be upgradeable for future technologies
- To be able to be built with available "off the shelf" equipment

PURPOSE

To provide guidelines and suggestions for amateur radio operators using digital communications, and to assist with routine and emergency communications links to served agencies and affiliated organizations. These include, but are not limited to; the State of Missouri Emergency Management Agency (SEMA), American Red Cross, Salvation Army, National Weather Service, other public service and disaster relief organizations, and affected areas of the Saint Louis County area during ARES® activation.

ORGANIZATION

An updated and more detailed list can always be found at <http://www.stlares.org>.

SAINT LOUIS COUNTY ARES® DIGITAL OPERATIONS TEAM MEMBERS

- ASSISTANT EMERGENCY COORDINATOR – DIGITAL OPERATIONS
 - Peter B. Brisbane, NØMTH
 - n0mth.pb@gmail.com
- ASSISTANT DIGITAL OPERATIONS
 - Gary Hoffman, KBØH
 - kb0h@arrl.net

TRAINING

It is the goal of the Digital Coordinator to provide routine training on a minimum quarterly basis depending on the needs defined by the Emergency Coordinator. Because of the different types of hardware and software available for digital communications, training will be kept to basic configuration, routine & emergency procedures, and digital operations within the Saint Louis County ARES® digital network.

STANDARDIZATION

Because of the variety of hardware and software available for digital communications, it is in the best interests to standardize hardware and software used within Saint Louis County ARES® in order to ensure the most efficient implementation, operations, and ongoing support.

HARDWARE

Besides a personal computer & transceiver, the only other item recommended for for NBEMS functionality is a Sound Card Interface.

- Examples of Sound Card Interfaces
 - West Mountain Radio – RIGblasters
 - Signalink USB – Tigertronics

Acoustic coupling can be used in cases where an operator's station does not have a Sound Card Interface available or is having technical issues that prevent it from working correctly.

SOFTWARE

Unique software is required for the different modes that are used by Saint Louis County ARES®. See the "DIGITAL MODES" section for more information about mode specific software.

SUPPORT

Because of the variety of hardware, software, and software emulation that can be used, support by the Digital Coordinator is provided on a 'best effort' basis in order to comply with the Objectives in this manual.

DIGITAL MODES

The following digital modes are the standard modes used within the Saint Louis County ARES® as directed by the Emergency Coordinator.

- APRS – Automatic Packet Reporting System
- MEPN – Missouri Emergency Packet Network
- NBEMS – Narrow Band Emergency Messaging System
- Packet
- WinDRM
- Winlink 2000

Recommended hardware, software and configuration information is found in the following pages broken down by the approved modes for Saint Louis County ARES®.

NBEMS – Narrow Band Emergency Messaging System

Narrow Band Emergency Messaging Software (NBEMS) is an Open Source software suite that allows amateur radio operators to reliably send and receive data using nearly any computer (Windows, Mac, and Linux) and any analog radio without requiring a dedicated digital infrastructure or specialized modem hardware.ⁱ

- HARDWARE REQUIREMENTS
 - Laptop or Desktop PC
 - Transceiver
 - Sound Card Interface and appropriate cabling to your transceiver.

Acoustic coupling can be used in cases where an operator's station does not have a Sound Card Interface available or is having technical issues that prevent it from working correctly.

- SOFTWARE REQUIREMENTS
 - FLDIGI
 - FLMSG
 - FLWRAP
 - FLRIG

The above software can be downloaded from: <http://www.w1hkj.com>

Special thanks to the pa-sitrep.com website for the following information.ⁱⁱ

NBEMS/FLDIGI – Software Downloads

FIRST! - Be sure you have only one copy of cygwin1.dll (the one that came in your zipped file) on your computer.

WindowsXP Users

- Single right click on the "Start" button on the bottom left corner of your desktop.
- Arrow up and single left click "Explore". This opens your entire computer file directory.
- Single right click on your computer's root directory (usually Local Disc (C:))
- Arrow down and single left click on "Search".
- In the "All or part of the file name" search box, type cygwin1.dll then click "Search".
- After the search is complete, single right click on the instances of cygwin1.dll (**with the exception of the one in your FLDIGI file folder**) then arrow down and left click delete. Repeat this for each instance of this file with the exception of the one in your FLDIGI file folder.

Windows Vista, & 7 Users

- Single right click on the "Start" button on the bottom left corner of your desktop.
- Arrow up and single left click "Explore". This opens your entire computer file directory.
- Single left click on your computer's root directory (usually Local Disc (C:))
- In the "search" box in the upper right hand corner of the window, type cygwin1.dll
- Single right click on the instances of cygwin1.dll (**with the exception of the one in your FLDIGI file folder**) then arrow down and left click delete. Repeat this for each instance of this file with the exception of the one in your FLDIGI file folder.

Now you are ready to install FLDIGI.

Go to the desktop (or the directory where you saved the NBEMS/FLDIGI download file) and double click the FLDIGI file icon.

This will open up the file folder, which is in a compressed .zip format.

If running WindowsXP:

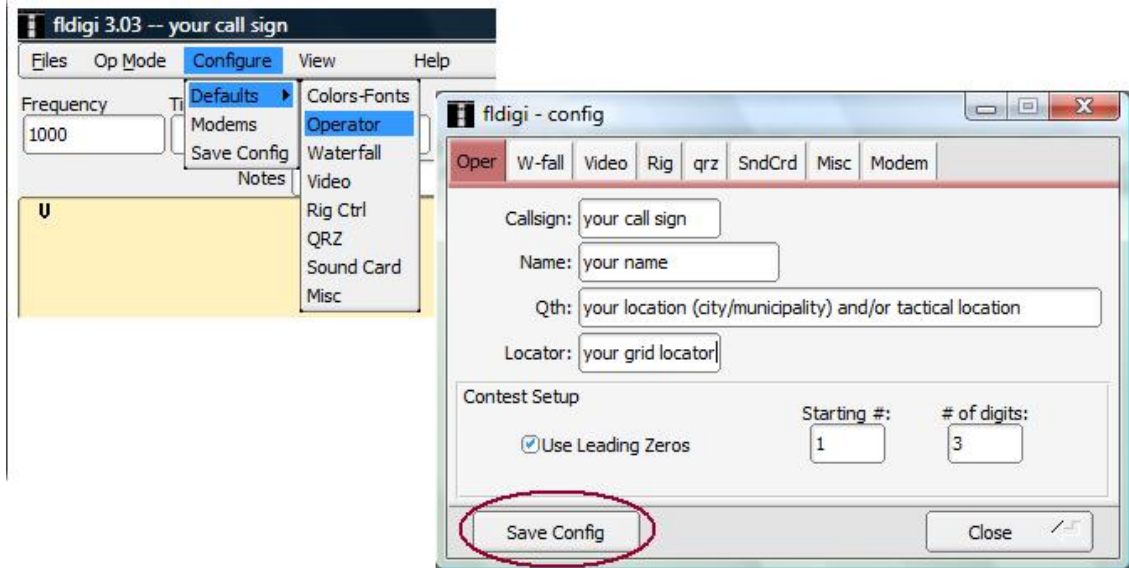
- Click "file" at the top right side of the current window, then click "Extract All". This opens an extraction wizard.
- Click "Next", then click "Browse" and select the directory where you would like the NBEMS/FLDIGI file folder to reside then click "Next". The window should now say that the files were extracted properly.
- Make sure the box marked "Show Extracted Files" is checked, then click "Finish".
- Double click on the FLDIGI folder icon.
- Now single right click on fldigi.exe, arrow down and single left click on "Create Shortcut". A new file will appear in the folder that says "Shortcut to fldigi.exe".
- Single right click on that folder, arrow down and single left click on "Cut".
- Close all open windows, then single right click on your desktop, arrow down and single left click on "paste".
- You should now have a shortcut icon to FLDIGI on your desktop.

If running Vista:

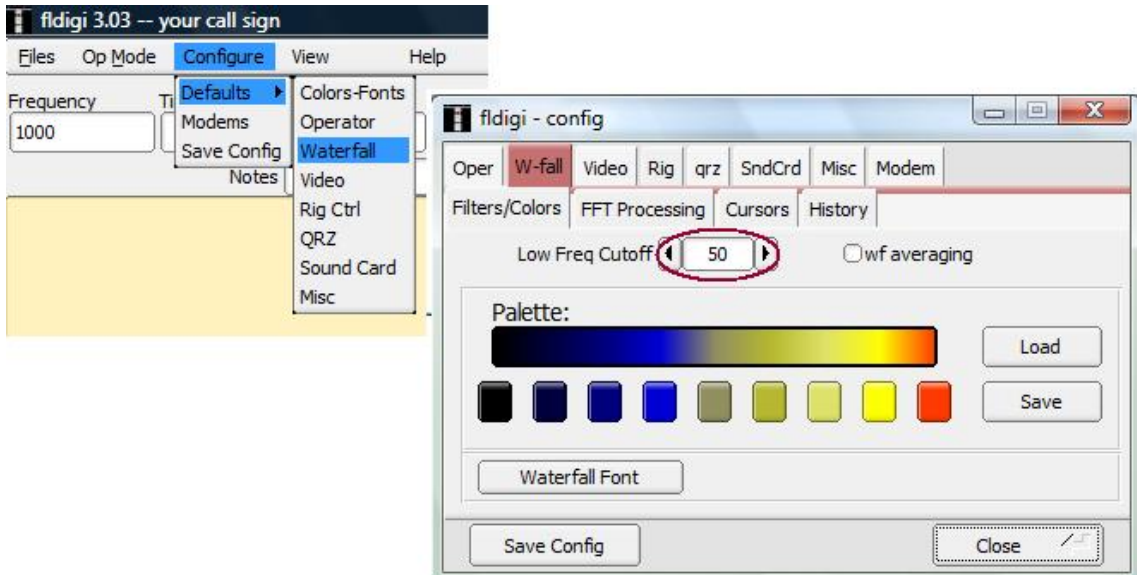
- Single left click "Extract all files" from the selections along the top of the current window, then click "Extract All".
- Single left click "Browse" and select the directory where you would like the NBEMS/FLDIGI file folder to reside. Make sure the box marked "Show Extracted Files" is checked, then click "Extract".
- Double click on the FLDIGI folder icon.
- Now single right click on fldigi.exe, arrow down and single left click on "Create Shortcut". A new file will appear in the folder that says "Shortcut to fldigi.exe".
- Single right click on that folder, arrow down and single left click on "Cut".
- Close all open windows, then single right click on your desktop, arrow down and single left click on "paste".
- You should now have a shortcut icon to FLDIGI on your desktop.

SOFTWARE CONFIGURATION

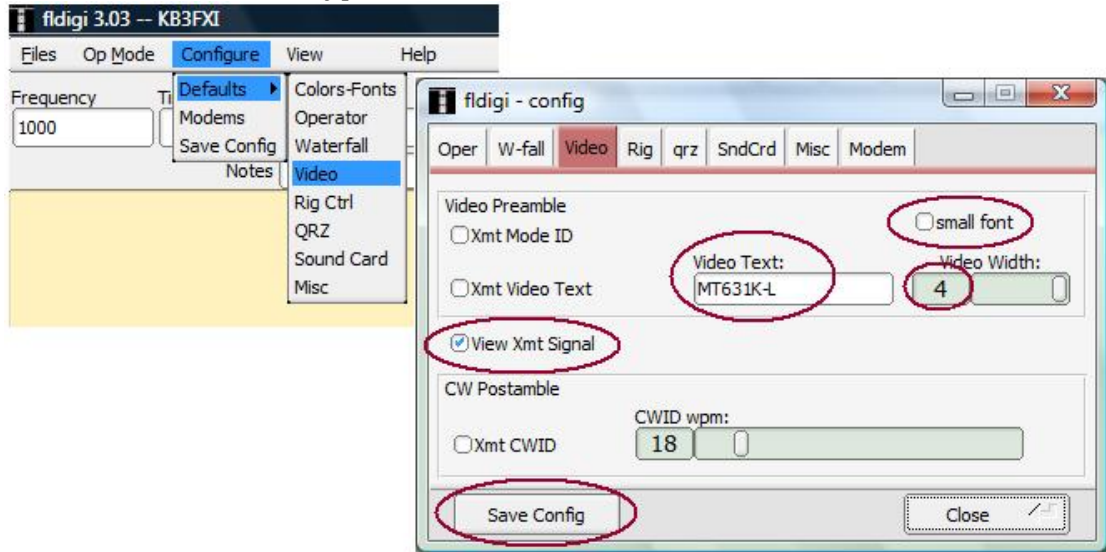
- 1) Click Configure, arrow down to defaults, arrow over and click Operator. Then enter the appropriate information, click Save Config, then click close.



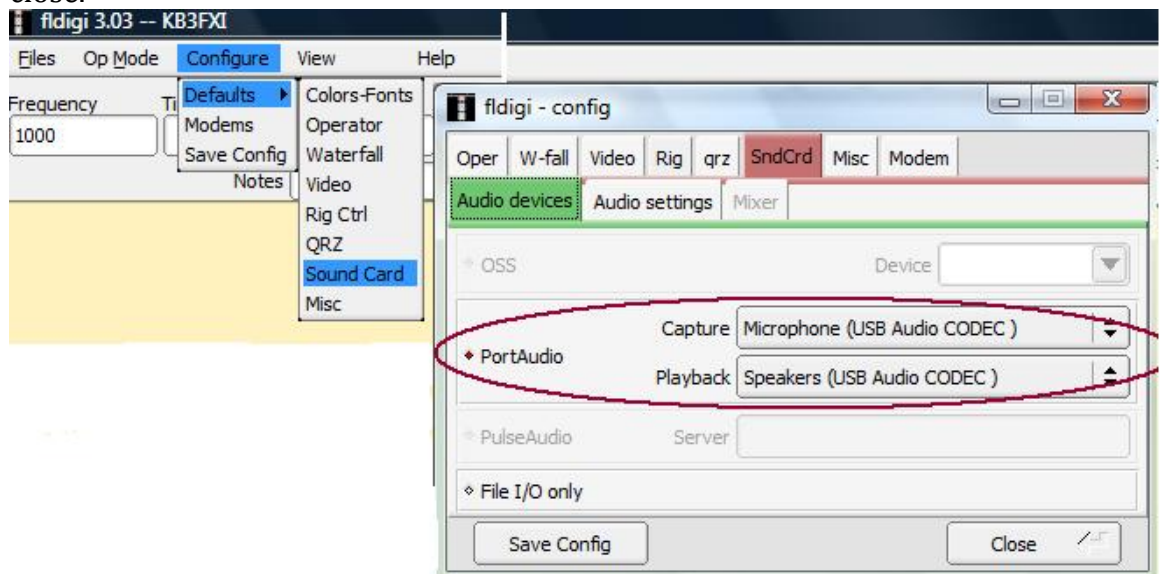
- 2) Click Configure, arrow down to defaults, arrow over and click Waterfall. Click the left arrow on the low cutoff box until the figure is at 50. Click Save Config, then close.



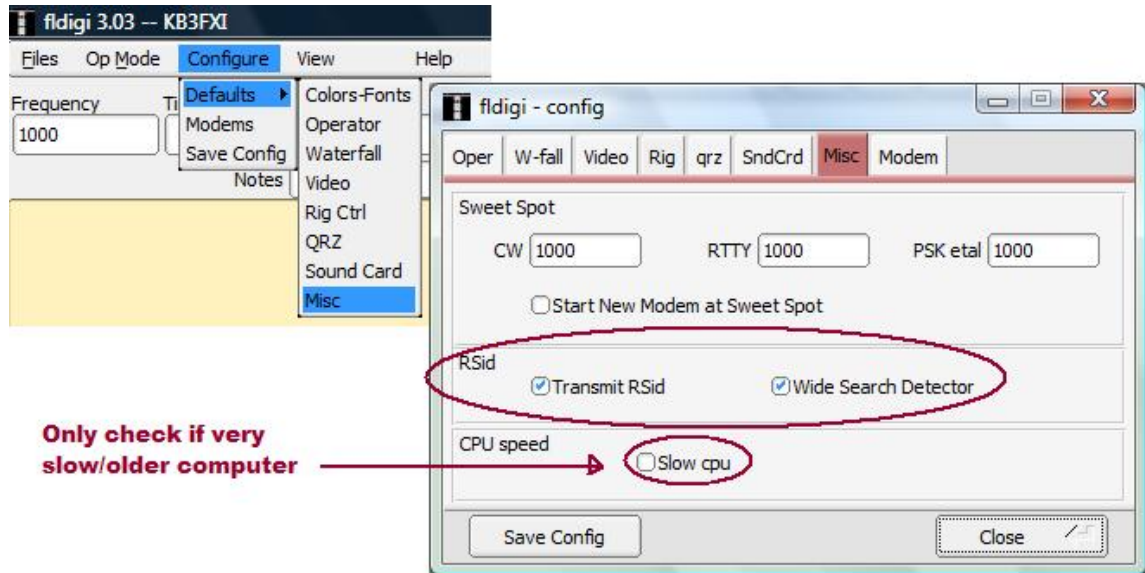
- 3) Click Configure, arrow down to defaults, arrow over and click Video. Uncheck small font, video text - type "MT631K-L", video width - 4, check View Xmit



- 4) Click Configure, arrow down to defaults, arrow over and click Sound Card. Select the appropriate sound card for capture and playback under port audio for the sound card that you will be transmitting with. Click Save Config, then close.



- Click Configure, arrow down to defaults, arrow over and click Misc. Check Transmit RSID and Wide Search Detector. Make sure Slow CPU is unchecked



- On the main screen of FLDIGI, go to the bottom of the screen and set the first waterfall figure to -20, the second figure to 70, and the x setting to x1. Uncheck the sql box on the right bottom of the fldigi window.



Adding the Standardized WPA NBEMS Macro Set

- Go to http://www.pa-sitrep.com/NBEMS/fldigi_macro.htm
- Right click on the link to the macro, arrow down to "Save Target As" and left click.
- You should now see your windows file directory. You will need to click on your profile directory (this will be the name that appears when you start your windows login). Double click on your windows profile name in the directory.
- If you made it to the proper directory, you should see an existing file named "macros". This is the file you will be replacing.
- Left click the save button. A window should come up saying that the file already exists and will ask if you want to replace/overwrite. Click yes.

NBEMS/FLDIGI Sound Card Calibration

- 1) Download and save CheckSR.exe to your desktop. This is a small, standalone, application that consist of a single exe file. When you double click on it, once it's saved to your desktop, it provides the capability of analyzing your sound card offsets and gives you the corrections in parts per million (ppm):<http://www.pa-sitrep.com/checksr/CheckSR.exe>
- 2) Open NBEMS/FLDIGI, go to configure, defaults, sound card, audio devices tab and make sure you have the sound card you use for your interface properly selected from the capture and playback drop down choices. Then click the audio settings tab.
- 3) Under the audio settings tab, you should see a sample rate drop down box for capture and playback. Under each drop down box, select the sample rate that has (native) listed after it and take note of this figure. Click save config, then click save. Close FLDIGI.
- 4) Going back to CheckSR, open the application (if it's not already open, double click on the desktop icon now) and from the drop down boxes for sound card settings, Input and Output, choose the sound card you are using with FLDIGI. Next, select the sample rate from the drop down box in CheckSR for the sample rate that FLDIGI showed as "Native" then click start.
- 5) Let the application run for about 15-20 minutes. You will notice that the numbers will progressively stabilize. After about 15-20 minutes, click stop then write down the resulting figures on input and output for the measurements in Hz and PPM. Keep this record.
- 6) Open FLDIGI, go to configure, defaults, sound card and click on the audio settings tab. Enter the PPM figures for RX ppm (CheckSR ppm Input figure) and TX ppm (CheckSR ppm Output figure). If you had a figure that resulted in a minus from CheckSR, enter the PPM setting with the minus symbol followed directly by the figure with no space. Then click save config, then close.

Although this procedure does not seem to be necessary for MT63 2k long on FM, it is advisable that anyone using FLDIGI, regardless of modes used, should perform this procedure immediately following setup. Once these calibrations are applied to the software, no changes should ever have to be made again, unless you change your software to radio interface sound card.

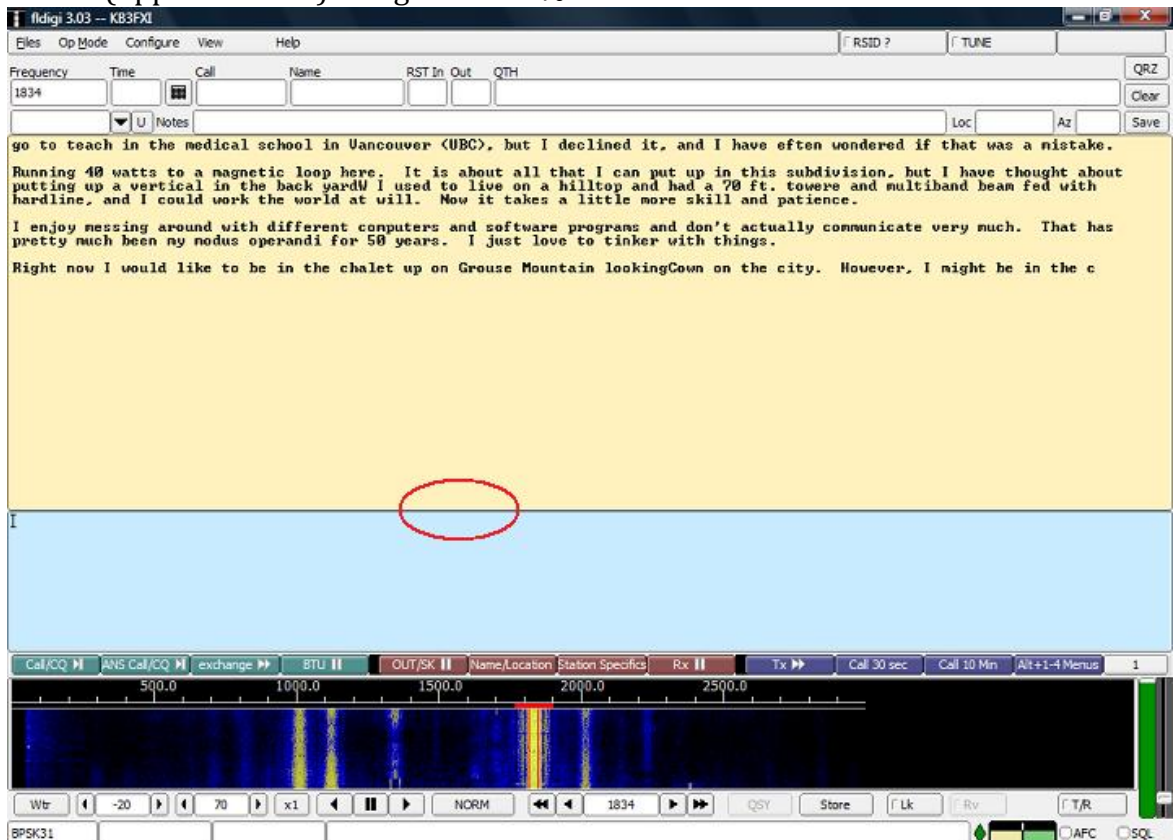
NBEMS/FLDIGI Getting Started

BPSK31 - First QSO

These instructions are assuming that you are using a properly configured sound card interface. Keep in mind that if you do not have a sound card interface, you can plug a simple microphone into your sound card mic jack to monitor received audio from your transceiver speaker, but you will not have automated push to talk in order to transmit.

Double click your FLDIGI desktop icon. If you have any errors or the program closes, please see the first step on the [installation page](#)

1. Adjust your TX and RX window sizes by arrowing over the divider between the upper window (received text) and the lower window (transmit text). Left click and hold, then drag the divider up or down. Typically it is better to have the RX (upper window) using about 75% of the overall screen.





2. Go to Op Mode at the top of the screen and left click, arrow down to PSK then arrow over to BPSK-31 and left click. This sets you in PSK-31, the most common digital mode you'll find on the HF bands.
3. Tune your transceiver to a common PSK31 frequency:
 - Daytime: 14.070 MHz/USB, 10.140 MHz/USB, 7.070 MHz/USB
 - Evenings/Night: 3.580 MHz/USB, 7.070 MHz/USB, 10.140 MHz/USB

4. As is the case for all digital comms with FLDIGI, make sure all DSP including compression and noise blanker are turned off on your transceiver.
5. Arrow over a PSK signal in the waterfall and left click on the signal. You should now see the receive text being decoded in the upper RX window. If you see no text, make sure the squelch box at the bottom right hand corner of the program is unchecked.
6. Wait for a station to call CQ. On the received text, arrow over the first character on the Call Sign in the CQ and RIGHT click. This brings up a window that will let you insert the text that you right clicked on into the log. Arrow to Call and left click. You will notice that the call sign has now been inserted into the log.
7. You are now ready to respond to the calling station.
8. Left click on the 2nd macro in the 1 set that is labeled "ANS CALL/CQ" or hit F2 on your keyboard. You should now be transmitting and you should see that the station call you added in the log is now being sent along with your call sign. At the end of your response, assuming you are using a sound card interface, the rig should automatically go back into receive. At any time if your rig does not return to receive mode, you can pres the esc button on your keyboard to manually abort transmission.
9. If your system is configured properly and band conditions are sufficient, the CQ calling station should respond. Typical first exchange is name, location and signal report.
10. As you receive the calling station's name and location, you can right click on the given text and insert the information into the log, just as you did in step 6 to insert the call sign into the log. If the location is city and state (two words), highlight both words by left clicking and holding then drag over the desired text, then unclick. You will see that the text is now highlighted and you can right click to insert to the appropriate section of the log.
11. To repsond with your first information exchange, click on the "exchange" macro or hit F3 on your keyboard. Now you can manually type your information or click the station info macro.
12. IT IS IMPORTANT TO NOTE that the exchange and station information macros will not automatically end your transmission, so you will want to click the BTU (Back to you) macro or hit F4 on your keyboard.

The symbols displayed on the macro buttons indicate how the macro will function:

 Indicates auto transmit and auto receive

 Indicates auto start (you will need to use BTU or manually switch to receive)

 Indicates auto receive

NBEMS/FLDIGI - EmComm Modes

The NBEMS group will be focusing on 3 primary digital emergency communications modes:

MT63 - Olivia - DominoEX

Each mode has its advantages and disadvantages and our recommendations are based on extensive field-testing under varying situations and conditions.

MT63 2k Long - Local FM Comms

For local portable, mobile and fixed station operations on 2m and 70cm FM (repeater or simplex), MT63 2K long is our primary mode for detailed situation reports and database transmission and has been chosen for the following reasons:

- Can be used very effectively without a sound card interface (audio coupling)
- Extremely effective under poor RF conditions
- Extremely accurate decoding (major duplication of data and forward error corrected)
- Very forgiving on sound card tuning and calibration when used on FM
- Excellent for sending larger situation reports or databases

MT63 1k Long - Regional/Local HF Comms

For regional and local portable, mobile and fixed station operations on HF USB under moderate to good condition, MT63 1K long is our primary mode for detailed situation reports and database transmissions and has been chosen for the following reasons:

- Very effective under moderate to good RF conditions
- Extremely accurate decoding (major duplication of data and forward error corrected)
- Works extremely well under QRM and QRN conditions - Excellent for sending larger situation reports or databases

Disadvantages:

- Requires fairly accurate tuning
- Does not work well under very poor RF weak signal conditions
- Long decoding FEC delay not well suited for short keyboard to keyboard communications
- 1k audio bandwidth is very wide as compared to other digital modes

Olivia 16 Tone/500 Hz - Regional/Local HF Comms

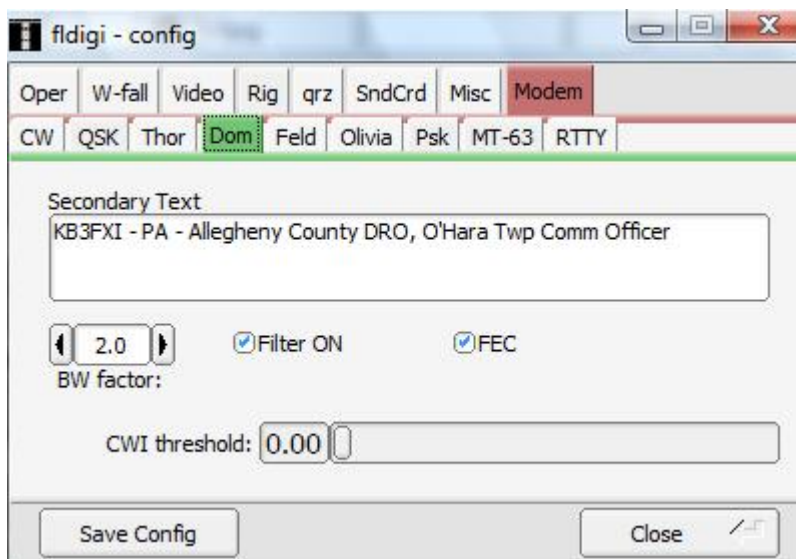
For regional and local portable, mobile and fixed station operations on HF USB under good to poor conditions, Olivia 16/500 is our primary mode for short messages and situation reports and has been chosen for the following reasons:

- **EXTREMELY** accurate decode, even under the worst conditions (major duplication of data and forward error corrected)
- Very resilient to QRM and QRN
- Best suited for short messages and situation reports under poor HF conditions

Disadvantages:

- Slow data rate (slightly faster than writing speed)
- 500 Hz audio bandwidth is wider than several other modes

DominoEX11(FEC) - Regional/Local HF Comms



For regional and local portable, mobile and fixed station operations on HF USB under good to moderate conditions, DominoEX11(FEC) is our primary mode for short messages and keyboard to keyboard communications and has been chosen for the following reasons:

- Duplication of data and forward error correction provides good copy under moderate RF conditions
- Well suited for keyboard to keyboard (chat)
- Relatively narrow audio bandwidth (approx. 200 Hz)
- More forgiving on tuning inaccuracies than Olivia
- Resilient to QRM and QRN

Disadvantages:

- Not available on many programs other than NBEMS/FLDIGI and Multipsk
- Not as reliable as Olivia 16/500 under very weak RF conditions

NETWORK

NBEMS PRIMARY LAN (*Everyday & Emergency Use*)

The NBEMS LAN is used in conjunction with other modes and frequencies that have been defined and generally accepted by the local amateur radio community.

Center your waterfall on 1500.

| MODE/METHOD | PRIMARY | SECONDARY |
|--------------|------------|------------------|
| MT63/2K Long | 145.030MHz | ?? 440.050MHz ?? |
| MT63/1K Long | HF ?? | HF ?? |

SECONDARY LAN (*Development, Testing, Learning, Experimenting*)

The SECONDARY LAN is used for development, testing, learning and experimenting with new modes, hardware, and software configurations. Fine-tuning, and such can take place here before moving a node or system into the PRIMARY LAN. This way misconfiguration will not affect the PRIMARY LAN or cause problems with its operations. Remember that full implementation of network support in the SECONDARY LAN may not be there to successfully test. In that case, it's best to contact someone willing to assist in testing and continue testing here before working with the PRIMARY LAN.

| MODE/METHOD | PRIMARY | SECONDARY |
|-------------|------------|------------|
| NBEMS | 145.050MHz | 145.030MHz |

Single Multi-Zone?

Alternate Single-Zone?

Nodes? (Hospitals, EOC, Fixed w/alternate power)

PROCEDURES / DIGITAL NETS

ROUTINE

Everyday traffic

EMERGENCY

Small Scale (single hospital – single zone)

Medium Scale (multiple hospital – single zone)

Large Scale (multiple hospital – multiple zone)

RESOURCES

ARES HARDWARE

SOFTWARE LINKS/REPOSITORY (For Standardization)

Populate after standard software is agreed upon.

NETWORK MAPS

Generate from existing maps, gather information to generate PDF files that include maps for modes, frequencies, etc.

NETWORK CONTACTS

List contacts of existing MEPN

List APRS gurus

List other mode gurus and node SysOps

SIMPLE SCENARIO FLOWCHARTS

HowTo's for the District C network.

REFERENCES

ⁱ "ARRL." *NBEMS*. N.p., n.d. Web. 22 Aug. 2013. <<http://www.arrl.org/nbems>>. "PA-SitRep.com." *PA-SitRep.com (NBEMS/FLDIGI Emergency Communications for Western Pennsylvania)*. N.p., n.d. Web. 29 Sept. 2013.

ⁱⁱ "PA-SitRep.com." *PA-SitRep.com (NBEMS/FLDIGI Emergency Communications for Western Pennsylvania)*. N.p., n.d. Web. 29 Sept. 2013.