

Fusion Radio Tips and Tricks

This document contains a number helpful hints and tricks for use with your Yaesu Fusion radios.

Thanks to Chuck - K0ORK, Dewey - WB7OEV, Dennis - KD0ZPF, and Matt - KE0CAA for contributions to this Fusion tip sheet!

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General Fusion Radio Information

Note: The FTM-3200 does not support many of the Fusion features described below

- Install and SD card in the radio. Some functions are not available without it. It will enable you to send and receive messages and photos as well as create a GPS track of where you've been. (GPS logging must be turned on.)
- Fusion cannot transmit digital and analog at the same time. AMS allows convenient and automatic switching between analog and digital, but it only does one at a time. All Fusion radios support AMS.
- Fusion does not require any sort of pre-registration. Turn on the radio and use it. Yaseu's networking system is WiRES-X. If you own a WiRES-X box, you will need to register it. However if WiRES-X is already connected to the repeater you do register. This is unlike Dstar and other commercial systems that may require each user to pre-register to join the network or repeater system.
- If a person is talking using digital and another starts talking using FM, the station that "wins" is determined by signal strength. The response can be nothing (no impact), garbled digital reception, or complete capture of the digital signal in which case the repeater would revert to FM (if programmed for Auto).
- Photos
 - Sending a photograph uses the Digital Wide (DW) mode. It is not possible to use voice while in DW. DW is used because of the large amount of data a photo transmission requires. A high quality JPEG at 320x240 can take about a minute. A low quality JPEG at 160x120 takes about 8 seconds. The best compromise seems to be using 320x240 with low quality JPEG which takes about 20 seconds. The picture and compression settings apply when the picture is taken, not when it is sent.
 - An SD card is needed to send and receive photos. A copy of all photos received (or sent) is kept on the SD card.
 - It's best to warn people that you are sending a picture since any other transmission will cause errors and the picture transmission will fail. This potentially is a useful tool for Skywarn type operations. Conduct the net on a voice channel while sending digital messages and photos on a Fusion digital channel. These are dual band radios. Nothing says "wall cloud" like a picture of one.
 - The camera/microphone can be used on any Fusion radio. Besides the PTT, there are two other buttons. One takes a picture and the other transmits the last picture taken. The camera is wide angle. There isn't a viewfinder, but it's still possible to get good at "aiming from the hip".
 - While you can easily move pictures from the SD card to a computer, putting your own photos on the SD card is problematic. A clean solution does not yet exist. (It requires software manipulation of data files in addition to the photo file having the correct name format, size, resolution, and compression.)

All Fusion Radios

Adjusting the Fusion Clock or What to do when Daylight Savings Time Comes and Goes

Please refer to the following document on HamOperator.com:

http://www.hamoperator.com/Fusion/FusionFiles/K9EQ-Fusion-PDF-0016_Clock.pdf

Muting Tips

Muting the Non-operating VFO

Courtesy of Dewey, WB7OEV

REVIEW FOR APPLICABILITY TO ALL FUSION RADIOS

Sometimes it is difficult to hear with audio coming from both 'A' and 'B' VFOs at the same time. The voices become mixed and one cannot tell with VFO to respond to. You can mode the audio of the non-operating VFO, *(the VFO that is not primary...the one that is not Highlight on the display)*

Here's a tip for muting the non-operating VFO.

- Goto the main menu (press the 'DISP' key for over 1 second).
- select the 'TX/RX'.
- select the 'AUDIO'.
- select 'MUTE'.
- select the level of mute.
 - 30 %
 - 50%
 - 100%
 - OFF
 - The higher the value for 'MUTE', the more the non-operating VFO audio is reduced.
 - OFF deactivates the non-operating VFO.
- Press PTT to exit the setup mode.

Here is a tip for setting transmit fixed in AMS mode.

Courtesy of Dewey, WB7OEV

Yaesu Digital Radios comes with a feature called AMS (Automatic Mode Select), which automatically select the mode to transmit, depending on the signal received.

For example, if the signal received is 'FM', the radio automatically is put into the FM mode. If the signal received is 'DIGITAL', the radio is automatically put into the DIGITAL mode.

If you want the Radio to stay in DIGITAL mode, you can set the radio manually to the DIGITAL mode, this take the radio out of AMS, thus it a signal is received in FM, you would not hear it. In order to hear 'FM', you would have to manually change to the proper mode.

The advantage of operating in 'AMS' mode...you can receive both 'FM' or 'DIGITAL' signal...the radio transmits back in the correct mode.

A Tip...if you want the radio to always transmit `DIGITAL`, while operating in 'AMS' mode...do the following. However BARS/MNWIS recommends that you leave your radio in AMS so that a quick click of the microphone permits you to change modes. To do this replace "TX-DN" with "TX-M" for "Manual". In other words you can manually control if your transmission will be in an analog or digital mode.

FT1(X)DR Procedure

- Set to VFO 'A' (Digital is done from 'A' only).
- Go to the main menu on your radio...*(Press the `DISP` key for 2 seconds, this will take you to the menu).*
- Select the 'TX/RX' item 2...then press the `ENT` key
- Select the 'DIGITAL' item 2...then press 'ENT' key.
- Select the 'DIGITAL MODE'...then press 'ENT' key.
- Dial down to 'AMS MODE'...press 'ENT' key.
- Using the KNOB...dial to select the desired mode, in this 'TX DN'...then press the 'ENT' key.
- Press 'DISP' key four times to return to main display..

FT2DR Procedure

- Set the display to VFO A or VFO B.
- If 'A' or 'B' is in Memory mode...set to VFO mode using the 'V/M' button.
- Then switch to AMS by tapping the 'MODE' icon...until you see a bar above the 'FM' or 'DN' or 'VM', this puts the radio into 'AMS'.
- The middle icon (*or button*) will be highlighted. *NOTE: The icon may display 'AUTO'.*
- Tap middle button until it displays 'TX DN'. *This sets the radio transmission to digital when using 'AMS' ONLY.*
- Now when the radio is set to 'AMS', it will transmit digital regardless what signal is received.
- Set the digital radio frequency in VFO 'A'. if the frequency is programmed in memory, put VFO 'A' in memory mode ('V/M' button).
- Tap the 'MODE' button until you see a bar above the 'FM' or 'DN' or 'VM', this puts the radio into 'AMS'.

FTM-100DR Procedure

Coming soon.....

FTM-400DR Procedure

- Set the radio to VFO 'A', (*the FTM-400DR can only do digital mode from VFO 'A' only*).
- Press the 'DISP/SETUP' button for 2 seconds to display the main menu.
- Tap the 'TX/RX' button
- Select the 'DIGITAL' item 2.
- Press the green '>' button.
- Select the 'AMS TX MODE' line, item 1.
- Press the green 'AUTO' until you see 'TX DN FIXED'. *This will set the transmit to 'DIGITAL' when the radio is AMS.*
- Press 'BACK' three times to display the frequency you want to use for DIGITAL.

- Press the 'DX' button until you see a bar above the 'FM' or 'DN' or 'VM', this puts the radio into 'AMS'.
Note: *The indicator will flash when the VFO is set to AMS.*

FT-991 Procedure

Coming soon.....

The **advantage** setting the transmit to digital...when you are operating in AMS and working a digital contact...someone breaks in with an FM signal will change the receive back to FM and you are able to listen to the signal. If you resume your contact with other digital station, you can do so without having to manually change it back digital.

The **disadvantage**...if you receive an FM transmission and you want to respond to it...you have to manually change the radio to the FM, by leaving the AMS mode and setting it to FM.

FT1(X)DR and FT2DR

This section contains tips and tricks that are common to both the FT1 and FT2.

Listening to the broadcast bands on the FT1(X)/2DR

Courtesy of Dewey, WB7OEV

- On both the FT2D and FT1D, switch to 'VFO
- Press the 'BAND' button repeatedly...to cycle through to either the 'AM' or 'FM' band.
-
- Then turn the 'DIAL' to the desired broadcast station you want to hear.
- Or
 - You can use the keypad to enter the frequency of the station you want to listen to.
 - Example: Enter 00100 (1,000 kHz) to listen to KOMO or 097300 (97.3 mHz) to listen to KIRO FM.

Listening to broadcast using dual receive

Courtesy of Dewey, WB7OEV

- Listening to a Radio Broadcast Using AF Dual Receive
- Set the VFO A or B to the frequency to be monitored
- Press the A/B key to VFO A
- Touch the [F MW] icon on the screen, the function screen appears.
- Touch the [A DUAL] icon on the screen, the AF-DUAL function is activated
- Press the (BAND) key to select AM or WFM
- Rotate the DIAL to tune to the frequency of the broadcast station.
- To disable the AF-DUAL FUNCTION, touch [F MW] followed by [A DUAL]

FT1DR

Display Battery Voltage

To display the battery voltage continually on the multi-line display press the **F** and then the **A/B** button. Do this for both the A and the B side if so desired.

FT1DR Manual GPS entry

Doing this you will be able to send and receive position data from other radios even if your radio can not have a GPS fix due to being inside a building.

1. Type in your address to google maps <https://www.google.com/maps/place/> and hit enter. Look at the map, does this show your location?
2. If it does right click the red icon next to your address and then click "what's here" in the upper right corner a picture will appear and the last line will have a number like "45.111471, -93.205588" highlight and copy.
3. Go to <http://boulter.com/gps/> to convert the GPS coordinates to what the radio wants to use.
4. Paste the number form #2 above into the "enter coordinates" box.
5. Click convert and map.
6. Use the numbers from the GPS line. It should look like this;

Latitude

Longitude

N 45 06.688

W 93 12.335

7. Turn on the radio, push and hold the DISP button to get in the menu.
8. Pick #9 APRS.
9. Press ENT and rotate the knob to #24 "MY POSITION",
10. Rotate the knob to pick GPS
11. Pick LAT and then push the F button. The cursor will move to the last number pair enter the first 2 digits from the third set ie 68 by rotating the knob. Next push the F button again to move to the next pair and rotate the knob to match the 2nd pair ie 06.Repeat for the 3rd set ie 45.Push the F key again and enter either N or S Push the F button again to get back to Lat.
12. Rotate the knob and repeat the process for LON W 093 12 33.
13. Rotate the knob to the P1 position and press enter to move the numbers to this screen.
14. Press the transmit button to go back to the main screen.

FT1DR Automatic GPS entry

This allows you to take a current GPS reading and store it in one of ten locations. It is not possible to manually enter these values, they must come directly from the GPS receiver.

1. Turn GPS on
2. Go to the location you wish to permanently store
3. Verify that GPS has a good lock:
 - a. Press and hold 'DISP' until the menu comes up
 - b. Select "DISPLAY"
 - c. Select "GPS Info"

- d. Press "ENT" if necessary to see the receiver status. You should have lock on at least five satellites (the bargraph is black).
4. Press and hold 'DISP' to enter the menu mode.
5. Select "APRS"
6. Select "MY POSITION"
7. Select P1 - P9
8. Press "ENT"
9. The current GPS location will be populated in the selected register

Why would you want to do this?

1. Power reduction. GPS takes power. GPS does not have to be on to report your QTH. Even with your GPS off, the coordinates you specify in "MY POSITION" will be transmitted.
2. You can't receive GPS. Where I work I cannot get a GPS signal. So I did the next best thing. Stood outside the front door, got a GPS lock, and stored the location. So when I'm at work I just use the saved QTH.
3. I use one register to save the repeater's QTH and often use this during nets. That way other users know how far they are from the repeater.
4. You want people to have an approximate idea of where you live, but don't want them to know where you are standing inside your house. Go to a location near your house, such as a park or road intersection. Store that location then use it, rather than GPS, to transmit your location. The range and bearing will still be pretty accurate for those who are more than a mile or two away.

Why would you want to do this...to conserve battery power being one reason...another keep the Backlight on continuously in low light Conditions.

Changing the Display Backlight on the FT1DR

Courtesy of Dewey, WB7OEV

Why would you want to do this...to conserve battery power being one reason...another keep the Backlight on continuously in low light Conditions.

The FT1DR by default turn the backlight off after 5 seconds. You can extend time by doing the following;

- Press and hold the 'DISP' for over 1 second.
- Turn the 'DIAL' to select '1 DISPLAY'
- Press the 'ENT'.
- Turn the 'DIAL' to select '5 LAMP'
- Press 'ENT'.
- Turn the 'DIAL' to select the time (10 SEC),
 - Another option: 'CONTINUOUS' to leave the light on.
- Press 'PTT' To save your selection and exit the main menu.

Accessories You Will Want

An Antenna

A number of people have reported that the stock FT1DR antenna works “okay”, but could work much better. SWR measurements have also indicated that it may not perform as well.

I use a Comet SMA-503 with good success. Over-the-air measurements seem to indicate about a 3-5 dB improvement. Larger antennas may provide better performance on 2 meters. I chose the 503 since I mostly operate on UHF and it was a good compromise between size and performance.

A Drop-in Charger

Take a look at the tip sheet on power consumption (#0002). The FT1DR has a lot of circuitry and thus uses some power. The Yaesu drop-in charger charges the battery at twice the rate of the radio via the external DC connection.

A Battery

You will want another battery. We've had success with the Batteries America batteries. Their capacity ratings seem to be honest (as are Yaesu's). They also have a really nice spring clip for the back of the battery - much nicer than the one that comes from Yaesu. I really like that clip a lot better.

One word of warning, however. The larger battery from Batteries America is larger. You'll need to remove it from the radio to charge it in the drop-in charger.

A Micro-SD Card

It's cheap and it enables a lot of capability including the ability to send and receiver photos, keep a GPS log of where you've been, save photos and messages you've written or have received, and to backup and restore your radio's configuration and channels.

It Works Differently

One thing that can mess people up is that the HTs and mobile radios work a little differently than radios you have used in the past.

1. The mode of operation (FM/DN/DW/VW/AMS) is not stored with the channel. The setting is global to all the channels on the particular band.
2. You press and hold the power button to turn the radio on and off and press it momentarily to lock the radio. Man, this one takes time getting use to but trust us. It will soon seem “normal”.
3. Items associated with a memory channel (such as CTCSS/DCS mode and frequency, power level, etc.) can be changed and the change is permanent without having to save the channel. Most radios require you to save the channel to the same channel to make the change permanent.

FT1D(X)R

FT2DR

Power and Accessories

The FT1 and FT2 use the same batteries, chargers, and microphone/headset accessories.

The battery indicator on the FT2 is much improved over the FT1 and provides a reasonable indication of when battery charging/replacement is required.

In general the FT2 offers much better battery life than the FT1.

Changing the Display Backlight on the FT2DR

Courtesy of Dewey, WB7OEV

Why would you want to do this...to conserve battery power being one reason...another keep the Backlight on continuously in low light Conditions.

The FT2DR come with the backlight on in continuous mode as the default. You can set the Backlight to turn off after a certain amount of time has passed by you doing the following;

- Press the 'DISP' over 1 second to go to the main menu.
- Touch 'DISPLAY'
- Touch '4 LAMP'
- Rotate the DIAL to select 'KEY', then press the 'DISP' key.
- Rotate the DIAL to select the time for the backlight stay on.
- Press the 'DISP' key.
- Rotate the DIAL to select 'SAVE', then press the 'DIAL' key.
- Rotate the DIAL to select 'ON'. This turns off the backlight off.

For more information on HT power consumption and battery management, see:

http://www.hamoperator.com/Fusion/FusionFiles/K9EQ-Fusion-PDF-0002.0.0_FT1DR_Power_and_Battery_Performance.pdf

FTM-100DR

Copying channels from the FTM-400DR to the FTM-100DR

Courtesy of Dennis, KD0ZPF

**Note: Always turn the radio(s) off when inserting or removing an SD card.
This procedure assumes Chuck's Channels are loaded in the FTM-400.**

1. Format a micro SDHC card in the FTM-100.
2. Backup the formatted SD card using the FTM-100DR.
3. Turn off the FTM-100 and remove the SD card.
4. Insert the SD into the FTM-400DR.
5. Turn on the FTM-400 and write MEMORY CHANNELS to the SD card.
6. When finished, turn off the FTM-400 and remove the SD card.
7. Insert the SD card into the FTM-100 and turn the radio on.
8. Read the MEMORY CHANNELS into the FTM-100.
9. When The FTM-400 channels are now copied to the FTM-100

FTM-400DR

Cross-band Operation

1. Turn on the radio and select the frequencies that you want to use remembering that you may only have one VHF and one UHF. Notes set the one that will go to your HT using a DCS code and make sure to pick a simplex frequency that is not used by anyone local. Also set the power on both bands now, using the lowest power setting you can. This does two things, 1, it keeps your radio cooler and lowers your power consumption. 2, it will not broadcast your signal any further then you need on simplex or to the repeater.
2. Turn off the FTM-400.
3. While holding down the DISP, F, AND GM buttons turn on the radio.
4. once the radio is booted it will show "X-BAND Repeater" between the 2 VFO lines
5. To exit cross band shut off the radio and restart while holding the DISP,F, AND GM buttons down. verify that the screen no longer shows "X-BAND Repeater"

Note: APRS must be turned off otherwise cross banding will be disabled. (Thanks to KC0VRV for noticing this.)

Scanning on the FTM-400

The FTM-400 has two banks of 500 channels. One bank is for the 'A' or top side and the other is for the 'B' or bottom side of the radio. The two banks are isolated from each other. Programming channel 50 on 'A' does not change channel 50 on 'B'.

1. Scanning on the 'A' side is independent of scanning on the 'B' side.
2. Each channel can be set to 'OFF', 'SKIP', or 'SELECT'.
3. Each side can be set to 'ALL MEM' or 'SELECT MEM'.

The combination of the channel setting and memory scan type determines how the scanning will behave as shown in the following table.

| X = Channel will be scanned | | Memory Scan Type | |
|-----------------------------|--------|------------------|------------|
| | | ALL MEM | SELECT MEM |
| Channel Skip/Select | OFF | X | |
| | SKIP | | |
| | SELECT | X | X |

Since Memory Scan Type can be changed for an entire bank, it's possible to have two scan modes. Set the Channel Memory Scan Type as follows:

- For channels you never want to scan, set channel to SKIP.
- For channels you always want to scan, set channel to SELECT.
- For channels you sometimes want to scan, set channel to OFF.
- To scan all the enabled channels, select scan type of ALL MEM.
- To only scan the channels you always want to scan, set scan type to SELECT MEM.

Managing Channels on the FTM-400

If you're like me, I prefer to have the same channel number mean the same channel no matter which side I'm on. Unfortunately the FTM-400 uses two separate banks of memory for the 'A' and 'B' side. That means if you change Channel 50 on the 'A' side, Channel 50 on the 'B' side will remain the same.

There's no easy answer to solve this problem. Yaesu did not provide a memory configuration option. However this work-around can be used. This does use the RT Systems programming software. Fortunately you only need the software since the programming is done via the removable micro SD card.

1. Use the 'A' side as the master side. Select the "A band" tab at the bottom of the channels window.
2. Edit the A band so the channels are the way you'd like them.
3. Select all of the A band channels with CTRL-A.
4. Copy the channels with CTRL-C
5. Select the B band tab.
6. Select the first channel.
7. Paste a copy of the A band with CTRL-V.

There are two problems (other than it's a pain):

1. RT Systems software will remove any blank channels so that the channels are continuous. In other words, if you have channels 1-25 and 50-60 occupied and the remainder of the entries are empty, the copied channels will occupy 1-35. Argh because I like to have blocks of channels for different purposes with room between them so I can always enter a new, related channel in the field. The work-around for that is to use the above procedure, but copy the blocks of channels one at a time.
2. If you want a different scan setting for the 'A' and 'B' channels you'll need to manually go in and set each channel in 'B'. For example, sometimes I want to know, "Is anybody out there?" So I'll scan all of my channels, but the software won't let me take the skip/select column and set them all to 'OFF' with one operation. Each channel must be changed individually.

The RT software seems to work well with channels, but the radio functions can be problematic. For example, the software gives options for programming the 'A' - 'D' keys on the microphone as function keys, but the Yaesu firmware does not permit this. Fortunately you can separate the channels from the radio control information and only update the channel information in the radio.

Manual position in APRS

Doing this you will be able to send and receive position data from other radios even if your radio can not get a GPS fix due to being inside a building.

1. Type in your address to google maps <https://www.google.com/maps/place/> and hit enter. Look at the map, does this show your location?
2. If it does right click the red icon next to your address and then click "what's here" in the upper right corner a picture will appear and the last line will have a number like
3. "45.111471, -93.205588" highlight and copy.
4. Go to <http://boulter.com/gps/> to convert the GPS coordinates to what the radio wants to use.
5. Paste the number form #2 above into the "enter coordinates" box.
6. Click convert and map.
7. Use the numbers from the GPS line. It should look like this;

Latitude

Longitude

N 45 06.688

W 93 12.335

8. On the radio, push and hold the DISP button to get in the menu, pick APRS go to number 27 "MY POSITION" pick that, pick LAT and enter the first 6 digits from the N line. when finished pick enter. Repeat with LON and W.
9. Go back in the menu to #26 "my position set and select "manual".
10. Exit back to the main screen by pushing the back button multiple times.

Locked-out Frequencies

The FTM-400 has certain frequencies that it cannot receive. In the U.S., it is illegal to build a radio capable of cellular radio reception. (And yes, that law made more sense before everything went digital encrypted.) But it's still the law. So you'll see coverage statements like "Rx: 800-999 cellular blocked". But the FTM-400 also blocks part of the 900 MHz Amateur band!

Here's why. The FCC requires image responses to be a minimum of -40 dB. In order to achieve that requirement, the FTM-400 also blocks some non-cellular frequencies. The following frequencies are blocked by the FTM-400. The Ham band is shown in red:

729.500~749.990 MHz

824.000~849.000 MHz

869.000~894.000 MHz

912.000~943.510 MHz

957.000~988.510 MHz

Change Log

| Rev | Date | Change |
|-----|-------------|---|
| 5 | 5-Mar-2015 | Start of log |
| 6 | 24-Dec-2015 | Added FT2DR, FTM-100 + copying channels from the FTM-400 |
| 7 | 10-Apr-2016 | - Added contributions from Dewey, W0OEV - Other minor changes and clean-up |

Disclaimer

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