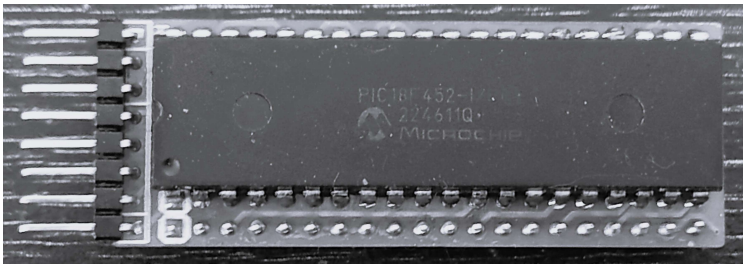
FT-757GX
FTPLUS
OPERATION
SUPPLEMENT

Designed, manufactured and programmed in England

Guide v1.4.1
Firmware v1.4.1

FTPLUS REPLACEMENT CPU SYSTEM FOR THE FT-757GX



GENERAL DESCRIPTION

This is a replacement microprocessor package for the Yaesu FT-757GX mobile transceiver. This has been created because the original CPU for this radio has been out of production for many years.

This has been built upon many months of work and testing and it continues to be actively developed.

Using VK2TRP's project as a start point, it has been slowly improving and evolving until it has reached its current level.

It is hoped that this item DOES NOT replace a working original CPU. Working originals ensure the originality of your radio and avoids the potential to cause damage by incorrect or inexperienced installation.

The package involves two parts. The firmware which this document is outlining – and the main PCB itself.

The part is based on a DIP-40 PIC 18F452 IC. These are low cost, easy to program and easy to incorporate into a design like this.

The firmware attempts to faithfully recreate the functions of the original CPU, while providing some useful functional upgrades.

These features are outlined below, which will be covered in greater depth throughout this manual. It is hoped that operators will take an interest in how things were created and this document will do its best to outline this.

Original CPU	**FTPLUS**
8 Memory Channels	14 Memory Channels + 20 VFOs
Memory programming	Memory Programming
Yaesu CAT one-way control	Yaesu CAT one-way control
Split transmit	Split transmit
Clarifier function	Clarifier function
Single Speed Dial	Single Speed Dial
Standard limited PMS system	Improved PMS system
	Accelerated Fuzzy Logic Dial
	CB Transceiver Mode
	Fine Tuning
	Kenwood Duplex CAT control
	Frequency Correction
	Multiple baud speed options
	Open-source and upgradeable!
	++more

THIS DOES NOT REPLACE THE ORIGINAL YAESU INSTRUCTION MANUALS. IT IS INTENDED TO SUPPLEMENT THAT DOCUMENT.

WARNING:

You undertake the modification of your equipment at YOUR OWN RISK. The author will NOT BE HELD LIABLE FOR ANY DAMAGE, HOWEVER CAUSED. As a skilled Radio Amateur, it is assumed this is within your skills. This has been tested to a good standard, however reports of bugs are welcome.

WHEN TESTING CAT REMOTE PTT FUNCTIONS, ENSURE A 100W DUMMY LOAD IS CONNECTED TO THE ANTENNA SOCKET, ALSO USE THE LINEAR SWITCH ON THE BACK OF THE RADIO TO DISABLE POWER OUTPUT WHEN TESTING. YOU HAVE BEEN WARNED.

CONTENTS

INITIAL SETUP

CAT mode

When switching on your radio for the first time, the default settings will be:

CAT mode: Yaesu
Baud rate: 4800

These can be changed when you first switch on your radio. This is the procedure:

Power off transceiver
Hold SPLIT button
Power on the transceiver

You will see some numbers alternating in the display:

757 > 140

These are CAT modes. Due to the lack of ability of showing printed text in the VFD display, we have to use numbers.

757 - Yaesu mode (as in Yaesu “757”)
140 – Kenwood mode (as in Kenwood TS-”140”)

When your desired selection is showing, press SPLIT to save and set BAUD or MR/VFO to exit setup. This stores this value to the system.

This will cycle between 757 and 140, for 5 times. If no selection is made, the default (757) option is saved.

If you pressed MR/VFO to save, setup will exit, saving CAT mode.

If you pressed SPLIT button, CAT mode will be saved, then you will see more numbers.
This is to set BAUD rate. Read next section.

CAT baud rate

After setting CAT mode, we will enter BAUD rate selection

You will see different values showing on your display:

1200 (or 001200)
2400 (or 002400)
4800 (or 004800)
9600 (or 009600)
19200 (or 019200)
38400 (or 038400)
57600 (or 057600)
115200.

As before, press SPLIT on your chosen selection.

The BAUD rates will cycle through 5 times. If no selection is made, the default (4800) is saved.

Hint!

The system speed is also the speed when in the bootloader mode, for your convenience.

Example: If you set a BAUD rate of 57600, this will also be the BAUD rate when in bootloader mode.

Setup mode can be accessed anytime by following these procedures.

Overview:

Press SPLIT when powering on to enter CAT setup

Choose 757 or 140 selected with SPLIT or MR/VFO

If SPLIT is pressed, baud rate will be set as above.
If MR/VFO was pressed, setup will exit, saving just CAT mode.

If NOTHING is pressed, defaults will be saved: 757 mode and 4800 BAUD.

MEMORY PROGRAMMING

To save a tuned frequency to the onboard memory bank, we follow the same procedure as the original CPU.

In VFO mode (VFO A or B), tune to your desired prequency and press VFO>M.

The current memory channel location will flash and beep TWICE in the display.

In addition, you can save from a third VFO frequency, when MR mode is active.

Channels are numbered from 0 to E, so when you reach 9, any further increases will be in letters, so one after 9 is ‘A’.

In CB mode, saving of CB frequencies directly to the memory bank isn’t implemented, as one can just save these frequencies from VFO mode if desired, by pressing M>VFO in CB mode.

HINT!

In VFO mode:
You can change memory channel WITHOUT entering MR mode. Just hold BAND UP or BAND DOWN for 1.5 seconds to increase or decrease the current channel. There will be two flashes and beeps, showing the new channel.

In MR mode:
You can tune up and down the entire frequency range, without disturbing your VFO A or B contents, making a “third” VFO. Frequencies tuned using this feature, are NOT saved at all, unless the VFO>MR button is pressed.
You can also move up and down the bands, by pressing and holding BAND UP/DOWN for 1.5s. A short press on BAND UP/DOWN moves the current memory up or down by one.

In CB mode:
To transfer a CB frequency to VFO/MR, press M>VFO when in CB mode. This will save the CB frequency to current VFO, allowing a save to MR if required.

To move a saved frequency to VFO A or B, press M>VFO to move, or M<>VFO to swap.

This works regardless of VFO or MR mode. When the chosen button is pressed, the display will flash and beep, before the frequencies are swapped or moved.

Ensure you have your desired MR and VFO selected before pressing this button, to avoid any mistakes.

VFO / MR / CB Transceiver Mode*

Three modes exist within FTPLUS. All modes are accessed by pressing MR/VFO.

To toggle between VFO and MR modes, a single short press on MR/VFO will change modes.

To enter CB Transceiver mode, hold down MR/VFO for approximately 3 seconds, in Wideband mode only.

VFO A /B – VFO tuning

VFO A or VFO B will be shown in the display.

When in this mode, press BAND UP / DOWN to move from one frequency band to the next. **Current frequency will be allocated to the current "VFO" memory. This effectively gives and extra 20 memory channels, overwriting the stock "bands".**

Press and hold BAND UP / DOWN to increase or decrease memory channel (hidden in VFO mode of course) – this is handy for saving frequencies to memory without entering MR mode first.

MR – Memory Recall

Tune the whole frequency range. MR will be shown in the display, along with the current channel.

To change channel, a short press on BAND UP/ DOWN will change selected channel up or down.

Press and hold BAND UP/ DOWN to increase or decrease CHOSEN BAND. This is a convenience feature, allowing you to change bands in preparation for saving, using the extra VFO we use within MR mode.

When in MR mode, you can tune the radio as you wish, WITHOUT affecting VFO A or B.

CB Transceiver Mode – FCC / CEPT / UK

Use VFO wheel, microphone or BAND UP / DOWN to change channels.

Channel number is displayed, together with a number.
1 = FCC/CEPT band
2 = British 27/81
3 = 80 Channel mode

The default band is CEPT / FCC, upon a new install.

To change bands, when in CB mode, press SPLIT quickly.

Depending on your display CPU, you may see 'CE' or 'b' in the display for a second. This signals your current band.

To view your chosen frequency, press CLAR and the frequency will be shown for a second.

To change to 80ch mode

Channels are arranged as follows:

1 – 40 CEPT CB
41 – 80 UK CB

Hold SPLIT for approximately 3 seconds until a beep is heard.

Depending on your display CPU, the words 'ALL CB' will be displayed.

To exit 80 channel mode, hold SPLIT once again.

To exit CB mode, press MR/VFO

HINT!

Bands can be quickly restored by holding VFO>M for 2 seconds. All VFO saves will be replaced to stock values. No other settings are changed.

Memories can be saved quickly over the CAT interface, if an app supports it. See the CAT section for more details

To copy a CB frequency to VFO A or B, press M>VFO when in CB mode.

*** CB Mode is only available when radio is in WIDEBAND condition, either permanently with the switch on the front panel, or temporary wideband over serial.**

VFO Button Tuning Mode

When in VFO mode, it is possible to manually tune to ANY FREQUENCY, without using the VFO dial and without using a computer.

This is a special mode intended for when the VFO dial is inoperative, damaged or missing.

Entering Button Tuning Mode

1. Ensure transceiver is in VFO mode (VFO A or B).

2. Ensure DIAL LOCK (D LOCK) is enabled and LOCK is illuminated in the display.

3. Hold down D-LOCK for approximately 1.5 seconds. The transceiver will beep. Release D-LOCK.

4. The display will show the frequency, with the left-most digit flashing slowly.

Operation

5. Press BAND UP / DOWN or MIC UP / DOWN to change value as required.

6. Press D-LOCK or MIC FAST momentarily. The flashing digit will move to the right 1 place. Repeat step 5.

7. You will notice all the digits can be changed and altered as you like, the hidden digit will scroll into view.

Exit if you wish (press VFO A/B or hold MIC FAST) or commence FAST TUNING (MOMENTARY PRESS D-LOCK or MIC FAST)

Fast Tuning

The WHOLE DISPLAY will flash. You can now press or hold BAND UP / DOWN or MIC UP / DOWN to rapidly tune in 500Hz steps.

When finished, Press VFO A/B to save (or hold MIC FAST) and exit, or press D-LOCK momentarily to start entering individual digits again.

Exiting Button Tuning Mode

Press VFO A/B or hold MIC FAST to exit and save to current VFO

HINT!

If you press D-LOCK too many times, just keep pressing D-LOCK and the cursor will cycle through the display digits again.

Example: BAND UP / DOWN Change Values, D-LOCK to move on next segment. See below:

1 2 3 4 5 6
Flash

Press D-LOCK momentarily

1 2 3 4 5 6
Flash

Press D-LOCK momentarily

1 2 3 4 5 6
Flash

Press D-LOCK momentarily

1 2 3 4 5 6
Flash

Press D-LOCK momentarily

1 2 3 4 5 6
Flash

Press D-LOCK momentarily

1 2 3 4 5 6
Flash

Press D-LOCK momentarily (Last number visible)

2 3 4 5 6 7
Flash

Press D-LOCK momentarily

1 2 3 4 5 6
Flash Flash Flash Flash Flash Flash
(FAST TUNING MODE)

Repeat if required, or exit using VFO A/B or holding MIC FAST to SAVE.

Microphone Button Functions

Microphone button action has been improved in FTPLUS, compared to the standard Yaesu settings.

The function of these buttons is described below.

In virtually all functions that require up and down, you can use the microphone.

VFO Mode

UP/DOWN (Single Press)
In fine-tune mode, frequency is changed by 10hz.

UP/DOWN (Holding)
Frequency is changed by 100hz.

FAST + UP/DOWN
Frequency is changed by 1Khz.

FAST (Single Press)
Band increase. (Looping).

FAST (Holding)
Change to MR mode.

MR Mode

UP/DOWN (Single Press)
Channel Up/Down by 1.

UP/DOWN (Holding)
Channel Up/Down quickly.

FAST + UP/DOWN
FAST (Single Press)
No Function.

FAST (Holding)
Change to CB mode (if wideband active).
Change to VFO mode (if wideband inactive).

CB Mode

UP/DOWN (Single Press)
Channel UP/DOWN by 1.

UP/DOWN (Holding)
Channel UP/DOWN quickly.

FAST + UP/DOWN
No Function

FAST (Single Press)
Change Band(FCC / CEPT - BRITISH)

FAST (Holding)
Exit CB Mode

Hint!

Serial CAT transmit is shared with MIC DOWN signal. So if you are using bidirectional Kenwood CAT and you press MIC DOWN button, this will cause a zero to be sent to the data stream.

This will not cause any problems or faults to the radio, as the data is self-correcting once the DOWN button is released.

However, it is good practice to not use the MIC DOWN button if Kenwood CAT is in use.

There may be some programs out there that don't like the data stream altered. However at time of writing, none have been identified.

TUNING DIAL TYPE SELECTION

Within FTPLUS, there are two VFO dial MODES

To change dial type, ensure you are in VFO or MR mode and HOLD M>VFO for approximately 3 seconds.

DIAL A – STANDARD DIAL

This is the standard Yaesu-specification dial. One revolution is equal to approximately 10khz.

DIAL B – ACCELERATED DIAL

This dial will move up and down faster, the more "effort" is put in to spinning the tuning wheel. Spinning quickly will increase the frequency counting speed faster or slower.

There are 4 different "speeds".

Speed 1 = 10khz per revolution
Speed 2 = 50khz per revolution
Speed 3 = 100khz per revolution
Speed 4 = 250khz per revolution

Speeds are handled seamlessly and automatically.

HINT!

Speeds can be changed over CAT serial! See CAT section for more information

FINE TUNING MODE

In VFO or MR mode, fine tuning can be activated.

To activate or deactivate Fine Tuning, hold down D-LOCK until a beep is heard

When this mode is active, small turns on the VFO tuning wheel will make the display move one digit to the LEFT, allowing the missing digit to be displayed

For example, when tuned to 7.000.0 mhz, turning the dial will make the frequency display move one digit left while tuning, so the display would display 70.000.1, 70.000.2 etc. The display will hide the extra digit when tuning stops.

This gives approximately 5khz increase / decrease in frequency per revolution.

This mode also works when tuning using the MIC buttons.

FREQUENCY CORRECTION AND ALIGNMENT

FTPLUS has an alignment feature, which allows you to set, for example a ZERO POINT if your radio is not quite aligned correctly

Example:

You tune to 27.555 and all stations sound high-pitched. This is because your radio is slightly off-frequency.

The procedure is outlined here:

Tune to a desired frequency, using fine-tune if necessary to get to true ZERO.

Activate the alignment mode and slowly turn the tuning dial clockwise or anticlockwise, until the stations sound correct. The difference between your displayed frequency and the true frequency is called an OFFSET.

An offset can either be +/-.

The number doesn't really matter, but when the stations are sounding correct, you press the SAVE button to store the offset. This will then be applied wherever you tune.

There are even two modes for this.

Default mode is one single offset for the whole tuning range.

You can also activate "per-band" offsets, so you can set different offsets per band.

Handy if you need one offset for 40 meters LSB and a different one for 20 meters USB!

To proceed, please continue reading.

1) CHOOSE AN OFFSET MODE

If your radio is out of tune by approximately the same amount across the whole tuning range, single offset mode is sufficient

If it varies from band to band, activate multiple offset mode.

To toggle offset modes, hold down VFO<>M.
You will hear either two or three beeps.

Two beeps is SINGLE OFFSET MODE
Three beeps is PER-BAND OFFSET MODE

2) TUNE TO A KNOWN ON-FREQUENCY SIGNAL. IGNORE HOW IT SOUNDS OFF FREQUENCY! TUNE TO WHAT WOULD BE ITS CORRECT FREQUENCY.

Ensure you get it as close as possible to 0 in the hz digit of the display. It will sound incorrect, or off-frequency as we have not yet aligned it.

Activating Fine Tune can help and make things even more accurate. Being on ZERO, means you have found ZERO POINT. The display is on Zero point, but the radio tuning circuits are not. We correct this now.

HOLD DOWN CLAR for approximately 3 seconds.
The display will show a single 0.

With the station broadcasting in the background, adjust the tuning dial until the most "correct" sound is heard.

When happy, hold down CLAR for 3 seconds until you hear a beep. The tuned frequency should now match your displayed frequency.

HINT!

To reset to zero, press D-Lock when in alignment mode.
For a reminder of your chosen display frequency, press CLAR once quickly.

CAT INTERFACE AND MODES INTRODUCTION

FTPLUS supports two methods of CAT communication.

1) Original Yaesu FT-757GX mode

RS232:	**Receive from PC only**
Baud Rate:	**4800 Baud**
Stop Bits:	**2**

No other cables are required. Use the original CAT port on the back of the FT-757GX

Some extra commands have been added, which could be turned into a custom command in FLRIG

See Page 13.

2) Advanced Kenwood CAT emulation

RS232:	**Bidirectional Half-Duplex**
Baud Rate:	**1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200**
Stop Bits:	**2**

This requires a “serial TX” transmit line to your RS232 USB device.

On FTPLUS boards, this extra TX connection is provided on the circuit board itself.

This transmit line is provided on the PCB of FTPLUS. labelled RS232 TX. This is also connected to MIC DOWN button on the front panel, (PIN 3 MIC socket). It is for the operator to decide the best way of attaching the TX line.

Examples:

Use the CAT port on the back of transceiver as normal and piggyback a wire to MIC DOWN on the front panel, for serial transmit. You could even attach this to your hand microphone plug.

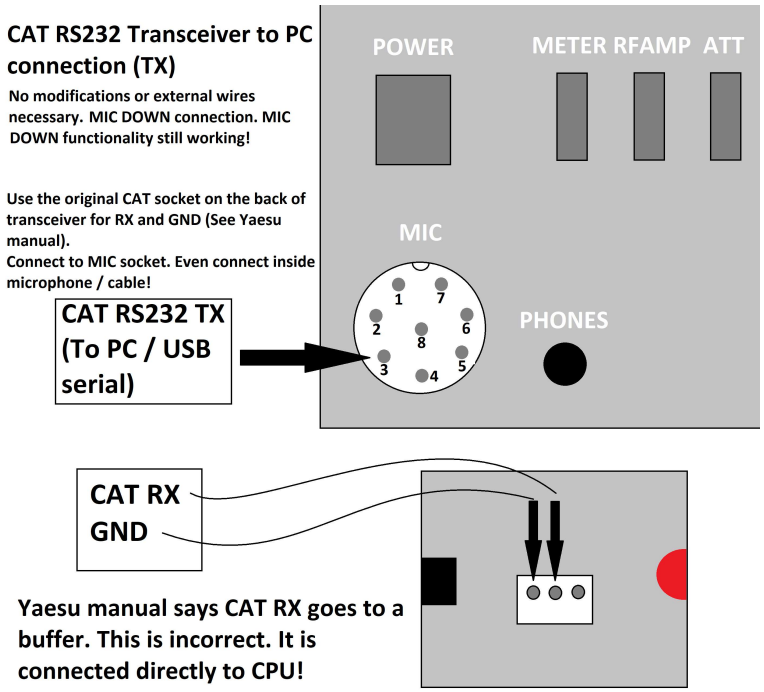
Or

Disconnect the AGC wire from J11 Pin 5 and reattach this to TX pin on FTPLUS.

Or

Feed 3 x DuPont or similar cables to the RS232 port on FTPLUS and fit these between the casing of the radio, for RX, GND and TX serial.

See Page 14.



CAT INTERFACE AND MODES
YAESU MODE

Please see the original FT-757GX manual for information regarding CAT commands and formatting.

Some NEW COMMANDS have also been added for your convenience. Commands are assembled and sent in exactly the same way as the Stock Yaesu system

F1 = 100 & 10 Hz
F2 = 10Khz & 1 Khz
F3 = 100Khz & 1Mhz
F4 = 10Mhz & 100Mhz (100Mhz = not used)
CM = Command
XX = Value not important, is ignored

Eg F1 F2 F3 F4 CM would be sent as F1F2F3F4CM

Command: E0, E1, E2, E3, E4, E5, E6, E7, E8, E9, EA, EB, EC, ED, EE

Requires (F1 F2 F3 F4 E0) – (F1 F2 F3 F4 EE)
This is for fast memory saving. E0 – EE are the channel numbers (0 – 14).

Command: 0A (for reference)

Requires (F1 F2 F3 F4 0A)
Setting of frequency for current VFO

Command: 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 1A, 1B, 1C, 1D, 1E

Requires (F4 F3 F2 F1 10) – (F4 F3 F2 F1 1E)
Fast memory saving, in human-readable format. 10 – 1E are the channel numbers (0 – 14).
EG 7.000mhz to channel 3 = 0700000013
EG 10.100Mhz to channel 10 = 101000001A

Command: 0F (for reference)

Requires (F4 F3 F2 F1 0F)
Setting of frequency for current VFO in human-readable format

OTHER COMMANDS

S1 – Speed 1 (Slowest)
S2 – Speed 2 (Slow)
S3.– Speed 3 (Fast)
S4 – Speed 4 (Fastest(
XX = Value not important, is ignored

Eg S1 S2 S3 S4 CM would be sent as S1S2S3S4CM

Command: FB

Requires (S1 S2 S3 S4 FB)
Dial speeds setting (in accelerated dial mode)

Speeds are in *10 Hz, written in HEX format.
Eg an S1 of 05 = 50Hz, 09 = 90Hz, 10 = 160Hz, FF = 255Hz

Example 050A1932FB would be:
Speed1 = 05, Speed2 = 0A(10), Speed3 = 19(25), Speed4 = 32(50)

Giving Speed1 50hz, Speed2 100hz, Speed3 250hz, Speed4 500hz.

Command: FC

Requires (XX XX XX XX FC)

Temporary wideband, until next reboot.

If activated when transceiver is widebanded via the internal switch, will emulate non-widebanded condition until reboot. This is useful for testing perhaps.

Command: FD

Requires (XX XX XX XX FD)

CB Mode on/off (only in widebanded mode, either temporary or permanent wideband)

Command: FE

Requires (XX XX XX XX FE)

Full EEPROM reset

ADVANCED KENWOOD CAT EMULATION

Ensure the serial transmit TX pin is connected as outlined in the previous section

To change CAT modes, follow the INITIAL SETUP procedure at the beginning of this document.

There is also a limited semi-automatic CAT selection. If BAUD rate is correct and a valid Kenwood command is sent, FTPLUS should enter Kenwood mode.

This can vary between applications on how successful this is.

If you INIT the CAT interface and you get an error, try a few more times.

The RS232 receive buffer needs to set up and clean itself. If after trying a few times you cannot connect, double check your BAUD rate.

If it is still not working, follow INITIAL SETUP to restore to CAT defaults and try again.

Hint!

A handy way of testing CAT is to open a serial terminal and press the MIC DOWN button. If you see a 0, or a 00, serial is correctly set up. This cannot tell you if your BAUD rate is correct, however.

CAT PTT is supported in FTPLUS. A slight modification to the radio is required to take advantage of this. Soldering is required.

DIAL LOCK is disabled while CAT PTT is active. If DIAL LOCK is enabled, dial will be unlocked during CAT PTT and will be locked again after CAT PTT ends.

KENWOOD COMMANDS CURRENTLY SUPPORTED.

See other publications regarding Kenwood commands. Here is a brief summary:

AI0; / AI1 - Auto information
UP; DN; - Up / Down buttons
FA FB - Read / Set VFO A/B frequency
FN - VFO A/B/ MR Mode
FR FT - Current VFO in use
IF - Information
LK - Dial lock
MC - Set Memory Channel
MD – Mode (Set as dummy value, due to physical switch. Dummy value and physical switch positions should match
MR - Memory Read
MW – Memory Write
RC, RD, RU, RT – RIT mode (Clarifier)
RX – Receive mode
TX – Transmit mode (See CAT PTT section)
SC – Scan (PMS)
SP – Split mode
ID – Identifier (ID006 = Kenwood 140s)

EXTRA

IE0; / IE1; / IExxx
This enables or disables the Kenwood identifier for compatibility purposes.
This command should be sent from any serial terminal. You will hear a confirmation beep.
IE0; = ID Disabled (Recommended, default)
IE1; = ID Enabled. Can cause problems!
IExxx; = Custom CAT ID, eg IE006; is default.

YA; Enables Yaesu mode CAT. However if any further Kenwood AT commands are sent, Kenwood mode is reselected.

So after YA; - disconnect and set up your software for Yaesu mode

NEW PMS SYSTEM

The PMS system is a scanning system, designed to scan through frequencies quickly and stop when a signal is received.

The original PMS system was rather limited it its scope.

So a new system has been designed.

There are two PMS controls.

The PMS switch itself.
The 500K button.

The PMS switch turns the feature on or off
The 500K button changes how the PMS scan is performed.

The different PMS modes are outlined on this page.

VFO MODE – Press PMS to begin and to end scanning

500k button pushed OUT:

Scanning will begin from the current frequency, to the start of the NEXT band.

Example: You are tuned to 7.165Mhz. Scanning will begin from 7.165 mhz and carry on until the start of the NEXT VFO, which is 10,100mhz, before looping back to start of current band, which is 7.000Mhz.

500k button pushed IN:

Scanning will begin from the start of the current CEPT/FCC band, until the end of the band.

Example: You are tuned to 7.165mhz. Scanning will begin from 7.000mhz and carry on until the end of the 40 meter band, which is 7.200 mhz

Most, if not all CEPT/FCC bands are programmed. Just tune to anywhere within your chosen band and PMS will do the rest

MR MODE – Press PMS to begin and end scanning

500k button pushed OUT:

Scanning will begin from frequency stored at current memory channel, to the frequency stored at the NEXT channel.

Example:
You have 14.150 stored to channel 2
You have 7.165mhz stored to channel 3
You have 10.150mhz stored to channel 4.

If you are currently tuned to channel 3, pressing PMS will scan from between channel 3 to channel 4. So the scanning range will be from 7.165 to 10.150, going UP. Once 10.150 is reached, the cycle begins again from 7.165.

If you are currently tuned to channel 2, pressing PMS will scan from between channel 2 and channel 3. So the scanning range will be from 14.150 to 7.165mhz, going DOWN.
Once 7.165 is reached, the cycle will restart from channel 2 (14.150).

If the SAME FREQUENCY is stored, eg 7.000 is stored as default in channel 0 and channel 1, you will hear an error beep because scanning isn't possible, as the start and end frequencies are the same.

500k button pushed IN: ***

All channels are scanned individually, beginning at Channel 0 and ending at Channel E, then starting again.

*** This can cause rapid relay clicking and it isn't recommended to use

NEW PMS SYSTEM contd.

CB MODE – Press PMS to begin and end scanning

500k BUTTON HAS NO EFFECT IN CB MODE DURING PMS SCANNING

All frequencies of the CURRENT CB BAND are scanned, in channel form.

Pressing PMS will begin scanning from Channel 1 until the last channel of the current band.

1 – 40 CEPT
1 – 40 GB
1 – 80 80 Channel mode

To scan a different band, ensure PMS is stopped. Change transceiver to desired band and press PMS to start scanning.

NOTES ABOUT SCANNING – ALL MODES

Current frequency or channel can be skipped, by pressing BAND UP / DOWN or MIC UP/ DOWN.

If PMS IS STOPPED WHILE NO SIGNAL IS RECEIVED, IE THE FREQUENCINES AND CHANNELS ARE CHANGING, THE PREVIOUS FREQUENCY / CHANNEL WILL BE RETUNED, JUST AS THOUGH NO PMS HAS TAKEN PLACE.

IF PMS IS STOPPED WHILE LISTENING TO A TRANSMISSION, THE TRANSCEIVER WILL STAY ON THAT FREQUENCY OR CHANNEL

OTHER FUNCTIONS

EEPROM RESET

To reset the EEPROM back to defaults, with the radio switched on, press and hold VFO A/B until beeps are heard.

Radio will reboot.

BAND RESET

If jumbled up “bands” are causing confusion, hold VFO>M when in VFO mode, to set them back to default. No other settings are altered. This only resets the “VFOs” back to their stock positions.

WIDEBAND INFORMATION

The radio can be widebanded using the switch behind the front panel, as usual.

If transceiver is NOT widebanded, CB mode is disabled.

If out-of-band transmit is attempted when transceiver is NOT widebanded, a beep will be heard and TX will be prevented until transceiver is retuned to a valid frequency.

TEMPORARY WIDEBAND

There is a temporary wideband facility, which is a command sent over Yaesu mode serial. See CAT section for more information.

This wideband will only persist until next power cycle reboot. See CAT section.

BUTTON ACTION QUICK REFERENCE

BUTTON	BUTTON PRESSED	BUTTON HELD
SPLIT	**(VFO/MR MODE) SPLIT (CB MODE) FCC / GB BAND**	**CB 80 CH MODE**
MR/VFO	**MR/VFO MODE**	**CB / EXIT CB**
VFO<>M	**VFO/MR SWAP**	****SINGLE ALIGNMENT *** BANDS ALIGNMENT**
VFO>M	**VFO/M SAVE**	**RESET VFOS (BANDS)**
M>VFO	**MR TO VFO A/B**	****STANDARD DIAL ***ACCELERATED DIAL**
UP	**UP BAND/CHANNEL**	**(IN VFO MODE) UP MEM CH (IN MR MODE) UP BAND**
DOWN	**DOWN BAND/CHANNEL**	**(IN VFO MODE) DOWN MEM CH (IN MR MODE) DOWN BAND**
D-LOCK	**DIAL LOCK**	**(LOCKED) – BUTTON TUNE (UNLOCKED) – FINE TUNE**
CLAR	**CLARIFIER**	**ALIGNMENT MODE / SAVE**

**** 2 X BEEPS**
***** 3 X BEEPS**

CAT SPECIAL COMMAND GLOSSARY

YAESU MODE:

E0 – EE (Example XX XX XX XX EE	**FREQUENCY SAVING LSB HEX**
10 – 1E (Example XX XX XX XX 1E)	**HUMAN-READABLE FREQ SAVING**
0F (Example XX XX XX XX 0F)	**HUMAN-READABLE FREQUENCY SET**
FB (Example XX XX XX XX FB)	**ACCELERATED DIAL SPEEDS**
FC (Example - - - - - - - - FC)	**TEMPORARY WIDEBAND**
FD (Example - - - - - - - - FD)	**CB MODE TOGGLE**
FE (Example - - - - - - - - FE)	**EEPROM RESET**

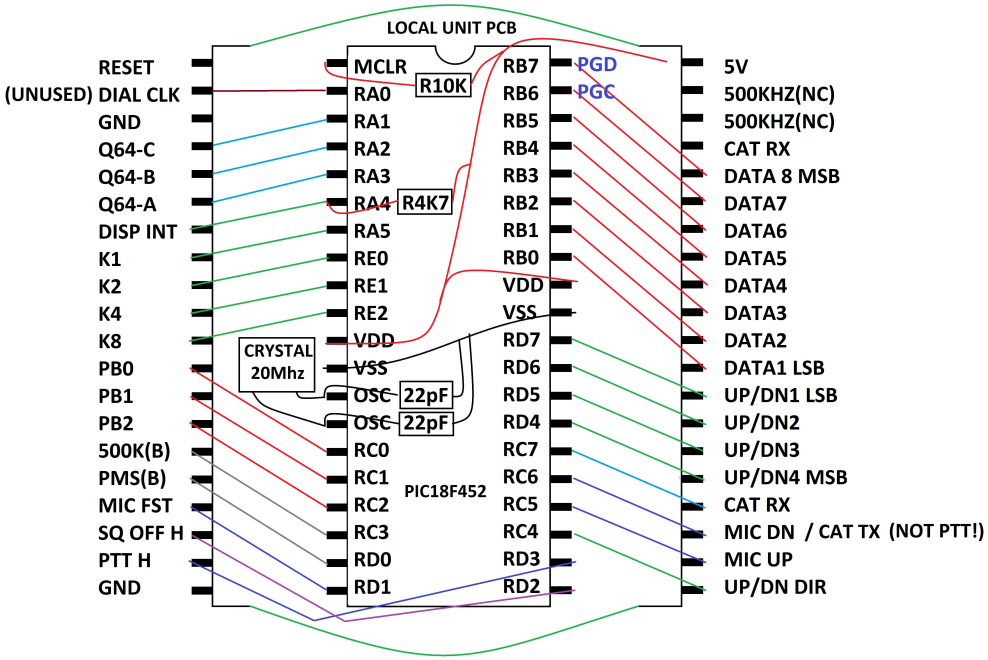
KENWOOD MODE

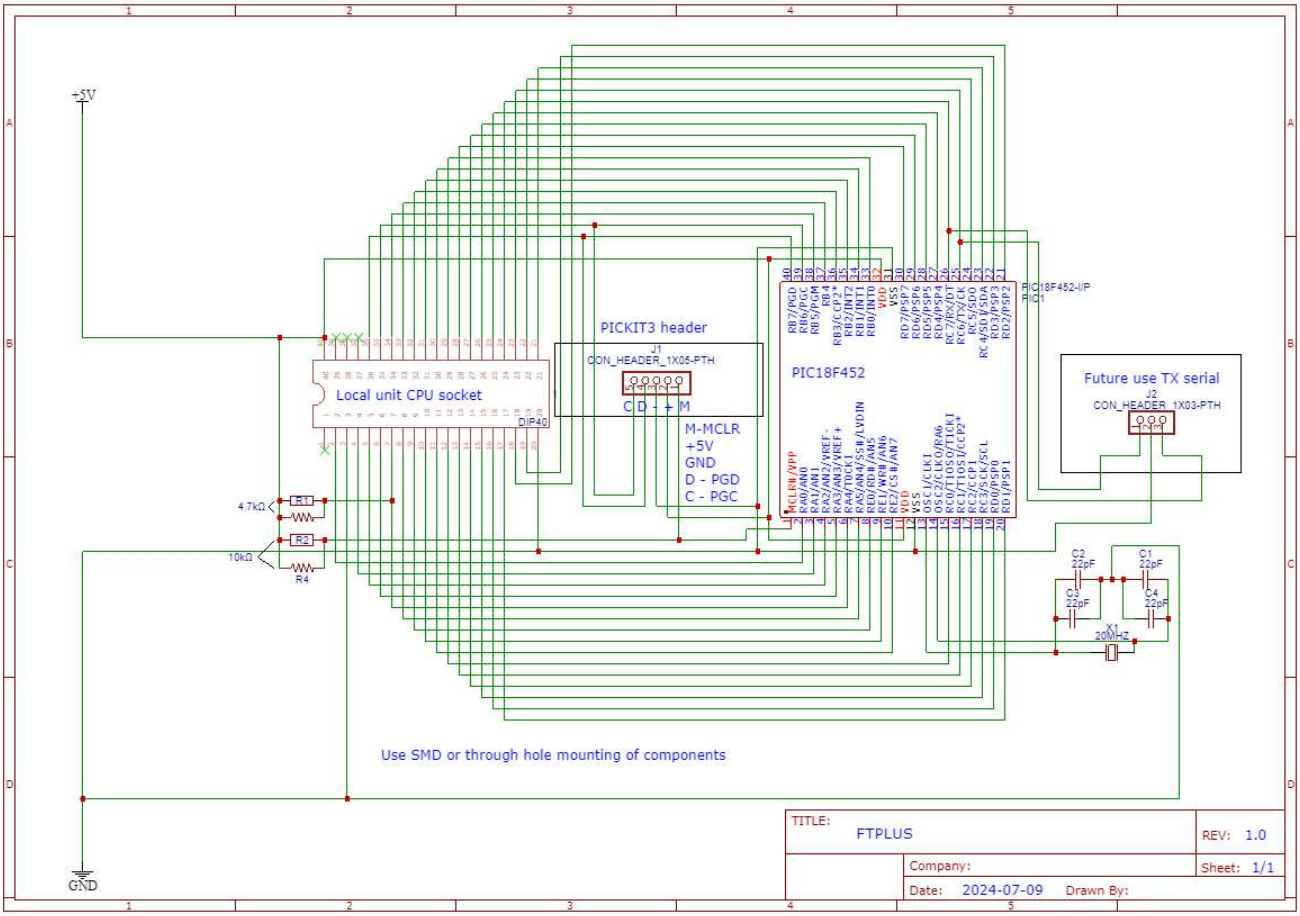
IE0; IE1; IExxx;	**CAT ID disable / enable change**
YA;	**Yaesu mode**

SCHEMATICS, TECHNICAL INFORMATION, PARTS LIST

FT PLUS – LOCAL UNIT CONNECTION MAP AND SCHEMATIC

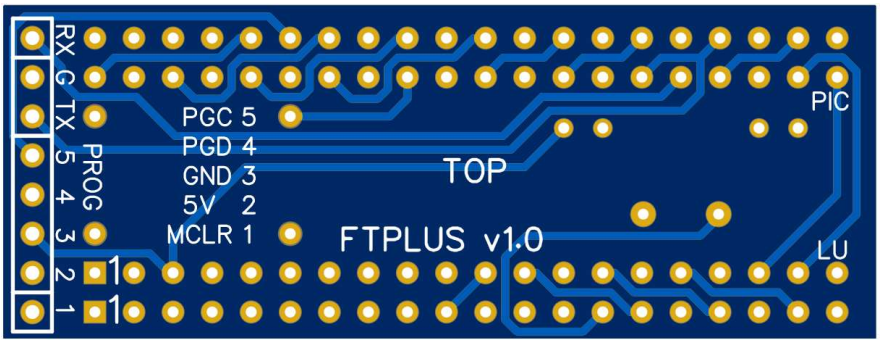
USE EITHER 0603 SMD COMPONENTS OR THROUGH HOLE. THE BELOW



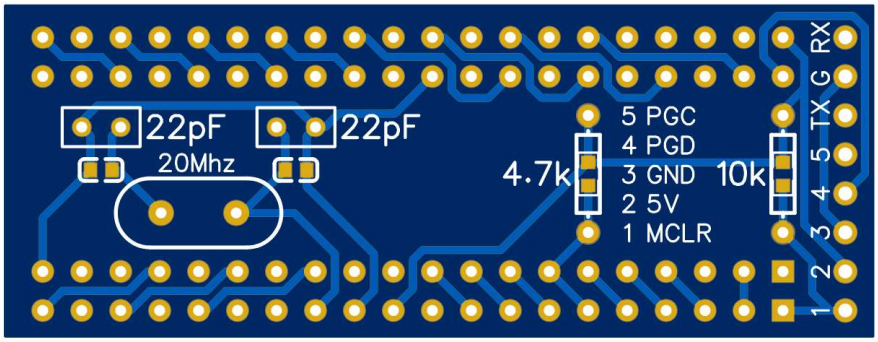


SCHEMATIC HAS 8 PASSIVE COMPONENTS. THIS IS FOR DIAGRAM PURPOSES.

SCHEMATICS, TECHNICAL INFORMATION, PARTS LIST



UPPER VIEW



LOWER VIEW

Parts list: (Pads to accommodate THROUGH HOLE OR SMD components are provided.)

2x	**22pF Capacitor – SMD 0603 / THT**
1x	**4.7K Ohm Resistor – SMD 0603 / THT**
1x	**10K Ohm Resistor – SMD 0603 / THT**
1x	**20 Mhz Crystal Oscillator**
4x	**20 Pin Turned Pin**

Serial Pinout: (OPTIONAL. Recommended: Use CAT socket and MIC DOWN.)

RX	**RS232 RX (Tied with CAT port on back of transceiver)**
G	**RS232 GND**
TX	**RS232 TX (Tied with Mic Down button on MIC connector - PIN 3)**

PICKIT 3 Programmer Pinout: (If CAT PTT is fitted, read WARNING!!!)

5	**PGC (RB6)**
4	**PGD (RB7)**
3	**GND**
2	**5V**
1	**MCLR**

It is recommended that turned pins are used on the local unit and on FTPLUS.

CAT PTT Modification PAGE 1

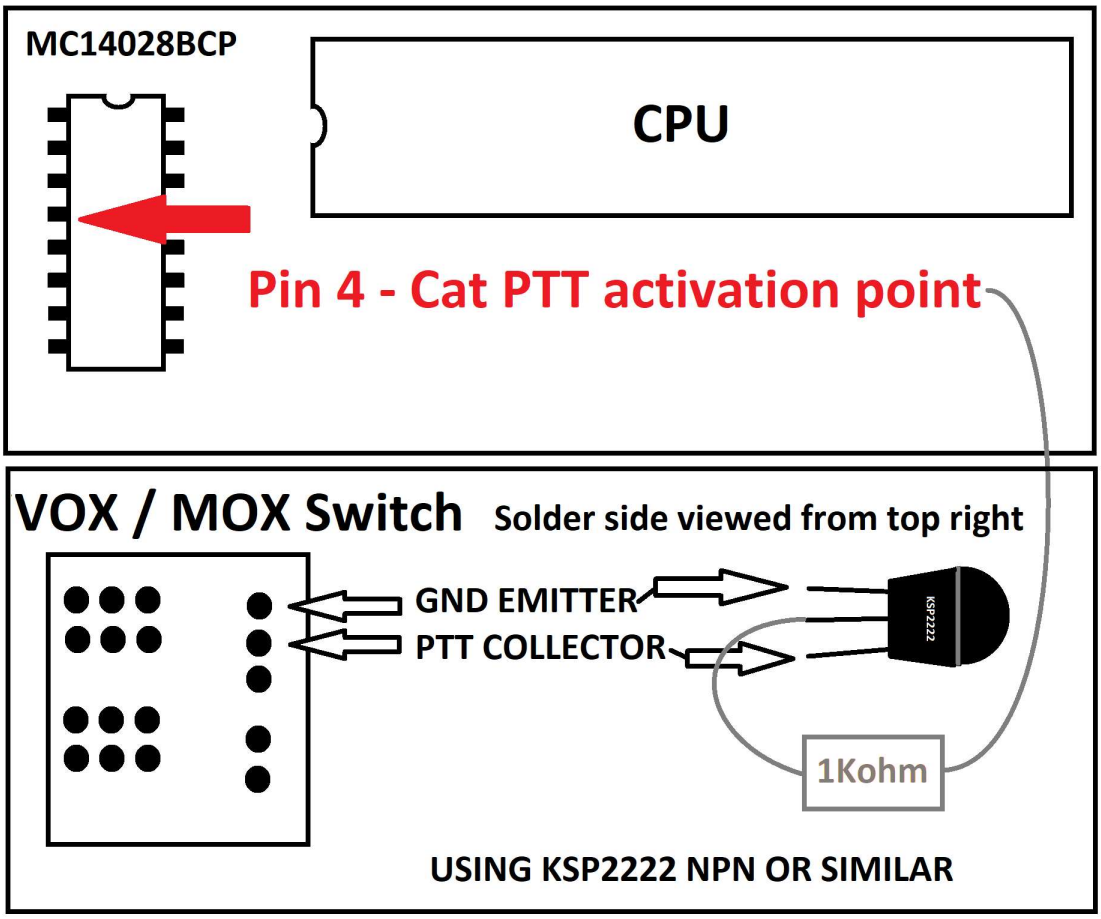
Parts required:

- Approx 4 inches (100mm) of wire, eg DuPont
- NPN transistor, at least 100mA (for example KSP2222, BC547 etc)
- 1000 Ohm resistor (1K)

Instructions:

- Radio turned OFF
- Remove radio top cover
- Remove FTPLUS for easier access if needed
- Locate IC marked MC14028BCP to the left of the processor
- Locate Pin 4 (going from top left). Solder length of wire to Pin 4.
- Solder 1K resistor to other end of wire
- Solder BASE of transistor to other end of resistor

- Locate MOX / VOX switch board (in front panel, directly under the left hand screw hole for the top lid), attach emitter and collector as shown



CAT PTT Modification PAGE 2

ATTENTION!

IF CAT PTT MODIFICATION IS FITTED, WHEN UPDATING FIRMWARE WITH PICKIT 3, PRESS THE LINEAR BUTTON TO SWITCH OFF THE FINAL OUTPUTS.

UPGRADING THE FIRMWARE WITH THE CHIP FITTED IN THE RADIO, WILL ACTIVATE PTT IF YOU HAVE CAT PTT FITTED.

WARNING

EITHER REMOVE FTPLUS TO PROGRAM, OR MAKE SURE LINEAR BUTTON IS PUSHED IN DURING FIRMWARE FLASHING, WHEN UPGRADING FIRMWARE WITH PICKIT 3!!!

BOOTLOADER SERIAL UPGRADES ARE UNAFFECTED. You can safely update over serial.

CAT PTT IS NOT REQUIRED TO USE BOOTLOADER MODE

This modification is NOT COMPULSORY. Other methods of activating PTT exist, eg VOX, RTS, DTR lines etc

CAT PTT mode will only be active when FTPLUS is in KENWOOD mode.

To disable PTT completely, a switch can be fitted between the activation point and the resistor if required.

The 10mS “ON-AIR” light upon power-up is normal. Nothing is transmitted.

FIRMWARE UPDATE + BOOTLOADER

FT PLUS uses standard Pickit 3 pinout to reprogram. The programming pins are on the left hand side of the PCB. These may be marked:

- M MCLR
- + 5V
- - GND
- D PGD
- C PGC

BOOTLOADER SUPPORT

To make future upgrades easier, you can flash the official FTPLUS BOOTLOADER with a PICKIT 3 or similar device. Once you have done this, connect the CAT / RS232 TX and RX, then you can update over serial.

Notes About Bootloader (AFTER INSTALLATION OF BOOTLOADER)

- Recommended serial program: SIOW.exe
- BAUD: Default: 4800, unless changed in FTPLUS SETUP (See INITIAL SETUP).
- Stop Bits: 2
- Data Bits: 8 (normally default in most software)
- Parity: NONE (normally default in most software)

To install bootloader:

- Flash FTPLUS_BOOTLOADER.HEX using Pickit 3.

To activate bootloader mode:

- Power off the radio
- Start up your serial program, with the above settings and ensuring TX, GND and RX are connected (either to FTPLUS PCB or... RX to CAT port, TX to Mic socket pin 3.
- Hold down PMS switch. Turn on radio. You should see “FTPLUS HEX file?”
- Upload the new HEX file. Example – in SIOW, click “File” then click “Download Software”
- Software will download and flash automatically. See pictures on pages 22, 23.

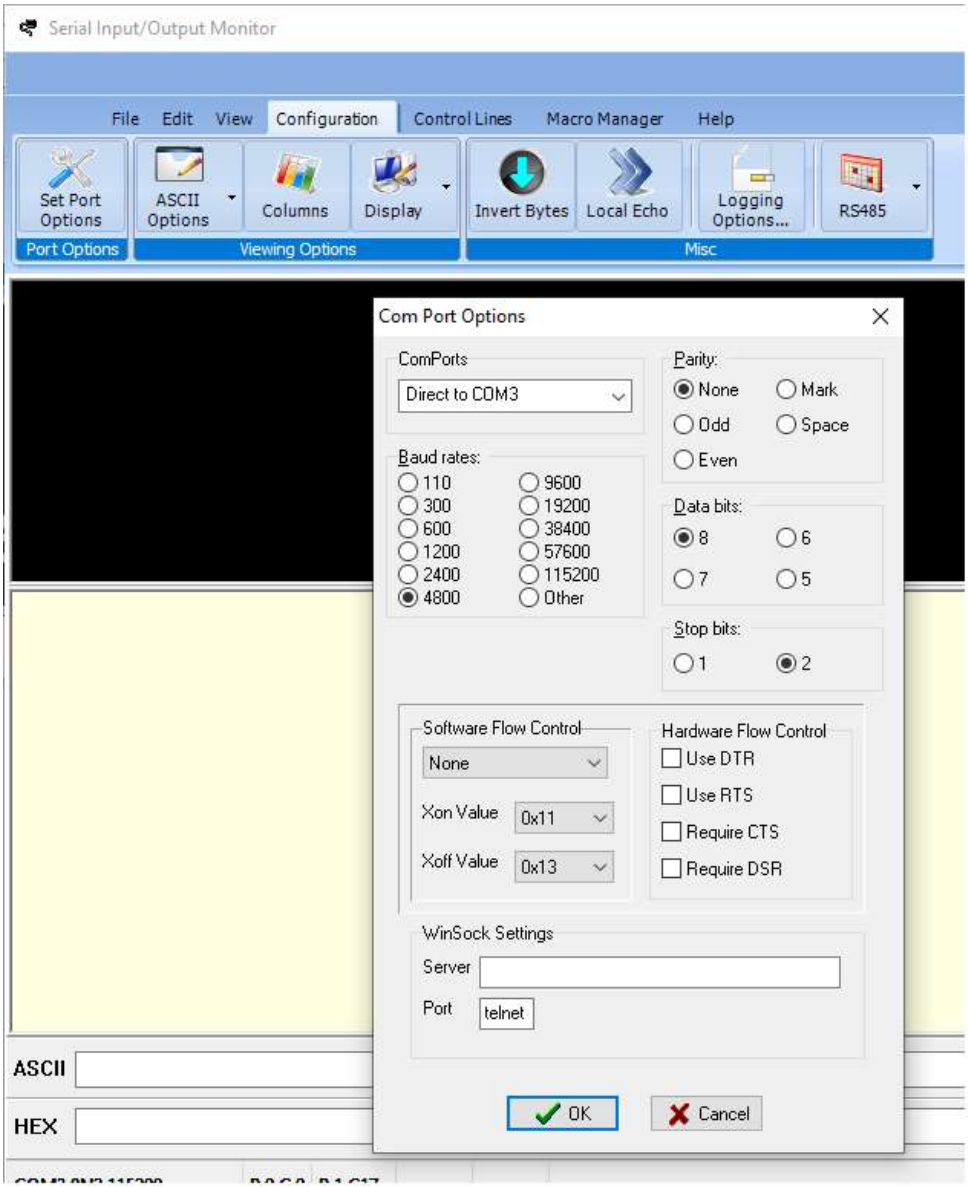
CAUTION:

- **FTPLUS v1.3 Onwards are are supported. Do not attempt to flash earlier versions with serial, as bootloader will be overwritten, needing Pickit 3 to fix.**
- **CAT PTT is NOT REQUIRED to benefit from the bootloader. Only TX, GND and RX are needed, plus your USB-serial device.**
- **Bootloader and main FTPLUS program baud speeds are the same. Example: If 115200 baud is selected in FTPLUS, this same speed will be used in the bootloader.**

UPGRADING VIA BOOTLOADER PAGE 1

This guide is valid for SIOW.exe program

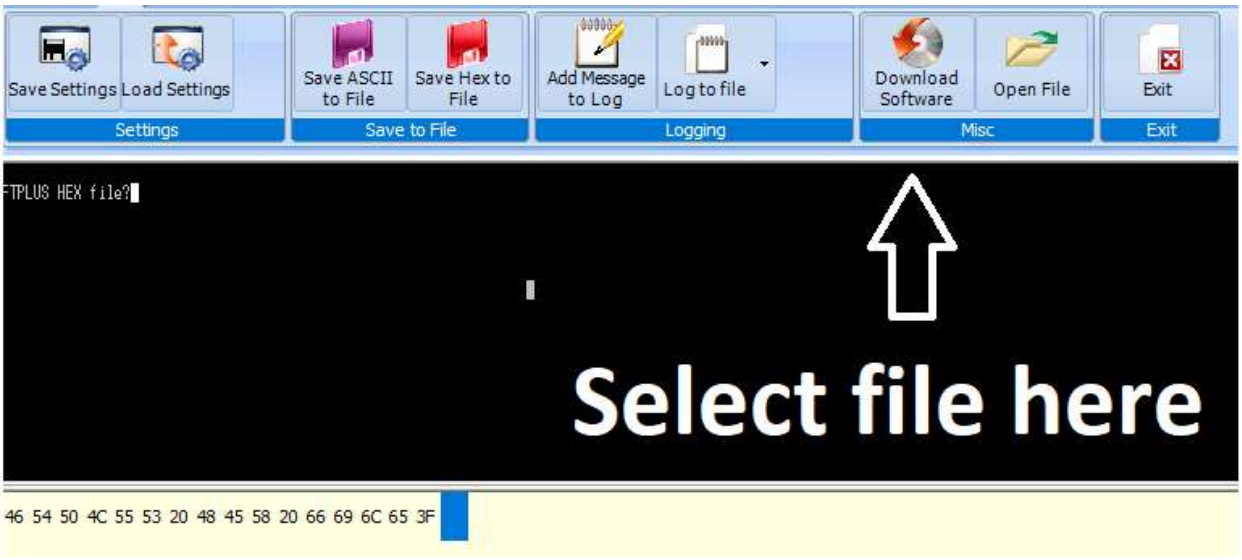
Power off radio.
Set up your serial port AS REQUIRED. If you have selected a different BAUD RATE in FTPLUS, set this to that speed.



Press OK.

UPGRADING VIA BOOTLOADER PAGE 2

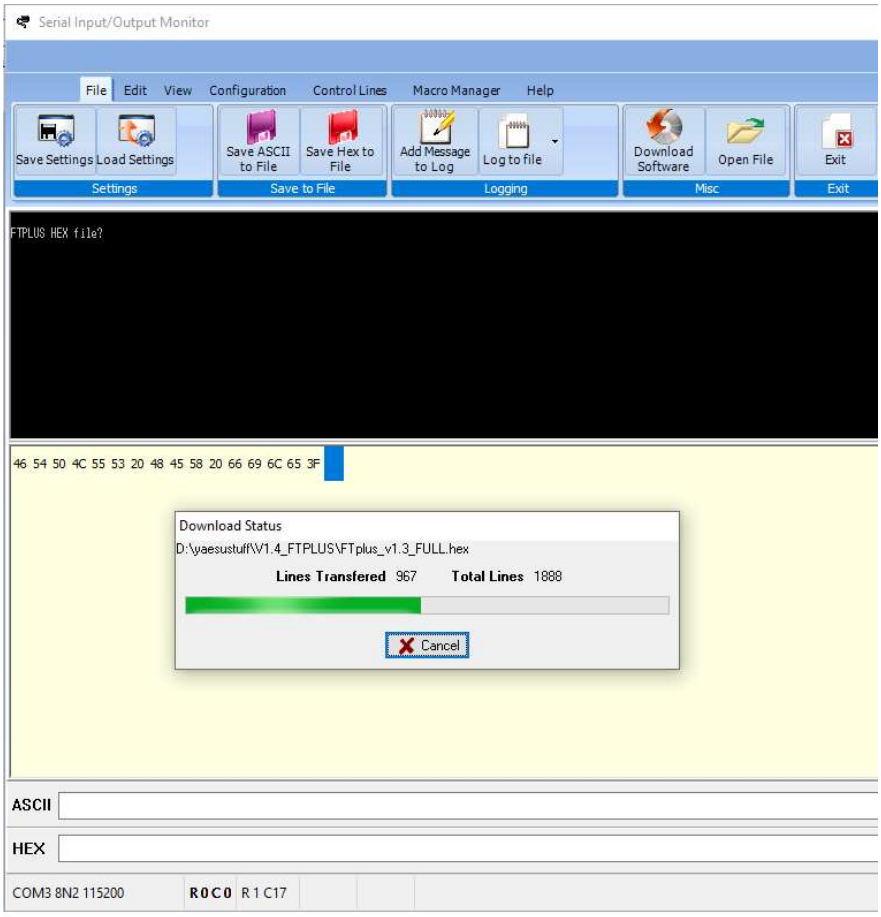
Hold down PMS and switch on radio. If done correctly, you will see this:



Choose your new HEX file.

WARNING: Uploading the PICKIT version of the HEX file will overwrite the bootloader. MAKE SURE IT IS BOOTLOADER VERSION.

Uploading will begin. Radio will reboot automatically:



NOTES

Changelogs (More details are on Github)

v1.4.1 Changelog

1.4.1

BUGFIX: Tuning limits missing. Was allowing tuning outside of HF (big no-no).
BUGFIX: Dial lock disengaging during CAT TX.
It has to disengage due to the line decoder we use for Cat TX also being used for dial lock. This is unavoidable.
If CAT PTT is enabled and dial lock is on, dial lock will be disengaged until CAT PTT finishes

FEATURE: (possibly useless)
In Kenwood CAT TX, the command ID; should return ID006; However due to wsjt-x being broken, its disabled.
Enable using IE1;
Disable using IE0;
Change CAT transceiver ID by writing IE<XXX>. The XXX can be any number. EG send IE008;
and when ID; is requested, ID008; will be replied. The default for TS-140 is ID006; so you would
send IE006; to restore.
So...
IE turns on / off / changes ID
ID gets the reply(sent by your control program (FLrig or whatever)
Recommended to turn this off as WSJT-X really seems to have a headache with the ID. So don't send it.

v1.4 Changelog
FEATURE:

Multi-VFO. There are now 20 VFO storage locations, on a fresh start, these are aligned with bands (can be changed to anything). EG Fresh start...7.000.0 on VFO A and B. Change A and B to whatever you like as usual. HOWEVER... Press BAND UP or DOWN and the band will increase as you expect... eg press UP... VFO A and B are at the default 10.100.0!

Set these A and B however you like too, jumping forward and back, using BAND UP/DOWN, VFO A/B as you like. This permits more storage. All VFOs can be set anywhere you wish, using any tuning method (Microphone / dial / cat / button tuning or whatever.

To reset VFOS back to standard, hold VFO>M. This only sets all VFOs back to default, nothing else.

BUGFIX:

TX inhibit was still be able to be bypassed in some cases. This is now fixed.

CHANGES:

In Button Tuning Mode, to exit, press VFO A/B instead of holding D-LOCK.
EEPROM writes are now far less frequent, with the main cache VFO saved every 30 seconds.

CAT values are now loaded and saved from a buffer to avoid frequent EEPROM writing. This gives a nice performance boost at lower baud rates. Buffer is flushed to EEPROM every 2 seconds, if there are any changes

Kenwood CAT: both VFOs are now reported correctly.

Semi-auto CAT mode selection: If CAT detects Kenwood command (with the ; terminator), Kenwood mode will be activated.

**Its semi-auto because to change back to Yaesu, press VFO A/B as usual when starting, or send YA; in Kenwood mode.

Bootloader now autoconfigures speed, depending on FTPLUS baud speed. Example: If 115200 baud is selected in FTPLUS, this same speed will be used in the bootloader.

v1.3.1
Brown-out setting changed to 2.7v as 4.5v was a little too sensitive
Main() redone so display refreshes as needed. A nice little performance boost

v1.3 Initial first release.

Credits:

Daniel Keogh VK2TRP for PLL information and taking those first steps!

Siegmund Souza for testing and additional research

Matthew Bostock M0WCA for programming and new board design and features

Thanks also for all the encouragement during developing this. I just hope it brings some old radios back from the dead.