KDØRC

**TeensyMaestro**

User Manual

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1. Introduction

The TeensyMaestro is a Teensy (Arduino work-alike) based set of controls for the FlexRadio 6000, 8000 and Aurora series of Software Defined Radios. It provides knobs, buttons, display and a keyer. It is designed to augment SmartSDR (SSDR), not replace it. There are many functions that the TeensyMaestro cannot perform that require SSDR or a real Maestro.

The TeensyMaestro uses a USB cable for power, to load the firmware and to edit the SD card. It uses an ethernet cable to connect with the radio. All communication with the radio is via TCP/IP, not the USB cable.

The primary design goal was to provide the most used controls in the form of knobs and buttons while retaining all the power and convenience of the computer-based SSDR. It uses the extensive TCP/IP Application Programming Interface (API) provided by FlexRadio. It also leverages the Flex Arduino library built by Enzo, IW7DMH. Without this library, the TeensyMaestro would not have been built.

While the TeensyMaestro has a color touch screen, it does not display a panadapter or waterfall. It does show basic slice information in a similar way that the “flag” does in SSDR. The touch screen is a rudimentary resistive type, so it does not have cell phone like capabilities but provides some simple functions. There are no functions that rely solely on the touch screen; the physical controls cover all touch screen functions.

New feature (as of V1.040) – When the Flex radio is powered off, a connected TeensyMaestro will also power off. If the TeensyMaestro is powered on without a network connection or a powered-up Flex to connect to, it will still go into stand-alone mode. This allows the keyer to be used with any modern radio.

New feature (as of V1.045) – VFO acceleration is now implemented. The rate increases exponentially with increasing VFO knob velocity. Acceleration Factor and the ability to turn the feature on and off are available in the Misc Menu. Start-up defaults can also be set in the MMConfig.ini file.

New features (as of V2.000) – Simon’s, NV0E PC board with a cheaper display is supported. Two footswitch PTT to allow for easier SO2R operation. One switch always controls slice A and the other controls slice B. Ability to select a specific Flex to connect to, or “ANY” to connect to the first Flex found.

1. Setup
   1. Connections and power

Power up the Flex and start SmartSDR. Plug the Teensy ethernet cable into the same network (LAN) as the Flex. If this is a DHCP-served router or modem (most are), the TeensyMaestro will obtain an IP address for connection to the radio. If you use a network switch to connect the computer (running SSDR), the radio and the TeensyMaestro together without benefit of DHCP (i.e. no modem/router), then you may or may not need to change settings on the SD card (see section 6.3, below).

Turn on the TeensyMaestro by plugging one end of a USB cable into the back of the TeensyMaestro and the other end into any USB port that provides 5 VDC. The TeensyMaestro does work without SmartSDR running and connected to the same Flex radio, but generally, that is not the preferred way to operate. The rest of setup will assume that the Flex is powered up (green light on steadily), SmartSDR is running and connected and that the TeensyMaestro is connected to the same network as the radio. It is also assumed that the TeensyMaestro is powered up *after* the radio has a solid green light and SmartSDR is running and connected to the radio.

* 1. Loading the Software

Before using the TeensyMaestro for the first time, the software must be loaded. As of V2.000, there are two load images (.hex files) available. One is for the original design that uses the 3.5 inch HX8357 display (Hardware Version 1), and the other is for the new design that uses the 4.0 inch ST7796S display (Hardware Version 2). Note that the NV0E PC board is Version 2 hardware.

Download and unzip the version corresponding to the hardware that you have built:

Hardware Version 1: **TeensyMaestroPlusKeyerV002.000.HW1.ino.zip**

Hardware Version 2: **TeensyMaestroPlusKeyerV002.000.HW2.ino.zip**

Teensy.exe is used to load the .hex file (executable object code). Start Teensy.exe and plug the Teensy into an available USB port:



Click *File*, *Open HEX File* and select **TeensyMaestroPlusKeyerV002.000.ino.hex** from whatever location you have it saved (use the latest version that is available on GitHub. V002.000 is shown for illustrative purposes only). Press the Program Load button on top of the Teensy board and the software will load and start.



USB

Use this SD Card slot

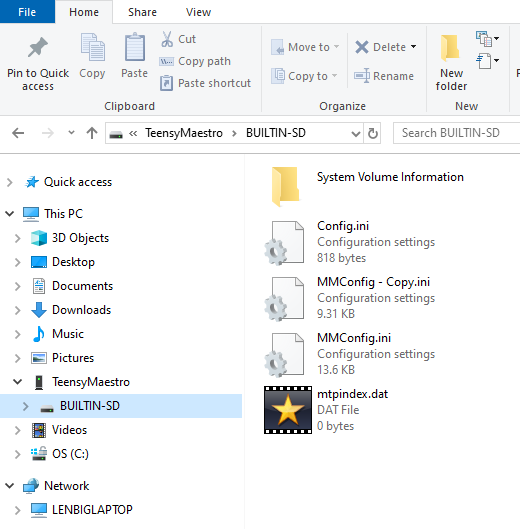
Program Load button

* 1. SD Card

The Teensy board has a micro-SD card slot that can be used to hold configuration information. Edit MMConfig.ini to fit your needs and copy it to a FAT32 formatted micro-SD card (see section 6, below for information on editing the file). A very small card can be used, as MMConfig.ini is the only file needed.

The display has an SD card slot on it, but it is not used in this application. Be sure to put the SD Card in the slot on the Teensy board itself, not in the one on the display.

New as of V1.046 – The SD card can be edited directly from a PC using the USB cable (same USB port as is used for programming and power).



The files on the SD card in the Teensy are shown along with a **System Volume Information** folder and the **mtpindex.dat** file that the system puts there (leave them alone). In the example above, there are three files that I put there, all ending in .ini.

My technique for editing a file is to create a working folder on the PC for this purpose. I then drag the file to be edited to the working folder, edit the file, save it, and then drag it back to the SD card. When prompted, click "**Copy and Replace**". If you open the file on the SD card with Notepad, it will rename it which is quite annoying. Using the drag, edit, drag back method makes it pretty easy and leaves you with a backup copy on your PC.

Once you edit and save your changes back to the SD card, you need to restart the TeensyMaestro for the changes to take effect. If you wired up the power button, that is the quickest way. If not, there are four options in the Misc Menu:

* Reload CW Messages (does not reload anything else and has a bug if you reload a second time without power cycling the Teensy)
* Restart TeensyMaestro
* Power TeensyMaestro Off (must be manually powered back on)
* You can also pull the power, but this is a bit hard on the USB connectors
  1. Standalone Operation

The TeensyMaestro will work without SmartSDR running. This means that you can get some minimal functionality out of your radio, but it is far from optimal. There are two modes of Standalone Operation available.

1. Non-GUI Client (only available on V 3.2 and up)

This is the normal way that the TeensyMaestro operates. If SmartSDR is brought up after the TeensyMaestro is running in this mode, most operation is normal.

1. GUI Client

If you hold any button down while powering up (or resetting) the TeensyMaestro, it will become a GUI Client (even though it does not have a panadapter display present). This means that it uses MultiFlex if you connect SmartSDR or another GUI client at the same time. If both slices are open in the TeensyMaestro, none will be available to SmartSDR.

If you start the TeensyMaestro after the radio is booted (solid green light) but before SmartSDR or a Maestro is connected, the TeensyMaestro will start up in GUI Client mode.

This mode is useful if you want to operate standalone as you will have profiles available.

1. Controls
   1. Radio Controls

The front panel is laid out with Slice A controls to the left and Slice B controls to the right. All of the encoders have push buttons built in except for the VFO controls. The section below describes the function of the rotary encoder, followed by the short press action in single angle brackets (< >) followed by the long press action in double angle brackets (<< >>). In some cases, the encoder will take on a different function as indicated by the angle brackets.

* + 1. VOL A encoder <Mute> <<Select Slice>>

Adjust Slice A volume (0 – 100).

Short press mutes or unmutes Slice A.

Long press sets Slice A as the active slice. If Slice A is not in use, it creates Slice A and sets it to be the active slice.

* + 1. AGC-T A encoder <RIT Set> << XIT Set >>

Adjust Slice A AGC threshold (0 – 100). <Adjust Slice A RIT (-99999 – 99999)>. <<Adjust Slice A XIT (-99999 – 99999)>>. In FM, NFM or DFM modes, this encoder controls Squelch (0 – 100).

Short press highlights the Slice A RIT and turns it on. Rotary encoder now adjusts RIT. The Selected Timeout parameter can be set in the MMConfig.ini file to control the timeout. Default is 5 seconds of no encoder operation, after which the highlight goes away and the encoder returns to its primary function. Setting Selected Timeout to zero disables the timeout and the RIT function has to be turned off manually with a short press. If the RIT is selected, a long press will clear it to zero.

Long press highlights the Slice A XIT and turns it on. Rotary encoder now adjusts XIT. The Selected Timeout parameter can be set in the MMConfig.ini file to control the timeout. Default is 5 seconds of no encoder operation, after which the highlight goes away and the encoder returns to its primary function. Setting Selected Timeout to zero disables the timeout and the RIT function has to be turned off manually with a short press. If the XIT is selected, a long press will clear it to zero.

* + 1. Low/Shift A encoder <NB> << NB Set >>

If mode is CW, shifts Slice A filter passband up or down in 10 Hz increments. If mode is not CW, adjusts filter low cut in 10 Hz increments. <<Adjust Slice A NB (0 – 100)>>.

Short press toggles Slice A NB on and off.

Long press highlights the Slice A NB and turns it on. Rotary encoder now adjusts the NB. After 5 seconds of no encoder operation or an additional long press, the highlight goes away and the encoder returns to its primary function.

* + 1. Hi/Width A encoder <NR> << NR Set >>

If mode is CW, adjusts Slice A filter passband width up or down in 10 Hz increments. If mode is not CW, adjusts filter high cut in 10 Hz increments. <<Adjust Slice A NR (0 – 100)>>.

Short press toggles Slice A NR on and off.

Long press highlights the Slice A NR and turns it on. Rotary encoder now adjusts the NR. After 5 seconds of no encoder operation or an additional long press, the highlight goes away and the encoder returns to its primary function.

* + 1. CW Speed encoder <Menu Select> << Menu Exit >>

Adjusts CW speed (5 – 100 WPM).

If not already in menu system:

Short or long press enters menu. If in CW mode, short press brings up the CW Message Menu and long press brings up the Filter Menu. In all other modes, long or short press brings up the Filter Menu.

If in menu system:

Short press executes selected item. If no item is selected, short press exits menu system.

Long press exits menu system without executing any items, selected or not.

Five second press from any screen:

Will restart the Teensy MCU. If the TeensyMaestro is powered up before the radio, you can use this feature to restart instead of cycling power. Press and hold the Menu Select button until a blue screen appears with the message “Release to RESTART”.

* + 1. RIT A <Step Dn> <<Menu Dn>>.

Short press to toggle RIT A on or off. Long press to change VFO A step size down. Note that the TeensyMaestro VFO steps are independent from SmartSDR VFO steps.

If in the menu system, short press to navigate one menu item down.

* + 1. XIT A <Step Up>.

Short press to toggle XIT A on or off. Long press to change VFO A step size up.

* + 1. PTT.

Press to engage PTT, release to return to receive. No long or short press options.

* + 1. Slice 0 PTT.

Designed for SO2R operations. If slice 0 (usually A) is in use, transmit on slice 0. If slice 0 is not the TX slice, then make it the TX slice and transmit. If slice 0 and slice 1 PTT are hit simultaneously, first one wins. The other PTT can be held down and will transmit as soon as the first one releases PTT. No long or short press options.

* + 1. Slice 1 PTT.

Designed for SO2R operations. If slice 1 (usually B) is in use, transmit on slice 1. If slice 1 is not the TX slice, then make it the TX slice and transmit. If slice 0 and slice 1 PTT are hit simultaneously, first one wins. The other PTT can be held down and will transmit as soon as the first one releases PTT. No long or short press options.

* + 1. Tune.

Press to engage Tune, release to return to receive. No long or short press options. This was implemented to put the Flex into Tune mode when initiated by a tune cycle from a tuner. Grounding pin C14 of MUX 0 activates Tune.

* + 1. Power.

Press to power on/off. No long or short press options. See **Power Button** in the **Configuration File section** for different options.

* + 1. Mic Selector Switch.

Use this switch to select one of two mics. It is a 3PDT switch. Two poles switch tip and ring and one pole grounds or opens pin 52 on the Teensy board. This is used to select one of two mic profiles. With this switch, you can automatically change mic profiles when you select a mic. See **Configuration File** for information on setting the mic profiles.

* + 1. Slice B controls work in identical fashion as the A controls and will not be described separately here.
  1. Keyer Controls
     1. Six CW message buttons.

Short press activates messages 1 – 6. Long press activates messages 7 – 12. See CW Menu for more information on configuring the buttons to activate TeensyMaestro messages vs. Flex CWX messages.

* + 1. SmartSDR.



Turn off Iambic when using the TeensyMaestro keyer if it is plugged into the keyer jack or you will get all dots. If you connect the keyer to pin 4 of the 15 pin accessory connector, Iambic can be on or off to control the behavior of whatever you have plugged into the key jack.

1. Touch Display
   1. Display

The TeensyMaestro has a 3.5 inch 320 x 480 color touch screen. It shows similar information as the “flag” does in SmartSDR. It does not show a panadapter or waterfall and is designed to work *with* SSDR, not instead of it.



These green boxes indicate the approximate location of the touch zones and are not displayed on the screen.

* 1. Touch Screen

There are 6 touch zones on the display. Touching the slice name (A or B) will set that slice as the active slice and will gray out the inactive slice. If no slice is in use, touching the gray slice name in the blank space will create that slice and set it to active. This function is not available on Flex versions less than 3.xx. Note that the slice names on unused slices will be “A” or “B” and will be gray. Once the slice is created, the actual slice name will be used.

Touching a grayed-out TX indicator will set TX on for that slice and will gray out the other slice TX indicator. Touching a red TX indicator will turn it off and will not affect the other TX indicator.

Touching the screen in the large center area displays the splash screen as long as it is being touched. Information such as Teensy MAC address, IP address and Flex radio information like model and version is displayed. There is also a Misc Menu item to show this screen.

Touching the lower right-hand corner will reset the display. This is useful if your display loses connectivity (white screen of death…). If this happens often, check to be sure that you have good connections to all the display wiring.

Note that touching the screen when the screen saver (blank screen) is active will restore the normal view and reset the screen save timer. Note also that this is a resistive, not a capacitive touch screen. This means that it can respond to simple touches, but is not capable of the intricate gestures that a cell phone or tablet screen are capable of. All touch functions (except screen reset) are available using the physical controls or menu items, so it is not necessary to use the touch screen to get full functionality.

* 1. Display elements



The left side shows Slice A, the right shows Slice B. The bottom shows items not tied to a slice. If a slice is not in use, its side of the screen will be blank.

The frequency and license class will turn red if the Out of Band Display option is on, the TX indicator is on and the frequency is out of band for the displayed license class (mode dependent).

The frequency background color will change to blue when the VFO Tracking option is on.

A yellow slice name (Slice B in the above example) shows the active slice. Each slice can be operated with its controls regardless of active status. Active status is more important in SmartSDR for mouse wheel control of frequency.

The slice with TX highlighted in red indicates the transmit frequency, just like SmartSDR.

NB, NR, RIT and XIT are active when yellow and inactive when gray.

Step shows VFO step size in Hz. Default is 10 for CW, 100 for everything else. See Configuration File below for more info on changing the default. Note that this is the step size for the TeensyMaestro tuning controls only. The step size for SmartSDR or a real Maestro is not affected.

The filter graphics for CW show offset (0 Hz in this example) width (400 Hz) lower and upper bounds (-200 Hz and 200 Hz respectively). Note that any filter bound that is lower in frequency than the carrier shows as a negative number. Lower sideband (LSB) will show negative bounds and upper sideband (USB) will show positive. If a control takes a bound past the carrier frequency, it will change sign.

Across the bottom panel are:

* CW speed and active profile. If no profile is active, this will be blank.
* License class, CW Message Source and CW contest serial number.
* RF Power, CW Paddle “handed-ness” and keyer mode.

1. Menu
   1. Navigation.

Press (Short or Long) the Menu Select button to enter the menu system. A short press will take you to the last used menu and a long press will take you to the first menu. Turn the CW Speed encoder to scroll through menu items on a menu page. Selected items will be highlighted with a yellow box.

Short press the Menu Select button to activate the selected item. Long press the Menu Select button to exit the menu without taking action. Depending on the item, activating it will leave the menu system, or leave you in the menu system to cycle through choices. If no items are selected (i.e. nothing is highlighted) a short or long press of the Menu Select button will exit the menu system without activating any items.

Use the Menu Up and Menu Dn buttons to scroll among menu pages.

* 1. Filter Menu

List of filters based on mode of the active slice.

* 1. Profile Menu

Lists all profiles in the radio. Multiple menu pages will be used if necessary.

* 1. Misc Menu
     1. A>B

Copy Slice A frequency to Slice B.

* + 1. B>A

Copy Slice B frequency to Slice A.

* + 1. Reload CW Messages

Reads the CW messages from the SD card and loads them into memory.

* + 1. Out of Band Display

ON or OFF. Default is ON, can be changed in config file.

* + 1. Snap to Tune Step

ON or OFF. Default is OFF, can be changed in config file. Operates on TeensyMaestro tune step, not the radio step size.

* + 1. VFO Tracking

ON or OFF. Default is OFF, can be changed in config file. Causes both slices to move together by the step size of the VFO being tuned. A blue background behind the VFO frequency indicates that VFO Tracking is active. Changing frequency of either slice in SmartSDR also tracks, allowing synchronization of both slice frequencies. To change a slice independently, using either the TeensyMaestro or SmartSDR, VFO Tracking has to be turned off.

* + 1. Short Press Click

ON or OFF. Default is OFF, can be changed in config file. Uses the sidetone speaker for a click sound when buttons are pressed.

* + 1. Long Press Click

ON or OFF. Default is OFF, can be changed in config file. Uses the sidetone speaker for a click sound when buttons are pressed. Especially useful to know when the long press time has expired, and the button can be released.

* + 1. Restart TeensyMaestro

Equivalent to cycling power. Can also be restarted by holding the Menu Select button down for 2 seconds.

* + 1. Power TeensyMaestro Off

Power off. Equivalent to pressing power button (See “Power Button:” in Configuration File, below).

* + 1. Show Splash Screen

Displays the splash screen until any button is pressed. Button’s normal actions will not be taken.

* + 1. Center Control Function

Allows setting the Menu Select encoder to any of the following functions:

CW Speed, Mic Gain, RF Power, Tune Power, WNB Level, Mon Level, VOX Level, VOX Delay, Band.

* + 1. VFO Acceleration

ON or OFF. Default is ON.

* + 1. VFO Acceleration Factor

Default 3000. A smaller factor causes faster acceleration.

* 1. Memory Menu

List of memories in the radio. Multiple menu pages will be used if necessary. Sorted by memory name.

* 1. Mode Menu

Used to change mode of active slice.

* 1. Band Menu

Used to change band of active slice.

* 1. Transmit Menu
     1. RF Power

0 - 100

* + 1. Mic Gain

0 – 100

* 1. Client Menu

List of connected Clients (stations) currently connected to the radio. Used to connect (bind) the TeensyMaestro to the desired station so that profiles, memories and other actions are applied to the desired station. Also allows multiple TeensyMaestros to be connected in a MultiFlex environment.

* 1. CW Menu
     1. CW Message Source

TEENSY – Message buttons send messages from the TeensyMaestro memories.

FLEX – Message buttons send messages from the Flex CWX memories.

Messages sent by selecting them from the CW Message Menu always send the TeensyMaestro messages, regardless of the source. Selecting memories using the CWX function of SmartSDR always sends Flex CWX memories.

* + 1. CW Paddles

Right Handed

Left Handed

Default is Right Handed, can be changed in config file.

* + 1. CW Mode

A – Iambic mode A.

B – Iambic mode B.

C – Cootie key (side-swiper) emulation.

U – Ultimatic (last element repeats, has dot and dash insertion).

S – Semi-automatic bug emulation.

Default is B, can be changed in config file.

* + 1. CW Sidetone

ON

OFF

* + 1. CW Sidetone Freq

100 – 6000 Hz in 10 Hz increments.

Select this option with a short press of the Menu Select button. The highlight will move from the entire line to the current setting. Now the CW Speed knob can be used to adjust the sidetone frequency. Short press the Menu Select button to accept the value and exit the menu. Long press the Menu Select button to exit without changing the value.

* + 1. Set contest serial number

Select this option with a short press of the Menu Select button. The highlight will move from the entire line to the current setting. Now the CW Speed knob can be used to adjust the serial number. Short press the Menu Select button to accept the number, save it to EEPROM and exit the menu. Long press the Menu Select button to exit without changing the value.

* + 1. Clear contest serial number to 1

Sets the serial number to one. Typically done at the beginning of a contest.

* + 1. Keyer Output

LOCAL – Keys the rig via the Key jack.

ETHERNET – Keys the rig over the ethernet connection. Useful for remote operation. No sidetone is generated by the radio; use the TeensyMaestro sidetone.

* 1. CW Message Menu

List of CW messages from SD Card. Each message can be played from the menu or from the 6 message buttons (see CW Message Source, above). A tap of the key will stop any message in progress.

* + 1. CW Message Commands

$C – Send MyCall. MyCall is set in the config file.

$N – Send next serial number. Increment serial number by one after the send.

$NR – Send last used serial number. Do not increment serial number. Useful to provide a fill if the other station requests it.

$N+ – Increment the serial number without sending it. Useful as a stand-alone key (i.e. a CW message with no other text or commands in it) to increment the serial number if the previous contact was sent manually.

$N- – Decrement the serial number without sending it. Useful as a stand-alone key to decrement the serial number if it was accidently increased or in case of a dupe.

$Snnn – Change CW speed to nnn WPM, return to speed prior to $S command when message finishes playing.

$SPnnn – Change CW speed to nnn WPM, leave this speed in effect when message finishes playing.

$S – Change speed back to speed prior to $S command executed in same message.

$R – Repeat message continuously. Tap the key to stop message.

$Pnnnn – Pause nnnn milliseconds. Generally used with the $R command to listen for calls between messages or to time beacon transmissions.

\*xx… – Prosign. Any number of characters following the \* will be run together to form a prosing (e.g. \*AS for wait). A space or end of line ends the prosign.

\_ – Cut zero. Underscores will be sent at 1.5 times the length of a normal dash.

1. Configuration File
   1. SD Card Configuration File

The **MMConfig.ini** file provides a way to customize the functionality of the TeensyMaestro and must be on the SD Card and named exactly like this to work. If there is no config file on the card or if the card is not in its slot when the TeensyMaestro is started, all values will take on defaults, but the unit will operate. Some functions will be limited or not useful, for example CW message memories will be blank.

The SD Card is read at power up, and the values are parsed and stored internally. The SD Card can be inserted or removed while the TeensyMaestro is powered up. This provides a method to make changes without re-starting the TeensyMaestro. To apply changes made while the unit is powered up, use the “Reload Config File” menu option.

* 1. Editing MMConfig.ini

This file can be edited in any text editor like Windows Notepad. Lines need to end in CR (0xA) or CRLF (0xA 0xD) for the file to function correctly. Notepad takes care of this automatically, so it is a good choice to use.

* 1. Configuration settings and defaults
     1. Configuration parameter syntax

Configuration parameters have three parts; the parameter name, a colon followed by a space and data. Each setting can be in upper, lower or mixed case. All commands and data will be converted to upper case for configuration parsing.

* + 1. Comments

Comments are preceded with a semicolon “;”. A comment can start at the beginning of a line, in which case the whole line is ignored, even if it contains otherwise legal configuration settings. Comments in the body of a line cause the rest of the line to be ignored.

For example, this line is ignored because of the leading semicolon:

;WPM: 24 ; Sets default WPM. Comment out to start with last used WPM.

If the leading semicolon is removed, the “WPM: 24” configuration will be applied and everything from the second semicolon to the end of the line will be ignored.

* + 1. Connect:

Determines which radio to connect to. ANY will connect to the first Flex radio that it finds. A serial number (e.g. 0720-1014-6400-xxxx) will cause it to wait for that specific radio to come online. Further, it will wait for a GUI client such as SmartSDR or a Maestro to connect. Default is ANY.

* + 1. Connect:

ANY will connect to the first Flex it encounters on the network. If no radio is found, it will go to keyer-only mode. A full serial number (including dashes) will cause it to only connect to that specific radio (e.g. 0720-1014-6400-1234). The TeensyMaestro will wait indefinitely for the specific radio. Default is ANY.

* + 1. MyCall:

Freeform text. Will be used on the splash screen and is the text that will be sent if the $C macro is used in a CW memory. No default, no checking for legitimate callsigns.

* + 1. License Class 1:

License class associated with the first two license class columns in the frequency privilege table. In the USA, this would be set to Extra.

* + 1. License Class 2:

License class associated with the second two license class columns in the frequency privilege table. In the USA, this would be set to Advanced.

* + 1. License Class 3:

License class associated with the third two license class columns in the frequency privilege table. In the USA, this would be set to General.

* + 1. License Class 4:

License class associated with the fourth two license class columns in the frequency privilege table. In the USA, this would be set to Tech.

* + 1. License Class 5:

License class associated with the fifth two license class columns in the frequency privilege table. In the USA, this would be set to Novice.

* + 1. MyLicense:

Must match one of the five license classes defined (see above). Used to determine in band operation. Default is License Class 1. Unlike all other MMConfig.ini entries, MyLicense must follow the License Class entries.

* + 1. TeensyMaestroID:

Only used in stand-alone mode. Allows individual identification of any TeensyMaestros connected in stand-alone mode. Useful when multiple clients are connected. Also useful when disconnecting to be sure the desired station is disconnected. No spaces are allowed in the ID. Default is blank.

* + 1. Splash:

Time to leave the splash screen up in milliseconds (e.g. 10000 = 10 seconds). Default is 0.

* + 1. Screen Save:

Screen saver time out in seconds. The screen saver kicks in after the specified time out period has elapsed since the last keyer paddle press, straight key press, button press, knob turn, or display update (except for the S meter). The screen saver is implemented as a blank screen. Default is 1200 (20 minutes).

* + 1. Power Button:

Configures the power button to power the TeensyMaestro on or off or act like a reset button. Valid values are:

* Power – 50 mS hold time to power on. 5 second hold time to power off.
* Power Fast – 50 mS hold time to power on. 0 mS hold time to power off.
* Reset - Instant power off and back on, effectively turning the power switch into a reset button.

Default is Power.

* + 1. WPM:

Keyer speed (5 – 100 WPM). No default (uses keyer speed from the Flex).

* + 1. VFO Tracking:

ON or OFF. Default is OFF. Causes both slices to move together by the step size of the VFO being tuned. Changing frequency on SmartSDR does not track, allowing synchronization of slice frequencies

* + 1. VFO A SSB Default Rate:

Number of VFO A pulses between encoder updates in SSB mode. The lower the number, the faster the tuning rate. If it is too small, it gets to be ridiculously difficult to set the VFO to a particular frequency. Can only be changed in the MMConfig.ini file. Default is 40.

* + 1. VFO B SSB Default Rate:

Number of VFO B pulses between encoder updates in SSB mode. Default is 40.

* + 1. VFO A CW Default Rate:

Number of VFO A pulses between encoder updates in CW mode. Default is 10.

* + 1. VFO B CW Default Rate:

Number of VFO B pulses between encoder updates in CW mode. Default is 10.

* + 1. VFO A SSB Default Step:

Sets the default step size for VFO A in SSB mode. Step size can be changed from the front panel. Note that steps are specified using a step index of 0 – 7. Default is 3 (100 Hz).

0 = 1 Hz step

1 = 10 Hz step

2 = 50 Hz step

3 = 100 Hz step

4 = 500 Hz step

5 = 1000 Hz step

6 = 2000 Hz step

7 = 3000 Hz step

8 = 5000 Hz step

* + 1. VFO B SSB Default Step:

Sets the default step size for VFO B in SSB mode. Step size can be changed from the front panel. Note that steps are specified using a step index of 0 – 7. Default is 3 (100 Hz).

* + 1. VFO A CW Default Step:

Sets the default step size for VFO A in CW mode. Step size can be changed from the front panel. Note that steps are specified using a step index of 0 – 7. Default is 1 (10 Hz).

* + 1. VFO Acceleration:

Values are ON or OFF. Default is ON. When ON, the VFO tuning rate goes up exponentially with the speed of the tuning knob.

* + 1. VFO Acceleration Factor:

Default 3000. Scaling factor for VFO knob acceleration. A smaller factor yields faster acceleration.

* + 1. VFO B CW Default Step:

Sets the default step size for VFO B in CW mode. Step size can be changed from the front panel. Note that steps are specified using a step index of 0 – 7. Default is 1 (10 Hz).

* + 1. Snap to Step:

Snaps VFO to TeensyMaestro step size. Values are ON or OFF. Default is OFF.

* + 1. Long Press:

Time in milliseconds for a button press to be considered a long press. Default is 250.

* + 1. Short Press Click:

Values are ON or OFF. Default is OFF. Uses the sidetone speaker for a click sound when buttons are pressed. Can be turned on and off in the Misc Menu.

* + 1. Long Press Click:

Values are ON or OFF. Default is OFF. Uses the sidetone speaker for a click sound when buttons are pressed. Especially useful to know when the long press time has expired, and the button can be released. Can be turned on and off in the Misc Menu.

* + 1. Selected Timeout:

Number of milliseconds before highlight turns off when adjusting RIT, XIT, NB and NR values. Default is 5000 (5 seconds). Setting to zero disables the timeout requiring a short press to return to the primary function of the control.

* + 1. Vol A encoder steps:

Number of encoder increments per detent click. If you turn the volume encoder knob for slice A and get more than one value increment per click, then you need to set this to the number of jumps in value per click. Most encoders will be 1:1, 2:1 or 4:1. If all encoders are the same, change all of the encoder step values to the same value. If you have a mix, set each as needed. Default is 1 (1:1).

* + 1. Vol B encoder steps:

Number of encoder increments per detent click.

* + 1. AGC A encoder steps:

Number of encoder increments per detent click.

* + 1. AGC B encoder steps:

Number of encoder increments per detent click.

* + 1. Low A encoder steps:

Number of encoder increments per detent click.

* + 1. Low B encoder steps:

Number of encoder increments per detent click.

* + 1. High A encoder steps:

Number of encoder increments per detent click.

* + 1. High B encoder steps:

Number of encoder increments per detent click.

* + 1. CW encoder steps:

Number of encoder increments per detent click.

* + 1. Button Debounce:

Button debounce value in milliseconds. Default is 30 ms.

* + 1. Profile: <profile name>

Startup profile. Sets the radio to this profile whenever the TeensyMaestro is powered up. The profile name must be placed within angle brackets, and must be an existing profile in the radio. Invalid profiles will be ignored. Comment out to leave the radio on the last used band/profile. No default.

* + 1. Mic Profile 1: <mic profile name>

Mic profile that will be set when the Mic Selector Switch grounds pin 52 of the Teensy. The profile name must be placed within angle brackets, and must be an existing profile in the radio. Invalid profiles will be ignored.

* + 1. Mic Profile 2: <mic profile name>

Mic profile that will be set when the Mic Selector Switch un-grounds pin 52 of the Teensy. The profile name must be placed within angle brackets, and must be an existing profile in the radio. Invalid profiles will be ignored.

* + 1. Mic Profile Switch Overrides Global:

Values are ON or OFF. Default is OFF. When a global profile is loaded, it loads whatever mic profile was open at the time the profile was saved. Turning on this parameter causes the profile selected by the Mic Selector Switch to remain in effect after a global profile change. Note that an explicit change of a mic profile in SmartSDR or a Maestro will be honored.

* + 1. Filter Menu:

Values are ON or OFF. Default is ON.

* + 1. Profile Menu:

Values are ON or OFF. Default is ON.

* + 1. Memory Menu:

Values are ON or OFF. Default is ON.

* + 1. CW Menu:

Values are ON or OFF. Default is ON.

* + 1. CW Msg Menu:

Values are ON or OFF. Default is ON. Messages loaded using **CW MSG:** (see below) are still available using the CW Message buttons, even if this option is turned off.

* + 1. Mode Menu:

Values are ON or OFF. Default is ON.

* + 1. Band Menu:

Values are ON or OFF. Default is ON.

* + 1. Transmit Menu:

Values are ON or OFF. Default is ON.

* + 1. Client Menu:

Values are ON or OFF. Default is ON.

* + 1. Menu Encoder:

Allows setting the Menu Select encoder to any of the following functions:

CW Speed, Mic Gain, RF Power, Tune Power, WNB Level, Mon Level, VOX Level, VOX Delay, Band. Default is CW Speed. This can be overridden dynamically using the Misc Menu item ”Center Control Function”.

* + 1. CW Msg Source:

Determines whether the CW message buttons send the messages from the SD Card in the Teensy or from those stored in CWX in the Flex radio. Values are Teensy or Flex. Default is Teensy.

* + 1. CW Paddles:

Values are Left or Right for left or right handed operation. Default is Right.

* + 1. CW Mode:

Values are A, B, C, S or U. Default is B.

A = Iambic mode A

B = Iambic mode B

C = Cootie key (side-swiper) emulation

S = Semi-automatic bug emulation

U = Ultimatic (last held paddle repeats)

* + 1. CW Msg:

Freeform text to be sent when selected from the CW Message menu (regardless of value of CW Msg Source) or when the CW Message buttons are pressed (if CW Msg Source = Teensy). Up to twelve messages can be defined. See section 1.6.1 above for details on CW message commands.

* + 1. CW Word Spaces:

Number of dit-lengths to add to word spacing when playing Teensy CW memories. Setting this to zero, or leaving the parameter out of the file will cause word spacing to be the “official” 7 dit-lengths between words.

* + 1. ShowSpots:

Values are Yes, No, Y, N. If not set to Y or Yes, spots defined with the **Spot:** command (see below) will not be sent to the radio. This can be useful if there is high network latency causing the radio to disconnect. Default is Yes.

* + 1. Spot:

Spot frequency in MHz and text to display as a permanent spot. Separate frequency and text with a space. Text may not have any spaces (underscore is a good substitute). Useful to mark nets, repeaters or even band edges.

* + 1. TeensyIP:

IP address to use when connecting directly to the radio (i.e. no DHCP server). Default is 169.254.0.25. If Flex radio, computer and TeensyMaestro are connected directly using a network switch (Field Day mode), change this address to be on the same network segment. If it does not work using the default, go to CMD mode on the computer (cmd.exe) and enter ipconfig. The computer IP address will show as **IPv4 Address. . . . : nnn.nnn.nnn.nnn**  Duplicate the first two numbers and make sure that the whole address is not a duplicate of any other device on the network.

* + 1. TeensyGateway:

IP gateway address to use when connecting directly to the radio (i.e. no DHCP server). Default is 169.254.0.1. Future use.

* + 1. TeensyMask:

IP mask to use when connecting directly to the radio (i.e. no DHCP server). Default is 255.255.0.0. Future use.

* + 1. Out Of Band Indicator:

Values are ON or OFF. Used to send a spot to the SmartSDR screen (requires spots to be enabled in SSDR) indicating out of band for the MyLicense class. Also turns the frequency and license class red in the TeensyMaestro display.

As of TeensyMaestro V 1.034, the Out Of Band Indicator takes TX signal width into account. For all modes except RTTY and CW, the TX Filter High Cut is used. For CW and RTTY, 100 Hz is used. On USB, if the TX Filter High Cut is 3000 Hz, the Out Of Band spot will appear when you are within 3000 Hz of the upper band edge. Conversely, on LSB, if the TX Filter High Cut is 3000 Hz, the Out Of Band spot will appear when you are within 3000 Hz of the lower band edge. On CW the Out Of Band spot will appear when within 100 Hz of the upper or lower band edge. On RTTY, the spot will appear when the Mark frequency is within 100 Hz of the upper band edge or the Space frequency is within 100 Hz of the lower band edge.

Only used for slice with TX on. Default is ON.

* + 1. Out Of Band Spot Time:

Number of seconds to leave an out of band spot on the SmartSDR screen. Default is 5 seconds.

* + 1. 160 CW:

Five pairs of frequencies representing the CW privileges for Extra, Advanced, General, Technician and Novice class licensees respectively. Each value is separated from the next by a comma. Zero values indicate no privileges. Works in conjunction with Out Of Band Indicator and Out Of Band Spot Time (above). Default is privileges as of December, 2020.

**;Band Mode Extra | Advanced | General | Technician | Novice**

**160 CW: 1800000, 2000000, 1800000, 2000000, 1800000, 2000000, 0, 0, 0, 0**

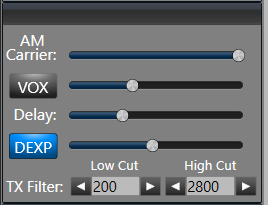
* + 1. 160 PHONE:

Five pairs of frequencies representing the phone privileges for Extra, Advanced, General, Technician and Novice class licensees. Each value is separated from the next by a comma. Zero values indicate no privileges. Default is privileges as of December, 2020.

Supported bands (same format as 160):

* + 1. 80 CW:
    2. 80 PHONE:
    3. 60A CW:
    4. 60A PHONE:
    5. 60B CW:
    6. 60B PHONE:
    7. 60C CW:
    8. 60C PHONE:
    9. 60DCW:
    10. 60D PHONE:
    11. 60E CW:
    12. 60EPHONE:
    13. 40 CW:
    14. 40 PHONE:
    15. 30 CW:
    16. 30 PHONE:
    17. 20 CW:
    18. 20 PHONE:
    19. 17 CW:
    20. 17 PHONE:
    21. 15 CW:
    22. 15 PHONE:
    23. 12 CW:
    24. 12 PHONE:
    25. 10 CW:
    26. 10 PHONE:
    27. 6 CW:
    28. 6 PHONE:
    29. 2 CW:
    30. 2 PHONE:
    31. 1.25 CW:
    32. 1.25 PHONE:
    33. 70cm CW:
    34. 70cm PHONE:
    35. 33cm CW:
    36. 33cm PHONE:

Note that on 60 meters, you need to set your TX High Cut to 2800 for this feature to work properly.



* + 1. Display SPI Clock:

Sets the TFT display SPI clock frequency in MHz. Default is 20. If the display does not start up correctly every time, change this value up or down until you find a frequency that works reliably. Signal line lengths, stray capacitance and other factors can all have an effect on how fast you can run this clock.

* + 1. Startup Delay:

Sets the start up delay in milliseconds. Useful if the TFT display, MUX boards or touch controller need more time before they are ready or anything else that you might add to the circuit). Default is 250.

* + 1. Disable GUI Client:

If set to “Yes”, prevents a held button during powerup from putting the TeensyMaestro into GUI Client mode. This manifests itself as a MultiFlex connection if SmartSDR or a real Maestro is already connected to the radio. Default is No.

1. Remote Operation
   1. The TeensyMaestro can be operated remotely over a VPN. A good choice is SoftEther. SoftEther VPN Server needs to be set up on the computer co-located with the radio and on the computer in the field. One (and ***ONLY*** one) of the servers needs to have the Cascade Connection option set to interconnect the servers as if they are one local network. A more extensive write-up will be provided (including the SoftEther setup) in this manual soon.



1. Troubleshooting
   1. Dreaded white screen of death.

This may manifest itself as a snowy, white or otherwise corrupt screen. Most likely causes are SPI Clock speed (HW version 1 only), inadequate power or loose signal or power connections.

If you suspect the SPI clock, find this line in the MMConfig.ini file on the SD card:

**Display SPI Clock: 30 ; Default = 20 change this up or down if you get a corrupt display**

Start by changing the value to 20. You will need to power the TeensyMaestro off and back on to use the new value. If that does not resolve the issue, try a value of 10. If it won’t work at 10, there is likely a wiring problem between the Teensy board and the TFT display.

The Teensy board communicates with the TFT display using Serial Peripheral Interface (SPI) operating at clock speeds in the tens of MHz. Long signal lines will tend to reduce the maximum clock frequency that can be used. Because the clock is operating at RF, reflections on the lines can sometimes be better at higher frequencies, sometimes better at lower. This means that you may need to experiment some to get this working properly.

If you suspect the power:

1. Try a different USB cable.
2. Make sure that all cables are plugged in properly, especially if you use the short panel-mount cable between the Teensy board and the back panel.
3. Check all power and signal connections between the Teensy board and display.

All of that being said… If the screen is working fine, then occasionally goes white, touch the lower right-hand corner of the touch screen to reset the display. Only the display will reset, not the Teensy board.

* 1. Screen suddenly went black.

Most likely the screen saver activated itself. To redisplay the screen, do any of the following:

* Touch the screen.
* Turn any knob.
* Press any button.
* Press a keyer paddle.
* Press the straight key.
* If SmartSDR is running, change any attribute on SmartSDR that is reflected on the TeensyMaestro (e.g. change frequency, mute or un-mute, change a filter setting).
  1. Can’t load firmware using Teensy.exe.

If you hover your mouse over the file name in the Teensy.exe panel, you should the name of the file and a percentage usage. If, instead of the percentage it says “(too large!)”, then you likely do not have a good USB cable. Check to be sure that you are not using a “charge only” cable.



* 1. Both slices show blank, no controls are responsive except for CW Speed.

Check to be sure that the TeensyMaestro is connected to the same LAN segment as the Flex radio. Power the TeensyMaestro off and back on to re-try.

* 1. TeensyMaestro connects, then Flex radio crashes with a software error (power button double-flashes red, then restarts).

As of December, 2020, this is a known issue with the Flex API and is supposed be fixed in the next release. Update: as of 3.2.31 it is fixed!

This happens when you connect to the Flex radio without SmartSDR running. Normally, you should start SmartSDR, then power up the TeensyMaestro. To use the TeensyMaestro without SmartSDR (stand-alone mode), see section 2.4.

Many SmartSDR features like antenna selection and RF Gain are not available in stand-alone mode. The TeensyMaestro is designed to work *with* SmartSDR, not instead of it.

If SmartSDR is started after starting the TeensyMaestro in stand-alone mode, it will use multiFLEX to connect (V3.xx and up), and you will not have true parallel operation of SmartSDR with the TeensyMaestro. SmartSDR versions lower than 3 will not work in this mode.

* 1. TeensyMaestro keyer produces all dots.



Turn off Iambic when using the TeensyMaestro keyer if it is plugged into the keyer jack or you will get all dots. If you connect the keyer to pin 4 of the 15 pin accessory connector, Iambic can be on or off to control the behavior of whatever you have plugged into the key jack and will not impact anything hooked up to the accessory connector.

* 1. Power button does not shut off or reset the TeensyMaestro.

If the Teensy processor is out to lunch, it can’t honor the short press setting established by the Power parameter in the config file. Hold the power button for 5 seconds or remove power to shut off the TeensyMaestro.

* 1. Stuck on a white screen when operating in Standalone mode.

Upgrade to V 1.015 or newer to avoid this bug.

* 1. Selected profile does not have any effect on the radio.

Caused when operating the TeensyMaestro without a GUI client (like SmartSDR) running. Power down the TeensyMaestro, then hold any button while powering back up. Continue holding the button until the screen indicates that you should release it. This puts the TeensyMaestro into GUI client mode, and Profiles will be able to be loaded again.

* 1. VFO A or B encoders do not work.

The VFO encoders are specified to work at 5 – 24 VDC on the red wire. Most work fine at 3.3 V, but a few don’t. If yours doesn’t, connect the red wire to Vin (5 V) on the Teensy board.