CTR2-Dial MIDI Mode Manual

v3.00.00



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Updated to firmware v3.00.00

Revised sections for this version are highlighted in yellow

Contents

Clearing up the confusion 4
Adding more confusion… 4
Simplifying the options… 4
How to use this manual 5
Legal Notice 5
Change Log 6
v3.00.00: November 15, 2026 6
System Overview 6
MIDI Mode 6
Multiple Controllers / One Firmware 7
Quick Start Guide 7
Basic Concepts 7
Initial Setup 8
Connect to your App 8
Configure the MIDI Mapping in your App 8
Editing Labels in MIDI Mode 9
Importing Configurations into CTR2-Dial 9
Your App Executes the Wrong Control 9
Time to Play! 9
MIDI Mode's Controls 9
MIDI Mode's Features 10
Hardware 11
3.5mm Jacks on CTR2 Units 11
MIDI Control Types 12
MIDI Button Pairs for Dial Button Mode 13
Home Page 14
Dial Control 14
Dial Graphics 15
Tuning Lock 16
Ring Control Options 16
Dial Menu 18
Knob Menu 18
Editing the Knob Menu 19
Controls Menu 19
Knob Turn Menu 19
Knob Push-and-Turn Menu 19
Switch Short-Press Menu 20
Switch Long-Press Menu 20
Editing Control Assignments 20
Buttons Menu 21
Assigning a Knob Switch to a Button Function – CTR2-Uno and CTR2-Duo 21
PTT Page 22
Using a Hardware PTT Switch and Straight Key 23
Settings Menu 23
Label and Settings Maps 27
Editing Labels and Control Types 27

Dial Settings Editor 27
Button Editor 28
Editing With a Terminal 29
Backing Up and Restoring your Settings 30
Export Settings 31
Import Settings 32
Editing 3rd-Party App Maps 33
Remote Ham Radio Maps 33
RemoteTx Mapping 34
PTT Input 35
iOS and MacOS App Maps 35
Thetis Maps 37
Advanced Options 38
Operation with N1MM Logger+ 38
Troubleshooting 39
Appendix A: Connecting MIDI Mode to Your App 41
Remote Ham Radio 41
RemoteTx 41
AetherSDR, RimuSDR, and SDRoxide 41
Marcus' Apps for iOS or MacOS 42
Enable Permissions 42
Select the CTR2 Controller Device 42
CTR2 Dial Controller Screen 43
Windows Applications 44
Thetis 44
RimuSDR Maps 45
AetherSDR Maps 46
SDRoxide Maps 46
SparkSDR 47
Flex Radio CW Zombie Mode 47
Appendix B: Installing or Updating CTR2-Dial Firmware 48
Installing Firmware using ESPConnect (New Method) 48
Re-entering you Call Sign and Registration key 50
Selling your CTR2 Controller 50
Installing Firmware using EspressIF Flash Download Tool (Old Method) 51
Installing using Linux or Mac 53
Appendix C: Configuring Tera Term 53
Appendix D: Configuring Putty 54
Appendix E: Apple or Linux Terminal Programs 56
Appendix F: Power Requirements 57
Appendix G: Using CTR2-Dial with Non-MIDI Programs 58
Configuring CoyoteMIDI 58
Configure SmartSDR for Windows Frequency Control 58
Configure wfView Frequency Control 59
CoyoteMIDI Startup Options 60
Appendix H: Change Log 61

Clearing up the confusion



Over the years, **CTR2** controllers based on the M5Dial controller from M5Stack, have undergone a series of iterations. First, I released **CTR2-Dial**. This unit supported Bluetooth and USB MIDI control and only supported the CW paddle interface on the single-knob version. Next, the **CTR2-Flex** unit was added to the product line. It too was based on the M5Dial, and was designed to control Flex radios over WiFi. I added additional I/O to this unit so the dual-knob version supported the CW paddle interface, the knob(s) gained a push switch, and it provided an internal keyer with sidetone. It could run the original **CTR2-Dial** MIDI firmware, or the newer **CTR2-Flex** WiFi firmware. Eventually, I merged **CTR2-Dial** and **CTR2-Flex** firmware into a single binary and (unfortunately) kept the **CTR2-Flex** name for the combined firmware.

Adding more confusion…

In an effort to reduce confusion, I retired the **CTR2-Dial** and **CTR2-Flex** single and dual-knob hardware units, and came out with **CTR2-Uno**, **CTR2-Duo**, and **CTR2-Quad** units. These units had 1, 2, or 4 knobs respectively. They all ran the new **CTR2-Flex** combined firmware that supported both **MIDI** and **Flex WiFi** control modes. Unfortunately, within the combined **CTR2-Flex** firmware, I kept the **CTR2-Dial** name for the MIDI control firmware and the **CTR2-Flex** name for the Flex control firmware. So instead of simplifying my product line, I complicated it even more.

Simplifying the options…

In an effort to (hopefully) reduce confusion, I've decided to rename the firmware that runs on M5Dial controllers back to **CTR2-Dial**. I've also removed the **CTR2-Dial** and **CTR2-Flex** mode designations within the firmware and now call them simply **MIDI** and **Flex mode**. This aligns with how these options are defined in **CTR2-MIDI** and **CTR2-Max** firmware. This manual has been edited to reflect these changes.

CTR2-Dial firmware runs on any M5Dial based **CTR2** controller including **CTR2-Uno**, **CTR2-Duo**, **CTR2-Quad**. It also runs on the older **CTR2-Flex**, and **CTR2-Dial** hardware.

MIDI mode turns your M5Dial based **CTR2** controller into a MIDI controller that's custom designed for ham radio operators. It works with a wide variety of radio control apps like Marcus' (DL8MRE) SmartSDR for iOS/MacOS, AetherSDR, RimuSDR, Thetis, among others. **MIDI** mode is a one-way controller. It has no idea what the radio is doing. It only sends MIDI commands to the control app. This mode is covered in this manual.

Flex mode creates a custom WiFi controller specifically designed for the Flex 6000/8000/Aurora SDR radios. It is based on the popular **CTR2-Micro** controller firmware. It utilizes the Flex Network API to directly monitor and control the Flex radio over an IP network connection. In addition, it provides real-time CW keying and PTT control over the network. **CTR2-Dial** v3.0 firmware adds support for the new **CTR2 Relay** USB mode in AetherSDR. This mode allows **Flex** mode to connect to your radio over a USB connection on your computer, instead of using WiFi, when running AetherSDR.

Because the Flex API is a two-way protocol, **Flex** mode is aware of the radio's operating state (frequency, mode, band, etc.) A **Dashboard** display provides easy access to many of the radio's functions, and a new **Controls** menu for **CTR2-Quad** makes it easy to see how each control on your controller is configured.

The manual for **Flex** mode can be found here.

If you're anxious to get your **CTR2** controller online, jump to the Quick Start Guide.

How to use this manual

This manual should be used as a reference manual. An expanded Help system if you will. Items in the Table of Contents link to their write up in the manual. I've tried to group things logically and have added hyperlinks so you can quickly jump to other sections.

As this document evolves, sections that have changed since the last update will be highlighted in yellow.

The version number of this manual will follow the latest released version number of the firmware.

Feel free to contact me if you have question about a certain feature or have ideas for future improvements. I love to get feedback on my work. My email address is good on QRZ.com.

Legal Notice

What would a manual be without a legal notice? Here goes…

- This is a hobby endeavor. Nothing is guaranteed! Use this device at your own risk!
- I will do my best to make sure that you receive functioning hardware. I will work with you if there is a problem with your unit on arrival.
- I make no warranty that the firmware provided will perform up to your expectations or be suitable for your application. A lot of compromises had to be made to fit the small display so review this manual to be sure you're comfortable with the user interface.
- Software bugs are a fact of life and I try to find and correct all bug reports to the best of my ability ASAP.
- **CTR2-Dial** requires a license key to be fully functional. License keys can be purchased separately if you build your own unit. They are included with any purchase of any M5Dial based **CTR2** controller from Lynovation.com.
- License keys are tied to your call sign. This allows you to use the same key on as many devices as you own. You are not allowed to include your license key on units that you build to sell or give to others. They will need to purchase their own key.

Change Log

v3.00.00: November 15, 2026

- Renamed **CTR2-Flex** firmware to **CTR2-Dial** to better identify that this firmware is designed for the M5Dial. All references to **CTR2-Dial mode** have been changed to **MIDI mode**, and all references to **CTR2-Flex mode** have been changed to **Flex mode**.
- Added a new **Controls** menu for **CTR2-Quad** hardware

Changes to previous versions can be found in Appendix H

System Overview



CTR2-Uno, **CTR2-Duo**, and **CTR2-Quad** utilize the M5Dial from M5Stack. The M5Dial is small, rugged controller based on the ESP32-S3 processor. It includes a 1.28" round color touchscreen display and an integrated encoder (the gray ring). It can be powered from a USB connection, an external 6-to-36-volt battery, or from a 3.7-volt Lithium battery. The current versions of **CTR2** M5Dial based units use USB for power. The user can upgrade their unit to use these other power sources if desired.

CTR2-Dial firmware runs on any M5Dial based **CTR2** controller (including the discontinued **CTR2-Dial** and **CTR2-Flex** hardware) and supports both Bluetooth and USB MIDI control (**MIDI** mode), and Flex radio API control over WiFi or **CTR2 Relay** USB in AetherSDR (**Flex** mode).

Flex mode is covered under a separate manual that can be downloaded here. This manual will focus on **MIDI** mode.

MIDI Mode

MIDI mode doesn't "talk" to your radio directly. It uses MIDI commands to tell a radio control app what to do. The MIDI protocol was developed to control musical instruments. It's a very small, simple, and fast protocol. Many radio control apps have adopted MIDI to allow other programs to control their functions instead of using proprietary CAT protocols.

The main advantage of using a dedicated MIDI controller like the a **CTR2** controller over using a mouse is that the radio control app doesn't have to be "in focus" on your computer for the **CTR2** unit to control it. Commands from **CTR2-Dial** go directly to the app that it is registered to. You can change frequency or other parameters using **CTR2-Dial** while you are entering log data or working in another program.

Another advantage of **CTR2** controllers over generic MIDI controllers is that **CTR2** controllers are custom designed and built for ham radio operation. They have built in paddle, key, and PTT interfaces that make

it easy to support these functions (if the radio control app you're using supports them). It also supports Bluetooth LE and USB connections so it is usable on a wide range of devices.

Like a mouse, **CTR2-Dial** only sends commands. It does not receive information back from the app or the radio. It has no idea what is going on in the "real world". The 3rd-party app you're using manages the user interface and the control communications with the radio.

The **Quick Start Guide** will help you configure **CTR2-Dial** and get it setup up with your 3rd-party app.

Multiple Controllers / One Firmware

As mentioned previously, three versions of hardware using the M5Dial are available. Which unit you choose depends on your use case. You can easily switch between **Flex** and **MIDI** mode on the last page in the **Settings** menu.

Quick Start Guide

If you're like most hams, when you receive a new tool for your shack, you just want to plug it in and try it out.

Your **CTR2** controller is not one of those tools! Be prepared for a learning curve as you discover the features in your controller.

CTR2-Dial MIDI mode uses Bluetooth or USB MIDI to control a 3rd-party app and that app controls your radio. The radio you can control and the functions you have available, are determined by the 3rd-party app. The goal of this section is to give you a basic understanding of how **MIDI** mode works, and get you connected so you can start learning about your **CTR2** unit.

Basic Concepts

Let's start with how **CTR2-Dial** works with your 3rd-party app.

CTR2 M5Dial Based Radio Controller

As discussed previously, there are several hardware versions of **CTR2** controllers based on the M5Dial from M5Stack. **CTR2-Dial MIDI** mode runs on all of them. It's what makes your **CTR2** controller a MIDI controller. All of the controls in **MIDI** mode are "hardwired" to MIDI control #s. You can edit the labels that are displayed on the screen when you select a Dial control or open the Buttons menu. What each dial or button does is determined by the MIDI mapping in the 3rd-party app.

MIDI mode is a one-way controller. It only sends MIDI commands to the 3rd-party app. It has no awareness of what the app or radio are actually doing.

3rd-Party App

The key to controlling your radio with **MIDI** mode is the 3rd-party app it's connected to. The app's MIDI map translates the incoming MIDI commands from **MIDI** mode to radio functions such as tuning the frequency or changing the bands. There are many 3rd-party apps available.

They are generally designed for a specific radio manufacturer, and sometimes a specific radio model. Examples include several iOS/MacOS apps by Marcus, DL8MRE, AetherSDR and RimuSDR for Flex radios, Thetis for the Apache and Hermes Lite 2 radios, and SDR-Console by Simon Brown, among others. If your app supports MIDI control, **CTR2-Dial's MIDI** mode should work with it.

As an added bonus, **MIDI** mode works with several browser-based control apps such as RemoteHamRadio, RemoteTx, OnlineRemoteRadio, and Hams.Live.

Initial Setup

The first order of business is to power up your **CTR2** unit. This is generally done by plugging it into a USB port on your computer. It can also be powered by a 5-volt phone charger or USB battery.

WARNING: Do not use an unpowered USB hub to power the controller. Unpowered hubs cannot provide the current required to run the controller reliably.

When the unit boots, the flash screen will show the firmware title, operating mode (**MIDI** or **Flex**), and version number. If your unit boots into **Flex** mode, open the **Settings** menu, navigate to the last page, and select **Run MIDI Mode** on the menu. The unit will reboot into **MIDI** mode.

Connect to your App

Once you have **CTR2-Dial** running in **MIDI** mode, you'll need to connect it to your app. By default, the firmware supports both USB and Bluetooth MIDI. The connection mode you choose depends on your hardware. If you're using a desk computer or notebook, generally USB MIDI is the best way to go. If you're running an iPad or iPhone, Bluetooth is easier because it doesn't require the **CTR2** unit to be plugged into the device's USB port.

You can find specific information on connecting to different devices in Appendix A.

Configure the MIDI Mapping in your App

Most apps have an **Import** feature that will allow you to import a MIDI map into the app. I have maps available for a variety of 3rd-party apps on the CTR2-Dial Configuration Files page on Lynovation.com. App maps generally use file extensions *".map"* for SmartSDR, SDR-Control, etc., *".xml"* for AetherSDR and SDR-Console, or *".m2c"* for Thetis. Instruction for loading these map file can be found in the Editing 3rd-Party App Maps section below.

To check **MIDI** mode's labels against the MIDI mapping in your app, simply select a dial control in the **Dial control** page, then turn that dial. For buttons, open the **Buttons** menu and touch a button. The app should highlight the MIDI command it received from **CTR2-Dial** in its map, and show the radio function mapped to that MIDI command. If there's no function mapped to a MIDI command, the app should give you a menu of functions to choose from.

If the control labels in **MIDI** mode don't match the functions mapped in the app, you can edit them. The next section shows how to do that.

Editing Labels in MIDI Mode

There are two ways to edit the labels associated with the controls in **MIDI** mode.



1. Use the simple text editor built into **MIDI** mode. **Edit Map Name**, **Edit Dial Setting** and **Edit Btn Label** can be found on page 8 in the **Settings** menu. This editor allows you to change each character in the label using **knob A**. You can advance to the next character, insert new characters, or delete the current character using the onscreen buttons. When editing a **Dial** setting, you also have the option of changing the MIDI control type for that dial.

2. Connect a dumb terminal to **CTR2-Dial** and edit labels using the terminal's keyboard. Information on doing this can be found in the Editing Labels and Control Types section.

The goal is to match up the labels in **CTR2-Dial** with the actual function controlled by the 3rd-party app.

There are also spreadsheets in the CTR2-Dial Configuration Files zip file that provide examples of how **MIDI** mode can be mapped for various 3rd-party control apps. You can use these sheets as a basis for setting up your own configuration.

Importing Configurations into CTR2-Dial

CTR2-Dial includes **Import** and **Export** tools that you can use to load a configuration or save load an existing configuration. The CTR2-Dial Configuration Files zip file includes configuration files that match many 3rd-party app maps. These are text files with the extension "**.CTR2**". The Backing Up and Restoring your Settings section has Information on using these tools.

Your App Executes the Wrong Control

If you execute a control in **MIDI** mode and the app executes the wrong function you must either edit the label in **MIDI** mode to match the function mapped to that MIDI control # in the app, or edit the app's map to execute the function shown by the label in **MIDI** mode. It doesn't matter which data you change, but they must match.

Time to Play!

With the basic configuration done, the best way to learn about **MIDI** mode is to use it. Once you're comfortable with it, you can edit the labels and functions in **MIDI** mode and in your 3rd-party app to fit you're operating style.

MIDI Mode's Controls

MIDI mode has 18 virtual **Dial** controls that are assigned to MIDI control #100 through #117. The MIDI control # is shown on the **Dial control** display just above the label. The Dial Editor allows you to edit the dial's label and MIDI control type.

60 virtual buttons in the Buttons menu are assigned to MIDI control #1 through #60. MIDI button numbers are not displayed due to display size constraints. You can edit the label for each button in the

Button Editor. If you find that you don't need 60 buttons, you can change the # of buttons displayed in the **Buttons** menu with the # Buttons option on page 2 of the Settings menu.

The table below lists the MIDI button numbers on each page of the Button menu, in the order they're displayed.

Page	Buttons		Page	Buttons		Page	Buttons		Page	Buttons		Page	Buttons	
1	1	4	**2**	7	10	**3**	13	16	**4**	19	22	**5**	25	28
	2	5		8	11		14	17		20	23		26	29
	3	6		9	12		15	18		21	24		27	30
Page	**Buttons**		**Page**	**Buttons**		**Page**	**Buttons**		**Page**	**Buttons**		**Page**	**Buttons**	
6	31	34	**7**	37	40	**8**	43	46	**9**	49	52	**10**	55	58
	32	35		38	41		44	47		50	53		56	59
	33	36		39	42		45	48		51	54		57	60*

* Button 60 is shared with Dial #100's CCW action when using the Button MIDI type.

I have posted a video on YouTube describing the mapping process. You can find it here.

NOTE: You can export **CTR2-Dial's** settings to your computer to back them up, and import them back in as needed. More information on importing and exporting settings can be found in the Backing Up and Restoring Your Settings section.

MIDI Mode's Features

CTR2-Dial MIDI mode runs on the M5Dial from M5Stack. The M5Dial features an ESP32-S3 processor, a 1.28" color touchscreen, and a built-in selector ring and hardware pushbutton. The firmware includes the following features:

- Supports USB MIDI, Bluetooth-LE MIDI, and HID connections
- 60 virtual button controls for modes/bands/filters selection
- 18 virtual dial (wheel/slider) controls for tuning, volume, RIT, XIT, etc.
- Assign the gray Ring encoder on the M5Dial display to any of the available **Dial controls**
- Up to four optional physical knobs
    - **CTR2-Uno** and **CTR2-Duo** units have 6 wheel/slider functions for each knob to choose from in the **Knob** menu. You can edit these functions.
    - **CTR2-Quad** units support the following:
        i. Knobs can be programmed to two functions (turn and push-and-turn)

ii. Knobs assigned to a **<DIAL>** function control the selected virtual **Dial control** and the selected control in the dashboard

- Two pushbuttons are provided on the **CTR2-Quad** – each pushbutton can be programmed to any two button functions (using short and long-press) or one can be dedicated to control PTT.
- The gray ring on the M5Dial can be configured as a fine-tuning control (to make fine adjustments to the selected **Dial control**), or it can be assigned to control the currently selected **Dial control**, or it can be assigned to control a specific **Dial control,** regardless of what is selected in the **Dial control** page.
- Tuning can be locked to prevent inadvertent tuning
- A 3.5mm (1/8") stereo input jack allows you to use your paddles to control the keyer, straight key, or PTT in the app (not all 3rd-party apps support all modes)
    - Separate jacks are provided on **CTR2-Quad** for paddles and key/PTT
- A virtual PTT switch and an external PTT switch input
- Four beep volume levels, Off, Low, Medium, and High
- Automatic speed sensitive tuning & control adjustments
- Two maps allow **MIDI** mode to be used with separate programs without requiring configuration changes
- Seven color themes and backlight control
- Sleep and power down timers to save battery power
- Manual power down
- User programmable labels for each button and dial control
- Many power options – see the hardware manuals for each unit
- Turn the Bluetooth radio off to save 50 mA of current draw for battery operation
- Backup **CTR2-Dial's** settings using the **Import** and **Export Settings** option
- Firmware updating is done through the USB-C port
- Run **MIDI** or **Flex** modes without re-flashing the unit

Hardware

Hardware is covered in separate manuals for each model. Click the following links to open the hardware manual page for each unit: **CTR2-Uno** **CTR2-Duo** **CTR2-Quad**

3.5mm Jacks on CTR2 Units

CAUTION: The 3.5mm jack(s) on CTR2 units are for paddle, key, and PTT inputs only. They are not designed for output. Do not connect these jacks to your radio as this may damage the unit.

MIDI Control Types

Before discussing **MIDI** mode's functions, it's important to understand the types of MIDI controls **MIDI** mode supports. The table below summarizes each function.

Buttons	Application
Button controls	Buttons are implemented using MIDI Note controls. Each button in **MIDI** mode is assigned to a MIDI Note # starting at 1 and continuing to 60. When you execute a button function the program sends a MIDI Note ON command immediately followed by a MIDI Note OFF command to the app.
Wheels & Sliders	**Application**
WheelA	This control is used with Marcus' iOS/MacOS programs, AetherSDR, RimuSDR, RHR, RemoteTx, and most other modern control apps for frequency control. This control is continuously adjustable and is centered at 64 counts. Frequency up/down control is initiated by sending a value above or below 64 depending on the direction the dial is turned. The offset from 64 counts determines the turning speed.
WheelB	This control is similar to WheelA and is used with Thetis and some older control apps. This wheel sends 126 counts to decrement the frequency by one step and 1 to increment the frequency by one step. When the **Dial** or **Knob** is quickly turned **MIDI** mode sends 10 commands for each step instead of one to speed up tuning.
WheelB-r	This control is the same as Wheel B except that 1 is sent to decrement frequency and 126 is sent to increment frequency. This control type was added to support the PI HPSDR control program.
SliderA	This control is similar to potentiometer. Its range is 0 to 127 counts. Turning the **Dial** control CCW reduces the count until 0 is reached. Turning it clockwise increases the count until 127 is reached.
SliderB	This control is similar to **SliderA** except that it is used specifically for center tuned controls like RIT and XIT. This control is centered at 64 counts. Decrementing below 64 counts applies a negative offset and incrementing above 64 counts sends a positive offset. When the value of this control reaches 64 when turning from either direction, **MIDI** mode beeps and pauses for 750 milliseconds. This allows you to find zero on the control. **HINT:** Touching the control's label in the center of the **Dial control** display when the control is "off zero" resets the control to its zero position (64 counts).
Buttons Wheel Type	This control assigns a pair of MIDI button controls to send up and down button controls to the control program using the **Dial** or **Knob**. The lower control # is sent when the control is turned CCW and the upper control # is set when the control is turned CW. This is normally used for frequency or frequency tuning step up/down control. The control pair is determined by the Dial # as shown in the next table.

MIDI Button Pairs for Dial Button Mode

When the **Button** control type is selected for a **Dial control**, the MIDI button pair is determined by the **Dial control** #. Turning the knob CCW sends the lower MIDI command #, and turning it CW sends the upper MIDI command # from the table below.

Dial Ctrl #	Button Pair	Dial Ctrl #	Button Pair	Dial Ctrl #	Button Pair
100	60*/61	106	72/73	112	84/85
101	62/63	107	74/75	113	86/87
102	64/65	108	76/77	114	88/89
103	66/67	109	78/79	115	90/91
104	68/69	110	80/81	116	92/93
105	70/71	111	82/83	117	94/95

* **Button 60** is shared with the last button in the **Button** menu.

EXAMPLE

To assign a knob control to increment or decrement the frequency tuning step in SmartSDR, do the following:

1. Determine which **Dial control** you want to use. We'll use #103 in this example.
2. Using the **Edit Dial Setting** option on page 8 of the **Settings** menu, select the fourth button on the first menu (#103). Edit its label as needed, then touch the **Type** option to step to **Button**.
3. Open the **Edit Mapping** menu in the **CTR2 Dial Controller Tool** in SmartSDR
4. Select control 103 on the **Dial control** then turn the dial CCW. MIDI button 66 should be highlighted in the **Edit Mapping** menu in SmartSDR.
5. Select the *Tune Step Previous* function from the function list.
6. Turn the dial CW. MIDI button 67 should highlight in the **Edit Mapping** menu in SmartSDR.
7. Select the *Tune Step (1,20,100,1000)* function from the function list.

Now, turning the knob for **Dial control** #103 will increment or decrement the frequency tuning step in SmartSDR.

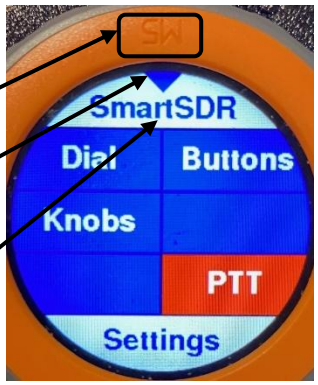
This is especially useful on **CTR2-Quad** with it's dual-function knobs. For instance, you can assign the VFO control (#100) to knob D's **Turn** function and assign the step control in the example above (#103) to the **Push-and-Turn** function for knob D. Now, you can tune your radio with knob D and press and turn it to change the tuning resolution.

Home Page

The user interacts with **MIDI** mode using the touch screen to select from a series of menus. The **Home** page is the default display. The caption can be set with the **Edit Map Name** option on page 8 of the **Settings** menu.

From the **Home** page, you can select the various control pages and **Settings** menu.

There is a single physical button labeled **M5**, (yes, the label is upside down) built into the orange ring of the M5Dial. To press it, press the gray ring directly above the **M5** label. M5 is circled on the photo at the right.



The small triangle at the top of the display (just above the map name) indicates the unit is using Bluetooth to connect to the app.

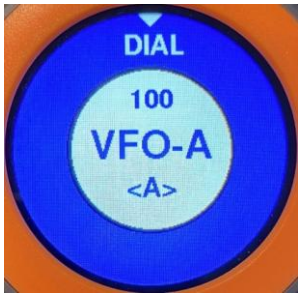
The map name indicates the radio control app the current map is configured for. It can be edited on page 8 of the Settings menu.

Press the **M5** button in any control or menu page to return to the **Home** page.

From the **Home** page you can quickly access the **Dial**, **Buttons**, **Knob** (**Controls** on the **CTR2-Quad**), and virtual **PTT** pages, or open the **Settings** menu.

Dial Control

The virtual **Dial control** supports 18 MIDI wheel or slider controls. The dial touch pad is the outer ring around the round center label. Swipe your finger around the outer ring to adjust the control.



Each dial control is assigned a MIDI control number starting at 100 and is shown of the top of the center label. This # indicates the control # you need to map in your app's MIDI function menu to execute this control.

The label for the selected control is shown below the MIDI control #. The label lets you know which function the app is *supposed to* execute for this control. If the label doesn't match the MIDI function mapped in the app, you can edit it to match.

Hint: Quickly change to the *Buttons* or *Knob menus* by swiping across the center of the display either *left* or *right*. Swipe from the *left* to open the *Knob menu* or from the *right* to open the *Buttons menu*.

Dial Graphics

The **Dial's** background depends on the MIDI **control type** selected for the control.

Control types can be set using a dumb terminal program, or you can use the **Edit Dial Setting** on page 8 of the Settings menu.



This screenshot shows a wheel control. Wheels are continuously variable and used for tuning. The MIDI control # (100) is shown on the top line of the center circle. The label in the middle (in this case **VFO-A**) indicates the control function and can be edited by the user. **<A>** at the bottom of the label indicates that this is a **WheelA** control.

In addition to wheel controls, you can select from two slider controls.



SliderA control is the most common. The outer touch ring on the **Dial** control represents a gauge with the level indicated by the filled arc that starts on the bottom left. In the photo to the right the volume is set at 26% and the level gage is 26% full. The MIDI control # (101) is displayed at the top of the center label.



SliderB is used for RIT, XIT, and other +/- offset functions. In this display the offset is represented by an arc that starts at the top center of the display. For negative offsets it grows to the left and for positive offsets it grows to the right from center. The MIDI control # (107) is displayed at the top of the center label.

When the RIT/XIT control is offset as shown, touching the center label (**RIT>**) resets the offset back to 0. You can enable/disable RIT or XIT from the *Buttons menu*. You can also assign the enable/disable RIT or XIT buttons to one of the knob switches.



Button Dial allows you to use MIDI buttons instead of wheels or sliders to be used with a **Dial control**. In this display, the button pair is displayed above the label. The lower button number is sent when the dial is turned counter-clockwise, and the upper number is sent when the dial is turn clock-wised. An example of configuring this control is shown here.

Touching the center label opens the *Dial menu* where you can select a control for the *dial control*. You can also rotate the gray ring on the M5Dial to change the selected dial control.

Shortcut: Touch to the *left* of the **DIAL** caption at the top to switch to the **Knobs menu** or touch to the *right* to switch to the **Buttons menu**.

Tuning Lock

To lock tuning to prevent inadvertent changes simply long-press the label on a control that is set for a Wheel MIDI type (typically VFO controls). When tuning is locked, the **Dial control** will be "grayed out" as shown here. Adjusting the control, or turning a knob assigned to this control will post a message with instructions on how to reset the lock.



To unlock the control, long-press the center label.

Ring Control Options

The encoder used in the gray ring control on the M5Dial display is a detent (bumpy) encoder with 12 "clicks" per rotation. Because it isn't very sensitive, and somewhat difficult to turn, it has limited functionality. There are four Ring modes to choose from. These are selected in by touching the **Ring:** option on page 10 of the **Settings** menu.

- **Navigation** mode – (default) – use the ring to select dial controls and menu pages.
- **Fine-Tune** mode – to enable, touch the outer ring on the **Dial control** display to turn on fine-tuning. **< RING >** will be displayed in the page caption. Turning the gray ring will change the selected control's value by one count. **Fine-Tune** mode will time out after 3 seconds of inactivity.
- **Sync2Dial** mode – the ring adjusts the dial control selected in the **Dial control** (or on the **Dial menu**) – this works in any page, similar to how the knobs work.
- **Selected Dial Control** – the ring adjusts a specific **Dial control** that you select from the **Ring:** option in the **Settings** menu. This also works from any page.

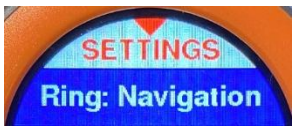
The selected ring mode is indicated by vertical lines the Bluetooth antenna icon area at the top of each page. No lines indicate the ring control is in **Navigation** mode. A single line indicates the ring is in **Fine-Tune** mode. Two lines indicates **Sync2Dial** ring mode is active. Three lines indicates a selected *dial control* is assigned to the ring control.

NOTE: When **Navigation** or **Fine-Tune** modes are not selected you must use the on-screen navigation controls to move between menu pages and select **Dial controls**.

The following screenshots should help explain the process of selecting a ring control option.

Navigation mode (default)

The screenshot at the right shows that the ring is in **Navigation** mode. In this mode, turning the ring will change menu pages or the selected dial control.



No lines are shown at the top of the display.

In the **Settings** menu, touch the **Ring: Navigation** button to switch to **Fine-Tune** mode.

Fine-Tune mode

In this mode, the ring can be used to fine-tune the selected control while in the **Dial control** page. Touch the outside ring on the **Dial control** to enable fine-tuning. This mode will timeout after 3 seconds of inactivity.



A single line in the Bluetooth antenna area is visible in this mode.



In the **Settings** menu, touch the **Ring: Fine-Tune** button to switch to **Sync2Dial** mode.

Sync2Dial mode

In **Sync2Dial** mode the ring controls the currently selected **Dial control** from any page, similar to how the **Knob** controls work.



Two lines are shown in the Bluetooth antenna icon area when this mode is active.

In the **Settings** menu, touch the **Ring: Sync2Dial** button to open the **Ring Ctl** menu.

Ring Ctl Menu

The **Ring Ctl** menu appears when you touch the **Ring: Sync2Dial** button to change the ring mode. This menu is similar to the **Dial menu** and is used to assign one of the **Dial controls** to the **Ring** control. There are three pages of menus. Use the **Next** button on the bottom to step to the next page. Touch a control label to assign that control to the **Ring** control. In this example, the **AGC-T** control is selected.



Pressing **Esc** in this menu returns the **Ring** mode back to **Navigation** mode without selecting a control.

Selected Dial Control Mode

Once you select a control in the **Ring Ctl** menu you will return to the **Settings** menu and the **Ring:** option will show the selected control.



Note the three lines in the antenna icon area at the top of the page.

To return to ring **Navigation** mode, touch the **Ring:** button in the **Settings** menu again.

Dial Menu



If the gray ring on the M5Dial is set for navigation or fine-tune mode, it can be used to change the **Dial control's** function. Otherwise, to change the virtual dial's function you'll need to open the **Dial menu**. To do this, touch the MIDI control# on the **Dial control**. This menu allows you to select from a three-page menu of dial functions. The current dial setting will be highlighted (**VFO** in this example). Touch the left or right side of the bottom button or twist the gray ring on the M5Dial (if in ring navigation or fine-tune mode) to move to the next page.

Touch a button to select a control and return to the **Dial control** page. Touch the selected function to return to the **Dial control** page without changing the selection.

The caption button (**DIAL MNU**) is a two-function button.

- Touch the left side to switch to the **Knob** menu.
- Touch the right side to switch to the **Buttons** menu.

Hint: Quickly change to the **Knob** or **Button** menus by swiping across the center of the display either *left* or *right*. Swipe from the *left* to open the **Knob** menu or from the *right* to open the **Buttons** menu.

Knob Menu



The **Knob** menu is used with **CTR2-Uno**, **CTR2-Duo**, and older **CTR2-Flex** and **CTR2-Dial** units. It allows you to assign **Dial controls** to the knob(s) on the unit.

CTR2-Quad units provide a more advanced **Control** menu that allows you to assign **Dial** and **Button** controls to the knobs and switches on the unit.

The caption at the top of the page is a dual-function button.

- Touch the *left* side to switch to the **DIAL** control
- Touch the *right* side to switch to the **Buttons** menu

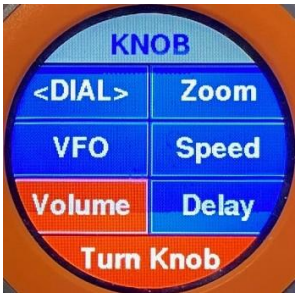
If the gray ring on the M5Dial is in navigation mode, turn the ring to switch pages on **CTR2-Duo** units. You can also just touch the footer button.

Each knob can be assigned to one of 6 functions. Two-knob units have a menu page for each knob.

The first option is hard-coded to **<DIAL>**. When this option is selected, turning the **Knob** on any page will change the control selected in the **Dial control** page.

Selecting one of the other five functions on this page assigns that function to the **Knob** and it will be controlled independently from the **Dial control**.

Editing the Knob Menu



You can easily change the **Dial control** assignments in the **Knob** menus. Just touch a button to select it, then touch it again to edit it. The selected function and the bottom button will turn red. Turn any knob to scroll through the functions available in the **Dial control** menu.

Touch the button again or let the select timer timeout (6 seconds) to save the new setting.

On two-knob units, touch the bottom button (**Knob B->**) or turn the gray ring on the M5Dial (if the ring is in navigation or fine-tune mode) to change the **Knob menu** page.

Controls Menu

The **Controls** menu replaces the **Knob** menu on **CTR2-Quad**. This menu has four pages that allow you to assign **Dial** and **Button** controls to the knobs and switches on your unit.

The controls on **CTR2-Quad** support dual-function knobs and switches. Each knob has a **turn** and a **push-and-turn** function and each knob switch and pushbutton has a **short-press** and **long-press** function.

Knob Turn Menu



The **Knob Turn** menu displays the four knobs on **CTR2-Quad** in their relative positions. Each label displays the knob's letter, A, B, C, or D.

Touch the caption to return to the **Home** page, or touch the left or right side of the bottom **<- Page ->** button to go to the previous or next page. You can also turn the gray ring to navigate between pages.

Knob Push-and-Turn Menu



The **Push/Turn** menu allows you to set the **Push-and-Turn** function of each knob. Each label displays the knob's letter, A, B, C, or D, with a **+** to identify it as a push-and-turn control.

NOTE: While this menu is displayed, the **Turn** and **Push-and-Turn** functions are reversed. In other words, turning a knob while this page is open sends the displayed **Push-and-Turn** function.

Switch Short-Press Menu



The **Switch Short-Press** menu allows you to edit the **short-press** button functions assigned to the knob switches and pushbuttons on **CTR2-Quad**.

Pushbuttons #1 and #2 are shown with dimmed labels and have 1 and 2 on their labels. The knob switches appear in their relative positions and have A, B, C, and D on their labels.

Switch Long-Press Menu



The **Switch Long** menu allows you to edit the **long-press** button functions assigned to the knob switches and pushbuttons on **CTR2-Quad**.

Pushbuttons #1 and #2 are shown with dimmed labels and have 1 and 2 on their labels. The knob switches appear in their relative positions and have A, B, C, and D on their labels with a **+** to identify it as a long-press control.

NOTE: While this menu is displayed, the **Short** and **Long-press** functions are reversed. In other words, pressing one of the switches or button on the unit, while this page is open, sends the displayed **long-press** function.

Editing Control Assignments



Edit the knob and switch assignments the same way you do in the **Knob** menu. Touching a control to enable editing turns that control label red. While editing is enabled, turn any knob to scroll through the available functions for that control. Touch the control's label or the bottom button, or wait for editing to time out, to accept the change.

Buttons Menu



Open the **Buttons** menu from the **Home** menu to select from up to 60 button functions. Touching a button immediately sends the MIDI control for that function.

There are up to 10 pages of buttons with six buttons on each page. You can set the number of buttons in this menu using the **# Buttons** option on page 2 of the **Settings** menu. In this example, the # of buttons has been set to 48.

If ring navigation or fine-tune mode is enabled, turn the gray ring on the M5Dial to select a page, otherwise, pressing the *left* or *right* side of the button at the bottom of the display (**1/8** in this photo) to decrement or increment the page.

To prevent unintended operation, the caption and footer buttons are dual-function buttons. The first touch selects the button and the second touch executes the selected function.

- On the caption button touch the left side to switch to the **Knob Menu** page. Touch the right side to switch to the **Dial** page.
- On the footer button touch the left side to decrement the menu page number. Touch the right side to increment the menu page number.

Press the **M5** button on the orange ring to return to the **Home** page.

Hint: Quickly change to the **Dial control** or **Knob/Control menu** by swiping across the center of the display either *left* or *right*. Swipe from the *left* to open the **Dial control** or from the *right* to open the **Knob** or **Controls** menu.

Assigning a Knob Switch to a Button Function – CTR2-Uno and CTR2-Duo

Knob switches can be set to two actions: a short-press (less than 1 second) and a long-press (greater than 1 second). Use the **Controls** menu on **CTR2-Quad** to set switch actions. For one and two-knob units, use the following procedure.

Switch Short-Press Action

To assign a **short-press** button action to a knob's push switch, do the following:

- Open the **Buttons** menu and navigate to the page with the virtual button you want to assign
- **Press-and-Hold** the **Knob** switch you want to use
- **Touch-and-release** the virtual button you want the switch to execute

Once you have assigned a virtual button to a **Knob** switch**,** that knob's letter will appear in that button's label. That function will be sent to the radio control app anytime you press that **Knob's** switch.

Switch Long-Press Action

To assign a **long-press** button action to a knob's push switch, follow the steps above for setting the **short-press** action then while still holding the knob down, touch the desired virtual button a second time. **Buttons** set to **long-press** actions will have a **"+"** appended to the knob's letter displayed on the button.

This screenshot shows **Knob A's** short-press action is set to the **Band ^** function and its long-press action is set to the **Band v** function.



To clear a function, hold the **Knob** switch down and touch the selected virtual button again.

NOTE: You must clear both switch actions from the button before you can assign it to another knob.

PTT Page

The **PTT** page offers a virtual PTT button. Simply touch the display to key your radio and lift your finger to unkey. The MIDI control # sent to the app is determined by the **PTT->MIDI** control # is selected on page 5 in the **Settings** menu.



If your radio control app supports latching PTT, map to that function in your app to the MIDI control # selected for PTT in the **Settings** menu. In latching mode, touching and releasing the display keys PTT. Touch and release the display again to unkey PTT.

NOTE: If your app supports latched PTT, the display on your **CTR2** unit will not remain red while your radio is keyed when you lift your finger off the display.

The default MIDI control # for PTT is 99. You can choose from 96, 97, 98, or 99 in the **Settings** menu under **PTT->MIDI**.

NOTE: Controls 20, 21, 30, and 31 are also available in **PTT->MIDI** to allow compatibility with apps such as RHR and RemoteTx that are configured for **CTR2-MIDI**.

NOTE: If your radio keys up when you press the PTT display but your microphone doesn't produce power output, check the microphone settings in the app.

Using a Hardware PTT Switch and Straight Key

You can use a straight key (or external keyer) and/or an external PTT switch connected to the **Paddle Input** jack on your **CTR2** unit. To do this:

1. Connect your straight key (or external keyer) to the TIP and SHIELD (ground) terminals on a 3.5mm (1/8") stereo plug. Connect your PTT switch between the RING and SHIELD on the same plug.
2. Plug the stereo plug into the *Paddle Input* jack on **CTR2-Uno**, **CTR2-Duo** (or the older **CTR2-Dial** and **CTR2-Flex** hardware). On **CTR2-Quad**, plug it into the *Key/PTT* jack.
3. In the Settings menu, set **Pdl->** to **MIDI: 98/99** (or **30/31** if using Remote Ham Radio or RemoteTx). Contact closures on the input jack will send MIDI commands 98 and 99 (or 30 and 31).
4. In the **Settings** menu, set **PTT->** to **MIDI: 99** (or **31** if using **MIDI** mode with Remote Ham Radio)

Once configured, pressing the straight key will send MIDI command 98 (or 30) and pressing the PTT switch will send the MIDI control defined in **PTT->MIDI** to your app to key PTT. Make sure those control # are mapped to MOX or PTT in your app.

CAUTION: The 3.5mm jack(s) on CTR2 units are for paddle, key, and PTT inputs only. They are not designed for output. Do not connect these jacks to your radio as this may damage the unit.

Settings Menu



To enter the **Settings** menu, press the **Settings** button at the bottom of the **Home** page.

The **Settings** menu is divided up into 10 pages with three buttons on each page. You must press a button twice to change its setting.

Press the **M5** button or touch the **SETTINGS** caption to return to the **Home** page**.**

To change menu pages touch on the left or right side if the footer button (**<8/10>** in this example) or turn the gray ring if ring navigation or fine-tuning mode is enabled.

The table below summarizes each setting option.

Page	Btn	Function	Description
1	1	**Beep Mode**	Changes the volume of control beeps: Off, Low, Medium, and High
	2	**Speed Tune**	When enabled, touch and hold the outer ring on the **Dial** for > 1 second to enter speed tuning mode. Valid for *WheelA* and *WheelB*.
	3	**Dial Sens**	Changes the sensitivity of the virtual dial. Range: Low, Medium, High. Default is Medium.

2	1	**Ctrl Map**	Selects control Map 1 or 2. Each map can be configured for a specific radio control app. Use a different color theme for each map. Default is *Map 1*.
	2	**# Buttons**	Changes the number of buttons displayed in the **Buttons** menu. This allows you to limit the # of buttons to the buttons you actually use. Range is 6 to 60. Default is 42. **NOTE:** v2.05.00 automatically modifies the button arrays from the configuration file from previous versions to add 18 additional buttons to each map. The new configuration file is not backwards compatible with versions below 2.05.00. If you flash an earlier version you should erase the flash memory prior to loading it.
	3	**Theme**	Select the color theme for the selected Map. Options include Dark, Light, Blue, Orange, Green, Red, and Violet. Default is Blue for Map 1 and Violet for Map 2.
3	1	**Sleep**	Sets a timer that turns off the display backlight after no activity for the set number of minutes to reduce current draw. Sleep mode does not close USB or Bluetooth connections. Range: Never, 1, 5, 10, 30, and 60 minutes.
	2	**Pwr Off**	Sets a timer to turn off the unit after no activity for the set number of minutes. Pwr Off mode reduces current draw to 14 microamps and closes USB and Bluetooth connections. Range: Never, 10, 30, 60, 120, and 180 minutes.
	3	**Power Down**	Immediately closes the Bluetooth and USB connection and puts the unit to sleep, reducing current draw to 14 microamps. Touch the display to wake up the unit. **NOTE:** If you are powering your **CTR2** controller with a 3.7-volt battery you will need to press and hold the **M5** button on the orange ring for > 10 seconds to wake the controller up from sleep mode.
4	1	**# Knobs**	Selects the number of external knobs your unit is equipped with. (One and two knob configurations cannot be detected in the firmware.) For **CTR2-Uno**, **CTR2-Duo**, (and older **CTR2-Flex** and **CTR2-Dial** hardware) you have the following options: **None**, **One, Two**, or **Swap A/B** (for two knob units) • When this firmware is running on **CTR2-Dial** hardware the paddle jack is only available in the **None** and **One** options. **CTR2-Quad** hardware is automatically detected and this setting is fixed to **# Knobs: Four**
	2	**Knob/Knob A Or SW1 Setup**	On **CTR2-Uno**, **CTR2-Duo**, (and older **CTR2-Flex** and **CTR2-Dial** hardware) this option selects either Normal or Reverse direction for *Knob A*. The default is **Normal**. On **CTR2-Quad** this option toggles the PTT setting of pushbutton #1. You can use this switch instead of the virtual PTT page or an external PTT switch to key your radio. **NOTE:** Toggling this setting resets any button switch actions that were assigned to SW1 in the *Buttons menu.*

4	3	**Knob B Or SW2 Setup**	On **CTR2-Duo**, (and older **CTR2-Flex** and **CTR2-Dial** dual-knob hardware) this option selects either Normal or Reverse direction for *Knob B*. The default is **Normal**. This option is not available on single knob units. On **CTR2-Quad** this option toggles the PTT setting of pushbutton #2. When PTT is enabled, you can use this switch instead of the virtual PTT page or an external PTT switch to key your radio. **NOTE:** Toggling this setting resets any button switch actions that were assigned to SW2 in the *Buttons menu.*
5	1	**Pdl->**	Selects the MIDI control #s mapped to the *Paddle Input* jack. Default is 96/97 and these are usually mapped to the *Left* and *Right* paddle controls in the app. Option 98/99 can be selected and mapped to the Straight Key and PTT options in the app. For compatibility with Remote Ham Radio and RemoteTx's mapping for **CTR2-MIDI** you can also select 20/21 and 30/31 pairing. **NOTE:** By default, controls 20/21 and 30/31 are mapped to buttons. Remove these mappings in your app when controlling them with the paddle input.
	2	**PTT->**	Selects which MIDI control # is mapped to the virtual **PTT** button page and the PTT input jack, and the switches on **CTR2-Quad**. The default 99 is typically mapped to PTT or MOX in the app. Range: 96, 97, 98, and 99. MIDI controls 20, 21, 30, and 31 are also available for compatibility with Remote Ham Radio and RemoteTx's **CTR2-MIDI** mapping. To use an external PTT switch, wire it to the RING and SHIELD of the **Paddle Input** jack and select **98/99** on the **Pdl In** option above and set **PTT Ctrl** to **99**. If using Remote Ham Radio or RemoteTx, select **30/31** on the **Pdl In** option and set **PTT Ctrl** to **31**. See Using a Hardware PTT Switch and Straight key.
	3	**PDLS or PDLS & KEY**	Swaps the TIP and RING inputs on the **Paddle Input** jack on **CTR2-Uno** and **CTR2-Duo** (and older **CTR2-Dial** and **CTR2-Flex**) hardware. On **CTR2-Quad** hardware, this option swaps the TIP and RING on either the *Paddle* input jack and/or the *Key/PTT* input jack.
6	1	**Import Settings**	Import settings from a previously exported setting file using XModem. In Tera Term select *File->Transfer->XMODEM->Send* and select a previously saved configuration file on your computer. Next, touch **Import Settings** to start the transfer.
	2	**Export Settings**	Backup **CTR2-Dial's** configuration by exporting them to a file on your computer. To do this, in Tera Term select *File->Transfer->XMODEM->Receive* then enter the name of the file you wish to save. Next, touch **Export Settings** to start the transfer. Once this file has been saved you can recover from a unintended memory erase when flashing new firmware by using the **Import Settings** option above. **NOTE:** You can also use the import/export options to create setting files for different radio control apps.
	3	**Info**	Displays program name, mode, version #, and Bluetooth ID

7	1	**Ring Mode**	Selects the operating mode of the gray ring on the display. See Ring Control Options for a complete discussion on Ring modes.
	2	**Rotate Screen**	Rotates the screen 90 degrees for each selection. This allows the screen to be aligned for various M5Dial mounting configurations
	3	**Touch Delay**	Enables or disables a 120-millisecond delay on touch input. This can be used to reduce unintended touch events and occasional randomly generated touch events from the M5Dial touch sensor.
8	1	**Edit Map Name**	Allows you to edit the current map's name. This name is displayed in the caption of the **Home** page. You can enter the radio control app's name here to identify the app this map is used with.
	2	**Edit Dial Setting**	Opens the Dial control label and MIDI control type editor. See Editing CTR2-Dial's Labels and Control Types for more information on dial labels and MIDI control #s.
	3	**Edit Btn Label**	Opens the Button label editor. See Editing CTR2-Dial's Labels and Control Types for more information on button labels. Opens the Button label editor. See Editing CTR2-Dial's Labels and Control Types for more information on button labels.
9	1	**Backlight**	Adjusts the backlight. Range: Low, Medium1, Medium2, and High. Lower settings reduce current draw on the unit.
	2	**BT On/Off**	Turns the Bluetooth radio on or off. When using a USB connection to your radio control app you can turn the Bluetooth radio off and save about 50 milliamps of current draw.
	3	**Future Use**	
10	1	**Run CTR2-Flex**	Available on v2.xx firmware. Shuts down the **CTR2-Dial** MIDI controller firmware and restarts the unit with **CTR2-Flex** WiFi controller firmware.
	2	**Restore to Start Up**	This option allows you to reset your settings to what they were when you first booted **CTR2-Dial**, *if you didn't choose to reset your call and registration key in* ***Reset to Factory***. This is handy in case you want to "roll back" changes you made during the current session.
	3	**Demo Mode: Edit Call & Key** **Normal Mode: Reset to Factory**	**In Demo Mode:** This option allows you to enter your call and registration key without using a terminal program. To enter text, use the ring encoder on the M5Dial or Knob A to select a character and touch the display or press and turn Knob A to move to the next character. Press **OK** to accept. You can also connect a terminal program and use the terminal keyboard to enter your call and registration key. **In Normal Mode:** This option resets CTR2-Flex's configuration back to the original factory settings. **NOTE:** You will be given the option to reset your call sign and firmware registration key. **NOTE:** If you reset the configuration by mistake, and didn't choose to reset your call and registration key, execute the **Restore to Start Up** option to restore your settings before powering the unit down.

Label and Settings Maps

MIDI mode supports two maps for control settings. Select the map you want to use on page 2 of the **Settings** menu. These maps store control labels and MIDI control types for the dial controls. They do not change the MIDI command #s assigned to the controls in **MIDI** mode. You must *edit your apps' map* to change the *function* the app executes for MIDI command #'s that **MIDI** mode sends.

The name of each map is displayed in the caption of the **Home** page. You can edit this name to reflect which radio control app **CTR2-Dial** is configured to control. Map names are limited to 8 characters.

You can edit the labels and control types in each map to fit your needs. For instance, you can configure **Map 1** to contain the labels and control types for SmartSDR and **Map 2** for labels and control types for SDR-Control. Simply switch maps to match the app you're using.

HINT: I recommend using different color themes on each map so it's easy to determine which map you're using.

Editing Labels and Control Types

To edit labels and control types, choose from two control editors that allow you to edit the properties associated with **MIDI** mode's **Dial** and **Button** controls. You can also use a dumb terminal to edit this data.

The Edit Dial Settings editor on page 8 of the **Settings** menu allows you to edit the label and the MIDI control type assigned to each **Dial control.**

The Edit Btn Settings editor allows you to edit the label associated with each **Button** control.

For more information on how **MIDI** mode controls your radio control app, see How **MIDI** mode Works with Your Control App.

Dial Settings Editor



When you select the **Edit Dial Setting** option the **EDIT DIAL** menu opens. This menu is similar to the **Dial menu** in that it has three pages of dial controls to choose from. The selected dial control will be highlighted, but it's not used in this menu.

Turn the gray ring on the M5Dial (if ring navigation or fine-tune is enabled), or touch the left or right side of the bottom button (**< 1/3 >**) to select a menu page.

Touch the label of the **Dial control** you want to edit. The edit page will open. Touch the **EDIT DIAL** caption to cancel this mode and exit back to the **Settings** menu.

The MIDI control # for the selected dial control will be displayed in the caption of the edit page. MIDI control # is hardcoded and cannot be edited.



The edit cursor will highlight the character to be edited ("V" in this example). Turn **Knob A** to change the character. Touch **Next** to move the edit cursor to the next position, or touch another character in the label to move the edit cursor to that position. There are eight characters available for labels.

Touch **Ins** to insert a character at the cursor position and **Del** to delete the character at that position.

To change the MIDI control type associated with this control, touch **Type:** on the display. The MIDI control type will step to the next control type. Refer to the MIDI Control Types section for a description of each control type.

When you're done editing, touch **OK**. To exit without saving your changes, touch **Esc**.

Button Editor

When you touch the **Edit Button Labels** the **EDIT BTN** menu opens. This menu has up to 10 pages of buttons (depending on the **# Buttons** setting in the **Settings** menu) with six buttons on each page, similar to the **Buttons** menu. Turn the M5Dial's ring if ring navigation or fine-tune mode is enabled, or touch the left or right side of the bottom button (**< 1/7 >** in this example) to move to the next page. Touch the **EDIT BTN** caption to cancel this mode and exit back to the **Settings** menu.



Once you select a button to edit, the **Button Editor** opens. The MIDI control # is shown in the caption – it cannot be changed.

The **Button Editor** has the same features as the **Dial Editor** but it doesn't have a MIDI **Type** setting. This is because buttons always send MIDI button On/Off commands.



Editing With a Terminal

Onscreen editors are useful for small editing changes but if you have several controls to edit, it's easier to use a dumb terminal.

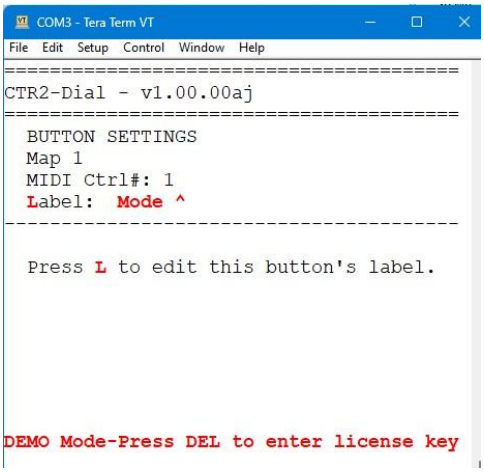
Start your terminal program and connect it to the virtual USB serial port assigned to **CTR2-Dial** by your operating system.

When the terminal first starts you will be presented with a blank screen because the terminal server is waiting for you to wake it up. This is done by pressing any key (usually Space).

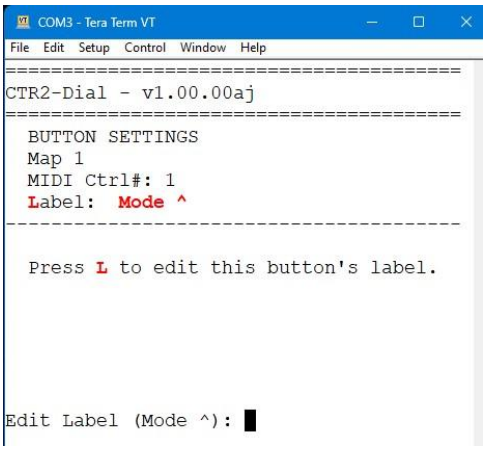
NOTE: Dial controls without labels will not show up on the **Dial control** menu unless a terminal is connected to **CTR2-Dial**. To add a label to a blank control, select it in the **Dial menu**.

The header of each page contains the firmware version #.

If you provided the M5Dial for your unit, the first time you connect, **CTR2-Dial** will be running in **Demo** mode and a note will be displayed at the bottom of the terminal page instructing you to press the **DEL** key to enter your call and registration key. If you don't have a key, you can ignore this message and remain in **Demo** mode. In this mode the program will shut down in 15 minutes and changes you make will not be saved. Other than that, the program is fully operational.

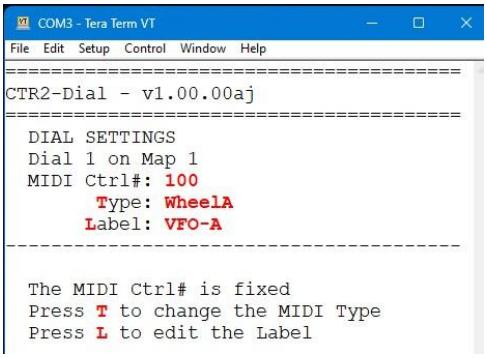


To edit a control, simply select it on the **CTR2** unit. The terminal page will update with that control's settings. In the screenshot at the right, **MIDI** mode is on page 1 of the **Buttons** menu. The first button on the selected page is always displayed first. To edit the label on this button, press the **L** key on the terminal. The **Edit Label:** line will appear with the current label in parenthesis. Enter the new label at the prompt.



Wheel and slider controls on the **Dial** pages include additional settings.

Dial controls are assigned to MIDI control #s 100 through 117. You cannot change these.



Press **T** to step through the MIDI control type assigned to the control or press **L** to edit the label.

Once you have **MIDI** mode's map configured the way you want, edit the map in your radio control app to match.

You can export your settings to your computer so you have a backup copy. This process will be described next. You can also import settings from other configurations. You can find configurations on the Lynovation web site on the CTR2 Configuration Files page.

NOTE: Backup files created with v1 firmware are not compatible with v2 or v3 firmware.

Backing Up and Restoring your Settings



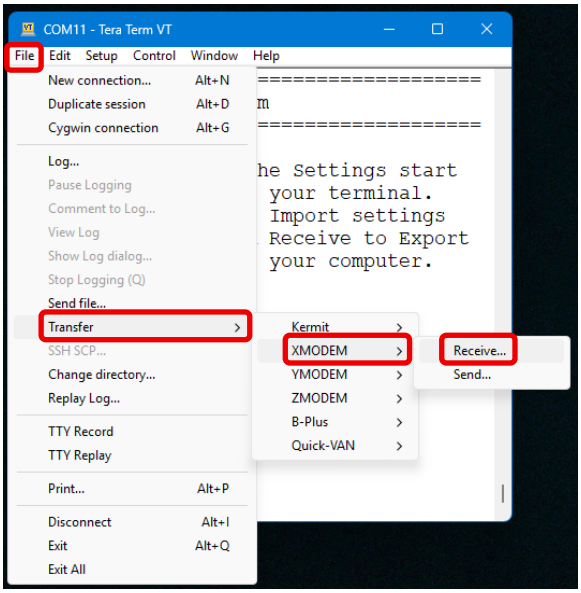
Once you have your **CTR2-Dial** setup the way you want it, go to the **Settings** page and **Export** your settings to back up the file on your computer.

CTR2-Dial uses the XModem file transfer protocol to transport settings to and from backup files on your computer. XModem is an older protocol and not many terminal programs support it anymore. Tera Term does and I'll use it in the document. Putty does not. To get XModem functionality with Putty you need to download and install ExtraPutty. This program is a branch off of Putty. You can download it from here.

Before you can use the **Import Settings** option you must export the settings from **CTR2-Dial** once you've made changes. If you want to just return to factory settings, select the **Reset to FACTORY** option in the **Settings** menu.

Export Settings

To export the current settings from **CTR2-Dial**, connect Tera Term to **CTR2-Dial** then open its XModem transfer utility. This can be found at *Files->Transfer->XMODEM->Receive…* option shown here.



When you select this option, Tera Term will ask you to enter the file name for the file you want to create. Navigate to the folder you want to save it in then give it a name. *I prefer to use the ".**CTR2**" extension but you can use any extension you want*.

NOTE: If you don't enter an extension, your file will be created without one.

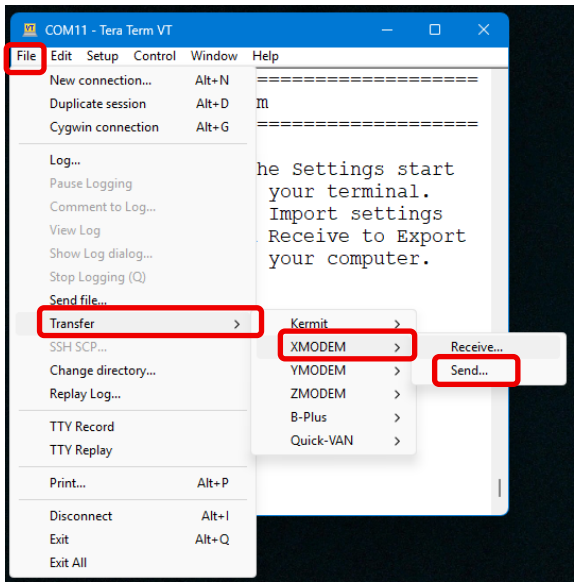
When you click OK, Tera Term will open the XModem transfer window and wait for the transfer to start. At this point, touch the **Export Settings** option in the **Settings** menu.

You can select whether to send just the basic configuration of you unit, or a full system backup that includes all of the radio and frequency information (including your WiFi credentials and radio address). If you plan on sharing your configuration with others, I recommend saving just the basic configuration.

The transfer should complete in a second or two and you should have a new file in your backup folder. You can view this file with a text editor. I don't recommend editing the values in this file because invalid values may cause problems with **CTR2-Dial's** boot process.

Import Settings

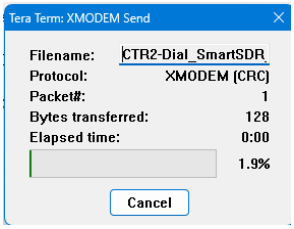
Now that you have a backup file of your settings (or have downloaded a configuration file from the Lynovation web site) you can import them using the **Import Settings** option.



To start an import, touch the **Import Setting** button in the **Settings** menu. Next, in Tera Term, navigate to the *File->Transfer->XModem* and select the *Send* option. Tera Term will ask you to select a file. Select one of the files you previously exported, or a file from the CTR2-Dial Configuration File zip file. Tera Term will then open the file transfer window and transfer the file.

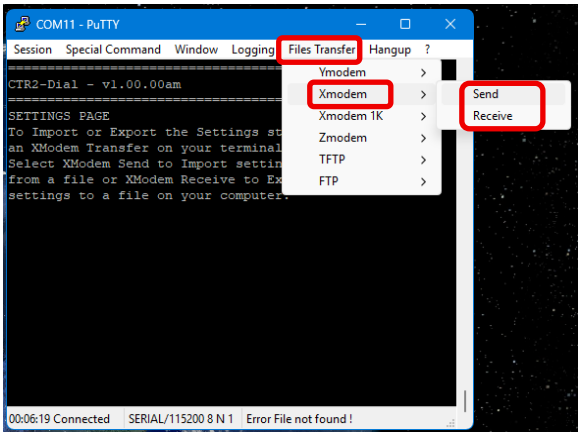
HINT: You can use the export and import settings functions to save and reload multiple versions of your settings. Perhaps you use **CTR2-Dial** on more than two apps and have each app configured differently. You can export the settings for each of your apps then import them back in when you want to change apps. This is also handy if you have more than one **CTR2** controller, or if you want to share your configuration with other users.

NOTE: If the file transfer stalls (as shown here), cancel the transfer in Tera Term and run it again. This seems to be a random bug in Tera Term as it doesn't happen all the time. The import function in **CTR2-Dial** will timeout after 30 seconds if the transfer doesn't complete.



Using ExtraPutty

If you use the XModem transfer option in ExtraPutty as shown here, use the *Xmodem* option, not the *Xmodem 1K* option.



Editing 3rd-Party App Maps

The following sections describe how to map several apps that you may use. It's not an inclusive list of all the apps that support MIDI control. These instructions are included in the configuration files available on the Lynovation web site under CTR2 Configuration Files.

Before editing the settings in **MIDI** mode, you may want to export the settings to your computer in case you need to restore them in the future.

Remote Ham Radio Maps

The current release of Remote Ham Radio is designed to use **CTR2-MIDI** and does not include mapping for **CTR2-Dial**. The instructions below allow you to change the map in **CTR2-Dial** to fit the current MIDI mapping in RHR.

In the RHR console, open the **Tools** menu and select **CTR2-MIDI**.

Connect a terminal to **CTR2-Dial** running in **MIDI** mode and change the labels on the following controls:

Keying Input

Navigate to page 5 in the **Settings** menu and change the **Pdl->MIDI:20/21** to use your paddles to control the keyer in RHR. Change **Pdl->MIDI:30/31** to use the paddle input jack to control the straight key and PTT functions instead.

Dial Controls

The **Dial** labels should be edited in a terminal or with the **Edit Dial Setting** option on page 8 in the **Settings** menu to match the function assigned in RHR.

DIAL ACTIONS		
Dial #	**MIDI Control #**	**Action Taken**
1	100	Change VFO
2	101	Slice Volume
3	102	NR Level
4	103	NB Level
5	104	VOX Level
7	106	Keyer Speed

The other **Dial** controls are not currently used. To avoid confusion set their labels to a single space. This will hide them on the **Dial control** page (but not in the **Dial menu**) until you connect a terminal to **CTR2-Dial**.

Button Controls

The number of buttons available in **CTR2-Dial** has been greatly expanded over those available on the **CTR2-MIDI**. This means that there will be a lot of holes in the **Buttons** menu in **MIDI** mode when set to match the current mapping used in RHR for **CTR2-MIDI**.

BUTTON ACTIONS			
Button and MIDI Ctrl #	**Original *MIDI* Button**	**Action Taken**	**Dial Label**
1	BTN1	CW Mode	CW
11	BTN1 (long-press)	Toggle NR	NR
2	BTN2	SSB Mode	SSB
Button and MIDI Ctrl #	**Original *MIDI* Button**	**Action Taken**	**Dial Label**
12	BTN2 (long-press)	Toggle NB	NB
3	BTN3	FT8	FT8
13	BTN3 (long-press)	FT4	FT4
4	BTN4	Toggle PTT	PTT
14	BTN4 (long-press)	Toggle VOX	VOX
5	BTN5	Band Down	Band v
6	BTN6	Band Up	Band ^

All other button labels in **MIDI** mode can be changed to a single space.

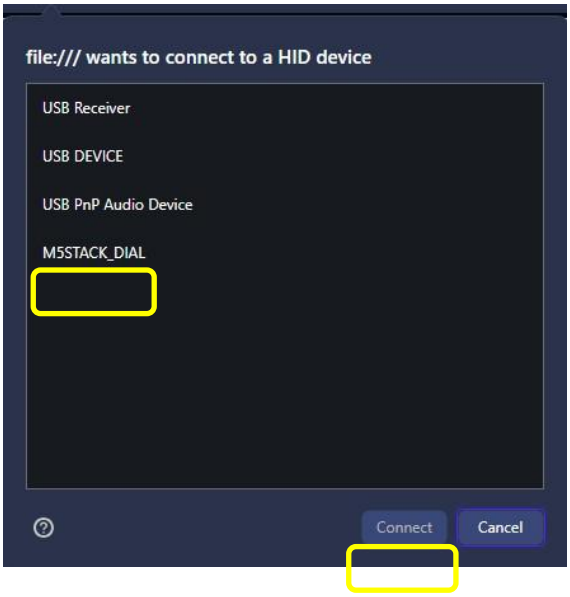
RemoteTx Mapping

Important: HID and RemoteTx support does not work in **Flex** mode.

To use **MIDI** mode with RemoteTx, click **VFO** in **RemoteTx's *Radio*** page, before you connect to the radio.



A list of USB devices on your computer will open. Select the **M5STACK_DIAL** device, then press **Connect**. The **VFO** button should turn red, indicating that the **CTR2-Dial's MIDI** mode is connected to this browser session.



To use **CTR2-Dial's MIDI** mode with **RemoteTx**, you'll want to edit the labels and knob control types to match the HID controls **RemoteTx** is programmed for. A spreadsheet showing the required mapping can be found at **CTR2 Configuration Files** on Lynovation.com. Download the zip file and navigate to the **RemoteTx** folder. This folder also contains a **MIDI** mode configuration file, *CTR2-Dial_Settings_for_RemoteTx.ctr2*, that you can import into your **CTR2** unit to change all of the settings for **RemoteTx**.

PTT Input

RemoteTx only supports PTT control. It does not support a CW keyer. Plug a straight key (to be used for PTT) or PTT switch into the 3.5mm paddle jack on your **CTR2** unit. Wire your switch to TIP or RING and SHIELD of a 3.5mm stereo plug.

NOTE: RemoteTx is looking for MIDI control 20 or 21 for PTT. To set your unit up for this, open the **Settings** menu and navigate to page 5. Touch the **Pdl->MIDI** button until it shows **Pdl->MIDI: 20/21**. If you've wired your switch to the TIP and SHIELD of the paddle plug, touch the **PTT->MIDI** button until it shows **PTT->MIDI: 20**. If you wired your switch to the RING and SHIELD of the paddle plug, select **PTT->MIDI: 21**.

iOS and MacOS App Maps

Maps for Marcus' apps are available from the **CTR2 Configuration Files** page on Lynovation.com.

To change the default map that comes with you iOS/MacOS app, first, make sure your app has permission to use your iCloud drive.

Load the app map you want to use into your iCloud folder. Next, open the **CTR2 Controller** object in the app's **Tools** menu then go to the **Edit Mapping** page. On this page, click or touch the **File** icon at the top of the page then select *Import Mapping from iCloud Drive*. This will open a list of files available on your iCloud drive. Select the appropriate map from the list.

<<< IMPORTANT >>>
Once you have loaded the map you must change at least one of the control assignments before the map will be saved to your app. To do this, select one of the controls, change it to something else, then change it back to its original setting. If you don't do this the map will revert back to the original map.

The default configuration for **MIDI** mode's **Map 1** is setup for SmartSDR for iOS/MacOS, *but it does not match the default map shipped with SmartSDR*. You will need edit this map manually or import the correct map from the Lynovation web site for your app. If you use other apps from Marcus (SDR-Control, FT-Control, TS-Control, or K4-Control) you'll also need to import the correct map to your app *and import the correct **CTR2-Dial** configuration file, or edit the labels in **CTR2-Dial** manually*. I have a video on YouTube explaining the mapping process.

Using Paddles with the App's Keyer

Marcus' iOS/MacOS apps include a keyer that you can control with the paddles connected to **CTR2-Dial**.

> **NOTE 1:** If you're using Bluetooth-LE MIDI you may notice a difference in how the paddles work with the app's keyer as opposed to a hardwired paddle/keyer. The latency in the Bluetooth-LE connection can cause up to 15 milliseconds of delay. This will throw your "fist" timing off, especially in Iambic B mode where an extra element may be added. It may take some practice to get use to the timing change. If this is a problem for you consider using USB MIDI instead.
>
> **NOTE 2**: Using Bluetooth headphones adds additional latency. You might consider using an adapter on you iOS device that supports a wired headphone along with an OTG connection and use USB MIDI to minimize this latency.

Follow these steps to configure the app and **MIDI** mode for paddle keying:

- In the app, map **Button 96** to **Trigger CW Left Paddle** and **Button 97** to **Trigger CW Right Panel**. You can swap this mapping if your paddles are wired backwards.
- Plug your paddles into the **Paddle In** jack on your **CTR2** unit.
- Set the radio's mode to CW
- In SmartSDR, press the **View** menu in the Panadapter display and select **CWX Panel**. You can adjust speed and other setting here.
- In SDR-Control, select the **CW Keyer** option in the **Tools** menu to configure the keyer. DO NOT enable the MIDI device in this panel, this is done in the **CTR2 Dial Controller Tool** panel.
- Pressing either paddle will now activate the keyer and key the radio.

Using a Straight Key or an External PTT Switch

Straight Key Wiring

If you want to use a straight key with **MIDI** mode, map **Button 98** to **Trigger CW Straight Key** in the app then wire your straight key to the TIP and SHIELD of a 3.5mm (1/8") stereo jack and insert it into the **Paddle In** jack on your **CTR2** unit. Do not use a mono jack as the shield will ground the RING lead on the **Paddle In** jack.

PTT Switch Wiring

If you want to use an external PTT switch with **MIDI** mode, map **Button 99** to **PTT Push** in the app and wire your PTT switch to the RING and SHIELD of a 3.5mm (1/8") stereo jack and insert it into the **Paddle In** jack on your **CTR2** unit.

NOTE: You can wire your straight key and external PTT switch to the same stereo plug.

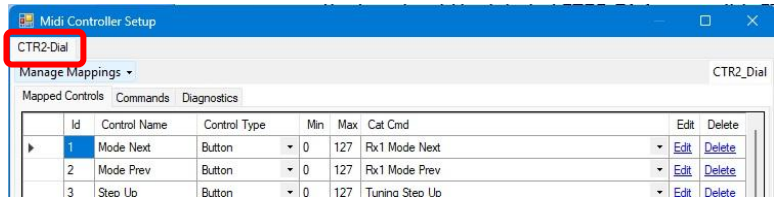
Select **Pdl In: 98/99** in page 5 of the **Settings** menu to tell **CTR2-Dial** to route the paddle jack inputs to MIDI control #s 98 and 99.

CAUTION: The 3.5mm jack(s) on CTR2 units are for paddle, key, and PTT inputs only. They are not designed for output. Do not connect these jacks to your radio as this may damage the unit.

Thetis Maps

Thetis is a little different than RHR and iOS/MacOS apps in that it uses **MIDI** mode's **WheelB** control instead of **WheelA** for frequency tuning. **Map 2** is pre-configured with **WheelB** for tuning. You can select **Ctrl Map: 2** on page 2 of the **Settings** menu.

With the **Setup -> Setup -> Serial/Network/Midi CAT** window open in Thetis, select the **MIDI** tab and click the **Configure MIDI** button. The program will find and initialize **CTR2-Dial** using USB.

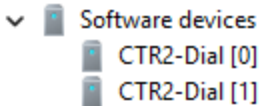


Windows doesn't support Bluetooth LE, so you must use USB MIDI with Thetis.

NOTE: If the program doesn't initialize **CTR2-Dial**, check to make sure you are using a USB-C data cable, not a USB-C charge cable.

It's a Software Device

If you can't get Thetis to recognize **CTR2-Dial**, verify that **CTR2-Dial** appears in the **Device Manager** under **Software devices**, and not under **Sound, Video, and game controllers**. If it appears there, right click on the entry and uninstall it. Cycle the power on you PC and try connecting **CTR2-Dial** again.



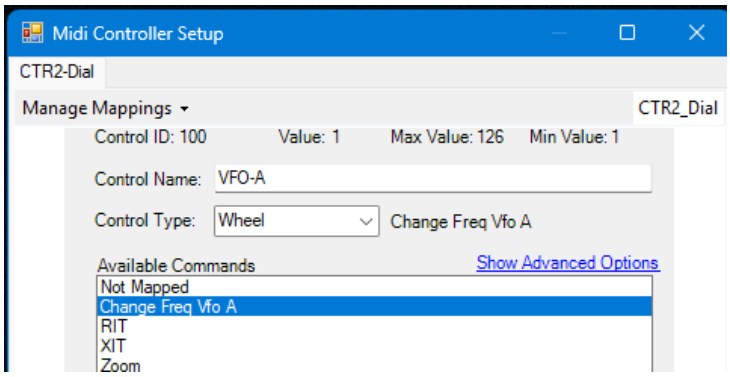
Mapping Controls

You can download a default Thetis map from the Lynovation web site. Once you have unzipped the Thetis file go to the **Midi Controller Setup** page in the app select **Manage Mappings -> Import Mappings** and select the Thetis map you unzipped.

To manually map your **CTR2-Dial** to Thetis, or change the default mapping, use the following process:

Touch a button or change a *dial* or *knob* setting and the window at the left will open.

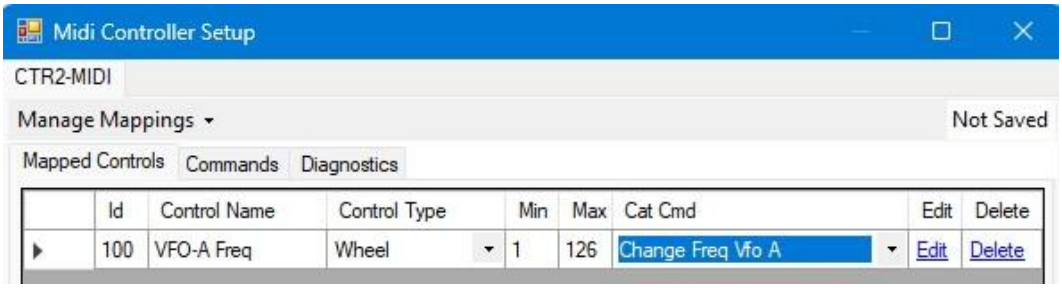
In this example, I changed the dial control when it was set to the first control (VFO-A, MIDI control 100).



NOTE: When mapping **dial controls,** you need to run the dial fully CCW until you get to 1 and then fully CW until you get to 127 to set the Min and Max range values.

Next, give the control a name. I'll call it **VFO-A Freq** and select **Change Freq VFO A** from the **Available Commands** list.

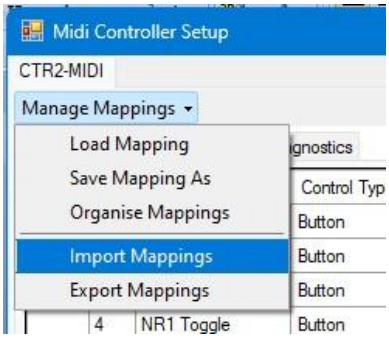
Click the **Done** and then the **Save** button to return to the **Manage Mappings** page.



Now follow the same procedure to the other *dials*, *knobs*, and *buttons* in **CTR2-Dial**.

NOTE: When using the Thetis **Wheel** control type you must set the encoder on **CTR2-Dial** to **WheelB**.

When you're finished mapping controls make sure to click the **Save** button in the **Midi Controller Setup** page and **Apply** before you leave the **Setup** page so these functions will be restored the next time you run Thetis.



Managing Thetis Maps

You can save or load your map setting from the Thetis database using the **Load Mapping** and **Save Mapping As** options on the **Manage Mappings** tab. To load a map from others, use the **Import Mappings** option. To save your map to share with others, use the **Export Mappings** option.

NOTE: You may need to open the **Configure MIDI** page in Thetis every time you start it in order for it to find **CTR2-Dial.**

Advanced Options

Operation with N1MM Logger+

You can use **MIDI** mode as an interface to use N1MM's CW keyer with SmartSDR or SDR-Control for iOS. To do this, follow the instructions on the N1MM Interfacing Basics webpage to build a key interface circuit. This will require a USB serial adapter with a keying interface circuit wired to its RTS output. Connect the output of the keying interface circuit to the TIP and SHIELD of **CTR2-Dial's** *Paddle input* jack. Next, map the *Left Paddle input* on **CTR2-Dial** to **Trigger CW Straight Key**. With this setup you can control your radio using the N1MM Logger+ and use keyboard keying in N1MM Logger+.

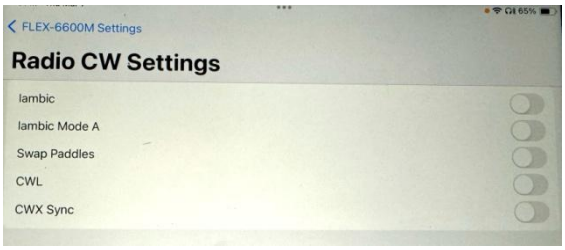
The biggest advantage of using a **CTR2** controller over using a mouse to control your radio is that commands from **CTR2** units go directly to your radio control app whereas your control app must be "in focus" to use a mouse. This is especially handy when running logging programs like N1MM Logger.

Unfortunately, this configuration doesn't allow you to use a set of paddles with the *MIDI* at the same time nor does it allow N1MM Logger+ to control your radio remotely.

If you're looking to have N1MM Logger control your radio remotely you might consider using **CTR2-Micro** to remotely control and key your radio with SmartSDR or SDR-Control providing the user interface. Instructions for this can be found in the CTR2-Micro Operation Manual under the **Advanced Options** section.

Troubleshooting

Issue	Solution
I can't connect the app to the **CTR2-Dial** using USB MIDI	1) Make sure you're in **MIDI** mode. 2) Make sure you are using a USB-C data cable. Many USB-C cables are power only. These will not work with USB MIDI. 3) If using a mobile device (iPhone, iPad, Android, etc) you must use an OTG adapter for your device. This adapter provides a USB connection for an external device. Newer iPhones and iPads with USB-C connectors do not require an OTG adapter.
I can't connect the app to the **CTR2-Dial** Bluetooth LE device	Make sure the Bluetooth radio is turned on and the app has permission to use Bluetooth. Follow the instructions in the Connecting CTR2-Dial to the App and Enable Permissions sections.
I have to connect **CTR2-Dial** every time I start the app.	**CTR2-Dial** will stay connected to the app on your iOS or Mac device with Bluetooth-LE as long as it remains powered up. If you power down the **CTR2** unit you'll need to open the **Tools -> CTR2 Dial Controller** window and click the **Find CTR2 Dial Bluetooth-LE Device** button then click **Enable** to reconnect it to the app. When connecting with USB MIDI it should say connected even through a power cycle. **NOTE:** You may need to open the **MIDI Configuration** window in Thetis every time you open it so it will find **CTR2-Dial**.
My Flex radio starts sending a string of Dits or Dahs when I select CW mode	This seems to be a bug SmartSDR v6.9.15. If you press the paddles when the app is not in CW mode but the CWX panel is open that paddle press is buffered in the app. When you change to CW mode from another mode, CWX triggers the last paddle press you made and keeps sending it until you press the paddle again, turn off CW mode, or close the CWX panel. This should be fixed in the latest update of SmartSDR.
CTR2-Dial connects to my device but does not control anything	1) Make sure you're in **MIDI** mode. 2) Verify that you have mapped each MIDI control to a function in your app.
Frequency tuning is not working	1) Make sure you have the correct map selected in the **Settings** page. 2) Use **WheelA** for most apps. Use **WheelB** for Thetis and some older apps. 3) Make sure you have the correct MIDI command mapped to the frequency control in your app.
How can I tell when I'm at the center (0 Hz) when controlling RIT or XIT?	Use the **SliderB** control for **RIT** and **XIT** controls. The display will show a black bar indicating the offset and **CTR2-Dial** will beep and pauses tuning for about ½ second when the control reaches its center position (64 counts). **SliderA** does not beep at center or show the +/- offset.

Paddles don't key the radio	1) Verify the radio is in CW mode 2) Verify the keyer is in **Breakin** mode and **Sidetone** in **On** in the P/CW panel 3) Verify **Pdl->** in the **Settings** menu is set the same MIDI control #s that you have mapped in the app for left and right paddle control. 4) Open the CWX Panel in the app's **View** menu 5) If you're using a Flex radio, it might be in CW Zombie mode.
Paddles are reversed	Remap the MIDI control #s to swap Left and Right paddle assignments
No sidetone in SmartSDR when keying	Open the left pop-out window in the Panadapter display on the app and click the **Audio** menu. Set the **Local Audio Monitor** slider to 0.
Slow response or timing issues with keyer	Connecting multiple Bluetooth devices to your iOS device (i.e. CTR2-Dial and a BT headset) may affect the app's keyer response to paddle input. To fix this problem, click the **Flex 6xxx** button on the bottom of the display, select the **CW** item to open the Radio CW Settings window and disable **CWX Sync**. You may also consider using USB MIDI with an OTG adapter on your mobile device. 
Operating the paddles on a single knob unit displays **Knob B's** control and the keyer does not work.	Port B on the M5Dial (on the old **CTR2-Dial** hardware) supports either paddle input or the second external encoder (**Knob B**). The **# Knobs:** setting in the **Settings** menu determines which device is connected to **Port B**. **NOTE:** Starting with v 1.01.00 a new **None** option has been added to the **# Knobs:** settings. This allows you to turn off all external devices connected to **Port B**. Options are **None, One** (for a single encoder), **Two** (for two encoders), or **Knobs: Swap A/B**. The paddle interface works in all modes.
Turning **Knob B** causes the **Transmit** indication	See the explanation in the previous topic. Change the **# Knobs:** setting in **Settings** from **One** to **Two**.
The knobs (encoders) don't work.	**# Knobs** in the **Setting** menu is set to **None**. Open the **Settings** menu and change the **# Knobs:** setting to match your unit's configuration. You can also reverse the location of the **A** and **B** encoders on dual-encoder units using **Swap A/B**.
Can I change **Knob A** and **Knob B** positions?	Yes, on the dual-encoder unit you can swap the **A** and **B** encoder positions by selecting **Knobs: Swap A/B** in the **Settings** menu.
I can't get the M5Dial into programming mode	When using ESPConnect, the first connection attempt will always fail**.** The first attempt switches the unit from **Tiny USB** mode to **Serial/JTAG**, but the app doesn't tell you this. Click **Connect** again and select the **Serial/JTAG** port. On some units, you may need to do this three times. **Do not cycle power between connection attempts**.
How do I know what app my CTR2-Dial is configured for?	A new feature in v2.05.00 allows you to enter a name for each map. This name is displayed in the caption of the **Home** page. Set the name to the name of the app this map is configured for (i.e. SmartSDR, SDR-Control, Thetis, etc.)
The Key and PTT jack does not control my radio	The 3.5mm jack(s) on CTR2 units are designed for input only. Connecting these jacks directly to your radio may damage your CTR2 unit. To use a straight key, external keyer, or external PTT switch to control your radio, refer to this section.

Appendix A: Connecting MIDI Mode to Your App

This section describes how to connect **CTR2-Dial** to various apps. Once you are connected to the app see the MIDI Mode's Controls section to understand how **CTR2-Dial** controls work with the app.

Remote Ham Radio

To connect **CTR2-Dial** to Remote Ham Radio simply plug your **CTR2** unit, running **CTR2-Dial**, into a USB port on your computer then select the **CTR2-MIDI** option in the RHR console's **Tool** menu (hopefully a **CTR2-Dial** option will be added in the future). The **CTR2-MIDI** option is pre-configured **CTR2-MIDI** so you'll need to change the configuration of CTR2-Dial to match RHR. You can see how the *MIDI*'s controls are mapped to RHR in the Remote Ham Radio Configuration section.

RemoteTx

RemoteTx is a browser based remote control system. Instead of connecting to the browser using MIDI commands, **CTR2-Dial** connects to **RemoteTx** as an HID (Human Interface Device). This eliminates most of the problems users experience with MIDI control in browser, especially when refreshing a page.

NOTE: RemoteTx is a subscription service and requires a Chrome, Edge, or Opera based browser.



To connect the *MIDI* to RemoteTx, plug your **CTR2** unit running **CTR2-Dial** into a USB port on your computer and start the **RemoteTx** web page. Select the *Radio* button at the top of the page and click the **VFO** button. Next select the **M5STACK_DIAL** device from the dropdown list.

For information about setting your **CTR2** unit up to work with **RemoteTx**, see the RemoteTx Mapping section.

AetherSDR, RimuSDR, and SDRoxide

Plug **CTR2-Dial** into a USB port on your computer. The app will automatically detect **CTR2-Dial** once you have loaded the settings file for the app from my CTR2-Dial Configuration Files page.

NOTE: There is a known bug in Windows where **CTR2-Dial** will not be enumerated properly if it is plugged in and powered up before you boot Windows. If your app doesn't find **CTR2-Dial** automatically, simply cycle the power on **CTR2-Dial** after you have started the app.

Marcus' Apps for iOS or MacOS

Enable Permissions

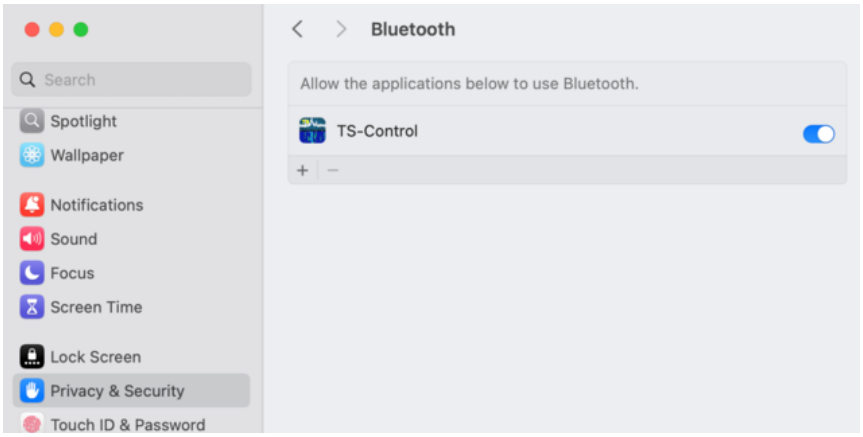
If you plan on using Bluetooth with Marcus' apps on your **iOS** device, open the app's **Settings** window and allow Marcus' apps access Bluetooth (not all devices have this menu).





You can also allow the app to use your iCloud Drive to save maps in this window.

The app on **MacOS** will generally ask you if you want to enable Bluetooth the first time you start it. If you're already running SmartSDR, navigate to **Apple -> System Settings -> Privacy & Security -> Bluetooth.** This screenshot shows the *TS-Control* app has permission to use Bluetooth.



Select the CTR2 Controller Device

In Marcus' apps, select the **CTR2 Dial Controller** device in the **Tools** menu. The **Tools** menu will look different in each app so just look for the **CTR2 Dial Controller**.

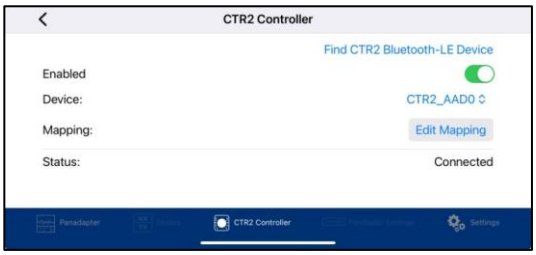
Here's an iOS and MacOS example of the **Tools -> Controller** menu.





CTR2 Dial Controller Screen

Once you select **CTR2 Dial Controller** from the **Tools** menu a screen like this will appear. It may look different depending on the Apple device you're using but it has basically the same information.



USB Wired Connection

To use your **CTR2** unit running **CTR2-Dial** with a wired USB connection on Mac's and newer iOS devices, connect your **CTR2** unit to your device using a USB data cable, select **STAMP_S3** from the **Device** menu, and click the **Enabled** button. The **Status** should change to **Connected**. Press the **Edit Mapping** button and press a button or turn the encoder to verify the app is receiving MIDI commands.



NOTE: To use a wired USB connection with an older iOS device (with a Lightning connector) you'll need to purchase a Lightning OTG (*On The Go*) adapter such as the one shown here. These are also referred to as "Camera Adapters" on Amazon. The adapter I use has two USB-A connectors on it. It also has a Lightning port so you can connect a wall charger or battery to power your phone and **CTR2** unit.

Bluetooth-LE Connection

To use Bluetooth-LE MIDI, make sure the Bluetooth radio is on (it is controlled in the **Settings** menu) then click the **Find CTR2 Bluetooth-LE Device** link to initiate a search for your **CTR2** unit running **CTR2-Dial**. The search will fail the first time you try to access a new device. If you get a failure notice, close the failure popup notification, **wait 10 seconds**, then click the **Find** link again. Once it registers your **CTR2** unit (your device's name is **CTR2_xxxx** with xxxx being the last four digits of the M5Dial's MAC address) click the **Enabled** button to start the Bluetooth connection. You don't need to select the name on the **Device** list unless you have two or more units running **CTR2-Dial** available.

NOTE: You can only have one **CTR2** unit connected via Bluetooth to the app at one time. You can use a second **CTR2** unit connected as a USB device. To do this, connect the Bluetooth **CTR2** unit using the **CTR2 Controller** device in the app's **Tools** menu and then connect the second **CTR2** unit using USB to the **CTR2 Dial Controller** device in the **Tools** menu.

If you can't get the app to connect to your **CTR2** unit, you probably haven't allowed the app to use Bluetooth (see Enable Permissions above). If you still can't get it to connect, download **MIDI-Wrench** or **midimittr** for iOS or **Conji** for the Mac from the App store. They are free apps

used to troubleshoot BLE MIDI issues. Connect your **CTR2-Dial** unit to one of these apps first and then try to connect again in the radio control app.

MacOS Bluetooth Connection Problems

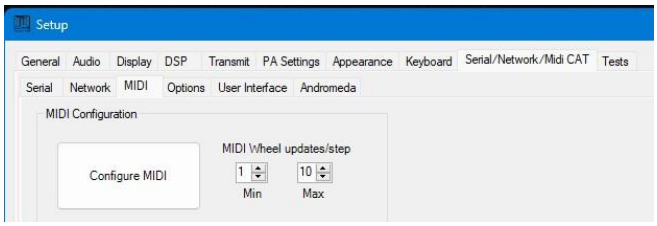
Follow these steps to connect **CTR2-Dial** to your Mac using Bluetooth:

1. Connect your **CTR2** unit running **CTR2-Dial** firmware to a USB port on your Mac.
2. In the **CTR Dial Controller** tool screen, check the **Enabled** button then click **Find CTR2 Bluetooth-LE Device** at the top of the screen.
3. The Mac may report that it can't find a Bluetooth-LE device. Wait 10 seconds the click **Find CTR2 Bluetooth-LE Device** again.
4. The Mac should report that it has found a Bluetooth device named **CTR2_xxxx** where xxxx is the address of your **CTR2** unit.
5. Select **Stamp_S3** on the **Device** list to use USB MIDI while connected to the Mac.
6. Select **CTR2_xxxx** on the **Device** list to use Bluetooth MIDI.
7. You may need to change the state of the **Enabled** checkbox to get your **CTR2** device to connect.
8. You can now unplug your **CTR2** unit from the Mac and use it remotely with Bluetooth.

Windows Applications

Thetis

Windows only supports USB MIDI connections. When you connect **CTR2-Dial** to your Windows computer's USB port it will automatically register as a MIDI device and be assigned a virtual COM port. Windows does not support Bluetooth-LE MIDI (at least not very well).



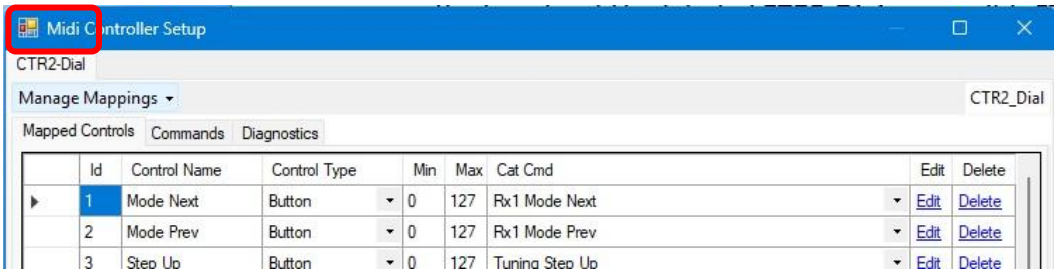
NOTE: USB MIDI requires a USB-C data cable. USB-C power cables, provided by many products, will not work!

Most Windows apps will need to be configured (i.e. mapped). **Thetis** is used as an example here but connecting to and mapping controls in other apps should be similar.

Additional information on mapping MIDI controls in Thetis can be found here.

Start by selecting the **Settings** menu on the main page in Thetis then select the **Serial/Network/MIDI CAT** tab. Click the **MIDI** tab as shown above.

Next, click the **Configure MIDI** button to open the **Midi Controller Setup** page. The program should go through an initialization sequence and end up on this page if it finds **CTR2-Dial** on the USB port. The tab at the top should be labeled **CTR2-Dial** or possibly **STAMP_S3**. If the initialization fails, double-check that you are using a USB-C data cable, not a charge cable and try again.

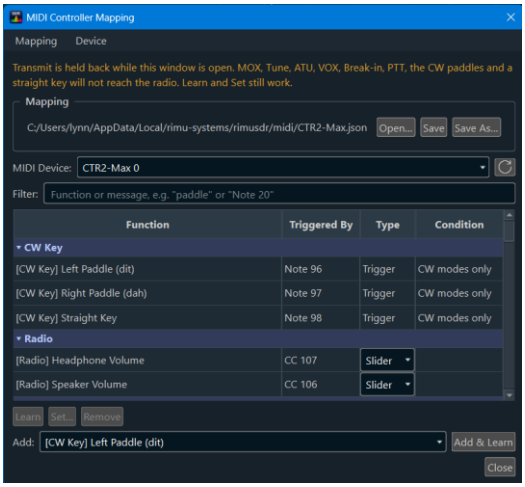


RimuSDR Maps

RimuSDR is a new Flex radio control app designed for Linux. It also has limited functionality for Windows PCs.

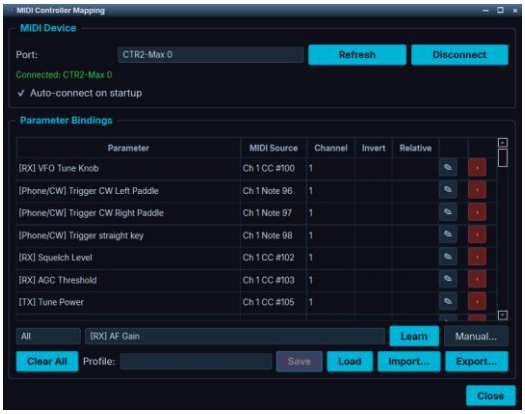
The CTR2-Dial Config Files page contains a **RimuSDR** file set. Included is a pre-defined .JSON file that you can import directly into **RimuSDR** using the **Settings -> MIDI Controller…** menu option. Click the **Open…** button to load the .JSON file.

A **CTR2-Dial_RimuSDR_MIDI_Map_v1.xx.ctr2** file is also available that you can import directly into **CTR2-Dial** using the **Import Settings** option in the **Settings** menu.



AetherSDR Maps

AetherSDR is another newcomer to the radio control scene. It supports several radios including Flex and Hermes Light. native Windows, Apple, and Linux builds.



To access the MIDI map in **AetherSDR**, select **Settings -> Controller -> MIDI Mapping…**

CTR2-Dial should be automatically detected and connected when you start the program. If it's not, click the **Refresh** button on this page and select it from the list.

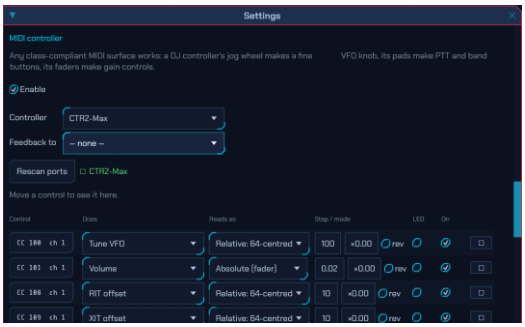
To assign a MIDI control to one of the functions in AetherSDR, simply select the function from the dropdown list then click the **Learn** button. Next, execute the knob or switch on **Max** that you want to assign to that function. The function and MIDI assignment will be added to the list of parameter bindings.

You can **Load**, **Import**, and **Export** MIDI configurations.

AetherSDR MIDI setting files are [.XLM] files and they are stored in the C:\Users\{user name}\AppData\Local\AetherSDR\midi folder in Windows. Consult the app's documentation for file locations for Apple and Linux distributions.

SDRoxide Maps

SDRoxide is another new radio control app that supports multiple radios and MIDI (and thereby **CTR2-Dial' MIDI** mode).

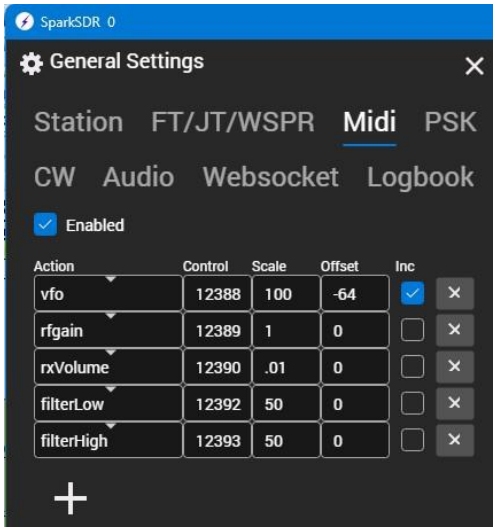


To enable MIDI control, select **SYS->SETTINGS->Controls** then scroll down to the **MIDI Controls** section.

The app is currently under active development and doesn't yet support loading or saving MIDI configurations. You'll need to manually enter the configuration you want to use with **CTR2-Dial's MIDI** mode.

I have a spreadsheet and a **CTR2-Dial** configuration file in the **SDRoxide** folder in CTR2-Dial Config Files with my suggested mapping.

SparkSDR



SparkSDR (https://www.sparksdr.com/) has limited support for MIDI control. It doesn't support buttons, only the *dial* and *knob* controls. To map *CTR2-Dial* knob functions to this program, first plug your **CTR2** unit into a USB port on your computer and open SparkSDR. Once you have the program running, click on the **General Settings** menu and select **Midi**. You should see **CTR2-Dial 0** as a MIDI controller and turning the encoder should display MIDI messages from the controller. To map these messages to a control in the app simply press the **+** icon and enter the **Control** number shown in the **Last midi message:** window in the **Control** column. Then select an **Action** and set the **Scale** and **Offset** required for that control. You may need to play with these values to get the control action you want. Check the **Inc** box if you want the value from CTR2-Dial to be added to the current setting of the control. This is only used with the **vfo** control. This screenshot shows the settings I use.

Flex Radio CW Zombie Mode

If you plan on using your **CTR2** unit running **CTR2-Dial** firmware with a Flex radio using remote CW keying, there is an odd problem in Flex firmware where the radio can go into **CW zombie mode**. This happens occasionally when connecting and disconnecting multiple clients to the radio that send remote keying commands (at least I think that's what causes it).

In **zombie mode** the radio looks like it is transmitting CW, the light on the front panel turns red, the TX icon turns red, the MOX button turns blue *but **no RF carrier is generated** or displayed on the panadapter.* The only way I have found to get the radio out of zombie mode is to disconnect all clients and power cycle the radio.

Appendix B: Installing or Updating CTR2-Dial Firmware

CTR2-Dial firmware is pre-installed on assembled **CTR2** units supplied with the M5Dial controller.

CTR2-Dial firmware is distributed as a single BIN file. This simplifies the installation process and reduces the possibilities of entering the wrong offset address for individual BIN files. The address of the single BIN file always starts at **0x0**. Instructions for switching between the two firmwares can be found here.

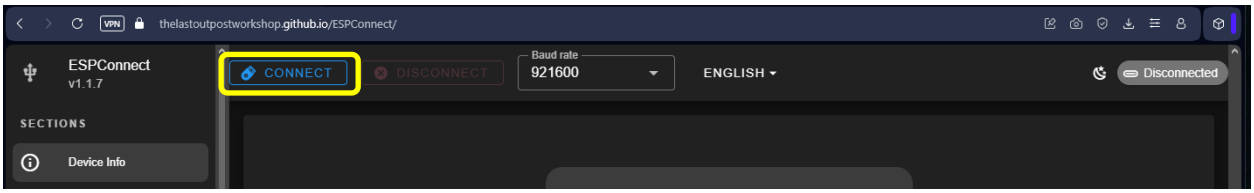
Before you begin, download the latest **CTR2-Dial** firmware from my web site. Unzip the firmware distribution zip file into a folder.

Installing Firmware using ESPConnect (New Method)

By far, the easiest, and recommended method to install or update firmware on an ESP32 process is with ESPConnect, an open-source ESP32 management project.

ESPConnect is a browser-based tool that must be opened on a Chromium-based browser that supports Web Serial, such as Chrome, Edge, Brave, or Opera. It will run on a Windows PC or an Apple Mac. Unfortunately, Linux doesn't support Web Serial in any browser.

To start, open **ESPConnect** here: https://thelastoutpostworkshop.github.io/ESPConnect/



Next, plug your **CTR2** unit into a USB port on your computer.

NOTE: Do not connect it to an unpowered USB hub.

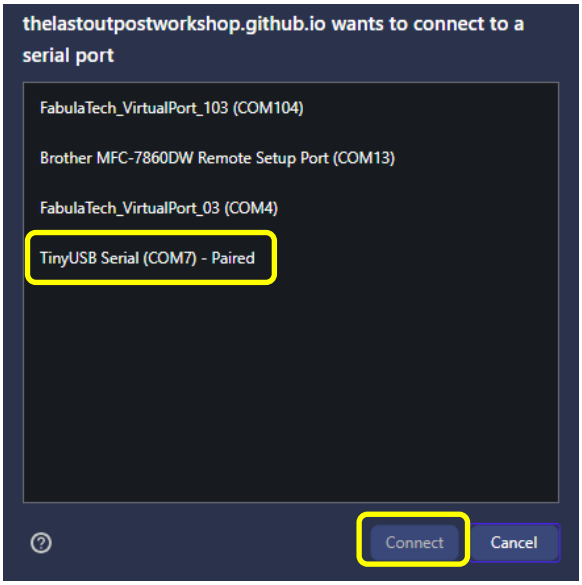
Click the **Connect** button.

A device list will pop up showing the available USB devices on your computer.

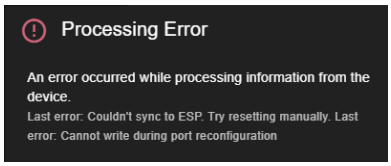
On a Windows PCs, all **CTR2** units will be shown as a **TinyUSB Serial** device, as shown here.

On Macs, **CTR2** units based on the M5Dial will be listed as an **M5STACK_DIAL** device.

Select the **CTR2** device and click the **Connect** button.



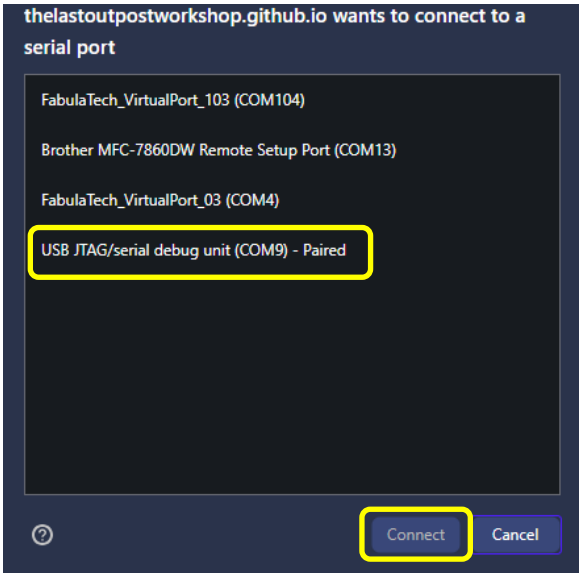
A popup warning will appear telling you that an error occurred. Some errors may tell you to press the BOOT button on the processor to put it into bootloader mode. You do not need to do this.



This is the normal response when trying to connect to a **Tiny USB serial** device.

Do not cycle the power on CTR2. Click the **Connect** button on the home page again.

This time, the **TinyUSB serial** (or **M5STACK_DIAL** on Macs) will not be shown on the list. Instead, a new device, **USB JTAG/serial debug unit** will be shown (on both PCs and the Mac).



This is the bootloader port and the unit is now ready to program.

Select the **USB JTAG/serial debug unit** device then click **Connect**.

NOTE: Apparently, not all ESP32-S3 processors will enable the **USB JTAG** port automatically. If your's doesn't, you'll need to open the enclosure an press the **Programming** button on the back of the M5Dial.

Once you're connected to your **CTR2** unit, the left menu items on the page will be enabled.

<<< WARNING >>>
ESPConnect is a powerful device editor. Many of the functions can cause problems with **CTR2** firmware if you change them. If you don't know what a functions does, DON'T CHANGE IT!

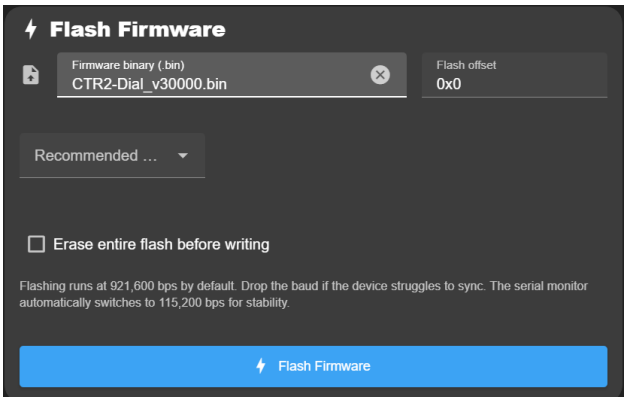
Click on the **Flash Tools** menu item and scroll down to the **Flash Firmware** section.

Click the **Firmware binary (.bin)** text box.



A file navigation screen will appear. Navigate to where you unzipped the firmware zip file from the firmware update page and click on the **CTR2-Dial_v3xxxx.bin** file.

Your display should now look like this:



Leave the **Flash offset** set to **0x0** and uncheck the **Erase entire flash before writing** checkbox.

Click the **FLASH FIRMWARE** button to start the flash process.

Once the process completes, cycle the power on your **CTR2** unit. The version # will be displayed when the unit boots. The version # should match the version # from the firmware zip file.

This completes the firmware update process.

Re-entering you Call Sign and Registration key

If you clicked the **Erase entire flash before writing** button, you'll erase your call and registration key and your unit will start in Demo mode. You'll need to enter your call sign and registration key before configuring your unit. Your call and registration key are written on the label on the bottom of the unit. It's also included on the original confirmation email I sent when you ordered your unit. You can contact me if you can't find it.

There are two ways to enter your registration credentials.

1. Connect your unit to a terminal program such as Tera Term or Putty (see Appendix B or C, or to the terminal in your Mac, Appendix D). Once connected, press any key to start the terminal server on the unit. Next, press the **Del** or **Backspace** key on the keyboard. Enter the call sign you registered and the registration key you received from me. *The registration key is 8 hexadecimal digits (0 to 9 and A to F).*
2. Use the on-screen editor to enter your registration credentials. Select **Enter Call & Key** on the last page in the **Settings** menu. Turn **Knob A** to change the letter and touch the screen (or press and **Next** button) to advance to the next letter position. Press the **OK** button to accept. The input sequence starts with your call and advances to your registration key once your call has been entered.

Once registered, your call sign will appear on the splash screen at boot up, the program won't shut down after 15 minutes, and you'll be able to save changes in the maps and import or export backup files. Your call will can also be automatically inserted into a CW macro using the **^** prosign.

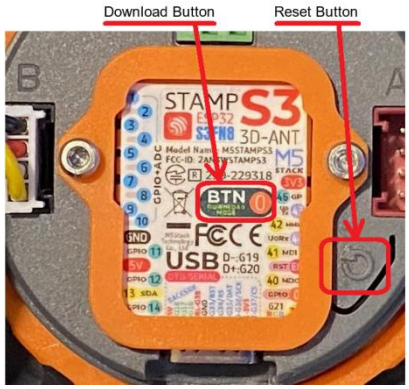
Selling your CTR2 Controller

Your registration key is based on your call sign, so it is the same for any **CTR2** controller you own. If you sell your controller, have the new owner contact me for a registration key based on their call.

Installing Firmware using EspressIF Flash Download Tool (Old Method)

The EspressIF Flash Download Tool is the original flash tool provided by the makers of ESP32 micro controllers. It's geared for developers and many find it difficult to use. I recommend using **ESPConnect** for most users.

This section will describe the process of using this tool to update your M5Dial. I highly recommend using **ESPConnect**, described above, instead.



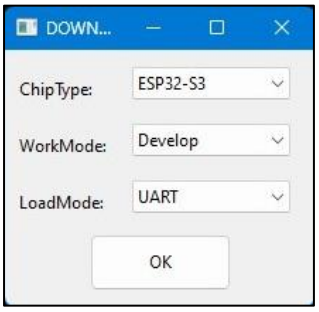
You must force the M5Dial into programming mode before you can flash firmware to it. To do this, follow this procedure

1) Open the enclosure and locate the back of the M5Dail
    a. On 3D printed enclosures remove the four screws holding the base to the shell with a 2mm Allen wrench
    b. On the New Age enclosure remove the four rubber feet on the bottom by pulling them off then remove the four Phillips screws under the feet
2) Press and hold the **DOWNLOAD (BTN)** button on the M5Dial then apply power to **CTR2-Dial**. The display will be blank when the unit boots into programming mode. If the unit is already powered up, press and hold the **DOWNLOAD** button then press and release the **RESET** button. You should hear a beep from your computer as it registers the new USB COM port and the display will be blank.
   NOTE: If you have problems getting the **DOWNLOAD** button to work its lever may have slipped off the button on the board. Remove the label and flick the lever back onto the button. Thanks Joe, KO8V for the tip!
3) You can now use the procedure below with EspressIF Flash Download tool (on Windows) or run the script (on Linux and Mac) with the new COM port to flash the new firmware to the M5Dial.
4) Once the download completes, cycle the power on the unit to start the new firmware.

Now that you have the M5Dial in programming mode, follow these steps to install or update to the latest **CTR2-Dial** firmware:

1. Download and unzip the latest **CTR2-Dial** firmware from **my web site**. Unzip that file into a different folder than where you store other Lynovation firmware update files.

2. Download and open the **EspressIF Flash Downloader Tool**. When it starts, select the **ESP32-S3 Chip Type**. Leave **WorkMode** set to *Develop* and **LoadMode** set to *UART.*

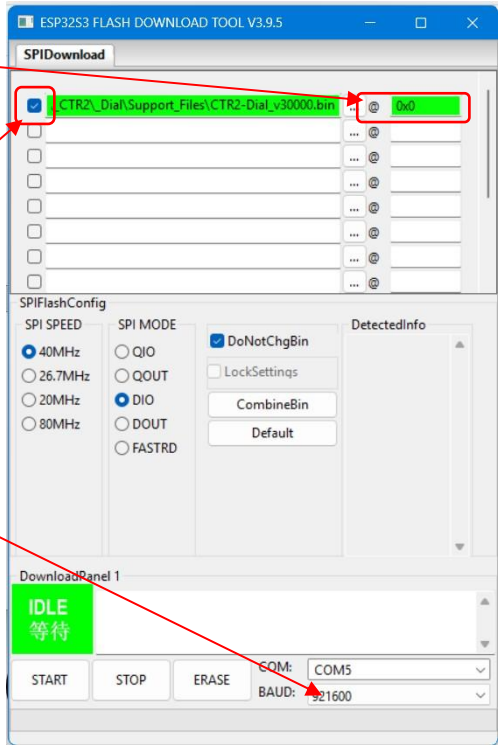


3. Map the **CTR2-Dial.bin** file that you unzipped from the **CTR2-Dial_v3.xx.xx** firmware distribution file into the downloader tool and set the offset address to **0x0**.

4. Select the checkbox on the left of the **CTR2-Dial_vxxxx.bin** filename as shown.

5. Set the **COM:** port to the port assigned to **CTR2-Dial** and set the **Baud:** to 921600.

   NOTE: You must use a USB-C data cable. USB-C charge-only cables (supplied with may devices) will not work.



6. On new installs, click the **ERASE** button to clear the factory demo from the M5Dial's memory.

   NOTE: If you erase the memory after running the **CTR2-Dial** firmware you will need to re-enter your call sign and registration key, re-select the number of knobs on your unit, and re-enter your WiFi and radio settings the next time you start **CTR2-Dial**. If you previously exported your settings, you can restore them using the Import Settings option in the **Settings** menu.

7. Click the **START** button to download the firmware.

8. Once the download is complete, cycle the power on the unit to start the new CTR2-Dial firmware.

   NOTE: The ESP32-S3 processor will revert back to its operating COM port after the reboot.

Installing using Linux or Mac

Mac users should use the new method using ESPConnect, described above. **ESPConnect** doesn't run on Linux, so Linux users have no other option other than to follow the procedure below.

A script file is supplied in the firmware update zip file. This script file can be used in a Linux or Mac environment if you don't have access to a Windows computer.

Instructions for using this script file are include in the CTR2-Micro Operation Manual in **Appendix B**.

The firmware that allows USB MIDI control changes the way the virtual COM port works on the ESP32-S3. One COM port is used in the normal operating mode and another COM port is used for flashing the firmware. In order to flash new firmware to the unit you must force the ESP32-S3 to switch from the normal operating mode to programming mode.

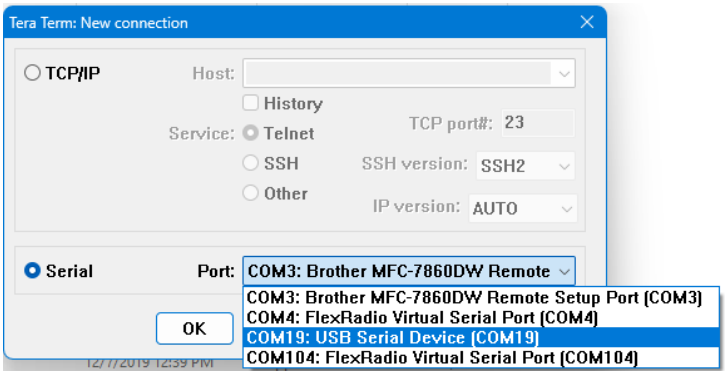
To use the script file:

1) Force the M5Dial into programming mode as described above.
2) Edit the COM port in the script to the programming port. This port will be different than the operating COM port.
3) Edit the path to the .BIN file in the script.
4) Run the script.

Appendix C: Configuring Tera Term

On Windows, Tera Term is the simplest terminal program to get running for a serial connection.

If you search for Tera Term you find a lot of garbage with malware attached to it. I've downloaded a clean copy of Tera Term v4.106 and posted it in the **CTR2 Group IO files section**. You can download it here. As far as I know, Tera Term is only available for Windows.



When you first open Tera Term you'll be presented with the **Tera Term New connection** window. Simply select the **Serial** radio button, select the COM port Window's assigned to your Micro when you plugged it in, and click the **OK** button.

Since you are connecting to a USB serial port there is no need to set the baud rate. It will run at USB speed regardless of the baud setting.

That's it! Tera Term should now connect to **CTR2-Dial**. Once connected, press any key to start **CTR2-Dial's** terminal server.

You can change the terminal size in the **Setup** menu. Select **Terminal…** Set the **Terminal Size** to *41 x 20.* **CTR2-Dial's** terminal interface was designed for this size.

While in the **Terminal…** settings verify the **New-line** options are set to *CR* for both **Transmit** and **Receive** and the **Terminal ID** is set to *VT100*.

You'll probably want to change the font size and colors. These are also changed in Tera Term's **Setup** menu. Select **Display** to change the font and background colors to your liking. Select **Font** to change the font and font size. I like *Courier New*, *Regular*, and *14-point size*. Your preferences may differ.

Once you have the program configured the way you like, select the **Setup->Save Setup…** menu and save your configuration. If you use the default file name, TERATERM.INI the program will automatically start a Telnet session using the COM port you selected above when it opens. This provides one-click access to your **CTR2-Dial** firmware.

Appendix D: Configuring Putty

Putty is a terminal program that can be configured for a variety of needs. **CTR2** controllers based on the M5Dial only supports serial connections. This section describes how to configure the program to interface with **CTR2-Dial**.

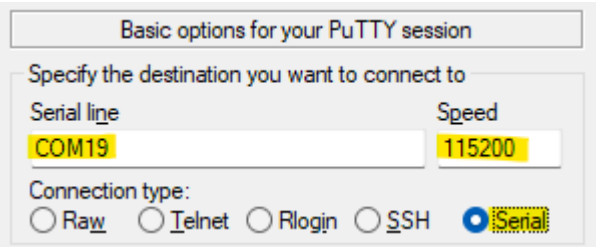
NOTE: Putty does not have XModem transfer capability. If you want to export and import backup files for **CTR2-Dial's** settings, consider using Tera Term or install ExtraPutty.

Download Putty for Windows from https://www.putty.org/. It's also available for Linux at https://www.ssh.com/academy/ssh/putty/linux and for Mac at https://www.ssh.com/academy/ssh/putty/mac.

You'll need to connect to **CTR2-Dial** using its USB serial port in order to configure it. Make sure to use a USB data cable, not a "charge-only" supplied with many USB-C devices.

Serial Session

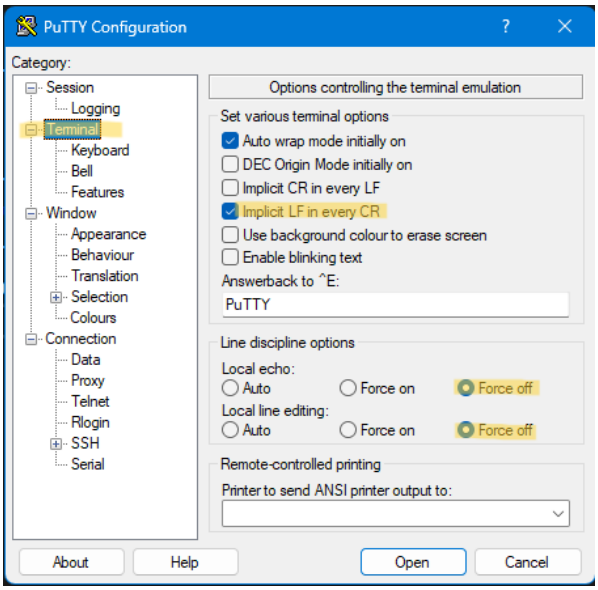
Select **Serial** then set the **Serial Line** to the COM port you found in the Device Manager and set **Speed** (Baud Rate) to 115200.



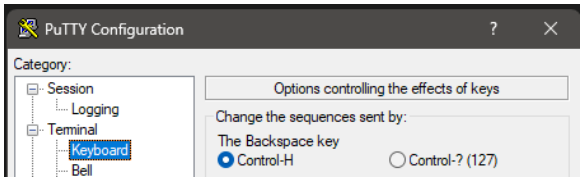
NOTE: Since this is a USB serial port the **Speed** (baud rate) doesn't matter. Data will be sent at USB speeds regardless of the **Speed** setting.

Next, select the **Terminal** item and set the **Implicit LF in Every CR** to on, and **Local Echo,** and **Local Line Editing** to **Force Off**.

You can change the window size under the **Window** item. Set the **Columns** to at least *41* and the **Rows** to at least *20*.



Next, select the **Keyboard** menu option and note the setting for the **Backspace key.** If **Control-H** is selected you will need to press **Ctrl+Backspace** to send the **Del** key (ASCII 127). If **Control-? (127)** is selected, press the **Backspace** key to send the **Del** key code.



Once this has been done, return to the **Session** menu item, enter a name for this session and click the **Save** button. This allows you to easily re-open this session with just a couple of clicks.



If you right-click on the Putty icon in the Windows toolbar the last few sessions you had open will be displayed. Just select the one you want to open it.

You can adjust the display colors on the **Windows->Colours** menu item. The Micro uses the **Bold** attribute to highlight the ***hotkeys*** and other items. I like to set the **Background** color to blue and the **Bold** color to yellow but you can find the colors that work for you. After you get a color combination you like return to the **Session** menu and **Save** the session.

Appendix E: Apple or Linux Terminal Programs

The Apple Mac and Linux have built-in terminal programs so there is no need to install a separate app. To connect your **CTR2** unit to a terminal session use the following process.

First, list your current serial ports without your **CTR2** unit plugged in.

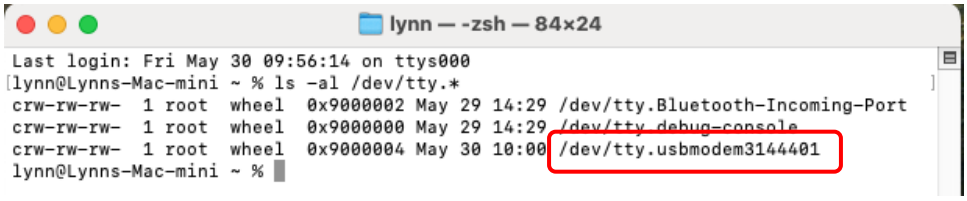
- On the Mac open **Applications/Utilities/Terminal.app**. On Linux open the terminal program supplied by your distro.
- On the Mac, enter ***ls -l /dev/tty.usb****, on Linux, enter ***ls /dev/tty**** This will return a list of all known serial ports.
- Next, plug **CTR2-Dial** into the computer's serial port and execute the command above again. This is easily done by pressing the *Up* arrow key.
- Compare the new list with the old list. **CTR2-Dial's** serial port ID will appear on just the new list. For Mac users the serial port ID format will be **/dev/tty.usbserialxxxxx** where **xxxxx** is a unique device ID #. Linux users will see something like **/dev/ttyACMx** or **/dev/ttyUSBx**, where **x** is a unique # for that port.

NOTE: If a new virtual serial port is not created when you plug your **CTR2-Dial** into your PC make sure you are using a USB-C cable that supports data. Many USB-C cables only provide power to the remote device.

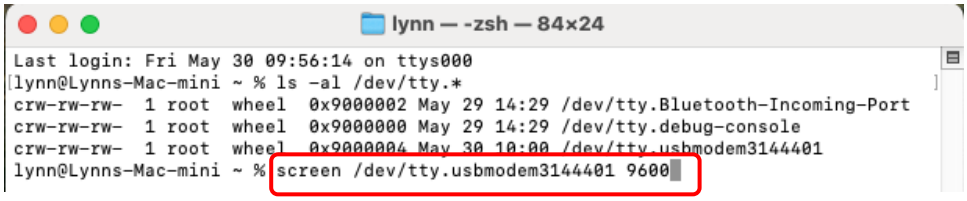
Once you know your **CTR2** unit's USB serial port ID, write it on the label on the bottom of the unit using a fine-tipped permanent marker for future reference. Put a piece of transparent tape over the label to seal the ink so it doesn't rub off (it's not as permanent as you think). You can always remove the tape if you want to change what's written on the label.

Once you have the serial port ID, enter the following: **screen {serial port ID} 9600**. Include the complete device description (i.e. **/dev/ttyxxxxxxx**) for the **serial port ID**. This will open the serial port using 9600 baud in a terminal session. The following screenshots demonstrate these steps.

1. Get the list of serial devices on your computer. We're looking for the **usb** device.



2. Open the **screen** utility using the **usbmodem31444-1** device. Your USB device will have a different numerical #.



3. This is **CTR2-Dial's** terminal display. Press the indicated key to edit each field.



Appendix F: Power Requirements

The approximate current on an M5Dial equipped **CTR2** unit's USB connection is shown below for various configurations. If you've installed the 3.7-volt lithium battery option, these numbers will help you determine the length of time your unit will run on the battery. The M5Dial doesn't have the hardware necessary to monitor the battery's state of change, so you won't know when the battery is about to be depleted.

WiFi Mode	Backlight	Current
On	High	170 mA
	Medium 2	152 mA
	Medium 1	133 mA
	Low	115 mA
Off	High	121 mA
	Medium 2	105 mA
	Medium 1	82 mA
	Low	70 mA

Appendix G: Using CTR2-Dial with Non-MIDI Programs

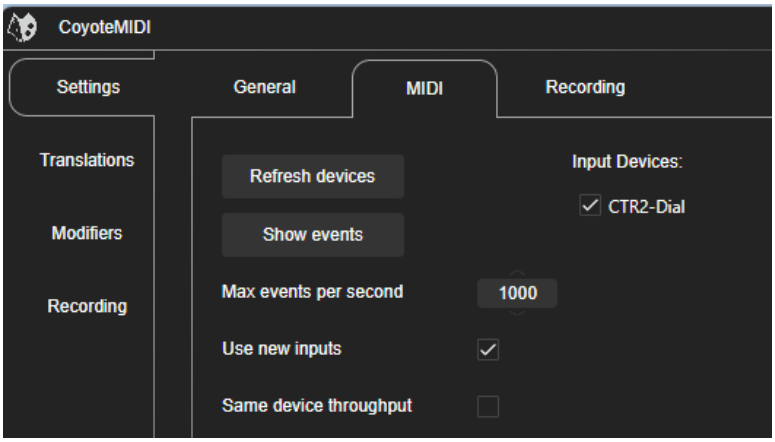
CTR2-Dial firmware is not limited to programs that support MIDI controls. Third-party MIDI translator apps such as CoyoteMIDI can receive MIDI commands from **CTR2-Dial** and convert them to other actions such as mouse scroll or keystroke actions. MIDI translator programs are available for Windows, Mac, and Linux.

These apps allow **CTR2-Dial** to be used as a physical tuning knob with radio control programs such as SmartSDR for Windows, wfView, and WebSDR that don't normally support external tuning knobs. And it doesn't stop there. These apps also allow **CTR2-Dial** to be used with any program that accepts mouse scrolls or keystroke for control. For instance, it makes a great jog wheel for Audacity.

There are a couple of drawbacks to using a translation app instead of native MIDI control. First, like your mouse or keyboard, the app you want to control must be "in focus" to receive the mouse scrolls or keystrokes from the translation app. Second, most programs don't have a lot of control functions tied to mouse scroll or keystroke actions. For instance, SmartSDR for Windows only accepts mouse scroll actions for frequency control and wfView only supports the J and K keys for frequency control.

Configuring CoyoteMIDI

This section will cover configuring CoyoteMIDI to interface with SmartSDR for Windows and wfView. The translator you choose will have a different setup procedure but they're all basically the same.



Before you start, plug your **CTR2** unit running **CTR2-Dial** firmware into a USB port on your computer. It will automatically register as a MIDI device. Open the **Dial** control and turn the gray ring to select the first control, typically named **VFO**. There

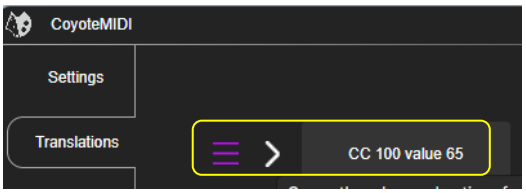
Once you've installed CoyoteMIDI open the app and navigate to the **Settings -> MIDI** tab. **CTR2-Dial** should show up on the **Input Devices:** list. Click the checkbox to enable it.

Configure SmartSDR for Windows Frequency Control

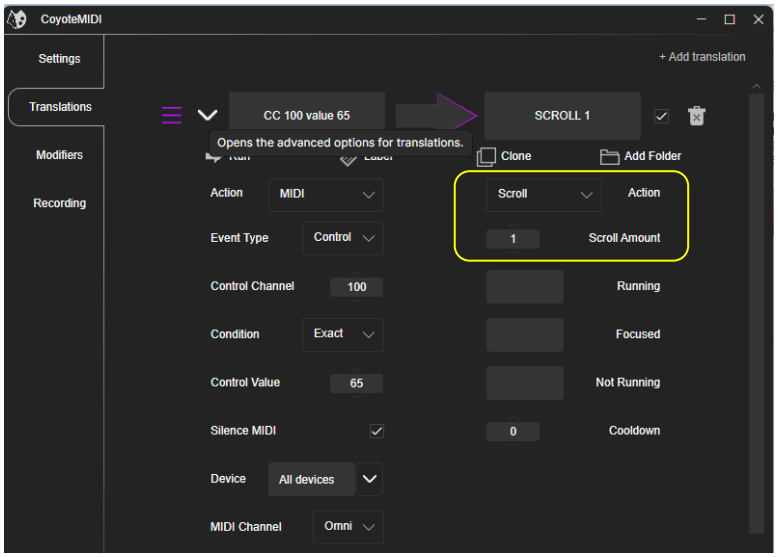
Next, select the **Translations** tab and click the **+ Add Translation** button in the top-right corner.

The first example uses the **VFO** dial control (MIDI control #100). This mode uses the **WheelA** MIDI control where a value of 65 represents a clockwise turn and 63 represents a counter-clockwise turn of the knob.

Click the box with **Click to record** then turn the knob on CTR2-Dial *slowly* clockwise. You should see **CC 100 value 65** appear in the left box. If you don't see this, make sure the selected control on CTR2-Dial shows control 100 above the control's label. Hover the mouse over this entry to show the violet menu and **>** icons.



Click the **>** icon to view the details of this command. I've already set this command to be translated to the **SCROLL 1** mouse command.



The options on the left should be as shown. If not, edit them to match what's shown here.

To configure the **SCROLL** 1 output, click the **Action** dropdown box and select **Scroll**. Next, set the **Scroll Amount** to **1** so each tick of the clockwise turn of the encoder produces on scroll tick.

That's it. You configured your first translation. Click the **+Add Translation** button again and follow the same process to program the counter-clockwise knob turn. In this case, set the **Scroll Amount** to **-1**. This will send the reverse mouse scroll.

Now open SmartSDR for Windows and the frequency should change as you change the knob on CTR2-Dial. You can edit the label on CTR2-Dial with a terminal program if you want to change it.

Configure wfView Frequency Control

You can set up translations for many other programs the same way. Next, we'll go over setting up keystroke "J" and "K" to control the frequency in wfView.

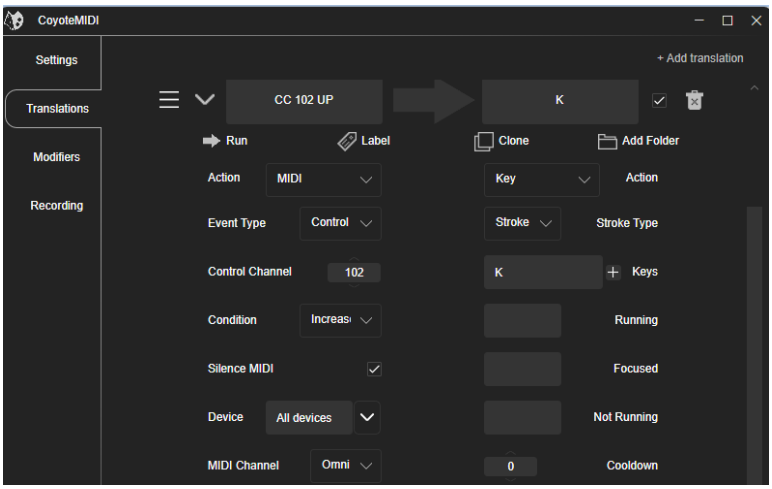
Turn the gray ring on CTR2-Dial to switch to control 102. This is normally shown as **AGC-T**. You can change this label with a terminal program. You can also use any other knob control.

NOTE: This encoder uses the **SliderA** control type. This type operates like a potentiometer and has a range of 0 to 127 counts. To use this control type we'll look for the value increasing or decreasing to determine the direction the knob is turning. You can edit the MIDI control type in a terminal if you want to change it to **WheelA**. If you do this, follow the setting in the first example.

Click the **+Add Translation** button to add another translation.

Click the box that says **Click to record** then turn the knob on the *MIDI* clockwise. You should see **CC 102 value xx**, where xx is a number between 1 and 127.

Hover the mouse next to this box then click the **>** icon to show the details.



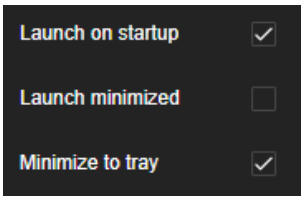
On the left column, click the **Condition** dropdown box and select **Increase**. This action will trigger when the MIDI value is increasing. The title in the top box will change to **CC 102 UP**.

In the **Action** dropdown box in the right column select **Key** and in the **Stroke Type** select **Stroke**. Finally, in the **+ Keys** box, enter **K**. This is the key used to increment the frequency in wfView.

Next, click the **+ Add Translation** button again, click the new box showing **Click to record** and turn CTR2-Dial's knob counter-clockwise. Now, follow the same process as outlined above except select **Decrease** in the **Condition** box and enter the letter **J** in the **+ Keys** box. wfView uses the **J** key to decrement the frequency. I'm not aware of any other keystrokes wfView supports. If there are more they can easily be added.

CoyoteMIDI Startup Options

There are a couple of options in the **Settings -> General** menu that you might want to set if you regularly use the *MIDI* and CoyoteMIDI with your apps. If you select **Launch on startup** and **Minimize to tray** options CoyoteMIDI will automatically start when you boot your computer and will be available in the Windows tray if you need to change anything.



Appendix H: Change Log

v2.05.06: September 30, 2026

- Fixed a bug I injected into v2.05.04 that erased the map name in **MIDI** mode

v2.05.04/.05: September 28/29, 2026

- No changes to **CTR2-Dial** firmware. This update just changed the manual's version # to match the **CTR2-Flex** firmware version.

v2.05.03: August 17, 2026

- Fixed a bug in **CTR2-Dial** mode that was preventing saving updates from the text editor
- Fixed a bug in **CTR2-Flex** mode that prevented the band map from saving correctly
- Added the profile# to the SSID and Password settings in **CTR2-Flex** mode
- Changed the default **CTR2-Dial** import/export configuration file names from the .TXT extension to the .CTR2 extension.

v2.05.02a: August 2, 2026 (Manual updated only)

- Simplified manual – removed most of the **CTR2-Flex** references – for **CTR2-Flex** firmware, download its manual here.

v2.05.02: July 5, 2026

- Fixed bug in CTR2-Flex that caused all four knobs on Quad to control the selected parameter in the Flex Dashboard – this change does not affect the CTR2-Dial firmware

v2.05.01a: April 15, 2026

- Added additional information and a warning about the Paddle/Key/PTT jack's function

v2.05.01: March 17, 2026

- Fix bug in that blocked saving the # of knobs in older **CTR2-Dial hardware**
- Fixed bug that caused the unit to toggle between **CTR2-Dial** and **CTR2-Flex firmware** when waking a unit up that is running on battery
- Fixed bug that was blocking knob A from moving the cursor in the text editor
- Added **TUNEtgl** to **CTR2-Flex's** Button menu. This action will key the radio in tune mode for tuning external tuners. Press button to toggle on/off.
- Added a Quick Start Guide to this manual

v2.05.00: March 4, 2026

- Added Edit Map Name to the Settings menu. This option allows you to change the caption of the **Home** page to match the radio control app that you're using (i.e. SmartSDR, Thetis, etc.)
- Added 18 additional buttons to the Buttons menu for a total of 60 buttons in each map and updated the CTR2-Dial Configuration Files from v1.3 to v2.0 with the new button assignments.
- Added a new # Buttons option to the **Settings** menu. This option allows you to control the number of buttons displayed in the **Buttons** menu so you only see the buttons you want to use. Range is 6 to 60, default is 60.

  NOTE: The v2.05.00 configuration file is not backwards compatible with versions below 2.05.00.

If you decide to replace this version with an earlier version, you should erase the flash memory prior to loading the older version.

v2.04.01: February 12, 2026

- Updated Appendix B: Installing or Updating CTR2-Dial Firmware to include ESPConnect as the primary method to flash firmware to the M5Dial on PCs and Macs (sorry, not Linux).
- Added HID support to allow **CTR2** units running **CTR2-Dial** firmware to control RemoteTx stations. See the RemoteTx section for details.
- Fixed several bugs in the **Knob** menu that were causing the wrong Dial function to be displayed.
- The text editor page now works correctly when pressing and turning knob A to move the cursor position.
- Removed the second page of Dial functions from the **Uno's Knob** menu. There are now only 6 functions available in this menu. On **Duo** units there is a menu for each knob.

v2.04.00: January 30, 2026

- Revised this manual to focus on **CTR2-Dial** firmware. Hardware references have been moved to the **CTR2-Uno**, **CTR2-Duo**, and **CTR2-Quad** hardware manuals. Click these links to open these manuals.
- A new **configuration repository** has been added to the Lynovation web site under Download -> Configuration Files. **CTR2-Dial** and **CTR2-MIDI** configuration files and MIDI maps for various 3rd-party radio control apps can be found here.
- Added Ring: Fine-Tune mode to the **Settings** menu
- **CTR2-Flex** firmware is covered under a separate manual. This manual can be found here.
    - The following new features have been added to this version:
    - Support for **CTR2-Quad's** four knobs, two pushbuttons, and separate input jacks for paddles and key/PTT
    - Added the option to export just your unit's basic settings or its basic settings and all of your favorite frequency lists. Export just the basic settings when sharing your unit's configuration with others. You can also your files to the CTR2 group.

v2.03.06: December 26, 2025

- Additional code refinements to paddle debouncing

v2.03.05: November 10, 2025

- Firmware is now released as a single .BIN file instead of four .BIN files
- Added information on switching between CTR2-Flex and CTR2-Dial firmware modes
- Added paddle release debounce to fix issues with cheaper paddles adding extra code elements
- Improved keyer Bug mode so it works properly now
- Fixed several bugs in the Export and Import Settings functions
    - WiFi credentials and radio IP settings are now encrypted in exported settings files

v2.03.04: October 9, 2025

- Fixed bug that caused Dial/Flex modes to switch when running unit on lithium batteries

v2.03.03: September 16, 2025

- Added Touch Delay On/Off to **Setting** menu to enable or disable the 120-millisecond delay on touch events that was added in v2.03.02
- Added Paddle Normal/Reverse to Setting menu to roll paddle wiring**v2.03.02: September 10, 2025**
- Added 120 mSec debounce to screen touch – Some M5Dials send random touch events
- NOTE: v2.03.01 was released for one day – removed it to fixe bugs in debounce code

v2.03.00: September 4, 2025

- You can now enter your registration credentials without using a terminal program.

v2.02.00: August 18, 2025

- You can now edit control labels (and MIDI types for **Dial** controls) without using a terminal program.
- Added **Ring Control** options – you can now assign a dial function to the gray ring encoder on the display
- Added a Tuning Lock option

v2.01.01: August 10, 2025

- You can now choose whether or not you want to reset your call and registration key in the Reset to Factory option.
- Updated the Dial and Button labels in Map 1 so they match the MIDI function mapping in SmartSDR for iOS/MacOS.
  NOTE: You will need to reset your unit to Factory settings to update the labels on you unit.

v2.01.00 – August 9, 2025

- Removed the **Maps and More Maps** section and replaced it with **How CTR2-Dial Works with Your Control App**. Also rearranged and edited sections to make it easier to use this manual.

v2.01.00 – August 7, 2025

- Added the ability to assign encoder switches on CTR2-Flex hardware to virtual buttons
- Added additional information about mapping CTR2-Dial to your control app
- Added a new link to download Tera Term. Get it from the CTR2 Group IO File folder here.

v2.00.00 – July 24, 2025

• Integrated CTR2-Dial firmware into CTR2-Flex v2.00.00 firmware

- This gives you the ability to run either CTR2-Dial MIDI firmware or CTR2-Flex WiFi firmware on the same device
- CTR2-Flex v2 runs on CTR2-Dial and CTR2-Flex hardware
- No functional changes were made to CTR2-Dial firmware when it was integrated into CTR2-Flex v2 with the exception of a few Settings menu items being moved around
- Your current CTR2-Dial v1 settings will automatically be converted and saved to CTR2-Flex v2
- You can run CTR2-Flex from the Settings menu
- If you don't run a Flex 6000 or 8000 radio and/or don't have CTR2-Flex hardware, you can continue running CTR2-Dial v1.01.01

v1.01.01d – July 21, 2025

- Added additional information to Appendix B on preparing CTR2-Dial to flash firmware

v1.01.01c – June 29, 2025

- Added information about using EspressIF's new browser-based flash download tool ESPLaunchPad

v1.01.01b – May 30, 2025

- Added Appendix E with information on using the **screen** command in Mac and Linux for a terminal interface

v1.01.01a – May 22, 2025

- Added a note about using a USB-C data cable

v1.01.01 – May 14, 2025

- Fixed a bug in the new encoder swap code introduced in v1.01.00. Swapping encoders works now.
- Renamed the **Port B:** option in **Settings** to **# Knobs:** and changed the options from **Off, Paddles**, **Enc B** and **Swap A/B** to **None, One**, **Two**, and **Swap A/B**.
- Paddle input now works when **# Knobs** is set to **None**
- Added a note about problems with the **DOWNLOAD** button when flashing firmware
- Added Appendix G: Using CTR2-DialI with Non-MIDI Programs with examples of how to use CTR2-MIDI with programs like SmartSDR for Windows that do not support MIDI control

v1.01.00 – May 7, 2025

- Released for production

v1.01.00k – May 5, 2025

- Added the ability to edit the functions in the **Knob** menus without having a terminal connected
- Added [Knobs: Swap A/B] option for dual-encoder units
- Added Backspace key to start registration entry and added note about Del key mapping in Putty
- Open **Port B:/# Knobs** option in settings after successful registration key entry

v1.01.00f – May 1, 2025

- Added left/right swipe to the **Dial control** and the **Dial, Knob**, and **Buttons** menus to switch between pages.

v1.01.00e – April 30, 2025

- Increased encoder functions from 12 to 18 for each map
- Hide unlabeled encoder functions on Dial control unless user has connected to the unit with a terminal to edit the function labels.
- Updated the Dial and Knob graphics to minimize the flashing that was present in earlier versions.
- Added a **Port B: Off** option to Port B settings. This allows you to completely turn off Port B when not using the paddle or encoder B options. See this note about setting Port B on a new unit.
- Removed touch & hold speed acceleration on wheel controls – replaced with speed sensitive tuning on all controls.

- Added a new **Info** option in the Settings menu. This option displays the firmware version #, registered call sign, and the registration key for the firmware.
- Added support for the new port expander interface board. This board will support two external encoders and the paddle input jack.

v1.00.06 – January 30, 2025

- Fixed a major bug in the initialization file. I was not updating button labels above #16 so any changes made to buttons above this number would revert back to default on a power cycle. All users should update to this version.
- Fixed the code that allows you to swipe left or right on the **Buttons** menu to change pages

v1.00.05a – January 29, 2025

- Updated manual to include more information about connecting to Mac computers using Bluetooth
- Added troubleshooting information for issues cause by an incorrect setting of **Port B** in the **Settings** menu.

v1.00.05 – January 28, 2025

- Added "double-touch" to many of the caption and footer buttons. Touch once to select and again to execute
- Added left and right functions to some of the caption and footer buttons.

v1.00.04 – January 24, 2025

- Fixed bug causing incorrect MIDI control # to be displayed on Knob changes

v1.00.03 – January 23, 2025

- Fixed bug causing a single reverse pulse when tuning through 0 degrees on the Dial.

v1.00.02 – January 22, 2025

- Fixed minor bug in PTT page – touching **PTT** caption did not return you to the **Home** page
- Added path to Thetis MIDI maps to Thetis section

v1.00.01 – January 20, 2025 – Shipped version

- Added **WheelB-r** (reverse) wheel option to switch direction of dial rotation for PI HPSDR
- Touching the **CTR2-Dial** caption on the **Home** page returns to the previously open page
- Fixed bugs in **Knob B** property editing
- Added Power Requirements to Appendix F
- Changed the procedure to flash firmware to the M5Dial to require manually forcing the M5Dial into programming mode
- Added a new MIDI Control Types table

v1.00.00 – January 16, 2025 – Initial Release

- Updated photos with new enclosure
- Added Import/Export Settings options
- Allows single encoder to use all 12 Knob settings