
Lynovation CTR2-Mini+ Radio Controller

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In the September 2022 issue of *QST*, an article featured the CTR2-Mini, a radio controller designed by Lynn Hansen, KU7Q. To briefly summarize the CTR2-Mini, it's a convenient way to control an HF transceiver via CAT control. Controlling a radio via the Mini has many benefits, including a colorful screen and easy-to-access menus. The CTR2 project piqued my interest, as I believe that some of the items used in this project will continue to evolve and be developed for amateur radio use. The use of Wi-Fi and an application programming interface (API) allows for multiple systems to communicate with each other and provide control, such as is the case with FlexRadio systems, which utilize an API to get and send commands and get information about the current status of the radio.

Subsequently, I was provided an opportunity to test the CTR2-Mini+, their latest of the CTR2 series. I



Bottom Line

The CTR2-Mini+ is everything you want it to be. It can be used to control your radio locally or remotely, and you can use it for its programmable keys or even to practice Morse code.

found multiple ways to effectively incorporate this radio controller into my daily amateur radio use. Compared to *SmartSDR*, the CTR2-Mini+ is easier to utilize as a radio controller for several reasons. The most noticeable upgrade to the CTR2-Mini is the controller's front panel, which now includes a six-button keypad. These buttons provide programmable shortcuts to rapidly access an operator's most used or favorite features.

On my desktop computer, I utilize a keyboard and a mouse to remotely control my FLEX-6400. This approach works fine, as long as I am sitting at my desktop, which is the problem; I'm increasingly less at my desktop, and more often than not working on a tablet with *SmartSDR* to access my Flex radio. A tablet does the job. Yes, there is a touchscreen on the tablet. Still, a touchscreen with no keyboard becomes a lesson in patience when navigating *SmartSDR*, FlexRadio's graphical software for controlling a radio. There are also several other options that make it possible to control a Flex radio remotely, including the utilization of a Stream Deck and *FRStack* software, or the utilization of Node-RED-based flows to control the Flex radio.

Description

I received the Mini+ as an assembled unit. At approximately 5 × 5.5 × 3.5 inches, the Mini+ is small enough to be carried around and utilized while traveling, easily fitting in a camera bag, a convenient way to carry my various electronics. A 2.4-inch LCD screen (the Wio Terminal) is attached to a black plastic case that has several control options. On the top portion of the case, there are six buttons labeled 1 through 5 and PTT, a power OFF and volume (VOL) knob, an encoder knob, a sidetone speaker, and a sidetone headphone jack. The rear panel (see Figure 7) includes many ports, a 12 V dc input (12VDC), CAT I/O, a PTT key output (PTT/K OUT), RADIO I/O, a paddle input (PDDL IN), and a PTT key input (PTT/K IN).

The Mini+ is just over 13 ounces in weight without the power supply. The pushbuttons on the Mini+ are placed in rows of two, spring-loaded, color coded, and labeled 1, 2, 3, 4, 5, and PTT. On the bottom portion of the black plastic case are two brass hex spacers that help to provide an angle for the Mini+ to rest, and still allow for the operator to clearly see and utilize all buttons and the LCD screen. The hex spacers are removable, as they just unscrew from the case. Before turning on the Mini+, I made sure it was going to fit in my bag, which it did. So far, the Mini+ seemed to be well built.



Figure 7 — The CTR2-Mini+ back panel has connections for footswitches, paddles, 12 V dc input, CAT cables, and multi-radio links.

My first step in getting the Flex set up for use with the CTR2-Mini+ was to download and print the 69-page user manual (see <https://ctr2.lynovation.com/ctr2-mini-operation-manual>). I initially felt overwhelmed by the sheer size of the user manual, but most of it is used as a reference, as opposed to step-by-step instructions to operate the device.

Firmware Update

One of the things I noticed in the manual and on the website was the potential firmware update. The Wio Terminal included in this device is the brains of the operation. Inside the Wio is a programming code, which is in charge of everything the CTR2-Mini+ does — listening for input from each of the buttons, connecting to Wi-Fi, telling the radio to adjust the squelch, and activating the PTT. The firmware update was my first step in the exploration of the unit, as I wanted to ensure I had the latest features and bug fixes, if any. Updating the firmware was easy (see <https://ctr2.lynovation.com>). On the download page, I quickly found the latest firmware, dated December 31, 2022 (CTR-Mini_v113000), and downloaded it to my computer. I then found the instructions on the website:

- Connect the Wio Terminal to your PC. This can be done on Windows, Linux, or Mac.
1. Quickly double-click the power button (pushing it down past the "On" position twice) on the Wio to put it into programming mode.
2. Your PC's file browser should open with the Arduino folder selected. If not, navigate to it. It will be with your removable drives.
3. Copy and paste the CURRENT.UF2 file in the CTR2-Mini_v10xxxx.zip link below into the Arduino folder, replacing the original CURRENT.UF2 file.

That's how easy it is to upgrade the firmware. At the bottom of the page I was able to see the revisions included in this firmware; this addressed fixes to not

only the firmware of the device, but also the instructions in the user manual. During the time I tested the product, I saved personal settings multiple times and then upgraded the firmware. I can confirm that a firmware upgrade does not remove user-created personal profiles/settings.

Setting Up the Radio Connection

With the firmware update complete, I browsed through the Quick Start Guide on page 9 of the manual. Step 3b explained how to connect a Flex radio with the CTR2 Mini+. This involves connecting the Wio portion of the Mini+ to the local Wi-Fi, entering the radio IP address information in the Wio, and directing the CAT control to TCP port 4992. I was doing this remotely (from outside of my personal network) by connecting the CTR2-Mini+ to my Flex radio. To connect my Flex to the CTR2 remotely, you must open port 4992 on your home router (or the router where your Flex radio is located). It's mentioned in the manual that there is potential to expose the Flex radio to be controlled by anyone on the internet at this point, as it doesn't require authentication to access and control. I found this information to be incredibly valuable and accurate.

In the future, I may choose to configure some sort of VPN to prevent bad actors from taking control of my radio. Additionally, when testing the Wi-Fi connectivity with the CTR2-Mini+, I tried both 2.4 GHz and 5 GHz networks. After double-checking case sensitivity in my network name and password, I did not have any issues connecting. Inputting the network name and password requires the use of the encoder/VFO knob and the blue button on the face of the Wio Terminal.

Now the Mini+ was connected to my Flex radio. There were about eight different directions in which I wanted to go. Keeping things as simple as possible, I started turning knobs and pressing buttons to check out their functionality and my abilities. I realized the game plan I was formulating was to customize the pushbuttons, get a feel for the navigation through the menus, use the Mini+ to operate CW with one of my iambic paddles, and use the PTT button alongside my Bluetooth headphones, which will be synced to my tablet. The Mini+ doesn't currently have the ability to send and receive audio, so I leverage the Mini+ with my Bluetooth headphones to give me the ability to listen and communicate through *SmartSDR*, while still controlling through the Mini+. The advantage of using my Bluetooth headphones is that they're 100% portable, and *SmartSDR* has great transmit equalization options. Additionally, I can activate the PTT button in

SmartSDR through the Mini+ controller, without accessing *SmartSDR*. I am aware that I could use VOX, but I am not comfortable with VOX going off at any audio level — especially if I am somewhere busy, like a coffee shop.

Programming the CTR2-Mini+

With the aforementioned ideas in mind, I decided to program each of the five pushbuttons that were available first (refer to page 17 of the user manual). Programming the buttons is easy. On the main screen, tap the encoder. Once the encoder is pressed, a menu displays different options. Utilize the encoder to scroll to **CONFIGURATION**, and tap the encoder again. Once inside the configuration menu, there are several options that could be set: programming function buttons, programming (C) buttons (buttons located on the Wio Terminal), changing the theme/color sequence of the graphical user interface (GUI) presented on the Wio screen, and many other options. Within the configuration menu, certain sub-settings may be configured by using the encoder and blue button on the Wio or by using a key. I used my paddle to type my call sign, W9FFF. I enjoy the ability to configure my Mini+ with a key, as it allows me to practice Morse code.

Additional options for configuring the text data include using terminal mode. Terminal mode is used by connecting a USB cable to the Wio Terminal and to a computer, setting the baud rate in Windows, opening the *Tera Term* software, and utilizing a command prompt-style screen to configure the settings. Although this option won't always be practical, it became straightforward to leverage the initial setup feature of the Mini+.

As for configuring the buttons, there are two different banks for programming buttons, so really, the five buttons you can program may be utilized twice. The bank used will depend on the time the button is pressed. I programmed each of the pushbuttons within both banks to my liking, having a combination of the ability to change modes and bands, tune the radio, as well as other various features that I'd utilize most.

During this time, I learned about C-button programming. The C button is located on the top of the Wio device. When selecting the programming, I was able to choose between most of the same options as I could program with the standard pushbuttons. I opted to program my C button to open the **MODE** menu, which will help me rapidly change between the different modes.

Practicing CW with the CTR2-Mini+

Feeling confident that the buttons were programmed to my liking, I now wanted to utilize my CW key through the Mini+. I've wanted to improve my Morse code skills, and I've made use of many tools and techniques to continue to learn. The Mini+ has come in handy, as it has a practice mode under the keyer menu. In this menu, I was able to choose a variety of practice techniques, focusing on fixed- or random-length letters, call signs, numbers, custom uploaded practice files, and more.

For the sake of practice and familiarity, I chose to listen to Q codes to learn them. The Mini+ allows for adjustment of both speed and spacing of letters, and utilizes the Koch training method to help teach Morse code. However, I was unable to set these below 15 WPM. The speed may be increased faster than 15 WPM, but 15 WPM is actually a feature. This forced me to learn the characters and code by ear, not by mentally processing the combination of dits and dahs. I can attest that I am not good with code. I can send it with relative ease, but I am unable to process it by ear. I have been spending about 10 – 15 minutes a day picking an option within the menu and listening. When I think I understand a Q code, for example, I look at the on-screen trainer to see how well I did. The trainer tool is useful as a way to keep me learning, but it is not the primary purpose of my Mini+.

Using the CTR2-Mini+ as an Operation Tool

In order to utilize the Mini+ with my tablet and a set of Bluetooth headphones, I tested both of my Bose Avantree headphones. They both have Bluetooth capability, so I can sync them to my tablet (see Figure 8). This configuration allows me to not only listen to my Flex radio, but utilize the headphones' built-in microphone to transmit to my Flex radio.

The Mini+ activates the PTT button in the event that I am utilizing SSB mode. As mentioned earlier, I've never been comfortable with VOX as a PTT activation method, especially in public settings. Utilizing FlexRadio's *SmartSDR* software to activate the PTT is possible, but I must be inside the *SmartSDR* software to utilize that feature. If I am working within another application, pressing an external PTT button makes things very simple. I sometimes utilize the Mini+ in public places; by plugging in an audio cable to the headphone (HP) port on the top portion of the Mini+, I can also use CW mode with an external keyer. Plugging into the HP port allows me to hear the tones I am generating from my key, while also utilizing the tablet and headphones to continue to hear the airwaves.



Figure 8 — A simple solution that utilizes the CTR2-Mini+, a tablet, and an iambic paddle for remote CW use. Not pictured are headphones that plug into the HP port.

This setup works well for me. Being able to operate and change bands, frequencies, filter widths, and even slices with the Flex radio is a convenient option to have. While operating remotely, I can easily access all of the possibilities by tapping the VFO encoder a few times or leveraging my user-defined buttons. An easily accessible remote meter panel has an excellent user interface that allows me to view a combination of my S-meter, power meter, ALC meter, and compressor meter all at the same time. Additionally, while operating remotely and with specific ports open at the Flex radio's location, I can place the Mini+ into GUI mode, which gives me a graphical panadapter. This allows me to see where signals may be on the spectrum for the band in which I am operating.

Support

I previously mentioned that I upgraded the firmware to this device. While utilizing some features of the Mini+, I observed what may have been a bug in the current firmware. I believe it had to do with an array being called for the numerical Morse code characters.

I reached out to Mr. Hansen and informed him of my findings, and was surprised to receive a prompt response and an updated firmware emailed to me that evening. The support provided in this experience was great and personable. From browsing articles online, it appears that Mr. Hansen is open to hearing ideas regarding the Mini+ features, and I am convinced that this will help the future popularity of the Mini+ and other CTR2 devices.

In Summary

The Mini+ has the capability to control multiple radios via one device. It really can be what you want it to be, and if you have questions regarding the Mini+, I encourage you to browse through the manual to determine if this product is a solution for something you are working on now or may be working on in the future.

Although this article was written while using my Flex radio, the CTR2-Mini+ is supported for CAT control by a variety of different radios. It has great potential to conveniently access features to your current radio, as well as train with Morse code. This product has many

features, with the potential for more to come in the future.

Taking into consideration the current features offered, the quick response to support, and the overall build quality, I consider (for the price tag) a fully assembled CTR2-Mini+ to be a good value. I am excited to watch for the future development of this product.

Manufacturer: Lynovation, **www.lynovation.com**.
Price: \$140 for the assembled unit. For more details on the kit version, please visit the manufacturer's website.