

CTR2-Voice

Operation Manual

v1.01.02



Last Revision: February 28, 2024

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Updated to firmware v1.01.02

Revised sections for this version are highlighted in yellow

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Introduction

CTR2-Voice is a custom speech synthesizer designed to operate with [CTR2-Micro](#), Lynovation's miniature amateur radio controller and keyer. Its main function is to provide an audio radio control interface for blind and sight limited operators, although sighted users will find it useful for using the *Micro* without a display when operating portable or mobile.

In this document **CTR2-Micro** will be referred to as the *Micro* and **CTR2-Voice** will be referred to as the *Voice*.



The *Micro* doesn't have a built-in display. Instead, it relies on a terminal or web browser to access the feature menus. With the addition of the *Voice* the need for a separate display is eliminated. Radio parameters and *Micro* menus are spoken by the *Voice* as the operator navigates the interface.

The *Voice* is the same physical size as the *Micro*, 60mm x 60mm x 20mm (about 2.3" x 2.3" x 1"). There is only one level control on the *Voice* in addition to a USB-C connector for power and a 3.5mm (1/8") phone jack for the audio output. The 20 milliwatt audio output is transformer and DC blocked to eliminate interference and ground loops. The output can be fed to a set of amplified speakers or a small set of headphones. The level control near the audio output jack can reduce the output level down to millivolts to drive the Mic input on a computer sound card or your station's audio mixer.

The *Micro* connects to the *Voice* using WiFi. The *Voice* can be configured as either a WiFi Station or a WiFi Access Point.

- [Station mode](#) requires an external WiFi router. Both the *Voice* and the *Micro* connect to the same WiFi router. This allows it to be placed anywhere in your shack. This mode is usually required if you are running an IP based radio like the Flex or Apache Labs ANAN.
- [Access point mode](#) provides a WiFi network that the *Micro* can use to connect to the *Voice*. This mode is useful when operating the *Micro* and the *Voice* in a portable or mobile environment.

The unit requires 5 VDC. No USB data connection is required after the initial setup is completed. Power can be supplied by a computer's USB port, a cell phone charger, or a 5 volt USB battery pack.

The *Voice* includes the following features:

- The WiFi credentials are set up on the *Voice* the same way they are on the *Micro* by using a terminal program connected to the USB serial port on the *Voice*. Once these are set the user doesn't need to interact with the *Voice* again.
- There are no user controls on the *Voice* other than a level setting potentiometer. Output parameters such as volume, tone, voice speed, delay, and number pronunciation are changed in the *Micro's* **Configure -> Report -> Voice Settings** menu.

- The audio output is transformer and DC isolated so any powered speaker can be used. Amazon carries a wide selection for around \$10. You may even have a set of old computer speakers laying around that would work.

Legal Notice

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

- This is a hobby endeavor, not a commercial enterprise. Nothing is guaranteed! Use this device at your own risk!
- I will do my best to make sure you receive functioning hardware if you buy the assembled unit and will work with you if there is a problem with your unit on arrival.
- I cannot guarantee or warranty the hardware supplied in the kit.
- I make no warranty that the firmware provided for the Micro will perform up to your expectations or be suitable for your application. Software bugs are a fact of life and I try to find and correct all bug reports to the best of my ability ASAP.
- Many of the features in the firmware are experimental. If you find a problem with any of them let me know.

How to use this manual

This manual should be used as a reference manual. Items in the Table of Contents link to their write up in the manual. The main categories have short write ups describing the functions available in that section. 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.

Change Log

v1.01.01/1.01.02 – February 28, 2024

- Don't check for WiFi Station credentials when starting Access Point mode
- Added a spinner on the left side of line 2 in the terminal to show when text messages from CTR2-Micro are arriving on the WiFi link
- Not saying "SSID=" properly in the Micro's **Configure** -> **WiFi** menu
- v1.01.01 was shipped on one unit before this changes were made.

v1.01.00- February 26, 2024

- Added the option to enable the *Voice* to act as an Access Point. This creates allows the *Voice* to create a WiFi network the *Micro* can use to connect to the *Voice* when operating in the field or mobile.

v1.00.01- February 20, 2024

- Fixed bug that would intermittently announce the WiFi connection state
- Added additional abbreviations to abbreviation library
- Speaking the last "]" in menu items with [^] notation for shortcut keys

v1.00.00 – February 11, 2024

- Initial release of CTR2-Voice

What is CTR2-Voice?

Background

CTR2-Voice was designed after several members of the blind ham community discovered that CTR2-Micro had a Morse code report feature that allowed users to navigate the menu system and set radio parameters using Morse code. Code mode was added to the *Micro* in an effort to support standalone (without a display) operation. These hams wondered if this feature could be expanded to use with a screen reader.

The first addition to the *Micro* was a **Text** report mode. This mode just outputs messages normally sent to the Code report to a connected terminal program such as Tera Term or Putty instead. In **Text** report mode a clean command line display is maintained. One or two lines of text are sent to the terminal for each change in the *Micro*. This makes it easy for a screen reader to follow. This mode works well and gives blind and limited sight operators a viable option to operate their radios when using the *Micro*. The big drawback to **Text** report mode is that it requires a computer running terminal software along with the screen reader. You also need to keep the terminal display "in focus" on the computer for the screen reader to follow your actions on the *Micro*.

Once **Text** mode was operational it made sense to start looking for a text-to-speech synthesizer that could speak the text being sent to the terminal. This would eliminate the need for a computer, terminal program, screen reader, and program focus issues.

I tried several speech synthesizers with disappointing results. Their English was either heavily robotic or the Chinese accent was so prevalent it wasn't intelligible. Finally I found a synthesizer board based on the SYN6988 speech synthesizer. This unit has surprisingly good (although not perfect) English and does a pretty decent job of converting text to speech. I developed a look-up table that tweaks many of the words it has trouble with so they are easier to understand.

Hardware

The *Voice* is designed to use the same enclosure used by the *Micro*. This enclosure is the perfect size for a busy operating desk or for portable and mobile operation.

The *Voice* uses the same Xiao ESP32-C3 processor used by the *Micro*. This tiny little board provides a single-core processor running at 160 MHz. It includes a WiFi radio for network connection.

As shown in the photo there is only a single level control on the side of the unit and a single LED on the face of the unit. The LED provides power and WiFi connection status.

The LED flashes indicate the following:

- One flash every 2 seconds – WiFi is Off
- One flash every 1 second – WiFi is On and the unit is in **Access Point** mode
- Two quick flashes every 1 second – WiFi is on the unit is in **Station** mode

You'll find the 3.5mm (1/8") audio output jack and USB-C connector on the rear edge.

The audio level control pot is accessible through a small hole on the right edge, near the audio phone jack. →

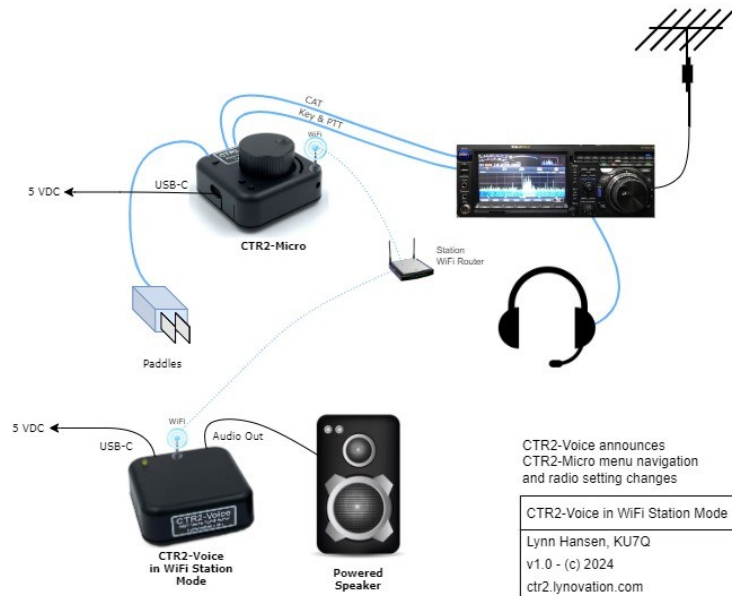


Hardware Setup

Station Mode

The drawing at the right shows a complete *Micro* and *Voice* configuration with both the *Micro* and the *Voice* in WiFi station mode and connected to the station WiFi router. The WiFi router sets the IP address of both units using DHCP. The *Voice* will announce its IP address when it connects to the network.

Instructions for setting up the *Voice* as a WiFi Station can be found in the [Configuring the Voice](#) section below.



If you operate CW connect your paddles to the **Paddle In** jack on the *Micro*. Next, connect the *Micro*'s **CAT I/O** jack to your radio's **CAT** or **Control** connector. Finally, if using PTT or the keyer on the *Micro*, connect the **KEY/PTT** jack on the *Micro* to the radio's PTT and Key inputs on your radio. The *Voice* can be deployed anywhere in your shack as it connects to the *Micro* using WiFi. A powered speaker announces changes as you change radio settings and navigate the menu system on the *Micro* in addition to changes you make directly on the radio.

Access Point Mode

The *Voice* can be configured as a WiFi access point to eliminate the need for an external router. In this mode the *Voice* provides the WiFi router for the *Micro* to connect to.

Instructions for setting up the *Voice* in access point mode can be found in the [Configuring the Voice](#) section below.

The IP address of the *Voice* in access point mode will always be **192.168.4.1**. It assigns the IP address to the *Micro*. It is usually (but not always) **192.168.4.2**.



Audio Level Control

As mentioned above the audio output of the *Voice* is rated at 20 milliwatts and is transformer and DC isolated. This eliminates noise caused by ground loops. While 20 milliwatts is enough to drive a small headset most users will want to drive an amplified speaker. A level control port is provided in case you need to reduce the level down so the output can be fed the Mic input of a computer sound card or to your station's audio mixer. The level pot can drop the level down to around -25 dBm. Should you need less an internal load/termination jumper can be installed that will drop the level another 14 dB.

Configuring the *Voice*

When you receive your *Voice* unit, connect the audio output to your powered speaker then connect the USB-C port to your computer. After a few seconds you will hear "CTR2-Voice version 1.xx.xx, Connect terminal to configure". This lets you know the *Voice* is operational and ready for configuration.

You must use a terminal program such as Tera Term or Putty to configure the *Voice* for the first time. To connect a terminal program to the *Voice* you must first determine the virtual COM port assigned to it. You then connect a terminal program to this port. Once connected the *Voice's* configuration screen will appear after you press any key.

NOTE: Connecting to the *Voice* is identical to connecting to the *Micro*. This procedure is covered in detail in the [CTR2-Micro Operation Manual](#) in **Appendix C**.

Navigation of the menu is done using either the *hotkeys* (the highlighted characters next to each menu item) or by using the up and down arrow keys to move to each menu then pressing [Enter] to execute that item. You will note that the *Voice* will speak each menu selection as you scroll. It will also announce the digits you are entering into each field. This gives you a peek at how the *Voice* works with the *Micro*.

Pre-configure Option

Beginning February 28, 2024, when you purchase both a CTR2-Micro and a CTR2-Voice I will configure CTR2-Voice as an access point and program its WiFi credentials into CTR2-Micro so that when you receive your units they will be ready to use. If you let me know what radio you will be using I can also set the radio CAT and the CAT jumpers to match your radio.

WiFi Modes

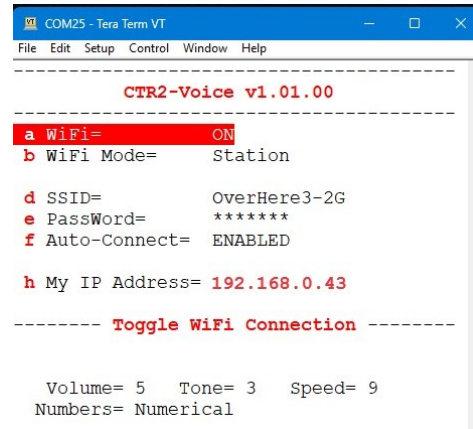
The *Micro* has two WiFi modes, **Station** and **Access Point**. The WiFi mode must be changed in the terminal session. To change it, select **WiFi Mode=** on the menu then press the [Enter] key or the **[b]** key.

In **Station** mode the *Micro* and the *Voice* connect to your station's WiFi network. In **Access Point** mode, the *Voice* becomes the WiFi router and you connect the *Micro* to the *Voice's* **Access Point** using the preset SSID of **CTR2-Voice** and password **ctr2-voice** (all lower case). This is done in the *Micro's* **Configure** -> **WiFi** menu.

Station Mode

In **Station** mode you enter the credentials for your station's WiFi router. Make sure **Auto-Connect** is enabled otherwise the *Voice* won't reconnect after you exit the terminal program.

Select **a WiFi= Off** to turn the *Voice's* WiFi radio on (press [Enter] or the **[a]** key). The *Voice* will connect to your station router and the router will assign it an IP address. This address will be displayed in the **My IP Address=** field and must be entered into the *Micro's* **Configure -> Report -> CTR2-Voice IP** menu field.



```
COM25 - Tera Term VT
File Edit Setup Control Window Help
-----
CTR2-Voice v1.01.00
-----
a WiFi= ON
b WiFi Mode= Station
d SSID= OverHere3-2G
e PassWord= *****
f Auto-Connect= ENABLED
h My IP Address= 192.168.0.43
----- Toggle WiFi Connection -----
Volume= 5 Tone= 3 Speed= 9
Numbers= Numerical
```

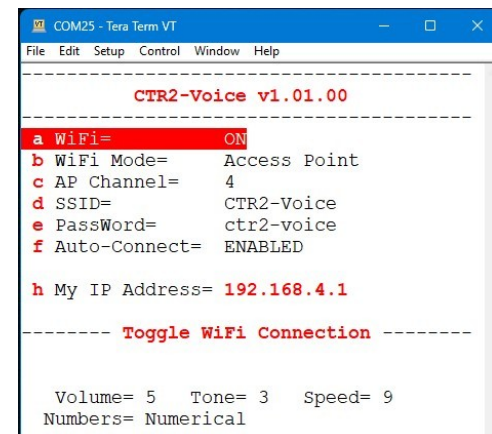
NOTE: If you have access to your router's settings you should reserve the IP address assigned to the *Voice* by the router's dynamic addressing system otherwise this address may change if your router is power cycled.

Once you have the *Voice* connected to your WiFi system with **Auto-Connect** enabled, no other user interaction is required with the *Voice* and it can be set aside with the powered speaker.

Access Point Mode

Access Point mode allows you to use the *Voice* as a WiFi router when you don't have access to a WiFi network such as when operating portable or mobile.

When **Access Point** mode is selected the SSID is fixed to **CTR2-Voice** and password is fixed to **ctr2-voice**, (all lower case). You will need to enter these parameters in the *Micro's* **Configure -> WiFi** menu to connect the *Micro* to the *Voice's* access point.



```
COM25 - Tera Term VT
File Edit Setup Control Window Help
-----
CTR2-Voice v1.01.00
-----
a WiFi= ON
b WiFi Mode= Access Point
c AP Channel= 4
d SSID= CTR2-Voice
e PassWord= ctr2-voice
f Auto-Connect= ENABLED
h My IP Address= 192.168.4.1
----- Toggle WiFi Connection -----
Volume= 5 Tone= 3 Speed= 9
Numbers= Numerical
```

The **IP Address** of the *Voice* is also fixed to **192.168.4.1**. Enter this address in the *Micro's* **Configure -> Report -> CTR2-Voice IP** field.

You can also edit the WiFi **channel** the **Access Point** will use. Normally you shouldn't need to change this but if you have a difficult time keeping a WiFi connection between the *Micro* and the *Voice* there may be interference on the channel. You can select any channel between 1 and 11.

Be sure to leave **Auto-Connect** enabled before disconnecting the terminal otherwise it won't restart with WiFi enabled.

NOTE: The **Access Point** will only allow four WiFi devices to connect to it, *and it is not connected to the internet or any of the devices connected your station's WiFi network*. This includes radios such as the Flex and other IP based radios. You can connect your cell phone's WiFi to it and use its web browser with the *Micro*. To do this, select **Low Data** rate on your phone.

Using CTR2-Voice

Now that you have the *Voice* configured and connected to your WiFi system you can place it aside.

All controls are set using the in the *Micro's Configure -> Report -> Voice Settings* menu shown here.

On the *Micro* press [Enter] or the encoder to open the Main menu. Next, use the encoder or Up and Down keys on the keyboard to scroll to the **Configure** menu then press [Enter] to open it. Next, scroll to the **Report** menu and open it.

Report Menu

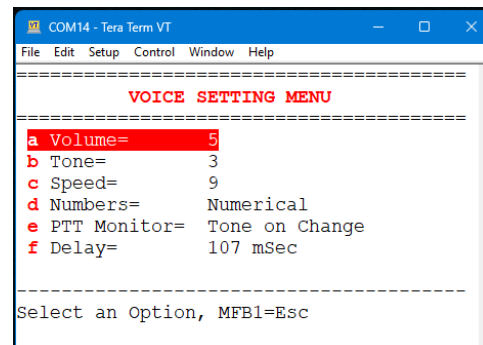
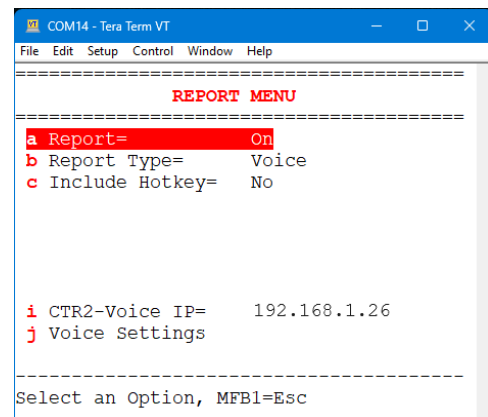
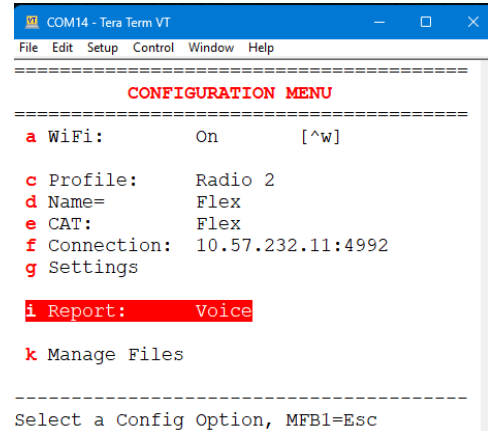
The *Report Menu* has the following options:

- a. **Report= On/Mute** enables or disables the selected report.
- b. **Report Type=** allows you to choose the type of report. Options are **None**, **Code**, **Display**, **Voice**, **Display+Voice**. You'll want to select **Voice**.
- c. **Include Hotkey= Yes/No**. This item gives you the option to have the *Hotkeys* included in the report. *Hotkeys* are the key used to execute a menu item. You probably won't want them on the **Voice** report.
- i. **CTR2-Voice IP=**. This is where you enter the IP address shown on the *Voice's* terminal menu. This tells the *Micro* how to find the *Voice* on the network. Once you enter this address scroll up to **Report= Muted** and press [Enter] or the encoder to unmute the report. The *Voice* will connect and start announcing the **Full Report**. This report announces the contents of the *Micro's Home Page*. You can stop the report at any time by pressing the MFB assigned to the **Report** function or by turning the encoder.
- j. **Voice Settings** opens the voice settings submenu described next.

Voice Settings Menu

This menu allows you to change several parameters on the *Voice*.

- a. **Volume** allows you to change the output of the synthesizer. The range 0 to 9. You can also use the level control on the *Voice* to adjust the output level.
- b. **Tone** allows you to change the tone of the synthesizer's voice. The range is 0 to 9.
- c. **Speed** gives you some control over the speed the voice plays. The range is 0 to 9.
- d. **Numbers** changes how numbers are pronounced.



- I. **Digits** pronounces individual digits. 14.123456 is announced as “one four dot one two three four five six”.
- II. **Numerical** pronounces full numbers. 14.123456 is announced as “fourteen dot one hundred twenty three thousand four hundred fifty six”.
- e. **PTT Monitor** allows you to choose the type of report you want when you key PTT. This gives you a verbal confirmation of the state of your radio’s PTT.
 - I. **No report** means that the *Voice* is quiet when you key PTT.
 - II. **Tone on PTT** sends a high tone when PTT is pressed and a low tone when released.
 - III. **Voice on PTT** says “PTT On” and “PTT Off” when you key and unkey PTT.
- f. **Delay** changes the amount of time the *Voice* waits when changes are made. Shorter delays cause the *Voice* to start speaking quicker. This delay is in addition to the built-in 700 milliseconds it takes for the synthesizer to process the text and start speaking. Range is 20 to 5000 milliseconds.

Appendix A: Updating CTR2-Voice Firmware

Kits and assembled CTR2-Voice units have the firmware already installed on them but inevitably changes will be made to the program over time. To install the latest firmware on CTR2-Voice follow these steps:

1. Download and unzip the CTR2-Voice firmware from [my web site](#). Unzip it into a different folder than where you store the Micro's firmware update files.
2. Open the **EspressIF Flash Downloader Tool** as described in the [CTR2-Micro Operation Manual](#) under **Appendix B: Loading and Updating Firmware**. When it starts, select the **ESP32-C3 Chip Type** and **USB** for the **LoadMode**.
3. Extract the four .BIN files in the CTR2-Voice firmware distribution file to a folder the map them into the downloader tool.
NOTE: The address for each file is embedded in its file name. Enter this address in the address field to the right.
4. Enable the checkboxes for the four files as shown here.
5. Set the COM: port to the port assigned to CTR2-Voice and set the Baud to 921600.
6. Click the **Start** button to start the download.

Once the download is complete, cycle the power on the *Voice* to start the new firmware.

