TopBytes Morse Trainer
https://morse.topbytes.net

Release 3.0.0

User Manual

Mar 17, 2026

CONTENTS

TopBytes Morse Trainer. Small portable battery powered device to help with learning to send and receive morse code. Connect your own straight key or morse paddle using a *standard 3.5mm stereo plug*.

Purchase exclusively from Martin Lynch & Sons Ltd

CHAPTER

ONE

INTRODUCTION

Thank you for purchasing the Morse Trainer. Here you will find details about all the different features of it. We continue to improve the trainer, so please check back here regually for new releases.

If you have an idea for a new feature then please complete this form with the details.

1.1 Main Screen

After power on the main screen is displayed.

Clicking on the logo in the top left corner, will display the "About" screen, where you can perform a *Firmware Upgrade*.

Top right is the *Settings* Cog, clicking here will display the settings pages allow reconfiguration of the unit.

The green box in the middle displays the characters which have been decoded from the morse received, while the white box below will show the raw morse as received.

To the right is the **delete** button. Clicking this button will remove the last character decoded.

The *Games* button allows the selection of a game to play or other actities.

The **Clear** button will clear the history of received characters and morse.

CHAPTER

TWO

HARDWARE

2.1 Power Switch

Fig. 1: Right of unit with power switch

The power switch is on the right side of the unit, move the switch forward to turn on the unit, and push away to turn off.

2.2 Morse Key socket

On the Right side is a 3.5mm stereo style socket into which you plug your morse straight key or paddle.

- **Shield** is wired to the common ground.
- **Ring** is wired to dash side of paddle or not connected
- **Tip** is wired to dot side of paddle or straight key

Fig. 2: 3.5mm jack plug

2.3 Audio Output via 3.5mm Jack

The 3.5mm jack on the back of the unit serves dual purposes and can be configured to operate in two different modes:

Key Output Mode (Default)

In this mode, the 3.5mm jack provides digital key signals for external keying circuits or LED indicators:

- **Tip**: Dot signal output (active LOW when dot is pressed)
- **Ring**: Dash signal output (active LOW when dash is pressed, if Paddle Output is enabled)
- **Shield**: Common ground

This mode is useful for:

- Connecting external LED indicators
- Interfacing with radio transmitters
- Connecting to other keying circuits

Audio Output Mode

In this mode, the 3.5mm jack outputs audio tones, allowing you to connect external speakers or headphones:

- Both Tip and Ring output the same audio signal
- Volume is independently controllable (0-100%)
- Tone and Octave settings apply to the audio output

This mode is useful for:

- Connecting external speakers for louder practice
- Using headphones for private practice
- Recording morse code output

Switching Between Modes

You can switch between Key Output and Audio Output modes via the web interface:

1. Connect to device web interface
2. Navigate to Hardware Configuration page

3. In the "Output Configuration" section, toggle "Audio Output"
4. Adjust "3.5mm Jack Volume" if using Audio Output mode
5. Click "Save Hardware Settings"

Volume Control

When in Audio Output mode: - Use the "3.5mm Jack Volume" slider to control external audio volume (0-100%) - The internal buzzer volume is controlled separately via "Internal Buzzer Volume" - The "Sound Enable" master toggle affects both outputs

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Note: The 3.5mm jack audio output uses PWM (Pulse Width Modulation) to generate audio tones. The quality is suitable for morse code practice but is not hi-fi audio quality. A simple speaker or piezo element works best.

2.4 Paddle Hand Configuration

The Morse Trainer supports both right-hand and left-hand paddle operation. You can easily switch between them using either the on-device settings screen or the web interface.

How to Change

Via Settings Screen:

1. Enter Settings screen
2. Press the "Right/Left" button on Page 1
3. Button displays current configuration
4. Press to toggle between modes

Via Web Interface:

1. Connect to device web interface
2. Navigate to Morse Configuration page
3. Select "Right Hand" or "Left Hand" from Paddle Hand dropdown
4. Click "Save Morse Settings"

Note: Your paddle hand preference is saved to device memory and persists across reboots.

2.5 Charging

Warning: Be sure to use a USB-A to USB-C cable to charge.

If you observe the screen begin to flicker then it's a sign the battery is getting low. Plugin to recharge the battery.

The unit can continue to function while recharging.

The Morse Trainer has a 18650 Li-ion battery inside. This will run the unit for around a day. This battery can be recharged via the USB-C socket on the left side. At the back a red light is displayed while charging and blue when the battery is fully charged.

Fig. 3: Back of unit showing charging lights

2.6 NRC unit

A Morse Trainer unit has been dontated to the NRC (National Radio Center, Bletchly Park). It's on the front reception desk for anyone to practice their morse code. If you can't find it please ask a member of staff.

The paddle is also 3D printed, details of making your own paddle can be found on Thingiverse https://www.thingiverse.com/thing:7023246

Fig. 4: NRC demo unit with paddle and morse reference chart

CHAPTER

THREE

SETTINGS

Pressing the cog on the main page will take you into the settings pages.

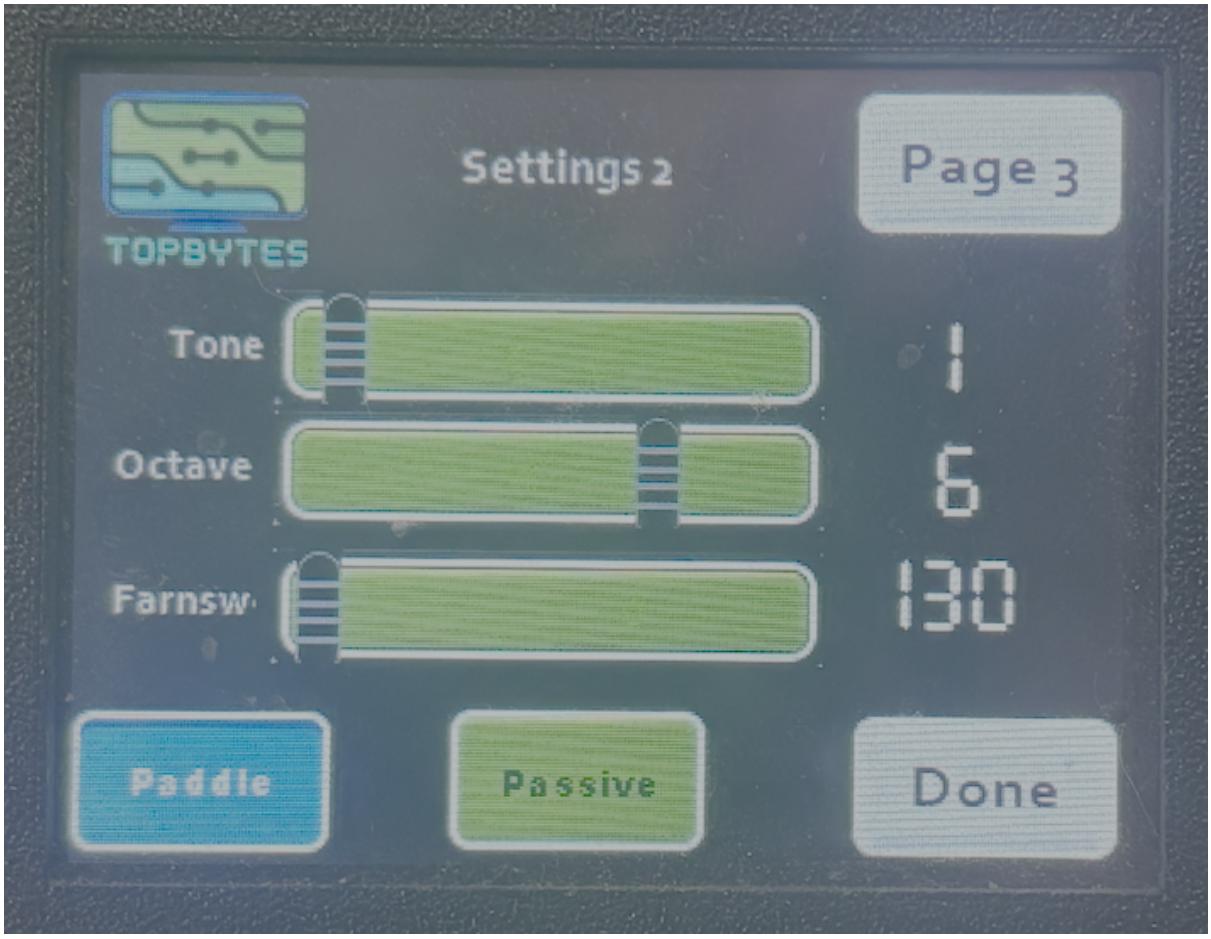
3.1 Page 1

- **WPM**, Words Per Minute, Move the slider to change the length of a dot, which in turn will determine the length of everything else.
- **Right/Left**, Switch the paddle for Left and Right handed operation. This swaps which side of the paddle is a dot and which is a dash in software. See Paddle Hand Configuration for details.
- **Spaces**, add a space to the output when the delay between characters is long enough.
- **Farnsworth**, (if available) Adjust extra spacing between characters (50-2000ms). Higher values give more time to process each character - useful for learning.
- **Audio/Key**, Toggle the 3.5mm jack output between audio tone mode (for speakers/headphones) and key signal mode (for external keying circuits).

- **Koch**, Toggle Koch training mode on or off. When enabled, a slider and level display appear allowing you to set the Koch level (2-40). Games will only use characters up to your current Koch level.
- **Language**, The flag shows the current language selected, clicking on it offers the choice of different languages.

Select the **Done**, button to return to the main page. Pressing **Page 2** will take you to the next page of settings.

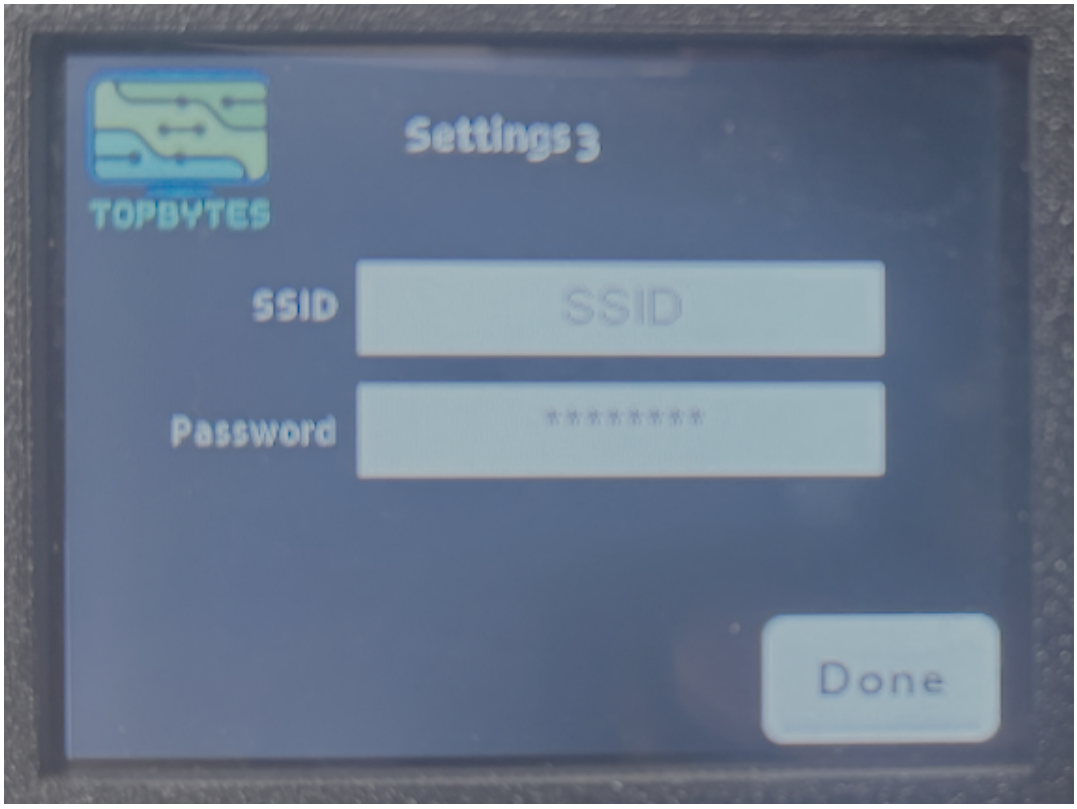
3.2 Page 2



- **Tone**, Select the tone for the morse buzzer
- **Octave**, Adjust the octave of the morse buzzer
- **Farnsworth**, Adjust the Farnswoth, which is the spacing between characters and words.
- **Paddle/Straight**, Select between using a Paddle and a straight key.
- **Passive/Active**, Select between Passive and Active Buzzer.

Note: Tone and Octave settings are only valid when using a "Passive" buzzer and hidden otherwise.

3.3 Page 3 - WiFi Settings



Configuring WIFI, select on the "SSID" and "Password" boxes to enter the credentials to connect to your WIFI network.

3.4 Web Interface Configuration

In addition to on-device settings, you can configure your Morse Trainer via a web interface when connected to WiFi.

Accessing Web Interface

1. Connect device to WiFi network (via Page 3 settings)
2. Note the IP address displayed on screen
3. Open web browser on computer/phone/tablet
4. Navigate to the device IP address

Available Configuration Pages

Hardware Configuration

- Master Sound Control - Sound Enable (master mute toggle) - Tone selection (0-11) for morse audio - Octave selection (1-8) for morse audio
- Key Input - Key Type (Paddle / Straight Key)
- Output Configuration (3.5mm jack) - Paddle Output (separate dash output) - Audio Output (audio tones vs key signals) - 3.5mm Jack Volume (0-100%)
- Buzzer Volume - Internal Buzzer Volume (0-100%)

Morse Configuration

- WPM (Words Per Minute) - 5-60 WPM
- Farnsworth Spacing - 50-2000ms
- ELIZA Response Delay - 5-60 seconds
- Paddle Hand (Right Hand / Left Hand)
- Spaces toggle
- Extra characters toggle

WiFi Configuration

- SSID and password entry
- Connection status

System

- Device information
- Reboot device
- Factory reset
- Firmware update (when not in AP mode)

Note: All settings configured via web interface are automatically saved to device memory and persist across reboots.

Warning: Firmware update button only appears when device is connected to WiFi (not in AP mode), as internet access is required to download firmware updates.

CHAPTER

FOUR

WEB INTERFACE CONFIGURATION

The Morse Trainer includes a built-in web server that allows you to configure all settings via a web browser on your computer, phone, or tablet. This is especially useful for initial setup and detailed configuration.

4.1 Access Point Mode (First Time Setup)

When you first power on your Morse Trainer, or if it cannot connect to a WiFi network, it automatically enters **Access Point (AP) Mode**.

What is AP Mode?

In AP mode, the Morse Trainer creates its own WiFi network that you can connect to directly. This allows you to configure the device even without an existing WiFi network.

Connecting to AP Mode

1. **Power on the Morse Trainer**
2. **Look for the WiFi network** on your device:
   - Network name: `MorseTrainer-XXXXXX` (where XXXXXX is part of the device's MAC address)
   - Password: `morsetrainer`
3. **Connect your computer/phone/tablet** to this network
4. **Open a web browser** and navigate to:
   - Recommended: `http://morsetrainer.local` (works on most devices)
   - Alternative: `http://192.168.4.1` (always works)
5. **You should see the Morse Trainer web interface**

Note: While in AP mode, your device will not have internet access. The Morse Trainer is acting as a router, not providing internet connectivity.

Initial Configuration in AP Mode

Once connected, you should:

1. Navigate to the **WiFi Configuration** page
2. Enter your WiFi network's SSID and password
3. Save the settings
4. The device will reboot and attempt to connect to your WiFi network

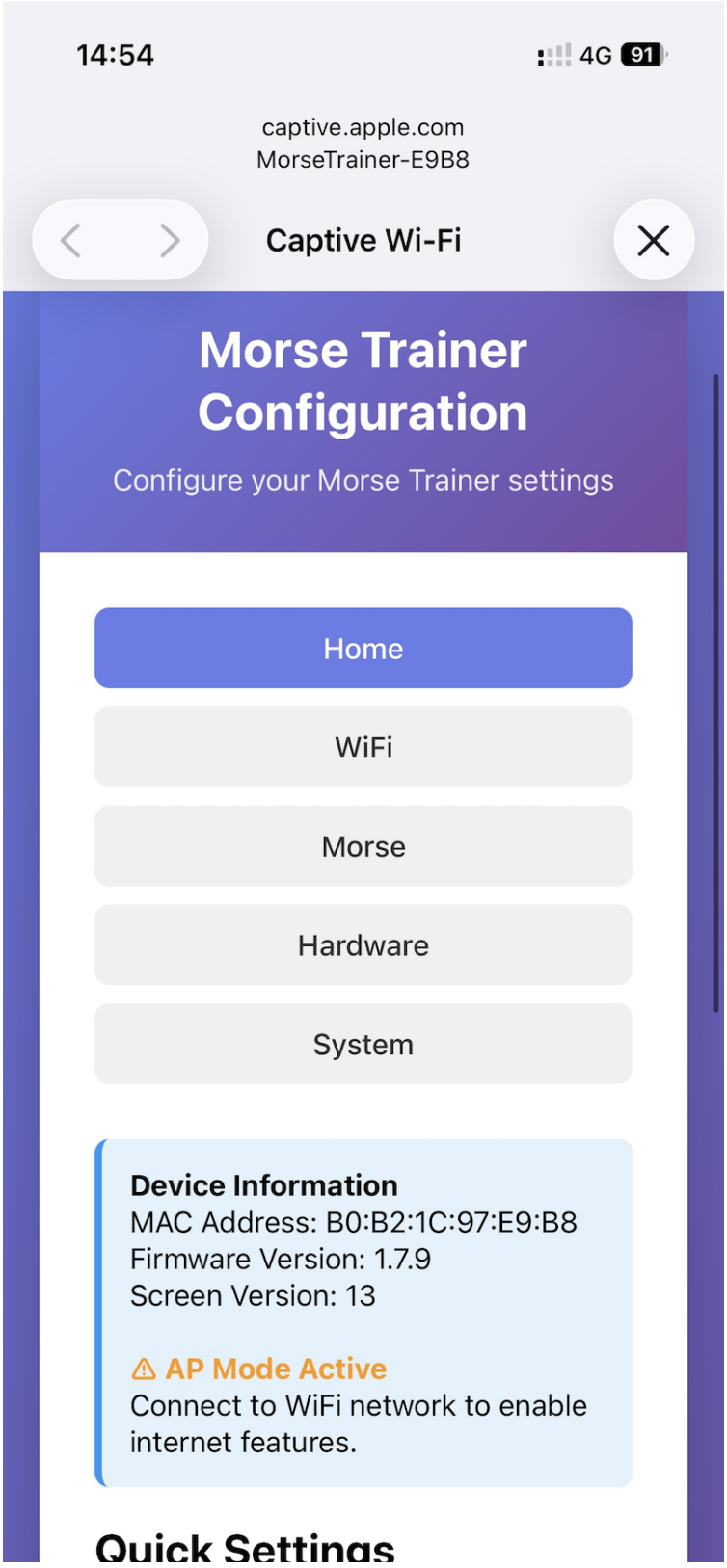


Fig. 1: Morse Trainer in AP Mode

4.2 Station Mode (Normal Operation)

Once configured, the Morse Trainer will connect to your WiFi network in **Station (STA) Mode**. In this mode, the device connects to your existing WiFi network just like any other device (laptop, phone, etc.).

Finding the Device IP Address

After connecting to your WiFi network, you need to find the device's IP address:

Method 1: Check the About Screen

- The IP address is displayed on the About screen (accessible from the main page)
- Shows the local IP in Station mode, `192.168.4.1` in AP mode, or `No WiFi` if not connected

Method 2: Check Serial Console

- Connect via USB
- Serial monitor will show: `Connected to Wifi` followed by `IP: xxx.xxx.xxx.xxx`

Method 3: Use mDNS (Recommended)

- Open a web browser
- Navigate to `http://morsetrainer.local`
- Works on most devices (macOS, iOS, Linux, Android)
- Windows users need Bonjour Print Services installed

Method 4: Check Your Router

- Log into your router's admin panel
- Look for connected devices
- Find device named "morsetrainer"

Accessing the Web Interface in Station Mode

1. **Open a web browser** on any device connected to the same WiFi network
2. **Navigate to the device using one of these methods:**
   - **Recommended**: `http://morsetrainer.local` (works on most devices)
   - **Alternative**: `http://[device-ip-address]` (example: `http://192.168.1.100`)
3. **The web interface home page will load**

4.3 Web Interface Pages

4.3.1 Home Page

URL: /

The home page displays:

- Device information (MAC address, firmware version, screen version)
- Quick navigation to all configuration pages
- Current device status

Available Quick Links:

- WiFi Configuration
- Morse Configuration

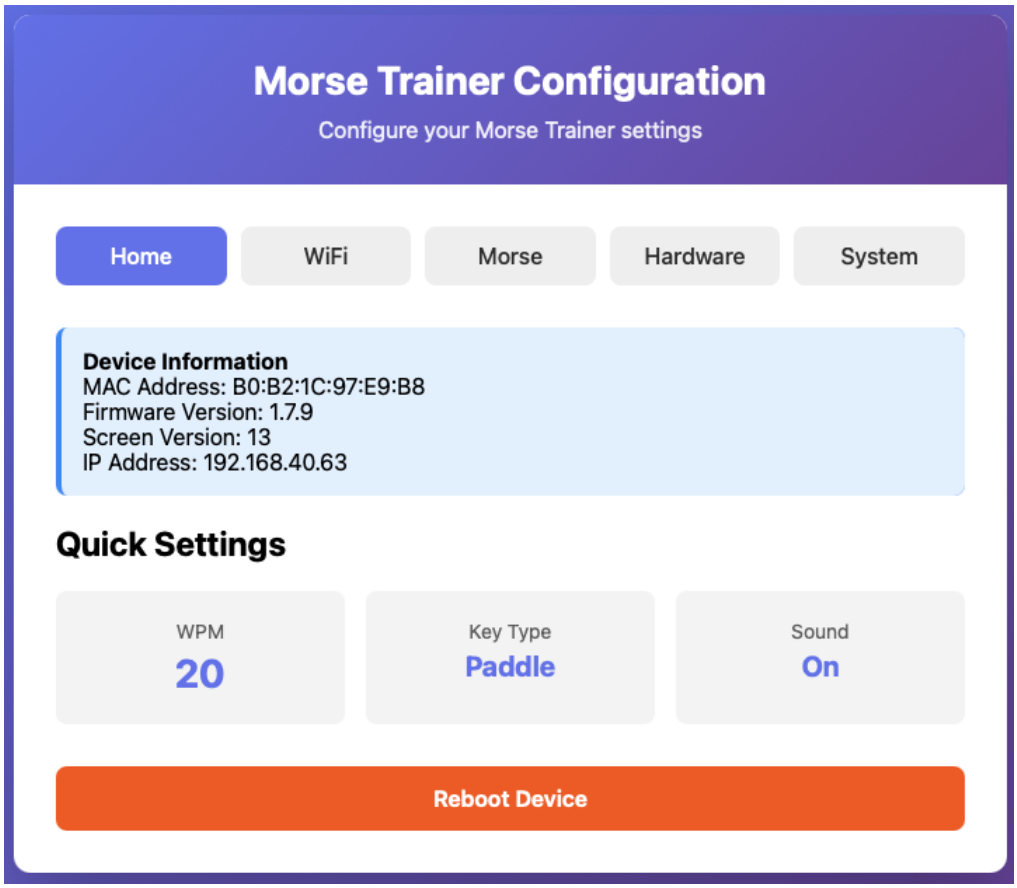
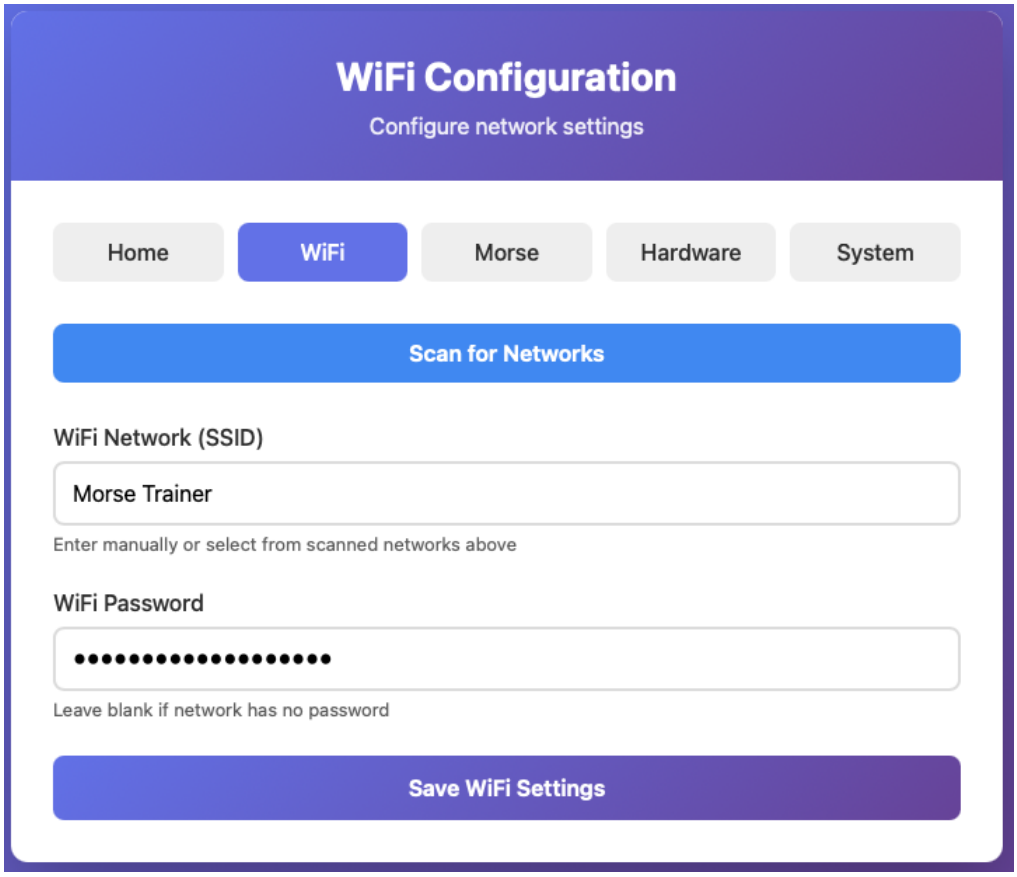


Fig. 2: Web Interface Home Page

- Hardware Configuration
- System Settings

4.3.2 WiFi Configuration

URL: `/wifi`



Configure network connectivity:

Settings:

- **SSID**: Your WiFi network name
- **Password**: Your WiFi network password

After Saving:

- Settings are saved to persistent memory
- Device will reboot
- Attempts to connect to the specified network
- If connection fails, device returns to AP mode

Note: Make sure to enter the SSID and password correctly. If the device cannot connect, it will fall back to AP mode after ~100 connection attempts.

4.3.3 Morse Configuration

URL: `/morse`

Configure morse code timing and game settings:

Settings:

- **WPM (Words Per Minute)**: 5-60 WPM

  Speed of morse code playback

- **Farnsworth Spacing**: 50-2000ms

  Extra spacing between characters for learning. Higher values give more time to process each character.

- **ELIZA Response Delay**: 5-60 seconds

  Time to wait after your last morse input before ELIZA responds in QSO mode

- **Paddle Hand**: Right Hand / Left Hand

  Swap DOT and DASH paddle assignments for left-handed operation

- **Spaces**: Enable/disable automatic space insertion

  Adds spaces when pause between characters is long enough

- **Extra Characters**: Enable/disable extended character set

  Includes punctuation and special characters beyond standard alphanumeric

All settings save immediately and persist across reboots.

4.3.4 Practice Text

URL: `/practice`

Configure custom practice text for the Listen and Send Letters games.

Settings:

- **Practice Text**: A text area where you can paste or type your own practice words and sentences. Words are separated by spaces or newlines.
- **Use Custom Text**: Toggle to enable or disable custom text mode.

  When enabled, the Listen and Send Letters games pick random words from your practice text instead of generating random character strings. Up to 200 words are stored on the device.

Usage Tips:

- Paste callsigns, common QSO phrases, or vocabulary you want to practice
- Text is automatically converted to uppercase
- Each word is picked randomly — longer texts give more variety
- Disable the toggle to return to random character generation at any time
- Factory reset clears the practice text

Note: Practice text is stored in the device's internal preferences memory. No external storage or filesystem is required.

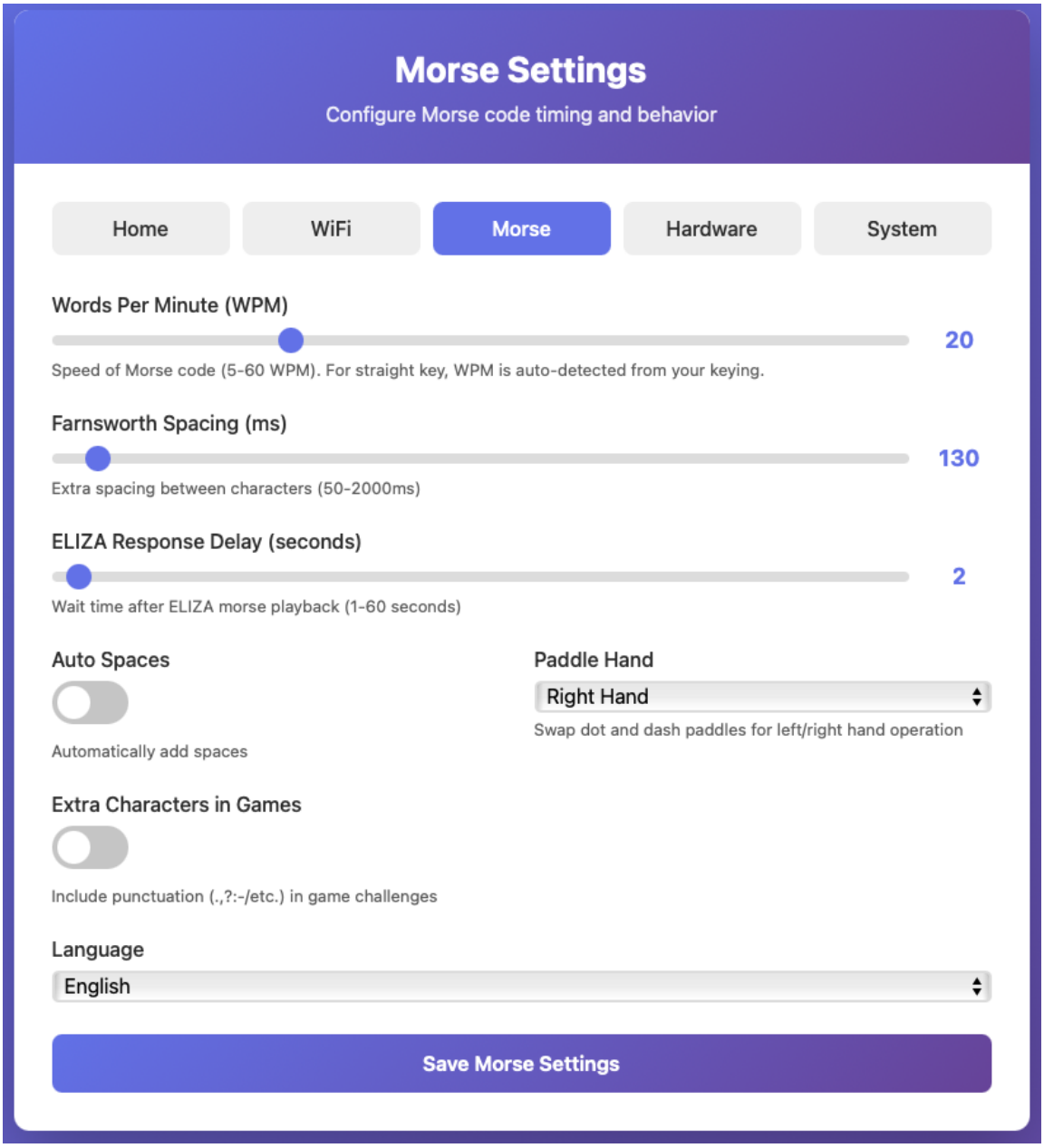


Fig. 3: Morse Configuration Page

4.3.5 Hardware Configuration

URL: `/hardware`

Configure physical hardware settings organized into four main sections:

Master Sound Control

These settings affect all audio outputs (both internal buzzer and 3.5mm jack):

- **Sound Enable**: Toggle audio on/off

  Master mute control for silent operation. Disables both the internal buzzer and 3.5mm jack audio output.

- **Tone**: 0-11 (C through B)

  Musical note for morse audio (passive buzzer only)

  - 0 = C
  - 1 = C#
  - 2 = D
  - 3 = Eb
  - 4 = E
  - 5 = F
  - 6 = F#
  - 7 = G
  - 8 = G#
  - 9 = A (440 Hz - standard pitch)
  - 10 = Bb
  - 11 = B

- **Octave**: 1-8

  Octave range for the selected tone

  - Lower (1-3): Deeper tones
  - Middle (4-5): Standard, pleasant for extended use
  - Higher (6-8): Brighter, more cutting tones

Note: Tone and Octave settings apply to both passive buzzer and 3.5mm audio output. Active buzzers have a fixed frequency.

Key Input

- **Key Type**: Paddle / Straight Key

  Select input device type

Output Configuration

Configure the 3.5mm jack output behavior:

- **Paddle Output**: Enable/disable separate dash output on ring contact

  When enabled, the dash paddle contact triggers output on the ring contact of the 3.5mm jack (for separate dot/dash LED indicators).

- **Audio Output**: Enable/disable audio tone generation on 3.5mm jack

  When enabled, the 3.5mm jack outputs audio tones instead of key signals. Use this to connect external speakers or headphones.

- **3.5mm Jack Volume**: 0-100%

  Volume control for audio output on the 3.5mm jack. Only applies when Audio Output is enabled.

  - 0% = Silent
  - 50% = Default balanced volume
  - 100% = Maximum volume

Note: The 3.5mm jack can operate in two modes:

- **Key Output Mode** (Audio Output disabled): Provides digital key signals for external keying circuits or LED indicators
- **Audio Mode** (Audio Output enabled): Provides PWM audio tones for speakers or headphones

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Buzzer Volume

- **Internal Buzzer Volume**: 0-100%

  Volume control for the device's internal buzzer, independent of the 3.5mm jack volume.

  - 0% = Silent
  - 50% = Default balanced volume
  - 100% = Maximum volume

4.3.6 System Settings

URL: `/system`

Advanced system operations:

Available Actions:

- **Check for Firmware Update**

  (Only visible when connected to WiFi, not in AP mode)

  - Checks server for firmware updates
  - Downloads and installs automatically
  - Device reboots after successful update
  - **Warning:** Requires internet connection and adequate battery

- **Factory Reset**

  - Resets ALL settings to defaults
  - Clears WiFi credentials
  - Clears all preferences
  - Device reboots after reset
  - **Cannot be undone**

- **Reboot Device**

  - Restarts the device
  - All settings are preserved

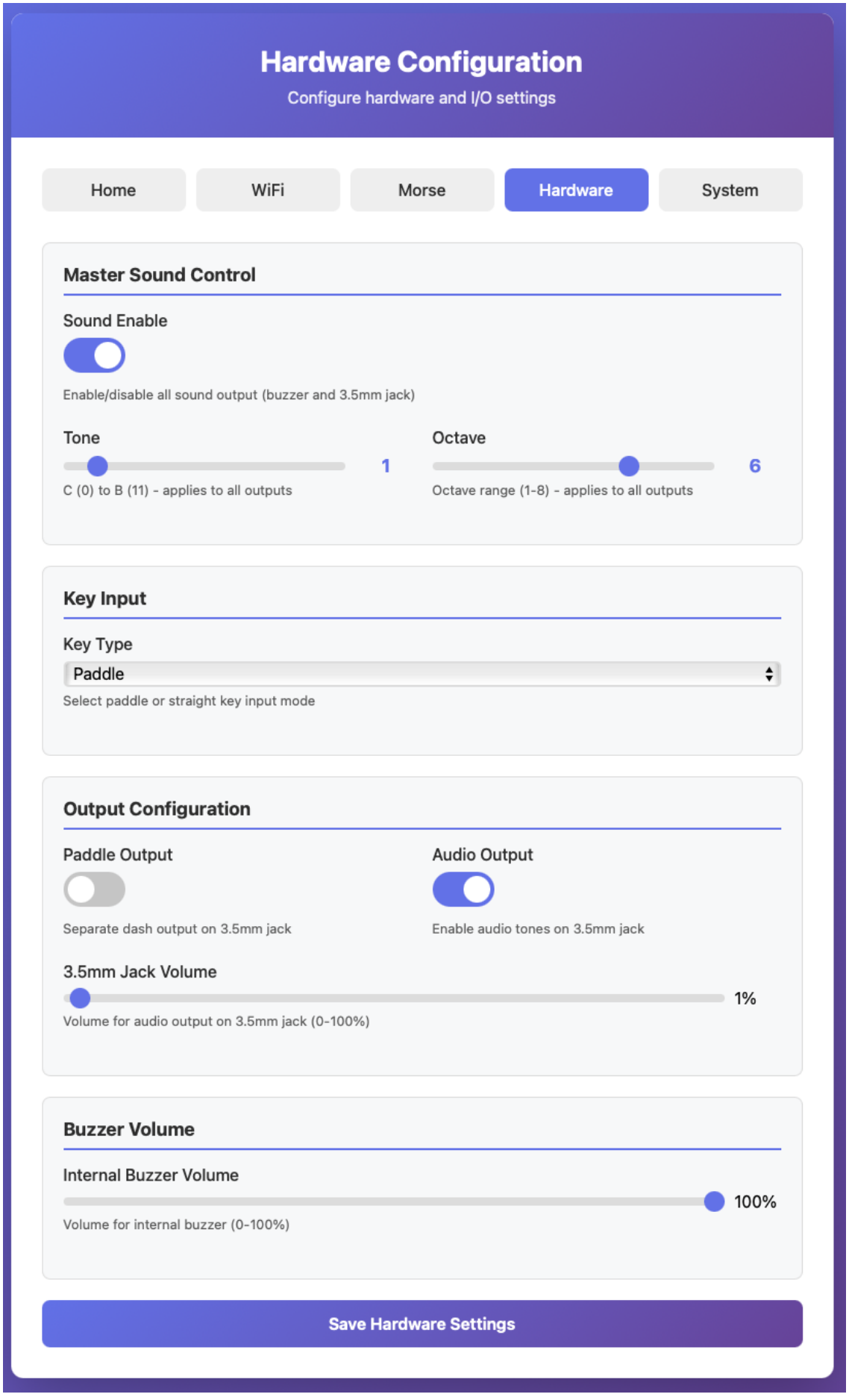


Fig. 4: Hardware Configuration Page

- Useful for applying certain changes or troubleshooting

Danger: Always ensure the device has adequate battery power or is plugged in during firmware updates or factory resets.

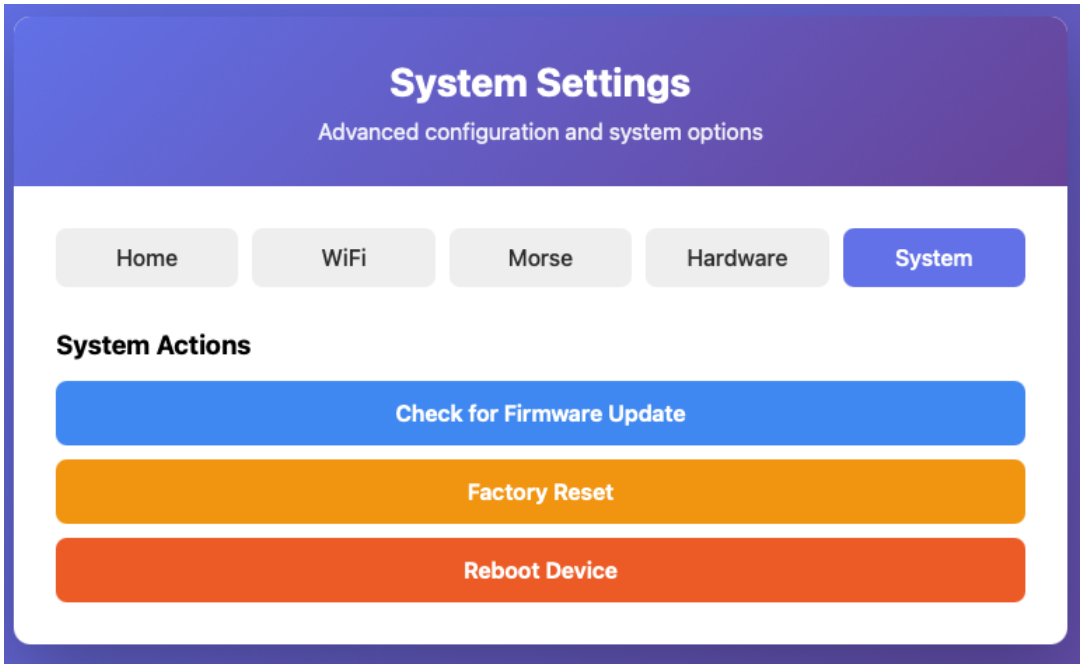


Fig. 5: System Settings Page

4.4 Troubleshooting

4.4.1 Cannot Access Web Interface

Symptom: Browser shows "Cannot connect" or "Page not found"

Solutions:

1. **Verify WiFi Connection**
   - Check device is powered on
   - Verify WiFi credentials are correct
   - Check device WiFi LED status
2. **Try mDNS First**
   - Navigate to `http://morsetrainer.local`
   - Works on most devices without IP lookup
   - If this fails, proceed to next step
3. **Check IP Address**
   - Confirm you're using the correct IP
   - Check serial console or router for IP
   - Scan network for the device

4. **Verify Same Network**
    - Your computer/phone must be on the same WiFi network
    - Cannot access from different network/subnet
5. **Restart Device**
    - Power cycle the Morse Trainer
    - Wait for WiFi connection to establish
    - Try accessing again
6. **Fall Back to AP Mode**
    - If all else fails, factory reset to start over
    - Device will enter AP mode automatically

4.4.2 Device Stuck in AP Mode

Symptom: Device always creates its own network, never connects to WiFi

Causes:

- Incorrect WiFi password
- WiFi network out of range
- WiFi network on 5GHz (ESP32 only supports 2.4GHz)
- Router MAC filtering enabled

Solutions:

1. **Check WiFi Settings**
    - Connect to AP mode
    - Navigate to WiFi Configuration
    - Verify SSID is exactly correct (case-sensitive)
    - Re-enter password carefully
2. **Check Network Compatibility**
    - Ensure network is 2.4GHz, not 5GHz
    - WPA2 security recommended
    - Open networks and WPA/WPA2 supported
3. **Check Router Settings**
    - Disable MAC filtering temporarily
    - Check if router is blocking new devices
    - Verify DHCP is enabled
4. **Check Signal Strength**
    - Move device closer to router
    - Check for interference
    - Try different channel on router

4.4.3 Web Page Not Loading Correctly

Symptom: Page loads but appears broken or incomplete

Solutions:

1. **Clear Browser Cache**
   - Hard refresh: Ctrl+F5 (Windows) or Cmd+Shift+R (Mac)
   - Clear cache and cookies
   - Try different browser
2. **Check Connection Stability**
   - WiFi signal may be weak
   - Try moving closer to device (AP mode) or router (Station mode)
3. **Restart Web Server**
   - Reboot the device
   - Wait for full startup
   - Try accessing again

4.4.4 Firmware Update Fails

Symptom: Update starts but fails to complete

Solutions:

1. **Check Internet Connection**
   - Verify router has internet access
   - Try accessing other websites
   - Device must be in Station mode, not AP mode
2. **Check Battery Level**
   - Ensure battery is charged above 50%
   - Better: plug in during update
   - Low battery can cause update failure
3. **Check Server Availability**
   - Update servers may be temporarily down
   - Try again later
   - Check for announcements
4. **Use Serial Update Method**
   - See *Firmware Upgrade* for alternative update methods
   - Can update via USB serial connection

4.4.5 Settings Not Saving

Symptom: Changes revert after reboot

Solutions:

1. **Verify Save Operation**
   - Click "Save" button after changes
   - Wait for confirmation message
   - Allow time for preferences to write
2. **Check Storage**
   - Preferences storage may be corrupted
   - Try factory reset
   - Reconfigure from scratch
3. **Update Firmware**
   - Older firmware may have bugs
   - Update to latest version
   - Check release notes for fixes

4.5 Advanced Usage

4.5.1 Multiple Devices

You can access multiple Morse Trainers on the same network:

- Each device has a unique IP address
- Each device has a unique AP mode name (based on MAC address)
- Keep track of which IP belongs to which device
- Consider setting static IP addresses in your router

4.5.2 Browser Compatibility

The web interface works with:

- Chrome / Chromium (recommended)
- Firefox
- Safari
- Edge
- Mobile browsers (iOS Safari, Chrome Android)
- Internet Explorer (basic support, may have issues)

4.5.3 Saving Bookmarks

For quick access:

1. Navigate to your device's IP address
2. Bookmark the page
3. Name it "Morse Trainer - [Device Name]"
4. Access anytime from bookmarks

Note: IP addresses may change if using DHCP. Consider setting a static IP reservation in your router for consistent access.

4.5.4 mDNS / Bonjour

The Morse Trainer includes full mDNS (multicast DNS) support for zero-configuration networking:

How to Use:

- Access your device at: `http://morsetrainer.local`
- No need to find or remember IP addresses
- Works automatically in both Station and AP modes

Advantages:

- No IP address lookup needed
- Works even if DHCP assigns different IP
- Consistent access URL across network changes
- Works with multiple Morse Trainers (each has unique name in AP mode)

Note: If `http://morsetrainer.local` doesn't work, fall back to IP address access methods described above. Some corporate or restricted networks may block mDNS traffic.

4.6 Security Considerations

Network Security:

- The web interface has no password protection
- Anyone on the same WiFi network can access and configure the device
- Do not expose to untrusted networks
- AP mode password is `morsetrainer` by default

Recommendations:

1. Use a secure WiFi network with WPA2 encryption
2. Don't connect to public WiFi networks
3. Keep firmware updated for security patches

Data Privacy:

- No personal data is collected or transmitted

- Settings stored locally on device only
- Firmware updates downloaded from official servers
- No analytics or tracking

For additional help:

See also:

- *Settings* - On-device settings configuration
- *Firmware Upgrade* - Firmware update procedures
- *Hardware* - Hardware connections and setup

CHAPTER

FIVE

GAMES

There are currently six games built into the morse trainer. The games are designed to aid in both sending and receiving morse.

Select a game below to learn more about it.

5.1 Follow Me

The Follow Me game is a morse code memory game. The trainer plays a growing sequence of characters in morse and you must key them back correctly.

5.1.1 How to Play

1. Select **Follow Me** from the Games menu
2. The trainer plays a single character in morse
3. Key the character back using your paddle or straight key
4. If correct, the trainer adds another character and plays the full sequence
5. Key back the entire sequence
6. The sequence grows with each successful round
7. A wrong character ends the round — the correct sequence is shown, then a new round begins

5.1.2 Scoring

- **Score** shows how many rounds you completed in the current sequence (resets to 0 on a wrong answer)
- **Best** shows the longest sequence you achieved during the session

5.1.3 Display

The sequence display shows the current target characters. When the sequence exceeds 5 characters, only the last few are shown with a ~ prefix (e.g. `~FGHIJ`).

Touch the sequence display to scroll through the full sequence from start to end.

5.1.4 Replay

Press the **Replay** button at any time to hear the current sequence again. Your input is reset so you can start keying from the beginning after listening.

5.1.5 Koch Mode

When Koch mode is enabled, characters are drawn only from the Koch sequence up to your current level. This integrates Follow Me practice with progressive Koch method learning. The Koch level is shown in the top corner of the screen.

5.1.6 Done

Press **Done** to return to the game selection screen.

5.2 Listen

The listen game generates a random string of characters of the length defined by the slider. **Play** will play out the morse associated with the string. Try and write down the letters. **New** will generate a new string.

Pressing on the green box in the middle will reveal the string to provide confirmation.

5.2.1 Loop Playback

Press and hold the Play button for more than 1 second to enter loop playback mode. The Play button locks down to indicate loop mode is active.

In loop mode:

- A new random string is generated and played
- After playback, the trainer waits 5 seconds then generates and plays another string
- **Short press** Play to stop the loop and return to normal mode

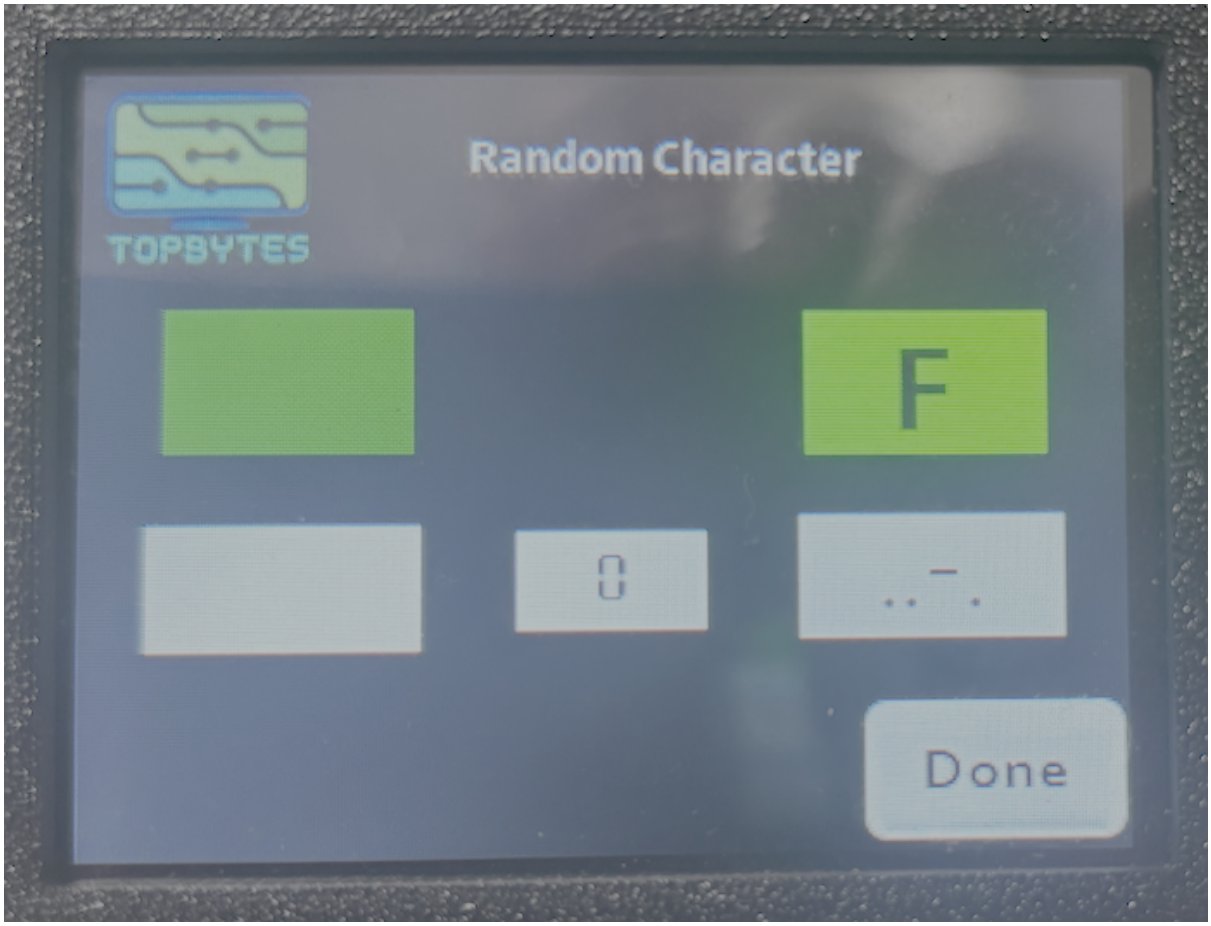
This is useful for continuous listening practice without having to press Play each time.

5.2.2 Custom Word Lists

When a custom practice word list is configured via the *web interface*, the Listen game picks random words from your custom text instead of generating random character strings. The word length slider is hidden as it is not relevant in this mode.

See the *Practice Text* section of the Web Interface documentation for setup instructions.

5.3 Random Letter



On the right is a random character, and below is the morse sequence for it. Press on the morse box to hide it.

on the left side is the morse and character received from the key or paddle.

In the middle is a counter of how many you have correctly sent. Next to that is your percentage correct. See how close you can get to 100%.

5.4 Send Random String

With the send game, a random string is generated of the length defined by the slider.

At the bottom is the raw morse and characters received. When the characters match the Morse Trainer will move onto a new string.

5.5 Send Letters

Select on the green box to enter a string you would like to send. Press "Playback" to start sending the morse.

5.5.1 Loop Playback

The Send Letters game also supports loop playback. **Press and hold** the Play button for more than 1 second to enter loop mode. See the *Listen* game documentation for full details on how loop playback works.

5.5.2 Custom Word Lists

When a custom practice word list is configured via the *web interface*, words are picked from your custom text. The word length slider is hidden in this mode.

5.6 ELIZA Interactive Mode

The Morse Trainer includes an interactive ELIZA mode where you can have two-way conversations in morse code.

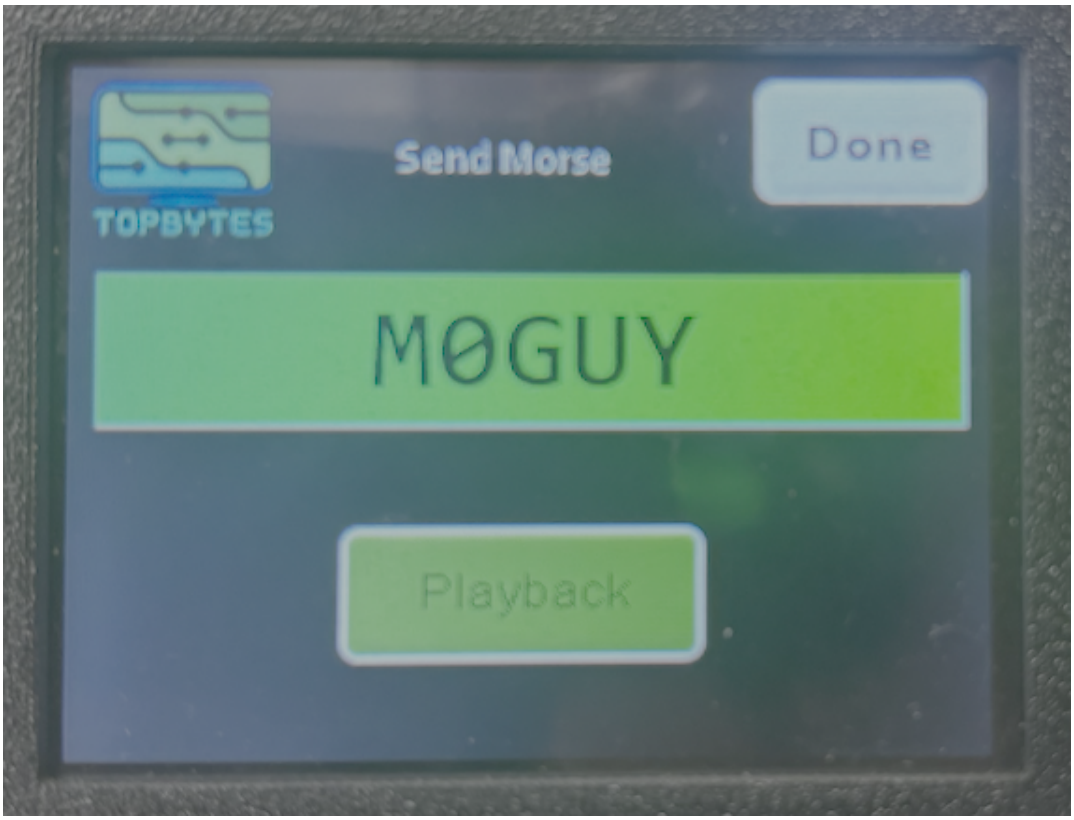
Touching on the green box where ELIZA is showing what's sent toggles to hide and show the text.

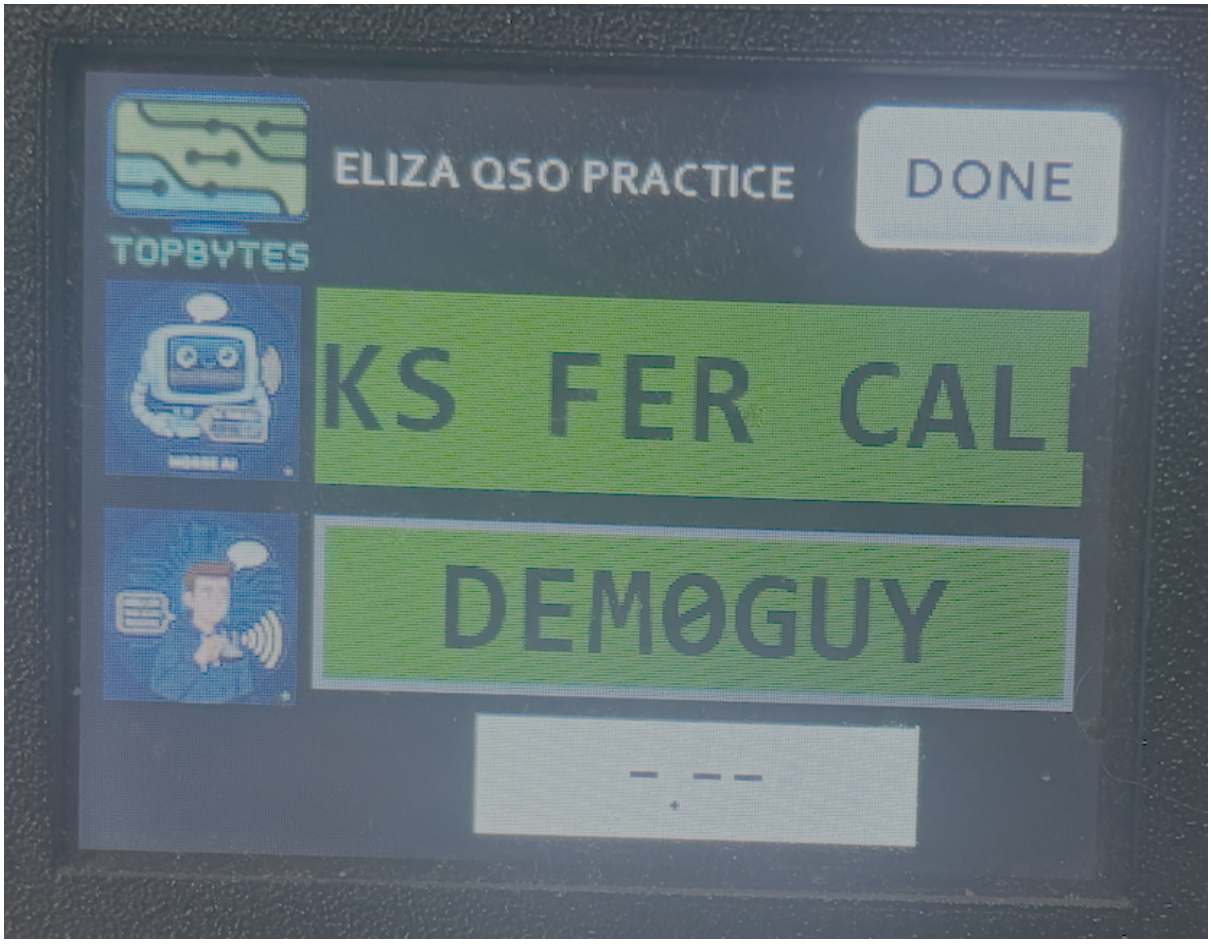
Two Game Modes

Practice Mode

- Free-form conversation without pressure
- No scoring or progress tracking
- Best for casual practice and conversation skills
- Focus on natural QSO flow

Learning Mode


TOPBYTES
Send Morse
Done
M0GUY
Playback


TOPBYTES
ELIZA QSO PRACTICE
DONE
KS FER CAL
DEM0GUY
_ _ _

- Structured QSO protocol teaching
- Tracks 6 QSO elements: RST, QTH, NAME, RIG, ANT, WX
- Visual progress indicators
- Transitions to free-form after covering 5/6 elements
- Best for beginners learning proper QSO protocol

How It Works

1. **ELIZA sends CQ call**: `CQ CQ CQ DE M0GUY M0GUY K`
2. **You respond with your callsign**: Send your callsign (e.g., `W1ABC` or `DE W1ABC`)
3. **ELIZA greets you**: Sends RST, QTH, NAME and asks how you copy
4. **You exchange information**: Send your details (location, name, rig, antenna, weather)
5. **Natural conversation**: ELIZA responds intelligently to your messages
6. **Sign off**: End with `73` when ready to finish

Callsign Recognition

ELIZA supports multiple callsign formats:

- Standard: `DE W1ABC K`
- Simplified: `W1ABC` or `M0GUY`

If ELIZA can't recognize your callsign, it will respond:

```
SRI UR CALL NOT COPIED PSE AGN DE M0GUY K
```

Simply resend your callsign in one of the supported formats.

Response Timing

ELIZA waits for a configurable delay (default 10 seconds) after your last morse input before responding. This mimics natural conversation pacing in real QSOs. You can adjust the ELIZA Response Delay via the web interface (Morse Configuration page).

Aborting Playback

Press the **Done** button at any time to:

- Abort morse playback immediately (within 60-120ms)
- Return to main screen
- Cancel current transmission

The display and buttons remain responsive even while ELIZA is transmitting morse.

Configuration

ELIZA Response Delay

- Default: 10 seconds
- Range: 5-60 seconds
- Configure via web interface (Morse Configuration page)

Farnsworth Spacing

- Range: 50-2000ms
- Extra spacing between characters for learning
- Applies to ELIZA's morse playback
- Configure via web interface (Morse Configuration page)

Common QSO Abbreviations

- **QSO**: Contact/conversation
- **CQ**: General call (seeking any station)
- **DE**: "From" (e.g., CQ DE W1ABC)
- **K**: "Over" (invitation to transmit)
- **BK**: "Back to you"
- **GM/GA/GE**: Good morning/afternoon/evening
- **OM**: Old man (fellow ham)
- **UR**: Your/you're
- **FB**: Fine business (great!)
- **TKS**: Thanks
- **FER**: For
- **CPY**: Copy (understood)
- **HW**: How
- **RST**: Readability-Signal-Tone (signal report)
- **599**: Perfect signal
- **QTH**: Location
- **WX**: Weather
- **ANT**: Antenna
- **RIG**: Radio equipment
- **73**: Best regards (end of conversation)
- **SK**: End of contact

CHAPTER

SIX

MORSE CODE

Listed below are the morse character sequences which are currently understood by the Morse Trainer.

6.1 Standard Morse Characters

Morse	Letter	Morse	Number
.-	A	-----	0
-...	B	.----	1
-.-.	C	..---	2
-..	D	...--	3
.	E	....-	4
..-.	F	.....	5
--.	G	-....	6
....	H	--...	7
..	I	---..	8
.---	J	----.	9
-.-	K		
.-..	L		
--	M		
-.	N		
---	O		
.--.	P		
--.-	Q		
.-.	R		
...	S		
-	T		
..-	U		
...-	V		
.--	W		
-..-	X		
-.--	Y		
--..	Z		

6.2 Punctuation characters

Morse	Character
--..--	,
..--..	?
---...	:
-....-	-
-.--.	(
-...-	=
-..-	x
.-.-.-	.
-.-.-.	;
-..-.	/
.----.	'
..--.-	_
-.--.-	)
.-.-.	+
.--.-.	@

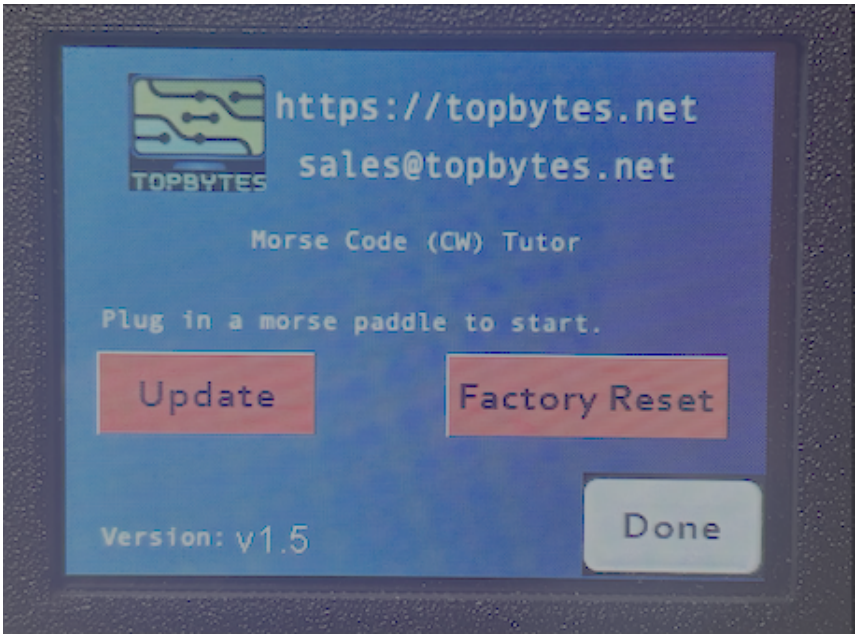
CHAPTER

SEVEN

FIRMWARE UPGRADE

As new features are released. New firmware for the Morse Trainer will be released. There are two systems which will need to be upgraded, the screen and the micro processor.

Danger: Make sure the unit has enough battery power or plugged in during the upgrade.

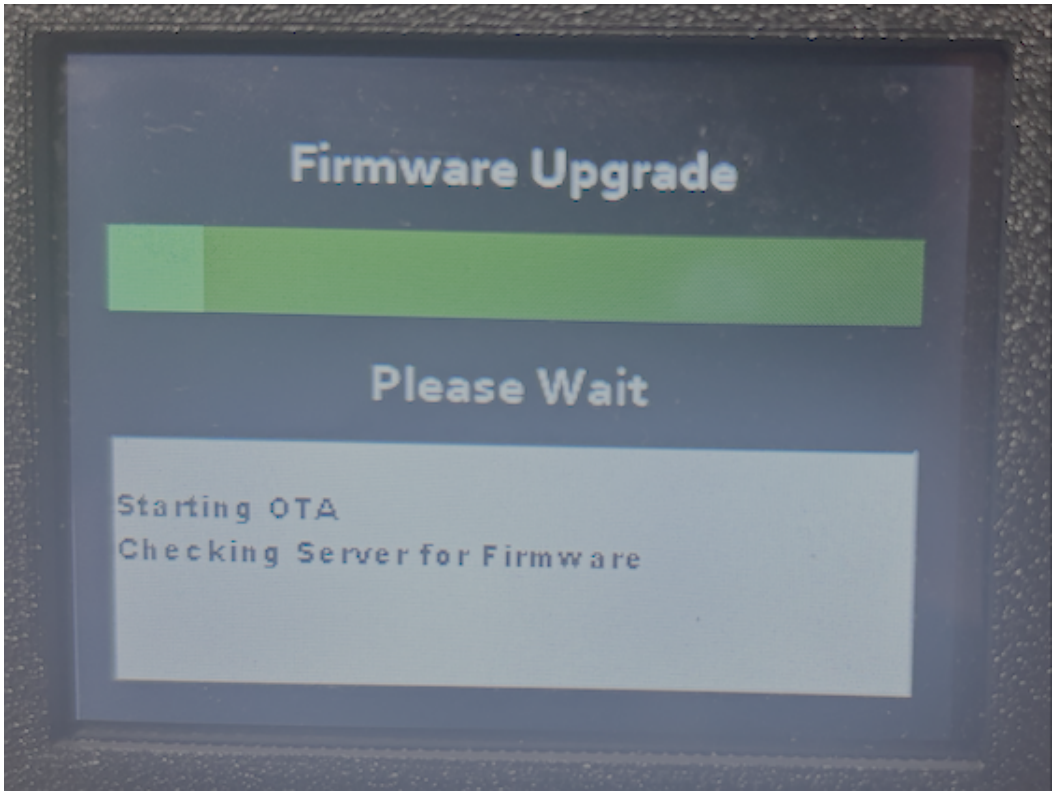


The simplest way to upgrade the firmware is to provide the Morse Trainer with a WiFi connection, and then press the "Update" button on the About screen.

On pressing the "Update" button, if you have configured the WiFi the Morse Trainer will connect to our servers and start downloading the firmware for the micro processor. Once the firmware is received and validated the unit will reboot. On reboot should a new screen firmware be required, this will then be downloaded and written to the screen. Once complete the unit will reboot again and be ready for use.

Danger: Do not turn off the unit until the upgrade has completed.

You should notice the version on the boot screen and About page have changed to reflect the new image.



7.1 Emergency Recovery

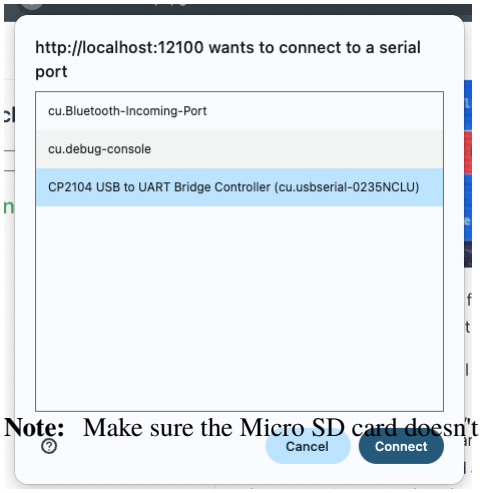
Should the Over The Air (OTA) firmware update fail and the system stops to function, it's possible to recover the system directly. You will need to unscrew the 4 case screws on the sides and pull apart. Inside you will see the micro processor board with it's own micro USB socket.

You will need a micro USB to USB cable (make sure it's one which provides data not just power). Plug the Morse Trainer into your computer.

Note: You need to use the Chrome web browser to perform the upgrade

---

Click on the "Connect" button above and select the USB port associated with your Morse Trainer



Once connected you'll see a dialog with two options

- INSTALL MORSE TRAINER
- LOGS & CONSOLE

Select the "Install Morse Trainer" to begin reinstalling the firmware. Once the firmware is restored, it will connect to the screen and check it's firmware. If necessary it will attempt to upgrade it. However if you haven't configured WiFi then this will fail.

If the screen upgrade fails, you will need to force the update. Copy the TFT file to a micro SD card formatted FAT32.

Note: Make sure the Micro SD card doesn't have any other files in the root folder.

Install the SD card into the screen and power on the Morse Trainer. Wait for the install to complete. Power off the Morse Trainer, and

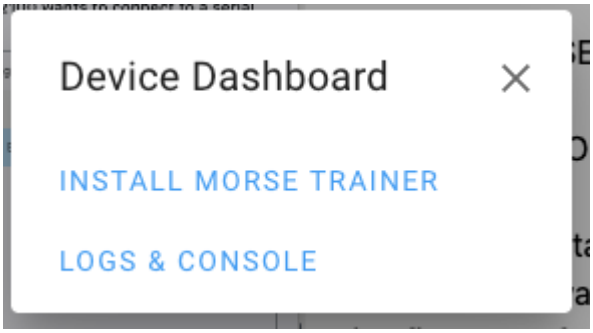
remove the SD Card.

Power the unit back on and it will be recovered to the latest version.

7.2 Factory Reset

Factory reset will restore all the Morse Trainer settings back to their defaults.

Should the Morse Trainer stop performing as expected, first plug the Morse Trainer into USB power and allow to charge. If after recharging the battery it's still having issues, you can try to resetting to factory defaults.



7.3 Console

Selecting Console will provide debug information during operation. You can also send commands via serial to the micro processor. This is most useful for debugging and development.

7.3.1 Update Screen

```
update screen
```

This will force a redownload and update of the screen. It doesn't matter the current version running.

7.3.2 Update Firmware

```
update firmware
```

Update the firmware on the micro processor, same function as pressing the "update" button on the about page.

7.3.3 SSID

```
ssid <WIFI NETWORK NAME>
```

Update the WIFI network name.

7.3.4 WiFi Password

```
password <WIFI PASSWORD>
```

Update the WIFI network password, this can be helpful if the password is complex, and can be hard to type in on the touch screen.

7.3.5 Reboot ESP

```
reboot esp
```

Restart the micro processor.

7.3.6 Reboot Screen

```
reboot screen
```

Restart the screen. After the screen has restarted, it will appear to hang only showing the "Boot" screen. This is because the micro processor thinks the screen is on a different one. It's therefor necessary to also reboot the esp afterwards.

7.3.7 Restore

```
restore
```

Factory reset the Morse Trainer to defaults.

7.3.8 Calibrate

```
calibrate
```

Set the screen to calibrate, for touch calibration

7.3.9 Settings

```
settings
```

Display the current settings configured.

CHAPTER

EIGHT

RELEASE NOTES

8.1 Version 3.0.0 (February 2026)

New Features

1. "Follow Me" Game

- **New game mode:** Trainer plays a growing morse sequence, player must repeat it back
- **Progressive difficulty:** Each correct repetition adds one character to the sequence
- **Score tracking:** Current score and best score (session) displayed on screen
- **Replay button:** Re-hear the current sequence at any time (resets input for a fresh attempt)
- **Touch-to-scroll:** Tap the sequence display to scroll through the full sequence when truncated
- **Truncated display:** Shows last 4 characters with ~ prefix when sequence exceeds 5 characters
- **Koch mode support:** When Koch mode is active, characters are drawn from the Koch sequence at the current level
- **Localized:** "Follow Me" title and button labels in EN, FR, DE

2. Loop Playback for Listen and Send Letters Games

- **Press-and-hold Play (>1s):** Enters loop mode — generates a new word, plays it, waits 5 seconds, repeats
- **Visual indicator:** Play button locks down while looping
- **Short press to stop:** Tap Play during loop to stop immediately
- **Works with custom word lists:** Loop mode uses practice text when enabled

3. Custom Practice Word Lists via Web Interface

- **New `/practice` web page:** Paste custom practice text into a textarea
- **Toggle control:** Enable/disable custom text mode from the web interface
- **Used in games:** Listen and Send Letters games pick random words from the practice text
- **Word length controls hidden:** When custom text is active, the word length slider/label are automatically hidden (not relevant)
- **Up to 200 words:** Text is split by whitespace and stored as individual words
- **Factory reset clears:** Practice text and custom text mode cleared on factory reset

4. Settings Page Enhancements

- **Audio Output toggle:** Switch between 3.5mm audio output and key signal output directly from Settings page 1
- **Koch Mode toggle:** Enable/disable Koch training mode from Settings
- **Koch Level slider:** Set Koch level (2-40) with a slider

- **Auto-hide:** Koch slider and level display hidden when Koch mode is off

5. About Page — IP Address Display

- **Station mode:** Shows local IP (e.g. *192.168.1.42*)
- **AP mode:** Shows AP IP (*192.168.4.1*)
- **No WiFi:** Shows *No WiFi*

8.2 Version 2.0.4 (November 2025)

Critical Bug Fixes

1. WiFi Connection Timeout Fix

- **Fixed boot hang**: Device now boots successfully even when configured WiFi network is unavailable
- **10-second timeout**: Maximum 10 seconds (100 × 100ms) to attempt WiFi connection before continuing
- **Graceful fallback**: Automatically enters AP mode if WiFi connection fails
- **Improved reliability**: Device always completes boot sequence regardless of network availability

2. Morse Character Gap Timing Fix

- **Corrected timing**: Character gap reduced from 5× to 3× dot length (standard Morse timing)
- **Better recognition**: Characters decode faster and more accurately
- **Prevents merging**: Fixed issue where characters would merge together due to excessive gap timeout
- **Standard compliance**: Now matches worldwide Morse code timing standards
- **Example at 20 WPM**: Character gap reduced from 300ms to 180ms

3. ELIZA Word Spacing with Farnsworth

- **Always includes spaces**: ELIZA responses now properly play spaces between words
- **Farnsworth support**: Word spacing honors Farnsworth timing settings
- **Adaptive spacing**: - Standard mode: 7 dot lengths for word spacing - Farnsworth mode: Extended spacing (FARNSWORTH + 4 dot lengths)
- **Fixed delays**: Uncommented delay calls that were preventing proper timing
- **Responsive abort**: Delays broken into 50ms chunks for quick Done button response

Straight Key Improvements

- **Stereo Audio Output**: Fixed audio only coming from right channel when using headphones in straight key mode
  - Audio outputs to both DOT_OUT_PIN and DASH_OUT_PIN for stereo
  - Respects AUDIO_VOLUME setting (0-100%)
  - Consistent with paddle mode implementation
- **WPM Timing Updates**: Web interface WPM changes now immediately update straight key timing
  - Automatic recalculation of DOT_LENGTH, DASH_LENGTH, and CHARACTER_GAP_MS
  - Fixes bug where WPM changes had no effect on straight key detection
  - Web interface now behaves identically to Nextion screen adjustments

Bug Fixes

- Fixed straight key stereo audio output (was mono, right channel only)
- Fixed WPM timing synchronization for straight key mode

8.3 Version 2.0.3 (November 2025)

Network Configuration Improvements

- **DHCP Hostname**: Device now properly registers as "morsetrainer" with DHCP servers instead of using default ESP32 hostname
- **mDNS/Bonjour Support**: Full zero-configuration networking implementation
  - Access device at `http://morsetrainer.local` without knowing IP address
  - Works in both Station mode (WiFi connected) and AP mode
  - Cross-platform: macOS, iOS, Linux (Avahi), Windows (Bonjour Print Services)
  - Automatic startup when WiFi connects

Bug Fixes

- **LEDC Channel Management**: Fixed potential GPIO interrupt conflicts by using explicit LEDC channel assignments
  - Channel 0: Internal buzzer (7-bit resolution)
  - Channel 1: Dot audio output (12-bit resolution)
  - Channel 2: Dash audio output (12-bit resolution)
- **Straight Key Buzzer Volume**: Volume control now properly applied in straight key mode, consistent with paddle mode behavior

8.4 Version 2.0.1 (November 2025)

New Audio Features

- **Audio Output on 3.5mm Jack**: The 3.5mm jack can now output PWM-generated audio tones for connecting external speakers or headphones
- **Dual-Mode 3.5mm Jack**: Switchable between Key Output mode (digital signals for LEDs/keying circuits) and Audio Output mode (morse code tones)
- **Independent Volume Controls**: Separate volume sliders (0-100%) for both the internal buzzer and 3.5mm audio output
- **Master Sound Control**: Unified sound enable toggle affects both buzzer and audio outputs

Web Interface Improvements

- **Reorganized Hardware Page**: Settings now organized into logical sections with visual grouping:
  - Master Sound Control (affects all outputs)
  - Key Input configuration
  - Output Configuration (3.5mm jack settings)
  - Buzzer Volume control
- **Improved Settings Organization**: Paddle Hand setting moved to Morse Configuration page for better logical grouping

Straight Key Enhancements

- **Adaptive Timing Detection**: Intelligent auto-detection of WPM and dot/dash timing for straight key operation
  - Automatically analyzes timing patterns from a circular buffer of 30 samples
  - Finds natural clustering between dots and dashes to determine optimal threshold

  - Auto-calculates WPM based on average dot length using PARIS standard
  - Continuously adapts to operator's keying speed changes
  - No manual WIGGLE adjustment needed

Documentation Updates

- New section on *Audio Output* explaining both operating modes
- Updated Hardware Configuration documentation with detailed audio settings
- Enhanced web interface documentation reflecting reorganized settings

8.5 Version 2.0.0 (November 2025)

New Features

- **ELIZA**: QSO Chat bot. Hold a complete QSO with the trainer or just have a chat
- **Farnsworth Timing**: implemented in ELIZA mode and all morse playback
- **Conditional Firmware Update Button**: Update button intelligently hidden when in AP mode (no internet access)

User Experience Improvements

- **Morse Playback Abort**: Done button now aborts morse playback within 60-120ms instead of waiting for entire message
- **Screen Updates During Playback**: Display and buttons remain responsive while morse is being transmitted
- **Interrupt-Based Paddle Detection**: Enhanced with 20ms debounce time and 30ms element spacing for reliable operation

8.6 Version 1.7.8 (September 2025)

- Improved battery performance by shutting down WIFI module when not required.

8.7 Version 1.7.7 (2nd September 2025)

- **New Game Added**, *ELIZA Interactive Mode*, listen to some common QSO transmissions.

8.8 Version 1.7.6 (1st September 2025)

- Slight shift around on the About screen
- Added percent correct counter on Random letter game
- New Update service
- Support for Special Editions

8.9 Version 1.7.5 (24th August 2025)

- Add Incorrect and Percentage correct values to Random Letter Game. How is your accuracy?

8.10 Version 1.7.4 (16th August 2025)

- Fixed pass through when using straight key

8.11 Version 1.7.3 (15th August 2025)

- Fixed issue with Mute when using a straight key

8.12 Version 1.7.2 (14th August 2025)

- Fixed issue with setting SSID and password on screen. If you can't set the WIFI details
  - Follow the *Emergency Recovery* process.

  or
  - Create a temporary WIFI network (eg Phone hotspot) with the following values and upgrade normally.
    - SSID **Morse Trainer**
    - PASSWORD **emj@ghm6cph*mcp8AKC**

8.13 Version 1.7.1 (3rd August 2025)

- Localisation with initial support for the following languages
  - English
  - French
  - German
- Fixed issue with Random letter, when hiding the required morse it would show again on next character
- Send game word hidden until touched
- Listen Game characters hidden until touched

8.14 Version 1.6.5 (31st July 2025)

- Fixed issue with entering SSID and Password via console connections

8.15 Version 1.6.4 (15th July 2025)

- Display ID of unit on About screen

8.16 Version 1.6.3 (14th July 2025)

- Fixed show hide for send and listen games.
- Changed slide limits to 2-10 for send and listen games
- Fixed Show hide morse for Random Character game.

8.17 Version 1.6.2 (8th July 2025)

- Fixed issue with Random letter game sometimes showing a blank Character

8.18 Version 1.6.1 (7th July 2025)

- Removed quote (") from list of chars, it was causing issues in Random letter Game
- Fixed issue with slow morse decode when not on main screen.
- Fixed issue on "Send Game" where slider didn't update size of characters to send
- Updated straight key support, added "Wiggle" slider. Adds a wiggle factor for the length of a dot and dash. Adjust along with the WPM.
- Removed the "Pullup/down" button, all the "offical" trainers no longer require this.

8.19 Version 1.5.6 (16th June 2025)

- Adding "Calibrate" command to serial console

8.20 Version 1.5.5 (10th June 2025)

- Check which screen is currently displayed and switch from boot screen if necessary inside loop
- Updated screen firmware to feed back which screen is being displayed

8.21 Version 1.5.4 (10th June 2025)

- Removed the multiplication symble as a seperate char. It's the same as 'x'

8.22 Version 1.5.3 (4th June 2025)

- Display longer version numbers
- Align boot screen version information
- Fixed issue with storing WIFI credentials

8.23 Version 1.4 (27th May 2025)

- Adding console commands
- Hide, Tone and Octave sliders when selecting "active" buzzer
- Improved feedback for firmware update, new update page, with progress bar

CHAPTER

NINE

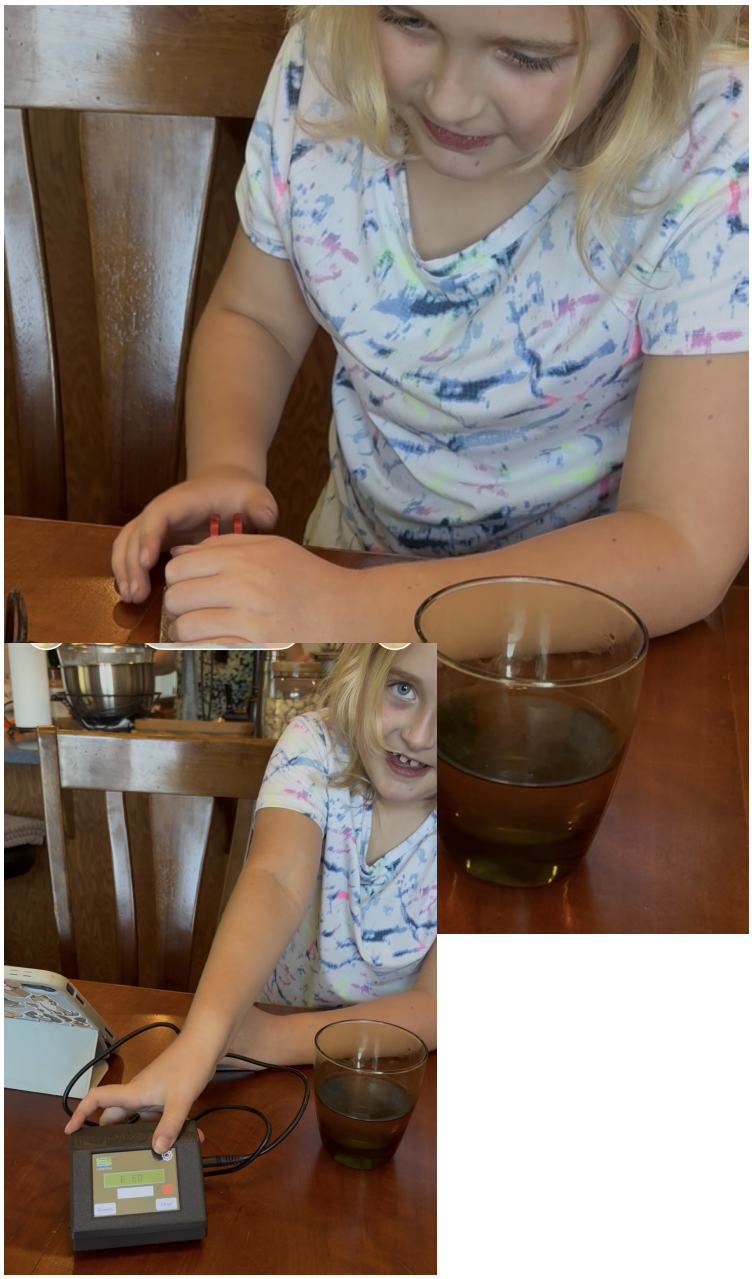
TESTIMONIALS

9.1 Ian Andrews

This a great little product and well worth the wait its teaching me a lot about morse code the only thing I found was the charging point came loose inside but soon remedied that ! Its sturdy and love all the functions on it ! This is now my new hobby as Dan at ml&s will tell you ! I dont think there's anything on the market that will match it !

9.2 Adam Gilmore (G1ZHD)

9.3 Terry Webster (KD9DWU)



Topbytes Morse Trainer is exactly the teaching aide I needed to start my CW training. I had stalled using other methods and was at the point of giving up. My old ears and brain wasn't getting it. Then I saw a video from ML&S on the Morse Trainer. I decided to give it a go. And I'm very pleased that I did. I'm able to hear and see what I'm sending and I'm able to retain it. Just what I needed. The best thing about this purchased is my granddaughter saw the Morse Trainer and wanted to know what it was. She was fascinated in turning dits and dahs into letters. She's only nine yrs old. So I hope I may have CW buddy in the future. I won't go into all the features of the Morse Trainer because there are plenty of videos talking about it. Keep up the great work Guy!!!

CHAPTER

TEN

REGULATORY COMPLIANCE

10.1 EU Declaration of Conformity

Hereby, **TopBytes Ltd** declares that the radio equipment type **Morse Trainer** (Model: MORSETRAINER-01) is in compliance with Directive 2014/53/EU (Radio Equipment Directive).

The full text of the EU Declaration of Conformity is available at:

https://morse.topbytes.net/compliance

10.2 Applicable EU Directives

This product complies with the essential requirements of the following EU directives:

Directive	Title
2014/53/EU	Radio Equipment Directive (RED)
2011/65/EU	Restriction of Hazardous Substances (RoHS), as amended by 2015/863
2012/19/EU	Waste Electrical and Electronic Equipment (WEEE)
Regulation (EU) 2023/1542	EU Battery Regulation

Note: The Radio Equipment Directive 2014/53/EU covers the essential requirements of both the EMC Directive 2014/30/EU and the Low Voltage Directive 2014/35/EU for radio equipment. These are therefore not declared separately.

10.3 Harmonised Standards Applied

The following harmonised standards have been applied to demonstrate conformity:

Standard	Title	Essential Requirement
EN 300 328 V2.2.2	Wideband transmission systems -- 2.4 GHz band	Article 3.2 -- Radio spectrum
EN 301 489-1 V2.2.3	EMC for radio equipment -- Common requirements	Article 3.1(b) -- EMC
EN 301 489-17 V3.2.4	EMC for radio equipment -- WLAN specific	Article 3.1(b) -- EMC
EN IEC 62368-1:2020 +A11	Audio/video, IT & communication equipment -- Safety	Article 3.1(a) -- Health & Safety
EN 62311:2020	Human exposure to electromagnetic fields	Article 3.1(a) -- RF exposure
EN IEC 62133-2:2017 +A2	Portable sealed secondary lithium cells and batteries -- Safety	Article 3.1(a) -- Battery safety
EN IEC 63000:2018	RoHS technical documentation	RoHS Directive 2011/65/EU

10.4 Radio Equipment Information

10.4.1 WiFi Operating Parameters

Technology	IEEE 802.11 b/g/n (WiFi)
Operating frequency band	2400--2483.5 MHz
Maximum transmit power	< 100 mW (20 dBm) EIRP
Number of channels	13 (EU)
Channel bandwidth	20 MHz
Antenna	Internal (PCB trace, non-removable)

10.4.2 Operating Restrictions

The 2.4 GHz WiFi frequency band (2400--2483.5 MHz) is harmonised across all EU and EEA member states. There are **no country-specific restrictions** for this product within the EU/EEA.

This device operates as a WiFi client (infrastructure mode) connecting to existing wireless networks. It also supports access point (AP) mode for initial configuration. It does not function as a general-purpose wireless router or repeater.

10.5 RF Exposure Information

This device complies with EU requirements for limiting exposure of the general public to electromagnetic fields, as assessed in accordance with EN 62311:2020.

The Morse Trainer is a low-power device that transmits at a maximum of 100 mW EIRP in the 2.4 GHz band. It is designed for tabletop or desktop use and is not intended to be worn on the body or held against the head.

This device has been evaluated for RF exposure compliance at a minimum separation distance of **20 cm** between the device and the user's body. At this distance and power level, the electromagnetic field exposure is well below the limits set by Council Recommendation 1999/519/EC (based on ICNIRP guidelines).

Recommendations:

- Use the device on a desk, table, or shelf -- not directly against the body
- Do not modify the antenna or connect external antennas
- If co-locating with other radio equipment, maintain reasonable separation

10.6 Safety Warnings

10.6.1 Battery Safety

Warning: This device contains a rechargeable lithium-ion (Li-ion) 18650 battery.

- Use only replacement batteries of the same type, chemistry, and rating.
- Do not short-circuit, puncture, crush, or incinerate the battery.
- Do not expose the battery to temperatures above 60°C or below -20°C.
- If the battery appears swollen, leaking, or damaged, stop using the device immediately. Do not attempt to charge a damaged battery.
- Charge only with a certified USB power supply (5V, CE-marked).
- Do not leave the device charging unattended for extended periods.
- Keep spare batteries away from metallic objects (coins, keys) that could short-circuit the terminals.
- The battery is user-replaceable. When replacing, ensure correct polarity.

10.6.2 Charging

- Charge the device using the USB-C port with a compliant 5V USB power supply.
- The red LED indicates charging is in progress; the blue LED indicates charging is complete.
- Do not use damaged cables or power supplies.
- Disconnect the USB cable during thunderstorms.
- Do not charge the device in direct sunlight or near heat sources.

10.6.3 Operating Environment

- **Indoor use only.** This device is not designed for outdoor or weatherproof use.
- Operating temperature: 0°C to +40°C.
- Storage temperature: -20°C to +60°C.
- Humidity: 20% to 80% relative humidity, non-condensing.
- Do not expose the device to moisture, rain, or liquids.
- Do not use the device in dusty, dirty, or excessively hot or cold environments.
- Do not block ventilation openings or place the device in enclosed spaces without airflow.
- Maximum operating altitude: 2000 m above sea level.

10.6.4 General Safety

- **This device is not a toy.** Keep out of reach of small children.
- Do not disassemble, modify, or attempt to repair the device beyond battery replacement. There are no other user-serviceable parts inside.
- Do not expose the device to strong magnetic fields, excessive vibration, or mechanical shock.
- If the device emits unusual smells, sounds, or smoke, disconnect the power and remove the battery immediately. Contact the manufacturer.
- This device is intended for Morse code training and amateur radio hobbyists. It is not intended for use in safety-critical, medical, or life-support applications.

10.6.5 Audio Output

- When using headphones or earphones via the 3.5mm jack, start at a low volume and increase gradually.
- Prolonged listening at high volume may cause hearing fatigue.
- The built-in buzzer produces audible tones during Morse code practice. This is normal operation.

10.7 Waste Disposal (WEEE)

This product is marked with the crossed-out wheelie bin symbol, indicating that it must **not** be disposed of with unsorted household waste when it reaches the end of its life.

Correct disposal: Take the product to a designated collection facility for the recycling of waste electrical and electronic equipment (WEEE). Contact your local authority or retailer for information on your nearest collection point.

Separate collection and recycling of waste electrical and electronic equipment helps to:

- Conserve natural resources
- Ensure hazardous substances are handled safely
- Protect the environment and human health

10.7.1 Battery Disposal

The 18650 Li-ion battery must be removed and disposed of separately. Do not dispose of batteries in household waste.

Take used batteries to a designated battery collection point. Many retailers and local authorities provide battery recycling facilities.

Per Regulation (EU) 2023/1542 (EU Battery Regulation), portable batteries must be collected separately for recycling.

Producer	TopBytes Ltd
WEEE category	Category 3 -- IT and telecommunications equipment

10.8 Producer Information

Producer	TopBytes Ltd
WEEE category	Category 3 — IT and telecommunications equipment

10.9 Manufacturer

Name	TopBytes Ltd
Address	55 Kings Ride, HP10 8BP, UK
Website	https://www.topbytes.net
Product support	https://dxspotter.topbytes.net
Email	support@topbytes.net

10.10 Firmware Updates

The Morse Trainer supports over-the-air (OTA) firmware and screen updates via WiFi. Firmware updates may include:

- Bug fixes and performance improvements
- New training modes and features
- Updates to maintain regulatory compliance

The device checks for updates when connected to WiFi. Updates are downloaded securely via HTTPS.

Note: Firmware updates do not change the radio parameters (frequency, power) beyond the limits declared in this documentation.

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