WENC2

Installation and Commissioning Guide

Document Version: 2.0 — March 2026

ionia automation technologies

ionia-automation.com

WENC2 Installation and Commissioning Guide

This guide is intended for the automation technician installing, commissioning and maintaining the WENC2 wireless encoder transmission system in the field. It applies to all models (MONO, DUO, TRI).

1. System Overview

WENC2 is a two-device system that transmits incremental quadrature encoder signals from the rotating or moving section of a machine to the stationary side wirelessly in the 5 GHz band. **TX** is installed on the rotating side and reads the encoder; **RX** is installed on the stationary side and regenerates the same signals as true quadrature outputs. From the drive's perspective, RX looks like a physically connected encoder — no hardware or software change is required on the drive.

Models

Model	Channels	Active Terminals
WENC2-MONO	1	ENC0
WENC2-DUO	2	ENC0 + ENC1
WENC2-TRI	3	ENC0 + ENC1 + ENC2

Key Electrical Characteristics

Property	Value
Supply (TX and RX)	10–30 V DC
Encoder supply output (TX Terminal 3)	+23.5 V filtered
Encoder input (TX)	Incremental quadrature A/B/~A/~B, 2- or 4-wire, optically isolated
Encoder output (RX)	HTL 24 V, over-current and short-circuit protected
Motor speed range	0–3600 RPM @ 1024 ppr encoder
Operating temperature	-20 °C … +60 °C

Important: RX's full encoder output is produced only in **normal operation mode**. In service mode the output is refreshed at approximately **100 ms intervals** (status update) but is **not suitable for closed-loop operation**. The drive cannot reliably track the encoder while in service mode.

2. Wiring

2.1 TX — Motor Side

Terminal	Function	Model
1	+24V supply input	All
2	GND	All
3	+23.5V encoder supply	All
4	GND (encoder)	All
5	**ENC0.A**	All
6	ENC0./A	All
7	**ENC0.B**	All
8	ENC0./B	All
9	**ENC1.A**	DUO, TRI
10	ENC1./A	DUO, TRI
11	**ENC1.B**	DUO, TRI
12	ENC1./B	DUO, TRI
13	**ENC2.A**	TRI
14	ENC2./A	TRI
15	**ENC2.B**	TRI
16	ENC2./B	TRI

2.2 RX — Drive Side

Terminal	Function	Model
1	+24V supply input	All
2	GND	All
3	GND	—
4	**ENC0.A**	All
5	ENC0./A	All
6	**ENC0.B**	All
7	ENC0./B	All
8	GND	—
9	**ENC1.A**	DUO, TRI
10	ENC1./A	DUO, TRI
11	**ENC1.B**	DUO, TRI
12	ENC1./B	DUO, TRI
13	**ENC2.A**	TRI
14	ENC2./A	TRI
15	**ENC2.B**	TRI
16	ENC2./B	TRI

RX outputs are at **HTL level (24 V)** and connect directly to the drive's encoder input. On the drive, encoder type is set to **HTL / push-pull**, signal selection to **A/B only** (Z/index is not used); the PPR parameter is entered with **the PPR value of the encoder in the field**.

2.3 Encoder Connection Types

4-wire (differential) — recommended. A, /A, B, /B are all connected. Highest immunity to noise.

2-wire (single-ended). Only A and B are connected:

- **On the TX side**, /A and /B terminals are **bridged to GND** (otherwise the TX input floats and reads unstable).
- **No bridging on the RX side** — /A and /B are the differential complement outputs produced by RX.

> **Quadrature integrity is mandatory.** Internal error-correction, accurate counting and noise-rejection hardware and algorithms require A and B signals to be read together. **Pulses from A only or B only cannot be used or transmitted alone.**

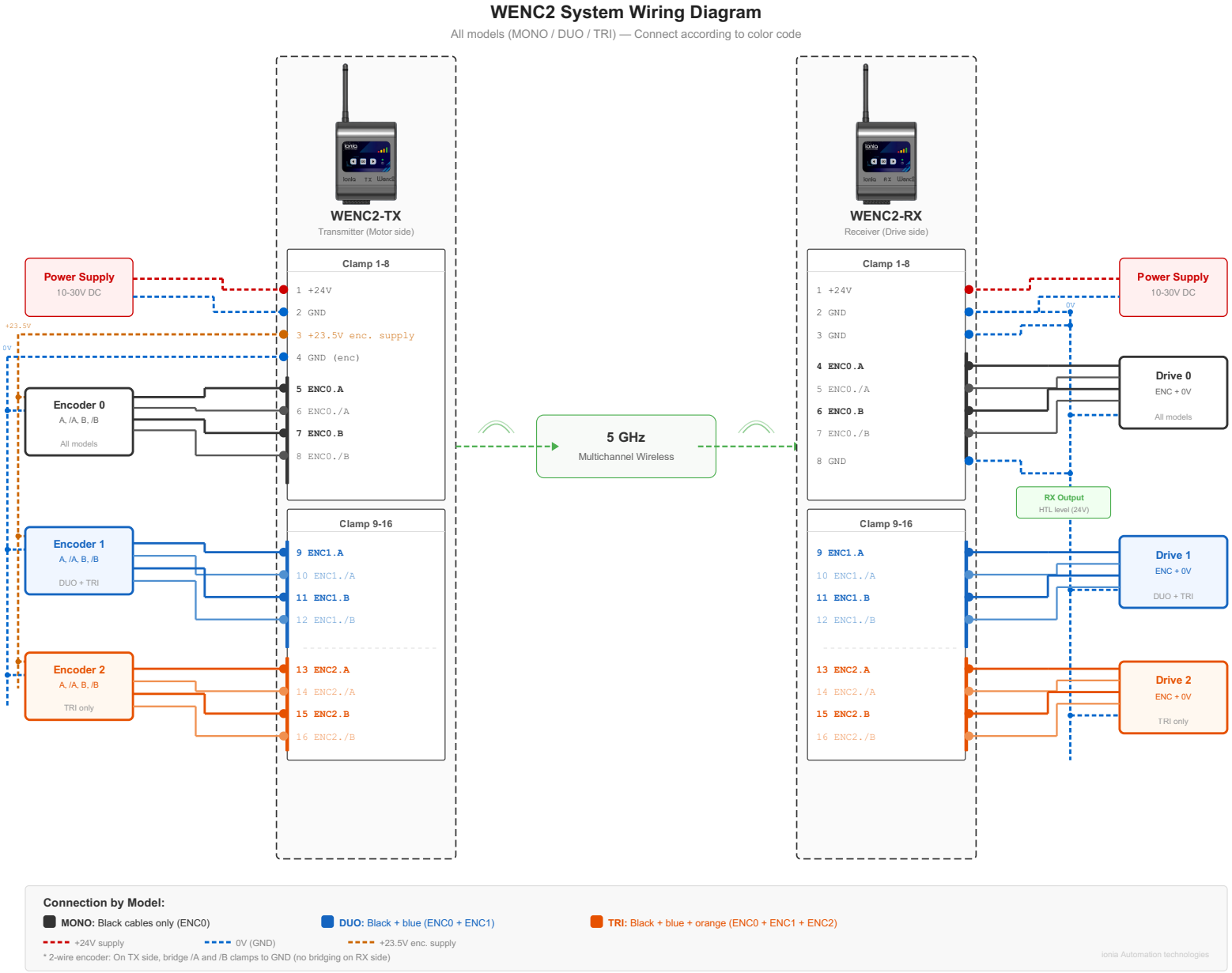
2.4 Drive-Side Parameter Setup

When configuring the encoder interface on the drive:

Parameter	Value
Encoder type	HTL / push-pull (24 V)
Signal selection	A/B (quadrature); **the 4-wire output is available and is more noise-immune**. If desired, 2-wire operation with /A, /B left unconnected is permitted — leaving the ends open is not a problem
PPR / CPR	The PPR value of the field encoder (WENC2 is transparent and does not change it)
Direction	As required by the process; if reversed, swap A–B or flip direction in the drive parameter

Color code: Black ENC0 (all models) · **Blue** ENC1 (DUO + TRI) · **Orange** ENC2 (TRI only). Connect wires in the colors matching your model; leave the others unused.

2.5 Wiring Diagram



3. Mounting

3.1 TX — Rotating Side

- TX is mounted on the motor or rotating platform, **as close to the encoder as possible**. Keep the encoder cable short.
- The TX antenna must remain **outside any metal enclosure**. A closed metal box attenuates 5 GHz signals significantly.
- If the rotating side is powered through a slip-ring, the slip-ring only carries the TX supply lines (+24 V / GND) — no encoder signals pass through it.
- In locations with vibration, secure the cable so that the load is not transferred to the connectors.

3.2 RX — Stationary Side

- RX is mounted inside the electrical cabinet or close to the drive.
- If the cabinet is **metal**, place the RX antenna outside the cabinet (plastic-windowed cabinet or antenna led out).
- TX and RX antennas are positioned to **see each other**; there should be no large metal obstacles on the line of sight.
- **In metal-cabinet systems such as bunchers, RX must also be placed inside the cabinet** — the Faraday effect of the outer shell blocks the signal; keeping RX inside the same electromagnetic volume keeps the link healthy.

3.3 Grounding and Cabling

- TX and RX GNDs together with the drive's encoder GND are connected to a **common reference**.
- The encoder cable should be **shielded twisted pair**. Bond the shield at one end only (recommended: RX / cabinet side) to chassis.
- If supply runs are long, use a separate fuse but keep the GND common with the drive.
- Route the encoder cable as far as possible from power cables, VFD outputs and frequency inverters.

3.3.1 Supply Isolation — Critical

It is important for process and system health that the 24 V DC supply be **truly isolated** (galvanically isolated) from earth, line and neutral.

Poorly isolated power supplies are common in the market — a typical symptom is measuring **~90 V AC between earth and +24 V or 0 V (DC GND)**. This type of supply:

- Causes irreparable noise on the encoder lines.
- May induce permanent electronic failure (cumulative ESD-like damage).

> **The ideal system:** Route **220 V AC** through the slip-ring to the rotating side, place an **isolation transformer** on the rotating side, followed by a **220 V AC → 24 V DC** power supply. This prevents high-voltage arcing from carbon contamination on the slip-ring, noise and earth-loop disturbances from propagating into the encoder line.

3.4 Distance and Line of Sight

- Typical working distance ranges from a few metres to tens of metres; as long as line of sight is clear, **absence of obstacles** matters more than the distance itself.
- Concrete walls, metal enclosures and cabinet doors are heavy attenuators at 5 GHz.
- Under favourable conditions, healthy communication **beyond 50 metres** has been achieved; however, environmental variables (metal density, other RF sources, walls) can shorten this distance markedly.
- For verification, use the **signal strength meter** in the service-mode Web UI — take a measurement during commissioning to confirm that the distance/placement is adequate.

4. Initial Commissioning

Factory devices are unpaired and automatically enter service mode when powered up.

4.1 Step by Step

1. Verify wiring and grounding.
2. Apply supply to TX and RX. Both devices enter service mode automatically (LED: Knight Rider animation).
3. Connect to the WiFi network from a tablet or phone:
    - **SSID:** `WENC_XXXXXX` (last 6 characters are the last 3 bytes of the device MAC)
    - **Password:** `12345678` (default)
    - **Turn off the phone's mobile data** — to ensure WiFi priority.
4. Open `http://192.168.10.1` in the browser. The RX Web UI loads.
5. Press **"Scan Devices"**. TX appears in the list (MAC, encoder channels, signal strength).
6. Press **"Pair"** and confirm. LEDs: bottom-up fill → 3× blink → solid — pairing successful.
7. Press **"Return to Normal Operation"**. Both devices restart and switch to normal operation.

4.2 Drive-Side Verification

1. The drive encoder interface must be configured as HTL (24 V) with the correct PPR (see §2.4).
2. Turn the motor manually or slowly. The drive's encoder counter should increase or decrease.
3. **If the direction is reversed** — three options:
    - Reverse direction in the drive parameter (preferred), **or**
    - In a 4-wire connection, simply **swap A with /A** (the most practical — two-wire swap), **or**
    - On the TX side, swap ENC.A and ENC.B (use this method for 2-wire connections).
4. **If the position oscillates between +1 / −1**, the wiring is faulty (see §7).
5. Before putting the line under production load, confirm that the encoder output is stable (no oscillation in RPM under constant load).

4.3 PPR / RPM Scope

WENC2 operates **transparently** with the drive — it forwards what comes from the encoder unchanged. The system scope is defined over **3600 RPM @ 1024 ppr** (pulse bandwidth).

Different PPR values may be used; the upper RPM limit scales inversely with the pulse rate:

Encoder PPR	Upper RPM Limit (approx.)
1024	3600
512	7200
2048	1800

When the encoder is changed, only the **drive's PPR / pulse-count parameter** is updated; no change is needed on the WENC2 side.

5. Service Mode

Service mode is used for pairing, Web UI monitoring, device settings and OTA updates. In service mode the **RX encoder output is not produced** (for safety).

5.1 Entering Service Mode (3 Ways)

Method	How
Automatic	An unpaired device (factory-new or after a factory reset) boots directly into service mode when powered up
Button	With power off, hold the button down and apply power; **release after 2 s** (LED confirms with 2× fast blink)
Remote	While RX is already in service mode, the **"Take TX Peer to Service Mode"** button in the Web UI moves TX wirelessly into service mode

> **The button has effect only while power is being applied.** Pressing it during normal operation does nothing.

5.2 Factory Reset

When power is applied while the button is held **for 30 seconds**:

- LEDs perform 6× fast blink
- All settings are cleared (pairing, device name, AP password)
- The device returns to factory state and restarts in service mode

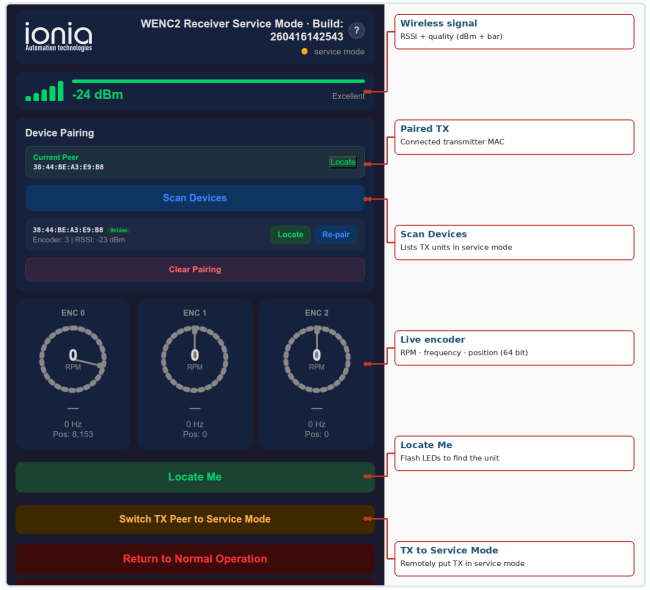
5.3 Web UI Features

> **Open it during every commissioning.** The Web UI presents live encoder data, signal quality measurement, A/B signal diagnostics and system diagnostics in a single screen — physical wiring verification, direction check and distance/placement assessment are all performed here. Commissioning is not considered complete without accessing the Web UI.

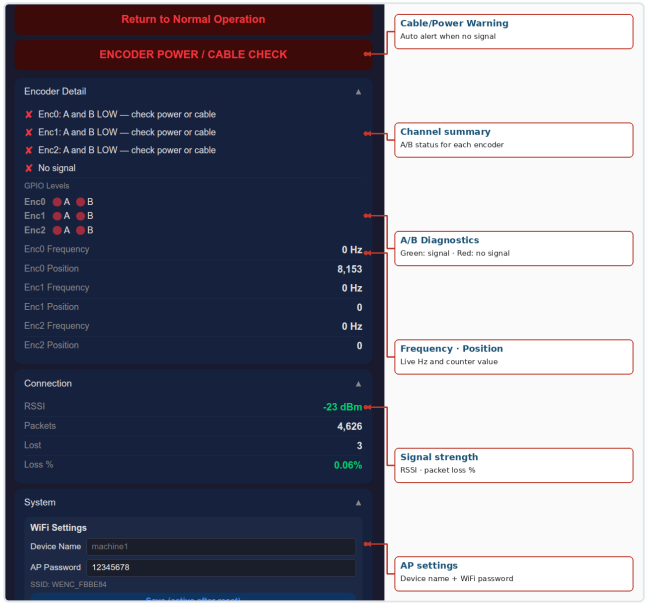
Feature	Description
Encoder monitoring	Live rotation animation, RPM/Hz, direction (CW/CCW/Stop), position counter
A/B Signal Diagnostics	A and B signal indicators per channel (green = signal present, red = signal absent). Cable fault detection
Signal strength	Bar + dBm + quality + packet loss ratio
System info	TX/RX temperature, restart counter, firmware version, MAC
Find Me	Flashes the TX and RX LEDs for ~5 s — physical location identification
TX Service Mode	Places TX remotely into service mode
Unpair	Clears the pairing on both devices
Normal Operation	Restarts both devices and returns them to normal mode
OTA Update	RX and TX firmware upload (model compatibility checked)
Device Settings	Change device name and AP password

Web UI Screens

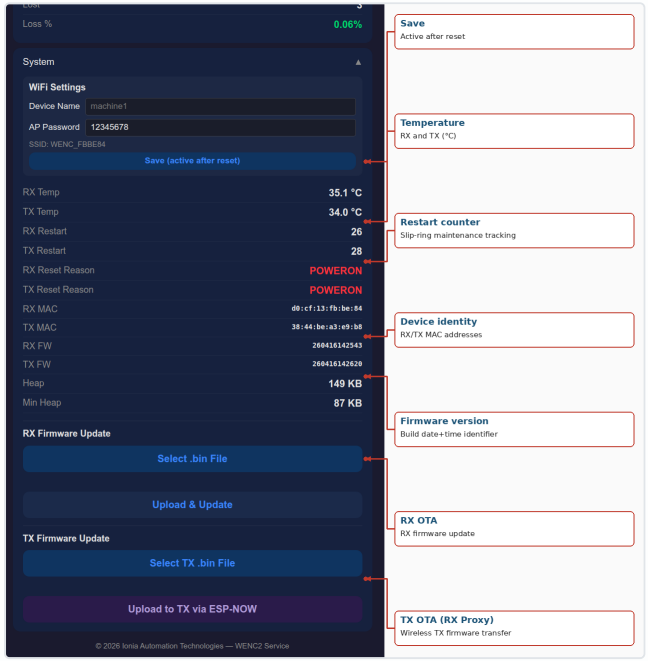
Commissioning and maintenance are handled entirely from the Web UI. Key fields on each screen are annotated below.



Main Screen — Signal quality, TX pairing, live encoder data (RPM · frequency · position), service mode controls.



A/B Signal Diagnostics — Per-channel A/B status (cable/power check), packet and loss statistics.



System and OTA — RX/TX firmware update, restart counter (slip-ring maintenance), device identity.

5.4 Re-Pairing

1. Put RX into service mode (button or Web UI).
2. Press **"Unpair"** in the Web UI.
3. Both devices are reset and come back in service mode.
4. Repeat the steps in §4.1.

5.5 Device Settings

Setting	Description	Default
Device Name	Name shown in the WiFi SSID	MAC address (last 3 bytes)
AP Password	WiFi access point password (min 8 characters)	`12345678`

Settings are persistent — preserved across restarts. A factory reset restores the defaults.

6. Field Maintenance

6.1 Normal Operation LED Indicator

In normal mode, the 4 LEDs on RX indicate the link quality:

LED Count	Meaning
4	Excellent signal
3	Strong signal
2	Moderate signal
1	Weak signal
0	TX not found (no link)

If no signal is present, the LEDs stay off — this is normal (TX off, too far, or blocked).

6.2 Restart Counter — Slip-Ring Maintenance Tracking

The restart counter was added specifically to detect momentary supply drops and recoveries — it is the primary diagnostic tool for troubleshooting. When the rotating side is fed through a slip-ring, loss of brush–ring contact causes momentary power interruptions that restart the device. The Web UI's "System Info" page shows TX and RX restart counters.

- **High restart count** → poor contact → maintenance required.
- **TX vs RX differentiation:**
  - High **TX** restart increase → poor slip-ring contact on the **motor side** (brush wear, ring oxidation).
  - High **RX** restart increase → supply problem on the **drive side** (loose terminal, fuse, power supply).
- Record the counters at commissioning as a **reference value**; check periodically (e.g. monthly) to track the rate of increase.

6.3 Suggested Periodic Checks

Interval	Action
Monthly	Web UI → check signal strength and restart counter
Quarterly	Visual inspection of slip-ring brush wear
Yearly	Terminal tightness check, cable insulation review

7. Troubleshooting

Symptom	Likely Cause — Resolution
No LEDs at all	No supply. Check 10–30 V DC. In normal mode LEDs stay off when there is no signal — this is normal
Cannot enter service mode	Hold the button **before applying power**; wait until the LED blink appears. An unpaired device is already in automatic service mode
WiFi network not visible	Is RX in service mode? (Knight Rider animation). Check from the OS WiFi settings, not the browser
Web UI does not open	Make sure you are connected to the correct SSID (`WENC_` prefix). Disable mobile data on the phone. `http://192.168.10.1` (not HTTPS)
"Scan Devices" does not list TX	Is TX powered up and in service mode? Is there a metal enclosure/wall between TX and RX? Do the antennas have line of sight?
Pairing fails	Both devices must be in service mode. If the signal is very weak, bring the devices closer together
Encoder turns but no count on the drive	RX output wiring is faulty. If RX is in service mode, no output is produced — return to normal operation
Reversed direction on the drive	Reverse the direction parameter on the drive; **or** swap A with /A in a 4-wire connection (most practical); **or** swap ENC.A with ENC.B on the TX side for 2-wire connections
Position oscillates between +1 / −1	Encoder wiring fault. Check A/B/~A/~B connections. In 2-wire connections, did you bridge /A,/B to GND on the TX side?
A/B diagnostics — all dots red	No encoder supply (TX Terminal 3 → encoder +, Terminal 4 → encoder GND) **or** /A,/B → GND bridging forgotten in a 2-wire connection on the TX side
Dots do not change while the encoder turns	That signal cable is broken. Check the A or B line
One channel's dots are red, the others normal	Check that channel's wiring or the encoder itself
Frequent restarts	Compare the restart counters (§6.2). High **TX increase** → slip-ring maintenance; high **RX increase** → check drive-side supply
Device does not work after OTA	Wait 60 seconds — the device automatically rolls back to the previous version. Then retry with the correct model firmware

8. Reference

8.1 LED Animation Table

State	Animation	Description
Boot — button held ~1 s	2× fast blink	Entered service mode
Boot — button held 30 s	6× fast blink	Factory reset
Service — unpaired	Knight Rider (D4↔D1)	Searching for TX
Service — paired	Centre-out pulse	Link established
Pairing successful	Bottom-up fill → 3× blink → solid	Pairing complete
Normal — signal	1–4 LEDs (signal strength bar)	Link quality
Normal — no signal	All off	TX off or out of range
Find Me	All LEDs flashing (~5 s, 200 ms on/off)	Triggered from Web UI

8.2 Wireless Link

Parameter	Value
Band	5 GHz
Protocol	5 GHz robust protocol compliant with Wi-Fi 6ax licensing
Channel	Automatic channel hopping
Topology	Point-to-point, with peer MAC authentication

8.3 Web UI Access

Parameter	Value
SSID	`WENC_XXXXXX`
AP Password	`12345678` (changeable)
IP	`192.168.10.1`
Browser URL	`http://192.168.10.1`

9. OTA Update

9.1 RX Update (Direct)

1. Put RX into service mode.
2. Enter the OTA section in the Web UI.
3. Select and upload the RX firmware file (`.bin`).
4. The system automatically verifies model compatibility (wrong model is rejected).
5. On completion, RX restarts.

9.2 TX Update (RX-Proxy)

Because TX has no direct cable, its update is performed through RX:

1. Both devices must be in service mode.

2. Enter the TX OTA section in the Web UI.
3. Select and upload the TX firmware file (`.bin`).
4. RX transmits the firmware to TX wirelessly (progress indicator shown).
5. On completion, TX restarts.

9.3 Safe Update (Anti-Rollback)

- Wrong-model firmware is rejected automatically.
- After a failed update, the device **automatically rolls back to the last working firmware within 60 seconds**.
- This mechanism prevents bad firmware from being stranded in the field.
