WENC2

Installation and Commissioning Guide



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WENC2 Installation and Commissioning Guide

This guide is intended for the personnel 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)	15–30 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	0–6000 RPM @ 1024 ppr (102.4 kHz); theoretical ≈ 8800
Operating temperature	-20 °C … +70 °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.**

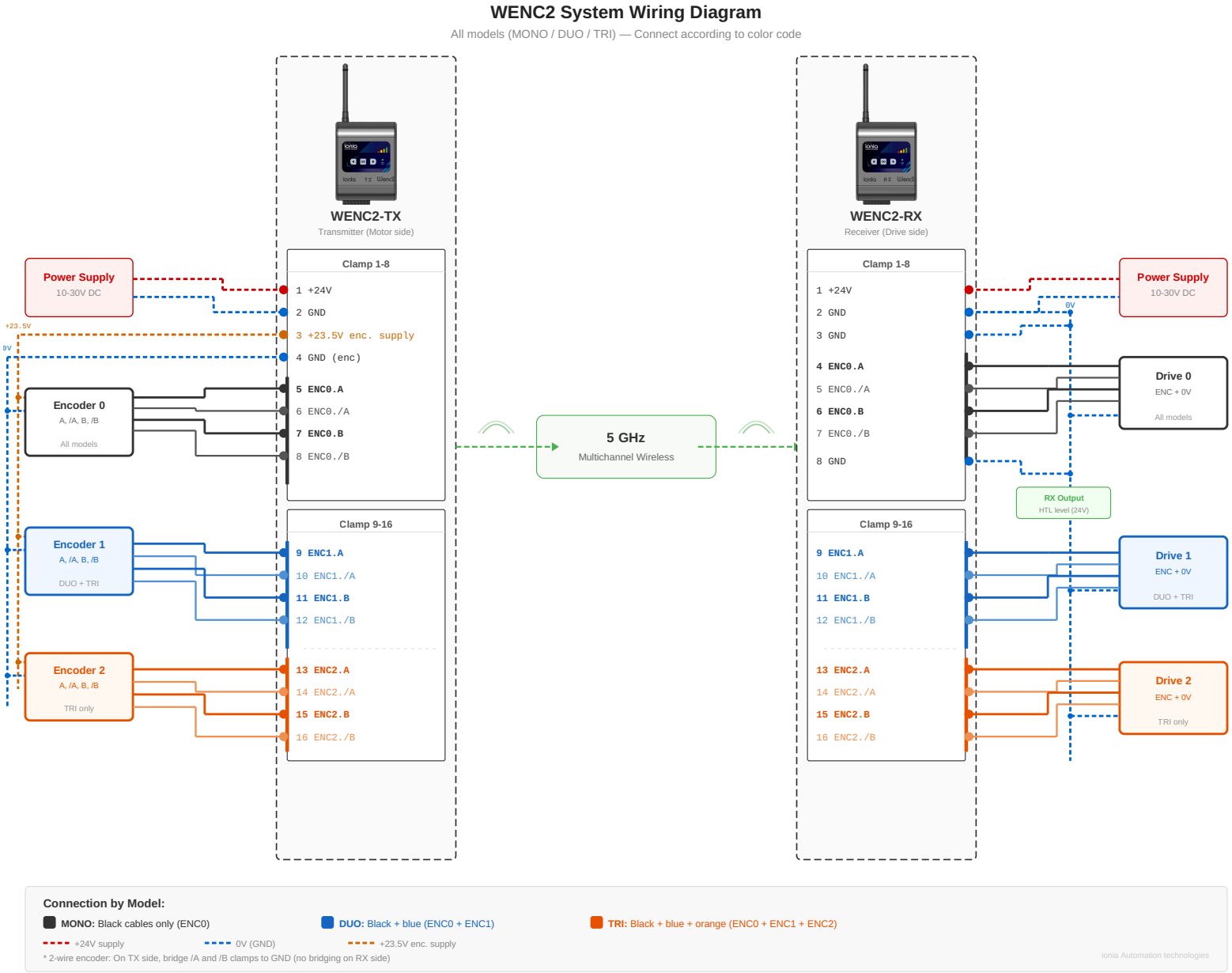
2.4 Drive-Side Parameter Setup

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** is possible; 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: slow sweep animation).
3. Connect to the WiFi network from a tablet or phone:
    - **SSID:** `WENC_RX_xxxxxx / WENC_TX_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. Per channel, the pulse frequency (A signal) operating range is **0–102 kHz**; the theoretical ceiling is **≈ 150 kHz**. Reference: **6000 RPM @ 1024 ppr** (= 102.4 kHz).

The speed limit scales inversely with the encoder PPR: `RPM = f × 60 / PPR`

Encoder PPR	Operating upper limit	Theoretical ceiling
512	12000 RPM	17500 RPM
1024	6000 RPM	8800 RPM
2048	3000 RPM	4400 RPM
4096	1500 RPM	2200 RPM

The mechanical limits of the encoder and motor apply in addition. When the encoder is changed, only the **PPR / pulse-count parameter in the drive** is updated; no setting is needed on WENC2. Output frequency resolution is ≈ 2.4 Hz.

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 Single-Button Operation

Each device has a **single button**. Operation depends on the current state:

State	Action	Result
Normal operation	Hold 5 s	Switches to service mode as soon as the 5 s threshold is reached (no need to release); the paired device is also called into service mode. A short press is ignored in normal operation (prevents accidental switching).
Service mode	Short press	**Find:** the LEDs of the paired device flash for ~5 s.
Service mode	Double short press (within 0.8 s)	**Button pairing window, 60 s.** Double-press on both devices; two devices with an open window (TX + RX, strongest signal) pair automatically. No Web UI needed. Physical access = authorization (both devices must be touched).
Service mode	Hold 3 s	**Exit service mode**, return to normal operation.
At power-up	Hold ≥ 0.1 s	Starts in service mode (2 short flashes).
At power-up	Hold 10 s	**Factory reset** (progress LED lights at ≈ 3.3 s and ≈ 6.7 s). WiFi name/password (12345678), device name, pairing and settings return to defaults; serial number and model are kept.

An unpaired device always starts in service mode. A paired device starts directly in normal mode and looks for its peer (there is no start-up waiting window).

5.2 Factory Reset

Factory reset (progress LED lights at ≈ 3.3 s and ≈ 6.7 s). WiFi name/password (12345678), device name, pairing and settings return to defaults; serial number and model are kept.

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
Output Mode	Per-channel selection of the 4 output modes and advanced settings (§10)
Software Update	Wireless update with the signed `.ota` package (§9)

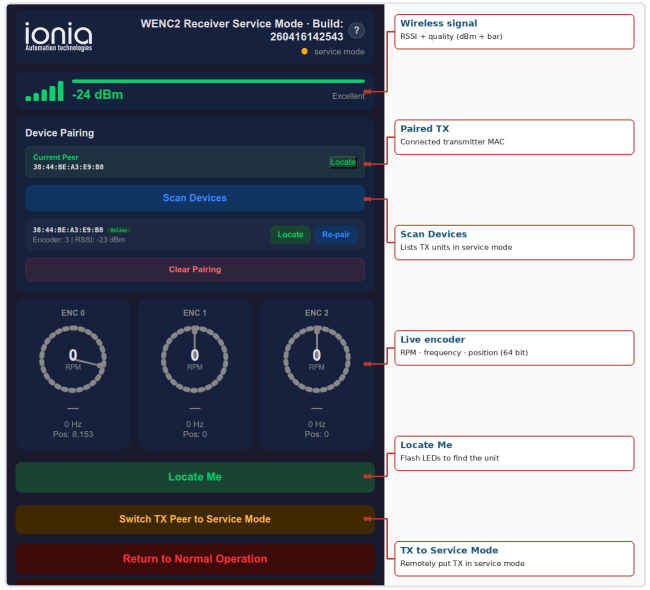
Service Web UI — What's New

- **Access:** default SSID `WENC_RX_<last 3 MAC bytes>` / `WENC_TX_<…>` (`WENC_RX_<name>` if a name is set), password `12345678` (changeable, 8–32 characters). Address `192.168.10.1` or `wenc-rx.local` / `wenc-tx.local`; captive portal — the page opens automatically on connecting. There is no administrator password; protection is the WiFi password.
- **TX Web UI:** live measurement (rotation wheel, A/B LEDs, cable diagnostics: idle / check B / check A / phase / OK), cable check without pairing, “Max Hz” column, simulated speed-profile signal (up to 600 s).
- **System:** boot counter and last reset reason (TX and RX), download of the black-box record (last 64 events), factory reset (with confirmation).
- **Settings:** WiFi name, device name (1–20 characters: A-Z a-z 0-9 _ -), WiFi password; per-field instant validation.
- **Language:** Turkish / English selection.

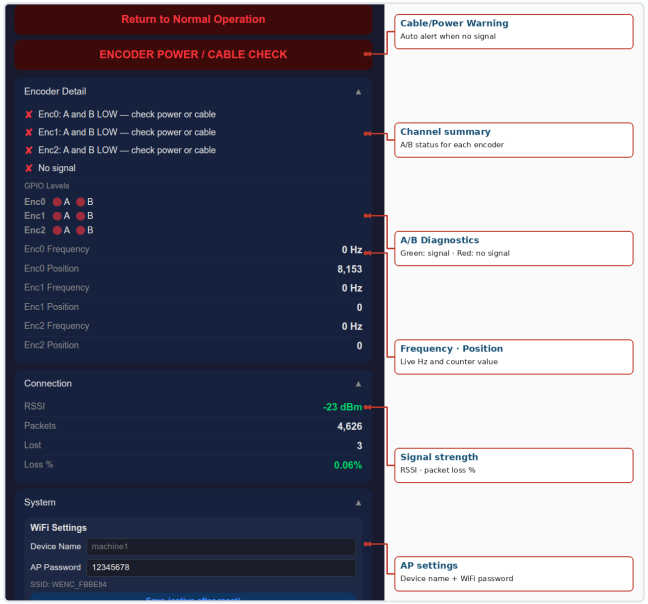
- **“What are the modes?”** section: mode diagrams and comparison table.

Web UI Screens

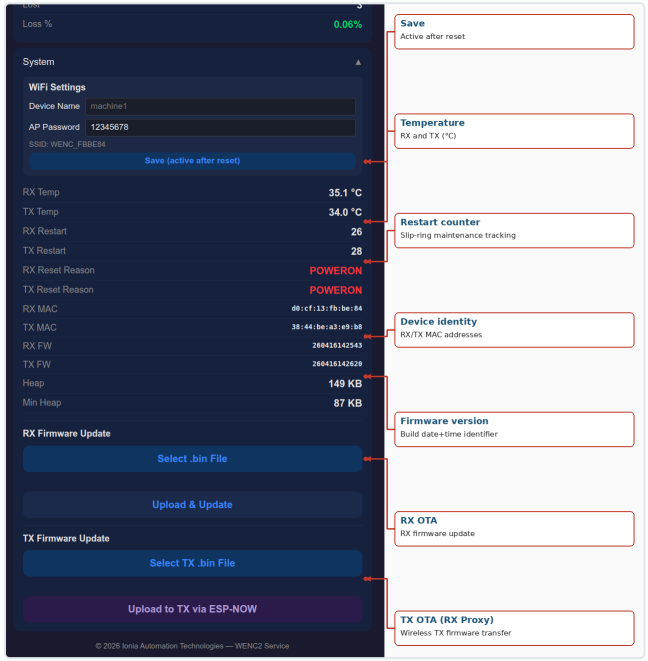
Commissioning and maintenance are handled entirely from the Web UI. Key fields on each screen are annotated below.



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.

5.6 Entering Service Mode and the Web UI

The service Web UI is reached through the device's own WiFi network. Service mode can be entered in four ways:

1. **In normal operation:** hold the button for 5 s. The paired device is also called into service mode.
2. **At power-up:** hold the button while applying supply (≥ 0.1 s); the LEDs give 2 short flashes.
3. **Unpaired device:** always starts in service mode.
4. **From the RX Web UI:** press **Take Paired TX to Service Mode** to call the paired TX into service mode.

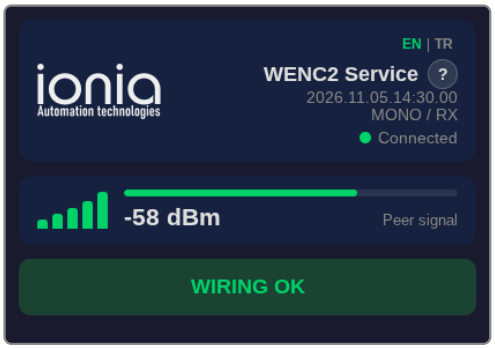
Then connect a phone or PC to the WiFi network **WENC_RX_xxxxxx** (RX) or **WENC_TX_xxxxxx** (TX), password **12345678**. The page normally opens by itself; if not, browse to **192.168.10.1** or **wenc-rx.local** / **wenc-tx.local**.

Leaving service mode: hold the button for 3 s, or press **Return to Normal Operation** in the Web UI.

> **Important:** Service mode is for observation and installation only. The machine is not run in production in service mode. Return to normal operation when the work is finished. In normal operation the WiFi network is off.

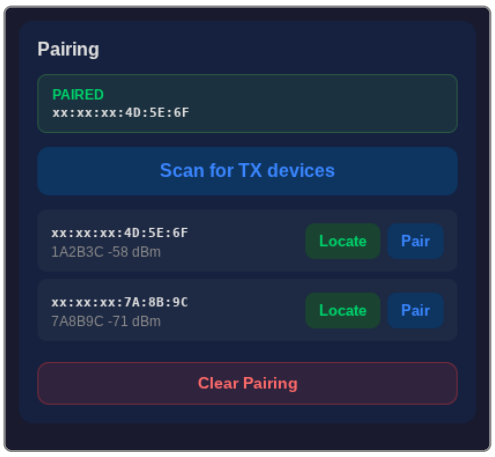
5.7 Using the Web UI

The Web UI opens in English; the **EN | TR** buttons at the top switch the language (including the help and update pages). The screenshots below show the RX page unless stated otherwise; the TX page is similar.



1. Header and connection badge

Shows the language buttons, the firmware signature (build date-time), the device role (RX/TX) and the connection badge (**Connected**), the signal strength in dBm and the peer signal. **WIRING OK** means the encoder cable check passed.



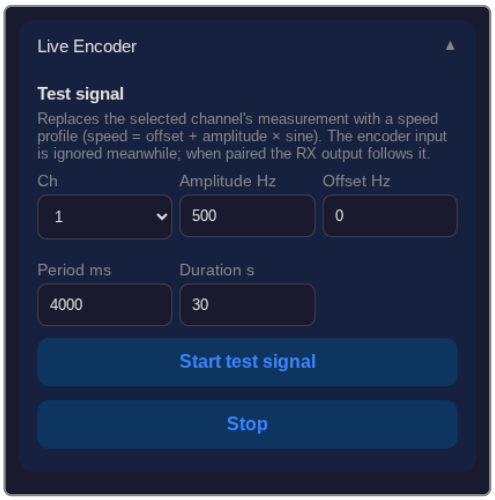
2. Pairing

Press **Scan for TX devices**; the found devices are listed with their signal strength. **Locate** flashes the LEDs of that device so you can identify it. Press **Pair** and confirm. **Clear Pairing** removes the pairing (both devices return to service mode).



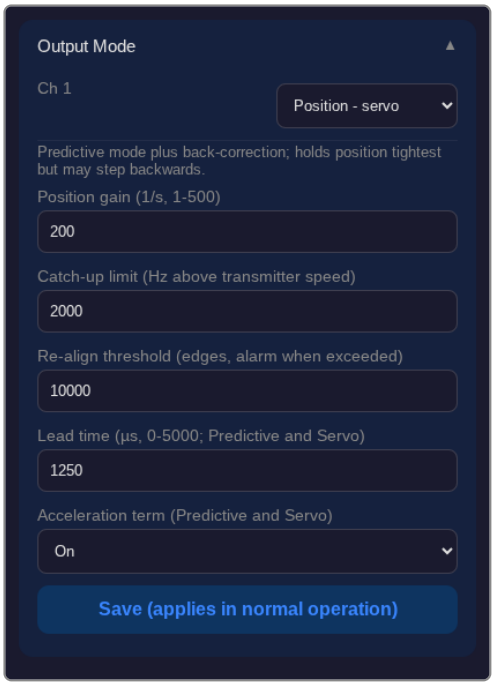
3. Live Encoder (TX)

Shows per channel the live frequency, direction, maximum Hz and position, the A/B LEDs and the cable diagnostics (idle / check B / check A / phase / OK). **Zero position / max** resets the position and the maximum value. Cable checks work without pairing.



4. Test signal (TX)

Replaces the measured value of a chosen channel with a sinusoidal speed profile (if paired, the RX output follows it): set **Amplitude**, **Offset**, **Period** and **Duration** (up to 600 s), then **Start test signal**. Stop it with **Stop**. Useful for checking the drive wiring without turning the machine.



5. Output Mode (RX)

Select the output mode per encoder channel (0 speed transfer, 1 position – safe, 2 position – predictive, 3 position – servo) and press **Save**; it takes effect in normal operation. **Advanced settings** hold position gain, catch-up limit, re-align threshold, lead time and acceleration term.

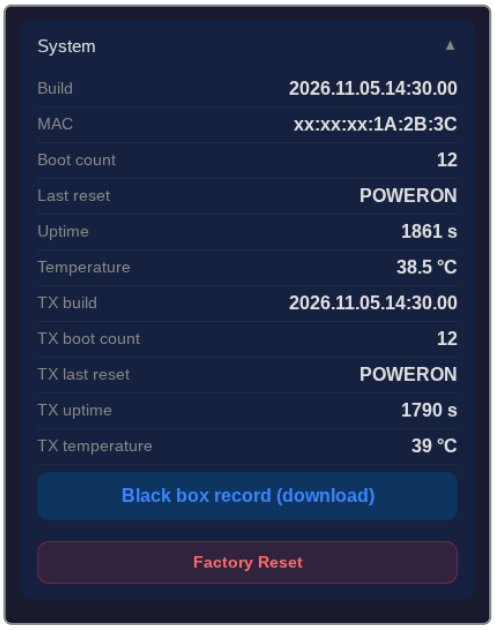
6. What are the modes?

Expands a comparison of the four modes with drawings and a table (pulse-loss compensation, backward steps, delay, behaviour on link loss, typical use). In position modes 1–3 no pulse is lost: missing pulses are completed when the link returns. (§10.2)



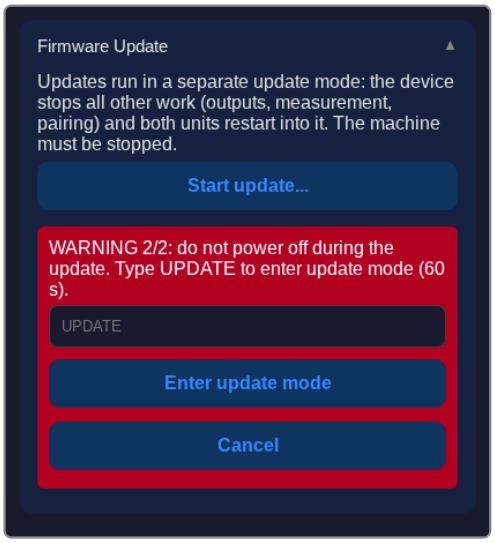
7. Connection

Shows the network, channel and peer. Change the **WiFi name**, the **Device name** (1–20 characters: A–Z a–z 0–9 _ -) and the **WiFi password** (8–32 characters), then **Save**. Each field is checked as you type.



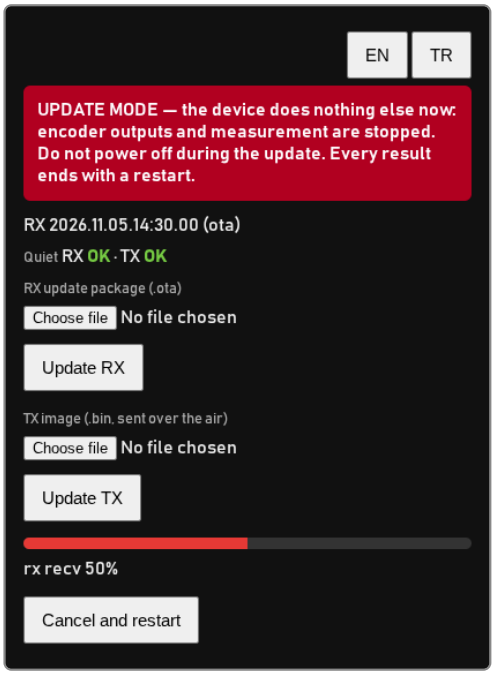
8. System

Shows the build signature, boot counter, last reset reason, uptime and temperature of RX and TX. **Black box record (download)** saves the last 64 events. **Factory Reset** restores the defaults after confirmation (serial number and model are kept).



9. Firmware Update

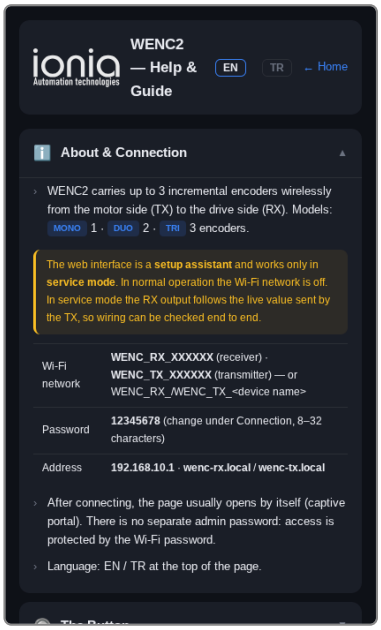
Start update opens the update procedure. Read the warning, type **UPDATE** in the box and press **Enter update mode** (**Cancel** gives up). The update is refused while the machine is turning (encoder > 10 Hz): stop the motor first.

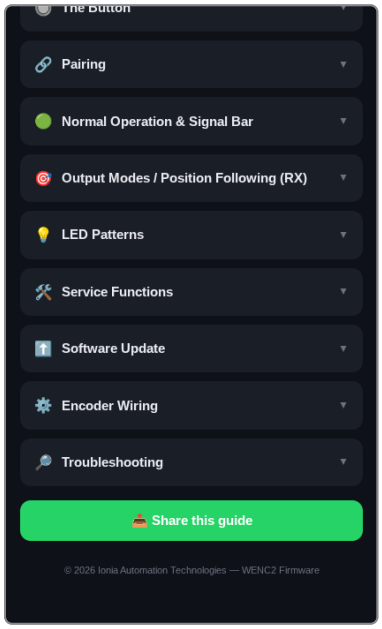


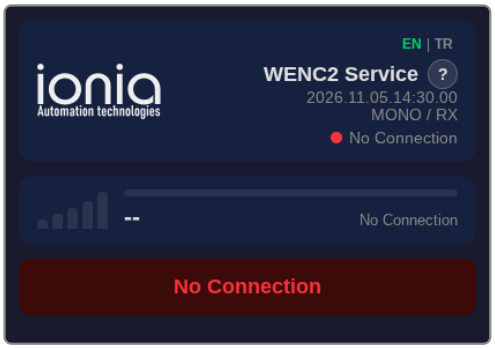
10. Update mode page

The device restarts in update mode; outputs and measurement stop. Select the **.ota** package of the device you are connected to and start the update with its update button (**Update RX** / **Update TX**); the progress bar follows the transfer. When it reaches 100 % the device restarts and returns to the service page. When started from RX, RX and the paired TX enter update mode together: connect to each device's own WiFi network and upload its own package. **Cancel and restart** aborts.

11. Help page
A built-in help and guide (button, pairing, modes, troubleshooting) opens from the Web UI in the selected language, with collapsible sections.







12. No Connection
If the link to the device is lost the badge turns to **No Connection** (red) and the signal bar empties; reconnect to the device's WiFi network.

6. Field Maintenance

6.1 Normal Operation LED Indicator

LEDs	Signal strength (RSSI)	Meaning
4 (D1–D4)	> −57 dBm	Excellent (devices side by side)
3	> −67 dBm	Strong
2	> −75 dBm	Moderate
1	> −85 dBm	Weak
0	—	No link / very weak

The value is filtered (±3 dB hysteresis). Both TX and RX show the bar.

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 15–30 V DC. In normal mode LEDs stay off when there is no signal — this is normal
Cannot enter service mode	In normal operation hold the button for **5 s**; at power-up hold it ≥ 0.1 s. An unpaired device is already in service mode
WiFi network not visible	Is the device in service mode? (LED sweeping slowly, or inner/outer pair alternating). Look in the OS WiFi settings, not the browser. Network name: `WENC_RX_…` / `WENC_TX_…`
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 update	The device automatically returns to its previous software. Then retry with the correct package for that device (RX package to RX, TX package to TX)

8. Reference

8.1 LED Animation Table

Pattern	Appearance	Meaning
Fast sweeping light	75 ms step, back and forth	Power-up
Medium sweeping light	150 ms step	Normal mode, searching for peer (also on RX while there is no link)
Slow sweeping light	300 ms step	Service mode, **not** paired
Inner pair / outer pair alternating	D2+D3 ↔ D1+D4, 400 ms	Service mode, paired
All blink	200 ms on/off	Pairing window open / pairing in progress
Fill from bottom + 3 blinks + steady	~1.6 s, then the service-paired pattern	Pairing complete
Fill from bottom → signal bar	1–4 LEDs steady	Normal mode, linked; bar = signal strength
All on, then turn off one by one	1 s cycle	TX: link lost, reconnecting
Fast flash	~5 s	“Find” command received
Short flash, long dark	100 ms / 1 s	Error: device not configured (no model record) — contact service
Rotating pair, one direction	120 ms	Update mode: waiting for the package
Quarters fill + next LED blinks	progress	Update in progress (each LED = 25 %)
All four steady	—	Update finished, restarting
Fast diagonal flicker	D1+D3 ↔ D2+D4, 60 ms	Update error / cancelled (the old software keeps running)
All off	—	No power

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_RX_xxxxxx` / `WENC_TX_xxxxxx`
AP Password	`12345678` (changeable)
IP	`192.168.10.1`
Browser URL	`http://192.168.10.1`

9. OTA Update

Updates are wireless — no cable or USB is needed in the field. Only an update package (`.ota`) **signed and encrypted by Ionia** is accepted; other, damaged or wrong-model packages are rejected. Rollback protection: an older package (lower security version) cannot be installed.

1. Put the device into service mode (hold the button for 5 s). Connect to its WiFi network `WENC_TX_xxxxxx` / `WENC_RX_xxxxxx` , password `12345678` .
2. Open `192.168.10.1` (or `wenc-tx.local` / `wenc-rx.local`) → **System → Software update**.
3. Confirm by typing `UPDATE` in the box. If the machine is turning (encoder > 10 Hz) the update is refused — stop the motor first.
4. The device restarts in **Update mode**: outputs and measurement stop, the LEDs show a rotating pair. If the update is started from the **RX** page, **RX and the paired TX both** restart into update mode; if started from TX, only TX does. In update mode each device broadcasts its own WiFi network; the page redirects to 192.168.10.1 automatically.
5. Connect to each device through **its own network** and upload **its own .ota package** (RX package to RX, TX package to TX — a TX package is not relayed through RX). A progress bar is shown and the LEDs fill quarter by quarter.
6. At 100 % the page shows “Done”, the device restarts, the page counts down and returns to the service Web UI (if it does not return within 90 s, reconnect to the WiFi network).

9.1 Safety Guards

- If the upload does not start within 5 min, takes longer than 20 min in total, or shows no progress for 30 s, the device restarts and starts with its old software.
- If the new software does not confirm itself at its first start, the device automatically returns to the previous software.
- **Do not cut the power during an update.**

10. Output Modes and Position Tracking

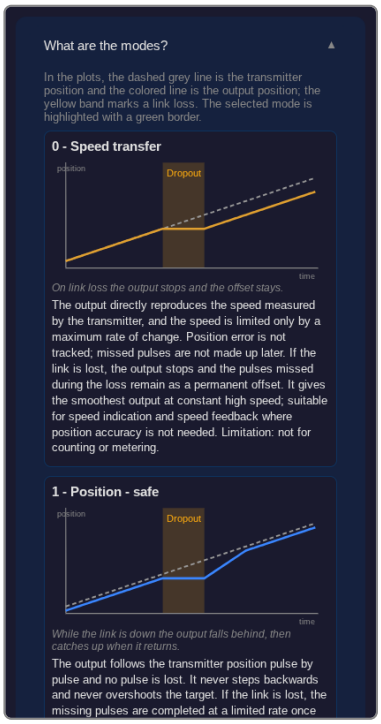
10.1 Speed transfer or position tracking?

In **speed transfer** (mode 0) the transmitter measures the encoder frequency and the receiver reproduces that frequency. This is smooth at constant speed, but pulses that are missed during a link interruption are not made up, so a position offset can remain.

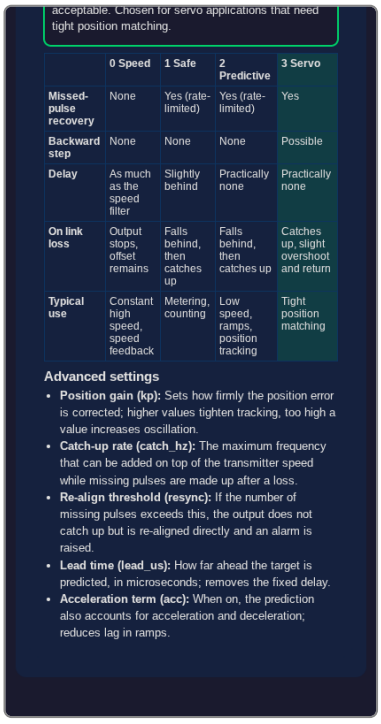
In the **position modes** (1–3) the number of pulses is transferred, not only the frequency. The receiver outputs exactly as many pulses as the encoder produced: after a short link interruption the missing pulses are completed when the link returns, so **no pulse is lost**. The mode is chosen separately for each encoder channel.

10.2 The four modes

In the plots of the Web UI (“What are the modes?”) the dashed grey line is the transmitter position, the colored line is the output position, and the yellow band marks a link loss.







Mode 0 — Speed transfer (default)

The output reproduces the speed measured by the transmitter; only the rate of change is limited. Position error is not tracked. It gives the smoothest output at constant high speed.

- **Delay:** As long as the speed filter
- **On link loss:** The output stops; the pulses missed during the loss remain as a permanent offset.
- **Backward step:** None
- **Typical use:** Speed feedback to the drive, steady high speed, speed indication. Not for counting or metering.

Mode 1 — Position, safe

The output follows the transmitter pulse by pulse. It never steps backwards and never overshoots the target. There is no prediction, so the output lags slightly behind.

- **Delay:** Slightly behind
- **On link loss:** The output falls behind; the missing pulses are completed at a limited rate when the link returns.
- **Backward step:** None
- **Typical use:** Length metering, counting, cut length: wherever no pulse may be lost.

Mode 2 — Position, predictive

All properties of the safe mode, plus a short look-ahead that includes acceleration, which removes the fixed delay. At constant high speed the output is slightly less smooth than in mode 0.

- **Delay:** Almost none
- **On link loss:** Falls behind, then catches up when the link returns (as mode 1).
- **Backward step:** None
- **Typical use:** Low speed, ramps, position following without lag and without pulse loss.

Mode 3 — Position, servo

Uses the predictive estimate and corrects back if the target is passed (±1 pulse dead band at rest). It holds position most tightly.

- **Delay:** Almost none
- **On link loss:** Catches up, may overshoot slightly and returns.
- **Backward step:** Possible
- **Typical use:** Tight position matching; drive position follower (electronic gear / master-slave position).

10.3 Comparison

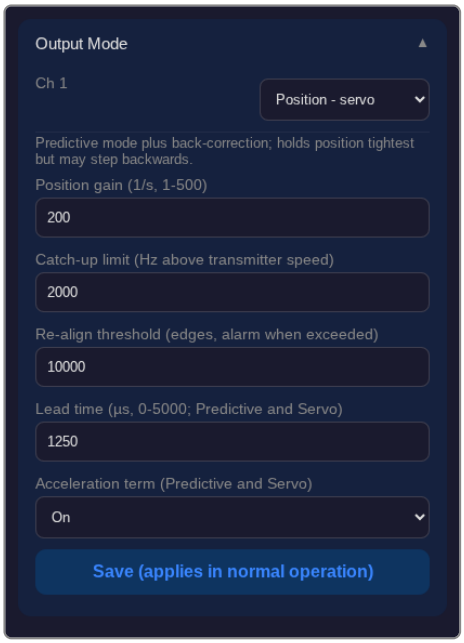
Mode	Missed-pulse compensation	Reverse step	Delay	On link loss	Suitable use
0 — Speed transfer (default)	None	None	As long as the speed filter	Output stops, error remains	Constant high speed, speed feedback
1 — Position, safe	Yes (limited rate)	None	Slightly behind	Falls behind, then catches up	Length measurement, counting
2 — Position, predictive	Yes (limited rate)	None	Almost none	Falls behind, then catches up	Low speed, ramps, position following
3 — Position, servo	Yes	Possible	Almost none	Catches up, overshoots slightly and returns	Tight position match; position follower (drive in position/slave mode)

10.4 Which mode should I choose?

Requirement	Mode
Speed feedback to the drive, steady high speed	0 — Speed transfer
Counting, metering, cut length; no pulse may be lost and no backward step is acceptable	1 — Position, safe
Low speed or ramps; position following with almost no delay	2 — Position, predictive
Drive is a position follower (electronic gear, master-slave) and tight matching is needed	3 — Position, servo
Not sure	Keep the default (mode 0)

10.5 Setting the mode

1. Put the RX into service mode and open its Web UI (see §5.6).
2. Open **Output Mode** and select the mode for each encoder channel.
3. If needed, open **Advanced settings** and adjust the values (see §10.6).
4. Press **Save**. The setting takes effect in normal operation; return the device to normal operation.



10.6 Advanced settings

Parameter	Range	Default	Meaning	When to change
`kp` (position gain)	1–500 1/s	200	How firmly the position error is corrected.	Higher = tighter tracking; too high causes oscillation.
`catch_hz` (catch-up rate)	—	2000 Hz	Maximum extra frequency added while missing pulses are made up.	Lower it if the drive cannot follow a sudden speed rise.
`resync` (re-align threshold)	—	10000 pulses	If more pulses are missing, the output is re-aligned directly and an alarm is raised.	Raise it for very long link interruptions.
`lead_us` (lead time)	0–5000 µs	1250	How far ahead the target is predicted (modes 2 and 3).	Adjust if a residual lag or overshoot remains.
`acc` (acceleration term)	on / off	on	Prediction also considers acceleration (modes 2 and 3).	Switch off only if ramps look unsteady.

If you are unsure, use the default values.

10.7 Drive side

For a position follower the drive must be set to its position (slave) mode, with its encoder input connected to the WENC2 RX output. Select the parameters according to the drive manual.

> **Caution:** Mode 3 may overshoot the target briefly and return, and it can step backwards. Where reverse pulses are not acceptable (cutting, metering), choose mode 1.

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