WENC2

Datasheet

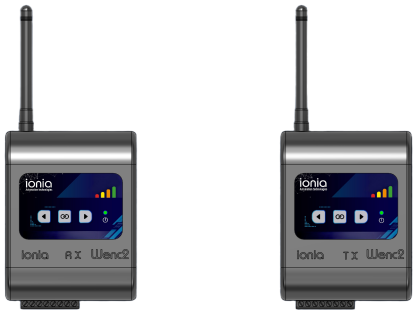

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Table of Contents

Technical reference applicable to all models (MONO, DUO, TRI).

> In this document, values marked with **—** will be defined by measurements during the production phase. Contact the manufacturer for the latest version.

1. Product Description

WENC2 is a wireless transmitter-receiver system that carries motor encoder signals in industrial environments. The TX (transmitter) reads encoder inputs, and the RX (receiver) reproduces the signals as a quadrature output for the drive.

It replaces the encoder cable in applications where pulling cable is difficult or impossible (rotating bobbin, rotary table, slip-ring systems, multi-axis machines).

Models

Model	Encoder Channels	Description
WENC2-MONO	1	Single encoder channel
WENC2-DUO	2	Dual encoder channels
WENC2-TRI	3	Three encoder channels

2. Key Specifications

Parameter	Value
Communication	5 GHz robust protocol compliant with Wi-Fi 6ax licensing
Link security	Paired MAC verification + CCMP encryption framework
Topology	Point-to-point (peer-to-peer), automatic channel hopping
Supply voltage	RX: 10–32 V DC • TX: 15–32 V DC *(see §3.1)*
Encoder type	Incremental quadrature (A/B/~A/~B)
Encoder connection	4-wire (differential) or 2-wire (single-ended)
Encoder supply output (TX)	+23.5 V filtered
RX output level	HTL (24 V), over-current and short-circuit protected
Encoder input isolation	Optically isolated
Drive interface	HTL / push-pull, A/B (Z / index not used)
Motor RPM range (1024 ppr)	0–3600 RPM
Operating distance (line of sight)	> 100 m LOS (open area); actual range depends on environment
RF output power	≤ 17 dBm (5 GHz, declared)
Antenna gain	1.1 dBi (2 × external antenna in package)
Operating temperature	−20 °C … +60 °C

3. Electrical Parameters

3.1 Supply

TX and RX have different supply ranges. **The TX lower limit is set by the DI logic threshold** (see §3.2, Note). **On the RX side, the HTL output level tracks the supply voltage** (V_out ≈ V_supply − 1 V).

3.1.1 TX Supply

Parameter	Value
Supply voltage	**15 – 32 V DC** (nominal 24 V)
Minimum supply	15 V *(due to DI logic threshold)*
Absolute Max (short-duration peak)	42 V
Typical current @ 24 V (normal mode, excl. encoder current)	28 mA
Average / peak current @ 24 V	29 mA avg / 32 mA peak
Average / peak current @ 15 V	42 mA avg / 59 mA peak
Reverse polarity protection	Withstands down to −32 V
Over-voltage protection	35 V varistor + fuse (Abs Max peak: 40 V)

3.1.2 RX Supply

Parameter	Value
Supply voltage	**10 – 32 V DC** (nominal 24 V)
Absolute Max (short-duration peak)	35 V
Typical / peak current @ 24 V (no load)	50 mA avg / 57 mA peak
Typical / peak current @ 15 V (no load)	55 mA avg / 64 mA peak
Typical / peak current @ 10 V (no load)	66 mA avg / 85 mA peak
HTL output level (supply-tracking)	23 V_pp @ 24 V • 14 V_pp @ 15 V • 9 V_pp @ 10 V
Reverse polarity protection	Withstands down to −32 V
Over-voltage protection	35 V varistor + fuse

> **RX supply-output relation:** The RX HTL output voltage tracks the supply voltage. For the drive's HTL 24 V thresholds to be met, **RX supply should be nominal 24 V**. Below 15 V supply the output level may fall below standard HTL thresholds.

3.2 Encoder Input (TX)

Parameter	Value
Input signal	A, /A, B, /B (incremental quadrature)
Level	HTL (24 V tolerant)
DI logic LOW threshold	V_in < 13.8 V
DI logic HIGH threshold	V_in > 14.0 V
A/B input current	Sink / source @ 24 V, ±2 mA (typical)
Connection types	4-wire differential or 2-wire single-ended
Isolation	Optically isolated
Encoder supply output (Terminal 3)	V_supply − 0.5 V *(nominal +23.5 V @ 24 V supply)*
Encoder supply current limit (Terminal 3)	500 mA continuous; protection triggers above 1000 mA

> **Note — TX minimum supply:** Since the DI HIGH threshold is 14 V, the TX supply voltage cannot fall below this level. For this reason **TX minimum supply is set to 15 V** (with a practical safety margin). The same threshold explains why the encoder supply output is tied to V_supply.

3.3 Encoder Output (RX)

Parameter	Value
Output signal	A, /A, B, /B (quadrature)
Level	HTL / push-pull (supply-tracking, see §3.1.2)
Continuous current per channel	100 mA sink / 100 mA source
Absolute Max per channel	1000 mA (PTC protected)
Short-circuit protection	PTC based; response ≈ 300 ms, auto-recovery
Index (Z) signal	**Not used** (WENC2 transmits A/B only)

> **Quadrature integrity is required.** A and B signals must be read together for the built-in error recovery, correct counting and noise rejection hardware/algorithms to function. **A-only or B-only pulses cannot be used or transmitted on their own.**

3.4 Protection and Connection Safety

Parameter	Value
TX input — optical isolation	Galvanic isolation between terminals and internal electronics
RX output — over-current protection	Yes, auto-recovery
RX output — short-circuit protection	Yes
ESD rating (terminal)	±4 kV contact / ±8 kV air (IEC 61000-4-2 Level 2 target) *(all I/O: 40 V varistor + 10 kΩ GND pulldown)*

4. Performance / Timing

Parameter	Value
Boot time — unpaired device (power → service AP up)	≈ 5 s
Boot time — paired device (power → normal mode active)	≈ 12 s
Max encoder pulse frequency	> 64 kHz
Service mode status update interval	≈ 100 ms (status update)

> **Service mode output:** The full RX encoder output is produced only in **normal operation mode**. In service mode the output runs at ~100 ms intervals (status update) — **it is not suitable for closed-loop operation**.

5. Mechanical Specifications

TX and RX use the same enclosure. Mechanical dimensions are identical; the difference is only the terminal print / labeling.

5.1 TX Mechanical

Parameter	Value
Enclosure dimensions (W × D × H, antenna excluded)	70 × 103 × 60 mm
Weight (with antenna, excl. terminal)	120 g
IP rating	IP20 *(open housing with ventilation holes)*
Mounting	TS35 (35 mm) DIN rail clip + cross-head screw holes
Terminal type	Screw terminal (pluggable), 2 × 8 pin
Terminal pitch	3.81 mm
Screwdriver tip	2.5 mm flat
Conductor cross-section	0.22 – 0.75 mm² (AWG 24 – 18)
Antenna type	External, screw-type connector
Antenna band	5 GHz
Antenna gain	1.1 dBi

5.2 RX Mechanical

Parameter	Value
Enclosure dimensions (W × D × H, antenna excluded)	70 × 103 × 60 mm
Weight (with antenna, excl. terminal)	120 g
IP rating	IP20 *(open housing with ventilation holes)*
Mounting	TS35 (35 mm) DIN rail clip + cross-head screw holes
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Antenna gain	1.1 dBi

> **High-IP applications:** For installations that require dust, moisture or wash-down compliance, WENC2 can be supplied in a custom sealed enclosure on request.

6. Environmental Conditions

Parameter	Value
Operating temperature	−20 °C … +60 °C *(industrial-grade components)*
Storage temperature	−40 °C … +85 °C
Operating humidity	10 – 95 % RH (non-condensing)
Operating altitude	≤ 2000 m
EMC immunity (design target)	IEC 61000-4-2 (ESD) / 4-4 (EFT) / 4-5 (Surge) — contact the manufacturer for field report
Vibration (design target)	EN 60068-2-6 (10 – 500 Hz, 2 g)
Shock (design target)	EN 60068-2-27 (15 g, 11 ms)

> Environmental parameters are based on the industrial-grade declarations of the components used. This section will be updated as accredited lab tests are completed.

7. Operating Modes

7.1 Normal Mode

Paired devices start in normal mode automatically when powered.

- TX and RX connect automatically (using the stored peer MAC address)
- Encoder data is transmitted in real time
- RX reproduces an identical quadrature signal to the drive
- WiFi access point is **off** (Web UI unreachable)
- LEDs show the signal strength

7.2 Service Mode

Used for pairing, monitoring, settings and OTA updates.

- RX opens a WiFi access point → Web UI access from tablet/phone
- Encoder values can be monitored live in the Web UI
- A/B signal diagnostics detect cable faults
- Device settings (name, password) can be changed
- OTA firmware update can be performed
- **RX encoder output runs as ≈100 ms status update** — not suitable for closed-loop

8. Terminal Assignments

8.1 TX (Transmitter — Motor Side)

Terminal	Function	Model
1	+24 V supply input	All
2	GND	All
3	+23.5 V encoder supply output	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-wire encoder: Only A and B are connected. On the TX side, /A and /B terminals are **bridged to GND**. On the RX side no bridging is done.

8.2 RX (Receiver — Drive Side)

Terminal	Function	Model
1	+24 V 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 **HTL level (24 V)** and connect directly to the drive's encoder input.

9. PPR / RPM Coverage

WENC2 works **transparently** with the drive — it forwards encoder pulses unchanged. System coverage is defined over **3600 RPM @ 1024 ppr** (pulse bandwidth).

Different PPR values are possible; the upper RPM limit scales inversely with the pulse rate:

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

When the encoder changes, only the **PPR / pulse count parameter in the drive** is updated; no setting is required on the WENC2 side.

10. LED Indicators and Boot Modes

10.1 LED Bar (D1–D4)

4 signal LEDs + 1 power LED (always on).

10.2 Normal Mode — Signal Strength

LED	Threshold
D4 (25%)	RSSI ≥ -85 dBm
D3 (50%)	RSSI ≥ -70 dBm
D2 (75%)	RSSI ≥ -55 dBm
D1 (100%)	RSSI ≥ -40 dBm

All LEDs off = no link.

10.3 Service Mode Animations

State	Animation	Description
Boot (~1 s held)	2× fast blink	Service mode entered
Boot (30 s held)	6× fast blink	Factory reset
Service — unpaired	Knight Rider (D4↔D1)	Searching for peer
Service — paired	Center-outward pulse	Link established
Pairing succeeded	Bottom-up fill → 3× blink → solid	Pairing complete
Locate Me	All LEDs flash (~5 s)	Triggered from Web UI

10.4 Boot Modes

The button is active **only while power is being applied** (during boot). Pressing the button during normal operation has no effect.

Press Duration	Behavior
Boot without press	Normal mode (if paired) or auto service mode (if unpaired)
Hold 2 s	Enter service mode (LED confirms with 2× blink, then release)
Hold 30 s	Factory reset (all settings cleared, reboots in service mode)

11. Web UI Features (Service Mode)

WiFi Connection Info

Parameter	Value
SSID	`WENC_XXXXXX` (XXXXXX = last 3 bytes of MAC)
Default password	`12345678`
IP	`192.168.10.1`
Browser URL	`http://192.168.10.1`

11.1 Main Screen

- **Encoder rotation animation:** Live rotation visual per encoder
- **RPM / Hz / Direction:** Instant speed and direction (CW/CCW/Stop)
- **RSSI indicator:** Signal strength bar + dBm value + quality
- **Link status:** Channel, packet loss rate

11.2 A/B Signal Diagnostics

For each encoder channel, A and B signal levels are shown with colored indicators:

- **Green** = signal present (HIGH)
- **Red** = signal absent (LOW)

When the encoder rotates, the indicators are expected to change. This feature is used to detect cable faults (visible only in service mode).

11.3 System Information

Info	Description
CPU temperature	TX and RX chip temperature
Restart counter	TX and RX total restart count
Reset reason	Reason of the last restart
Firmware	TX and RX firmware version and date
MAC	TX and RX MAC addresses

Restart Counter — Slip-Ring Maintenance Tracking

The restart counter was added for detection of momentary power interruptions. On systems powered through a slip-ring, brush–ring contact loss causes short power drops that restart the device.

- High restart count → poor contact → maintenance needed
- **High TX increment** → motor-side slip-ring contact poor
- **High RX increment** → drive-side supply problem (loose terminal, fuse, power source)
- Record the counters as a reference after commissioning; track the rate of increase with periodic checks
- Factory reset clears the counters

11.4 Pairing

- **Scan Devices:** Lists nearby TX units
- **Pair:** Creates a persistent pairing with the selected TX
- **Locate Me:** Flashes the TX/RX LEDs for ~5 s to find the physical unit
- **Unpair:** Clears pairing on both devices

11.5 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`

11.6 OTA Update

- **RX Update:** Direct firmware upload
- **TX Update (Proxy):** Wireless firmware transfer to TX via RX
- Model compatibility is checked automatically (wrong model is rejected)
- If the upload fails, the device rolls back to the previous working firmware

11.7 Other

- **Switch TX Peer to Service Mode:** Remotely puts the TX into service mode
- **Return to Normal Operation:** Both devices return to normal mode
- **Help:** Commissioning and troubleshooting guide

12. Secure Update (Anti-Rollback)

After an OTA update the new firmware must validate itself within 60 seconds. If validation fails (crash, error etc.), the device automatically rolls back to the **previous working firmware**. This mechanism prevents broken updates from being installed in the field.

Parameter	Value
Rollback time	≤ 60 s

13. Compliance and Certifications

The wireless layer of WENC2 is based on a Wi-Fi 6 (IEEE 802.11ax) dual-band (2.4 / 5 GHz) certified RF module.

13.1 Supported Wireless Standards

- IEEE 802.11 a/b/g/n/ac/ax dual-band Wi-Fi 6
- Bluetooth 5 (LE) and IEEE 802.15.4 (Thread / Zigbee) capability
- CCMP encryption framework defined in IEEE 802.11-2012

13.2 RF Module Certifications

Certification	Authority / Region
FCC	USA
IC (ISED)	Canada
CE / RED	European Union
MIC	Japan
SRRC	China
KCC	South Korea
ANATEL	Brazil
WFA (Wi-Fi Alliance)	International Wi-Fi 6 compliance
BQB	Bluetooth SIG
Thread 1.4	Thread Group

> The certifications apply at RF module level. Final product declarations of conformity (CE / UKCA etc.) and market-specific registrations are the responsibility of ionia automation technologies.

14. Ordering and Package Contents

14.1 Order Codes

Order Code	Encoder Channels	Contents
WENC2-MONO	1	1 × TX + 1 × RX
WENC2-DUO	2	1 × TX + 1 × RX
WENC2-TRI	3	1 × TX + 1 × RX

14.2 Standard Package Contents

- 1 × TX transmitter
- 1 × RX receiver
- 2 × 5 GHz 1.1 dBi external antenna
- 4 × 8-pin 3.81 mm pluggable screw terminal sockets
- Cardboard packaging

15. Troubleshooting Reference

Symptom	Possible Cause	Solution
LEDs not lit	No power or no signal	Check supply (10–30 V). In normal mode LEDs are off when there is no signal
Pairing fails	Devices are not in service mode	Put both devices into service mode (Knight Rider animation)
Web UI does not open	Wrong WiFi or mobile data on	Connect to the SSID that starts with `WENC_` and turn off mobile data
Encoder turning but no count at drive	Cable fault or RX in service mode	Use A/B signal diagnostics in the Web UI. If RX is in service mode, return to normal operation
Direction inverted at drive	A/B order inverted	Invert via drive parameter; **or** on a 4-wire connection swap A with /A (most practical); **or** on a 2-wire connection swap ENC.A with ENC.B on the TX
All indicators red	Encoder has no power	Broken cable or, on 2-wire, the /A, /B → GND bridge is missing
Indicators do not change	Signal wire broken	Check the corresponding A or B line
Position oscillates between +1/−1	Wrong wiring	Check A/B/~A/~B connection order
Frequent restarts	Poor slip-ring contact or supply issue	Compare the restart counters — TX increment → slip-ring maintenance; RX increment → drive-side supply check
Not working after OTA	Broken firmware	Auto-rollback restores the previous version (within 60 s)

Appendix A — Wiring Diagram