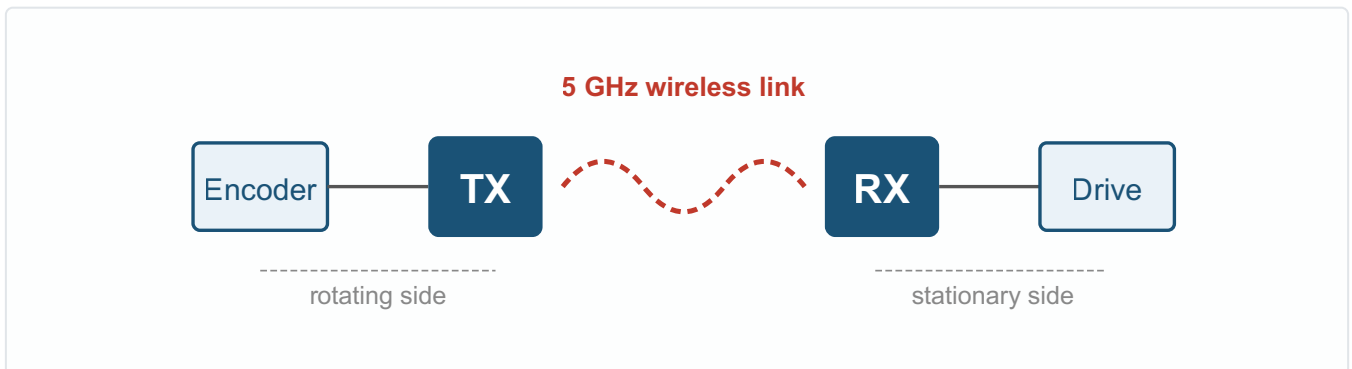


WENC2

# Wireless Encoder Transmission System

Slip-ring-free encoder transmission for rotating motors



WENC2 is a two-device system that transmits incremental quadrature encoder signals from the rotating or moving section of a machine over a 5 GHz wireless link. **TX** reads the encoder inputs; **RX** regenerates the same signals as true quadrature outputs. From the drive's point of view, RX appears as a physically connected encoder; no hardware or software modification is required on the drive side.

## Models

### WENC2-MONO

1 encoder channel. Single bobbin or single rotating axis applications.

### WENC2-DUO

2 encoder channels. Pay-off or take-up, plus capstan or traverse motor.

### WENC2-TRI

3 encoder channels. Multi-axis twisting / winding systems (capstan + take-up + traverse).

## Engineering Problem

<b>Signal integrity</b>	Momentary brush-to-surface disconnections cause pulse loss; oxidation and arc-induced noise can produce spurious pulses.
<b>Mechanical wear</b>	Brushes and ring surfaces require periodic maintenance; missed intervals lead to unplanned downtime.
<b>Limited closed-loop</b>	Because the feedback signal is not reliable, the inner motor cannot be truly closed-loop controlled. To compensate, auxiliary haul-off / tension regulation equipment such as caterpillar haul-off, capstan or dancer is added to the line; this extends the line and increases investment.

## WENC2 Approach

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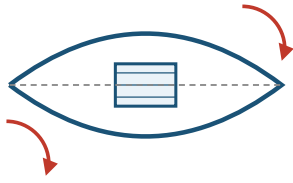
Instead of carrying the encoder signal through a slip ring, a TX is placed on the rotating side and an RX on the stationary side. The signal is transmitted wirelessly and regenerated on the RX side. As a result, the drive sees a real encoder and can operate in true closed-loop; mechanical wear sources are eliminated; and in certain applications the need for auxiliary tension/haul-off regulation equipment is reduced or removed altogether.

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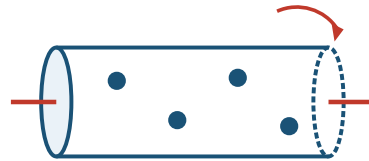
## Applications in Cable and Wire Manufacturing

The machines below include motor / encoder systems located inside a rotating body, bow or bobbin. The classical solution is a slip ring. WENC2 eliminates the slip ring on the encoder feedback path in each example.



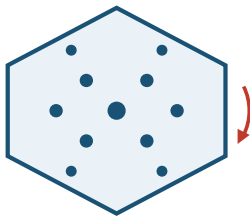
### Double Twist Buncher

Take-up bobbin, capstan and traverse motors are located inside the rotating bow; two twists are produced per rotor turn. The take-up encoder delivers more stable tension in torque mode, the capstan encoder provides accurate lay length via closed-loop, and the traverse encoder enables a precise winding pattern under closed-loop control. All encoder signals are carried across via WENC2.



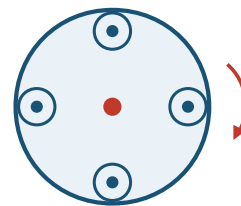
### Tubular Strander / Buncher

Multiple bobbins inside a rotating tube with 100% back-twist. The tension motor encoder signal of each bobbin is transmitted wirelessly.



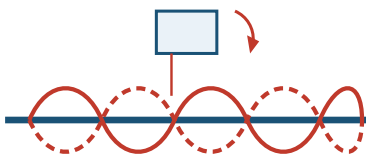
### Rigid / Cage Strander

Fixed bobbins inside a rotating frame (19 / 37 / 61 bobbin configurations). Back-tension and length encoders are carried over WENC2.



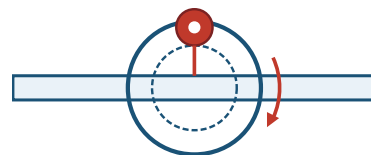
### Planetary Strander

Cage and planet bobbins have two independent rotation axes. For large-section conductors, both planet and cage motor encoder signals are transmitted.



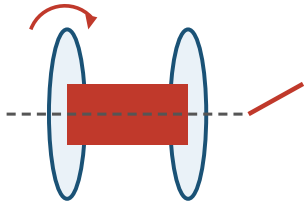
### Armouring Line

Fork or planetary type rotating bobbins for GI wire / strip armour winding. Accurate lay length is produced without a rotating caterpillar, using take-up speed, spool diameter and rev calculation; the traverse motor delivers a correct winding pattern under closed-loop. A more stable haul is achieved with smaller motors; installation, maintenance and energy costs are noticeably reduced. Bobbin encoder signals are transmitted via WENC2 to the stationary controller.



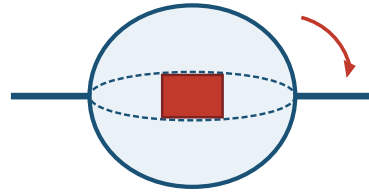
### Taping / Lapping Line

Rotating taping / wrapping head (insulating tape, mica, paper, foil). Head position and tension are controlled wirelessly.



### Rotary Pay-off / Take-up

Rotating take-up or pay-off bobbin. The bobbin speed and length encoder signal, together with the traverse encoder providing a correct winding pattern under closed-loop, reach the central drive without a slip ring layer. Stable tension and speed are obtained.



### Drum Twister

MV / HV cable twisting inside a large rotating drum. Accurate lay length is produced without a rotating caterpillar, based on take-up speed, spool diameter and rev calculation; the traverse motor also maintains a correct winding pattern under closed-loop. Installation, maintenance and energy costs are noticeably reduced. The drum-internal motor encoder signals are transmitted outside the drum via the 5 GHz link.

## Typical Product Types

LV / MV / HV power cables · Railway signal and control cables · Automotive cables · Steel wire ropes · Coaxial and fiber-optic cables · Armoured control and communication cables.

## Other Industrial Areas

WENC2 may also be considered as an alternative solution in applications where encoder signals are carried across a slip ring or equivalent rotary connection. The list below shows usage examples with asynchronous (AC inverter-driven) motors.

Sector	Example Application
<b>Cranes and gantries</b>	Rotary trolley, rotating cabin, hoist drum encoder
<b>Centrifuges</b>	High-speed basket, decanter speed (AC motor driven)
<b>Rotary dryer / fermenter</b>	Rotating drum speed and position monitoring
<b>Mixers and reactors</b>	Rotating agitator speed / position (AC drive)
<b>Textile</b>	Bobbin winder, traverse winding
<b>Heavy machinery / mining</b>	Rotating milling head, screen, TBM sensor data

**Scope note:** WENC2 has so far been validated with asynchronous (ACIM / AC inverter-driven) motors and HTL-level 2- or 4-wire quadrature encoders. Applications that require servo position feedback have not been validated and are therefore out of scope.

## Technical Specifications

Wireless Communication		Electrical	
Band	5 GHz	Supply	10–30 V DC
Topology	Point-to-point (peer-to-peer)	Encoder supply output (TX)	+23.5 V filtered
Channel management	Automatic channel switching	Operating temperature	-20 °C ... +60 °C
Protocol	Wi-Fi 6ax compliant 5 GHz robust protocol	Terminal	16 clamps (TX and RX)
Encoder Interface		Commissioning	
Input type	Incremental quadrature (A/B/~A/~B)	Pairing	Web UI (Wi-Fi access point)
Wiring	4-wire (differential) or 2-wire	Web UI IP	192.168.10.1
Number of channels	1 / 2 / 3 (model-dependent)	OTA update	RX + TX proxy
Motor RPM range	0–3600 @ 1024 ppr encoder	Secure update	Anti-rollback
TX input isolation	Optically isolated	LED indication	4 signal LEDs + POWER
RX output level	HTL (24 V), overcurrent and short-circuit protected		

## Comparison with Alternative Solutions

Solution	Signal Quality	Maintenance	Closed-loop	Initial Investment
Carbon-brush slip ring	Low	Periodic	Limited	Low
Gold / silver contact slip ring	Medium	Periodic	Limited	Medium
2.4 GHz general-purpose IoT link	Low (latency)	Low	No	Low
<b>WENC2 (5 GHz dedicated link)</b>	<b>High</b>	<b>None</b>	<b>Yes</b>	<b>Medium</b>

## Ordering Information

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

Every set is factory-tested before shipment. Field firmware upgrades are possible via OTA.

# Web UI Commissioning

Every WENC2 device opens its own WiFi access point in service mode. A tablet or phone connects and opens 192.168.10.1 in the browser. Commissioning, diagnostics, OTA updates and slip-ring maintenance tracking are all handled from the Web UI — no external software, cable or license required.

**Wireless signal**  
RSSI + quality (dBm + bar)

**Paired TX**  
Connected transmitter MAC

**Scan Devices**  
Lists TX units in service mode

**Live encoder**  
RPM - frequency - position (64 bit)

**Locate Me**  
Flash LEDs to find the unit

**TX to Service Mode**  
Remotely put TX in service mode

**Main Screen** — Signal quality, TX pairing, live encoder data (RPM, frequency, 64-bit position).

**Cable/Power Warning**  
Auto alert when no signal

**Channel summary**  
A/B status for each encoder

**A/B Diagnostics**  
Green: signal - Red: no signal

**Frequency - Position**  
Live Hz and counter value

**Signal strength**  
RSSI - packet loss %

**AP settings**  
Device name + WiFi password

**A/B Signal Diagnostics** — Per-channel A/B cable and power status, packet statistics.

**Save**  
Active after reset

**Temperature**  
RX and TX (°C)

**Restart counter**  
Slip-ring maintenance tracking

**Device Identity**  
RX/TX MAC addresses

**Firmware version**  
Build date+time identifier

**RX OTA**  
RX firmware update

**TX OTA (RX Proxy)**  
Wireless TX firmware transfer

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

## History and Sustainability

The timeline below summarises the evolution of the WENC product family, its field validation and manufacturing maturity.

<b>Late 2012</b>	Design work on the WENC1 project began.
<b>2014</b>	Field testing of the prototype started.
<b>2016</b>	Field testing was completed after five revisions.
<b>2016 - 2020</b>	Retail production was carried out based on individual orders.
<b>January 2021</b>	Industrial series production began; the product was named <b>ionia WENC</b> .
<b>June 2021</b>	An advanced laboratory and fully independent series production SMT lines were established; production and test processes were made systematic.
<b>Through 2025</b>	WENC1 remained in series production.
<b>Q2 2025</b>	WENC2 was manufactured and field testing started.
<b>Q1 2026</b>	WENC2 entered series production.

We manufacture on our in-house SMT line without external dependency, keeping our quality processes under control at every stage.

## Version Differences

Feature	WENC1	WENC2
<b>Number of encoder channels</b>	1	3 (MONO / DUO / TRI)
<b>RF band</b>	2.4 GHz	2.4 / 5 GHz dual-band
<b>RF regulation</b>	Proprietary 2.4 GHz	IEEE 802.11ax Wi-Fi 6 certified module (FCC, CE/RED, IC, MIC, SRRC, KCC, ANATEL, WFA)
<b>Protocol</b>	Proprietary protocol	Peer MAC-authenticated robust protocol
<b>CPU</b>	16-bit	32-bit RISC
<b>Internal position counter</b>	32-bit	64-bit
<b>Service mode</b>	—	Web UI (tablet / phone)
<b>Firmware update</b>	—	OTA (RX + TX proxy)
<b>Output / supply protection</b>	Basic	Over-temperature + overcurrent
<b>Supply peak protection</b>	40 V	45 V Abs Max
<b>Supply conversion</b>	SMPS	High-efficiency next-generation SMPS
<b>Thermal tolerance</b>	Standard	Operation up to +70 °C

WENC2 is built on the field experience accumulated with WENC1; it offers a higher channel count, wider band and robustness, field upgradeability and comprehensive protection circuits.

## Compliance and Certifications

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The wireless transmission layer of WENC2 is based on a Wi-Fi 6 (IEEE 802.11ax) dual-band (2.4 / 5 GHz) certified RF module. The module holds the principal certifications required for legal compliance across major international markets; WENC2 is built on top of this compliance base.

### 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 as defined in IEEE 802.11-2012

### RF Module Certifications

Certification	Authority / Region
FCC	United States
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 listed are valid at the RF-module level. End-product declarations of conformity (e.g. CE / UKCA) and market-specific registration processes are the responsibility of ionia automation technologies.

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