Enabling Your Machines to Do More

June 2024

INDUSTRY LEADING CUSTOMERS & PARTNERS

Rockwell Automation, ifm, B&R, SICK, ROHM, Schneider Electric, ZIMMER Group, VAHLE, EMERSON, SCHMALZ, BALLUFF, hilscher, RAVEN, ATI, OPTIMA, DMG MORI, ROTZINGER, amazon, LEWCO, TURCK, Endress+Hauser

GLOBAL PRESENCE

- **CoreTigo Offices**
  Germany, Italy, USA, Israel (HQ)
- **Worldwide Distributors:**
  North America, Europe, Asia

BROAD RANGE OF INDUSTRIES & SOLUTIONS

- Maximizing Flexibility & Adaptivity
- Reducing Footprint
- Simplifying Maintenance & Deployment
- Increasing Capacity & Speed
- Improving OEE
- Reducing Changeover Time
- Downtime Reduction

THE MOST RELIABLE WIRELESS TECHNOLOGY FOR INDUSTRIAL AUTOMATION

Cable Grade **Reliability**

Designed for **Real-time Control & Monitoring**

Part of the global **IO-Link Standard**

IO-Link wireless

CoreTigo

Serving a Variety of Industries & Markets

CoreTigo
Industrial Wireless Automation

CPG (F&B, Pharma)

Adaptive Packaging Machines

Bottling, Heat Treatment

Glove Integrity Testing

OEE improvement

Automotive

EV Battery Assembly

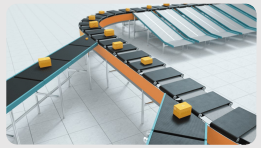
Car Seat Assembly

Cranes & Gantries

Air Flow Monitoring

Logistics

Crossbelt Sortation Systems



AMRs

ASRS / Smart Warehouse

Predictive Maintenance

Other Discrete Mfg.

CNC Machines Intelligent Tooling

Converting Machines

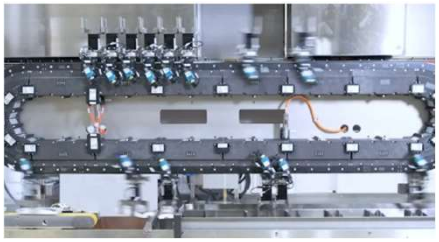
Solar Panels

Stone Processing

IO-Link Wireless – Bridging the Gap

IO-Link wireless

Control of Actuators in High-speed Motion

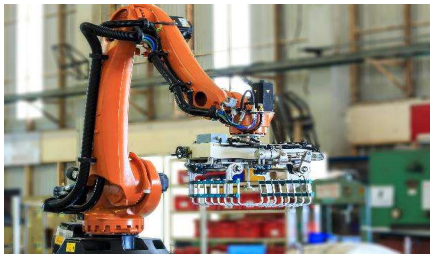


Independent Mover Systems
Rotary Tables & Carousels

Condition Monitoring & OEE Improvement

Machines
& Production Lines

Flexible and Simplified End-of-Arm Tooling



Robots & Cobots

Data Collection at Tooling/Clamping Point

CNC, Grinding
& Milling Machines

Reliable & Scalable AMR to Machine Interaction

AMRs &
Mobile Equipment

Fast & Precise Wireless Control

Crossbelt Sortation Systems

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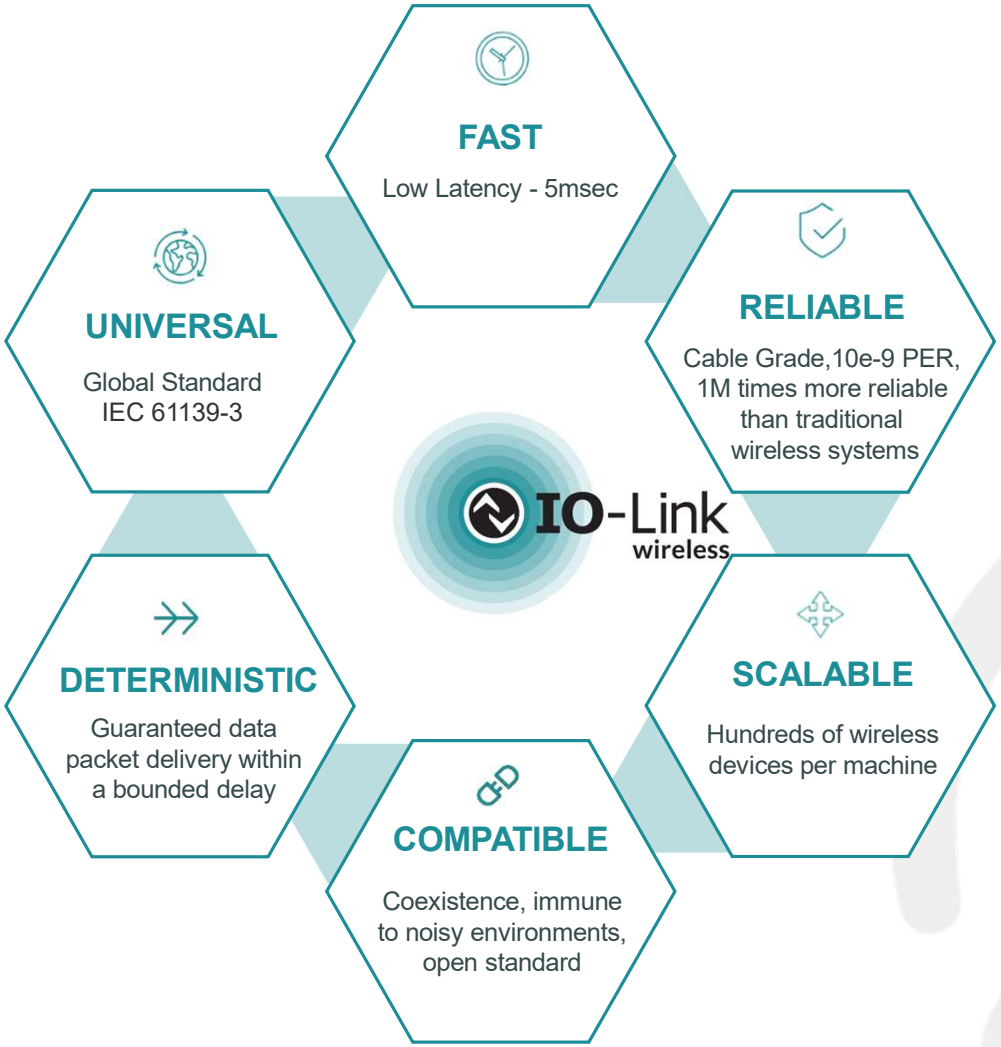
IO-Link Wireless – Breaking the Limits

Designed for Control & Monitoring

The ONLY wireless technology that meets the harsh Industrial requirements



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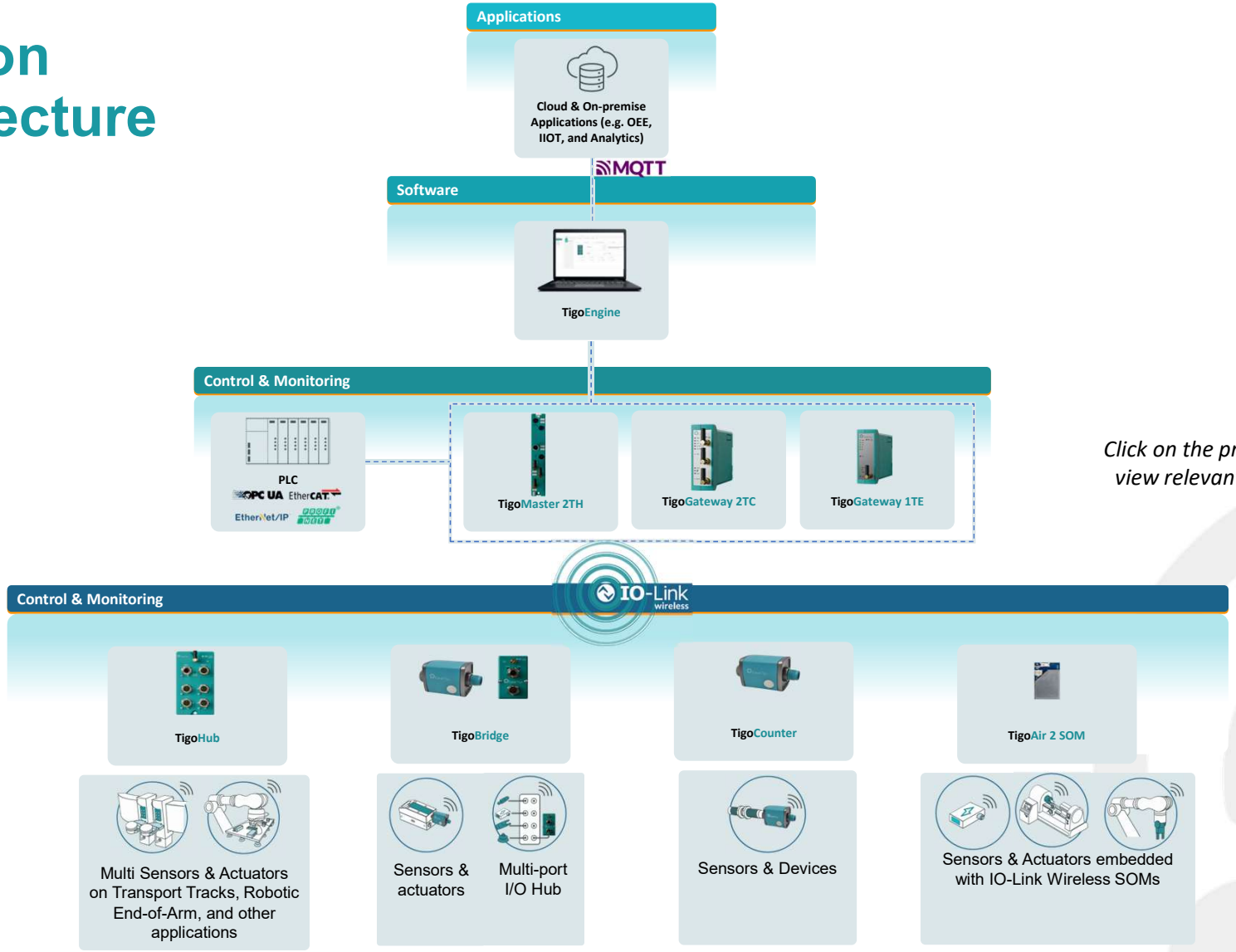
Solution Architecture



Click on the product picture to view relevant product video

Range of power options:

- ⚡ Slip Rings
- ⚡ Inductive Power
- ⚡ Battery
- ⚡ 24V

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Transport Tracks & Smart Conveying Systems

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Transport Tracks – Challenges

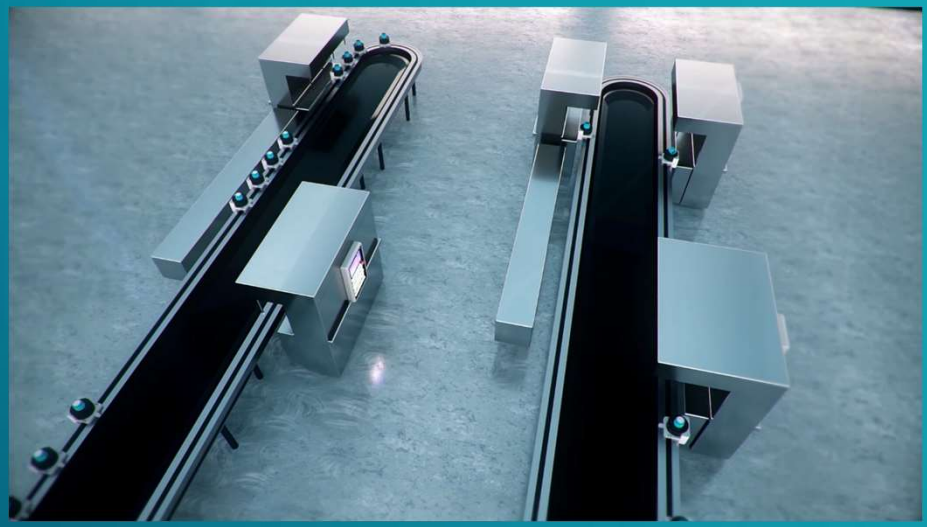
Cables are not feasible on independent transport track movers for sensor and actuator communication

Lack of flexibility and adaptivity to support multiple product and package types per machine

Manual changeover & setup is time consuming and causes machine downtime

Current solutions require **dedicated/custom tools** per product size and form factor

Large machine footprint due to external robotics and mechanical components



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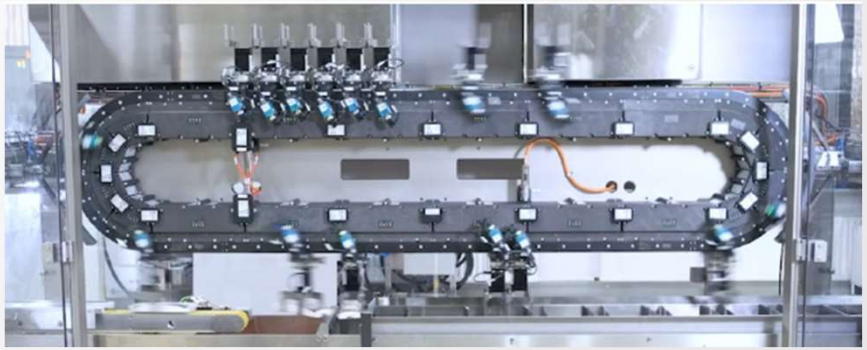
IO-Link Wireless – Enhancing Conveying Systems

- ❑ Enable continuous actuation while in high-speed motion
- ❑ Real-time wireless control of devices such as grippers and vacuum pumps



- **Vendor Agnostic –** compatible with any transport track system
- **Multiple Devices –** numerous sensors and actuators on a single mover
- **Device Agnostic –** supports IO-Link, Digital or Analog devices
- **Scalable –** hundreds of wireless devices on a single machine
- **Unrivaled Performance –** cable-grade reliability at low latency without trading off speed

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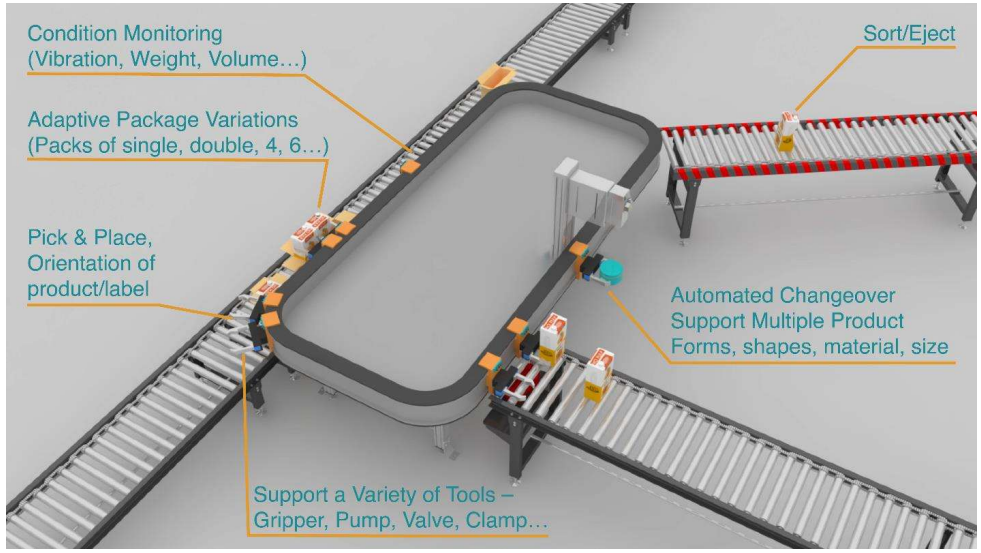
Benefits: Adaptive, Efficient, Sustainable

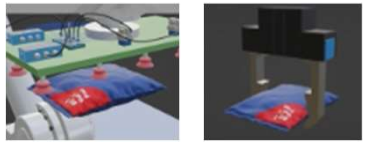
X4	**>75%**	**X2**	**>30%**
Faster Time to Market	Changeover Time Reduction	Throughput Increase	Footprint Reduction

- **Support multiple product and package variations** on a single machine with automatic changeover and maximum flexibility
- **Sustainable & cost-effective design** reduces external automation equipment and machine footprint, energy consumption and number of machines
- **Reduce time to market** for applying new product/package designs
- **Increase ROI** by maximizing machine throughput and utilization

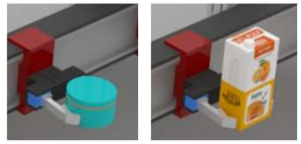
Real-time Wireless control & monitoring on independent movers



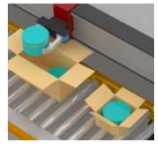
Watch Video



Variety of tool types on each mover



Multiple Product Types Without Changeover



Multiple Package Types

Case Study: Rotzinger Adaptive Packaging Machine

Swiss Packaging Machine Builder

Link to Video

CHALLENGE

- Secondary food packaging machine with requirements for high throughput and support of multiple package and product variations
- Machine is based on a multi-carrier smart conveyer system which requires doing actions on products while in constant high-speed motion
- Cables and conventional wireless solutions are not feasible

SOLUTION

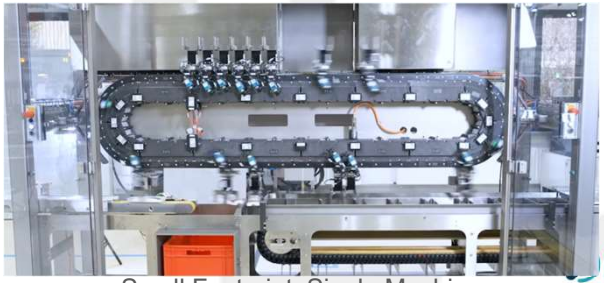
- Wireless control of grippers on the movers via an IO-Link Wireless Bridge connected directly to it on the mover
- Power is supplied to the Bridges and Grippers by a contactless power supply system.

BENEFITS

- **Adaptive -** Full flexibility to support multiple product types (different product sizes are automatically adjusted) and package types (one, two or more primary packages per secondary package).
- **Reduced changeover time –** eliminate manual changeovers
- **Machine footprint reduction -** reduce external equipment
- **Sustainable -** less energy, space and decreased number of machines

Adaptive and Flexible Pick & Place


Variety of Product Form Factors


Small Footprint, Single Machine

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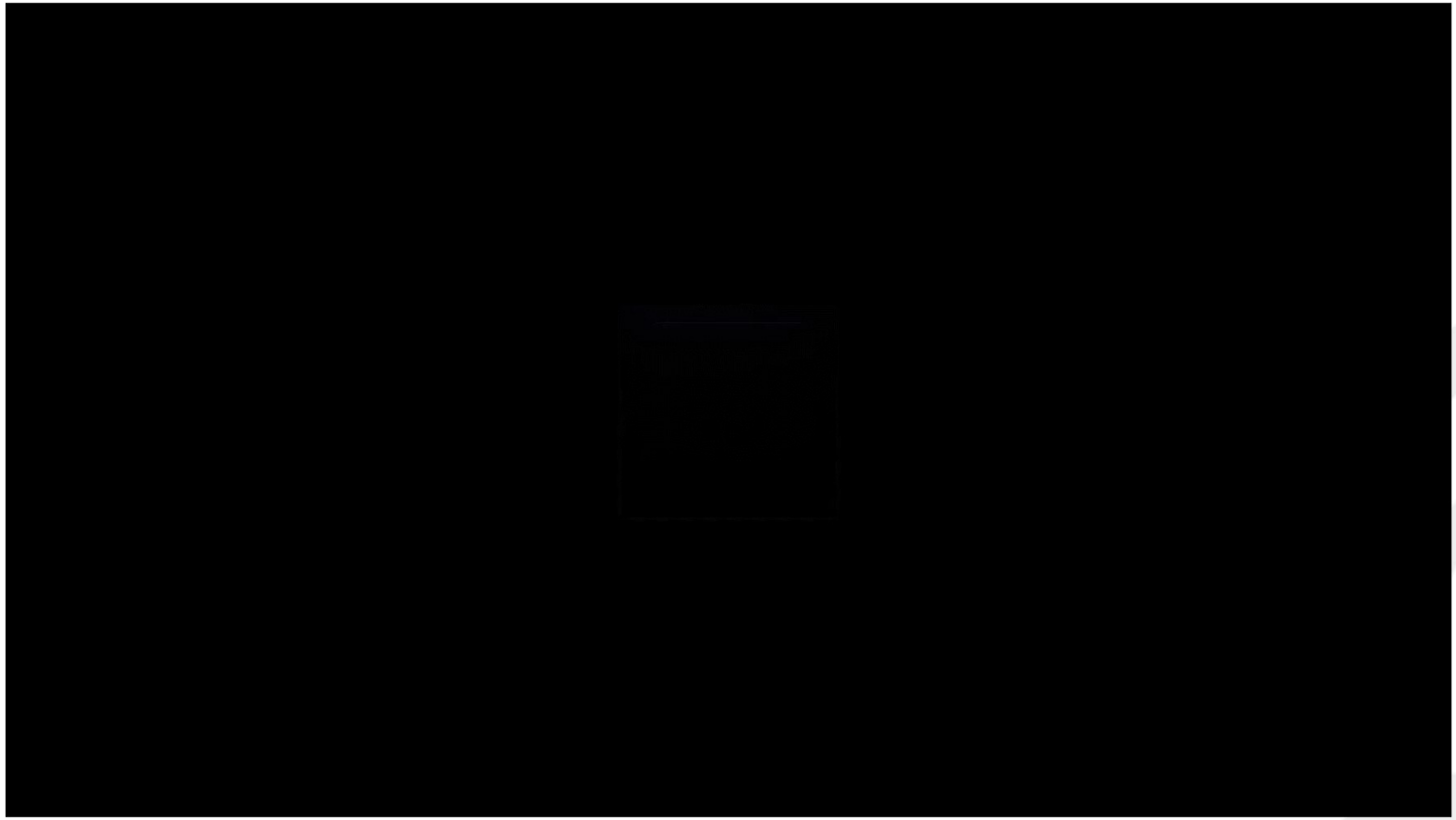
Rotzinger Adaptive Packaging Machine with IO-Link Wireless

Link to Video



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Case Study: EV Battery Manufacturing

EV Battery Manufacturer

CHALLENGE

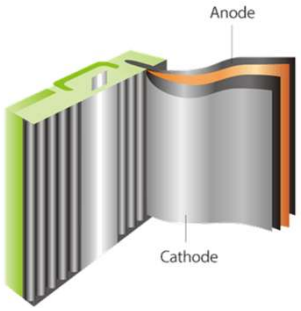
- Support variety of battery sizes with minimal manual changeovers for different battery sheet sizes
- Large footprint of machines with external delta robots and robots for pick and place of dozens of sheets per battery

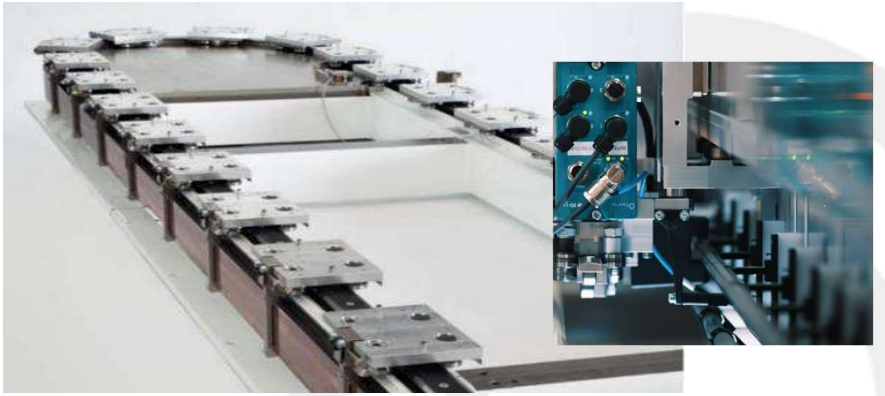
SOLUTION

- Controlling a vacuum pump and valves wirelessly on each mover
- TigoHub on each mover enables multiple actuators and sensors to be connected wirelessly (vacuum pump, valves, vacuum sensor)
- Near Field antenna solution enables dozens of movers to be controlled on a single machine without interferences

BENEFITS

- **Sustainability** - Energy conservation due to smaller clean rooms required for smaller machines
- **Flexibility** – support variety of battery sizes, simple sorting and ejecting of damaged sheets
- **Capacity** – high speed movers enable increased capacity





Wireless control of vacuum pumps and valves on each mover enables holding the battery sheet at high speeds without flying off the mover and without damaging the sheet

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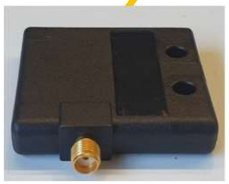
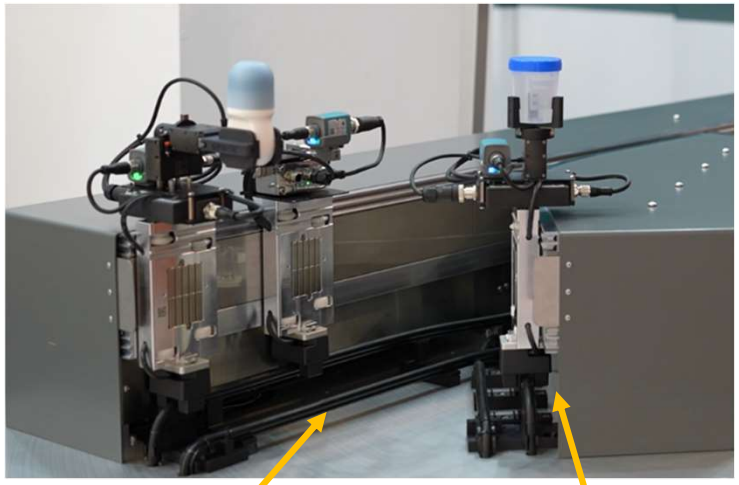
Contactless Power & Wireless Data Communication
Near-Field Antenna Solution



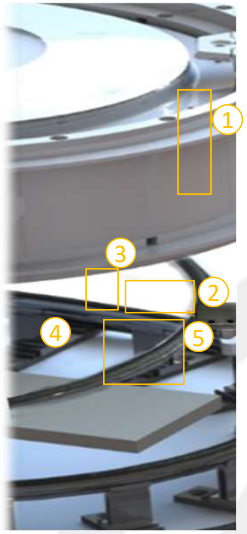
Near Field Antenna

Radiated Cable running along transport track. Communicates with Near Field Antenna on each mover.



Inductive Power Rail

U-Shaped Inductive Power Pickup Unit



① Actuator
② TigoHub
③ Near-Field Antenna
④ Radiating Cable
⑤ Inductive Power + Power Pickup Unit

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Condition Monitoring & IIOT

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CONDITION MONITORING - CHALLENGES

Predicitve Maintenance & OEE Improvement

- Not all required data is available from PLC or HMI, multiple sensors must be added
- Data needs to be collected anywhere, from both moving and fixed components for data analytics and insights

Deployment Cost & Complexity

- Deployments in hard-to-reach areas are complex and sometimes not possible with cables
- Sterile environments require expensive high-end cables and periodic sterilization
- Machine retrofit must be achieved with minimum downtime and cabling

Reliability

- Conventional wireless solutions are not reliable in harsh industrial environments and require using systems at the IT level

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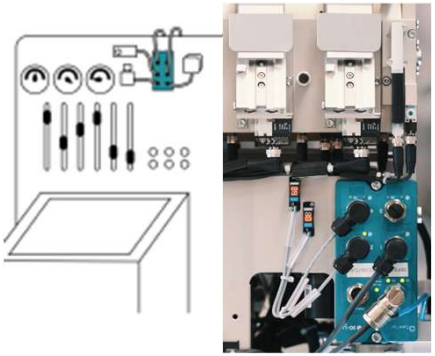
SEAMLESS INTEGRATION AND DEPLOYMENT

TigoBridge

Immediate integration to off-the shelf IO-Link, Analog and Digital Sensors

TigoHub



IO-Link Wireless Hub for Multiple Analog, Digital & IO-Link Sensors

TigoCounter

IO-Link Wireless Counter device - connects to a Digital output and enables automated object counting capabilities

- **Device Agnostic -** Converts any IO-Link, Digital or Analog device to IO-Link Wireless.
- **Flexible -** Fit for both fixed and fast rotating/moving components.
- **Complexity Reduction -** Simple retrofit and relocation of existing machines and production lines.
- **Unrivaled Performance -** Cable-grade reliability, immune to noisy and harsh environments, coexists with other networks.
- **Scalability -** Supports hundreds of wireless devices on a single machine or workcell area.
- **Integration -** Integrates seamlessly both at the OT and IT level.

Benefits: Data Collection Anywhere Anytime

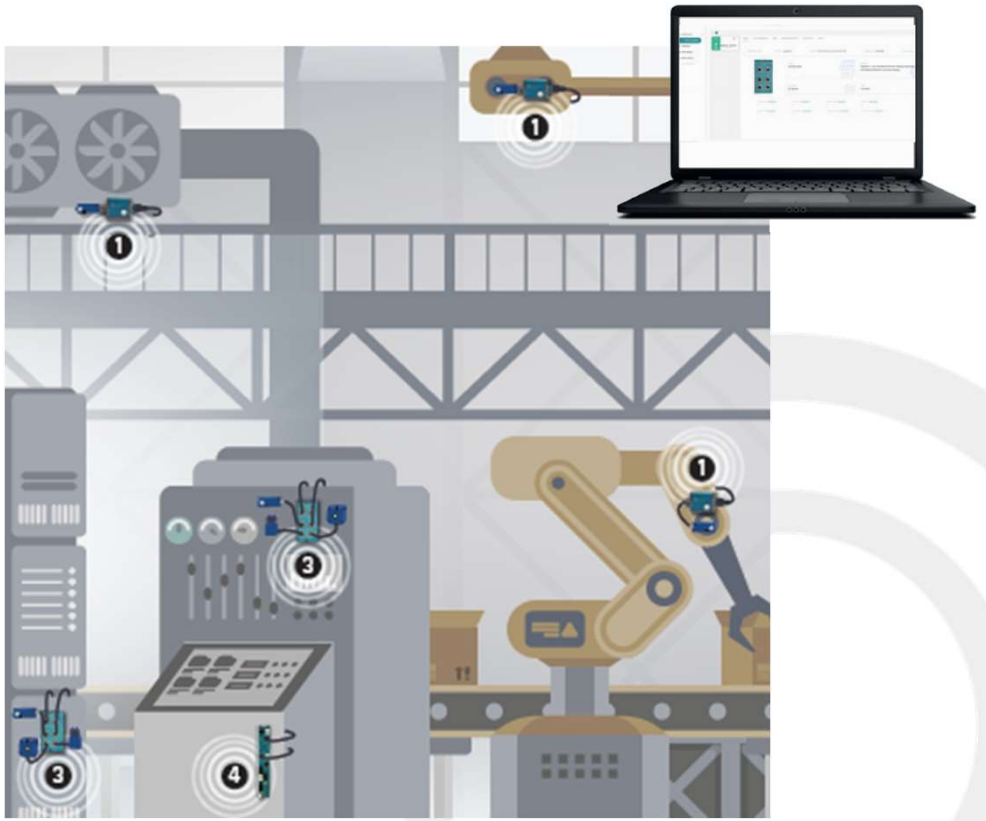
Improve OEE
- Real-time visibility and timeline of events enable workflow optimization, increased awareness and improved communication

Maximize Throughput
- Bottlenecks and inefficiencies detection enable to increase capacity and improve performance

Predictive Maintenance
- Reduce unplanned downtime and improve maintenance operations

Cost Effective
- Reduce cable wear & tear and simplify deployment

Automation
- Eliminate manual data entry and empower operators with meaningful contextualized data.



Case Study: OEE Improvement

USA Pharmaceutical Manufacturer

CHALLENGE

- Combination of manual and automatic workstations leading to lack of centralized data collection tools
- Mobile workstations relocation complexity causes downtime
- Capacity and performance is not optimized on all workstations

SOLUTION

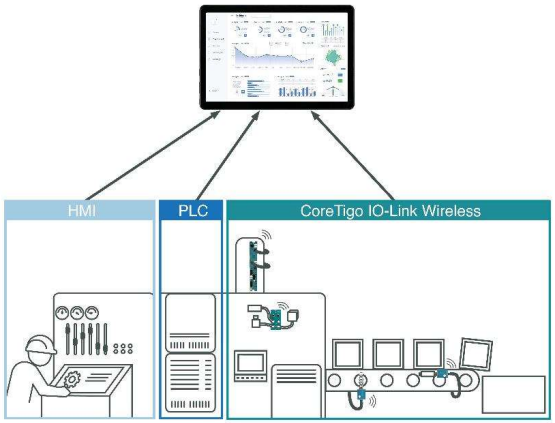
- Addition of TigoCounter wireless counting devices along dozens of point on production line
- Enable visibility of data and KPIs to the operator on the HMI
- Use data to find the opportunities for improvement and the problematic workstations

BENEFITS

- Faster cycling of machines with real-time performance feedback
- Improved communication between operators and management, and elimination of manual counting
- Increased throughput by using counters to understand performance of individual batches
- Simplified workstation relocation and reduced downtime

>30%
Deployment Cost Reduction

>20%
OEE Improvement



TigoCounter connected to digital sensors for automated product counting

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Case Study: Ulmer Schokoladen, Box Sealer Production Counting

Manufacturer of Chocolate Decoration and Ingredients

CHALLENGE

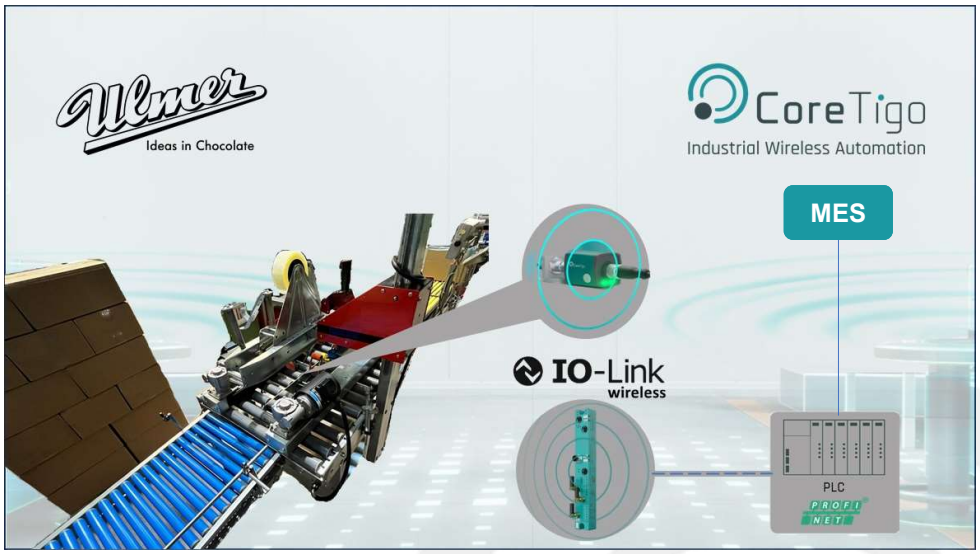
- Manual counting of cartons coming out of the production line
- Sealing machine is portable and relocated from time to time
- Cables limit flexibility and require connecting/disconnecting

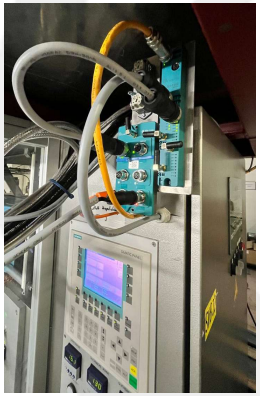
SOLUTION

- Optical proximity sensors connected to TigoBridges
- TigoHub connected to secondary PLCs collects digital outputs and passes the data back wirelessly to a TigoMaster connected to the main PLC and the factory's MES system.

BENEFITS

- **Flexibility** – seamless connectivity when relocating machines
- **Efficiency** – elimination of manual counting
- **Complexity Reduction** – simplified machine retrofit and PLC connectivity





Case Study: Emerson Air Treatment

Beverage Manufacturer

CHALLENGE

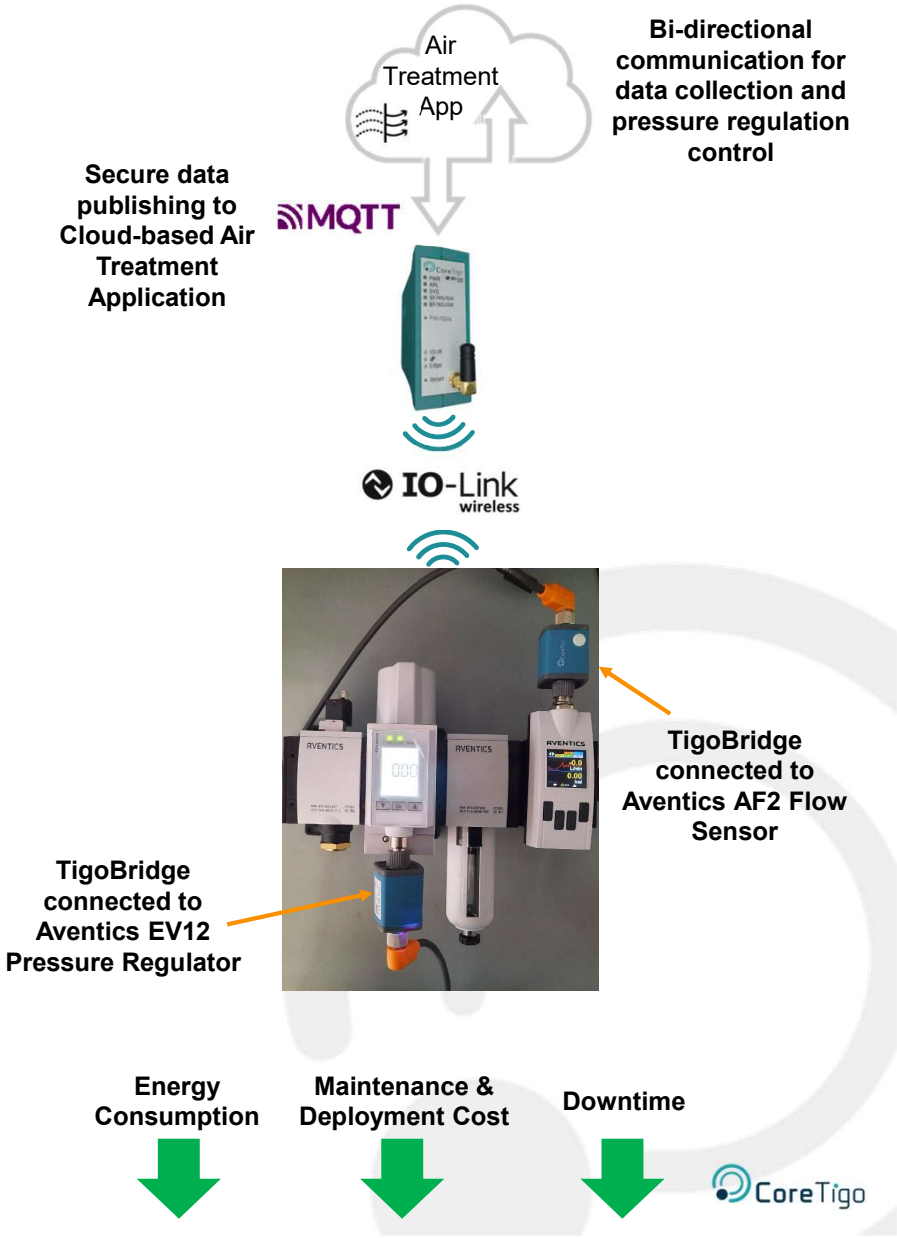
- Manual Air Treatment Process – manual pressure regulator and non-real-time air leakage detection
- Frequent pressure settings required PLC programming
- Air leakages - unnecessary energy, lead to non-optimal machine operation
- Non-optimal air consumption when machine is not in operation mode (should be reduced for 6 to 2 Bar to maintain stable and safe operation)

SOLUTION

- Seamless integration of IO-Link Wireless Bridge to IO-Link Flow Sensor and Pressure Regulator
- Bypass PLC by communicating data from TigoGateway directly to cloud application
- Utilize data for air flow analytics, leakage detection and optimized pressure settings

BENEFITS

- **CO2 Footprint Reduction** – significant energy reduction due to reduced air leakages and optimal machine idle mode operation
- **Sustainability and Regulatory Compliance** – environmental regulations for pollution prevention and green manufacturing
- **Downtime Reduction** - prevent non-optimal air flow for long periods, which can lead to unplanned downtime and maintenance; less cable wear and tear due to wireless solution
- **Simple Deployment** - no modifications to PLC setup; wireless comm.
- **Cost Savings** – energy expenses, maintenance/deployment cost



Case Study: Air Flow Monitoring

Global Bearings Manufacturer

CHALLENGE

- Air leakage detection process is manual and lacks real-time capabilities
- Energy used for compressed air accounts for a large amount of the total electrical power consumption
- Downtime events due to compressed air issues

SOLUTION

- Seamless integration of IO-Link Wireless Bridge to IO-Link sensors which enable richer data and advanced diagnostics.
- Data is integrated to monitoring software application for visibility dashboards, alerts and analytics

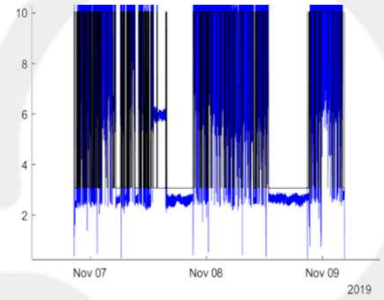
BENEFITS

- **Early Fault Detection** - real-time detection of leakages
- **Optimized Maintenance** – eliminate manual leakage detection processes
- **Reduced Downtime** – prevent non-optimal air flow for long periods, which can lead to unplanned downtime and maintenance
- **Sustainability & Cost Savings** - reduction of energy consumption on compressed air

~30%
Compressed Air Energy Goes to Waste

20%
Energy Savings

>30%
Deployment Cost Reduction



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Case Study: Dust Collector and Tank Monitoring

USA Fire Retardant Manufacturer

CHALLENGE

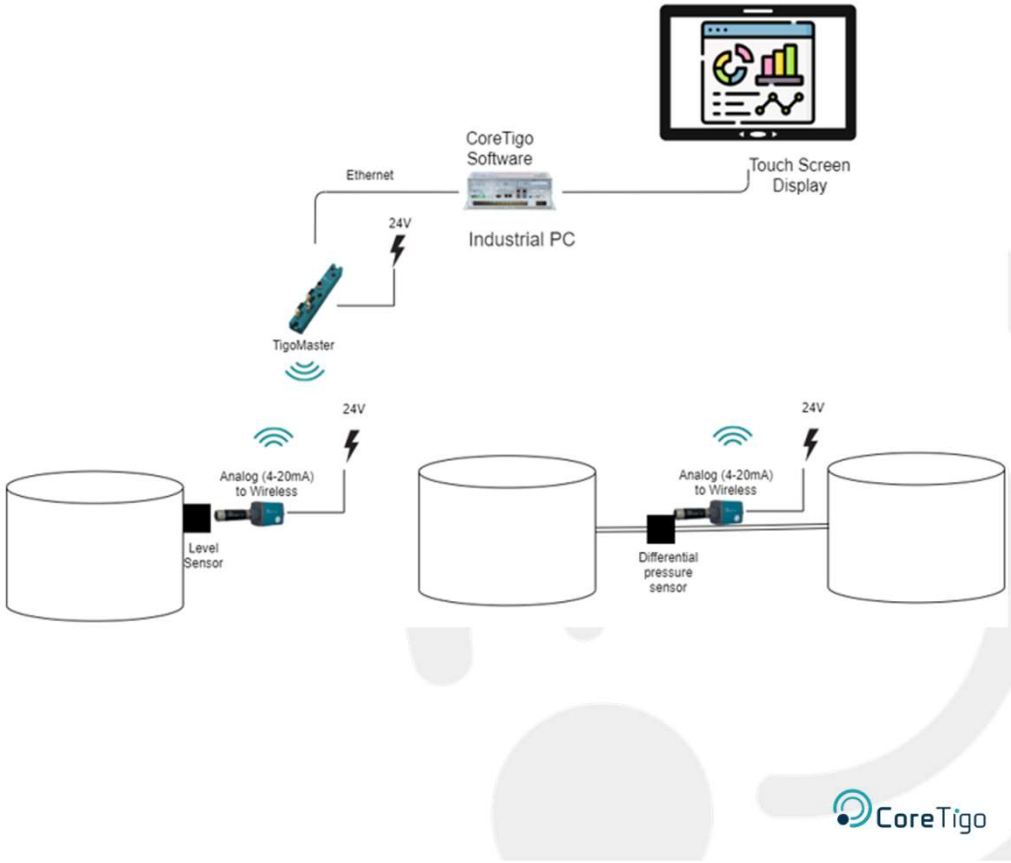
- Analog sensors need to be installed in hard-to-reach areas
  - Air flow sensor mounted on vent near the ceiling
  - Level sensor mounted on large chemical tanks

SOLUTION

- TigoConverters for conversion of Analog sensors data
- Data for process monitoring is communicated via MQTT to plant SW

BENEFITS

- **Operational Efficiency** – Real-time monitoring of tank level and differential pressure across Dust collector filter.
- **Time/Cost Savings** – No fieldbus routing required, no PLC programming required. Filters changed only when required.
- **Hardware Savings** – No separate enclosure required, no PLC required, no remote IO rack required.



Case Study: Steel Manufacturing OEE & Quality Improvement

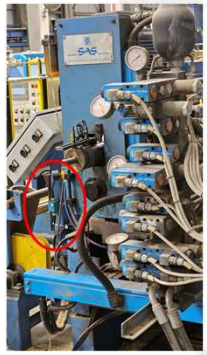
Copper Alloy Manufacturer

CHALLENGE

- Manual counting of finished products
- Lack of data for quality control
- Lack of real-time data for workflow optimization
- Maintenance costs and overhead due to breakage of molds
- Multiple PLC types and lack of data connectivity from OT to IT level (ERP)
- Harsh industrial environment (noisy, hot, steel)

SOLUTION

- Deployment of temperature sensors and proximity sensors
- Connectivity through IO-Link Wireless
- TigoGateway data collection over-the-air and directly transferring the data to the ERP system



BENEFITS

- OEE improvement through real-time automated counting
- Improved maintenance by prevention of mold breakage
- Improved quality by detecting root cause of defective units
- Improved workflow through real-time counting and dispatching of operators accordingly
- IO-Link Wireless Benefits: Bypassing PLC for data communication to ERP/IT, Non-interference with Wi-Fi plant network, Cost savings and complexity reduction on pulling cable under the floor

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Distribution Centers – Conveyer Systems Condition Monitoring

CHALLENGE

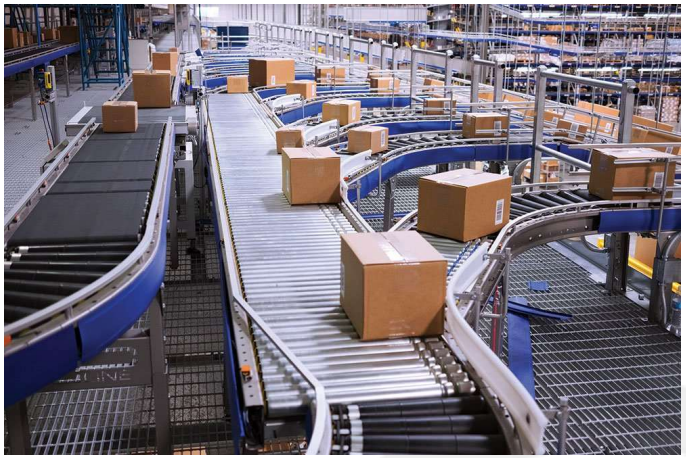
- Deployment complexity of communication cabling along conveyer belts
- Wear and tear of motors, gears and belts causes line downtime and increased maintenance cost/operations

SOLUTION

- Addition of IO-Link condition monitoring sensors on motors and gears
- Data analytics for predictive maintenance

BENEFITS

- Predictive Maintenance – gain knowledge in a timely manner before line breakdown/stoppage
- Improved Maintenance – reduced spare parts and maintenance operations



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Case Study: Machine Line Centralized Control & Monitoring

Injection Molding Manufacturer

CHALLENGE

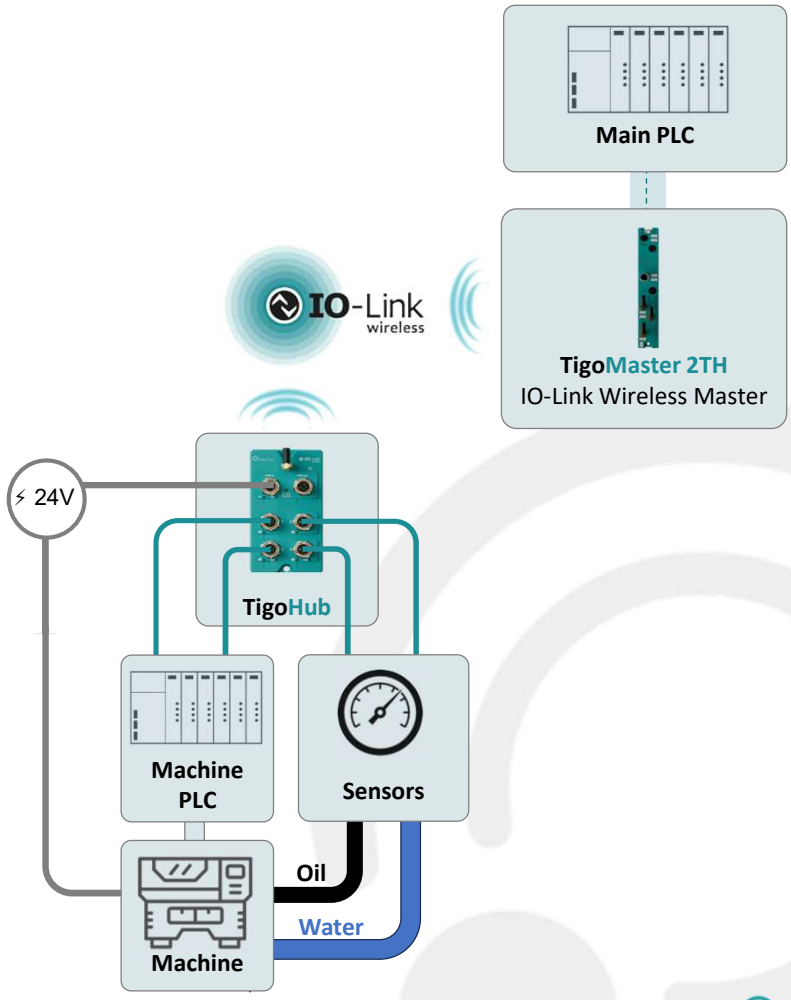
- Production line produces 4-5% defective products. This needs to be reduced to below 1%.
- Dozens of machines are spread across the production floor, dozens of meters from the main line PLC which needs to control them.
- A wired connection from the main PLC to the machines requires an expensive & complex infrastructure layout, as well as production line shutdown
- Additionally, the controller of each machine can only be accessed physically, or via pre-programmed IOs. No reprogramming is permitted.

SOLUTION

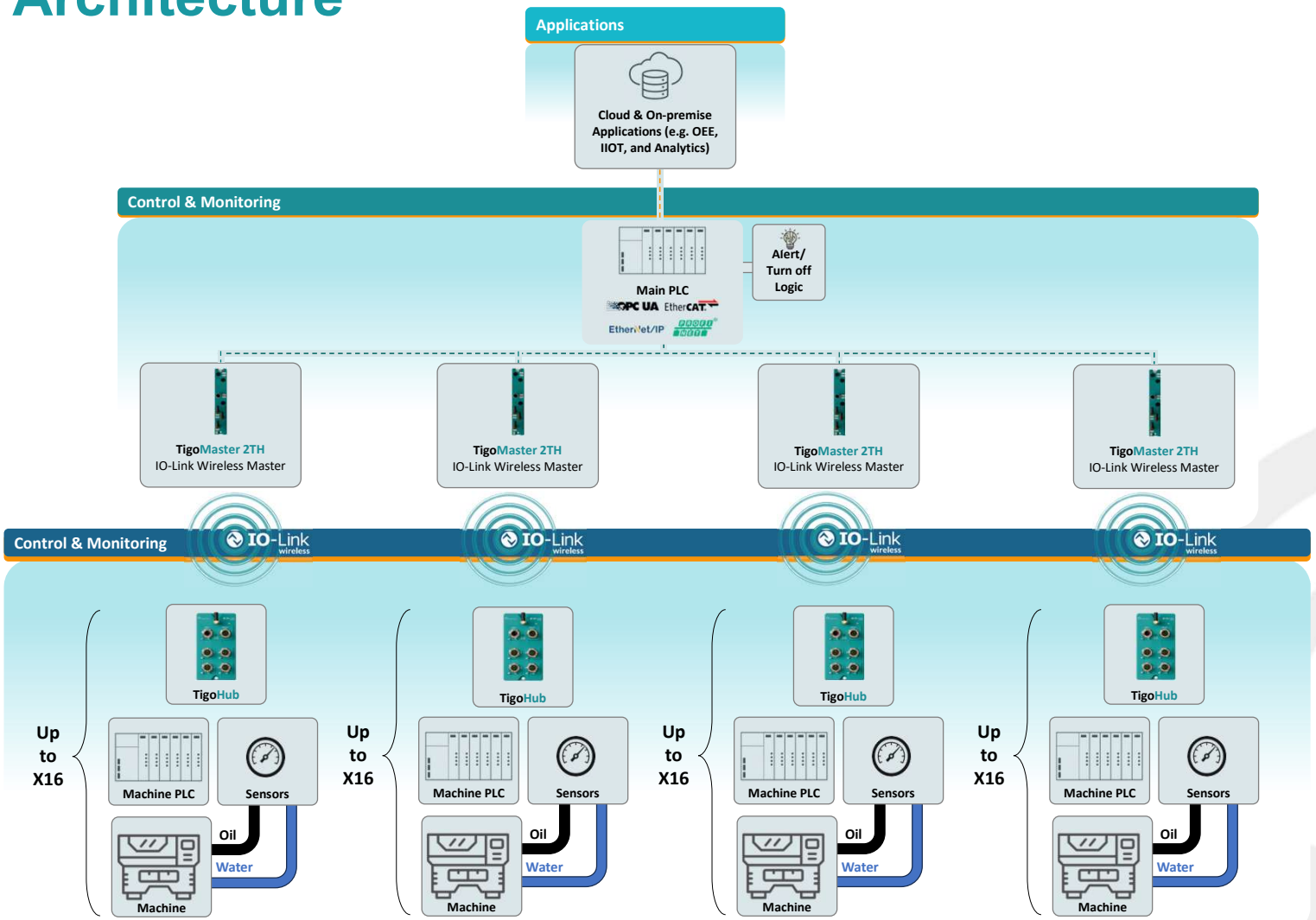
- CoreTigo's TigoMaster is connected to the main PLC, allowing to control up to 16 machines over the air.
- CoreTigo's TigoHub is integrated into each machine's cabinet to toggle 24v I/Os on the Machine's PLC.
- Data from the sensors is sent over the air via the Hub to the TigoMaster and Main PLC.
- Control commands to shut down the machine and activate smart tower lights are sent from the Main PLC and Master to the Hub and Machine PLC.

BENEFITS

- **Yield Improvement** – defective products ratio dropped from 4-5% to below 0.5%
- **Simple Deployment** – rapid and seamless deployment of the IO-Link Wireless solution prevented shutdowns and reduced complexity, saving ~$40K.
- **Ease of Use** – plug-and-play integration to Siemens PLC and 4 digital I/Os per machine
- **Enhanced Functionality** – Adding the TigoHub on each machine enabled to wirelessly add sensors for oil and water supply to the machines, monitoring and alerting in case of pipe cracks, and simplifying overall machine retrofit.



Case Study: Machine Line Centralized Control & Monitoring Solution Architecture



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Robotics
End-of-Arm Tooling

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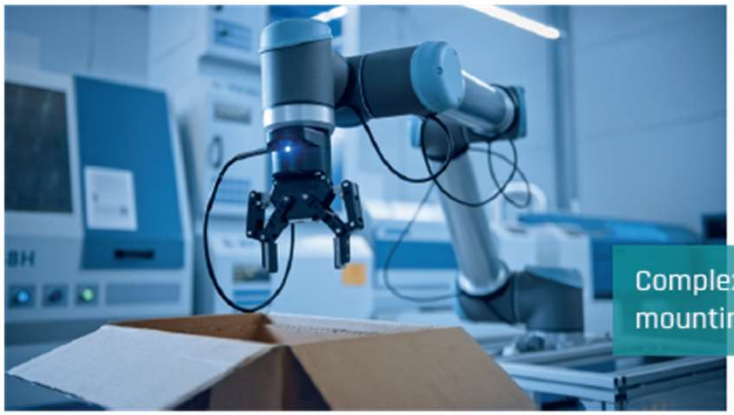
Robotics Challenges



Complex routing and mounting of cables

Collision Risk

Complex Dresspacks and Mounting Accessories

Multiple I/O's

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Robotics Challenges

Maintenance

- Cables in constant motion break and wear out, and require periodic replacement
- Replacement and spare parts of high-quality slip rings are costly and time consuming

Complexity

- Cabling dresspacks increase deployment complexity and cost
- Multiple tools need to be wired separately for data communication
- Retrofitting tools on end of arm after initial deployment is complex

Flexibility

- Cables and dresspacks frequently get in the way of robot motion range
- Adding multiple devices at the end of arm requires additional circuits leading to larger and more cumbersome slip rings, which can lead to external cabling

Cost Effectiveness

- Resistance to bending & torsion-load increase cost of cabling
- Cables increase payload and footprint
- High quality and custom-made slip rings for both power and communication are expensive

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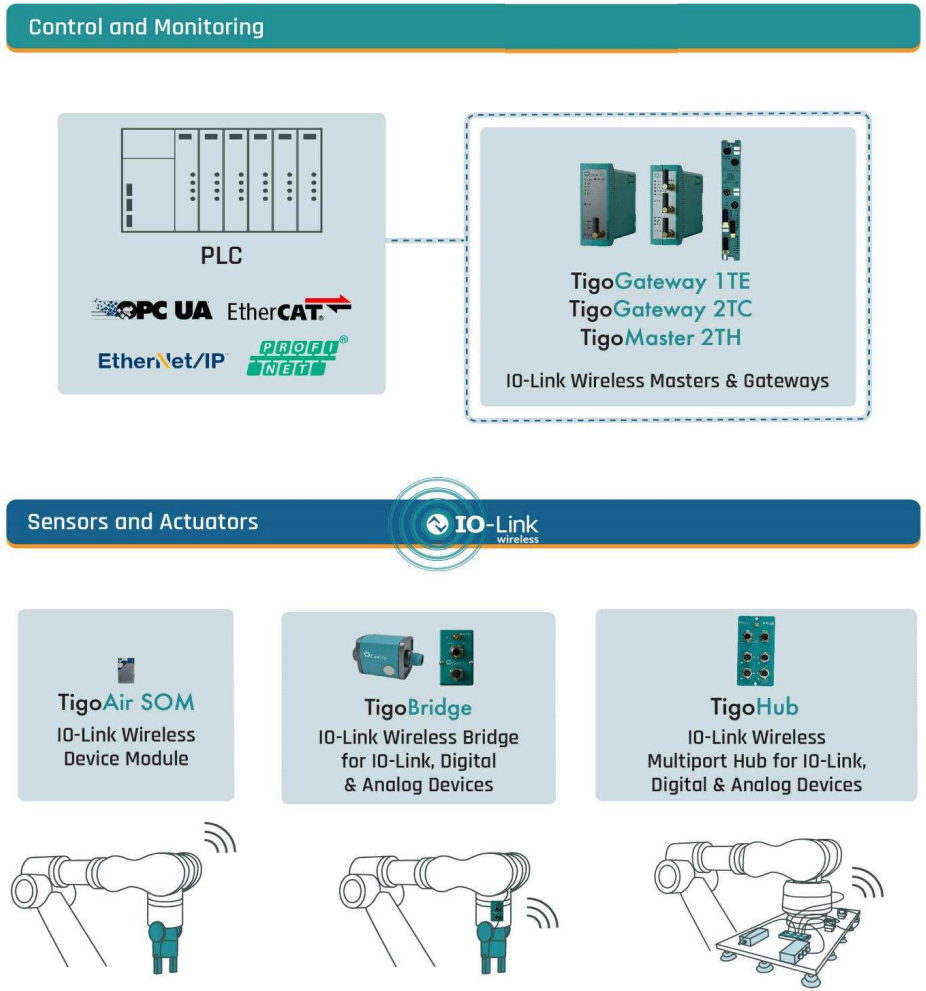
IO-Link Wireless For Robotics



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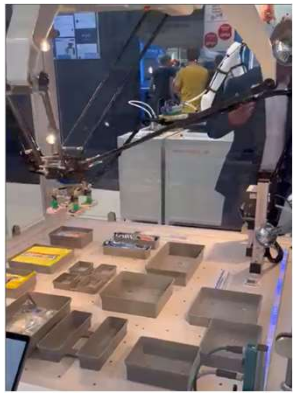
IO-Link Wireless Robotics Integrations

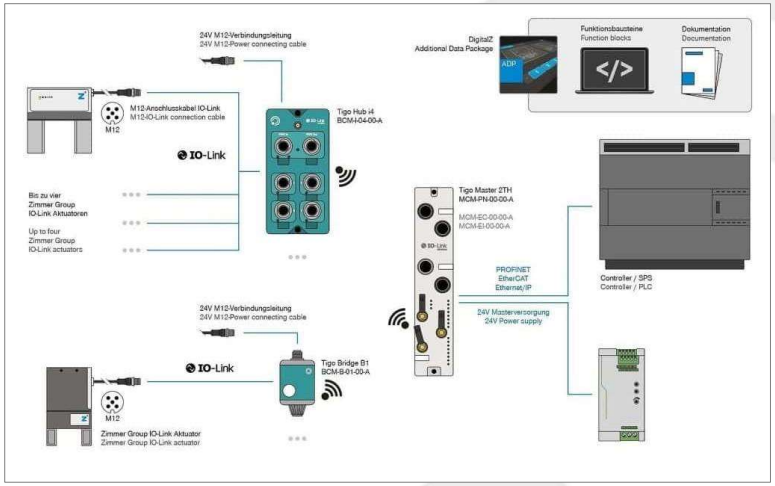
ECBPMi Cobot Vacuum Generator - End-of-Arm Electric vacuum generator in miniature design for dense workpieces with embedded IO-Link Wireless

IO-Link Wireless TigoAir 2 SOM for embedded solutions



SCTSi Valve Island - A Compact terminal with blocked compact ejectors for simultaneous, independent handling of different parts with only one vacuum system with Embedded IO-Link Wireless

Zimmer Grippers mounted on multicarrier system movers with IO-Link Wireless Bridge



IO-Link Wireless for variety of Zimmer gripping and clamping systems

Case Study: Highspeed Palletizing Delta Robot

Italian Packaging Machine Builder for Pharma Industry

CHALLENGE

- Communication cables create complexity along delta robot arms and limit the speed of the robot
- Enable flexible design for adding/removing sensors per application
- Minimize space consumption of the palletizer

SOLUTION

- IO-Link Wireless control of vacuum pump via TigoBridge
- Communication of analog sensor data via IO-Link Wireless to monitor the tilt of the carton when placed improperly
- Integration of IO-Link Wireless SOM into servo motor for control of carton orientation

BENEFITS

- **Performance –** Increase speed by 15% due to low weight and flexible design
- **Flexibility** – Adaptive EOA with the ability to support multiple sensors and actuators (gripping device and orientation servo motor)
- **Machine Footprint -** reduce size by 20%

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Case Study: Delta Robot

Italian Packaging Machine Builder for Food Industry

CHALLENGE

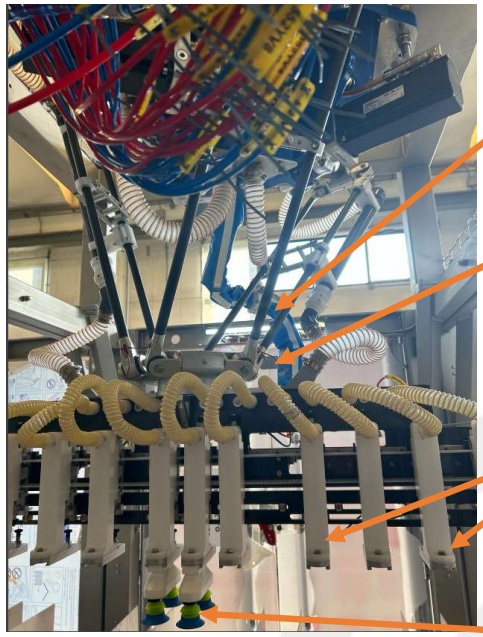
- Controlling valves on Delta robot while avoiding the communication lines
- Typical fieldbus cable needs to be replaced every 2 years
- Debugging connectivity problems is hard and time consuming

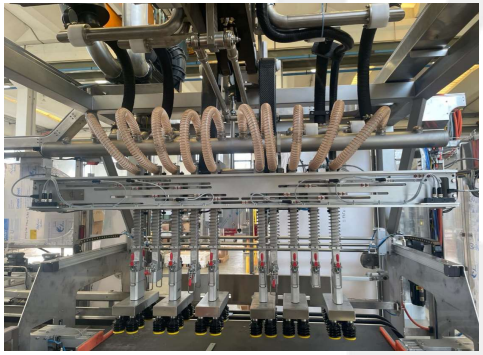
SOLUTION

- IO-Link Wireless control of 12 valves using 2 TigoHubs
- 24v wiring through the Delta robot arm

BENEFITS

- **Reliability** – avoid downtime due to communication issues
- **Flexibility** – flexible design to control multiple actuators simultaneously and simple add-on of sensors
- **Improved Maintenance** – reduced maintenance operations for debugging and reduced maintenance costs due to cable wear and tear





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Case Study: Pharmaceutical Packaging

Packaging Machine Builder

CHALLENGE

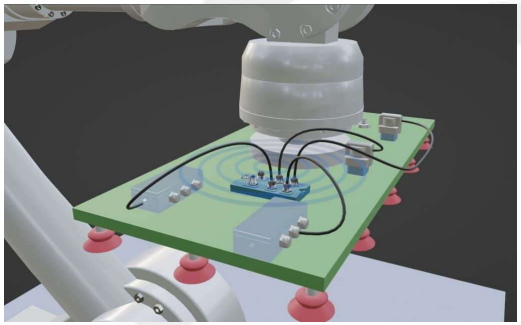
- Limited space inside machine requires small robot footprint
- End of arm tool includes 60 I/O's with large dresspacks

SOLUTION

- Connect multiple TigoHubs on EOAT
- IO-Link Wireless Master connected to robot's controller

BENEFITS

- **Payload Reduction** – enables higher speeds and less wear and tear
- **Footprint Reduction** – enables smaller machine design
- **Increased Maneuverability** – significant reduction of dresspacks and external cables
- **Maintenance Reduction** – less cable wear and tear



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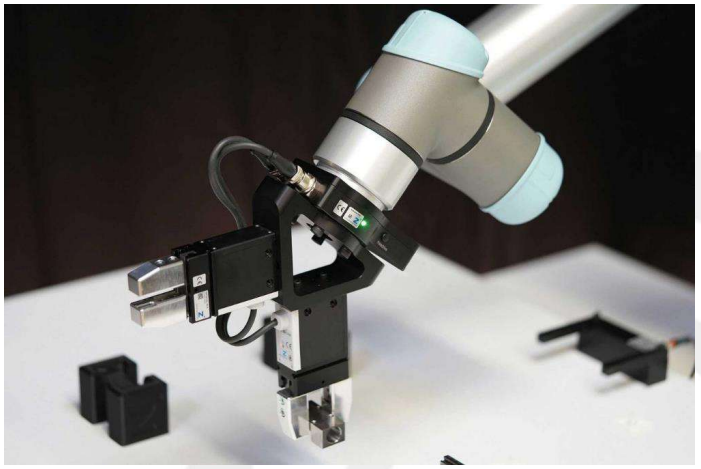
Benefits: Simple, Flexible, Resilient

- **Dresspacks Reduction –** reduce payload, increase maneuverability, reduce deployment complexity
- **Simple Tool Changeover –** easy exchange of end of arm tools without the need to disconnect/reconnect cables
- **Multiple Devices –** dozens of sensors and actuators on a single EOAT without cables for communication reduces payload, space consumption and complexity
- **Slip Rings Simplification –** reduce the need for slip rings with data communication, which reduces cost, size and weight
- **Simple Retrofit** – no need for adding cablings and reassembling dresspacks when adding I/O (e.g. additional sensors)
- **Communication with AMRs/AGVs** – Reliable wireless closed loop communication of a robot at the end of a production line with an AMR/AGV
- **Cost and Maintenance Reduction –** reduce cable wear and tear and expensive high-torsion resistant cables



AMRs &
Mobile Equipment

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AMRs - CHALLENGES

Reliability

- Wi-Fi network is not pervasive throughout the factory floor, there are dead spots
- Wi-Fi is not deterministic for control applications
- High wireless network traffic can lead to delays or packet loss in communication

Latency

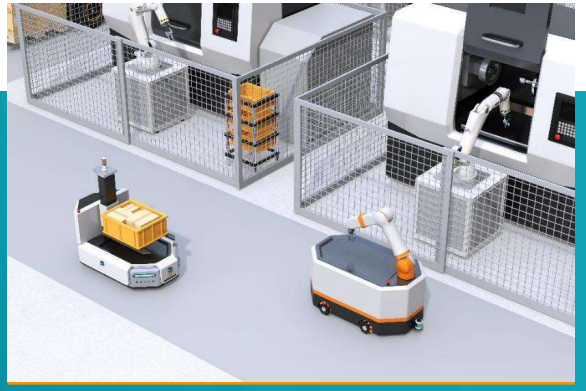
- Delays in communication can affect the AMR's responsiveness, leading to inefficiencies or safety concerns, especially in time-sensitive operations

Interference

- Other wireless devices or physical obstacles can interfere with the signals, causing disruptions or delays in communication of the AMR with the production line devices
- Harsh and noisy industrial environments

Deployment

- Deploying a redundant pervasive Wi-Fi network can be cost prohibitive
- Collisions with IT network and coordination between IT/OT



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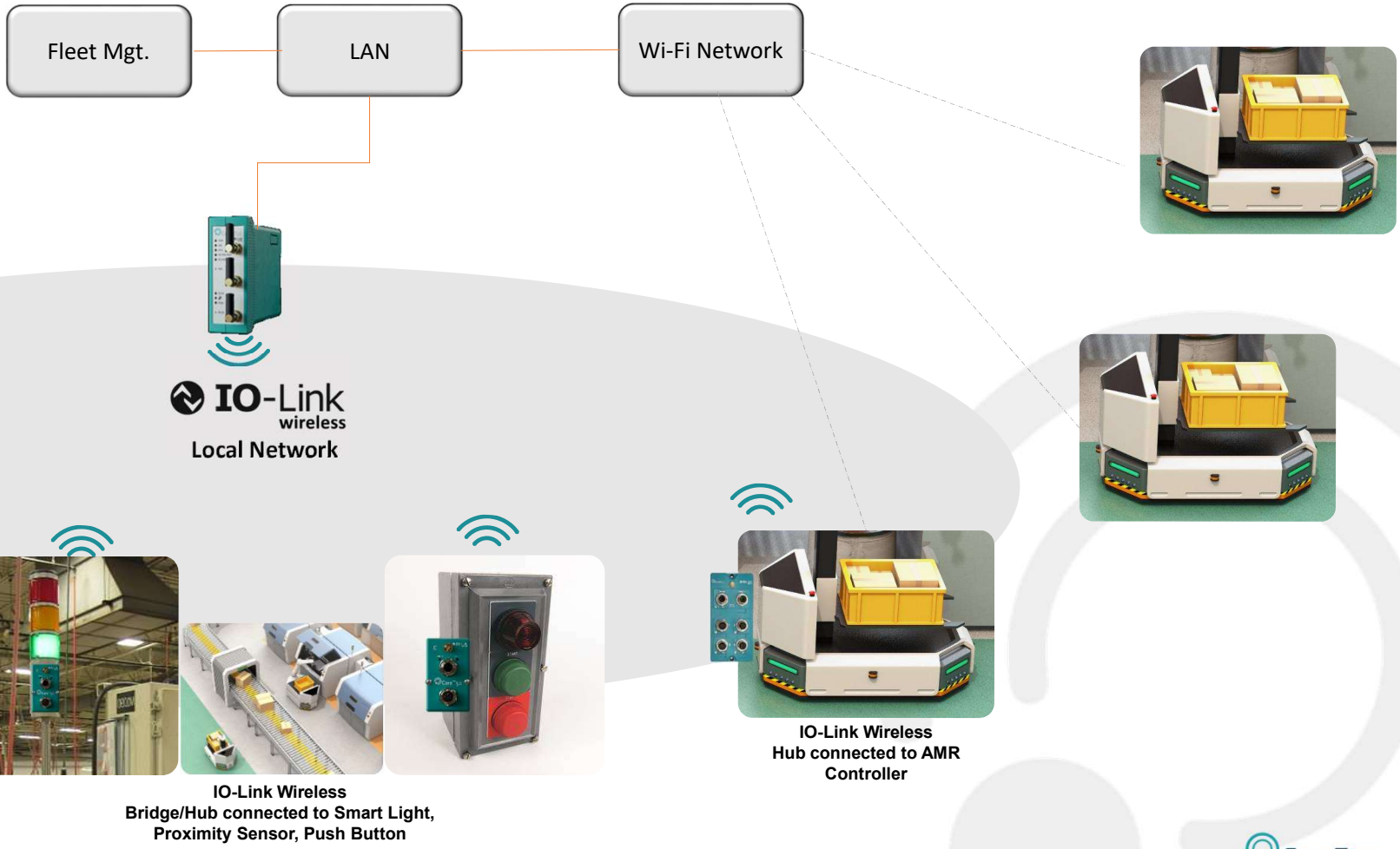
Solution Architecture

- AMR's require fast and ultra-reliable communication when communicating with equipment on the production floor.
- Such communication can be directly with the PLC at the point of access of the AMR.
- It can also be with push buttons, gates, relays, and other actuators and sensors.
- Such interaction should be in a closed nearby loop with minimal points of failure.



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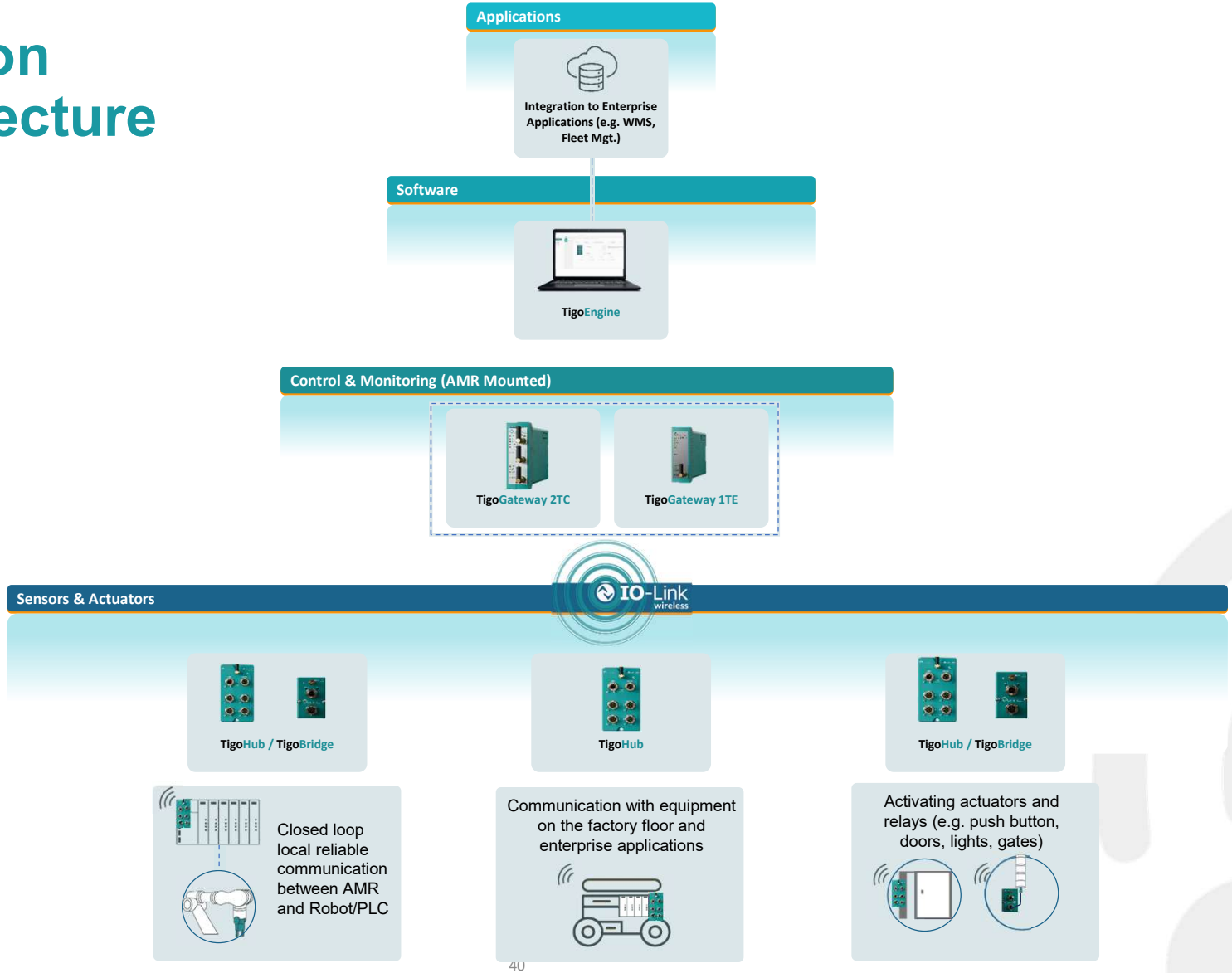
Solution Architecture



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Case Study: AMR Loading & Communication

AMR Integrator

CHALLENGE

- Loading/unloading between AMR and end of line is too long (can be up to 7 sec.)
- AMR communication at egress points with gates, relays, and other actuators is complex and not done in a closed loop

SOLUTION

- Direct communication with sensors and at end of line and actuators at egress points by connecting them to Bridges/Hubs
- IO-Link Wireless Master on-board AMR for mobile communication in closed loop

BENEFITS

- **Fast and Reliable –** low latency, fit for harsh environments without line of sight and coexists with other wireless systems
- **Simplified Retrofit –** easy and cost-efficient add-on of sensors and actuators communicating directly with AMR

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Case Study: Mobile Equipment Monitoring

Italian Converting Machine Builder

CHALLENGE

- Manual connection of forklift to the machine for data collection is time consuming and causes errors and broken connectors.
- Flexibility is required to support multiple positions and payloads along the machine and across the production floor

SOLUTION

- Simple conversion of load cells and proximity sensors on each forklift to IO-Link Wireless devices
- Integration and communication of the data from the wireless devices to multiple PLCs and machine entry points

BENEFITS

- **Operational efficiency** – manual operations reduction and improved operator productivity
- **Increased Flexibility** – enhanced mobility enables simple access to multiple machine positions
- **Improved Maintenance** – reduction of broken connectors and cable wear & tear
- **Quality Improvement** – error reduction due to automated process

TigoHub connected to load cells and proximity sensors onboard forklifts, communicates seamlessly with PLC when arriving at each ingress point of the converting machine

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Benefits: Independent and Reliable

Independent
- Closed loop local communication for high-speed reliable interaction

Reliable
- Ultra-reliable wireless control enables deterministic communication
- Designed for harsh industrial environments
- Coexists with other IT/OT networks

Scalable
- Scalable design for supporting multiple stations

Simple
- Simple deployment for connectivity to various sensors, actuators and PLC

ASRS

Automated Storage & Retrieval System

Case Study: Telescopic Forks

Italian machine builder and system integrator of automatic handling systems

CHALLENGE

- Flexible loading unit supports all sizes and weights
- Improve the reliability of communication by replacing busbar communication with wireless
- Simple integration to fieldbus network and control servo motors

SOLUTION

- IO-Link Wireless was chosen, and each telescopic fork was equipped with two TigoBridges
- Wireless is been used to control the servo motors, fingers and gather data for monitor and analysis

BENEFITS

- **Reliability** – Improve performance compared to previous generation that had drops in communication
- **Cost** – lower cost than using busbar
- **Simplicity** – plug and play solution

Watch the video

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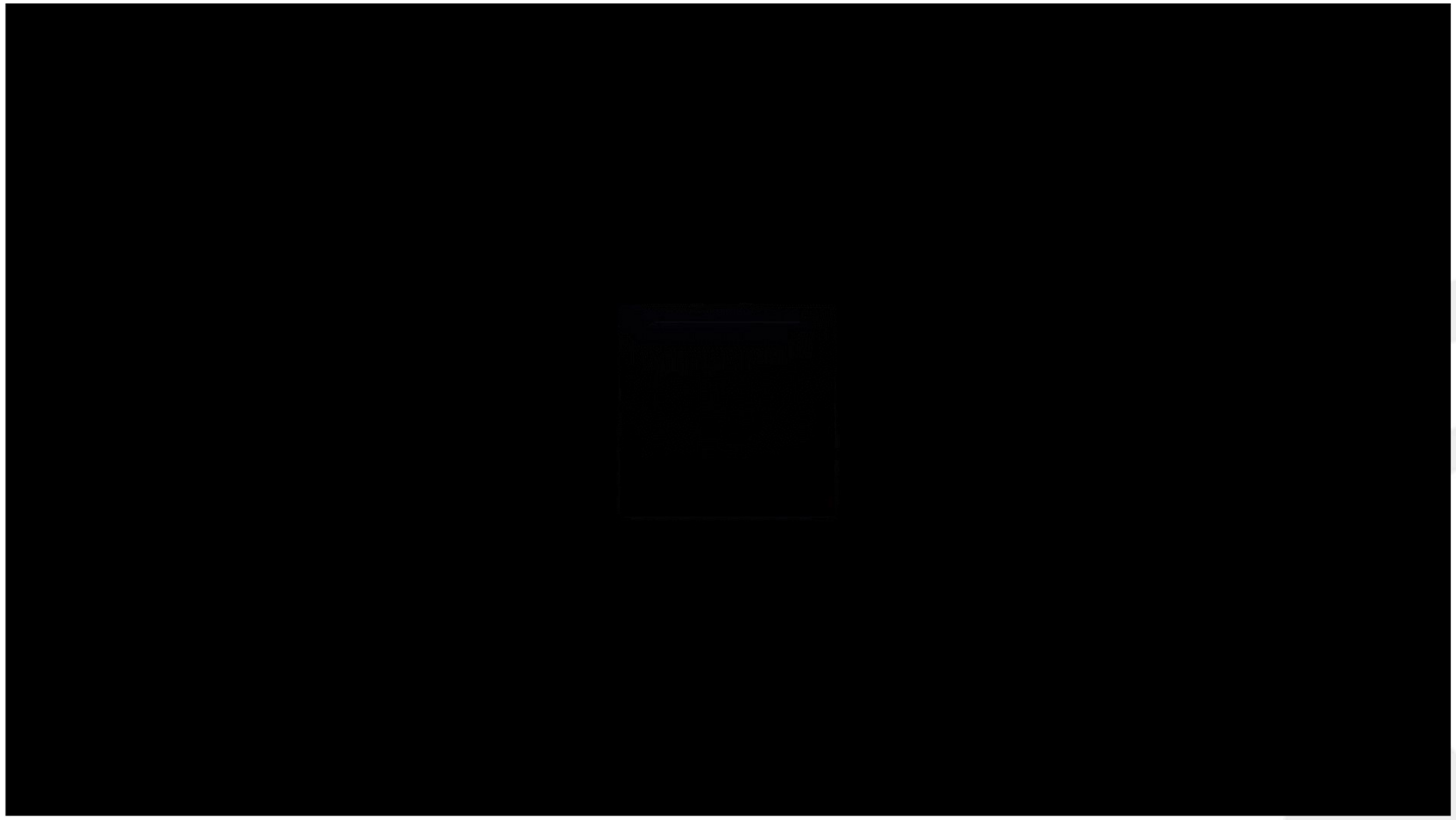
Case Study: Eurofork Telescopic Forks

Watch the video



Crossbelt Sortation Systems

Crossbelt Sortation - Challenges

Flexibility

- Product variation - ability to handle a wide variety of product shapes, sizes, weights
- Space utilization – requires narrow discharge area for increased number of hampers

Scalability and Capacity

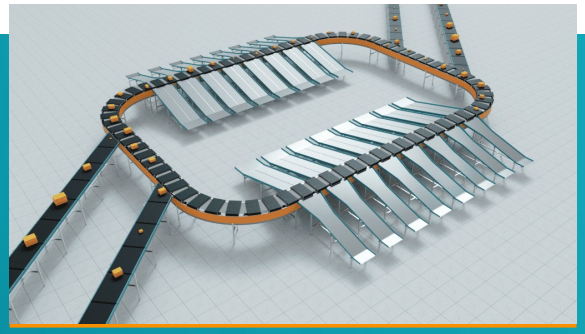
- Flexible and modular design is needed for supporting increasing business volumes
- Increased sortation speed

Reliability

- System needs to be extremely reliable at very high speeds with low error rates to ensure sortation integrity and minimal downtime

Cost

- Total cost of ownership of system increases due to non-cost-effective expansions and maintenance



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Crossbelt Technology Comparison

Parameter	Wi-Fi	CoreTigo Solution
Speed	2.5m/s	5m/s At least 40% more capacity
Wireless Reliability	Wi-Fi signals impacted by EMC	Near Field solution - not impacted by EMC
IT Network Impact	Same protocol as IT network	Industrial standard wireless protocol – no impact on IT, no radiation outside of machine area
Aftersales Maintenance	Multiple cables on carriers, complex maintenance	No cables on carriers, easy to replace one belt
Scalability	Complex configuration	Simple add-on and expansion/ re-layout

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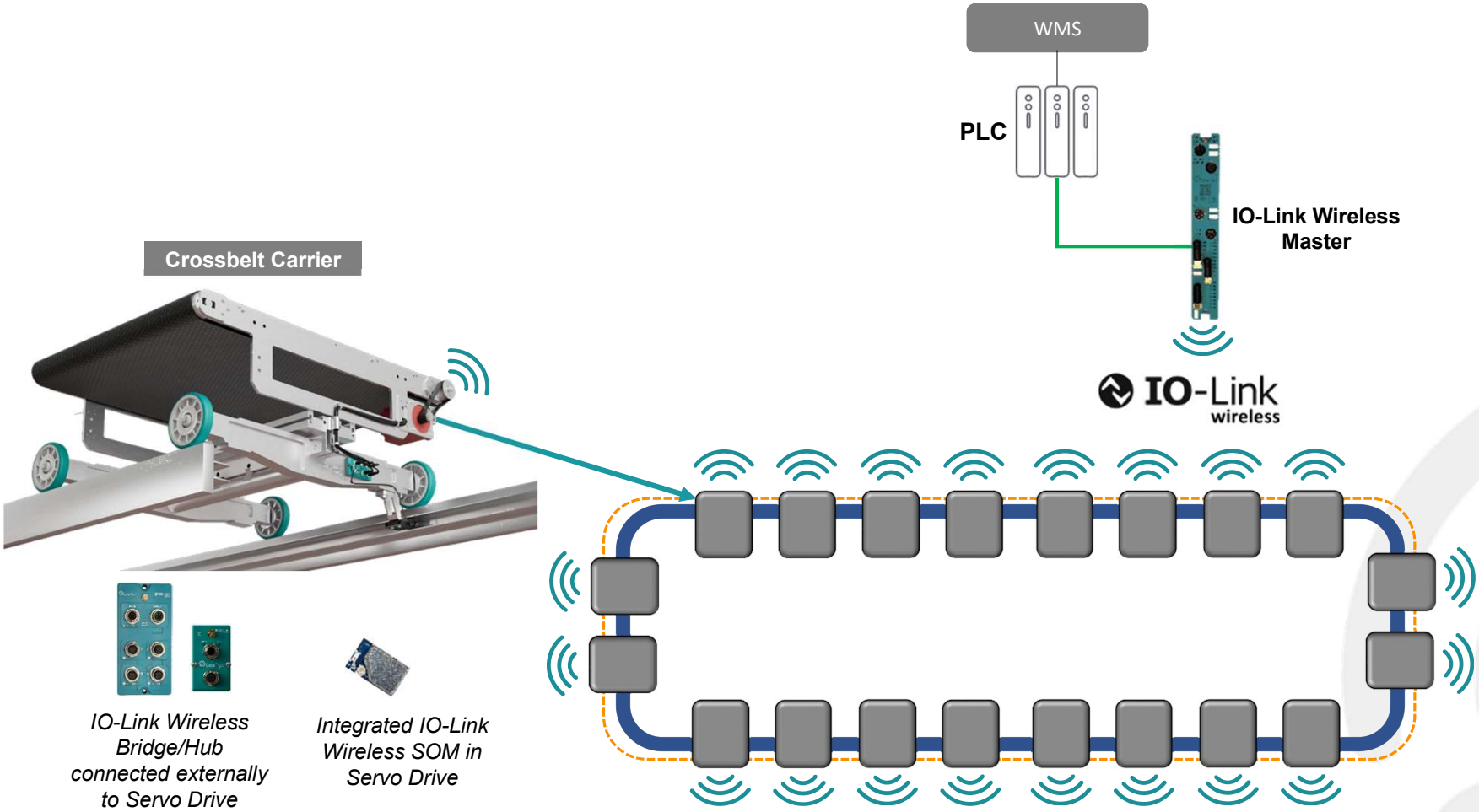
Solution Architecture



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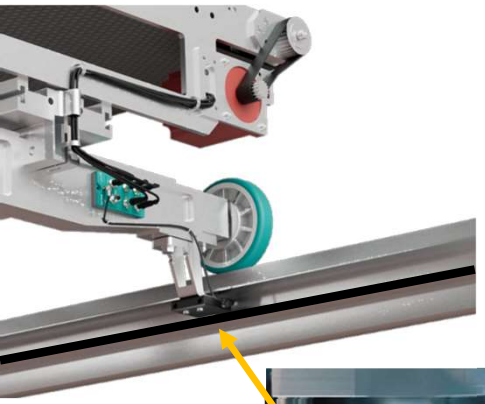
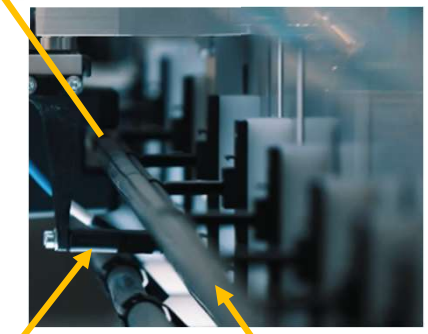
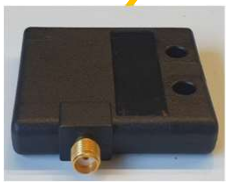
Real-time Wireless Data Communication





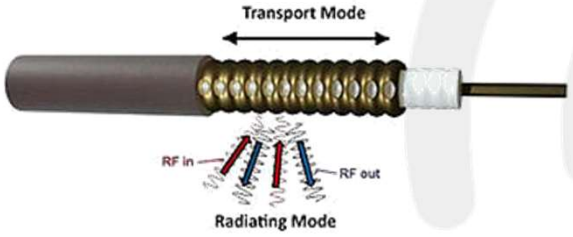


Near Field Antenna

Radiated Cable running along transport track. Communicates with Near Field Antenna on each mover.

Near-field Antenna System

- Near-field antenna is mounted on each crossbelt carrier
- Radiated cable antenna serves as the transmission line mounted along the conveyer line
  - The radiated cable is a leaky feeder solution which emits and receives radio waves
- Near field solution ensures ultra-reliable communication which is not prone to interferences



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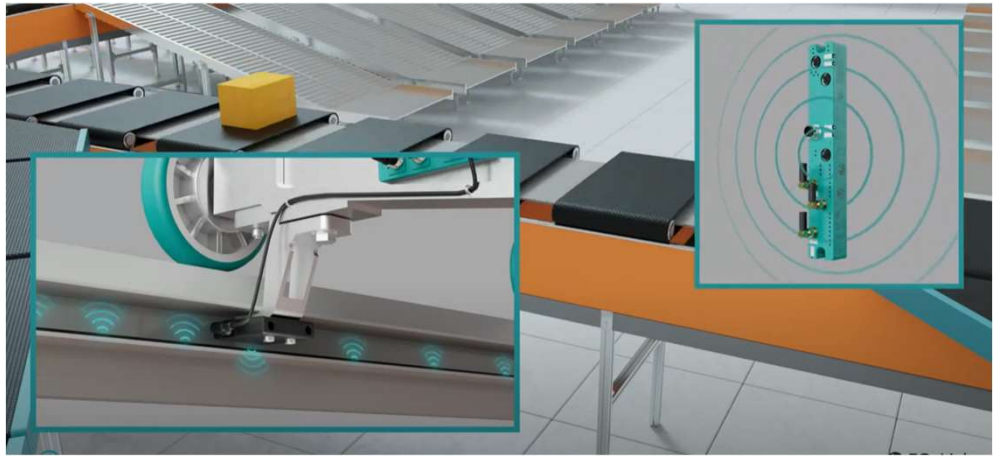
Benefits: Independent and Reliable

Cost Effective
- 20% less than Wi-Fi based on same architecture
- Reduce aftersales maintenance and commissioning effort

Scalable
- Modular design enables simple expansion and deployment
- Fixed segment lengths of Radiated Cable Antenna and Master per segment

Fast & Precise
- Narrowest discharge area for handling small items, increasing resolution and better space utilization
- Low latency designed for industrial automation control applications enables fastest speed

Reliable
- Highest wireless communication reliability – designed for harsh industrial high-speed motion applications
- Near Field Antenna System not impacted by EMC, no external RF radiation outside machine area



Watch the video

Case Study: Cross Belt Sortation System

Vertical Cross Belt Sorting Machine

CHALLENGE

- Improve sorting resolution to support variety of package dimensions (narrow discharge area)
- Increase sortation speed
- Flexible and modular design for line layout changes and maintenance

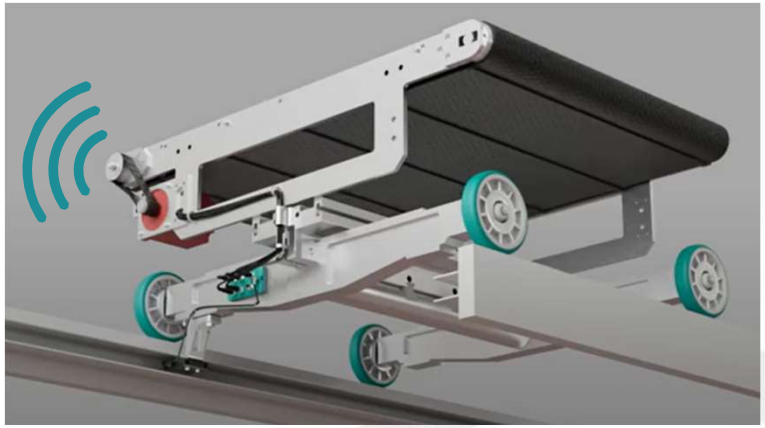
SOLUTION

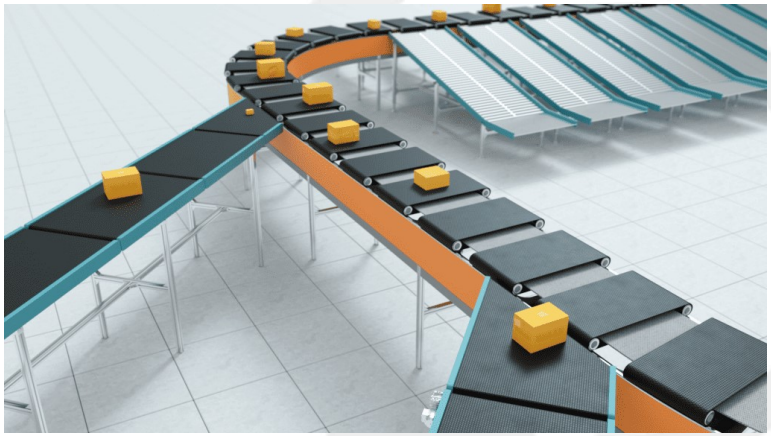
- Integrate IO-Link Wireless for controlling each servo motor on the carrier
- Support up to 500 crossbelt carriers per line
- Near field radiated antenna is been used to improve reliability, avoid interferers and cyber attack

BENEFITS

- **Precision -** Narrowest discharge area for handling small items, increasing resolution and better space utilization
- **Capacity** – increase machine speed from 2.5m/sec to 4.5m/sec
- **Commissioning time** – reduce the time from 2 weeks to 3 days
- **Cost** – reduce communication cost by 30%

Watch the video





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Rotary Units

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Case Study: Pedrini Natural Stone Processing

Italian Machine Builder and System Integrator

CHALLENGE

- Stone thickness grinding machine with 2 rotary heads (Calibrators), each with 24 spindles with diamond grinding tools
- Measurement of the current consumption of each spindle while processing requires complex slip ring communication
- Real-time measurements are needed for system calibration and optimization

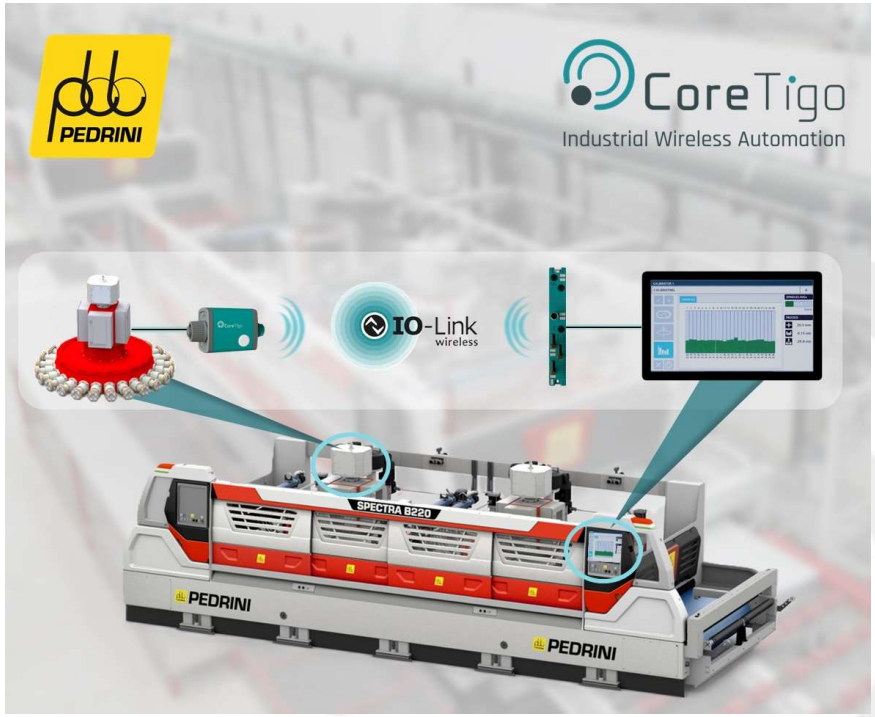
SOLUTION

- Slip Ring is used to provide power for the spindles motors and sensors
- TigoBridge is connected to a multiport I/O Hub that communicates current data from 8 spindles simultaneously (and a total of 48 spindles per machine with 6 TigoBridges).
- TigoMaster communicates data to PLC and the spindle calibration and optimization application is displayed on HMI

BENEFITS

- **Cost** - reduced the slip ring cost
- **Slip ring complexity reduction** – cost-effective, reduced deployment time and effort
- **Increased flexibility** – simple retrofit and system expansion
- **Improved maintenance** – reduced spare parts for expensive slip rings, reduced cable wear and tear
- **Reliability** – better performance than Wi-Fi , coexists with other wireless networks, does not require line of sight, and is designed for high-speed motion applications in harsh industrial environments.

Watch the Video



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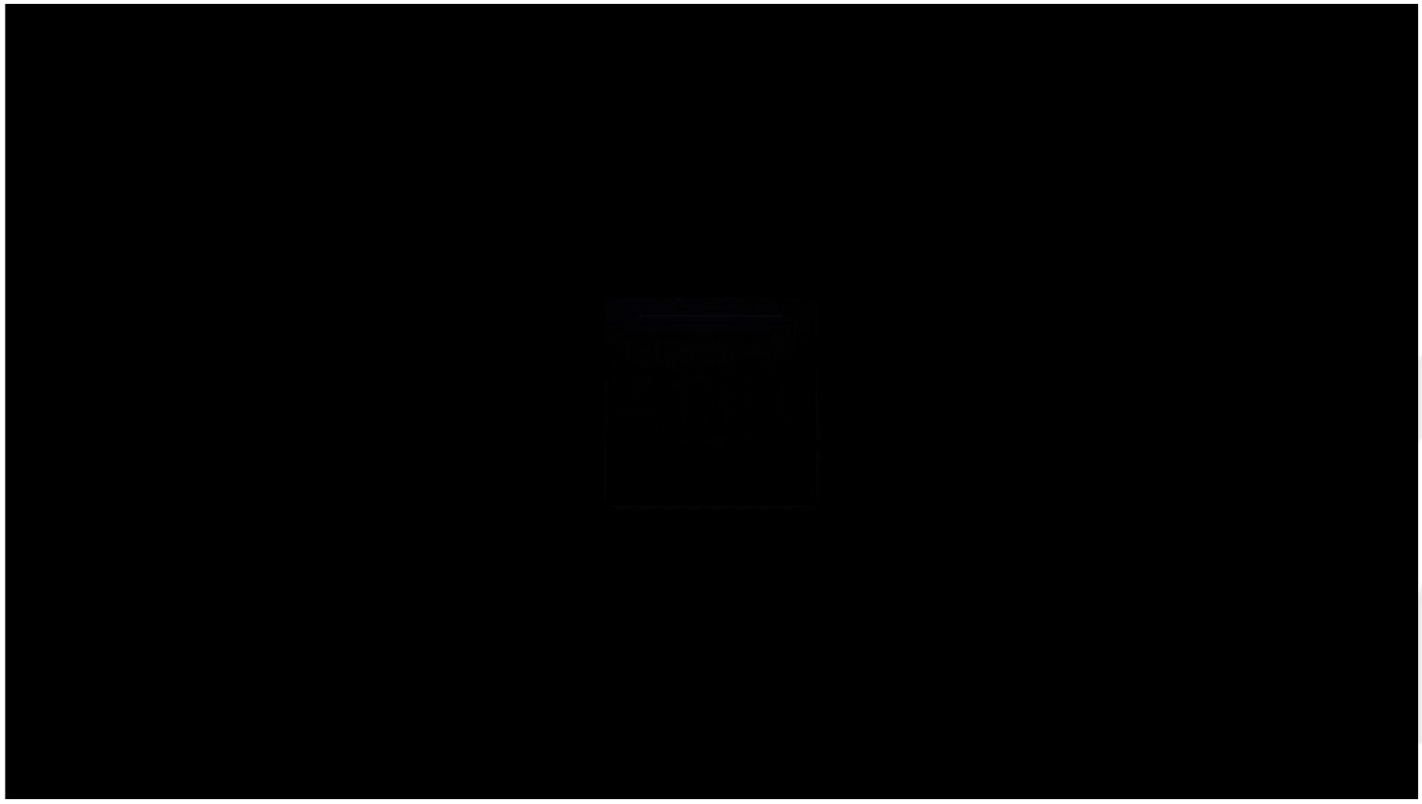
Pedrini Spectra B220 Stone Processing Machine with IO-Link Wireless

Watch the Video



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Case Study: Woodworking

Canadian Lumber Factory

CHALLENGE

- Harsh environment causes significant wear and tear on the slip rings used on the sawing drums
- Dust and moisture cause integrity issues with the communication slip rings

SOLUTION

- TigoHub connected to power from the slip rings, and 6 DIOs communicating wirelessly from the Hub for control and monitoring
- TigoMaster communicates wirelessly with 16 Drums (Hubs)

BENEFITS

- **Maintenance –** reduced slip ring maintenance operations and cost
- **Downtime Reduction –** due to slip ring reliability and malfunctions
- **Simple Deployment –** less cables and simple add-on of TigoHubs

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Case Study: Packaging Wrapping Machine

Italian Machine Builder and System Integrator

CHALLENGE

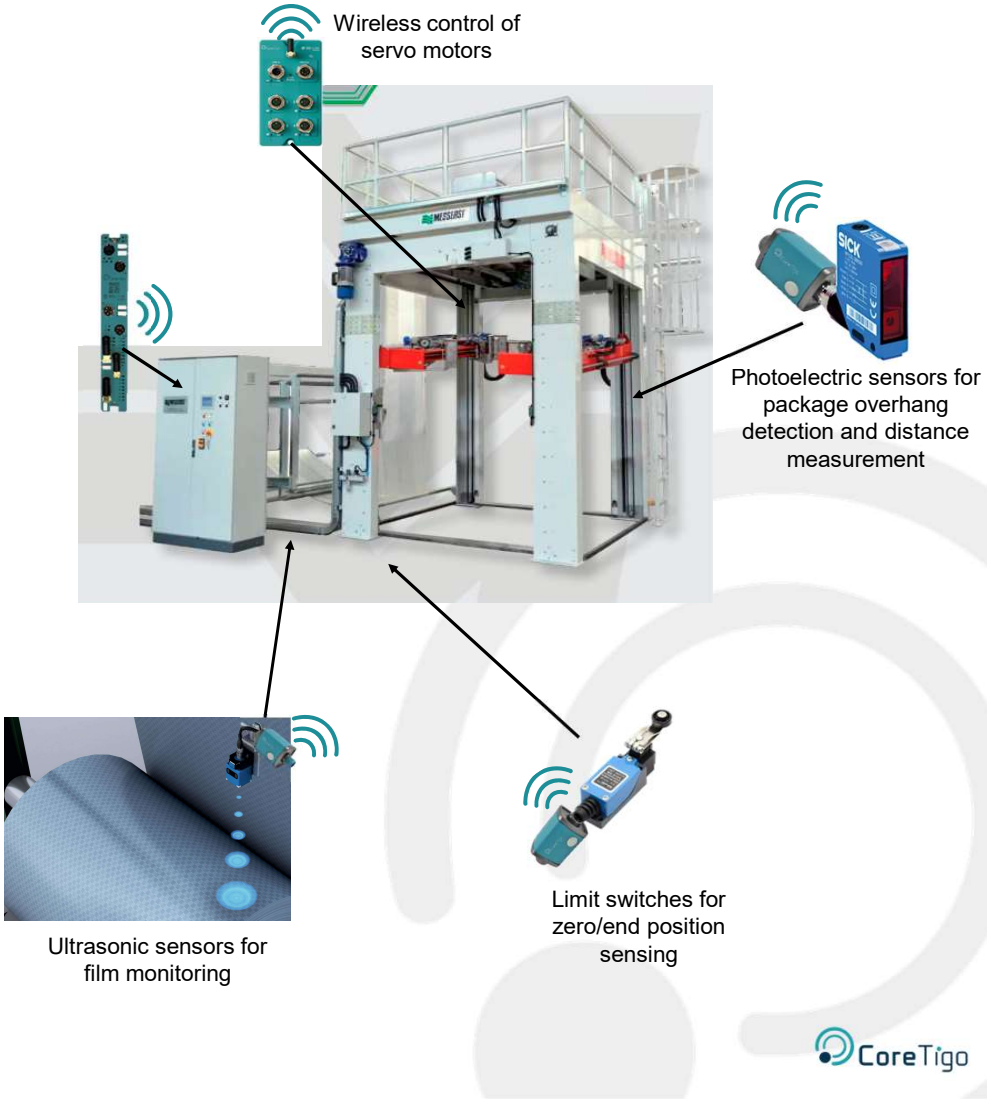
- Reliable communication between the machine controller and the moving machine parts
- Connect several sensors to the PLC in low latency
- Replace expensive slip ring with wireless communication

SOLUTION

- In place of a slip ring, an Industrial IO-Link Wireless solution is used to guarantee reliable, wear-free communication between the central controller and moving machine part

BENEFITS

- **Cost** – reduce the cost by replacing high quality slip-ring that provides power and communication with lower cost slip-ring for power only
- **Maintenance-** wear free communication, no need for maintenance
- **Ease of use** – plug and play integration to Siemens PLC and 4 digital IO



Glove Integrity Testing

Glove Integrity Testing - Challenges

Safety

- The demand for higher safety in handling operations inside an isolator increases the need for frequent monitoring of the Gloves, which are critical parts of an Isolator

Usability

- Isolator machines have numerous stations and the tester needs be easy to use – cables and pneumatic pipes create complexity

Accuracy

- Standalone testers don’t communicate with the machine’s PLC and may cause human errors
- All data needs to be recorded for traceability

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Case Study: Glove Integrity Testing

Isolator Machine Builder

CHALLENGE

- Machine's Tester unit was not connected to the PLC
- The HMI, sensors and logic were all an integral part of the Tester unit

SOLUTION

- Battery powered integrated sensors and IO-Link Wireless on the Tester to enable mobility
- Data communication from Tester to PLC directly from the IO-Link Wireless Master
- Visualize the Tester results on the HMI

BENEFITS

- Easy to use solution
- Complexity reduction - no external cables for communication to the PLC or power supply (battery powered)
- Seamless integration and data communication to PLC
- Seamless integration to IO-Link sensors and other digital I/O on Tester

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Intelligent Machine Tooling

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Machine Tooling Challenges

Rapid Rotation Speed

1000‘s of RPM

Harsh Conditions

Inside CNC, Milling, Grinding Machines

Design

Low power, battery operated, small footprint

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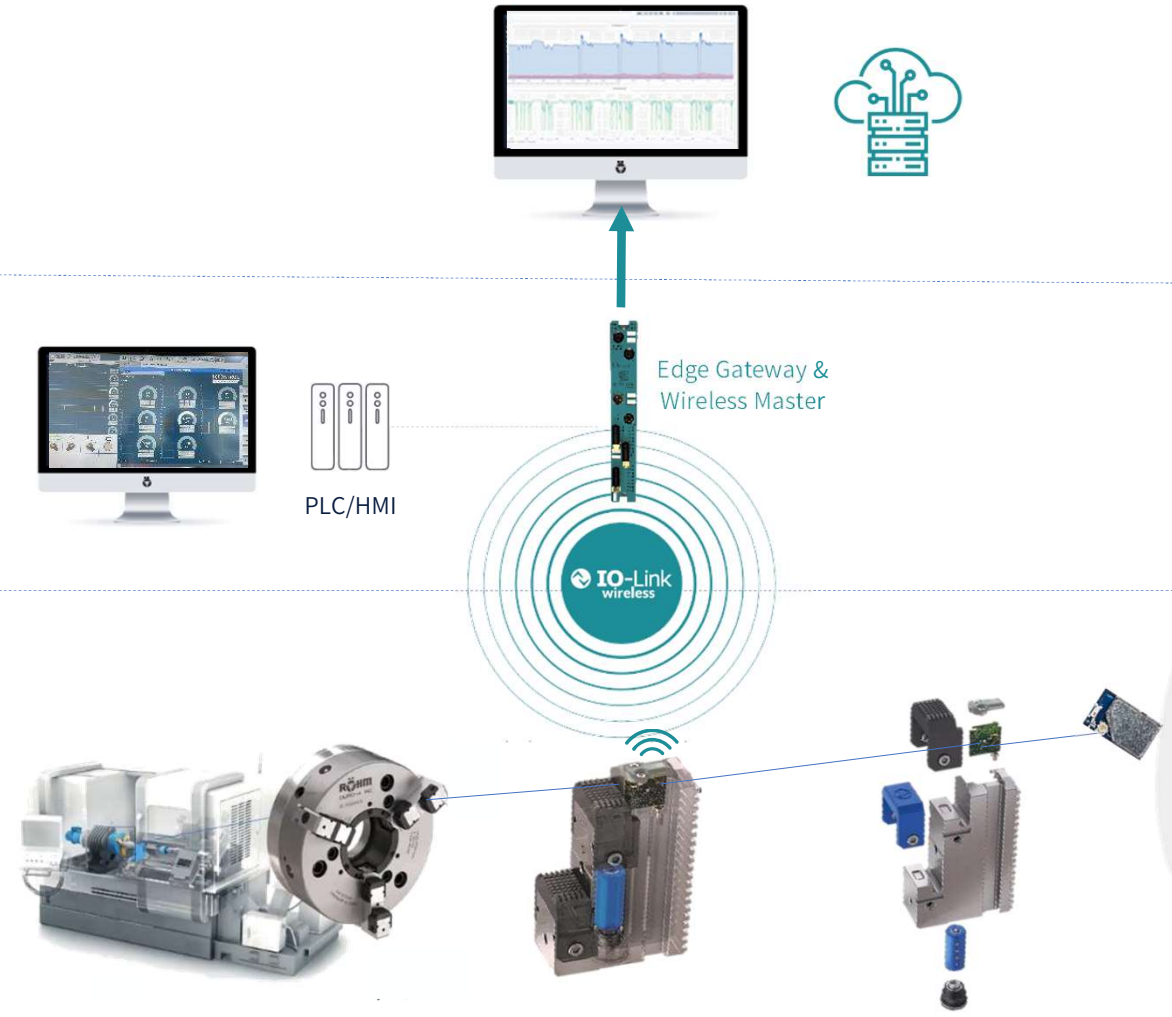
IO-Link Wireless – Intelligent Tooling Solution

DATA COLLECTION & ANALYTICS

REAL-TIME MASTER & EDGE GATEWAY

SMART FLEXIBLE DEVICES



4 ***Application***
Cloud or on-premise software for data collection, traceability, dashboards and analytics

3 ***PLC Integration:***
Direct communication to PLC via Industrial Ethernet/OPC UA for machine tuning and HMI visualization

2 ***Variety of Tools:***
Can be applied on the workpiece clamping device or on the tool clamping device

1 ***Sensor Integration:***
Real-time measurement of force, vibration, temperature and more (analog, digital or IO-Link sensors)

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Intelligent Tooling Benefits

- **Automatic Setup –** Precise part confirmation and tool setup without manual intervention
- **Machine Tuning –** Real-time measurement of excessive and declining clamping while machining
- **Safety** – Reduce safety hazards and machine damage caused due to inadequate clamping forces
- **Predictive Maintenance & Quality Assurance** – early indication of wear and tear and production deficiencies
- **Traceability & Analytics -** Measure, document and archive all stages in the manufacturing process in real-time (damage and quality analysis)

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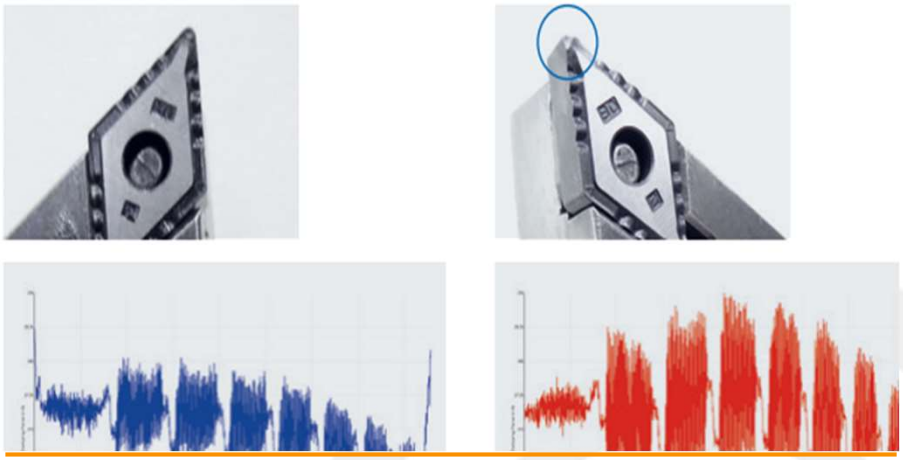

Example: Pattern evaluation of sensitive measurements at the tooling point enables the most reliable and most precise condition-based solution

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CoreTigo Product Portfolio

TigoMaster

TigoMaster 2TH
IO-Link Wireless Master IP67 platform. Supports up to 16 IO-Link Wireless devices. Supports PROFINET, EtherCAT, EtherNet/IP, OPC UA.

TigoGateway 1TE
An IP20 IO-Link Wireless Master with Edge Computing functionality. Supports up to 8 IO-Link Wireless Devices. Supports PROFINET, EtherCAT, EtherNet/IP, OPC UA and MQTT.
Includes a Linux OS (Docker enabled) for running a variety of applications and edge computing.

TigoGateway 2TC
An IP20 IO-Link Wireless Master. Supports up to 16 IO-Link Wireless Devices. Supports PROFINET, EtherCAT, EtherNet/IP, and OPC UA.

TigoBridge

TigoBridge A1 / B1
IO-Link Wireless Bridge with IP67 enclosure. Converts IO-Link devices to IO-Link Wireless. Includes internal antenna.
TigoBridge A1 – IO-Link Class A devices
TigoBridge B1 – IO-Link Class B devices

TigoBridge A2 / B2
IO-Link Wireless Bridge with IP67 enclosure. Includes external antenna options (Dipole or Near Field antenna).
TigoBridge A2 – IO-Link Class A devices or 2 x DIO devices
TigoBridge B1 – IO-Link Class B devices or single DIO device

TigoHub

TigoHub i4
IO-Link Wireless Hub with IP65 enclosure. Converts multiple IO-Link & Digital devices to IO-Link Wireless. Includes M12 connectors for data & power, and external antenna options (Dipole or Near Field)

TigoCounter

IO-Link Wireless Counter device with IP-67 enclosure which connects to a Digital output and enables object counting capabilities.

TigoAir SOM

TigoAir 2 SOM
An embedded module (11x18mm) for designing and building IO-Link Wireless sensors, actuators or I/O hubs.

TigoAir LK1 SOM
An embedded module (11x17mm) for designing and building IO-Link Wireless sensors and actuators.

TigoBridge SOM

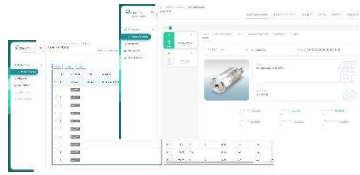
TigoBridge SOM
An embedded module for designing and building IO-Link Wireless Bridge devices. Converts IO-Link data to IO-Link Wireless.

TigoConverter

Analog to IO-Link device converter. Connects to current (4-20mA) or voltage (0-10VDC) source. Connects directly to TigoBridge and TigoHub for turning Analog devices to IO-Link Wireless.

TigoEngine

Engineering Tool for IO-Link Wireless system setup and configuration, network analytics & diagnostics, performance monitoring, data aggregation and MQTT publishing.



TigoStarter

TigoStarter K22/K23
Evaluation Kit for IO-Link Wireless System

TigoStarter K7
Development Kit for IO-Link Wireless Devices

CoreTigo

Serving a Variety of Industries & Markets

CoreTigo
Industrial Wireless Automation

CPG (F&B, Pharma)

Adaptive Packaging Machines

Bottling, Heat Treatment

Glove Integrity Testing

OEE improvement

Automotive

EV Battery Assembly

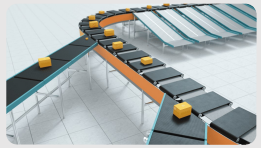
Car Seat Assembly

Cranes & Gantries

Air Flow Monitoring

Logistics

Crossbelt Sortation Systems



AMRs

Smart Warehouse

Predictive Maintenance

Other Discrete Mfg.

CNC Machines Intelligent Tooling

Converting Machines

Solar Panels

Stone Processing

CoreTigo

Thank you!

info@coretigo.com

www.coretigo.com

TigoStarter

CoreTigo

TigoStarter K23

Kit components		
Image	Name	Description
	TigoMaster 2TH EIP/PN/CAT	2-Track IO-Link Wireless Master
	TigoBridge A1	Class A IO-Link Wireless Bridge
	TigoBridge B1	Class B IO-Link Wireless Bridge
	TigoHub i4	IO-Link Wireless Multiport Hub
	TigoConverter	Analog to IO-Link device converter (4-20mA)
	TigoEngine	TigoEngine software single user license for IO-Link Wireless setup
	D-Coded Cable	1 x D-Coded M12 Male to RJ45 Cable
	L-Coded Cable	2 x L-Coded PVC Black Female Cable
	A-Coded Cable	2 x A-Coded Female PVC Cable

CoreTigo

TigoStarter K22

Kit components		
Image	**Name**	**Description**
	TigoMaster 2TH EIP/PN/CAT	2-Track IO-Link Wireless Master
	TigoBridge A1	Class A IO-Link Wireless Bridge
	TigoBridge B1	Class B IO-Link Wireless Bridge
	TigoEngine	TigoEngine software single user license for IO-Link Wireless setup
	D-Coded Cable	1 x D-Coded M12 Male to RJ45 Cable
	L-Coded Cable	1 x L-Coded PVC Black Female Cable
	A-Coded Cable	2 x A-Coded Female PVC Cable

CoreTigo

TigoBridge A1/B1

TigoBridge A1

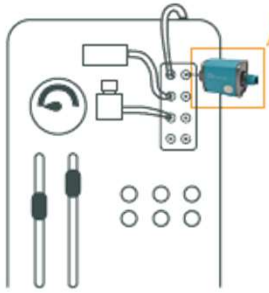
- Converts IO-Link Class A devices to IO-Link Wireless
- Converts Analog devices to IO-Link Wireless (with TigoConverter)
- Internal custom antenna

Device Setup Options

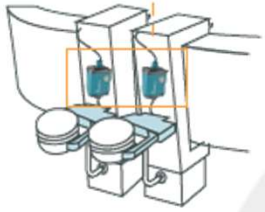
Convert an IO-Link Device (e.g., Sensor, Actuator, Hub) to IO-Link Wireless

Convert an Analog Device to IO-Link Wireless with TigoConverter

Device Application Examples



TigoBridge with IO-Link Hub Connects Multiple Sensors for Condition Monitoring & IIOT



TigoBridge on Transport Track Movers

TigoBridge on Robotic End-of-Arm

CoreTigo

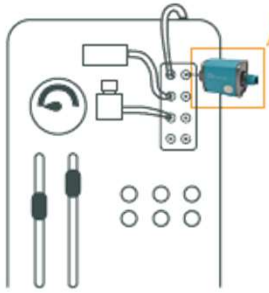
TigoBridge B1

- Converts IO-Link Class B devices to IO-Link Wireless
- Internal custom antenna

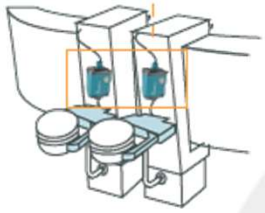
Device Setup Options

Convert an IO-Link Device (e.g., Sensor, Actuator, Hub) to IO-Link Wireless

Device Application Examples



TigoBridge with IO-Link Hub Connects Multiple Sensors for Condition Monitoring & IIOT



TigoBridge on Transport Track Movers

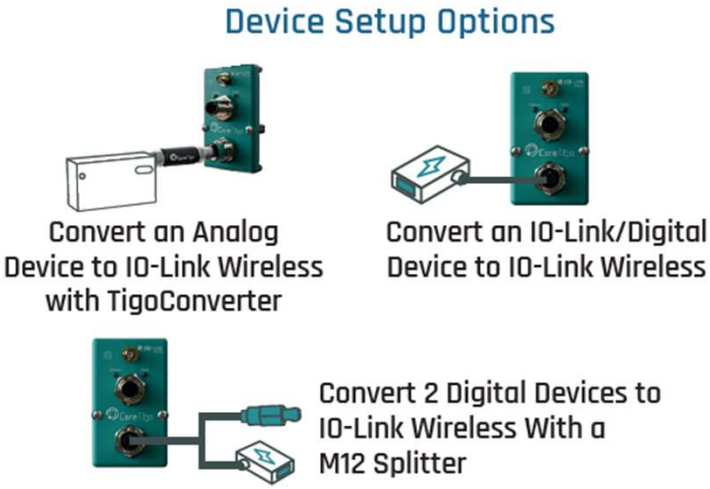
TigoBridge on Robotic End-of-Arm

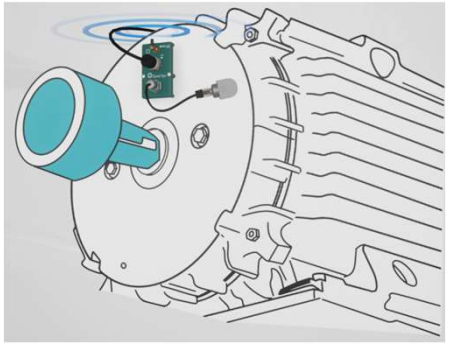
CoreTigo

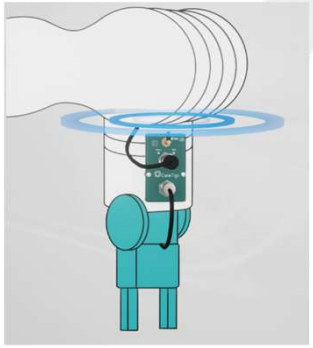
TigoBridge A2/B2

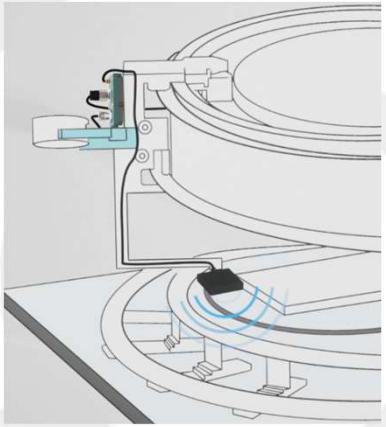
TigoBridge A2

- Converts IO-Link Class A devices to IO-Link Wireless
- Converts up to 2 x DIO to IO-Link Wireless
- Converts Analog devices to IO-Link Wireless (with TigoConverter)
- External antenna connector – dipole antenna or TigoNFA Near Field Antenna









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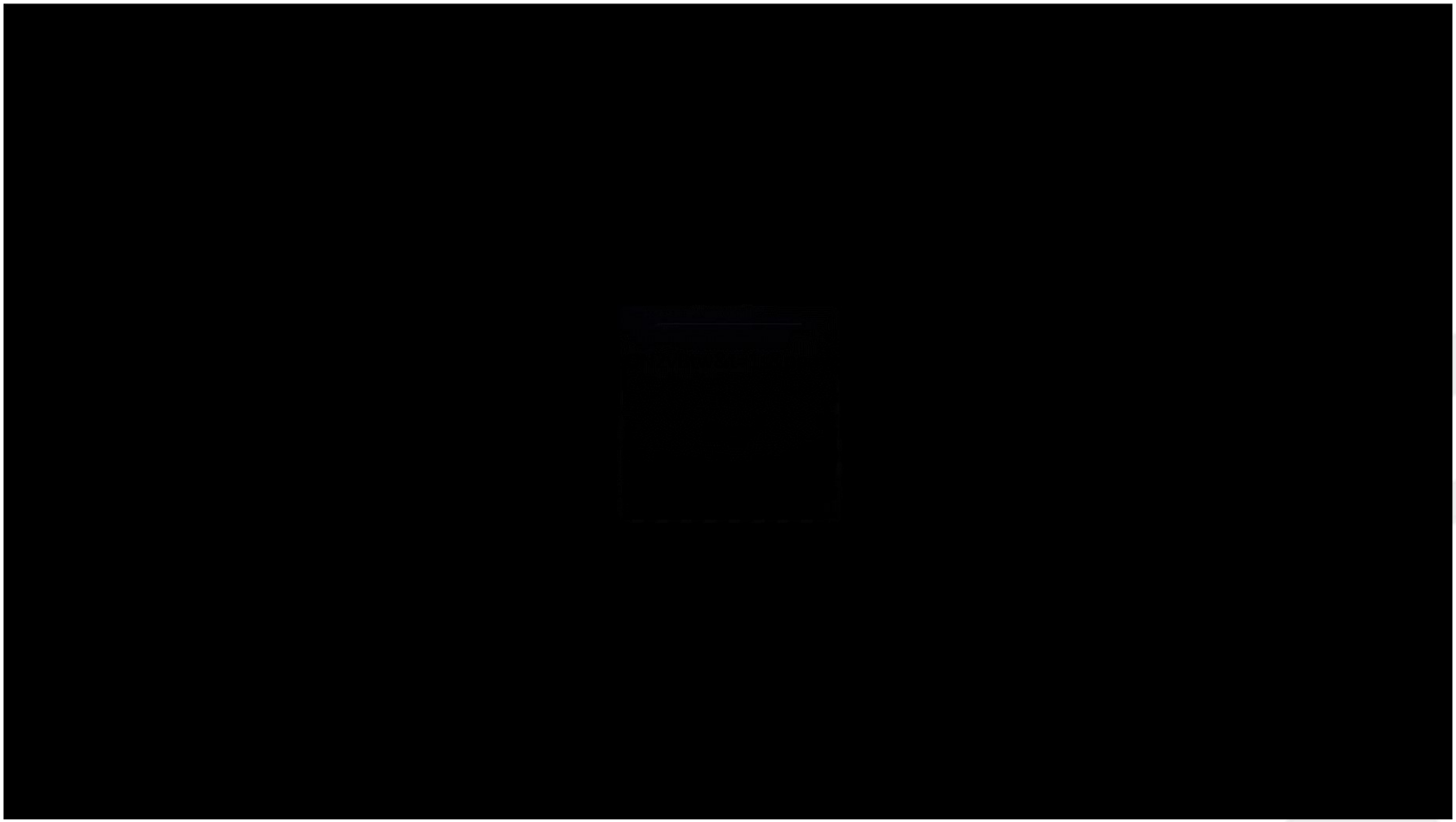
TigoBridge A2 – Product Video

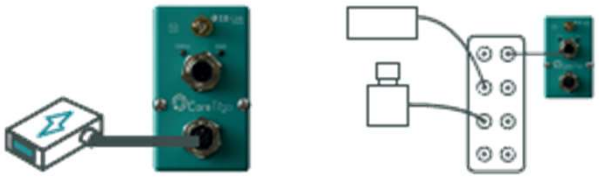
Watch Video



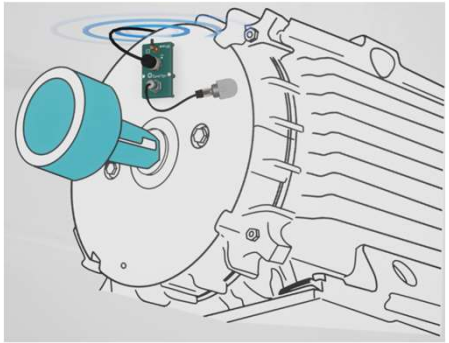
TigoBridge B2

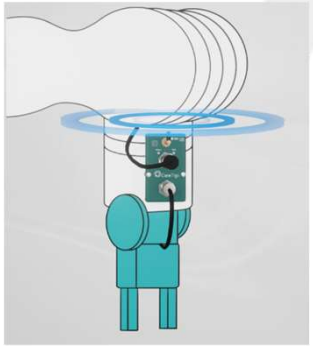
- Converts IO-Link Class B devices to IO-Link Wireless
- Converts 1 x DIO to IO-Link Wireless
- External antenna connector – dipole antenna or TigoNFA Near Field Antenna

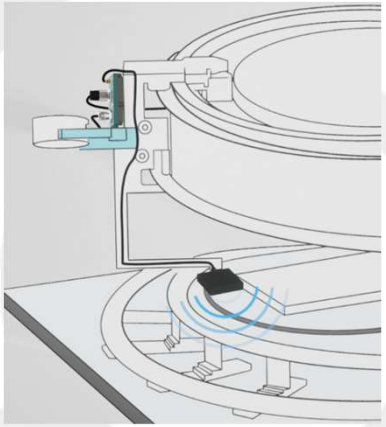
Device Setup Options



Convert an IO-Link/
Digital Device to
IO-Link Wireless







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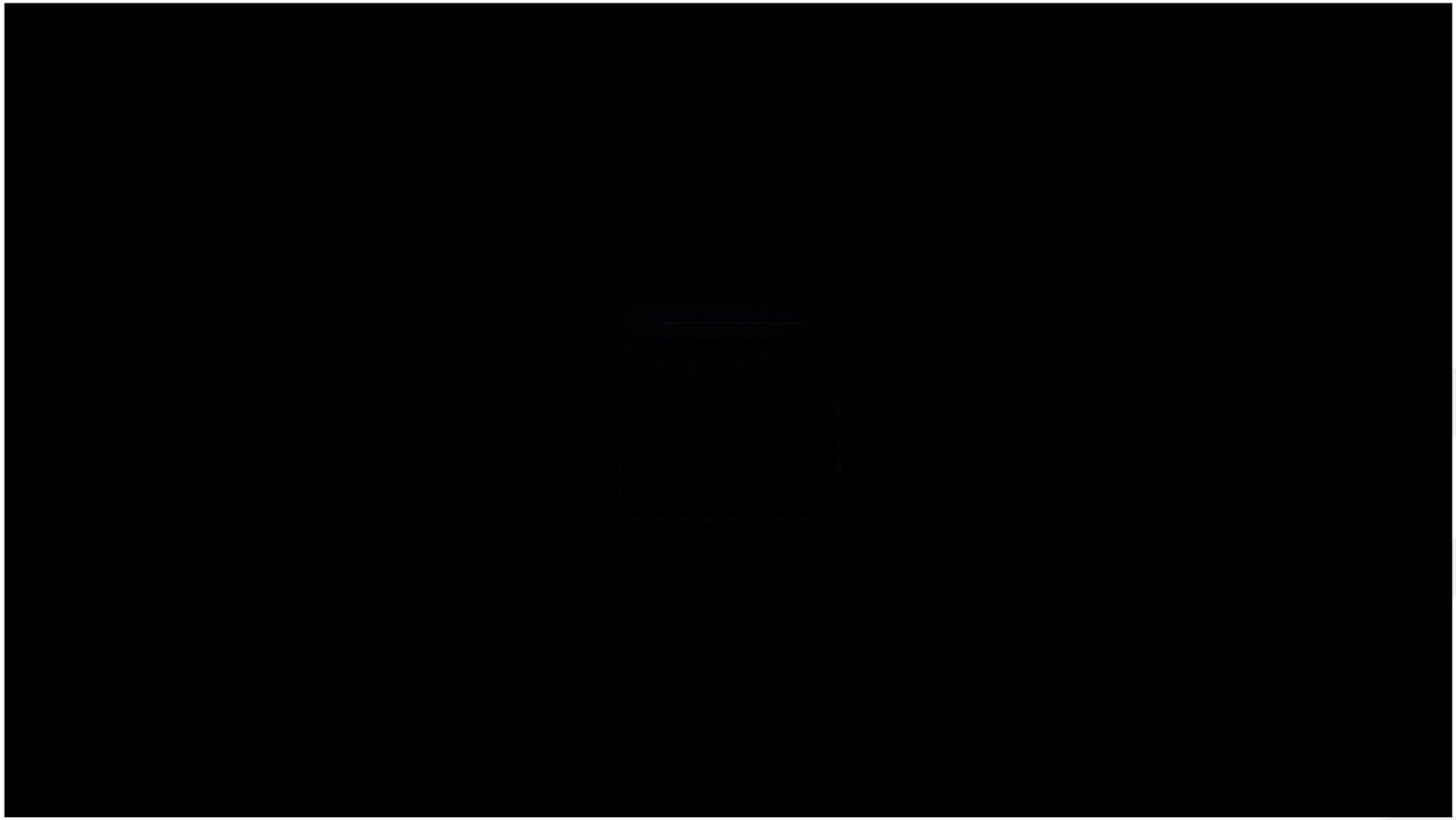
TigoBridge B2 – Product Video

Watch Video

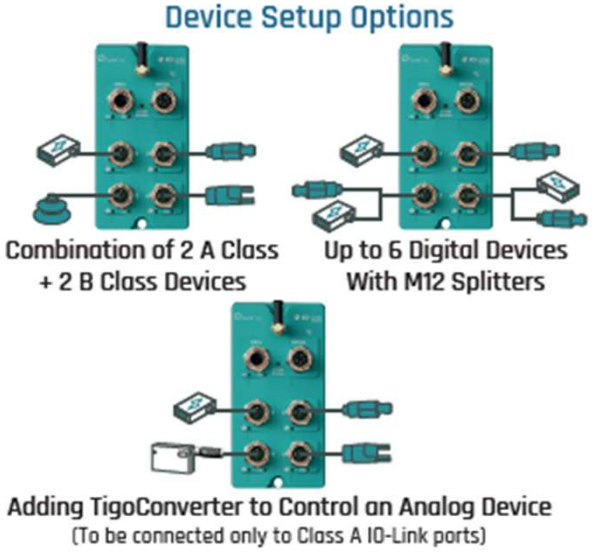


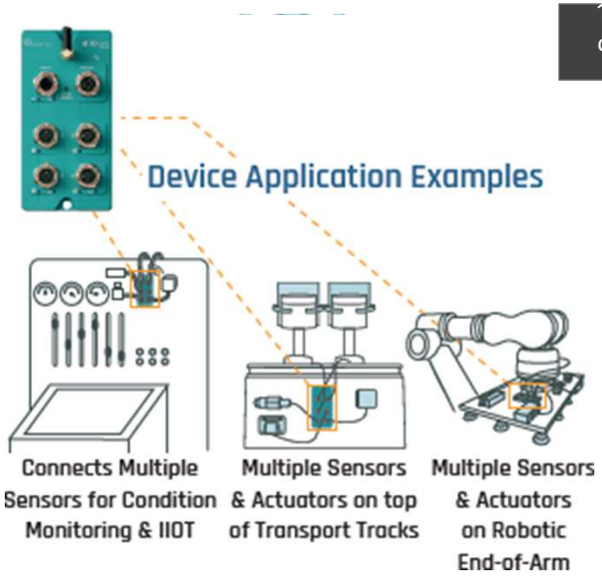
TigoHub

CoreTigo

TigoHub i4-2

- Multiport hub for IO-Link Wireless connectivity of IO-Link, DIO & Analog devices
- Connect up-to 4 IO-Link and up-to a combination of 6 IO-Link/DIO/Analog devices and convert to IO-Link Wireless





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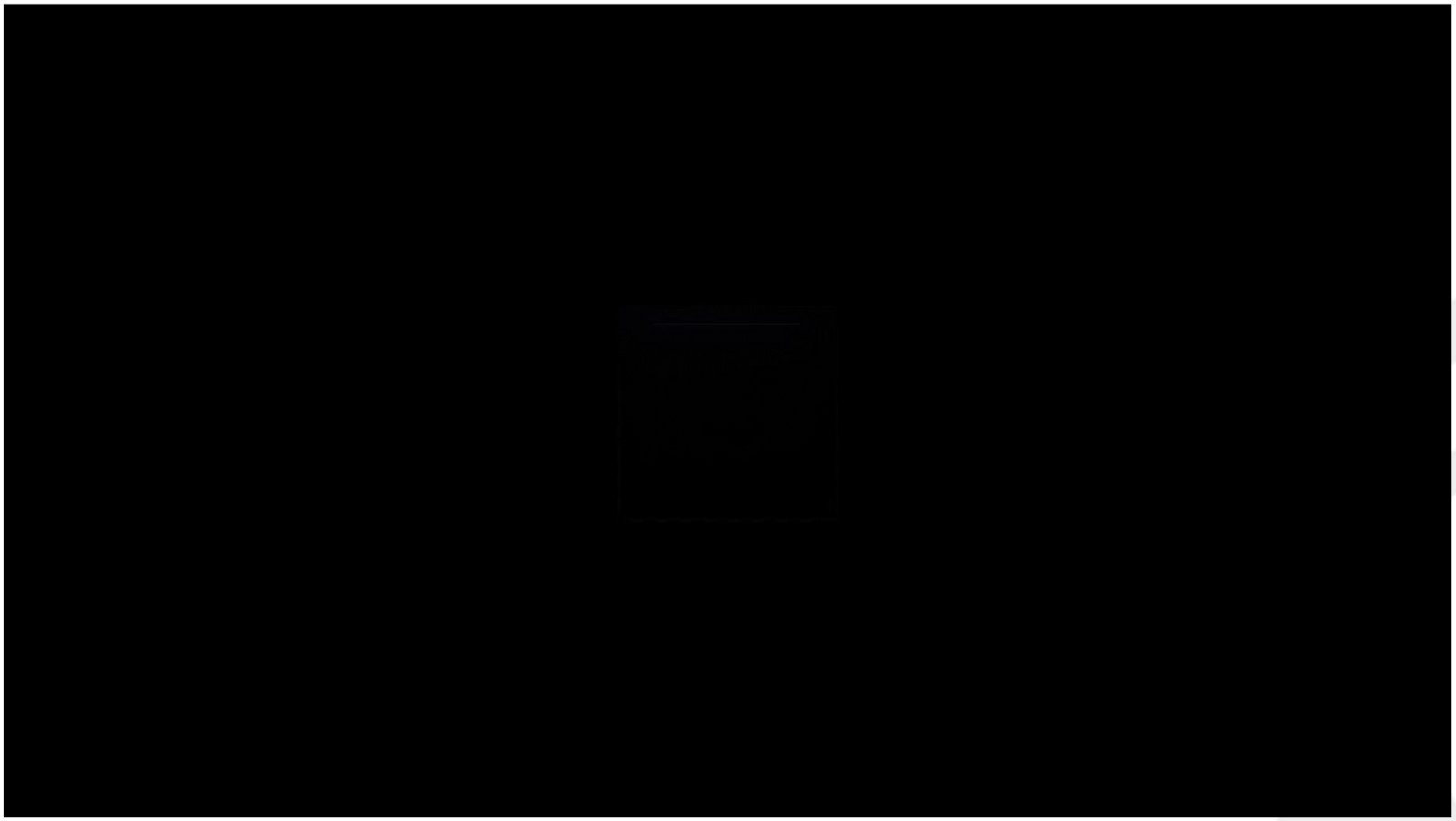
TigoHub i4-2 – Product Video

Watch Video

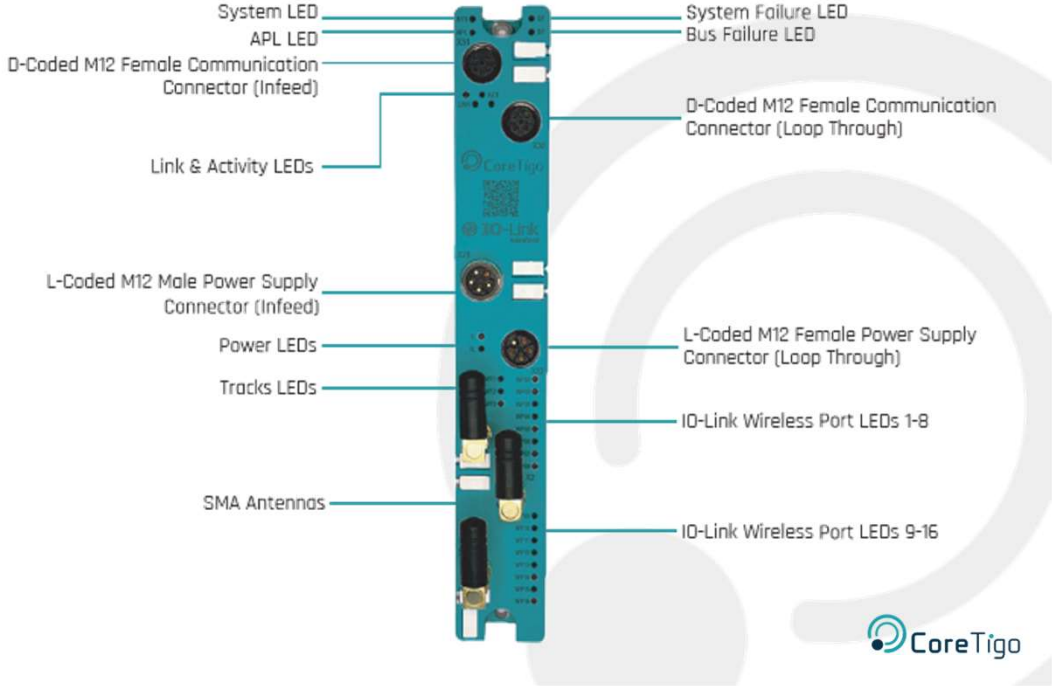


TigoMaster 2TH

CoreTigo

TigoMaster 2TH

- TigoMaster 2TH is an industrial-grade IP67 IO-Link Wireless Master platform
- It has two IO-Link Wireless tracks, each supporting up to 8 devices, 16 IO-Link Wireless devices simultaneously.
- Includes interfaces to a variety of Industrial Ethernet protocols, such as EtherNet/IP, PROFINET, EtherCAT and OPC UA
- TigoMaster 2TH can be setup, configured and monitored by the TigoEngine (CoreTigo's Engineering Tool for IO-Link Wireless systems), via an internal Web Server interface or by a PLC.



TigoGateway

CoreTigo

TigoGateway 1TE

- ❑ Industrial-grade IP20 IO-Link Wireless Master with Edge Computing functionality
- ❑ Supports up to 8 IO-Link Wireless Devices simultaneously
- ❑ Includes interfaces to a variety of Industrial Ethernet and IIoT protocols
- ❑ Edge computing capabilities, with a Linux OS and Docker Containers that are used for a variety of advanced applications, and implementation of business logic

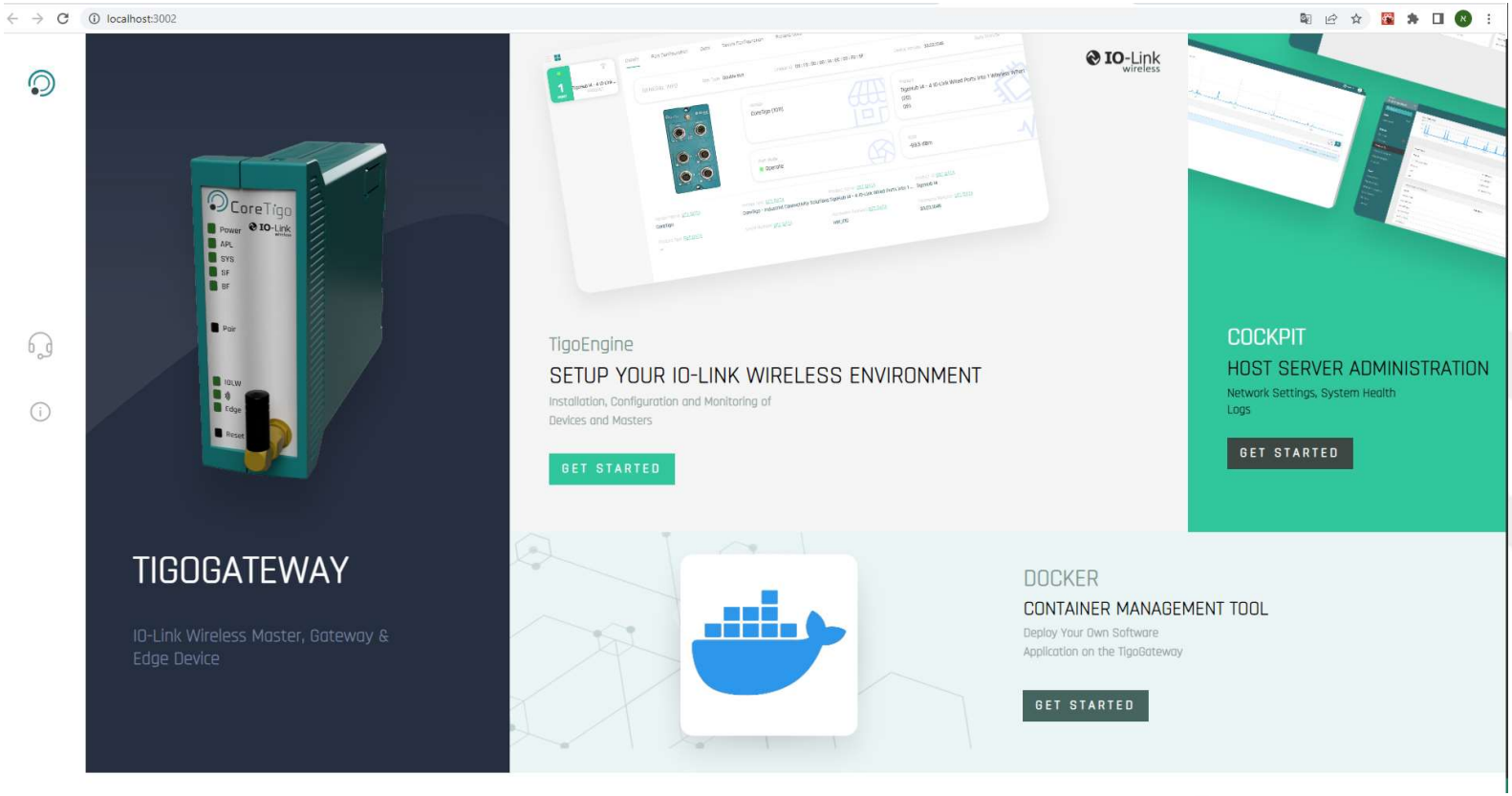
Product Specifications:

- 1 Track IO-Link Wireless
- Industrial Ethernet – PROFINET, EtherNet/IP, EtherCAT
- Linux OS
- Docker Containers
- MQTT (Secure), OPC UA
- Edge Computing
- Physical Components:
  - IP20 housing
  - RJ45 connectors (IT/OT)
  - Power supply + connectors
  - Antenna

CoreTigo

TigoGateway 1TE Edge Computing Platform Engineering Tool, Soft PLC, Docker Apps…

1. **TigoEngine**
2. **Docker Container** Mgt. Tool
3. **Cockpit** – OS and PC admin tool



TigoGateway 2TC

- ❑ Industrial-grade IP20 IO-Link Wireless Master
- ❑ Supports up to 16 IO-Link Wireless Devices simultaneously
- ❑ Includes interfaces to a variety of Industrial Ethernet and IIoT protocols

Product Specifications:

- 2 Track IO-Link Wireless
- Industrial Ethernet – PROFINET, EtherNet/IP, EtherCAT
- Physical Components:
  - IP20 housing
  - RJ45 connectors (IT/OT)
  - Power supply + connectors
  - Antenna

TigoGateway 1TE – Product Video

Watch Video

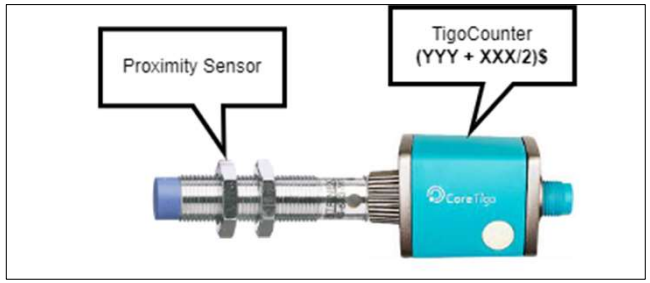
CoreTigo

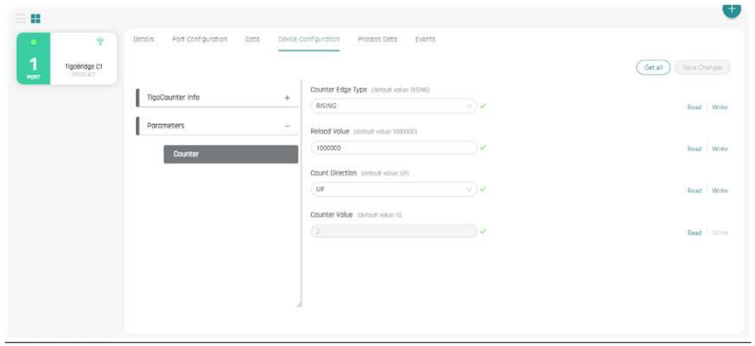
TigoCounter

CoreTigo

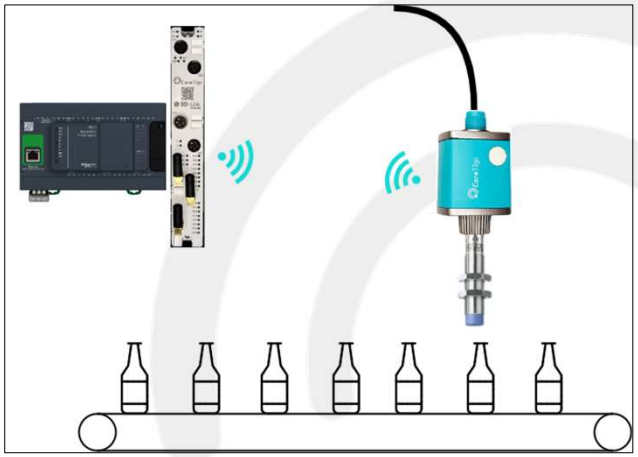
TigoCounter C1

- IO-Link Wireless Counter device which connects to a Digital output and enables object counting capabilities along with transmission of the data wirelessly to an IO-Link Wireless Master.
- Used for a variety of industrial applications, such as object counting of products on a moving conveyor, motor rotation counting or power consumption metering.





Counter Parameters	
Max counting rate	2kHz
Counter Edge Type	Rising, Falling
Reload Value	Configurable
Counting Direction	Up, Down



TigoCounter

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TigoConverter

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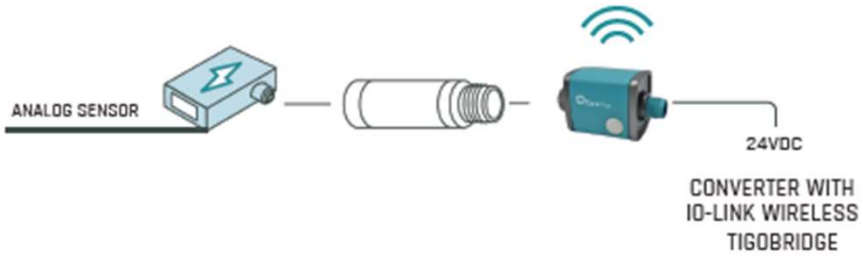
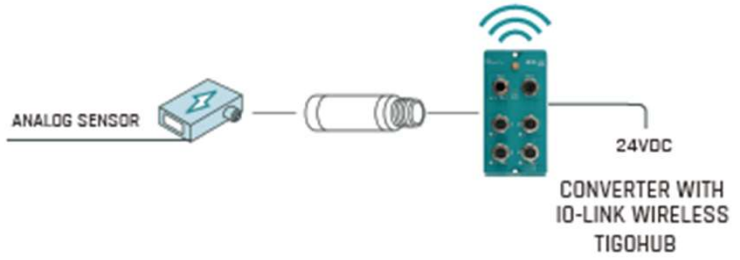
TigoConverter ACI (Analog to IO-Link Converter)

- Analog to IO-Link device converter that connects to a current (4mA to 20mA) or voltage (0-10VDC) source and outputs the value to IO-Link.
- The IO-Link Wireless Bridge/Hub (Class A Ports) connects directly to the Analog Converter, enabling the measurements from the analog sensors to be communicated to the IO-Link Wireless Master over the air in the most reliable manner.
- Simplifies deployment and machine retrofit by seamlessly creating a wireless connection of analog devices, such as vibration sensors and load cells.

Watch Video





CoreTigo

TigoEngine

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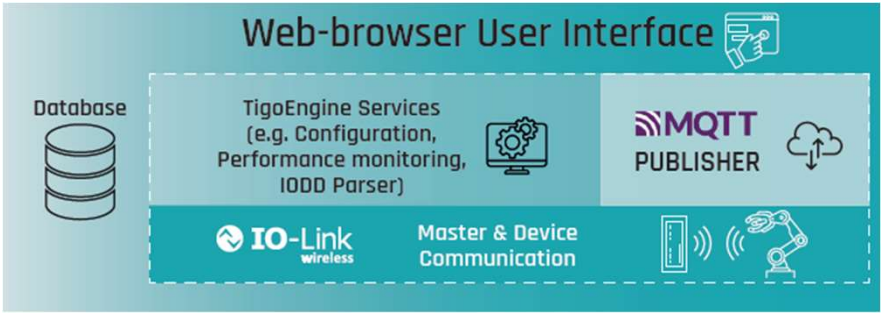
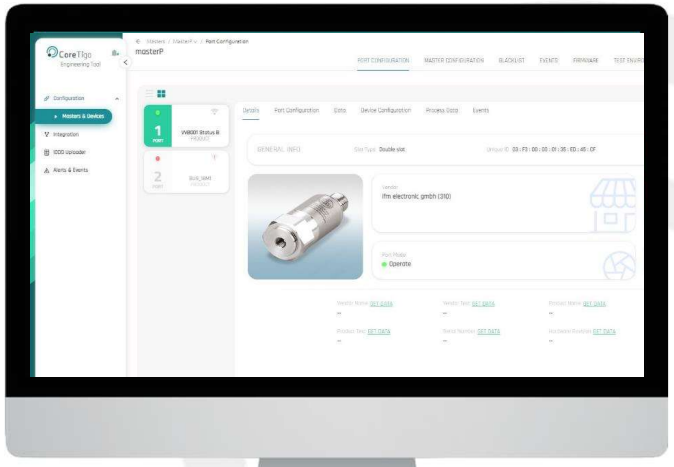
TigoEngine

Software-based Engineering Tool for efficient setup and use of IO-Link Wireless Masters and Devices

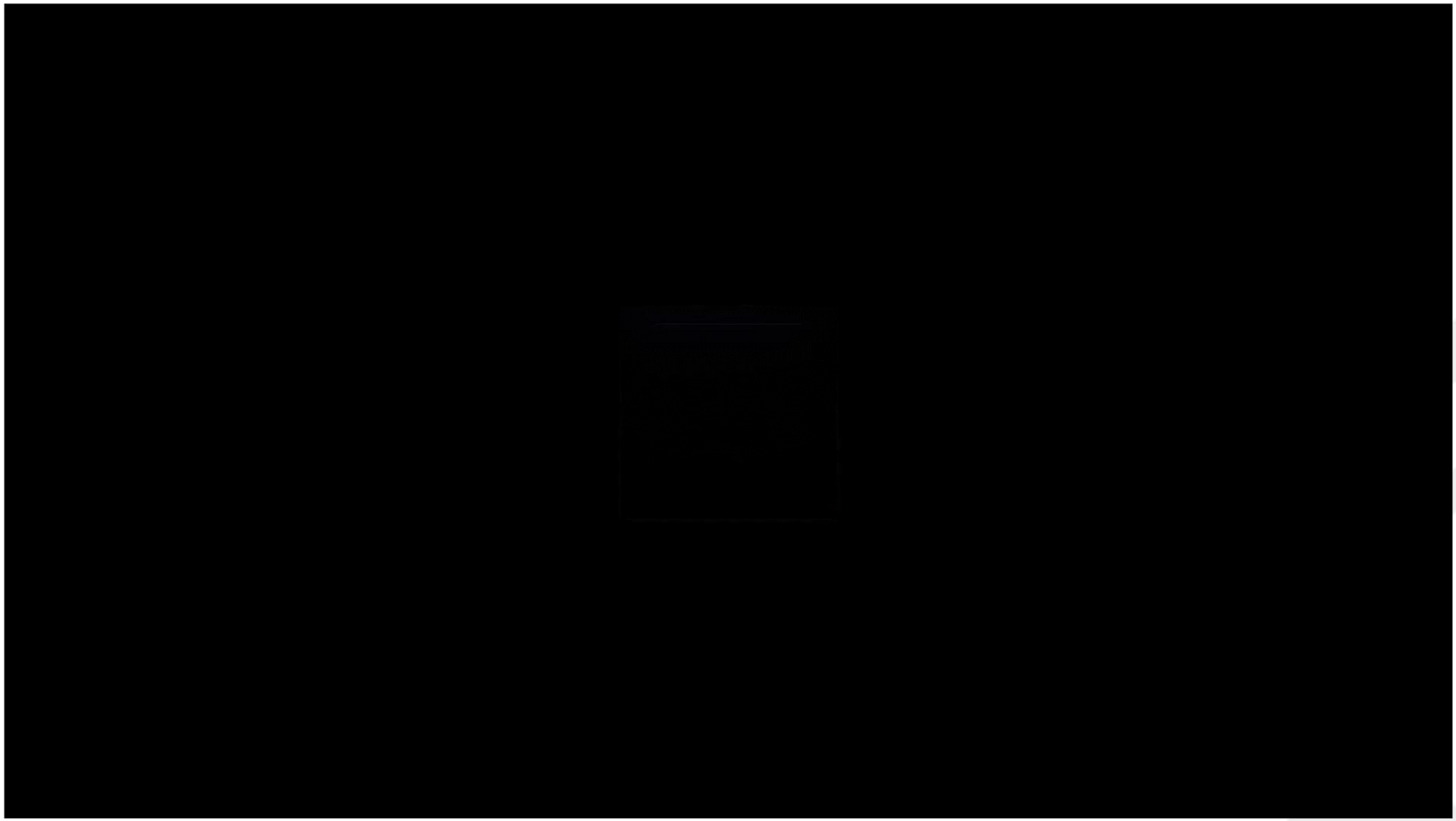
- IO-Link Wireless Masters communication setup
- Scan for available IO-Link Wireless Devices within range of an IO-Link Wireless Master
- Pair and connect IO-Link Wireless Devices to the relevant IO-Link Wireless Masters
- IODD Finder and Parsing Tool for simple configuration of IO-Link Devices
- Wireless channels Blocklist configuration
- Expose Process Data to 3rd party applications via secure MQTT Publisher
- Over-the-air software upgrade of IO-Link Wireless Devices
- On demand (OD) operations, both read and write, to any port
- Performance and health monitoring
- Docker enabled





TigoEngine

Watch Video



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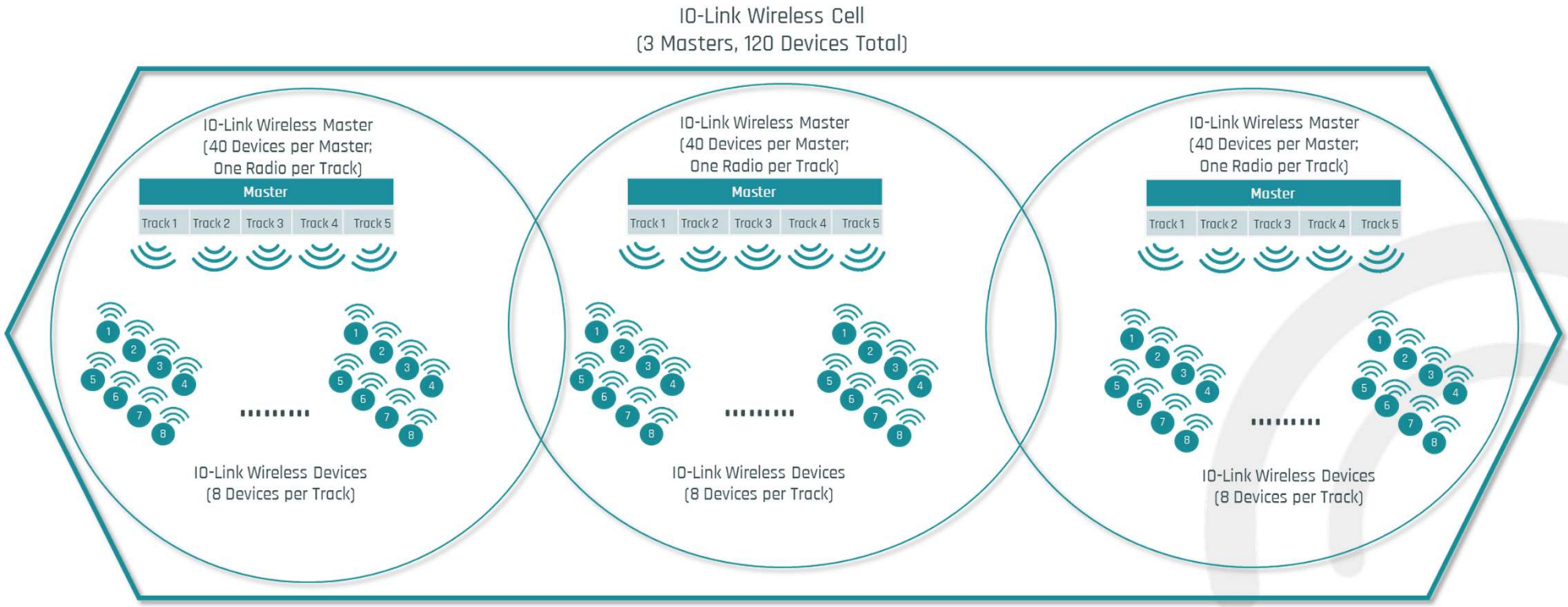
IO-Link Wireless Overview

CoreTigo

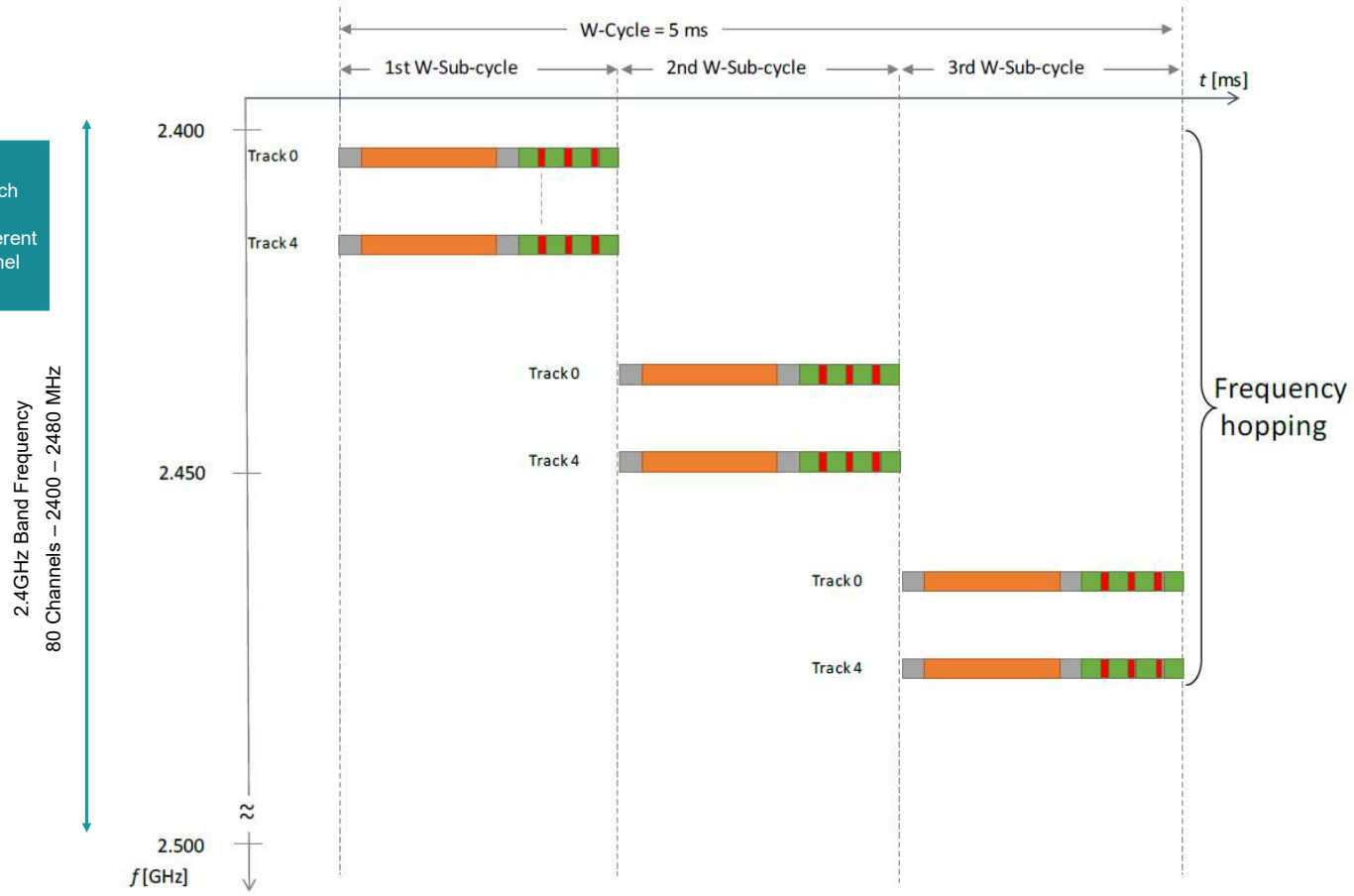
IO-Link Wireless Topology – Cell, Master, Track, Device



CoreTigo

IO-Link Wireless Frequency Hopping

Each Track in each Sub-cycle is transmitted on Different Frequency Channel

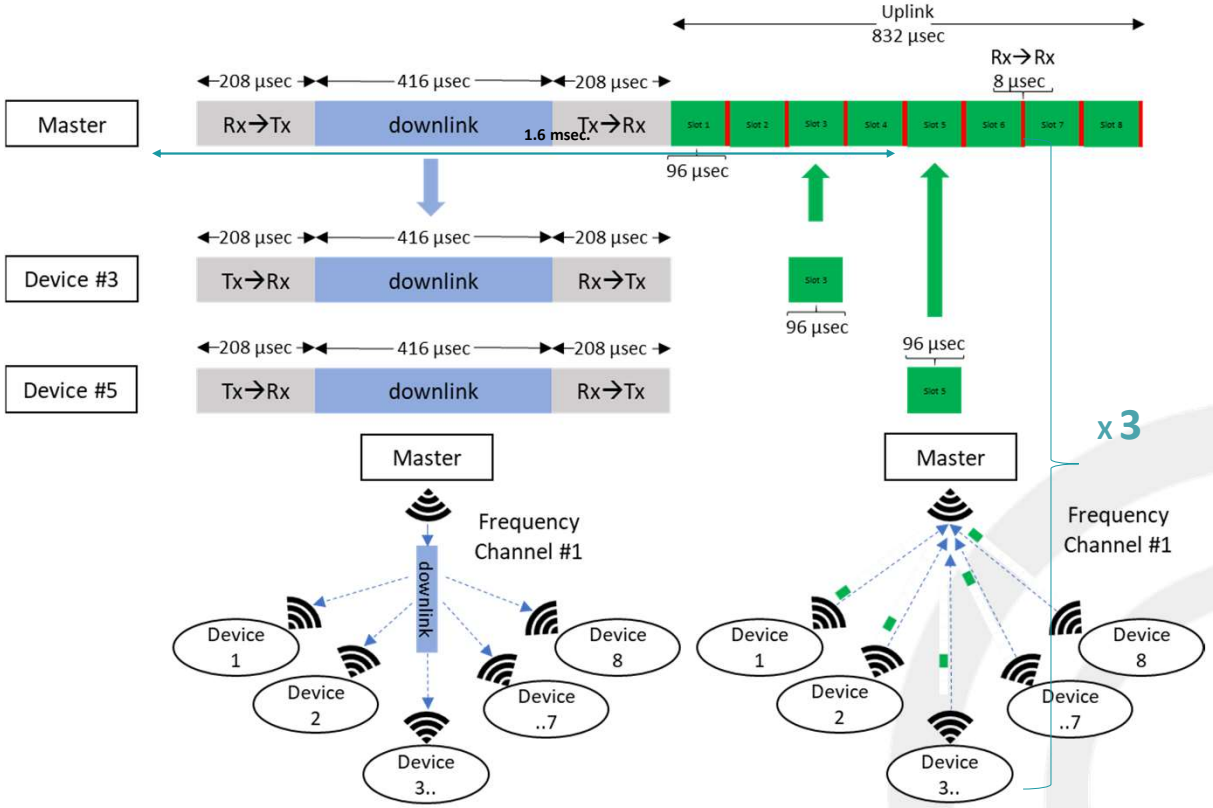


- Basic W-Cycle consists of 3 W-Sub-Cycles transmitted in different frequencies
- Frequencies set according to Hopping table to improve robustness against burst interferences

CoreTigo

IO-Link Wireless Cycle Structure

- 5 msec. — Total Cycle Time
- 1.6 msec. — Sub-Cycle Time
- 96 micro sec. — Single Device Slot Time, up to 2 Bytes of Data
- 8 micro sec. — Time Between Device Messages Uplink



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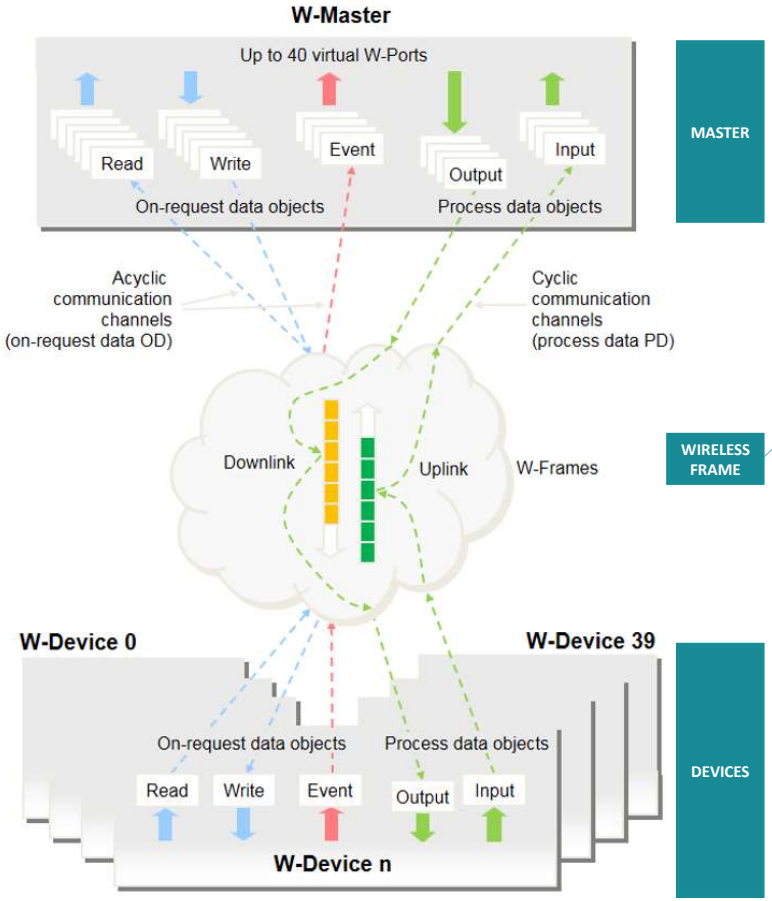
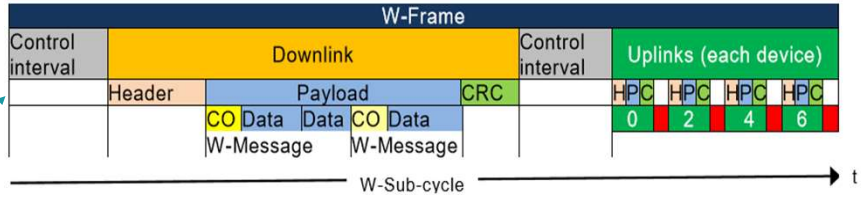
IO-Link Wireless Frame Structure





- 3 x Wireless Sub-cycles per Wireless Cycle
- Each Sub-cycle is communicated on a different frequency
- Each Sub-cycle includes data from all Devices on Track
- Downlink → Broadcast from Master to all W-Devices
- Uplink → Single-cast time multiplexing (uplink from W-Devices subsequently according to timeslot)
- Control intervals switches Tx/Rx and updates next frequency hopping
- Header: Preamble, Syncword, MasterID, TrackN, Ack