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# Moving Mining and Bulk Handling Toward Automation and Industry 4.0

Key industrial players are constantly seeking to increase the level of automation in their plants and systems in order to improve safety, working conditions and efficiency. Today, performance monitoring, remote monitoring, remote control and automation are the key issues in an industry that is reinventing itself. Cybersecurity is also a „must“ in this new environment to prevent attacks.

Building a strong communication system embedded in mobile equipment in operation to access this path to automation is especially challenging for old legacy machines that were not designed for it. In addition, remote control and camera monitoring often require the modernization of industrial machines in use.



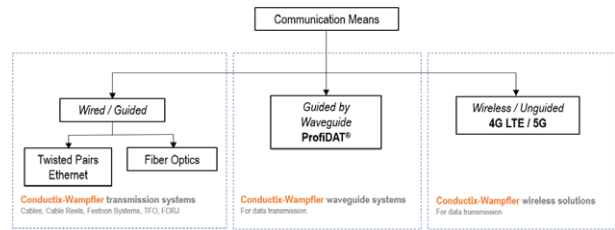
## How to integrate performance monitoring, remote monitoring, and remote control?

Nearly all industries are deploying IIoT (Industrial Internet of Things) projects to implement these capabilities, resulting in operational benefits and a return on investment within a few quarters. Tailored solutions are needed to modernize existing equipment. IIoT enables rapid deployment of process automation.

IIoT-based condition monitoring is protecting more equipment from failure by alerting maintenance teams just before a catastrophic failure occurs. Taking it a step further to predictive maintenance allows for smart and prudent optimization of maintenance schedules, reducing maintenance costs and production downtime. The icing on the cake is the massive collection of shop floor data, and the analytics enable a step-change improvement to just-in-time strategies.

## Implementing IIoT systems - what does it take?

Any IIoT solution requires cloud-based devices and systems to authenticate all sensors and ensure data confidentiality and integrity. A central IIoT platform – ideally a hybrid edge-cloud solution with high connectivity to the various components – is essential to implement an efficient IIoT system. Operators must select the appropriate means to support this data transmission based on their operational needs.



Each medium differs primarily in terms of speed, bandwidth, coverage, latency, which enables capabilities such as remote machine operation using augmented reality and full 4K video streaming, and the level of security that can be achieved.

## Data communication through guided or unguided communication means

Multiple means of communication can support the operation of automated and remotely operated mobile equipment. In an automated environment, a complete, persistent, and secure network is essential to ensure the safety of human-operated equipment, automobiles, and even pedestrians as they mix with unmanned vehicles.

The radio frequency networks such as 4G LTE / 5G are widely used, the speed can reach 10 Gbps and the installation cost of an access point is among the lowest of all solutions thanks to the wireless transmission. However, antennas need to be installed for complete coverage, which requires both civil works and a high performance fiber optic backbone network.

Ethernet requires a copper wire connection and offers speeds up to 1 Gbps. However, copper wires act as

Parameter	Ethernet	Fiber Optic	5G
<b>Technology</b>	Copper wires connection with twisted pairs for data transmission	Uses light to transmit data through fiber optic cables	5G is the fifth generation of mobile wireless systems, which uses radio waves for sending and receiving data
<b>Speed</b>	1 Gbps	Theoretical speed is up to 1 petabit per second, however practical speed is up to 100 Gbps	20 Gbps downlink and 10 Gbps uplink
<b>Reach</b>	100 meters from powered-device to powered-device	Signal over fiber can travel up to 70 km without losing signal	Up to few 100 meters
<b>Response time</b>	100 ms	Faster than 5G (0,33 μs)	Slower than fiber optics (10 ms)
<b>Last mile</b>	Technology can be rolled out for the last mile if hardware connection to the equipment is possible.	Fiber optic as last mile takes more manhours and money for laying.	Use wireless as last mile technology which can be rolled out in very short time
<b>Rollout time</b>	Much longer than 5G	Longer than 5G	Very less
<b>Cost to enduser</b>	Cheaper than fiber optic	Higher than 5G	Comparatively cheaper than fiber connections
<b>Installation cost</b>	Cheaper than fiber optic	Higher cost of fiber including its laying	Much lower than fiber optic
<b>Operational cost</b>	Much lower than 5G	Much lower than 5G	Very high, up to 5 times to that of fiber connectivity

an antenna, collecting EM radiation and converting it to electricity (EM interference), making this medium susceptible to electromagnetic interference. Using shielded cable minimizes this problem, but EMC (electromagnetic compliance) remains a concern.

The fiber optics are made of glass, are non-conductive and therefore safe in all electromagnetic environments. They can be safely used around electrical transmission lines, as well as in high RF and magnetic fields such as radar beams and high power industrial environments. The fiber optic networks allow long distance connection with transmission speed exceeding 100s Gbps, large bandwidth capability, lowest latency in response time of any media, immunity to electromagnetic interference.

### Fiber - the strongest medium for securing your data in your facilities

Optical fiber provides a robust physical barrier to network intrusion. Unlike electrical media such as twisted pair and radio links, there is no easy way to extract or inject signals into the link. That's even more true in a private industrial environment, where security is completely under the control of the operator and access to the equipment is difficult. Of course, the network and data protection methods used on copper and wireless networks should be applied

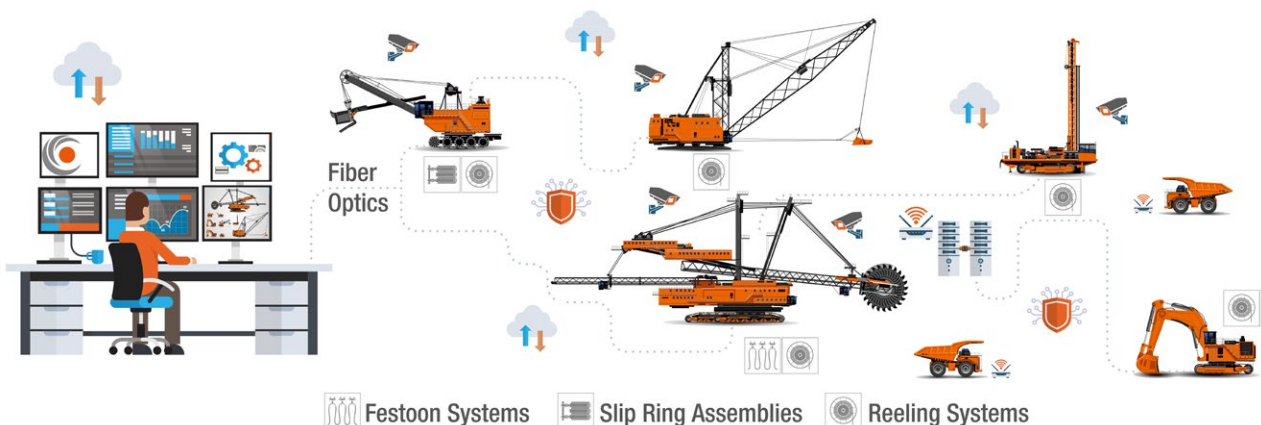
to the endpoints: prevention of physical connection, encryption, etc.

### Network infrastructure solution example: Combining FO & 5G in the Mining & Bulk Market Segment

In an open pit mine, all of the heavy equipment such as shovels, reclaimers, stackers, and tripper cars are powered directly from the power grid via a high-voltage cable due to their massive energy consumption. However, they can easily be equipped with a reliable direct fiber connection using a composite cable that carries HV, fiber, and an optional low-voltage and electrical bus.

The direct fiber connection of this large mining equipment removes many technical issues and burdens from the deployed LTE/5G radio networks used to control and automate the mobile equipment:

- These massive systems are increasingly remotely controlled, and no one can lose control of a giant bucket wheel excavator or reclaimer for more than a few 1/100s - the fiber link is massively redundant and adds no latency.
- Permanent video monitoring of multiple focal points and potential problem areas is required: The FO link can have up to 24 single-mode



fibers, each capable of carrying an Ethernet frame at 40 Gbps, plus redundancy by connecting fibers in parallel.

















- As these „plants on wheels“ perform multiple simultaneous operations, operations and maintenance teams equip them with sensors to measure operating parameters, detect early failures, and perform the right maintenance before a damaging breakdown occurs: the FO link allows the deployment of wired and local radio connections of hundreds of sensors without risking temporary overload of the main radio network in case of a local problem.
- Their high-speed fiber-optic connection could be used to strengthen LTE/5G networks locally, benefiting the untethered mobile equipment working around them by installing additional cell antennas on their large steel structures.

### Conductix-Wampfler: a broad portfolio of solutions for the cabling and handling of fiber optic connections

With solutions for reeling systems, including rotary joints and festoon systems with mixed power and data, Conductix-Wampfler offers a complete catalog of proven cables that support power and data transmission with twisted pair for fieldbus or fiber optic for high-speed data. Our catalog includes reeling cables as well as flexible cables for cable festoons and cable chains.

### Systems for the reliable transmission of optical signals

Over ten years ago, Conductix-Wampfler developed its reliable TFO („Transmitter Fiber Optic“) to transmit data through an uninterrupted fiber link to multiple fibers in a cable reel. It has proven its reliability in all kinds of environments around the world, such as automated container handling in ports, on mining machines, and in bulk storage facilities.

Application									
	Reeling Systems						Festoons	Cable Chains	Specials
Fiber Optic Cables without Copper Wires									
				RXG			TXG	CXP	SXP
Composite Cable Power/Control/Twisted Pair/Fiber Optics									
	WG-D	WGF-D	RXP-D	RXG-D	HVR-FO	WXG-D	TXG-D	CXP-D	SXP-D
Outer jacket material	Rubber	Rubber	PUR	Rubber	Rubber	Rubber	Rubber	PUR / TPE	PUR



In fact, it is the most reliable fiber optic rotary joint (FORJ) for reeling systems in harsh environments. It handles up to 24 single-mode fiber connections and produces attenuation of less than 1.5 dB at a maximum speed of 70 rpm in ambient temperatures from -40°C to +60°C.

Other FORJs are available in our portfolio for unlimited rotations up to a maximum speed of 300 rpm, life > 15 million revolutions, operating temperature -25°C to +70°C and IP65 protection. The fiber optic rotary joints are ideal for filling, packaging and labeling machines, machine tools, cable reels, robotics, rotating cameras and offshore applications.

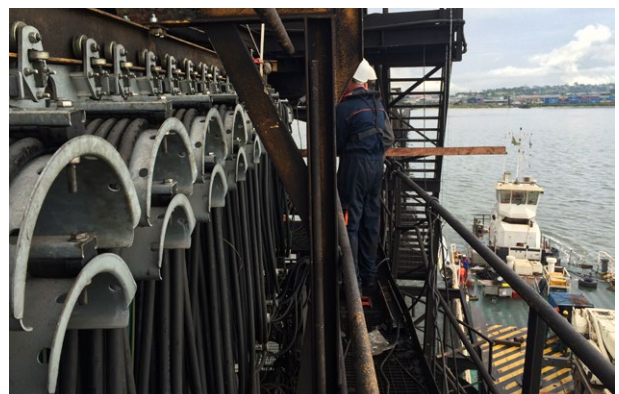


In applications with central slip rings installed in the main axis of rotating systems, such as slewing stacker/reclaimers or ship loaders and unloaders, they are equipped with our TFO for limited rotation types (e.g. 900°C) and unlimited rotation optical joints in other cases.

For easy upgrading of mining equipment, a special range of products has been designed to wind a pure fiber optic cable in a limited space; this FO reel is added to the existing HV power supply.



Fiber optic technology can also be used for festoon systems or cable chains. Special fiber optic cables for harsh environments are selected by our application engineers and included in cable packages. All of this equipment is tailored to the customer's machine to facilitate integration. Dimensional surveys are carried out on site to complete the engineering work before „as built“ drawings are issued, taking into account any local constraints.



Conductix-Wampfler can offer on-site integration of its systems as a turnkey solution. Our qualified installation teams are located around the world and are



eager to perform the system integration and ensure a perfect setup. Our technology and field expertise enable us to perform a job professionally and minimize installation downtime when replacing an HV cable reeling system.

We are available for all your service needs and would be happy to provide you with a customized quote. Contact your nearest sales office or learn more from our Global Service Director Ludovic Phan: [ludovic.phan@conductix.com](mailto:ludovic.phan@conductix.com)



### Summary:

Fiber optic technology is an essential technical asset for implementing a reliable communication network for all machinery and equipment at sites. A combination of 5G for autonomous mobile vehicles and fiber for fixed and rail-mounted heavy equipment can be the communication infrastructure that enables IIoT implementation.

Conductix-Wampfler's expertise in fiber optic technology and cable machinery, its knowledge of power and data transmission systems for mobile equipment, and its service capabilities to provide a turnkey solution make Conductix-Wampfler the best partner to help you address this challenging issue.

Contact Conductix-Wampfler to add both the security and virtually unlimited capacity of fiber optic connectivity to your existing mobile equipment, processing and storage areas.