How IO-Link enables mine asset visibility

Enabling effective monitoring and predictive maintenance

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How does the Australian mining sector meet production demand while achieving ESG goals? Can safety be improved in the midst of a talent shortage? This white paper examines these topics and talks to the role that IO-Link can and should play in addressing the pain points that miners face with asset management, maintenance, and performance.

Specifically, this white paper explores how IO-Link is used in the mining industry to monitor equipment, enable predictive maintenance, increase visibility across processes, and avoid downtime – thereby improving efficiency, sustainability, and safety. It includes insights from ifm digitalisation expert Freddie Coertze and mining technology service providers RAM and Process E&I – both ifm customers who have implemented IO-Link in remote asset monitoring projects.

Additionally, the paper discusses the significance of Y-Path technology, why it matters, and how it enhances digitalisation by enabling parallel access to process and service data – contributing to more comprehensive monitoring and streamlined device management, further driving operational improvements.

Industry overview

The mining industry is often described as the backbone of the Australian economy, having been instrumental in Australia's development since the middle of the 19th century, and still accounting for 13.6 per cent of GDP as of 2023.[1] Global demand for Australian mining output remains extremely strong: Australia today is the world's leading mining exporter, generating $218 billion in annual export revenue, or 37 per cent of Australia's total goods and services revenues.[2]

But to maintain this level of success in future, Australia must overcome many challenges, including those relating to labour, environmental and ESG considerations, and safety.

On the labour front, while new mining projects will require more than 28,000 new roles by 2028,[3] 71 per cent of mining leaders say the current talent shortage is an obstacle to delivering on production targets.[4]

On the environmental front, Australia has recently enshrined a net-zero 2050 target into law, with supporting legislation mandating new reporting requirements on emissions, adding additional pressure to a sector already contending with the negative ramifications of climate change in and of itself.[5]

And although significant improvements have been made to safety in mining, there is still work to be done, with seven deaths having occurred in the Australian mining industry this year, as of this writing.[6]

To address these ongoing challenges, effective asset monitoring is crucial to identifying and resolving issues before they disrupt whole systems – jeopardising efficiency, sustainability, and safety.

Why remote asset visibility matters for mining

Freddie Coertze, ifm

Remote asset monitoring – the practice of using technology to observe, track, and manage assets from a distance, including heavy machinery, vehicles, conveyors, and environmental conditions – is a crucial support for the mining industry.

As Freddie Coertze, national IoT business manager for ifm Australia, explains, mining machinery is often built with only those features necessary for it to operate while the means of ensuring its longevity must come from elsewhere.

"As far as diagnostics go, if a machine has a fault, you can go and put certain gauges on to test things and identify a problem," Coertze explains. "But with remote asset monitoring the idea is to make those things a permanent fixture – instead of waiting for failure to happen, a range of sensors are installed permanently on the machine to monitor trends over time and identify values before a catastrophic failure occurs."

IO-Link: How it works, why it matters

"IO-Link is a plug-and-play point-to-point digital communication protocol – comprised of a sensor, a smart block, and a simple cable in between – connecting all your sensors and actuators from the field back into your smart block, providing you detailed diagnostics and actionable insights," says Coertze.

To keep mining operations running smoothly, assets must be effectively monitored. To monitor assets effectively, data must be collected and analysed in real time. And to collect and analyse data in real time, it's necessary to have technology that easily receives and integrates data from a variety of sources in the field – and it's at this point that IO-Link matters.

> *"One of the key differentiators of ifm's IO-Link solution is the Y-Path," says Coertze. "This design allows for simultaneous access to both process and service data from a single sensor. It means you can not only collect real-time operational data but also monitor the health of your equipment without interrupting operations. This parallel access to data ensures hassle-free diagnostics and continuous monitoring, which is critical for maximising uptime and maintaining efficiency in mining operations."*

IO-Link serves as the hub for data collection and integration in mining operations, connecting digital sensors to control systems in a seamless and efficient manner. It affords several distinct advantages:

- **Seamless connectivity:** IO-Link allows for easy integration between new and existing sensors, making it a highly adaptable solution for mines looking to digitalise their asset monitoring without costly infrastructure overhauls.
- **Cost-effective digitalisation and IIoT integration:** By supporting both analogue and digital outputs, IO-Link enables mines to transition to digital systems smoothly, enhancing real-time monitoring and strategic planning without significant expense. Furthermore, IO-Link plays a key role in integrating operational technology (OT) with IT systems and IIoT platforms, improving asset visibility and enabling data-driven decision-making.
- **Enhanced diagnostics and predictive maintenance:** IO-Link provides detailed real-time data and advanced diagnostics capabilities, enabling predictive maintenance and quicker problem-solving. By continuously monitoring equipment conditions, operators can identify and address issues before they lead to failures, reducing downtime and improving operational efficiency.
- **Easy setup and fast sensor replacement:** IO-Link simplifies installation by using standard M12 connectors, reducing wiring errors and setup times. Additionally, stored sensor parameters allow for quick plug-and-play replacements, ensuring minimal downtime when devices need to be replaced.
- **Interference-proof, exact data transmission:** IO-Link's purely digital data transmission eliminates the signal loss and external interference common with analogue signals. This ensures precise, reliable sensor readings, even in harsh mining environments.
- **Controller and fieldbus independence:** IO-Link devices can be integrated into any fieldbus or control system, providing flexible solutions for various infrastructure setups.
- **Multiple measured values from a single device:** IO-Link sensors can capture and transmit multiple process values – such as temperature, flow, and volume – through one unit, reducing the need for multiple sensors and simplifying installations.

CASE STUDY: RAM

Founded in 2014, Remote Asset Monitoring (RAM) specialises in monitoring critical machine components – particularly in the mining industry.

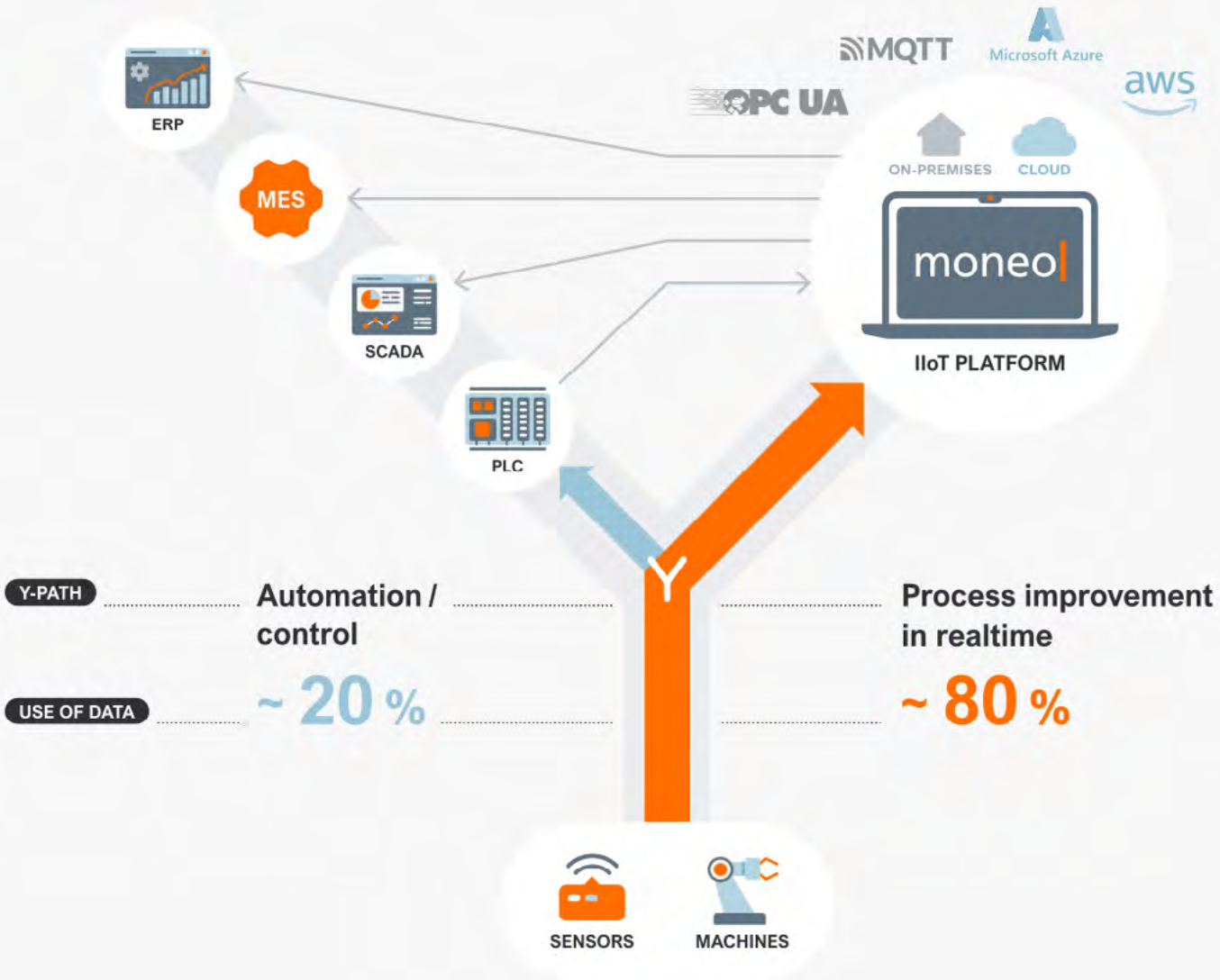
A key challenge RAM encountered in its early years was finding sensors and components from different manufacturers that worked effectively in concert.

"Before IO-Link we would be faced with the challenge of having a sensor from one manufacturer that wouldn't talk to another component – and so we'd have to buy a signal converter," says RAM co-founder Tom Rideout. "There are so many sensors involved in asset monitoring that this can amplify into a large problem. With IO-Link we have one overall method of connection – which is pretty handy."

Among the benefits that have accrued to RAM since implementing IO-Link are:

1. **Ability to get multiple process values** (e.g. flow and temperature) from a single IO-Link sensor, reducing wiring complexity and installation time compared to using separate analogue sensors.
2. **Improved diagnostics capabilities** – IO-Link allowed RAM to set custom fault codes and alerts, such as sensor disconnection or out-of-limits readings. This was not possible with traditional analogue sensors.
3. **Reliability and data accuracy** – IO-Link sensors provided consistent, trustworthy data without the uncertainty associated with analogue signals that could be affected by wiring issues.
4. **Compatibility and ease of use** – The IO-Link ecosystem allowed RAM to easily integrate different sensor types from ifm without compatibility problems, saving significant time and effort.

Y-PATH Diagram



Increase efficiency, lower downtime with IO-Link

Operational efficiency and minimising downtime are critical for maintaining productivity and profitability – particularly when skilled labour is scarce and expensive.

The ability of IO-Link to offer detailed diagnostics and configuration capabilities enables predictive maintenance and quicker problem-solving. "With IO-Link, we can monitor trends over time and identify issues before they get to failure," Coertze says. "This proactive approach significantly reduces downtime and improves overall efficiency."

Superior visibility and diagnostic capability have knock-on benefits in terms of labour utilisation: "By providing real-time data and simplifying troubleshooting, IO-Link reduces the time our technicians spend on manual inspections and routine maintenance," notes Coertze. "This allows our skilled workforce to focus on more strategic tasks, optimising labour resources and improving productivity."

Cost savings are another significant benefit of adopting IO-Link. "When you consider the expenses associated with traditional analogue sensors and wiring, IO-Link presents a more cost-effective solution," notes Coertze. "For example, integrating eight flow meters with IO-Link can result in a 40 to 50 percent cost saving compared to traditional setups. IO-Link eliminates the need for additional temperature sensors, modules, and extensive cabling because the flow sensor has a temperature sensor built in – and IO-Link can transmit both types of data simultaneously."

Moreover, the ease of integration with existing control systems means that transitioning to IO-Link does not require a complete overhaul of current network architectures. "One concern with new technology is the complexity and the change factor," says Coertze. "However, IO-Link masters or smart blocks can be integrated with your current control system without significant changes. Our startup packages guide users step-by-step on how to map data from the smart block back into the PLC, making the process straightforward."

Improve sustainability with IO-Link

With new climate change and ESG laws and regulations coming into effect, IO-Link can help organisations meet their obligations by enabling more efficient use of resources and reducing waste.

"By providing real-time, detailed data on equipment performance, IO-Link allows operators to optimise processes and reduce energy consumption," explains Coertze. "For example, accurate monitoring of flow and pressure ensures that pumps and other machinery operate at optimal efficiency, reducing unnecessary energy usage."

The predictive maintenance capabilities of IO-Link mean that equipment is serviced only when necessary, extending the life of assets and minimising the consumption of spare parts. "Avoiding premature replacement of components not only saves costs but also reduces the environmental impact associated with manufacturing and disposing of these parts," Coertze adds.

IO-Link

CASE STUDY: Process E&I

Process E&I is an electrical and instrumentation design consultancy specialising in the mining and process industries. The company focuses on electrical systems, control systems, and communication networks for large-scale mining projects worldwide.

A significant challenge Process E&I faced was the reliance on outdated fieldbus technologies like Profibus, which were being phased out by vendors. The mining industry's cautious approach to adopting new technologies made this transition even more complex.

"In mining, companies prefer to stick with what they know works because failures can be costly," says Jon Mullan, Process E&I Principal Engineer. "Before IO-Link, we relied on traditional systems that were complex and difficult to manage. We're still in the early stages of IO-Link, but I think it could be a game changer for us."

Since integrating IO-Link, Process E&I has experienced several key benefits:

1. **Cost savings:** IO-Link reduced expenses on sensors by roughly 50 per cent compared to traditional analogue inputs.
2. **Enhanced diagnostics:** The technology provides real-time, detailed data, allowing for quick identification of issues – whether it's equipment performance or sensor faults – which was challenging with traditional systems.
3. **Simplified commissioning and maintenance:** Standardising on IO-Link simplified processes and improved knowledge retention, reducing the need for manual adjustments in the field.
4. **Flexibility and distributed architecture:** IO-Link allowed them to distribute I/O closer to the instruments, addressing space constraints and reducing cabling complexity in crowded plant environments.

Improve safety with IO-Link

Safety is paramount in the mining industry, and IO-Link technology offers innovative ways to enhance it. By integrating safety devices into the IO-Link system, operators can achieve a more unified and streamlined approach to safety management.

"IO-Link is extending its capabilities to include safety devices such as emergency stop buttons and light curtains," says Coertze. "This integration simplifies the safety architecture and ensures that safety data is readily available and actionable."

The ability to monitor equipment conditions in real-time allows for immediate responses to potential safety hazards. "With detailed diagnostics and continuous monitoring, IO-Link enables us to detect anomalies that could indicate safety issues," Coertze explains. "This proactive approach helps prevent accidents before they occur."

Moreover, the ease of replacing sensors without the need for technical expertise means that maintenance personnel can address issues quickly without introducing new risks. "If a sensor fails, you can replace it with an identical one, and the IO-Link master will automatically parameterise the new sensor," Coertze notes. "This plug-and-play functionality reduces downtime and ensures that safety systems remain fully operational."

An IO-Link future

The future of IO-Link is promising, with developments that will further enhance its applications in the mining industry. Wireless IO-Link and advanced safety integration are among the exciting advancements on the horizon.

"Wireless IO-Link is an emerging technology that allows data transmission from sensors to the master without physical cables," says Coertze. "This opens up new possibilities for applications where cabling is impractical or poses a risk, such as on portable or rotating equipment. It's starting to gain traction, especially in logistics and warehouse automation, and will extend to mining asset monitoring as well."

The integration of safety functions into IO-Link systems is another significant development. "We're working on extending IO-Link to include safety devices, making it a comprehensive solution for all automation needs," Coertze says. "This will simplify the safety architecture and enhance overall operational safety."

In conclusion

IO-Link is proving itself to be a key means by which mining operations can improve visibility of assets – enhancing efficiency, promoting sustainability, and improving safety in the process. Its ease of integration, cost-effectiveness, and advanced diagnostic capabilities make it an ideal solution for sophisticated asset monitoring.

"As mining operations continue to evolve, embracing technologies like IO-Link will be crucial for staying competitive and meeting industry demands," says Coertze. "At ifm, we're committed to supporting our customers in leveraging IO-Link to achieve their operational goals."

For more information on how IO-Link can improve your mining operations, contact ifm today.

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