



Edge-to-Cloud CNC Machine Condition Monitoring Solution



Vibration



Temperature



Acoustics



Displacement



Speed

Five Years Out

arrow.com

CNC Machine Maintenance Approaches

Reducing or eliminating unplanned downtime ranks among the highest priorities for business stakeholders. An hour of downtime in an average-sized plant can cost about \$250,000, posing an expensive problem.

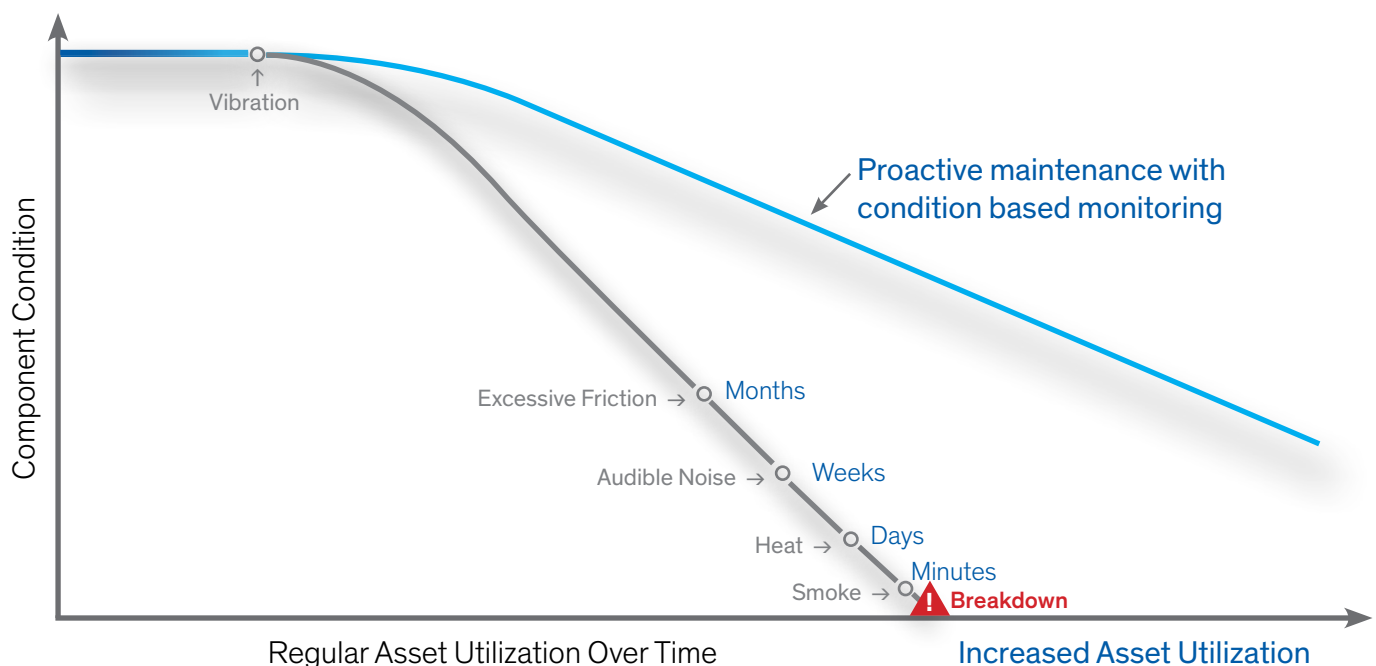
Manufacturing operations experience many downtime events due to planned routine maintenance and unexpected stoppages. Many companies implement planned maintenance schedules to identify potential problems and prevent uptime issues. These approaches take the form of manual checks and periodic replacement of machine components that are most prone to wear and tear. Manual checks can be effective but are not scalable. They are often limited by human error or simply the lack of skilled resources.

CNC machines are challenging, as they are complex and require expertise. A compounding problem is that a typical manufacturing site may have CNC machinery with a wide range of ages and models, which make manual efforts difficult to scale and systematize.

Leading manufacturing organizations take proactive and predictive approaches to maintenance. Using sensors for 24x7 monitoring of machine operational characteristics, stakeholders watch for erratic or anomalous data to prevent incidents that cause downtime. These approaches are referred to as condition based monitoring (CBM). CBM systems collect real-time machine characteristics such as vibration, noise, and temperature, and use the data to assess machine performance. Stakeholders can set alerts for deviant conditions and be notified when a deviation occurs. In more sophisticated implementations, past operational data is utilized to predict future behavior using learning algorithms.

CBM is not a new concept, yet advances in artificial intelligence (AI), sensors, wireless connectivity, and cloud infrastructure are taking CBM to a new level. These technologies can dramatically alter traditional methods and make unplanned downtime a rare event.

Reactive versus Proactive Maintenance

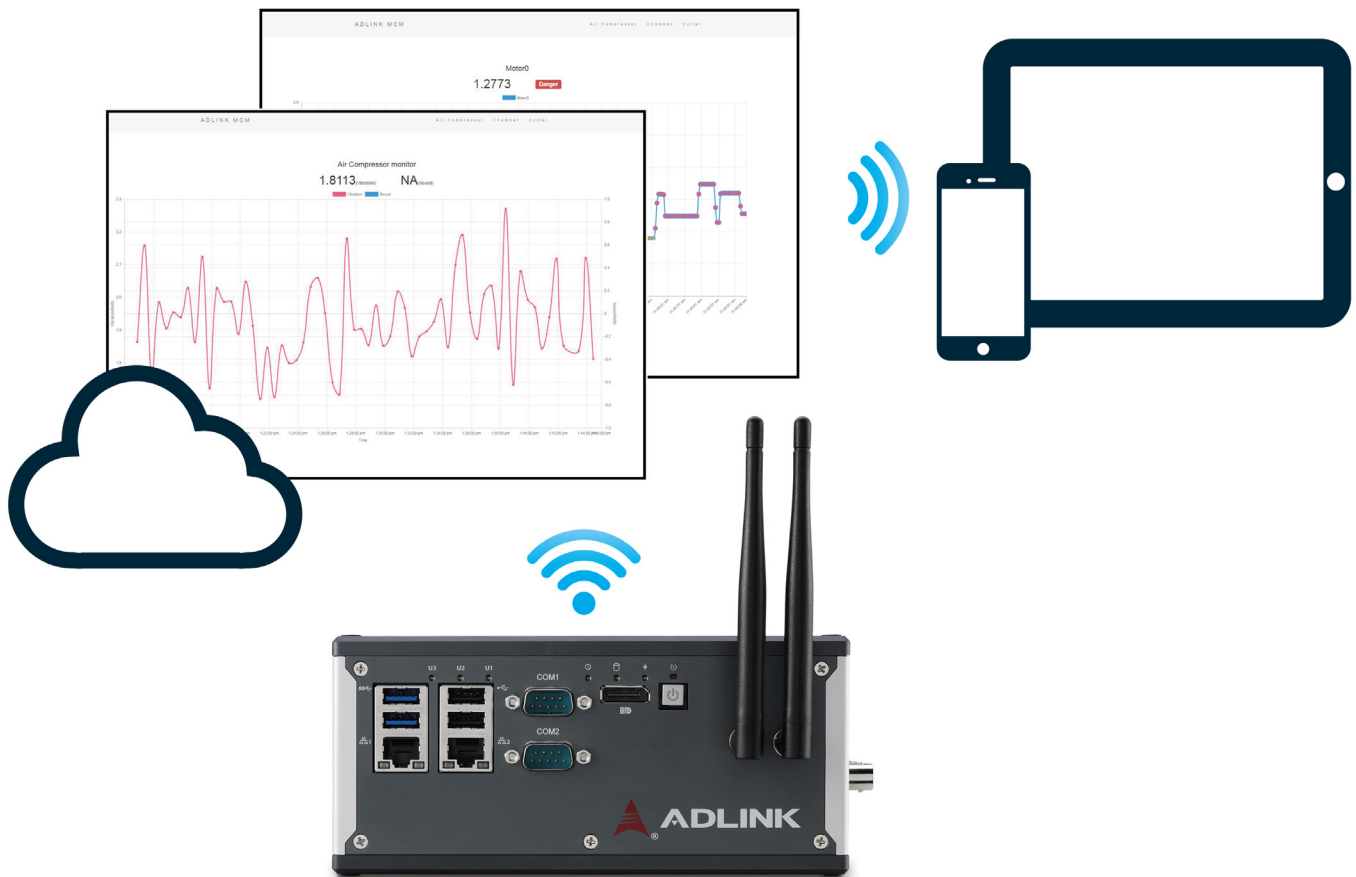


Edge MCM Quick Start Solution

Machine Health Made Easier

Arrow and ADLINK — in collaboration with Intel, Microsoft, and SAS — are bringing to market a machine condition monitoring (MCM) solution that aims to revolutionize the way manufacturing stakeholders manage machine assets. CNC machines are notorious for failures related to consider unbalanced connectors or fasteners, cracked spindles, or loose machine components. These machine conditions are particularly amenable to condition monitoring and early detection of problems can not only save on expensive fixes, but also prevent unplanned downtime.

The Edge MCM Quick Start is a comprehensive data acquisition and analysis system. The system tracks many operating conditions, including vibration, motion, noise, and displacement. It can capture CNC machine degradation events well before they can be noticed by humans. The collected data undergoes rapid analysis right at the edge for alerts and actions. Data is also aggregated at the cloud level for pattern analysis and predictive insights. Enterprises can now deploy the system for all their CNC machinery assets and proactively manage asset health through cloud-based dashboards.



Powered by



Benefits of the Edge MCM Quick Start Solution

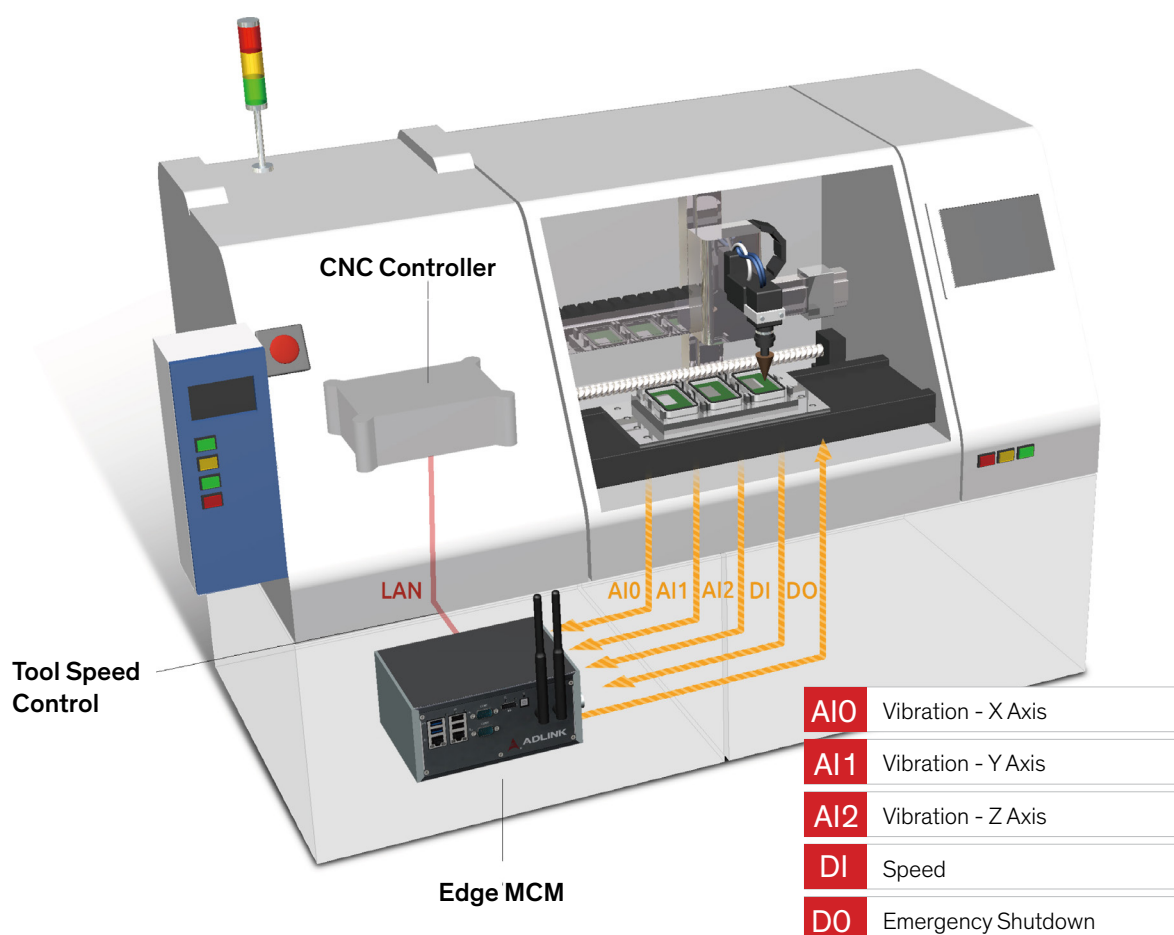
Integrating data collection, vibration analysis algorithms, computation, and network connection tasking in a single system, the Edge MCM Quick Start enables rotating machinery, tooling, and plant and automation equipment operators to easily overcome challenges inherent in conventional equipment maintenance.

For End Users

- > Dramatically reduce downtime and opportunity costs
- > Drive new efficiencies — eliminate manual checks and manage remotely
- > Gain predictive insights with aggregated data over time
- > Future-proof systems that scale from simple monitoring to predictive analysis

For System Integrators

- > Partner with technology leaders for a complete end-to-end solution
- > Increase customer satisfaction
- > Enable digitization of legacy equipment
- > Develop new service-based revenue streams using machine data and on-going analysis
- > Easily deploy and scale with a compact, flexible, and complete IIoT solution



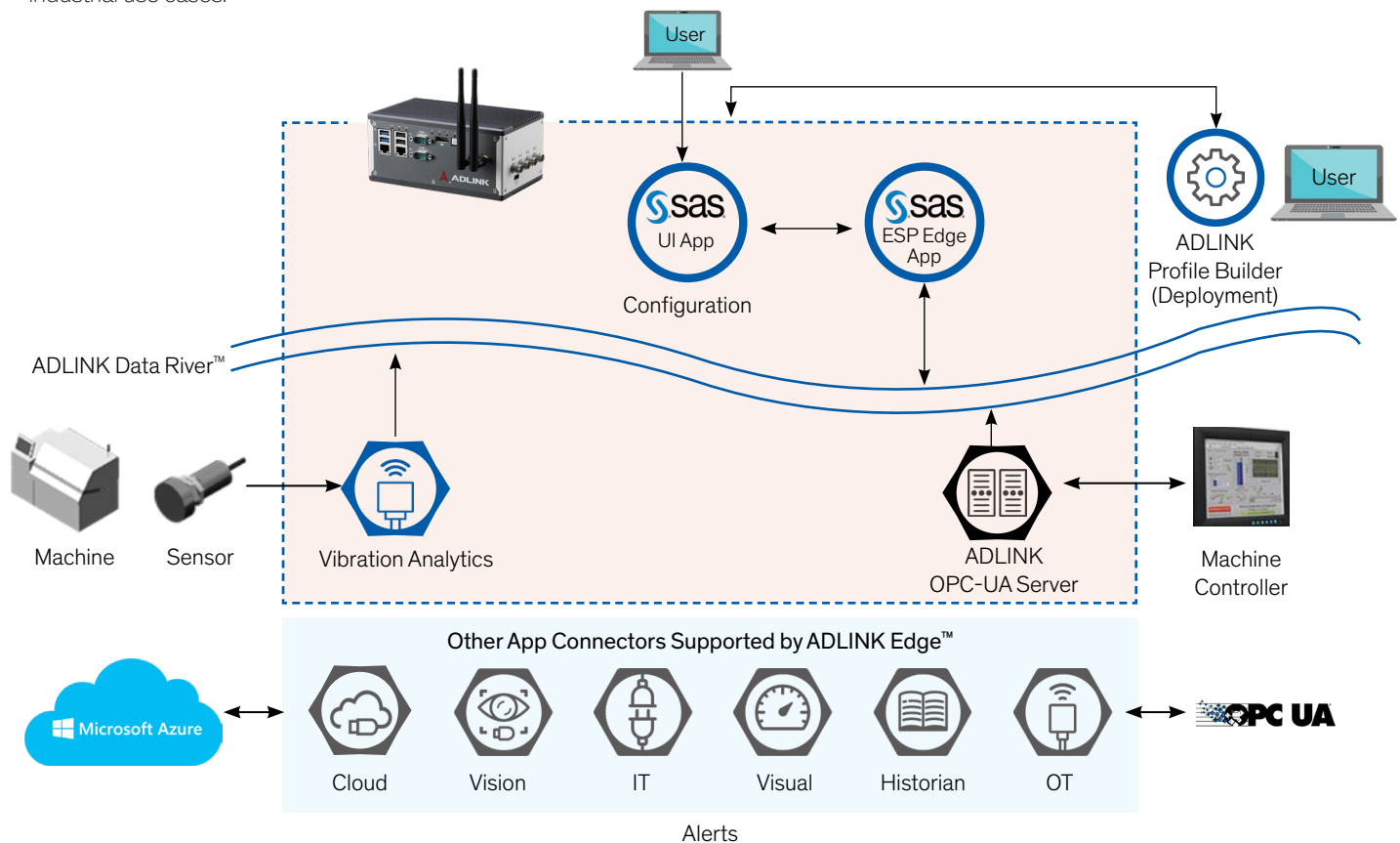
Edge MCM Quick Start Solution Components

Partner with Industry Leaders – SAS, Microsoft, Intel® and ADLINK

How the Solution Works

Measurement of CNC equipment parameters by the Edge machine condition monitoring solution works this way:

- > **Data acquisition:** Industrial sensors are attached to CNC machines to monitor a wide variety of parameters.
- > **Local processing:** Data from multiple sensors is processed by ADLINK Edge™ sensor conditioning, analyzed in-stream and then insights generated for visualization with SAS Event Stream Processing (ESP).
- > **Real-time data management:** ADLINK Edge™ software manages operational data between the Edge MCM platform, SAS Event Stream Processing and Microsoft Azure IoT Edge to ensure accurate, real-time data flow.
- > **Cloud transmission and storage:** Data from multiple Edge MCM platforms can be sent simultaneously to the Microsoft Azure cloud for storage and on-going analysis. Both wired and wireless options are available.
- > **Device management:** Azure IoT Hub manages Edge MCM devices for application, data model updates, firmware updates, and patches.
- > **Machine learning and model development:** SAS data mining and streaming model development tools use machine learning to continuously analyze data for deep insights and predictive capabilities. New models are developed to further optimize machine operation.
- > **Alerts:** SAS Event Stream Processing issues alerts and ADLINK Edge™ manages these alerts, streaming to Azure IoT Hub or client's backend systems.
- > **Performance optimized for Industrial IoT:** Intel® processors deliver power-efficient performance and specialized capabilities for new industrial use cases.

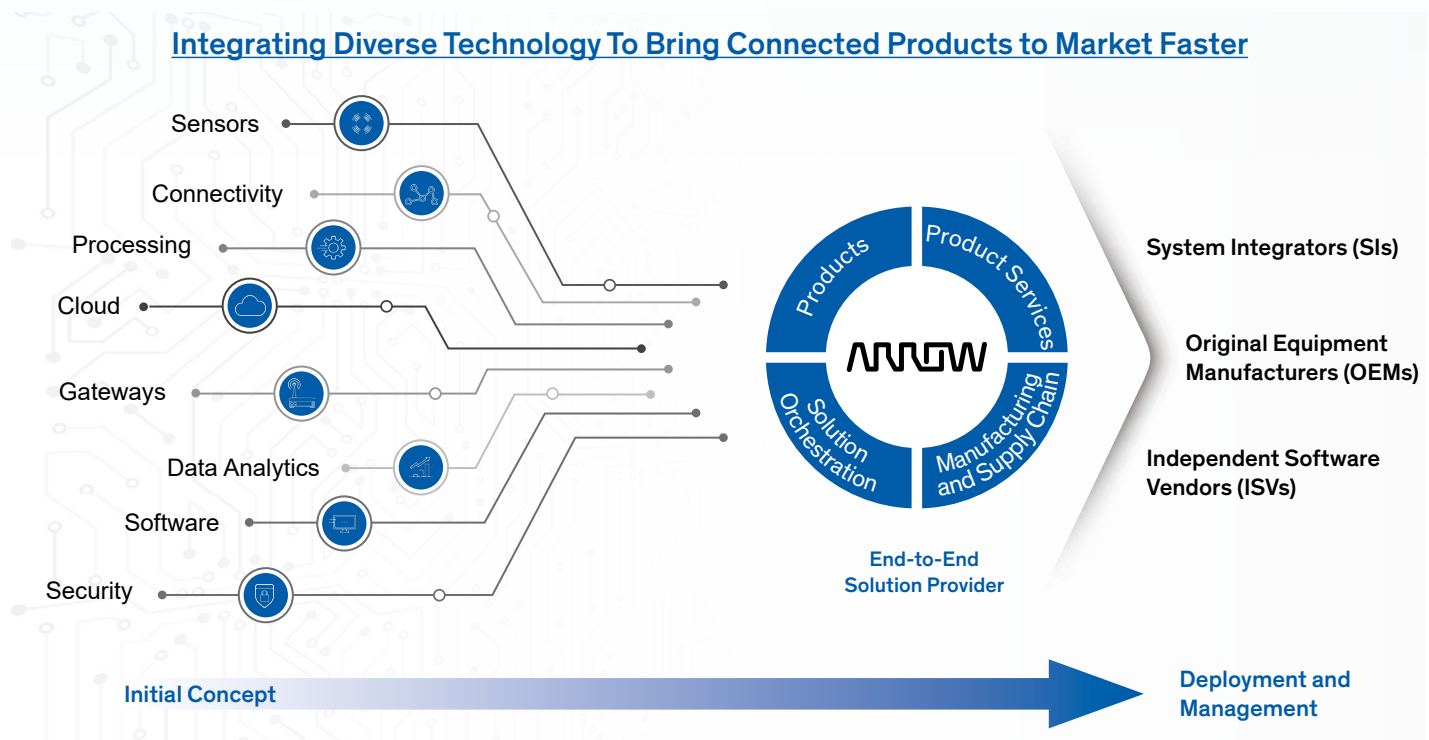


ADLINK, SAS, and Microsoft Azure make it easy to run your data, analytics, and AI workloads in the cloud and at the edge. Decisions can be automated, trusted, and analytically driven.

Arrow Services: Your End-to-End Solution Provider for CNC Machine Condition Monitoring

Leverage an Extensive Ecosystem, Products, Services Portfolio, Expertise, and Scale

Using Arrow's multiple integration centers – with the ability to develop and orchestrate software, hardware, and service IoT and Edge bundles tailored to a customer's unique requirements – we can deliver and deploy CNC machine condition monitoring solution globally upon demand. From technology and services to full solution development, our customers trust that Arrow, leveraging an extensive ecosystem, has the capabilities, expertise, and scale to orchestrate complex edge solutions that effectively address their needs.



Arrow Services for CNC Machine Condition Monitoring Solution Include

- > ADLINK hardware and software customization
- > Microsoft cloud engineering
- > SAS data analytics and modeling
- > Installation and deployments at scale

Getting Started is Easy with the Edge MCM Quick Start Solution

To jumpstart implementation of the machine conditioning monitoring solution, we provide a simple turn-key, on-premise solution that captures vibration data and provides immediate insights as a starting point. Feature enhancements, cloud capabilities, and machine learning algorithms can easily be incorporated based on end-application requirements.

Quick Start Solution Includes

- > ADLINK MCM-100 hardware
- > Edge IoT middleware platform
 - SAS® Event Stream Processing for Edge Computing
 - ADLINK vibration analytics
 - SAS vibration models for CBM
 - ADLINK OPC-UA server

Benefits of the Quick Start Solution

- > Power on and instantly visualize sensor data to identify trends and anomalies
- > No code needed, pre-configured by ADLINK, SAS, and Arrow
- > Connects, transitions, and supports accelerometer data that can be used by SAS to create ML models
- > Analyze data for insights that lead to optimized maintenance plans and maximized machine uptime

Streamlined Engagement from Concept to Deployment and Ongoing Support

Our proven processes and support maximize your project and implementation success



Step 1: Initiate baseline implementation using the Quick Start Solution



Step 2: Build proof of concept and customize solution with cloud, machine learning, and remote management capabilities



Step 3: Transition and scale to production and deployment with Arrow Services



Step 4: Provide ongoing support, remote device management, continuous model development, etc



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