



**Edge-to-Cloud CNC  
Machine Condition  
Monitoring Solution**



# 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.

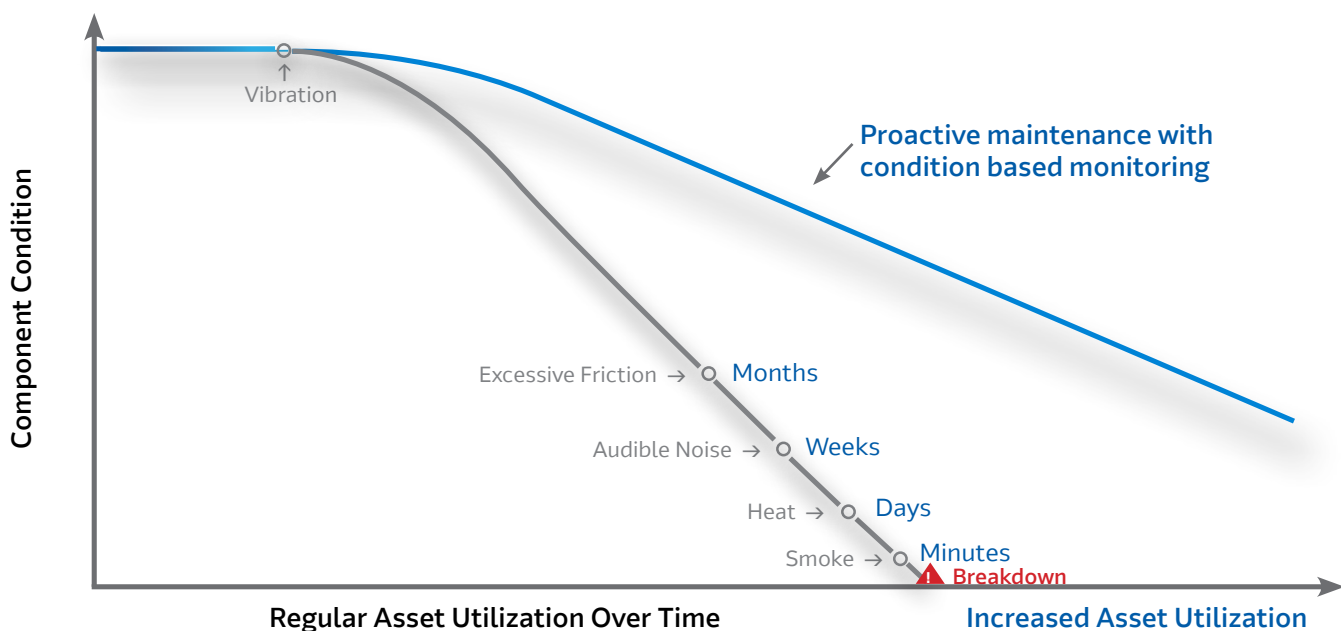
Manufacturing operations experience many downtime events due to planned routine maintenance and unexpected stoppages. Many companies implement planned maintenance schedules to identify potential problems and prevent uptime issues. These approaches take the form of manual checks and periodic replacement 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

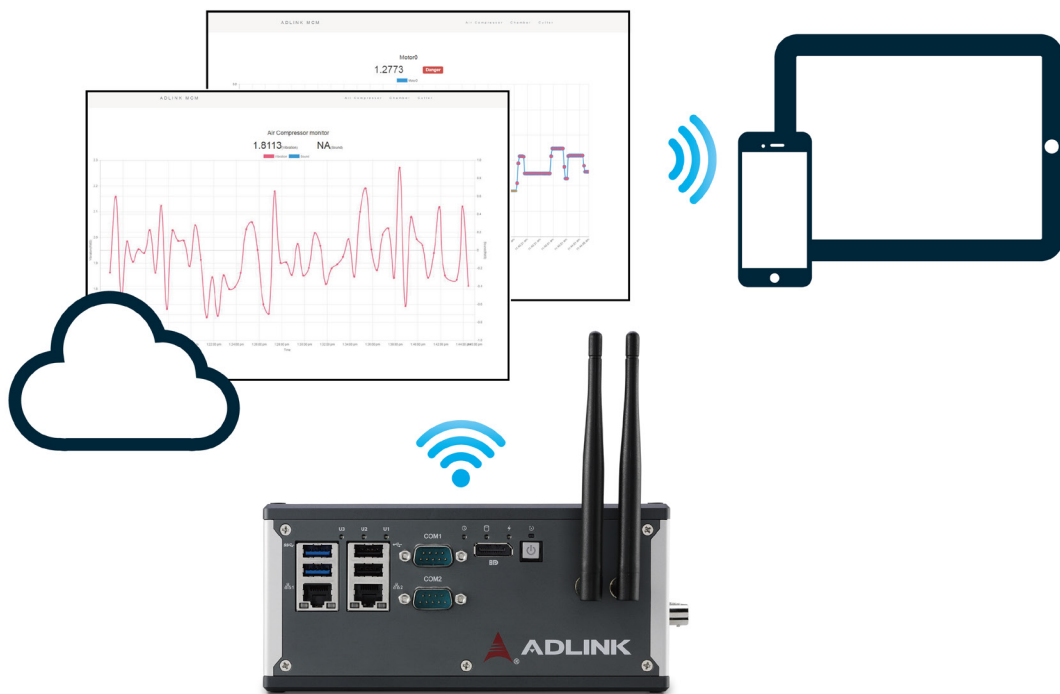


# Edge MCM Quick Start Solution

## 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.



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# Benefits of the Edge MCM Quick Start Solution

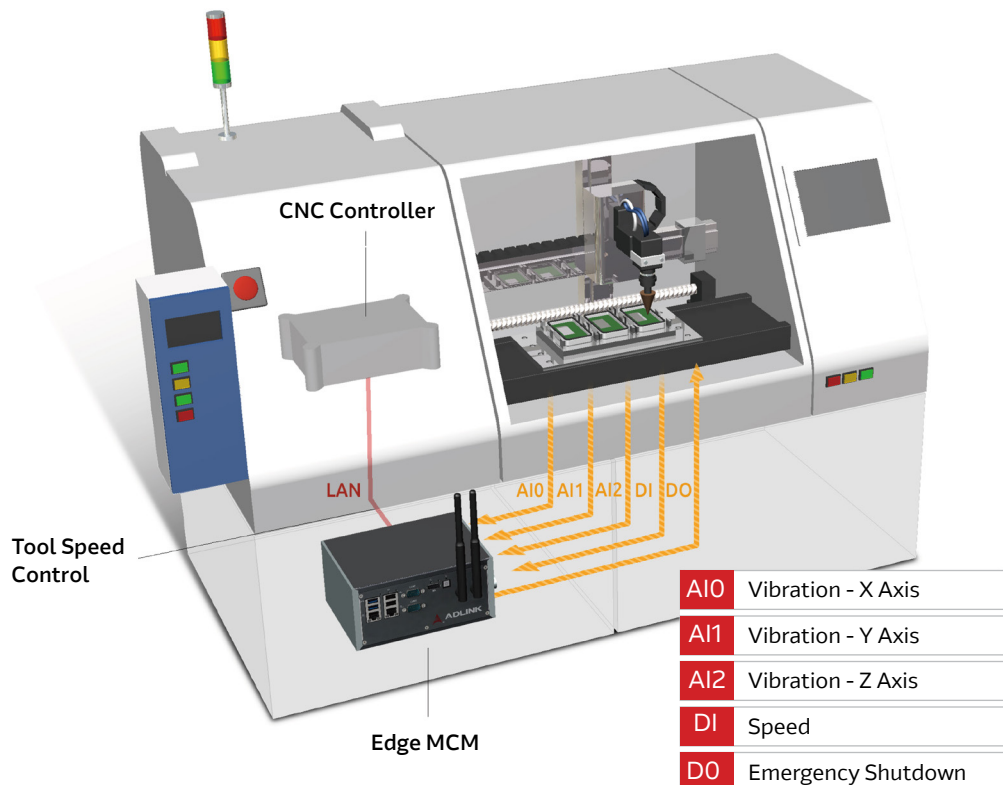
Integrating data collection, vibration analysis algorithms, computation, and network connection tasking in a single system, the Edge MCM Quick Start enables rotating machinery, tooling, and plant and automation equipment operators to easily overcome challenges inherent in conventional equipment maintenance.

## 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



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

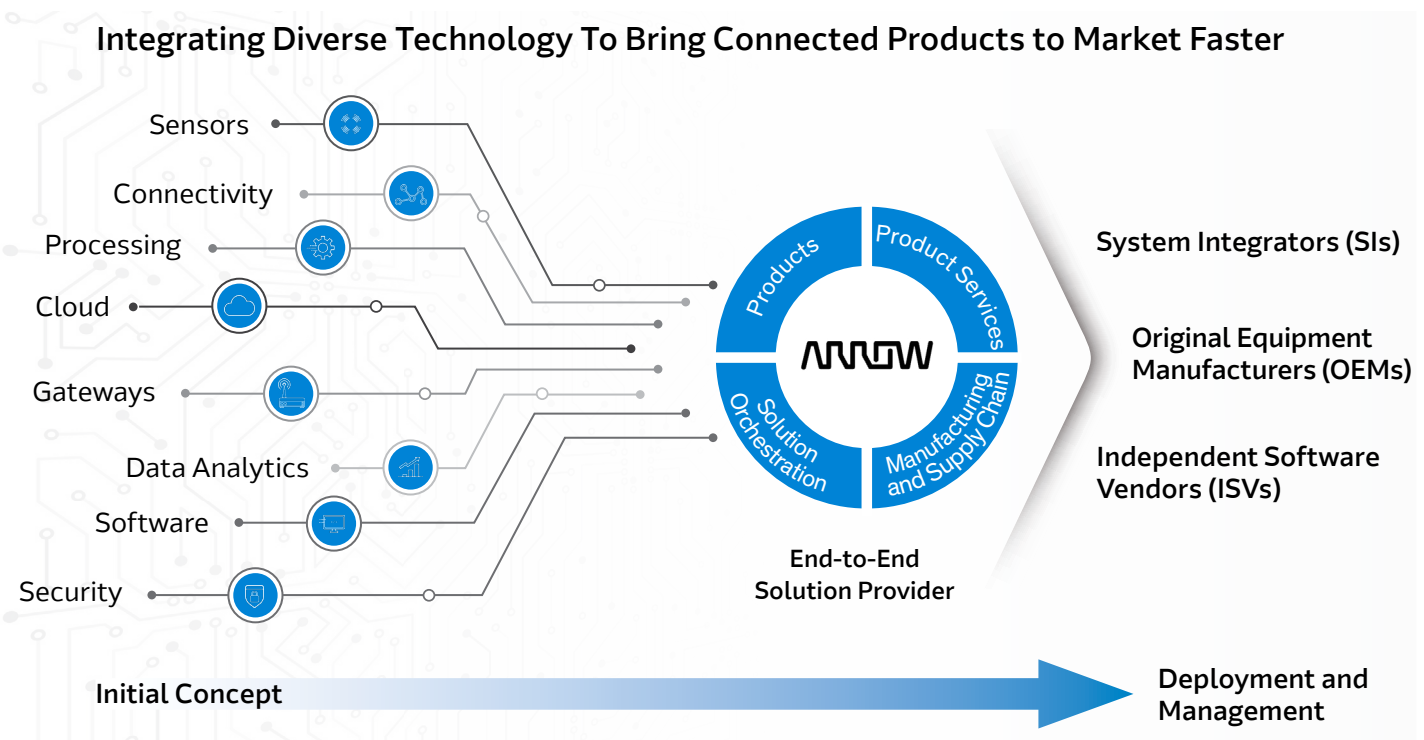
Measurement of CNC equipment parameters by the Edge machine condition monitoring solution works this way:

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- The diagram illustrates the ADLINK Edge™ architecture. At the top, a 'User' laptop is connected to the central platform. The central platform, enclosed in a dashed blue box, contains two main components: the 'sas UI App' (labeled 'Configuration') and the 'sas ESP Edge App'. These two apps are connected by a double-headed arrow. To the left of the central platform, a 'Machine' and a 'Sensor' are connected to a 'Vibration Analytics' module (represented by a blue hexagon with a Wi-Fi icon). This module is connected to the 'sas UI App'. To the right of the central platform, the 'sas ESP Edge App' is connected to an 'ADLINK OPC-UA Server' (represented by a black hexagon with a server icon). This server is connected to a 'Machine Controller' (represented by a monitor icon). Above the central platform, an 'ADLINK Data River™' (represented by a blue wavy line) connects the 'sas UI App' to the 'ADLINK Profile Builder (Deployment)' (represented by a blue gear icon). This profile builder is connected to another 'User' laptop. Below the central platform, a section titled 'Other App Connectors Supported by ADLINK Edge™' shows a row of six hexagonal icons: 'Cloud' (cloud icon), 'Vision' (eye icon), 'IT' (lightbulb icon), 'Visual' (gauge icon), 'Historian' (book icon), and 'OT' (Wi-Fi icon). These connectors are connected to a 'Microsoft Azure' cloud icon on the left and an 'OPC UA' icon on the right. At the bottom, the word 'Alerts' is written.

# Arrow Intelligent Solutions (AIS): 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 Intelligent Solutions (AIS) 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 Intelligent Solutions (AIS)



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



Arrow Electronics guides innovation forward for over 180,000 leading technology manufacturers and service providers. With 2020 sales of \$29 billion, Arrow develops technology solutions that improve business and daily life. Learn more at **[arrow.com/fiveyearsout](https://arrow.com/fiveyearsout)**

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**Five Years Out**